Public Comment on DDOE's Draft Stormwater Management Guidebook

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Thank you for the opportunity to provide public comments on DDOE's *Draft Stormwater Management Guidebook*. My comments focus on strengthening the requirements for use of compost-amended soils and the acceptance of compost-related products such as compost berms, compost filter socks, and compost blankets as best management practices in the Guidebook.

I commend DDOE for providing a specification for compost amended soils in the Guidebook (Appendix K: Soil Compost Amendment Requirements) and for promoting the use of compost amended soils in several BMPs (such as Impervious Surface Disconnection filter paths; growing or filter media for rain gardens, green roofs, and bioretention systems; channel systems; vegetated swales; stormwater wetlands; and tree planting and preservation).

Given the importance of adding organic matter via compost to soils to improve soil's water infiltration and water holding capacity, I request that:

1. DDOE add Amend Soil with Compost as a 14th Stormwater Management (stand-alone) practice in Chapter 3 of the *Stormwater Guidebook*.

2. The Guidebook establish and require a minimum soil quality and depth for post construction development or redevelopment in order to improve onsite capture of stormwater flow and water quality. (This could be included another the stand-alone practice to Amend Soil with Compost recommended above.)

3. The Guidebook identify and promote compost blankets, compost berms, and compost sock filters as BMPs for stormwater control as well as erosion and sedimentation control. See (a) attached fact sheet from the US Composting Council, "Using Compost in Stormwater Management," (b) EPA Region V's web site "What Are the Compost BMPs" at http://www.epa.gov/region05/waste/solidwaste/compost/bmp.html, (c) EPA's factsheet "Stormwater Best Management Practices: Compost Blankets" available online at http://www.epa.gov/npdes/pubs/compostblankets.pdf, (d) EPA's National Pollutant Discharge Elimination System web page "Compost Filter Berms," at http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_res

ults&view=specific&bmp=119&minmeasure=4, and (e) EPA's NPDES web page "Compost Filter Socks" at http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=120&minmeasure=4. (Note: please ensure that the information on these web sites becomes part of the public record.)

4. Appendix K be updated to reflect state-of-the-art science and best practices on compost amended soils and to offer some flexibility for using compost that is not STA (such as allowing MD Dept. of Agriculture registered compost to be used). For instance, Appendix K notes that compost amendments are not recommended where slopes exceed 10%, but other resources indicate they can be used for slopes up to 30%. It also notes that compost shall be the result of the biological degradation and transformation of plant-derived materials under conditions that promote anaerobic decomposition. But composting is inherently aerobic not anaerobic. Regarding only allowing STA compost, many composters in the region point out that they do not have STA certification because it is very expensive. In Maryland, MDE's statewide compost study group is recommending that compost procurement policies spec compost that is registered with MDA.

5. Allow for broader uses of compost than just leaf compost. Several times the manual specifies "leaf compost." See, for example, Table 3.8.3 on p. 177, which covers specs for dry swale material. Compost made in part from food scraps should not be excluded. The National Capital Region Organics Task Force (which I co-chair) is working to expand the infrastructure for composting, particularly facilities that can process pre- and post-consumer food scraps. Facilities that produce compost from non-leaf yard trimmings and food scraps should be able to qualify for use in the Guidebook. Some manure-based composts may need to be restricted due to high phosphorus content. DDOE should fully review and update its specs on compost.

6. DDOE review (a) Washington State's Department of Ecology's *Stormwater Management Manual for Western Washington*, updated August 2012; and (b) *Guidelines and Resources For Implementing Soil Quality and Depth BMP T5.13* by the Building Soil network. These reports can serve as models for integrating sample BMPs and requirements related to compost amended soil and soil quality and depth requirements into DDOE's own Guidebook. They are available online at: http://www.ecy.wa.gov/programs/wq/stormwater/manual.html and http://www.ecy.wa.gov/programs/swfa/organics/pdf/SoilBMP.pdf. (Please make these reports part of the official public record as part of my comments; they were too large to include with my email.)

