

# Sediment Trap

## (1063)

Wisconsin Department of Natural Resources  
Technical Standard

### I. Definition

A *temporary*<sup>1</sup> sediment control device formed by excavation and/or embankment to intercept sediment-laden runoff and to retain the sediment.

### II. Purposes

To detain sediment-laden runoff from disturbed areas for sufficient time to allow the majority of the sediment to settle out.

### III. Conditions Where Practice Applies

Sediment traps are utilized in areas of concentrated flow or points of discharge during construction activities. Sediment traps shall be constructed at locations accessible for clean out. Sediment traps are designed to be in place until the contributory drainage area has been *stabilized*.

The contributory drainage area shall be a maximum of five acres. For concentrated flow areas smaller than one acre, ditch checks may be installed; refer to WDNR Technical Standard Ditch Check (1062).

For larger drainage areas and/or for sediment basins requiring an engineered outlet structure refer to WDNR Technical Standard Sediment Basin (1064) or Wet Detention Basin (1001).

### IV. Federal, State, and Local Laws

Users of this standard shall be aware of applicable federal, state, and local laws, rules, regulations, or permit requirements governing the use and placement of sediment traps. This standard does not contain the text of federal, state, or local laws.

### V. Criteria

This section establishes the minimum standards for design, installation and performance requirements.

A. **Timing** – Sediment traps shall be constructed prior to disturbance of up-slope areas and placed so they function during all phases of construction. Sediment traps shall be placed in locations where runoff from disturbed areas can be diverted into the traps.

B. **Sizing Criteria** – Properly sized sediment traps are relatively effective at trapping medium and coarse-grained particles. To effectively trap fine-grained particles, the sediment trap must employ a large surface area or polymers.

The specific trapping efficiency of a sediment trap varies based on the surface area, depth of dead storage, and the particle size distribution and concentration of sediment entering the device.

1. **Surface Area** – The minimum surface area of a sediment trap shall be based on the dominant textural class of the soil entering the device. The surface area calculated below represents the surface for the permanent pool area (if wet) or the surface area for the dead storage. This surface area is measured at the invert of the stone outlet (see Figure 1).

a. For coarse textured soils (loamy sand, sandy loam, and sand):

$$A_{s(\text{coarse})} = 625 * A_{dr}$$

<sup>1</sup> Words in the standard that are shown in italics are described in X. Definitions. The words are italicized the first time they are used in the text.

- b. For medium textured soils (loams, silt loams, and silt):

$$A_{s(\text{medium})} = 1560 * A_{dr}$$

- c. For fine textured soils (sandy clay, silty clay, silty clay loam, clay loam, and clay):

$$A_{s(\text{fine})} = 5300 * A_{dr}$$

For the equations above:

$A_s$  = surface area of storage volume in square feet

$A_{dr}$  = contributory drainage area in acres

Note: The equations above were derived using a representative particle distribution for detached sediment for each textural class. Sediment traps designed based on this standard will achieve 80% reduction of suspended solids for the drainage area.

- d. The surface area of sediment traps used in areas with fine to medium sized soils can be reduced when used in conjunction with water applied polymers. When employing polymers, size the surface area for controlling fine particles using the criteria for medium soils (V.B.1.b.) and when controlling medium sized particles use the sizing equation contained in (V.B.1.a.) for coarse soils. See WDNR Technical Standard Sediment Control Water Application of Polymers (1051) for criteria governing the proper use and selection of polymers.
2. Depth – The depth of the sediment trap measured from the sediment trap bottom to the invert of the stone outlet, shall be at least three feet to minimize re-suspension and provide storage for sediment.
  3. Shape – The sediment trap shall have a length to width ratio of at least 2:1. The position of the outlet to the inlet shall be as such to minimize short-circuiting of the water flow path.

4. Side Slopes – Side slopes shall be no steeper than 2:1.

Note: A sediment trap sized with the surface area equations above, a three-foot depth, and 2:1 side slopes will generally result in an 80% sediment reduction. Slopes flatter than 2:1 will require larger surface areas to provide adequate storage.

