ARBORICULTURAL ASSESSMENT REPORT

Client:	Mr E. Drewitt
Site:	30 Queens Drive, Ashburton, Canterbury
Scope:	Undertake a visual tree assessment (VTA) and climbing inspection of the Silver lime *Tilia tomentosa* growing in the rear of the property.
Author:	Martin Göhns
Date:	31 October 2014

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1.0 Introduction.

1.1 Treetech Specialist Treecare Ltd. received instructions from David Harford of Urbis Ashburton 2012 Ltd, on behalf of Mr E. Drewitt (the owner of 30 Queens Drive),to carry out an arboricultural condition assessment on the Silver Lime *Tilia tomentosa* growing within 30 Queens Drive, Ashburton.

1.2 This report has been commissioned to assess the condition of the tree and provide recommendations for future management.

1.3 The site was inspected on Thursday 3 April 2014 and the following report is based upon the findings and the conditions found on the day.

1.4 The report provides data on tree parameters, an assessment of condition and action for risk management.

2.0 Scope of report

2.1 The objective of this assessment is to deliver advice to the tree owner on the health and structural integrity of the tree and provide recommendations for risk management to meet their duty of care, insofar as is reasonably practicable, that people and property are not exposed to unreasonable levels of risk.

3.0 Survey methodology

3.1 The tree has been inspected using an industry recognised system of Visual Tree Assessment.

3.2 The tree has been assessed for risk, taking into account features such as general health, vigour, condition of the trunk, branches and foliage, buttress roots, the presence of decay fungi and other indicators of health status and mechanical defects which may affect structural stability.

3.4 Tree height has been measure using a Hahlöf digital clinometer. Stem girth was measured at 1.4m above ground level using a metric diameter tape. Crown dimensions were measured with a metric 30m tape. Stem numbering within my report is consistent with arborist report prepared by Walter Fielding - Cottrell dated 21 January 2014 to prevent confusion.

3.5 The tree has been inspected from ground levelonly by a qualified arborist experienced in Visual Tree Assessment and qualified in Professional Tree Inspection.

3.6 In addition to the ground based VTA assessment an aerial inspection of the canopy was carried out. No invasive testing was carried out or samples taken for analysis.

3.7 The assessment of the potential risk posed by the tree from stem and/or branch failure is a culmination of the potential target, the likelihood of failure impacting the target and potential consequences. In order to determine the potential risk trees or parts of the tree pose, matrices commonly used in risk management

across multiple industries have been used which are outlined in Appendix A of this report.[1]

3.8 Tree height has been measured using a Haglöf electronic clinometer. Tree girth has been measured using a metric trunk diameter tape.

4.0 Qualifications and Experience

4.1 My name is Martin Anthony Göhns. I hold a Technicians Certificate in Arboriculture (UK) and a National Certificate in Nursery Practices (UK). I hold a professional tree inspection qualification gained in the UK and an ISA (International Society of Arboriculture) Tree Risk Assessment qualification gained in New Zealand in April 2014. I have worked in the arboricultural and horticultural industries for 32 with the last 12 years, specialising in arboricultural consultancy.

4.2 I am a currently employed by Treetech Specialist Tree Care Ltd as the Senior Consultant Arborist and have held this position for 6 months. My role includes tree inspection of the street tree and park tree asset and providing technical support for Christchurch City Council, detailed inspection and condition assessments of notable and protected trees, preparation of arboricultural implication reports for construction and provide technical advice with regard to tree and design conflicts, tree condition assessments and reports, resource consent applications and expert witness, transplant feasibility assessments, contract and financial management.

4.3 Prior to my current role I was employed by The Specimen Tree Company Ltd in Auckland as a consultant arborist and held this position for just over 3 years. My role included the preparation of arboricultural Implication reports for construction, preparation of evidence and the attendance of hearings regarding resource consent applications and recent plan change reviews, transplant feasibility studies, tree inspections and condition reports and contract management.

4.4 I was previously employed in New Zealand by Christchurch City Council for 14 months as an arborist/contract manager responsible for the management and replacement planting of the city's road reserve trees.

4.5 Prior to emigrating to New Zealand I was employed by one of the leading environmental consultancies in the UK as principal consultant, primarily responsible for delivering tree risk management on large tree populations for local authorities estates and retirement villages, tree root and building investigations, implication reports for construction and contract management. I held this position for 6 years.

