Arborist report

Impact assessment

DA 2019/00061

Site address

11 - 17 Mosbri Crescent, The Hill 2300

Arcadia Park and Mosbri Crescent Park

Prepared for

the City of Newcastle Council

Crescent Newcastle Pty Ltd

30 April 2021

CONTENTS

1. INTRODUCTION

1.1. This report has been provided to accompany an amended development application for the subject site.

1.2. It includes current plans for the proposal, stormwater and all previous information supplied in a variety of documents over the course of two years in clarification.

1.3. It is divided into three sections:

- The subject site of 11 – 17 Mosbri Crescent
- Arcadia Park
- Mosbri Crescent Park

1.4. It discusses trees which will be impacted upon by a development proposal, and seeks approval for the following:

- Demolition of all existing structures;
- Earthworks, including mine grouting;
- Construction of residential accommodation comprising 172 dwellings, being:
- Eleven (11) two storey townhouse style dwellings fronting Mosbri Crescent, located above a basement car park;
- Three (3) residential flat buildings (Building A, B, and C) containing 161 dwellings, ranging from one to three bedrooms; being
- Building A including a nine (9) storey east wing and six (6) storey west wing;
- Building B comprising seven (7) storeys and a roof top communal open space, with (9) town house style dwellings facing the internal courtyard;
- Building C comprising five (5) levels;
- Interconnected car parking for Building A, B & C located on the ground floor and first level;
- Pedestrian path, providing connection from Mosbri Crescent to Kitchener Parade;
- Associated landscaping, communal open space, services and site infrastructure;
- Connection to existing infrastructure from Arcadia Park; and
- Connection to existing stormwater underground infrastructure of Mosbri Crescent Park

1.5. The site plan and survey used herein has been supplied by the owner from Monteath & Powys Pty Ltd, Newcastle West 2302. The proposals footprint has been supplied from Marchese Partners International Pty Ltd, North Sydney 2060.

1.6. This document has been prepared in accordance with Newcastle City Council legislation: Section 5.03 of Newcastle City Council's *Development Control Plan 2012 (adopted 19/02/2018); Newcastle Urban Forest Technical Manual, February 2018* (UFTM), section *4.0 and 6.0*.

1.7. This document has been prepared with close regard to the Australian Standard, *AS 4970 -2009 Protection of Trees on Development Sites*. The tree protection zones (TPZ) and structural root zone (SRZ) have been overlaid onto an supplied plans to show encroachments.

1.8. Amongst other common arboricultural methods, Area Tree Vet uses symptom evaluation by means of Visual Tree Assessment (VTA) as developed by Claus Mattheck et al (1994)[a]. These trees were assessed applying VTA.

1.9. The International Society of Arboriculture (ISA) hazard evaluation system has been used for the purposes of recording tree characteristics, health, defects, and site conditions. The results of this onsite assessment are more comprehensively contained herein.

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2. SUMMARY

2.1. **11-17 Mosbri Crescent:**

- Trees of the site cannot be retained for the proposal to proceed and will require compensatory planting to offset their removal and implementation of the landscape plan by Arcadia Landscape architects, Sydney.
- Palm tree 48 and Coral tree 46 share boundaries. In reference to Arborist comments from document dated 8/4/2020, On further assessment we have determined that the tree can be retained, without adverse effects to its existing form or health, subject to excavation remaining outside the SRZ, which is considered feasible.
  - ***TREE PROTECTION MEASURE:*** *Tree 46 to be retained with excavation not to occur within SRZ. A bond for retention of the tree could be conditioned by the determining authority if found necessary. Pruning may be required to mitigate risks of failure and provision of a safe working environment.*
  - *Palm tree 48 to be retained: Alteration of building offset will not occur within the SRZ. Less than 5% encroachment is anticipated to its TPZ for the retaining wall which is well within acceptable guidelines of AS4970-2009.*
- Trees along the north nature strip are storm damaged and pose hazards for the general public.
  - In reference to Arborist comments from document dated 8/4/2020: Trees 21, 19 and 20 have been recommended to be removed.
- Tree 13A will be affected by the connecting path of Council's access way between Mosbri Crescent and Kitchener Parade. In reference to Arborist comments from document dated 8/4/2020:
  - *Tree 13A to be retained. Arborist impact assessment states there will be incursion into the TPZ and SRZ as a result of the publicly accessible footpath to be constructed along the north western boundary. In discussion, as the TPZ and SRZ of the tree will be covered by only the footpath there will be a need to excavate no deeper than to remove grass and install formwork for the footpaths cement base. This tree will have a structural root system deeper than 600mm, which is far deeper than establishment of a footpath will require.*
  - ***TREE PROTECTION MEASURE:*** *Project arborist to be on-site during initial formwork installation of foot path. At that time, manual inspection of SRZ is to occur first to identify any roots requiring cutting.*

2.2. **Arcadia Park:**

- The Vegetation Management Plan (VMP), proposed restoration of Arcadia Park prepared by Coast Ecology Environmental Assessments dated 7 February 2018, discusses a variety of exotic species (page 21). The recommendations of this document are concurrently supported and therefore these species should eventuate in their removal. The additional recommendation of the VMP, 4.4 Bush fire (page 18) to maintain an asset protection zone (APZ) is also supported and should be implemented along the eastern boundary (west side of Arcadia Park) where necessary.
- There is no works conducted in Arcadia Park.
- Furthermore, the offset from the building has been altered to such an extent that encroachments are negligible and will not affect the health or structural integrity of trees along the boundary.

2.3. **Mosbri Crescent Park:**

- The amended stormwater plan prepared by Northrop significantly reduces the impact to trees of the subject park to such an extent that only one tree will experience incursion to TPZ and SRZ zones. Tree 2 (Bottlebrush) will require removal.
- Surrounding trees of the park will not require implementation of tree protection measures as they will not be affected by connection to the existing stormwater.

Vivianne Bleiker, Consultant Arborist, Area Tree Vet.

3.TPZ SRZ OVERLAID ONTO PROPOSAL *(THIS PAGE IS A3 IN SIZE)*

4. SITE TREE DATA

* Multi-stemmed: The trees diametre is a calculated exaggeration due to it being multi-stemmed (more than one trunk). The matrix used to calculate their trunk diametres and subsequent TPZ (and SRZ) is from Newcastle City Council, document named *AS-4970-2009-Calculations-for-WEB-and-Intranet-130317*, author D. Harris.
Abbreviations used in this data section: ~ = approximately < = less than > = greater than

