



# Lahars from Mt Ruapehu



## Tongariro/Taupo

Mount Ruapehu in the central North Island is the largest and most active of the three volcanoes of Tongariro National Park World Heritage Area. It is a composite andesite strato-volcano with a large crater lake near the summit and glaciers on its upper flanks.

Lahars from the Mount Ruapehu crater lake are a significant hazard on the volcano and in the draining valleys and surrounding plains. They threaten New Zealand's largest ski area as well as nationally important

### What is a lahar?

Lahar is an Indonesian word that refers to a rapidly flowing mixture of rock debris and water (other than normal water flows) originating from a volcano. Large lahars can present a significant natural hazard. When they overflow their channels they can destroy, erode or bury obstacles in their path.

There are various kinds of lahar. A debris-flow lahar contains large amounts of sediment of varying size (from small particles to boulders) and flows like a thick slurry. A hyperconcentrated-flow lahar contains less sediment (mainly sand-sized particles or smaller) and flows like a thin slurry. Management precautions for the predicted Mt Ruapehu crater lake lahar are based on a debris-flow lahar that downsizes into a hyperconcentrated flow.

### Are lahars common?

Lahars are a well-known hazard on Mount Ruapehu. The combination of a large volume of water (10 million cubic metres in the crater lake) poised at about 2500 metres above the surrounding terrain high on top of an active volcano constitutes a potentially hazardous situation should the volcano erupt or crater rim fail.

At least 13 lahar episodes have occurred since 1945, most directly associated with a volcanic eruption. The latest occurred during the 1997 eruption, but the most deadly was in 1953 leading to the Tangiwai railway disaster. The 1953 lahar was the most hazardous in the last century, but much larger lahars in the Whangaehu occurred in the previous 400–850 years.

Ruapehu lahar debris from the 1995 eruption  
K. Williams



Ice cliff at crater lake Harry J. R. Keys



## Lahars and the landscape

Lahars have played a considerable role, over many thousands of years, in shaping the outstanding landscapes and biodiversity of Tongariro National Park. The biodiversity of the Whangaehu outwash fan and the Rangipo Desert, which includes tussock shrublands, gravel fields and stone fields, depends in part on disturbance by natural large lahars.

## What causes lahars on Mt Ruapehu?

Most Ruapehu lahars recorded since 1861 have been triggered by eruptions that have ejected water from the crater lake. However, lahars can also be triggered by a collapse of part of the rim of a crater lake, with or without an eruption. The lahar in 1953 was triggered by the collapse of a barrier of lava, tephra (ash) and ice in the former outlet of the lake. Other triggers include heavy rain on volcanic deposits or glacier bursts. Many of the lahars that have occurred on Mount Ruapehu have had no known precursor.

## Where and how big?

The next lahar could be generated by a dam-break from the deposits of the 1995–96 eruption or by another eruption. There are recent lahar paths on all sides of the mountain, but the most active path by far is the one down the Whangaehu Valley on the eastern side. The Whangaehu lahar path is one of the most active in the world.

Several estimates of size of the dam-break lahar have been made. Uncertainties include the role of glacier ice, dam-break dynamics and variation in debris content. Dam-break and hydraulic models estimate that the lahar flow-rate 40 kilometres downstream of the lake could be double the rate of the 1953 lahar. Other models suggest that the flow-rate will be similar to the 1953 event. Such a lahar would flow down the Whangaehu Valley.

Historically most eruption lahars have been smaller or similar sized to the 1953 event but prehistoric lahars have been much larger.

## What has been done to prevent future damage?

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

- A public consultation process has been carried out with scientific input and risk assessments.
- Reliable early warning and emergency response systems have been set up. Sensors have been installed in the upper lahar path, and in the event of a lahar alarms are automatically sent to police, rail and road authorities and other agencies. This

system should give at least 40 minutes warning of a lahar at the Desert Road and two hours' warning at Tangiwai. This alarm system is called the Eastern Ruapehu Lahar Alarm Warning System (ERLAWS).

- Long-term and ongoing monitoring of the crater lake levels has been established so that we should now have several weeks to months advance notice of when we need to be on increased alert. Automatic barrier arms have been installed at highway bridges, as well as flashing lights and warning signs.
- A 'bund' (stopbank) has been constructed to prevent overflow from the Whangaehu lahar path into the Tongariro River headwaters.
- Most utility companies have made changes to their assets so that they can withstand (or are isolated from) lahars. In particular the SH 49 bridge at Tangiwai has been raised and strengthened.
- One engineering option that has been publicly discussed is to bulldoze a trench to channel a lahar spill-over. However, the Minister of Conservation decided that there would be no intervention at the crater lake, as engineering at the outlet would provide a short-term solution and would only address the risk of a lahar from one known location of weakness at the crater lake's rim. It is not possible to confidently identify all weak areas of the crater rim.
- Changes in the shape of the crater rim are regularly surveyed.

The current management solutions reduce the lahar risks to very low levels surrounding Mount Ruapehu. However, recent evidence suggests that the risk of dam collapse may be some years away. This suggests that we need to consider long-term solutions to manage the risks associated with this active volcano.

## Further information

For more information about lahars at Mt Ruapehu, contact the Turangi Department of Conservation office (phone 07 386 8607) or visit [www.doc.govt.nz](http://www.doc.govt.nz)



H. Christophers



Lahar alarm warning equipment H. Christophers



Mt Ruapehu in eruption Harry J. R. Keys