

Waterloo Integrated Station Development

Waterloo Tree Report

DOCUMENT No: SMCSWSWL-JHG-SWL-EM-REP-000002

Document and Revision History

Document Details	
Title	Waterloo Tree Report
Client	Sydney Metro City & Southwest

Revisions

Rev #	Date	Description	Prepared by	Reviewed by	Approved by
A	02/09/2020	Issued for internal use and Sydney Metro review	Project Arborist & John Holland	S. Reynolds	A. Knispel
0	08/09/2020	For issue to DPIE	Project Arborist & John Holland	S. Reynolds	A. Knispel
1	25/11/2021	Updated to include an additional tree on Wellington Street	Project Arborist & John Holland	S. Reynolds	A. Knispel

Glossary

Term	Explanation
AIA	Arboricultural Impact Assessment
CoA	Conditions of Approval
CSSI	Critical State Significance Infrastructure
DBH	Diameter at Breast Height
DPIE	Department of Planning, Industry & Environment
EIS	Environmental Impact Statement
ISD	Integrated Station Development
Minister, the	NSW Minister for Planning
SMCSW	Sydney Metro City and Southwest
SRZ	Structural Root Zone
TPZ	Tree Protection Zone

Table of contents

Glossary 2

1 Introduction..... 4

2 Summary of Arboricultural Impact Assessments..... 5

Appendix A – Waterloo ISD Arboricultural Impact Assessment prepared by Arboreport..... 7

Appendix B – Waterloo ISD Arboricultural Impact Assessment prepared by Tree IQ 8

1 Introduction

John Holland has prepared this Tree Report to identify impacts to trees within and around the Waterloo Integrated Station Development (ISD) site.

This report has been prepared to satisfy the requirements of the Project Conditions of Approval (CoA) E6. Table 1 outlines how compliance with CoA E6 is being, or will be, met.

Table 1: Compliance Matrix

Condition E6	Compliance
The CSSI must be designed to retain as many trees as possible and provide replacement trees such that there is a net increase in the number of trees.	The Waterloo ISD is being designed as per the EIS and PIR. Any trees that require removing will be replaced such that there is a net increase in the number of trees.
The Proponent must commission an independent, experienced and suitably qualified arborist to prepare a comprehensive Tree Report before removing any trees as detailed in the EIS, as amended by the documents listed in A1. The Tree Report must include:	The arborists are independent, experienced and suitably qualified. Arborists have prepared the specialist arboriculture aspects of this Tree Report which fulfils the condition requirement.
(a) a description of the condition of the tree(s) it's amenity and visual value;	The amenity (visual) value assessment for each tree is included in Appendix A, Section 6. This measures the tree's contribution to the landscape, it may be based on the tree's visual form, however it also includes non visual attributes such as provision of shade for a seat, screening of poor views or for privacy, or if it has historical significance. Appendix B provides an assessment for Tree 59.
(b) consideration of all options to avoid tree removal, including relocation of services, redesign or relocation of ancillary components (such as substations, fencing etc.) and reduction of standard offsets to underground services; and	This has been completed as part of the detailed design process.
(c) measures to avoid tree removal, minimise damage to, and ensure the health and stability of those trees to be retained and protected. This includes details of any proposed canopy or root pruning, root protection zone, excavation, site controls on waste disposal, vehicular access, materials storage and protection of public utilities.	Trees that are to be retained are protected as per the recommendations of in Appendix A Section 9. During the design process, every effort is made to retain significant tree/s where possible taking into consideration a number of criterion including safety, security, urban design, access, pedestrian flow etc. Appendix B provides details the removal of Tree 59.
In the event that tree removal cannot be avoided, then replacement trees are to be planted within, or in close proximity to the CSSI or other location in consultation with the Relevant Councils and agreed by the Secretary. The size of the replacement trees will be determined in consultation with the relevant Council.	This has been completed and detailed in the Station Design and Precinct Plan.
A copy of the Tree Report must be submitted to the Secretary before the removal, damage and/or pruning of any trees, including those affected by the site establishment works.	This Tree Report has been submitted for the proposed works prior to any pruning/damage or removal being undertaken.

Condition E6	Compliance
All recommendations of the Tree Report must be implemented by the Proponent, unless otherwise agreed by the Secretary.	Tree protection measures are implemented as per the Appendix A Section 9 recommendations.
The Tree Report may be prepared for the entire CSSI or separate reports may be prepared for individual areas where tree removal and/or pruning is proposed.	The Tree Report has been prepared for the Waterloo Station and is a live document to both service the works program and to only seek approval for trees in which the impact cannot be mitigated.

2 Summary of Arboricultural Impact Assessments

The Waterloo site is bounded by Botany Road, Cope Street, Wellington Street and Raglan Street. This report assesses trees located on both sides of these streets, however, excludes trees that are related to the over station development (Tree No. 45 and 46) as these will be assessed in a separate report.

Tree surveys have been undertaken by an independent, experienced and suitably qualified arborists. The Arboreport arborist assessed 58 trees that may be impacted as a result of the work. The Tree IQ Arborist assessed one tree. The assessments included the following:

- Genus, species and common name;
- Height, spread, trunk diameter, diameter at breast height (DBH), age;
- Description of the condition of the tree, including health, vigour, and structural condition;
- Significance, amenity, visual value and ecological value
- Form and structural condition;
- Visible defects or evidence of wounding;
- Structural Root Zone (SRZ) and Tree Protection Zone (TPZ); and
- Potential impact from the Project

The purpose of the Arboricultural Impact Assessments (AIA) are to assess the trees for significance and suitability for retention from an arboricultural perspective. This is reviewed against the proposed impacts as a result of the scope of works. Recommendations are provided based on the trees suitability for retention and their significance. The AIA includes a tree location plan which is a graphical representation of the trees assessed in the report.

The Arboreport AIA initially identified 20 trees that are within the development footprint and may require removal based on the proposed work and the design. It should be noted that modifications to the utility route planned for Cope Street has been revised based on final design to avoid direct impacts to trees. As a result, the installation of utilities on Cope Street will not result in any tree removal on the eastern side of the street. One small tree (T7) requires removal during the installation of pre-cast columns.

A total of 22 trees were identified with >10% encroachment of the TPZ and considered to be a major encroachment to the tree. Where possible, and following investigation on site, for the trees identified as having high significance, construction modifications will be investigated to avoid direct impacts to trees where possible.

For the majority of the project, tree removal is required to accommodate the proposed construction of the station and associated infrastructure. These trees are proposed to be removed as part of the

site wide removal and replacement scheme which will result in approximately 55% canopy coverage and 55 replacement trees.

Refer to Appendix A for specific details on the impact assessment of the trees for Waterloo ISD prepared by Arboreport.

Refer to Appendix B for specific details on the impact assessment prepared by Tree IQ for Tree 7 on Wellington Street.

Appendix A – Waterloo ISD Arboricultural Impact Assessment prepared by Arboreport



WATERLOO METRO STATION

ARBORICULTURAL IMPACT ASSESSMENT

PREPARED FOR:

JOHN HOLLAND GROUP

PREPARED BY:

ADRIAN SWAIN
Dip. Hort, Arboriculture
Dip. Hort, Landscape Design
Cert II Conservation Land Management
(Natural Area Restoration)
IACA, AILDM, AIH, ISA



<i>date</i>	<i>revision</i>	<i>prepared</i>	<i>checked</i>
11/08/20	Issued for Approval	AS	AS
18/08/20	Amended to client comments	AS	AS
20/08/20	Amended to client comments	AS	AS
01/09/20	Amended to client comments	AS	AS

Executive Summary

This report was commissioned by John Holland Group to address Project Planning Approval Condition E6 (CSSI 15_7400).

The aim of this report is to provide an assessment of the impacts of the development on fifty eight (58) trees in accordance with AS4970 – 2009, *Protection of trees on development sites*.

This report collates and presents information collected by Adrian Swain on the 26/06/20. The data collected is located at **6. Tree Survey Table** (page 14) also see **7. Tree Survey Table Notes** (page 18) for notes relating to tree survey table.

Generally the site's vegetation was observed to consist of street trees growing within the road reserve with the exception of several trees along Cope street east where trees were surveyed growing within the front setbacks of adjacent properties. The existing surveyed trees are shown at **8. Tree Location Plan** (page 22).

The Waterloo Metro Station development is underground it will also involve the surface urban integration works involving the construction of associated service relocations, public domain landscape treatments, road upgrades and road realignments.

