

EROSION CONTROL ON CONSTRUCTION SITES

by Dana Young and Tim Blake



Sediment is being discharged into this stream (inset) because the stream banks were not stabilized by seeding and mulching or other erosion-control measures, which should happen immediately after grading.



Following a few basic principles will keep the silt on the site without costing you an arm and a leg

“Under the threat of court injunction, the Acme Corporation and its contractor agreed to stop work on a condo project until proper erosion-control measures are installed.” This type of news story is now a familiar sight in daily newspapers in Vermont and other New England states.

In the past few years, water-pollution concerns have shifted from failed septic-systems to discharges of sediment into state waters. The focus has shifted due to the large increase in construction projects.

Violations occur when sediment is allowed to discharge into streams (see sidebar “What is Erosion?”). Sediment may seem like a relatively innocuous pollutant, but excessive sedimentation can do serious harm to streams, lakes, and harbors—harming fisheries, water supplies, flood control, and recreational value.

In Vermont, penalties for discharging sediment-laden water are severe—maximum fines can reach \$25,000 per day, in addition to punitive damages

and reimbursement of clean-up costs. Cleaning up sediment in public drainage facilities costs two to thirty times what it would have cost to control it on-site. To avoid violations, the best approach is to use proven erosion-control techniques before and during excavation and construction. Properly sequencing all phases of construction is extremely important. When in doubt, seek the assistance of engineers and local and state agencies.

Basic Concepts

With an understanding of the erosive forces and the basic control strategies, the contractor can eliminate most erosion problems on building sites. The key concepts to keep in mind on all sites follow:

Limit the amount of disturbed soil.

Soil that is not disturbed will not erode. This sounds simple enough, but too frequently contractors claim that the entire construction area “has to be completely cleared.” Often some thought before dropping the blade can both

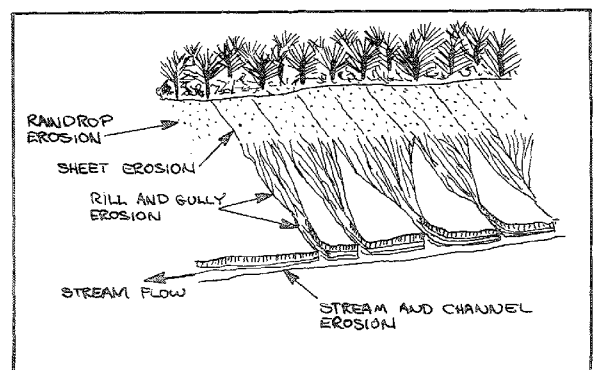
WHAT IS EROSION?

Soil erosion is the removal and loss of soil by water, ice, gravity, and wind. Water is the major culprit here in New England.

The force of raindrops falling on bare or sparsely vegetated soil detaches soil particles (*raindrop erosion*). Water running along the ground surface picks up these particles and carries them along as it flows. Water that is not yet concentrated washes in a thin broad layer or sheet, causing *sheet erosion*.

As runoff gains in velocity and concentration, it detaches more soil particles, cuts narrow and then wider depressions into the soil surface, and adds to its load of sediment. The narrow depressions are called, *rills*, the deeper and wider depressions are *gullies*. As runoff, along with its load of sediment, reaches a stream, it adds to the stream's volume and velocity. Increased volume and velocity may cause *stream* and *channel erosion*.

Sedimentation is the settling out of the soil particles that have been transported by water. Sedimentation occurs when the sediment-laden water slows down enough and for a long enough time for the particles to settle out of suspension. Heavier particles, such as sand and pebbles, settle out more rapidly than do fine particles, such as clays and silts.



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limit erosion and lower the costs of replanting vegetation during landscaping. It may be worth taking the extra step of fencing off areas not to be disturbed.

