EARTHQUAKES, TREES AND THE ‘NEW NORMAL’

1 BACKGROUND

In the early morning hours of 4 September 2010, the city of Christchurch, New Zealand experienced a magnitude 7.1 earthquake. Since that first earthquake, Christchurch has experienced a further 7000 aftershocks, including a devastating 6.3 magnitude on 22 February, 2011, and a double impact of a 5.7 followed one hour later by a 6.3 magnitude earthquake on 13 June 2011. The state of the city has been characterised as the ‘new normal’.

2 EARTHQUAKE EFFECT ON TREES

» Damage to trees was substantial. Many trees were deemed unsafe and were removed, while hundreds more are being monitored by Christchurch City Council.

» Some damage was direct and highly visible, (image 3) while other issues are likely to manifest from wide-spread liquefaction.

» Direct damage includes: Limb/stem snapping due to violent shaking; and damage to structural roots resulting in leaning trees and tipups (image 1,2).

» Indirect damage is related to liquefaction (image 4).

3 WHAT IS LIQUEFACTION?

» During violent shaking, sandy soil particles realign and settle in a more compacted manner, reducing the pore volume.

» This subsidence squeezes water out of pores and upwards towards the soil surface.

» Sand volcanoes eject sand upwards, where it is deposited onto the surface (image 4).

» The resulting soil profile is stratified comprising a settled, compacted lower layer and a loose upper layer.

» Changes in soil properties may affect hydrology, aeration, and soil chemistry.

» Effects on root development and function are likely.

4 A CASE STUDY: MCHAFFIES RESERVE

» This small reserve contains 13 large Eucalyptus trees, ranging in DBH from 50 cm to 175 cm.

» Site is characterised by substantial liquefaction.

» Depth of loose sand deposited by sand volcanoes was measured and an interpolated surface was modelled showing the extent and depth of the deposition (see map 1).

» In some areas, 45cm of loose sand was deposited over the subsided original grade (image 4).

» How will the Eucalyptus trees respond to the drastically modified soil environment?

5 WHAT’S NEXT?

» Christchurch City Council staff continue to monitor trees.

» University of Canterbury hopes to continue forming collaborations with other research institutions to fully understand earthquake effects on trees.

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Dr. Morgenroth wishes to acknowledge Christchurch City Council staff Tony Armstrong, Dieter Steinegg, and Jonathan Hansen for their support.

Many thanks to Kat Morgenroth for designing this poster.