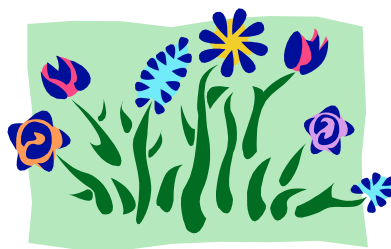


Rain Garden Design for Home Owners

A guide compiled for
Alabama
Master Gardens



What is a rain garden and why should I plant one?

Rain gardens are just that, gardens. However, they are also beautifully landscaped miniature bio-retention basins that catch rain water that runs off nearby roofs, driveways, and other impervious surfaces. Rain gardens delay and filter surface runoff and increase the amount of water that infiltrates into the ground. This reduces pollutant transport caused by immediate runoff into nearby streams and lakes. By collecting the runoff from impervious surfaces and increasing infiltration, rain gardens can play a valuable role in urban storm water management. The plants, mulch and soil in rain gardens help to trap, utilize or degrade pollutants, such as oil from driveways and parking lots, nutrients from lawns and vegetable gardens, and bacteria from pet wastes. Rain gardens also trap sediment and temporarily hold water that would otherwise end up immediately in storm drains. Essentially, rain gardens are beautiful, miniature water treatment plants.



By increasing infiltration, rain gardens not only improve the quality of storm water, they reduce the potential for local flooding of streets, sidewalks and yards. By detaining storm water and increasing the time it takes for this water to concentrate in streams, rain gardens have the potential to significantly reduce property damage from flooding in high rainfall areas. In the long run, rain gardens will not only help prevent landscape and stream bank erosion, they will help maintain base flow in streams during dry cycles and aid in recharge of aquifers.

Rain gardens work by using a series of filtration mechanisms. Physically the plants and soils within the gardens act to trap potential pollutants. In slow-moving water, pollutants have time to physically stick to roots and soil particles.



Chemically, some of the pollutants and water are absorbed by the plants and used in energy cycles. Beneficial bacteria and other microorganisms in the plant rooting zone can break down many of the pollutants and make them harmless. Harmful bacteria from pet waste are digested by soil organisms or killed when the rain garden rooting zone goes into a

rapid drying cycle (usually within 48 hours). Lastly, the porous nature of the soil in a rain garden will allow most of the water from the first inch of rainfall to soak deeper into the ground. The biologically active zone of soil below the rain garden will provide further water treatment as the percolating water moves on to meet water needs of surrounding vegetation, riparian buffer plants, or as it goes to provide stream base flow or help recharge ground water.

Where should a rain garden be located?

Generally speaking, rain gardens can be located just about anywhere on a landscape. There are guidelines to choosing preferred locations that will make rain gardens more effective, easier to build and safer for small children and pets.

- ❖ Rain gardens should be placed where they catch the desired runoff and maximize infiltration. This will usually be some low-lying area on the landscape, but one that has good, internal soil drainage.
- ❖ Gardens need to be placed at least 10 feet from any building foundation to prevent potential structural damage due to wetness or flooding.
- ❖ Rain gardens should NOT be placed over septic systems. This can overwhelm the system and cause an unsightly and smelly mess.
- ❖ Those areas where water puddles long enough to form small ponds are not ideal for rain gardens. Infiltration and soil permeability are already low in such areas and rain gardens will only make the problem worse.
- ❖ Rain gardens should be placed in full or intermediate sunlight. Exposure to some direct sunlight will speed up the drying cycle, assist in killing pathogens, and promote better plant growth.
- ❖ Choosing a relatively flat section of your yard that has well-drained soil will make digging and building your garden easier.



How do you determine shape and

size of a rain garden?

Rain gardens can be just about any shape or size. However, to be most effective a rain garden should be tailored to catch the desired amount of runoff. Most rain gardens are designed to catch the first inch of rainfall producing runoff. This initial runoff usually contains the most pollutants.

Many rain gardens are kidney bean shaped with the largest side facing the source of runoff. The shape of a rain garden however, is not a critical factor. In fact, rain gardens are often confined by roadways, sidewalks, parking lots or medians. So, use your imagination and site conditions to design your garden.



