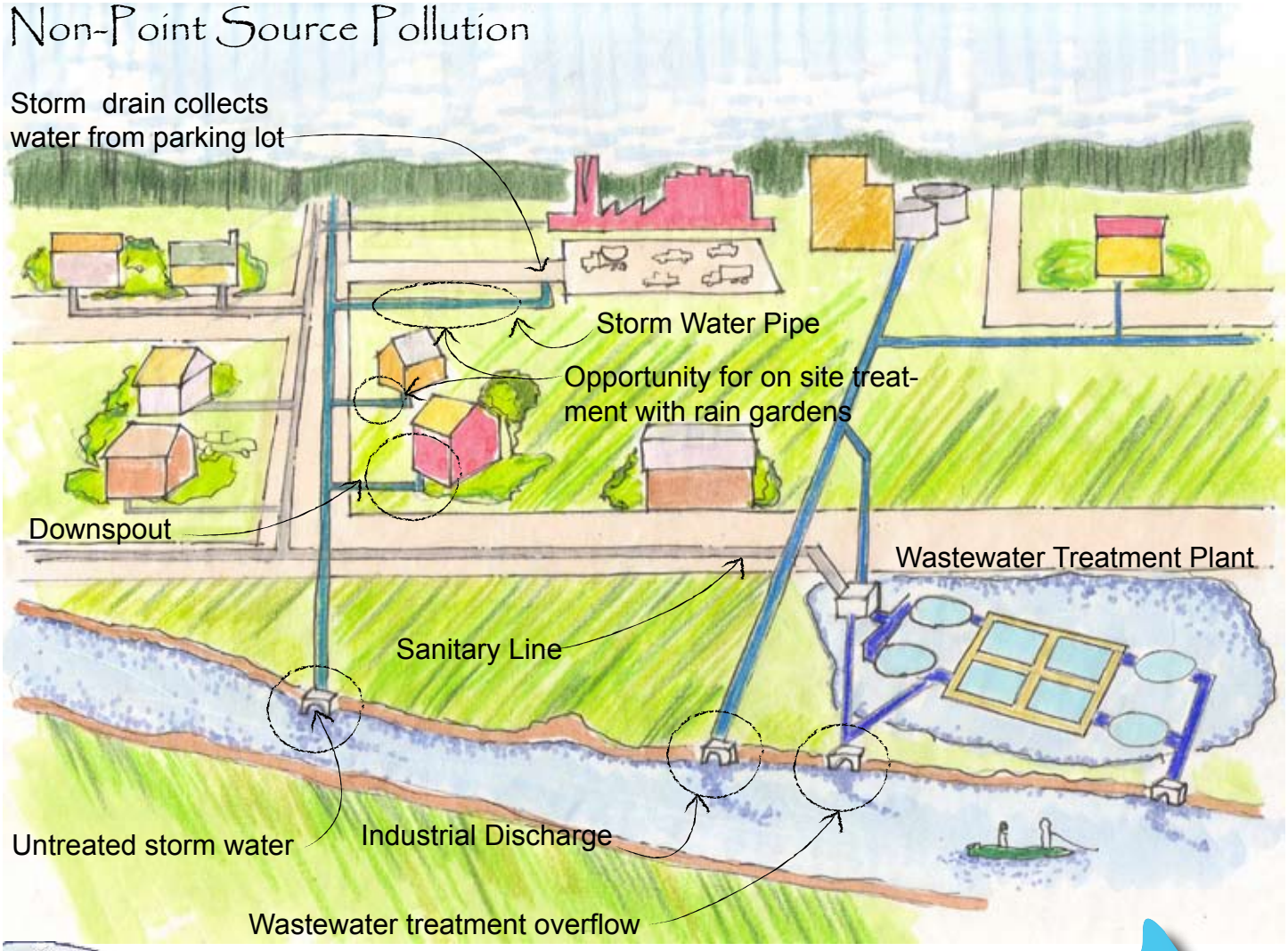
Rain Gardens

A How-To Guide

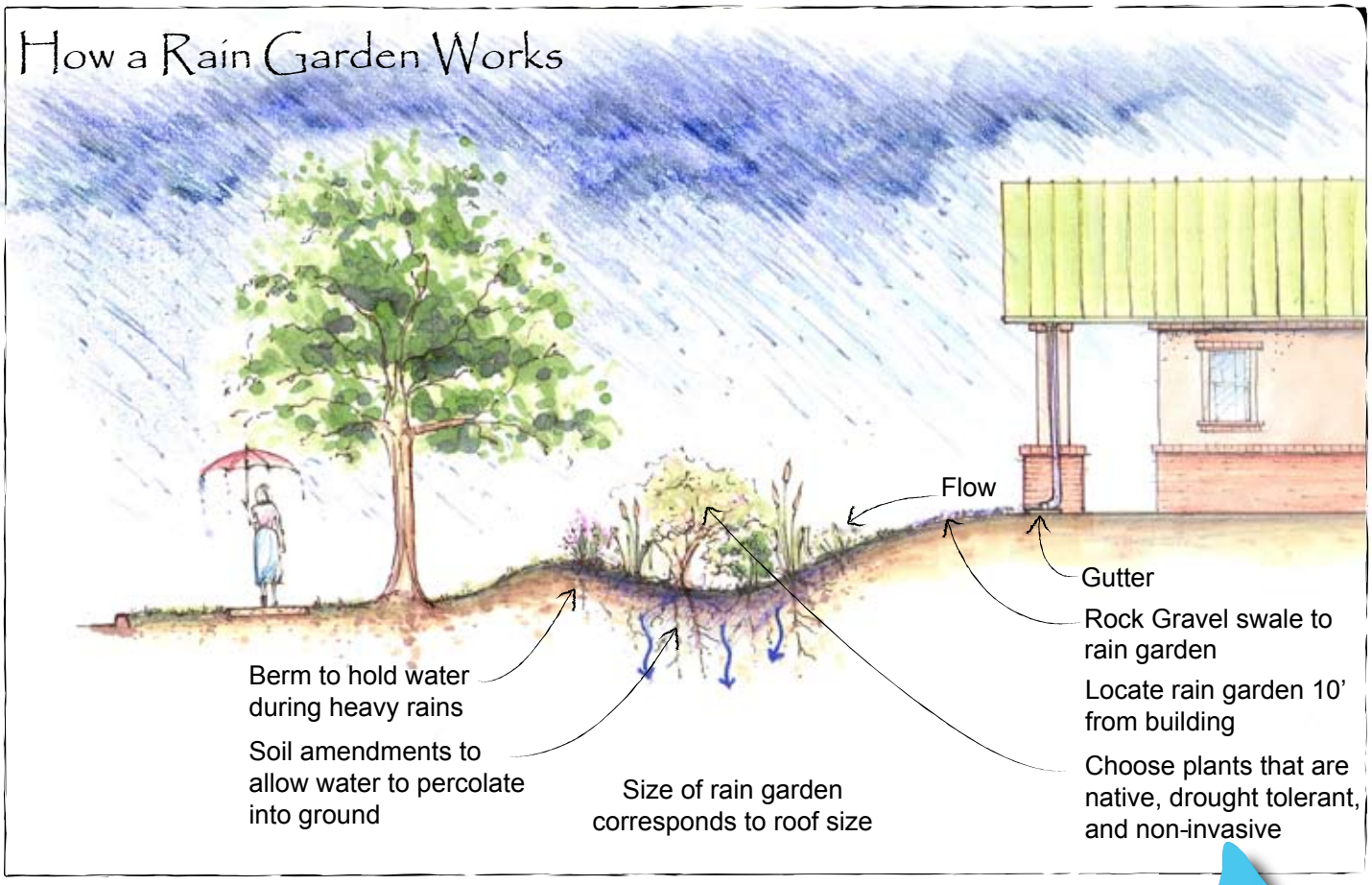
Non-Point Source Pollution



Why Rain Gardens ?

Do Drops

- Impervious surfaces associated with development, such as rooftops, driveways and roads, are areas that shed rainwater.
- Impervious surfaces increase storm water runoff.
- Construction activity on development sites usually compacts the soil, limiting the ground's capacity to absorb water. These factors reduce the ability of our landscape to absorb and filter storm water.
- Pollution enters our waterways through our storm drainage systems, including sewers and open ditches, which flow untreated to our streams and lakes.
- Studies by the United States Environmental Protection Agency (USEPA) have shown that a substantial amount of the pollution in our streams, rivers and lakes is carried there by runoff from our own yards, driveway, and rooftops. An easy way to help keep these pollutants out of our local waterways is to install a rain garden!



Vegetated Swale,
"Thinking Outside the Pipe"
Landscape Architecture Magazine
February 2006

