EPA United States Environmental Protection Agency

Stormwater Best Management Practice

Compost Blankets

Permits for Clean Water NPDES

Minimum Measure

Construction Site Stormwater Runoff Control

Subcategory

Erosion Control

Figure 1. *Applying a compost blanket on a bare and eroding slope*

Figure 2. *Same slope after revegetation*

Purpose and Description

A compost blanket is a layer of loosely applied composted material placed on the soil in disturbed areas to reduce stormwater runoff and erosion. This material fills in small rills and voids to limit channelized flow, provides a more permeable surface to facilitate stormwater infiltration, and promotes revegetation. Seeds can be mixed into the compost before it is applied. Composts are made from a variety of feedstocks, including yard trimmings, food residuals, separated municipal solid waste, and municipal sewage sludge (biosolids). Controlling erosion protects water quality in surface waters, such as streams, rivers, ponds, lakes, and estuaries; and increasing stormwater infiltration replenishes groundwater aquifers. Applying a compost blanket also works well as a stormwater best management practice (BMP) because it:

- Retains a large volume of water, which aids in establishing vegetation growth within the blanket,
- Acts as a cushion to absorb the impact energy of rainfall, which reduces erosion,
- Stimulates microbial activity that increases the decomposition of organic matter, which increases nutrient availability and improves the soil structure,
- Provides a suitable microclimate with the available nutrients for seed germination and plant growth, and
- Removes pollutants such as heavy metals, nitrogen, phosphorus, fuels, grease and oil from stormwater runoff, thus improving downstream water quality (USEPA 1998).

Applicability and Limitations

Compost blankets can be placed on any soil surface: flat, steep, rocky, or frozen. The blankets are most effective when applied on slopes between 4:1 and 1:1 (horizontal run:vertical rise); such as construction sites, road embankments, and stream banks; where stormwater runoff can occur as sheet flow. On the steeper slopes (1:1) the compost blanket should be used in conjunction with netting or other confinement systems to further stabilize the compost and slope, or the compost particle size and depth should be specially designed for this application. Compost blankets should not be placed in locations that receive concentrated or channeled flows either as runoff or a point source discharge. If compost blankets are placed adjacent to highways and receive concentrated runoff from the traffic lanes, they should be protected by compost berms, or a similar BMP that diffuses or diverts the concentrated runoff before it reaches the blanket (Glanville, Richard, and Persyn 2003). Because a compost blanket can be applied to the ground surface without having to be incorporated into the soil, it provides excellent erosion and sediment control on difficult terrain, such as steep or rocky slopes (Figures 3, 4). Projects where the cost of transporting and applying composts is most easily justified are situations that demand both immediate erosion control and growth of vegetative cover, such as projects completed too late in the growing season to establish natural vegetation before winter or areas with poor quality soils that don't readily support vegetative growth (Glanville, Richard, and Persyn 2003).

Figure 3. *Applying a compost blanket on a steep, rocky slope*

Figure 4. Same slope after revegetation

Office of Water, 4203M
www.epa.gov/npdes/pubs/compostblankets.pdf
www.epa.gov/npdes/stormwater/menuofbmps

EPA 833-F-11-007
March 2012

What Is Compost?

Compost is the product of controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth. It is an organic matter resource that has the unique ability to improve the biological, chemical, and physical characteristics of soils or growing media. Compost contains plant nutrients but is typically not characterized as fertilizer (USCC 2008).

This decomposition of organic material is produced by metabolic processes of microorganisms. These microbes require oxygen, moisture, and food in order to grow and multiply. When these three factors are maintained at optimal levels, the natural process of decomposition is greatly accelerated. The microbes generate heat, water vapor, and carbon dioxide as they transform the raw materials into a stable soil conditioner. Compost can be produced from many raw organic materials, such as leaves, food scraps, manure, and biosolids. However, the mature compost product bears little physical resemblance to the raw material from which it originated.

Figure 5. *Mature compost product*

How Is Compost Beneficial?

