Resources

Stormwater Information

Ferguson, Bruce. *Introduction to Stormwater: Concept, Purpose, Design* (1998).

Woolworth, James W. *Out of the Gutter — Reducing Polluted Runoff in the District of Columbia.* Natural Resources Defense Council, July 2002.

After the Storm — A Citizen's Guide to Understanding Stormwater. US EPA 2003. www.epa.gov/npdes/pubs/after_the_storm.pdf

Stormwater Managers' Resource Center. www.stormwatercenter.net

Low Impact Development Center. www.lowimpactdevelopment.org/EPA03.htm

Center for Watershed Protection. www.cwp.org

Rain Gardens and Rain Barrels

Maryland Green Building Program (How to Build Your Own Rain Barrel). www.dnr.state.md.us/ed/scyby.pdf

Rain Gardens (A how-to manual for homeowners) by Roger Bannerman, Wisconsin Department of Natural Resources and Ellen Considine, U.S. Geological Survey. July 2003. http://clean-water.uwex.edu/pubs/raingarden

Rain barrels may be purchased at local nursery, hardware, garden centers or local community groups. If not available in your local area, search the internet for sources to purchase a rain barrel.

Roof Gardens/Greenroofs

Building Green: A Guide to Using Plants on Roofs, Walls and Pavements (1993). The London Ecology.

Urban Agriculture: A Guide to Container Gardens. www.messiah.edu/hpages/facstaff/jebeneze/urbanagriculture/garden.htm

Urban Agriculture Notes (published by City Farmer, Canada's Office of Urban Agriculture)

Rooftop and Urban Agriculture websites:

www.cityfarmer.org/subrooftops.html

www.greenroofs.com/how-tos.htm

Roofscapes Inc. www.roofmeadows.com

Conservation Landscaping

Alliance for the Chesapeake Bay. www.AllianceChesBay.org

National Wildlife Federation. www.nwf.org

Footnotes

[1] Chesapeake Bay Program. www.chesapeakebay.net

[2] Jones Fall Watershed Association. *Rain Barrels.* www.jonesfalls.org

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Taking Care of Stormwater:

A BayScapes Guide

This guide is designed to help you understand and implement practices in your own backyard or community which reduce the impact of stormwater runoff on local streams.

ALLIANCE for the CHESAPEAKE BAY

BayScapes promote environmentally-sound landscaping practices that create wildlife habitat, conserve water, and prevent pollution — for the benefit and restoration of our local waterways and the Chesapeake Bay — at homes, businesses, and public spaces.

What is the problem?

Parking areas, streets and rooftops are ***impervious surfaces*** (loosely defined as areas where water cannot penetrate the ground). Even a lush lawn growing on compacted soil can be considered an impervious surface. Traditional drainage systems concentrate runoff from these surfaces and remove it as quickly as possible by a system of gutters, curbs, pipes, sewers, and channels. The result is large amounts of fast-moving and sometimes highly polluted water discharging into local rivers, causing erosion, flooding, and unstable stream channels. Pollutants can include litter, pet waste, vehicle fluids, and fertilizers and pesticides applied to lawns.

Studies have shown that significant impairment of waterways often occurs when 10% of the land in the watershed is covered with parking lots and rooftops; however, if these areas exceed 25% of the land, severe ecosystem and water quality impairment occurs. For example, in the District of Columbia, over 60 % of the land area is covered by impervious surfaces. Imagine the damage that has been done to the Potomac and Anacostia Rivers in the District from the runoff from these surfaces.

Currently more than 44 square miles of the estuary and over 1500 miles of streams in the Chesapeake Bay watershed do not meet water quality standards due solely to runoff.[1]

What is the solution?

In this guide you will learn about practices that integrate a variety of methods to reduce the impact of stormwater runoff and non-point source pollution. Most of the practices described are approaches you can implement in your own backyard or school. Others require the support and expertise of local planning officials. By learning more about these alternative design methods, you can help promote these site design practices in your own local community.

Alternatives to Impervious Surfaces

Islands within cul-de-sac areas

If this area is covered with lawn, check with your homeowner association or local government to see if the lawn can be replaced with native plants that will attract butterflies and birds. By replacing lawn with native plants, not only do you restore vital wildlife habitat, but you also help improve local water quality by reducing the application of fertilizer and pesticides needed to keep the lawn green.

Natural resource preservation and conservation landscaping

Preserving the natural landscape and resources can improve the marketability of a community and homes within it. Existing wooded areas, mature trees, and natural terrain provide an attractive appearance and recreational amenities. Landscaping with plants native to the Bay region's climate and soil conditions (conservation landscaping), requires less water, fertilizer, pesticides and maintenance than non-native plant varieties in ornamental gardens.

