MOORE TREES
Consulting Arborist

Picus Sonic Tomograph Test Report

28, 30, 32 Malton Road, Beecroft

Five (5) Trees

Prepared for
Hornsby Shire Council, PO Box 37, Hornsby NSW 1630

Prepared by
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Summary

This report has been commissioned by Gareth Hambridge, Tree Management Officer, Parks & Recreation, Hornsby Shire Council, PO Box 37, Hornsby NSW 1630. The report concerns five (5) mature trees, at various locations, listed in Table 1.

For this report I have conducted testing on Trees 1-5. The tests were conducted at various heights measured from ground level. These tests have been undertaken with the use of the Picus® Sonic Tomograph. This instrument uses the velocity of sound waves to calculate the area of sound wood within the test site of the subject trees. Test results are shown as a colour coded two-dimensional image.

The site visit and tests were undertaken on the 20th January 2023 on the subject trees. Previous testing was undertaken on 4th April 2019, and the subject tree at 32 Malton Road was also tested in August 2015.

Tree 1: At this stage, the tree is not imminently dangerous however it is likely to continue to increase in size and girth. The combination of the poor first order branching structure and the damaged wood at the base of the tree do not allow for a long-term safe specimen. In 2019 weight reduction pruning was recommended and this appears to have been undertaken, however this is ultimately a short term solution.

Tree 2: Tree 2 is not imminently dangerous however its removal should occur within the next twelve (12) months. It fails the t/R calculation and has a very asymmetrical weight distribution of the lower stem.

Tree 3: Tree 3 would appear to have a large central portion of damaged wood in the basal area. It is likely cracking and splitting is occurring. Potentially the tree is at the limit of t/R ratio threshold and not imminently dangerous however consideration to its removal should occur within the next five (5) years based on increases in damaged wood quantities.

Tree 4: Tree 4 is safe to retain.

Tree 5: Tree 5 is showing damaged wood in areas that would indicate that an inclusion is occurring between the two (2) stems. As recommended in 2015, provided weight reduction of 15% of the upper canopy occurs, this tree should be possible to retain for a further 5-15 years. It appears this weight reduction pruning was undertaken based on the presence of old pruning wounds. Ultimately this tree may have to be considered for removal due to its limited safe useful life expectancy.

Table of Contents

1. Introduction

This report has been commissioned by Gareth Hambridge, Tree Management Officer, Parks & Recreation, Hornsby Shire Council, PO Box 37, Hornsby NSW 1630. The report concerns five (5) mature trees, located at Malton Road, Beecroft within the Hornsby Shire Council area (Diagram 1). These trees are all Council street trees, located on the road verge. These tree locations can be seen in Diagram 2.

For the purpose of this report an ultrasound test has been conducted on each tree, at various heights shown in Table 1, due to the potential defect location. These tests have been undertaken with the use of the Picus® Sonic Tomograph. This instrument uses the velocity of sound waves to calculate the area of sound wood within a tree. Test results are shown as a colour coded two-dimensional image.

The site visit and tests were undertaken on the 20th January 2023 on the subject trees.

This Report is not a Visual Tree Assessment (VTA) Report, however I have commented on the overall heath and condition, as it relates to the trees' ability to deal with decay/fungi activity. This report is a structural report on the subject trees and not a risk based assessment on the potential impacts to surrounding infrastructure and pedestrians.

The target area below the trees assessed for this report would be considered reasonably high, with many cars parked along Malton Road, power lines and residential houses. The location of these trees and the surrounding infrastructure would give these trees an *'Constant use'* target rating (Matheny & Clark, 1994). Industry standards would consider a *'Constant use'* rating an often-frequented area, a busy area, or where a residential dwelling is located however, I do feel that the residential dwellings surrounding these trees are just outside the target area. Generally, the human targets below these trees will be mostly mobile.

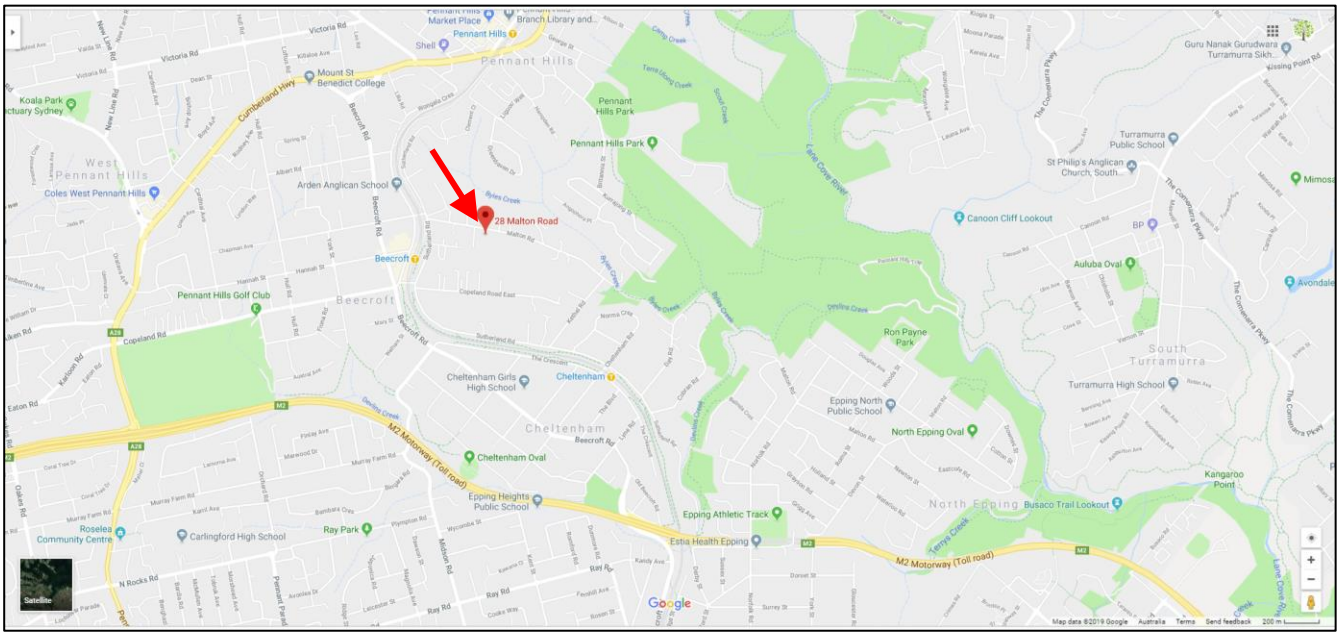


Diagram 1: Red arrow is the location of Malton Road, and the subject trees. (Google.com/maps, 2023)

Diagram 2: Tree locations. (Sixmaps, 2023)

2. Methodology

2.1 The Picus® Sonic Tomograph

The Picus® Sonic Tomograph was developed by The Company Argus Electronics GmbH, Germany. It is a device created to measure decay within trees. The device has been accepted worldwide as a leading method of near nondestructive testing of trees. This instrument uses the velocity of sound waves to calculate the area of decay within a tree. These sound waves are activated from sensors placed around the tree.

Image of a typical test set up.

Ultrasonic velocity has been demonstrated to be very sensitive to the early stages of wood degradation (Wilcox, 1988). Test results are shown as a colour coded two dimensional image (Plate 3). The lower limit to the size of defect that the Picus can detect depends on the size of the tree, number of sensors, and type of wood. The higher density of the wood, the smaller the defect that can be detected (Gilbert & Smiley, 2004).

To date, Moore Trees has conducted numerous destructive tests (where the subject tree has been cut down) on many species of trees, both native and exotic. These tests have confirmed the accuracy of the Picus® Sonic Tomograph. Other independent studies have also confirmed the accuracy of this device (Schwarze, Rabe, Ferner & Fink, 2004). Ultrasonic tomography has been compared with other

Tomographic techniques (Nicolotti, 2003) and has been found to be very effective in finding small structural anomalies within a tree.

Unlike other instruments used for decay detection the Picus® Sonic Tomograph does not drill into the tree and breach the tree's barrier zones that are created to help confine and slow the spread of decay. Studies have confirmed that other invasive decay detection devices, such as drilling devices, can aid the spread of pre-existing decay within a tree (Kersten and Schwarze, 2005).