TREE #	COMMON / BOTANICAL NAME	AGE CLASS	DBH in metres	TPZ in metres as a radius	SRZ in metres as a radius	HEIGHT in metres	CANOPY SPREAD in metres				CANOPY CIRCUMFERENCE in metres²	STRUCTURE	HEALTH	VIGOUR	ESTIMATED LIFE EXPECTANCY IN YEARS	LANDSCAPE SIGNIFICANCE
							N	S	E	W						
1	Weeping bottlebrush *Callistemon viminalis*	Semi-mature	0.35*	4.2	2.1	7	4.2	2.2	3.7	4.7	43	Fair	Fair	Fair	5 - 15	Low
2	Queensland firewheel tree *Stenocarpus sinuatus*	Semi-mature	0.26*	3.1	1.9	8	2.6	1.2	2.3	2.8	15	Average	Average	Good	15 - 40	Low
3	Weeping bottlebrush *Callistemon viminalis*	Semi-mature	0.29*	3.5	2.0	6	3.1	2.5	1.9	3.4	24	Average	Average	Good	15 - 40	Low
4	Weeping bottlebrush *Callistemon viminalis*	Semi-mature	0.19*	2.3	1.6	6	1.9	1.2	2.5	3.8	17	Average	Average	Average	15 - 40	Low
5	Weeping bottlebrush *Callistemon viminalis*	Semi-mature	0.23*	2.8	1.8	6	1.9	1.7	2.2	3.2	16	Average	Average	Average	15 - 40	Low
6	Weeping bottlebrush *Callistemon viminalis*	Semi-mature	0.24*	2.9	1.8	6	2.0	1.0	1.2	2.4	9	Average	Fair	Fair	15 - 40	Low
7	Water gum *Tristaniopsis laurina*	Mature	0.43*	5.2	2.3	9	2.6	4.5	2.8	6.4	52	Fair	Good	Good	15 - 40	Moderate
8	Queensland umbrella tree *Schefflera actinophylla*	Semi-mature	0.26	3.1	1.9	7	1.8	3.3	2.2	2.3	19	Poor	Fair	Fair	15 - 40	Low
9	Broad leaved paperbark *Melaleuca quinquenervia*	Mature	0.85	10.2	3.1	12	5.4	2.9	4.8	5.3	66	Average	Average	Average	15 - 40	Moderate
10	Magenta lillypilly *Syzygium paniculatum*	Mature	0.45*	5.4	2.4	6	3.3	3.8	3.5	3.4	39	Average	Fair	Fair	5 - 15	Low
11	Coastal She-oak *Casuarina equisetifolia*	Mature	0.67	8.0	2.8	12	7.1	9.1	1.8	7.8	130	Good	Good	Good	15 - 40	High
12	Cadaghi *Corymbia torelliana*	Mature	0.67	8.0	2.8	12	7.3	6.3	1.7	9.3	119	Good	Poor	Poor	5 - 15	Low
12A	Coastal banksia *Banksia integrifolia*	Mature	0.42*	5.0	2.3	8	7.2	1.2	2.3	4.8	47	Poor	Average	Average	5 - 15	Low
13	Sweet pittosporum *Pittosporum undulatum*	Semi-mature	0.23*	2.8	1.8	3	2.2	2.5	2.2	1.2	13	Average	Average	Average	15 - 40	Low
13A	Radiata/Monterey pine *Pinus radiata*	Mature	0.76	9.1	2.9	10	6.4	8.0	6.3	7.0	150	Average	Average	Average	15 - 40	High
14	Broad leaved paperbark *Melaleuca quinquenervia*	Semi-mature	0.43*	5.2	2.3	5	3.1	5.7	4.8	2.6	51	Fair	Fair	Fair	5 - 15	Moderate
15	Broad leaved paperbark *Melaleuca quinquenervia*	Semi-mature	0.30*	3.6	2.0	4	1.9	4.4	2.6	2.7	26	Fair	Average	Average	15 - 40	Low
16	Norfolk island hibiscus *Lagunaria patersonii*	Semi-mature	0.33	4.0	2.1	5	3.8	3.2	2.7	2.8	31	Good	Good	Good	15 - 40	Low
17	Norfolk island hibiscus *Lagunaria patersonii*	Semi-mature	0.29*	3.5	2.0	5	3.5	3.3	2.6	3.1	31	Average	Good	Good	15 - 40	Low
18	Swamp She-oak *Casuarina glauca*	Mature	0.57*	6.8	2.6	10	5.6	5.7	4.4	4.0	77	Fair	Poor	Poor	5 - 15	Low
19	Mountain grey gum *Eucalyptus cypellocarpa*	Mature	0.84	10.1	3.1	14	12.9	13.5	4.1	6.5	269	Average	Fair	Fair	15 - 40	High
20	Smooth bark apple *Angophora costata*	Mature	0.47	5.6	2.4	12	10.4	3.0	6.3	7.6	146	Average	Fair	Fair	15 - 40	High

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							N	S	E	W						
21	Camphor laurel *Cinnamomum camphora*	Mature	1.07	**12.8**	**3.4**	12	7.7	8.0	5.7	6.7	155	Average	Fair	Fair	15 - 40	High
22	Swamp mahogany *Eucalyptus robusta*	Semi-mature	0.25	**3.0**	**1.8**	10	1.7	3.5	2.2	3.3	23	Average	Fair	Fair	15 - 40	Low
23	Swamp mahogany *Eucalyptus robusta*	Mature	0.55	**6.6**	**2.6**	12	4.8	2.3	4.3	6.7	64	Average	Average	Average	15 - 40	Moderate
24	Swamp mahogany *Eucalyptus robusta*	Semi-mature	0.20	**2.4**	**1.7**	8	1.5	1.5	1.5	1.5	7	Average	Average	Average	5 - 15	Low
25	Swamp mahogany *Eucalyptus robusta*	Semi-mature	0.24	**2.9**	**1.8**	12	1.5	1.5	1.5	1.5	7	Average	Average	Average	5 - 15	Low
26	Broad leaved paperbark *Melaleuca quinquenervia*	Mature	1.05	**12.6**	**3.4**	5	4.3	4.1	5.8	5.8	78	Good	Average	Average	15 - 40	Moderate
27	Norfolk island hibiscus *Lagunaria patersonii*	Semi-mature	0.29*	**3.5**	**2.0**	10	3.8	3.6	4.6	3.8	49	Fair	Average	Average	15 - 40	Moderate
28	Casuarina *Casuarina sp.*	Mature	0.30	**3.6**	**2.0**	14	1.0	3.0	0.0	3.0	10	Good	Poor	Poor	5 - 15	Low
29	Casuarina *Casuarina sp.*	Mature	0.43*	**5.2**	**2.3**	15	2.0	2.0	2.0	2.0	13	Average	Fair	Average	5 - 15	Low
30	Swamp She-oak *Casuarina glauca*	Mature	0.45*	**5.4**	**2.4**	15	3.0	3.0	3.0	3.0	28	Average	Fair	Average	5 - 15	Low
31	Small fruited fig *Ficus microcarpa var. Hillii*	Mature	1.78*	**15[b]**	**4.2**	18	11.9	12.7	10.7	13.3	461	Average	Average	Average	15 - 40	High
32	Broad leaved paperbark *Melaleuca quinquenervia*	Semi-mature	0.26*	**3.1**	**1.9**	12	3.0	2.0	2.0	4.0	24	Poor	Fair	Fair	15 - 40	Low
33	African Olive *Olea europaea subsp. cuspidata*	Semi-mature	0.74*	**8.9**	**2.9**	6	3.5	3.5	3.5	3.5	38	Poor	Fair	Fair	15 - 40	Low
34	Swamp She-oak *Casuarina glauca*	Mature	0.47	**5.6**	**2.4**	10	4.5	4.5	4.5	4.5	64	Average	Average	Average	15 - 40	Moderate
35	Swamp mahogany *Eucalyptus robusta*	Mature	0.38	**4.6**	**2.2**	11	3.5	5.7	3.7	4.8	61	Average	Average	Average	15 - 40	Moderate
35A	Casuarina *Casuarina sp.*	Mature	0.32	**3.8**	**2.1**	5	0.0	0.0	0.0	0.0	0	Ceased function				Very low
36	Casuarina *Casuarina sp.*	Mature	0.45	**5.4**	**2.4**	8	0.0	0.0	0.0	0.0	0	Ceased function				Very low
37	Swamp mahogany *Eucalyptus robusta*	Mature	0.73	**8.8**	**2.9**	17	8.4	8.7	7.0	8.3	207	Average	Average	Average	15 - 40	High
38	Small fruited fig *Ficus microcarpa var. Hillii*	Mature	1.32*	**15[c]**	**3.7**	11	7.0	11.0	10.0	13.0	330	Average	Average	Average	15 - 40	High
39	Norfolk island hibiscus *Lagunaria patersonii*	Semi-mature	0.20	**2.4**	**1.7**	9	2.0	1.8	2.7	1.7	13	Poor	Poor	Poor	5 - 15	Low
40	Swamp mahogany *Eucalyptus robusta*	Mature	0.48	**5.8**	**2.4**	15	6.5	2.1	6.7	1.6	57	Average	Fair	Fair	15 - 40	Moderate
41	Small fruited fig *Ficus microcarpa var. Hillii*	Mature	1.80*	**15[d]**	**4.2**	20	12.0	14.0	9.0	15.0	491	Average	Average	Average	15 - 40	High
42	Lillypilly *Syzygium species*	Semi-mature	0.39*	**4.7**	**2.2**	5	4.8	3.3	2.2	2.2	31	Poor	Poor	Poor	5 - 15	Low

