Brush/Fabric Barrier (BFB)

Practice Description

A brush/fabric barrier is a dam-like structure constructed from woody residue and faced with a geotextile fabric to provide a temporary sediment basin. This practice is applicable on sites with a small drainage area where brush and other woody debris are available from a clearing and grubbing operation.

Planning Considerations

This practice is intended to be a temporary sediment basin with a limited life span and applicable only for small drainage areas.

The barrier should be located downslope from areas with potential sheet and rill erosion, with adequate storage volume in front of the barrier, and with no more than 2 acres of drainage area.

Adequate woody material from clearing and grubbing required on the site must be available for the construction of the barrier.

The practice should be located and designed so that adequate storage volume and detention time can be obtained, and failure of the barrier will not result in hazard to the public or damage to work on either on-site or off-site property.

Design Criteria and Construction

Prior to start of construction, a qualified design professional should determine the location and storage for the barrier. Typically, brush/fabric barriers are constructed where materials are readily available and at a location with adequate storage characteristics.

Drainage Area

Brush/fabric barriers should be designed with no more than 2 acres of drainage area. A sediment basin should be considered for larger drainage areas (see *Sediment Basin Practice*).

Structure Life

The design life of the structure should be 1 year or less. The barrier should be removed, and sediment accumulations properly stabilized prior to completion of the construction project.

Sediment Storage

The barrier should be designed to provide 67 cubic yards of sediment storage per acre of disturbed drainage area. Sediment should be removed and properly utilized on-site when half of the sediment storage volume has been filled.

Site Location and Preparation

The site for the barrier should be located so that a basin capable of providing the sediment storage required can be obtained or created. The site for the barrier should be smoothed prior to placement of the brush.

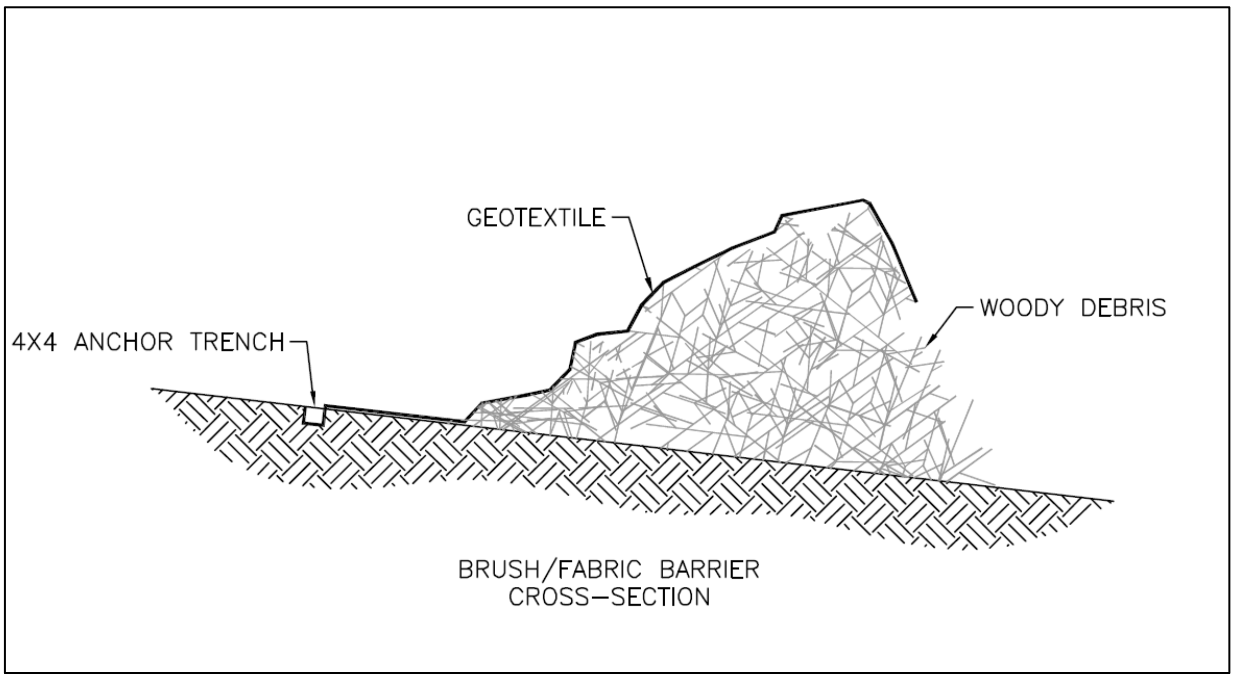


Figure BFB-1 Typical Installation

Materials Installation

Place the cleared and grubbed material in a densely compacted row, mostly on the contour, with each end upturned so that excessive flows will go over the top of the barrier and not around the ends of the barrier. Figure BFB–1 shows the typical installation.

Densely packed material should be placed so that the main stems of the woody debris are aligned with the length of the barrier. Small stems and limbs protruding from the bundle that could damage the fabric should be trimmed.

Generally, the barrier should be at least 3 feet tall, but no more than 6 feet tall. The width of the barrier perpendicular to the direction of flow should be at least 5 feet at its base.

Geotextile filter fabric consistent with the fabric used for silt fencing can be used to cover the face of the barrier. It is best to use wide and long rolls of the fabric so that splicing is minimized or eliminated. The fabric used to face the upstream surface of the brush should be non-woven geotextile equivalent to Class II fabric (see Table BFB-1).

The fabric should be securely buried at the bottom of an excavated trench that is at least 6″ deep in front of the barrier. Prior to backfilling the trench, the fabric should be securely staked at 3-foot centers with minimum 18″ long wooden stakes.

The fabric to be used should be supplied in lengths and widths to minimize vertical splices and eliminate horizontal splices. Avoid longitudinal splices of the fabric. Vertical splices must be securely fastened to each other so that flows will not short-circuit through the splice. The minimum vertical splice overlap should be 3 feet. Vertical splices must be securely fastened to each other so that flows will not short-circuit through the splice.

The top edge of the fabric should be secured so that it will not sag below the designed storage elevation. The upper edge can be anchored with twine fastened to the fabric and secured to stakes behind the barrier.

Table BFB-1 Requirements for Nonwoven Geotextile

Property	Test method	Class I	Class II	Class III	Class IV [1]
Tensile strength (lb) [2]	ASTM D 4632 grab test	180 minimum	120 minimum	90 minimum	115 minimum
Elongation at failure (%) [2]	ASTM D 4632	≥ 50	≥ 50	≥ 50	≥ 50
Puncture (pounds)	ASTM D 4833	80 minimum	60 minimum	40 minimum	40 minimum
Ultraviolet light (% residual tensile strength)	ASTM D 4355 150-hr exposure	70 minimum	70 minimum	70 minimum	70 minimum
Apparent opening size (AOS)	ASTM D 4751	As specified max. no. 40 [3]	As specified max. no. 40 [3]	As specified max. no. 40 [3]	As specified max. no. 40 [2]
Permittivity sec^{-1}	ASTM D 4491	0.70 minimum	0.70 minimum	0.70 minimum	0.10 minimum

Table copied from NRCS Material Specification 592.

[1] Heat-bonded or resin-bonded geotextiles may be used for Classes III and IV. They are particularly well suited to Class IV. Needle-punched geotextile is required for all other classes.
[2] Minimum average roll value (weakest principal direction).
[3] U.S. standard sieve size.

Construction Verification

Check finished size, elevation, storage, and shape for compliance with standard drawings and materials list. (Check for compliance with specifications if included in contract specifications.)

Common Problems

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

Variations in topography on-site indicate brush/fabric barrier will not function as intended. Change in design plan will be needed.

There is not adequate cleared, woody material to construct the barrier.

Materials specified in the plan are not available.

Maintenance

Inspect the barrier for short-circuiting of water or flow around the ends of the barrier after each significant rainfall event.

Sediment should be removed if it reaches a depth half of the original fabric height. If the area behind the barrier fills with sediment, there is a greater likelihood that water will flow around the end of the barrier and cause the practice to fail.

Large rainfall events that overtop the structure can result in gully erosion behind the barrier. This should be repaired as needed.

Brush/fabric barriers are temporary structures and should be removed when their useful life has been completed. All accumulated sediment should be properly stabilized. and the area where the barrier was located should be seeded and mulched immediately unless a different treatment is prescribed.

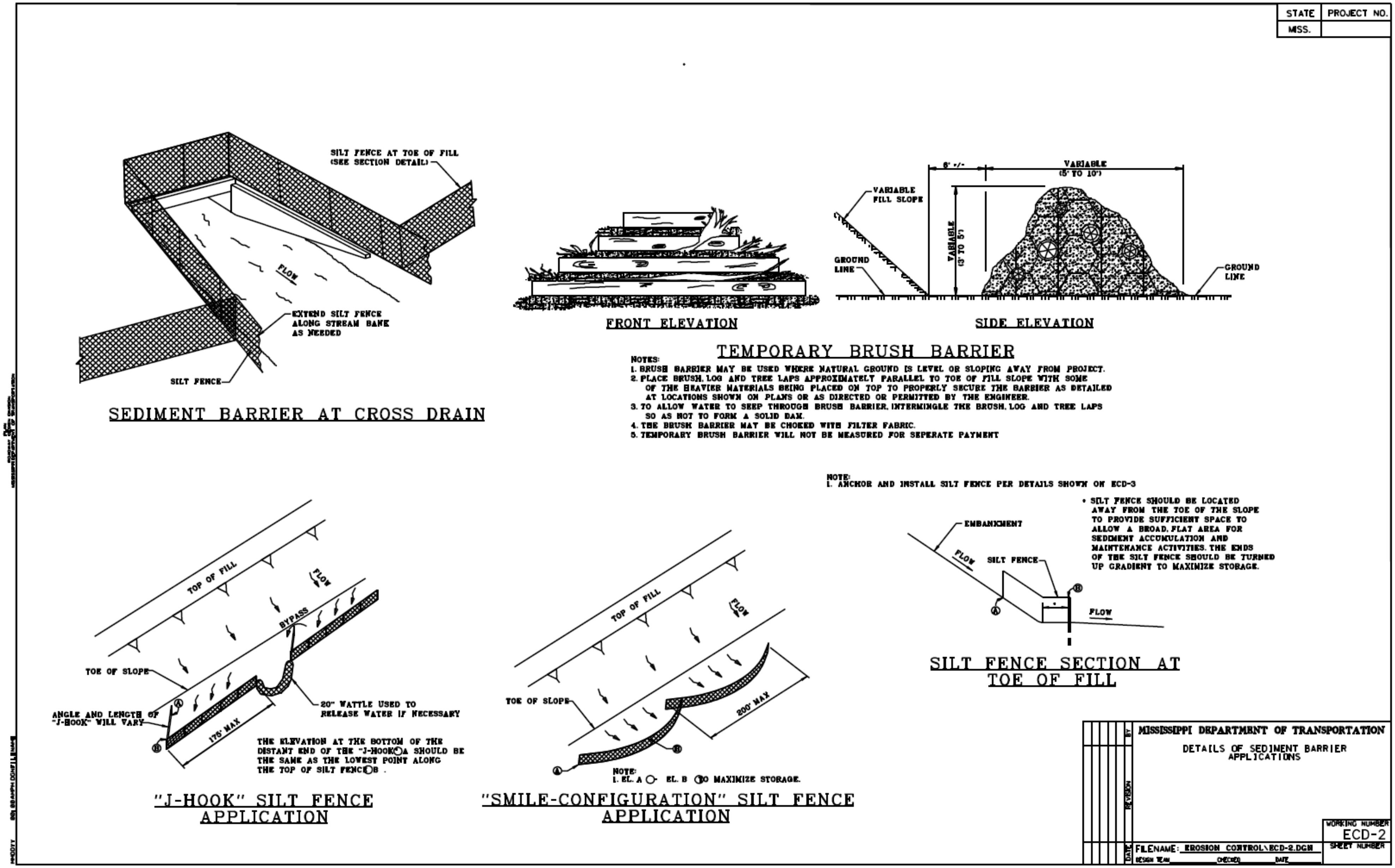
References

BMPs from Volume 1

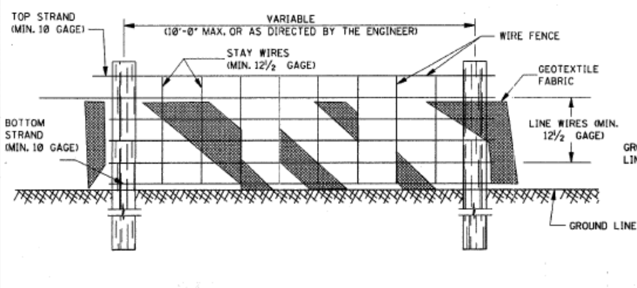
Chapter 4

MDOT Drawing ECD-2

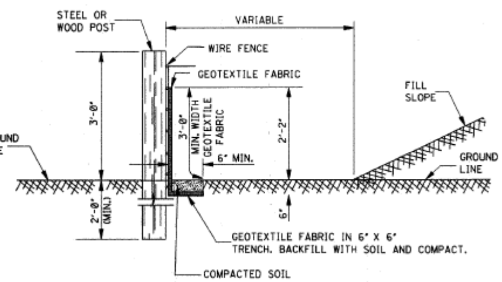
MDOT Drawing TEC-1


STATE
PROJECT NO.
MISS.
SILT FENCE AT TOE OF FILL (SEE SECTION DETAIL)
FLOW
EXTEND SILT FENCE ALONG STREAM BANK AS NEEDED
SILT FENCE
SEDIMENT BARRIER AT CROSS DRAIN
FRONT ELEVATION
6' +/-
VARIABLE (5' TO 10')
VARIABLE FILL SLOPE
VARIABLE (3' TO 5')
GROUND LINE
GROUND LINE
SIDE ELEVATION
TEMPORARY BRUSH BARRIER
NOTES:
1. BRUSH BARRIER MAY BE USED WHERE NATURAL GROUND IS LEVEL OR SLOPING AWAY FROM PROJECT.
2. PLACE BRUSH, LOG AND TREE LAPS APPROXIMATELY PARALLEL TO TOE OF FILL SLOPE WITH SOME OF THE HEAVIER MATERIALS BEING PLACED ON TOP TO PROPERLY SECURE THE BARRIER AS DETAILED AT LOCATIONS SHOWN ON PLANS OR AS DIRECTED OR PERMITTED BY THE ENGINEER.
3. TO ALLOW WATER TO SEEP THROUGH BRUSH BARRIER, INTERMINGLE THE BRUSH, LOG AND TREE LAPS SO AS NOT TO FORM A SOLID DAM.
4. THE BRUSH BARRIER MAY BE CHOKED WITH FILTER FABRIC.
5. TEMPORARY BRUSH BARRIER WILL NOT BE MEASURED FOR SEPERATE PAYMENT
NOTE:
1. ANCHOR AND INSTALL SILT FENCE PER DETAILS SHOWN ON ECD-3
• SILT FENCE SHOULD BE LOCATED AWAY FROM THE TOE OF THE SLOPE TO PROVIDE SUFFICIENT SPACE TO ALLOW A BROAD, FLAT AREA FOR SEDIMENT ACCUMULATION AND MAINTENANCE ACTIVITIES. THE ENDS OF THE SILT FENCE SHOULD BE TURNED UP GRADIENT TO MAXIMIZE STORAGE.
EMBANKMENT
FLOW
SILT FENCE
A
B
FLOW
SILT FENCE SECTION AT TOE OF FILL
TOP OF FILL
FLOW
BYPASS
TOE OF SLOPE
ANGLE AND LENGTH OF "J-HOOK" WILL VARY
A
B
175' MAX
20" WATTLE USED TO RELEASE WATER IF NECESSARY
THE ELEVATION AT THE BOTTOM OF THE DISTANT END OF THE "J-HOOK" A SHOULD BE THE SAME AS THE LOWEST POINT ALONG THE TOP OF SILT FENCE B .
"J-HOOK" SILT FENCE APPLICATION
TOP OF FILL
FLOW
TOE OF SLOPE
200' MAX
A
B
NOTE:
1. EL. A - EL. B TO MAXIMIZE STORAGE.
"SMILE-CONFIGURATION" SILT FENCE APPLICATION
MISSISSIPPI DEPARTMENT OF TRANSPORTATION
DETAILS OF SEDIMENT BARRIER APPLICATIONS
REVISION
BY
DATE
WORKING NUMBER
ECD-2
SHEET NUMBER
FILENAME: EROSION CONTROL\ECD-2.DGN
DESIGN TEAM
CHECKED
DATE

STATE	PROJECT NO.
MISS.	



FRONT ELEVATION

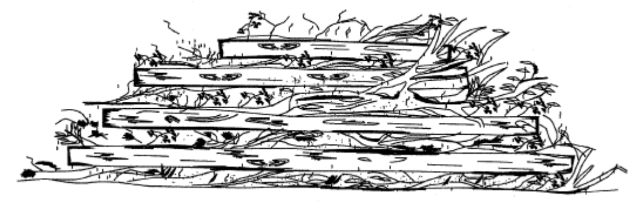


SIDE ELEVATION

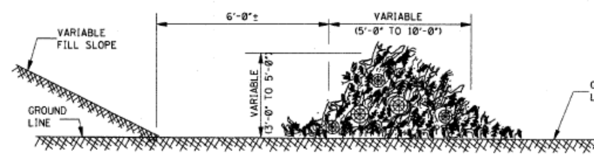
TEMPORARY SILT FENCE

NOTES:

1. WIRE SHALL BE MINIMUM OF 32" IN WIDTH AND SHALL HAVE A MINIMUM OF 6 LINE WIRES WITH 12" STAY SPACING.
2. GEOTEXTILE FABRIC SHALL BE A MINIMUM OF 36" IN WIDTH AND SHALL BE FASTENED ADEQUATELY TO THE WIRE AS DIRECTED BY THE ENGINEER.
3. STEEL POST SHALL BE 5'-0" IN HEIGHT AND OF THE SELF-FASTENER ANGLE STEEL TYPE. WOOD POST SHALL BE A MINIMUM OF 5'-0" IN HEIGHT AND 3" OR MORE IN DIAMETER. WIRE FENCE SHALL BE FASTENED TO WOODEN POST WITH NOT LESS THAN 9 GAGE WIRE STAPLES 1" LONG.
4. GEOTEXTILE FABRIC MEETING THE TYPE II MATERIAL REQUIREMENTS AND INSTALLED ACCORDING TO SPECIFICATIONS MAY BE USED WITHOUT WIRE FENCE.



FRONT ELEVATION

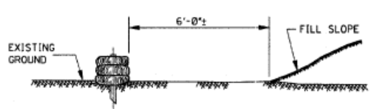


SIDE ELEVATION

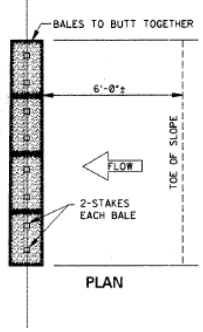
TEMPORARY BRUSH BARRIER

NOTES:

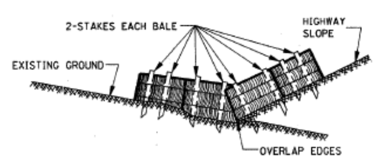
1. BRUSH BARRIER TO BE USED WHERE NATURAL GROUND IS LEVEL OR SLOPING AWAY FROM PROJECT.
2. PLACE BRUSH, LOG AND TREE LAPS APPROXIMATELY PARALLEL TO TOE OF FILL SLOPE WITH SOME OF THE HEAVIER MATERIALS BEING PLACED ON TOP TO PROPERLY SECURE THE BARRIER AS DETAILED AT LOCATIONS SHOWN ON PLANS OR AS DIRECTED BY THE ENGINEER.
3. TO ALLOW WATER TO FLOW THROUGH BRUSH BARRIER, INTERMINGLE THE BRUSH, LOG AND TREE LAPS SO AS NOT TO FORM A SOLID DAM.



ELEVATION



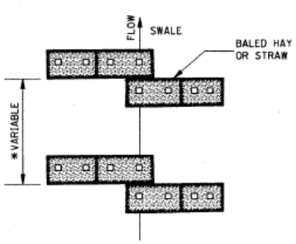
PLAN



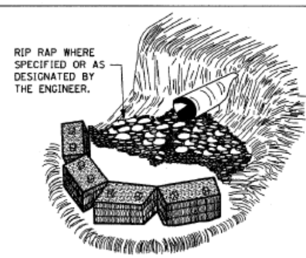
ELEVATION

NOTE: SIMILAR TREATMENT TO BE USED IN DITCHES.

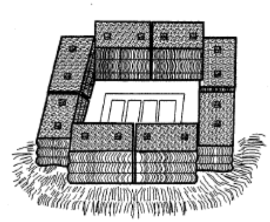
FALL OF DITCH (%)	DISTANCE* (ft)
0 - 1	100'
1 - 2	50'
>2	25'



PLAN



CULVERT



DROP INLET

TEMPORARY EROSION CHECKS USING HAY OR STRAW BALES

NOTE: EMBED ALL BALES 3" MINIMUM INTO GROUND AND STAKE (2" X 2" X 36") SECURELY.

