

ARBORICULTURAL IMPACT ASSESSMENT (AIA) & TREE CONSTRAINTS MANAGEMENT PLAN (TCMP)

NEV STAFFORD PARK,
BANANA & WEINAM STREETS,
REDLAND BAY

SEPTEMBER 2024

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

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Limitation

This report is only concerned with the condition and management strategies required for the tree. It includes an assessment based on the site visits and the information that I have been advised.

This report does not take into account the possibility of extreme climatic events not normally expected in this locality. Such events could include, but are not restricted to, severe windstorms, floods, or drought. This report also does not take into account the possibility of future outbreaks of pests or diseases.

Information contained in this report covers only the tree(s) that were examined and reflects the condition of the tree(s) at the time of inspection.

There is no warranty or guarantee, expressed or implied, that problems and/or deficiencies of a tree may not arise in the future.

DETAIL of REVISION AMENDMENTS

Arboricultural Impact Assessment and Tree Constraints Management Plan (AIA & TCMP) Control – the latest approved version of the AIA & TCMP is to be made available for all project personnel in consultation with the project's representative and/or Treescience with respect to the copyright release.

Each new revision to the AIA & TCMP will be distributed to all required personnel for review and approval.

The revision type is noted in the footer of each page. The document will be allocated a new revision type if the changes made affect the overall meaning of the document.

When a new revision to the document is available, a notification email is to be distributed to all project personnel by the project's representative advising of the update.

All individuals working near protected trees, if applicable, are responsible for the implementation and review of the latest AIA & TCMP.

DOCUMENT VERSION CONTROL

REV #	DESCRIPTION	SITE CAPTURE	AUTHOR	REVIEWED BY	APPROVED BY	DATE
1	Arboricultural Impact Assessment & Tree Constraints Management Plan	GC	JJ	KK	JJ	10/09/24

DISTRIBUTION

COPY	DESCRIPTION	DATE
Locked PDF	Engineering Solutions QLD Pty. Ltd.	10/09/24
Treescience File Reference	AIA & TCMP_Nev Stafford Park Cycleway, Redland Bay_Sept 2024_Treescience_V1	10/09/24

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Jason-jay Naylor (Director/Principal Arboricultural Scientist) for Treescience Pty Ltd atf The Treescience Trust

DEFINITIONS & ABBREVIATIONS

CLIENT	An organisation inviting and receiving tenders and letting contracts. For the purposes of this project – Engineering Solutions QLD Pty. Ltd.
CONTRACTOR	An organisation that contracts with a client to carry out consultancy, construction, and related services. For the purposes of this project – Treescience.
LOCAL or STATE GOVERNMENT DEPARTMENT	Redland City Council
GOVERNMENT AGENCY	A government department, authority, corporation, or entity established by an Act of the State Parliament
PROJECT TYPE	Proposed cycleway
SUB CONTRACTOR	Organisation that contracts with a principal contractor as the client to carry out construction and related services.

DOCUMENTS REVIEWED

FC-22-014-3E -(A) Nev Stafford PARK SIGNED

NOTE: This report is to be read in conjunction with the documents reviewed as referenced above unless otherwise stated within the body of the AIA & TCMP.

EXECUTIVE SUMMARY

The constituted views within this report meet the criteria for tree protection under the local and state Planning Scheme and were performed in accordance with AS4970–2009 by a suitably qualified Arborist (AQF Level 9).

Findings and Recommendations

A total of forty-five (45) trees were assessed.

A total of thirty-nine (39) trees are identified for retention from an arboricultural perspective. The tree of critical interest is manageable given adequate tree protection measures are implemented in accordance with this conditional report.

A total of six (6) trees were identified as other. Trees #33 and #44 are identified for removal on the provided drawings and trees #34–#36 are in the vicinity of tree #33 where tree #45 is in the vicinity of tree #44. From an arboricultural perspective with respect to AS4970–2009: Protection of Trees on Development Sites, the subject trees are viable for retention given the appropriate AWMS, tree protection measures and Arborist Supervision is applied for all works within the TPZ of the subject trees.

All forty-five trees assessed are classified as Council controlled trees.

The proposed construction footprint calculates out as major TPZ encroachments for trees #1, #3, #4, #6, #7, #9, #10, #21, #22, #23, #30, #31, #33, #36 & #37 and minor TPZ encroachments for trees #3, #4, #6, #7, #9, #10, #11, #12, #15, #19, #22, #34 & #44. Trees #2, #5, #8, #13, #14, #16, #17, #18, #20, #24 to #29, #32, #35, #38 to #43 & #45 have works directly adjacent to their TPZ's.

It is therefore considered based on the material provided, performing a site assessment, and having the relevant industry related experience that there is no arboricultural reason that should preclude this aspect of the proposed construction works which were assessed in accordance with AS4970–2009.

It is critical that all works within the defined TPZ are to be carried out under the direct guidance of Treescience and in accordance with this report.

The recommendations made within this report are subject to approval by the consenting authority.

The following factors were considered in relation to the proposed development:

- o potential construction impacts within and/or directly adjacent to a TPZ
- o tree species, tree age, tree health, structure, tree significance & construction tolerances
- o compliance requirements within AS4970–2009

The recommended minimum TPZ is marked as a clearly defined thatched line on all construction certificate drawings. The thatched line is keyed 'Tree Protection Zone'. Therefore, we recommend:

- o All works are to be conducted in accordance with this conditional AIA, unless alternative tree preservation measures are developed and approved by the relevant representatives and Treescience.
- o That this report is reviewed according to the final development approval and immediately prior to operational works approval.
- o Appoint Treescience as the Supervising Project Arborist to perform the 'watching brief' throughout the development to monitor the tree protection requirements and liaise with the consenting authority and relevant representatives.
- o The appointed Supervising Project Arborist will assist in supervising where required the associated works within the defined TPZ's and outline the action mitigation measures as required.
- o Establish a line of communication between the consenting authority, site Manager and Treescience, prior to any works commencing.
- o All contractors to attend a tree preservation induction and then sign and comply with the requirements of a 'Certificate of Recognition and Acceptance' form.
- o Ensuring design specifications and construction methodologies consider the tree of critical interest above and below the ground before implementation as outlined within the Arboricultural Work Method Statement(s).
- o Employment of careful documented arboricultural supervision and diligent management during the construction process for works within and/or directly adjacent to a TPZ; and
- o Ensuring any tender documents for the project reflect the requirement to undertake works and include supervision by Treescience.

Although this report proposes strategies and various specification for tree protection and associated site works, it may require amendments prior to Operational Works commencing, in order to reflect the development approval and any changes in tree health.

TABLE OF CONTENTS

Executive Summary:	page 6.
Definitions:	page 11.
Keywords:	page 11.
List of Abbreviations:	page 11.
01 Introduction:	page 12.
02 Scope of the Report:	page 13.
03 Method, Reporting Stages & Assessment Limitations:	page 14.
04 Project Area:	page 17.
05 Individual Tree Appraisal:	page 17.
06 Tree Retention Verse Removal:	page 40.
07 Development Impacts on Site Trees in Accordance with AS4970-2009:	page 40.
08 Understanding the Fundamentals of a TPZ & SRZ:	page 63.
09 Design Review:	page 67.
10 Proposed Tree Works Activities:	page 69.
11 Proposed Construction Activities:	page 72.
12 Arboricultural Work Method Statements	page 74.
13 Tree-Specific Mitigation Measures for Pre-Start Certification	page 79.
14 When to Consult with the Supervising Project Arborist:	page 86.
15 Design Considerations:	page 86.
16 Synopsis & Conclusion	page 87.
17 Implementations of the AIA & TCMP	page 90.

Certification of Performance

Bibliography

Appendix ONE: Tree Protection Signage *example*

Appendix TWO: Tree Protection Poster

Appendix THREE: Tree Protection Handout

Appendix FOUR: Type & Effects of Tree Damage

Precedent Disclaimer for Consultancy

DEFINITIONS

- *A tree – “A woody perennial plant, typically having a single stem or trunk growing to a considerable height and bearing lateral branches at some distance from the ground. Compare with SHRUB. - (in general use) any bush, shrub, or herbaceous plant with tall erect stem, e.g., a banana plant (The New Oxford Dictionary of English, 1st edn (1998))”.*
- *Tree keeper – The land that is, the soil in which the plant was initially planted even if its roots or branches subsequently stray beyond the property boundary.*

KEYWORDS

- *Tree Protection Zone – is a distance from the trunk set aside for the protection of a tree's crown and roots to provide for the viability of the tree(s) nominated for retention*
- *Structural Root Zone – is an area considered essential for tree stability*
- *Consenting Authority – Local and/or State Government*
- *Supervising Project Arborist – an AQF Level 5 Arborist (min 3–5yrs post graduate experience) with industry related experience to guide construction outcomes within a TPZ and has a thorough understanding of the guidelines and principles within AS4970–2009.*

LIST of ABBREVIATIONS

DBH – Diameter at Breast Height @ 1.3m

- *NALL – Natural Assets Local Law*
- *TPZ – Tree Protection Zone*
- *SRZ – Structural Root Zone*
- *PAIA – Preliminary Arboricultural Impact Assessment*
- *AIA – Arboricultural Impact Assessment*
- *TCMP– Tree Constraints Management Plan*
- *AWMS – Arboricultural Work Method Statement.*

NOTE: the area between the tree protection fencing and the tree of critical interest is deemed the exclusion zone for the related tree as outlined within this report unless otherwise advised.

01 INTRODUCTION

Treescience Pty Ltd was engaged by Engineering Solutions QLD Pty. Ltd. (Client) to prepare an AIA & TCMP with respect to a tree of critical interest.

This report has been prepared in accordance with Australian Standards AS4970-2009: Protection of Trees on Development Sites (AS4970-2009) to satisfy the interest of the consenting authority for the proposed redevelopment works at Nev Stafford Park adjacent to Banana & Weinam Streets (the project area) with respect to a tree of critical interest.

The purpose of the report is to assist the Client to set appropriate constraints, in the form of a report, including a tree preservation specification, that will ensure the construction processes and use of the land suitably allows for a tree of critical interest to not only survive but thrive for years to come.

The following factors were considered in relation to the proposed development:

- potential construction impacts within and/or directly adjacent to a TPZ
- tree species, tree age, tree health, structure, tree significance & construction tolerances
- compliance requirements within AS4970-2009

The constituted views within this report meet the criteria for tree protection under the local and state Planning Scheme and were performed in accordance with AS4970-2009 by a suitable qualified Arborist (min AQF Level 9).

It is assumed by Treescience that the reviewed and issued design drawing(s) are final, which the recommendations within this AIA & TCMP are founded.

01.1 client brief.

We request advice from a suitably qualified Arborist (min AQF level 5) to satisfy the interest of the consenting authority regarding the potential impact(s) of the proposed redevelopment and construction outcomes with regards to a tree of critical interest.

01.2 reporting compliance outcomes.

Specifically, the intent of the AIA & TCMP was to collect the tree attributes and provide arboricultural relevant information pertaining to the tree of critical interest that would assist in developing appropriate tree management strategies in accordance with AS4970-2009.

This AIA & TCMP considers the physiological needs of a tree and establishes the Tree Protection Zone (TPZ) in accordance with AS4970-2009 that is essential in avoiding injury or damage to a tree during proposed construction works.

The procedures and presentations within this report, therefore, adhere strictly to the good practice standards recognised within the AS4970-2009. AS4970-2009 provides guidance for:

- A balanced approach on deciding which trees are appropriate for retention, and
- Means of protecting and monitoring retained trees during development.

02 SCOPE OF THE REPORT

This report sets out to consider a tree's physical and structural requirements in order to maintain suitable tree health and stability in relation to the pending construction works through identifying and reducing potential conflicts.

This report will provide measures to ensure the protection and long-term survival of the nominated tree(s) above and below the ground. It should be noted that the proposed tree management strategies outlined within this report by Treescience are of a dynamic nature and of changeable character that underscores the flexibility of this working document.

This report outlines the historical documentation of the tree management practices and processes surrounding the proposed construction works adjacent to a tree of critical interest which is nominated for retention.

The application of diligent arboricultural management as outlined in this report will avoid unnecessary tree removal or damage to a tree nominated for retention. This report requires a re-examination according to any subsequent changes to the proposed design based on the document(s) and procedures reviewed by Treescience. The report shall include but not be limited to the following items:

- Demonstrate that any impacts to a tree of critical interest have been assessed and methods have been put in place to either remove, mitigate, or reduce such impacts to a lower level (as practical) for tree(s) proposed to be retained.
- Identify additional feasible mitigation measures that may be implemented during construction works for a protected tree(s) where works are identified within and/or directly adjacent to a TPZ.
- Provide guidance on the protection of retained tree(s).
- Outline the protection materials to be used to mitigate an impact via the installation of fencing, trunk/branch protection, ground protection, tree surgery, tree pruning/removal or plant health care etc., with regards to amelioration and remediation strategies to maintain tree health and encourage root proliferation into surrounding soils from the region where TPZ encroachment has been identified.
- Specify the Arboricultural Work Method Statements (AWMS) pertaining to specific construction parameters on the site and/or within TPZ.
- Identification of requirements for the short and longer-term management.
- Defining responsibilities; and
- Ensure the tree management procedures within this report are in accordance with the AS4970-2009.

03 METHOD, REPORTING STAGES & ASSESSMENT

LIMITATIONS

03.1 method.

Prior to any onsite inspection being carried out, a site survey plan and relevant drawings were provided to Treescience in order to help identify and assess the condition of the tree(s) of critical interest and assess any potential impacts to the tree(s) of critical interest within and/or adjacent to the proposed project area.

Since any part of a tree could fall, depending on the physical condition, it would be clearly impracticable to undertake a detailed investigation of every part of every tree. Therefore, the tree of critical interest has been inspected visually while standing at ground level, using binoculars as an aid where appropriate.

Visual Tree Assessment (VTA) criteria was employed to assess the mechanical integrity of the aerial parts of the tree of critical interest as outlined by Mattheck & Breloer (2002); with methods of hazard assessment as determined by Matheny & Clark (1994) and Lonsdale (1999).

The first part of the VTA takes into account biological factors such as vitality (leaves, bark, twig growth etc.), presence of fungi, old branches, wound occlusion, or wound wood development and/or compartmentalisation, and other biological factors that contribute to tree growth.

The second part of the VTA deals with tree structure or the mechanical aspects of trees such as breakages (defect symptoms such as bulges or ribs, wounds, leaning that causes transverse cracks, bark cracks and other abnormalities) and wind throw (root buttresses, soil cracks, sail area, root severance etc.).

Therefore, by applying up-dated arboricultural principles and practices as outlined above, the future health, influencing factors associated with previous and future activities which many have impacted the tree of critical interest has been considered in detail.

Additionally, soil characteristics and tree architecture were generally noted and/or analysed employing standard industry tools such as optical laser equipment, measuring tapes, microscopes, and auger/coring devices etc.

It should be noted that this assessment did not involve a detailed examination of the below ground characteristics or internal tree parts or wood degradation elements.

03.2 stage one reporting.

Completion of the *Tree Inventory and/or Preliminary Arboricultural Report* at the pre-design stage assesses the value and contribution of a tree located within and/or adjacent to the proposed project area, independent of any proposed layout design. This unbiased approach of evaluating a tree will allow the highest quality tree to be retained, which will be capable of tolerating the pressures during the proposed development processes.

This assessment represents the constraints imposed on-site by the existing tree(s), indicating TPZ's, tree dimensions, tree health and structure. This initial information should be used as a design tool to inform the proposed layout and foreseen tree preservation requirements.

03.3 stage two reporting.

In the post planning stage, the *Preliminary Arboricultural Report* will help inform the design team of the potential conflicts associated with the location of established existing tree(s), help establish a satisfactory layout, which will allow a harmonious juxtaposition of the established existing tree(s) with built structures and their associated infrastructure based on the identified guidelines within AS4970-2009.

03.4 stage three reporting.

As a part of the post planning approval stage an Arboricultural Impact Assessment & Tree Constraints Management Plan is to be commissioned. This report will determine that the final layout designs have satisfactorily been considered in alliance with a construction methodology to ensure the development can be successfully achieved based on the arboricultural constraints as outlined within AS4970-2009.

The Arboricultural Impact Assessment & Tree Constraints Management Plan will review the impacts of the planning conditions, which may include modifications to the TPZ's to meet the legislative requirements for the various State/Local Government Planning Authorities, while ensuring compliance with AS4970-2009.

03.5 stage four reporting.

The conclusion of the approval phase culminates with the implementation of the approved Arboricultural Impact Assessment & Tree Constraints Management Plan. A level of on-site Arboricultural supervision is required by a 'Supervising Project Arborist' for the following stages where works are within a TPZ:

- pre-construction – (identify trees for retention, document, and review tree conditions, establish TPZ's, inform all relevant parties of the defined TPZ and mitigation measures plus review any work method statements).
- construction – (supervise all tree clearing works and works that encroach within the defined TPZ's, monitor tree health for trees nominated for retention, provide direction/advice to construction personal and approved contractors where required, ensure tree and root protection measures are maintained for the duration of works).
- post construction – (inspect completed works, specify any remedial or follow-up works as required for tree health purposes, provide on-going monitoring of tree health as required and issue a final certification report).

03.6 summary of the various reporting stages.