Organic matter is vital to soil quality. Amending soil with compost is the best way to increase the organic matter in soil, which improves soil's ability to retain water. Compost can hold up to 20 times its weight in water and increases the ability of soil to store water by 16,000 gal/acre ft for each 1% of organic matter. Earthworm populations increase proportionately with organic matter and their macropores increase stormwater percolation. Benefits of promoting soil tilth are better erosion control; reduced stormwater runoff (with better water quality as compost is a natural filter for pollutants such as heavy metals, nitrogen, phosphorus, fuels, grease and oil); and healthier landscapes that require less water, fertilizer, and pesticides.

Establishing minimum soil quality and depth criteria will help ensure that stormwater can infiltrate the soil. Amending existing landscapes and turf systems by increasing the percent organic matter and depth of topsoil can substantially improve the permeability of the soil, the disease and drought resistance of the vegetation, and reduce fertilizer demand. Organic matter is the least water-soluble form of nutrients that can be added to the soil. Composted organic matter generally releases only between 2 and 10 percent of its total nitrogen annually, and this release corresponds closely to the plant growth cycle. Compost contains humus, which acts as a glue that keeps soil particles stuck together and resilient against eroding forces. Studies show that increasing soil organic content with compost amendments increases the water-holding capacity of the soil manifold. In Washington state, soil best practices call for amending landscape beds with 10% organic matter (equating to 30-40% compost by volume for low organic subsoil) and turf areas with 5% organic matter. Results are dramatic: only 15% surface water runoff occurred on compost-amended soils as compared to 55-75% surface water runoff on disturbed soils.

If DDOE were to take the time to strengthen its BMPs on compost amended soils; establish minimum soil quality standards and depth for post construction; and identify compost berms, blankets, and socks as approved BMPs, its Stormwater Guidebook could serve as an important model for neighboring jurisdictions to replicate.

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

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

Figure 2. *Same slope after revegetation*

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

Figure 4. Same slope after revegetation

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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.

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 9. *Netting stabilizing a compost blanket*

Figure 10. *Stapling netting to the slope*

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.

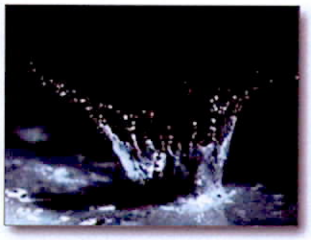

Figure 12. *Impact of rainfall*

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

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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*

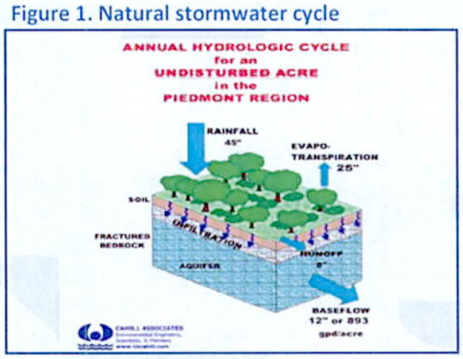
US Composting Council

USCC factsheet:

Using Compost in Stormwater Management

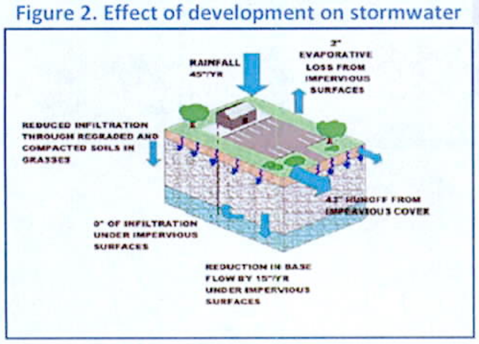
Precipitation falling on the Earth and flowing over and through the soil is a major source of water pollution. While the precipitation is natural, what happens to it after it falls is dramatically affected by human activity. For example, in the Piedmont Region of Pennsylvania, of the 45" of rain that falls during the average year, 25" would be expected to be returned to the atmosphere by vegetative evapotranspiration, 12" would infiltrate deeper into the ground, and only 8" would runoff over the surface. Yet after development, as much as 95% might leave as surface runoff (PA DEP, 2006).

Figure 1. Natural stormwater cycle



Increased runoff leads to increased erosion, more frequent and more intense flooding, habitat and species loss, higher pollutant loads, and water quality degradation. While the emphasis in stormwater management over the past 50 years has been on "peak rate" control, that is, detaining stormwater so that the highest rate of flow was no more that what would have been expected before the development (hence the ubiquitous detention basins in modern landscapes), there is a paradigm shift underway that recognizes that the most effective storm water management will be one that attempts to emulate natural processes. Thus management practices that emphasize the roles of soils and plants are gaining prominence. These practices are enhanced, and often even depend, on the incorporation of good quality compost into the practice.

