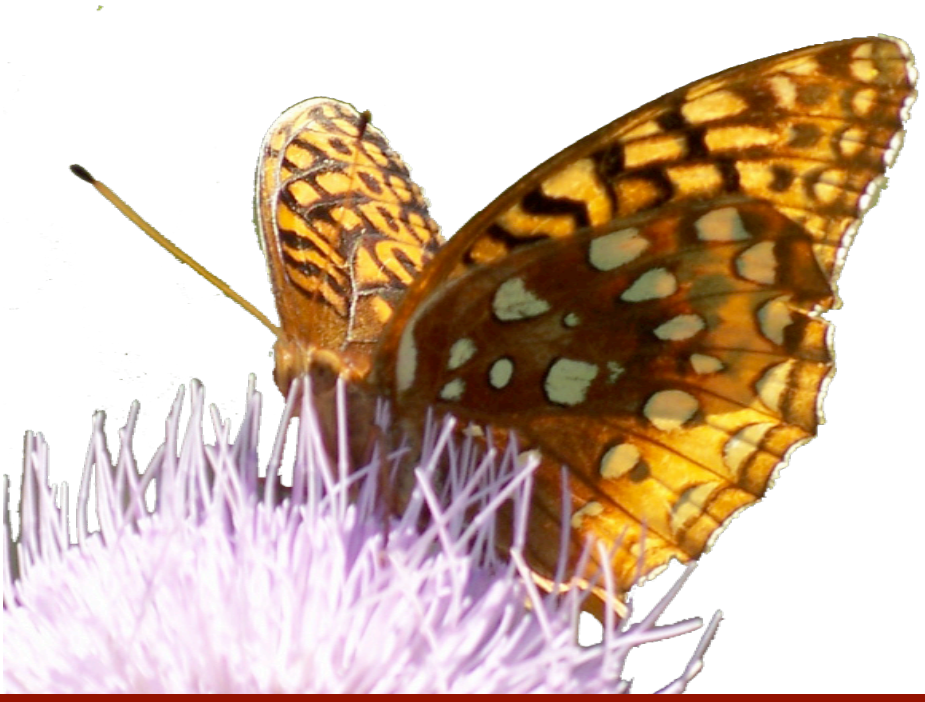
RAIN GARDENS

beautify your yard

clean our water



how are rain gardens different from other gardens?

Rain gardens are beautiful landscape features that can help minimize water pollution by managing stormwater on site before it can enter our waterways. They work by slowing down the rush of water from hard surfaces, such as roofs, holding the water for a short period of time, and then allowing it to naturally penetrate into the ground.

Utilizing native plants is important for proper functioning of your garden. The term "native" is used to describe plants that are natural inhabitants of your region. These plants are important because they have adapted to the growing conditions in your region for thousands of years and, as a result, they are easily maintained and provide essential habitat for local wildlife, such as butterfly's, that depend on these particular plants. Many varieties of plants sold in stores today are "exotic," or imported from outside regions. While many of these plants have gained popularity because of their availability, some are not well suited to your climate, nor do they offer the habitat local wildlife is accustomed to. Consequently, exotic plants may not survive local weather conditions or attract wildlife as much as native plants.

In addition to a beautiful landscape feature, rain gardens also clean our water. The primary purpose of a rain garden is to reduce the amount of water being conveyed to the stormwater system or waterways. To make this reduction possible a rain garden essentially provides a buffer between the storm water from your property and the sewer system. As a result, roof and yard drainage is impeded from entering the street or storm sewer where it can carry pollutants to our waterways. Instead, it is soaked up by the native plants or filtered through the soil. By planting a rain garden you are not only beautifying your property and providing a haven for local wildlife, but you are also doing your part to ensure a healthy water supply for everyone in your community.

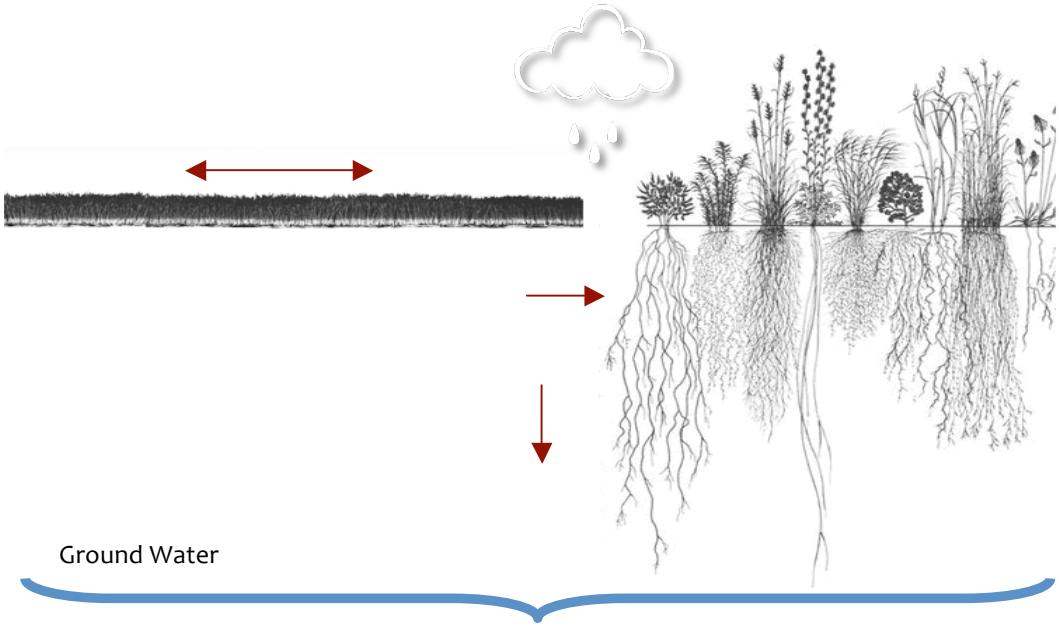
landscape comparison

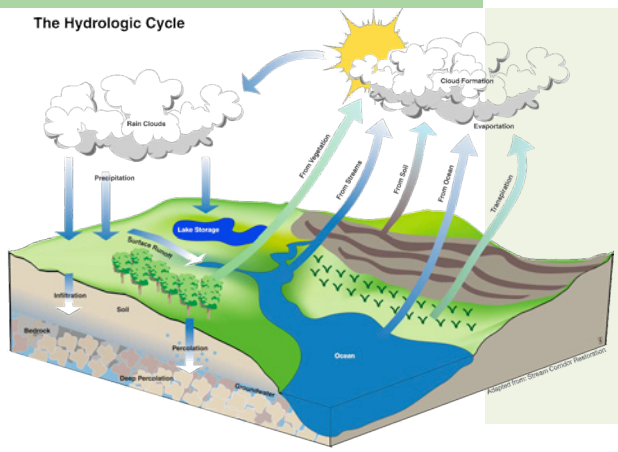
✓ YES × NO – Minimal	Rain Garden	Common Garden	Average Lawn
Beautiful flowers throughout the year with a variety of plants	✓	✓	×
Provides habitat for native wildlife such as butterfly's	✓	–	×
Reduces pollution in our waterways carried by storm-water	✓	–	–
Protects our communities from flooding	✓	–	–
Can survive regional weather conditions such as drought	✓	×	×
Increases water infiltration into the soil to recharge groundwater	✓	×	×
Purifies our water naturally	✓	–	×
Reduces fossil fuel usage by decreasing mowable land	✓	✓	×

frequently asked questions

1). Why doesn't my grass lawn soak up the rainwater?

