



# Stormwater Management for Homeowners Fact Sheet 5: Rain Gardens

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This fact sheet is part of a series. Please refer to definitions in the glossary at the end of this fact sheet. Glossary terms are italicized on first mention in the text.

## Introduction

When rain falls on *pervious surfaces*, like soil, mulch, and vegetative groundcovers, it soaks in through a process called *infiltration*. The water can be used by plants, or it can recharge underground water storage areas called *aquifers*.

When rain falls on *impervious surfaces*, like roads, driveways, and rooftops, it does not infiltrate. Instead, water quickly collects and flows off these surfaces to the nearest stream, river, pond, lake, reservoir, bay, sound, or ocean. Water that moves in this way is called *runoff* or *stormwater*. It carries *pollutants* with it, including fertilizer, pesticides, fluids from cars, *sediment* from bare soil areas, bacteria from animal waste, plant debris like leaves and grass clippings, and trash like plastic bottles and cigarette butts. The more area covered in impervious surfaces, the greater the amount of pollution and volume of runoff, which increases the likelihood of flooding, stream *erosion*, harm to wildlife and the environment, and degradation of water quality.

Stormwater best management practices, or *BMPs* for short, are tools for managing runoff. They reduce the speed and volume of runoff and clean up the pollutants in it. Homeowners can use different practices, like *rooftop redirection*, *rain barrels*, *permeable pavement*, *grass swales*, *rain gardens*, and *buffers*, in their landscapes to manage runoff at the source. This prevents large volumes of polluted runoff from going into storm drains that flow directly into nearby water bodies. Some additional benefits of BMPs include improved drainage; a healthier and more attractive landscape, increased property value, wildlife food and habitat, improved water quality, and a cleaner environment.

## What Is a Rain Garden?

A rain garden is a natural or man-made planted shallow depression that temporarily holds runoff from impervious areas until it evaporates, is absorbed by the plants, or infiltrates into the ground (see fig. 1). Think “puddle with plants.” A rain garden is a stormwater management practice that improves water quality by reducing the amount and speed of runoff and by filtering out pollutants.

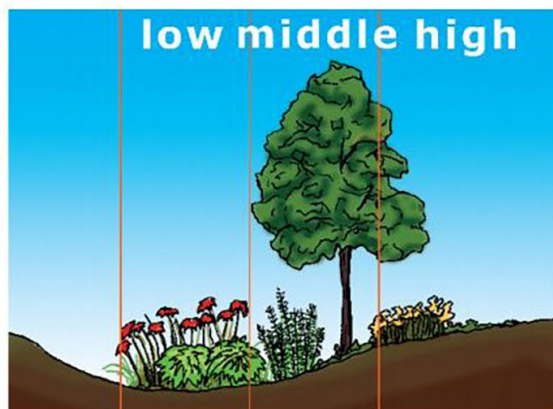


Figure 1. Cross section and overview of a typical rain garden.

## Where Can a Rain Garden Be Used?

Rain gardens are very adaptable and can be used in many locations; however, each landscape is different. A site evaluation and a percolation test, or *perc test* for short, are recommended to make sure the rain garden is placed in the best location for it to work properly. Look at the landscape during or shortly after a rainfall. Where does the runoff from the site's impervious surfaces like the roof, driveway, parking area, or patio go? Runoff follows the path of least resistance.

Rain gardens can be located anywhere along the natural runoff pathway. If the garden can't be located along the natural water pathway, runoff can also be directed into a rain garden (through pipes or swales) (see fig. 2). Rain gardens can be in sun or shade and should be located at least 10 feet away from building foundations, not on steep slopes, not over underground utilities or a septic field, not where soil clay content is high, and not where the *water table* is high. The bottom of the rain garden should be at least 2 feet above the seasonal high water table level to promote infiltration.



Figure 2. Example of a downspout with a flexible extension pipe. Direct the runoff 10 feet away from the foundation and into the landscape. Photo by Mary Ann Kincaid, Virginia Beach Master Gardener Water Steward.

## How Do Rain Gardens Work?

The purpose of a rain garden is to slow down the runoff long enough to filter it before it moves on. The plants, soil, and the microorganisms in the soil act as a filter to clean or break down pollutants. The runoff can then flow out of the rain garden into another BMP, like another rain garden, a grass swale, or a buffer, or into a nearby storm drain, stream, *stormwater pond*, or other body of water. It can infiltrate into the soil, evaporate back into the atmosphere, or the plants can absorb and

use it. Water is meant to be held temporarily (two to four days), so it is filtered and gone before the next rainfall and so mosquitos don't breed. Sediment is filtered when it is trapped by the plants and settles to the bottom of the garden.

A rain garden's finished depth should be 6 to 8 inches lower than the surrounding soil surface. The depression may need to be dug 12 inches deep if compost is being added to the garden soil or if plants with large root balls are being planted and mulch is applied. Compost adds additional volume, and plant root balls displace the garden soil, which raises the soil level. Mulch on top of the soil also raises the level.

