WESTWORKS
CONSULTANCY

Tree Protection Report

Location: 34-36 St Michaels Terrace, Mount Pleasant

Report Prepared for: Carcione Group of Companies

Date: 12 December 2024

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1.0 Introduction

An assessment was undertaken on 10 trees located within the subject area addressed to 34-36 St Michaels Terrace on the 9th of December 2024, to provide information regarding the protection of trees on site from the planned development.

The subject area requested for survey is planned for the demolition of the house and development of a two-story structure with a car park.

A Tree Protection Report outlines the requirements for protecting trees identified for retention in accordance with the Australian Standard AS4970:2009-Protection of Trees on Development Sites and provides an overview of the health, structure, dimensions and tree protection zones for each individual tree.

2.0 Methodology

This tree assessment consisted of a ground based basic tree assessment utilising the principals of Visual Tree Assessment (VTA) as outlined by Mattheck and Breloer (1994) and Lonsdale's approach (1999) and methods as per The Australian Standard for Protection of Trees on Development Sites (AS 4970- 2009)

This assessment also included the following:

- Collecting details of the Protections zone for the whole tree and Structural Root Zone
- Careful consideration of each tree's requirements in conjunction with the clients limitations to produce recommendations to best protect and work around each tree as required

The trees were assessed against the following areas:, using the following tools.

- Acoustic hammer.
- Forestry Workers Measuring Tape.
- Camera.
- Probing tools

Please note: an aerial assessment, PiCUS sonic tomograph and soil or tissue sampling was not undertaken during this assessment, however, each are an available option for an additional assessment should the results of this investigation deem it appropriate.

2.1 Species Identification.

This consultant and associates have a combined over 20 years' experience working with Western Australian tree species, with key proficiency identifying those which are endemic and native to the local Perth regions. Additionally, there are resources to the disposal of Westworks Consultancy to assist in tree species identification including, but not limited to, peer reviewed books and journals, outsourced associates with particular expertise and access to the Western Australian Herbarium (Department of Biodiversity, Conservation and Attractions).

2.2 Tree Measurements

- The height of the tree is an approximate height taken in meters (m)
- The canopy spread gives an indication of the general spread of the canopy in meters.
- The diameter of the trunk (DBH) is measured at 1.4m above ground level.
- The diameter of the root flare (DRF) is measured as low to the ground as possible.

2.3 Methodology – Tree Health

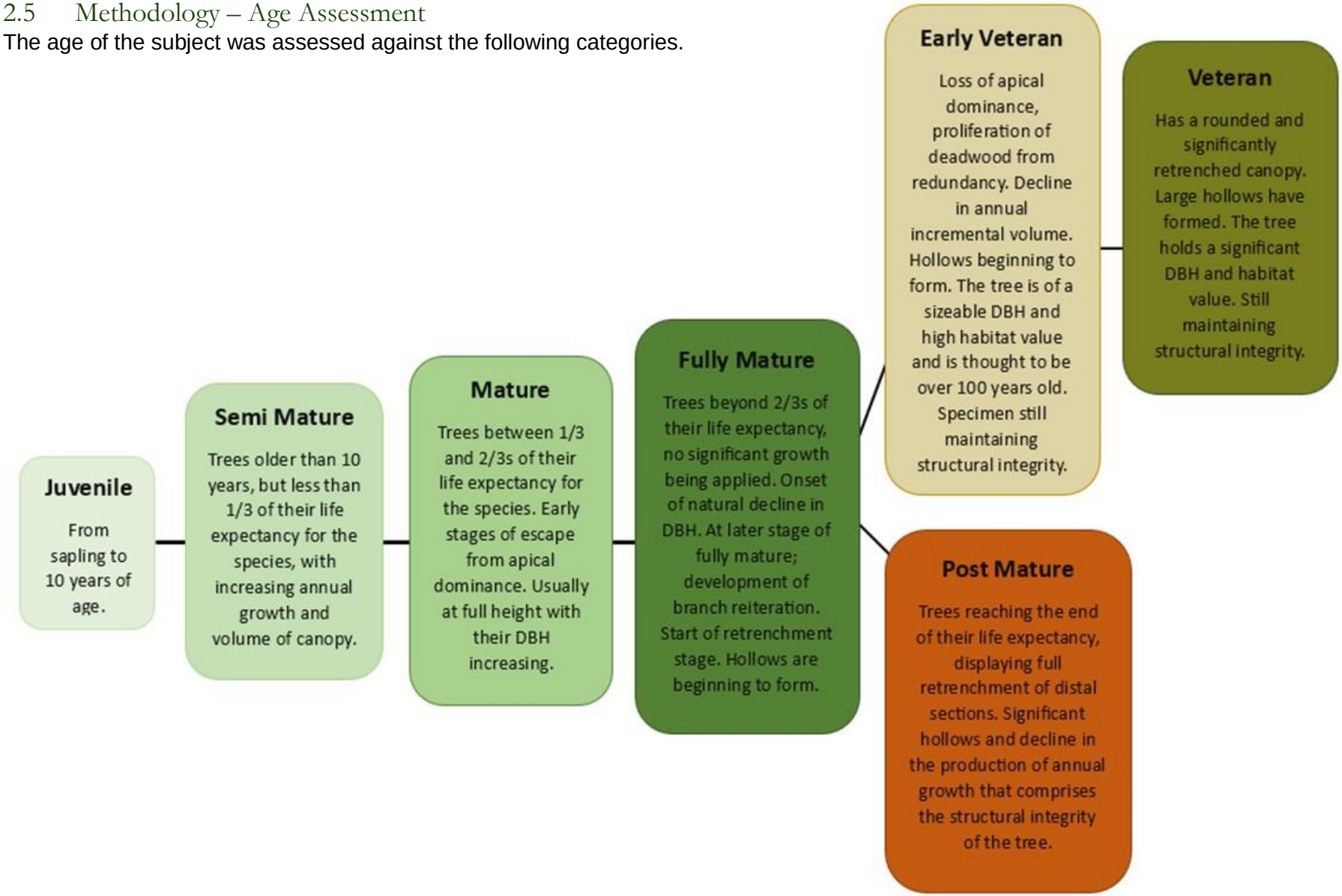
- **Good:** The tree will show good to excellent vigour throughout the tree for the species. The tree will exhibit a full and healthy canopy of foliage with only minimal pest or diseases evident.
- **Fair:** The tree is growing in a reasonable condition and shape with adequate canopy foliage for the species. Minor dead wood may be present throughout the crown, with reasonable colour and density when compared to a typical healthy specimen of that species.
- **Poor:** The tree appears stunted and not growing to its full capability with the canopy potentially visibly showing signs of openness and thinning with excessive amounts of dead or dying limbs. Evidence of established pest and disease issues will be evident or symptoms of stress indicating the tree is in decline.
- **Very poor:** The tree is in a state of decline with the canopy visibly open with considerable deadwood with pest and diseases being present throughout the tree as it enters the final stages of senescing.
- **Dead:** No more living tissue evident.

2.4 Methodology - Structure

- **Good:** The tree will have optimum spacings of first order branches, with open angles of attachment and no inclusions, the trunk is applying very visible signs of annualised response growth. There are no observable defects. This is a high-quality specimen for the species.
- **Fair:** The tree is displaying evenly spaced first order branches, with structurally sound unions, the trunk is applying annualised wood to maintain optimum structural integrity. There may be some minor defects, yet the tree is managing these appropriately. This is a “normal” specimen for the species.
- **Poor:** Minor structural defects observed, there may be damage to the cambium, included bark, which reduces the structural integrity of a union, and/or the tree may have been lopped, which has significantly altered its form.
- **Very poor:** The tree is in a state of decline with poor branch spacings and attachment. Major structural defects have been observed.
- **Has Failed:** The tree is of a significantly poor structural integrity to the point where A failure event was observed to have occurred.

2.5 Methodology – Age Assessment

The age of the subject was assessed against the following categories.



