ARBORICULTURAL REPORT

TREE INSPECTION, RISK ASSESMENT & IMPACT ASSESSMENT

SUBJECT TREE CIRCA 1915

SITE ADDRESS: 109 PALMERSTON ST / ROBERTSON PARK, PERTH, WA.

CLIENT: STARLIGHT PROPERTY GROUP

PREPARED BY: Alex Corke, Independent Consulting Arborist.

REPORT DATE: 01.11.2020

branch arboriculture

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CONTENTS:

1.0 Brief:

1.1 Branch Arboriculture has been engaged to inspect and assess a mature Moreton Bay Fig, *Ficus macrophylla* (subject tree) situated within the grounds of Robertson Park, adjacent to 109 Palmerston St, Perth, (subject property) and prepare an Arboricultural Report to establish the subject trees' current health and structural condition, and an Impact Assessment outlining the potential impact that the proposed subdivision and development may have on the subject tree's future health and structural condition.

1.2 The initial request for this report comes as a requirement from WAPC Planning Department prior to subdivision approval, to support the application, and has expressed concerns that:

> **'the proposal has not demonstrated that site works associated with carrying out the subdivision of the site will not have an adverse effect on the fig tree to the north and as such have requested that an Arboriculture Report is provided which considers the tree to determine its tree protection zone and demonstrate how the proposed subdivision is to mitigate impacts to the tree.'**

1.3 The findings from this Arboricultural Report and Impact Assessment may have some bearing on demolition and construction methods, and potentially the overall design and structure of the proposed development, particularly in a case such as this, where the subject tree may be adversely affected by site demolition and construction activities. The subject tree in this case also has a root system that has the potential to cause structural damage to the finished development.

1.4 Should the Impact Assessment find that the subject tree may be adversely impacted by proposed works, an Arboricultural Method Statement and Tree Protection Plan should be prepared to support the application in conjunction with an amended design proposal.

2.0 General Observations:

2.1 Alex Corke, independent consulting arborist from Branch Arboriculture, undertook the onsite arboricultural inspection of the subject tree from the ground on the 30th of October, 2020 during fine, hot, and clear weather conditions.

2.2 The subject tree is one of three Moreton Bay Figs forming a single extended co-dominant crown on the southeast area of Robertson park, with an elevated concrete walkway bridging over the exposed structural root crown of the two southernmost trees. Ground Ivy covers the tree growth zone to the east, with tennis courts to the west. To the south within the dripline of the subject tree is the subject property – a period brick and tile dwelling, currently vacant and in poor repair.

2.3 Substantial reduction pruning, to a height of approximately 20 m has been carried out to the south, reducing the overhanging canopy extension over the subject property, recently undertaken by Professional Tree Services, under the instruction of the City of Vincent, and at the request of the owner of the subject property.

2.4 The subject tree, as part of a group of three mature trees, adds significant amenity value to the park and its surrounding neighbourhood, providing visual, aesthetic, botanic, scientific, ecological benefits, and a commemorative and cultural a link to the colonial history of the site. The size and form of this species is suited to open parkland situations (although it is not their natural habitat) and should be protected at all reasonable cost. (See p.10 for Helliwell tree valuation below)

2.5 The QTRA risk assessment part of this report has been undertaken as a 'duty of care', and assesses the level of risk the subject tree represents to people and to property compared against the likelihood of part or whole tree failure.

2.6 Trees confer many benefits to the community and development sites:

- Providing visual amenity, softening or complementing the effect of the built environment, and adding maturity to new developments.

- Displaying seasonal change and providing opportunities for wildlife in built-up areas.

- Making places more comfortable in tangible ways by contributing screening and shade, reducing wind speed and turbulence, intercepting precipitation, and reducing glare.

- Trees are also important elements of green infrastructure, contributing to urban cooling through evapo-transpiration and providing micro-climatic effects that can reduce energy demands in buildings.

They therefore represent a key resource that can significantly contribute to climate change adaptation and as such existing trees are an important factor on construction sites, whether on or near the working areas, and trees should be a material consideration in the planning stages of any new development.

3.0 Plan of Site Showing Subject Tree and Property Boundary Locations:

4.0. History, Heritage & Background:

4.1 As noted above (2.1) The subject tree is the southernmost of a group of three Moreton Bay Figs, allegedly planted in the grounds of Ormiston house in 1882 by engineer, MP, and Mayor of Perth, Edward Keane (1844 – 1904). (Ormiston house has been subsequently demolished, but a limestone wall in the park grounds now traces the outline of the original building close to the subject tree.) In archived photographs, these three trees can be seen to be well developed and close to a mature size by the early 20th century, and form part of the historical tapestry of the site in the colonial era. The site upon which the trees grow, as a pre-colonial wetland, also has substantial archaeological significance - although the species, being non-endemic, may have less cultural significance to the local indigenous Noongar People.

