

ABN 90887347745

Arboricultural Development Assessment Report

Nepean Hospital Redevelopment STAGE 2 WORKS September 2021 *FINAL Updated 25.11.2021*







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Summary

Health Infrastructure c/o CBRE P/L, Level 21, 363 George Street, Sydney NSW 2000. The report concerns a proposed development works for Nepean Hospital Redevelopment, Main Works project, Stage 2.

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

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

Tree to be retained are numbered as 1-6, 220, 221, 223, 227, 230, 231, 235, 272, 274, 275, 276, 277, 278, 280, 282, 283, and Tree group 391. All other trees will be removed.

Current civil works plans have not been finalised at the time of this report and as such it is imperative that with the trees to be retained plans will need to show no level changes or services trenches through the TPZ of these trees. Old underground services to be made redundant, where they pass through a TPZ of any tree to be retained, shall be left in situ where possible.

Trees to be retained will be required to be fenced for the demolition and construction period. The entire TPZ area within the fenced area shall be mulched with 100mm of leaf and woodchip mulch for the duration of the works. For Trees 220, 221 and 223, a temporary irrigation system will be installed for the duration of the works ensuring the TPZ area is watered twice per week for two (2) hours.

Any hard landscape features below trees to be retained, such as any sculptures that require concrete footings, chairs, tables, pedestrian paths, landscape features that may require below grade concrete footings may require non destructive methods to determine the extent of roots present. Tender documentation should clearly detail that this non-destructive root mapping may be required where works occur within a TPZ area of any tree to be retained.

Trees 227, 230, 231, 235, 280, 282 and 283 will all be retained as they are located in and around previous works that have now been completed. No tree protection will be required for these trees as they are located away from the works.

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1 INTRODUCTION

- **1.1** This report has been conducted to assess the health and condition of the site trees within the Stage 2 works area located within the Nepean Hospital grounds. This report has been prepared for Health Infrastructure c/o CBRE P/L, Level 21, 363 George Street, Sydney NSW 2000 as required for a State Significant Development Application at this site. This report concerns the Main Works project associated with the Hospital Redevelopment Stage 2 works.
- 1.2 Health Infrastructure NSW (HI) is the applicant for the proposed Stage 2 Redevelopment of Nepean Hospital in Penrith Local Government Area (LGA). The proposal is State Significant Development (SSD) for the purposes of the Environmental Planning and Assessment Act 1979 (EP&A Act) and clause 14(a) of Schedule 1 of the State Environmental Planning Policy (State and Regional Development) 2011 (SEPP SRD) as it involves development for the purposes of a hospital with a capital investment value in excess of \$30 million.
- **1.3** The Stage 2 Redevelopment seeks to deliver significantly enhanced acute services, as well as a new campus main entry and drop-off area. It complements the recent Stage 1 Redevelopment (SSD 8766) approved in February 2019 and due for completion by early 2022. The proposed Stage 2 Tower will be located west of, and connected to, the Stage 1 Tower. Portions of the North Block (north section) will be demolished with the remaining sections of the North Block (to the south of the Stage 2 Tower) to remain operational.
- 1.4 The subject trees were assessed for their health and condition. Although not being submitted to the Local Council (Penrith City Council), the Penrith City Council Development Application guidelines for trees have been used to determine what arboricultural data would be collected for each tree.

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.
- 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).
- **1.5 Documents and information provided:** I have been provided the following documents for this report;
 - Stage 2 Nepean Hospital Master Plan by Arcadia dated August 2021.
 - Civil Works SSDA SEARs Condition Report by Meinhardt/Bonacci, dtd Sept2021
 - Secretary's Environmental Assessment Requirements (SEARs) general requirements
 - Site Survey by Cardno, Rev 4, dated 7.6.17, Drawing No. 118117502, Sheets 1-55.

The Stage 2 Redevelopment's State Government environmental assessment requirement (SEARs) was issued by the Department of Planning, Industry and Environment on 22 April 2021. In preparing this report, the following SEARs General Requirements, Key Issues, and Agency's Advice letters have been addressed.