2.6 Useful Life Expectancy

- **Very Long** (Greater than 40 + years)

  Very high quality and high value, these trees would hold such a condition that make them a valuable part of the environment/ landscape, would be considered to hold a Useful Life Expectancy (ULE) of greater than 40 years, thus allowing them to make a substantial contribution for a long period of time.

- **Long** (Greater than 20 to 40 years)

  High quality and high value, these trees would hold such a condition that make them a valuable part of the environment/ landscape, would be considered to hold a Useful Life Expectancy (ULE) of 40 years of greater, thus allowing them to make a substantial contribution.

- **Medium** (Between 11 and 20 years)

  Medium quality and medium value, trees of this category are thought of as making a significant contribution to the area they dwell in and would be considered to hold a ULE of a minimum of 20 years.

- **Short** (Between 6 and 10 years)

  Low quality and low value. These trees would be regarded as being in an adequate condition that would see them being retained for a period that would allow new plantings to establish. They would be considered as having a ULE of 5 to 10 years.

- **Transient** (Less than 5 years)

  Very Low quality and very low value, these trees would be regarded as having a poor form, displaying a low vitality, and may be exhibiting initial signs of structural decline. They would be considered to have a ULE of less than 5 years and are to be included in a plan for replacement.

- **Dead or hazardous** (no remaining ULE).

  Trees in this category would be considered to hold such a condition that would potentially hold no value or in their current state it would be reasonable to undertake their removal for reasons of sound Arboricultural management, due to a high level of risk.

3.0 Tree Information Required for Protection

The Australian standard for Protection of trees on development sites, AS 4970 – 2009, serves to set out protection measures for trees throughout the period of construction and is comprised of two zones (Diagram 1).

Tree Protection Zone

The Tree Protection Zone (TPZ) considers protection of both the canopy and roots. For this protection zone to be effective, it is ideal that no plant or equipment intrude throughout the duration of excavation or construction.

The Tree Protection Zone should be the primary consideration during the design process, and only when absolutely necessary should it fall to the second zone.

Structural Root Zone

The second zone is the Structural Root Zone (SRZ). This area considers the larger roots, those which function primarily as anchor support for the tree, keeping it upright and in the ground. Disturbance and damage to these roots can have long lasting effects on the tree's overall condition, for this reason it is generally considered to be the 'No Dig Zone.'

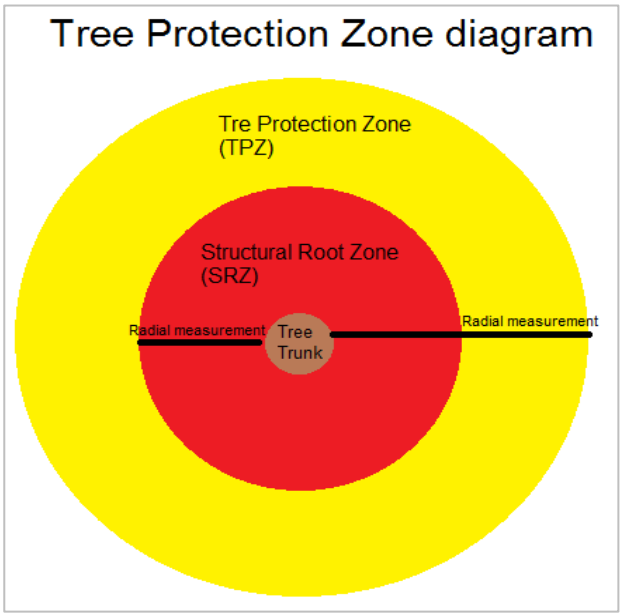
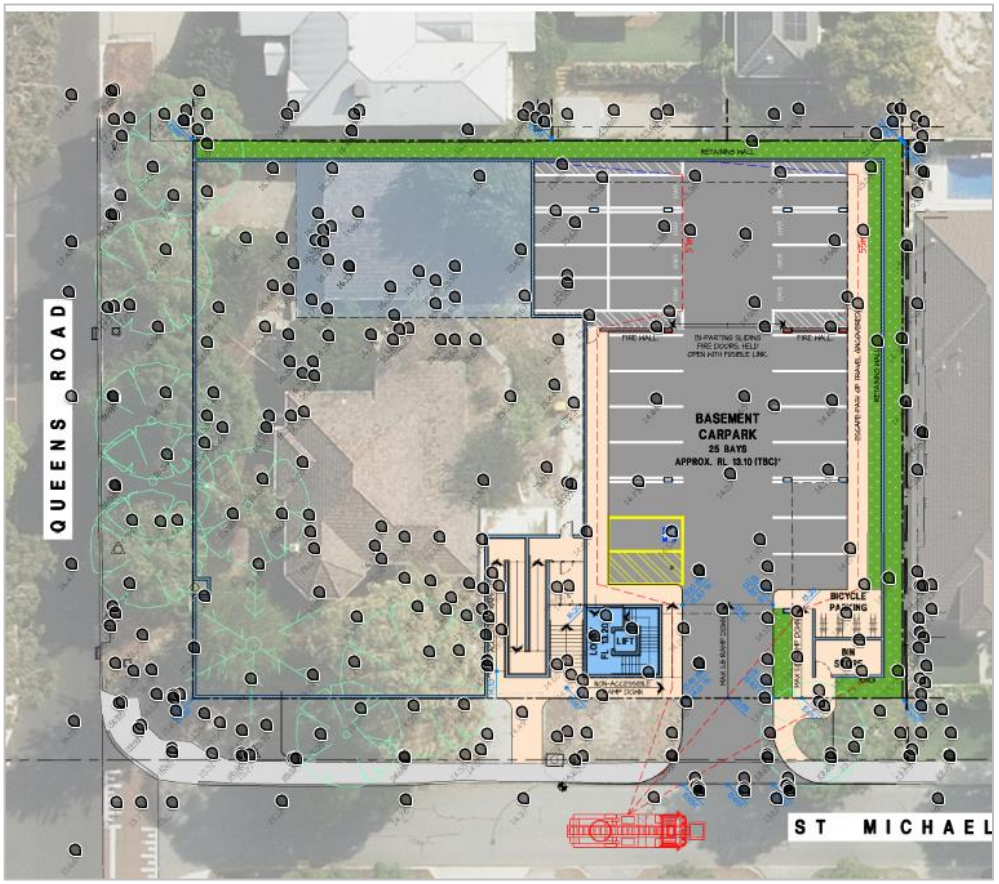