This will involve the demolition of existing structures and regrading site levels through excavation, cutting and filling of soil on site. The extent of site works is also illustrated at **8. Tree Location Plan** (page 22).

The matrix below gives a brief overview summary of tree significance and level of encroachment from the development of numbered trees.

ENCROACHMENT WITHIN TPZ					
Numbering of trees as shown on Tree Location Plan					
TREE LANDSCAPE SIGNIFICANCE		No Impact	Minor Encroachment ($<10\%$ of TPZ)	Major Encroachment ($>10\%$ of TPZ)	Within Development Footprint
	High	-	- 21 & 23,	- 9, 13, 20 22, 53 & 55	- 8, 10, 15, 18, 19 & 61
	Medium	- 16	- 47, 48, 49, 50 & 51	- 5, 7, 24, 25 & 44	- 14, 34, 35, 36, 37 & 39
	Low	-	- 52, 54, 56, 57 & 58	- 1, 2, 3, 4, 6, 17, 26, 27, 28, 29, 30, 31, 42 & 43	- 11, 12, 32, 33, 38, 40, 41 & 60
	Total Number of trees	1	15	22	20

In consideration of the data collected recommendations are provided for the removal or retention of trees including specific tree protection measures required to reduce the anticipated impacts from the construction on those trees to be retained. This report specifically recommends:

- The removal of Tree No.'s 1, 2, 3, 4, 5, 6, 7, 11, 12, 14, 17, 20, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 53, 55, 60 & 61 as there is an unavoidable major encroachment into the tree protection zone.

- The immediate removal of Tree No.11, as it is dead.
- The removal of Tree No.'s 47, 48, 49, 50, 51, 52, 54, 56, 57 & 58 as part of the landscape architects tree removal and replacement plan for the precinct.
- The retention of Trees 16, 21 & 23. The construction will not impact these trees.
- The retention of Tree No.'s 8, 9, 10, 13, 15, 18, 19, 22, 53 & 55. These trees are of high significance and will require design modification to avoid and minimise impacts from the major encroachment. Specifically using tree friendly methodologies such as non-destructive digging and root mapping when adjusting the road realignment to better accommodate the existing woody roots for these trees.
- The retention of trees 8, 9, 10, 13, 15, 18, 19, 53 & 55 These trees are of high significance and will require design modification to avoid and minimise impacts from the major encroachment. Specifically, the proposed utility installations will need to be undertaken in a tree friendly manner. Methodologies may include the use of directional drilling, vacuum excavation, and underboring.
- Minor pruning of overhanging branches in the lane behind 72-82 Botany. Pruning is only necessary if branches cannot be tied back prior to site shed delivery.
- Additional root, trunk & branch protection is required for Trees to be retained. It is anticipated that construction activities will not be able to be excluded from the entire TPZ as the installation of the tree protection fence is not reasonably practicable.
- Hand excavation is required for all works located within the TPZ of all retained trees. These works shall be supervised by the project arborist.
- An AQF Project Arborist shall be engaged to certify the tree protection works
- For additional tree protection notes see **9. General Tree Protection Notes** (page 24).
- A Tree Protection Plan should be prepared to guide construction methodology and barrier installation as necessary to protect the trees during construction works. The plan should be prepared following provision of a CMP (Construction Management Plan) and/or TMP (Traffic Management Plan), in liaison with Construction plans and consistent with any conditions of consent and AS4970 (2009), sections 4 & 5.
- This arboricultural assessment should be reviewed upon the preparation of detailed design plans.

Table of Contents

Executive Summary.....	2
Table of Contents.....	4
1. Introduction	5
2. Methodology	5
3. Observations.....	7
4. Discussion	8
5. Recommendations	13
6. Tree Survey Table	14
7. Tree Survey Table Notes	18
8. Tree Location Plan	22
9. General Tree Protection Notes	24
10. References.....	28

1. Introduction

This report was commissioned by John Holland Group to address Project Planning Approval Condition E6 (CSSI 15_7400).

The aim of this report is to provide an assessment of the impacts of the development on fifty eight (58) trees in accordance with AS4970 – 2009, *Protection of trees on development sites*.

This report collates and presents information collected by Adrian Swain on the 26/06/20. The data collected is located at **6. Tree Survey Table** (page 14) also see **7. Tree Survey Table Notes** (page 18) for notes relating to tree survey table.

2. Methodology

2.1. Limitations

Care has been taken to obtain all information from reliable sources. All data has been verified as far as possible. However Adrian Swain - Consulting Arborist can neither guarantee nor be responsible for the accuracy of information provided by others. Unless stated otherwise:

- Information contained in this report covers only the tree/s examined and reflects the health and structure of the tree at the time of inspection. The documented, observations, results, recommendations and conclusions given may vary after the site visit due to environmental conditions. Liability will not be accepted for damage to person or property as a result of natural processes, unforeseeable actions or occurrences.
- Observations recorded for trees located within adjacent properties have been made without entering that property. Deciduous trees inspected during winter and all trees obscured by other vegetation are not able to be properly assessed. As a result measurements for these trees are estimated. Similarly these trees were not subject to a complete visual inspection and defects or abnormalities may be present but not recorded.
- Defects such as cambial damage, cracks, decay or hollows may be present which are not visible from the ground. This report does not include an aerial survey of the crown.
- Defects such as root damage, cracks or decay may be present under the ground. This report does not include an subterranean survey of the root plate.
- The inspection was limited to visual examination from the base of the subject tree without dissection, excavation, probing or coring (unless specifically noted otherwise).
- There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the subject tree may not arise in the future.

2.2. Site Inspection

A visual inspection of the tree/s was performed from ground level, data collected includes:

- Genus, Species, Common Name;
- Height, Width, DBH (Diameter at Breast Height), DRB (Diameter above Root Buttress);
- Age, Health & Vigour;
- Significance, Amenity (Visual Value) and Ecological Value;
- Form and Structural Condition;

- Visible Defects or Evidence of Wounding.

2.3. Measurement

- Tree locations are supplied by client on the survey plan or triangulated using a measuring tape.
- Diameter at breast height (DBH) and Diameter above Root Buttress (DRB) are measured using a diameter tape.
- Height is measured using a clinometer or Nikon Forestry Pro.
- Canopy width is estimated using a measured stride paced out on site.
- Structural Root Zone (SRZ) and Tree Protection Zone (TPZ) radii are calculated (in accordance with AS 4970-2009).
- Development impact/setback is measured from the nearest face of the trunk to the face of the structure in Auto CAD using the perpendicular distance function.

2.4. Recording Data

Data collected is collated in the tree survey table located at **6. Tree Survey Table** (page 14). The tree survey table contains abbreviations for terms describing the tree's characteristics; explanatory notes pertaining to these are located at **7. Tree Survey Table Notes** (page 18).

The physical data for tree locations, crown width and DRB is schematically described in **8. Tree Location Plan** (page 22).

2.5. Reference Documents

The report was written in coordination with:

- Survey Plan prepared by Veris Pty Ltd DETL-001 Revision B, dated 22/06/20.
- Utility Design prepared by WSP - SMCSWSWL-WSP-SWL-UT-SK01 Revision A Sheet 1 of 4, dated 28/07/20.
- Utility Design prepared by WSP - SMCSWSWL-WSP-SWL-UT-SK02 Revision A Sheet 2 of 4, dated 28/07/20.
- Landscape Plan prepared by Aspect WMQ-PBDN-ASP-LS-DRG-DA-006 Revision 4, dated 30/07/20.
- Landscape Plan prepared by Aspect WMQ-BLD1-ASP-LS-DRG-DA-001 Revision 4, dated 30/07/20
- Landscape Plan prepared by Aspect WMQ-BLD2-ASP-LS-DRG-DA-001 Revision 4, dated 30/07/20
- Landscape Plan prepared by Aspect WMQ-BLD3-ASP-LS-DRG-DA-001 Revision 4, dated 30/07/20
- The Australian Standard for the Protection of Trees on Development Sites (AS 4970 – 2009).

2.6. Council Tree Preservation Regulatory Controls

The City of Sydney Council tree preservation controls exclude dead, dying or dangerous trees, noxious weeds or listed nuisance species. The order defines a tree as (whether exotic, endemic or indigenous) as:

- a. Having a height of five (5) metres or more; or

- b. Having a canopy (crown) spread of over five (5) metres; or
- c. Having a trunk circumference of 300mm measured at ground level; or
- d. Is listed in the register of Significant Trees.