Biological Benefits

Provides an excellent substrate for soil biota. The activity of soil microorganisms is essential for productive soils and healthy plants. Their activity is largely based on the presence of organic matter. Soil microorganisms include bacteria, protozoa, and fungi. They are not only found within compost, but will also proliferate within the soil under a compost blanket. These microorganisms play an important role in organic matter decomposition, which leads to humus formation and nutrient availability. Some microorganisms also promote root activity; specific fungi work symbiotically with plant roots, assisting them in extracting nutrients from the soils.

Suppresses plant diseases. The incidence of plant diseases may be influenced by the level and type of organic matter and microorganism present in soils. Research has shown that increased populations of certain microorganisms may suppress specific plant diseases, such as pythium blight and fusarium wilt.

Chemical Benefits

Provides nutrients. Compost blankets contain a considerable variety of macro- and micronutrients essential for plant growth. Since compost contains relatively stable sources of organic matter, these nutrients are supplied in a slow-release form.

Modifies and stabilizes pH. The pH of composts differ. When necessary, a compost may be chosen that is most appropriate for revegetating a particular construction site.

Physical Benefits

Improved soil structure and moisture management. In fine-textured soils (i.e., clay or clay loam), the addition of compost will increase permeability, and reduce stormwater runoff and erosion. The soil-binding properties of compost are due to its humus content. Humus is a stable residue resulting from a high degree of organic matter decomposition. The constituents of humus hold soil particles together, making them more resistant to erosion and improving the soil's ability to hold moisture.

Effectiveness of Compost, Topsoil, and Mulch

Because of the biological, chemical, and physical benefits it can provide, compost makes a more effective erosion control blanket than topsoil. An Iowa State University study (Glanville, Richard, and Persyn 2003), sponsored by the Iowa Department of Natural Resources and Iowa Department of Transportation (DOT), compared the quantity of runoff from road embankments treated with topsoil and with compost blankets. The test plots were exposed to simulated, high intensity rainfall (3.7 inches/hour) lasting for 30 minutes. Results showed that the amount of runoff from the embankment treated with a compost blanket was far less than the runoff from the embankment treated with topsoil.

Mulch is a protective covering placed around plants for controlling weeds, reducing evaporation, and preventing roots from freezing. It is made of various substances usually organic, such as hardwood or pine bark. A compost blanket is a much more effective BMP for erosion control and revegetation than mulch. A University of Georgia research study (Faucette and Risse 2002) reported that correctly applied compost blankets provide almost 100 percent soil surface coverage, while other methods (e.g., straw mats and mulches) provide only 70 to 75 percent coverage. Uniform soil coverage is a key factor in effective erosion and sediment control because it helps maintain sheet flow and prevents stormwater from forming rills under the compost blanket.

Compost Quality

Compost Properties

Maturity. Maturity indicates how well the compost will support plant growth. One maturity test measures the percent of seeds that germinate in the compost compared to the number of seeds that germinate in peat based potting soil. For example, if the same number of seeds was planted in the potting soil (control) and in a marketed compost product, and 100 of them germinate in the potting soil and 90 germinate in the compost, the compost's maturity would be 90 percent. Another maturity test compares the growth and vigor of seedlings after they have been growing in both compost and potting soil.

Stability. Stability determines how "nice" the compost is. While microbial decay is actively transforming the feedstocks into compost, the unstable mixture may have unpleasant characteristics such as odors. However, after the decay process is completed, the stable compost product no longer resembles the feedstock or has offensive characteristics. During the composting process, CO_2 is produced because the microbes are actively respiring. So the microbial respiration (CO_2 evolution) rates can be measured and used to determine when the microbial decay is completed and the compost product has stabilized.

Presence of Pathogens. The pathogen count indicates how sanitary the compost is. EPA has defined processes for composting biosolids that reduce the number of pathogenic organisms to nondetectible levels and ensure the resulting compost will be sufficiently heat treated and sanitary. These processes to further reduce pathogens (PFRP) are defined in 40 CFR, Part 503, Appendix B, Section B. Compost quality specifications often require compost to be treated by a PFRP process, so there are no measurable pathogenic microorganisms present.

