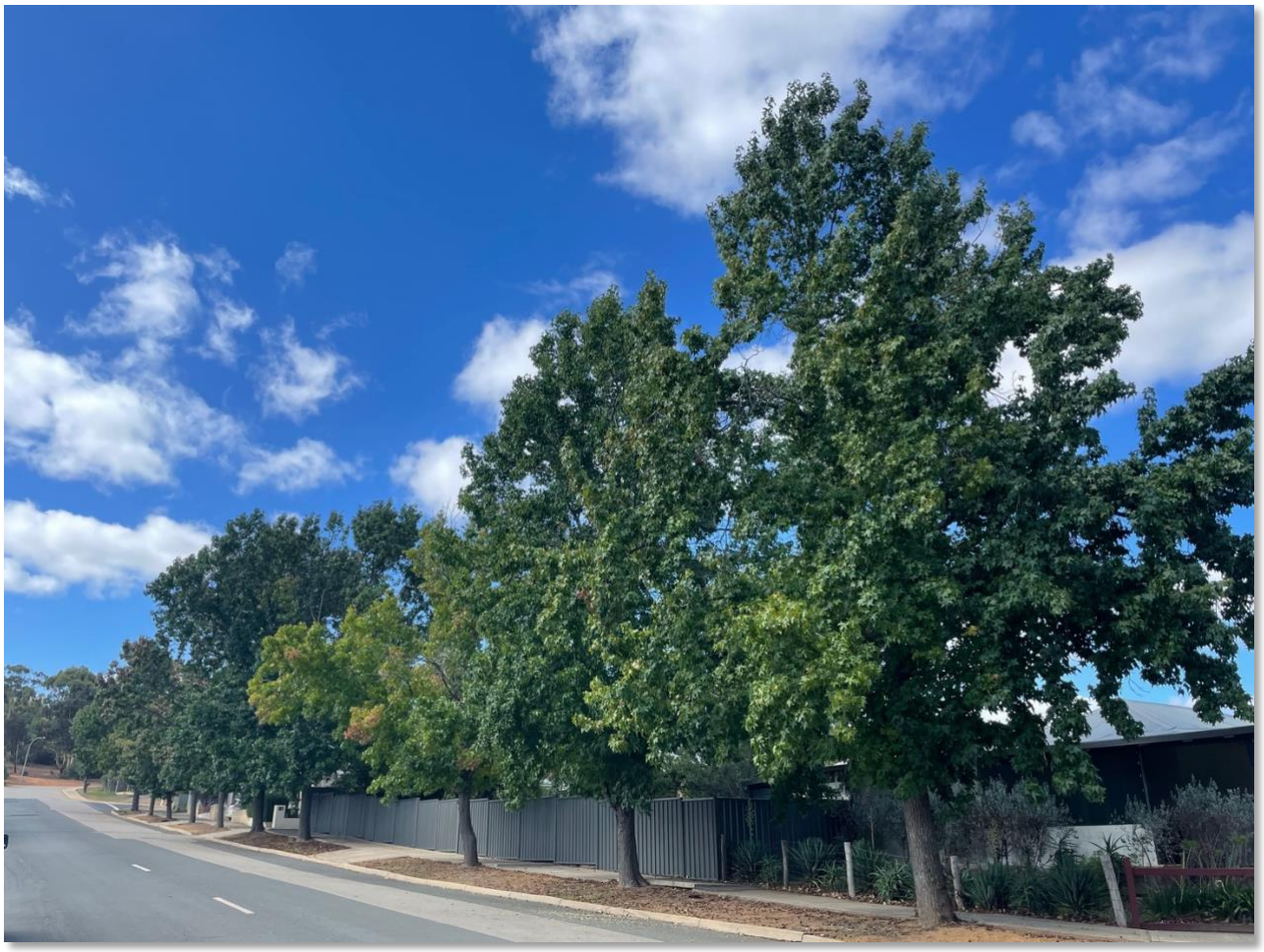
Arboricultural Report

# Hill Street, Boddington

25th March 2021



Prepared for:
Jeff Atkins
Shire of Boddington

# Contents

# Introduction and Scope

Beaver Tree Services has been engaged by Jeff Atkins, Manger Works and Services at Shire of Boddington, to inspect and provide advice regarding the management of a population of trees along Hill St, in Boddington.

This row of 11 trees is impacting on adjacent infrastructure including the footpath and retaining walls or boundary wall of nearby properties. Advice has been sought on likely future growth patterns of these trees, particularly with respect to the roots.

The inspection of these was carried out from ground level on a clear sunny day. No excavation or below ground investigation was carried out of the roots.

This report will be restricted to arboricultural matters within the skill, experience and training of the author and not deal will matters of law or engineering.

# Tree Description

The trees have been identified as a *Liquidambar styraciflua*, commonly known as Liquidambar or also Sweetgum or American Redgum. They originate from North America, predominantly the south east, and are relatively common both naturally occurring as well as being a feature tree planting in parks and street verges. They are now widely planted across the world and are a commonly planted tree within the greater Perth region.

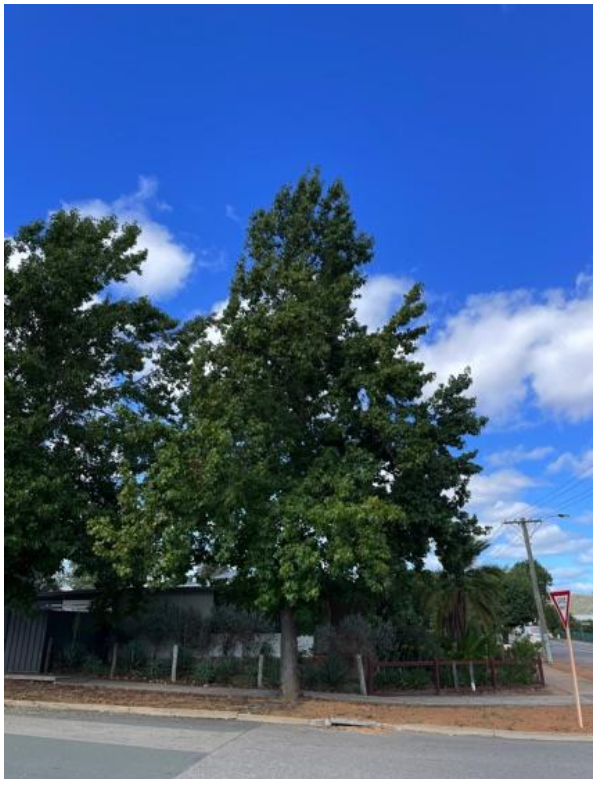


*Figure 1* - Tree 11 a typical example of a liquidambar

They are a large deciduous tree and in ideal conditions can grow in excess of 40m, although they rarely exceed 20m outside their native environment, unless in ideal conditions. There are few examples in the Perth region that exceed 20m. The have a broadly pyramidal shape when juvenile but this rounds out with age, creating a beautiful shade tree, with spectacular colours in autumn. These spectacular autumn colour do give way to a large amount of fallen leaves, as well as the spiky, somewhat hard fruits, which can be messy and occasionally create a slip or trip hazard.

