Arboricultural Impact Assessment

Ryde Hospital

Prepared for

Health Infrastructure NSW

(Contact: Dimitra Rousounidou, TSA Projects)

Prepared by

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12th April 2022

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Secretary's Environmental Assessment Requirements (SEARs)

This Arboricultural Impact Assessment (AIA) report supports a State Significant Development Application (SSDA) for the proposed Ryde Hospital Redevelopment (Concept & Stage 1 Early Works). The Ryde Hospital Redevelopment is being delivered by Health Infrastructure and the Northern Sydney Local Health District (NSLHD), on behalf of the NSW Government.

The Ryde Hospital site is located at 1 Denistone Road, Denistone and comprises Lots 10-11 DP 1183279 and Lots A-B DP 323458. It has an area of approximately 7.69Ha and currently accommodates the existing Ryde Hospital campus.

This report accompanies a State Significant Development Application that seeks approval for the establishment of a maximum building envelope and gross floor area for the future new hospital buildings and physical Stage 1 Early Works to prepare the site for the future development. For a detailed project description refer to the Environmental Impact Statement prepared by Ethos Urban.

Item	SEARS Requirement	Relevant Section of Report
7.	Assess the number, location, condition and significance of trees to be removed and retained and note any existing canopy coverage to be retained on-site.	3.2 Tree location plan 4.2 Tree assessment schedule 5.4 Encroachment & impacts 5.5 Urban forest canopy

Acknowledgement

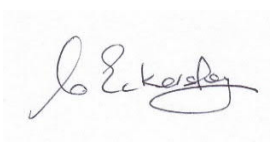
ArborViews recognises the land, upon which the subject trees of this report are growing, is the Traditional Land of the Wallumedegal People of the Eora Nation, and that sovereignty of the First Peoples of Australia has never been ceded. ArborViews respects the Traditional Custodians and acknowledges their ancient and evolving culture, and their ongoing living relationship with Country. ArborViews pays respect to their Elders – past, present, and emerging – and to their cultural knowledge-holders.

Disclaimer

This report is to be read and considered in its entirety. Visual Tree Assessment (VTA) methodology has been used to form the basis of the report. No aerial inspection, internal analysis or below ground root inspection has been undertaken. The assessment and recommendations are based on the current situation. Trees are living, dynamic entities and circumstances can change. The duty of care by owners of trees requires an ongoing appropriate level of professional inspection and assessment. All recommendations contained in the report should be implemented.

Declaration

We confirm we are the authors of this report and that we are appropriately qualified and have the relevant experience necessary to prepare this report. We acknowledge our professional duty to provide impartial and objective opinions and recommendations free from undue influence and confirm we have fulfilled this duty.



Ian McKenzie
12th April 2022

Charmian Eckersley
12th April 2022

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1 Summary

The NSW Government has provided Health Infrastructure NSW funds to redevelop Ryde Hospital and provide a state-of-the-art medical facility for the surrounding community. The existing facilities are housed in a disparate group of detached buildings that have developed independently over the years as needs arose. Many of the existing buildings will be demolished to accommodate a new single, multi-storey hospital to provide emergency care, critical care, medicine and surgery, community and outpatient services, and a multi-level car park to service the hospital.

Well kempt gardens and trees grow between the existing buildings providing a pleasant outdoor environment that appears well-used by staff and visitors.

ArborViews Australia has been engaged to undertake an Arboricultural Impact Assessment (AIA) of the trees within the proposed development zone.

Eighty-seven trees within or immediately adjacent to the development zone were identified as satisfying City of Ryde's criteria for protected trees and were assessed for this report. Of these 87 assessed trees, 27 have high Tree Retention Value (TRV), 49 have moderate TRV and 11 have low or very low TRV.

At least 33 trees will be removed to facilitate Stage 1 works. Up to fourteen trees in the early works area may be able to be retained depending on the impact their retention will have upon the individual works being undertaken during Stage 1.

The Blue Gum High Forest in the southern portion of the site provides a significant contribution to the urban forest canopy resulting in about 50% canopy over the whole site. This will be reduced by approximately 2% with the removal of the 33 trees that need to be removed. The canopy over the actual hospital campus will decrease from the current level of around 14% by about 5% by the removal of the 33 trees in Stage 1. New tree planting will compensate for the removal of the trees but will take at least 10 to 15 years to return to the current canopy level.

Final design is progressing within the maximum envelopes that have been identified for the hospital building and the multi-level car park. Further assessment of any high or moderate retention value trees that are within the maximum envelopes but outside the final building footprints should be undertaken following finalisation of design.

It is recommended that trees are removed progressively throughout the site preparation works rather than removing the relevant trees all at once. This will help sustain urban canopy and the benefits it provides for longer. It is also recommended that the trees which will be planted later in the project are ordered when the landscape plan is confirmed, allowing them to grow larger by the time they are planted on site.

Appointment of a project arborist and preparation of a Tree Protection Plan and Specifications will be necessary to ensure the appropriate protection of trees being retained, as recommended in the Australian Standard *Protection of Trees on Development Sites* AS 4970—2009.

2 Introduction

2.1 Précis

An estimated 30,000 more residents are anticipated to move into the suburbs surrounding Ryde Hospital over the next decade and the NSW Government has committed to redeveloping Ryde Hospital into a state-of-the-art facility to accommodate the expanded population.

The redevelopment will feature expanded and improved emergency, critical care, medicine and surgery, community and ambulatory care (outpatient) services. It will also preserve the historic Denistone House, retain the rehabilitation services at Graythwaite and make best use of the current services already available at Ryde.

Minimising the loss of canopy across the site and ensuring sufficient new tree planting to replace lost canopy as quickly as practical are fundamental to delivering a high quality medical facility where the importance of green infrastructure in a modern hospital setting is appropriately reflected.

2.2 Disclaimer

This report is to be read and considered in its entirety. Visual Tree Assessment (VTA) methodology has been used to form the basis of the report. No aerial inspection, internal analysis or below ground root inspection has been undertaken. The assessment and recommendations are based on the current situation. Trees are living, dynamic entities and circumstances can change. The duty of care by owners of trees requires an ongoing appropriate level of professional inspection and assessment. All recommendations contained in the report should be implemented.

2.3 Brief

The goal of the report is to assess trees within and adjacent to the Development Zone for the Ryde Hospital Redevelopment and to provide an Arboricultural Impact Assessment (AIA) report. Each tree will be located on a tree location plan, described in terms of its dimensions and physical features, assessed for useful life expectancy (ULE) and landscape significance, and designated a tree retention value. Indicative Tree Protection Zones (TPZ) shall be calculated for each tree and overlaid on drawings to ascertain conflicts with the proposed development, thus identifying which trees can be retained and which trees will need to be removed.

The report will be used to identify unacceptable impacts upon the subject trees from the proposed works and to mitigate the impacts and protect the trees during the works.

It will form part of the documentation submitted with the State Significant Development Application for the Ryde Hospital Redevelopment (Concept and Stage 1 Early Works).

2.4 Methodology

ArborViews visited the site on the 9th, 10th and 11th March 2022 and assessed 87 trees within and immediately adjacent to the nominated Development Zone, shaded blue in Figure 1.

Figure 1 Trees within and adjacent to the nominated Development Zone were assessed.

Trees were defined in accordance with City of Ryde Development Control Plan 2014 (DCP), (Part 9.5, Section 1.4 & Part 10). That is, a tree is a woody plant at least 5 metres in height or having a trunk circumference of 450 mm. Species included in the exempt species list in the City of Ryde DCP 2014 and species listed as weeds in the Ryde local government area were excluded and not assessed.

ArborViews is providing a tree assessment schedule with tree number, species, trunk diameter at breast height (DBH), tree retention value and indicative Tree Protection Zone (TPZ and Structural Root Zone (SRZ) dimensions.

The location of trees is shown in the Tree Location Plan (Section 3.2 and Appendix 1).

Data was collected for each tree and recorded using Trimble® Terraflex™. The trees were assessed in accordance Visual Tree Assessment (VTA) methodology as described by Mattheck & Breloer (1994, pp. 145-6). The following data was collected for each subject tree:

- Tree species
- Trunk diameters at breast height (DBH) and above the buttress (DAB)
- Tree height
- Crown spread
- Age classification
- Health and vitality
- Structure and form
- Useful life expectancy (ULE)
- Wildlife significance
- Landscape significance

Tree risk assessment was undertaken at Level 1 – limited visual assessment (Smiley et.al., 2017) using Quantified Tree Risk Assessment (QTRA) methodology (QTRA, 2020).

Habitat value was considered and attributed a rating on a scale of very high, high, moderate and low.

Tree retention value was determined by combining ULE, which incorporated tree risk, with the landscape significance of the tree including its habitat value.

Tree Protection Zone (TPZ) and Structural Root Zone (SRZ) dimensions were calculated using the formulas from the Australian Standard *Protection of Trees on Development Sites* AS 4970—2009 and plotted on a site plan to show potential encroachment by the proposed development.

The resulting impacts were assessed and any unacceptable impact on the stability or ongoing viability were identified. Where necessary, measures to mitigate negative impacts were recommended.

No aerial inspection, internal analysis, tissue analysis or soil testing has been undertaken.

3 Site Details

3.1 Site description

Ryde Hospital is in Denistone, 14 kilometres north-west of the Sydney CBD. The hospital campus is bounded by Denistone Road, Florence Avenue, Ryedale Road and Fourth Avenue, along with three private medical practices, two private residences and the NSW Ambulance station. There is also approximately three and a half hectares of Endangered Ecological Community (EEC) Blue Gum High Forest to the south of the hospital campus, within the 7.7 hectares of land owned by Ryde Hospital.

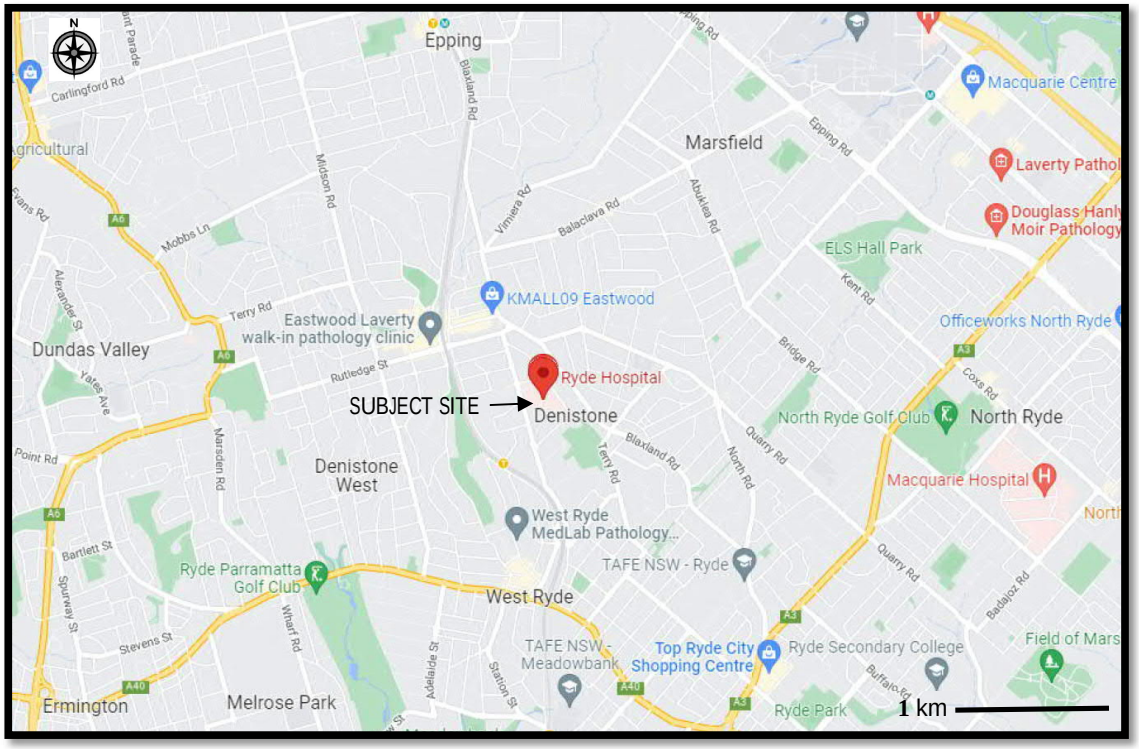


Figure 2 Locality plan. Ryde Hospital is in the suburb of Denistone and is bounded by Denistone Road, Florence Avenue, Ryedale Road and Fourth Avenue.

The Development Zone is approximately 3.1 hectares and incorporates the majority of the built area. Within the hospital campus, only Denistone House, The Stables, the Graythwaite Rehab Centre and the Mental Health Service building are excluded from the Development Zone. The Development Zone extends from Ryedale Road on the western side to Denistone road on its eastern side.

Existing canopy coverage of the hospital campus is estimated to be about 14%. This compares with the City of Ryde which currently has 32.9% canopy cover having declined from 39.8% in 2013. However the Blue Gum High Forest area provides 100% canopy lifting the average canopy cover for the entire Ryde Hospital site to about 50%.

Figure 3 Aerial image showing Ryde Hospital Campus, including the Blue Gum High Forest in the south, outlined by the orange line. The Development Zone is indicated by the broken yellow line.

Figure 4 This *Eucalyptus saligna* (Sydney blue gum), Tree 86, is the 'Grandmother Tree', which purportedly has Indigenous cultural significance.

3.2 Tree location plan

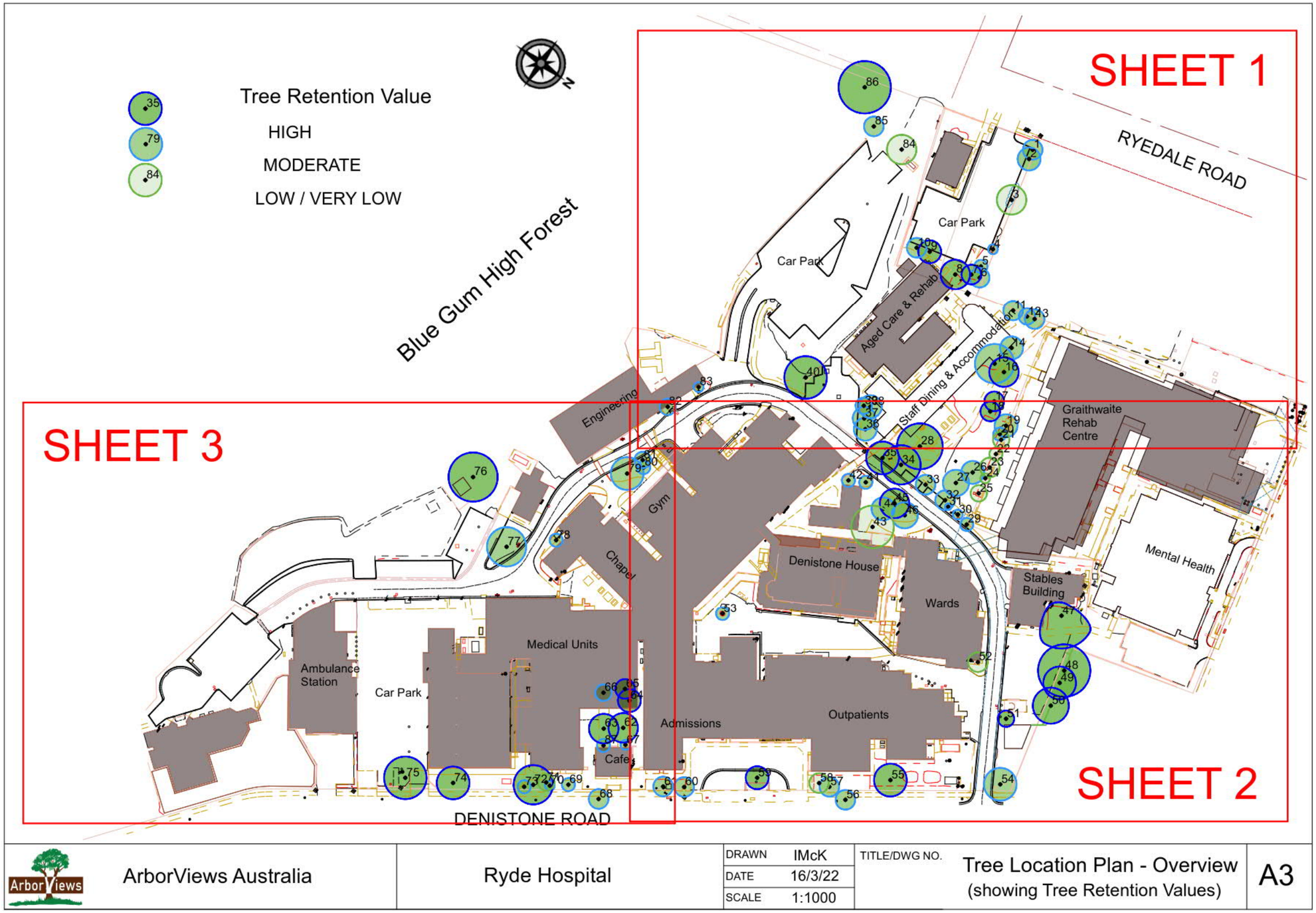
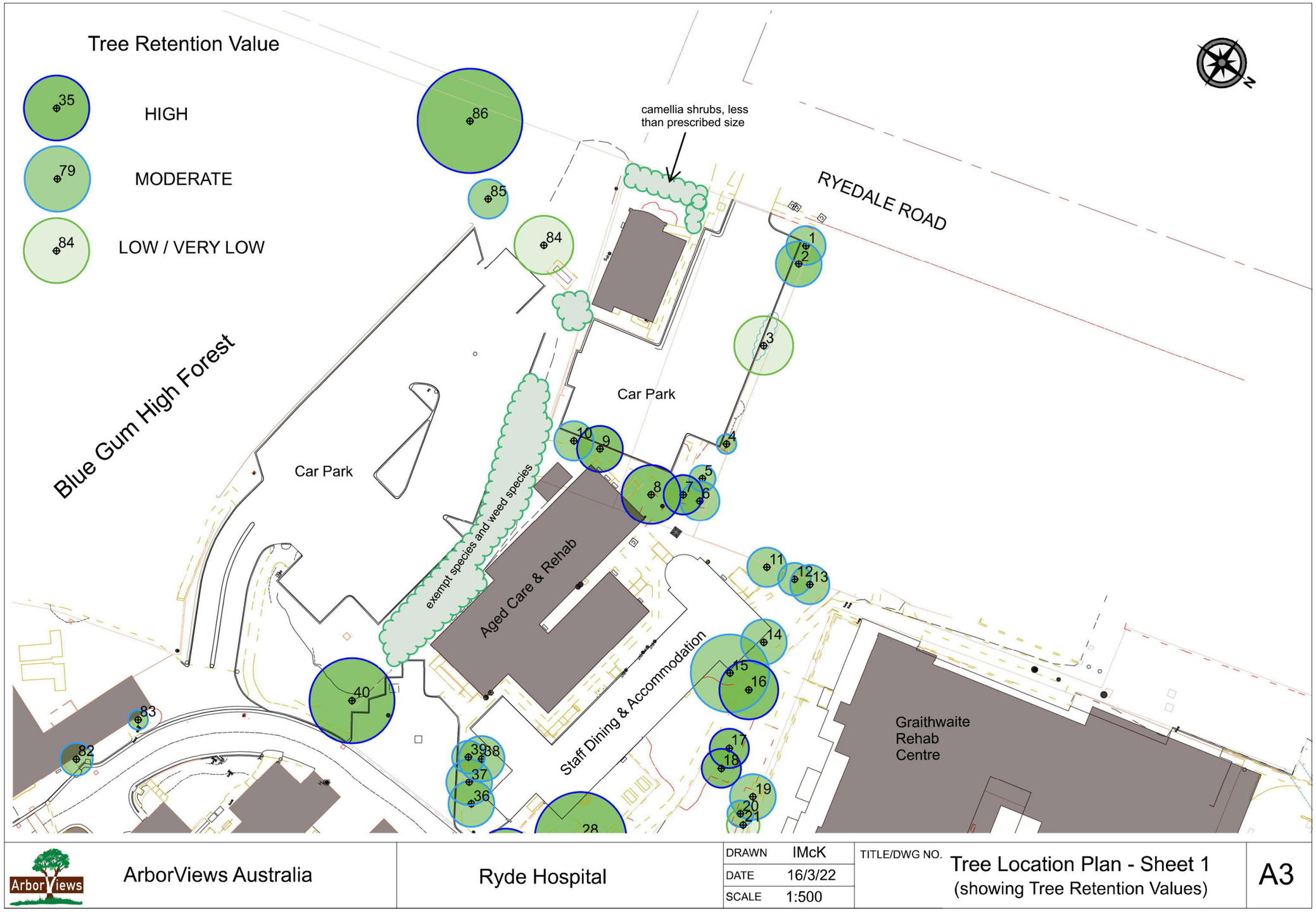


