

BENTOLINER GEOSYNTHETIC CLAY LINERS

Laying the Groundwork

Historically, containment systems have used liners consisting of either compacted clay or synthetic polymers as barriers to contaminate. Traditional containment systems consist of a geomembrane and a compacted clay liner (CCL) composite liner system. Research conducted by the United States Environmental Protection Agency (USEPA) demonstrates the performance of composite liner systems as shown in Figure 1 . Geosynthetic clay liners can be used as an alternative to the space consuming CCLs in composite liner systems.

What is a GCL?

A geosynthetic clay liner (GCL) is a manufactured hydraulic barrier used in containment applications as an alternative to traditional compacted clay liners (CCL). BentoLiner GCL products consist of two layers of geotextiles encompassing a layer of sodium bentonite.

Solmax BentoLiner GCLs

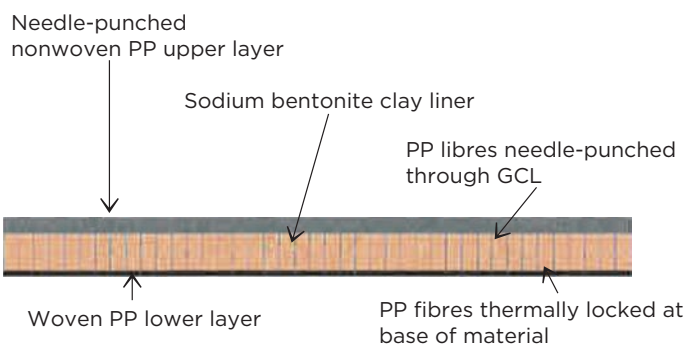
Solmax BentoLiner GCLs are produced by distributing a uniform layer of the bentonite between two geotextiles. Fibers from upper nonwoven geotextile are needle-punched through the layer of bentonite and incorporated into the lower geotextile (either a woven or a scrim nonwoven). This process results in a strong mechanical bond between fabrics that increases the internal shear resistance of the GCL.

The bentonite clay utilized in Solmax BentoLiner GCL is a clay mineral that swells as water enters between the clay platelets. When hydrated under confinement, the bentonite swells to form a low permeability clay layer with a hydraulic conductivity value of $< 5 \times 10^{-9}$ cm/sec. This equates to approximately 0.6 m of compacted clay with a hydraulic conductivity of 1×10^{-7} cm/sec.

What makes a Solmax BentoLiner GCL unique is that it consists of a woven geotextile for dimensional stability and is reinforced for increased internal shear strength. Solmax BentoLiner GCL products offer an array of different features for applications requiring a wide range of load and slope conditions in landfill, mining, and pond applications.

SOLMAX





Structure of SOLMAX's BentoLiner GCL

SOLMAX BentoLiner GCLs are manufactured to meet international standards. Their engineering behaviour has been designed in accordance with recognised international requirements, specifically GRI-GCL3 (2019) which is an internationally recognised standard for the engineering behaviour of GCLs.



GCL Benefits

● Increased Airspace and Liner Performance

For environmental containment systems, Solmax BentoLiner GCLs can be used to completely replace or significantly reduce the required thickness of the CCL. This results in less excavation and re-compaction which saves time and money, and in most applications, increased air space means increased revenue.

Solmax BentoLiner GCLs are part of a trend towards the combined use of geosynthetics and clay materials in containment applications. In a geomembrane/GCL composite liner system, the geomembrane and GCL work synergistically to maximize liner system integrity. In the USEPA study of 199 landfills, the geomembrane/GCL composite liner system outperformed all other liner systems as shown in Figure 1.

● Installation Efficiency

Solmax BentoLiner GCLs can be easily transported with fewer trucks than traditional CCLs. It can also be rapidly installed on a project which reduces overall project schedule and costs.

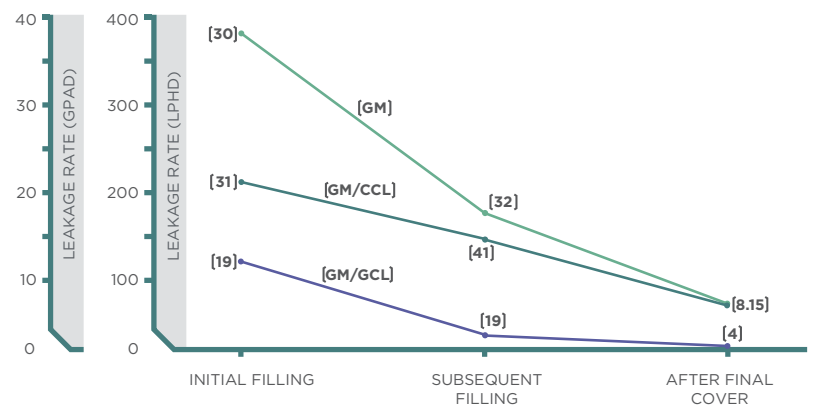
● GCL Slope Performance

Solmax BentoLiner needle-punching provides an increased internal shear strength that overcomes the low internal shear strength of the sodium bentonite clay which allows the use of these products on steeper slopes. A range of reinforcement can be achieved on products based on project specific requirements when requested.

● Quality Assurance

The controlled environment of our production facility allows for greater control over critical performance characteristics. The intensive manufacturing quality control program ensures consistent hydraulic and physical properties through the latest testing procedures. Thorough manufacturing quality control minimizes the expensive and time consuming on-site quality assurance testing required for compacted clay liners.