GENERAL NOTES:

1. 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.
2. TEMPORARY BRUSH BARRIERS SHALL BE USED AS REQUIRED BUT WILL NOT BE MEASURED FOR SEPARATE PAYMENT.
3. THE USE OF TEMPORARY EROSION CONTROL MEASURES OTHER THAN TEMPORARY BRUSH BARRIERS WILL ONLY BE REQUIRED AND MEASURED FOR SEPARATE PAYMENT WHEN APPROPRIATE PAY ITEM(S) IS INCLUDED IN THE BID SCHEDULE OF THE PROPOSAL.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

TYPICAL TEMPORARY EROSION CONTROL MEASURES
(SILT FENCE, HAY BALES & BRUSH BARRIER)

ENGLISH

BY | REVISION | DATE

ISSUE DATE: OCTOBER 1, 1998

WORKING NUMBER TEC-1

SHEET NUMBER 142

Filter Strip (FS)

Practice Description

A filter strip is a wide belt of vegetation designed to provide infiltration, intercept sediment and other pollutants, and reduce stormwater flow and velocity. Filter strips are similar to grassed swales except that they are designed to intercept overland sheet flow (not channel flow). They cannot treat high-velocity flows. Surface runoff must be evenly distributed across the filter strip. Vegetation may consist of existing cover that is preserved and protected or that is to be planted to establish the strip. Once a channel forms in the filter strip, the filter strip is no longer effective. This practice applies on construction sites and other disturbed areas.

Planning Considerations

Filter strips provide their maximum benefit when established as early as possible after disturbances begin. This concept should receive strong consideration during the scheduling of practices to be installed. In some instances, the existing vegetation may be preserved to serve as a filter strip.

Filter strips should be strategically located on the contour to reduce runoff and increase infiltration. They should be situated downslope from the disturbed site and where runoff-water enters environmentally sensitive areas.

Overland flow entering filter strips should be primarily sheet flow. All concentrated flow should be dispersed prior to entering the filter strip.

Flow length should be based on slope percent and length, predicted amount and particle size distribution of sediment delivered to the filter strip, density and height of the filter strip vegetation, and runoff volume.

The slope of the drainage area above a filter strip should be greater than 1% but less than 10%. The ratio of the drainage area to the filter strip should be less than 50:1.

Existing vegetation may be used if it meets stand density and height requirements and provides for uniform flow through the existing vegetation. The existing vegetation strip must be on a contour to be effective.

Site preparation for filter strips requires that the filter strip be placed on the contour. Variation in placement on the contour should not exceed a 0.5% longitudinal (perpendicular to the flow length) gradient.

All soil amendments should be applied according to a soil test recommendation for the planned vegetation.

The vegetation for filter strips must be permanent herbaceous vegetation of a single species or a mixture of grasses or legumes that have stiff stems and a high stem density near the ground surface. Stem density should be such that the stem spacing does not exceed 1″.

Design Criteria and Construction

Installation (Preservation of Existing Vegetation)

Prior to start of installation, filter strips should be designed by a qualified professional. Plans and specifications should be referred to by field personnel throughout the construction process.

Designate the areas for preserving vegetation on the design plan map.

Indicate in the plan that the designated areas will be fenced or flagged and will not be disturbed. This includes avoiding surface disturbances that affect sheet flow of stormwater runoff and not storing debris from clearing and grubbing, and other construction waste material, in the filter strips during construction.

Installation (Planting)

Site Preparation

If the upper edge of the filter strip does not have a level edge, remove any obstructions and grade the upper edge of the filter strip so that runoff evenly enters the filter strip.

Fill and smooth any rills and gullies that exist over the filter strip area to ensure that overland flow will discharge across the filter strip along a smooth surface.

Seedbed Preparation

Grade and loosen soil to a smooth firm surface to enhance rooting of seedlings and reduce rill erosion. If existing, break up large clods and loosen compacted, hard, or crusted soil surfaces with a disk, ripper, chisel, harrow, or other tillage equipment. Avoid preparing the seedbed under excessively wet conditions.

For broadcast seeding and drilling, tillage should adequately loosen the soil to a depth of at least 6″, alleviate compaction, and smooth and firm the soil for the proper placement of seed.

For no-till drilling, the soil surface does not need to be loosened unless the site has surface compaction. If compaction exists, the area should be chiseled across the slope to a depth of at least 6″.

Applying Soil Amendments

Liming

Follow soil test recommendation. If a soil test is not available, use 2 tons/acre of ground agricultural lime on clayey soils (approximately 90 lbs/1000 ft^2) and 1 ton/acre on sandy soils (approximately 45 lbs/1000 ft^2). (Exception: If the cover is tall fescue and clover, use the 2 tons/acre rate (90 lbs/1000 ft^2) on both clayey and sandy soils.)

Spread the specified amount of lime and incorporate into the top 6″ of soil after applying fertilizer.

Fertilizing

Apply fertilizer at rates specified in the soil test recommendation. In the absence of soil tests, use the following as a guide:

Grass alone: 8-24-24 or equivalent - 400 lbs/acre (9.2 lbs/1000 ft^2). When vegetation has emerged to a stand and is growing, 30 to 40 lbs/acre (0.8 lb/1000 ft^2) of additional nitrogen fertilizer should be applied.

Grass-legume mixture: 8-24-24 or equivalent-400 lbs/acre (9.2 lbs/1000 ft^2). When vegetation has emerged to a stand and is growing, 30 to 40 lbs (0.8 lb/1000 ft^2) of additional nitrogen fertilizer should be applied.

Legume alone: 0-20-20 or equivalent-500 lbs/acre (11.5 lbs/1000 ft^2).

Note: Fertilizer can be blended to meet exact fertilizer recommendations. Take soil test recommendations to local fertilizer dealer for bulk fertilizer blends. This may be more economical than bagged fertilizer.

Incorporate lime and fertilizer to a minimum depth of at least 6″ or more by disking or chiseling on slopes of up to 3:1.

Planting

Plant the species specified in the plan at the rate and depth specified. In the absence of plans and specifications, plant species and seeding rates may be selected by qualified persons using Figure FS-1 and Table FS-1.

Apply seed uniformly using a cyclone seeder, drill seeder, cultipacker seeder, or hydroseeder.

When using a drill seeder, plant grasses and legumes ¼″ to ½″ deep. Calibrate equipment in the field.

When planting by methods other than a drill seeder or hydroseeder, cover seed by raking or by dragging a chain, brush, or mat. Then firm the soil lightly with a roller. Seed can also be covered with hydro-mulched wood fiber and tackifier. Legumes require inoculation with nitrogen-fixing bacterial to ensure good growth. Purchase inoculum specific for the seed and mix with seed prior to planting.

Mulching

Cover 65% to 75% of the surface with the specified mulch materials. Crimp, tack, or tie down straw mulch with netting. Mulching is extremely important for successful seeding (see *Mulching Practice* for more details.)

Construction Verification

Check materials and installation for compliance with specifications during installation of products.

Table FS-1 Commonly Used Plants for Permanent Cover

Species	Seeding Rates/Ac PLS[1]	North Seeding Dates	Central	South
Bahia grass,[2] Pensacola	40 lbs	--	Mar 1-July 1	Feb 1-Nov 1
Bermuda grass, Common	10 lbs	Apr 1-July 1	Mar 15-July 15	Mar 1-July 15
Bahia grass, Pensacola Bermuda grass, Common	30 lbs 5 lbs	--	Mar 1-July 1	Mar 1-July 15
Bermuda grass, Hybrid (Lawn Types)	Solid sod	Anytime	Anytime	Anytime
Bermuda grass, Hybrid (Lawn Types)	Sprigs 1/sq ft	Mar 1-Aug 1	Mar 1-Aug 1	Feb 15 - Sep 1
Fescue, Tall	40-50 lbs	Sep 1-Nov 1	Sep 1-Nov 1	--
Sericea	40-60 lbs	Mar 15-July 15	Mar 1-July 15	Feb 15 -July 15
Sericea & Common Bermuda grass	40-60 lbs 10 lbs	Mar 15 -July 15	Mar 1-July 15	Feb 15-July 15
Switch grass, Alamo	4 lbs	Apr 1-Jun 15	Mar 15-Jun 15	Mar 15-Jun 15

[1] A late-fall planting of Bahia grass should contain 45 pounds of small grain to provide cover during winter months.

[2] PLS means pure live seed and is used to adjust seeding rates. For example, to plant 10 lbs of a species with germination of 80% and with 10% inert material, 10 PLS = 10 lbs/80% - 10% = 10/0.70 = 14.3 lbs.

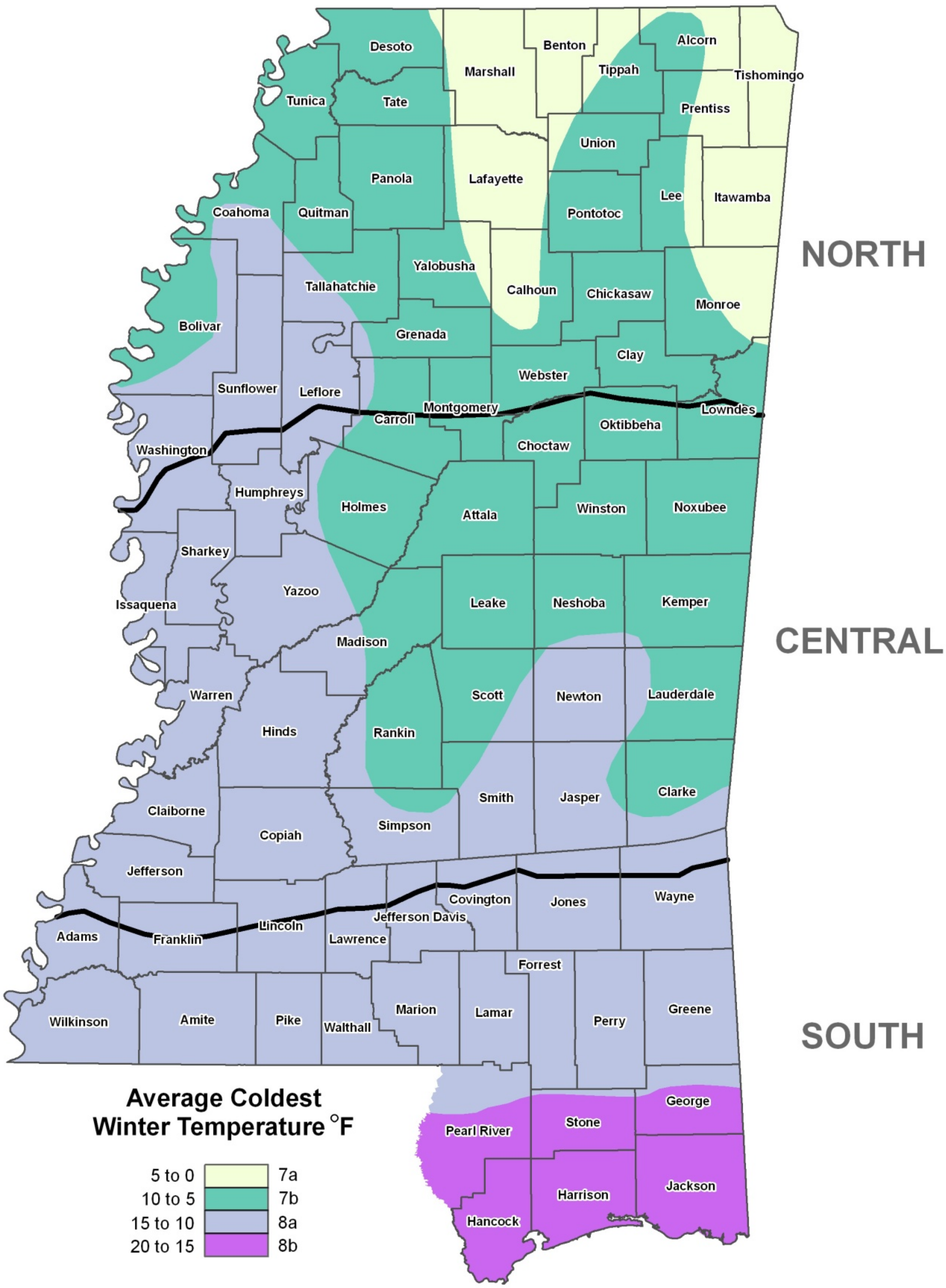


Figure FS-1 Geographical Areas for Species Adaptation and Seeding Dates

Common Problems

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

Variations in topography on-site indicate filter strip will not function as intended.

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

Seeding at the wrong time of the year results in an inadequate stand. Reseed according to specifications of a qualified professional.

Inadequate mulching results in an inadequate stand, bare spots, or eroded areas; prepare seedbed, reseed, cover seed evenly, and tack or tie down mulch, especially on slopes, ridges, and in channels (see recommendations under *Maintenance*).

Maintenance

Erosion

Check for eroded channels in the filter strip after every storm event until the vegetation is well established. Eroded areas should be repaired by filling and/or smoothing and by reapplication of lime, fertilizer, seed, and mulch. It is particularly important that the surface is smooth and promotes sheet flow of storm runoff.

Generally, a stand of vegetation cannot be determined to be fully established until vegetative cover has been maintained for at least 1 year after planting.

Reseeding

Inspect seeding monthly for stand survival and vigor.

If stand is inadequate, identify the cause of failure—choice of plant materials, lime and fertilizer quantities, poor seedbed preparation, or weather—and take corrective action. If vegetation fails to grow, have the soil tested to determine whether pH is in the correct range or if nutrient deficiency is a problem.

Stand conditions, particularly percent coverage, will determine the extent of remedial actions such as seedbed preparation and reseeding. A qualified professional should be consulted to advise on remedial actions. Consider drill seeding if enough residue exists.

Fertilizing

Establishment may require refertilizing the stand in the second growing season. Follow soil test recommendations or the specifications provided for establishment.

Mowing

Mow vegetation to prevent woody plants from invading.

Certain species can be weakened by mowing regimes that significantly reduce their food reserves stored for the next growing season. Fescue should not be mowed closer than 4″ during the summer. Sericea should not be mowed closer than 4″ during the growing season, and it should not be mowed at all between late summer and frost. Bermuda grass and Bahia grass are tolerant of most mowing regimes and can be mowed often and close, if so desired, during their growing season.

References

Volume 1

Floating Turbidity Barrier (FB)

—— FTB —— FTB ——

Practice Definition

A floating turbidity barrier consists of geotextile material (curtain) with floats on the top, weights on the bottom, and an anchorage system that minimizes sediment transport from a disturbed area that is adjacent to or within a body of water. The barrier provides sedimentation and turbidity protection for a watercourse from up-slope land-disturbance activities where conventional erosion and sediment controls cannot be used or need supplemental sediment control, or from dredging or filling operations within a watercourse. The practice can be used in non-tidal and tidal watercourses where intrusion into the watercourse by construction activities has been permitted and subsequent sediment movement is unavoidable.

Planning Considerations

Soil loss into a watercourse results in long-term suspension of sediment. In time, the suspended sediment may travel long distances and affect widespread areas. A turbidity barrier is designed to deflect and contain sediment within a limited area and provide enough residence time so that soil particles will fall out of suspension and not travel to other areas.

Turbidity barrier types must be selected based on the flow conditions within the waterbody, whether it is a flowing channel, lake, pond, or a tidal watercourse. The specifications contained within this practice pertain to minimal- and moderate-flow conditions where the velocity of flow may reach 5 ft/sec (or a current of approximately 3-knots). For situations where there are greater flow velocities or currents, a qualified design professional and the product manufacturer should be consulted.

Consideration must also be given to the direction of water movement in channel-flow situations. Turbidity barriers are not designed to act as water impoundment dams and cannot be expected to stop the flow of a significant volume of water. They are designed and installed to trap sediment; not to halt the movement of water itself. In most situations, turbidity barriers should not be installed across channel flows. There is an exception to this rule. This occurs when there is a danger of creating a sediment buildup in the middle of a watercourse, thereby blocking access or creating a sediment bar. Curtains have been used effectively in large areas of moving water by forming a very long-sided, sharp "V" to deflect clean water around a work site, confining a large part of the sediment-laden water to the work area inside the "V" and directing much of the sediment toward the shoreline. Care must be taken, however, not to install the curtain perpendicular to the water current.

In tidal or moving water conditions, provisions must be made to allow the volume of water contained within the barrier to change. Since the bottom of the barrier is weighted and external anchors are frequently added, the volume of water contained within the curtain will be much greater at high tide versus low tide, and measures must be taken to prevent the curtain from submerging. In addition to allowing slack in the curtain to rise and fall, water must be allowed to flow through the curtain if the curtain is to remain in roughly the same place and maintain the same shape. Normally, this is achieved by constructing part of the curtain from a heavy, woven filter fabric. The fabric allows the water to pass through the curtain, but retains the sediment particles. Consideration should be given to the volume of water that must pass through the fabric and the sediment particle size when specifying fabric permeability.

Sediment, which has been deflected and settled out by the curtain, may be removed if so directed by the on-site inspector or the permitting agency. However, consideration must be given to the probable outcome of the procedure, which may create more of a sediment problem by re-suspension of particles and accidental dumping of the material by the equipment involved. It is, therefore, recommended that the soil particles trapped by a turbidity curtain be removed only if there has been a significant change in the original contours of the affected area in the watercourse. Regardless of the decision made, soil particles should always be allowed to settle for a minimum of 6-12 hours before removal by equipment or before removal of a turbidity curtain.

It is imperative that all measures in the erosion-control plan be used to keep sediment out of the watercourse. However, when proximity to the watercourse makes successfully mitigating sediment loss impossible, the use of the turbidity curtain during land disturbance is essential. Under no circumstances should permitted land-disturbing activities create violations of water quality standards.

Design Criteria and Construction

Floating turbidity barriers are normally classified into three types:

- Type I (see Figure FB-1) is used in protected areas where there is no current and the area is sheltered from wind and waves.

- Type II (see Figure FB-1) is used in areas where there may be small to moderate current (up to 2 knots or 3.5 ft/sec) and/or wind and wave action can affect the curtain.

- Type III (see Figure FB-2) is used in areas where considerable current (up to 3 knots or 5 ft/sec) may be present, where tidal action may be present, and/or where the curtain is potentially subject to wind and wave action.

Turbidity curtains should extend the entire depth of the watercourse whenever the watercourse in question is not subject to tidal action and/or significant wind and wave forces. This prevents sediment-laden water from escaping under the barrier, scouring, and re-suspending additional sediments.

In tidal and/or wind- and wave-action situations, the curtain should never be so long as to touch the bottom. A minimum 1-foot gap should exist between the weighted, lower end of the skirt and the bottom at “mean” low water. Movement of the lower skirt over the bottom due to tidal reverses or wind and wave action on the flotation system may fan and stir sediments already settled out.

In tidal and/or wind- and wave-action situations, it is seldom practical to extend a turbidity curtain depth lower than 10 to 12 feet below the surface, even in deep water. Curtains that are installed deeper than this will be subjected to very large loads with consequent strain on curtain materials and the mooring system. In addition, a curtain installed in such a manner can "billow up" toward the surface under the pressure of the moving water, which will result in an effective depth that is significantly less than the skirt depth.

Turbidity curtains should be located parallel to the direction of flow of a moving body of water. Turbidity curtains should not be placed across the main flow of a significant body of moving water.

When sizing the length of the floating curtain, allow an additional 10-20% variance in the straight-line measurements. This will allow for measuring errors, make installation easier and reduce stress from potential wave action during high winds.

An attempt should be made to avoid an excessive number of joints in the curtain. A minimum continuous span of 50 feet between joints is a good “rule of thumb.”

For stability reasons, a maximum span of 100 feet between anchor or stake locations is also a good rule to follow.

The ends of the curtain, both floating upper and weighted lower, should extend well up onto the shoreline, especially if high water conditions are expected. The ends should be secured firmly to the shoreline to fully enclose the area where sediment may enter the water.

When there is a specific need to extend the curtain to the bottom of the watercourse in tidal or moving water conditions, a heavy, woven, pervious filter fabric may be substituted for the normally recommended impervious geotextile. This creates a “flow-through” medium, which significantly reduces the pressure on the curtain and will help to keep it in the same relative location and shape during the rise and fall of tidal waters.

Typical installation layouts of turbidity curtains can be seen in Figure FB-3. The number and spacing of external anchors will vary depending on current velocities and potential wind and wave action. Manufacturer’s recommendations should be followed.

In navigable waters, additional permits may be required from the U.S. Army Corps of Engineers or other regulatory agencies if the barrier creates an obstruction to navigation.

Site Preparation

If a floating turbidity barrier is specified in the erosion and sediment control plan, it should be installed before any land-disturbing activities. Shoreline anchor points should be located according to the plans.