Figure 5 Overview of tree location plan showing trees' locations and their tree retention values (TRV).



ArborViews Australia	Ryde Hospital	DRAWN	IMcK	TITLE/DWG NO. Tree Location Plan - Sheet 1 (showing Tree Retention Values)	A3
		DATE	16/3/22		
		SCALE	1:500		

Figure 6 Sheet 1 of tree location plan showing trees' locations and their tree retention values (TRV).

Figure 7 Sheet 2 of tree location plan showing trees' locations and their tree retention values (TRV).

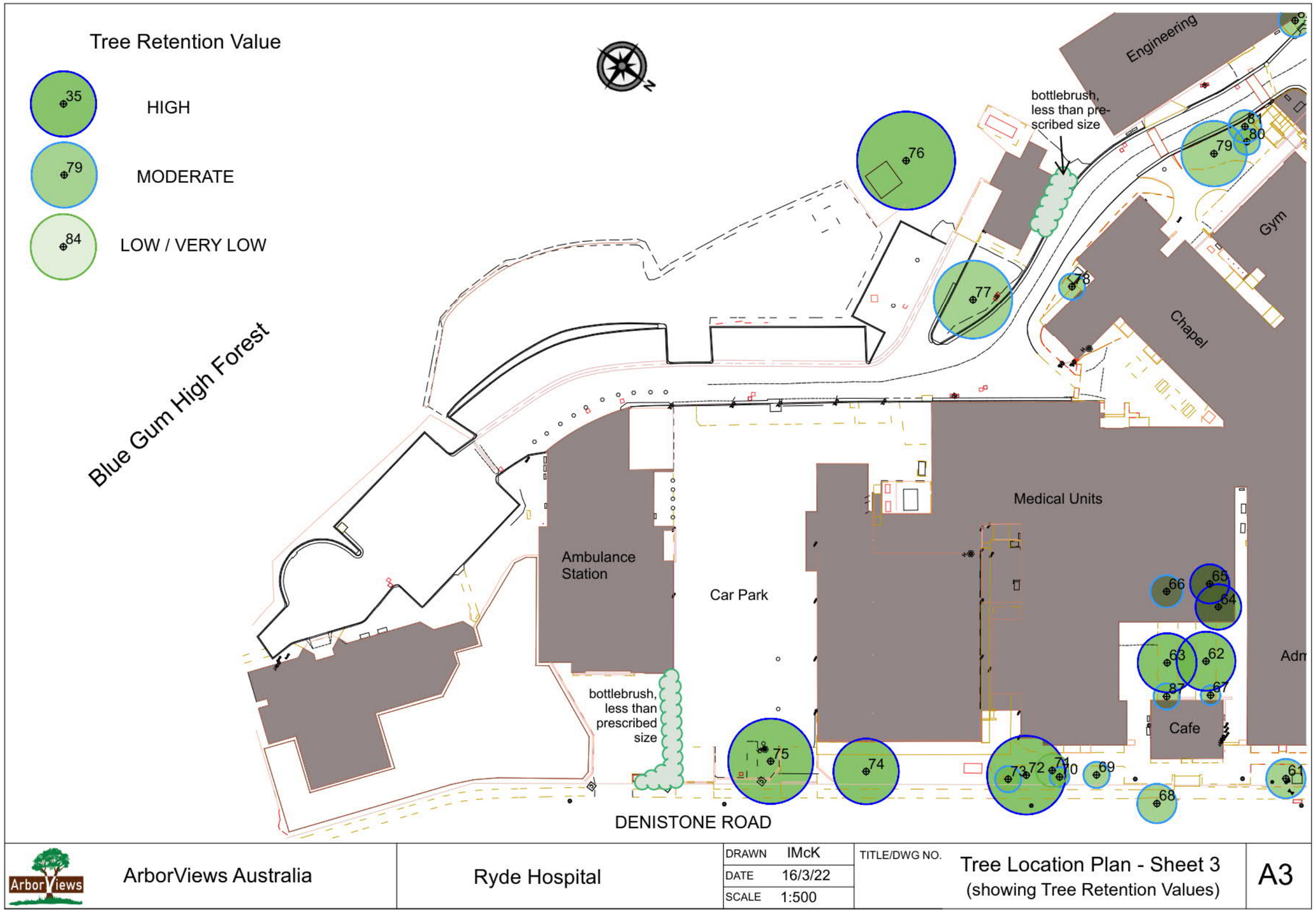


Figure 8 Sheet 3 of tree location plan showing trees' locations and their tree retention values (TRV).

4 Arboricultural Assessment

4.1 Tree assessment

The Ryde Development Control Plan 2014 (DCP) and the related Tree Management Technical Manual (2016) provide relevant guidance with respect to the assessment of trees on development sites in the City of Ryde local government area.

The Ryde Tree Management Technical Manual requires that retention values are determined for all trees prescribed under the DCP located within the subject site and trees on adjoining land and street trees that may be impacted by the proposed development. Trees categorised as having high retention value are a priority for retention. Trees categorised as moderate should be considered for retention. Trees that have low or very low retention value are not considered a constraint to development but nonetheless should be retained where the proposed development is not constrained by their retention.

Tree assessment first describes a tree – its location, species, common name and dimensions.

Secondly, the sustainability of a tree in its location is assessed. Age, health, vitality, structural condition, form, suitability to the site and growing conditions, and risk are considered in determining the useful life expectancy (ULE) of the tree. Assessment of a tree's ULE considers the factors that affect the likely period that the tree will be retained. This includes its natural life expectancy modified by risk and conflict with infrastructure. ULE is an assessment of the tree's current situation and can change with circumstances, prolonged life expectancy with improved growing conditions or shortened life expectancy due to future impacts or change of use of its surrounding environs. ULE is categorised as one of the following – greater than 40 years, 15 to 40 years, 5 to 15 years, or less than 5 years.

Thirdly, the tree's significance in the landscape is assessed. Environmental, social and cultural factors are considered. Size, suitability of location, visual prominence, ecological importance, amenity the tree provides, Indigenous cultural significance, and heritage value affect the tree's landscape significance. The wildlife value of native trees in particular has particular bearing on landscape significance. Trees contribute habitat and food for birds, mammals, reptiles, amphibians and invertebrates. The likely benefit to wildlife is assessed and considered in determining landscape significance. There are numerous signs of arboreal mammals using the subject trees. In particular, the bottlebrush, Callery pears, cypress pines and palms provide good food and/or habitat. Landscape significance is rated as one of seven categories – significant, very high, high, moderate, low, very low or insignificant.

Sustainability of a tree is combined with its landscape significance to determine its tree retention value. Tree retention value is important in the development context because it guides what effort and other resources should be given to retaining and protecting a tree or when it may be preferable to permit tree removal and compensatory tree planting.

A more detailed overview of tree assessment is provided in Appendix 2. Newcastle City Council (NCC) provides a detailed explanation and methodology for determining tree retention value in its Urban Forest Technical Manual (2018). The methodology has been adapted from other similar methodologies.

Table 1 Matrix to determine tree retention value (TRV)

	Landscape Significance Rating						
Useful Life Expectancy (ULE)	**1** significant	**2** very high	**3** high	**4** moderate	**5** low	**6** very low	**7** insignificant
greater than 40 years	High Retention Value						
15 to 40 years			Moderate				
5 to 15 years					Low		
less than 5 years						Very Low	

Eighty-seven trees were assessed, of which:

- 27 trees have high retention value,
- 49 trees have moderate retention value,
- 10 trees have low retention value, and
- one tree has very low retention value.

Many weed species (*NSW Weedwise*) and exempt species (Ryde DCP) on the site that were not assessed have very low retention value. Species not assessed include *Cinnamomum camphora* (camphor laurel), *Cotoneaster* sp. (cotoneaster), *Ligustrum lucidum* (privet), *Ligustrum sinense* (privet), *Schefflera actinophylla* (umbrella tree), *Senna pendula* var. *glabrata* (cassia) and *Tecoma stans* (yellow bell).

Ryde DCP 2014 defines a tree as being at least 5 metres in height or having a stem circumference of at least 450 mm in diameter at 1.4 metres above the ground. Trees less than the prescribed size were not assessed. These include a group of *Camellia japonica* (camellia) at the front of Camellia Cottage, a row of grevilleas and bottlebrush adjacent to the ambulance station and several other bottlebrushes scattered around the site.

Tree assessment data for the subject trees is provided in the Tree Assessment Schedule at Section 4.2 of this report.

Tree retention values are indicated on the Tree Location Plan in 3.2 and Appendix 1. of this report.

Photos of trees assessed as being high and moderate TRV are included in Appendix 5.

4.2 Tree assessment schedule

Table 2 Tree assessment schedule

tree no.	species & (common name)	height	DBH	DAB	avg crown spread	age class	health	vitality	structure	form	habitat value	ULE (years)	landscape significance	tree retention value	notes
1	Cupressus sempervirens (Mediterranean cypress)	7	20	27	6	mature	good	normal	good	typical	low	> 40	moderate	moderate	
2	Jacaranda mimosifolia (jacaranda)	7	36	40	7	mature	good	normal	good	typical	moderate	> 40	moderate	moderate	Wound on trunk at 2m. Vine growing up trunk.
3	Lagerstroemia indica (crepe myrtle)	11	42	40	9	mature	poor	low	fair	typical, codominant trunk	low	5 - 15	moderate	low	2 suckers 13 cm diameter at base. Deadwood up to 150mm. Decaying into stems. Termite tracks on deadwood. Three large dead stems. Pathogen affected.
4	Jacaranda mimosifolia (jacaranda)	6	11	20	3	young	good	normal	good	failed or damaged leading stem replaced by epicormic growth.	low	> 40	low	moderate	Wisteria vine on trunk.
5	Melaleuca quinquenervia (broad-leaved paperbark)	7	18	22	4	mature	good	normal	good	typical, codominant trunk, Codominant at 1.6m.	moderate	> 40	moderate	moderate	
6	Melia azedarach (white cedar)	10	30	36	6	mature	good	normal	fair	codominant trunk, included bark, To dominant at 2m.	moderate	15 - 40	moderate	moderate	
7	Melaleuca quinquenervia (broad-leaved paperbark)	12	43	50	6	mature	good	normal	good	typical	high	> 40	high	high	
8	Melaleuca quinquenervia (broad-leaved paperbark)	13	60	75	9	mature	good	normal	good	typical, codominant trunk, Trunk divides into 4 stems at 2m.	high	> 40	high	high	

tree no.	species & (common name)	height	DBH	DAB	avg crown spread	age class	health	vitality	structure	form	habitat value	ULE (years)	landscape significance	tree retention value	notes
9	Casuarina cunninghamiana (river oak)	13	28	36	7	mature	good	normal	good	typical	moderate	> 40	high	high	
10	Cupressus sempervirens (Mediterranean cypress)	10	35	50	6	mature	good	normal	good	typical, crown raised	low	> 40	moderate	moderate	
11	Callistemon viminalis (bottlebrush)	7	26	28	6	mature	good	normal	good	typical	moderate	15 - 40	moderate	moderate	
12	Callistemon viminalis (bottlebrush)	7	15	19	5	mature	good	normal	good	asymmetric, suppressed, bowed, 35˚ lean.	moderate	15 - 40	moderate	moderate	
13	Callistemon viminalis (bottlebrush)	7	20	23	6	mature	good	normal	good	asymmetric, suppressed, bowed, 30˚ lean.	moderate	15 - 40	moderate	moderate	
14	Plumeria acutifolia (frangipani)	6	23	35	7	mature	good	normal	fair	typical, codominant trunk, Codominant at base.	low	15 - 40	moderate	moderate	
15	Melia azedarach (white cedar)	13	54	65	12	mature	good	normal	fair	straight lean, codominant trunk, 20 deg lean to NE. Codominant at base.	moderate	15 - 40	high	moderate	Overextended lateral branch and codominant with included bark.
16	Brachychiton acerifolius (Illawarra flame tree)	11	30	39	9	mature	good	normal	good	typical, crown raised	moderate	> 40	high	high	
17	Corymbia maculata (spotted gum)	16	27	30	7	mature	good	normal	good	typical	high	> 40	high	high	
18	Corymbia maculata (spotted gum)	17	27	34	6	mature	good	normal	good	typical	high	> 40	high	high	Multiple mammal scratches on trunk.

tree no.	species & (common name)	height	DBH	DAB	avg crown spread	age class	health	vitality	structure	form	habitat value	ULE (years)	landscape significance	tree retention value	notes
19	Pyrus calleryana (Callery pear)	8	20	30	7	mature	good	normal	good	typical	moderate	15 - 40	moderate	moderate	Offers shade for people having lunch.
20	Callistemon salignus (willow bottlebrush)	8	20	28	4	mature	good	normal	fair	codominant trunk, Codominant at base	high	15 - 40	moderate	moderate	
21	Pyrus calleryana (Callery pear)	8	20	46	5	mature	good	normal	fair	codominant trunk, Stump regrowth.	high	5 - 15	moderate	low	Mammal scratches on trunk. Possums eating fruit on all Pyrus calleryana.
22	Pyrus calleryana (Callery pear)	6	20	43	4	mature	good	normal	fair	codominant trunk, Stump regrowth.	moderate	5 - 15	moderate	low	Mammal scratches on trunk.
23	Pyrus calleryana (Callery pear)	8	25	32	6	mature	good	normal	fair	codominant trunk, Stump regrowth.	moderate	5 - 15	moderate	low	
24	Acacia sp. (wattle)	5	8	11	3	young	good	normal	good	typical	low	5 - 15	low	low	No flowers or seed pods available to confirm species.
25	Acacia sp. (wattle)	7	13	15	5	young	good	normal	fair	self-corrected lean, Windthrown	low	5 - 15	low	low	No flowers or seed pods available to confirm species.
26	Syncarpia glomulifera (turpentine)	9	19	26	7	mature	good	normal	good	typical	moderate	> 40	moderate	moderate	
27	Corymbia maculata (spotted gum)	17	26	41	8	mature	good	normal	fair	Codominant trunk at 0.5m with included bark & swelling.	high	15 - 40	high	moderate	Multiple Mammal scratches on trunk.
28	Grevillea robusta (silky oak)	24	85	110	14	mature	good	normal	good	Crown raised from building to S.	high	> 40	high	high	