Rain gardens are very site-adaptable. More than one rain garden can be used on a site. For example, they can be used at different points along the runoff pathway, in different pathways, or at different downspouts. Sometimes two or more small rain gardens are connected and used instead of one large one because of design or space considerations.

## Plants for Rain Gardens

A planting list should include:

- Plants that tolerate both shorter wet periods and longer dry periods.
- Plants that have ornamental value such as flowers, berries, or unique leaves or bark for interest all year.
- *Herbaceous* and *evergreen* plants.
- A mix of groundcovers, perennials, shrubs, and trees (if the garden is large enough) because different plants filter pollutants differently.
- Native and/or non-native plants that are adapted to the local environment and the specific site conditions.
- Plants that are not aggressive or invasive in their growth habits.

See the Resources section for sample planting lists.

## Calculating the Size

The size of a rain garden is based on the amount of stormwater that is flowing into it. Calculate the square footage of the impervious surface that will be drained to the rain garden by measuring the length and width of the impervious area and multiplying the two numbers to get the number of square feet (ft<sup>2</sup>). If there is more than one impervious area, add the two areas together. Divide the square footage by 20 to get the size of the rain garden needed. This number is the minimum square footage.

Rain gardens can be larger than the minimum, and they can be one garden or several small connected gardens to meet the minimum size requirement.

Rain gardens can be any shape and generally have curving, more natural-looking edges that blend into the surrounding landscape. Very heavy rainfall can cause the garden to overflow, so plan for that in the design. Will the excess runoff go into another BMP, like another rain garden, a swale, or a stormwater pond, or will it go into a flowerbed, lawn, or storm drain? A sample rain garden size calculation is below.

## Example

Total roof area:

$$60 \text{ feet} \times 80 \text{ feet} = 4,800 \text{ ft}^2$$

Only one-quarter of the roof area will drain into the rain garden, so:

$$4,800 \times 0.25 = 1,200 \text{ ft}^2$$

Total driveway area:

$$15 \text{ feet} \times 45 \text{ feet} = 675 \text{ ft}^2$$

Total area going into the rain garden (roof + driveway):

$$1,200 + 675 = 1,875 \text{ ft}^2$$

Rain garden size:

$$1,875 \text{ square feet} \div 20 = 93.75 \text{ ft}^2$$

## Basic Installation Instructions

Place plants in their proper moisture zones (see figure 1). The bottom of the rain garden will stay wet the longest, so plants that tolerate wet soil for longer periods of time should be planted in the lowest zone. Plant shrubs and perennials in groups of three to five for a more natural look. Trees are recommended only if the rain garden is large enough to accommodate them, and they are usually planted as individuals. Place taller and larger plants in the center, at the back, or at one end of the garden, depending on how the garden is being viewed. Use shorter plants around the edges, in front of larger plants, or under taller plants.

Space the plants according to their mature size. Groundcovers and perennials should be spaced so their canopies will grow together and cover the ground quickly to minimize weeds and mulching. Shrubs should be planted so their mature canopies will touch but not grow together and compete. For example, inkberry shrubs that grow 4 feet wide should be planted 4 feet apart on center (see figure 3).



Figure 3. Top, newly planted rain garden; bottom, after three years. Photo by L. Fox.

Spread a 2- to 3-inch layer of organic mulch (pine bark, shredded hardwood, pine straw) around new plants and over any bare ground areas. Mulch provides organic matter that supports microorganisms, improves water infiltration, prevents weeds, and keeps the soil from drying out when there is no rainfall.

Rain garden plant lists are available from books, online, and in “Rain Garden Plants,” Virginia Cooperative Extension publication 426-043. Links to some rain garden plant lists are in the Resources section.

## Cost

Costs for rain gardens vary widely and can range from as low as \$5 to more than \$20 per square foot. Each rain garden is unique, and many factors influence the final price, including:

- Design costs for site-specific conditions or user preferences.
- Size of garden(s).
- Labor for digging, grading, and hauling away excess soil.
- Species and number of plants.

- Labor for plant installation.
- Mulch and labor to spread it.
- Labor for long term maintenance including: weed management, replacing any dead plants, pruning, maintaining the garden edge.

Many homeowners like to install their own rain gardens, which significantly reduces the cost. Numerous resources are available (see Resources section), including design guides, size calculators, plant lists, and, in some areas, Virginia Cooperative Extension or other groups that offer rain garden classes and workshops. Propagating plants that are in the surrounding landscape or purchasing plants at local gardening organization sales can also help reduce overall costs.

Some cities and counties offer incentive programs that encourage residential stormwater management practices. The incentives could include rebates, utility bill credits, or cost sharing for installation. Homeowners should contact their local stormwater, public works, or soil and water conservation office to find out about these programs.

