ARBORICULTURAL REPORT

Quantified Tree Risk Assessment

PREPARED FOR: Watson Young Architects Pty. Ltd.

Subject Site: Sacred Heart & St Johns Campus
204 Churchill Avenue, Braybrook, VIC 3019
09-06-2023

Prepared by:

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9th June 2023

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Re: Quantified Tree Risk Assessment (QTRA) of subject limb on Tree 15 over the main entrance foot path.

Hi Jack,

Following you request, a risk assessment of the defective limb on Tree 15 was conducted on 9th June 2023. This risk assessment was conducted using Quantified Tree Risk Assessment Version 5.

Figure 1. Tree 15 (Maribyrnong's Significant Tree Register Asset ID # 63)

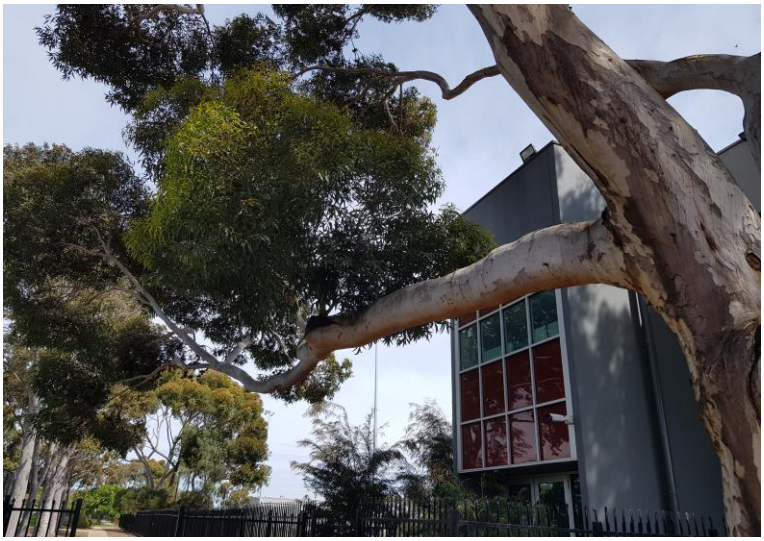

Figure 2. Subject limb in question

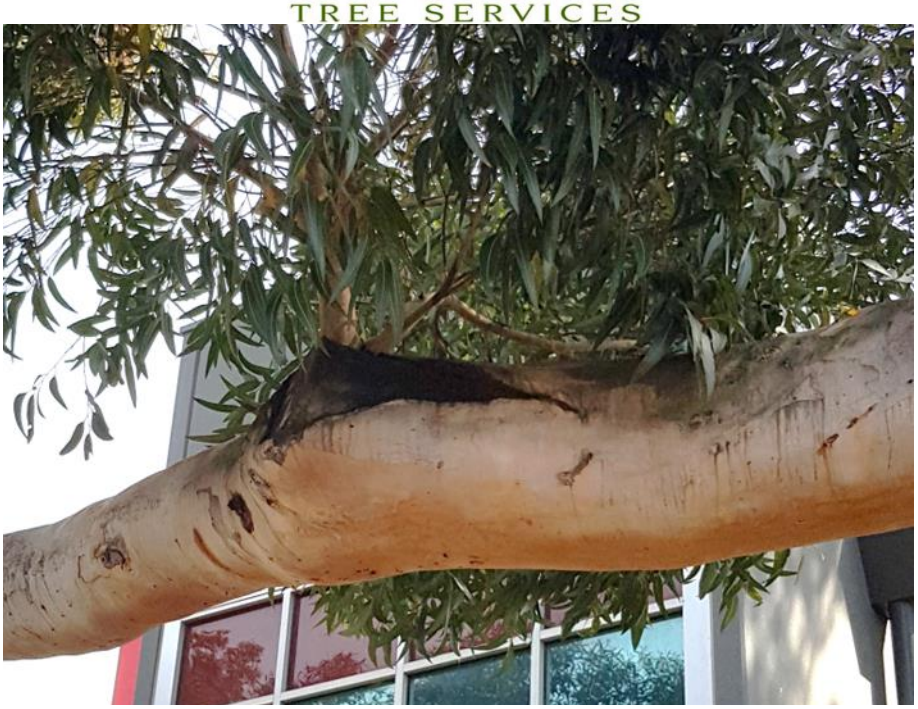

Figure 3. Damage midway along the subject limb.

QTRA Overview

A risk assessment using Quantified Tree Risk Assessment, Version 5 (2015) has been conducted on the assessed trees. The risk assessment method has the following components:

- Probability of failure (PF) - The probability of failure rating is attributed to the tree part that is most likely to fail under normal conditions within the next 12 months.
- Size of part likely to fail (FS) - The failure size rating is attributed to the branch or trunk that is most likely to fail and cause the most damage under normal conditions over the next 12 months.
- Target occupancy (TO) - The target occupancy is attributed to the object that is most likely to be hit / injured / damaged in the event of failure.

