United States Environmental Protection Agency | Office of Water Washington, D.C. | EPA 832-F-99-027 September 1999

Storm Water Technology Fact Sheet
Vegetative Covers

DESCRIPTION

Soil erosion and sedimentation caused by vegetation removal, soil disturbances, changes to natural drainage patterns, or increases in impermeable ground cover are two of the primary problems associated with storm water runoff. One of the most effective ways to prevent erosion and sedimentation is to stabilize disturbed land through the addition of vegetation. This practice is referred to as "vegetative covering." Vegetative covers can be used to preserve existing vegetation and/or revegetate disturbed soils. They can provide both dust control and a reduction in erosion potential by increasing infiltration, trapping sediment, stabilizing the soil, and dissipating the energy of hard rain.

One method for establishing vegetative covers is planting either temporary or permanent new vegetation. Specific practices can include applying sod to a site, or temporarily or permanently seeding the site. Sod is a strip of permanent grass cover placed over a disturbed area to provide an immediate and permanent turf that both stabilizes the soil surface and eliminates sediment loss. Temporary seeding consists of planting grass seed immediately after rough grading to provide soil protection until a final cover is established. Permanent seeding establishes perennial vegetation in disturbed areas.

A second method for enhancing vegetative covering is by preserving existing vegetation. This allows a site's natural vegetation (existing trees, vines, bushes, and grasses) to function as a natural buffer zone during land disturbance activities.

APPLICABILITY

Vegetative covers can be applied at any site and are not restricted by the size of the site or local land uses. The type of soil, topography, and climate at the site determine the appropriate tree, shrub, and ground cover species for that particular management practice. Local climatic conditions help determine the appropriate time of year for planting. Temporary seeding is most suitable in areas disturbed by construction where the ground is left exposed for several weeks or more. Permanent seeding and planting is appropriate for any graded or cleared area where long-lived plant cover is desired. Some areas where permanent seeding is especially important are filter strips, buffer areas, vegetated swales, steep slopes, and stream banks.

ADVANTAGES AND DISADVANTAGES

Vegetative covering can be a relatively low-cost and low-maintenance practice for controlling dust and preventing erosion. It also adds to the aesthetics of a storm water control area.

Limitations of vegetative covers as a management practice include:

- Vegetative covering must be coordinated with climatic conditions for proper establishment. For example, cold climate areas have limited growing seasons and arid regions require careful selection of plant species.
- An appropriate maintenance program must be implemented to ensure the optimum performance.

DESIGN CRITERIA

Table 1 summarizes the design criteria for vegetative covers.

PERFORMANCE

Qualitatively, vegetative covers are clearly effective in controlling dust and erosion when properly implemented. The amount of runoff generated from vegetated areas is considerably reduced and of better quality than runoff from unvegetated areas. However, based on data currently available, it is not possible to quantify the water quality benefits of vegetative coverings as a BMP.

OPERATION AND MAINTENANCE

Several measures must be taken after seeding and sodding an area to promote successful growth. It is especially important to check and monitor an area after a rain event to ensure that the seeds and sod have not been damaged. If damage has occurred, the cause of damage must be assessed before repeating seed bed preparation and seeding procedures. Once a vegetative cover has been established, it is important to attend to the following:

- Watering the sod frequently and uniformly.
- Maintaining appropriate grass height for the species selected and the intended use.
- Performing occasional soil tests to determine if the soil is being appropriately fertilized.
- Controlling weeds.
- Spot seeding small and damaged areas.

COSTS

The general base capital costs for constructing a vegetative cover average around $13,800/acre for seeding and $29,000/acre for sodding. A more detailed summary of the cost estimates for sodding and seeding is provided in Table 2. Please note that costs vary depending on regional climates and soil conditions.

REFERENCES

1. Hennepin Conservation District, Minnesota,1989. *Erosion and Sediment Control Manual*.
2. Metropolitan Washington Council of Governments, Controlling Urban Runoff, 1987. *A Practical Manual for Planning and Designing Urban BMPs*.
3. Minnesota Pollution Control Agency ,1989. *Protecting Water Quality in Urban Areas*.
4. Southeastern Wisconsin Regional Planning Commission, 1991. *Costs of Urban Nonpoint Source Water Pollution Control Measures*. Technical Report No. 31.
5. U.S. EPA, Pre-print, 1992. *Storm Water Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices*.
6. Washington State Department of Ecology, 1992. *Storm Water Management Manual for the Puget Sound Basin*.

