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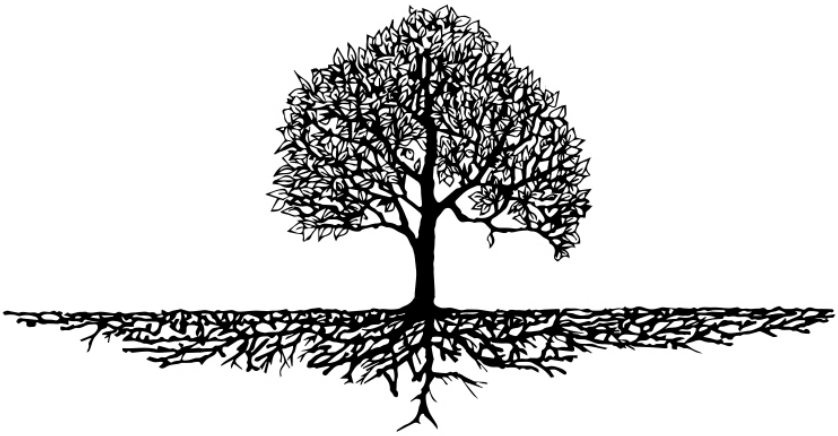
Client	Lend Lease
Location	UNSW D14 Building, UNSW Kensington Campus
Document Type	Arboricultural Impact Assessment & Tree Protection Plan / Specification.
Date	17th April 2019



The Ents Tree Consultancy

Development Reports | Hazard Assessments | Tree Management

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1. Contents

2. Introduction

2.1 On the 3rd October 2018 the Lend Lease engaged The Ents Tree Consultancy to complete an Arboricultural Impact Assessment for the proposed development at the D14 site, UNSW Kensington Campus. The objectives of the report are to nominate the trees that are to be removed and those that are to be retained under the SSD Approval Process. The trees nominated for retention will be retained in good condition for the duration of the works based on the Australian Standard for the Protection of Trees on Development Sites AS4970.

2.2 On the 1st April 2019 Lend Lease issued an amended set of architectural and landscaping plans for the D14 building and requested a review of the plans for the 3rd April 2019. The plans are in response to the submissions received and reflect the updated DA design. Prior to works commencing, a detailed Arboricultural Impact Assessment will be prepared in consultation with Lendlease and UNSW and in accordance with the conditions of development consent.

2.3 The Ents Tree Consultancy recommends no disturbances to the structural root zone of any tree and less than 25% disturbance to the tree protection zone of any tree, refer to tree table Appendix 2. If this advice is not adhered to by the UNSW planning team in the design of the building or landscape, The Ents Tree Consultancy will not be liable for any decline in tree health and a loss of tree stability as a result of the works. This report will assess the nominated trees that are within or adjoining the design envelope which may be impacted upon by the works or the associated activities. This includes landscaping works immediately adjoining the site and access past trees to enter the site as shown on the plans. Consultation was sought with the client about the number and position of trees to be inspected prior to a survey being completed.

2.4 The site inspection of the nominated trees occurred on the 5th and 6th October 2018. Further assessments have been made in 2019 to consider options for tree retention. This tree report will detail the condition of the nominated trees, observe the condition, longevity and significance of each tree. The report will then recommend removal or retention of the trees or the required setbacks to ensure the viability of trees to be retained. Recommendations for removal or retention will be based on the tree's significance, the requirements of the proposed works and compatibility of the trees with the works. The report will also assess any potential impacts for trees nominated to be retained and attempt to remove or minimise them where possible. Recommended tree protection measures as set out in the Australian Standard AS4970 Protection of Trees on development sites will be nominated as required.

2.5 The purpose of this report is to assess the area of the proposed works envelope as well as the areas adjoining the proposed works envelope to consider flow on affects from the proposed works activities, refer to Appendix 4a. The report will provide tree management options for trees on the site in regard to the planning of the proposed works which will include a tree protection plan, refer to Appendix 4a. The Tree Protection Guidelines will be discussed for all trees nominated to be retained. The information in this report will be based on the information presented by the client at the time of the inspection as well as the site inspection. The Australian Standard AS4970 Protection of Trees on development sites will be used as a guide to manage the site. Additional Tree Protection measures are included in appendix 8. The proposed works for College Walk upgrades will not be covered in this report as this is proposed as part of separate UNSW campus masterplan upgrade works.

2.6 To achieve the objectives of the report, the trees will be assessed noting the species, size, general condition. The trees will be assessed using the internationally recognised VTA assessment method for above ground parts only. The trees characteristics and eventual size will be taken into consideration as will the trees position in relation to structures and hard scapes. Recommendations will be outlined in section 5 of the report. A detailed list of the trees surveyed as at 3rd October 2018 and will be provided in Appendix 2 of the report and an existing numerical system has been used to identify them for this report and future reference on this job site.

3 Methodology

3.1 The trees were assessed using the standard Visual Tree Assessment technique (VTA). The trees were assessed from the ground for this report.

3.2 A Lufkin 6.5m diameter tape was used to obtain the Diameter at breast height (DBH) as recommended at 1.4 metres unless otherwise stated due to variations in the trees form.

3.3 The height of the trees was estimated and the spread of the trees canopy was paced out.

3.4 A Canon 5D Digital camera with a 24-105mm lens was used to take all photographs in this report.

3.5 The ULE rating system has been used as a guide to assist in determining the Useful Life Expectancy of the trees surveyed. Refer to Appendices 1.

4. Discussion

4.1 The trees nominated to be assessed are located on and adjoining the proposed works site from Fig Tree Lane to the East, College Walk to the South, Alumni Park to the West and the UNSW Village/ White House to the North, on the UNSW Kensington Campus. Some of the trees are significant in the immediate landscape and some are considered important in the local areas landscape in terms of amenity and function. A stand of trees in Fig Tree Lane are Heritage listed and the utmost care should be taken not to disturb the trees nominated Structural Root Zones, Tree Protection Zones or their crowns. The trees are located on partially sheltered site with some protection from surrounding structures, trees and topography from most aspects. The soil on site appears to be sandy loam that has been disturbed previously when the existing building and hardscapes were built and the site was cleared.

4.2 Based on the information provided by the client, there is a preliminary design for the proposed development subject to assessment and approval by the Department of Planning and Environment. This report will list the tree proposed to be removed based on the information provided by the client and the site plan provided by the client. The report will list discuss the trees nominated to be retained, the required setback for each tree's structural root zone and tree protection zone. The designers should allow aim for a disturbance of less than 10%, however disturbances of up to 25% disturbance to the trees projected tree protection zone (TPZ) may be considered depending on the condition of the tree and its species. This is at the upper limit of what is permissible for ensuring ongoing viability. To achieve stability of the tree in relation to the soil, no excavations, (strip footings or level changes) are recommended within the trees projected structural root zone (SRZ). Please refer to the tree table Appendix 2 for each trees Structural Root Zone (SRZ) and Tree Protection Zone (TPZ).

4.3 It should be noted that the majority of the significant trees located within the existing D14 site area are to be removed under a separate UNSW masterplan campus enhancement process by way of a Review of Environmental Factors. Some of the trees on site and all the trees adjoining the site are proposed to be retained and protected for the duration of the works. The trees nominated to be retained, will need to be retained using sympathetic building activities to allow the works to proceed. Options for managing the trees nominated to be retained on and adjoining the proposed works site should be based on the Australian Standard AS4970 2009 Protection of trees on development sites. It should be noted that heavy pruning of the trees crown will not be permissible. Any proposed pruning works should be planned to adhere to the Australian Standard for the Pruning of Amenity Trees AS4373 2007.