The Point 3 in the SEARs table sets out the Arboricultural matters for this report. Most matters have been addressed within this report, with the exception to matters that are required to be addressed by the Landscape Architect.

1.6 Location: The proposed development site is located at Derby Street, Kingswood NSW 2747, known as Nepean Hospital (Diagram 1). The project site from herein will be referred to as "the Site". The study area can be seen in Diagram 2.



Diagram 1: Location of subject site, Nepean Hospital (Red arrow) (whereis.com.au, 2021)



Diagram 2: Location of the Stage 2 study area (Part Plan, Health Infrastructure 2021)

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 16th April 2021. 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 Height:** The heights and distances within this report have been measured with a Bosch DLE 50 laser measure.
- **2.3 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 to help determine construction impacts. The TPZ calculation is based on the Australian Standard *Protection of trees on development sites,* AS 4970, 2009. The calculated TPZ distances can be seen in the Tree Schedule (Appendix 2).
- 2.4 Structural Root Zone (SRZ): The 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. No roots should be severed within this area. A detailed methodology on the TPZ and SRZ calculations can be found in Appendix 4. It is possible that the current design may change. It is strongly recommended that the Architect applies the calculated TPZ and SRZ distances to their construction drawings and assess impacts should designs change. The Architect should notify Moore Trees during the design stage should any works fall within the TPZ and SRZ distances of the trees to be retained.

- 2.5 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.
- 2.6 Impact Assessment: An impact assessment will eventually be conducted on the site trees. This will be conducted by assessing the site survey and plans provided by CBRE Project Management. 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.
 - Location of sediment controls in relation to TPZ areas
 - Location of stockpile areas in relation to TPZ areas
 - Canopy clearance for scaffolding Australian Standard (Scaffolding) 1576.1, 2010 and Scaffolding Code of Practice 2009-Safe work Australia.

3 RELEVANT BACKGROUND INFORMATION

- **3.1** The site is located on the corner of Parker Street and Barber Avenue and is part of the Nepean Hospital complex. The Stage 2 study area (Diagram 2) contains multiple low and high-rise buildings and associated car parking areas. No formal planted plan was noted and trees and shrubs appear to have been randomly planted throughout the area as required. Some of the areas are newly landscaped due to new buildings. Tree species consist of both native and exotic species.
- **3.2 Environmental Significance**: A Tree Protection Order (TPO) applies to the whole of the Penrith Local Government Area and is part of the Penrith City Council Local Environmental Plan, 2010. This TPO protects all trees above three (3) metres in height.
- **3.3** The Site Trees: The site was inspected on 16th April 2021. Each tree has been given a unique number for this site and can be viewed on the Tree Location Plan (Appendix 1). Trees 1-6 are located on the eastern side of the car park tower. Trees 500 and 501 are located on the western side of the car park tower on Parker Street. All other trees are scattered in and around existing buildings. All species found are listed in the Tree Schedule (Appendix 2).
- **3.4** Tree 1 is a large mature Grey box (*Eucalyptus moluccana*). Great lengths have been undertaken to retain this tree through previous construction works, namely the construction of the car park tower (Plate 1). This tree has survived this process and all efforts should be made to ensure its continued survival. Near this tree are Trees 2-6 which are all newly planted *Eucalyptus* saplings.



Plate 1: Trees 1-5. P. Vezgoff.



Plate 2: Trees 196-210. P. Vezgoff.

3.5 Trees 196-210 are a dense mix of native and exotic specimens including Brushbox (*Lophostemon confertus*), Willow Bottle brush (*Callistemon salignus*), Jacaranda (*Jacaranda mimosifolia*). These trees are growing in a confined area and have codominant canopies with each other (Plate 2). These trees would not be considered significant. Near this same area are Trees 195, 365-367 being a row of small Willow Bottle brush (*Callistemon salignus*), *Acacia* and a *mature* Spotted gum (*Corymbia maculata*). These trees would not be considered significant (Plate 3).



