

REPORT:

ARBORICULTURAL ASSESSMENT

**Royal North Shore Hospital
Redevelopment**

Pacific Hwy St Leonards NSW

Prepared 17 October 2008
Reference 11057

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SUMMARY

This report considers a total of one hundred and seventy nine (179) trees, within the Royal North Shore Hospital site which were assessed as part of the proposed redevelopment. One hundred and fifty one (151) trees are proposed for removal, with the retention and protection of twenty eight (28) trees recommended within the site. Four trees are located along Herbert Street (street trees), with two (2) proposed for removal.

Trees 60, 62, 63, 64a, 64b, 64c, 64d, 65, 66, 67, 68, 69, 70, 118, 139, 140, 141, 142, 143, 144, 145, 146, 147, 212, 213, 214, 332 and 333 are proposed to be retained in situ with suitable set backs provided, except Trees 60, 62, 63, 64a, 64b, 65 & 118 which will be directly impacted by construction works. However, these trees will be protected and the impact ameliorated by modified construction techniques and pruning.

Trees 26 – 38, 44- 59, 61, 72 – 84, 86 – 91, 99, 109, 110, 112 – 117, 119, 121 – 138, 148 – 190, 192 – 207, 327 – 331 and 334 - 344 are proposed to be removed as they are in poor condition, or are an undesirable species or are located within or too close to the proposed building or construction footprint and are unable to be retained.

The general condition of each tree/s is listed in Table 1.0; a summary of works in Table 2.0, and minimum setbacks for protective fencing from development works per tree to be retained is summarized in Table 3.0.

Table 1.0 General condition of trees. Trees are described in greater detail in section 5.0.

UTM Tree No.	Genus and species	Common name	Condition G = Good F = Fair P = Poor D = Dead
26	<i>Lophostemon confertus</i>	Brush Box	G
27	<i>Lophostemon confertus</i>	Brush Box	G
28	<i>Lophostemon confertus</i>	Brush Box	F
29	<i>Lophostemon confertus</i>	Brush Box	G
30	<i>Lophostemon confertus</i>	Brush Box	F
31	<i>Lophostemon confertus</i>	Brush Box	G
32	<i>Araucaria heterophylla</i>	Norfolk Island Pine	G
33	<i>Lophostemon confertus</i>	Brush Box	G
34	<i>Eucalyptus leucoxylon subsp. leucoxylon</i>	Yellow Gum	F
35	<i>Eucalyptus leucoxylon subsp. leucoxylon</i>	Yellow Gum	P
36	<i>Cupressus sempervirens var. stricta</i>	Mediterranean Pine	G
37	<i>Camellia sasanqua</i> (Stand of seven (7))	Camellia	G
38	<i>Camellia sasanqua</i> (Stand of four (4))	Camellia	G
44	<i>Jacaranda mimosifolia</i>	Jacaranda	G
45	<i>Plumaria rubra</i>	Frangipani	F
46	<i>Viburnum tinus</i> (Stand of three (3))	Viburnum	G
47	<i>Cedrus deodara</i>	Himalayan Cedar	G

Table 1.0 - Continues

UTM Tree No.	Genus and species	Common name	Condition G = Good F = Fair P = Poor D = Dead
48	<i>Jacaranda mimosifolia</i>	Jacaranda	F
49	<i>Lophostemon confertus</i>	Brush Box	G
50	<i>Lophostemon confertus</i>	Brush Box	G
51	<i>Lophostemon confertus</i>	Brush Box	G
52	<i>Lophostemon confertus</i>	Brush Box	F
53	<i>Lophostemon confertus</i>	Brush Box	G
54	<i>Lophostemon confertus</i>	Brush Box	G
55	<i>Corymbia citriodora</i>	Lemon Scented Gum	F
56	<i>Lophostemon confertus</i>	Brush Box	G
57	<i>Lophostemon confertus</i>	Brush Box	F
58	<i>Howea forsteriana</i>	Kentia Palm	G
59	<i>Lophostemon confertus</i>	Brush Box	F
60	<i>Lophostemon confertus</i>	Brush Box	G
61	<i>Lophostemon confertus</i>	Brush Box	G
62	<i>Lophostemon confertus</i>	Brush Box	G
63	<i>Lophostemon confertus</i>	Brush Box	P
64a	<i>Lophostemon confertus</i>	Brush Box	G
64b	<i>Lophostemon confertus</i>	Brush Box	G
64c	<i>Lophostemon confertus</i>	Brush Box	G
64d	<i>Lophostemon confertus</i>	Brush Box	G
65	<i>Lophostemon confertus</i>	Brush Box	G
66	<i>Lophostemon confertus</i>	Brush Box	G
67	<i>Lophostemon confertus</i>	Brush Box	G
68	<i>Lophostemon confertus</i>	Brush Box	G
69	<i>Lophostemon confertus</i>	Brush Box	G
70	<i>Lophostemon confertus</i>	Brush Box	G
72	<i>Syagrus romanzoffianum</i>	Cocas Palm	G
73	<i>Jacaranda mimosifolia</i>	Jacaranda	G
74	<i>Populus nigra 'Italica'</i>	Lombardy Poplar	F
75	<i>Cupressus torulosa</i>	Bhutan Cypress	G
76	<i>Cupressus macrocarpa 'Brunniana'</i>	Brunnings Golden Cypress	G
77	<i>Cupressus macrocarpa 'Brunniana'</i>	Brunnings Golden Cypress	F
78	<i>Jacaranda mimosifolia</i>	Jacaranda	P
79	<i>Populus nigra 'Italica'</i>	Lombardy Poplar	F
80	<i>Lagerstroemia indica</i>	Crepe Myrtle	F
81	<i>Glochidion ferdinandi</i>	Cheese Tree	G
82	<i>Prunus sp.</i>	-	F
83	<i>Pittosporum eugenioides 'Variegatum'</i>	Pittosporum	G
84	<i>Eucalyptus eximia</i>	Yellow Bloodwood	P

Table 1.0 - Continues

UTM Tree No.	Genus and species	Common name	Condition G = Good F = Fair P = Poor D = Dead
85	<i>Weed sp</i>	-	F
86a	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	G
86b	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	G
87	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	G
88	<i>Celtis occidentalis</i>	Hack-berry	G
89	<i>Camellia japonica</i>	Camellia	G
90	<i>Ceratopetalum gummiferum</i>	NSW Christmas Bush	F
91	<i>Ceratopetalum gummiferum</i>	NSW Christmas Bush	G
99	<i>Eucalyptus scoparia</i>	Wallangarra White Gum	F
109	<i>Cotoneaster lacteus</i>	Cotoneaster	F
110	<i>Olea europea subsp. africana</i>	African Olive	F
112	<i>Lophostemon confertus</i>	Brush Box	F
113	<i>Lophostemon confertus</i>	Brush Box	F
114	<i>Cinnamomum camphora</i>	Camphor laurel	P
115	<i>Cinnamomum camphora</i>	Camphor Laurel	P
116	<i>Acacia binervia</i>	Coast Myall	F
117	<i>Cupressus glabra</i>	Arizona Cypress	F
118	<i>Ficus microcarpa var. hillii</i>	Hills Weeping Fig	G
119	<i>Acmena smithii</i>	Lillypilly	F
121	<i>Melaleuca bracteata</i> 'Golden Gem'	Black Tea Tree	G
122	<i>Melaleuca bracteata</i> 'Golden Gem'	Black Tea Tree	F
123	<i>Acer negundo</i>	Box Elder	P
124	<i>Syncarpia glomulifera</i>	Turpentine	G
125	<i>Ficus rubiginosa</i>	Port Jackson Fig	F
126	<i>Strelitzia nicolai</i>	Giant Bird of Paradise	G
127	<i>Magnolia grandiflora</i>	Bull Bay Magnolia	G
128	<i>Lophostemon confertus</i>	Brush Box	G
129	<i>Lophostemon confertus</i>	Brush Box	G
130	<i>Acer negundo</i>	Box Elder	G
131	<i>Lophostemon confertus</i>	Brush Box	F
132	<i>Acer negundo</i>	Box Elder	G
133	<i>Acer negundo</i>	Box Elder	F-G
134	<i>Hymenosporum flavum</i>	Native Frangipani	F-G
135	<i>Camellia japonica</i> (x3)	Camellia	G
136	<i>Lophostemon confertus</i>	Brush Box	G
137	<i>Jacaranda mimosifolia</i>	Jacaranda	G
138	<i>Jacaranda mimosifolia</i>	Jacaranda	G

Table 1.0 - Continues

UTM Tree No.	Genus and species	Common name	Condition G = Good F = Fair P = Poor D = Dead
139	<i>Lophostemon confertus</i>	Brush Box	F
140	<i>Lophostemon confertus</i>	Brush Box	G
141	<i>Lophostemon confertus</i>	Brush Box	F
142	<i>Lophostemon confertus</i>	Brush Box	G
143	<i>Lophostemon confertus</i>	Brush Box	G
144	<i>Lophostemon confertus</i>	Brush Box	G
145	<i>Prunus sp.</i>	-	G
146	<i>Archontophoenix cunninghamiana</i> (x7)	Bangalow Palm	G
147	<i>Washingtonia robusta</i>	Mexican Fan Palm	G
148	<i>Jacaranda mimosifolia</i>	Jacaranda	G
149	<i>Bauhinia variegata</i>	Orchid Tree	F
150	<i>Lophostemon confertus</i>	Brush Box	G
151	<i>Lophostemon confertus</i>	Brush Box	G
152	<i>Lophostemon confertus</i>	Brush Box	G
153	<i>Lophostemon confertus</i>	Brush Box	G
154	<i>Lophostemon confertus</i>	Brush Box	G
155	<i>Lophostemon confertus</i>	Brush Box	F
156	<i>Lophostemon confertus</i>	Brush Box	G
157	<i>Lophostemon confertus</i>	Brush Box	G
158	<i>Cupressus macrocarpa</i>	Monterey Cypress	F
159	<i>Lophostemon confertus</i>	Brush Box	F
160	<i>Lophostemon confertus</i>	Brush Box	G
161	<i>Lophostemon confertus</i>	Brush Box	G
162	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	G
163	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	G
164	<i>Araucaria cunninghamiana</i>	Hoop Pine	G
165	<i>Lophostemon confertus</i>	Brush Box	G
166	<i>Lophostemon confertus</i>	Brush Box	G
167	<i>Lophostemon confertus</i>	Brush Box	G
168	<i>Lophostemon confertus</i>	Brush Box	G
169	<i>Lophostemon confertus</i>	Brush Box	G
170	<i>Lophostemon confertus</i>	Brush Box	G
171	<i>Archontophoenix cunninghamiana</i> (x2)	Bangalow Palm	G
172	<i>Cyathea brownii</i>	Norfolk Tree Fern	G
173	<i>Phoenix canariensis</i>	Canary Island Date Palm	G
174	<i>Cupressus sempervirens</i>	Mediterranean Cypress	G
175	<i>Bauhinia variegata</i>	Orchid Tree	G

Table 1.0 - Continues

UTM Tree No.	Genus and species	Common name	Condition G = Good F = Fair P = Poor D = Dead
176	<i>Erythrina crista-galli</i>	Coral Tree	F
177	<i>Cedrus deodara</i>	Himalayan Cedar	G
178	<i>Plumeria rubra</i>	Frangipani	F
179	<i>Plumeria rubra</i>	Frangipani	G
180	<i>Jacaranda mimosifolia</i>	Jacaranda	G
181	<i>Lophostemon confertus</i>	Brush Box	G
182	<i>Dead</i>	-	G
183	<i>Dead</i>	-	G
184	<i>Corymbia citriodora</i>	Lemon Scented Gum	G
185	<i>Archontophoenix cunninghamiana</i> (X2)	Bangalow Palm	G
186	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	F
187	<i>Syncarpia glomulifera</i>	Turpentine	G
188	<i>Syncarpia glomulifera</i>	Turpentine	G
189	<i>Viburnum tinus</i>	Viburnum	G
190	<i>Dead</i>	-	G
191	<i>Removed</i>	-	G
192	<i>Syncarpia glomulifera</i>	Turpentine	F
193	<i>Lophostemon confertus</i>	Brush Box	G
194	<i>Lophostemon confertus</i>	Brush Box	G
195	<i>Syncarpia glomulifera</i>	Turpentine	F
196	<i>Syncarpia glomulifera</i>	Turpentine	F
197	<i>Syncarpia glomulifera</i>	Turpentine	G
198	<i>Syncarpia glomulifera</i>	Turpentine	G
199	<i>Syncarpia glomulifera</i>	Turpentine	G
200	<i>Syncarpia glomulifera</i>	Turpentine	G
201	<i>Syncarpia glomulifera</i>	Turpentine	G
202	<i>Syncarpia glomulifera</i> (x5)	Turpentine	G
203	<i>Syncarpia glomulifera</i> (x2)	Turpentine	G
204	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	G
205	<i>Cupressus sempervirens</i>	Mediterranean Cypress	G
206	<i>Howea forsteriana</i>	Kentia Palm	G
207	<i>Howea forsteriana</i>	Kentia Palm	G
212	<i>Jacaranda mimosifolia</i>	Jacaranda	G
213	<i>Lophostemon confertus</i>	Brush Box	G
214	<i>Lophostemon confertus</i>	Brush Box	G
327	<i>Angophora costata</i>	Sydney Red Gum	G
328	<i>Syncarpia glomulifera</i>	Turpentine	G

Table 1.0 - Continues

UTM Tree No.	Genus and species	Common name	Condition G = Good F = Fair P = Poor D = Dead
329	<i>Lagunaria petersonii</i>	Norfolk Island Hibiscus	F
330	<i>Toona ciliata</i>	Australian Red Cedar	G
331	<i>Toona ciliata</i>	Australian Red Cedar	F
332	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	G
333	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	G
334	<i>Eucalyptus cinerea</i>	Argyle Apple	G
335	<i>Eucalyptus leucoxylon</i>	Yellow Gum	G
336	<i>Casuarina cunninghamiana</i> (x2)	River She-Oak	G
337	<i>Eucalyptus leucoxylon</i>	Yellow Gum	G
338	<i>Eucalyptus botryoides</i> <i>Acacia elata</i> <i>Lagerstroemia indica</i> <i>Ficus microcarpa</i> var. <i>hillii</i>	Southern Mahogany Cedar Wattle Crepe Myrtle Hills Weeping Fig	G
339	<i>Acer buergeranum</i>	Trident Maple	
340	<i>Pittosporum undulatum</i> <i>Schinus areira</i> <i>Acer buergeranum</i>	Native Pittosporum Peppercorn Trident Maple	F
341	<i>Acacia elata</i>	Cedar Wattle	G
342	<i>Grevillea robusta</i>	Silky Oak	F
343	<i>Cinnamomum camphora</i>	Camphor Laurel	G
344	<i>Olea europea</i> var. <i>africana</i>	African olive	G-F

Table 2.0 Schedule of works and trees affected. Trees are described in greater detail in section 5.0.

Tree No.	Common name	Description of work to be done
26	Brush Box	Propose to remove .
27	Brush Box	Propose to remove .
28	Brush Box	Propose to remove .
29	Brush Box	Propose to remove .
30	Brush Box	Propose to remove .
31	Brush Box	Propose to remove .
32	Norfolk Island Pine	Propose to remove .
33	Brush Box	Propose to remove .
34	Yellow Gum	Propose to remove .
35	Yellow Gum	Propose to remove .
36	Mediterranean Pine	Propose to remove .
37	Camellia	Propose to remove .
38	Camellia	Propose to remove .
44	Jacaranda	Propose to remove .
45	Frangipani	Propose to remove .
46	Viburnum	Propose to remove .
47	Himalayan Cedar	Propose to remove .
48	Jacaranda	Propose to remove .
49	Brush Box	Propose to remove .
50	Brush Box	Propose to remove .
51	Brush Box	Propose to remove .
52	Brush Box	Propose to remove .
53	Brush Box	Propose to remove .
54	Brush Box	Propose to remove .
55	Lemon Scented Gum	Propose to remove .
56	Brush Box	Propose to remove .
57	Brush Box	Propose to remove .
58	Kentia Palm	Propose to remove .
59	Brush Box	Propose to remove .
60	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
61	Brush Box	Propose to remove .
62	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
63	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
64a	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
64b	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
64c	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.

