

GEOSYNTHETICS FOR MINING INFRASTRUCTURE

Value Engineering with TenCate Geosynthetics



Tailings & Water Management

Closure & Rehabilitation

Embankments & Slopes

Dump Walls & Retaining Structures

Haul Roads

Railways

Port Expansions

Mine Processing

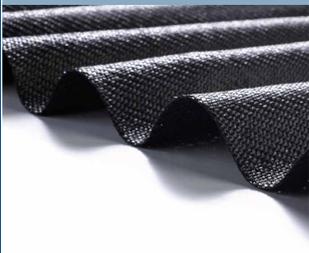
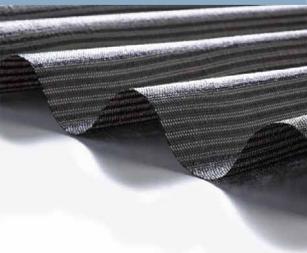
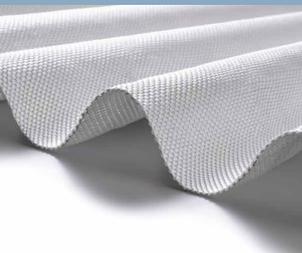


VALUE ENGINEERING THROUGH GEOSYNTHETICS

TenCate Geosynthetics help mining companies solve their geotechnical or processing challenges. We do this through the practical use of our geosynthetics, which bring our clients enormous benefits in respect to time, cost and the environment.

Our solutions are used at all stages through the life of the mine - from construction of a new mine site, during the operation and expansion phases, as well as in the mine closure and rehabilitation phases.

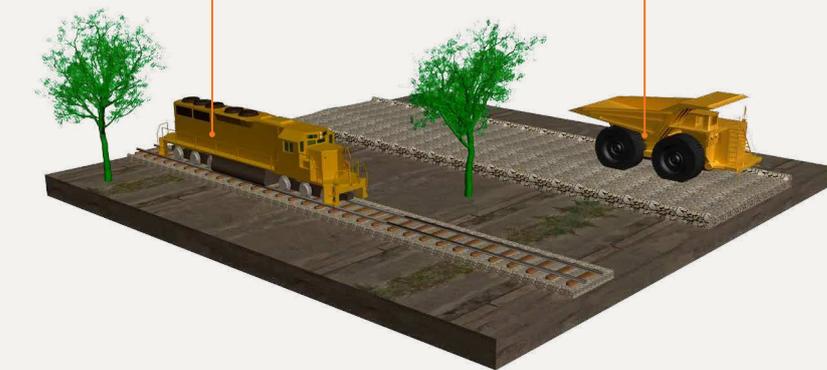
We have done this around for the world, for more than 40 years.

			
GEO TUBE® SYSTEM	WOVEN GEOTEXTILES		GEOGRIDS
 <p>Geotube® Dewatering</p>	 <p>Mirafi® HPA</p>	 <p>Mirafi® PET</p>	 <p>Miragrid® GX</p>

RAILWAYS

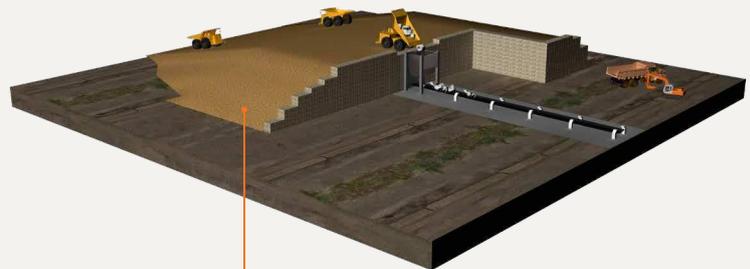
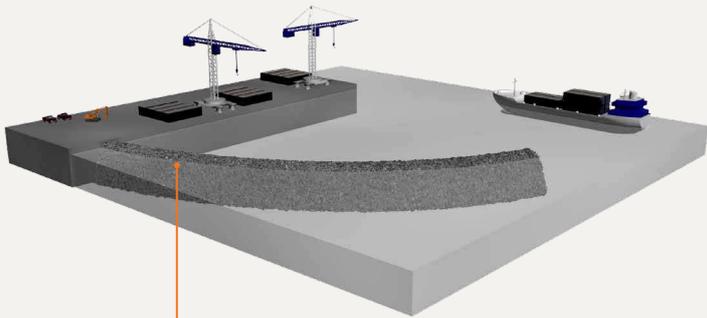
HAUL ROADS

EMBANKMENTS & SLOPES

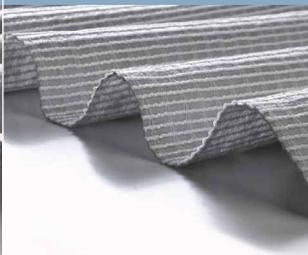
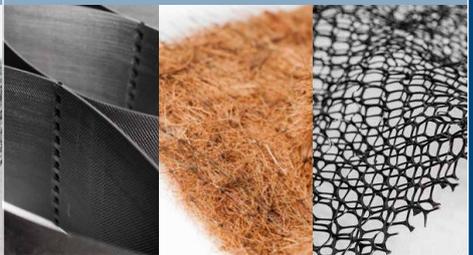