2.7. Determining a tree's significance

The significance of a tree is an essential criterion to establish the importance that a particular tree may have on a site. When determining a tree's significance within the landscape context, the following questions are asked of each tree. Significance may be expressed in increments of High, Medium or Low. For a High rating the majority (≥ 4) of the answers will be yes; For a Medium-High rating 3.5 of the answers will be yes; for a Medium rating half ($=3$) of the answers will be yes; for a Low-Medium rating 2.5 of the answers will be yes; and for the Low rating the minority of answers will be yes (≤ 2).

1. Is the tree of botanical interest; Is it included in a significant tree register or listed as a heritage item under the Federal State or Local Regulations?
2. Is the tree visually prominent in the locality?
3. Is the tree well structured?
4. Is the tree in good health and/or does it display signs of good vigour?
5. Is the tree typically formed for the species?
6. Is the tree currently located in a position that will accommodate future growth?

3. Observations

3.1. Site Description

The site is comprised of the land bounded by Raglan Street in the North, Cope Street in the East, Wellington Street in the South and Botany Road in the West, excluding the Waterloo Congregational Church but including both sides of the streets mentioned. The site is comprised of multiple amalgamated lots for the purpose of constructing the Waterloo Metro Station integrated development. The site has a general southerly aspect.

3.2. Summary of site inspection data

Generally the site's vegetation was observed to consist of street trees growing within the road reserve with the exception of several trees along Cope street east where trees were surveyed growing within the front setbacks of adjacent properties. The existing surveyed trees are shown at **8. Tree Location Plan** (page 22).

3.3. Summary of Development

The Waterloo Metro Station development is underground it will also involve the surface urban integration works involving the construction of associated service relocations, public domain landscape treatments, road upgrades and road realignments.

Construction stage site offices located at the rear of 74-82 Botany Road, Waterloo

This will involve the demolition of existing structures and regrading site levels through excavation, cutting and filling of soil on site. The extent of site works is also illustrated at **8. Tree Location Plan** (page 22).

3.4. Tree significance and encroachment matrix

The matrix below gives a brief overview summary of tree significance and level of encroachment from the development of numbered trees.

ENCROACHMENT WITHIN TPZ					
Numbering of trees as shown on Tree Location Plan					
TREE LANDSCAPE SIGNIFICANCE		No Impact	Minor Encroachment ($<10\%$ of TPZ)	Major Encroachment ($>10\%$ of TPZ)	Within Development Footprint
	High	-	- 21 & 23,	- 9, 13, 20, 22, 53 & 55	- 8, 10, 15, 18, 19 & 61
	Medium	- 16	- 47, 48, 49, 50 & 51	- 5, 7, 24, 25 & 44	- 14, 34, 35, 36, 37 & 39
	Low	-	- 52, 54, 56, 57 & 58	- 1, 2, 3, 4, 6, 17, 26, 27, 28, 29, 30, 31, 42 & 43	- 11, 12, 32, 33, 38, 40, 41 & 60
	Total Number of trees	1	15	22	20

4. Discussion

4.1. Trees with a Minor TPZ Encroachment

The construction encroaches within the TPZ by 10% or less.

- Trees 21 & 23 are located adjacent to the development, providing less than 10% encroachments within the TPZ for each tree. These trees are considered to be of high significance and should be retained and protected.

Tree sensitive construction measures must be implemented if works are to proceed within the TPZ as prescribed by the Australian Standard AS4970-2009 *Protection of trees on development sites*.

If excavation works are required to be undertaken within the TPZ of retained trees, they should be carried out by first excavating a narrow trench to the depth required, by hand along the closest line of cut to tree. This will allow the location of woody structural roots greater than 40mm which can then be pruned cleanly by an AQF Level 3 Arborist or Horticulturist.

- Trees 47, 48, 49, 50 & 51 are located adjacent to the development, providing less than 10% encroachments within the TPZ for each tree. These trees are considered to be of medium significance and are suitable for retention.

For the majority of the project extensive tree removal is required to accommodate the proposed construction. The Landscape Architect has proposed a tree removal and replacement scheme.

These trees are proposed to be removed as part of the site wide removal and replacement scheme.

- Tree 52 is located within a proposed to the development, providing less than 10% encroachments within the TPZ for each tree. These trees are considered to be of low significance and these trees should not be considered a constraint on the development.

For the majority of the project extensive tree removal is required to accommodate the proposed construction. The Landscape Architect has proposed a tree removal and replacement scheme.

This tree is proposed to be removed as part of the site wide removal and replacement scheme.

- Trees 54, 56, 57 & 58 are located adjacent to the development, providing less than 10% encroachments within the TPZ for each tree. These trees are considered to be of low significance and these trees should not be considered a constraint on the development.

Tree sensitive construction measures must be implemented if works are to proceed within the TPZ as prescribed by the Australian Standard AS4970-2009 Protection of trees on development sites.

If excavation works are required to be undertaken within the TPZ of retained trees, they should be carried out by first excavating a narrow trench to the depth required, by hand along the closest line of cut to tree. This will allow the location of woody structural roots greater than 40mm which can then be pruned cleanly by an AQF Level 3 Arborist or Horticulturist.

These trees are proposed to be removed as part of the site wide removal and replacement scheme.

4.2. Trees with a Major TPZ Encroachment

The construction encroaches within the TPZ by more than 10% or is within the SRZ.

- Trees 9, 53 & 55 are located 5.3m, 3.2m & 2.8m respectively from the High Voltage Power Mains Installation, providing 45.6%, 18.6% and 30.3% respective encroachments within the TPZ and within the SRZ. These trees are considered to be of high significance and should be retained and protected.

This level of encroachment is considered to be a significant impact and unsustainable by these trees.

In order to retain these trees the services would need to be relocated away from the tree or under-bored to avoid significant root damage. The proposed kerb and gutter would also need to be relocated to be further away than the existing alignment to avoid conflicts with the structural root zone.

The kerb and gutter alignment is unable to be modified and as such Trees 53 & 55 will have to be removed

If the HV Power Mains are able to be underbored tree 9 will be able to be retained. If this is not possible Tree 9 will have to be removed.

- Tree 20 is located immediately adjacent to proposed traffic signal pole, providing a major encroachment within the TPZ and encroachment within the SRZ. This tree is considered to be of high significance and should be considered a constraint on the development.

The level of encroachment will require this tree to be removed because the traffic signal location cannot be altered.

It is proposed to remove this tree.

- Tree 13 is located 5.3m from the High Voltage Power Mains Installation, providing a 26.2% encroachment within the TPZ and within the SRZ. This tree is considered to be of high significance and should be retained and protected.

This level of encroachment is considered to be a moderate high impact and sustainable by the tree.

In order to retain this tree the services would need to be relocated away from the tree or under-bored to avoid significant root damage.

- Trees 22 is located 8.2m from the kerb realignment and High Voltage Power Mains Installation, providing a 22.5% encroachment within the TPZ and within the SRZ. This tree is considered to be of high significance and should be retained and protected.

This level of encroachment is considered to be a moderate high impact and sustainable by the tree.

In order to retain this tree the services would need to be relocated away from the tree or under-bored to avoid significant root damage. Similarly sensitive reconstruction of the kerb and gutter would be required to avoid tree root damage.

- Trees 5 & 7 are located 0.3m and 0.7m respectively from the kerb realignment and high voltage power mains installation, providing 78.9% and 63.5% respective encroachments within the TPZ and within the SRZ. These trees are considered to be of medium significance and are suitable for retention.

The extensive encroachments are considered to be significant and unsustainable by the tree. These trees will be required to be removed.

It is proposed to remove these trees as part of the removal and replacement strategy proposed by the Landscape Architect.

- Trees 24, 25 & 44 are located 2.9m, 0.1m and 0.3m respectively from the kerb realignment, providing 41.6%, 45.2% and 42.2% respective encroachments within the TPZ and within the SRZ. These trees are considered to be of medium significance and are suitable for retention.

The extensive encroachments are considered to be significant and unsustainable by the tree. These trees will be required to be removed.

It is proposed to remove these trees as part of the removal and replacement strategy proposed by the Landscape Architect.

- Trees 1, 2, 3, 4, 6, 17, 26, 27, 28, 29, 30 & 31 are located immediately adjacent to the High Voltage Power works, providing a major encroachment within the TPZ and encroachment within the SRZ.

These trees are considered to be of low significance and should not be considered a constraint on the development.

The level of encroachment will require these trees to be removed.

It is proposed to remove these trees as part of the removal and replacement strategy proposed by the Landscape Architect.

- Trees 42 & 43 are located immediately adjacent to the Botany Road kerb realignment works, providing a major encroachment within the TPZ and encroachment within the SRZ.