The QTRA Risk Score methodology is probabilistic and the lower the value the higher the risk. The risk score is presented as a numeric value however it is properly expressed as a fraction e.g. Risk Score = 1,440 indicates that the predicted event has a 1/1,440 chance of occurrence. 1/1 indicates that an event is certain to occur and 1/10,000,000 indicates that it is extraordinarily unlikely.

QTRA Version 5 uses Monte Carlo simulations to arrive at a mean value for the risk score values. In short, Monte Carlo simulations mean QTRA calculators work out the 'most likely' Risk of Harm from 10,000 possible outcomes for each combination of PF, FS and TO Range.

An accepted threshold of risk is generally in the order of 1/10,000 and any tree that scores less than 10,000 would be expected to be remedied within the next twelve months. QTRA has proposed advisory risk thresholds as a reasonable approach to balancing safety from falling trees with the costs of risk reduction, these thresholds are shown in Table 1. In addition to these thresholds however, it is also noted that tree managers should make decisions based on their own situation, values and resources.

Table 1. QTRA advisory risk thresholds

Threshold	Description	Action
	Unacceptable Risks will not ordinarily be tolerated	• Control the risk
1/1000		
	Unacceptable (where imposed on others) Risks will not ordinarily be tolerated	• Control the risk • Review the risk
	Tolerable (by agreement) Risks may be tolerated if those exposed to the risk accept it, or the tree has exceptional value.	• Control the risk unless there is broad stakeholder agreement to tolerate it, or the tree has exceptional value • Review the risk
1/10,000		
	Tolerable (where imposed on others) Risks are tolerable if as low as reasonably practicable (ALARP)	• Assess costs and benefits of risk control • Control the risk only where a significant benefit might be achieved at reasonable cost • Review the risk
1/1, 000,000		
	Broadly Acceptable Risk is already ALARP	• No action currently required • Review the risk

The QTRA method does not provide predictions of what will or will not happen but an estimate of the risk from any particular tree hazard. The purpose of QTRA is not necessarily to provide high degrees of accuracy, but rather to provide for the quantification of risks and to assist in the prioritisation of tree works within a group of trees. The quantification of risk is not the only consideration when managing tree safety. The financial cost of reducing the risk and the potential loss of the many benefits from trees should be accounted for when making risk management decisions. By quantifying the risks, we can more readily assess this balance.

Target Presence (Occupancy)

The target presence is attributed to the object that is most likely to be hit / injured / damaged in the event of failure.

For example: If a tree is overhanging a road it is unlikely that the road will become damaged in the event of tree failure, passing vehicles are more likely to be affected.

Therefore, the target range would be attributed according to the volume and frequency of vehicles on that road as shown in Table 2.

Table 2: QTRA Target Ranges

Target Range	Property (repair or replacement cost)	Pedestrian frequency	Vehicular frequency (number per day)	Probability Ratio
1	>$240,000	Occupation: Constant - 2.5 hours/day Pedestrians & cyclists: 720/hour - 73/hour	28,000 – 2,900 vehicles @ 100km/h 32,000 – 3,300 vehicles @ 80km/h 42,000 – 4,300 vehicles @ 60km/h 47,000 – 4,800 vehicles @ 50km/h	1/1 - >1/10
2	>$24,000 - $240,000	Occupation: 2.4 hours/day - 15 min/day Pedestrians & cyclists: 72/hour - 8/hour	2,800 - 290 vehicles @ 100km/h 3,200 - 330 vehicles @ 80km/h 4,200 - 430 vehicles @ 60km/h 4,700 - 480 vehicles @ 50km/h	1/10 - >1/100
3	>$2,400 - $24,000	Occupation: 14 min/day - 2 min/day Pedestrians & cyclists: 7/hour - 2/hour	280 - 29 vehicles @ 100km/h 320 - 33 vehicles @ 80km/h 420 - 43 vehicles @ 60km/h 470 - 48 vehicles @ 50km/h	1/100 - >1/1,000
4	>$240 - $2,400	Occupation: 1 min/day - 2 min/week Pedestrians & cyclists: 1/hour - 3/day	28 - 4 vehicles @ 100km/h 32 - 4 vehicles @ 80km/h 42 - 5 vehicles @ 60km/h 47 - 6 vehicles @ 50km/h	1/1,000 - >1/10,000
5	>$24 - $240	Occupation: 1 min/week - 1 min/month Pedestrians & cyclists: 2/day - 2/week	3 - 1 vehicles @ 100km/h 3 - 1 vehicles @ 80km/h 4 - 1 vehicles @ 60km/h 5 - 1 vehicles @ 50km/h	1/10,000 - >1/100,000
6	≤$24	Occupation: <1 min/month - 0.5 min/year Pedestrians & cyclists: 1/week - 6/year	None	1/100,000 - 1/1,000,000

Where a tree exists over several layers of human traffic frequency it is important to consider the probable failure that is likely to occur from the tree in question in determining the appropriate occupation statistic to identify a target range.

