



ARBORICULTURAL IMPACT ASSESSMENT

SITE ADDRESS:

Lot 2, 30 Margaret Drive, Bacchus Marsh, Vic. 3340

REPORT DATE:

28 October 2024

TREETEC REFERENCE:

marg0424to_AIA.V3

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1 Introduction

1.1 Purpose

Treetec have been engaged to assess the tree population at, or in close proximity to, 30 Margaret Drive, Bacchus Marsh (the site).

In accordance with AS4970-2009 Protection of trees on development sites (section 2.3.5), the purpose of this report is to identify and assess development related impacts relating to assessed trees, and to provide a summary of the assessment herein.

1.2 Background

This report has been updated to include significant design amendments to reduce the potential impacts to adjacent trees.

The proposed works involve construction of a residential dwelling, including the installation of all associated infrastructure.

A new crossover is proposed to be constructed from Margaret Drive to provide access to the site.

1.3 Scope

- Based on the current proposal, determine which trees on or near the site (the subject trees) may be impacted by the development
- Provide details on the subject trees including their species, amenity value, condition and dimensions
- Assess the impact the proposed development is likely to have on the subject trees
- Comment on measures likely to be required to enable the protection of subject trees proposed to be retained.

1.4 Method

- Tom Oldmeadow undertook an arboricultural assessment on 13 May 2024
- All observations were taken at ground level, using stage 1 of the Visual Tree Assessment (VTA) method (Mattheck and Breloer 1994)
- Data collected has been categorised in line with definitions found in Appendix 7.2- Glossary.

1.5 Limitations

- Root assessment requiring excavation was not undertaken. Therefore, root condition has not been included unless above ground signs, such as soil heaving or cracking were observed
- Aerial examination (tree climbing) was not undertaken
- Tree height and canopy width were estimated
- Only noteworthy trees that might be significantly impacted by the proposed works (regardless of property boundaries) are included in this report. Environmental weeds, shrubs, dead trees and juvenile exotic trees of very low amenity/retention value were not assessed individually
- Diameter at Breast Height (DBH) of trees on neighbouring properties was estimated.

For the full list of assumptions and limitations for this report please refer to Appendix 7.1

1.6 Documents viewed

- Town planning drawings. Job number- 21086. Dated- 08/10/2024. Prepared by- Quality Home Designs.
- Feature survey. Job number- 225498. Dated- 30/05/2024. Prepared by- GeoHub.
- Request for further information (RFI). Issued by- Heritage Victoria. Reference- P38100. Dated- 28/03/2024

1.7 Planning scheme and applicable overlays

The site is covered by the Moorabool Planning Scheme and is zoned General Residential Zone – Schedule 3 (GRZ3).

Local law / Relevant planning overlays

(None specified)

2 Findings

2.1 Site summary

The ~1144sqm subject site is a vacant block free of trees and structures.



Plate 1 - Panoramic view of the site looking west, showing trees on adjoining land to the north and west.



2.2 Vegetation on adjoining land

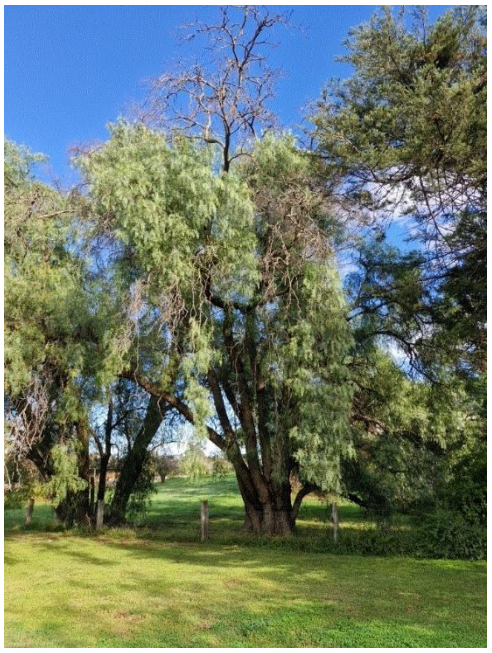

Tree number	Location
Tree 1	Nature strip of Margaret Drive
Trees 2 - 4	Adjoining land to the west
Tree group 5	Adjoining land to the north


2.3 Vegetation not detailed

Some additional vegetation has been identified on the plan (plotted as 'V') but these have not been individually assessed as they are unlikely to be impacted by the proposed works shown on the plan, or are very low amenity value shrubs/plants.

