



INSTALLATION GUIDELINE

# **BENTOLINER** Enviromat GCL

Advanced barriers for environmental engineering



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# 1. GENERAL

This document is prepared to help ensure that the geosynthetic clay liner, once installed, will perform its intended design functions. To do so, the product must be identified, handled, stored and installed in such a way that its physical property values are not affected and the design conditions are ultimately met as intended. This document does not account for every possible construction scenario. This document contains information consistent with generally accepted practices of identifying, handling, storing and installing geosynthetic clay liners for most lining and capping applications. Failure to follow these guidelines may result in the unnecessary failure of the **BENTOLINER®** Enviromat® GCL in an otherwise properly designed application.

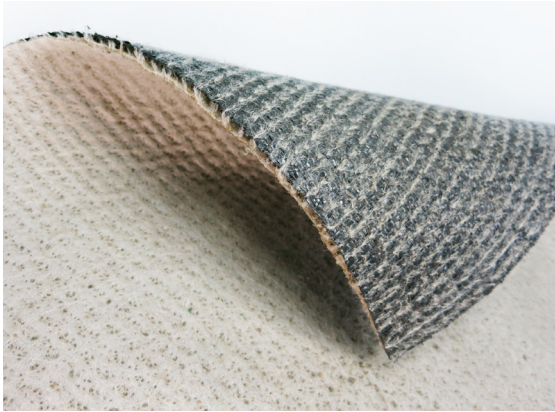


Figure 1: BENTOLINER Enviromat GCL

## 2. PRODUCT AND APPLICATION

**BENTOLINER** Enviromat GCL filter consists of a layer of sodium bentonite clay sandwiched between an upper nonwoven PP geotextile layer and a lower woven PP geotextile layer. The **BENTOLINER** Enviromat GCL's are internally reinforced by the needle-punching of PP fibres through the three component layers with the fibres thermally locked at the lower **BENTOLINER** Enviromat GCL's structure. (see Figure 1).

The **BENTOLINER** Enviromat GCL acts as a barrier material preventing the passage of liquids and gases. Once installed in the ground, the sodium bentonite in the **BENTOLINER** Enviromat GCL absorbs surrounding moisture content, hydrates and expands, resulting in a barrier layer of very low hydraulic conductivity.

**BENTOLINER** Enviromat GCL is used in various applications, such as pond lining, landfill base liners and capping, vertical trench cut-off barriers, groundwater protection covers (see Figure 2).

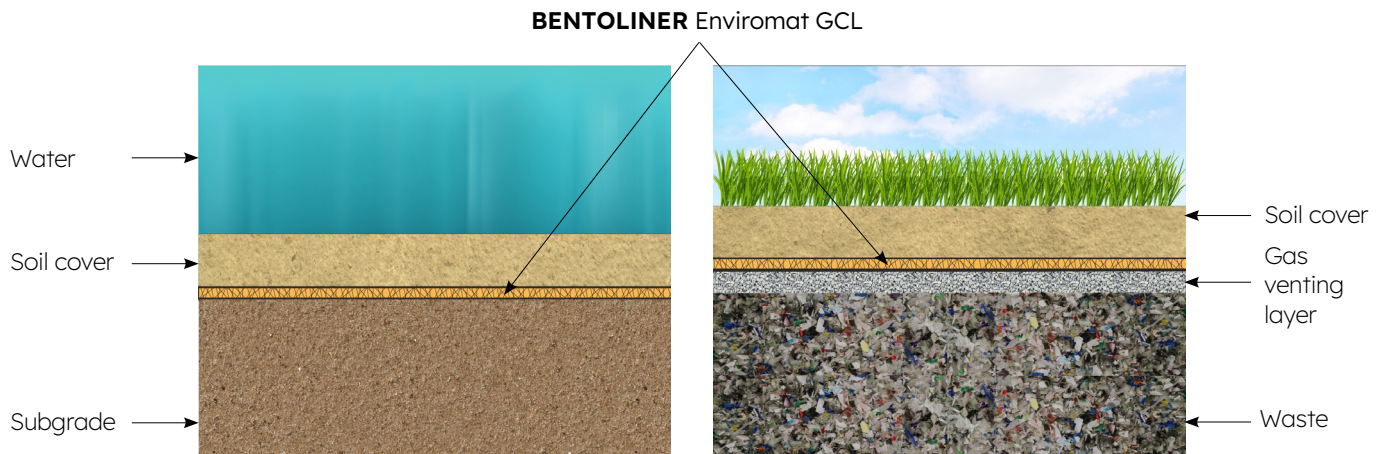


Figure 2: Typical applications of BENTOLINER Enviromat GCL's (a) Pond lining (b) Landfill capping

## 3. MATERIAL IDENTIFICATION, STORAGE AND HANDLING

The **BENTOLINER** Enviromat GCL shall be rolled on cores having strength sufficient to avoid collapse or other damage from normal use. Each roll shall be wrapped with a plastic covering to protect the **BENTOLINER** Enviromat GCL product from damage during shipping and handling. Each roll shall be identified with a durable gummed label or the equivalent, clearly legible on the outside of the roll wrapping. The label shall indicate the manufacturer's name, the style number and the roll number.