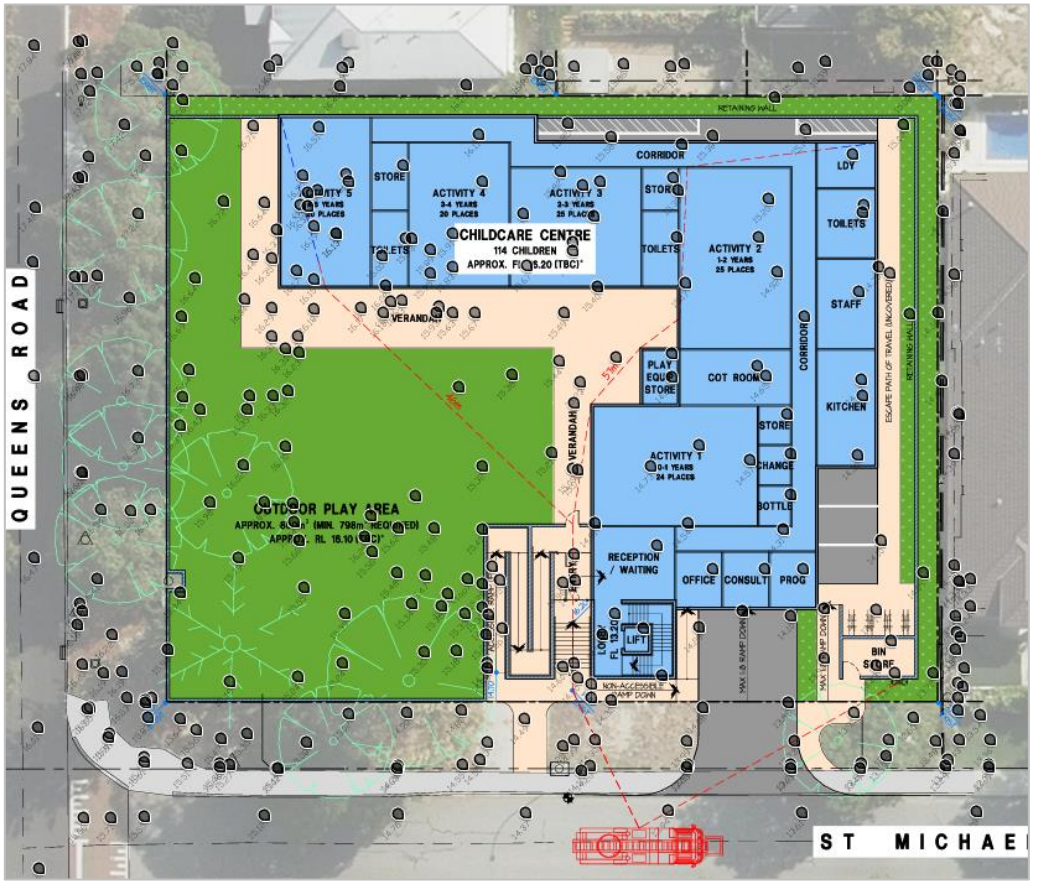
Diagram 1. Order and size of the Tree Protection Zone (TPZ) and the Structural Root Zone (SRZ).

However, consultation with a Project Arborist during the planning and design stage can allow encroachment into these zones up to a maximum area threshold of 10%. It is essential that this work be discussed with the Project Arborist to ensure a tree is in suitable condition to handle the stress, as well as to ensure the encroachment is minimal – variations of this threshold may exist for individual trees depending on the existing status of the root zone. Any work carried out in these zones must be supervised by a qualified Project Arborist until encroachment has ceased.

Information regarding method requirements for this work can be provided following consultation with this consultant when more information regarding the design and work requirements are available

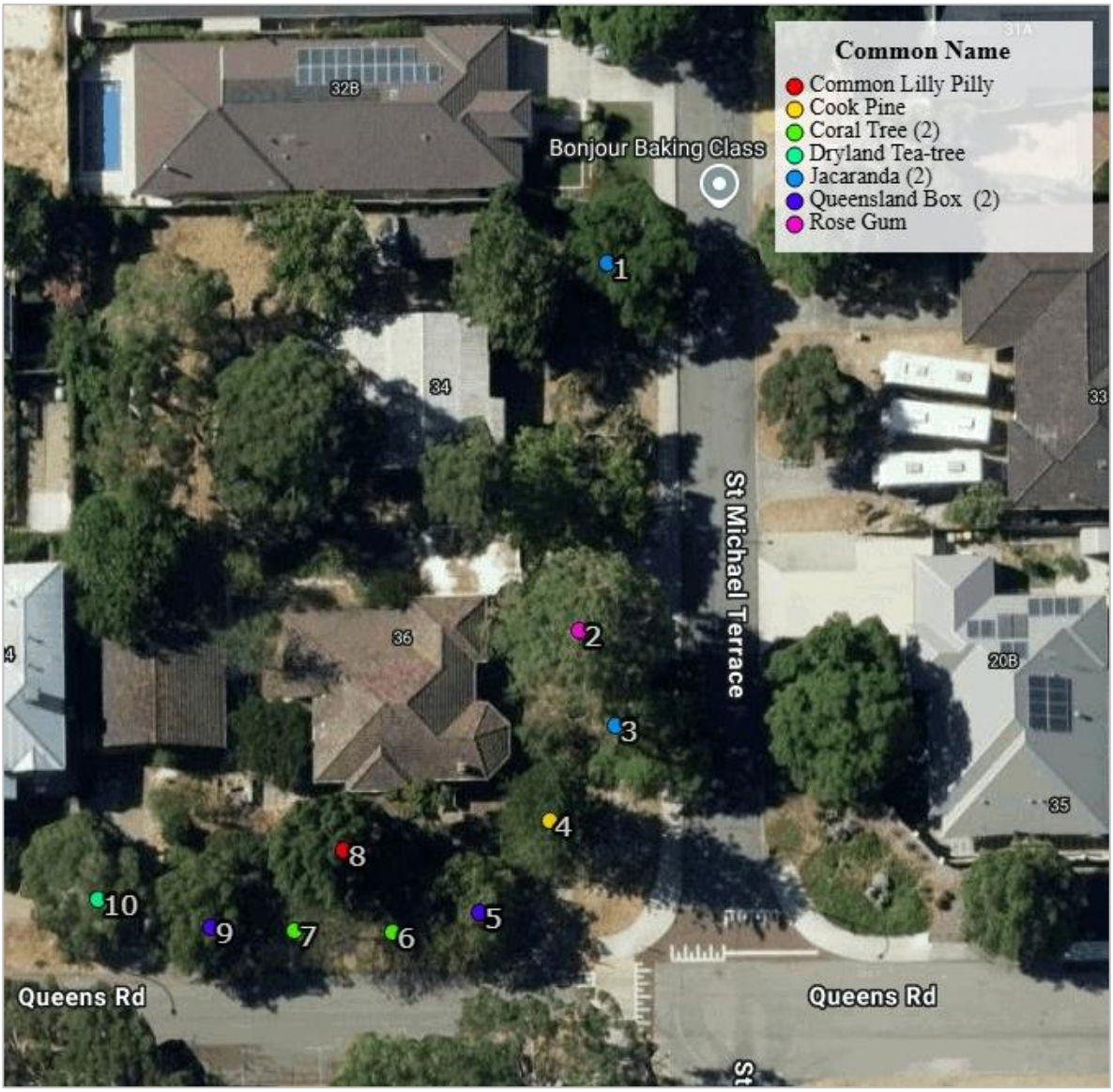
4.0 Concept Plan





5.0 Location of Subject Tree(s)

Subject trees are marked with coloured dots, correlating to their species name in the legend provided.



6.0 Tree Assessment

Each of the 10 subject trees collected in the subject area is allotted a single page summary report, produced using an arborist specific GIS software.

All observations presented in this report are true for the date of assessment (9 December 2024).

Details include:

- Descriptions of the subject trees' health and structure
- The measurements for the TPZ and the SRZ
- Any works recommended to improve the health and structural integrity of the tree.
- The latitude & longitude of the trees' location within the grounds, &
- A photo of the whole tree.

Summary reports are on the following pages.

Jacaranda Tree ID #1

Tree Details

Latin Name:	Jacaranda mimosifolia
Common Name:	Jacaranda
Tree Age:	Mature
Health:	Good
Structure:	Fair
Tree Height (Estimated) [m]:	11
Canopy Spread [m]:	12
DBH [cm]:	44
DBH Range:	30-45cm
Diameter at Root Flare (DRF) [cm]:	0.475
Tree Protection Zone (TPZ) [m]:	5.28
Structural Root Zone (SRZ) [m]:	2.42
Useful Life Expectancy:	40+ years
Observations-Structural Issues:	None observed
Species origin:	Exotic
Work Requirements:	No Action Required
Observation Comments:	
Retention Category:	Retain

Tree Location

Longitude:	115.846283
Latitude:	-32.028783

Photos | Street View | Map View

image.jpg
09/12/2024

Rose Gum Tree ID #2

Tree Details

Latin Name:	Eucalyptus grandis
Common Name:	Rose Gum
Tree Age:	Mature
Health:	Fair
Structure:	Fair
Tree Height (Estimated) [m]:	18
Canopy Spread [m]:	16
DBH [cm]:	56
DBH Range:	46-60cm
Diameter at Root Flare (DRF) [cm]:	0.85
Tree Protection Zone (TPZ) [m]:	6.72
Structural Root Zone (SRZ) [m]:	3.09
Useful Life Expectancy:	40+ years
Observations-Structural Issues:	Missing bark on trunk
Species origin:	Native
Work Requirements:	No Action Required
Observation Comments:	
Retention Category:	Retain

