AXIOM ARBOR
TREE SERVICES

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Arboricultural Impact Assessment Report

Prepared for: Northern Beaches Essential Services Accommodation

Site: 16 Wyatt Avenue Belrose NSW 2085

Subject: Arboricultural Impact Assessment

Local Government Authority: Northern Beaches Council

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1 Introduction

In April 2021, the owners of Northern Beaches Essential Services Accommodation commissioned Louis Putnam Gray of Axiom Arbor Tree Services to write an Arboricultural Impact Assessment for the site at 16 Wyatt Avenue Belrose to accompany a proposed development called the Northern Beaches Essential Services Accommodation.

1.1 Scope

The report has been undertaken to meet the following objectives.

- Conduct a visual assessment of all significant trees located within 5m of the development site from ground level. For the purpose of this report, a significant tree is a tree with a height equal to or greater than 5m (DCP)
- Determine the trees estimated contribution years and remaining, Useful Life Expectancy and award the trees a retention value
- Provide an assessment of the potential impact the proposed development is likely to cause to the condition of the subject trees in accordance with AS4970-2009 " The Protection Of Trees On Development Sites"
- Specify tree protection Measures in accordance with AS4970-2009

1.2 Limitations

The observations and recommendations are based on the site inspections identified by the sighted plans in section 1.2.1 only. The findings of this report are based on the observations and site conditions at time of inspection.

All of the observations were carried out from ground level. The accuracy of the assessment of the subject trees structural condition and health is limited to the visibility of the tree at the time of inspection.

Root decay can sometimes be present with no visual indication above ground. It is also impossible to know the extent of any root damage caused by mechanical damage such as underground root cutting during the installation of services without undertaking detailed root investigation. Any form of tree failure due to these activities is beyond the scope of this assessment.

The report reflects the subject tree(s) as found on the day of inspection. Any changes to the growth environment of the subject tree, or tree management works beyond those recommended in this report may alter the findings of the report. There is no warranty, expressed or implied, that the problems or deficiencies relations to the subject tree, or subject site may not arise in the future.

Tree identifications is based on accessible visual characteristics at the time of inspection. As key identifying features are not always available the accuracy of identification is not guaranteed. Where tree species is unknown, it is indicated with an *spp.*

Alteration of this report invalidates the entire report

1.2.1 Plans sighted

Table 1 - Plans sighted

Plan	Plan #	Author	Date
Site Survey	11971B	Bee and Lethbridge	12/2/21
Site Plan	A0.02 DA03	Platform Architects	27/5/21
Upper Building Basement Plan	A1.01 DA03	Platform Architects	27/5/21
Upper Building Lower Ground Floor Plan	A1.02 DA03	Platform Architects	27/5/21
Upper Building Ground Floor Plan Sheet 1	A1.03 DA03	Platform Architects	27/5/21
Upper Building Ground Floor Plan Sheet 2	A1.04 DA03	Platform Architects	27/5/21
Upper Building Ground Floor Plan	A1.05 DA03	Platform Architects	27/5/21
Upper Building Roof Plan	A1.06 DA03	Platform Architects	27/5/21
Lower Building Basement Plan	A1.07 DA03	Platform Architects	27/5/21
Lower Building Ground Floor Plan Sheet 1	A1.08 DA03	Platform Architects	27/5/21
Lower Building Ground Floor Plan Sheet 2	A1.09 DA03	Platform Architects	27/5/21
Lower Building First Floor Plan Sheet 1	A1.10 DA03	Platform Architects	27/5/21
Lower Building First Floor Plan Sheet 2	A1.11 DA03	Platform Architects	27/5/21
Lower Building Roof Plan Sheet 1	A1.12 DA03	Platform Architects	27/5/21
Lower Building Roof Plan Sheet 2	A1.13 DA03	Platform Architects	27/5/21
NE Elevations Upper and Lower Building	A2.01 DA03	Platform Architects	27/5/21
SW Elevations Upper and Lower Building	A2.02 DA03	Platform Architects	27/5/21
SW Elevations Upper and Lower Building	A2.03 DA03	Platform Architects	27/5/21
SE Elevation NW Elevation	A2.04 DA03	Platform Architects	27/5/21
SE Elevation NW Elevation	A2.05 DA03	Platform Architects	27/5/21

1.3 The site

16 Wyatt ave Belrose is a large site encompassing 9345m^2. The front of the site (South east) closest to Wyatt avenue is the location of the main dwelling on site, which is a two-story brick house with a tile roof with an inground pool behind. The site opens out to a large paddock area with old farm buildings, currently used to house horses. The very rear of the site contains a large sloped grassed area with a clad farm building. The site is on a moderate gradient, sloping SSE to NNW by up to 28m.

Under the Warringah Council Local Environment Plan (LEP) 2000, the site:

- Does not form part of a heritage item
- Is not part of a significant environmental or native vegetation area.
- Under the Land Use Zone Maps, is Zoned as a Deferred Matter

It is also noted that the site is located in a designated RFS 10/50 bushfire clearing zone.

1.3.1 Site soil

The site soil is that of the "Somersby" residual landscapes. These landscapes contain moderately deep red and yellow earths overlaying laterite gravels and clays on crests to leached sands on drainage lines. Limitations include localised permanently high-water tables, areas of laterite and stony soil, very low soil fertility and highly permeable soil.

1.4 Referred legalities and regulations

- Warringah Council Local Environment Plan (LEP) 2000
- Warringah Council Development Control Plan (DCP) 2000
- Australian Standard 4970-2009 '*The Protection of Trees on Development Sites*'
- Australian Standard 4373-2007 *'The Pruning of Amenity Trees'*
- State Environmental Planning Policy (Vegetation in non-rural areas) 2017

Figure 1 - 16 Wyatt ave Belrose outlined in red

2 Methodology

On the 19th of April 2021 the site was visited by Louis Putnam Gray of Axiom Arbor Tree Services. The trees were inspected visually from ground level to determine their health, structure, for the recording of the Tree Protection Zones (TPZ) and Structural Root Zones (SRZ).

The health and vigor of the trees were assessed by the following:

- Leaf size, colour and shape
- Canopy cover and density
- Amount of deadwood
- Leaf drop
- Epicormic shoots
- Reaction wood formed

The structure of the trees were assessed by the following:

- Trunk and bark anomalies
- Presence of decay and fungal fruit bodies
- The site to where branches were once attached
- Stem and branch junctions
- Crown weight distribution.

The following assessments also took place:

- Tree height was estimated using authors prior experience
- Canopy spread was paced out as an approximation
- The cardinal points were found using the compass on the authors mobile telephone

- Tree A-Z, developed by Jeremy Barrell was used to give the trees a rating within the current landscape and by taking the development footprint into account. The matrix for this landscape is found in the appendix
- Diameter at Breast Height (DBH) was measured using a diameter tape at 1.4m above ground level where possible
- Diameter at Base (DAB) was measured using a diameter tape above the flare of the Root Crown
- Tree Protection Zones and Structural Root Zones have been calculated using formulas proven in the Australian Standards 4970 *The Protection of Trees on Development Sites*
- The Tree Protection Zone (TPZ) was found using DBH x 12
- The Structural Root Zone (SRZ) was calculated using the formula
  SRZ **radius** = $(D \times 50)^{0.42} \times 0.64$
- A measuring tape was used to measure the distance between the trunk of 3 trees to the existing dwelling
- For the purpose of this report, major tree roots are defined as being 30mm in diameter or greater
- Local maps were obtained using Google Earth
- All photos taken are from the author.

3 Observations and results

A full tree inventory can be found within the appendix

3.1 Development under proposed plans

This project has a number of different elements that will affect the trees to be retained on site.

3.1.1 Demolition of existing structures

Under the current proposal, the subject dwelling and pool located at the front of the property are proposed for demolition. The farm shed and ancillary outdoor structures and hard surfaces at the rear of the property have also been proposed for demolition. The demolition of the existing dwelling and driveway will be occurring within the protection zone of trees #1, 2, 7, 8, and 9.

The demolition of a farm shed and surrounding hard surfaces will be occurring within the TPZ of tree #10, 26, 27, 28 and 29.

3.1.2 Entrance pathway and bin storage room at the front of the property

The entrance pathway for the property is located within the middle of the site frontage between the existing Leighton Green Cypress hedge. The pathway runs through the

Protection zone of tree 3b and tree 4 on the nature strip, and tree #1 inside the property

For the entry to comply with regulations regarding disabled ramps, the ramp will need to be straight and 1.6m wide whilst retaining its current gradient.

The bin storage area is located at the southern corner of the property within the footprint of tree #3, the protection zone of a Council owned tree #4 and within protection zone of tree #5.