TREE #	COMMON / BOTANICAL NAME	AGE CLASS	DBH in metres	TPZ in metres as a radius	SRZ in metres as a radius	HEIGHT in metres	CANOPY SPREAD in metres				CANOPY CIRCUMFERENCE in metres^2	STRUCTURE	HEALTH	VIGOUR	ESTIMATED LIFE EXPECTANCY IN YEARS	LANDSCAPE SIGNIFICANCE
							N	S	E	W						
43	Weeping willow *Salix babylonica*	Mature	0.59	**7.1**	**2.7**	10	6.5	7.2	4.6	0.0	67	Poor	Fair	Poor	5 - 15	Moderate
44	Canary Island Date Palm *Phoenix canariensis*	Mature	0.88	**10.6**	**3.1**	6	4.2	1.3	4.7	1.5	27	Average	Average	Average	15 - 40	Low
45	Canary Island Date Palm *Phoenix canariensis*	Mature	0.74	**8.9**	**2.9**	6	4.0	0.5	2.1	4.1	22	Average	Average	Average	15 - 40	Low
46	Coral Tree *Erythrina x sykesii*	Mature	0.58*	**7.0**	**2.6**	12	5.7	6.3	4.5	4.5	86	Poor	Fair	Fair	15 - 40	Moderate
47	Willow / Wallangarra white gum *Eucalyptus scoparia*	Mature	0.67	**8.0**	**2.8**	12	9.2	6.9	8.0	4.6	161	Average	Average	Good	15 - 40	High
47A	Broad leaved paperbark *Melaleuca quinquenervia*	Mature	0.49*	**5.9**	**2.5**	12	3.4	2.7	1.4	5.8	35	Good	Good	Good	15 - 40	Low
48	Canary Island Date Palm *Phoenix canariensis*	Mature	0.74	**8.9**	**2.9**	8	4.0	4.0	4.0	4.0	50	Average	Good	Good	15 - 40	Moderate
49	Swamp mahogany *Eucalyptus robusta*	Mature	0.48*	**5.8**	**2.4**	12	5.9	2.3	2.7	5.9	56	Average	Average	Average	15 - 40	Moderate
50	Casuarina *Casuarina sp.*	Mature	0.39	**4.7**	**2.2**	10	1.5	2.9	1.5	4.4	20	Good	Fair	Fair	15 - 40	Low
51	Casuarina *Casuarina sp.*	Semi-mature	0.22	**2.6**	**1.8**	11	2.7	2.8	2.6	2.3	21	Good	Fair	Fair	15 - 40	Low
52	Coast myall *Acacia binervia*	Mature	0.25*	**3.0**	**1.8**	6	2.2	2.6	1.5	2.9	17	Average	Average	Average	15 - 40	Low
53	Swamp mahogany *Eucalyptus robusta*	Mature	0.47*	**5.6**	**2.4**	11	3.6	3.2	7.9	2.9	60	Average	Good	Good	15 - 40	Moderate
54	River she-oak *Casuarina cunninghamiana*	Semi-mature	0.30*	**3.6**	**2.0**	9	4.9	5.6	3.5	3.4	60	Good	Good	Good	15 - 40	Moderate
55	River she-oak *Casuarina cunninghamiana*	Mature	0.43*	**5.2**	**2.3**	11	6.0	2.2	3.8	4.7	54	Good	Fair	Fair	15 - 40	Moderate
56	River she-oak *Casuarina cunninghamiana*	Semi-mature	0.27	**3.2**	**1.9**	11	3.2	1.0	2.4	3.9	22	Average	Fair	Fair	15 - 40	Low
57	Turpentine *Syncarpia glomulifera*	Semi-mature	0.34*	**4.1**	**2.1**	8	2.7	3.0	4.6	0.6	23	Average	Average	Average	15 - 40	Low
58	Swamp mahogany *Eucalyptus robusta*	Mature	0.43*	**5.2**	**2.3**	10	3.1	3.1	2.5	4.7	35	Fair	Average	Average	15 - 40	Low
59	Swamp mahogany *Eucalyptus robusta*	Mature	0.40	**4.8**	**2.3**	20	5.2	4.6	5.3	4.8	77	Good	Average	Fair	15 - 40	Moderate
60	Brown / Plum Pine *Podocarpus elatus*	Semi-mature	0.30*	**3.6**	**2.0**	5	2.1	3.7	2.4	3.9	28	Good	Good	Good	15 - 40	Low

Conditions

1 - Weeping bottlebrush
Seven leading trunks, divergent from the root crown, several inclusions. Leans slightly west. Directionally pruned east and south. Poor foliage cover.

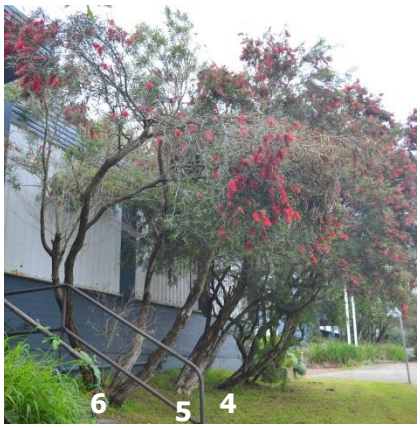

2 - Queensland firewheel
Short trunk with three leaders. Root crown shoots. Directionally pruned south. Leans slightly west. Foliage tips browned.