Materials and Installation Requirements

Barriers should be a bright color (yellow or "international" orange) that will attract the attention of nearby boaters. The curtain fabric must meet the minimum requirements noted in Table FB-1.

When installing Type I barrier in the calm water of lakes or ponds, it is usually sufficient to merely set the curtain end stakes or anchor points (using anchor buoys if bottom anchors are employed); then, tow the curtain in the furled condition out and attach it to these stakes or anchor points. Following this, any additional stakes or buoyed anchors required to maintain the desired location of the curtain may be set, and these anchor points made fast to the curtain. Only then, the furling lines should be cut to let the curtain skirt drop.

When installing Type II or III barriers in rivers or in other moving water, it is important to set all the curtain anchor points. Care must be taken to ensure that anchor points are of sufficient holding power to retain the curtain under the expected current conditions, before putting the furled curtain into the water. Anchor buoys should be employed on all anchors to prevent the current from submerging the flotation at the anchor points. If the moving water into which the curtain is being installed is tidal and will subject the curtain to currents in both directions as the tide changes, it is important to provide anchors on both sides of the curtain for two reasons:

- Curtain movement will be minimized during tidal current reversals.
- The curtain will not overrun the anchors, pulling them out when the tide reverses.

When the anchors are secure, the furled curtain should be secured to the upstream anchor point and then sequentially attached to each next downstream anchor point until the entire curtain is in position. At this point, and before unfurling, the "lay" of the curtain should be assessed and any necessary adjustments made to the anchors. Finally, when the location is ascertained to be as desired, the furling lines should be cut to allow the skirt to drop.

The anchoring line attached to the flotation device on the downstream side will provide support for the curtain. Attaching the anchors to the bottom of the curtain could cause premature failure of the curtain due to the stresses imparted on the middle section of the curtain.

Seams in the fabric should be either vulcanized welded or sewn, and should develop the full strength of the fabric.

Flotation devices should be flexible, buoyant units contained in an individual flotation sleeve or collar attached to the curtain. Buoyancy provided by the flotation units should be sufficient to support the weight of the curtain and maintain a freeboard of at least 3″ above the water surface level.

Load lines must be fabricated into the bottom of all floating turbidity curtains. Type II and Type III curtains must have load lines also fabricated into the top of the fabric. The top load line should consist of woven webbing or vinyl-sheathed steel cable and should have break strength in excess of 10,000 pounds (5 t). The supplemental (bottom) load line should consist of a chain incorporated into the bottom hem of the curtain of sufficient weight to serve as ballast to hold the curtain in a vertical position. Additional anchorage should be provided as necessary. The load lines should have suitable connecting devices that develop the full breaking strength for connecting to load lines in adjacent sections. (See Figures FB-1 and FB-2 which portray this orientation.)

Table FB-1 Curtain Fabric Material Requirements for Floating Turbidity Barriers

Characteristic Test Method	16 Oz Nominal Laminated	18 Oz Laminated	22 Oz Coated	Geotextile Filter
Construction	Vinyl Laminate On 1300 Denier 9 X 9 Scrim	Vinyl Laminate On1300 Denier 9 X 9 Scrim	Vinyl Coated On Woven 6 Oz Polyester Base	Woven Polypropylene
Weight ASTM D-751-95 Sec 16	Nominal 16 Oz/Sq Yd 376 Gr/Sq M	18 Oz/Sq Yd 423 Gr/Sq M	22 Oz/Sq Yd 517 Gr/Sq M	7.5 Oz/Sq Yd 176 Gr/Sq M
Adhesion ASTM D-751-95 Sec 43.1.2	15 Lb/In 14 Dan/5 Cm	15 Lb/In 14 Dan/5 Cm	14 Lb/In 13 Dan/5 Cm	Not Applicable
Tensile Strength ASTM D-751-95 Sec 12	324 X 271 Lb/In 308 X 258 Dan/5 Cm	397 X 373 Lb/In 378 X 363 Dan/5 Cm	500 X 400 Lb/In 476 X 389 Dan / 5 Cm	350 X 250 Lb/ In 333 X 230 Dan / 5 Cm
Tear Strength ASTM D-751-95 Sec 29	76 X 104 Lb/In 72 X 99 Dan/5 Cm	96 X 86 Lb/In 91 X 82 Dan/5 CM	132 X 143 Lb/In 126 X 136 Dan / 5 Cm	95 X 55 Lb/In 90 X 52 Dan / 5 Cm
Hydrostatic ASTM D-751-95 Sec 34.2	385 Lb/Sq In 2674 kPa	385 Lb/Sq In 674 kPa	881 Lb/Sq In 6118 kPa	Not Applicable

External anchors may consist of 2″ x 4″ or 2½″ minimum-diameter wooden stakes, or 1.33 pounds/linear foot steel posts when Type I installation is used. When Type II or Type III installations are used, bottom anchors should be used.

Bottom anchors must be sufficient to hold the curtain in the same position relative to the bottom of the watercourse without interfering with the action of the curtain. The anchor may dig into the bottom (grappling hook, plow, or fluke-type) or may be weighted (mushroom type), and should be attached to a floating anchor buoy via an anchor line. The anchor line would then run from the buoy to the top load line of the curtain. When used with Type III installations, these lines must contain enough slack to allow the buoy and curtain to float freely with tidal changes without pulling the buoy or curtain down and must be checked regularly to make sure they do not become entangled with debris. As previously noted, anchor spacing will vary with current velocity and expected wind and wave action. Manufacturer's recommendations should be followed. See orientation of external anchors and anchor buoys for tidal installation in Figure FB-2.

Installing two parallel curtains, separated at regular intervals by 10-foot-long wooden boards or lengths of pipe can increase the effectiveness of the barrier.

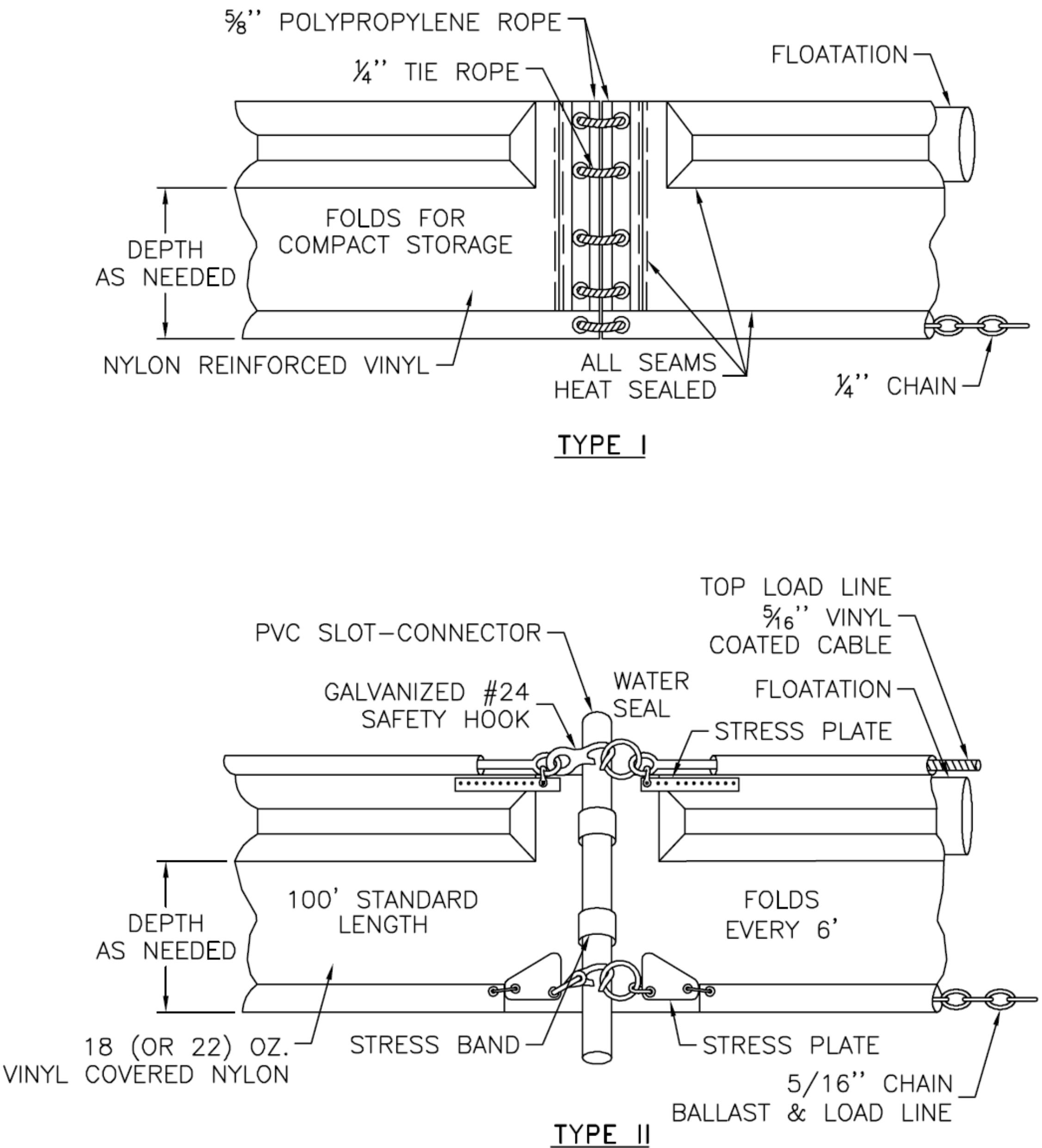


Figure FB-1 Type I and II Floating Turbidity Barriers

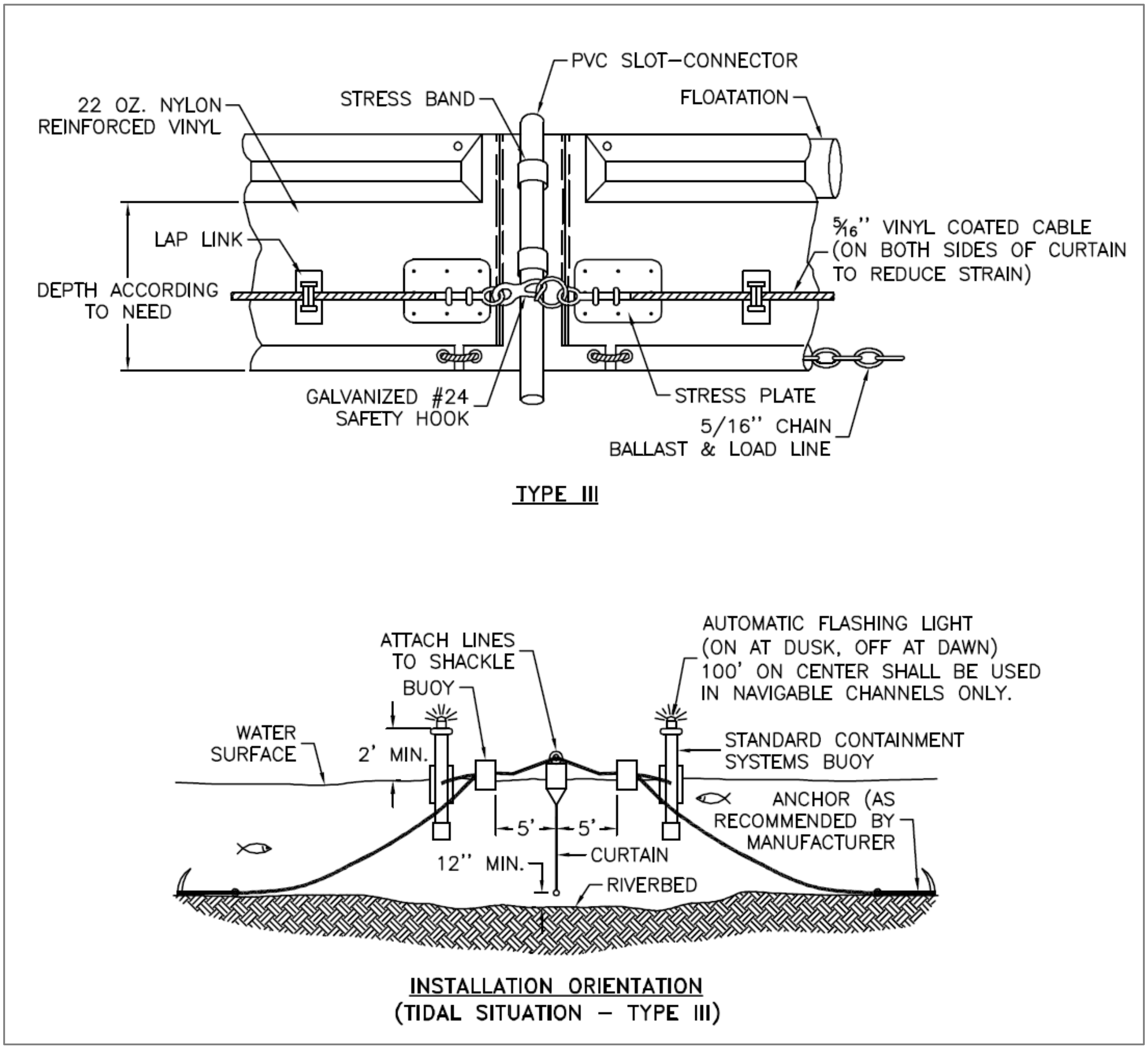


Figure FB-2 Type III Floating Turbidity Barrier

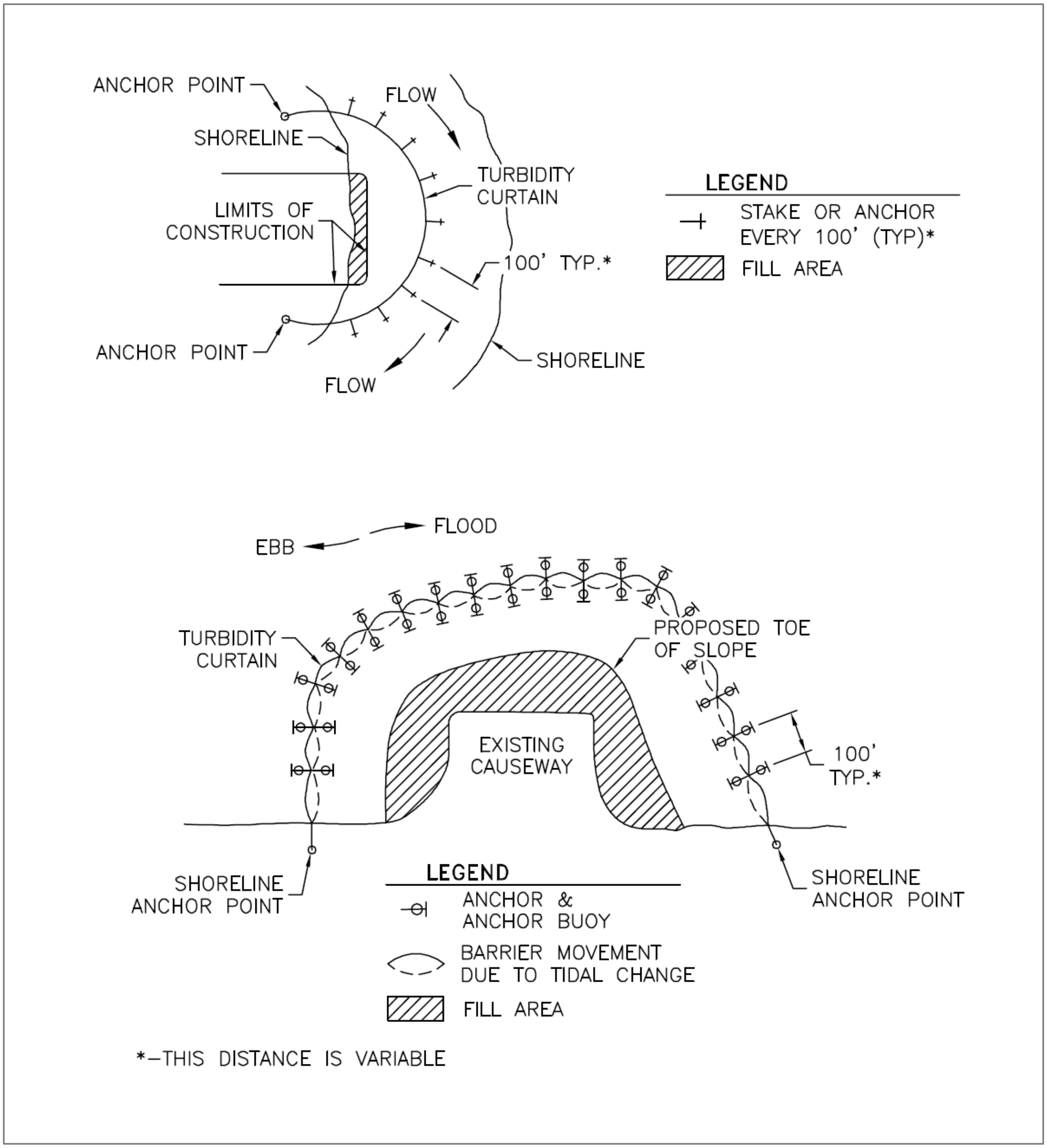


Figure FB-3 Typical Installation Layouts

Construction Verification

Check the type of floating turbidity barrier, installation location, and the installation and anchorage procedures for compliance with the standard drawings and materials list. (Check for compliance with specifications if included in contract specifications.)

Removal

Care should be taken to protect the skirt from damage as the turbidity curtain is dragged from the water.

The site selected to bring the curtain ashore should be free of sharp rocks, broken cement, debris, etc., so as to minimize damage when hauling the curtain over the area.

If the curtain has a deep skirt, it can be further protected by running a small boat along its length with a crew installing furling lines before attempting to remove the curtain from the water.

Common Problems

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

Variations in topography on site indicate that a floating turbidity barrier will not function as intended. Change in plan will be needed.

The specified anchorage system will not function as planned.

Turbid water is escaping from the barrier enclosure.

Materials specified in the plan are not available.

Maintenance

The floating turbidity barrier should be maintained for the duration of the project to ensure the continuous protection of the watercourse. Anchors, anchor lines, and buoys must be regularly checked to remove debris.

If repairs to the geotextile fabric become necessary, normally, repair kits are available from the manufacturer. Follow the manufacturer's instructions to ensure the adequacy of the repair.

When the curtain is no longer required as determined by the responsible individual, the curtain and related components should be removed in such a manner as to minimize turbidity. If required by the contract or the responsible individual, sediment should be removed and the original depth (or plan elevation) restored before removing the curtain. Remaining sediment should be sufficiently settled before removing the curtain. Any spoils should be taken to an upland area and stabilized.

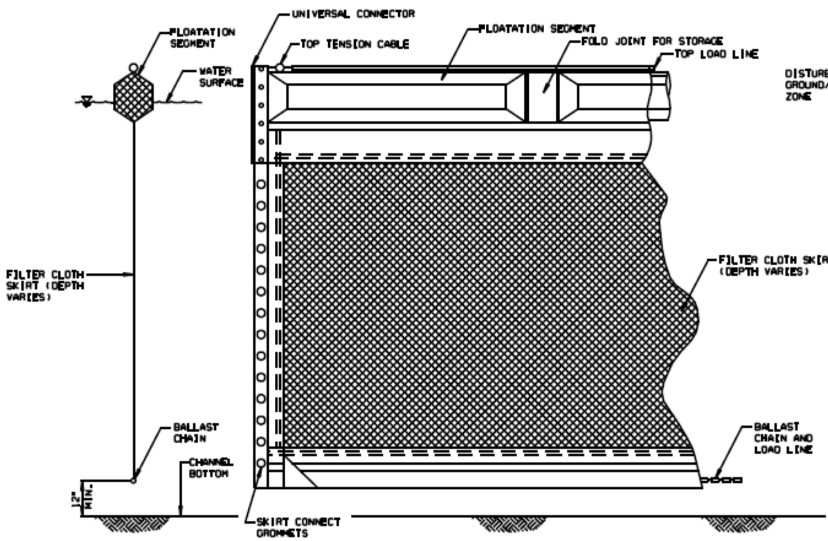
References

MDOT Drawing ECD-19

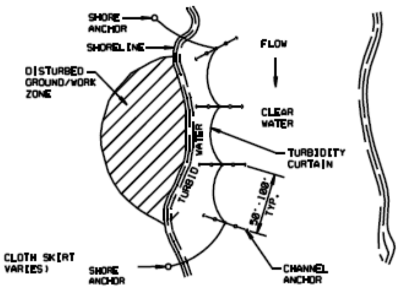
Floating Turbidity Curtain 4-277

STATE	PROJECT NO.
MISS.	