Grass lawns are somewhat impervious surfaces, meaning that most water does not seep into the soil like it would under natural conditions. The reason is that grass has a very compact root structure making it difficult for water to penetrate. Instead, it flows over the surface and into your street then storm sewer and most likely into a stream.





Think about our planet before development. Impervious surfaces such as pavement did not exist. Rather the water cycled through a natural process without interruption. This process, called the hydraulic or water cycle, filters our water naturally through the ground, by plant uptake and through the clouds. Each step purifies our water and provides us with a fresh source

2). Do I have the right type of soil for a rain garden.

It depends. The rain garden eliminates the compact grass and replaces it with native plants that have loose root structures allowing for water to infiltrate the soil and either be utilized by the plants or seep into the ground water being purified along the way. However, a heavy clay laden soil may inhibit the water from infiltrating and may cause it to sit for longer. In this case, you can amend the soil with compost during construction. We will cover how to test your soil in this manual.

3). Do rain gardens require a lot of maintenance?

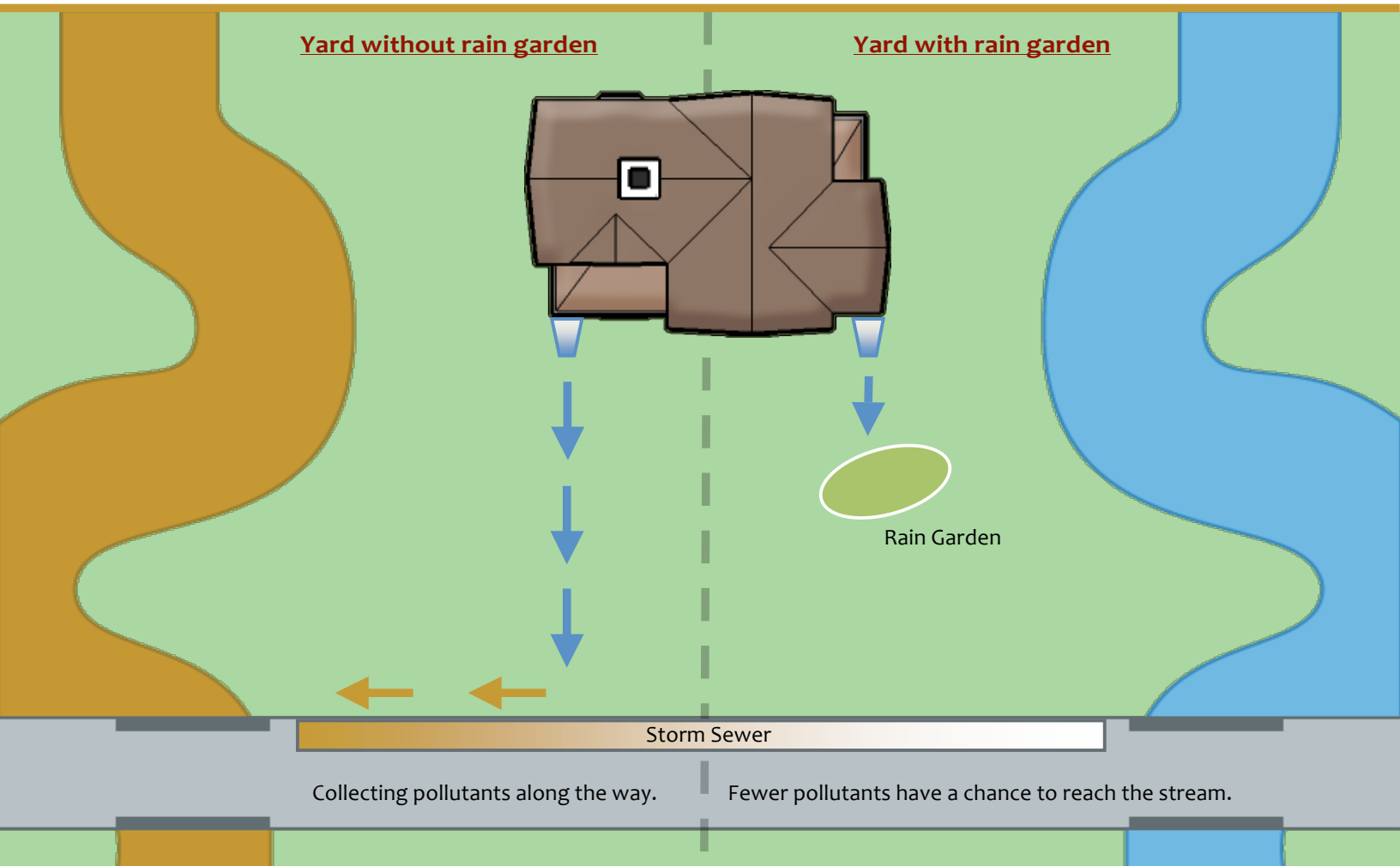
No. In fact, they require less maintenance than a common garden with exotic plants. This is because the plants have adapted to your local climate and soils for thousands of years and are thus fully capable of surviving with little maintenance. However, for the first year, weeding may be necessary to give the new plants a chance to thrive.

4). Why is storm water a problem in urban areas?

Uncontrolled and untreated stormwater from the urban environment can run off the landscape and into waterways. This runoff can include such pollutants as sediments, pathogens, fertilizers, hydrocarbons, and metals. Also, solid and compacted areas including grass, roofs, and pavement increase runoff volumes that rapidly flow into our waters. This increase in volume and velocity violates the natural water cycle and often causes stream bank erosion, channel incision, and sediment deposition in stream channels. In addition, runoff from these developed areas can increase stream temperatures that along with the increase in flow rate and pollutant loads, negatively affect water quality and aquatic life.

5). How does a rain garden work? (See figure)

Water flows from your gutter or parking lot directly into the rain garden. While the plants will use some of the water, the remaining will seep slowly down into the ground water system. The amount of rainwater your garden will hold depends on its size in addition to drainage area. For example, on an average size home, a rain garden collecting stormwater from one gutter may capture up to 25% of your total roof runoff.



creating a rain garden

Four variables are important in determining the size of your rain garden; location, depth, and soil type and drainage area. These variables should be determined before the size can be calculated.

