

# STREAM RESTORATION

## Using Bioengineering Techniques

### “A Demonstration Project”

#### Rock Creek Park, City of Frederick

Throughout the years, streams in Maryland have been meandering and changing course by the process of erosion. Some of this erosion is natural from storm events, but some is manmade, triggered by increased runoff from developments, shopping centers, and even highways. As we add these impervious surfaces and reduce natural infiltration of rain and snowmelt, the watershed responds by increasing storm flow and water velocity in the streams. Commonly, streams widen and streambeds erode downward, generating sediment that creates further problems downstream.



#### Baughman's Lane, 2 years after construction

Streamside woody vegetation increases habitat diversity and filters runoff.

Traditionally, minimizing erosion of streambanks has been accomplished by structural means (e.g., loose stone rip rap on a 2:1 slope or stone-filled gabion baskets). Structures may be the only solution in some situations, but an alternative does exist using “**soil bioengineering**” technology—the use of trees, shrubs, and plants to create the desired outcome: stable streambanks and healthy streams. Often, some rock and coir fiber roll toe protection or other structural measures are used in combination with vegetative techniques to enable the practices to withstand the current hydrological regime and address problems like stream down-cutting. The streamside trees, shrubs and plants, once established, provide self-perpetuating erosion control; the branches slow water near the bank and roots bind soil. The diverse vegetation increases wildlife habitat, provides a natural attractive setting, and improves water quality—filtering out pollutants from runoff from adjacent areas and reducing sediment and nutrients in the stream.





Before  
Eroding Stream Meander



After  
Protected Stream Meander



Before  
Eroding Bike Path



After  
Protected Bike Path



# PROJECT DESCRIPTION AT THE BAUGHMAN'S/BEL AIRE LANE PROJECT

## PROBLEM

- Undermining of asphalt bike path
- Potential exposure of sewer lines
- Eroding streambanks
- Restricted fish passage
- Increased sedimentation and turbidity
- Loss of trees and other natural vegetation
- Erosion from stormwater drainages

## BIOENGINEERING SOLUTIONS

- Upper streambank stabilization;
  - Live stakes, coir fiber matting,
  - Trees, shrubs, grasses
- Toe and Meander protection;
  - Coir fiber roll, planted
  - Stone (rip-rip, imbricated)
- Fish Habitat Enhancement;
  - Rock cross vanes to improve fish passage, pools
  - Shade from planted trees
- Stormwater/overflow channels;
  - Live stakes, coir fiber matting, shrubs, grasses

## **BENEFITS OF BIOENGINEERING**

- Minimizes further bank erosion and tree loss
- Protects threatened property
- Creates a natural appearance
- Shades streams, improving the fishery
- Increases wildlife habitat
- Reduces sediment, phosphorus, nitrogen, and other pollutants
- Reduces cost of construction



Stabilized streambanks using coir fiber matting, coir fiber roll toe protection and rock vanes

# **BIOENGINEERING TECHNIQUES USED AT THE BAUGHMAN'S/BEL AIRE LANE PROJECT AT ROCK CREEK PARK**



**LIVE STAKES / COIR FIBER MATTING**

Stout live woody cuttings create root mat that reinforces and binds soil after fiber matting biodegrades.



**COIR FIBER ROLL**

Fiber roll protecting toe of slope near sewer line and man-hole. Provides toe protection and enhances establishment of permanent vegetation.



**ROCK CROSS VANE**

Directs flow to center of stream, away from banks, reducing erosive pressure. Increases variety and quality of fish habitat.



**IMBRICATED ROCK**

Allows trapping of sediment between rocks and establishment of natural riparian plant species.



## **COSTS!!!**

Utilizing soil bioengineering methods can improve the environment in the stream corridor at reduced costs over traditional methods—a winning combination.

### **ROCK CREEK PARK PROJECT COSTS PER FOOT**

Bioengineering practices and supporting structural practices vary a great deal in cost, but typically cost less than conventional structural alternatives. The overall average cost of constructed practices on the Rock Creek Park project between Baughman's and Bel Aire Lane for treating 1383 feet of bank along a 1700-foot reach of stream was **\$111.50/foot**. A typical treatment might involve stone or coir fiber roll toe protection, fiber matting, and live stakes, at \$78 to \$93/foot. Because some stream restoration work had previously been done in the immediate vicinity, design costs for this project were fairly low at less than \$15/foot of stream length.

<b>Bioengineering &amp; Supporting Practices</b>	<b>Average Cost/foot</b>
Coir fiber roll toe protection	\$ 45
Stone toe protection	\$ 60
Coir fiber matting protection	\$ 5
Live stake installation (3-4 rows)	\$ 8
Imbricated stone	\$133
Rock cross vane	\$2100/structure

Structural options: Gabion basket \$120-\$150/foot      Stone rip-rap \$200-\$250/foot

## **PUBLICATIONS**

For more information on stream restoration and bioengineering, refer to these publications:

- USDA NRCS Engineering Field Handbook, Chapter 16, "Streambank and Shoreline Protection".
- Stream Corridor Restoration: Principles, Processes, and Practices. October 1998. Federal Interagency Stream Restoration Working Group, Washington, DC. Downloadable at [http://www.usda.gov/stream\\_restoration](http://www.usda.gov/stream_restoration).
- Soil Bioengineering or Streambank Restoration for Riparian Forest Buffers. Maryland Cooperative Extension Fact Sheet 729. Downloadable at <http://www.agnr.umd.edu/ces/pubs/topics/forwildmgmt>.
- Riparian Forest Handbook1: Appreciating and Evaluating Stream Side Forests. Virginia Department of Forestry, 900 Natural Resources Drive, Suite 800, Charlottesville, VA 22903. Contact: Samuel Austin, Forest Hydrologist, (804) 977-6555.

## HOW TO GET STARTED

The following organizations and agencies were involved with the Rock Creek Park project and will provide you advice and assistance to help you determine if your site is suitable for a bioengineering project and to obtain a list of experienced consultants for design and contractors for construction.

- City of Frederick Department of Public Works  
Contact: Marc Stachowski  
111 Airport Drive East  
Frederick, MD 21701-3152  
301-694-1162
- Maryland Department of Natural Resources  
Contact: Anne Hairston-Strang  
Capital Grants and Loans Administration  
Shore Erosion Control  
Tawes State Office Building  
580 Taylor Avenue E1  
Annapolis, MD 21401  
410-260-8523
- Maryland Eastern Shore Resource Conservation and Development Council, Inc.  
Contact: David H. Wilson  
8133 Elliott Road, Suite 201  
Easton, MD 21601  
410-822-9300
- Western Maryland Resource Conservation and Development Council, Inc.  
Contact: Timothy Hann  
First Flight Airpark  
18450 Showalter Road, Suite 111  
Hagerstown, MD 21742-1347  
301-733-2973
- Frederick Soil Conservation District  
92 Thomas Johnson Drive  
Suite 230  
Frederick, MD 21702-4300  
301-695-2803
- Other Local Soil Conservation District Offices  
Located under County Government  
in Phone Book

*This brochure was funded by the U.S. EPA Section 319 Non Point Source Program, and does not necessarily reflect the opinion or position of the EPA.*

MD Eastern Shore RC&D Council, Inc.  
8133 Elliott Road, Suite 201  
Easton, MD 21601  
410-822-9300