4.2 The subject tree, nearby trees, and adjoining park area, have various heritage listings:

- 'Trees of Significance Inventory', City of Vincent
- 'Municipal Inventory' - City of Vincent
- 'Heritage List State Heritage Register' - Robertson Park and Archaeological Sites Place No. 08705
- 'National Trust WA Significant Tree' registered.

4.3 Discussion with the City of Vincent Parks Services Coordinator suggest that there is no 'Tree Preservation Order' in conjunction with any of these heritage listings with regards to the subject tree, however the City's website states that:

"CONSERVATION OF TREES The removal, destruction of and/or interference with any tree(s) listed on the Town of Vincent Trees of Significance Inventory contravenes this Scheme unless planning approval has first been obtained from the Council."

4.3 Image of subject tree Circa 1915 (Ormiston house at front):

5.0 Tree Inspection and Assessment Methodology:

5.1 The health and structural characteristics of the Subject tree were assessed using contemporary arboricultural principles and practices, and for the purposes of this report, a basic VTA (Visual Tree Assessment) to assess tree health and identify potential anatomical defects was undertaken and the QTRA (Quantative Tree Risk Assessment) system was used to determine the Risk of Harm, by establishing targets / occupancy rates and comparing the findings with a probability of failure. (For list of inspection criteria used for VTA see appendix (ii) p.18, and VTA /QTRA see explanatory notes in appendices (iii) p.19)

5.2 The subject tree was inspected from ground level, with binoculars to observe upper crown structure where necessary. Where subject tree stem required further investigation, 'sounding' was carried out with a nylon hammer to assess the acoustic nature of the heartwood. This can aid in detection of cavities and decayed wood.

5.3 Inspection findings are documented in 6.0 Field note surveys on page 8 and summarised on page 10.

5.4 Whilst every effort is made to ensure an accurate assessment of subject trees' health and structural condition during the survey, no responsibility can be taken for resultant damage or injury occurred by the structural failure of a tree. The survey provides a study of what is visible, not obscured, or inaccessible on the day of survey. Please note that the findings of this report are only valid for 12 months from the date of the tree inspection. This report does not constitute to a full tree risk policy for the entire site, nor does it take into account any underground geological conditions or activity that may affected the structural condition of the trees. (for full details of limitations of liability please see page 16)

6.0 Tree Inspection and VTA Field Notes/Details:

Tree number:	1
Tree location:	Robertson Park (east), Adjacent to 109 Palmerston St. Perth.
Date of Tree Inspection/assessment:	30/10/2020
Botanic name: (Common name)	*Ficus macrophylla* (Moreton Bay Fig)
Origin of species:	Native, Q/NSW
Trunk diameters: DBH, Basal Ø:	3.1m, 3.1m
Height: (approx.)	28m
Crown spread: (N/E/S/W)	15m/21m/10m/22m
Age:	Mature (Veteran)
Health:	Good. No evidence of detrimental levels of pests or diseases, foliage appearance and density good. Inner/lower crown minor deadwood present. Epicormic regrowth on lower stem pruning cuts.
Structure:	Good. Significant above ground buttress root development to (average) 6m from stem. Stem divides at 3.4m agl- union appears sound. Significant hollow at base of southern stem at approx. 4m agl, from apparent stem failure in past, well occluded, extent of hollow not observed. Stem/branch structural unions in upper crown appear sound. Stem/buttress fluting displaying reaction wood indicating good response to external stresses. No evidence of root plate lift or recent major limb failure
Crown form:	Co-dominant, broad, asymmetrical.
Useful life expectancy:	> 25 years
Maintenance recommendations:	None
Additional observations:	Recent extensive canopy reduction pruning to south over subject property
QTRA Risk rating - whole (WT) part tree (PT) failure within following 12-month period:	PT - T3, S2, PoF 6 = RoH: 1/<1M -Broadly Acceptable. WT- T3, S1, PoF 6 = RoH: 1/<1M -Broadly Acceptable.
Image of subject tree: (From South)	

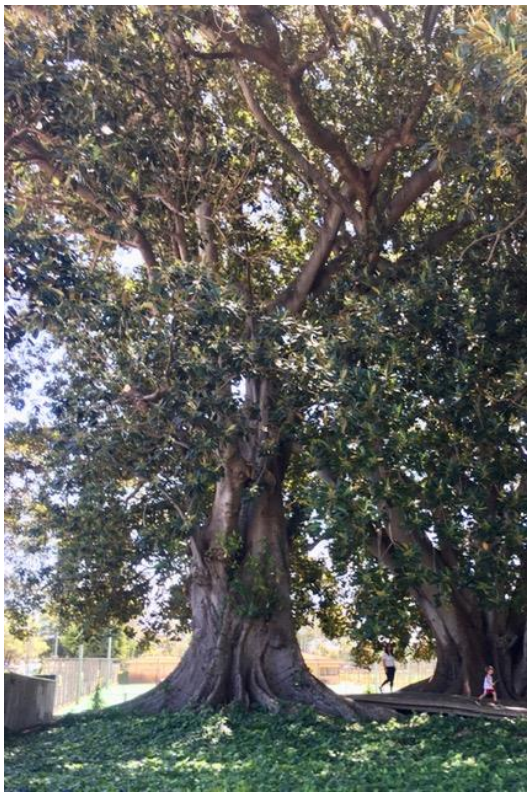
7.0 Additional Images:

