25/1/08 SUDS

Green Roofs / Rooftop Gardens, Rain Gardens and Green Walls

The use compost in engineered soils used in stormwater management has grown substantially throughout the world. The use of these soils in green roofs / rooftop gardens, rain gardens and green walls allows for excess water to be managed, while creating an aesthetically pleasing display. Further, there are often additional economic and environmental benefits to these applications.

Green roofs are typically broken down into two categories: intensive (traditional rooftop gardens) and extensive gardens. Generally, extensive gardens use a more shallow layer of soil (5-10cm), while intensive gardens use soil over 15cm in depth. Traditional rooftop gardens are more expensive to construct than are *extensive* gardens, and usually establish larger plant materials. Extensive gardens often use a lighter weight media and establish specialty plants that are more self-sustaining (e.g., Sedums, which can go 60–80 days without water). Both intensive and extensive gardens are good for reducing storm water runoff (up to 78% was found in a North Carolina State University study) and have shown the ability to bind heavy metals found in degrading roofing materials. However, green roofs provide many others benefits.

Green Roof benefits:

- Precipitation retention and runoff reduction
- Storm water flow mitigation
- Pollutant reduction
- Extends the life of roofs (from 20 vs. 40 years because it absorbs destructive ultra violet rays)
- Helps to cool urban areas and insulate buildings
- Potentially improves air quality (oxygen release, carbon sequestration)
- Creates wildlife habitats
- Buffers noise

A combination of lightweight aggregate, sand and compost are often specified to meet the soil requirements. Lightweight expanded shale, slate and clay are the most popular aggregates. Compost is typically no more that 10 to 25% of the media. In the UK, aggregate produced from construction debris (e.g., brick) is even being used in the soil. The growth of green roofs appears to be related to the stormwater management requirements of communities, capturing it in the media so it never (or less of it) gets to the sewer system. Further, studies are being completing to evaluate the media's ability to assist in pollutant removal, for water that passing through it.

Excerpts of this section are from the Biocycle article, Green roofs grow with brown compost

A rain garden is a garden which takes advantage of rainfall and stormwater runoff in its design and plant selection. Usually, it is a small garden which is designed to withstand the extremes of moisture and concentrations of nutrients, particularly nitrogen and phosphorus, that are found in stormwater runoff. Rain gardens are sited ideally close to the source of the runoff and serve to slow the stormwater as it travels downhill, giving the stormwater more time to infiltrate and less opportunity to gain momentum and erosive power.

	
Rain garden	Extensive green roof

On the surface, a rain garden looks like an attractive garden. It may support habitat for birds and butterflies, it may be a formal landscape amenity or it may be incorporated into a larger garden as a border or as an entry feature. What makes it a rain garden is in how it gets its water and what happens to that water once it arrives in the garden.

Below the surface of the garden, a number of processes are occurring which mimic the hydrologic action of a healthy forest. Soils are engineered and appropriate plants selected for the rain garden. The garden is a small bioretention cell in which stormwater is cleaned and reduced in volume once it enters the rain garden. Nitrogen and phosphorus levels and overall sediment loads in the stormwater are reduced by the action of the plants and growing media on the water. Multiple rain gardens over an area will have a positive cumulative effect on both the volume and quality of stormwater run off.

There are two basic types of rain gardens – under-drained and self-contained. Both types of rain gardens are used to improve stormwater quality, reduce runoff volumes and generally facilitate the infiltration of cleaned water. The type of rain garden that is built, depends upon the volumes of water to be treated, existing soil conditions, available space, and budget for the project.

In some cases where infiltration is not desired, the underdrain system can move excess water into a conventional storm sewer pipe system. Rain gardens are typically designed to drain within four hours after a 2.5cm rain event. Under-drained rain gardens typically are designed to drain within 2 hours of the design storm event. This is achieved through the use of highly porous planting media and underdrains which carry the cleaned rainwater away from the garden. Rain gardens with no underdrain typically hold moisture longer, particularly in the lower areas of the garden. Plants selected for this type of garden should be able to tolerate inundation for a more extended period of time. However, as in the case of the underdrained rain garden, the surface is drained within four hours, although the soil may be saturated. As in the bioretention cell, soils are amended with a very porous planting media, minimally to a depth of 40cm and ideally to a depth of 60 – 90cm. In both

types of gardens, the ground is excavated and the planting media is imported to the site. The volume of compost used within the media may vary, but the more that is included, the wetter the media will stay over an extended period of time.

Plants with deep fibrous root systems tend to have a competitive advantage in a rain garden and provide the most cleaning and filtration benefits to the environment. Typical rain gardens are populated with natives or native cultivars because those are most well adapted to a locality, but other ornamental horticultural plants that are non-invasive but able to grow in the garden conditions can also be excellent choices.

Excepts from Low Impact Development Center website

Green walls are tools that allow for the stabilisation of eroded or damaged slopes, while creating an attractive vegetated landscape. This technology is used to replace cement or steel constructed walls. Further, aside from being structurally sound, they can be used strategically to curtail sediment movement and absorb water. Green walls are created using compost socks (porous socks used to contain compost), which gives the compost structural stability.

	
Compost filter sock used in stream bank stabilization	Sock wall locked in place with geotextile