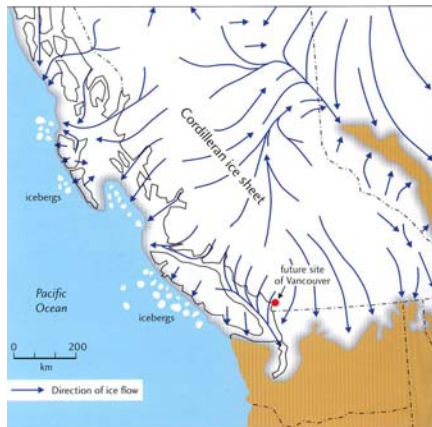
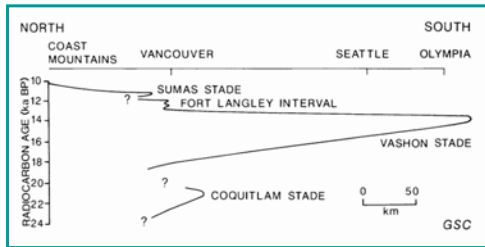


## Landslide and erosion problems in glacio-fluvial soil escarpments, Greater Vancouver

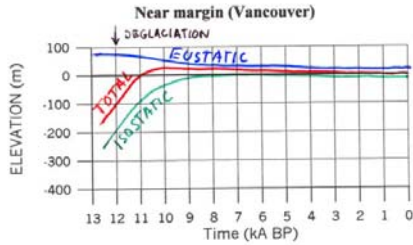
*Oldrich Hungr, Geological Engineering, UBC*



**15 000 years ago, Vancouver was covered by as much as 2 km of ice**



Glacier retreat

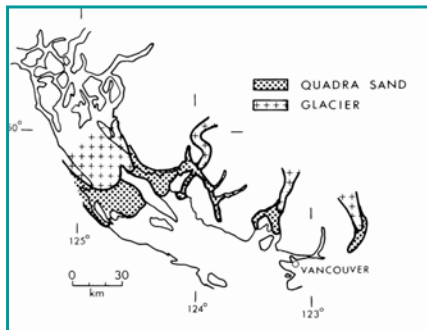


Deglaciation 11 000 years ago

The unloaded land rose by ~100 m relative to the sea level

- Elevation relative to the present sea level
- Eustatic sea level depression

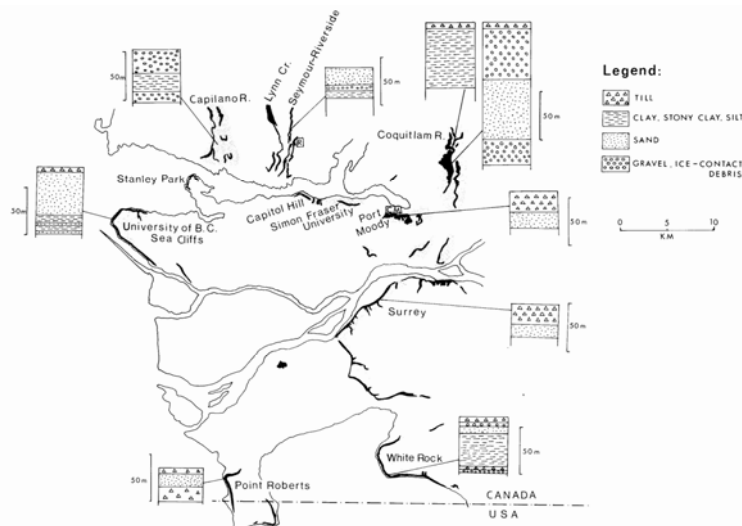
Meltwater deposited large quantities of sand and gravel in front of the glacier fronts. The sand deposits were raised ~100 m high to form glacio-fluvial terraces (“uplands”)



