RAIN GARDEN EDUCATIONAL PROGRAM
So....Why a Rain Garden?

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Director of Education and Outreach, Great Swamp Watershed Association

With thanks to Chris Obropta, Rutgers Water Resources
Who are GSWA?

We support a “One River, One Community” vision for the rural, suburban, and urban communities along the Passaic River, Building understanding that the health of the watershed is integrally connected to the quality of our daily lives.
Support from the Stackhouse Foundation
How do we achieve our mission?

Educate
- Educate on current and future water and environmental issues we face.

Advocate
- Advocate for smarter decision-making - and weigh in where needed.

Steward
- Steward the land we own and encourage good stewardship practices in others.

Underpin with Water Quality Testing
- Underpin our work with scientifically conducted water quality testing programs and research.
So...What happens when it rains anywhere in our watershed?
Pervious vs Impervious surfaces
Erm.. What’s stormwater?

Stormwater is water from rain or melting snows that flows over surfaces, becoming “runoff,” as it flows over the ground surface and returns to lakes, streams and rivers.
How does my property contribute to Stormwater Runoff?

The combined roof drainage areas, patios structures and driveway drainage areas make up the total impervious cover drainage area for your yard.
What’s so awful about Impervious surfaces?

- Prevent groundwater infiltration
-Enable rapid stormwater runoff causing increased erosion and flooding
-Increase nonpoint source pollution entering waterways
So...What can stormwater run-off pick up along the way?
Examples of Nonpoint Source Pollution

- Oil and grease from cars
- Fertilizers
- Pesticides
- Animal waste
- Grass clippings
- Septic systems
- Sewage leaks
- Household cleaning products
- Litter
- Agriculture
- Sediment and soils
How does development impact stormwater runoff?

- More development
- More impervious surfaces
- More stormwater runoff
Stream Health

**Percent Impervious Surface**

- **<5%**
  - Water cool and clean
  - Stream banks and bottom typically stable
  - Trout can be found
  - Endangered species can be found
  - Many fish species
  - Many salamander species
  - Many freshwater mussels
  - Many insect taxa

- **5-10%**
  - Water may be warmer and slightly polluted
  - Erosion may be evident
  - No brook trout
  - Most rare and endangered species absent
  - Many pollution tolerant fish
  - Fewer salamander species
  - Only tolerant mussels
  - Fewer insect taxa

- **10-20%**
  - Water warmer
  - Erosion usually obvious
  - Trout absent
  - Rare stream species absent
  - Fewer fish species
  - Only three tolerant salamander species
  - No native mussels
  - Mostly tolerant insects

- **>20%**
  - Water warm and pollution usually evident
  - Unstable habitat
  - Trout absent
  - Non-native species dominate some streams
  - Only tolerant fish species
  - One salamander species
  - No native mussels
  - Only tolerant insects
Is your home Connected or Disconnected?
Green infrastructure or GI:

- Helps reduce runoff
- Recharges groundwater
- Controls erosion
- Gradually improves water quality
- Offers an opportunity to increase valuable native planting
- Offers watering-free landscaping in the yard
The Solution...

PLACE A RAIN GARDEN BETWEEN TWO IMPERVIOUS SURFACES

REDUCE THE AMOUNT OF RUNOFF ENTERING STORM SEWERS
Rain Gardens

Rain gardens are a landscaped, shallow depressions that are designed to intercept, treat, and infiltrate stormwater at the source before it becomes runoff. The plants used in the rain garden are native to the region and help retain pollutants that could otherwise harm nearby waterways.
GI Mimics Natural Forest Systems
Rainwater is an asset and not a waste product.

By infiltrating rainwater into the ground we can significantly reduce the threat of downstream flooding as well as pollution impacting waterbodies and drinking water supplies.
Enhance water quality by allowing water to be naturally filtered by soil instead of being piped, untreated into large bodies of water.
# Water quality benefits

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Soil particles</strong></td>
<td>Remove dissolved metals and phosphate</td>
</tr>
<tr>
<td><strong>Plant uptake</strong></td>
<td>Removes small amounts of nutrients</td>
</tr>
<tr>
<td><strong>Microbial Processes</strong></td>
<td>remove pathogens from water</td>
</tr>
<tr>
<td><strong>Sedimentation</strong></td>
<td>Removes suspended solids, debris, trash, phosphates and pathogens</td>
</tr>
<tr>
<td><strong>Provides</strong></td>
<td>Flood control, groundwater recharge and nutrient removal</td>
</tr>
</tbody>
</table>
How much water can a rain garden intercept? Some Math.....

