



RainScapes

Environmentally-Friendly Landscapes for
Healthy Watersheds

Rain Gardens

Why should I install a rain garden?



One inch of rain falling over a 1,500 square foot home on a small lot can produce over

5,000 gallons of stormwater runoff. Typically, roof downspouts release runoff directly onto lawns or hard surfaces such as driveways, streets, and sidewalks that prevent the water from soaking into the ground. When water cannot soak into the ground, it flows over the surfaces and enters storm drains that flow to streams. As it flows over hard surfaces and lawns, the stormwater picks up pollutants such as sediment, grease and oil from cars, and pesticides and fertilizers from lawns. The storm drain pipes collect the stormwater and send it into the streams in surges, which can cause downstream erosion, flooding, and stream habitat problems.

Rain gardens are functional landscaping features. In addition to making your landscape look more attractive, they can address flooding and erosion problems in your yard and neighborhood.

(continued on page 2)

What is a rain garden?

Rain gardens are attractive landscape features constructed to capture stormwater runoff from hard surfaces such as your roof, driveway, patio, or sidewalk. A rain garden is a garden with a shallow depression that collects and drains stormwater. Rain gardens typically are planted with native plants with deep roots that loosen the soil, so stormwater can soak into the ground more easily. Rain gardens help to meet the RainScapes' goal of using innovative natural approaches to reduce water pollution, stream channel erosion, and drainage problems caused by stormwater runoff.



Sunny rain garden - first summer



Shady rain garden - first growing season, attractive overflow design



Fall rain garden

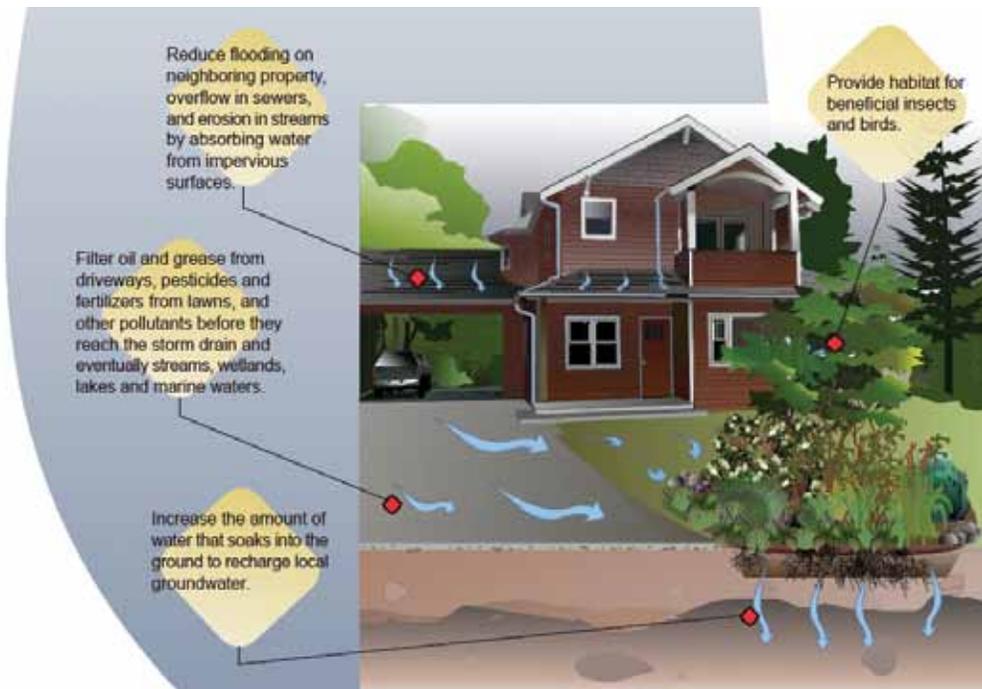


Image courtesy of Washington State University Rain Garden Handbook

Is my site right for a rain garden?

Not all sites are suitable for a rain garden and a conservation landscape may be a more appropriate project. If you have poorly drained soils, steep slopes, or space constraints, you should consider conservation landscaping. See rainscapes.org for more information.

(continued from page 1)

Stormwater is reduced because you are collecting the stormwater and allowing it to naturally soak into the ground.

What are the Benefits and Incentives?

Rain gardens allow about 30% more rainwater to soak into the ground than traditional lawns. Since rain gardens capture stormwater onsite, they can reduce the harmful effects to streams caused by large and rapid stormwater flows.