- C. **Embankment** – Embankments of temporary sediment traps shall not exceed five feet in height measured from the downstream toe of the embankment to the top of the embankment. Construct embankments with a minimum top width of four feet, and side slopes of 2:1 or flatter. Earthen embankments shall be compacted.

Where sediment traps are employed as a perimeter control, the embankments shall have stabilization practices place prior to receiving runoff.

- D. **Outlet** – Sediment traps shall be constructed with both a principal and emergency spillway. The stone outlet of a sediment trap shall consist of a stone section of embankment (stone outlet) located at the discharge point. The stone outlet section provides a means of dewatering the basin back to the top of the permanent storage between storm events, and also serves as a non-erosive emergency spillway for larger flow events.

1. Outlet Size – The size of the outlet shall depend on the contributory drainage area and desired outflow. The length of the stone outlet / weir outlet can be calculated based on the size of the drainage area found in Table 1. Refer to section IX References for the equation used to calculate flow through a stone outlet or gabion.

**Table 1 Weir Length**

Drainage Area (acres)	Weir Length (feet)
1	4.0
2	6.0
3	8.0
4	10.0
5	12.0

The emergency spillway (top of the weir) shall be sized to adequately pass the 10-year 24-hour storm without overtopping the sediment trap. The crest of the spillway shall be at least one foot below the top of the embankment. The minimum weir lengths provided in Table 1 are adequate to pass the 10 year event.

Note: The weir length has little effect on overall treatment efficiency provided the sizing criteria in Section V.B. is adhered to.

The stone outlet shall have a minimum top width of 2 feet and a maximum side-slope of 2:1.

Discharge from the sediment basin shall be safely conveyed to a stormwater facility, drainage way, or waterbody. The discharge velocity shall be below the velocity to initiate scour unless appropriate stabilization methods are employed.

2. Stone Size – Stone shall consist of angular well graded 3 to 6 inch clear washed stone.
  3. Keyway Trench – The stone outlet shall be protected from undercutting by excavating a keyway trench across the stone foundation and up the sides to the height of the outlet. See Figure 1. Underlying with geotextile fabric is optional.
- E. Provide access for cleanout and disposal of trapped sediment.

## VI Considerations

- A. Sediment traps generally require excessive surface areas to settle clay particles and fine silts. If these conditions exist on the site consider using a sediment basin (WDNR Technical Standard Sediment Basin 1064) or adding polymer to the sediment trap. See WDNR Technical Standard Sediment Control Water Application of Polymers (1051) for criteria governing the use of polymers

- B. To improve trapping efficiency, filter fabric can be placed on the up-slope side of the stone outlet / gabion and anchored with stone. When fabric is utilized to enhance filtering, more frequent maintenance is required to prevent clogging. When using fabric, a monofilament type fabric shall be used (such as WisDOT Type FF). The apparent opening size of the fabric, not the stone size, will dictate the flow rate through the outlet therefore outlet lengths need to be calculated since values in Table 1 are based on stone. When calculating the size of the outlet a clogging factor of 50% should be used for the fabric.
- C. Consider possible interference with construction activities when locating sediment traps.
- D. Provisions should be made for protecting the embankment from failure caused by storms exceeding the 10-year design requirement. Consider a stabilized and non-erosive emergency spillway bypass.
- E. In general, groundwater impacts from temporary sediment traps that have storage areas in contact with groundwater are not a major concern. However, sediment trap contact with groundwater should be avoided in areas with karst features, fractured bedrock, or areas of significant groundwater recharge.
- F. Sediment trapping is achieved primarily by settling within the pool formed by the trap. Sediment trapping efficiency is a function of surface area, depth of pool, and detention time. If site conditions permit, a length to width ratio greater than 2:1 will increase efficiency.
- G. If site conditions prevent the sediment trap from having a three-foot depth, then an equivalent storage volume must be created through increasing the surface area.
- H. For sediment traps in place longer than 6 months, consider outlets constructed of two types of stone. A combination of coarse aggregate and riprap (WisDOT light riprap classification) should be used to provide stability. A one-foot layer of one inch washed stone then should be placed on the up-slope face to reduce drainage flow rate.