Grass Swales and Filter Strips

Swales are an alternative to the curb and gutter system. Grasses or other low-growing vegetation are planted to reduce runoff velocity and allow filtration, while high volume flows are channeled away safely. Native plant species such as white ash, red cedar, arrowwood viburnum, chokeberry, sunflowers and switchgrass could be planted in these swales due to their tolerance of salt spray and snow compaction in the winter months.

Filter Strips are landscape features designed within parking lots to collect runoff from the large impervious surfaces. They may direct water into specially designed vegetated detention areas or underground sand filters that capture pollutants and gradually release water over a period of time.

Decks, Patios and Pathways

These areas can be constructed with pervious materials that allow water to be absorbed into the ground. Wood, stone, cobble, loosely laid brick and paving blocks are some of the materials that can be used in the outdoor landscape.

Heavily traveled lawn areas may become impervious if the soil underneath has become compacted by heavy machinery or foot traffic. Because soil compaction is difficult and expensive to correct, the emphasis is on prevention. Pathways made of uncomposted hardwood mulch (obtainable from a tree company) can be used to keep traffic in one area. Paving blocks made with cement or plastic are not recommended for high traffic areas for durability reasons. For patios and pathways, depending on the soil type and infiltration rate, a gravel layer may be needed underneath the materials to prevent settling and to allow further infiltration.

The Benefits of Trees

According to the American Forestry Association, a single urban tree provides a benefit of $273 per year. Trees provide many benefits: energy savings by reducing heating and cooling costs; sheltering and feeding wildlife; cleansing the air by absorption of carbon dioxide and nutrients; and reduction of the impacts of stormwater runoff by intercepting rainfall and slowing runoff. The roots of a tree also help to hold the soil in place thus reducing erosion.

Rain Gardens

What is a Rain Garden?

A ***rain garden*** is a method in which plants, soils and soil dwelling organisms remove pollutants from stormwater, improving water quality. Runoff flowing from rooftops, parking lots and driveways can be directed into rain gardens.

A rain garden allows about 30% more water to soak into the ground compared to conventional lawn. These gardens are specifically designed to treat and filter stormwater runoff in 4 to 6 hours after a rainfall event; therefore they will not become a breeding area for mosquitoes. ***Bioretention*** refers to larger sites that are specially engineered to treat runoff.

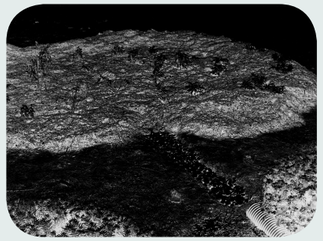
Some benefits of rain gardens include:

- increasing the amount of water filtering into the ground and recharging the groundwater supply, while reducing the amount of pollutants such as sediment and nutrients from entering local waterways.
- providing valuable wildlife habitat and free educational opportunities to observe birds and butterflies visiting the garden.
- reducing streambank erosion by decreasing the volume and power of a storm's runoff.
- adding sheer beauty to the landscape.

How does a rain garden work?

A rain garden has four zones: the ponding area, middle zone, outer zone and berm area. The ponding area is the wet area where the runoff enters the rain garden from the outer zone. The plants that grow in the ponding area must tolerate standing water and fluctuating water levels. The middle zone is slightly drier and the plants can tolerate fluctuating water levels. The higher outer zone includes a portion of the berm and often is the driest of the three zones. The plant material selected for the outer zone must be able to tolerate dry conditions most of the time. The berm area is a low "wall" that surrounds the garden on three sides. Its function is to "hold" the water in during a storm event.

Within the garden, a mulch/organic layer plays an important role in removing harmful chemicals. Shredded hardwood mulch is recommended because it allows for a greater surface area for absorption and resists flotation and washout. The planting medium should be a good mixture of leaf mulch (20%) blended into a sandy soil (50%) and topsoil (30%). Maintain these gardens as you would other landscaped areas around your home. If sediment builds up in the garden, it must be removed. Do not use this area for composting organic yard waste.



A young rain garden

What size should the rain garden be?

The recommended size of rain gardens typically range from 100 to 300 square feet to allow for adequate plant variety and easier installation. The size is determined by how deep the garden will be, type of soils and area of the roof/lawn draining into the garden. As a general rule, allow at least 150 square feet or 15–20% of the roof area for sandy soil, 30% of the roof area if the soil has some clay and 60% of the total roof area for true clay soils.

Planning Tips

- Each site is unique depending on topography, soil permeability, drainage basin, volume and velocity of water flow.
- The rain garden should be placed at least 10 feet from the foundation so infiltrating water doesn't seep into the building. If space is limited, make sure the area is graded to slope away from the foundation.
- Build the garden in full or partial sun. The sun helps evaporate the excess water.