Once you have picked a site for your rain garden, the most important things in planning and sizing your garden are:

- Size of drainage area (roof, lawn, driveways, etc.),
- Soil characteristics, and
- Garden depth.

1. The first step in determining the size your rain garden should be is to survey and calculate drainage area size. Drainage area size can be used to estimate runoff volume, and thus, how much water your rain garden will need to catch. If you are building a rain garden in your lawn to collect water from a drain spout, you will need to determine the water volume discharged from that spout.

For example, assume you wish to build a rain garden that catches water from a building drain spout on your property. Your roof is 60 ft by 40 ft, or 2400 sq ft. The drain spout drains about $\frac{1}{4}$ of the roof. So, the drainage area for your rain garden is $2400 \times \frac{1}{4}$, or about 600 sq ft. The roof will produce nearly 100 percent runoff and a one-inch rain would discharge around 50 cubic feet (approximately 375 gallons) of water to your garden.



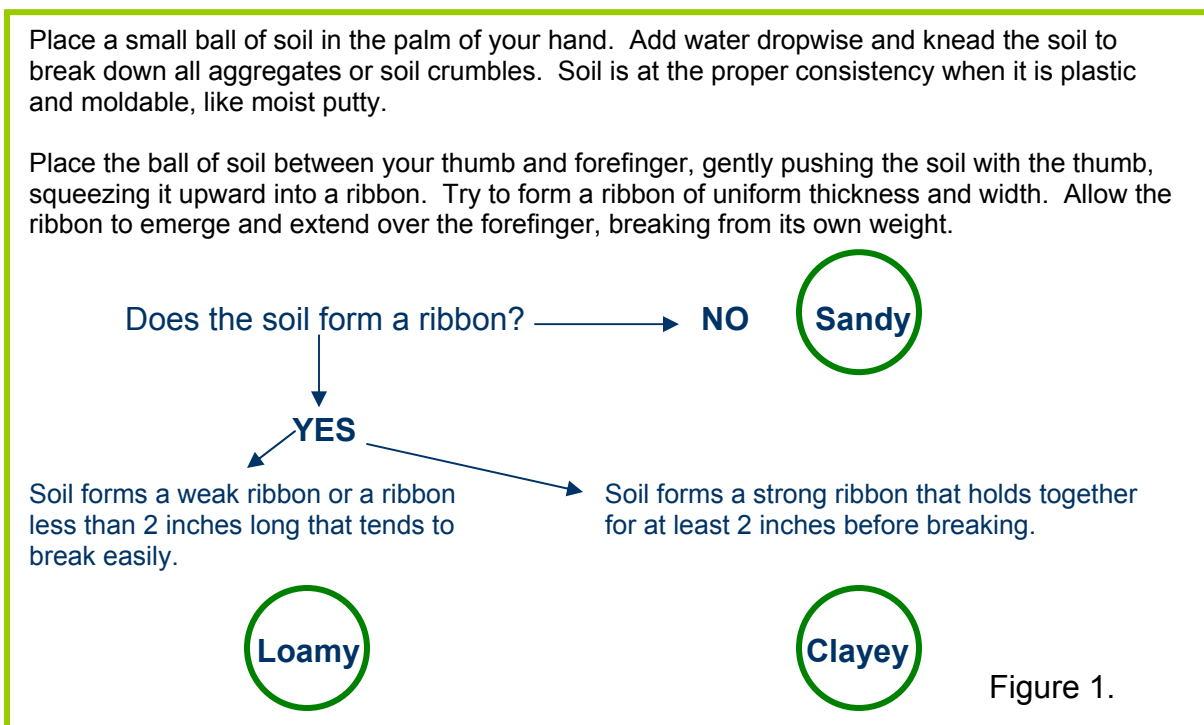
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You can use this calculation to build a rain garden that is 10 to 30 feet from the building and water source, or you can use a pipe to direct runoff directly to your rain garden. If your rain garden is more than 30 feet from the building and drain spout you should consider the lawn area between the building and garden as part of the drainage area that will also discharge water to your rain garden.