Tree Location

Longitude:	115.846260
Latitude:	-32.029037

Photos | Street View | Map View

image.jpg
09/12/2024

Jacaranda Tree ID #3

Tree Details

Latin Name:	Jacaranda mimosifolia
Common Name:	Jacaranda
Tree Age:	Mature
Health:	Good
Structure:	Fair
Tree Height (Estimated) [m]:	10
Canopy Spread [m]:	10
DBH [cm]:	38.2
DBH Range:	30-45cm
Diameter at Root Flare (DRF) [cm]:	0.425
Tree Protection Zone (TPZ) [m]:	4.58
Structural Root Zone (SRZ) [m]:	2.31
Useful Life Expectancy:	40+ years
Observations-Structural Issues:	Deadwood
Species origin:	Exotic
Work Requirements:	Remove all deadwood over 25mm in diameter
Observation Comments:	Deadwood in canopy due to phototropism from adjacent verge tree
Retention Category:	Retain

Tree Location

Longitude:	115.846290
Latitude:	-32.029103

Photos Street View Map View

image.jpg
09/12/2024

Cook Pine Tree ID #4

Tree Details

Latin Name:	Araucaria columnaris
Common Name:	Cook Pine
Tree Age:	Mature
Health:	Good
Structure:	Fair
Tree Height (Estimated) [m]:	17
Canopy Spread [m]:	8
DBH [cm]:	50.8
DBH Range:	46-60cm
Diameter at Root Flare (DRF) [cm]:	0.59
Tree Protection Zone (TPZ) [m]:	6.1
Structural Root Zone (SRZ) [m]:	2.65
Useful Life Expectancy:	40+ years
Observations-Structural Issues:	None observed
Species origin:	Native
Work Requirements:	Uplift canopy to 2m above ground level
Observation Comments:	Excellent specimen
Retention Category:	Retain

Tree Location

Longitude:	115.846236
Latitude:	-32.029169

Photos | Street View | Map View

image.jpg
09/12/2024

Queensland Box Tree ID #5

Tree Details

Latin Name:	Lophostemon confertus
Common Name:	Queensland Box
Tree Age:	Mature
Health:	Fair
Structure:	Fair
Tree Height (Estimated) [m]:	8
Canopy Spread [m]:	8
DBH [cm]:	37.5
DBH Range:	30-45cm
Diameter at Root Flare (DRF) [cm]:	0.44
Tree Protection Zone (TPZ) [m]:	4.5
Structural Root Zone (SRZ) [m]:	2.34
Useful Life Expectancy:	40+ years
Observations-Structural Issues:	None observed
Species origin:	Native
Work Requirements:	Uplift canopy to 2m above ground level
Observation Comments:	
Retention Category:	Retain

Tree Location

Longitude:	115.846178
Latitude:	-32.029233

Photos Street View Map View

image.jpg
09/12/2024

Coral Tree Tree ID #6

Tree Details

Latin Name:	Erythrina sykesii
Common Name:	Coral Tree
Tree Age:	Semi mature
Health:	Fair
Structure:	Fair
Tree Height (Estimated) [m]:	7
Canopy Spread [m]:	6
DBH [cm]:	35.71
DBH Range:	30-45cm
Diameter at Root Flare (DRF) [cm]:	0.39
Tree Protection Zone (TPZ) [m]:	4.29
Structural Root Zone (SRZ) [m]:	2.23
Useful Life Expectancy:	40+ years
Observations-Structural Issues:	Missing bark on branch, Missing bark on trunk
Species origin:	Exotic
Work Requirements:	No Action Required
Observation Comments:	
Retention Category:	Retain

Tree Location

Longitude:	115.846107
Latitude:	-32.029246

Photos Street View Map View

image.jpg
09/12/2024

Coral Tree Tree ID #7

Tree Details

Latin Name:	Erythrina sykesii
Common Name:	Coral Tree
Tree Age:	Mature
Health:	Fair
Structure:	Fair
Tree Height (Estimated) [m]:	10
Canopy Spread [m]:	10
DBH [cm]:	43.42
DBH Range:	30-45cm
Diameter at Root Flare (DRF) [cm]:	0.485
Tree Protection Zone (TPZ) [m]:	5.21
Structural Root Zone (SRZ) [m]:	2.44
Useful Life Expectancy:	40+ years
Observations-Structural Issues:	None observed
Species origin:	Exotic
Work Requirements:	No Action Required
Observation Comments:	This tree has been lopped in the past, monitor regrowth
Retention Category:	Retain

Tree Location

Longitude:	115.846027
Latitude:	-32.029245

Photos Street View Map View

image.jpg
09/12/2024

Common Lilly Pilly Tree ID #8

Tree Details

Latin Name:	Acmena smithii
Common Name:	Common Lilly Pilly
Tree Age:	Mature
Health:	Fair
Structure:	Fair
Tree Height (Estimated) [m]:	15
Canopy Spread [m]:	11
DBH [cm]:	48
DBH Range:	46-60cm
Diameter at Root Flare (DRF) [cm]:	0.61
Tree Protection Zone (TPZ) [m]:	5.76
Structural Root Zone (SRZ) [m]:	2.69
Useful Life Expectancy:	40+ years
Observations-Structural Issues:	None observed
Species origin:	Native
Work Requirements:	No Action Required
Observation Comments:	This tree is likely within the private property
Retention Category:	Retain

Tree Location

Longitude:	115.846067
Latitude:	-32.029189

Photos | Street View | Map View

image.jpg
09/12/2024

Queensland Box Tree ID #9

Tree Details

Latin Name:	Lophostemon confertus
Common Name:	Queensland Box
Tree Age:	Mature
Health:	Fair
Structure:	Fair
Tree Height (Estimated) [m]:	8
Canopy Spread [m]:	8
DBH [cm]:	38.7
DBH Range:	30-45cm
Diameter at Root Flare (DRF) [cm]:	0.423
Tree Protection Zone (TPZ) [m]:	4.64
Structural Root Zone (SRZ) [m]:	2.31
Useful Life Expectancy:	40+ years
Observations-Structural Issues:	None observed
Species origin:	Native
Work Requirements:	No Action Required
Observation Comments:	
Retention Category:	Retain

Tree Location

Longitude:	115.845959
Latitude:	-32.029243

Photos | Street View | Map View

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09/12/2024

Dryland Tea-tree Tree ID #10

Tree Details

Latin Name:	Melaleuca lanceolata
Common Name:	Dryland Tea-tree
Tree Age:	Mature
Health:	Fair
Structure:	Fair
Tree Height (Estimated) [m]:	9
Canopy Spread [m]:	9
DBH [cm]:	44
DBH Range:	30-45cm
Diameter at Root Flare (DRF) [cm]:	0.61
Tree Protection Zone (TPZ) [m]:	5.28
Structural Root Zone (SRZ) [m]:	2.69
Useful Life Expectancy:	40+ years
Observations-Structural Issues:	None observed
Species origin:	Native
Work Requirements:	No Action Required
Observation Comments:	Bat box installed on main trunk
Retention Category:	Retain

Tree Location

Longitude:	115.845866
Latitude:	-32.029223

Photos Street View Map View

image.jpg
09/12/2024

7.0 Tree Protection During Construction

In line with the Australian Standard AS4970:2009-Protection of Trees on Development Sites there are several control measures required to protect these trees.

The primary control is to ensure that once the trees have been planted that no more disturbance is made to their root zone, including the immediate areas around it where roots are being encouraged to grow. It is recommended to use the trees current SRZ and TPZ as a guide for protection post root pruning.

