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HOMEWOOD
CONSULTING PTY LTD

Arboricultural Impact Assessment

for

Kerstin Thompson Architects

Assessment of trees at 49 Newcombe Street
Portarlington

Prepared by

[redacted]

Prepared for

[redacted]

Consulting Arborist

[redacted]

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19 November 2024

Tel: 1300 404 558
ABN: 39 531 880 706

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Executive Summary

Seven trees were assessed at 49 Newcombe Street Portarlington in relation to the proposed redevelopment of the site. The table below summarises the impact of the proposed works on the assessed trees.

Arboricultural Impact	Tree Retention Value		Total No. of Trees
	Low	Third Party	
Impact Removal	1	0	1
Impact Major - viable	0	6	6
TOTAL	1	6	7

- **One tree (ID: 4)** has an **encroachment of 100%** from cut and fill earthworks associated with the construction of the proposed development. Its **removal is required** to facilitate the proposed design. This tree is of Low retention value and does not warrant design modifications for its retention.
- **Six trees (IDs: 1-3 & 5-7)** have a **major TPZ encroachment** from cut and fill earthworks associated with the construction of the proposed development, ranging from 13% to 40% of the total TPZ area.
  - These trees are all **Third Party Owned** and must be protected from any proposed development within the subject site. All trees are expected to remain viable if the tree protection measures recommended in Section 8 are followed.

All retained trees require protection to ensure they remain viable throughout demolition and construction.

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Recommended Tree Protection Measures

- **Project Arborist Engagement:**
  - Prior to the commencement of works, a Project Arborist should be engaged. The Project Arborist's role is to:
    - ◊ Develop a Tree Management Plan following completion of the design and construction specifications.
    - ◊ Induct contractors into the Tree Management Plan.
    - ◊ Ensure tree protection measures are in place and are adequate prior to the commencement of works, ensure trees are protected throughout construction and that trees remain viable post construction.
    - ◊ Supervise permitted works and undertake root pruning within TPZs when required.
    - ◊ Record and report compliance per relevant authority requirement (e.g., planning permit conditions).
- **Site Planning:**
  - Identify vehicle and machinery access and egress points. Where access for vehicles or machinery is required through the TPZ of trees to be retained, ground protection measures will be required to prevent soil compaction.
  - Where vehicles or machinery will be working closely adjacent to trees to be retained, protection for the trunk and branches may be required to prevent mechanical impact.

  - Storage of equipment and materials on site should be outside of the TPZ of trees to be retained.

- **Tree Protection:**
  - Tree Protection Fencing is to be installed where practical. Where TPZ fencing is impractical, bunting flags/mesh barrier fencing may be considered and will require approval by the project arborist.
  - Where works are permitted within the TPZ, fencing is to be taken in to only the minimum amount necessary to allow the works to be completed.
  - Hardstand must be constructed at, or above existing grade within the TPZs of trees to be retained.
  - Soft and hard landscaping within Tree Protection Zones should be assessed by the Project Arborist at the design stage, and prior to the commencement of works. In general:
    - ◊ There should be no grade changes within the TPZ of trees to be retained. If a level surface is required, no more than 100mm of fill (e.g. topsoil or crushed rock) should be used.
    - ◊ There should be no soil preparation for landscaping (cultivation, replacement of existing substrate or compaction) within the TPZ of trees to be retained.
    - ◊ Excavation for planting holes, fence posts, garden edging, etc. should be undertaken manually within the TPZ of trees to be retained. If significant roots (greater than 50mm diameter) are encountered these are to be retained unscathed and the location of the landscape component shifted. Any small roots are to be cleanly pruned by the Project Arborist, at right angles, using sharp, clean tools.
  - Underground services within Tree Protection Zones should be assessed by the Project Arborist at the design stage, and prior to the commencement of works.
  - All underground services (including water, sewage, electricity, gas and communications) should be located outside of the TPZ of trees to be retained.
  - If underground services are to be routed within an established TPZ, they should be installed by directional boring with the top of the bore to be a minimum depth of 800mm below the existing grade.
  - Bore pits should be located outside of the TPZ or manually excavated under the direct supervision of the Project Arborist.
  - Any demolition, excavation or levelling permitted within TPZs of trees to be retained must be supervised by the Project Arborist.

Further description of the tree protection measures listed can be seen in Appendix 3.

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Contents

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Table 1: Table of Revisions

Rev No.	Report Date	Description	Author	Internal Review Date	Reviewed by
0	*19/11/2024*	*Report for Submission to client*	[redacted]	*19/11/2024*	[redacted]

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1. Introduction

Homewood Consulting Pty Ltd has been engaged to provide an arboricultural impact assessment on trees at 49 Newcombe Street Portarlington in relation to the proposed redevelopment of the site.

This report has been prepared in accordance with Australian Standard 4970-2009 *Protection of Trees on Development Sites*. It provides an assessment of the trees with regard to their health, structure and retention value in the landscape and identifies the impact of the proposed development on the future longevity of the trees.

The report recommends design and construction methods to minimise impacts on retained trees where there is encroachment into the Tree Protection Zone.

2. Method

On Thursday, 14 November 2024 Taylor Richards conducted a site inspection.

Data collected for the trees includes:

- Botanical Name
- Canopy Dimensions
- Diameter at Breast Height (DBH)
- Diameter above basal root flare
- Health
- Structure
- Useful Life Expectancy (ULE)
- Retention Value.