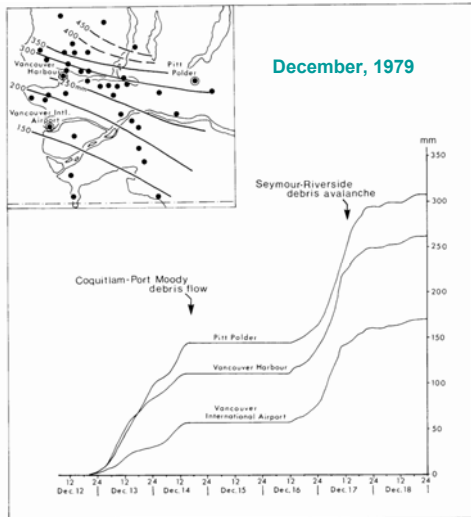
## Glacio-fluvial uplands in Greater Vancouver



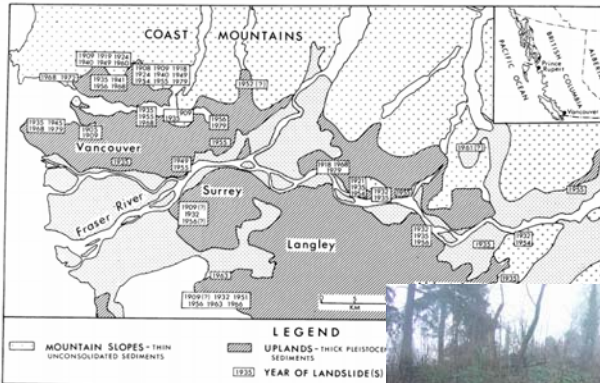
## Sand and Gravel Escarpments



Reference: Eisbacher, G.H. and Clague, J.J., 1981, Urban landslides in the vicinity of Vancouver, B.C., with special reference to the December, 1979 rainstorm. Canadian Geotechnical Journal, 1\*:205-216



**Rain!**



**Landslides!**

**January 19, 2005,  
 Spanish Banks**

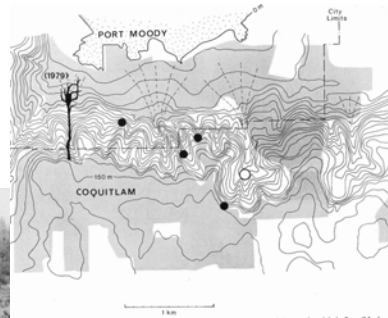




December 17, 1979  
Riverside Drive



December 14, 1979,  
Port Moody



December, 1981, White Rock



c 1990  
Chilliwack

# DEADLY MUDSLID



**FORCE OF NATURE**  
Woman and husband survive slide

**HOW IT HAPPENED**  
Understand the mudslide

**AROUND THE AREA**  
Havoc on the road

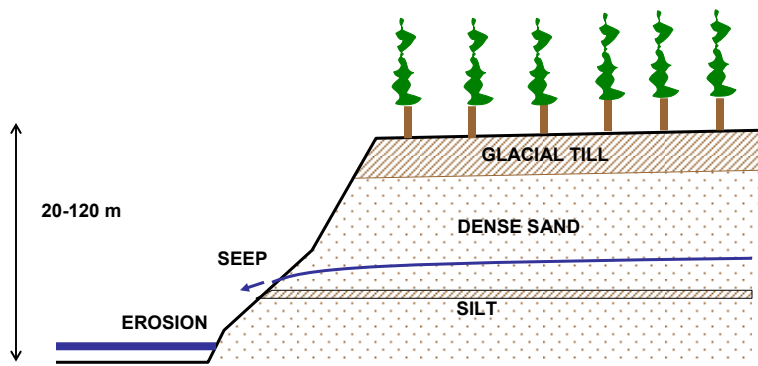
**BY WILLIAM...**  
A mudslide, similar to the one that hit North Vancouver last week, is the deadliest mudslide in the province's history. The mudslide, which hit the area on Monday, killed a woman and her husband. The mudslide was the deadliest in the province's history. The mudslide was the deadliest in the province's history. The mudslide was the deadliest in the province's history.

