Sediment Basin (SBN)

Practice Description

A sediment basin is an earthen embankment suitably located to capture runoff, with an emergency spillway lined to prevent spillway erosion, interior porous baffles to reduce turbulence and evenly distribute flows, and equipped with a floating skimmer for dewatering. Sediment basins are designed to provide an area for runoff to pool and settle out a portion of the sediment. Old technology utilized a perforated riser for dewatering, which allowed water to leave the basin from all depths. One way to improve the sediment capture rate is to have an outlet that dewaters the basin from the top of the water column where the water is cleanest. A skimmer is probably the most common method to dewater a sediment basin from the surface. The basic concept is that the skimmer does not dewater the basin as fast as runoff enters it but, instead, allows the basin to fill and then slowly drain over multiple days. This process has two effects. First, the sediment in the runoff has more time to settle out prior to discharge. Second, a pool of water forms early in a storm event, which increases sedimentation rates in the basin and reduces turbidity. Many of the storms will produce more volume than the typical sediment basin capacity and flow rates in excess of the skimmer capability, resulting in flow over the emergency spillway. This water is also coming from the top of the water column and has thereby been “treated” to remove sediment as much as possible (adapted from *Soil Facts: Dewatering Sediment Basins Using Surface Outlets*, N. C. State University, Soil Science Department).

Planning Considerations

Sediment basins are needed where drainage areas are too large for other sediment-control practices.

Select locations for basins during initial site evaluation. Locate basin so that sudden failure should not cause loss of life or serious property damage. Install sediment basins before any site grading takes place within the drainage area.

Select sediment basin sites to capture sediment from all areas that are not treated adequately by other sediment-control measures. Always consider access for cleanout and disposal of the trapped sediment. Locations where a pond can be formed by constructing a low dam across a natural swale are generally preferred to sites that require excavation. Where practical, divert sediment-free runoff away from the basin.

Because the emergency spillway is actually used relatively frequently, it is generally stabilized using geotextile and riprap that can withstand the expected flows without erosive velocities. The spillway should be placed as far from the inlet of the basin as possible to maximize sedimentation before discharge. The spillway should be located in natural ground (not over the embankment) to the greatest extent possible.

As discussed in the *Chemical Stabilization Practice,* the proper introduction of polyacrylamides (PAM) into the turbid runoff water at the inlet of the basin and/or at the first baffle should be considered to help polish the discharge from the basin for decreasing the turbidity. See the *Flocculants and Polymers Practice*.

Where heavy loads of coarse sediment are expected, a forebay or sump area prior to the basin should be considered for capture of heavier particles.

Baffles

Porous baffles effectively spread the flow across the entire width of a sediment basin, or trap and cause increased deposition within the basin. Water flows through the baffle material, but is slowed sufficiently to back up the flow, causing it to spread across the entire width of the baffle (Figure SBN-1). Spreading the flow in this manner utilizes the full cross section of the basin and reduces turbulence, which shortens the time required for sediment to be deposited.

The installation of baffles should be similar to a silt fence (Figure SBN-2) utilizing posts and wire backing. The most proven material for a baffle is 700-900 g/m^2 coir erosion blanket (Figure SBN-3). Other materials proven by research to be equivalent in this application may be used. A support wire or rope across the top will help prevent excessive sagging if the material is attached to it with appropriate ties. Another option is to use a sawhorse type of support with the legs stabilized with rebar inserted into the basin floor. These structures work well and can be prefabricated off-site and quickly installed.

Baffles need to be installed correctly to fully provide their benefits. Refer to Figure SBN-2 and the following key points:

- The baffle material needs to be secured at the bottom and sides by staking, trenching, or securing horizontally to the bottom. Flow should not be allowed under the baffle.

- Most of the sediment will accumulate in the first bay, so this should be readily accessible for maintenance.

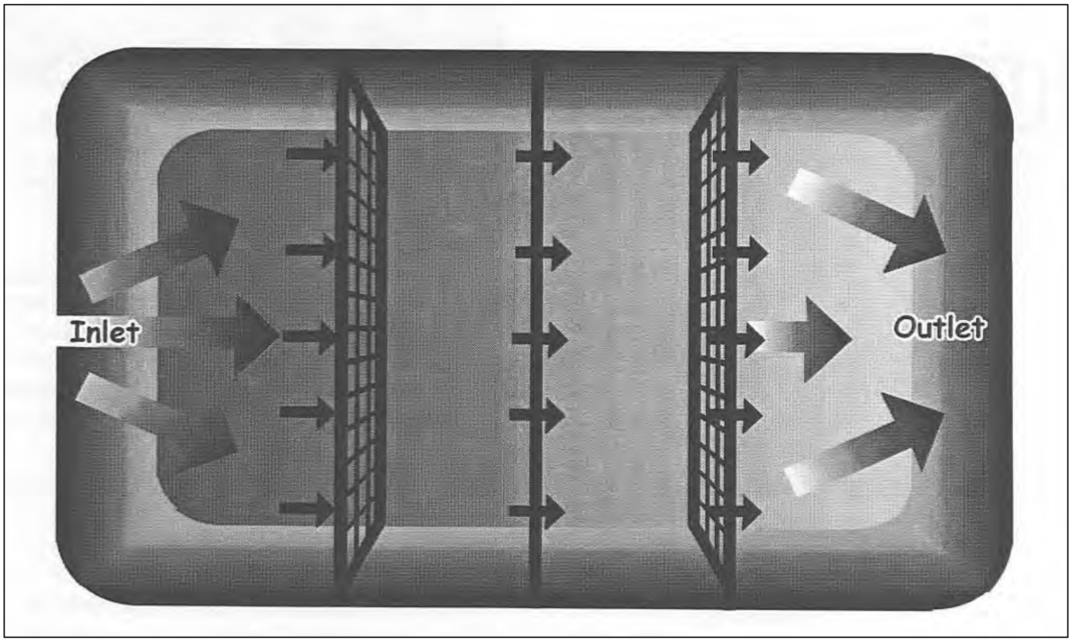


Figure SBN-1 Porous baffle in a sediment basin
(from North Carolina Erosion and Sediment Control Planning and Design Manual)

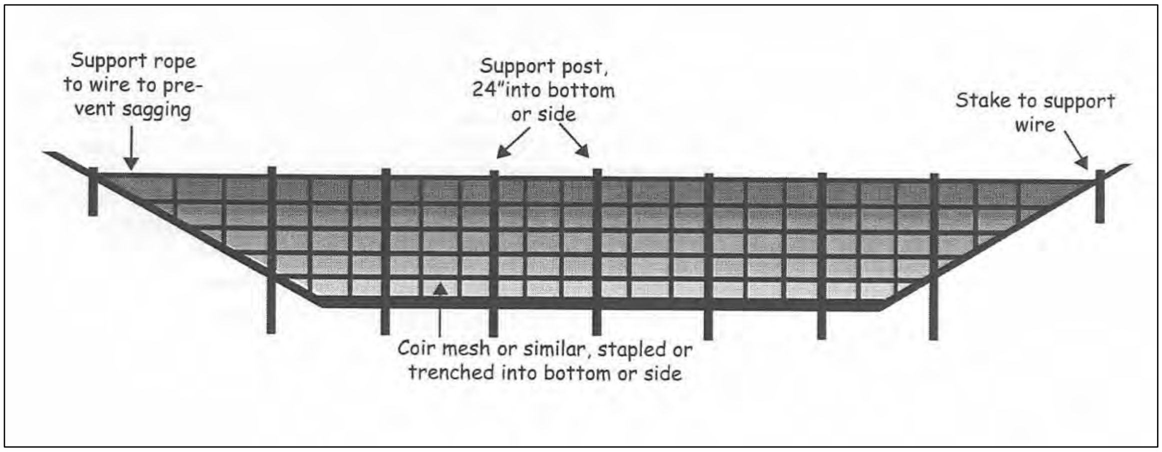


Figure SBN-2 Cross section of a porous baffle in a sediment basin
(Note: there is no weir because the water flows through the baffle material)
(from North Carolina Erosion and Sediment Control Planning and Design Manual)

Figure SBN-3 Example of porous baffle made of 700 g/m^2 coir erosion blanket as viewed from the inlet

Skimmer Option

A skimmer is a sediment basin dewatering-control device that withdraws water from the basin's water surface, thus removing the highest quality water for delivery to the uncontrolled environment. A skimmer is shown in Figure SBN-4. By properly sizing the skimmer's control orifice, the skimmer can be made to dewater a design hydrologic event in a prescribed period.

