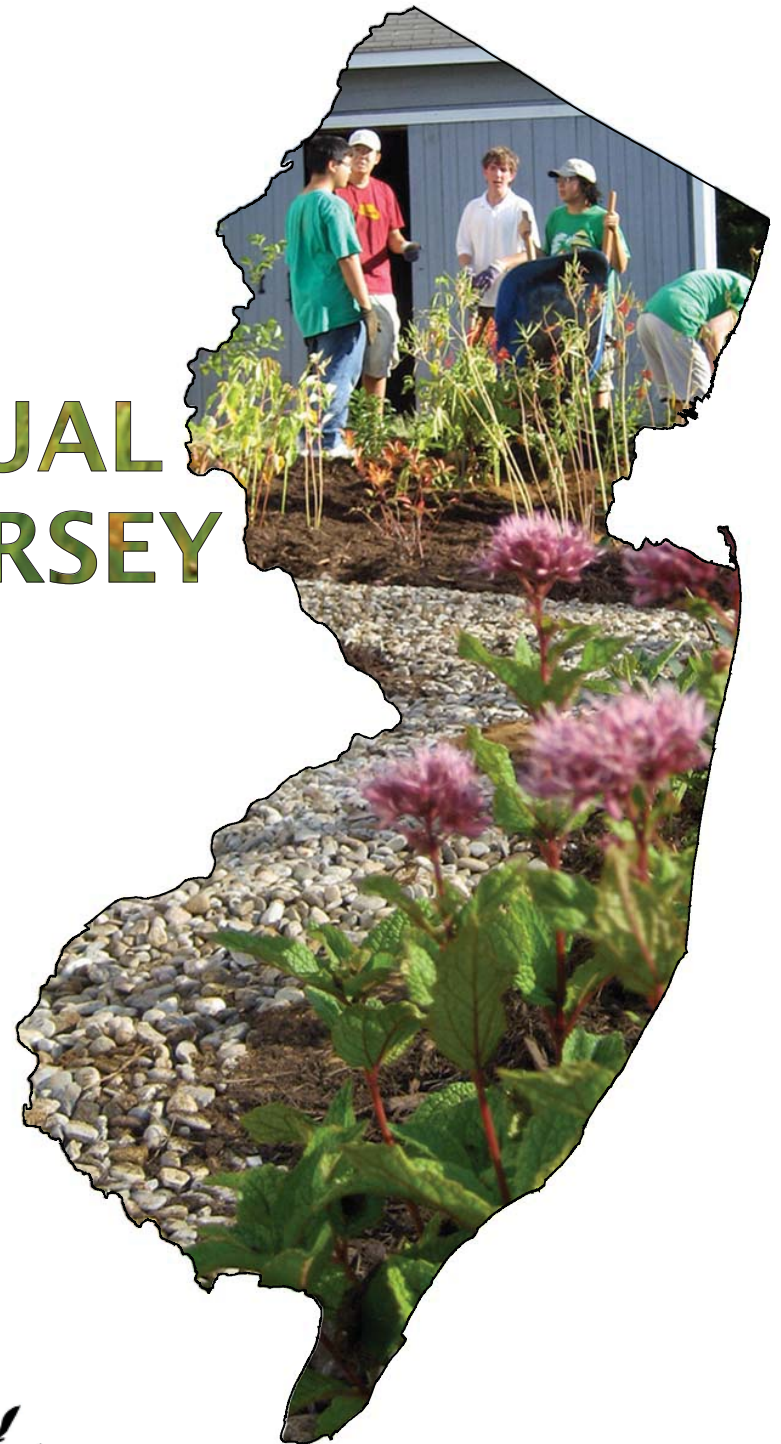


RAIN GARDEN MANUAL OF NEW JERSEY



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Special thanks to all of our partners throughout New Jersey who have contributed photographs and images to help make this Manual a success for the Rain Garden State!

Front cover photo courtesy of Pat Eisemann

Cooperating Agencies: Rutgers, The State University of New Jersey, U.S. Department of Agriculture, and County Boards of Chosen Freeholders. Rutgers Cooperative Extension, a unit of the Rutgers New Jersey Agricultural Experiment Station, is an equal opportunity program provider and employer.

This material is based upon work supported in part by the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture, under Agreement No. 2008-51130-19504. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.



Welcome!

The Rutgers Cooperative Extension Water Resources Program and the Native Plant Society of New Jersey are excited to share this Rain Garden Manual with you. Rain gardens are an easy way for everyone in New Jersey to help protect our State's precious water resources and add to the health and diversity of our native habitats and landscapes. These shallow landscaped depressions are able to intercept, treat, and infiltrate stormwater at its source (your yard and home) helping to protect the quality of our lakes, rivers, and streams and recharge our groundwater. Every drop of water kept out of our storm drains reduces flooding, mitigates pollution, and improves base flow in our waterways.

We look forward to introducing you to the beautiful native plants that can be used in rain gardens. These many trees, shrubs, wildflowers and grasses adapted to our State provide both aesthetics and function in your landscape.

This manual is intended to give you the step-by-step procedure you need to create a beautiful and sustainable rain garden landscape. Rain gardens are something everyone can do. This manual will walk you through the fears or reservations you might have and will give you encouragement, as well as the tools and answers you need to create and sustain a rain garden on your property. Remember, a rain garden is one of the best and easiest things you can do to protect and conserve New Jersey's natural resources.

Christopher C. Obropta, Ph.D., P.E.
Rutgers Cooperative Extension
Water Resources Program

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Native Plant Society of New Jersey

Rain Garden

Water Quality and Habitat
Enhancement Project

This garden is designed to intercept, filter, and infiltrate stormwater at the source, before it becomes runoff. The plants are native to the region and help retain contaminants that could otherwise harm nearby waterways. Rain gardens are beautiful, low-maintenance, and inexpensive gardens that you can install at home.

<https://wheatonarts.org/parts/edu>



INTRODUCTION

Key Points:

CHAPTER 1

- Impervious surfaces prevent groundwater infiltration and enable stormwater runoff and nonpoint source pollutants to enter waterways.
- A rain garden is a landscaped, shallow depression that captures, filters, and infiltrates stormwater at the source before it becomes runoff.
- A rain garden should reduce runoff, recharge groundwater, and use native plants.
- Native plants control erosion by stabilizing soils and increase infiltration, leading to an overall improvement of water quality.
- Installing a rain garden is a simple way to save money and energy, while also preserving New Jersey's natural resources.

3 KEY POINTS:

A Rain Garden should:

- *Reduce Runoff*
- *Recharge Groundwater*
- *Use Native Plants*

Introduction

Why a Rain Garden?

Rain that falls to the earth evaporates into the atmosphere, is used by plants, or infiltrates down through the soil into the groundwater. The remainder of the rainfall flows across the land surface into gutters, drains, streams, rivers, and lakes as stormwater runoff. As the rain moves over the land surface, it washes off pollutants and carries these contaminants to local waterways. The pollution that is carried by stormwater runoff to our waterways is called nonpoint source pollution (see “Nonpoint Source Pollution” information on page 10). Stormwater runoff that carries nonpoint source pollution to our waterways is the major reason many of our streams, rivers, estuaries, ponds and lakes are not meeting water quality standards and are considered impaired. In fact, nonpoint source pollution in stormwater runoff causes up to 60% of our existing water pollution problems, making it the largest source of pollution in our New Jersey waters (NJDEP, Bureau of Nonpoint Pollution Control, Division of Water Quality).

Rain gardens are a simple, cost-effective tool homeowners, municipalities, and schools can use to reduce stormwater runoff, improve groundwater recharge, and trap nonpoint source pollutants before they reach our waterways.



Holy Nativity Lutheran Church
Wenonah, NJ

CAPTURE

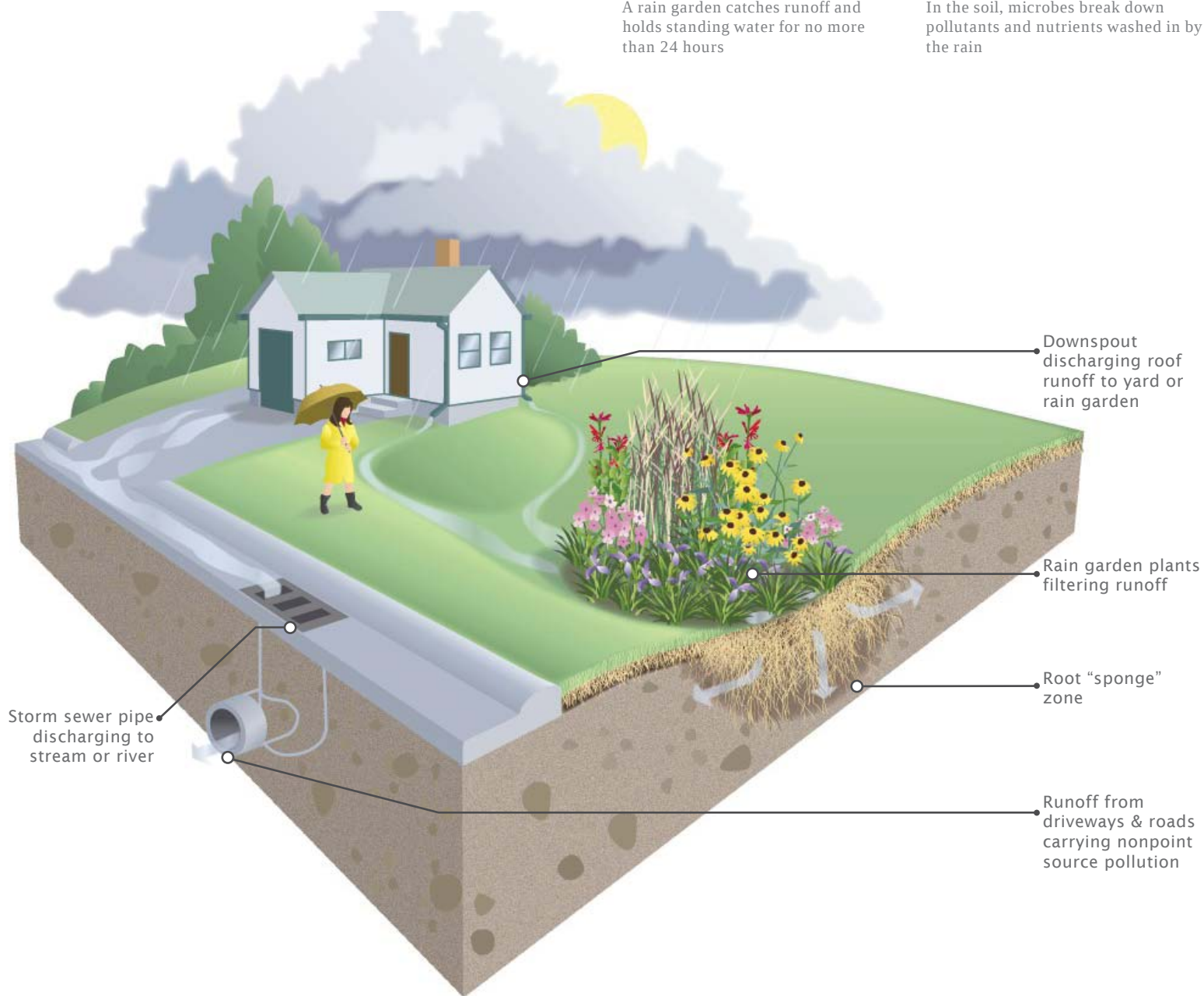
A rain garden catches runoff and holds standing water for no more than 24 hours

FILTER

In the soil, microbes break down pollutants and nutrients washed in by the rain

INFILTRATE

Deep-rooted plants loosen the soil, creating a sponge zone. Water soaks in and groundwater aquifers are recharged



Stormwater and You

Development activities throughout New Jersey are rapidly covering the land with impervious surfaces like roadways, driveways, and rooftops. These impervious surfaces increase the amount of stormwater runoff and nonpoint source pollutants carried to nearby waterways. These areas also prevent water from infiltrating into the ground, thereby depriving groundwater aquifers of the water they need to remain stable. Approximately half of the water we use in New Jersey comes from groundwater aquifers. Additionally, groundwater provides many of New Jersey's streams with "baseflow". During the long periods between rainfall, groundwater seeps into our streams, keeping them flowing and sustaining aquatic life. This baseflow provided by the groundwater to the stream is critical in keeping streams healthy and viable.

In addition to the impervious surfaces associated with developed communities, many of the soils in these areas are disturbed and compacted during the development process. Even though turf grass is often covering these compacted soils, the infiltration capacity of these areas is greatly decreased. Compaction reduces the amount of rain that can infiltrate through soils and increases stormwater runoff by two to ten times from that of natural (undeveloped) landscapes.



Natural landscapes, including wetlands, meadows, and forests, consist of native plant communities adapted to specific climate, soil, and hydrologic conditions. The roots of these plants help to make the land very porous so that the soil quickly infiltrates rain that falls to the land surface.

What is a rain garden?

A rain garden is a landscaped, shallow depression that captures, filters, and infiltrates stormwater runoff. The rain garden removes nonpoint source pollutants from stormwater runoff while recharging groundwater. A rain garden has two main goals. The first goal is to serve as a functional system to capture, filter, and infiltrate stormwater runoff at the source, and the second goal is to be an aesthetically pleasing garden. Rain gardens are an important tool for communities and neighborhoods to create diverse, attractive landscapes while protecting the health of the natural environment.

NONPOINT SOURCE POLLUTION:

"Nonpoint source pollution" is also called "people pollution." It is the pollution that comes from our everyday lives. It is the fertilizers that wash off our farms and lawns. It is the pet waste that washes into our streams. It is the sediment (or soil) that erodes from our lands into our local waterways. It is the oil and grease that comes from our parking lots. Finally, it is the pollutants such as nitrogen, phosphorus, and heavy metals that settle out of our atmosphere onto our roads and rooftops. When it rains, the stormwater runoff carries nonpoint source pollution and may ultimately wash it to our waterways.

As the image on the left illustrates, stormwater runoff picks up oil and grease from the parking lot, flows through a curb cut, and into a rain garden. The rain garden acts as a sponge to trap the nonpoint source pollutants, preventing them from reaching the nearby lake.

Rain gardens can be readily implemented throughout our communities to begin the process of re-establishing the natural processes of the land. Rain gardens:

- capture stormwater runoff reducing erosion and sedimentation and the amount of water that flows to our streams and waterways during rain storms,
- protect water quality by filtering out and breaking down pollutants,
- infiltrate runoff and thereby recharge groundwater supplies and provide baseflow to nearby streams and waterways,
- provide the opportunity to establish native plant communities to promote biodiversity and habitat for beneficial wildlife, and
- integrate necessary soil improvements and native plants adapted to periodic wet and dry periods mimicking our New Jersey natural landscape.

While the Environmental Protection Agency (EPA) defines stormwater runoff as the number one threat to water quality in our lakes and streams, rain gardens are one of the quickest and easiest methods everyone can use to reduce runoff and help protect our water resources. Beyond the aesthetic and ecological benefits, rain gardens encourage environmental stewardship and community pride. In addition, using native plant materials in rain gardens is an important way to promote biodiversity and preserve native species in our developed communities. When used throughout a community, rain gardens can also provide significant economic benefits by lowering costs for local government and businesses to maintain and upgrade traditional stormwater infrastructure pipes and management basins.

How does a rain garden differ from any other garden?