FLOATING TURBIDITY CURTAIN

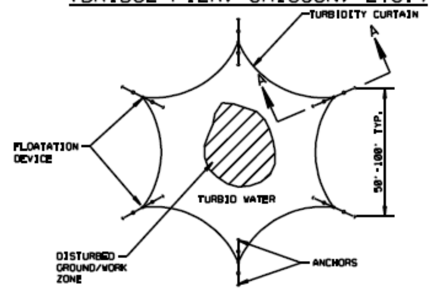


TYPICAL ANCHORING PLAN FOR SHORELINE/RIVER EDGE WORK



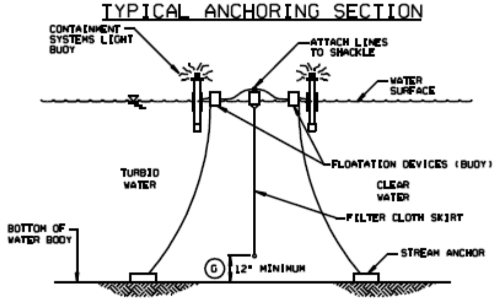
PLAN VIEW

TYPICAL ANCHORING PLAN FOR MID CHANNEL WORK (BRIDGE PIER, CAISSON, ETC.)



PLAN VIEW

TYPICAL ANCHORING SECTION



SECTION A-A

AUTOMATIC FLASHING LIGHT BUOY (ON AT DUSK-OFF AT DAWN) 100' ON CENTER SHALL BE USED IN NAVIGABLE CHANNELS ONLY

EROSION CONTROL PLAN LEGEND: ┼──┼──┼──┼ FLOATING TURBIDITY CURTAIN

FLOATING TURBIDITY CURTAIN GENERAL NOTES

(A) FLOATING TURBIDITY CURTAINS (ALSO KNOWN AS TURBIDITY BARRIERS OR SILT CURTAINS) CREATE A BARRIER TO PREVENT TURBID WATER FROM ENTERING CLEAR WATER. FLOATING TURBIDITY CURTAINS SHOULD BE USED TO ISOLATE ACTIVE CONSTRUCTION AREAS WITHIN OR ADJACENT TO A BODY OF WATER TO MINIMIZE THE MIGRATION OF SILT LADEN WATER OUT OF THE CONSTRUCTION ZONE.

(B) TURBIDITY CURTAINS SHALL NOT BE INSTALLED PERPENDICULAR ACROSS THE MAIN FLOW OF A SIGNIFICANT BODY OF MOVING WATER.

(C) FLOATING TURBIDITY CURTAINS SHALL NO BE USED WHERE THE ANTICIPATED FLOW VELOCITIES WILL EXCEED 5 FT/SEC.

(D) TURBIDITY CURTAINS SHALL BE ANCHORED TO PREVENT DRIFT SHOREWARD OR DOWNSTREAM. ANCHORAGE SHALL BE INSTALLED ON BOTH SHORE AND STREAM SIDE. CURTAINS SHALL BE INSTALLED AS CLOSE TO PROJECT SITE AS POSSIBLE. BARRIERS SHOULD BE A BRIGHT COLOR (YELLOW OR "INTERNATIONAL" ORANGE ARE RECOMMENDED) THAT WILL ATTRACT THE ATTENTION OF NEARBY BOATERS.

(E) SHORE ANCHORS SHALL CONSIST OF A POST WITH DEADMAN OR APPROVED EQUAL. STREAM ANCHORS SHALL BE OF SUFFICIENT SIZE TO STABILIZE THE BARRIER WITH NUMBER AND SPACING DEPENDENT ON WATERWAY VELOCITIES AND MANUFACTURER'S RECOMMENDATIONS.

(F) IN SHALLOW WATER (2 FEET OF DEPTH OR LESS) A TURBIDITY CURTAIN MAY BE INSTALLED ON STAKES DRIVEN INTO THE BED OF THE WATER BODY.

(G) FABRIC SECTIONS SHALL BE CONNECTED END TO END WITH MINIMUM ." DIAMETER POLYPROPYLENE ROPE. FABRIC SHALL BE SEAMED TOGETHER IN A MANNER THAT RETAINS THE OVERALL TENSILE STRENGTH.

(H) DESIGN OF CURTAIN AND ANCHORAGE SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. FILTER CLOTH SKIRT SHOULD BE ABLE TO WITHSTAND THE FORCES IMPARTED ON IT DUE TO THE EXPECTED WIND VELOCITY OR STREAM VELOCITY. FABRIC SHALL BE MADE OF A NON-DETERIORATING MATERIAL, SUCH AS PLASTIC OR NYLON, WHICH WILL ALLOW WATER TO PASS THROUGH WHILE STILL RETAINING SEDIMENT.

(I) THE TURBIDITY CURTAIN AND ADJACENT WORK AREAS SHALL NOT BE DISTURBED 12 HOURS PRIOR TO REMOVAL FROM WATER BODY. MAINTENANCE SHALL BE PERFORMED AS NEEDED. CONTRACTOR SHALL REMOVE THE CURTAIN AT COMPLETION OF WORK IN A MANNER THAT WILL PREVENT SILTATION OF THE WATERWAY. DURING REMOVAL, EXTREME CARE SHOULD BE TAKEN NOT TO DISTURB ANY SEDIMENT DEPOSITS.

(J) MAINTAIN 12" MINIMUM GAP BETWEEN SKIRT BOTTOM AND CHANNEL BOTTOM TO PREVENT ACCUMULATED SEDIMENT FROM PULLING TOP OF CURTAIN BELOW WATER SURFACE.

(K) IN WIND OR WAVE ACTION SITUATIONS, THE MAXIMUM DEPTH OF THE CURTAIN SHALL BE 12 FEET.

(L) CONCENTRATED FLOWS SHALL NOT DISCHARGE BEYOND FLOATING TURBIDITY CURTAIN. CURTAINS ARE NOT TO BE INSTALLED ACROSS FLOWING BODY OF WATER.

(M) WHEN INSTALLED IN A NAVIGABLE WATERWAY, BUOYS SHOULD BE LIT ACCORDING TO REGULATORY AGENCY STANDARDS.

(N) WHEN ESTIMATING THE LENGTH OF TURBIDITY CURTAIN, ALLOW 10 TO 20 PERCENT VARIANCE IN STRAIGHT LINE MEASUREMENT.

(O) PAYMENT FOR FLOATING TURBIDITY CURTAIN SHALL INCLUDE ALL MATERIAL AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF TURBIDITY CURTAINS

(P) ONLY FLOATING TURBIDITY CURTAINS LISTED ON THE APPROVED PRODUCTS LIST MAY BE USED.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

FLOATING TURBIDITY CURTAIN

WORKING NUMBER: ECD-19

SHEET NUMBER

BY / REVISION / DATE

FILENAME: EROSION CONTROL\ECD-19.DGN

DESIGN TEAM ____ CHECKED ____ DATE ____

Rock Filter Dam (RD)

CD

Practice Description

A rock filter dam is a stone embankment designed to help capture sediment in natural or constructed drainageways on construction sites. This practice can also be used as a forebay to a sediment basin to help capture coarser particles of sediment. It is usually located so that it intercepts runoff (primarily from disturbed areas), is accessible for periodic sediment removal, and does not interfere with construction activities

Planning Considerations

Rock filter dams are used across drainageways to help remove coarser sediment particles and reduce off-site sediment delivery. Since rock filter dams are installed in flowing water, all local, state and federal laws and regulations must be followed during the design and construction process.

Dams should be designed so that impounded water behind the structures will not encroach on adjoining property owners or on other sediment- and erosion-control measures that outlet into the impoundment area.

Dams should be located so that the basin intercepts runoff (primarily from disturbed areas) and has adequate storage, and so that the basin can be accessed for sediment removal. Dams should also be located, as much as possible, in areas that do not interfere with construction activities.

Rock filter dams are not permanent structures. The design life of the structure is 3 years or less.

Design Criteria and Construction

Drainage Area

The drainage area above the dam should not exceed 10 acres.

Dam Height

The height of dam will be limited by the channel bank height or 8 feet, whichever is less. The dam height should also not exceed the elevation of the upstream property line. Water will bypass over the top of the dam, and the back slope of the rock dam should be designed to be stable.

Spillway Capacity

The top of the dam should be designed to handle the peak runoff from a 10-year, 24-hour design storm with a maximum flow depth of 1 foot and freeboard of 1 foot. Therefore, the center portion of the dam should be at least 2 feet lower than the outer edges at the abutment (see Figure RD-1).

Dam Top Width

The minimum top width should be 6 feet (see Figure RD-2).

Dam Side Slopes

Side slopes should be 3:1 (horizontal: vertical) or flatter on the back slope and 2.5:1 (horizontal: vertical) or flatter on the front slope.

Outlet Protection

The downstream toe of the dam should be protected from erosion by placing a riprap apron at the toe. The apron should be placed on a zero grade with a riprap thickness of 1.5 feet. The apron should have a length equal to the height of the dam as a minimum (and longer, if needed) to protect the toe of the dam.

Location

The dam should be located as close to the source of sediment as possible so that it will not cause water to back up onto adjoining property.

Basin Requirements

The basin behind the dam should provide a surface area that maximizes the sediment trapping efficiency. The basin should have a sediment storage capacity of 67 cubic yards per acre of drainage area.

Riprap Requirements

Stone for riprap should consist of field stone or rough, unhewn quarry stone of approximately rectangular shape. The stone should be hard and angular and of such quality that it will not disintegrate on exposure to water or weathering, and it should be suitable in all other respects for the purpose intended. The specific gravity of the individual stones should be at least 2.5.

The minimum median stone size should be 9″. The gradation of rock to be used should be specified using Tables RD-1 and RD-2. Table RD-1 is used to determine the weight of the median stone size (d_{50}). Using this median weight, a gradation can be selected from Table RD-2, which shows the commercially available riprap gradations as classified by the Mississippi Department of Transportation.

The dam should be faced with 1 foot of smaller stone (½″ to ¾″ gravel) on the upstream side to increase efficiency for trapping coarser particles.

Table RD-1 Size of Riprap Stones

Weight	**Mean Spherical Diameter (ft)**	**Rectangular Shape** Length	Width, Height (ft)
50	0.8	1.4	0.5
100	1.1	1.75	0.6
150	1.3	2.0	0.67
300	1.6	2.6	0.9
500	1.9	3.0	1.0
1000	2.2	3.7	1.25
1500	2.6	4.7	1.5
2000	2.75	5.4	1.8
4000	3.6	6.0	2.0
6000	4.0	6.9	2.3
8000	4.5	7.6	2.5
20000	6.1	10.0	3.3

Table RD-2 Graded Riprap

Class	**Weight (lbs.)** d_{10}	d_{15}	d_{25}	d_{50}	d_{75}	d_{90}
1	10	-	-	50	-	100
2	10	-	-	80	-	200
3	-	25	-	200	-	500
4	-	-	50	500	1000	-
5	-	-	200	1000	-	2000

Geotextiles

Geotextiles should be used as a separator between the graded stone, the soil base, and the abutments. Class I geotextile, as specified in Table RD-3 below, should be used. Geotextile should be placed immediately adjacent to the subgrade with no voids between the fabric and the subgrade.

Table RD-3 Requirements for Nonwoven Geotextile

Property	Test method	Class I	Class II	Class III	Class IV [1]
Tensile strength (lb) [2]	ASTM D 4632 grab test	180 minimum	120 minimum	90 minimum	115 minimum
Elongation at failure (%) [2]	ASTM D 4632	≥ 50	≥ 5 0	≥ 50	≥ 50
Puncture (pounds)	ASTM D 4833	80 minimum	60 minimum	40 minimum	40 minimum
Ultraviolet light (% residual tensile strength)	ASTM D 4355 150-hr exposure	70 minimum	70 minimum	70 minimum	70 minimum
Apparent opening size (AOS)	ASTM D 4751	As specified max. no. 40 [3]	As specified max. no. 40 [3]	As specified max. no. 40 [3]	As specified max. no. 40 [3]
Permittivity sec^{-1}	ASTM D 4491	0.70 minimum	0.70 minimum	0.70 minimum	0.10 minimum

Table copied from NRCS Material Specification 592.

1 Heat-bonded or resin-bonded geotextile may be used for Classes III and IV. They are particularly well suited to Class IV. Needle-punched geotextile are required for all other classes.

2 Minimum average roll value (weakest principal direction).

3 U.S. standard sieve size.

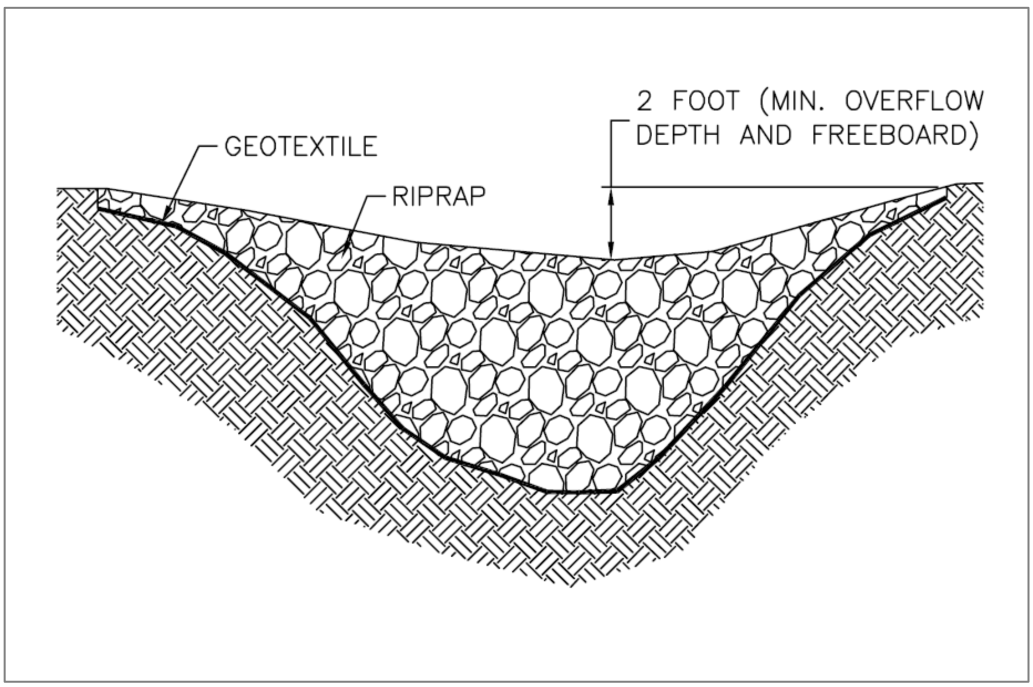


Figure RD-1 Typical Front View of Rock Filter Dam

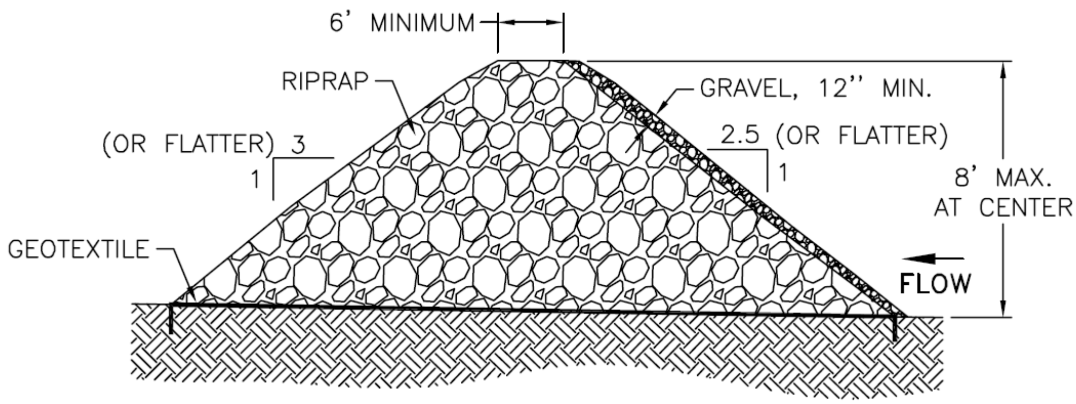


Figure RD-2 Typical Section of Rock Filter Dam

Construction

Prior to start of construction, rock filter dams should be designed by a qualified design professional. The rock filter dam plan should include details on dam height, dam top width, dam side slopes, and rock size(s). Plans and specifications should be referred to by field personnel throughout the construction process.

Site Preparation

Determine exact location of underground utilities, and avoid construction over and under utilities.

Clear and grub the area under the dam, removing and properly disposing of all root material, brush, and other debris.

Divert runoff from undisturbed areas away from the rock dam and basin area. Smooth the dam foundation.

If specified, cover the foundation with geotextile fabric, making sure the upstream strips overlap the downstream strips at least 1 foot and the upslope end is embedded into the foundation at least 1 foot.

Rock Placement

Construct the dam by placing well-graded, hard, angular, durable rock of the specified size over the foundation to planned dimensions and securely embed into both channel banks.

Once the dam is in place, clear the sediment basin area and dispose of the cleared material.

Set a marker stake to indicate the clean-out elevation (i.e., point at which the basin is 50% full of sediment).

Erosion and Sediment Control

Stabilize all disturbed areas with either *Temporary* or *Permanent Seeding*.

Construction Verification

Check materials and finished elevations of the rock filter dam for compliance with specifications.

Common Problems

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

Variations in topography on site indicate rock filter dam will not function as intended; changes in plan may be needed.

Materials specified in the plan are not available.

Maintenance

Inspect the rock dam and basin after each storm event.

Check the dam for rock displacement and the abutments for erosion and repair immediately when repair is needed. If rock size appears too small or embankment slope is too steep, replace stone with larger size or reduce slope.

Check the drainageway at toe of dam for erosion. If erosion is occurring, a repair involving geotextile fabric (including another toe-in) and additional rock are probably needed to establish a stable outlet.

Remove sediment from the pond reservoir area when it accumulates to ½ the design volume. If the basin does not drain between storms because the filter stone (small gravel) on the upstream face has become clogged, the clogged filter stone should be replaced with clean stone.

Once the construction site is permanently stabilized, remove the structure and any unstable sediment. Smooth the basin site to blend with the surrounding area and stabilize. Sediment should be placed in designated disposal areas and stabilized.

References

BMPs from Volume 1

Chapter 4

Mulching (MU) 4-48
Permanent Seeding (PS) 4-53
Temporary Seeding (TS) 4-103

Sediment Barrier (SB)

SILT FENCE
STRAW BALE BARRIER

Practice Description

Silt fencing is a temporary sediment barrier used across a landscape to reduce the quantity of sediment that is moving farther downslope. Commonly used barriers include silt fence (a geotextile fabric that is trenched into the ground and attached to supporting posts) or hay bales trenched into the ground. Other barrier materials include sand bags, brush piles, and various man-made materials and devices that can be used in a similar manner as silt fence and hay bales.

This practice applies where sheet and rill erosion occurs on small disturbed areas. Barriers intercept runoff from upslope to form ponds that temporarily store runoff and allow sediment to settle out of the water and stay on the construction site.

Planning Considerations

Sediment barriers may be used on developing sites. They should be installed on the contour so that flow will not concentrate and cause bypassing by runoff going around the end of the barrier or overtopping because of lack of storage capacity.

The most commonly used sediment barriers are silt fences, manufactured sediment logs (several names other than "logs" are used), and hay bales. Silt fences and manufactured sediment logs are preferable to hay bales because they are more likely to be installed correctly. The design and installation of a hay bale sediment barrier is the same as for *Straw Bale Sediment Traps*. Manufactured sediment logs should be installed according to manufacturer's recommendations.

The silt fence is the only sediment barrier covered in this manual.

The success of silt fences depends on a proper installation that causes the fence to develop maximum efficiency of sediment trapping. Silt fences should be carefully installed to meet the intended purpose.

A silt fence is specifically designed to retain sediment transported by sheet flow from disturbed areas, while allowing water to pass through the fence. Silt fences should be installed to be stable under the flows expected from the site. Silt fences should not be installed across streams, ditches, waterways, or other concentrated flow areas.

Silt fences are composed of woven geotextile supported between steel or wooden posts. Silt fences are commercially available with geotextile attached to the post, and can be rolled out and installed by driving the post into the ground. This type of silt fence is simple to install, but more expensive than some other installations. Silt fences must be trenched in at the bottom to prevent runoff from undermining the fence and developing rills under the fence. Locations with high runoff flows or velocities should use wire reinforcement.

Design Criteria

Silt fence installations are normally limited to situations in which only sheet- or overland-flow is expected because they normally cannot pass the volumes of water generated by channel flows. Silt fences are normally constructed of synthetic fabric (woven geotextile), and the life is expected to be the duration of most construction projects. Silt fence fabric should conform to the requirements of Table SB-1.

The drainage area behind the silt fence should not exceed ¼ acre per 100 linear feet of silt fence for non-reinforced fence and ½ acre per 100 linear feet of wire-reinforced fence. When all runoff from the drainage area is to be stored behind the fence (i.e. no stormwater disposal system is in place), the maximum slope length behind the fence should not exceed the value shown in Table SB-2.

Type A Silt Fence

The Type A fence is 36″ wide with wire reinforcement and is used on sites needing the highest degree of protection by a silt fence. The wire reinforcement is necessary because the Type A silt fence is used for the highest flow situations and has almost 3 times the flow rate as the Type B silt fence. Type A silt fence should be used where runoff flows or velocities are particularly high or where slopes exceed a vertical height of 10 feet.