Within these zones site workers and contractors are NOT to allow the following to occur:

- Mechanical excavation including trenching without consulting the site Arborist.
- Excavation for silt fencing.
- Cultivation.
- Storage.
- Preparation of chemicals, including preparation of cement products.
- Parking of vehicles and plant.
- Refuelling.
- Dumping of waste.
- Placement of fill.
- Lighting of fires.
- Soil level changes.
- Temporary or permanent installation of utilities and signs.
- Physical damage to the tree.

To protect these trees, it is recommended to:

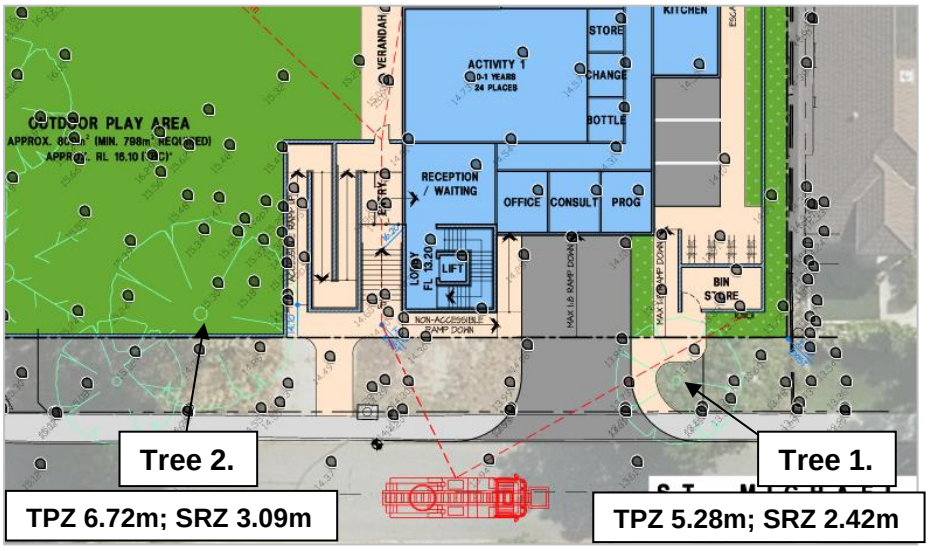
- Plan and action nearby underground services prior to transplanting or design these services outside the TPZ.
- Install tree protective fencing around each tree. the fencing should be 1.8m high and installed so that they cannot be moved.
- The fence should be identified with a TPZ sign to inform workers of the restricted access. The role of these fences is to prevent any damage to the complete tree including root system (SRZ & TPZ), stem and branch structure as well as the crown or canopy.
- Tree protection fencing rules should be included in the site induction for all employees and contractors.
- The recommended watering regime must be maintained as described.
- Planning of site operations should take sufficient account of wide loads, tall loads and plant with booms, jibs, and counterweights (including piling rigs), in order to operate without coming into contact with retained trees.

8.0 Conclusion

All ten trees were found to be in a fair or good condition and suitable for retention. Guided by the current concept plan provided all trees are likely to have some form of development and installation encroach the TPZ and/or SRZ. The Australian Standard for the Protection of Trees on Development Sites (AS4970:2009) stipulates the TPZ to be the boundary of encroachment with a 10% threshold exception. Where possible, design modifications should be the primary step in accommodating tree protection where this threshold is likely to be exceeded. Alternatively, there are different methods of excavation and means of management that can allow for a greater encroachment, dependent on the condition of the tree, the degree of works and only when approved by a qualified arborist consultant.

Tree 1 is pictured to have a footpath beneath the canopy, through the SRZ, and the development of a slope within the TPZ. Where excavation is to occur for the change of ground level, works must be done so using Tree Protection methods which carefully expose the roots, allowing an onsite Arborist Consultant to prune those which are able to be removed. This is to prevent taring and fracturing from radiating into the SRZ causing larger issues in the future. Using the limited information currently provided, this is not expected to exceed the 10% threshold, however exact measurements will be required prior to the undertaking of the work. The development of the footpath will compact the soil above the roots, however, provided the remainder of the root plate is left open, free from impermeable materials and compaction, it is not expected to negatively impact the tree. The removal of soil must be done so with consideration, as the roots in this area are much larger and damage to this zone will have a greater impact. Additionally, this work will require movement of people, materials and machinery beneath the canopy, due diligence is required to ensure branches are not damaged in the process.

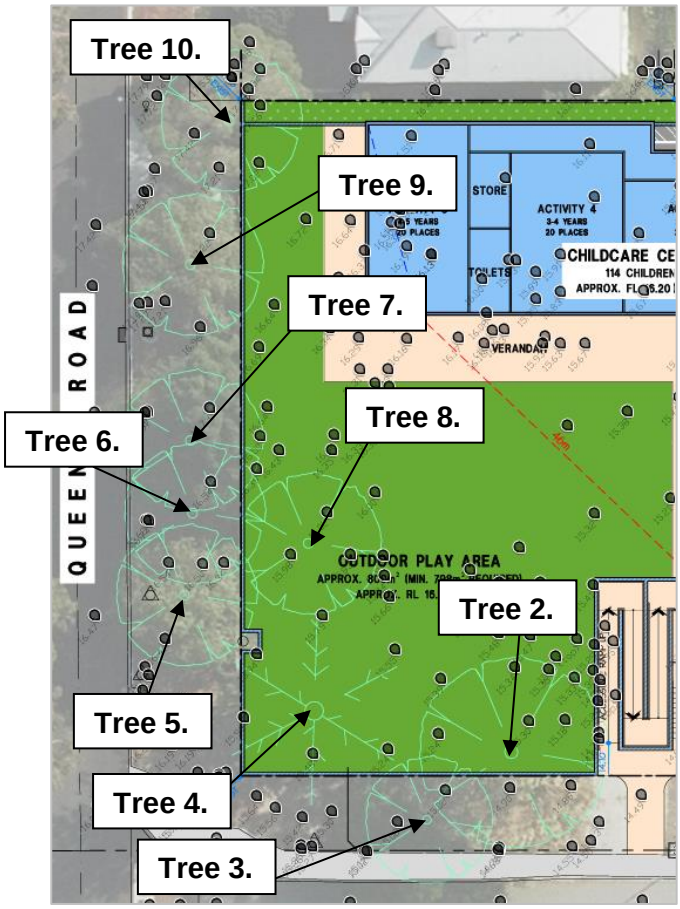
Tree 2 is pictured to have the fence or boundary wall through the SRZ, and the wall of the accessibility slope through the TPZ, and likely the canopy spread. It should be a priority to avoid the need for pruning this canopy to make room for the wall, as this will affect the form and aesthetic of the tree, as well as risking the development of exponential response growth (epicormic branches) from growing in place. Modifications are required in this area of the design if this type of preliminary work would be required.



Regarding the encroachment of the boundary wall or fence, it is recommended to consider the materials and methods required for installation to limit the degree of root disturbance. As the boundary is through the SRZ of most trees, excavation using heavy machinery to develop a trench for footings and foundation is highly likely to have a negative impact on all trees, as this will result in structural root damage and removal.

To avoid this, it is recommended to choose a boundary material that can be installed with isolated footings spaced apart, rather than a sunken solid material that requires a trench. Vacuum excavation is a suitable method for removing soil between roots as it drastically reduces the risk of damage and most often allows for the placement of infrastructure between roots rather than having to remove them.

Additionally, as the canopies of many trees are fairly well spread, and some are near the approximate height of an average boundary wall, care must be taken to prevent injury to branches. It is recommended that following the finalised design, a second minor assessment be undertaken to determine which, if any, branches can be removed where it may benefit the processes of development and prevent damage.