This aerial view shows the mudslide that slammed into two homes in North Vancouver last week, leaving one woman dead and a man critically injured.

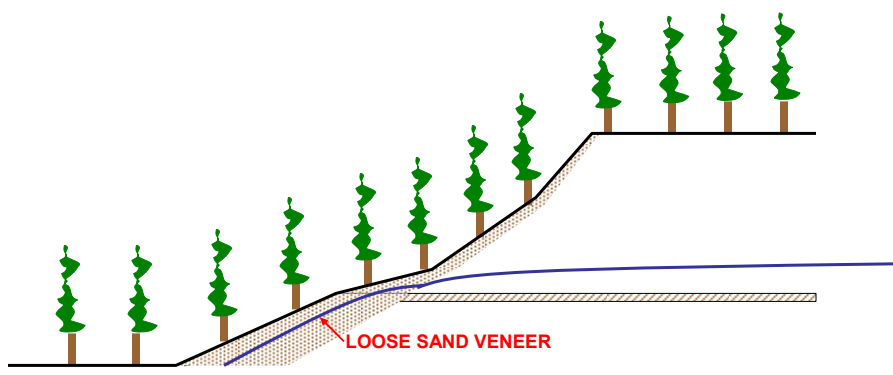
**Slide destroys North Van home;**

Riverside Drive  
January 19, 2005



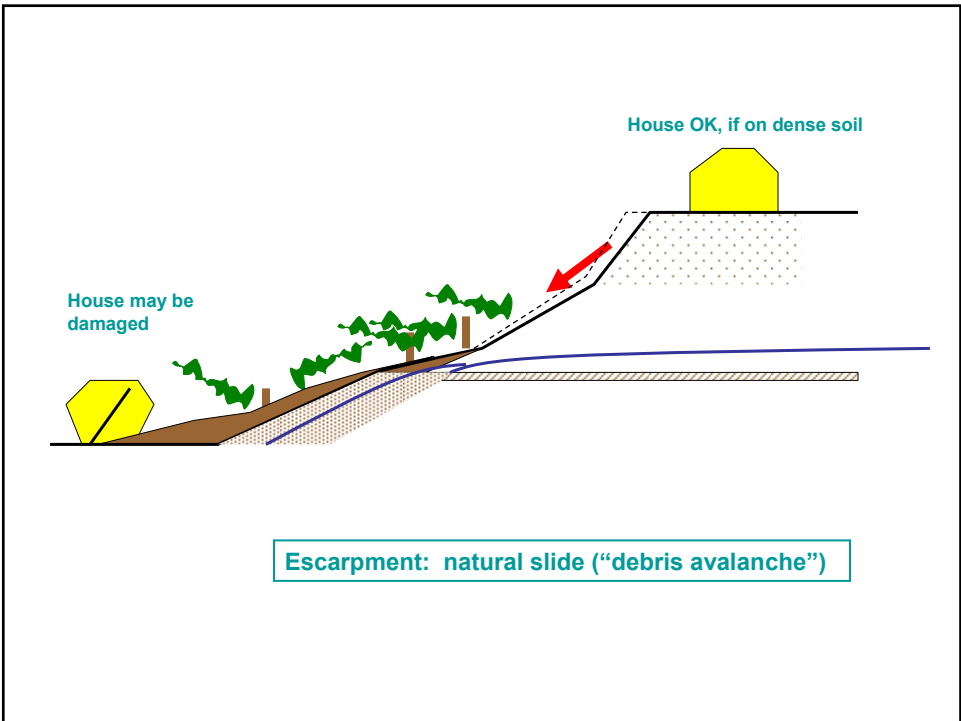
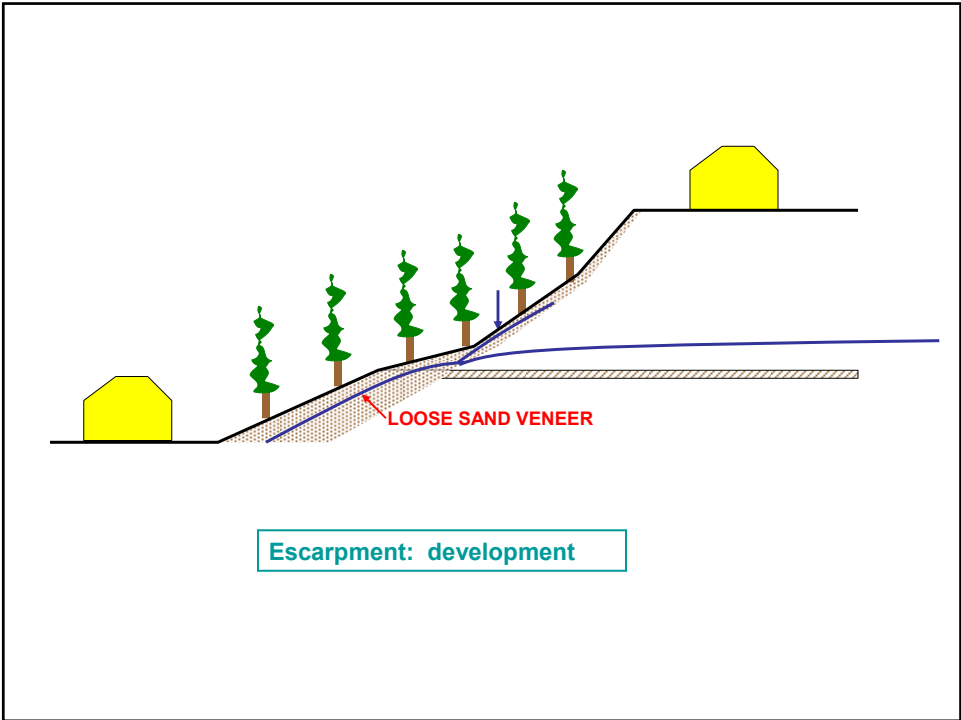