Upon delivery, check the roll labels to verify that the correct **BENTOLINER** Enviromat GCL product has been received. Immediately inspect the GCL rolls to ensure it is free of any flaws or damage that might have occurred during shipping or handling. While unloading or transferring the **BENTOLINER** Enviromat GCL from one location to another, care should be taken to prevent damage to the wrapping, core, label or the **BENTOLINER** Enviromat GCL itself.

The **BENTOLINER** Enviromat GCL rolls shall be located and placed in a manner that ensures the integrity of wrapping, core and label as well as the physical properties of the **BENTOLINER** Enviromat GCL product until they are ready to be transported to the field site. It is important to store the **BENTOLINER** Enviromat GCL rolls indoor or covered to avoid any risk of moisture effects. This can be achieved by elevating the **BENTOLINER** Enviromat GCL rolls off the ground on dunnage and under cover on all sides.(see Figure 3).

Care should be taken to ensure the **BENTOLINER** Enviromat GCL rolls are adequately covered and protected from ultraviolet radiation, chemicals that are strong acids or strong bases, fire or flames including welding sparks, temperature in excess of 60 C, and human or animal destruction.

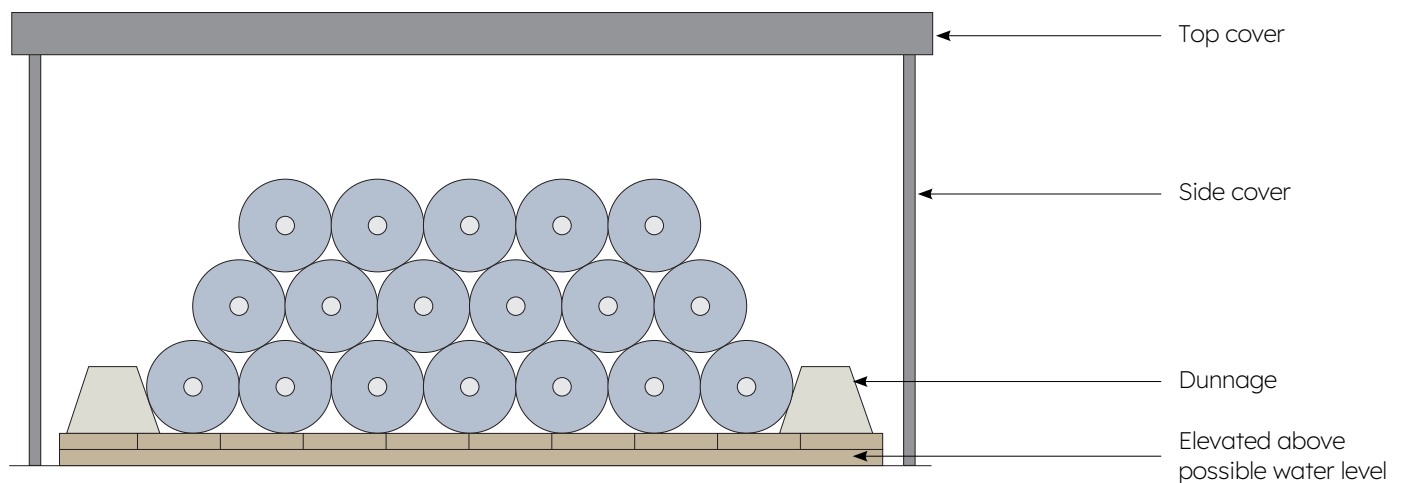


Figure 3: Recommended setup for safe onsite stacked storage of **BENTOLINER** Enviromat GCL rolls