The costs of using a skimmer system are similar, or occasionally less, than a conventional rock outlet or perforated riser. However, the basin is more efficient in removing sediment when a skimmer is used. Another advantage of the skimmer is that it can be reused on future projects. Skimmers are generally maintenance free, but may require occasional maintenance to remove debris from the orifice.

A skimmer must dewater the basin from the top of the water surface. The rate of dewatering must be controlled. A dewatering time of 48 to 120 hours (2 to 5 days) is required for the basin to function properly.

Perforated Riser

The perforated risers are a common dewatering device in basins that will be retained for stormwater detention post-construction. These devices dewater the basin quickly by drawing water from the entire water column.

Flashboard Riser Option

A flashboard riser forces the basin to fill to a given level before the water tops the riser and is then drained. As with the skimmer option, removing water from the top improves sediment capture, as the top of the water column is often where the least amount of sediment resides. The benefit of the flashboard riser is that water level can be controlled by removed (or adding) "stop logs" to adjust the water level.

Flashboard Riser (Source: NRCS)

Solid Riser Option

A solid riser option is another that is commonly used when the sediment basin will be used for post-construction stormwater control. A solid riser manages stormwater by forcing water to drain over the top of the riser pipe. The disadvantage to the solid riser option is that the only way to fully dewater the basin (for sediment removal) is through a pump system.

Design Criteria and Construction

Summary:	**Temporary Sediment Trap**
Emergency Spillway:	Trapezoidal spillway with non-erosive lining. 10-year, 24-hour rainfall event
Maximum Drainage Area:	10 acres
Minimum Volume:	3,600 cubic feet per acre of drainage area
Minimum L/W Ratio:	2:1
Minimum Depth:	2 feet
Dewatering Mechanism:	Skimmer(s) attached at bottom of barrel pipe
Dewatering Time:	2 – 5 days
Baffles Required:	3

Compliance with Laws and Regulations

Design and construction should comply with state and local laws, ordinances, rules, and regulations.

Design Basin Life

Structures intended for more than 3 years of use should be designed as permanent structures. Procedures outlined in this section do not apply to permanent structures. See *Volume 2: Stormwater Runoff Management* for permanent stormwater control methods.

Dam Height

Maximum height should be 10 feet, measured from the designed (settled) top elevation of the dam to the lowest point of the original ground surface.

Basin Locations

Select areas that

- Are not intermittent or perennial streams;
- Allow a maximum amount of construction runoff to be brought into the structure;
- Provide capacity for storage of sediment from as much of the planned disturbed area as practical;
- Exclude runoff from undisturbed areas where practical;
- Provide access for sediment removal throughout the life of the project; and
- Interfere minimally with construction activities.

Basin Shape

Ensure that the flow-length to basin-width ratio is 2:1 or larger to improve trapping efficiency. Length is measured at the elevation associated with the minimum storage volume. Generally, the bottom of the basin should be level to ensure that the baffles function properly. The area between the inlet and first baffle (forebay) can be designed with reverse grade to improve the trapping efficiency.

Storage Volume

Ensure that the sediment-storage volume of the basin is at least 3,600 cubic feet per acre for the area draining into the basin. Volume is measured below the emergency spillway crest. Remove sediment from the basin when approximately one-half of the storage volume has been filled.

Baffles

Space the baffles to create equal zones of volume within the basin.

The top of the baffle should be the same elevation as the maximum water depth flowing through the emergency spillway.

Baffles should be designed to go up the sides of the basin banks so water does not flow around the baffles. Most of the sediment will be captured in the inlet zone. Smaller particle size sediments are captured in the latter cells.

The design life of the fabric can be up to 3 years, but it may need to be replaced more often if damaged or clogged.

Spillway Capacity

The emergency spillway system must carry the peak runoff from the 10-year 24-hour storm with a minimum 1 foot of freeboard (distance between the surface of the water with the spillway flowing full and the top of the embankment). Base runoff computations on the most severe soil cover conditions expected in the drainage area during the effective life of the structure.

Sediment Cleanout Elevation

Determine the elevation at which the invert of the basin would be half-full. This elevation should also be marked in the field with a permanent stake set at this ground elevation (not the top of the stake).

Basin Dewatering

Basin dewatering discussion will be limited to the skimmer options. Additional dewatering options are discussed in “Planning Considerations” (earlier in this practice). The basin should be provided with a surface outlet. A floating skimmer should be attached to a Schedule 40 PVC barrel pipe of the same diameter as the skimmer arm. The skimmer apparatus will control the rate of dewatering. The skimmer should be sized to dewater the basin in 48 to 120 hours (2–5 days). The barrel pipe should be located under the embankment with at least one anti-seep collar at the center of the embankment projecting a minimum of 1.5 ft in all directions from the pipe. The barrel-pipe outlet must be stable and not cause erosion.

Skimmer Orifice Diameter

Faircloth Skimmer Selection Procedure

The skimmer performance charts (Table SBN-1) are recommended for use in selecting Faircloth Skimmers for use in dewatering sediment control basins. Always verify performance with the manufacturer’s information.

Required input data:
Basin volume = ________ ft^3
Desired dewatering time = ________ days

Procedure:

1. First use the basin volume (ft^3) and the desired dewatering time (days) and determine the required skimmer outflow rate in cubic feet per day (ft^3/d) from the following equation

$$Q = \frac{V}{t_d}$$

2. Scan the skimmer performance charts (Table SBN-1) and select the (a) skimmer size and (b) the skimmer orifice diameter (in inches) if desired.

Table SBN-1 Faircloth Skimmer Selection Charts

1.5-inch skimmer (H = 0.125 ft)

Orifice (in.)	**Outflow Rate (ft^3/d)**
None	2,079
1.0	809
0.5	193

2-inch skimmer (H = 0.167 ft)

Orifice (in.)	**Outflow Rate (ft^3/d)**
None	5,429
1.0	924
0.5	231

2.5-inch skimmer (H = 0.167 ft)

Orifice (in.)	**Outflow Rate (ft^3/d)**
None	9,548
1.0	1,039
0.5	250

3-inch skimmer (H = 0.25 ft)

Orifice (in.)	**Outflow Rate (ft^3/d)**
None	10,588
1.5	2,541
1.0	1,136
0.5	289

4-inch skimmer (H = 0.333 ft)

Orifice (in.)	**Outflow Rate (ft^3/d)**
None	16,863
2.5	8,181
2.0	5,236
1.5	2,945
1.0	1,309
0.5	327

5-inch skimmer (H = 0.333 ft)

Orifice (in.)	**Outflow Rate (ft^3/d)**
None	26,276
3.5	16,035
3.0	11,781
2.5	8,181
2.0	5,236
1.5	3,715
1.0	1,309
0.5	327

6-inch skimmer (H = 0.417 ft)

Orifice (in.)	**Outflow Rate (ft^3/d)**
None	44,371
4.5	29,645
4.0	23,427
3.5	17,941
3.0	13,186
2.5	9,144
2.0	5,852
1.5	3,292
1.0	1,463
0.5	366

8-inch skimmer (H = 0.5 ft)

Orifice (in.)	**Outflow Rate (ft^3/d)**
None	127,416
5.5	48,510
5.0	40,098
4.5	32,475
4.0	25,660
3.5	19,654
3.0	14,438
2.5	10,029
2.0	6,410
1.5	3,619
1.0	1,598
0.5	404

Example: Select a skimmer that will dewater a 20,000-ft^3 sediment basin in 3 days.

