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ENGINEERING GEOLOGY & GEOTECHNICAL MODELS

ENGINEERING GEOLOGY

Brickworks Stabilisation

Geotechnical Overview of the Brickworks Projects

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Introduction

- History of the Brickworks
- Overview of the Proposed Development
- Geotechnical Features
- Geotechnical Design
- Progress of the Work

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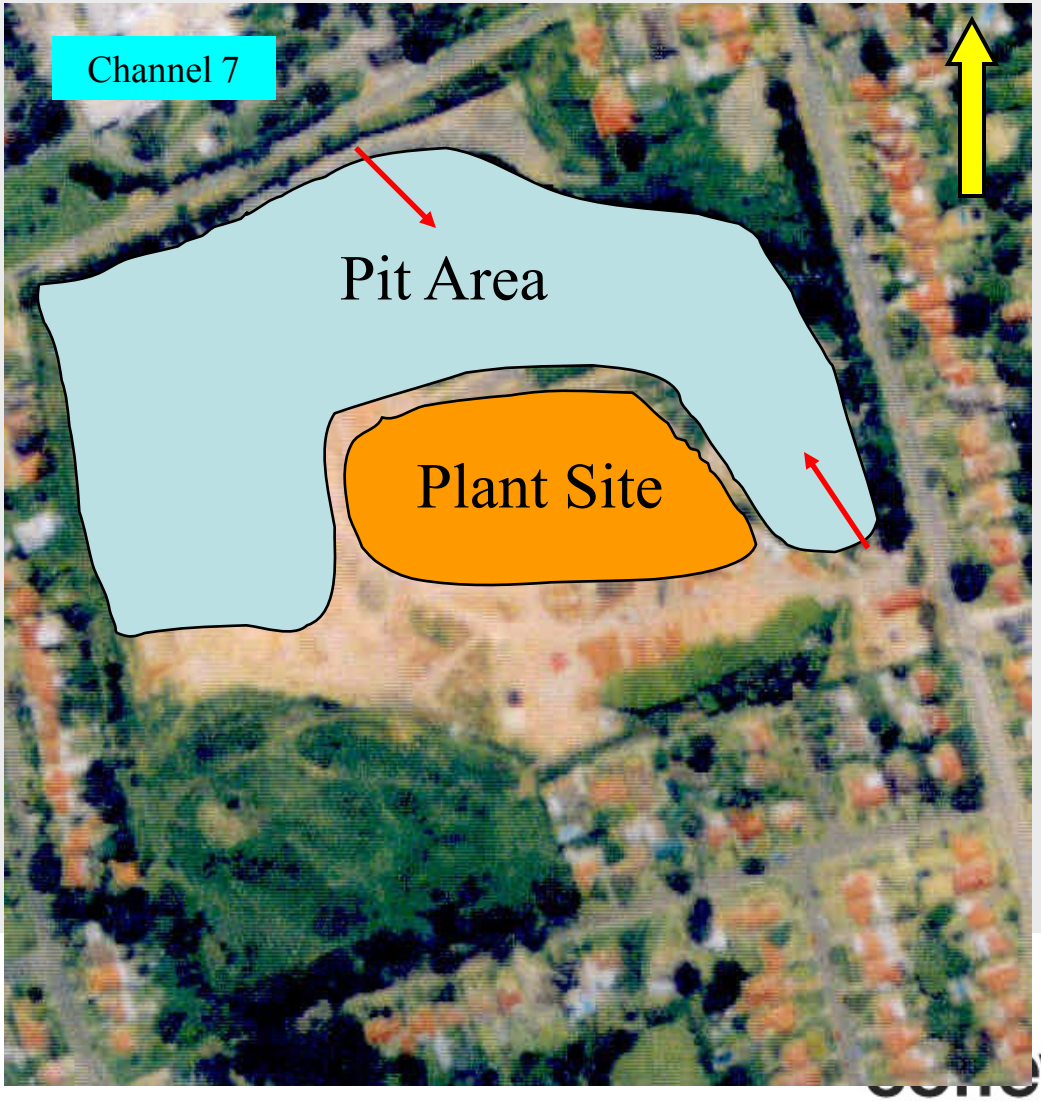
Brickworks



- Site Covers about 15 hectares
- Maximum Pit Depth about 30m

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Brickworks History

- Brickworks commenced operations early last century
- Originally coal fired kilns, later changed to gas.
- Bricks are made from a dry pressed mixture of shale and clay.
- Very labour intensive operation, high wastage but little capital investment required.
- Colour variation by controlling temperature and oxygen during firing.
- Pit opened by drill and blast into the 1960's.

Proposed Development

- Roughly 1 million cubic metres of fill to be placed
- 260 to 320 residential lots
- Mixture of detached houses, terrace houses and apartments

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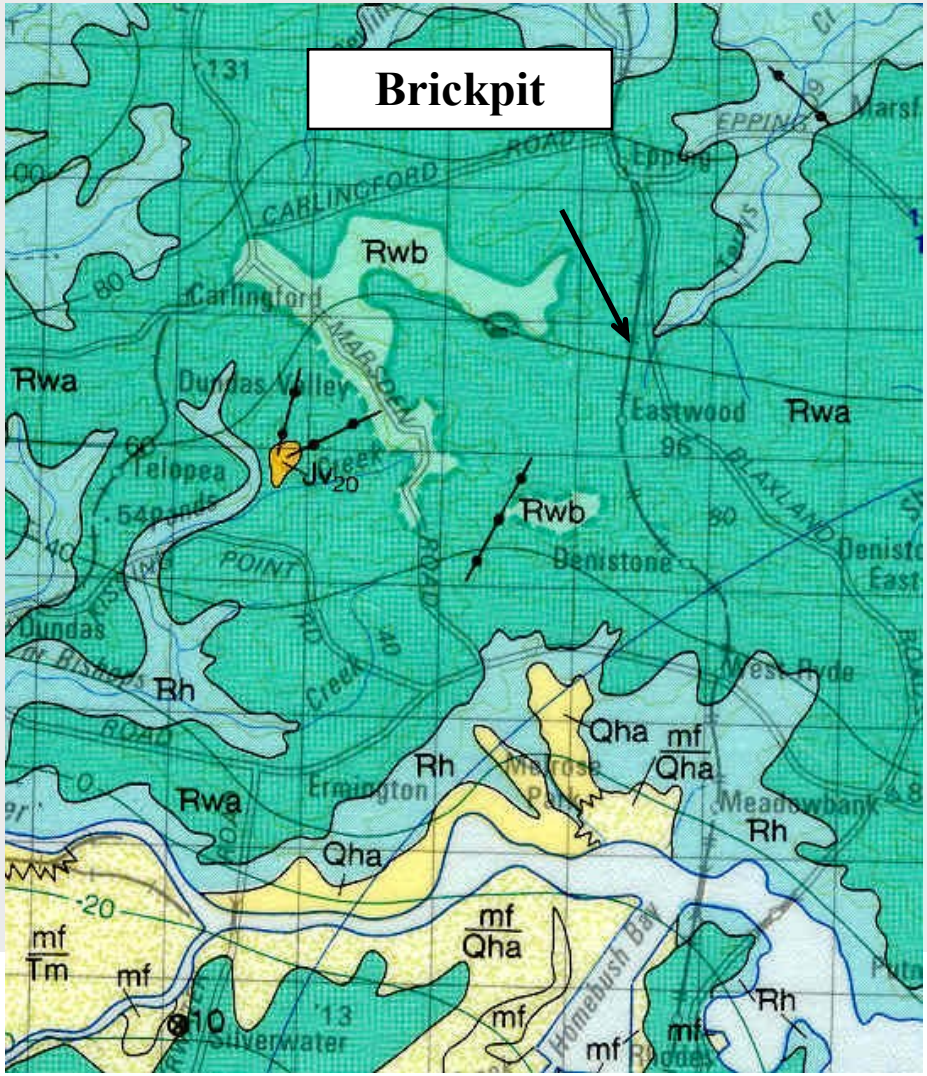
Geology



The 1:100,000 Geology Sheet shows the pit at the boundary between Bringelly Shale (Rwb) and Ashfield Shale (Rwa)

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Geotechnical Issues

- Settlement
- Pit Face Stability
- Earthworks Control

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Settlement

Predicted Settlements are:

Immediate (within 3 months of filling)

