Coir Fibers Add Natural Strength and Durability to Lake Shore Stabilization Project

RoLanka International, Inc.

When an eroding shoreline threatened to destroy portions of a popular walkway around North Creek Lake in Montgomery Village, Maryland, village officials took action to solve the problem in a way that was friendly to the residents – both human and wildlife. Their solution combined soil bioengineering practices, reinforced with biodegradable materials, and hard armor to protect the shoreline from the impacts of waves, water fowl and people. It featured the use of densely-packed rolls and blocks of coir fiber to support the establishment of erosion-controlling trees and shrubs along much of the shoreline. At the same time, areas leading to the water's edge were protected from foot traffic by stair-like structures built of large, flat, stacked rocks.

Densely packed coir rolls

Coir Block System

The 6.5-acre lake, which includes three small islands, was built in the mid-1970s, as part of the county's storm water management system. Montgomery Village is located not far north of Washington, D.C., and was established as one of the region's first planned communities nearly 40 years ago. The lake is part of the 80-acre North Creek Lake Park which offers recreational activities, like walking, jogging, fishing and picnicking. It's also home to Canada geese and mallard ducks.

A Natural Solution

Lakeside erosion had progressed to the point where the gravelly loam shoreline was eroding inland at the rate of about one foot a year. "It represented an accumulation of problems over the past few years," says Scott Gole, assistant director of recreation and parks for the Montgomery Village Foundation, which manages the park. The causes included the vegetation-destroying activities of people walking on the lake banks as they fished and the geese and ducks geese entering and exiting the lake and feeding along the shore. This exposed the soil to accelerated erosion by rainfall, storm water runoff and the lake's wind-driven waves.

"In controlling the erosion we wanted to retain a natural appearance and still provide areas where people and wildlife could access the lake without disturbing the soil," Gole says.

The erosion control project was designed by Chesapeake Environmental Management, based in Bel Air, Md. It included four major components to protect the eroding banks along the perimeter of the lake as well as the shorelines of the three small islands:

- Coir rolls would provide initial bank stability until roots of woody species could establish a network of roots to hold the soil in place. The coir fiber cores of the rolls support the growth of trees and shrubs which are planted next to them. In time, sediment deposited by wave action around the coir rolls provides a growth medium for the vegetation.
- Coir blocks would be used to construct fabric-wrapped layers of compacted soil to stabilize the higher banks and areas subject to stronger wave forces. They offer a faster, easier approach to constructing encapsulated soil lifts than conventional geotextile fabrics.
- Structures made of imbricated stones would protect water access sites.
- The areas between the stabilized shoreline and the asphalt walkway would be seeded with tall fescue mixture to control erosion from stormwater runoff.

Stabilizing Shorelines

Ecotone, Inc., an environmental design and construction company in Jarrettsville, Md., installed the erosion control practices in a three-month project that began in August, 2004. The company, which works throughout the Mid-Atlantic region, has extensive experience using coir rolls (logs). For this project, the company selected BioD-Roll 40, made by RoLanka International, Inc. The 16-in. diameter, 10-ft. long roll consists of coir fiber densely packed inside a coir twine netting with 2 in. x 2 in. openings. The rolls are designed to resist erosion and support establishment of vegetation for at least five years.

"We chose the natural coir twine netting instead of a polyethylene netting because of the relatively low wave velocity and height," says Scott McGill, co-owner of the company. "Also, the coir twine is more environmentally friendly. So, it was more suitable for the project."

Prior to installing the rolls, the slopes were reshaped to gradients of 3H:1V to 4H:1V for improved long-term bank stability and easier installation of the rolls. Two adjacent rolls were installed along 1,775 linear ft. of lake's perimeter and three rolls were placed side by side along 1,125 linear ft. of the higher banks of the islands. They were held in place using 3-ft. long, 2 x 2-in. wood stakes.