tree no.	species & (common name)	height	DBH	DAB	avg crown spread	age class	health	vitality	structure	form	habitat value	ULE (years)	landscape significance	tree retention value	notes
29	Pyrus calleryana (Callery pear)	9	17	21	4	mature	good	normal	good	typical	moderate	15 - 40	moderate	moderate	
30	Pyrus calleryana (Callery pear)	7	15	18	3	mature	good	normal	good	typical	moderate	15 - 40	moderate	moderate	
31	Pyrus calleryana (Callery pear)	7	13	17	2	mature	good	normal	good	typical, straight lean, 10˚ NW	moderate	15 - 40	moderate	moderate	
32	Jacaranda mimosifolia (jacaranda)	8	18	32	6	mature	good	normal	fair	codominant trunk, Possibly two trees, or stump regrowth.	low	15 - 40	moderate	moderate	
33	Pyrus calleryana (Callery pear)	7	26	33	6	mature	good	normal	fair	codominant trunk, Stump regrowth.	moderate	15 - 40	moderate	moderate	
34	Jacaranda mimosifolia (jacaranda)	13	64	75	12	mature	good	normal	fair	asymmetric, Extended branch from codominant union over carport space and road.	moderate	> 40	high	high	Decay in codominant branch union at 0.5m.
35	Brachychiton acerifolius (Illawarra flame tree)	12	55	72	10	mature	good	normal	good	typical	moderate	> 40	high	high	
36	Callistemon viminalis (bottlebrush)	6	26	44	7	mature	good	normal	fair	codominant trunk	moderate	15 - 40	moderate	moderate	
37	Callistemon viminalis (bottlebrush)	6.5	26	35	7	mature	good	normal	fair	codominant trunk, Codominant at base.	moderate	15 - 40	moderate	moderate	
38	Callistemon viminalis (bottlebrush)	6.5	29	43	7	mature	good	normal	fair	typical, codominant trunk, Codominant at base.	moderate	15 - 40	moderate	moderate	

tree no.	species & (common name)	height	DBH	DAB	avg crown spread	age class	health	vitality	structure	form	habitat value	ULE (years)	landscape significance	tree retention value	notes
39	Callistemon viminalis (bottlebrush)	6.5	18	21	5	mature	good	normal	fair	suppressed, bowed	moderate	15 - 40	moderate	moderate	
40	Pinus radiata (radiata pine)	16	88	93	13	mature	good	normal	good	typical	moderate	> 40	high	high	
41	Archontophoenix alexandrae (Alexandra palm)	10	22	30	4	mature	good	normal	good	typical	moderate	> 40	moderate	moderate	Mammal scratches on trunk.
42	Archontophoenix alexandrae (Alexandra palm)	10	24	31	4	mature	good	normal	good	typical	moderate	> 40	moderate	moderate	
43	Lophostemon confertus (brush box)	13	53	65	13	senescing	poor	low	good	typical	low	5 - 15	moderate	low	40% deadwood in canopy. Virus affecting leaves.
44	Livistona chinensis (Chinese fan palm)	7	30	44	7	mature	good	normal	good	typical	moderate	> 40	moderate	moderate	
45	Cupressus sempervirens (Mediterranean cypress)	18	76	89	9	mature	good	normal	good	typical	moderate	> 40	high	high	
46	Syagrus romanzoffiana (cocos palm)	13	33	35	8	mature	good	normal	good	typical	moderate	> 40	moderate	moderate	
47	Jacaranda mimosifolia (jacaranda)	13	64	72	15	mature	good	normal	fair	self-corrected lean, 30° lean to E.	moderate	> 40	very high	high	Heritage cartilage. Leans away from heritage building (stables) to the NE. Old pruning wound near base of trunk.
48	Eucalyptus saligna (Sydney blue gum)	28	70	80	16	mature	good	normal	good	typical	high	> 40	very high	high	Neighbour's tree. Diameters estimated.

tree no.	species & (common name)	height	DBH	DAB	avg crown spread	age class	health	vitality	structure	form	habitat value	ULE (years)	landscape significance	tree retention value	notes
49	Toona ciliata (Australian red cedar)	9	30	35	10	mature	good	normal	good	typical	high	> 40	high	high	Neighbour's tree.
50	Eucalyptus botryoides (bangalay)	21	40	45	11	mature	good	normal	good	self-corrected lean	high	> 40	high	high	Species ID not confirmed. Sample leaves & fruit inaccessible. Stringybark. Bark not retained. Discolourous leaves. Neighbour's tree.
51	Cupressus sempervirens (Mediterranean cypress)	13	80	88	5	mature	good	normal	good	crown raised, Low LCR	moderate	> 40	high	high	Live crown ratio 50%.
52	Plumeria acutifolia (frangipani)	6	27	32	6	mature	good	normal	good	typical, self-corrected lean, codominant trunk	low	15 - 40	low	low	
53	Butia capitata (wine palm)	7.5	38	46	4	mature	good	normal	good	typical	moderate	> 40	moderate	moderate	
54	Cupressus sempervirens (Mediterranean cypress)	12	120	115	10	mature	good	normal	poor	codominant trunk, Codominant with open split between stems	moderate	15 - 40	high	moderate	Heritage curtilage tree.
55	Corymbia maculata (spotted gum)	22	66	84	10	mature	good	normal	good	typical	high	> 40	high	high	
56	Lagerstroemia indica (crepe myrtle)	5	45	56	6	mature	good	normal	fair	typical, codominant trunk	moderate	15 - 40	moderate	moderate	Street tree
57	Prunus persica (peach)	5	28	35	6	mature	good	normal	good	typical	low	15 - 40	moderate	moderate	
58	Robinia pseudoacacia (golden robinia)	10	42	48	6	senescing	fair	low	fair	codominant trunk, included bark, Dead stubs at union.	low	< 5	moderate	very low	30% deadwood.

tree no.	species & (common name)	height	DBH	DAB	avg crown spread	age class	health	vitality	structure	form	habitat value	ULE (years)	landscape significance	tree retention value	notes
59	Araucaria columnaris (Cook pine)	18	67	83	7	mature	good	normal	good	typical	moderate	> 40	very high	high	
60	Cupressus sempervirens (Mediterranean cypress)	11	74	64	6	mature	good	normal	good	typical	moderate	> 40	moderate	moderate	
61	Callistemon viminalis (bottlebrush)	9	40	45	6	mature	good	normal	good	typical	moderate	15 - 40	high	moderate	
62	Phoenix canariensis (Canary Island date palm)	14	75	97	9	mature	good	normal	good	typical	high	> 40	very high	high	
63	Phoenix canariensis (Canary Island date palm)	14	75	100	9	mature	good	normal	good	typical	high	> 40	very high	high	Diameters estimated. Trunk covered in ivy - constraint to inspection. Action: remove ivy.
64	Phoenix canariensis (Canary Island date palm)	11	62	92	7	mature	good	normal	good	typical	moderate	> 40	high	high	Internal courtyard
65	Butia capitata (wine palm)	7	37	45	6	mature	good	normal	good	typical	moderate	> 40	high	high	Internal courtyard
66	Butia capitata (wine palm)	9	39	48	5	mature	poor	low	good	typical	moderate	5 - 15	high	moderate	In decline. Fronds showing dieback. Internal courtyard.
67	Livistona chinensis (Chinese fan palm)	5	22	31	3	mature	good	normal	good	typical	low	> 40	low	moderate	Leans 15 degrees to E.
68	Lagerstroemia indica (crepe myrtle)	7	48	60	6	mature	good	normal	fair	typical, codominant trunk	high	15 - 40	moderate	moderate	Street tree. Multiple mammal scratches on trunk.

tree no.	species & (common name)	height	DBH	DAB	avg crown spread	age class	health	vitality	structure	form	habitat value	ULE (years)	landscape significance	tree retention value	notes
69	Plumeria acutifolia (frangipani)	5	25	25	4	mature	good	normal	fair	typical, codominant trunk	low	15 - 40	moderate	moderate	Leans 20˚ towards the footpath.
70	Banksia integrifolia (coast banksia)	3	18	24	3	mature	good	normal	fair	typical, asymmetric, suppressed, bowed, Leans 25 degrees towards footpath.	moderate	> 40	moderate	moderate	
71	Cupressus sempervirens (Mediterranean cypress)	6	34	37	5	mature	good	normal	fair	typical, codominant trunk, included bark	moderate	15 - 40	low	low	
72	Cupressus funebris (Chinese weeping cypress)	14	73	80	12	mature	good	normal	good	typical	moderate	> 40	high	high	Pruned from powerline.
73	Cupressus sempervirens (Mediterranean cypress)	12	23	26	4	mature	good	normal	good	typical	low	> 40	moderate	moderate	Pruned from pathway.
74	Lophostemon confertus (brush box)	13	64	80	10	mature	good	normal	fair	typical, Pruned from powerlines and building.	moderate	> 40	high	high	Soil build-up around base. Poorly pruned. Basal wound on trunk. Codominant with included bark at 1.5m.
75	Syncarpia glomulifera (turpentine)	14	89	95	13	mature	good	normal	fair	codominant trunk, crown raised, Pruned from driveway.	high	> 40	very high	high	Vehicular damage to branch over access road. Could remove branch over access road.
76	Corymbia citriodora (lemon-scented gum)	21	89	95	15	mature	good	normal	fair	codominant trunk	high	> 40	very high	high	Identical DBH & DAB for Trees 75 & 76 is not an error.
77	Cupressus sempervirens (Mediterranean cypress)	13	121	121	12	mature	good	normal	fair	codominant trunk	moderate	15 - 40	moderate	moderate	DBH & DAB at 0.5m
78	Cyathea australis (tree fern)	5	12	19	4	mature	good	normal	good	typical	low	> 40	moderate	moderate	Can be transplanted.

tree no.	species & (common name)	height	DBH	DAB	avg crown spread	age class	health	vitality	structure	form	habitat value	ULE (years)	landscape significance	tree retention value	notes
79	Callistemon viminalis (bottlebrush)	11	56	66	10	mature	good	normal	fair	typical, codominant trunk	moderate	15 - 40	high	moderate	
80	Macrozamia johnsonii (macrozamia)	2	34	49	4	mature	good	normal	good	typical	low	> 40	moderate	moderate	Can be transplanted.
81	Banksia serrata (old man banksia)	6	20	25	5	mature	good	normal	good	typical, self-corrected lean, Bend in trunk at 1m then straight lean.	moderate	> 40	moderate	moderate	
82	Callistemon viminalis (bottlebrush)	6	20	40	5	mature	good	normal	good	typical, codominant trunk	moderate	15 - 40	moderate	moderate	Epicormic shoots from base
83	Macrozamia johnsonii (macrozamia)	1.6	45	30	3	mature	good	normal	good	typical	moderate	> 40	low	moderate	Can be transplanted.
84	Acacia saligna (golden wreath wattle)	7	36	45	9	mature	good	normal	fair	typical, codominant trunk	moderate	5 - 15	low	low	
85	Eucalyptus saligna (Sydney blue gum)	8	25	30	6	young	good	normal	good	typical	moderate	> 40	moderate	moderate	
86	Eucalyptus saligna (Sydney blue gum)	21	125	148	16	mature	good	normal	good	typical	high	> 40	significant	high	Grandmother tree. Purportedly has Indigenous cultural significance.
87	Archontophoenix alexandrae (Alexandra palm)	13	25	36	4	mature	good	normal	good	typical	high	> 40	moderate	moderate	Multiple Mammal scratches on trunk.

4.3 Species

There was a high diversity of species in the trees assessed. The 87 subject trees comprised 35 species, with mostly only one or two specimens from each species. There were up to about ten trees of each of *Callistemon viminalis* (bottlebrush), *Cupressus sempervirens* (cypress pine) and ten *Pyrus calleryana* (callery pear). About half the species were Australian native with only a handful native to the local area.

4.4 Tree risk assessment

Whilst not the primary objective of this tree assessment, risk was assessed as a matter of course, and incorporated into assessment of ULE. Quantified Tree Risk Assessment (QTRA) methodology was used to assess risk. A summary of the risk assessment methodology is included as Appendix 3.

Eighty-six of the 87 subject trees were assessed as having a less than one in a million risk of harm (ROH). Less than one in a million RoH is considered to be as low as reasonably practical and is generally acceptable.

Tree 54, a *Cupressus sempervirens*, near Entrance No. 2 from Denistone Road, was assessed as having on 1:4,000 RoH, which sits within the yellow QTRA risk assessment threshold. A risk within this threshold is generally not considered tolerable.

The 1:4,000 RoH was determined by considering three criteria – target range, size of the tree or branch, and the probability of failure. Tree 54 is a large, old, multi-stemmed conifer. One of the stems has partially failed resulting in a split down into the codominant union of the main trunk. If the stem fails totally, the most likely result is that it will fall across the internal hospital road.

Vehicles entering and leaving the hospital via this entrance were assessed as the most exposed target. It was estimated that between 48 and 470 vehicles per day would use this section of road. This is QTRA target Range 3. The size of the stem that would fall is greater than 450 mm diameter earning Size Range 1 categorisation. The last criterion is the probability of failure (PoF) within a 12-month time frame, which was estimated to be within the PoF Range 3, which is between a 1:10 and 1:100 probability that the stem will fail within the next year.

Tree 54 was assessed as having a moderate tree retention value, which warrants consideration being given to its retention. Tree 54 can be retained and the risk can be mitigated to an acceptable level by pruning the southern stem to reduce the load on the split trunk and remove the part of the tree that may fail. The area of the trunk where the split is located would not be removed and decay may develop in future years. However, this would not require more frequent assessment for the foreseeable future.

Figure 9 Tree 54 is adjacent to Entrance No. 2 from Denistone Road.

Figure 10 The trunk has a split that increases the likelihood of stem failure.

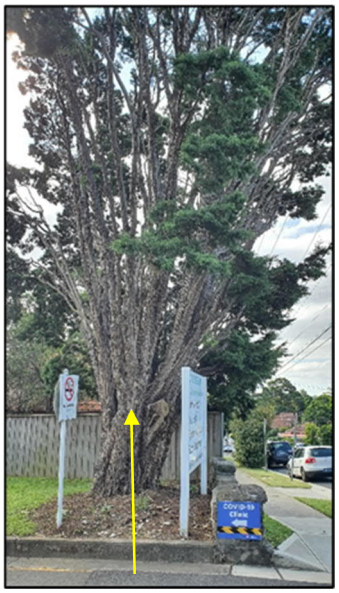


Figure 11 The stem likely to fail overhangs the entrance road.

Figure 12 Pruning the branch as indicated above will reduce the load on the spilt and remove the branch that could fail and impact a target.

5 Development Impact Assessment

5.1 Protection of trees on development sites

Trees are valuable assets in urban areas generally and especially so in hospitals where research has shown that the presence of trees in hospital grounds improves patients' recovery time, reduces the need for pain medication and reduces the likelihood of postsurgical complications (Scientific American, 2012).

The Draft Greener Places Design Guide was prepared by the NSW State Government Architect in response to the Premier's Priority of *Greening our City*. It explains the value and benefits of green infrastructure and provides guidance for the State and local government, along with industry, to provide appropriate green infrastructure across the urban landscape. The Design Guide proposes an urban tree canopy target of 40% for the Greater Sydney Regions and outlines strategies that relate to achieving this canopy target, including establishing minimum urban tree canopy targets for state significant projects.

The development proposal zone currently has about 14% canopy of which the moderate and high retention value trees provide about 12%. However, if the protected Blue Gum High Forest is included in the calculation, the existing canopy is about 50%. Retention of exiting trees, where possible, is the most effective way of sustaining tree canopy on the site. Trees that are retained must be adequately protected throughout the development to ensure their useful safe expectancy (ULE) and retention value are not negatively impacted.

The Australian Standard *Protection of Trees on Development Sites* AS 4970—2009 provides guidance for the protection of trees that are identified in the development application and assessment process as needing to be retained. Trees need to be protected below ground as well as above ground. Protecting roots is fundamental to the effective preservation of trees on a development site. Most tree roots are in the top half metre of soil and grow laterally rather than downward. The roots have two main functions. They provide anchorage and stability for the tree as well as taking up water, oxygen and nutrients that keep the tree alive and healthy. Various activities common in land development may cause damage to roots, or to the above ground parts of trees, subsequently affecting the health and/or safety of trees thereby diminishing the value of these important assets.

5.2 Tree Protection Zone (TPZ) *& Structural Root Zone* (SRZ)

The management and protection of a tree during development will affect its future. A well-managed tree can withstand impacts from development with little or no effect. If a tree is poorly managed, its ongoing viability and even its stability may be negatively impacted and its useful life expectancy (ULE) significantly reduced.

The Australian Standard *Protection of Trees on Development Sites* AS 4970—2009 recommends that an area around a tree is isolated from development-related activities and is managed so that any impact upon the tree is mitigated. This area is the Tree

Protection Zone (TPZ) and is generally a circle around the tree whose radius is 12 times the trunk diameter and range up to 15 metres radius around a large tree. Generally, a significant proportion of the tree's foliage above ground and fine absorptive roots below ground will occur within the TPZ and if protected should be adequate to ensure the ongoing viability of the tree.

Sometimes works may need to occur within the TPZ which may be acceptable if properly managed. However, it is vital that works, particularly works that involve any excavation, are not permitted to negatively affect woody structural roots whose function is to anchor the tree and maintain its stability in the ground. The Australian Standard defines the area within which structural roots are located as the Structural Root Zone (SRZ) and provides a formula by which to calculate it. Most SRZs are between 1.5 metres and 4.0 metres radius, depending upon the size of the tree. It is not just the structural roots within an SRZ that must be protected, but the soil also. Stability is a function of the relationship between the roots and the soil. If there is no soil, the tree will fall over.

A schedule of the radial dimensions of the Tree Protection Zones (TPZ) and Structural Root Zones (SRZ) is provided in Table 2 below. The TPZs and SRZs are shown for the assessed trees on the drawings in Section 5.4.

Table 3 Schedule of Tree Protection Zones (TPZ) and Structural Root Zones (SRZ). The figures in the TPZ and SRZ columns are the radius of the zones in metres.

