TREETALK
ARBORICULTURAL CONSULTING

ABN 36 323 568 677

Arboricultural Impact Assessment

One Sydney Harbour
Barangaroo South
Development Application
Finalisation

Project No 5029/D/2016/A

September 2016

Prepared for

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Appendices

Arboricultural Impact Assessment:

One Sydney Harbour – Temporary drainage - Barangaroo South: Stage 1B

1.0 Summary

This Arboricultural assessment is to accompany a modification application made under section 96(2) of the Environmental Planning and Assessment Act 1979 to the approved remediation and land forming works at Barangaroo South (Development Consent SSD 5897).

Trees 102, 103 and 104 at One Sydney Harbour - Barangaroo South - Hickson Road, previously addressed in TreeTalk Report 5029/D 2015, have to date, been protected during site works processes.

Plans have been modified to ensure that works are below most tree roots.

If all works are performed below 1.0m from the surface, and pits are outside 5m from the trees, impact upon major tree roots will be minimal and the trees should continue to grow in there current condition.

2.0 Background and Works Proposed

TreeTalk Arboricultural Consulting has been engaged by Lend Lease Construction & Infrastructure, to provide advice on tree management in relation to temporary drainage works required near trees being protected. (Works approved under SSD 5897, future Stage 1B Basement, and associated landscape works at Barangaroo South).

Plans[1] for these works have been considered.

Works Proposed

One Sydney Harbour – Temporary drainage Barangaroo South: Stage 1B Basement as per plans provided in Appendix A.

The aims of this report are:

- To satisfy the requirements of the consent authority by providing information about the impact of planned works in the vicinity of trees and how these can be managed to limit impact upon trees being retained.
- To provide an Impact assessment on the remaining trees marked as 102, 103 and 104 including protecting measures.

[1] by Cardno Case No. CN 135412SW (Sheet 6 of 12) CITY OF SYDNEY DRAINAGE, CITY AREA SWC 29 Revision L: Issued to Sydney Water. Dated 16.05.16 (as copied into Appendix A).

3.0 Findings

The Trees

The trees are mature street trees *Ficus microcarpa* var. ‘*Hillii*’ (Hills Weeping Fig). In *Good* to *Fair* health and condition.

Tree Protection Zones

See Appendix F for Data and details of findings and Appendix E for ideal Tree Protection Zones as per AS4979.

