# Case Study

Geofabrics

**Project:** **Boggabri Erosion Control Flumes**
**Date:** **01/01/06**
**Client:** **Indemitsu Boggabri Coal**
**Location:** **Boggabri, New South Wales**

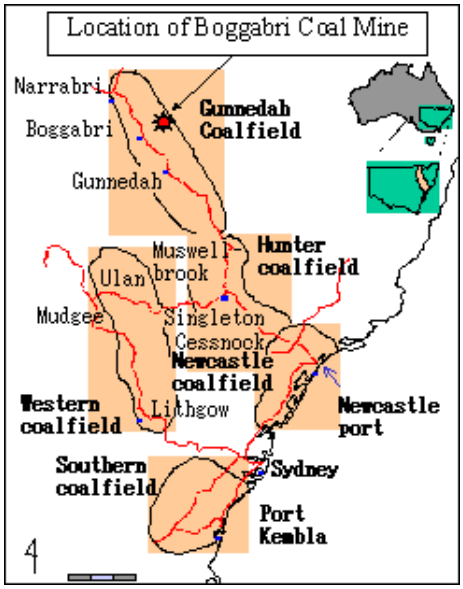
Geofabrics AUSTRALASIA PTY LTD

## Background

During the past ten to fifteen years, the resources sector has seen phenomenal growth however in the areas of coal, gas and petroleum the expansion has been unprecedented. In NSW, coal mining in the Hunter Valley near Singleton and Muswellbrook has always been the focus of attention for coal mining and growth, however despite expectations that deposits will be available for some years to come, it is agreed that the coal reserves are dwindling.

This fact is seen in the Lower Hunter near Lake Macquarie and Central Coast where mines are closing or entering 'care & maintenance' phases. Despite expansion of some mines, due to their proximity to dense residential areas, applications for expansion are being met with fierce resistance from residents and approvals are difficult to get for environmental reasons.

Currently the Port of Newcastle and the coal loading facilities are experiencing major infrastructure and capital works expenditures. The output through Newcastle has trebled in the last four years and has been regarded as a bottleneck for coal throughput as coal is transported ever increasing distances by rail to the port. Consequently major expansion of rail infrastructure is also being undertaken to cope with this increasing demand. With demand for export coal expected to continue to rise, coal sourced from mines north west of the Hunter are increasingly viable due to high coal prices.




A region of New South Wales that has not been developed, although geological exploration has been ongoing for a number of years, is the Gunnedah Basin area in north western NSW. This area is now considered to be the next major coal province as the Hunter Valley coal reserves dwindle. As well, it is considered an excellent potential source of petroleum and methane gas (of the order of 750 billion cubic metres). Coal is found at favourable depths of between 250m and 850m and one billion tonnes of coal is expected to be mined over the next ten years.

Boggabri is a small town on the Kamilaroi Highway approximately 100 kilometres north of Gunnedah. In 2006, the town had a population of 901 residents but since the local mine has been developed this has increased significantly.

**The Problem**
The Boggabri mine at Mauls Creek is an open cut operation owned by Japanese energy company, Indemitsu. The daily operations are contracted to Downer EDI Mining and produces 1.5 million tonnes of low ash thermal coal which is ideal for export markets. However it also produces 14 million tonnes of overburden. This strip ratio (9:1) is considered high, especially when one considers that there are plans to treble production by 2014.

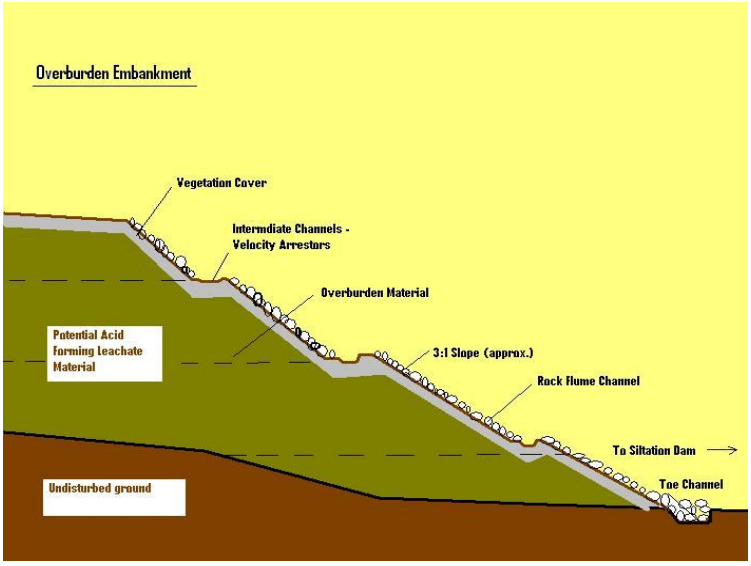
Located in the Leard State Forest, the mine is monitored constantly to prevent environmental damage from the massive mountains of overburden and the need to control acid sulphate soil leachate runoff from the site into local creeks and river systems.

As in many new mining developments in regional NSW, local communities and farmers are actively protesting due to loss of land to traditional farming. Gunnedah is rich in wheat, sorghum, barley and cotton. However the region is world renowned for their high quality cattle and sheep with the largest Sales Yards in the country last year selling more than $91 million in stock. Therefore the mine is seen as a threat to this already lucrative and traditional business. The environmental issues are critical to the ongoing operation of the mine as locals closely monitor this high profile mine.