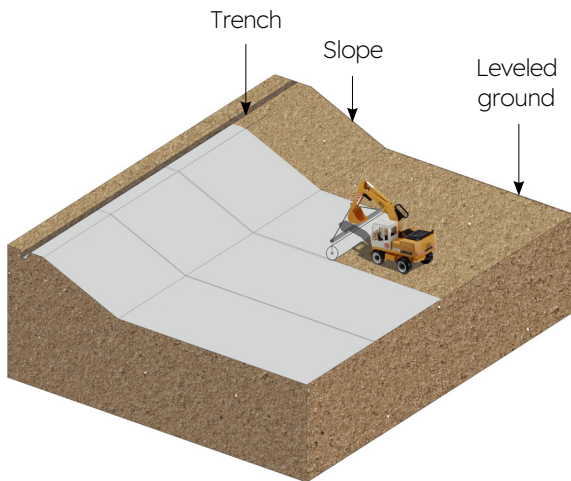
## 4. GROUND PREPARATION

The subgrade should consist mainly of fine-grained soils with maximum aggregate size not more than 20 mm. Make sure the subgrade is firm and unyielding, without any abrupt elevation changes, voids and cracks, and free from standing water. Ensure the subgrade surface is smooth and free of sharp and protruding edges, construction debris and other foreign matters that could damage the **BENTOLINER** Enviromat GCLs. Remove wheel ruts, footprints and other abrupt grade changes, followed by compaction of subgrade in accordance to the project specifications.

If the **BENTOLINER** Enviromat GCL's are laid over a geosynthetic material such as geomembrane or geotextile, make sure the surface is firm and unyielding, without any abrupt elevation changes, and free from standing water. Ensure that the geosynthetic surface is smooth and free from sharp and protruding edges, construction debris and other foreign matters that could damage the **BENTOLINER** Enviromat GCLs.

## 5. INSTALLATION

**BENTOLINER** Enviromat GCL's are supplied generally in standard rolls of specific roll length and width. Before unrolling the **BENTOLINER** Enviromat GCL's, verify the roll identification, length, and installation location with the contract drawings. While unrolling the **BENTOLINER** Enviromat GCL's, inspect it for damage or defects. Discard or repair any damage that occurs during storage, handling or installation as directed by the engineer.

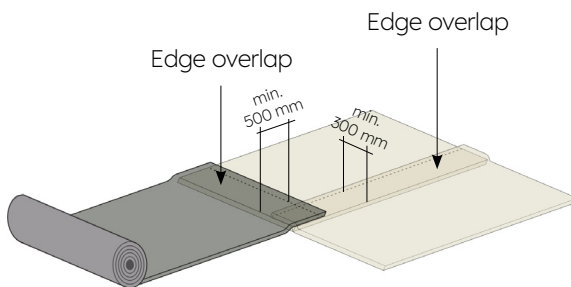


**Figure 4: Unrolling BENTOLINER Enviromat GCL at running slope direction with spreader bar**

The **BENTOLINER** Enviromat GCL's roll wrapping should only be removed immediately prior to installation. Anchor one end of the **BENTOLINER** Enviromat GCL at top of slope and unroll the **BENTOLINER** Enviromat GCL without wrinkles and folds on ground by using a spreader bar (see Figure 4).

Cut the **BENTOLINER** Enviromat GCL to length with a sharp carpet knife if necessary. Keep the installed **BENTOLINER** Enviromat GCL's to an absolute minimum disturbance caused by man walking. End overlaps are not allowed in the installation on slope.

## 6. JOINTING



**Figure 5: Typical overlap joints for BENTOLINER Enviromat GCL's**

Edge overlap of 300 mm and end overlap of 500 mm are generally sufficient to prevent discontinuity of the **BENTOLINER** Enviromat GCL's during the backfilling process (see Figure 5). Direct trafficking or walking are strictly not allowed over the overlap zone. Ensure the overlap zone is free from wrinkles and foreign matter such as fine soils or other debris. The overlaps should be shingled in the direction of the grade and must be sealed with bentonite paste to prevent potential flow of water entering the overlap zone.

To overlap the **BENTOLINER** Enviromat GCL's, firstly place marking on the top side of the underlying **BENTOLINER** Enviromat GCL panel as a reference point to apply the bentonite paste. Secondly, prepare

undercoat bentonite paste within a container and stir consistently to form a uniform mixture. Then apply the undercoat on the underlying panel by following the marking. Next, prepare and apply topcoat bentonite paste on top of undercoat. Lastly, roll the upper panel in place and compress it to complete the overlapping.

The recommended ratio of bentonite to water for undercoat and top coat are as below:

- i. Undercoat (1:6 ratio of bentonite to water)
- ii. Top coat (1:4 ratio of bentonite to water)

## 7. SOIL COVER PLACEMENT

Place a minimum 300 mm soil cover over the **BENTOLINER** Enviromat GCL immediately after the installed area has been inspected. While fine-grained soil is recommended, stone size up to maximum 20 mm is still acceptable to be used as soil cover.