3.1.3 New Driveway

A new concrete driveway has been proposed from Wyatt avenue on the eastern side of the block that links the two proposed buildings. The driveway is widened for 2 cars at the point of entry for the block and is ramped above ground to control the gradient and even out the amount of fall. The ramped driveway runs along the north eastern side of the upper building with an entry point for the upper garage. The driveway turns in a northerly direction alongside the southern building, elevated above ground. The driveway turns once again in a north west direction and then hairpin turns into the garage for the lower building. The driveway falls within the footprint and protection zone of trees numbered 1, 2, 3a, 7, 8, 9, 14, 15, 26, 27, 28, 29, and 37

3.1.4 Upper Building

The upper building is comprised of 4 levels following the gradient of the land. The building contains 28 individual boarding rooms inclusive of the caretaker's room, along with various storage rooms, laundry facilities and common areas. The basement has parking for up to 11 cars, 4 motorbikes and also includes 6 bicycle spaces. The building requires a cut of up to 5m into the site and will be within the protection zone of trees #2, 7, 8 and 9.

3.1.5 Lower Building

The lower building is larger than the upper building comprising of 39 boarding rooms over 3 levels inclusive of the basement. The building runs in a south – north direction then doglegs to the north-west. The building requires a cut and fill of approximately 4m to level the land based on the different gradients. The basement has parking for up to 20 cars , 6 motorbikes and 9 bicycles. Storage areas and a laundry are also included in the building. Construction of the building is located within the footprint and protection zone of trees #14, #15 #37.

3.2 Exempt species and 10/50 bushfire clearing entitlement.

The following trees are classified as exempt species or an exempt height for that species using the Northern Beaches Council Tree Regulatory controls and are eligible for removal. These are trees # 1, 2, 5, 14, 15, 16.

Three (3) trees are eligible for removal under the 10/50 bushfire clearing entitlement as they are located within 10m of the existing dwelling, these are trees # 7, 8 and 9.

One (1) tree, #26, is eligible for removal under the 10/50 bushfire clearing entitlement as it is located within 10m of an existing farm building over 50m^2 in area (under 6.5 and 7.1 of the 10/50 clearing code of practice for NSW).

3.3 Impact Assessment Schedule

Table 2 - Impact Assessment Schedule

Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
1	*Pinus spp – radiata* (Radiata Pine)	Z3	15	3.5	-	Tree identified as an exempt species under the Northern Beaches Council Tree Regulatory Controls	Remove and replace
2	*Liquidambar styraciflua* (Liquidamber)	Z3	5.16	2.51	-	Tree identified as an exempt species under the Northern Beaches Council Tree Regulatory Controls	Remove and replace
3	*Eucalyptus globulus subsp. bicostata* (Southern Blue Gum)	Z4	5.58	2.61	Footprint	Tree is located within the footprint for the new Garbage Bin Storage Area. Tree is in a state of decline with a short useful life expectancy	Remove and replace
3a	*Lagerstroemia indica* (Crepe Myrtle)	A1	2	1.5	footprint	Tree is located within the footprint of the widened driveway. The tree is a small species and can be easily replaced with an advanced specimen	Remove and replace
3b	*Lagerstroemia indica* (Crepe Myrtle)	A1	2	1.5	footprint	Tree is located within the footprint of the new entrance pathway. Tree is a small species that can be easily replaced with an advanced specimen	Remove and replace
4	*Eucalyptus haemastoma* (Scribbly Gum)	A2	7.92	3.63	27.3% Major	The construction of the bin room, front pathway and new kerb and gutting will result in a 27.3% incursion into the TPZ of the tree which is considered major under section 3.3.3 of AS4970-2009. Excavations required for the bin room (6.08%) and front pathway (7.87%) are to be done by hand under the supervision of the project	Retain

Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
						arborist. The construction of the bin room and front path must be done on or above existing grade. The slabs should consist of a bed Sandy loam with 1.5-2cm stone chips or gravel with no fines to act as a skeleton and be used as a subbase .This will help limit damage to the fine feeder roots. Then once the base is down and compacted, permeable paving/ asphalt /concrete can be placed on top. While its acknowledged that any intrusion into these protection zones will negatively affect the ability of the tree to freely uptake water, nutrients and will prohibit gaseous exchange; these methods will minimise root severance. The construction of the kerb and guttering will result in a 13.36% incursion into the TPZ of this tree. As seen in figure 4, a small swale has formed between the existing asphalt and the tree due to erosion, water run-off and vehicle compaction. Due to this depression, construction of new kerb and guttering will require minimal excavation to achieve adequate levels. Supervision from the project arborist during the excavation stage for the kerb and gutter is required. This tree will require protection fencing during the life of the development	
5	*Cupressus macrocarpa* (Monterey Cypress)	Z3	7.2	2.57	-	Tree identified as an exempt species under the Northern Beaches Council Tree Regulatory Controls. Conflicting with service wires	Remove and replace
6	*Pinus spp – radiata* (Radiata Pine)	A1	4.2	2.25	0%	Neighbouring tree. Tree protected by dividing fence, no extra protections necessary	Retain
6a	*Eucalyptus spp – possibly haemastoma* (Eucalyptus)	A1	4.2	2.25	0%	Neighbouring tree. Tree protected by dividing fence, no extra protections necessary	Retain

Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
7	*Eucalyptus saligna* (Sydney Blue Gum)	Z2	7.92	3.08	41.29% Major	Construction of the new driveway and building results in a 41.29% incursion into the TPZ and SRZ of the tree which is considered major under section 3.3.3 od AS4970-2009. Tree is eligible for removal as it is located 2.9m from the existing dwelling as the property is located within the 10/50 bushfire clearing entitlement.	Remove and replace
8	*Corymbia citriodora* (Lemon Scented Gum)	Z2	6.84	2.85	40.34% Major	Construction of the new driveway and building results in a 40.34% incursion into the TPZ and SRZ of the tree which is considered major under section 3.3.3 of AS4970-2009. Tree is eligible for removal as it is located 2.9m from the existing dwelling as the property is located within the 10/50 bushfire clearing entitlement.	Remove and replace
9	*Jacaranda mimosifolia* (Blue Jacaranda)	Z2	2	1.77	26.17% Major	Tree identified as an exempt species under the Northern Beaches Council Tree Regulatory Controls. The tree is also located 2.7m from an existing dwelling and is eligible for removal under the 10/50 bushfire clearing entitlement.	Remove and replace
10	*Casuarina cunninghamiana* (River She Oak)	A1	6.84	2.74	8.71% Minor	Demolition of the existing ancillary farm shed will equate to an 8.71% incursion into the TPZ of this tree which is considered minor under section 3.3.2 of AS4970-2009. The tree is located on an embankment, with works occurring well below the natural ground level of the tree. No works are predicted to impact the root system or canopy of this tree. Due to topography, tree protection is not required	Retain
11	*Casuarina glauca* (Swamp She Oak)	A2	3.6	2.34	0%	Construction works occurring outside of protection zone below grade of tree, due to topography and location, tree protection is not required	Retain
12	*Eucalyptus saligna* (Sydney Blue Gum)	A2	4.56	2.5	0%	Construction works occurring outside of protection zone below grade of tree, due to topography and location, tree protection is not required	Retain
13	*Banksia integrifolia* (Coast Banksia)	A1	5.04	2.57	0%	Construction works occurring outside of protection zone below grade of tree, due to topography and location, tree protection is not required	Retain
14	*Cinnamomum camphora*	Z3	10.2	3.68	Footprint driveway	Tree identified as an exempt species under the Northern Beaches Council Tree Regulatory Controls	Remove and replace

Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
	(Camphor Laurel)						
15	*Pittosporum undulatum* (Native Daphne)	Z1	3.72	2.08	-	Tree identified as an exempt height for species under the Northern Beaches Council Tree Regulatory Controls	Remove and replace
16	*Pittosporum undulatum* (Native Daphne)	Z1	2	1.61	0%	Construction works occurring well outside of protection zone of tree. No protections necessary due to site topography	Retain
17	*Pittosporum undulatum* (Native Daphne)	A2	2.64	1.88	0%	Construction works occurring well outside of protection zone of tree. No protections necessary due to site topography	Retain
18	*Angophora costata* (Sydney Red Gum)	A2	2	1.57	-	Construction works occurring well outside of protection zone of tree. No protections necessary due to site topography	Retain
19	*Angophora costata* (Sydney Red Gum)	A2	7.44	3.01	-	Construction works occurring well outside of protection zone of tree. No protections necessary due to site topography	Retain
19a	*Angophora costata* (Sydney Red Gum)	A2	2.64	1.82	-	Construction works occurring well outside of protection zone of tree. No protections necessary due to site topography	Retain
20	*Angophora costata* (Sydney Red Gum)	A2	3.24	1.94	-	Construction works occurring well outside of protection zone of tree. No protections necessary due to site topography	Retain

Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
21	*Banksia serrata* (Old Man Banksia)	A1	2	1.88	-	Construction works occurring well outside of protection zone of tree. No protections necessary due to site topography	Retain
22	*Angophora costata* (Sydney Red Gum)	A1	2.64	2	-	Construction works occurring well outside of protection zone of tree. No protections necessary due to site topography	Retain
23	*Angophora costata* (Sydney Red Gum)	A1	4.8	2.47	-	Construction works occurring well outside of protection zone of tree. No protections necessary due to site topography	Retain
24	*Eucalyptus spp* (Eucalyptus)	A2	3	2.25	-	Construction works occurring well outside of protection zone of tree. No protections necessary due to site topography	Retain
25	Banksia serrata (Old Man Banksia)	Z5	-	-	-	Tree has failed at root plate and is hung up in adjoining eucalypt. Location identified as very low occupation area, removal at discretion of home owner	Remove and replace
26	*Casuarina cunninghamiana* (River She Oak)	A2	7.32	3.04	37.71% Major	Construction of the new driveway will result in a 37.71% encroachment into the TPZ and SRZ of this tree which is considered major under AS4970-2009. The location of the tree at the base of the rock shelf may indicate that the tree has formed an asymmetrical root plate, towards the area of incursion. This would result in a greater impact to the root system of the tree, affecting its uptake of water and nutrients through loss of root mass. This tree is not retainable under the current proposal and will require replacement. Tree is eligible for removal under the 10/50 entitlement as it is located 7.6m from an existing farm building greater than 50m^2 in area.	Remove and Replace

Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
27	*Casuarina glauca* (Swamp She Oak)	A2	2.16	1.85	Footprint driveway	The tree is located within the footprint of the proposed driveway, this tree would be required to be removed and replaced under the current proposal.	Remove and Replace
28	*Casuarina glauca* (Swamp She Oak)	A2	4.44	2.51	Footprint	The tree is located within the footprint of the proposed driveway, this tree would be required to be removed and replaced under the current proposal.	Remove and Replace
29	*Casuarina glauca* (Swamp She Oak)	A2	3.84	2.41	Footprint	The tree is located within the footprint of the proposed driveway, this tree would be required to be removed and replaced under the current proposal.	Remove and Replace
30	*Casuarina cunninghamiana* (River She Oak)	A2	6	2.67	0%	No works are projected within the TPZ of this tree. Additional TPZ fencing required to protect root system from heavy machinery compaction and activities listed in section 6.7 of this report.	Retain
31	*Casuarina glauca* (Swamp She Oak)	A2	3.84	2.37	0%	No works are projected within the TPZ of this tree. Additional TPZ fencing required to protect root system from heavy machinery compaction and activities listed in section 6.7 of this report.	Retain
32	*Casuarina glauca* (Swamp She Oak)	A2	2.76	2.33	0%	No works are projected within the TPZ of this tree. Additional TPZ fencing required to protect root system from heavy machinery compaction and activities listed in section 6.7 of this report.	Retain
33	*Casuarina glauca* (Swamp She Oak)	Z9	4.8	2.37	0%	No works are projected within the TPZ of this tree. Additional TPZ fencing required to protect root system from heavy machinery compaction and activities listed in section 6.7 of this report.	Retain
34	*Casuarina glauca* (Swamp She Oak)	A2	4.32	2.3	0%	No works are projected within the TPZ of this tree. Additional TPZ fencing required to protect root system from heavy machinery compaction and activities listed in section 6.7 of this report.	Retain
35	*Casuarina glauca* (Swamp She Oak)	Z9	7.92	2.97	0%	No works are projected within the TPZ of this tree. Additional TPZ fencing required to protect root system from heavy machinery compaction and activities listed in section 6.7 of this report.	Retain

Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
36	*Casuarina glauca* (Swamp She Oak)	A2	6.36	2.95	0%	No works are projected within the TPZ of this tree. Additional TPZ fencing required to protect root system from heavy machinery compaction and activities listed in section 6.7 of this report.	Retain
36a	*Melaleuca linariifolia* (Snow in Summer)	A2	2.64	2	0%	Tree is located outside the development area and protected by a boundary fence. No additional protections necessary	Retain
36 b	*Melaleuca linariifolia* (Snow in Summer)	A2	4.08	-	0%	Tree is located outside the development area and protected by a boundary fence. No additional protections necessary	Retain
36c	*Melaleuca linariifolia* (Snow in Summer)	A2	4.8	-	0%	Tree is located outside the development area and protected by a boundary fence. No additional protections necessary	Retain
36 d	*Melaleuca linariifolia* (Snow in Summer)	A2	3.84	-	0%	Tree is located outside the development area and protected by a boundary fence. No additional protections necessary	Retain
37	*Eucalyptus viminalis* (Sydney Peppermint)	A2	13.56	3.78	25.65% Major	Construction of the driveway and excavation for the lower building will result in a 25.65% incursion into the TPZ and SRZ of this tree which is considered major under section 3.3.3of AS4970-2009. 20.68% of the total incursion amount is a result from the ramped driveway on the north eastern side of the tree. Whilst the ramp will be above ground, its construction will require a significant amount of disruption to the TPZ through excavation and the movement of materials. The cumulative impacts from the loss of root mass through construction, added compaction issues through transportation of materials and	Remove and replace

Tree ID	Species	Retention value	TPZ radius (m)	SRZ radius (m)	TPZ encroachment	Discussion/ Conclusion	Recommendation
						machinery movement and with the presence of an active subterranean termite nest (possibly *Coptotermes acinoformis*), the Useful Life Expectancy of the tree will be reduced. This tree cannot be successfully retained in the long term under the current proposal and is recommended for removal and replacement.	
38	*Casuarina glauca* (Swamp She Oak)	A2	4.44	2.39	39.18% Major	No works are projected within the TPZ of this tree. TPZ fencing required to protect root system from heavy machinery compaction and activities listed in section 6.7 of this report.	Retain and Protect
39	*Casuarina glauca* (Swamp She Oak)	A1	5.16	2.67	20.71% Major	No works are projected within the TPZ of this tree. TPZ fencing required to protect root system from heavy machinery compaction and activities listed in section 6.7 of this report.	Retain and protect

3.4 Site photos

Figure 2 - Trees 1 & 2

Figure 3 – Trees #3, 5, 6, 6a

Figure 4 – Trees 3a, 3b, 4

Figure 5 – Trees 7, 8, 9 close to existing dwelling

Figure 6 - Trees 10, 11, 12, 13

Figure 7 – Trees 14 & 15

Figure 8 - Trees 16 - 19a, away from development area

Figure 9 – Trees 20-25, away from development area

Figure 10 - Trees 26, 27, 28, 29

Figure 11 – Trees 30-36

Figure 12 - Trees 36a, b, c, d away from development area

Figure 13 – Trees 37, 38, 39

Figure 14 - Tree 37, red arrow shows subterranean termite nest

Figure 15 - Blue circle shows hole from probe to determine if nest is active, yellow arrow shows active termites

4 Discussion

4.1 Comment on roots and the Protection of Trees on Development Sites

Tree roots grow opportunistically in response to their environment with oxygen as their greatest limiting factor. They generally radiate out from the trunk and are shallow to best access water, nutrients and air from above ground. (Gerhold et al, 2003).

A study of tree after storms found a relationship between the trunk diameter and a 'structural root plate' of large diameter woody roots. These roots play a significant role in anchoring the tree in the ground. It was also recognized that for leaning trees, the roots opposite the lean were often larger in diameter and extend further through the soil. It was determined that tensional forces along roots contribute significantly to anchoring the above ground parts of the tree. Through careful excavation, smaller diameter roots were shown to extend beyond the canopy with the fine feeding roots at 5-7 times the height of a tree (Mattheck & Breloer, 1994; Perry ,1982).

For trees on development sites, direct physical damage to tree roots such as severing and indirect impacts through soil compaction, soil water changes and soil chemical changes can impact on large sections of the root system and interfere with the long-term health of the tree. As damage occurs closer to the trunk, defence against pathogens and whole tree stability decrease (Fite & Smiley2009; Smiley,2008).

Tree protection zones are applied to trees on construction sites to prevent damage to roots and the above ground parts of trees. The Australian Standards 4970 *protection of trees on development sites* provides formulas to calculate protection setback distances around trees. These distances are measured as radius from and approximate center of the trunk and are used to infer an area of expected root growth. Site changes within these zones can be possible depending on the type of change and the methods used to make the change (Matheny and Clark, 1998). Further, it is reasonable to consider existing site conditions and the limitations imposed on a 'typical' spread.

4.2 Building within Protection Zones, considerations under the standard, summary of table 3.2, loss of root mass

Section 3.3.4 of AS4970-2009 *The Protection of Trees on Development Sites* lists considerations that the project arborist can take into account when building within a Protection Zone. These considerations help the project arborist into making a determination on the encroachment and whether the development will negatively impact trees to be retained.

The greatest impact to retention of trees on site comes through the construction of the driveway through either loss of root mass or root efficacy as the result of the construction process. For the trees on site that have a major incursion into their TPZ

and SRZ, a determination has been made in respect to the level of each major incursion and whether tree retention is practical by taking considerations listed in section 3.3.4 of the standard into account.

Tree #4, the *Eucalyptus haemastoma* is located on the Council nature strip. The combined impacts through the construction of the bin room (6.08%) and front path (7.87%) can be managed through tree sensitive construction techniques and Arborist supervision. The location for the new kerb and guttering will result in a 13.36% incursion and can be constructed within a small swale that has formed between the eroded asphalt and the base of the tree. Due to the gradient of the land, this should require minimal excavation to build a gutter that will effectively disperse water. Under guidance of the project arborist and installation of protective fencing, the construction of the bin room, front path and kerb should have a minimal detrimental impact to the tree.