- 9 out of 10 rainfall events are less than 1”
- NJ has around 44” of rain per year
- Typical rain garden treats and recharges:
  \[ 0.9 \times 44” = 40”/year = 3.3 \text{ ft water/yr} \]
- If rain garden receives runoff from 1,000’ sq.ft.
- Total volume treated and recharged is
  \[ 1,000 \text{ sq. ft.} \times 3.3 \text{ ft/year} = 3,300 \text{ cubic ft/yr,} \]
  \[ = 25,000 \text{ gallons per year!} \]
Rain Garden concept

- Downspout discharging roof runoff to yard or rain garden
- Rain garden plants filtering runoff
- Root "sponge" zone
- Runoff from driveways & roads carrying nonpoint source pollution

Storm sewer pipe discharging to stream or river
Anatomy of the Rain Garden

**BUFFER**
The buffer, or outer edge, of the rain garden slows down the flow of water, filters out sediment, and provides absorption of the pollutants in stormwater runoff. Plants located in this area of the rain garden tolerate and thrive in dry soil.

**SLOPE**
The slope of the rain garden pitches downward and connects the buffer of the rain garden to the base. It creates a holding area to store runoff awaiting treatment and infiltration. Plants situated in this area should tolerate both wet and dry soils equally.

**PLANTING SOIL LAYER**
This layer is usually native soil. It is best to conduct a soil test of the area checking the nutrient levels and pH to ensure adequate plant growth.

**INLET**
The inlet is the location where stormwater enters the rain garden. Stones are often used to slow down the water flow and prevent erosion.

**BASE**
The bottom area is the flat, deepest visible area of the rain garden and is planted with plant species that prefer wet soil. The base should be level so that the maximum amount of water can be filtered and infiltrated. It is very important that this area drains within 24 hours to avoid problems with stagnant water that can become a mosquito breeding habitat.

**ORGANIC MATTER**
Below the base is the organic matter, such as compost and a 30 layer of triple shredded hardwood mulch. The mulch acts as a filter and provides a home to microorganisms that break down pollutants.

**BERM**
The berm is a constructed mound, or bank of earth, that acts as a barrier to control, slow down, and contain the stormwater in the rain garden. The berm can be vegetated and/or mulched.

**SAND BED**
If drainage is a problem, a sand bed may be necessary to improve drainage. Adding a layer of coarse sand (also known as bank run sand or concrete sand) will increase air space and promote infiltration. It is important that sand used in the rain garden is not playbox sand or mason sand as these fine sands are not coarse enough to improve soil infiltration and may impede drainage.

**OVERFLOW**
The overflow (outlet) area serves as a way for stormwater to exit the rain garden during larger rain events. An overflow notch can be used as a way to direct the stormwater exiting the rain garden to a particular area surrounding the rain garden.
Parts of the Rain Garden Process

- Planning
- Installing
- Maintaining
- Plant Choice
Plan it

Investigate your property, heres what to consider.
Rain gardens should ideally be located between the source of runoff (roofs & driveways) and the runoff destination (drains, streams, low spots).

Plan it: Where to put it?
Plan it: Things to Consider

1. Identify drainage area run off that will be captured
2. Look for current drainage issues such as ponding, wet spots
3. Consider current landscaping practices
4. Look at current flow direction in heavy storms
5. Measure impervious surfaces

continued
1. Determine location of buried lines
2. Conduct a percolation test
3. Know your soil type—conduct a soil test
4. Figure the approximate soil amendment materials needed
5. Choose correct native plants and numbers
6. Design the plant layout
Plan it: Call BEFORE you dig!

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**

- **NJ One Call: 1-800-272-1000**
- Free markout of underground gas, water, sewer, cable, telephone, and electric utility lines
- Call at least 3 full working days, but not more than 10 days, prior to planned installation date
- Do not place rain garden within 5’ horizontally and 1’ vertically from any utilities
Plan it: Conduct a percolation Test

Dig a hole 12” deep by 6” diameter.
Fill hole with water and let stand until all the water has drained into the ground.
Refill the empty hole with water again. Measure the depth of water with a ruler.
Check the depth of water with a ruler every hour for 4 hours.
Calculate how many inches of water drained per hour.

+/- 1” of water draining /hour is a good site
Q. What size does a rain garden have to be?

A. It depends!

10ft x 10ft – 15ft x 20ft is typical.

A 100 square feet rain garden will often receive water from an area 5 to 10 times larger than the rain garden.
Plan it: Calculate Roof Line Runoff

Surface Area = (L1xW)
Example: House is 60ft x 40ft.