Direct trafficking over the **BENTOLINER** Enviromat GCL without soil cover is strictly not allowed. Ensure that the overlap joint remains intact during the soil cover placement process.

Generally, temporary construction access roads should not be located over **BENTOLINER** Enviromat GCL laid and soil covered areas. If it is unavoidable a minimum of 900 mm thick soil cover should be provided over the **BENTOLINER** Enviromat GCL or otherwise instructed by the engineer.



## 8. PROTECTION OF TEMPORARY TERMINATION EDGE OF THE LAID OUT BENTOLINER ENVIROMAT GCL'S, PENETRATION DETAILS AND REPAIRS

To protect the temporary termination edge of the laid out **BENTOLINER** Enviromat GCL's place and overlap a minimum 500 mm distance of cover material over both the termination edge and adjacent soil to prevent any possible contamination of the **BENTOLINER** Enviromat GCL (see Figure 6a). Place a minimum 300 mm thick of temporary backfill over the termination edge to prevent dislocation of the cover material (see Figure 6b). To continue laying the **BENTOLINER** Enviromat GCL, remove the backfill followed by the cover material (see Figure 6c). Along the overlapping region, apply undercoat and topcoat over the underlying **BENTOLINER** Enviromat GCL panel to continue the laying process (see Figure 6d).