2.5 Tree data

Tree #	1	
Species	<i>Eucalyptus leucoxylon</i>	
Common name	Yellow Gum	
Type	Victorian native	
DBH (cm)	68	
Height (m)	14	
Spread (m)	12	
Structure	Good	
Health	Good	
Age	Mature	
Amenity value	High	
ULE (yrs)	15 > 40	
TPZ (m)	8.2	
SRZ (m)	3.1	
Notes	Street tree growing within the nature strip of Margaet Drive. Codominant stems from base, union appears sound. Minor deadwood.	
Impact assessment	Low. Proposed works are outside of the TPZ; however, may be impacted by construction related activities (see discussion).	
Recommendations	Erect fencing to protect from development related impacts (see site plan). Fencing should consist of chain wire mesh panels held in place with concrete feet, or similar, in accordance with AS 4970-2009 <i>Protection of trees on development sites</i> .	
Tree #	2	
Species	<i>Schinus molle</i>	
Common name	Peppercorn Tree	
Type	Exotic	
DBH (cm)	110	
Height (m)	14	
Spread (m)	18	
Structure	Fair	
Health	Fair	
Age	Mature	
Amenity value	High	
ULE (yrs)	15 > 40	
TPZ (m)	13.1	
SRZ (m)	3.8	
Notes	Growing within the neighbouring property to the west. 4 large stems from ground, potentially grown from cut stump. Areas of dieback throughout canopy. Major deadwood. Low canopy extends 10m into subject site.	
Impact assessment	Proposed driveway and garage footprint will result in a major 12.8% TPZ encroachment. Root disturbance as a result of these low impact works is expected to be minimal (see discussion). Some canopy pruning will be required to achieve clearance over the carport. The current condition (signs of stress) indicates the tree will be more susceptible to adverse impacts as a result of root disturbance or canopy loss.	
Recommendations	Pruning should be done by a qualified arborist in accordance with 4373-2007 <i>Pruning of amenity trees</i> . Gravel driveway/carport surface should be constructed on-grade within the TPZ using minimal compaction.	

Tree #	3	
Species	<i>Schinus molle</i>	
Common name	Peppercorn Tree	
Type	Exotic	
DBH (cm)	130	
Height (m)	12	
Spread (m)	16	
Structure	Fair	
Health	Fair	
Age	Mature	
Amenity value	High	
ULE (yrs)	15 > 40	
TPZ (m)	15.0	
SRZ (m)	3.9	
Notes	Growing within the neighbouring property to the west. 9 stems from ~1.5m, potentially from point of previous lopping. Areas of dieback throughout canopy. Major deadwood. 2 large low stems over subject site. Low canopy extends 10m into subject site.	
Impact assessment	Low. Proposed driveway and garage footprint will result in a minor 5.9% TPZ encroachment. Root disturbance as a result of these low impact works is expected to be minimal. Some canopy pruning will be required to achieve clearance over the carport. The current condition (signs of stress) indicates the tree will be more susceptible to adverse impacts as a result of root disturbance or canopy loss.	
Recommendations	As per Tree 2.	
Tree #	4	
Species	<i>Cupressus macrocarpa</i>	
Common name	Monterey Cypress	
Type	Exotic	
DBH (cm)	200	
Height (m)	12	
Spread (m)	6	
Structure	Poor	
Health	Fair	
Age	Senescent	
Amenity value	Medium	
ULE (yrs)	< 5	
TPZ (m)	15.0	
SRZ (m)	4.8	
Notes	Growing within the neighbouring property to the west. Remnants of a much larger tree comprised of 1 large stem, cut to 10-12m, and several live branches. Leaning over subject site. Extensive decay throughout lower trunk, with large split forming. Low canopy 7.5m into site. The calculated TPZ is likely to be excessive for the small live crown of this tree.	
Impact assessment	Low. Proposed works are outside of the TPZ; however, may be impacted by construction related activities (see discussion).	
Recommendations	Erect fencing to protect from development related.	

Tree #	5 (group of 7)	
Species	<i>Ulmus parvifolia</i>	
Common name	Chinese Elm	
Type	Exotic	
DBH (cm)	30	
Height (m)	9	
Spread (m)	5	
Structure	Fair / good	
Health	Poor	
Age	Juvenile / semi-mature	
Amenity value	Medium	
ULE (yrs)	5 > 15	
TPZ (m)	3.6	
SRZ (m)	2.1	
Notes	7 trees in a row growing within the neighbouring property to the north. Extensive long-term canopy damage from possum browsing. Low canopies extend ~4m into subject site.	
Impact assessment	Low proposed works are outside of the TPZs	

3 Discussion

3.1 Carport

The footprint of the posed carport encroaches within the TPZs of Trees 2 and 3. The utilisation of the Surefoot footings for the construction of the carport requires minimal soil disturbance, and therefore, the likelihood of root damage is considered very low.

