Compost Filter Berms

Description

A compost filter berm is a dike of compost or a compost product that is placed perpendicular to sheet flow runoff to control erosion in disturbed areas and retain sediment. It can be used in place of a traditional sediment and erosion control tool such as a silt fence. The compost filter berm, which is trapezoidal in cross section, provides a three-dimensional filter that retains sediment and other pollutants (e.g., suspended solids, metals, oil and grease) while allowing the cleaned water to flow through the berm. Composts used in filter berms are made from a variety of feedstocks, including municipal yard trimmings, food residuals, separated municipal solid waste, biosolids, and manure.

Vegetated compost filter berm. Note sediment on upstream side of berm and clear water on downstream side. Source: S. McCoy, Texas Commission on Environmental Quality.

Compost filter berms are generally placed along the perimeter of a site, or at intervals along a slope, to capture and treat stormwater that runs off as sheet flow. A filter berm also can be used as a check dam in small drainage ditches. The berms can be vegetated or unvegetated. Vegetated filter berms are normally left in place and provide long-term filtration of stormwater as a post-construction best management practice (BMP). Unvegetated berms are often broken down once construction is complete and the compost is spread around the site as a soil amendment or mulch.

Filter berms, in general, provide an effective physical barrier in sheet flow conditions; however, the use of compost in the filter berm provides additional benefits. These benefits include the following:

- The compost retains a large volume of water, which helps prevent or reduce rill erosion and aids in establishing vegetation on the berm.
- The mix of particle sizes in the compost filter material retains as much or more sediment than traditional perimeter controls, such as silt fences or hay bale barriers, while allowing a larger volume of clear water to pass through the berm. Silt fences often become clogged with sediment and form a dam that retains stormwater, rather than letting the filtered stormwater pass through.
- In addition to retaining sediment, compost can retain pollutants, such as heavy metals, nitrogen, phosphorus, oil and grease, fuel, herbicides, pesticides, and other potentially hazardous substances, from stormwater.improving water quality downstream of the berm (USEPA, 1998).
- Nutrients and hydrocarbons adsorbed and/or trapped by the compost filter can be naturally cycled and decomposed through bioremediation by microorganisms commonly found in the compost matrix (USEPA, 1998).

Applicability

Compost filter berms are applicable to construction sites with relatively small drainage areas, where stormwater runoff occurs as sheet flow. Common industry practice is to use compost filter berms in drainage areas that do not exceed 0.25 acre per 100 feet of berm length and where flow does not typically exceed 1 cubic foot per second (see Siting and Design Considerations discussion for more detail). Compost filter berms can be used on steeper slopes with faster flows if they are spaced more closely or used in combination with other stormwater BMPs such as compost blankets or silt fences.

Siting and Design Considerations

Compost Quality: Compost quality is an important consideration when designing a compost filter berm. Use of sanitized, mature compost will ensure that the compost filter berm performs as designed and has no identifiable feedstock constituents or offensive odors. The compost used in filter berms should meet all local, state, and Federal quality requirements. Biosolids compost must meet the Standards for Class A biosolids outlined in 40 Code of Federal Regulations (CFR) Part 503. The U.S. Composting Council (USCC) certifies compost products under its Seal of Testing Assurance (STA) Program. Compost producers whose products have been certified through the STA Program provide customers with a standard product label that allows comparison between compost products. The current STA Program requirements and testing methods are posted on the USCC EXIT Disclaimer website.

The nutrient and metal content of some composts are higher than some topsoils. This, however, does not necessarily translate into higher metals and nutrient concentrations or loads in stormwater runoff. A recent study by Glanville, et al. (2003) compared the stormwater runoff water quality from compost- and topsoil-treated plots. They found that although the composts used in the study contained statistically higher metal and nutrient concentrations than the topsoils used, the total masses of nutrients and metals in the runoff from the compost-treated plots were significantly less than plots treated with topsoil. Likewise, Faucette et al. (2005) found that nitrogen and phosphorus loads from hydroseed and silt fence treated plots were significantly greater than plots treated with compost blankets and filter berms. In areas where the receiving waters contain high nutrient levels, the site operator should choose a mature, stable compost that is compatible with the nutrient and pH requirements of the selected vegetation. This will ensure that the nutrients in the composted material are in organic form and are therefore less soluble and less likely to migrate into receiving waters.