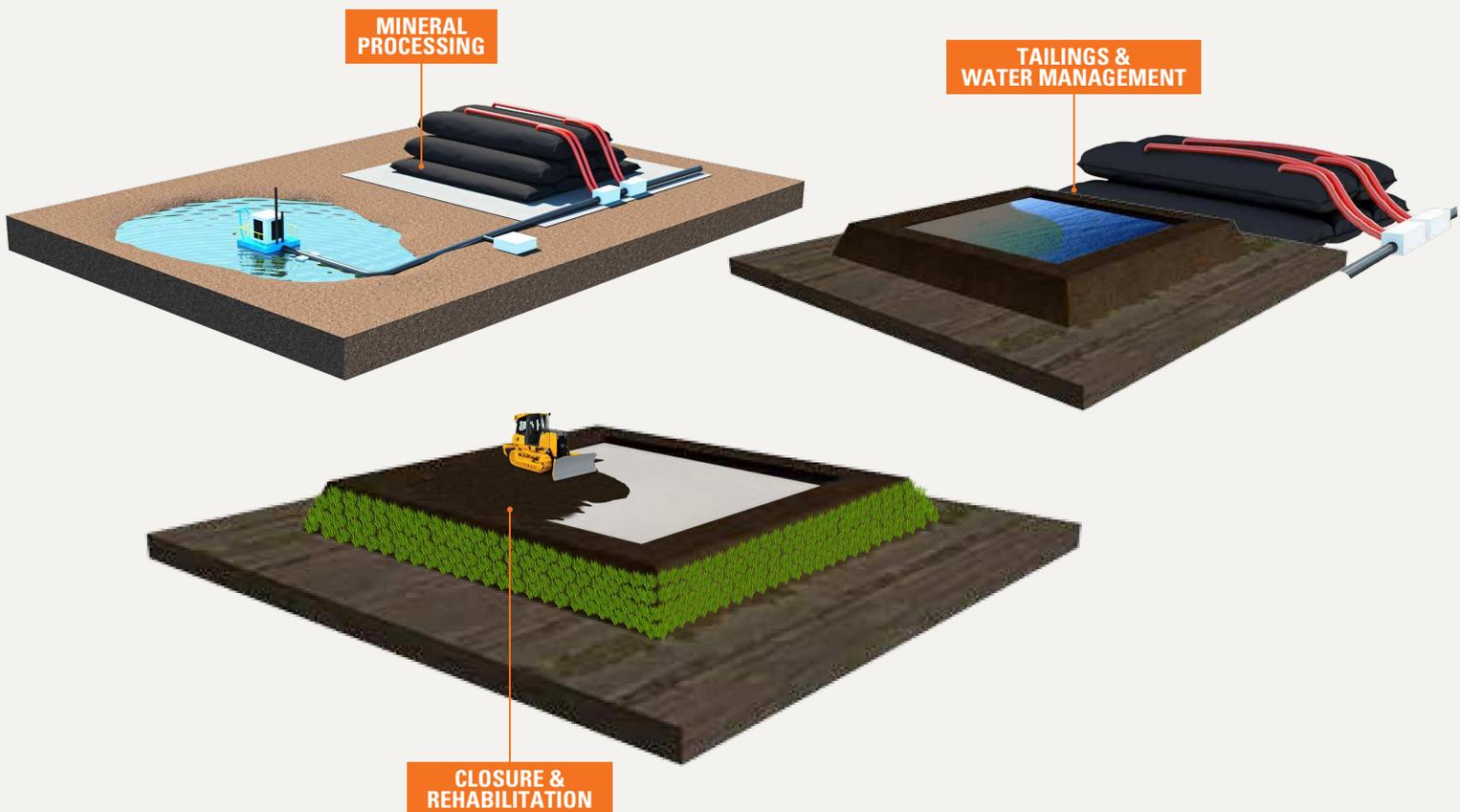
PORT EXPANSIONS

DUMPWALLS



TENCATE
Polyfelt®

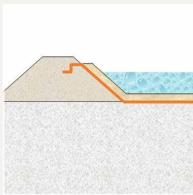
NONWOVEN GEOTEXTILES	GEOCOMPOSITES		EROSION CONTROL SOLUTIONS	
<p>Polyfelt® TS</p> 	<p>Polyfelt® PEC</p> 	<p>Enviromat® GCL</p> 	<p>Envirocell / Envirofelt / Polymat</p> 	



TAILINGS & WATER MANAGEMENT

Protecting your environment

Management of water and mine waste is a major environmental and safety issue in mines today. Our innovative geosynthetic solutions allow engineers to safely and efficiently manage water and mine waste in a variety of ways.