7.1: Subject tree viewed from Palmerston st:

7.2 Subject tree from subject property:

7.3 Buttress roots and subject property boundary:

7.4 Stem and branch structure:



8.0 Tree Valuation:

8.1 The purpose of tree valuation is to provide a reasoned and objective way of evaluating a tree. The Helliwell System is one of the most commonly used methods in Australia which enables arborists to place a monetary value on the visual amenity provided by individual trees and tree groups.
This method has been extensively used in court cases, insurance claims and public inquiries to place visual amenity values on individual trees and tree groups.
The basic approach of the Helliwell system is to allocate point scores under a number of different factors such as tree size, life expectancy, suitability to setting etc. These scores are then combined to give an overall comparative score for a tree or group of trees.
It is then possible to attach a value to this point score by use of a monetary conversion factor, which allows us to attach a monetary value to each tree which is considered a valuable community asset.
Seven standard factors are identified for the tree. For each of the factors the tree is given a score of up to 8 points, the scores for all the factors are then multiplied together to give an assessment of the amenity value of the tree, which is then multiplied by the monetary conversion rate. The value per point rate for the assessment has been assigned at $71.13 which has been calculated using the appropriate conversion exchange rates and increased yearly with CPI.

8.2 The valuation calculation for the subject tree is as follows:

Factor	**Points**									
	0	0.5	1	2	3	4	5	6	7	8
Canopy Size										**>200m²**
Useful life expectancy					**40-100**					
Importance in landscape						**Great**				
Presence of other trees			**>30%**							
Relation to setting						**Particula -rly suitable**				
Form				**Good**						
Special Factors				**One**						

Total Score: 8 x 3 x 4 x 1 x 4 x 2 x 2 = 1,536 x Current point value conversion: $71.13 = $109,255.68

8.3 The Helliwell valuation calculates that for insurance and legal liability purposes, the amenity benefit of the subject tree can be valued at: **$109,244.68**

9.0 Summary of Findings:

9.1 The results of the VTA carried out on the subject tree indicate that it appears to be in good health and structurally sound at the time of inspection.

9.2 No exposed buttress or structural roots were within the subject property boundary.

9.2 Given the subject trees' age - whilst still in good health - it is at the latter stages of its life - sometimes referred to over, or post mature, or veteran.

Whilst younger trees are capable of withstanding and reacting to the stresses often incurred by construction activity, stresses such as significant root trauma or canopy loss could have an adverse effect in a tree of this age and trigger slow, but terminal decline.

Note: Trees that have incurred root damage often take many years to display symptoms, as trees will use energy reserves in the form of starch-sugars (carbohydrates) stored in stem and root tissues to compensate for an inability to provide soluble nutrients due to the root loss. (the subject tree will have significant reserves due to the volume of woody tissue in the stem and buttress roots).

Often, in these cases, the first symptoms of root damage is underdeveloped, thinning foliage and dieback in the upper crown, which in this particular species can expose previously well shaded bark tissue to sunscorch, causing further stress and necrotic tissues through which pathogens can breach the trees natural defences and increase the rate of decline.

9.3 The QTRA risk assessment for the subject tree for whole tree or partial limb failure within the following 12 month period, upon assessment of target/occupancy (buildings, infrastructure and pedestrians), produced a risk rating of < 1/1 million: a 'Broadly Acceptable' risk rating, whereby the Risk of Harm is as low as reasonably practicable.

9.4 Arboricultural risk assessments enable the managers of trees to fulfill their duty of care in relation to pre-determined risk levels. These reports identify specific conditions and characteristics of each individual tree and its site conditions and consider the risks imposed on the community balanced against amenity value. Recommendations thereof are cognisant of the specifics of the hazards, associated risk, amenity and budgetary values.

9.5 Normal amounts of leaf litter and other falling debris – fruit, bark, flowers, twigs and small branches etc.-and other tree related minor inconveniences which may cause sooty moulds, trip hazards/ blocked gutters etc. are, within the remit of this report, considered a low risk - when compared with the amenity benefits conferred by the subject tree to the community.

9.8 Note that sporadic high energy 'microburst' weather systems are often very localised and are too unpredictable to be considered in the scope of a standard tree inspection, and due to the relative infrequency of such storm events, have no bearing on QTRA Risk of Harm calculations/outcomes.

9.9 As a general rule, where a tree is found to be of a 'tolerable' or 'broadly acceptable' risk, the benefits of living with the tree far outweigh the risk imposed on the community by their continued presence.