These trees are considered to be of low significance and should not be considered a constraint on the development.

The level of encroachment will require these trees to be removed.

It is proposed to remove these trees as part of the removal and replacement strategy proposed by the Landscape Architect.

- Tree 60 is located within the proposed kerb and gutter realignment, providing an unsustainable encroachment. This tree is considered to be of low significance and should not be considered a constraint on the development.

This tree is proposed to be removed and replaced as part of a site wide renewal and replacement planting strategy.

4.3. Trees within the development footprint

- Trees 8, 10, 15, 18 & 19 are located within the High Voltage power mains installation. These trees are considered to be of high significance and should be retained and protected.

Extensive redesign of the High Voltage power mains would be required to retain these trees.

These trees cannot be retained based on the current design.

It is proposed to remove these trees as part of the removal and replacement strategy proposed by the Landscape Architect.

- Tree 61 is located within the road realignment. This tree is considered to be of high significance and should be retained and protected.

Extensive redesign of the roadway layout would be required to retain this tree.

This tree cannot be retained if the development is approved in its current form.

It is proposed to remove this tree as part of the removal and replacement strategy proposed by the Landscape Architect.

- Tree 14 is located within the High Voltage power mains installation. This tree is considered to be of medium significance and are suitable for retention.

Extensive redesign of the High Voltage power mains would be required to retain this tree.

This tree cannot be retained if the development is approved in its current form.

It is proposed to remove this tree as part of the removal and replacement strategy proposed by the Landscape Architect.

- Trees 34, 35, 36, 37 & 39 are located within the road realignment. These trees are considered to be of medium significance and is suitable for retention.

Extensive redesign of the roadway layout would be required to retain these trees.

These trees cannot be retained if the development is approved in its current form.

It is proposed to remove these trees as part of the removal and replacement strategy proposed by the Landscape Architect.

- Trees 11, 12, 32, 33, 38, 40 & 41 are located within the development footprint. These trees are considered to be of low significance and should not be considered a constraint on the development.

These trees cannot be retained if the development is approved in its current form.

It is proposed to remove these trees as part of the removal and replacement strategy proposed by the Landscape Architect.

4.4. Significant Trees affected by proposed Utility Installations

Trees 8, 9, 10, 13, 15, 18, 19, 53 & 55 are significant trees that are suitable for retention.

To enable the retention of these trees the proposed utility installations will need to be undertaken in a tree friendly manner.

Common tree friendly utility installation methodologies require the use of directional drilling, vacuum excavation, and underboring. These methodologies have been successfully implemented to minimise root damage on significant trees and have allowed them to be retained.

4.5. Trees in adjacent properties

There are a series of trees located in the rear of 72 Botany Road Waterloo. These tree have a series of minor (less than 40mm branches that extend over the rear boundary into a rear accessway.

It is proposed to install site sheds for the proposed construction works down this lane way, In the unlikely event that there are clearance issues the small branches could easily be temporarily tied back for the delivery.

- If this is insufficient minor pruning may be required as follows:
- 1 x 40mm branch from a Celtis sp. ,
- 1 x 30mm branch from a Radermachera
- 1 x 30mm branch from a Radermachera
- 8 x 20mm branches from a Cupaniopsis

5. Recommendations

In consideration of the data collected recommendations are provided for the removal or retention of trees including specific tree protection measures required to reduce the anticipated impacts from the construction on those trees to be retained. This report specifically recommends:

- The removal of Tree No.'s 1, 2, 3, 4, 5, 6, 7, 11, 12, 14, 17, 20, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 53, 55, 60 & 61 as there is an unavoidable major encroachment into the tree protection zone.
- The immediate removal of Tree No.11, as it is dead.
- The retention of Trees 16, 21 & 23. The construction will not impact these trees.
- The removal of Tree No.'s 47, 48, 49, 50, 51, 52, 54, 56, 57 & 58 as part of the landscape architects tree removal and replacement plan for the precinct.
- The retention of Tree No.'s 8, 9, 10, 13, 15, 18, 19, 22, 53 & 55. These trees are of high significance and will require design modification to avoid and minimise impacts from the major encroachment. Specifically using tree friendly methodologies such as non-destructive digging and root mapping when adjusting the road realignment to better accommodate the existing woody roots for these trees.
- The retention of trees 8, 9, 10, 13, 15, 18, 19, 53 & 55 These trees are of high significance and will require design modification to avoid and minimise impacts from the major encroachment. Specifically, the proposed utility installations will need to be undertaken in a tree friendly manner. Methodologies may include the use of directional drilling, vacuum excavation, and underboring.
- Minor pruning of overhanging branches in the lane behind 72-82 Botany. Pruning is only necessary if branches cannot be tied back prior to site shed delivery.
- Additional root, trunk & branch protection is required for Trees to be retained. It is anticipated that construction activities will not be able to be excluded from the entire TPZ as the installation of the tree protection fence is not reasonably practicable.
- Hand excavation is required for all works located within the TPZ of all retained trees. These works shall be supervised by the project arborist.
- An AQF Project Arborist shall be engaged to certify the tree protection works.
- For additional tree protection notes see **9. General Tree Protection Notes** (page 24).
- A Tree Protection Plan should be prepared to guide construction methodology and barrier installation as necessary to protect the trees during construction works. The plan should be prepared following provision of a CMP (Construction Management Plan) and/or TMP (Traffic Management Plan), in liaison with Construction plans and consistent with any conditions of consent and AS4970 (2009), sections 4 & 5.
- This arboricultural assessment should be reviewed upon the preparation of detailed design plans.

6. Tree Survey Table

No impact	Minor encroachment	Major encroachment	Within development footprint
-----------	--------------------	--------------------	------------------------------

NO#	Genus	Species	Common Name	Height	Spread	DBH	DRB	SRZ	TPZ	Age	Health	Crown	Signifi- cance	Am	Eco	Form	Development Setback and Encroachment	Comments
1	Acacia	longifolia	Sydney Golden Wattle	7	10	500	600	2670	6000	S	P	P	L	M	M	USV	2m from proposed pram ramp and high voltage trenching 32.4% encroachment into TPZ and SRZ.	Sparse canopy leaning. End of useful life. Inclusions D/W, active failures.
2	Olea	africana	African Olive	6	8	300	400	2252	3600	M	G	G	L	M	L	SU	2.2m from proposed high voltage trenching 13.5% encroachment into TPZ	Known weed, nuisance species. Recent fire @ base of tree has caused significant cambiana damage to trunk & scald, dieback in crown.
3	Ficus	microcarpa var. hillii	Hills weeping Fig	8	13	400	450	2366	4800	SM	F	F	L	M	M	BSD	2.6m from proposed high voltage trenching 14.6% encroachment into TPZ	Garden @ base obscured basal inspection. Tree suppressed by T5 congested leaders possible Inclusion @ 2.7m
4	Eucalyptus	sideroxylon	Mugga Ironbark	5.5	6.5	210	230	1785	2520	SM	G	G	L	M	M	US	0.3m from proposed kerb realignment and high voltage trenching 59.6% encroachment into TPZ and SRZ	Base of trunk obscured by lamandra.
5	Eucalyptus	punctata	Grey Gum	13	12.5	410	450	2366	4920	M	G	G	M	H	H	U	0.3m from proposed kerb realignment and high voltage trenching 78.9% encroachment into TPZ and SRZ	Wound on trim Northside @ 1m mechanical damage vandalism
6	Corymbia	eximia	Yellow Bloodwood	5	5	130	140	1500	2000	J	G	G	L	L	L	US	0.6m from proposed kerb realignment and high voltage trenching 63.5% encroachment into TPZ and SRZ	Blased crown over road. Leaning. Base of trunk obscured by gardens.
7	Eucalyptus	sideroxylon	Mugga Ironbark	6	8	250	250	1849	3000	SM	G	G	M	M	M	L	Within proposed HV trenching	Crown extends over entire road. Basal wounds from vehicles as growing over kurb & gutters.
8	Eucalyptus	microcorys	Tallowwood	24	17	775	825	3053	9300	M	G	G	H	H	M-H	SD	2.6m from proposed high voltage trenching 45.6% encroachment into TPZ	Excellent species.
9	Eucalyptus	microcorys	Tallowwood	24	20	1090	1180	3548	13080	M	G	G	H	H	M-H	SD	Within proposed HV trenching	Tree leaning over road.
10	Eucalyptus	sideroxylon	Mugga Ironbark	24	10	520	590	2652	6240	M	G	G	H	H	M	U	Remove Dead tree	Suppressed by T13
11	Dead	Tree	Mugga Ironbark			340		1500	4080								Within proposed HV trenching	
12	Corymbia	eximia	Yellow Bloodwood	6	3.5	110	130	1500	2000	J	G	G	L	L	M	U	5.3m from proposed high voltage trenching 26.2% encroachment into TPZ	D/W dead stubs
13	Eucalyptus	sp	Eucalyptus	24	22	1290	1290	3683	15480	M	G	G	H	H	H	USD	Within proposed HV trenching	Mechanical wound @3m street side. Lifting kerb.
14	Eucalyptus	sideroxylon	Mugga Ironbark	14	11	340	350	2129	4080	M	G	G	M	M	M	US	Lower FOB East side, poor attachment.	East side lower FOB lapped dead stubs, poor occlusion, mechanical damage, base of trunk street tree.
15	Eucalyptus	microcorys	Tallowwood	22	17.5	735	880	3136	8820	M	G	G	H	H	M	BSD	Within proposed HV trenching	Leaning to NW
16	Bauhinia	variegata L.	Bauhinia	10	10	440	440	2344	5280	M	G	G	M	H	L	SD	No Impact	
17	Corymbia	eximia	Yellow Bloodwood	5	3	130	140	1500	2000	J	G	G	L	L	H	U	0.5m from proposed high voltage trenching 37% encroachment into TPZ	Mechanical wound N side base of trunk
18	Eucalyptus	microcorys	Tallowwood	22	17	660	770	2965	7920	M	G	G	H	H	M	US	Within proposed HV trenching	Lower FOB rem, good occlusion. Some cambian damage to exposed roots street side.
19	Eucalyptus	microcorys	Tallowwood	26	16	790	1030	3351	9480	M	G	G	H	H	M	US	Within proposed HV trenching	Growth over kerb, exposed roots.