Rain gardens offer multiple benefits to the community and the local environment, which include:

- Reduced polluted stormwater runoff from yards into local streams

- Reduced localized flooding
- Reduced erosion
- Pollution prevention
- Groundwater recharge
- Enhanced wildlife habitat
- Aesthetics

However, the most important reason to install a rain garden may be that you are doing your part to help the environment and protect your local streams and the Chesapeake Bay.

The RainScapes Rewards Rebate Program offers a rebate for installing a rain garden on residential, institutional, multi-family, or commercial properties. Please visit rainscapes.org for additional rebate information.

How to...

Assess Your Property

Take some time to walk around your property to assess the drainage conditions. The best time to make your observations is when it is raining, so that you can see where the rain lands and where it flows. Consider these questions to help you identify where a rain garden could be placed to capture stormwater runoff on your property:

- Are there places on your property where rain regularly runs off of a hard surface such as your roof, driveway, patio or compacted lawn?
- Where does the rainwater go? Is the runoff directed to your lawn, the street, or a storm drain?

The rain garden should be placed so that it catches the runoff from your roof downspouts, driveway, sump pump outlets, patio, or sidewalk. The key is to place the rain garden between the point where rain falls on your property (i.e. your roof, driveway, or patio, etc.) and where runoff water would exit your property (i.e. an adjacent stream, storm drain, etc.).

Once you have identified the pattern of drainage on your property, you can narrow down the potential rain garden locations on your property. Follow these steps to identify the best location in your yard for a rain garden:

1. Measure the area that will drain to your rain garden. Use the tables (1, 2 or 3) on the next page to determine the size of your rain garden. The area is determined by the relationship between hard surfaces draining to the garden, the depth of digging in the garden and the amount of rain you are trying to catch.
2. Fit the rain garden into your current landscape. A well designed rain garden will improve the aesthetics of your property.
3. Avoid marked underground utilities and septic tanks
 - Identify and mark existing utilities before digging
 - Call “Miss Utility”: 1-811-257-7777 or submit an Internet Locate Request for homeowners: <http://www.missutility.net/iticleite/>
4. Place the rain garden at least 10 feet away from basements and 5 feet from concrete or asphalt slabs like sidewalks, driveways, patios and garages.
5. Avoid placing your rain garden under existing tree canopies
6. Avoid placing the rain garden in a soggy area in your yard, which indicates that the soil in that area cannot drain well. The best place for the rain garden is just uphill from the low spot in soil that passes the infiltration test. (See Testing the Soil).
7. Bedrock and ground water should be at least 2 feet below the rain garden surface. If you are concerned about these issues on your property, consult with RainScapes staff first.
8. If you place the rain garden to collect runoff from a downspout, make sure the edge of the garden is 10 feet away from your house and downhill from the foundation.
9. Make sure that when the rain garden overflows, the excess water will be directed away from your home and your neighbor’s property.

Consult with RainScapes staff or a knowledgeable professional to determine if the site is suitable for a rain garden.

Testing the Soil

Since rain gardens depend on water soaking through the ground, it is important that the soils drain well. After locating a place you wish to build your rain garden, you must test how well the soil drains to determine if the site is suitable. To determine if your soil is suitable for a rain garden, you must perform a soil drainage or infiltration test, which measures how fast the water soaks into the soil. Collected water in rain gardens should soak into the soil within 24 to 36 hours.

1. Dig a hole in the potential rain garden location that is about one foot in diameter and two feet deep (or as deep as your rain garden excavation will be).
2. Fill the hole with water.
3. Allow the water to naturally soak into the soil and wait until the water drains completely.
4. Within twelve hours, refill the hole with water and record the time it takes for water to drain. This should take no longer than 36 hours.

Consult with RainScapes staff or a qualified professional if it takes longer than 24 to 36 hours for water to drain through your test pit.

How to...

Design and Plan

1. Assess your site.
 - Determine the size of the garden
2. Design your garden
3. Build your garden
 - Layout the garden
 - Set your levels
 - Excavate
 - Build a berm/dispose of soil
 - Deliver/Add soil mix
 - Plant
 - Mulch
 - Water
4. Maintain your garden
 - Establishment
 - Ongoing

Sizing the Rain Garden

The amount of rainfall that will fill a rain garden depends on how large the rain garden is compared to its drainage area. The tables below provide guidance on how to properly size a rain garden. Montgomery County recommends that residential rain gardens capture 1.5 to 2.7 inches of rain.

