



WESTWORKS – CONSULTANCY –

Tree Protection Report

Location: Foothills Men's Shed

62 Hartfield Road, Forrestfield.

Report Prepared for: City of Kalamunda

Date: 12 February 2025

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1.0 Introduction

An assessment was undertaken on 3 trees located within the site of the Foothills Men's Shed construction site was undertaken on the 10 February 2025, to provide advice on the measures required to protect the subject trees from negative impacts throughout construction of a new building.

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 client's 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

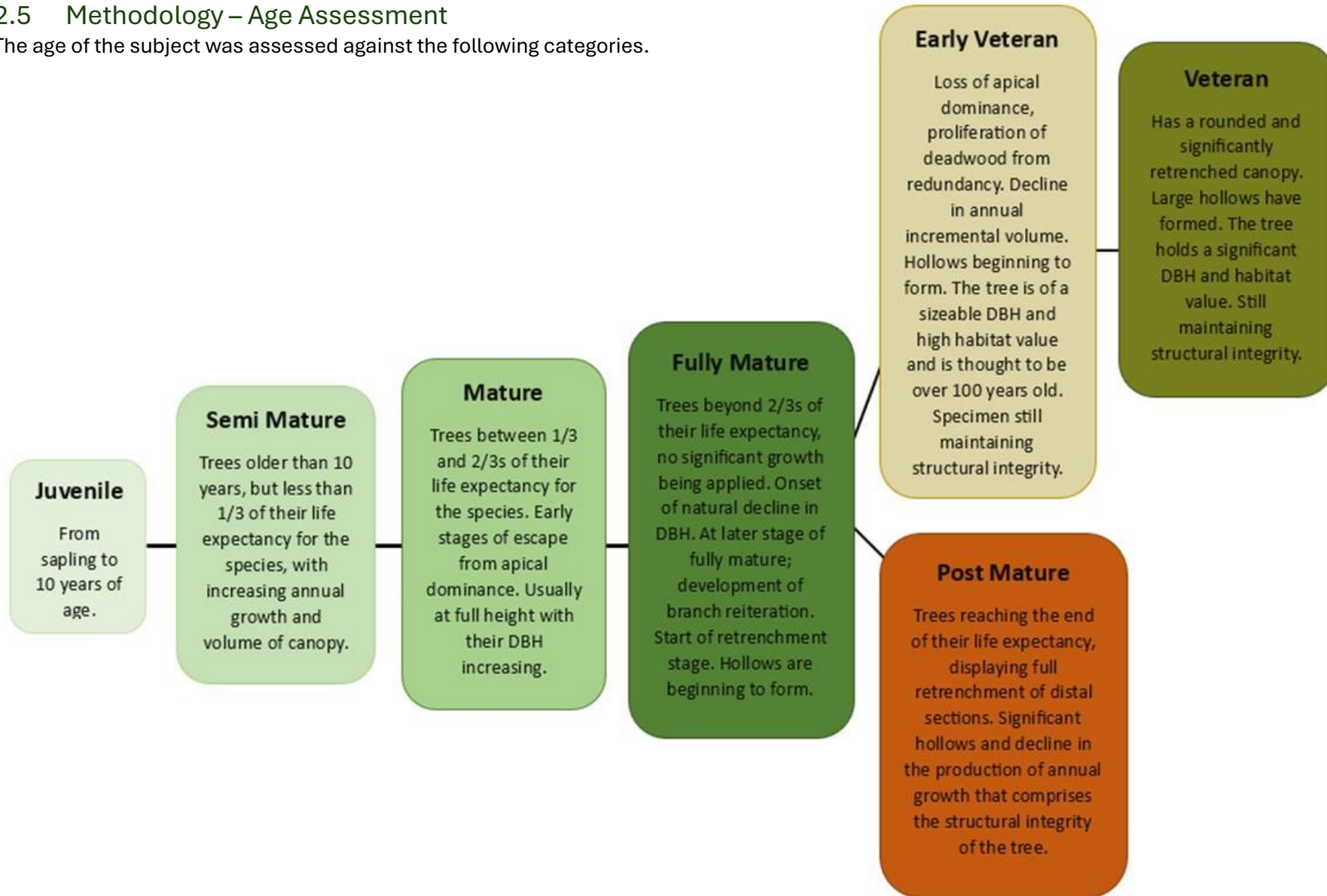
- **Good:** The tree will show good to excellent vigour throughout the tree for the species. The tree will exhibit a full and healthy canopy of foliage with only minimal pest or diseases evident.
- **Fair:** The tree is growing in a reasonable condition and shape with adequate canopy foliage for the 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 or 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).