Benefits of Rain Gardens

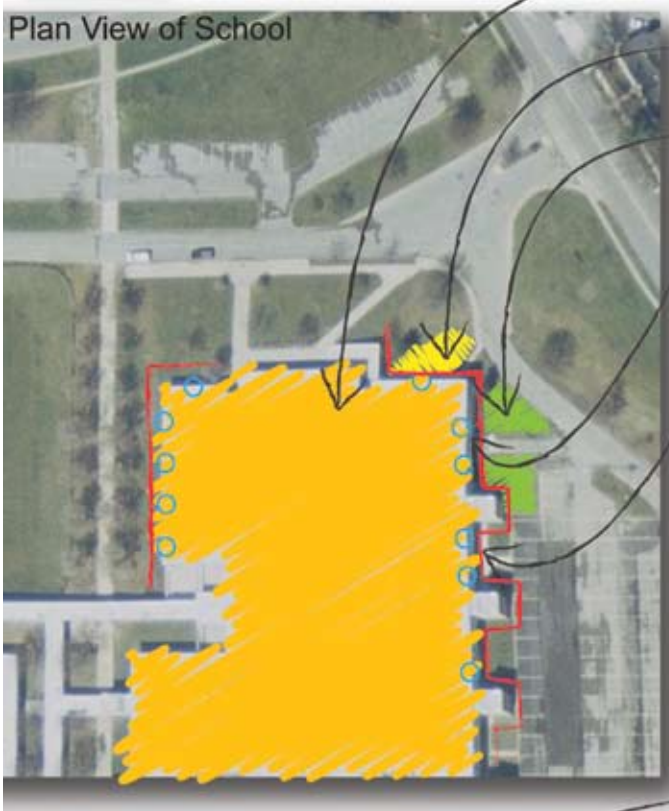
Do Drops

- Helps keep water clean by filtering storm water runoff before it enters local waterways
- Helps alleviate problems associated with flooding and drainage
- Enhances the beauty of individual yards and communities
- Provides habitat and food for wildlife including birds and butterflies
- Recharges the ground water supply

Do Drops

Rain barrels can also be incorporated into your rain garden plans. They can hold a set amount of rain water which could be used at a later time, while the overflow can be directed to your rain garden. Rain barrels can also be customized to suit your taste.

Finding the Right Location for Your Rain Garden



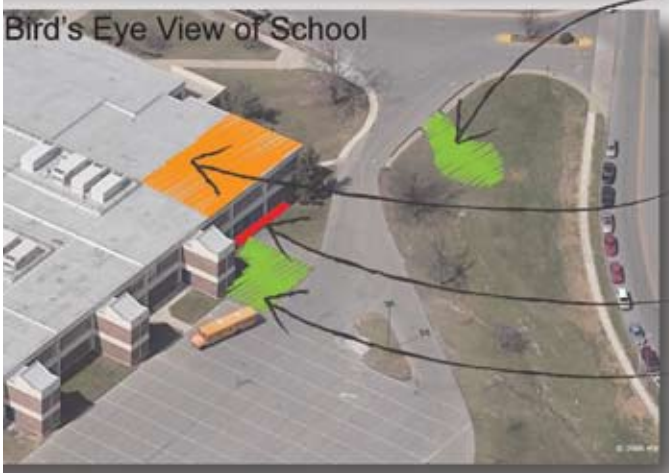
Total roof area

Wet areas with poor drainage should be avoided

Possible location for rain garden

Find the locations of downspouts and where they drain

Place rain gardens at least 10 feet from the building in order to protect the foundation

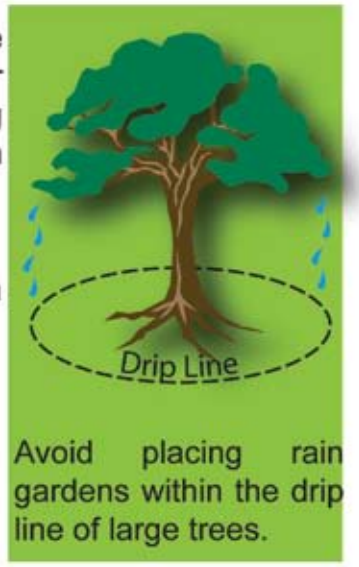


Curb cuts can be utilized to route water from roads and parking lots and into rain gardens

Defined roof area that drains into possible rain garden

10 foot building set back

The ideal location for rain garden



Avoid placing rain gardens within the drip line of large trees.

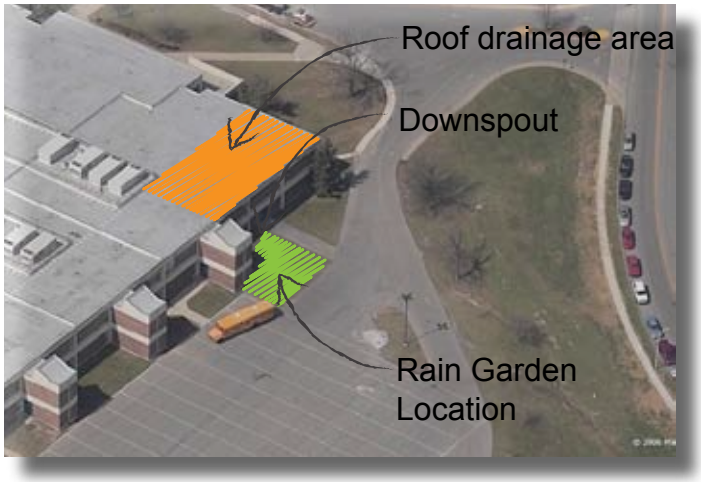
Do Drops

- Locate rain garden so that there is minimal disturbance to nearby tree roots.
- Sunny or partly sunny locations are best for rain gardens, but shade gardens are possible.
- Rain gardens should be integrated with your landscape.
- Place rain gardens up-slope of excessively wet areas to reduce the amount of water that flows into them. Because these areas are already poorly drained, rain gardens should not be placed in an area of your yard where water collects.
- Rain gardens should not be placed over or near the drain field of a septic system.