Another consideration is planting bed depth, which is the depth of the rain garden soil media. More water can be stored with a deeper planting bed, but a shallower depth is easier and

faster to construct. Use the shallowest planting bed depth that can capture the desired amount of rain and may result in less soil that has to be removed.

Shaded areas indicate inches of rain captured for any combination of drainage area and rain garden area. In the top row, choose the drainage area closest to the measured area. In the left column, choose the closest rain garden area to the measured area. As an example, the blue box shows that a 50 sq. ft. rain garden with a one foot planting bed can store 3.0 inches of rain from a 200 sq. ft. drainage area.

Rain garden sizing tables

Table 1. Sizing table for 1 ft planting media.

Media footprint (square feet)	Drainage area (square feet)					
	100	200	300	400	500	600
Inches of rain stored	5	1.1	0.6	0.4	0.3	0.2
15	2.2	1.1	0.7	0.6	0.4	0.4
30	3.8	1.9	1.3	1.0	0.8	0.6
50	6.0	3.0	2.0	1.5	1.2	1.0
60	7.1	3.6	2.4	1.8	1.4	1.2
75	8.8	4.4	2.9	2.2	1.8	1.5
100	11	5.7	3.8	2.9	2.3	1.9
125	14	7.1	4.7	3.6	2.8	2.4

Table 2. Sizing table for 2 ft planting media.

Media footprint (square feet)	Drainage area (square feet)					
	100	200	300	400	500	600
Inches of rain stored	5	1.3	0.7	0.4	0.3	0.2
15	2.8	1.4	0.9	0.7	0.6	0.5
30	5.0	2.5	1.7	1.2	1.0	0.8
50	7.9	4.0	2.6	2.0	1.6	1.3
60	9.4	4.7	3.1	2.3	1.9	1.6
75	12	5.8	3.9	2.9	2.3	1.9
100	15	7.6	5.1	3.8	3.1	2.5
125	19	9.5	6.3	4.7	3.8	3.2

Table 3. Sizing table for 3 ft planting media.

Media footprint (square feet)	Drainage area (square feet)					
	100	200	300	400	500	600
Inches of rain stored	5	1.5	0.7	0.5	0.4	0.3
15	3.3	1.7	1.1	0.8	0.7	0.6
30	6.1	3.1	2.0	1.5	1.2	1.0
50	9.8	4.9	3.3	2.5	2.0	1.6
60	12	5.8	3.9	2.9	2.3	1.9
75	14	7.2	4.8	3.6	2.9	2.4
100	19	9.5	6.4	4.8	3.8	3.2
125	24	12	7.9	5.9	4.7	3.9

Using the sizing tables

1. Estimate how much impervious area (roof, patio, driveway, or a combination) could be directed to the rain garden. For roof drainage, measure the footprint of the house to find the total area. Divide by the number of downspouts to estimate the roof area contributing to each downspout.
2. Look at the tables; start at the top and find the impervious area that you just calculated.
3. Decide how much rain you wish to catch in your rain garden (for a rebate, this should be at least 1.5 inches).
4. Tables 1-3 give you rain garden areas, but start with Table 1, since it involves the least amount of excavation. Determine your rain garden area by looking at the left column that lists rain garden square feet based on the impervious area and the inches of rain treated in the garden.
5. If you know you don't have enough land for the ponding area, then move to Table 2 or 3.
6. Make a note of the selected planting bed depth to use in construction.

Remember, the rain garden depth equals the depth of the soil media (planting media) plus an additional 6” for a temporary ponding area. So a Table 2 rain garden would actually be 30 inches deep. See Rain Garden Footprint on page 6. The wet zone is the planting media footprint. The dry zone is the extent of the ponding footprint. The figure at the bottom of page 6 also shows these zones and the rain garden berm.

Most mosquitoes take 7 to 12 days to breed, however, a few species can lay eggs, hatch, and develop from larva to an adult in 4 days. If your rain garden is designed properly, it will drain within a few hours to a day, which is not enough time for mosquito eggs to hatch. Rain gardens are intended to dry out between rain storms; they are not intended to hold a permanent pool of water. Additionally, native plants in rain gardens attract wildlife such as dragonflies that are natural predators of mosquitoes.