Tree No.	TPZ	SRZ	Tree No.	TPZ	SRZ	Tree No.	TPZ	SRZ
1	2.4	1.9	30	2.0	1.6	59	8.0	3.1
2	4.3	2.3	31	2.0	1.6	60	8.9	2.7
3	5.0	2.3	32	2.2	2.1	61	4.8	2.4
4	2.0	1.7	33	3.1	2.1	62	9.0	3.3
5	2.2	1.8	34	7.7	2.9	63	9.0	3.3
6	3.6	2.2	35	6.6	2.9	64	7.4	3.2
7	5.2	2.5	36	3.1	2.3	65	4.4	2.4
8	7.2	2.9	37	3.1	2.1	66	4.7	2.4
9	3.4	2.2	38	3.5	2.3	67	2.6	2.0
10	4.2	2.5	39	2.2	1.7	68	5.8	2.7
11	3.1	1.9	40	10.6	3.2	69	3.0	1.8
12	2.0	1.6	41	2.6	2.0	70	2.2	1.8
13	2.4	1.8	42	2.9	2.0	71	4.1	2.2
14	2.8	2.1	43	6.4	2.8	72	8.8	3.0
15	6.5	2.8	44	3.6	2.3	73	2.8	1.9
16	3.6	2.2	45	9.1	3.2	74	7.7	3.0
17	3.2	2.0	46	4.0	2.1	75	10.7	3.2
18	3.2	2.1	47	7.7	2.9	76	10.7	3.2
19	2.4	2.0	48	8.4	3.0	77	14.5	3.6
20	2.4	1.9	49	3.6	2.1	78	2.0	1.6
21	2.4	2.4	50	4.8	2.4	79	6.7	2.8
22	2.4	2.3	51	9.6	3.1	80	4.1	2.5
23	3.0	2.1	52	3.2	2.1	81	2.4	1.8
24	2.0	1.5	53	4.6	2.4	82	2.4	2.3
25	2.0	1.5	54	14.4	3.5	83	5.4	2.0
26	2.3	1.9	55	7.9	3.1	84	4.3	2.4
27	3.1	2.3	56	5.4	2.6	85	3.0	2.0
28	10.2	3.4	57	3.4	2.1	86	15.0	3.9
29	2.0	1.7	58	5.0	2.4	87	3.0	2.2

5.3 Description of proposed development

It is proposed to redevelop Ryde Hospital to provide expanded clinical services and increase healthcare capacity for the expanding local population.

A concept development application will be submitted that includes:

- A Concept Proposal for a new hospital building and associated refurbishment works of selected existing hospital facilities, including a maximum building envelope and gross floor area; and
- Stage 1 preliminary enabling works, including demolition, infrastructure and utility services relocation/upgrades, bulk earthworks, establishment of the internal road network and car parking. (Planning Secretary's Environmental Assessment Requirements, Application number SSD-36778089)

The proposed concept is a single multi-storey building within a defined envelope to replace the conglomerate of existing detached buildings. In addition, a multi-level car park will be erected on the northern portion of the site, accessible from Ryedale Road. The existing Blue Gum High Forest will be retained in the southern portion of the site. The maximum envelopes for the hospital building and car park are shown in Figures 12 to 15 and Appendix 4.

The proposed early works area is shown in Figures 12 and 16. The aged care and rehabilitation building, the staff dining and accommodation building and the cleaners build will be demolished.

5.4 Encroachment of TPZs & SRZs, and resulting impacts

The Australian Standard *Protection of Trees on Development Sites* AS 4970—2009 lists various activities that should be excluded from TPZs, due to their potential to impact tree stability and/or ongoing viability. Some activities can have a chronic impact that may be able to be mitigated with improved management or when the encroachment is removed. For example, storage of materials, placement of fill. Other impacts will be acute and more difficult to mitigate. For example, trenching for services, removing soil to lower grade.

The Australian Standard *Protection of Trees on Development Sites* AS 4970—2009 defines minor encroachment as less than 10% encroachment of the TPZ and no encroachment of the SRZ.

Major encroachment is either more than 10% encroachment or encroachment into the SRZ. The standard stipulates that the project arborist must demonstrate that proposed major encroachment will not compromise the stability and/or ongoing viability of the tree.

It is assumed that there will be major encroachment into the TPZs by various aspects of the enabling works.

Forty-seven of the 87 subject trees are within the early works area. Ten of these 47 trees have high retention value and should be retained if possible. Twenty-nine trees have moderate retention value and warrant consideration for their retention.

Table 4 Retention values of trees within the early works area.

	High TRV	Moderate TRV	Low & Very Low
Early works area (47 trees)	10 trees – 7, 8, 9, 16, 17, 18, 28, 34,35 & 45.	29 trees – 1, 2, 4, 5, 6, 10, 11, 12, 13, 14, 15, 19, 20, 26, 27, 29, 30, 31, 32, 33, 36, 37, 38, 39, 41, 42, 44, 46 & 85.	8 trees – 3, 21, 22, 23, 24, 25, 43 & 84.

The impacts upon trees of the preliminary enabling works will vary depending on the nature of the works. Building demolition and the removal of road and car park surfaces could be undertaken without the need to remove trees. The relocation of underground utility services would require excavation which can impact upon tree stability and ongoing viability if SRZs and TPZs are encroached without proper measures to protect roots. The establishment of new roads and car parks may require excavation to lay sub-base which may compromise tree health and stability.

Some trees may require removal eventually, depending on the final design, but need not be removed to facilitate the Stage 1 works. While ever they can be retained, they will provide urban forest benefits and mitigate the impacts of tree removal resulting from the project. This may also provide better opportunities for animals to relocate.

It is considered likely that at least 33 trees will need to be removed to facilitate the Stage 1 works. They are Trees 7, 8, 9, 10, 14, 15, 16, 17, 18, 21, 22, 23, 24, 25, 27, 28, 31, 32, 33, 34, 35, 36, 37, 38, 39, 41, 42, 43, 44, 45, 45, 84 and 85.

Tree protection measures will be required for trees that are retained. A tree protection plan and specifications will be developed that ensures adequate and appropriate protection of trees being retained, including in the short term.

The 20 high and 17 moderate retention value trees in the remainder of the site will be considered as part of the ongoing design process.

Eleven trees in the building maximum envelope are species of palms that potentially could be relocated.

Table 4 provides details about the amount of encroachment into each tree's TPZ, the impact of the encroachment and recommendations.

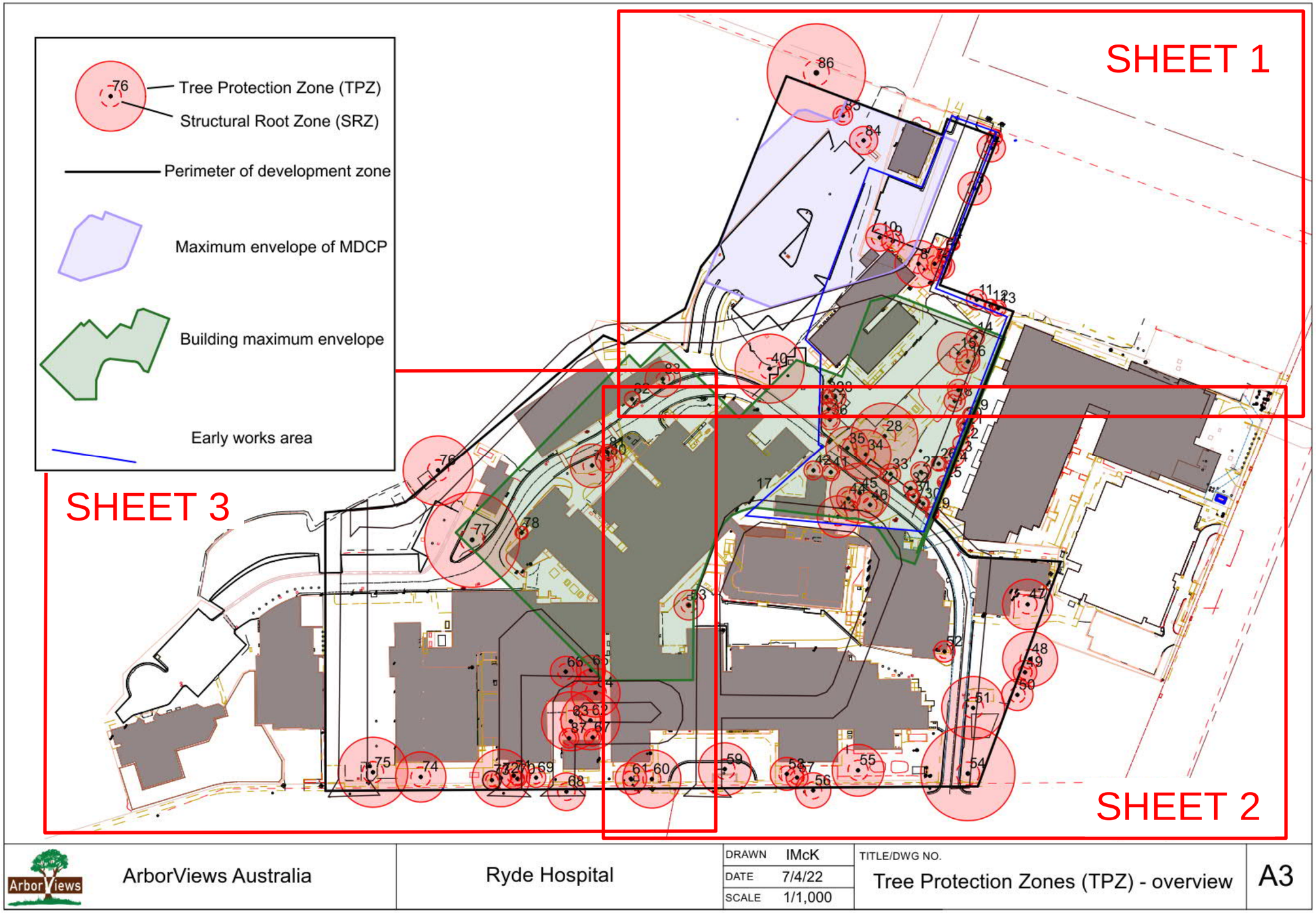


Figure 13 Overview showing TPZs & SRZs overlaid with development envelopes and proposed new internal roads. See Appendix 4 for accurate scale.

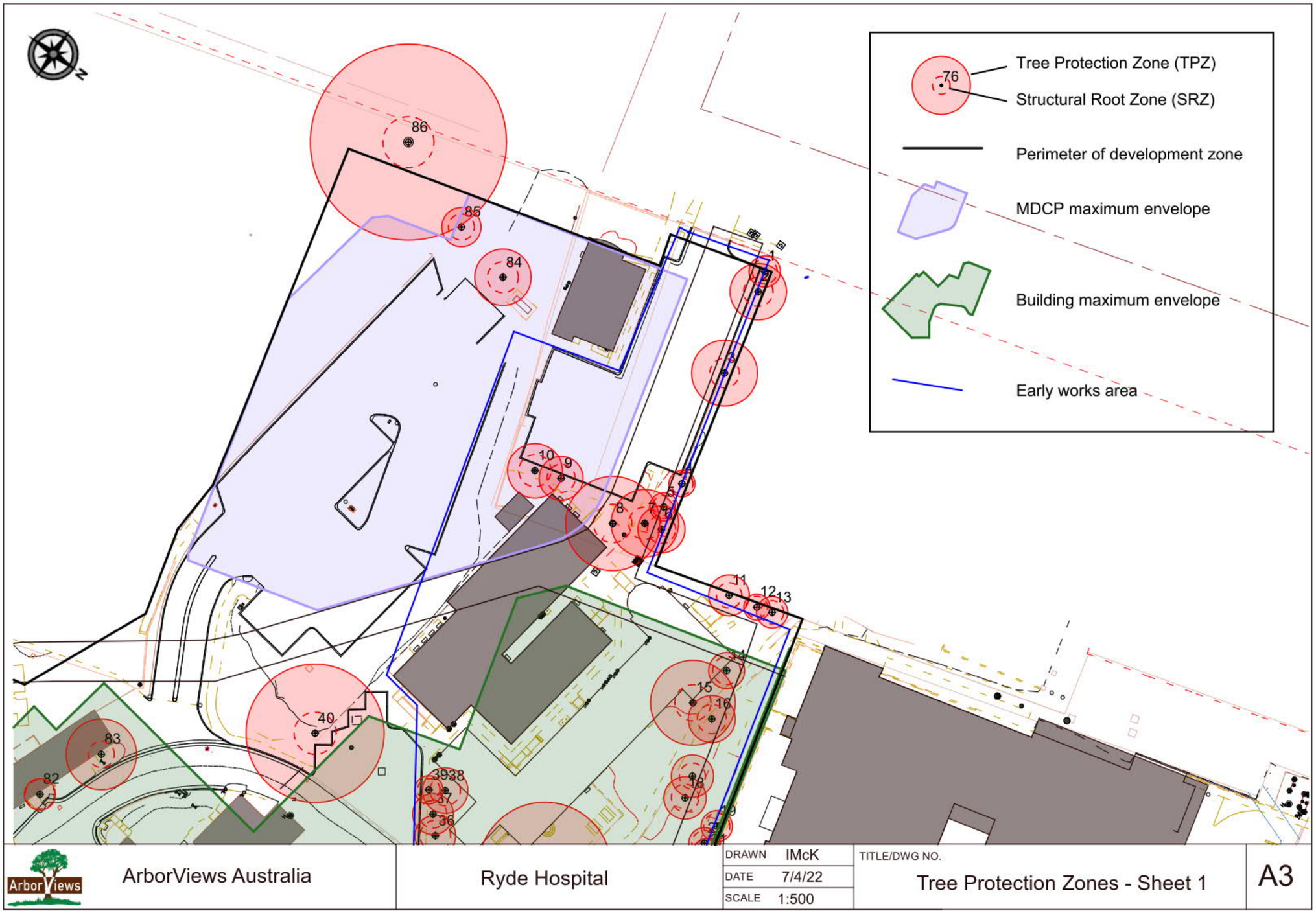


Figure 14 Sheet 1 showing TPZs & SRZs overlaid with development envelopes and Proposed new internal roads. See Appendix 4 for accurate scale.

Figure 15 Sheet 2 showing TPZs & SRZs overlaid with development envelopes and Proposed new internal roads. See Appendix 4 for accurate scale.

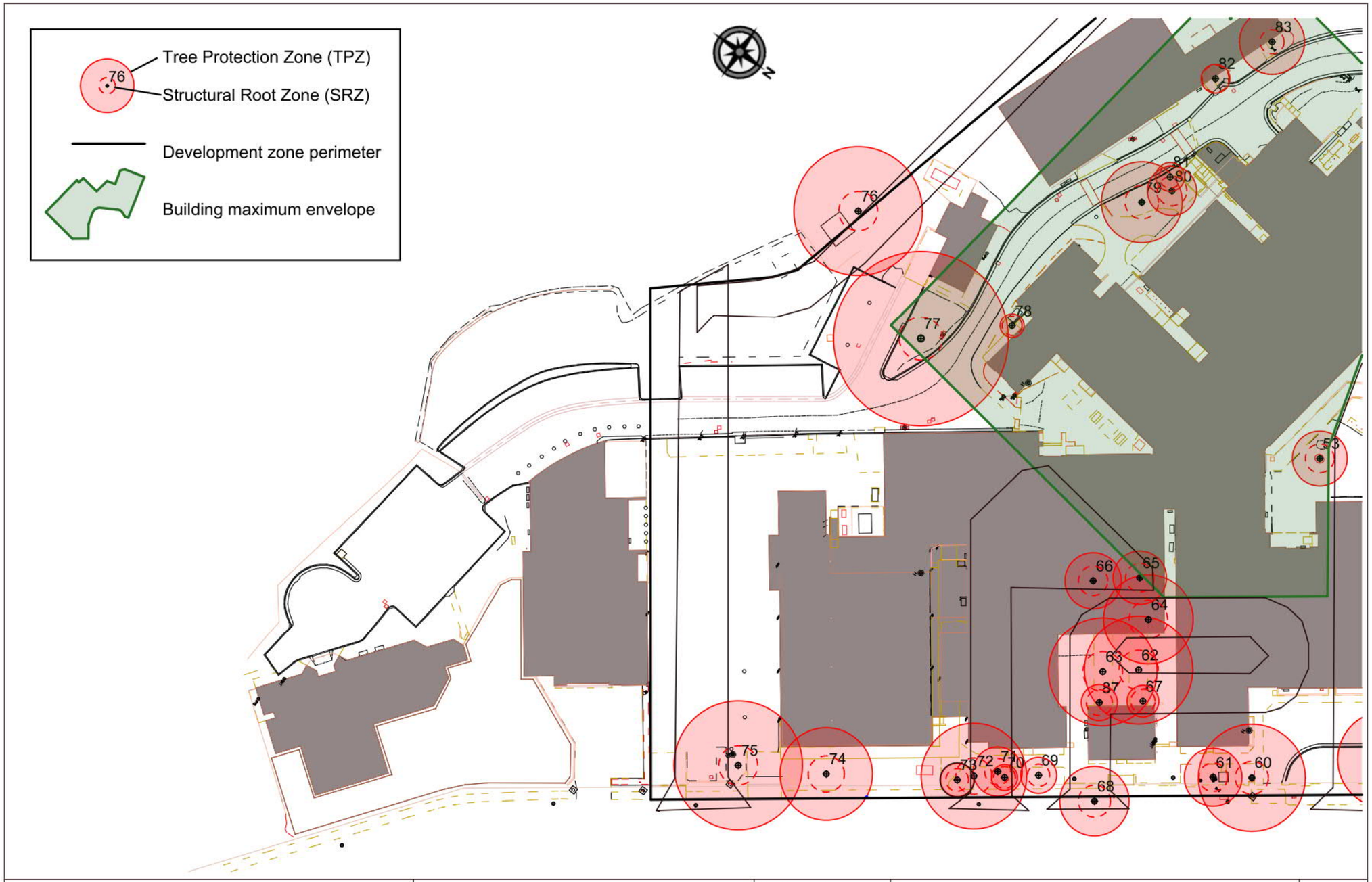


Figure 16 Sheet 3 showing TPZs & SRZs overlaid with development envelopes and Proposed new internal roads. See Appendix 4 for accurate scale.

Table 5 Schedule of TPZ encroachment, resulting impacts & recommendations.