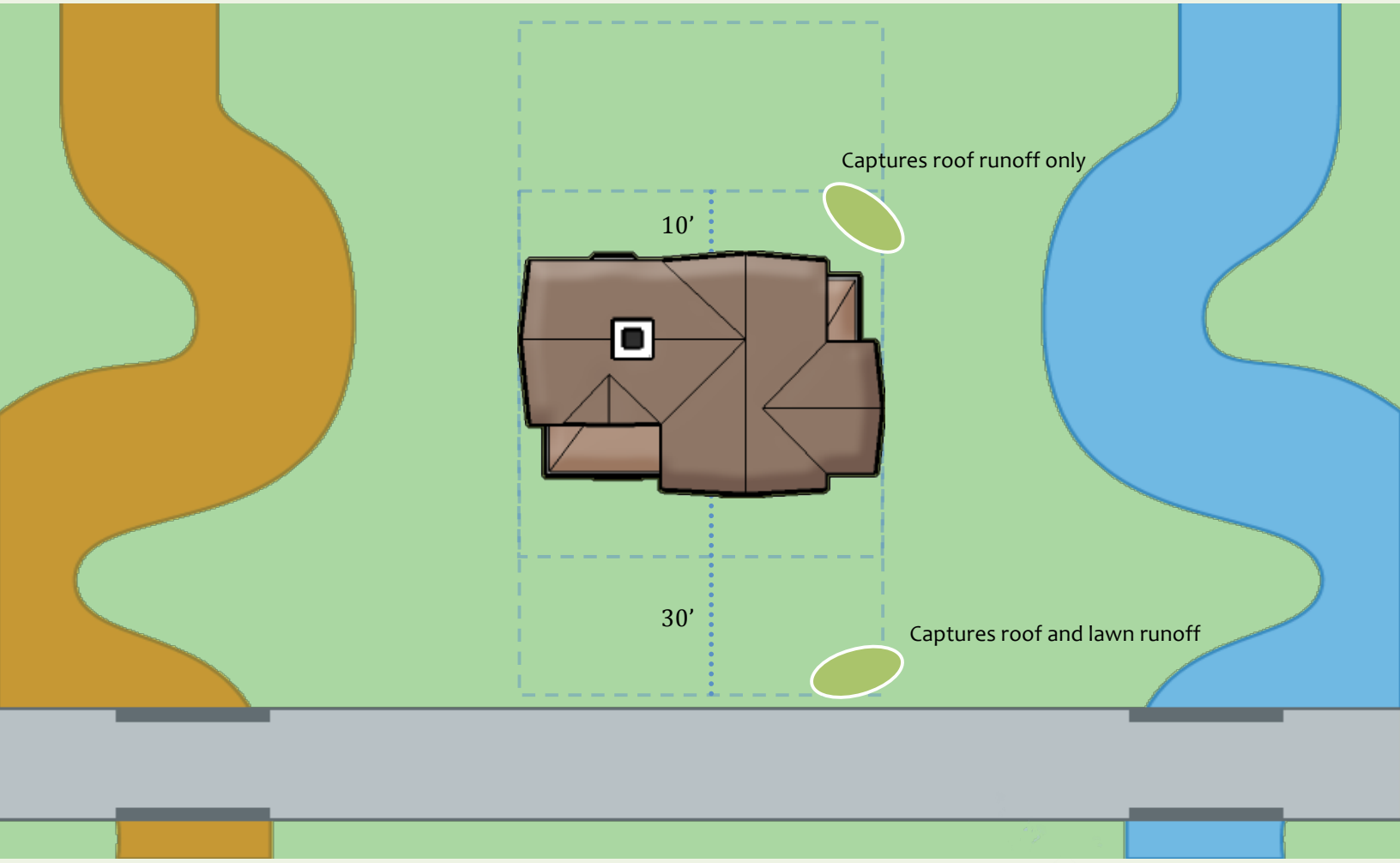
Location + Depth + Soil + Drainage Area = Size

Location

A rain garden can be planted wherever you like. A front yard rain garden will prevent runoff from entering the street. A backyard garden may not play a significant role in preventing runoff, but it creates an area of infiltration for ground water recharge.

In addition to being a functional water filtration system, a rain garden produces amazing sights and smells that can be enjoyed by family, friends, and neighbors.

Lastly, a rain garden must be located at least 10 ft from the building's foundation and either capture water directly from the spout or further down the yard. In the latter case, consider the additional surface area of your yard draining into the garden. We'll cover this in the drainage section.



When choosing a rain garden location consider…

- planting > 10 ft from the buildings foundation;
- avoiding high traffic areas where soil compaction may be an issue;
- integrating into existing gardens;
- never planting over septic systems;
- planting away from large trees that can make construction difficult due to root systems;
- avoiding areas where water saturation is frequent and can cause a lack water penetration;
- planting the garden on a flatter surface to make construction easier;
- choosing a location in either full or partial sun.

Depth

A typical rain garden ranges between 4 to 8 inches deep. A garden less than 4 inches will need a larger surface area in order to hold water while a garden more than 8 inches deep may hold water for too long. The depth of your garden depends on the slope of your land. If your land is flat, simply dig a 3-5 inch rain garden. However, if your yard slopes, you will have to do a simple calculation. No matter your slope though, the goal is to make your garden surface level.

1

- Pound two stakes into your yard 15 feet apart. One should be on the uphill and another on the downhill. See figure below.
- Tie a string to the bottom of your uphill stake and another to the downhill stake at the point where the string is level. Use a carpenters level to be exact.
- Measure the string width in inches and then its height on the downhill stake between the string and the ground.

2

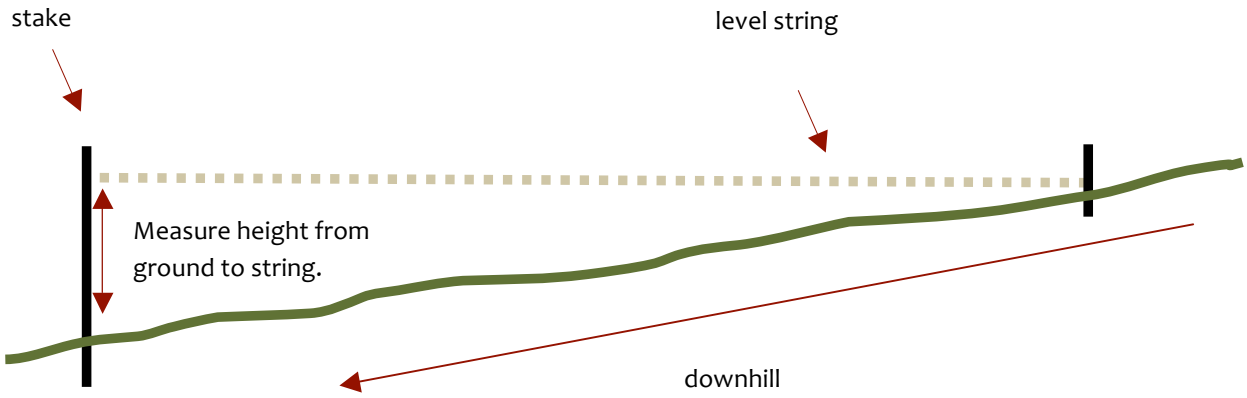
The Slope Calculation

height ÷ width × 100 = % slope

3

Using the slope you just calculated, choose a depth for your garden.