2.1.2 Analysing the Picus® Report

Please read the following points to help you understand the Picus Sonic Tomograph Report.

1. Sensor 1, unless otherwise stated, is located on the northern side of the tree.
2. The test height is always measured at sensor 1.
3. Depending on some species of fungi, the active fungus that has colonized cells will not be visible to the human eye.
4. In most cases the altering wood from the fungus cannot be seen by the human eye.
5. The circumference measurement of the Tomogram is created from the location of the tips of the pins.
6. With some readings the 'Sound wood' and 'Damaged wood' quantities will not total 100%. The unspecified quantity is wood density that cannot be measured. That means that it may be sound or it may not. It is considered to be altering wood.

The Tomogram produced by the Picus® Sonic Tomograph may at times vary to what will visually be observed when the test area is revealed. It is important that only trained professionals make comments and recommendations regarding any test results.

2.2 The t/R ratio

The t/R ratio is based on many years of study of over 1200 tree failures of broad leaved and coniferous trees (Mattheck & Breloer, 2003). This ratio is based on a 70:30 rule. The study found that when most trees achieved a decay linear measurement of greater than 70% (i.e. less than 30% sound wood) the tree had a high likelihood of failure. The theory and this study can be read in more detail in the book '*The Body Language of Trees', 2003* by Claus Mattheck and Helge Breloer, *pages 36-37.*

This t/R ratio has been used in combination with the Picus® Sonic Tomograph to assess the structural integrity and make recommendations for the future management of the subject tree.

Note: If a tomogram reading is at 51% sound wood this will indicate that the sound wood quantity has reached the limit of 30% of the t/R ratio (See Appendix 2).

2.3 Location of test

The test area was conducted at various heights for each tree, measured from ground level. These test heights were selected as the most likely area of the trunks or stems to fail, based on an initial visual assessment of each tree.

Tree No.	Location	Test heights
1	28 Malton Rd, Beecroft	Test 1: 1500mm Test 2: 200mm
2	28 Malton Rd, Beecroft	1400mm
3	30 Malton Rd, Beecroft	100mm
4	30 Malton Rd, Beecroft	100mm
5	32 Malton Rd, Beecroft	1300mm

Table 1: Test heights measured from ground level.

2.4 Report limitations

This report does not include root excavation or aerial inspection.

2.5 Testing System

The structural testing system used for this report is the Picus 3 system running 12 sensors on software version Q74.

3. Test results

Tree 1

PICUS test by: Paul Vezgoff

Test 1 Height at sensor one (1), north: 1500 millimetres

Tree Circumference: 4680mm at test height

Test 2 Height at sensor one (1), north:200mm

Tree Circumference: 6350mm at test height

Botanical Name: Blackbutt *(Eucalyptus pilularis)*

Location: 28 Malton Road, Beecroft

Date of test: 20/01/2023

Plate 1: *Tree 1,* 28 Malton Road, Beecroft. *P. Vezgoff.*

Summary

Tree 1, located on the southern side of Malton Rd, is a large mature Blackbutt *(Eucalyptus pilularis)* approximately thirty (30) metres in height with a 10-13 metre radius. It is growing on the grass road verge. It is possible that the original main leader has become damaged at some stage, leading to the four (4) current main stems growing at approximately three (3) metres from ground level. Test 1 has been undertaken at one thousand, five hundred (1500) millimetres, measured from ground level. Test 2 has been undertaken at two hundred (200) millimetres, measured from ground level. The tree is in good health, however the first order branch structure is not ideal in an urban environment. It is hard to determine if it has had any previous failures. The tree is generally free of dead wood over thirty (30)

millimetres in diameter. The tree has clearly ruptured a water pipe at the base of the tree, as evidenced by the water pooling on the north side of the tree.

Test 1 (higher test) was found to be structurally sound, with sound wood of 99% at the location of the test site (Plate 3). Test 2 (lower test) has a central area of damaged wood most likely relating to termite damage. (Plate 4). The results for test 2 are showing as 37% sound wood and 52% damaged wood.

Plate 2: *The blue line is the Test 1 location and Red line is the approximate location of the Test 2 on Tree 1. P. Vezgoff.*

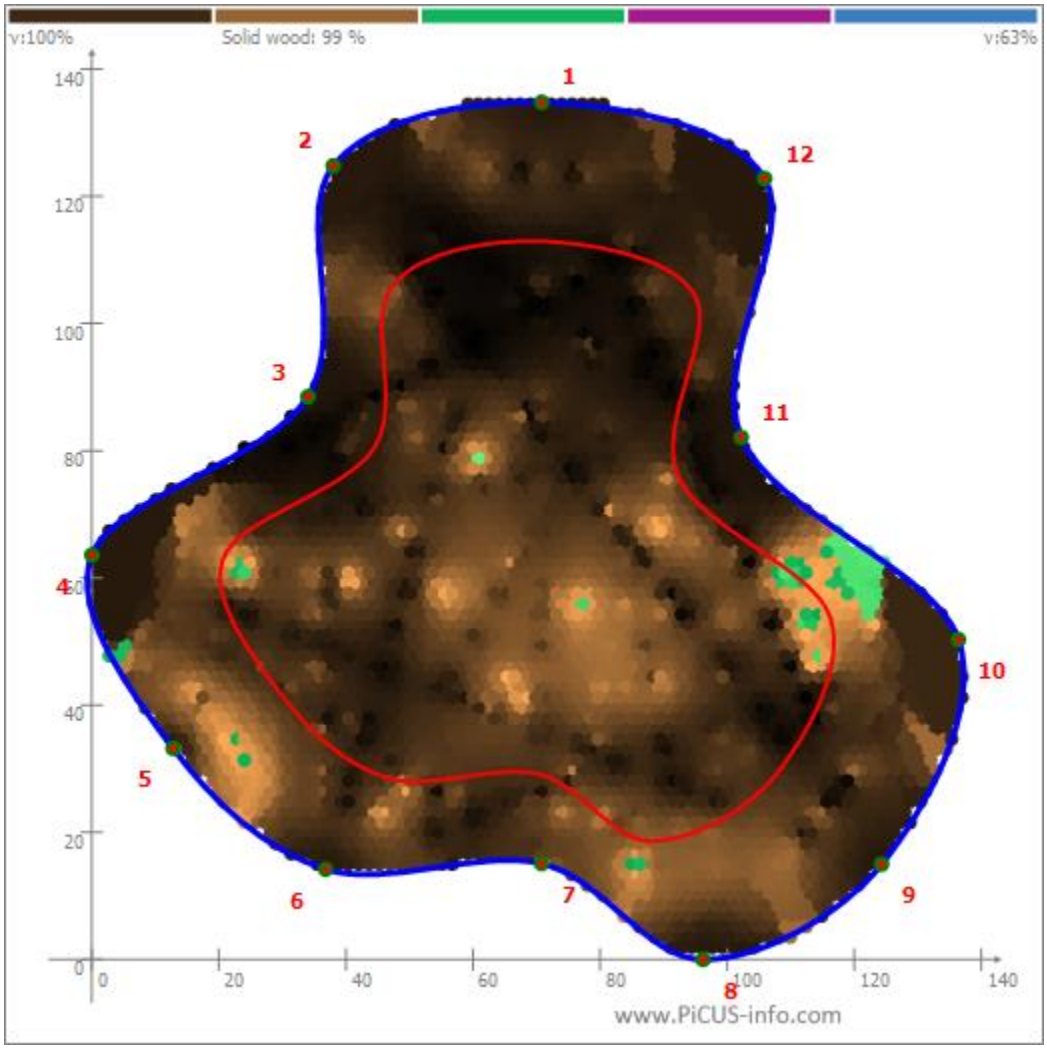


Plate 3: 2023 *Tomogram of the Test 1 location on Tree 1 at 1500mm from ground level. Sensor 1 is north. The red line is indicative of the 70/30 ratio taken as a radial measurement from the centre of the trunk to each sensor.*