Rain Barrels

Stormwater can be collected from rooftops by diverting downspouts into rain barrels. Rain barrels help slow the flow of runoff from impervious surfaces and store water for future landscape uses. Multiple rain barrels can be linked to increase storage capacity.

The lid on a rain barrel should be screened to prevent mosquitoes from entering and breeding. If children are present, a lock may need to be installed on the lid.

What are the advantages of having a rain barrel?

Lawn and garden watering make up nearly 40% of a typical household's water use during the summer growing season. A rain barrel could save most homeowners about 1300 gallons of water during the summer months, lowering water bills significantly. A 70 gallon rain barrel full of rooftop runoff will water 240 square feet of garden space (10' x 24').[2] The water collected and stored in the rain barrel can also be used for car washing and window cleaning, but not for drinking.

Where can I get a Rain Barrel?

You can purchase or order a rain barrel at most local lawn and garden centers. You can also make your own using a large trash can or food grade container (i.e. 55-gallon drum). Do not use containers that have stored chemicals, motor oils or other toxic products. See Resource Section for online sources to purchase a rain barrel or learn how to make one.

How do I install a Rain Barrel?

Most are easy to install; however, installation methods vary depending upon the brand. Installation of a typical rain barrel will involve disconnecting and cutting off a portion of the downspout and redirecting it into the top or side of the barrel. Most rain barrels have an overflow pipe that either redirects the water back into the downspout via a diverter or into the lawn or rain garden in the event that the barrel becomes full. The rain barrel should be placed on concrete blocks, bricks, etc. for ease of attaching a hose to the spigot. Always be sure to empty your barrel before winter freezes and turn it upside down to prevent water collecting in it.

What is a cistern?

A cistern is a large rain barrel that has a greater holding capacity and can be installed either above or below ground depending on the model. A little more up-front engineering and physical space may be needed when installing a cistern. Water from an outdoor cistern may be used to water your lawn and garden. Indoors, this stored water can be used for flushing toilets, washing clothes, and for drinking if filtered adequately. A cistern is considerably more expensive than a rain barrel, but it can provide for more of your water needs and may pay for itself in the long run.

Roof Gardens/Greenroofs

Roof areas may represent up to 50% of impervious surfaces in new developments. Planting vegetation on a specially designed rooftop can capture rooftop runoff. The vegetative layer retains water in the soil and plants. This water is later released through evapotranspiration. Vegetation can be installed in containers that make up a ***roof garden*** and may not require the roof to be re-engineered. ***Greenroofs,*** on the other hand, involve planting vegetation directly on the roof surface and require engineering expertise.

Benefits

The cost of installing a greenroof is 30% more than a traditional roof. However, the benefits of roof gardens and greenroofs are many: reduced stormwater runoff (up to 50%); improved air and water quality; reduced energy consumption (by insulating buildings); increased habitat for birds and beneficial insects; sources of urban food production; enhanced building value; extended roof life; reduced heat island effects and sound barrier. A recent study estimated that the greening of all of Chicago's rooftops would produce $100 million in saved energy annually.

1 inch of rain on a 1,000 sq. ft. roof generates about 623 gallons of water

Design and Plant Material

The slope of your roof will determine what kind of roof garden you can have. You must consult a licensed engineer regarding the load carrying capacity of the roof to ensure that the structure will support your garden design. A low cost way to start a roof-top garden on a flat roof is to use containers, such as plastic swimming pools.

Plant material for a roof garden should be drought tolerant and like hot, sunny growing conditions. Certain native wildflowers, grasses and shrubs will also survive in a raised bed containing at least eight inches of soil (i.e. plastic swimming pool). Vegetables for human consumption can be grown if a heavy layer of organic mulch is applied. A greenroof, however, requires plants that can thrive in a thin layer of growing medium. Sedum, a low-growing succulent perennial plant that can be found in hues of green, pink, yellow and white are good for greenroofs. Sedums thrive in poor soil and with little rainfall. Annual plants may not thrive on rooftops due to high water demands and dry conditions.

Before planting, check the following:

- Has the load carrying capacity of the roof been checked? Can the roof support a garden?
- Will the roof garden be a variety of containers or a greenroof that is professionally designed and installed?
- If it is a roof garden with containers, what type of plants will be planted?
- If the plants last more than one season, is there a way to protect them from freezing temperatures and drying winter winds?
- Is there an auxiliary watering system in case of drought? Can a rain barrel or cistern be installed to capture rainwater or can a hose be attached to a water tap close to the roof?
- Who will maintain the garden, especially if it is located on a commercial or school building?
- Are there liability issues to be addressed if it is for public use?