The American Association of State Highway Transportation Officials (AASHTO) and many individual state Departments of Transportation (DOTs) have issued specifications for filter berms (AASHTO, 2003; USCC, 2001). These specifications describe the quality and particle size distribution of compost to be used in filter berms, as well as the size and shape of the berm for different scenarios. The filter berm media parameters developed for AASHTO specification MP 9-03 are shown in Table 1 as an example (Alexander, 2003). Research on these parameters continues to evolve; therefore, the DOT or Department of Environmental Quality (or similar designation) for the state where the filter berm will be installed should be contacted to obtain any applicable specifications or compost testing recommendations.

Design: Filter berms installed to control erosion and sediment on a slope or near the base of a slope are trapezoidal in cross section, with the base generally twice the height of the berm. The height and width of the berm will vary depending upon the precipitation and the rainfall erosivity index (EPA, 2001) of the site. Example compost filter berm dimensions for various rainfall scenarios developed for AASHTO specification MP 9-03 are shown in Table 2 (Alexander, 2003). Example filter berm dimensions based on the site slope and slope length developed by the Oregon Department of Environmental Quality (ODEQ) are shown in Table 3 (ODEQ, 2004).

The compost filter berm dimensions should be modified based on site-specific conditions, such as soil characteristics, existing vegetation, site slope, and climate, as well as project-specific requirements. Coarser compost products are generally used in regions subject to high rainfall or wind erosion.

Table 1. Example Filter Berm Media Parameters

Parameters[1,4]	Units of Measure	Berm to be Vegetated	Berm to be left Unvegetated
pH[2]	pH units	5.0.8.5	Not applicable
Soluble salt concentration[2] (electrical conductivity)	dS/m (mmhos/cm)	Maximum 5	Not applicable
Moisture content	%, wet weight basis	30.60	30.60
Organic matter content	%, dry weight basis	25.65	25.100
Particle size	% passing a selected mesh size, dry weight basis	- 3 in. (75 mm), 100% passing - 1 in. (25 mm), 90 . 100% passing - 0.75 in. (19 mm), 70 . 100% passing - 0.25 in. (6.4 mm), 30 . 75% passing Maximum particle size length of 6 in (152 mm) Avoid compost with less than 30% fine particle (1mm) to achieve optimum reduction of total suspended solids No more than 60% passing	- 3 in. (75 mm), 100% passing - 1 in. (25 mm), 90 . 100% passing - 0.75 in. (19 mm), 70 . 100% passing - 0.25 in. (6.4 mm), 30 . 75% passing Maximum particle size length of 6 in (152 mm) Avoid compost with less than 30% fine particle (1mm) to achieve optimum reduction of total suspended solids No more than 60% passing

		0.25 in (6.4 mm) in high rainfall/flow rate situations	0.25 in (6.4 mm) in high rainfall/flow rate situations
Stability[3] Carbon dioxide evolution rate	mg CO_2.C per gram of organic matter per day	<8	Not applicable
Physical contaminants (manmade inerts)	%, dry weight basis	<1	<1

Source: Alexander, 2003

[1] Recommended test methodologies are provided in [Test Methods for the Evaluation of Composting and Compost EXIT Disclaimer].
[2] Each plant species requires a specific pH range and has a salinity tolerance rating.
[3] Stability/maturity rating is an area of compost science that is still evolving, and other test methods should be considered. Compost quality decisions should be based on more than one stability/maturity test.
[4] Landscape architects and project engineers may modify the above compost specification ranges based on specific field conditions and plant requirements.