Another typical feature of these trees, particularly pertinent in this case, is that they have relatively shallow aggressive root system, often with exposed surface roots.

There are 11 of these trees planted on the southern verge of Hill St, between Hotham St and

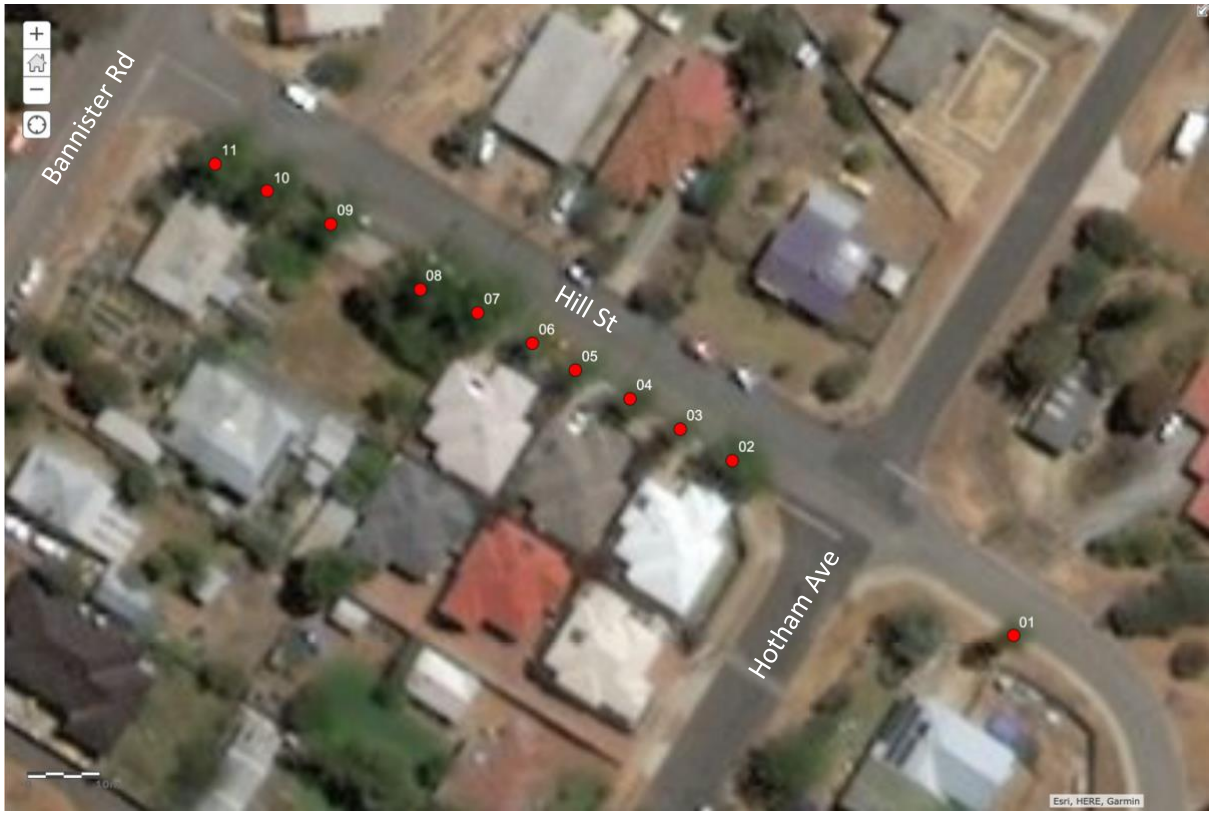



*Figure 2* - Location and ID of assessed trees

Bannister Rd with one on the southern side of Hotham Ave. In aggregate these trees are in fair-to-good condition, with good leaf colour, density and distribution, however they to appear to be relatively small for their estimated age. Two are in somewhat poor condition with dead patches in they upper canopy. There was no specific cause identified or attributable for this and it was not known whether this was a temporary condition or indicative of a long-term issue.

They range in height from 6.6m up to 12.4 m. Both the canopy spread, and trunk diameter have a similar corresponding variation in range. Individual specifications are provided in the table in Appendix 2

There is no reliable data on the exact age of the trees, but they appear to be approximately 40 years old and are in the early-mature phase of their life cycle. This means that the tree has not yet reached full mature size and is likely to increase in size, both in terms of the canopy but also the radial expansion in diameter of both the trunk and roots.

There is some debate as to the longevity of this species with some examples recorded up to 400 years old however this is likely an anomaly with naturally occurring specimens rarely exceeding 150 years and cultivated examples much less, particularly in constrained urban environments.

## Site Description

The trees are planted along the southern verge of Hill St from Bannister Rd. As shown below there is an approx. 4m wide verge, comprised of approx. 1.5m wide footpath and 2.4m wide gravel surface.

Trees 2-11 are all located in the gravelled area between the kerb and the footpath but no further than 200mm from the footpath surface. Tree 1, located on the southern side of the Hotham St intersection is planted between the footpath and the property boundary, approx. 400mm from the surface of the footpath. Trees 2-7 are adjacent to 1, 1A and 1C Hill St all of which have a retaining wall as part of their respective property boundaries.