## VII Plans and Specifications

- A. Plans and specifications for installing sediment traps shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. The plans and specifications shall address the following:
1. Location and spacing of sediment traps
  2. Schedules and sequence of installation and removal
  3. Standard drawings and installation details
  4. Rock gradation
- B. All plans, standard detail drawings, or specifications shall include a schedule for installation, inspection, maintenance, and identify the responsible party.

## VIII Operation and Maintenance

Sediment Traps shall, at a minimum, be inspected weekly and within 24 hours after every precipitation event that produces 0.5 inches of rain or more during a 24-hour period. Sediment may need to be removed more frequently.

- A. Deposits of sediment shall be removed when they reach a depth of one foot.
- B. If the outlet becomes clogged it shall be cleaned to restore flow capacity.
- C. Recommend provisions for proper disposal of the sediment removed from the trap.
- D. Maintenance shall be completed as soon as possible with consideration given to site conditions.
- E. Sediment traps shall be removed and the location stabilized after the disturbed area draining to the sediment trap is stabilized and no longer susceptible to erosion.

## IX References

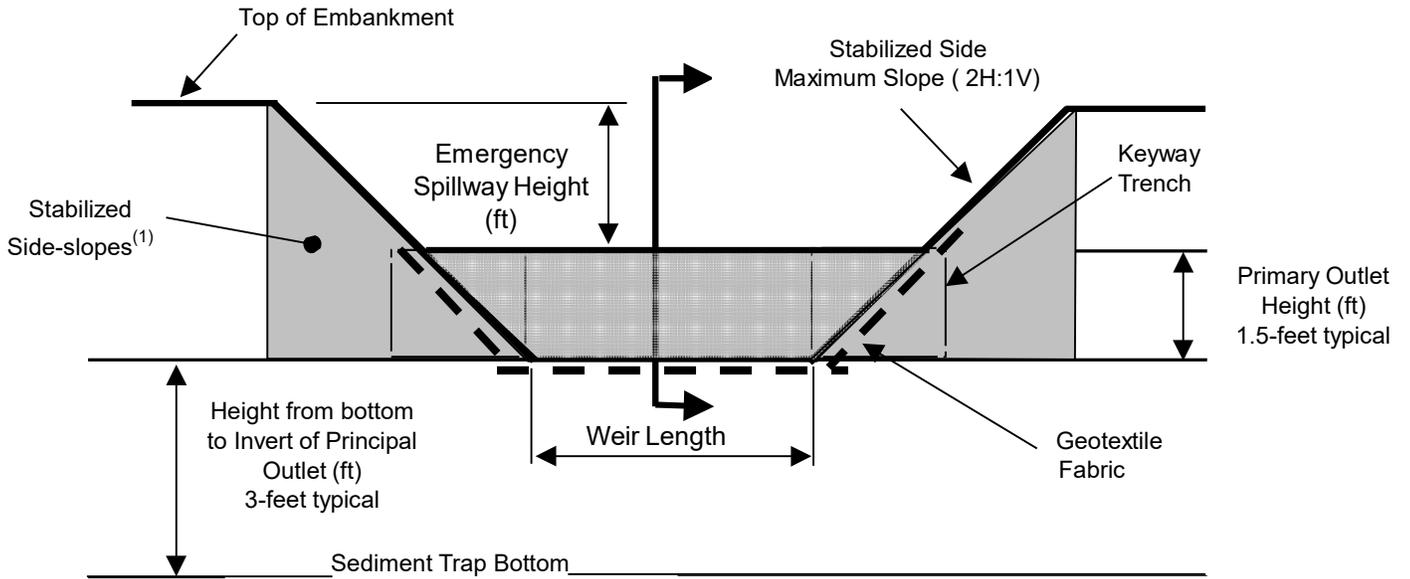
C. McIntyre, G. Aron, J. Willenbrock, and M. Deimler. Report No. 10: Analysis of flow through porous media as applied to gabion dams regarding the storage and release of storm water runoff. NAHB/NRC Designated Housing Research Center at Penn State, Department of Civil Engineering; August 1992.