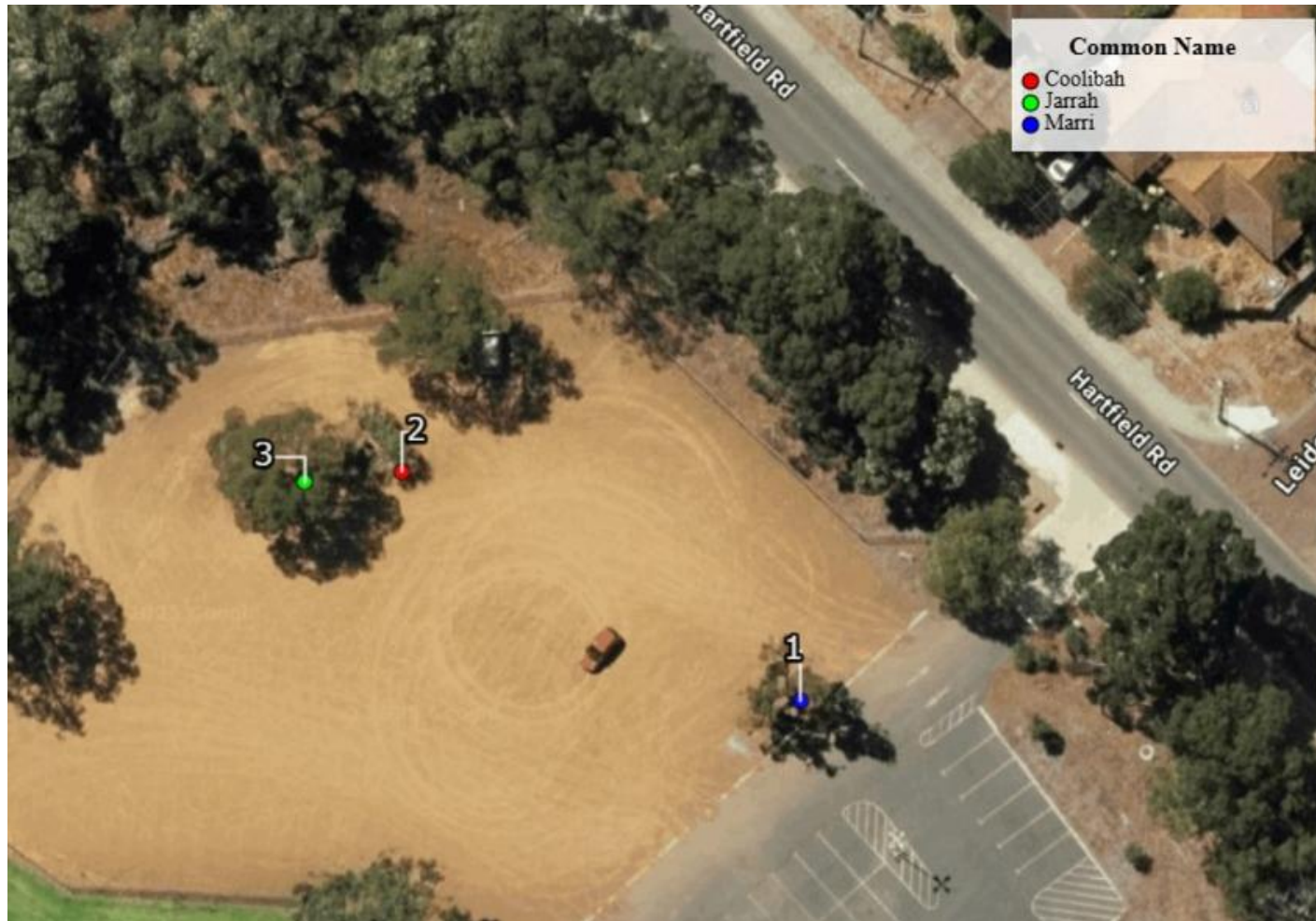
Trees in this category would be considered to hold such a condition that would potentially hold no value or in their current state it would be reasonable to undertake their removal for reasons of sound Arboricultural management, due to a high level of risk.