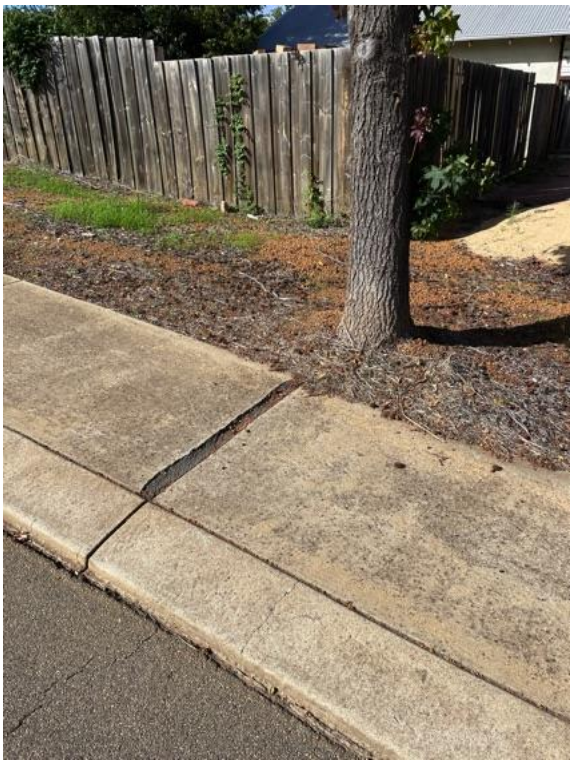


*Figure 3* - Tree 1 planting location

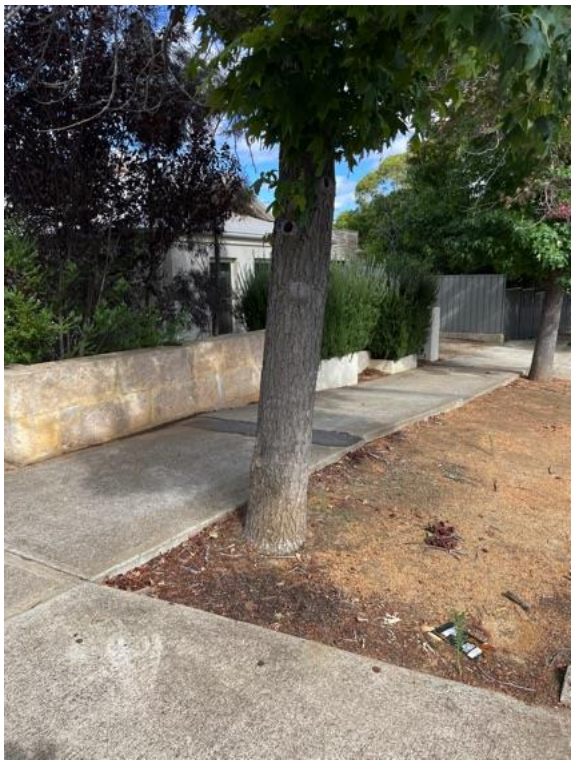


*Figure 4* - Planting location typical of trees 2-11

Every single one of these trees has caused damage to either the footpath, kerb or retaining wall closest to it. Whilst a comprehensive underground assessment either by Ground Penetrating Radar or non-destructive excavation has not been carried out there is no disputing that this damage has been caused by these trees. There are no other trees, mature or otherwise, in sufficiently close proximity, that could cause such damage. These roots are perpendicular to the footpath and parallel to the cracks in the concrete. This is consistent with the standard root growth pattern where, absent any other interference, roots will radiate from the trunk.

The trees are in such close proximity to the footpath that there is no alternative space for the for the roots to grow. The interface between the concrete of the footpath and the base underneath can be a source of increased moisture from condensation build-up as the temperature of different materials changes at different rates. This in turn can promote increased root growth rate underneath the footpath and retaining wall, both lateral elongation and radial expansion. The radial increase in root diameter cannot be easily absorbed by compression of previously compacted base below the footpath but is instead directed upward, lifting and cracking the concrete panel.
Figures 5-8 below illustrate some of the damage caused by these trees but is not a comprehensive catalogue.

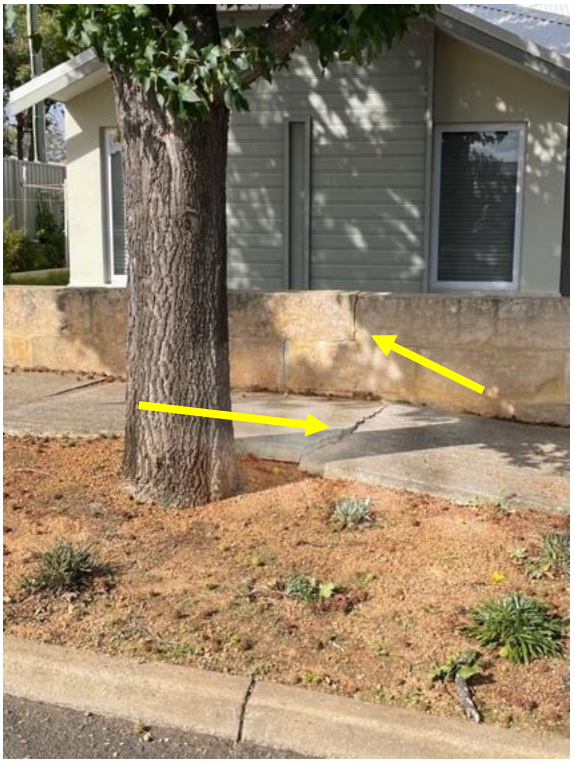


*Figure 5* - Tree 2 Cracked lifted footpath, cracked wall

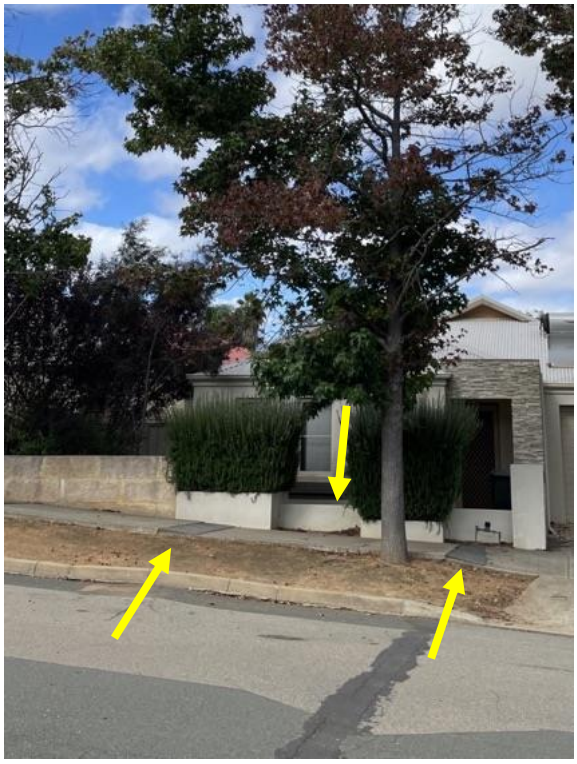


*Figure 6* - Lifted and repaired footpath, cracked wall

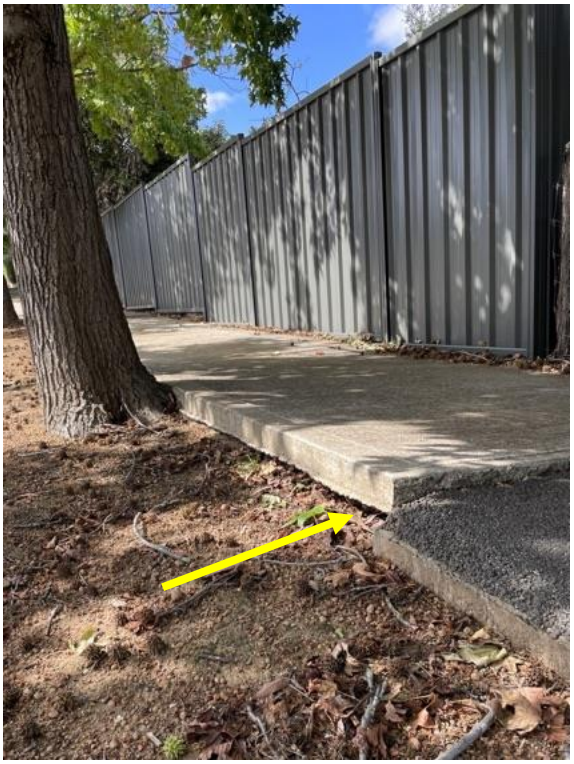


*Figure 7* - Tree 9 Lifted footpath

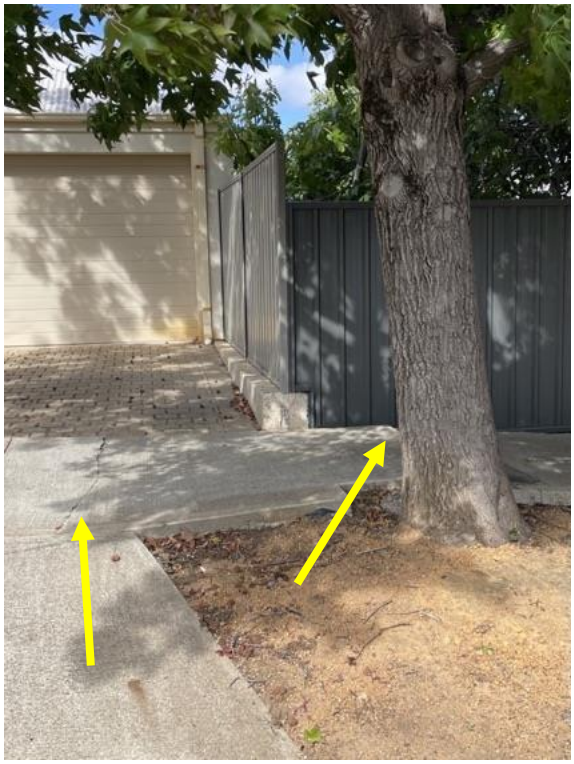


*Figure 8* - Tree 7 Cracked and lifted foot path, uneven driveway

Damage to the foundation of the adjacent houses has not been considered as contemporary building codes and practices specify foundations that mean this would be extremely unlikely to occur.