Other compost properties that may be found in compost quality specifications are plant nutrients and heavy metal concentrations, pH, moisture content, organic matter content, soluble salts, and particle size.

Compost Quality Testing

A compost testing, labeling, and information disclosure program, the Seal of Testing Assurance Program, has been established by the United States Composting Council (USCC), a private, nonprofit organization. Under this program testing protocols for determining the quality and condition of compost products at the point of sale have been jointly approved and published by the USCC and U.S. Department of Agriculture. These Test Methods for Evaluating Compost and Composting, the TMECC Testing Protocols are conducted by independent laboratories to help compost producers determine if their compost is safe and suitable for its intended uses, and to help users compare various compost products and verify the product safety and market claims. The goal of the program is to certify the compost products have been sampled and tested in accordance with these approved protocols. Compost producers who participate in this program have committed to having their products tested by an approved laboratory according to the prescribed testing frequency and protocols and to providing the test results to anyone upon request. The products of participating compost producers carry the USCC certification logo and product information label.

Compost Quality Specifications

The Federal Highway Administration supported developing specifications for compost used in erosion and sediment control through a cooperative agreement with the Recycled Materials Resource Center at the University of New Hampshire. The original compost blanket specifications (Alexander 2003) were developed under this grant. Working with the USCC and Ron Alexander (Alexander 2003), the American Association of State Highway and Transportation Officials finalized and approved these specifications (AASHTO 2010), which include: narrative criteria (e.g., no objectionable odors or substances toxic to plants), numerical specifications [e.g., pH, soluble salts, moisture content, organic matter content, particle size, stability, and physical contaminants (e.g., metal, glass, plastics)], and pathogen reduction using the EPA processes to further reduce pathogens. These AASHTO specifications also recommend the TMECC testing protocols. A number of states have now developed specifications for the compost they use in erosion and sediment control. Examples are the California DOT specifications and Texas DOT specifications.

Compost Blanket Installation

Once any trash and debris have been removed from a site, a compost blanket can be uniformly applied usually between 1 and 3 inches thick using a bulldozer, skid steer, manure spreader, or hand shovel. Application rates (thickness) are often included in compost blanket specifications. The compost blanket should extend at least 3 feet over the shoulder of the slope to ensure that stormwater runoff does not flow under the blanket (Alexander 2003). On very rocky terrain or if the slope is too steep for heavy equipment, a pneumatic blower truck is needed to apply the compost (Figure 6). If the slope is steep, a compost blanket may work best in conjunction with other BMPs, such as compost socks placed across the slope to reduce the runoff velocity (Figure 7) or compost berms placed at the top of the slope to divert or diffuse concentrated runoff before it reaches the compost blanket (Figure 8).

Figure 6. *Using a pneumatic blower truck to apply a compost blanket on a rocky 1:1 slope*

Figure 7. *Using compost socks to reduce the runoff velocity*

Figure 8. *Using a compost berm to divert or defuse highway runoff before it reaches the compost blanket*

Fabric netting can also be used to hold the compost blanket on steep slopes (Figure 9). The netting is usually stapled to the slope (Figure 10), and then the compost is blown on the slope and into the netting.

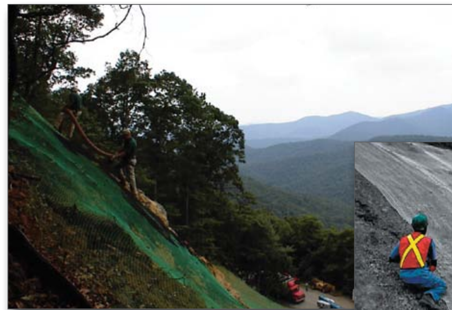

Figure 9. *Netting stabilizing a compost blanket*

Figure 10. *Stapling netting to the slope*

Mature compost for erosion control on moderate slopes is shown in Figure 11, with a red pen for size comparison. The compost in Figure 5 is too fine for erosion control. Coarser compost should be avoided on slopes that will be landscaped or seeded, as it will make planting and crop establishment more difficult. But coarse and/or thicker compost is recommended for areas with higher annual precipitation or rainfall intensity, and even coarser compost is recommended for areas subject to wind erosion (Alexander 2003).