- < 4% slope = 3-5 inch depth
- Between 5% - 7% slope = 6-7 inch depth
- Between 8% - 12% slope = 8 inch depth



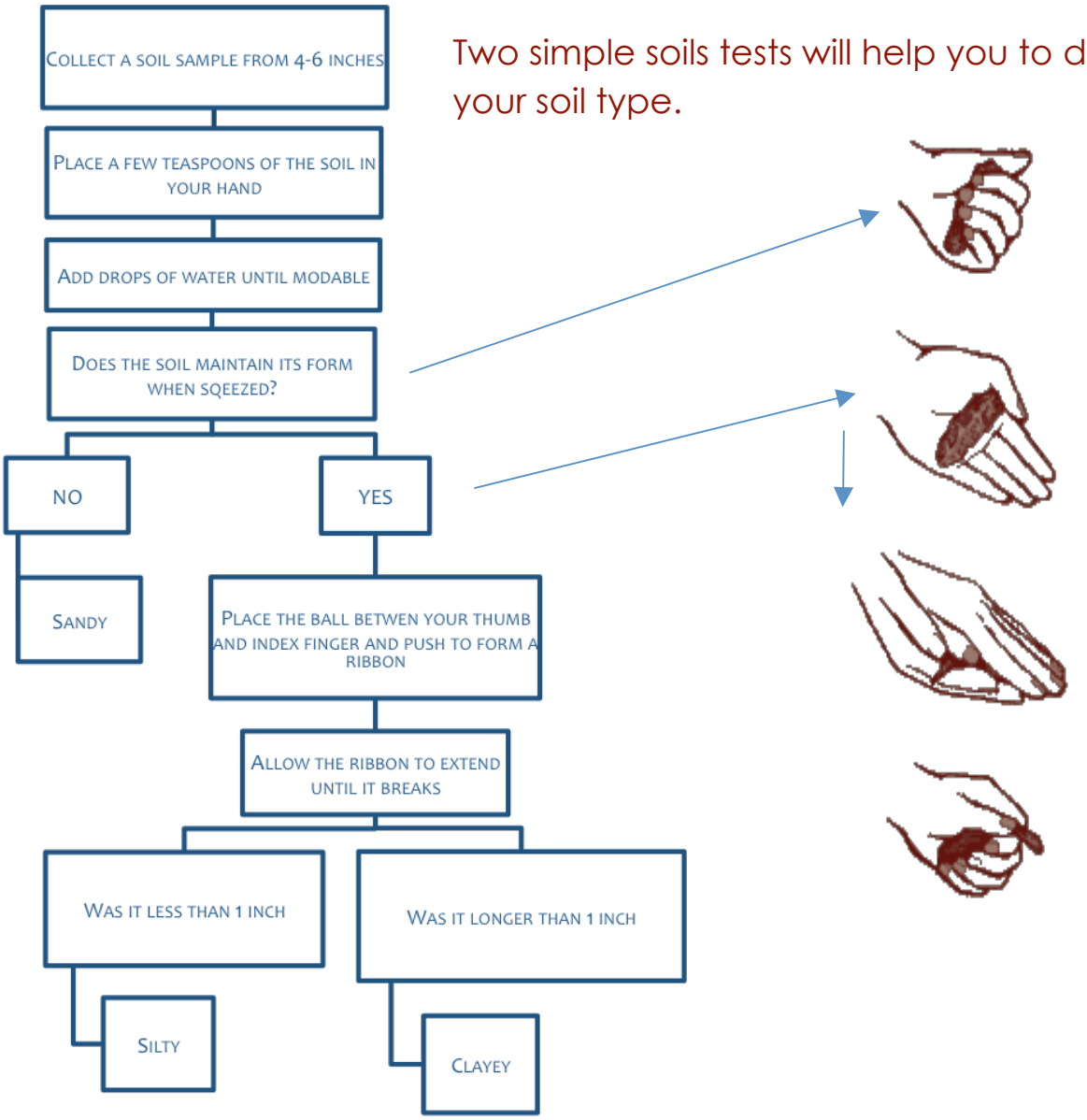
Soil Characteristics

It is important to know your soil type before you start a rain garden project. An effective rain garden depends on water penetrating, also called infiltrating, into the soil of your garden. For example, a heavy clay soil not only infiltrates water very slowly, but also inhibits seed germination. You should consider incorporating topsoil, peat, compost, or black dirt into the substrate before planting in this case.

On page 12 we will determine our rain garden size, but as a general rule the size of a rain garden in clay soils should be 60 percent of the total drainage area. Sandy soils infiltrate water more quickly, so a rain garden in a sandy location does not need to be as large. For sandy soils, the rain garden size should be about 20 percent of the area draining into it. Silty, that is, soils with a mixture of both sand and clay, can be sized somewhere between 20 and 60 percent, keeping in mind that the slower the infiltration, the larger the area should be.

1

Two simple soils tests will help you to determine your soil type.



2. To test the infiltration of your soil, dig a hole 6-8 inches deep in the area that the rain garden will be located. Fill the hole with water. Observe how long it takes for the water to infiltrate into the soil. If any water stays in the hole for 12 hours or longer, then the soil is not suitable for a rain garden.

an important note on clay

The Lake Michigan Coastal Region has a soil base with high clay content. If you find that clay is the dominant soil type in your yard, you may need to take a few additional steps to grow an effective rain garden.

1. Mix organic matter into the soil. This can be accomplished by mixing in 2 to 4 inches of compost with the existing soil.
2. For soils with high clay content, it may be beneficial to remove approximately 1-2 feet of the existing soil and replace it with a soil more suitable for rain gardens. Consider a soil mixture of 50 - 60 percent sand, 20 – 30 percent topsoil, and 20 – 30 percent compost. The mix should contain no more than 10 percent clay.

