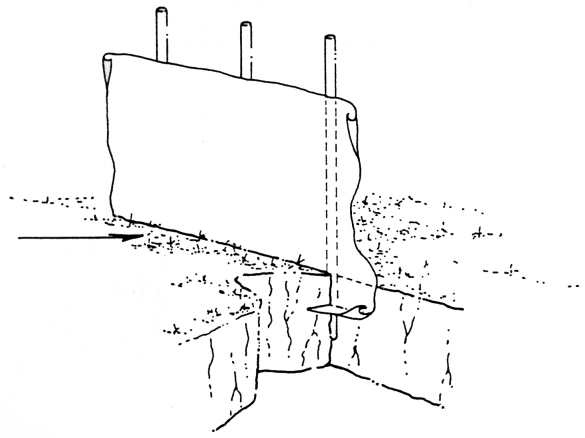
Silt Fences



Description

A silt fence is a temporary barrier designed to retain sediment on the construction site. It consists of a geotextile attached to supporting posts that are trenched into the ground. The fence retains sediment primarily by retarding flow and promoting deposition on the uphill side of the fence. Runoff is also filtered as it passes through the geotextile.

Silt fences are intended to intercept and detain small amounts of sediment from disturbed areas. They can also prevent sheet erosion by decreasing the velocity of runoff. In some instances, straw or hay bales could be used, however their failure rate is high.

The use of silt fences as a sediment barrier is not recommended in areas of concentrated flow, such as ditches. In those cases, soil berms, silt dikes, straw wattles and excelsior logs, or rock check dams should be used.

Advantages

- Easy installation
- Cost-effective
- Materials readily available
- Widely accepted practice
- Effectiveness is superior to straw bales

Limitations

- Not effective for concentrated flows less than 1.0 cfs
- Proper installation is critical for effective performance
- Frequent inspection and maintenance required

Purpose

Water Quantity	
Flow attenuation	☐
Runoff volume reduction	☐
Water Quality	
Pollution prevention	
Soil erosion	■
Sediment control	■
Nutrient loading	◧
Pollution removal	
Total suspended sediment (TSS)	☐
Total phosphorus (P)	☐
Nitrogen (N)	☐
Heavy metals	☐
Floatables	☐
Oil and grease	☐
Other	
Fecal coliform	☐
Biochemical oxygen demand (BOD)	☐

■ Primary design benefit
◧ Secondary design benefit
☐ Little or no design benefit

Silt Fences

Requirements

Design

General Planning and Siting

In operation, the fence generally becomes clogged with fine particles, which in turn reduces the flow rate. This causes a pond to develop more quickly behind the fence. The designer should anticipate ponding and provide sufficient storage areas and overflow outlets to prevent flows from overtopping the fence. Since silt fences are not designed to withstand high standing water, locate them so that only shallow pools can form. Tie the ends of a silt fence into the landscape to prevent flow around the end of the fence before the pool reaches design level. Often a crescent shape will perform better than the traditional straight line. Provide stabilized outlets to protect the fence system and release storm flows that exceed the design storm.

Deposition occurs as the storage pool forms behind the fence. The designer can direct flows to specified deposition areas through appropriate positioning of the fence or by providing an excavated area behind the fence. Plan deposition areas at accessible points to facilitate routine cleanout and maintenance. Show deposition areas in the erosion and sedimentation control plan. A silt fence acts as a diversion if placed slightly off the contour. This may be used by the designer to control shallow, uniform flows from small, disturbed areas and to deliver sediment-laden water to deposition areas.

Silt fences serve no function along ridges or near drainage divides where there is little movement of water. Confining or diverting runoff unnecessarily with a silt fence may create erosion and sedimentation problems that would not otherwise occur, as well as add costs.

- Install silt fences on the contour (as opposed to up and down a hill) and construct so that flow cannot bypass the ends.
- Ensure that the drainage area is no greater than 1/4 acre per 100 feet of fence.
- Make the fence stable for the 10-year peak storm runoff.
- By design, ensure that the depth of impounded water does not exceed 2 feet at any point along the fence.

Types

The following three types of silt fences are used for different circumstances. For details on each type of fence, see Table 1.

- *Heavy Duty.* Use at locations where extra strength is required, such as near water bodies; on areas with unstable wetland soils, steep slopes, highly erodible soils or high runoff; and on areas that are inaccessible to equipment.
- *Preassembled.* For light-duty applications, to protect temporary construction or to supplement the other types of silt fence. This type is installed with plow-type equipment with preattached stakes spread at 6- to 8-foot intervals.
- *Machine-Sliced Installation:* Appropriate for general use during site grading and to protect critical areas. Preferred for most sites due to the effective installation method.

