Stormwater Best Management Practice

Compost Filter Socks

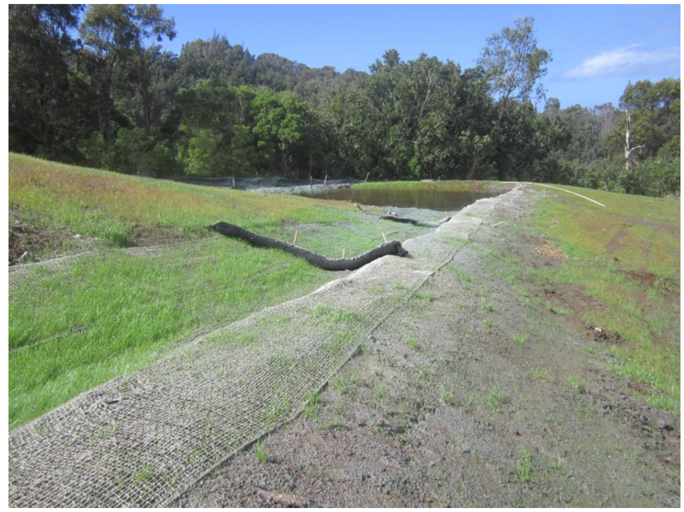
Minimum Measure: Construction Site Stormwater Runoff Control
Subcategory: Erosion Control

Description

A compost filter sock is a type of contained compost filter berm. The filter sock is typically a mesh tube filled with composted material that is placed perpendicular to the direction of sheet flow to control erosion and retain sediment in disturbed areas. A compost filter sock has an oval or round cross-section and provides a three-dimensional filter to retain sediment and other pollutants (e.g., suspended solids, nutrients, metals and motor oil) and allow clean water to flow through (Faucette et al., 2009). The filter sock can replace a traditional erosion and sediment control practice, such as a silt fence or straw bale barrier, and is often more effective. The composts in filter socks come from a variety of feedstocks, including yard trimmings, food residuals, separated municipal solid waste, biosolids and manure.

Construction staff generally place compost filter socks along the perimeter of a site or at intervals along a slope to capture and treat sheet flow. They can also serve as storm drain inlet protection on pavement. They are flexible, and construction staff can fill them in place or fill and move them into position, making compost filter socks especially useful on steep or rocky slopes where installation of other erosion and sediment control practices is not feasible. Compost filter socks have more surface area contact with the underlying soil than typical sediment control devices, so stormwater is less likely to create rills under them and/or create channels carrying unfiltered sediment. The greater contact area and weight of compost filter socks also allows water to pond upgradient and suspended sediments to settle out.

Compost filter socks can be vegetated or unvegetated. Vegetated filter socks can remain in place to provide long-term stormwater filtration as a post-construction stormwater control measure. The vegetation grows into the slope, further anchoring the filter sock. Construction staff often cut open unvegetated filter socks upon project completion, and they spread the compost around the site as soil amendment or mulch. They then dispose of the mesh sock unless it is biodegradable.



Compost filter socks installed in a vegetated channel leading to a sediment basin.

Credit: Anthony D'Angelo for USEPA, 2015

Applicability

Compost filter socks apply to construction sites or other disturbed areas where stormwater discharge occurs as sheet flow. Compost filter socks can apply to steeper slopes with faster flows if they have closer spacing, lie beside and/or on top of each other, have larger diameters, or work in combination with other stormwater controls such as compost blankets.

It is also important to account for regional considerations such as ambient temperature and moisture conditions. Freezing temperatures and prolonged dry periods can impact the compost's effectiveness and life span (USACE, 2008).

Compost Quality Considerations

Compost quality is an important consideration when designing a compost filter sock. Use of sanitized, mature, biologically stable compost ensures that the compost filter sock performs according to design, has no identifiable feedstock constituents or offensive odors, and minimizes soluble nutrient loss.

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Maturity: Maturity indicates how well the compost will support plant growth. One maturity test compares the percentage of seeds that germinate in compost compared to a potting soil mix. The difference in germination rates marks the maturity of the compost.

Stability: Stability indicates microbial activity in the compost and can directly correlate to carbon dioxide production from the compost due to microbe respiration during the decay process. A stable compost has no offensive odors, does not resemble the original material and has low rates of carbon dioxide off-gassing.

Absence of pathogens: The pathogen count indicates how sanitary the compost is. In 40 CFR, Part 503, EPA has defined processes for composting that reduce the number of pathogenic organisms to nondetectable levels and ensure the resulting compost is sufficiently heat-treated and sanitary.

The compost in filter socks should meet all local, state and federal quality requirements and meet the guidelines outlined in Table 1. All compost should comply with 40 CFR, Part 503, which establishes safe standards for pathogen reduction and presence of heavy metals.

Table 1. Quality guidelines for compost used in filter socks.

Parameters	Units of Measure	Acceptable Range
pH	N/A	5.0–8.5
Soluble salt concentration (electrical conductivity)	dS/m (millimhos/cm)	Maximum 5 dS/m
Moisture content	Percent, wet weight basis	30–60%
Organic matter content	Percent, dry weight basis	25–100%
Particle size	Percentage passing a selected mesh size, dry weight basis	2 inches, 100% passing; 3/8 inches, 50% passing
Biological stability/maturity (carbon dioxide evolution rate)	mg CO_2-C per gram of organic matter per day	Less than 8 mg
Physical contaminants (human-made inerts)	Percent, dry weight basis	Less than 1%

Source: AASHTO 2017, USDA 2011

The U.S. Composting Council (USCC) certifies compost products under its Seal of Testing Assurance Program. Compost producers whose products the Seal of Testing Assurance Program has certified provide customers with a standard product label that allows comparison among compost products. The USCC website contains information on the current Seal of Testing Assurance Program requirements and testing methods.