4.4 There are several trees rated as high retention to the east and north of the proposed works site. These are **trees 404 – 408** and **tree 411**. To the south there are **Trees 480 – 483**. These trees should be given adequate room for retention with all disturbances to the crowns and root zones of these trees kept to a minimum. There are trees within this group which are more valuable than others. These trees (404 – 408) are the stand alone feature trees on Fig Tree Lane. These trees are heritage listed and are on the council's significant tree register. Tree 411 also contributes to the significance of the landscape in the area. No disturbance to the trees crowns or root zones are anticipated for trees 411, 408, 407, 406 and 405. Due to the proximity of the site access past the trees, tree protection will be required. All existing hardstands and garden areas should remain in place to minimise stress to the trees. No pruning will be permitted for access or scaffolding. Any services, level changes or new paving works within the trees projected TPZ need to be calculated by the AQF level 5 Site Arborist when further details are provided.

4.5 **Tree 404** is proposed to have a 12% disturbance for the installation of a site compound. The majority of the site will be in the footprint of the old building or on existing hardstand. This level of disturbance is acceptable for this tree. Preliminary details have been provided at this stage of the design process for the installation of services in the Tree Protection Zone The majority of proposed in-ground services associated with the construction process are at high level (on top of hoarding) or utilise cable runs through existing pits and conduits. It is recommended that all services are placed outside of the structural root zone without exception. All service connections and deviation works should be outside of the trees projected tree protection zone or account for a disturbance of less than 10% of the total area. Any excavations within 5m of the tree will need to be completed by hand and will need to be completed under the supervision of the AQF level 5 Arborist.

4.6 **Tree Protection Trees 404 – 408 & 411.** These trees are outside of the site envelope and no site access is permitted past the trees as the trees are of high value. If access is required past these trees, all of these trees will require tree protection measures to be installed to retain the trees in good condition for the duration of the works. All existing hardscapes must remain in place for the duration of the works within the tree protection zones, limiting any root disturbance. If access is required past the trees, tree protection will need to be installed to protect the trees vascular tissue and rootzones in exposed garden areas,1.8m tree protection fencing will be required to be installed prior to the works commencing. Trees 404-408 will have the fences installed at the edge of their garden beds, separating the trees from the works.

4.7 **Pruning of Trees** will be limited to a small amount of crown lifting for access to the eastern side of the tree to prevent impacts with branches or foliage being caught in machinery. No vehicles higher that 5m will be able to access the site from gate 5. All works must be completed by the UNSW preferred contractor in accordance with the Australian Standard for the Protection of Trees on Development Sites AS4373.

4.8 **Trees 480 & 481** are located to the south east of the works envelope. The main issue for these trees is that there a coms service is planned to be excavated at 6m to the north of the trees, based on preliminary service drawings. The location of the services is outside of the trees projected structural root zones. The impact to the tree protection zone of each tree is calculated at less than 10%. This level of disturbance is acceptable for this species at this age.

4.9 **Tree Protection Trees 480 & 481** have hardscapes that will remain in place for the duration of the works protecting the rootzone of the trees from compaction and damage. To protect the vascular tissue of the trees a 1.8m chainmesh fence can be installed at the edge of the garden beds. Alternatively, custom made trunk wraps can be installed for trees 480 & 481 by the AQF level 5 site Arborist or under supervision of the AQF level 5 site Arborist if required. Refer to Appendix 4a.

4.10 **Trees 482 & 483** are located to the south of the works envelope. The main issue for these trees is that there are services planned to be excavated at 3m to the north of the trees, based on preliminary service drawings. The location of the services is at the edge of (Tree 483) or within (Tree 482) the trees projected structural root zones. All excavations within 5m of these trees for services will need to be completed by hand for the purpose of retaining roots 50mm+ in diameter for tree stability. Alternatively, the service can be moved further to the north. The impact of the service installation on the trees projected Tree Protection Zone is 30% for tree 482 and 25% for tree 483. This is at the upper limit of what the trees can tolerate and although the species has a high-level tolerance to construction impact. The retention of roots greater than 50mm in diameter by hand excavation will lower the percentage of roots to 15-20% Sympathetic construction methods to reduce the stress on these trees should be considered, trench realignment or directional drilling.

4.11 **Trees 482 & 483** have hardscapes that will remain in place for the duration of the works protecting the rootzone of the trees from compaction and damage. To protect the vascular tissue of the trees a 1.8m chainmesh fence can be installed at the edge of the garden beds. Alternatively, custom made trunk wraps can be installed for trees 480 & 481 by the AQF level 5 site Arborist or under supervision of the AQF level 5 site Arborist if required. Refer to Appendix 4a.

4.12 **Tree 402** is a large and significant standalone tree that is of high value. Unfortunately, this tree was struck by lightning around November 2018 and died and was removed by UNSW maintenance team (refer to UNSW correspondence attached to this report). The tree has been removed and a replacement tree is recommended for the area, the submitted landscape design for this area includes a number of replacement trees to east of the site.

4.13 **Trees 409, 409a, 409b & 410.** This is a stand of four small trees to the north and east of the works site. One tree to the south-east of the group is proposed to be removed (409a). The trees have a moderate retention value and are mostly away from the proposed works. The main concern for these trees is for the installation of services and hardscapes surrounding the trees. At present based on the information provided there are no disturbances within the trees projected structural root zones and a disturbance of less than 10% for the trees projected tree protection zones. Any additional services, level changes or new paving works within the trees projected TPZ need to be calculated by the AQF level 5 Site Arborist when further details are provided.

4.14 **Tree Protection Trees 409, 409b and tree 410.** These trees outside of the works area to the north. If the trees are outside of the hoarding tree protection fencing may not be required. If the trees are exposed to the works or works activities, they will require tree protection measures to be installed to retain the trees in good condition for the duration of the works. It is anticipated that the existing hardscapes in the tree protection zones will remain in place surrounding the trees for the duration of the works protecting the trees root zones, limiting any root disturbance. To protect the trees vascular tissue and rootzones in exposed garden areas,1.8m tree protection fencing will be required to be installed prior to the works commencing. The trees will have the fences installed at the edge of their garden beds or at .5m off the edge of the proposed building to be demolished, separating the trees from the works. Refer to Appendix 4a.

4.15 **Trees 457-464**. These trees form a stand from east to west on the southern edge of Alumni Park. The two trees to the east of the stand are not compatible with the works and are proposed to be removed. The trees proposed to remain should be given adequate room for retention with all disturbances to the crowns and root zones of these trees kept to a minimum. Limited disturbances to the trees crown and root zones are proposed. There are no disturbance proposed to the projected structural root zones of the trees. The infiltration pipes to the North East and north of the trees will need to be reduced to beyond the trees structural root zone to ensure this occurs.

4.16 Site access will be required over the trees root zones at 3.5 to 4m to the north of the trees, impacting upon 20-25% of the trees projected tree protection zones. The installation of a porous no fines concrete road or ground protection will remove the disturbance in this area or reduce it to less than 10%. The porous concrete or ground protection will remain in place for the length of the project and will then be removed. The ground will be aerated, and a root stimulant will be applied to reinvigorate the trees. Additional irrigation will be required in the areas not impacted upon by the temporary road.

