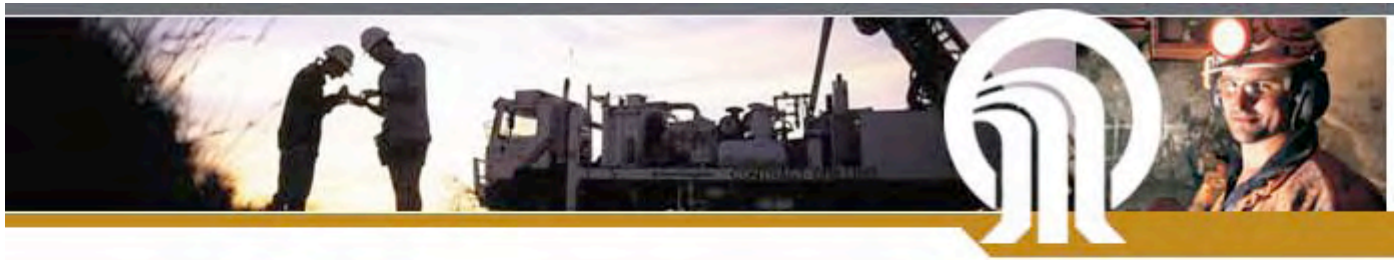

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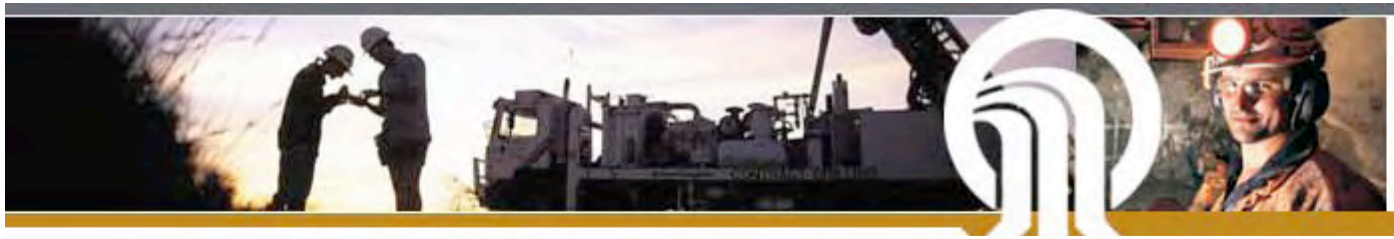
Landforming – the Telfer journey

18 April 2007

Bentley Technology Park

TARGET ZERO
Our goal is zero injuries



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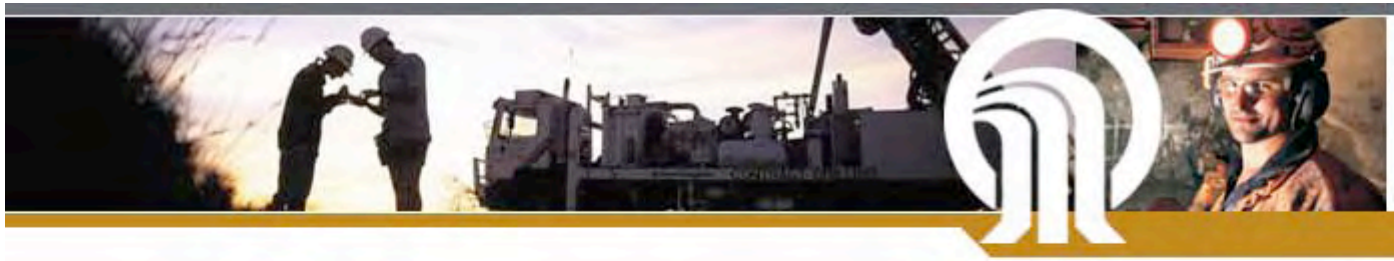
Location

TARGET ZERO
Our goal is zero injuries



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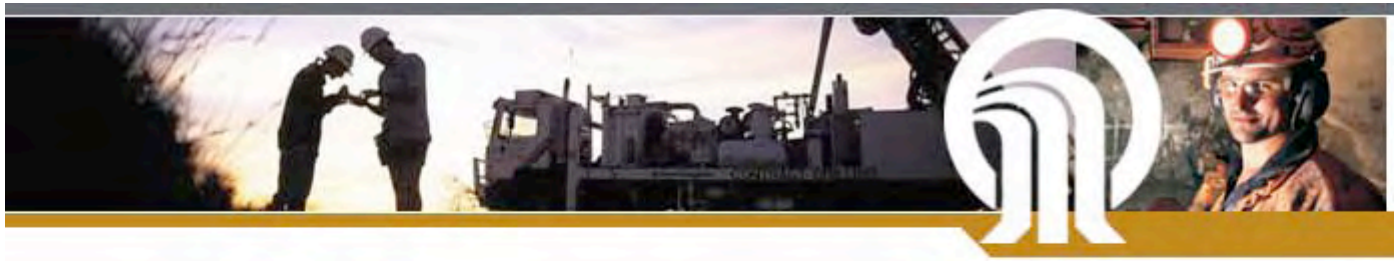
In the beginning

- In 2003, the Telfer expansion was given approval to proceed pending several ministerial conditions, one of those was to compile and implement a Waste Rock Management Plan.
- The main government objective within the Waste Rock Management Plan was for Telfer "*to design and construct waste rock dumps that are compatible with the regional physiography, stable in the long term and do not present any on-going acid mine drainage risks*".
  - To be compatible with the regional physiography, we decided on the Mesa landform (concave slopes),
  - To be stable in the long term, we decided landform evolution modelling will be used, and
  - to ensure the landform doesn't present any ongoing ARD risk, we decided on a store and release cover design.
  - This essentially takes us on a journey….

TARGET ZERO
Our goal is zero injuries



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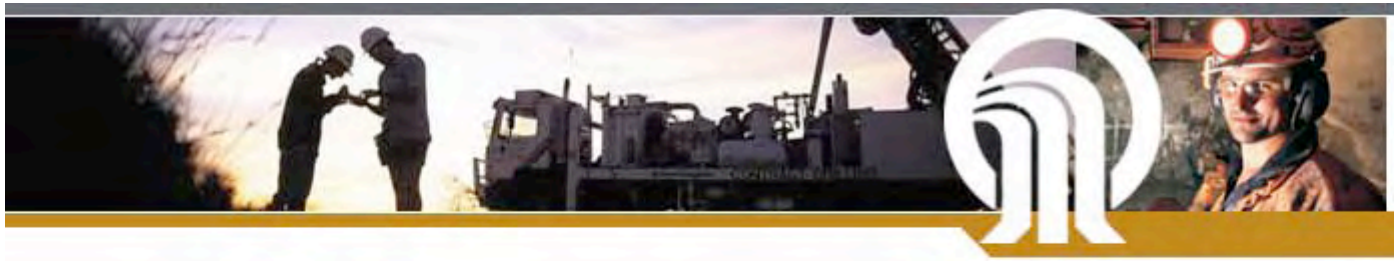
Challenge

- But how will all these components hang together?
- First, a little background about Telfer…..