Solution: First, compute the required outflow rate as

$$Q = \frac{V}{t_d} = \frac{20000\,ft^3}{3d} = 6670\,ft^3/d$$

Now, go the Selection Charts (Table SBN-1) and select an appropriate skimmer. If the 2-inch skimmer with no orifice is chosen, the outflow rate will be 5,429 ft^3/d, which will require about 3.5 days to dewater the basin. An alternative might be to use a 4-inch skimmer with a 2.5-inch-diameter orifice, which will have an outflow rate of 8,181 ft^3/d and dewater the basin in about 2.5 days.

Example: A More Precise Alternative: Each skimmer comes with a plastic plug that can be drilled forming a hole that will limit the skimmer's outflow to any desired rate. Thus, for a specific skimmer, the orifice that will dewater a basin in a more precisely chosen time can be determined. The flow through an orifice can be computed as

$$Q = CA\sqrt{2gH}$$

where C is the orifice coefficient (usually taken to be 0.6), A is the orifice cross-sectional area in ft^2, g is the acceleration of gravity (32.2 ft/sec^2), and H is the driving head on the orifice center in feet. The orifice equation can be simplified to yield the orifice flow in gpm using the diameter, D (in inches), and the head, in feet, as

$$Q = 12D^2\sqrt{H} \ .$$

Or, the orifice flow in ft^3/d using the diameter, D (in inches), and the head, in feet, as

$$Q = 2310D^2\sqrt{H} \ .$$

If we solve the orifice equation for the orifice diameter using the desired outflow rate (6670 ft^3/d) and the head driving water through the skimmer (0.333 ft for a 4-inch skimmer) as

$$D = \sqrt{\frac{Q}{2310\sqrt{H}}} = \sqrt{\frac{6670}{2310\sqrt{0.333}}} = 2.24 inches$$

We see that if the plastic plug were drilled to a diameter of 2.24 inches and placed in a 4-inch skimmer, the dewater rate would be 6,670 ft^3/d and the 20,000-ft^3 basin would dewater in 3 days.

Outlet Protection

Provide outlet protection to ensure erosion does not occur at the pipe outlet.

Basin Emergency Spillway

The emergency spillway should carry the peak runoff from a 10-year storm. The spillway should have a minimum 10-foot bottom width, 0.5-foot flow depth, and 1-foot freeboard above the design water surface.

Construct the entire flow area of the spillway in undisturbed soil to the greatest extent possible. The cross section should be trapezoidal, with side slopes 3:1 (horizontal: vertical) or flatter for grass spillways (Figure SBN-5) and 2:1 (horizontal: vertical) for riprap. Select vegetated lining to meet flow requirements and site conditions.

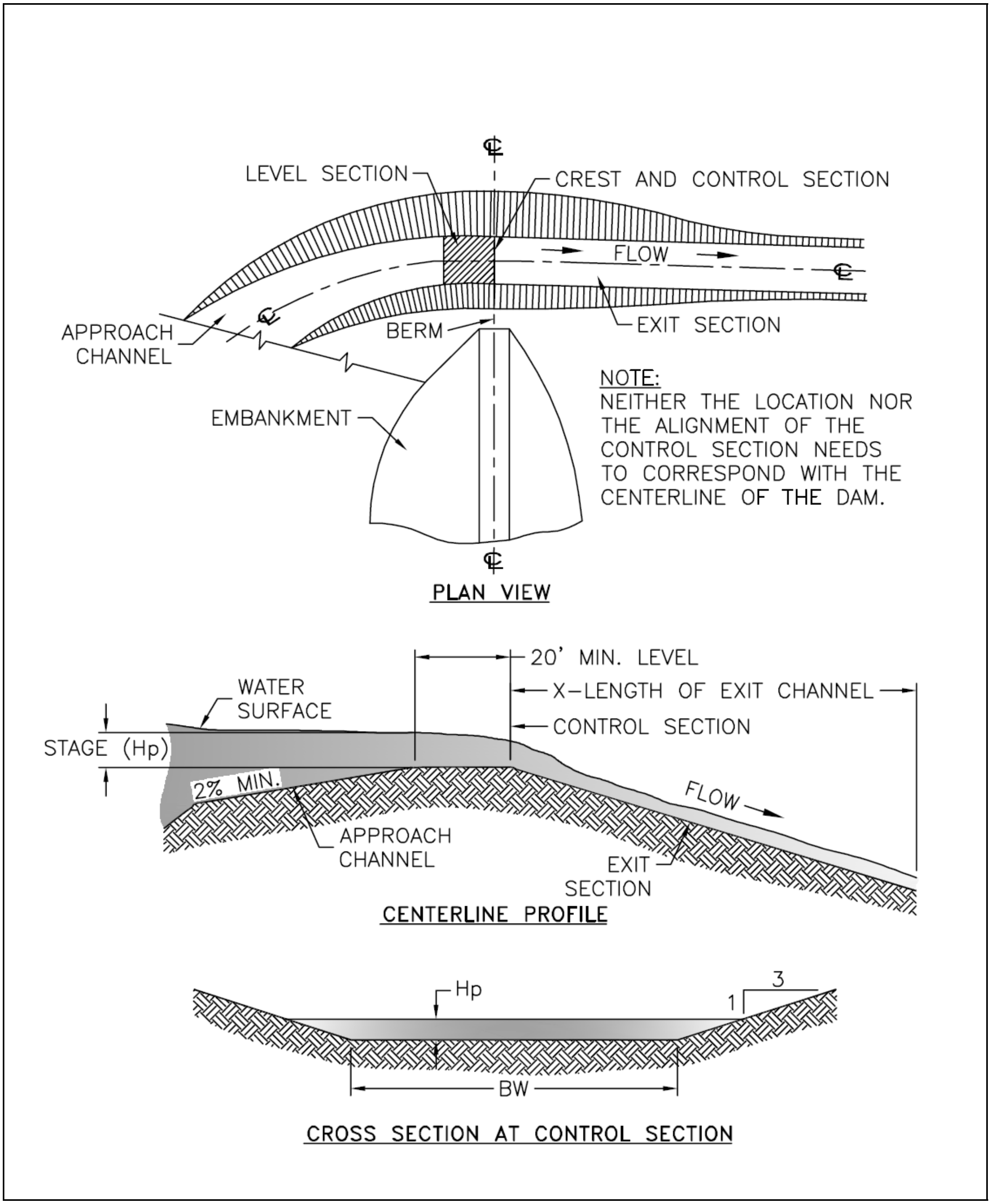


Figure SBN-5 Excavated grass spillway views

Inlet Section
Ensure that the approach section has a slope toward the impoundment area of not less than 2% and is flared at its entrance, gradually reducing to the design width of the control section. The inlet portion of the spillway may be curved to improve alignment.

