



# Ohio Department of Natural Resources

## Division of Soil and Water Resources

### Fact Sheet

Fact Sheet 98-49

## Dam Safety: Open Channel Spillways (Earth and Rock)

Open channels are often used as the emergency spillway and sometimes as the principal spillway for dams. A principal spillway is used to pass normal inflows, and an emergency spillway is designed to operate only during large flood events, usually after the capacity of the principal spillway has been exceeded. For dams with pipe conduit principal spillways, an open channel emergency spillway is almost always required as a backup in case the pipe becomes clogged. Open channels are usually located in natural ground adjacent to the dam and can be vegetated, rock-lined, or cut in rock.

### Design

Flow through an emergency spillway does not necessarily indicate a problem with the dam, but high velocity flows can cause severe erosion and result in a permanently lowered lake level if not repaired. Proper design of an open channel spillway will include provisions for minimizing any potential erosion. One way to minimize erosion is to design a flatter channel slope to reduce the velocity of the flow. Earthen channels can be protected by a good grass cover, an appropriately designed rock cover, concrete or various types of erosion control matting. Rock-lined channels must have adequately sized riprap to resist displacement and contain an appropriate geotextile fabric or granular filter beneath the rock. Guide berms are often required to divert flow through open channels away from the dam to prevent erosion of the embankment fill. If an open channel is used for a principal spillway, it must be rock-lined or cut in rock due to more frequent or constant flows.

Ohio Administrative Code Rule 1501:21-13-04 requires that the frequency of use for an earth (grass-lined) or a rock-lined emergency spillway be less than:

- Once in 50 years for Class I dams;
- Once in 25 years for Class II dams; and
- Once in 10 years for Class III dams.

### Maintenance

Maintenance should include, but not be limited to, the following items:

• **Grass-covered channels should be mowed at least twice per year to maintain a good grass cover and to prevent trees, brush and weeds from becoming established.** Poor vegetal cover can result in extensive and rapid erosion when the spillway flows. Repairs can be costly. Reseeding and fertilization may be necessary to maintain a vigorous growth of grass. One suggested seed mixture is 30% Kentucky Bluegrass, 60% Kentucky 31 Fescue, and 10% Perennial Ryegrass.

• **Trees and brush must be removed from the channel.** Tree and brush growth reduces the discharge capacity of the spillway channel. This increases the lake level during large storm events which can lead to overtopping and failure of the dam.

• **Erosion in the channel must be repaired quickly after it occurs.** Erosion can be expected in the spillway channel during high flows, and can also occur as a result of rainfall and runoff, especially in areas of poor grass cover. Terraces or drainage channels may be necessary in large spillway channels where large amounts of rainfall and runoff may concentrate and have high velocities. Erosion of the side slopes may deposit material in the spillway channel, especially where the side slopes meet the channel bottom. In small spillways, this can significantly reduce the discharge capacity. This condition often occurs immediately after construction before vegetation becomes established. In these cases, it may be necessary to reshape the channel to provide the necessary capacity.

• **All obstructions should be kept out of the channel.** Open channel spillways often are used for purposes other than passage of flood flows. Among these uses are reservoir access, parking lots, boat

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ramps, boat storage, pasture and cropland. Permanent structures (buildings, fences, etc.) should not be constructed in these spillways. If fences, bridges or other such structures are absolutely necessary, they should cross the spillway far enough upstream or downstream from the control section so that they do not interfere with the flow. Construction of any structures in or across the channel requires prior approval from the Division of Soil and Water Resources.

•**Weathering of rock channels can be a serious problem and is primarily due to freeze/thaw action.** Deterioration due to the effects of sun, wind, rain, chemical action and tree root growth also occurs. Weathered rock is susceptible to erosion and displacement during high flows; therefore, rock channels are often designed with 1 to 3 feet of earth with a grass cover over the rock surface to help insulate the rock from the effects of freeze/thaw action.

## Monitoring

Open channel spillways should be monitored for erosion, poor vegetal cover, growth of trees and brush, obstructions, and weathering and displacement of rock. Monitoring should take place on a regular basis and after large flood events. It is important to keep written records of observations. Photographs provide invaluable records of changing conditions. All records should be kept in the operation, maintenance, and inspection manual for the dam.

Any other questions, comments concerns, or fact sheet requests, should be directed to:

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## Downstream View of Open Channel Spillway