No.	Species	TRV	Details of TPZ encroachment	Comments & recommendations
1	Cupressus sempervirens (Mediterranean cypress)	moderate	34% encroachment by new road which is existing car park, including encroachment into SRZ.	There is major encroachment within the TPZs of Trees 1 to 6 inclusive by the demolition of the existing car park. The impact of the encroachment will depend on the depth of excavation. If excavation is minimal and doesn't extend into the rhizosphere, some or all the trees could be retained. If excavation is deeper, the trees will need to be removed.
2	Jacaranda mimosifolia (jacaranda)	moderate	38% encroachment by new road which is existing car park, including encroachment into SRZ.	
3	Lagerstroemia indica (crepe myrtle)	low	40% encroachment by new road which is existing car park, including encroachment into SRZ.	
4	Jacaranda mimosifolia (jacaranda)	moderate	13% encroachment by new road which is existing car park, including encroachment into SRZ.	
5	Melaleuca quinquenervia (broad-leaved paperbark)	moderate	50% encroachment by new road which is existing car park, including encroachment into SRZ.	
6	Melia azedarach (white cedar)	moderate	33% encroachment by new road which is existing car park, including encroachment into SRZ.	
7	Melaleuca quinquenervia (broad-leaved paperbark)	high	Tree is within the new internal road.	Trees 7 and 8 cannot be retained with the proposed location of roads.
8	Melaleuca quinquenervia (broad-leaved paperbark)	high	Tree is within the new internal road and will be impacted by stage 1 bulk earthworks.	
9	Casuarina cunninghamiana (river oak)	high	Tree is within the MDCP envelope.	Trees 9 and 10 are within the envelope for the MDCP and the within the early works area. Major encroachment is likely into Tree 9's TPZ by car park demolition and bulk earthworks. It is unlikely they will be able to be retained.
10	Cupressus sempervirens (Mediterranean cypress)	moderate	Tree is within the MDCP envelope.	
11	Callistemon viminalis (bottlebrush)	moderate	Nil encroachment.	Trees 11, 12 and 13 will be retained. Tree protection fencing should be erected around the perimeter of their TPZs prior to the commencement of any works.
12	Callistemon viminalis (bottlebrush)	moderate	Nil encroachment.	
13	Callistemon viminalis (bottlebrush)	moderate	Nil encroachment.	
14	Plumeria acutifolia (frangipani)	moderate	Tree is within building maximum envelope. There will be major encroachment by building demolition and bulk earthworks.	Trees 14 to 18 will need to be removed to accommodate the proposed Stage 1 bulk earthworks.
15	Melia azedarach (white cedar)	moderate	Tree is within building maximum envelope. There will be major encroachment by building demolition and bulk earthworks.	
16	Brachychiton acerifolius (Illawarra flame tree)	high	Tree is within building maximum envelope. There will be major encroachment by bulk earthworks.	
17	Corymbia maculata (spotted gum)	high	Tree is within building maximum envelope. There will be major encroachment by bulk earthworks.	
18	Corymbia maculata (spotted gum)	high	Tree is within building maximum envelope. There will be major encroachment by bulk earthworks.	
19	Pyrus calleryana (Callery pear)	moderate	Tree is within building maximum envelope but may not be affected by bulk earthworks.	Trees 19 and 20 may need to be removed depending on final design but can be retained and protected pending assessment of arboricultural impact by the final design, with a view to retention.
20	Callistemon salignus (willow bottlebrush)	moderate	Tree is within building maximum envelope but may not be affected by bulk earthworks.	
21	Pyrus calleryana (Callery pear)	low	Tree is within building maximum envelope but may not be affected by bulk earthworks.	Trees 21 to 23 have low tree retention value (TRV) and consequently should not present a constraint to design or works. Any constraint to design or works warrants their removal. TPZ fencing will be required if they are retained.
22	Pyrus calleryana (Callery pear)	low	Tree is within building maximum envelope but may not be affected by bulk earthworks.	

No.	Species	TRV	Details of TPZ encroachment	Comments & recommendations
23	Pyrus calleryana (Callery pear)	low	Tree is within building maximum envelope but may not be affected by bulk earthworks.	
24	Acacia sp. (wattle)	low	Tree is within building maximum envelope but may not be affected by bulk earthworks.	Trees 24 and 25 have low tree retention value (TRV) and consequently should not present a constraint to design or works. Any constraint to design or works warrants their removal. TPZ fencing will be required if they are retained.
25	Acacia sp. (wattle)	low	Tree is within building maximum envelope but may not be affected by bulk earthworks.	
26	Syncarpia glomulifera (turpentine)	moderate	Tree is within building maximum envelope with minor TPZ encroachment by bulk earthworks.	Trees 26 may be removed depending on final design but can be retained and protected pending assessment of arboricultural impact by the final design.
27	Corymbia maculata (spotted gum)	moderate	Tree is within building maximum envelope. There will be major encroachment by bulk earthworks.	Trees 27 and 28 will need to be removed to accommodate the proposed Stage 1 bulk earthworks.
28	Grevillea robusta (silky oak)	high	Tree is within building maximum envelope and will be wholly encroached by bulk earthworks.	
29	Pyrus calleryana (Callery pear)	moderate	Tree is within building maximum envelope but should not be affected by bulk earthworks.	Trees 29 and 30 may need to be removed depending on final design but can be retained and protected pending assessment of arboricultural impact by the final design, with a view to retention.
30	Pyrus calleryana (Callery pear)	moderate	Tree is within building maximum envelope with minor TPZ encroachment by bulk earthworks.	
31	Pyrus calleryana (Callery pear)	moderate	Tree is within building maximum envelope and will be wholly encroached by bulk earthworks.	Trees 31 to 39 inclusive will need to be removed to accommodate the proposed Stage 1 bulk earthworks.
32	Jacaranda mimosifolia (jacaranda)	moderate	Tree is within building maximum envelope and will be wholly encroached by bulk earthworks.	
33	Pyrus calleryana (Callery pear)	moderate	Tree is within building maximum envelope and will be wholly encroached by bulk earthworks.	
34	Jacaranda mimosifolia (jacaranda)	high	Tree is within building maximum envelope and will be wholly encroached by bulk earthworks.	
35	Brachychiton acerifolius (Illawarra flame tree)	high	Tree is within building maximum envelope and will be wholly encroached by bulk earthworks.	
36	Callistemon viminalis (bottlebrush)	moderate	Tree is within building maximum envelope and will be wholly encroached by bulk earthworks.	
37	Callistemon viminalis (bottlebrush)	moderate	Tree is within building maximum envelope and will be wholly encroached by bulk earthworks.	
38	Callistemon viminalis (bottlebrush)	moderate	Tree is within building maximum envelope and will be wholly encroached by bulk earthworks.	
39	Callistemon viminalis (bottlebrush)	moderate	Tree is within building maximum envelope and will be encroached by bulk earthworks.	
40	Pinus radiata (radiata pine)	high	48% encroachment, including SRZ encroachment, by the building maximum envelope and existing road.	Tree 40 may need to be removed depending on final design but can be retained pending assessment of the impact of the final design, with a view to retention. It's outside early works area and should be protected with TPZ fence. Tree protection during demolition of road surface will be specified with tree protection plan.
41	Archontophoenix alexandrae (Alexandra palm)	moderate	Tree is within building maximum envelope and will be wholly encroached by bulk earthworks.	Trees 41 and 42 cannot be retained in their current location but are palms that can be considered for transplanting to new location on the site.
42	Archontophoenix alexandrae (Alexandra palm)	moderate	Tree is within building maximum envelope and will be wholly encroached by bulk earthworks.	
43	Lophostemon confertus (brush box)	low	Tree is within building maximum envelope and will be encroached by bulk earthworks.	Tree 43 will need to be removed to accommodate the proposed Stage 1 bulk earthworks.
44	Livistona chinensis (Chinese fan palm)	moderate	Tree is within building maximum envelope and will be wholly encroached by bulk earthworks.	Trees 44 cannot be retained in its current location but is a palm that can be considered for transplanting to new location on the site.

No.	Species	TRV	Details of TPZ encroachment	Comments & recommendations
45	Cupressus sempervirens (Mediterranean cypress)	high	Tree is within building maximum envelope and will be wholly encroached by bulk earthworks.	Tree 45 will need to be removed to accommodate the proposed Stage 1 bulk earthworks.
46	Syagrus romanzoffiana (cocos palm)	moderate	Tree is within the building maximum envelope and will be wholly encroached by bulk earthworks.	Tree 46 will need to be removed to accommodate the proposed Stage 1 bulk earthworks.
47	Jacaranda mimosifolia (jacaranda)	high	Nil encroachment.	Tree 47 will be retained. Tree protection fencing should be erected around the perimeter of its TPZ prior to the commencement of any works.
48	Eucalyptus saligna (Sydney blue gum)	high	Nil encroachment.	Trees 48, 49 and 50 are in a neighbouring property and will be retained. Tree protection fencing should be erected around the perimeter of the parts of their TPZs within the construction zone prior to the commencement of any works.
49	Toona ciliata (Australian red cedar)	high	Nil encroachment.	
50	Eucalyptus botryoides (bangalay)	high	Nil encroachment.	
51	Cupressus sempervirens (Mediterranean cypress)	high	Nil encroachment.	Tree 51 will be retained. Tree protection fencing should be erected around the perimeter of its TPZ prior to the commencement of any works.
52	Plumeria acutifolia (frangipani)	low	32% encroachment by demolition of Building 9.	Tree 52 has low retention value and can be removed to facilitate demolition.
53	Butia capitata (wine palm)	moderate	Tree is within the building maximum envelope.	Tree 53 may need to be removed but can be retained pending assessment of the impact of the final design. It can be considered for relocation elsewhere on site.
54	Cupressus sempervirens (Mediterranean cypress)	moderate	Nil encroachment.	Tree 54 will be retained but requires risk mitigation works. Fencing should be erected around the perimeter of its TPZ prior to the commencement of any works.
55	Corymbia maculata (spotted gum)	high	16% encroachment by demolition of Building 6.	Tree 55 will be retained and protected. Tree protection during demolition will be specified with tree protection plan.
56	Lagerstroemia indica (crepe myrtle)	moderate	Nil encroachment.	Trees 56 and 57 can be retained and protected. Tree protection during demolition of Building 6 will be specified with tree protection plan.
57	Prunus persica (peach)	moderate	Nil encroachment.	
58	Robinia pseudoacacia (golden robinia)	very low	18% encroachment by demolition of Building 6.	Removal and replacement planting recommended on the basis of Tree 58's poor health and very low TRV.
59	Araucaria columnaris (Cook pine)	high	44% TPZ encroachment by new entry road, including 2.1 m into the 3.1 m SRZ. Also encroachment all sides by demolition of existing internal road and bus shelter.	Recommend that the design of the entry is reviewed so that SRZ is not encroached and TPZ encroachment is significantly reduced. Alternatively, Tree 59 will need to be removed to accommodate the new entry road.
60	Cupressus sempervirens (Mediterranean cypress)	moderate	12% by demolition	Trees 60 and 61 can be retained and protected. Tree protection during demolition of Building 5 will be specified with tree protection plan.
61	Callistemon viminalis (bottlebrush)	moderate	5% by demolition	
62	Phoenix canariensis (Canary Island date palm)	high	Tree is within the new internal road footprint.	Trees 62 to 67 and Tree 87 are palms that cannot be retained in the current location but consideration should be given to transplanting any or all of them to different locations on the site. It is recommended that their suitability for transplanting be assessed by a palm transplant specialist and that the logistics and cost of transplanting be considered as well as the benefit that mature palms could contribute to the project.
63	Phoenix canariensis (Canary Island date palm)	high	Tree is within the new internal road footprint.	
64	Phoenix canariensis (Canary Island date palm)	high	Tree is within the new internal road footprint.	
65	Butia capitata (wine palm)	high	Tree is within the new internal road footprint.	
66	Butia capitata (wine palm)	moderate	Tree is within the new internal road footprint.	
67	Livistona chinensis (Chinese fan palm)	moderate	Tree is within the new internal road footprint.	

No.	Species	TRV	Details of TPZ encroachment	Comments & recommendations
68	Lagerstroemia indica (crepe myrtle)	moderate	Tree is within the footprint of the new entry driveway crossover.	Tree 68 is a street tree that will need to be removed to accommodate the new entry.
69	Plumeria acutifolia (frangipani)	moderate	Nil encroachment.	Trees 69 can be retained and protected. Tree protection during demolition of Buildings 3 and 4 will be specified with tree protection plan.
70	Banksia integrifolia (coast banksia)	moderate	Tree is within the new internal road footprint.	Trees 70, 71 and 72 cannot be retained as they are within the footprint of the new internal road.
71	Cupressus sempervirens (Mediterranean cypress)	low	Tree is within the new internal road footprint.	
72	Cupressus funebris (Chinese weeping cypress)	high	Tree is within the new internal road footprint.	
73	Cupressus sempervirens (Mediterranean cypress)	moderate	5% encroachment by new internal road footprint.	Trees 73 can be retained and protected. Tree protection during demolition of Buildings 2 and 3 will be specified with tree protection plan.
74	Lophostemon confertus (brush box)	high	29% encroachment by demolition of Building 2.	Tree 74 can be retained and protected. Tree protection during demolition of Building 2 will be specified with tree protection plan.
75	Syncarpia glomulifera (turpentine)	high	8% by demolition, 39% by new road	Tree 75 can be protected during demolition of Building 2. Demolition of existing entry and design and construction details of new entry should be undertaken with a view to endeavouring to retain Tree 75.
76	Corymbia citriodora (lemon-scented gum)	high	46% TPZ encroachment by the proposed fire services road, including SRZ encroachment.	The design and construction of the fire services road should avoid the SRZ of Tree 76 and reduce encroachment into the TPZ.
77	Cupressus sempervirens (Mediterranean cypress)	moderate	Tree 77 itself and 37% of its TPZ are in corner of the building maximum envelope.	Tree 77 may need to be removed depending on final design but can be retained and protected pending assessment of arboricultural impact by the final design, with a view to retention.
78	Cyathea australis (tree fern)	moderate	Tree is wholly within the building maximum envelope.	Trees 78 to 83 inclusive cannot be retained as they are within the envelope of the new building. However, they should not be removed any earlier than necessary as they will continue to provide urban forest benefits for as long as they are retained.
79	Callistemon viminalis (bottlebrush)	moderate	Tree is wholly within the building maximum envelope.	
80	Macrozamia johnsonii (macrozamia)	moderate	Tree is wholly within the building maximum envelope.	
81	Banksia serrata (old man banksia)	moderate	Tree is wholly within the building maximum envelope.	
82	Callistemon viminalis (bottlebrush)	moderate	Tree is wholly within the building maximum envelope.	
83	Macrozamia johnsonii (macrozamia)	moderate	Tree is wholly within the building maximum envelope.	
84	Acacia saligna (golden wreath wattle)	low	Tree is wholly within the MDCP maximum envelope.	Trees 84 and 85 cannot be retained as they are within the envelope of the multi-level car park. However, they should not be removed any earlier than necessary as they will continue to provide urban forest benefits for as long as they are retained.
85	Eucalyptus saligna (Sydney blue gum)	moderate	Tree is within the MDCP maximum envelope.	
86	Eucalyptus saligna (Sydney blue gum)	high	5% by car park envelope	Tree 86 will be retained and protected. Tree protection fencing and other protection measures shall be specified with the tree protection plan for the duration of the project.
87	Archontophoenix alexandrae (Alexandra palm)	moderate	tree within new road	See comments and recommendations for Trees 62 to 67.

Figures 17 a & b Palms that cannot be retained in their current location may be able to be relocated elsewhere on the development site.

5.5 Urban forest canopy

If it is assumed that all trees within the building and MDCP maximum envelopes and new internal roads are removed, 20 of the 87 trees assessed may be retained, three of which are within a neighbouring property. This equates to about 2,700 m^2, or 64% of the existing canopy on site being removed. This increases to 69% if the neighbour's canopy is not included in the calculation.

Canopy across the campus will decline to as little 5% during and following the project until new trees are able to grow sufficient to replace lost canopy. This may take ten to fifteen years, or longer if the landscape is not designed to facilitate the development of urban canopy and appropriately maintained.

Figure 18 The layout of the new entry road will need to be amended to enable this Cook pine (Tree 59) at the front of the hospital is to be retained.

6 Recommendations

6.1 Project design

1. It is recommended that trees that have high retention value are retained where-ever possible and incorporated into the design.

2. It is recommended that appropriate consideration is given to retaining trees with moderate retention value and incorporating them into the design.

3. It is recommended that species with high and moderate tree retention value that cannot be retained in their existing location and that can be successfully relocated are relocated in preference to being removed. Species of palms are generally good candidates for relocation due to their relatively contained root balls.

4. It is recommended that Table 5 in this report is used to guide removal, retention and protection of trees on the development site.

5. It is recommended that the arboricultural assessment of high and moderate retention value trees within the maximum envelopes is reviewed for any trees outside the building footprint when the design is finalised.

6. It is recommended that trees approved for removal are retained until such time as they are required to be removed to facilitate works. These trees will help sustain canopy cover and continue to provide urban forest benefits that would otherwise be lost prematurely.

7. It is recommended that following completion of the landscape plan, all trees identified in the landscape plan are ordered from a reputable tree grower, who only provides tree stock grown in accordance with the Australian Standard *Tree stock for landscape use* AS 2303—2018. This will provide time for the trees to grow as much as possible before planting on site, thereby providing maximum benefit when they are planted.

6.2 Prior to the commencement of works

8. It is recommended that a project arborist is engaged for the duration of the project. The project arborist should have AQF level 5 qualification in arboriculture, or equivalent, and relevant experience in tree management on development sites.

9. It is recommended that prior to the commencement of any works on site, a Tree Protection Plan and Tree Protection Specification are produced, in accordance with the Australian Standard *Protection of Trees on Development Sites* AS 4970—2009.

10. It is envisaged that the Tree Protection Plan and Tree Protection Specification are updated following confirmation of the final design. The various stages of the development should be reflected in these documents with appropriate protection measures installed as required to coincide with the relevant works. Pruning specifications, where necessary, should be included with the Tree Protection Specification.

,

11. It is recommended that the project arborist inspects tree protection measures and certifies they comply with the Tree Protection Plan and Tree Protection Specification prior to the commencement of works.

6.3 During works

12. It is recommended that the project arborist is consulted about critical tree-related issues throughout all stages of the redevelopment of the sports complex.