Tree #37 has a major incursions of 25.65% of the TPZ through the construction of the driveway and the lower building which would severely affect the root systems of the tree, limiting its uptake of water and nutrients therefore affecting tree longevity. The cumulative impact from the loss of root mass and efficacy alongside the presence of subterranean termites reduces Useful Life Expectancy of the tree.

5 Conclusion

This report assesses the impact of the proposed construction of a boarding house at the subject site to all trees located within the near vicinity of the proposal including trees that may be affected during the transportation of materials. The report was compiled in accordance with AS4970-2009 *The Protection of Trees on Development Sites,* the Warringah Council Development Control Plan 2000 and Warringah Council Local Environment Plan 2000.

Forty-Seven (47) trees have been assessed as part of this development.

Of the 47 trees assessed, six (6) trees are eligible for removal as they are classified as an exempt species or exempt height for that certain species within the Northern Beaches Council tree regulatory controls. A further three (3) trees are eligible for removal as they are located within 10m of an existing dwelling and can be removed using the 10/50 bushfire clearing entitlement.

A further one (1) tree is eligible for removal as it is located within 10m of an existing farm building greater than 50m^2 and can be removed using the 10/50 bushfire clearing entitlement.

A further seven (7) trees are recommended for removal as they fall within the construction footprint or have a major incursion into their Protection Zone that would necessitate removal. Of the seven (7) trees, six (6) were classified as category "A" trees with one (1) tree classified as a category "Z" tree.

One (1) category "A" tree is recommended for retention with incursions greater than 10%. The singular tree, a Council owned *Eucalyptus haemastoma* (Scribbly Gum) located on the nature strip has an incursion into its TPZ through the construction of a front pathway, bin room and new kerb and guttering. This tree requires arborist supervision for excavation within its TPZ.

Thirty-one (31) total trees are scheduled for retention, with protection measures dependent on their proximity to the proposed works and site topography.

This report does not provide approval for tree removal or pruning works. All recommendations in this report are subject to approval by the relevant authorities and/or tree owners. This report should be submitted as supporting evidence with the development application

Table 3 - Conclusions table

Impact	Reason	Category A		Category Z
		A1	A2	Z
Trees recommended to be removed	Building construction, within footprint, major incursion	3a, 3b, 27, 28, 29, 37,		3,
Trees recommended to be removed	Exempt species, exempt through proximity to dwelling, poor condition, excessive nuisance			1, 2, 5, 7, 8, 9, 14, 15, 26
Trees recommended to be retained due to TPZ encroachment greater than 10%	Removal of existing surfacing/structures and/or installation of new surfacing/structures	4,		
Trees recommended to be retained due to encroachments of 10% or less	Removal of existing surfacing/structures and/or installation of new surfacing/structures	6, 6a, 10, 11, 12, 13, 17, 18, 19, 19a, 20, 21, 22, 23, 24, 30, 31, 32, 34, 36, 36a, 36b, 36c, 36d, 38, 39		16, 25, 33, 35

6 Recommendations, Protection requirements

6.1 Assigning a site arborist

Before work commences on site, a site arborist should be appointed. The site arborist must hold a minimum AQF5 level of qualification in Arboriculture. The site arborist will periodically attend the site to gather information needed for the issuing of certificates of compliance for the duration of the build.

Duties of the site arborist include:

- Oversee the correct implementation of tree protection measures listed below
- Recording of tree health and vigor on a quarterly basis, if the trees are in ill health, solutions should be sort after
- Be witness to any excavation works within a tree protection zone, and advise upon the discovery of roots above 30mm in diameter
- Numbering the trees and advising contractors which trees are to be protected and which trees are to be removed

6.2 Tree works

Any pruning or removal of the trees on site must be done by an Arborist with an minimum AQF 3 qualification and be done to standard under AS4373-2007 "*Pruning of Amenity Trees".*

The following trees are recommended for removal to accommodate the proposed development.

- Trees 1, 2, 3, 3a, 3b, 5, 7, 8, 9, 14, 15, 26, 27, 28, 29, 37

All pruning and removal works must have the consent of the Local Governing Authority before they may take place

6.3 Tree Protection Fencing

Fencing should be erected before any machinery or materials be brought onto the site and before the commencement of works unless otherwise outlined. Once erected, protective fencing must not be removed or altered without approval from the site arborist. The location of the Tree Protection Fencing is located on the Tree Protection plan. The fencing shall be

- 1.8m tall
- Chain wire panels without shade cloth
- Held in place by concrete feet
- Placed at ground level
- Fastened together
- Have lockable entry points

Signage identifying the TPZ must be placed on the fencing around the TPZ and must be clearly visible within the development site. The signage shall be

- 400mm high x 400mm wide minimum
- Fastened to the fencing
- Announce the sectioned area as a Tree Protection Zone
- Include the name and contact details of the site arborist
- State the area is prohibited to all persons and activities
- Be of a sturdy material

Fencing and signage is to be installed prior to site establishment

An example of tree protection fencing is found in the appendix

6.4 Supervision of excavation works within the TPZ of Protected Trees

Excavation required for the construction of the bin room , front path, kerb and guttering must be under the guidance and supervision of the project arborist and dug using hand tools only.. All roots discovered must be documented, and only pruned with a sharp implement if necessary.

6.5 Construction of the Bin Room and Front Path

The construction of the bin room and front path must be done on or above existing grade. The slabs should consist of a bed Sandy loam with 1.5-2cm stone chips or gravel with no fines to act as a skeleton and be used as a subbase .This will help limit damage to the fine feeder roots. Then once the base is down and compacted, permeable paving/ asphalt /concrete can be placed on top.

6.6 Replacement of trees

Tree replacement is to be done on a minimum 1:1 ratio using locally indigenous advanced specimens where practicable.

The two *Lagerstroemia indica* (Crepe Myrtle) scheduled for replacement on the Council owned nature strip are to be replaced using the same species planted from a container of no less than 100L in size.

To minimise the disturbance of roots within the Protection Zones of trees it is advised that trees or shrubbery planted within an existing TPZ of a tree to be retained come in a maximum pot size of 200mm, with tube stock preferential as to minimise root disturbance

6.7 Restricted activities

The tree protection zone is an area designed to protect the roots and the root crowns of trees on development sites, on larger trees is can also encompass parts of the canopy. Works carried in these areas can have detrimental effects to the health, structure and stability of a tree, many of which are irreversible.

The following activities are restricted within tree protection zones.

- Machine excavation including trenching
- Excavation or silt fencing
- Cultivation
- Storage
- Preparation of chemicals, including cement products
- Parking of vehicles or plant
- Refueling
- Dumping of waste
- Wash down and cleaning of equipment
- Placement or fill
- Lighting of fires
- Soil level changes
- Physical damage to tree

Though some of the above activities are listed as restricted, the council may have approved the building development with the knowledge that some of these activities may occur. The site arborist must be first consulted prior to any works being undertaken within a TPZ to help advise on minimising impacts to the trees. The site arborist must supervise on all activities that take place within a TPZ.

6.8 Site Materials Storage

An area designated for site material storage and/or storage sheds is found on the tree protection plan located within the appendix.

6.9 Hold Points

Below is a sequence of hold points requiring project arborist certification throughout the development process. It provides a list of hold points that must be checked and certified. All certification must be provided in written format upon completion of the development. The final certification must include details of any instructions and remediation undertaken during the development. The principal contractor should be responsible for implementing all tree protection requirements.

Table 4 - Hold Points Table

Hold Point	Stage	Date completed and signature of project arborist
Project arborist to hold pre construction site meeting with principal contractor to discuss methods and importance of tree protection measures and resolve any issues in relation to feasibility of tree protection requirements that may arise. Project arborist to mark all trees approved for removal under DA consent	Prior to development work commencing	
Project arborist to assess and certify that tree protection has been installed in accordance with AS4970-2009 prior to works commencing on site.	Prior to development work commencing	
In accordance with AS4970-2009 the project arborist should carry out regular site inspections to ensure works are carried out in accordance with the recommendations. Site inspections are recommended on a monthly frequency	On-going throughout the development	
The removal of existing structures inside the TPZ of any tree to be retained, such as existing buildings and hard surfaces must be supervised by the project arborist.	Demolition	
Project arborist must supervise all manual excavations and root pruning inside the TPZ of any tree to be retained. Project arborist to approve all pruning of roots greater that 30mm inside TPZ. All root pruning of roots greater than 30mm in diameter must be carried out by a qualified Arborist/Horticulturalist with an minimum AQF level 3	Construction	
Project arborist to approve relocation of tree protection for installation of services. Project Arborist to certify that all underground services including storm eater inside TPZ of any tree to be retained have been installed in accordance with AS4970-2009	Construction	
Consulting Arborist to approve relocation of tree protection for landscaping. All landscaping works within the TPZ of trees to be retained are to be undertaken in consultation with the project arborist to minimise impact to trees.	Construction/Landscape	
After all demolition, construction and landscaping works are complete the project arborist should assess that the subject trees have been retained in the same condition and vigour. If changes to condition are identified, the project arborist should provide recommendations for remediation.	Under completion of development	

7 References

Australian Standard 4970-2009 – *The Protection of Trees on Development Sites*

Australian Standard 4373-2007 - *The Pruning of Amenity Trees*

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Mattheck C, & Breloer H, 1994, *The Body Language of Trees,* Stationary Hall, London

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Perry, T. O. 1982, *The Ecology of Tree Roots and the Practical Significance Thereof,* Journal of Arboriculture 8: 197-211

Smiley, ET 2008, 'Root Pruning and Stability of Young Willow Oak', Arboriculture & Urban forestry, vol 34 no. 2, pp 123-128.