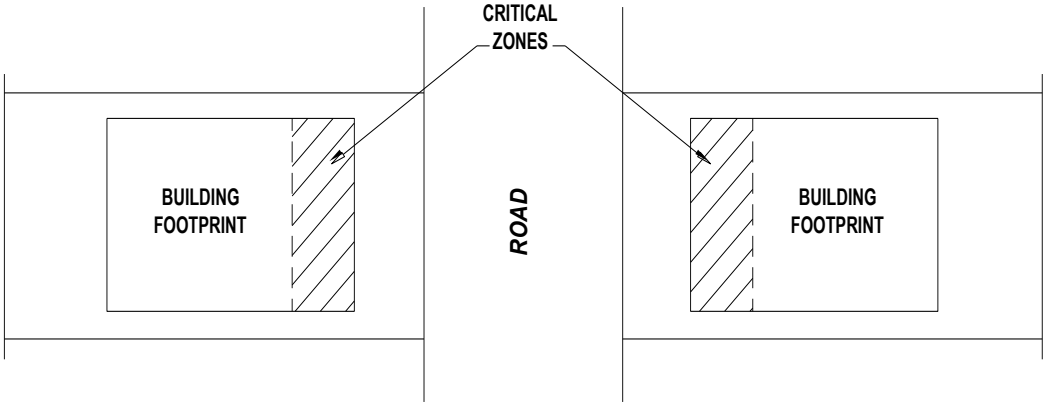
- 70mm – 10m fill thickness
- 280mm – 20m fill thickness

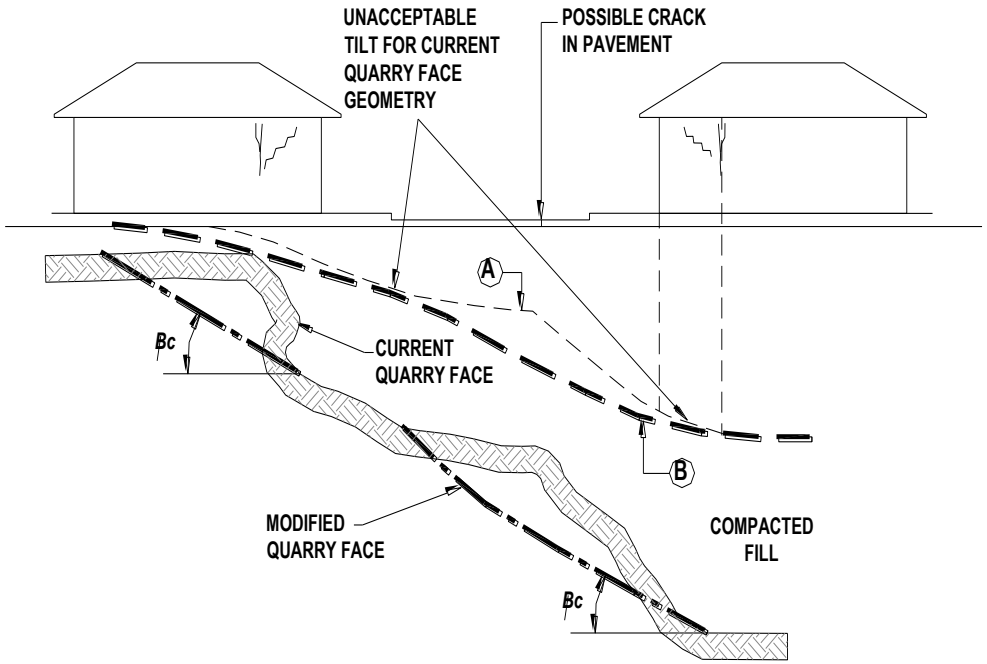
Long Term (>3 months after filling)

- 25mm – 10m fill thickness
- 85mm – 20m fill thickness

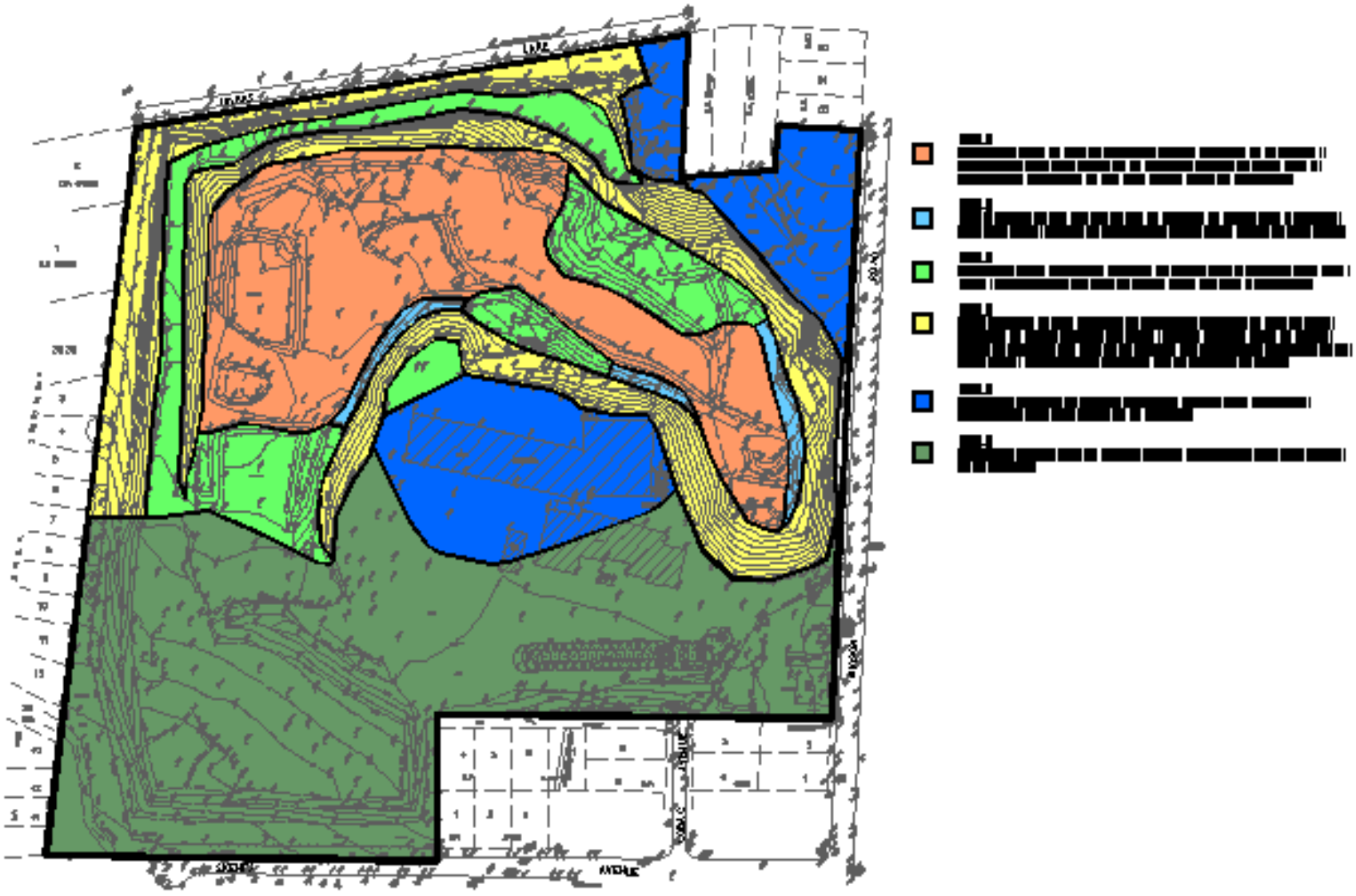
Settlement

Key consideration is tilt resulting from differential settlement arising from variable thickness of fill





Development Zoning Based on Settlement



Settlement Monitoring

Installations

Liquid Settlement Gauges

- Installed at different levels as the site is filled
- Provide a point measurements of settlement

Hydrostatic Profile Gauge

- Pipe is laid in a trench and then a probe is run along the pile to obtain a settlement profile

Settlement Monuments

- Pins installed at the final ground surface
- Provide a number of point measurements across filled areas.

Settlement Laboratory Testing

- Test rigs have been ordered to allow testing of 75mm diameter samples.
- Two rigs will allow samples of shale and sandstone to be tested at three different confining pressures to simulate different fill thicknesses.
- The samples will be compacted in accordance with the specification.
  - Loaded in the ‘as compacted’ state.
  - Saturated after immediate settlement is complete.
  - Monitored for creep settlements.