Figure 2. Effect of development on stormwater



Stormwater management practices that utilize compost.

Stormwater management is generally segregated into two divisions, construction and post-construction. While construction practices have a greater impact in the short term, the post-construction design and implementation will continue to have impacts for decades. The move to reduce the environmental impact of development is called low-impact development, or LID. LID is defined as design and implementation of post-construction storm water hydrology that mimics pre-development patterns[1]. LID management practices seek to reduce both peak flow rates and runoff volume by slowing flows and increasing infiltration thereby decreasing pollutant loads entering water bodies. Incorporating compost into these practices can dramatically lower runoff volume due to improved water holding capacity, healthy vegetation/biomass, and increased infiltration.

LID Stormwater practices that include or benefit from the use of compost include:

Rain gardens and/or Bioretention Systems[2]

Figure 3. A rain garden in Maplewood, MN

[1] A good source of information on LID is the Low Impact Development Center, http://www.lowimpactdevelopment.org/

[2] A general description of this and other stormwater BMPs can be found at the EPA Menu of BMPs: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm.

A rain garden is a landscaped feature designed to treat on-site stormwater runoff. Not only is it highly effective at removing pollutants, it decreases total stormwater entering the storm drain system and does so in an esthetically pleasing manner. Sometimes called bioretention or bioinfiltration beds, they are growing in popularity throughout the country. They typically feature native plants, several inches of wood mulch, and a planting mix that includes 20-30% compost.[3]

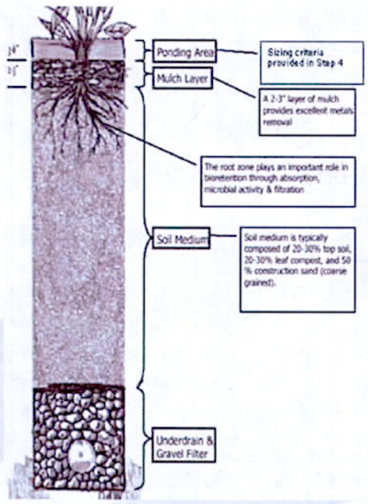


Figure 4. Section of a rain garden

Infiltration zones (including lawns, basins, filter strips, trenches, and others)

As noted above, under natural conditions a considerable amount of precipitation would typically infiltrate into the ground rather than run off over the surface. Once below the surface it either is taken up by plants or percolates further into the ground. In order to emulate that process stormwater designers are incorporating infiltration in many areas of the landscape. Some of this infiltration occurs directly in subsurface layers, being conveyed there through piping or via pervious surfaces, such as porous concrete. Other practices infiltrate the water through turf or other vegetation. For any vegetated infiltration practice to be effective for the long term it must be based on soil that is as healthy as possible. While there are many factors affecting soil health and quality, "the most critical factor is maintaining organic matter levels and carbon cycling through the soil" (Bierman,1998).

Even though soil organic matter is dynamic in nature, with constant additions and decay, having an initial adequate level of soil organic matter is the best way to assure long-term sustainability of a vegetated infiltration area. In many, if not most, situations, adding compost to the soil will be the most efficient way to achieve that minimum organic matter content.

The most aggressive example of this has been in the Pacific Northwest, home to the Soils for Salmon movement. They have been successful in instituting a post-construction soil standard that requires a minimum organic matter content in the soil of 5%. As stated in the introduction to the standard, "Healthy soil provides important stormwater management functions including efficient water infiltration and storage, adsorption of excess nutrients, filtration of sediments, biological decomposition of pollutants, and moderation of peak stream flows and temperatures. In addition, healthy soils support vigorous plant growth that intercepts rainfall, returning much of it to the sky through evaporation and transpiration" (WA DOE, 2005).