Warringah Development Control Plan 2000

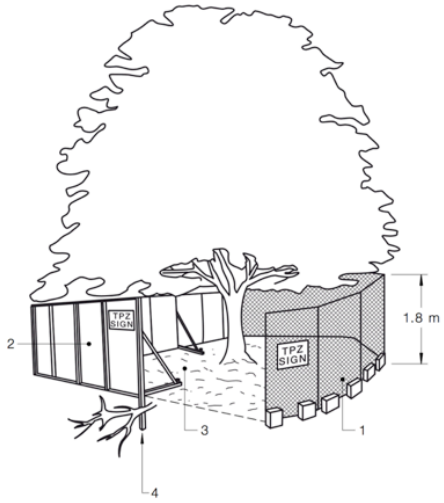
Warringah Local Environment Plan 2000

www.google.com/maps

8 Appendices – Health & Structure - Trunk Protection – Protective Fencing, Trees AZ, SULE, Tree Inventory – Site Plans

Health and Physiological condition		
Category	**Example Condition**	**Summary**
Good	• Crown has good foliage density for species • Tree shows no or minimal signs of pathogens that are unlikely to have an effect on the health of the tree • The tree is displaying good vigour and reactive growth development	• The tree is in above average health and condition with no remedial works required
Fair	• The tree may have started to dieback or have over 25% deadwood • Tree may have slightly reduced crown density or thinning • There may be some discoluoration of foliage • Average reactive growth development • There may be early signs of pathogens which may further deteriorate the health of the tree • There may be epicormic growth indication increased levels of stress within the tree	• The tree is in below average health and condition, tree may require remedial works to improve tree health
Poor	• The tree may be in decline, have extensive dieback or have over 30% deadwood • The canopy may be sparse, or the leaves may be unusually small for species • Pathogens or pests are having a significant detrimental effect on the health of the tree	• The tree is displaying low levels of health and removal or remedial works may be required
Dead	• The tree is dead of almost dead	• The tree should generally be removed

Structural condition		
Category	**Example Condition**	**Summary**
Good	• Branch unions appear to be strong with no signs of defects • There are no significant cavities • The tree is unlikely to fail in usual weather conditions • The tree has a balanced crown shape and form	• The tree is considered structurally good with well-developed form
Fair	• The tree may have minor structural defects within the structure of the crown that could potentially develop into more significant defects • The tree may have a cavity that is unlikely to fail but may deteriorate in the future • The tree has an unbalanced shape or leans significantly • The tree may have minor damage to its roots • The root plate may have moved in the past, but the tree has now compensated for this • Branches may be rubbing or crossing	• The identified defects are unlikely to cause major failure • Some branch failure may occur in usual conditions • Remedial works can be undertaken to alleviate potential defects
Poor	• The tree has significant structural defects • Branch unions may be poor of weak • The tree may have a cavity or cavities with excessive levels of decay that could cause catastrophic failure • The tree may have root damage or display signs of recent movement • The tree crown may have poor weight distribution which could cause failure	• The identified defects are likely to cause either partial or whole failure of the tree



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

Figure 13 - Tree Protection Fencing

TreeAZ Categories Field Sheet (Version 10.04-USC)

CAUTION: TreeAZ assessments must be carried out by a competent person qualified and experienced in arboriculture. The following category descriptions are designed to be a brief field reference and are not intended to be self-explanatory. They must be read in conjunction with the most current explanations published at www.TreeAZ.com.

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

	Local policy exemptions: Trees that are unsuitable for legal protection for local policy reasons including size, proximity and species
Z1	Young or insignificant small trees, i.e. below the local size threshold for legal protection, etc
Z2	Too close to a building, i.e. exempt from legal protection because of proximity, etc
Z3	Species that cannot be protected for other reasons, i.e. scheduled noxious weeds, out of character in a setting of acknowledged importance, etc
	High risk of death or failure: Trees that are likely to be removed within 10 years because of acute health issues or severe structural failure
Z4	Dead, dying, diseased or declining
Z5	Severe damage and/or structural defects where a high risk of failure cannot be satisfactorily reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, overgrown and vulnerable to adverse weather conditions, etc
Z6	Instability, i.e. poor anchorage, increased exposure, etc
	Excessive nuisance: Trees that are likely to be removed within 10 years because of unacceptable impact on people
Z7	Excessive, severe and intolerable inconvenience to the extent that a locally recognized court or tribunal would be likely to authorize removal, i.e. dominance, debris, interference, etc
Z8	Excessive, severe and intolerable damage to property to the extent that a locally recognized court or tribunal would be likely to authorize removal, i.e. severe structural damage to surfacing and buildings, etc
	Good management: Trees that are likely to be removed within 10 years through responsible management of the tree population
Z9	Severe damage and/or structural defects where a high risk of failure can be temporarily reduced by reasonable remedial care, i.e. cavities, decay, included bark, wounds, excessive imbalance, vulnerable to adverse weather conditions, etc
Z10	Poor condition or location with a low potential for recovery or improvement, i.e. dominated by adjacent trees or buildings, poor architectural framework, etc
Z11	Removal would benefit better adjacent trees, i.e. relieve physical interference, suppression, etc
Z12	Unacceptably expensive to retain, i.e. severe defects requiring excessive levels of maintenance, etc

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

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

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

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

Further explanations to assist categorization

Z1	Any existing statutory definitions of trees that are too small to be legally protected should be applied and trees less than those heights or diameters will be Z1. If there are none, then if the tree has been planted for less than 5 years it is Z1. If it is less than 20 feet in height, it will be Z1 unless it is significant, i.e. clearly mature, but small trees are not Z1. If it is greater than 35 feet in height it is not Z1 unless it was planted in the last 5 years. Applying Z1 to trees between 20 and 35 feet is a matter of judgment; the most obvious test being that the tree could be easily and reliably moved or replaced. Ideally, the replacement tree should not be less than 20% of the replaced tree's dimensions.
Z2	Any existing statutory rules that prevent protection of trees within a fixed distance of a structure will allow a tree to be subcategorized as Z2.
Z3	Any existing statutory rules or guidance that prevent protection of trees for reasons other than size and proximity dictate Z3, i.e. invasive or alien species. If none exist, then Z3 cannot be applied.
Z4	This subcategory is for trees that are unlikely to recover from a serious health problem. The condition must be terminal with no obvious potential to recover, i.e. severe crown dieback related to excavation damage or root decay, to the extent that the structural branch framework is compromised. Trees that are likely to recover or improve should not be placed in this subcategory, i.e. trees suffering from a foliar problem that has little impact on the branch framework and varies from year to year.
Z5	Severe means so bad that there is no realistic chance of the tree achieving its full potential and there is a high risk of failure. In many cases, the risk of failure can be reduced by dramatic reduction in tree size, but this has severe health, maintenance cost and amenity implications, so is unlikely to be a sustainable management option. A common example is a severely unbalanced tree within a group that will be particularly vulnerable in adverse weather conditions and the adjacent trees mean there is no hope of remedial works resulting in an improvement. Topped trees do not automatically fit into this subcategory, although there is an obvious temptation. Species prone to decay, such as willow and poplar, often have severe decay at the origin of vigorous re-growth, creating a high risk of failure in adverse weather conditions. Z5 is clearly appropriate for them. However, this needs to be a careful judgment because topping in itself does not necessarily condemn a tree to this