Provide a riprap splash pad or other outlet protection device for any point where flow may overtop the sediment fence. Ensure that the maximum height of the fence at a protected, reinforced outlet does not exceed 1 foot and that support post spacing does not exceed 4 feet.

This silt fence should be installed as shown in Figure SB-1. Materials for posts and fasteners are shown in Tables SB-3 and SB-4. Details for overlap of the silt fence and fastener placement are shown in Figure SB-4.

Table SB-1 Specifications for Silt Fence

Specifications	**Type A**	**Type B**	**Type C**
Tensile Strength (Lbs. Min.)[1] (ASTM D-4632)	Warp – 260 Fill – 100	Warp – 120 Fill – 100	Warp – 120 Fill – 100
Elongation (% Max.) (ASTM D-4632)	40	40	40
AOS (Apparent Opening Size) (Max. Sieve Size) (ASTM D-4751)	No. 30	No. 30	No. 30
Flow Rate (Gal/Min/Sq. Ft.) (GDT-87)	70	25	25
Ultraviolet Stability[2] (ASTM D-4632 after 300 hours weathering in accordance with ASTM D-4355)	80	80	80
Bursting Strength (PSI Min.) (ASTM D-3786 Diaphragm Bursting Strength Tester)	175	175	175
Minimum Fabric Width (Inches)	36	36	22

1 Minimum roll average of five specimens.
2 Percent of required initial minimum tensile strength.

Table SB-2 Slope Limitations for Silt Fence

Land Slope (Percent)	Maximum Slope Length Above Fence (Feet)
<2	100
2 to 5	75
5 to 10	50
10 to 20*	25
>20	15

*In areas where the slope is greater than 10%, a flat area length of 10 feet between the toe of the slope to the fence should be provided.

Type B Silt Fence

This 36″ wide filter fabric should be used on developments where the life of the project is greater than or equal to 6 months.

This silt fence should be installed as shown in Figure SB-2. Materials for posts and fasteners are shown in Tables SB-3 and SB-4. Details for overlap of the silt fence and fastener placement are shown in Figure SB-4.

Type C Silt Fence

Though only 22″ wide, this filter fabric allows the same flow rate as Type B silt fence. Type C silt fence should be limited to use on relatively minor projects, such as residential home sites or small commercial developments where permanent stabilization will be achieved in less than 6 months.

This silt fence should be installed as shown in Figure SB-3. Materials for posts and fasteners are shown in Tables SB-3 and SB-4. Details for overlap of the silt fence and fastener placement are shown in Figure SB-4.

Table SB-3 Post Size for Silt Fence

	Minimum Length	**Type of Post**	**Size of Post**
Type A	4'	Steel	1.3 lb./ft. min.
Type B	4'	Soft Wood Oak Steel	3″ diameter or 2 X 4 1.5″ X 1.5″ 1.3 lb./ft. min.
Type C	3'	Soft Wood Oak Steel	2″ diameter or 2 X 2 1″ X 1″ 0.75 lb./ft. min.

Table SB-4 Wood Post Fasteners for Silt Fence

	Gauge	**Crown**	**Legs**	**Staples/Post**
Wire Staples	17 min.	¾″ wide	½″ long	5 min.
	Gauge	Length	Button Heads	Nail/Post
Nails	14 min.	1″	¾″ long	4 min.

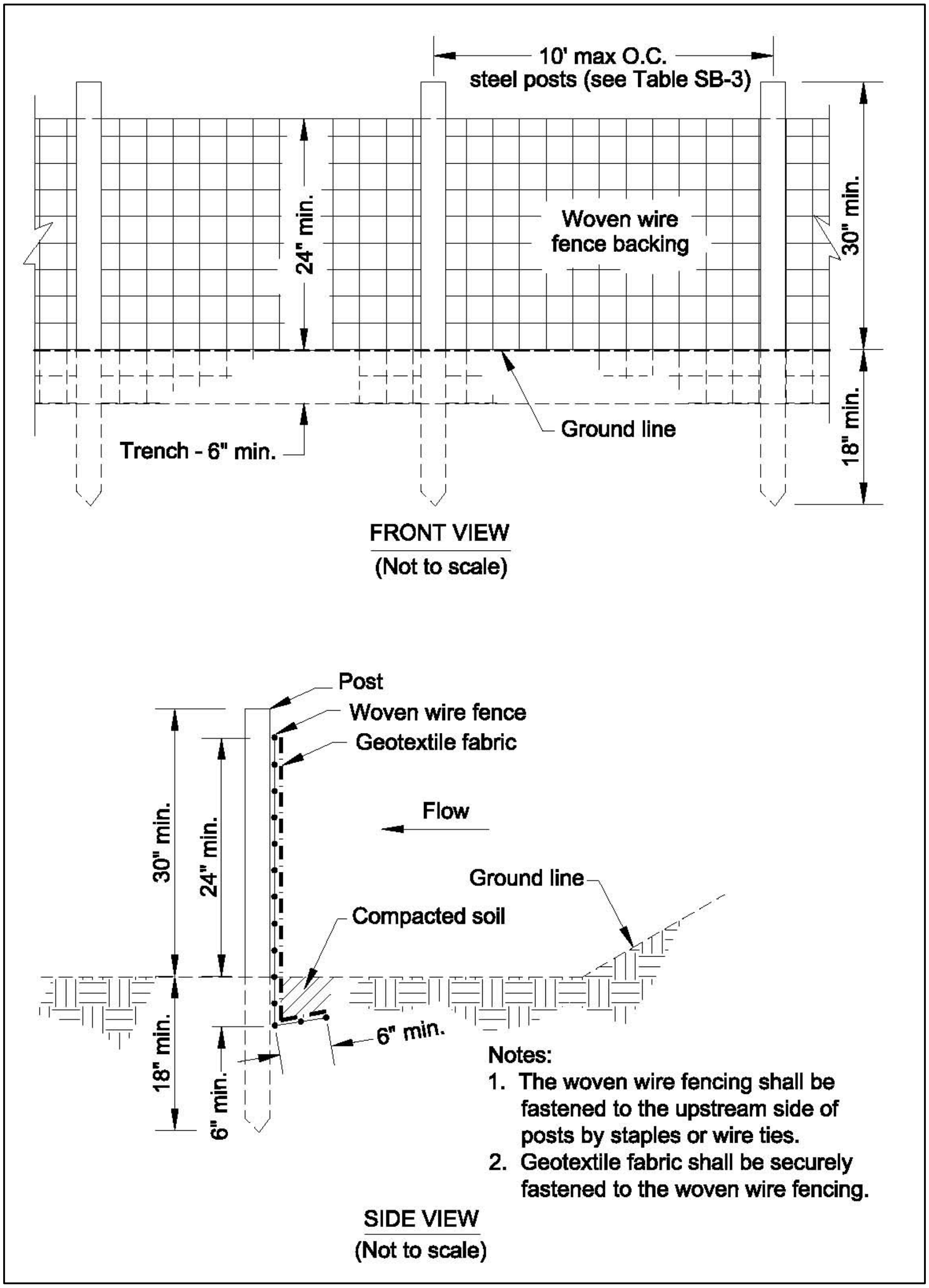


Figure SB-1 Silt Fence-Type A

(1) For fabric material requirements see Table SB-1
(2) For post material requirements see Tables SB-3 and SB-4

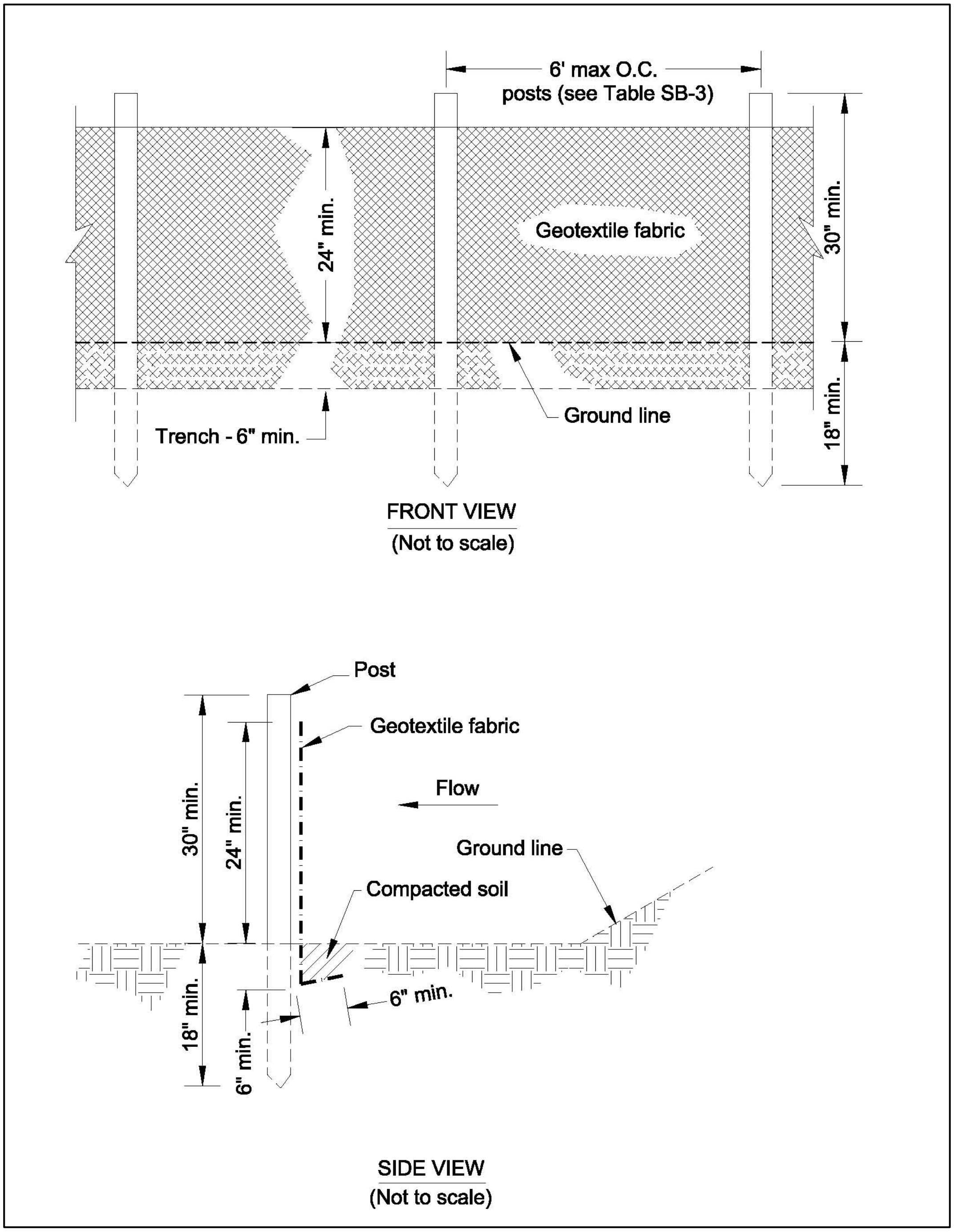


Figure SB-2   Silt Fence - Type B

(1) For fabric material requirements see Table SB-1
(2) For post material requirements see Tables SB-3 and SB-4

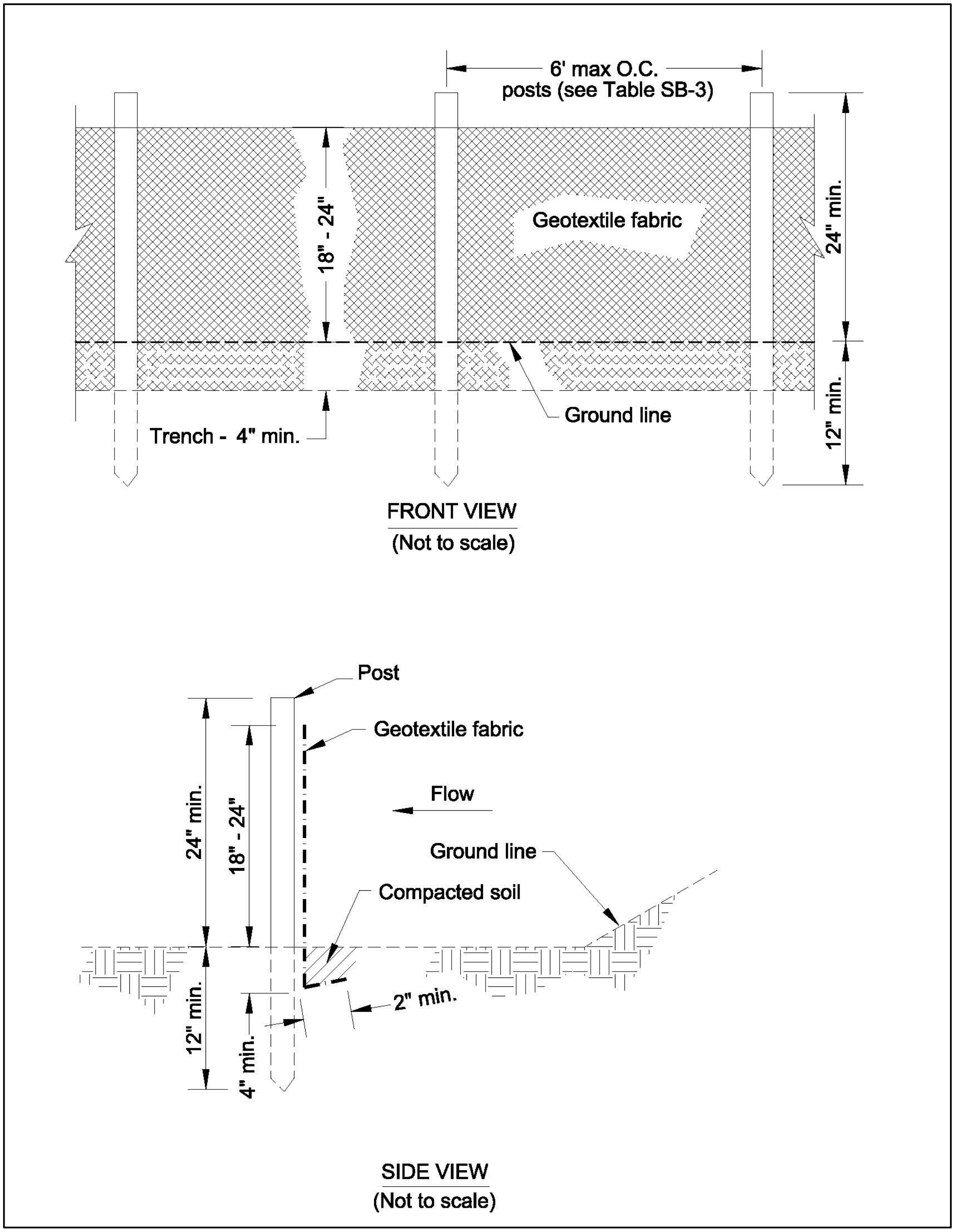


Figure SB-3 Silt Fence – Type C

(1) For fabric material requirements see Table SB-1
(2) For post material requirements see Tables SB-3 and SB-4

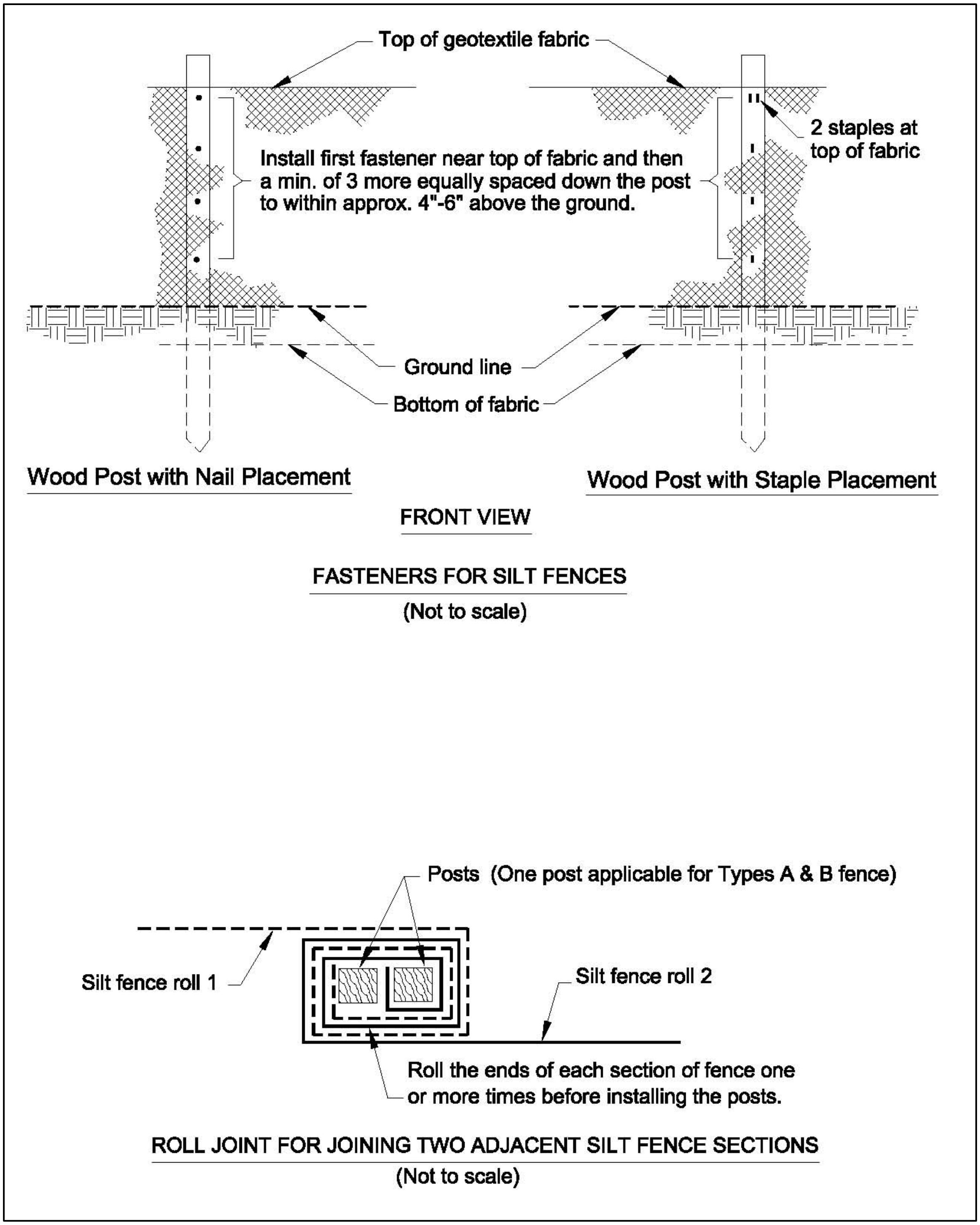


Figure SB-4 Silt Fence Installation Details

Construction

Prior to start of construction, sediment barriers should be designed by a qualified professional. Plans and specifications should be referred to by field personnel throughout the construction process.

Note: Silt fence is the only barrier installation being covered in this handbook.

Site Preparation

Determine exact location of underground utilities so that locations for digging or placement of stakes can be selected where utilities will not be damaged.

Smooth the construction zone to provide a broad, nearly level area for the fence. The area should be wide enough throughout the length of the fence to provide storage of runoff and sediment behind the fence.

Silt Fence Installation

Silt fence should be installed on the contour, so that runoff can be intercepted as sheet flow; ends should be flared uphill to provide temporary storage of water. Silt fence should be placed so that runoff from disturbed areas must pass through the fence. Silt fence should not be placed across concentrated flow areas such as channels or waterways. When placed near the toe of a slope, the fence should be installed far enough from the slope toe to provide a broad, flat area for adequate storage capacity for sediment. Dig a trench at least 6″ deep along the fence alignment as shown in Figures SB-1 and SB-2 for Types A & B fences. Type C fences require only a 4″ deep trench as shown in Figure SB-3. **Please note that installation with a silt fence installation machine may permit different depths if performance is equal.**

Drive posts at least 18″ into the ground on the downslope side of the trench. Space posts a maximum of 10 feet if fence is supported by woven wire, or 6 feet if high-strength fabric and no support fence is used.

Fasten support wire fence to upslope side of posts, extending 6″ into the trench, as shown in the appropriate figure for the type fence (see Figure SB-1, SB-2 or SB-3).

Attach a continuous length of fabric to the upslope side of fence posts. Minimize the number of joints and, when necessary to join rolls, they should be joined by rolling the ends together using the "roll joint" method illustrated in Figure SB-4. Avoid joints at low points in the fence line.

For Types A and B silt fence, place the bottom 12″ of fabric in the 6″ deep (minimum) trench, lapping toward the upslope side. For Type C fabric, place the bottom 6″ in the 4″ deep (minimum) trench lapping toward the upslope side.

