



PROTECTING THE Bluff

AN INTEGRATED EROSION CONTROL DESIGN STABILIZES LAKE MICHIGAN'S SHORE.

BY JILL PACK



The steep bluff embankment along Lake Michigan's shore experienced excessive erosion but was stabilized with an integrated design to control the water flows.

Stabilizing steep slopes can be a challenge no matter the location. Add in highly erodible soil and adverse lake-effect weather, and the stakes go up. On a residential site along Lake Michigan's shore in South Haven, Michigan, concerned homeowners had to call in design and construction experts to protect their property from visible—and distressing—erosion.

SI-SI-Slipping Away

The South Haven homeowners live along a steep embankment that has near vertical drops and extends 120 feet down to meet Lake Michigan. This area is covered by clay loess, a highly erodible regional soil type designated by layers of clay and deposits of silt laid down over time from glacial movements. Unstable by nature, loess is notorious for having substantial ground flows. This means that any disturbance can lead to seepage and water flows stemming from the embankment.

Unfortunately for the homeowners, an earlier installation of waterfront access stairs disturbed the site's bluff enough that, over time, it began to create erosion control issues. Along with the bluff seepage of groundwater, high-velocity surface runoff exacerbated the water control problems. This led to sediment pollution, deposits on the beachfront and the exposure of many stairway footings.

The impending loss of the stairway led the South Haven homeowners to call on specialists from JFNew, DeBest Inc. and Price and Company. JFNew, a natural resources and ecological consulting firm headquartered in Walkerton, Indiana, served as the lead contractor and vegetation specialist. DeBest Inc. of South Haven

PLANTING FOR NOW AND LATER

To prevent temporary soil erosion along the bluff, the crew planted the entire site with a temporary seed mix that included species such as little bluestem, switchgrass and other common native grasses. For long-term protection, native perennial plant plugs were installed through the matting.

Because the weather during installation was hot, dry and windy, homeowners irrigated the slope to quicken vegetation establishment. The mix of annual vegetation and perennial plugs took root within weeks, and by the end of the fall growing season, a full stand of vegetation had been established. Additional native grasses and shrubs were permanently planted this spring. It is expected that, over the next few years, the native plantings will continue to propagate and spread, ultimately replacing the temporary seeding.

served as the local contractor. And Price and Company of Wyoming, Michigan, offered erosion control support and products. “Together these companies developed a design that would offer an effective solution to stabilize the embankment and to restore the bluff back to a natural vegetative setting,” says Joe LaGrow, a regional representative with Price and Company.

A Stable Slope Solution

Upon consultation, the three companies determined that an integrated design was needed to offer effective slope and surface stabilization during the temporary unvegetated phase and to protect the bluff permanently.

Plans called for cutting back the upper portion of the slope to a 1:1 slope gradient and tiering the lower portion of the slope to create benches. The terraces would allow the vegetation more stability and help to reduce the runoff velocities and sediment movement downslope to the beach and lake.

The team chose a Presto Geosystems Geoweb cellular confinement system for slope stability on the upper portion of the slope. The system was selected to improve the performance and stability of the 3–4 inches of soil fill that was applied to fix the grade of the embankment. The perforations in the cellular confinement system allowed for lateral drainage through the system, thereby enhancing the performance of the system in the saturated soil conditions expected onsite.

To prevent surface soil erosion from the confinement system and to help reinforce the establishing vegetation from runoff water, the team chose to use a C350 Composite-Turf Reinforcement Mat (C-TRM) manufactured by North American Green. The C-TRM’s three-dimensional permanent netting structure combined with a coconut fiber matrix had the benefits of both an erosion control blanket and permanent matting for temporary and permanent protection.