5.0 Observations

5.1 The tree has an asymmetrical canopy orientated to the south due to being suppressed to the north from an Oak tree located to the north-western corner of the property. The Oak had recently been felled at the time of my inspection with sawdust visible on the ground. The stump of the felled tree is approximately 9.2m from the subject tree.

[1] ISO. 2009. *International Standard: Risk Management–Risk Management Techniques* Appendix B

5.2 The height of the tree has been measured at 19.7m. North-south canopy spared has been measure at 17.1m and east-west canopy spread of 19.5m. The tree is 12.5m from Mr Dewitt's house and within falling distance of the neighbouring house at 32 Queens Drive.

5.3 The structure of the tree consists of three main stems emanate from the base of the tree. Stem #1 leans to the south-east and is closest to Mr Dewitt's house. Stem #2 orientates to the west and stem #3 orientates to the north-east. Two large pruning wounds were evident at the stem base, to the north-west, indicating historic stem removal.[2] These wounds were much smaller in diameter than the existing three stems. Included bark was noted at the attachment points of the three stems. Included bark is an internationally recognised and well documented structural weakness in trees.

5.4 Average buttress root flare for the tree species was noted at the stem base with no visible defects noted. No fungal brackets were observed. The area immediately beneath the tree was laid to lawn and no obstacles were present prohibiting a complete visual inspection of the soil surface. There was evidence of saturated ground or ponding around the root zone at the time of my inspection.

5.5 The stem base was probed for signs of cavities with one cavity observed to the west of the tree at the junction of stem 1 and stem 3. An approximate 29 cm penetration was observed. The stems sounded with hammer up to approximately 2.0m in height no significant decay detected, this is wall recognised and widely used non-invasive method for detecting decay in trees.

5.6 The tree had an approximately 60% live crown (to total height) ration. Pruning wounds were evident on the lower sections of the stems as a result of previous branch removal to raise the canopy of the tree. Although asymmetrical the canopy had a fully formed branch structure. No sign of apical dieback or significant deadwood was present that would indicate the tree was in decline or in poor health. No foliage was present at the time of my inspection.

5.7 A non-invasive Cobra bracing system has been installed at approximately half the total height of the tree, connecting stems #1 and #2 and #1 and #3. Two Cobra bracing systems were evident, which have been installed at different times. The most recent installation was a 4 ton system in 2013 confirmed by the date end caps installed.[3] An earlier installation is present which is smaller in diameter than the 2013 system and is indicative of a 2 ton system.[4]

5.8 The earlier Cobra system connecting both stem #1 and #2 (east-west) and stem #1 and #3 (north-east – south-west) was noted has being at high tension. The system has been installed at natural forks in the branch structure. Incremental growth of the trees stems has partially included the points of attachment.[5] There is evidence of previous failure of a cobra brace between stem #1 and #2 with the remnants of the brace trees partially included.[6]

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[2] Refer to picture 1
[3] Refer to picture 2
[4] Refer to picture 3
[5] Refer to picture 4
[6] Refer to picture 5

5.9 The Cobra system installed in 2013 has been installed above the earlier system. Significant slack was noted in the recently installed braces.

5.10 The installed braces connecting stems #1 and #2 are connected to the main stems at an approximate diameter >450mm.[7] The stems have a similar angle of lean and the tension between at the connecting points is likely to be similar.

5.11 The installed braces connecting stems #1 and #3 are connected via a secondary branch on stem #3 with an approx. diameter of 300mm and the main stem of #1 with an approx. diameter >450mm.[8] Significant end weight was noted on stem #1 which leans towards the property and is at a greater angle than stems #2 and #3. Due to the end weight noted the secondary branch attached of the Cobra system on stem #3 has been pulled into the adjacent secondary branch lateral with an approx. Diameter <200mm at the point of attachment.[9]

6.0 Discussion

6.1 Multi-stemmed trees are potentially weaker than single stemmed trees; this is exacerbated in this instance by the presence of included bark preventing the incremental wood growth fusing together. Included bark is considered to be a significant structural defect in trees with the potential to give rise to stem failure due to the weak union created.

6.2 The installation of the Cobra system will have been an attempt to prevent the potential failure of the stems, the braces were noted as being under high tension. Mr Walter Fielding – Cotterell's report dated 21 January 2014 states that the system was installed in 1997. As stated in paragraph 5.7 above, the diameter of the previously installed system is indicative of a 2 ton system which I consider to be inadequate for the size of the stems of the tree which are likely to in excess of 4 ton.

