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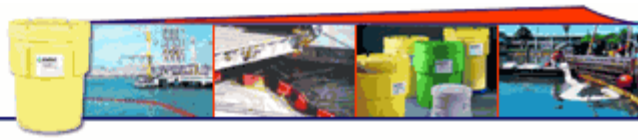
THE ENVIRONMENTAL EQUIPMENT SUPPLY HOUSE



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STATE MINIMUM STANDARDS AND SPECIFICATIONS
Source: Virginia Erosion and Sediment Control Handbook
Third Edition 1992

TURBIDITY CURTAIN

Definition
A floating geotextile material placed so as to minimize sediment transport from a disturbed area adjacent to or within a body of water.

Purpose
To provide sedimentation protection for a watercourse from up-slope land disturbance, or from dredging or filling within the watercourse.

Conditions Where Practice Applies
Applicable to non-tidal and tidal watercourses where intrusion into the watercourse by construction activities 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 curtain 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 curtain types must be selected based on flow conditions within the water body, be it a flowing channel lake pond, or tidal watercourse. The specifications contained within this practice pertain to minimal and moderate flow conditions where the velocity of flow (current) may reach 5 feet per second (approximately three knots). Where there are greater flow velocities or currents, a qualified engineer and the manufacturer should be consulted.

Consideration must also be given to the direction of water movement in channel flow situations. Turbidity curtains 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 curtains should not be installed across channel flows.
In tidal or moving water conditions, provisions must be made to allow the volume of water contained within the curtain to change. Since the bottom of the curtain is weighted and external anchors are frequently added, the volume of water contained within the curtain will be much greater at high tide then at low tide and measures must be taken to prevent the curtain from submerging. To allow the slack of the curtain to rise and fall, water must be allowed to flow through the curtain while allowing it to remain in approximately the same spot and to maintain its 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 pollutants and consideration should be given to the quality of water that must pass through the fabric, and 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 inspectors or Plan Approving Authority. However, consideration must be given to the probable outcome of the procedure: will it create more of a sediment problem by re-suspending particles and by accidental dumping of the material by the equipment involved? In light of such possibility, it is recommended that the soil particles be trapped by a turbidity curtain be removed only if there has been a significant change in the original contours of the 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 to 12

hours prior to the removal of the equipment, or prior to their removal by equipment, or prior to removal of a turbidity curtain.
It is imperative that the intended function of the other controls in this chapter, to keep sediment out of the watercourse, be the strategy used in every erosion control plan. However, when proximity to the watercourse makes successful mitigating sediment loss impossible, the use of the turbidity curtain during land disturbance is essential.

DESIGN CRITERIA

1. Type I configuration (see page 8) should be used in protected areas where there is no current and the area is sheltered from wind and waves.

2. Type II configuration (see page 8) should be used in areas where there may be slow to moderate running current (up to 2 knots or 3.5 feet per second) and/or wind and wave action which can affect the curtain.

3. Type III configuration (see page 8) should be used in areas where considerable current (up to 3 knots or 5 feet per second) may be present, where tidal action may be present, and/or where the curtain is potentially subject to wind and wave action.

4. 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.

5. 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 ballast and the bottom of the skirt 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.

6. 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 which are installed deeper than this will be subject 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" towards the surface under the pressure of the moving water, which will result in an effective depth significantly less than the skirt depth.

7. 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 significantly moving body of water.

8. 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 installing easier, and reduce stress from potential wave action during high winds.

9. 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".

10. For stability reasons, a maximum span of 100 feet between joints (anchors or stake locations) is also a good rule to follow.

11. The ends of the curtain, both floating upper and weighted lower,

should extend well up into the shoreline, especially if high water conditions are expected. The ends should be secured firmly to the shoreline (preferably to rigid bodies such as trees or piles) to enclose fully the area where sediment may enter the water.

12. 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 keeps it in the same relative location and shape during the rise and fall of tidal waters.

13. Typical alignments of turbidity curtains can be seen on page 9. The number and spacing of external anchors may vary depending on current velocities and potential wind and wave action; Parker Systems recommendations should be followed.

CONSTRUCTION SPECIFICATIONS

Materials

1. Barriers should be a bright color (yellow or "international" orange are recommended) that will attract the attention of nearby boaters.

2. The curtain fabric must meet the minimum requirements noted in table on page 7.

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

4. Flotation devices shall be flexible, buoyant units, contained in an individual flotation sleeve or collar attached to the curtain.
Buoyancy provided by the flotation units shall be sufficient to support the weight of the curtain and maintain a freeboard of at least 3 inches above the water surface (see page 9).
5. Load lines must be fabricated into the bottom of all floating turbidity curtains. Type II and Type III must have load lines also fabricated into the top of the fabric. The top load line shall consist of woven webbing or vinyl-sheathed steel cable, and shall have break strength in excess of 10,000 pounds. The supplemental (bottom) load line shall consist of a chain incorporated into the bottom hem of the curtain, with sufficient weight to serve as ballast to hold the curtain in a vertical position. Additional anchorage shall be provided as necessary. The load lines shall have suitable connecting devices which develop the full breaking strength for connecting to load lines in Type I adjacent sections (see page 8).

6. External anchors may consist of wooden or metal stakes (2- x 4-inch or 2.5-inch minimum diameter wood, or 1.33 pounds/linear foot steel) when Type I installation is used; when using type II or Type III installation, bottom anchors must be used.

7. 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 installation, 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 potential wind and wave action; manufacturer's recommendations should be followed. See orientation of external anchors and anchor buoys for tidal installation on page 9.