A 'Visual Tree Assessment' (VTA) was conducted for each tree. A VTA consists of a detailed visual inspection of a tree and its surrounding site, including a complete walk around the tree, looking at the buttress roots, trunk, branches and leaves. The tree is observed from a distance and close up to consider crown shape, landscape context and surroundings.

The assessment was conducted from ground level with no instruments used other than a diameter tape to measure trunk diameter. Any assessments of decay are qualitative only.

A feature survey plan has been supplied by KTA (Drawing No. TP070, 2023) The plotted trees have been aligned to the feature survey for greater location accuracy.

Table 2 shows the data collected for the trees (page 9). For definitions and descriptors of the data collected on site see Appendix 1.

3. Protection of Trees on Development Sites

The Tree Protection Zone (TPZ) is the principal means of protecting trees on development sites. It is a combination of the root area and crown area which is isolated from construction disturbance, so that the tree remains viable. The TPZ incorporates the Structural Root Zone (SRZ), the area around the base of a tree required for the tree's stability in the ground; the woody root growth and soil cohesion in this area necessary to hold the tree upright. Further description of the TPZ and SRZ, and methods used for their calculation can be seen in Appendix 2.

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3.1 Arboricultural impact

The arboricultural impact of a proposed design is determined based on the level of encroachment into the TPZ of a tree as specified in Australian Standard AS4970-2009. The broad types of impact are described below:

Table 2: Arboricultural Impact categories and descriptors

Category	Description
Impact - Removal	The tree is within the footprint of the proposed design and will require removal to facilitate the design. In order to successfully retain the tree, a design modification would be required.
Impact – Major, not viable	The proposed design has a Tree Protection Zone area encroachment greater than 10%, or it impacts the Structural Root Zone. While the tree does not require outright removal under the design, the proposed works are expected to have a significant impact on the tree such that it is expected to die or fail in the future as a result of the works. In order to successfully retain the tree, a design modification would be required which reduces the impact to an acceptable level, unless a non-destructive root exploration has demonstrated that root distribution is limited in the proposed area of works.
Impact – Major, viable	The proposed design has a Tree Protection Zone area encroachment greater than 10%, or impacts the Structural Root Zone. The tree is expected to remain viable because of one, or a combination of the following: • Alternative construction methods are proposed which reduce the impact on the tree • Site conditions have limited root development within the proposed area of works • The species is known to be particularly tolerant to root disturbance • A non-destructive root exploration was undertaken and demonstrated that root distribution was limited in the proposed area of works. The tree will require the establishment of a Tree Protection Zone prior to the commencement of works, which may require compensation for the area lost to encroachment.
Impact - Minor	The proposed design has a Tree Protection Zone area encroachment of less than 10%, and does not impact the structural root zone. The tree is expected to remain a viable landscape component with the establishment of a Tree Protection Zone prior to the commencement of works, which may require compensation for the area lost to encroachment.
No impact	The proposed design does not enter the Tree Protection Zone. The tree is expected to remain a viable landscape component with the establishment of a Tree Protection Zone prior to the commencement of works.
Remove tree (condition)	The tree is in such poor condition that it is recommended for removal, regardless of the proposed design. The tree does not warrant retention and protection throughout the proposed works.

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4. Design Proposal

4.1 Existing Conditions

The existing site is a moderately sized block which contains an existing building, a concrete driveway along the western boundary, turf which encompasses the remainder of the site and a single self-seeded palm situated amongst the paving at the rear of the building. The site shares a fenceline with a residential dwelling and wine bar to the west, a kindergarten to the east and a park reserve to the north. There is no street tree along the property frontage to the south.

Figure 1: The property frontage and drive along the western boundary.

Figure 2: The extensive lawn area and rear of the existing building.

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4.2 Proposed Works

The proposed development will involve the demolition of the existing dwelling and the concrete drive which runs along the western boundary. Once cleared, a new dwelling is proposed across the southern extent of the site with paved and garden areas to encompass the remainder of the site.

Figure 3: An excerpt of the proposed site plan (KTA, Drawing No. TP070)

A survey plan showing the location of existing trees and site plans showing the proposed works have been prepared by KTA (Drawing No. TP070, 2023). These concept plans have been used to determine the impact of proposed works on the assessed trees.

No information regarding the installation of utilities or landscaping has been provided.

Table 3 displays the assessment data for all trees, as well as the dimensions of the TPZs, SRZs and the arboricultural impact from the proposed design.

Section 6 shows the Arboricultural Impact Assessment Plan. TPZs and SRZs for the assessed trees are depicted to scale and the construction footprint of the proposed works is indicated.

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5. Tree Assessments

Table 3: Summary of tree assessments and arboricultural impact from the proposed design.

