

OHIO STREAM MANAGEMENT GUIDE

Gabion Revetments

Guide No. 15

Streambank erosion is a natural process that occurs in streams. Depending on the soil type and land use, streambank erosion can account for 40 percent or more of total soil loss in some watersheds (Farm Journal, 1992). The major factor accounting for streambank erosion is the velocity of the flowing water. Velocity is affected by the stream cross section, stream bed gradient, bank cover, depth of flow and degree of meander. Water flowing at two feet per second can move a cobblestone weighing half a pound, but an increase to ten feet per second can move a stone that weighs one hundred and fifty pounds.

There are numerous methods of controlling streambank erosion. When a streambank requires protection from high velocity flows, structural methods should be considered. Two structural methods commonly used are riprap revetments and gabion revetments. Structural methods are also used when infrastructure, such as utility lines, roads or buildings, are endangered by the eroding stream. When installing streambank protection, the velocities during everyday flows as well as the velocities during large storm events should be considered in the design process.

This Ohio Stream Management Guide describes the basic uses for gabion revetments, their installation and maintenance. Depending on the skill, equipment and labor force available to a landowner, the services of a land improvement contractor may be needed to install the

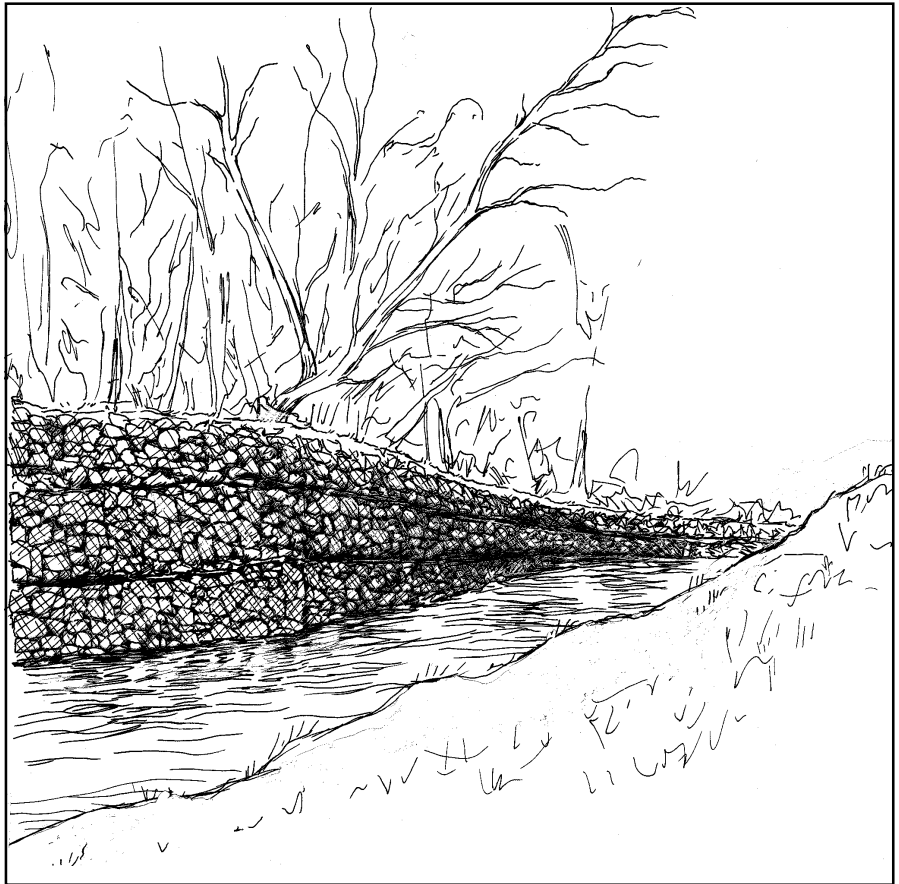


Figure 1. Gabion revetment on streambank

revetment. Projects on larger streams and projects protecting structures or utilities should be designed by a professional engineer. Design advice and limited assistance on smaller projects may be obtained at your local Soil and Water Conservation District. Prior to purchasing materials, check the stream's water quality against the manufacturer's recommendations. If the water quality would cause premature deterioration of the baskets, other bank protection measures need to be considered.

As with any project in a stream environment, the Ohio Department

of Natural Resources recommends that you consult with the applicable local, state and federal authorities listed in Guide 06, *Permit Checklist for Stream Modification Projects*, prior to construction. The extent of permit requirements will depend on the location and design of your project.