LANDFILL LINER SYSTEM PERFORMANCE



(Ref: 2002 Bonaparte, Daniel and Koerner, U.S. EPA)

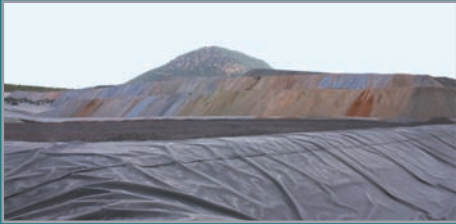
Figure 1

GCL APPLICATIONS



SOLID WASTE

GCLs are used in both base liner systems and closures to replace expensive compacted clay liners in order to save time and money while increasing performance.



MINING

Solmax Bentoliner products provide a cushioning and self-sealing layer underneath the geomembrane liner leading to less punctures, less solution loss and increased returns.



INDUSTRIAL PONDS

Bentoliner GCLs are often the choice of engineers in composite liner systems due to cost savings and ease of installation versus clay liners.



RESERVOIRS AND CANALS

Solmax Bentoliner minimizes water loss in existing and new canals due to its superior self-healing properties and ability to be installed on steep slopes.



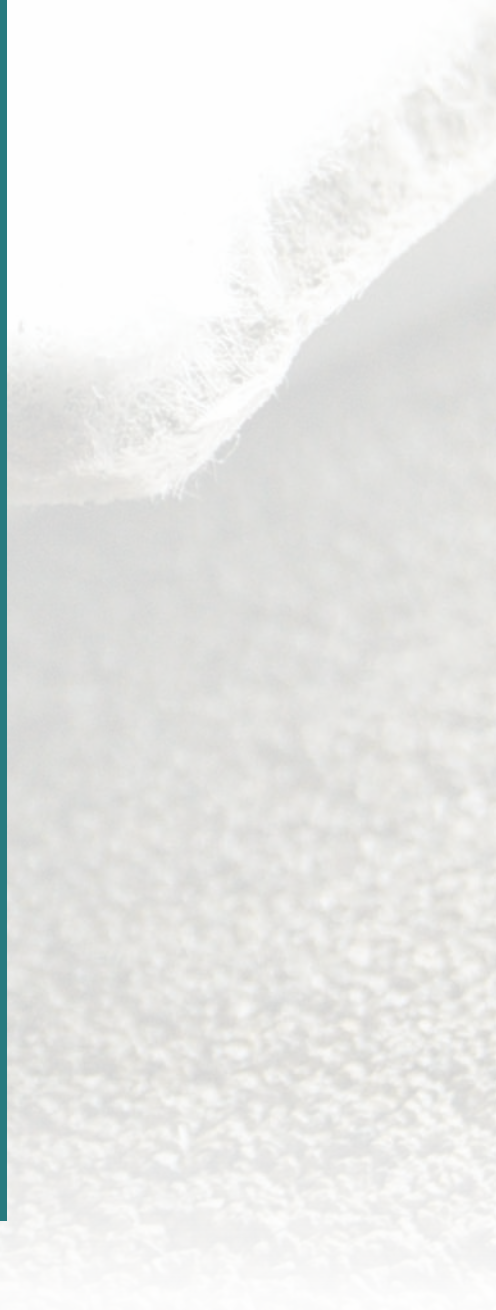
STRUCTURAL WATERPROOFING

Solmax BentoLiner combines the dimensional stability and increased internal shear strength of reinforced geotextiles with the high swelling capacity and low permeability of sodium bentonite provides a high sealing effect that prevents water ingress between the waterproofing and the concrete structure.



POWER UTILITIES

GCLs are becoming an important component of lining systems because of the benefits they provide in cost effective construction, improved quality and the lack of suitable soil options.





WHO WE ARE

Solmax is a geosynthetics pioneer, innovator, and leader. With almost five decades' experience, our GSE and TenCate Geosynthetics acquisitions make us the world's largest geosynthetics manufacturer. With plants in North America, Europe, Asia, and the Middle East, our geosynthetics are used in critical applications by the biggest names in mining, petroleum, waste management, construction, agriculture and irrigation, civil engineering, hydraulic and environmental works, infrastructure, and transportation. Our products safeguard the earth from waste and contaminants, and protect investments, helping preserve the integrity and longevity of vital infrastructure in the toughest environments. With expertise across all geosynthetics categories, Solmax is an innovation powerhouse.



THIS IS WHAT WE'RE MADE OF

Being an industry leader takes substance, and our substance runs deep. That's why people around the world have trusted Solmax to make their projects easier and better. And our unstoppable commitment to innovation means we never stop collaborating with our customers to develop new products that meet their needs.

Solmax lining products are known throughout the world as a mark of quality and reliability. Our customers depend on us to deliver geosynthetic lining products that withstand virtually every threat and danger imaginable, and we take that responsibility seriously, testing and retesting until we exceed industry standards — and everyone's expectations.

ENGINEERING SUPPORT

The Solmax Engineering Support Staff is comprised of multidisciplinary product professionals to support every aspect of your project design, from concept to installation. Rely on our project team to help you solve your design challenges. Our extensive network of industry experts offer comprehensive:

- **Alternative solution development and assessment**
- **Project management**
- **Technical support**
- **Design tools**
- **Customer Service**

SOLMAX



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