ID	Botanical Name	Origin	Height & Width (m)	DBH (cm)	Age Class	Health	Structure	Retention Value	Comments	TPZ Radius (m)	SRZ Radius (m)	TPZ Encroachment (%)	TPZ Impact
1	*Agonis flexuosa*	Native	8 x 7	60	Mature	Good	Fair	3rd Party	Trunk dimensions estimated	7.20	2.85	13	Impact Major - viable
2	*Platanus x acerifolia*	Exotic	7 x 6	23	Semi mature	Good	Good	3rd Party	Trunk dimensions estimated	2.76	2.00	40	Impact Major - viable
3	*Phoenix canariensis*	Exotic	2 x 2	15	Young	Good	Fair	3rd Party	Trunk dimensions estimated	2.00	NA	29	Impact Major - viable
4	*Phoenix canariensis*	Exotic	2 x 2	15	Young	Good	Poor	Low	Growing through concrete, to be removed	2.00	NA	100	Impact Removal
5	*Strelitzia nicolai*	Exotic	6 x 5	49	Mature	Good	Fair	3rd Party	Trunk dimensions estimated	5.88	NA	27	Impact Major - viable
6	*Olea europaea*	Exotic	2 x 2	13	Mature	Fair	Poor	3rd Party	Very recently lopped to the height of fence, trunk dimensions estimated	2.00	2.00	32	Impact Major - viable
7	*Ulmus procera*	Exotic	4 x 2	9	Semi mature	Good	Poor	3rd Party	Suckers	2.00	1.50	22	Impact Major - viable

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6. Arboricultural Impact Assessment Plan

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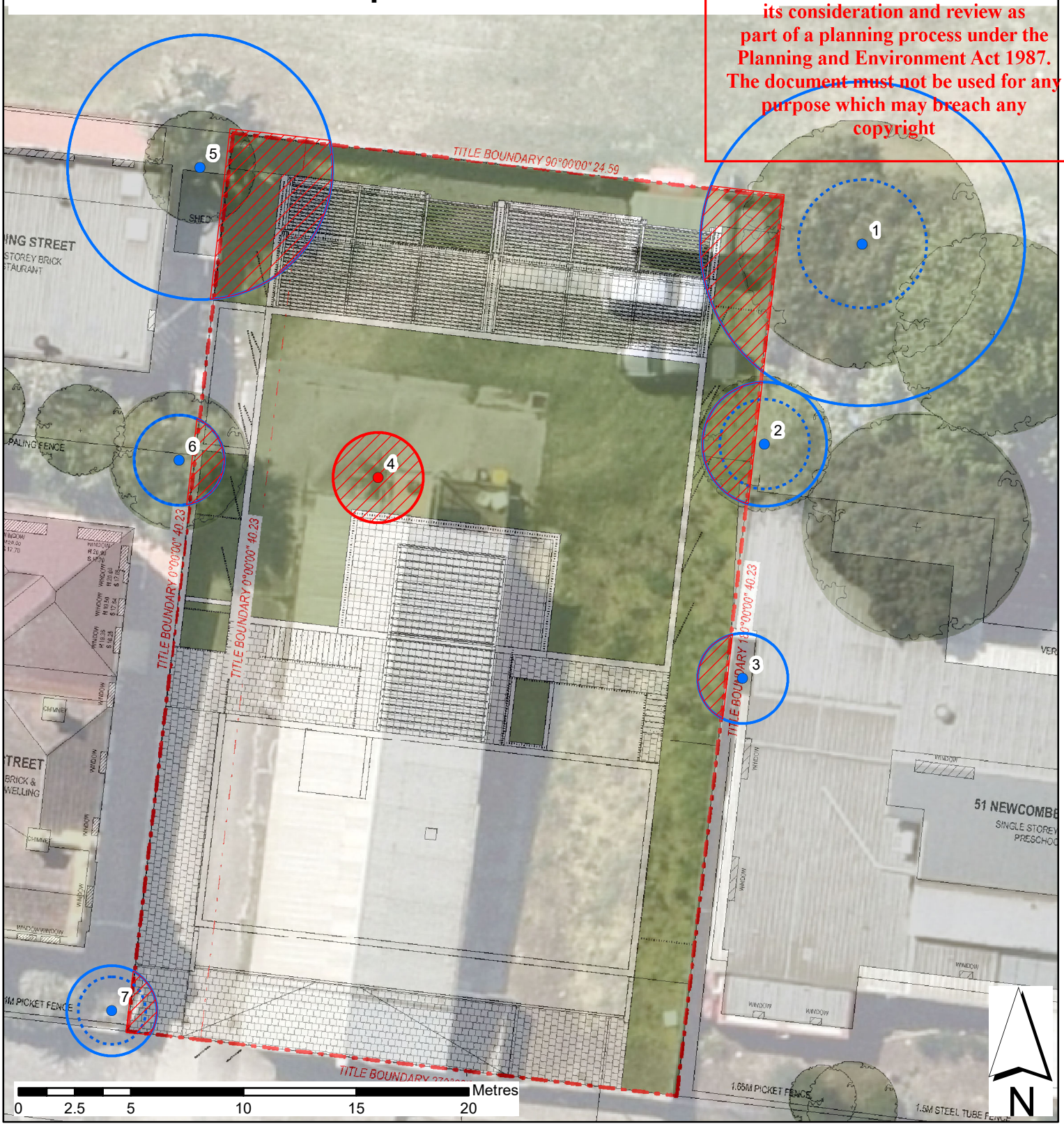

49 Newcombe Street, Portarlington

Legend

Trees/SRZ/TPZ/Retention Value

- Low
- Third party ownership

Encroachment Impact Category

- Major (>=10% or SRZ)
- Minor (<10% and no SRZ)

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HOMEWOOD CONSULTING PTY LTD
Unit 10/350 Settlement Road
Thomastown VIC 3074
Tel: 1300 404 558
ABN: 39 531 880 706