Proposed Works

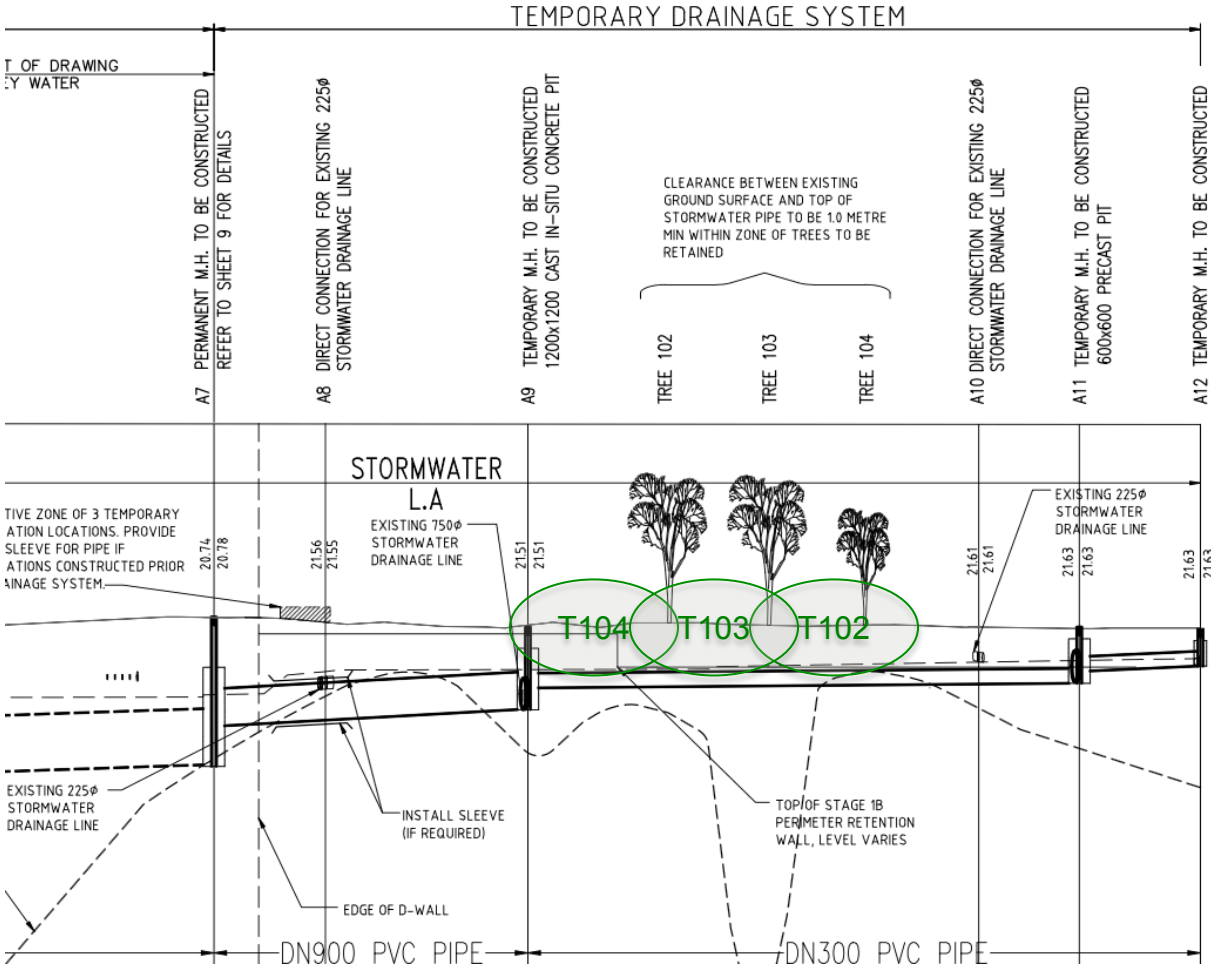

Image 1: Enlarged section of plan of proposed works from Appendix A

4.0 Discussion

Plans

Consideration has been given to the plans of temporary drainage works and to ensure that the trees can be retained, plan modifications have been made so that works are below or outside most tree roots.

Assessment of these plans in relation to tree protections requirements finds that the proposed temporary 300mm diameter pipeline Line A. (L .A) as noted on the attached plan, has works being perform with directional drilling at one metre below soil surface and entry and exits pits are 5 metres and outside most of the tree protection zones.

Tree Root Location

As tree roots grow where space and air is available (see diagrams in Appendices B) most tree roots are located in the top 30 – 60cm of soil where there is air available.

The structural root zones of Trees 102, 103 and 104 are 2.9, 2.8 and 2.7 respectively. There may be sinker roots deeper, however, works will be outside the theoretical Structural Root Zones and below most roots.

Works as Planned

If it is possible to install the pipe so the top of the pipe is one metre below the existing street level, and pits - at ground level – are no closer than 5 metres from the trees, then retention of the trees is possible.

At these distances it is highly unlikely that any large roots will be encountered and if they are they will be outside the area of most structural roots.

Caution

Should any large (10cm or greater) roots be found or tree health or stability become evident your project arborist must be consulted immediately.

5.0 Conclusion

If all works are performed below 1.0m from the surface as per plans in Appendix A, the impact upon major tree roots will be minimal.

All surface tree protection measures must remain in place for Trees 102, 103 and 104 (and Trees 100 and 101) should be retained as previously recommended.

Please contact me directly, if any sections of this report require clarification or if works as discussed cannot be complied with. Should any concerns become evident your project arborist must be consulted immediately.

Sue Wylie
Principal Arboriculturist
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Diploma of Horticulture (Arboriculture)
Australian Qualification Framework (AQF5)

"*The Voices of Arboriculture*"

Age of Tree:

Young: Less than 1/3 life expectancy
Semi-mature: 1/3 to 2/3 life expectancy
Mature: Older than 2/3 life expectancy
Over-Mature /Senescent: Older than 2/3 life expectancy and showing signs of irreversible decline

Condition of tree:

Good: Tree is generally healthy and free from and obvious signs of structural weakness or significant adverse effects of pests and diseases or infection.

Fair: Tree is generally vigorous although has some indication of being adversely affected by the early effects of disease or infection or environmental or mechanical damage. Appropriate tree maintenance can usually improve trees overall health and halt decline.

Poor: Tree in decline and is not likely to improve with reasonable maintenance practices or has a structural fault such as bark *inclusion*.

Dead: Tree no longer capable of sustained growth

Diameter at breast height (DBH): The nominal trunk diameter at 1.4 m above ground level
D = Ø arb = Trunk diameter, measured above the root buttress

Project Arborist: The person responsible for carrying out the tree assessment, report preparation, consultation with designers, specifying tree protection measures, monitoring and certification. The project arborist will be suitably experienced and competent in arboriculture, having acquired through training, qualification (minimum Australian Qualification Framework (AQF) Level 5, Diploma of Horticulture (Arboriculture)) and/or equivalent experience, the knowledge and skills enabling that person to perform the tasks required by this Standard.

Structural Root Zone (SRZ): The area around the base of a tree required for the tree's stability in the ground. The woody root growth and soil cohesion in this area are necessary to hold the tree upright. The SRZ is nominally circular with the trunk at its centre and is expressed by its radius in metres.
This zone considers a tree's structural stability only, not the root zone required for a tree's vigour and long-term viability, which will usually be a much larger area.

Tree: Long-lived woody perennial plant greater than (or usually greater than) 3 m in height with one or relatively few main stems or trunks (or as defined by the determining authority).