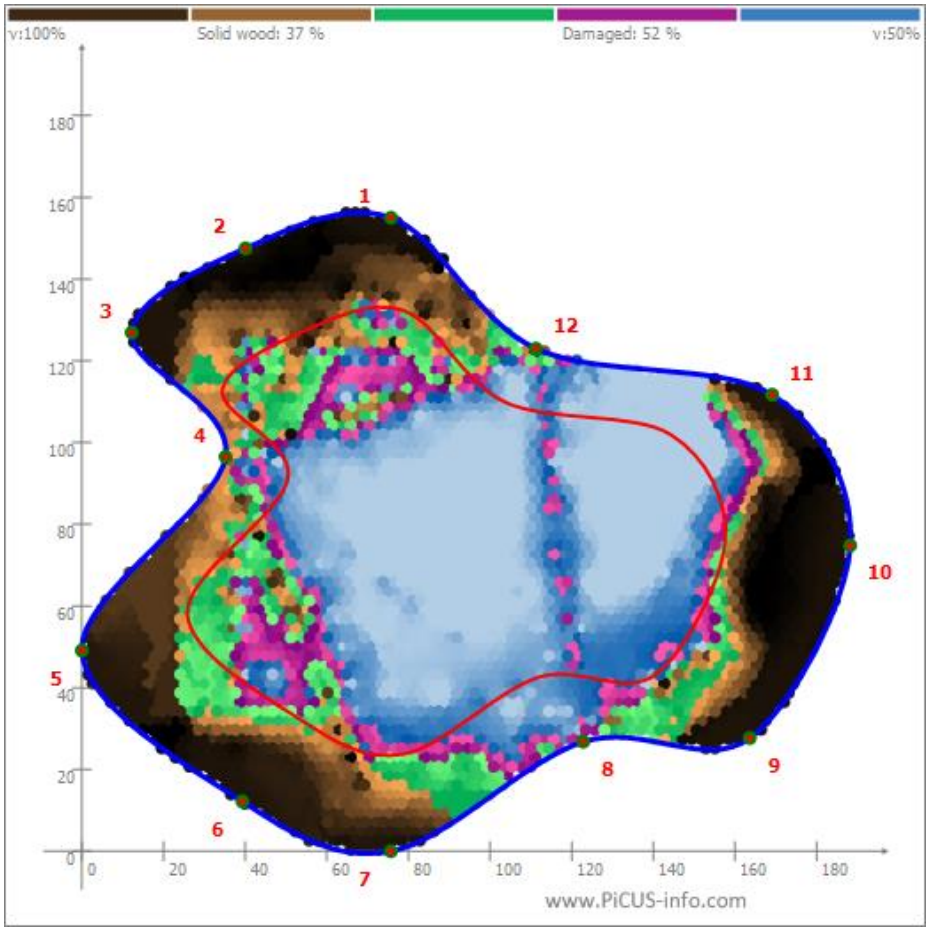


Plate 4: 2023 *Tomogram of the Test 2 location on Tree 1 taken at 200mm from ground level. Sensor 1 is north. The red line is indicative of the 70/30 ratio taken as a radial measurement from the centre of the trunk to each sensor.*

Tree 2

PICUS test by: Paul Vezgoff

Test Height at sensor one (1), north: 1400 millimetres

Tree Circumference: 5460mm at test height

Botanical Name: Blackbutt *(Eucalyptus pilularis)*

Location: 28 Malton Road, Beecroft

Date of test: 20/01/2023

Plate 5: *Tree 2*, 28 Malton Road, Beecroft. *P. Vezgoff.*

Summary

Tree 2 is a large mature Blackbutt in good health however the tree has been lopped at some stage and has developed several stems bifurcating from approximately 2.5 metres in height. There is a large wound in the basal area, most likely caused by mechanical means. There is decay apparent and the termite damage area could be probed quite extensively with a steel rod. The tree is approximately thirty (30) metres in height with a fourteen (14) metre spread, and a slight canopy bias to the north. However as seen in Plate 5, a large portion of the main lower stem also has a northerly bias.

The visual inspection revealed no obvious inclusions between the main stems. There is a lot of weight beginning to form in the first order limbs, particularly growing over the road, and should they fail, they will hit power lines in the street on the northern side of Malton Road.

One (1) ultrasound test has been conducted on this tree. Test 1 was conducted at one thousand, four hundred (1400) millimetres from ground level (Plate 7). The test was undertaken to assess the structural integrity of the main stem based on the visual evidence of what appears to be included bark.

The test results show that the tree has 17% sound wood at the test location and 78% is showing as damaged wood (Plate 7).

Results show that the tree has extensive cracking and splitting occurring within the main stem. There appears to be a slight separation of the stems between sensors 9-10 and also 7-8, and between 6-7 there is possibly some separation of the lateral first order branch occurring.

Plate 6: *Red line is the approximate location of the test on Tree 2. P. Vezgoff.*

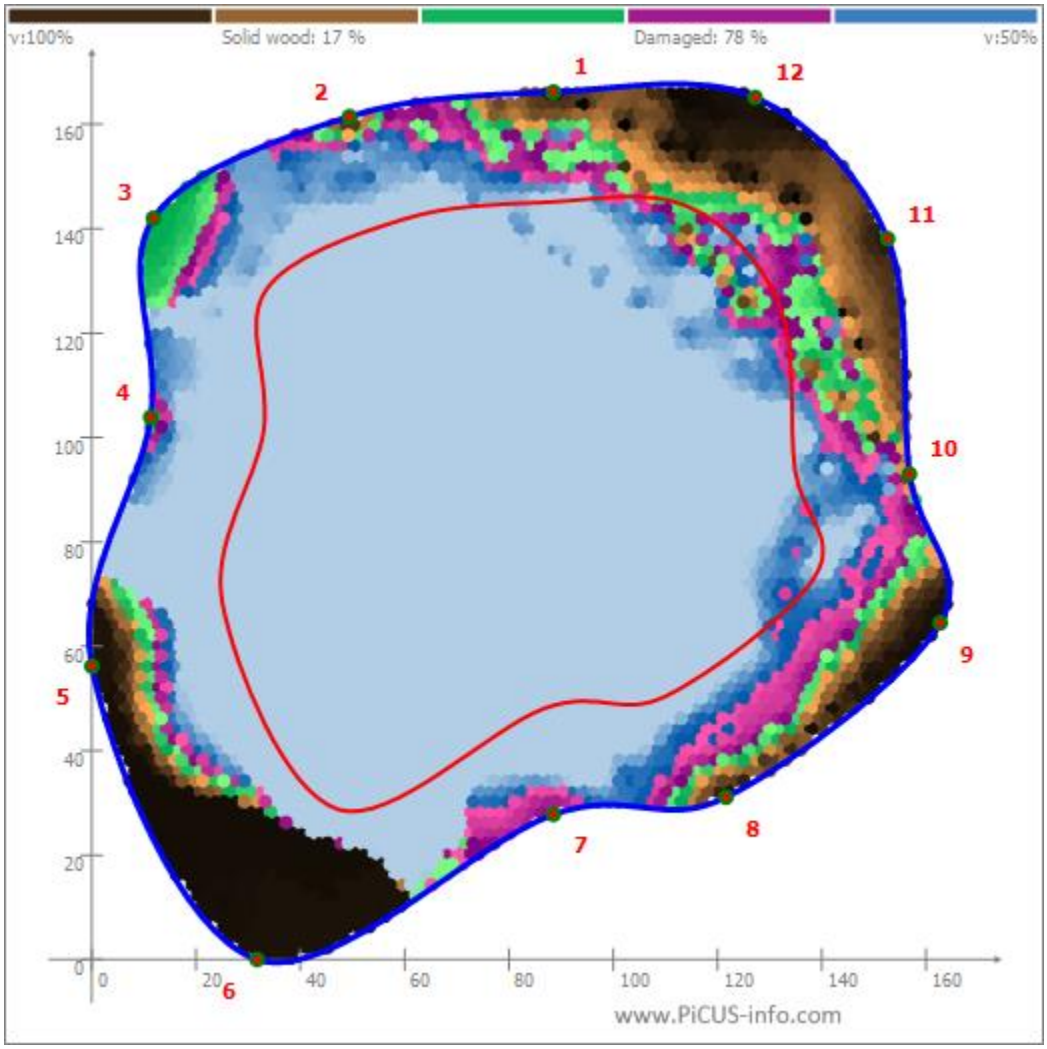


Plate 7: 2023 *Tomogram of the test location on Tree 2. Sensor 1 is north. The red line is indicative of the 70/30 ratio taken as a radial measurement from the centre of the trunk to each sensor. The tomogram shows that extensive cracking and splitting is occurring. Termite damage is also likely to be contributing to the areas of damaged wood.*

Tree 3

PICUS test by: Paul Vezgoff

Test Height at sensor one (1), north: 100mm

Tree Circumference: 4210mm at test height

Botanical Name: Blackbutt *(Eucalyptus pilularis)*

Location: 30 Malton Road, Beecroft

Date of test: 20/01/2023

Plate 8: *Trees 3 (red arrow) and 4,* 30 Malton Road, Beecroft. *P. Vezgoff.*

Summary

Trees 3 and 4 are mature Blackbutt trees located outside 30 Malton Road. These trees are both in good health and condition with reasonably dominant main stems and symmetrical canopies. They are approximately twenty (20) metres in height with fourteen (14) metre spreads. They are free of cracks, splits and fruiting bodies. Tree 4 is the better visual specimen of the two (2) trees. The footpath is in fair condition and some minor repairs have occurred.