# Discussion

The primary management issue regarding these trees the interaction between their roots and surrounding infrastructure including the footpath, crossovers, and boundary fences or retaining walls. The Australian Standard for Protection of Trees on Development Sites (AS 4970-2009) provides guidelines for root management and whilst this is not a development site, the root management practices described are directly applicable to this situation. Any work to repair existing damage or prevent further damage will necessarily involve the application of this Standard, which provides two specific levels of protection for tree roots.

The first is a Tree Protection Zone (TPZ) which is ...” a specified area ... below ground and at a given distance from the trunk ... for the protection of the tree’s roots and crown to provide for the viability and stability of a tree.” The radius of the TPZ is to be calculated by using the following formula TPZ = DBH x 12. Using the Diameter at Breast Height (DBH) of the smallest tree, Tree 3, of 276mm it results in a TPZ diameter of 3.3m.

The second level of protection specified by the Australian Standard is the Structural Root Zone (SRZ). This is defined as “... the area around the base of the tree required for the tree’s stability...woody root growth and soil cohesion are required in this area are necessary to hold the tree upright.” The radius for the SRZ is calculated as SRZ = $(Dx50)^{0.42}$ x 0.64. In this case also using the smallest diameter of Tree 3 this gives a SRZ of 1.93m

The larger area for the TPZ is necessary for the health and vitality of the tree whereas the smaller SRZ is concerned with the structural stability of the tree. Both are necessary for the long-term viability of the tree. The Standard provides guidelines for dealing with excavation or trenching that encroaches within the TPZ but there is to be no encroachment within the SRZ. Individual TPZ and SRZ figures have been calculated for each tree and are included in the table in Appendix 2 and are mapped in Appendix 3.

It is important to note that for all trees the minimum required area for the protection of structural roots extends beyond both the footpath and the property boundary. Any work to mitigate current damage or future damage will compromise the structural integrity of these trees.

The primary method of controlling problematic roots or preventing damaging interactions with other assets is the use of a root barrier. This is an impermeable membrane, usually plastic, extending from the surface to a depth of up to 1m that resists root penetration and redirects growth in alternative directions. Ideally this is installed early in the lifecycle of a tree but is frequently and successfully used in managing mature or established trees. However, in order to install root barriers, the potential impact on the tree needs to be assessed, as trenching to the full depth of the installed root barrier is required.

In this case if a root barrier were to be installed parallel and at the property boundary, to prevent further impact on the retaining walls only, even based on the measurements of the smallest diameter tree it would encroach significantly into both the TPZ and SRZ. Installing root barrier between the

footpath and the trees is not feasible as the maximum distance is approx. 400mm. This would result in the immediate failure of all trees.

The Standard outlines the potential issues from the loss of roots

(A) loss of stability if structural woody roots or even lower order woody roots are cut;
(B) reduction in water and nutrient uptake;
(C) an eventual loss of leaves, reduced photosynthesis and thus sugar production;
(D) decay as a result of wounding; and
(E) predisposition to soil borne pathogens

# Management options

Below is a set of options for managing this tree in order of severity of impact on the tree:

1. Leave the trees in their present state and allow natural growth patterns to continue. This will obviously not mitigate or minimise the issue in any way. Natural growth pattern of the roots means that it will continue to impact on the walls and foot paths.
2. Pune the roots at the property boundary to prevent root incursion onto private residences. This will stop any future damage to fences, retaining walls, driveways or other assets on private property but it will cause the decline and likely eventual death of majority of these trees. It will require the removal of some or all of the footpath to install and will not mitigate any future impact on the footpath.
3. Install a root barrier parallel to the edge of the footpath to prevent any root incursion under the foot path. This will likely result in the rapid death of the trees and likely whole tree failure.
4. Remove the trees. This will eliminate the problem entirely but also removes any amenity and environmental benefits that the tree provides.

It is important that any work carried out on the roots or canopy of this tree is of the highest standard and in accordance with AS 4373-2007 Pruning of Amenity Trees. This work should be carried out by an arborist qualified to at least Australian Qualification Framework (AQF) Level 3 in Arboriculture

# Recommendations

Whilst the retention of trees, particularly mature trees is preferable, consideration needs to be given to the lifecycle of the trees and their long-term management, not just of these specific trees as individuals but these trees as part of the urban forest canopy.

Specific technical arboricultural recommendations form only part of the equation when considering management options. Other factors such as maintenance costs, liability, security, infrastructure or asset protection also must be considered by the property owner or manager.

In this instance for example there is little in terms of arboricultural intervention required for the benefit or protection of the trees. It is the trees' ongoing interaction with the built environment that is posing the management challenges.

It is no longer possible that these trees are able to grow to their natural size and form without having a significant impact on surrounding built assets and infrastructure. They are also of such size and

maturity that they are no longer able to be controlled or reduced without significant negative long-term consequences to the trees

It is my opinion that the best long-term outcome is to remove these trees and to replace them with more suitable, native species utilising contemporary confined space planting techniques such as tree wells.

## Conclusion

Trees provide many tangible and intangible benefits to both the owner and the community around the tree including shade, fauna habitat, aesthetics, heat moderation, air quality and much more. However, trees require management and maintenance, particularly as they age. It is incumbent on the owner to ensure that a tree does not unreasonably impact on another person or their right to enjoy their property.

Joshua Groenewold
Diploma of Arboriculture

## Limitation of Assessment

It is our policy to attach the following clause regarding limitations. The assessment of the trees presented in this report has been made using accepted arboricultural techniques.

Notwithstanding the recommendations and conclusions in this report, it must be recognised that trees are living organisms and are subject to change on a daily basis. They aren't immune to change in site or weather conditions or general seasonal variations.

It is both professionally and practically impossible to predict with absolute certainty the behaviour of any single tree or its component parts, regardless of the methods and techniques of any assessment. Inevitably, a standing tree will always pose some level of risk. Most trees have the potential for failure under adverse weather conditions, and the risk can only be eliminated if the tree is removed.

Although every effort has been made to ensure that his assessment is accurate, the tree should be re-assessed periodically. The assessment presented in this report is only valid at time of inspection.