10.0 General Tree Protection & Establishing Tree / Root Protection Zones:

10.1 The standard procedure for protection of trees on construction sites is to establish a Tree Protection Zone (TPZ), and Structural Root Zone (SRZ). These Zones are theoretical and should be documented on construction drawings for reference, and in most cases do not need to be physically installed.

10.2 For the purposes of this report, it is not necessary to reproduce all the information contained in AS 4970 as part of these recommendations, and it must be noted that these are guidelines only and not statute. However, it is recommended that in order to protect the roots of subject tree effectively, these guidelines are read, understood and implemented by Site and Project Managers prior to commencement of site works wherever practicable.

10.3 Tree Protection Zones and Structural Root Zone measurements are calculated using formulae presented in AS 4970 – 2009 'Protection of Trees on Development Sites' and are based on diameter measurements of the Subject trees' lower stem (stem diameter at 1.4m above ground level (DBH), and diameter above root collar):

10.4 The definition and calculation of Tree protection Zones (TPZ) is: A specified area above and below ground at a given distance from the trunk set aside for the protection of a tree's roots and crown to provide for the viability and protection of the tree to be retained The TPZ is the combination of the root area and crown area requiring protection. The TPZ should not be less than 2m nor greater than 15m, except where crown protection dictates.

10.5 The definition and calculation of Structural Root Zones (SRZ) is: 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, so the entire profile (depth) of the root zone is included in the structural root zone. The SRZ is nominally circular with the trunk at its centre and is expressed by its radius in metres. This zone considers a trees' structural stability only, and not the root zone required for a trees' vigour and long-term viability, which will usually be a much larger area.

Note: Tree root systems are opportunistic, unpredictable, variable, site specific and unique, and a simple, formulaic approach to the TPZ and SRZ cannot apply to every tree in every situation.

10.6 Protective fencing at a minimum distance of two metres from the base of the tree generally provides sufficient protection for structural roots in most cases, and prevents damage to the main stem and assists in making contractors aware of the need for caution when working near trees.

10.7 Encroachment into TPZ's and TPZ's is possible when deemed essential to construction plans, and provisions for encroachment can be made where necessary. Encroachment falls into two categories:

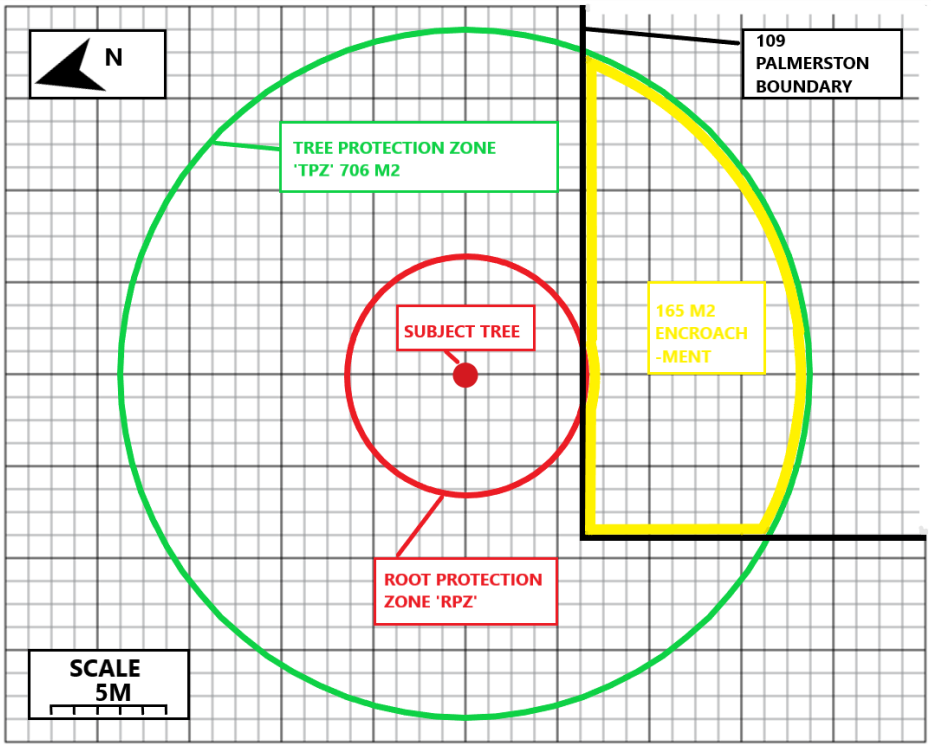
Minor – If the proposed encroachment is less than 10% of the area of the TPZ and is outside the SRZ, detailed root investigations should not be required. The area of root mass lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ.

Major - If the proposed encroachment is greater than 10% of the TPZ or inside the SRZ, an Arboricultural Consultant must demonstrate that the tree would remain viable. The area of root mass lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ.

10.8 Site specific calculations for subject tree are:

TPZ: 15m Radius from the base of the tree.
SRZ: 5.3m Radius from the base of the tree.