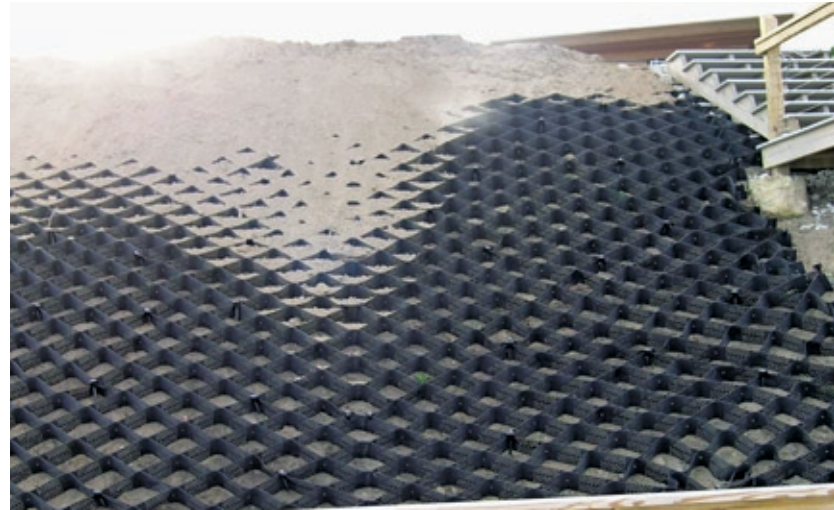
To finish the integrated design, a sediment control device was needed to help build the tiers, to slow the runoff water velocities and to trap any sediment that might migrate downslope from

adjoining land. Coir logs and standard straw wattles were suggested but rejected based either on high cost or poor performance. Ultimately, the team selected North American Green’s SedimentSTOP, a rolled sediment filtration device, based on its ability to filter runoff water.

Mirroring Mother Nature

With the integrated design system selected, the contractors started work in May 2007. “Access to the site was tricky,” says Brian Majka, project manager from JFNew. “With many homeowners building their homes to maximize property frontage, it restricted us to a mere eight-foot clearance on either side of the home to access the slope. Because of that, we were limited to using only small equipment for the project as well as doing a majority of the work by hand.”

Equipment onsite was limited to a Bobcat skid-steer loader and a small excavator, but the crew managed to complete the work, cutting back the near vertical upper portion of the slope to a 1:1 slope. The crew then installed the cellular confinement system on this portion of the slope and anchored it at the leading edge in a small concrete trench, topping it off with a standard loamy topsoil fill.



A perforated cellular confinement system was installed on the slope's upper portion and filled with a standard loamy topsoil (top). The area was then seeded and protected with a coconut-filled turf reinforcement mat (bottom).



Rolled sediment filtration devices and turf-reinforcement mats were used to build and stabilize the terraces.

After prepping the upper portion of the slope, the crew seeded the area and installed the C-TRM overtop. They then tiered the remainder of the slope every 8 to 10 feet, creating 4- to 5-foot-wide benches. The SedimentSTOP rolls were used to help create the tiered benches, as well as to protect the edges of the tiers while the turf reinforcement mat was installed on the top face of the tiered benches. The Lake Michigan bluff project—originally



Within weeks of the project's completion, the native seed mix was returning the bluff to a natural vegetated condition.

expected to take two to four weeks to complete—extended to several months due to the large amount of handwork done on the site. At the project's completion in September 2007, a total of 26 terraces had been created, and more than 17,250 linear feet of sediment filtration devices and approximately 1,500 square yards of C-TRM had been used.

The homeowners were pleased with the results from this cost-saving design and with how quickly the site was stabilized and revegetated. The erosion control products seemed to disappear under the vegetation, resulting in a bluff that was as natural look-

THE EROSION CONTROL PRODUCTS SEEMED TO DISAPPEAR ... RESULTING IN A BLUFF THAT WAS AS NATURAL LOOKING AS IF MOTHER NATURE HAD DESIGNED IT HERSELF.

ing as if Mother Nature had designed it herself. And more importantly, the bluff was stabilized by the start of winter, just in time to thwart the effects of spring thaw. **SP**

Jill Pack of Evansville, Indiana, is actively involved in the development and design of erosion and sediment control systems.

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