BIO-ENGINEERED WALL RESCUES RIVER—

# TRAGEDY AVERTED

**Running over 100 miles through five Ohio counties, the Little Miami River was designated a Scenic and Wild River by the state and federal government in April 1969. In Hamilton County, the river flows past adjacent Lake Isabella, where an abandoned railroad spur acts as a dike between the lake and the river. Both the river and lake are a favorite recreation destination for surrounding residents.**

Photo ©Hamilton County

The Little Miami River is separated from Lake Isabella by an abandoned railroad spur, which had been slowly eroding.

Composed of porous material, the dike has been slowly eroded away by the river's hydraulic forces. The county had been battling the erosion for years, when finally the problem reached a critical point. The County Park District had to act quickly if the integrity of the river and lake was going to be preserved.

In the 1960s the country became aware that many rivers were being dammed, dredged, diked, diverted, and degraded at an alarming rate. America needed the resources these rivers provided to support the growing population. Congress created the National Wild and Scenic River designation to strike a balance between the country's need for resources and the need to preserve the natural character and beauty of these rivers. Unlike national park designations that halt all development, the Scenic and Wild River Act allows commercial use of the waterways.

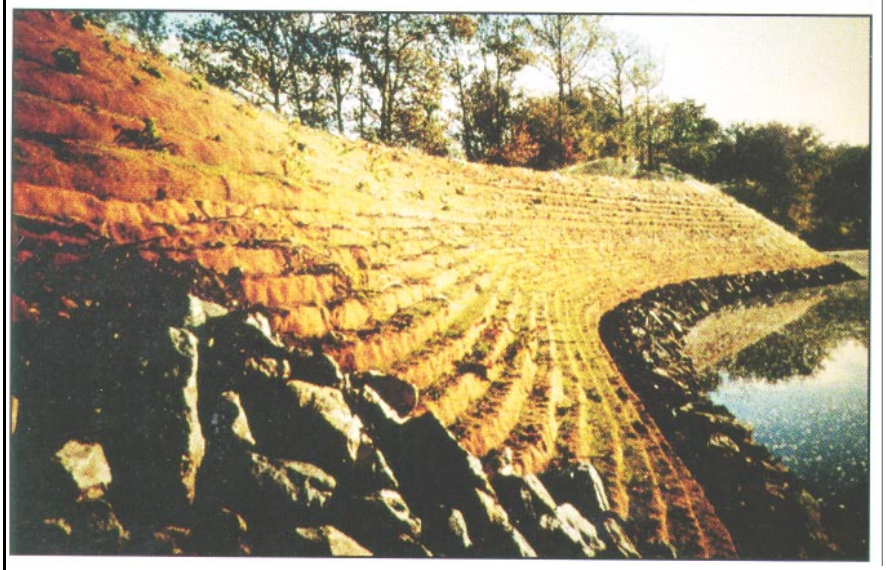
The Little Miami River is home to over 86 species of fish and 36 species of mussels including five types that are considered endangered species. The river was home to Tecumseh, the renowned Chief of the Shawnee, and to such American legends as Daniel Boone. The Little Miami embodies the essence of the Scenic and Wild River Act, offering visitors not only a beautiful natural vista, but a rich American history.

## THE CHALLENGE

Facing the catastrophic prospect of the Little Miami River eroding through the dike and merging with Lake Isabella, Ohio's Hamilton County Park District needed a long-term erosion control solution–one that would minimally impact the environment.

"The Little Miami River is one of the highest quality rivers in Ohio," explains Bob Gable of the Ohio Department of Natural Resources. "The section of the Little Miami River adjacent to Lake Isabella is the habitat for species of fish and fresh water mollusks that are sensitive to sedimentation and habitat alteration."

