

# Slope hazard susceptibility assessment

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## Summary

The Christchurch City Council engaged Tonkin & Taylor Limited to prepare a slope hazard susceptibility assessment and report for the eight settlement study areas in the Akaroa Harbour Basin. The final report includes landslide susceptibility zoning maps at a scale suitable for long-term strategic planning of the settlements.

## Methodology

Using historic and recent aerial photographs, contours maps, field checks and the existing knowledge of slope instability, various factors have been brought together to identify and classify slope hazard susceptibility zones. These factors include:

- Geology,
- Slope angle and aspect;
- The distribution of existing instability; and
- Hydrological conditions.

Vegetation cover is not included as a consideration and all susceptibility is considered as if the slopes are typical farm pasture, or cleared for development.

The report splits the eight settlement study areas into identifiable areas and each area is classified by the relevant factors that contribute to slope instability. A total of 440 separately identified locations have been established. These are assessed and classified in terms of their susceptibility to instability.

## Land instability assessment findings

Future instability will be subject to natural trigger events (rainfall and earthquakes) and potentially exacerbated by human development. The report identifies several types of historic slope instability or slope hazards:

- *Bedrock landslides*: large to very large ancient and generally inactive bedrock failures between approximately 10 to 50m below the ground surface.
- *Active gullies*: areas prone to tunnel erosion, surface erosion and small to medium scale landslides
- *Large loess/bedrock landslides*: landslides moving at depths of 5 to 15m, or near the interface between loess (wind-blown silt deposits) and weathered bedrock.

The role of bedrock landslides in slope instability is uncertain. These have been mapped separately as an additional layer to indicate that these add complexity to the slope and the potential for slope movements. Both active gullies and the large loess/bedrock landslides are factored into slope hazard zoning. Active gully and large landslide activity is expected to continue into the future in a similar manner to the recent past.

In all, four slope instability hazard zones were identified within the settlement study areas:

- *Minor-negligible* (generally valley floors and some gentle ridge crests)
- *Intermediate* (gentle slopes, or valley floors where debris run-out is likely)
- *Locally significant* (primarily active gullies)
- *Significant* (existing large bedrock/loess landslides)

A higher susceptibility zone indicates relatively greater difficulty (and therefore cost) for development. The long term risk (and cost) to Council of providing reticulated services and access is also likely to be proportionally greater for higher susceptibility zones. It is important to note that there is not necessarily a direct relationship between general susceptibility zoning and the ability to develop on any given site and this information should not be used alone to reach final decisions on resource consent or building consent applications for these areas.

The report also identifies areas where liquefaction is 'possible', based on expert knowledge and judgement from elsewhere. These areas are generally located on valley floors, adjacent to the coast where 'mudflat' type sediments are likely to occur, and/or in areas of landfill/reclamation. No areas were identified as having 'likely' liquefaction potential.

### ***Mapping***

The following maps are provided with the report. All data used to inform preparation of these maps is provided in appended figures and tables.

- Settlement locations and large landslides (1:50,000);
- Settlement locations and active gullies (1:50,000);
- Slope Hazard Susceptibility Zoning by settlement (1:10,000)
- Liquefaction Potential by settlement (1:10,000)

### ***Implications for Settlements***

Some settlements have greater areas of 'negligible-minor' susceptibility than others. Settlements with significant pockets of this ranking and which are not otherwise constrained by: (a) being subject to bedrock landslide, (b) being subject to possible liquefaction and/or (c) already significantly taken up for urban development, are:

- Large contiguous areas:
  - Wainui;
  - French Farm;
  - Duvauchelle
- Moderate sized pockets:
  - Barrys Bay;
  - Robinsons Bay; and
  - Takamatua.

Tikao Bay and Akaroa have very little land which is not subject to the above constraints. However, there is also a significant amount of 'intermediate susceptibility' land in all study areas (particularly Wainui, Duvauchelle, Takamatua and Akaroa) which may be suitable for urban consolidation in respect of slope stability issues following further more detailed study and cost assessments.