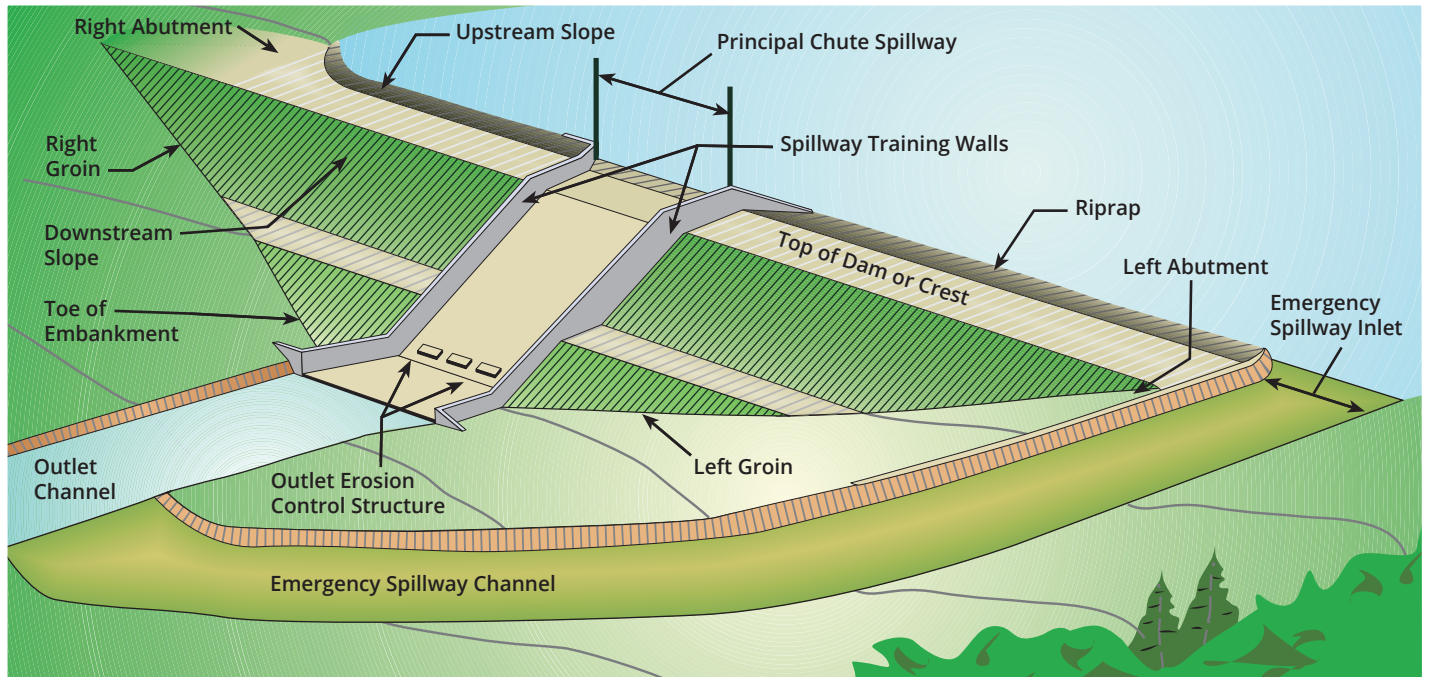


Common Problems for Small Dams with Concrete Channel Spillways



A dam safely passes a flood event by a combination of storing water in the lake and passing water through its spillways. Earthen embankments are not designed to have floodwaters overtop them. An emergency spillway should not pass over the crest of the dam; it should be located in the abutment area.

The Division of Water Resources regulates over 1600 dams in Ohio and has performed thousands of safety inspections. A dam, like any man-made structure, will change and deteriorate over time. Keeping a dam in good condition will allow better inspections and easier maintenance. Proper inspection and maintenance will help prevent small problems from turning into larger, costly repairs. The following paragraphs, pictures, and fact sheets (Nos. 27, 28, 31, 49, 51, 54 & 59) address common problems that have been noted during inspections. For additional information about dam safety, please visit the division's web site at water.ohiodnr.gov.

Earthen Embankments

The establishment and control of proper vegetation is an important part of dam maintenance. Properly maintained vegetation can help prevent erosion of embankment and earth channel surfaces, and aid in the control of

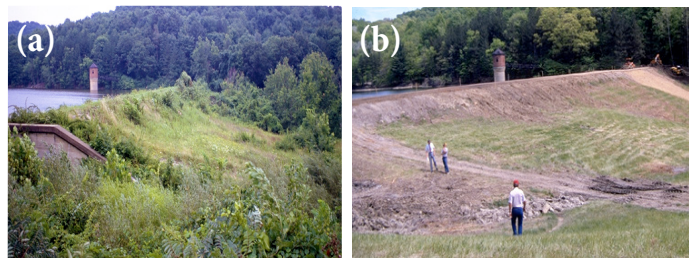


An excellent grass cover will reduce erosion and is easily maintained.

groundhogs and muskrats. Embankment slopes are normally designed and constructed so that the surface drainage will be spread out in a thin layer as "sheet flow" over the grass cover. When the sod is in poor condition or flow is concentrated at one or more locations, the resulting erosion will leave rills and gullies in the embankment slope.