4.17 Service installation works to the south of the trees at 4m to the south will impact on 20% of the trees projected tree protection zone. This disturbance is acceptable for this species at this age. It is recomended that the service is moved further south if possible to reduce impacts on the trees. All works will need to be clarified by the AQF level 5 Arborist to assess the impacts on the trees. All existing hardstands and garden areas should remain in place to minimise stress to the trees.

4.18 **Pruning of Trees** will be limited to a small amount of crown lifting for access to the northern side of the tree to prevent impacts with branches or foliage being caught in machinery. No vehicles higher that 5m will be able to access the site from gate 2. All works must be completed by the UNSW preferred contractor in accordance with the Australian Standard for the Protection of Trees on Development Sites AS4373.

4.19 **Tree Protection Trees 457-462.** All of these trees will require tree protection measures to be installed to retain the trees in good condition for the duration of the works. It is anticipated that the existing hardscapes to the south of the trees will remain in place for the duration of the works. Site access to the north of the trees will require ground protection to be installed and maintained within the tree protection zones for the duration of the works, limiting any root disturbance. To protect the trees vascular tissue and rootzones in exposed garden areas,1.8m tree protection fencing will be required to be installed prior to the works commencing. The tree protection fencing will stand on the gutter to the south of the trees and will extend to the edge of the garden bed to the north, the tree protection zones to the west and to .5m off the works to the east. Refer to Appendix 4a.

4.20 **Tree Removals.** To allow the proposed works to proceed trees NR1-NR9, trees 403, 409b, 465-479 and trees 1120-1228 are approved for removal as part of the demolition of the existing building under the separate campus upgrade process subject to an REF and are covered by a separate Arboricultural Impact Assessment. Trees 1119, 463 and 464 are proposed to be removed as part of the SSD works. Tree 1119 is proposed for removal as this tree is at the end of its life. These trees should be replaced within a new landscape plan with appropriately sized specimens capable of thriving in the area that they are proposed to be planted. Requirements of the trees soil volume, canopy space and general biological function and species characteristics should be considered prior to selection for the site.

4.21 **Transplanting Options.** There are several palm trees on the site that are desirable specimens that could be reused on this site or transplanted to another position on the site if deemed appropriate by the UNSW. Tree 403 represents a group of 5 semi mature to mature native palm trees. Trees NR2 and NR3 represent 6-7 semi mature palm trees that have the potential to be reused on site or transplanted to another position on the campus grounds.

5. Recommendations

5.1 After reviewing the site and the information provided by the client, it is noted that within the D14 site area, trees NR1-NR9, trees 403, 409b, 465-479 and trees 1120-1228 are proposed to be removed as part of the approved separate campus upgrade REF works (covered by a separate Arboricultural Impact Assessment). Trees 463, 464 and 1119 are proposed to be removed as part of the SSDA redevelopment works, the subject of this report. These trees should be replaced within a new landscape plan with appropriately sized specimens capable of thriving in the area that they are proposed to be planted. Requirements of the trees soil volume, canopy space and general biological function and species characteristics should be considered prior to selection for the site.

5.2 Trees 404-409, 411, 457-462, and trees 480-483 are proposed to be retained and protected for the duration of the works. The installation of the tree protection measures in section 4 of the report will assist in reducing the disturbance to the trees nominated to be retained. The AQF level 5 site Arborist will need to sign off on the tree protection measures prior to works commencing, (Hold Point).

5.3 All proposed construction works within or at the edge of any structural root zone or the distance from the trunk nominated by the AQF level 5 site Arborist of any tree will need to be supervised and recorded by the AQF level 5 site Arborist, (Hold Point). Permission to sever the roots 100mm within the structural root zone of trees will require written consent from the local council prior to cutting. It is the client's responsibility to arrange site inspections and co-ordinate the works with the AQF level 5 site Arborist.

5.4 Monthly inspections and reporting are required to ensure the trees are adequately protected and the works are being completed in accordance with the scope of works. The reports must be submitted to the UNSW project manager at the end of each month, (Hold Point). At the end of the works period the tree will be inspected by an AQF 5 Arborist to determine if the trees have been maintained adequately. If this is done the compliance certificate will be issued. If trees have been damaged or breaches of the Australian Standards have occurred, the UNSW and council will be contacted for further advice.

5.5 At the end of the works period the temporary service road in Alumni Lawn will need to be removed and the lawn area will need to be aerated. The addition of fertilizer and biological root stimulants will need to be added to the site by the AQF level 5 site Arborist to ensure the trees have the best chance of remaining viable. (Hold Point).

5.6 It is recommended that construction proceeds using the Australian Standard AS4970 2009 Protection of trees on development sites as a basis for tree protection on the site as well as the site-specific instructions listed in section 5 of this report. Additional Tree Protection measures are listed in Appendix 7 of the report to assist in the care of the trees on site.

Please do not hesitate to call ***0422 265 128*** if you have any questions regarding the contents of this report.

Regards

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Disclaimer

All trees have been assessed based on the information and facts of the site and as presented by the client or relevant parties at the time of inspection. No responsibility can be taken for incorrect or misleading information provided by the client or other parties. The nominated tree/s are assessed for biological requirements and hazard potential with reasonable care. The trees are assessed from the ground and by visual means only unless otherwise stated. All tree protection and tree preservation measures are designed to minimise the damage to the tree/s or to reduce the hazard potential of the tree/s. No responsibility can be taken by the author of this report for future damage to structures by the existing trees or planted trees. Trees are inherently dangerous, therefore will always have a hazard potential. Trees fail in ways that are not predictable or fully understood. There is no guarantee expressed or implied that failure or deficiencies may not arise of the subject trees in the future. No responsibility is accepted for damage to property or injury/death caused by the nominated tree/s.

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Appendix 1 ULE Rating

Useful Life Expectancy (ULE): Useful life expectancy refers to an expected period of time the tree can be retained within the landscape before its amenity value declines to a point where it may detract from the appearance of the landscape and/or becomes potentially hazardous to people and/or property. ULE values consider tree species, current age, health, structure and location. ULE values are based on the tree at the time of assessment and do not consider future changes to the tree's location and environment which may influence the ULE value.

Category rating:	Category definition in years:	Category rating:
1	> 40 Years	High
2	15 to 40 Years	Medium
3	10-20 Years	Low
4	0 Years	Dead

Appendix 2 Assessment of Trees

UNSW Tree #	Species	Height (m)	DBH* & DAC**	Canopy Spread (m)	TPZ ***	Health #	Structure #	ULE Rating ****	Landscape Rating +	Stars Rating +	Observations and comments
408	*Ficus macrophylla* Moreton Bay Fig	24	1.82 DAC 1.95	26	15 SRZ 4.4	A	A	1	H	H	A mature and significant tree that is co-dominant forms part of the Fig Tree Lane stand. This tree has a broad crown and extensive root system. A heritage item that requires minimal disturbances to its tree protection zone and crown.
407	*Ficus macrophylla* Moreton Bay Fig	24	2.1 DAC 2.2	26	15 SRZ 4.6	A	A	1	H	H	A mature and significant tree that is co-dominant forms part of the Fig Tree Lane stand. This tree has a broad crown and extensive root system. A heritage item that requires minimal disturbances to its tree protection zone and crown.
406	*Ficus macrophylla* Moreton Bay Fig	24	2.05 DAC 2.15	24	15 SRZ 4.55	A	A	1	H	H	A mature and significant tree that is co-dominant forms part of the Fig Tree Lane stand. This tree has a broad crown and extensive root system. A heritage item that requires minimal disturbances to its tree protection zone and crown.
405	*Ficus macrophylla* Moreton Bay Fig	20	1.57 DAC 1.75	22	15 SRZ 4.2	A	A	1	H	H	A mature and significant tree that is co-dominant forms part of the Fig Tree Lane stand. This tree has a broad crown and extensive root system. A heritage item that requires minimal disturbances to its tree protection zone and crown.
404	*Ficus macrophylla* Moreton Bay Fig	16	1.2 DAC 1.25	16	15 SRZ 3.65	A	A	1	H	H	A mature and significant tree that is co-dominant forms part of the Fig Tree Lane stand. This tree has a broad crown and extensive root system. A heritage item that requires minimal disturbances to its tree protection zone and crown.
411	*Ficus macrophylla* Moreton Bay Fig	16	1.2 DAC 1.4	16	15 SRZ 3.9	A	A	1	H	H	A mature and significant tree that is co-dominant forms part of the Fig Tree Lane stand. This tree has a broad crown and extensive root system. A heritage item that requires minimal disturbances to its tree protection zone and crown.