2. The next step should be to determine if the soil on

your site is suitable for a rain garden. The soil should allow water to infiltrate the soil and slowly drain through the soil. All soils are a mixture of sand (large particles), silt (intermediate size particles), and clay (very tiny particles). Decomposing soil organic matter allows these particles to form stable aggregates that can enhance water movement through the soil (percolation) regardless of the amount of sand, silt and clay present.

Generally, a soil high in clay will tend to impede water movement. A soil high in sand will tend to drain very rapidly. To estimate the amount and sand, silt and clay in the soil perform the test in Figure 1. This will place soil into one of three broad categories: 1) sandy which is dominated by sand, 2) loamy which means that it contains a lot of silt, 3) clayey which is dominated by clay.



Regardless of the amount of sand, silt, and clay in your soil, you can do a simple percolation test to determine how quickly water moves through your soil. Dig a hole about 12 inches deep and about 6 inches in diameter. A post-hole digger is good for this. Fill the hole with water three times and allow it to thoroughly saturate the surrounding soil. Fill the hole with water a fourth time and observe how long it takes the water to soak out of the hole. If the soil is already saturated from rain, you may not have to fill it three times.

Rapid percolation: Water drains out of the hole within an hour; soil may not hold water long enough for establishment of vegetation. Organic matter amendments needed.

Moderate percolation: Water drains out of the hole within 8 hours; ideal for effective rain garden establishment.

Slow percolation: Water does not completely drain within 24 hours; site may be too wet, clayey or low for effective rain garden. Additional digging and soil amendments necessary

3. Determine the depth of your garden. Remember the goal is to have a garden that is level, even on a sloping landscape, and most gardens are between 4 and 8 inches deep. In most cases it is not advisable to build a garden that is more than 8 inches deep because it may hold water for too long, be a tripping hazard or look like a hole in the ground.



The determining factor in how deep your rain garden should be is the slope of your lawn. If your lawn is perfectly flat your rain garden should be 3-4 inches deep. Unfortunately most lawns are not flat, so your rain garden may need to be a little deeper.

To determine the slope of your lawn:

- ❖ Pound two stakes into the ground about 15 feet apart.
- ❖ Tie a string to the bottom of the uphill stake and then tie the string to the downhill stake. Make sure your stakes are perpendicular to the ground.
- ❖ Level the string with the use of a carpenter's level.
- ❖ Measure the distance between the two stakes in inches.
- ❖ Then measure the height of the string above the ground on the downhill stake in inches.
- ❖ Divide the height by the distance between the stakes and multiply by 100 to find the slope.
- ❖ Remember if you have a slope greater than 12% you should choose another location.

Example: Distance between stakes is 15 feet or 180 inches and the height of the string above the ground on the down hill stake is 10 inches:

$$\frac{10}{180} \times 100 \% = 5.5\% \text{ slope}$$

Once you have calculated the slope, select a depth from the following table.

Table 1. Lawns slopes and suggested depths.

Slope	Depth of rain garden
< 4%	3-5 in
5-7%	6-7 in
8-12%	8 in
> 12%	unacceptable

4. Now that you know the size of your drainage area, soil type and depth of your garden, you can use the following tables to determine what the **size factor** for your rain garden should be by looking at your soil type and depth of the garden.

Table 2. Size factors for rain gardens.

Soil	less than 30 ft from down spout			more than 30 ft from down spout
	3-5 in. deep	6-7 in. deep	8 in. deep	All Depths
Sand	0.19	0.15	0.08	0.03
Loamy	0.34	0.25	0.16	0.06
Clayey	0.43	0.32	0.2	0.1

Multiply the **size factor** by the drainage area to determine the recommended rain garden size in square feet.

For example, your rain garden is less than 30 feet from the down spout, the calculated depth is 6 in, and you have clayey soil. Your size factor is 0.32. The drainage area is 600 sq ft. So multiply 600 by 0.32, the suggested rain garden size is about 190 sq ft.

If you determine the rain garden area is more than 300 sq ft, you may want to consider consulting a professional or you could break up your garden into two smaller gardens.