Backfill the trench with compacted earth or gravel as shown in Figures SB-1 – SB-3.

Provide good access in areas of heavy sedimentation for cleanout and maintenance.

Erosion Control

Stabilize disturbed areas in accordance with the vegetation plan. If no vegetation plan exists, consider planting and mulching as a part of barrier installation, and select planting information from the appropriate planting practice (*Permanent Seeding* or T*emporary Seeding*). Select mulching information from the *Mulching Practice*.

Construction Verification

Check finished grades and dimensions of the sediment fence. Check materials for compliance with specifications.

Common Problems

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

Variations in topography on site indicate sediment fence will not function as intended, or alignment is not on contour, or fence crosses concentrated flow areas; changes in plan may be needed.

Design specifications for filter fabric, support posts, support fence, gravel, or riprap cannot be met; substitutions may be required. Unapproved substitutions could lead to failure.

Drainage area appears to exceed ¼ acre for 100 feet of non-reinforced silt fence and ½ acre for 100 feet for reinforced fence. Additional sediment-control BMPs may be required.

Maintenance

Inspect sediment fences at least once a week and after each significant rain event.

Make required repairs immediately.

Should the fabric of silt fence collapse, tear, decompose, or become ineffective, replace it promptly.

Remove sediment deposits when they reach a depth of 15″ or ½ the height of the fence as installed, to provide adequate storage volume for the next rain event and to reduce pressure on the fence.

After the contributing drainage area has been properly stabilized, remove all barrier materials and unstable sediment deposits, bring the area to grade, and stabilize it with vegetation.

References

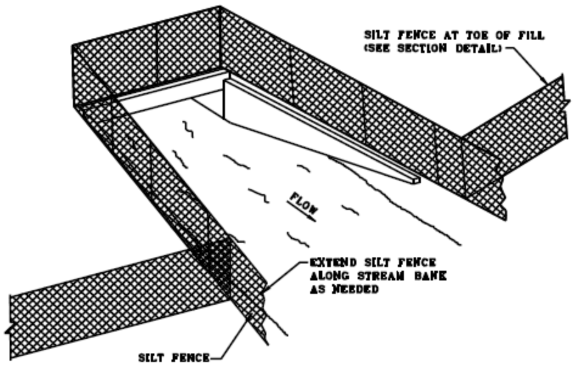
BMPs from Volume I

MDOT Drawing ECD-2

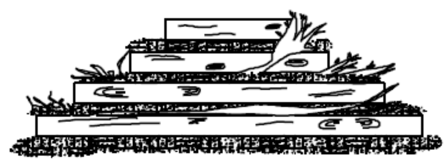
MDOT Drawing ECD-3

MDOT Drawing SSF-1

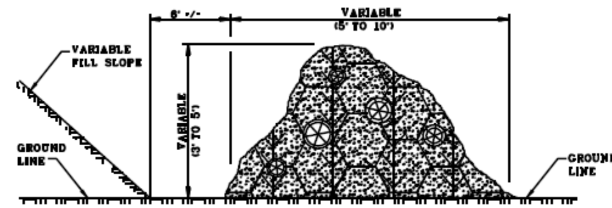
STATE	PROJECT NO.
MISS.	



SEDIMENT BARRIER AT CROSS DRAIN



FRONT ELEVATION

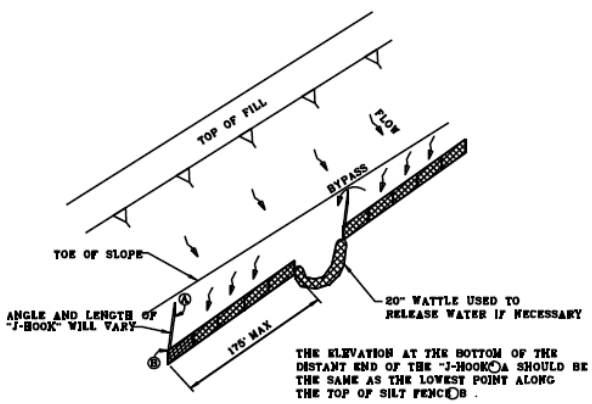


SIDE ELEVATION

TEMPORARY BRUSH BARRIER

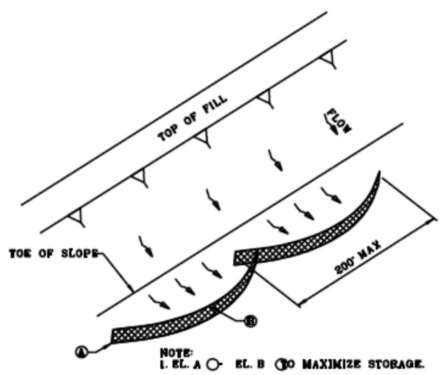
NOTES:
1. BRUSH BARRIER MAY BE USED WHERE NATURAL GROUND IS LEVEL OR SLOPING AWAY FROM PROJECT.
2. PLACE BRUSH, LOG AND TREE LAPS APPROXIMATELY PARALLEL TO TOE OF FILL SLOPE WITH SOME OF THE HEAVIER MATERIALS BEING PLACED ON TOP TO PROPERLY SECURE THE BARRIER AS DETAILED AT LOCATIONS SHOWN ON PLANS OR AS DIRECTED OR PERMITTED BY THE ENGINEER.
3. TO ALLOW WATER TO SEEP THROUGH BRUSH BARRIER, INTERMINGLE THE BRUSH, LOG AND TREE LAPS SO AS NOT TO FORM A SOLID DAM.
4. THE BRUSH BARRIER MAY BE CHOKED WITH FILTER FABRIC.
5. TEMPORARY BRUSH BARRIER WILL NOT BE MEASURED FOR SEPERATE PAYMENT

NOTE:
1. ANCHOR AND INSTALL SILT FENCE PER DETAILS SHOWN ON ECD-3



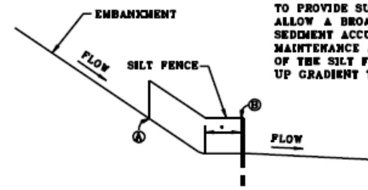
THE ELEVATION AT THE BOTTOM OF THE DISTANT END OF THE "J-HOOK" A SHOULD BE THE SAME AS THE LOWEST POINT ALONG THE TOP OF SILT FENCE B .

"J-HOOK" SILT FENCE APPLICATION



NOTE:
1. EL. A = EL. B TO MAXIMIZE STORAGE.

"SMILE-CONFIGURATION" SILT FENCE APPLICATION



• SILT FENCE SHOULD BE LOCATED AWAY FROM THE TOE OF THE SLOPE TO PROVIDE SUFFICIENT SPACE TO ALLOW A BROAD, FLAT AREA FOR SEDIMENT ACCUMULATION AND MAINTENANCE ACTIVITIES. THE ENDS OF THE SILT FENCE SHOULD BE TURNED UP GRADIENT TO MAXIMIZE STORAGE.

SILT FENCE SECTION AT TOE OF FILL

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

DETAILS OF SEDIMENT BARRIER APPLICATIONS

BY | REVISION | DATE

WORKING NUMBER ECD-2

SHEET NUMBER

FILENAME: EROSION CONTROL\ECD-2.DGN

DESIGN TEAM ____ CHECKED ____ DATE ____

STATE	PROJECT NO.
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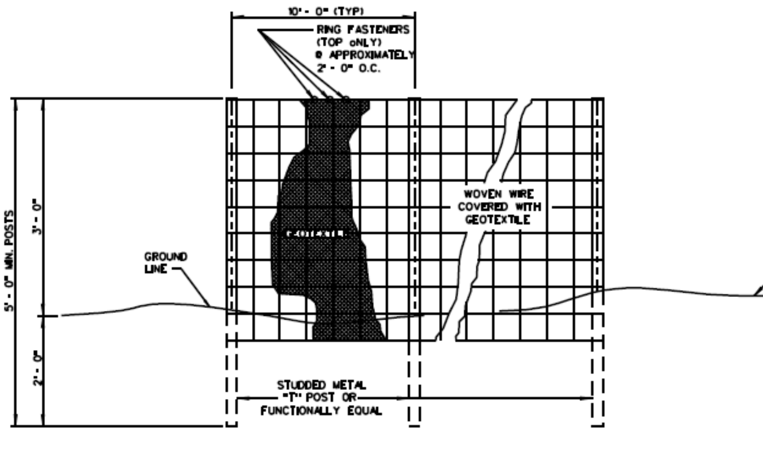
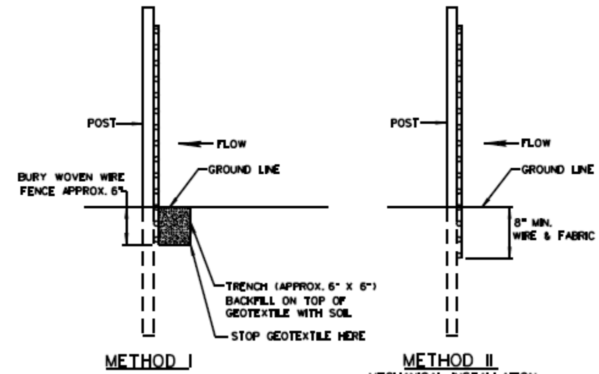


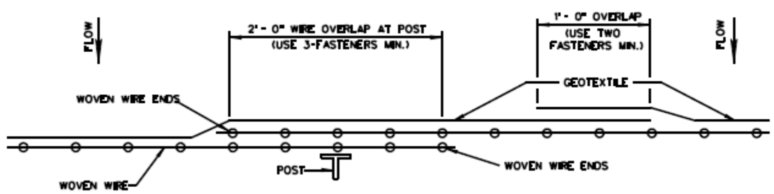
ELEVATION VIEW



SIDE VIEW

NOTES:

1. SILT FENCES SHALL BE USED IN AREAS WHERE FLOW IS NOT SEVERE.
2. SILT FENCES ARE TEMPORARY SEDIMENT CONTROL ITEMS THAT SHALL BE ERECTED OPPOSITE ERODIBLE AREAS SUCH AS NEWLY GRADED FILL SLOPES AND ADJACENT TO STREAMS AND CHANNELS.
3. SILT FENCE SHOULD BE PLACED WELL INSIDE RIGHT-OF-WAY AND ALONG EDGE OF CLEARING LIMITS. THIS WILL ALLOW ROOM FOR A BACK-UP FENCE IF FIRST FENCE BECOMES FULL.
4. WHEREVER POSSIBLE SILT FENCE SHALL BE CONSTRUCTED ACROSS A LEVEL AREA IN THE SHAPE OF A SMILE. THIS AIDS IN PONDING OF RUNOFF AND FACILITATES SEDIMENTATION.
5. THE CONTRACTOR MAY ELECT TO USE EITHER METHOD I OR METHOD II. COST TO BE LINEAR FEET OF SILT FENCE.
6. METHOD II INSTALLATION SHALL BE ACCOMPLISHED USING AN IMPLEMENT THAT IS MANUFACTUREED FOR THE APPLICATION AND PROVIDES A CONFIGURATION MEETING THE REQUIREMENTS OF THE DETAIL.
7. WIRE SHALL BE MINIMUM OF 32" IN WIDTH AND SHALL HAVE A MINIMUM OF 6 LINE WIRES WITH 12" STAY SPACING.
8. GEOTEXTILE FABRIC MEETING THE TYPE I MATERIAL REQUIREMENTS AND INSTALLED ACCORDING TO SPECIFICATION MAY BE USED WITHOUT WIRE FENCE.



PLAN VIEW

REQUIRED LAPPING

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

DETAILS OF SILT FENCE INSTALLATION

WORKING NUMBER: ECD-3

SHEET NUMBER

FILENAME: EROSION CONTROL\ECD-3.DGN

DESIGN TEAM ____ CHECKED ____ DATE ____

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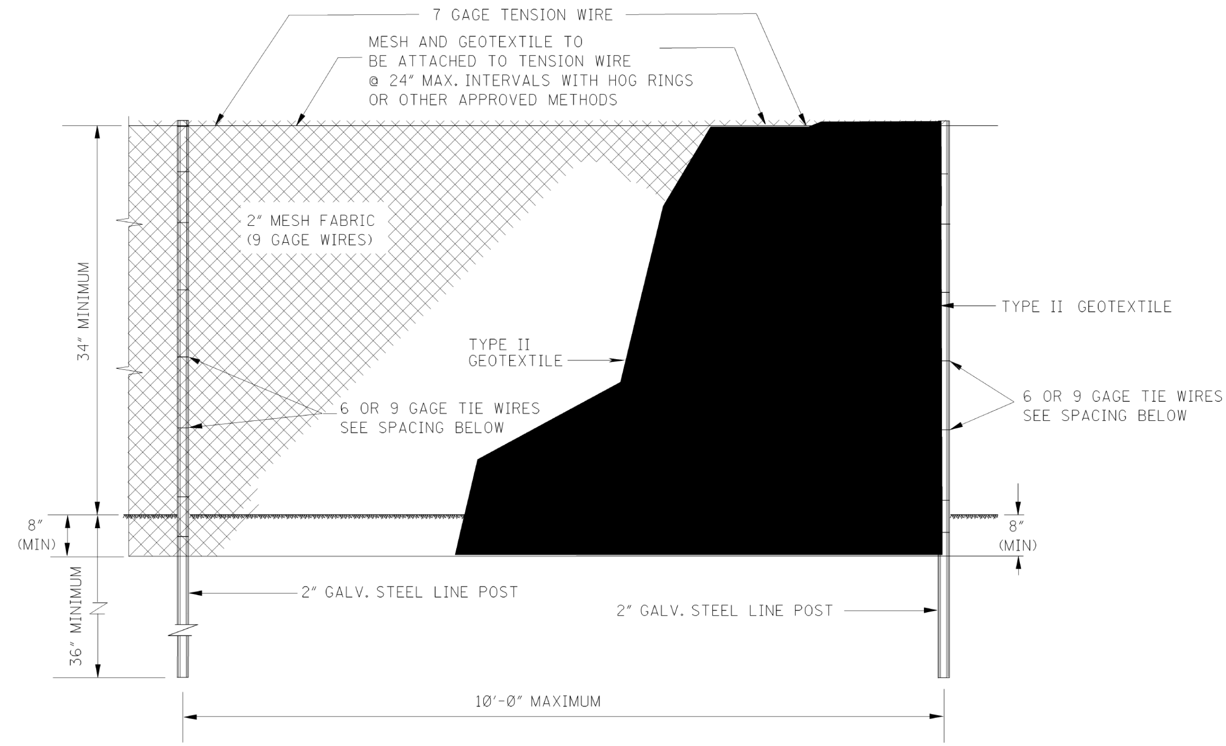
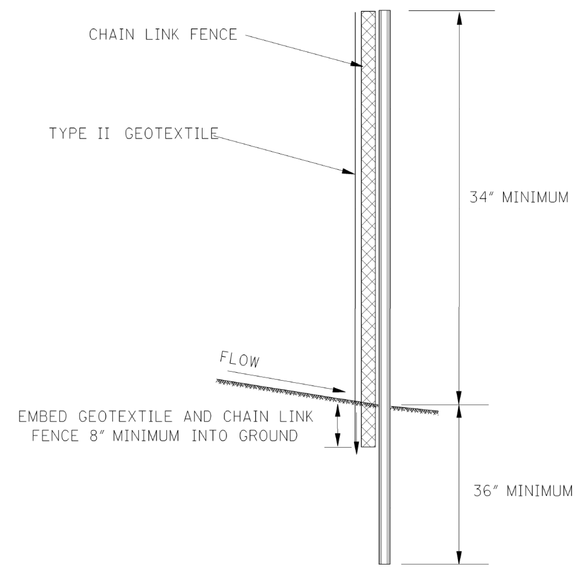
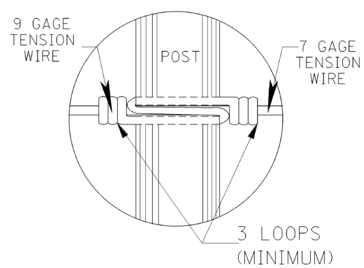






TENSION WIRE TIE DETAILS

6 OR 9 GAGE TIE WIRE SPACING	
TOTAL TEST LOAD (lbs)	TIE WIRE SPACING (C-C)
518	12"
475-517	11"
430-474	10"
387-429	9"
344-386	8"
301-343	7"
258-300	6"

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SUPER SILT FENCE

WORKING NUMBER SSF-1

SHEET NUMBER

FILENAME: SSF-1.DGN

DESIGN TEAM ______ CHECKED ______ DATE ______

BY / REVISION / DATE

ROADWAY DESIGN DIVISION
MISSISSIPPI DEPARTMENT OF TRANSPORTATION

11/17/2010 7:54 AM SSF-1.DGN

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.

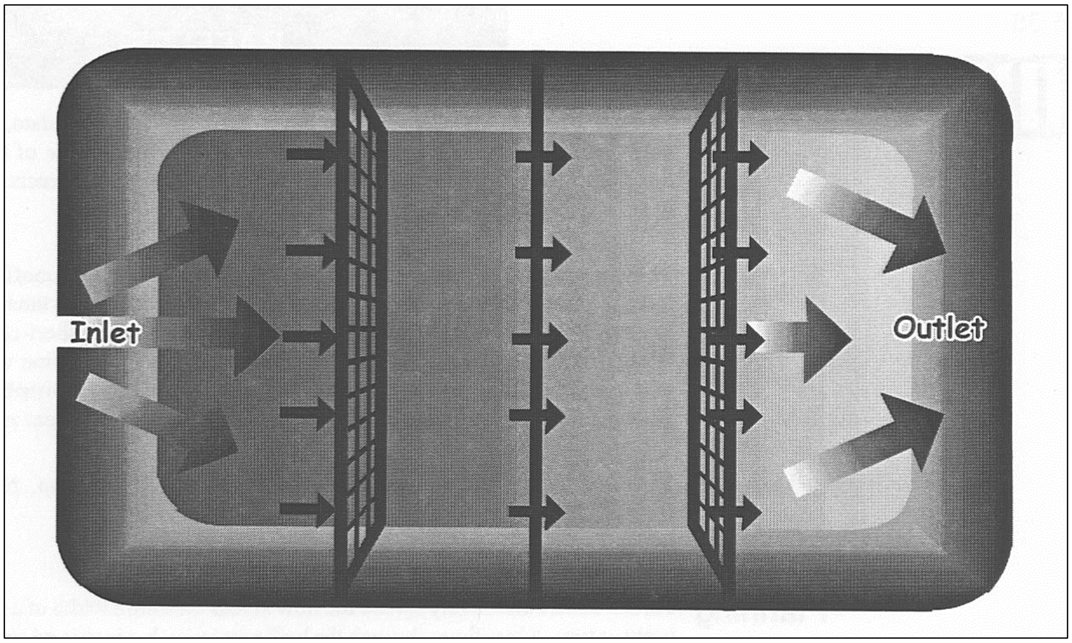


Figure SBN-1 Porous baffle in a sediment basin
(from North Carolina Erosion and Sediment Control Planning and Design Manual)

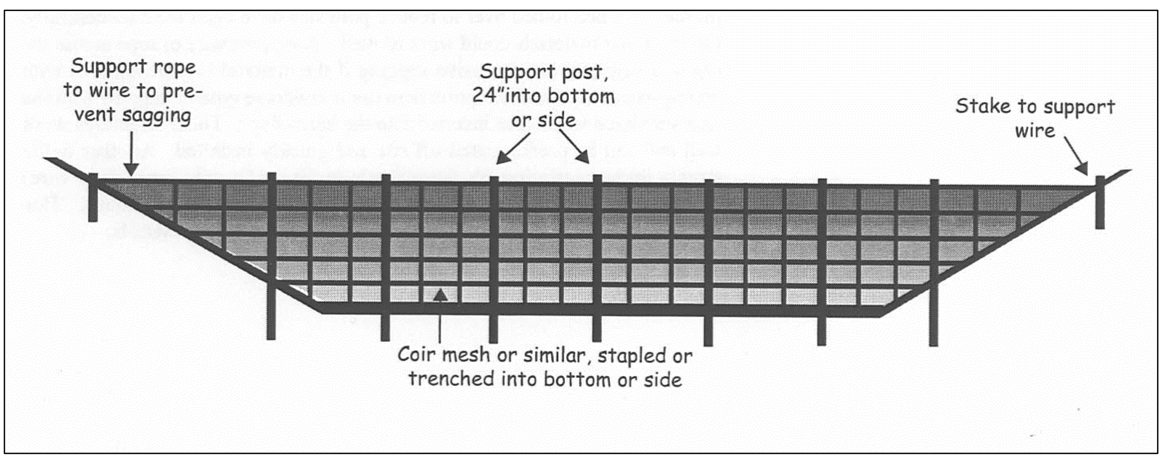


Figure SBN-2 Cross section of a porous baffle in a sediment basin
(Note: there is no weir because the water flows through the baffle material)
(from North Carolina Erosion and Sediment Control Planning and Design Manual)

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.