Tree Id	TPZ (m)	SRZ (m)	Canopy Spread (m)
1	5.28	2.42	12
2	6.72	3.09	16
3	4.58	2.31	10
4	6.1	2.65	8
5	4.5	2.34	8
6	4.29	2.23	6
7	5.21	2.44	10
8	5.76	2.69	11
9	4.64	2.31	8
10	5.28	2.69	9

9.0 Recommendations

9.1 Design Considerations

- Works beneath the canopy dripline must be careful to not cause any damage to tree branches or the trunk.
- Works within the TPZ must have an arborist consultant onsite throughout the duration of this encroachment to undertake any root pruning that may be required.
- Boundary wall footings and foundation materials and methods of instalment must not require trenching.
- Vacuum excavation for the installation of chosen footings is required to navigate around root systems, only the arborist consultant can undertake the pruning of roots to make room for materials.
- Wall to the accessibility slope should be positioned or of a low enough height to ensure no pruning for clearance is required of tree 2.

9.2 Arborist Works Recommended

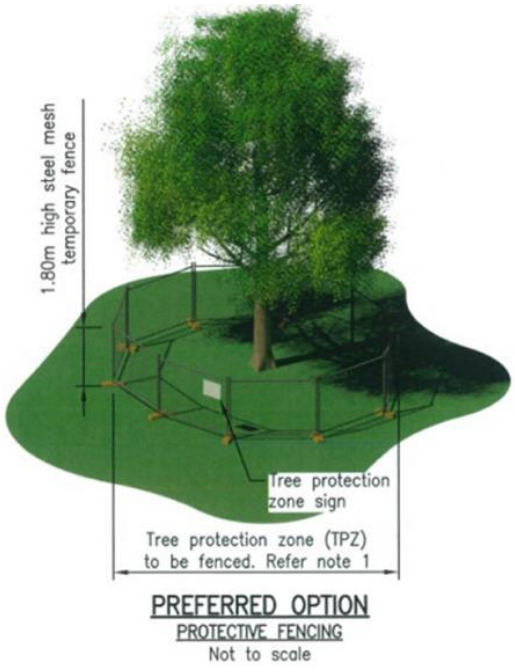
Tree Id	Latin Name	Tree Height (m)	Work Requirements	Observation Comments
3	*Jacaranda mimosifolia*	10	Remove all deadwood over 25mm in diameter	Deadwood in canopy due to phototropism from adjacent verge tree
4	*Araucaria columnaris*	17	Uplift canopy to 2m above ground level	Excellent specimen
5	*Lophostemon confertus*	8	Uplift canopy to 2m above ground level	

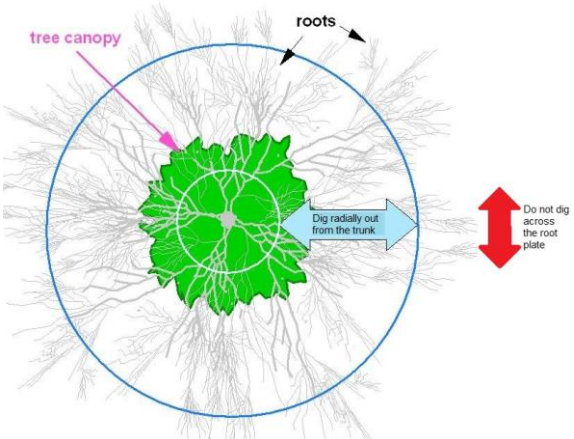
9.3 Tree Protection Data Summary

Tree Id	Latin Name	Health	Tree Height (m)	Canopy Spread (m)	DBH (cm)	Diameter at Root Flare (cm)	TPZ (m)	SRZ (m)
1	*Jacaranda mimosifolia*	Good	11	12	44	47.5	5.28	2.42
2	*Eucalyptus grandis*	Fair	18	16	56	85	6.72	3.09
3	*Jacaranda mimosifolia*	Good	10	10	38.2	42.5	4.58	2.31
4	*Araucaria columnaris*	Good	17	8	50.8	59	6.1	2.65
5	*Lophostemon confertus*	Fair	8	8	37.5	44	4.5	2.34
6	*Erythrina sykesii*	Fair	7	6	35.71	39	4.29	2.23
7	*Erythrina sykesii*	Fair	10	10	43.42	48.5	5.21	2.44
8	*Acmena smithii*	Fair	15	11	48	61	5.76	2.69
9	*Lophostemon confertus*	Fair	8	8	38.7	42.3	4.64	2.31
10	*Melaleuca lanceolata*	Fair	9	9	44	61	5.28	2.69

9.4 AS:4070: Tree Protection Requirements

- It is imperative that Tree Protection fencing is installed around all trees 2m from the trunk whenever works within the area (boundary/path development) is not carried out. Fencing must remain *in situ* for the duration of site works until completion.
- TPZ fencing and other measures must be fixed so that they cannot be moved either by accidental physical impact or other inadvertent means. The fencing should be 1.8m steel mesh style fencing.
- There should be no entry within any Tree Protection Fencing by any construction crew or other persons during the construction phase without authorisation and/or attendance of the site Arborist. The purpose of the TPZ is to be included as part of the site induction for <u>all</u> contractors and sub-contractors working on the site.
- An irrigation system should be installed to provide regular water to all trees on site. Most especially important for trees 2-10.
- There shall be no use of strip style excavation within the TPZ of any retained tree, e.g., for removal of topsoil, installation of boundary fencing, future foundations, installation of services, kerb/roadside guttering etc without identifying roots over 50mm in diameter and pruning them first.
- Methods of excavation encroaching the TPZ should be done so radially (pulling away from the tree) rather than laterally (across the root plate) to prevent taring and radiating fractures.





10.0 Glossary of Arboricultural Terminology

Abscission - The shedding of a leaf or other short-lived part of a woody plant, involving the formation of a corky layer across its base; in some tree species twigs can be shed in this way.

Abiotic - Pertaining to non-living agents, e.g., environmental factors.

Absorptive roots - non-woody, short-lived roots, generally having a diameter of less than one millimetre, the primary function of which is uptake of water and nutrients.

Adaptive growth - In tree biomechanics, the process whereby the rate of wood formation in the cambial zone, as well as wood quality, responds to gravity and other forces acting on the cambium. This helps to maintain a uniform distribution of mechanical stress.

Adaptive roots - The adaptive growth of existing roots; or the production of new roots in response to damage, decay or altered mechanical loading.

Adventitious shoots - Shoots that develop other than from apical, axillary, or dormant buds; see also 'epicormic'

Anchorage - The system whereby a tree is fixed within the soil, involving cohesion between roots and soil and the development of a branched system of roots which withstands wind and gravitational forces transmitted from the aerial parts of the tree.

Axil - The place where a bud is borne between a leaf and its parent shoot.

Bacteria - Microscopic single-celled organisms, many species of which break down dead organic matter, and some of which cause diseases in other organisms.

Bark - A term usually applied to all the tissues of a woody plant lying outside the vascular cambium, thus including the phloem, cortex, and periderm; occasionally applied only to the periderm or the phellem.

Basidiomycotina (Basidiomycetes) - One of the major taxonomic groups of fungi.

Bolling - A term sometimes used to describe pollard heads.

Bottle-butt - A broadening of the stem base and buttresses of a tree, in excess of normal and sometimes denoting a growth response to weakening in that region, especially due to decay.

Bracing - The use of rods or cables to restrain the movement between parts of a tree.

Branch:

- **Primary** - A first order branch arising from a trunk or stem
- **Lateral** - A second order branch, subordinate to a primary branch
- **Sub-lateral** - A third order branch, originating from lateral branch

Branch bark ridge - The raised arc of bark tissues that forms within the acute angle between a branch and its parent stem.

Branch-collar - A visible swelling formed at the base of a branch.

Brown-rot - A type of wood decay in which cellulose is degraded, while lignin is only modified.

Buckling - An irreversible deformation of a structure subjected to a bending load.

Buttress zone - The region at the base of a tree where the major lateral roots join the stem, with buttress-like formations on the upper side of the junctions.

Cambium - Layer of dividing cells producing xylem (woody) tissue internally and phloem (bark) tissue externally.

Canker - A persistent lesion formed by the death of bark and cambium due to colonisation by fungi or bacteria.

