Landfill erosion control and leachate management

A unique use of geosynthetics enables multiphase remediation along a Canadian waterway.

The Red Hill Creek is a 68 km^2 (26 mi^2) watershed located on the southern shore of Lake Ontario. On the west side of the creek within the city of Hamilton are the former Rennie Street and Brampton Street landfill sites. These old city "dumps" were created when approximately 1.4 million m^3 (1.8 million yd.^{3}) of waste was disposed into a 1-km (0.6-mi)-long section of the floodplain of the creek.

Leachate was being expressed as seeps along the west bank of the creek from the landfills. In addition, the encroachment of the Red Hill Creek by the landfills had created very steep valley slopes. The valley encroachment had also caused enhanced rates of erosion adjacent to the landfills that were leading to undermining of the banks and potential failure of the landfill slopes into the creek.

The city of Hamilton retained Dillon Consulting Ltd. to assist them in undertaking and implementing a strategy to control erosion and manage leachate for the sites. The strategy that was developed included the following:

- Stopping the flow of leachate to the creek through the removal/plugging of buried utilities,
- Construction of a low-permeability cover on the Rennie Street landfill to minimize further generation of leachate,
- Re-alignment of Red Hill Creek away from the landfill sites in a stable natural-channel design, permitting construction of a horizontal leachate collection system at the toe of the landfills, and
- Stabilization and lining of the landfill slopes to prevent slope failure and direct leachate to the collector system.

A geosynthetic clay liner (GCL) was selected to cover the top of the Rennie Street landfill in order restrict any further infiltration of surface water into the landfill to minimize generation of leachate that could flow to the creek. During the summer of 2001, the hired contractor installed the GCL over a regraded landfill surface that directed surface water to a collection system away from the creek. A sand layer for gas venting was placed under the GCL. The GCL was covered with an adequate thickness of cover soil, including a non-woven geotextile in the constructed rainwater channel as a separator between the cover soil and the installed riprap. Discussions are underway with a local community liaison committee to identify potential end uses for the site. With this cover design, engineering and environmental limitations on the end use are only related to excavation and building construction.

Photo 1. Installation of the geosynthetic clay liner over the existing landfill, 2001. View of the stormwater channel.

The main component of the work is being carried out along the slope adjacent to the creek and in the creek itself. One of the most significant challenges of the project was to design a collection system against the creek and along a slope of 35˚ without exposing any existing waste. This was achieved by first excavating a wider floodplain for the creek and re-aligning the creek approximately 5 to 15 m (16 to 50 ft.) away from the landfill, in a natural channel design. Once the creek had been realigned, the construction of the horizontal collection system was started by installing a lining wall between the creek and the collection pipe (Photo 2).

Once the horizontal collection system was constructed, the slope 1.5(H): 1(V) along the landfill was sealed by installing a system of drainage net, GCL and a structured geogrid for the soil cover veneer stability. This engineered solution using Tensar geogrids can support the soil cover on steep slopes, reducing the strain placed on the underlying lining system and ensuring the long-term stability of the landfill. The GCL contained leachate within the landfill, and the drainage net directed the leachate into the collection system. The geogrid system was designed and constructed in a wrapping technique, which included an initial lift of 600-mm stone wrapped in a combination of geogrids and non-woven fabrics installed over the slope biaxial grid. A second lift of selected topsoil wrapped in a geogrid and erosion blanket was installed over the initial stone lift. This process was continued in lifts along the length and width of the slope for a total coverage of approximately 30,000 m^2 (35,880 yd.^{2}). The entire sealing system was completed by hy-

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Photo 2. Installation of the pipe collection system along with the lining system, which included the use of a 60 mil HDPE, GCL, and drainage net.

Photo 3. Construction of the slope along the landfill included the use of drainage net to collect the contaminants, a GCL, and a geogrid wrap system to ensure slope stabilization.

droseeding the slope with a mixture of native grasses and wild flowers and then covered with erosion control blankets. Tensar Earth Technologies engineered the complete system, along with the slope stability. The project engineers undertook peer review. Terrafix Geosynthetics Inc. supplied contractor assistance and supervision during the entire length of the project.

The construction leachate collector and slope stailization measures are expected to be completed in August. Final plans of the project are to return the area to its natural environment. This process has already begun with the growth of vegetation over the erosion blanket and the geogrid system (Photo 4). The combination of geosynthetics provided the project engineers a system to collect the leachate from the existing landfills and secure the steep slopes of the landfills, while providing the owners a final natural setting with minimal signs of synthetic products. This project is under consideration for engineering and environmental project awards. GFR

Photo 4. New creek and stabilized slope with vegetation growth in progress. The geogrid system had a built-in erosion blanket that was also hydroseeded.

Project Information

GCL manufacturer: Bentofix Technologies Inc. (A joint partnership of Terrafix Geosynthetic Inc., GSE Lining Technology Inc., and Naue Fasertechnik GmbH.)

Geogrid manufacturer:
Tensar Earth Technologies Inc.

Geosynthetic installer:
Hard Rock (2001) and Aecon (2002)

Geosynthetic supplier:
Terrafix Geosynthetics Inc.

Project engineers: Dillon Consulting Ltd.

Owner: City of Hamilton

Geosynthetic design engineers:
Tensar Earth Technologies Inc.

Bill Allison, P.E., is a partner with Dillon Consulting Ltd. and project engineer for this project.

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