Table 4. Media Footprint vs. Ponding Footprint (square feet)

Media Footprint	Ponding Footprint
5	24
15	37
30	56
50	81
60	94
75	112
100	144
125	175

Developing a Planting Plan

Basic garden composition principles apply to rain gardens. This means that it is desirable to have four seasons of interest, the color scheme and style of the garden should fit your needs, and garden maintenance should be considered when developing a planting plan. There are many resources that focus on composition; a rain garden can look like any style of garden once the soil and drainage aspects are solved.

The best plants for rain gardens are plants that have fibrous, deep roots and are able to withstand periods of drought and periods of extended wet conditions. This manual includes a list of recommended rain garden plants and some sample rain garden planting design templates. Other templates are available online and links to those are included in the “For More Information” section.

Plant Selection

Plant selection is critical to the success of your rain garden. The most important step is to match a plant’s water tolerance to its location in the rain garden. Some plants are adapted to their “feet” (roots) getting wet, while other plants prefer drier soil conditions. Different locations within the rain garden will have different levels of water after a storm. The center of the rain garden is the lowest point, so



Native plants support pollinators

it will be the wettest area. Plants in this part of the rain garden should prefer moist soil. Plants placed along the sides of the rain garden should prefer average to dry soil conditions. Plants at the top (edge) of the rain garden should prefer dry soil conditions but be able to tolerate brief periods of flooding. Avoid selecting plants that require wet conditions—these plants are wetland plants and need wet soils for the majority of the growing season. Plant soil moisture tolerance information can be found in most nursery catalogs, and is labeled as wet, moist, average and dry, though you may need to look at additional references in this section.

Remember that rain gardens are designed to drain within 24-36 hours, so they will be dry for most of the season. Some native plant guides list

ranges of “flood depths” that particular plants can tolerate. Knowing the depth of standing water that a plant can handle will help you know where the plant should be placed in the rain garden (bottom, side, or top).

Other considerations are plant size (how tall and wide plants will grow when they are mature—space them accordingly), the amount of sunlight the plant needs (typically full sun, partial shade, and shade), and plant aggressiveness (you want your plants to stay where they are planted instead of taking over your garden).

Native plants have deep root systems that are much bigger than the root depth of conventional turf grass. Typical turf grass typically has roots that are 2-4 inches deep. Rain garden plant roots will usually grow to the depth of the garden and may extend further, depending on local soil conditions. As the plant matures, plants grow new roots looking for water and nutrients and discard about 30 percent of the roots annually, leaving “root channels” or holes in the soil where old roots decayed, which break up the soil. Water flows through the “root channels” and soaks into the soil more quickly. Drainage through soil will improve over time with native plants. To be eligible for a rebate, at least 75% of plants must be native species, which are plants that have adapted to local climate, rainfall, and soil conditions.

Helpful resources for choosing native wildflowers, grasses, and shrubs for our region include:

- The U.S. Fish & Wildlife Service’s guide called “Native Plants for Wildlife Habitat and Conservation Landscaping: Chesapeake Bay Watershed.” <http://www.nps.gov/plants/pubs/chesapeake/>

Or

<http://www.nps.gov/plants/pubs/nativesMD/pdf/MD-Piedmont.pdf>

- The National Park Service’s “Plant Lists for Maryland Regions” <http://www.nps.gov>