UNSW Tree #	Species	Height (m)	DBH* & DAC**	Canopy Spread (m)	TPZ ***	Health #	Structure #	ULE Rating ****	Landscape Rating +	Stars Rating +	Observations and comments
410	*Acer negundo* Box Elder	7	.25 DAC .35	6	3 SRZ 2.15	A	Ba	2	L	L	
409	*Acer negundo* Box Elder	9	.25 DAC .35	6	3 SRZ 2.15	A	Ba	2	L	L	
409a	*Acer negundo* Box Elder	10	.35 DAC .45	7	4.25 SRZ 5.5	A	Ba	2	L	L	
409b	*Acer negundo* Box Elder	8	2 x .15 DAC .25	5	3 SRZ 1.85	A	Ba	2	L	L	
403	*Archontophoenix cunninghamiana* Bangalow Palm	10	.25 DAC .35	5	3 SRZ 2	A	A	1	M	M	A group of five trees located in the garden area. Could be retained or transplanted if further than 4m from Tree 402 and no roots from Tree 402 are located near root mass of each Palm.
402	*Eucalyptus grandis* Flooded Gum	19	1.07 DAC 1.2	14	13.25 SRZ 3.6	A	A	1	H	H	A mature and significant tree located close to the existing building and hardscapes. All works within 4m are to be completed by hand for demolition. Proposed works should remain in the existing building footprints with no services, excavations or level changes within 4m of tree disturb less than 20% of trees projected TPZ.
480	*Ficus microcarpa "hillii"* Hills Fig	15	.65 DAC .75	16	8 SRZ 3	A	A	1	H	H	A mature tree that forms part of the quadrangle lawn. Originally four trees intended to be hedged, allowed to mature. Some pavement lifting around trees, SRZ extends into College Walk.
481	*Ficus microcarpa "hillii"* Hills Fig	15	.77 DAC .85	16	8 SRZ 3	A	A	1	H	H	A mature tree that forms part of the quadrangle lawn. Originally four trees intended to be hedged, allowed to mature. Some pavement lifting around trees, SRZ extends into College Walk.
482	*Ficus microcarpa "hillii"* Hills Fig	16	.77 DAC .85	16	9 SRZ 3.2	A	A	1	H	H	SRZ extends into College Walk.
483	*Ficus microcarpa "hillii"* Hills Fig	16	2 x .40 DAC .65	16	8 SRZ 2.75	A	A	1	H	H	SRZ extends into College Walk.

UNSW Tree #	Species	Height (m)	DBH* & DAC**	Canopy Spread (m)	TPZ ***	Health #	Structure #	ULE Rating ****	Landscape Rating +	Stars Rating +	Observations and comments
479	*Eucalyptus microcorys* Tallowood	15	.44 DAC .55	9	5.5 SRZ 2.6	A	A	1	M	M	This trees diameter at breast height will double. This trees root zone extends into College Walk and to the building to the North. Several trees of the same species already removed due to damage.
478	*Eucalyptus microcorys* Tallowood	16	.29 DAC .40	6	3.5 SRZ 2.25	A	A	1	M	M	This trees diameter at breast height will double. This trees root zone extends into College Walk and to the building to the North. Several trees of the same species already removed due to damage.
477	*Eucalyptus microcorys* Tallowood	16	.39 DAC .50	8	5 SRZ 2.5	A	A	1	M	M	This trees diameter at breast height will double. This trees root zone extends into College Walk and to the building to the North. Several trees of the same species already removed due to damage.
476	*Eucalyptus microcorys* Tallowood	16	.35 DAC .45	8	4.2 SRZ 2.35	A	A	1	M	M	This trees diameter at breast height will double. This trees root zone extends into College Walk and to the building to the North. Several trees of the same species already removed due to damage.
475	*Eucalyptus microcorys* Tallowood	16	.35 DAC .45	8	4.2 SRZ 2.35	A	A	1	M	M	This trees diameter at breast height will double. This trees root zone extends into College Walk and to the building to the North. Several trees of the same species already removed due to damage.
474	*Eucalyptus microcorys* Tallowood	16	.35 DAC .45	8	4.2 SRZ 2.35	A	A	1	M	M	This trees diameter at breast height will double. This trees root zone extends into College Walk and to the building to the North. Several trees of the same species already removed due to damage.
473	*Eucalyptus microcorys* Tallowood	17	.45 DAC .55	9	5.5 SRZ 2.6	A	A	1	M	M	This trees diameter at breast height will double. This trees root zone extends into College Walk and to the building to the North. Several trees of the same species already removed due to damage.
472	*Podocarpus elatus* Brown Pine	9	.15 DAC .20	5	2 SRZ 1.5	A	A	1	L	L	Group of two trees with significant growth potential.
471	*Podocarpus elatus* Brown Pine	9	.15 DAC .20	5	2 SRZ 1.5	A	A	1	L	L	Group of two trees with significant growth potential.
470	*Eucalyptus microcorys* Tallowood	17	.35 DAC .45	9	5.5 SRZ 2.6	A	A	1	M	M	This trees diameter at breast height will double. Several trees of the same species already removed due to damage.

UNSW Tree #	Species	Height (m)	DBH* & DAC**	Canopy Spread (m)	TPZ ***	Health #	Structure #	ULE Rating ****	Landscape Rating +	Stars Rating +	Observations and comments
467	*Eucalyptus microcorys* Tallowood	17	.35 DAC .45	9	5.5 SRZ 2.6	A	A	1	M	M	This trees diameter at breast height will double. Several trees of the same species already removed due to damage (465, 468 and 496).
466	*Eucalyptus microcorys* Tallowood	9	.15 DAC .20	5	2 SRZ 1.5	A	A	1	L	L	Group of two trees with significant growth potential.
464	*Eucalyptus microcorys* Tallowood	14	.64 DAC .75	10	7.8 SRZ 3	A	A	1	M	M	Located in the SE corner of Alumni Park.
463	*Eucalyptus microcorys* Tallowood	14	.50 DAC .60	8	6 SRZ 2.7	A	A	1	M	M	Located in the SE corner of Alumni Park.
462	*Eucalyptus microcorys* Tallowood	14	.64 DAC .75	10	7.8 SRZ 3	A	A	1	M	M	Located in the SE corner of Alumni Park.
NR1	*Eucalyptus microcorys* Tallowood	5	.07 DAC .10	3	2 SRZ 1.5	A	A	1	L	L	A stand of three young trees located in the SE corner of Alumni Park. NR = not recorded by UNSW on tree plan.
NR2	*Archontophoenix cunninghamiana* Bangalow Palm	7	.10 DAC .15	3	2 SRZ 1.5	A	A	1	M	M	A group of six palm trees located in lawn area. These trees could be retained or transplanted.
NR3	*Archontophoenix cunninghamiana* Bangalow Palm	7	.10 DAC .15	3	2 SRZ 1.5	A	A	1	M	M	A group of six palm trees located in lawn area. These trees could be retained or transplanted.
NR4	*Arbutus unedo* Irish Strawberry	6	.15, .20 DAC .30	6	3.5 SRZ 2	A	A	2	L	L	
NR5	*Liquidambar styraciflua* Sweet Gum	12	.20 DAC .30	6	2.4 SRZ 2	A	A	1	M	M	
NR6	*Liquidambar styraciflua* Sweet Gum	12	.20 DAC .30	6	2.4 SRZ 2	A	A	1	M	M	
NR7	*Liquidambar styraciflua* Sweet Gum	9	.20 DAC .30	6	2.4 SRZ 2	A	A	1	M	M	
NR8	*Liquidambar styraciflua* Sweet Gum	8	.20 DAC .30	6	2.4 SRZ 2	A	A	1	M	M	
NR9	*Callistemon viminalis* Weeping Bottle Brush	8	4 x .10 DAC .30	6	3.5 SRZ 2	A	A	2	L	L	