	subcategory. Some trees, such as plane, oak and lime, are particularly good at coping with this treatment and often are able to mature with a low risk of failure. If remedial works will allow the tree to be retained with no significant adverse impact on amenity, health or maintenance costs, then it does not fit here.
Z6	Trees can become poorly anchored because of soil erosion through climatic factors , i.e. water or wind, wear from traffic, i.e. pedestrian or vehicular, changing soil conditions, i.e. increasing wetness, sudden and severe physical stress from storms and root damage such as decay or severance reducing root strength. In some cases, i.e. storm induced instability, there may be a realistic chance of recovery and a subcategorization of Z6 may be premature. However, if excessive remedial work is required, it is likely that Z6 is a defensible subcategory. Alterations to tree exposure to the wind occurs because of changes in the shelter provided by adjacent objects such as buildings or trees. This often applies to groups of trees where one large dominant individual will be lost because of poor health or a structural problem, which then dramatically exposes the remaining trees.
Z7	• **Establishing thresholds of acceptable levels of inconvenience:** In its broadest sense, inconvenience is the interference with the authorized use of land. In relation to trees, it can be in the form of roots disrupting landscaping and hard surfacing, parts of trees physically preventing land use, tree debris such as leaves and fruit falling and tree crowns causing excessive shade. The principles for establishing what are acceptable levels of inconvenience are the same irrespective of the cause. In a community context, it is generally accepted that trees provide a significant benefit to society and it is reasonable for individuals to tolerate some level of inconvenience from their presence. However, the precise location or value of these thresholds is not always obvious and is often a subjective interpretation rather than a definitive point. There will always have to be a balancing of the benefit to the community weighed against the inconvenience suffered by the individual. What is an acceptable, tolerable or reasonable level of inconvenience is often a matter of judgment for each specific situation, tempered by experience and common sense. This, should be guided by court, tribunal and planning decisions that have made informed judgments on these issues. • **Common examples:** Very large trees near existing occupied buildings can dominate to the extent that the disbenefit from the anxiety of the occupants outweighs the benefit of the tree. Regular and severe staining caused by fallen debris to a swimming pool surround may be unacceptable because the stark contrast in colours creates a dirty impression whereas the same staining on a path or drive surface may be more acceptable. In contrast, falling leaves blocking gutters causing them to be cleaned once a year is not that much of a local inconvenience in the context of the wider benefits that trees impart. • **Making the decision:** Assessing inconvenience is almost entirely a subjective judgment, based on experience and understanding of what is perceived as being reasonable and unreasonable for a normal person. As with all these judgments, a simple test is to imagine a court hearing where a judge has to decide if the levels of inconvenience are intolerable. If they are, then the tree is Z11; if they are not that bad, then the tree belongs in another subcategory.
Z8	Where more serious damage occurs to property from root action, then court/tribunal judgments on liability help to focus on what level of damage is deemed tolerable by society. A common example is direct damage from roots, trunks and branches to structures and surfacing. Repairs to walls may require such extensive excavation and cutting of roots that the tree cannot be retained. However, the use of innovative techniques may reduce root damage, but still produce a viable boundary, allowing the tree to be retained. Root damage to surfacing is often a sustainable reason for removal if rectifying the damage will significantly adversely affect the tree. In contrast, the potential for roots to deform surfacing would be a less reliable basis for allocation to this subcategory because it is so unpredictable. As a general rule, there would need to be good evidence for ongoing damage, with little scope for remedial works, before a tree could be reliably allocated to this subcategory.
Z9	This is a similar subcategory to Z5, but where the defect is not so severe that remedial works have to be extensive and immediate. Quite often, there are less severe defects that are so bad there is no realistic potential for the tree to improve, but it could be retained in the short term with some significant remedial works. This would only be seen as a temporary measure because to continue applying the same principle would not be cost-effective compared to replacement. A typical example would be a tree with a large and progressive cavity that will clearly prevent it ever improving its condition or contribution to amenity. However, substantial thinning and reduction would allow it to be retained in the short term to allow other replacement trees to develop to buffer its inevitable loss. The benefit of retaining it in the short term might outweigh the cost of doing the works as a one-off, but not on a regular basis.
Z10	It is common to find trees that are obviously not good enough for long term retention because they look unhealthy or are so unbalanced or so tall and thin or that they will never improve. However, the problems are not so severe that there is a high risk of death or failure, and they cannot be discounted for that reason. This subcategory is for those trees and relies on the principle of sustained amenity to justify the allocation. Trees with no potential to improve are taking up space where new trees could be growing, which would be enhancing the desirable objective of an uneven age class structure. The replacements would obviously be small trees and these would then fall into the Z1 subcategory. As set out in the Z1 explanations, the precise location on the site is not often that critical, so these trees would not generally be considered worthy of being a material constraint.
Z11	This applies to trees in groups where one individual is destructively interfering with another. The judgment of which is the better tree is obviously subjective and would be informed by which tree had the best potential for sustainable retention. An obvious example is one tree growing up through another and directly rubbing, causing damage. Retaining both would probably result in the loss of each, whereas removing one may allow the other to achieve its full potential. Another example would be one tree shading and preventing the sustainable development of a neighbour to the extent that both trees would be prematurely removed if left alone. The removal of one tree may be justified if it allowed the remaining tree to reach its full potential. If both trees could be retained as a group and achieve their full potential, then they should not be included in this subcategory.
Z12	This is a matter of judgment and may vary widely. It primarily applies to existing trees that are not suited to their location, but there is resistance to their replacement. As a general principle, all trees will incur some management costs and these would normally not be a valid reason for removal. However, as those costs increase, their acceptability decreases to a point where it will be more cost-effective to plant a new tree more suited to the location rather than incur the burden of repeated and excessive costs indefinitely. Typical examples include topped trees with excessive decay, pollarded trees to reduce subsidence risk, trees beneath power lines and trees close to buildings, roads and paths. All these examples will require high levels of maintenance that may not be financially acceptable unless the benefits that arise from retaining the trees are particularly high.
A1	Trees that do not require any specific remedial works above those that would be required for normal maintenance.
A2	Trees with minor defects likely to recover from remedial works to be retainable in the long term, i.e. pollards with little decay.
A3	'Special' means unusual, rare or uncommon, i.e. a tree of some historical/cultural significance, etc.
A4	Trees can be a habitat that may be protected by legislation, which may be a material constraint on the type and timing of changes that can occur on a site. If an ecological assessment has not been carried out by the time of the survey, and the arborist suspects there may be habitat issues, the tree should be identified as A4, and specialist assessment should be sought.

Appendix - Useful Life Expectancy (SULE), (Barrel, 2001

A trees useful life expectancy is determined by assessing a number of different factors including the health and vitality, estimated age in relation to expected life expectancy for the species, structural defects, and remedial works that could allow retention in the existing situation.

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

TREE INVENTORY											
#	**Tree species**	**Height Spread (M)**	**DBH & DAB (cm)**	**TPZ (M)**	**SRZ (M)**	**Incursion %**	**Health Structure**	**Age Class**	**ULE (yrs)**	**Tree A-Z rating**	**Comments**
1	*Pinus spp – radiata* (Radiata Pine)	14 x 14	132 114	15	3.5	-	G - G	M	40+	Z3	- Co-dominant compression fork - Exempt species under Northern Beaches Council Tree Regulatory Controls
2	*Liquidambar styraciflua* (Liquidamber)	9 x 8	21.5, 22.5, 29.5 52	5.16	2.51	-	G – F	M	15-40	Z3	- Multi stemmed basal compression fork - Exempt species under Northern Beaches Council Tree Regulatory Controls
3	*Eucalyptus globulus subsp. bicostata* (Southern Blue Gum)	13 x 7	46.5 57	5.58	2.61	Footprint bin area	F/P – F	OM	5-15	Z4	- Crown dieback, abundance of deadwood, epicormic regrowth throughout canopy -Senescence / stress
3a	*Lagerstroemia indica* (Crepe Myrtle)	3 x 3	4, 5, 2 12	2 (min)	1.5 (min)	Footprint driveway crossover	G – G	Y	40+	A1	- Street tree
3b	*Lagerstroemia indica* (Crepe Myrtle)	3 x 2	2, 2, 1 10	2 (min)	1.5 (min)	Footprint entrance pathway	G – G	Y	40+	A1	- Street tree
4	*Eucalyptus haemastoma* (Scribbly Gum)	10 x 18	16.5, 24, 26, 35, 40 125	7.92	3.63		F – F	M	5-15	A2	- Street tree - Heavily pruned for power line clearance - trunk wounds, old borer activity, basal cavity
5	*Cupressus macrocarpa* (Monterey Cypress)	14 x 7	60* 55*	7.2	2.57	-	F – F/P	M	5-15	Z3	- Pruned for power line clearance - multiple branch failure sites within canopy - included multi stemmed junctions - Exempt species under Northern Beaches Council Tree Regulatory Controls - Adjoining dead tree
6	*Pinus spp – radiata* (Radiata Pine)	12 x 6	35* 40*	4.2	2.25	0%	G – G	M	40+	A1	- Neighbouring tree
6a	*Eucalyptus spp – possibly heamastoma*	11 x 7	35* 40*	4.2	2.25	0%	G – F	M	15 – 40	A2	- Neighbouring tree - Established lean, trunk wounds