Base information supplied by: KTA
Date: 18/11/2024
Plotted: TJR
Projection: GDA 94 Zone 55

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7. Arboricultural Impact Assessment Summary

Table 4: Summary of impact from the proposed design

Arboricultural Impact	Tree Retention Value		Total No. of Trees
	Low	Third Party	
Impact Removal	1	0	1
Impact Major - viable	0	6	6
TOTAL	1	6	7

- **One tree (ID: 4)** has an **encroachment of 100%** from cut and fill earthworks associated with the construction of the proposed development. Its **removal is required** to facilitate the proposed design.
  - This tree has a **Low retention value** and regardless of its location within the footprint of the proposed development, a redesign or use of sensitive construction methodology in order to maintain this tree is unwarranted. It is more than likely that this tree is self-seeded and is of the lowest arboricultural value to the site.
- **Six trees (IDs: 1-3 & 5-7)** have a **major TPZ encroachment** from cut and fill earthworks associated with the construction of the proposed development, ranging from 13% to 40% of the total TPZ area.
  - Trees 1-3 are almost exclusively impacted by proposed landscaping; due to the simplicity of the site plan it is unclear on the specifics of the works.
  - Trees 5-7 are impacted by some hardscape and landscaping elements of the design.

  These six trees are all **Third Party Owned** and must be protected from any proposed development within the subject site. However, they are expected to remain viable if the tree protection measures recommended in Section 8 are followed.

All retained trees require protection to ensure they remain viable throughout demolition and construction.

8. Recommended Tree Protection Measures

- **Project Arborist Engagement:**
  - Prior to the commencement of works, a Project Arborist should be engaged. The Project Arborist's role is to:
    - ◊ Develop a Tree Management Plan following completion of the design and construction specifications.
    - ◊ Induct contractors into the Tree Management Plan.
    - ◊ Ensure tree protection measures are in place and are adequate prior to the commencement of works, ensure trees are protected throughout construction and that trees remain viable post construction.
    - ◊ Supervise permitted works and undertake root pruning within TPZs when required.
    - ◊ Record and report compliance per relevant authority requirement (e.g., planning permit conditions).
- **Site Planning:**

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- Identify vehicle and machinery access and egress points. Where access for vehicles or machinery is required through the TPZ of trees to be retained, ground protection measures will be required to prevent soil compaction.
- Where vehicles or machinery will be working closely adjacent to trees to be retained, protection for the trunk and branches may be required to prevent mechanical impact.
- Storage of equipment and materials on site should be outside of the TPZ of trees to be retained.

- **Tree Protection:**
  - Tree Protection Fencing is to be installed where practical. Where TPZ fencing is impractical, bunting flags/mesh barrier fencing may be considered and will require approval by the project arborist.
  - Where works are permitted within the TPZ, fencing is to be taken in to only the minimum amount necessary to allow the works to be completed.
  - Hardstand must be constructed at, or above existing grade within the TPZs of trees to be retained.
  - Soft and hard landscaping within Tree Protection Zones should be assessed by the Project Arborist at the design stage, and prior to the commencement of works. In general:
    - ◊ There should be no grade changes within the TPZ of trees to be retained. If a level surface is required, no more than 100mm of fill (e.g. topsoil or crushed rock) should be used.
    - ◊ There should be no soil preparation for landscaping (cultivation, replacement of existing substrate or compaction) within the TPZ of trees to be retained.
    - ◊ Excavation for planting holes, fence posts, garden edging, etc. should be undertaken manually within the TPZ of trees to be retained. If significant roots (greater than 50mm diameter) are encountered these are to be retained unscathed and the location of the landscape component shifted. Any small roots are to be cleanly pruned by the Project Arborist, at right angles, using sharp, clean tools.
  - Underground services within Tree Protection Zones should be assessed by the Project Arborist at the design stage, and prior to the commencement of works.
  - All underground services (including water, sewage, electricity, gas and communications) should be located outside of the TPZ of trees to be retained.
  - If underground services are to be routed within an established TPZ, they should be installed by directional boring with the top of the bore to be a minimum depth of 800mm below the existing grade.
  - Bore pits should be located outside of the TPZ or manually excavated under the direct supervision of the Project Arborist.
  - Any demolition, excavation or levelling permitted within TPZs of trees to be retained must be supervised by the Project Arborist.

Further description of the tree protection measures listed can be seen in Appendix 3.

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9. References

AS 4970 - 2009, *Australian Standard, Protection of Trees on Development Sites*, Standards Australia.

AS 4373 – 2007, *Australian Standard, Pruning of Amenity Trees*, Standards Australia.

Biddle, P.G., 1998, *Tree root damage to buildings, Causes, Diagnosis and Remedy,* Willowmead Publishing Ltd., Wantage, UK.

Mattheck, C. and Breloer, H. 1994, *The body language of trees: a handbook for failure analysis*, London: HMSO.

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Appendix 1. Data Collection Definitions & Descriptors

Tree assessments are based on the assessor's experience and opinion of the tree.

1.1 Botanical name

The scientific name identifying the genus and species of the tree. Each species has only one scientific name.

1.2 Common Name

The colloquial name for a tree species, usually in plain English. Common names for a species are often local or regional and each species can have multiple common names.

1.3 Tree dimensions

Tree height and canopy width in metres (estimated unless stated otherwise).