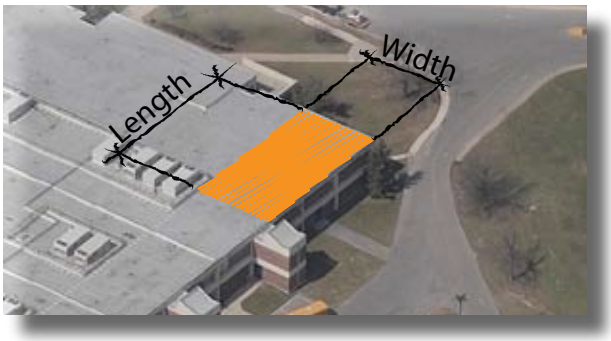
Determining Drainage Area of Roof

In order to estimate the size of your roof, you will need to measure the footprint, or the outside dimension of your building. Your building's footprint will be relatively equal to the area of your roof, which can be determined by multiplying the width of your building (in feet) by its length (in feet).

Estimating Roof Drainage Area



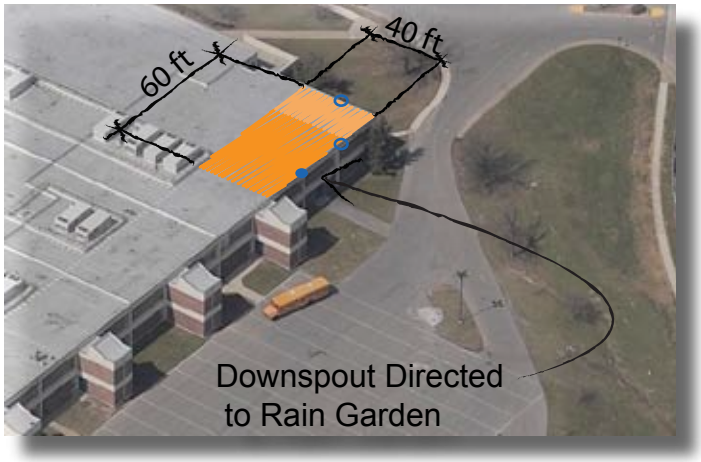
Drainage Area Calculations

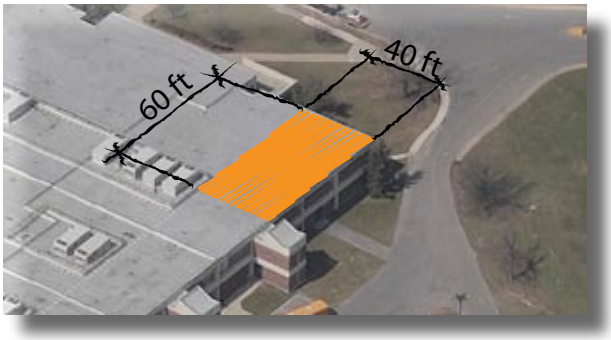


Roof Drainage Area
Length ft X Width ft = Square Feet ft^2

Dividing Roof Area into Sections

To estimate your drainage area, count the number of downspouts and then divide the number of downspouts that drain to your area by the total number of downspouts



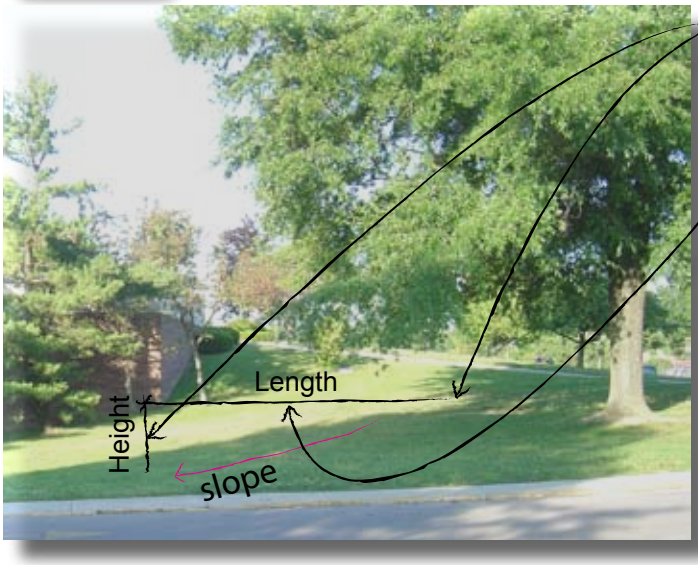


Roof Drainage Area
60 ft X 40 ft = **2400 ft^2**

Downspouts directed to garden / Total Number of downspouts	X	100 =	Percentage of roof area that drains to garden
1 / 3	X	100 =	**33%**