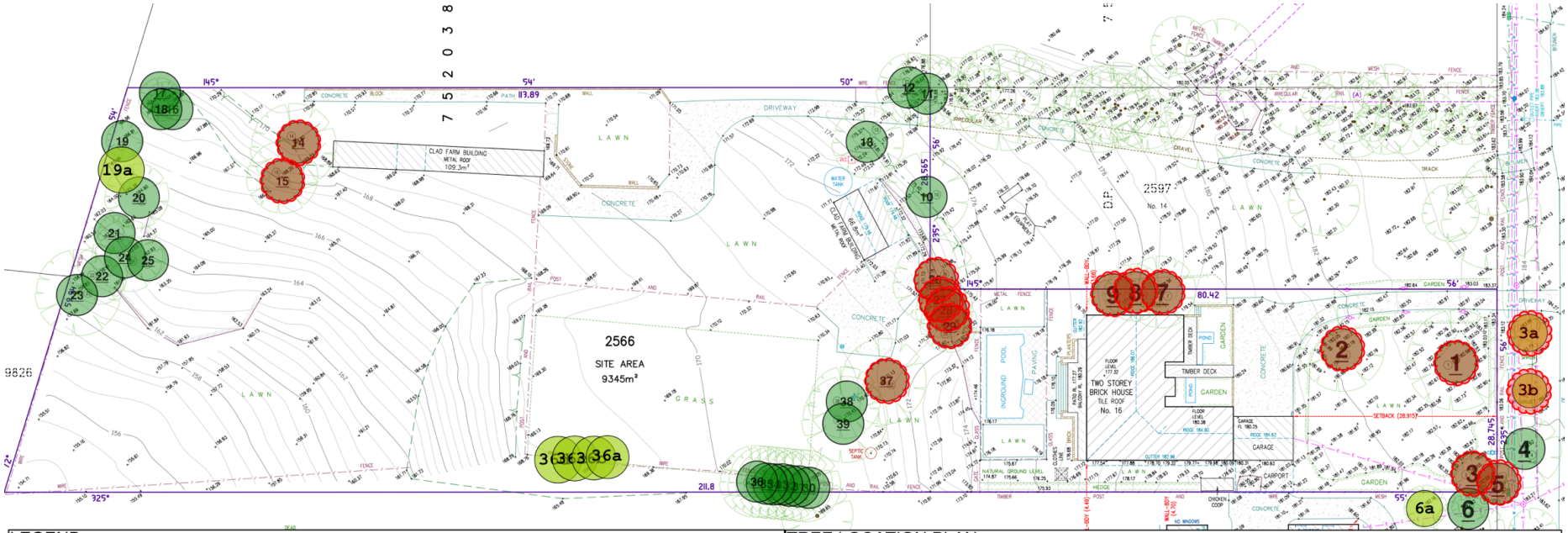
	(Eucalyptus)										
7	*Eucalyptus saligna* (Sydney Blue Gum)	18 x 12	66 84	7.92	3.08	41.29% 81.37m²	G – G	M	40+	Z2	- 2.9m base of tree to existing dwelling - Can be removed under 10/50 bushfire clearing entitlement
8	*Corymbia citriodora* (Lemon Scented Gum)	17 x 8	57 70	6.84	2.85	40.34% 59.3m²	G – G	M	40+	Z2	- 2.9m base of tree to existing dwelling - Can be removed under 10/50 bushfire clearing entitlement
9	*Jacaranda mimosifolia* (Blue Jacaranda)	5 x 5	10.5, 11.5 22.5	2 (min)	1.77	26.17% 3.29m²	G – G	M	40+	Z2	- 2.9m base of tree to existing dwelling - Can be removed under 10/50 bushfire clearing entitlement
10	*Casuarina cunninghamiana* (River She Oak)	17 x 10	57 64	6.84	2.74	8.71% 12.81m²	G – G	M	40+	A1	- growing on embankment
11	*Casuarina glauca* (Swamp She Oak)	14 x 6	30 44	3.6	2.34	0%	G – F	M	40+	A2	- Neighbouring tree - Suppressed
12	*Eucalyptus saligna* (Sydney Blue Gum)	17 x 7	38 51.5	4.56	2.5	0%	G – F	M	40+	A2	- Trunk wound with best activity - Neighbouring tree
13	*Banksia integrifolia* (Coast Banksia)	16 x 8	42 55	5.04	2.57	0%	G – G	M	40+	A1	- Growing on embankment - Protect adjoining lemon myrtles
14	*Cinnamomum camphora* (Camphor Laurel)	17 x 20	48,38, 42, 24, 34 129	10.2	3.68	-	G - G	M	40+	Z3	- Exempt species under Northern Beaches Council Tree Regulatory Controls
15	*Pittosporum undulatum* (Native Daphne)	7 x 7	22, 22 33	3.72	2.08	-	G -F	M	15-40	Z1	- Suppressed from adjoining camphor - Exempt height for species under Northern Beaches Council Tree Regulatory Controls
16	*Pittosporum undulatum* (Native Daphne)	6 x 4	15 18	2 (min)	1.61	-	G – G	SM	40+	Z1	- Exempt height for species under Northern Beaches Council Tree Regulatory Controls
17	*Pittosporum undulatum* (Native Daphne)	11 x 7	22 26	2.64	1.88	0%	G – G	M	40+	A2	- Very rear of site
18	*Angophora costata* (Sydney Red Gum)	10 x 3	14	2 (min)	1.57	0%	G – F/P	SM	15-40	A2	- very rear of block - trunk wound with frass present

			17								
19	*Angophora costata* (Sydney Red Gum)	20 x 16	62 80	7.44	3.01	0%	G/F – G	M	15-40	A2	- Trunk would with Ganoderma bracket fungus on northern side
19a	*Angophora costata* (Sydney Red Gum)	13 x 6	22 24	2.64	1.82	0%	G – G	M	40+	A2	
20	*Angophora costata* (Sydney Red Gum)	8 x 6	18*, 20* 28*	3.24	1.94	0%	G – G	M	15-40	A2	- Suppressed - Next to adjoining dead *Angophora* with active bee hive
21	*Banksia serrata* (Old Man Banksia)	6 x 4	16 26	2 (min)	1.88	0%	G -G	M	40+	A1	
22	*Angophora costata* (Sydney Red Gum)	15 x 6	22 30	2.64	2	0%	G – G	M	40+	A1	
23	*Angophora costata* (Sydney Red Gum)	17 x 10	40* 50*	4.8	2.47	0%	G – G-F	M	40+	A1	- Fused with sandstone boulder
24	*Eucalyptus spp* (Eucalyptus)	10 x 6	18*, 18* 40*	3	2.25	0%	G-F – G	M	15-40	A2	- Basal Wound
25	*Banksia serrata* (Old Man Banksia)	8	-	-	-	-	-	-	-	Z5	- Failed at root plate and hung up in adjoining tree. -Still alive
26	*Casuarina cunninghamiana* (River She Oak)	22 x 14	61 82	7.32	3.04	37.71% 63.48m^2	G – G	M	40+	Z2	- Base of rock shelf, asymmetric root plate. 7.6m from existing farm shed >50m^2
27	*Casuarina glauca* (Swamp She Oak)	12 x 6	18 25	2.16	1.85	Footprint Driveway	G – G	M	40+	A2	- Base of rock shelf, asymmetric root plate
28	*Casuarina glauca* (Swamp She Oak)	17 x 6	37 52	4.44	2.51	Footprint driveway	G 0 G	M	40+	A2	- Base of rock shelf, asymmetric root plate
29	*Casuarina glauca* (Swamp She Oak)	16 x 6	22, 23 47	3.84	2.41	Footprint driveway	G – G	M	40+	A2	- Base of rock shelf, asymmetric root plate
30	*Casuarina glauca* (Swamp She Oak)	22 x 11	50* 60*	6	2.67	0%	G – G	M	40+	A2	-Asymmetrical crown to east
31	*Casuarina glauca* (Swamp She Oak)	17 x 7	32	3.84	2.37	0%	G – G	M	40+	A2	

			45								
32	*Casuarina glauca* (Swamp She Oak)	17 x 6	20, 12 35	2.76	2.33	0%	G – G	M	40+	A2	
33	*Casuarina glauca* (Swamp She Oak)	17 x 7	40 45	4.8	2.37	0%	F – P	M	5-15	Z9	-Failed /damaged apical leader
34	*Casuarina glauca* (Swamp She Oak)	18 x 10	36 42	4.32	2.3	0%	G – G	M	40+	A2	
35	*Casuarina glauca* (Swamp She Oak)	18 x 10	38, 54 77	7.92	2.97	0%	F – F/P	M	5-15	Z9	- Failed co-dominant stem
36	*Casuarina glauca* (Swamp She Oak)	22 x 10	48, 23 76	6.36	2.95	0%	G – G	M	40+	A2	
36a	*Melaleuca linariifolia* (Snow in Summer)	6 x 4	22 30*	2.64	2	0%	G – G	M	15-40	A2	- on embankment between neighbouring property
36b	*Melaleuca linariifolia* (Snow in Summer)	8 x 4	34 -	4.08	-	0%	G – G	M	15-40	A2	- on embankment between neighbouring property
36c	*Melaleuca linariifolia* (Snow in Summer)	8 x 6	40 -	4.8	-	0%	G – G	M	15-40	A2	- on embankment between neighbouring property
36d	*Melaleuca linariifolia* (Snow in Summer)	6 x 5	25, 20 -	3.84	-	0%	F – G	M	15-40	A2	- on embankment between neighbouring property -inundated with vine
37	*Eucalyptus viminalis* (Manna Gum)	22 x 16	113 137	13.56	3.78	25.65% 148.22m^2	F – G	M	15-40	A2	- Active subterranean termite nest of possibly *Coptotermes acinaciformis* found on northern side of tree at base of root crown - Extent of damage from termites unknown
38	*Casuarina glauca* (Swamp She Oak)	12 x 8	37 46	4.44	2.39	0%	G – G	M	40+	A2	- semi suppressed
39	*Casuarina glauca* (Swamp She Oak)	16 x 7	43 60	5.16	2.67	0%	G – G	M	40+	A1	