1.4 DBH

Diameter of the trunk at breast height (1.4m above ground level) measured using a diameter tape unless stated otherwise. Used to calculate the Tree Protection Zone radius.

1.5 Basal diameter

Diameter of the trunk above the root buttress, measured using a diameter tape unless stated otherwise. Used to calculate the Structural Root Zone radius.

1.6 Health

Category	Description
Very Good	The tree is demonstrating excellent or exceptional growth. The tree exhibits a full canopy of foliage and is free of pest and disease problems.
Good	The tree is demonstrating good or exceptional growth. The tree exhibits a full canopy of foliage and has only minor pest or diseases problems.
Fair	The tree is in reasonable condition and growing well. The tree exhibits an adequate canopy of foliage. There may be some deadwood present in the crown. Some grazing by insects or possums may be evident.
Poor	The tree is not growing to its full capacity; extension growth of the laterals is minimal. The canopy may be thinning or sparse. Large amounts of deadwood may be evident throughout the crown. Significant pest and disease problems may be evident or there may be symptoms of stress indicating tree decline.
Very Poor	The tree appears to be in a state of decline. The tree is not growing to its full capacity. The canopy may be very thin and sparse. A significant volume of deadwood may be present in the canopy or pest and disease problems may be causing a severe decline in tree health.
Dead	The tree is dead.

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1.7 Structure

Category	Description
Good	The tree has a well-defined and balanced crown. Branch unions appear to be sound, with no significant defects evident in the trunk or the branches. Major limbs are well defined. The tree is considered a good example of the species.
Fair	The tree has some minor problems in the structure of the crown. The crown may be slightly out of balance, and some branch unions may be exhibiting minor structural faults. If the tree has a single trunk, it may be on a slight lean or exhibiting minor defects.
Poor	The tree may have a poorly structured crown. The crown may be unbalanced or exhibit large gaps. Major limbs may not be well defined. Branches may be rubbing or crossing over. Branch unions may be poor or faulty at the point of attachment. The tree may have suffered root damage.
Very Poor	The tree has a poorly structured crown. The crown is unbalanced or exhibits large gaps with possibly large sections of deadwood. Major limbs may not be well defined. Branches may be rubbing or crossing over. Branch unions may be poor or faulty at the point of attachment. Branches may exhibit large cracks that are likely to fail in the future. The tree may have suffered major root damage.
Has Failed	A section of the tree has failed or is in imminent danger of failure and the tree is no longer a viable specimen.

1.8 Age Class

Category	Description
Mature	Tree has reached the expected size for the species at the site.
Semi-mature	Established tree that has not yet reach the expected size for the species at the site.
Young	Recently planted tree or juvenile self-sown tree (generally less than 5 years old).

1.9 Useful Life Expectancy (ULE)

Category	Description
40+ years	The tree is in excellent condition and under normal conditions and with appropriate management is expected to continue as a viable landscape component in excess of 40 years.
20 - 40 years	The tree is in good condition and under normal conditions and with appropriate management is expected to continue as a viable landscape component for 20-40 years.
10 - 20 years	The tree is in fair condition and under normal conditions and with appropriate management is expected to continue as a viable landscape component for 10-20 years.
5 - 10 years	The tree is in fair to poor condition or it is not a long lived species. Removal and replacement may be required within the next 10 years.
1 - 5 years	The tree is in poor condition due to advanced decline or structural defect. Removal and replacement may be required within the next 5 years.
0 years	The tree is dead or is considered hazardous in the location. Removal may be required.

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1.10 Tree Origin

Category	Description
Exotic	The species originates in a country other than Australia.
Australian Native	The species originates within Australia.
Indigenous	The species originates within the local environs.

1.11 Tree Retention Value

Term	Description
Very High	Tree of exceptional quality in good condition. A prominent landscape feature and/or of historic, cultural, ecological or other significance. Has the potential to be a long-term landscape component where managed appropriately. All efforts should be made to retain the tree and protect from arboricultural impact.
High	Tree of high quality in good to fair condition. Generally, a prominent landscape feature. Has the potential to be a medium to long-term landscape component where managed appropriately. All efforts should be made to retain the tree and protect from arboricultural impact.
Medium	Tree of moderate quality in fair condition. Generally, a modest landscape feature. May have a health or structural issue that can be resolved with arboricultural input or may refer to a medium to small tree in good condition. Has the potential to be a medium to long-term landscape component where managed appropriately. Where practical, design modifications should be considered in order to retain and protect from arboricultural impact.
Low	Either: Tree of low quality in poor condition. Generally, provides little amenity value. Unlikely to be a long or medium term landscape component. The tree may be considered a weed species, structurally unsound, dead/dying/diseased, nearing the end of its ULE or may not be suitable for the site. Or: small tree of good or fair condition which is easily replaced in the landscape through planting of advanced stock.
Third party ownership	The tree is located outside of the subject site and is owned by a third party. It may be owned by a private entity (residential) or public body (council). Third party owned trees must be retained and protected from arboricultural impact, unless a mutually acceptable outcome is negotiated with the tree owner and relevant authorities.

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Appendix 2. Tree Protection Zones & Structural Root Zones

2.1 Tree Protection Zones

All parts of the tree may be damaged by development and damage to any one part of the tree may affect its functioning as a whole.