For example a tree may exist within an open park zone for which the human traffic may be in target range 4 (>3 pedestrians per day but <1/hour) attracting a relatively low probability ratio, however, it may also be adjacent to an arterial path with associated human traffic for categorisation in target range 2 (8-72 pedestrians/hour).

If the likely failure from the tree is away from the path then a target range of 4 would be appropriate. However if the likely failure is toward the path then the appropriate target range would be 2.

If the likely failure is of dead wood which is evenly distributed throughout the canopy then the higher range would be used.

If there are several possible types of failure with different failure sizes over different zones of human occupation around a tree then each should be assessed and the values that will produce the highest risk score should be used. If there is no obvious potential for failure then the higher human occupation range should be used.

Probability of failure

The probability of failure rating is attributed to the tree part that is most likely to fail under normal conditions within the next twelve months.

Probability of failure is very closely related to the structure of the tree. If a tree has good structure it should generally not be attributed a relatively high probability of failure range value for significant tree parts. However if the part most likely to fail is dead wood then it may be appropriate for the probability of failure range value to be relatively high.

Failure potential is attributed to the tree *prior to any recommended works being completed*. Following the completion of works, the probability of failure requires reassessing to ensure that the probability range is updated.

Table 3: QTRA Probability of Failure Ranges

Probability of Failure Range	Probability of Failure Ratio	Probability of Failure Percentage	Description
1 (Severe)	1/1 - >1/10	>10% - 100%	The structure of the specimen has large and very significant faults and defects. Active failure is often present and branch or trunk failure is imminent. Failure within the next twelve months would appear certain. The probability of failure over the next twelve months is 10 - 100%.
2 (High)	1/10 - >1/100	>1% - 10%	The structure of the specimen has large and significant faults and defects. Branch or trunk failure within the next twelve months would appear likely. The probability of failure over the next twelve months is 1 - 10%.
3 (Moderate)	1/100 - >1/1,000	>0.1% - 1%	The structure of the specimen has significant faults and defects. Branch or trunk failure within the next twelve months would appear possible. The probability of failure over the next twelve months is 0.1 - 1%.
4 (Low)	1/1,000 - >1/10,000	>0.01% - 0.1%	The structure of the specimen has some faults that may result in failure but failure is unlikely. The probability of failure over the next twelve months is 0.01 to 0.1%.
5 (Very Low)	1/10,000 - >1/100,000	>0.001% - 0.01%	The structure of the specimen has some minor faults that may result in failure but failure is very unlikely. The probability of failure over the next twelve months is less than 0.01%.
6 (Negligible)	1/100,000 - >1/1,000,000	>0.0001% - 0.001%	The probability of failure is highly unlikely, between 0.01 to 0.001%.
7 (None)	1/1,000,000 - - >1/10,000,000	>0.00001% - 0.0001%	The probability of failure can be considered none, less than 0.0001%.

Tree 15 – Risk Assessment (Maribyrnong's Significant Tree Register Asset ID # 63)

Failure Size

The majority of the trees canopy appears to be structurally sound i.e. There are no major and identifiable structural faults within the trees canopy apart from the western limb, the failure of the western limb over the pavement is considered to be the most likely part of the tree to cause the most damage under normal conditions over the next twelve months. This puts the limb of Tree 15 in a size range with the diameter of the limb / branch being between 110mm – 250mm diameter.

Probability of failure

The probability of failure for the western limb has been placed in range 2. This limb has had a section of the first order limb removed that was located on the upper side or tension side of this limb. The wound wood development and growth has not satisfactorily compartmentalised this exposed pruning cut / wound. There also appears to be varying levels of decay present within this wound. The tree has also produced several epicormic sprouts / regrowth to compensate this wound exposure. Limb failure over the next twelve months appears likely due to the over extension growth of this limb the trunk wound within the upper section and midway along the limb. The probability of failure over the next twelve months is 1 – 10%

Target Occupancy

Given the current conditions around the tree, the target presence has been assigned to range 2. That is to say that on average the target zone would be occupied by people / students between 2.4 hours / day – 15 mins / day. This take into consideration the main entrance, foot path location and the amount of student that walk beneath this limb.

Outcome

Based on current conditions the QTRA risk score for Tree 15 is 1/5000 which places the risk of harm below QTRA's advisory threshold of 1/1000 for 'Unacceptable' risk (where imposed on others).

Management actions to control the risk is either reduce the limb to the epicormic regrowth midway along the limb or to remove the limb all together back to the tree's trunk.

Consulting Arborist:

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