OHIO STREAM MANAGEMENT GUIDE

Live Cribwalls

Guide No. 17

WHAT IS A LIVE CRIBWALL?

A live cribwall is a wooden log cabin-type structure built into a streambank which is filled with rock, soil and cuttings of willow. The cuttings will sprout and develop a root mass that, in conjunction with the log structure, will armor the stream bank and protect it from erosion. The submerged rocks and logs provide excellent aquatic habitat. Well built cribwalls can last for decades as the live materials take over the structural function of the logs.

The purpose of this Ohio Stream Management Guide is to describe the applicable site conditions and design, installation and maintenance guidelines for live cribwalls. The specifications listed herein are gleaned from literature sources and not based on field experience here in Ohio. As with any construction project in a stream, it is recommended 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.

Live cribwalls are often used in conjunction with other practices that further protect streambanks from eroding forces. Compatible practices, described in other Ohio Stream Management Guides, may be selected by finding similar site requirements and applications.

Live cribwalls have also been successfully used to prevent the development of a split channel in a stream. If used to protect roads, structures or utilities, a professional engineer should be involved in the design process.

These structures are not effective in locations where the stream is down cutting because the base of the structure will be undermined. The major disadvantage of live cribwalls is that it is labor and equipment intensive. They are therefore used only where the expected benefit warrants the investment.

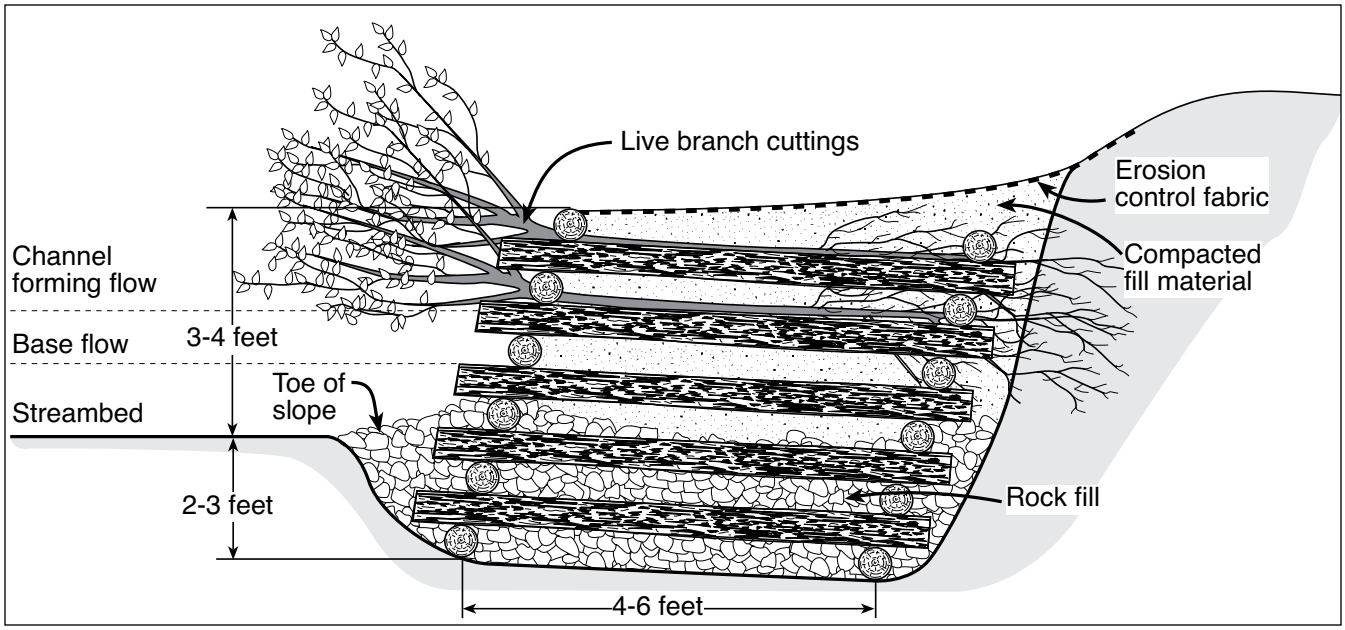

Figure 1. Cross section of a live cribwall.

