Sustainability Aspects of Engineered Turf Systems for Environmental Closure and Erosion Protection

Ming Zhu, Ph.D., P.E. (mzhu@watershedgeo.com),
Rutuparna Joshi, P.E. (rjoshi@watershedgeo.com),
Thomas Orzech (torzech@watershedgeo.com), and
Bryan Scholl, Ph.D., P.E. (bscholl@watershedgeo.com)
(Watershed Geosynthetics, Alpharetta, GA, USA)

Background/Objectives. Engineered turf systems have been used for environmental closure and erosion protection in the last decade. For example, the engineered turf final cover system, which consists of, from bottom to top, a structured geomembrane, an engineered turf, and a specified infill, has been used to close waste containment facilities, including municipal solid waste (MSW) and industrial waste landfills and coal combustion residual (CCR) impoundments. A similar system with a cementitious infill has been used to protect levees, earth embankments, and channels from soil erosion. Compared with traditional environmental closure and erosion protection systems, the engineered turf systems utilize fewer natural materials, pose less impact on the environment, require less post-construction maintenance, and provide better field performance. This presentation provides an overview of engineered turf systems, followed by a discussion that is focused on carbon emissions and real-world performance to demonstrate how the systems contribute to sustainability of environmental closure and erosion protection projects.

Approach/Activities. When used to close waste containment facilities, the engineered turf final cover system contains a significantly smaller carbon footprint than a traditional soil cover. The engineered turf cover eliminates at least two (2) feet of soils that are obtained from borrow areas and thus, preserves land sources and corresponding carbon sequestration. Carbon emissions associated with harvesting soil from borrow areas and transporting them to the site are eliminated. In addition, carbon emissions associated with cover construction are significantly reduced due to faster construction speed and less use of heavy construction equipment. The results of a life-cycle assessment (LCA) are presented to compare carbon emissions of the engineered turf cover and a traditional soil cover.

After a waste containment facility is closed with the engineered turf cover, the large space can be beneficially reused for development of a solar farm to provide a clean source of green energy. The engineered turf cover makes a preferred foundation for the solar farm as a result of minimal post-closure maintenance (i.e., no re-vegetation, fertilization, or mowing). The integration of the engineered turf cover with a solar system further improves the sustainability of the closed facility.

Because the engineered turf systems do not rely on natural soils and vegetation, they provide predictable and consistent performance that is less affected by changing weather and climate conditions. Case studies are presented to show the real-world performance of the engineered turf systems to protect landfills and earth structures under extreme weather conditions, such as hurricanes and severe storms.

Results/Lessons Learned. The overview of the engineered turf systems and the case histories in this presentation are expected to be beneficial to site owners who are seeking feasible, cost-effective, and sustainable solutions to address challenges associated with environmental closure and erosion protection. Such applications can contribute to the overall sustainability of the projects and improve climate resilience of the facilities over their lifetime.