SMI CMLR
Centre for Mined Land Rehabilitation

Soil hydrological and mechanical processes and their effect on the environmental performance of rebuilt landforms

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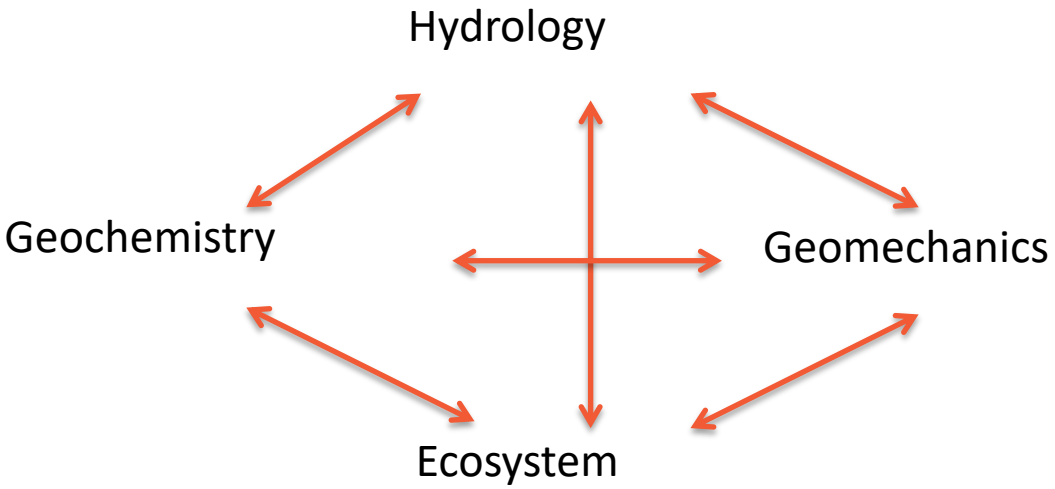
Design of landforms