The Control Section
The control section of the spillway should be level and straight and at least 20 feet long for grass spillways and 10 feet for riprap. Determine the width and depth for the required capacity and site conditions. Wide, shallow spillways are preferred because they reduce outlet velocities.

The Outlet Section
The outlet section of the spillway should be straight, aligned, and sloped to ensure supercritical flow with exit velocities not exceeding values acceptable for site conditions.

Outlet Velocity
Ensure that the velocity of flow from the basin is nonerosive for existing site conditions. It may be necessary to stabilize the downstream areas or the receiving channels.

Embankment
Embankments should not exceed 10 feet in height, measured at the center line from the original ground surface to the designed (settled) top elevation of the embankment. Keep a minimum of 1 foot between the designed (settled) top of the dam and the design water level in the emergency spillway. Additional freeboard may be added to the embankment height, which allows flow through a designated bypass location. Construct embankments with a minimum top width of 8 feet and side slopes of 2.5:1 (horizontal: vertical) or flatter.

There should be a cutoff trench in stable soil material under the dam at the centerline. The trench should be at least 2 feet deep with 1.5:1 (horizontal: vertical) side slopes, and sufficiently wide (at least 8 feet) to allow compaction by machine.

Embankment material should be a stable mineral soil, free of roots, woody vegetation, rocks, or other objectionable materials, with adequate moisture for compaction. Place fill in 9-inch layers through the length of dam and compact by routing construction hauling equipment over it. Maintain moisture and compaction requirements according to the plans and specifications. Hauling or compaction equipment must traverse each layer so that the entire surface has been compacted by at least one pass of the equipment wheels or tracks.

Excavation
Where sediment pools are formed or enlarged by excavation, keep side slopes at 2:1 (horizontal: vertical) or flatter for safety.

Erosion Protection
Minimize the area disturbed during construction. Divert surface water from disturbed areas. When possible, delay clearing the sediment impoundment area until the dam is in place. Keep the remaining temporary pool area undisturbed. Stabilize the spillway, embankment, and all disturbed areas with permanent vegetation. The basin bottom should also be established to a vegetative cover as this promotes sediment deposition.

Trap Efficiency

Improve sediment basin trapping efficiency by employing the following considerations in the basin design:

- Surface area—In the design of the settling pond, allow the largest surface area possible. The shallower the pool, the better.
- Length—Maximize the length-to-width ratio of the basin to provide the longest flow path possible.
- Baffles—Provide a minimum of three porous baffles to evenly distribute flow across the basin and reduce turbulence.
- Inlets—Area between the sediment inlets and the basin bottom should be stabilized by geotextile material, riprap with geotextile, a pipe drop, or other similar methods (Figure SBN-6 shows the area with rocks). Inlets to basin should be located the greatest possible distance away from the spillway.
- Dewatering—Allow the maximum reasonable detention period before the basin is completely dewatered (at least 48 hours).
- Inflow rate—Reduce the inflow velocity to nonerosive rates, and divert all sediment-free runoff.
- Establish permanent vegetation in the bottom and side slopes of the basin.
- Introduce the appropriate PAM material either at the turbulent entrance of the runoff water into the basin and/or apply to the first baffle. Apply the PAM according to manufacturer's recommendations.

Safety

Avoid steep side slopes. Fence basins properly and mark them with warning signs if trespassing is likely. Follow all state and local safety requirements.

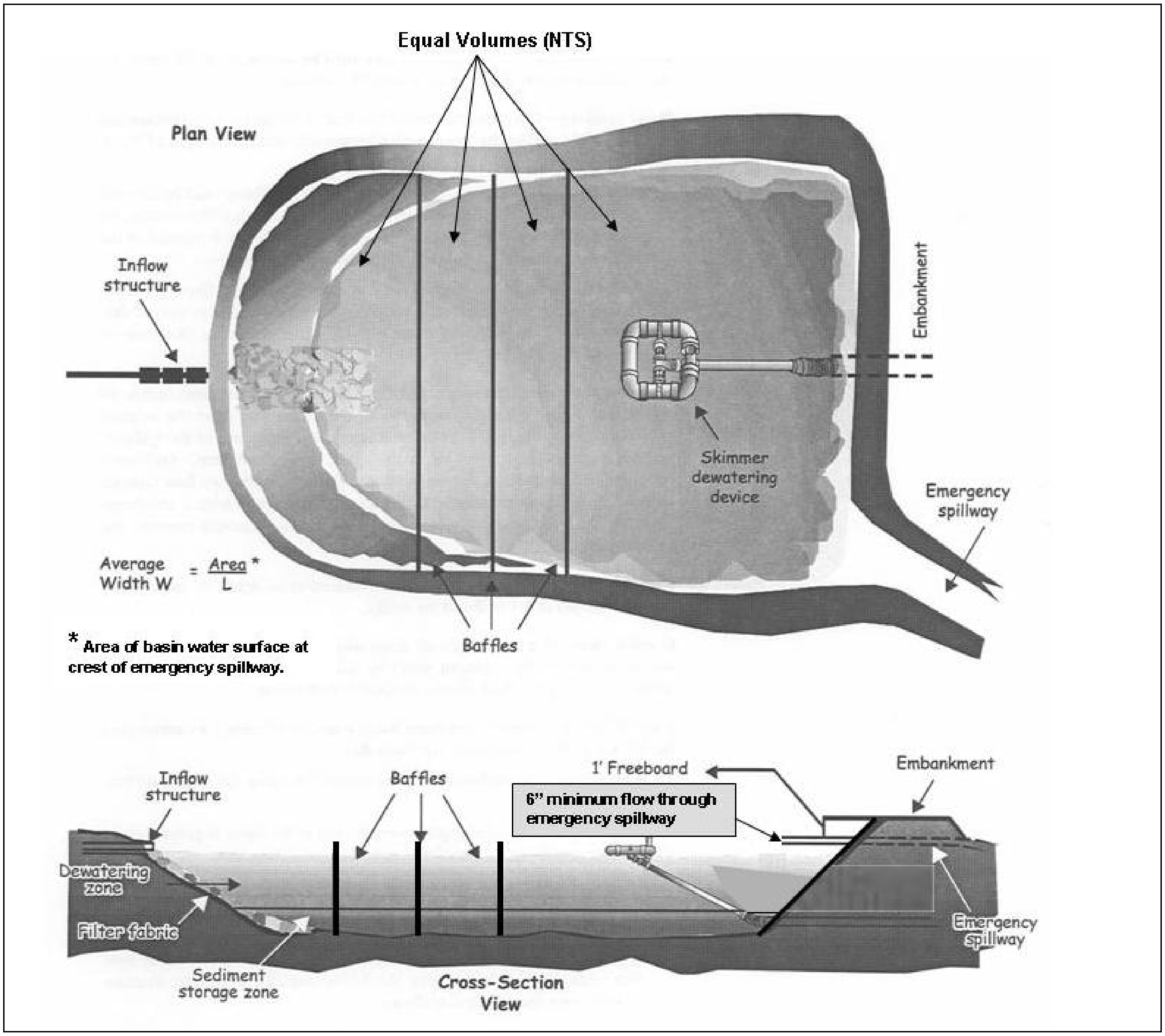


Figure SBN-6 Example of a sediment basin with a skimmer outlet and emergency spillway
(modified from Pennsylvania Erosion and Sediment Control Manual, March 2000)

Design Procedure

Step 1. Determine peak flow, Q_{10}, for the basin drainage area utilizing the NRCS runoff curve number method (see *Appendix A: Erosion and Stormwater Runoff Calculations*).