## References


Australian Standard AS 4373-2007 Pruning of Amenity Trees

Australian Standard AS 4970—2009 Protection of trees on development sites

Harris, R.W., Clark, J.R., Matheny, N.P., Harris, V.M. and Steinke, G.A. (2017) Arboriculture: Integrated management of landscape trees, shrubs, and vines. 4th edn. United States: Prentice Hall.

Holliday, I. (2002) A field guide to Australian trees 3rd edition. Australia: New Holland Publishers.

Kerruish, R.M., Unger, P.W. and Walkington, A.L. (2003) Plant protection 1: Pests, diseases and weeds. 3rd edn. Sydney, NSW, Australia: RootRot Press.

Macoboy, S., What Tree is That?, (2003), New Holland Publishers, Sydney

Rodd, T. and Stackhouse, J. (2008) Trees: A visual guide. Berkeley: University of California Press.

# Appendix 1 – Tree Location Map

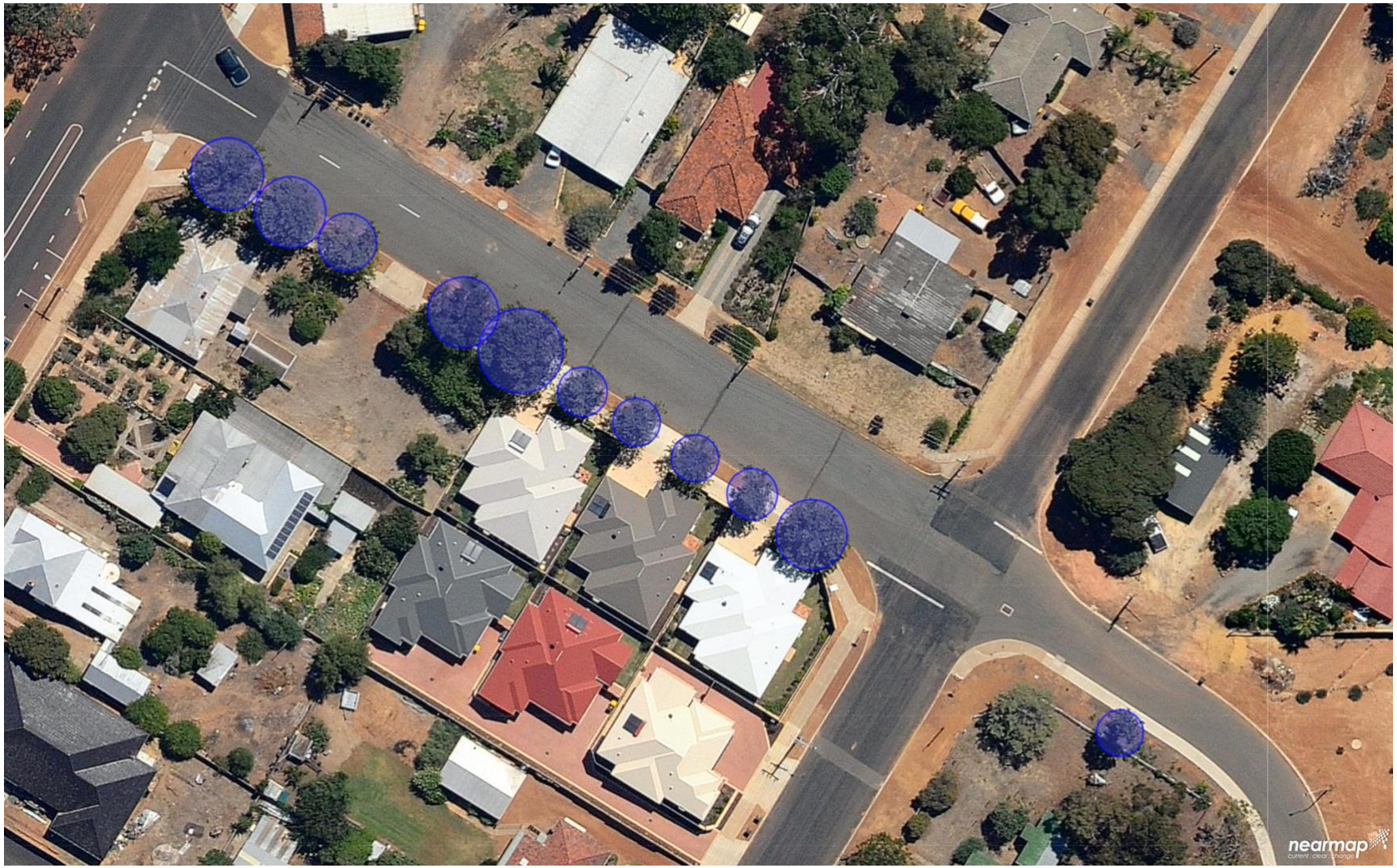



*Figure 9* - Showing tree locations and approximate canopy size

# Appendix 2 – Individual Assessments

Table Notes

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **ID** | Sequence number | **Spread** | Approximate canopy dia. (m) | **DBH** | Diameter Breast Height (mm) | **Priority** | High = 3 month |
| **Species** | Scientific name | **Health** | overall tree health | **TPZ** | Tree Protection Zone (m) | | Medium = 12 months |
| **Height** | in meters | **Structure** | overall tree structure | **SRZ** | Structural Root Zone (m) | | Low = 2 years |

| ID | Species of Tree | Height | Spread | Health | Structure | DBH | TPZ | SRZ | Remedial Action | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| *01* | Liquidambar styraciflua | 8.6 | 5.5 | Good | Good | 310 | 3.7 | 2.02 | Nil | |
| *02* | Liquidambar styraciflua | 10.0 | 8.8 | Good | Fair | 447 | 5.4 | 2.36 | Nil | |
| *03* | Liquidambar styraciflua | 9.0 | 6.4 | Good | Good | 276 | 3.3 | 1.93 | Nil | |
| *04* | Liquidambar styraciflua | 6.6 | 5.9 | Good | Fair | 293 | 3.5 | 1.98 | Nil | |
| *05* | Liquidambar styraciflua | 7.6 | 5.9 | Poor | Fair | 319 | 3.8 | 2.05 | Remove major deadwood | Dead limbs in upper canopy |
| *06* | Liquidambar styraciflua | 7.5 | 6.2 | Poor | Fair | 295 | 3.5 | 1.98 | Remove major deadwood | Dead limbs in upper canopy |
| *07* | Liquidambar styraciflua | 12.2 | 10.4 | Good | Fair | 465 | 5.6 | 2.40 | Canopy raise, minor distal pruning | Low-hanging limbs impacting on fence |
| *08* | Liquidambar styraciflua | 11 | 8.7 | Good | Fair | 431 | 5.2 | 2.35 | Distal pruning | Several limbs elongated beyond canopy |
| *09* | Liquidambar styraciflua | 8.4 | 7.2 | Fair | Good | 341 | 4.1 | 2.11 | Remove major deadwood | Some dead limbs in upper canopy |
| *10* | Liquidambar styraciflua | 10.8 | 8.8 | Good | Good | 391 | 4.7 | 2.23 | Nil | |
| *11* | Liquidambar styraciflua | 12.4 | 9.1 | Good | Good | 423 | 5.1 | 2.31 | Nil | |