One (1) ultrasound test has been conducted on Tree 3. Test 1 was conducted at one hundred (100) millimetres, measured from ground level (Plate 10). The test results show that the tree has 55% sound wood at the test location and 36% is showing as damaged wood (Plate 10).

Plate 9: *Red line is the approximate location of the test on Tree 3. P. Vezgoff.*

Plate 9: *Red line is the approximate location of the test on Tree 3. P. Vezgoff.*

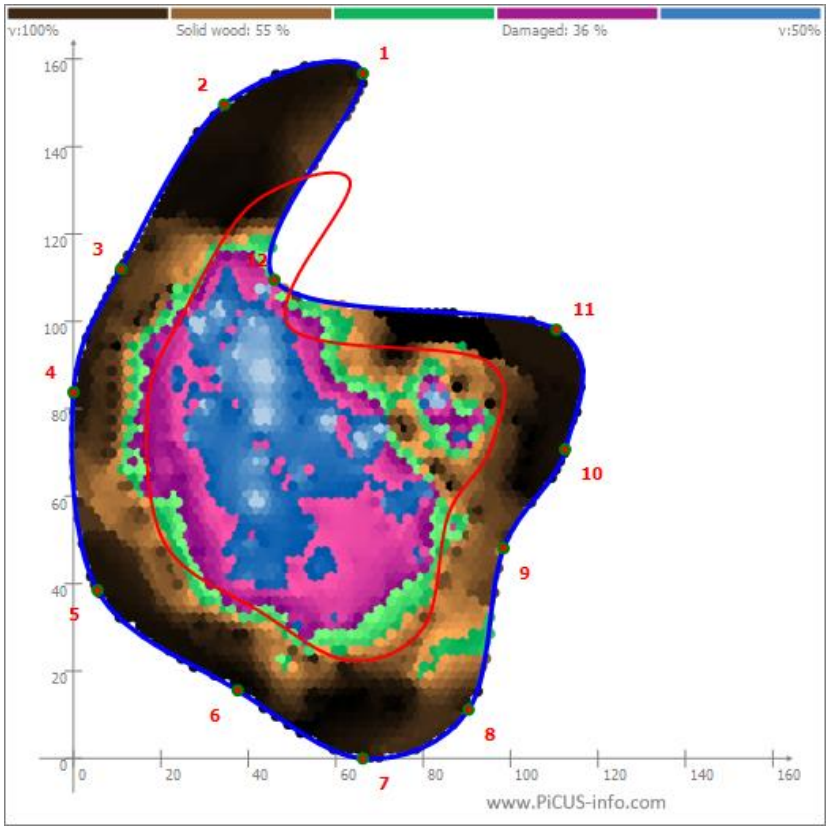


Plate 10: 2023 *Tomogram of the test location on Tree 3. Sensor 1 is north. The red line is indicative of the 70/30 ratio taken as a radial measurement from the centre of the trunk to each sensor. Due to the unusual geometry of the tree the red t/R line is not accurate near Sensor 12*

Tree 4

PICUS test by: Paul Vezgoff

Test Height at sensor one (1), north: 100mm

Tree Circumference: 4650mm at test height

Botanical Name: Blackbutt *(Eucalyptus pilularis)*

Location: 30 Malton Road, Beecroft

Date of test: 20/01/2023

Plate 11: *Tree 4,* 30 Malton Road, Beecroft. *P. Vezgoff.*

Summary

One (1) ultrasound test has been conducted on Tree 4. Test 1 was conducted at one hundred (100) millimetres, measured from ground level (Plate 12). The test was undertaken to assess the structural integrity of the base of the tree. A Telstra pit and hydrant are located below Tree 4. Also, what may be some trenching appears to have gone through the root zone of Tree 4, as evidenced by a new footpath slab that been replaced.

The test results show that Tree 4 has 98% sound wood at the test location (Plate 13).

Plate 12: *Red line is the approximate location of the test on Tree 4. P. Vezgoff.*

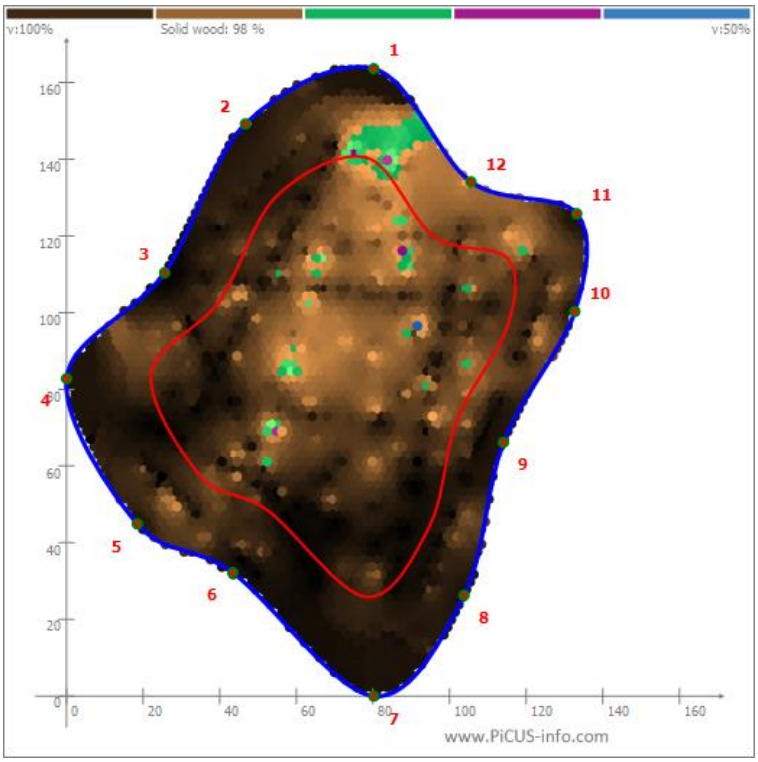


Plate 13: 2023 *Tomogram of the test location on Tree 4. Sensor 1 is north. The red line is indicative of the 70/30 ratio taken as a radial measurement from the centre of the trunk to each sensor.*

Tree 5

PICUS test by: Paul Vezgoff

Test Height at sensor one (1), north: 1300 millimetres

Tree Circumference: 5290mm at test height

Botanical Name: Blackbutt *(Eucalyptus pilularis)*

Location: 32 Malton Road, Beecroft

Date of current test: 20/01/2023

Plate 14: *Tree 5,* 32 Malton Road, Beecroft*, Blackbutt (Eucalyptus pilularis). P. Vezgoff.*

Summary

Tree 5 is a mature Blackbutt *(Eucalyptus pilularis)* growing on the road verge of 32 Malton Road (Plate 14). It is located thirteen (13) metres from a residential dwelling. It is twenty six (26) metres in height with a spread of thirteen (13) metres. The tree is in good health and has a reasonably symmetrical canopy. The canopy of this tree is interconnected with other trees (co dominant). There is no evidence of fruiting bodies or termite damage noted. It is difficult to determine, but it is quite likely that, the inclusion is gradually getting worse as evidenced by the "ears" growing either side of the inclusion and the tomogram would also suggest that the inclusion is certainly present mid-way up the stem before the point where the two (2) stems bifurcate.