Pit Face Stability

Two main stability issues:

- Near vertical faces that are continually suffering rock falls
- Existing slip at the eastern end of the north face

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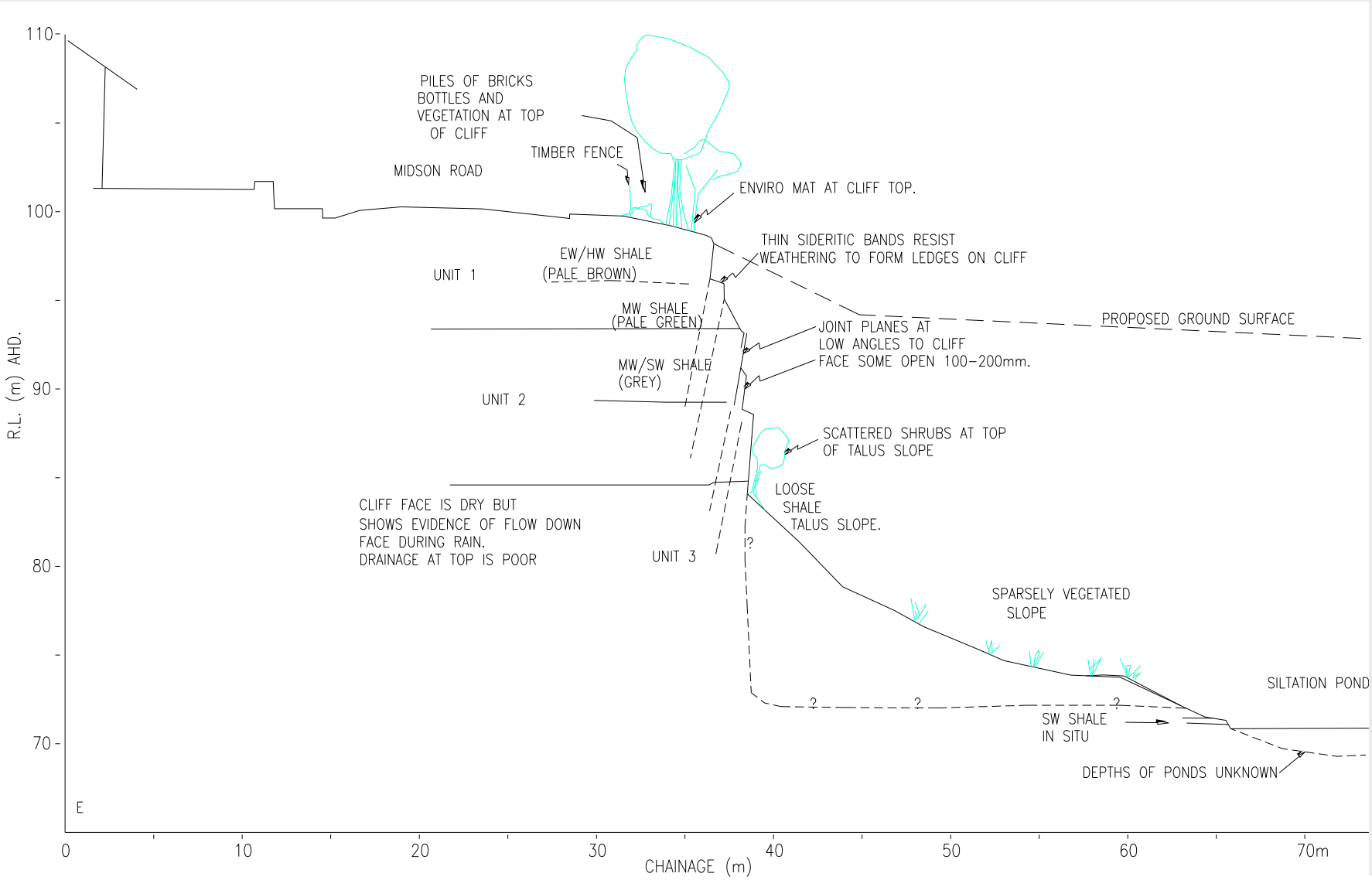

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Mobbs Lane Face

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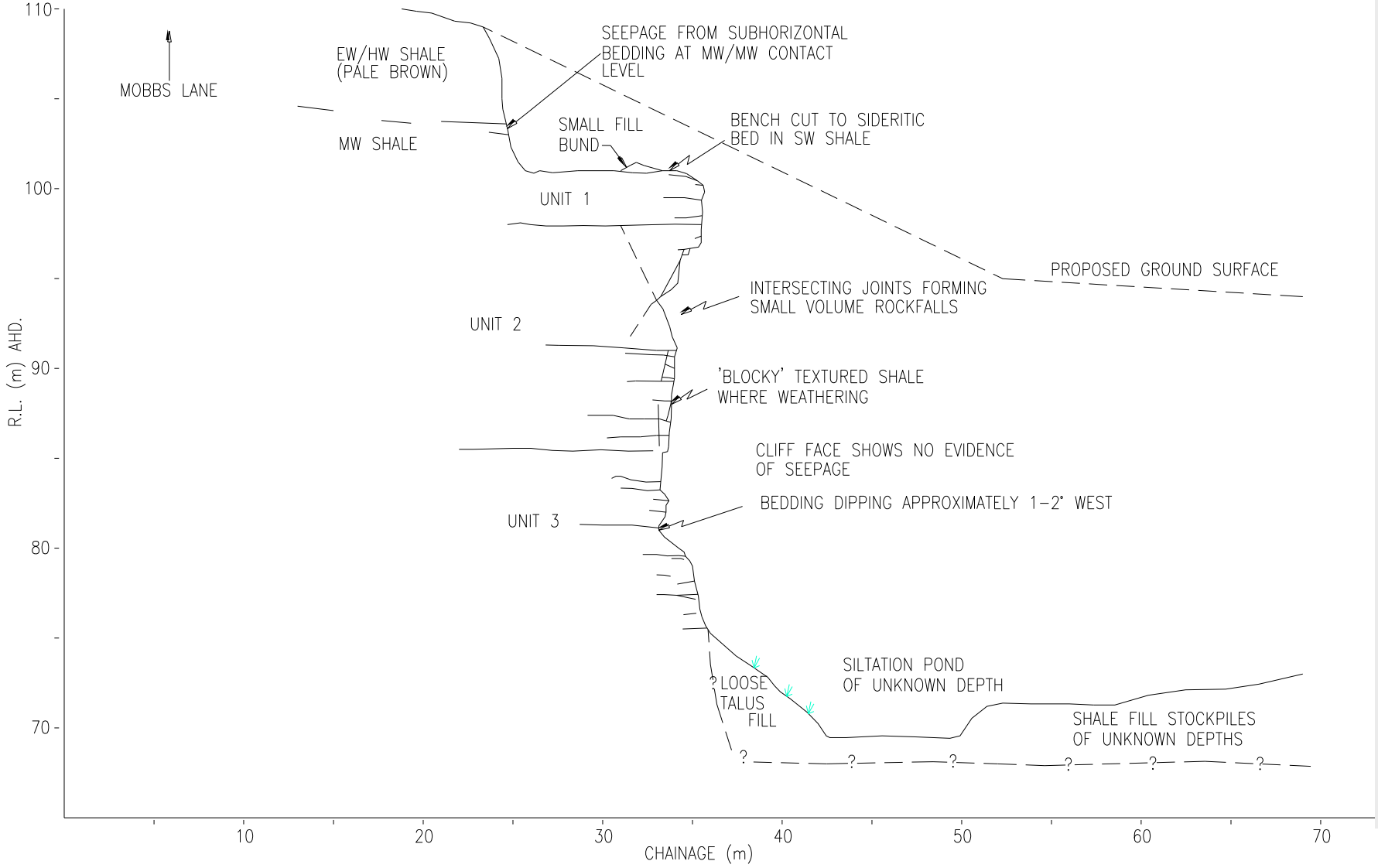

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Existing Slip

Occurred in 1999

Existing Slip

- The failure occurred in September 1999.
- About 40,000 cu.m of material in the slide.
- North east pit wall was 20m from the rear of No.96 Mobbs Lane.
- Poor drainage - Area behind the Mobbs Lane houses.
- Absorption trenches constructed to take roof water when No.96 was built.
- Drainage ditch was excavated at the toe of the north east pit wall in 1996 and deepened in 1998.
- 1998-1999 were wet years.