Table 2.0- Continues

Tree No.	Common name	Description of work to be done
64d	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
65	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
66	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
67	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
68	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
69	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
70	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
72	Cocas Palm	Propose to remove .
73	Jacaranda	Propose to remove .
74	Lombardy Poplar	Propose to remove .
75	Bhutan Cypress	Propose to remove .
76	Brunnings Golden Cypress	Propose to remove .
77	Brunnings Golden Cypress	Propose to remove .
78	Jacaranda	Propose to remove .
79	Lombardy Poplar	Propose to remove .
80	Crepe Myrtle	Propose to remove .
81	Cheese Tree	Propose to remove .
82	Birch	Propose to remove .
83	Pittosporum	Propose to remove .
84	Yellow Bloodwood	Propose to remove .
85	Cotoneaster	Propose to remove .
86a	Bangalow Palm	Propose to remove .
86b	Bangalow Palm	Propose to remove .
87	Bangalow Palm	Propose to remove .
88	Hack-berry	Propose to remove .
89	Camellia	Propose to remove .
90	NSW Christmas Bush	Propose to remove .
91	NSW Christmas Bush	Propose to remove .
99	Wallangarra White Gum	Propose to remove .
109	Cotoneaster	Propose to remove .
110	African Olive	Propose to remove .
112	Brush Box	Propose to remove .
113	Brush Box	Propose to remove .
114	Camphor laurel	Propose to remove .
115	Camphor Laurel	Propose to remove .
116	Coast Myall	Propose to remove .

Table 2.0- Continues

Tree No.	Common name	Description of work to be done
117	Arizona Cypress	Propose to remove .
118	Hills Weeping Fig	Retain and protect as per the Tree Protection Plan – Appendix G.
119	Lillypilly	Propose to remove .
121	Black Tea Tree	Propose to remove .
122	Black Tea Tree	Propose to remove .
123	Box Elder	Propose to remove .
124	Turpentine	Propose to remove .
125	Port Jackson Fig	Propose to remove .
126	Giant Bird of Paradise	Propose to remove .
127	Bull Bay Magnolia	Propose to remove .
128	Brush Box	Propose to remove .
129	Brush Box	Propose to remove .
130	Box Elder	Propose to remove .
131	Brush Box	Propose to remove .
132	Box Elder	Propose to remove .
133	Box Elder	Propose to remove .
134	Native Frangipani	Propose to remove .
135	Camellia	Propose to remove .
136	Brush Box	Propose to remove .
137	Jacaranda	Propose to remove .
138	Jacaranda	Propose to remove .
139	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
140	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
141	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
142	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
143	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
144	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
145	-	Retain and protect as per the Tree Protection Plan – Appendix G.
146	Bangalow Palm	Retain and protect as per the Tree Protection Plan – Appendix G.
147	Mexican Fan Palm	Retain and protect as per the Tree Protection Plan – Appendix G.
148	Jacaranda	Propose to remove .
149	Orchid Tree	Propose to remove .
150	Brush Box	Propose to remove .
151	Brush Box	Propose to remove .
152	Brush Box	Propose to remove .
153	Brush Box	Propose to remove .
154	Brush Box	Propose to remove .

Table 2.0- Continues

Tree No.	Common name	Description of work to be done
155	Brush Box	Propose to remove .
156	Brush Box	Propose to remove .
157	Brush Box	Propose to remove .
158	Monterey Cypress	Propose to remove .
159	Brush Box	Propose to remove .
160	Brush Box	Propose to remove .
161	Brush Box	Propose to remove .
162	Bangalow Palm	Propose to remove .
163	Bangalow Palm	Propose to remove .
164	Hoop Pine	Propose to remove .
165	Brush Box	Propose to remove .
166	Brush Box	Propose to remove .
167	Brush Box	Propose to remove .
168	Brush Box	Propose to remove .
169	Brush Box	Propose to remove .
170	Brush Box	Propose to remove .
171	Bangalow Palm	Propose to remove .
172	Norfolk Tree Fern	Propose to remove .
173	Canary Island Date Palm	Propose to remove .
174	Mediterranean Cypress	Propose to remove .
175	Orchid Tree	Propose to remove .
176	Coral Tree	Propose to remove .
177	Himalayan Cedar	Propose to remove .
178	Frangipani	Propose to remove .
179	Frangipani	Propose to remove .
180	Jacaranda	Propose to remove .
181	Brush Box	Propose to remove .
182	-	Propose to remove .
183	-	Propose to remove .
184	Lemon Scented Gum	Propose to remove .
185	Bangalow Palm	Propose to remove .
186	Bangalow Palm	Propose to remove .
187	Turpentine	Propose to remove .
188	Turpentine	Propose to remove .
189	Viburnum	Propose to remove .

Table 2.0- Continues

Tree No.	Common name	Description of work to be done
190	-	Propose to remove .
191	-	Propose to remove .
192	Turpentine	Propose to remove .
193	Brush Box	Propose to remove .
194	Brush Box	Propose to remove .
195	Turpentine	Propose to remove .
196	Turpentine	Propose to remove .
197	Turpentine	Propose to remove .
198	Turpentine	Propose to remove .
199	Turpentine	Propose to remove .
200	Turpentine	Propose to remove .
201	Turpentine	Propose to remove .
202	Turpentine	Propose to remove .
203	Turpentine	Propose to remove .
204	Bangalow Palm	Propose to remove .
205	Mediterranean Cypress	Propose to remove .
206	Kentia Palm	Propose to remove .
207	Kentia Palm	Propose to remove .
212	Jacaranda	Retain and protect as per the Tree Protection Plan – Appendix G.
213	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
214	Brush Box	Retain and protect as per the Tree Protection Plan – Appendix G.
327	Sydney Red Gum	Propose to remove .
328	Turpentine	Propose to remove .
202	Turpentine	Propose to remove .
203	Turpentine	Propose to remove .
204	Bangalow Palm	Propose to remove .
205	Mediterranean Cypress	Propose to remove .
206	Kentia Palm	Propose to remove .
207	Kentia Palm	Propose to remove .
212	Jacaranda	Propose to remove .
213	Brush Box	Propose to remove .
214	Brush Box	Propose to remove .
327	Sydney Red Gum	Propose to remove .
328	Turpentine	Propose to remove .
329	Norfolk Island Hibiscus	Propose to remove .
330	Australian Red Cedar	Propose to remove .
331	Australian Red Cedar	Propose to remove .
332	Silver-leaved Ironbark	Retain and protect as per the Tree Protection Plan – Appendix G.

Table 2.0- Continues

Tree No.	Common name	Description of work to be done
333	Silver-leaved Ironbark	Retain and protect as per the Tree Protection Plan – Appendix G.
334	Argyle Apple	Propose to remove .
335	Yellow Gum	Propose to remove .
336	River She-Oak	Propose to remove .
337	Yellow Gum	Propose to remove .
338	Southern Mahogany Cedar Wattle Crepe Myrtle Hills Weeping Fig	Propose to remove .
339	Trident Maple	Propose to remove .
340	Native Pittosporum Peppercorn Trident Maple	Propose to remove .
341	Cedar Wattle	Propose to remove .
342	Silky Oak	Propose to remove .
343	Camphor Laurel	Propose to remove .
344	African olive	Propose to remove .

1.0 INTRODUCTION

URBAN TREE MANAGEMENT © has prepared this report for Mr Raz Favotto of Theiss Pty Ltd, on behalf of NSW Health.

The proposed development is for the construction of a new Acute Hospital, Community Health Facility, multi-level car park and associated works on land known as the 'Royal North Shore Hospital Redevelopment', (RNSH) (*the site*), and is to be administered as a Project Application under Part 3A of the Environmental Planning and Assessment Act 1979, (the Act). The Project is referred to as MP 08_0172.

In summary, the proposed scope of works includes:

- Acute Hospital building.
- Community Health Facility.
- Multi-level car park for 576 vehicles.
- Refurbishment/alterations to the Douglas Building.
- Pedestrian bridge linking new Hospital and Douglas Building.
- New roads associated with the development of the Acute Hospital building, Community Health Facility and car park.
- At grade parking and the temporary use of land for parking purposes during construction.
- Public Domain works including footpaths, lighting and street tree planting.
- Demolition of Building 10
- Landscaping and tree removal.

This Report has been prepared to address those matters related to tree removal/retention and protection, and the assessment of MP 08_0172. Refer to 'Background' discussion below.

Mr Laurie Dorfer attended *the site*, on Tuesday 14 and Thursday 16 October 2008 and the trees and their growing environment were examined.

The proposed building design and its configuration and infrastructure were arrived at prior to the undertaking of an arboricultural assessment of the trees on the site to determine their significance by URBAN TREE MANAGEMENT ®©.

The trees are indicated in Appendix G – Survey of Subject Tree/s and Tree Protection Plans. This report has relied upon the following plans/reports:

- Trees to be removed Plan, by COX, Dwg No. DWG-AR-CW-0023, Issue B. dated 17 Sept. 2008.
- Tree Heritage Study (Draft), by Taylor Brammer Landscape Architects Pty Ltd, dated 17 April 2005.
- Elevations by COX, Dwg No. DWG-CP-AR-0108, 0110, 0111, Issue F, dated 1 Nov. 2007.
- Cross Sections by COX, Dwg No. DWG-CP-AR-0113, Issue F, dated 1 Nov. 2007.
- Site Works Plan by COX, Dwg No. DWG-IC.C.2002, 2003, 2004, Sheet 1 of 3, 2 of 3 & 3 of 3, dated Sep 2008.
- Nth & Sth Elevations by COX, Dwg No. DWG-CP-AR-0402, 0501, Issue T01, dated Sept 2008.
- Landscape Plan by Oculus, Dwg No. DWG-CH2-L-0001, Issue A, dated 25 October 2007.

The trees have been identified and numbered to correspond with the Tree Heritage Study, undertaken by Taylor Brammer Landscape Architects Pty Ltd. Only trees of that report situated within the site form part of this report. Trees which have since been removed - to accommodate the R+E building, or have died were omitted from this report.

Background

Concept Plan

A Concept Plan Approval was issued by the Minister for Planning on 9 February 2007, (Major Project Application No. 06_0051), which gave concept approval for the following hospital related components:

- Subdivision of the site into a hospital precinct and other development precincts.
- A maximum floor area of 178,370m² across the development precincts (maximum FSR are prescribed for each precinct)
- Minimum and maximum FSR for the various components of the proposal including residential, employment generating uses, nurses accommodation etc.
- The conceptual road design.
- Urban design, landscaping, open space and heritage concepts.
- Maximum heights.
- Car parking provision to be in accordance with Willoughby Council DCP.
- Improved servicing of the site.
- Staged re-opening of Westbourne Street to through traffic.

Project Application Approval was given for demolition works and site preparatory works to ground level.

On 31 January 2008, the Concept Plan and Project Application Approval was modified in so far as amendments being to conditions related to agreements with public transport providers and with respect to the scheduling of a Traffic Management and Accessibility Plan (TMAP) (Conditions M9.1 and M10.1).

The Concept Plan and Project Application was further modified on 7 April 2008. The modification allowed for the erection of temporary buildings and imposed relevant conditions.

Project Application

Further to the Concept Approval for the whole RNSH site, and along with it the identification of development precincts within the site, on 19 August 2008 a request was made to the Minister to declare the core medical precinct as "Critical Infrastructure Project", under Clause 6 of SEPP Major Projects 2005 (the SEPP), to permit the lodgement of a Project Application, under Part 3A of the Act.

The application was accompanied by a Preliminary Environmental Assessment, (PEA), for development within the core medical precinct and a request for any relevant Director-General's environmental assessment requirements (DGR's).

On 30 September 2008, the DGR's were issued by the NSW Department of Planning, under s.75F of the Act. The project has been declared a Major Project Application, (MP 08-0172).

2.0 AIMS & OBJECTIVES

Aims

Detail the condition of the tree/s on the site or on adjoining properties where such trees may be affected by the proposed works. This will be undertaken by assessment of individual specimens or stands, and indicate remedial works or protection measures for their retention in a safe and healthy condition, or a condition not less than that at the time of initial inspection for this report, or in a reduced but sustainable condition due to the impact of the development. Where possible expected impacts will be ameliorated through tree protection measures able to be applied, and will consider the location and condition of the trees in relation to the proposed building works, or recommend removal and replacement where appropriate.

Provide as an outcome of the assessment, the following: a description of the trees, observations made, discussion of the effects the location of the proposed building works may have on the trees, and make recommendations required for remedial or other works to the trees, if and where appropriate.

Determine from the assessment a description of the works or measures required to ameliorate the impact upon the trees to be retained, by the proposed building works or future impacts the trees may have upon the new building works if and where appropriate, or the benefits of removal and replacement if appropriate for the medium to long term safety and amenity of the site.

Objectives

Assess the condition of the subject tree/s.

Determine impact of development on the subject tree/s.

Provide recommendations for retention or removal of the subject tree/s.

Provide specifications for protection of tree/s to be retained.

Provide recommendations for replacement tree/s where appropriate.

3.0 METHODOLOGY

Note: Individual methodologies applied as applicable.

- 3.1 The method of assessment of tree/s applied is adapted from the principles of visual tree assessment undertaken from the ground, which considers:
1. Tree health and subsequent stability, both long and short term
 2. Sustainable Retention Index Value (SRIV) (IACA 2005)©
 3. Hazard potential to people and property
 4. Amenity values
 5. Habitat values
 6. Significance
- 3.2 This assessment is undertaken using standard tree assessment criteria for each tree based on the values above and is implemented as a result of at least one comprehensive and detailed site inspection to undertake a visual tree assessment of each individual tree, or stand of trees, or a representative population sample.
- 3.3 Any dimensions recorded as averages, or by approximation are noted accordingly.
- 3.4 In the absence of an appropriate Australian Standard for the protection of trees on development sites, the British Standard BS 5837 – 1991 Guide for “Trees in relation to construction” is applied by UTMA P/L and was used in this report to provide tree protection setback methodology because its methodology is similar to that proposed by the draft Australian Standard AS4837 “Guide for the planning and protection of trees on development sites” as a point of reference and guide for the recommended minimum clearances from the centre of tree’s trunk to development works and is applied as a generalized benchmark and the distances may be increased or decreased by the author as a result of other factors providing mitigating circumstances or constraints as indicated by but not restricted to the following:
1. Condition of individual trees,
 2. Tolerance of individual species to disturbance,
 3. Geology e.g. physical barriers in soil, rock floaters, bedrock to surface
 4. Topography e.g. slope, drainage,
 5. Soil e.g. depth, drainage, fertility, structure,
 6. Microclimate e.g. due to landform, exposure to dominant wind,
 7. Engineering e.g. techniques to ameliorate impact on trees such as structural soil, gap graded fill, lateral boring,
 8. Construction e.g. techniques to ameliorate impact on trees such as pier and beam, bridge footings, suspended slabs,
 9. Root mapping,
 10. Physical limitations - existing modifications to the environment and any impact to tree/s by development e.g. property boundaries, built structures, houses, swimming pools, road reserves, utility services easements, previous impact by excavation, or construction in other directions, soil level changes by cutting or filling, existing landscaping works within close proximity, modified drainage patterns,
 11. Extraneous factors e.g. potential future impacts from development on adjoining land when the tree is located on or near to a property boundary.