13. It is recommended that the Tree Protection Plan and Tree Protection Specification are implemented and complied with for the duration of the development project.

14. It is recommended that the project arborist undertake inspections of trees and tree protection at least monthly throughout the project.

15. It is recommended that tree removal is avoided during the months when protected species of mammals and birds are reproducing and raising young – April to October.

16. It is recommended that immediately prior to tree removal, the project arborist confirms the correct trees have been identified for removal.

17. It is recommended that a licenced wildlife rescuer is present on site when trees that may harbor wildlife are being removed.

18. It is recommended that approved tree removal is undertaken in accordance with the *Guide to Managing Risks of Tree Trimming and Removal Work* (Safe Work Australia, 2016) by a practicing arborist who has a minimum qualification of certificate 3 in arboriculture.

19. It is recommended that any pruning that is required shall be detailed in a pruning specification prepared by the project arborist and undertaken by an arborist who has certificate 3 in arboriculture, in accordance with the Australian Standard *Pruning of Amenity Trees* AS 4373—2007.

20. It is recommended that debris from tree removal and pruning is chipped and stored on site for future use as mulch after it has dried. Any debris from trees identified as being infected with contagious, damaging pathogens should be disposed of to landfill.

21. It is recommended that the project arborist supervises all works within any Structural Root Zone (SRZ) and any additional or unplanned work within any Tree Protection Zone (TPZ).

22. It is recommended that roads and car parks are constructed to minimise disturbance of soil within Tree Protection Zones (TPZ).

23. If excavation or disturbance of soil is undertaken, supervision by the project arborist will be required within Structural Root Zones (SRZ) and woody roots within any SRZ shall not be damaged, pruned or severed unless written approval of the project arborist is obtained.

24. All new trees should be:
    - Tree stock that is compliant with the Australian Standard *Tree Stock for Landscape Sites* AS 2303—2018;
    - planted by a qualified arborist or horticulturist with appropriate experience in tree planting;
    - planted in a hole that is no deeper than their root ball and is not backfilled;
    - protected with suitable tree guards but should not be tied to stakes; and
    - maintained in accordance with an appropriate maintenance regime ensuring mulching and adequate watering for at least three years after planting.

6.4 At the completion of works or stages of works

25. It is recommended that the project arborist shall certify in writing that the tree protection has been implemented and complied with in accordance with the Tree Protection Plan, Tree Protection Specification and any additional reasonable directions by the project arborist.

7 References

Australian Standards Committee EV-018, Arboriculture (2007), *AS 4373–2007 Australian Standard – Pruning of Amenity Trees,* Standards Australia, Sydney, Australia.

Australian Standards Committee EV-018 Arboriculture (2009), *AS 4970–2009 Australian Standard – Protection of Trees on Development Sites,* Standards Australia, Sydney, Australia.

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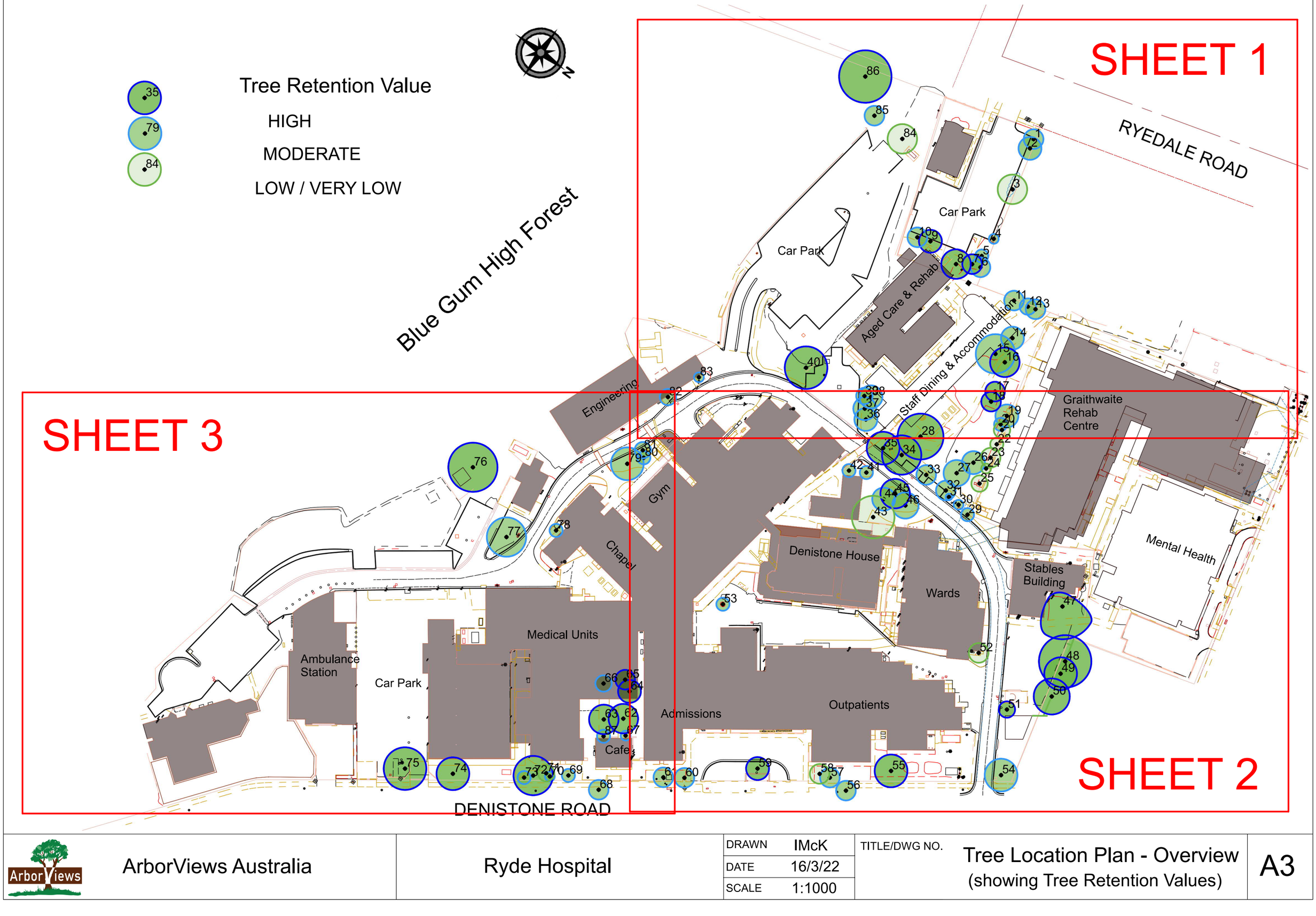

ArborViews Australia	Ryde Hospital	DRAWN	IMcK	TITLE/DWG NO. Tree Location Plan - Overview (showing Tree Retention Values)	A3
		DATE	16/3/22		
		SCALE	1:1000		

Tree Retention Value

35 HIGH

79 MODERATE

84 LOW / VERY LOW

camellia shrubs, less than prescribed size

RYEDALE ROAD

Blue Gum High Forest

Car Park

Car Park

exempt species and weed species

Aged Care & Rehab

Staff Dining & Accommodation

Graithwaite Rehab Centre

N

ArborViews Australia	Ryde Hospital	DRAWN	IMcK	TITLE/DWG NO. Tree Location Plan - Sheet 1 (showing Tree Retention Values)	A3
		DATE	16/3/22		
		SCALE	1:500		

Appendix 1

ArborViews Australia	Ryde Hospital	DRAWN	IMcK	TITLE/DWG NO.	Tree Location Plan - Sheet 2 (showing Tree Retention Values)
		DATE	16/3/22		A3
		SCALE	1:500		

Tree Retention Value

35 HIGH

79 MODERATE

84 LOW / VERY LOW

Blue Gum High Forest

Engineering

bottlebrush, less than pre-scribed size

76

81

80

79

Gym

77

78

Chapel

Medical Units

Ambulance Station

Car Park

65

66

64

63

62

Adm

87

67

Cafe

bottlebrush, less than prescribed size

75

74

73

72

71

70

69

68

61

DENISTONE ROAD

ArborViews Australia	Ryde Hospital	DRAWN	IMcK	TITLE/DWG NO.	Tree Location Plan - Sheet 3 (showing Tree Retention Values)
		DATE	16/3/22		A3
		SCALE	1:500		

Tree Assessment – an overview

A tree is described by its species, its size and its age. Health, vigour, structure and form are assessed and are the basis of the tree's useful life expectancy (ULE). The tree's ULE combined with its importance in the landscape are used to determine the tree's retention value.

Tree no. – Each tree is identified by a number on the site plan and in the tree assessment schedule.

Species – The scientific name of the tree using binomial nomenclature.

Common name – The common name is the name by which the tree is commonly known. Many species may have more than one common name, which may vary between geographical areas.

DBH – Diameter at Breast Height. This is the mean trunk diameter measured at 1.4 metres above ground level. If there are multiple stems, the notional DBH is calculated by adding the cross-sectional areas of the stems and determining a diameter for a circle of that area. DBH is measured in centimetres with a diameter tape.

Height – The height of the tree is measured in metres with a laser height meter. If this is not possible due to obstacles, tree height is estimated.

Crown spread – This is the average spread of the branches and foliage of the tree measured north south and east west. Crown spread is either measured with a laser distance meter, paced out, or measured on Nearmap. Crown spread can be used to calculate approximate crown area and help calculate crown volume.

Age class – Trees are categorised into three age classes – young, mature and senescing.

Health – Health relates to freedom from predation by pests, diseases, ailments and stress. The tree's health is categorised on a scale of excellent, good, fair, poor and dead.

Vigour – Vigour refers to the tree's capacity to resist impacts upon its health and its ability to grow. Vigour is categorised as normal, high, low or dormant.

Structure – The structure of the tree is the arrangement of its parts (roots, stem, branches, etc.). The assessment of structure generally considers injuries, defects, structural weaknesses, anchorage and the physical effects of attack from insects, bacteria and fungi. Risks from trees usually relate to structural defects, which, as well as being a factor in the condition of a tree, are a primary consideration in risk assessment. The structure of the tree is assessed on a scale of excellent, good, fair or poor.

Form – The form of a tree relates to its shape, architecture, crown symmetry, crown density, live crown ratio, suppression, phototropism, whether the tree leans and the type of lean.

Useful life expectancy (ULE) – ULE is measured as:

- long term (greater than 40 years),
- medium term (15 to 40 years),
- short term (5 to 15 years), and
- plan for removal (less than 5 years).

ULE is the period for which the tree can practically be retained. It is affected by the tree's health and vigour, its structural condition, risk it may present, conflict with infrastructure, suitability in its location and conflict with changing land use.

Landscape significance – A tree's significance in the landscape relates to the amenity it provides, its environmental value and its contribution to heritage. These are affected by the tree's species, its ecological importance, its size and form, its location and its visual prominence. Landscape significance is categorised on a seven-point scale of significant, very high, high, moderate, low, very low and insignificant. Heritage listed trees have the highest rating and weed species have the lowest rating.

Tree retention value – Tree Retention Value is based on a tree's ULE and the landscape significance of the tree. The matrix at table 1 below is used to determine the retention value, which is rated as high, moderate, low or very low.

Table 1 Methodology used to assess Tree Retention Values[1]

	Landscape Significance Rating						
Tree sustainability period	1 significant	2 very high	3 high	4 moderate	5 low	6 very low	7 insignificant
greater than 40 years	**high**						
15 to 40 years			**moderate**				
5 to 15 years					**low**		
less than 5 years						**very low**	

[1] Newcastle City Council, 2018, *Newcastle Urban Forest Technical Manual, Feb 2018*, Newcastle.

Quantified Tree Risk Assessment

A Non-technical Summary

Tree safety management is about limiting the risk of harm from tree failure while maintaining the benefits conferred by trees. Although it may seem counter-intuitive, the condition of trees should not necessarily be the first consideration. Instead, tree managers should first take account of the usage of the land on and around which the trees stand, and this in turn will inform the process of assessing the trees.

The Quantified Tree Risk Assessment (QTRA) method applies established and accepted risk management principles to tree safety management. Firstly, the targets (people and property) onto which trees could fail are assessed and quantified, thus enabling tree managers to determine whether they need to assess trees and to what degree of rigour an assessment or inspection of the trees is required. Where necessary, a tree or branch is then considered in terms of both its size (potential impact) and probability of failure. Values derived from the assessment of these three components (target, size and probability of failure) are combined to calculate a risk of harm within the coming year. The year is simply a convenient time-frame over which to measure the risk and does not in itself infer that the risk should be re-assessed annually; rather the frequency of re-assessment should be informed by the level of risk and the characteristics of the tree population and land-use.

The quantification of risk is not the only consideration when managing tree safety. The financial cost of reducing the risk and the potential loss of the many benefits from trees should be accounted for when making risk management decisions. By quantifying the risks we can more readily assess this balance.

The method moves the management of tree safety away from labelling trees as either ‘safe’ or ‘unsafe’ and requiring definitive statements of tree safety from either tree surveyors or tree managers. Instead, QTRA quantifies the risk of harm from tree failure in a way that enables tree managers to account for the various costs and benefits of risk reduction and operate to pre-determined risk thresholds. Using a traffic light system of colour coding the risk from trees, we have simplified the decision making process for tree owners and tree managers. For more information on the QTRA method and the decision making process, download the QTRA Practice Note, which is available in eight languages and seventeen country-specific versions.

Green	**Broadly Acceptable**	Do nothing.
Yellow	**Tolerable**	Do nothing, unless you expect the risk to increase significantly before the next assessment. The benefits conferred by the tree will usually outweigh the risk.
Amber	**Tolerable**	Reduce the risk unless there is broad stakeholder agreement to retain it.
Red	**Unacceptable**	Reduce the risk.

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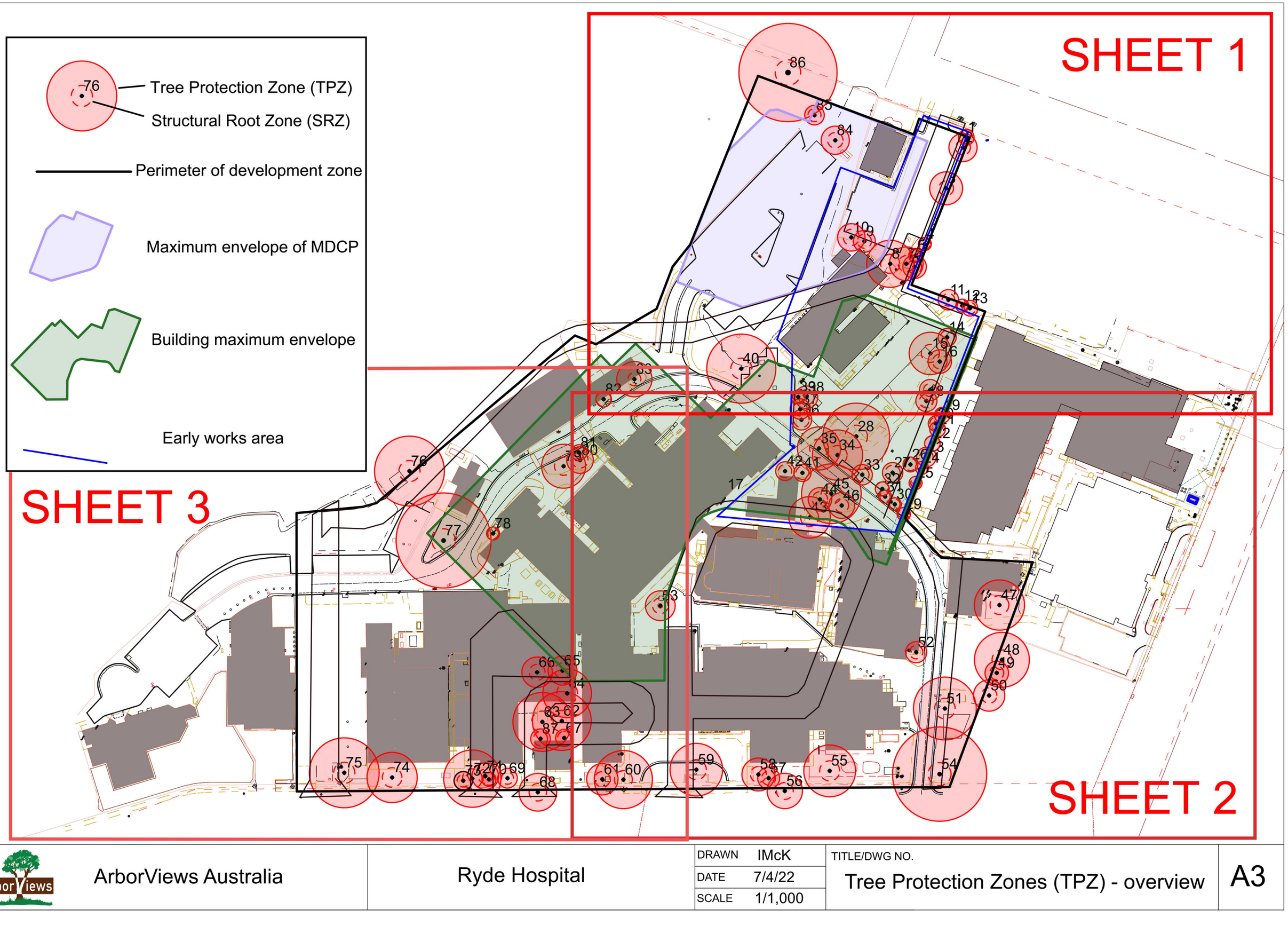
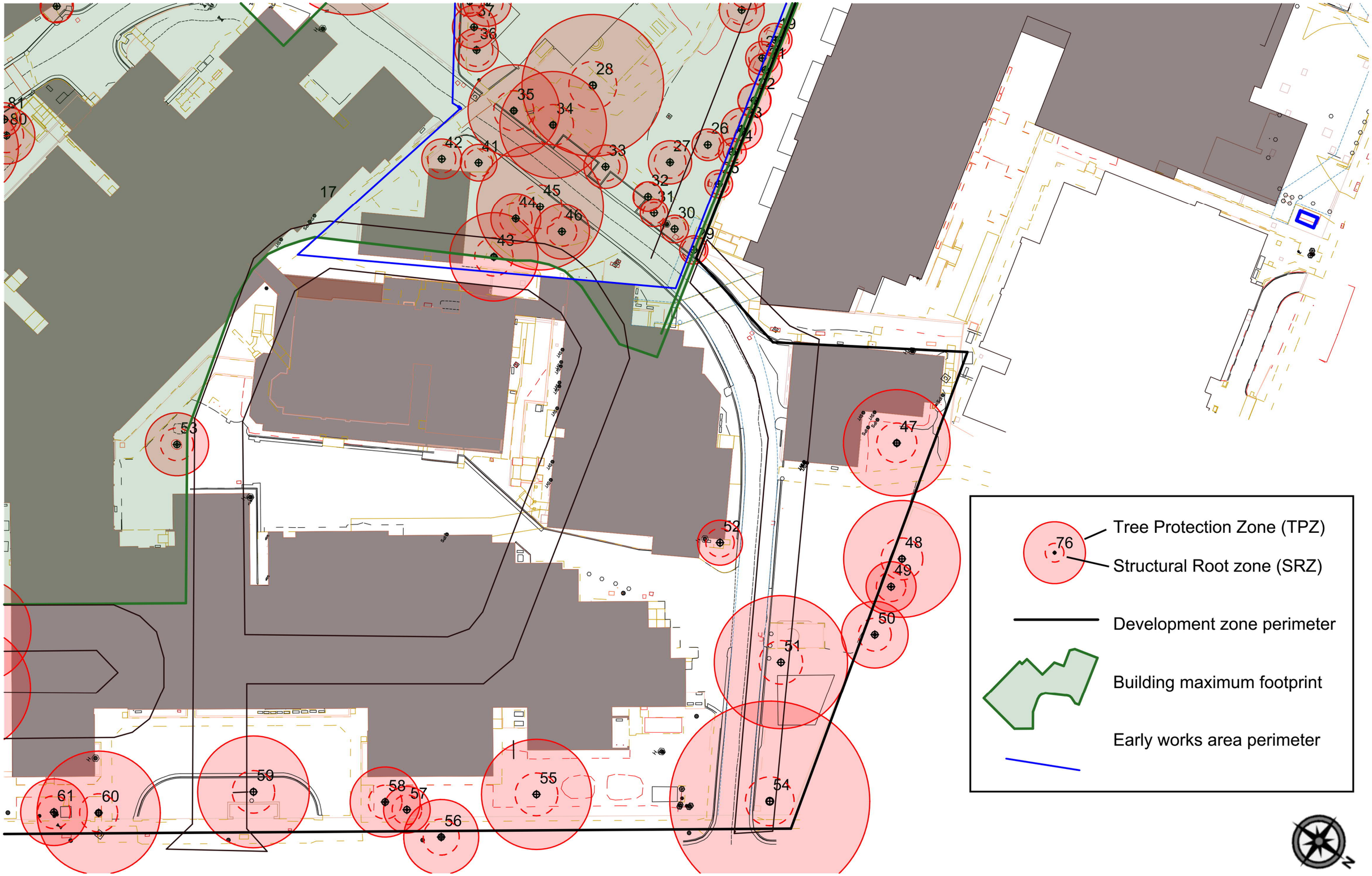