Treescience has been involved in this project since stage **ONE**. Therefore, this report initiates stage **FOUR**. The recommendations within this report are founded on the provided drawings as acknowledged within the referenced documents reviewed (page 5).

03.7 assessment limitations.

Treescience is unaware of the Geographic Information System (GIS) accuracy within provided survey drawings, however, the relevant survey plans have been provided to Treescience to identify the tree(s) of critical interest within and adjacent to the project area to serve the investigative purposes of this report.

The tree assessment summary presented within this report is based on an inspection that was conducted in August 2024 using VTA methods.

The weather was clear, and we had an unobstructed view of the tree(s) of critical interest.

04 PROJECT AREA

The wider project area is a parkland environment consisting of established and emerging vegetation throughout the park and adjacent to the road reserve region.

Some tree removal and replanting works have recently occurred prior to our onsite assessment.

Therefore, the wider project area is defined as partially modified and has been selectively cleared of vegetation in the past to facilitate park structure(s) and landscape interests.

The adjacent neighbouring land was classified as a Council controlled parkland, and Council controlled road reserve.

05 INDIVIDUAL TREE APPRAISAL

In assessing the tree(s) of critical interest within/and or adjacent to the proposed construction footprint, the following factors have been considered:

- Arboricultural values.
- Future pressure for tree removal and pruning.
- Infrastructure placement.
- Direct impacts from construction and/or demolition activities.
- TPZ encroachments.
- Tree preservation strategies and construction mitigation measures; and

- Future tree management objectives above and below ground.

05.1 arboricultural rating table.

Arboricultural rating relates to the combination of tree condition factors, including health and structure (arboricultural merit), and conveys an amenity value. Amenity relates to the trees biological, functional, and aesthetic characteristics (Hitchmough 1994) within the developing urban landscape context.

CATEGORY	DESCRIPTION
High	Trees of high quality with an estimated remaining life expectancy of at least 30 plus years. A tree of extraordinary qualities which displayed good to fair structure with good vitality which is a good example of the species, or prominent large specimen, or has botanical significance or historical interest or commemorative interest or cultural significance. A single tree which is a part of group or avenue of trees. Generally, a tree that presents prominent arboricultural features with various areas of visual interest within the urban forest. Retention of these trees is highly desirable.
Moderate	Trees of moderate quality with an estimated remaining life expectancy of at least 20 plus years. A tree of moderate qualities which displayed a minimum of fair structure and health with a high emerging potential. A large to moderate tree which contributes to the landscape character, which could have material conservation or other cultural values. The tree could be marginally structurally compromised or display ill health qualities but has the potential to respond to beneficial arboricultural or tree surgery treatment(s). Retention of these trees is desirable.
Low	A tree of depleted and/or little landscape amenity. The tree presented poor health and/or with poor structure with an estimated remaining life expectancy of less than 10 years. The tree is not a significant specimen in its size and could easily be replaced. The tree is functionally inappropriate to a specific location and would be expected to be problematic if retained now or in the near foreseeable future. Basically, the tree is an unremarkable tree of very limited merit or such impaired condition that they do not qualify in higher categories. Retention of such trees may be considered if they do not require a disproportionate expenditure.
None	A tree that is significantly structurally compromised, dead and/or displayed health problems that cannot be mitigated through beneficial arboricultural treatment(s) and therefore cannot realistically be retained as a living tree in the context of the current land use for longer than 10 years. The tree should be considered for removal. This category excludes stag trees or trees with ecological values.

The following images depict the various tree(s) of critical interest growing environment, canopy morphology, branching arrangements, site characteristics, urban infrastructure and/or area(s) of interest.



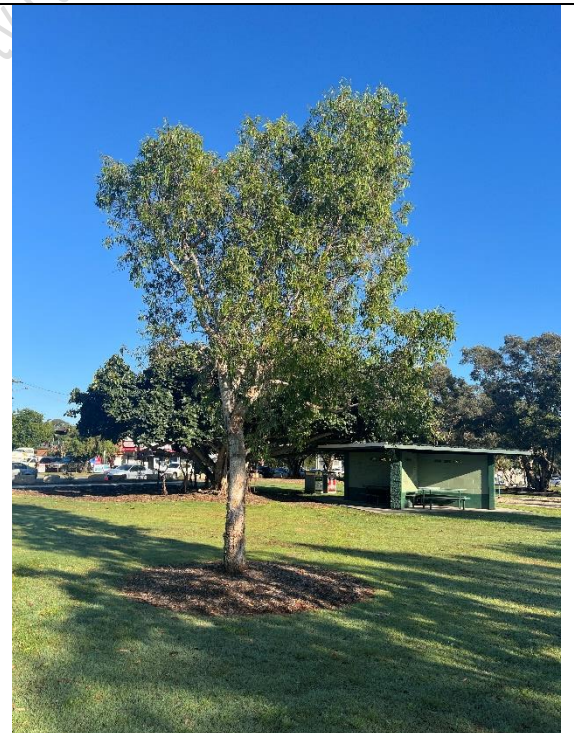
Trees #1 & #2



Trees #3-#10



Trees #11-#16



Trees #18 & #19



Tree #19



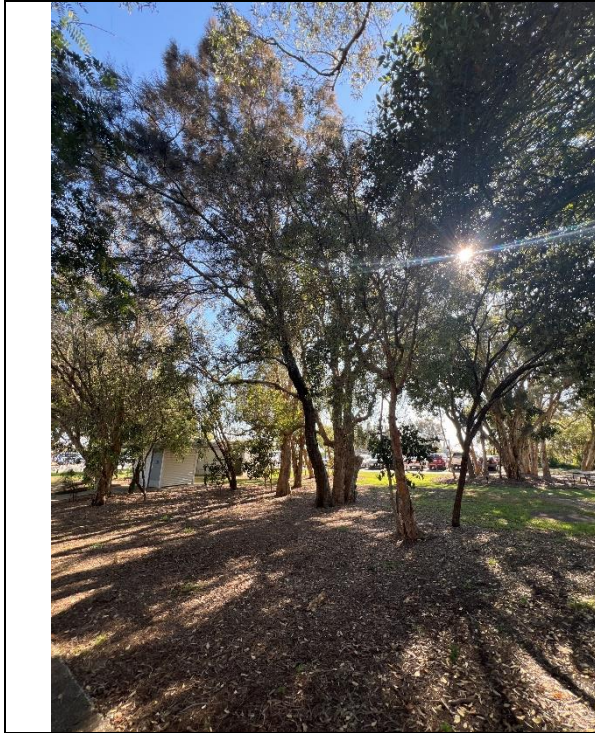
Trees #20-#23



Trees #16, #21 & #22



Tree #23



Trees #25-#30



Trees #30- #36



Tree #37



Trees #38 to #42



Tree #44



Tree #45

05.2 individual tree attributes and landscape amenity table.

The individual tree attributes and landscape amenity table is a collaboration of the individual tree dimensions, attributes and landscape amenity values pertaining to a tree of critical interest.

Tree number	Botanical name	Common name	Tree age	DBH (mm)	Tree height (m)	Average canopy width (m)	Tree health	Tree structure	Arboricultural values	Construction tolerance	Ecological values	Retain remove other	Comments
1	Eucalyptus tereticornis	Forest Red Gum	Early mature	300	13	7	Fair	Fair	Moderate	Fair-poor	Nothing observed	Retain	
2	Eucalyptus tereticornis	Forest Red Gum	Early mature	200	8	5	Fair	Fair	Moderate	Fair-poor	Nothing observed	Retain	Growing in association with tree 1
3	Melaleuca viminalis	Bottlebrush	Mature	300	5	6	Good	Fair	Moderate	Fair	Nothing observed	Retain	
4	Libidibia ferrea	Leopard Tree	Early mature	300	6	7	Good	Fair	Moderate	Fair	Nothing observed	Retain	
5	Melaleuca viminalis	Bottlebrush	Mature	200	5	5	Fair	Fair	Moderate	Fair	Nothing observed	Retain	
6	Melaleuca viminalis	Bottlebrush	Mature	250	5	4	Fair	Fair/poor	Moderate	Fair	Nothing observed	Retain	
7	Melaleuca viminalis	Bottlebrush	Early mature	100	4	2	Fair	Fair	Low	Fair	Nothing observed	Retain	
8	Melaleuca viminalis	Bottlebrush	Early mature	150	4	3	Fair	Poor	Low	Fair	Nothing observed	Retain	
9	Libidibia ferrea	Leopard Tree	Early mature	300	7	7	Fair	Fair	Moderate	Fair	Nothing observed	Retain	

Tree number	Botanical name	Common name	Tree age	DBH (mm)	Tree height (m)	Average canopy width (m)	Tree health	Tree structure	Arboricultural values	Construction tolerance	Ecological values	Retain remove other	Comments
10	Melaleuca viminalis	Bottlebrush	Mature	250	6	7	Good	Fair	Moderate	Fair	Nothing observed	Retain	
11	Melaleuca viminalis	Bottlebrush	Juvenile	50	1	1	Good	Good	Low	Fair	Nothing observed	Retain	Newly planted juvenile specimen, omitted from the provided drawings and located on the road reserve region side of the existing footpath.
12	Melaleuca viminalis	Bottlebrush	Juvenile	50	1	1	Good	Good	Low	Fair	Nothing observed	Retain	Newly planted juvenile specimen, omitted from the provided drawings and located on the road reserve region side of the existing footpath.
13	Melaleuca viminalis	Bottlebrush	Juvenile	50	1	1	Good	Good	Low	Fair	Nothing observed	Retain	Newly planted juvenile specimen, omitted from the provided drawings and located on the road reserve region side of the existing footpath.
14	Melaleuca viminalis	Bottlebrush	Juvenile	50	1	1	Good	Good	Low	Fair	Nothing observed	Retain	Newly planted juvenile specimen, omitted from the provided drawings and located on the road reserve region side of the existing footpath.
15	Melaleuca viminalis	Bottlebrush	Juvenile	50	1	1	Good	Good	Low	Fair	Nothing observed	Retain	Newly planted juvenile specimen, omitted from the provided drawings and located on the road reserve region side of the existing footpath.
16	Melaleuca viminalis	Bottlebrush	Juvenile	50	1	1	Good	Good	Low	Fair	Nothing observed	Retain	Newly planted juvenile specimen, omitted from the provided drawings and located on

Tree number	Botanical name	Common name	Tree age	DBH (mm)	Tree height (m)	Average canopy width (m)	Tree health	Tree structure	Arboricultural values	Construction tolerance	Ecological values	Retain remove other	Comments
													the road reserve region side of the existing footpath.
17	Melaleuca viminalis	Bottlebrush	Mature	300	5	5	Fair	Fair	Moderate	Fair	Nothing observed	Retain	The subject tree is on the opposite side of the Banana St.
18	Melaleuca leucadendra	Paperbark	Early mature	200	5	3	Good	Fair	Moderate	Good	Nothing observed	Retain	
19	Ficus benghalensis	Fig Tree	Mature	600	7	15	Good	Fair	Moderate	Excellent	Nothing observed	Retain	
20	Lagunaria patersonia	Norfolk Island Hibiscus	Mature	300	9	8	Good	Fair	Moderate	Fair	Nothing observed	Retain	The proposed pathway is directly adjacent to the subject tree.
21	Lagunaria patersonia	Norfolk Island Hibiscus	Early mature	400	9	8	Good	Fair	Moderate	Fair	Nothing observed	Retain	The proposed pathway is directly adjacent to the subject tree.
22	Melaleuca quinquenervia	Paperbark	Mature	700	12	11	Fair	Fair	Moderate	Good	Nothing observed	Retain	The subject tree is a broad-spreading specimen.
23	Senna siamea	Kassod Tree	Early mature	350	5	7	Fair	Fair	Moderate	Fair	Nothing observed	Retain	The subject tree was omitted from the provided drawings and is adjacent to tree 22.
24	Melaleuca leucadendra	Paperbark	Early mature	200	6	3	Fair	Fair	Moderate	Good	Nothing observed	Retain	The subject tree was omitted from the provided drawings and is in the vicinity of trees 25-27.
25	Casuarina cunninghamiana	She-oak	Mature	400	8	8	Fair	Fair	Moderate	Poor	Nothing observed	Retain	

Tree number	Botanical name	Common name	Tree age	DBH (mm)	Tree height (m)	Average canopy width (m)	Tree health	Tree structure	Arboricultural values	Construction tolerance	Ecological values	Retain remove other	Comments
26	Melaleuca quinquenervia	Paperbark	Early mature	350	12	6	Fair	Fair	Moderate	Good	Nothing observed	Retain	
27	Melaleuca quinquenervia	Paperbark	Mature	400	15	6	Fair	Fair	Moderate	Good	Nothing observed	Retain	
28	Melaleuca quinquenervia	Paperbark	Mature	450	14	8	Fair	Fair	Moderate	Good	Nothing observed	Retain	
29	Melaleuca salicina	Bottlebrush	Early mature	300	7	5	Fair	Fair	Moderate	Fair	Nothing observed	Retain	
30	Melaleuca quinquenervia	Paperbark	Early mature	350	14	5	Fair	Fair	Moderate	Good	Nothing observed	Retain	The proposed pathway is directly adjacent to the subject tree.
31	Alphitonia excelsa	Soap Tree	Early mature	250	6	4	Fair	Fair/poor	Moderate	Fair	Nothing observed	Retain	The subject tree was omitted from the provided drawings and is adjacent to tree 30.
32	Melaleuca leucadendra	Paperbark	Early mature	250	6	5	Fair	Fair	Moderate	Good	Nothing observed	Retain	The subject tree was omitted from the provided drawings and is adjacent to tree 30.
33	Melaleuca quinquenervia	Paperbark	Mature	450	15	8	Fair	Fair	Moderate	Good	Nothing observed	Other	The subject tree has been identified for removal on the provided drawings.
34	Melaleuca viminalis	Bottlebrush	Early mature	250	5	5	Fair	Fair	Moderate	Fair	Nothing observed	Other	The subject tree has been omitted from the provided drawings and is within the vicinity of tree 33, which has been identified for removal on the provided drawings.

Tree number	Botanical name	Common name	Tree age	DBH (mm)	Tree height (m)	Average canopy width (m)	Tree health	Tree structure	Arboricultural values	Construction tolerance	Ecological values	Retain remove other	Comments
35	Melaleuca viminalis	Bottlebrush	Early mature	250	5	5	Fair	Fair/poor	Moderate	Fair	Nothing observed	Other	The subject tree has been omitted from the provided drawings and is within the vicinity of tree 33, which has been identified for removal on the provided drawings.
36	Melaleuca viminalis	Bottlebrush	Early mature	250	5	4	Fair	Fair	Moderate	Fair	Nothing observed	Other	The subject tree has been omitted from the provided drawings and is within the vicinity of tree 33, which has been identified for removal on the provided drawings.
37	Melaleuca quinquenervia	Paperbark	Mature	500	13	9	Fair	Fair	Moderate	Good	Nothing observed	Retain	
38	Lagunaria patersonia	Norfolk Island Hibiscus	Mature	350	7	6	Fair	Fair	Moderate	Fair	Nothing observed	Retain	
39	Buckinghamia celsissima	Ivory Curl	Early mature	200	6	4	Good	Fair	Moderate	Fair	Nothing observed	Retain	The subject tree was omitted from the provided drawings and is adjacent to trees 40 and 41.
40	Lagunaria patersonia	Norfolk Island Hibiscus	Early mature	250	6	4	Fair	Fair	Moderate	Fair	Nothing observed	Retain	
41	Lagunaria patersonia	Norfolk Island Hibiscus	Mature	300	6	5	Fair	Fair	Moderate	Fair	Nothing observed	Retain	
42	Lagunaria patersonia	Norfolk Island Hibiscus	Mature	300	5	5	Fair	Fair	Moderate	Fair	Nothing observed	Retain	The subject tree was omitted from the provided drawings and is adjacent to trees 40 and 41.

Tree number	Botanical name	Common name	Tree age	DBH (mm)	Tree height (m)	Average canopy width (m)	Tree health	Tree structure	Arboricultural values	Construction tolerance	Ecological values	Retain remove other	Comments
43	Melaleuca viminalis	Bottlebrush	Early mature	200	4	2	Fair	Fair	Moderate	Fair	Nothing observed	Retain	The subject tree is on the opposite side of the Banana St.
44	Melaleuca quinquenervia	Paperbark	Early mature	350	7	9	Fair	Fair	Moderate	Good	Nothing observed	Other	The subject tree has been identified for removal on the provided drawings
45	Casuarina cunninghamiana	She-oak	Early mature	150	4	3	Fair/poor	Fair	Low	Poor	Nothing observed	Other	The subject tree was omitted from the provided drawings and is adjacent to tree 44.

05.3 individual tree attributes and landscape amenity table summary.

Generally, the tree health was fair as evident by leaf colour, shoot extension, canopy density and production of wound wood.

The structural form generally appeared typical for the species and age class based on their available growing space and above ground influences.

A total of forty-five (45) trees were assessed.

A total of thirty-nine (39) trees are identified for retention from an arboricultural perspective. The tree of critical interest is manageable given adequate tree protection measures are implemented in accordance with this conditional report.

A total of six (6) trees were identified as other. Trees #33 and #44 are identified for removal on the provided drawings and trees #34–#36 are in the vicinity of tree #33 where tree #45 is in the vicinity of tree #44. From an arboricultural perspective with respect to AS4970–2009: Protection of Trees on Development Sites, the subject trees are viable for retention given the appropriate AWMS, tree protection measures and Arborist Supervision is applied for all works within the TPZ of the subject trees.