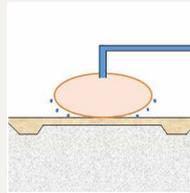
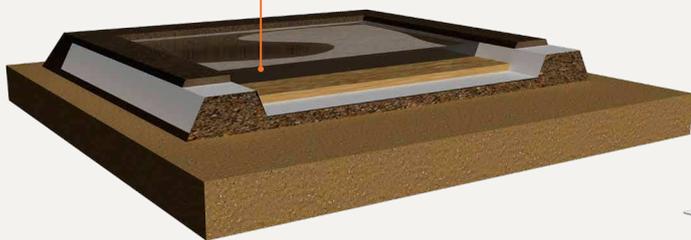


Containment

GCL and geonets can be part of the lining system that contains waste within the tailings storage facility, thereby protecting the surrounding environment.

Our solution:
Enviromat® GCL, Polyfelt® DN

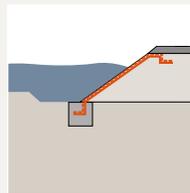
Geosynthetics for containment and protection



Dewatering

Geotube® dewatering of tailings and mine waste is a proven, economical dewatering solution across many waste streams, including acid mine drainage.

Our solution:
Geotube® Dewatering

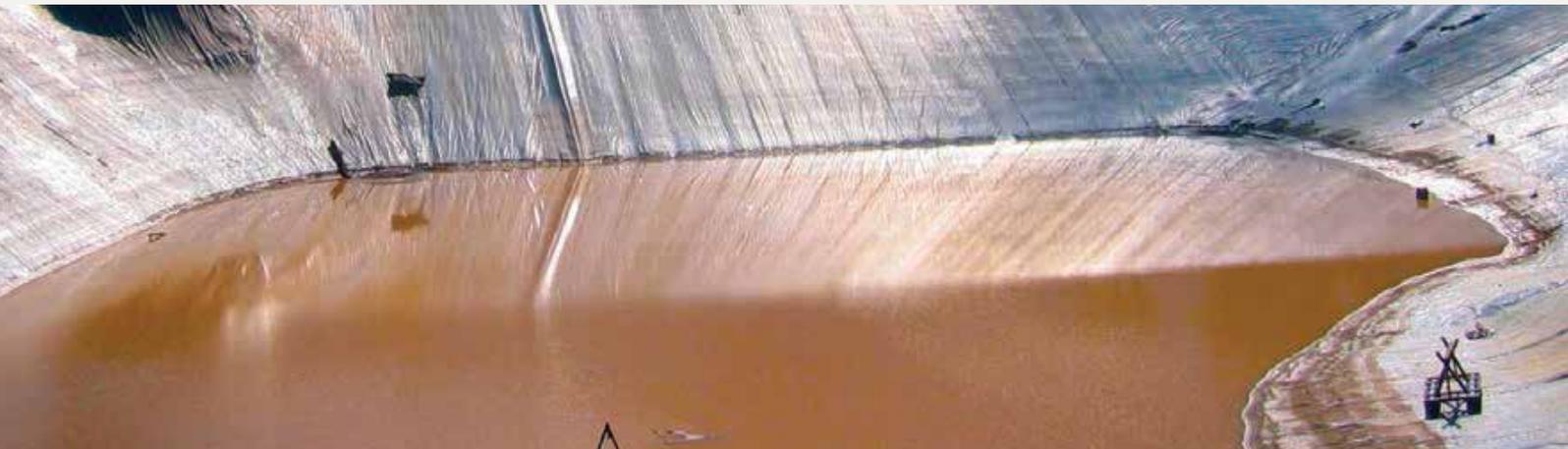


Protection

Nonwoven geotextiles protect the lining system from puncture, helping reduce leakage of mine waste into the environment.

Our solution:
Polyfelt® TS

Geotube® Dewatering



Dewatering

TenCate Geotube® dewatering technology has been proven across a wide range of mine waste streams across nearly every mineral being mined.

Mining companies have used Geotube® dewatering technology on their sites for many different applications, such as dewatering of tailings, sediment ponds or other mine waste (as well as a solution for acid mine drainage problems).

Geotube® dewatering technology is widely used in the mining sector for good reason; simplicity and low cost. Since Geotube® dewatering technology works without belts or gears, there are less moving parts, less wear, less downtime and less spare parts than in conventional dewatering techniques. And lower upfront capital expenditure.

Geotube® dewatering technology is highly versatile, can be tailored to the specific waste stream on site and scaled to specific site production rates and size constraints (including stacking of containers).

Geotube® dewatering technology is also one of the most effective solutions available for mine sites. Volume reduction can be as much as 90%, with high solid levels that make removal and disposal easy.



Sludge before (left) and after (right) treatment with Geotube® dewatering technology.

CASE STUDY

Application:
Tailings management

Location:
Malaysia



Wastes from refining rare earth minerals require proper management and storage in an environmentally secure way. Geotube® was proposed as an alternative to dewater and store process residue rather than the conventional method of mechanical dewatering equipment.

A Rapid Dewatering Test of the sludge determined the polymer requirements to flocculate the sludge. A preparation and injection system to deliver polymer into the incoming slurry stream was set up and the Geotube® configuration arranged to facilitate sequential pumping and filling of multiple tubes.

