



# Temporary Sediment Basin Design

An Online Continuing Education Course for Engineers

**Course Number: C-1028**

**Credit: 1 Hour / 1 PDH / 1 CPD**

# Temporary Sediment Basin Design

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## Introduction

Sediment caused by erosion can cause various environmental problems sites where land disturbance has occurred. Erosion and Sedimentation Best Management Practices (BMPs) are used to control site erosion and sedimentation. Although BMP's are helpful, it is almost inevitable to have some degree of site erosion and sedimentation. When erosion occurs, it is the object of the BMPs to inhibit the escape of sediment from the site.

Sedimentation can be stopped by various structural devices, including sediment traps, check dams, silt fences, hay bales, temporary sediment basins, and other solutions. This course will cover the design of temporary sediment basins used to collect sediment in stormwater runoff. A temporary sediment basin detains runoff before it is released. The temporary detention of the water allows the sediment to settle out before it is released. Temporary sediment basins are generally designed to detain a certain amount of sediment per acre. Although they are technically temporary, some temporary basins are designed to serve as permanent stormwater management facilities.

The sediment basin should be constructed by excavating and placing an embankment to create a storage area. The storage area should be enough to detain the minimum required storage volume ( $V_s$ ). Typically, the minimum required storage area is 67 cy/ac. The detained runoff will exit the

sediment basin through a principal spillway. An emergency spillway should also be constructed to provide release from storms larger than the design storm.

Stormwater that flows from the contributing drainage area to the temporary sediment basin is detained temporarily before it is discharged offsite. As the Stormwater is detained, the impurities and soil particles or sediment settle to the bottom. This allows the treated water to flow offsite. The sediment that remains in the basin is removed at various intervals, usually when 22 cy/acre of sediment has accumulated in the pond.

## **Design**

The design guidelines included in this course are based on the design of a temporary sediment basin per the Manual for Erosion and Sediment Control in Georgia, but the design criteria used can be applied to any region. Detailed drainage design is not included in this course. The runoff is based on calculations from the Rational Method, but the engineer may use an alternate method to determine the runoff. The design of the basin should allow sufficient sediment time for the particles to settle to the bottom of the pond. The principal spillway should be designed to adequately handle the 25-year design storm. Typically, the 2-year storm is used to design the principal spillway. Temporary sediment basins may serve a very large drainage area. Extensive drainage calculations may be required when determining the peak runoff.

## **Construction**

Before constructing the temporary sediment basin, the area should be cleared and grubbed to remove any topsoil and vegetation. The basin should be clean and clear of any debris brush or trees. The emergency spillway should be constructed in undisturbed ground.

The embankment materials shall be taken from an approved borrow source. The areas where fill will be placed should be scarified prior to the placement of embankment material. The embankment shall be placed in 6 to 8-inch layers and should be compacted per the minimum project specifications.

The cut-off trench or core trench should be excavated along the centerline of the dam where the embankment was placed. The minimum depth of the cut-off trench should be 2 feet, with side slopes no steeper than 1:1 and a minimum bottom width of 4 feet. Compaction requirements should conform to those set forth in the project specifications for embankment. The trench should be drained during backfilling and compaction operations.

The riser of the principal spillway shall be secured to a riser with a watertight connection. The base of the riser should be encased in concrete to prevent flotation (see Figure 4.1). The principal spillway should be filled in lifts of 4 inches and should be hand-compacted per the embankment compaction specifications. At least 2 feet of fill should be placed over the barrel before it is traversed with construction equipment.

After the construction of the sediment basin is complete, it should be stabilized with temporary vegetation. The vegetation should be placed immediately after construction is completed to prevent the erosion of the embankment.