TARGET ZERO
Our goal is zero injuries



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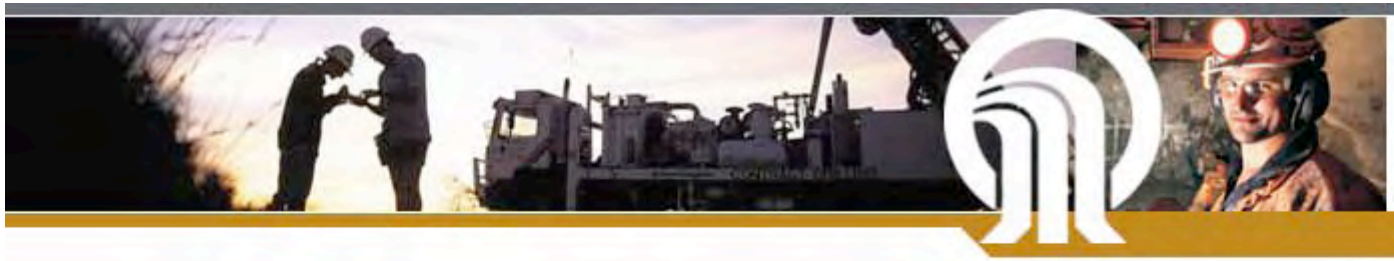
Mining

- Stage 1 - Gold discovered 1971, first gold produced 1977, cessation of operations 2000,
- Stage 2 - new process plant constructed and operational 2004
- 500 million tonne of primary and 50 mt of oxide ore
- Exploitation via open cut and underground method over 25 years
- Mill through put is 23 mtpa
- Extraction via flash flotation, CIL and heap leach
- 1.3 billion tonnes of waste rock
- 300 million tonnes has ARD potential
- 700,000 oz Au and 200,000 tonnes Cu concentrate annually



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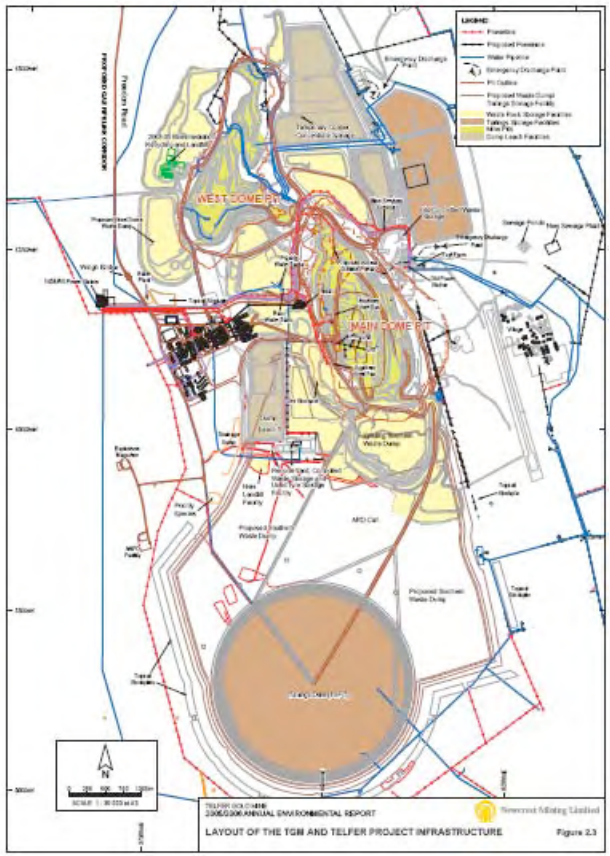
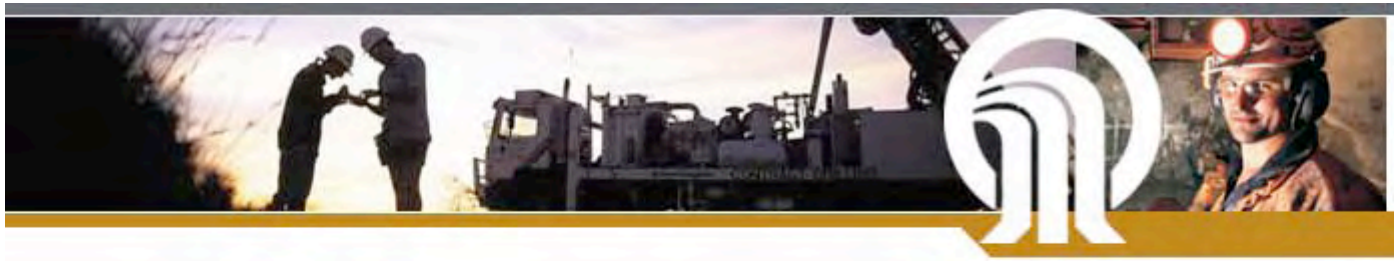
Telfer General Arrangement



TARGET ZERO
Our goal is zero injuries



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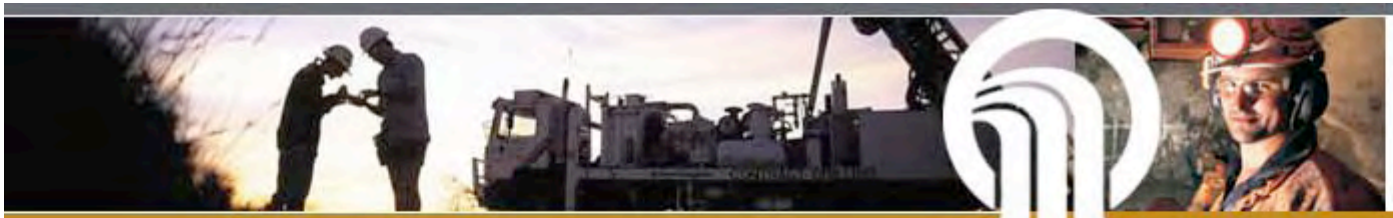
Biophysical

- Rainfall - 270mm (370 mm since 1992, and 463 mm since 2003)
- Potential evaporation - 4,000 mm p/y
- Vegetation - Spinifex communities, with Acacia and Eucalyptus spp
- Rock types - siltstones, sand stones and quartzites
- Regional landforms - Mesa type formations 30-70 meters high



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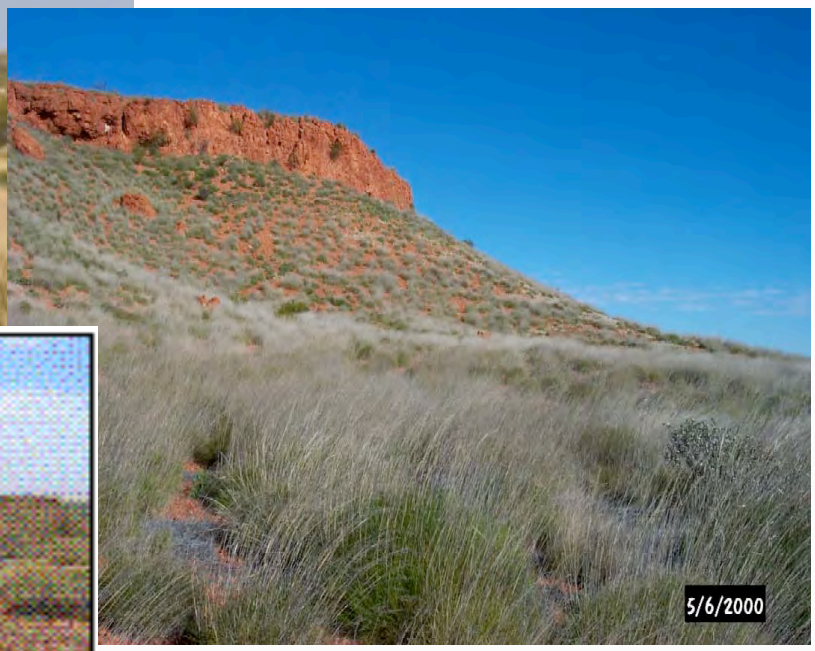
Mesa landform of the Telfer region