UNSW Tree #	Species	Height (m)	DBH* & DAC**	Canopy Spread (m)	TPZ ***	Health #	Structure #	ULE Rating ****	Landscape Rating +	Stars Rating +	Observations and comments
1229	*Syzgium luehmannii* Lily Pily	8	2 x .10 DAC .15	4	2 SRZ 1.5	A	A	1	L	L	
1228	*Arbutus unedo* Irish Strawberry	8	.20 DAC .30	6	2.4 SRZ 2	A	A	2	L	L	
1227	*Arbutus unedo* Irish Strawberry										Dead tree.
1226	*Arbutus unedo* Irish Strawberry	8	2 x 10 DAC .30	6	2.4 SRZ 2	A	A	2	L	L	
1225	*Arbutus unedo* Irish Strawberry	9	2 x 20 DAC .30	6	2.4 SRZ 2	A	A	2	L	L	
1224	*Arbutus unedo* Irish Strawberry	8	3 x 10 DAC .25	6	2.4 SRZ 2	A	A	2	L	L	
1223	*Eucalyptus botryiodes* Bangalow Gum	16	.50 DAC .60	14	6 SRZ 2.7	A	A	1	M	M	
1222	*Eucalyptus botryiodes* Bangalow Gum	7	.20 DAC .30	6	2.4 SRZ 2	A	A	1	M	M	
1221	*Lophostemon confertus* Brush Box	12	.30 DAC .40	8	3.6 SRZ 2.25	A	A	1	M	M	
1220	*Sapium sebiferum* Tallowood	8	2 x .15 DAC .30	6	3.5 SRZ 2	Ba	Ba	2	L	L	
1119	*Acacia decurrens Black Wattle*	14	.40 DAC .50	10	5 SRZ 2.5	Ba	Ba	3	L	L	

Explanatory Notes for Table

- *Dbh = Diameter of trunk at breast height.
- ** DAC = Diameter above the root collar used to measure the Structural Root Zone (SRZ).
- ***TPZ is the recommended TPZ 12x the DBH at 1.4m, SRZ is the trees structural root zone. Refer to AS4970 for details.
- **** ULE Explanation can be found in Appendix 1.
- + IACA Landscape value and S.T.A.R.S Rating system. Refer to Appendix 5
- # Health and Structure values represented above are P = poor, BA = Below Average, A = Average, G = Good

Appendix 3 Images of Trees



Image 1 above left shows the significant stand of trees along fig tree lane which should be retained with minimal disturbance. Image 2 above centre shows trees 1219, 1219a, 1219b & tree 1220. Image 3 above right shows trees 403 in a group and the significant Gum tree 402. Image 4 below left shows trees 480 & 481. Image 5 below left centre shows trees 472-479 from the east. Image 6 below right centre shows trees 470 & 741 from the west. Images 7 & 8 show trees 466 & 467.





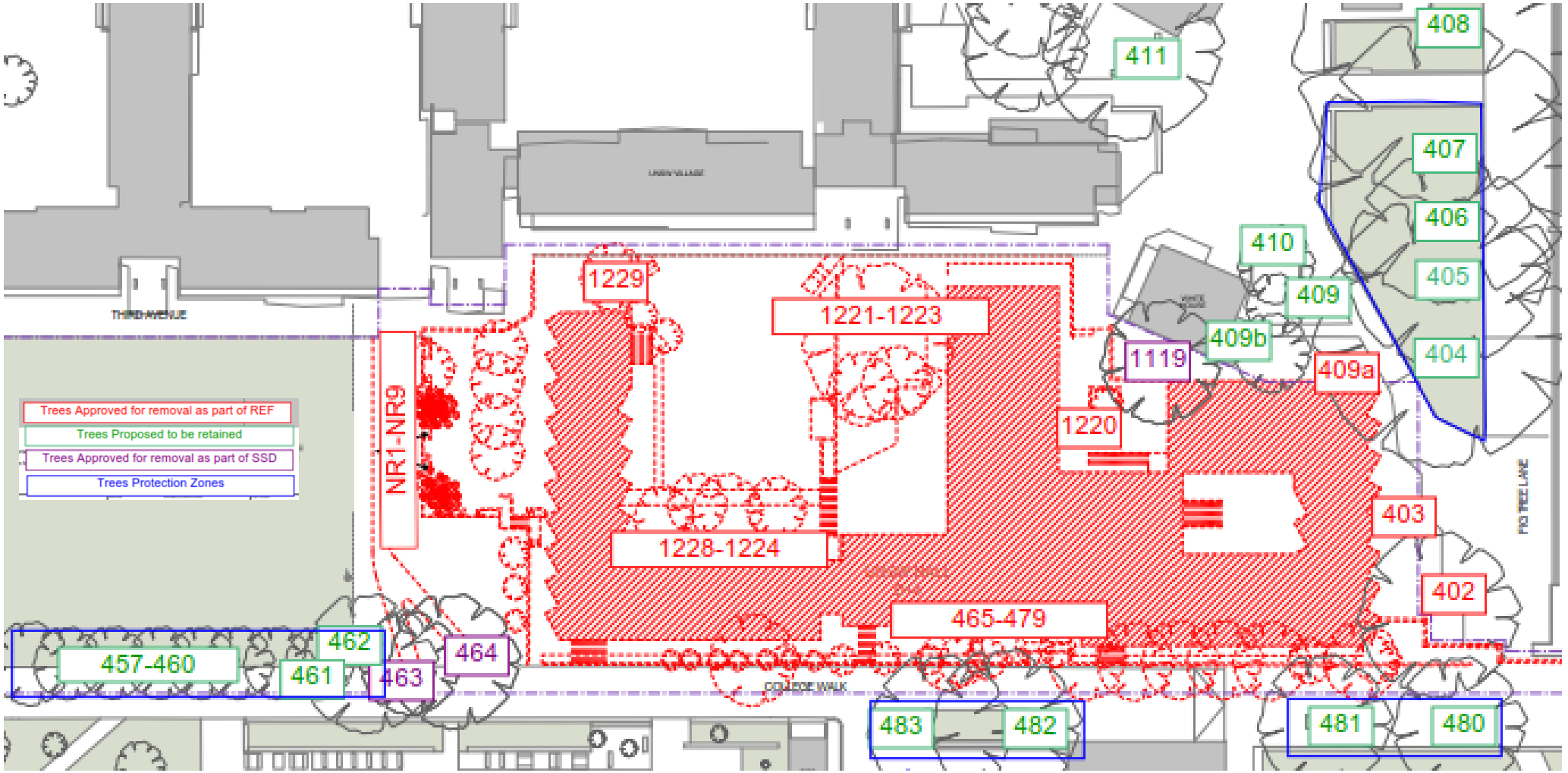


Image 9 above left shows trees 464 to 461. Image 10 above centre NR1 to the SE of Alumni Lawn. Image 11 show the palm tree groups NR2, NR3 and tree NR4 to the west of the existing building. Image 12 shows trees NR5 to NR8 that are to the west of the existing building. Image 13 below left shows tree NR5-NR8. Image 14 shows tree 1229. Image 15 below right shows trees 1224-1228 on the northern side of the existing D14 building.