Roof area is +/- 2,400 square ft

Downspout collects 25% of roof, Downspout drainage area is equal to 600 square feet drainage.
Plan it: Determining the size Things to Consider

- The size of the rain garden is dependent upon the amount of runoff entering it

### Rain Garden Sizing Table
Based on New Jersey’s Water Quality Design Storm (1.25” of rain over 2 hours)

<table>
<thead>
<tr>
<th>Drainage Area</th>
<th>Size of 3” Deep Rain Garden *CLAY SOIL*</th>
<th>Size of 6” Deep Rain Garden *SILTY SOIL*</th>
<th>Size of 8” Deep Rain Garden *SANDY SOIL*</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 ft²</td>
<td>200 ft²</td>
<td>100 ft²</td>
<td>75 ft²</td>
</tr>
<tr>
<td>750 ft²</td>
<td>350 ft²</td>
<td>150 ft²</td>
<td>112 ft²</td>
</tr>
<tr>
<td>1,000 ft²</td>
<td>400 ft²</td>
<td>200 ft²</td>
<td>149 ft²</td>
</tr>
<tr>
<td>1,500 ft²</td>
<td>600 ft²</td>
<td>300 ft²</td>
<td>224 ft²</td>
</tr>
<tr>
<td>2,000 ft²</td>
<td>800 ft²</td>
<td>400 ft²</td>
<td>299 ft²</td>
</tr>
</tbody>
</table>

\*SOIL TEXTURE AMENDMENTS NEEDED
Plan it: Determining depth of the Rain garden

- Depth of rain garden is dependent upon the soil texture found at the site of the rain garden when examined.
- Depth is usually 3-8 inches.
Rain garden should be at least 10’ from the house so infiltrating water doesn’t seep into foundations.

Do not place the rain garden directly over a septic system.

Do not put rain garden in places where the water already ponds, or the lawn is always wet.

Avoid large tree root zones.

A flat portion of the yard will be easier to dig.

Place in full or partial sunlight as a preferred option to maximize plant choice.
Plan it: the ideal site

A typical rain garden is 4-8” deep.

Deeper and you have a shallow pond.

Shallower and you need a huge area to infiltrate a roof-line’s worth of runoff.

- Rain garden should be a level bed to allow rainfall to spread out over entire area.
- Create a lip or berm to allow rainwater to infiltrate, and store temporarily but have an overflow for heavy storms.
Plan it: plan to finished concept

A Rain Garden

Design and Renderings By: Kim Corbo Nystio
2007

The Site...
...of the proposed garden is a 30' x 225' area of storm flow past the parking lot behind the Ag Building. A curb will be set in the curb to allow storm water runoff to be infiltrated by the new Rain Garden.
Rain gardens have 3 distinct planting zones:

- Berm/lip or upland area (Driest)
- The walls or slope of the depression (wetter)
- Ponding area. (wettest)

Each zone will stay wet for a different amount of time and plants need to match the wetness zone.
Install It!
Install it: delineate the area
Install it: Excavate the area
Install it: Get friends and family involved and dig to desired depth and profile
Install it: Grade and shape the area
Install it: add in soil amendments
Install it: How do I amend the soil?
Soil amendments improve the rain garden’s infiltration rate and help the plants grow, they improve the capacity to manage stormwater.
Install it: Amendments

Soil amendments increase percolation, it’s a worthwhile step.
Install it: Create the lip or berm
Install it: Getting runoff to the entry point of the rain garden
Install it: Create an overflow for a really heavy storm-
Install it: Ready to plant!
Install it: lay out plants to figure spacing before planting
Install it: ensure plants are well watered in
Install it: Mulch deeply around plants to increase water holding and deter weeds
Plant Choice: Go Native!

• Native plants have deeper root systems than many ornamentals and annuals.

• They penetrate and break up soils deep into lower water recharge layers.

• Deep roots and tolerance for drought mean they are well adapted to the vagaries of NJ climate.
Plant Choice: Additional benefits of going native

- Winter Interest
- Fall Color
- Sun/Shade tolerance
- Nectar Source- Pollinators baby!
- Screening for privacy
- interest through the year
- Low maintenance
- Wildlife specifica beneficial species
Plant Choice: Right plant, right place

- Assess the site conditions:
  - base soil and sun/shade
- Select plants that thrive in those conditions
- Match final size & shape of plants to site
- Avoid invasive plants

There are many resources out there!!
Plant Choice: Lowest zone, ponding area
Plant Choice: Depression slope, middle area plants
Plant Choice: These plants can deal with a range of wetness over time as the depression fills and empties.
Plant Choice: Driest upper zone, upland area plants
Plant Choice: Shrubs and small stature trees for structure
Plant Choice: Shrubs can give winter interest and shelter
Plant Choice: Design Aesthetics

Design Aesthetics

- Formal or traditional design
  - Shrub bed
  - Perennial garden
  - Hedges

- Naturalized planting & design
  - Butterfly garden
  - Meadow (warm season grasses & wildflowers)
  - Buffer plantings
### Plant Choice: Grasses and Groundcovers