Step 2. Determine any site limitations for the sediment pool elevation, emergency spillway, or top of the dam.

Step 3. Determine basin volumes:

- Compute minimum volume required (3,600 ft^3/acre of drainage area).
- Specify sediment cleanout level to be clearly marked (one-half the design volume). Specify that the basin area is to be cleared after the dam is built.

Step 4. Determine area of basin, shape of basin, and baffles:

- Check length/width ratio (should be 2:1 or larger).
- Ensure the bottom of the basin is level.
- Design and locate a minimum of three coir baffles. The baffle spacing should produce equal volumes of storage within the basin when the basin is full. The top elevation of the baffles will be set in Step 7.

Step 5. Size the skimmer, skimmer orifice, and barrel pipe.

Use Table SBN-1 or the precise alternative design to size the orifice. Generally, a Schedule 40 PVC barrel pipe the same size as the skimmer arm is used under the embankment.

Step 6. Design the anti-seep collar.

Ensure that anti-seep collar is no closer than 2 feet from a pipe joint and as close to the center of the embankment as possible. Collar must project at least 1.5 feet from the pipe and be watertight.

Step 7. Determine the emergency spillway dimensions.

Size the spillway bottom width and flow depth to handle the Q_{10} peak flow. Tables SBN 2 and SBN-3 can be used for the design process for grassed emergency spillways. Use appropriate design procedures for spillways with other surfaces. Set top of baffles at the elevation of the designed maximum flow depth of the emergency spillway.

Step 8. Spillway approach section.

Adjust the spillway alignment so that the control section and outlet section are straight. The entrance width should be 1.5 times the width of the control section with a smooth transition to the width of the control section. The approach channel should slope toward the reservoir no less than 2%.

Step 9. Spillway control section.

- Locate the control section in natural ground to the greatest extent possible.
- Keep a level area to extend at least 20 feet (grass) or 10 feet (riprap) upstream from the outlet end of the control section to ensure a straight alignment.
- Side slopes should be 3:1 (grass) or 2:1 (riprap).

Step 10. Design spillway exit section.

- Spillway exit should align with the control section and have the same bottom width and side slopes.
- Slope should be sufficient to maintain supercritical flow, but make sure it does not create erosive velocities for site conditions. (Stay within slope ranges in appropriate design tables.)
- Extend the exit channel to a point where the water may be released without damage.

Step 11. Size the embankment.

- Set the design elevation of the top of the dam a minimum of 1 foot above the water surface for the design flow in the emergency spillway.
- Constructed height should be 10% greater than the design to allow for settlement.
- Set side slopes 2.5:1 or flatter.
- Determine depth of cutoff trench from site borings. It should extend to a stable, tight soil layer (a minimum of 2 ft deep).
- Select borrow site remembering that the spillway cut may provide a significant amount of fill.

Step 12. Erosion control

- Select surface-stabilization measures to control erosion.
- Select groundcover for emergency spillway to provide protection for design flow velocity and site conditions. Riprap stone over geotextile fabric may be required in erodible soils or when the spillway is not in undisturbed soils.
- Establish all disturbed areas, including the basin bottom and side slopes, to vegetation.

Step 13. Safety.

- Construct a fence and install warning signs as needed.

Table SBN-2 Design Table for Vegetated Spillways Excavated in Erosion-Resistant Soils
(side slopes 3 horizontal: 1 vertical)

Discharge Q CFS	Slope Range Minimum Percent	Slope Range Maximum Percent	Bottom Width Feet	Stage Feet
15	3.3	12.2	8	.83
	3.5	18.2	12	.69
20	3.1	8.9	8	.97
	3.2	13.0	12	.81
	3.3	17.3	16	.70
25	2.9	7.1	8	1.09
	3.2	9.9	12	.91
	3.3	13.2	16	.79
	3.3	17.2	20	.70
30	2.9	6.0	8	1.20
	3.0	8.2	12	1.01
	3.0	10.7	16	.88
	3.3	13.8	20	.78
35	2.8	5.1	8	1.30
	2.9	6.9	12	1.10
	3.1	9.0	16	.94
	3.1	11.3	20	.85
	3.2	14.1	24	.77
40	2.7	4.5	8	1.40
	2.9	6.0	12	1.18
	2.9	7.6	16	1.03
	3.1	9.7	20	.91
	3.1	11.9	24	.83
45	2.6	4.1	8	1.49
	2.8	5.3	12	1.25
	2.9	6.7	16	1.09
	3.0	8.4	20	.98
	3.0	10.4	24	.89
50	2.7	3.7	8	1.57
	2.8	4.7	12	1.33
	2.8	6.0	16	1.16
	2.9	7.3	20	1.03
	3.1	9.0	24	.94
60	2.6	3.1	8	1.73
	2.7	3.9	12	1.47
	2.7	4.8	16	1.28
	2.9	5.9	20	1.15
	2.9	7.3	24	1.05
	3.0	8.6	28	.97
70	2.5	2.8	8	1.88
	2.6	3.3	12	1.60
	2.6	4.1	16	1.40
	2.7	5.0	20	1.26
	2.8	6.1	24	1.15
	2.9	7.0	28	1.05
80	2.5	2.9	12	1.72
	2.6	3.6	16	1.51
	2.7	4.3	20	1.35
80	2.8	5.2	24	1.24
	2.8	5.9	28	1.14
	2.9	7.0	32	1.06
90	2.5	2.6	12	1.84
	2.5	3.1	16	1.61
	2.6	3.8	20	1.45
	2.7	4.5	24	1.32
	2.8	5.3	28	1.22
	2.8	6.1	32	1.14
100	2.5	2.8	16	1.71
	2.6	3.3	20	1.54
	2.6	4.0	24	1.41
	2.7	4.8	28	1.30
	2.7	5.3	32	1.21
	2.8	6.1	36	1.13
120	2.5	2.8	20	1.71
	2.6	3.2	24	1.56
	2.7	3.8	28	1.44
	2.7	4.2	32	1.34
	2.7	4.8	36	1.26
140	2.5	2.7	24	1.71
	2.5	3.2	28	1.58
	2.6	3.6	32	1.47
	2.6	4.0	36	1.38
	2.7	4.5	40	1.30
160	2.5	2.7	28	1.70
	2.5	3.1	32	1.58
	2.6	3.4	36	1.49
	2.6	3.8	40	1.40
	2.7	4.3	44	1.33
180	2.4	2.7	32	1.72
	2.4	3.0	36	1.60
	2.5	3.4	40	1.51
	2.6	3.7	44	1.43
200	2.5	2.7	36	1.70
	2.5	2.9	40	1.60
	2.5	3.3	44	1.52
	2.6	3.6	48	1.45
220	2.4	2.6	40	1.70
	2.5	2.9	44	1.61
	2.5	3.2	48	1.53
240	2.5	2.6	44	1.70
	2.5	2.9	48	1.62
	2.6	3.2	52	1.54
260	2.4	2.6	48	1.70
	2.5	2.9	52	1.62
280	2.4	2.6	52	1.70
300	2.5	2.6	56	1.69

Example of Table Use:

Given: Discharge, Q_{10} = 87 cfs, Spillway slope (exit section) = 4%.

Find: Bottom Width and Stage in Spillway.

Procedure: Using a discharge of 90 cfs, note that the spillway (exit section) slope falls within slope ranges corresponding to bottom widths of 24, 28, and 32 ft. Use bottom width of 32 ft, to minimize velocity. Stage in the spillway is 1.14 ft.