To a certain extent, a traditional landscaped bed or flower garden can provide functions similar to a rain garden. But, to provide all the benefits of a rain garden including capturing,

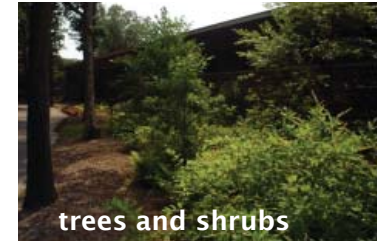
A Rain Garden can be...



a butterfly habitat



along a sidewalk



trees and shrubs



a parking island



a wet meadow



a perennial garden

Photo courtesy of Bill Young

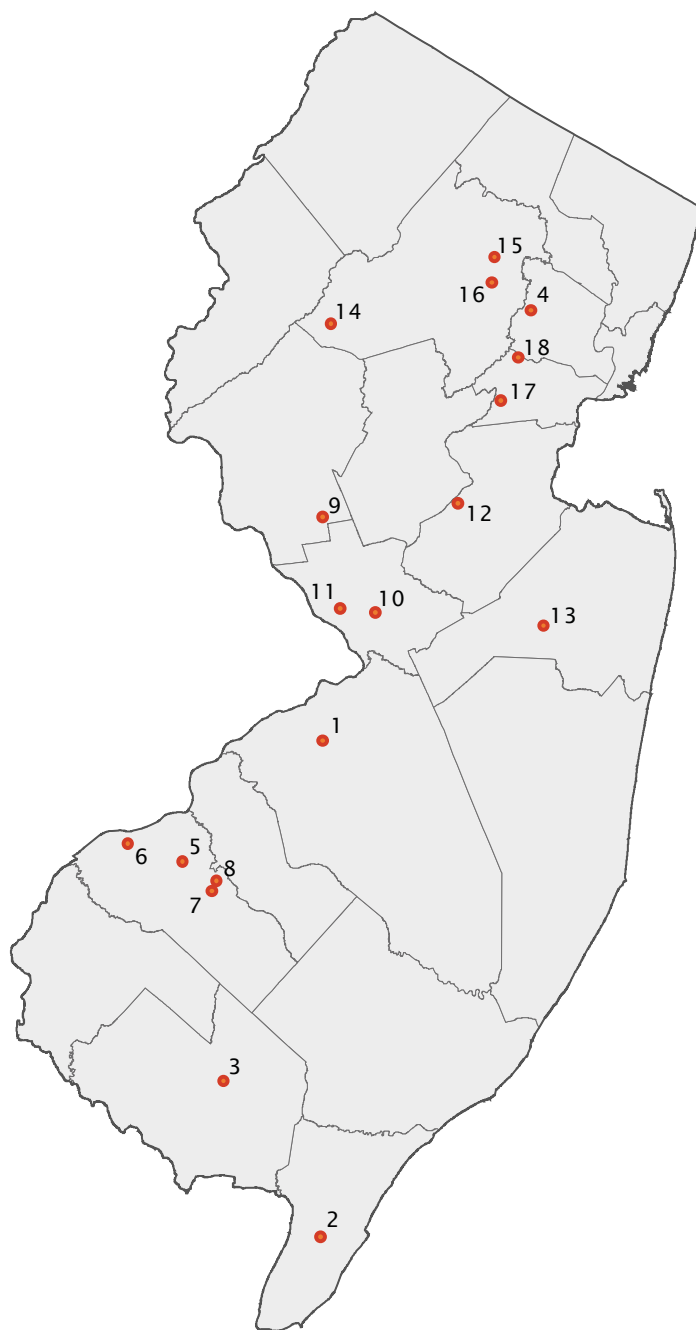
filtering, and infiltrating stormwater runoff, a shallow basin must be dug and planted slightly below-grade to store water.

Ideally, a rain garden is planted with a variety of grasses, wildflowers, and woody plants that are adapted to the soil, precipitation, climate, and other specific site conditions. Using native plants with deeper root systems facilitates infiltration and also sustains the landscape through periods of drought that sometimes occur in our New Jersey summers.

Native plants provide a multitude of benefits to both the local ecosystem and the homeowner. For local wildlife, native plants supply food and habitat. In addition, most native plant species produce long root systems. For example, a non-native turf grass, such as Kentucky bluegrass, has roots that typically reach only six to eight inches in depth, while the roots of a native grass like big bluestem will extend to nine feet deep. Not only do these longer root systems help stabilize soils by controlling erosion, they also increase infiltration to lessen the impacts of floods and droughts, leading to an overall improvement in water quality. Once established, native plants require very little maintenance, as they typically do not require irrigation or the application of pesticides or fertilizers.

Where can you see a rain garden in New Jersey?

Many rain gardens have been installed throughout New Jersey. Below are several locations where great examples of rain gardens can be found. Before beginning the process of planning and installing your rain garden, visit one located near you.



For more information on demonstration rain gardens near you, visit www.water.rutgers.edu

Burlington County

1. Rutgers Cooperative Extension of Burlington County

Cape May County

2. Rutgers Cooperative Extension of Cape May County

Cumberland County

3. Wheaton Arts and Cultural Center

Essex County

4. Essex County Environmental Center

Gloucester County

5. Holy Nativity Lutheran Church
6. Greenwich Township Library
7. Atkinson Park
8. Hurffville Elementary School

Hunterdon County

9. Marion F. Clawson Memorial Park

Mercer County

10. Mercer County Community College
11. Delaware River Basin Commission

Middlesex County

12. Rutgers Cooperative Extension of Middlesex County (EARTH Center)

Monmouth County

13. Rutgers Cooperative Extension of Monmouth County (Agriculture Building)

Morris County

14. Washington Township Library
15. Leonard Park
16. Parsippany-Troy Hills Town Hall

Union County

17. Fanwood Memorial Library
18. Hanson House/ Hanson Park Conservancy
Reeves-Reed Arboretum

SAVE MONEY + SAVE ENERGY:

Planting a rain garden can save you money on your energy bill:

- Carefully situated plants, particularly deciduous trees located on the southern and western sides of your house, can reduce your energy bill by up to 25% for a typical household.
- Planting deciduous trees along the southern and western sides of your house contributes to a cooler house in the summer, while still allowing for the sun to shine in the windows in the winter.
- Trees, shrubs, or vines provide shade and act as windbreaks.
- Summer air temperatures can be three to six degrees cooler in tree-shaded neighborhoods.

How do you build a rain garden?

The design of a rain garden involves understanding several interrelated principles including:

- the hydrologic cycle or water cycle,
- nonpoint source pollution,
- natural resource conservation,
- wildlife habitat,
- nutrient cycles,
- soil chemistry,
- horticulture,
- landscape architecture,
- design,
- ecology, and more.

While these many principles may sound complicated, this manual provides the information you need and the simple step-by-step instructions that will allow you to enjoy creating your own rain garden to protect the water resources of New Jersey and enhance your landscape.



Princeton, Mercer County, NJ
Photograph courtesy of Curtis Helm





PLANNING YOUR RAIN GARDEN

Key Points:

- Disconnect impervious surfaces. Place a rain garden between two impervious surfaces to control and slow down stormwater before it becomes runoff.
- The size of a rain garden is dependent upon the amount of runoff entering the rain garden (determined by drainage area).
- The depth of the rain garden is dependent upon the soil texture of the site.
- Good soil infiltration is important. Adding coarse sand to the rain garden's soil will improve infiltration rates.
- Clayey soils, in particular, need coarse sand and compost amendments.
- Select appropriate native plant species based upon the zones of the rain garden. Plants that prefer wet conditions belong in the base of the rain garden, plants that tolerate wet and dry conditions equally belong on the slope, and plants that prefer dry conditions belong on the buffer of the rain garden.

CHAPTER 2

How to Begin

Goals & Strategies

Setting goals and strategies will help guide you through the process of building a rain garden. In addition to the obvious goal of designing and building a rain garden, another key consideration should be to better manage stormwater runoff. Installing a rain garden may also fulfill other goals such as to reduce irrigation of the lawn and landscape. The strategy of this goal could then be to plant only native plants in the rain garden. Other methods of achieving goals for a rain garden project may include: catching 50% of runoff in the rain garden, or using captured water in rain barrels to water plants in the rain garden.

Budget

It is important to consider costs prior to beginning a rain garden project. If you construct the rain garden yourself, without hiring a landscaper, a residential rain garden can typically average between \$3 to \$5 per square foot to install, depending on soil conditions, the desired plant species, and the size and density of plants used. For projects incorporating curbing, storm drains, or underdrains, the cost of the rain garden will increase. It is recommended that you reach out to a landscape professional for support in the design and construction of these more complex projects. Generally, the cost of plants will be the majority of the total cost of the project. Refer to pages 60-66 of the Appendix for a list of recommended plants and concept sketches. Call a local nursery to determine costs of plant materials.



Village School
Holmdel, NJ

Site Selection

Locating Your Rain Garden

The first step is to identify an appropriate location on your property for constructing the rain garden. Consideration must be given to where the water will enter, how it will fill up the rain garden, and where it will flow out. Remember that you will want to control how the rain garden overflows during a large storm. Where will the water go when it overflows? Consider the impact of this potential overflow, and try to minimize it by directing the overflow towards grassy areas, wooded areas, or existing storm drains. Make sure that the rain garden will neither drain towards your foundation, nor towards the neighboring property.

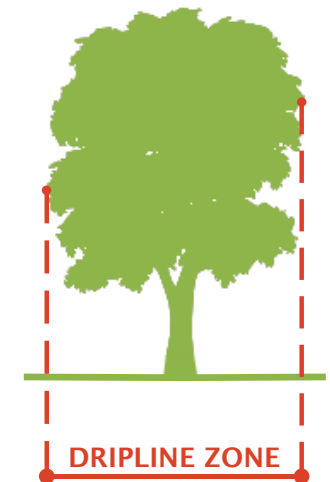
FIRST THINGS FIRST!

Before you design your rain garden, remember to:

- Research site specific information such as the location of utilities, wetlands, fire lanes, future building plans, etc.
- Survey the grounds to identify possible rain garden sites including areas with downspouts, gutters, soil erosion or locations where water ponds and puddles during/after storms.
- Do you need a permit? Not typically, but if you are in doubt, it is best to contact your county and municipal offices.
- Pay attention to drainage problem areas. It may help to take pictures.

There are several important things to consider when selecting the site of a rain garden:

1. For a building with a basement, the rain garden should be located at least ten feet from the building. This will prevent water from seeping into the building's basement. For a building with no basement, the rain garden can be placed two feet away from the building.
2. Do not place the rain garden within 25 feet of a septic system, and make sure that the rain garden is placed upslope of any leach field.
3. Do not situate the rain garden in soggy places where water already ponds. Instead, capture the water before it collects in these locations.
4. Avoid seasonably-high water tables within two feet of the rain garden depth. For real time data regarding the water table in your area, refer to the U.S. Geological Survey website (www.nj.usgs.gov/publications and from there, go to the link www.waterdata.usgs.gov). While this data provides a general idea of the water table, keep in mind that the water table fluctuates seasonally depending upon rainfall amounts.
5. Consider flat areas of the yard first. This will make digging out the rain garden much easier.
6. To prevent disrupting large tree roots, refrain from positioning the rain garden within the dripline of large trees. The dripline of a tree is the ring around the tree canopy on the ground surface that receives most of the rainwater from the tree canopy. Most of the tree's roots are located within this zone, as indicated in the illustration above, right.
7. Provide adequate space for the rain garden. A typical rain garden for most homes ranges from approximately 100 to 300 square feet in area.



Evidence of erosion: This photograph shows that, during a rainstorm, water flows down the impervious sidewalk and carves a gully through the ground surface as it flows downhill. A rain garden situated here could contain the water and improve infiltration.

LOCATE YOUR UTILITY LINES!

Call BEFORE You Dig!

*NJ One Call
1-800-272-1000*

The different colors of the markout flags represent specific utilities.

-  **ELECTRIC**
-  **GAS, OIL, STEAM**
-  **COMMUNICATIONS, CATV**
-  **WATER**
-  **SEWER**

Call Before You Dig

It is critical that work not damage underground water, gas, and electrical services. Contact New Jersey's "One Call" system at 1-800-272-1000 or 811 for a free markout of underground gas, water, sewer, cable, telephone, and electric utility lines before any outdoor construction or digging. Making this call before you dig will help prevent property damage and potential injuries. Call at least three full working days, but not more than ten days, prior to the planned installation date. Mention that you are going to be installing a garden that may have a depth of one foot (or more, if you are installing an under-drain). Utility company representatives will come to your site and mark the locations of utilities with spray paint, so you can be certain of avoiding them. Before their visit, make sure that you mark out the general location of the proposed rain garden with white spray paint or white flags (you can purchase these at a local hardware store). The representatives should inspect a larger area of the yard, not just the specific boundary of the rain garden. This will provide more flexibility for the location of the rain garden. Do not place the rain garden within five feet horizontally and one foot vertically from any utilities.

Understanding Your Property

A rain garden could probably fit in several different areas on your property. To find the most suitable location, it is essential to understand how rainwater flows through your yard. Walk around your property either during or soon after a large rainstorm. You will notice that on pervious areas of your property such as the lawn, a stone driveway, or a garden bed, the ground absorbs much, if not all, of the rain. On the other hand, take a look at the hard surfaces, such as a rooftop, a driveway, a road, or a compacted lawn area. The water does not soak into these impervious surfaces; instead, it runs off and flows downhill, looking for a place with a more porous surface in which to infiltrate. Positioning a rain garden so that the stormwater runoff flows from an impervious surface towards and into the rain garden can alleviate most flooding and erosion issues commonly found on small properties.

PLACES TO AVOID:

Do not locate a rain garden:

Next to trees. Soils near trees tend to have the best drainage, and should not be disturbed.

Near heavily used pedestrian areas. Foot traffic will cause soil compaction, which will decrease infiltration rates and disturb plant growth.

On top of buried utility lines, septic tank leach fields, water supply wells.

Over the buffer strip between the street and the sidewalk. This area usually holds multiple buried utility lines.

Within ten feet from your house if you have a basement foundation.

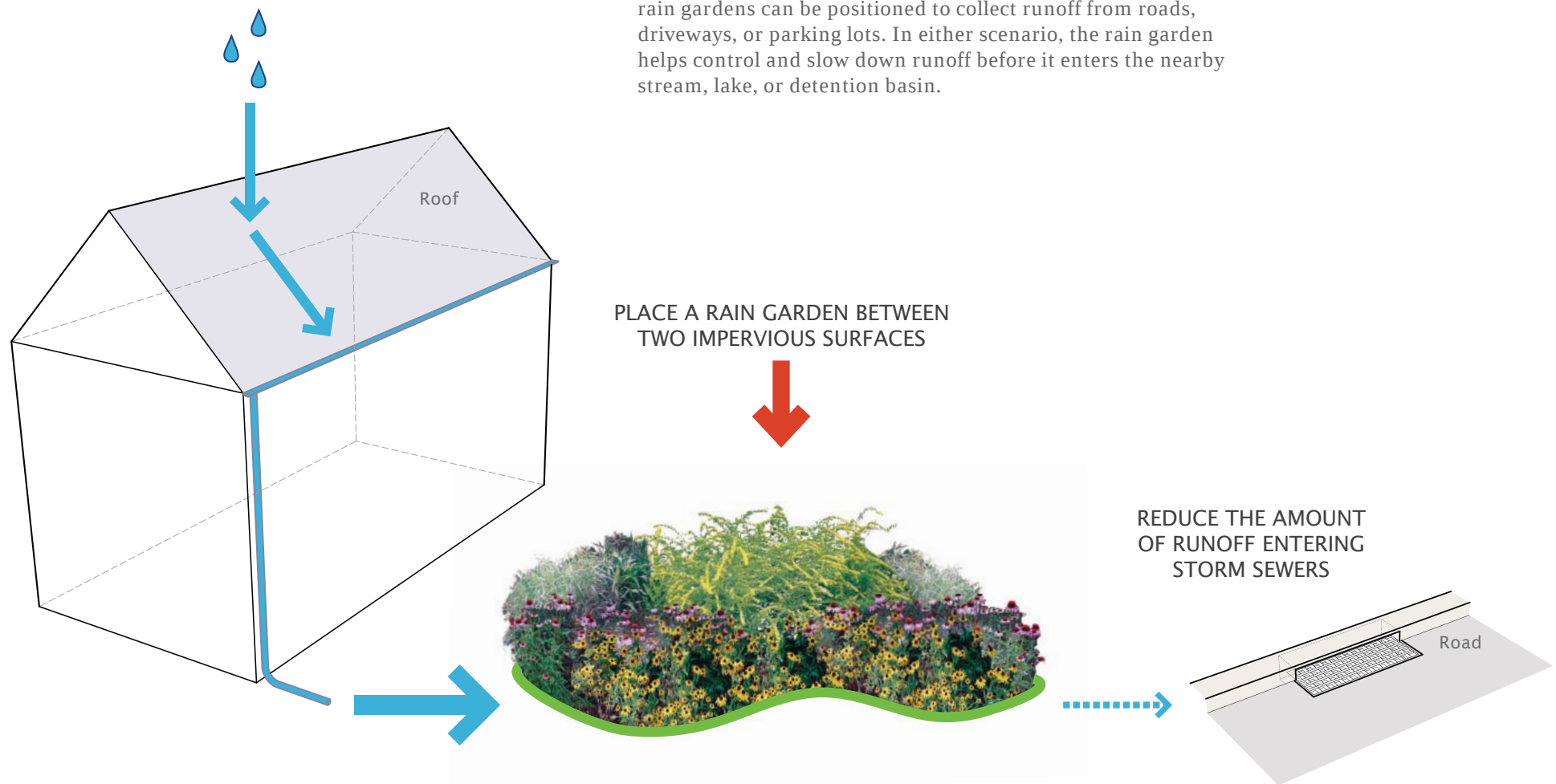
On the uphill side of a retaining wall if it is a structural feature (and not merely decorative) and was not specifically designed with a drainage system.

Beneath trees. Disturbing tree root systems (the tree's dripline) will cause stress, particularly to oak trees. If you cannot avoid doing this, do not disturb more than 10% of a tree's root system.