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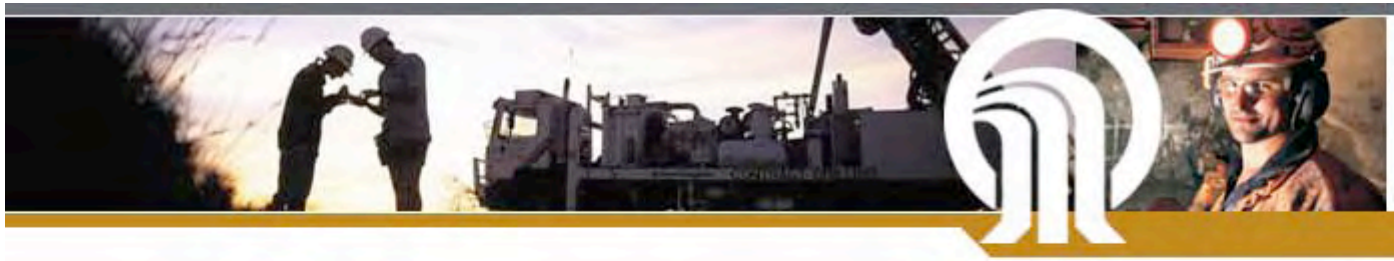

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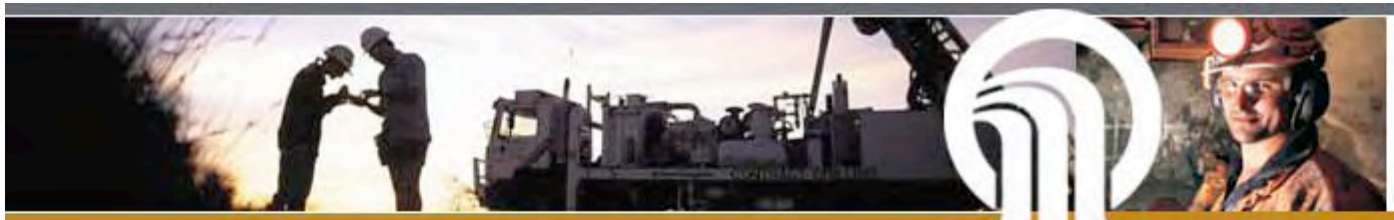
Mesa Characteristics

- Mesa slopes made up of 7, 16, 25 and 60 degree angles
- Flat surfaces with competent capping layer
- Slopes are rock armoured
- Vegetation cover is about 33%, with Spinifex the dominant spp
- No signs of rill, gully or piping erosion



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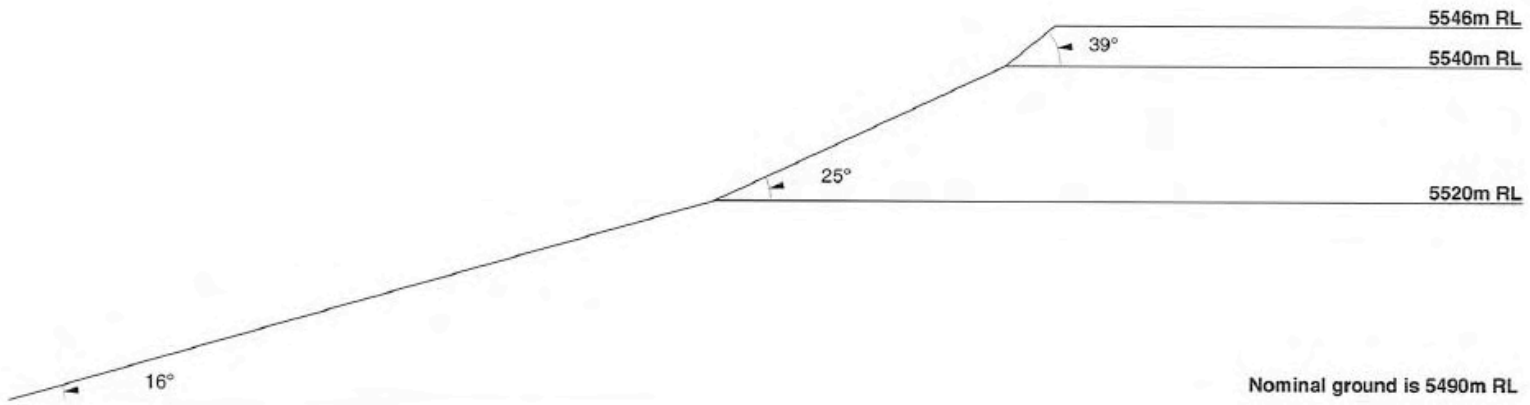
Slope angles



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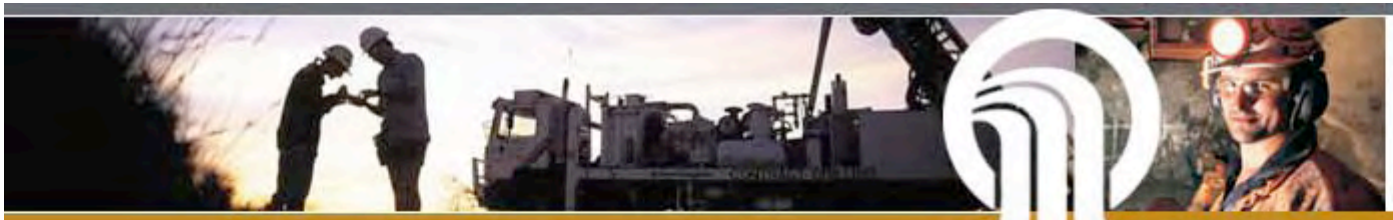