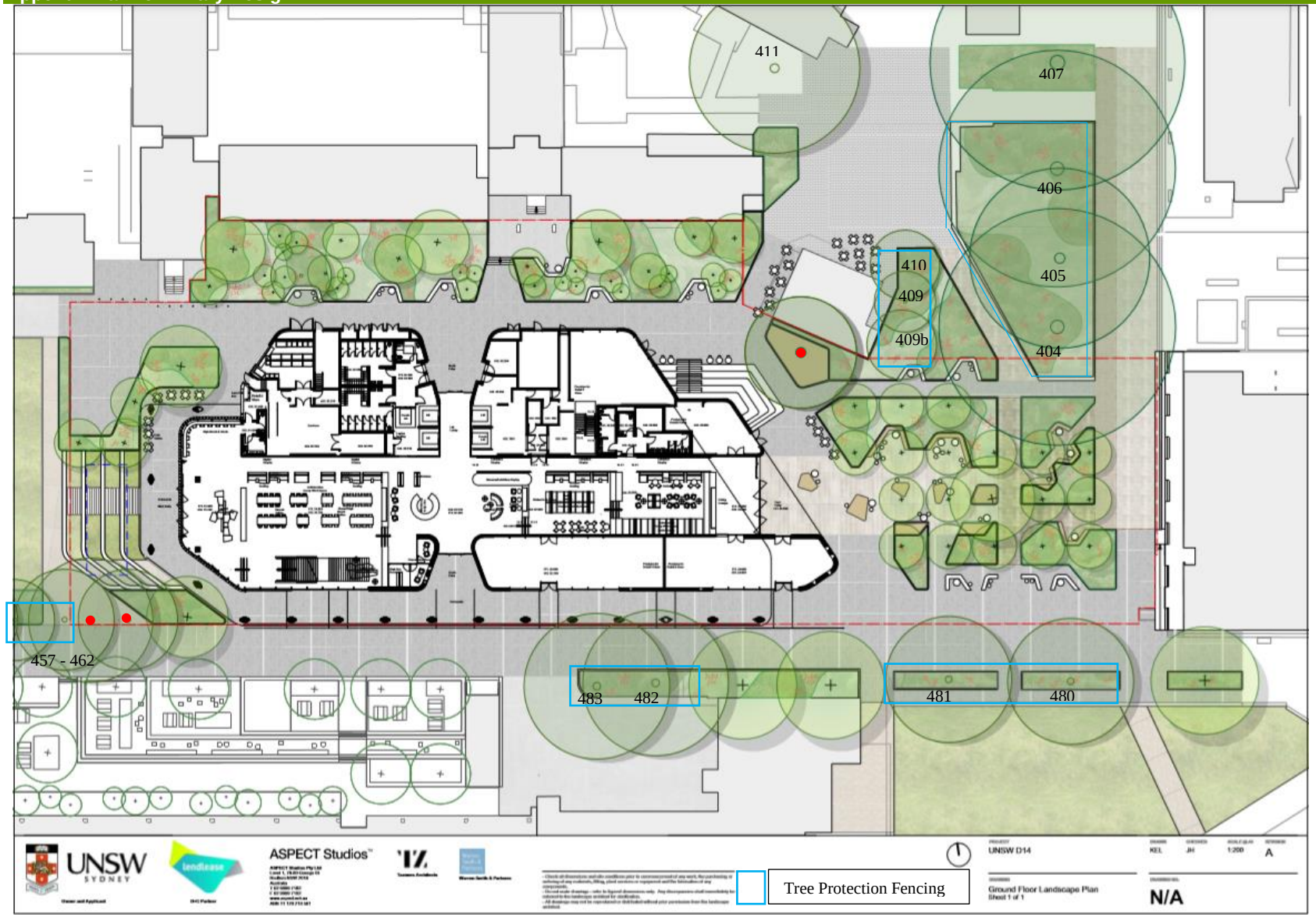



Image 16 shows trees 1221 – 1223. Image 17 shows tree 411 to the north of the proposed works site. This tree should not be disturbed.

Appendix 4 Tree numbers, Site Plan



Appendix 4a Preliminary Design



Appendix 5 Legend for S.T.A.R.S matrix assessment

IACA Significance of a Tree, Assessment Rating System (STARS) ©
(IACA 2010) ©

In the development of this document IACA acknowledges the contribution and original concept of the Footprint Green Tree Significance & Retention Value Matrix, developed by Footprint Green Pty Ltd in June 2001.

The landscape significance of a tree is an essential criterion to establish the importance that a particular tree may have on a site. However, rating the significance of a tree becomes subjective and difficult to ascertain in a consistent and repetitive fashion due to assessor bias. It is therefore necessary to have a rating system utilising structured qualitative criteria to assist in determining the retention value for a tree. To assist this process all definitions for terms used in the *Tree Significance - Assessment Criteria* and *Tree Retention Value - Priority Matrix*, are taken from the IACA Dictionary for Managing Trees in Urban Environments 2009.

This rating system will assist in the planning processes for proposed works, above and below ground where trees are to be retained on or adjacent a development site. The system uses a scale of *High*, *Medium* and *Low* significance in the landscape. Once the landscape significance of an individual tree has been defined, the retention value can be determined.

Tree Significance - Assessment Criteria

1. High Significance in landscape

- The tree is in good condition and good vigour;
- The tree has a form typical for the species;
- The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of substantial age;
- The tree is listed as a Heritage Item, Threatened Species or part of an Endangered ecological community or listed on Councils significant Tree Register;
- The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape due to its size and scale and makes a positive contribution to the local amenity;
- The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values;
- The tree's growth is unrestricted by above and below ground influences, supporting its ability to reach dimensions typical for the taxa *in situ* - tree is appropriate to the site conditions.

2. Medium Significance in landscape

- The tree is in fair-good condition and good or low vigour;
- The tree has form typical or atypical of the species;
- The tree is a planted locally indigenous or a common species with its taxa commonly planted in the local area
- The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street,
- The tree provides a fair contribution to the visual character and amenity of the local area,
- The tree's growth is moderately restricted by above or below ground influences, reducing its ability to reach dimensions typical for the taxa *in situ*.

3. Low Significance in landscape

- The tree is in fair-poor condition and good or low vigour;
- The tree has form atypical of the species;
- The tree is not visible or is partly visible from surrounding properties as obstructed by other vegetation or buildings,
- The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area,
- The tree is a young specimen which may or may not have reached dimension to be protected by local Tree Preservation orders or similar protection mechanisms and can easily be replaced with a suitable specimen,
- The tree's growth is severely restricted by above or below ground influences, unlikely to reach dimensions typical for the taxa *in situ* - tree is inappropriate to the site conditions,
- The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms,
- The tree has a wound or defect that has potential to become structurally unsound.