A total of thirty-six (36) trees were defined as exhibiting moderate arboricultural rating.

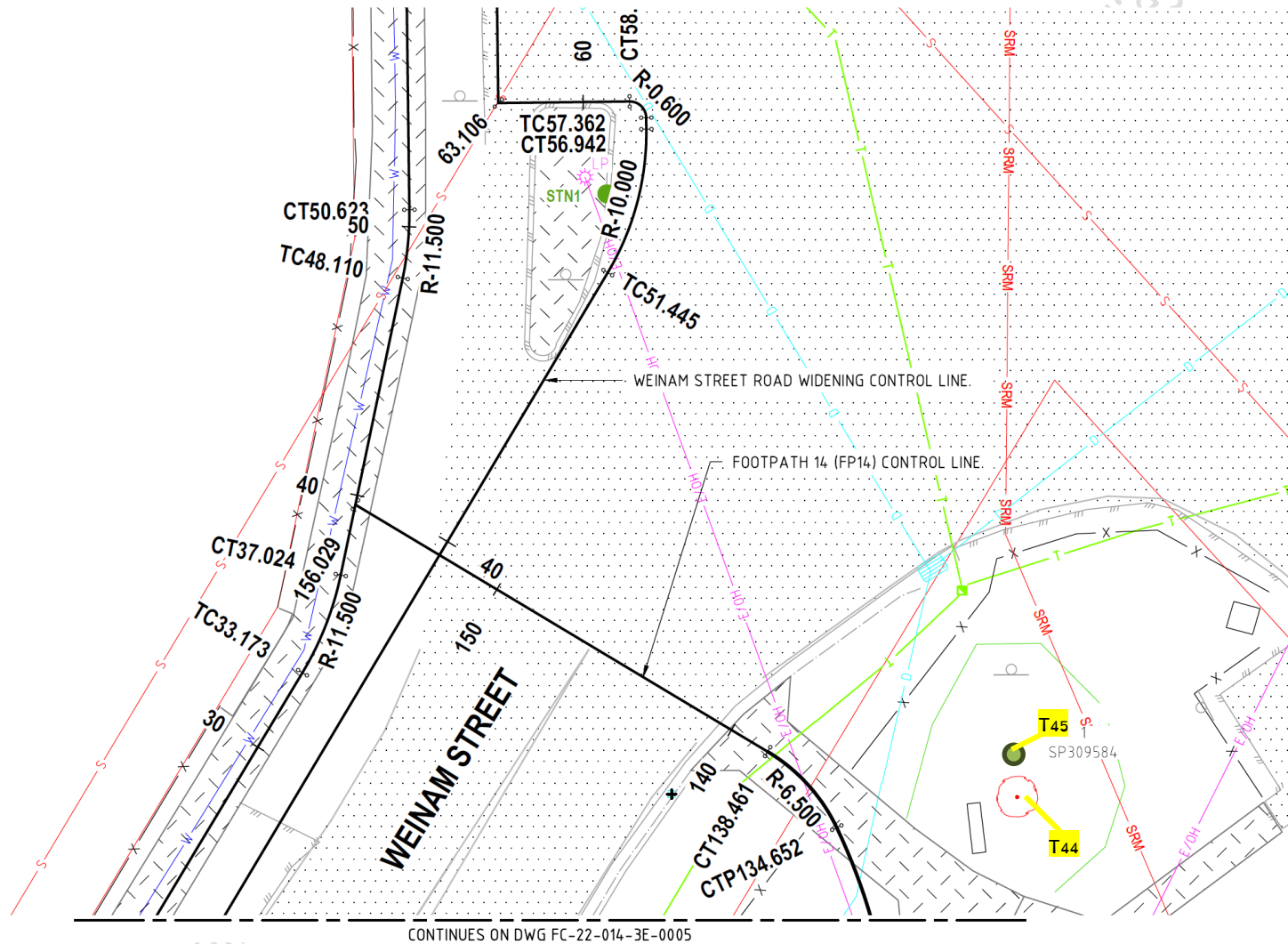
A total of nine (9) trees were defined as exhibiting low arboricultural rating.

All forty-five (45) trees are classified as Council controlled trees.

None of the forty-five trees were classified as having ecological values.

It should be noted that no detail fauna survey was undertaken by Treescience, and where general habitat features were observed they have been documented within the individual tree attributes and landscape amenity table.





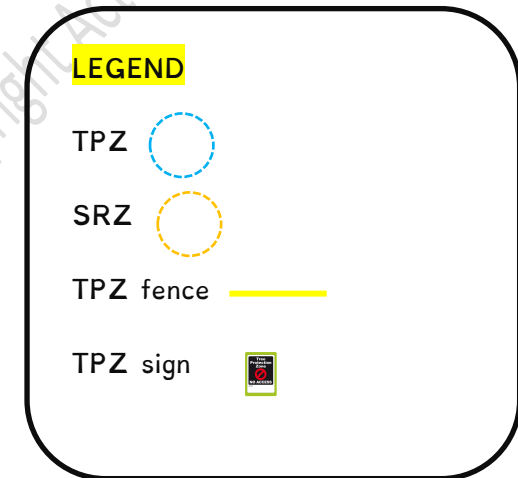
05.5 tree constraints management plan. (approx. scale)

A PRESTART MEETING IS REQUIRED BEFORE THE PROPOSED WORKS COMMENCE, WITH THE APPOINTED PROJECT ARBORIST (min AQF Level 5 with 5 years post graduate experience) AND RELEVANT REPRESENTATIVES.

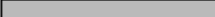
FAILURE TO COMPLY COULD RESULT IN PREMATURE TREE DECLINE AND/OR COMPROMISE A TREE'S STRUCTURAL INTEGRITY.

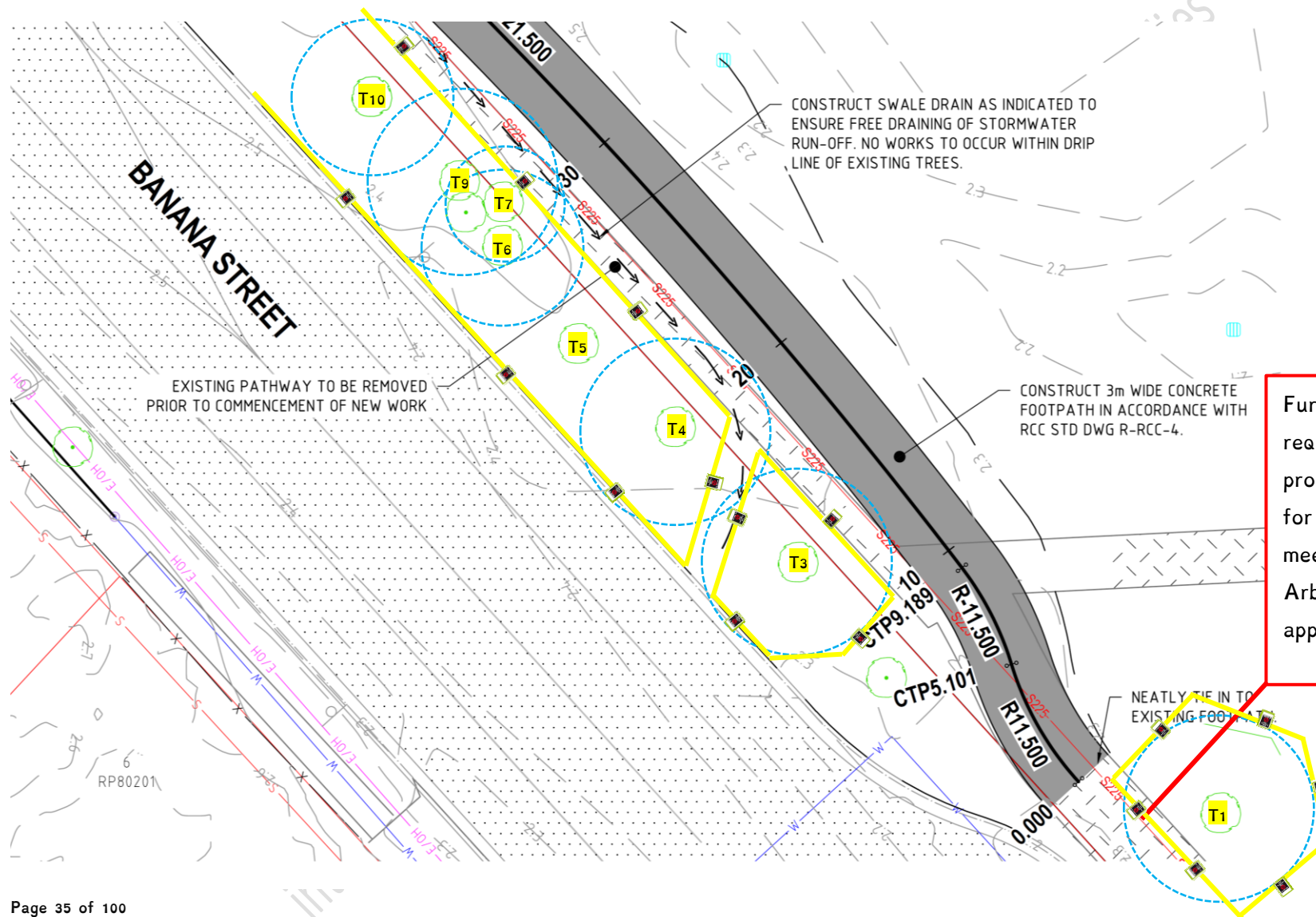
THE INTERFERENCE OF COUNCIL CONTROLLED VEGETATION MAY REQUIRE APPROVAL FROM THE CONSENTING AUTHORITY.

THE INTERFERENCE OF PRIVATE VEGETATION WILL REQUIRE APPROVAL FROM THE TREE KEEPER.

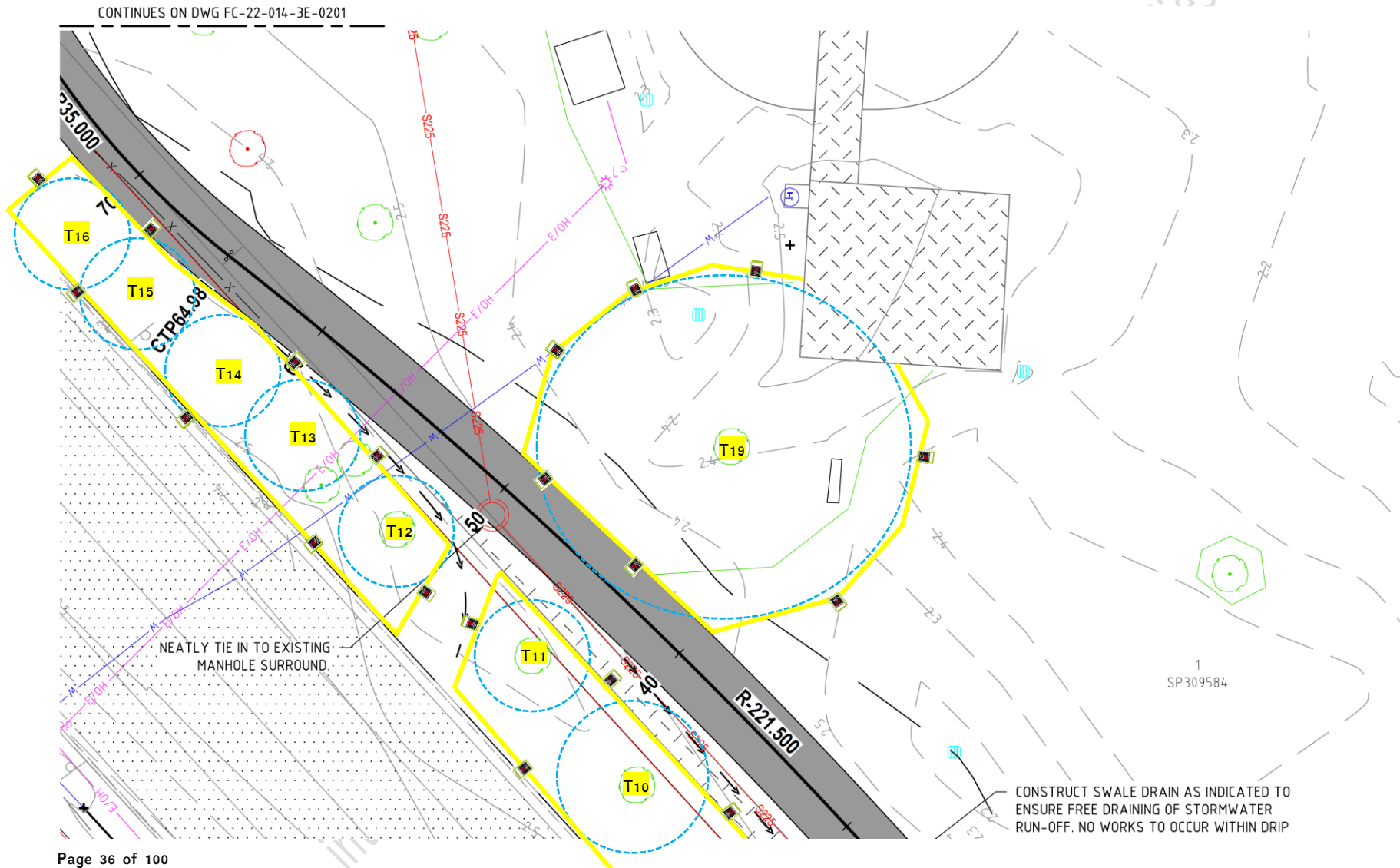


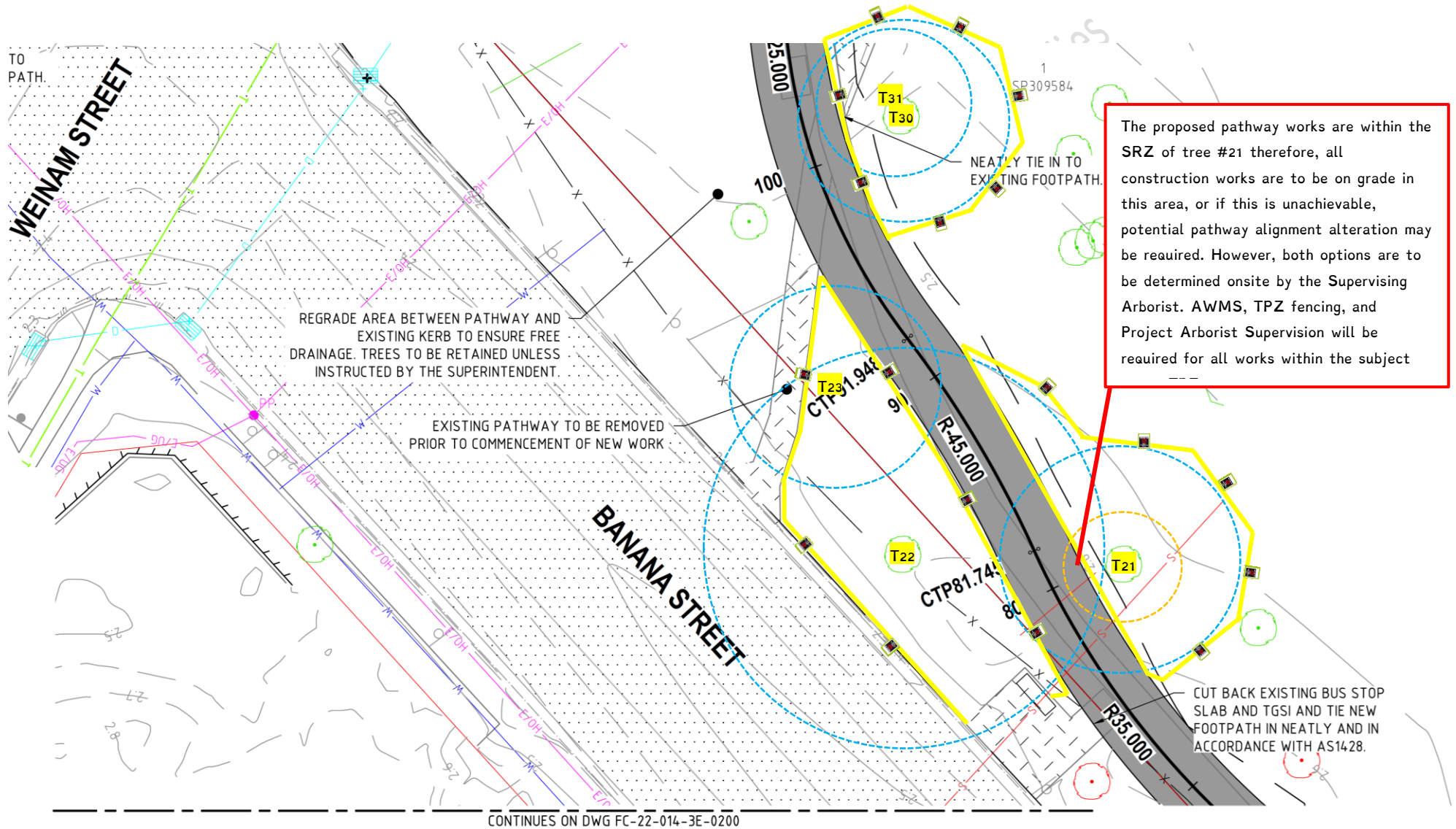
LEGEND	
	EXISTING LIGHTPOLE AND POWERPOLE
	EXISTING WATERMAIN
	EXISTING WATER CONDUIT
	EXISTING DRAINAGE LINE
	EXISTING CONTOURS
	EXISTING LOT BOUNDARY
	EXISTING BOTTOM OF BATTER
	EXISTING TOP OF BATTER
	EXISTING TELCO LINE & STRUCTURE
	EXISTING UNDERGROUND ELECTRICITY LINE
	EXISTING OVER HEAD ELECTRICITY LINE
	EXISTING CONCRETE EDGE LINE
	EXISTING GRAVITY SEWER MAIN
	EXISTING RISING SEWER MAIN
	EXISTING VEGETATION TO REMAIN
	EXISTING VEGETATION TO BE REMOVED
	EXISTING PAVEMENT SURFACING
	EXISTING CONCRETE
	EXISTING ROAD CENTRELINE
	EXISTING KERB AND CHANNEL