# Appendix 3 – TPZ and SRZ Map

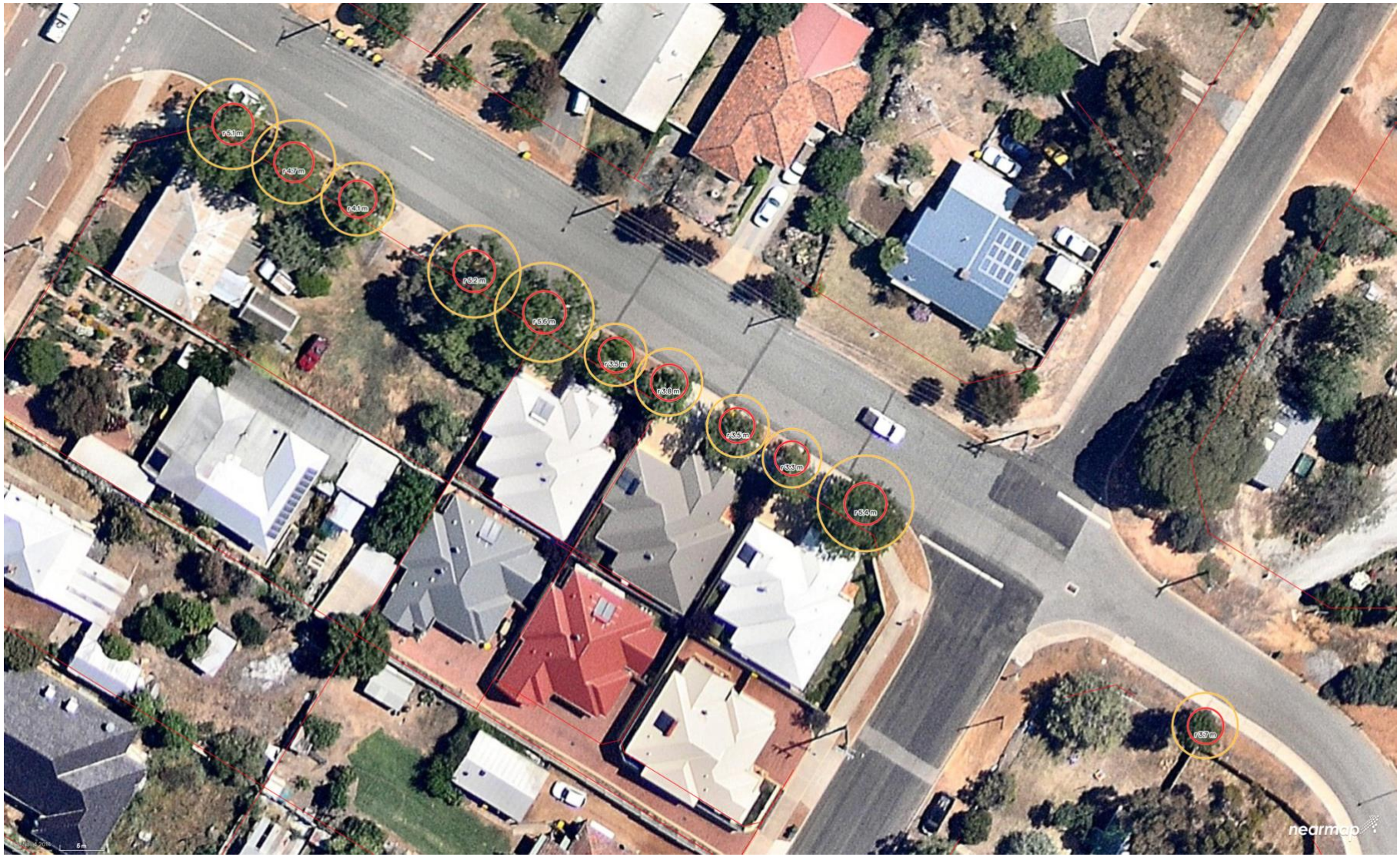
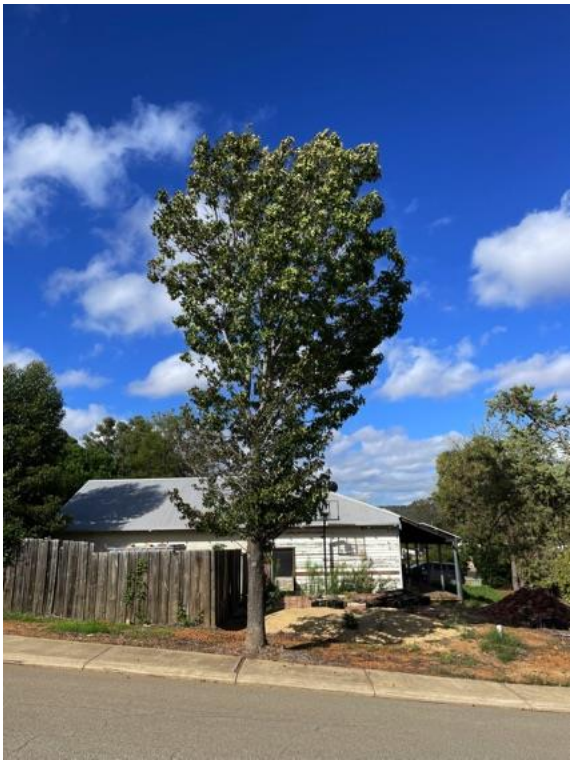



*Figure 10* Showing TPZ (yellow) and SRZ (red). Figures are radius of TPZ in meters