Note: Computations are based on: Roughness coefficient, n = 0.40, and a maximum velocity of 5.50 ft per sec.

Table SBN-3 Design Table for Vegetated Spillways Excavated in Very Erodible Soils (side slopes 3 horizontal: 1 vertical)

Discharge Q CFS	Slope Range		Bottom Width Feet	Stage Feet
	Minimum Percent	Maximum Percent		
10	3.5	4.7	8	.68
15	3.4	4.4	12	.69
	3.4	5.9	16	.60
20	3.3	3.3	12	.80
	3.3	4.1	16	.70
	3.5	5.3	20	.62
25	3.3	3.3	16	.79
	3.3	4.0	20	.70
	3.5	4.9	24	.64
30	3.3	3.3	20	.78
	3.3	4.0	24	.71
	3.4	4.7	28	.65
	3.4	5.5	32	.61
35	3.2	3.2	24	.77
	3.3	3.9	28	.71
	3.5	4.6	32	.66
	3.5	5.2	36	.62
40	3.3	3.3	28	.76
	3.4	3.8	32	.71
	3.4	4.4	36	.67
	3.4	5.0	40	.64
45	3.3	3.3	32	.76
	3.4	3.8	36	.71
	3.4	4.3	40	.67
	3.4	4.8	44	.64
50	3.3	3.3	36	.75
	3.3	3.8	40	.71
	3.3	4.3	44	.68
60	3.2	3.2	44	.75
	3.2	3.7	48	.72
70	3.3	3.3	52	.75
80	3.1	3.1	56	.78

Example of Table Use:

Given: Discharge, Q_{10} = 38 cfs, Spillway slope (exit section) = 4%.

Find: Bottom Width and Stage in Spillway.

Procedure: Using a discharge of 40 cfs, note that the spillway (exit section) slope falls within slope ranges corresponding to bottom widths of 36 and 40 ft. Use bottom width of 40 ft, to minimize velocity. Stage in the spillway is 0.64 ft.

Note: Computations are based on: Roughness coefficient, n = 0.40 and a maximum velocity of 3.50 ft per sec.

Construction

Prior to the start of construction, sediment basins should be designed by a qualified design professional.

Plans and specifications should be referred to by field personnel throughout the construction process. The sediment basin should be built according to planned grades and dimensions. Follow all federal, state and local requirements on impoundments.

Consider the following guidance as construction proceeds.

Site Preparation

Locate all utilities at the site to ensure avoidance.

Clear, grub, and strip the dam foundation and emergency spillway area, removing all woody vegetation, rocks, and other objectionable material. Dispose of trees, limbs, logs, and other debris in designated disposal areas.

Stockpile surface soil for use later during topsoiling.

Delay clearing the pool area until the dam is complete and then remove brush, trees, and other objectionable materials to facilitate sediment cleanout.

Keyway Trench

Excavate the keyway trench along the centerline of the planned embankment to a depth determined by the qualified design professional (at least 2 feet). The trench bottom elevation should extend up both abutments to the riser crest elevation and should have a bottom width of at least 8 feet and side slopes no steeper than 1.5:1 (horizontal: vertical). Compaction requirements will be the same as those for the embankment.

Skimmer

Prevent the skimming device from settling into the mud by excavating a shallow pit under the skimmer or providing a low support under the skimmer of stone or timber (Figure SBN-1).

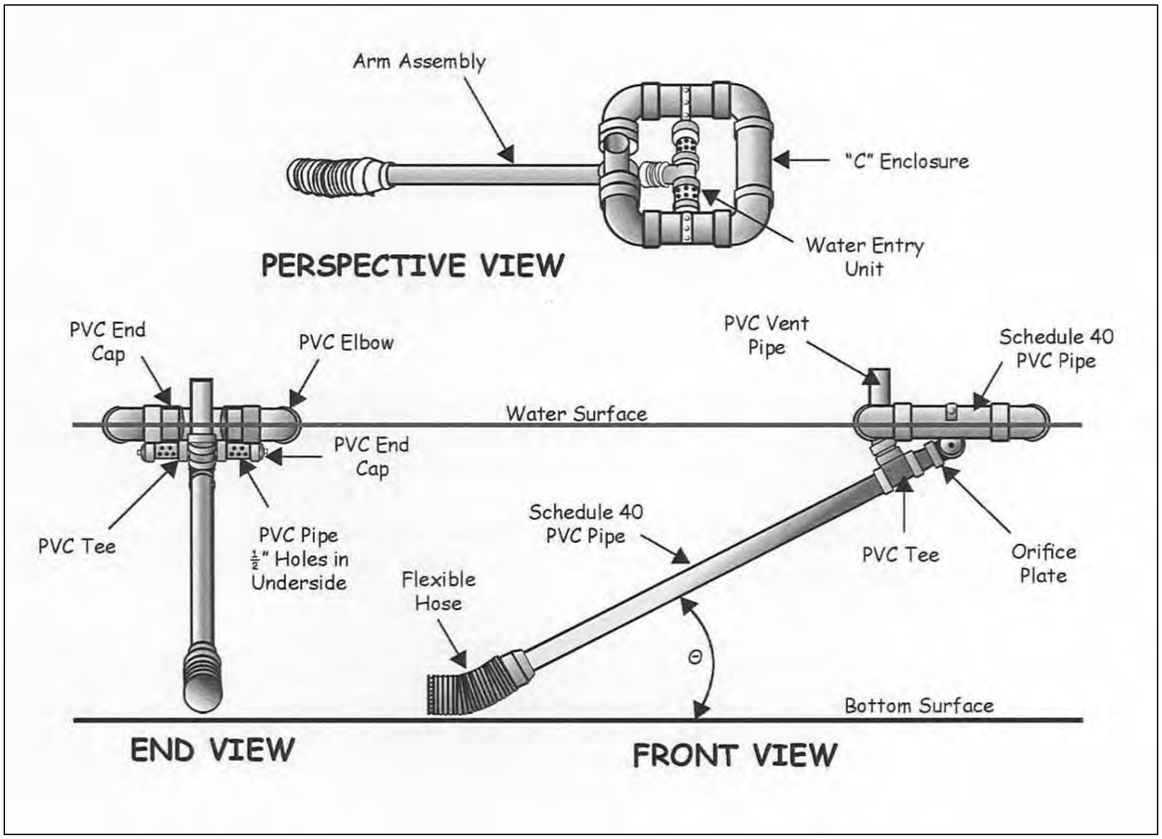


Figure SBN-1 Schematic of a skimmer (Source: Pennsylvania Erosion and Sediment Pollution Control Manual, March 2000)

Place the barrel pipe (typically the same size as the skimmer arm) on a firm, smooth foundation of impervious soil. Do not use pervious material such as sand, gravel, or crushed stone as backfill around the pipe. Place the fill material around the pipe in 4-inch layers and manually compact it under and around the pipe to at least the same density as the adjacent embankment. Care must be taken not to raise the pipe from the firm contact with its foundation when compacting under the pipe haunches.

Construct the anti-seep collar(s), if shown on the plans.

Place a minimum depth of 2 feet of compacted backfill over the pipe before crossing it with construction equipment. In no case should the pipe conduit be installed by cutting a trench through the dam after the embankment is complete.

Assemble the skimmer following the manufacturer’s instructions, or as designed.

Lay the assembled skimmer on the bottom of the basin with the flexible joint at the inlet of the barrel pipe. Attach the flexible joint to the barrel pipe and position the skimmer over the excavated pit or support. Be sure to attach a rope to the skimmer and anchor it to the side of the basin. This will be used to pull the skimmer to the side for maintenance.

