

BENTOMAT® GEOSYNTHETIC CLAY LINERS (GCL)

WHAT IS A GCL?

A GCL is a type of geocomposite that is frequently used in environmental containment applications and is an alternative to a traditional compacted clay liner. Bentomat geosynthetic clay liners consist of two layers of geotextiles surrounding a layer of low permeability sodium bentonite that are needlepunched together to increase internal shear resistance.



FEATURES & BENEFITS

Supergroove™ Technology

Bentomat products are the only geosynthetic clay liners that feature the Supergroove, a groove in the nonwoven fabric that allows the bentonite to migrate out and self-seam at the overlap. This feature eases the installation process by eliminating the need for supplemental bentonite, and the additional labor to apply it.

Granular Bentonite

All Bentomat geosynthetic clay liners feature granular bentonite, which creates less dust during installation than powdered bentonite, and is more likely to stay in place once deployed. The granular bentonite is less likely to shift through the needlepunch reinforcement, thus providing consistent hydraulic performance.

Durable Needle punched Reinforcement

Bentomat reinforced geosynthetic clay liners are reinforced by consistent durable needlepunching, resulting in finished product that can withstand shear stresses on steep slopes. The high needlepunch density provides higher peak internal shear strengths, without relying on supplemental processing.

ENGINEERING SUPPORT

In addition to offering high quality products, CETCO provides unparalleled engineering support. Our technical staff is well trained in specification review and can offer testing or design assistance. Additionally, CETCO maintains a full library of laboratory test reports from past projects and reference articles to assist you on your project.

ADVANTAGES OVER COMPACTED CLAY

Self-Healing & Self-Seaming

Bentomat® geosynthetic clay liners contain sodium bentonite, which is a naturally occurring clay with a high affinity for water. When hydrated, sodium bentonite swells up to 15 times its original volume. This provides the ability to seal around penetrations, self-heal punctures, and self-seam at the overlaps.

Better Hydraulic Performance

Geosynthetic clay liners have a total thickness of less than one inch and provide better hydraulic performance than several feet of compacted clay. A fully hydrated GCL typically has a permeability of 5×10^{-9} cm/sec, approximately 20 times lower than a typical compacted clay liner permeability.

Resistant to Varying Weather Conditions

A geosynthetic clay liner is less likely to be impacted by freeze-thaw or desiccation-rewetting cycles. Freeze-thaw cycles frequently cause compacted clay liners to crack and lead to increased leakage. A geosynthetic clay liner provides consistent performance and is not subject to performance decreases resulting from varying moisture content, density, or clay content, like compacted clay liners.

Ease of Installation & Increased Air Space

Geosynthetic clay liners are an environmentally friendly alternative to clay liners because they require significantly less installation effort than a compacted clay liner. One truckload of GCL is equivalent to 150 truckloads of compacted clay, thereby using up fewer natural resources. When a GCL is used in place of a thicker compacted clay liner it also takes up less air space, which leaves more room for waste.

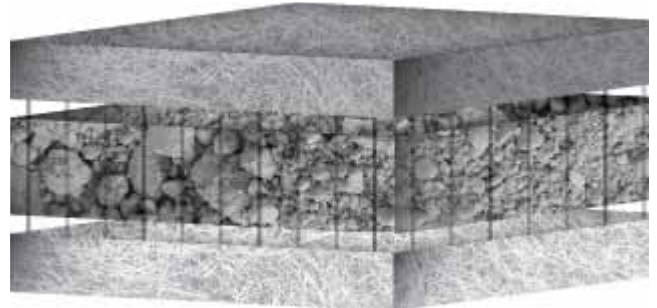


BENTOMAT® GCL PRODUCT OFFERING

STANDARD REINFORCED GCL

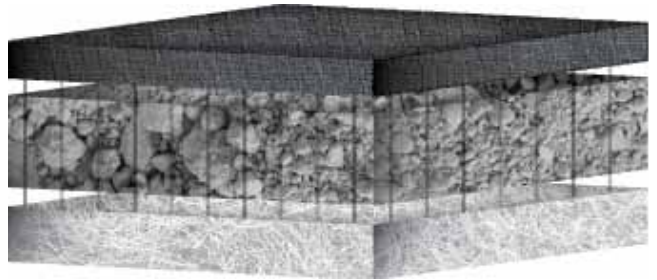
Bentomat DN

- Commonly used in canyon landfills where slopes are as steep as 1.5H:1V
- Suitable for applications requiring high internal and interface shear strength
- Consists of a layer of Volclay® sodium bentonite between two heavier weight nonwoven geotextiles
- Needle-punch reinforcement



