



*creating
sustainable
environments™*



GEOWEB® CHANNEL PROTECTION SYSTEM

Engineers are challenged to find cost-effective ways to manage increasing environmental and stormwater issues.

The Geoweb® channel protection system offers an innovative and economical alternative to traditional formed concrete channels. The system eliminates the need to build forms and use reinforcing steel or expansion joints required by other concrete systems. The cellular structure creates a permanent flexible form conforming to changes in the slope, grade and subgrade soils without uncontrolled cracking.

Examples where the Geoweb system solved unique channel protection problems are illustrated in this case study summary.



GEOWEB® *channel protection system*

CONCRETE-FILLED CASE STUDY SUMMARY 1

providing sustainable channel protection solutions



case study 1

INTERMITTENT FLOW • EMPIRE LANDFILL, TAYLOR PENNSYLVANIA • FALL 1986

THE CHALLENGE

In order to accommodate potential storm events, landfill stormwater management systems must meet stringent regulations. These systems include both run-on diversion and run-off interceptors around the site perimeter, as well as channels and down-drains from the terraced landfill area. Typical interceptor channels follow the landfill toe, and are trapezoidal-shaped with a 2-16% gradient, 8 ft-wide bottom and 2h:1v channel side slopes. In the past, rock-filled gabions or shot rock were used to protect the interceptor channels from erosion. A more cost-effective alternative was desired to adequately handle the stormwater flows, while minimizing site disturbance and providing ease of maintenance. The flexible channel armament system chosen was the 100 mm (4 in), tendoned Geoweb® system infilled with concrete.



THE INSTALLATION

The channel was excavated and a nonwoven geotextile placed to provide drainage and soil filtration. For stability against the 7.2 m/sec (23 ft/sec) projected flow velocities, three tendons per



Project photos courtesy ACF Environmental

section were integrated through the Geoweb sections. The sections were expanded longitudinally down the channel invert and adjacent sections connected. Concrete was placed by a backhoe to the top of the cells and given a raked finish. A 3-man crew was used to install the 2,839 (30,560 ft²) channel with a length of 580 m (1900 ft).

THE RESULTS

The Geoweb channel system has handled higher-than-normal storm events and continues to perform as expected.

case study 2

MEDIUM FLOW • AG SIMPSON PLANT, OAKVILLE, ONTARIO, CANADA • FALL 1986

THE CHALLENGE

Requiring a concrete-lined channel for stormwater containment and runoff, this industrial plant sought a more cost-effective alternative to traditional formed and poured concrete. The original design called for a formed 150 mm (6 in) deep reinforced concrete liner on the 300 m (1,000 ft) long section of channel. The side slopes were 1h:1v to 3h:1v with peak flow velocities projected at 3.5 m (11-12 ft) per second. The 100 mm (4 in) depth Geoweb® system was chosen as the alternative channel protection solution.

THE INSTALLATION

A non-woven geotextile was placed down the channel side slopes and across the bottom and toed in 305 mm (12 in) along the crest. Next, Geoweb sections were placed and secured with 380 mm (15 in) long stakes along the top row of cells. A 4,000-psi concrete was poured into the upper cells and raked into the lower



cells. Designated cells in the channel bottom were filled with clear stone to allow groundwater drainage collected by the underlying geotextile. For safety reasons, a rough-raked finish was applied.



THE RESULTS

The concrete pour was completed on the 2,800 m² (30,000 ft²) channel in two days with a four-man crew. Total project time was eight days to complete the 300 m (1,000 ft) channel liner. The project was completed in half the projected time and cost of traditional formed and poured concrete systems. Over time, sediment buildup over the concrete surface has provided an environment for vegetative growth.



case study 3

HIGH FLOW • MOLLY ANNE'S BROOK, HALEDON/PATERSON, NEW JERSEY • SUMMER 1999

THE CHALLENGE

The US Army Corps of Engineers – Philadelphia District needed to increase the flow capacity of an existing channel in an area with limited right-of-way, rock outcroppings, and high stream velocities due to stormwater runoff from the surrounding areas. Design velocities approaching 6m/sec (20 ft/sec) along a 91-m (300-ft) section of a sharp channel bend would require substantial reinforcement of the new channel lining. A 54-in thick riprap section would traditionally be designed, however, Corps engineers desired a more cost-effective solution. The final design integrated the 100 mm (4 in) deep, concrete-filled, tendoned Geoweb® system.



THE INSTALLATION

After grading the slopes, a non-woven geotextile underlayment was placed. The Geoweb sections with tendons were expanded on the 2h:1v side slopes from top to bottom and anchored. Cell-

wall perforations provided a high factor of safety against the dislodging of the concrete fill in the individual Geoweb cells. The channel is exposed to freeze-thaw cycles and high

flow-velocity storm events.

