Geosynthetic Clay Liner (GCL) Shrinkage

GCL under geomembrane and movement due to repeated wetting and drying cycles.

When the liner system is exposed (not buried under cover soil) for extended periods of time, the GCL under the geomembrane tends to get hydrated due to moisture in the subgrade migrating into the GCL and condensation forming under the geomembrane and being absorbed by the GCL.

The exposed liner system is often subject to repeated hot and cold cycles causing the GCL to repeatedly hydrate and then dry.

The GCL panels, if not heat bonded together, may shrink causing a reduction in the panel overlap and gaps between panels.

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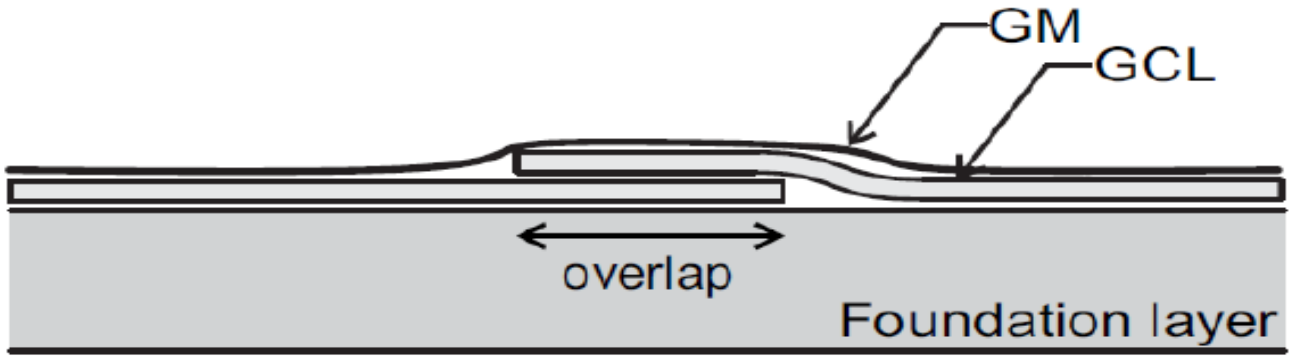

Figure 1. Illustration of a GCL overlap beneath a geomembrane (GM).

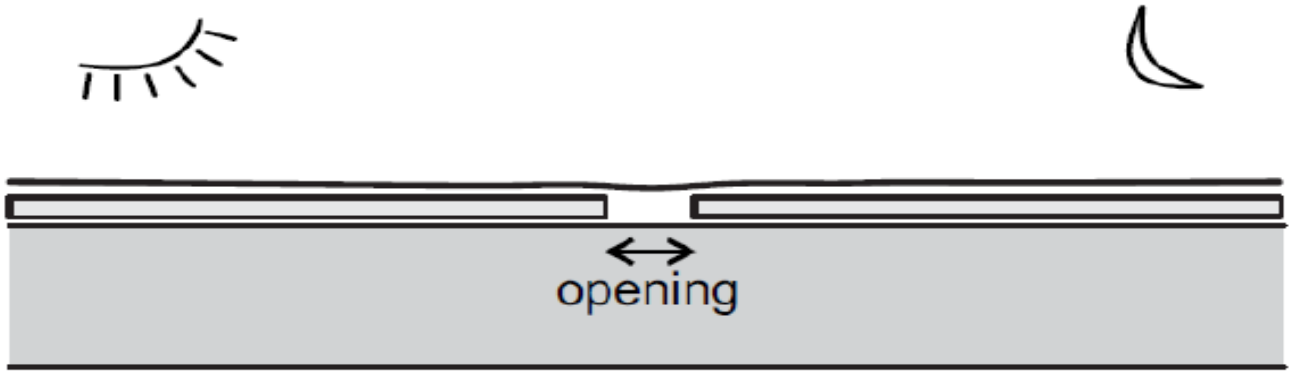

Figure 2. Illustration of loss of overlap between GCL panels beneath an exposed GM.