No impact	Minor encroachment	Major encroachment	Within development footprint
-----------	--------------------	--------------------	------------------------------

NO#	Genus	Species	Common Name	Height	Spread	DBH	DRB	SRZ	TPZ	Age	Health	Crown	Signifi- cance	Am	Eco	Form	Development Setback and Encroachment	Comments
20	<i>Eucalyptus</i>	<i>microcarpa</i>	Tallowwood	25	16	600	710	2866	7200	M	G	G	H	H	M	US	0.6m from proposed traffic signals 22.1% encroachment into TPZ and SRZ Proposed kerb realignment offset away from tree	Exposed roots @ base.
21	<i>Eucalyptus</i>	<i>microcarpa</i>	Tallowwood	24	17	605	780	2981	7260	M	G	G	H	H	M	US	8.2m from proposed kerb realignment and high voltage trenching 22.5% encroachment into TPZ Proposed kerb realignment offset away from tree	Exposed roots growing over and lifting kerb & gutter Surface roots out to kerb.
22	<i>Ficus</i>	<i>microcarpa</i> var <i>hillii</i>	Hills Weeping Fig	25	30	1520	1520	3946	18240	M	G	G	H	H	H	BSD		
23	<i>Ficus</i>	<i>microcarpa</i> var <i>hillii</i>	Hills Weeping Fig	25	30	1045	1045	3371	12540	M	G	G	H	H	H	BSD		
24	<i>Lophostemon</i>	<i>confertus</i>	Brush Box	9	11	450	400	2252	5400	SM	G	F	M	M	M	U	2.9m from proposed kerb realignment 41.6% encroachment into TPZ & SRZ	Previously lopped for power lines. Exposed roots. Most of crown is epicormic regrowth.
25	<i>Lophostemon</i>	<i>confertus</i>	Brush Box	9	7	255	300	1996	3060	SM	G	F	M	M	M	U	0.1m from proposed kerb realignment 45.2% encroachment into TPZ & SRZ	Previously lopped for power lines. Exposed roots. Most of crown is epicormic regrowth.
26	<i>Ficus</i>	<i>benjamina</i>	Weeping Fig	9	8	250	260	1879	3000	J	G	P	L	L	M	U	0.3m from proposed kerb realignment and high voltage trenching 83.5% encroachment into TPZ & SRZ	Codom @ 1.4m lopped @ 3m
27	<i>Ficus</i>	<i>benjamina</i>	Weeping Fig	9	5	240	300	1996	2880	J	G	P	L	L	M	U	0.2m from proposed kerb realignment and high voltage trenching 82.9% encroachment into TPZ & SRZ	Lopped @ 3m
28	<i>Ficus</i>	<i>benjamina</i>	Weeping Fig	8	4	220	220	1752	2640	J	G	P	L	L	M	U	0.4m from proposed kerb realignment and high voltage trenching 80.8 encroachment into TPZ & SRZ	Pruned away from awning & road.
29	<i>Ficus</i>	<i>benjamina</i>	Weeping Fig	7	5	190	270	1910	2280	J	G	P	L	L	M	U	0.3m from proposed kerb realignment and high voltage trenching 78.4% encroachment into TPZ & SRZ	Extensive aerial roots pruned away from awning and road.
30	<i>Lophostemon</i>	<i>confertus</i>	Brush Box	7	3	130	170	1572	2000	J	G	P	L	L	M	U	0.1m from proposed kerb realignment and high voltage trenching 75.7% encroachment into TPZ & SRZ	Lopped to 3m. Last leader lateral, assuming dominance.
31	<i>Ficus</i>	<i>benjamina</i>	Weeping Fig	9	9	260	360	2155	3120	J	G	Av	L	L	M	U	0.5m from proposed kerb realignment and high voltage trenching 42% encroachment into TPZ & SRZ	Exposed roots pruned away from awning, lopped @ 3m
32	<i>Eucalyptus</i>	<i>sideroxylon</i>	Mugga Ironbark	8	5	140	160	1533	2000	J	P	P	L	L	M	U	Within proposed road widening	Pruned for power lines. Last leader.
33	<i>Eucalyptus</i>	<i>sideroxylon</i>	Mugga Ironbark	9	8	240	270	1910	2880	SM	G	F	L	L	M	U	Within proposed road widening	Pruned for power lines. epicormic regrowth.
34	<i>Platanus</i>	<i>orientalis</i> x <i>hybrida</i>	London Plane Tree	14	8	330	440	2344	3960	SM	G	G	M	M	L	U	Within proposed road widening	Lifting pavement bias over road. Leader lost dominance over laterals assuming dominance.
35	<i>Lophostemon</i>	<i>confertus</i>	Brush Box	12	11	380	440	2344	4560	M	G	Av	M	H	M	U	Within proposed road widening	Lifting parent girdling roots
36	<i>Platanus</i>	<i>occidentalis</i>	American Sycamore	18	13	365	430	2322	4380	M	G	G	M	H	L	US	Within proposed road widening	Codom @ 2.1m
37	<i>Lophostemon</i>	<i>confertus</i>	Brush Box	10	10	340	430	2322	4080	M	G	F	M	H	M	US	Within proposed road widening	

No impact	Minor encroachment	Major encroachment	Within development footprint
-----------	--------------------	--------------------	------------------------------