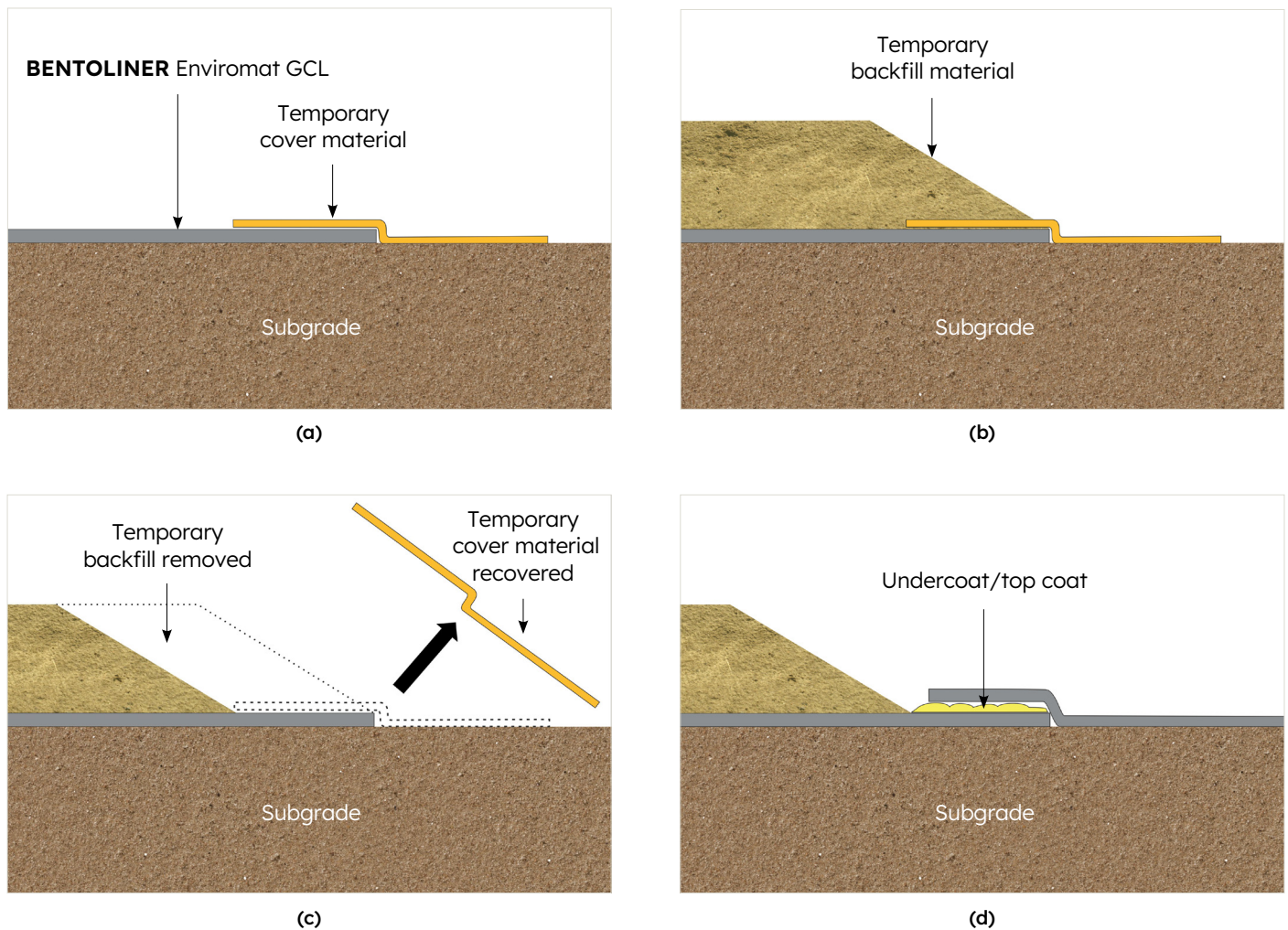


Figure 6: Protection over temporary termination edge of the laid out **BENTOLINER** Enviromat GCL

Refer to Section 6 for overlapping details at penetration and cut areas. Figure 7 and Figure 8 show the typical pipe penetration details on slope and flat ground respectively.

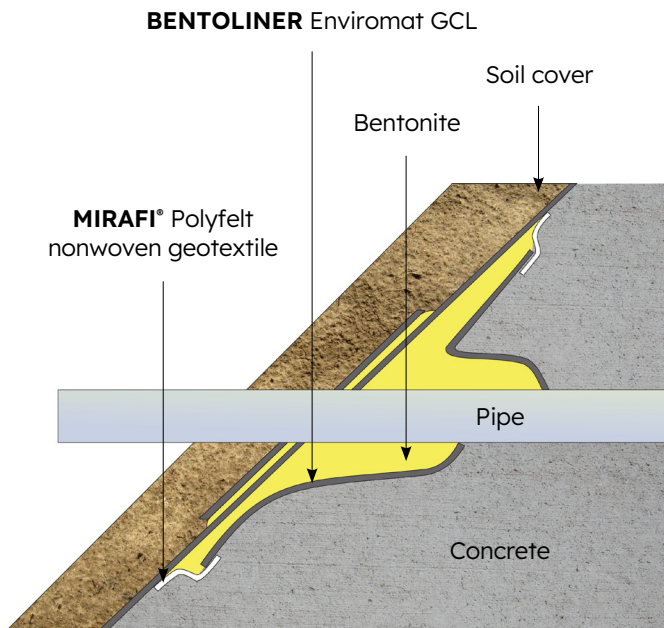


Figure 7: Typical pipe penetration detail in concrete

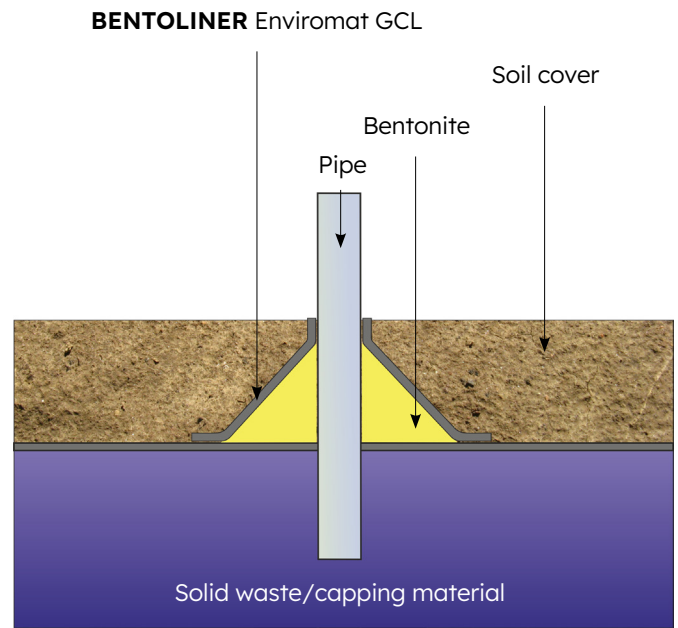


Figure 8: Typical pipe penetration detail

If the **BENTOLINER** Enviromat GCL is damaged with holes, tears, or rips during transportation, handling or installation before backfilling, it should be repaired by patching using a geotextile. If the bentonite component of the **BENTOLINER** Enviromat GCL is disturbed either by loss of material or by shifting, it should be covered by a full **BENTOLINER** Enviromat GCL patch of the same product. A minimum overlap of 500 mm is recommended.

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