Install outlet protection as specified.

Embankment

Scarify the foundation of the dam before placing fill.

Use fill from predetermined borrow areas. It should be clean, stable soil free of roots, woody vegetation, rocks, and other debris; and must be wet enough to form a ball without crumbling, yet not so wet that water can be squeezed out.

Place the most permeable soil in the downstream toe and the least permeable in the center portion of the dam.

Place the fill material in 6″ to 9″ continuous uncompacted layers over the length of the dam. Fill should then be compacted to a 4″ to 6″ thick continuous layer (for example, routing construction equipment over the dam so that each layer is traversed by at least four passes of the equipment).

Protect the spillway barrel with 2 feet of fill that has been compacted with hand tampers before traversing over the pipe with equipment.

Construct and compact the dam to an elevation 10% above the design height to allow for settling. The embankment should have a minimum 8-foot top width and 2.5:1 side slopes, but the design may specify additional width and gentler side slopes.

Place a reference stake at the sediment clean-out elevation shown on the plans (50% of design storage volume).

Emergency Spillway

Construct the spillway at the site located by a qualified design professional according to the plan design (in undisturbed soil around one end of the embankment, and so that any flow will return to the receiving channel without damaging the embankment).

Basin and Baffles

Ensure the basin has a length-to-width ratio of at least 2:1 or more as specified. Grade the basin so that the bottom is level front-to-back and side-to-side. Discharge water into the basin in a manner to prevent erosion. Use diversions with outlet protection to divert sediment-laden water to the upper end of the pool area to improve basin trap efficiency.

Install porous coir baffles as specified to ensure water does not flow under or around the baffles (Figure SBN-2).

Install posts or sawhorses across the width of the sediment trap.

Steel posts should be driven to a depth of 24 inches, spaced a maximum of 4 feet apart, and installed up the sides of the basin as well. The top of the fabric should be at least the height of the required storage volume elevation.

Install at least three rows of baffles between the inlet and outlet discharge point and at the locations specified in the plans.

When using posts, add a support wire or rope across the top to prevent sagging.

Wrap porous coir material (700–900 g/m^2) over a sawhorse or the top wire. Hammer rebar into the sawhorse legs for anchoring. Attach fabric to a rope and a support structure with zip ties, wire, or staples.

The bottom and sides of the fabric should be anchored in a trench or pinned with 8-inch erosion-control matting staples.

Do not splice the fabric, but use a continuous piece across the basin.

Figure SBN-2 Example of porous baffle made of 700-g/m^2 coir erosion blanket as viewed from the inlet (Source: North Carolina Erosion and Sediment Control Planning and Design Manual)

Erosion Control

Minimize the size of all disturbed areas.

Divert runoff from undisturbed areas away from the basin.

Use temporary diversions to prevent surface water from running onto disturbed areas.

Divert sediment-laden water to the upper end of the sediment pool to improve trap effectiveness.

Vegetate and stabilize the embankment, the emergency spillway, and all disturbed areas including the basin bottom and side slopes.

Safety

Because sediment basins that impound water are hazardous, the following precautions should be taken:

- Fence the area and post warning signs if trespassing is likely.
- Ensure that the basin does not exceed design heights.

Construction Verification

Check the finished grades and configurations for all earthworks. Check elevations and dimensions of all pipes and structures.

Common Problems

Consult with a registered design professional if any of the following occurs:

Variations in topography on-site indicate sediment basin will not function as intended.

Seepage is encountered during construction; it may be necessary to install drains.

Design specifications for fill, pipe, seed variety, or seeding dates cannot be met; substitutions may be required. Unapproved substitutions could lead to failure.

Maintenance

Inspect the sediment basin at least weekly and after each significant storm event (½ inch or greater).

Remove and properly dispose of sediment when it accumulates to ½ the design volume.

Remove trash and other debris from the skimmer, emergency spillway, and pool area.

Periodically check the embankment, emergency spillway, and outlet for erosion damage, piping, settling, seepage, or slumping along the toe or around the barrel and repair immediately.

Remove the basin after the drainage area has been permanently stabilized, inspected and approved. Do so by draining any water, removing the sediment to a designated disposal area, and smoothing the site to blend with the surrounding area; then stabilize.

References

Volume 1

Chapter 2

Vegetation for Erosion and Sediment Control 2-10

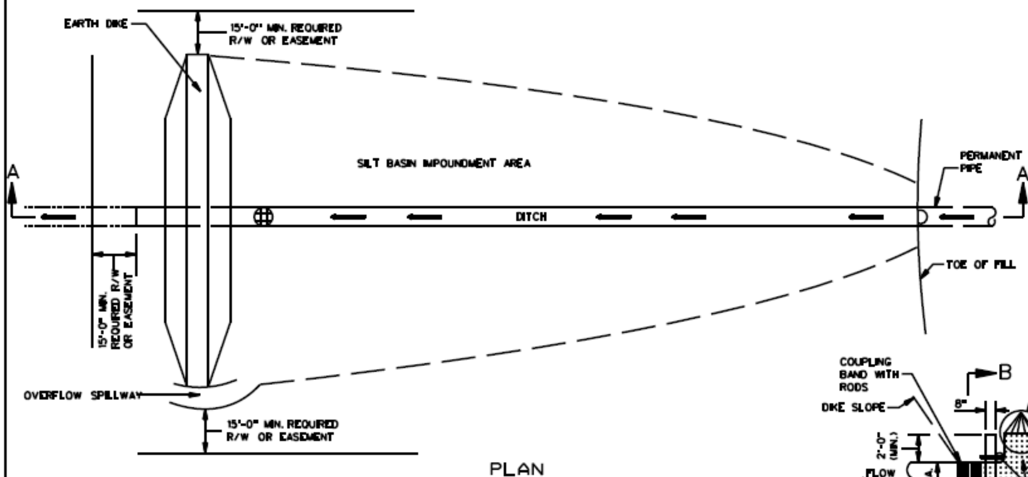
Chapter 4

Permanent Seeding (PS) 4-53
Flocculants and Polymers (FLC) 4-328

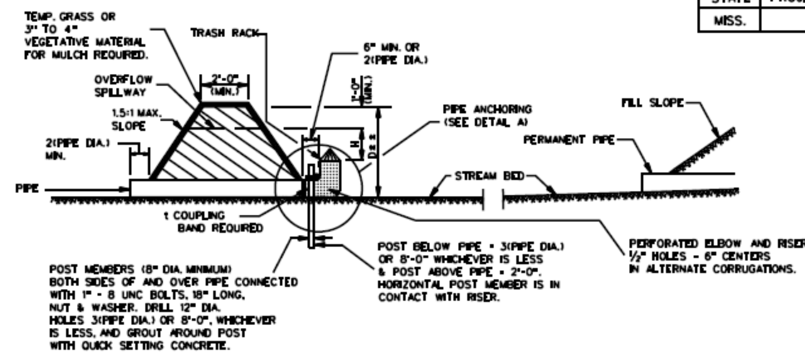
MDOT Drawing TEC-3

Appendix G (Available in Appendices Volume)

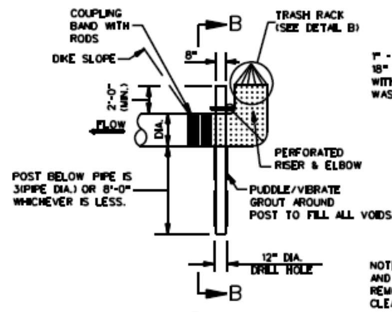
STATE	PROJECT NO.
MISS.	