Tree Protection Zone (TPZ): A specified area above and below ground and at a given distance from the trunk set aside for the protection of a tree's roots and crown to provide for the viability and stability of a tree to be retained where it is potentially subject to damage by development.

Vigour: Ability of a tree to sustain its life processes. The term 'vigour' in this document is synonymous with commonly used terms such as 'health' and 'vitality'.

Work: Any physical activity in relation to land that is specified by the determining authority.

[1] Australian Standard 4970-2009: *Protection of trees on development sites* Licensed to Ms Sue Wylie

Boland, D.J., Brookner, M.I.H., et al, (1992), *Forest Trees of Australia*, CSIRO, Australia

Harris R.W., Clark, J.R., Matheny N., (2004) *Arboriculture – Integrated Management of Landscape Trees, Shrubs and Vines*. Pub. Prentice Hall, New Jersey USA

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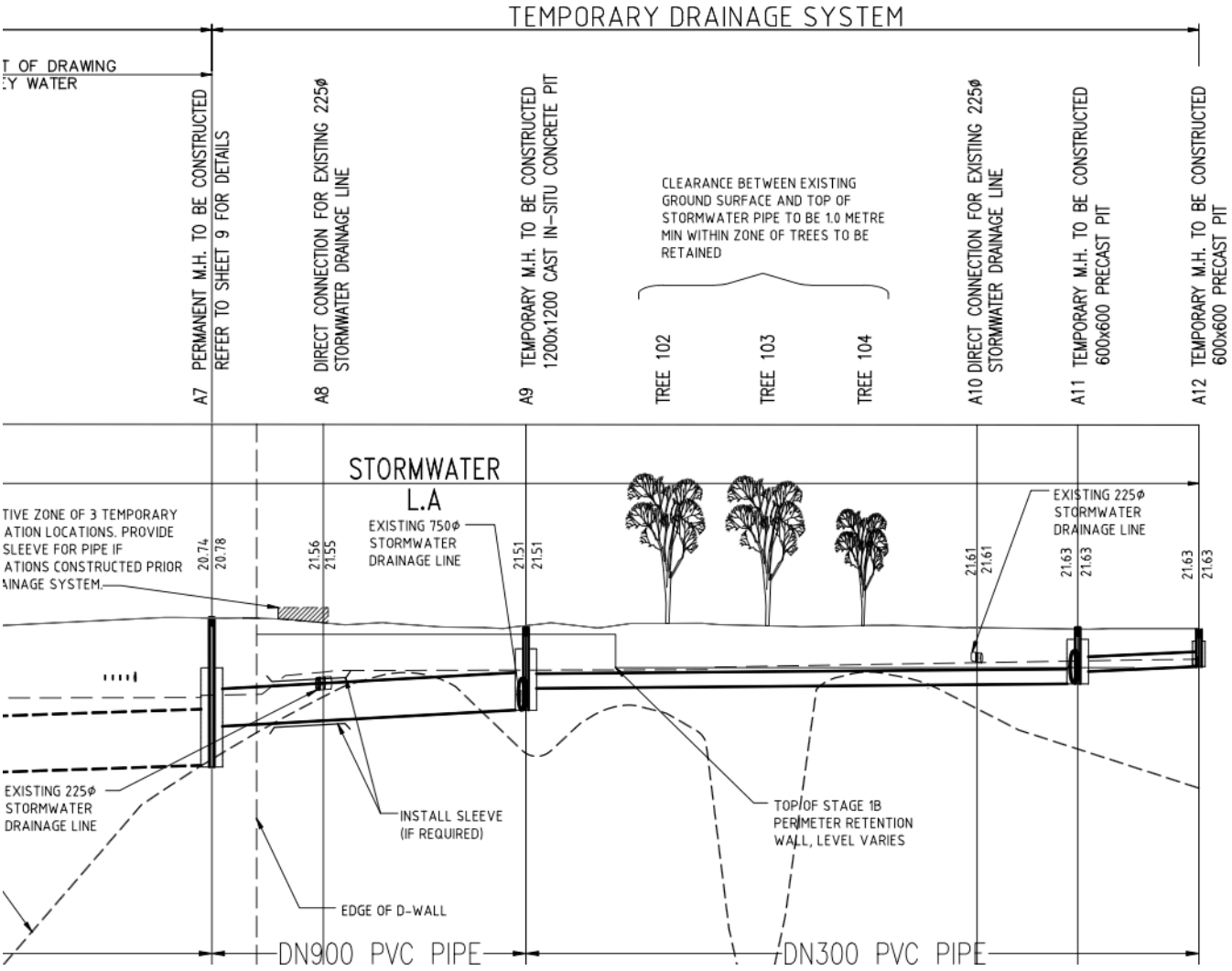
Shigo, Alex L. (1991) *Modern Arboriculture - Touch Trees*, Pub. Shigo and Tree Associates, Snohomish, WA, USA.