Divert as much runoff as possible before it reaches your site. This prevents damage before it starts. To divert the water, construct earth berms (diversions) across the slope. If the grade of the drainage channel is steeper than about 3 to 5 percent, you'll need to line it with stone or equivalent materials. It's important to locate the diversions so the water empties onto a stable area (such as a nearly level slope with a dense vegetative cover). Since diversions concentrate water flow, you can cause worse erosion by diverting the water to an erosion-prone area. Plan ahead and find stable outlets.

Keep the time period of soil disturbance short. Large projects should be phased so that work is completed on one portion of the site before another is disturbed. Line your ducks up ahead of time. Order erosion-control materials early enough so that they will be on-site when you need them. Follow seeding immediately with mulching, and apply mulch to *all* disturbed areas. Remember, mulch will keep the soil in place by cushioning the raindrop impact. But, most important, it will assist with seed germination and protect the seeds from harsh conditions such as low rainfall and extreme heat.

Mulch will not work, however, in areas of concentrated flow. Here you should use one of the new erosion-control blankets or netting materials available today. These are stapled to the ground. Follow the manufacturer's directions to the letter, especially details for burying the ends. Learn about the new products and choose ones that suit the job—for example, mowed and unmowed areas require different types of material.

Control sediment at downslope positions. Downslope controls are your last line of defense, intended to catch any eroded sediment before it gets into neighboring properties, streams, or public storm-water systems. Options include haybale dikes, silt fences, and sediment traps. If you find, during the course of construction, that these structures are being overwhelmed with sediment, it means that your upslope treatments are not doing their job. More measures are needed upslope to keep the soil in place. Also, beware when the soil is rich in clays and silts, because once these are dissolved in the water, they take much time to settle out.

Tools of the Trade

To apply the basic principles outlined above, you'll need to familiarize yourself with the materials and techniques of erosion control. Which specific tools you use will be determined by the specific site conditions and local regulations. The main tools are:

Vegetative. Plant or landscape all disturbed areas as soon after final grading as possible. Use appropriate seed mixes, even at higher rates than recommended in your particular area (seed is cheap, the labor to reseed isn't.) It is imperative that you get the seed into, not just on top of, the soil, using whatever technique is available. Definitely mulch, and make sure you match the type of mulch to the intended use of the area. For example, if establishing a lawn, use straw instead of hay, which has large amounts of unwanted seed.

Sediment basins. Sediment traps/basins work by holding back the water



In this ski area, a stream is being temporarily diverted through corrugated ADS pipe, while a new stone-lined channel is being constructed elsewhere on the site. This inexpensive pipe can also be wed to divert spring runoff around an exposed building site.

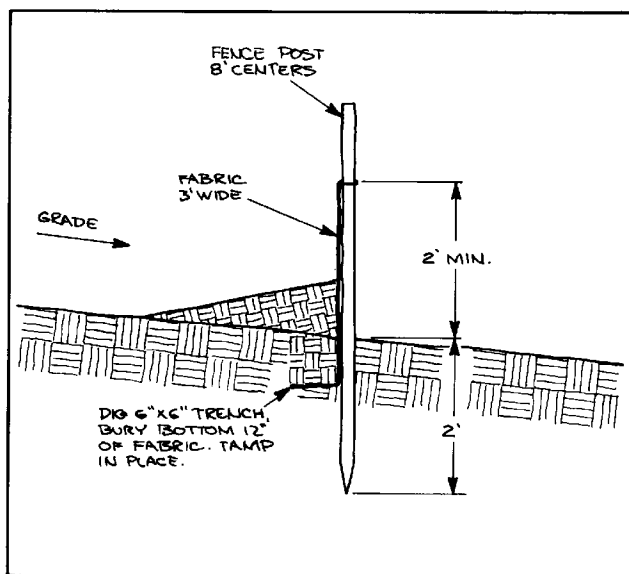


Figure 1. Silt fence detail. In order to do any good, the fabric must be tied into the ground. Left waving in the air, a silt fence does no good.