- Objective

  safe – stable – sustainable

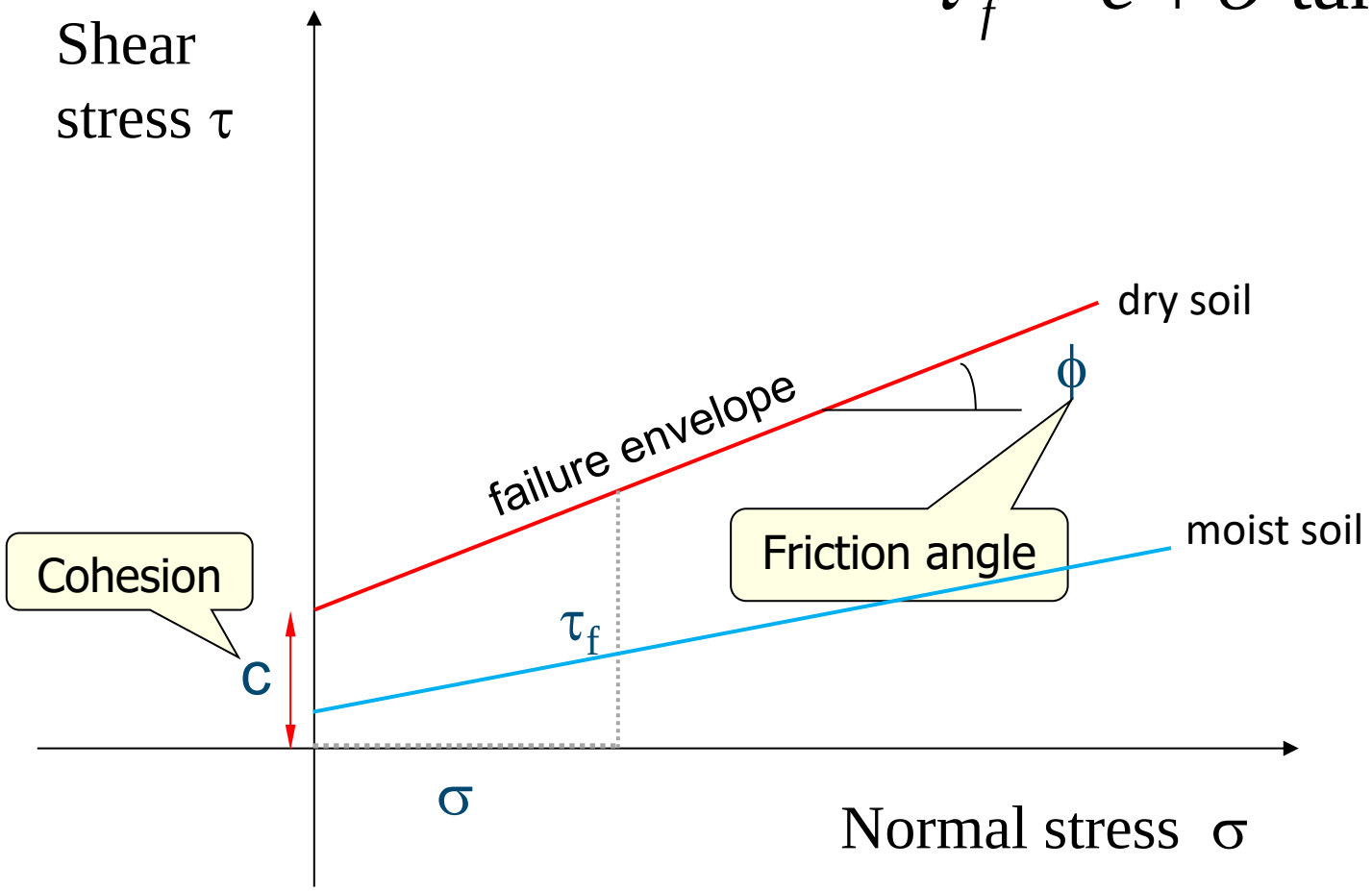
- Stability in the area of



- Role of climate

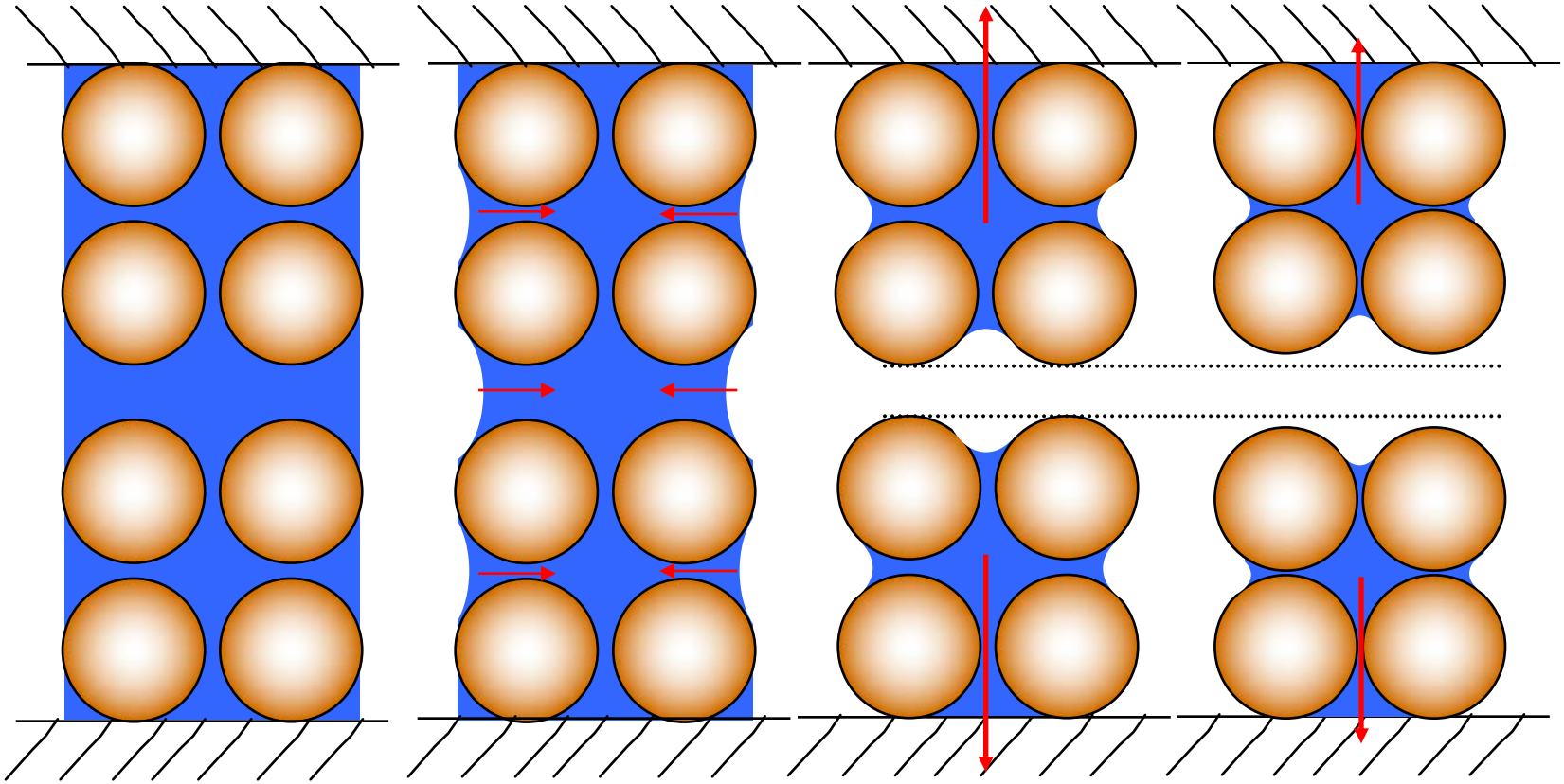
Geomechanics and Hydrology

$$\tau_f = c + \sigma \tan \phi$$

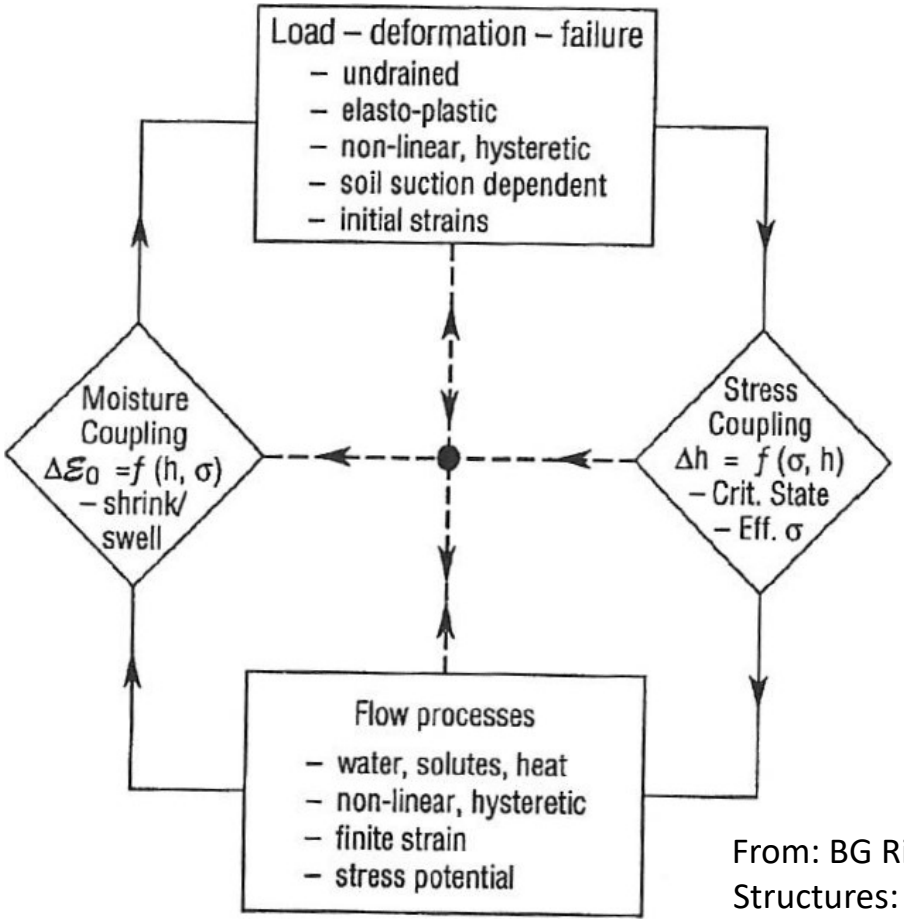