GABION REVETMENTS

Gabions are stone-filled galvanized or coated wire baskets placed along a streambank. Gabions are particularly effective for protecting

the submerged part of the streambank. They provide the same basic protection as riprap, but can be utilized when the streambank slope cannot be cut back due to physical constraints (e.g., roads, utilities or buildings) or when larger rock is not readily available.

SIZING

The typical size of a wire basket is three feet wide by three feet high per cell purchased in the desired length. Wire baskets can be purchased prefabricated or requiring assembly. Stone size diameter should be a minimum of four inches to prevent the stone from washing through the mesh of the wire basket.

INSTALLATION PROCEDURE

Basic installation consists of the following steps; detailed installation specifications, provided by the manufacturer, should be reviewed and followed during installation. Improper installation can lead to collapse of the gabion revetment.

1. Place appropriately sized geotextile filter fabric on the streambank slope following the manufacturer's recommendations.

Caution should be taken not to tear the filter fabric. A highly permeable fabric should be used.

2. Make an entrenchment into the stream bed at least one foot deep and large enough to hold the bottom row of baskets. The trench floor should be level along the project length. Pin the empty baskets into the stream bed with several steel rods that are three to four feet long.

3. Fill the wire baskets with stone. Tight layers, free of voids, should be formed when the stone is in place. A tight layer can be obtained by varying the size of the stone and may require some hand manipulation.

4. As the baskets are filled with stone, place wire reinforcements in each direction every twelve inches to retain the shape of the basket (see Figure 3).