Steve Aitken – Taunton Press

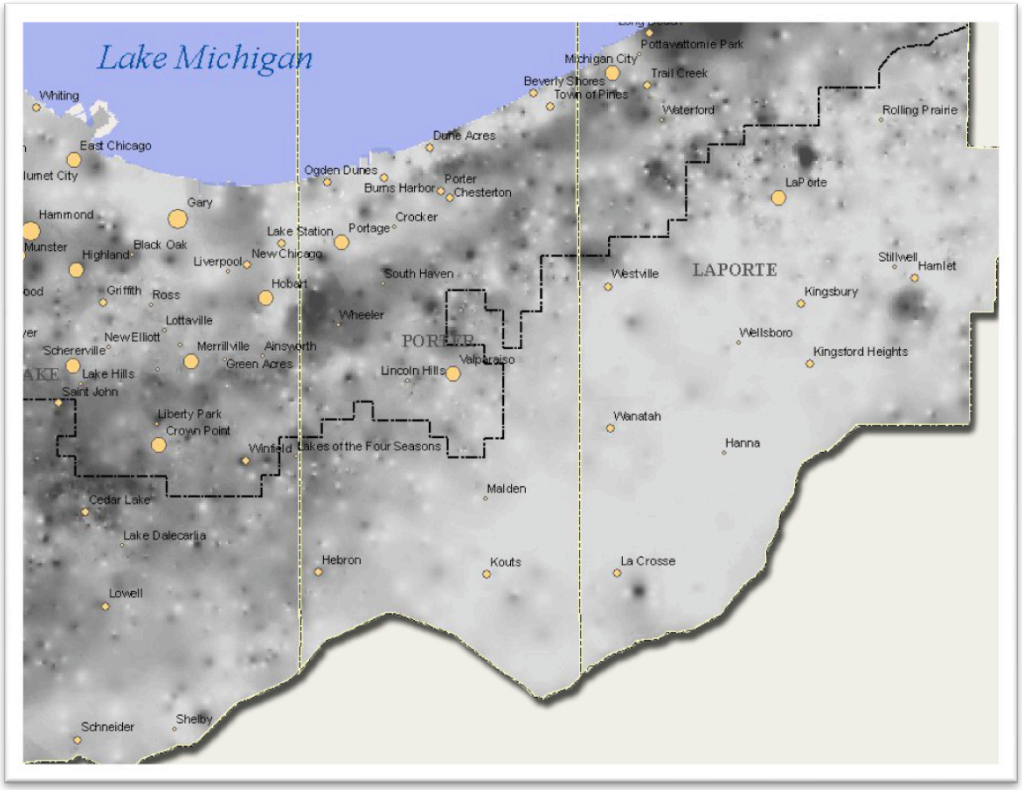
Use these soil maps to give you a rough idea of the type of soil that may exist in your yard. However, do not rely on these maps as your only source. It is important to physically check your own soil before planting your rain garden.

region clay map

Thickness Range (Feet)

High : 445

Low : 0

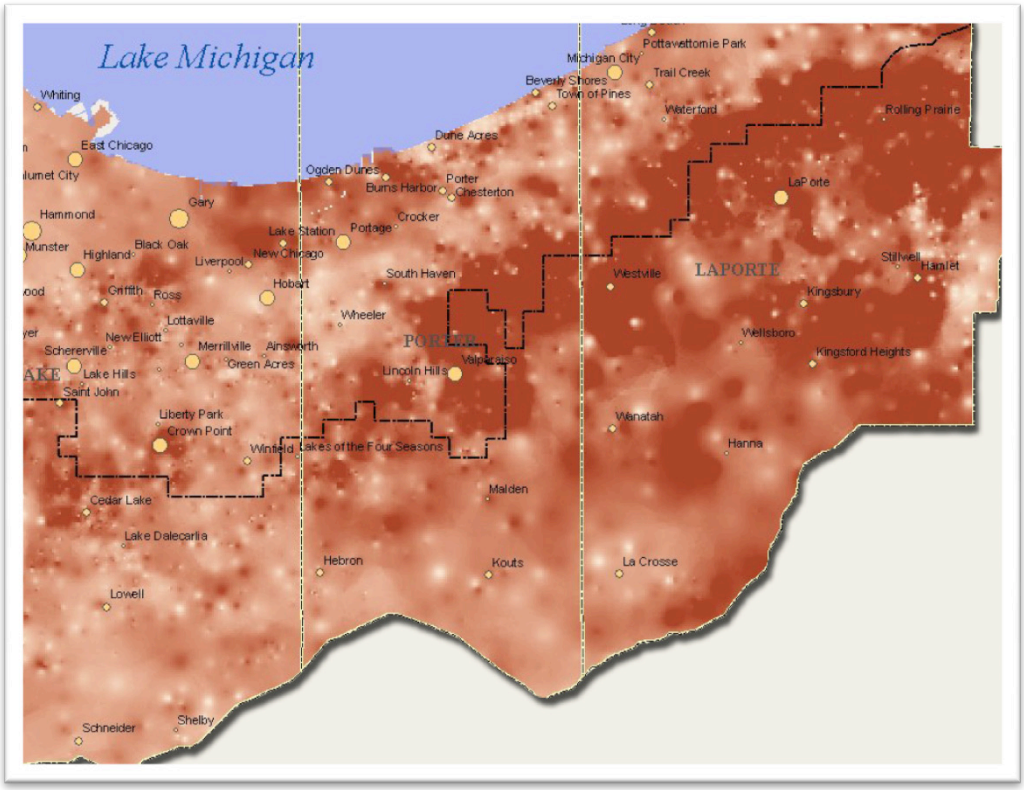


region sand map

Thickness Range (Feet)

High : 732

Low : 0



Drainage Area

On average, the larger the drainage area, the larger the rain garden must be. A garden collecting water solely from a roof downspout collects water from only the portion of the roof that feeds that down spout. Typically, each downspout contributes 25% of drainage from a roof. However, you may want check on your own by making a visual identification.

A garden further away from the downspout collects water from the lawn in addition to the roof. This surface area must be included in the drainage calculation.

Calculating Your Drainage Area

The Goal: To determine the % of your roof that feeds your downspout.

Note: A rough estimate will do. Typically homes have four downspouts, each capturing 25% of the roof runoff.

1. Determine your drainage footprint. This is the square footage of your roof/lawn. For gardens less than 30ft from a building foundation that collect water from only the downspout, simply calculate your building's square footage. If you do not have this information, you may use a measuring tape to determine the length and width of your building. Then, multiply the length times the width to get your total square footage.

2. For gardens greater than 30ft from the building foundation, you must consider the lawn area in addition to the roof area. Measure the portion of the lawn that feeds the rain garden. For example, if you have 4 downspouts, visualize your building in 4 quadrants, each quadrant receiving water from a downspout. Then measure the length and width of the lawn area that is receiving water from only the downspout you are considering for the rain garden. Multiply the length and width together then add to your home square footage estimate.

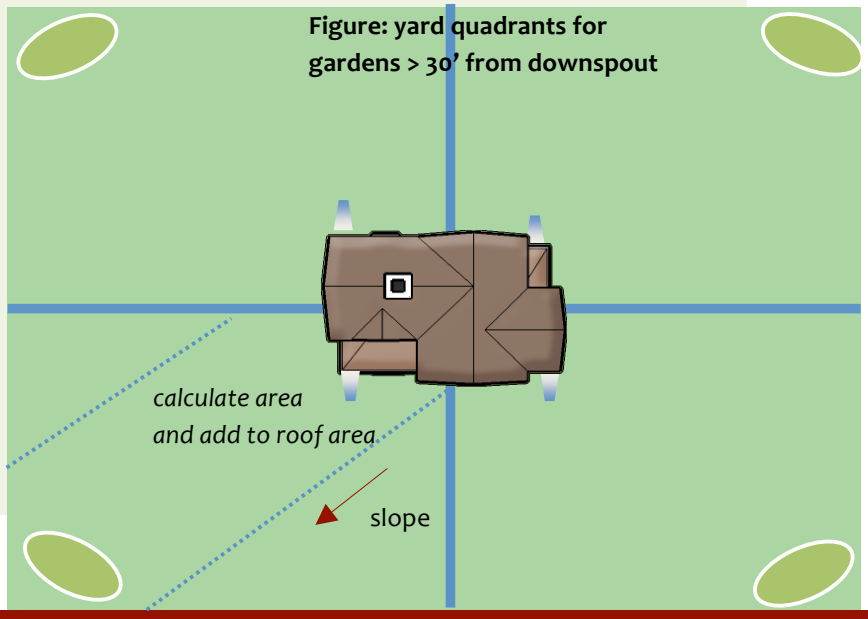
3. Multiply the roof, and lawn areas if applicable, by the percent of the roof that feeds your down spout.