Root damage is the most common cause of damage to trees on development sites. Roots may be directly damaged when removed, wounded, crushed or torn during grading, excavation or trenching. Soil compaction from foot traffic and vehicle traffic indirectly damages tree roots, resulting in loss of pore space within the soil which is essential for the exchange of gases between the soil and atmosphere and for soil drainage.

Trunks of trees may be wounded mechanically during demolition and construction work. This not only predisposes a tree to potential decay, but it also interferes with the transport of water, nutrients and sugars throughout the tree. Serious impacts may structurally weaken the tree.

The canopy of trees can be damaged through incorrect pruning techniques or mechanical injury by trucks, cranes, excavators etc. The removal of leaves reduces the level of photosynthesis and reduces the tree's capacity to function normally and to withstand stresses. Incorrect pruning and mechanical damage can produce wounds that are susceptible to infection by wood decay organisms.

For trees to be retained and their requirements met, procedures must be in place to protect trees at every stage of the development process. This needs to be taken into account at the earliest planning stage of any outdoor event or design of a development project where trees are involved.

The most common method of protecting trees during construction is by setting up a Tree Protection Zone (TPZ). The TPZ is an area isolated from construction disturbance area, so that the tree remains viable. The TPZ has been calculated according to the Australian Standard (AS 4970-2009) for the subject trees. This method calculates the TPZ radius to equal distance to the edge of the crown plus 1m.

A TPZ should not be less than 2m nor greater than 15m, except where additional crown protection is required.

The TPZ of palms, cycads, tree ferns and other monocotyledonous trees should not be less than 1m outside of the projection of the crown.

2.2 Structural Root Zones

The Structural Root Zone (SRZ) is the minimum volume of roots required by the tree to remain stable in the ground. If the SRZ is breached the chances of windthrow are significantly increased. Windthrow is an event where the entire tree fails/falls over.

It is important to note that the SRZ is not related to tree health. It refers to the physical volume of roots required for the tree to remain stable in the ground (Figure 4). It is in no way related to the physiological requirements of the tree but is the minimum volume of roots required for the tree to remain standing (Mattheck and Breloer 1994).

Palms, cycads, tree ferns and other monocotyledonous trees do not have a calculated SRZ. Their impacts are solely based off the TPZ.

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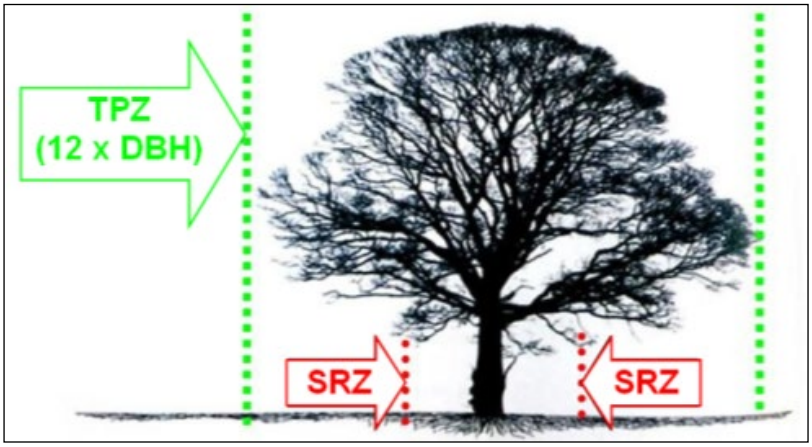

Figure 4: The SRZ = minimum volume of roots required to maintain tree stability (Biddle 1998).

2.3 TPZ and SRZ encroachment

It may be possible to encroach into or make variations to the standard TPZ. Encroachment includes (but is not limited to) excavation, compacted fill and machine trenching.

Table 5: Levels of TPZ encroachment as defined by AS 4970-2009

Level of Encroachment	Description / Definition	Requirements
Minor	Encroachment of less than 10% of the TPZ and outside the SRZ is deemed to be minor encroachment.	Detailed root investigations should not be required but the encroachment must be compensated with an extension to the TPZ elsewhere (Figure 5). Variations must be made by the Project Arborist considering other relevant factors including tree health, vigour, stability, species sensitivity and soil characteristics.
Major	Encroachment of more than 10% of the TPZ or into the Structural Root Zone (SRZ) is deemed to be major encroachment.	The Project Arborist must demonstrate that the trees would remain viable. This may require root investigation by non-destructive methods and/or consideration of relevant factors of tree health, vigour, stability, species sensitivity and soil characteristics. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ.

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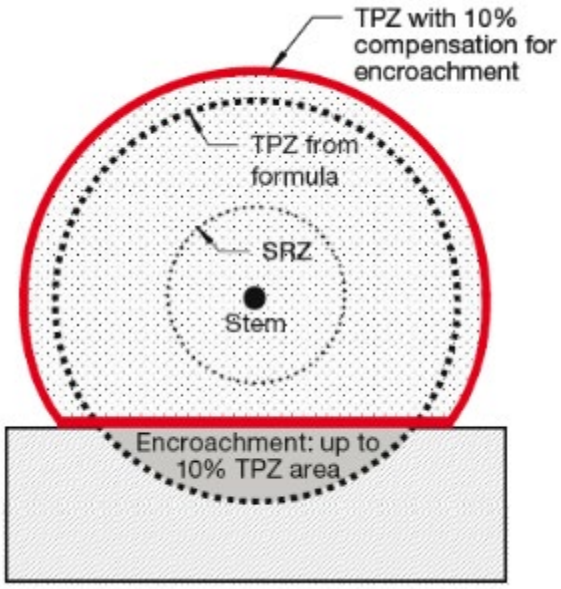

Figure 5: Example of minor TPZ encroachment and compensatory offset (image from AS 4970-2009).