Hydrology and Geomechanics

Capillary forces and tensile strength



Coupling of processes

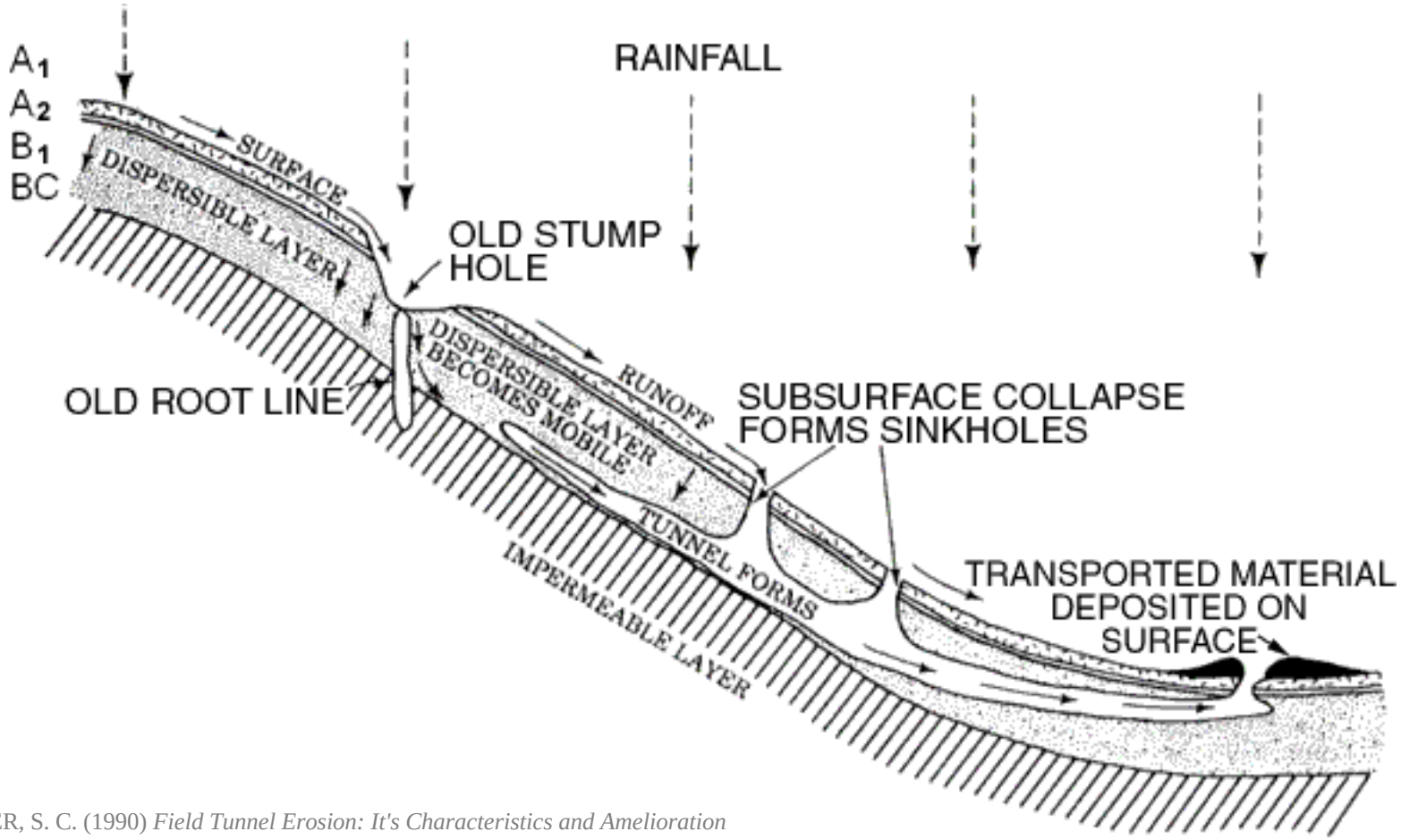


From: BG Richards. The Analyses of Mine Structures: An Historical Perspective. 2018. AusIMM Special Issue *From start to finish: life-of-mine perspective*