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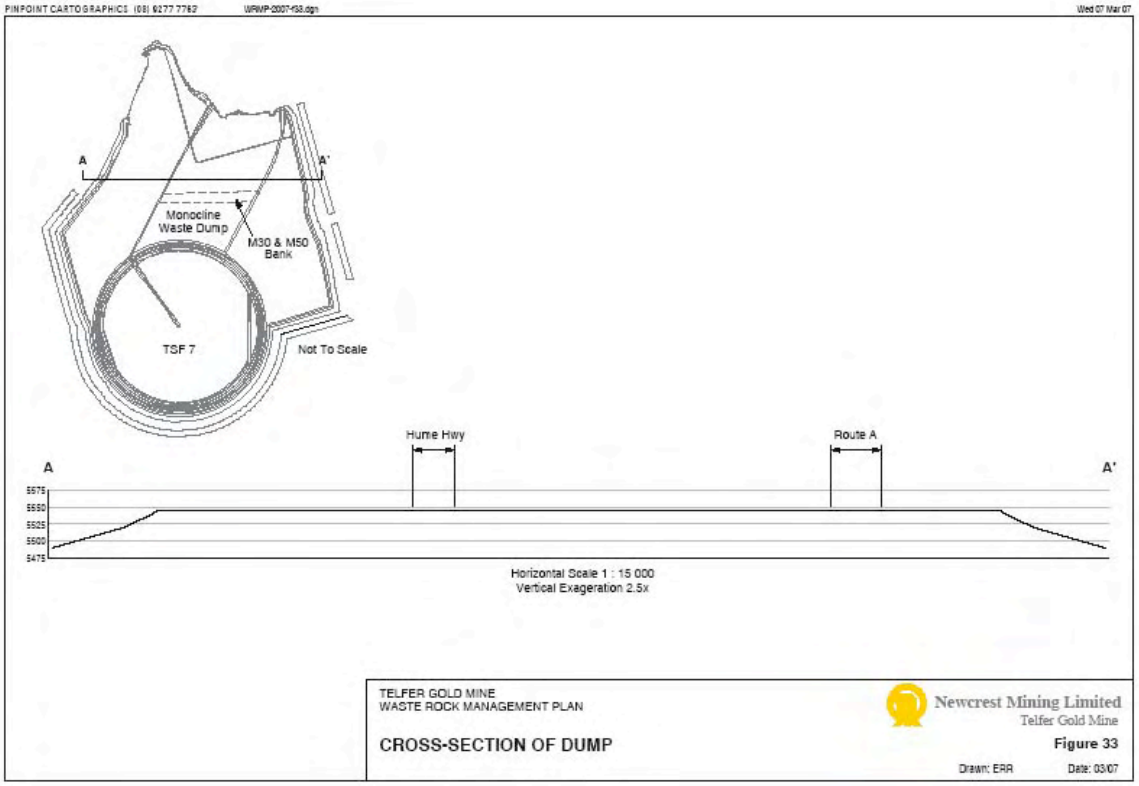
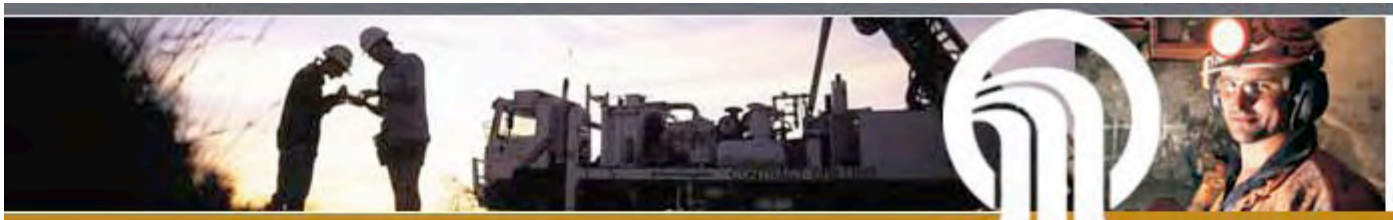
Southern Waste Dump



TARGET ZERO
Our goal is zero injuries



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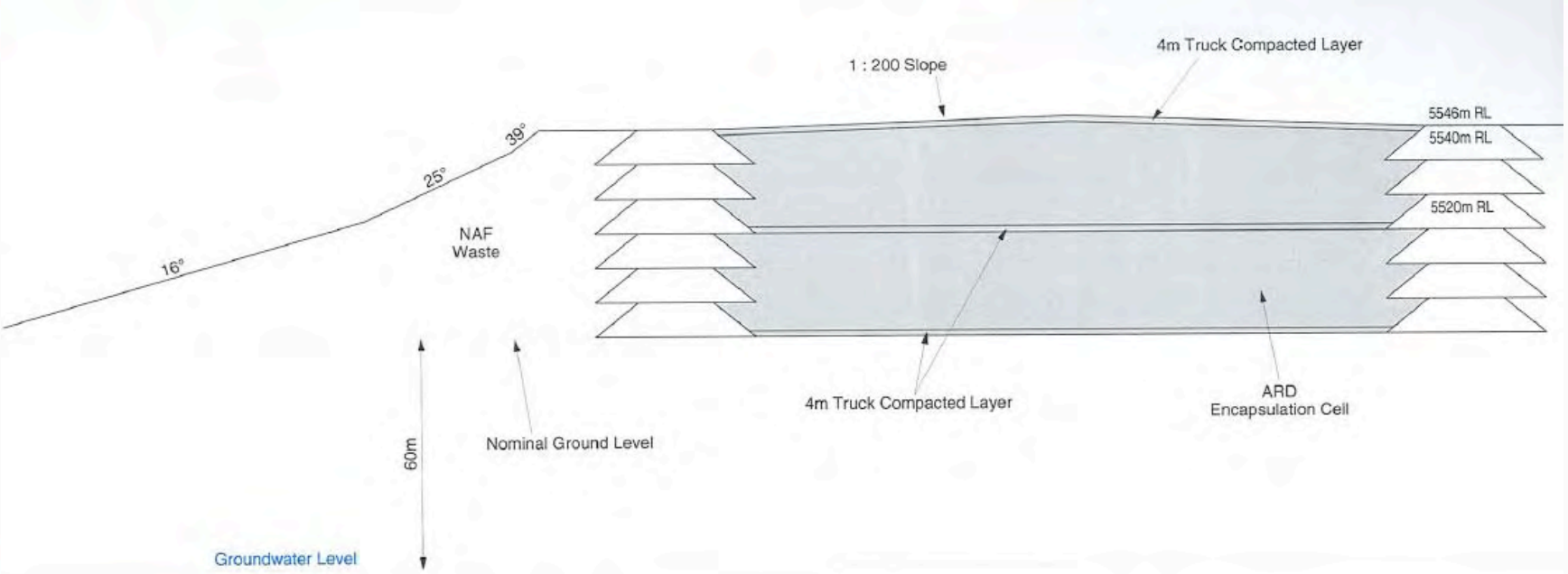
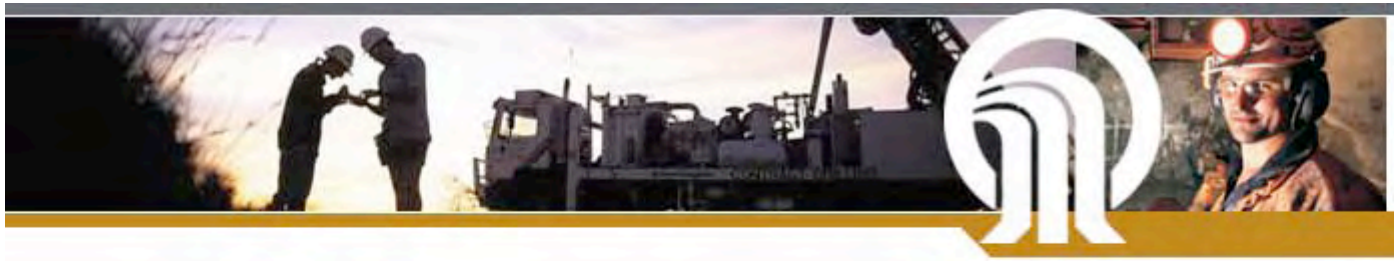
ARD Section