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Appendix 3. Tree Protection Measures

3.1 Tree Protection Fencing

The Tree Protection Zone is delineated on site by a physical barrier of protective fencing that is a minimum of 1.8m high. It is installed around retained trees prior to site establishment and retained intact until completion of the works (Figure 6). Once erected, protective fencing must not be removed or altered without approval by the Project Arborist. The TPZ fence should be secured to restrict access.

Where TPZ fencing is impractical - e.g. if site access is required through the TPZ, other tree protection measures should be used, including ground protection and/or trunk and branch protection (see 3.8 and 3.9).

Figure 6: TPZ fencing is erected around retained trees prior to site works.

3.2 Signs

Signs identifying the TPZ should be placed around the edge of the TPZ and be clearly visible from within the development site (Figure 7).

Figure 7: Example of a TPZ warning sign clearly displayed on TPZ fencing.

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3.3 Activities restricted within the TPZ

Activities restricted within the TPZ include but are not limited to:

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- machine excavation including trenching
- excavation for silt fencing
- cultivation and landscaping
- storage of materials
- preparation of chemicals, including preparation of cement products
- parking of vehicles and plant
- refuelling
- dumping of waste
- wash down and cleaning of equipment
- placement of fill
- lighting of fires
- soil level changes
- temporary or permanent installation of utilities and signs
- physical damage to the tree.

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3.4 TPZ Maintenance

The fenced TPZ area should be mulched to retain soil moisture throughout the period of works. The mulch must be maintained to a depth of 50-100mm. Where the existing landscape within the TPZ is to remain unaltered (e.g. garden beds or turf) mulch may not be required.

Soil moisture levels should be regularly monitored by the Project Arborist. Temporary irrigation or watering may be required within the TPZ. An above-ground irrigation system should be installed and maintained by a competent individual.

All weeds should be removed by hand without soil disturbance or should be controlled with appropriate use of herbicide.

3.5 Working within the TPZ

Some works and activities within the TPZ may be permitted by the determining authority. These must be directly supervised on site by the Project Arborist. Any additional encroachment that becomes necessary as the site works progress must be reviewed by the Project Arborist and be acceptable to the determining authority before being carried out.

3.6 Landscaping

Soft and hard landscaping within Tree Protection Zones should be assessed by the Project Arborist at the design stage, and prior to the commencement of works. In general:

- There should be no grade changes within the TPZ of trees to be retained. If a level surface is required, no more than 100mm of fill (e.g. topsoil or crushed rock) should be used.
- There should be no soil preparation for landscaping (cultivation, replacement of existing substrate or compaction) within the TPZ of trees to be retained.

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- Excavation for planting holes, fence posts, garden edging, etc. should be undertaken manually within the TPZ of trees to be retained. If significant roots (greater than 50mm diameter) are encountered these are to be retained unscathed and the location of the landscape component shifted. Any small roots are to be cleanly pruned by the Project Arborist, at right angles, using sharp, clean tools.

3.7 Underground services

Underground services within Tree Protection Zones should be assessed by the Project Arborist at the design stage, and prior to the commencement of works.

- All underground services (including water, sewage, electricity, gas and communications) should be located outside of the TPZ of trees to be retained.
- If underground services are to be routed within an established TPZ, they should be installed by directional boring with the top of the bore to be a minimum depth of 800mm below the existing grade.
- Bore pits should be located outside of the TPZ or manually excavated under the direct supervision of the Project Arborist.

3.8 Ground Protection

If temporary access for machinery is required within the TPZ, ground protection measures will be required. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ. Examples of ground protection include track mats (Figure 8) and rumble boards strapped over mulch or crushed rock (Figure 9). Depending on weather conditions, geotextile fabric may be required to prevent mulch and crushed rock mixing into the site soils.

Figure 8: Track mats.

Figure 9: Rumble boards over crushed rock.

3.9 Trunk and Branch Protection

Where trees cannot be isolated from vehicles or machinery by TPZ fencing, trunk and branch protection may be required to prevent mechanical damage. Protection may consist of

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padding surrounding the trunk or branch, held in place with batons strapped together, or similar (Figure 10). Boards are to be strapped to trees, not nailed or screwed.

Crown protection may also include pruning, tying-back of branches or other measures. If pruning is required, it must be undertaken by a qualified arborist and as per the specifications of AS 4373-2007 *Pruning of Amenity Trees* and should be undertaken before the establishment of the TPZ.

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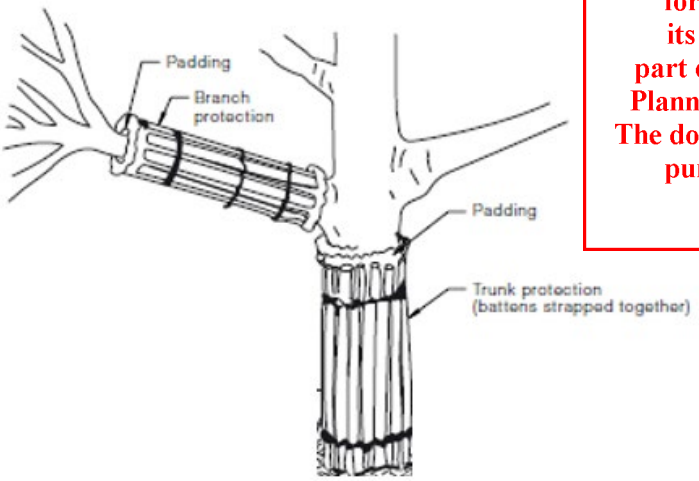

Figure 10: Example of trunk and branch protection (Source: AS 4970-2009).