MECHANICAL PROCESSES AND STABILITY

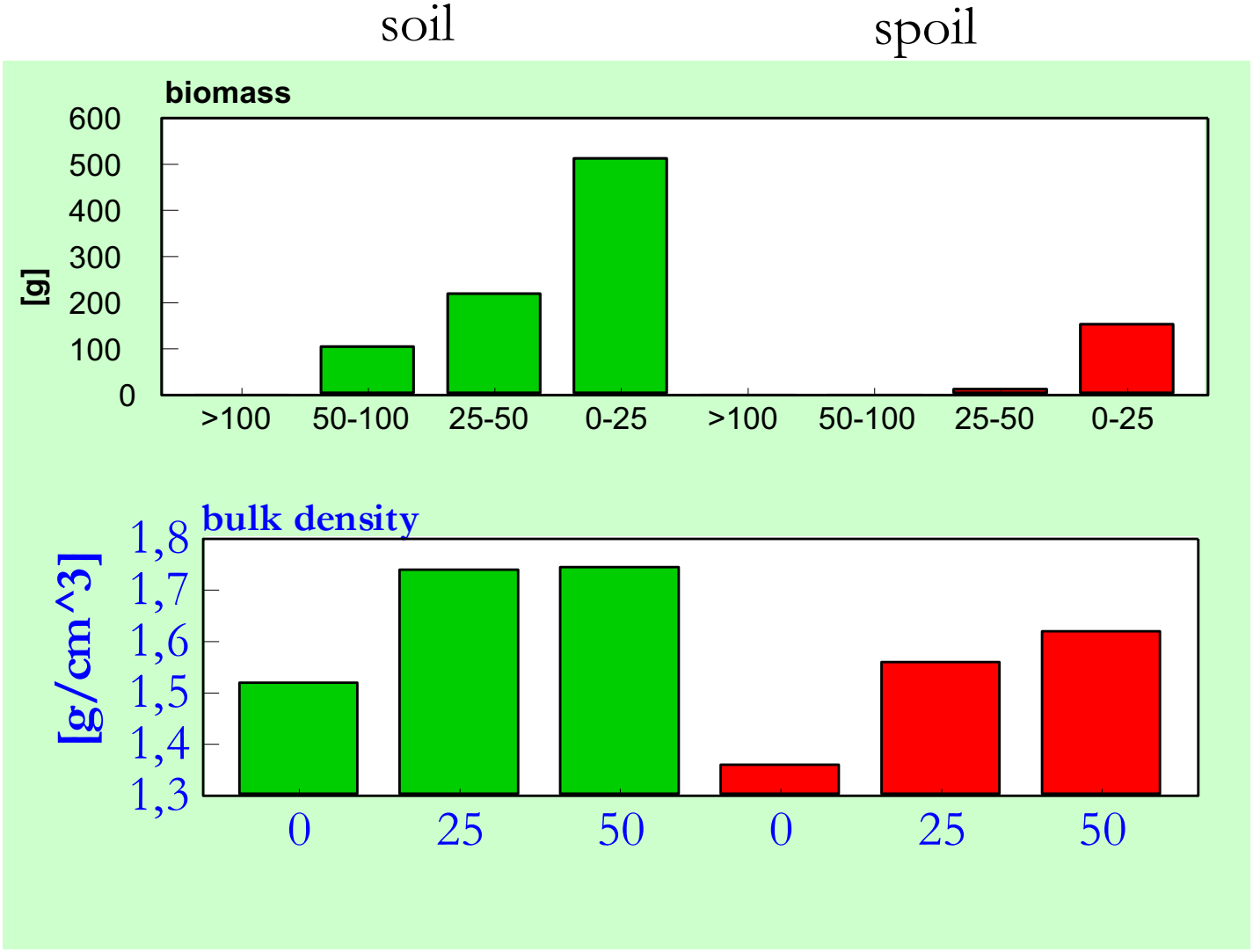

Tunnel/gully erosion

Cause of gully erosion



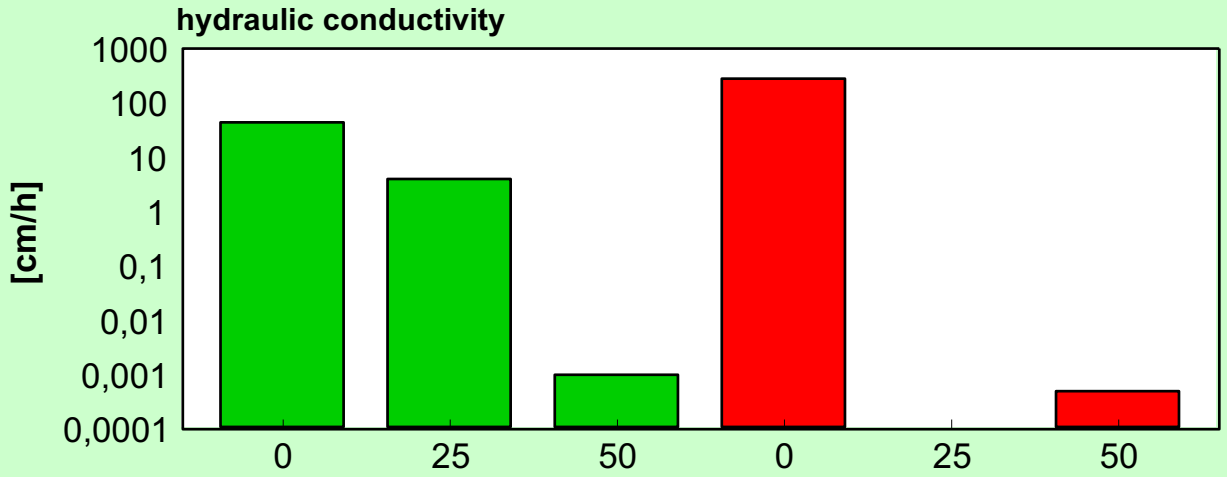
BOUCHER, S. C. (1990) *Field Tunnel Erosion: It's Characteristics and Amelioration*
Clayton, Department of Conservation and Environment, Land Protection Division: Monash University, Department of Geography and Environmental Science