10.9 Graphic showing approximate scaled location of TPZ/SRZ dimensions, and areas of encroachment of the site, should the entire site be demolished, sifted, graded and compacted prior to development. Encroachment into the SRZ is negligible, however TPZ encroachment is approximately 23 %.



10.10 Given that the subject tree is able to extend and develop roots in areas of the park contiguous with the TPZ , the percentage of encroachment in most cases would be acceptable, however as noted above, the subject tree being almost beyond maturity, construction activities in this area should be carried out with minimal disturbance to the tree.

11.0 IMPACT ASSESSMENT

11.1 The Impact Assessment is intended to assist decision-making with regard to the existing subject tree in the context of design, demolition, and construction of the proposal for the subject property.

11.2 The subject trees' root system and canopy, with allowance for future movement and growth, should be taken into account at all stages of the development process.

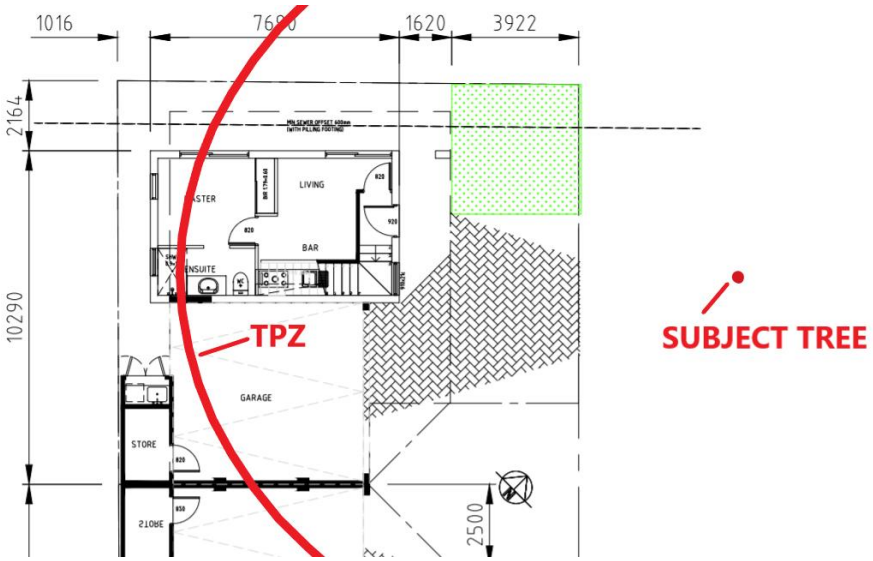
11.3 During their lifetime, trees will be vulnerable to disturbance, injury, environmental changes, pests and diseases. Construction work often exerts pressures on existing trees, as do changes in their immediate environment following the construction. A tree that has taken many decades to reach maturity can be damaged irreparably in a few minutes by actions that might be unwitting or negligent. As such, the early provision of physical protection from damage is therefore critical.

11.4 Where tree retention is proposed in conjunction with nearby construction, the objective should be to achieve a harmonious relationship between trees and structures that can be sustained in the long term. The practices recommended in this assessment are intended to assist in achieving this objective.

11.1 Following a review of the submitted plans, and taking into account the above information regarding the subject tree, It is certainly feasible to carry out the proposed development without causing irreversible damage to the subject tree - however, the design will require minor amendments to the plans and demolition/construction methods.

11.2 An Arboricultural Method Statement (AMS) and Tree Protection Plan (TPP) outlining prescribed demolition and construction methods will be required in order to effectively protect the subject tree, and may require periodical site visits from a designated Project Arborist at critical stages of the development. These requirements may be conditional to development approval and **must be implemented prior to commencement of any site works.**

11.3 Below is a thumbnail sketch (scale approximate) providing an estimate of TPZ encroachment from the finished development:



11.5 In the above image, the percentage of encroachment from the finished development is likely to be minor (Note. finalised plans with dimensions will be required to determine exact extent of encroachment) and the following construction methods should be utilised within the TPZ to reduce impact: Note. The following recommendations may require amendment upon finalisation of plans.

- For the duration of demolition and site grading operations, the TPZ should be fenced off entirely within the subject property to avoid compaction and root severance. Any resulting level discrepancy should be manually carried out.

- Pier and beam type boundary fencing will be required to avoid transverse trenching across the root system – pier footings can be manually excavated to leave roots intact. The above ground beams allow for further root expansion without damage to masonry. 'Colourbond' fencing'- without plinths installed - is also suitable.

- All utility trenching should be confined to the southern boundary of the block.

- Screw pile footings, with engineered beams or similar will be required to carry the front (northern) edge of the ground floor slab for Units 3 & 4, instead of trench footings.

- Drive way paving should be manually compacted (ie. with small plate compactor to avoid root damage prior to paving, without the use of exterior grout to allow for penetration of water and nutrients. Note. permeable paving with a 'no fines' substrate laid onto geotextile is preferred to better allow for precipitation to reach subject tree roots and limit future lifting of paving from opportunistic root development.