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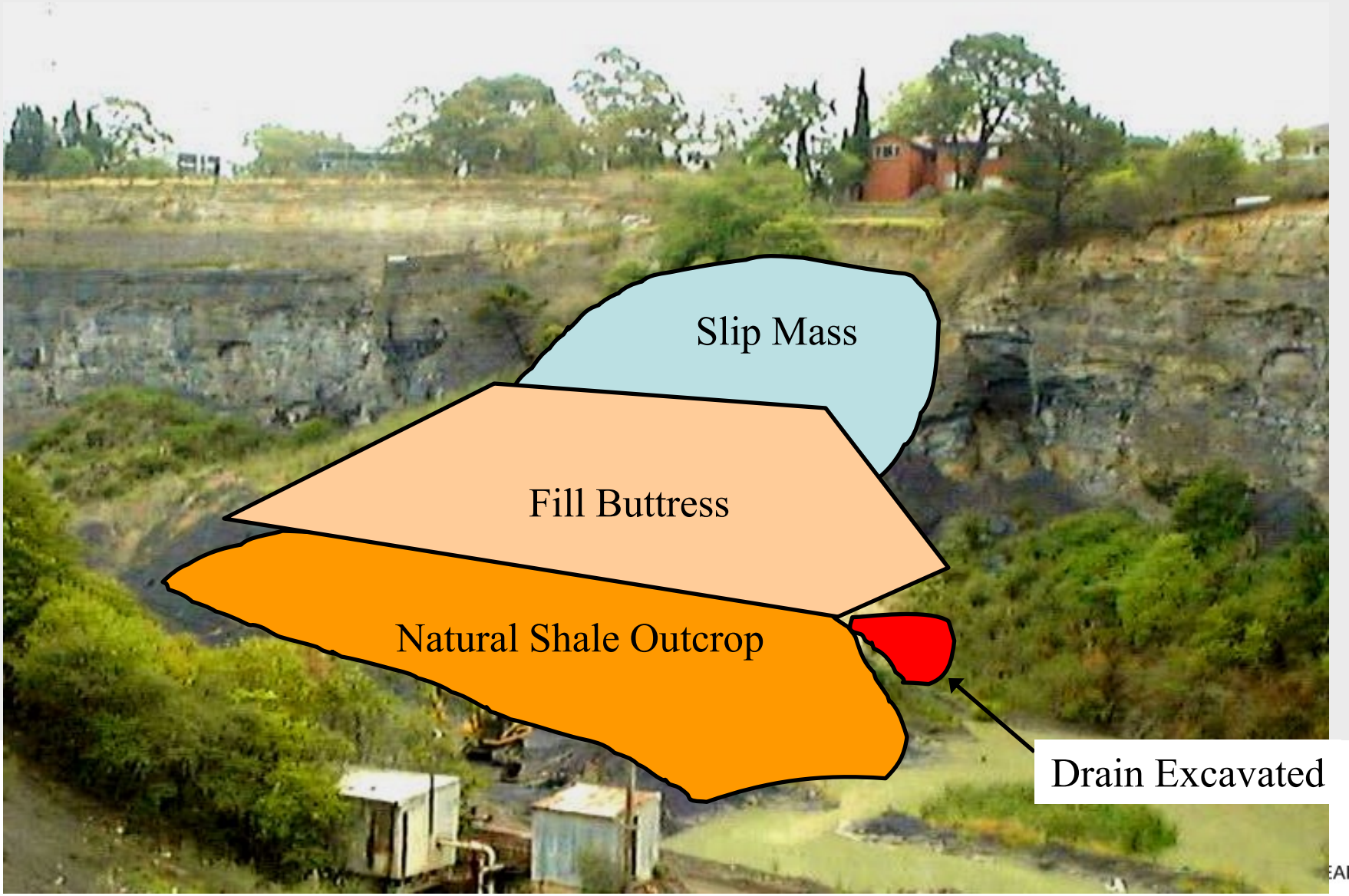
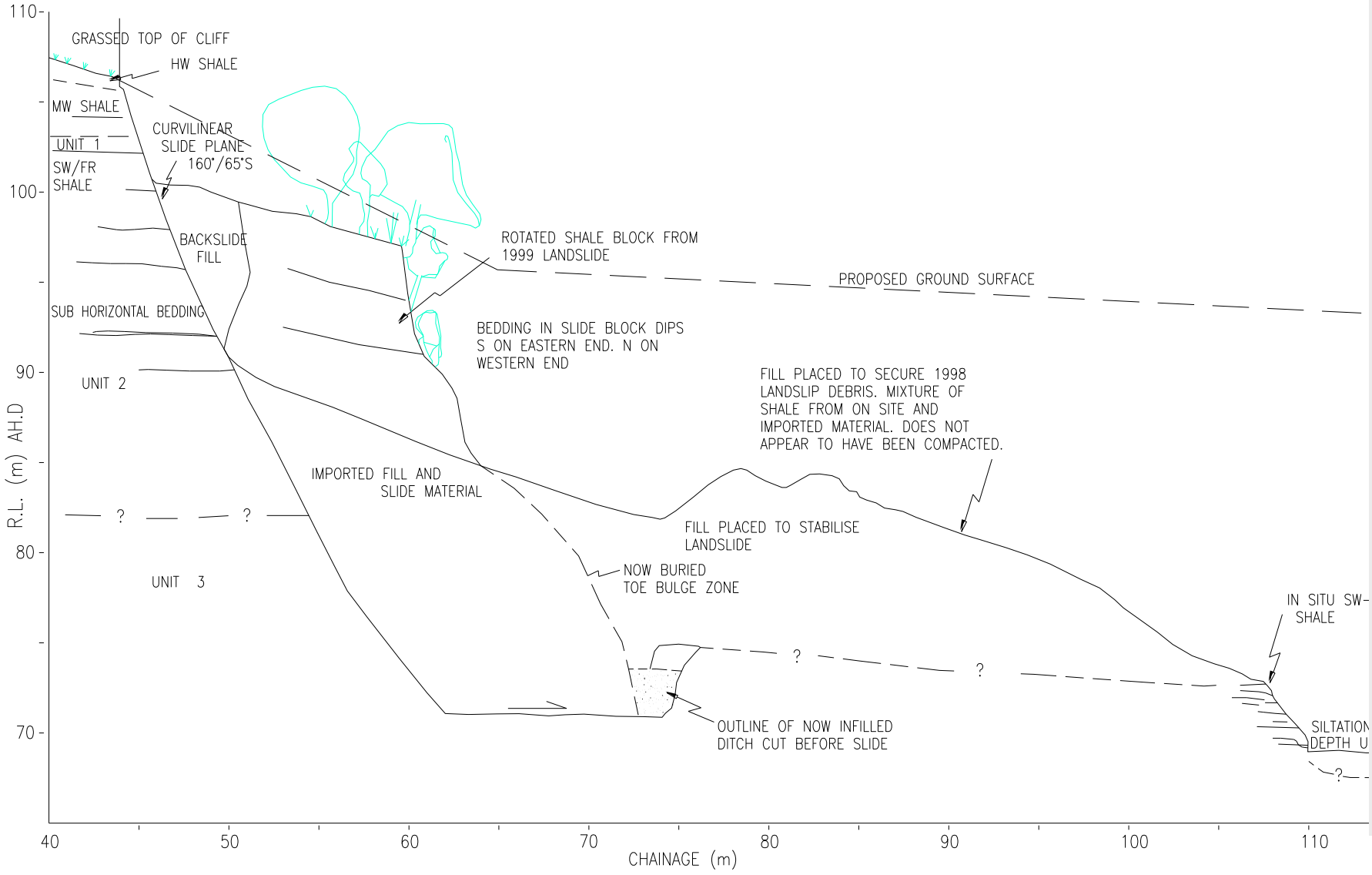
Existing Slip





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Oops!

Prior to the failure in 1999 a leading geotechnical consultants report on the pit walls stated:

" … while small wedge failures and fretting/erosions of the faces were observed, it is considered unlikely that a large scale wedge is present which could cause significant failure of the face that would affect Mobbs Lane, Midson Road, or the adjacent properties."

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Temporary Stabilisation Measures