Total Roof Drainage Area	X	Roof Area %	=	Contributing Roof Drainage Area
2400 ft^2	X	33%	=	**800 ft^2**

Determining the Size



Finding the Slope and Depth

1. Set one stake at the uphill side of your rain garden and another stake at the downhill side.
2. Tie a string at ground level to the uphill stake.
3. Secure the other end of the string to the downhill stake, ensuring that the string is level.
4. Measure the length (in inches) between the two stakes. Next, measure the height (in inches) between the ground and the string of the downhill stake.

$$\frac{\text{Height}}{\text{Length}} \times 100 = \%\ \text{Slope}$$

Slope Depth	
< 4%	3 to 5 inches
5% - 7%	**6 to 7 inches**
8% - 12%	8 inches max

Example

$$\frac{9\ \text{in}}{180\ \text{in}} \times 100 = \underline{\mathbf{5\%}}\ \text{Slope}$$

5. Use Slope table above to determine the depth of rain garden. **For example**, with a slope of **5%** the depth will be **6 inches**.

Calculating the Size

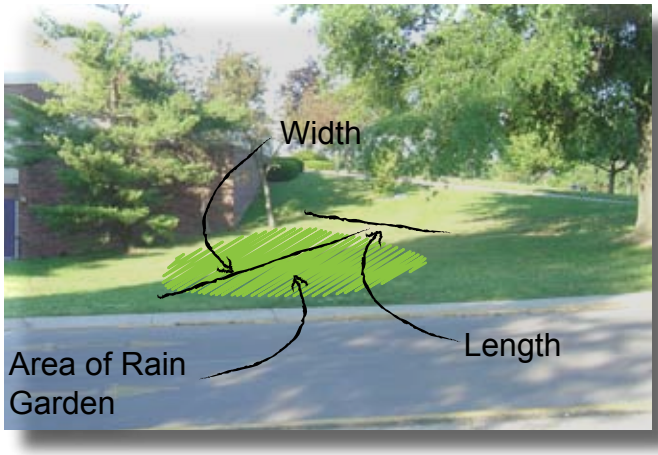
1. Using the Rain Garden Size Factor Tables on the right, determine your garden size based on your soil type, garden depth and distance from downspout.
2. For help determining your soil type see the Do Drops box on the next page.
3. **For example**, if you have **Sandy Soils** with a depth of **6 in**, the size factor will be **0.15**.
4. Multiply the size factor by the drainage area to find the square feet (ft^2) of the rain garden.

Drainage Area	X	Size Factor	=	Square Feet (Ft^2) of Rain Garden
800 ft^2	X	0.15	=	**120 ft^2**

Rain Garden Size Factor Table (less than 30 feet from downspout)			
	4 in.	**6 in.**	**8 in.**
Sandy Soil	0.19	***0.15***	0.08
Silty Soil	1.35	0.25	0.06
Clayey Soil	0.43	0.32	0.20

Rain Garden Size Factor Table (more than 30 feet from downspout)	
	Size Factor, all depths
Sandy Soil	0.03
Silty Soil	0.06
Clayey Soil	0.10

Determining the Shape



The longer side of the rain garden should face up-slope; that is, the length of the rain garden should be perpendicular to the slope and the downspout. This allows the garden to catch as much water as possible.

However, the rain garden should still be wide enough for the water to spread evenly over the whole bottom and to provide the space for a variety of plants. A good rule of thumb is that the rain garden should be about twice as long (perpendicular to the slope) as it is wide.

For Example, if you take your rain garden square footage, **120 ft²**, and you want an **8**-foot wide garden, the length would be **15** feet.

$$\frac{\text{Rain Garden Area Square Feet (ft}^2\text{)}}{\text{Width in Feet}} = \text{Length in Feet}$$

$$\frac{120\ \text{ft}^2}{8\ \text{ft}} = \text{15 ft in Length}$$

Do Drops

Determining Soils Types

In general, if your soil profile is sandy (coarse textured soils), you may be able to simply loosen the soil and improve it with some yard waste compost to prepare your rain garden for planting. Silty soils (intermediate textured soil) drain better than clayey soils (fine textured soils), but both types may need help to function properly. If you are unsure of your soil type you can contact your local Soil and Water Conservation District (SWCD).

There may be extra considerations in planning and building rain gardens containing silty, clayey, or compacted soils. These soils reduce the ability of rain water to percolate, the downward movement of water through the soil. Consequently, you can increase the size of your rain garden and/or completely replace the soil to help combat the slow percolation of clayey and compacted soils in that area. A recommended soil mix is 50-60% sand, 30-40% loamy topsoil (which can be purchased from local garden stores or landscape suppliers) and 5-10% organic matter derived from yard waste compost. If you would like a more exact soil mix, contact your local SWCD for a list of local suppliers who will be able to provide you with a bio-retention soil mix.