More than 100 units of Geotube® GT500D dewatering tubes – circumference of 36.6m, lengths between 39m to 57m and stacked five levels high - were installed over a year. In total, 180,000m³ of dry solids were captured within the tubes.

Geotube® dewatering handles huge residue volumes and achieves a very high solids capture rate at a low capital investment. The increased dewatering capability enabled the plant to accommodate the sudden rise in demand for rare earth minerals. This allowed the plant to schedule a complete maintenance overhaul of their mechanical dewatering equipment without affecting production and resolved the constraint of lack of disposal area at the site.

Geotube® dewatering saved the client substantial costs in capex, maintenance and operational costs.

www.tencategeotube.com



CLOSURE & REHABILITATION

Restoring your environment

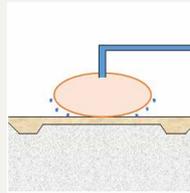
Mining companies increasingly accept that mine closure and rehabilitation is part of their social license to operate. We offer engineers innovative solutions to help make the land useful and productive again.



Reinforcement

High-strength woven geotextiles provide a reinforcement layer under the soil cover layer, increasing the bearing capacity of the tailings.

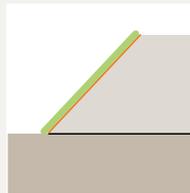
Our solution:
Mirafi® PET



Dewatering

Geotube® dewatering of mine waste during closure provides engineers with a tool to manage moisture content and shear strength of the waste.

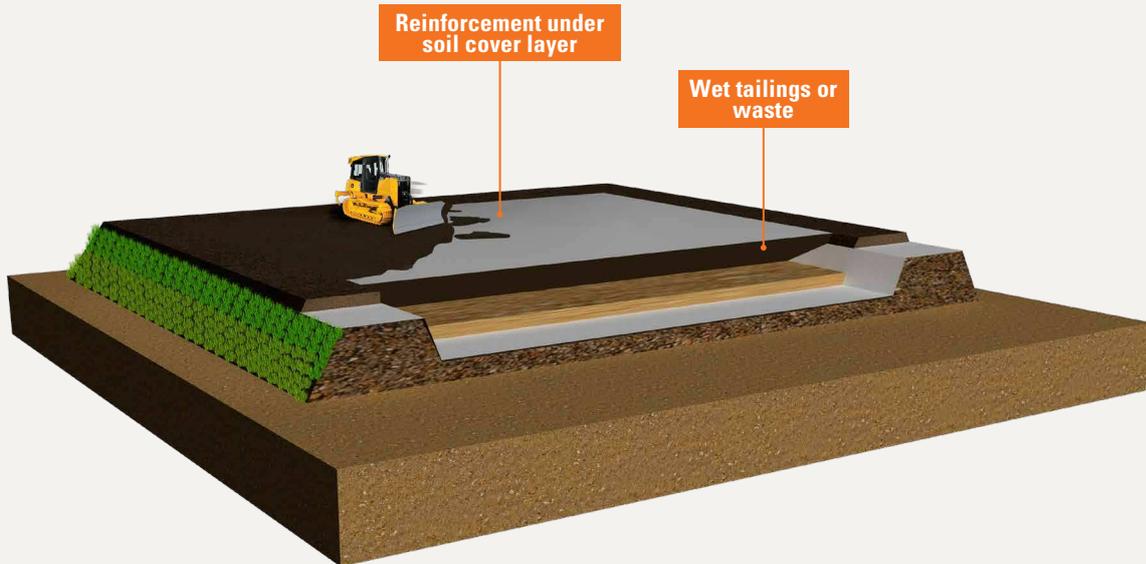
Our solution:
Geotube® Dewatering



Revegetation

Erosion control solutions assist the revegetation process by enhancing stability of vegetative layer and providing root reinforcement.

Our solution:
Envirofelt or Polymat



Closure of Ponds and Tailings Dams

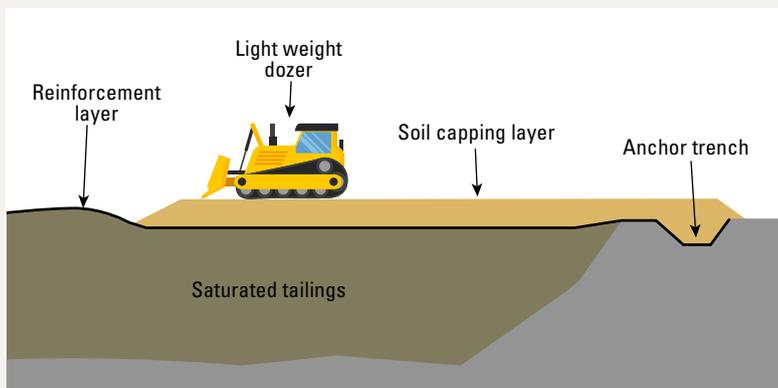
Conventional mine closure may involve capping the mine waste with a soil cover layer. Where the mine waste has low strength, the use of geosynthetic reinforcement will increase the bearing capacity of this soil capping layer.

