



## Case Study

# Geogrid Tenax TT060, TT045, Landlok TRM450

### Location:

Shotton  
Cramlington  
Northumberland

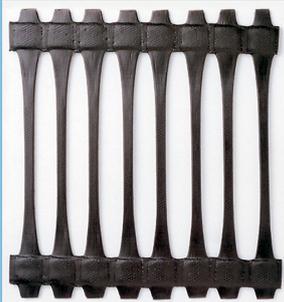
### Client:

Banks Group and  
Blagdon Estates

**BANKS**Group  
development with care

### Project:

Northumberlandia:  
Reinforced Soil Slopes



### Contractor:

Cetco Europe

**CETCO**<sup>®</sup>

A wholly owned subsidiary of AMCOL International Corp.

### Consultant:

Wardell Armstrong LLP



### Geosynthetic Limited

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**Northumberlandia is the world's largest human form sculpted into the landscape, designed by the renowned landscape architect and artist Charles Jencks. The woman earth sculpture is lying at the entrance of a coal surface mine in Northumberland, north of England.**

Northumberlandia is 400m long and 34m high at her highest point. It takes about 20 minutes to walk the 1,162 metre-long path around the landform. In total 1.5 million tonnes of soil and clay from the surface mine were used in the creation of this sculpture.

To construct the most challenging parts of the sculpture a solution was required to achieve the steep slope angles and complex shapes needed for the chin, nose, nostrils and eye brows.

The design was based on a section with a maximum reinforced slope height of 6.9m, slope angle of 60 degrees and a top gabion wall height of 3.5m. The reinforced soil slopes were designed according to BS8006:10 for the internal stability and Eurocode 7 BSEN1997-1:04 for the global stability.

For the reinforcement of the slope Tenax RW TT060 and TT045 Geogrids were used with a regular spacing of 600mm, wrapped around at the face. The finished slopes were protected with Landlok TRM450 to ensure a vegetated face. Compacted weathered mudstone with no cohesive material was used as the reinforced fill with the following parameters: Friction angle  $\Phi = 27^\circ$ ,  $C = 0$ ,  $\gamma = 19\text{kN/m}^3$ . Compacted mudstone was used as the foundation material with: Friction angle  $\Phi = 35^\circ$ ,  $C = 0$ ,  $\gamma = 20\text{kN/m}^3$ . The main challenge during construction was



control of the water content and settlement due to the large amount of rainfall. So, halfway through the project it was necessary to install a new internal drainage system within the structure, tied into the lagoons on the project. The lagoons, initially ornamental, were increased in size to take away the water and to become drainage lagoons.

Geosynthetic Ltd worked in partnership with Cetco Europe to provide a "design, supply and construction" package for the project. Northumberlandia is another example of the technical and economic advantages of solutions as Reinforced Soil Walls and Slopes using geosynthetics.

*"Working with Geosynthetic provided innovative stabilisation solutions to maintain the integrity of this award winning earth sculpture."*

Andrew Roe  
Associate Director & Principal Landscape Architect, Wardell Armstrong LLP





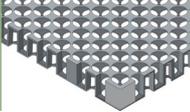
**2 in 1**  
Landscaping Fabric



**Gas Membrane**  
Radon, CO2, Methane,  
Hydrocarbon Control



**RoofCell**  
Sub Surface Drainage  
And Water Storage



**Alert®**  
Contamination Indicator



**Geoglas®**  
Asphalt Reinforcement



**Stratagrid**  
Soil Reinforcement Geogrid



**AquaBlock®**  
Water Containment Liners



**Geomembrane**  
Impermeable Membrane



**Strataweb**  
Slope Stabilisation



**Bentotex® GCL**  
Geosynthetic Clay Liner



**Golpla**  
Grass & Gravel Paving System



**T-Block**  
Modular Retaining System



**Cellweb® TRP**  
Tree Root Protection



**Golpla Pregrown**  
Ready To Lay Paving System



**Telegrid**  
Woven Polyester Geogrid



**DuoDrain®**  
Composite Drainage Product



**Interlock**  
Extruded HDPE Geogrids



**Televev**  
High Strength  
Woven Geotextile



**East Coast**  
Biodegradable  
Erosion Control



**Knotblock®**  
Japanese Knotweed Barrier



**Tenax**  
Soil Reinforcement Solutions



**Ekotex®**  
Non Woven Geotextile



**Landlok**  
Turf Reinforcement Mat



**Total Traffic Exopave**  
Heavy Duty Paver



**Fiberforce®**  
Equestrian Geotextile



**Nicospan**  
Erosion Control



**Trinter**  
Erosion Control Mat



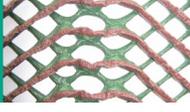
**Fibertex**  
Non Woven Geotextile



**Rhyno®**  
Woven Geotextile



**Turfmesh**  
Grass Reinforcement



**Flexitex**  
Textile Shuttering



**RockBox**  
Gabion Mattresses



**RootBlock**  
Root Barrier