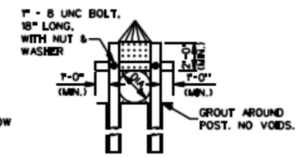
PLAN



SECTION A-A



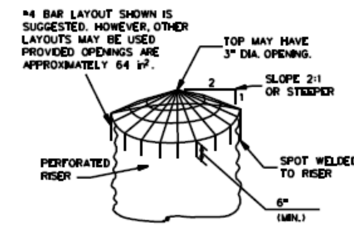
DETAIL A



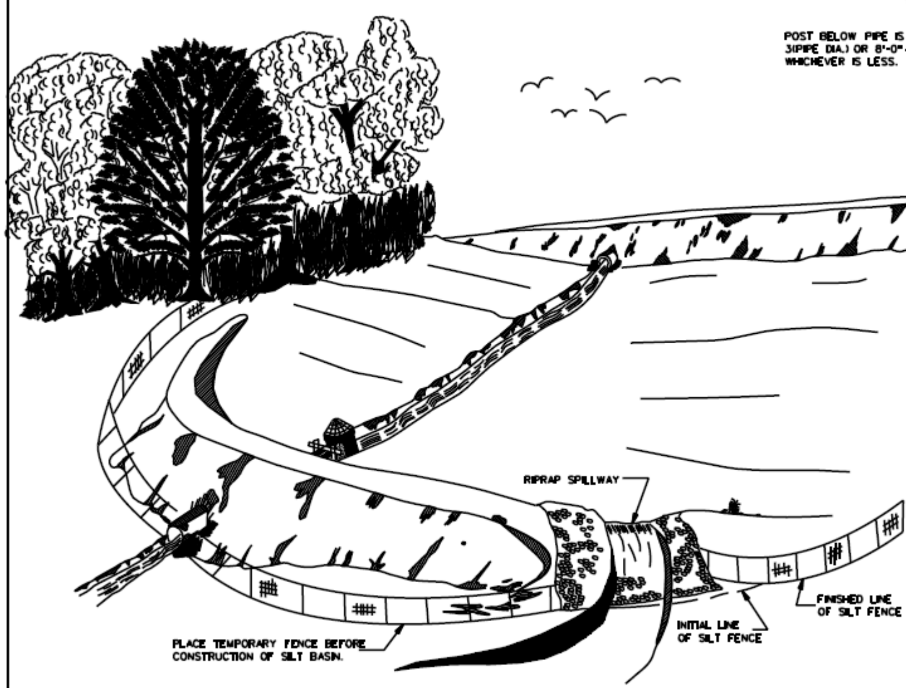
SECTION B-B

NOTE: POST MEMBERS MAY BE GREEN TIMBER AND MAY BE CUT OFF AT NATURAL GROUND REMOVAL. POST MUST BE 8" MINIMUM CLEAN DIAMETER.

PIPE ANCHORAGE



DETAIL B
TRASH RACK INSTALLATION



TEMPORARY SILT BASIN (TYPE B)

GENERAL NOTES:

1. PROVIDE OVERFLOW SPILLWAY IN NATURAL GROUND AT A MINIMUM OF 1'-0" BELOW TOP OF DIKE. CROSS-SECTIONAL AREA OF SPILLWAY IS EQUAL TO 1.5 TIMES THE AREA OF THE OUTLET PIPE MINIMUM. RIPRAP SHALL BE REQUIRED AT THE SPILLWAY. AFTER THE PURPOSE OF THE SILT BASIN HAS BEEN SERVED, THE DIKE AND RIPRAP MAY REMAIN IN PLACE AT THE DISCRETION OF THE ENGINEER, BUT THE DRAIN PIPE WITH RISER SHALL BE REMOVED AND THE NEWLY DISTURBED AREA REVEGETATED.
2. BASIN AND DIKE DIMENSIONS DO NOT REQUIRE CONSTRUCTION TO NEAT LINES.
3. THE SILT BASIN MAY BE CONSTRUCTED IN ANY SHAPE WITH THE DIKE EXTENDING ALONG ONE OR MORE SIDES AS LONG AS THE LENGTH MEASURED IN THE DIRECTION OF FLOW IS APPROXIMATELY TWICE THE WIDTH AND THE IMPOUNDMENT AREA AND DEPTH AT LEAST AS LARGE AS INDICATED.
4. MINIMUM DIMENSIONS FOR SILT BASIN (TYPE B) ARE AS FOLLOWS:

MIN. DIMENSIONS OF SILT BASIN (TYPE B)				† COUPLING BAND	
PIPE	** D (ft-in)	H (ft-in)	* AREA (ft²)	LENGTH (in)	COUPLING RODS/SIDE
15"	4'-0"	1'-0"	310	12"	2 & 2
18"	5'-0"	1'-0"	550	12"	2 & 2
24"	5'-0"	1'-0"	1100	12"	2 & 2
30"	6'-0"	1'-6"	1850	24"	3 & 3
36"	6'-0"	1'-6"	2800	24"	3 & 3
42"	7'-0"	2'-0"	4200	24"	3 & 3
48"	8'-0"	2'-0"	6200	24"	3 & 3

NOTES:
* 1. IMPOUNDMENT SURFACE AREAS ARE MEASURED AT ELEVATION OF TOP OF ELBOW RISER.
** 2. RISER REQUIRED WHERE MINIMUM "D" DIMENSION IS EXCEEDED. LENGTH OF RISER IS EQUAL TO THE AMOUNT THAT MINIMUM "D" DIMENSION IS EXCEEDED.
† 3. COUPLING RODS TO BE ½" DIAMETER MINIMUM WITH LUGS.

5. IN SELECTING BASIN SIZE, CONSIDERATION MUST BE GIVEN TO THE AREA DISCHARGING INTO THE BASIN OTHER THAN THAT WHICH COMES THROUGH THE PIPE UNDER THE ROADWAY. THIS WILL AT TIMES NECESSITATE A LARGER BASIN AND OUTLET PIPE SECTION.
6. THE DIKE SHALL BE CONSTRUCTED OF A MATERIAL SUITABLE FOR ROADWAY EMBANKMENT.
7. SILT BASIN (TYPE B) REQUIRED AT LOCATION(S) INDICATED ON PLANS.
8. THE CONTRACTOR SHALL BE REQUIRED TO FURNISH ALL MATERIALS AND PERFORM ALL WORK FOR THE PROPER INSTALLATION, MAINTENANCE AND REMOVAL OF TEMPORARY EROSION CONTROL MEASURES NECESSARY TO CONTROL SILTATION.
9. THE USE OF THE TEMPORARY EROSION CONTROL MEASURE SHOWN ON THIS SHEET WILL ONLY BE REQUIRED AND MEASURED FOR SEPARATE PAYMENT WHEN AN APPROPRIATE PAY ITEM IS INCLUDED IN THE BID SCHEDULE OF THE PROPOSAL.
10. RIPRAP AND TEMPORARY SILT FENCE, USED IN CONJUNCTION WITH TYPE B SILT BASINS AS SHOWN BY THE DETAILS ON THIS SHEET, WILL NOT BE MEASURED FOR SEPARATE PAYMENT. THEIR COST SHALL BE INCLUDED IN THE PRICE BID FOR TYPE B SILT BASIN.

BY
REVISION
DATE

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

TYPICAL TEMPORARY EROSION CONTROL MEASURES
(TYPE B SILT BASIN)

ENGLISH

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