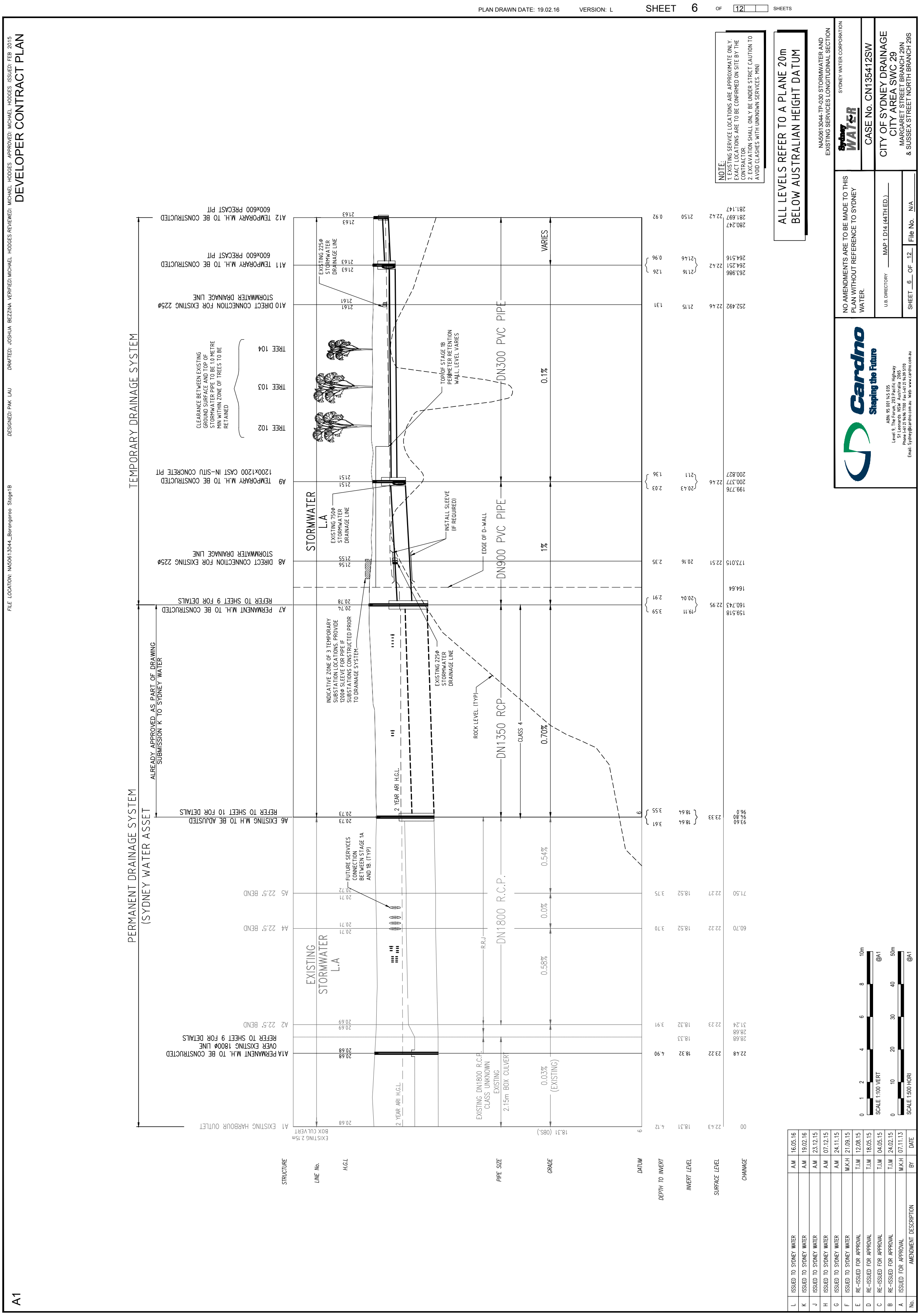
Smiley, Thomas E; Matheny, Nelda; Lilly, Sharon (2011!) *Best Management Practices – Tree Risk Assessment*. The International Society of Arboriculture (ISA).

Standards Australia (2007) Australian Standard AS4373-2007 *Pruning of Amenity Trees,* Pub. Standards Australia, Sydney.

Standards Australia (2009) Australian Standard AS4970-2009 *Protection of Trees on Development Sites*, Pub. Standards Australia, Sydney. Licensed to Ms Sue Wylie