Explanatory notes

Tree Species – Botanical name. Where tree species is unknown it is indicated with an '*spp*'
Height/Spread – Height of the tree and spread of the canopy as inspected from ground level
DBH – Diameter at Breast Height. Measured at approximately 1.4m above ground level by use of diameter tape. Measurement used for TPZ calculation
DAB – Diameter at Base. Measured slightly above root flare at base of tree using a diameter tape. Measurement used for SRZ calculation
TPZ – Tree Protection Zone. DBH x 12 measured in radius from the centre of the trunk
SRZ - Structural Root Zone – (DABx50) 0.42 x 0.64. Measured in radius from the centre of the trunk
Incursion % - incursion of proposed development into TPZ
Health/ Structure – Good/Fair/Poor/Dead
Age Class – Over mature (OM), Mature (M), Semi-mature (SM), Young (Y)
ULE –Useful Life Expectancy of the tree in its current environment at time of assessment.
TREE A-Z Rating – Recognised rating method developed by Jeremy Barrell used to catrgorise trees. Specific values explained in detail in appendix
*** next to dimension –** Estimated DBH or DAB due to access or site issues. Numbers slightly inflated to compensate for estimation



LEGEND

TREE NUMBER

40

PROPOSED FOR REMOVAL

TREE LOCATION PLAN

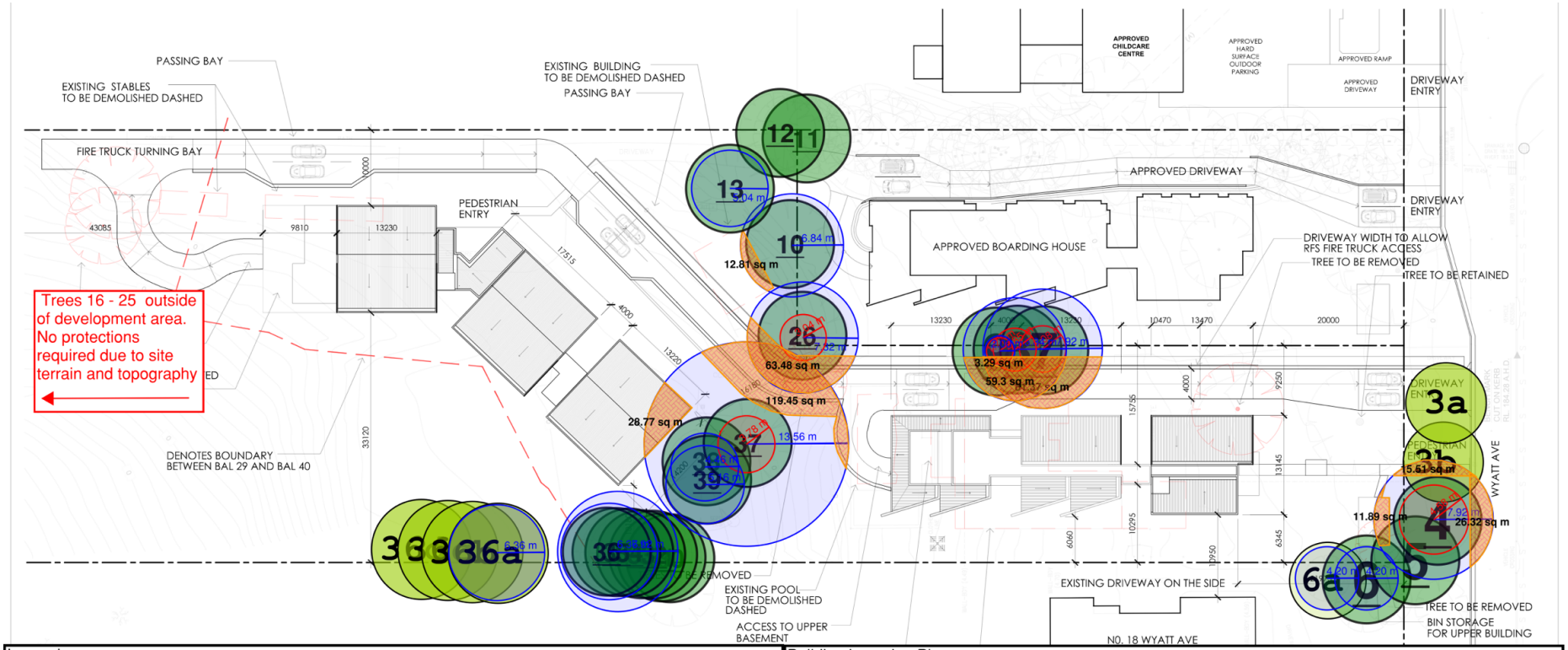
16 Wyatt Avenue Belrose NSW 2085

No Scale - Site Survey

Axiom Arbor Tree Services

June 2021

AXIOM ARBOR
TREE SERVICES



Legend

Tree Number	Tree Protection Zone	Structural Root Zone	Area of Incursion
40	7.30 m	5.98 m	92.24 sq m

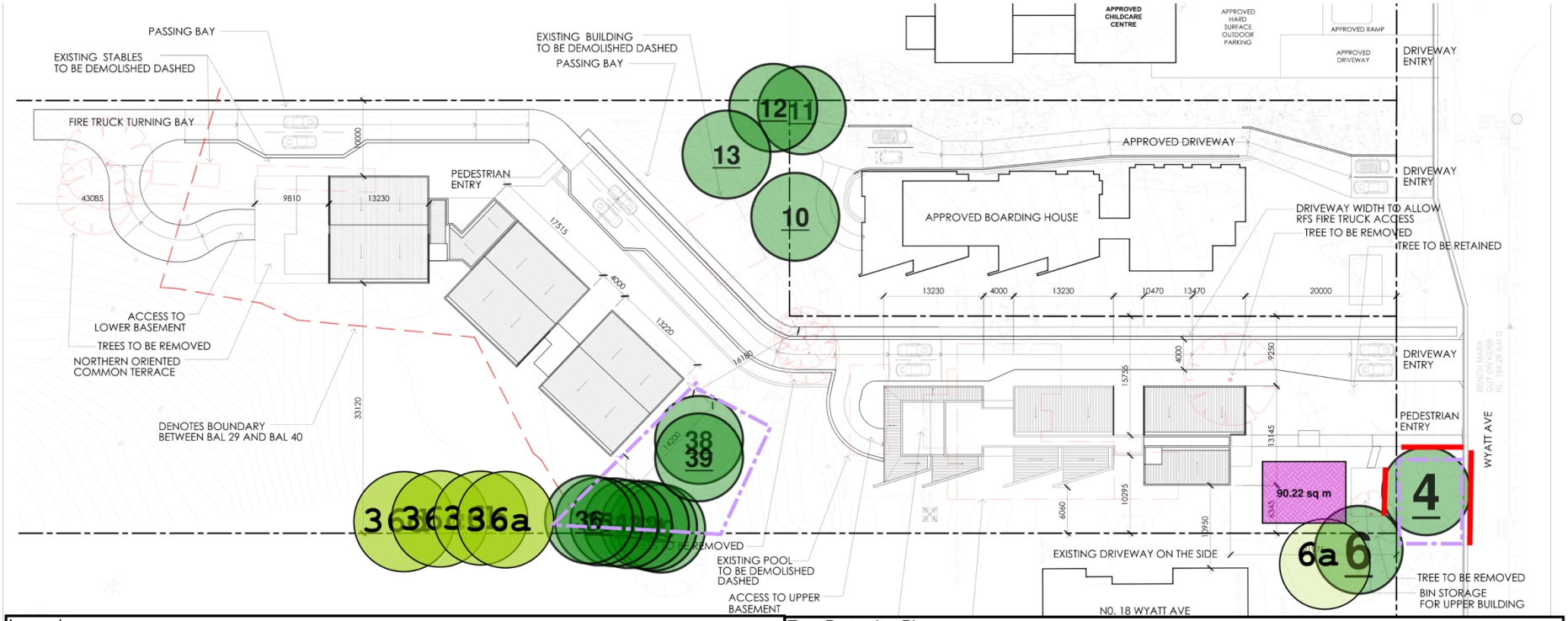
Building incursion Plan

16 Wyatt Avenue Belrose NSW 2085

Scaled using Site Plan 1:500 A3

Axiom Arbor Tree Services
June 2021

AXIOM ARBOR TREE SERVICES



Legend

Tree Number | Tree Protection Fencing | Arborist supervision | Site storage / sheds

40

90.22 sq m

Tree Protection Plan

16 Wyatt Avenue Belrose NSW 2085

Scaled using Site Plan 1:500 A3

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May 2021

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