	PROPOSED TOP OF BATTER
	PROPOSED CHANGE OF GRADE
	PROPOSED LOT
	PROPOSED MAJOR CONTOURS
	PROPOSED MINOR CONTOURS
	PROPOSED PAVEMENT SURFACING
	PROPOSED CONCRETE
	PROPOSED LANDSCAPING BY OTHERS
	PROPOSED CUTBACK LINE
	PROPOSED KERB AND CHANNEL
	PROPOSED BOTTOM OF BATTER
	PROPOSED DRAINAGE SWALE
	GRAVITY SEWER MAIN TO BE CONSTRUCTED DURING STAGE 3A WORKS
	PROPOSED DRAINAGE STRUCTURE NUMBER
	PROPOSED DRAINAGE LINE
	PROPOSED DRAINAGE STRUCTURE
	PROPOSED ROAD SIGNAGE
	PROPOSED WHEEL STOPS

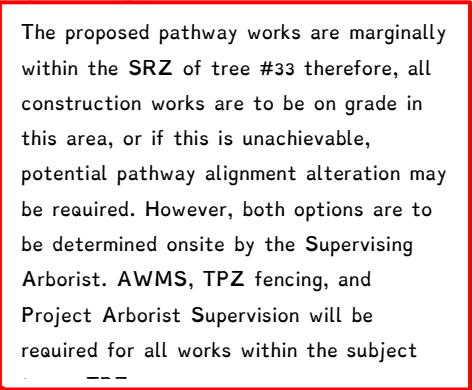


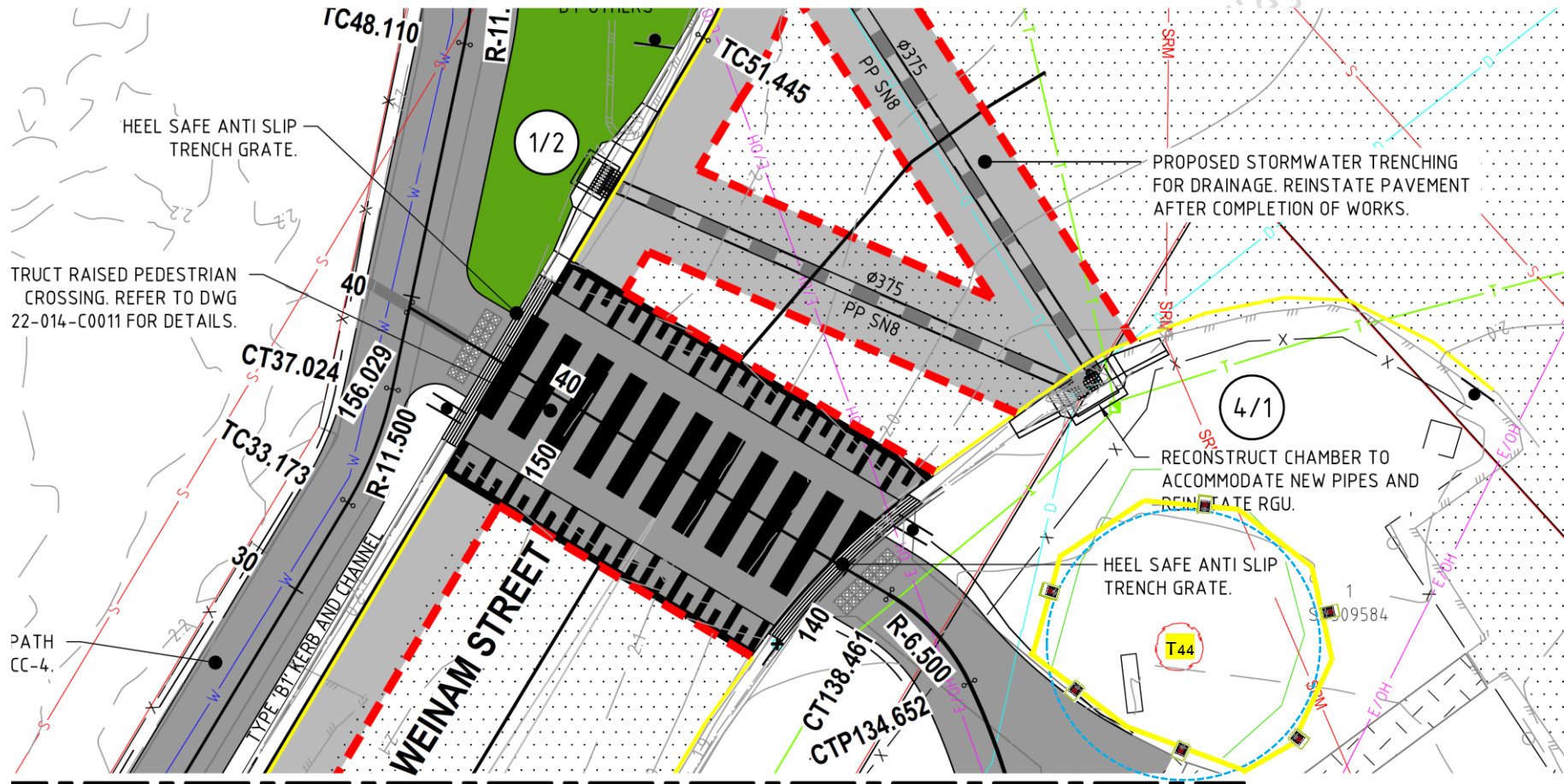
Further detail drawings are required to quantify the proposed construction methods for the sewer main or a prestart meeting with the Supervising Arborist to ascertain the appropriate AWMS.





The proposed pathway works are within the SRZ of tree #21 therefore, all construction works are to be on grade in this area, or if this is unachievable, potential pathway alignment alteration may be required. However, both options are to be determined onsite by the Supervising Arborist. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject





06 TREE RETENTION VERSE REMOVAL

The existing tree(s) on the site may be classified as either an opportunity or a constraint within the context of the site. The conditions of the tree, dimensions, established location and construction tolerance etc., are some elements that have been considered when assessing what tree is suitable for retention as outlined in the individual tree attributes and landscape amenity table.

Removal of a healthy and suitably structured tree generally relates to the demolition and construction requirements within a defined TPZ. These construction components are assessed as being integral to the functionality of the redevelopment along with considering the elements for long term tree retention.

In other areas where the proposed works are within and/or directly adjacent to a TPZ, tree removal has been limited through detail design, construction planning, and/or works method statement review.

Avoidance of substantial impacts to a tree nominated for retention has been undertaken through individual tree evaluation and design process to avoid direct impacts to a tree nominated for retention, while ensuring the proposed design and construction intent is located outside of a TPZ wherever possible.

07 DEVELOPMENT IMPACTS ON SITE TREE/S IN ACCORDANCE WITH AS4970-2009

During development works, trees often become damaged or killed because of injury they receive throughout the construction phases. This is usually due to root crushing injury, root severance, mechanical injury from collision with above ground parts, soil compaction from vehicular movement or soil contamination through spillage or tipping out of toxic materials within canopy dripline. In order to prevent injury from occurring, a TPZ is established for each tree worthy of retention. The amount of protection required is evaluated and based on several factors in accordance with the guidelines outlined within AS4970-2009 and related industry experience.

07.1 TPZ encroachment considerations.

To meet the tree preservation requirements of Australian Standards AS4970-2009: Protection of Trees on Development Sites, the potential impacts of encroachment into the TPZ's have been considered by Treescience as outlined below:

- a) The location and distribution of tree roots has been determined via an onsite assessment and performing non-destructive hand excavation methods on a need by basis. If further comprehensive investigation methods are undertaken (pneumatic, hydraulic, or ground penetrating radar), the use of such methods will be documented within the body of this report and correctly referenced.
- b) The potential loss of root mass resulting from a TPZ encroachment has been appraised from an arboricultural perspective.
- c) The trees' construction tolerance has been categorised and appropriately considered within the context of the proposed design.
- d) Tree age, branching architecture, canopy morphology and overall tree form has been considered.
- e) Soil characteristics, topography, and drainage etc., are some of the design elements that have been considered.
- f) The presence of pre-existing or past structures or obstacles affecting root growth or branching formation has been considered; and
- g) Design factors have been considered with regards to the trees' future growth as well as allocated growing space above and below the ground based on our review of the provided design drawing(s).

07.2 TPZ encroachment calculations table.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
1	Eucalyptus tereticornis	2.2m = sewer	300	3.6	2	2.5	13.7	Major	Inground services	Contiguous	The proposed inground services calculates as a major TPZ encroachment. Further detail drawings are required to quantify the proposed construction methods or a prestart meeting with the Supervising Arborist to ascertain the appropriate AWMS. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.
2	Eucalyptus tereticornis	2.5m	200	2.4	1.7	1.7	0	n/a	Inground services	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
3	Melaleuca viminalis	1.9m = demolition; 2.9m = swale & sewer; 3.1 = pathway	300	3.6	2	2.5	18, 5 & 3	Major & Minor	Inground services, demolition of impervious surfaces & minor grade changes	Contiguous	The proposed demolition works of the existing pathway calculate as a major TPZ encroachment, however, based on the type of disturbance, the TPZ encroachment is manageable. The proposed swale, pathway construction and sewer calculates as a minor and therefore manageable TPZ encroachment. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. Further detail drawings are required to quantify the proposed construction methods or a prestart meeting with the Supervising Arborist to ascertain the appropriate AWMS. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
4	Libidibia ferrea	1.9m = demolition; 2.2m = swale; 2.9m = sewer	300	3.6	2	2.5	18, 13.7 & 5	Major & Minor	Inground services, demolition of impervious surfaces & minor grade changes	Contiguous	The proposed demolition works of the existing pathway calculate as a major TPZ encroachment, however, based on the type of disturbance, the TPZ encroachment is manageable. The proposed swale calculates as a major TPZ encroachment. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. The proposed inground services calculates as a minor TPZ encroachment. Further detail drawings are required to quantify the proposed construction methods or a prestart meeting with the Supervising Arborist to ascertain the appropriate AWMS. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
5	Melaleuca viminalis	2.5m	200	2.4	1.7	1.7	0	n/a	Inground services, demolition of impervious surfaces & minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
6	Melaleuca viminalis	1.9m = demolition; 2.9m = swale	250	3	1.8	2.1	12.6 & 0.4	Major & Minor	Inground services, demolition of impervious surfaces & minor grade changes	Contiguous	The proposed demolition works of the existing pathway calculate as a major TPZ encroachment, however, based on the type of disturbance, the TPZ encroachment is manageable. The proposed swale calculates as a minor and therefore manageable TPZ encroachment. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
7	Melaleuca viminalis	0.9m = demolition; 1.8m = swale	100	2	1.5	1.4	22.4 & 1.9	Major & Minor	Inground services, demolition of impervious surfaces & minor grade changes	Contiguous	The demolition of the existing pavement is calculated as a major TPZ encroachment, however, the works are localised and manageable. The proposed swale calculates as a minor TPZ encroachment. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.
8	Melaleuca viminalis	2.2m	150	2	1.5	1.4	0	n/a	Inground services, demolition of impervious surfaces & minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
9	Libidibia ferrea	1.6m = demolition; 2.6m = swale & sewer; 3.3 = pathway	300	3.6	2	2.5	22.7, 8.4 & 1.4	Major & Minor	Inground services, demolition of impervious surfaces & minor grade changes	Contiguous	The proposed demolition works of the existing pathway calculate as a major TPZ encroachment, however, based on the type of disturbance, the TPZ encroachment is manageable. The proposed swale and sewer calculates as a minor and therefore manageable TPZ encroachment. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
10	Melaleuca viminalis	1.9m = demolition; 2.9m = swale	250	3	1.8	2.1	12.6 & 0.4	Major & Minor	Inground services, demolition of impervious surfaces & minor grade changes	Contiguous	The proposed demolition works of the existing pathway calculate as a major TPZ encroachment, however, based on the type of disturbance, the TPZ encroachment is manageable. The proposed swale calculates as a minor and therefore manageable TPZ encroachment. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.
11	Melaleuca viminalis	1.5m = demolition	50	2	1.5	1.4	7.2	Minor	Inground services, demolition of impervious surfaces & minor grade changes	Contiguous	The proposed demolition works calculates as a minor TPZ encroachment and therefore manageable. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
12	Melaleuca viminalis	1.6m = swale & demolition	50	2	1.5	1.4	5.2	Minor	Inground services, demolition of impervious surfaces & minor grade changes	Contiguous	The proposed swale and demolition works calculates as a minor TPZ encroachment and therefore manageable. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.
13	Melaleuca viminalis	2m	50	2	1.5	1.4	0	n/a	Demolition of impervious surfaces & minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
14	Melaleuca viminalis	2m	50	2	1.5	1.4	0	n/a	Demolition of impervious surfaces & minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
15	Melaleuca viminalis	1.9m	50	2	1.5	1.4	0.7	Minor	Demolition of impervious surfaces & minor grade changes	Contiguous	The proposed pathway construction works calculates as a minor TPZ encroachment and therefore manageable. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.
16	Melaleuca viminalis	2m	50	2	1.5	1.4	0	n/a	Demolition of impervious surfaces & minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
17	Melaleuca viminalis	15m+	300	3.6	2	2.5	0	n/a	No perceived works	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
18	Melaleuca leucadendra	15m+	200	2.4	1.7	1.7	0	n/a	Minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
19	Ficus benghalensis	6m	600	7.2	2.7	5	4	Minor	Minor grade changes	Contiguous	The proposed pathway construction is calculated as a minor and manageable TPZ encroachment. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.
20	Lagunaria patersonia	4.6m	300	3.6	2	2.5	0	n/a	Minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
21	Lagunaria patersonia	1.5m	400	4.8	2.3	3.3	30.4	Major	Minor grade changes	Contiguous	The proposed pathway works are within the SRZ of the subject tree therefore, all construction works are to be on grade in this area, or if this is unachievable, potential pathway alignment alteration may be required. However, both options are to be determined onsite by the Supervising Arborist. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
22	Melaleuca quinquenervia	3.2m = pathway; 6.8m = demolition	700	8.4	2.8	5.8	26.3 & 4.8	Major & Minor	Demolition of impervious surfaces & minor grade changes	Contiguous	The proposed pathway construction calculates as a major TPZ encroachment, however, based on the type of disturbance, the TPZ encroachment is manageable. The proposed pathway demolition calculates as a minor and manageable TPZ encroachment. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.
23	Senna siamea	1m = demolition; 2.2m = pavement	350	4.2	2.1	2.9	22.2 & 18.2	Major	Demolition of impervious surfaces & minor grade changes	Contiguous	The proposed demolition and construction works are calculated as major encroachments, however, based on the type of disturbance, the TPZ encroachment is manageable. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
24	Melaleuca leucadendra	6.5m	200	2.4	1.7	1.7	0	n/a	Minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
25	Casuarina cunninghamiana	6.3m	400	4.8	2.3	3.3	0	n/a	Minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
26	Melaleuca quinquenervia	6.5m	350	4.2	2.1	2.9	0	n/a	Minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
27	Melaleuca quinquenervia	7.3m	400	4.8	2.3	3.3	0	n/a	Minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
28	Melaleuca quinquenervia	8.3m	450	5.4	2.4	3.7	0	n/a	Minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
29	Melaleuca salicina	10m+	300	3.6	2	2.5	0	n/a	Minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
30	Melaleuca quinquenervia	2.4m	350	4.2	2.1	2.9	15.7	Major	Minor grade changes	Contiguous	The proposed pathway construction calculates as a major TPZ encroachment, however, based on the type of disturbance, the TPZ encroachment is manageable. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.
31	Alphitonia excelsa	2m	250	3	1.8	2.1	11	Major	Minor grade changes	Contiguous	The proposed demolition and construction works are calculated as major encroachments, however, based on the type of disturbance, the TPZ encroachment is manageable. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
32	Melaleuca leucadendra	3.4m	250	3	1.8	2.1	0	n/a	Minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
33	Melaleuca quinquenervia	2.3m	450	5.4	2.4	3.7	23.7	Major	Minor grade changes	Contiguous	The proposed pathway works are marginally within the SRZ of the subject tree therefore, all construction works are to be on grade in this area, or if this is unachievable, potential pathway alignment alteration may be required. However, both options are to be determined onsite by the Supervising Arborist. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.
34	Melaleuca viminalis	2.6m	250	3	1.8	2.1	2.9	Minor	Minor grade changes	Contiguous	The proposed pathway works calculates as a minor TPZ encroachment and therefore manageable. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
35	Melaleuca viminalis	3m	250	3	1.8	2.1	0	n/a	Minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
36	Melaleuca viminalis	1.8m	250	3	1.8	2.1	14.2	Major	Minor grade changes	Contiguous	The proposed pathway calculates as a major TPZ encroachment; however, the localised soil grade changes are perceived as minor. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.
37	Melaleuca quinquenervia	3.1m	500	6	2.5	4.1	18.6	Major	Minor grade changes	Contiguous	The proposed pathway construction calculates as a major TPZ encroachment, however, based on the type of disturbance, the TPZ encroachment is manageable. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
38	Lagunaria patersonia	10m+	350	4.2	2.1	2.9	0	n/a	Minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
39	Buckinghamia a celsissima	10m+	200	2.4	1.7	1.7	0	n/a	Minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
40	Lagunaria patersonia	10m+	250	3	1.8	2.1	0	n/a	Minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
41	Lagunaria patersonia	5.9m	300	3.6	2	2.5	0	n/a	Minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
42	Lagunaria patersonia	10m+	300	3.6	2	2.5	0	n/a	Minor grade changes	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.
43	Melaleuca viminalis	20m+	200	2.4	1.7	1.7	0	n/a	No perceived works	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.