# Appendix 3 – Individual photos



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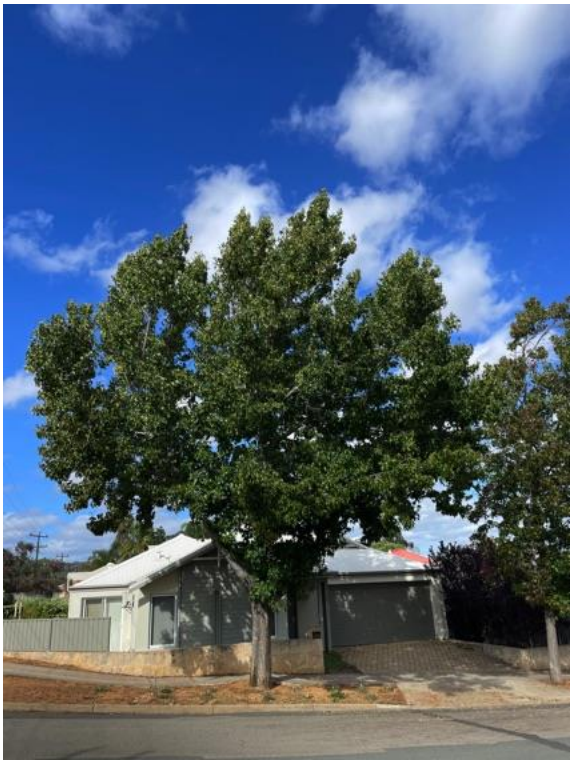
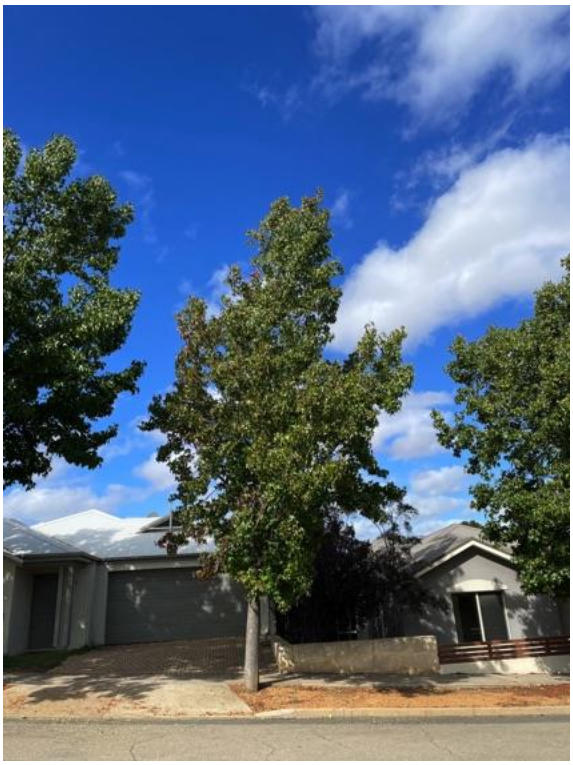
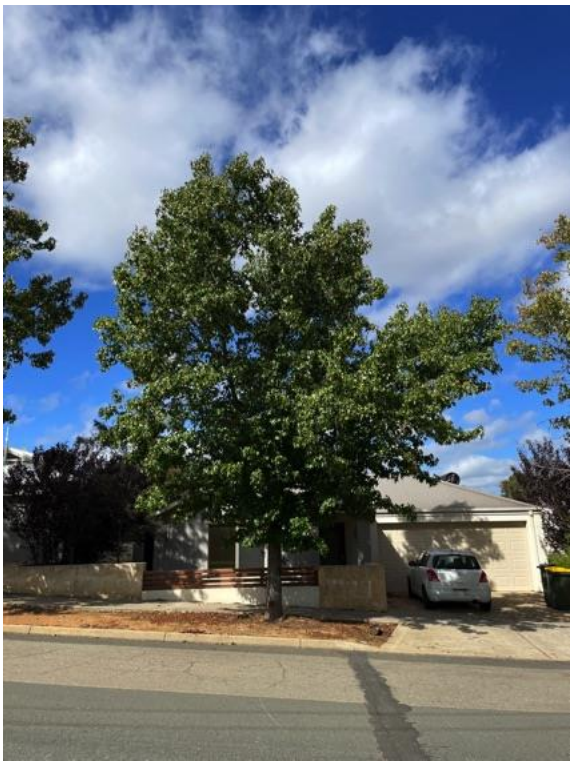


Tree 02



Tree 03



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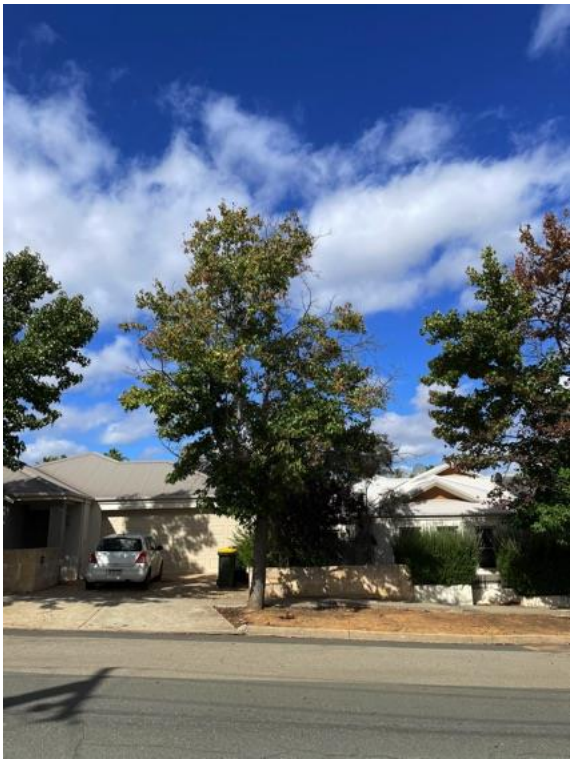
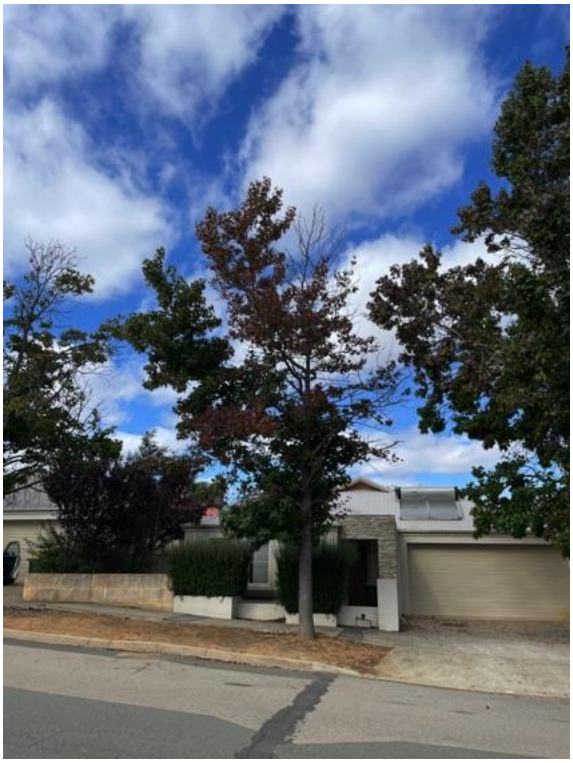
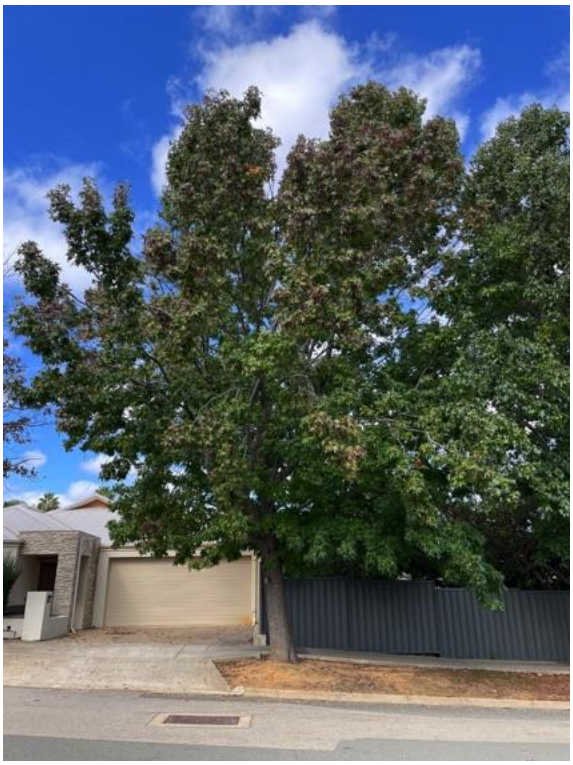