- 3.5 Trees in groups may be referred to as stands and a stand may exclusively contain specimens to be either retained or removed or a combination of both. A stand may be used to discuss all the trees on a given site to expedite their assessment, or refer to trees growing proximate to one another or within a defined space. Stands may be comprised by mass boundary or screen plantings, to form a group of the same or a mixture of taxa. Each stand is considered as a single unit with each component tree assessed and expressed in tabular form, or indicated by a given percentage as a population sample of each stand. Where it is appropriate for a stand of trees to be retained in full or part, the location and setback of Tree Protection Zone fences or works, are prescribed to provide for the preservation of the stand or selected component trees, in a condition not less than that at the time of initial inspection for its incorporation into the landscape works for the site, or in a reduced but sustainable condition due to the impact of the development but ameliorated through tree protection measures.
- 3.6 The trees/s have been allocated a significance rating as determined by the UTM Rating Systems for Tree Significance – Appendix A which allows the retention value to be determined.

4.0 TREE PRUNING STANDARDS

- 4.1 Any pruning recommended in this report is to be to the Australian Standard® AS4373 'Pruning of amenity trees', and conducted in accordance with the NSW Work Cover Authority Code of Practice for the Amenity Tree Industry, 1998.
- 4.2 All pruning or removal works are to be in accordance with the appropriate Tree Management Policy where applicable, or Tree Management Order (TMO), or Tree Preservation Order (TPO).
- 4.3 Tree maintenance work is specialised and in order to be undertaken safely to ensure the works carried out are not detrimental to the survival of a tree being retained, and to assist in the safe removal of any tree, should be undertaken by a qualified arboriculturist with appropriate competencies recognised within the Australian Qualification Framework, with a minimum of 5 years of continual experience within the industry of operational amenity arboriculture, and covered by appropriate and current types of insurance to undertake such works.

5.0 TREE ASSESSMENT

5.1 Assessment of tree/s or stand/s of trees.

[illegible]

5.1 Assessment of tree/s or stand/s of trees - Continues

[illegible]

5.1 Assessment of tree/s or stand/s of trees - Continues

[illegible]

5.1 Assessment of tree/s or stand/s of trees - Continues

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5.1 Assessment of tree/s or stand/s of trees - Continues

[illegible]

5.1 Assessment of tree/s or stand/s of trees - Continues

UTM Tree No.	Genus & species / Common Name	Age Y = Young M = Mature O = Over-mature	Condition G = Good F = Fair P = Poor D = Dead	Crown Form D = Dominant C = Co-dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Ht. Approx. metres	Crown spread approx. metres / Orientation R = Radial	Crown Symmetry 1 = symmetrical 2 = asymmetrical / Orientation	Crown cover / Crown density % D = dormant	DBH in mm @ 1.4m, or other, as indicated / trunk orientation other than R = radial, e.g. N/S	Trunk Lean 1. = Upright-Slight 2. = Moderate 3. = Severe 4. = Critical. 5. = Acaulescent / Orientation / ST = Static P = Progressive	Pests & diseases 1 = No or 2 = Yes (If 2. see comments)	Branch Bark included 1 = No or 2 = Yes or 3 = N/A	Vigour 1 = Normal Vigour 2 = Low Vigour	Form 1 = Good form 2 = Poor form	SRIV Age, Vigour, Condition/ Index Rating	Estimated Life Expectancy 1. Long 2. Medium 3. Short
335	<i>Eucalyptus leucoxylon</i> Yellow Gum	M	G	D	14	12X12 R	2 E	85/90	550 AV N/S	2 SE	1	1	1	1	MNVG 10	1
336	<i>Casuarina cunninghamiana</i> River She-Oak (X2)	Y-M	G	D-C	10-15	3-5	1-2S	90/90	120-280 R	1 S	1	1	1	1	-	1
337	<i>Eucalyptus leucoxylon</i> Yellow Gum	Y	G	F	14	6X6 R	2 SW	90/90	250 AV E/W	1	1	1	1	1	YNVG 9	1
338	<i>Eucalyptus botryoides</i> Southern Mahogany <i>Acacia elata</i> Cedar Wattle <i>Lagerstroemia indica</i> Crepe Myrtle <i>Ficus microcarpa</i> var. <i>hillii</i> Hills Weeping Fig	Y-M	F-G	C-D	5-14	3-5	1-2	80-90/80-90	150-650 AV	1, 5	1	1	1	1-2	-	1, 3
	Comments															
335	Medium volume large deadwood throughout.															
336	-															
337	-															
338	-															

5.1 Assessment of tree/s or stand/s of trees - Continues

[illegible]

Observations

- 5.2 *The site* supports predominantly planted, possibly some remnant, exotic and indigenous, evergreen and deciduous trees.
- 5.3 The trees are generally common taxa, which have predominantly been planted over a period of 20 -50 years, with several reaching <100 years of age.
- 5.4 The *Syncarpia glomulifera* – Turpentine were possibly remnants specimens – being once typical for the vegetation type of the area.
- 5.5 The *Lophostemon confertus* – Brush Box are most numerous on site, which generally form the greatest visual canopy – being typically planted in rows or avenues.
- 5.6 Tree maintenance has been neglected for some years, with considerable deadwood and overgrown vegetation observed to many trees.

Tree Significance

- 5.7 See Appendix A for Tree Significance - Assessment Criteria.

Significant Trees for *the site (the trees)* as established by URBAN TREE MANAGEMENT © using the **UTM Ratings System**.

Significance Scale	1	2	3	4	5
UTM Tree No.	47, 49, 50, 51, 52, 53, 54, 56, 57, 59, 60, 61, 62, 64a, 64b, 64c, 64d, 65, 66, 67, 68, 69, 70, 86, 87, 99, 112, 113, 118, 124, 125, 127, 128, 129, 131, 136, 136, 138, 139, 140, 141, 142, 143, 144, 146, 147, 150, 151, 152, 153, 154, 155, 156, 157, 159, 160, 161, 162, 163, 164, 165, 166, 167, 169, 170, 176, 177, 185, 186, 187, 188, 192, 193, 194, 196, 197, 199, 201, 202, 203, 204, 212, 213, 214, 327, 328, 330, 331,	26, 27, 28, 29, 30, 31, 33, 34, 37, 38, 44, 48, 58, 73, 74, 75, 76, 77, 79, 81, 83, 89, 91, 116, 117, 119, 126, 148, 158, 168, 171, 172, 175, 178, 179, 180, 184, 195, 198, 200, 205, 206, 207, 329, 332, 333, 334, 335, 336, 338, 339, 340, 341, 343	32, 36, 45, 46, 55, 63, 78, 80, 82, 84, 90, 114, 115, 121, 122, 123, 130, 132, 133, 134, 135, 145, 149, 173, 174, 181, 189, 342,	109, 110, 344, 72, 88	35, 182, 183, 190

Significant Scale

- 1 – High
 2 – Medium
 3 – Low
 4 – Environmental Pest/Noxious Weed
 5 – Hazardous

Tree Retention Value

5.8 See Appendix A for Retention Value – Priority Matrix.

Retention Value	High Priority for Retention	Medium Consider for Retention	Low Consider for Removal	Remove Priority for Removal
UTM Tree No.	26, 27, 28, 29, 31, 33, 47, 49, 50, 51, 52, 53, 54, 56, 57, 58, 59, 60, 61, 62, 64a, 64b, 64c, 64d, 65, 66, 67, 68, 69, 70, 73, 75, 81, 86, 87, 89, 91, 99, 112, 113, 118, 119, 124, 125, 127, 128, 129, 131, 136, 137, 138, 139, 140, 141, 142, 143, 144, 146, 147, 148, 150, 151, 152, 153, 154, 155, 156, 157, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 176, 177, 180, 184, 185, 186, 187, 188, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 207, 212, 213, 214, 327, 328, 330, 331, 335, 336, 337, 339, 341, 343	30, 32, 34, 36, 37, 38, 44, 46, 48, 76, 80, 83, 90, 116, 117, 126, 130, 132, 134, 135, 149, 158, 172, 173, 174, 175, 178, 179, 189, 206, 329, 333, 334, 338, 340, 342	45, 55, 63, 72, 74, 77, 78, 79, 82, 84, 88, 109, 110, 114, 115, 121, 122, 123, 133, 145, 181	35, 182, 183, 190, 344

Retention Value

High – Priority for Retention

Medium – Consider for Retention

Low – Consider for Removal

Remove - Priority for Removal

Discussion

5.9 The proposed design facilitates the retention of Trees 60, 62, 63, 64a, 64b, 64c, 64d, 65, 66, 67, 68, 69, 70, 118, 139, 140, 141, 142, 143, 144, 145, 146, 147, 212, 213, 214, 332 and 333, which are recommended to be retained in situ and incorporated into the construction works for the site. However, the proposed works will directly impact 60, 62, 63, 64a, 64b, 65 & 118 - this will be ameliorated by implementing modified construction techniques and crown modification pruning. The trees to be retained are to be incorporated into the construction works for the site with Tree Protection Zones provided as shown in Table 3.0 below.

Table 3.0 This table applies only to trees being retained. Tree Protection Zone fencing locations are measured from the centre of each tree with the actual distances for the side closest to the building/ construction works e.g. excavation shown (see explanatory notes below). Tree Protection Zone fences and setbacks where applicable are indicated in Appendix A.

1. Tree No.	2. Trunk Diameter (See Section 5) (mm)	3. Age of tree Y = Young M = Mature O = Over-mature (Senescent)	4. Tree Vigour Normal Vigour = 1 or Low Vigour = 2	5. British Standard BS 5837:1991 Recommended distance per DBH in metres (see Appendix C) (m)	6. Reduced distance by British Standard (one third on one side only) (m)	7. Proposed Distance from tree to proposed construction works. (m)
60	720	M	1	6	4	1.9 *
62	560	M	1	6	4	1.5 *
63	440	M	1	6	4	1 *
64a	500	M	1	6	4	1 *
64b	560	M	1	6	4	2.2 *
64c	780	M	1	6	4	0.5 *
64d	1100	M	1	6	4	≥4
65	750	M	1	6	4	1.5 *
66	680	M	1	6	4	≥4
67	800	M	1	6	4	≥4
68	660	M	1	6	4	≥4
69	740	M	1	6	4	≥4
70	950	M	1	6	4	≥4
118	1750	M	1	8	5.5	≥4 **
139	600	M	1	6	4	≥4
140	650	M	1	6	4	≥4
141	450	M	1	6	4	≥4
142	450	M	1	6	4	≥4
143	550	M	1	6	4	≥4
144	650	M	1	6	4	≥4
145	350	M	1	6	4	≥4
146	220	M	1	6	4	≥4
147	360	M	1	6	4	3.5 ***
332	350	M	1	6	4	≥4
333	340	M	1	4	2.5	≥2.5

Table 3.0 - Continues

1. Tree No.	2. Trunk Diameter (See Section 5) (mm)	3. Age of tree Y = Young M = Mature O = Over- mature (Senescent)	4. Tree Vigour Normal Vigour = 1 or Low Vigour = 2	5. British Standard BS 5837:1991 Recommended distance per DBH in metres (see Appendix C) (m)	6. Reduced distance by British Standard (one third on one side only) (m)	7. Proposed Distance from tree to proposed construction works. (m)
212	200	M	1	6	4	≥4
213	600	M	1	6	4	≥4
214	340	M	1	6	4	≥4

* Acceptable only if roots are protected from compaction/impact (timber/metal sheeting, gap graded fill etc).

** Acceptable with crown modification pruning.

*** Acceptable as a specimen of palm taxa tolerant of encroachment.

Explanatory notes for Table 3.0.

This table is based upon British Standard BS 5837: 1991 Guide for "Trees in relation to construction" (Appendix B) for suitable set backs (**British Standard- Column 5**). However, these set backs can be reduced by up to one third on one side only while retaining suitable set backs in other directions (**Reduced - Column 6**). The final column (**Proposed - Column 7**) provides the set backs as provided by the proposed construction works.

Impact by Proposed Works

- 5.8 Trees 60, 62, 63, 64a, 64b, 64c & 65 – Medium impact to roots is expected as caused by compaction from vehicles. The area adjacent to the trees is proposed to support a temporary parking area. The compaction of the surrounding ground may compromise the trees condition and vigour.
- 5.9 Trees 64d, 66, 67, 68, 69, 70, 139, 140, 141, 142, 143, 144, 145, 146, 332, 333, 212, 213 & 214 - No direct impact is expected as the proposed set backs from works are outside the recommended or reduced set backs (Column 5 & 6 – Table 3).
- 5.10 Tree 118 – Direct crown impact is expected to enable suitable building clearance - building encroachment of 9.5m towards one quadrant of the north/east section of the crown is proposed. An additional 2m will be required to support scaffolding – 7.5m from the centre of the trunk is required. Approximately 15%-20% of the live crown will be required to be removed. Pruning may be undertaken to ameliorate the impact; however the crown will be altered in shape - the condition and vigour should not be adversely affected. Once construction is finalised, the visual alteration of the crown when viewed from the street should be minimal.

- 5.11 Tree 147 - Minor impact is expected as the adjacent area is proposed to support a temporary parking area. Being a palm taxa, further reduction in set back is acceptable. The 3.5m set back proposed should not adversely affect condition and vigour.

Tree Protection Works – Specific

Prior to Demolition

- 5.12 Tree Protection Zones (TPZ), including fencing are to be installed around all trees proposed to be retained (except Trees 64d, 64c, 66, 67, 68, 69, 70, 139, 140, 141, 142 & 143) with set backs as detailed in Table 3 and Appendix G -Tree Protection Plan.
- 5.13 Trees 64d, 64c, 66, 67, 68, 69, 70, 139, 140, 141, 142 & 143 will not require Tree protection fencing installed due to suitable distance from the proposed works. Only trees surrounding the temporary carparking area require protection fencing installed.
- 5.14 The TPZ should be further reduced alongside Trees 332 & 333 (street trees) to accommodate and maintain pedestrian access (See Appendix G -Tree Protection Plan). The set backs should be maintained at 1m x 2m.

During Demolition /Tree Removal

- 5.15 Removal of trees should be undertaken only by cutting down such a tree without damaging the trees to be retained. Where damage is likely to a retained tree, the removed trees should be undertaken manually by aerial sectioning and lowering, and the grinding out of its stump.
- 5.16 Tree 118 should be pruned as detailed – Reduction prune second order structural branch to north/east: x3 third order and x1 fourth order structural branch back to junction, also second order structural to E: x1 third order branch back to junction.
- 5.17 Due to the susceptibility by *Ficus spp.* to sun scald on structural branches - whereby wounding may occur from sudden exposure to sunlight, wrapping exposed structural branches of Tree 118 with hessian is recommended. Hessian sheeting should be fastened only by twine or hessian tie to prevent damage to branch tissue.
- 5.18 Trees 60, 62, 63, 64a, 64d, 66, 67, 70, 139, 140, 142, 143, 213, 214, 332 & 333 should also be pruned as detailed – Remove all large deadwood i.e. >10mm diameter and usually >2 metres long, which is generally considered of high risk potential.

Prior to Construction

- 5.19 Trees 60, 62, 63, 64a, 64b, & 65 should be further protected to minimise compaction by displacing loads as detailed – A single thickness metal or timber sheeting should be laid on the soil surface within the temporary parking area which will provide sufficient protection for the loads applied. The ground beneath the boarding should be left undisturbed and if necessary, a porous geotextile fabric and sand used to level the ground. The boarding should be left in place until the building works are finished. Alternatively, a gap graded fill such as gravel 40 mm diameters with no fines should be considered to a depth of min. 100mm within the 4m set back.

During to Construction

- 5.20 No utility services are to be located through or within any Tree Protection Zone within *the site*. Where locating of such services is unavoidable it should only be undertaken in consultation with a Consulting Arboriculturist.
- 5.21 Where structural woody roots with a diameter of 20mm or greater are to be pruned, these are to be cut cleanly to undamaged woody tissue.

Post construction

- 5.22 Tree Protection Zone fencing should be removed only once construction has finished and landscaping is to commence.
- 5.23 Remove all hessian from all structural branches from Tree 118. No twine or hessian tie should remain within the crown.