TREE #	TREE SPECIES	ESTIMATED DISTANCE FROM PROPOSED CONSTRUCTION WORKS TO THE SUBJECT TREE	DBH (mm)	TPZ RADIUS (mm)	SRZ RADIUS (mm)	DISTANCE TO MEET THE 10% ENCROACHMENT	% of TPZ ENCROACHMENT	TPZ ENCROACHMENT MAJOR or MINOR	PROPOSED WORKS WITHIN OR DIRECTLY ADJACENT TO THE TPZ	TPZ OFFSET AREA - CONTIGUOUS OR NON-CONTIGUOUS	COMMENTS
44	Melaleuca quinquenervia	3.1m	350	4.2	2.1	2.9	7.7	Minor	Inground services, minor grade changes & potential machinery movement	Contiguous	The proposed pathway construction is calculated as a minor and manageable TPZ encroachment. The existing soil surface should not be significantly lowered beyond 150mm or significantly raised beyond 300mm. AWMS, TPZ fencing, and Project Arborist Supervision will be required for all works within the subject tree's TPZ.
45	Casuarina cunninghamiana	4m	150	2	1.5	1.4	0	n/a	Inground services, minor grade changes & potential machinery movement	n/a	The proposed construction works are outside of the subject tree's TPZ, therefore meeting the requirements of AS4970-2009.

07.3 TPZ encroachment calculations table summary.

AS4970–2009 guidelines are largely founded on the distance of disturbance from a tree.

It should be noted that it is extremely difficult to speculate the volume and/or directional growth of a tree's entire woody root system, particularly in the case of an urban tree.

Therefore, the expert view provided by Treescience is that the type and volume of disturbance is more important than the distance from a tree.

A TPZ relates to the root system of the tree and is necessary to maintain the health of the tree during and following the proposed development of the site, by limiting construction activities and machinery access within the TPZ. The TPZ also ensures that the development does not compromise the stability of a tree through root damage.

The TPZ does not indicate the root extent (root spread) of a tree. The TPZ merely designates the area in which soil disturbance must be minimised (and therefore root damaged minimised) in order to maintain the health, longevity, and stability of a tree.

A TPZ is not a 'sterile zone' or an 'exclusion zone' for all activities and development, but instead defines the area around a tree in which tree-sensitive design and construction techniques must be employed, in order to maintain the health, longevity and structure of a tree.

The TPZ has been calculated using a method that conforms to AS4970–2009 as outlined within this report. AS4970–2009 allows for the use of species-and-tree-specific data to modify the factorial (up and down) to be more specific to the tree being assessed, i.e., relating to the tolerance of the species to root disturbance and the age class of the tree for its species etc.

The TPZ encroachment calculations table provides in meters as a radial measurement, unless otherwise stated, taken from the centre of the trunk region for an individual tree applying the generic matrix within AS4970–2009.

The proposed redevelopment works/construction footprint calculates out as either, a major or minor or zero TPZ encroachment for a tree nominated for retention. These results were founded on the broad calculations within the generic matrix within AS4970–2009 based on the distance of disturbance from a tree as opposed to the type of disturbance.

The identified TPZ encroachments principally relates to but not limited to the following proposed construction works:

- demolition;
- construction;
- in-ground services.

The SRZ has been calculated applying the matrix within AS4970–2009. This is a formula-based method which uses the diameter of the tree at above the root buttress (effectively at ground level in most trees) multiplied by a non-linear factor. In this case, the proposed development footprint is inside the SRZ of subject trees #21 and #33.

The SRZ is effectively an ‘exclusion zone’ for all activities and development, as it defines the area around the tree in which major structural (anchorage) root are likely to occur. Any development occurring within the SRZ must not modify the natural soil in any way, and no encroachment is allowable (without potentially affecting the stability of the tree).

07.4 major TPZ encroachment.

A total of fifteen (15) trees, trees #1, #3, #4, #6, #7, #9, #10, #21, #22, #23, #30, #31, #33, #36 & #37, will be subjected to a TPZ encroachment greater than 10%.

07.5 minor TPZ encroachment.

A total of thirteen (13) trees, trees #3, #4, #6, #7, #9, #10, #11, #12, #15, #19, #22, #34 & #44, will be subjected to a TPZ encroachment less than 10%.

07.6 no TPZ encroachment.

A total of twenty-four (24) trees, trees #2, #5, #8, #13, #14, #16, #17, #18, #20, #24 to #29, #32, #35, #38 to #43 & #45, have no TPZ encroachment.

07.7 risk mitigation summary and procedures

- The TPZ is marked on the relevant construction drawing(s) along with tree identification numbers.
- Prior to the commencement of any works, Treescience and relevant representatives are to meet on site to assess and document the status of the trees health and agree on the relevant work method(s) and outline the communication pathway for all works within a TPZ.

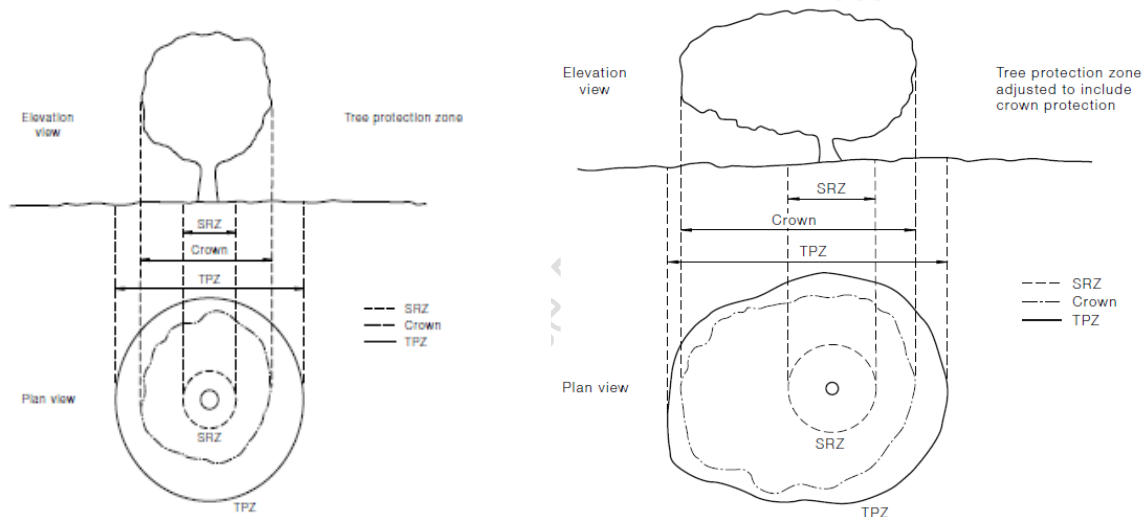
- All contractors, site workers, machinery operators are to attend a tree preservation induction and then sign and comply with the requirements of a 'Certificate of Recognition and Acceptance' of the conditional specifications outlined within this report prior to the commencement of works.
- Further detail design drawing/s are to be reviewed by Treescience prior to the commencement of any works within a TPZ.
- If works are within a TPZ, consultation with Treescience is required prior to the commencement of works to discuss the required work method and tree protection measures.
- All proposed excavation works within a TPZ are to be identified through survey pegs and/or marker paint prior to the commencement of works.
- The tree protection fence and/or other protection measures are to be erected prior to the commencement of works and correctly installed for the duration of the project as defined by Treescience.
- Access into a defined TPZ or movement of any TPZ protection barriers will only be permitted in consultation with Treescience.
- No machinery with an upward pointing exhaust is to be operated under a low-lying tree canopy (to avoid heat damage to the tree canopy) where possible for greater than 4hrs.
- All machinery operating within a TPZ requires a spotter and adoption of appropriate steps to mitigate direct impacts with a tree below and above the ground.
- The excavator should be placed as far outside the TPZ area as possible and should reach over into the TPZ toward the trunk region and drag soil back toward the machine to prevent ripping and tearing of tree roots.
- If a Hydro-vacuum machine is required, the machine is to be placed outside of the TPZ where possible, plus have an allocated spotter to ensure the plant does not come into contact with a tree.

- Hydro-vacuum excavation is to occur at low pressure (@450PSI) in order to navigate through the root zone without causing damage unless otherwise determined onsite by the Treescience Supervising Project Arborist. The nozzle (or soft tip) is to produce a fine mist and not a cutting nozzle when working within the immediate region of a tree root of critical interest as defined by Treescience. This approach generally reduces the potential of bark being stripped from a root or root severance.
- It is understood that selective tree roots will require removal. The retention and removal of tree roots will occur on a need by basis in direct consultation with Treescience.
- Root pruning or removal is to be undertaken by the Treescience Supervising Project Arborist (min AQF level 5 with 5yrs post graduate experience) and the use of appropriate hand tools. The final cut will be as small as possible, free from ragged, split, or torn ends and straight for all tree roots cut.
- If the area of excavation with regards has an extensive network of tree roots or a tree root greater than 50mm in diameter or greater, the area of excavation is to be backfilled within 12hrs of opening without causing damage to tree roots or covered using wet hessian, to ensure tree roots retain moisture and do not dry out for all trees nominated for retention. The volume of soil to cover exposed tree roots, future soil extraction method(s) and watering etc., is to be defined by Treescience. The hessian is to be comprised from 100% Jute which is a natural fiber.
- Backfilling around tree roots, the imported soil is to be comprised of an indigenous topsoil and organic matter with a neutral pH, free from weed growth and harmful materials. The backfilling of soil is to be carefully rammed & watered in and around tree roots to eliminate air pockets.
- No stock piling of bulk or harmful materials are to be placed in a defined TPZ.
- All tree pruning works are to form alliance with Australian Standards AS4374-2007: Pruning of Amenity Trees and/or permit.

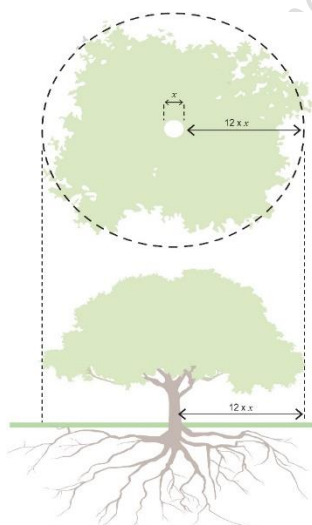
08 UNDERSTANDING THE FUNDAMENTALS OF A TPZ & SRZ

The AS4970-2009 states that the TPZ is "... the principle means of protecting a tree on development sites. The TPZ is a combination of the root area and crown area requiring protection. It is an area isolated from construction disturbances so that the tree remains viable."

The AS4970-2009 states that the Structural Root Zone (SRZ) "... is the area required for tree stability.



Source AS4970-2009 page 14. TPZ and SRZ overview.



An example of how to calculate a TPZ.

The TPZ for individual trees is calculated based on trunk (stem) diameter (DBH), measured at 1.3 metres up from ground level.

The radius of the TPZ is calculated by multiplying the tree's DBH by 12.

For example, a tree with 40cm DBH requires a TPZ of 4.8 metres.

The method provides a TPZ that addresses both tree stability and growth requirements.

TPZ distances are measured as a radius from the centre of the trunk at ground level.

AS4970–2009 recommends an AQF Level 5 Arborist be engaged to determine the impacts on various trees where major TPZ encroachments are identified via non-destructive comprehensive root investigation exploratory measures as outlined within AS4970–2009 07.2 & 07.3(a). The purpose of comprehensive root investigation exploratory measures is to verify the quantity, size, depth, and orientation of the tree roots along the perimeter of the proposed encroachment in order to make an informed judgement in relation to the potential impact on the tree of critical interest.

08.1 AS4970–2009 3.3.2 ‘minor TPZ encroachment’.

If the proposed encroachment is less than 10% of the area of the TPZ and is outside the SRZ (see Clause 3.3.5), detailed root investigation should not be required. The area lost to this encroachment should be compensated for elsewhere and contiguous within the TPZ.

08.2 AS4970–2009 3.3.3 ‘major TPZ encroachment’.

If the proposed encroachment is greater than 10% of the TPZ or inside the SRZ (see Clause 3.3.5), the project arborist must demonstrate that the tree(s) would remain viable. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ. This may require root investigation by non-destructive methods and consideration of relevant factors listed in Clause 3.3.4.

08.3 AS4970–2009 3.3.4 ‘TPZ encroachment considerations’.

When determining the potential impacts of encroachment into the TPZ, the project arborist should consider the following:

- (a) Location and distribution of the roots to be determined through non-destructive investigation methods (pneumatic, hydraulic, hand digging or ground penetrating radar). Photographs should be taken, and a root zone map prepared. NOTE: Regardless of the method, roots must not be cut, bruised, or frayed during the process. It is imperative that exposed roots are kept moist, and the excavation back filled as soon as possible.*

08.4 AS4970–2009 3.3.4 ‘design factors’.

Tree sensitive construction measures such as pier and beam, suspended slabs, cantilevered building sections, screw piles and contiguous piling can minimize the impact of encroachment.

When siting a structure near to a tree, the future growth of the tree, both above and below ground should be taken into account. Precautions should be taken at the planning and design stage to minimize potential conflict between trees and new structures.

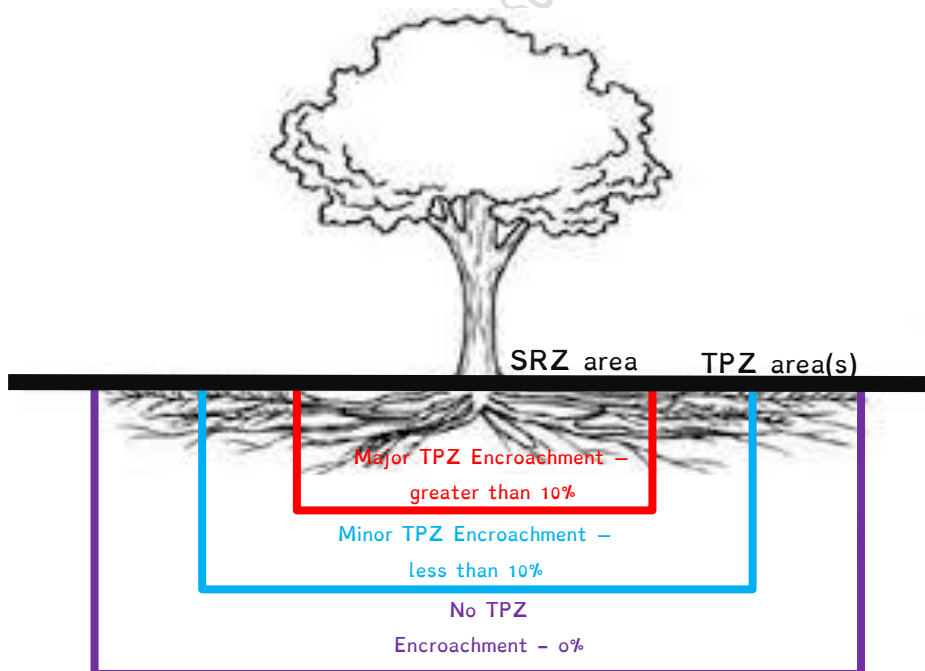
When the root zone is reactive clay, techniques such as localized pier and beam (bridged), screw pile footings or root and soil moisture control barriers may be appropriate to minimize effects on structures.

As noted above regarding ‘major TPZ encroachments’, AS4970–2009 largely relates to excavation practices and methods into the existing soil with an assumed loss of tree roots or potential impacts.

08.5 mitigating TPZ encroachment.

Encroachment within a TPZ must be compensated and off-set as contiguous directly adjacent to the TPZ or non-contiguous where possible within the project area.

The mitigation measures must ensure the direct impact(s) to a tree nominated for retention are reduced or restricted. Mitigation measures should be increased relative to the level of encroachment within the TPZ to ensure the tree does not prematurely decline or become structurally compromised and therefore remains viable. With consideration of the guidelines within AS4970–2009, TPZ mitigation measures table (below) generally outlines the mitigation requirements for each category of TPZ encroachment.



The three (3) levels of TPZ encroachment.