Source: Prabeen, 2011 Pan AM CGS

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GCL under exposed geomembrane experiencing a gap between adjacent panels; not heat bonded

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GCL under exposed geomembrane experiencing a gap between adjacent panels; not heat bonded

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GCL under exposed geomembrane experiencing a gap between adjacent panels; not heat bonded

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Repair GCL gap with additional panel of GCL overlapped 12 inches and heat bonded on all edges.

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To mitigate GCL shrinkage, the following is suggested:

- Cover the geomembrane system with protective/drainage soils as soon as possible after liner installation to provide ballast and minimize the heating/cooling cycles and possibility of condensate forming under the geomembrane.
- When covering the geomembrane is not possible, Heat bond the GCL with a 12 inch overlap using a heat gun or controlled flame torch.
- Or include a vapor barrier (40 mil HDPE) under the GCL between the subgrade and the GCL.

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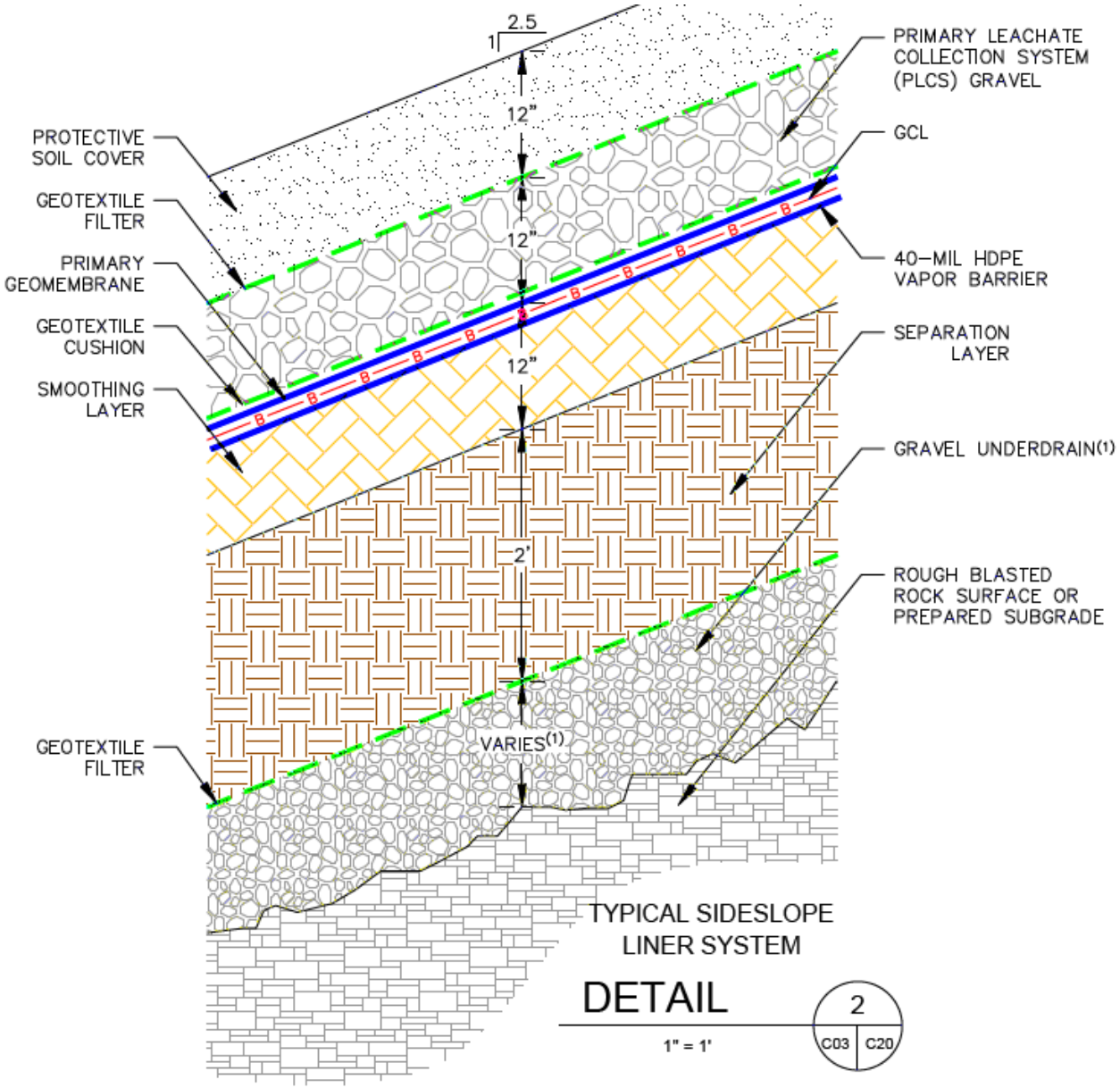