Tree Protection Works – General

- 5.24 The Tree Protection Zones are to be incorporated into the construction works for the site and the protection fences to be located as indicated in Appendix G – Tree Protection Plan.
- 5.25 The Tree Protection Zones are to be constructed as described here and detailed in Appendix D, and in Appendix G. The trees will be sustained within the constraints of the modifications to the site by development works. Attention is drawn specifically to Appendix E for the protection of all trees to be retained and particular parts as indicated being 1.0, 1.2.1, 1.3.2, 1.3.3 and 1.4.1.1.

Tree Removal - Specific

- 5.26 The remaining trees are proposed to be removed for the reasons as detailed –
- Trees 26, 27, 28, 34, 35, 36, 89, 90, 91, 114, 115, 135, 154, 155, 156, 157, 158, 159, 160, 329 - Located too close to the proposed building footprint with stability compromised or condition and vigour adversely affected.
- Tree 29, 30, 31, 32, 33, 37, 38, 44, 45, 46, 47, 48, 49, 99, 109, 110, 117, 119, 121, 122, 123, 124, 125, 128, 129, 130, 131, 132, 133, 134, 136, 137, 138, 175, 176, 177, 181, 184, 185, 186, - Located within the proposed building footprint and is unable to be retained.
- Tree 50, 51, 86, 87, 88, 150, 151, 152, 153, 162, 163, 164, 179, 180, 187, 188, 189, 192, 193, 194, 195, 196, 198, 199, 327, 328, 331, 337 - Located within the proposed construction footprint of the road and is unable to be retained.

Trees 52, 53, 72, 112, 113, 161, 165, 178, 197, 336, 338, 339, 340, 341, 342, 343 - Located too close to the proposed construction footprint of the road with stability compromised or condition and vigour adversely affected.

Tree 54, 55, 56, 57, 58, 59, 61, 73, 74, 75, 76, 77, 79, 80, 81, 82, 83, 84, 116, 126, 127, 148, 149, 166, 167, 168, 169, 170, 171, 172, 173, 174, 200, 201, 202, 203, 204, 205, 206, 207, 330, - Located within the proposed construction footprint of the temporary road/car park and is unable to be retained.

Tree 78 – Remove due to poor condition.

Trees 182, 183 & 190 – Remove as dead.

Tree 334, 335 – Located within the proposed construction footprint of the ambulance bay.

Tree 344 – Remove as undesirable species.

General Comments

- 5.27 The removal of these trees as proposed will collectively have considerable impact on the local amenity, due primarily to the number and size of some of the specimens removed. However, the opportunity being provided allows for the planting of new specimens selectively chosen and situated in locations as per the Landscape Plan, and in greater numbers than the trees removed - this should provide a net increase in the local amenity.
- 5.28 The proposed landscape plan supports many advanced replacement trees in 200 litre containers. These replacement trees will be located in positions where they may grow to maturity unhindered and will not conflict with built structures or utility services.
- 5.29 Each replacement tree is to be a vigorous specimen with a straight trunk, gradually tapering and continuous, crown excurrent, symmetrical, with roots established but not pot bound. The trees are to be propagated to the standards of Natspec Guide to *Specifying Trees* by Ross Clark 2003, or approved similar and be maintained by an appropriately qualified and experienced landscape contractor for up to one (1) year after planting, or as appropriate.

6.0 CONCLUSION

This report has examined one hundred and seventy nine (179) trees within and adjacent to *the site* and considers the retention of twenty eight (28). The trees to be retained are to be protected through the implementation of adequate measures for their integration into the development as detailed in the statement of commitment of this report.

If all the recommendations and procedures detailed herein are adhered to, the tree/s subject of this report will remain stable and viable, continuing to develop as important landscape component/s providing elements of long term amenity for the property and its owners or occupants, and the local community.

The recommendations made in this report are subject to approval by the consent authority.

7.0 STATEMENT OF COMMITMENT

- 7.1 Trees 60, 62, 63, 64a, 64b, 64c, 64d, 65, 66, 67, 68, 69, 70, 118, 139, 140, 141, 142, 143, 144, 145, 146, 147, 212, 213, 214, 332 and 333 are to be retained in situ and protected as detailed in 5.12 - 5.25, and sections 4.0, and Appendices D and E. Tree protection fences and/or works, to be located in accordance with Appendix G – Tree Protection Plan.
- 7.2 No tree protection fencing is required around Trees 64d, 64c, 66, 67, 68, 69, 70, 139, 140, 141, 142 & 143.
- 7.3 Where Tree Protection Zone fences are to be moved or relocated, this must be undertaken in consultation with the Consulting Arboriculturist, to ensure that tree protection is maintained.
- 7.4 Where structural woody roots with a diameter of 20mm or greater are to be pruned, these are to be cut cleanly to undamaged woody tissue.
- 7.5 No cut or fill is to be undertaken within the TPZ of any retained tree, unless specified by the Consulting Arboriculturist.
- 7.6 Tree 118 is to further protected by wrapping exposed structural branches with hessian to prevent sun scald as detailed in 5.16.
- 7.7 Trees 60, 62, 63, 64a, 64b, & 65 should be further protected with the placement of metal/timber sheeting or gravel on the ground surface within the parking area of the TPZ as detailed in 5.19.
- 7.8 Trees 60, 62, 63, 64a, 64d, 66, 67, 70, 118, 139, 140, 142, 143, 213, 214, 332 & 333 are to be pruned as detailed in 5.16 and 5.18 and undertaken in accordance with section 4.0, parts 4.1.
- 7.9 Trees 26 – 38, 44- 59, 61, 72 – 84, 86 – 91, 99, 109, 110, 112 – 117, 119, 121 – 138, 148 – 190, 192 – 199, 204 – 207, 327 – 331 and 334 - 344 are proposed to be removed as detailed in 5.26 and to be undertaken in accordance with section 4.0, parts 4.1.



Laurie Dorfer
Senior Consultant
Urban Tree Management Australia P/L

REFERENCES

1. British Standards Institution 1991, *British Standard 5837 Guide for Trees in relation to construction*, British Standards Institution, London, UK.
2. IACA 2005, Sustainable Retention Index Value, *Institute of Australian Consulting Arboriculturists*, Australia, www.iaca.org.au .
3. Matheny N & Clark JR 1998, *Trees and Development - a Technical guide to Preservation of Trees during Land Development*, International Society of Arboriculture, IL 61826-3129 USA.
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5. Work Cover NSW 1998, *Code of Practice for the Amenity Tree Industry*, New South Wales Government, Australia.

DISCLAIMER

The author and Urban Tree Management take no responsibility for actions taken and their consequences, contrary to those expert and professional instructions given as recommendations pertaining to safety by way of exercising our responsibility to our client and the public as our duty of care commitment, to mitigate or prevent hazards from arising, from a failure moment in full or part, from a structurally deficient or unsound tree or a tree likely to be rendered thus by its retention and subsequent deterioration from modification/s to its growing environment either existing or proposed, either above or below ground, contrary to our advice.

Appendix A

UTM Rating System for Tree Significance

The significance of a tree is highly subjective and difficult to ascertain in a consistent and repetitive fashion. However, it is necessary to determine a rating to assist in determining the retention value for each tree. URBAN TREE MANAGEMENT © has developed a significance rating whereby the retention values can be determined.

Many variables can be taken into consideration by individuals undertaking assessments which include but are not limited to; exposure of location, contribution as a component of the overall landscape for amenity or aesthetic qualities, importance due to uniqueness of taxa for species, subspecies, variety, form, or as an historical or cultural planting, or for age, or substantial dimensions, or habit, or as remnant vegetation, or habitat potential, or a rare or threatened species, or uncommon in cultivation, or of Aboriginal cultural importance, or is a commemorative planting. *Note: Where a tree is considered significant this must be expressed clearly and defined by a methodology and balanced against diminishing factors such as nuisance, as any tree will be of some significance but not every tree can be significant.*

Once the actual significance of an individual tree has been defined by the criteria, the retention value can then be determined (Table 1.0 in this Appendix).

Tree Significance - Assessment criteria

1. High Significance in landscape

- The tree is in good condition, or normal vigour and form typical of the species,
- The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of grand age.
- The tree is listed as a Heritage Item, Threatened Species or part of a Threatened Community or listed on Councils significant Tree Register.
- The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape by bulk and scale and makes a positive contribution to the local amenity.
- The tree has been influenced by historic figures, events or part of the heritage development of the place.
- The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values.
- The growing environment supports the tree to its full dimensions above and below ground without conflict or constraint.

2. Medium Significance in landscape

- The tree is in fair-good condition, or normal or low vigour and form typical or atypical of the species,
- The tree is a planted locally indigenous or a common species with its taxa readily planted in the local area,
- The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street,
- The tree provides a fair contribution to the visual character and amenity of the area,
- The tree is moderately constrained by above or below ground influences of the built environment to reach full dimensions.

3. Low Significance in landscape

- The tree is in fair-poor condition, or normal or low vigour and form typical or atypical of the species,
- The tree is not visible or is partly from surrounding properties as obstructed by other vegetation or buildings.
- The tree provides a minor contribution or has a negative impact on the visual character and amenity of the area.
- The tree is severely constrained by above or below ground by influences of the built environment and therefore will not reach full dimensions; tree is inappropriate to the site conditions.
- The tree is listed as exempt under the provisions of the local Council Tree Preservation Order.
- The tree has a wound or defect that has potential to become structurally unsound.

4. Environmental Pest/Noxious Weed Species

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

5. Hazardous/Irreversible Decline

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

The tree is to correspond with at least three (3) of the criteria in categories 1, 2 and 3, and one (1) criteria only is required in categories 4 and 5 to be classified in that group.

Note: The assessment criteria are for individual trees only and are not to be applied to stands of trees.

Table 1.0 Tree Retention Value - Priority Matrix.

	Tree Significance				
Estimated Life Expectancy	1. High Significance in Landscape	2. Medium Significance in Landscape	3. Low Significance in Landscape	4. Environmental Pest / Noxious Weed Species	5. Hazardous / Irreversible Decline
Long > 40 years	Priority for Retention (High)	Consider for Retention (Medium)	Consider for Removal (Low)	Priority for Removal (Remove)	
Medium 15 to 40 Years					
Short <1-15 Years		Consider for Retention (Medium)	Consider for Removal (Low)	Priority for Removal (Remove)	
Dead					

Legend for Matrix Assessment

	Priority for Retention (High) - These trees are considered important for retention and should be retained and protected. Design modification or re-location of building/s should be considered to accommodate the set backs as detailed in Table 3. Special construction works must be implemented e.g. pier and beam etc if works are to proceed within the Tree Protection Zone.
	Consider for Retention (Medium) - These trees may be retained and protected. These are considered less critical; however their retention should remain priority with removal considered only if adversely affecting the proposed building/works and all other alternatives have been considered and exhausted.
	Consider for Removal (Low) – These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.
	Priority for Removal – These trees are considered hazardous, or in irreversible decline, or weeds and should be removed irrespective of development.

Appendix B

Modified extract from British Standard BS 5837: 1991 Guide for “Trees in relation to construction.”

Table 1. Protection of trees: minimum distances for protective fencing around trees			
Tree age	Tree vigour	Trunk diameter	Minimum distance
Young trees	Normal vigour	mm	m
		< 200	2.0
		200 to 400	3.0
		> 400	4.0
Young trees	Low vigour	< 200	3.0
		200 to 400	4.5
		> 400	6.0
Mature trees	Normal vigour	< 350	4.0
		350 to 750	6.0
		> 750	8.0
Mature trees and overmature trees	Low vigour	< 350	6.0
		350 to 750	9.0
		> 750	12.0

Note 1. It should be emphasized that this table relates to distances from centre of tree to protective fencing. Other considerations particularly the need to provide adequate space around the tree including allowances for future growth (see 6.3), and also working space (see 6.7), will usually indicate that structures should be further away.

Note 2. With appropriate precautions, temporary site works can occur within the protected area, e.g. for access or scaffolding (see 8.3).

Appendix C

Matrix - Sustainable Retention Index Value (S.R.I.V.)©

Developed by IACA – Institute of Australian Consulting Arboriculturists www.iaca.org.au

To be used with the values defined in the Glossary.
An Index value as indicated where ten (10) is the highest value.

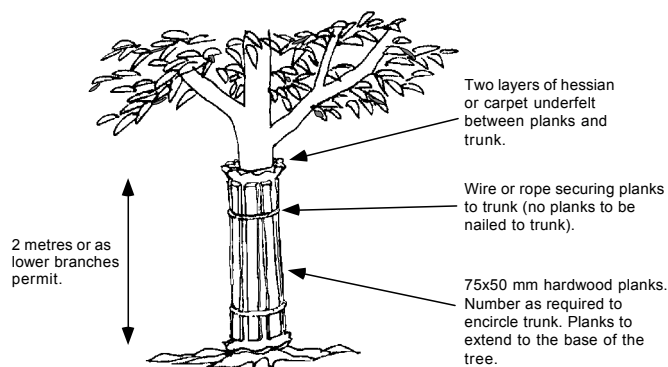
Age Class	Vigour Class and Condition Class					
	Normal Vigour & Good Condition (NVG)	Normal Vigour & Fair Condition (NVF)	Normal Vigour & Poor Condition (NVP)	Low Vigour & Good Condition (LVG)	Low Vigour & Fair Condition (LVF)	Low Vigour & Poor Condition (LVP)
	Able to be retained if sufficient space available above and below ground for future growth. No remedial work or improvement to growing environment required. May be subject to abnormal vigour. Retention potential - Medium – Long Term.	Able to be retained if sufficient space available above and below ground for future growth. Remedial work may be required or improvement to growing environment may assist. Retention potential - Medium Term. Potential for longer with remediation or favourable environmental conditions.	Able to be retained if sufficient space available above and below ground for future growth. Remedial work unlikely to assist condition, improvement to growing environment may assist. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions.	May be able to be retained if sufficient space available above and below ground for future growth. No remedial work required, but improvement to growing environment may assist vigour. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions.	May be able to be retained if sufficient space available above and below ground for future growth. Remedial work or improvement to growing environment may assist condition and vigour. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions.	Unlikely to be able to be retained if sufficient space available above and below ground for future growth. Remedial work or improvement to growing environment unlikely to assist condition or vigour. Retention potential - Likely to be removed immediately or retained for Short Term. Potential for longer with remediation or favourable environmental conditions.
Young (Y)	Index Value 9 Retention potential - Long Term. Likely to provide minimal contribution to local amenity if height <5m. High potential for future growth and adaptability. Retain, move or replace.	Index Value 8 Retention potential - Short – Medium Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. High-moderate potential for future growth and adaptability. Retain, move or replace.	Index Value 5 Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Moderate-low potential for future growth and adaptability. Retain, move or replace.	Index Value 4 Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Moderate potential for future growth and adaptability. Retain, move or replace.	Index Value 3 Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Moderate-low potential for future growth and adaptability. Retain, move or replace.	Index Value 1 Retention potential - Likely to be removed immediately or retained for Short Term. Likely to provide minimal contribution to local amenity if height <5m. Low potential for future growth and adaptability.
Mature (M)	Index Value 10 Retention potential - Medium - Long Term.	Index Value 9 Retention potential - Medium Term. Potential for longer with improved growing conditions.	Index Value 6 Retention potential - Short Term. Potential for longer with improved growing conditions.	Index Value 5 Retention potential - Short Term. Potential for longer with improved growing conditions.	Index Value 4 Retention potential - Short Term. Potential for longer with improved growing conditions.	Index Value 2 Retention potential - Likely to be removed immediately or retained for Short Term.
Over-mature (O)	Index Value 6 Retention potential - Medium - Long Term.	Index Value 5 Retention potential - Medium Term.	Index Value 4 Retention potential - Short Term.	Index Value 3 Retention potential - Short Term. Potential for longer with improved growing conditions.	Index Value 2 Retention potential - Short Term.	Index Value 0 Retention potential - Likely to be removed immediately or retained for Short Term.

