USCC factsheet:

Using Compost Can Reduce Water Pollution

Water pollution is a fact of modern life. According to the U.S. EPA,

> Over 40% of our assessed waters still do not meet the water quality standards states, territories, and authorized tribes have set for them. This amounts to over 20,000 individual river segments, lakes, and estuaries. These impaired waters include approximately 300,000 miles of rivers and shorelines and approximately 5 million acres of lakes -- polluted mostly by sediments, excess nutrients, and harmful microorganisms. An overwhelming majority of the population - 218 million - live within 10 miles of the impaired waters. (USEPA, 2007)

Water pollutants come from municipal, industrial, commercial, residential and agricultural sources, affecting both human and environmental health. Research has shown that compost and composted products can help reduce water pollution. Compost products can be used directly to prevent pollution or remediate polluted water and work indirectly by replacing polluting activities with less polluting alternatives. This factsheet will review the primary ways that compost can be used to address water pollution: through pollution prevention, bioremediation, and stormwater management.

Pollution Prevention

Organic wastes, such as manure, waste water treatment solids, or even grass clippings, are a major source of non-point source pollution (that's pollution that enters the waters in diffuse sources, such as runoff from farm fields, versus pollution coming from identifiable point, like an industrial or municipal drain pipe). The process of composting takes these raw materials and stabilizes them under controlled conditions. Stabilizing the material takes the nutrients, such as nitrogen, and ties them up in the compost's organic matter. The nutrients are slowly released over time, increasing the opportunity for up-take by plants and reducing downstream water pollution problems...[1] For that reason composting is recognized as a Best Management Practice by the EPA's Non Point Source Program (USEPA, 2003)[2] Compared to raw manure, not only is composted manure itself less polluting, but as a manufactured product it can be transported further from the place of generation. This is particularly relevant to industries like concentrated animal operations, where finding an economical way to move their large amounts of manure is a major issue.

Using compost has several positive benefits. It improves the water dynamics of soil, including water infiltration, percolation, and water-holding capacity. This can reduce irrigation needs, and associated leaching potential. For example, a study in the pollution-prone sandy soils of Florida showed that annual applications of ¾-1" of compost per acre would result in increased soil moisture and reduced water seepage below the root zone, "thus reducing the potential for nitrogen and atrazine (an herbicide) to leach into groundwater" (Savabi, 2005).

The Recycled Organics Units of New South Wales in Australia conducted a Life Cycle Analysis of compost. They concluded there were a number of positive environmental impacts from the use of compost in agriculture (Sharma and Campbell, 2003):

- Reduced irrigation water from increased water holding capacity of 3 to 10%, thereby saving 14,000 to 100,000 gallons/acre/year.
- Reduced fertilizer use from replacing some chemical fertilizers directly and by increasing soil cation exchange capacity, allowing it to hold and release nutrients more efficiently.
- Reduced herbicide use from using composted mulches for weed suppression
- Reduced soil loss from erosion as a result of improved soil structure and reduced bulk density.

Stormwater Management

Precipitation falling on the Earth and flowing over and through the soil is how most water becomes polluted. While the precipitation is natural, what happens to it

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[1] However, it must be cautioned that using compost as a fertilizer to meet crop nitrogen needs will almost always result in the overapplication of phosphorous. From a nutrient management standpoint, it is better to apply the compost on a phosphorous basis and supplement the crop's nitrogen needs in other ways. Since composts vary considerably in the nutrient content, it is important to know the analysis of your compost. See the USCC factsheet on Compost Testing for more information.

[2] For more information on the US EPA's Non Point Source Program, go to http://www.epa.gov/owow/nps/

after it falls is dramatically affected by human activity. For example, under natural conditions in the Piedmont Region of Pennsylvania, of the 45” of rain that falls during an average year, generally only 8” (18%) will be converted to surface runoff, the rest either infiltrating into the ground or evapotranspiring from plants and ground surfaces. Yet after development, as much as 95% of total rainfall is converted to surface runoff (PA DEP, 2006).

Increased runoff leads to increased erosion, more frequent and more intense flooding, habitat and species loss, higher pollutant loads, and water quality degradation. There is a paradigm shift underway that recognizes that the most effective storm water management will be one that attempts to emulate natural processes. Management practices that emphasize the roles of soils and plants are therefore gaining prominence. These practices are enhanced, and often even depend, on the incorporation of good quality compost into the practice.

Stormwater management is generally segregated into two components, construction and post-construction. The impacts of construction are often severe, but are time-limited. Post-construction impacts are less acute, but persist until the management is changed—decades and longer.