Use of a vapor barrier to isolate the GCL from the underlying soil and eliminate exposure to moisture and the formation of condensation.

Use when the overlying geomembranes remain uncovered for extended periods of time. Not needed if system is buried immediately.

GCL Joining - Technical specifications (example):

- Floor Area: Overlap a minimum of 6 inches along length and 12 inches along width and heat-bond adjacent panels together. This is accomplished by overlapping the GCL seams as indicated, applying a propane torch or hot air gun to the seamed area, then dragging a sand bag over the area to press the seam together right after the heat is applied in accordance with GRI-GLC6 “Field Seaming of Overlapped Geosynthetic Clay Liners”.
- Side Slopes: Overlap a minimum of 12 to 24 inches along length and heat-bond adjacent panels together. This is accomplished by overlapping the GCL seams as indicated, applying a propane torch or hot air gun to the seamed area, then dragging a sand bag over the area to press the seam together right after the heat is applied in accordance with GRI-GLC6 “Field Seaming of Overlapped Geosynthetic Clay Liners”.
- Spread granular bentonite at the rate of 4 ounces per lineal foot of overlap. This requirement maybe waived if an acceptable seam method is provided as a product feature (like Cetco Bentomat “supergroove”).

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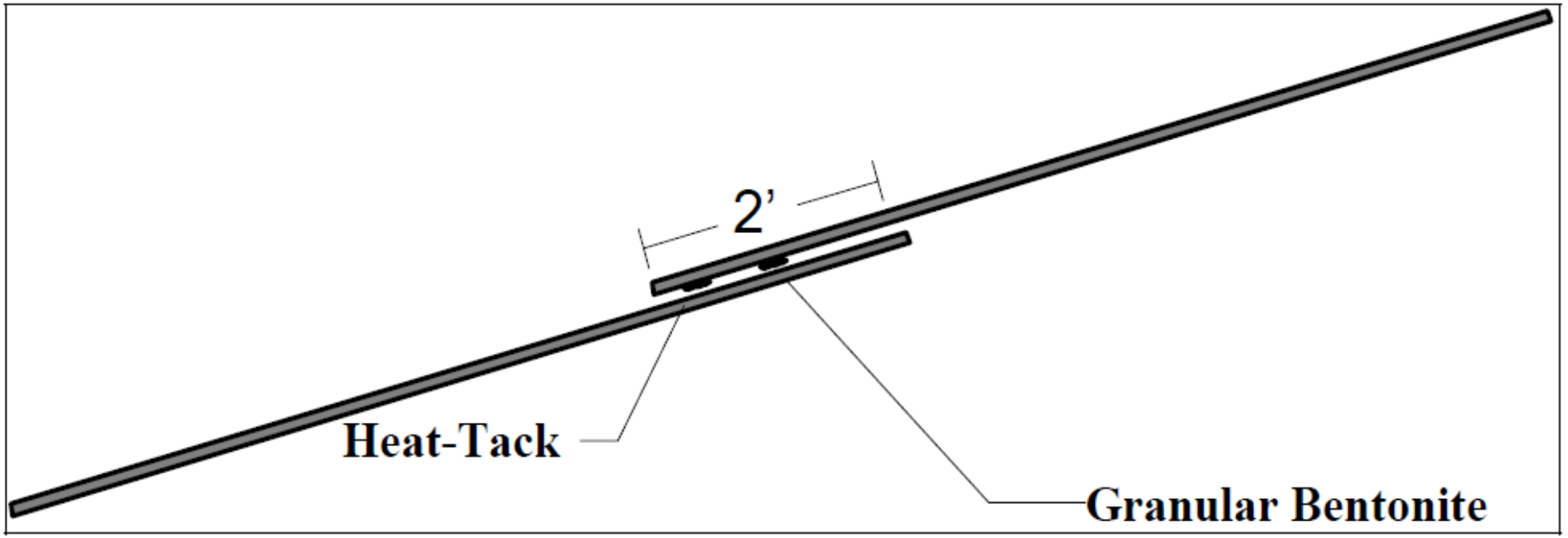