One (1) ultrasound test has been conducted on this tree at the approximate location of the previous test (Plate 15), at 1300 millimetres from ground level (Plate 15). The test was undertaken to assess the structural integrity of the main stem based on the visual evidence of what appears to be included bark.

The test results show that the tree has 25% sound wood at the test location and 66% is showing as damaged wood (Plate 16).

Plate 15: *Red line is the approximate location of the test on Tree 5. P. Vezgoff.*

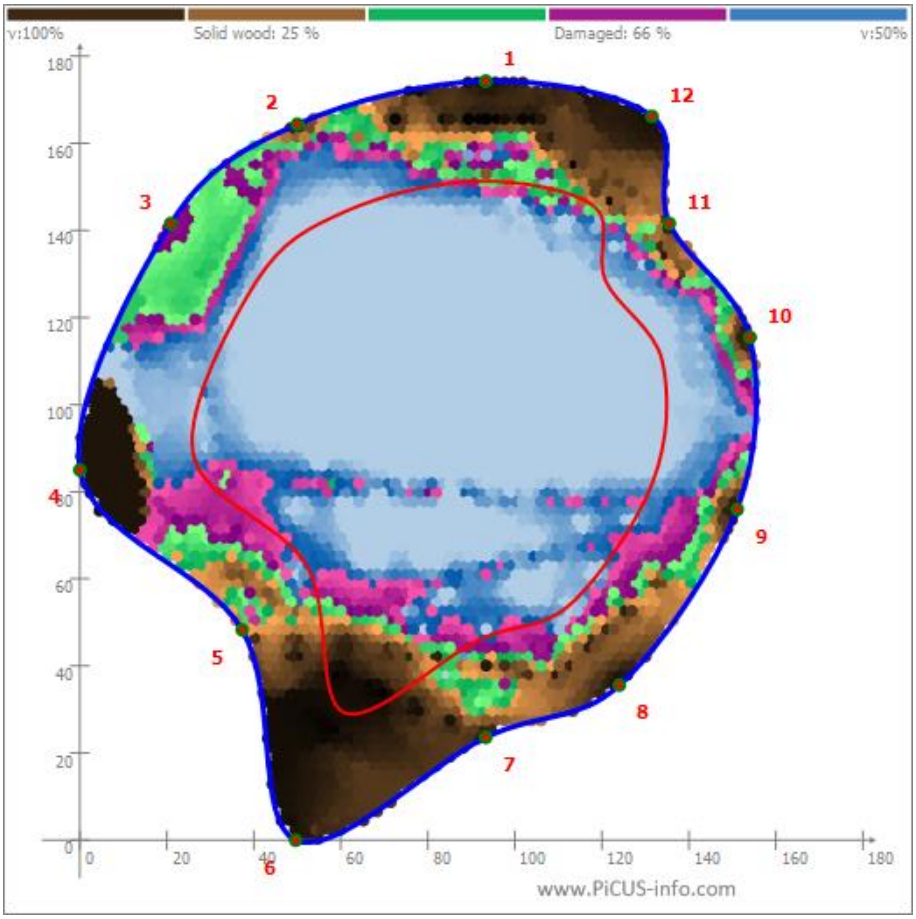


Plate 16: 2023 *Tomogram of the test location on Tree 5 Sensor 1 is north. The red line is indicative of the 70/30 ratio taken as a radial measurement from the centre of the trunk to each sensor. The tomogram shows that extensive cracking and splitting is occurring. Termite damage is also likely to be contributing to the areas of damaged wood.*

Conclusions

All trees tested are large mature *Eucalyptus* specimens. It is common for mature *Eucalyptus* trees to develop internal cavities either through decay or termite damage. Often termite damage in a tomogram may show as a series of patches rather than one large area of damaged wood. Although this damage may be present it does not automatically mean that the tree is dangerous. A summary of test results is detailed below in Table 2:

Tree No.	Test Height	2019 Test Results %		2023 Test Results %		Pass or fail t/R
		Sound Wood	Damaged Wood	Sound Wood	Damaged Wood	
1	1500mm	95%	N/A	99%	N/A	Pass
	200mm	42%	48%	37%	52%	Fail
2	1400mm	26%	66%	17%	78%	Fail
3	100mm	36%	54%	55%	36%	Pass
4	100mm	95%	N/A	98%	N/A	Pass
5	1300m	42%	43%	25%	66%	Fail

Table 2: Summary of test results.

Table 2 shows that since the 2019 tests, the internal quantities of damaged wood have slowly increased over the last four (4) years. Table 3 shows that the trees are all still slightly increasing in girth which would be new wood that would be classed as soundwood, however this does not appear to have decreased the quantities of damaged wood measured, with the exception of Tree 3 where a slightly different test height has skewed the results.

Tree No.	Test Height	2019 Circumference	2023 Circumference
1	1500mm	4370mm	4680mm
	200mm	6320mm	6350mm
2	1400mm	5350mm	5460mm
3	100mm	4150mm	4210mm
4	100mm	4360mm	4650mm
5	1300mm	4960mm	5290mm

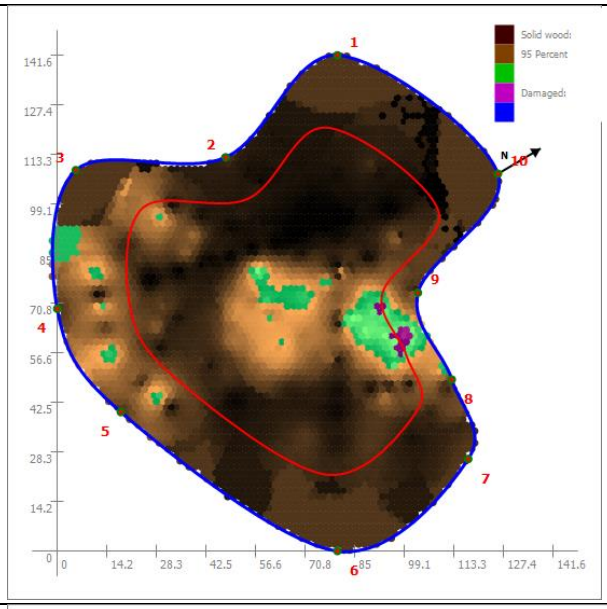
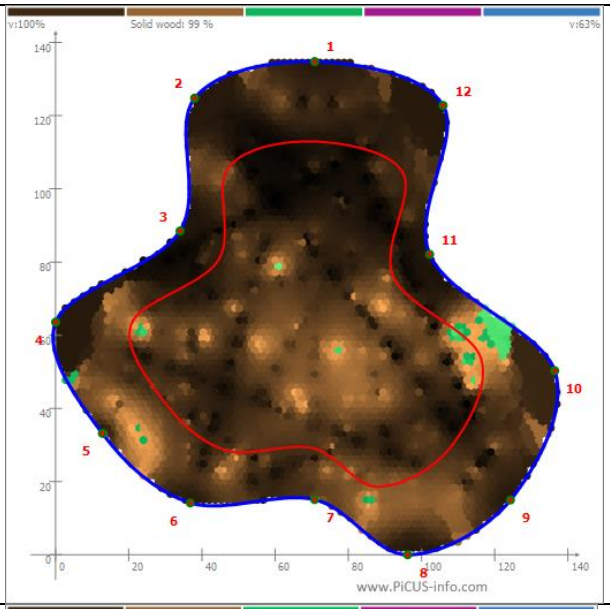
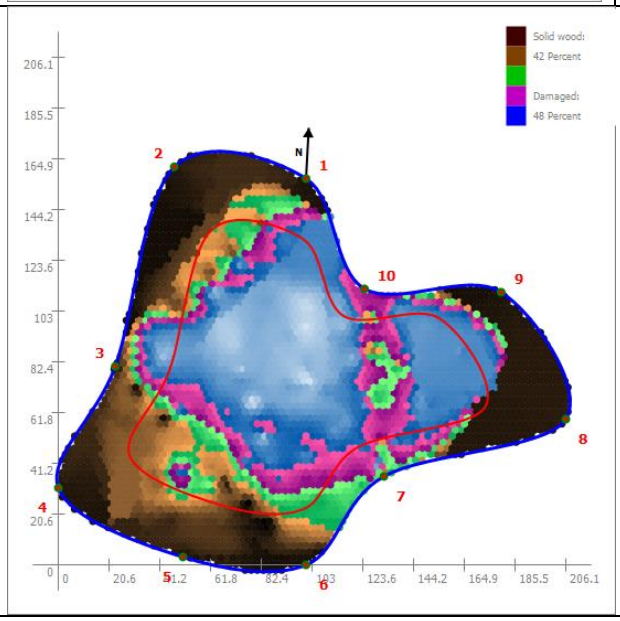
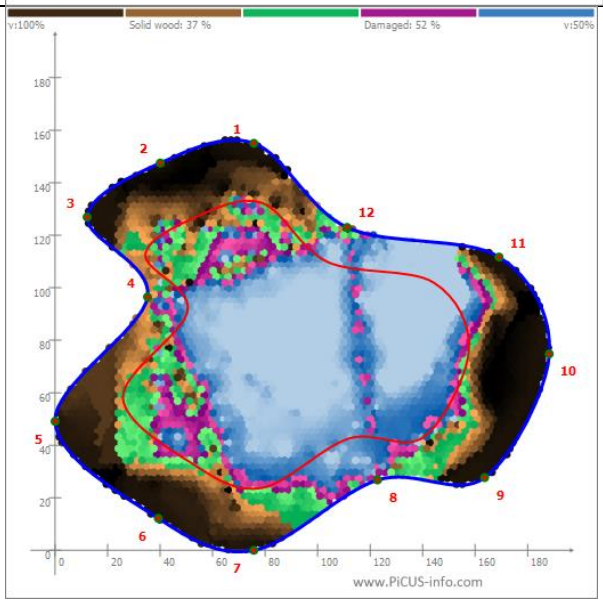
Table 3: Summary of girth increases at test height.