Environmental Pest / Noxious Weed Species

- The tree is an Environmental Pest Species due to its invasiveness or poisonous/ allergenic properties,
- The tree is a declared noxious weed by legislation.

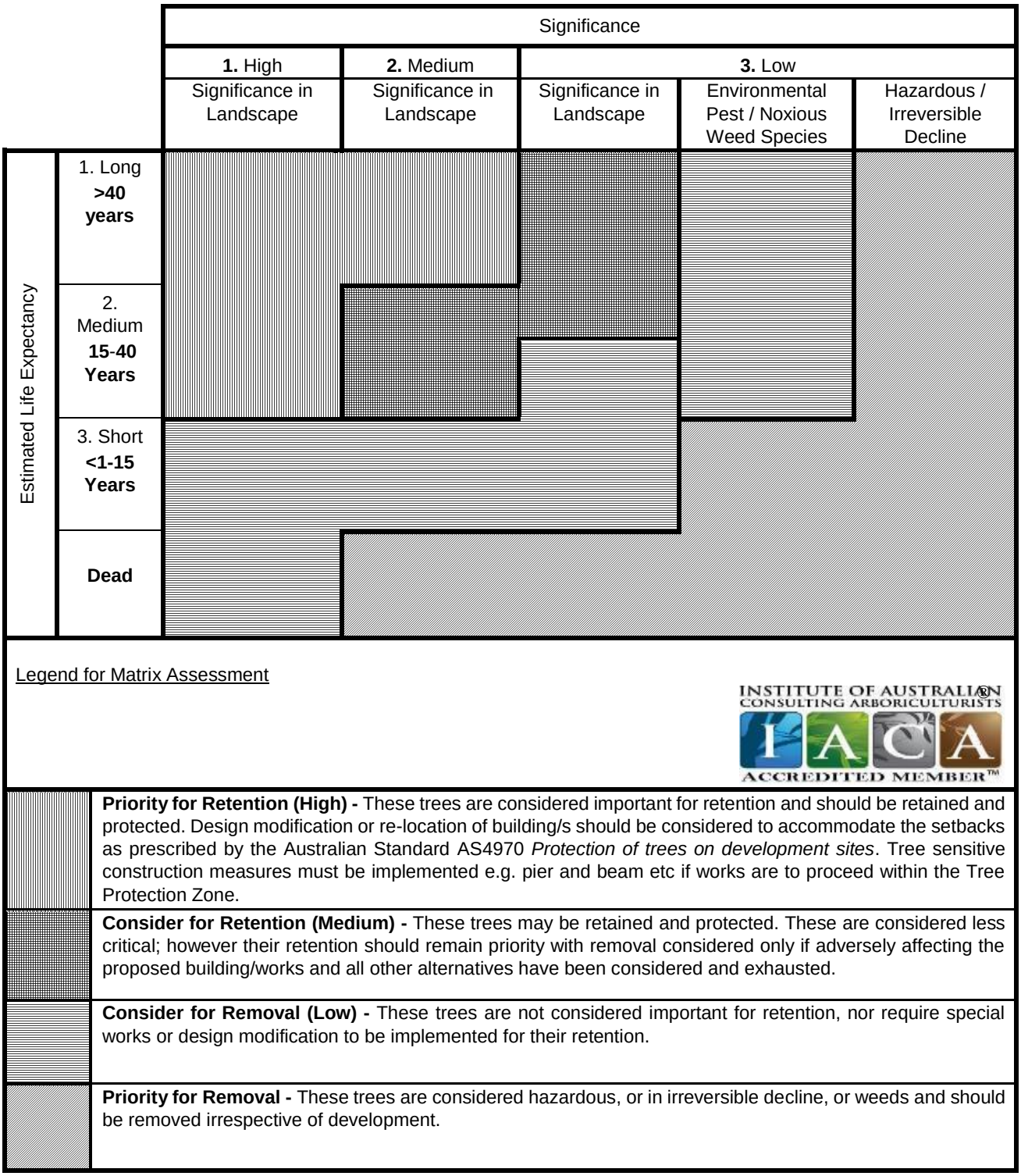
Hazardous/Irreversible Decline

- The tree is structurally unsound and/or unstable and is considered potentially dangerous,
- The tree is dead, or is in irreversible decline, or has the potential to fail or collapse in full or part in the immediate to short term.

The tree is to have a minimum of three (3) criteria in a category to be classified in that group.

Note: The assessment criteria are for individual trees only, however, can be applied to a monocultural stand in its entirety e.g. hedge.

Table 1.0 Tree Retention Value - Priority Matrix.



Legend for Matrix Assessment

	Priority for Retention (High) - These trees are considered important for retention and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the setbacks as prescribed by the Australian Standard AS4970 *Protection of trees on development sites*. Tree sensitive construction measures must be implemented e.g. pier and beam etc if works are to proceed within the Tree Protection Zone.
	Consider for Retention (Medium) - These trees may be retained and protected. These are considered less critical; however their retention should remain priority with removal considered only if adversely affecting the proposed building/works and all other alternatives have been considered and exhausted.
	Consider for Removal (Low) - These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.
	Priority for Removal - These trees are considered hazardous, or in irreversible decline, or weeds and should be removed irrespective of development.

REFERENCES

Australia ICOMOS Inc. 1999, *The Burra Charter – The Australian ICOMOS Charter for Places of Cultural Significance*, International Council of Monuments and Sites, www.icomos.org/australia

Draper BD and Richards PA 2009, *Dictionary for Managing Trees in Urban Environments*, Institute of Australian Consulting Arboriculturists (IACA), CSIRO Publishing, Collingwood, Victoria, Australia.

Footprint Green Pty Ltd 2001, *Footprint Green Tree Significance & Retention Value Matrix*, Avalon, NSW Australia, www.footprintgreen.com.au

Appendix 6 References

Australia ICOMOS Inc. 1999, *The Burra Charter – The Australian ICOMOS Charter for Places of Cultural Significance*, International Council of Monuments and Sites, www.icomos.org/australia

Draper BD and Richards PA 2009, *Dictionary for Managing Trees in Urban Environments*, Institute of Australian Consulting Arboriculturists (IACA), CSIRO Publishing, Collingwood, Victoria, Australia.

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Standards Australia (2009), Protection of Trees on Development Sites AS4970.

Standards Australia (2007), Pruning of Amenity Trees AS4373.