Example

Drainage Area: 2,100 sq. ft. x .25 = 525 sq. ft.

Your drainage area in this example would be 525 square feet.

Figure: yard quadrants for gardens > 30' from downspout



Garden Size

Finally, we will use the information determined from the depth, soil type, and drainage area to calculate an efficient rain garden size.

The tables below include size factors, a number that we can use in conjunction with our calculations to determine the most efficient rain garden size. Use the appropriate table depending on your gardens distance from the downspout.

- Locate your soil type and garden depth from the table.
- Multiply the size factor from the table below by the total drainage area calculated previously.
  - For example: 525 sq. ft x 0.19 = 99.74. So, your garden would be 99.75 square feet.
- It is recommended that a garden over 300 square feet should be split into at least two gardens.

Gardens less than 30' from downspout

Soil Type	3-5 in. deep	6-7 in. deep	8 in. deep
Sandy	0.19	0.15	0.08
Silty	0.34	0.25	0.16
Clayey	0.43	0.32	0.20

Gardens greater than 30' from downspout

Soil Type	Size factor
Sandy	0.03
Silty	0.06
Clayey	0.10

Length and Width

GOAL: To allow for an even distribution of water as it enters the garden.

- The higher the slope the more water the garden will collect in a shorter period of time. Because of this, the garden should be wider with an increasing slope.
- The garden should be approximately twice as long as it is wide. The length should be perpendicular to the slope of the lawn.
- Choose a width that suits your yard that is no wider than 15ft.
- Divide the size of your garden, its square footage, by the width you have just chosen. The result is your garden length.

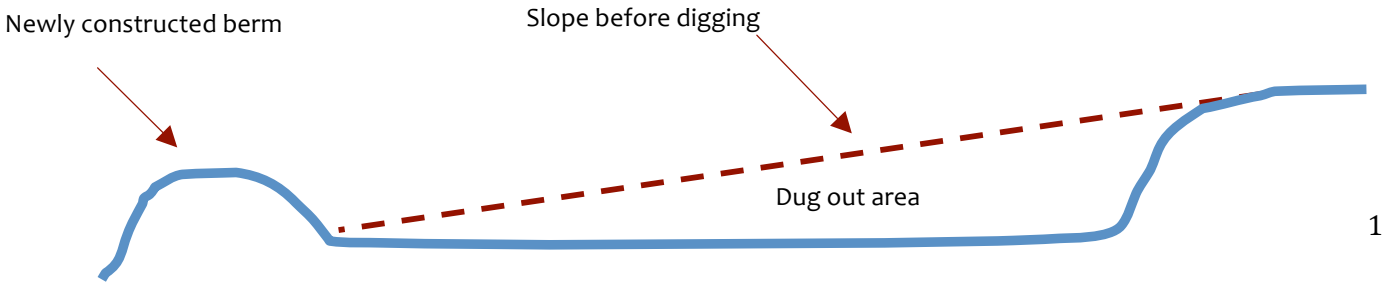
construction

If your rain garden is being constructed on an existing lawn, digging can be made much easier by killing the grass first; the goal being to kill the root system to make it easier to dig the area. This can be accomplished in many ways, but two chemical-free choices are listed below. If you must use a chemical agent, Round-Up or something similar will work just fine.

- Method 1: Place a non-clear plastic bag over the lawn in the shape of your garden and allow the grass to die. This process may take up to two-weeks.
- Method 2: Place newspapers approximately 10 pages thick over your proposed garden area. Place mulch on top of the newspapers to keep them in place.

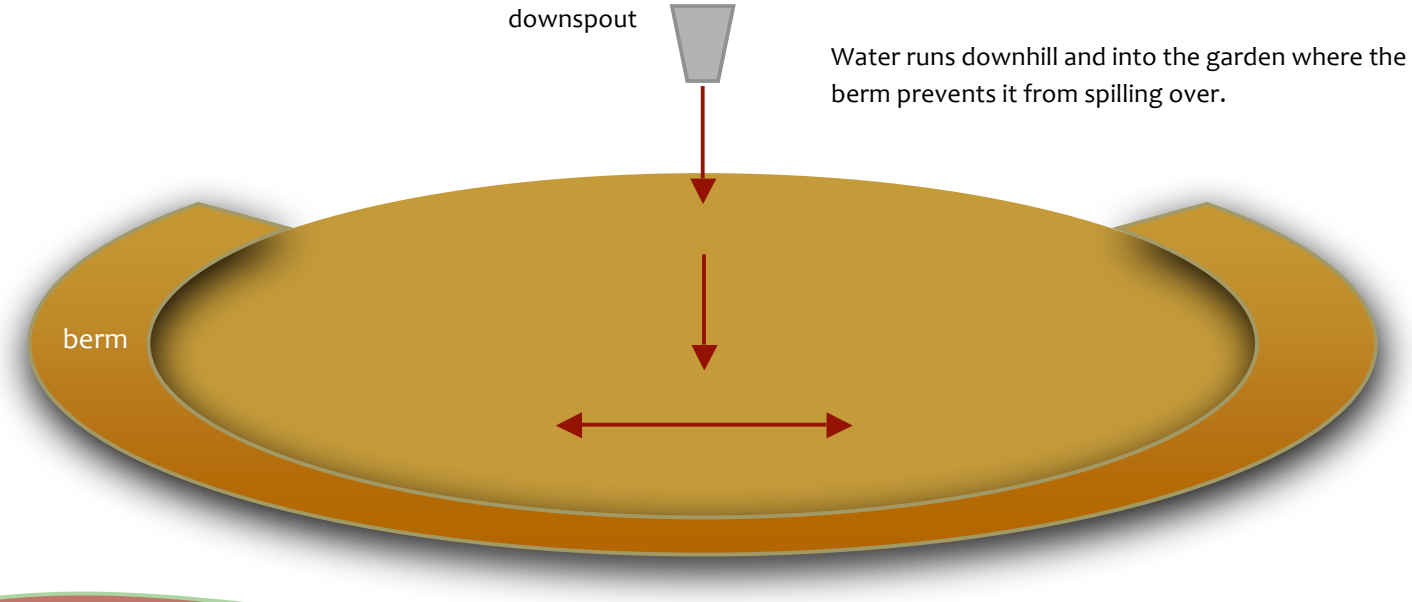
Digging the Garden

1. Use rope as a boundary guide for your garden. Dig the entire garden to the depth calculated previously. Place the soil on the edge where the berm will be located, about 1 foot wide. The berm is a ridge around the perimeter of the bottom part of the garden. It ensures proper infiltration by preventing water runoff from spilling over the garden. Berms are detailed further on the following page. If you have a very steep slope, the soil you dig from the top of the garden will be placed in the lower part of the garden to ensure a level surface. In this case, additional soil may need to be brought in to construct the berm.
2. Using a 2 X 4 board and a level, make sure the garden is entirely flat. If not, continue to dig out high areas and fill in low areas with the same soil.
3. If you plan to add compost to help get your plants established, now is the time to do so. However, remember that your original depth estimate does not include room for compost. Adding 1-2 inches to your depth should accommodate the additional material.
4. Finally, use a metal rake to smooth over the soil and to ensure little compaction for planting.