ArborViews Australia	Ryde Hospital	DRAWN IMcK DATE 7/4/22 SCALE 1/1,000	TITLE/DWG NO. Tree Protection Zones (TPZ) - overview	A3

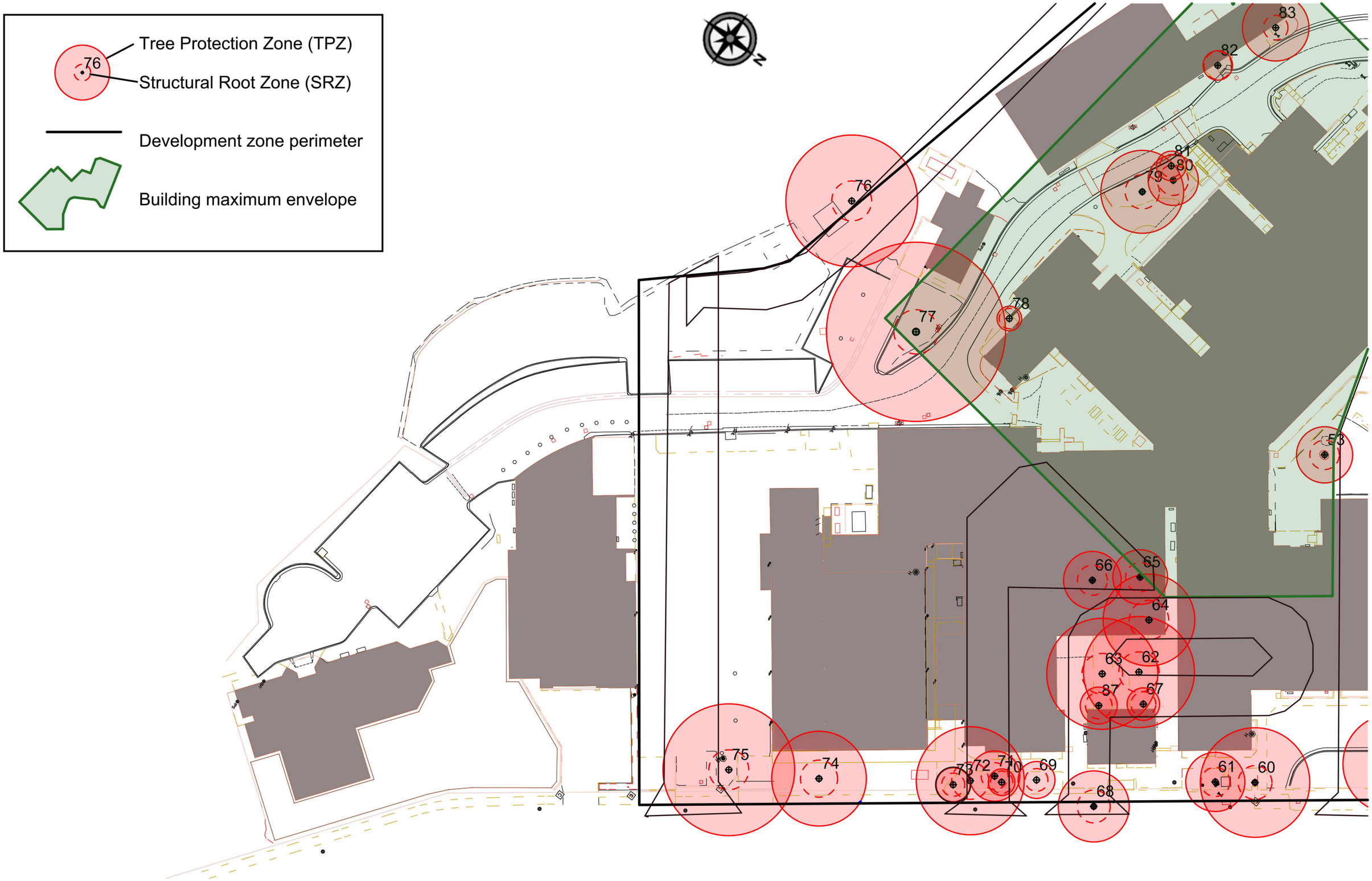
ArborViews Australia	Ryde Hospital	DRAWN IMcK DATE 7/4/22 SCALE 1:500	TITLE/DWG NO. Tree Protection Zones - Sheet 1	A3

Appendix 4



ArborViews Australia	Ryde Hospital	DRAWN IMcK DATE 7/4/22 SCALE 1:500	TITLE/DWG NO. Tree Protection Zones - Sheet 2

A3



ArborViews Australia	Ryde Hospital	DRAWN IMcK DATE 7/4/22 SCALE 1:500	TITLE/DWG NO. Tree Protection Zones - Sheet 3	A3

Photos of trees with high and moderate Tree Retention Value (TRV)

Figure 1 Tree 1 - moderate Tree Retention Value, Cupressus sempervirens.

Figure 2 Tree 2 - moderate TRV, Jacaranda mimosifolia.

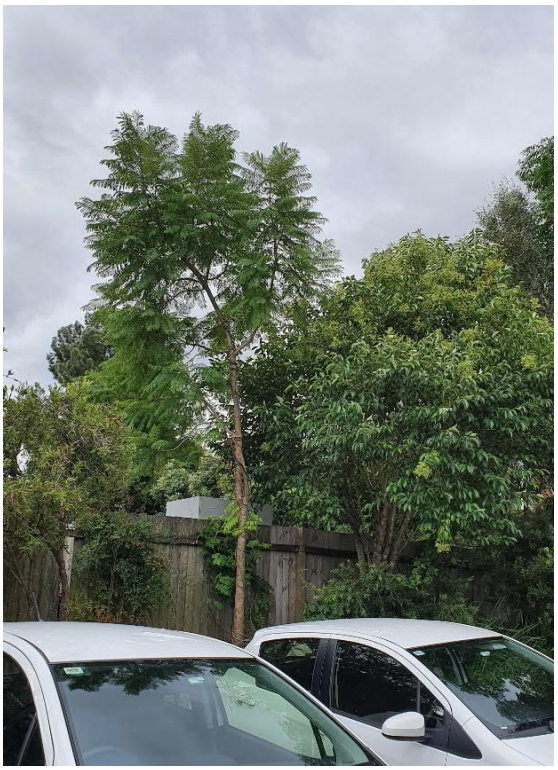


Figure 3 Tree 4- moderate TRV, Jacaranda mimosifolia.

Figure 4 Tree 6 - moderate TRV, Melia azedarach.

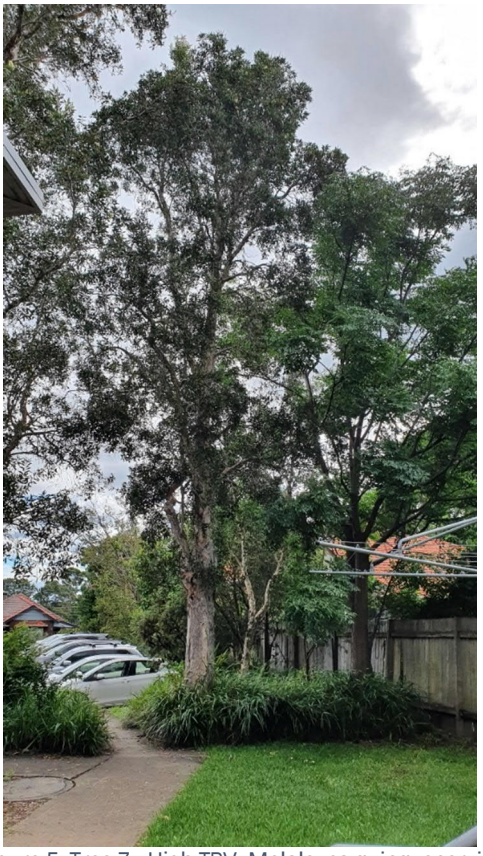


Figure 5 Tree 7 - High TRV, Melaleuca quinquenervia.

Figure 6 Tree 8 - high TRV, Melaleuca Quinquenervia.

Figure 7 Tree 9 - high TRV, Casuarina cunninghamiana.

Figure 8 Tree 10 - moderate TRV, Cupressus sempervirens.

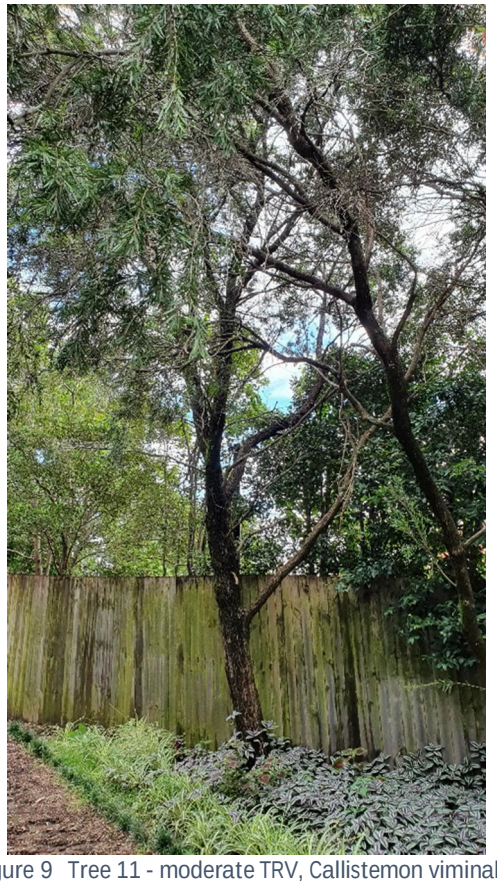


Figure 9 Tree 11 - moderate TRV, Callistemon viminalis.

Figure 10 Tree 12 - moderate TRV, Callistemon viminalis.

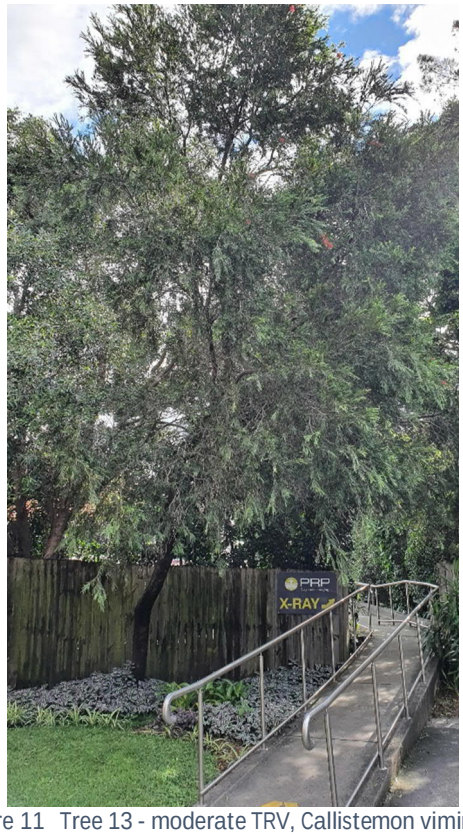


Figure 11 Tree 13 - moderate TRV, Callistemon viminalis.

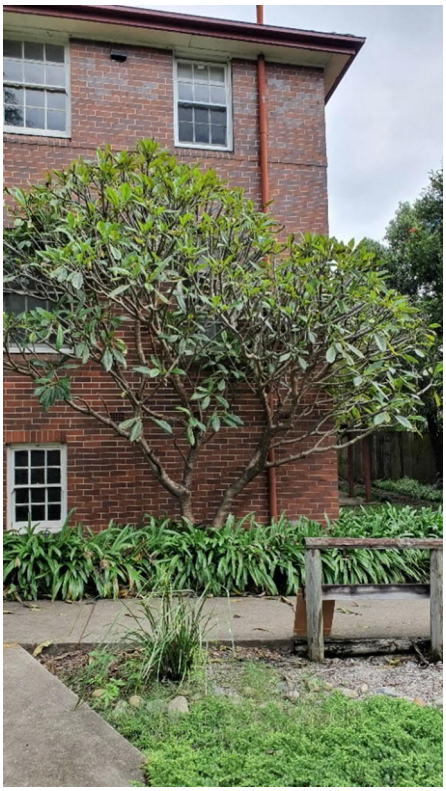


Figure 12 Tree 14 - moderate TRV, Plumeria sp.

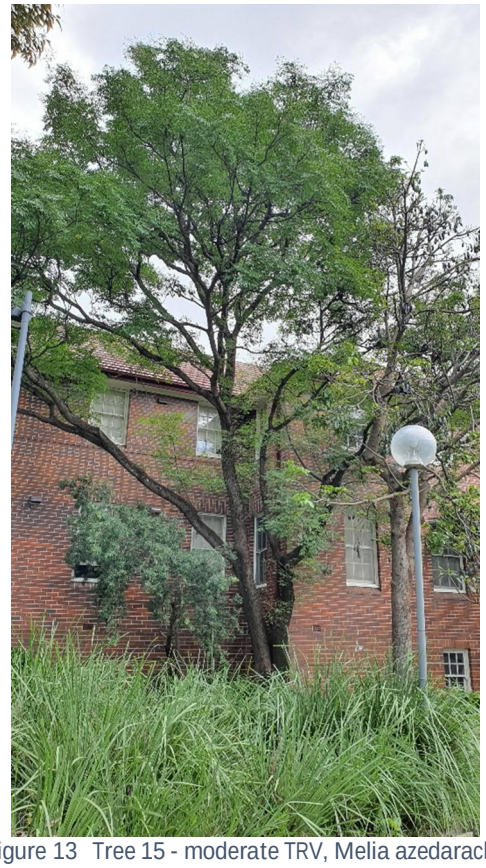


Figure 13 Tree 15 - moderate TRV, Melia azedarach.

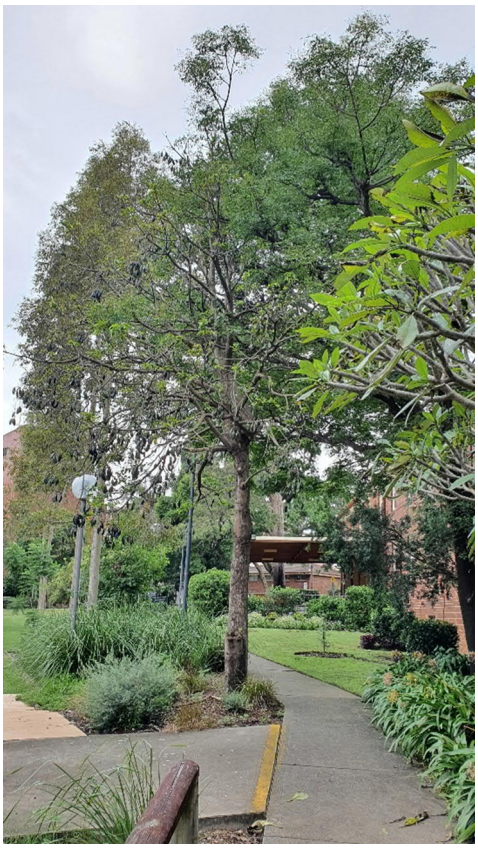


Figure 14 Tree 16 - high TRV, Brachychiton acerifolius.