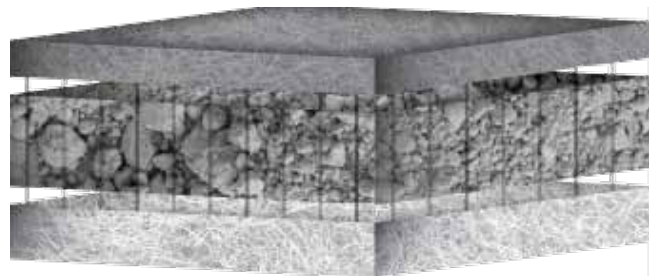
Bentomat ST

- Ideal for applications involving slopes up to 3H:1V
- Most commonly specified GCL in the world
- Consists of a layer of Volclay sodium bentonite between a woven and nonwoven geotextile
- Needle-punch reinforcement



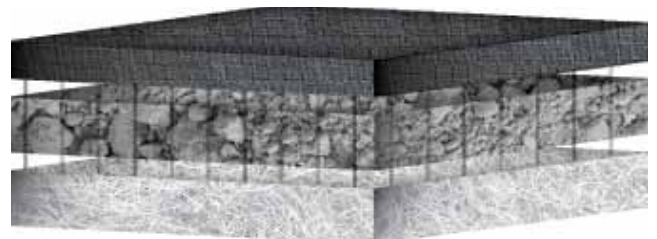
Bentomat SDN

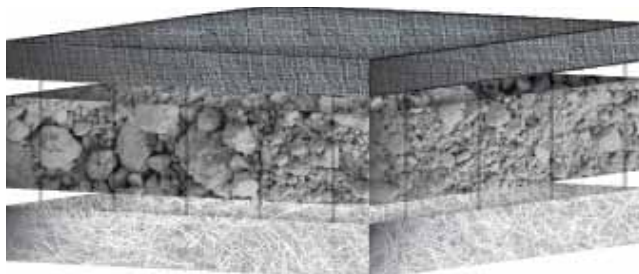
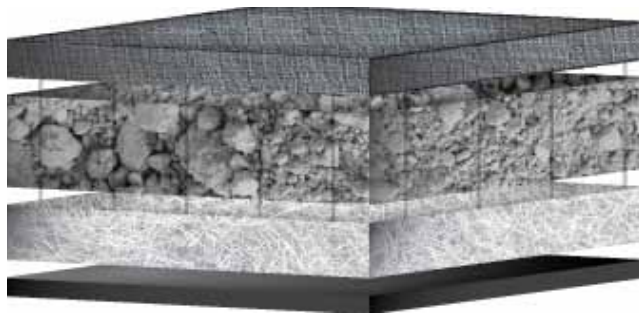
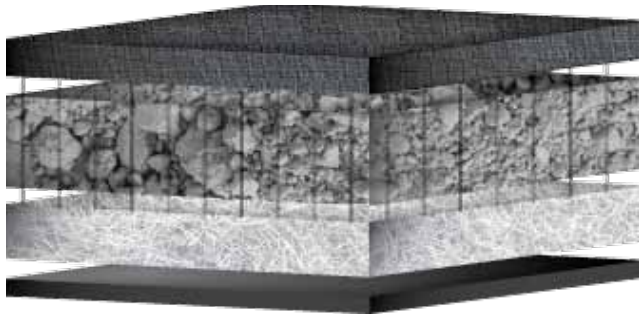
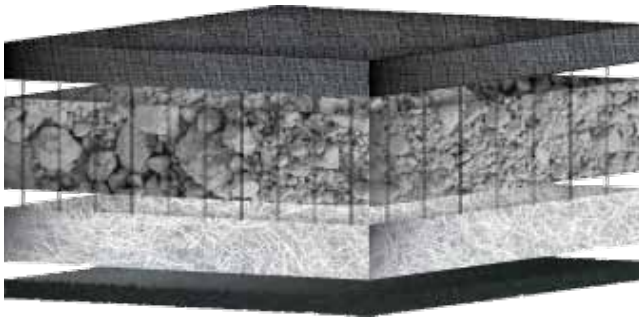
- Cost-effective alternative for moderate to steep slopes requiring good overall liner system stability
- Consists of a layer of Volclay sodium bentonite between two nonwoven geotextiles
- Needle-punch reinforcement