Appendix D

1.0 TREE PROTECTION ZONES - STANDARD PROCEDURE

- 1.1 Each tree to be retained is to have its dripline fenced off, except where otherwise indicated, to create a **Tree Protection Zone**, and this may include one enclosure to protect a single or multiple tree/s, or multiple enclosures separated over the site. The area contained is the **Tree Protection Zone**, and is to exclude any activity, except where otherwise stated. **Tree Protection Zone** works may extend beyond the fenced area or replace a fence if appropriate. The **Tree Protection Zone** is to exclude: modification of existing soil levels, storage of materials including waste, site sheds and machinery; preparation of building materials e.g. concrete, or chemical treatments; the movement of pedestrian or vehicular traffic; or the temporary, or permanent location of services, or the works required for their installation, e.g. trenches, holes or canals. The above list is not meant to be exhaustive, and is intended as a guide to the types of activities that are excluded from within the **Tree Protection Zone**, except where otherwise stated.
- 1.2 The Tree Protection Fence that defines the **Tree Protection Zone** is to be 1.8m high steel chain link with galvanised steel pipes, or approved similar, located around the dripline of the tree except where otherwise stated, as a minimum distance from the tree for its protection and should be made larger where possible. The perimeter of the **Tree Protection Zone** to be further delineated by the attachment of shade cloth material to the outside surface area of the fence facing the inside of the site to reduce the movement of dust and other air borne residue from building activities that may be phytotoxic to plants or plant parts. The fence is to be installed prior to the commencement of any works on site, (except weed removal and tree maintenance, e.g. pruning, irrigation and mulching), and is to be maintained for the duration of the project. The fence must have a lockable opening for access to, and the security of the enclosed area. A temporary TPZ fence or fence section may be required to be established initially, where demolition of existing structures is required to provide an area of sufficient space for the full extent of the Tree Protection Zone to be installed.
- 1.3 Tree Protection signage is to be attached to each **Tree Protection Zone** and displayed in a prominent position and the sign repeated at 10m intervals or closer where the fence changes direction. The lettering for each sign to be a minimum of 72 point and printed in Arial font. The signs to be a minimum size of 600mm x 500mm. Each sign to advise as minimum details, the following:
1. **Tree Protection Zone** (title)
 2. (TEXT) "This fence has been installed to prevent damage to the trees and their growing environment both above and below ground, and access is restricted."
 3. (TEXT) "If encroachment or incursion into this Tree Protection Zone is deemed to be essential the Consulting Arboriculturist should be informed prior to the undertaking of such works."
 4. (TEXT) **Name, Address and Telephone number** of the *developer* (to enable enquiries concerning the trees to be directed to the developer).

- 1.4 Where a tree is to be retained and a **Tree Protection Zone** can not be adequately established due to restricted access e.g. tree located along side an access way, the trunk will be protected by wrapping 2 layers of hessian or carpet underfelt around the trunk for a minimum of 2m or as lower branches permit, then wire or rope secures 75x50x2000mm hardwood planks to the trunk (do not nail to the trunk). The number of planks to be used is as required to encircle the trunk and the planks are to extend to the base of the tree. (Diagram courtesy G. Cluble)



- 1.5 If a tree is growing down slope from an excavation, a silt fence located along the contours of the site in the area immediately above the **Tree Protection Zone** fencing may need to be installed and regularly maintained to prevent burial and asphyxiation of the roots of the tree. To allow for the maintenance of both fences, the silt fence must be constructed separately to the tree protection fence and the 2 fences must be constructed independently of each other and standalone. To reduce competition with the tree the area within the **Tree Protection Zone** is to be kept free of weeds. These are best removed by the application of foliar herbicide with Glyphosate as the active constituent. This is the preferred method rather than removal by cultivation of the soil within the dripline, to minimise root disturbance to the tree. The removal of woody weeds such as Privet should use the cut and paint method of herbicide application. Weeds to be controlled within the **Tree Protection Zone**, for the duration of the project.
- 1.6 The area of the Tree Protection Zone to be mulched to a depth of 100 millimetres with organic material being 75% leaf litter and 25% wood, and this being composted material preferably from the same genus and species of tree as that to where the mulch is to be applied, i.e. species specific mulch. The depth of mulch and type as indicated, to be maintained for the duration of the project. Where deep excavation will expose the soil profile to drying out the root plate is to be protected by pegging jute matting across the ground surface 2m back from the edge of the profile and 2m down the face of the profile and is to be in one continuous sheet or layers up to 5mm thick and overlapped 300mm and pegged. Pegs are to be a minimum length of 200mm and spaced at 500mm increments in a grid pattern. Once installed mulch is to be placed on top of the jute matting previously described.
- 1.7 No services either temporary or permanent are to be located within the **Tree Protection Zone**. If services are to be located within the **Tree Protection Zone**, special details will need to be provided by a qualified Consulting Arboriculturist for the protection of the tree regarding the location of the service/s.

- 1.8 A tree will not be fertilised during its protection within the ***Tree Protection Zone***, as this may hasten its decline if it were to decline. If a tree is to be fertilised this should be in consultation with a qualified Consulting Arboriculturist.
- 1.9 In the event of prolonged dry periods, or where a tree has been transplanted, or where excavation nearby, especially up slope, leads to drying out of a soil profile, or modification to ground water flow, or flows across an existing ground surface to the tree and its growing environment; deep root watering thoroughly at least twice a week is to be undertaken to irrigate the tree. The need for such watering is determined readily by observing the dryness of the soil surface within the dripline of the tree by scraping back some mulch. Mulch to be reinstated afterwards. In the event of disrupted ground or surface water flows to the tree due to excavation, filling or construction, a reticulated irrigation system may be required to be installed within the ***Tree Protection Zone***. If an irrigation system is to be installed, consideration must be given to volume, frequency, and drainage of water delivered, and this should be in consultation with a qualified Consulting Arboriculturist.

Appendix E

1.0 TREE PROTECTION ON CONSTRUCTION SITES

Note: Individual protection measures to be applied where stated as applicable.

- 1.1.0 General notes
- 1.2.0 Cautionary notes for the protection of retained trees
- 1.3.0 Demolition of built structures - precautions to protect trees
- 1.4.0 Excavation and construction close to Tree Protection Zones

1.1.0 General notes

- 1.1.1 The application of any measures for the protection of trees on development sites is determined by the species characteristics of the subject tree, and the existing physical constraints of the growing environment on site both above and below ground.
- 1.1.2 This report considers where applicable, British Standard BS 5837 : 1991 Guide for "Trees in relation to construction." as no Australian Standard currently exists for the protection of trees on development sites.
- 1.1.3 This report applies the **Tree Protection Zone - Standard Procedure** as developed and continually improved over time by URBAN TREE MANAGEMENT ® © for the effective protection of trees on development sites (see Appendix F). However, this does not restrict the author from applying additional or alternative conditions where it is deemed appropriate by the author for the protection of trees on development sites. Such additional or alternative conditions may be founded upon professional judgement based on:
 - the experience of the Consulting Arboriculturist
 - scientific research
 - new technology
 - industry best practice
 - consideration of the individual tree species and its relative tolerance to development impacts
 - the individual or cumulative factors present or proposed to impact upon the growing environment essential for the trees' survival
- 1.1.4 Where this report makes reference to the retention of subject trees it is for their incorporation into the landscaping works for the site, and they are to be documented on a Landscape Plan for the site (*the Landscape Plan*).

1.2.0 Cautionary notes for the protection of retained trees

1.2.1 Location of services

If a utility service is to be located within the area of the dripline of a protected tree or within the Tree Protection Zone, the British Standard BS 5837 : 1991 Guide for "Trees in relation to construction." provides the following: "7.5.8 An alternative solution is to excavate a narrow trench passing directly towards the tree along a radius to not closer than 1m from the trunk, tunnel straight beneath the tree, preferably not less than 750mm deep, and exit on the opposite side along another radius (see figure 3, see Appendix F in this report). Provided the trench is kept as narrow as possible, the amount of root severance will be minimal, and will be far less than if a trench passes close beside the tree. It may be necessary to sleeve a service where it passes beneath a tree in order to reduce the risk of damage to the service and facilitate future servicing and repair." The tunneling could be achieved by the use of horizontal directional drilling to link the two trenches, being a horizontal steerable drilling system. Such a system has capabilities of installing pipeline ranging from 100mm, up to 1100mm diameters for lengths of just over 1000m and has little to no disruption to tree roots. Such tunneling is usually undertaken beneath structural woody roots radiating away from the trunk and not just under the center of the tree.

1.2.1.1

Location of services Option B (Driveway Construction)

If a service is to be located within the area of the dripline of a protected tree or within the Tree Protection Zone, and site conditions such as shallow bed rock or if mass rooting has occurred from multiple trees growing in close proximity to each other, the service trench is to be elevated and positioned above natural ground level within the new driveway structure. The existing driveway surface is to be scabbled and a reinforced concrete topping is to be provided with down turned thickened edges constructed under the kerb edging to prevent lateral movement. A suitable subgrade material to manufacturers' recommendations is to be utilised if and where appropriate. Construction is to occur in a manner so as not to cause damage to the subject trees root system. All works to be in accordance with engineers' details.

1.2.2 Precautions in respect of temporary work

For Precautions in respect of temporary work, British Standard BS 5837 Guide for “Trees in relation to construction.” provides the following:

“8.3.1 if temporary vehicle access is required through the protected area, a reinforced concrete slab should be laid over the existing soil surface, with appropriate protection along the road edge.

8.3.2 If it is essential for scaffolding to be erected within a protected area, fencing in accordance with 8.2.2 or 8.2.3 should be erected to provide just sufficient space for scaffolding. The ground between this fence and the building should be protected by boarding (e.g. scaffold boards) as shown in figure 6. (see Appendix E in this report) A single thickness of boarding laid on the soil surface will provide sufficient protection for pedestrian loads, but more substantial boarding sufficient to spread the load should be used for heavier traffic. The ground beneath the boarding should be left undisturbed and should be protected with a porous geotextile fabric. If necessary, sand should be laid on the fabric to level the ground. When required, the building scaffolding should be erected. The boarding should be left in place until the building works are finished.”

1.3.0 Demolition of built structures - precautions to protect trees

1.3.1 Demolition of existing Buildings

The demolition of the buildings should be undertaken with access restricted to the driveway and the building platform for each of the existing buildings, or to areas of the land where no trees are growing within 6m of any tree to be retained. Where access or space for a safe working environment is restricted, or where the area of the 6m set back must be compromised, a 100mm layer of Eucalyptus wood mulch must be laid over the area of encroachment. Where vehicular access is required across the mulch layer further root protection should be provided by laying a temporary pathway over the mulch. The temporary pathway should be constructed of a grated steel material capable of supporting the vehicles used during demolition e.g. similar to ramps used to load vehicles onto the backs of trucks. Trunks of trees are to be protected from vehicular damage as per section 6.4 of this report.

1.3.2 Demolition of landscape structures

The demolition of walls, driveways retaining walls, paths and pools etc. within 6m of a tree to be retained should be undertaken manually using hand tools. Where a driveway is to be demolished being of concrete strip or slab type construction, it should be undertaken by working from the end of the driveway closest to the building back towards the street by utilising the driveway as a stable platform to prevent soil compaction. Where a concrete slab driveway passes less than 1m from the base of a tree and the area beneath the driveway is to be undisturbed and incorporated into the landscape works for the site, the volume of space previously occupied by the driveway must be replaced with local top soil from the site or otherwise a loamy sand, to replace the mass of the concrete on the root plate which may be critical to the ballast and centre of mass for the stability of the tree. If the tree becomes unstable immediately contact the Consultant Arboriculturist.

1.3.3 Removal of existing trees near trees to be retained

Removal of a tree within 6m of a tree to be retained should be undertaken only by cutting down such a tree without damaging the trees to be retained, and by grinding out its stump. Where possible the structural roots of 20mm diameter or greater of the tree to be cut down should not be removed, to minimise soil disturbance and to reduce the impact on the roots of any tree to be retained nearby. Where structural roots are to be removed this should be undertaken manually by the use of non-motorized hand tools after the stump has been ground out when such roots are often easier to locate from the site of the stump from which they have been severed.

1.4.0 Excavation and construction close to Tree Protection Zones

1.4.1 Excavation close to Tree Protection Zones

1.4.1.1

Where structural woody roots with a diameter of 20mm or greater are to be pruned outside the area of the Tree Protection Zone, they are to be excavated manually first by using hand tools to determine their location. A Waterknife or Airknife can be used as a mechanised alternative to locate such structural woody roots. Once located those roots to be severed are to be cut cleanly with a final cut to undamaged woody tissue and this will prevent tearing damage to the roots from excavation equipment which can extend beyond the point of excavation back towards the tree.

1.4.1.2

Where a large vigorous tree is to be retained near to built structure, and dependent upon its taxa, age class and propensity for its roots system to regenerate, it may be prudent to install a root barrier immediately adjacent to the footing of the new building, or to deepen and strengthen the footings themselves to act as a root barrier, but for such structural advice an appropriately qualified chartered structural engineer should be consulted.

1.4.2 Root location and protection where structures are to be positioned near a retained tree

1.4.2.1

If walls or a driveway or other structures are to be constructed near a protected tree, careful excavation is to be undertaken manually by using non-motorized hand tools to determine the location of first order and lower order structural roots with a diameter of 20mm (*structural woody roots*) or greater, without damaging them. Boundary walls or fences should use columns or posts with in fill panels, or a wall to be constructed with suspended sections 100mm clear above or beside any structural woody root or further as required, or any new wall to be built only to the depth of that existing. Structural woody roots to be further protected by utilising the construction techniques of pier or bridge footings, or screw piles between or over them with a minimum clearance above or beside of 100mm, or further as required to allow for future and ongoing growth.

1.4.2.2

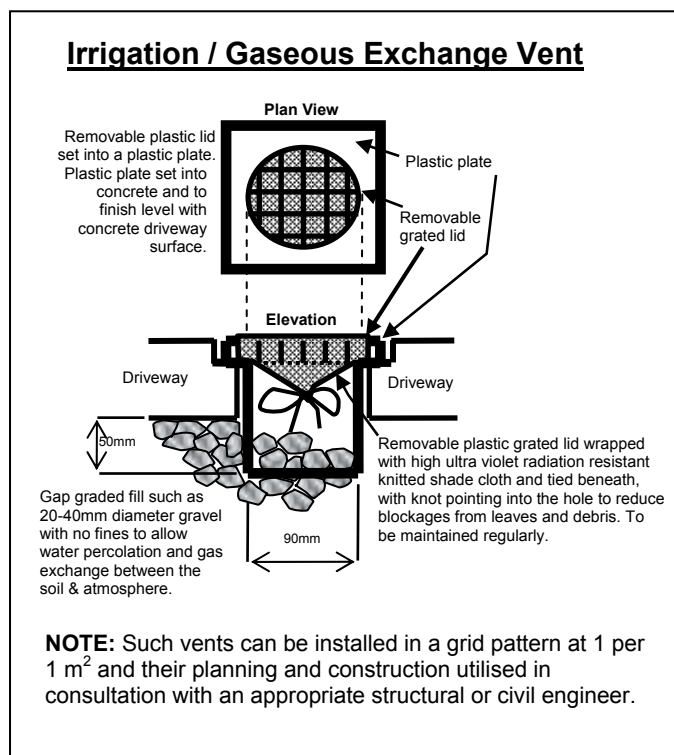
Where a driveway or footpath is to pass by the tree a suspended slab is to be constructed or approved similar, to protect the roots that may be encountered at, near, or above ground, and may be constructed on gap graded fill. Where such a driveway or footpath is to be constructed the edge of the structure closest to the tree is to terminate no closer than 0.5m from the closest edge of trunk, or further depending on the species and its likely further growth to allow for future development and expansion of the trunk, buttresses, and first order and lower order roots as may be advised by a Consultant Arboriculturist. The side of the driveway closest to a tree is to be edged with a concrete kerb of minimum dimensions of 150 x 150mm, to prevent vehicular collision with the trunk. Here a *Waterknife* or an *Airknife* can be used as a mechanised alternative to locate first order and lower order structural woody roots.