3 - Weeping bottlebrush
Short trunk, two leaders at root crown - divergent, others forking at ~80cm. Slight basal flare. Directionally pruned south-south-east.

4 - Weeping bottlebrush
Divergent trunks from ground surface. Leans west. Surface root north. Tear out wound to north-west trunk. Bowed branching.

5 - Weeping bottlebrush
Short trunk, partially anastomised, fluted. Bows southwards. Failed branch north Topped/lopped.

6 - Weeping bottlebrush
Three trunks arising from ground surface, divergent. West leader pruned out, other directional pruning. Branch failure west. Tear out wound to south leader. Inner canopy and epicormic dead wood.



7 - Water gum
Seven leading trunks, divergent from the root crown, partially anastomised. Basal flare. Surface root west. Dead stub with dieback into one of the trunks, additional impact wound by crossed over leader, wounded with probable *Nectria* canker or other fungal pathogen. Twig failures, dead hanger in canopy.


8 - Queensland umbrella
Lopped. Largely deceased with new growth at root crown. *Monstera species* taking over trunk and surrounding ground surface.


9 - Broad leaved paperbark
Basal flare, trunk fluted. Fused trunks. Large surface root network, wounded east - mechanical damage.


10 - Magenta lillypilly
Multi-stemmed acaulescent, with two main trunks, fusing leaders south-west. Basal flare, surface roots. Broad spreading habit. Significantly Psyllid afflicted foliage, small leaf size. Sporadic foliage cover.

11 - Coastal She-oak
Leans west. Basal flare, trunk fluted, fissured. Directionally pruned and crown lifted, notch cavities. Small diametre dead branches, dead wood fungal fruit bodies. Some epicormic growth at stubs.

12 - Cadagi
Basal flare, trunk taper. Directionally pruned and crown lifted. Lower trunk bulge, south. Two fused scaffolds with canker - large, mature bracket fungal fruit body at central branch junction, north. Twig and crown dieback. Poor foliage cover.

12A - Coast banksia
Two leading trunks lean north, inclusion. Basal flare, surface roots. Seams at central branch junction, exuding. Compression crack to scaffold west. West branch failure. Health deficiencies, gall.


13 - Sweet pittosporum
Short trunk with four leaders. Rampant Psyllid infestation, browned foliage tips. Dead wood and twig dieback.

13A - Radiata pine
Quantity of surface roots, to 4m north-west. Directionally pruned and crown lifted. Branches with transverse scars. Leans south. No apical dominance.

14 - Broad leaved paperbark
Co-dominant. Basal flare. Branching south. Extensive branch bow and sweep.

15 - Broad leaved paperbark
Basal flare. Short trunk, co-dominant, divergent. Larger leader is a fusion of two, included bark.


16 - Norfolk Island hibiscus
Basal flare, predominantly south. Trunk fluted. Balanced branch distribution at central branch junction, at ~1.8m.

17 - Norfolk Island hibiscus
Basal flare, predominantly south. Trunk fluted. Co-dominant, differing sizes. Balanced branch distribution at central branch junction, at ~1.6m. Branch bow and sweep, low hanging canopy. Upper canopy branch congestion, acute.


18 - Casuarina
Basal flare, trunk fluted. Co-dominant, inclusion, adaptive rib. Lower trunk leans north. Lengthy tension crack (~2.5m) of east scaffold from branch junction, into heart wood at branch bark ridge. West side failed branches. Poor foliage cover. Other splits, windthrown.


19 - Mountain grey gum
Stout trunk branching at ~2m. Surrounded by Camphor laurel, Pittosporum saplings and Strangler fig. Vine entwining trunk and branches. Hazard beam cracks, north-west. Lengthy lateral branching. Epicormic regrowth along branch lengths. Dead canopy branches. Failed branches. Storm damaged.


20 - Smooth bark apple gum
Leans north-east. Branching over road. Dead wood. Dead canopy. Suppressed.


21 - Camphor laurel
Basal flare, surface roots. Acaulescent, leader congestion anastomising.


22 - Swamp mahogany
Suppressed canopy, east. Dead wood. Epicormic.

23 - Swamp mahogany
Basal flare. Stout. Two acutely divergent leaders at ~ 2.5m, one lower bowed horizontal scaffold westwards. Directionally pruned of east scaffold.

24 - Swamp mahogany
Upright. Dense understory vegetation. High branching. Central branch junction gathering lost vegetation.

25 - Swamp mahogany
Basal flare. On landform drop-off, leans south. High branching.

26 - Broad leaved paperbark
Large surface root south-east, basal flare, trunk fluted. Leans eastwards. Fused leaders. Low branching. Foliage concentrated at branch ends.

27 - Norfolk Island hibiscus
Acaulescent, differing sizes. Directionally pruned. Foliage concentrated at branch ends.

28 - Casuarina
Asymmetrical. Exotic *Ivy species* affliction to framework. Amongst a grove of same and understory Pittosporum.

29 - Casuarina
Part of a lignotuber cluster. Exotic *Ivy species* affliction to framework. Amongst a grove of same and understory Pittosporum.

30 - Casuarina
Acaulescent, co-dominant. Basal flare, trunk fluted. On landform drop-off, leans south. Exotic *Ivy species* affliction along southern trunk.

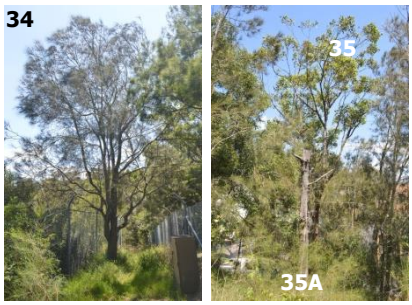
31 - Small fruited fig
Acaulescent, ~ 9 trunks. Basal flare, fissures. Surface roots to ~7m south.

32 - Broad leaved paperbark
Lopped. All growth upright, acute epicormics. Failed west branch. Dense understory.

33 - African olive
Lopped at root crown. Congested epicormic regrowth. Foliage concentrated at ends. Inner twig dieback.

34 - Casuarina
Trunk taper. Low branching at ~1.5m into 3 leaders. Deeply fissured, growth splits. Directionally pruned north-west. Poor foliage cover.

35 - Swamp mahogany
Upright. Acute scaffold branch junction, seam with delaminating bark. South scaffold pruned out. Branch failure. Twig dieback. Reaction wood along framework, discolouration, bulges, wounds, damaged branches. Epicormic new growth.



35A - Casuarina
Pruned. Storm damaged. Delaminated bark, disintegrating. Dead.

36 - Casuarina
Pruned. Storm damaged. Delaminated bark, disintegrating. Dead.

37 - Swamp mahogany
Stout trunk, taper. Basal flare. Branch interaction with Fig, tree 38. Small diametre failed branches.

38 - Small fruited fig
Extensive surface root network. Partial branch anastomosis with tree 37.

39 - Norfolk Island hibiscus
Basal flare. Slight lean east. Exotic *Ivy species* at base.

40 - Swamp mahogany
Stout trunk. Large quantity of broken out branches south, storm damaged, west, east. Large diametre dead stubs.

41 - Small fruited fig
Persistent *Monstera species* affliction. Poor foliage cover, south side.