- Soakwells must be manually excavated if located within the TPZ, and stormwater pipes manually trenched to avoid root severance.

12.0 Discussion:

For further information or discussion, or for any queries pertaining to this survey or findings within, Please contact Alex Corke using the details provided below:

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13.0 Disclaimer/ Limitation of Liability:

13.1 Tree Consultants are tree specialists who use their qualifications, education, knowledge, training, diagnostic tools and experience to examine trees, recommend measures to enhance the aesthetic, structure and health of trees, and attempt to reduce the risk of living near trees. Clients may choose to accept or disregard the recommendations of this assessment and report.

13.2 Branch Arboriculture Tree Consultancy cannot detect every condition that could possibly lead to the structural failure of a tree. Trees are living organisms that fail in ways that the arboriculture industry does not fully understand. Conditions are often hidden within trees and below ground. Unless otherwise stated, observations have been visually assessed from ground level. Branch Arboriculture Tree Consultancy cannot guarantee that a tree will be healthy or a low risk of harm under all circumstances, or for a specified period of time. Likewise, remedial treatments cannot be guaranteed.

13.3 Treatment, pruning and removal of trees may involve considerations beyond the scope of Branch Arboriculture Tree Consultancy's service, such as property boundaries and ownership, disputes between neighbours, sight lines, landlord-tenant matters and other related incidents. Branch Arboriculture Tree Consultancy cannot take such issues into account unless complete and accurate information is given prior or at the time of the site inspection. Likewise, Branch Arboriculture Tree Consultancy cannot accept responsibility for the authorisation or non-authorisation of any recommended treatment or remedial measures undertaken.

13.4 In the event that Branch Arboriculture Tree Consultancy recommends re- inspection of trees at stated intervals. It is the client's responsibility to make arrangements with Branch Arboriculture Tree Consultancy to conduct the re-inspection.

13.5 Trees can be managed, but they cannot be controlled. To live or work near a tree involves a degree of risk. All written reports must be read in their entirety; at no time shall part of the written assessment be referred to unless taken in full context with the whole written report. If this written report is to be used in a court of law, or any other legal situation, Branch Arboriculture Tree Consultancy must be advised in writing prior to the written assessment being presented in any form to any other party.

Appendix (i): Subject tree Age/Health/Structure Category Definitions:

Tree Age:

- **Young**: Sapling/advanced tree nursery stock/natural seedling putting on significant new growth each growing season, < 10 years.

- **Semi mature:** < 10 years – well established increasing in height and spread, but not at full potential.

- **Mature:** Established, reduced extension growth of shoot tips, reached or close to full potential (determined by site conditions.)

- **Over mature:** No longer adding significant extension growth, potentially receding, but still adding annual girth growth (senescing)

Tree Health:

- **Good**: The tree is demonstrating good extension growth for the species. The tree should exhibit a full canopy of foliage (or healthy buds in winter state) and may be affected by typical/minor pest or diseases. Foliage colour, size and density should be typical of a healthy specimen of that species.

- **Fair**: The tree is in reasonable condition and growing well for the species. The tree should exhibit an adequate canopy of foliage. There may be extensive dead wood present in the crown, foliage may be distorted, discoloured or animals may be evident and/or foliage colour, size or density may be abnormal for a healthy specimen of that species.

- **Poor**: The tree is not growing to its full capacity; extension growth of the laterals may be minimal. The canopy may be thinning or sparse. Large amounts of dead wood may be evident throughout the crown. Significant pest and disease problems may be evident or symptoms of stress indicating tree decline.

Dead: The tree is no longer photosynthesising and cellular material has ceased to function – Note at this stage trees still provide vital habitat as part of an ecosystem.

Tree Structure:

- Good: The tree has a well-defined and balanced crown. Branch unions appear to be strong, with no defects evident in the trunk or the branches. Major limbs are well defined. The tree would be considered a good example of the species. Probability of significant failure is highly unlikely.

- Fair: The tree has some minor problems in the structure of the crown. The crown may be slightly out of balance, and some branch unions or branches may be exhibiting minor structural faults. If the tree is single trunked, it may be on a slight lean or be exhibiting minor defects. Probability of significant failure is low.

- Poor: The tree may have a poorly structured crown. The crown may be unbalanced or exhibit large gaps. Major limbs may not be well defined. Branches may be rubbing or crossing over. Branch unions may be poor or faulty at the point of attachment. The tree may have suffered major root damage. Probability of significant failure is moderate.