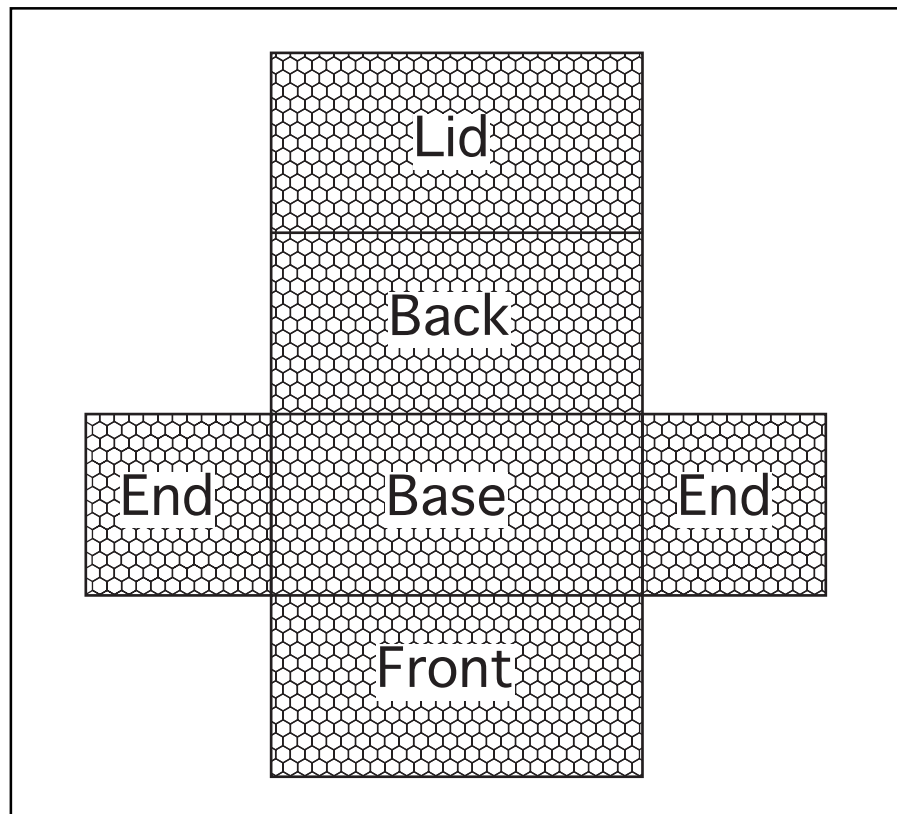


Figure 2. Gabion basket as it arrives from manufacturer for assembly

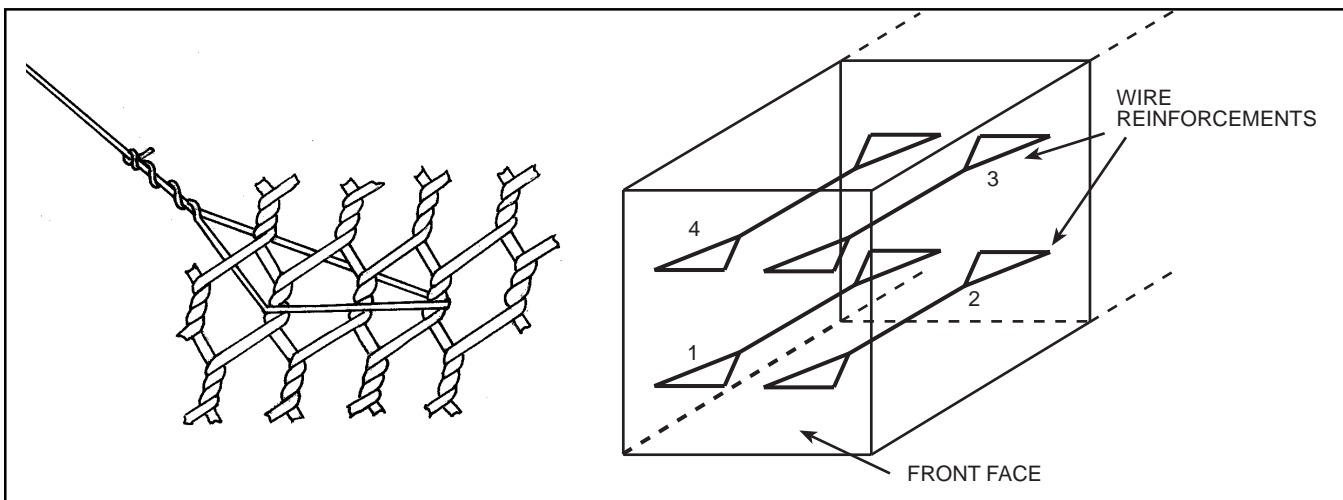


Figure 3. Use wire reinforcements to retain rectangular shape and increase stability

5. Secure the tops of the baskets with a galvanized wire and lace the baskets to each other (see Figure 4). The length of wire needs to be about 1.5 times the length to be laced. Wire longer than 5 feet is difficult to handle. Secure one end at a corner, and lace the wire by alternating single and double loops at 5 inch intervals. Secure the wire again at the end.

6. Stagger the joints of the wire baskets during construction to make the structure stronger and more stable. Each row should be stair-stepped back from the previous row.

7. Any open area between the filter fabric and baskets should be backfilled with gravel to provide positive drainage. Open areas should be minimal if gabions are properly installed.

8. Where sunlight is available, dormant cuttings of willow or other rapidly-rooting species may be

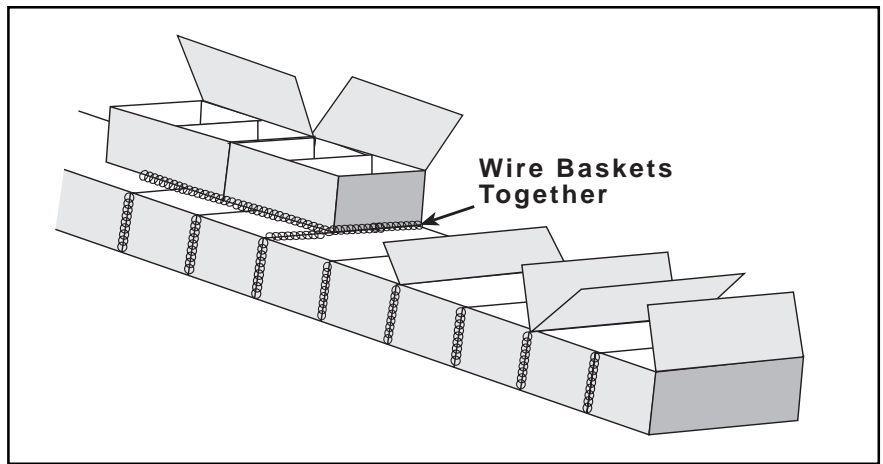


Figure 4. Wire the baskets shut and wire them to each other

placed between the layers of baskets during construction (Figure 5). The branches must be long enough to reach the undisturbed soil. Make sure the buds point out, toward the sunlight. See Guide 07 for information on harvesting and using plant materials.

MAINTENANCE REQUIREMENTS

The primary factor in maintaining a gabion revetment is in the durability of the wire used in the basket. A gabion revetment is susceptible to wire deterioration. The stream's water quality should be