3.2 Driveway

The footprint of the posed driveway also encroaches within the TPZs of Trees 2 and 3. Compaction of the soil profile beneath the driveway has the potential to reduce the productivity of roots. Minimising the initial compaction during the construction of the driveway will allow the trees time to adapt to any change in conditions and reduce the likelihood of adverse impacts.

3.3 Construction related activities

Trees without encroachment but in the vicinity of works may be impacted by construction related activities including, (but not limited to); compaction from vehicle parking, positioning of plant and/or foot traffic, and mechanical damage to trunk/branches from delivery/drop off of materials, etc.

Adequate tree protection measures including fencing or ground protection are important in preventing these impacts during construction.

3.4 Low tree canopies

Trees 2 -4 and Tree group 5 all have canopies that extend over the boundary and into the subject site.

The canopies of Trees 2 and 3 extend 10.5m into the site, are low to the ground, and include large structural limbs.



Plate 2 - Large limbs (Tree 2) over the western boundary.



Plate 3 - Low canopies extending 10.5m into the subject site.

At ~6.3m from the boundary, the proposed carport will require some canopy pruning to both Tree 2 and 3 to achieve adequate clearance from the structure. This will not require the removal of any significant limbs and the canopy loss is expected to be within the tolerances of both trees.

3.5 Tree 4 structure

This tree displays structural defects that indicate an increased likelihood of failure. A large crack is evident within the lower decayed section of the trunk.



Plate 4 - Lower trunk with stem leaning towards subject site.



Plate 5 - Large crack in lower trunk, visible on both sides of tree.

The remaining stem (cut to about 10-12m) has a lean and wight bias, a failure in the lower trunk would result in the stem falling into the subject site.

4 Conclusion

The arboricultural assessment undertaken at 30 Margaret Drive, Bacchus Marsh comprised four trees and one tree group, all growing on land adjoining the site.

Significant design amendments have been made and the current proposal is not expected to compromise the long-term viability of the subject trees.

Specific impacts on the assessed trees are summarised below.

- The proposed driveway and garage footprints will result in a minor 5.9% and major 12.8% encroachments into the TPZs of Trees 2 and 3 respectively. Root disturbance as a result of these low impact works is expected to be minimal.
- Some canopy pruning of Trees 2 and 3 will be required to achieve clearance over the carport. This will not require the removal of any significant limbs and the canopy loss is expected to be within the tolerances of both trees.
- The proposed works are outside off the calculated TPZ of Trees 1, 4 and Tree group 5, adverse impacts are unlikely.
- Below ground service/utility locations or the driveway position are not shown or accurately detailed on site plans, therefore, assessed impacts may be greater if these works occur within TPZs of retained trees.

No other trees are expected to be impacted by the proposed development.

Tree 4 was observed to have poor structural condition with an increased likelihood of failure. Due to the lean and wight bias, were a failure to occur, the remaining stem of this tree would land within the subject site.

5 Recommendations

Tree protection fencing – Erect fencing to protect Trees 1-4 from development related impacts (see site plan). Fencing should consist of chain wire mesh panels held in place with concrete feet, or similar, in accordance with AS 4970-2009 Protection of trees on development sites.

Tree pruning – Any pruning should be done by a qualified arborist in accordance with 4373-2007 *Pruning of amenity trees*.

Driveway construction – Gravel driveway/carport surface should be constructed on-grade within TPZs using minimal compaction.

Underground services/utilities – Ensure underground installations are routed outside of TPZs. If they must pass through a TPZ, utilise low impact methods for the installation, such as;

- horizontal boring at a depth greater than 700mm
- hydro excavation under arborist supervision, ensuring significant roots (to be determined by the arborist) are retained and protected from damage.

General - Design of any landscaping should be cognisant of root protection. Do not excavate within the nominated tree protection zones of retained trees including those trees on neighbouring properties unless permitted by the responsible authority.

6 References

Department of Transport and Planning. VicPlan, Accessed - October 24, Available at: <https://mapshare.vic.gov.au/vicplan/>

Mattheck, C. and Breloer, H. (1994), *The Body Language of Trees: A Handbook for Failure Analysis*, London: HMSO.