42 - Lillypilly
Acaulescent. Failed branches. Twig die back, dead wood. New growth epicormic. Branch bow eastwards.

43 - Weeping willow
Low hollow, failed scaffolds. Internal cavity. Large diametre dead wood. Branching southwards, bowed.

44 - Canary Island date palm
Leans north. Phototrophic at edge of retaining wall.

45 - Canary Island date palm
On retaining wall. Adjoins palm 44.

Both palms had rudimental crown lifting.

46 - Coral
Acaulescent co-dominant. Larger leader head failure. Elevated root plate. Large diametre failed branches west-south-west. Twig dieback. Branch bow and sweep, interaction - rub wound, rib.

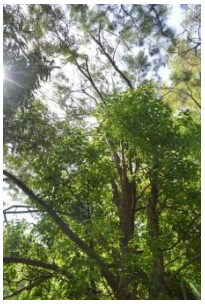
47 - Willow gum
Basal flare. Surface roots. Leans north-east. Low scaffold at ~2m. Pruned. Storm afflicted, epicormic regrowth.

47A - Broad leaved paperbark
Basal flare. Large diametre surface root south-west. Co-dominant at ~1.1m, divergent to upright leaders. Above canopy.

48 - Canary Island date palm
On boundary. Elevated root plate. Trunk bowed west to east. Crown lifted. Accumulation of dead fronds and vegetative matter at base.

49 - Swamp mahogany
Basal flare. Co-dominant. Apical failure. Branching north, bow and sweep. Deep seams at branch junctions, inclusions, cracks. Surrounding tall Pittosporum saplings.

50 - Casuarina
Basal flare, trunk fluted. Camphor laurel sapling alongside causing suppression of lower branching. Dead wood. Foliage concentrated at ends.



51 - Casuarina
Basal flare. Upright. Balanced branching. Twig dieback and small diametre dead wood. Trunk has latent bud shoots.

52 - Coastal myall
Central branch junction at DBH. Trunk and branch bow and sweep, rolled collars at bends. Canopy interaction with tree 53.

53 - Swamp mahogany
Stout trunk. Co-dominant at ~1m. Scaffold failure north-west. Transverse scars.

54 - Casuarina
Basal flare. Surface roots, wounded - mechanical damage. Co-dominant at root crown, leaders of differing sized. Small diametre failed branches, dead wood. Epicormic regrowth.


55 - Casuarina
Basal flare, trunk fluted, tapers. Co-dominant at ~1m, seam with rib formation. South side canopy suppression, lengthy dead branches, asymmetrical.


56 - Casuarina
Basal flare, trunk fluted. Dead branches, north. Foliage concentrated to upper canopy.

57 - Turpentine
Acaulescent, co-dominant, acutely convergent to root crown. Low dead wood.

58 - Swamp mahogany
Leans east. Low branching. Trunk and branch bow and sweep. Canopy interaction with adjoining trees.


59 - Swamp mahogany
Upright. Trunk taper. Much epicormic regrowth along branch lengths has died. Tear out wounds north-west. Twig dieback. Failed branch stubs.


60 - Plum pine
Co-dominant at root crown, acutely divergent. Lower branch abscission. West branches on boundary fence.


Discussion of landscape significance and sustainability

4.1. Most of the sites' trees have been storm damaged and present with hazards. These trees have either poor form, structural, health and vigour issues and are rated low in their estimated life expectancy and their canopy sizes often masks their poor retention values.

4.2. **Trees along the western entry** are within 3 metres of the building and would otherwise be exempt from requiring approval to remove, these rate low as most have subsided and/or present with damage to access ways.

4.3. **The north-eastern corner** is populated by a largely unchecked grove of Casuarina species. An exotic Ivy species has affected many of the trees; in that the Ivy has caused damage and is saprophytic to the fissured trunks. This has caused tree decline and a reduction of lower branches. Many trees are on the edge of the north-east retaining wall are situated on a high drop off; these trees have a lean and are clearly destabilised due to inadequate rooting space.

4.4. **Those trees outside the north boundary** have been damaged and are significantly asymmetrical posing issues for road clearance. Their sustainability and viability in their location is questionable due to increasing hazards to the public in general.

4.5. **The adjoining Arcadia Park** is undergoing vital and necessary remediation and clearing up. Much of the boundary between this park and the site has been left fallow and is a significant biological hazard. The Biodiversity assessment (BA) produced for council, dated 7 February 2018 by Coast Ecology addresses several trees with hollows. One of which is on the subject site - **tree 43**. It is a Weeping willow which is hollowed out to approximately 2 metres. I concur with the findings of the BA that no current fauna is using this hollow and that the hollow is at such a low height that the probability of it being used is very low. This tree is in decline but is not seen to be affected by proximity of works.

4.6. **The quantity of Camphor laurel saplings and African and European olive species** throughout the park and this site should be of concern. They are clearly displacing native flora. I would anticipate most of these will all eventually be removed as they readily seed and spread.

4.7. **Trees to the east of the boundary along the fence line** present with some element of risk in relation to fire. Newcastle Council VMP for Arcadia Park indicates the need to enable an APZ. This is beyond the scope of this report but is seen of mutual benefit. It is not possible to remove branches without affecting the trees mass damping and subsequent wind throw dynamics of trees along the east boundary. However, the new structures will afford these trees some protection. Along the boundary, the proposed easement between sites is of benefit to tree sustainability, they are trees numbered 50, 51, 52, 53, 54, 55, 56, 57, 58, 59 and 60.

Construction encroachment and Impact of development to trees of the site

4.8. The Australian Standard: *AS 4970-2009 Protection of trees on development sites,* discusses the impact proposed development has on trees and trees' impacts in close proximity to built assets.

4.9. The TPZ and SRZ has been overlaid onto the supplied plan to demonstrate the minimum scope of trees' root systems. See page 4.

Tree protection zone (TPZ): Considers an area around a tree to be set aside for its protection. The TPZ considers its growing environment above and below ground to determine the size of allowable encroachment prior to site works which can affect tree health and sustainability. The TPZ is a combination of the trees root protection zone and crown protection zone.

Structural root zone (SRZ): The SRZ need only be calculated when major encroachment into a TPZ is proposed. The SRZ is the area around the base of the tree required for the tree's stability in the ground, it is considered critical to the trees integrity. The woody root growth and soil cohesion in this area are necessary to hold the tree upright. This zone considers a trees structural stability only, not the root zone required for a tree's vigour and long-term viability, which will usually be much larger[1].

TPZ and SRZ calculations use the trees DBH. TPZ is calculated thus: DBH x 12. The SRZ is calculated thus: (D x 50)0.42 x 0.64. These measurements are a radii measured from the trunk outwards in each direction.

4.10. Trees within the site will be affected by the proposal to a greater or lesser extent, if not to their SRZ or TPZ then by demolition works and construction. Cutting and filling will be necessary. Ground surface compaction is an additional and unavoidable outcome, even with consideration of the allocated setback and stormwater/gutter requirements.