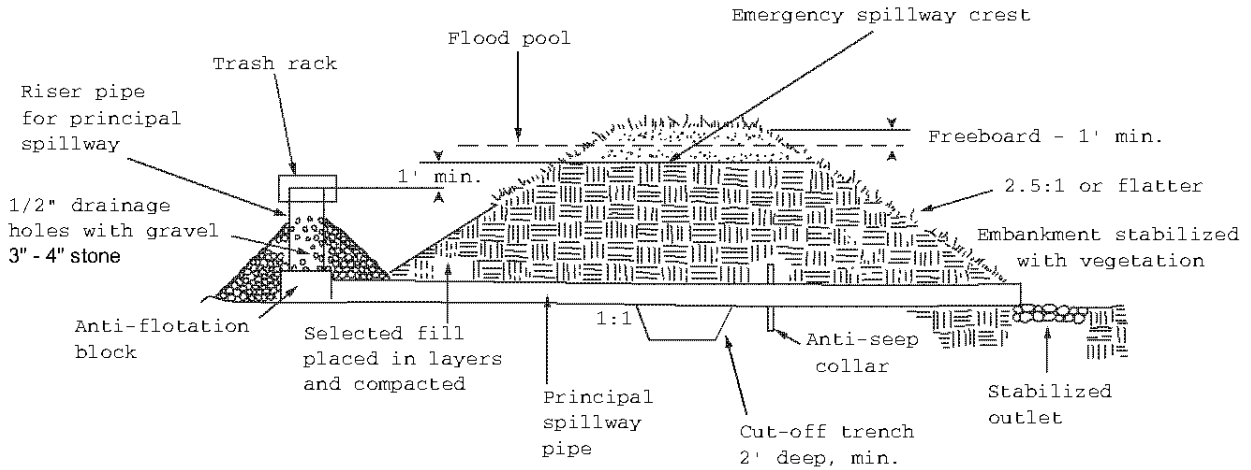
Embankment material may be compacted using a sheepfoot roller, as shown in the following photo.

Photo 1.1 – Compaction Equipment



Figure 1.1 – Basic components of a temporary sediment basin

<sup>1</sup>Source: [http://www.gaswcc.org/docs/green\\_book\\_5ed.pdf](http://www.gaswcc.org/docs/green_book_5ed.pdf)

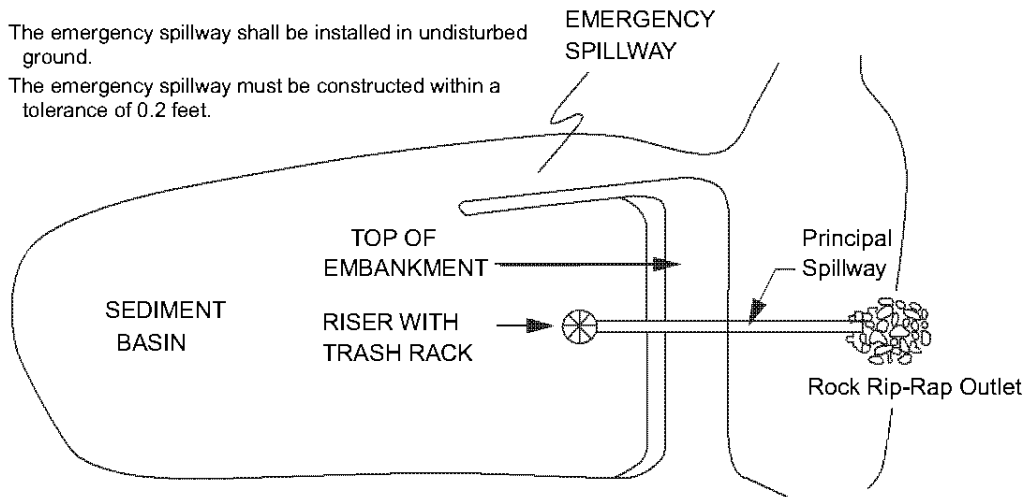


### CROSS SECTION

<u>Fill Height</u>	<u>Minimum Top Width</u>
less than 10 ft	8.0 ft
10 feet to 15 ft	10.0 ft

NOTES:

1. The emergency spillway shall be installed in undisturbed ground.
2. The emergency spillway must be constructed within a tolerance of 0.2 feet.