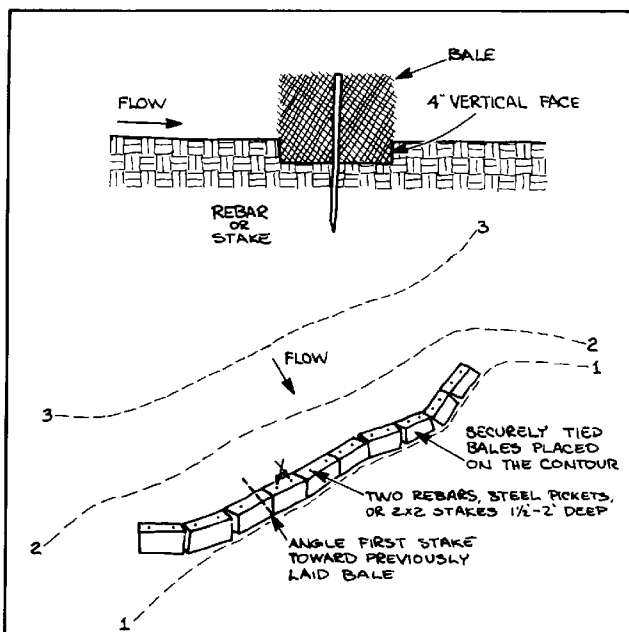


Figure 2. Haybale detail. Haybales can serve a purpose if they are properly embedded and anchored, and are placed across the slope at the bottom of a site. But haybales alone do not make an erosion control system.

for a long enough time for the sediment to settle out. These devices are designed according to complex engineering criteria and are usually regulated by local or state agencies.

Conduit outlet protection (COP). This is the stone at the end of the pipe outlet where it drains to daylight. There are many designs out there, but keep in mind that they all protect the pipe, not the soil below. Look beyond to make sure that the water leaving the COP will not erode the area below. If erosion is likely, such as on steep slope, relocate the pipe, or provide a stable structure down the slope. If possible, have the pipe empty at the bottom of the slope.

Stabilized construction entrance. Create a pad of 1½ to 2½-inch crushed stone, 6 to 8 inches thick over filter fabric, at entrances to public rights-of-way. This eliminates excessive tracking of sediment onto public roads.

Haybale dikes/silt fence. These are barriers constructed along the contour to trap sediment (see Figures 1 and 2). In order to work, they must be entrenched into the ground and staked down. They are never intended to withstand concentrated flows (for example, at the bottom of a drainage channel).

Developers often place too much reliance on haybales to control all erosion. On many jobs, we see haybales everywhere—even up and down the slope, where they do nothing. They would do far more good broken open and spread around as mulch, than left intact and located incorrectly. (Of course, you could continue putting haybales everywhere to help the local farm economy.)

Channels. These are the various ways to direct water through or around a site. A *diversion* is a berm combined with a channel constructed across the slope by either cut-and-fill, or filling operations. A *waterway* is a grassed, broad and shallow channel, constructed by excavating. It usually runs up and down the slope. A *lined waterway* is used where natural or man-made channels are steep and require stone, or equivalent, to withstand the flow velocities. Never expect vegetation to be able to withstand water running down steep or constricted channels.

Summary

Familiarize yourself with the regulations regarding soil-erosion control. Do more than is minimally required. You'll benefit, in that greenery and landscaping sell houses.

Some general principles to keep in mind: Divert water away from the site; limit large areas of disturbance; have erosion-control measures in place before clearing or grading land; time construction work so that you will be seeding and mulching at the proper time of the year (for example, don't start clearing land in November in New England).

Be aware that you'll need to spend money up-front for erosion-control. But good planning and proper timing can limit these costs. Avoid surprises. Beware of statements on the plans such as: "The contractor is responsible to cause and maintain a clear runoff from the site at all times." Make the engineer do his job and develop a detailed plan, which you can budget for.

Finally, please think beyond "haybale" technology. ■

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