Table 2. Example Compost Filter Berm Dimensions for Various Rainfall Scenarios

Annual Rainfall/ Flow Rate	Precipitation/year (Rainfall Erosivity Index)	Berm Dimensions (height x width)
Low	1 . 25 in. (20 . 90)	1 ft x 2 ft to 1.5 ft x 3 ft (30 cm x 60 cm to 45 cm x 90 cm)
Average	26 . 50 in. (91 . 200)	1 ft x 2 ft to 1.5 ft x 3 ft (30 cm x 60 cm to 45 cm x 90 cm)
High	e 51 in. (e 201)	1.5 ft x 3 ft to 2 ft x 4 ft (45 cm x 90 cm to 60 cm x 120 cm)

Source: Alexander, 2003

Table 3. Example Compost Filter Berm Dimensions Based on Slope and Slope Length

Slope	Slope Length	Berm Dimensions (height x width)
<50:1	250 ft	1 ft x 2 ft
50:1 . 10:1	125 ft	1 ft x 2 ft
10:1 . 5:1	100 ft	1 ft x 2 ft
3:1 . 2:1	50 ft	1.3 ft x 2.6 ft
>2:1	25 ft	1.5 ft x 3 ft

Source: ODEQ, 2004

Siting: For sites in high rainfall areas or where there are severe grades or long slopes, larger dimension berms should be used. The project engineer may also consider placing berms at the top and base of the slope, constructing a series of berms down the profile of the slope (15 to 25 feet apart), or using filter berms in conjunction with a compost blanket.

Installation: The compost berm can be installed by hand; by using a backhoe, bulldozer, or grading blade; or by using specialized equipment such as a pneumatic blower or side discharge spreader with a berm attachment. The compost should be uniformly applied to the soil surface, compacted, and shaped to into a trapezoid. Compost filter berms can be installed on frozen or rocky ground. The filter berm may be vegetated by hand, by incorporating seed into the compost prior to installation (usually done when the compost is installed using a pneumatic blower or mixing truck with a side discharge), or by hydraulic seeding following berm construction. Proper installation of a compost filter berm is the key to effective sediment control.

Limitations

Compost filter berms can be installed on any type of soil surface; however, heavy vegetation should be cut down or removed to ensure that the compost contacts the ground surface. Filter berms are not suitable for areas where large amounts of concentrated runoff are likely, such as streams, ditches, or waterways, unless the drainage is small and the flow rate is relatively low.

Maintenance Considerations

Compost filter berms should be inspected regularly, as well as after each rainfall event, to ensure that they are intact and the area behind the berm is not filled with silt. Accumulated sediments should be removed from behind the berm when the sediments reach approximately one third the height of the berm. Any areas that have been washed away should be replaced. If the berm has experienced significant washout, a filter berm alone may not be the appropriate BMP for this area. Depending upon the site-specific conditions, the site operator could remedy the problem by increasing the size of the filter berm or adding another BMP in this area, such as an additional compost filter berm or compost filter sock, a compost blanket, or a silt fence.

Effectiveness

Numerous qualitative studies have reported the effectiveness of compost filter berms in removing settleable solids, total suspended solids, and various organic and inorganic contaminants from stormwater. These studies have consistently shown that compost filter berms are at least as effective as other traditional erosion and sediment control BMPs in controlling sediment; however, the results of the studies varied depending upon the site conditions. One quantitative study conducted in Portland, Oregon (W&H Pacific, 1993) compared the effectiveness of a silt fence and a mixed yard debris compost filter berm to a control plot during five storm events. The study found that the filter berm was over 90 percent effective in removing settleable and total suspended solids when compared to the control plot and was approximately 66 percent more effective than the silt fence. Another quantitative study performed by the Snohomish County, Washington, Department of Planning and Development Services (Caine, 2001) showed no decrease in turbidity with a silt fence but a 67 percent reduction in turbidity using a compost filter berm.

Cost Considerations

The TCEQ reports that compost filter berms cost $1.90 to $3.00 per linear foot when used as a perimeter control and $3 to $6 per linear foot when used as a check dam (McCoy, 2005). The ODEQ reports that compost filter berms cost approximately 30 percent less to install than silt fences (Juries, 2004). These costs do not include the cost of removal and disposal of the silt fence or the cost of dispersing the compost berm once construction activities are completed. The cost to install a compost filter berm will vary, depending upon the availability of the required quality of compost in an area.

References

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