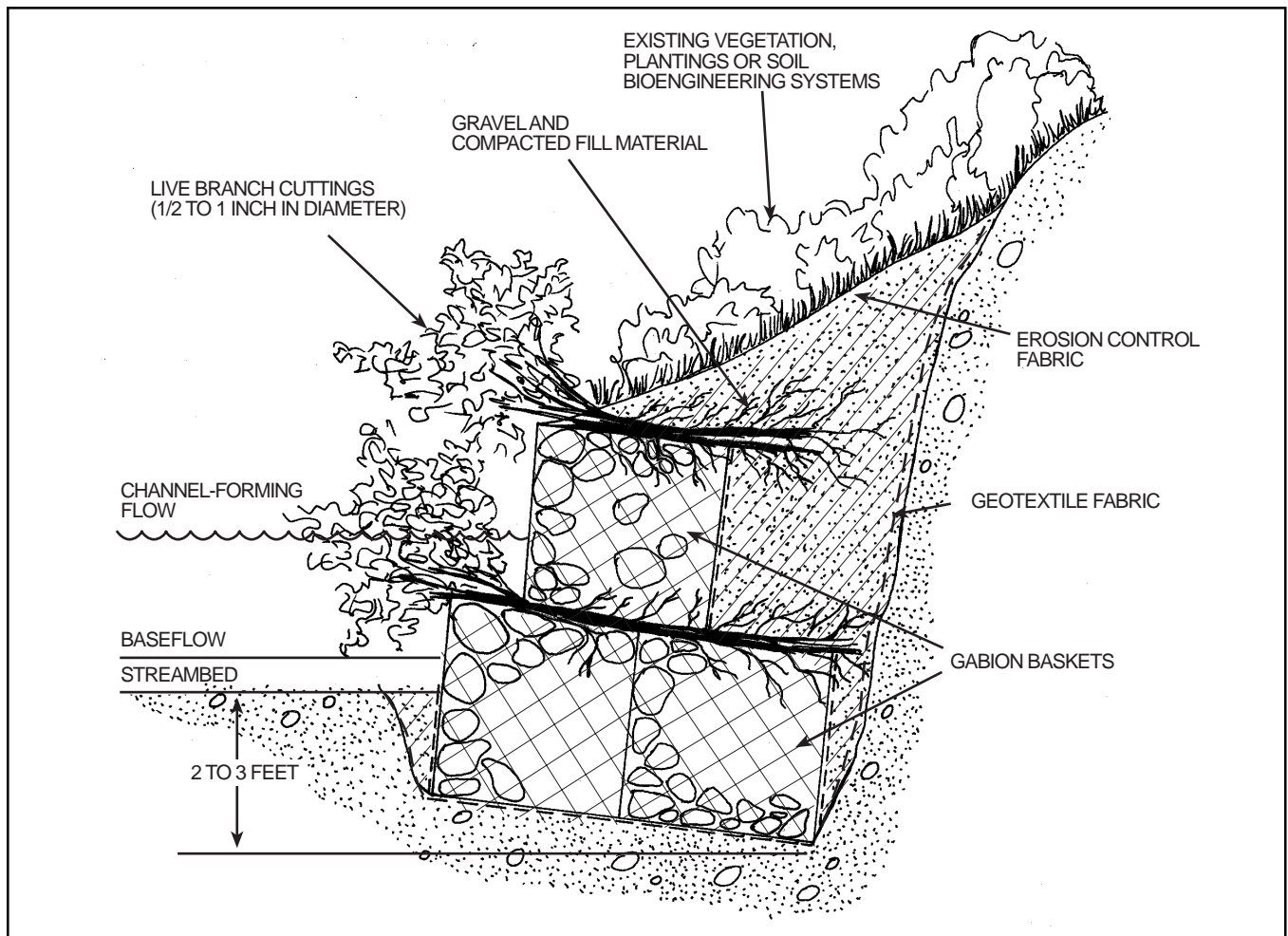


Figure 5. Cross section of vegetated gabion revetment

within the manufacturer's recommendations. Broken wire needs to be replaced with galvanized or coated wire. A gabion revetment needs to be inspected annually and after high flow events. Any displacement or shifting of the wire baskets needs to be corrected immediately.

ADVANTAGES

- Designed for high velocity flows
- Can be installed where tight physical constraints exist
- Easily fits contours of streambank
- Openings provide positive drainage of streambank
- Freeze & thaw sequences shift stones with minimal impact to structure
- Heavy machinery may not need to be used
- Minimal maintenance costs

DISADVANTAGES

- Wire baskets are susceptible to deterioration
- Labor intensive
- Installation cost may be expensive

REFERENCES:

Iowa Department of Water, Air and Waste Management. *How To Control Streambank Erosion*, 1984.

Smith, Darrell. "Raging Waters." *Farm Journal*, May 1992.

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U.S. Army Corps of Engineers, North Central Division. *Help Yourself*, 1978.



This Guide is one of a series of Ohio Stream Management Guides covering a variety of watershed and stream management issues and methods of addressing stream related problems. All Guides, including an **Index of Titles**, are available from the Ohio Department of Natural Resources. To obtain copies contact the ODNR Public Information Center at 1952 Belcher Drive Building. C-1, Columbus, Ohio 43224-1386 or 614/265-6791

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