BMP RECOMMENDATIONS FOR STORMWATER CREDITS

The following list is not meant to be a comprehensive summary of acceptable stormwater management practices but rather a list of commonly used SMPs in urban settings that would help property owners earn stormwater credits. For more information about PWD approved SMPs please refer to *Philadelphia's Stormwater Management Guidance Manual* available online at www.phillyriverinfo.org.

Convert Lawn to Meadow

Lawn and turf areas, when converted to meadow, are better for managing stormwater -- meadows provide habitat, slow down surface runoff flow rates, absorb stormwater, and when maintained properly, can enhance aesthetics. Converting lawn to meadow reduces the curve number for that land surface, which will in turn reduce the Gross Area stormwater charge.

Low-growing meadow plants that require mowing only twice per year are suggested to be used to reduce maintenance and safety concerns. The plants recommended for meadows include a grass species mixture typically used in the rough area of golf courses. *Links Mix* (Fisher & Son Company, Inc.) grows to 18" inches at full height. While this grass mixture requires less mowing than groomed lawn, its composition also allows broad-leaved weeds to be easily identified and eradicated before they become rampant and out-compete the desirable plants. One key to the meadow's aesthetic success is a mown turf border between the meadow and surrounding areas. Since meadows and taller lawn could be perceived as not being cared for, a mown border indicates that the "rough" look is intentional, and gives it a neater appearance. With the eventual public understanding and acceptance of the ecological benefits, and committed stewardship of proper meadow management, hardy, herbaceous, meadow-like perennials could be added to the grass species in key locations over time.

Reduce Impervious Surfaces

Impervious surfaces increase stormwater runoff volumes, temperatures, and flow rates, and also affect stormwater fees. Impervious surfaces, such as oversized parking lots and unused concrete slabs, can be removed and replaced with pervious surfaces to reduce stormwater charges and runoff in many areas.

While meadow is a preferred option for impervious surface replacement due to its additional benefits of evapotranspiration and habitat creation, pervious pavement also allows infiltration and provides hardscape, if necessary for play surfaces or vehicles. Pervious pavement options include turf pavers, porous concrete and asphalt, and interlocking concrete pavers specifically designed for stormwater infiltration.

Infiltration Trenches

An infiltration trench is a linear subsurface bed that is used to capture, store, and infiltrate upstream stormwater runoff. Infiltration trenches should be installed along the contour and typically consist of a bed of clean-washed, uniformly graded aggregate, 1 to 2 feet deep, wrapped in non-woven geotextile filter fabric to separate from the surrounding soil. Infiltration trenches may be installed below a vegetated swale system to enhance the volume capacity, provided that the infiltration rate of the soil is adequate. The bottom of an infiltration trench should be flat or very gently sloped, and the trench can be benched in sections to achieve a flat trench bottom. Runoff from impervious drainage areas can be directed to an infiltration trench for distribution and infiltration, and that contributing impervious area is eligible for Impervious Area Credit.

Rain Gardens

A rain garden, also called a bioretention area, is a shallow surface depression with amended soils below, planted with vegetation that manages stormwater runoff from small drainage areas. The contributing drainage area to a rain garden would be eligible to receive Impervious Area Credit. The vegetation planted in rain gardens should be preferably native, and tolerant of salt, wet conditions, and dry conditions. Rain gardens manage small storm events and consist of inflow areas, shallow ponding areas over planting soil, a mulch layer, vegetation, and an overflow mechanism to take larger rainfall events to the stormwater system or other stormwater management features. Rain gardens can be constructed with a subsurface sand or gravel bed if additional stormwater storage capacity is required.

Rain gardens can be placed in lawns, in planted islands of paved areas, along roadways, and in other small open spaces adjacent to impervious surfaces. A rain garden can be sized and shaped to fit landscape constraints, and multiple bioretention areas can be placed throughout a site to capture runoff from various surfaces. If rain gardens are placed in areas that would be landscaped under a conventional stormwater plan, the additional cost of this type of feature is minimal.