4.11. There are three remaining Fig trees along the eastern side which will be affected. The quantity of root and branches to accommodate the proposal is not in keeping within guidelines of AS4373-2007 Pruning of amenity trees. Although a tolerant species, their future is limited in an urban situation as they would require their own management plan to keep them in check. This is not practicably or logistically viable. We note that council has previously approved removal of several other fig trees on the site for similar reasons. they have also implemented a program of removing figs throughout the surrounding street trees.

4.12. **Tree 13A, Radiata pine** in the adjoining property to the north-west corner. **Tree 46** and **Palm 48** are dominantly in Arcadia Park. They are retainable and are discussed in the Summary section on page 3.

4.13. For the provision of the proposal, due to landform cut and fill and establishment of retaining walls, no tree in the bounds of the proposal is able to support the extent or sustain timing impacts of development encroachment to a sustainable level. Therefore, no tree is retainable.

4.14. As the site has a future, long term plan, and due to their condition, trees **19, 20 and 21** along Kitchener Parade should be considered to be replaced. This should be supported by approval to remove from the determining authority and was discussed in the Arborist document of 8/4/2020. Further information is given in the Summary section of this document, page 3.

[1] AS 4970-2009 Protection of trees on development sites. Section 1.4.5 Structural root zone (SRZ)

Compensatory planting

4.15. The matrix for determining the quantity of replacement trees follows the guideline of the UFTM Part A Private Trees, page 19, 4.3 Compensatory planting, table 4[16].

4.16. In the UFTM, paragraph 1 of section 4.3 indicates that trees of moderate to significant value which cannot be retained require compensatory planting.

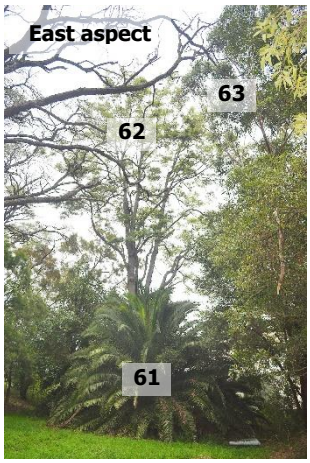
4.17. The table below is for those trees requiring offset replacements.

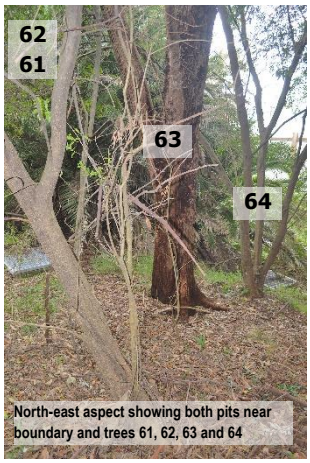
Tree number	Canopy projection	Quantity of replacement plantings
7	52	3
9	66	4
11	130	5
14	51	3
22	155	5
23	64	4
26	78	4
27	49	3
31	461	5
34	64	4
35	61	4
37	207	5
38	330	5
40	57	3
41	491	5
47	161	5
Total quantity of trees to replanted		**67**

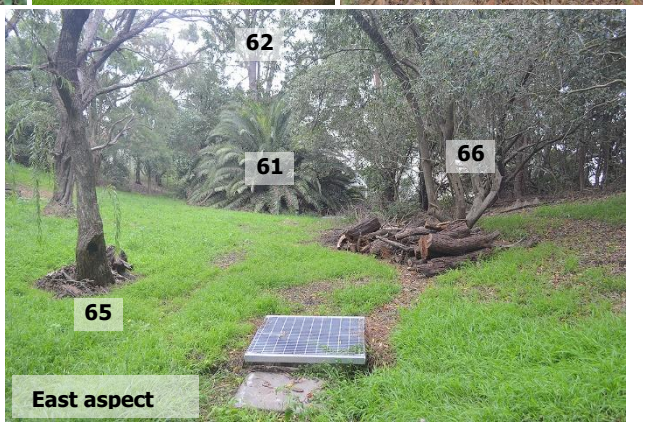
5. ARCADIA PARK - DATA

5.1. TPZ of Palm is 1m from the outside of the crown projection.

#	Common / Botanical name	Age class	DBH in centimetres	TPZ in metres as a radius	DRB in centimetres	SRZ in metres as a radius	Height	Condition
60	Brown / Plum Pine *Podocarpus elatus*	Mature	30	**3.6**	38	**2.2**	14	Co-dominant at root crown, divergent. Basal flare. Recently fruited. Branches on boundary fence. Densely foliated. Healthy.
61	Canary Island Date Palm *Phoenix canariensis*	Mature	110	**6**	110	**3.4**	6	Forming a cluster of possibly four juveniles of the same species. Inaccessible area, very congested undergrowth. Low fronds. Appearing in good health.
62	Silky oak *Grevillea robusta*	Mature	60	**7.2**	70	**2.8**	20	Grows alongside palm 61, sharing same root space. Differentiated trunk bark to lower trunk 1m and 3m, east. Two leaders at approximately 3m. Dead branches. Congested understory attributing to probable trunk degradation.
63	Swamp mahogany *Eucalyptus robusta*	Mature	50	**6**	68	**2.8**	15	Stout. Basal flare, slight buttressing. West side surface roots. Lisp north-north-east. Co-dominant at 2m. Structurally sound. Healthy.
64	Wild olive *Olea europaea subsp. cuspidata*	Juvenile	26*	**3.1**	39	**2.2**	8	Multi-stemmed; 16cm, 16cm and 12cm DBH. Ivy along lower trunk. End weighted branches. High canopy.
65	Weeping willow *Salix babylonica*	Mature	30	**3.6**	45	**2.4**	12	Basal flare. Leader west and east have failed; east side with cavity. Other branch failures. Trunk bow and sweep, bends north-west. Poor form. Structurally deficient.
66	Wild olive *Olea europaea subsp. cuspidata*	Juvenile	31*	**3.7**	47	**2.4**	10	Multi-stemmed at 30cm; 19cm, 17cm, 14cm and 12cm DBH, divergent to upright. Accumulation of cut logs at base. Branch bow and sweep. Twig dieback and dead branches. Accumulation of cut logs at base. Leader and branch bow and sweep. Dead branches and twig dieback throughout. Poor form.