Our proven reinforcement solutions for mine closure projects include TenCate Mirafi® PP and TenCate Mirafi® PET woven geotextiles as well as TenCate Polyfelt® PEC reinforcement geocomposite.

Careful planning is required for the reinforcement material selection and installation process to ensure this reinforcing layer performs as designed and can be installed safely and simply.

TenCate Geotube® dewatering technology may also form part of the overall solution adopted.

We have proven a track record in assisting engineers with selection and installation of geosynthetic reinforcement for mine closure.



CASE STUDY

Application:
Mine tailings pond closure

Location:
Spain



The Sotiel Coronada mining complex is located at Calanas in the province of Huelva (Andalucia), Southwest Spain. Following completion of mining and processing activities in the area, the reclamation and closure of the large pyrite tailing ponds (surface area around 35 ha) was decided.

Due to the extensive area to be reclaimed, the large volumes of fill to be moved, and the tight time schedule, large volume, heavy earth moving equipment had to be used. This posed a major technical problem as the heavy equipment had to traffic over the very soft tailings extended to a depth approximating 18m.

The solution was to construct a 1m thick stone-fill working platform over a layer of TenCate Polyfelt® PEC 400 composed of high modulus polyester yarns in a composite structure and having an initial tensile strength of 400 kN/m in both longitudinal and cross directions.

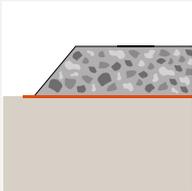
Polyfelt® PEC also acts as a geotextile separator preventing the intermixing of the soft tailings with the stone fill. Then, the stone fill was back-dumped from the earth moving equipment and then bulldozed over the top of the geocomposite reinforcement to ensure there was minimal disturbance of the soft tailings below.



EMBANKMENTS & SLOPES

Building your infrastructure

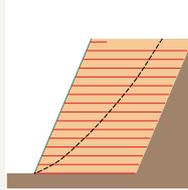
Many mine sites utilize the benefits of reinforced soil structures that use geosynthetic reinforcement to provide stability and reduce deformations.



Reinforcement of Embankments

Embankments built on soft soils will use geosynthetic reinforcement at the base to improve stability and allow higher, steeper embankments to be completed safely, quickly and easily.

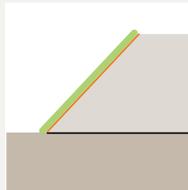
Our solution:
Mirafi® PET



Reinforcement of Slopes

Geosynthetic reinforcement within the reinforced soil slope allows slopes to be built to any height or at any slope angle, whilst providing stability and limiting deformations.

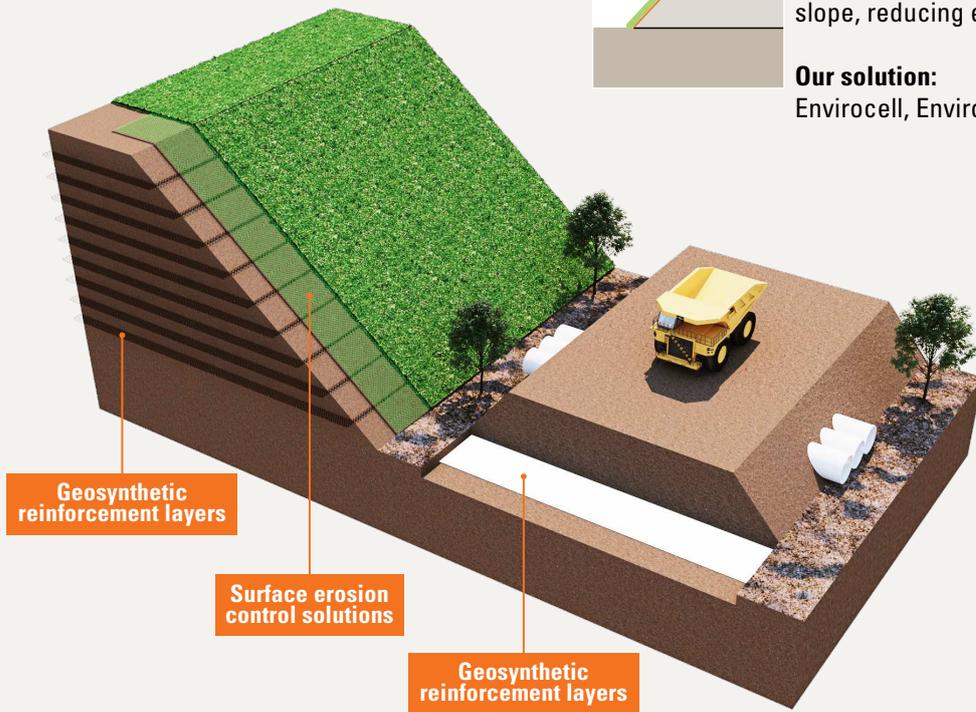
Our solution:
Miragrid® GX or Polyfelt® PEC



Erosion Control

Erosion control solutions help establish and retain a long-term vegetated soil slope, reducing erosion from rainfall.