Plate 3: Tree group 365-367 along with some smaller shrubs. P. Vezgoff.

3.6 Between the new childcare centre and construction offices are various trees that consist of Tallowwood (*Eucalyptus microcorys*), Forest red gum (*Eucalyptus tereticornis*), Spotted gum (*Corymbia maculata*), Jacaranda (*Jacaranda mimosifolia*), Willow Bottle brush (*Callistemon salignus*), Brushbox (*Lophostemon confertus*), Acmena smithii, Grey box (*Eucalyptus moluccana*). In general, all trees were in good health and condition in this area (Plates 6 and 7). Trees 231 and 237 are in an area of mostly completed works so no impacts are expected near this area (Plate 7).



Plate 6: From left, Trees 229, 282, 283. P. Vezgoff.



Plate 7: Trees 227 and 231. P. Vezgoff.

3.7 Trees 363 and 364 are both Giant Bird of paradise (*Strelitzia nicolai*). These trees would not be considered highly significant to the site.



Plate 8: Trees 363, 364. P. Vezgoff.



Plate 9: From left 220, 221 and 223 that should be possible to retain. P. Vezgoff.

- **3.8** Majority of the trees on site were found to be in good health and condition. The main trunks, first and second order branches are free of cracks, splits, or fruiting bodies. Old pruning wounds are showing good occlusion, a sign that the tree is photosynthesizing effectively. New extension growth was noted with leaf colour showing good vitality. The subject trees would be considered to have 95% live canopies. The basal area and woody root zone were free of any ground heaving, or lifting. A handful of trees had suffered from minor storm damage but, in general, the site trees have been well maintained.
- 3.9 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 Page | 15 Moore Trees Arboricultural Report for Nepean Hospital S2Works project

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 52% of the site's tree population has a life expectancy of greater than forty (40) years and 34% had a medium life expectancy. Trees that have a short life expectancy total 14%.



Graph 1: SULE ratings for the site.

3.10 Impacts: Based on the plans provided, site trees will be required to be removed due to bulk earth works and level changes (Plate 9). Tree to be retained are numbered as 1-6, 220, 221, 223, 227, 230, 231, 235, 272, 274, 275, 276, 277, 278, 280, 282, 283 and Tree group 391. All other trees will be removed.



Plate 9: Part plan showing the extent of bulk earth works which will have the greatest impacts to the site trees. (Part plan of Tree Protection Plan and Project plan overlays).

3.11 Trees 227, 230, 231, 235, 280, 282 and 283 are shown within the project boundaries however this area of the site has already had works completed that included landscaping, access ramps and car parking. It is not envisaged that these trees will be impacted by the works (Plate 10). It is assumed the child care centre will remain operational during the works so access to the car parking (between Trees 230 and 227) will be required thus Trees 227, 230, 231, 235, 280, 282 and 283 should be outside of the actual works area.



Plate 10: Trees 227, 230, 231, 235, 280, 282 and 283 are shown within the project boundaries however this area of the site has already had works completed that included landscaping, access ramps and car parking. (Part plan of Tree Protection Plan and Project plan overlays).

3.12 The levels changes from the bulk earthworks will impact most of the other site trees. Although these works indicate the minimum disturbance being 0-0.5 metre, a five hundred (500) millimetre disturbance across a TPZ area will have long term impacts to any mature tree. Fine feeder roots and structural woody roots will be located within this five hundred (500) millimetres of soil profile (Appendix 8). Tree 223 (Plate 9) which, I have been informed is to be retained, has level changes across the entire TPZ area (Plate 11) of seven (7) radial metres. I have shown this tree to be retained however the levels within the TPZ of this tree will need to remain as is in order for this tree to survive (Plate 11).

3.13 In terms of canopy loss for the Stage 2 project this will amount to approximately 40% canopy loss.



Plate 11: Part plan showing the extent of bulk earth works and services below Trees 220, 221 and 223. The green shade indicates a potential change in levels of 0-.5m which would not be acceptable in order to retain Tree 223. Redundant services (Red dashed line) will be left in situ (Part plan of Tree Protection Plan and Project plan overlays).