<table>
<thead>
<tr>
<th>BUFFER</th>
<th>BASE</th>
<th>SLOPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broomsedge</td>
<td>Big bluestem</td>
<td>Bluejoint grass</td>
</tr>
<tr>
<td>Bearberry</td>
<td>Virginia wild-rye</td>
<td>Sedges</td>
</tr>
<tr>
<td>Panic grass</td>
<td>Switchgrass</td>
<td>Fowl mannagrass</td>
</tr>
<tr>
<td>Switchgrass</td>
<td>Wool grass</td>
<td>Softrush</td>
</tr>
<tr>
<td>Little bluestem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indiangrass</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Images of various grass species](image-url)
## Plant Choice: Wildflowers and Ferns

### BUFFER
- Butterfly milkweed
- Wild indigo
- Purple coneflower
- Beebalm
- Black-eyed susan

### BASE
- New England aster
- New York aster
- Columbine
- Coreopsis
- Joe-pye weed
- Blazing star
- Sensitive fern
- Cinnamon fern
- Ironweed

### SLOPE
- Swamp milkweed
- Marsh marigold
- Turtlehead
- Boneset
- Rosemallow/hibiscus
- Blueflag iris
- Cardinal flower
- Blue lobelia
- Monkey flower
# Plant Choice: Trees and Shrubs

<table>
<thead>
<tr>
<th>BUFFER</th>
<th>BASE</th>
<th>SLOPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hackberry</td>
<td>Red Maple</td>
<td>River Birch</td>
</tr>
<tr>
<td>Red Bud</td>
<td>Service Berry</td>
<td>Buttonbush</td>
</tr>
<tr>
<td>Pepperbush</td>
<td>River Birch</td>
<td>Silky Dogwood</td>
</tr>
<tr>
<td>American Holly</td>
<td>Silky Dogwood</td>
<td>Green Ash</td>
</tr>
<tr>
<td>Bayberry</td>
<td>Red-twig Dogwood</td>
<td>Swamp White Oak</td>
</tr>
<tr>
<td>Witchhazel</td>
<td>Inkberry Holly</td>
<td>Pin Oak</td>
</tr>
<tr>
<td>White Oak</td>
<td>Winterberry</td>
<td>Cranberrybush Viburnum</td>
</tr>
<tr>
<td>Red Oak</td>
<td>Sweetbay Magnolia</td>
<td></td>
</tr>
<tr>
<td>Arrowwood Viburnum</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Plant Images](image1.jpg)
Rain Garden Examples
Rain Garden Examples: Roof Runoff design

Design

Installed Rain Garden
Rain Garden Examples: Parking Lot Runoff

Design

Installed Rain Garden
Rain Garden Examples: Roof, sump pump and Driveway Runoff !!!

Design

Installed Rain Garden
Rain Garden Examples: Driveway and Sump pump
Rain Garden Examples: Rain Barrel overflow

Design

Installed Rain Garden
Mulch with top dressing such as undyed cedar mulch
Water until established-soaker hose can help initially
Remove unwanted weeds- little and often
Fertilize at planting, and check soil after 3 years
Inspect during and after rain events for issues
Remove collected trash frequently
Black top chippings or other sediments
Maintain it: Long-Term maintenance

- Troubleshoot problems- if erosion occurs, build up berm, plant more grasses or add more mulch or stone to harden area.
- Prune, thin and cut back shrubs to encourage multiple stem growth
- Remove excess sediment, trash or debris as it collects
Maintain it: Troubleshoot problems

- Slowing down the speed of water as it enters the garden:
  - Attach a perforated plastic diffuser to the end of your gutter/downspout.
  - Use river rock at the entrance point of the rain garden.
  - Site your rain garden within a 10–15 foot grass buffer between the garden and the gutter/downspout. Use native grasses and let them grow tall.
Resources and Thanks

- Thanks to Chris Obropta from Rutgers University Water Resources Page for use of their Rain garden educational materials, used in the creation of this presentation.
- Rutgers University Cooperative Extension has many useful articles, homeowner guides and rain garden design and installation information:
  - [http://water.rutgers.edu/Projects/Projects.htm](http://water.rutgers.edu/Projects/Projects.htm)

continued
http://www.npsnj.org/rain_garden_home.htm
Site Visits

- If you live in the Summit area, we can schedule a 30-45 minute visit to help you plan and design your garden and plan for success.

- Contact Ginger Von Ryzin at gvonryzin@greatswamp.org and cc Hazel at Hazele@greatswamp.org

- We will schedule a time that works for you and make a plan that will allow you to move forward with your rain garden wither this fall or next spring

continued