Engineers were faced with the



Completed in October 1997, the Lake Isabella project encompassed 850 lineal ft of bank in heights up to 30 ft.

challenge of reconstructing a slope to withstand the river's hydraulic forces, yet still mesh with the area's scenic beauty. The river's special environmental designation prevented using traditional revetment materials such as concrete, timber, or large riprap. Conversely, purely natural alternatives, like vegetative revetments, lacked the durability to endure the river's erosive force.

## A BIO-ENGINEERED SOLUTION

Inter-Fluve, Inc. (Bozeman, Montana), the engineering firm on the project, recommended an innovative combination of synthetic and natural erosion control systems that would provide the durability needed, while meeting the aesthetic and environmental requirements.

"Hydraulic and geotechnical modeling indicated that a bio-engineered slope would be the best option given the project's needs," explains Dale Miller, an Inter-Fluve hydrologist involved with the project. "The final construction included a stone foundation, geocell layers, natural coir fabric encapsulated soil lifts, and internal geogrid material, all combined with a comprehensive seeding and vegetating effort."

Specially hand picked small pieces of riprap with a natural appearance were placed below the water line at the toe of the slope. The toe and first ten ft of the slope were reinforced with riprap. Initially, the use of large riprap was rejected because of the unnatural appearance it created, but was found necessary to provide strong erosion resistance in the areas most affected by the river's flow.

The next ten ft section of the bank used perforated Geoweb®, a cellular confinement system manufactured by Presto Products Company (Appleton, Wisconsin). The system is a high-density polyethylene, three-dimensional, expandable honeycomb-like structure that contains holes specific in size, quantity, and spacing. The hole design boosts frictional interlock with aggregates and concrete, increases root lock-up with vegetated systems, and improves lateral drainage. Water, nutrients, and soil-organisms pass from cell-to-cell, making for healthy vegetation.

The system's tan facia, combined with its ability to sustain vegetation, made it the right solution for this sensitive project, explains Mark Converse of Meredith Brothers, Inc., the Geoweb distributor on the project.

Directly above the cellular confinement section of the slope, 18-in. high fabric-encapsulated soil lifts were added, with the bank's uppermost treatment consisting of graded slopes with minor erosion control measures.

## INSTALLATION

Large amounts of liberated sediment could damage the river's ecosystem. Great lengths were taken to minimize environmental impact on the river during installation. Part of that effort was the time frame chosen in which to work, August to October, when water levels are the lowest-minimizing potential sediment and diversion problems.

Initial construction required that the river water be diverted away from the bank being excavated. A riprap diversion was used. As a precautionary measure, the stones were washed clean before they were introduced into the river. Once water was diverted, riprap could be installed at the slope's toe.

The entire slope was excavated. Filter gravel was installed as a base

with a layer of common fill compacted on top of the base. The three remaining major sections of the slope project were installed in turn: the cellular confinement section, the soil lift section, and the final uppermost treatment.

The cellular confinement sections were expanded and infilled with a specially prepared mixture of aggregates and topsoil, then wrapped in coir fabric. New sections were expanded and stacked one on top of the last, set back slightly to produce the desired slope grade and to provide vegetation a place to take hold. This section of the slope was then vegetated by inserting willow roots into custom cut notches in the side of the cellular confinement system. A series of geogrids was added at specified intervals to stabilize to the slope.

The fabric-encapsulated soil lifts were wrapped with a dual layer of woven and non-woven coir fabrics and filled with topsoil. The lifts were seeded and planted with rooted cuttings, giving the needed erosion control protection at the 100-year flood level while appearing natural from the river.

The uppermost sections of the bank were graded, then covered with four in. of topsoil and woven coir fabric. Sections were then seeded and planted with shrubs.

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The bio-engineered wall constructed has been named a demonstration project for other municipalities who might encounter like erosion control challenges.

Completed in October 1997, the Lake Isabella project encompassed 850 lineal ft of bank, in heights up to 30 ft. The bio-engineered wall has been named a demonstration project for other municipalities that might encounter similar erosion control challenges. Contractor on the project was Sunesis Construction (Cincinnati, Ohio). **PW**