NO#	Genus	Species	Common Name	Height	Spread	DBH	SRZ	TPZ	Age	Health	Crown	Signifi- cance	Development Setback and Encroachment			Comments	
													Am	Eco	Form		
38	Lophostemon	confertus	Brush Box	2.4	1	20	30	1500	2000	J	G	L	L	M	J	Within proposed road widening Newly planted tree.	
39	Robinia	pseudoacacia	Black Locust	10	9	235	310	2024	2820	SM	G	G	M	M	L	US	Within proposed road widening Lifting pavement surface roots
40	Lophostemon	confertus	Brush Box	7	4	160	200	1683	2000	J	G	G	L	L	M	U	Within proposed road widening Mechanical damage to base southside. 2x torn branches 30-40mm
41	Lophostemon	confertus	Brush Box	7	4	190	230	1785	2280	J	G	G	L	L	M	U	Within proposed road widening Timber free guard at base
42	Lophostemon	confertus	Brush Box	5	2	180	240	1817	2160	J	Av	P	L	L	L	U	0.3m from proposed kerb realignment Extensive cambian damage to base of trunk 55%. 37.5% encroachment into TPZ & SRZ 50% of upper crown removed from passing traffic.
43	Lophostemon	confertus	Brush Box	3	1	25	40	1500	2000	J	G	G	L	L	M	U	0.3m from proposed kerb realignment Newly planted tree. Tree guard adjacent not yet installed. 39.7% encroachment into TPZ & SRZ
44	Lophostemon	confertus	Brush Box	10	10	330	400	2252	3960	M	G	F	M	M	M	US	0.3m from proposed kerb realignment Exposed roots lifting pavement past clearance pruning to crown. 42.2% encroachment into TPZ & SRZ Bias crown away from road. Previously pruned for power lines epicormic regrowth crown. Pavement repair from lifting roots.
47	Lophostemon	confertus	Brush Box	11	11.5	380	450	2366	4560	M	G	Av	M	H	M	US	Proposed kerb realignment offset away from tree Proposed kerb realignment offset away from tree
48	Platanus	orientalis x hybrida	London Plane Tree	12	14	440	550	2575	5280	M	G	P	M	H	L	US	Proposed kerb realignment offset away from tree Crown pollarded for power lines.
49	Lophostemon	confertus	Brush Box	8	7	260	340	2104	3120	SM	G	P	M	M	M	U	Proposed kerb realignment offset away from tree Codom @ 3m. Pollarded crown for power lines.
50	Lophostemon	confertus	Brush Box	10	8	295	345	2117	3540	SM	G	G	M	M	M	U	Proposed kerb realignment offset away from tree Pruned away from road way.
51	Lophostemon	confertus	Brush Box	10	8	290	330	2077	3480	SM	G	G	M	M	M	U	Proposed kerb realignment offset away from tree Pruned away from road way.
52	Platanus	orientalis x hybrida	London Plane Tree	11	1.5	270	320	2051	3240	SM	G	F	L	M	L	U	Proposed kerb realignment offset away from tree Pollarded for power lines.
53	Melaleuca	quinenervia	Broad-leaved Paperbark	14	9	570	620	2707	6840	M	G	F	H	H	H	L	3.2m from proposed high voltage trenching Lopped for power lines. 1x leader extending over road, pushing kerb, lifting pavement. 18.6% encroachment into TPZ
54	Robinia	pseudoacacia	Black Locust	7	6	180	200	1683	2160	SM	G	G	L	L	L	U	Proposed kerb realignment offset away from tree Past pruning for power lines.
55	Melaleuca	quinenervia	Broad-leaved Paperbark	9	14	900	900	3166	10800	M	G	F	H	H	H	US	2.8m from proposed high voltage trenching Lopped for clearance to residence and power lines. 30.3% encroachment into TPZ
56	Tristaniaopsis	laurina	Water Gum	6	4	100	110	1310	1200	J	G	F	L	L	M	U	Proposed kerb realignment offset away from tree Crown lifted
57	Tristaniaopsis	laurina	Water Gum	6	8	300	300	1996	3600	M	G	G	L	M	L	UV	2.7m from proposed kerb realignment Lower limbs removed for clearance. 4.9% encroachment into TPZ
58	Tristaniaopsis	laurina	Water Gum	6	8	300	300	1996	3600	M	G	G	L	M	L	UV	2.8m from proposed kerb realignment Lower limbs removed for clearance. 4.1% encroachment into TPZ
60	Tristaniaopsis	laurina 'Luscious'	'Luscious' Water Gum	4	1	25	50	940	300	J	G	L	L	M	U	Within proposed road widening	
61	Melaleuca	quinenervia	Broad-leaved Paperbark	18	13	880	880	3136	10560	M	G	G	H	H	H	U	Dead stub @ 1m codom @ 1m. Branch removed @ 4m. Within proposed road widening

7. Tree Survey Table Notes

7.1. Genus, Species and Common Name

The botanical and common name of each tree is identified and recorded. Occasionally the exact species name is unknown; sp. is recorded to indicate this.

7.2. Height (m), Spread (m), Trunk Dia, DBH and DRB (mm)

- The tree's height and spread (diameter) is recorded in metres.
- The tree **DBH** is recorded in millimetres. DBH is an abbreviation of Diameter (of the trunk) measured at Breast Height (or 1.2m from the base of the trunk). If more than one trunk is present the DBH is calculated in accordance with AS4970-2009 Protection of Trees on Development Sites.
- If the tree has multiple trunks multiple trunks each trunk DBH (**Trunk Dia**) will be recorded individually.
- The tree **DRB** is recorded in millimetres. DRB is an abbreviation of Diameter (of the trunk) measured above the Root Buttress. It is required to calculate the SRZ in accordance with AS4970-2009 Protection of Trees on Development Sites when there is major encroachment within the TPZ, ie. greater than 10% is encroached upon or if there is an encroachment within the SRZ.

7.3. Age

The age class of each tree is estimated as either:

- **J** – Juvenile, a young sapling, easily replaced from nursery stock.
- **SM** - Semi Mature, a tree that has not grown to mature size.
- **M** - Mature, a tree that has reached mature size and will slowly increase in size over time.
- **OM** - Over Mature, a tree that has been mature for a long period and is beginning to display signs of decline, e.g. large dead branches.
- **S** - Senescent, an over mature tree that is now in decline.

7.4. Health and Vigour

The trees health and vigour is recorded as a measurement of:

- **G** - Good the tree does not appear stressed with no excessive dieback, insect infestation, decay, dead wood or epicormic shoots.
- **Avg** - Average Health the tree appears stressed and have some crown dieback, and/or a few epicormic shoots, and/or some dead wood in the crown and some new growth at branch tips. These trees may benefit from remediation of the growing environment to reduce stress and return it to good health.
- **F** - Fair the tree may have areas of crown dieback, and/or epicormic shoots, and/or areas of decay, and/or reduced new growth at branch tips. These trees have been stressed for a short period of time, remediation of the growing environment may improve the trees health.
- **P** - Poor the tree may have large areas of crown dieback, and/or many epicormic shoots, and/or reduced new growth at branch tips. These trees have been stressed for a long time, remediation of the growing environment would not return the tree to good health.

- **D** – Dead the tree is dead

7.5. Structural Condition (Crown)

The structural condition of each tree is assessed and recorded as either:

- **G** - Good Condition: the tree appears to have no visible indication of inherent structural defects.
- **Avg** - Average Condition: the tree has minor structural defects which may be corrected with remedial works or pruning, allowing the tree to return to Good Condition.
- **F** - Fair Condition: the tree has visible structural defects such as (but not limited to) dead branches, and/or an unbalanced crown, and/or leaning trunk and/or areas of decay. These trees do not demonstrate the typical form of their species, or have been damaged or have begun to deteriorate. Remedial works or pruning may return the tree to Average Condition.
- **P** - Poor Condition: the tree has significant structural defects such as (but not limited to) very large dead branches, and/or extremely unbalanced crown, and/or subsiding trunk and/or large areas of decay. These trees do not demonstrate the typical form of their species, or have been severely damaged or have deteriorated significantly. Remedial pruning would not return the tree to Fair Condition.

7.6. Significance

Measured as High, Medium or Low, see **0. The City of Sydney Council** tree preservation controls exclude dead, dying or dangerous trees, noxious weeds or listed nuisance species. The order defines a tree as (whether exotic, endemic or indigenous) as:

- e. Having a height of five (5) metres or more; or
- f. Having a canopy (crown) spread of over five (5) metres; or
- g. Having a trunk circumference of 300mm measured at ground level; or
- h. Is listed in the register of Significant Trees.

Determining a tree's significance (page 6). Significance may be expressed in increments of High, Medium or Low. For a High rating the majority (≥ 4) of the answers will be yes; For a Medium-High rating 3.5 of the answers will be yes; for a Medium rating half ($=3$) of the answers will be yes; for a Low-Medium rating 2.5 of the answers will be yes; and for the Low rating the minority of answers will be yes (≤ 2).

7.7. Amenity (Visual) Value

Amenity (Visual) value is a subjective measurement based on the tree's contribution to the landscape, it may be based on the tree's visual form, however it also includes non visual attributes such as provision of shade for a seat, screening of poor views or for privacy, or if it has historical significance. The amenity (visual) value is recorded as:

- **H** - High, the trees form is an excellent example of its species and it makes a great specimen and/or it has other attributes such screening, or is historical significance. These trees are visually prominent and valuable to the community or public domain.
- **M** - Medium, the tree may have an altered form and/or it has attributes that provides amenity to local residents only.
- **L** – Low, the tree is not a good specimen and it does not provide substantial benefit to local residents or the community.

7.8. Ecological Value

Ecological value is a measurement of the tree's contribution to the environment. It is determined by the tree's area of origin, its potential to provide habitat to native fauna and its potential to become an environmental pest. The ecological value is recorded as:

- **H** - High, the tree is locally native or remnant and/or it has habitat value for native fauna.
- **M** - Medium the tree is native but not locally native.
- **L** - Low, the tree is not native and/or it may be a listed nuisance or weed species.
- **Ha** – Habitat, is the tree valued by fauna for food (ie. foliage fruit or sap) or shelter (ie. nesting, roosting, dry or hollow).

