

OHIO STREAM MANAGEMENT GUIDE

Gravel Riffles Provide In-Stream Structure

Guide No. 22

Gravel riffles consist of gravel and cobble-sized stone arranged at distinct intervals in shallow streams. Gravel riffles promote the formation of stable substrate in channels that have been modified or otherwise heavily impacted by development. Gravel substrate provides productive habitat for aquatic organisms and areas for fish to spawn.

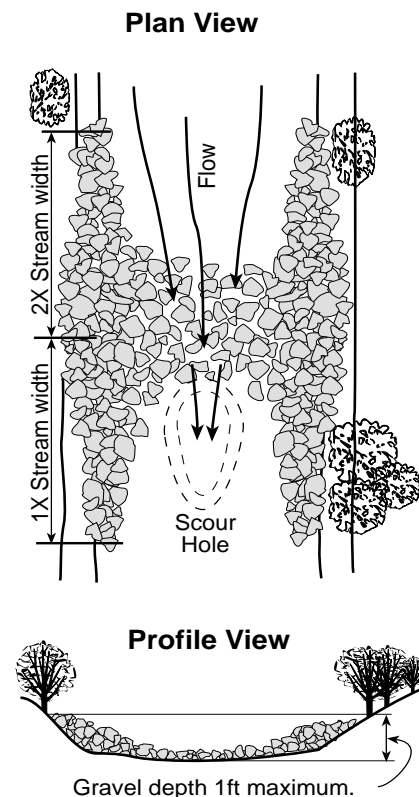


Figure 1. A Gravel riffle

Many streams in Ohio have been modified to improve their capacity to convey stormwater. This has most often been achieved by straightening the channel alignment and lowering the streambed to increase channel slope and flow velocity. Although these practices greatly improve the efficiency with which stormwater can be carried away, this kind of channel modi-

fication degrades the stream's water quality and destroys aquatic habitat.

Reducing channel roughness removes much of the in-stream structure that provides habitat for fish and other aquatic life. Restoring some of this structure through biotechnical practices (methods that use vegetation and natural materials to restore channel roughness) provides additional hiding, spawning and feeding areas for fish. This also increases the substrate suitable for benthic (bottom dwelling) organisms to become established which supports a healthier, more diverse aquatic ecosystem. Other biotechnical practices, such as establishing streamside vegetation to enhance in-stream structure, can vastly improve a stream's value as an aquatic habitat while maintaining much of its ability to convey runoff.

The purpose of this Ohio Stream Management Guide is to describe the site conditions suitable for gravel riffles, their design and installation. The guidelines listed herein are a compilation of specifications from agencies in other states and from field experience here in Ohio. As with any construction project that takes place within a stream, the Ohio Department of Natural Resources recommends 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.

WHERE TO USE GRAVEL RIFFLES

The use of gravel riffles should be considered if a coarse gravel substrate was an original characteristic of the stream, but has been removed. This situation is common in deepened, modified, or relocated channels. It may also occur

where the bedload sediment supply has been interrupted by the construction of an in-stream pond or by the enclosure of the upstream channels in a storm drain system. Constructed gravel riffles are usually of greatest value in small channels. The bedload of larger streams is more likely to supply adequate coarse material to maintain natural riffles. A stream's natural condition can further be enhanced when gravel riffles are supplemented with the addition of forested riparian corridors.

Gravel riffles should be used to augment natural channel formation. Supplies of gravel and cobble introduced into a channel will not force a channel into a desired shape but can mimic what will eventually accumulate from natural deposition of bedload sediment.

DESIGN AND INSTALLATION

The length of gravel riffles should range from one to two times the channel width. The thickness of the gravel should generally be less than one foot and not more than the depth of the water at normal stage flow so that it doesn't extend out of the water and back up a significant pool or otherwise act as a dam. To concentrate lower stream flows, the gravel should be placed so that it is slightly lower in the middle of the channel and higher along the streambanks as illustrated in figure 1.