1.4.2.3

Alternatively a footpath or driveway may be constructed at ground level without any excavation, removing turf by raking, having sprayed with herbicide first if time permits. Here the path or driveway section is to extend for a distance past the tree equivalent to the lateral spread of the crown of that tree alongside the footpath, or driveway.

1.4.2.4

Watering / Gaseous exchange vents are to be installed in the area of the driveway that passes within the dripline of the tree or the prescribed **Tree Protection Zone** area and the number and location are to be determined by a Consultant Arboriculturist and the driveway design approved by a Certified Engineer. Exposed edges of the path are to be concealed with the finished level beside the path equivalent to the top of the path by minimal filling with a sandy soil and turf, or mulch, or a garden bed with minimal cultivation, or other landscape treatments as appropriate.



1.4.3 *Root protection where a driveway close to a tree is to be demolished and a new driveway constructed in a similar location to a previous driveway.*

After demolition of an existing driveway as per 5.3.2, the level of the base for the new driveway should be located at the same existing level as that of the base of the previous driveway, and should extend for a distance past the tree equivalent to the lateral spread of the crown of that tree alongside the driveway. To prevent excavation from damaging the existing roots which may be located at, near or above the surface of the soil beneath the base of the previous driveway, the new driveway may need to be raised by constructing it on pier or bridge footings between or over them (see 5.4.2 for minimum clearances), or based on a gap graded fill and the driveway constructed with any exposed edges concealed to the top of the driveway by minimal filling with a sandy soil and turf, or mulch, or a garden bed with minimal cultivation, or other landscape treatments as appropriate. Where roots have grown to occupy the soil between the concrete strips of a concrete, stone or brick strip driveway, they and the soil may be excavated to the level of the base of the concrete strips, but where such roots have a diameter of 20mm or greater, a Consulting Arboriculturist should be contacted prior to such works being undertaken. Where roots are to be severed, they are to be cut cleanly with a final cut to undamaged woody tissue.

1.4.4 *Root protection where a footpath is to be constructed close to a tree.*

1.4.4.1

A footpath may be constructed at ground level without any excavation, by first killing with herbicide the plants to be removed from the pathway area, and then removing that plant material by cutting the trunks of woody shrubs to ground level and by raking all other plant material to expose the top soil surface without organic matter. This will remove the need for physically disturbing the soil and the roots of the tree. The path section is to extend for a distance past each tree equivalent to the lateral spread of the crown of that tree where it extends alongside the footpath.

1.4.4.2

To prevent excavation from damaging the existing roots which may be located at, near, or above the surface of the soil, a gap graded fill as a fill material of a media as appropriate, to a depth of 100mm above the soil surface, or above the top of the root of any tree to be retained, or above the soil surface may be utilised as a base treatment to construct the foot path. Any exposed edges to be concealed to the top of the edges of the footpath and tapering back to the base of the trunk of each tree by minimal filling at each trunk of no greater than 100mm with a sandy soil and turf, or mulch, or a garden bed with minimal cultivation with ground covers, or other landscape treatments as appropriate. A Consultant Arboriculturist should be contacted prior to such works being undertaken or if any structural roots are considered appropriate to be severed being those roots of 20mm diameter or greater.

1.4.5 *Structural Soil to accommodate load bearing conditions*

A structural soil should only be considered as a new media into which the trees could be planted if the planting was into a new area where the area surrounding was to be load bearing such as a footpath, driveway or road.

1.4.6 *Gap graded fill to accommodate compacted sub grade and root growth*

To further protect woody roots with a diameter of 20mm or greater, a gap graded fill with no fines such as gravel 40mm diameter should only be considered as a fill media above existing grade when soil levels are to be increased near existing trees and the roots can utilise the new media to develop ongoing and future root growth and provide for gaseous exchange between the soil and the atmosphere.

Appendix F

Glossary

Vigour

Vigour / Vigor Ability of a tree to sustain its life processes. This is independent of the *condition* of a tree but may impact upon it. Vigour can appear to alter rapidly with change of seasons (seasonality) e.g. *dormant*, deciduous or semi-deciduous trees.

Normal Vigour Ability of a tree to maintain and sustain its life processes. This may be evident by the *typical* growth of leaves, *crown cover* and *crown density*, branches, roots and trunk, and a deterioration of their functions with reduced *resistance* to *predation*. This is independent of the *condition* of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation.

Low Vigour Reduced ability of a tree to sustain its life processes. This may be evident by the *atypical* growth of leaves, reduced *crown cover* and reduced *crown density*, branches, roots and trunk, and a deterioration of their functions with reduced *resistance* to *predation*. This is independent of the *condition* of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation.

Dormant Tree Vigour Determined by existing turgidity in lowest order branches in the outer extremity of the crown, with good bud set and formation, and where the last extension growth is distinct from those most recently preceding it, evident by bud scale scars. Normal vigour during dormancy is achieved when such growth is evident on a majority of branches throughout the crown.

Abnormal Vigour *Accelerated growth* of a tree due to incidental or deliberate artificial changes to its growing *environment* that are seemingly beneficial, but may result in *premature aging* or failure if the favourable conditions cease, or promote *prolonged senescence* if the favourable conditions remain, e.g. water from a leaking pipe; water and nutrients from a leaking or disrupted sewer pipe; nutrients from animal waste, a tree growing next to a chicken coop, or a stock feed lot, or a regularly used stockyard; a tree subject to a stringent watering and fertilising program; or some trees may achieve an extended lifespan from continuous *pollarding* practices over the life of the tree.

Age

Age Most trees have a stable biomass for the major proportion of their life. The estimation of the age of a tree is based on the knowledge of the expected lifespan of the taxa *in situ* divided into three distinct stages of measurable biomass, when the exact age of the tree from its date of cultivation or planting is unknown and can be categorized as *Young*, *Mature* and *Over-mature*.

Young Tree aged less than <20% of life expectancy, *in situ*.

Mature Tree aged 20-80% of life expectancy, *in situ*.

Over-mature Tree aged greater than >80% of life expectancy, *in situ*, or *senescent* with or without reduced *vigour*, and declining gradually or rapidly but irreversibly to death.

Periods of Time

Periods of Time The life span of a tree in the urban environment may often be reduced by the influences of encroachment and the dynamics of the environment and can be categorized as *Immediate*, *Short Term*, *Medium Term* and *Long Term*.

Immediate An *episode* or occurrence, likely to happen within a twenty-four (24) hour period, e.g. tree failure or collapse in full or part posing an imminent danger.

Short Term A period of time less than <1 – 15 years.

Medium Term A period of time 15 – 40 years.

Long Term A period of time greater than >40 years.

Trunk

Trunk A single stem extending from the *root crown* to support or elevate the *foliage crown*, terminating where it divides into separate *stems* forming *first order branches*. A trunk may be evident at or near ground or be absent in *acaulescent* trees of *deliquescent* habit, or may be continuous in trees of *excurrent* habit. The trunk of any *caulescent* tree can be divided vertically into three (3) sections and can be categorized as *Lower Trunk*, *Mid Trunk* and *Upper Trunk*. For a *leaning* tree these may be divided evenly into sections of one third along the trunk.

Acaulescent A *trunkless* tree or tree growth forming a very short *trunk*.

Caulescent Tree grows to form a *trunk*.

Condition

Good Condition Tree is of good habit, with *crown form* not severely restricted for space and light, physically free from the adverse effects of *predation* by pests and diseases, obvious instability or structural weaknesses, fungal, bacterial or insect infestation and is expected to continue to live in much the same condition as at the time of inspection provided conditions around it for its basic survival do not alter greatly. This may be independent from, or contributed to by vigour.

Fair Condition Tree is of good habit or *misshapen*, a form not severely restricted for space and light, has some physical indication of *decline* due to the early effects of *predation* by pests and diseases, fungal, bacterial, or insect infestation, or has suffered physical injury to itself that may be contributing to instability or structural weaknesses, or is faltering due to the modification of the *environment* essential for its basic survival. Such a tree may recover with remedial works where appropriate, or without intervention may stabilise or improve over time, or in response to the implementation of beneficial changes to its local environment. This may be independent from, or contributed to by vigour.

Poor Condition Tree is of good habit or *misshapen*, a form that may be severely restricted for space and light, exhibits symptoms of advanced and *irreversible decline* such as fungal, or bacterial infestation, major die-back in the branch and *foliage crown*, *structural deterioration* from insect damage e.g. termite infestation, or storm damage or lightning strike, ring barking from borer activity in the trunk, root damage or instability of the tree, or damage from physical wounding impacts or abrasion, or from altered local environmental conditions and has been unable to adapt to such changes and may decline further to death regardless of remedial works or other modifications to the local *environment* that would normally be sufficient to provide for its basic survival if in *good to fair* condition. Deterioration physically, often characterised by a gradual and continuous reduction in vigour but may be independent of a change in vigour, but characterised by a proportionate increase in susceptibility to, and *predation* by pests and diseases against which the tree cannot be sustained. Such conditions may also be evident in trees of advanced senescence due to normal phenological processes, without modifications to the growing environment or physical damage having been inflicted upon the tree. This may be independent from, or contributed to by vigour.

Dead Tree is no longer capable of performing any of the following processes or is exhibiting any of the following symptoms:

Processes

Photosynthesis via its foliage crown (as indicated by the presence of moist, green or other coloured leaves);

Osmosis (the ability of the root system to take up water);

Turgidity (the ability of the plant to sustain moisture pressure in its cells);

Epicormic shoots or *epicormic strands* in Eucalypts (the production of new shoots as a response to stress, generated from latent or adventitious buds or from a *lignotuber*);

Symptoms

Permanent leaf loss;

Permanent wilting (the loss of turgidity which is marked by desiccation of stems leaves and roots);

Abscission of the *epidermis* (bark desiccates and peels off to the beginning of the sapwood).

Leaning Trees

Leaning A tree where the *trunk* grows or moves away from upright. A lean may occur anywhere along the *trunk* influenced by a number of contributing factors e.g. genetically predetermined characteristics, competition for space or light, prevailing winds, aspect, slope, or other factors. A *leaning* tree may maintain a *static lean* or display an increasingly *progressive lean* over time and may be hazardous and prone to *failure* and *collapse*. The degrees of leaning can be categorized as *Slight Lean*, *Moderate Lean*, *Severe Lean* and *Critical Lean*.

Slight Lean A leaning tree where the trunk is growing at an angle within 0°-15° from upright.

Moderate Lean A leaning tree where the trunk is growing at an angle within 15°-30° from upright.

Severe Lean A leaning tree where the trunk is growing at an angle within 30°-45° from upright.

Critical Lean A leaning tree where the trunk is growing at an angle greater than >45° from upright.

Progressive Lean A tree where the degree of *leaning* appears to be increasing over time.

Static Lean A tree where the degree of *leaning* appears to have stabilized over time.

Self-correcting *Atypical* stem growth subsequently influenced and modified by *tropisms*, e.g. *gravitropism* and *phototropism*, where *reaction wood* attempts to return it to a more *typical* habit or *form*, e.g. a trunk with a *butt sweep* where it is returning to upright.

Form of Trees

Crown Form The shape of the crown of a tree as influenced by the availability or restriction of space and light, or other contributing factors within its growing environment. Crown Form may be determined for tree shape and habit generally as *Dominant*, *Codominant*, *Intermediate*, *Emergent*, *Forest* and *Suppressed*. The habit and shape of a *crown* may also be considered qualitatively and can be categorized as *Good Form* or *Poor Form*.

Good Form Tree of *typical* crown shape and habit with proportions representative of the taxa considering constraints such as origin e.g. indigenous or exotic, but does not appear to have been adversely influenced in its development by environmental factors in situ such as *soil water* availability, prevailing wind, or cultural practices such as lopping and competition for space and light.

Poor Form Tree of *atypical* crown shape and habit with proportions not representative of the species considering constraints and appears to have been adversely influenced in its development by environmental factors in situ such as *soil water* availability, prevailing wind, cultural practices such as lopping and competition for space and light; causing it to be *misshapen* or disfigured by disease or vandalism.

Crown Form Codominant Crowns of trees restricted for space and light on one or more sides and receiving light primarily from above e.g. constrained by another tree/s or a building.

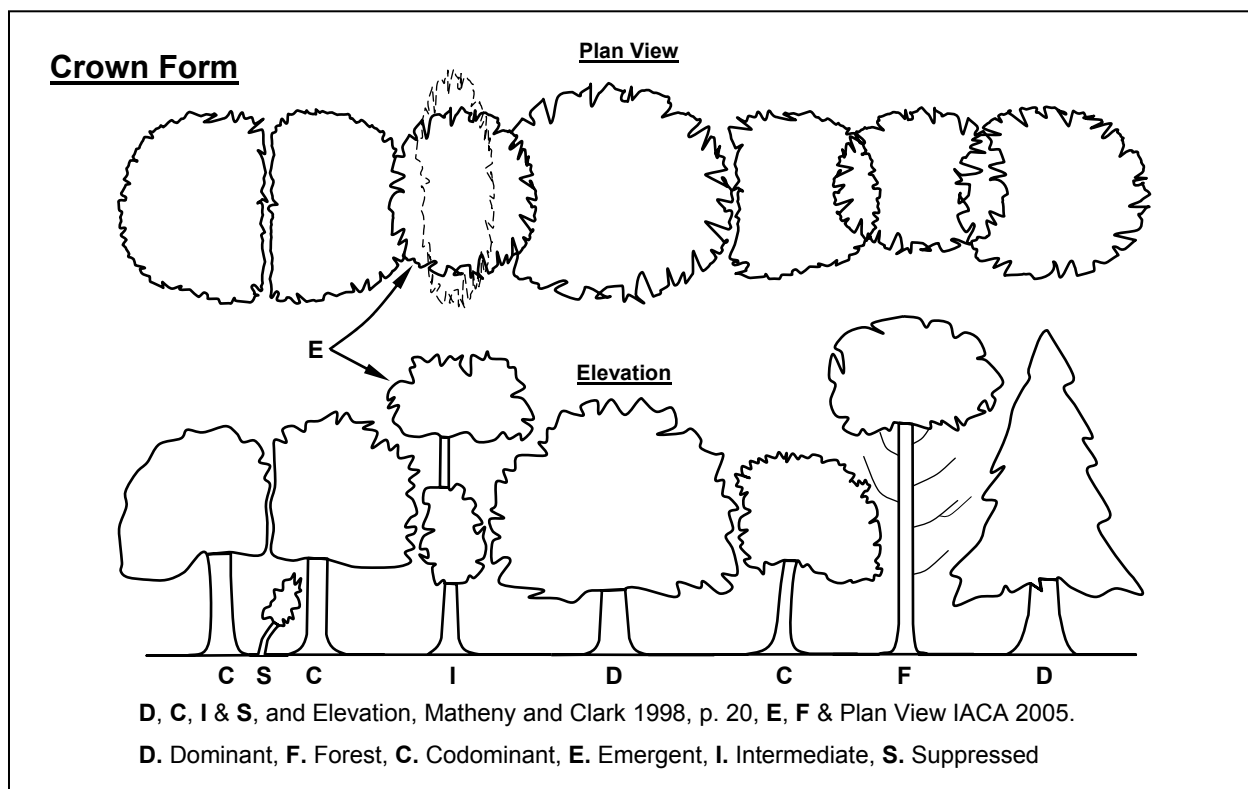
Crown Form Dominant Crowns of trees generally not restricted for space and light receiving light from above and all sides.