ProofSafe Tree Protection Zone encroachment calculator, available online at: https://proofsafe.com.au/tpz_incursion_calculator.html

Standards Australia (2009), AS 4970-2009 *Protection of trees on development sites*

Standards Australia (2007), AS 4373-2007 *Pruning of amenity trees*

7 Appendix

7.1 Assumptions & Limitations

1. **Treetec** does not assume responsibility for legal matters, and assumes that legal descriptions, titles and ownerships are correct and good.
2. **Treetec** assumes that any property or project is not in violation of any applicable codes, ordinances, statutes or other government regulations.
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10. Site plans, diagrams, graphs and photographs in this report, being intended as visual aids, are not necessarily to scale and should not be construed as engineering or architectural reports or surveys.
11. Information in this report covers only those items that were examined in accordance with the Terms of Reference, and reflects the condition of those items that were examined at the time of the inspection.
12. Inspections are limited to visual examination of accessible components unless otherwise stated in the "Method of Inspection".
13. There is no warranty or guarantee, expressed or implied, that the problems or deficiencies of the plants or property in question may not arise in the future.
14. Due to the dynamic nature of trees and development there can be no guarantee that the Useful Life Expectancy (ULE) of the subject tree/s won't be adversely impacted.

7.2 Glossary

AGE CATEGORY	The age of the tree is represented as Juvenile, Semi-mature, Mature or Senescent.
Juvenile:	A young tree, given normal environmental conditions for that tree it will not yet flower or fruit.
Semi-mature:	Able to reproduce but not yet nearly the size of a mature specimen in that location.
Mature:	Has reached or nearly reached full size and spread for that species in the given location.
Senescent:	Health and / or structure is being adversely impacted by the old age of the tree.
ARBORICULTURAL VALUES	Values assigned to a tree or group of trees to provide an overview of their significance with consideration to a range of factors (see below)
AMENITY VALUE	Provides a summary of the general condition and also the overall significance contributed to the landscape (Visual appeal). Factors include; physical condition (health, structure, form), age, size, and species. Trees may possess one or more of the attributes listed.
High:	Large size, good health and structure, significant in relation to the local landscape, prominent location.
Medium:	Moderate size, fair health and/or structure, somewhat significant in relation to the local landscape, prominent location.
Low:	Small common species, poor health and structure, insignificant in relation to the local landscape, environmental weed.
CANOPY SPREAD	Overall size of the canopy as looking from a plan view. Recorded at the widest point.
CODOMINANT STEMS	Two stems of approximately the same thickness and height originating from the same position in the tree.
COMMON NAME	A non-scientific name commonly used for that tree.
COPPICE	The practice of cutting a tree down to a stump and allowing basal regrowth.
CROWN WIDTH	See 'Canopy spread'
DEAD (AS DEAD)	Cessation of all metabolic processes (or very soon to be)
DEADWOOD	Deceased above ground tree parts such as stems or branches. <i>Minor</i> deadwood – less than 40mm diameter <i>Major</i> deadwood – greater than 40mm diameter
DEVELOPMENT	The use of land including; the subdivision of land, erection or demolition of a building or works, the carrying out of a work, road works, the installation of utilities and services, and any other act, matter or thing as defined by the relevant legislation.
DIAMETER AT BREAST HEIGHT (DBH)	The diameter of the trunk measured at or near 1.4m above ground level. Where there is more than 1 stem originating below 1.4m the measurement recorded is calculated as described in AS 4970-2009.
DIAMETER ABOVE ROOT BUTTRESS (DARB)	The diameter of the trunk measured above the root buttress. This measurement is used to calculate the structural root zone (see SRZ).
EPICORMIC GROWTH	New shoots forming from dormant buds within the bark on the trunk and/or branches.
FORM	Reference to the symmetry of the crown as observed from all angles and in accordance with the morphology of that species, and documented as Poor, Fair or Good.