TEMPORARY DRAINAGE SYSTEM
T OF DRAWING
Y WATER
A7 PERMANENT M.H. TO BE CONSTRUCTED REFER TO SHEET 9 FOR DETAILS
A8 DIRECT CONNECTION FOR EXISTING 225ø STORMWATER DRAINAGE LINE
A9 TEMPORARY M.H. TO BE CONSTRUCTED 1200x1200 CAST IN-SITU CONCRETE PIT
CLEARANCE BETWEEN EXISTING GROUND SURFACE AND TOP OF STORMWATER PIPE TO BE 1.0 METRE MIN WITHIN ZONE OF TREES TO BE RETAINED
TREE 102
TREE 103
TREE 104
A10 DIRECT CONNECTION FOR EXISTING 225ø STORMWATER DRAINAGE LINE
A11 TEMPORARY M.H. TO BE CONSTRUCTED 600x600 PRECAST PIT
A12 TEMPORARY M.H. TO BE CONSTRUCTED 600x600 PRECAST PIT
STORMWATER
L.A
TIVE ZONE OF 3 TEMPORARY
ATION LOCATIONS. PROVIDE
SLEEVE FOR PIPE IF
ATIONS CONSTRUCTED PRIOR
AINAGE SYSTEM.
EXISTING 750ø STORMWATER DRAINAGE LINE
EXISTING 225ø STORMWATER DRAINAGE LINE
20.74
20.78
21.56
21.55
21.51
21.51
21.61
21.61
21.63
21.63
21.63
21.63
EXISTING 225ø STORMWATER DRAINAGE LINE
INSTALL SLEEVE (IF REQUIRED)
TOP OF STAGE 1B PERIMETER RETENTION WALL, LEVEL VARIES
EDGE OF D-WALL
DN900 PVC PIPE
DN300 PVC PIPE

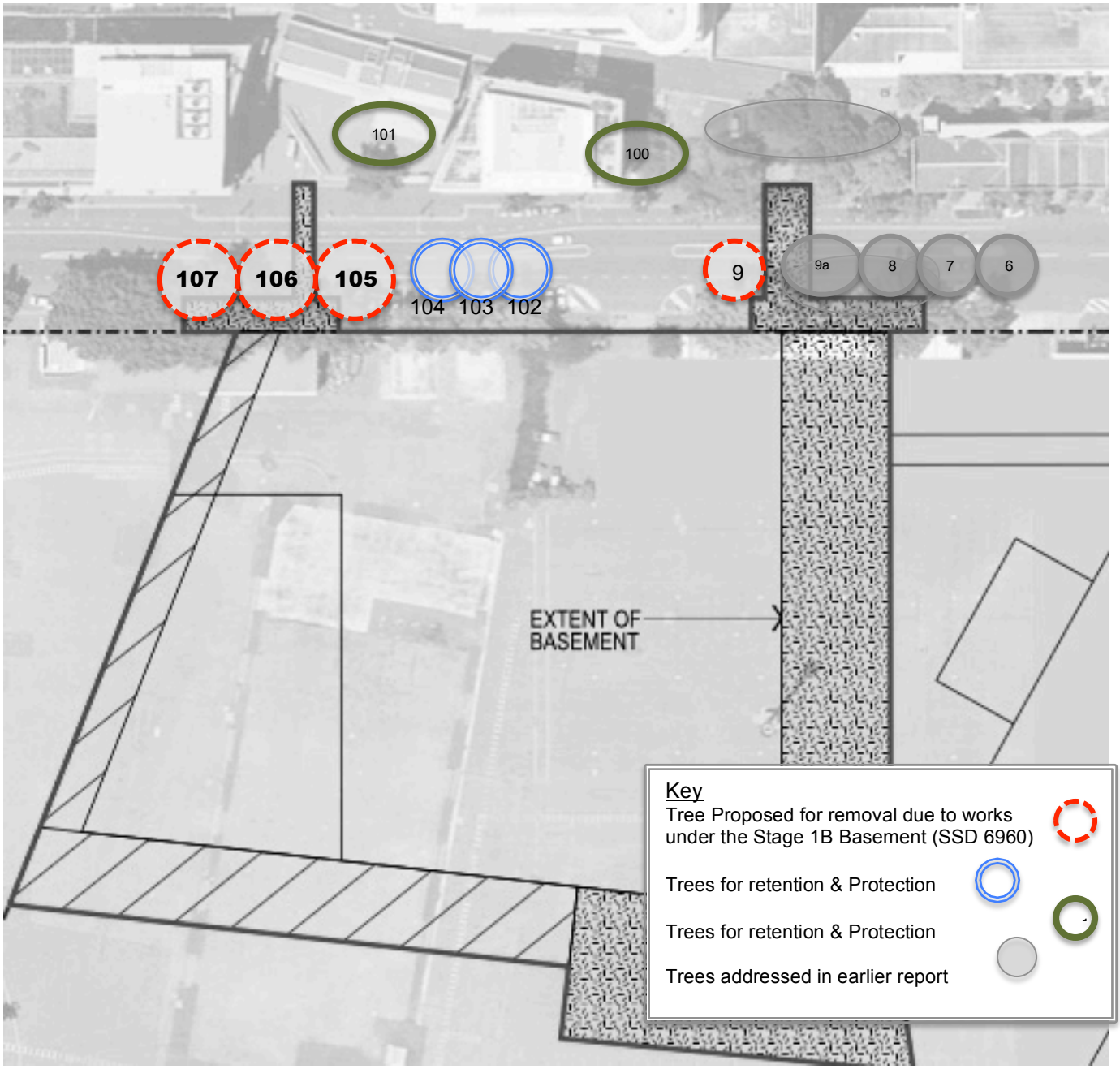
Plan by Cardno Case No. CN 135412SW (Sheet 6 of 12) CITY OF SYDNEY DRAINAGE, CITY AREA SWC 29 Revision L: Issued to Sydney Water. Dated 16.05.16