Creating the Berm

Now that you have soil in the location of your berm, smooth and compact the soil by either stomping it with your feet or using a garden compaction tool. Any method will do as long as the soil is compacted enough to prevent erosion. You may wish to plant grass or mulch the berm for continued protection. Or, you may consider planting dry tolerant native plants on the berm since this location should not be in the path of drainage water, rather above it to prevent its escape.



Planting your garden

General Guidelines

- Use nursery-propagated plants only. You will need plants that have an established root system to stand up to the force of the water entering the garden, a reason why seeds are not appropriate.
- Native plants should be planted 1-2 feet apart depending on the species.
- Dig a hole twice as large as the plug you are planting and only deep enough to cover the plant crown.

Picture: Angela Modonia – The Post Standard – June 22, 2008

Native Plant Ideas

The table below lists potential rain garden plants and their characteristics. However, they are just an idea and should not trump your personal preferences. Also, keep in mind the list is not exhaustive and determining appropriate plants can be made easy by visiting your local native nursery or conducting an internet search. Consider your yard and garden conditions and find plants that meet those conditions such as sunshine, soil type, and water needs. Also, you will be looking for plants that can tolerate somewhat wet conditions.

Create a table such as this one to help you in your plant selection. Many nurseries sell rain garden plant mixes with plugs ready to plant. For an additional cost, you can have a professional plant the garden for you.

Grasses, Rushes and Sedges						
Common Name	*Bloom Color*	*Height*	*Bloom Time*	*Full Sun*	*Partial Sun*	*Shade*
Crested Oval Sedge	Green	2-3'	May - June	X	X	
Bottlebrush Sedge						
Brown Fox Sedge						
Virginia Wild Rye						
Fowl Manna Grass						
Common Rush						
Torrey's Rush						
Rice Cut Grass						
Switch Grass						
Dark Green Rush						
Wool Grass						
River Bulrush						
Great Bulrush						

Forbs						
Common Name	*Bloom Color*	*Height*	*Bloom Time*	*Full Sun*	*Partial Sun*	*Shade*
Swamp Milkweed						
Sneezeweed						
Water Horehound						
Monkey Flower						
Ditch Stonecrop						
Pinkweed						
Black-Eyed Susan						
Common Arrowhead						
Wild Senna						
Purple Meadow Rue						

For your convenience the next two pages have actual rain garden designs acquired from raingardens.org. Both designs are for soils with higher clay content like those of the Lake Michigan region.

RiverMaid Designs

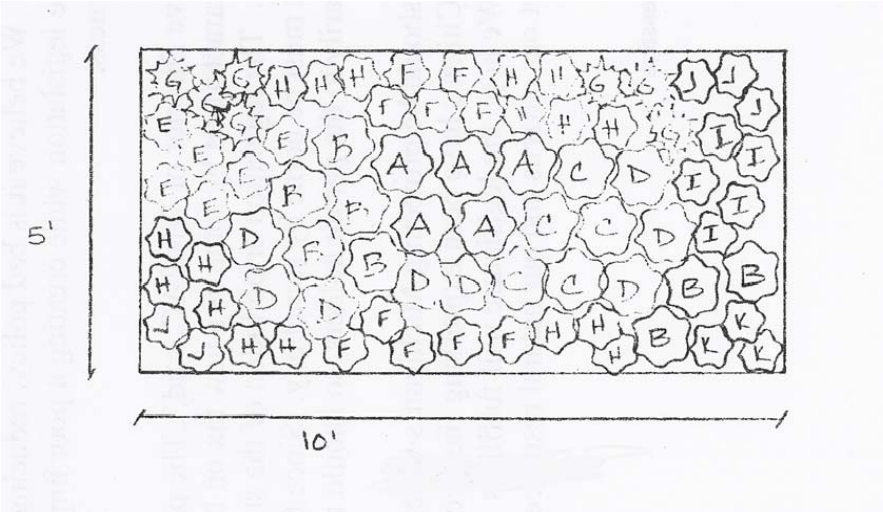
This beautiful garden was designed for http://www.raingardens.org

rain gardens of West Michigan

Short Great Lakes Prairie Rain Garden for Clay Soils

SUN (6+HOURS)

KEY	QTY	BOTANICAL NAME	COMMON NAME	HEIGHT
A	5	Eupatorium perfoliatum	Boneset	3-4'
B	8	Echinacea purpurea	Purple Coneflower	3-4'
C	5	Solidago ohioensis	Ohio Goldenrod	3-4'
D	8	Bouteloua curtipendula	Side-oats Grama	2-3'
E	6	Lobelia siphilitica	Great Blue Lobelia	1-4'
F	10	Physostegia virginiana	Obedient Plant	1-2'
G	7	Glyceria striata	Fowl Manna Grass	2-3'
H	17	Rudbeckia hirta	Black-eyed Susies	1-3'
I	5	Senecio aureus	Golden Ragwort	1-2'
J	5	Sisyrinchium angustifolium	Blue-eyed Grass	1'
K	3	Allium cernuum	Nodding Pink Onion	1-2'



Nature-guided Garden design

http://www.hawksandowls.com/Beccas_Site/rivermaid_design.htm

becca@hawksandowls.com 616-785-3208

RiverMaid Designs

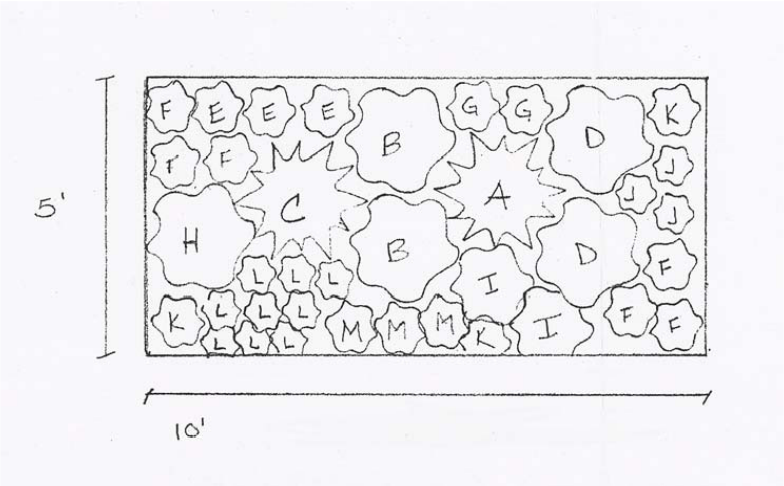
This beautiful garden was designed for http://www.raingardens.org

rain gardens of West Michigan

Tall Great Lakes Prairie Rain Garden for Clay Soils

SUN (6+ hours)