Shade tolerant plants - first year

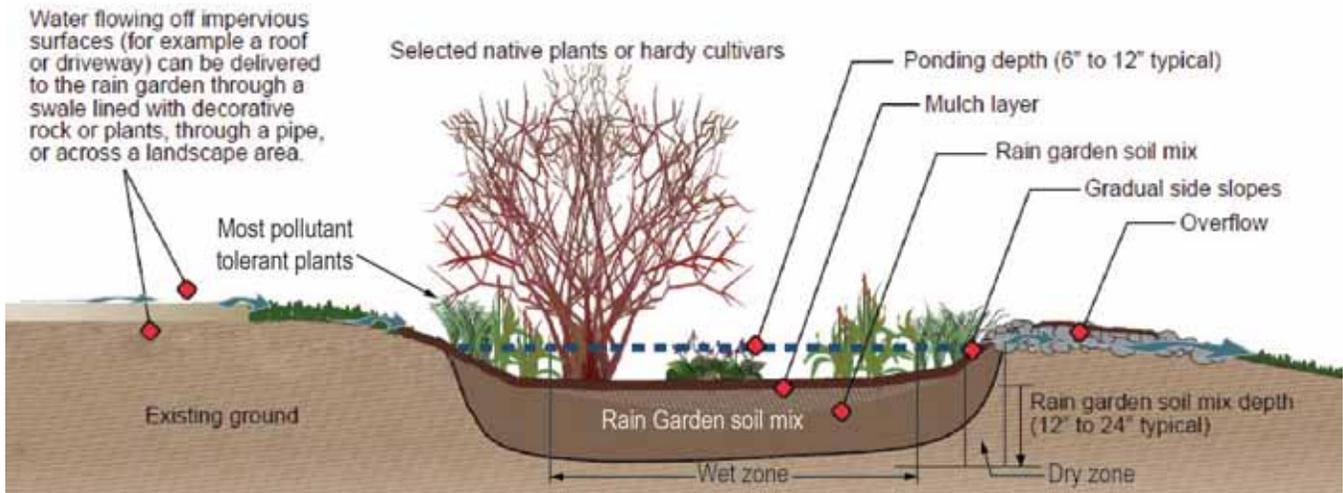
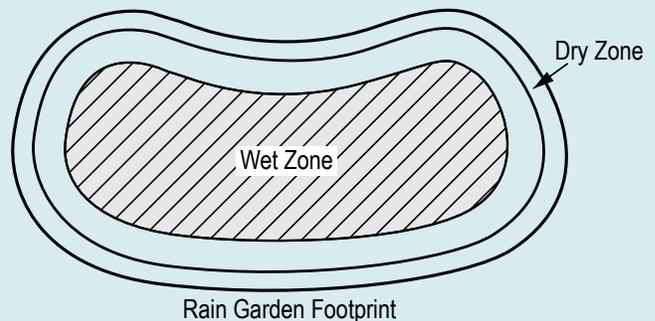


Image courtesy of Washington State University Rain Garden Handbook

Plan how water will get to the rain garden

There are a variety of ways to direct stormwater to your rain garden:

- Direct a roof downspout to the rain garden through a grass or rock-lined swale
- Direct a roof downspout to the rain garden through a buried PVC pipe (place a “splash guard” or large rock under the pipe outlet to avoid erosion in the rain garden)
- Collect driveway runoff in a shallow trench drain and pipe water to the rain garden
- Install a 1-inch speed bump in your driveway to send runoff to rain garden (requires hand shoveling in the winter)
- Direct rain barrel overflow into the rain garden

Plan where water will go when the rain garden is full

All rain gardens will overflow during periods of heavy rainfall. Overflow from your rain garden can be released through a “notch” cut in the berm. The notch should be reinforced with either turf or stone to prevent erosion. The water should go where it would normally have flowed before the rain garden was constructed. A soft surface, such as a lawn or shrub planting area is usually the best location for overflow because it will provide additional opportunities for water to soak into the ground. Avoid sending the excess water towards your home’s foundation or neighboring home’s foundation.



Brookside Gardens - signs help explain the rain garden



2-celled rain garden just after installation



and during first growing season

Can I do this Project Myself?

Maybe. Detailed design templates are provided at [rainscapes.org](https://www.rainscapes.org):

You may need to consider hiring a qualified designer and/or installer if:

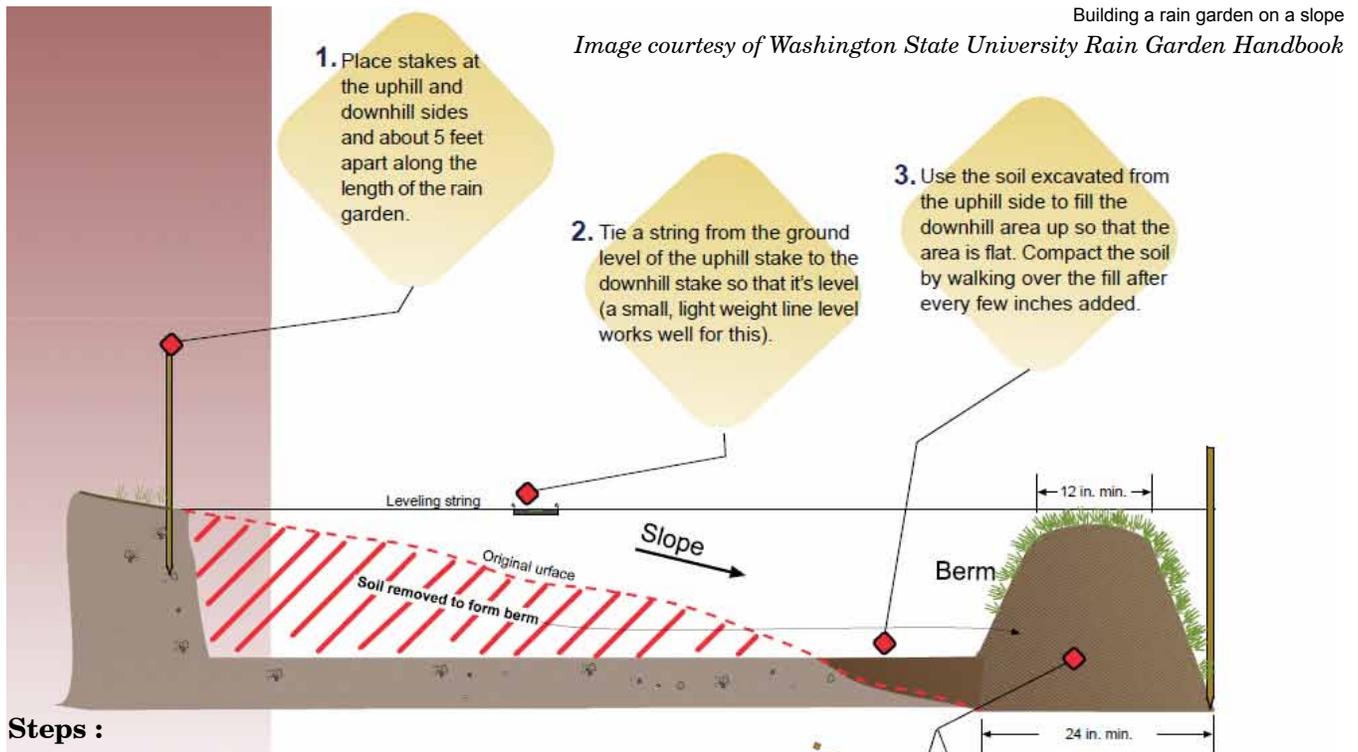
- you are trying to treat off-site drainage
- your site has a steep slope
- you are considering terracing
- you have a lot of trees

If you are hiring a contractor to build a more complex rain garden, you can give the contractor these plans.

How to Build and Implement

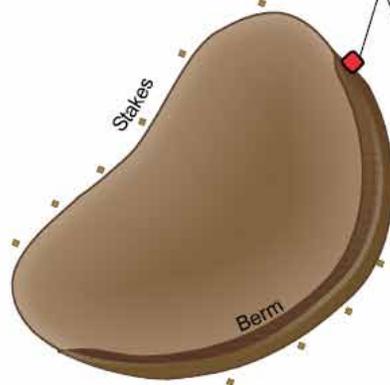
Equipment:

- Rope, string, or garden hose
- Stakes
- Lightweight line level
- Sod-cutter (optional- you can rent these)
- Shovel and rake (if done on a slope, shovel will not be needed)
- Tiller or back hoe (use teeth to till)
- Edging machine (optional- helps to keep grass out of the rain garden)



Steps :

1. Outline the footprint of the rain garden with rope, string, or a garden hose.
2. Pull up the sod with a sod-cutter or a shovel. The sod-cutter is preferred so that you have rolls of sod to finish the site or dispose easily.
3. Dig out the garden bed (to the depth determined from the sizing chart for the planting bed depth plus an additional 6 inches for



4. Create a berm at the downhill side to confine water in the rain garden. For the correct height, build the berm up to the string. To keep the top level, the berm will be highest at the downhill end and then become shorter up the sides until tapering off at the uphill end. The berm should be a minimum of 24 inches wide at the base, have gently sloping sides, and be well compacted.

the ponding depth). Set aside the excavated material to use for the berm.