2.7 Origin of species

- **Endemic** – A species of plant indigenous to the subject location, not found outside this region (South-West Province).
- **Native** – A species of plant indigenous to Australia.
- **Exotic** – A species of plant introduced to Australia via anthropogenic activities.

3.0 Location of Subject Tree(s)

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



4.0 Tree Assessment

Each of the 3 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 (10 February 2025).

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.

Marri Tree ID #1

Tree Details

Latin Name:	Corymbia calophylla
Common Name:	Marri
Tree Age:	Semi mature
Health:	Poor
Structure:	Fair
Tree Height (Estimated) [m]:	8
Canopy Spread [m]:	8
DBH [cm]:	63.5
DBH Range:	60-75cm
Diameter at Root Flare (DRF) [cm]:	0.655
Tree Protection Zone (TPZ) [m]:	7.62
Structural Root Zone (SRZ) [m]:	2.77
Useful Life Expectancy:	20-40 years
Observations-Structural Issues:	Deadwood, Canopy decline
Work Requirements:	Supplemental Water required, Fertiliser required, Apply mulch
Observation Comments:	

Tree Location

Longitude:	116.005065
Latitude:	-31.995719

Photos [Street View](#) [Map View](#)



T1.jpg
11/02/2025

Coolibah Tree ID #2

Tree Details

Latin Name:	Eucalyptus victrix
Common Name:	Coolibah
Tree Age:	Semi mature
Health:	Fair
Structure:	Fair
Tree Height (Estimated) [m]:	5
Canopy Spread [m]:	4
DBH [cm]:	14
DBH Range:	8-16cm
Diameter at Root Flare (DRF) [cm]:	0.27
Tree Protection Zone (TPZ) [m]:	2
Structural Root Zone (SRZ) [m]:	1.91
Useful Life Expectancy:	20-40 years
Observations-Structural Issues:	Leaning trunk
Work Requirements:	No Action Required
Observation Comments:	

Tree Location

Longitude:	116.004722
Latitude:	-31.995552

Photos Street View Map View



image.jpg
10/02/2025

Jarrah Tree ID #3

Tree Details

Latin Name:	Eucalyptus marginata
Common Name:	Jarrah
Tree Age:	Semi mature
Health:	Fair
Structure:	Fair
Tree Height (Estimated) [m]:	10
Canopy Spread [m]:	11
DBH [cm]:	78.95
DBH Range:	>75cm
Diameter at Root Flare (DRF) [cm]:	0.88
Tree Protection Zone (TPZ) [m]:	9.47
Structural Root Zone (SRZ) [m]:	3.14
Useful Life Expectancy:	40+ years
Observations-Structural Issues:	None observed
Work Requirements:	No Action Required

Observation
Comments:

Tree Location

Longitude:	116.004639
Latitude:	-31.995560

Photos [Street View](#) [Map View](#)



image.jpg
10/02/2025

5.0 Tree Protection Information

TPZ and SRZ.

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).

The first is the Tree Protection Zone (TPZ) which 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. When necessary, works can be undertaken the TPZ, up to the Structural Root Zone, with guidance from an arborist.

The second, is the Structural Root Zone (SRZ). Works can only be undertaken in this zone provided a qualified Project Arborist has assessed the plans and in onsite at all times to supervise the SRZ encroachment.

It is important that any excavation works conducted within the TPZ is done so in a radial pattern and not across the root plate of the trees (Diagram 2). This excavation is best done by hand, or with vacuum systems. Mechanical equipment should only be used for hard digging.

Please note, the root system of any tree extends considerably further than the canopy line, as depicted above. As such, it is imperative the radial pattern for mechanical equipment be followed. Digging across the root plate (diagram 2) leads to damage along the root, possibly fracturing at the root crown, where the root joins onto the base of the tree. This can lead to death of the root and possible decline or even death of the tree.