Appendix (ii): List of inspection criteria used for the purposes of the VTA inspection/assessment of health and structural characteristics of the subject trees. (note: inspections are not limited to the following criteria):

- Root heave and/or disturbance.
- Exposed roots – lowering of soil level – scorch/desiccation/trip hazard.
- Altered/abnormal soil levels and infill at base of stems – collar rot/root asphyxiation.
- Girdling roots – roots encircling the stem.
- Bark necrosis, canker.
- Cavities/decay pockets in stem and branch structure.
- Fungal brackets/fruiting bodies /mycelium.
- Termite activity/Parasitic plants.
- Proximity of underground/overground services/utilities.
- Proximity of aboveground structures, eg. buildings, retaining walls, etc.
- Bark tears, lesions, splits and cracks.
- Abnormal/swollen & cracked areas in bark tissue.
- Physical abnormalities, eg lightning strikes, bridge grafts, etc.
- Unnatural change in bark colour, texture and form.
- Compression folds in bark.
- Excessive gum, sap, kino exudation and/or weeping.
- Borer, leaf miner and other insect activity.
- Included bark at major stem and branch unions.
- Evidence of tree surgery and infrastructure, eg cabling, bracing, propping, and other abiotic tree attachments.
- Branch attachments.
- Evidence of lopping and/or pollarding and poor pruning cuts.
- Branch sockets – areas where branches have been torn from union.
- Branches of uneven taper.
- Crossing, broken and hung-up branches – branch stubs.
- Die-back symptoms – stag heading and reduction in foliage density.
- Major dead wood – > 40mm Ø.
- Minor dead wood – < 10mm Ø.
- Foliage – changes in colour, size, shape and thickness variation.
- Epicormic growth.
- Growth habit of tree – leaning/crooked/ asymmetrical growth.

Appendix (iii) Notes on VTA and QTRA:

VTA:

In 1994, Claus Mattheck introduced a biomechanically based system of Visual Tree Assessment (VTA), the basis of which is the identification of symptoms produced by a tree in reaction to a weak point, or area of mechanical stress.

VTA is a non-invasive method of examining the health and structural condition of individual trees. It has become the standard approach for surveying trees. By visually examining a tree, an arboriculturalist can gather information on the condition of its roots, trunk, main branch structure, crown, buds and leaves to make an assessment and draw conclusions about its general condition; structure, health, and vitality.

It is a systematic approach, which directs the arboriculturalist through a procedure from biological and routine observations to analysis, using their understanding of failure criteria.

In any inspection regarding tree health or safety, an arboriculturalist will look for biological signs, such as undersized leaves, discoloured foliage, dead branches, large or numerous cankers and fungal fruiting bodies. They will be able to recognize the significance of these observations by comparing them with the typical growth patterns and appearance of the tree involved.

They will also look at the tree for signs of structural weakness or for a change in growth patterns that may indicate defects. If mechanical weakness is suspected, there may be a need for more investigation using specialist decay detection and measuring equipment.

A list of diagnostic criteria used for the inspections can be found in appendix (ii)

QTRA (A Non–Technical Summary):

Tree safety management is a matter of balancing the risk of harm from tree failure while maintaining the benefits conferred by trees. Although it may seem counter-intuitive, the condition of trees should not necessarily be the first consideration. Instead, tree managers should first take account of the usage of the land on and around which the trees stand, and this in turn will inform the process of assessing the trees.

The QTRA method applies established and accepted risk management principles to tree safety management. By quantifying the risk of harm as a probability, QTRA enables the tree manager to manage the risk from tree failure to widely accepted risk thresholds.

Using this approach, first the targets (people and property) onto which trees could fail are assessed and quantified, thus enabling tree managers to determine whether they need to assess trees and to what degree of rigour an assessment or inspection of the trees is required. Where necessary, a tree or branch is then considered in terms of both its size (potential impact) and probability of failure. Values derived from the assessment of these

three components (target, size and probability of failure) are combined to calculate a risk of harm as a probability, which can then be compared to advisory levels of risk acceptability.

This method moves the management of tree safety away from labelling trees as either 'safe' or 'unsafe' thereby requiring definitive statements of tree safety from either tree surveyors or tree managers. Instead, QTRA quantifies the risk of harm from tree failure in a way that enables tree managers to balance safety with tree value and operate to pre-determined risk thresholds.
By taking a QTRA approach to tree risk, managers commonly find they spend less resources on assessing and managing tree risk, whilst maximising the benefits their tree populations provide. Furthermore, in the event of a 'tolerable' or 'acceptable' tree risk being realised, they are in a robust position to demonstrate that they have acted both reasonably and proportionately.

Note: The QTRA method does not provide predictions of what will or will not happen but provides an estimate of the risk of harm from any particular tree hazard over a twelve-month period.

Appendix (iv) Glossary of common arboricultural terms which may be found in the preceding report:

Abiotic: Pertaining to non-living agents, e.g. mechanical/environmental factors.

Adaptive growth: In tree biomechanics, the process whereby the rate of wood formation in the cambial zone, as well as wood quality, responds to gravity and other forces acting on the cambium. This helps to maintain a uniform distribution of mechanical stress.

Agl: Above ground level - used to describe the vertical location of tree parts/defects.

Branch Collar: The swollen ring of growth formed around the base of a branch by the successive layers of each growth increment of the branch and the supporting branch or trunk to which it is connected.