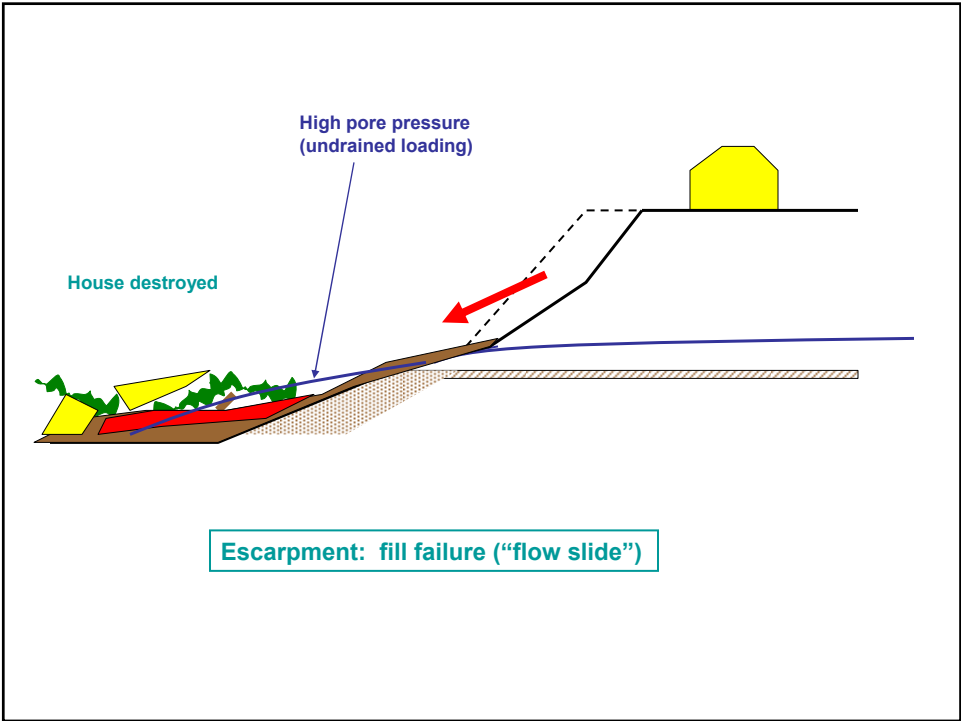
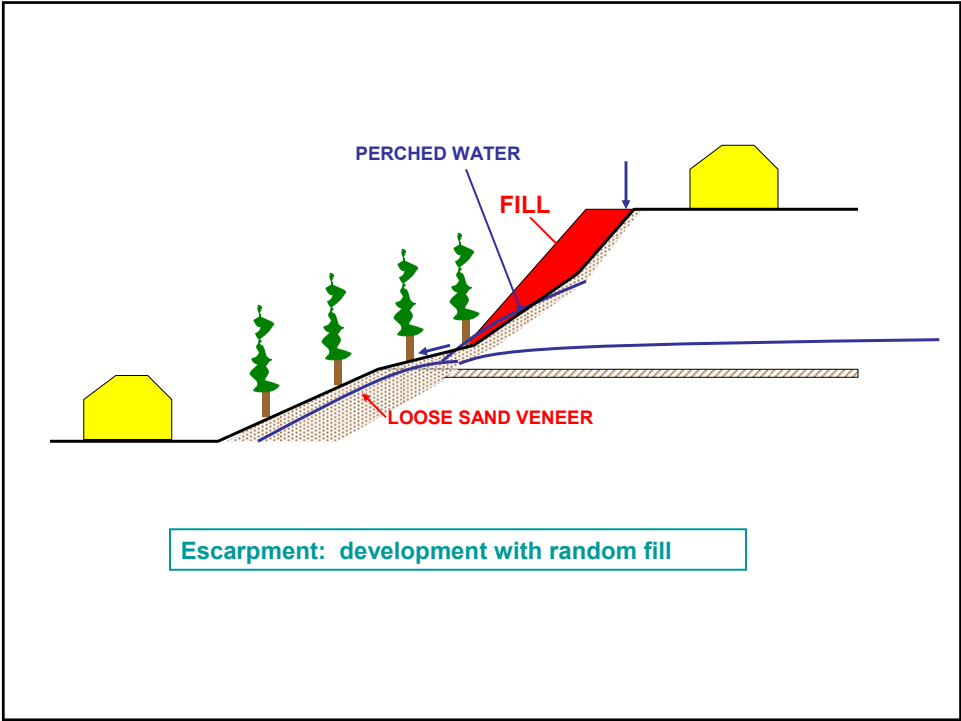
Escarpment: original configuration (active toe erosion)

