



# Charles Creek Debris Flow Mitigation Structure

## Geographical location

South of Lions Bay, British Columbia

## When it began or was completed

Investigation began in 1982; mitigation structure was completed in 1985.

## Why a Canadian geotechnical achievement?

Catastrophic and damaging debris flows have occurred on Charles Creek in 1969, 1972, 1981, and two in 1983. They damaged and destroyed Highway 99 (Sea-to-Sky Highway), a number of subdivision road bridges, a rail bridge and several houses with some loss of life. To mitigate against future events a debris flow mitigation structure, the first of its kind in Canada, was designed and constructed. The mitigation structure includes a zoned earthfill dam with a concrete exterior designed to contain approximately 33,000 m<sup>3</sup> of debris, a decant structure and a spillway. The unique decant structure was designed to stop logs and boulders up to 2 m in diameter traveling at 7 m/s, while allowing water to pass. The structure was designed to retain water should the decant structure plug. The spillway was designed to accommodate a flow of 700 m<sup>3</sup>/s.

Subsequent debris flows occurred in 1990, 1991, 1995, 2005, 2007, 2009, 2010, with volumes estimated up to 25,000 m<sup>3</sup>. After each major debris flow, as intended, the debris was physically removed from behind the structure.

Given the close proximity of Highway 99, the railway and houses, the construction of this mitigation structure has considerably reduced economic losses. Given the previous loss of life from past events, the mitigation structure has very likely saved lives.

The mitigation structure is owned and maintained by the BC Ministry of Transportation and Infrastructure.

## Submitted by

Paul Wilson (Thurber Engineering)

## Key Reference

Blais-Stevens A and Hungr, O. 2007. **Landslide Hazards and their Mitigation along the Sea to Sky Corridor, British Columbia**. 4th Annual Canadian Hazards and Risk Network Symposium.

Price, J. 1986. **Debris Torrent Control Facilities (Vancouver BC, Canada)**, IABSE Structures, C-38/86, International Association for Bridge and Structural Engineering Periodica, Vol 3, pp 60-61.

## Photographs



Aerial view of Charles Creek mitigation structure.



Structure after 2009 debris flow, and before debris was removed (for scale, the width of spillway opening is ~8 m).