Rain gardens provide a number of benefits. Runoff velocity is reduced as it enters a rain garden, and water quality is improved. As stormwater ponds at the surface, pollutants settle out, and it is filtered through soils and vegetation. The volume of runoff is reduced through surface ponding, soil storage, evapotranspiration, and infiltration. Additionally, rain gardens, if maintained properly, enhance the aesthetics of a site and can provide habitat and forage.

Recommended native plant species for rain gardens are many (see *City of Philadelphia Stormwater Management Guidance Manual*, Chapter 8). However, at recreation centers and schools, plants that are particularly hardy and resilient would be best suited due to their ability to withstand the challenging use environment and assumed limited maintenance. Annual maintenance tasks for rain garden vegetation includes: spring and fall clean up, regular weeding during the growing season, cutting back perennials and pruning woody plants, plant replacement as necessary, and watering during exceptionally dry times. In addition, litter pickup and clean out of any inlets and pipes is required to keep systems attractive and functioning.

Flow-Through Planter Boxes

A stormwater planter box is a structure, usually formed from concrete or brick, which is filled with plants and absorbent soils in order to temporarily store and treat rainwater, typically from disconnected downspouts. Planter boxes can be designed with open bottoms to infiltrate water, or they may be designed to discharge directly to the storm sewer system after temporarily detaining runoff. All stormwater management measures, including planter boxes, must be designed with an overflow connection to a secondary stormwater management system or storm sewer. Flow-through planter boxes serve as an effective BMP in obtaining Impervious Area Credit.

Planter boxes capture runoff from small storm events, usually from roof areas. They provide water quality treatment, in addition to slowing and reducing the discharge of small rainfall events. Planter boxes provide an aesthetically-pleasing opportunity for stormwater management in densely developed areas, and can reduce stormwater peak rates and volume through capturing runoff from impervious surfaces. Additionally, they reduce the need to irrigate the landscape plantings contained within.

Planter boxes should be planted with preferably native plants that tolerate wet conditions well, and have the ability to withstand drought and heat. Depending on the plant palette, maintenance for planter boxes would consist of tree and shrub care (pruning, integrated pest management, and watering as necessary) and cutting back, weeding, and watering of the groundcover and perennial plants. Overflow inlets or underdrain pipes would need to be periodically cleaned of debris.

Disconnect Impervious Surfaces

"Disconnecting" impervious surfaces from conventional stormwater flow paths means to instead, convey and disperse the runoff to and throughout pervious areas, which reduces the burden on storm sewer systems. Dispersing stormwater runoff from impervious to pervious surfaces alleviates flooding, stream erosion, and water pollution. Downspouts from roof areas can be directed to vegetated swales, rain gardens, or other vegetation to encourage absorption, evapotranspiration, and infiltration. Roof runoff can also be captured and put to use with rain barrels and cisterns. Impervious surfaces, such as parking lots, streets, and sidewalks can be graded to disperse runoff toward pervious areas rather than conveying and concentrating it to inlets and pipes. Curb cuts along roads and sidewalk edges can be used to allow runoff to enter a vegetated system, such as a street bump-out, tree trench, or stormwater planter box. Areas that are disconnected are eligible to receive Impervious Area Credit.

Tree Trenches

A tree trench is a linear stormwater management feature consisting of trees planted in several feet of amended planting soils, and it is designed to capture runoff from adjacent impervious areas. Tree trenches are applicable in linear areas with limited space to manage stormwater, such as along streets. In addition to managing stormwater, tree trenches enhance aesthetics by providing greening, improving air quality, and reducing the urban heat island effect.

Tree trenches should be designed with a shallow surface depression and several feet of absorbent planting soils. Subsurface stone storage beds can also be placed below or alongside the planting soils for additional storage capacity. Small drainage areas can be conveyed to tree trenches along the street through curb cuts or trench drains, or piped directly into the planting soils and stone beds. Overflow structures should be provided within the tree trench to both bring runoff into the soil and stone beds, and to overflow the entire tree trench system to another stormwater management feature or sewer system to prevent system failure during large storm events.