Our solution:
Envirocell, Envirofelt or Polymat

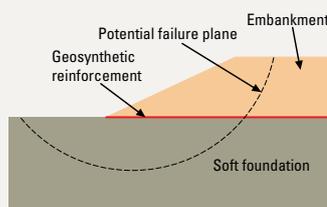


TenCate Geosynthetics are world leaders in soil improvement solutions. We solve common geotechnical challenges such as heavy loads on soft soils or steep slopes with high rainfall.

We are used to helping build complex geotechnical structures with problematic soils. Our typical solutions are shown below.

Basal Reinforcement Under Embankments

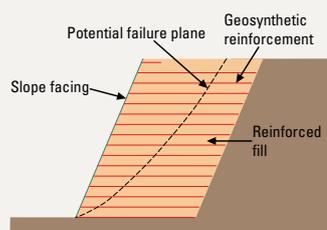
High embankments with heavy loads from mine infrastructure and low-height embankments over soft soils are common mining challenges. Basal reinforcement provides stability and limits deformation in the top surface of the embankment.



Basal reinforced embankments on soft soil

Reinforced Soil Slopes

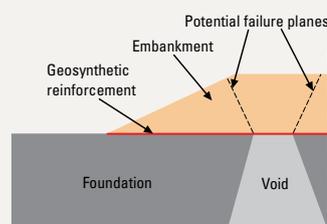
Reinforced soil slopes create access roads or working platforms, and can utilise site-won materials as the fill and backfill materials. An appropriate facing system or erosion mat will stabilize the slope face.



Reinforced fill slopes

Spanning Voids

Voids create excessive localized settlements. By including geosynthetic reinforcement appropriately under the base of the embankment over the vulnerable foundation, we ensure no distress at the surface of the embankment.



Basal reinforced embankments spanning voids

CASE STUDY

Application:
Low height embankment

Location:
Australia



Cape Preston is located in the Pilbara region of Western Australia and is the port facility for the Sino Iron Ore project, operated by CITIC Pacific Mining.

A crucial part of the overall project was construction of a 30km long services corridor, of which 2km was through over soft estuarine mud 4m in depth overlying firm sandy soil.

The causeway was up to 7m high, with a crest width of 32m and built from mine waste rock capable of withstanding 240 tonne mine vehicles and safe transport of 1,400 tonne grinding mills.

The use of high strength geotextile as the basal reinforcement under the embankment was assessed as the most cost-effective solution and having the least associated risk.

The embankment design required the use of 3 layers of TenCate Mirafi® PET basal reinforcement with tensile strength of 800 kN/m.

Roll lengths were customized to ensure no transverse geotextile joints were within the embankment foundation.



HAUL ROADS

Durable, efficient access roads

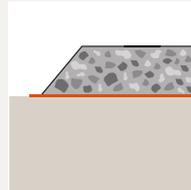
Our geosynthetics are used to stabilize unsealed roads and working platforms with heavy loads from mine vehicles. Our solutions deliver significant benefits:

- Cost savings and a lower environmental impact through reducing the granular layer thickness required to stabilize the platform
- No mixing between the granular materials of the road construction and the subgrade leading to an improved bearing capacity and performance
- Stronger platforms over time due to the reinforcement

TenCate Geosynthetics offer a complete range of products and solutions to fulfil the different functions involved in the construction of trafficked areas.



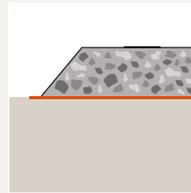
Depending on the subgrade properties and the traffic, the stabilization of the structure may require either:



Separation / Filtration and Reinforcement

Geosynthetics improve the bearing capacity of a structure. This limits the deformation and lateral movement of the granular material, reducing settlement and improving load distribution.

Our solution:
Mirafi® HPA



Separation

Geotextiles prevent upper granular layers penetrating soft subgrades beneath, reducing the amount of granular material required to stabilize a structure.

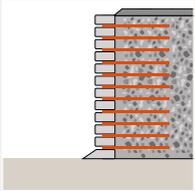
Our solution:
Polyfelt® TS



DUMP WALLS & RETAINING STRUCTURES

High walls with high loads

Dump walls (or crusher walls) are required to support very high stresses from the heavy trucks at the top of the wall emptying their loads whilst being close to the face of the wall.



Reinforcement

Building vertical walls with our reinforcement geosynthetics is an extremely effective and economical solution.

Our solution:

Miragrid® GX, Polyfelt® PEC

Soil reinforced walls using our reinforcement solutions are proven, simple to install and supported by well-established design principles.

Our solutions permit the use of local fill material, with the same material used for fill and backfill, allowing a more economical structure.

Geosynthetic reinforcement layers



CASE STUDY

Application:

Coal mine dump wall

Location:

Indonesia



PT Kaltim Prima Coal located at Sangatta, on the East coast of Kalimantan, has been extracting coal in this location since the early 1990's, and is today one of the largest coal mining companies in Indonesia.