Compartmentalisation: The confinement of disease, decay or other dysfunction within an anatomically isolated area of plant tissue, due to passive and/or active defences operating at the boundaries of the affected region.

Compressed fork/union: An acute angled fork that is mechanically compromised by the growth pressure that two or more adjacent stems exert on each other.

Basal flare: the natural taper from stem base to buttress roots.

Buttress roots: woody adaptive growth providing mechanical support (tension), from stem base to root crown.

Callus Tissue/Wood: Undifferentiated and unlignified wood that forms initially after wounding around the margins of a wound separating damaged existing wood from the later forming lignified wood or wound wood.

Cambium: Layer of dividing cells producing xylem (woody) tissue internally and phloem (bark) tissue externally .

Canker: A persistent lesion formed by the death of bark and cambium due to colonisation by fungi or bacteria.

Co-dominant: Crowns of more than one tree combine to form single canopy.

Condition: An indication of the physiological condition of the tree. Where the term 'condition' is used in a report, it should not be taken as an indication of the stability of the tree.

Construction: Site based operations with the potential to affect existing trees.

Crown/Canopy: The main foliage bearing section of the tree.

Crown Lifting: The removal of limbs and small branches to a specified height above ground level.

Dbh: Diameter at breast height – an industry standard method of measuring a trees' girth. The
measurement is taken as close as possible to 1.6m agl.

Deadwood: Branch or stem wood bearing no live tissues. Retention of deadwood provides valuable habitat species and seldom represents a threat to the health of the tree.

Defect: In relation to tree hazards, any feature of a tree which detracts from the uniform distribution of mechanical stress, or which makes the tree mechanically unsuited to its environment

Epicormic shoot. A shoot having developed from a dormant or adventitious bud and not having developed from a first-year shoot.

First order branch: A branch arising from the main stem forming the main structure of the crown.

Growth Cracks: Longitudinal split that may develop as a rupture in the bark from normal growth.

Hanger: Unattached/ broken limb held within crown.

Heartwood: The central section of a branch or trunk, usually darker coloured than sapwood, comprised of lignin blocked secondary xylem sapwood cells that are no longer conductive but provide a structural and protective function.

Included bark: A branch/stem union in which the bark in two or more adjacent stems has become trapped, whereby the tissues at this point are not biomechanically connected. Structural failure may occur if the union is weak and or excessive stresses are imposed.

Lateral: A second order branch, subordinate to a primary branch or stem and bearing sub-lateral branches · (Sub-lateral/ third order branch, subordinate to a lateral or primary branch, or stem and usually bearing only twigs).

Leader: A structural stem exhibiting apical dominance.

Lopped/Lopping: Branches that have been cut between the 'internodes' - points where new branches arise along a branch length. Such cuts may produce multiple shoots from the cut surface which may be weakly attached.

Natural Target Pruning: This is where the final cut is made outside of the branch collar and bark branch ridge – see AS 4373 – Pruning of Amenity Trees – 2007.

Occlusion: Woody callus growth produced when a wound occurs, eg. a pruned branch, or damage to bark tissue. Vigorous callus tissue growth which will eventually cover the wound completely is a good indicator of a healthy tree.

Root Crown/Collar: The area at the base of the stem where the main roots arise from the trunk.

Sapwood: The living cells in the outer, usually light coloured, water and nutrient conducting wood, forming a region of secondary xylem.

Structural Branches: Main or first order branches elongated to form a permanent framework of branches supporting the crown.

SRZ : Structural Root Zone a theoretical area in which the main structural roots necessary for stability/structural integrity of the tree are likely to be found, whose measurements are calculated using formulae recommended in AS 4970 – 2009 which and are based on diameter measurements of the Subject trees' lower stem.

TPZ: Tree Protection Zone a theoretical area for protection of trees on development sites, whose measurements are calculated using formulae recommended in AS 4970 – 2009 which and are based on diameter measurements of the Subject trees' lower stem.

Appendix (v) References / Bibliography:

Common Sense Risk Management of Trees. National Tree Safety Group (forestresearch.gov.uk)

AS 4970 – 2009 Protection of Trees on Development Sites

BS 5837:2012 Trees in Relation to Design, Demolition and Cnstruction

Hair, C. 1997 The Evolution of Robertson Park and its Neighbourhood

Helliwell Guidance Note 4: Arboricultural Assoc (2012 UK)

QTRA user Manual Version 5.3/17

Principle of Tree Hazard Assessment and Management Edinburgh; Forestry Commission. Lonsdale, D (1999)

Body Language of trees: Handbook for Failure Analysis. Mattheck, Breloer (1996)

Field Guide for Visual Tree Assessment Germany; Karlsruhe Research Centre. Mattheck, C (2007)

Modern Arboriculture USA; Shigo and Trees, Shigo, A.L (1991)

Diagnosis of ill-health in trees Edinburgh; Forestry Commission Strouts, R.G (2000)

Principles of Tree Hazard Assessment. HM's Stationary Office, Lonsdale, D. (1999)

End Of Report