Construction practices using compost—prevention and treatment

The highest risk of erosion and sedimentation is during construction, particularly in the beginning phases while the majority of land disturbance and earth-moving is going on. 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 Comm., 2003). As with most things, “an ounce of prevention is worth a pound of cure”. Once pollutants, whether sediment, nutrients or other contaminants, are in runoff water it is very difficult to keep them from moving downstream. Using a “blanket” of composted mulch to cover exposed soil has proved to be highly effective at providing that prevention. The blankets significantly reduce the total runoff (to zero in some cases), increase the time for runoff, reduce soil erosion and release significantly less nutrients than typical erosion prevention practices (Glanville et al, 2003, Faucette et al, 2005).

Since it is not always feasible to prevent erosion during construction, compost can be effectively used to filter storm water leaving a construction site. Typically construction sites use silt fence or hay bales to provide sediment control around the perimeter of the site. Using composted mulch, either in freestanding filter berms or contained in long tubes called “filter socks”, has proved to be much more effective. While the typical practices act as temporary storm water detention devices, counting on gravity to settle out solids, the compost-based practices work both as a detention and a filter, removing suspended solids, settleable solids, along with soluble pollutants such as petroleum hydrocarbons and nutrients (Faucette, 2006).

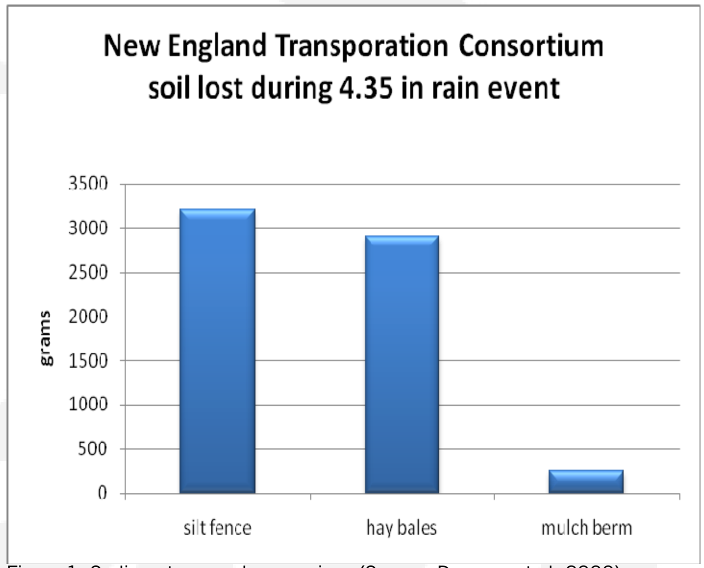

Figure 1. Sediment removal comparison (Source: Dumars et al, 2000)

Post-Construction Practices

While construction impacts on water pollution are dramatic, they are short-term. In the long run it is the design and use of the post-construction stormwater practices that will have lasting effects. The move to more sustainable storm water management is called Low Impact Development (LID). “Low Impact Development is a new, comprehensive land planning and engineering design approach with a goal of maintaining and enhancing the pre-development hydrologic regime of urban and developing watersheds” (Low Impact Development Center, 2007). Healthy soils rich in organic matter are critical to the long term functioning of many of these practices. A mature compost is an excellent source of organic matter, enhancing the physical (e.g. lower bulk density and increased water-holding capacity), chemical (like slow release nutrients) and biological (supplying a rich diversity of microflora) attributes of the soil (Magdoff, 1992).

For a description of the primary LID practices that use compost, and for more details on using compost to prevent and control erosion, see the companion fact sheet, Using Compost in Stormwater Management .

Bioremediation[3]

Instead of addressing water pollution by reducing storm water runoff, the problem can also be addressed through targeting specific pollutants typically found in storm water. If the pollutants are not there or not mobile, then they will not pollute the water. Bioremediation uses compost to clean and restore contaminated soils by degrading and binding contaminants in soil. The process has been used both in-situ, where compost and other amendments are incorporated into a contaminated soil, and by removing the contaminated soils and adding them to a compost pile.

Microorganisms in compost have been used to break down a variety of contaminants, such as chlorinated hydrocarbons, wood preservatives, solvents, pesticides, petroleum products, and even explosives. What's more, even non-organic pollutants, such as lead and other heavy metals, can be remediated with compost. The compost binds the metals in ways that make the metals unavailable to plants, so that soils can be used to grow plants where previously they could not. This has proved to be a cost effective method of returning both urban and rural soils to productive use.

As we work towards a more sustainable future, composting will help clean our waters through bioremediation, stormwater applications, and pollution prevention by stabilizing organic wastes and improving our soils.

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[3] Summarized from "Innovative Uses of Compost: Bioremediation and Pollution Prevention", USEPA 1997

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