In October, aquatic species, such as duck potato (*Sagitaria latifolia*), blue flag (*Iris versicolor*) and arrow arum (*Pentandra raf.*), were planted in water, several inches deep, below the lowest row of coir rolls along the outer shoreline of the lake and the islands. The following month, 3 to 4-ft.-long dormant stakes of wetland tree species were planted in between the rolls on the lake perimeter. They included red osier dogwood (*Cornus stolonifera*), silky dogwood (*Cornus amomum*) and streamco willow (*Salix purpurea*)

Reinforced soil walls

The Rolanka BioD-Block system was installed on some of the island banks where the erosion threat was greatest. “These were the highest banks and they were exposed to the longest wind fetch,” McGill says.

This system features a 10-ft.-long, densely-packed block of elongated coir fiber measuring 16 in. high and 9 in. wide. A woven coir fabric is wrapped tightly around and secured to the block. Depending on the type of block, this fabric extends back 16 to 48 in. from the top and 28 to 75-in. from the bottom. When installed, the outside of the block forms the face of a 16-in high soil lift, while the fabric forms the top and bottom of the compacted, reinforced soil layer. This system features a male and female end to create a strong connection between adjacent blocks while maintaining structural integrity. Unlike conventional encapsulated soil lift construction methods, this approach usually requires no inner fabric, such as a stitched biodegradable coir blanket, and installs faster to reduce costs.

Prior to installing the coir blocks, woody materials were removed from the banks and a 16-in. diameter coir roll was installed at the base of the slope to provide additional support for the blocks. Three rows of coir blocks were then installed one above the other and setback to form a 4-ft. high mechanically stabilized earth structure along a total of 95 linear ft. of shoreline. However, with no way to efficiently transport and place large amounts of compact fill behind the coir blocks, the reinforcing layers of coir fabric were extended back about 1 ft., rather than the more typical 4 to 6 ft., to build the earth wall.

Aquatic species were then planted in the water below the coir blocks.

Shoreline armor

Areas of the shore used for public access to the water were protected from foot traffic and wave action with imbricated stone. Weighing up to about 2,000 lb. each., the square-edged quarry stones were installed in two or three rows in stair-step fashion along the shore to stabilize the bank toe. The surface of the top row of stones is about 1 ft. above the average water level of the lake. A total of 1,040 linear ft. of shoreline received this treatment.

“In addition to allowing people to reach the lake, the steps also allow the ducks and geese to get in and out of the water,” McGill says.

Throughout the project, turbidity curtains were placed in the lake around each construction site to contain any sediment disturbed by the site preparation and material installation.

Some unusual challenges

While installing the coir products and imbricated stone went smoothly, McGill’s crew faced several unusual challenges. For the lake perimeter work, a skid-steer loader was used to prepare sites for the coir rolls and a trackhoe was used to install the imbricated rock. However,

due to limited access, transporting rock required a half-mile trip around the lake to bring in the rock with a backhoe one load at a time.

The only access to the islands was by a 16-ft. long boat. “We carried the coir rolls and blocks cross-wise on the boat to the islands,” says Lance Smith, project foreman. “It took about a day to transport all the material.” Site preparation on the islands was all done by hand using tools like picks, shovels and a plate compactor.

Because of high public interest in the project, the crews also fielded many questions from by-standers. “The people were very inquisitive and we took the time to explain to them what we were doing and why,” Smith says. “They seemed very appreciative of what we were doing.”

He reports the project was subject to numerous rain events in October and November. “It’s remained very stable, except for some minor erosion where the coir rolls butted up against the imbricated boulders,” he says. “This was repaired by placing Class 1 riprap at the junctions, then covering it with topsoil and reseeding.”

“We think the project will make a big improvement in controlling erosion,” adds Gole. “The residents like what they’ve seen. There are no more cut banks. While the coir rolls and blocks are visible now, they’ll be hidden once the vegetation starts to grow out. The key will be when the coir materials have all degraded and the vegetation takes over to hold the banks in place.”