Construction staff should choose a mature, biologically stable compost that meets the particle size specifications in Table 1 above. This ensures that the nutrients in the composted material are in organic form, 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 have issued specifications for filter socks (AASHTO, 2017; USCC, 2001). These specifications describe the quality and particle size distribution of compost for compost filter socks for highway construction projects. Research on these parameters continues to evolve; therefore, design engineers should contact the department of transportation or state environmental agency where they will install the filter sock to obtain any applicable specifications or compost-testing recommendations. Compost filter socks can apply to many types of construction projects and various landscaping projects as well. Construction staff may modify these parameters depending on local site conditions or needs, as appropriate.

Siting and Design Considerations

Filter sock assembly involves tying a knot in one end of the mesh sock, filling the sock with the composted material (usually using a pneumatic blower), then knotting the other end once the sock reaches the desired length. A filter sock is normally the width of the slope to ensure that stormwater does not break through at the intersection of socks placed end to end. Where this is not possible, construction staff place the socks end to end along a slope and interlock the ends.

The diameter of the filter sock varies depending on the purpose of the filter sock, as well as the steepness and length of the slope. Construction staff usually place compost filter socks along a contour perpendicular to sheet flow. In areas of concentrated flow, compost filter socks often serve as check dams. Local rainfall and appropriate storm scenarios should determine the sizing and spacing of filter socks. Specifications manuals can provide detailed information regarding diameter, length, specific location and spacing recommendations for filter socks (e.g., USDA 2011 and ASSHTO 2017).

Studies examining the use of erosion and sediment control practices utilizing compost in bioretention systems, compost blankets and as soil amendments have shown both reductions in organic nutrients and releases of nutrients (N and P) in leachate and infiltrate. The potential for nutrient discharges from erosion and sediment control practices that utilize compost should be considered to determine whether compost use is appropriate especially in cases where there are receiving waterbodies that are sensitive to or are currently impaired by nutrients. Site conditions, compost type and composition, compost berm placement and management of the compost system also will affect potential nutrient loadings or reductions and pollutant loadings to receiving waters. The use of this practice should be considered weighing the overall efficacy of the system in terms initial nutrient loadings, mid-life nutrient trapping capacity and the potential for end-of-life nutrient discharges where nutrients are of concern.

Installation

The advantage of compost filter socks over similar stormwater controls is that they do not require trenching; therefore, installing them does not disturb the soil. However, construction staff should trim or remove vegetation and debris to ensure full contact with the ground surface. Once staff have filled the filter sock and placed it, they should anchor it to the slope. The preferred anchoring method is to drive stakes at regular intervals through the center of the sock at least 8 inches into the ground (USDA, 2011); alternatively, construction staff can place stakes on the downstream side of the sock. They should direct the ends of the filter sock upslope to prevent stormwater from running around them. Incorporating seed into the compost before placement in the filter sock can vegetate the filter sock. Since it is not necessary to trench compost filter socks into the ground, construction staff can install them on frozen ground or even cement.

Limitations

Construction staff can install compost filter socks on any type of soil surface; however, they should cut down or remove heavy vegetation to ensure that the compost contacts the ground surface. Stormwater and sediment control devices, including filter socks, are not appropriate for use in streams.

Maintenance Considerations

Construction staff should inspect compost filter socks regularly, including after each rainfall event, to ensure proper function. Excessive upstream ponding or overtopping indicates that the current configuration is not adequate. In these cases, construction staff should place an additional filter sock further up the slope or use an additional erosion control, such as a compost blanket, in conjunction with the filter sock. Staff should remove accumulated sediment when it reaches one half the height of the filter sock or as the current EPA Construction General Permit or equivalent state and local permits mandate. If the compost filter sock is a temporary application, at the end of the project, construction staff can spread the compost material in areas that do not receive concentrated flow (USDA, 2011).

Effectiveness

A number of studies have shown that compost filter socks are at least as effective as traditional erosion controls at removing settleable solids, total suspended solids and a variety of other pollutants from stormwater. An Ohio State University study found that compost filter socks have a 50 percent higher flow-through rate than silt fences without a reduction in sediment removal efficiencies (Keener et al., 2007). A U.S. Department of Agriculture study found that compost filter socks reduced clay and silt particulates (the major contributors to suspended solids and turbidity) by 65 percent, outperforming straw bales and mulch berms. The same study saw a reduction in bacteria of 75 percent, reduction in heavy metals of 37 to 71 percent and reduction in petroleum hydrocarbons of 43 to 84 percent (Faucette et al., 2009). In a similar study, compost filter socks reduced phosphorus concentrations by about 60 percent, compared to removal rates of around 20 percent by silt fences (Faucette et al., 2008).

Cost Considerations

The cost to install a compost filter sock depends on the availability of the required quality of compost in an area. The cost for a biodegradable compost filter sock generally ranges from $5 to $10 per linear foot, with the cost mostly dependent on the cost of the compost (RSMeans, 2019). Although costs for fully biodegradable netting can be more than non-biodegradable netting, the labor cost savings from not having to remove the control measure—as well as the subsequent benefit to soil condition and vegetation establishment—may justify this cost. However, there is still the cost to remove and dispose of sediment that accumulates to at least one-third the distance between the top of the fiber roll and the ground surface.

Additional Information

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

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