Silt Fences

Table 1: Silt Fence Specifications

Source: MnDOT, 2000

	Heavy Duty		Machine Sliced	Preassemb
Description	Composite of mesh backing, posts, geotextile and fasteners, assembled		Machine installed geotextile fastened to posts on site	Ready-to-inst geotextile atta driveable pos
Geotextile				
Type	Woven		Woven monofilament *	Woven
Width	48 inches		36 inches	36 inches
Grab Tensile ASTM C4632 (machine direction)	100 lb. minimum		130 lb. minimum	100 lb. minimu
Apparent Opening Size ASTM D4751	#20-70 sieve		#30-40 sieve	#20-70 sieve
UV Stability ASTM D4355 500 hours	70 percent minimum		70 percent minimum	70 percent min
Flow Rate ASTM D4491 gal/min/sq. ft.			100 gal./min./sq. ft.	
Top Fastening Component	6-inch overlap, top of mesh backing		Selvaged edge	Sewn-in cord
Net Backing				
Material	Woven wire mesh	Plastic mesh		
Steel Wire Gauge	14 minimum	-		
Max. Mesh Opening	6 inches	2 inches		
Rope for Ditch Check				
Type			Polyethylene	
Diameter			5/8-inch minimum	
Posts				
Material	Steel T-post		Steel T-post with welded plate	Wood
Minimum Size	1.26 lbs./in./ft.		1.26 lbs./in./ft.	2 x 2 inch
Minimum Length	5 feet		5 feet	5 feet
Min. Embedment	24 inches		24 inches	18 inches
Maximum Spacing	8 feet		6 feet; 4 feet for ditch checks	6 feet
Post Fastener	U-shaped clips (for both		Plastic zip ties, 50 lb. tensile	Gun staples, o
Mininum Fasteners per	3 (for both woven wire			

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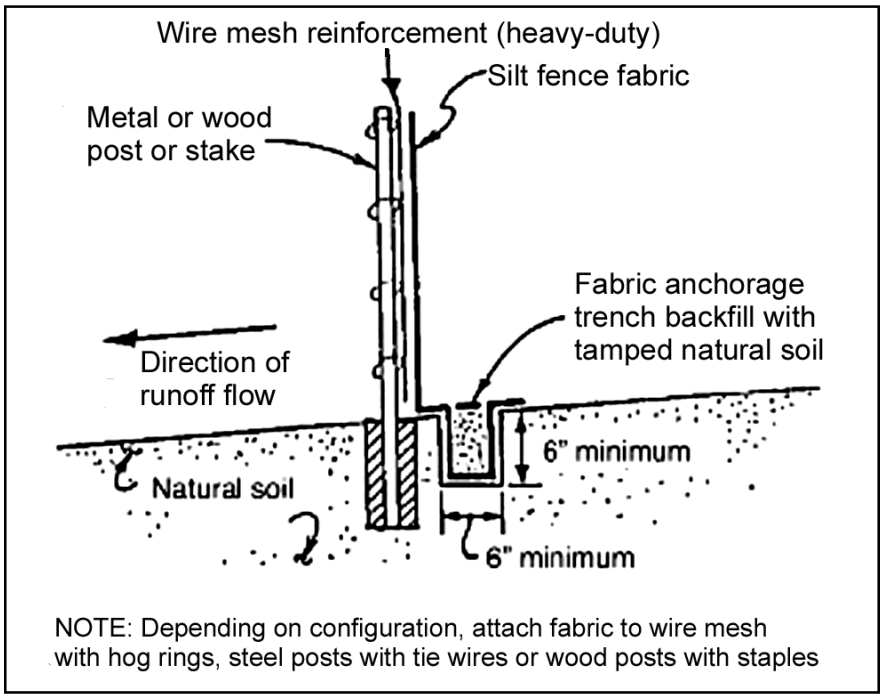

Figure 1: Typical Installation for Silt Fence
Source: MPCA, 2000

Design (continued)

Basic Components

- *Geotextile* should be uniform in texture and appearance and have no defects, flaws or tears that would affect its physical properties. It should contain sufficient ultraviolet (UV) ray inhibitor and stabilizers to provide a minimum two-year service life outdoors. (See Table 1)
- *Wire mesh backing* is required with heavy duty silt fence. Use three vertically placed wire fasteners ("hog rings") to fasten the geotextile woven wire fence material at a minimum spacing of 2 feet (see Table 1).
- *Steel posts* are used for heavy duty silt fence (maximum 8 feet apart) and machine-sliced installation (maximum 6 feet apart). Steel posts should be 1.25 lb./linear ft. with a minimum length of 5 feet. They should have projections to facilitate fastening the fabric. Standard metal T posts with a welded plate for both installations.