HEALTH	<p>A trees vigour as exhibited by the crown density, leaf colour, seasonal extension growth, presence of stress indicators, ability to withstand diseases and pests, and the degree of dieback. Where a deciduous tree is inspected without foliage and health is undetermined a '?' will be noted.</p>
	<p>Dead: Cessation or near cessation of all metabolic processes.</p>
	<p>Poor: Indicating symptoms of extreme stress such as minimal foliage, or extensively damaged leaves from pests and diseases. Death probable if condition of tree deteriorates.</p>
	<p>Fair: Some minor deadwood or terminal dieback indicating a stressed condition. Minor leaf damage from pests.</p>
	<p>Good: Usual for that species given normal environmental conditions – full canopy with only minor deadwood, normal leaf size and extension growth, minimal pest or disease damage</p>
HEIGHT	<p>The distance in metres from the ground to the highest point in the crown, calculated in the vertical plane. This measurement unless otherwise specified is an estimation only.</p>
IMPACT ASSESSMENT	<p>An assessment of adverse impact the proposed works are likely to have on a tree or tree group. May be short or long term; usually judged on the likely reduction in ULE directly attributable to the works. Impact usually relates to the level of TPZ encroachment, but also factors the type of impact. One or more factors may apply.</p>
	<p>Low: Proposed works are outside of the TPZ and impacts are likely to be nil. Or, minor damage may occur such as; smaller roots may be damaged or a small area of canopy pruned. Unlikely to significantly impact tree health, form, or ULE.</p>
	<p>Moderate: Direct (physical wounding), or indirect (environmental impacts) are possible, root damage may occur, canopy pruning likely, and an occurrence will reduce the ULE.</p>
	<p>High: Tree/s likely to be lost in the medium or short term, or adversely impacted so that tree health, and therefore, ULE are significantly reduced, or the tree will become unstable and/or present an unacceptable level of risk.</p>
	<p>Proposed to be removed: Trees that are within the footprint of works and proposed to be removed by the client, or are not viable to retain due to the factors listed in the conclusions of this report. Trees proposed for removal are not always required to be removed.</p>
INCLUDED BARK UNION	<p>A union within a tree that has included bark (bark pressing on bark), these unions are usually poorly attached and more likely to fail as the included bark is equivalent to a split. Often characterized by an acute angle and sometimes forming ribs or flaring immediately below the union where the tree reacts to the weakness by placing secondary growth.</p> <p>Though these unions are weaker than a 'good' union, the risk of failure cannot be calculated and a poor union does not automatically justify the removal of the tree.</p>
LOPPING / TOPPING (includes coppicing)	<p>The removal of parts of a tree giving no consideration to the trees natural defence systems.</p>
PRUNING	<p>Systematic removal of branches of a plant whilst giving consideration to the trees natural defence systems.</p>
STRUCTURAL ROOT ZONE (SRZ)	<p>The area around the base of a tree required for the tree's stability in the ground. The woody root growth and soil cohesion in this area are necessary to hold the tree upright. The SRZ is nominally circular with the trunk at its centre and is expressed by its radius in metres.</p>

	This zone considers a tree's structural stability only, this is different from the root zone required for a tree's vigour and long-term viability, which will usually be a much larger area.
STRUCTURE	Reference to the structural integrity of the tree with consideration of the crown, trunk and roots. Determined using the Visual Tree Assessment (VTA) method (Mattheck and Breloer 1994). The failure of small (<60mm calliper) live or dead limbs is normal and not considered here.
	Very poor: Clear indications that a significant failure is likely in the near future
	Poor: Obvious signs of structural weakness and a failure is likely, one might expect a significant failure event within the next 5 years, possibly tomorrow
	Fair: Signs of weakness present though not obviously significant, likely to become worse over time
	Good: No obvious signs of structural weakness
TREE	Long-lived, woody perennial plant with one or relatively few main, self-supporting, stems or trunks. Greater than (or usually greater than) 3m in height (or as defined by the responsible authority).
TREE NUMBER	Identifying number allocated to individual trees or groups of trees, may be used to locate trees using site plans or tags on trees.
TREE PROTECTION ZONE (TPZ)	An exclusion area radius measured from the centre of the trunk at ground level that allows for protection of canopy and roots; both the structural roots that give the tree stability and the smaller absorption roots. The radius of the TPZ is normally calculated for each tree by multiplying the DBH × 12. The minimum distance will be 2m and maximum 15 as stipulated in AS 4970-2009 – Protection of Trees on Development Sites.
TREETEC REFERENCE	Unique identifier assigned to an individual report by Treetec
TYPE	Status of the species as it relates to the location.
	Indigenous: Naturally occurring to the local area
	Victorian Native: Naturally occurring within Victoria
	Australian Native: Naturally occurring within Australia
	Exotic: Introduced species to Australia
UNION	The point where a branch or stem is attached to another branch or stem.
USEFUL LIFE EXPECTANCY (ULE)	Useful Life Expectancy is an estimation of how many years a tree can reasonably be retained in the landscape provided growing conditions do not significantly worsen and any recommended works are completed. It takes into consideration factors such as risk, species, age, health and site conditions. Usually represented as either 0, <5, 5 - 15, 15 - 40, or >40.
WORKS	Any physical activity in relation to development. See 'development'.
WOUNDWOOD	Tissue that forms following wounding (sometimes referred to as callus tissue). Wounds include pruning cuts and the site of branch failures, etc.