Near Vertical Faces

- Batter Mesh
- Horizontal Drains
- Rock Bolts
- Scaling

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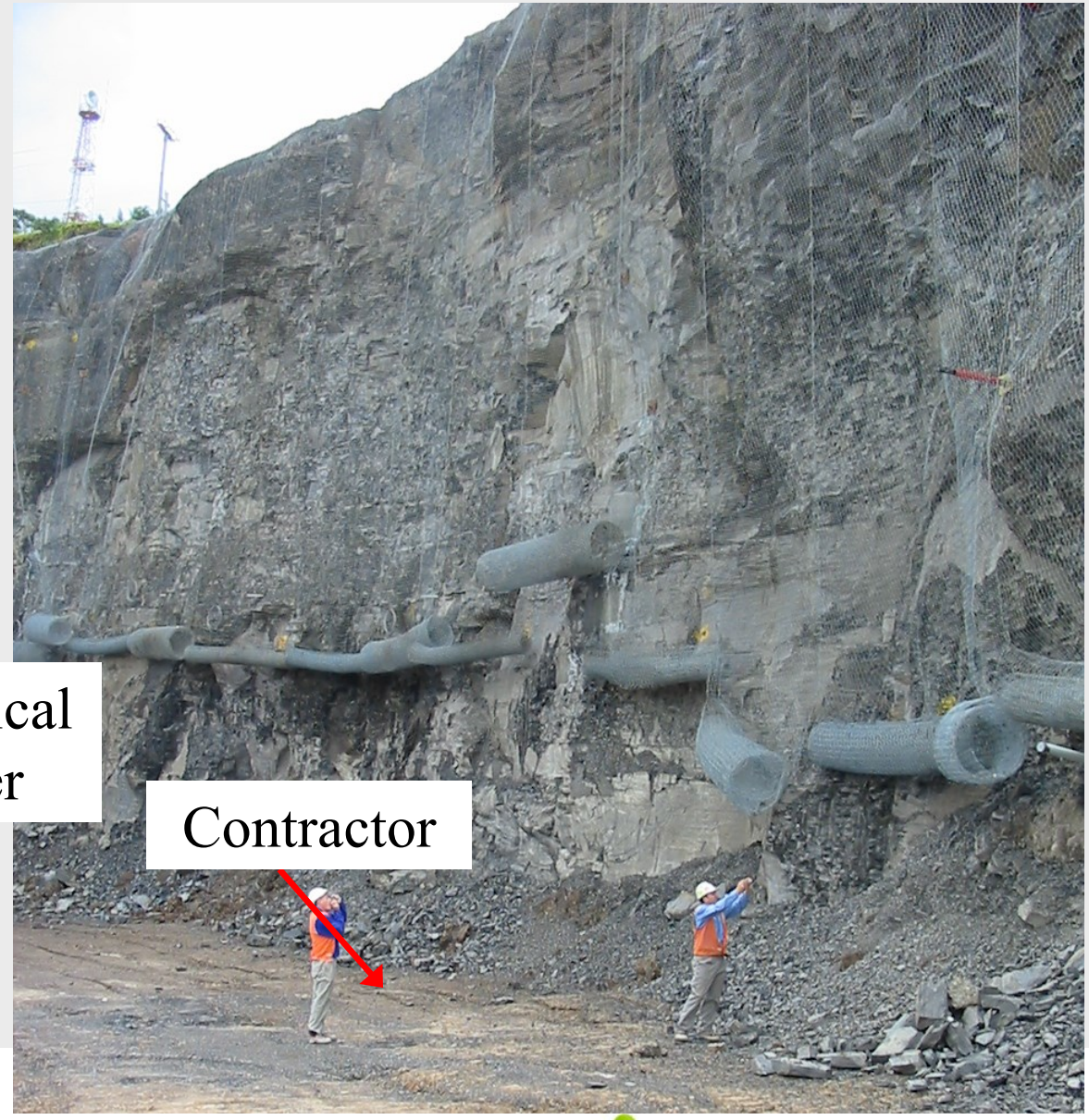
Batter Mesh



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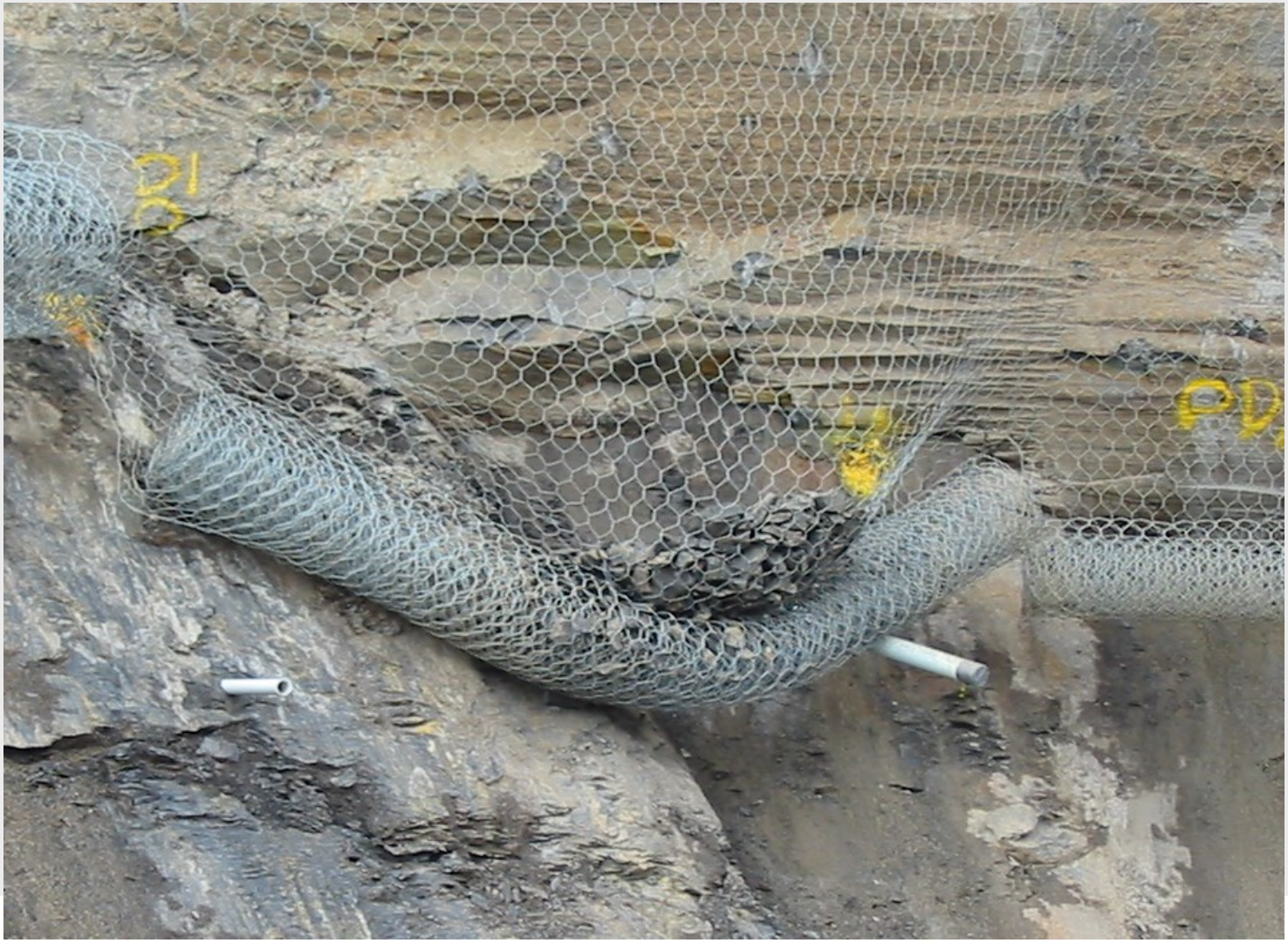
Does the Batter Mesh Work?



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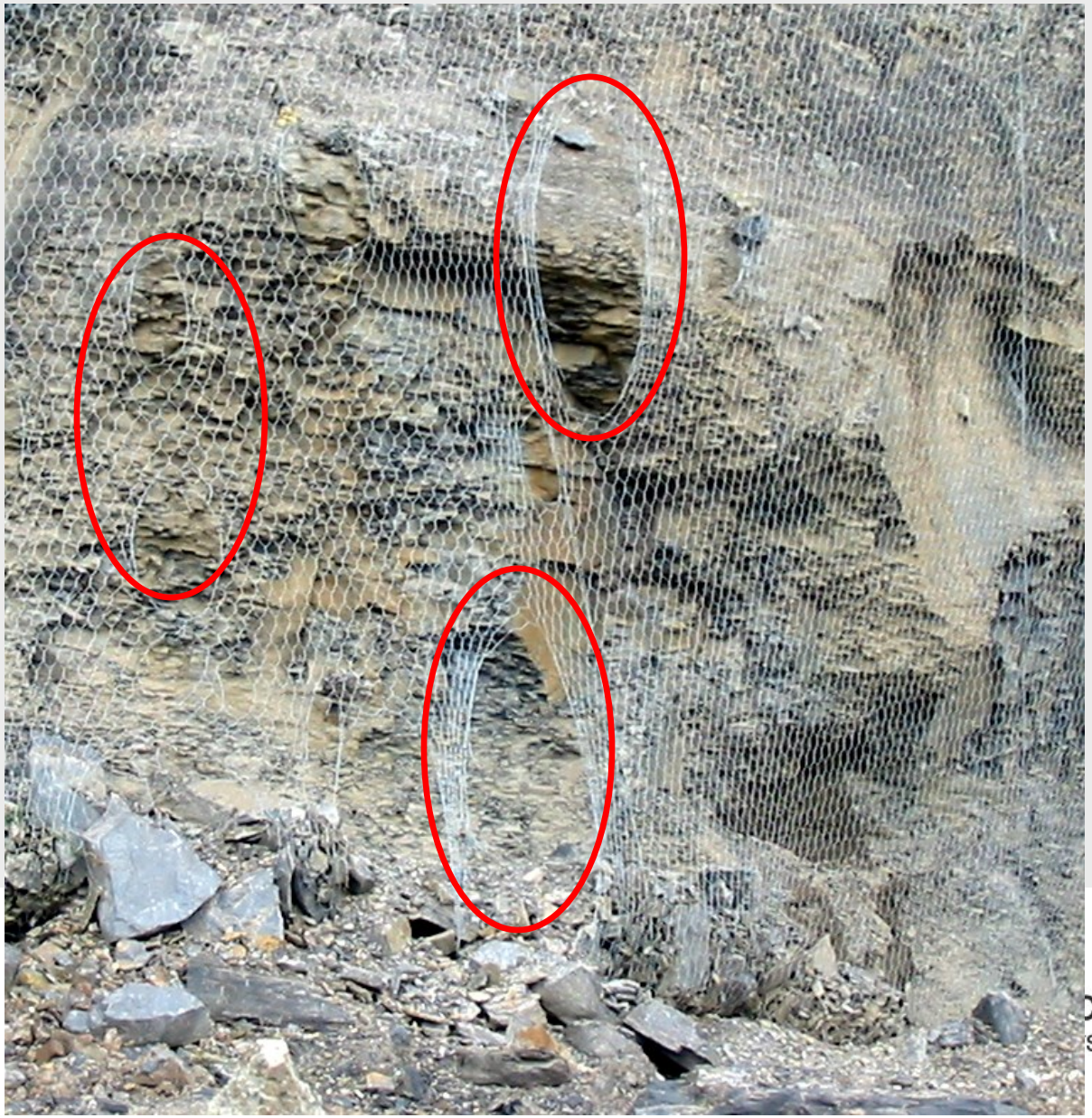
Does the Batter Mesh have Limitations?