4 RECOMMENDATIONS

- **4.1** Based on the plans provided tree to be retained are numbered as 1-6, 220, 221, 223, 227, 230, 231, 235, 272, 274 275, 276, 277, 278, 280, 282, 283 and Tree group 391. All other trees within the Stage 2 area will be removed.
- **4.2** Current civil works plans have not been finalised at the time of this report and as such it is imperative that with the trees to be retained plans will need to show no level changes or services trenches through the TPZ of these trees. Old underground services to be made redundant, where they pass through a TPZ of any tree to be retained, shall be left in situ where possible.
- **4.3** The proposed new stormwater line (NSW211526-REF-0000-SM-DRAI-PLAN-TB2-MAIN-WORKS-SHEET-2-211115) that will be a 600mm diameter pipe will be very close to Tree 223. Taking into consideration the shoring that may be required for this 2 metre deep trench the excavation should be no closer than 4.5 metres to the trunk. This would equate to a 20% TPZ incursion of the overall 7.2 metre TPZ distance. That said, preferably the excavations would be no closer than 6 metres. If works require a large degree of root loss or the severing of roots greater than 100mm in diameter this tree may have to be removed once works commence. The project Arborist shall have to be present for the excavation works within the TPZ of Tree 223.
- 4.4 Trees to be retained will be required to be fenced for the demolition and construction period. The entire TPZ area within the fenced area shall be mulched with one hundred (100) millimetres of leaf and woodchip mulch for the duration of the works. For Trees 220, 221 and 223 a temporary irrigation system will be installed for the duration of the works ensuring the TPZ area is watered twice per week for two (2) hours.
- **4.5** Any hard landscape features below trees to be retained such as any sculptures that require concrete footings, chairs, tables, pedestrian paths, landscape features that may require below grade concrete footings may require non destructive methods to determine the extent of roots present. Tender documentation should clearly detail that this non destructive root mapping may be required where works occur within a TPZ area of any tree to be retained.

- **4.6** The location of new services may potentially impact on the site trees to be retained and their root systems. Strip trenching through TPZ areas can sever roots, thus destabilising trees. All disciplines that have to plan service locations that require trenching shall be supplied the TPZ distances in this report so that major incursions of greater than 10% can be avoided. These disciplines may include but not be limited to; stormwater design, gas, water and electricity locations.
- **4.7** Trees 227, 230, 231, 235, 280, 282 and 283 will all be retained as they are located in and around previous works that have now been completed. No tree protection will be required for these trees as they are located away from the works.
- **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.

5 TREE PROTECTION

- 5.1 Trees to be protected: Trees to be retained will be required to be fenced for protection. All fencing shall be installed as specified in Section 5.2 (Tree Protection – Implementation of Tree Protection Zone). Indicative locations of the fencing are shown in the Tree Protection Plan (Appendix 1).
- **5.2 Implementation of Tree Protection Zone:** All tree protection works should be carried out before the start of demolition or building work. It is recommended that chain mesh fencing with a minimum height of 1.8 metres be erected as shown in the Tree Protection Plan (Appendix 1) at a seven metre radius from the trunk. Specifications for this fencing are shown in Tree Protection Fencing Specifications (Appendix 5).
- **5.3** The Tree Protection Zone (TPZ) and Structural Root Zone (SRZ): The TPZ is implemented to ensure the protection of the trunk and branches of the subject tree. The TPZ is based on the Diameter at Breast Height (DBH) of the tree. The SRZ is also a radial measurement from the trunk used to protect and restrict damage to the roots of the tree.

The Tree Protection Zone (TPZ) and Structural Root Zone (SRZ) have been measured from the centre of the trunk. TPZ and SRZ distances are all listed in the Tree Schedule (Appendix 2). The following activities shall be avoided within the TPZ and SRZ of Trees to be retained;

- •Erecting site sheds or portable toilets.
- •Trenching, ripping or cultivation of soil (with the exception of approved foundations and underground services).
- •Soil level changes or fill material (pier and beam or suspended slab construction are acceptable).
- •Storage of building materials.
- •Disposal of waste materials, solid or liquid.