WHERE TO USE LIVE CRIBWALLS

Live cribwalls are effective at reducing erosion and streambank instability on: the outside bends of streams with strong currents; where a there is a steep streambank with an unstable toe of the slope; and where immediate protection from erosion is needed while vegetation becomes established. (The toe is where the stream bed meets the bank slope.) They can be used to reduce the steepness of a slope by building a low wall to protect the toe and grading the soil above it back at a gentler grade.

SITE REQUIREMENTS

Live cribwalls are effective for streambank stabilization on streams up to 75 feet wide. The structures are placed along scoured or excavated areas of the bank. Therefore the streambank must have adequate room between what is to be protected and the edge of the water (existing or as designed) to allow for the placement

of log cabins' that are six feet deep. To anchor the structure the channel bed must be excavated, so this practice is not applicable for sites on bedrock. The live cuttings of willow or other rapidly-rooting species require full sunlight for part of the day during the growing season to grow properly. Therefore, the site will need full sun for the cribwall to be effective.

DESIGN

The length of the eroding streambank can be treated with a number of cribwall structures each of which should not exceed 20 feet in length. The series of structures must be designed to start at and end at areas of the bank where there is no active erosion. If it is not anchored to the bank this way, the stream will scour into the soil around the ends of the cribwall, rendering it useless.

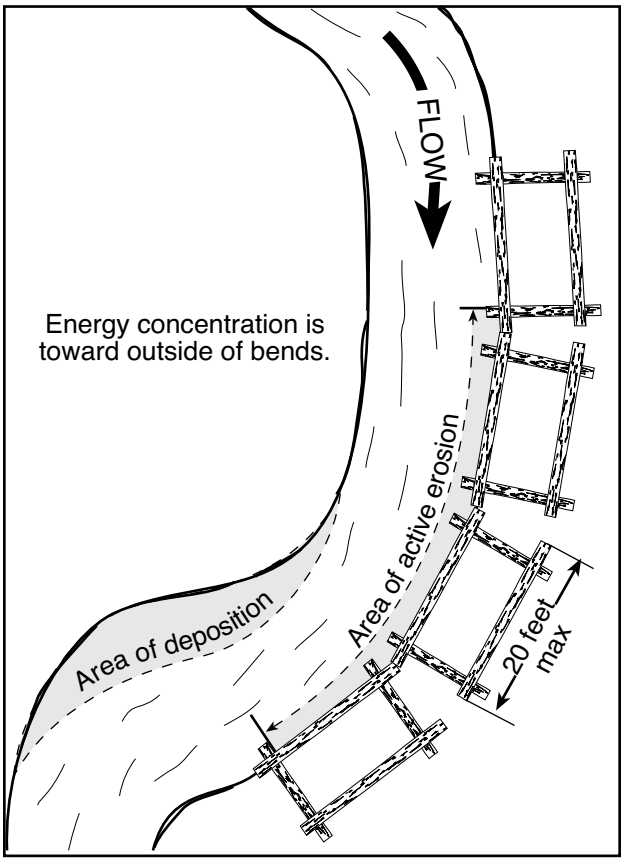

Figure 2. Placement of cribwall structures.

The structure's height depends on the elevation of channel-forming flows. The elevation at which water will flow over the low bank into the floodplain is called the bankfull flow and is considered the channel-forming flow. The bankfull flows are the most critical because they have enough energy to carry solid materials and happen frequently enough (on average every 1.5 years) for their impact to add up.

The cribwall needs to be somewhat higher than the elevation of the channel-forming flow in order to protect the outside bank (see Figure 1), but it should not exceed seven feet measured from the excavated base. If the existing bank is significantly higher than the cribwall's design height, the bank area above the live cribwall needs to excavated to a slope of 1 foot rise for every 2 foot of horizontal distance.

CONSTRUCTION AND INSTALLATION

Step 1

Collect cuttings from willow, red-osier dogwood or other rapidly-rooting species (listed in Guide 07). These cuttings must be taken from live trees during their dormancy (approximately between mid-November and late March). The cuttings can be 0.5 to 2 .5 inches in diameter at the butt end and need to be six to eight feet long. The harvest should be made no more than 48 hours prior to installation. If not using them immediately keep the cuttings moist by wrapping them in wet cloth or blankets and do not allow them to dry out.

Step 2

Construction begins with the excavation of the bank. This excavation should be done during times of low stream flow and just prior to the installation of the live cribwall. Excavation should be about six feet into the bank measured from the water's edge (either existing or as designed) at low flow. Excavation should also extend two to three feet below the existing streambed. The floor of the excavated area should be sloped so that it is one to two feet lower in the back, toward the bank. As shown in Figure 1, this will tilt the weight of the cribwall away from the water's edge, adding to its stability.