Canopy species - Tree species that mature to form a closed forest canopy.

Cleaning out - The removal of dead, crossing, weak, and damaged branches, where this will not damage or spoil the overall appearance of the tree.

Compartmentalisation - The chemical confinement of disease, decay, or other dysfunction within a trees tissue, due to passive and/or active defences operating at the boundaries of the affected region.

Compression fork - An acute angled fork that is mechanically optimised for the growth pressure that two or more adjacent stems exert on each other.

Compression strength - The ability of a material or structure to resist failure when subjected to compressive loading, measurable in trees with special drilling devices.

Compressive loading - Mechanical loading which exerts a positive pressure, the opposite to tensile loading.

Tree Protection Zone - Area from which access is prohibited for the duration of the project to prevent damage to a tree.

Crown/Canopy - The main foliage bearing section of the tree.

Crown lifting - The removal of limbs and small branches to a specified height above ground level.

Crown thinning - The removal of a proportion of secondary branch growth throughout the crown to produce an even density of foliage around a well-balanced branch structure.

Crown reduction/shaping - A specified reduction in crown size whilst preserving, as far as possible, the natural tree shape.

Crown reduction/thinning - Reduction of the canopy volume by thinning to remove selected branches whilst preserving the natural tree shape.

Deadwood - Branch or stem wood bearing no live tissues.

Decurrent - A system of branching in which the crown is borne on a number of major widely spreading limbs of similar size.

Defect - In relation to tree hazards, any feature of a tree which detracts from the uniform distribution of mechanical stress, or which makes the tree mechanically unsuited to its environment.

Delamination - The separation of wood layers along their length, visible as longitudinal splitting.

Dieback - The death of parts of a woody plant, starting at shoot-tips or root-tips.

Disease - A malfunction in or destruction of tissues within a living organism, usually excluding mechanical damage; in trees, usually caused pathogens.

Distal - In the direction away from the main body of a tree or subject organism (cf. proximal)

Dominance - In trees, the tendency for a leading shoot to grow faster or more vigorously than the lateral shoots; also, the tendency of a tree to maintain a taller crown than its neighbours.

Dormant bud - An axial bud which does not develop into a shoot until after the formation of two or more annual wood increments; many such buds persist through the life of a tree and develop only if stimulated to do so.

Dysfunction - In woody tissues, the loss of physiological function, especially water conduction, in sapwood.

DBH (Diameter at Breast Height) - Stem diameter measured at a height of 1.4 metres or the nearest measurable point. Where measurement at a height of 1.4 metres is not possible, another height may be specified.

Endophytes - Micro-organisms that live inside plant tissues without causing overt disease, but in some cases capable of causing disease if the tissues become physiologically stressed.

Epicormic shoot - A shoot having developed from a dormant or adventitious bud and not having developed from a first-year shoot.

Excrescence - Any abnormal outgrowth on the surface of tree or other organism.

Excurrent - In trees, a system of branching in which there is a well-defined central main stem, bearing branches which are limited in their length, diameter, and secondary branching (cf. decurrent).

Fastigiate - Having upright, often clustered branches.

Flush cut - A pruning cut which removes part of the branch bark ridge and or branch-collar.

Girdling root - A root which circles and constricts the stem or roots possibly causing death of phloem and/or cambial tissue.

Habit - The overall growth characteristics, shape of the tree and branch structure.

Haloing - Removing or pruning trees from around the crown of another (usually mature or post-mature) tree to prevent it becoming supressed.

Hazard beam - An upwardly curved part of a tree in which strong internal stresses may occur without being reduced by adaptive growth, prone to longitudinal splitting.

Heartwood/false-heartwood - The dead central wood that has become dysfunctional as part of the aging processes and being distinct from the sapwood.

Heave - The lifting of pavements and other structures by root diameter expansion; also, the lifting of one side of a wind-rocked root-plate.

High canopy tree species - Tree species having potential to contribute to the closed canopy of a mature forest.

Incipient failure - In wood tissues, a mechanical failure which results only in deformation or cracking, and not in the fall or detachment of the affected part.

Included bark (ingrown bark) - Bark of adjacent parts of a tree (usually forks, acutely joined branches or basal flutes) which is in face-to-face contact.

Infection - The establishment of a parasitic micro-organism in the tissues of a tree or other organism.

Internode - The part of a stem between two nodes; not to be confused with a length of stem which bear nodes but no branches.

Lever arm - A mechanical term denoting the length of the lever represented by a structure that is free to move at one end, such as a tree or individual branch.

Lignin - The hard, cement-like constituent of wood cells; deposition of lignin within the matrix of cellulose microfibrils in the cell wall is termed Lignification.

Lions tailing - When a branch of a tree that has few if any side branches except at its end and is thus liable to snap due to end-loading.

Loading - A mechanical term describing the force acting on a structure from a particular source, e.g., the weight of the structure itself or wind pressure.

Longitudinal - Along the length (of a stem, root, or branch).

Lopping - A term often used to describe the removal of large branches from a tree, but also used to describe other forms of cutting

Minor deadwood - Deadwood of a diameter less than 25mm and or unlikely to cause significant harm or damage upon impact with a target.

Mulch - Material laid down over the rooting area of plants to help conserve moisture; mulch may consist of organic matter, or artificial material.

Mycelium - The body of a fungus, consisting of branched filaments (hyphae).

Occlusion - The process whereby a wound is progressively closed by the formation of new wood and bark around it.

Pathogen - A micro-organism which causes disease in another organism.

Photosynthesis - The process whereby plants use light energy to split hydrogen from water molecules and combine it with carbon dioxide to form the molecular building blocks for synthesizing carbohydrates and other biochemical products.

Phytotoxic - Toxic to plants.

Pollarding - The removal of the tree canopy, back to the stem or primary branches, usually to a point just outside that of the previous cutting.

Primary branch - A major branch, generally having a basal diameter greater than 0.25 x stem diameter.

Probability - A statistical measure of the likelihood that a particular event might occur.

Pruning - The removal or cutting back tree parts to growth points.

Rams-horn - In connection with wounds on trees, a roll of occluding tissues which has a spiral structure as seen in cross section.

Reactive Growth/Reaction Wood - Production of woody tissue in response to altered mechanical or external loading.

Residual wall - The amount of non-decayed wood remaining following decay of internal wood

Rib - A ridge of wood that has usually developed because of locally increased mechanical loading. Often associated with internal cracking in the wood of the stem, branch, or root.

Ringbarking (girdling) - The removal of a ring of bark and phloem around the circumference of a stem or branch, normally resulting in an inability to transport photosynthetic assimilates above or below the area of damage.

Ripewood - The older central wood of those tree species in which sapwood gradually ages without being converted to heartwood.

Root-collar - The transitional area between the stem/s and roots.

Root zone - Area of soils containing absorptive roots of the tree/s described. The Primary root zone is that which we consider of primary importance to the physiological well-being of the tree.

Sapwood - Living xylem tissues.

Selective delignification - A kind of wood decay (white-rot) in which lignin is degraded faster than cellulose.

Shedding - In woody plants, the normal abscission, rotting off or sloughing of leaves, floral parts, twigs, fine roots, and bark scales.

Shrub species - Woody perennial species forming the lowest level of woody plants in a forest or garden and not normally considered to be trees.

Simultaneous white rot - A kind of wood decay in which lignin and cellulose are degraded at about the same rate.

Soft-rot - A kind of wood decay in which a fungus degrades cellulose within the cells,

Spores - Propagules of fungi; most spores are microscopic and dispersed in air or water.

Sporophore - The spore bearing structure of fungi.

Stem/s - Principle above-ground structural component(s) of a tree that supports its branches.

Stress - In plant physiology, a condition under which one or more physiological functions are not operating within their optimum range, for example due to lack of water, inadequate nutrition, or extremes of temperature: In mechanics, the application of an external force to an object.

Stringy white-rot - The kind of wood decay produced by selective delignification.