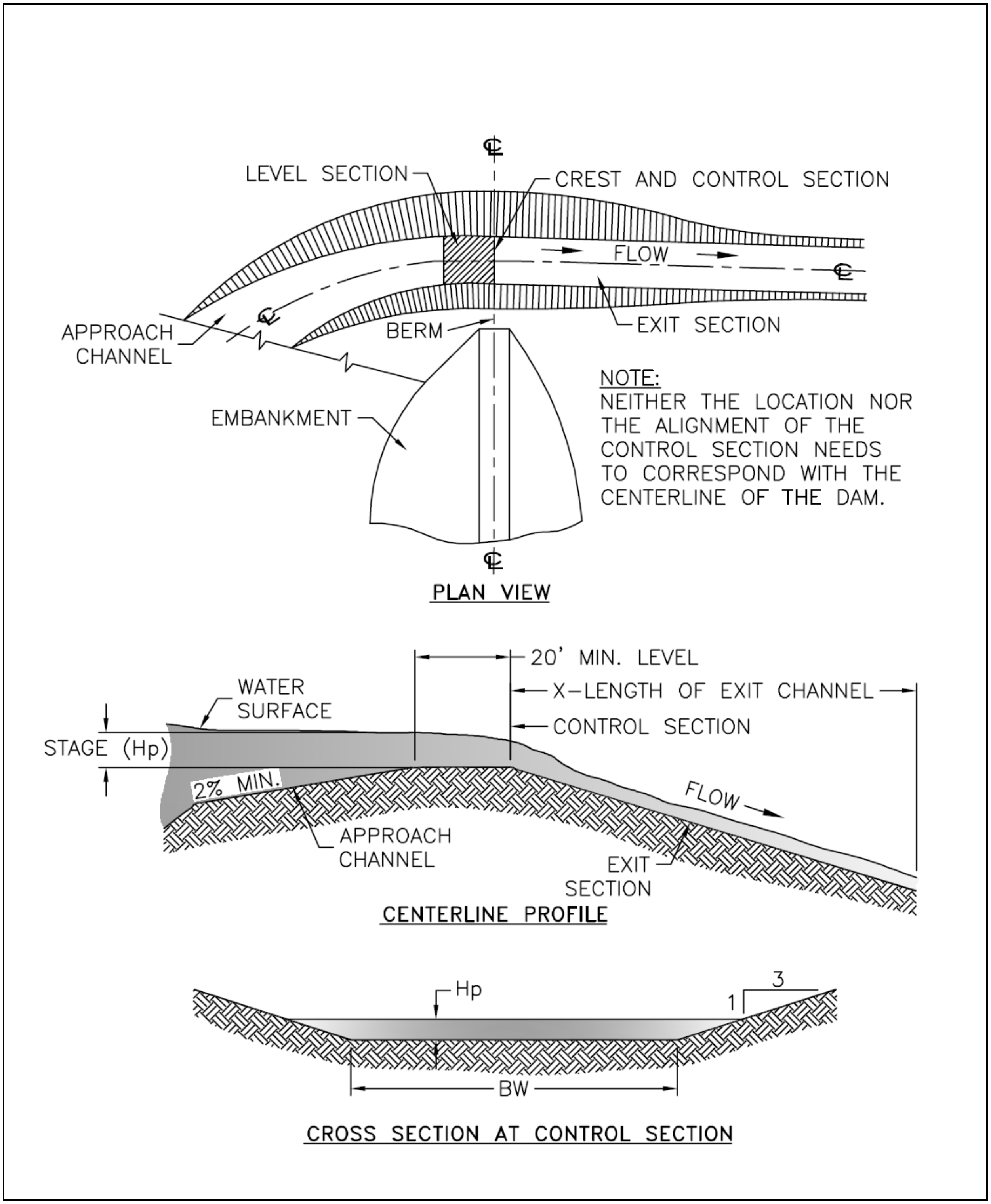


Figure SBN-5 Excavated grass spillway views

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.

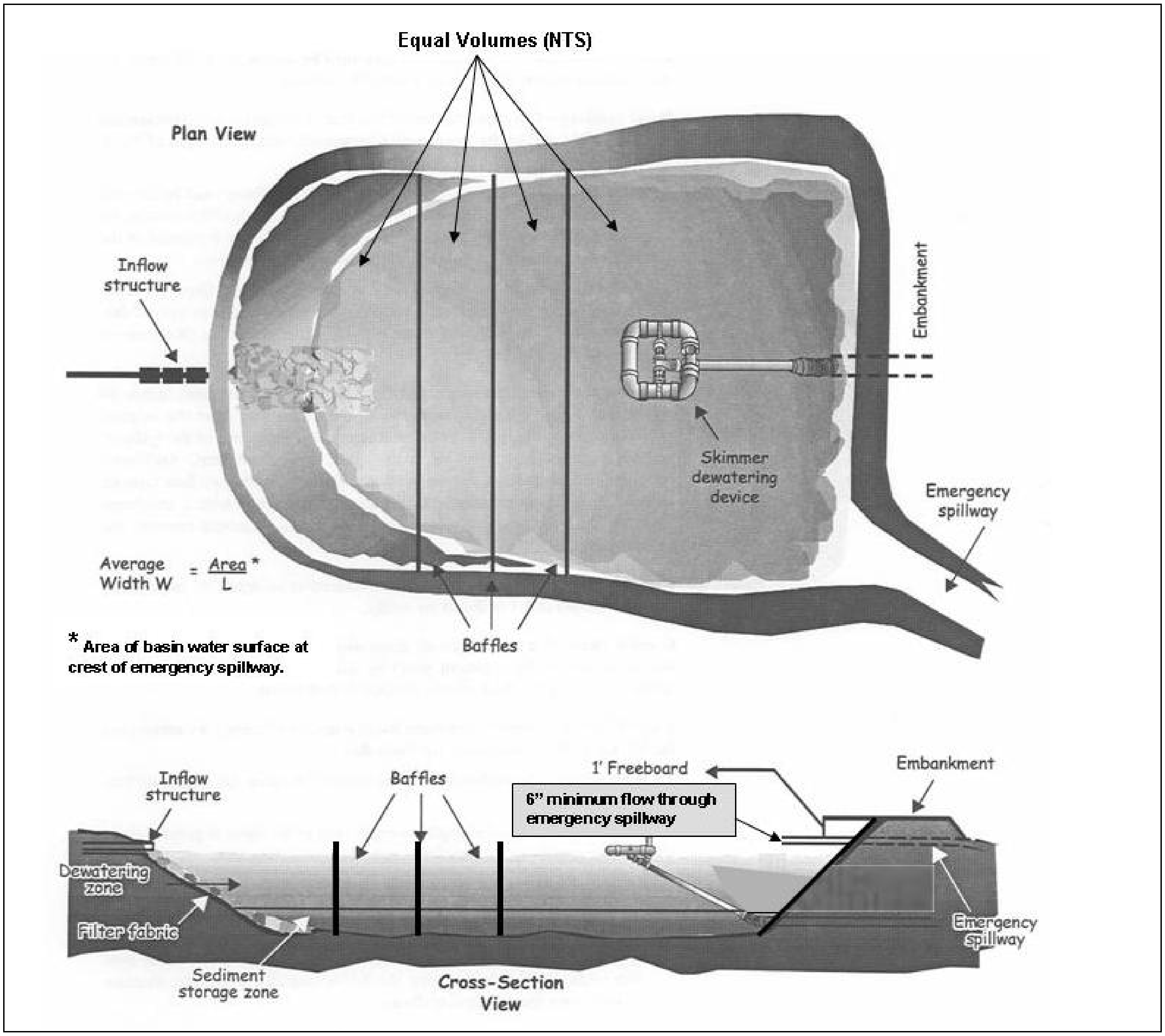


Figure SBN-6 Example of a sediment basin with a skimmer outlet and emergency spillway
(modified from Pennsylvania Erosion and Sediment Control Manual, March 2000)

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).

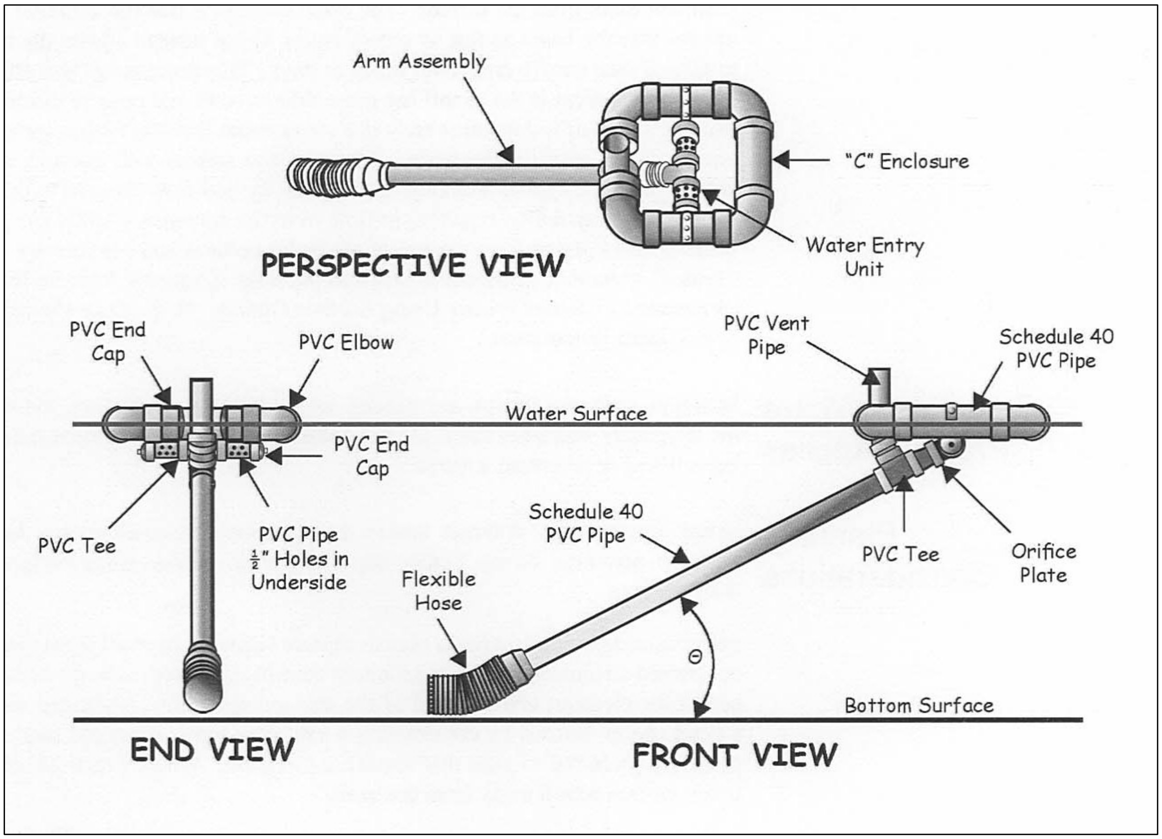


Figure SBN-1 Schematic of a skimmer (Source: Pennsylvania Erosion and Sediment Pollution Control Manual, March 2000)

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

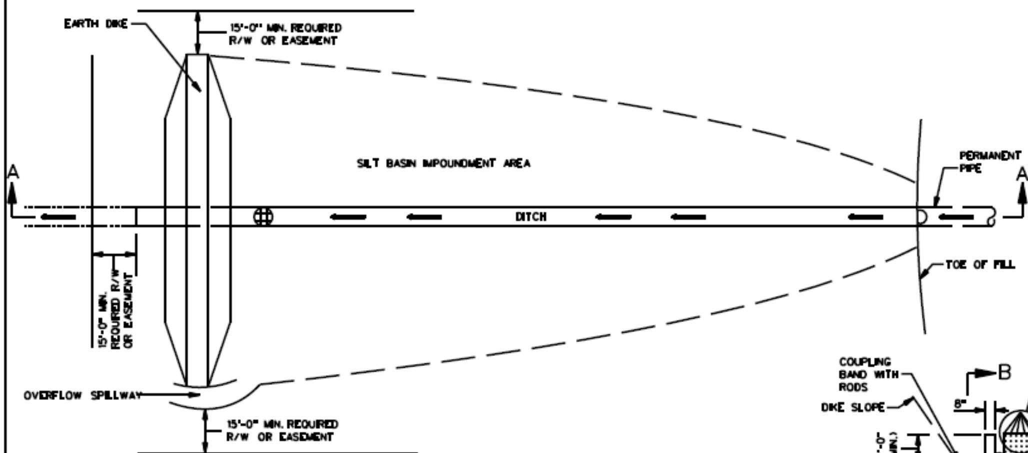
Chapter 4

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

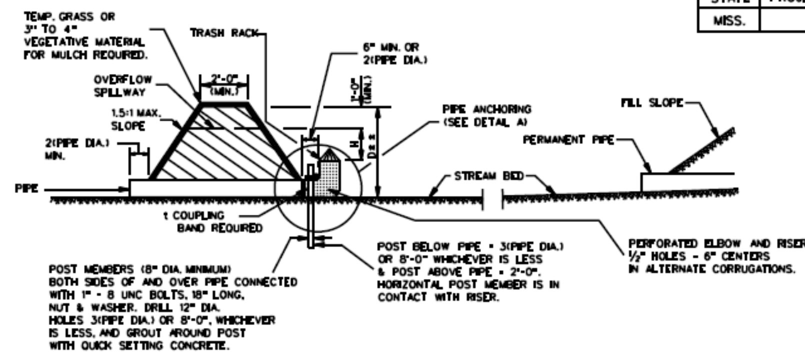
MDOT Drawing TEC-3

Appendix G (Available in Appendices Volume)

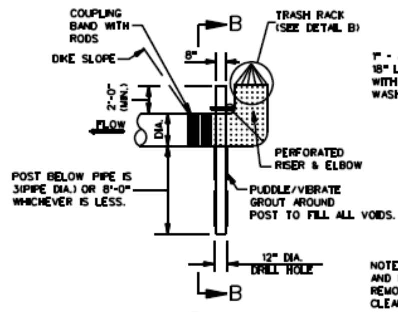
STATE	PROJECT NO.
MISS.	



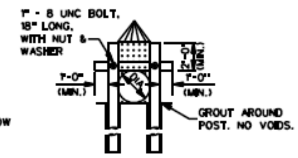
PLAN



SECTION A-A



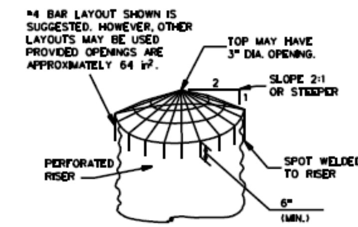
DETAIL A



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

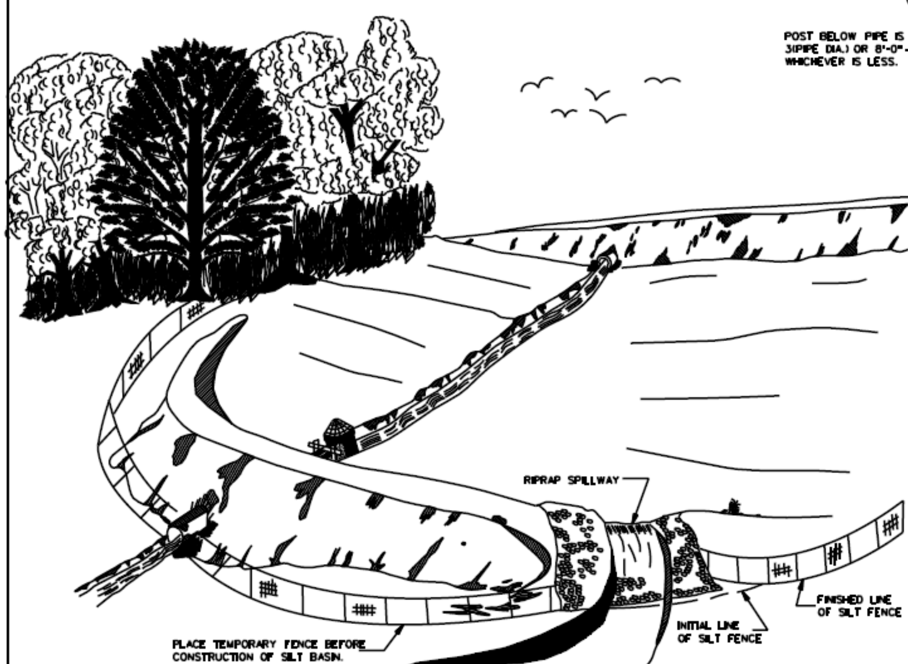
GENERAL NOTES:

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.



TEMPORARY SILT BASIN (TYPE B)

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
STANDARD PLAN

BY | REVISION | DATE

TYPICAL TEMPORARY EROSION CONTROL MEASURES
(TYPE B SILT BASIN)

WORKING NUMBER TEC-3

ISSUE DATE: OCTOBER 1, 1998

SHEET NUMBER 144

Straw Bale Sediment Trap (SST)

Practice Description

A straw bale sediment trap is a temporary catch basin consisting of a row or more of entrenched and anchored straw bales. The purpose is to intercept and detain small amounts of sediment to prevent sediment from leaving the construction site. This practice applies within disturbed areas with small drainage basins.

Planning Considerations

In certain situations, straw bales can be used as an alternative to silt fence for trapping sediment. The practice should be used to trap sediment only for a short duration from small drainage areas. Straw bales' comparatively low flow rate should be considered before choosing to use this practice. Ponding above the bales can occur rapidly due to the low flow rate. Overtopping and bypass of the bales can cause significant damage to the site. Additional measures should be used if turbidity leaving the site served by this practice is an issue.

Design Criteria and Construction

Drainage Area

For disturbed areas subject to sheet erosion the drainage area should be restricted to ¼ acre per 100 feet of barrier. The slope length behind the barrier should be restricted according to Table SST-1.

If used in minor swales, the swale should be relatively flat in grade (3 percent or less) and the drainage area should be limited to 1 acre.

Table SST-1 Criteria for Straw or Hay Bale Placement

Land Slope (Percent)	Maximum Slope Length Above Bale (Feet)
<2	75
2 to 5	50
5 to 10	35
10 to 20	20
>20	10

Bale Size

Bales should be 14″ x 18″ x 36″.

Anchors

Two 36″ long (minimum) 2″ x 2″ hardwood stakes should be driven through each bale after the bales are properly entrenched. Alternate anchors can be two pieces of No. 4 steel rebar, 36″ long (minimum). See Figures SST-1 and SST-2 for details on proper installation of straw bales.

Effective Life

Straw and hay bales have a relatively short period of usefulness and should not be used if the project duration is expected to exceed 3 months. Bale placement should result in the twine or cord being on the side and not the bottom of the bale.

Location

This practice should be used on nearly level ground and be placed at least 10 feet from the toe of any slope. The barrier should follow the land contour. The practice should never be used in live streams or in swales where there is a possibility of washout. The practice should also not be used in areas where rock or hard surfaces prevent the full and uniform anchoring of the bales.

