Lahars from Mount Ruapehu — mitigation and management

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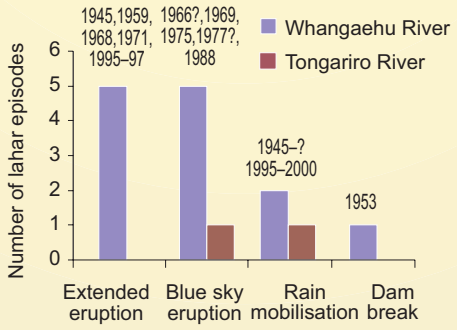
Mount Ruapehu and Crater Lake

Mt Ruapehu (2797 m) is a composite andesite strato-volcano in the central North Island of New Zealand. It is the largest and most active of the three volcanoes of Tongariro National Park World Heritage Area, and has a crater lake (10^7 m^3) and glaciers.

Lahars from Crater Lake are a significant hazard on the volcano and in its draining valleys and surrounding plains. They threaten New Zealand's largest ski area and nationally important infrastructure.



Numbers of different lahar-producing episodes since 1945

What is the current lahar hazard?

At least 13 lahar episodes have occurred since 1945, most directly associated with an eruption. One (1953) was triggered later by dam-break. Rim collapse, glacier burst or rain are other known triggers. There have been no useful precursors for many of these lahars.

Following eruptions in 1995–96, a dam-break lahar was predicted, and a process to assess risk and develop mitigation measures was initiated.

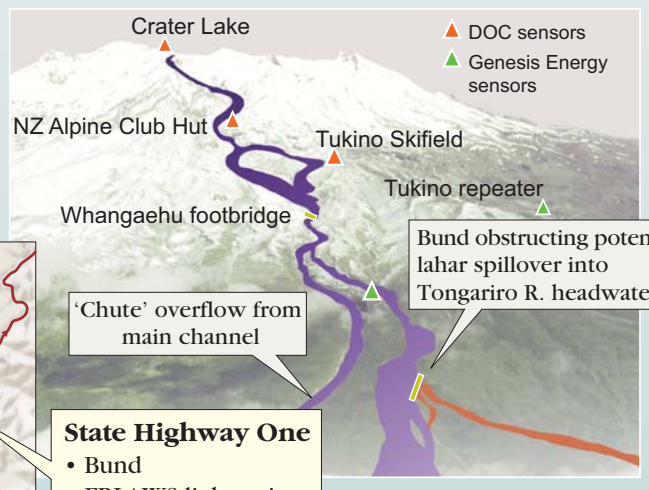
What has been done?

- A public consultation process with scientific input and risk assessments was carried out.
- A sequence of decisions have been made to reduce risks to manageable residual levels.
- Reliable early warning and emergency response systems have been set up (ERLAWS and EDS).
- A bund to prevent overflow from the Whangaehu lahar path into the Tongariro River headwaters has been constructed.
- Some utility companies have made changes to their assets so that they can withstand lahars, or are isolated from them.
- The Minister of Conservation decided that there would be no intervention at Crater Lake, as engineering at the outlet would provide a short-term solution to only one lahar problem.
- Crater rim deformation is regularly surveyed.

Herb Christophers

Automatic lights are installed on State Highways 1 and 49.

State Highway 49 bridge being raised and strengthened.



Eastern side of Ruapehu with lahar sensor sites and bund

Whakapapa ski area
- Eruption Detection System
- Improved staff training
- Public awareness campaign

Whangaehu Valley
- Raised footbridge
- Signage

Crater monitoring
- Lake, dam and rim
- Volcano (GNS science)

Tangiwai
- Close visitor area
- Highway bridge raised
- ERLAWS gates and lights
- Traffic control
- Train alarm and control
- Agency integration
- Pine harvest upstream

State Highway One
- Bund
- ERLAWS lights, signs
- Traffic control

Aqueduct site
- Extra survey work
- Checks on the day

Others roads and bridges
- Individual notification
- ERLAWS lights and signs

Flood tower
- Rail warning system
- Horizons web cam

The 300-m-long bund under construction

Department of Conservation
Te Papa Atawhai

How large might this lahar be?

Several estimations of lahar size have been made. Uncertainties include the role of glacier ice, dam-break dynamics and variation in debris content.

Dam-break and 1-D hydraulic models estimate lahar flow-rate 40 km downstream of lake to be double that of the 1953 lahar.

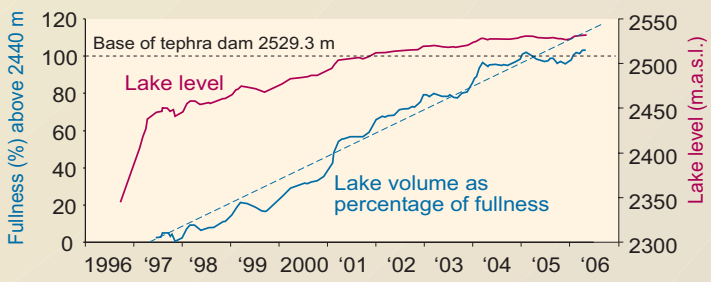
Granular flow model combined with paleohydraulic analysis of the 1953 event using Clarke's glacier burst model suggests flow-rate at 40 km will be similar to 1953.

Auckland Star

Tangiwai rail disaster caused by bridge collapse during dam-break lahar in 1953.

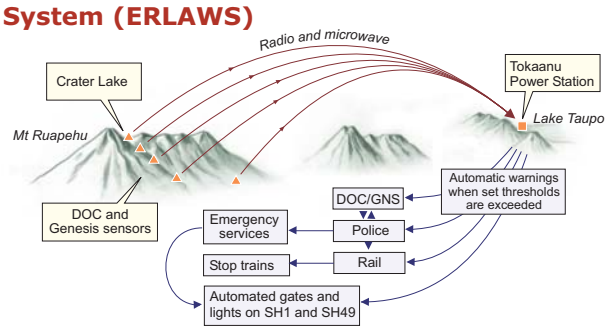
Conclusions

The current management solutions reduce lahar risks to very low levels off, and adequate levels on Mt Ruapehu. However, Crater Lake may be reaching an equilibrium fluctuating about the former overflow level, i.e. the base of the tephra dam.



This means that dam collapse may be some way off and raises the question of what are appropriate levels of readiness for the longer term and how they should be sustained. Long-term solutions are needed for managing the risks associated with this very active volcano.

Eastern Ruapehu Lahar Alarm and Warning System (ERLAWS)



- Sensors linked to acoustic flow monitors installed at three sites in upper Whangaehu lahar path.
- Data from 8 sites telemetered to Tokaanu Power Station and displayed via the internet in near real-time.
- Alarms automatically sent to police, rail and road authorities and other agencies; plus automatic barrier arms at highway bridge, and flashing lights and signs.
- Agencies have developed an integrated response plan. Rail and power companies have additional sensors and alarm systems.

More at www.doc.govt.nz/whats new/issues

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