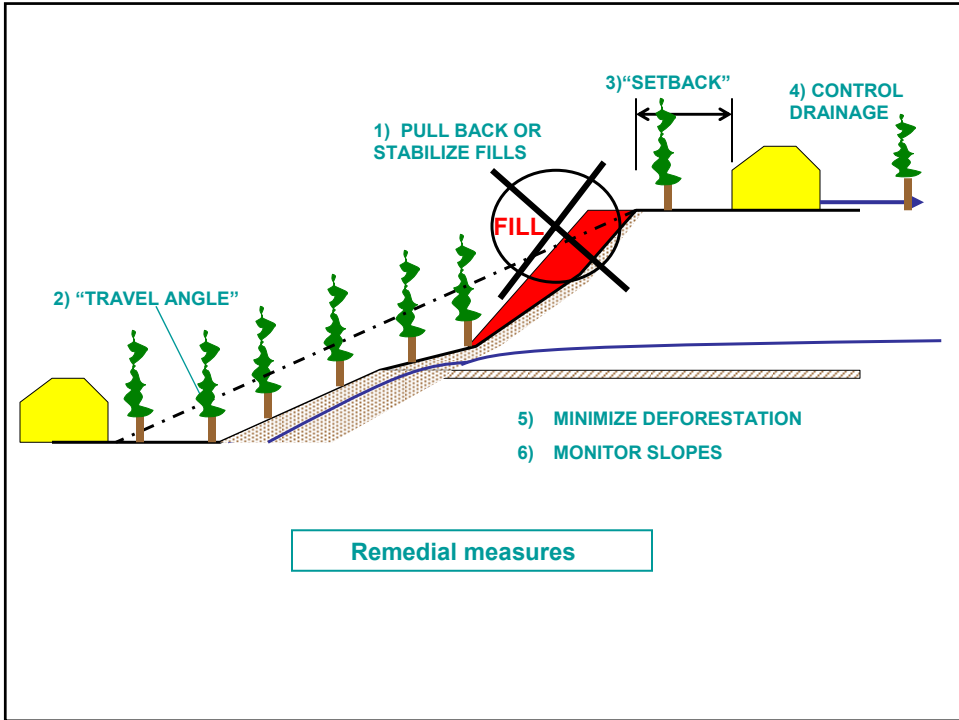


Escarpment: long-term natural slope profile









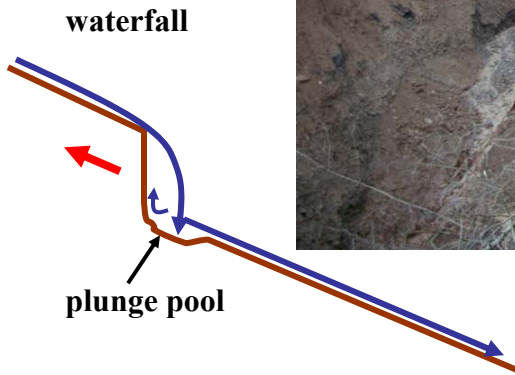
1972 Po Shan Road, Hong Kong, 67 dead





**Erosion  
problems:**

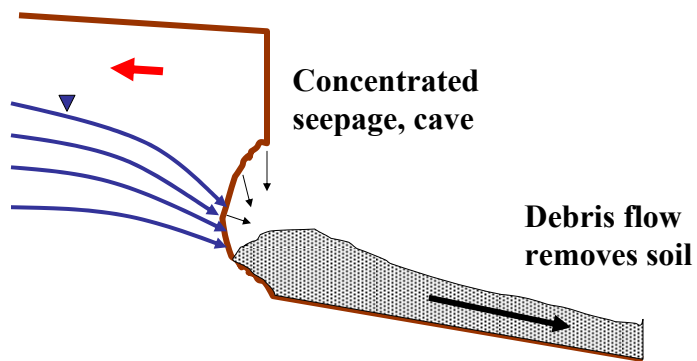
**Backward  
erosion**



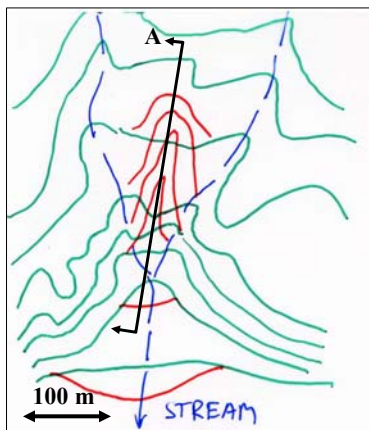
**Chilliwack landfill**

**Gully created in several  
hours, due to diversion  
of a stream. 10 000 m<sup>3</sup>**

## Seepage erosion



## Coquitlam gravel pits, 1985



20 m contours:  
 before —  
 after 2 days —