7.3 General comments

Pruning standards/Lopping

An Australian Standard exists to give guidance on pruning of trees (*AS 4373 2007 - Pruning of Amenity Trees*).

It is important that all remedial works are carried out by a competent contractor in accordance with the Australian Standard.

Lopping, as defined within the standard, is detrimental to trees and often results in decay and poorly attached epicormic shoots. Natural Target Pruning methods should be used wherever possible when removing sections from trees.

7.4 Impact on trees

Physical/Mechanical damage to trees

Physical damage to tree parts, particularly the trunk, provides entry points for pests and diseases such as fungal infections. This may cause long-term decay and can lead to partial or complete tree failure and death.

Alteration of soil levels

Alteration of soil levels around trees will affect the root zone and stability of a tree as well as tree metabolism. This may result in reduced tree health, excessive deadwood, thinning foliage and poor vigour. It can take years for impacts to become evident, at which time it is usually irreversible.

Works within a TPZ

Works such as site cut and fill, re-grading, installation of underground services, building footings or landscaping have the potential to damage tree roots.

It may be possible to work within a TPZ without significantly impacting a tree, however the size and number of roots in the area, and the specifics of the tree and its resilience to impacts, would all need to be reviewed prior to commencement. Design and construction methods may need alteration to minimise adverse impacts.

Site cut and fill has the potential to physically impact roots and thus should be located to ensure minimal disturbance within the TPZ of retained trees. If a shallow cut is proposed within a TPZ, consider increasing fill to eliminate the cut. If the grade is to be raised, the material should be coarser or more porous than the underlying material. If site cuts must occur, avoid batter cuts and instead design a vertical retaining wall to minimise disturbance.

Installation of underground services should also be routed outside TPZs; if there is no other option, they should be installed using non-destructive methods such as air or hydro excavation, or installed by boring under the TPZ at a depth of at least 700 mm (where practicable). The project arborist should assess the likely impacts of boring (including bore pit locations) on retained trees.

Driveways and pathways should not encroach into a TPZ; if encroachment is unavoidable, any hard surfaces should:

- 1) not involve any scraping or excavation – most small absorbing roots are within the upper 100mm of soil.
- 2) be constructed of a permeable material and laid on a base and sub-base specifically designed to allow the movement of water through and into the soil below.

If buildings are permitted within a TPZ, foundations should be suspended on piers leaving the ground undisturbed other than the careful placement of pier holes. The bottom of supporting beams should be above existing ground level or, if this is not possible, beams should run radially

away from the tree trunk. There should be no excavation of any description, including piers, within a Structural Root Zone (SRZ).

All works within TPZs must be approved by the responsible authority prior to commencement.

Description of TPZ encroachment

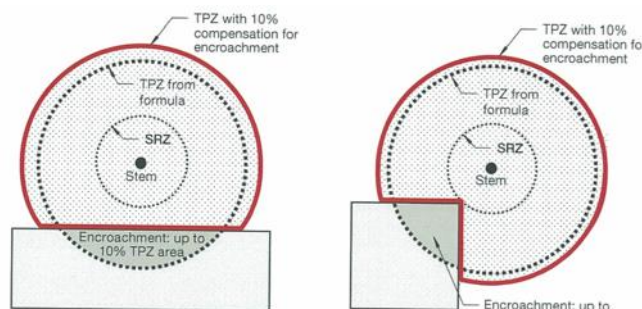
In accordance with *Australian Standard 4970-2009 (Protection of trees on development sites)* encroachment and TPZ variations is determined as per below.

General

It may be possible to encroach into or make variations to the standard TPZ. Encroachment includes excavation, compacted fill and machine trenching.

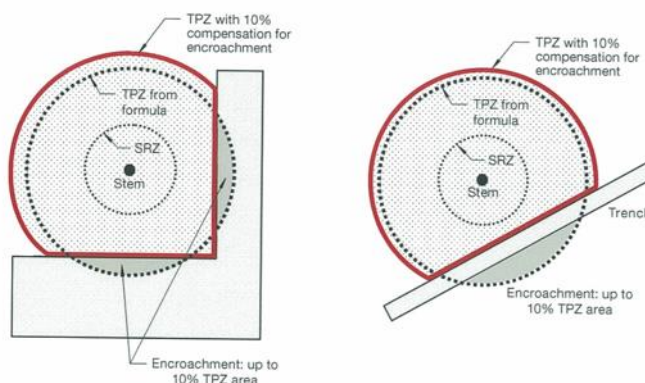
Minor encroachment

If the proposed encroachment is less than 10% of the area of the TPZ and is outside the SRZ detailed root investigations should not be required. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ. Variations must be made by the project arborist considering relevant factors listed in (see standard)...



