



# Natural Hazards



## NATURAL HAZARDS

Natural hazards are defined as natural phenomena that pose a threat to human activity. In most cases we cannot control or contain natural hazards and the effects of the hazards are often worsened because of our patterns of settlement and land use.

The natural hazards likely to put life or property at risk in Marlborough are flooding, earthquakes and drought. Development pressures on the Wairau Plain for both residential development and viticulture mean that considerable assets are at risk from major floods. Development pressures in this area and the southern part of the district are also vulnerable to drought. Similarly considerable assets and human life are at risk from being located within the zone of highest earthquake risk in New Zealand.

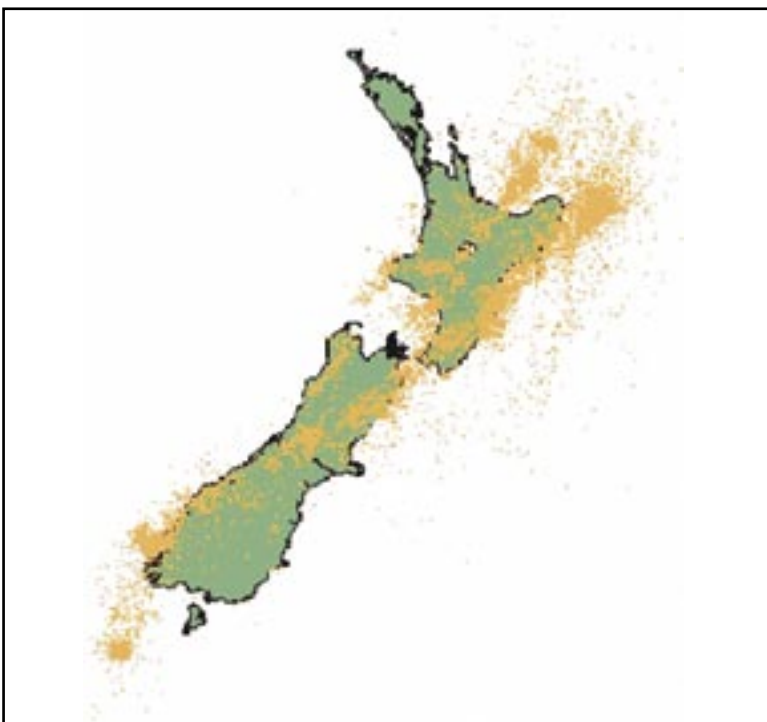
The fact that natural hazard episodes are few and far between, however, makes it easy for us to put the thought of such events out of our minds. It is therefore important that new development proposals seriously question the potential of natural hazards. For existing development, risk assessment is still important in managing natural hazards, as shown by the major flood event that occurred in Picton and Waikawa in February 2004.

While some considerable knowledge has been gathered over time in relation to flooding on the Wairau Plain, there are other natural hazards that are not as well understood. Work is continuing on filling these gaps in information, which will provide a more complete picture of the natural hazards that may affect Marlborough, as well as the degree of risk posed to the district.

## SEISMIC INVESTIGATIONS

Further investigations on seismic hazards have been undertaken as part of ongoing research to identify the extent of hazard risk to the Marlborough community. (The 'avoidance or mitigation of natural hazards' is one of the functions of the

*Shallow quakes over the last 10 years (IGNS)*



Council under the Resource Management Act 1991.) Seismic hazard is a top ranked hazard in terms of the School of Earth Sciences (Victoria University) 1999 scoping report prepared for the Council. Prior to the publication of this report there had been little active investigation into seismicity in Marlborough.

The first phase of the Council's seismic hazard investigations gathered information on the main known active faults in Marlborough, including the Wairau section of the Alpine Fault. The Wairau section of the Alpine Fault was identified as presenting the highest potential seismic hazard risk for Marlborough.

These initial investigations had concluded that an earthquake on the Wairau section of the Alpine Fault would have very serious consequences including direct ground rupture at the fault trace, strong earthquake shaking, with impacts all over the district, liquefaction in areas such as the lower Wairau valley, and other secondary effects such as landslides.