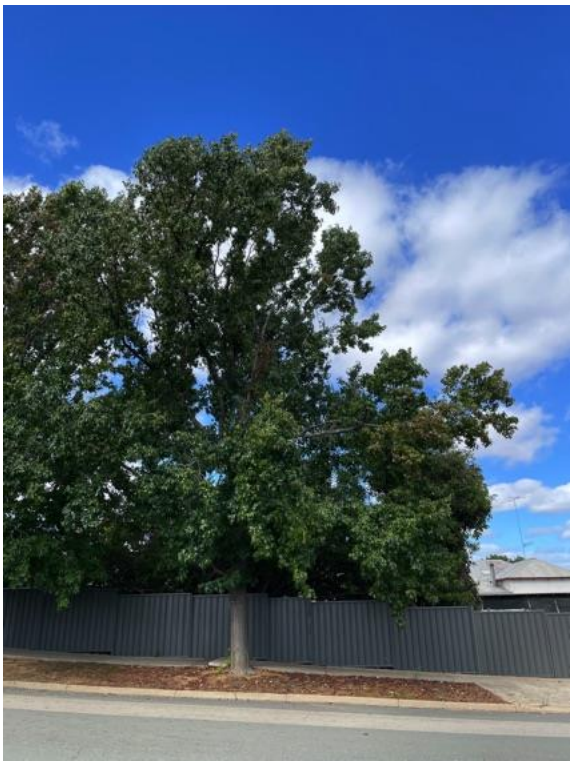
Tree 05



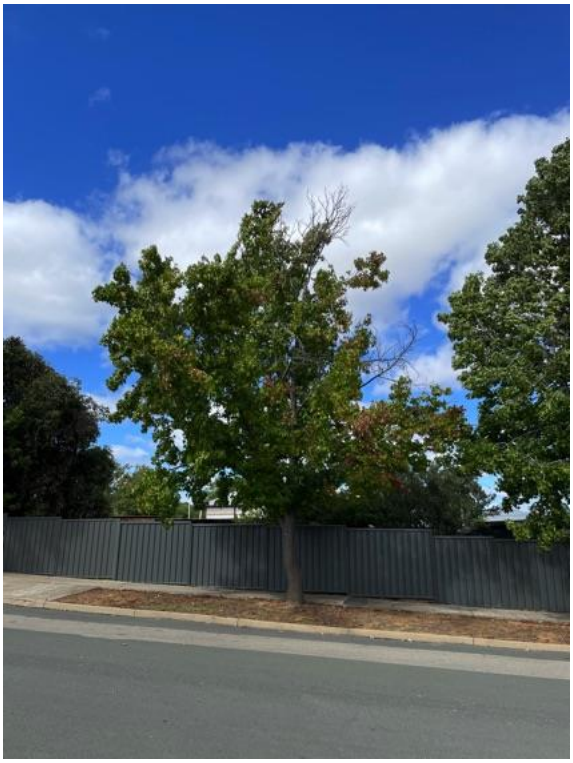
Tree 06



Tree 07



Tree 08



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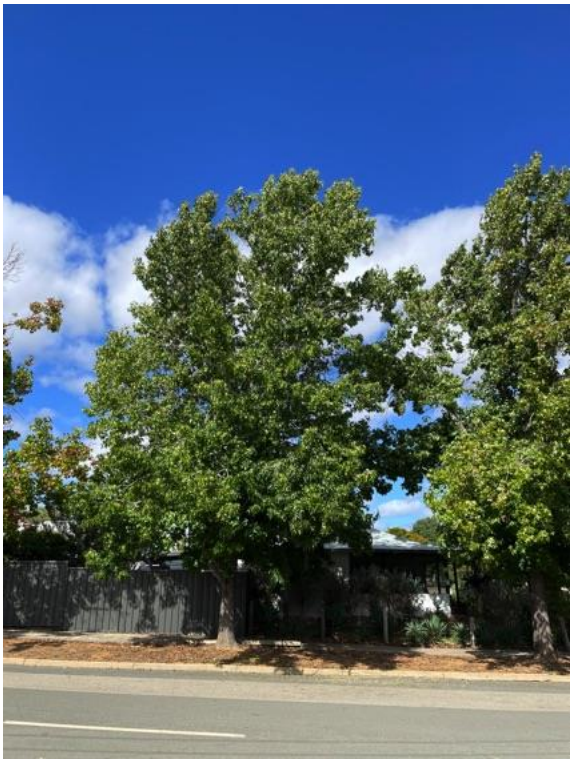
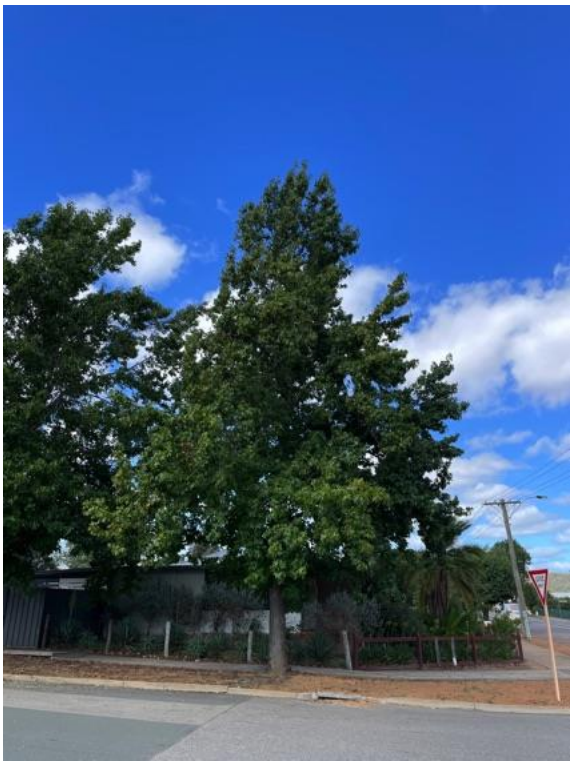


Tree 10



Tree 11

# Appendix 5 – Replanting Considerations

In the event of the removal of the liquidambars the following recommendation are made regarding the replacement of these trees.

## Species selection

It is recommended that replacement trees be selected from a native plant palette with characteristics more suited for the site. Small to medium sized native suitable for the site include:

- Illyarrie - *Eucalyptus erythrocorys*
- Red flowering gum - *Corymbia ficifolia*
- Silver Princess - *Eucalyptus caesia*
- Little ghost gum - *Eucalyptus victrix*

## Site Preparation

Careful consideration should be given to site design if replacement trees are to be planted. Planting in the existing site without modification will eventually lead similar problems. Site considerations should include:

- Installation of root barries to protect assets
- Use of structural soils to compensate for reduced soil volume

## Standard of Work

- All tree stock will be sourced from nurseries in accordance with Australian Standard AS2303 Tree Stock for Landscape Use
- Tree planting will be carried out in accordance with industry best practice
- Any pruning work is to be done to AS4373 Pruning of Amenity Trees by qualified arborists.

## Maintenance plan

A maintenance plan should be prepared and may include the following:

- Watering plan for establishment
- Formative pruning
- Scheduled assessment