Bentomat STM

- Commonly specified in mining applications
- Reduced bentonite loading is more cost-effective and easier to transport to remote mining sites
- Good alternative for projects where hydraulic requirements may not be as stringent
- Consists of a layer of Volclay sodium bentonite between a woven and nonwoven geotextile
- Needle-punch reinforcement





COMPOSITE LAMINATE GCL

Bentomat® CLT

- Ideal for more demanding landfill covers and liquid containment applications involving steep slopes
- Consists of a layer of Volclay® sodium bentonite between two geotextiles laminated to a textured HDPE geomembrane
- Needle-punch reinforcement

Bentomat CL

- Used in landfill covers, ponds, and liquid containment
- Ideal for applications involving slopes up to 3H:1V
- Excellent hydraulic performance and has puncture and tensile strengths beyond conventional plastic membranes
- Consists of two carrier geotextiles encapsulating a layer of Volclay sodium bentonite with a polyethylene geofilm laminated to one side
- Needle-punch reinforcement

Bentomat 600CL (non-reinforced)

- Used for flat areas of landfill caps and high hydraulic head conditions in liquid containment applications
- Suitable for low shear strength applications
- Consists of two light-weight geotextiles encapsulating a layer of Volclay sodium bentonite with a polyethylene geofilm laminated to one of the geotextiles
- Needle-punch bonded

NON-REINFORCED GCL

Bentomat 200R

- Acts as low-permeability liner under a geomembrane in applications with slopes up to 10H:1V, or where high internal shear strength is not critical
- Excellent cost-effective alternative to compacted clay
- Consists of a layer of Volclay sodium bentonite between a woven geotextile and a light-weight nonwoven geotextile
- Needle-punch bonded

GCL APPLICATIONS

CIVIL & HIGHWAY

In State College, Pennsylvania, 765,000 ft² of Bentomat® ST was installed to provide an acid rock remedial barrier. During the I-99 expansion, the Pennsylvania DOT uncovered acid rock drainage generating deposits, which produced a threat of contamination to surrounding streams and wells. The use of a GCL prevented infiltration from generating a hazardous situation.



SECONDARY CONTAINMENT

In northwestern Australia, Bentomat CL was chosen to line the bermed area around fuel storage tanks at Port Headland. The area is arid and the climate is harsh so Bentomat CL was chosen for its moisture content. A GCL was more likely to maintain its moisture and low permeability.



SOLID WASTE

In Ashtabula, Ohio, Bentomat DN was used to line and cap a sediment disposal cell. Both the liner and cap utilized Bentomat DN in lieu of a compacted clay layer below the geomembrane. Bentomat DN was chosen because of its durable reinforced construction and its high interface frictional surfaces provided by the nonwoven geotextile backings.



MINING

In Globe, Arizona, approximately 8 million ft² of Bentomat STM and Bentomat DN were chosen to line a copper heap leach pad. Bentomat DN was chosen for the sloped areas for its high internal and interface shear strength properties. Bentomat STM was chosen for the flat sections for its light weight and ease of transport. The Bentomat products provided a cushioning and self-healing layer, leading to less puncture damage from the crushed ore, decreased leach solution lost, and increased precious metal returns.





POWER UTILITIES

Approximately 2 million ft² of Bentomat® CL & Bentomat 600 CL were installed in a gypsum surface impoundment at a utility company. The CL series was installed to create a state-of-the-art composite liner system, utilizing the low permeability of a HDPE membrane and self-healing characteristics of a traditional GCL. The Easy Roller™ deployment system was used to meet the condensed timeline.



PONDS

In Greenville, South Carolina, approximately 320,000 ft² of Akwaseal was installed to line two campus ponds. Due to the high hydrostatic head conditions, mild slopes, and type of application, Akwaseal was chosen as the composite laminate system, featuring a low-permeability plastic membrane and self-sealing bentonite clay.



CANALS

Approximately 500,000 ft² of GCL was used to repair a historical canal that stretches between Easton and Bristol, PA after major flood damage. Bentomat CL was chosen because it allowed the engineer to expand the dimensions to allow for greater flow. The use of GCL was the most cost-effective due to availability, installation time, and quality control of the material.



DAMS

In Wilkesboro, North Carolina, approximately 34,000 ft² of Bentomat CLT was installed to line the upstream face of a water retention dam. This was the first regulatory review and approval in the state by the North Carolina Department of Environment and Natural Resources Dam Safety Program for this category of dam. Bentomat CLT was chosen for its low-permeability, textured plastic membrane and self-sealing bentonite clay.