INSTALLATION

1.In calm waters, such as lakes and ponds (Type I installation) it is usually sufficient merely to set the curtain end stakes or anchor points (using anchor buoys if bottom anchors are employed), then tow out the curtain in the furled condition 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 should the furling lines be loosened to let the curtain skirt drop. Furling systems are a valuable option to have included on the curtain for ease of installation and removal.

2. In rivers or in other moving water (Type II and Type III installations), it is important to set all the curtain anchor points. Care must be taken, prior to putting the furled curtain into the water, to ensure that anchor points are of sufficient holding power to retain the curtain under the existing current conditions. Again, 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:

a) Curtain movements will be minimized during tidal current reversals.
b) The curtain will not overrun the anchors and pull them out when the tide reverses.

Once the anchors are secure, the furled curtain should be secured first to the anchor point that is farthest upstream, then attached sequentially to each downstream anchor point in turn 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 loosened to allow the skirt to drop.

3. Always attach anchor lines to the flotation device, not to the bottom of the curtain. The anchoring line attached to the downstream side of the flotation device will provide support for the curtain. Attaching the anchors to the bottom of the curtain could cause premature failure of the curtain due to stresses imparted on its middle section.

4. There is an exception to the rule that turbidity curtains should not be installed across channel flows; it occurs when there is a danger of creating a silt build-up in the middle of a watercourse, thereby blocking access or creating a sand 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, confine a large part of the silt-laden water to the work area inside the "V" and direct much of the silt toward the shoreline. Care must be taken, however, not to install the curtain perpendicular to the water current.

5. See page 9 for typical installation layouts.

REMOVAL

1. Care should be taken to protect the turbidity curtain skirt from damage by furling the curtain before it is removed from the water.

2. 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.

3. If the curtain has a deep skirt and no furling system, it can further be protected by running a small boat with a crew installing furling lines along its length before attempting to remove the curtain from the water.

MAINTENANCE

1.The developer / owner is responsible for maintenance of the filter curtain for the duration of the project in order to ensure the continuous protection of the watercourse.

2. Should repairs to the geotextile fabric become necessary, there are repair kits available from Parker Systems, and their instructions must be followed to ensure the adequacy of the repair.

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

PHYSICAL PROPERTIES OF TURBIDITY CURTAIN FABRIC

PHYSICAL PROPERTY	REQUIREMENT
THICKNESS, MILS	45
WEIGHT/OZ.SQ.YD:	
TYPE I	18
TYPE II	18 OR 22
TYPE III	22
GRAB TENSILE STRENGTH, LBS.	300
UV INHIBITOR	MUST BE INCLUDED

OPTIONS AVAILABLE

Fabrics:

Impervious

Reinforced PVC Coated
- 14 Oz./Sq. Yd.
- 18 Oz.
- 22 Oz.

Reinforced Alloy Coated
- 24 Oz./Sq. Yd.
- 30 Oz.

Reinforced Urethane Coated
- 23 Oz./Sq. Yd.

Pervious
- Geotextile (Woven Polyolifin Mesh)
- Skirt Insert (as required)
- Entire Barrier

Upper Tension Member:
- Polyolifin Rope
- 1/4" Coated Galvanized Cable
- 5/16" Coated Galvanized Cable

Lower Tension Members (Ballast):
- 1/4" Galvanized Proof Coil Chain
- 5/16" Galvanized Proof Coil Chain
- 3/8" Galvanized Proof Coil Chain
- Dual ¼" Galvanized Proof Coil Chains

Flotation:

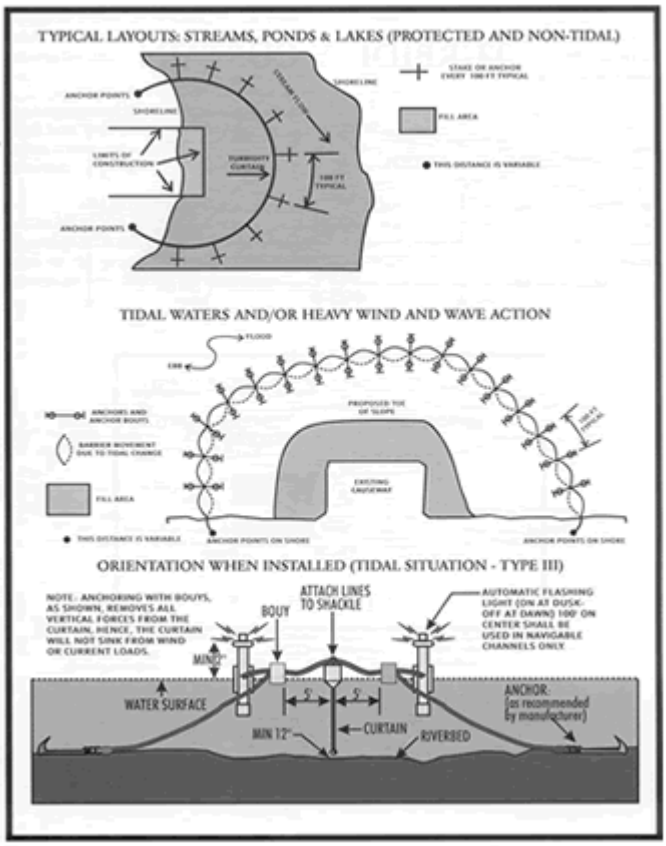
Styrofoam: Available in 4" x 4"through 12" x 12"

Rolled Polyolifin Foam with diameters 6" and up (resistant to oil)

Section Connections:

Grommets & Laced
Slotted Tube (PVC Pipe)
Extruded Aluminum
Quick-Latch

When specifying a barrier to prevent silt migration: Due to the many variables to be considered at a construction site, we recommend that you consult with our field tested experts to obtain the best possible results.



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