7.9. Form

The form, structure or shape of each tree is assessed and recorded as either one or a combination of several of the below terms; **(U)** Upright, **(B)** Broad, **(C)** Conical, **(Sh)** Shrub, **(BC)** Bias Crown **(CS)** Crown Shy (also referenced is the adjacent dominant tree canopy ie. **T4**), **(V)** Vase, **(D)** Dome, **(P)** Palm, **(S)** Spreading, **(L)** Leaning or **(BM)** Basal Multi Trunked.

Crown form may also be assessed in accordance with the relationship with the neighbouring tree and recorded as either: **S** - Suppressed, the crown is located beneath another larger crown and is leaning away (Crown Shy); **CD** - Codominant, the crown is adjacent to another crown of similar size, their crown areas may appear joined; **D** - Dominant, the crown is above other lower crowns; **E** - Emergent, the crown emerges from a lower canopy formed by other dominant or codominant crowns.

7.10. Defects

The presence of one or a combination of several defects is recorded **(W)** Wound, **(D)** Decay, **(F)** Fungus, **(B)** Bulge, **(FB)** Fibre Buckling, **(C)** Cracks, **(S)** Split, **(H)** Hollow, **(DB)** Die Back, **(E)** Epicormic shoots, **(DW)** Dead Wood, **(I)** Inclusion, **(CA)** Cavities, **(PF)** Previous Failure, **(R)** Root Damage, **(P)** Pruning wound, **(PD)** Pests and diseases, **(ST)** Storm Damage.

7.11. SRZ (Structural Root Zone) – Radius (mm)

The SRZ is a radial area extending outwards from the centre of the trunk. This area contains the majority of the structural woody roots. This area is responsible primarily for stability. Root damage or root loss within this zone greatly increases the opportunity for decay fungi to ingress into the heartwood, causing internal decay in addition to destabilising the tree's structural integrity. The SRZ is calculated as follows (This calculation is derived from the Australian Standard 4970 – 2009 Protection of Trees on Development Sites):

$$\text{SRZ (Radius)} = (D \times 50)^{0.42} \times 0.64$$

7.12. TPZ (Tree Protection Zone) – Radius (mm)

The TPZ is a circular area with a radius measured by multiplying the DBH by twelve (12), or a circular area the size of the tree's drip line whichever is greater. This area contains the majority of the essential structural and feeder roots responsible for stability, gaseous exchange and water and nutrient uptake. Excavation, back filling, compaction or other disturbance should not occur in this area.

The TPZ is used to identify the minimum area required for the safe retention of a given tree. This calculation is derived from the Australian Standard 4970 – 2009 Protection of Trees on Development Sites. An incursion to 10% within the TPZ is potentially acceptable if no other option is available. A major encroachment (in excess of 10%) is required to be clearly justified by the project Arborist and compensated for elsewhere. Justification methodology may vary depending on site or the individual tree's health, vigour and ability to withstand disturbance and may require root investigation.

7.13. Development Setback / Impact

The successful retention of trees on construction sites is dependent on the adequate allocation and management of the space above, below and around trees to be retained.

The trunk and canopy of trees to be retained must be protected to ensure the trunk and branches are not damaged during construction. The removal of bark and / or branches allows the potential ingress of micro-organisms which may cause decay. Similarly the removal of bark restricts the tree's ability to distribute water, mineral ions and glucose.

It is essential to prevent the disturbance of the soil beneath the drip line of each tree, because this is the area where oxygen, water and mineral ions are absorbed by tree roots. Oxygen, water and mineral ions are essential for healthy plant growth. If soil becomes compacted, the ability of roots to function correctly is greatly reduced. Similarly the removal or damage of roots will reduce the ability of roots to function correctly. Woody roots provide stability for the tree and they also transport nutrients to the leaves.

The potential implications of removing or damaging roots are threefold:

1. The risk of whole tree failure is increased, as tree roots anchor and stabilise the tree. Woody roots are developed to assist in the support of the tree in prevailing wind, with these roots removed wind throw may occur, which would result in the mass failure of the tree.
2. The ability of the tree to absorb and transfer the essential nutrients, oxygen and water from the soil to the leaves is greatly affected. This will place the tree under stress and reduce the tree's ability to photosynthesise, and in turn cause the tree to use up stored energy reserves. These energy reserves are used to fight infection and insect attack, for new growth, maintenance of existing tissues and also for healing wounds. Once energy reserves become depleted a tree is much more susceptible to drought, disease and pest attack.
3. Open wounds are sites by which decay-causing pathogens can enter the tree. The severance or damage of woody roots creates sites where pathogens may gain ingress. Whilst the effect of decay may not be immediately apparent, the long term health and structure of the tree will be compromised.

7.14. Comments

Comments generally relate to the suitability for retention. The comments allow for a brief notation of other factors relevant to the assessment of the tree.

8. Tree Location Plan

9. General Tree Protection Notes

9.1. Structural Root Zone (SRZ)

The SRZ is a radial area extending outwards from the centre of the trunk calculated as follows:

$$\text{SRZ (Radius)} = (D \times 50)^{0.42} \times 0.64$$

9.2. Tree Protection Zone (TPZ)

The TPZ is a radial area extending outwards from the centre of the trunk equal to the DBH x 12. This area shall be protected by a TPF (see below). For all trees to be retained a TPZ is to be created and maintained.

The TPZ function is primarily to protect the root zone by restricting access however the canopy of the tree shall also be protected from damage or injury. The Project Arborist shall approve the extent of the TPZ.

The TPZ shall be mulched to a depth of 75mm with an approved organic mulch. Supplementary watering shall be provided in dry periods to reduce water or construction stress, particularly to those trees which may have incurred root disturbance.

An area equivalent to the encroachment is required to be provided (additional to and contiguous with the remaining TPZ) to offset against the encroachment. This additional area is to be protected during construction.

In the TPZ the following activities shall be excluded:

- Excavation, compaction or disturbance of the existing soil.
- The movement or storage of materials, waste or fill.
- Movement or storage of plant, machinery, equipment or vehicles.
- Any activity likely to damage the trunk, crown or root system.
- Scaffolding.

9.3. Tree Protection Fencing (TPF)

Prior to site establishment, tree protection fencing shall be installed to establish the TPZ for trees to be retained. Tree protection fencing shall be maintained entire for the duration of the construction program.

Tree protection fencing shall be:

- To enclose as much of the TPZ as can reasonably be enclosed, allowing for pedestrian access and 1m offset around construction footprint and scaffolding.
- Cyclone chain link wire fence or similar, with lockable access gates.
- Certified and Inspected by the Project Arborist
- Installed prior to the commencement of the works.
- Prominently signposted with 300mm x 450mm boards stating **"NO ACCESS TO THIS AREA - TREE PROTECTION ZONE CONTACT PROJECT ARBORIST 0407 006 852"**.

9.4. Trunk, Lower Branches and Root Zone Protection

Other measures may be required in addition to tree protection fencing. These specific protection measures will be installed as directed by the Project Arborist to protect the canopy, trunk or branches from the risk of damage.

Trunk and lower branch protection may be required to alleviate mechanical damage to a height of 3m. The minimum trunk protection shall consist of an initial padding layer beneath and battens consistent with *The Australian Standard for the Protection of Trees on Development Sites (AS 4970 – 2009), Section 4 and paragraph 4.5.2 and Figure 4*. The battens shall consist of lengths of 100 x 50mm (or varied to accommodate risk and tree structure) timber boards secured side by side, spaced 50mm apart with galvanised steel banding for the full circumference of the trunk without driving nails or screws into the trunk or branches. Trunk protection should be installed prior to any site works, maintained throughout the construction program and removed post construction.

Root protection may be required if site access and construction activities will not be able to be excluded from the entire TPZ as the installation of the tree protection fence is not reasonably practicable. Installation of root protection prior to the commencement of works to prevent the damage to roots such as i) Rumble boards as per section 4.5.3 - Ground protection and Figure 4 of AS4970 Protection of trees on development sites; or ii) construction of the above ground driveway.

The Project Arborist shall be consulted if there is risk of damage to a retained tree. The Project Arborist may require:

- A 75mm layer of approved mulch to be installed to the TPZ.
- A temporary drip irrigation system to be installed to the TPZ.