Figure 11. *Compost for erosion control on moderate slopes*

Grass, wildflower, or native plant seeds appropriate for the soil and climate can be mixed into the compost. Although seed can be broadcast on the compost blanket after installation, it is typically incorporated into the compost before it is applied, to ensure even distribution of the seed throughout the compost and to reduce the risk of the seed being washed from the surface of the compost blanket by stormwater. Wood chips may also be added to reduce the erosive effect of rainfall's impact energy.

Figure 12. *Impact of rainfall*

Inspection and Maintenance

The compost blanket should be inspected periodically and after each major rainfall. If areas of the compost blanket have washed out, another layer of compost should be applied. In some cases, it may be necessary to add another BMP to control the stormwater, such as a compost filter sock or silt fence. On slopes greater than 2:1, establishing thick, permanent vegetation as soon as possible is the key to successful erosion and sediment control. Restricting or eliminating pedestrian traffic on such areas is essential (Faucette and Ruhlman 2004).

Climate Change Mitigation

In 2005 an estimated 246 million tons of municipal solid wastes were generated in the United States. Organic materials including yard trimmings, food scraps, wood waste, paper and paper products are the largest component of our trash and make up about two-thirds of the solid waste stream. When this organic matter decomposes in landfills, the carbon is converted to methane (CH_4) and other volatile organic compounds, which are released into the atmosphere and contribute to global warming. EPA has identified landfills as the single largest source of methane, a potent greenhouse gas that is 23 times more efficient at trapping heat than carbon dioxide (CO_2). Landfills contribute approximately 34 percent of all man-made methane released into the atmosphere in the United States (USEPA 2007). Two approaches for mitigating climate change are reducing carbon emissions and sequestering carbon in the atmosphere.

Reducing carbon emissions. When organic materials are composted and then recycled, the composting feedstocks are diverted from already burdened municipal landfills, and landfill-generated methane gas emissions are reduced.

Figure 13. *As compost like this is recycled, green house gasses are reduced*

Sequestering Carbon. Carbon sequestration is the act of removing carbon dioxide from the atmosphere and storing it in carbons sinks, such as oceans, plants and other organisms that use photosynthesis to convert carbon from the atmosphere into biomass. Forest ecosystems and permanent grasslands are prime examples of terrestrial carbon sinks that sequester carbon. We no longer have the vast expanses of prairies and eastern forests, but we are using compost blankets to revegetate construction sites, road banks, and green roofs; and this vegetation sequesters carbon.

Figure 14. *Compost blankets will nurture revegetation, which sequesters carbon and prevents erosion*

References

AASHTO 2010. Standard Practice for Compost for Erosion/Sediment Control (Compost Blankets), R 52-10. Washington, DC: American Association of State Highway and Transportation Officials.
www.epa.gov/npdes/pubs/aashto.pdf

Alexander, R. 2003. Standard Specifications for Compost for Erosion/Sediment Control, based on work supported by the Federal Highway Administration under a Cooperative Agreement with the Recycled Materials Resource Center at the University of New Hampshire, Durham, New Hampshire.
www.alexassoc.net/organic_recylcing_composting_documents/standard_compost_erosion_sediment_control_specs.pdf

Faucette, Britt, and Mark Risse 2002. "Controlling Erosion with Compost and Mulch." BioCycle June: 26–28.
www.epa.gov/npdes/pubs/biocycle2002.pdf

Faucette, Britt, and Melanie Ruhlman 2004. "Stream Bank Stabilization Utilizing Compost." BioCycle January: 27.
www.epa.gov/npdes/pubs/biocycle2004.pdf

Faucette, L.B., C.F. Jordan, L.M. Risse, M. Cabrera. D.C. Coleman, L.T. West 2005. "Evaluation of Stormwater from Compost and Conventional Erosion Control Practices in Construction Activities." Journal of Soil and Water Conservation 60: 288–297. Available from J. Soil & Water Con. abstract free and full text for a fee.