Over areas of shallow bedrock or shallow groundwater (three feet below ground surface or less). Shallow bedrock will hinder infiltration and plant growth, and shallow groundwater may cause permanent flooding in the rain garden. Also, shallow conditions may pollute the groundwater as the rain garden may not have enough time to filter pollutants before they infiltrate into the soil.

In addition to establishing the source of the water, it is important to determine where the runoff travels to once it leaves your property. Look for signs such as erosion, patches of dead grass, and areas of sediment accumulation to identify the preferred flow path of stormwater runoff.

Rain gardens are commonly placed at least ten feet from the end of a downspout so that the runoff flows off of the rooftop, down the downspout, and into the rain garden. Similarly, rain gardens can be positioned to collect runoff from roads, driveways, or parking lots. In either scenario, the rain garden helps control and slow down runoff before it enters the nearby stream, lake, or detention basin.



REMEMBER:

*SURFACE AREA EQUALS
LENGTH MULTIPLIED BY
WIDTH!*

$$SA = L \times W$$

Things to Consider

To ensure that the location of the rain garden is most appropriate, ask the following questions:

1. Does the house have rooftop gutters and downspouts that can be associated with a rain garden?

IF YES:

- Does the house have gutters that catch the roof runoff and direct this water to downspouts?
- Do these downspouts discharge onto the ground?
- Are these downspouts directly connected to the underground storm sewer?

2. If a connection cannot be made to the rooftop, examine the existing stormwater infrastructure.

- Is there a curb and/or gutter connected to the road, driveway, or parking lot?
- Are there any nearby catch basins or storm sewers? If yes, look into the catch basins. What direction does the pipe flow?
- Are there any existing swales and/or ditches?
- Are there any existing detention or retention basins?

3. What is the topography of the yard? (flat or sloped)

IF FLAT:

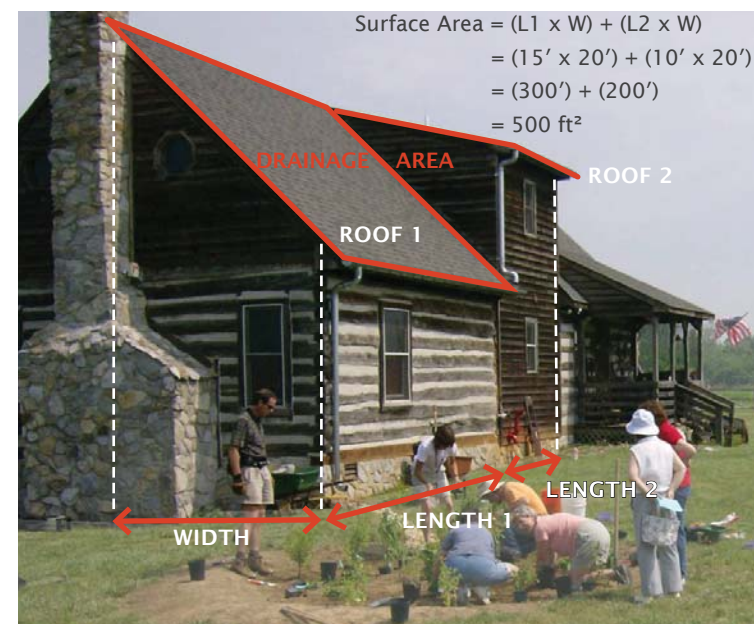
- A rain garden is best situated on a flat portion of the yard. This will make digging out the rain garden much easier.

IF SLOPED:

- A rain garden should not be placed on a slope of more than 12% because it may require a retaining wall or high berm to be able to hold the runoff entering the rain garden.

Drainage Area Calculation

Now that you have determined the appropriate site within your yard for the rain garden, you will need to determine the necessary size of the rain garden. To calculate this, identify the area of impervious surface that will drain into the rain garden. More than likely, this surface is either a rooftop or a paved surface such as a road, driveway, or parking lot. The size of this impervious surface area will help determine the size (square footage) of your rain garden.



In this example, the total impervious surface area consists of two roofs with the same width but different lengths.

Hockman Farm
Winchester, VA

Drainage Area: The Rooftop Scenario

To begin, the rooftop scenario is the easiest method for determining the drainage area, as it is a simple calculation of the volume of water that discharges from the impervious surface of the roof, into the gutter, and carried to the ground by a downspout.

Using a measuring tape, measure the area of the roof by measuring the length and width along the foundation of the building where the building meets the ground. If there are two different roof surfaces draining into the same downspout, add their areas together to get the total surface area. Refer to the image on the previous page for an example calculation. If a single rooftop has more than one downspout, and the rain garden will only connect to one of those downspouts, you will need to figure out the roof top area draining to just the one downspout. To do this, take the total surface area of the rooftop and divide it by the total number of downspouts.

If the building has no gutters or downspouts, you can install a shallow ditch lined with stones along the roof dripline to convey the water into the rain garden.

If the downspout connects with underground pipes directly to the storm sewer system, try to disconnect the downspout before the pipe goes underground. Divert the water to the rain garden using a PVC pipe and fittings and/or a corrugated plastic pipe.



Drainage Area: The Road, Driveway, or Parking Lot Scenario

The road, driveway, or parking lot scenario is a bit more difficult to calculate, as the drainage area may be more difficult to define. It is best to go outside after a rain event, observe the direction of the runoff, and measure the surface area of the impervious surface that is flowing into the rain garden. Sediment accumulation along curbs provides evidence of the direction of water flow; if there is no curb, look for dead grass patches and erosion. Remember that roads, parking lots, and driveways are often pitched to convey water to one side, or both sides (in this case, look for a slight ridge in the center).

If there is no curb between the impervious surface and the location of the rain garden, it is best to leave a grass buffer (at least two feet wide) between the road and the rain garden. To help direct the runoff into the rain garden, a notch (approximately one foot wide) lined with stone can also be cut into this buffer area. The stone will help to slow the flow of water.

If there is a curb between the impervious surface and the location of the rain garden, a curb cut is needed. This will allow the water to flow into the rain garden.



A curb cut and a stone buffer provides the inlet for runoff to enter the rain garden from the adjacent roadway.

Lions Lake Park
Voorhees, NJ



Make observations after a rainstorm to determine the direction of the runoff and the drainage area of the rain garden.



The image on the far left shows the approximate drainage area for a roof with more than one downspout. The two images in the center and near right depict both before and after the disconnection of the downspout from underground pipes.

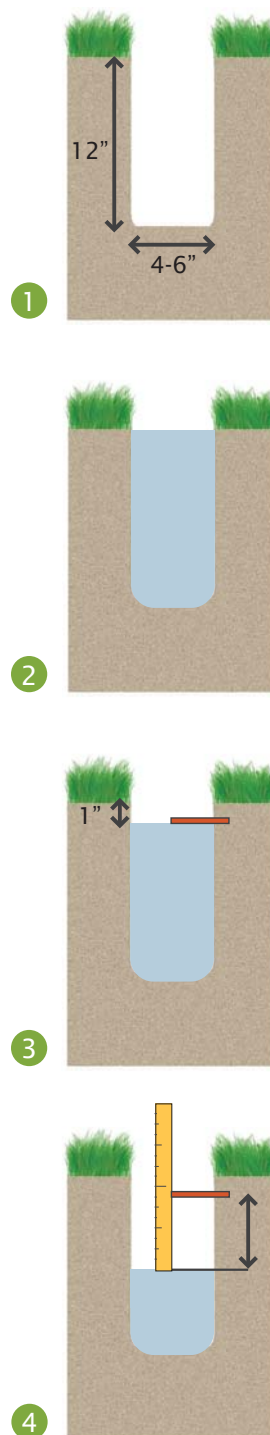
Summit Middle School
Summit, NJ

Check Your Soil: Infiltration Test (Percolation Test)

Good soil drainage is important. Determine how fast the soil drains at your site by conducting an infiltration test (also referred to as a percolation test). This test will let you know how well the existing soil infiltrates water. Ideal soils will infiltrate completely within 24 hours at a percolation rate of approximately 1.5 inches per hour.

As the diagram to the right indicates, complete the following steps:

1. Dig a hole in the proposed rain garden site, approximately 12 inches in depth and four to six inches in diameter. To be more accurate, dig two holes. A standard post-hole digger is typically the tool of choice for this activity.
2. Fill with water to saturate the soil and then let stand until all the water has drained into the soil.
3. Once the water has drained, refill the empty hole again with water so that the water level is about one inch from the top of the hole. Use a stick to indicate the location of the starting water level. Record the time using a watch. Measure the depth of the water with a ruler.
4. Check the depth of water with a ruler every hour for at least four hours.
5. Calculate how many inches of water drained per hour. With sandy soils, the water should descend quickly. With clay soils, the water should descend slowly.

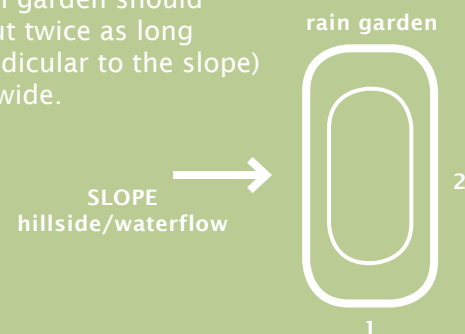


If the drainage rate is less than 1.5 inches per hour, or the water does not drain within 24 hours, add soil texture amendments such as coarse sand during installation. Alternatively, consider placing the rain garden in a different location on your property.

It is important to note that sometimes an infiltration test provides a false reading of a site's soil conditions. For example, during dry conditions, an infiltration test may demonstrate that the soil drains quickly and does not need amendments. However, during a rainy season, an infiltration test on that same soil may reveal that it is clayey and does not infiltrate well.

A GOOD RULE OF THUMB:

The rain garden should be about twice as long (perpendicular to the slope) as it is wide.





As illustrated in the image on the left, in addition to the recommended soil amendments, it may be helpful to add sand wicks to a rain garden site with clay soils. To do this, dig out holes, preferably 1 foot deep if possible, and fill in with pockets of coarse sand. This will increase the infiltration capacity of the rain garden.

Trailside Nature Center
Mountainside, NJ

Check Your Soil: Soil Test

While the infiltration test will give an initial evaluation of the site's soil conditions, a soil sample that you collect and submit to Rutgers Cooperative Extension (RCE) Soil Testing Laboratory will provide the most accurate reading of the soil (refer to page 59 in the Appendix of this Manual for contact information and a sample soil test analysis). The standard soil fertility test, which includes both a nutrient and pH analysis and recommendations, costs approximately \$20. A soil texture test/mechanical analysis (sand, silt, clay percentage) is \$30. You can purchase a soil test kit from your local RCE County Office. At the potential rain garden site, take approximately ten random soil samples near the location that you would like for your future rain garden. When taking your soil sample, remember to take about ten soil cores randomly at depths of 3, 6, 9, and 12 inches. Combine all of these into one composite sample. Send the soil sample and the order form to the RCE Soil Testing Laboratory. The results usually take about two weeks and will recommend any amendments needed for the soil based on the nutrient and pH analyses. The results of the soil texture test will help in calculating if coarse sand, topsoil, and/or compost are needed for the rain garden.

It is very likely that your soils will be highly compacted and will not drain well. To compensate for this, you may need to use a special soil mix within the rain garden. An ideal soil mix for a rain garden is 85 to 95% sands with no more than 25% of the sands as fine or very fine sands; no more than 15% silt and 2 to 5% clay content. The entire mix shall be amended with 3 to 7% organics (*NJBMP Manual, 2009, page 9.1-4*). You may be able to use the existing soil, but if it is not in good condition, you may have to spend money on new soil and/or amendments such as lime, gypsum, and specific nutrients.

REMEMBER:

A rain garden is not a garden permanently filled with water!

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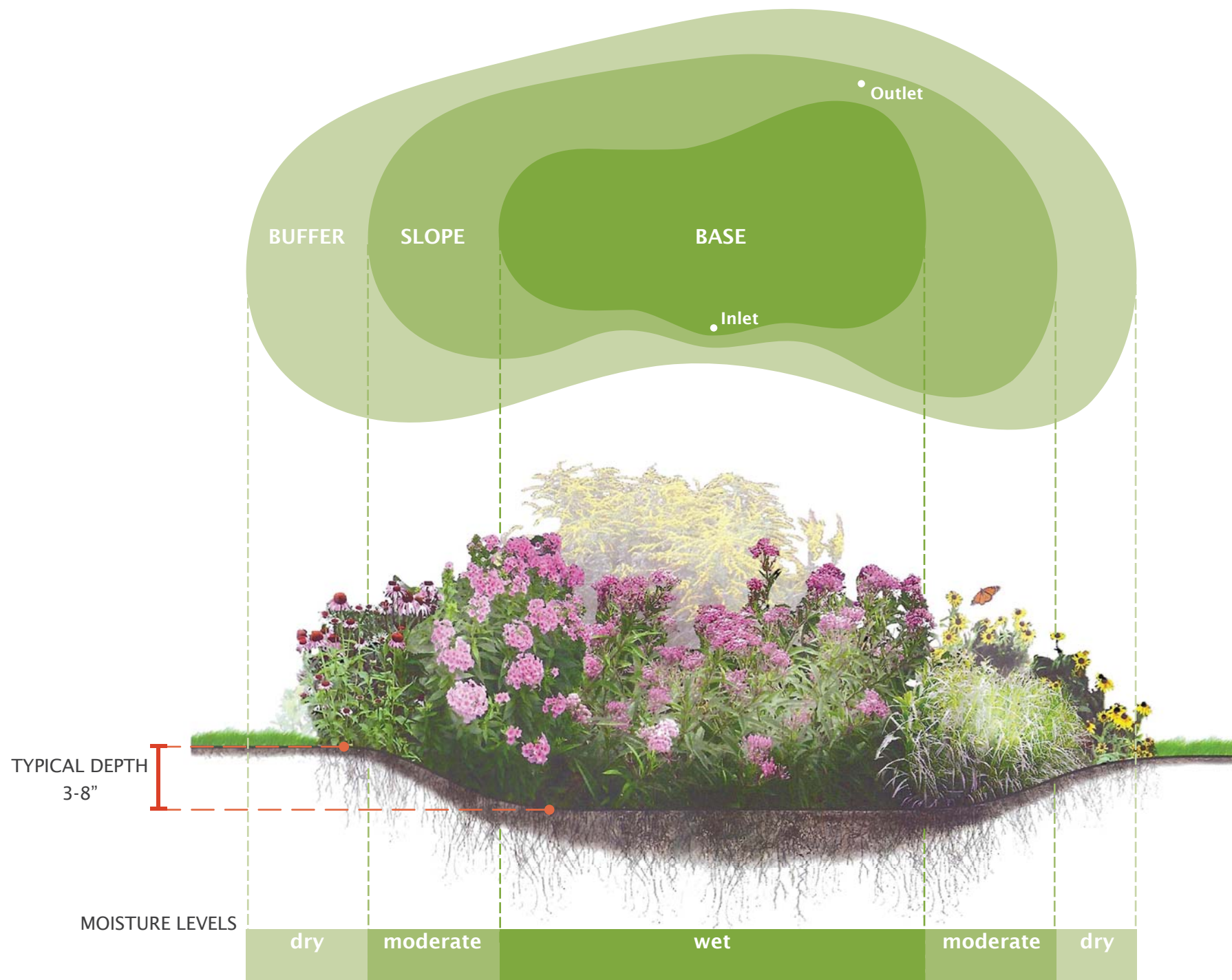
Insert the trowel or spade to a depth of 3, 6, 9, or 12 inches, remove some soil and set it aside.



Insert the trowel again ½ inch from the first cut and just as deep. Collect a thin slice of soil, and place it in a clean bucket.



Repeat this procedure about ten times, and combine all of these soil cores into one composite sample.



Determining the Depth of the Rain Garden

The depth of the rain garden is dependent upon the soil texture found at the potential location for the rain garden. The depth of a rain garden usually ranges from three to eight inches. Typically, a rain garden with sandy soil should be eight inches deep, and a rain garden with silty soil (in between sandy and clayey) should be six inches deep. A rain garden with clay soil should be three inches deep. As mentioned on pages 22-23, clay soils do not infiltrate well and need soil amendments. Rain gardens in clay soils should have an increased surface area (square footage), as well as a decreased depth. For a further explanation on rain garden depths, refer to the diagram on the right.