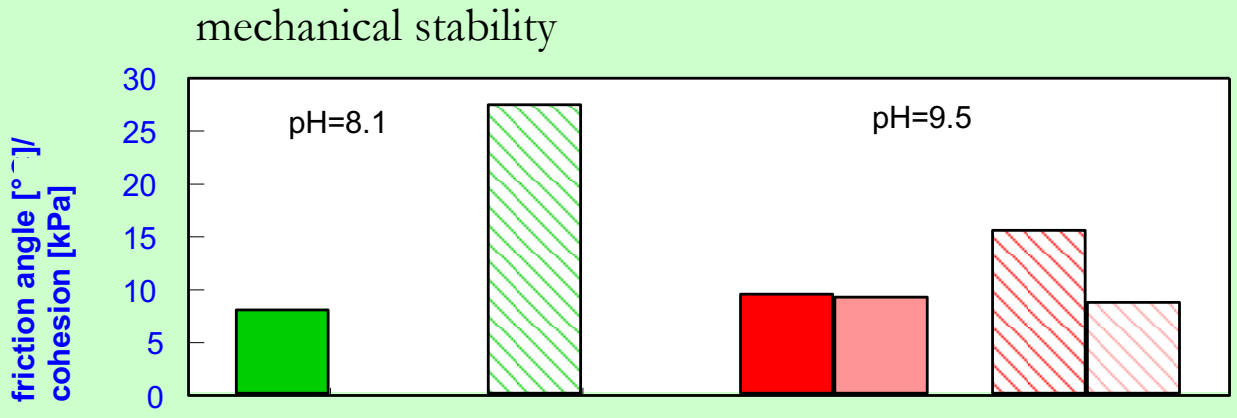
Stability controlling parameters



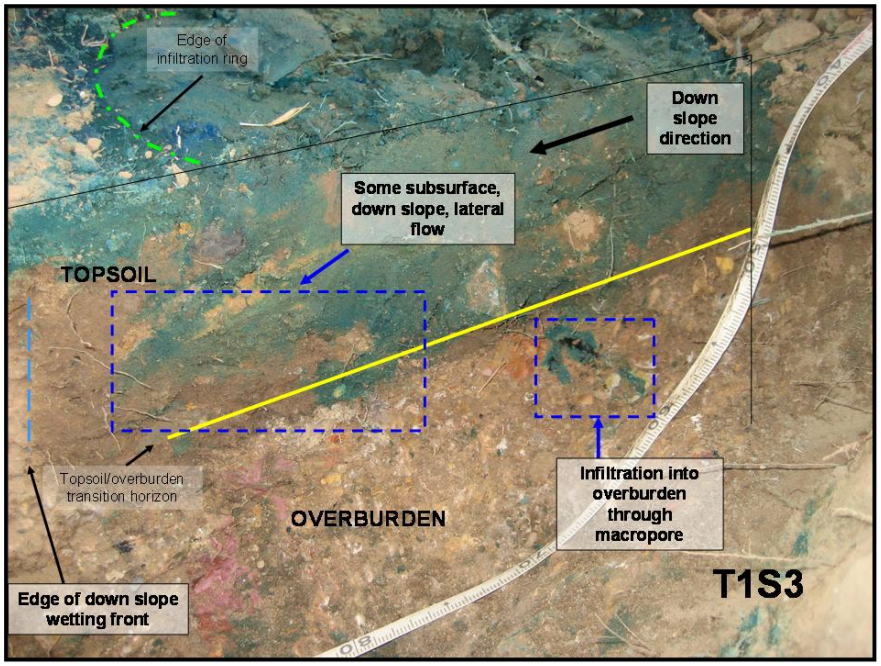
Stability controlling parameters

soil spoil





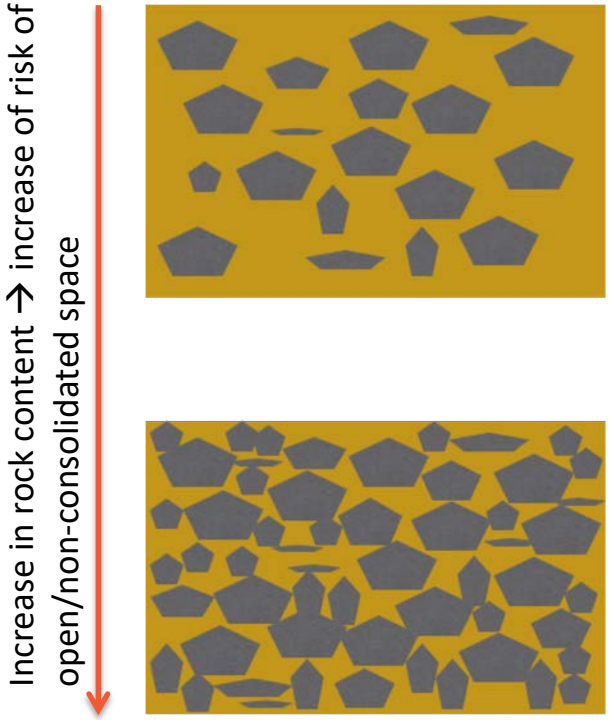
Lateral flow tests



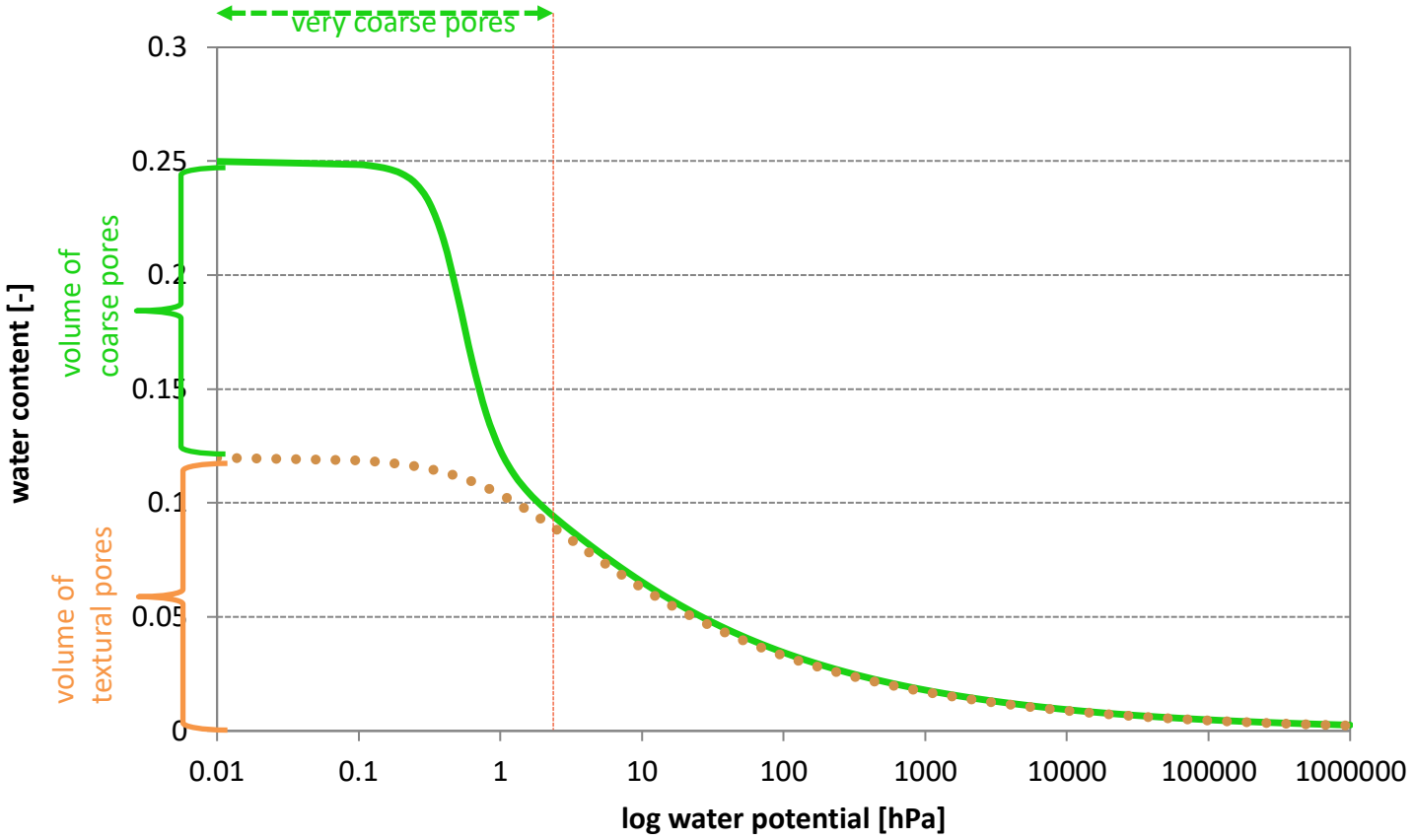
- Water infiltrates to the topsoil/overburden interface.
- Infiltration rate is reduced, with subsurface lateral flow initiated or flow into the overburden through macro-pores.