Faucette, L.B., L.M. Risse, C.F. Jordan, M.L. Cabrera, D.C. Coleman, L.T. West 2006. "Vegetation and Soil Quality Effects from Hydroseed and Compost Blankets Used for Erosion Control in Construction Activities." Journal of Soil and Water Conservation 61: 355–362. Available from J. Soil & Water Con. abstract free and full text for a fee.

Faucette, L.B., J. Governo, C.F. Jordan, B.G. Lockaby, H.F. Carino, R. Governo 2007. "Erosion Control and Storm Water Quality from Straw with PAM, Mulch, and Compost Blankets of Varying Particle Sizes." Journal of Soil and Water Conservation 62: 404–413. Available from J. Soil & Water Con. abstract free and full text for a fee.

Faucette, L.B. 2008. "Performance and Design for Compost Erosion Control and Compost Storm Water Blankets." Proceedings of the International Erosion Control Association Annual Conference. Orlando, Florida: International Erosion Control Association. Abstract available from IECA.

Faucette, L.B., B. Scholl, R. E. Bieghley, J. Governo. 2009. "Large-Scale Performance and Design for Construction Activity Erosion Control Best Management Practices." Journal of Environmental Quality 38: 1248–1254. Available from J. Env. Qual. Abstract and full text free.
www.soils.org/publications/jeq/abstracts/38/3/1248

Filtrexx 2009. Filtrexx International's Carbon Reduction & Climate Change Mitigation Efforts, Item # 3324. Grafton, OH: Filtration International, LLC.

Glanville, Tomas D., Tom L. Richard, Russell A. Persyn 2003. Impacts of Compost Blankets on Erosion Control, Revegetation, and Water Quality at Highway Construction Sites in Iowa. Ames: Iowa State University of Science and Technology, Agricultural and Biosystems Engineering Department.
www.eng.iastate.edu/compost/papers/FinalReport_April2003_ExecSummary.pdf

Risse, M., L.B. Faucette. 2009. Compost Utilization for Erosion Control, Bulletin No. 1200. Athens: University of Georgia, Cooperative Agriculture Extension Service.

USCC 2001. Compost Use on State Highway Applications. This is a series of case studies as well as model specifications developed by state DOTs for using compost in highway construction projects. Ronkonkoma, NY: U.S. Composting Council. Available from USCC for a fee.
http://compostingcouncil.org/publications/

USCC 2008. USCC Factsheet: Compost and Its Benefits. Ronkonkoma, NY: U.S. Composting Council.
http://compostingcouncil.org/admin/wp-content/uploads/2010/09/Compost-and-Its-Benefits.pdf

USEPA 1998. An Analysis of Composting as an Environmental Remediation Technology, EPA 530-R-98-008. Washington, DC: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response.
www.epa.gov/osw/conserve/rrr/composting/pubs/

USEPA 2007. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005, USEPA 430-R-07-002. Washington, DC: U.S. Environmental Protection Agency, Office of Atmospheric Programs.
www.epa.gov/climatechange/emissions/downloads06/07CR.pdf

Websites

Caltrans 2010. Compost Blanket. California Department of Transportation.
www.dot.ca.gov/hq/LandArch/ec/organics/compost_blanket.htm

USEPA 2010. Compost Based Stormwater Best Management Practices Webinars. U.S. Environmental Protection Agency, Region 5, Chicago.
www.epa.gov/region5/waste/solidwaste/compost/webinars.html

Photograph Credits

Figures 1, 2. *Barrie Cogburn, Texas DOT*

Figures 3, 4. *Dwayne Stenlund, CPESC Minnesota DOT*

Figure 5. *Larry Strong, affiliation unknown*

Figure 6. *Scott McCoy, KSS Consulting, LLC*

Figure 7. *Tom Glanville, Iowa State University*

Figure 8. *Jason Giles, CPESC, Rexius*

Figures 9, 10. *Britt Faucette, CPESC, Filtrexx International, LLC*

Figure 11. *Jason Giles, CPESC, Rexius*

Figure 12. *Larry Beran, Texas A&M University*

Figures 13, 14. *Jami Burke, CESCL, Cedar Grove Landscaping and Construction Services*