TARGET ZERO
Our goal is zero injuries



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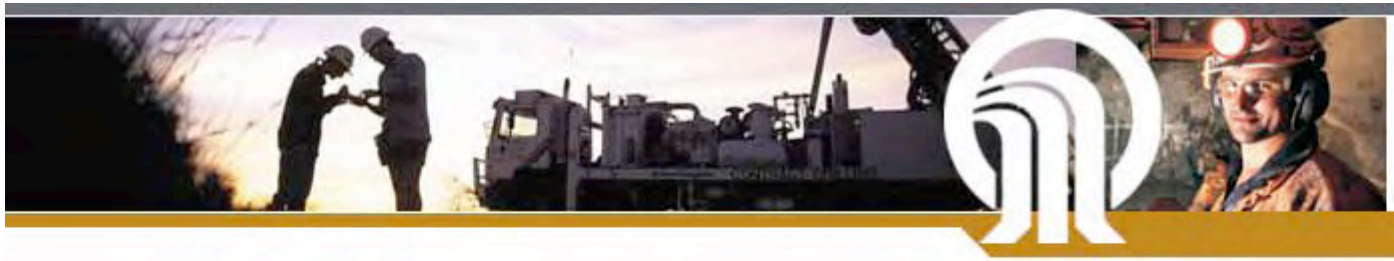
Overall

- Need to minimise the instances where water can come into contact with the ARD material
- Need to prevent surface water ponding and increase water absorption by soil and vegetation
- This leads us to the need for a “store and release cover” system.



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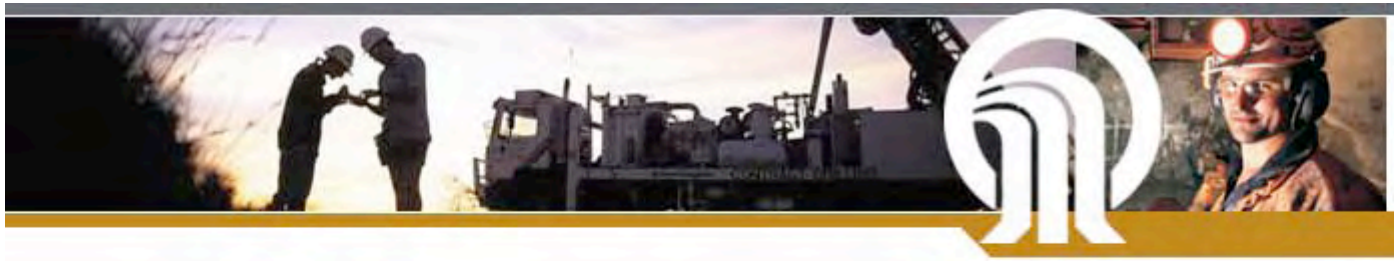
Cover system

- To construct a working store and release cover, manage the ARD within and to construct a stable landform such as a Mesa, we need to first understand the physical and chemical characteristics of the waste rock types generated at the mine.

- Cover will comprise of:
  - approximately 2.0m of siltstone material, and anecdotally
  - 20cm of sandstone or quartzite (rock armour)
  - 5 cm of topsoil

- But we admit there are knowledge gaps, such as:
  - Water behaviour/interaction, long term land form stability, and weed seed and top-soil viability relationships with the man built Mesa

TARGET ZERO
Our goal is zero injuries



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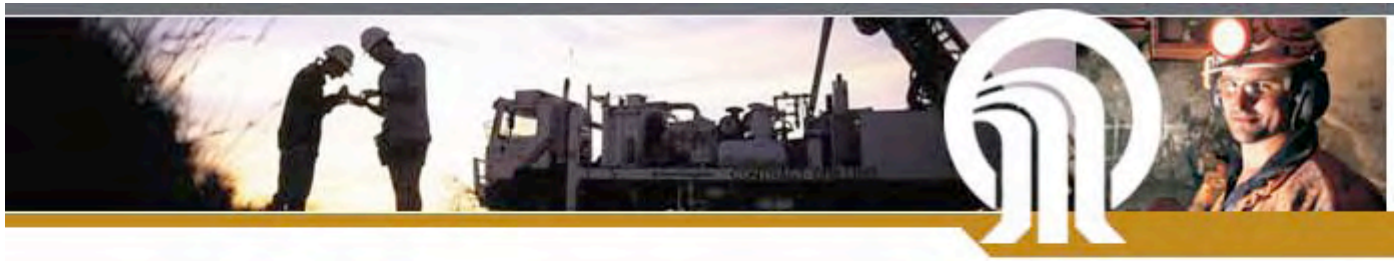
Research and Development

- We identified these gaps early in the landform planning process and approached the University of Western Australia (UWA) and then later, Kings Park and Botanic Gardens (KPBG) to assist in solving the unknowns.

- In partnership with UWA we applied for and received 1.228 million dollars of ARC-Linkage and MERIWA funding to conduct Ecohydrology studies at Telfer over a 4 year period.
  - Peer review by Rio Tinto, BHP Billiton, and
  - Government observations by DoIR and DEC

- In parallel to the UWA studies, we have partnered with the KPBG to conduct weed, seed and topsoil viability studies over the same period.



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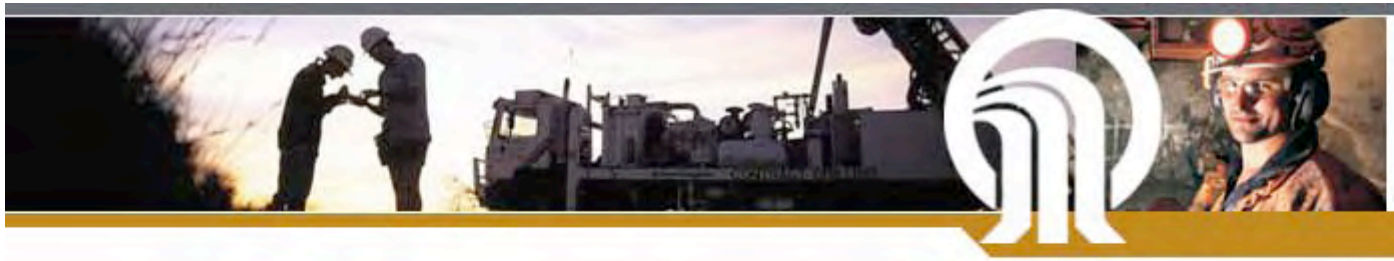
Trial Plots

- Based on our early research with UWA and KPBG and our knowledge of the Mesa land form, Telfer conducted a small slope and surface trial plot in November 2006.