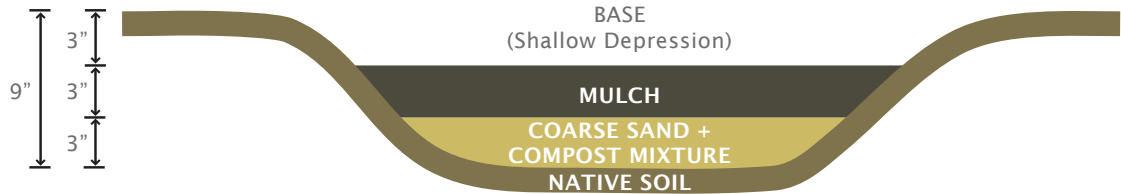
Determining the Size of the Rain Garden

The size of the rain garden is dependent upon the amount of runoff entering the rain garden. Using the drainage area calculated on pages 20-21 and the existing soil texture of the rain garden, refer to the Rain Garden Sizing Table (below, right) to determine the necessary square footage of your rain garden. For example, a drainage area of 750 square feet with clay soils would need a rain garden with an area of 350 square feet. If you do not have the adequate space for the size of the rain garden that the Sizing Table recommends, build it as close to the recommended size, and then account for more overflow. A rain garden is sized to handle New Jersey's Water Quality Design Storm of 1.25 inches of rain over two hours.

6" DEEP RAIN GARDEN - NO SOIL AMENDMENTS



3" DEEP RAIN GARDEN - SOIL AMENDMENTS



Rain Garden Depth

The depth of a rain garden (usually in inches) refers to the open space of the rain garden's base. A rain garden with amendments needs to be dug deeper than a rain garden without amendments to accommodate for the sand and compost. As the above diagrams depict, the rain garden with soil amendments has a depth of three inches, while the rain garden without amendments has a depth of six inches, despite the fact that both rain gardens were both originally dug down to a depth of nine inches. The three inch layer of amendments (one cubic yard) accounts for the difference.

Rain Garden Sizing Table Based on New Jersey's Water Quality Design Storm

Drainage Area	Size of 3" Deep Rain Garden CLAY SOIL*	Size of 6" Deep Rain Garden SILTY SOIL	Size of 8" Deep Rain Garden SANDY SOIL
500 ft²	200 ft²	100 ft²	75 ft²
750 ft²	350 ft²	150 ft²	112 ft²
1,000 ft²	400 ft²	200 ft²	149 ft²
1,500 ft²	600 ft²	300 ft²	224 ft²
2,000 ft²	800 ft²	400 ft²	299 ft²
*SOIL TEXTURE AMENDMENTS NEEDED			

REMEMBER:

Soil texture amendments improve the rain garden's infiltration rate.

Soil quality amendments improve the rain garden's growing conditions for plants.

Determining Soil Amendments of the Rain Garden

The existing soil conditions found at the site of your rain garden will determine whether or not soil amendments are necessary. There are two different types of amendments that you may need to add: soil texture amendments and soil quality amendments. Soil texture amendments will increase the rain garden's ability to retain water, and soil quality amendments will improve the rain garden's growing conditions for plants. See page 35 in the next Chapter for more information regarding the installation of soil amendments.

Soil Texture Amendments

Soil texture amendments improve the soil's ability to infiltrate water. Remember that sandy soils have the fastest infiltration; clayey soils have the slowest. The ideal soil texture for a rain garden is a sandy loam soil, as it retains nutrients and water, while still allowing for adequate infiltration.

The results of the infiltration test will determine if the soil needs soil texture amendments. As indicated on page 22, if your infiltration test resulted in more than 1.5 inches of infiltration per hour, amendments are not necessary. Conversely, if your infiltration test resulted in less than 1.5 inches of infiltration per hour, you should add soil texture amendments to the soil, as your soil is likely compacted or poorly drained. Coarse sand is typically used as a soil texture amendment, with a loamy topsoil, purchased at a local garden shop, mixed into it. Generally, it is recommended to add one cubic yard (a combination of sand and compost) of amendments for every 100 square feet of rain garden, which translates to a three inch layer of amendments.

Soil Quality Amendments

Soil quality amendments improve the soil's nutrient capacity, which results in improved growing conditions for plants. Adding soil quality amendments can be appropriate for any soil type based upon the soil test result recommendations from the Rutgers Cooperative Extension Soil Testing Laboratory. Common soil quality amendments include: gypsum, lime, fertilizer, or other organic matter.



compost



mulch



coarse sand



river rocks

Determining the Inlet and Overflow

Stormwater runoff enters the rain garden from an inlet, which can be an extended gutter, a stone or concrete spillway, a vegetated or stone-lined swale, a diversion berm along the bottom of a slope, a paved surface, or across a sloped lawn. Most of the stormwater that enters a rain garden should infiltrate into the ground within the first 24 hours following a typical rain event. For larger storms, stormwater exits through the overflow area, which usually consists of a low point in the berm directing flow away from structures and toward open lawn areas or a stormwater catch basin. The area should be protected with stones and landscaping fabric to prevent erosion and weed growth.

The images to the right of the Cherry Hill Department of Public Works Building show how water flows from the gutter on the roof, descends through the downspout to the ground surface, and enters into the rain garden through the inlet. The water exits the rain garden through the outlet and overflow area. In this case, it flows through an underground pipe under the sidewalk to a nearby catch basin in the parking lot.

Preventing Erosion

There are several effective ways to prevent erosion from occurring in the rain garden. First, do not make the slopes of the garden too steep (a slope no greater than 3:1). In addition, slowing down the velocity of the water flowing through the rain garden will minimize erosion. In the inlet area, add a one foot wide area of rocks to slow the flow of water. Remember that more rocks can always be added after installation if there are any signs of erosion.

Determining Mulch Quantity

Allow for a three inch depth of mulch (triple-shredded hardwood with no dye) to be spread throughout the entire rain garden. This means that every 50 square feet of rain garden needs 0.5 cubic yards of mulch. For example, a 100 square foot rain garden requires 1.0 cubic yards of mulch.

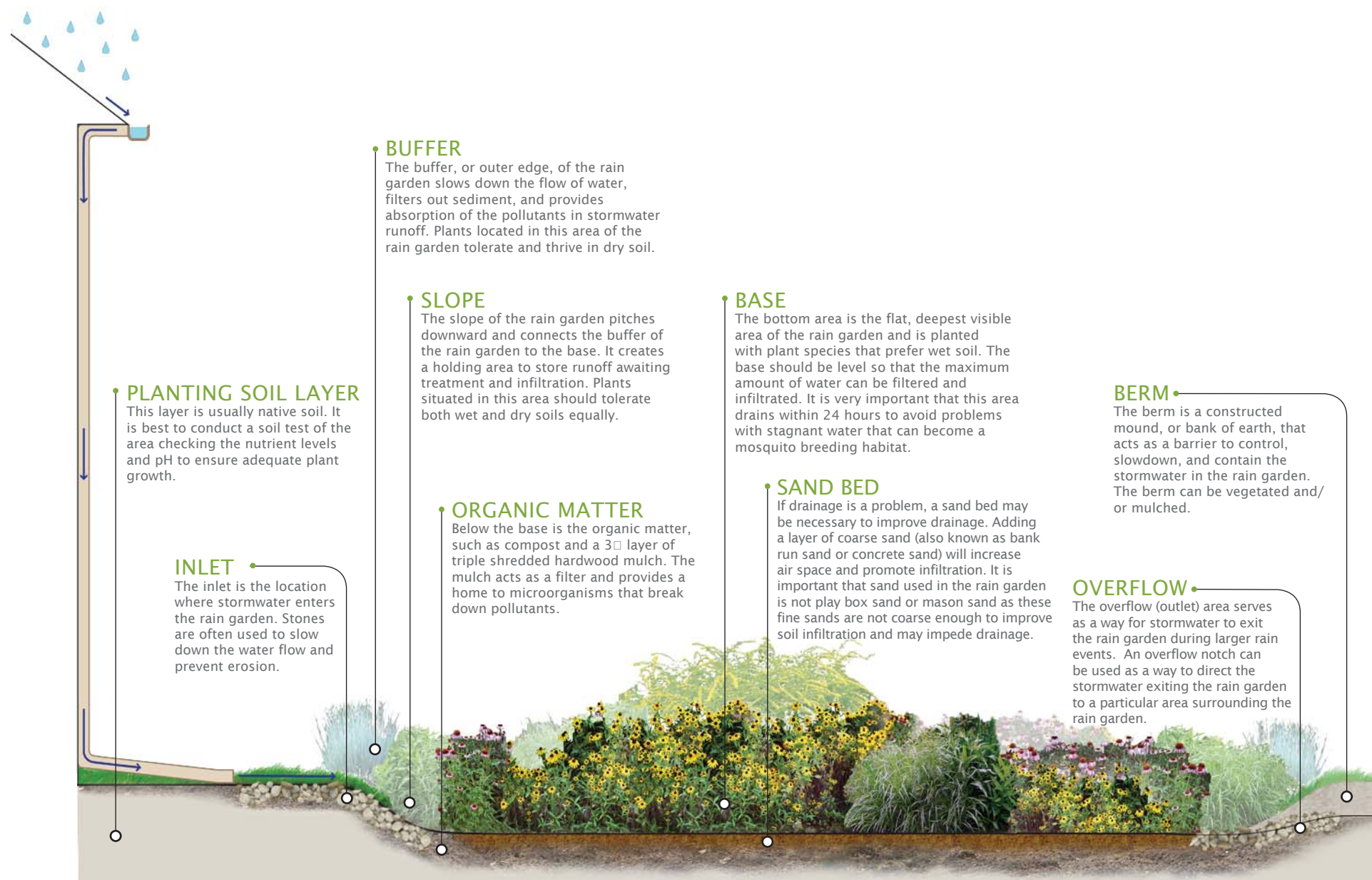


This plastic catch basin serves as the rain garden's outlet by connecting to a pvc pipe running underneath the adjacent sidewalk so that the water can overflow into the parking lot.

Cherry Hill Department of Public Works
Cherry Hill, NJ

Parts of a Rain Garden

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Rain Garden Design

Shaping Your Rain Garden

Go outside to the location of your rain garden. Using a garden hose or rope, outline the desired shape of your rain garden on the ground. This will provide you with the most flexibility to adjust the shape, but spray paint or stakes will also work.

Although many rain gardens are in the shape of a circle or a kidney bean, your rain garden can take on whatever shape you prefer. Sketching may help you develop a layout with which you are comfortable.

Selecting Plants for Your Rain Garden

The success of your rain garden depends on selecting the right plants for the right place. Observe your rain garden site and record pertinent information such as hours of sun, reflections off of adjacent buildings and excessive wind. These conditions may contribute to unusual 'microclimates' due to increased heat or exposure, and it is necessary to choose plants accordingly.

Plant your rain garden with plants adapted for your specific site. Whether in the sun or shade, rain gardens can be planted with shrubs and accentuated by flowers that are beautiful and low maintenance – as long as you select the plants that love the given conditions. Native plants, or plants that are indigenous to this climate or region, can thrive without a lot of care, extra water, fertilizer, or pesticides.

In particular, use native hardy perennial species with well-established root systems that survive in both dry and wet conditions. These plants do not require substantial fertilization, absorb water more efficiently than turf-style grasses, and are much easier to maintain than exotic species.



May



June



July



August

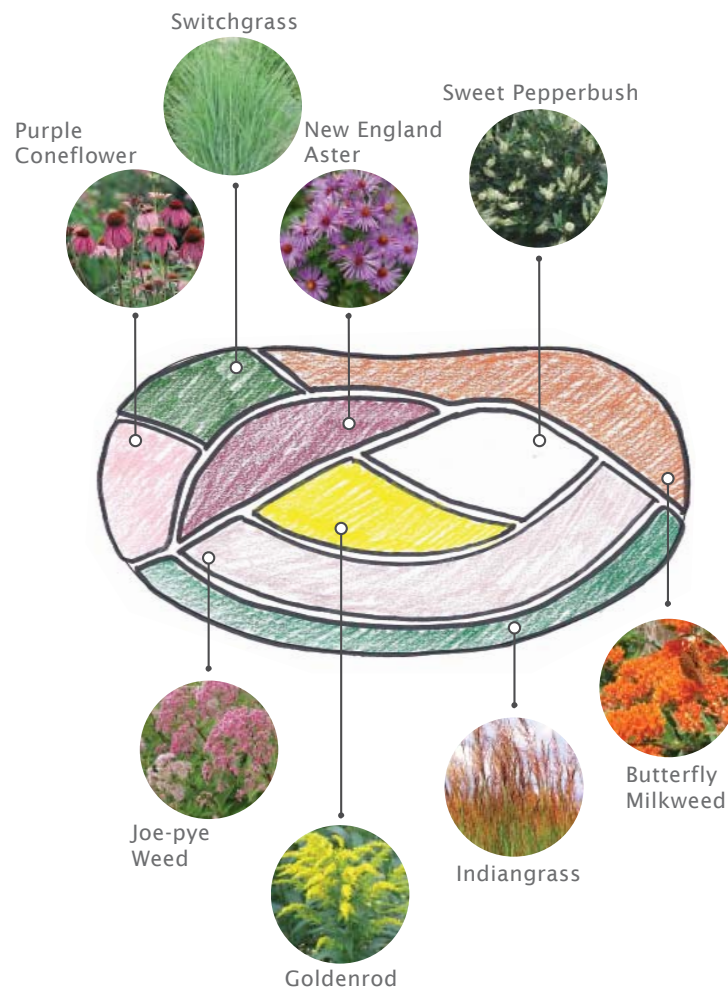


September



October

Butterfly Habitat Rain Garden: Planting Plan



WETLAND INDICATOR STATUS:

For standardized information on plant species, check this out:

www.plants.usda.gov

In addition to plant characteristics such as bloom time, sun and soil requirements, and flower color, this website provides the U.S. Fish and Wildlife Service wetland indicator status for each plant species. Page 31 of this Manual includes a sectional study of plant moisture tolerances.

Select species based upon the following qualities:

- Plant size
- Seasonal interest
- Moisture tolerances
- Sun preferences
- Plant aggressiveness
- Salt tolerance
- Habitat creation.

Using the planting plans included in this manual as inspiration, create a sketch of your rain garden design. Refer to pages 60-66 of the Appendix in this Manual for suggested planting plans and native plant lists. Refer to pages 54-57 for sources of native plant material.

Your planting layout should directly correspond with the layout of the buffer, slope, and base of your rain garden. The plant list on page 60 of this Manual lists appropriate plants for each rain garden zone. In particular, plants that like wet conditions belong within the base. Refer to the following page (page 31) for information regarding planting guidelines based upon the U.S. Fish and Wildlife wetland indicator status.

Plant spacing depends upon the future mature size and the growth rate of the plant species you select for your rain garden. Nurseries carry various sized containers. Although more expensive, larger plants may bloom faster; they are also more likely to experience transplant shock. Plugs, which are a small, economical option, may be available, particularly for grasses.

Plants that grow and spread quickly will need to be planted farther apart. Follow the spacing guidelines specific to each species. This will aid you in determining how many plants you need to fill your rain garden.



As this rain garden demonstrates, using plants that differ in height, color, shape, bloom time, and textures increase the aesthetic appeal of a rain garden. In addition, these homemade plant markers add interest and a bit of personality to the rain garden. Be creative!