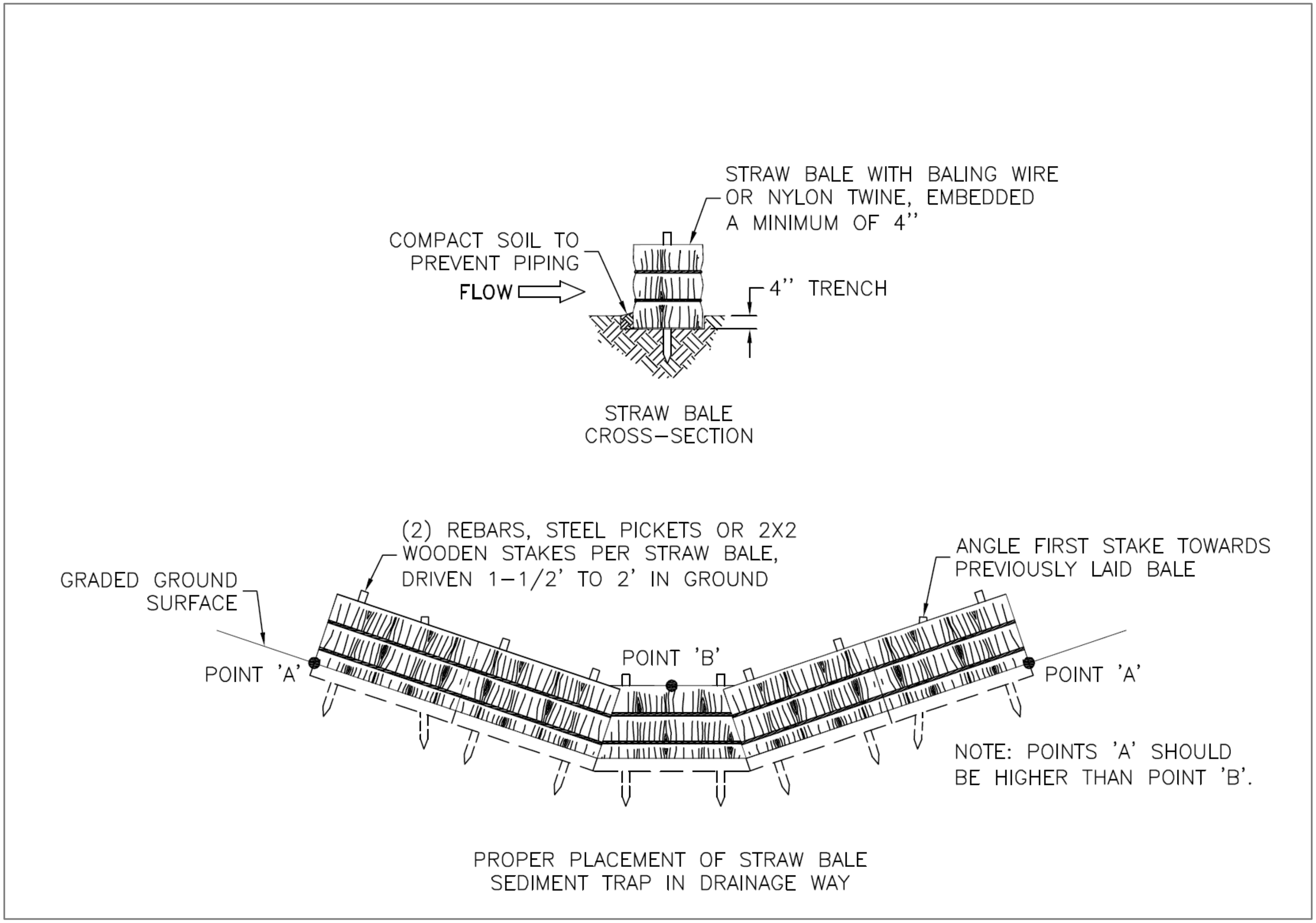
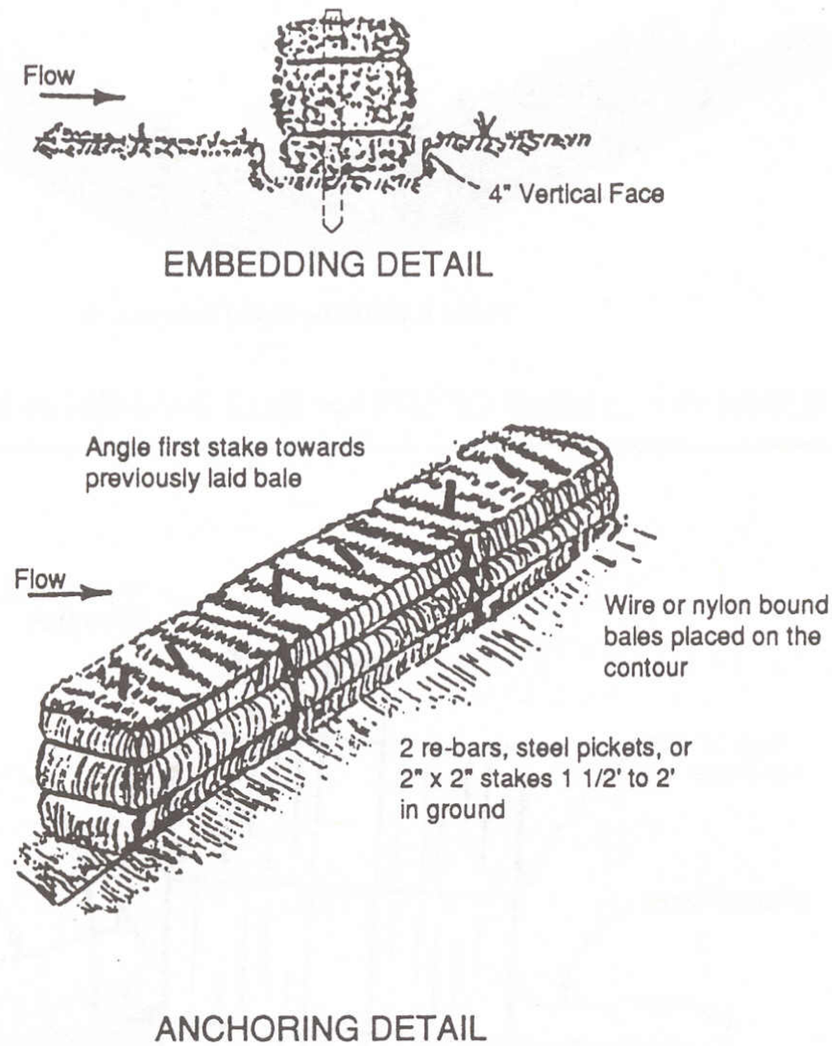


Figure SST-1 Placement of Straw Bale



NOTE:

- Anchor and embed into soil to prevent washout or water working under barrier
- Repair or replacement must be made promptly as needed

Figure SST-2 Anchoring Technique for Straw Bales

Construction

Prior to start of construction, straw bale sediment traps should be designed by a qualified professional. Plans and specifications should be referred to by field personnel throughout the construction process. The straw bale sediment trap should be built according to planned grades and dimensions.

Site Preparation

Determine exact location of underground utilities so that locations for digging or placement of stakes can be selected where utilities will not be damaged.

Smooth the construction zone to provide a broad, nearly level area for the row of bales. The area should be wide enough to provide storage of runoff and sediment behind the straw bales.

To facilitate maintenance, provide good access for cleanout of sediment during maintenance period.

Installation of Straw Bale

Excavate a trench to the dimensions shown on the drawings. The trench should be long enough that the end bales are somewhat upslope of the sediment pool to ensure that excess flows go over the bales and not around the bales.

Place each bale end-to-end in the trench so the bindings are oriented around the sides rather than top and bottom.

Anchor the bales by driving two 36″ long 2″ x 2″ hardwood stakes through each bale at least 18″ into the ground. Drive the first stake toward the previously laid bale to force the bales together.

Wedge loose straw into any gaps between the bales to slow the movement of sediment-laden water.

Anchor the bales in place according to the details shown on the drawings. If specific details are not shown, backfill and compact the excavated soil against the bales to ground level on the downslope side and to 4″ above ground level on the upslope side.

Erosion Control

Stabilize disturbed areas in accordance with the vegetation plan. If no vegetation plan exists, consider planting and mulching as part of the installation and select planting information from either the *Permanent Seeding* or *Temporary Seeding Practice*. Select mulching information from the *Mulching Practice*.

Construction Verification

Check finished grades and dimensions of the straw bale sediment trap. Check materials for compliance with specifications.

Common Problems

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

Variations in topography on site indicate sediment trap will not function as intended; changes in plan may be needed.

Design specifications for materials cannot be met; substitutions may be required. Unapproved substitutions could lead to failure.

Maintenance

Inspect straw bale barriers after each storm event and remove sediment deposits promptly after it has accumulated to ½ of the original capacity, taking care not to undermine the entrenched bales.

Inspect periodically for deterioration or damage from construction activities. Repair damaged barrier immediately.

After the contributing drainage area has been stabilized, remove all straw bales and sediment, bring the disturbed area to grade, and stabilize it with vegetation or other materials shown in the design plan.

Straw bales may be recycled as mulch.

References

BMPs from Volume 1

Chapter 4

Mulching (MU)	4-48
Permanent Seeding (PS)	4-53
Temporary Seeding	4-103

Flocculants and Polymers (FLC)

Practice Description

Flocculants are used to promote clumping in sediment-laden water. Flocculants can be used in chemical stabilization of soils on steep slopes as is discussed in the *Chemical Stabilization Practice*. This section discusses the use of flocculants in conjunction with pumped construction site stormwater systems. Flocculant is dissolved into sediment retention basin inflows via a rainfall-activated system. The flocculant causes individual particles to be destabilized (i.e. neutralizing electrical charges that cause particles to repel each other), accelerating the coagulation and settlement of particles out of the water column. Flocculant types include polyacrylamides (PAM), gypsum, and alum. Anionic PAM is a negatively charged long-chained molecule that consists of acrylamide and acrylate units. It is available as a crystalline powder, an emulsion, or a solid block or log (McLaughin, 2007). Anionic PAM used for turbidity reduction should contain less than 0.5 percent free acrylamide due to the suspected carcinogenic effect of acrylamide. Gypsum, a natural mineral composed of calcium sulfate and water, is often used in water and wastewater treatment processes. Alum is an aluminum sulfate material that can also be used for water clarification.

Planning Considerations

When utilizing flocculants to aid in sediment removal, the following criteria are required by the MDEQ: 1) only anionic polyacrylamide (PAM) polymer; 2) polymer shall contain less than 0.05% free acrylamide; 3) polymer shall be non-toxic to fish and other aquatic organisms, and; 4) polymer shall be selected for site-specific soil conditions (i.e. jar test). For polymer system treatment of turbidity, the following criteria are required at a minimum: 1) polymer shall be introduced through turbulent mixing into the stormwater upstream of sedimentation BMPs; 2) sedimentation basin shall be constructed in accordance with the criteria specified in ACT 5, T-5 (2)(A) of the Large Construction General Permit (see *Appendix B*); and 3) polymer shall be applied in accordance with manufacturer's instructions, and there shall be no discharge of undissolved polymer, clumps of polymer, and/or unsettled flocculant material.

Design Criteria and Construction

PAM Screening Method

Because of the varied type of soils across the state, there is no one type of PAM that is applicable to all. At this time, the only way to determine the most effective type (or types, if the site is large) of PAM is to do a jar test. Most PAM retailers will perform this test.

1. Obtain a clear container (approximately 16 oz).
2. Fill with tap water.
3. Add a small amount of PAM (a "pinch").
4. Add a teaspoon of soil from the site.
5. Shake for 10-20 seconds or until the water begins to clear, then allow to settle.
6. Repeat for several PAM products, and then select the product that clears the water the most quickly.

Pumped Injection

Pumped injection is an effective treatment route because the concentrations of PAM used can be controlled and the reaction between PAM particles and suspended solids is faster than a solid PAM dosing technique. This setup includes a turbid water source, a PAM dosing pump, and a silting basin to treat turbidity.

A pumped injection system consists of a PAM solution pump and a PAM reservoir. An electric pump is often used to inject the PAM solution, preferably a peristaltic pump with variable speeds. The PAM pump hose can be connected into the intake hose to ensure proper dosing and mixing. A sample configuration is provided as Figure FLC-1.

Dosage Rate

The recommended dosage rate of PAM is 1–5 milligrams per liter or parts per million. Rates can be adjusted based on the results of a jar test.

Baffles

A porous baffle of coir netting is recommended to catch the floating flocs created by the flocculation reaction. The preferred weight for sediment basins is 900 grams per square meter. The flocculation of turbid water may cause sediment baffles to become clogged faster than systems without flocculant use and may require more frequent replacements.

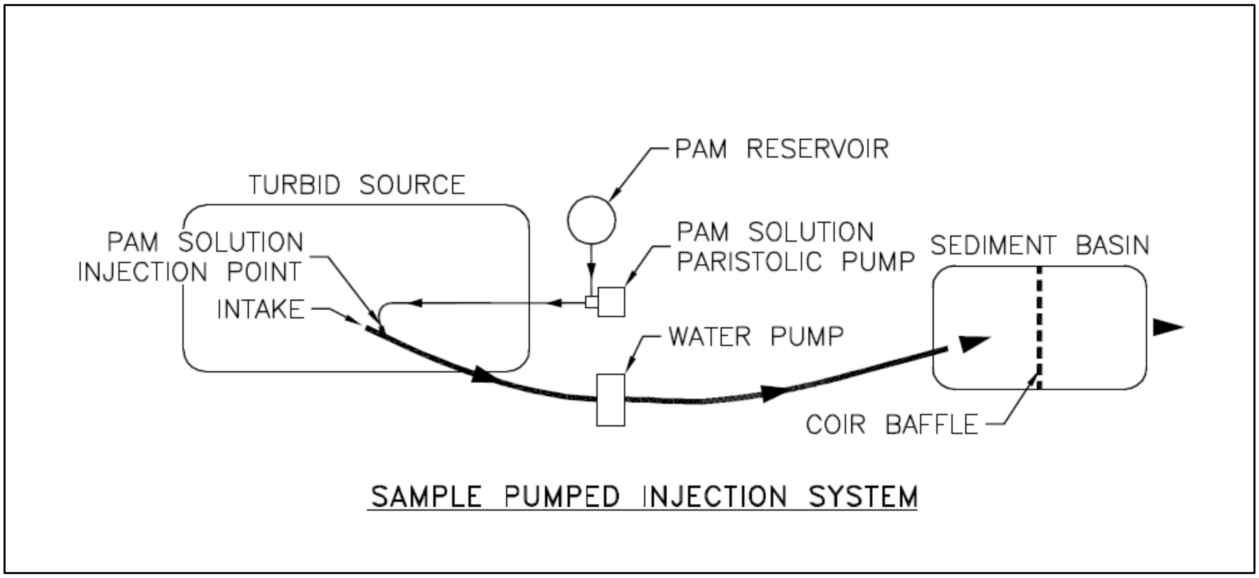


Figure FLC-1 Sample Pumped Injection System

PAM-Treated Channel

This practice uses solid PAM crystalline powder with a jute or coir-lined channel. The turbid water is pumped into the channel and mixes with the solid PAM as it travels toward a sediment basin. This method is also effective when used with fiber check dams (wattles).

The PAM power should only be applied when no water is in the channel. Some wetting of the erosion-control fabric may be required to stabilize the PAM powder. If PAM powder is added directly to the water flow, it will simply settle out and will not be effectively mixed.

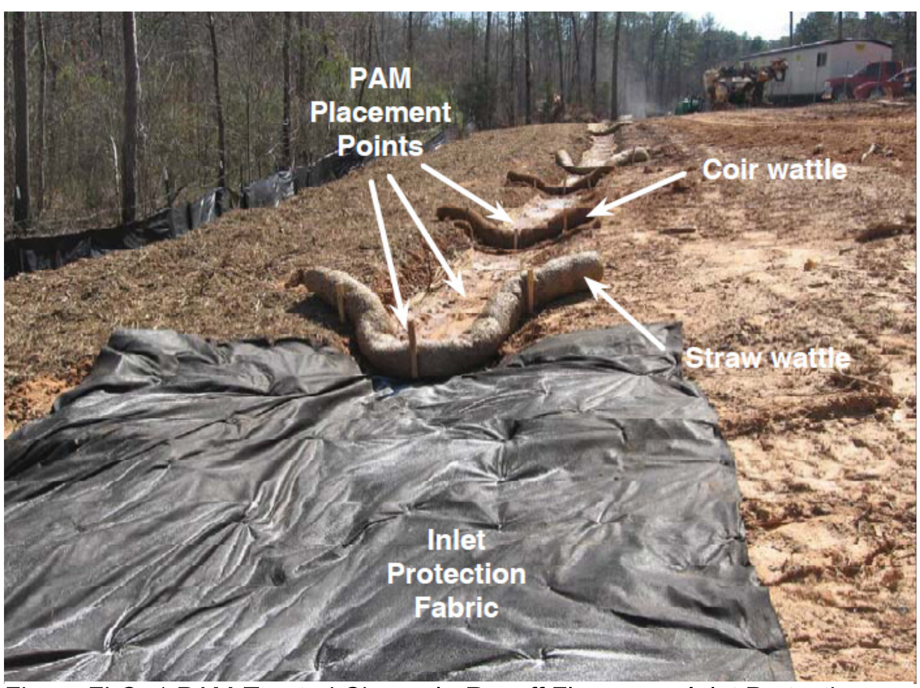


Figure FLC- 1 PAM-Treated Channel - Runoff Flows over Inlet Protection Fabric into Sediment Basin (Source: North Carolina State University)

Treatment Approach

Flocculant use should be installed as a treatment-train approach. Turbid water should be contained on-site, treated with flocculant, and then stored in a sediment basin until solid particles have settled out.

Coagulants

Coagulants such as gypsum and alum can be used to reduce turbidity as well, with approval of MDEQ. These materials can be spread by hand into the water after each storm. The suggested dosage rate is 20–30 pounds per 1,000 cubic feet of water, spread over the surface.

Monitoring

Monitoring is currently voluntary, the results of which will not be required to be documented and/or reported. There are currently no active numeric effluent limitations for construction stormwater discharges. Numeric effluent limitations are expected to be established by the EPA for the next permitting cycle. While these monitoring activities are currently optional, they are still helpful in determining the effectiveness of turbidity reduction procedures. The following monitoring procedures were taken from the Mississippi Large Construction General Permit recommendations found in Act 9: Optional Monitoring (see *Appendix B* for full permit document):

1. Monitor the turbidity of each storm water discharge from actively disturbed areas of the project site for each work day the discharge occurs. Actively disturbed areas are those portions of the project site that have undergone soil disturbing activities (i.e., clearing, grading, filling, excavating, etc.) and have not been stabilized.
    a) Monitoring should be conducted for each point of storm water discharge from the project site. For the purpose of this permit, a discharge point means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, or container from which storm water and/or pollutants are, or may be, discharged.
    b) Diffuse storm water, such as non-channelized flow that infiltrates into a vegetated area, and does not then discharge to surface waters, would not generally require monitoring.

2. Due to the unique characteristics of linear projects, portions may have suspended construction activity and have undergone temporary or final stabilization [see Definitions] while other portions of the same project may have active construction activities. Therefore, in recognition of these unique regulatory circumstances, only those areas that have active construction activities will require numeric turbidity monitoring. Those areas that have been completed and stabilized will not require turbidity monitoring.

3. Sampling:
    a) A minimum of three (3) samples per work day, per discharge, should be used to calculate a daily average turbidity value. Samples should be collected so as to be representative of the nature of the discharge over its duration. For example,

(i) Collect first sample within the first hour of discharge or within the first hour of the work day.
(ii) Collect second sample in the middle of discharge or the middle of the work day.
(iii) Collect last sample at the end of discharge or at the end of the work day.
(iv) Continue sampling at the start of the next work day if there continues to be a discharge (until discharge ends or end of the work day). These data should be used to calculate a separate daily average.

b) Monitoring samples should be collected at the nearest accessible point after final treatment, but prior to mixing with the receiving water body.
(i) Due to the unique characteristics of linear projects, there may be multiple discharge points spaced over a wide geographic area. Therefore, MDEQ will allow representative discharge sampling. For example, representative sampling at certain discharge locations may be representative of the discharge characteristics of other locations within the same sub-watershed. For multiple outfalls that discharge substantially identical effluents, the owner or operator may sample one (or more) of the outfalls and report that data as representative of the other outfalls. At a minimum, at least one discharge point per sub-watershed must be monitored and the same or similar controls must be implemented on the different discharge points.
(ii) Representative sampling of non-linear projects may be allowed on a case-by-case basis.

c) Monitoring may be accomplished via portable turbidity meters or fixed automated sampling/meter stations.
(i) Monitoring should be based on grab samples for portable meters.
(ii) Automated samplers should be programmed to yield a minimum of three (3) representative readings per discharge, per day.
(iii) Daily turbidity averages should be the average of all monitoring results collected on the day of discharge for the respective discharge point(s). For example, if there were five (5) turbidity readings in a given day, then the average turbidity for that day would be the average of all five (5) readings.

d) Grab samples should be collected according to the following methodology to ensure that each sample is representative of the flow conditions and other characteristics of the discharge.
(i) Collect samples from the horizontal and vertical center of the storm water outfall channel(s) or other sources of concentrated flow.
(ii) Avoid stirring the bottom sediments in the storm water channel in which samples are taken by not walking through the areas of storm water flow or disturbing the sediment with the sampling device.
(iii) Hold sampling container so that the opening faces the upstream direction of the storm water channel in which samples are taken.
(iv) Avoid overfilling sample container.

e) Monitoring should be conducted for any discharge that occurs during the normal working hours of the project site.

4. Turbidity Meters:
   a) Turbidity meters should meet the following design criteria:
      (i) Accuracy within +/- 5% of measurement,
      (ii) Minimum upper range of 1000 NTU,
      (iii) Able to be calibrated by operator, and
      (iv) Operating temperature range be at least 32 to 122 degrees.
   b) Turbidity meters should be operated, calibrated and maintained according to the meter manufacturer's instructions.

Construction Verification

Check finished grades and dimensions of the sediment basin. Check materials for compliance with specifications.

Common Problems

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

Pumped injection systems are not reducing turbidity in sediment basin. Check PAM reservoir and dosage rates.

A thick gel forms in PAM-treated channel. Application rates are too high – only a thin coating of PAM powder is need.

Maintenance

Regular inspections of PAM reservoir are required to maintain adequate supply.

Inspect power source and piping for potential failures.

Coir baffles may require regular replacement when using flocculants; inspect frequently for clogged baffles.

In PAM-treated channels, inspect channel lining often and replace when needed.

References

BMPs from Volume 1

Chapter 4

Chemical Stabilization (CHS) 4-25