The flexible system was formed around the bedrock outcropping and weep holes integrated near the slope bottom to alleviate pore water pressure and uplift. The secured sections were filled with low-slump concrete using a backhoe bucket.

THE RESULTS

The Philadelphia District estimates that the construction of the 300-linear-ft Geoweb channel protection system required less time and was 25% of the cost of a 54-in riprap section of equal length. The contractor reported the system as easy to install, required a minimal crew of three and was easily adapted to varying conditions.



Project photos courtesy ACF Environmental

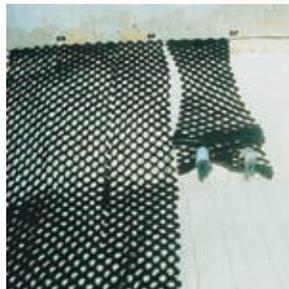
Following Hurricane Floyd, the Geoweb system performed as expected compared to extensive damage received by other systems.

case study 4

HIGH FLOW • AYALON CHANNEL – TEL AVIV, ISRAEL • AUGUST 1995
AWARDED 1997 TECHNOLOGICAL ADVANCEMENT AWARD FROM THE INTERNATIONAL EROSION CONTROL ASSOCIATION

THE CHALLENGE

City expansion and an increase in stormwater runoff had caused deterioration of the City's Ayalon Channel, designed to handle the Ayalon River's heavy water flow during the winter rainy season. Long, dry summers followed by short, rainy winters caused high flow, high velocity streams and often flooding. The corrosive effects of sewage water and other pollutants entering the channel augmented the already deteriorating state of the channel, primarily protected with gabions. Engineers chose the concrete-filled Geoweb® system as the solution to armor the channel.



THE INSTALLATION



The trapezoidal channel has a 5 m (16.4 ft) wide bottom and is 20 m (65.6 ft) wide at the top with 2h:1v embankment slopes. On both sides, 5 m (16.4 ft) high

vertical concrete walls exist. The total length of the channel is 2 km (1.2 miles). The 50-year maximum flow was calculated at 570 m²/sec (746 yd²/sec) with a velocity of 5 m/sec (16.4 ft/sec).

Restoration began with removing the old gabions and restoring the riverbed to its original design elevation with gravel. A rod for attaching high-strength tendons was inserted through eye-bolt anchors secured on both sides to the vertical concrete walls. Tendons were tied on one side to the steel rods, threaded through holes in unexpanded Geoweb sections, and placed across the channel. The tendoned sections were then expanded and interconnected. Short stubs of polyethylene pipe were installed to release hydrostatic pressures. Concrete was then poured and smooth-trowel finished, to accommodate increased flows.

THE RESULTS

The entire project from excavation through final concrete work was completed in just over three weeks. Built as a pilot project covering 15% of the total channel, the restored section has withstood several rainy seasons and has performed to design expectations.



case study 5

HIGH FLOW • ST. LOUIS METROPOLITAN SEWER DISTRICT (MSD)
ST. LOUIS, MISSOURI • SPRING 1986

THE CHALLENGE

As the St. Louis area expanded, so had the amount of stormwater runoff. In the past, earth and poured-in-place concrete channels were used to handle water runoff. The dramatic increase in runoff had caused severely eroded earth channels and subgrade erosion behind the concrete panels. St. Louis MSD engineers redesigned the channel side slopes to contain



greater volumes of water, resulting in a need for stronger armoring to prevent recurring erosion problems. Poured-in-place concrete was rejected as past experience showed subgrade soil became saturated and deformed behind the concrete panels, causing them to crack and move out of position. The St. Louis MSD decided to use a flexible armoring system—the Geoweb® channel protection system.

THE INSTALLATION

The channel was first graded and a non-woven geotextile was placed on the side slopes and channel bottom. On the steeper 1h:1v side slopes, the Geoweb sections were anchored in a trench



at the crest of the channel embankment. Stake anchoring was used on embankment slopes 2h:1v or less.

Beginning at the top of the channel, a 3,000 psi (20,682 kPa), low-slump concrete was poured in the sections and raked into the lower cells. Weep holes at 2.4 m (8 ft) intervals across the bottom of the slope allowed ground water to escape from behind the installation. The channel was finished with a raked surface for a more natural look.

THE RESULTS

The St. Louis MSD estimates cost-savings with the Geoweb system of 30-40% over traditional concrete channels through a reduction in labor costs, material and maintenance.



Project photos courtesy of ASP Enterprises



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