ADDITIONAL INFORMATION

Hennepin Conservation District
Ali Durgunoglu
10801 Wayzata Blvd. Suite 240
Minnetonka, MN 55305

International Erosion Control Association
P.O. Box 774904
Steamboat Springs, CO 80477

North Carolina State University
Dr. Greg Jennings
214 Weaver Labs, NCSU Box 7625
Raleigh, NC 27695

Southeastern Wisconsin Regional Planning Commission
Bob Biebel
916 N. East Avenue, P.O. Box 1607
Waukesha, WI 53187

TABLE 1 DESIGN CRITERIA FOR VEGETATIVE COVERS

Measure	Extent and Material	Dimensions	Hydraulic	Avoid	Miscellaneous
Temporary Seeding	Place topsoil as needed, to enhance plant growth. A loamy soil with an organic content of 1.5 percent or greater is preferred. Use rapid-growing annual grasses, small grains, or legumes. Apply seeds using a cyclone seeder, drill, cultipacker seeder, or hydroseeder.	Place topsoil where needed to a minimum compacted depth of 2 inches on 3:1 slopes or steeper; and of 4 inches on flatter slopes.	Divert channelized flow away from temporarily seeded areas to prevent erosion and scouring.	Heavy clay or organic soils as topsoil. Handbroadcasting of seeds (not uniform), except in very small areas. Mowing temporary vegetation. High-traffic areas.	Use where vegetation cover is needed for less than 1 year. Use chisel plow or tiller to loosen compacted soils. As needed, apply water, fertilizer, lime, and mulch. Incorporate lime and fertilizer into top 4-6 inches of soil. Plant small grains 1 inch deep. Plant grasses and legume 1/2 inch deep.
Permanent Seeding	Place topsoil as needed to enhance plant growth. A loamy soil with an organic content of 1.5 percent or greater is preferred. Where possible, use low maintenance local plant species. Apply seeds using a cyclone seeder, drill, cultipacker seeder, or hydroseeder.	Apply mulch to slopes 4:1 or steeper if soil is sandy or clayey, or if weather is excessively hot or dry. Place topsoil where needed.	Divert channelized flow away from temporarily seeded areas to prevent erosion and scouring.	Heavy clay or organic soils as topsoil. Hand broadcasting of seeds (not uniform), except in very small areas. High-traffic areas.	Use chisel plow or tiller to loosen compacted soils. As needed, apply water, fertilizer, lie, and mulch. Incorporate lime and fertilizer into top 4-6 inches of soil. Plant small grains 1 inch deep. Plant grasses and legume 1/2 inch deep.
Sodding	Sod should be machine-cut at a uniform thickness of ½ to 2 inches.		In waterways, select plant types able to withstand design flow velocity.	Gravel or nonsoil surfaces. Unusually wet or hot weather. Frozen soils. Mowing for at least two to three weeks.	Prior to laying sod, clear soil surface of debris, roots, branches, and stones bigger than 2 inches in diameter. Sod should be harvested, delivered, and installed within 36 hours. Lay sod with staggered joints along the contour. Lightly irrigate soils before sod placement during dry or hot periods. After placement, roll sod and wet soil to a depth of 4 inches. On slopes steeper than 3:1, secure sod with stakes. In waterways, lay sod perpendicular to water flow. Secure sod with stakes, wire, or netting.
Preservation of Natural Vegetation	Careful planning is required prior to start of construction.	Wherever possible, maintain existing contours.	Maintain existing hydraulic characteristics .	Activities within the drop line of trees. Concentrating flows at new locations.	Preservation of vegetation should be planned before any site disturbance begins. Proper maintenance is vitally important. Clearly mark areas to be preserved.

Source: HCD, 1989.