## HIGH RISK

The hazard presented by this fault was considered higher than any other in the district because:

- the active fault trace is located in the middle of the densely populated, and rapidly developing, lower and middle Wairau Valley. The fault trace passes through parts of west Renwick, and is projected to pass at depth under Blenheim.
- ground displacement at the fault trace in the next earthquake is expected to be 3.4 - 6.6m, and will be associated with a large earthquake with widespread shaking effects.
- previous research suggests that there may be a relatively high likelihood of a future fault rupture within the next 50 - 100 years.

The next stage of the investigations, was aimed at establishing reliable estimates of the timing of the most recent earthquake rupture on the Wairau section of the Alpine Fault. Paleoseismic trench investigations were consequently undertaken on a section of the fault at a site 4km west of Renwick. From these investigations, there is radiocarbon evidence of one rupture event prior to 1000 AD but the most recent rupture has occurred in the last 500 years.

This result was unexpected because the closest previous paleoseismic investigations near Wairau Valley township concluded that there had been no rupture of the Wairau section of the fault in that area for at least 1000 years, and probably longer. The new results suggest that the earthquake rupture event in the last 500 years near Renwick has either been missed in the previous trenches, or that the Wairau section of the Alpine Fault may have a more complex rupture segmentation pattern than has been previously recognized. The new result also suggests that both the amount of elastic strain stored at the fault, and the likelihood of the next earthquake rupture, may be lower than was previously thought.

Further paleoseismic work is recommended to provide a better understanding of the level of future earthquake hazard associated with the Wairau section of the Alpine Fault.

*Photo - top left: Buried wood sample from trenching work that is ideal for radiocarbon dating to provide an age estimate of the grey sediment that encloses it*



*Photo - bottom left: View during trench excavation, looking north across the fault zone ( grey brown clay) to the abrupt change to blue grey unfaulted gravel*



*Dublin Street, Picton*

## **FEBRUARY 2004 FLOOD EVENT**

On the morning of 17 February 2004, an extremely large, very localised and totally unpredicted rainfall event, struck the catchments of the Waitohi and Waikawa Streams in Picton and the Graham River in Whatamango Bay. Extreme rainfall fell over an intense two hour period. The resulting flood flows were the largest ever recorded in the Picton area and were far in excess of the design estimates for the three main waterways affected. Over a one hour period 62 mm were recorded, which is amongst the highest ever recorded in the South Island (even for areas like Milford Sound and Haast), and only bettered in New Zealand by occasional tropical downpours in Northland. This deluge caused 'flash flooding' in Waitohi and Waikawa Streams and in the Graham River.

*Waitohi Stream at Alexander's Holiday Park*





## WAITOHI STREAM

The Waitohi Stream, carrying a lot of logs and debris from the steep Essons Valley catchment, overtopped at Alexander's Holiday Park affecting the camp and some houses in Canterbury Street. Major culverts running underground from Waitohi Domain to the Edwin Fox area could not handle the flow produced.

Initially the Kent Street drain, and then the purpose-designed overflow area within Waitohi Domain, coped with the flood flows but very quickly the 50 year return period design storage volume was exceeded. Floodwaters then inundated the area bounded by Broadway, Kent Street, Market Street and Dublin Street. Floodwater became ponded up to 0.7m deep in the commercial/industrial area surrounding Dublin St.

The main sewer pump station in Dublin Street failed, when the floodwater level rose above the main switches within the station. Sewage overflows then occurred in that area and upstream.

*Waitohi Stream at Alexander's Holiday Park*



## WATER SUPPLY DAMS

Further up the catchment the two water supply dams (Barnes and Humphries) were also significantly overtopped during the rainfall event because the normal spillway capacity was exceeded. There were some concerns about the possibility of dam failure because of scour around dam abutments or from a sudden landslide into the full reservoirs. This resulted in a precautionary evacuation of low-lying areas in Picton. The dams have since undergone engineering investigation and have been deemed to be safe.