- The aim was to construct two trial plots, each including 4 treatments;
  - One, on a slope consisting of 3 batters each at 16, 25 and 39 degrees, and
  - The other, on a waste dump surface testing hummock-pile soil to rock ratios.

- The objective was to;
  - test the mechanical construction rational of the three angled slope, application of topsoil, and construction of the surface hummocks, &
  - Compare freshly harvested topsoil against old topsoil stockpiles



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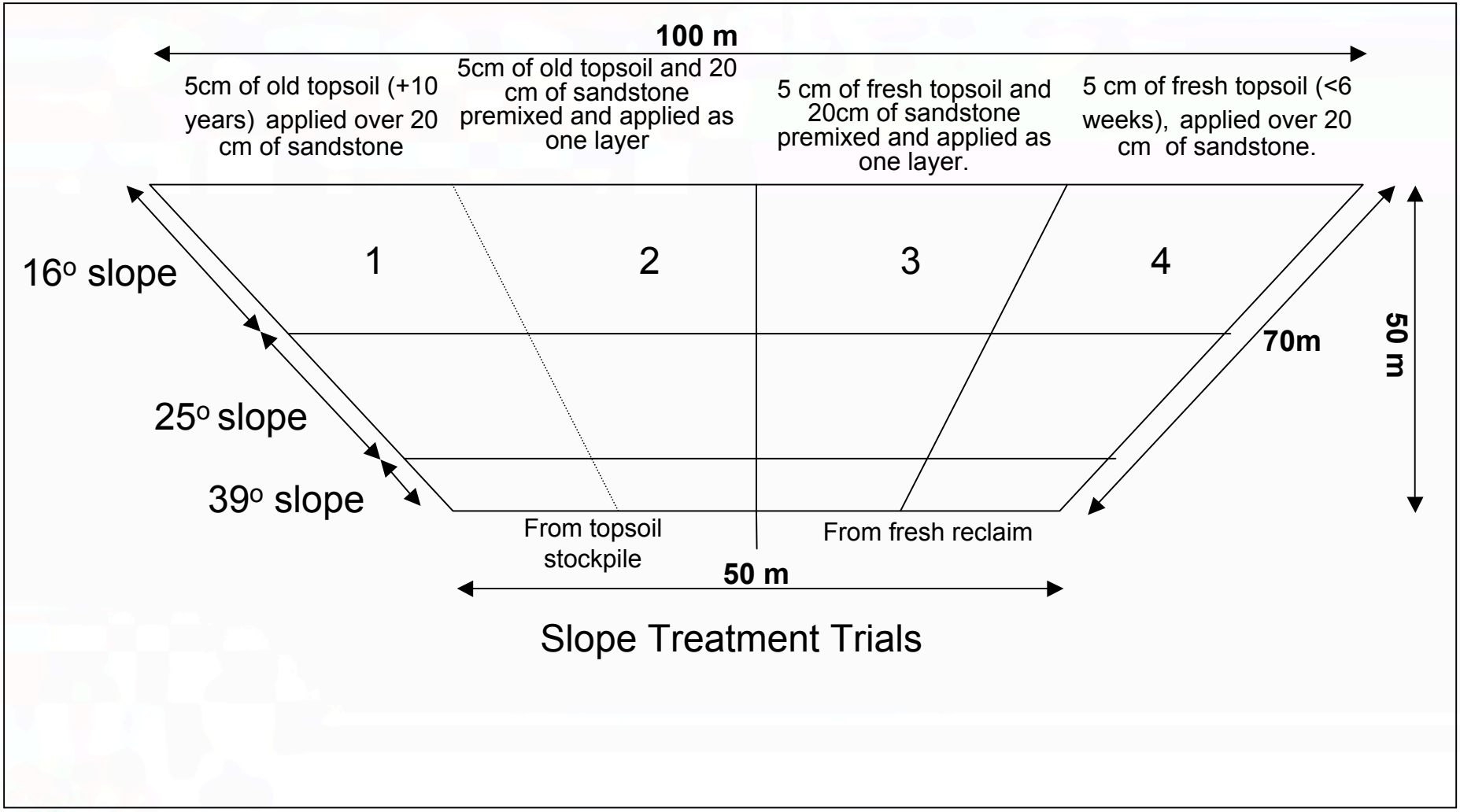
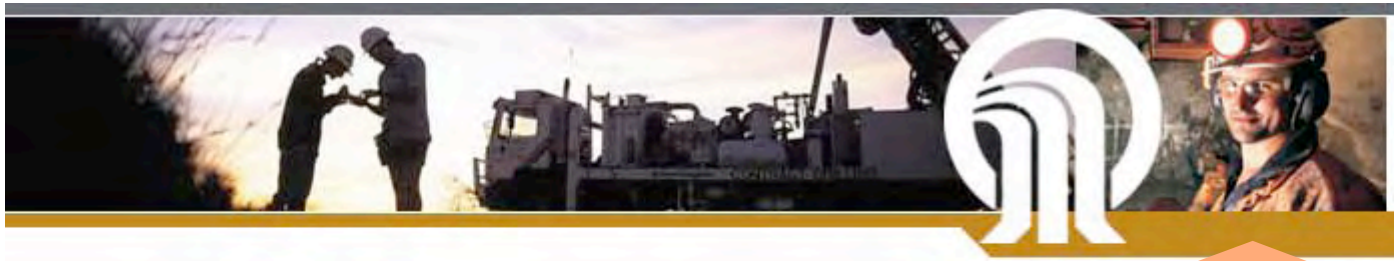


Slope Treatment Trials



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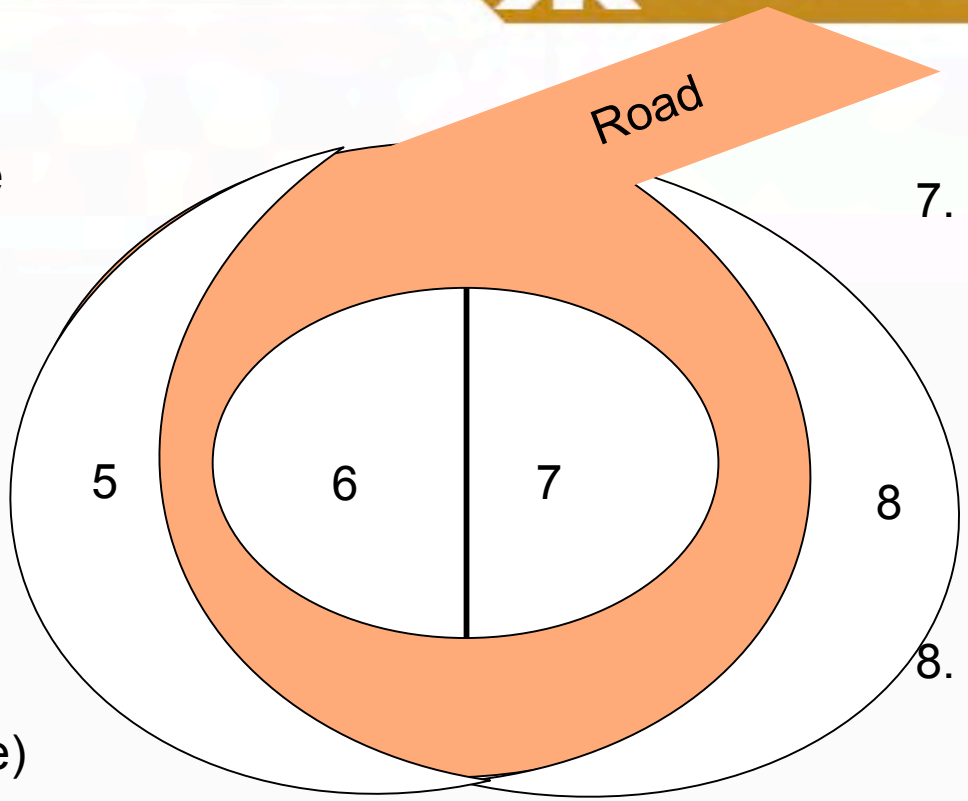
5. 1:1 Sandstone and old topsoil (+ 10 years stockpile)