Basic Soil Tests

Feel Test - Rub moist soil between your finger tips. Sandy soil feels gritty, silty soil feels smooth, and clayey soils feel sticky.

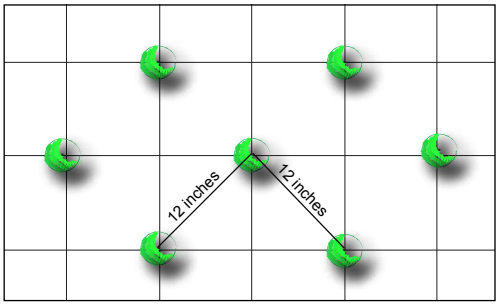
Ribbon Test - Moisten soil to a putty like consistency. Make a soil ribbon by squeezing the moist soil between your thumb and forefinger. Sandy soils will not form a ribbon. Silty soils will make a short, weak ribbon. Clayey soils will form a long, strong ribbon.

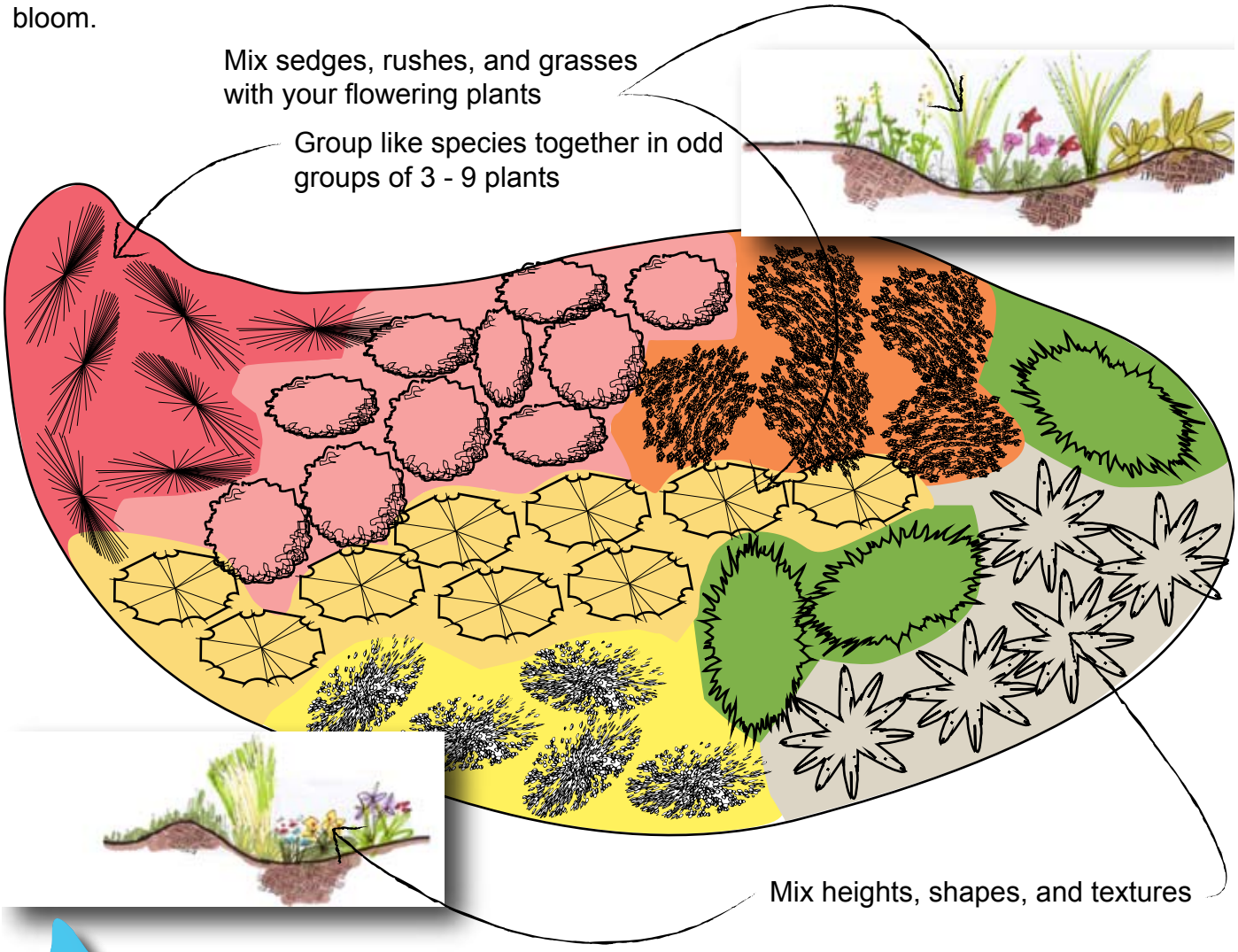
Dry Test - Mold soil into a ball and allow it to air dry for several hours. Once the soil is dry, crush it between your thumb and forefinger. Sandy soils will crumble easily, while silty soils will be moderately resistant and firm. Clayey soils will be very difficult, if not impossible, to crush.