TABLE 2 INSTALLATION COSTS

Description	Unit	Location	Material	Labor	Equipment	Indirect Cost	Total Cost	Year of Cost	Comments
Sodding									
Level									
>400 yd^2	yd^2	Loganville, GA[1]	$2.07	$1.80	$0.30	$1.68	$5.85	Jan-99	
	yd^2	Dubuque, IA[2]	$1.15	$0.93	$0.05	$1.07	$3.20	1998	Indirect costs include:$0.11 for indirect time, $0.56 for profit, and $0.40 for shipping/semi load.
101 yd^2	yd^2	Loganville, GA[1]	$2.70	$1.80	$0.30	$1.68	$6.40	Jan-99	
	yd^2	Dubuque, IA[2]	$1.15	$0.94	$0.05	$1.46	$3.60	1998	Indirect costs include: $0.43 for indirect time, $0.64 for profit and $0.40 for shipping/semi load
50 yd^2	yd^2	Loganville, GA[1]	$2.70	$1.80	$0.30	$1.68	$6.48	Jan-99	
	yd^2	Dubuque, IA[2]	$1.15	$0.98	$0.05	$2.00	$4.18	1998	Indirect costs include: $0.86 for indirect time, $0.75 for profit and $0.40 for shipping/semi load
Slopes									
401 yd^2	yd^2	Loganville, GA[1]	$2.70	$1.80	$0.30	$1.68	$6.48	Jan-99	
	yd^2	Dubuque, IA[2]	$1.15	$1.23	$0.05	$1.13	$3.56	1998	Indirect costs include: $0.11 for indirect time, $ 0.62 for profit and $0.40 for shipping/semi load
Seeding									
Mechanical Seeding	Acre	Hollston, MA[3]	$653.00	$435.00	$222.00	$430.00	$1,940.00	1998	pricing includes seed, fertilizer, hydromulch, and water only
	yd^2	Hollston, MA[3]	$0.14	$0.09	$0.05	$0.09	$0.36	1998	pricing includes seed, fertilizer, hydromulch, and water only
	Acre	Loganville, GA[1]	$931.40	$600.00	$300.00	$497.10	$2,328.50	Jan-99	
	yd^2	Loganville, GA[1]	$0.18	$0.12	$0.06	$0.10	$0.46	Jan-99	
	Acre	Dubuque, IA[2]	$1,267.21	$142.94	$258.70	$436.23	$2,105.08	1998	Indirect costs include: $103.50 for indirect time, $ 332.73 for profit, provided that equipment is available. Does not include grading. Includes straw mulch.
	yd^2	Dubuque, IA[2]	$0.26	$0.13	$0.24	$0.10	$0.73	1998	

TABLE 2 (CONTINUED) INSTALLATION COSTS

Description	Unit	Location	Material	Labor	Equipment	Indirect Cost	Total Cost	Year of Cost	Comments
Fine Grade/Seed	yd^2	Loganville, GA[1]	$0.18	$0.12	$0.06	$0.10	$0.46	Jan-99	Includes fertilizer & lime
	yd^2	Dubuque, IA	$0.26	$0.13	$0.24	$0.10	$0.73	1998	Indirect costs include: 0.02 for indirect time and 0.08 for profit; equipment is owned and costs include straw mulch)
Push Spreader									
Grass Seed	1,000 ft^2	Loganville, GA[1]	$15.00	$6.25	$0.30	$3.45	$25.00	Jan-99	
	1,000 ft^2	Dubuque, IA[2]	$15.18	$8.88	$54.00	$100.82	$178.88	1998	Indirect costs include: $80.00 for indirect time and $20.82 for profit; does not include mulch
Limestone	1,000 ft^2	Loganville, GA[1]	$2.85	$6.25	$0.30	$1.00	$10.00	Jan-99	
	1,000 ft^2	Dubuque, IA[2]	$2.50	$8.88	$54.00	$98.28	$163.66	1998	Indirect costs include: $80.00 for indirect time and $12.28 for profit; does not include mulch
Fertilizer	1,000 ft^2	Loganville, GA[1]	$3.33						
	1,000 ft^2	Dubuque, IA[2]	$2.80	$8.88	$54.00	$98.34	$164.02	1998	Indirect costs include: $80.00 for indirect time and $18.34 for profit; does not include mulch
Level Areas	Acre	Loganville, GA[1]	$750.00	$600.00	$139.50	$839.50	$2,328.50	Jan-99	
	Acre	Dubuque, IA[2]	$661.24	$109.26	$120.00	$251.30	$1,141.80	1998	Indirect costs include: $81.00 for indirect time and $170.30 for profit; does not include mulch
Sloped Areas	Acre	Loganville, GA[1]	$750.00	$600.00	$139.50	$839.50	$2,328.50	Jan-99	
	Acre	Dubuque, IA[2]	$661.24	$222.12	$120.00	$257.83	$1,261.19	1998	Indirect costs include: $81.00 for indirect time and $176.83 for profit; does not include mulch

1 information provided by Earthscape Landscaping and Lawn Care

2 information provided by Weathers Landscape Services

3 information provided by New England Hydroseeding, Inc.

Wisconsin Valley Improvement Company
Cathy J. Wendt
2301 North 3rd St.
Wausau, WI 54403

For more information contact:

Municipal Technology Branch
U.S. EPA
Mail Code 4204
401 M St., S.W.
Washington, D.C., 20460