Burlington County Community Agricultural Center
Moorestown, NJ

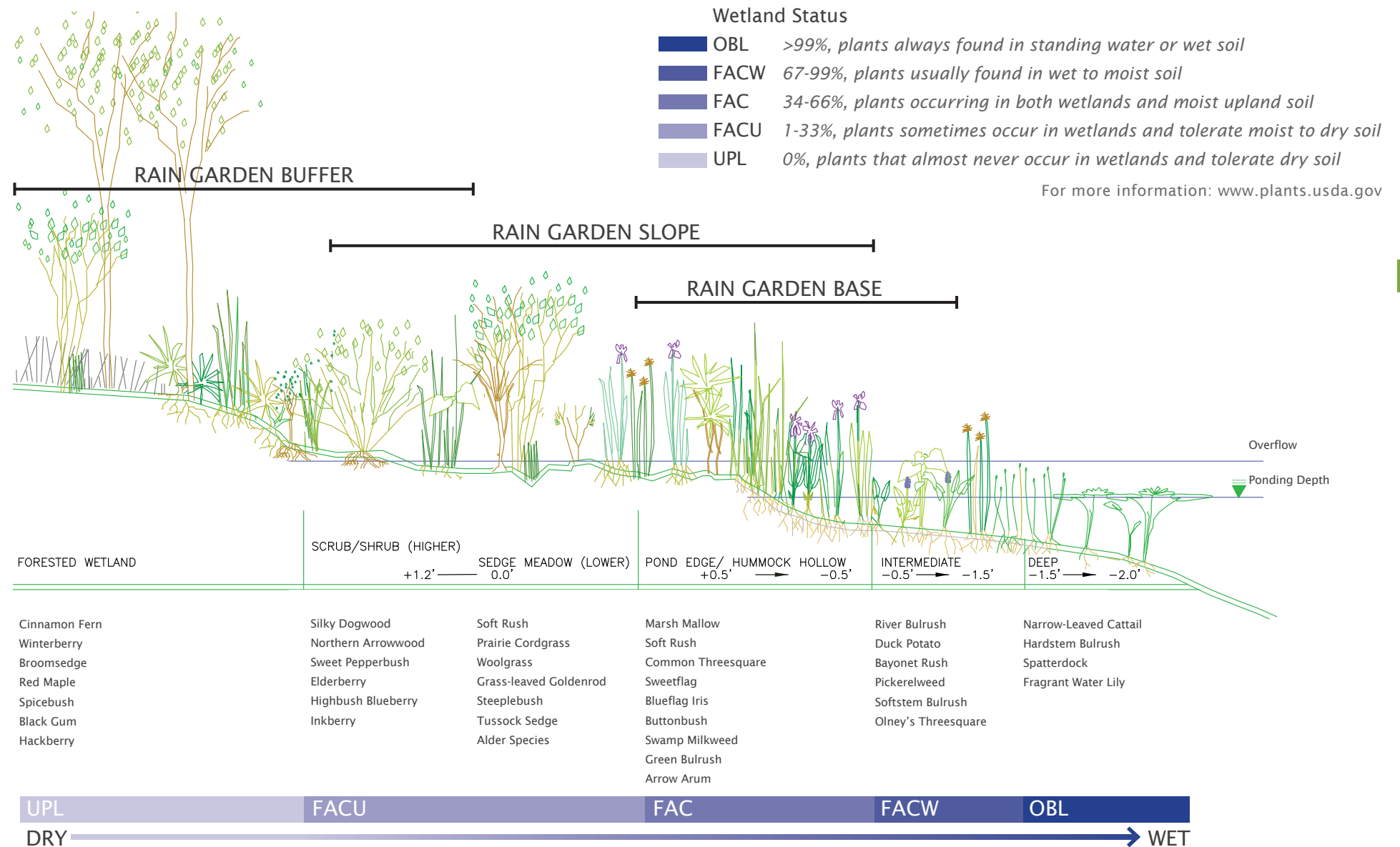
PLANTING DESIGN TIPS:

- Plants that prefer wet conditions should be planted in the deepest part (the base) of the rain garden where water will collect. Plants that prefer average or drier conditions should be planted along the edges of the rain garden.
- Create depth in the rain garden by placing large and tall plants in the back and smaller plants in the front.
- Plant masses of the same species together in odd numbers (generally three or five containers per species).
- Incorporate plants that have visual interest in the fall and winter. Grasses and evergreens can work well in a rain garden, and they provide color and interest in the colder months.
- Native plants provide habitat to animals and require less watering, and there are quite a few deer-resistant native plants species.

Wetland Indicator Status

Generalized Planting Guideline for Ponds + Wetlands Typical Planting Zones

This diagram illustrates typical planting zones for ponds and wetlands in New Jersey. Use a plant's wetland indicator status as a guide to where it should be planted in a rain garden.





Belmar Community Rain Garden
Belmar, Monmouth County, NJ

INSTALLING YOUR RAIN GARDEN

Key Points:

- Before installing the rain garden, it is essential to contact New Jersey's "One Call" system to get a free markout of underground utilities.
- Avoid compacting the soil of the rain garden during the installation phase.
- Planting native plants will not only be easier to maintain, but they also provide food and habitat for native animal populations.

CHAPTER 3

DO NOT FORGET!

Know what's below.
Call before you dig. **811**
1-800-272-1000
NJ One Call

Installing your Rain Garden

Getting Started

You have completed the necessary steps of planning and designing - now it is time to install your rain garden!

Before you begin the installation process, there are several important things to consider. First, it is most effective to start the actual construction of the rain garden in the spring when the abundant rains will allow for best plant establishment and easier digging. A summer or autumn start will also work, but the plants may need more watering until they become established.

Go outside to the site or your rain garden. Referring to your sketches and notes from Chapter 2, use a garden hose, rope, or spray paint to layout the shape of the rain garden. Make sure that the placement of the rain garden does not conflict with any of the utility markouts including underground gas, water, sewer, cable, telephone, and electric.



Village School
Holmdel, NJ

INSTALLATION STEPS:

1. Remove existing grass
2. Excavate to desired elevation and grade
3. Add soil amendments
4. Prepare berm (if necessary)
5. Prepare overflow
6. Level the base (lowest area)
7. Plant native species
8. Apply mulch
9. Water plants

Remove Existing Grass

Removing the existing grass can be done by digging with a shovel, renting a sod-cutter from a local hardware store, or hiring a landscape professional to do the work with a backhoe. Refer to www.water.rutgers.edu for a listing of landscape professionals trained in rain garden installations. Although a bit more costly, using a landscape professional may be advantageous, particularly if your rain garden is large and deep. The backhoe that a licensed operator uses will not only remove the grass, but it will easily dig deep into the ground. Regardless of the removal method, take out large chunks of grass with roots intact. This sod can be reused on the rain garden's berm or on other patches of the yard lacking grass.

ReBuilder's Source, Sustainable South Bronx
Bronx, New York City, NY



Excavate to Desired Depth and Slope

Using either a shovel or a backhoe, excavate the area to the desired depth. Remember that the soil infiltration test determines the appropriate depth of the rain garden. At this point, the hole that you dug should appear wide and flat. Now, consider how the edges of the rain garden meet the existing grade. Ideally, edges should maintain a gentle slope, perhaps a 3:1 slope or flatter. This means that if the rain garden has a depth of eight inches, the sides will slope down gradually for 24 inches, or three times the depth.

Add Soil Amendments

You have already determined whether or not your rain garden needs soil texture amendments and/or soil quality amendments (refer to page 26 in the previous chapter), so now it is time to add these necessary amendments.

Adding soil texture amendments consists of adding coarse sand and compost (loamy topsoil) to loosen up the soil and improve the drainage. First remove about four to six inches of the native soil (or even up to eight inches with heavy clay soils) from the base, or the deepest part, and set it aside temporarily. Use a rototiller to break up the soil that remains within the base. If you do not have a rototiller available, use shovels and rakes instead. Add about an inch of loamy topsoil and coarse sand at a time to the base of the rain garden, combining it with a small amount of the extra soil that you removed previously. Use the rototiller to work this soil mixture into the rain garden's soil; repeat these steps several times until you have added about two to three inches of loamy topsoil and coarse sand. Once you have built the soil of the base back up to the desired depth, level the base by raking and grading it. Refer to the diagram on page 25 for more information. You may have excess native soil material that can either be used for the berm or for a different area of your yard.

For the soil quality amendments, refer to the recommendations from the RCE Soil Testing Laboratory. The soil test results will specify the exact amendments needed, the proper quantity of these amendments, and the installation process.

TOOLS + MATERIALS NEEDED:

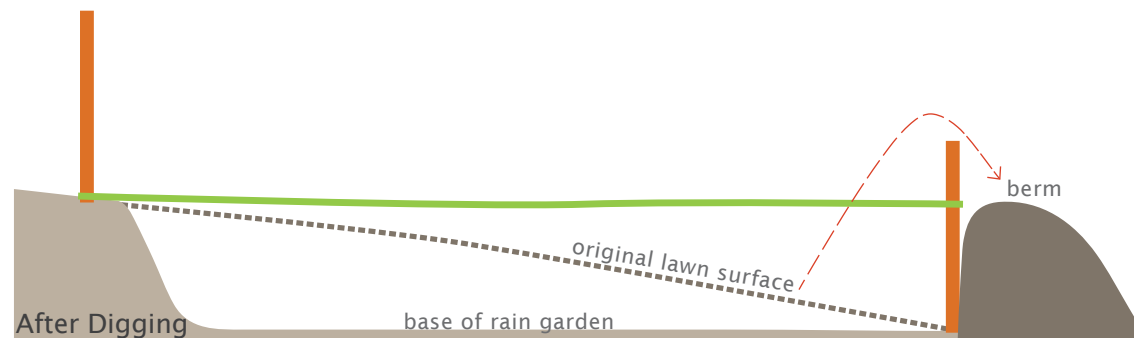
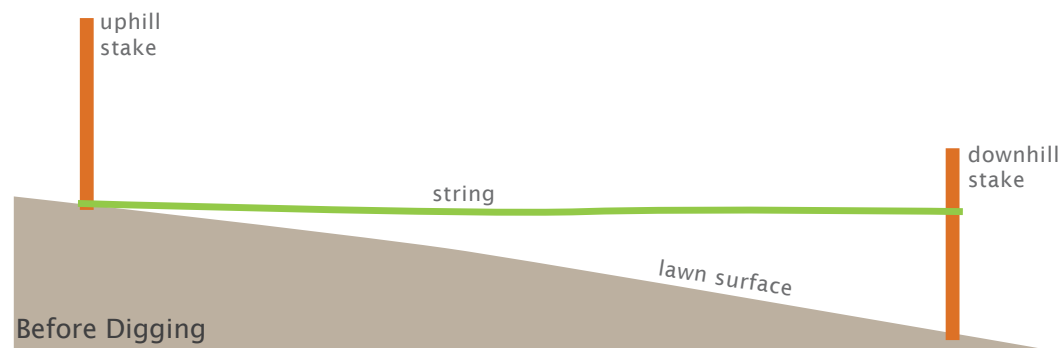
- Rakes and shovels
- Rototiller
- Wheelbarrow
- Triple-shredded hardwood mulch
- Plants
- Soil amendments, if necessary: fertilizer, pH adjustments (lime), coarse sand (bank run)
- Optional: decorative stone, signage, seating, pipe extensions, pavers for path
- Work crew (friends, neighbors, and family)

Prepare the Berm

Next, you may need to create a berm for the rain garden. As the diagram below illustrates, a berm is the mound of soil found along the rain garden's downhill side which acts as a barrier to control and contain stormwater during heavy rain storms. It is important to note that a berm may not be necessary if the rain garden is located on a level area in your yard. Use the soil that you shoveled out of the base to build the berm. Plant grasses, particularly native species, on the berm to help filter and slow down the flow of water leaving the rain garden.



Building the Berm



Prepare the Overflow

Once you have built the berm, you can prepare the overflow drainage area, which is a notch, or lowpoint, in the berm. This typically consists of river stone and landscape fabric and will serve as a way for stormwater to exit the rain garden during heavy rain events. First, to reduce weed growth, line the area with landscape fabric. Spread river stone out over the fabric, at a depth of three to six inches. The stone placed at this outlet point will slow the water, reducing erosion. Make sure that the overflow directs the flow of water away from structures and towards vegetated areas or a stormwater catch basin.

Level the Base

Before planting any plants, it is important to carefully level the base of the rain garden to prevent ponding in any one area. As the image above indicates, to check for level use two stakes, mason string, a string level, and a ruler or meter stick. Tie the string tightly between the two stakes, using the string level to ensure the string is level. Use the ruler to measure from the level mason string to the ground surface to ensure that the base is level. Repeat this process several times, ensuring an even surface throughout the entire base of the rain garden. If the base is not level, use a shovel and rake to correct it.

In addition, prior to planting, you may want to check the infiltration rate of the rain garden. This can also be conducted after planting, but it is much easier to modify and rework the soil without plants in the ground. Use a garden hose to soak and fill a small area of the rain garden. After the area has been soaked, fill with approximately two inches of water. Examine the area to make sure that it drains within an hour. If the garden drains adequately, install the plants as soon as possible. Wet soils will help the plants adjust easier to their new surroundings. In contrast, if it does not drain well, mix coarse sand into rain garden soils before planting to improve drainage. For more information, refer to the image of sand wicks on page 23.

Install the Plants

You are now ready to plant. First, look at any sketches or planting plans you developed during the design/planning phase. Mark out the location of each plant, making sure to maintain the recommended distances between each plant. Using a rope to outline the planting scheme may help.

Avoid compacting the soil during planting. To do this, minimize the amount that people walk through the garden during planting. If the rain garden is large, put a temporary pathway of mulch down where you expect to walk. Remove the mulch before you plant.

Protect plants from extreme sun and wind exposure. Keep them cool and moist prior to planting.

Dig a planting hole that is both deep and wide enough to let the roots hang vertically to the bottom of the hole. Keep in mind that the depth should be approximately the same as the plant's original container. Refer to the image on the top right.



Watch out for root-bound plants. Take the plant out of its container and observe for overgrown roots wrapped around the outside of the rootball. The roots of root-bound plants will continue to grow in a circle, confined to the shape of its original container. To ensure that the plant grows freely in the ground, make several vertical cuts down the sides of the rootball, and pull the roots apart. Refer to image on bottom left.

Place the plant so that the surface of the ground is slightly below the base of the plant. The rootball should be entirely enveloped by soil.

To reduce the number of air pockets around the roots, backfill the hole and water the plants.

Apply the Mulch

Once the plants are in the ground, apply mulch. Along with maintaining moisture and coolness, the layer of mulch will thwart weed growth. Add approximately two to three inches cover, making sure to leave about an inch of space surrounding the plant stems. When spreading the mulch, use the empty plant containers to protect small plants. Triple shredded hardwood mulch with no dye is preferred for rain gardens.

Water the Plants

Lastly, do not forget to water the plants! Plants should be watered immediately after planting and twice a week, unless it rains, until well established. Establishment usually occurs after the first year, when the plants will only need water during hot, dry spells. Using soaker hoses, at least for the first year, will make it much easier for you to maintain your rain garden.

The following pages contain photographs documenting each of these steps of building a rain garden. This specific rain garden installation occurred at the Gloucester County 4-H Fairgrounds in March 2008 as part of the Rain Garden Training for Professional Landscapers, funded by a United States Department of Agriculture (USDA) National Institute for Food and Agriculture (NIFA) National Water Program grant (www.usawaterquality.org).

Delineate the rain garden, using either spray paint, a rope, or a garden hose.



Remove existing grass with either a shovel or machinery. If using machinery, the heavy weight of the machinery can compact the soil. Be sure to only run the machinery along the edge of the rain garden, not directly on top of it.



Dig the rain garden to its appropriate depth based upon the soil infiltration test.



Add soil amendments if necessary. Use a rototiller or shovel to combine amendments with existing soil. Loosen and prepare the soil.



Shape the rain garden bed. Create a berm and an overflow area (outlet) for the water.



Level the base (lowest area) of the rain garden to prevent ponding. Use a ruler, two stakes, and something level to check for an even surface. If the base is not level, use a rake and shovel to smooth it out.



Before planting, place each plant in the desired locations. Dig a hole of equal depth, but slightly wider, to the size of the container. Take the plant out of the container, loosen the roots, and plant.



Use empty plant containers to protect small plants. Apply two to three inches of mulch throughout the rain garden.



Water plants, either by installing a soaker hose or watering manually.



At time of installation



First growing season



Second growing season



Photos courtesy of: United States Department of Agriculture and Madeline Flahive DiNardo

Pinelands Nursery
Columbus, Burlington County, NJ
Photograph courtesy of Don Knezik



MAINTAINING YOUR RAIN GARDEN

Key Points:

- Rain gardens are **low** maintenance gardens, not **no** maintenance gardens!
- Rain gardens should be inspected during the growing season, at the end of the growing season, after large storm events, and during weather extremes.
- The maintenance of a rain garden consists of tasks to be completed on a weekly basis and other tasks as they are needed seasonally.

CHAPTER 4

Maintaining Your Rain Garden

Initial Things to Consider

A rain garden will not require as much care as a lawn area but will need some maintenance to ensure long-term success. Weekly maintenance tasks include watering and weeding, while tasks such as mulching, pruning, mowing, re-planting, and soil testing can occur less frequently on an annual basis.

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REMEMBER TO:

Take pictures before, during, and after installation!

Town of Ulster Municipal Building
Ulster, NY



Weekly Maintenance

Watering

Water plants regularly, particularly during dry periods of the first growing season. Of course, the amount of water you provide will vary depending upon the plant species selected, but most plants require about an inch of water per week during the first growing season. Root systems will develop and become more substantial, so that after the first growing season, you will only have to water during severe dry periods.

Keep in mind that young, small plants are most vulnerable to stress. Be cautious that they do not get too dry or too wet. If you expect large amounts of rain soon after the rain garden's installation, cut an indentation in the berm. This notch will prevent the water in the rain garden from getting too deep and oversaturating the young plants. To be most effective, make sure that this indentation is cut lower than the overflow notch. You can fill in the indentation after a few months, once the plants have grown a bit larger, so that the rain garden will collect and contain more water.



Weeding

During the first few years, you will, more than likely, need to weed often during the growing season. You will need to weed less and less as the plants grow and surpass the weeds, so that by the third year you should only be weeding several times a year. Watch out for the most aggressive, invasive weed species.

Common Invasive Plants

(from left to right)

Multiflora Rose
Chinese Wisteria
Japanese Honeysuckle
Purple Loosestrife

Japanese Stiltgrass
Thistle
Asiatic Bittersweet
Garlic Mustard

CONSIDER THIS:

Many native plant species provide berries for birds, nectar for butterflies and hummingbirds, and food for caterpillars.