Crown Form Emergent Crowns of trees restricted for space on most sides receiving most light from above until the *upper crown* grows to protrude above the canopy in a stand or forest environment. Such trees may be *crown form dominant* or transitional from *crown form intermediate* to *crown form forest* asserting both *apical dominance* and *axillary dominance* once free of constraints for space and light.

Crown Form Forest Crowns of trees restricted for space and light except from above forming tall trees with narrow spreading crowns with foliage restricted generally to the top of the tree. The trunk is usually erect, straight and continuous, tapering gradually, crown often excurrent, with first order branches becoming structural, supporting the live crown concentrated towards the top of the tree, and below this point other first order branches arising radially with each *inferior* and usually temporary, divergent and ranging from horizontal to ascending, often with internodes exaggerated due to competition for space and light in the *lower crown*.

Crown Form Intermediate Crowns of trees restricted for space on most sides with light primarily from above and on some sides only.

Crown Form Suppressed Crowns of trees generally not restricted for space but restricted for light by being *overtopped* by other trees and occupying an understorey position in the canopy and growing slowly.



Symmetry

Symmetry Balance within a *crown*, or *root plate*, above or below the *axis* of the trunk of branch and foliage, and root distribution respectively.

Asymmetrical Imbalance within a crown, where there is an uneven distribution of branches and the foliage *crown* or *root plate* around the vertical *axis* of the trunk. This may be due to *Crown Form Codominant* or *Crown Form Suppressed* as a result of natural restrictions e.g. from buildings, or from competition for space and light with other trees, or from exposure to wind, or artificially caused by pruning for clearance of roads, buildings or power lines. An example of an expression of this may be, crown asymmetrical, bias to west.

Symmetrical Balance within a crown, where there is an even distribution of branches and the *foliage crown* around the vertical *axis* of the trunk. This usually applies to trees of *Crown Form Dominant* or *Crown Form Forest*. An example of an expression of this may be crown symmetrical.

Crown Spread Orientation Direction of the *axis* of *crown spread* which can be categorized as *Orientation Radial* and *Orientation Non-radial*.

Crown Spread Orientation Radial Where the *crown spread* is generally an even distance in all directions from the trunk and often where a tree has *Crown Form Dominant* and is *symmetrical*.

Crown Spread Orientation Non-radial Where the crown extent is longer than it is wide, e.g. east/west or E/W.

Significant Important, weighty or more than ordinary.

Significant Tree A tree considered important, weighty or more than ordinary. Example: due to prominence of location, or in situ, or contribution as a component of the overall landscape for *amenity* or aesthetic qualities, or *curtilage* to structures, or importance due to uniqueness of taxa for species, subspecies, variety, *crown form*, or as an historical or cultural planting, or for age, or substantial dimensions, or habit, or as *remnant vegetation*, or habitat potential, or a rare or threatened species, or uncommon in cultivation, or of aboriginal cultural importance, or is a commemorative planting.

Substantial A tree with large dimensions or proportions in relation to its place in the landscape.

Sustainable Retention Index Value (SRIV) A visual tree assessment method to determine a qualitative and numerical rating for the viability of urban trees for development sites and management purposes, based on general tree and landscape assessment criteria using classes of *age*, *condition* and *vigour*. SRIV is for the professional manager of urban trees to consider the tree *in situ* with an assumed knowledge of the *taxon* and its growing environment. It is based on the physical attributes of the tree and its response to its environment considering its position in a matrix for age class, vigour class, condition class and its sustainable retention with regard to the safety of people or damage to property. This also factors the ability to retain the tree with remedial work or beneficial modifications to its growing environment or removal and replacement. SRIV is supplementary to the decision made by a tree management professional as to whether a tree is retained or removed (IACA - Institute of Australian Consulting Arboriculturists 2005).

Diameter at Breast Height (DBH) Measurement of trunk width calculated at a given distance above ground from the base of the tree often measured at 1.4 m. The trunk of a tree is usually not a circle when viewed in cross section, due to the presence of *reaction wood* or *adaptive wood*, therefore an average diameter is determined with a *diameter tape* or by recording the trunk along its narrowest and widest axes, adding the two dimensions together and dividing them by 2 to record an average and allowing the orientation of the longest axis of the trunk to also be recorded. Where a tree is growing on a lean the distance along the top of the trunk is measured to 1.4m and the diameter then recorded from that point perpendicular to the edge of the trunk. Where a *leaning* trunk is *crooked* a vertical distance of 1.4m is measured from the ground. Where a tree branches from a trunk that is less than 1.4m above ground, the trunk diameter is recorded perpendicular to the length of the *trunk* from the point immediately below the base of the flange of the *branch collar* extending the furthest down the trunk, and the distance of this point above ground recorded as *trunk* length. Where a tree is located on sloping ground the DBH should be measured at half way along the side of the tree to average out the angle of slope. Where a tree is *acaulescent* or *trunkless* branching at or near ground such as a mallee or *sprout mass* as regrowth, an average diameter is determined by recording the radial extent of the trunk at or near ground.

Deadwood

Deadwooding Removing of dead branches by *pruning*. Such pruning may assist in the prevention of the spread of *decay* from *dieback* or for reasons of safety near an identifiable target.

Deadwood Dead branches within a tree's crown and considered quantitatively as separate to *crown cover* and can be categorised as *Small Deadwood* and *Large Deadwood* according to diameter, length and subsequent *risk* potential. The amount of dead branches on a tree can be categorized as Low Volume Deadwood, Medium Volume Deadwood and High Volume Deadwood.

Small Deadwood A dead branch up to 10mm diameter and usually <2 metres long, generally considered of low *risk* potential.

Large Deadwood A dead branch >10mm diameter and usually >2 metres long, generally considered of high *risk* potential.

Low Volume Deadwood Where <5 dead branches occur that may require *removal*.

Medium Volume Deadwood Where 5-10 dead branches occur that may require *removal*.

High Volume Deadwood Where >10 dead branches occur that may require *removal*.

Epicormic Shoots Juvenile shoots produced at branches or trunk from *epicormic strands* in some Eucalypts (Burrows 2002, pp. 111-131) or sprouts produced from dormant or latent buds concealed beneath the bark in some trees. Production can be triggered by fire, pruning, wounding, or root damage but may also be as a result of *stress* or *decline*. Epicormic shoots can be categorized as *Low Volume Epicormic Shoots*, *Medium Volume Epicormic Shoots* and *High Volume Epicormic Shoots*.

Low Volume Epicormic Shoots Where <10% of the *crown cover* is comprised of live *epicormic shoots*.

Medium Volume Epicormic Shoots Where 10-50% of the *crown cover* is comprised of live *epicormic shoots*.

High Volume Epicormic Shoots Where >50% of the *crown cover* is comprised of live *epicormic shoots*.

Dieback The death of some areas of the *crown*. Dieback can be categorized as *Low Volume Dieback*, *Medium Volume Dieback* and *High Volume Dieback*. Symptoms are leaf drop, bare twigs, dead branches and tree death, respectively. This can be caused by root damage, root disease, bacterial or fungal canker, severe bark damage, intensive grazing by insects, *abrupt changes* in growth conditions, drought, water-logging or over-maturity. Dieback often implies reduced *resistance*, *stress* or *decline* which may be temporary.

Low Volume Dieback Where <10% of the *crown cover* has died.

Medium Volume Dieback Where 10-50% of the *crown cover* has died.

High Volume Dieback Where >50% of the *crown cover* has died.

Crown Projection (CP) Area within the *dripline* or beneath the lateral extent of the *crown* (Geiger 2004, p. 2).

Dripline A line formed around the edge of a tree by the lateral extent of the *crown*. Such a line may be evident on the ground with some trees when exposed soil is displaced by rain shed from the crown.

First Order Roots (FOR) Initial woody roots arising from the *root crown* at the base of the *trunk*, or as an *adventitious root mass* for structural support and *stability*. Woody roots may be buttressed and divided as a marked gradation, gradually tapering and continuous or tapering rapidly at a short distance from the root crown. Depending on soil type these roots may descend initially and not be evident at the root crown, or become buried by changes in soil levels. Trees may develop 4-11 (Perry 1982, pp. 197-221), or more first order roots which may radiate from the trunk with a relatively even distribution, or be prominent on a particular aspect, dependant upon physical characteristics e.g. leaning trunk, *asymmetrical* crown; and constraints within the growing *environment* from topography e.g. slope, soil depth, rocky outcrops, exposure to predominant wind, soil moisture, depth of *water table* etc.

Orders of Roots The marked divisions between woody roots, commencing at the initial division from the base of the trunk, at the *root crown* where successive branching is generally characterised by a gradual reduction in root diameters and each gradation from the trunk and can be categorized numerically, e.g. *first order roots*, second order roots, third order roots etc. Roots may not always be evident at the *root crown* and this may be dependant on species, age class and the growing environment. Palms at maturity may form an adventitious root mass.

Root Plate The entire root system of a tree generally occupying the top 300-600mm of soil including roots at or above ground and may extend laterally for distances exceeding twice the height of the tree (Perry 1982, pp. 197-221). Development and extent is dependant on water availability, soil type, *soil depth* and the physical characteristics of the surrounding landscape.

Root Crown Roots arising at the base of a trunk.

Zone of Rapid Taper The area in the *root plate* where the diameter of *structural roots* reduces substantially over a short distance from the *trunk*. Considered to be the minimum radial distance to provide structural support and *root plate* stability.

Structural Roots Roots supporting the infrastructure of the *root plate* providing strength and *stability* to the tree. Such roots may taper rapidly at short distances from the *root crown* or become large and woody as with gymnosperms and dicotyledonous angiosperms and are usually 1st and 2nd order roots, or form an *adventitious root mass* in monocotyledonous angiosperms (palms). Such roots may be crossed and grafted and are usually contained within the area of *crown projection* or extend just beyond the *dripline*.

Appendix G

Tree Protection Plan & Location Plan

Trees the subject of this report are marked on the plans in the following appendix and are numbered as listed below

Tree No.	Genus and species	Common name
26	<i>Lophostemon confertus</i>	Brush Box
27	<i>Lophostemon confertus</i>	Brush Box
28	<i>Lophostemon confertus</i>	Brush Box
29	<i>Lophostemon confertus</i>	Brush Box
30	<i>Lophostemon confertus</i>	Brush Box
31	<i>Lophostemon confertus</i>	Brush Box
32	<i>Araucaria heterophylla</i>	Norfolk Island Pine
33	<i>Lophostemon confertus</i>	Brush Box
34	<i>Eucalyptus leucoxylon</i> subsp. <i>leucoxylon</i>	Yellow Gum
35	<i>Eucalyptus leucoxylon</i> subsp. <i>leucoxylon</i>	Yellow Gum
36	<i>Cupressus sempervirens</i> var. <i>stricta</i>	Mediterranean Pine
37	<i>Camellia sasanqua</i> (Stand of seven (7))	Camellia
38	<i>Camellia sasanqua</i> (Stand of four (4))	Camellia
44	<i>Jacaranda mimosifolia</i>	Jacaranda
45	<i>Plumaria rubra</i>	Frangipani
46	<i>Viburnum tinus</i> (Stand of three (3))	Viburnum
47	<i>Cedrus deodara</i>	Himalayan Cedar
48	<i>Jacaranda mimosifolia</i>	Jacaranda
49	<i>Lophostemon confertus</i>	Brush Box
50	<i>Lophostemon confertus</i>	Brush Box
51	<i>Lophostemon confertus</i>	Brush Box
52	<i>Lophostemon confertus</i>	Brush Box
53	<i>Lophostemon confertus</i>	Brush Box
54	<i>Lophostemon confertus</i>	Brush Box
55	<i>Corymbia citriodora</i>	Lemon Scented Gum
56	<i>Lophostemon confertus</i>	Brush Box
57	<i>Lophostemon confertus</i>	Brush Box
58	<i>Howea forsteriana</i>	Kentia Palm
59	<i>Lophostemon confertus</i>	Brush Box
60	<i>Lophostemon confertus</i>	Brush Box
61	<i>Lophostemon confertus</i>	Brush Box
62	<i>Lophostemon confertus</i>	Brush Box
63	<i>Lophostemon confertus</i>	Brush Box
64a	<i>Lophostemon confertus</i>	Brush Box
64b	<i>Lophostemon confertus</i>	Brush Box

Tree No.	Genus and species	Common name
64c	<i>Lophostemon confertus</i>	Brush Box
64d	<i>Lophostemon confertus</i>	Brush Box
65	<i>Lophostemon confertus</i>	Brush Box
66	<i>Lophostemon confertus</i>	Brush Box
67	<i>Lophostemon confertus</i>	Brush Box
68	<i>Lophostemon confertus</i>	Brush Box
69	<i>Lophostemon confertus</i>	Brush Box
70	<i>Lophostemon confertus</i>	Brush Box
72	<i>Syagrus romanzoffianum</i>	Cocas Palm
73	<i>Jacaranda mimosifolia</i>	Jacaranda
74	<i>Populus nigra</i> 'Italica'	Lombardy Poplar
75	<i>Cupressus torulosa</i>	Bhutan Cypress
76	<i>Cupressus macrocarpa</i> 'Brunniana'	Brunnings Golden Cypress
77	<i>Cupressus macrocarpa</i> 'Brunniana'	Brunnings Golden Cypress
78	<i>Jacaranda mimosifolia</i>	Jacaranda
79	<i>Populus nigra</i> 'Italica'	Lombardy Poplar
80	<i>Lagerstroemia indica</i>	Crepe Myrtle
81	<i>Glochidion ferdinandi</i>	Cheese Tree
82	<i>Prunus</i> sp.	-
83	<i>Pittosporum eugenioides</i> 'Variegatum'	Pittosporum
84	<i>Eucalyptus eximia</i>	Yellow Bloodwood
85	<i>Weed</i> sp	-
86a	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm
86b	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm
87	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm
88	<i>Celtis occidentalis</i>	Hack-berry
89	<i>Camellia japonica</i>	Camellia
90	<i>Ceratopetalum gummiiferum</i>	NSW Christmas Bush
91	<i>Ceratopetalum gummiiferum</i>	NSW Christmas Bush
99	<i>Eucalyptus scoparia</i>	Wallangarra White Gum
109	<i>Cotoneaster lacteus</i>	Cotoneaster
110	<i>Olea europea</i> subsp. <i>africana</i>	African Olive
112	<i>Lophostemon confertus</i>	Brush Box
113	<i>Lophostemon confertus</i>	Brush Box
114	<i>Cinnamomum camphora</i>	Camphor laurel
115	<i>Cinnamomum camphora</i>	Camphor Laurel
116	<i>Acacia binervia</i>	Coast Myall
117	<i>Cupressus glabra</i>	Arizona Cypress
118	<i>Ficus microcarpa</i> var. <i>hillii</i>	Hills Weeping Fig
119	<i>Acmena smithii</i>	Lillypilly
121	<i>Melaleuca bracteata</i> 'Golden Gem'	Black Tea Tree
122	<i>Melaleuca bracteata</i> 'Golden Gem'	Black Tea Tree