- **5.4 Tree Damage:** If the retained trees are damaged a qualified Arborist should be contacted as soon as possible. The Arborist will recommend remedial action so as to reduce any long term adverse effect on the tree's health.
- **5.5 Signage:** It is recommended that signage is attached to the tree protection fencing. A sample sign has been attached in Appendix 6. This sign may be copied and laminated then attached to the TPZ fencing.
- **5.6** Soil compaction: Mulch has been recommended to be placed within the TPZ fenced area of all trees to be retained. This is to help reduce soil compaction and moisture retention for the trees that are to be retained. Mulch is to be no thicker than one hundred (100) millimetres in depth and spread evenly across the TPZ area.
- **5.7 Arborist Certification:** It is recommended that the developer to supply Council or the Principal Certifying Authority with certification from the Project Arborist three (3) times during the construction phase of the development in order to verify that retained trees have been correctly retained and protected as per the conditions of consent and Arborist's recommendations. The certification is to be conducted by a Qualified Consulting Arborist with AQF level 5 qualifications that has current membership with either Arboriculture Australia (AA) or Institute of Australian Consulting Arboriculturists (IACA). Arborist certification is recommended:
 - (1) Before the commencement of demolition or construction to confirm the application of mulch and fencing has been installed;
 - (2) At mid point of the construction phase;
 - (3) At completion of the construction phase.

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

25th November 2021

Plan 1

Tree Protection Plan





Date: 25.11.2021 Drawn: P.Vezgoff Site Address: Nepean Hospital Derby Street, Kingwood

<u>Tree health & condition</u> <u>assessment schedule</u>

TREE HEALTH AND CONDITION ASSESSMENT SCHEDULE - Nepean Hospital – Stage 2 project

					Live						
		Height	Spread	DBH	canopy						TPZ
Tree	Species	(m)	(m)	(mm)	%	Defects	SULE	Condition	Age	Comments	(mm)
	Grey box (Eucalyptus						2a May only live for 15-40				
1	moluccana)	18	8	900	100	No visual defects	years	Good	Mature		10800
2	Eucalyptus sp	2.5	1	0.05	100	No visual defects	5a Sapling	Good	Sapling		1200
3	Eucalyptus sp	2.5	1	0.05	100	No visual defects	5a Sapling	Good	Sapling		1200
4	Eucalyptus sp	2.5	1	0.05	100	No visual defects	5a Sapling	Good	Sapling		1200
5	Eucalyptus sp	2.5	1	0.05	100	No visual defects	5a Sapling	Good	Sapling		1200
6	Eucalyptus sp	2.5	1	0.05	100	No visual defects	5a Sapling	Good	Sapling		1200
	Jacaranda (Jacaranda						2a May only live for 15-40				
193	mimosifolia)	10	10	300	80	No visual defects	years	Good	Mature		3600
	Spotted gum (Corymbia										
195	maculata)	20	15	500	80	No visual defects	1a >40 years	Good	Mature		6000
	Brushbox (Lophostemon										
196	confertus)	12	8	250	70	No visual defects	1a >40 years	Good	Mature		3000
	Willow Bottle brush (Callistemon					Included codom	2a May only live for 15-40				
197	salignus)	10	6	200	80	stems	years	Good	Mature		2400
	Jacaranda (Jacaranda						2a May only live for 15-40				
198	mimosifolia)	12	12	600	80	No visual defects	years	Good	Mature		7200
	Jacaranda (Jacaranda					Included codom	2a May only live for 15-40				
199	mimosifolia)	7	6	80	0	stems	years	Good	Mature		960
	Jacaranda (Jacaranda						2a May only live for 15-40				
200	mimosifolia)	12	10	250	80	No visual defects	years	Good	Mature		3000
	Jacaranda (Jacaranda						2a May only live for 15-40				
201	mimosifolia)	12	10	250	80	No visual defects	years	Good	Mature		3000
	Jacaranda (Jacaranda						2a May only live for 15-40				
202	mimosifolia)	12	10	400	80	No visual defects	years	Good	Mature		4800
203	Jacaranda (Jacaranda	12	10	400	80	No visual defects	2a May only live for 15-40	Good	Mature		4800