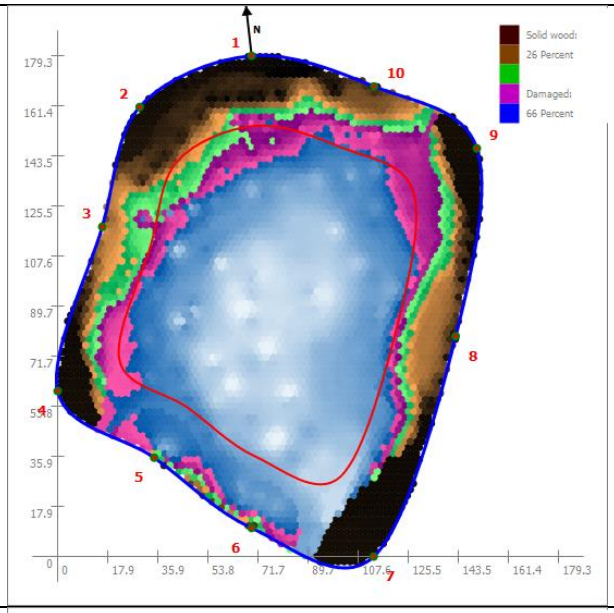
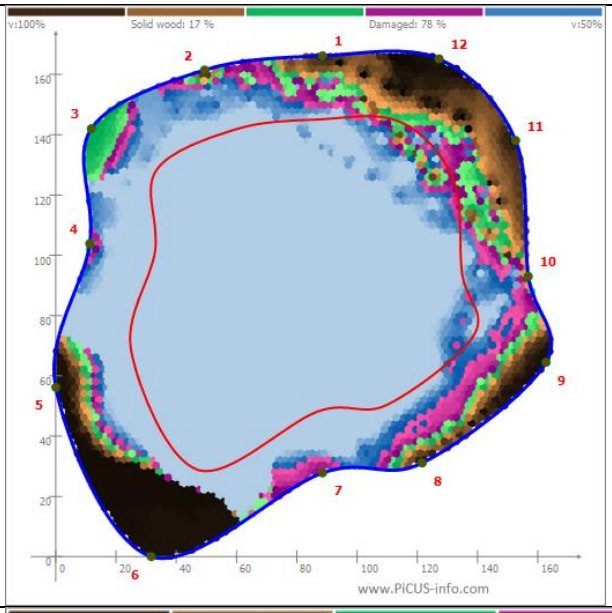
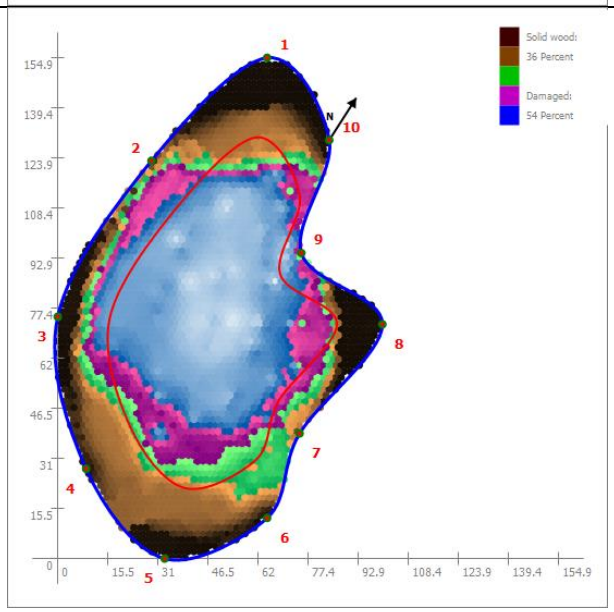
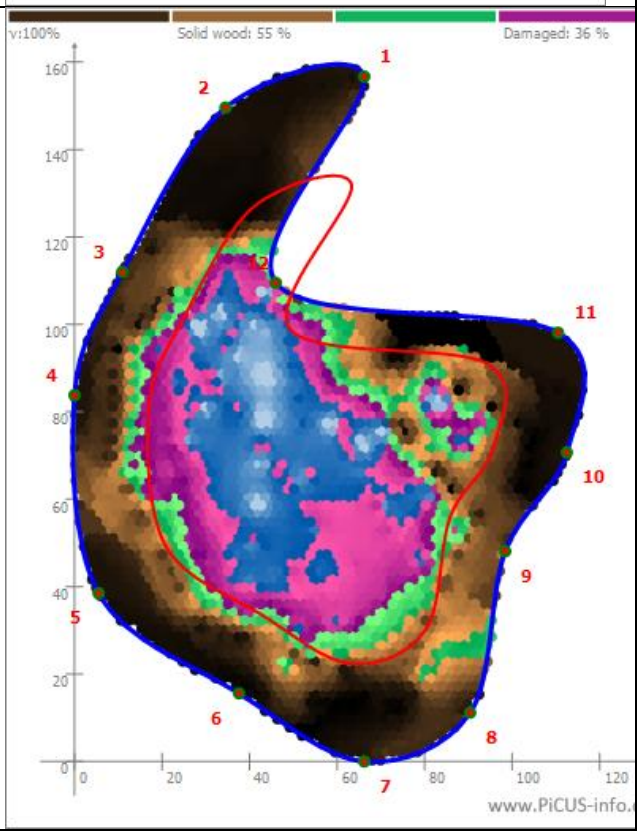
Based on the test results shown in Table 2, only Trees 3 and 4 are safe to retain however it should be noted Tree 3 is on the border line of the t/R calculation. Trees 1 and 2 have developed very poor branching structures from the lower main stem. This, in combination with the tall canopies, will be placing high tension and compression forces in the lower part of the tree. Should these areas fail, it would cause a significant portion of the tree mass to fail. Tree 5 is not imminently dangerous; however, it has clearly developed included bark between two (2) very large stems.

Table 4 shows a summary comparison of the tomograms from 2019 and 2023.

As detailed in the 2019 report my findings are the same, that being;
The subject trees are clearly large dominant trees in the surrounding area and do add to the visual amenity of Malton Road. Trees of this size and age in a forest environment may often have signs of previous branch failure. In a forest environment this would not be a problem where branches could fall freely to the ground unlikely to cause injury. In an urban environment the situation changes where the area below the tree does become a target area, as named by industry professionals. Some may argue that the house has been placed in the tree's environment however these trees have been planted as part of street scape planting at some stage, possibly around the 1930's. Having trees of this size and age around land zoned for residential living they in effect create pressures between environment, safety, and providing a space to live with small lots containing large forest trees, an unfortunate situation for tree and resident.