Appendix A2

Tree Location Plan

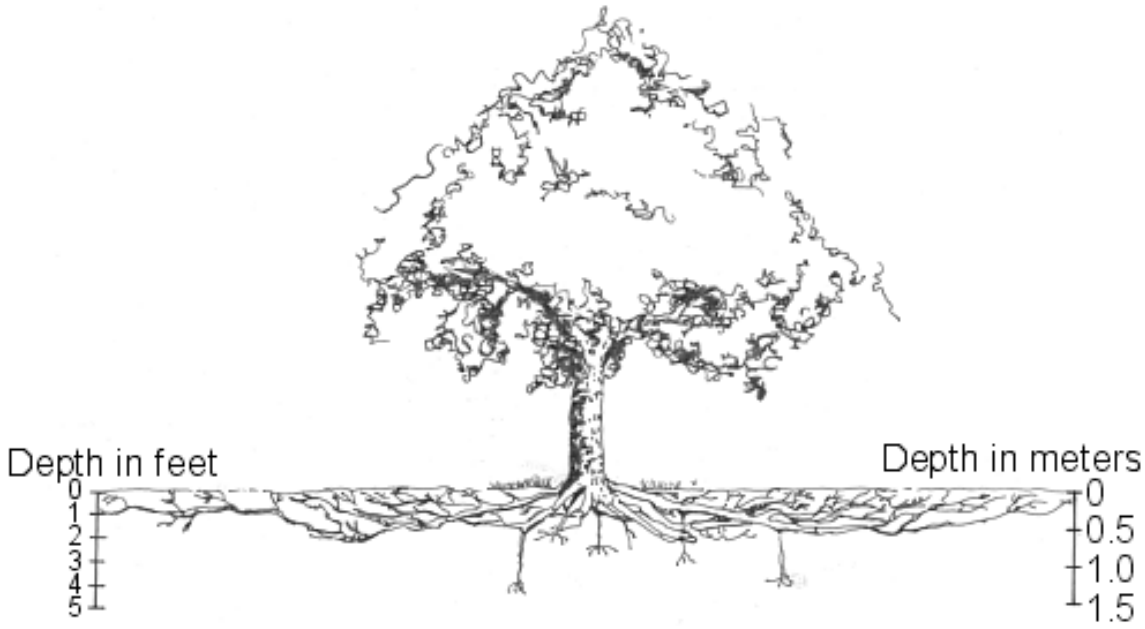
Tree numbers overlay Plan by: Lend Lease: One Sydney Harbour. Barangaroo. Stage 1B Basement SSD6960. Aerial Location Plan. Drawing BB2_PA2_A001. Revision A. Development Application. Dated 10 August 2015



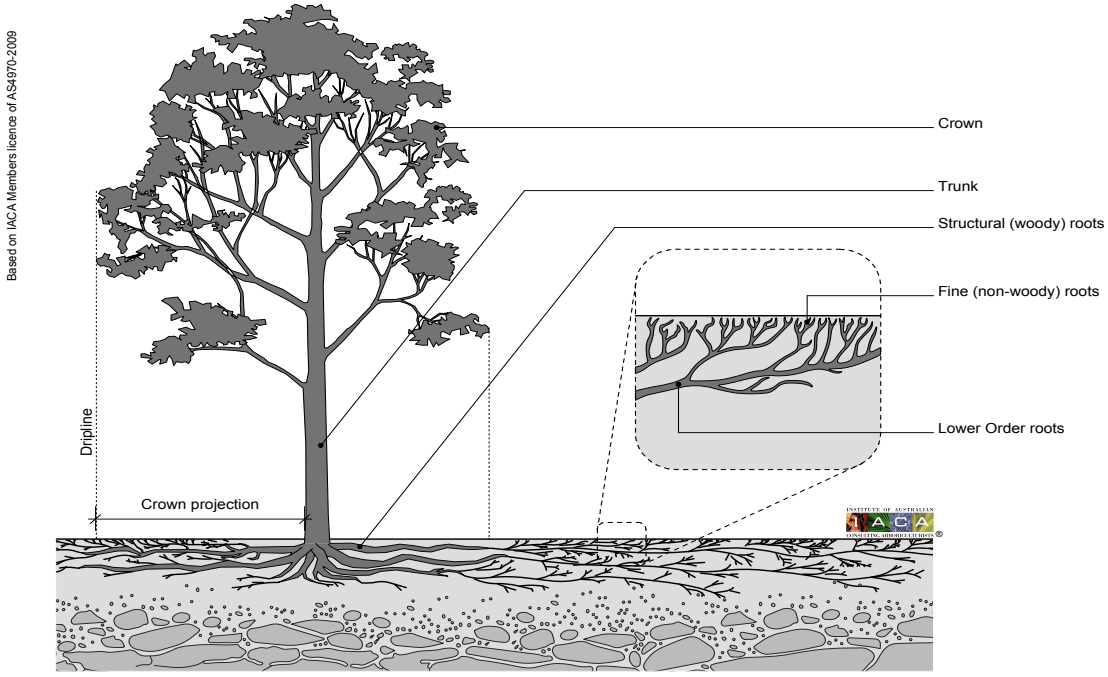
Appendix A3

Site Plan

Plan by: Lend Lease: One Sydney Harbour. Barangaroo. Stage 1B Basement SSD6960. Aerial Location Plan. Drawing BB2_PA2_A001. Revision A. Development Application. Dated 10 August 2015