Vegetated/green roofs

Vegetated roofs, or green roofs, are another growing LID practice with the potential for huge environmental benefits. The organization Green Roofs for Healthy Cities lists over 50 public and private benefits that may be attributed to green roofs[4]. With regards to stormwater, unlike metal or asphalt roofs that can contribute to thermal and chemical water pollution, green roofs can significantly reduce total stormwater as well as improve the quality of the water. A mature compost is often included in the growing media component of a green roof. In order to meet the exacting specifications for the media, including weight, porosity, and stability, compost usually makes up 10-15% of the total volume.

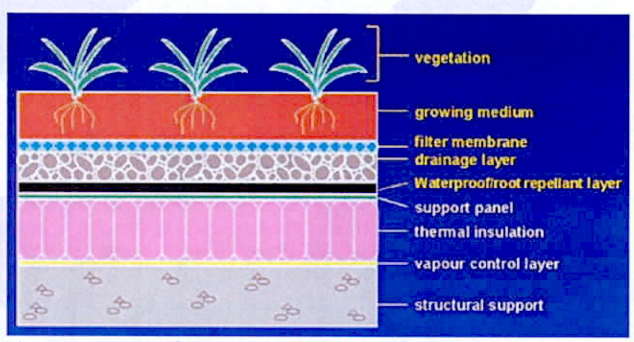


Figure 5. Layers of a vegetated roof

[3] A general design specification for rain gardens and other low-impact practices can be found at http://www.lid-stormwater.net/intro/homedesign.htm

[4] Visit http://www.greenroofs.org/ for more details about vegetated roofs.

Compost-based Erosion and Sedimentation Control Practices

The highest risk of erosion and sedimentation is while a project is under construction, especially in the beginning phases while the most earth-moving is going on. Without a protective "skin" of organic matter (both living and decaying) soils are easily erodible, with some variability depending on soil type and slope. Soil loss from construction sites can be 200 times that of forest lands, and 10 to 20 times that of agricultural lands (GA S&W Cons. Comm, 2002). Once pollutants, whether simply silt or specific contaminants, are picked up by water it is difficult to keep them from moving downstream. Therefore practices that prevent erosion are much more effective at preventing pollution than those that attempt to clean water after it has already gained a load of pollutants.

Preventing erosion with a compost blanket.

Figure 6. Applying a compost blanket in PA (photo credit: D. Caldwell)

Many studies have shown that compost can be highly effective for reducing and preventing erosion on an exposed slope.[5] Unlike most other stormwater BMPs compost has significant water holding capacity, so that low-to-medium intensity and duration rain events may produce no runoff at all (Persyn et al, 2004). Those that do produce runoff produce less, take longer before runoff starts and longer to reach peak flow (Glanville et al, 2003). Using compost of low nutrient value has the added benefit of releasing less phosphorous and nitrogen than hydroseeding, hydromulching, and seeded straw mulches, all common form of erosion prevention (Faucette et al, 2005). Compost not only helps prevent erosion immediately upon application, it also provides an effective substrate for seed growth, conserving moisture, suppressing weeds and providing slow release nutrients to support the establishment of vegetation, thus providing long term erosion prevention (Faucette et al, 2005). Compost blankets have a lower "C" factor compared to hydroseeding or rolled erosion control blankets, estimated to between .02 and .05, compared to .1 to .2 for competing practices.[6]

As of 2006 at least 32 state transportation departments, plus many Federal and local agencies, have adopted this as a best management practice. Generally these specifications are based on the generic one adopted by the American Association of State Highway and Transportation Officials (AASHTO) as MP-10, a version of which can be found at http://compostingcouncil.org/pdf/Erosion_Specs.pdf. These specifications take soil erodability and rainfall patterns into account to determine the proper depth of the blanket.

Although listed here as a construction practice, compost blankets are commonly seeded, becoming part of the post-construction landscape. At that point they are also acting as an infiltration practice as well as an erosion-prevention practice, reducing and delaying runoff and maintaining a vegetative cover on the soil.