6. MOSBRI CRESCENT PARK - DATA

#	Common / Botanical name	Age class	DBH in centimetres	TPZ in metres as a radius	DRB in centimetres	SRZ in metres as a radius	Height	Condition
1	Small fruited fig *Ficus microcarpa*	Mature	90	**10.8**	117	**3.5**	11	Surface root network to 3m south, 2m east and west. Basal flare. Slim waist. Central branch junction at approximately 2m. Subject to power line clearance pruning. Impact wounded scaffolds north-east. Inner canopy twig dieback. Dense canopy. Included bark condusive to species throughout. Sound. Healthy.
2	Weeping bottlebrush *Callistemon viminalis*	Semi-mature	22*	**2.6**	29	**2.0**	7	Co-dominant, 20cm and 10cm DBH. Mechanical damage to root crown. Pruning history. Suppressed canopy from adjoining tree 1, Fig. Trunk lisp northwards. Twig dieback and dead branches. Partial decline to east side.
3	Weeping bottlebrush *Callistemon viminalis*	Semi-mature	20*	**2.4**	27	**1.9**	5	Multi-stemmed x 4; 14cm, 7cm, 6cm and 11cm DBH. Pruning history. Trunk and scaffold branch failure history. Poor foliage cover. Multiple fungal fruit bodies in multiple locations along trunk and pruning locations.
4	Small leaved lillypilly *Syzygium luehmannii*	Mature	43*	**5.2**	65	**2.8**	12	Surface roots north-west, west and south-west, downslope, wounded. Basal flare. Multi-stemmed x 4; 26cm, 30cm, 13cm and 10cm DBH. Included bark to root crown of larger trunks, acutely convergent. Pruning history. Structurally deficient. Healthy.
5	Small leaved lillypilly *Syzygium luehmannii*	Semi-mature	35*	**4.2**	45	**2.4**	9	Multi-stemmed x 4; 23cm, 23cm, 10cm and 9cm DBH. Pruning history. North side wounded scaffold. Healthy.
6	Small leaved lillypilly *Syzygium luehmannii*	Juvenile	18*	**2.2**	23	**1.8**	5	Basal flare. Multi-stemmed x 3; 13cm, 11cm and 7cm DBH. Included bark at 1m, response growth. New growth along trunks.
7	White cedar *Melia azedarach*	Juvenile	12*	**1.5**	25	**1.8**	5	Wounded root crown. Co-dominant at 1m, 10cm and 7cm DBH, plus one sucker, convergent. Included bark at 30cm. Lanky, end weighted.
8	Cook Pine *Araucaria columnaris*	Mature	78	**9.4**	108	**3.4**	28	Elevated root plate. Basal flare south side. Surface roots west-south-west. Slight bow to trunk at 4m with exudations, bulge. North side dead branches to approximately 10m. Latent bud growth. Suspected of being storm damaged at 4m.
9	Broad leaved paperbark *Melaleuca quinquenervia*	Mature	87*	**10.4**	92	**3.2**	11	Surface roots predominantly eastwards. Multi-stemmed x 6; 65cm, 23cm, 29cm, 21cm, 33cm and 22cm DBH. Included bark at trunks. Subject to power line clearance pruning. Significant asymmetry. Divergent branching.
10	Moreton Bay fig *Ficus macrophylla*	Semi-mature	74*	**8.9**	119	**3.6**	10	Surface roots to 1.5m; to 3m west, wounded. Aerial roots, several anastomising with trunks. Basal flare. Trunk fluting. Multi-stemmed x 3; 45cm, 37cm and 46cm DBH. Subject to power line clearance pruning. Sound. Healthy.
19	Mountain grey gum *Eucalyptus cypellocarpa*	Mature	84	**10.1**	85	**3.1**	14	Stout. Congested undergrowth consisting of weed and undesirable species – Camphor laurel and Pittosporum. Vine incursion along trunk and branches. End weighted foliage distribution. Some epicormic growth along branch lengths. Branch failure history. Storm damaged.
20	Smooth bark apple *Angophora costata*	Mature	47	**5.6**	50	**2.5**	12	Differentiated trunk bark. Leans northwards, destabilised over roadway. Twig dieback and dead branches. Partial death of canopy.
21	Camphor laurel *Cinnamomum camphora*	Mature	107	**12.8**	110	**3.5**	12	Surface roots. Basal flare. Congestion of undergrowth, Wild olive and Camphor laurel. Congested branching.

Construction encroachment to trees of Mosbri Crescent Park

6.1. The revised stormwater plan connects to the existing infrastructure. This will have a major impact upon tree 2. Tree 2 cannot be retained and will require compensatory planting as an offset.

6.2. This revised stormwater plan has removed all potential excavation around any root systems to other trees of the park. No other TPZ or SRZ zones will receive impacts from this connection.

6.3. This is a most considered and compassionate effort for reducing impact to trees' of this park.

Photos


South-east aspect
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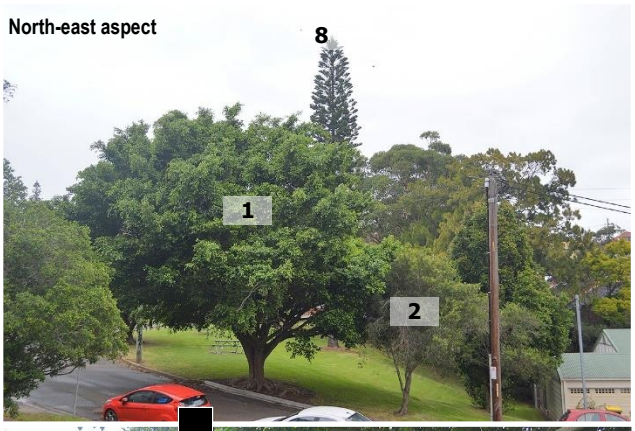
North-east aspect
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North-east aspect
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East aspect
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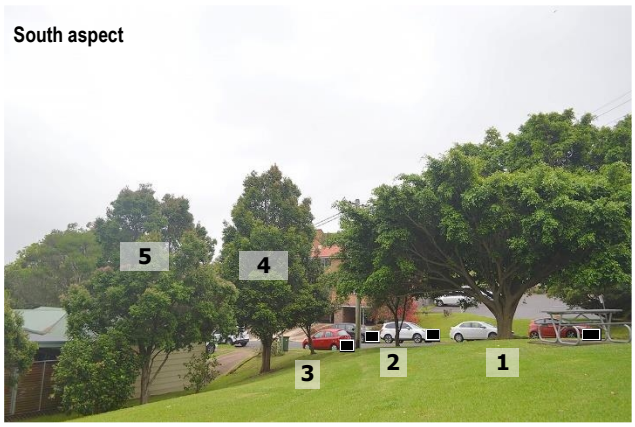
South aspect
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South aspect
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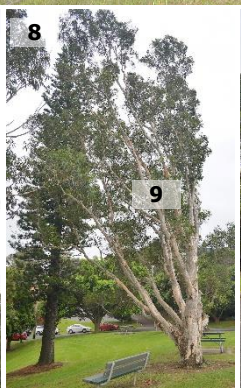
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7. EXTRACT FROM URBAN FOREST TECHNICAL PART A PRIVATE TREES, PAGE 19, 4.3 COMPENSATORY PLANTING, TABLE 4

4.3 Compensatory planting

Where it has been demonstrated it is not reasonable to retain a tree of moderate to significant value compensatory planting on private land will be required. A guide to compensatory planting rates for trees of moderate or high value is provided in **Table 4**.

Table 4 - A guide to compensatory planting on the development site

	Total area of crown projection to be removed[1]	Number of standard trees[2] to be planted
1	Up to $20m^2$	1 standard tree
2	21 m^2 – $40m^2$	2 standard trees
3	41 m^2 - $60m^2$	3 standard trees
4	61 m^2- $80m^2$	4 standard trees
5	81 m^2-$100m^2$	5 standard trees

Note 1: Crown Projection (m2) = average canopy radius x π

Note 2: A standard tree is a minimum 45L container volume, a minimum crown projection at maturity of $20m^2$ and of a desirable species.

Compensatory planting is to be located on the development site. The required compensatory planting is to be achieved by designing for planting of new trees in accordance with **Table 4** above.