9.5. Tree Damage

In the event of damage to a tree or the TPZ of a tree to be retained the Project Arborist shall be engaged to inspect and provide advice on remedial action. This should be implemented as soon as practicable and certified by the Project Arborist.

9.6. Excavation within the TPZ

Excavation within the TPZ shall be avoided. All care shall be undertaken to preserve tree root systems. Excavation within the TPZ shall subject to the approval and supervision of the Project Arborist.

Excavation shall be executed by hand to avoid damage to roots by first excavating a narrow trench to the depth required. This will allow the location of woody structural roots greater than 40mm which can then be retained intact as necessary or pruned cleanly by and AQF level 3 Arborist or Horticulturalist. Final cut of roots should result in a clean cut, using appropriate tools as prescribed by the Australian Standard AS4970-2009 *Protection of trees on development sites*.

If excavation within the TPZ is required other than that anticipated in this report the Project Arborist shall be notified. A root mapping exercise may be required and should be certified by the Project Arborist. Root mapping shall be undertaken by either ground penetrating radar (GPR), air spade, water laser or by hand excavation. The purpose shall be to locate woody structural roots greater than 40mm in diameter.

Where roots 40mm dia. or greater are encountered, alternative construction method shall be considered to ensure roots are not severed. Adequate allowance must also be made for future radial root growth. In paved areas, consideration should be given to raising the proposed pavement level and using a porous fill material in preference to excavation.

If there is no avoiding placing services through the TPZ excavate outside the TPZ and underbore below the root ball of the tree as directed by the Arborist.

9.7. Fill

All fill material to be placed within the TPZ should be approved by Arborist and equal to 5-7mm Round River Pea Gravel to provide aeration and percolation to the root zone. Otherwise no fill should be placed within the TPZ of trees to be retained.

9.8. Pavements

Proposed paved areas within the TPZ should be placed on or above grade to minimise excavation, and avoid root severance and/or damage. Pavements should be permeable or avoided otherwise.

9.9. Pruning

All pruning work required (including root pruning) should be in accordance with Australian Standard No 4373 -2007 - *Pruning of Amenity Trees*. A Pruning Specification Report may be required if pruning works are proposed.

Roots should be severed with clean sharp implement flush with the face of the excavation and maintained in a moist condition. Severing roots by earthmoving equipment is unacceptable as this results in tearing damage to roots, putting the tree at greater risk of root decay and/or structural instability. Root pruning shall be performed under the supervision of the Project Arborist.

If required, branch reduction should be made to internal lateral branches or stems which are at least 1/3rd of the diameter of the branch being cut – or – removed at the branch collar, consistent with AS 4373 -2007; Sections 6.4 a) & b) and 7.3. Deadwooding should be carried out as required.

Whilst work is being carried out by climbing arborists (AQF Level 3) an aerial inspection of stems, branches and their attachments should be made. If minor additional works are needed to remove or correct defects it should be done at that time. If significant defects are found requiring heavy pruning or whole tree removal, photos should be taken and an AQF Level 5 Arborist be consulted prior to work being done.

9.10. Tree Removal

Tree removal work shall be carried out by an experienced Level 3 Arborist in accordance with the NSW Work Cover Code of Practice for the Amenity Tree Industry (1998).

Care shall be taken to avoid damage to trees during the felling operation. Stumps shall be grubbed-out using a mechanical stump grinder to a minimum depth of 300mm without damage to other retained root systems.

9.11. Post Construction Maintenance

In the event of any tree deteriorating in health after the construction period, the Project Arborist shall be engaged to provide advice on any remedial action. Remedial action shall be implemented as soon as practicable and certified by the Project Arborist.

Tree protection fencing with additional trunk and root protection shall be removed following completion of construction. The mulch layer in the TPZ shall be retained and replenished where required to maintain a 75mm thickness.

10. References

1. **AS 4970 - 2009 Protection of Trees on Development Sites**; Standards Australia.
2. **AS 4373 - 2007 Pruning of Amenity Trees**; Standards Australia.
3. Fairley, A., Moore, P.; **Native Plants of the Sydney District an Identification Guide**; New Holland; Sydney; 2002.
4. Fakes, J.; **Arboriculture and Tree Care and Maintenance Notes**; TAFE NSW; 2004.
5. Gilman E, Kempf B, Matheny N, Clark J, 2013, **Structural Pruning – A Guide for the Green Industry**, Urban Tree Foundation, Visalia, Calif. USA.
6. Harris, R.W., Clark, J.R; & Matheny, N.P; **Arboriculture; Integrated Management of Landscape Trees, Shrubs & Vines 3rd Edition**; Prentice Hall, New Jersey; 1999.
7. Institute of Australian Consulting Arboriculturists (IACA); **IACA Significance of a Tree, Assessment Rating System (STARS)**; 2010.
8. Institute of Australian Consulting Arboriculturists (IACA); **Sustainable Retention Index Value (SRIV)**; Version 4; 2010.
9. Lonsdale, D.; **Principles of Tree Hazard Assessment and Management**; The Stationery Office; London; 2005.
10. Matheny, N.P. & Clark, J.R.; **Trees & Development: A Technical Guide to Preservation of Trees During Land Development**; International Society of Arboriculture, Savoy, Illinois 1998.
11. Mattheck, Dr. Claus R., Breloer, Helge; **The Body Language of Trees - A Handbook for Failure Analysis 6th Edition**; The Stationery Office; London. England; 1994.
12. Robinson, L.; **Field Guide to the Native Plants of Sydney**; Kangaroo Press; Sydney; 1994.
13. Shigo, A. L.; **Modern Arboriculture Touch Trees**; Shigo and Trees Associates; New Hampshire; 2003.
14. Wrigley, J. W., Fagg, M. A.; **Australian Native Plants Cultivation, Use in Landscaping and Propagation**; Kangaroo Press; Sydney; 2003.
15. Barrell, J.; **Tree AZ: Detailed Guidance on its Use (Version 9.03 Australia + New Zealand)**; Barell Tree Consultancy, 2005.
16. Draper, D.B., Richards, P.A.; **Dictionary for Managing Trees in Urban Environments**; CSIRO Publishing; Collingwood, Victoria; 2009.

Appendix B – Waterloo ISD Arboricultural Impact Assessment prepared by Tree IQ

23rd November 2021

Attn: Nathaniel Lasky
John Holland
84 – 88 Botany Road
Alexandria NSW 2017

**RE: Waterloo Integrated Station Development
Arboricultural Assessment – Tree 59**

This Arboricultural Assessment was prepared for John Holland and relates to one (1) tree which is required to be removed to allow for the widening of the site access gate on Wellington Street. A Visual Tree Assessment¹ (VTA) was undertaken by treeiQ on the 18th November 2021. A summary of the tree assessment is provided in the table below:

Visual Tree Assessment – Tree 59

Species	<i>Tristanopsis laurinia</i> (Water Gum)
DBH (mm)	200mm
Height (m)	5m
Radial Crown Spread (m)	3m
Health	Good
Structural Condition	Good
Useful Life Expectancy (years)	15-40
Landscape Significance	Low
Comments	Wound(s), various stages of decay. Previous branch failure.
Radial Tree Protection Zone (m)	2.4m
Radial Structural Root Zone (m)	1.7m

Discussion

Tree 59 was identified as *Tristanopsis laurinia* (Water Gum) and is located within the road reserve on the northern side of Wellington Street. The tree is a small specimen and has low Landscape Significance.

Refer to Plates (**Appendix 1**)

The tree is required to be removed to allow the site access gate on Wellington Street to be widened to facilitate the installation of pre-cast elements (columns) within the station box. This activity requires the mobilisation of a 750T crane. It is understood the option to use a smaller crane through the existing gate access has been considered however this is not feasible due to the weight and location for the placement of the precast elements.

¹ Mattheck & Breloer (2003)

Conclusion

Tree 59 is to be removed to allow for the widening of the the site access gate on Wellington Street. It is a small tree of low Landscape Significance and replacement tree planting using healthy, advanced-size specimen could replace the loss of amenity from tree removal within a short timeframe.

A 200L replacement tree should be provided to help offset the loss of canopy cover from tree removal. Species selection should be undertaken in accordance with the *City of Sydney Street Tree Masterplan* (2011).

Please do not hesitate to contact me if require any additional information or have any questions.

Yours sincerely



Anna Hopwood – Director
Grad Cert. (Arboriculture)
Dip. Hort (Arboriculture)
Dip. Hort (Landscape Design)
ISA TRAQ

Appendix 1: Plates



Plate 1: *Tristania laurina* (Water Gum) – Tree 59