Unfortunately, I cannot state that Trees 1, 2 and 5 are safe to retain for the long term. Fencing off 'safe' areas is not an option due to the location of the trees and targets below them. These trees have individual structural issues that create separate problems for each tree. It should be considered to possibly remove Trees 1, 2 and 5 at once to allow for a managed replanting of the street.

Tree #	2019 Test	2023 Test
1		
1		

Tree #	2019 Test	2023 Test
2		
3		

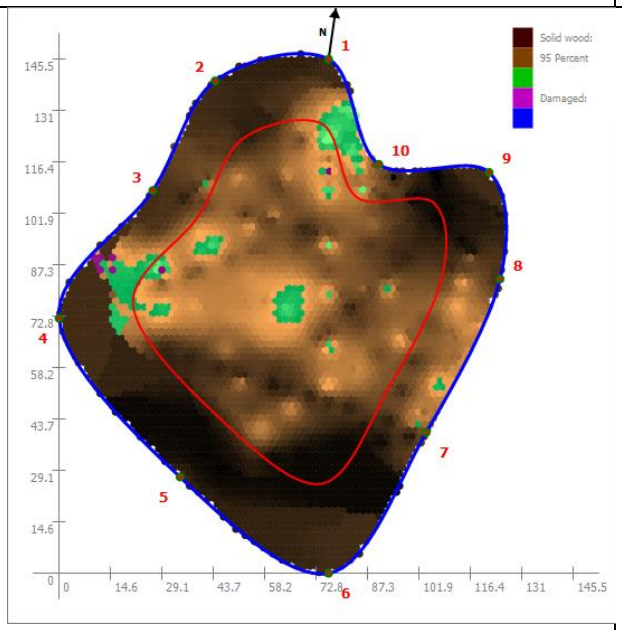
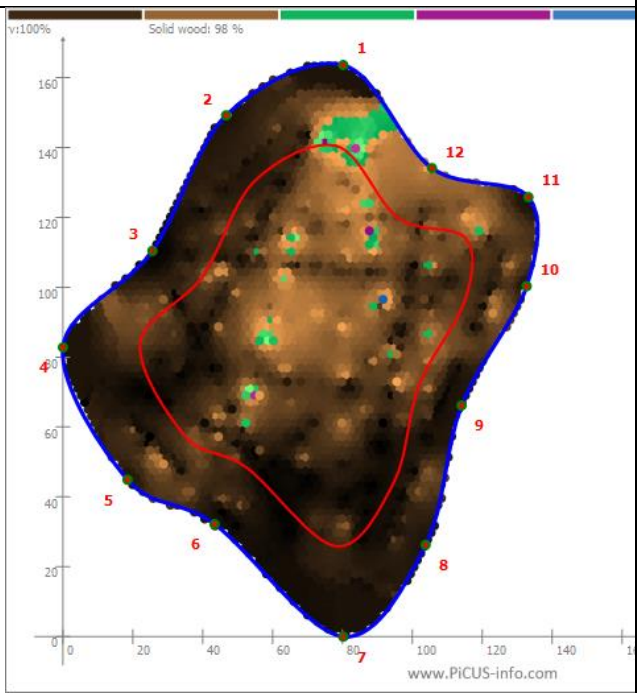
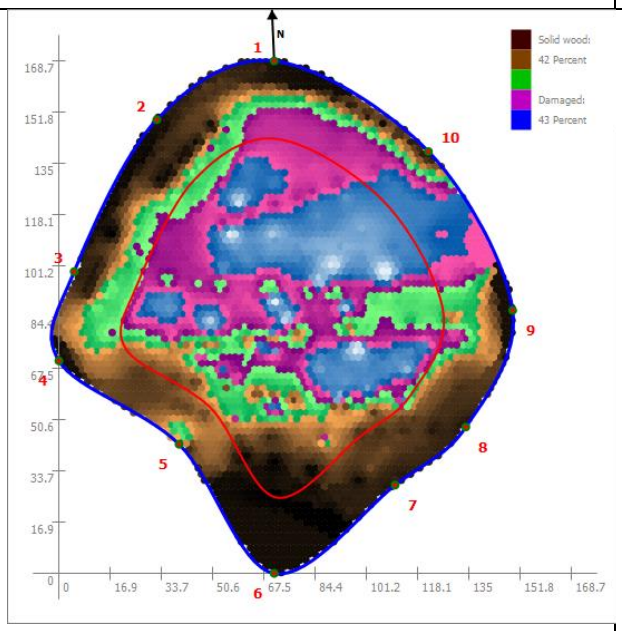
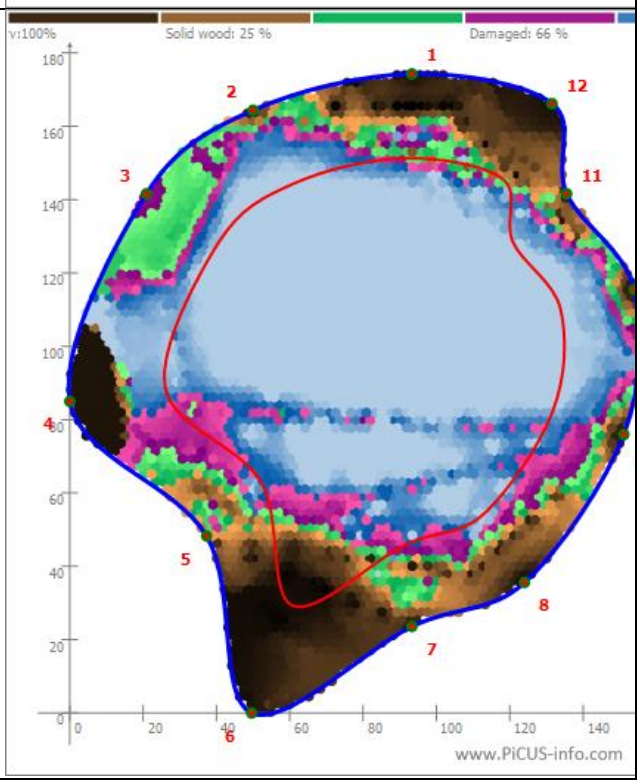
Tree #	2019 Test	2023 Test
4		
5		

Table 4: Summary tomograms 2019 / 2023.

5. Recommendations

Based on the tomogram and visual assessment of each test site, comparing the 2019 results with the 2023 results, I have made the following recommendations for each tree:

Tree 1: At this stage, the tree is not imminently dangerous however it is likely to continue to increase in size and girth. The combination of the poor first order branching structure and the damaged wood at the base of the tree do not allow for a long-term safe specimen. In 2019 weight reduction pruning was recommended and this appears to have been undertaken, however this is ultimately a short-term solution.

Tree 2: Tree 2 is not imminently dangerous however its removal should occur within the next twelve (12) months. It fails the t/R calculation and has a very asymmetrical weight distribution of the lower stem.

Tree 3: Tree 3 would appear to have a large central portion of damaged wood in the basal area. It is likely cracking and splitting is occurring. Potentially the tree is at the limit of t/R ratio threshold and not imminently dangerous however consideration to its removal should occur within the next five (5) years based on increases in damaged wood quantities.

Tree 4: Tree 4 is safe to retain.

Tree 5: Tree 5 is showing damaged wood in areas that would indicate that an inclusion is occurring between the two (2) stems. As recommended in 2015, provided weight reduction of 15% of the upper canopy occurs, this tree should be possible to retain for a further 5-15 years. It appears this weight reduction pruning was undertaken based on the presence of old pruning wounds. Ultimately this tree may have to be considered for removal due to its limited safe useful life expectancy.

This report is a structural report on the subject trees and not a risk based assessment on the potential impacts to surrounding infrastructure and pedestrians. Ultimately Council is the owner of these assets and Council needs to determine what level of risk they are willing to accept. Malton Road would not be considered a highly busy street. Passing traffic is infrequent, as are pedestrians. Most of the residential dwellings surrounding these trees are just outside the target area. Generally, the human targets below these trees will be mostly mobile throughout the day.

If you have any questions in relation to this report, please do not hesitate to contact me.