Major encroachment

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



NOTE: Less than 10% TPZ area and outside SRZ. Any loss of TPZ compensated for elsewhere.

Any additional encroachment that becomes necessary as the site works progress should be reviewed by the project arborist and be approved by the Responsible Authority before being carried out.

Where the project arborist identifies roots to be pruned within or at the outer edge of the TPZ, they should be pruned with a final cut to undamaged wood. Pruning cuts should be made with sharp tools such as secateurs, pruners, handsaws or chainsaws. Pruning wounds should not be treated with dressings or paints.

It is not acceptable for roots within the TPZ to be severed with machinery such as backhoes or excavators.

7.5 Protection of retained trees

Establishment of Tree Protection Zones

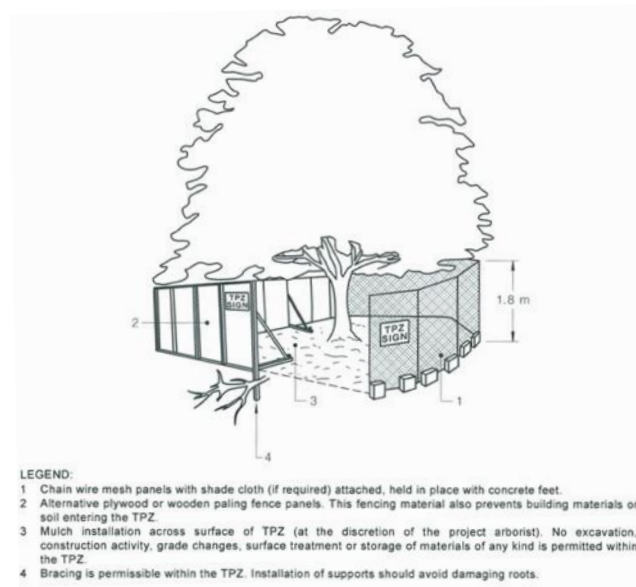
The tree protection zone (TPZ) is the principal means of protecting trees on development sites. Usually fencing will delineate the Tree Protection Zones (TPZ) as defined by *AS 4970-2009 Protection of trees on development sites*.

Fencing is installed following permitted vegetation removal and pruning, but prior to site establishment. Unless stated otherwise and approved by the responsible authority, fencing should be retained until completion of all construction related activity.

Tree protection zone fencing

The fence must provide high visibility and act as a physical barrier to construction activity. The fence should be adequately signed "Tree Protection Zone – No Access", be sturdy and prevent the entry of heavy equipment, vehicles, workers and the public.

Where feasible, tree protection fencing will consist of chain wire mesh panels held in place with concrete feet. Where chain mesh fencing is impractical to implement, alternate protection measures must be arranged.



Restricted activities within TPZ

A TPZ area may surround a single tree or group, or a patch of vegetation. Activities that must NOT be carried out within a TPZ unless permitted by the Responsible Authority include, but are not limited to, the following:

- (a) machine excavation including trenching;
- (b) excavation for silt fencing;
- (c) cultivation;
- (d) storage;
- (e) preparation of chemicals, including preparation of cement products;
- (f) parking of vehicles and plant;
- (g) refuelling;
- (h) dumping of waste;
- (i) wash down and cleaning of equipment;
- (j) placement of fill;
- (k) lighting of fires;
- (l) soil level changes;
- (m) vehicle movement – access ways;
- (n) changes of grade;
- (o) temporary or permanent installation of utilities and signs, and
- (p) damage to the tree.

Source – *AS 4970-2009 Protection of trees on development sites*
(Tree Protection)