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		Height	Spread		Live						TP7
Tree	Species	(m)	(m)	(mm)	%	Defects	SULE	Condition	Age	Comments	(mm)
	mimosifolia)						years				
							2a May only live for 15-40				
204	Hymenosporum flavum	8	4	100	80	No visual defects	years	Good	Mature		1200
	Jacaranda (Jacaranda						2a May only live for 15-40				
205	mimosifolia)	12	12	400	80	No visual defects	years	Good	Mature		4800
	Jacaranda (Jacaranda						2a May only live for 15-40				
206	mimosifolia)	8	5	100	80	No visual defects	years	Good	Mature		1200
	Willow Bottle brush (Callistemon					Dead wood >50mm	3a May only live for 5-15				
207	salignus)	8	6	300	40		years	Poor	Mature		3600
	Spotted gum (Corymbia						2a May only live for 15-40				
208	maculata)	12	10	450	60	No visual defects	years	Good	Mature		5400
	Forest red gum (Eucalyptus					Included codom	2a May only live for 15-40				
209	tereticornis)	18	15	700	60	stems	years	Good	Mature		8400
	Tallowwood (Eucalyptus						2a May only live for 15-40				
210	microcorys)	18	10	0	70	No visual defects	years	Good	Mature		0
	Jacaranda (Jacaranda						2a May only live for 15-40				
211	mimosifolia)	10	4	200	80	No visual defects	years	Good	Mature		2400
	Jacaranda (Jacaranda						2a May only live for 15-40				
212	mimosifolia)	10	4	200	80	No visual defects	years	Good	Mature		2400
	Jacaranda (Jacaranda						2a May only live for 15-40				
213	mimosifolia)	10	4	200	80	No visual defects	years	Good	Mature		2400
	Grey box (Eucalyptus										
214	moluccana)	12	6	200	80	No visual defects	1a >40 years	Good	Mature		2400
	Jacaranda (Jacaranda						2a May only live for 15-40				
215	mimosifolia)	10	4	200	80	No visual defects	years	Good	Mature		2400
216	Grey box (Eucalyptus moluccana)	12	12	350	80	Stem wounds	1a >40 years	Good	Mature		4200

		Height	Spread	DBH	Live						TD7
Tree	Species	(m)	(m)	(mm)	%	Defects	SULE	Condition	Age	Comments	(mm)
	Grey box (Eucalyptus										
217	moluccana)	18	12	500	80	Stem wounds	1a >40 years	Good	Mature		6000
	Grey box (Eucalyptus					Dead wood >50mm					
220	moluccana)	20	14	800	70		1a >40 years	Good	Mature		9600
	Grey box (Eucalyptus										
221	moluccana)	20	14	800	70	No Value	1a >40 years	Good	Mature		9600
	Lemon-scented gum tree						2a May only live for 15-40				
222	(Corymbia citriodora)	12	10	400	80	No visual defects	years	Good	Mature		4800
	Tallowwood (Eucalyptus										
223	microcorys)	15	15	600	80	No visual defects	1a >40 years	Good	Mature		7200
						Dead wood >50mm	2a May only live for 15-40				
224	Silky oak (Grevillea robusta)	15	8	400	50		years	Good	Mature		4800
	Tallowwood (Eucalyptus					Included codom	2a May only live for 15-40				
225	microcorys)	18	10	700	80	stems	years	Good	Mature		8400
	Tallowwood (Eucalyptus						2a May only live for 15-40				
226	microcorys)	10	4	150	80	No Value	years	Good	Sapling		1800
	Spotted gum (Corymbia										
227	maculata)	15	6	250	80	No visual defects	1a >40 years	Good	Mature		3000
220	Grey box (Eucalyptus	10	12	600	80	No visual defects	12 >10 years	Good	Maturo		7200
230		10	12	000	80			GUUU	Mature		1200
231	Silky Oak (Grevillea robusta)	8	5	100	80	No Value	1a >40 years	Good	Mature		1200
225	Jacaranda (Jacaranda mimosifolia)	10	6	300	80	No visual defects	Za iviay only live for 15-40	Good	Mature		3600
255		10	0	300	00				Nature		3000
272	Grey gum (Eucalyptus punctata)	15	10	400	/0	No visual defects	Ta >40 years	Good	Mature		4800