08.6 TPZ mitigation measures table.

ENCROACHMENT	OVERVIEW OF MITIGATION MEASURES
No TPZ encroachment (0%)	No mitigation measures are required, and the overall design meets the guidelines within AS4970-2009.
Minor TPZ encroachment (<10%)	The commissioned report must demonstrate the tree would remain viable and the level of TPZ encroachment has been considered and adequately mitigated. The TPZ area lost within the design must be compensated elsewhere and generally identified as a contiguous off-set. There should be no need for comprehensive root investigation exploratory measures. Arboricultural Work Method(s) are to be developed for the TPZ encroachment area. All works within the TPZ will normally require Project Arborist Supervision (min AQF Level 5 with 5 years post graduate experience). TPZ fence, trunk or branch protection or ground protection must be installed prior to the commencement of works.
Major TPZ encroachment (>10%)	The commissioned report must demonstrate the tree would remain viable with regards to the relevant factors influencing tree health and structure such as but not limited to: - Level of disturbance and position from a tree. - Tree health and age. - A tree's construction tolerance. - Root location and distribution. - Site constraints. - Design factors – overland water flow, reduced growing environment etc. The TPZ area lost within the design must be compensated elsewhere and generally identified as a contiguous or non-contiguous off-set. Comprehensive root investigation exploratory measures are required. Where comprehensive root investigation exploratory measures are a prerequisite, the commissioned report is defined as preliminary and is not to be issued to the respective parties until the recommended comprehensive root investigation exploratory measures are undertaken. The findings from the comprehensive root investigation exploratory measures are to be documented to form compliance with AS4970-2009. Based on the comprehensive root investigation exploratory findings, a Plant Health Care Program may be required before construction works commence. Arboricultural Work Method(s) are to be developed for the TPZ encroachment area. All works within the TPZ will normally require Project Arborist Supervision (min AQF Level 5 with 5 years post graduate experience). TPZ fence, trunk or branch protection or ground protection must be installed prior to the commencement of works.

09 DESIGN REVIEW

The design review carried out by Treescience determined the potential impacts and ascertained how the identified impacts may be mitigated to assist with tree preservation.

The findings of our design review are from an arboricultural perspective. The design review provides the respective parties and consenting authority with information on the measures required to protect a tree which is nominated for retention. Additionally, the design review provides measures to minimise construction impacts when works are within a TPZ and avoid where possible the requirements to remove a tree.

09.1 major TPZ encroachment strategies.

A TPZ encroachment of more than 10% of the area of the recommended TPZ may detrimentally affect the health of a tree by extensively severing or otherwise damaging the root system resulting in pre-mature tree decline and/or compromising a tree's structural integrity.

AS4970-2009, recommends an AQF Level 5 Arborist be engaged to determine the impacts on various trees where major TPZ encroachments are identified. The purpose of the comprehensive root investigation exploratory measures is to verify the quantity, size, depth, and orientation of the tree roots along the perimeter of the proposed encroachment in order to make an informed judgement in relation to the potential impact on the tree of critical interest. With consideration of the proposed work area and foreseen construction implications we believe the requirements for comprehensive root investigation exploratory measures are not mandatory in this instance.

09.2 minor TPZ encroachment strategies.

The proposed TPZ encroachment meets the broad guidelines within AS4970-2009 being 10% TPZ encroachment or less. Therefore, by modifying the general work practices associated with demolition and/or construction work practices within a TPZ it is our professional opinion that the tree of critical interest which is nominated for retention will not prematurely decline and/or be significantly structurally compromised with regards to the proposed activities within its TPZ.

The existing soil grade associated with a tree nominated for retention TPZ shall not be significantly lowered beyond 150mm without prior design outcomes documented and arboriculturally certified by Treescience.

Additionally, the existing soil grade associated with a tree nominated for retention TPZ shall not be significantly raised beyond 300mm without prior design outcomes documented and arboriculturally certified by Treescience.

09.3 design review and additional tree preservation strategies

The engagement of a Treescience Supervising Project Arborist to perform a 'watching brief' is probably the single most essential component to ensure successful tree preservation, in correlation with the Arboricultural Work Method Statement (AWMS). This will involve regular monitoring and providing of technical tree advice on a need by basis.

The continual monitoring of a tree nominated for retention throughout the construction process by the appointed Treescience Supervising Project Arborist will also aid the minimisation of potential impacts proposed for any works which encroach the TPZ area.

The erection of a substantial temporary TPZ barrier fence is required to protect these sensitive areas and the exact TPZ fencing locations will be confirmed by Treescience prior to the commencement of operational works as outlined within the 'tree constraints management plan'.

It should be noted that the extent of the details of stormwater or other inground services were not finalised at the time of this assessment. Further impacts on retained trees are possible where these works occur within designated TPZ's.

09.5 key issues associated with the concept design.

#	CONCEPT DESIGN	TPZ KEY ISSUES & IMPACTS	DESIGN & MITIGATION MEASURES
All trees nominated for retention	Excavation and construction	Issues: Damage to root system based on construction requirements Impacts: Minor reduction in tree health and possible onset of decay/fungal pathogens to severed tree root/s	Prior to the commencement of any works, the appointed Arborist and relevant representatives are to meet on site to assess and document the status of the tree and define the relevant work methods, outline the communication pathway and the appointed Arborist is to identify the various key areas of interest. Take all necessary steps to conform with AS4970-2009 and this report. Trunk padding and/or TPZ fencing, Arborist Supervision (min AQF level 5), Tree Surgery (pre-emptive root pruning) and Arboricultural Work Method Statement.
All trees nominated for retention	Machinery movement	Issues: Direct contact with trees and cambium damage Impacts: Minor reduction in tree health and possible onset of decay/fungal pathogens to from wound sites.	Ensure the machinery is fit for purpose in relation and is not oversized given the confined environment. Machinery spotter is required during works within the TPZ's Trunk padding and/or TPZ fencing, Arborist Supervision (AQF level 5), and Arboricultural Work Method Statements.

10

PROPOSED TREE WORK ACTIVITIES

It should be noted that the proposed tree work activities outlined within this report are of a dynamic nature and of changeable character that underscores the flexibility of this working document and pruning living tree. For all complex tree pruning outcomes it is recommended that Treescience is to oversee such works and provide certification upon completion.

All tree works must form alliance with Australian Standards AS4373-2007: Pruning of Amenity Trees (AS4373-2007) were appropriate. AS4373-2007 states, "the objective of this Standard is to provide arborist, tree workers, government departments, property owners, and contractors with a guide ...". The procedures in this Standard are guided by theories of branch attachment and compartmentalization of decay in trees (CODIT). Therefore, the proposed tree pruning works are to form alliance with AS4373-2007, CODIT theory, Treescience documented tree pruning specifications or that of the asset custodian and any onsite guidance from Treescience.

The proposed tree pruning must be carried out by trained and competent Arborist (minimum AQF Level 3) who has a thorough knowledge of tree physiology and pruning methods in accordance with AS4373-2007.

10.1 tree pruning.

Generally, canopy reduction of selective fourth and ninth order branching could occur as demonstrated in Figure 1.0 to improve the overall tree form and aid with construction outcomes. but also ensuring a level of flexibility with regards to the proposed tree pruning outcomes.

Such works are to rectify as far as possible applying correct arboricultural pruning principles any faults within the tree within the immediate works area.

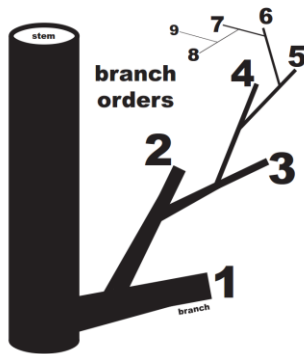


Figure 1.0

The natural shape of the tree should be preserved as much as possible with consideration of tree age and urban environment constraints.

This should be achieved by the removal of only those parts of the branch which extend below the desired clearance height.

It is estimated that no more than 10% of the tree canopy requires removal.

The following guidelines outline the tree pruning intent:

- Pruning cuts that expose heartwood shall be avoided when possible.
- Basal suckers/epicormic regrowth on the lower trunk region, primary and/or secondary scaffolding limbs are to be removed not exceeding 4.5m height from ground level.
- Established secondary interior branches shall be avoided from removal when possible; and
- Epicormic re-growth equal or less than 5mm in diameter growing in clusters can have one final pruning cut. The single/final pruning cut should be made as close as possible to the trunk/branch collar without re-wounding occurring.

Note: The aim of the single/final pruning cut is to create one small wound and not to re-damage living tissue.

- Epicormic re-growth greater than 5mm in diameter are to have a final cut made as close as possible to the branch collar without cutting into the branch collar or leaving a protruding stub.
- To remove broken, crossing, rubbing, diseased, stressed or dying branches, branches with poor attachment.
- To balance the canopy.
- To carry out minor weight reduction as required; and

- To clear the tree canopy from any obstacles e.g., built structure, service wires.

Finally, the amount of suggested tree pruning works required will not impact on the tree of critical interest either in terms of health or aesthetics if the document measures are followed.

10.2 tree removal/tree clearing.

The following measures should be employed in addition to general tree protection measures to ensure retained trees are protected during tree removal and site clean-up works:

- Tree removals/clearing works are to be carried out in such a way as to prevent damage to above and below-ground parts of any tree nominated for retention.
- If total extraction has the potential to cause direct impact to an adjacent tree nominated for retention and/or vegetation of importance then alternative options with regards to total extraction are to be explored such as poisoning a tree and leaving it standing.
- Stump and root material from a tree nominated for removal that are growing in association with a tree(s) nominated for protection are to be cut to ground level or by other means deemed appropriate by Treescience.; and
- Where possible, mulch from the removed trees should be retained and reused on site.

10.3 measures to protect and recover fauna during tree removal works.

A qualified Spotter-Catcher and Wildlife Rehabilitator is to be engaged prior to the tree removal works as defined by the consenting authority and relevant representatives.

Generally, the Spotter-Catcher and Wildlife Rehabilitator will perform a pre-and post-tree removal/vegetation clearing inspection(s), along with the various supporting report(s).

pre-construction activity checklist.

ACTIVITY	TIMING	MANAGEMENT RESPONSE
Inspection of site prior to vegetation removal by registered fauna spotter/catcher	Immediately prior to start	1.Licensed wildlife spotter/catcher to inspect trees to be trimmed/removed and identify hollows for retention/salvage, respectively.
		2.Non-itinerant fauna (other than koalas) is, where practicable, relocated/ushered to adjoining vegetation.
		3.Vegetation containing koala(s) is to be demarcated with high visibility flagging tape and no further clearing is to take place within 20m of the vegetation until such time as koala(s) has completely vacated the vegetation and the site.

tree/vegetation removal procedures.

ACTIVITY	MANAGEMENT RESPONSE
Registered fauna spotter/catcher to supervise all vegetation clearing/removal	1.Licensed wildlife spotter/catcher to inspect site vegetation with arborist/contractor ahead of clearing to check for presence of fauna. 2.Non-itinerant fauna (other than koalas) is, where practicable, relocated/ushered to treed areas around the site. 3.Vegetation containing koala(s) is to be demarcated with high visibility flagging tape and no further clearing is to take place within 20m of the vegetation until such time as koala(s) has completely vacated the vegetation and the site.
Injured wildlife observed	1.Immediately cease any activities, including clearing, which pose a threat to injured wildlife until injured wildlife has been removed from the site. 2.Contact the applicable agency/group listed to remove the injured wildlife from the site

11 PROPOSED CONSTRUCTION ACTIVITIES

11.1 manual excavation using appropriate machinery within the defined TPZ.

The Treescience Supervising Project Arborist will steer the site works and outline the action mitigation measures as required.

In other defined areas of sensitivity for this project where excavation is required within a defined TPZ, the Treescience Supervising Project Arborist will likely request a combination of a small mud bucket and/or ripper arrangement on an excavator or similar machinery configuration to help conduct comprehensive root investigation measures along the edge

closest to the tree of critical interest TPZ to help locate the presence of tree roots in an attempt to prevent unforeseen tree root severance.

Tree roots which are deemed to be removed will be removed by the Treescience Supervising Project Arborist or in combination with the machinery operator on a need by basis. Tree roots which are defined for retention will be clearly marked with marker paint by the Treescience Supervising Project Arborist to help guide/define the machinery operator work practices.

In determining tree root retention, the type of tree, tree canopy formation, tree structure, tree health, soil structure/profile, number of tree roots etc., will be considered on a tree root by tree root process with consideration of the constraints placed on the installation methodology and tree preservation prerequisite.

11.2 pre-emptive root pruning.

To prevent undue tree damage, pre-emptive root pruning will take place in combination with the hand excavation methods and any recommendations from the comprehensive root investigation exploratory measures.

All tree roots found during the comprehensive root investigation exploratory measures will be severed using a sharp handsaw, secateurs or similar by the Treescience Supervising Project Arborist on a case-by-case basis. This will ensure that the roots are not ripped or torn and will have a good point from which to re-grow can occur, enhancing occluding potential and assist in preventing fungal pathogens from entering exposed or wound site.

11.3 access and stockpiling.

Indicative locations of machinery/vehicular access and site stockpile locations will be determined at the Operational Works Approval pre-start meeting. Confirming most suitable locations on site will need to comply with this report in relation to the TPZ's and potential soil compaction, ensuring retained trees are protected at all times.

If the TPZ is breached a level of investigation measures are implemented prior to verify the present level of soil compaction, determine the requirements for a Plant Health Care Program and/or other TPZ mitigation measures.

There is to be no stockpiling of machinery, topsoil, fill, construction materials or site rubbish within retained vegetation or the limits of the exclusion fencing.

11.4 landscaping design.

All excavation with the TPZ for landscaping purposes i.e., planting shall be undertaken by hand. Any tree roots discovered (25mm+) are to be left and shall not be cut or otherwise damaged. Where possible, the soil structure within the TPZ shall be preserved.

No large trees are to be planted within the TPZ.

11.5 design summary.

The most significant impacts on a tree of critical interest based on the review carried out by Treescience will be from:

- Demolition of shallow impervious surfaces; and
- Excavation and soil grade changes.

Perceived minor impacts are:

- Tree pruning or removal works.
- Landscape works; and
- General construction activities adjacent to the TPZ.

However general construction works, site storage and access issues also have the potential to impact the trees on the site. Therefore, the intricacies associated with construction works should be addressed at Operation Works by the associated representatives and Treescience to ensure suitable tree preservation measures are adopted with consideration of the design outcomes, site constraints and tree preservation requirements within the project area.

12 ARBORICULTURAL WORK METHOD STATEMENT

The following Arboricultural Work Method Statement (AWMS) outlines the tree protection measures for the general excavation construction works within defined TPZ's. This AIA and AWMS pro-actively identify any impacts from the proposed construction works that could potentially harm a tree nominated for retention.

This working document also informs the appropriate people undertaking the related work tasks of their responsibilities as outlined in the following AWMS for works within a defined TPZ:

- **Arboricultural Work Method Statement – Activity: general excavation with a TPZ.**
- **Arboricultural Work Method Statement – Activity: demolition of shallow impervious within a TPZ.**

The following Arboricultural Work Method Statements provides general guidance on the physical protection and appropriate precautionary measures required in order to reduce any detrimental impacts on tree health or compromise the structural integrity of trees which is provided for your consideration. However, it is imperative that construction activities should not transpire until the relevant requirements of this report have been implemented.

These guidelines are by no means fixed as trees are dynamic in nature and each site has different considerations and variations that may alter or eradicate the need for certain steps. Continued consultation with the Supervising Project Arborist throughout works is necessary to ensure compliance and avoid unnecessary costs that may be incurred by attempting to interpret these guidelines without the aid of an arboricultural specialist assigned to the project.

12.1 Arboriculture Work Method Statement – activity: general excavation.

Tree roots which are deemed to be removed will be removed by the Supervising Project Arborist or in combination with the machinery operator. Tree roots which are defined for retention will be clearly marked with marker paint by the Supervising Project Arborist to help guide and define the machinery operator work practices. In determining tree root retention, the type of tree, tree canopy formation, tree structure, tree health, soil structure/profile, number of tree roots etc., will be considered on a tree root by tree root process with consideration of the constraints placed on the design requirements and tree preservation prerequisite.

Arboricultural Work Method Statement (AWMS)



Activity: General Excavation

Description of Works

Excavation with the use of a mechanical device within the Tree Protection Zone (TPZ) of tree(s) nominated for retention.

The methodologies within this AWMS follow a logical sequence of events. Variation to the sequence could significantly reduce the efficiency of the tree protection measures. This method statement should be read in conjunction with the relevant design drawing(s) and supporting technical reports.