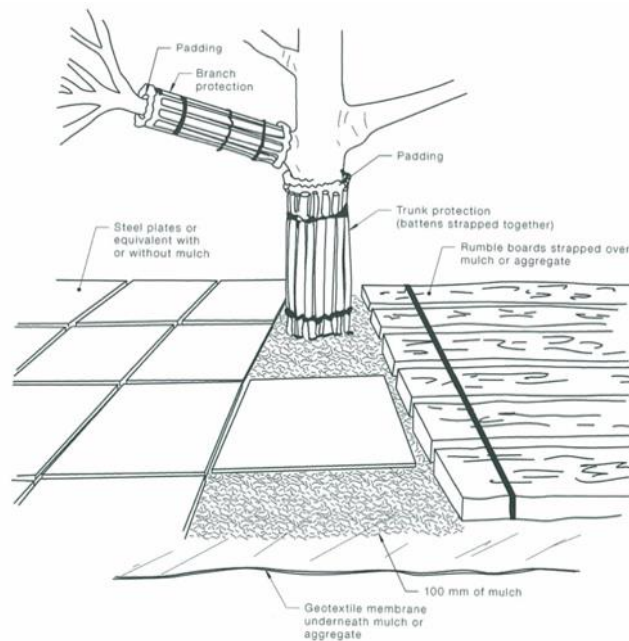
7.6 Alternative protection measures

If temporary access to the TPZ is required, protection for the trunk, branches or ground may be required. The materials and positioning of protection will be specified by the project arborist.

For temporary foot traffic through the TPZ, this may be facilitated using sheets of heavy plywood or similar material; this should not be considered a long term solution.

For machinery access within the TPZ, ground protection should be utilised to prevent root damage and soil compaction. Measures may include a permeable membrane such as geotextile fabric beneath a layer of mulch, or crushed rock below rumble boards or HPDE track mats. These measures may also be applied to root zones beyond the TPZ.

Where roots within the TPZ are exposed during approved works, temporary root protection should be installed to prevent them drying out. This may include jute mesh or hessian sheeting as multiple layers over any exposed roots and the excavated soil profile, extending to the full depth of the root zone. Root protection sheeting should be pegged in place and kept moist at all times.



NOTES:

- 1 For trunk and branch protection use boards and padding that will prevent damage to bark. Boards are to be strapped to trees, not nailed or screwed.
- 2 Rumble boards should be of a suitable thickness to prevent soil compaction and root damage.

**Source – AS 4970-2009 Protection of trees on development sites
(Ground Protection)**

7.7 Alternative design options

Designing all works outside the TPZ is the preferred option to ensure trees remain viable post construction. The options below may mitigate some tree damage and facilitate works within TPZs if approved by the Responsible Authority.

Non-destructive investigation

Air or Hydro excavation can be utilised to explore the proposed encroached TPZ area. These methods use compressed air or high pressure water to dislodge soil without damaging larger roots. This option should be employed during the design stage to identify roots, and during construction to minimise impacts.



Non-destructive digging

Underground boring

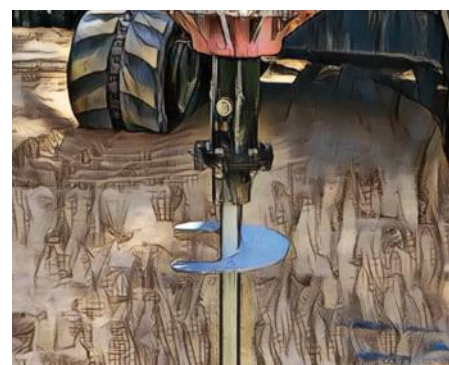
Horizontal boring can be used to drill a pathway for the installation of underground services and utilities without the need for open trenching. An entry and exit pit are required, however, if these are located outside of a Tree Protection Zone, and the boring depth under the TPZ is below ~700mm, the overall impact to the subject tree/s can be significantly reduced.



Horizontal boring

Low impact footing design

Screw pile or pier footings with beams above ground level, or cantilevered to support the floor of a building can be used to minimise impacts on trees. Consideration must be given to the soil type and lost catchment area beneath a raised structure. Footings should be positioned so as not to damage larger (>30mm diameter) roots.



Low impact footings: i.e. - screw piles

Bridging over the TPZ

Post/screw pile footings with cross members to support a bridge like structure raised above the TPZ can be used for driveways or pathways. Footings should be positioned so as not to damage larger (>30mm diameter) roots. Structures should be engineered to tolerate the expected loads. Consideration should be given to the location of transition between natural grade surfaces and the bridging structure, as some excavation at this location would be required. This is preferably outside of the TPZ.



Bridging over a TPZ

Permeable, porous, and pervious surfaces

Unlike traditional concrete surfaces, these alternatives enable a hard surface to be created whilst also allowing moisture to penetrate into the soil below. There are numerous options available, however, most usually require excavation to create a stable base that will allow water to filter into the soil below. This excavation can impact roots, thus nullifying the benefit of the alternative construction method. If permeable paving is utilised, it is of greater benefit if no disturbance to natural grade occurs and no compacted gravel subbase is installed. Soil pH is also a consideration as leaching from the bonding material of a poured surface will increase soil pH levels and may impact tree health through nutrient deficiencies.