HYDROLOGICAL PROCESSES AND ENVIRONMENTAL PERFORMANCE

Cover substrate containing rock



Consequences for pore system and water flow

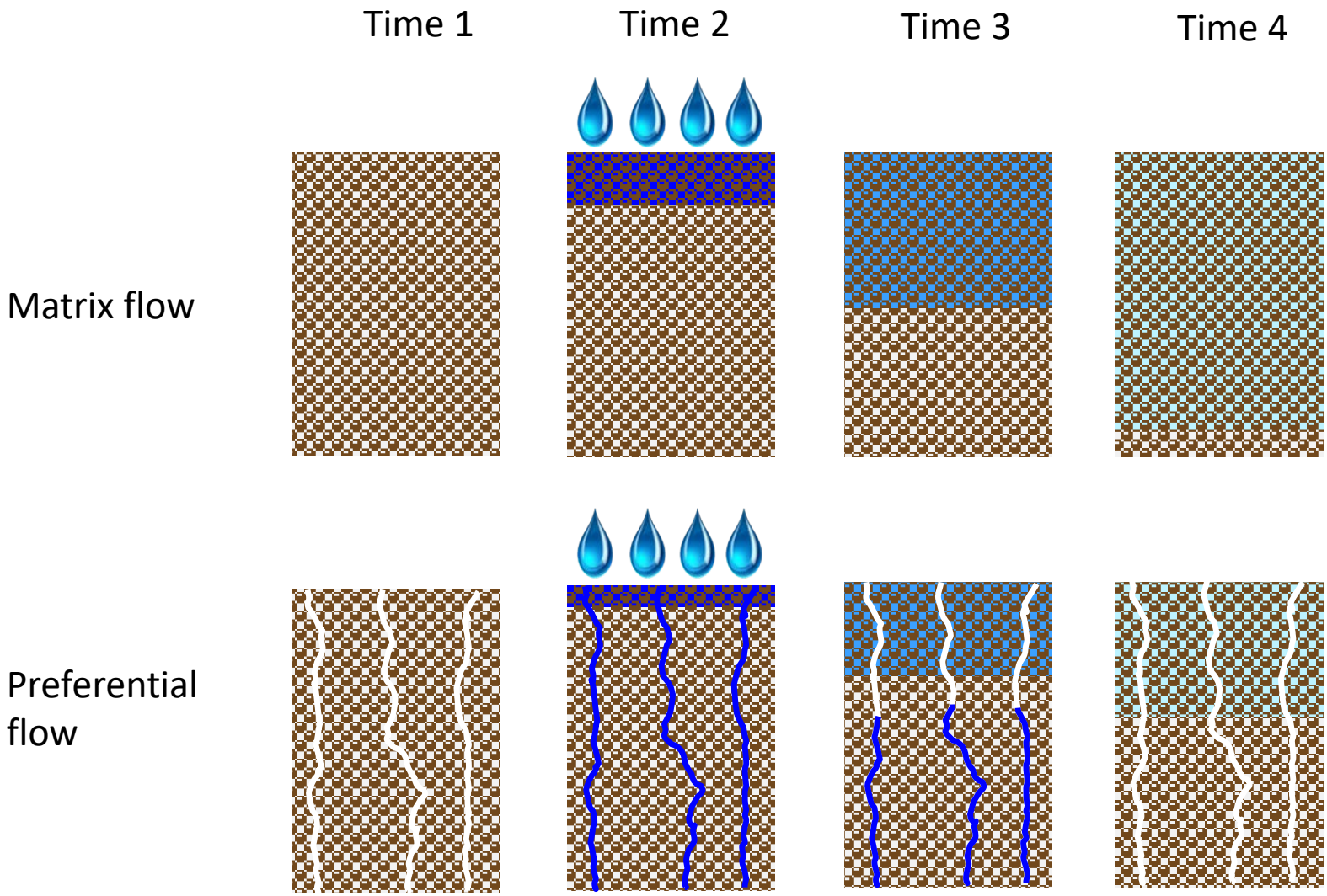


high water saturation

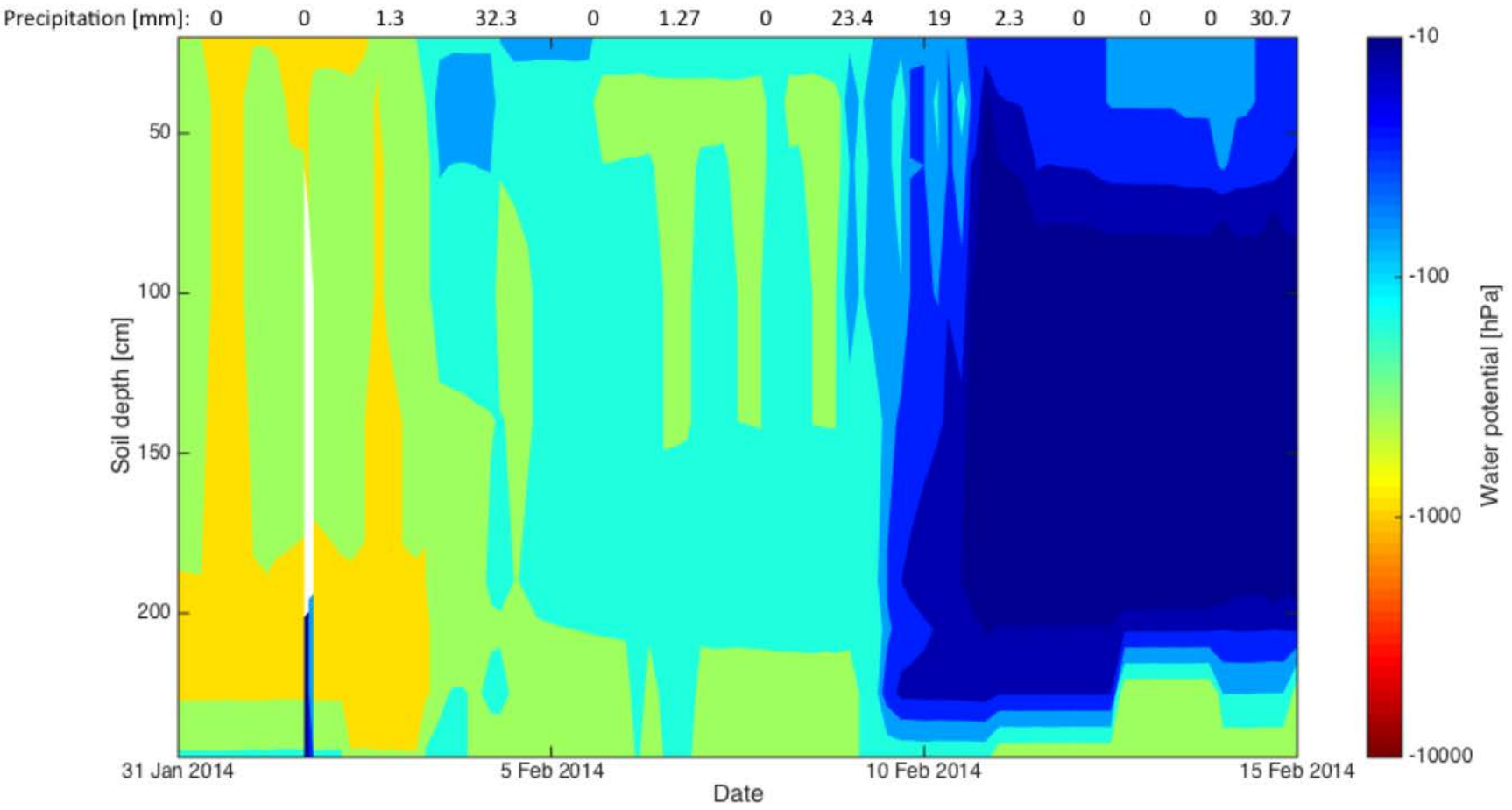
dry

Preferential flow in natural soils

Preferential flow



Rainfall distribution and preferential flow



HYDROLOGY AND GEOMECHANICS

Geometric features

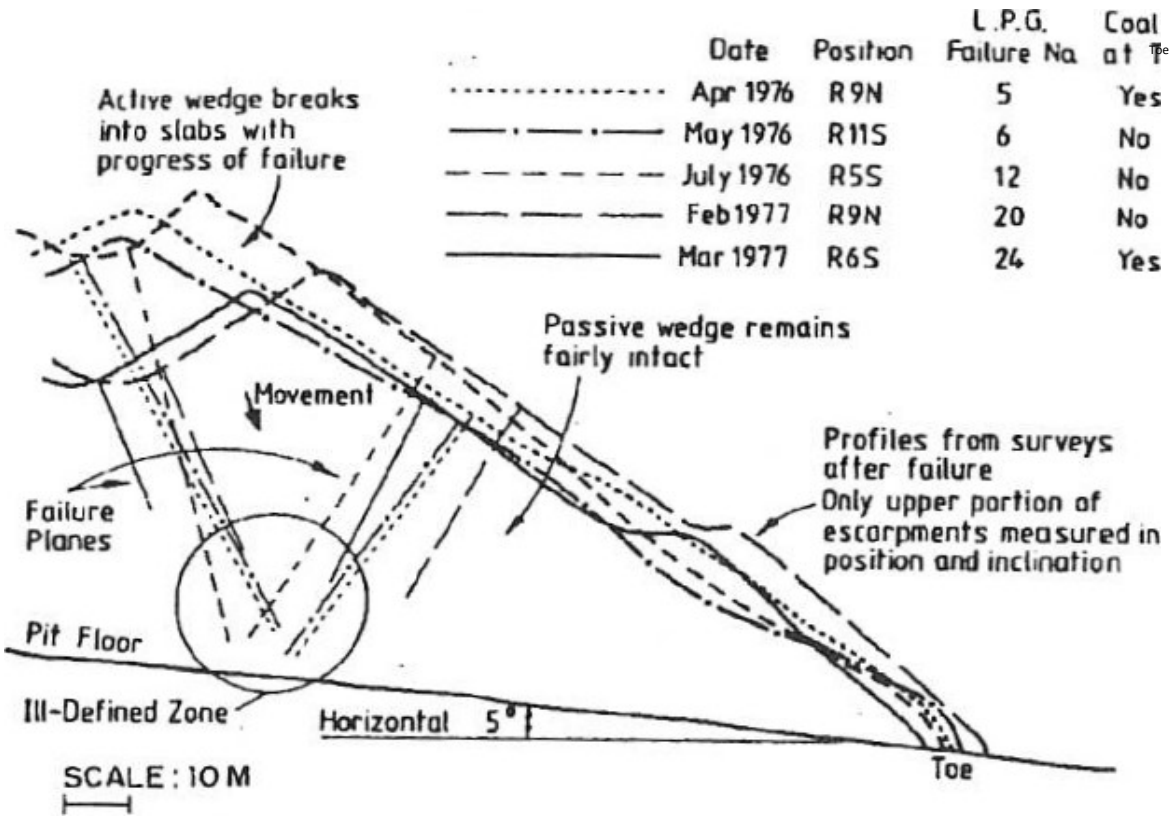


Figure 2. Geometric features of typical failures in spoil at Goonyella