Tree Protection Zone diagram

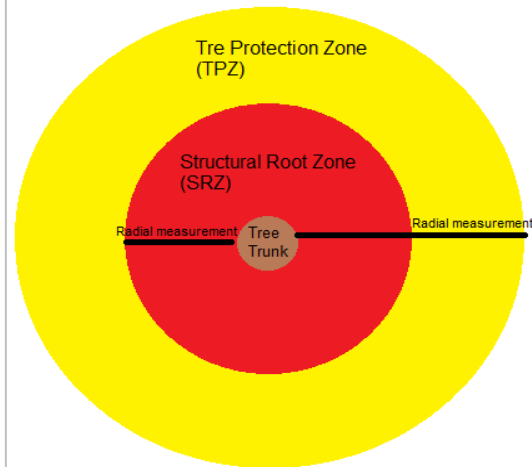


Diagram 1. Order and size of the Tree Protection Zone (TPZ) and the Structural Root Zone (SRZ).

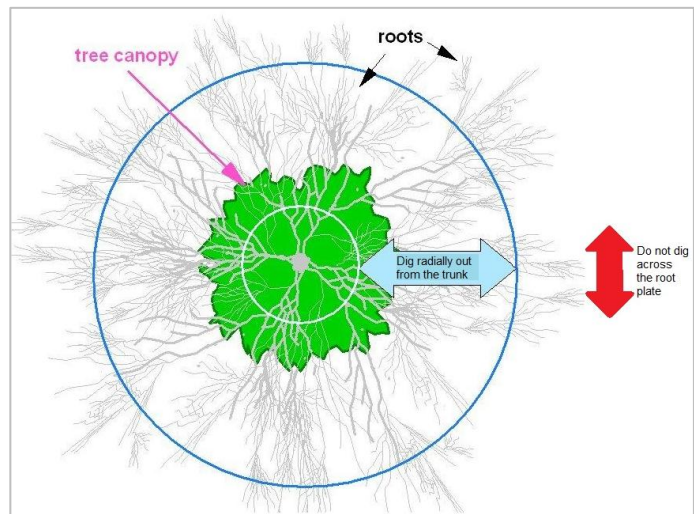


Diagram 2. Depiction of the root spread beyond the canopy line. Blue arrow indicates the approved radial pattern for necessary excavation. The red arrow shows the prohibited direction.

Excavation and root cutting within the zones.

Excavation can be undertaken outside the TPZ, using the following process.

The process with mechanical equipment starts by scraping radially along the surface to gradually expose roots, allowing them to be cut cleanly (Diagram 2). This reduces the possibility of significant damage occurring and will help to maintain the good condition of the trees into the future.

All staff and contractors undertaking any form of excavation would be required to follow this process and may only cut roots found outside the TPZ that are smaller than 50mm in diameter. Any requirement to cut roots larger than this should be deferred to the Project Arborist for advice. Where pruning of roots is undertaken, a sharp saw, or bypass secateurs must be used. The tool must also be cleaned with Methylated spirits or a 2% bleach solution before and after pruning to eliminate the possibility of contamination.

Roots are not to be torn, pulled, or cut with an axe. Once a root is cut appropriately, the remainder of it leading away from the tree can be pulled out.

Should any works need to be undertaken within the TPZ that are likely to or are observed to expose roots over 50mm in diameter, it is recommended that the work cease, and the Project Arborist be consulted prior to works continuing. The Project arborist will provide further guidance, possibly resulting in the need for site supervision. This is especially important for any form of soil movement and excavation. Any excavation within the SRZ can only be undertaken under the supervision of the Project Arborist.

6.0 Tree Protection Measures within TPZ and SRZ

Within the Tree Protection Zones (TPZ) and Structural Root Zones (SRZ) for each tree, 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.

6.1 TPZ control measures

- Always where possible, establish and work outside the TPZ, fencing off the TPZ boundary (see 7.3) to avoid physical damage to the tree and root plate.
- Where practical, always trench outside the TPZ. Impacting more than 10% of the TPZ can affect the long-term health of the tree.
- Where it is not possible to work outside the TPZ and an encroachment of more than 10% is required, the site Arborist must be contacted prior to further works being completed.
- Within the TPZ, minimise the extent impacted and for significant encroachments, under bore/directional drill at least 600 mm beneath the ground surface, or if excavating, hand dig or use an air knife.