		Height	Spread		Live						TD7
Tree	Species	(m)	(m)	(mm)	%	Defects	SULE	Condition	Age	Comments	(mm)
274	Grey gum (Eucalyptus punctata)	10	8	400	70	No visual defects	1a >40 years	Good	Mature		4800
275	English oak (Quercus robur)	6	6	100	80	Foliar pest	1a >40 years	Good	Mature		1200
							2a May only live for 15-40			Mixed species plaques at	
276	Silky oak (Grevillea robusta)			0	0	No visual defects	years	Good	Mature	base	0
							2a May only live for 15-40			Mixed species plaques at	
277	Mixed species plaques at base			0	0	No visual defects	years	Good	Mature	base	0
							2a May only live for 15-40			Mixed species plaques at	
278	Mixed species plaques at base			0	0	No visual defects	years	Good	Mature	base	0
										Mixed species, melia	
							2a May only live for 15-40			euucalyptus, allocasuarina	
279	Mixed species plaques at base			0	0	No visual defects	years	Good	Mature	,callistemon	0
	Mixed species, melia										
	eucalyptus, allocasuarina					Included codom	2a May only live for 15-40				
280	,callistemon	12	12	200	0	stems	years	Good	Mature		2400
						Included codom	2a May only live for 15-40				
281	Melaleuca (Melaleuca linariifolia)	10	5	150	70	stems	years	Good	Mature		1800
	Magenta lilly pilly (Syzigium										
282	paniculatum)	12	6	300	90	No visual defects	1a >40 years	Good	Mature		3600
	Magenta lilly pilly (Syzigium					Included codom					
283	paniculatum)	12	6	300	90	stems	1a >40 years	Good	Mature		3600
							3c Removed for a better				
363	Strelitzia nicolai	8	2	0.5	100	No visual defects	specimen.	Fair	Mature		1000
							3c Removed for a better				
364	Strelitzia nicolai	8	2	0.5	100	No visual defects	specimen.	Fair	Mature		1000
365	Grey box (Eucalyptus moluccana)	11	4	0.35	70	No visual defects	1a >40 years	Fair	Mature		4.2
366	Grey box (Eucalyptus moluccana)	14	6	0.5	80	No visual defects	1a >40 years	Fair	Mature		6
367	Grey box (Eucalyptus moluccana)	11	4	0.35	70	No visual defects	1a >40 years	Fair	Mature		4.2