Quantity	Legend	Botanical Name	Common Name	Height
1	A	Sorghastrum nutans	Indian Grass	5-7' tall
2	B	Eupatorium purpureum	Joe-Pye Weed	4-6' tall
1	C	Andropogon gerardi	Big Bluestem	5-8' tall
2	D	Silphium perfoliatum	Cup Plant	5-10' tall
3	E	Vernonia fascicolata	Ironweed	4-6' tall
6	F	Solidago rigida	Stiff Goldenrod	3-5' tall
2	G	Liatris spicata	Dense Blazingstar	3-6' tall
1	H	Baptista australis	Blue False Indigo	4-5' tall
2	I	Parthenium integrifolium	Wild Quinine	3-5' tall
3	J	Echinacea pallida	Pale Purple Coneflower	3-5' tall
3	K	Panicum virgatum	Switch Grass	3-6' tall
9	L	Ratibida pinnata	Yellow Coneflower	3-6' tall
3	M	Echinacea purpurea	Purple Coneflower	3-4' tall



Nature-guided Garden design

http://www.hawksandowls.com/Beccas_Site/rivermaid_design.htm

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Maintaining Your Garden

Water

Water your garden after planting and ensure the plants receive a minimum of 1 inch of water per week for 4-6 weeks. Once established, your plants will require little maintenance because they have adapted to your climate over thousands of years. This includes watering, as your plants are tolerant of even drought conditions.

Mulch

Apply mulch 3 inches thick while avoiding burying the crown of the plants. Also, choose denser mulch that will not float. Materials such as pine straw and wood chips will work fine in a rain garden.

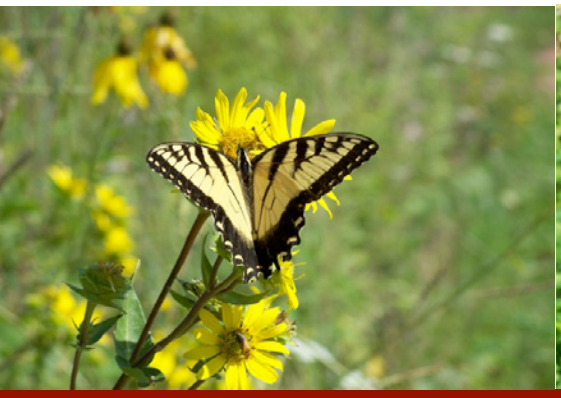
Weed

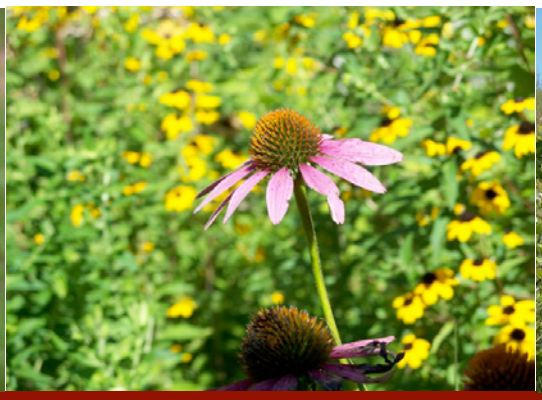
Weeding will be necessary for the first several years to ensure your young plants become established and not dominated by the weeds. Over time, however, your native plants will out compete the weeds and weeding should be infrequent.

It is common for some native plants to look like weeds before they bloom. You may want to place identification tags next to your young plants or take pictures of them to remind you of their appearance.

Fertilize

Not necessary. Your native plants should thrive in your yard as long as the plants are appropriate to your soil conditions and sunlight. Avoid using herbicides, pesticides, and fungicides in and around your garden to avoid a mass flux of chemicals from entering, and possibly disturbing your gardens filtering capabilities.





Rain Garden Examples

http://bartholomewswcd.org/BC_SWCD/Land_Use.htm

June 22, 2009

http://www.lowimpactliving.com/blog/2008/04/14/how-to-build-a-rain-garden/.

June 21, 2009

http://nemo.uconn.edu/tools/stormwater/rain_garden.html

June 21, 2009

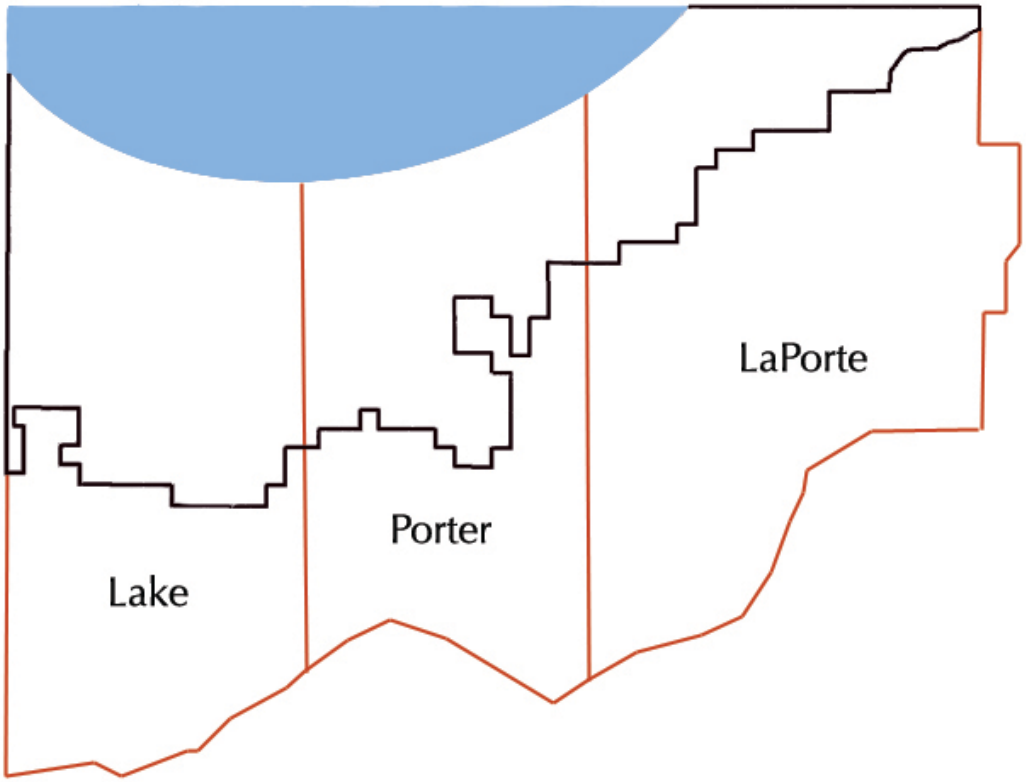
http://www.uvm.edu/~ran/ran/toolbox/bmp/raingardensrefs.php.

June 23, 2009

http://www.earthsangha.org/dca/na.html.

June 21, 2009

Lake Michigan Coastal Program Boundary



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DNR
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