  Standard applications may use *wooden posts*, 1.5-inch hardwood with a minimum length of 4 feet. They should have a sharpened end and should be set in the ground at least 1.5 feet deep. Each post should be spaced 4 to 8 feet apart, depending on the type, and securely fastened to the geotextile and net backing by ties or staples suitable for such purpose. (See Table 1)

Silt Fences

Construction

General Notes and Cautions

- Installation of each type of silt fence should meet the requirements of MnDOT Specifications 3886.
- Silt fence that is inadequately embedded in the ground will blow out, releasing water and sediment under the fence. Failure to properly install, inspect and maintain are the primary causes of this failure.
- Another common failure is when silt fences are overtopped in concentrated flow areas. The silt fence is not meant to be placed in concentrated flow areas—the slope length calculations in this document do not apply to concentrated flows.
- Silt fences are not terraces; they cannot be put in sequence to extend the slope length allowable. Other methods must be used if the allowable distance is exceeded.
- Improperly designed and installed silt fences are often eroded around the ends. The fence must be tied into the slope so that the base of the fence is above the design storage depth.
- Construct the silt fence from a continuous roll of geotextile if possible. Cut to the length of the barrier to avoid joints. When joints are necessary, securely fasten the geotextile fabric. It is preferred that the material be overlapped to the next post or the adjoining fabrics wrapped together around posts.
- Never attach silt fence to trees.

Heavy Duty Silt Fence

- Posts should be spaced maximum of 8 feet apart
- The geotextile should be attached to the upstream side of the post and any backing. The bottom edge of the geotextile should be buried at least 6 inches deep in a vertical slot or trench, with the soil pressed firmly against the embedded geotextile.
- When wire mesh is used, wire fasteners (hog rings) shall fasten the geotextile of the top of the mesh along the upper edge at a maximum spacing of 1 foot. A minimum of 3 metal U-shaped clips or wire shall fasten the wire mesh and two layers of geotextile to the metal posts.
- When plastic mesh is used, the mesh backing should be joined to the geotextile at the top with two rows of stitching. Geotextile should protrude below the bottom edge of the plastic mesh to allow embedment. A minimum of 3 metal U-shaped clips or wire shall fasten the plastic mesh and geotextiles to the metal posts.

Machine-Sliced Silt Fence

- Posts should be set a maximum of 6 feet apart.
- A geotextile fabric should be inserted in a slit in the soil (6 to 12 inches deep). The slit should be created such that a horizontal chisel point, at the base of a soil-slicing blade, slightly disrupts soil upward as the blade slices through the soil. This upward disruption minimizes horizontal compaction and creates an optimal soil condition for mechanical compaction against the geotextile. The geotextile should be mechanically inserted directly behind the soil-slicing blade in a simultaneous operation, achieving consistent placement and depth. No turning over (plowing) of soil is allowed for the slicing method.

Silt Fences

Requirements (continued)

Construction

- The contractor should compact the soil immediately next to the silt fence fabric by making at least two passes on each side with the wheels of a tractor, skid steer or roller.
- Each post should be tied in three places with 50-pound plastic zip ties. Position the post with the projections, or nipples, facing away from the silt fence fabric. Place all three ties within the top 8 inches of fabric, puncturing holes vertically a minimum of 1 inch apart. Position each tie diagonally through the fabric so that it rests on top of a post nipple and tighten.
- Ditch checks should be held in the slit by a 5/8-inch polyethylene rope.

Preassembled Silt Fence

- Posts should be spaced a maximum of 6 feet apart.
- The bottom edge of the geotextile is to be buried a minimum of 6 inches in a vertical trench with the soil pressed firmly against the embedded geotextile.
- A polyester or nylon cord (minimum diameter 1/8 inch) should be sewn into a seam running continuously along the top of the geotextile. Each post should be securely fastened to the geotextile by a minimum of five one-inch-long gun staples suitable for this purpose. Staples should be diagonal to the threads of the geotextile fabric.

Inspection

Corrective action is required when quality falls below specified standards, specifically when:

- Improper geotextile is used.
- Geotextile is insufficiently embedded.
- No wire is used on heavy-duty type fence.
- No geotextile overlap exists on heavy-duty fence.
- Soil is not compacted on machine-sliced fence.
- Soil is turned over and/or loosened due to inadequate equipment for machine-sliced fence.
- Components (geotextile, posts, wire, etc.) are inadequately fastened.
- Posts are incorrectly spaced.

Maintenance

- Inspect silt fences at least once a week and after each rainfall, or as required by the NPDES permit. Make any required repairs immediately. Repair scoured areas on the back side of fence at this time to prevent future problems.
- Should the fabric of a silt fence collapse, tear, decompose or otherwise become ineffective, replace it within 24 hours of discovery.

Silt Fences

- Remove silt deposits once they reach 30 percent the height of the fence to provide adequate storage volume for the next rain and to reduce pressure on the fence. Take care to avoid undermining the fence during cleanout.
- It may be easier and more effective to remove and replace the silt fence when removing silt deposits.
- Silt fences are to be removed upon stabilization of the contributing drainage area. Accumulated sediment may be spread to form a surface for turf or other vegetation establishment, or disposed of elsewhere. The area should be reshaped to permit natural drainage.

Sources

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