Harris R.W., Clark, J.R., Matheny N., (2004) *Arboriculture – Integrated Management of Landscape Trees, Shrubs and Vines*. Pub. Prentice Hall, New Jersey USA Page 35.



Structure of a Tree in a Typical Growing Environment — Scale 1:200 @ A4

- Most tree roots are in the top 30cm of soil and are easily damaged by compaction and the loss of air spaces necessary for healthy survival. Soil compaction is a common cause of tree decline on development sites.

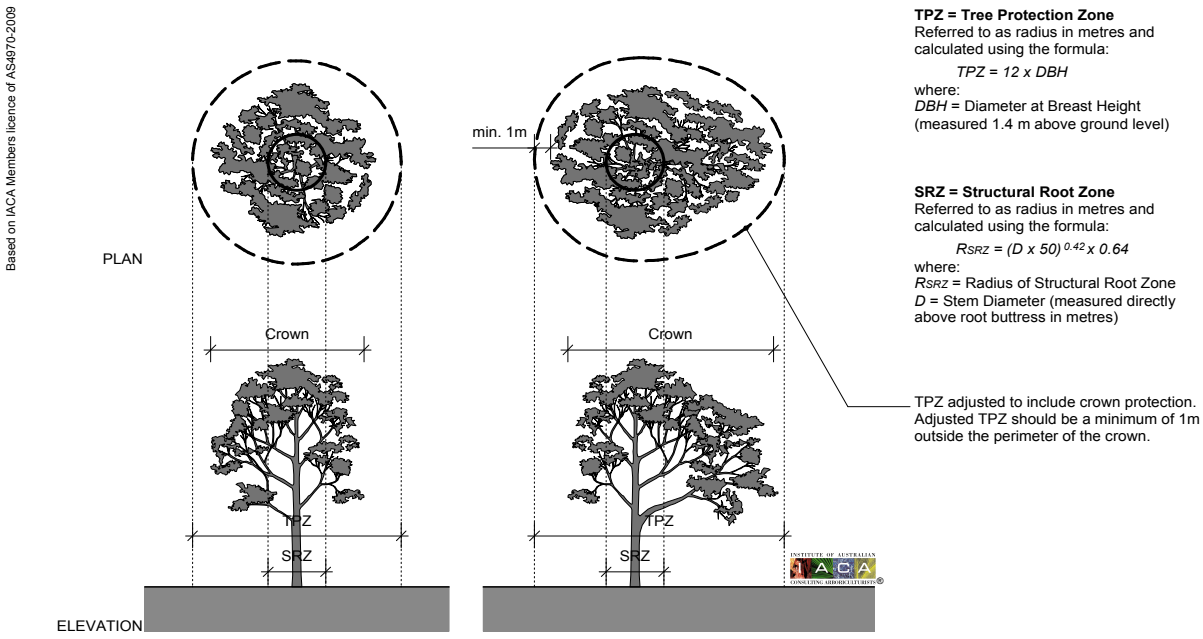
- Protection of tree roots requires that all activity be managed (and preferably eliminated within the Tree Protection Zone) with fencing (ie 12 times trunk diameter or as otherwise specified in the report).

- Roots fall into two main categories:
  - **Structural woody/Critical roots (SRZ):** These roots are instrumental in tree anchorage and structural support, nutrient storage and nutrient transport.
  - **The** fine/smaller **non-woody roots (TPZ)** are important in water and nutrient absorption as well as other functions important to tree health and survival.

- During site works demolition teams, builders and other workers on site will gravitate towards these green shady "different" areas, unaware of the damage they can cause, by compacting or contaminating the soil.

- Damaged trees are a liability and ongoing expense.

- Existing vegetation, particularly trees, are valuable assets that can continue to contribute to the property value long after new works have been completed.
- If well managed and protected trees provide an amenity to the immediate area and an environmental benefit to the wider community.



Indicative Tree Protection Zone (TPZ) Scale 1:500 @ A4

The theoretical Tree Protection Zones (TPZ) of trees being retained, are given in the appended Tree Protection Calculations section of the report (Appendix E).

Works within the area of small roots Tree Protection Zone (TPZ)

- Minimising soil compaction, by isolating most of the TPZ from works is important in the early stages of site works. Heavy equipment (such as those used in the demolition and the site preparation process) passing over the roots (or materials stockpiling) is detrimental to both the tree as well as the soil proposed for future plant growth (later landscaping).