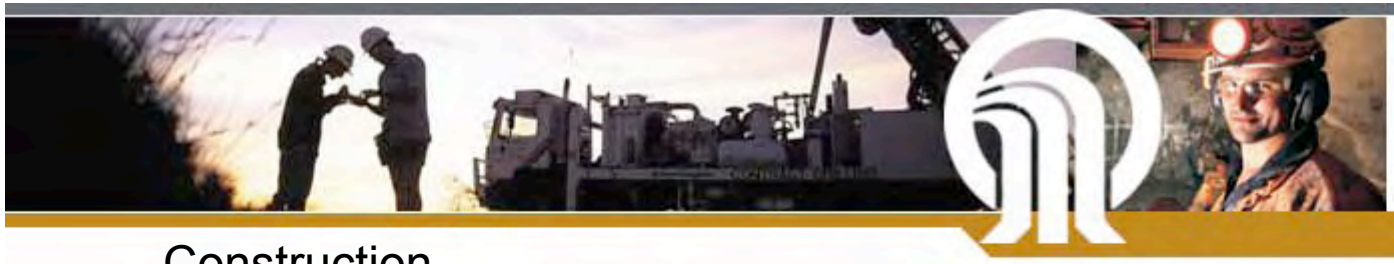
6. 1:1 Sandstone and premixed sandstone/old topsoil (+10 years stockpile)



7. 1:1 Sandstone and fresh topsoil (<6 weeks)

8. 1:1 Sandstone and premixed sandstone/fresh topsoil

TARGET ZERO
Our goal is zero injuries



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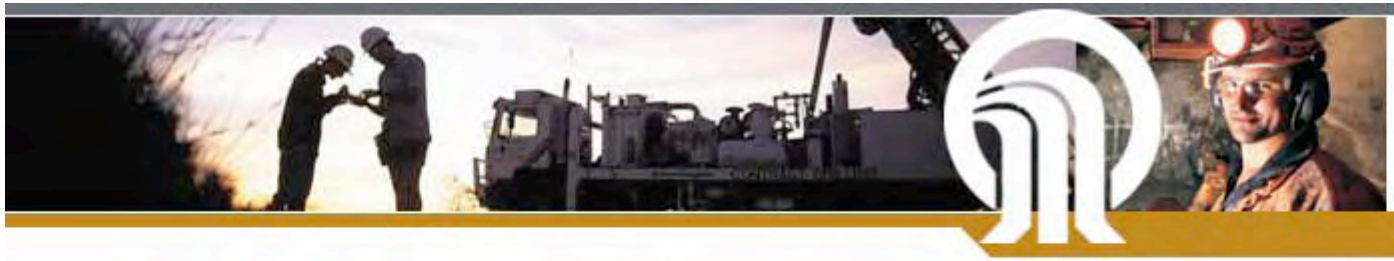
Construction

TARGET ZERO
Our goal is zero injuries



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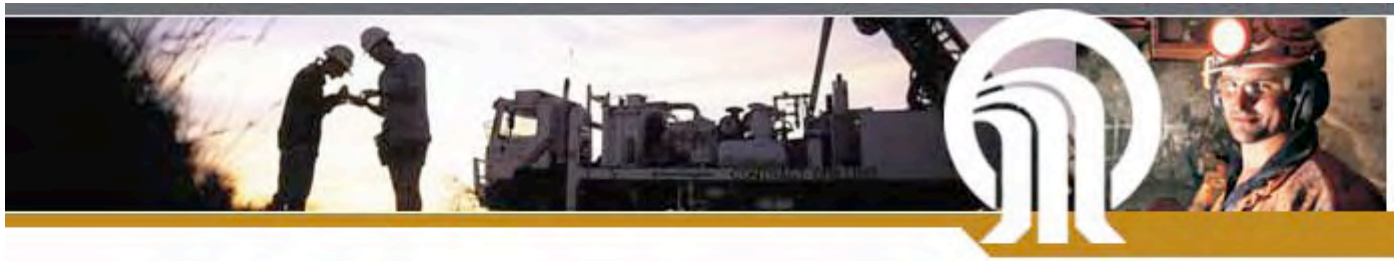
Mesa trail slope

TARGET ZERO
Our goal is zero injuries



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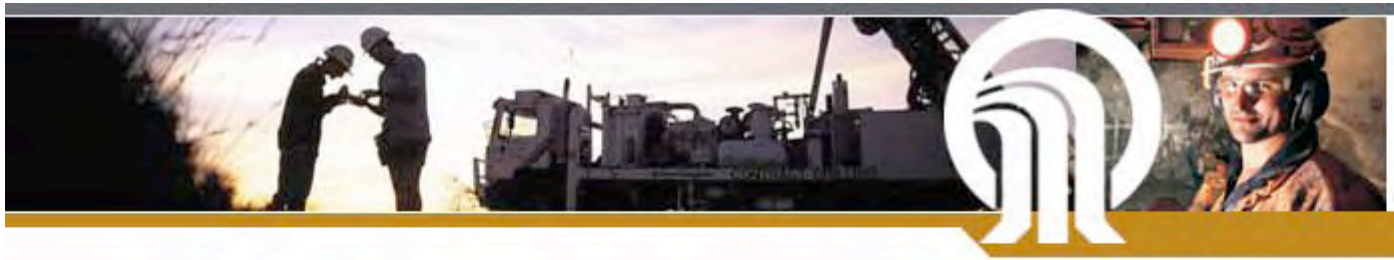
Rainfall

- As of 11 April 2007, a total of 590 mm of rain has fallen at Telfer since November 2006, including:
  - cyclone Isabelle on Jan 3, releasing 70mm within 24 hours
  - cyclone George on March 9, releasing 240mm within 72 hours
  - cyclone Jacob on March 12, releasing 63mm within 24 hours
  - cyclone Kara on March 28, releasing 110mm within 48 hours
  - smaller events of between 2 and 29 mm within 24 hour periods
- The observed outcomes are:



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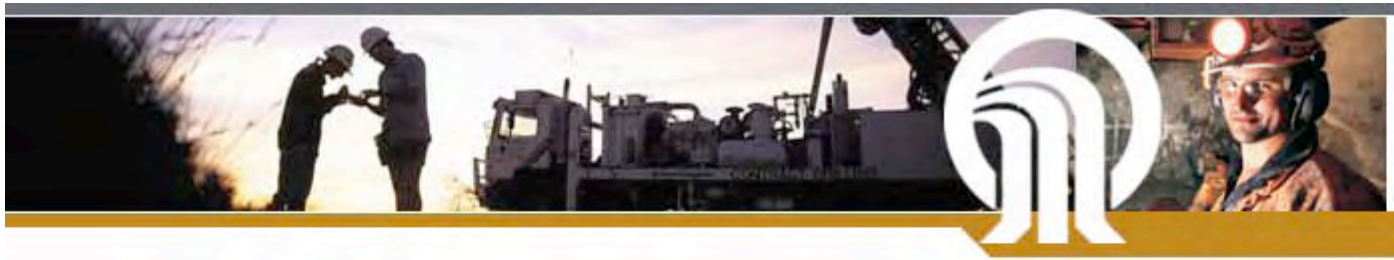
Mesa trail cross view – 16, 25 and 39 degree slopes

TARGET ZERO
Our goal is zero injuries



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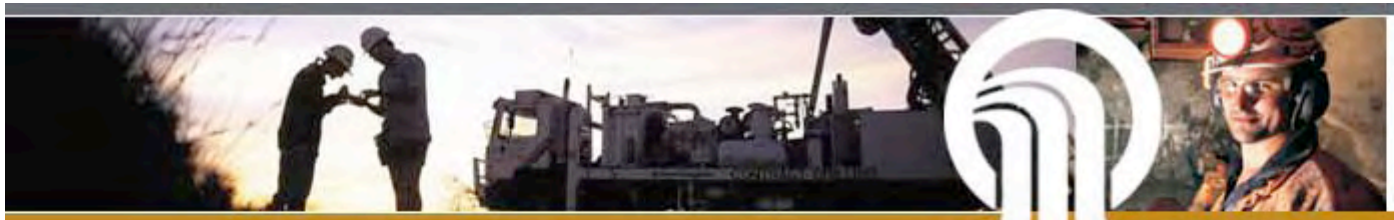
Trail Plot 1 – looking down slope after 116 mm and 590 mm rainfall

TARGET ZERO
Our goal is zero injuries



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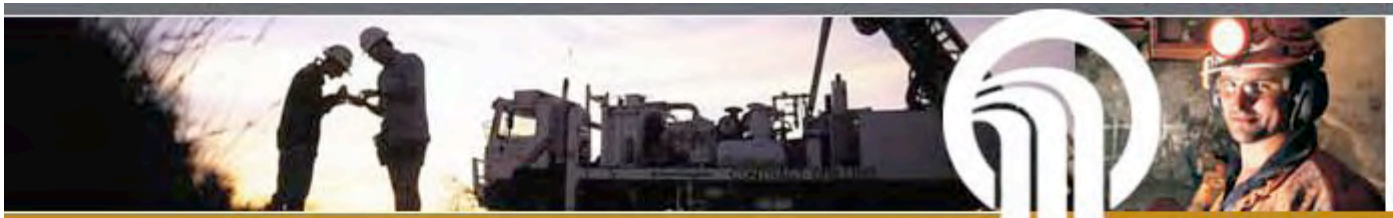
Plots 2 and 3 following 590 mm total rainfall

TARGET ZERO
Our goal is zero injuries



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Plot 4 – looking down slope after 116mm and 590mm rainfall

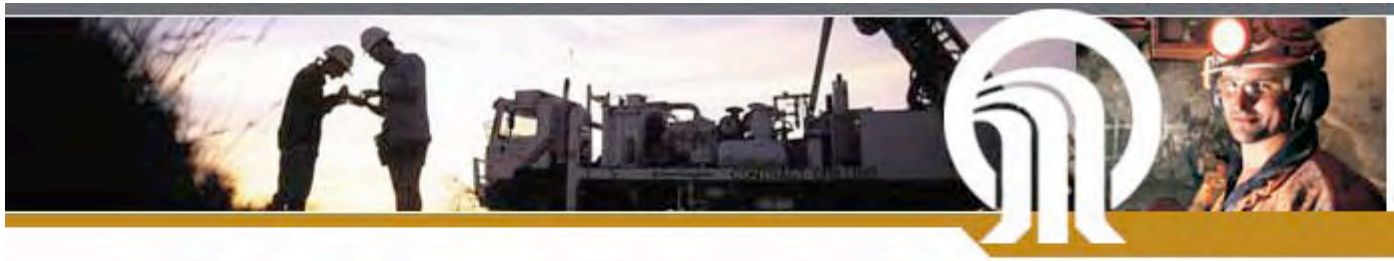
TARGET ZERO
Our goal is zero injuries

Plot 2 and 3 seedling growth


Surface treatments – plot 5 in the background to plot 8 in the foreground

Plot 7 – spinifex, acacia and grass spp breakthrough

Plot 8 – spinifex spp and groundcover spp



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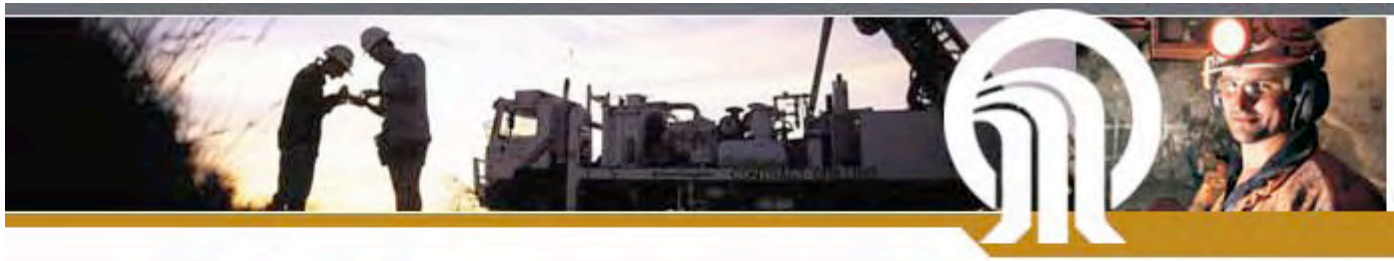
Key learnings

- It is possible to mechanically construct Mesa slopes
- Use appropriate equipment - D8 verses D11 dozers
- Demand an experienced operator
- Supervise all aspects of the work from start to finish
- Homogenously mixed rock armour and topsoils are showing early signs of good slope stabilisation
- Telfer soils applied as a layer over rock armour on slopes will not work
- Rock armour at 20cm thickness on slopes seems adequate so far
- One rock armour to one fresh topsoil seems preferred surface mix
- Surface hummocks of topsoil/armour at 50cm seems adequate so far
- Use of old topsoil does not necessarily equate to revegetation on either slope or surface



- Acknowledgments:
  - David Paige (Otb Group)
  - Brian Downing
  - Rob Loch (Landloch Pty Ltd)