Tree No.	Genus and species	Common name
123	<i>Acer negundo</i>	Box Elder
124	<i>Syncarpia glomulifera</i>	Turpentine
125	<i>Ficus rubiginosa</i>	Port Jackson Fig
126	<i>Strelitzia nicolai</i>	Giant Bird of Paradise
127	<i>Magnolia grandiflora</i>	Bull Bay Magnolia
128	<i>Lophostemon confertus</i>	Brush Box
129	<i>Lophostemon confertus</i>	Brush Box
130	<i>Acer negundo</i>	Box Elder
131	<i>Lophostemon confertus</i>	Brush Box
132	<i>Acer negundo</i>	Box Elder
133	<i>Acer negundo</i>	Box Elder
134	<i>Hymenosporum flavum</i>	Native Frangipani
135	<i>Camellia japonica (x3)</i>	Camellia
136	<i>Lophostemon confertus</i>	Brush Box
137	<i>Jacaranda mimosifolia</i>	Jacaranda
138	<i>Jacaranda mimosifolia</i>	Jacaranda
139	<i>Lophostemon confertus</i>	Brush Box
140	<i>Lophostemon confertus</i>	Brush Box
141	<i>Lophostemon confertus</i>	Brush Box
142	<i>Lophostemon confertus</i>	Brush Box
143	<i>Lophostemon confertus</i>	Brush Box
144	<i>Lophostemon confertus</i>	Brush Box
145	<i>Prunus sp.</i>	-
146	<i>Archontophoenix cunninghamiana (x7)</i>	Bangalow Palm
147	<i>Washingtonia robusta</i>	Mexican Fan Palm
148	<i>Jacaranda mimosifolia</i>	Jacaranda
149	<i>Bauhinia variegata</i>	Orchid Tree
150	<i>Lophostemon confertus</i>	Brush Box
151	<i>Lophostemon confertus</i>	Brush Box
152	<i>Lophostemon confertus</i>	Brush Box
153	<i>Lophostemon confertus</i>	Brush Box
154	<i>Lophostemon confertus</i>	Brush Box
155	<i>Lophostemon confertus</i>	Brush Box
156	<i>Lophostemon confertus</i>	Brush Box
157	<i>Lophostemon confertus</i>	Brush Box
158	<i>Cupressus macrocarpa</i>	Monterey Cypress
159	<i>Lophostemon confertus</i>	Brush Box
160	<i>Lophostemon confertus</i>	Brush Box
161	<i>Lophostemon confertus</i>	Brush Box
162	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm
163	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm
164	<i>Araucaria cunninghamiana</i>	Hoop Pine

Tree No.	Genus and species	Common name
165	<i>Lophostemon confertus</i>	Brush Box
166	<i>Lophostemon confertus</i>	Brush Box
167	<i>Lophostemon confertus</i>	Brush Box
168	<i>Lophostemon confertus</i>	Brush Box
169	<i>Lophostemon confertus</i>	Brush Box
170	<i>Lophostemon confertus</i>	Brush Box
171	<i>Archontophoenix cunninghamiana</i> (x2)	Bangalow Palm
172	<i>Cyathea brownii</i>	Norfolk Tree Fern
173	<i>Phoenix canariensis</i>	Canary Island Date Palm
174	<i>Cupressus sempervirens</i>	Mediterranean Cypress
175	<i>Bauhinia variegata</i>	Orchid Tree
176	<i>Erythrina crista-galli</i>	Coral Tree
177	<i>Cedrus deodara</i>	Himalayan Cedar
178	<i>Plumeria rubra</i>	Frangipani
179	<i>Plumeria rubra</i>	Frangipani
180	<i>Jacaranda mimosifolia</i>	Jacaranda
181	<i>Lophostemon confertus</i>	Brush Box
182	<i>Dead</i>	-
183	<i>Dead</i>	-
184	<i>Corymbia citriodora</i>	Lemon Scented Gum
185	<i>Archontophoenix cunninghamiana</i> (X2)	Bangalow Palm
186	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm
187	<i>Syncarpia glomulifera</i>	Turpentine
188	<i>Syncarpia glomulifera</i>	Turpentine
189	<i>Viburnum tinus</i>	Viburnum
190	<i>Dead</i>	-
191	<i>Removed</i>	-
192	<i>Syncarpia glomulifera</i>	Turpentine
193	<i>Lophostemon confertus</i>	Brush Box
194	<i>Lophostemon confertus</i>	Brush Box
195	<i>Syncarpia glomulifera</i>	Turpentine
196	<i>Syncarpia glomulifera</i>	Turpentine
197	<i>Syncarpia glomulifera</i>	Turpentine
198	<i>Syncarpia glomulifera</i>	Turpentine
199	<i>Syncarpia glomulifera</i>	Turpentine
200	<i>Syncarpia glomulifera</i>	Turpentine
201	<i>Syncarpia glomulifera</i>	Turpentine
202	<i>Syncarpia glomulifera</i> (x5)	Turpentine
203	<i>Syncarpia glomulifera</i> (x2)	Turpentine
204	<i>Archontophoenix cunninghamiana</i>	Bangalow Palm
205	<i>Cupressus sempervirens</i>	Mediterranean Cypress
206	<i>Howea forsteriana</i>	Kentia Palm


Tree No.	Genus and species	Common name
207	<i>Howea forsteriana</i>	Kentia Palm
212	<i>Jacaranda mimosifolia</i>	Jacaranda
213	<i>Lophostemon confertus</i>	Brush Box
214	<i>Lophostemon confertus</i>	Brush Box
327	<i>Angophora costata</i>	Sydney Red Gum
328	<i>Syncarpia glomulifera</i>	Turpentine
329	<i>Lagunaria petersonii</i>	Norfolk Island Hibiscus
330	<i>Toona ciliata</i>	Australian Red Cedar
331	<i>Toona ciliata</i>	Australian Red Cedar
332	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark
333	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark
334	<i>Eucalyptus cinerea</i>	Argyle Apple
335	<i>Eucalyptus leucoxylon</i>	Yellow Gum
336	<i>Casuarina cunninghamiana</i> (x2)	River She-Oak
337	<i>Eucalyptus leucoxylon</i>	Yellow Gum
338	<i>Eucalyptus botryoides</i> <i>Acacia elata</i> <i>Lagerstroemia indica</i> <i>Ficus microcarpa</i> var. <i>hillii</i>	Southern Mahogany Cedar Wattle Crepe Myrtle Hills Weeping Fig
339	<i>Acer buergeranum</i>	Trident Maple
340	<i>Pittosporum undulatum</i> <i>Schinus areira</i> <i>Acer buergeranum</i>	Native Pittosporum Peppercorn Trident Maple
341	<i>Acacia elata</i>	Cedar Wattle
342	<i>Grevillea robusta</i>	Silky Oak
343	<i>Cinnamomum camphora</i>	Camphor Laurel
344	<i>Olea europea</i> var. <i>africana</i>	African olive


Appendix G - TREE PROTECTION PLAN – A

Site: Royal North Shore Hospital: Reference 11057, Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

From Trees to be Removed Plan by Cox. For other tree protection measures see sections 5.0 and Appendices D and E.

Legend

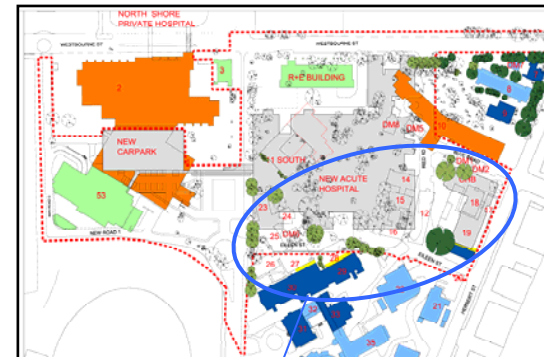
 **Tree Protection Zone (TPZ)**, fencing with setbacks as indicated, or other protection measures or works as indicated.

 **Tree Protection Zone**, area of special protection measures or works outside of or instead of a fenced area.

 Extent of Site works

10. Trees numbered in **orange and bold** are recommended for **retention**.

Tree Protection Zone setbacks taken from Table 3.0 and Appendix B.		
UTM Tree No.	British Standard BS 5837:1991 Recommended distance per DBH in metres	Reduced distance by British Standard (one third on one side only) (m)
118	8	5.5
212	6	4
223	6	4
214	6	4
332	6	4
333	4	2.5



Approximate volume of live crown required to be pruned.

Tree Protection Works - Specific

Prior to Demolition

1. **Tree Protection Zones (TPZ)**, including fencing are to be installed around all trees proposed to be retained (except Trees 64d, 64c, 66, 67, 68, 69, 70, 139, 140, 141, 142 & 143) with set backs as detailed in Table 3 and the Tree Protection Plan.
2. Trees, 64c, 64d, 66, 67, 68, 69, 70, 139, 140, 141, 142 & 143 will not require Tree protection fencing installed due to suitable distance from the proposed works. Only trees surrounding the temporary carparking area require protection fencing installed.
3. The TPZ should be further reduced alongside Trees 332 & 333 (street trees) to accommodate and maintain pedestrian access (See Appendix H -Tree Protection Plan). The set backs should be maintained at 1m x 2m.

During Demolition /Tree Removal

4. Removal of trees should be undertaken only by cutting down such a tree without damaging the trees to be retained. Where damage is likely to a retained tree, the removed trees should be undertaken manually by aerial sectioning and lowering, and the grinding out of its stump.
5. Tree 118 should be pruned as **detailed** – Reduction prune second order structural branch to north/east: x3 third order and x1 fourth order structural branch back to junction, also second order structural to E: x1 third order branch back to junction.
6. Due to the susceptibility by *Ficus spp.* to sun scald on structural branches, whereby wounding may occur from sudden exposure to sunlight, wrapping exposed structural branches of Tree 118 with hessian is recommended. Hessian sheeting should be fastened only by twine or hessian tie to prevent damage to branch tissue.
7. Trees 60, 62, 63, 64a, 64d, 66, 67, 70, 139, 140, 142, 143, 213, 214, 332 & 333 should be pruned as **detailed** – Remove all large deadwood i.e. >10mm diameter and usually >2 metres long, which is generally considered of high risk potential.

Prior to Construction

8. Trees 60, 62, 63, 64a, 64b, & 65 should be further protected to minimise compaction by displacing loads as **detailed** – A single thickness metal or timber sheeting should be laid on the soil surface within the temporary parking area which will provide sufficient protection for the loads applied. The ground beneath the boarding should be left undisturbed and if necessary, a porous geotextile fabric and sand used to level the ground. The boarding should be left in place until the building works are finished. Alternatively, a gap graded fill such as gravel 40 mm diameters with no fines should be considered to a depth of min. 100mm within the 4m set back.

During to Construction

9. No utility services are to be located through or within any Tree Protection Zone within *the site*. Where locating of such services is unavoidable it should only be undertaken in consultation with a Consulting Arboriculturist.
10. Where structural woody roots with a diameter of 20mm or greater are to be pruned, these are to be cut cleanly to undamaged woody tissue.

Post construction

11. Tree Protection Zone fencing should be removed only once construction has finished and landscaping is to commence.
12. Remove all hessian from all structural branches from Tree 118. No twine or hessian tie should remain within the crown.

Tree Protection Works – General

1. Trees to be retained are to be protected and not be damaged, and TPZ's retained and maintained.
2. The Tree Protection Fence that defines the Tree Protection Zone is to be 1.8m high steel chain link with galvanised steel pipes, or approved similar, located around the dripline of the tree except where otherwise stated, as a minimum distance from the tree for its protection and should be made larger where possible.
3. **All retained trees** Existing levels are to be preserved and no excavation except by hand to protect structural roots is to be undertaken within the Tree Protection Zones. No cut or fill filling is to be undertaken within any TPZ unless specified by the Consulting Arboriculturist.

Appendix G - TREE PROTECTION PLAN – B

Site: Royal North Shore Hospital: Reference 11057, Prepared by Urban Tree Management Australia P/L, 65 Excelsior Street, Merrylands NSW 2160, tel. 02 9760 1389.

From Trees to be Removed Plan by Cox. For other tree protection measures see sections 5.0 and Appendices D and E.

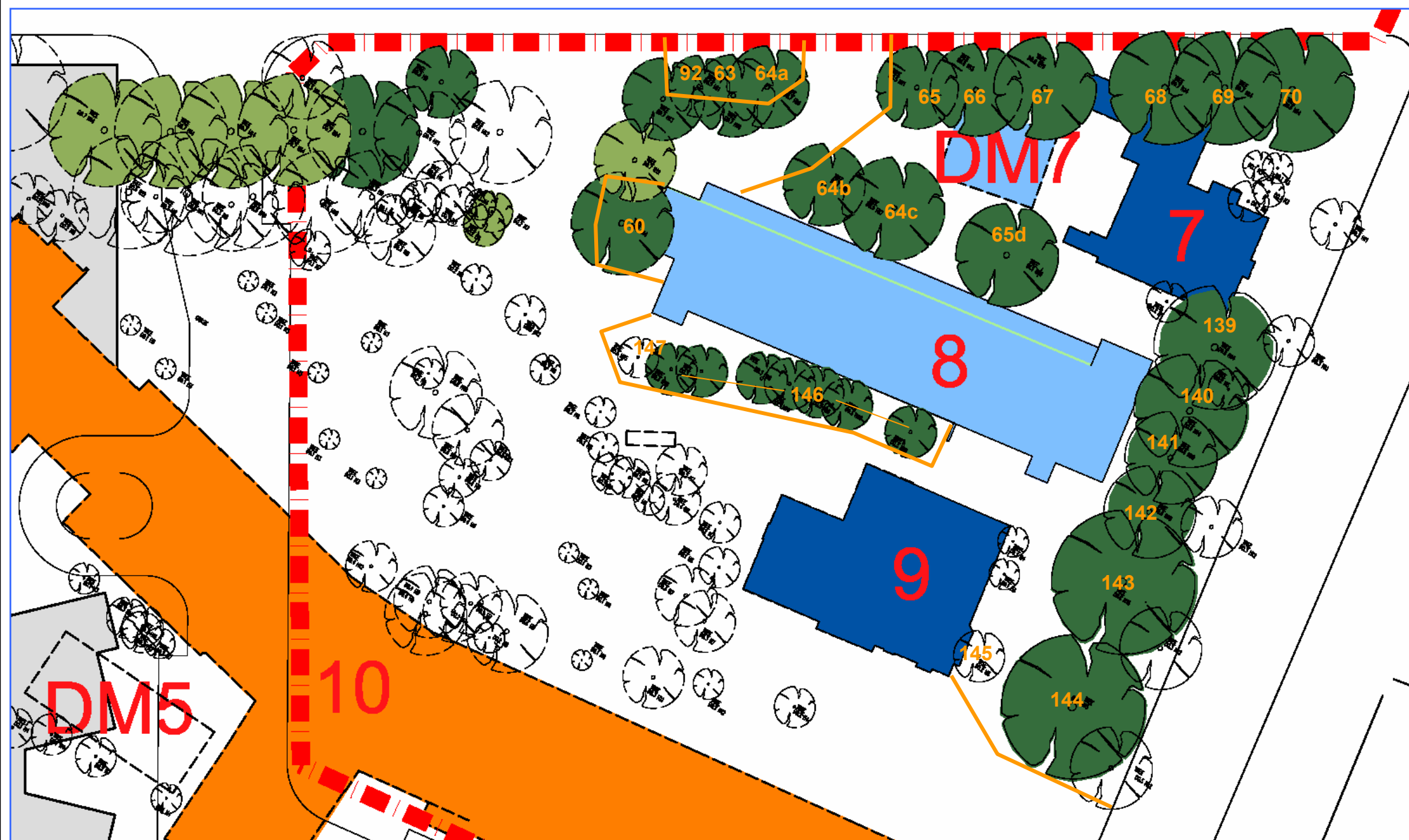
Legend

Tree Protection Zone (TPZ), fencing with setbacks as indicated, or other protection measures or works as indicated.

Tree Protection Zone, area of special protection measures or works outside of or instead of a fenced area.

Extent of Site works

10. Trees numbered in **orange and bold** are recommended for **retention**.



Tree Protection Zone setbacks taken from Table 3.0 and Appendix B.

UTM Tree No.	British Standard BS 5837:1991 Recommended distance per DBH in metres	Reduced distance by British Standard (one third on one side only) (m)
60	6	4
62	6	4
63	6	4
64a	6	4
64b	6	4
65	6	4
144	6	4
145	6	4
146	6	4
147	6	4

Trees, 64c, 64d, 66, 67, 68, 69, 70, 139, 140, 141, 142 & 143 will not require Tree protection fencing installed due to suitable distance from the proposed works. Only trees surrounding the temporary carparking area require protection fencing installed.