Some of the environmental issues considered included:-

- acidification (acid mine drainage)
- contamination of groundwater
- loss of biodiversity
- dust emissions
- erosion control of:-
    - haul roads
    - overburden embankments

The run-off from overburden embankments was a key consideration and therefore some factors which needed consideration included:-




- Slope stabilisation
- Stability over soft soils
- Liquefaction due to heavy rain events
- Perimeter catch channels
- Flume channels
- Rainfall runoff velocities
- Design of slopes 1:3

**Traditional Methods**
Traditional methods of directing water runoff from embankments has been rock revetment, however the problem of displaced rock caused by the action of large volumes of water at high velocity meant that maintenance of these structures were very high. The rock would migrate to the base of the embankment which then allowed erosion to occur. This increases the potential for fine acid sediments migrating and the risk of surrounding waterways becoming contaminated.

Bench contouring, drainage channels, water velocity dissipaters and large toe drainage channels mitigated some of these problems however the owners sought to make improvements and Geofabrics Australasia were asked to consider alternative solutions.

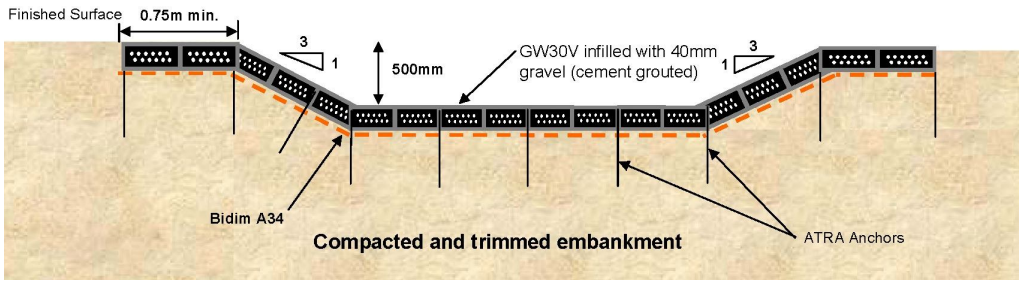
## The Solution

When the mine was inspected, various methods had been attempted to create a flume structure and with adequate erosion control measures.

The use of gabions and mattresses were considered however there was considerable cost in screening the overburden to obtain the desired sized rock. The cost of importing a suitable rock was out of the question when there was such a large quantity of excess material already on site.

Existing rock revetment flumes had failed and despite various attempts, maintenance costs were mounting. Some erosion control mats had been used, however Jute or similar biodegradable mats were only a short term solution, particularly as it was difficult and expensive to establish a top soil so that vegetation could grow in an otherwise acid rich soil.

In conjunction with the environmental people on site, it was agreed that we would produce some preliminary sketches for a flume using **Geoweb®** as a cellular confinement system.




The design suggestion shown above was presented Boggabri Coal for consideration. Initially, the typical rock size of the overburden was thought to be 100mm however there larger rocks up to 200mm present in small amounts. We recommended that, ideally, the material be screened of the larger sized rock and that a 40mm minus grading should be cement grouted into the cells to ensure erosion was kept to a minimum. As with the mattresses, the cost to pass the overburden through multiple screens increased the cost significantly and as cement grouting was costly, the client rejected this initial design.

In conjunction with the contractor Daracon Mining and the mine, it was agreed to trial the Geoweb® provided the size of the rock had a nominal size of about 100mm. The remaining finer fraction was considered sufficient that it would fill the voids within the cell and lock in the larger rock.

The most suitable depth of the Geoweb® panel was decided to be 150mm as this could contain the larger rock sizes. We recommended a geotextile separation layer to minimise any undermining of the structure and recommended that the Geoweb® be pocketed into the embankment to avoid the sides being undercut.

In addition we recommended that the Geoweb® be anchored into a trench at the upper end so that runoff could not undermine the structure. In the standard detail for Geoweb, Atra pins are used as they are manufactured from fibreglass and therefore not affected by the acidic soils. However due to costs, the mine decided to use 500mm galvanised pins fabricated locally from galvanised deformed bar reinforcement rod and placed every third cell to provide sufficient restraint to the Geoweb structure.

Prior to construction, the availability of 150mm Geoweb® and lead times from Presto meant that we could not meet the mine's time frame for delivery. We reviewed the grading of the overburden material and we suggested that based on the current size of rock, the 100mm deep Geoweb® cell would be sufficient to restrain the rock in the cell.

It was recommended that bidim® A34 geotextile be used as the separation layer and construction commenced in May 2009 with three trial flumes without any problems.

As can be seen from the adjoining photograph, the rock consisted of a fairly clean ballast sized fraction with most passing the 75mm sieve. The Geoweb® cells are perforated that not only allow the cells to drain easily but also helps to lock in the angular aggregate within the cell.

The construction of the flumes were completed in conjunction with transitions with the contour channels and berms to help dissipate the velocity of the run-off water. In addition, rock cages anchored through the Geoweb® were constructed in the flumes to reduce the velocity of the run-off water and reduce the possibility of rock migration.

**Conclusion**

The design and implementation was not without some difficulties and the final performance of the structure will be tested in the near future. The structure looks to be promising and both the contractor and Boggabri Coal are optimistic it will provide a better solution than the rock revetment currently being utilised thereby reducing maintenance costs significantly.

We would like to progress with further trials using 150mm deep Geoweb panels and therefore using a heavier rock to resist the forces exerted by the torrent of water that cascades down these flumes during a storm event.

The results will be monitored closely however the advantage to the mine will be a structure which will minimise erosion and reduce the sediment load in the toe drains. This then will reduce the possibility of contamination of the surrounding environmentally sensitive area by overtopping the drains and prevent any litigation and criticism from an already high profile mine site.