6.2 Activity Outside the Tree Protection Zone

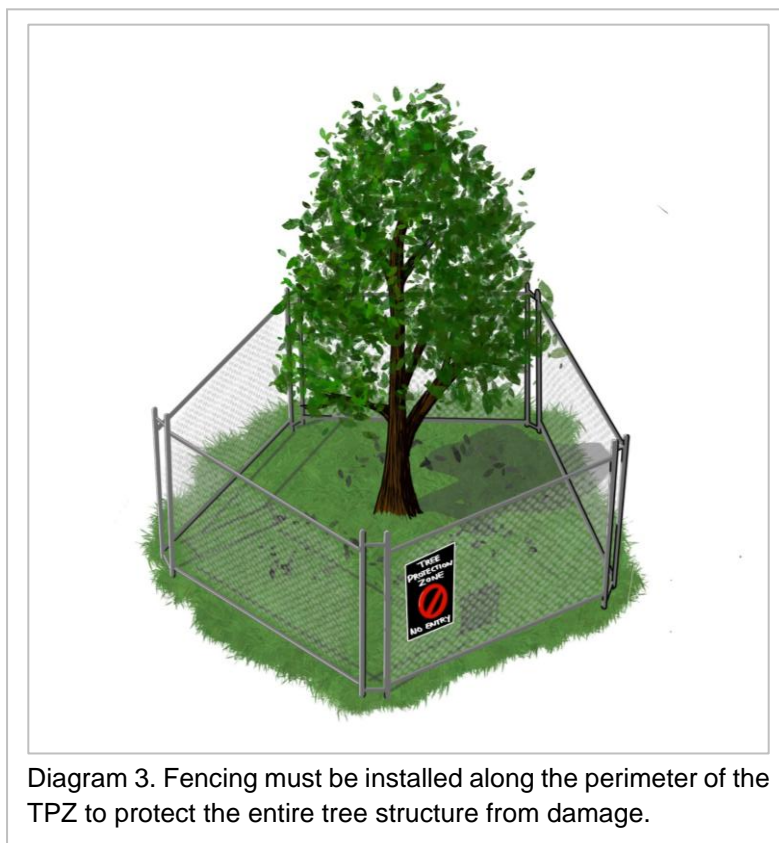
Planning of site operations should take sufficient account of wide loads, tall loads and plant with booms, jibs, and counterweights (including piling rigs), in order to operate without coming into contact with retained trees. Such contact can result in serious damage to the trees and may compromise their safe retention or make their retention impossible. Consequently, any transit or traverse of plant in proximity to trees should be conducted under supervision with a spotter, to ensure that adequate clearance from trees is maintained at all times.

Additional precautions outside the exclusion zone - Materials whose accidental spillage would cause damage to a tree should be stored and handled well away from the outer edge of its TPZ.

6.3 Tree Protection Fencing

An exclusion zone should be established along the TPZ perimeter (or as nominated) of retained trees and cordoned off with a physical barrier of a ridged chain mesh fence, 1.8m in height, which is securely anchored (Diagram 3). 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.

The site Arborist must be consulted at any time entry into a TPZ of the retained trees is required. No routing of services, parking of vehicles, stacking of builder's materials, equipment etc. is to occur within the TPZ of retained tree/s, nor disposal of fuels, paints, chemicals etc. within the protected TPZ area which could otherwise cause injury and/or adversely affect the health of a retained tree.



6.4 Installation of Underground Services Within the TPZ

All services should be routed outside the TPZ. If underground services must be routed within the TPZ, they should be installed by directional drilling or vacuum excavation. The directional drilling bore should be at least 600 mm deep.

For manual excavation of trenches the project arborist should advise on roots to be retained and should monitor the works. Manual excavation may include the use of pneumatic and hydraulic tools.

6.5 Avoiding Physical Damage to Roots

To avoid damage to tree roots, existing ground levels should be retained within the TPZ. Intrusion into soil (other than for piling) within the TPZ is generally not acceptable, and topsoil within it should be retained *in situ*. Limited manual excavation within the TPZ might be acceptable, subject to justification. However, such excavation should be undertaken carefully, using hand-held tools and preferably by compressed air soil displacement.

Exposed roots should immediately be wrapped, or covered with hessian, to prevent desiccation and to protect them from rapid temperature changes. Any wrapping should be removed prior to backfilling, which should take place as soon as possible with a maximum of 8hrs exposure.

Roots with a diameter smaller than 25mm may be pruned back, making a clean cut with a suitable sharp tool (e.g., secateurs or handsaw), except where they occur in clumps. Roots occurring in clumps, or with diameter 25 mm and over, should be severed only following consultation with the project Arborist, as roots may be essential to the tree's health and stability. As mentioned in '6.0 Tree Protection Information', all tools used to prune roots must be cleaned with Methylated spirits or a 2% bleach solution before and after pruning to eliminate the possibility of contamination.