Gravel size is best determined by examining the substrate and any gravel bars in the existing stream channel. Gravel should be sized so that it is stable at low and medium flows but erodible at high or bankfull flows. This typically ranges from one to four inches in diameter. Several methods (or criteria) can be used to determine the appropriate placement of gravel riffles as shown in figure 2 including: placing them where existing riffles are

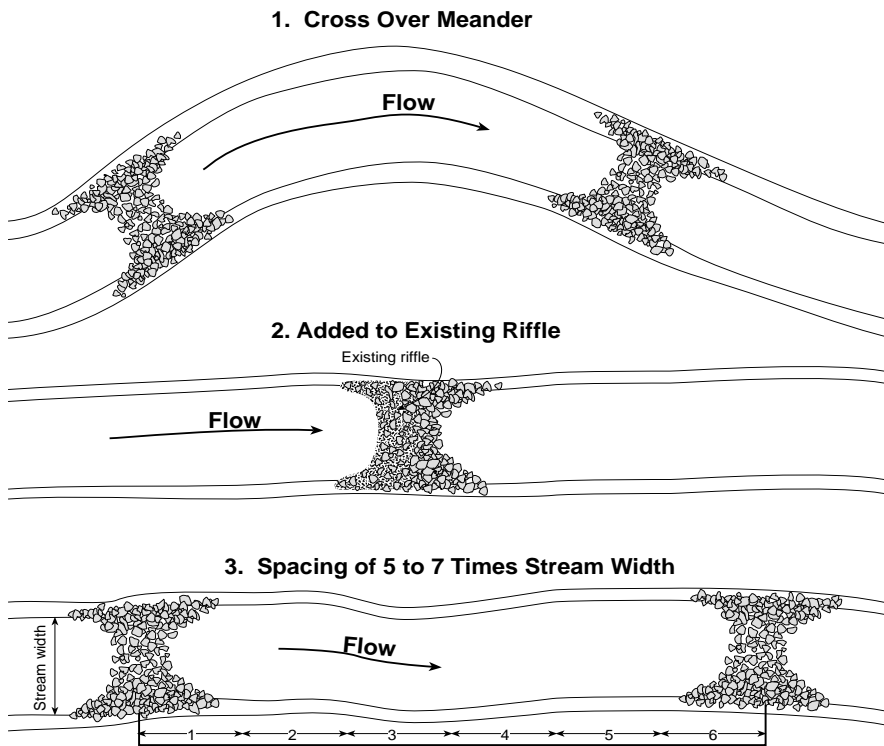


Figure 2. Gravel riffle placement and spacing

already forming; placing them to match the spacing of riffles in a similar undisturbed portion of the stream (not illustrated); placing them at the crossovers between meanders; or placing them spaced approximately five to seven stream widths apart.

EQUIPMENT NEEDED

Equipment used may vary based on the specific site's accessibility and limitations. The equipment most commonly used includes dump trucks, backhoes, waders, shovels and wheelbarrows.

MAINTENANCE

Inspect the gravel riffles after high-water events during the first year and once a year thereafter. Look along the streambanks near the gravel riffles for any erosion that may be occurring. If it is determined that the riffles are redirecting the stream's energy into the adjacent bank, the riffles will need to be modified in order to avoid further streambank erosion.

This guide is one of several biotechnical practices described in the Ohio Stream Management Guides series available on-line at the Ohio Department of Natural Resources' website. These practices use vegetation or other natural materials to achieve the desired stream management objectives. One of the primary advantages of biotechnical practices is how they help restore natural stream features such as in-stream habitat and streambank vegetation. Guide No. 10, *Biotechnical Projects in Ohio*, provides an overview of biotechnical practices, maps more than 50 project sites, and lists contacts that can arrange for site visits. No project should be undertaken without some understanding of the functions of stream energy and the source of the problem that needs to be corrected. Guide No. 03, *Stream Management and the Stream Natural Processes*, provides an overview of stream dynamics. Technical assistance about stream dynamics can also be obtained at your Soil & Water Conservation District, which is listed under county government in the local phone directory.

This guide is one of a series of guides covering a variety of watershed and stream management issues. For more information please see *Guide 05 Index of Titles* or call the ODNR Division of Water at 614/265-6739. All Guides are available from the Ohio Department of Natural Resources. Single copies are available free of charge and may be reproduced. Please contact:

ODNR Public Information Center
1952 Belcher Drive Bldg. C-1
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The guides are also available on-line as web pages and PDF files at:

<http://www.dnr.state.oh.us/odnr/water/>

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Fact sheet are available on-line at: <http://www.dnr.state.oh.us/odnr/water/pubs/onlnpubs.html>



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