From: BG Richards. The Analyses of Mine Structures: An Historical Perspective. 2018. AusIMM Special Issue *From start to finish: life-of-mine perspective*

Internal structures of waste dumps

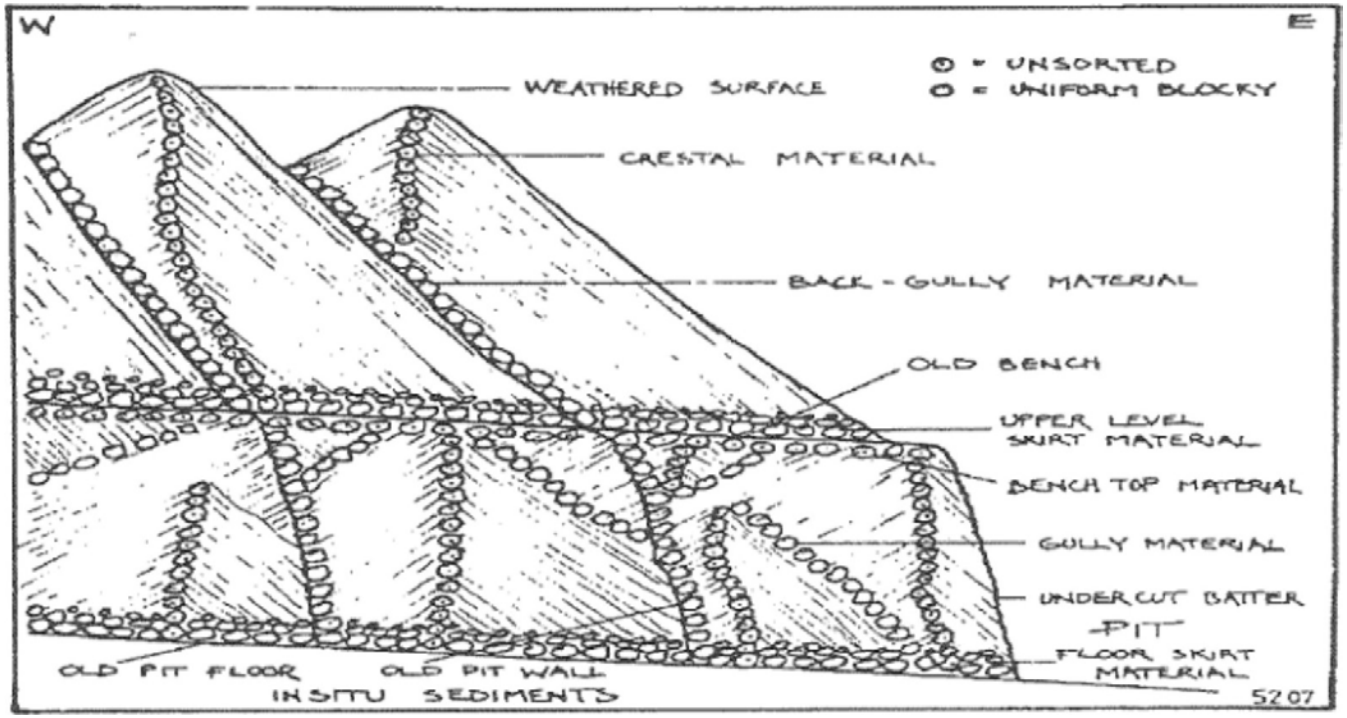


Figure 4. Diagrammatic cross-section showing typical structure and fabric

From: BG Richards. The Analyses of Mine Structures: An Historical Perspective. 2018. AusIMM Special Issue *From start to finish: life-of-mine perspective*

