**Case Study**

**Background**

The Dubuque Landfill Cell 9, Phase II is located in Dubuque, Iowa. The original liner system (from bottom up) consists of 1 ft (30 cm) groundwater collection layer, 8 oz/sy (270 g/m²) separation geotextile, 1ft (30 cm) earth barrier layer, 2 ft (60 cm) compacted clay layer, 60mil (1.5mm) HDPE liner, 8 oz/sy (270 g/m²) protection geotextile, and then 1ft (30cm) leachate collection drainage layer, as shown in Figure 1.

**Figure 1. Typical liner section in the original design**

---

**Technical Description:**

**Product:**
- GSE 60 mil White Textured Geomembrane
- GSE TenDrain 275 Geocomposite

**Description:**
- GSE White Textured is an HDPE geomembrane with texture on both sides. The U.V. stabilized upper white surface reflects light, improves damage detection, and reduces wrinkles.
- GSE TenDrain Geocomposite is a tri-planar geonet heat bonded to a GSE nonwoven needle punched geotextile. It provides high transmissivity under high and low loads.

**Quantity:**
- 600,000 sf GSE White HDPE Geomembrane
- 600,000 sf GSE TenDrain Geocomposite
The granular drainage layer above the subgrade is designed to control groundwater, in order to mitigate the risk of exposing the compacted clay liner to excessive moisture. Excessive moisture and even saturation will compromise the integrity of the compacted clay liner, thus reducing the effectiveness of the entire liner system over the design life of the landfill. A geonet geocomposite alternative to the granular drainage layer has technical and economic benefits, including air space saving, easy and quick installation, and quality control of the manufactured product. When a geocomposite is used for a groundwater control layer, the combined drainage capacity and capillary barrier, or ‘break,’ to control the upward movement of water is critical to its performance. A geocomposite will succeed as a capillary break only if the top and bottom geotextile do not come in contact with each other, thus providing a void space to break the capillary action from drawing water through the subgrade soil and the bottom geotextile.

**Solution**

GSE TenDrain geocomposite consists of a tri-planar geonet heat-laminated on both sides with a nonwoven geotextile. The tri-planar structure consists of middle ribs that provide direct flow, along with diagonally placed top and bottom ribs to minimize geotextile intrusion. Studies have shown that the tri-planar geocomposites are effective capillary barriers, (Henry and Affleck, 1998; Evans, Zhao, and Salzer, 2010). The Iowa State regulations require the granular drainage layer to meet or exceed a hydraulic conductivity of $1 \times 10^{-2}$ cm/s, and 12” (30cm) in thickness. A tri-planar geocomposite with the following properties exceed the above requirement.

The Engineer was able to redesign the groundwater control layer within a quick time frame. The project had already bid when the alternative groundwater drainage layer was proposed. The Engineer had to submit the alternative drainage layer to the Iowa Department of Natural Resources (IDNR) for approval prior to permit construction. The IDNR accepted the alternative groundwater control layer and a Change Order was issued for the tri-planar geocomposite. continued...
Results
The triplanar geocomposite was shipped to the site and installed in a very rapid timeframe. This gave the General Contractor flexibility to install the overlying compacted clay liner. The General Contractor was also able to install a portion of the geocomposite to better fit their construction schedule.

The tri-planar geocomposite alternative on this landfill expansion in place of the 12” granular groundwater control layer and 6” of the earthen barrier layer produced a revenue gain of over $650,000 from the air space savings. On top of the revenue gain, the drainage geocomposite has many other advantages. The geocomposite will provide a consistent drainage layer for any groundwater infiltration over the entire surface area. Also, construction with geocomposite is faster than the 12” granular drainage layer, with crews installing 1 to 2 acres of geocomposite per day.

In conjunction with the geocomposite proposition, engineers also approved a white HDPE liner as an alternative to the black HDPE liner in the original design. The white HDPE geomembrane provides a flat surface with fewer wrinkles which helps reduce damage to the liner when overlying cover soil is spread with heavy equipment. The chance for reduced damage from equipment and the improved visual damage when exposed make the white-surfaced HDPE liner an enticing alternative to the black HDPE in the original design.