3.9.1 Scaffolding

Where scaffolding is required it should be erected outside the TPZ. Where it is essential for scaffolding to be erected within the TPZ, branch removal should be minimised. The ground below the scaffolding should be protected by boarding (e.g. scaffold board or plywood sheeting Figure 11). Where access is required, a board walk or other surface material should be installed to minimise soil compaction. Boarding should be placed over a layer of mulch and impervious sheeting to prevent soil contamination. The boarding should be left in place until the scaffolding is removed.

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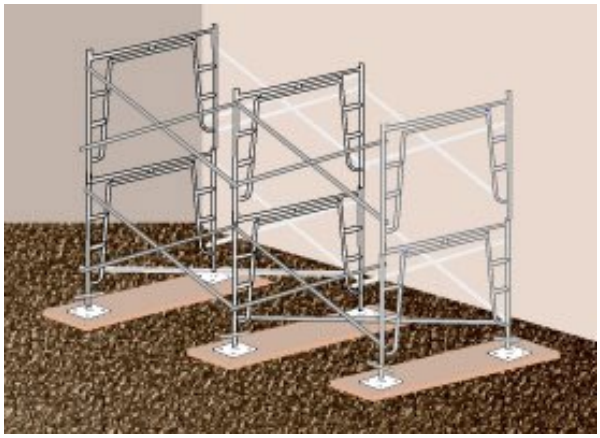

Figure 11: Scaffold on boarding.

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Tree Number: 1

Botanical Name: *Agonis flexuosa*

Common Name:	West Australian Willow Myrtle
Origin:	Native
Height & Width (m):	8 x 7
DBH (cm)	60
Health:	Good
Structure:	Fair
ULE:	20 to 40 years
Retention Value:	**Third Party Ownership**

TPZ Radius (m) 7.2
SRZ Radius (m) 2.85
Encroachment %: 13
TPZ Impact: Impact Major - viable

Comments:
Dimensions estimated

Tree Number: 2

Botanical Name: *Platanus xacerifolia*

Common Name:	London Plane
Origin:	Exotic
Height & Width (m):	7 x 6
DBH (cm)	23
Health:	Good
Structure:	Good
ULE:	40+ years
Retention Value:	**Third Party Ownership**

TPZ Radius (m) 2.76
SRZ Radius (m) 2.00
Encroachment %: 40
TPZ Impact: Impact Major - viable

Comments:
Trunk dimensions estimated

Tree Number: 3

Botanical Name: *Phoenix canariensis*

Common Name:	Canary Island Date Palm
Origin:	Exotic
Height & Width (m):	2 x 2
DBH (cm)	15
Health:	Good
Structure:	Fair
ULE:	10 to 20 years
Retention Value:	**Third Party Ownership**

TPZ Radius (m) 2
SRZ Radius (m) NA
Encroachment %: 29
TPZ Impact: Impact Major - viable

Comments:
Trunk dimensions estimated

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Tree Number: 4

Botanical Name: *Phoenix canariensis*

Common Name:	Canary Island Date Palm
Origin:	Exotic
Height & Width (m):	2 x 2
DBH (cm)	15
Health:	Good
Structure:	Poor
ULE:	< 5 years
Retention Value:	**Low**

TPZ Radius (m)
2
SRZ Radius (m)
NA

Encroachment %:
100
TPZ Impact:
Impact Removal

Comments:
Growing through concrete, to be removed

Tree Number: 5

Botanical Name: *Strelitzia nicolai*

Common Name:	Pacific Bird of Paradise
Origin:	Exotic
Height & Width (m):	6 x 5
DBH (cm)	49
Health:	Good
Structure:	Fair
ULE:	10 to 20 years
Retention Value:	**Third Party Ownership**

TPZ Radius (m)
5.88
SRZ Radius (m)
NA

Encroachment %:
27
TPZ Impact:
Impact Major - viable

Comments:
Trunk dimensions estimated

Tree Number: 6

Botanical Name: *Olea europaea*

Common Name:	European Olive
Origin:	Exotic
Height & Width (m):	2 x 2
DBH (cm)	13
Health:	Fair
Structure:	Poor
ULE:	10 to 20 years
Retention Value:	**Third Party Ownership**

TPZ Radius (m)
2
SRZ Radius (m)
2.00

Encroachment %:
32
TPZ Impact:
Impact Major - viable

Comments:
Very recently lopped to the height of fence, trunk dimensions estimated

Tree Number: 7

Botanical Name: *Ulmus procera*

Common Name:	English Elm
Origin:	Exotic
Height & Width (m):	4 x 2
DBH (cm)	9
Health:	Good
Structure:	Poor
ULE:	10 to 20 years
Retention Value:	**Third Party Ownership**

Comments:
Suckers

TPZ Radius (m)
2

SRZ Radius (m)
1.50

Encroachment %:
22

TPZ Impact:
Impact Major - viable

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