6.3 In 2013 a second Cobra bracing system has been installed which is noted as being a 4 ton system confirmed by the date end caps installed.[10] This system has been installed incorrectly with significant slack noted in both braces.[11] This is unlikely to have the desired effect of supporting the stems in the event of failure due the extent of travel before the slack is taken up.

6.4 Due to the tension noted on the pre-existing braces, failure of these braces is considered likely. Mr Walter Fielding – Cotterell's report dated 21 January 2014 notes that when the recent Cobra system was installed in December 2013 one of the braces was found to be broken, this is likely to have been the brace between stems stem #1 and #2 (east-west) as noted in paragraph 5.8.

6.5 What is of most concern is the degree of lean of stem #1 towards Mr Drewitt's house and the inadequate attempt to mitigate the structural defect (included bark). The pre-existing brace is connected to a secondary branch, which in turn is

[7] Refer to picture 5
[8] Refer to picture 6
[9] Refer to picture 7 and 8
[10] Refer to picture 3
[11] Refer to picture 9

supported by a lateral branch <200mm diameter which is supporting the entire weight of stem #1. With the pre-existing brace (indicative of a 2 ton system) considered to be inadequate and the recently installed brace installed incorrectly with a large amount of slack, there is a high risk of stem failure.

6.6 At the time of my inspection an Oak located to the north-western corner of the property had recently been felled. From the google map images available[12], it is considered that the Oak will have been a large tree providing protection for the Lime form north/north-westerly winds. With this protection now removed the Lime is more venerable to wind exposure which will only increase the wind loading on stem #1 and the bracing system.

6.7 In the "Hazard abatement/remedial tree work" section of Mr Walter Fielding – Cotterell's report he recommends the installation of a steel wire and eye bolt bracing system. This is an invasive system requiring drilling through the stems. Furthermore there is no recommendation for pruning to alleviate the end weight loading of the stems.

6.8 The installation of any bracing system to mitigate defects in trees generally is only part of the remedial works which normally would include pruning to mitigate the loading of the stem or branch being braced. The bracing should then be inspected on a regular basis to ensure that the installed system remains functional for the task intended. Neither pruning nor re-inspection of the proposed bracing system has been proposed in Mr Fielding – Cotterell's report. Furthermore I do not consider installing further bracing to support stem #1 is appropriate due to the structure of the tree. There are only three stems with no stem to the north to be able to successfully brace stem #1 to mitigate the lean towards Mr Drewitt's house.

7.0 Conclusions

7.1 In view of the defects noted, inadequate and incorrectly installed bracing systems and significant end weight noted, I consider the tree to be a high risk.

7.2 Mr Walter Fielding – Cotterell's report, dated 21 January 2014, recommends the installation of a steel wire and eye bolt system. Bracing systems are expensive to install and while this method of mitigation may be appropriate for some trees with local authority control is very onerous for trees within private ownership as regular inspection would be required to maintain and monitor its effectiveness. Furthermore the recommendation does not include pruning to mitigate the loading of the stems

7.3 The defects in the tree and potential for stem failure have been documented in my report and within Mr Walter Fielding – Cotterell's report and therefore ant failure would be considered foreseeable. Should stem failure occur damaging either Mr Drewitt's or the neighbouring house, Mr Drewitt may well be placed in a compromising situation with regard to his insurance company covering the cost of repairs with respect of foreseeability. Mr Drewitt has a duty of care to tree to ensure, insofar as is reasonably practicable, that people and property are not

[12] Refer to Tree Location Pal Appendix A

exposed to unreasonable levels of risk and therefore has an obligation to maintain the tree.

7.4 Mr Walter Fielding – Cotterell's report, dated 21 January 2014, recommends the installation of a steel wire and eye bolt bracing system but does not recommend remedial pruning or an inspection regime for the bracing. Bracing systems should be inspected on a regular basis to ensure that the installed system remains functional for the task intended. The installation of bracing systems may be appropriate for trees with local authority control, however this would be difficult to manage for trees within private ownership and may be consider onerous and expensive to maintain for homeowners, especially retired people with limited access to funds. The previously broken cobra brace documented in Mr Walter Fielding – Cotterell's confirms that managing installed bracing systems in privately owned trees is problematic and unlikely to mitigate the risks posed by the tree.