## X Definitions

*Stabilized (III)*: Means that all land disturbing construction activities at the construction site have been completed and that a uniform perennial vegetative cover has been established with a density of at least 70% of the cover for the unpaved areas and areas not covered by permanent structures or that employ equivalent stabilization measures.

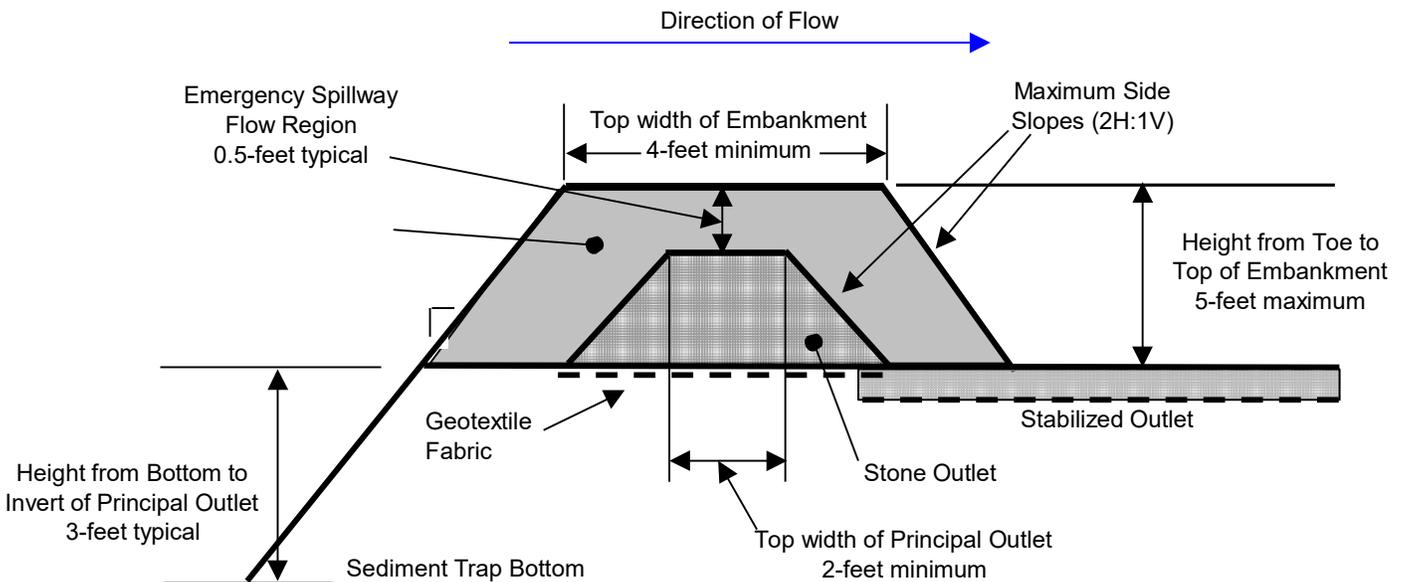
*Temporary (I)*: An erosion control measure that is in place for the duration of construction or until the site is stabilized.

**Figure 1: Sediment Trap Outlet Detail**



**Cross-section View of Principal Outlet**

Notes: (1) Side-slopes and faces of earthen embankment around outlet shall be armored with riprap or stabilized with erosion mat sufficient to handle flows from the 10-year storm.



**View A - A of Principal Outlet**