Prior to backfilling, retained roots should be surrounded with topsoil or uncompacted sharp sand. Alternatively, other loose inert granular fill should be applied before soil or other suitable material is replaced. This material should be free of contaminants and other foreign objects potentially injurious to tree roots.

Please note: builders' sand should not be used as it has a high salt content which is toxic to tree roots.

6.6 Maintaining Tree Health

Where excavation is being undertaken within the TPZ, it is recommended to apply supplemental water to each of the trees to prevent unnecessary stress.

Watering needs to start at least 2 months before construction starts. With water being applied, especially, to the side where there will not be any excavation. This is to encourage the trees to produce new roots to replace those that may be lost during excavation works and is why the tables guide watering throughout the whole year. Watering should continue throughout the construction period and for one summer after construction has finished.

Watering Regime; Trees 1 & 2		
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 L	every second day

As tree 1 has experienced significant intrusion into its TPZ/SRZ, it should be provided with 500 litres of water with 4% bioprime Trace now, and again in April. This is to be provided between waterings as per the tables provided.

Watering Regime for tree 3		
Time period	Volume	Frequency
15 Oct to 1 May	700 L	every second day
2 May to 1 July	350 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	350	every second day

The application of water is made easier by installing temporary or permanent irrigation. This can be achieved by, installing 19mm poly pipe in an eccentric ring (Plugged at one end), from the trunk outwards. Rain drip sprinklers (diagram 4) should be placed every 0.5m apart, with the end of the poly finishing adjacent a tap. Once the flow rate has been measured, A tap timer can be used to run the system.



Diagram 4. Fencing must be installed along the perimeter of the TPZ to protect the entire tree structure from damage.

7.0 Discussion

Tree 1 has already experienced significant intrusion into its Structural Root Zone (SRZ), as depicted by the adjacent photo.

The pink line indicates the SRZ. Excavation has been undertaken over 1m into this zone.

The builder is proposing to install services between this tree and the pad using Vacuum excavation, which is an ideal way to work around roots.



Diagram 1 – SRZ marked out for Tree 1

However, no roots can be cut and all services would need to be fed beneath any roots found.

The tree is already experiencing decline and any further disturbance and loss of roots will likely result in its death.

With regards to trees 2 and 3, there is ample space to remain outside the respective SRZ's.

It is most ideal if all works are undertaken a minimum of 2m from tree 2 and 9.5m from tree 3. As this would place all trenches out aside of the Full Tree Protection Zones.



Diagram 2 – SRZ marked out for Tree 2



Diagram 3 – SRZ marked out for Tree 3

8.0 Conclusion and Recommendations

It is recommended that an Arborist be present for the excavation adjacent Tree 1 and that any trench is not left open for more than 4 hours.

It is ideal that the trench be backfilled with a clean sand (Not Brickies sand) and that it is then provided with 500 litres of water as the trench is being filled.

In the week following this the tree should be provided with 500 litres of water with 4% Bioprime Trace.

All trenching adjacent to trees 2 and 3, should remain outside of the respective TPZ's

The watering plans (Page 19) should then be implemented for all trees.

Timeline of events

1. Apply water as per tables prior to excavation
2. Excavate trenches with vacuum excavation
3. Backfill the same day
4. Backfill with a clean sand
5. Apply water to each tree immediately after backfilling
6. Apply water and Bioprime Trace to Tree 1 within the week of excavation being completed.
7. Continue with the watering tables for all trees until 1 July 2025
8. Review all trees in the first week of April.

9.0 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 tree's 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 by 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.

Excescence - 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).

Fastigate - 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 suppressed.

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.

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11.0 Appendices

11.1 Appendix 1 - TPZ Sign

<div><div><div>TREE PROTECTION</div><div>ZONE</div><div></div><div>NO ACCESS</div></div><div><p>The Following in not permitted within this area:</p><ul style="list-style-type: none">• Moving of the fence• Storage of building materials• Disposal of waste materials• Excavation<p>Should you need to enter this area or move the fence for any reason, please contact:</p><p>_____ on _____</p></div></div>
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11.2 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

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- 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).
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- 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.
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