4. Create a flat-bottomed bowl.
5. Add the planting media one foot at a time, up to the chosen planting depth from Table 1. Make sure that each layer is perfectly level. Water the area gently, so that the soil is not displaced. Recheck the level of the surface after wetting the planting bed to make sure the surface is flat.
6. If your rain garden is built on a hill, you will want to build a mound of soil (a berm) on the downhill side to hold the water in. Cut a “notch” in the berm to let water out during the first year to allow plants to establish their roots. The hillside garden is the easiest to build by just raking the soil from the garden after tilling to the berm, with no shovel required. (See figure above).
7. Protect the berm notch and the inlet area with cobbles, an erosion control blanket, or rock placed in a step-like condition.
8. Place edging or a small wall around the garden to keep grass from creeping in, keep the mulch in, and enhance the aesthetic. Whatever edging you use, it needs to be lower than the grass edge or inlet to allow water to enter the garden.
9. Fill the rain garden with water to make sure it will drain within 24 hours and overflow in the direction you intended.
10. Before planting, place double shredded hardwood mulch over the garden bed to a depth of 3 inches; mulch prevents weeds, adds nutrients to the soil, and captures pollutants.
11. Remove plants from containers. If the plants are “root bound,” break up the roots with a knife or your fingers. Make sure that the roots are pointing downwards when you place the plant in the soil.
12. Plant native species based on moisture preferences (average to moist or dry conditions).

*Avoid compacting soil by standing or placing heavy equipment in the rain garden bed, which makes it harder for water to drain through the soil.



Rain garden with curvilinear grass berm



Watering is necessary for newly planted gardens, but established gardens are drought tolerant

Costs

Rain garden costs vary greatly and depend on the size, materials, and design of the garden. A typical price range is between \$4-35 per square foot. The lower figure is likely if you are a “do-it-yourselfer” with no hardscape and are using smaller plants. Factors that influence price include:

- access to the site
- labor
- the use of heavy equipment or hand tools
- soil disposal offsite
- size of plants selected
- size of the garden overall
- how much water it is designed to capture and soak in

When hiring a contractor, ask for referrals of successful projects and be clear about what the project entails.



Deer resistant plants are crucial to many landscapes

Maintenance

Most of the maintenance required for rain gardens occurs during the first year. Remember to:

- Water plants during the first growing season until plants are established. The garden should receive a minimum of 1 inch of water from the hose or rain per week (about 15.6 gallons/week for a 25-square-foot rain garden).
- Remove weeds.
- Remove litter, sand, and sediment that may have entered the rain garden.
- Remove and re-mulch (annually) with double shredded hardwood mulch to maintain 3 inches of cover.
- Prune dead vegetation (annually).
- Check where water enters the rain garden to make sure the area remains free of debris. Place rocks or a “splash block” to break up the water entering the rain garden to avoid washing out the garden during a major storm.

Different Applications

Rain gardens can have different appearances, dependent on your style preference and the level of maintenance you can do. Choose plants that you find attractive. You may want your garden to have a more manicured look or a “wild and wooly” look.



Rain garden in partial sun

For More Information

“Blue Thumb Guide to Rain Gardens: Design and Installation Guide for Homeowners in the Upper Midwest.”

http://metroblooms.org/store/product_details.php?category_id=10&item_id=19

Western Washington Rain Garden Handbook
Washington State University Pierce County Extension

http://county.wsu.edu/mason/nrs/water/Documents/Raingarden_handbook.pdf

Rain Garden Manual for New Jersey
Native Plant Society of New Jersey

http://www.npsnj.org/rain_garden_home.htm

Rain Garden Calculators <http://www.rainkc.com/index.cfm/fuseaction/home.showpage/pageID/17/index.htm>

Deer Tolerance

A list of deer resistant plants is provided on page 73 of the U.S. Fish & Wildlife Service’s guide to “Native Plants for Wildlife Habitat and Conservation Landscaping: Chesapeake Bay Watershed.”

To download or order a free copy of this guide, visit <http://www.nps.gov/plants/pubs/chesapeake/>

8-minute Video of Rain Garden Installation

Metro Blooms, July 24, 2008

http://metroblooms.org/raingarden_video.php

Where to Buy Native Plants

Most local nurseries carry native plants. The U.S. Fish and Wildlife Service website lists some native plant nurseries in the Chesapeake Bay watershed:

<http://www.fws.gov/chesapeakebay/BayScapes/bsresources/bs-nurseries.html>

Rain Garden Templates, Low Impact Development Center

http://www.lowimpactdevelopment.org/raingarden_design/templates.htm

Montgomery DEP Rain Garden templates

<http://www.rainscapes.org>