7.5 Due to the orientation of the three stems I do not consider installing further bracing to support stem #1 is appropriate to mitigate the potential risk of stem failure. There are only three stems with no stem to the north to be able to successfully brace stem #1 to mitigate the lean towards Mr Drewitt's house.

7.6 In view of the defects noted I do not consider that a high risk tree with well documented structural defects is a good candidate for inclusion in Ashburton District Council's schedule of protected trees.

7.7 It is my opinion that mitigation pruning is required in the first instance to all three stems to reduce the end weight loading and pressure on the bracing systems and basal stem unions. The tree can then be further evaluated with regard to its future management and protection status.

8.0 Limitations

8.1 If the tree is to remain it should be re-inspected within a three year period to evaluate the effectiveness of management proposals and to re-evaluate the condition of the tree to meet your duty of care to ensure, insofar as is reasonably practicable, that people and property are not exposed to unreasonable levels of risk.

8.2 Trees should be inspected by a suitably qualified arborist after severe weather, localised ground works or other factors that may affect tree health and structural integrity, to assess their condition and evaluate the need for any remedial action.

8.3 Any events that require a detailed inspection to assess tree condition should be carried out by a qualified arborist.

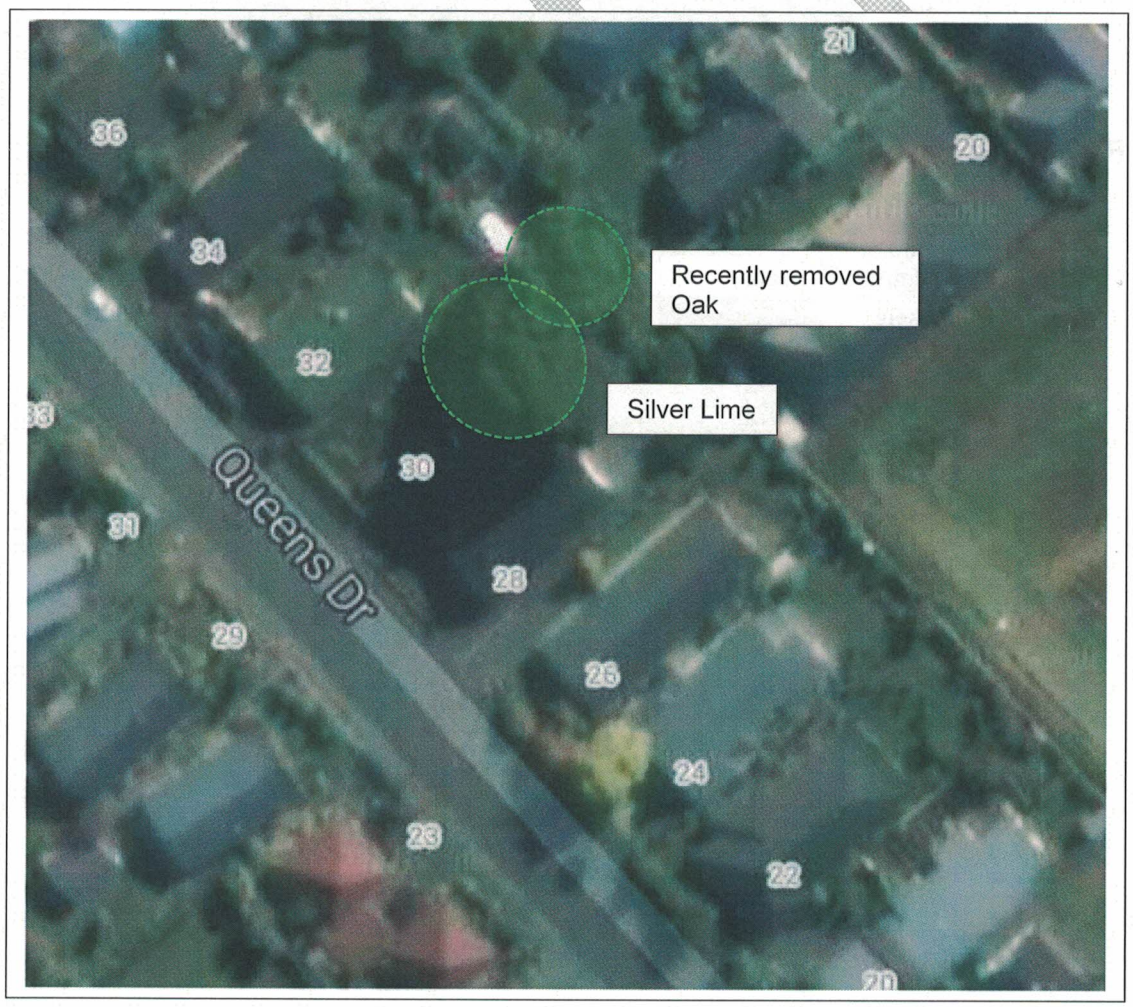
Martin Göhns

Senior Consultant Arborist
Treetech Specialist Treecare Ltd

Appendix A - Tree Location Plan
Appendix B - Photograph
Appendix C - Tree location plan

Tree location Plan

Appendix A



(ISO). 2009 matrices.

Appendix B

International Standard: Risk Management–Risk Management Techniques

Likelihood Matrix

Likelihood of Failure	Likelihood of Impact			
	Very low	Low	Medium	High
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Risk Rating Matrix

Likelihood of Failure& Impact	Consequences of Failure			
	Negligible	Minor	Significant	Severe
Very likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

Tree Survey Data

Appendix C

Species	Ht (m)	Diam (m) at 1.4m	Canopy spread (m)	Age class	Condtn	Risk target	Target use	Failure part	Likelihood of failure	Impact	Consequence	Observations