Plant Selection and Layout

Native plants are adapted to living in our local weather, soil, and ecosystems. Invasive exotic plants are plants that have been introduced to a habitat in which they did not evolve, and they persistently encroach upon native flora. When choosing native plants for the garden, it is important to consider the height of each plant, bloom time and color, and its overall texture. Use plants that bloom at different times to create a long flowering season. Mix heights, shapes, and textures to give the garden depth and dimension. This will keep the rain garden looking interesting even when few wildflowers are in bloom.

Plant spacing guide





Do Drops

Follow this link www.millcreekwatershed.org to the The Mill Creek Watershed Council of Communities web page for a gridded design layout template and other example layouts. Also on this web page is an extensive plant list for rain gardens in your area, complete with pictures and descriptions, and a table of plants that can be sorted by various characteristics. If you are having trouble unleashing your creative juices contact a landscape architect for help in designing your rain garden.

Garden Layout

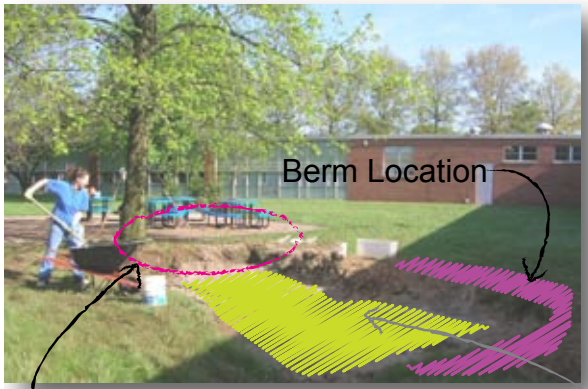
Layout the perimeter of the rain garden

Preparing the site

When preparing the site, take into consideration the amount of time it takes to acquire the materials needed for the construction of the rain garden.

- Place materials needed for the site as close to the site as possible. This will minimize the time and effort to move the soil and plants to the desired location of the rain garden.
- Use garden hose or spray paint to mark the perimeter of your rain garden.

Digging and leveling



Take care to avoid disturbing the root systems of trees

Make sure that the rain garden is level before adding soil amendments

Make sure your rain garden is level so that the water spreads out evenly.

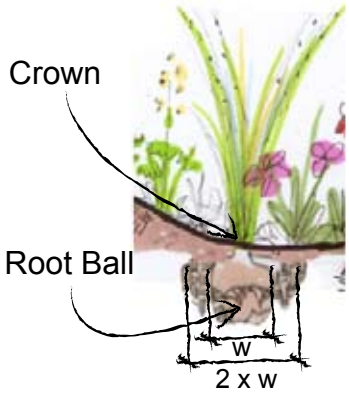
- When your rain garden is excavated to the appropriate depth, lay a board in the rain garden with a carpenter's level on it. Correct the spots that aren't level by adding soil to the low places and by removing soil from the high places. Move the board to different places throughout the rain garden, filling and digging as necessary to level the bottom of the rain garden.
- Use the excavated soil to form the berm on the down-slope side of the rain garden. The berm will need to be compacted and either planted with grass, or incorporated into the planting plan of the rain garden.

Back filling with topsoil

Once the rain garden has been leveled, you can then start adding topsoil and composted organic matter as needed. Refer to page 7 regarding soils and soil composition for more information on soils. Also, shape the berm so that it ties back into the existing landscape and rake the entire rain garden so that it is ready for planting.

Planting

Make sure to have at least a rough plan for which plants will be planted where. Lay out the plants as planned one foot apart in a grid pattern, keeping them in containers, if possible, until they are planted to prevent drying out before they get in the ground.



Dig each hole twice as wide as the root ball and deep enough to keep the crown of the young plant level with the existing grade. Make sure the crown is level and then fill the hole and firmly tamp around the roots to avoid air pockets. Refer to the planting diagram on the left.

Stick plant labels next to each individual grouping. This will help identify the young native plants from non-desirable species (weeds) as you weed the garden. An additional idea to help in the planting and layout of the rain garden is to use string to separate the bed into different zones of plant color, height, and species.