Make sure that your local nursery propagates from seed! This will increase regional plant diversity.

Annual Maintenance

Mulching

Add mulch every spring to maintain a three inch mulch layer on your rain garden. The mulch should prohibit most, if not all, weed growth. Any weeds that do succeed in growing should be easy to remove because they will have shallow roots. In addition to limiting weed seed germination, mulching also prevents the loss of soil through erosion. Remember that triple shredded hardwood mulch with no dye is preferred for rain gardens.

Pruning

Each spring, prune dead vegetation, deadhead flowers, and cut back tattered or unwieldy plants. This will encourage dense, new growth and improve the rain garden's filtering capacity. Remember that stems and seed heads can be left on the plants for winter interest, wildlife cover, and food for birds.

Replanting

Remove or replace plant material that is not thriving. Consider planting more of a particularly successful species.

Sediment Removal

Your rain garden may accumulate sediment, particularly if it collects runoff from a driveway or a road. This is a sign of success; however, occasionally use a flat shovel to remove any excess sediment, leaves, or debris. Be cautious particularly of any buildup occurring near the water inlet of the rain garden, especially if your rain garden is located next to a driveway or road and you notice sand in the buildup. A grass buffer, near the rain garden's inlet and between the rain garden and the road, will prevent road sand, salt, and sediment from entering your rain garden. A small rock bed at the inlet will function similarly. The debris in the water will drop out along the grass strip or rock bed, making it easier to clean your rain garden.



Rutgers County Extension Burlington County
Westampton, NJ

Soil Testing

Since you determined the nutrient and pH levels of your soil before planting the rain garden, remember to retest the soil every three to five years. Follow the recommendations to maintain the soil pH in an acidic range. If pH is less than 5.2, apply limestone; if greater than 7.0 to 8.0, add iron sulfate and sulfur to reduce pH. Add these amendments when no storms are expected to prevent runoff. Be sure to follow instructions or contact the local county extension office for guidance to prevent runoff of applied materials.

Fertilizing

Fertilizing is NOT a part of maintaining your rain garden! The garden sustains itself with the help of organic material in the topsoil.

Next Steps

Additional maintenance includes seed collection and taking cuttings from successful plants, planting more of a particularly successful species, re-seeding the berm if necessary, replacing rocks that may be diverting flow out of the garden, and building up areas where more protection is needed to prevent erosion.

After installation, if the rain garden is not infiltrating at the desired rate, make holes using an augur in the rain garden and fill these holes with coarse sand. Refer to page 23 of this Manual for more information.

Before & After Annual Maintenance



Essex County Environmental Center
Roseland, NJ



A Rain Garden Over Time



At time of installation
Springfield Township Municipal Annex Building
Springfield, NJ



First growing season



Second growing season



Third growing season



Fourth growing season



Essex County Environmental Center
Roseland, Essex County, NJ
Photograph courtesy of Essex County Environmental Center

CONCLUSION

Key Points:

- Not only does a rain garden provide an aesthetic addition to the landscape, but it also creates a functioning system that improves water quality.
- Once you have installed a rain garden at your house, you can move on to other sustainable elements such as a rain barrel, pervious pavement, or a green roof. The sky is the limit!

CHAPTER 5

Taking it a Step Further Enjoy Your Rain Garden!

Congratulations on installing your rain garden! You did it! Pat yourself on the back (and maybe get a back massage, too).

Not only did you add a beautiful landscaping feature to your yard, but you also created an area that will be fully functional at filtering nonpoint source pollution from stormwater runoff, the largest source of pollution in New Jersey waters (NJDEP, Bureau of Nonpoint Pollution Control, Division of Water Quality brochure). Another source of pollution in New Jersey's waters is sediment, which can make New Jersey's waters turbid, or cloudy, and can clog the gills of fish and aquatic invertebrates. Surprisingly, temperature can also be considered a pollutant in New Jersey's waters. You might not think of it, but runoff that goes over hot, impervious surfaces, like rooftops and roads, is dumped into New Jersey's waterways and, in turn, raises the temperature. A rain garden can help solve all of these sources of pollution!

Additionally, the rain garden will accent your landscape, attract beneficial wildlife, promote biodiversity, and, most importantly, be used as a tool to educate others about the importance of managing stormwater runoff and controlling nonpoint source pollution. As an added bonus, the rain garden will not only filter out nonpoint source pollution, but also recharge groundwater. Replenishing groundwater is essential, since approximately 50% of New Jersey's drinking water comes from aquifers that store groundwater. Unfortunately, New Jersey's aquifers are drying up due to human use, so replenishment of groundwater is crucial. And a rain garden does just that – it filters and infiltrates runoff into groundwater that then returns





Village School
Holmdel, NJ

as cool water to New Jersey's waterways and aquifers. Cool water in the waterways not only benefits wildlife, particularly fish, but also keeps the waterways' base-flow higher and peak-flow lower, meaning better habitat for wildlife and less flooding.

It is essential for people to realize that what we do on the land affects the waterways, and that all of the little actions you take to prevent nonpoint source pollution on the land can help our water – that includes installing rain gardens! The installation of your rain garden should give you the confidence to go out and try other things to improve our environment. How about trying rain barrels, cisterns, tree planting, water conservation fixtures (faucets, toilets, showerheads, etc.), low maintenance grasses, integrated pest management (IPM), community gardening, and/or solar panels? If you install a rain barrel, for example, you use less tap water for your garden, reducing your water bill. All of these environmental practices will save you money, while protecting New Jersey's environment at the same time.

IT ALL ADDS UP!

In New Jersey, 90% of rainfall events are less than 1.25 inches, with approximately 44 total inches of rain per year. Therefore, your rain garden will treat and recharge 3.3 feet of water per year!

$0.9 \times 44 \text{ inches} = 40 \text{ inches/year (or 3.3 feet)}$

If the rain garden receives runoff from 1,000 square feet, the total volume treated and recharged is 25,000 gallons of water per year.

$1,000 \text{ square feet} \times 3.3 \text{ feet} = 3,300 \text{ cubic feet/year (or 25,000 gallons)}$

So, if you build 40 rain gardens in your community, you will treat and recharge 1,000,000 gallons of water per year!

*Let's change New Jersey from **The Garden State** to **The Rain Garden State**!*

Baker Elementary School
Moorestown, Burlington County, NJ



APPENDIX



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Regional Native Plant Nurseries

(R)=Retail (W)=Wholesale

NEW JERSEY

A Wild Bird Oasis (R)

741 Stokes Road
Medford, NJ 08055
PH: 609-654-6777
www.awildbirdoasis.com

Arrowwood Nursery (R&W)

870 W. Malaga Road, Route 659
Williamstown, NJ 08094
PH: 856-697-6045

Cicconi Farms (R&W)

1005 Farmingdale Road
Jackson, NJ 08527
PH: 732-363-1420
EMAIL: email@cicconifarms.com
www.cicconifarms.com

Fairweather Gardens (R)

\$ 2.00 Catalog (Mail order only)
PO Box 330
Greenwich, NJ 08323
PH: 856-451-6261
www.fairweathergardens.com

Fernbrook Nursery, Inc. (W)

150 Georgetown Road, Route 545
PO Box 228
Bordentown, NJ 08505
PH: 609-298-8282
www.fernbrookfarms.com

Mapleton Nurseries (W)

140 Mapleton Road
Kingston, NJ 08528
PH: 609-430-0366
www.mapletonnurseries.com

New Moon Nursery (W)

975 Barretts Run Road
Bridgeton, NJ 08302
PH: 888-998-1951
EMAIL: Info@newmoonnursery.com
www.NewMoonNursery.com

Ocean Wholesale Nursery (W)

705 Wright DeBow Road
Jackson, NJ
PH: 732-833-7000
EMAIL: Oceanwholesale@AOL.com

Pinelands Nursery (W)

323 Island Road
Columbus, NJ 08022
PH: 609-291-9486
EMAIL: sales@pinelandsnursery.com
www.pinelandsnursery.com

Pleasant Run Nursery, Inc (W)

Heidi, Richard, & Louise
93 Ellisdale Road
PO Box 247
Allentown, NJ 08501
PH: 609-259-8585
www.pleasantrunnursery.com

Princeton Nurseries (W)

PO Box 185
4 Polhemustown Road
Allentown, NJ 08501
PH: 609-259-7671
TOLL FREE 1-800-916-1776
EMAIL: ADC@princetonnurseries.com
www.princetonnurseries.com

Rare Find Nursery, Inc (R&W)

957 Patterson Road
Jackson, NJ 08527
PH: 732-833-0613
EMAIL: info@rarefindnursery.com
www.rarefindnursery.com

Timber Creek Native Plant Nursery (R&W)

200 Peskin Road
Farmingdale, NJ 07727
PH: 732-928-0600
FAX: 732-928-0660

Toadshade Wildflower Farm (R)

53 Everittstown Road
Frenchtown, NJ 08825
PH: 908-996-7500
EMAIL: toadshad@toadshade.com
www.toadshade.com

Tuckahoe Nurseries, Inc. (W)

PO Box 576
Tuckahoe, NJ 08250
PH: 609-861-0533
EMAIL: tni@pro-usa.net
www.tuckahoenurseries.com



PENNSYLVANIA

Appalacian Nurseries (W)

1724 Clay Hill Road
Chambersburg, PA 17202
PH: 717-597-0066
EMAIL: info@appnursery.com
www.appnursery.com

Aquascapes Unlimited (W)

PO Box 364
Pipersville, PA 18947
PH: 215-766-8151
www.aquascapesunlimited.com

Better Forest Tree Seeds (W)

13872 Alan Seeger Road
Petersburg, PA 16669
PH: 814-667-3666
EMAIL: info@BetterForestTreeSeeds.com
www.betterforesttreeseeds.com

Bowmans Hill Wildflower Preserve (R)

PO Box 685 (No mail orders)
New Hope, PA 18938
PH: 215-862-2924
EMAIL: bhwp@bhwp.org
www.bhwp.org

Carino Nurseries (R&W)

Route 403 N., P.O. Box 538
Indiana, PA 15701
PH: 724-463-3350
EMAIL: info@carinonurseries.com
www.carinonurseries.com

Edge of the Woods Native Plant Nursery (R)

2415 Route 100
Orefield, PA 18069
PH: 610-395-2570
EMAIL: info@edgeofthewoodsnursery.com
www.edgeofthewoodsnursery.com

Ernst Conservation Seeds (W)

9006 Mercer Pike
Meadville, PA 16335
TOLL FREE: 1-800-873-3321
www.ernstseed.com

Flickingers' Nursery (W)

P.O. Box 245
Sagamore, PA 16250
TOLL FREE: 1-800-368-7381
FAX: 724-783-6528
www.flicknursery.com

Go Native Tree Farm (R&W)

2310 Chestnut View Drive
Lancaster, PA 17603
PH: 717-406-5267
FAX: 717-399-0195
EMAIL: gonative@voicenet.com
www.gonativetrees.com

Heirloom Seeds (R)

287 E. Finley Drive
West Finley PA 15377
PH: 724-663-5356
EMAIL: mail@heirloomseeds.com
www.heirloomseeds.com

Meadowood Nursery (R&W)

24 Meadowood Drive
Kirkwood, PA 17536-9647
PH: 717-529-3160
EMAIL: meadowoodnursery@comcast.net
www.meadowoodnursery.com

Mid Atlantic Natives (R&W)

12506 Susquehanna Trail South
New Freedom, PA 17349
PH: 717-227-0924
EMAIL: customerservice@midatlanticnatives.com
www.midatlanticnatives.com

Natural Landscapes Nursery (W)

354 North Jennersville Road
West Grove, PA 19390
PH: 610-869-3788
EMAIL: naturallands@gmail.com
www.naturallandscapesnursery.com

North Creek Nurseries (W)

388 North Creek Road
Landenberg, PA 19350
PH: 610-255-0100
EMAIL: info@northcreeknurseries.com
www.northcreeknurseries.com

Musser Forests, Inc (R&W)

1880 Route 119 Highway North, P.O. Box 340
Indiana, PA 15701
PH: 724-465-5685
EMAIL: info@musserforests.com
www.musserforests.com

Northeast Natives & Perennials (R)

1716 E. Sawmill Road
Quakertown, PA 18951
PH: 215-901-5552
EMAIL: nenatives_perennials@yahoo.com
www.nenativesandperennials.com

Octoraro Native Plant (W)

6126 Street Road
Hummelstown, PA 17036
PH: 717-566-9875
EMAIL: octoraro@Octoraro.com
www.Octoraro.com

Pikes Peak Nurseries (W)

8289 Route 422 Highway East
Penn Run, PA 15765
PH: 724-463-7747
EMAIL: pikespak@sgi.net
www.pikespeaknurseries.net

Pine Grove Nursery (W)

152 Pine Grove Nursery Road
Clearfield, PA 16830
PH: 814-765-2363
EMAIL: rschickling@pinegrovenursery.com
www.pinegrovenursery.com

Primrose Path (R&W)

921 Scottsdale-Dawson Road
Scottdale, PA 15683
PH: 724-887-6756
FAX: 724-887-3077
www.theprimrosepath.com

Redbud Native Plant Nursery (R&W)

1214 N. Middletown Road
Glen Mills, PA 19342
PH: 610 358-4300
FAX: 610 358-3330
redbudnativeplantnursery.com

Surgarbush Nursery (R)

4272 Morgantown Road
Mohnton, PA 19540
PH: 610-856-0998
Email: info@sugarbushnursery.com
www.sugarbushnursery.com

Sylva Native Nursery (W)

3815 Roser Road
Glen Rock, PA 17327
PH: 717-227-0486
FAX: 717-227-0484
EMAIL: sylvanat@aol.com
www.sylvanative.com

Yellow Springs Farm Native Plant Nursery (R&W)

1165 Yellow Springs Road
Chester Springs, PA 19425
PH: 610-827-2014
Email: catherine@yellowspringsfarm.com
www.yellowspringsfarm.com

Wetland Supply Company (W)

194 Goodview Drive
Apollo, PA 15613
PH: 724-727-3772
FAX: 724-727-3778
EMAIL: Wetplants@aol.com
www.wetlandsupply.com



NEW YORK

Greenbelt Native Plant (W)

3808 Victory Boulevard
Staten Island, NY 10314
PH: 718-370-9044
www.greenbeltnativeplantcenter.org

The Plantsmen Native Plant Nursery (R)

482 Peruville Road
Groton, NY 13073
PH: 607-533-7193
www.greenbeltnativeplantcenter.org

Wetland Plant Catalog (W)

2701 – A Route 305
PO Box 30
West Clarksville, NY 14786
PH: 585-968-3120
EMAIL: froghome@eznet.net
www.southerntierconsulting.com

Talmage Farm (W)

1122 Osborne Avenue
Riverhead, NY 11901-1114
PH: 631-727-3100
EMAIL: info@talmagefarm.com
www.talmagefarm.com

Fort Pond Native Plants (R)

P.O. Box 5061
26 South Embassy Street
Montauk, NY 11954
PH: 631-668-6452
EMAIL: info@nativeplants.net



Holy Nativity Lutheran Church
Wenonah, NJ

MARYLAND

The Perennial Farm (W)

12017 Glen Arm Road
Glen Arm, Maryland 21057
PH: 410-592-6106
EMAIL: info@perennialfarm.com
www.perennialfarm.com
www.growingforyou.com

VIRGINIA

Nature By Design (R)

300 Calvert Avenue
Alexandria, VA 22301
PH: 703-683-GROW (4769)
EMAIL: plantfolks@nature-by-design.com
www.nature-by-design.com

Pinelands Nursery, Inc. (W)

8877 Richmond Road
Toano, VA 23168
PH: 800-667-2729
EMAIL: sales@pinelandsnursery.com
www.pinelandsnursery.com

Sassafras Farm (R&W)

7029 Bray Road
Hayes, VA 23072-3435
PH: 804-642-0923
EMAIL: sassafrasfarm@verizon.net

Southern Exposure Seed Exchange (W)

P.O. Box 460
Mineral, VA 23117
PH: 540-894-9480
FAX: 540-894-9481
EMAIL: gardens@southernexposure.com
www.southernexposure.com

Website References

RAIN GARDEN WEBSITES

University of Wisconsin-Extension, Rain Garden Publications
www.clean-water.uwex.edu/pubs/home.htm#rain

Rain Gardens: A how-to manual for homeowners
www.clean-water.uwex.edu/pubs/pdf/home.rgmanual.pdf

Rain Gardens A household way to improve water quality in your community
www.clean-water.uwex.edu/pubs/pdf/home.gardens.pdf

Rain Gardens of West Michigan-Home
www.raingardens.org/index.php

Montgomery County Maryland, Rainscapes resource page
www.montgomerycountymd.gov/deptmpl.asp?url=/Content/DEP/Rainscapes/home.asp#garden

Southeastern Oakland County Resource Recovery Authority Healthy Lawns and Gardens Program
www.socwa.org/lawn_and_garden.htm

Maplewood Minnesota Rainwater Gardens Site
www.ci.maplewood.mn.us
(search site for “rain water garden”)

Wisconsin Natural Resources Magazine
www.dnr.wi.gov/wnrmag/html/supps/2003/feb03/run.htm

Montgomery County Government Services in Maryland
www.montgomerycountymd.gov/deptmpl.asp?url=/Content/DEP/Rainscapes/home.asp



Cauldwell Youth Garden, Sustainable South Bronx
Bronx, New York City, NY

LOW IMPACT & CONSERVATION WEB SITES

Impact Development Center's sizing tool explained:
www.lid-stormwater.net/bio_sizing.htm

Low Impact Development Center, Sustainable School Projects Website
www.lowimpactdevelopment.org/school/index.html

Prince George's County Maryland
www.goprincegeorgescounty.com
(Search for Bioretention)

Rutgers Cooperative Extension: Restoring NJ Riparian Forest Buffers
www.njaes.rutgers.edu/njriparianforestbuffers/

Rain Bird Games, Trivia and Water Conservation Activities
www.rainbird.com/iuow/community/crossword.htm
(Teaching Tool with Answers)

Soil Testing

Refer to the sample soil test analysis from Rutgers Cooperative Extension (RCE) Soil Testing Laboratory, right.