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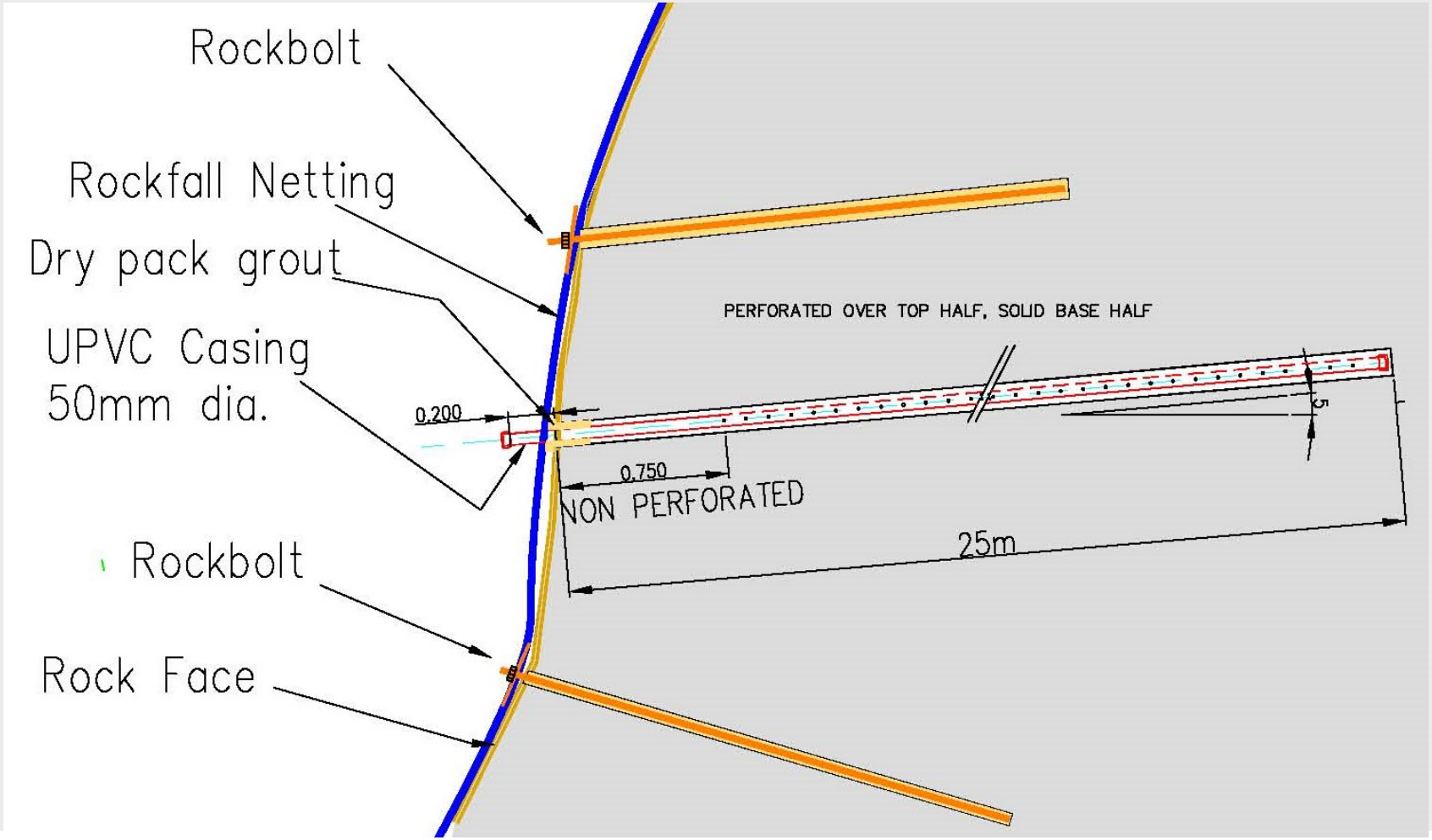
Drains



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Drains

- 50mm PVC
- 15m long

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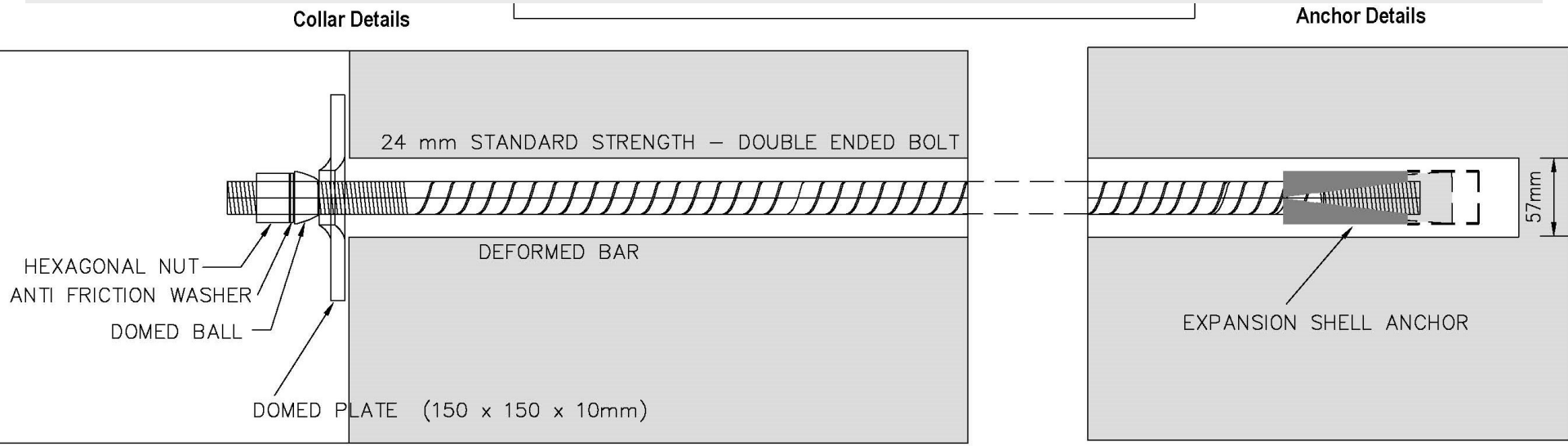
Rock Bolts



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Scaling

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- “Giraffe”
- 27m reach
- Used for Mobbs Lane
- Midson Rd scaled by hand