*Floodwaters overtopping dam headwall*



## WAIKAWA STREAM

The Waikawa Stream catchment experienced some of the highest rainfall intensities of the event. Most of the flood flow passed through the lower parts of the system without overtopping significantly. The remaining floodwaters flowed over the Beach Road reserve and then down Beach Road to discharge into the marina area. The Beach Road Reserve and Beach Road had been specifically designed to act as an emergency overflow path.

*Waikawa Stream*

## GRAHAM RIVER

The Graham River, in Whatamango Bay, experienced extreme flooding and debris flows during the event. The River is not protected by floodworks and escaped its banks across a wide floodplain and overtopped the road. A caravan parked

within the floodway was washed away but the only dwelling within the floodway was raised high enough to avoid being damaged.

## CIVIL DEFENCE EMERGENCY

When emergency managers evaluated the risk of dam failure, the resulting evacuation of people from homes, schools, a motor camp and businesses and associated roadblocks, along with security measures, etc, led to a State of Civil Defence Emergency being declared. At the height of the emergency, and largely in response to the evacuation of people from the floodplain downstream of the water supply dams, approximately 1000 people had been evacuated.

Later in the day, once the concerns about the safety of the dams had been addressed, the majority of those who had been evacuated were allowed to return home. Evacuees who lived in properties that had been inundated by floodwaters and possibly contaminated by sewage in the area bordered by Broadway, Market Street, Dublin Street and Kent Street, were not allowed to return home until the Council's building inspectors had assessed the sanitary condition of their homes.

*Floodwaters*

The Civil Defence Emergency was left in place until 4.15 pm the following day as a precaution against a further adverse weather event or other unexpected problems.





*Repairs to Waikawa Stream bank*

In the interim an emergency pump was set up to discharge sewage directly into Waitohi Stream. The bacterial levels in Picton Harbour were obviously very high as a consequence, with bathing and shellfish gathering being banned for some time. Bathing and shellfish bans in Waikawa Bay were also put in place, as although sewage contamination was not evident, the floodwaters pouring into the Bay were heavily laden with silt.

Seven residential properties were deemed unsanitary because of being inundated by water contaminated with sewage. They were declared uninhabitable until they had been cleaned up. This ranged from simple measures such as disinfection, through to much more extensive work such as replacement of carpets, wallboards, flooring and furnishings depending on the extent of inundation experienced.

The Waitohi Domain, which is a designed flood retention area, also became subject to sewage contamination from the failed Dublin Street sewage pump station. This area needed to be cleaned up and was only reopened following a process that involved removing visible solids (mud, silt) by scraping, scarifying, lime treatment for disinfection and being closed for 13 days to allow UV light disinfection.

The rainfall also affected roads in the area with extensive damage occurring to the Port Underwood Road.

Welfare efforts started early in the emergency with the evacuations, and continued for some time afterwards as cases of hardship, homelessness or health impediments, were dealt with. The Picton and wider Marlborough communities were very generous in helping in the clean-up after the floods.

*Waitohi Domain in centre of picture and flooded industrial area*

## CLEAN-UP

The Dublin Street pump station, which receives all of Picton's and Waikawa's sewage, failed when floodwaters rose to such an extent, and so quickly, that the main switchboard became inundated and shut down the station. Repair works were carried out as soon as floodwaters receded sufficiently. A replacement switchboard was installed and the pumps were running by mid evening.



## FUTURE FLOOD EVENTS

The 17 February flood event was by far the largest recorded event for the Waitohi and Waikawa Streams and the Graham River. The return period for river flows of such magnitude has been difficult to accurately quantify but has been estimated to be in excess of 200 years. This estimate has been based upon gathering extensive river channel cross-section information and flood level data in the days following the flood peak. The debris left by floodwaters allow a reasonably accurate flood level to be measured. Using these data with cross-

section information, provides the basis for the hydraulic calculations to estimate flood flows.

This event and other extreme rainfall events occurring throughout the country may be indicative of the suggested future changes in the intensity and frequency of rainfall events. The implications of future changes in weather are being considered when assessing and designing waterway systems in Marlborough.



*Large landslide - Awatere Valley*

## REFERENCES

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