Consequences for flow

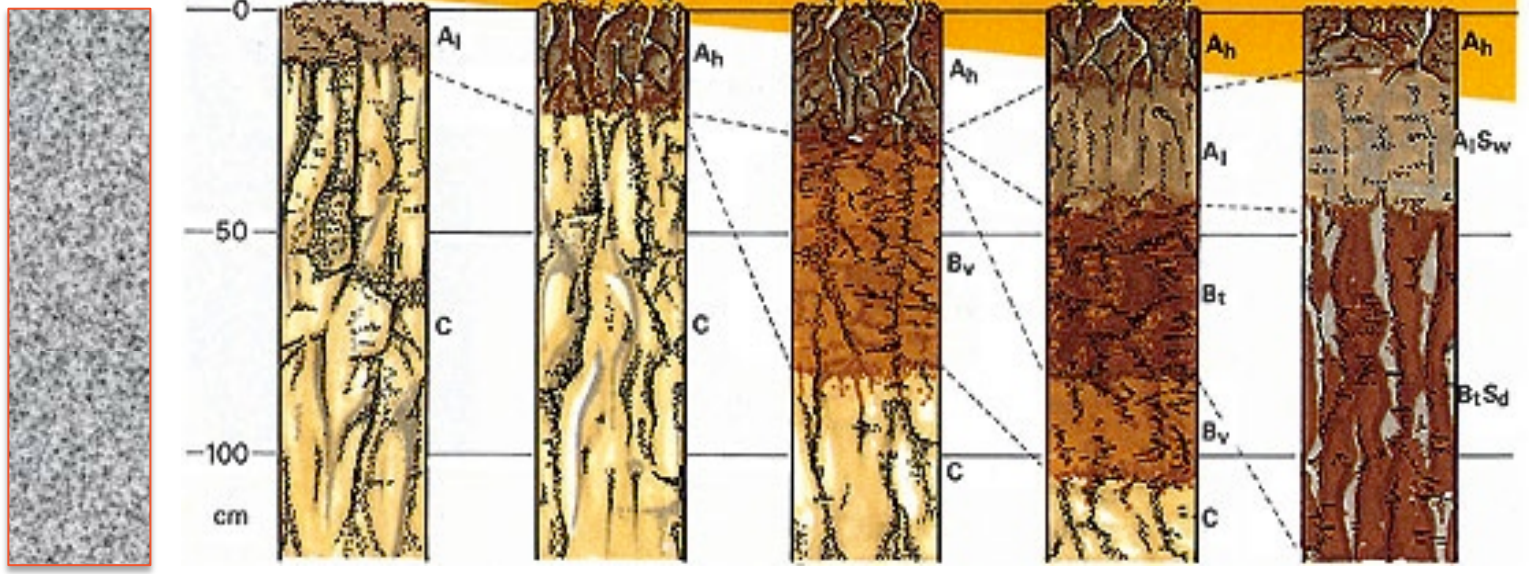
ACARP project: Meso-scale experiments at Pinjarra Hills

Trajectory of change

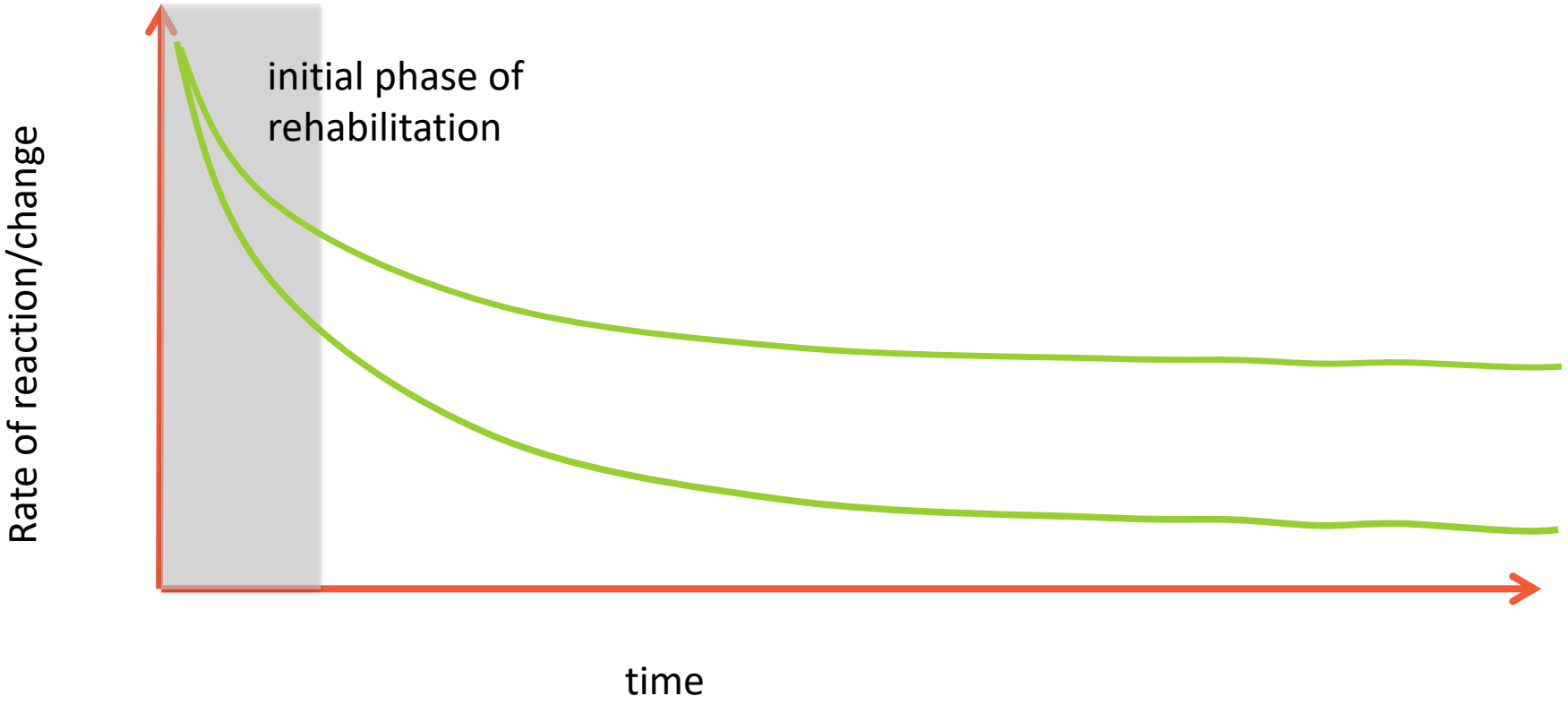
Soil development

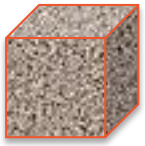
1000's of years

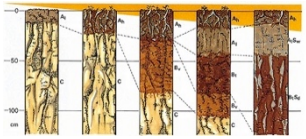
parent rock



Reaching for an equilibrium







Summary

- Necessity for holistic planning of final landform

  Optimising landform design by considering stability criteria

  - Material properties (and availability) → placement
  - Stability / trajectory of change

- Quasi-equilibrium state
- Quantification of risks/uncertainty

Acknowledgements:
M Edraki, B Emmerton,
M Hilton, N McIntyre