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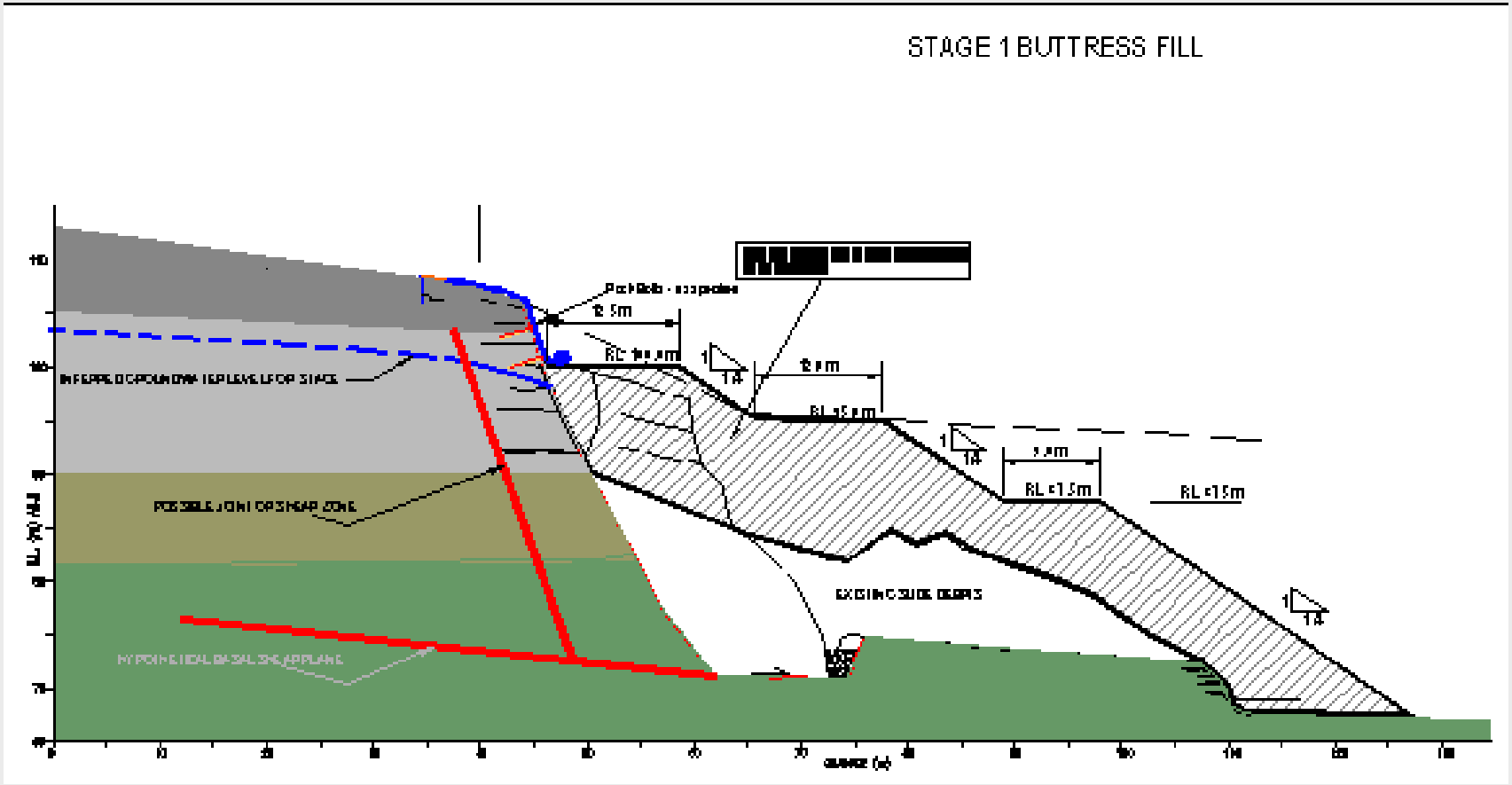
Slip Removal



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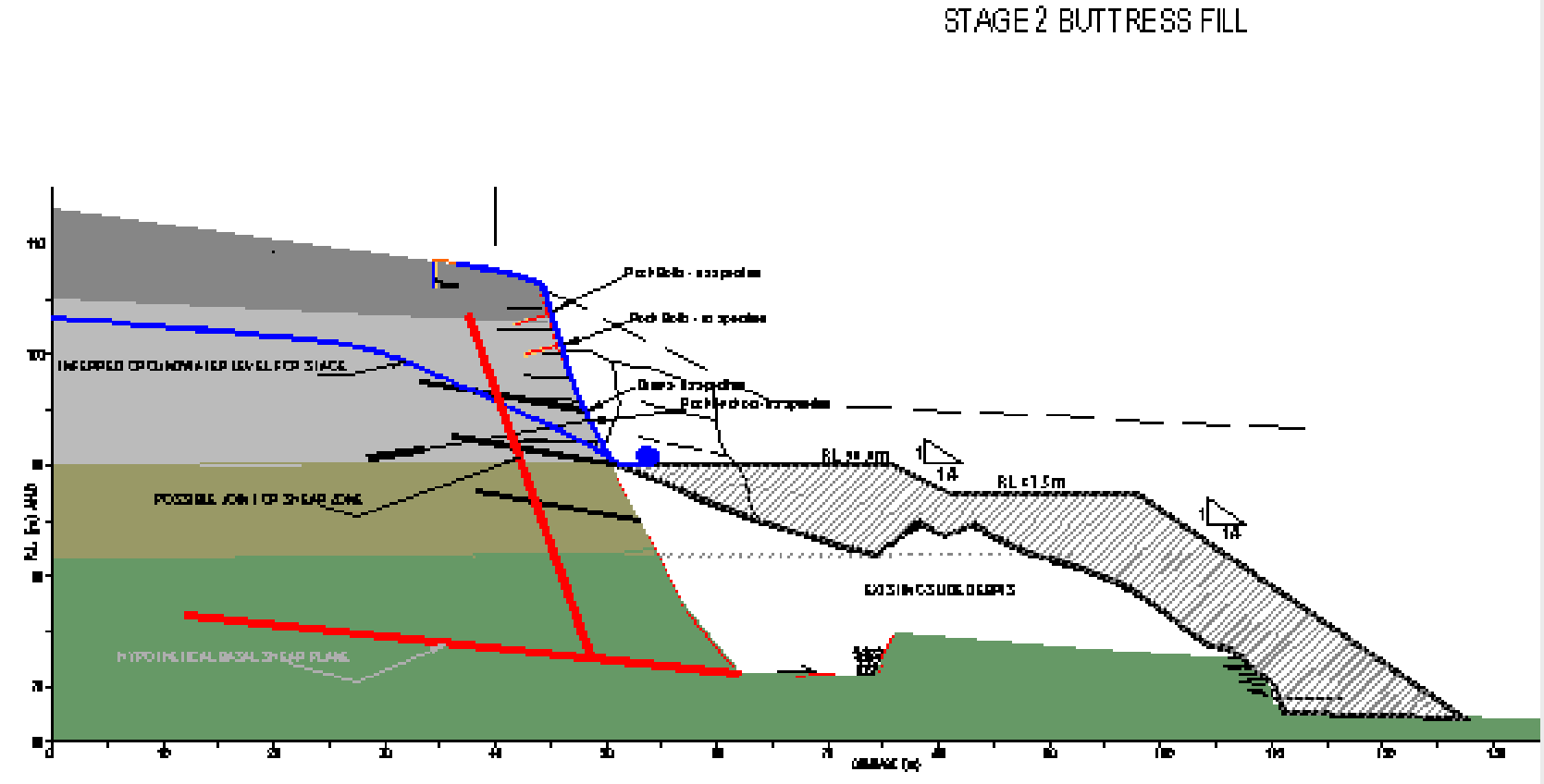
Slip Removal