Yours sincerely,

Paul Vezgoff, Consulting Arborist
Dip Arb (Dist), Arb III, Hort cert, AA, ISA
9th February 2023

Glossary

Barrier zone	A chemically defended tissue formed by the still living cambium, after a tree is wounded or invaded by pathogens, to inhibit the spread of decay into new annual growth rings.
Branch attachment	The structural linkage between branch and stem.
Branch Collar	The area of raised tissue around a branch.
Cellulose	Complex carbohydrate found in the cellular walls of the majority of plants.
Decay	The process of degradation of woody tissues by fungi and bacteria through the decomposition of cellulose and lignin.
Epicormic shoot	A shoot that arises from latent or adventitious buds that occur on stems branches or the bases of trees
Flush cut	pruning cut through / or removing the branch collar, causing unnecessary injury to the trunk or parent stem.
Hazard	A hazard is anything with the potential to harm health, life or property. (WorkCover NSW 1996)
Infrastructure	Permanent manmade installations that could consist of footpaths, buildings, underground pipes or services.
Lean	Departure of trunk from the vertical or near vertical position.
Lignin	An organic substance that impregnates certain cell walls to thicken and strengthen the cell to reduce susceptibility to decay and pest damage.
Risk	Is the likelihood or probability that a hazard will cause damage to health, life or property. (WorkCover NSW 1996)
Target Area	The area below a tree, usually within the drip zone.
Vigor	Overall health; capacity to grow and resist physiological stress.
Visual Tree Assessment	(VTA) Where a qualified Arborist will complete a detailed assessment of the tree.
Windthrow	The forces of wind pushing a tree followed by upheaval of the root plate.

Extract from the International Society of Arboriculture -
Glossary of Arboricultural Terms 2005

Appendix 1
Explanatory Notes

- **Mathematical abbreviations:** > = Greater than; < = Less than.

- **Measurements/estimates:** All dimensions are estimates unless otherwise indicated. Measurements taken with a tape or clinometer are indicated with a '*'. Less reliable estimated dimensions are indicated with a '?'.

- **Species:** The species identification is based on visual observations and the common English name of what the tree appeared to be is listed first, with the botanical name after in brackets. In some instances, it may be difficult to quickly and accurately identify a particular tree without further detailed investigations. Where there is some doubt of the precise species of tree, it is indicated with a '?' after the name in order to avoid delay in the production of the report. The botanical name is followed by the abbreviation sp if only the genus is known. The species listed for groups and hedges represent the main component and there may be other minor species not listed.

- **Height:** Height is estimated to the nearest metre.

- **Spread:** The maximum crown spread is visually estimated to the nearest metre from the centre of the trunk to the tips of the live lateral branches.

- **Diameter:** These figures relate to 1.4m above ground level and are recorded in centimetres. If appropriate, diameter is measure with a diameter tape. 'M' indicates trees or shrubs with multiple stems.

- **Estimated Age:** Age is estimated from visual indicators and it should only be taken as a provisional guide. Age estimates often need to be modified based on further information such as historical records or local knowledge.

- **Distance to Structures:** This is estimated to the nearest metre and intended as an indication rather than a precise measurement.

Appendix 2
t/R v Area% explanation

Percentage of area calculation

The t/R ratio is based on many years of study of over 1200 tree failures of broad leaved and coniferous trees (Mattheck & Breloer, 2003). This ratio is based on a 70:30 rule. The study found that when most trees achieved a decay linear measurement of greater than 70% (i.e. less than 30% sound wood) the tree had a high likelihood of failure. This is shown on the Diagram A below with the blue area showing the 70% and the red area showing the 30% of the radial measurement.

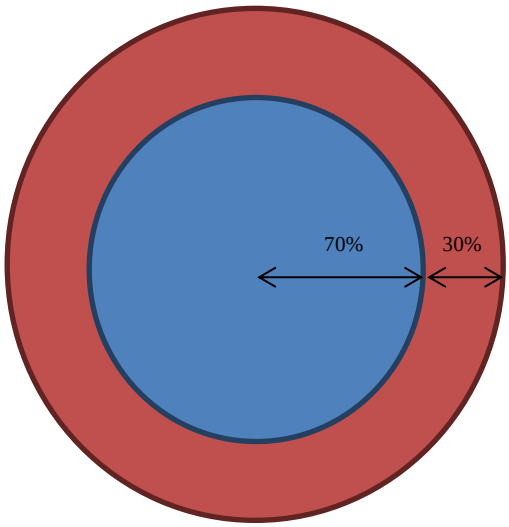
The percentage of sound wood that is shown in the colour coded tomogram image is not related to the t/R ratio. The red line in the tomogram is showing the 70/30 t/R ratio. The percentage of wood quantities in the top right corner of the tomogram are area calculations.

The following calculation can be applied to realize the percentage of the red area of the Diagram A, below.

$A = \pi r^2$ let complete radius = 10cm
Therefore let 70% of the radius=7cm
30% of the radius=3cm
Therefore $\pi\ x\ 10^2 - \pi\ x\ 7^2 =$ ` 30% of radius
$\pi\ x\ 10^2 - \pi x 7^2 = 3.141592654 - 153.93804$
=160.2212254
To find the percentage $= \frac{x}{y}$ x 100
Therefore percentage $= \frac{160.2212254}{314.1592654}\ x\ 100$
=50.99
=51%
Therefore the percentage of the red area is 51%.

Thus, if a tomogram reading is at 51% sound wood this will indicate that the sound wood quantity has reached the limit of 30% of the t/R ratio.

Diagram A



Appendix 3
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EDUCATION and QUALIFICATIONS

- 2007 – Diploma of Arboriculture (AQF Cert V) Ryde TAFE. (Distinction)
- 1997 – Completed Certificate in Crane and Plant Electrical Safety
- 1996 – Attained Tree Surgeon Certificate (AQF Cert II) at Ryde TAFE
- 1990 – Completed two month intensive course on garden design at the Inchbald School of Design, London, United Kingdom
- 1990 – Completed patio, window box and balcony garden design course at Brighton College of Technology, United Kingdom
- 1989 – Awarded the Big Brother Movement Award for Horticulture (a grant by Lady Peggy Pagan to enable horticulture training in the United Kingdom)
- 1989 – Attained Certificate of Horticulture (AQF Cert IV) at Wollongong TAFE

INDUSTRY EXPERIENCE

Moore Trees Arboricultural Services **January 2006 to date**
Tree Consultancy and tree ultrasound. Tree hazard and risk assessment, Arborist development application reports
Tree management plans.

Woollahra Municipal Council **Oct 1995 to February 2008**
ARBORICULTURE TECHNICAL OFFICER
August 2005 – February 2008
Tree asset management, programmed inspection, inventory and condition surveys of council trees, hazard and risk appraisal, Tree root damage investigation and reporting, assessment of impacts of capital works projects on council trees.
ACTING COORDINATOR OF TREES MAINTENANCE
June – July 2005, 2006
Responsible for all duties concerning park and street trees. Prioritising work duties, delegation of work and staff supervision.
TEAM LEADER
January 2003 – June 2005
TEAM LEADER
September 2000 – January 2003
HORTICULTURALIST
October 1995 – September 2000

Northern Landscape Services **July to Oct 1995**
Tradesman for Landscape Construction business

Paul Vezgoff Garden Maintenance (London, UK) **Sept 1991 to April 1995**

CONFERENCES AND WORKSHOPS ATTENDED

- TRAQ Conference, (2013/2018)
- International Society of Arboriculture Conference (Brisbane 2008)
- Tree related hazards: recognition and assessment by Dr David Londsdale (Brisbane 2008)
- Tree risk management: requirements for a defensible system by Dr David Londsdale (Brisbane 2008)
- Tree dynamics and wind forces by Ken James (Brisbane 2008)
- Wood decay and fungal strategies by Dr F.W.M.R. Schwarze (Brisbane 2008)
- Tree Disputes in the Land & Environment Court – The Law Society (Sydney 2007)
- Barrell Tree Care Workshop- Trees on construction sites (Sydney 2005).
- Tree Logic Seminar- Urban tree risk management (Sydney 2005)
- Tree Pathology and Wood Decay Seminar presented by Dr F.W.M.R. Schwarze (Sydney 2004)
- Inaugural National Arborist Association of Australia (NAAA) tree management workshop- Assessing hazardous trees and their Safe Useful Life Expectancy (SULE) (Sydney 1997).