Work Method

1. All site works/plant operators are to receive tree protection site induction by the Site Manager and/or Treescience Supervising Project Arborist if deemed necessary.
2. No vehicle or plant with upward pointing exhausts are to be operated under the subject tree canopy (to avoid heat damage to the tree canopy) where possible.
3. No vehicle or plant is to be operated within the designated Tree Protection Zone (TPZ) unless authorisation has been obtained by the Treescience Supervising Project Arborist.
4. No bulk or harmful materials such as concrete wash is to be placed in a defined TPZ.
5. Access into a defined TPZ or movement of the protection barriers/fencing will only be permitted in consultation with the Treescience Supervising Project Arborist.
6. The excavator bucket is to be inverted so that it presses down into the soil, severing any roots that may have been missed rather than lifting and tearing roots toward the lower trunk region when working near trees.
7. Ensure a spotter is available to confirm that any vehicles and machinery do not come into contact with any tree nominated for preservation.
8. All tree roots that are uncovered when excavating which are less than 50mm in diameter are to be cut cleanly and straight by the Treescience Supervising Project Arborist and all root pruning must be documented.
9. Hand digging must occur if machinery is not capable of work in and around tree roots deemed worthy of retention without causing damage as determined by the Treescience Supervising Project Arborist on a case-by-case basis.
10. Where air spades/water knife are to be used to aid identification of tree roots, the pressure must be reduced to mitigate the potential of bark being stripped from the roots or the occurrence of root severance.
11. Water is not to be used for cutting purposes unless instructed by the Treescience Supervising Project Arborist and in consultation with the relevant representatives.
12. If the area of excavation has an extensive network of tree roots or a tree root with a 50mm diameter or greater, the area of excavation is to be backfilled within 12hrs of opening without causing damage to tree roots or covered using wet hessian, to ensure the tree roots retain moisture and do not dry out. The hessian is to be comprised from 100% Jute which is a natural fibre & will rot down over time.
13. When backfilling around tree roots, the subject soil is to be comprised of an indigenous topsoil and organic matter with a neutral pH, free from weed growth and harmful materials. The backfilling of soil is to be carefully rammed & watered in and around tree roots to eliminate air pockets.
14. All works within the defined exclusion zone as outlined within this report requires authorisation by the Treescience Supervising Project Arborist.

Reporting of Incidents

All damage to protective barriers or accidental damage to trees (above or below ground) no matter how insignificant it may seem, must be reported to the relevant representative and the Treescience Supervising Project Arborist immediately. A record of the damage is to be made by the Site Manager and reported to the relevant representatives and the Treescience Supervising Project Arborist.

Name:	Date:	Signature:	Name:	Date:	Signature:
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12.2 Work Method Statement – Activity: demolition of shallow impervious surfaces.

Tree roots which are deemed to be removed will be removed by the Treescience Supervising Project Arborist using hand excavation methods and/or in combination with the machinery operator. Tree roots which are defined for retention will be clearly marked with marker paint by the Supervising Project Arborist to help guide/define the machinery operator work practices. In determining tree root retention, the type of tree, tree canopy formation, tree structure, tree health, soil structure/profile, number of tree roots etc., will be considered on a tree root by tree root process with consideration of the constraints placed on the design requirements and tree preservation prerequisite.

Arboricultural Work Method Statement (AWMS)

Activity: demolition of shallow impervious surfaces



Description of Works

Excavation with the use of a mechanical device within the Tree Protection Zone (TPZ) of tree/s nominated for retention.

The methodologies within this AWMS follow a logical sequence of events. Variation to the sequence could significantly reduce the efficiency of the tree protection measures. This method statement should be read in conjunction with the relevant design drawing(s) and supporting technical reports.

Work Method

1. Prior to the commencement of any works, Treescience and relevant representatives are to meet on site to assess and document the status of the trees health and agree on the relevant work method(s) and outline the communication pathway for all works within a TPZ.
2. All site works/plant operators are to receive tree protection site induction by the Site Manager and/or Treescience Supervising Project Arborist if deemed necessary.
3. The tree protection fence and/or other protection measures are to be erected prior to the commencement of works and correctly installed for the duration of the project as defined by Treescience.
4. Access into a defined TPZ or movement of the protection barriers/fencing will only be permitted in consultation with the Treescience Supervising Project Arborist.
5. All works within the defined exclusion zone as outlined within this report requires authorisation by the Treescience Supervising Project Arborist.
6. No vehicle or plant with upward pointing exhausts are to be operated under the subject tree canopy (to avoid heat damage to the tree canopy) where possible.
7. No vehicle or plant is to be operated within the designated Tree Protection Zone (TPZ) unless authorisation has been obtained by the Treescience Supervising Project Arborist.
8. No bulk or harmful materials such as concrete wash is to be placed in a defined TPZ.
9. All proposed excavation works within a TPZ are to be identified through survey pegs and/or marker paint prior to the commencement of works.
10. Ensure a spotter is available to confirm that any vehicles and machinery do not come into contact with any tree nominated for preservation.
11. All impervious areas should be cut into manageable sections prior to demolition works as defined at the pre-start meeting.
12. The excavator should be placed as far outside the TPZ area as possible and should reach over into the TPZ to lift the impervious sections away from the subject tree.
13. The excavator is to be fitted with a breaker, grab or hook in order to break up the impervious surfaces. The excavator implement should not protrude into the existing soil surface more than 50mm unless a level of exploratory root investigation measures has been undertaken, and/or approval has been obtained by the Treescience Supervising Project Arborist. The preference is to use a mud bucket, by lifting one edge of the concrete and pulling the section away from the subject tree.
14. Hand digging must occur if machinery is not capable of work in and around tree roots deemed worthy of retention without causing damage as determined by the Treescience Supervising Project Arborist on a case-by-case basis.
15. All tree roots that are uncovered when excavating which are less than 50mm in diameter are to be cut cleanly and straight by or under the guidance of the Treescience Supervising Project Arborist and all root pruning must be documented.
16. If the area of excavation has an extensive network of tree roots or a tree root with a 50mm diameter or greater, the area of excavation is to be backfilled within 12hrs of opening without causing damage to tree roots or covered using wet hessian, to ensure the tree roots do not dry out and retain moisture. The hessian is to comprise from 100% Jute which is a natural fibre and will rot down over time.
17. When backfilling around tree roots the subject soil is to be comprised of an indigenous topsoil and organic matter with a neutral pH value, free from weed growth and harmful materials. The backfilling of soil is to be carefully rammed and watered in around tree roots to eliminate air pockets.
18. The root zones or roots of critical interest are to be lined with a solid plastic material to prevent chemicals, and lime in the concrete from contaminating/burning the subject tree roots as determined by the Treescience Supervising Project Arborist.

Reporting of Incidents

All damage to protective barriers or accidental damage to trees (above or below ground) no matter how insignificant it may seem, must be reported to the relevant representative and the Treescience Supervising Project Arborist immediately. A record of the damage is to be made by the Site Manager and reported to the relevant representatives and the Treescience Supervising Project Arborist.

If difficulties are identified within the proposed AWMS a meeting is to be held immediately with the project manager and the Supervising Project Arborist to discuss alternatives with consideration of the tree preservation requirements in accordance with Australian Standards AS4970–2009: Protection of Trees on Development Sites.

13 TREE-SPECIFIC MITIGATION MEASURES FOR PRE-START CERTIFICATION

This section outlines the identified steps for tree-specific mitigation measures from the impact assessment of the proposed operational works adjacent to a tree, within and or adjacent to the project area in accordance with AS4970–2009.

AS4970–2009 highlights the requirements for tree protection where construction works will transpire and is considered general information only. The exact tree specific mitigation measures required for this project will be addressed at Operational Works by Treescience and the relevant representatives and must be certificated prior to the commencement of any proposed works.

13.1 establishing the TPZ.

The TPZ helps protect tree roots from preventable incidents such as but not limited to soil compaction damage, mechanical damage and chemical spills and are critical to ensure the viability of a tree of critical interest. Tree protection materials such as barriers and/or ground protection are to be installed prior to the commencement of any construction activity being undertaken on site including but not limited to:

- Any materials or machinery brought onto site; and
- Development or stripping of soil.

Furthermore, no construction activities should take place until the relevant requirements of this report have been implemented. The exact extent/design of the tree protection fencing will be nominated by the Treescience Supervising Project Arborist and relevant representatives in accordance with the development approval, site constraints and tree protection requirements following the industry guidelines set out within AS4970–2009 and approved reports/drawings.

Any proposed activities within a defined TPZ as outlined within this report requires approval by the Treescience Supervising Project Arborist prior to any works commencing in this region. The contractor will be required to identify all activities and control measures to ensure a tree of critical interest is adequately protected and considered above and below the ground, with tree protection to form a part of the everyday site induction manual. All inductees must be made aware of a tree of critical interest that is to be retained and the prohibited activities. Entry into the fenced TPZ areas by persons, vehicles or machinery is not permitted without consent from the Treescience Supervising Project Arborist and in consultation with the relevant representatives.

13.2 prohibited activities within a defined TPZ.

For the protection of tree(s), roots, and natural soil condition from preventable incidents such as but not limited to soil compaction, mechanical damage and chemical spills, no construction activities are to be undertaken within the fenced TPZ which may have any harmful effect on the protected tree(s). Machinery and other equipment must be kept away from the tree(s), branches, trunks, and roots, as well as any potentially harmful activities outside of the TPZ that may impact the protected tree(s) such as but not limited to soil erosion, radiant heat from machinery exhausts and polluting agents draining into the protected area.

Activities generally excluded from the defined TPZ include the following but not limited to:

- a) Re-positioning or removal of the tree protection materials at any time during the construction work unless approval has been obtained by the Supervising Arborist. The tree protection materials will only be removed once these works have been fully completed.
- b) Any construction activities within the fenced TPZ which may have any harmful effect on the protected tree.
- c) Compaction occurring within the TPZ.
- d) Harmful activities outside of the TPZ's e.g., soil erosion, radiant heat from machinery exhausts and polluting agents draining into the protected area.
- e) Machine excavation including trenching.
- f) Excavation for silt fencing.
- g) Cultivation.
- h) Storage.
- i) Preparation of chemicals, including preparation of cement products, including outside of the TPZ where polluting agents may drain into the protected area.
- j) Parking of vehicles and plant.
- k) Refuelling.
- l) Dumping of waste, including outside of the TPZ where polluting agents may drain into the protected area.
- m) Wash down and cleaning of equipment, including outside of the TPZ where polluting agents may drain into the protected area.
- n) Placement of fill.
- o) Lighting of fires.
- p) Soil level changes.
- q) Soil compaction activities.
- r) Temporary or permanent installation of utilities and signs; and/or
- s) Physical damage to a tree.

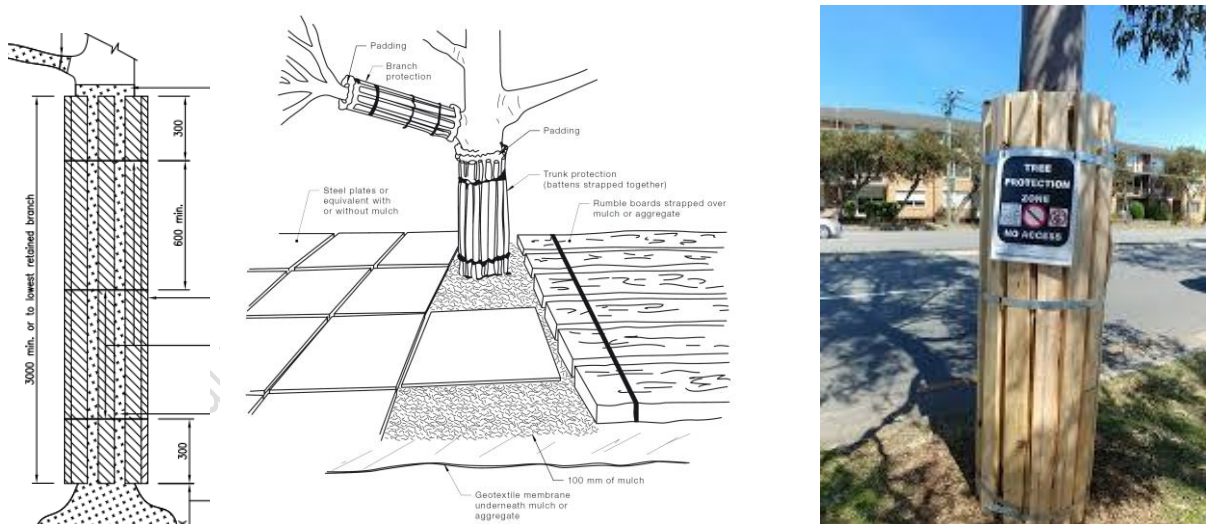
Note: The tree protection materials will not be re-positioned at any time during the construction work unless approval has been obtained by the Treescience Supervising Project Arborist. Furthermore, the tree protection materials will only be removed once these works have been fully completed. Entry into the fenced TPZ areas by persons, vehicles or machinery is not permitted without consent from Treescience and in consultation with the relevant representatives.

13.3 trunk protection (padding).

Other tree protection measures are to be implemented along with the proposed tree protection fencing design to protect the lower trunk region. The material and positioning of the protection measures (padding/timber/tie wire) will be specified, and correct installation will be confirmed by the Supervising Project Arborist in consultation with the relevant representatives.

Trunk protection is to generally consist of the following specifications:

- a) at a minimum, the height of the trunk protection is to be three (3) metres (m);
- b) tree padding shall be multiple layers of orange coloured polypropylene mesh to an approximate thickness of twenty-five (25) millimetres (mm);
- c) wooden slats shall be untreated hardwood, a minimum forty (40) millimetres (mm) thick and equivalent in length to the tree paddings with fifty (50) millimetres (mm) spacing and minimum three hundred (300) millimetres (mm) from ground level; and
- d) the padding and timber are to be held together with tie wire. The tie wire shall not contact the bark.



NOTE: pre-start TPZ Trunk Protection Certification will be issued prior to the commencement of any proposed works.

13.4 tree protection fencing design.

The tree protection fence should be erected prior to the commencement of works and correct installation confirmed by the Supervising Project Arborist. The tree protection

fencing should be installed at the edge of the defined TPZ and/or near the interface of the earth works and/or in consultation with relevant representatives and Treescience.

The tree protection fencing shall be suitably robust and securely braced to provide sufficient protection for the tree(s) nominated for retention and shall be maintained in good order for the duration of the development/construction period. Inspection of the tree protection fencing should be undertaken frequently by the Project Manager and/or Treescience.

The performance requirements for the tree protection fencing will be determined by the type of activity that will take place within the TPZ, topography, and length of the construction period in consultation with the relevant representatives and Treescience.

Typically, the performance requirement for the tree protection fencing will be:

- Tree protection fencing shall only be removed, altered, or relocated with the authorisation from Treescience.
- Installation, removal and, where required, replacement of tree protection fencing will be supervised and signed off by the relevant representative and Treescience.
- The area between the tree protection fencing and the tree of critical interest is deemed the defined TPZ or exclusion zone unless otherwise advised by Treescience; and
- The defined TPZ should be secured to restrict access in and around the tree nominated for retention.

The tree protection fencing is to be of an agreed design/construction style in consultation with the consenting authority, relevant representatives and Treescience with consideration of the overall TPZ area, defined TPZ, topography, and length of the development/construction period. It should be noted that existing perimeter fencing, and other structures may be suitable as part of the overall protective fencing design.

Ideally, tree protection fencing shall consist of 1.8-metre-high temporary/relocatable galvanised steel mesh panels in accordance with Australian Standards AS4687-2007: Temporary fencing and hoardings.

The tree protection fence is to be supported by steel poles, concrete anchor blocks and clamped at the top of each pair of panels. The tree protection fence must have a lockable opening for access. A tree of critical interest woody roots shall not be damaged during the installation, modifying, and dismantling of the tree protection fence.

Shade cloth material shall be attached to the outer surface of the tree protection fence where deemed necessary in consultation with the relevant representatives and Treescience. The purpose of the shade cloth is to reduce the transport of dust, other matter, and

liquids into the protected area. The shade cloth material shall be transparent to provide visibility into the defined TPZ where possible.

NOTE: pre-start TPZ Fencing Certification will be issued prior to the commencement of any proposed works.



13.5 TPZ signage.

Tree protection signage should be attached to the tree protection fencing and be displayed in prominent positions.

The TPZ sign shall be repeated at fifteen (15) metre intervals or closer where the TPZ fence changes direction. The signage shall be installed prior to the commencement of works on-site and shall be maintained in good condition for the duration of the development period.

Below is an example of a tree protection fence sign design.



NOTE: pre-start TPZ Signage Certification will be issued prior to the commencement of any proposed works.

13.6 site inductions and awareness briefings.

Site inductions and awareness of staff is proposed in accordance with the general provisions of the report and will convey the importance of avoiding damage to any retained vegetation.

The following documentation will be incorporated as part of site inductions and awareness training:

- o Tree Protection Fence Signage, refer to Appendix ONE.
- o Tree Protection Poster, refer to Appendix TWO.
- o Tree Protection Handouts, refer to Appendix THREE.
- o Types and Effects of Tree Damage Appendix FOUR.

Toolbox talks are proposed for specific tree protection training for construction personnel involved in tree impact works to convey the importance of the project's requirements not to damage any trees that have been identified for retention and define the tree preservation strategies.

Where, due to unavoidable site constraints, pedestrian traffic or plant and vehicular routes are required through TPZ's, protection of soil and roots should be addressed through a combination of fencing, mulching, and buffering material layer over the ground.

The TPZ area of interest should be mulched with good quality composted wood chip/leaf matter that generally complies with Australian Standards AS4454-2012: Composts, Soil Conditioners and Mulches (AS4454-2012).