5. Use your imagination. You can make your rain garden a unique part of your yard, by using your runoff as a water feature, making it an unusual shape. Here are some examples of unusual rain garden ideas.



A rain garden built around an unusual gazebo



Neat water features, a fountain and a waterfall



Stones and paths



How do you construct a rain garden?

To be safe, before you begin digging call you local utilities to make sure your garden will not interfere with electric, gas, phone, or water lines.

It is time to start construction! The first step is to prepare your site. If you decide to build your garden in a lawn, kill the existing grass before you begin. The best way to kill the grass is to place black plastic over the area where the rain garden will be. The grass will die from lack of sunlight. If you know in advance that you will be planting a garden, you can cover the area with newspaper and then put grass clippings or hay over the area in the fall. By spring you will have a great mulched area ready for a garden.

Before you begin to dig, lay out the outline of your garden using stakes and string. Once you have the outline, begin digging the garden to the desired depth. If your lawn is flat, the depth will be same for the entire garden. Save the soil removed from the garden. If your garden is on a slope, you will need to dig the uphill side deeper than the downhill side. You can use the soil from the uphill side to raise the edge of the downhill side so that the garden is level and of equal depth. This soil may also be used to build the berm described below.

If you have very slow percolation and/or clayey soil, you will need to augment the soil material below the garden to improve drainage. To do this, dig the original hole for your garden an **additional** 1.5-2 ft deep. Then add amendments to make the soil more porous and more nutritious for plants.



An ideal rain garden mix will consist of 50-60% sand, 20-30% topsoil, and 20-30% compost. Ideally, the clay content should be less than 10%.

For most situations a mix of 30% sand, 30% compost or fine pine bark, and 30% existing soil material will provide good plant growth and adequate drainage.

In clayey subsoil, it is ideal to line the bottom of your 1.5-2 ft deep hole with 3-6 inches of gravel, to aid subsurface infiltration. Once you

Tools you may need

- * tape measure
- * shovels
- * rakes
- * trowels
- * carpenter's level
- * wooden stakes
- * string
- * 2x4 boards (optional)
- * small backhoe or friends

have added gravel, fill in the hole with the amended soil material until you have the desired depth.

For all rain gardens it is important to build a berm, or small earthen dam, on the down hill side of the rain garden to keep water in the garden. Use the original soil material dug from the hole to build this berm. Pile the soil material in a crest below the garden and pack it using a shovel and your feet, so it will not be washed away by runoff. Stabilize your berm with either sod or ground cover to prevent raindrop erosion.



With the aid of a few friends you can have your rain garden dug in a day!

Planting and Caring for Your Garden

Now it is time to use your imagination and plant your garden. The general rule of thumb is that any plant can go in a rain garden as long as it is appropriate for the conditions in the garden.

Here are some guidelines to consider when planting your garden.

1. Consider all physical site restrictions and limitations. Choose plants that are appropriate for the sunlight exposure and soil conditions of your garden. Also choose plants that can tolerate standing water for up to 48 hours and plants that can tolerate some periods of drought.
2. Choose plants that are aesthetically pleasing to you. You may want to choose a theme. Many people choose plants that attract hummingbirds or butterflies. It is always desirable to use native plants, because they are more disease resistant and tolerant to local conditions.



3. Do your homework and use Internet resources. Many websites have planting tips and provide lists of available plants that are suitable for various soil and microclimate conditions of rain gardens. One example site is The Rain Gardens Organization (www.raingardens.org).

Native plant lists and sources are available at:
www.aces.edu/waterquality/mg.htm

Unique rain garden ideas for your home are available at:
www.bbg.org/gar2/topics/design/2004sp_raingardens1.html and
<http://www.icdc.com/~larsende/gard.htm>.

4. After planting your rain garden it is a good idea to mulch the entire garden with hardwood shavings. The mulch aids in the cleansing properties of the garden, and hardwood mulch does not float away.

5. Remember that your rain garden is a garden. It will take time for the plants to become established and the rain garden will need to be watered periodically and weeded. You may also need to re-mulch every couple of years.



Once your garden is in place
sit back and enjoy it!

