

## Internal Memo

**TO:** All Councillors  
**CC:** Acting General Manager  
**FROM:** Director Liveable City  
**DATE:** Monday 18 July 2011  
**SUBJECT:** Laman Street Risk Identification and Management

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Over the past weeks Councillors have received a large amount of documentation relating to the Laman St trees, including memos, meeting minutes and reports. As the measurement and management of risk is a key issue, I have attempted to succinctly summarise Council's approach in this memo.

### Summary

1. Laman Street Hills Fig trees appear healthy however they have severely asymmetric crown form, weak branches and defective linear root plates. Their crown mass is increasing annually and the load born by the defective root plates is therefore increasing. ENSPEC's Dr Ken James believes the trees are growing toward failure (Council Briefing May 2011).
2. An extensive body of research and reporting has been accumulated by Council since 2004. The foundational work was produced by Mr Marsden (2006, 2007, 2009 and 2010) and is supported by the Newcastle Tree Failure Case History. The Quantified Tree Risk Assessments (QTRA) for the Laman Street Hills Fig trees are one of the tools used by Council to understand the risk, but are secondary to the findings of progressively increasing tree instability based on physical analysis, and are not of themselves critical to addressing the tree instability issues in Laman Street. Council's (2010) risk assessment using the Matheny and Clark summation method also identified a high priority for risk mitigation.
3. Since trees are not engineered structures there are no specified service criteria. Council has adopted the safety yardstick for a normal root plate as provided in the research (Mattheck 2003). The Laman Street Hills Fig trees do not have normal root plates and therefore they have a reduced safety factor when compared to this yardstick.

Councils' risk assessment and any alternative risk assessment must have regard for the body of evidence that includes inground excavations showing the lack of support roots, the peer reviewed reporting, the Newcastle Tree Failure Case History and the recent branch failure incident in Laman Street (Memo Director Liveable City 15 July 2011).

### Discussion

1. A synopsis of the findings on the Laman Street Hills Fig trees.

Although the Laman Street Hills Fig trees are generally healthy, the physical evidence shows that they are mechanically defective. The fig trees on the northern side have unrestricted access to sunlight and soil resources from Civic Park that contribute to incremental increase in crown mass, height and width in the direction of the Park, and thus an increase in leverage on defective root plates. The structural root plates must be capable of adaptive

growth to account for the incrementally increasing load however the density of infrastructure and sterile soil conditions in Laman Street limit adaptive growth. The Laman Street Hills Fig trees therefore have a steadily increasing risk of failure.

The fig trees on the southern side have limited light due to competition from the northern trees and a limited area from which to draw soil water and nutrients. In addition to the circumstances affecting the northern trees, the southern trees are impacted by wind turbulence and downdraft from proximity to large building mass. Constant downdraft increases the transpiration rate and the demand for soil moisture and thus further limits load adaptive growth in branches and root plate. Under these circumstances these Hills Fig trees also have a steadily increasing risk of failure.

The extensive body of research and reporting has confirmed that the Laman Street Hills Figs have defective lineal root plates. The following investigations were conducted:

- 2006 trenching adjacent to the Fig trees found no primary woody roots.
- 2009 Ground Penetrating Radar (GPR) investigations suggested root distribution within the road and footway area.
- 2010 additional trenching to confirm the GPR findings found one woody primary root.



Trenching Laman Street Precinct 2010.

The actual time of failure for any of the trees cannot be predicted with any certainty however the likelihood of failure, in weather events of less intensity than the current risk management trigger (mean wind speed >50kph), is increasing.

## 2. Tree Risk Assessment and Management

An extensive body of research and reporting has been accumulated since 2004. The foundational work was produced by Council and Mr Marsden (2006, 2007, 2009 and 2010) and is supported by the Newcastle Tree Failure Case History. The key points are:

- The case book experience with Hills Figs, where the trees have developed lineal root plates that have an history of ongoing root plate severance and damage, is that the trees begin to fail when around 70 years old. The Laman St trees are past this age now.
- That the options for management of the trees by crown thinning or reduction, cabling or bracing are not viable, and lopping the trees back to a size small enough to resist wind throw would be inappropriate, and not recommended by the Australian Standards.
- As the trees with the shortest useful life expectancy will dictate the outcome for the entire group, removal and replacement of the trees as a group will secure the best long-term outcome.

In an attempt to measure level of risk, Council has commissioned three quantified tree risk assessments (QTRA) for the Laman Street Hills Fig trees.

- Mr Simonsen September 2009. In his modified QTRA Mr Simonsen estimated a Probability of Failure (PoF) for the calendar year of 2007 of 2/15 giving a Risk of Harm (RoH) of 1/19.8 during an extraordinary storm event.
- Mr Swain March 2010. An assessment of the risk mitigation strategy involving exclusion of pedestrian and traffic during times of high risk. He estimated a RoH of 1/14400 provided the strategy was maintained.
- Mr Swain July 2010. An assessment of the risk due to breaches of the exclusion strategy. He estimated a RoH of 1/400. He further reported that if parking was allowed in Laman street in wind events >50kp/h, the estimated RoH would be 1/20.

It is noteworthy that Council's current risk mitigation strategy is based on the more recent QTRA's of Mr Swain.

Council has also used the Matheny and Clarke hazard assessment method, having regard for the case history and accumulated technical reports. The assessment identified a high priority for the design and implementation of a risk mitigation strategy for Laman Street. The potential impact of a tree failure in Laman Street is considered severe because the case history shows large trees that failed in 2007 did not get hung up in adjacent trees or buildings. These failures due to defective linear root plates demolished adjacent large fig tree, crushed vehicles and damaged buildings.



Bruce St 2007 Hills Failure due to a defective lineal root plate.

3. The Laman Street Hills Fig trees are not static objects and are not manufactured to engineering specifications. They are dynamic, constantly growing organisms. Rather than repair defects trees lay down new tissue to reinforce overloaded areas. Because trees are generating systems they increase in size annually and so their need for space also increases.  
Trees are self-optimizing structures that survive by adaptive growth and therefore a strict regime of material behaviour cannot be imposed. As such tree managers with a public duty of care must adopt a precautionary approach to assessing risk in trees.

Should you have any further questions on this matter please phone me on 4974 2407 or Council's Manager Infrastructure Management Services, John Johnston on 4974 2610.

**Frank Cordingley**