When filling out the initial forms to be sent in with the soil, make sure to indicate that the soil will be planted with a perennial garden (which is similar to a rain garden).

FOR MORE INFORMATION, CONTACT:

RCE Soil Testing Laboratory

Rutgers, The State University of New Jersey
57 US Highway 1
New Brunswick, NJ 08901-8554

Telephone: 732-932-9295

Email: soiltest@njaes.rutgers.edu

Website: www.njaes.rutgers.edu/soiltestinglab

Amendment Recommendations

RUTGERS
New Jersey Agricultural
Experiment Station

Soil Testing Laboratory
Rutgers, The State University
P.O. Box 902
Milltown, NJ 08850-0902
Phone: (732) 932-9295

Soil Test Report
Lab No: 2008-7162

Name: Rutgers University, Env. Science
Chris Obrupty/Gregory Rusciano
Address: 14 College Farm Road
New Brunswick, NJ 08901
Phone: (732) 932-2739
Fax: (732) 932-8644
Referred To: Rutgers Cooperative Ext.

Date Received: 10/02/2008
Date Reported: 10/09/2008
Serial No: -
Sample ID: Dorsett.

Crop or Plant
New Perennial - Mixed Perennial

Soil Tests and Interpretation

pH: 5.90 Medium acidic; pH is slightly low for the growth of most crops except for acid-loving plants.

Lime Requirement Index: 7.85
Adams-Evans LRI is a measure of the soil's buffering capacity (resistance to change in pH).
It is used to determine liming rate, when necessary.

Macronutrients (pounds/acre)

Phosphorus: 607 (Above Optimum)	P
Potassium: 176 (Optimum)	K
Magnesium: 138 (Below Optimum)	Mg
Calcium: 698 (Below Optimum)	Ca

by Mehlich 3 extraction

Micronutrients (parts per million)

Zinc: 4.6 (Adequate)	Copper: 1.6 (Adequate)	Manganese: 7.5 (Adequate)	Boron: 5.9 (Adequate)	Iron: 211 (High)
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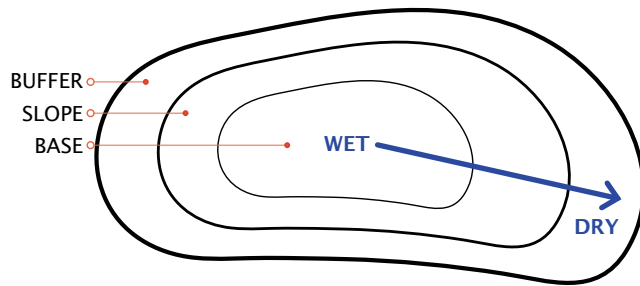
Special Tests and Results
No special tests requested.

Lime Recommendation
The soil test indicates a moderately acidic soil; the pH is below the best range for the growth of most Perennial. This soil should be treated with 15 pounds/1000 sq. ft. of limestone. Spread uniformly on the surface, then mix thoroughly to a 6 inch depth by shovel or by tilling.

Soil Test Report for Lab No. 2008-7162

Rain Garden Plant Lists

PLANTS BY RAIN GARDEN ZONE



GRASSES AND GROUNDCOVERS

BASE

- Bluejoint Grass (*Calamagrostis canadensis*)
- Sedges (*Carex spp.*)
- Fowl Mannagrass (*Glyceria striata*)
- Soft Rush (*Juncus effusus*)

SLOPE

- Big Bluestem (*Andropogon gerardii*)
- Switchgrass (*Panicum virgatum*)
- Virginia Wild-rye (*Elymus virginicus*)
- Wood Grass (*Sorghastrum nutans*)

BUFFER

- Bearberry (*Arctostaphylos uva-ursi*)
- Broomsedge (*Andropogon spp.*)
- Indiangrass (*Sorghastrum nutans*)
- Little Bluestem (*Schizachyrium scoparium*)
- Panic Grass (*Panicum virgatum*)
- Switchgrass (*Panicum virgatum*)
- Deer Tongue (*Dichanthelium clandestinum*)

WILDFLOWERS AND FERNS

BASE

- Blue Lobelia (*Lobelia siphilitica*)
- Blueflag Iris (*Iris virginica shrevei*)
- Boneset (*Eupatorium maculatum*)
- Cardinal Flower (*Lobelia cardinalis*)
- Seaside Goldenrod (*Solidago sempervirens*)
- Marsh Marigold (*Calthus palustris*)
- Monkey Flower (*Mimilus ringens*)
- Rose-mallow (*Hibiscus moscheutos*)
- Royal Fern (*Osmunda regalis*)
- Swamp Milkweed (*Asclepias incarnata*)
- Turtlehead (*Chelone glabra*)

SLOPE

- Blazing Star (*Liatris spicata*)
- Cinnamon Fern (*Osmunda cinnamomea*)
- Columbine (*Aquilegia spp.*)
- Coreopsis (*Coreopsis*)
- Ironweed (*Vernonia noveboracensis*)
- Joe-pye Weed (*Eupatorium spp.*)
- New England Aster (*Aster novae-angliae*)
- New York Aster (*Aster novi-belgii*)
- Sensitive Fern (*Onoclea Sensibilis*)

BUFFER

- Black-eyed Susan (*Rudbeckia laciniata*)
- Butterfly Weed (Milkweed) (*Asclepias tuberosa*)
- Purple Coneflower (*Echinacea purpurea*)
- Wild Indigo (*Baptista tinctoria*)
- Wild Bergamont (*Monarda didyma*)

TREES AND SHRUBS

BASE

- Buttonbush (*Cephalanthus occidentalis*)
- Cranberrybush Viburnum (*Viburnum trilobum*)
- Green Ash (*Fraxinus pennsylvanica*)
- River Birch (*Betula nigra*)
- Silky Dogwood (*Cornus amomum*)
- Swamp White Oak (*Quercus bicolor*)

SLOPE

- Green Ash (*Fraxinus pennsylvanica*)
- Red Maple (*Acer rubrum*)
- Red-twig Dogwood (*Cornus sericea*)
- River Birch (*Betula nigra*)
- Serviceberry (*Amelanchier canadensis*)
- Sweetpepperbush (*Clethera alnifolia*)
- Sweetbay Magnolia (*Magnolia virginiana*)
- Winterberry Holly (*Ilex verticillata*)

BUFFER

- American Holly (*Ilex opaca*)
- Arrowwood Viburnum (*Viburnum dentatum*)
- Bayberry (*Myrica pensylvanica*)
- Hackberry (*Celtis occidentalis*)
- Lowbush Blueberry (*Vaccinium angustifolium*)
- Red Bud (*Cercis canadensis*)
- Red Oak (*Quercus falcata*)
- White Oak (*Quercus alba*)
- Witchhazel (*Hamamelis virginiana*)

Rain Garden Plant Lists

PLANTS FOR WIND BREAKS + SCREENS

Trees

- **American Holly** (*Ilex opaca*)
- **Arborvitae**
- **Balsam Fir** (*Abies balsamea*)
- **Eastern Red Cedar** (*Juniperus virginiana*)
- **White Fir** (*Abies concolor*)
- **White Pine** (*Pinus strobus*)

PLANTS FOR DRY SOILS

Trees

- **American Hornbeam** (*Carpinus caroliniana*)
- **Eastern Red Cedar** (*Juniperus virginiana*)
- **Hackberry** (*Celtis occidentalis*)
- **Honeylocust** (*Gleditsia triacanthos*)
- **Northern Red Oak** (*Quercus rubra*)
- **Shagbark Hickory** (*Carya ovata*)
- **Washington Hawthorn**
(*Crataegus phaenopyrum*)
- **White Ash** (*Fraxinus americana*)
- **White Oak** (*Quercus alba*)

Shrubs

- **Bayberry** (*Myrica pensylvanica*)
- **Bush Cinquefoil** (*Potentilla fruticosa*)
- **Jerseytea** (*Ceanothus americanus*)
- **St. Johns Wort** (*Hypericum perforatum*)

Perennials

- **Bearberry** (*Arctostaphylos uva-ursi*)
- **Butterfly Milkweed** (*Asclepias tuberosa*)

PLANTS FOR WET LOCATIONS

Trees

- **Black Gum** (*Nyssa sylvatica*)
- **Black Willow** (*Salix nigra*)
- **Green Ash** (*Fraxinus pennsylvanica*)
- **Red Maple** (*Acer rubrum*)
- **River Birch** (*Betula nigra*)
- **Serviceberry** (*Amelanchier canadensis*)
- **Swamp White Oak** (*Quercus bicolor*)
- **Sweetgum** (*Liquidambar styraciflua*)
- **Sycamore** (*Platanus occidentalis*)

Shrubs

- **American Cranberry Bush**
(*Viburnum trilobum*)
- **Arrowwood Viburnum** (*Viburnum dentatum*)
- **Inkberry** (*Ilex glabra*)
- **Red Chokeberry** (*Aronia arbutifolia*)
- **Redosier Dogwood** (*Cornus sericea*)
- **Silky Dogwood** (*Cornus amomum*)
- **Spicebush** (*Lindera benzoin*)
- **Summersweet** (*Clethra alnifolia*)
- **Winterberry** (*Ilex verticillata*)

Grasses

- **Blue Lobelia** (*Lobelia siphilitica*)
- **Blueflag Iris** (*Iris virginica shrevei*)
- **Cardinal Flower** (*Lobelia cardinalis*)
- **New England Aster** (*Aster novae-angliae*)
- **New York Aster** (*Aster novi-belgii*)
- **Swamp Milkweed** (*Asclepias incarnata*)
- **Wild Bergamont** (*Monarda didyma*)

PLANTS FOR SHADY LOCATIONS

Trees

- **American Holly** (*Ilex opaca*)
- **American Hornbeam** (*Carpinus caroliniana*)
- **Eastern Hemlock** (*Tsuga canadensis*)
- **Eastern Redbud** (*Cercis canadensis*)
- **Flowering Dogwood** (*Cornus florida*)
- **Serviceberry** (*Amelanchier canadensis*)
- **Sugar Maple** (*Acer saccharum*)

Grasses

- **Arrowwood Viburnum** (*Viburnum dentatum*)
- **Inkberry** (*Ilex glabra*)
- **Spicebush** (*Lindera benzoin*)
- **Summersweet** (*Clethra alnifolia*)
- **Witchhazel** (*Hamamelis virginiana*)

Perennials

- **American Columbine** (*Aquilegia canadensis*)
- **Bleeding Hearts** (*Dicentra spectabilis*)
- **Cinnamon Fern** (*Osmunda cinnamomea*)
- **Royal Fern** (*Osmunda regalis*)
- **Sensitive Fern** (*Onoclea sensibilis*)
- **Solomon's Seal** (*Polygonatum commutatum*)
- **Woodland Phlox** (*Phlox divaricata*)

Rain Garden Plant Lists

PLANTS FOR WILDLIFE HABITAT

Trees

- **American Holly** (*Ilex opaca*)
- **Eastern Red Cedar** (*Juniperus virginiana*)
- **Hackberry** (*Celtis occidentalis*)
- **Serviceberry** (*Amelanchier canadensis*)
- **Wild Cherry** (*Prunus avium*)

Shrubs

- **Arrowwood Viburnum** (*Viburnum dentatum*)
- **Bayberry** (*Myrica pensylvanica*)
- **Black Haw Viburnum** (*Viburnum prunifolium*)
- **Redosier Dogwood** (*Cornus sericea*)
- **Spicebush** (*Lindera benzoin*)
- **Winterberry** (*Ilex verticillata*)

Perennials

- **Boneset** (*Eupatorium perfoliatum*)
- **Heath Aster** (*Aster ericoides*)
- **Ironweed** (*Vernonia noveboracensis*)

Grasses

- **Big Bluestem** (*Andropogon gerardii*)
- **Indiangrass** (*Sorghastrum nutans*)
- **Little Bluestem** (*Schizachyrium scoparium*)
- **Switchgrass** (*Panicum virgatum*)

PLANTS THAT DEER PREFER TO EAT (USE WITH CAUTION)

Trees

- **Balsam Fir** (*Abies balsamea*)
- **Cornelian Dogwood** (*Cornus cornaceae*)
- **Eastern Redbud** (*Cercis canadensis*)
- **Fraser Fir** (*Abies fraseri*)
- **Hemlock** (*Conium spp.*)
- **Rhododendron** (*Rhododendron ericaceae*)

Shrubs

- **Azalea** (*Rhododendron ericaceae*)

Perennials

- **Clematis** (*Clematis ranunculaceae*)
- **Cransbill geranium** (*Geranium sanguineum*)
- **Crocus** (*Crocus iridaceae*)
- **Daylily** (*Hemerocallis hemerocallidaceae*)
- **Echinacea** (*Echinacea spp.*)
- **English Ivy** (*Hedera helix*)
- **Hollyhock** (*Alcea*)
- **Hosta** (*Hosta agavaceae*)
- **Impatiens** (*Impatiens balsaminaceae*)
- **Lily** (*Lilium*)
- **Meadow rue** (*Thalictrum aquilegifolium*)
- **Pansy** (*Viola spp.*)
- **Peony** (*Paeonia spp.*)
- **Phlox** (*Phlox spp.*)
- **Sedum** (*Sedum spp.*)
- **Sunflower** (*Helianthus annuus*)
- **Trillium** (*Trillium melanthiaceae*)
- **Wood Hyacinth** (*Hyacinthoides hispanica*)



Hanson House Rain Garden
Cranford, NJ

Rain Garden Plant Lists

PLANTS THAT ARE DEER TOLERANT/RESISTANT

Trees

- **Ash** (*Fraxinus*)
- **Bayberry** (*Myrica pensylvanica*)
- **Beech** (*Fagus*)
- **Birch** (*Betula spp.*)
- **Carolina allspice** (*Calycanthus floridus*)
- **Fetterbush** (*Leucothoe fontanesiana*)
- **Great St. John's wort** (*Hypericum perforatum*)
- **Honeylocust** (*Gleditsia triacanthos*)
- **Hornbeam** (*Carpinus caroliniana*)
- **Leatherwood** (*Dirca palustris*)
- **Magnolia** (*Magnolia spp.*)
- **Maple spp.** (*Acer*)
- **Oak** (*Quercus spp.*)
- **Serviceberry** (*Amelanchier canadensis*)
- **Shrubby St. John's wort** (*Hypericum prolificum*)
- **Sourgum** (*Nyssa sylvatica*)
- **Spicebush** (*Lindera benzoin*)
- **Summersweet** (*Clethra alnifolia*)
- **Sweetgum** (*Liquidambar styraciflua*)
- **Trumpet Honeysuckle** (*Lonicera sempervirens*)
- **Viburnum spp.** (*Viburnum*)
- **Witchhazel** (*Hamamelis virginiana*)
- **Black-eyed Susan** (*Rudbeckia laciniata*)
- **Blue False Indigo** (*Baptista australis*)
- **Bluestar** (*Amsonia*)
- **Blue Vervain** (*Verbena hastata*)
- **Blue Wood Phlox** (*Phlox divaricata*)
- **Blueflag Iris** (*Iris virginica shrevei*)
- **Butterflyweed Milkweed** (*Asclepias tuberosa*)
- **Creeping Phlox** (*Phlox stolonifera*)
- **Culver's-root** (*Veronicastrum virginicum*)
- **Dense Blazing Star** (*Liatris spicata*)
- **Flowering Spurge** (*Euphorbia corollata*)
- **Fringed Bleeding-heart** (*Dicentra eximia*)
- **Giant Purple Hyssop** (*Agastache scrophulariifolia*)
- **Goat's Beard** (*Aruncus dioicis*)
- **Goldenrod spp.** (*Solidago*)
- **Great Blue Lobelia** (*Lobelia siphilitica*)
- **Helen's flower** (*Helenium autumnale*)
- **Jack-in-the-Pulpit** (*Arisaema triphyllum*)
- **Jacob's Ladder** (*Polemonium caeruleum*)
- **Mayapple** (*Podophyllum spp.*)
- **Monkey Flower** (*Mimilus ringens*)
- **Monkshood** (*Aconitum spp.*)
- **Mountainmint** (*Pycnanthemum spp.*)
- **New England Aster** (*Aster novae-angliae*)
- **Obedient Plant** (*Physostegia spp.*)
- **Rose Coreopsis** (*Coreopsis rosea*)
- **Skullcap** (*Scutellaria spp.*)
- **Skunk-cabbage** (*Symplocarpus foetidus*)
- **Small Agrimony** (*Agrimonia microcarpa*)
- **Swamp Rose-mallow** (*Hibiscus moscheutos palustris*)
- **Tickseed** (*Coreopsis spp.*)
- **Twin-Leaf** (*Jeffersonia diphylla*)
- **Virgin's bower** (*Clematis virginiana*)
- **Wild Bergamont** (*Monarda fistulosa*)
- **Wild Columbine** (*Aquilegia canadensis*)
- **Wild Ginger** (*Asarum canadense*)
- **Wild Onion/Leek** (*Allium canadense*)
- **Wood Geranium** (*Geranium maculatum*)

Perennials

- **Aromatic Aster** (*Aster oblongifolius*)
- **Baneberry** (*Actaea spp.*)
- **Beardtongue** (*Penstemon barbatus*)
- **Black Cohosh** (*Actaea racemosa*)

Grasses

- **Big Bluestem** (*Andropogon gerardii*)
- **Switchgrass** (*Panicum virgatum*)

Note: There is no such thing as a plant that is absolutely deer resistant - deer will eat anything if they are hungry enough! This list merely reflects the plants that deer tend to avoid.

