

Confinement system reduces erosion

A 11 developments can impact on lands abutting them but a residential subdivision in Hull, Quebec gives an interesting overview of problems faced and overcome.

Stormwater runoff patterns were substantially altered by the development after construction of the subdivision started in 1992. Much of the runoff is now directed into the existing Ruisseau Leamy channel, increasing normal storm flow volumes to 6.98 cubic metres per second. Peak storm flows have increased to 10.45 cubic metres per second, with a velocity of 3.48 metres per second.

The increased flows resulted in significant stream bank erosion taking place in an area downstream from the new subdivision where the Ruisseau Leamy channel runs through the back lots of homes built in 1980. The result was a loss of valuable soil and a negative impact on water quality.

Responsibility for corrective action fell upon the City of Hull, who retained the consulting engineering firm of Jean-Luc Allary and Associates to find an erosion mitigating solution. Under the terms of reference, property owners in the affected area would have input into the decision-making process. A solution that blended easily into the surrounding native woodlands and vegetation was mandatory. Compounding the situation was the fact that the existing soils in the channel were predominantly soft, weak clays. These clays are extremely prone to frost heave and differential settlement.

*Geosynthetic Product Manager,
Armtec Construction Products



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The solution selected was the textured finish Geoweb Cellular Confinement System® (CCS), as manufactured by Presto Products and supplied by Armtec Construction Products. The design consisted of a multi-component Geoweb channel lining running about 90 metres along the length of the channel. The system was chosen for two primary reasons, (i) flexibility in soft soil conditions and, (ii) the ability to provide a visually attractive, vegetated solution.

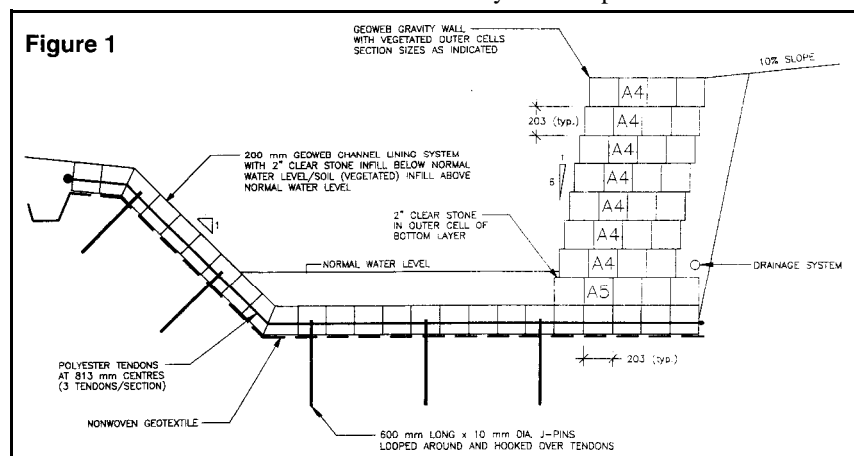
Geoweb CCS possesses a three dimensional structure manufactured from high density polyethylene. The CCS permits the use of common infill materials in demanding load support, soil stabilization and erosion control applications. On erosion control projects and depending upon conditions, the Geoweb reduces rilling and piping, increases flow capacity and prevents the build up of hydrostatic pressure. Its cellular con-

figuration permits rapid infilling of cells and features the ability to infill exposed cells with topsoil and seed in order to promote the growth of vegetation.

Due to the site geometry, the lining of the channel was a combination of conventional channel lining and retaining wall. (Figure 1.) The 1.6 metre high retaining wall was designed as a gravity wall, with a 1:6 H:V slope, using conventional retaining wall design methodology. In addition to the vegetated face, the consultant specified that the 200 mm deep exposed cell walls should be green in colour in order to better blend with the natural surroundings. All cells below the normal water level were infilled with 50 mm clear stone in order to facilitate drainage. The balance of cells behind the retaining wall face were infilled with sand compacted to 95% Standard Proctor Dry Density.

The balance of the channel lining system consisted of 200 mm deep, textured and tendoned Geoweb sections. Because of drainage considerations, the area below the normal water level was infilled with 50 mm clear stone, while the area above the normal water level was infilled with top soil and seeded for grass. Stone infill was deemed adequate for normal flow conditions, but under normal and maximum storm conditions, some emptying of cells was expected.

To prevent undercutting of the subgrade in this situation, a needle-punched nonwoven geotextile was placed at the CCS / subgrade interface. To prevent downstream sliding due to



By Doug Lowry, P.Eng.*

possible weight loss from cell emptying, and allowing for increased drag forces due to storm flow, additional precautions were taken to increase the system's factor of safety. This increased factor of safety took the form of three high strength polyester tendons per panel running transversely to the direction of flow, at mid-height of the panel. The individual CCS sections were anchored to the subgrade of the channel, using 600 mm long steel J-pins hooked over the tendons.

At the top of the 45 degree angle side slopes, the CCS was secured into a locking trench and backfilled. Areas below the normal water level were infilled with 50 mm clear stone for drainage. Areas above the normal water level were topsoil infilled and seeded for grass. Construction of the entire lining systems took 60 man days.

Constructed in the fall of 1995, this installation has now been exposed to one very harsh winter and one very high runoff spring. The system is performing as expected, visually as well as structurally, much to the satisfaction of the property owners.

**For more information, contact
Presto Geosystems.
Ph: 800-548-3424, 414-738-1338
or Fax: 414-738-1418**