Step 3

Use untreated logs or timber members. Place two logs, four to six inches in diameter, parallel to the stream edge four to five feet apart within the excavated area. Place the second two logs perpendicular to and at the ends of the first course of logs. As in a log cabin, allow about 6 inches of overhang in each direction. The four logs should be spiked together with long nails or re-bar. Each successive course of logs parallel to the stream flow should be set back six to nine inches from the log beneath it creating a stair-step effect (see Figure 1). Continue building the log cabin-like structure with alternating courses of logs up to the level of the stream's low flow. Build the remaining number of rectangular structures along the project's length, up to the same level.

Step 4

Place rock fill material in and around the bottoms of the structures up to the existing stream bed level. The weight of the rock will counteract against the log's buoyancy, securing the structures in place. Make sure that the excavated area between the stream bed and the structures is filled with rock to protect the toe of the slope. Fill the remaining area of the crib structures with soil up to the low flow level, i.e., up to the level constructed so far. Compact the soil.

Step 5

Before adding the next course of logs, lay a row of live dormant cuttings on the compacted backfill soil. Lay the cuttings perpendicular to the flow of the stream with the bud ends protruding one to two feet out of the open face of the cribwall. The butt ends must extend into the area behind the structure so their roots will eventually grow beyond the backfilled soil into the undisturbed soil. Repeat this step until the cribwall reaches the designed height.

MAINTENANCE

As with any structure, maintenance is important to the proper and continued function of the live cribwall. During the first year after construction the structure should be inspected for maintenance needs after high flow events; it should be inspected at least annually thereafter. Check the logs for proper alignment and evidence of rot to ensure the structural integrity of the cribwall. The health of the willow cuttings growing in the cribwall is also important; should significant mortality of the willows occur, supple-

Activity	Equipment Needed
Excavate bank	Backhoe
Compact backfill	Power tamper/compactor or hand tamper/compactors
Cut and construct log cribwall: Untreated logs four to six inches in diameter and 4.5 to 20 feet long;	Chain saw & safety equipment, drill, sledge hammer; spikes or re-bar
Harvest live cuttings 0.5 to 2.5 inches in diameter at butt end; 6 to 8 feet long.	Chain saw or loppers

mental cuttings should be inserted as replacements.

Periodic inspections will also reveal cribwall failures or new areas of unstable streambank that could affect the live cribwall. Should inspection reveal either of these conditions, action to deal with the problems should be taken as soon as practicable.

USING BIOTECHNICAL PRACTICES

A live cribwall is one of several bio-technical practices described in the Ohio Stream Management Guides. Biotechnical practices use vegetative or other natural materials to achieve stream management objectives, usually erosion control. One of the chief advantages of biotechnical practices is that they help restore natural stream features, like in-stream habitat and streambank vegetation. In some situations, a combination of structural and biotechnical practices, such as a live cribwall, may provide both needed strength and habitat. The materials used for biotechnical practices are generally less expensive than for more traditional approaches, but installation is more labor intensive and may require more frequent maintenance.

Some site conditions and/or project objectives will require use of more traditional, structurally engineered solutions. This is particularly true where high velocity stream flows can be expected. Projects built to protect roads, utilities or buildings should be designed by a professional engineer. No project should be undertaken with out an understanding of the functions of stream energy and the source of any problem to be corrected. Read Guide No. 03, Natural Stream Processes for an understanding of how streams function and consult with staff at your local Soil and Water Conservation District for help in deciding which practice would be the best solution in your situation.

REFERENCES :

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

Mecklenburg, Dan, 1996, Rainwater and Land Development, Ohio's Standards For Stormwater Management, Land Development and Urban Stream Protection, Ohio Department of Natural Resources.

Smith, Darrell. May, 1992. Raging Waters. Farm Journal. State of Ohio, Department of Transportation, 1997. Construction and Material Specifications.

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

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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. The first several guides in the series are overview guides intended to give the reader an understanding of the functions and values of streams. For more information about stream management programs, issues and methodologies, see Guide 05 Index of Titles or call the ODNR Division of Soil and Water Resources at 614/265-6740. All Guides are available from the Ohio Department of Natural Resources. Single copies are available free of charge and may be reproduced. Please contact:

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