The redirected stormwater irrigates the trees, and the expanded planting area -- provided by a trench rather than a pit -- allows greater opportunity for rooting space. Acceptable species can be selected from the Fairmount Park approved street tree species list (http://www.fairmountpark.org/RecommendedTreeList.asp) and must take into account existing conditions, such as overhead wires, parking, emergency access, and pedestrian circulation.

Green Roof

Green roofs are engineered, vegetated systems installed on roofs to control stormwater, mitigate pollution, reduce urban heat island effect, provide habitat, enhance aesthetics, recycle carbon, and conserve energy by stabilizing the indoor temperature and humidity of buildings. Green roofs also greatly extend the lifecycle of the building's roofing material by protecting it from the damaging effects of ultraviolet light. Green roofs earn Impervious Area Credit for the area that they encompass.

The strength of the supporting structure, as well as the size, slope, height, and directional orientation of the roof, are critical factors that must be assessed before installation of a green roof. Green roofs can be established on both existing and new roofs, and can be implemented in all areas including residential, commercial, and industrial sites.

Green roofs fall into two categories: extensive and intensive. Extensive green roofs consist of thin layers of growing medium (0.8”- 6”) with lightweight, water absorbing plants suited to a thinner soil profile, such as sedums and grasses, and are typically not irrigated. Intensive green roofs consist of deeper layers of soil (6” +) that can support larger plants, including trees and shrubs, and are often irrigated.

Capture and Reuse

Rooftops generate a large volume of stormwater runoff that has the potential to be detained and used. Numerous options are available for storing rooftop runoff for reuse; cisterns, rain barrels, and other vertical storage structures are simply large containers that store precipitation, being fed via the external roof leaders of buildings. This stored rainwater can then be used for passive irrigation, fire protection, or grey water reuse, such as flushing toilets. Reusing runoff reduces the burden on stormwater sewer infrastructure by reducing the volume and peak flows of stormwater runoff generated from buildings and other impervious surfaces. In turn, the demand for potable sources of water for uses such as irrigation and toilet flushing is reduced. The contributing drainage area to a reuse system is eligible to receive Impervious Area Credit, provided that the demand is justified.

It is necessary to calculate the volume of water coming off of a drainage area and the reuse-demand for stored water in order to properly size a storage device – captured water must be used or discharged prior to the next storm event to make room for the next storm’s runoff. An overflow or bypass of large storm events must be provided on the storage device, and screens, covers, or other measures should be implemented to prevent breeding of mosquitoes and other insects. Ideally, rain barrels and cisterns could be placed up-gradient of reuse areas to reduce or eliminate pumping needs. Stormwater runoff is not recommended for reuse as potable water unless adequate water quality treatment is provided.

Dry Extended Detention Basin

Dry extended detention basins are similar to traditional detention basins in that they provide temporary storage of runoff and function to attenuate stormwater runoff peaks. Extended detention basins offer the additional benefit of improved water quality through slight variations in design. The basin outlet structure must be designed to detain runoff from the water quality design storm for an extended period of time. Some volume reduction is achieved in a dry basin through initial saturation of the soil mantle and some evaporation takes place during detention. The extended detention basin must be planted with appropriate plantings and vegetation, as opposed to the traditional mown turf surface, to allow for increased volume removal through transpiration. Sediment forebays are highly encouraged, as this allows for greater deposition of suspended solids.

Existing traditional detention basins can easily be converted to extended detention basins by modifying the outlet structure and increasing vegetation present in the basin. If infiltration testing demonstrates rates high enough to account for volume removal, the basin may be analyzed as both an infiltration and detention basin. Impervious Area Credit is eligible for the impervious area routed to the basin provided that it infiltrates the water quality volume or meets the requirements of a dry extended detention basin. Refer to the *Pennsylvania Stormwater Best Management Practices Manual* for more information.