Figure 15 Tree 17 – high TRV, Corymbia maculata.

Figure 16 Tree 18 - high TRV, Corymbia maculata.

Figure 17 Tree 19 - moderate TRV, Pyrus calleryana.

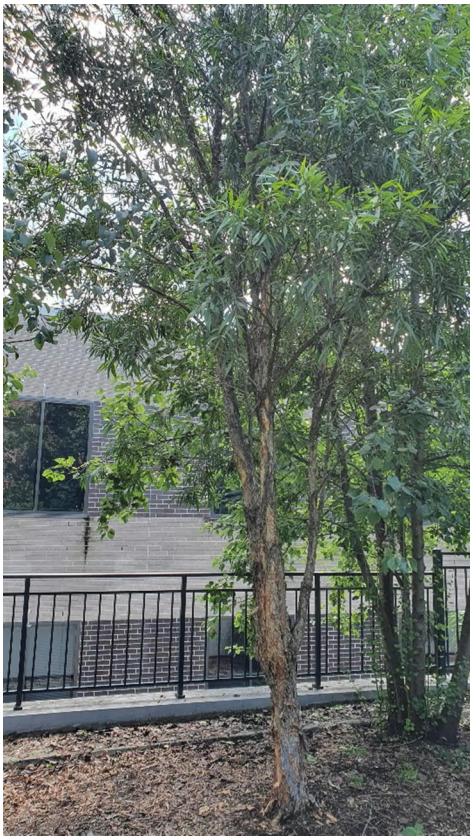


Figure 18 Tree 20 - high TRV, Callistemon salignus.

Figure 19 Tree 26 - moderate TRV, Syncarpia glomulifera.

Figure 20 Tree 27 - moderate TRV, Corymbia maculata.

Figure 21 Tree 27 - the spotted gum - is regularly used by arboreal mammals.

Figure 22 Tree 28 - high TRV - Grevillea robusta.

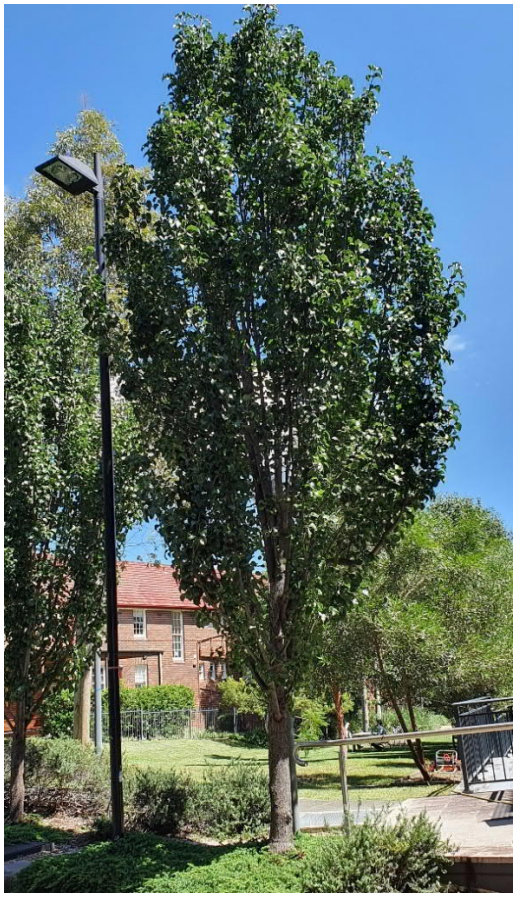


Figure 23 Tree 29 - moderate TRV, Pyrus calleryana.

Figure 24 Tree 30 - moderate TRV, Pyrus calleryana.

Figure 25 Tree 31 - moderate TRV, Pyrus calleryana.

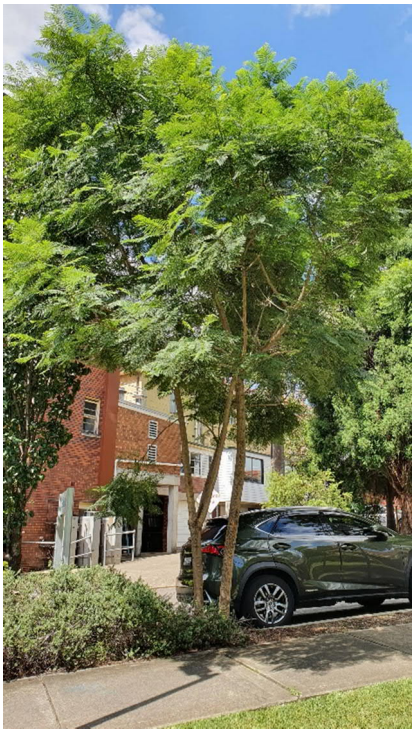


Figure 26 Tree 32 - moderate TRV, Jacaranda mimosifolia.

Figure 27 Tree 33 - moderate TRV, Pyrus calleryana.

Figure 28 Tree 34 - high TRV, Jacaranda mimosifolia.

Figure 29 Tree 35 - high TRV, Brachychiton acerifolius.

Figure 30 Trees 36 to 39 - four moderate TRV Callistemon viminalis.

Figure 31 Tree 40 - high TRV, Pinus radiata.

Figure 32 Tree 41 - moderate TRV, Archontophoenix alexandrae.

Figure 33 Tree 43 - moderate TRV, Archontophoenix alexandrae.

Figure 34 Tree 44 - moderate TRV, Livistona chinensis.

Figure 35 Tree 45 - high TRV, Cupressus sempervirens.

Figure 36 Tree 46 - moderate TRV, Syagrus romanzoffiana.

Figure 37 Tree 47 - high TRV in the curtilage of the heritage stables, Jacaranda mimosifolia.

Figure 38 Tree 48 - high TRV, Eucalyptus saligna in neighbouring yard.

Figure 39 Tree 49 - high TRV, Toona ciliata. Neighbouring tree.

Figure 40 Tree 50 - high TRV, Eucalyptus botryoides. Neighbouring tree.

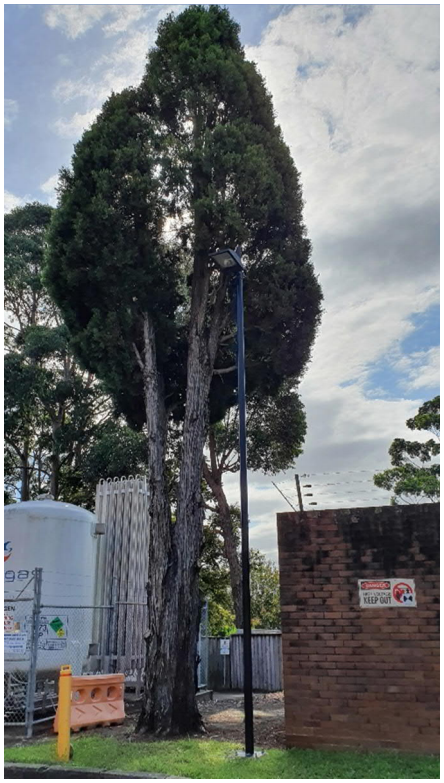


Figure 41 Tree 51 - high TRV, Cupressus sempervirens.

Figure 42 Tree 53 - moderate TRV, Butia capitata.

Figure 43 Tree 54 - moderate TRV, Cupressus sempervirens.

Figure 44 Tree 55 - high TRV, Corymbia maculata.

Figure 45 T56 - moderate TRV, Lagerstroemia indica. Street tree.

Figure 46 Tree 57 - moderate TRV, Prunus persica.

Figure 47 Tree 57 - TRV moderate, Prunus persica.

Figure 48 Tree 59 - high TRV, Araucaria columnaris.

Figure 49 Tree 60 - moderate TRV, Cupressus sempervirens.

Figure 50 Tree 61 - moderate TRV, Callistemon viminalis.

Figure 51 Tree 62 - high TRV, Phoenix canariensis.

Figure 52 T63 - high TRV, Phoenix canariensis.

Figure 53 T64 - high TRV, Phoenix canariensis.

Figure 54 Tree 65 - Butia capitata.

Figure 55 Tree 66 - high TRV, Butia capitata.

Figure 56 Tree 67 - moderate TRV, Livistona chinensis.

Figure 57 Tree 68 - moderate TRV, Lagerstroemia indica.

Figure 58 Tree 69 - moderate TRV, Plumeria acutifolia.

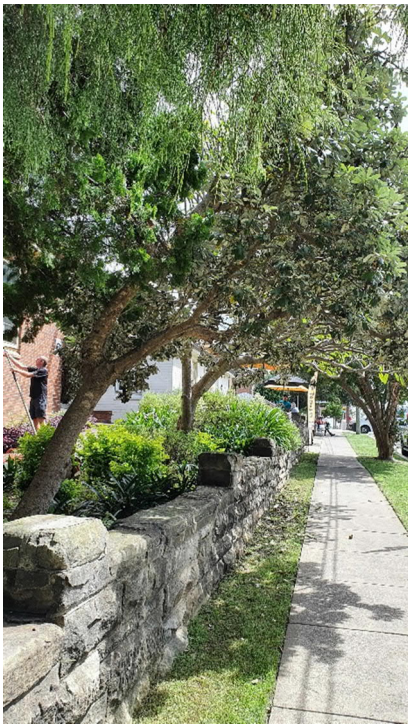


Figure 59 Tree 70 - moderate TRV, Banksia integrifolia.

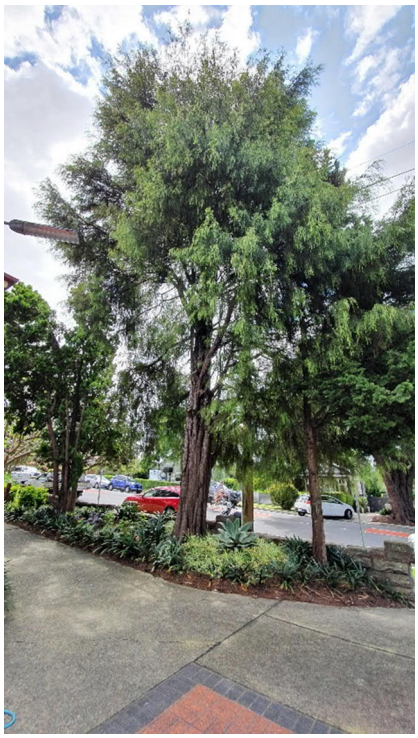


Figure 60 Tree 72 - high TRV, Cupressus casmiriana.

Figure 61 Tree 73 - moderate TRV, Cupressus sempervirens.

Figure 62 Tree 74 - high TRV, Lophostemon confertus.

Figure 63 Tree 75 - high TRV, Syncarpia glomulifera.

Figure 64 Tree 76 - high TRV, Corymbia citriodora.

Figure 65 Tree 77 - moderate TRV, Cupressus sempervirens.

Figure 66 Tree 78 - moderate TRV, Cyathea australis.

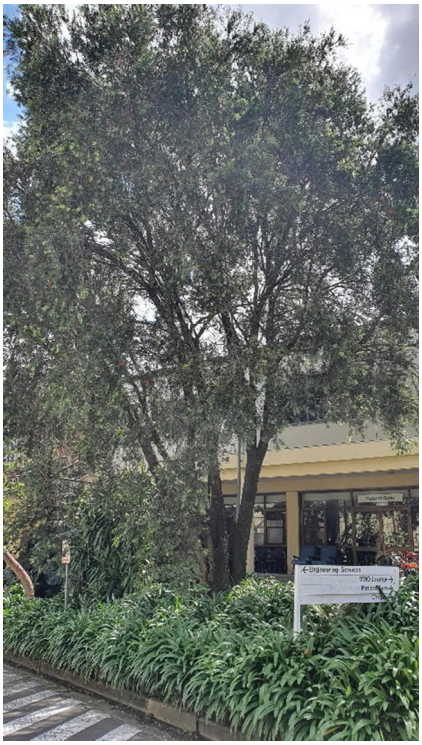


Figure 67 Tree 79 - moderate TRV, Callistemon viminalis.

Figure 68 Tree 80 - moderate TRV, Macrazamia communis.

Figure 69 Tree 81 - moderate TRV, Banksia serrata.

Figure 70 Tree 82, moderate TRV, Callistemon viminalis.

Figure 71 T83 - moderate TRV, Macrazamia communis.

Figure 72 T85 - moderate TRV, Eucalyptus saligna.

Figure 73 Tree 86 - high TRV, Eucalyptus saligna.

Figure 74 Tree 86 - Eucalyptus saligna.

Figure 75 Tree 87 - moderate TRV, Archontophoenix alexandrae.

Glossary of Arboricultural Terms

absorbing roots	fine, fibrous roots that take up water and mineral; most absorbing roots are within the top 30 cm of soil
adventitious	shoots and roots that develop other than at their normal positions of origin
aeration	provision of air to the soil to alleviate soil compaction and improve its structure
age class	young – less than 20% of life expectancy mature – 20% to 80% life expectancy over-mature – greater than 80% of life expectancy
allelopathic effect	effect caused by chemical substances produced by some plants that inhibit the growth and development of other nearby plants
bifurcation	natural division of a branch or stem into two or more stems or parts
bracket	fruiting or spore producing body of wood decay fungi, forming on the external surface of the trunk or branch
cambial	pertaining to cambium
cambium	thin layer of cells that produces phloem on the outside and xylem on the inside
canopy	converging crowns of two or more trees
chlorotic	leaves turning pale green, yellow or white from lack of chlorophyll, usually due to nitrogen deficiency
cleaning / clean out	in pruning – the selective removal of dead, dying, diseased, damaged, broken and defective branches
codominant	similar in size and importance, usually associated with trunks or scaffold branches; arising from a common junction and lacking a normal branch union
compaction (soil)	compression of the soil, often as a result of vehicle or heavy equipment, that breaks down soil aggregates and reduces soil volume and total pore space, especially the macropores
condition	overall state of the tree; refers to health, vigour and structure rated as excellent, good, fair, poor or dead
crown	the part of the tree comprising the total amount of foliage
DAB	Diameter Above Buttress – trunk diameter measured immediately above the root buttress
DBH	Diameter at Breast Height; trunk diameter measured at 1.4 metres above ground level
decay	*(n.)* an area of wood that is undergoing decomposition; *(v.)* decomposition of organic tissues by fungi or bacteria

decline	gradually diminishing health or condition of a tree
decurrent	the form of a tree with no central leader but with structural scaffold branches forming the basis of a spreading crown, compare with excurrent
defect (structural)	internal or external points of weakness that reduce the stability of the tree
desiccation	drying out, or dehydration, of part of a tree – usually roots or leaves
designated TPZ	is the actual area designated to be protected from activities that could affect the health or ongoing viability of the tree and is generally based upon the indicative TPZ but modified to recognise buildings and other existing encroachments in the indicative TPZ or parts of the indicative TPZ excised for development
epicormic	arising from a latent or adventitious bud
evapotranspiration	the process through which plants release water to the surrounding air, dissipating ambient heat
excurrent	the form of a tree with a central leader and symmetric, vertical crown, compare to decurrent
failure	structural collapse in part or full of part of a tree – roots, trunk or branches – often leading to the whole tree or part of the tree falling
fastigate	having clusters of vertical branches, appearing as a single columnar form
form	the shape and symmetry of a tree
hanger	broken or cut branch hanging in a tree
hazard	a condition that predisposes a tree to failure
health	freedom from pests, diseases, ailments, stress – measured as excellent, good, fair, poor or dead
heartwood	inner xylem, consisting of dead cells, does not transport water and minerals
hung-up	a tree or a branch that has failed and become caught in another tree, or in the same tree in the case of a branch
included bark	bark that becomes imbedded in a union between branches, a branch and stem, or co-dominant stems
indicative TPZ	is the circular area around a tree whose radius is calculated by multiplying the DBH by 12, regardless of existing obstructions
leader	dominant upright stem, particularly on excurrent trees
live crown ratio	ratio of the height of the crown containing live foliage to the height of the tree
lopping	cutting of branches or stems between branch unions (this practice is generally unacceptable).
occlusion	Growth processes where would wood develops to enclose the wound face be the merging of the wound margins concealing the wound
phloem	conductive tissue immediately beneath the bark; transports food

	materials throughout the tree
phototropic	the tendency of a tree to grow towards light
reactive soils	soils with high clay content that expand and shrink due to changes in moisture levels
rhizosphere	the root zone; the soil around the fine and woody roots
risk	a combination of the potential for tree failure and the likely consequences if failure does occur
root crown	area where the main root joins the plant stem, usually at or near ground level
sapwood	outer part of the xylem that transports water and minerals
scaffold branches	permanent or structural branches; arising from the trunk
Structural Root Zone (SRZ)	the area around the tree, usually within 3 to 4 metres from the trunk, in which the structural roots are situated, and which must be protected, particularly during construction.
structural roots	large, woody tree roots that anchor and support the trunk and crown; roots characterised by secondary thickening and relatively large diameter giving form to the root system and functioning in anchorage and support
structure	construction and arrangement of parts (roots, trunk, branches) – rated as excellent, good, fair or poor
target	person, object or structure that could be injured or damaged in the event of tree or branch failure
topping	cutting the main trunk to reduce the height of a tree (this is an unacceptable practice)
Tree Protection Zone (TPZ)	is the principal means of protecting trees on development sites and is a combination of the root area and crown area required to be isolated from construction impacts so that the tree will remain viable
vigour	capacity to grow, and to resist disease, ailments, pests, stress – categorised as normal, high low and dormant.
xylem	the wood – inside of the cambium layer; transports water and dissolved mineral nutrients from the roots to other parts of the tree; provides strength in trunk and branches

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The definitions included in this glossary have been adapted from the following:

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