Trees and Brush

Trees and brush must not be permitted on embankment surfaces or in vegetated earth spillways. Extensive root systems can provide seepage paths for water. Trees that blow down or fall over can leave large holes in the embankment. Brush hinders visual inspection, provides a haven for burrowing animals, and retards growth of grass vegetation.



(a) Embankments covered with trees and brush makes inspection difficult. (b) Cleared of trees and brush, this embankment is much easier to inspect, but needs a good vegetal cover.



(a) Collapsed muskrat burrows increase shoreline erosion and sloughing. (b) This shoreline has eroded due to lack of proper erosion protection leading to sloughing and cracking of the slope.

Upstream Slope

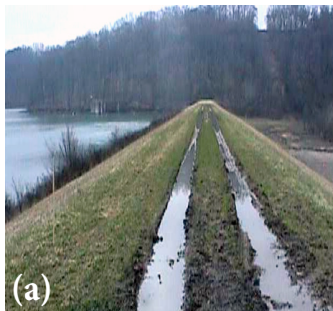
Slope protection may be needed to protect the upstream slope against erosion. Erosion can lead to cracking and sloughing, which can extend into the crest. Muskrats and groundhogs can also damage the slope. The upstream face of a dam is commonly protected against wave erosion by placement of a layer of rock riprap over a layer of bedding and a filter material.



This slope is well maintained with rock riprap along the shoreline.

Crest

Vehicular traffic should be discouraged, especially during wet conditions, to avoid ruts. Water collected in ruts may cause localized saturation, thereby weakening the



(a) Embankment crests with vehicle ruts will collect water and weaken the embankment. (b) Crest beginning to overtop in low area. This could lead to erosion and failure of the dam.

embankment. Ruts can develop into low areas. Low areas on the crest increase the likelihood that a dam will be overtopped during severe floods. Earthen embankments are not designed to be overtopped. Should the dam overtop, floodwaters will concentrate in the low area, increasing the likelihood of erosion of the crest and downstream

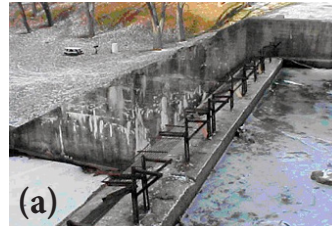


Crest with a good cover that will reduce the effects of vehicular traffic.

slope. Severe erosion can lead to failure of the embankment. A well-vegetated earth embankment may withstand limited overtopping if its crest is level and water flows over the crest and downstream slope as an evenly distributed sheet without becoming concentrated.

Concrete Spillways

A concrete weir or chute is often used as principal spillway for dam. The principal spillway is the first spillway to experience flow after a storm when the pool rises above the normal pool level. For the spillway to be effective, it must be clear of obstructions, in good structural condition, and on a solid foundation.



(a) The steel poles were used to hold a fish screen; the dam nearly failed during a flood because the screen collected debris and obstructed the spillway. The poles and screen were directed to be removed. (b) Spalled concrete can expose reinforcing steel, which can lead to rapid deterioration.

A spillway must remain unobstructed to maintain its flow capacity. Obstructions such as fish screens, walkways, vegetation, and bridge piers should be cleared from the spillway inlet. Loss of flow capacity could cause the dam to overtop and fail.



(a) A spillway outlet area as originally constructed. (b) Severe erosion has undermined the spillway outlet and threatens the overall structural safety of the spillway.



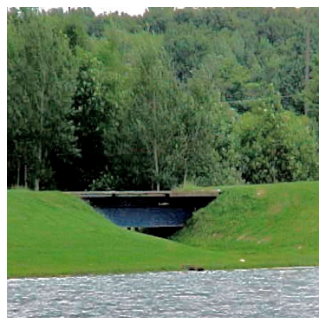
This dam is failing because of seepage under the spillway.

The spillway must remain in good structural condition to ensure that spillway flow stays within the spillway and does not cause erosion that could cause the spillway to fail. Concrete surfaces should be visually examined for structural problems due to weathering, stress, chemical attack, erosion, and other destructive forces. Structural problems are indicated by cracking, exposure of reinforcing bars, and large areas of spalled concrete.



A properly designed spillway includes a drainage system for collecting seepage under the spillway. The picture shows flow discharging from the spillway's drainage system.

Even if the spillway is in good structural condition, seepage under the spillway or erosion at the outlet or along the sides can cause the spillway to fail. Spillway floor slabs and walls should be checked for erosion of underlying base material known as undermining. Indicators of problems with seepage and erosion under the spillway include the misalignment at joints and large cracks.



This bridge blocks much of the spillway, reducing its ability to convey water.

Emergency Spillways

The emergency spillway is the second spillway to experience flow during a flood event. For most dams in Ohio, the emergency spillway consists of a grass-lined, earthen open channel. An open channel can convey much more flow than a pipe spillway, so it is important to keep the spillway free of obstructions. Obstructions reduce the flow capacity and could cause the dam to overtop and fail. Permanent structures including buildings, fences, and roadway embankments for access across the spillway should not be constructed in the spillway. Earthen channels should be protected by a good grass cover, an appropriately designed rock cover, concrete, or other various types of erosion



A tree is obstructing this spillway.



Notice the landscaping directly behind the table. Obstructions in the spillway reduce the capacity to convey water. They also can collect debris, further diminishing the capacity of the spillway.



This open-channel emergency spillway is clear of trees, brush and other obstructions. Also note the good grass cover.

control matting. Grass-lined 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.

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