## Maintenance

Newly planted plants should be watered 1 inch per week for the first six months unless there is sufficient rainfall. Once established, rain gardens are considered low-maintenance parts of the landscape. Maintenance is done on an as-needed basis and includes:

- Remove any trash, debris, or accumulated leaves that could clog the rain garden and cause it to not function properly.
- Monitor the bottom and sides of the garden for erosion and bare areas. Also look for bare soil areas or erosion in the parts of the landscape around the garden. Replant, seed, or mulch those areas and replace any plants that die.
- Periodically check after a rainfall to make sure water is not standing in the garden for more than four days because mosquitos breed in seven days. If it is, *aeration* may be necessary to improve infiltration. This is easily done with a digging fork or pitchfork.
- Crowded plants might need to be thinned after several years to keep them from competing.
- Remove weeds before they spread or seed to prevent them from competing with desirable plants and making the garden look unattractive.

- The garden may need to be watered during long periods without rainfall.
- After the initial installation, DO NOT mulch the garden every year like other landscape beds. Frequent mulching will fill in the garden so it no longer holds water or functions properly.

## Resources

Chesapeake Bay Program, “How-To’s and Tips” – [www.chesapeakebay.net/action/howtotips](http://www.chesapeakebay.net/action/howtotips)

Chesapeake Conservation Landscaping Council, “The Eight Essential Elements of Conservation Landscaping” – [www.ChesapeakeLandscape.org](http://www.ChesapeakeLandscape.org)

Chesapeake Stormwater Network, “Homeowner BMP Guide” – <https://chesapeakestormwater.net/homeowner-bmp-guide/>

Low Impact Development Center, “Rain Garden Design Templates for Maryland” – <https://lowimpactdevelopment.org/resources/rain-garden-templates-for-maryland/>

Virginia Cooperative Extension, “Rain Garden Plants,” VCE publication 426-043 – <http://pubs.ext.vt.edu/>

Virginia Cooperative Extension, “Best Management Practice” fact sheet series on urban stormwater management practices, 426-119 – 426-134, by D. Sample – <http://pubs.ext.vt.edu/>

Virginia Cooperative Extension, “Stormwater Management for Homeowners” fact sheet series, HORT-293P–HORT-298P, by L. Fox – <http://pubs.ext.vt.edu/>

Virginia Department of Forestry, “Rain Garden Technical Guide” – [https://dof.virginia.gov/wp-content/uploads/Rain-Gardens-Technical-Guide\\_pub.pdf](https://dof.virginia.gov/wp-content/uploads/Rain-Gardens-Technical-Guide_pub.pdf)

## Glossary

**Aeration** – The act of manually or mechanically poking holes into the ground; reduces soil compaction and creates channels through which oxygen, water, and nutrients can penetrate into the soil.

**Aquifer** – A natural underground storage area for water.

**BMP (best management practice)** – An action or device meant to manage runoff.

**Buffer** – An area of vegetation next to the water’s edge that protects water quality by slowing runoff, filtering pollutants and sediment, providing infiltration, and

stabilizing shorelines. Buffers also add plant diversity to the landscape and provide wildlife with food, habitat, and movement corridors.

**Erosion** – The loss of soil on property, often due to water flow.

**Evergreen** – A plant that keeps leaves throughout the year.

**Grass swale** – A graded, linear, shallow, open channel covered with plants, usually grass; used to slow down, spread out, and filter stormwater.

**Herbaceous** – Plants that have no woody stems and generally die back and are dormant over the winter.

**Impervious surface** – A surface that does not allow water to flow through it.

**Infiltration** – The process by which water enters the soil or other materials.

**Perc, perk, percolation test** – A test to measure the speed at which water infiltrates unsaturated soils.

**Permeable pavement** – Pavement with a top layer that allows water to infiltrate due to spaces in the paving material or spaces between the pavers.

**Pervious surface** – A surface that allows water to flow through it.

**Pollutants** – Materials that have a negative impact on human or environmental health.

**Rain barrel** – A small collection tank installed at the end of a downspout to collect and temporarily store rainwater runoff from a roof for later use.

**Rain garden** – A planted shallow depression that temporarily holds runoff from impervious areas until it evaporates, is absorbed by the plants, or infiltrates into the ground.

**Rooftop redirection (disconnection)** – A stormwater management practice that moves the runoff collected from rooftops through gutters and downspouts into the landscape where it can spread out, slow down, and infiltrate instead of moving the runoff directly into a storm drain system.

**Runoff** – Water that runs off impervious surfaces during rain events, often associated with urban areas. Runoff can also occur from pervious surfaces if the precipitation rate is greater than the infiltration rate. Also called “stormwater.”

**Sediment** – Soil, rock, or biological material particles formed by weathering, decomposition, and erosion.

**Stormwater** – Water that runs off impervious surfaces during rain events, often associated with urban areas. Also called “runoff.”

**Stormwater pond** – A pond that is used to temporarily hold and treat water pollution; used in residential developments to manage runoff from roads, driveways, and roofs.

**Water table** – The depth at which soils are fully saturated with water.

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