Tree	Snecies	Height (m)	Spread (m)	DBH (mm)	Live canopy %	Defects	SHIF	Condition	Δge	Comments	TPZ (mm)
368	White cedar (Melia azedarach)	12	4	0.2	90	Included codom stems	2c removed for more suitable planting	Fair	Mature	Multi stemmed specimen	2.4
369	Spotted gum (Corymbia maculata)	9	1	0.12	90	No visual defects	2c removed for more suitable planting	Fair	Sapling		1.4
370	White cedar (Melia azedarach)	9	3	0.25	90	No visual defects	2c removed for more suitable planting	Fair	Mature	Multi stemmed specimen	3
371	White cedar (Melia azedarach)	9	3	0.25	90	No visual defects	2c removed for more suitable planting	Fair	Mature		3
372	Grey box (Eucalyptus moluccana)	9	4	0.25	70	No visual defects	1a >40 years	Fair	Mature		3
373	White cedar (Melia azedarach)	9	3	0.25	90	No visual defects	2c removed for more suitable planting	Fair	Mature		3
374	Acmena smithii	8	2.5	0.2	90	No visual defects	2c removed for more suitable planting	Fair	Mature		2.4
375	Acmena smithii	6	2	0.12	90	No visual defects	2c removed for more suitable planting	Fair	Mature		1.4
376	Acmena smithii	7	2.5	0.2	90	No visual defects	2c removed for more suitable planting	Fair	Mature		2.4
377	Willow Bottle brush (Callistemon salignus)	9	4.5	0.25	90	No visual defects	2c removed for more suitable planting	Good	Mature		3
378	Willow Bottle brush (Callistemon salignus)	9	4.5	0.25	90	No visual defects	2c removed for more suitable planting	Good	Mature		3
379	Red ironbark (Eucalyptus sideroxylon)	8	2	0.25	60	No visual defects	2a May only live for 15-40 years	Fair	Mature	Drought affected	3
380	Forest red gum (Eucalyptus tereticornis)	14	6	0.48	90	No visual defects	2c removed for more suitable planting	Good	Mature		5.8
381	Willow Bottle brush (Callistemon salignus)	9	4.5	0.25	90	No visual defects	2c removed for more suitable planting	Good	Mature		3
382	Tallowwood (Eucalyptus microcorys)	13	5	0.45	0	No visual defects	4a Dead, dying or declining.	Dead	Overmatu	re	5.4

		Height	Spread	DBH	Live canopy						TPZ
Tree	Species	(m)	(m)	(mm)	%	Defects	SULE	Condition	Age	Comments	(mm)
383	Forest Oak (Allocasurina torulosa)	6	1.5	0.15	80	No visual defects	2c removed for more suitable planting	Fair	Mature		1.8
384	Grey box (Eucalyptus moluccana)	17	6	0.7	80	No visual defects	1a >40 years	Good	Mature		8.4
385	Melaleuca decora	4	2	0.2	80	No visual defects	4a Dead, dying or declining.	Poor	Mature		2.4
386	Forest Oak (Allocasurina torulosa)	6	1.5	0.15	80	No visual defects	2c removed for more suitable planting	Fair	Mature		1.8
387	Forest red gum (Eucalyptus tereticornis)	19	7	0.7	90	No visual defects	1a >40 years	Good	Mature	Co dom stems	8.4
388	White cedar (Melia azedarach)	8	2.5	0.25	90	No visual defects	2c removed for more suitable planting	Good	Mature		3
389	White cedar (Melia azedarach)	8	2.5	0.25	90	No visual defects	2c removed for more suitable planting	Good	Mature		3
390	White cedar (Melia azedarach)	8	2.5	0.25	90	No visual defects	2c removed for more suitable planting	Good	Mature		3
391	Tallowwood (Eucalyptus microcorys)	12	4.5	0.3	90	No visual defects	1a >40 years	Good	Mature		3.6

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.

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.

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.

$$TPZ = DBH \times 12$$

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 = $(D \ge 50)^{0.42} \ge 0.64$

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 0.15 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.

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.

Tree protection sign

sign sample

MODYE TYEES Tree Consultancy 0411 712 887

Tree Protection Zone

Fence not to be moved without approval from Arborist

Within this fence there is to be

Storage of materials Trenching or excavation Washing of tools or equipment





Tree structure information diagram



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

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 <u>estimated</u> from visual indicators and it should only be taken as a <u>provisional</u> <u>guide</u>. 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.

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Sydney

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

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

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

Woollahra Municipal Council

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

Tradesman for Landscape Construction business Paul Vezgoff Garden Maintenance (London, UK)

CONFERENCES AND WORKSHOPS ATTENDED

- International Society of Arboriculture Conference (Canberra May 2017)
- QTRA Conference, Sydney Australia (November 2016)
- TRAQ Conference, Auckland NZ / Sydney (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).

July to Oct 1995

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Oct 1995 to February 2008