David M. Crohn, Biosystems Engineering Specialist for the University of California Cooperative Extension, summarized how compost helps prevent erosion:

- Protecting the soil from the energy of falling rain
- Absorbing moisture
- Promoting infiltration
- Encouraging soil aggregate formation
- Promoting plant growth (Crohn, 2006)

Sediment Control – Filtering stormwater at a construction site

While preventing erosion is always the first choice, it is not always possible, and compost has also proved to be effective at filtering stormwater pollutants originating from construction sites. Typically this is done at the perimeter of the site, around storm inlets, and in storm

[5] For a good review of the research see Faucett et al, Evaluation of stormwater from compost and conventional erosion control practices in construction activities, in Journal of Soil and Water Conservation, v. 60 no. 6:288-297

[6] C refers to the Cover factor in the Revised Universal Soil Loss Equation, and is commonly used to compare effectiveness of different practices. C factors for compost and rolled erosion control blankets, Filtrexx Tech Link # 3303

channels. Both freestanding berms made of compost and compost "socks" (long tubes constructed of open weave or knit fabric and filled with composted mulch) have surpassed the traditional practices of silt fence and hay bales at reducing the pollutant loads of construction stormwater. Unlike the traditional practices, which work primarily as temporary stormwater detention devices allowing solids to settle out of the water, the berms and socks act as both detention and as true filters, removing not only the settleable solids but a significant percent of suspended solids as well as nutrients and hydrocarbons (Faucette, 2006). Berms have the advantages of a wide "footprint" with intimate soil contact that all but eliminates undercutting and very low disposal and cleanup costs, but have the disadvantages of lack of visibility in active construction zones and poor performance in direct flows. Socks have the advantages of visibility and ability to function in concentrated flows but slightly higher disposal costs.

Figure 7. Installing a 24" Filtrexx SiltSoxx. Photo by Cary Oshins

Researchers from Filtrexx International, a leader in developing compost-based stormwater water practices, and the independent Soil Control Lab, found that based on 45 tests of compost filter media the mean total solids removal was 92%, mean suspended solids removal was 30%, mean turbidity reduction was 24%, and mean motor oil removal rate was 89% (Faucette et al, 2006b). Moreover, the researchers found that by adding polymers to the filter media, removal efficiencies could be improved, sometimes dramatically. For example, turbidity reduction was increased from 21% to more that 77%, and soluble phosphorous removal increased from 6% to a remarkable 93%.

Continuing research has found a number of other applications for the compost socks. They have been used to construct sediment traps, sediment basins, ditch checks, water diversions, and streambank protectors. The key to the success of these practices is to understand the material used to fill the socks and how it functions—as filter media, growth media, or both. Especially if the device will be used as a filter, there needs to be a balance of pore space to allow water to pass through and surface area to trap pollutants. The material must be well stabilized so it does not release nutrients. Various states and agencies are developing specification for this material, and private providers of these systems, such as Filtrexx International, have detailed specifications to meet their certification standards.

References

Crohn, DM, 2006, Using compost to control erosion, Waterwise 1(5), http://esce.ucr.edu.

Faucett LB, Shields F, Kurtz K, 2006, Removing storm water pollutants and determining relations between hydraulic flow-through rates, pollutant removal efficiency, and physical characteristics of compost filter media, in: 2nd Interagency Conference on Research in Watersheds Proceedings, May 2006

Faucette LB, Jordan CF, Risse LM, Cabrera M, Coleman DC, West LT, 2005, Evaluation of stormwater from compost and conventional erosion control practices in construction activities. Journal of Soil and Water Conservation 60(6):288-297.

Georgia Soil and Water Conservation Commission, 2002, Erosion & Sedimentation Course Manual.

Glanville TD, Richard TL, Persyn RA, 2003, Impacts of Compost Blankets on Erosion Control, Revegetation and Water Quality at Highway Construction Sites in Iowa. Final Report. Iowa State University, Ames, IA.

PA Department of Environmental Protection, 2006, Chapter 2 of Pennsylvania Stormwater Best Management Practices Manual, Document #363-0300-002, Harrisburg, PA.

Persyn RA, Glanville TD, Richard TL, Laflen JM, Dixon PM, 2004, Environmental effects of applying composted organics to new highway embankments: Part 1. Interill runoff and erosion. Transactions of the ASAE 47(2):463-469.

Peter Bierman, 1998, Ohio State University, Soil Health and Soil Quality, downloaded from http://southcenters.osu.edu/soil/slides/sld001.htm.

Washington Department of Ecology, 2005, Guidelines and Resources for Implementing Soil Quality and Depth BMP T5.13 in WDOE Stormwater Management Manual for Western Washington, available at www.soilsforsalmon.org.

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