14 WHEN TO CONSULT WITH THE SUPERVISING PROJECT ARBORIST

The Project Manager is to consult with the appointed Treescience Supervising Project Arborist when any of the following occurs:

- If there needs to be any deviation from the approved final plans regarding any of the construction activities within defined TPZ's.
- If access is required within the defined TPZ/fenced TPZ.
- If the nominated tree for protection foliage starts to wilt or changes colour.
- If any cracks or splits appear in the branches or trunks (especially if this accompanied by the exudation of sap, liquids, or discolouration of the bark) of the tree nominated for protection.
- If any damage occurs to any part of the tree nominated for protection.
- The appearance of any infestation by insects, fungi or any other unusual displays within/upon the tree nominated for protection; and/or
- There is a need to move or dismantle the trunk padding, tree protection fencing, ground protection materials and any other associated materials that negates the pre-start certification.

Note: A guide to understanding some commonly encountered tree impacts and their potential effects is provided in the report's Appendices and should form part of your site induction material.

15 DESIGN CONSIDERATIONS

Treescience reviewed the proposed redevelopment and various tree(s) of critical interest while considering the elements associated with urban landscape amenity as listed below:

- the preservation of local amenity.
- screening of views to and from the site.
- a balance to the scale and bulk of structures.

Furthermore, the various tree(s) of critical interest were assessed against the transition of the use of the land to ensure appropriateness and suitability within the urban environment.

16 SYNOPSIS & CONCLUSIONS

Given the importance of protecting a tree of critical interest which is nominated for retention during the course of construction works, this report insists on suitable arrangements being made and kept in place. However, there needs to be an element of realism in such situations and therefore Treescience underscores the flexibility when working with trees.

Treescience concluding remarks are based on our detail tree assessment, contemporary arboricultural research, the guidelines within AS4970–2009 and industry experience.

Successfully retaining a tree on any redevelopment site depends on several controls being in place and determination and willingness by all parties is required. Primarily, the Site/Project Manager will have overall responsibility to ensure all control measures are observed and correctly implemented. Therefore, the engagement of a Treescience to perform a 'watching brief' is the single most essential component to help ensure successful tree preservation is up-held on a need-by-need basis. This will involve regular monitoring with the provision of technical tree advice and/or supervision where works are within a defined TPZ, along with monitoring and certifications for the various stages as a minimum.

The identified construction impacts within and/or adjacent to a tree of critical interest which has been nominated for retention are considered manageable but dependent upon:

- Employment of careful documented arboricultural supervision and diligent management during the construction process.
- Ensuring design specifications and construction methodologies consider the tree nominated for protection above and below the ground as outlined within this report; and
- Ensure that any tender documents for the project reflect the requirements for tree preservation, including TPZ fencing, trunk/branch protection, ground protection, appropriate AWMS's, arboricultural supervision, monthly monitoring, and relevant certifications.

It must be noted that AS4970–2009 guidelines are largely founded on the distance of disturbance from a tree. It should be noted that it is extremely difficult to speculate the volume and/or directional growth of a tree's entire woody root system. Therefore, the expert view provided by Treescience is that the type and volume of disturbance is more important than the distance from a tree.

The recommended minimum TPZ is marked as a clearly defined thatched line on all construction certificate drawings. The thatched line is keyed 'Tree Protection Zone'.

It is recommended that all trees identified for retention within reason are photographed prior to the commencement of development works as evidence that the tree(s) being retained displayed equal or greater health than before the development commenced.

A total of forty-five (45) trees were assessed.

A total of thirty-nine (39) trees are identified for retention from an arboricultural perspective. The tree of critical interest is manageable given adequate tree protection measures are implemented in accordance with this conditional report.

A total of six (6) trees were identified as other. Trees #33 and #44 are identified for removal on the provided drawings and trees #34–#36 are in the vicinity of tree #33 where tree #45 is in the vicinity of tree #44. From an arboricultural perspective with respect to AS4970–2009: Protection of Trees on Development Sites, the subject trees are viable for retention given the appropriate AWMS, tree protection measures and Arborist Supervision is applied for all works within the TPZ of the subject trees.

All forty-five trees assessed are classified as Council controlled trees.

The proposed construction footprint calculates out as major TPZ encroachments for trees #1, #3, #4, #6, #7, #9, #10, #21, #22, #23, #30, #31, #33, #36 & #37 and minor TPZ encroachments for trees #3, #4, #6, #7, #9, #10, #11, #12, #15, #19, #22, #34 & #44.

Trees #2, #5, #8, #13, #14, #16, #17, #18, #20, #24 to #29, #32, #35, #38 to #43 & #45 have works adjacent to their TPZ's.

My support of the proposed development is based on the following:

1. The proposed development conforms to the recommendation and guidelines outlined within AS4970–2009.
2. The proposed development is outside the subject tree's SRZ, and is therefore unlikely to destabilise the subject trees or result in premature decline;
3. The proposed development design has adequate set-back and general use within immediate area of the subject tree, plus the neighbouring property has a large, allocated lawn environment. Therefore, the design is unlikely to increase the risk (to both property and to safety) associated with the subject tree to an unacceptable level.

4. The subject tree has suitable construction tolerances, the TPZ encroachment can be offset as 'contiguous', the TPZ encroachment can be mitigate through AWMS's. Therefore, the proposed design is unlikely to have detrimentally impact on the health and longevity of the subject tree.

Therefore, we are of the professional opinion that the identified Arboricultural Work Method Statements adequately considers a tree of critical interest, and such works pertaining to the proposed construction outcomes will not result in premature tree decline or destabilise a tree of critical interest.

We are of the professional opinion that the proposed design satisfactorily accounts for a tree of critical interest above and below as outlined within the tree constraints management plan.

The final TPZ fence locations will be determined at the pre-start in consultation with the relevant representatives and Treescience.

It is imperative that all works within the defined TPZ are to be carried out under the direct guidance of a Treescience Supervising Project Arborist.

The findings and any associated recommendations detailed within the report are of a professional opinion of an experienced Arboriculturist and are the view of Treescience. This is based on the review of the information provided by The Client, and the provided brief.

It is assumed by Treescience that the reviewed and issued design drawings are final, which the recommendations within this report are founded.

The recommendations made within this report are subject to approval by the consenting authority.

The constituted views within this report were formed by a suitably qualified Arborist (AQF Level 9).

There are no questions falling outside my expertise, and the report is not incomplete or inaccurate in any respect.

I have made all the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld.

17 IMPLEMENTATIONS OF THE AIA & TCMP

Consideration has been given to the proposed layout, the condition of a tree of critical interest and the final use of the site with a focus on providing a desirable, balanced environment.

The findings and any associated recommendation detailed within the report are considered to be reasonable, practicable and in the interests of promoting sensible arboricultural management.

The recommendations are of a professional opinion of an experienced Arboriculturist (AQF Level 9) and are the view of Treescience. This is based on a review of the information provided by The Client, the brief, and a survey of the site/tree.

It is therefore recommended:

- That this report is reviewed according to the final development approval and immediately prior to operational works approval.
- Appoint Treescience as the Supervising Project Arborist to perform the 'watching brief'.
- Establish a line of communication between the consenting authority, site Manager, relevant representatives and Treescience, prior to any works commencing; and
- All contractors to attend a tree preservation induction and then sign and comply with the requirements of a 'Certificate of Recognition and Acceptance' of the conditional specifications outlined within this report.

17.1 pre-start/site specific induction of the arboricultural requirements.

- Check that all documentation is in place recognising the tree(s) nominated for retention and the defined TPZ's.
- Prior to demolition and/or site establishment, indicate clearly using flagging tape or spray paint on the tree trunks mark the tree(s) for removal.
- Ensure the AIA & TCMP is a controlled document.
- Installation of the tree & root protection steps in accordance with this report.
- Certification of tree & root protection installation; and
- Undertake a tree preservation site induction.

17.2 during construction.

- Treescience in consultation with Project Manager, Site Engineer or relevant representative will initiate and manage any remedial works or actions as required during.
- An auditable system of arboricultural site monitoring will be implemented for trees nominated for protection on or adjacent to the construction site that have been identified within this report; and
- Monthly audits of all construction work relating to a tree nominated for retention with established TPZ.

17.3 post construction stage.

- Treescience in consultation with Project Manager, Site Engineer or relevant representative will initiate and manage any remedial works or actions as required at the end of the construction stage; and
- Upon completion of all construction activities, Treescience will produce a final certification report indicating that all of the provisions within this report have been compliant, and works have been performed in accordance with State and Local Government requirements and AS4970-2009.

The findings and recommendation contained within this report are valid for a period of twelve months given trees are living organisms and their condition can change significantly over a relatively short period of time.

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Additional information

This report describes the role of the Treescience in the protection of a tree nominated for retention within and/or directly adjacent to the project area which has been documented within this report, as well as methods and materials required as a minimum for the duration of the project.

Moreover, this report has clearly defined and quantifies the level of professional advice and tree protection methods that will be required.

The purpose of this report is to provide consistent and uniform standards and minimum guidelines for retention and protection of a tree nominated for retention with regards to construction works within or directly adjacent to a TPZ.

Please read carefully and follow the guidelines as well-meaning individuals usually cause serious damage to trees during construction. This can sometimes result in death, severe short and long-term decline, or physical failure of the tree.

Thank you for the opportunity to provide advice on this matter and if you have any questions about this report, please contact Treescience on 1300 731 859.

Yours Faithfully

Treescience Pty Ltd



Jason-jay Naylor (Director/Principal Arboricultural Scientist) for Treescience Pty Ltd atf The Treescience Trust

Caveat

Unless states otherwise:

This report cannot be used within a court of law or any legal situation without the prior consent of Treescience Pty Ltd atf The Treescience Trust which will not be unreasonably withheld.

CERTIFICATION of PERFORMANCE

I am university educated and certify I have formal qualifications that meet and exceed AQF level 9 in Arboriculture. I have a master's degree with credentials and experience in all areas pertaining to urban forestry and detailed legal matters.

I have inspected the tree(s) and/or the property referred to in this report and have stated my findings accurately to the best of my ability. The extent of the evaluation and appraisal is stated in the report.

That I have no current or prospective interest in the vegetation or the property that is the subject of this report, and I have no personal interest or bias with respect to the parties involved.

That the analysis, opinions, and conclusions stated herein are my own, and are based on current scientific procedures and facts.

That my compensation is not contingent upon the reporting of a predetermined conclusion that favours the cause of the client or any other party, nor upon the results of the assessment, the attainment of stipulated results, or the occurrence of any subsequent events.

That my analysis, opinions, and conclusions were developed, and the report has been prepared according to commonly accepted arboricultural practices.

I further certify that I am a registered approved tree consultant for the 'Queensland Arboricultural Association' (#1481), an active financial member of the world governing body 'International Society of Arboriculture' where I have been a practicing certified international Arborist since 2006 and therefore meet the minimum qualification for writing arboricultural reports under the AQF (Australian Qualification Framework—Level 5).

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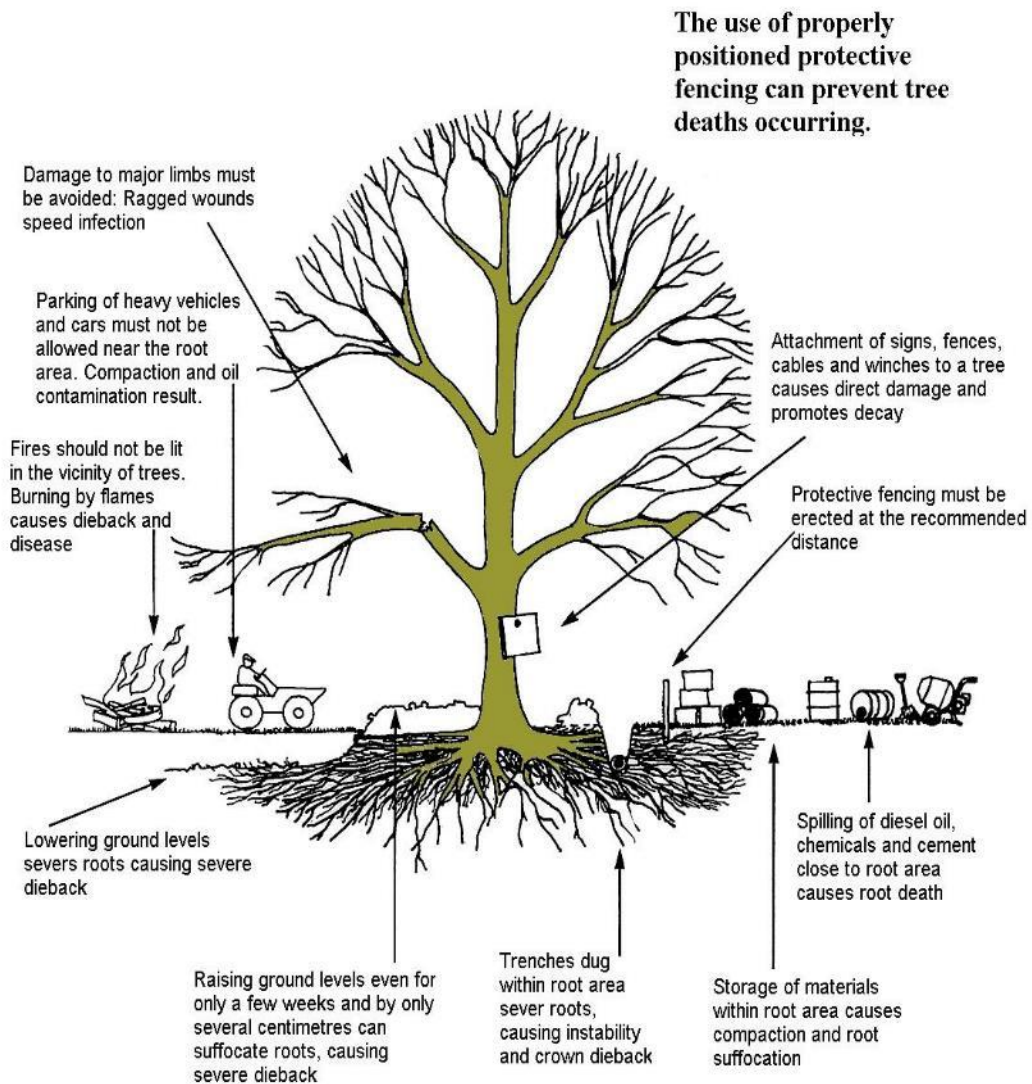
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APPENDIX ONE: tree protection signage



APPENDIX TWO: tree protection poster

Common causes of Tree Death



Project Arborist/team – Treescience 1300 731 859

APPENDIX THREE: tree protection handout

The Tree Protection Information Handout will be available at formal site inductions.

Construction and Trees



Why do we need to erect fencing around trees?

The fencing is designed to protect the tree/s and their roots from the harmful effects commonly associated with construction work, for example, any direct and indirect damage to the tree and its roots from, soil compaction, storage of materials, radiant heat (e.g., from machinery exhausts) chemicals and any other polluting agents draining into the protected area e.g., contaminated water from cleaning.

The major cause of damage to trees on construction sites is due to **compaction of the soil around their roots.**

- Roots use the spaces between soil particles to obtain oxygen, water, and nutrients.
- Heavy plant and machinery compresses (compacts) the soil, squashing out the air spaces, effectively suffocating the roots.
- Compacted soil stays compacted i.e., it does not recover on its own.
- The main symptom of the loss or damage of roots is often seen as die-back of the ends of the branches.
- Symptoms such as die-back may take several years to appear.
- The fencing type and distances are specified by an Arborist by referring to the appropriate Australian standards.

The installation and maintenance of protective fencing is a condition of the permit approvals and substantial fines apply for the unauthorised interference of any tree protective fencing and materials.

APPENDIX FOUR: type and effects of tree damage

The table below has been provided in order to convey some of the most common causes of development related damage to trees and their various parts.

Examples of damage relating to construction work	Crown Die Back	Root Death	Tree Instability	Loss of Vigor	Susceptibility to pest and diseases	Reduction in the availability of water and nutrients
Root damage / loss	Yes	Yes	Yes	Yes	Yes	/
Soil Compaction	Yes	Yes	/	Yes	Yes	Yes
Excavation within root zone	Yes	Yes	Yes	Yes	Yes	Yes
Physical damage to trunk or branches	/	/	/	/	Yes	/
Changes to ground levels (filling or grading)	Yes	Yes	Yes	Yes	Yes	Yes
Contamination of the ground with toxic materials	Yes	Yes	/	Yes	Yes	/
Installation of impermeable surfaces	Yes	Yes	/	Yes	Yes	/
Fluctuations or permanent changes to the water table	Yes	Yes	Yes	Yes	Yes	Yes
Fires and Heat	Yes	Yes	/	Yes	Yes	/

PRECEDENT DISCLAIMER for CONSULTANCY

Clients may choose to accept and/or disregard the recommendation formulated within this report.

The devices and techniques used to develop this report have been selected to minimise the reporting costs, while ensuring that the reporting information and the subsequent recommendation outlines within the report are suitable to the specific site.

This disclaimer is governed by the law in force in the states of Queensland and New South Wales, Australia.

Report assumptions:

- Any legal description provided of Treescience Pty Ltd atf The Treescience Trust (Treescience). is assumed to be correct. Any titles and ownerships to any property are assumed to be correct. No responsibility is assumed for matter outside the consultant's control.
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- All instructions (verbal or written) that define the scope of the report document have been included in the report document and all documents and other materials that the Treescience consultant has been instructed or consider or to take into account in preparing the report document have been included or list within the report document.
- To the authors knowledge all facts, matter, and all assumptions upon which the report document proceeds have been stated within the body of the report document and all opinion contained within the report document will be fully researched and referenced and any such opinion not duly researched is based upon the authors experience and observation.