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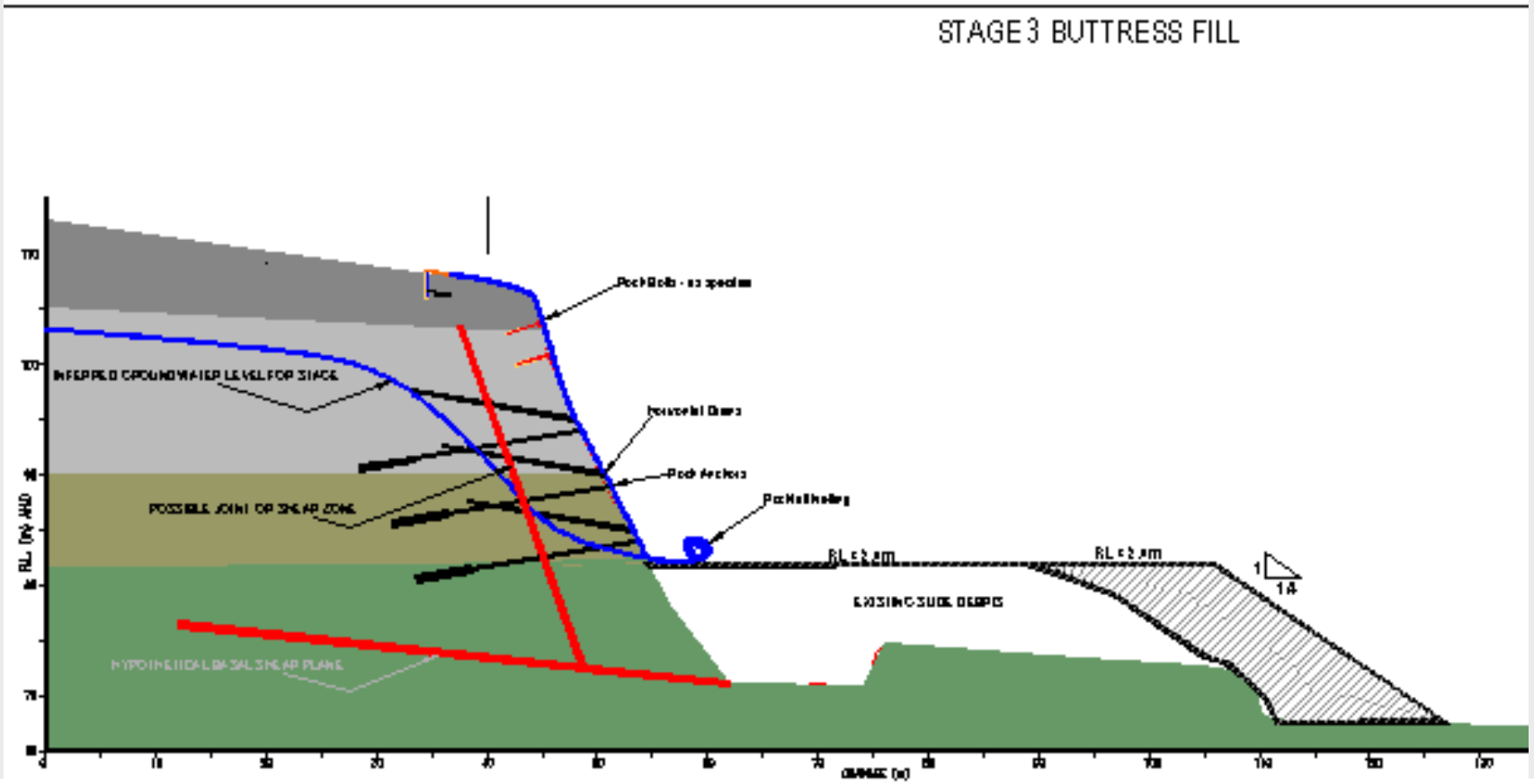
Slip Removal



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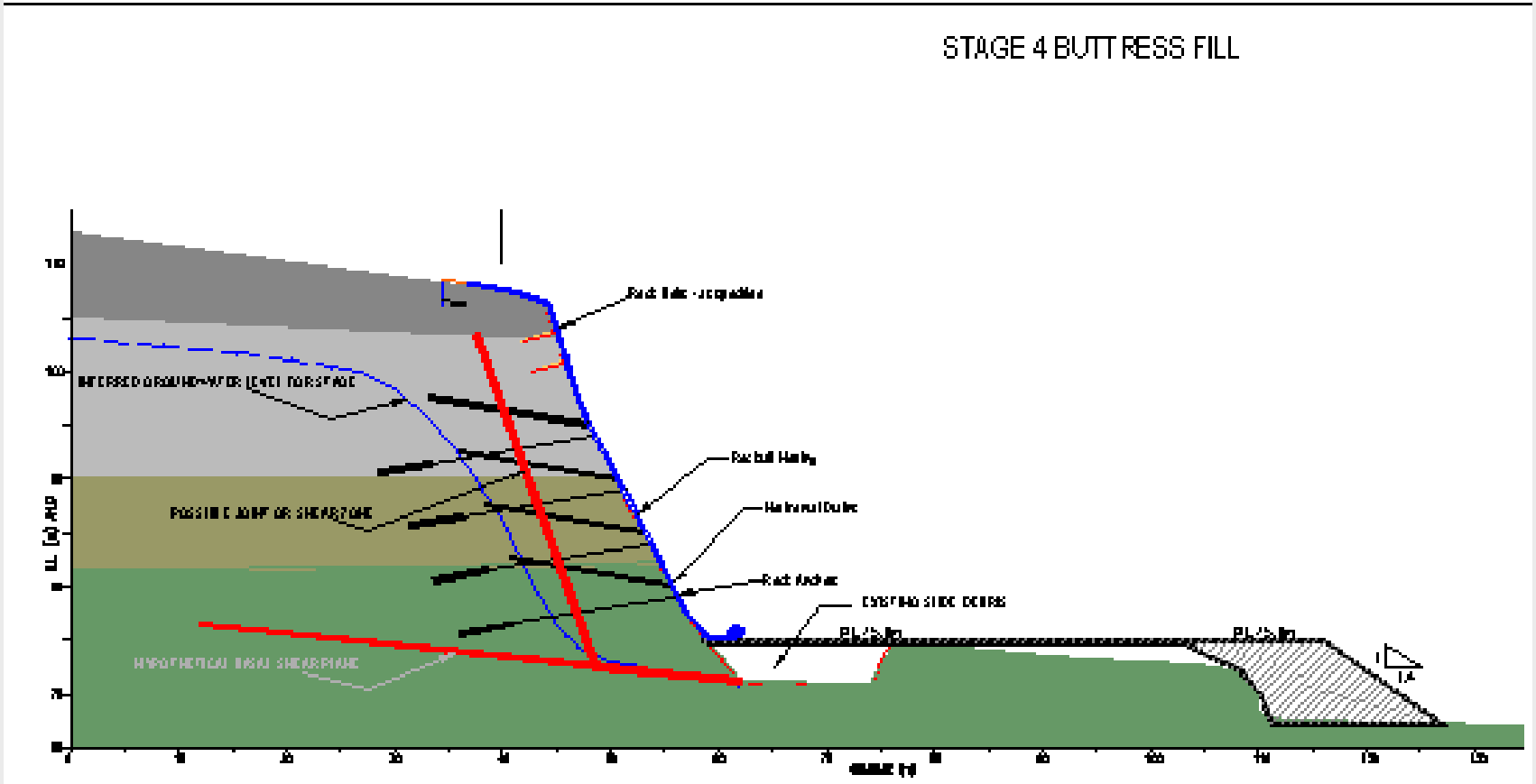
Slip Removal



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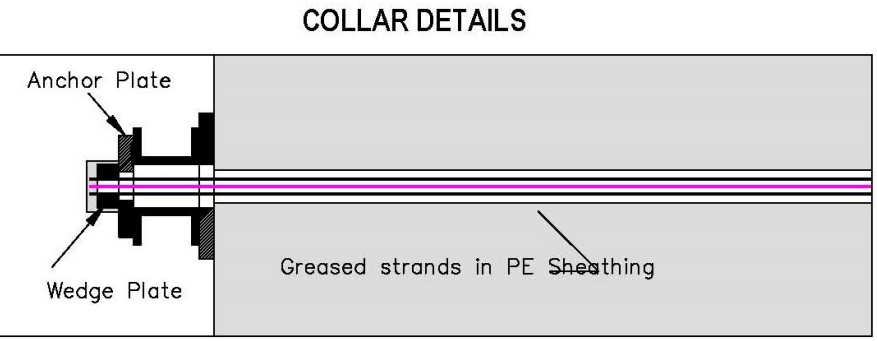
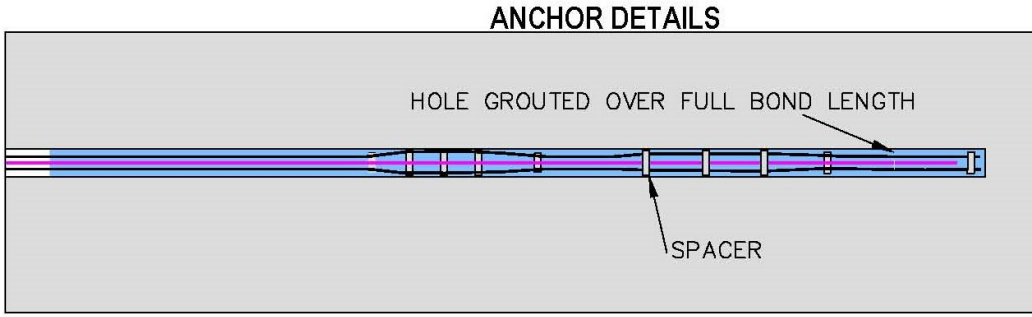
Rock Anchors





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Slip Removal Progress to Date

- Stage 2
- Excavated to RL93

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Slip Removal Progress to Date

Slip Removal Progress to Date

- Stage 3
- RL82

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Other Instability Features

- Slip in Fill
- Occurred after heavy rain

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Earthworks Control

- Level 1 Earthworks Testing
- Technician on Site Full Time
- Compaction Specification
  - Minimum of 98% Standard
  - Moisture –1% to +2% of Standard Optimum

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Compaction Plant

- CAT 825
- 25 tonne machine

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- Effective at breaking up high strength shale and brickbats
- Thin layers (spread in 2 x 100mm layers) to achieve breakdown and moisture conditioning

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