

Senior Planning Advisor
Nelson City Council
PO Box 645
Nelson 7040

Attention: Sharon Flood

Dear Sharon

Desk-top assessment of the liquefaction hazard at 'The Glen', Nelson

1 Introduction

This report has been prepared to assist Nelson City Council (NCC) in setting planning policy with respect to the potential liquefaction hazard at 'The Glen', Nelson, in accordance with your instructions.

2 Scope of work

This work has been carried out under Tonkin & Taylor's (T&T) existing agreement to investigate the potential liquefaction hazard at Tahunanui dated 28 February 2013. Your email (email: Flood-Lovell dated 21 April) provides authority to proceed, and outlines the scope of the work.

The scope of work includes:

- A desk-top assessment of the liquefaction potential for any previously investigated sites on the flat land near residential area at The Glen.
- Inferring the likely liquefaction potential around the residential area at The Glen based on the above information.
- Comparison of the inferred liquefaction potential at The Glen with that previously reported at Tahunanui.

2.1 Liquefaction

2.1.1 Previous liquefaction assessments

T&T have previously carried out a geotechnical investigation and liquefaction assessment for a site (henceforth referred to as the 'Site') located on recent alluvial and estuarine sediments to the south of the boulder bank, approximately 1.5 km to the east of the residential area at The Glen. This is the closest liquefaction assessment that T&T are aware of to The Glen.

Those investigations indicated that the ground conditions shown in Table 1 were consistent across the Site:



Table 1: Summary ground conditions

Soil	Depth (m)	Strength	Comments / Origin
Topsoil	0 - 0.6 m	Soft to firm	N/A
silty CLAY	0.6 – 2 m	firm to stiff	Alluvium
silty CLAY	2 - 3 m depth	Soft to firm	Alluvium
Clayey SILT/SILT	3 - > 20m depth	Soft to firm	Contained occasional thin lenses of silty sand

The following is a summary of the main conclusions with respect to liquefaction at the Site.

- There is a low risk of liquefaction at the Site,
- The ground conditions appear generally uniform consisting of soft to firm clays and silts up to and in excess of 20 m depth,
- The majority of the materials encountered are non-liquefiable, displaying a degree of plasticity that would resist liquefaction under seismic shaking,
- Though there is a low risk of liquefaction at the Site, ground settlement due to consolidation of weak soils under building loads can be expected,
- Groundwater was encountered at approximately 2 m depth below ground level (bgl).

With respect to the soil layers that were predicted to liquefy under seismic shaking,

- The thin lenses of silty sand encountered at between 5 m and 8 m depth are potentially liquefiable in a large 1 in 500 year (Ultimate Limit State) earthquake. These lenses are generally less than 0.1 m thick and not continuous across the site. If they did liquefy in a large earthquake, they would be unlikely to pose a liquefaction risk to surface structures.

2.1.2 Subsurface conditions at The Glen

We make the following conclusions with regards to the liquefaction potential on the flat land at The Glen, Nelson.

- Based on mapped geology (Dun Mountain, 1:50,000, DSIR, 1981), the flat land at The Glen is likely to be underlain by a mixture of marine sand and gravel, and alluvial and estuarine sediments comprising very poorly sorted fine-grained gravel, clay and silt that infill's the area to the south-east of the boulder bank, as is the case at the Site.
- Local topography at The Glen indicates that these sediments are likely to inter-finger with colluvial fans formed by erosion and instability of the slopes to the north-east.
- Due to the proximity to The Glen to sloping land, it is possible that the groundwater table is shallower than that at the Site, and perched groundwater may be present in any colluvial fans.
- The active Flaxmore Fault is inferred to pass directly beneath The Glen. Earthquakes generated on this fault are likely to produce very high levels of seismic shaking at The Glen.

3 Conclusions and recommendations

Recommendations and opinions in this report are based on a liquefaction assessment carried out at a Site remote from the subject study area, and a review of published geological mapping at The Glen. The nature and continuity of sub-surface conditions is inferred and it must be appreciated that actual conditions may vary from the assumed model.

3.1 Assessment of liquefaction potential at The Glen

The following conclusions are based on an assumption that subsurface conditions at The Glen are the same as at the Site.

- There is likely to be a generally low risk of liquefaction at The Glen,
- These soils are likely to be weak, and some settlement of soils under building loads can be predicted,
- Some damage to buildings and foundations could be anticipated in an Ultimate Limit State (ULS – 1 in 500 year event). However, this would be due to a strength reduction in already weak surficial soils rather than liquefaction,
- Locally liquefiable soils will be present and localised liquefaction effects will be evident following a large earthquake.

3.2 Comparison with Tahunanui liquefaction potential

As stated above, you have requested that we compare the inferred liquefaction potential at The Glen with that previously reported at Tahunanui. T&T have previously carried out a two stage assessment of the liquefaction potential at Tahunanui covered by the following reporting:

- 'Tahunanui Area Liquefaction Assessment' dated November 2013 (T&T ref 871023),
- 'Tahunanui Liquefaction Assessment Stage 2 – Assessment of Eastern Margin' dated September 2014 (T&T ref 871023).

The reports above concluded that in a ULS seismic event, moderate to severe liquefaction damage could be anticipated in the area to the west of Muritai Street at Tahunanui, and vertical settlements in the order of 100 – 300 mm.

Liquefaction analyses carried out at the Site (to the south of The Glen) indicate that there will be little to no surface effects due liquefaction in a ULS event, and no vertical settlement of soil due to liquefaction. We anticipate that this will also generally be the case at The Glen. However there is likely to be some localised moderate liquefaction effects. Site specific subsurface testing would be required to verify the extent of localised liquefaction effects.

4 Applicability

This report has been prepared for the benefit of Nelson City Council Senior Planning Advisor with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

Yours sincerely



Mark Foley
Project Director

Report prepared by Marcus Lovell, Senior Engineering Geologist

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