Structural roots - Roots, generally having a diameter greater than 50 millimetres, and contributing significantly to the structural support and stability of the tree.

Structural root zone (ZRZ) - The zone of the root plate most likely to contain roots that are critical for anchorage and the stability of the tree.

Subsidence - In relation to soil or structures resting in or on soil, a sinking due to shrinkage when certain types of clay soil dry out, sometimes due to extraction of moisture by tree roots.

Subsidence - In relation to branches of trees, a term that can be used to describe a progressive downward bending due to increasing weight.

Taper - In stems and branches, the degree of change in girth along a given length.

Targets - In tree risk assessment persons or property or other things of value which might be harmed or damaged by falling parts of a tree

Topping/ Lopping - In arboriculture, the removal of the crown of a tree, or of a major proportion of it.

Torsional stress - Mechanical stress applied by a twisting force.

Translocation - Plant physiology, the movement of water and dissolved materials through the body of the plant.

Transpiration - The evaporation of moisture from the surface of a plant, especially via the stomata of leaves; it exerts a suction which draws water up from the roots and through the intervening xylem cells.

Tree Protection Zone (TRZ) - This is an area left around a tree to ensure protection of the above and below ground parts of the tree during construction works. It will usually include the SRZ and is usually recommended to be fenced off for the period of the works.

Understorey - This layer consists of younger individuals of the dominant trees, together with smaller trees and shrubs which are adapted to grow under lower light conditions.

Understorey tree species - Tree species not having potential to attain a size at which they can contribute to the closed high canopy of a forest or garden.

Vascular wilt - A type of plant disease in which water-conducting cells become dysfunctional.

Vessels - Water-conducting cells in plants, usually wide and long for hydraulic efficiency; generally, not present in coniferous trees.

Vigour - The expression of carbohydrate expenditure to growth (in trees).

Vitality - A measure of physiological condition.

White-rot - A range of kinds of wood decay in which lignin, usually together with cellulose and other wood constituents, is degraded.

Wind exposure - The degree to which a tree or other object is exposed to wind, both in terms of duration and velocity.

Windthrow - The blowing over of a tree at its roots.

Woundwood - Wood with atypical anatomical features, formed in the vicinity of a wound.

11.0 References

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12.0 Appendices

12.1 Appendix 1 - TPZ Sign

12.2 Appendix 2 - Soil compaction

Due to the relationship between soil profiles and tree physiology, soil compaction is recognised as a primary cause for tree health decline.

Soil compaction is common in isolated planting areas such as: narrow medians, raised planters & small tree pits located in areas surrounded by concrete, bitumen or other impermeable surfaces. It is often caused by: heavy vehicular traffic during construction, frequent foot traffic, erosion and dense garden beds causing further restriction & competition by other vegetation (i.e., weeds, grass & over companion planting). These conditions cause a weak soil profile which will continue to require review and maintenance.

Soil compaction and Impermeable surfaces over the root plate of trees will:

- Reduce the physical space available for tree root movement.
- Reduce aeration by compressing the macropores in the soil. This in turn restricts or inhibits metabolic functions.
- Prevents water from reaching the soil, reducing water availability.
- Inhibits organic detritus processes; therefore, reducing nutritional composition and microbe abundance & diversity in the soil.
- The compression of macropores, can cause poor drainage leading to water logging and root rot.
- Soil can become hygroscopic and hydrophobic.
- Heavy and repeated surface activity can damage and break roots.
- Lead to property or infrastructure damage as roots seek path of least resistance.

An industry standard for the measurement of soil compaction for woody plant growth (i.e., Dicotyledon trees) is by resistance to penetration (psi) as determined with a penetrometer. A psi less than 90 is indicative of soil with few root growth impediments, with very minor constraints. Non-compacted soil should not exceed 250psi, reaching this resistance at a depth of 50cm.

While critical soil compaction limits can vary among species, research suggests the critical soil strength limit for trees is approximately 300psi. This level of compaction reduces the root growth by 60%.

Soil compaction can be alleviated by many ways. The level of intrusion and financial burden is dependent on the severity of the compaction.

Soil Compaction Limits for Trees (Dicotyledons)

Penetration Resitance (psi)	Acceptability	Root Response
1-100	Good	Few root growth impediments
100-200	Fair	Root penetration reduced to 80%
300	Average Action recommended	Soil compaction limit. Root penetration reduced to 60% strength
300-450	Poor Action Required	Root movement less than 5% strength
500+	Very Poor Action Required	Root Movement inhibited
700+	Unacceptable Intervention Required	Roots likley to cause damage to bitumen and concrete

12.3 Appendix 3 – Water recommendations

Recommended Watering Regime Small Trees		
Time period	**Volume**	**Frequency**
15 Oct to 1 May	200 L	every second day
2 May to 1 July	100 L	every second day
2 July to 15 Sept	50 L	every third day - do not water on days of heavy rain fall
16 Sept to 15 Oct	100L	Every second day

Watering Regime for medium Trees		
Time period	**Volume**	**Frequency**
15 Oct to 1 May	500 L	every second day
2 May to 1 July	250 L	every second day
2 July to 15 Sept	100 L	every third day - do not water on days of heavy rain fall
16 Sept to 15 Oct	250	Every second day

Watering Regime for Large Trees		
Time period	**Volume**	**Frequency**
15 Oct to 1 May	1000 L	Every day
2 May to 1 July	500 L	Every second day
2 July to 15 Sept	200 L	Every second day - do not water on days of heavy rain fall
16 Sept to 15 Oct	500	Every second day

Small tree – up to 6m in height

Medium Tree – up to 15m in height

Large tree – over 15m in height

13.0 Disclaimer and Limitations

a. References in this report to the “Consultant” means listed on the cover page as an employee of Westworks Consultancy. References in this report to Westworks Consultancy means Westworks Group Pty Ltd as trustee for Ussheridan Trust trading as Westworks Consultancy (ACN 156 131 010 ABN 23 100 208 057).

b. In this report a reference to a group of persons includes a reference to all of them collectively, any two or more collectively and each of them individually.

c. The releases and limitations in this report apply to the Arborist, Westworks Consultancy and any employees, directors, contractors, and agents of the Arborist and/or Westworks Consultancy.

d. This report only covers identifiable defects present at the time of inspection. The Arborist and Westworks Consultancy accept no responsibility and cannot be held liable for any structural defect or unforeseen event/situation that may occur after the time of inspection.

e. The Arborist and Westworks Consultancy cannot and do not guarantee trees contained within this report will be structurally sound under all circumstances and cannot and do not guarantee that the recommendations made will categorically result in the tree being made “safe.” Unless specifically mentioned this report will only be concerned with above ground inspections, that will be undertaken visually from ground level.

f. Trees are living organisms and as such cannot be classified as “safe” under any circumstances.

g. Failure events can occur for any number of reasons at any time and cannot always reasonably be foreseen, as any number of circumstances can come about at any time before or after an inspection that the Arborist and Westworks Consultancy may not be aware of.

h. All recommendations are made based on what can be reasonably identified at the time of inspection therefore the author accepts no liability for any recommendations made.

i. Care has been taken to obtain all information from reliable sources. All data has been verified or as much as possible; however, the Arborist and Westworks Consultancy can neither guarantee nor be responsible for the accuracy of information provided by others.

j. Booking of re-assessment after the prescribed period is the responsibility of the land manager/owner only. The Arborist and Westworks Consultancy are not responsible for providing reminders or notification that re assessment may be due and will not be held responsible to reinspect the listed trees until requested.

k. The Arborist and Westworks Consultancy make no express warranties under this report.

l. Except as the report specifically states, or as contained in any express warranty provided in relation to any goods or services provided or to be provided, the report does not include by implication any other term, condition or warranty in respect of the quality, merchantability, acceptability, fitness for purpose, condition, description, assembly, manufacture, design or performance of the goods or services or any contractual remedy for their failure.

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   iv. Any reinspection is the responsibility of the tree owner to arrange as required.