Silver Lime *Tilia tomentosa*	19.7	Stem #1 0.63 Stem #2 0.87 Stem #3 0.78	N/S 17.1 E/W 19.5	M	Poor	People/ buildings	Constant/ Intermittent	Main stem/ Major branch	Probable	Likely	Severe. Dwellings within 1x falling distance	Asymmetrical canopy. 3 x stems. Existing cobra brace between #1 and #2 stem. Historic brace (2t) under tension. New 2 x brace slack (4t). Stem #1 braced from #3 stem historic brace (2t) under severe tension - new brace (4t) under tension. North stem secondary branch - cobra braces attached supporting the entire stem#1. Secondary branch noted as touching fork which is taking full load of stem #1. Significant end Weight noted on all stems. No fungal brackets observed. Buttress roots probed for signs of cavities - stem #1 junction with stem #3 - 29 cm penetration. Centre probed with 10 cm penetration though build-up of leaf litter. 2 x stems removed 30 cm diameter. Some reactive growth observed. Stems sounded with hammer no significant decay detected.

Tree data Key

Age Class

Y	Young: Recently planted or establishing tree that could be transplanted without specialist equipment, i.e. up to 12 - 14cms stem girth.
S/M	Semi-mature: An established tree but one which has not reached its potential ultimate height and having significant growth potential.
E/M	Early-mature: A tree reaching its ultimate potential height, whose growth rate is slowing down but will still increase in stem diameter and crown spread.
M	Mature: A mature specimen with limited potential for any significant increase in size.
O/M	Over-mature: A senescent or moribund specimen with a limited safe life expectancy. Possibly also containing significant structural defects with associated safety and/or duty of care implications.

Overall condition has been categorised as good, fair, poor or dead.

Good	A healthy specimen with good vigour, form, long life expectancy and no significant defects.
Fair	Tree of average vigour and form. Minor defects may be present but not significant structural stability.
Poor	Tree with low vigour or poor form, significant defects present and/or possible limited life expectancy.
Dead	Tree in a severe state of decline with limited future or dead.

Photographs

Appendix D

Photo 1: previously removed stems

Photo 2: Orientation of the stems

Photo 3: Recently installed Cobra system

Photo 4: Recently installed 4 ton system on top. Previously installed in the bottom indicative of a2 ton system. Note this brace is under high tension. Stump of the recently removed Oak visible to the rear boundary.

Photo 5: Previously failed cobra system partially included at the point of attachment.

Photo 6: The installed braces connecting stems #1 and #3 are connected via a secondary branch on stem #3 with an approx. diameter of 300mm

Photo 7: The secondary branch supporting Stem #1 has been pulled into the adjacent secondary branch lateral with an approx. Diameter <200mm

Photo 8: The secondary branch supporting Stem #1 has been pulled into the adjacent secondary branch lateral with an approx. Diameter <200mm

Photo 9: Incorrectly installed 4 Ton Cobra brace with significant slack in the system note.