Rain Garden Design Samples

DEER TOLERANT RAIN GARDEN

Base

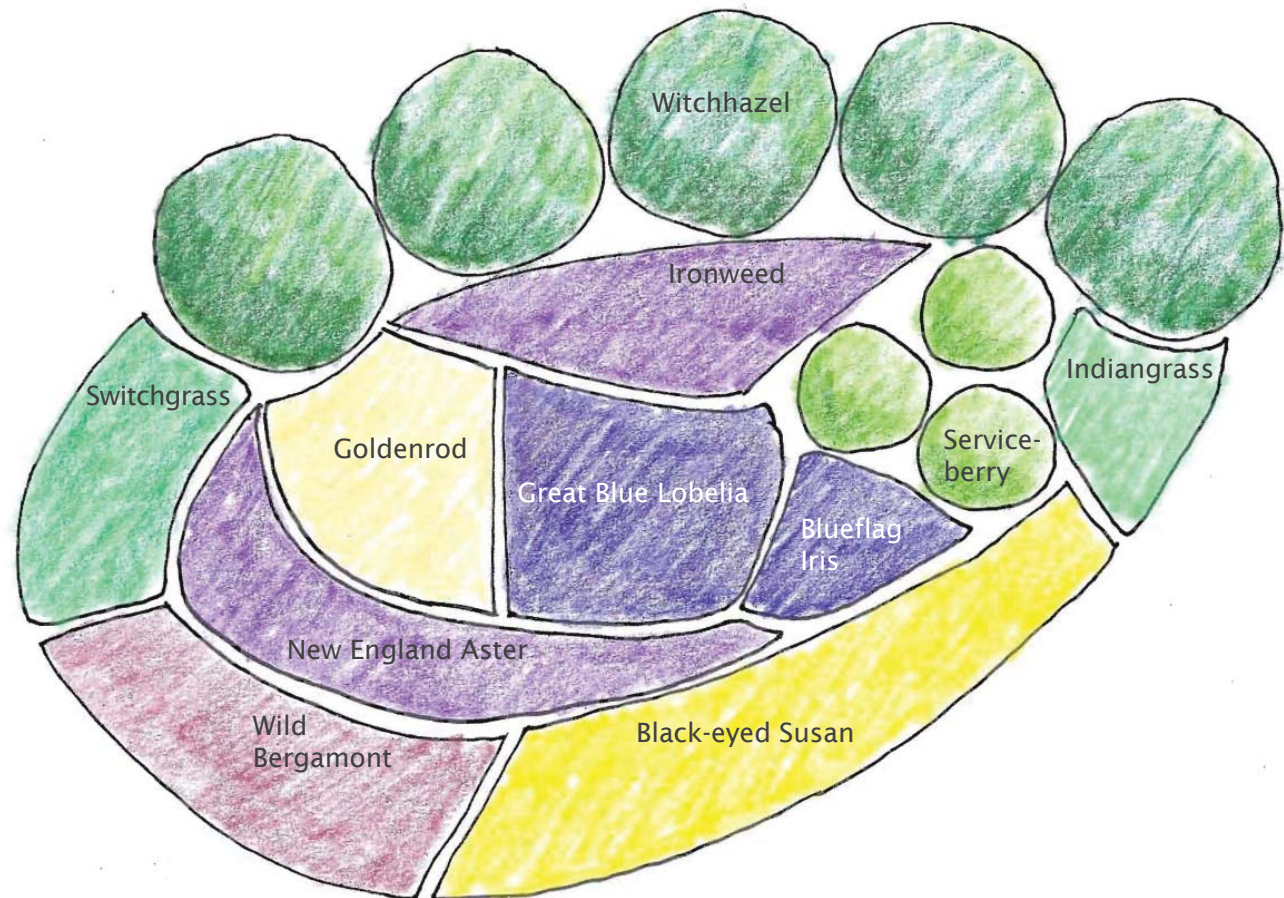
- Blueflag Iris
- Goldenrod
- Great Blue Lobelia

Slope

- Ironweed
- New England Aster
- Serviceberry

Buffer

- Black-eyed Susan
- Indiangrass
- Switchgrass
- Wild Bergamont
- Witchhazel



In addition to the Butterfly Habitat Rain Garden Design illustrated on page 29 of this Manual, use the planting plans illustrated on the following pages as an inspiration as you design your own rain garden.

Rain Garden Design Samples

TREE + SHRUB RAIN GARDEN

Base

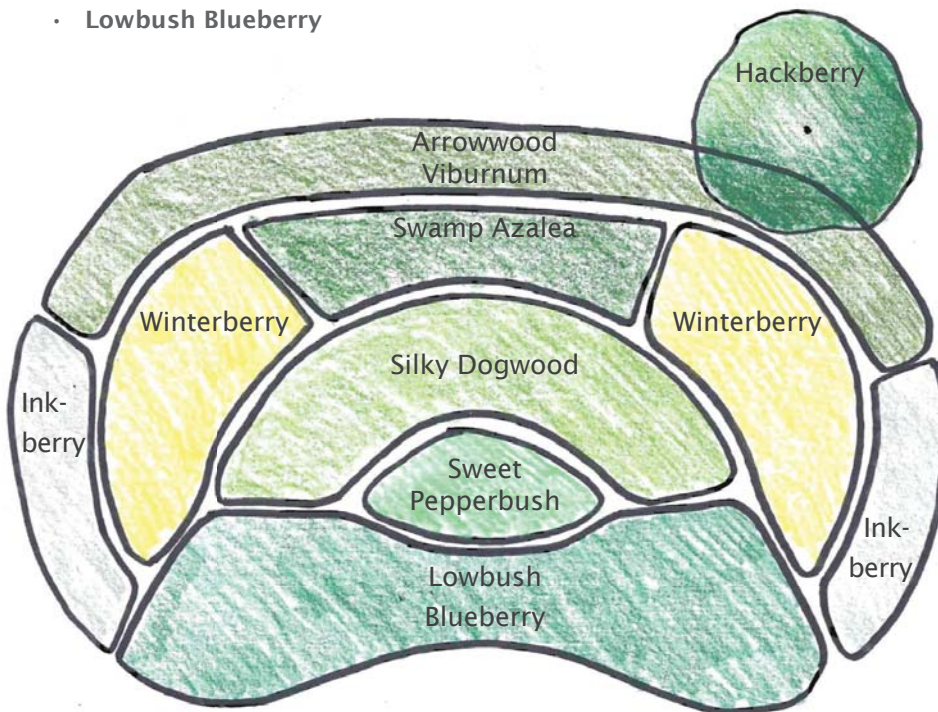
- Silky Dogwood
- Sweet Pepperbush

Slope

- Swamp Azalea
- Lowbush Blueberry
- Winterberry

Buffer

- Arrowwood Viburnum
- Hackberry
- Inkberry
- Lowbush Blueberry



ORNAMENTAL BARK, FLOWERS, AND BERRIES RAIN GARDEN

Base

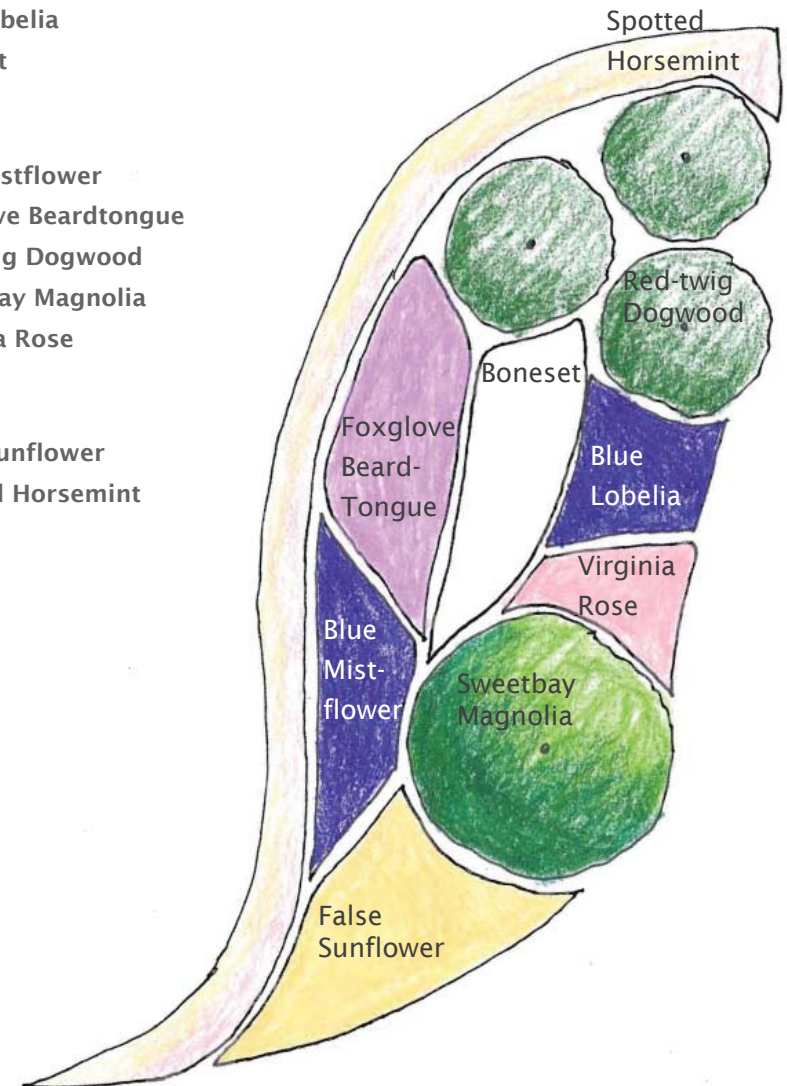
- Blue Lobelia
- Boneset

Slope

- Blue Mistflower
- Foxglove Beardtongue
- Red-twig Dogwood
- Sweetbay Magnolia
- Virginia Rose

Buffer

- False Sunflower
- Spotted Horsemint



Rain Garden Design Samples

DRY, SANDY SOIL RAIN GARDEN

Base

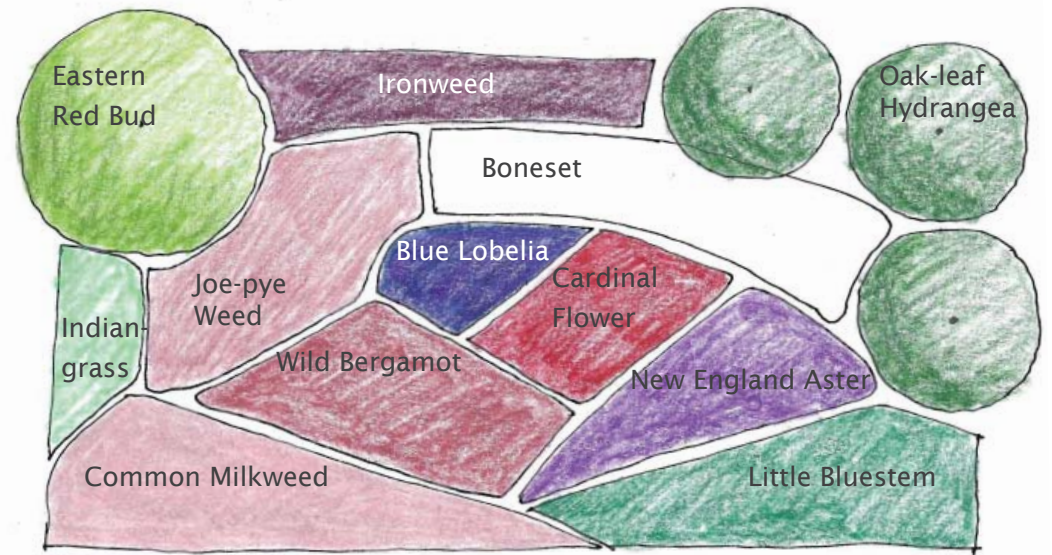
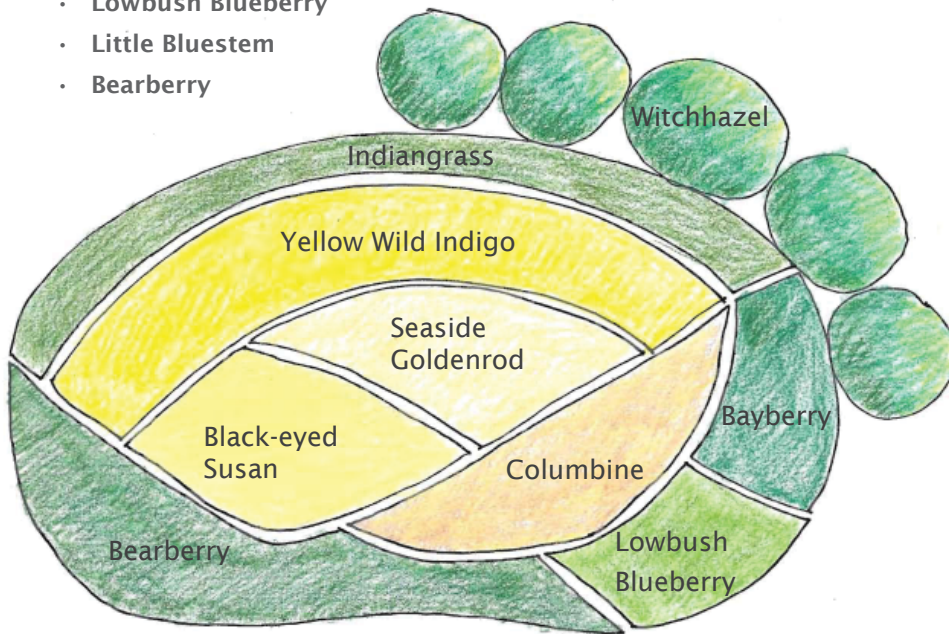
- Seaside Goldenrod

Slope

- Black-eyed Susan
- Columbine
- Yellow Wild Indigo

Buffer

- Bayberry
- Indiangrass
- Lowbush Blueberry
- Little Bluestem
- Bearberry



SUN/PART-SUN RAIN GARDEN

Base

- Blue Lobelia
- Cardinal Flower

Slope

- Boneset
- Joe-pye Weed
- New England Aster
- Wild Bergamot
- Virginia Rose

Buffer

- Common Milkweed
- Indiangrass
- Ironweed
- Little Bluestem
- Oak-leaf hydrangea
- Eastern Red Bud

Native Plants of New Jersey
(from left to right)

Lady's Slipper
White Pine
Sweet Gum



Mountain Laurel
American Beech
Giant's Solomon Seal
Strawberry Bush



Toad Trillium
Culver's Root
Sneezewood
Bloodroot



Turk's Cap Lily
Culver's Root
Blue Cohosh
Chokeberry



Photos courtesy of
Native Plant Society of New Jersey