Figure 2

Source: CETCO Design Reference January 2011

Heat bonding the GCL together

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Heat bonding the GCL to form a strong weld on adjacent/overlapped panels of GCL. Source: Geosynthetics Feb/Mar 2009

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Field destructive testing of the heat bonded seam of adjacent/overlapped GCL panels to form a strong bond. Source: Geosynthetics Feb/Mar 2009

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(a) Hand held hot air device

(b) Seam produced with hot air device

Figure 3. Hand held hot air device for seaming GCLs.

Source: GRI GCL6, June 2015

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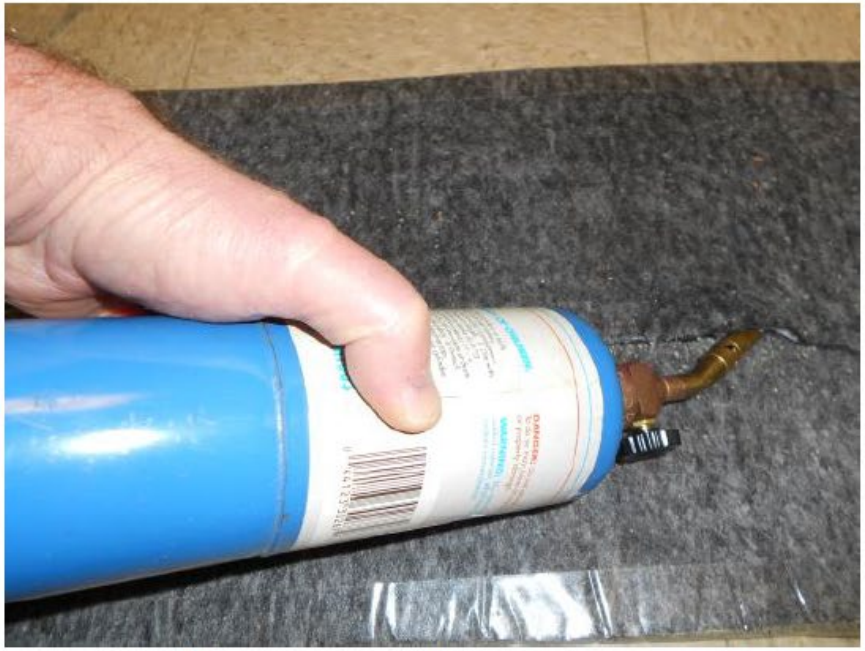

(a) Propane torch seaming GCL

(b) Seam produced with propane torch

Figure 4. Hand held propane torch for seaming GCLs.

Source: GRI GCL6, June 2015

Conclusions

If GCL installed directly under a geomembrane on top of a soil subgrade and the liner system is left exposed for extended periods of time or not covered by soils, then the GCL may become hydrated due to moisture pulled from the subgrade over time. Repeated hydration and drying of the GCL may cause shrinkage of the panels causing reduced seam overlap and gaps between panels. To minimize the risk of panel shrinkage:

- Cover/bury the liner system with protective/drainage soil immediately after installation.
- Heat bond together the adjacent panels of GCL.
- Include a vapor barrier under the GCL to isolate the GCL from the underlying soil.