The coal at the Sangatta mine is delivered to the coal crushing plant where it is crushed, screened and washed at the coal washing plant before it is placed onto a 13km long overland conveyor belt for transportation to the shipping terminal.

To minimize earthworks, the vertical dump wall was constructed by excavating into a hill slope.

As the fill material contained a significant fine fraction, our geocomposite TenCate Polyfelt® PEC reinforcement was chosen due to its better performance with residual soil.

A rock filled gabion was installed at the facing.

The Polyfelt® PEC geocomposite reinforcement was laid at 0.5 m vertical spacing throughout the height of the wall, wrapped around the face and anchored back into compacted fill.



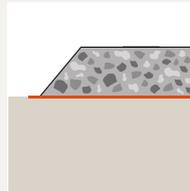
RAILWAYS

On the right track for safety

Geotextiles are widely used in heavy mine railway loads as separation layers or mud pumping solutions.

Nonwoven geotextiles such as TenCate Polyfelt® TS applied at subgrade surface level as a separator will control mud pumping due to its smaller pore size and tortuous pore channels through the geotextile thickness.

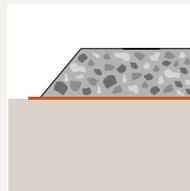
We have also engineered the revolutionary TenCate Mirafi® HPC geotextile that offers all the benefits of reinforcement, mud pumping control and rapid pore water dissipation combined in one composite. It is quick to install and significantly reduces mud pumping problems while enhancing the durability of the rail track.



Separation / Filtration

Prevents the fine soil particles being pumped up into the ballast layer. This means that the ballast layer remains cleaner, for longer.

Our solution:
Polyfelt® TS



Separation / Filtration and Reinforcement

Combining reinforcement with separation and filtration will improve the bearing capacity of the subgrade and separate the material layers, enhancing the stabilization and durability of the rail track.

Our solution:
Mirafi® HPC

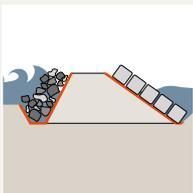
Geosynthetics for separation, filtration and reinforcement



PORT EXPANSIONS

Stable and durable structures

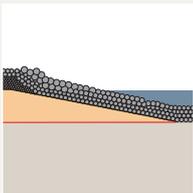
Port facilities are a key part of the mining supply chain. Port upgrades commonly require land reclamation and large hydraulic structures such as dykes, embankments and platforms on top of subgrade consisting of very weak materials such as mud, sludge, saturated silts or clays.



Filtration

Geotextiles filters with puncture and abrasion resistance installed under rock seawalls and other protection systems will maintain the underlying materials in place.

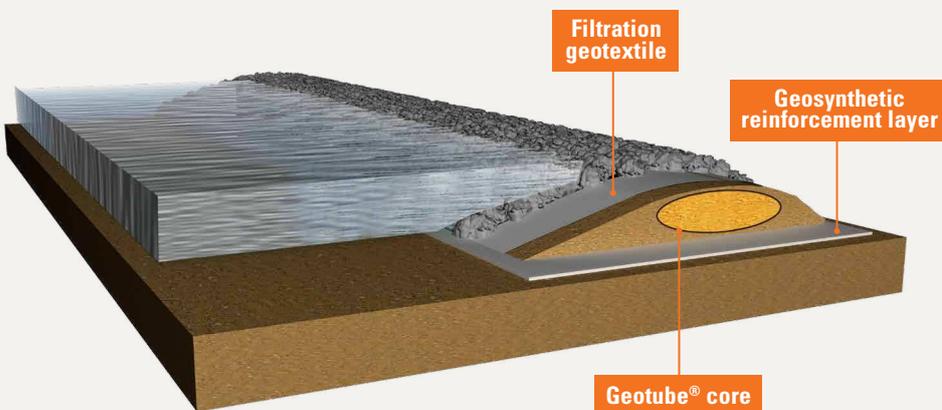
Our solution:
Polyfelt® F



Basal Reinforcement

Rock seawalls or bund walls for port expansions built on soft soils (such as estuarine silts) require reinforcement under the structure to minimize differential settlement and protect port infrastructure from damage.

Our solution:
Mirafi® PET



CASE STUDY

Application:
Brisbane port expansion
Location:
Australia



The Port of Brisbane is located at the mouth of the Brisbane River, and rapid development is expected to continue in the future. The port expansion project has the ultimate objective of allowing the Port to expand by reclaiming and developing an additional 230 ha of port land.

The first stage of this process involved the construction of a 4.6 km long and up to 7.5 m high perimeter seawall in order to contain the reclamation fill in an environmentally friendly and controlled manner.

The use of high strength geotextile as the basal reinforcement for the seawall was ultimately assessed to be the most cost effective solution, and having the least associated risk.

The final seawall design required the use of TenCate Mirafi® PET high strength woven geotextile basal reinforcement with tensile strength ranging between 400 kN/m and 850 kN/m, depending on the location and water depth.

The geotextile reinforcement was sewn offsite to form panels up to 42 m wide by 100 m long.

