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Stability analyses for a large landslide with complex geology and failure mechanism using numerical modelling

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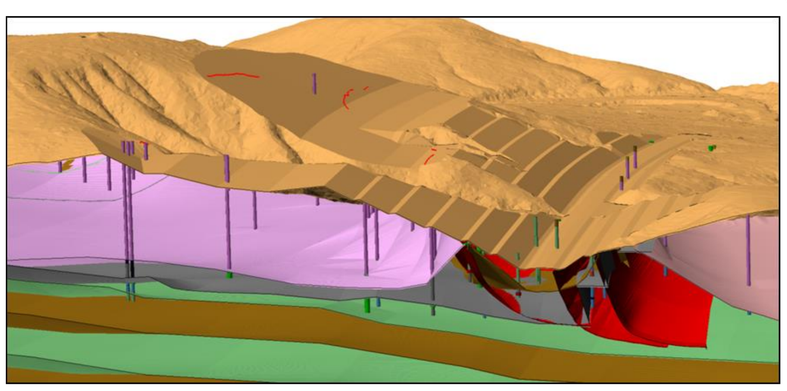
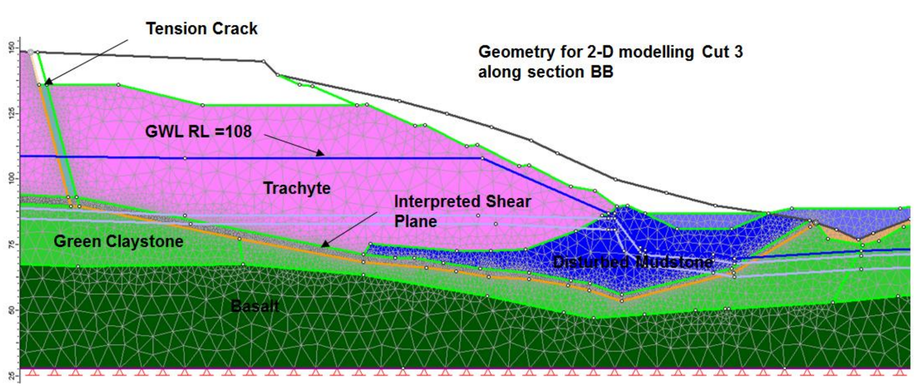
Numerical modelling was undertaken to study a deep-seated, large-scale landslide. Extensive sensitivity analyses and calibrations of the numerical model were required to accurately model the failure mechanism and design remedial solutions.



Geological model developed in Vulcan



Phase^2 2-D numerical model

Investigation and Monitoring

- 2 years of field investigation
- 4,800 m of rock core drilled

The landslide was monitored using surface and underground equipment measuring 3D displacements and groundwater fluctuations.

Numerical modeling

Numerical models were developed from the interpretation of the investigation results. The failure criteria for two-dimensional sections representing each cut were calibrated using the monitoring information.

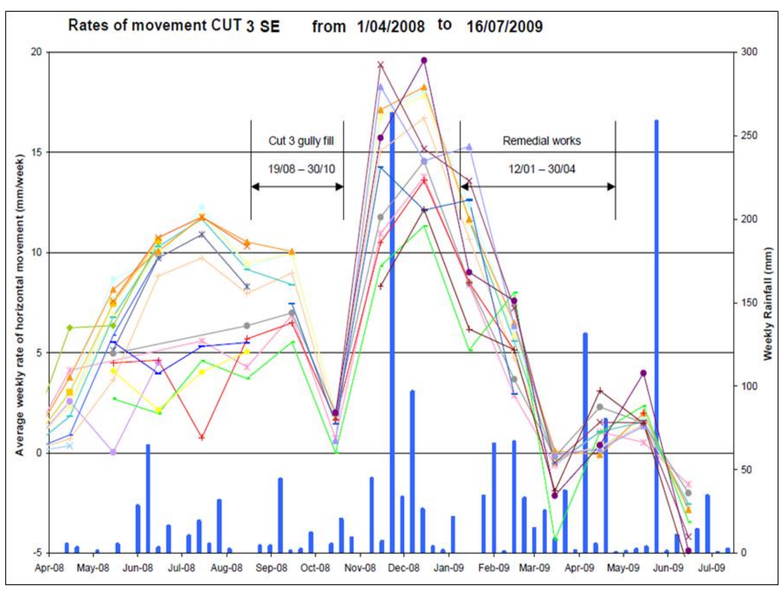
- Complex boundary conditions
- Modified Shear Strength Reduction (SSR) method used to estimate factor of safety
- Sensitivity analyses undertaken to refine calculation iterations and tolerance criteria
- Friction angle of shear zone back-analysed and compared with ring shear test results

Design of remediation

The numerical models were used to design a combination of remediation solutions:

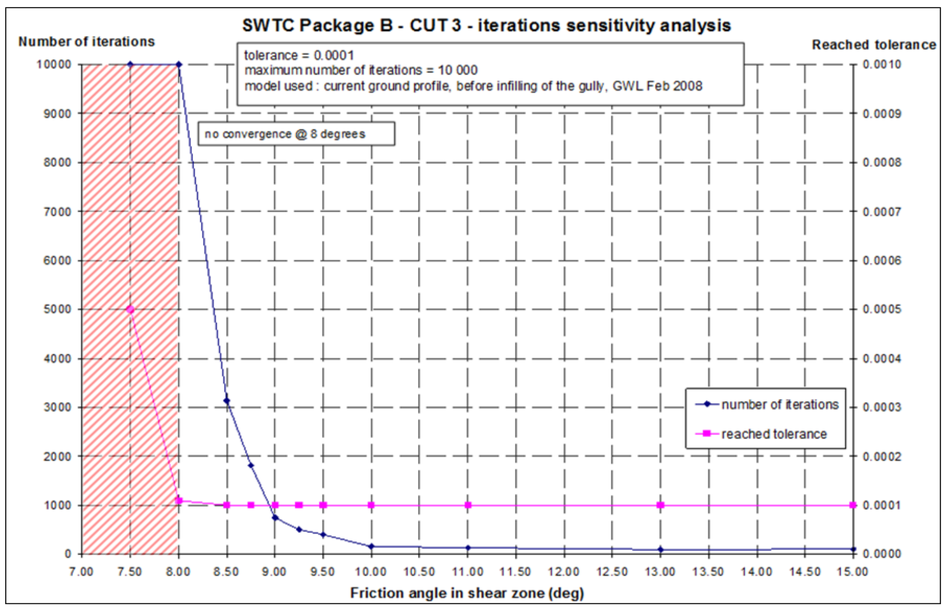
- Filling of landslide toe area
- Flattening of cut batters
- Groundwater level control by well pumping

The long term creep of the landslide is being monitored.



Relationship between rainfall and observed rates of surface movement before and after remediation

Aerial view of Cut 3 and Cut 4 during construction (2007)



Sensitivity analysis for error tolerance and number of iterations