Plant List (for more information go to www.millcreekwatershed.org)

Common Name	Color	Bloom Time	Height	Sun
Dry Areas				
Asters	Varies by Species	Spring - Fall	Varies by Species	F, P
Little bluestem grass	Foliage	Summer	2 - 4 feet	F, P
Butterfly Milkweed	Orange	Summer	12 - 18 inches	F, P
Sand Coreopsis	Yellow	Spring - Summer	12 - 18 inches	F
Purple Coneflower	Purple	Spring - Summer	24 - 30 inches	F
Blazing Stars	Purple	Summer - Fall	Varies by Species	F, P
June Grass	Foliage	Spring - Summer	12 - 18 inches	F, P
Prairie Dropseed	Foliage	Summer - Fall	2 - 3 feet	F, P
Moist Areas				
Aster	Varies by Species	Spring - Fall	Varies by Species	F, P
Blazing Stars	Purple	Summer - Fall	Varies by Species	F, P
Carex	Foliage	Spring - Summer	Varies by Species	F, P, S
Ironweed	Purple	Summer - Fall	Varies by Species	F
Wet Areas				
Aster	Varies by Species	Spring - Fall	Varies by Species	F, P
Carex	Foliage	Spring - Summer	Varies by Species	F, P, S
Joe-Pye Weed	Pink	Summer	3 - 6 feet	P, S
Common Rush	Foliage	Summer	12 - 18 inches	F, P
Cardinal Flower	Red	Summer - Fall	2 - 5 feet	F, P
Iris	Blue	Spring - Summer	2 - 3 feet	F, P
Queen of the Prairie	Pink	Summer	3 - 6 feet	F

* F = Full Sun, P = Partial Sun, & S = Shade

Maintaining the Rain Garden

Weeding will be needed the first couple of years. Remove by hand only those plants you are certain are weeds. Try to get out all the roots of the weedy plants. Weeds may not be a problem in the second season, depending on the variety and tenacity of weeds present. In the third year and beyond, the native grasses, sedges, rushes, and wildflowers will begin to mature and will out-compete the weeds. Weeding isolated patches might still be needed on occasion.

After each growing season, the stems and seed heads can be left for winter interest, wildlife cover and bird food. Once spring arrives and new growth is 4 to 6 inches tall, cut all tattered plants back. If the growth is really thick, hand-cut the largest plants and then use a string trimmer to mow the planting back to a height of six to eight inches. Dead plant material can also be removed with a string trimmer or weed whacker (scythe) and composted or disposed of as appropriate.

What does a Rain Garden Cost?

The cost of the rain garden will vary depending on who does the work and where the plants come from. If you grow your own plants or borrow plants from neighbors there can be very little cost or no cost at all. If you do all the work, but use purchased native plants, a rain garden will cost approximately $3 to $5 per square foot. If a landscape professional does everything, it will cost approximately $10 to $12 per square foot.

Hilltop's Cost for building their rain garden	
$326	Topsoil, mulch and delivery charges
$1300	for 149 plants (perennials in 1 gallon pots)
$0.00	Labor was donated
$1626	Total spent on rain garden

Do Drops

Additional ways to save costs are to contact your local municipality for equipment and grants to help with construction. The Soil and Water Conservation District (SWCD), National Resource Conservation Services (NRCS), Landscape Architecture firms, and local environmental groups can provide help with grants, equipment, and volunteers needed to help design and build a rain garden.

Final Thoughts: This document has been produced to support the Mill Creek Watershed Council of Communities vision statement and the restoration of the Mill Creek Watershed. Rain gardens can be applied anywhere there is runoff and a place to catch the runoff. Parking lots, city parks, your home, roadways, and places of business can all benefit from rain gardens. The application of rain gardens is almost limitless. Rain gardens can limit the amount of pollutants entering our waterways and help recharge our ground water.

Vision Statement

"Mill Creek Watershed is a sought-after location to live, work, and play."

Acknowledgments

- JF New Native Plant Nursery for providing plant list.
  11156 Luschek Drive, Cincinnati, OH 45241.
  P: 513.489.2402, F: 513.489.2404, www.jfnew.com.

- City of Reading, Ohio (www.readingohio.org) provided their assistance and input.

- Geauga Soil and Water Conservation District, *Rain Garden Manual for Homeowners*, provided information used in portions of this brochure. University of Wisconsin - Extension Environmental Resources Center and the Wisconsin Department of Natural Resources, *Rain Gardens: A How-to Manual for Homeowners,* provided information used in portions of this brochure.

- Thanks to the 6th grade gifted students at Hilltop Elementary in Reading, Ohio, along with Bruce Koehler and Nancy Ellwood, for choosing a rain garden as a solution to improve the water quality of Mill Creek. We also want to thank them for being the pilot project of the rain garden featured in this brochure and providing an example for this Rain Garden How-To brochure.

- Cindy Snodgrass for the artwork displayed in the rain garden.

- Mill Creek Watershed Council of Communities, info@millcreekwatershed.org, www.millcreekwatershed.org, One North Commerce Park Drive, Suite 124, Cincinnati, OH 45215. P. 513.563.880.

MILL CREEK
WATERSHED COUNCIL
OF COMMUNITIES

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