Hadlington, P. & Johnston, J. (1988). *Australian Trees: Their Care & Repair. University of NSW Press, Kensington*

Lonsdale, D. (1999). *Principles of Tree Hazard Assessment & Management.* Forestry Commission, The Stationery Office, London

Mattheck, C. & Breloer, H. (1994). *The Body Language of Trees.* Research for Amenity Trees No.4. The Stationery Office, London

Appendix 7 Glossary of Terms

Abiotic	Nonliving
Anthracnose	a fungal disease causing dead areas on the leaves, buds, stems.
Arboriculture	The science and art of caring for trees, shrubs and other woody plants in landscape settings.
Barrier Zone	Protective boundary formed in new wood in response to wounding or other injury.
Biotic	Alive, pertaining to living organisms.
Branch attachment	The structural union of a lateral branch.
Callus	Undifferentiated tissue produced in response to wounding.
Canker	A dead spot or necrotic lesion that is caused by a bark inhabiting organism/pathogen.
Cavity	an open wound characterized by the presence of decay resulting in a hollow.
Collar	the ring of tissue that surrounds the lateral branch at its point of attachment.
Compartmentalization	A physiological process that creates the chemical and physical boundaries that act to limit the spread of disease and decay organisms.
Compression wood	A type of reaction wood that forms on the underside of branches which tends to maintain a branch angle of growth.
Crown	The above ground parts of the tree, including the trunk.
DBH	The diameter of a trees trunk measured at 1.4m.
Decay	Process of degradation of woody tissues by fungi and bacteria through the decomposition of cellulose and lignin.
Decline	Progressive decrease in health of organs or the entire plant usually caused by a series of interacting factors.
Drip line	The width of the crown, as measured by the lateral extent of the foliage.
Epicormic shoot	a shoot that arises from latent or adventitious buds that occur on stems, branches or the bases of trees.
Included bark	Pattern of development at branch junctions where bark is turned inward, rather than pushed out; contrast with the branch nark ridge.
Mortality Spiral	The sequence of events describing a change in the trees health from vigorous to declining to death.
Photosynthesis	The transformation in the presence of chlorophyll and light, of carbon dioxide from (the air) and water (primarily from soil) into a simple carbohydrate and oxygen.
Pruning	systematic removal of branches of a plant usually a woody perennial.
Reaction wood	Specialized secondary xylem that develops in response to a lean or similar mechanical stress to restore the stem to vertical.
Taper	The change in diameter over the length of trunks and branches. Important to mechanical support.
Tension wood	A type of reaction wood that trees form on the upper side of branches and stems and roots.
VTA	Visual Tree Assessment is a method of evaluating structural defects and stability in trees.
Wound	Any injury that induces a compartmentalization response.

Appendix 8, The Ents Tree Consultancy Tree Protection Guidelines

Definitions

A. **Tree Protection Zone (TPZ),** The TPZ is divided into 2 areas. 1 The Structural Root Zone delineated by an area nominated in table section 4 of the report and is assumed to contain most structural roots. The Tree Protection Zone that is twelve times the diameter of the tree trunk which is used to gauge the amount of feeder roots. No machinery works are permitted in these areas unless specified in this report or without written approval from the Council or the Arborist employed for this job site.

B. **Qualified Arborist**, for supervision of works and reports level 5. For carrying out tree works level 3 Levels are as recognised by the Australian training framework.

Standards, AS4970 2009, Protection of Trees on development sites. AS 4373: 1996, The pruning of amenity trees.

Tree Protection Generally

1. Prior to works commencing erect a 1800mm chain mesh fence to protect the trees trunk at 12x Dbh or as specified in this report. The Tree Protection Zones as nominated should be marked with line marking paint and observed as an area free from machinery for the duration of the works unless stated otherwise in the accompanying report. Do not remove, alter or relocate without the approval of the Council or the Arborist employed for this site.

2. Trees to be protected in the works contract are items entrusted to the Contractor /owner by the Council for carrying out the work under the Contract. The Contractor/owner has obligations to protect these trees as part of the care of the work in the contract conditions.

3. Prior to commencing work on Site confirm with the Council all trees to be protected for the duration of the Works. Confirm also all access and haulage routes, storage areas, tree protection measures and work procedures. Ensure that the protection measures are in place prior to commencing work.

4. Use suitably qualified Arborist (level 5) to supervise earthworks or activities within the Structural Root Zone of tree, Do not severe roots 50mm or greater, which may cause damage to or affect the health of trees. Pruning of trees by the contractor is not permitted. If pruning works are required a suitably qualified (Minimum level 3) arborist will complete all works in the crown. All root pruning must be completed and documented by the level 5 site arborist.

5. Ensure construction trailers, vehicles and equipment do not come in contact with any tree at any time. Do not locate storage areas within the nominated Tree Protection Zone. Do not deposit or store materials, spoil, contaminants, and waste or washout water within Tree Protection Zones.

6. Take all reasonable precautions to protect trees to be retained on site from damage and decline, maintaining their health during the Contract. Implement recognised best practice industry standards to satisfy horticultural requirements for tree care.

7. Assess and monitor water stress in relation to trees on site. This is of particular importance if earthworks have occurred. Apply sufficient water to the trees on site as required to keep the trees healthy. Immediately report to the Council and site arborist, any trees on site that are injured, damaged or are in decline.

NOTE: Failure to comply with any part of these tree protection guidelines or the Australian standard AS4970 or AS4373 will result in the party breaching the Tree Protection Guidelines taking responsibility for all associated consequences.

Appendix 9 Curriculum Vitae

Education and Qualifications

- Undergraduate in Arboriculture Melbourne University (2018-present) AQF Level 8.
- Arboriculture Australia 3 Day Tree Anatomy Workshop 2015
- QTRA basic certificate 2014, QTRA Advanced Certificate 2016
- TRAQ Qualification 2014
- 2005 Diploma of Arboriculture (AQF Cert 5), Ryde TAFE. Distinction Pass.
- Barrell Tree Care Workshop- Trees on Construction Sites (Brisbane 2005)
- Tree Logic seminar- Urban Tree Risk Management (Sydney 2005)
- Tree Pathology and Wood Decay Seminar Sydney (2004)
- Excelsior Training Claus Mattheck (Sydney 2001)
- 2000 Tree Climbing Course (AQF Cert 2), Ryde TAFE.
- 1999 Advanced Certificate in Urban Horticulture, (AQF Cert 4), Ryde TAFE. Distinction Pass.
- 1995 Greenkeepers Trade Certificate (AQF 3) Ryde TAFE. Credit Pass.
- 1991 Higher School Certificate.

Professional Membership Accreditation

- **Institute of Australian Consulting Arborists ACM 0482014**
- **Arboriculture Australia Member number 2527**

Presentation of Scientific Papers

- **Managing Mature Trees NAAA (Sydney 2000), Presented a Paper "Habitat Value of Mature Trees"**

Industry Experience

- **2004 to Date, Sole Trader, The Ents Tree Consultancy.** Writing of tree reports for development applications, master plans, hazard evaluations, tree management plans and expert witness reports. Hazard assessments, tree surveys and consultations. Clients include The Royal Botanic Gardens Sydney, UNSW Master Planning Works including SIRF building, Tyree Building, DP sports field redevelopment, Sydney University Mays Green Precinct, Taronga Zoo Coastline Precinct, Capital Insight, Campbelltown Hospital Redevelopment, Parramatta Park Trust multiple jobs, Woollahra Council multiple jobs and many other jobs.
- **2003 to 2008, Arborist University of New South Wales**. Survey all trees on site, developed a Tree Management Database. Minimise hazard potential of all trees on site through evaluation and works. Generate and prioritise works and tree assessment-based areas usage, tree conditions and staff required. Development of UNSW Tree Protection Guidelines for master planning works. Acting Supervisor December 2006 to May 2007.
- **2003 Tree management Officer Randwick Council**. Liaise with public to explain and enforce the councils Tree Preservation order. Management of internal staff and contractors. Project management and co-ordination of street tree planting and maintenance.
- **1999 to 2003 Animal Food Production Manager and Arborist.** Management of Koala Food Plantation, Management of animal food supply registry for herbivores/omnivores. Coordination of staff contractors and volunteers. Maintain and manage tree management database, complete tree works within zoo grounds and at zoo owned plantations. Acting supervisor 6-month period 2002 for grounds department and asset management trade team.