Installation of the Mirafi® PET basal reinforcement panels required accurate placement from the barge during challenging wave conditions.



MINE PROCESSING

One total solution for mineral processing

TenCate Geotube® dewatering technology is a simple and cost-effective way of dewatering large and small volumes of Mining and Mineral wastes. This proven technology accommodates dewatering and containment in one, cost-effective operation and has been proven in use across many different mineral types.

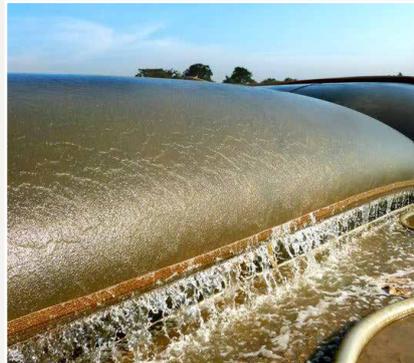
Utilizing Geotube® containers is an effective alternative to mechanical processing that enables the capture of precious metals and the efficient management of mine tailings, coal sludge, and other mine waste streams – with a lower up-front capital cost.

Geotube® containers are custom-sized to fit available space and easily removed when dewatering is complete.

Geotube® dewatering technology achieves volume reduction as high as 90%, improving the site water management processes and making waste removal and disposal easy.



Sludge before (left bottle) and after (right bottle) treatment with Geotube® dewatering technology.



CASE STUDY

Application:
Gypsum waste sludge dewatering

Location:
Malaysia



A major chemical group in Malaysia produces titanium pigments through a sulphate process which involves discharging red gypsum waste slurry that is treated using filter presses. At maximum capacity, the sludge lagoons fill up quickly. The client required a cost effective solution.

A full scale pilot tube using Geotube® GT500D was rolled out to identify future operational implications and confirm actual solid volume retention. The trial tube derived a 39% dewatered solids concentration.

Following the trial, more than 100 units of Geotube® dewatering tubes – circumference of 36.6m, lengths between 44m to 57m and stacked four levels high - were installed over a year. In total, 180,000m³ of dry solids were captured within the tubes increasing the plant dewatering capability by approximately 25%.

With this, the client was able to capitalize on the immediate surge in demand for titanium dioxide and have a complete maintenance overhaul of their aging mechanical dewatering equipment without affecting production.

The filtrate quality discharged from the Geotube® dewatering tubes was of significantly higher quality than that of filter presses, reducing subsequent processing costs. Geotube® dewatering offered the client substantial savings in capex, maintenance and operational costs.

www.tencategeotube.com



GEOSYNTHETICS GUIDE FOR MINING

YOUR PRODUCT SELECTION GUIDE

TenCate Geosynthetics offer a full range of products and solutions to solve geotechnical and environmental engineering problems found in the mining sector.

Fully supported by experienced technical specialists and a global distribution network, we make a difference to your mine operation.

		TENCATE Polyfelt®				TENCATE Miragrid®				TENCATE Mirafi®			TENCATE Geotube®			
		TS & TS Heavy Duty Nonwoven Geotextiles	F Filtration Geotextiles	PEC Geocomposites	Aldrain® Prefabricated Vertical Drains	EnviroMat® Geosynthetic Clay Liners	Envirocell Cellular Soil Confinement Systems	Polymat EM Soil Erosion Protection Mats	Envirofelt Surface Erosion Protection Mats	DN, DC Drainage Nets & Composites	GX Geogrids	HPa Woven Geotextiles	HPC Geocomposites	PET High Strength Woven Geotextiles	Geotube® Dewatering	Silt Curtain Systems

APPLICATION	FUNCTION	TS & TS Heavy Duty Nonwoven Geotextiles	F Filtration Geotextiles	PEC Geocomposites	Aldrain® Prefabricated Vertical Drains	EnviroMat® Geosynthetic Clay Liners	Envirocell Cellular Soil Confinement Systems	Polymat EM Soil Erosion Protection Mats	Envirofelt Surface Erosion Protection Mats	DN, DC Drainage Nets & Composites	GX Geogrids	HPa Woven Geotextiles	HPC Geocomposites	PET High Strength Woven Geotextiles	Geotube® Dewatering	Silt Curtain Systems
Tailings & Water Management	Containment				*				*							
	Dewatering														*	
	Protection	*														
	Sediment Pollution Prevention															*
Closure & Rehabilitation	Reinforcement			*									*			
	Dewatering													*		
	Revegetation					*	*	*								
Embankments & Slopes	Basal Reinforced Embankments			*	*								*			
	Reinforced Slopes			*							*					
	Erosion Control					*	*	*								
Haul Roads	Separation / Filtration	*														
	Subgrade Stabilization											*				
Dump Walls & Retaining Structures	Reinforcement			*						*						
Railways	Separation / Filtration	*														
	Railtrack Stabilization											*				
Port Expansions	Filtration	*														
	Basal Reinforcement			*									*			
Mine Processing	Dewatering													*		



TenCate Geosynthetics for Mining Infrastructure

Malaysia

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