### PLAN VIEW

The following are key design elements that are determined during the design of a temporary sediment basin:

1. Minimum riser crest elevation

The minimum riser crest elevation is determined by the stage-storage relationship of the temporary sediment basin, and the minimum required storage volume. The minimum required storage volume ( $V_s$ ) is 67 cubic yards per contributing drainage area in acres.

2. Clean-out elevation

The clean-out elevation is determined by the stage-storage relationship of the temporary sediment basin and the required clean-out storage volume. The minimum required storage volume ( $V_c$ ) is 22 cubic yards per contributing drainage area in acres.

3. Riser length

The riser length is the difference between the minimum riser crest elevation and the lowest elevation of pipe at the riser. The riser and all connecting pipes shall be watertight, with the exception of the inlet opening for the principal spillway.

4. Concrete riser base length and width

A concrete base attached to the riser is used to prevent the flotation of the riser. The concrete base should be 18 inches thick, and the riser should be embedded 9 inches into the base. A minimum of two (2) No. 6 steel bars are projected in the riser to anchor the riser to the concrete base.

5. Channel Stabilization

The emergency spillway should be designed to route the runoff from a 25-year, 24-hour frequency storm. The capacity may be reduced after considering the flow through the principal spillway. The exit channel of the emergency spillway should be treated with vegetation, rip rap, asphalt, or concrete to prevent erosion. The erosion control measure for the emergency spillway exit channel is related to the runoff velocity. Common treatments for the exit channel are treated, as shown below:

Runoff velocity not exceeding 5 ft/sec \_\_\_\_\_ **Vegetated Lining**  
Runoff velocity = 5 – 10 ft/sec \_\_\_\_\_ **Rock Riprap Lining**  
Runoff velocities exceeding 10 ft/sec \_\_\_\_\_ **Concrete Lining**

6. Anti-Seep Collar

Certain conditions require that one anti-seep collar should be installed near the center of the dam. The anti-seep collar should be installed around the principal spillway pipe. When any of the following conditions exist, an anti-seep collar should be installed:

- i. The settled height of the dam is greater than 15 feet
- ii. The conduit is smooth pipe larger than 8" in diameter
- iii. The conduit is corrugated metal pipe larger than 12" in diameter

Use an anti-seep collar with an 18-inch projection for heads (H) less than or equal to 10 feet. The anti-seep collar and its connection should be watertight.

7. Minimum emergency spillway crest elevation

The emergency spillway should be installed in undisturbed ground and not in fill.  
The emergency spillway will work when the Stormwater has overtopped the principal spillway and should direct the water through a designed channel. Without the emergency spillway, the water may overtop the entire basin and cause erosion to the outer banks of the temporary sediment basin. The emergency spillway design elements are elevations, grades, widths, and entrance, and exit channel slopes. The emergency spillway shall be over-excavated in order to ensure that the lining will be flush with the surface.

8. Design high water elevation

The design high water elevation is computed by adding the minimum elevation of the emergency spillway and the stage elevation of the emergency spillway. The stage elevation is the runoff of the 25-year storm minus the runoff in the emergency spillway.

9. Top of dam elevation

The top of dam elevation is the design high water elevation plus a minimum 1 foot of freeboard to the design high water elevation.

Example 1.1

A new parking lot is to be installed. The runoff from the drainage area is 100 cfs. Utilizing the rational method, the stormwater runoff is 100 cfs, respectively. The principal spillway of the temporary sediment basin is 100 cfs, respectively. The size of the basin is sufficient, and determine the size of the basin is

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1. Top of Dam
2. Storage Elevation
3. Clean Out Elevation
4. Riser Diameter
5. Thrash Rack Diameter
6. Minimum Emergency Spillway Crest Elevation