- If works are proposed within the TPZ by and area of greater than 10%,

Works within Structural Root Zone SRZ

- Where works are required near large roots ie those within the SRZ, it is essential to avoid damaging these roots that are providing tree anchorage. Failure to do so is likely to create a dangerous tree that could fall.
- All works within SRZ should be above ground and to specific arboricultural specifications (provided by your AQF Level 5 arborist and preferably with them on site).
- Consideration may be required such as root mapping (careful exploratory digging using hand tools) to locate any large roots - 3cm or greater in diameter) and to find suitable locations. Piers for pier and beam construction are the only work possible.
- Piers must avoid roots with 20 – 30mm plus diameters.

"*The Tree Protection Zone is the area around the tree or group of trees in which no grading or construction activity may occur. This area should be large enough to retain sufficient root or crown area to maintain tree health and stability.*" [2]

2 Harris, Clark Matheny (2004)

Appendix E

Trees being retained - Tree Protection Calculations as per AS 4970 - 2009

Tree No.	Species	DBH cm	Tree Protection Area	SRZ Radius	Intrusion into SRZ	TPZ Radius	Intrusion into TPZ	Tree Protection Measures
100	*Ficus microcarpa var. 'Hillii'* (Hills Weeping Fig)	40cm	72m^2	2.3m	Yes	4.8m	Yes	Isolate trunk and SRZ as per Appendix C2. Do not change road or paving levels within SRZ.
101	*Ficus rubiginosa* (Port Jackson Fig)	50cm	113m^2	2.5m	Yes	6.0m	Yes	Isolate trunk and SRZ as per Appendix C2. Do not change road or paving levels within SRZ.
102	*Ficus microcarpa var. 'Hillii'* (Hills Weeping Fig)	70cm	222m^2	2.9m	Yes	8.4m	Yes	Isolate trunk and SRZ as per Appendix C2. Do not change road or paving levels within SRZ.
103	*Ficus microcarpa var. 'Hillii'* (Hills Weeping Fig)	55cm	137m^2	2.6m	Yes	6.6 m	Yes	Isolate trunk and SRZ as per Appendix C2. Do not change road or paving levels within SRZ.
104	*Ficus microcarpa var. 'Hillii'* (Hills Weeping Fig)	60cm	163m^2	2.7m	Yes	7.2m	Yes	Isolate trunk and SRZ as per Appendix C2. Do not change road or paving levels within SRZ.

To retain a tree in its current condition it should be fenced to the extent of the TPZ before any other works on site particularly demolition. There should be no entry within TPZ fencing including storage of materials or equipment without further arboricultural advice being sought. Modifications to these distances can be made with specific assessment of works proposed.

Appendix F

Tree Schedule

Tree No.	Species	DBH Arb. cm	Height xSpread M	Vigour/ Health	Structure	Comments
100	*Ficus microcarpa var. 'Hillii'* (Hills Weeping Fig)	40cm est.	8 x 7m	Good	Good	Tree appears to be free of the adverse affects of pests and diseases and no major structural faults are observable from the ground
101	*Ficus rubiginosa* (Port Jackson Fig)	50cm est.	7 x 10m	Good	Good	Tree in concourse above public pathway (and may be private property). The roots appear to be enclosed within a constructed planter – part of the upper section of the site.
102	*Ficus microcarpa var. 'Hillii'* (Hills Weeping Fig)	70cm est.	9 x 10m	Good	Good	Large structural roots extend for several metres to the south within guttering. These roots must be considered in relation to any works (renewed kerb/guttering performed within the SRZ..
103	*Ficus microcarpa var. 'Hillii'* (Hills Weeping Fig)	55cm est.	7 x 8m	Good	Good	Tree appears to be free of the adverse affects of pests and diseases and no major structural faults are observable from the ground
104	*Ficus microcarpa var. 'Hillii'* (Hills Weeping Fig)	60cm est.	6 x 6m	Good	Good	Branch failure (inclusion) at 1.5m over street. Damage (12cm x 20cm) where included branching has failed. Roots lifting paving.
105	*Ficus microcarpa var. 'Hillii'* (Hills Weeping Fig)	65cm est.	9 x 10m	Good	Good	Tree appears to be free of the adverse affects of pests and diseases and no major structural faults are observable from the ground
06	*Ficus microcarpa var. 'Hillii'* (Hills Weeping Fig)	70cm est.	10 x10m	Good	Good	Roots growing over sandstone kerbing blocks. Footpath surfaces have been lifted by large roots and management of this root must be considered (within SRZ) in relation to any resurfacing of pathway.
107	*Ficus microcarpa var. 'Hillii'* (Hills Weeping Fig)	95cm est.	11 x 10m	Good	Good	Roots growing over sandstone kerbing blocks.
9	*Ficus microcarpa var. 'Hillii'* (Hills Weeping Fig)	76cm	14 x 11m	Fair	Fair	Beyond crosswalk. Co-dominant from 1.5m. Roots limited by sandstone edging and asphalt. Drainage inspection pit nearby.