Where it is demonstrated compensatory planting cannot be carried out in accordance with the above table, incorporating smaller trees into the landscape area will be required. Trees of different sizes and species can be planted to suit the site.

The compensatory planting locations and species are to be shown on the landscape concept plans. The landscape plan is to indicate opportunities for canopy cover, biodiversity and occupant amenity.

Note 1: Public land is not to be used for compensatory planting.

Note 2: Where space permits, the preferred planting location is within the front of the property. The planting location should take into account services and other infrastructure. Planting should be offset a minimum 1.5m from the front property boundary.

When determining appropriate compensatory tree planting, consideration must be given to:

- physical constraints of the site, eg. adequate space for the tree at maturity including clearances required for driveways and other utilities
- site soil conditions and microclimate
- growth habits of the proposed species, eg. crown shape and characteristics
- implications for neighbouring properties.

8. GLOSSARY[e]

Abscission: The shedding of plant organs such as fruit, leaves or branches. Influenced by various factors including environmental, stressors, disease or decline.

Acaulescent: A trunkless tree or a tree supported by a very short trunk.

Acute branch crotch: A branch crotch where the angle on the inner side of the union is less than <90°.

Acutely convergent: A branch growing in a direction towards its point of attachment where the angle in the crotch is less than <90°.

Acutely divergent: A branch growing in a direction away from its point of attachment where the angle in the crotch is less than <90°.

Adventitious: A bud arising from points other than terminals or axils.

Adaptive wood: Additional load-bearing wood formed in response to mechanical stresses and gravitational force upon the vascular cambium to provide a uniform distribution of loading.

Anastomosis / anastomise: Cross-linking of branching parts. Growth usually forms a graft or is fused together.

Apical: Forming at the apex.

Basal flare: Swelling at the root crown usually uniform around the base of the trunk involving tissue from the trunk and root crown.

Branch bark ridge (BBR): Extruded bark forming a convex protrusion or striation or series of ripples in the crotch of the *branch union*.

Co-dominant (multi-stemmed): Two or more leading trunks or stems (also known as 'leaders' for leading stems). Often presenting with **inclusion** (see explanation below) which may or may not be associated with a growth defect.

Compartmentalisation or CODIT (Shigo, 1979): A dynamic defence and protection process in trees to resist the spread of pathogens and decay organisms using existing and new cells as physical and chemically enhanced barriers as a system of four walls.

Compression fork: A fork formed where two stems with an *acute branch crotch* grow pressing against each other with *included bark* which becomes enclosed bar where the stems flatten at their interface under increasing compression from each successive growth increment, forming a weak graft as a welded fork which remains susceptible to tensile stress (Mattheck & Breloer 1994, p60).

Diametral cracks: Longitudinal cracks formed on opposite sides of a stem with the potential of a shear failure (Lonsdale 1999, p49).

Divergent branch: The direction taken by a branch as it grows away from another.

Epicormic shoots: Juvenile shoots produced at branches or trunk from epicormic strands (arising from meristematic tissue) or sprouts produced from dormant or latent buds concealed beneath the bark. Production can be triggered by fire, pruning, wounding, or root damage but may also result from stress or decline.

Exudate: Oozing of *sap* from severed or ruptured vascular cambium.

Fluted (Fluting[f]) A section of trunk, branch or root that is broadly convex or cable like and may be linear, helical or interconnected with sections usually separated by a fissure.

Inclusion, included bark: The bark on the inner side of the branch union, or is within a concave crotch that is unable to be lost from the tree and accumulates or is trapped by acutely divergent branches forming a compression fork. Growth of bark at the interface of two or more branches on the inner side of a branch union or in the crotch where each branch forms a branch collar and the collars roll past one another without forming a graft where no one collar is able to subsume the other. Risk of failure is worsened in some taxa where branching is acutely divergent or acutely convergent and ascending or erect.

Leader: A structural branch asserting apical dominance.

Occlude / occluding: Growth processes where wound wood develops to enclose the wound face by the merging of wound margins concealing the wound and restoring the growing surface of the structure with each growth increment gradually realigning fibres in the wood longitudinally along the stem to maximise uniform stress loading.

Also commonly used to refer to the uptake of surrounding structures into tree growth. Such as seen with the retaining wall where tree roots form in and around the rocks and therefore cannot be separated from each other without causing injury to the tree or damage to the structure.

Order of branches: The marked divisions between successively smaller branches (James 2003, p. 168) commencing at the initial division where the trunk terminates. Successive branching is generally characterised by a gradual reduction in branch diametres at each division, and each gradation from the trunk can be categorised numerically, e.g. first order, second order, third order etc. A scaffold branch is generally a first order branch or a tree with a dominant trunk.

Pollard, pollarding: A pruning technique to establish branches that terminate with a pollard head, from which arise multiple vigorous shoots (Australian Standard AS3473-2007 Pruning of Amenity Trees, p.7).

Rib: Adaptive wood that may form over a crack, included bark or enclosed bark and may be a sharp-edged rib as an elongated protuberance where a crack continues to develop or a round-edged rib where a broad convex swelling is formed over the crack by the addition of each new growth increment and the cracking is slowed or prevented from developing further (Mattheck & Breloer 1994, p. 57). Some rib-like growths may not be related to cracks or included bark having formed by older enlarged aerial roots, e.g. *Melaleuca quinquenervia.*

Scaffold branch: Considered a structural branch. Is the first order or other orders of branches elongated to form a permanent framework of branches supporting the crown, persisting beyond the tree's maturity.

Transverse stress: A loading force at a right angle to a structure, e.g. such as causes a hazard beam.

Transverse crack: Caused by tensile stress stretching the fibres along their axes (Lonsdale 1999, p 50).

9. REFERENCES

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10. ENDNOTES

[a] Lonsdale, D.; 1999, *Principles of Tree Hazard Assessment and Management*: Page 148, 5.1.3 Systems for quantifying hazard and risk; page 149, Figure 5.1 Tree assessment strategy; page 151, paragraph 1. Mattheck, C., Breloer, H.; Strouts, R, 1994, *The Body Language of Trees: A Handbook for Failure Analysis*: Page 196: The Visual Tree Assessment procedure.

[b] TPZ calculated out at 21.4 metres, however according to *AS 4970-2009, Section 3 Determining the Protection zones of the selected trees, page 11, paragraph 3.2 - Determining the TPZ*: A TPZ should not be less than 2m **nor greater than 15m** (except where crown protection is required).

[c] TPZ calculated out at 15.8 metres, however according to *AS 4970-2009, Section 3 Determining the Protection zones of the selected trees, page 11, paragraph 3.2 - Determining the TPZ*: A TPZ should not be less than 2m **nor greater than 15m** (except where crown protection is required).

[d] TPZ calculated out at 21.6 metres, however according to *AS 4970-2009, Section 3 Determining the Protection zones of the selected trees, page 11, paragraph 3.2 - Determining the TPZ*: A TPZ should not be less than 2m **nor greater than 15m** (except where crown protection is required).

[e] Largely adapted from Draper, B. D.; Richards, P., 2009, *Dictionary for Managing Trees in Urban Environments*, CSIRO Publishing, Collingwood, Victoria, Australia.

[f] Term by author