

Concave slopes – not a simple cure-all

Recent successes with concave batter slopes on minesite landforms seem to have created an expectation that:

- all outer batters should be concave, and
- all concave batters will be stable.

Neither expectation is correct.

Landloch has been designing and monitoring minesite landforms for rehabilitation for the last 14 years. One of the innovations that Landloch has applied is the use of concave slope profiles. When designed using runoff and erosion modelling based on accurate measurement of material erodibility, the concave profiles have been quite successful. Recent measurements at one site have verified the accuracy of the design simulations.

Unfortunately, these successes have encouraged moves by some in the WA mining industry to apply concave slopes quite widely without much critical thought. There are many examples of superficial mimicking of quite complex processes, with terms "cargo cult science" and even "cargo cult programming" being applied. The primary example is the Cargo Cult movement that originated in the Pacific islands after World War 2 (see text box).

Inconvenient facts are:

- On some materials, concave slopes give no reduction in potential erosion at all.
- Even where a concave profile does reduce erosion, failure to underpin the design by erosion modelling will not provide any certainty that erosion will be reduced to acceptable levels.

There is some belief that constructed landform batter profiles can be based on profiles of existing natural landforms in the same area. Although plausible, that concept suffers from several deficiencies:

- (a) the materials used to construct minesite landforms may be greatly different to those forming natural landforms, and/or in greatly different condition;
- (b) soil profiles created may differ from those forming natural landforms resulting in different surface and sub-surface hydrology; and
- (c) surface features of natural landforms (in some areas) are strongly influenced by recent (European settler) impacts, and may be undesirable on the rehabilitated landforms.

The Cargo Cult

An anthropological curiosity known as the Cargo Cult arose amongst the islands in the South Pacific after the Second World War.

The islanders saw Europeans receive stuff from the heavens, and decided that they too must make arrangements to receive stuff. So they cleared a large area in the forest, lit bonfires around this, built a hut close by in which they put a box with antennae sticking out of it, made 'headphones' out of coconut shells, and spoke earnestly into a 'microphone'. Then they waited for cargo to drop out of the skies.

The islanders were not stupid, merely ignorant. They figured out the 'front end' of the whole enterprise. They simply did not know that there was a very deep back end as well.

How to be sure that a minesite landform is properly planned?

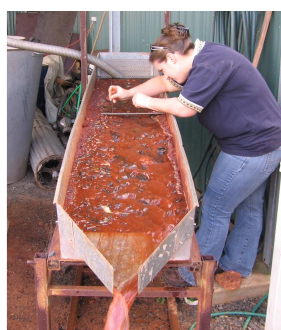
In Landloch's experience, basic requirements for a sound landform design include:

- (a) thorough characterisation of materials and climate; and
- (b) use of a defensible and clearly justified combination of scientific judgment and computer simulations of runoff and erosion (where necessary) to develop a landform uniquely suited to the local materials and climate, that will meet rehabilitation goals.

Simple application of a generic landform profile should be immediate cause for concern, and is a primary indicator that planning is lacking or minimal. Design plans should demonstrate clear understanding of the factors that – in the specific environment being considered – contribute to and control landform stability and function.

In terms of material characterisation, we emphasise the difference between a simple measurement of erosion and a comprehensive measure of erodibility. Erodibility is a material property derived from appropriate measurements of erosion. It is independent of climate and landform properties and can then be used in erosion modelling. Its proper measurement is a significant skill, though the cost of measurement is not prohibitive.

We also emphasise the role surface treatments play in increasing erosion resistance. Such treatments may include rock or tree debris. In some situations, use of these treatments may render use of concave slopes unnecessary.



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