The Whys of Rain Gardens
A brief introduction
March, 2017
Hazel England
Great Swamp Watershed
Passaic Watershed from source to sea
Pervious vs Impervious surfaces
The combined roof drainage areas and driveway drainage areas make up the total impervious cover drainage area for your yard.
Impervious surfaces:

- Prevent groundwater infiltration
- Enable rapid stormwater runoff causing erosion and flooding
- Increase non point source pollution entering waterways
Stream Health

<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
What does rainwater run-off pick up along the way?
Green infrastructure:

- Of which rain gardens are just one component
- 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
Rain water is an asset and not a waste product.

By infiltrating rain water into the ground we can significantly reduce the threat of flooding as well as pollution impacting streams, rivers, and lakes.
Enhance water quality by allowing water to be naturally filtered by soil instead of being piped, untreated into large bodies of water.
The Rain Garden Concept...
Rain gardens:

- Intercept, treat and infiltrate stormwater at source, to reduce runoff
- Removes non point source pollution
- Can create beneficial native habitat and can tie into existing landscape
Water quality benefits

- **Soil particles**: Remove dissolved metals and phosphate
- **Plant uptake**: Removes small amounts of nutrients
- **Microbial Processes**: remove pathogens from water
- **Sedimentation**: removes suspended solids, debris, trash, phosphates and pathogens
- **Provides**: flood control, groundwater recharge and nutrient removal
How much water can a rain garden intercept?

Some Math.....

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

When it captures and infiltrates precipitation into the groundwater.

A rain garden is a shallow depression dug slightly below grade to catch runoff and slowly allow recharge into the ground.
Main parts of a rain garden

**Grass Buffer**  This surrounds a rain garden and reduces runoff velocities, filtering out particulates.

**Depression**  The depression stores runoff awaiting treatment, presettling particulates that have not been filtered out by the grass buffer.

**Plants**  Plants are selected on their ability to cycle and assimilate nutrients, pollutants, and metals.

**Ponding Area**  Surface must be level for maximum infiltration.

**Organic or Mulch Layer**  This layer acts as a filter for pollutants, protects the soil from eroding, and provides an environment for microorganisms to degrade petroleum-based products and other pollutants.

**Sand Bed**  A sand bed further slows runoff, spreading the water over the basin. The sand helps to prevent anaerobic conditions in the planting soil and enhances exfiltration from the basin.

**Planting Soil Layer**  The soils provide needed nutrients while absorbing heavy metals, hydrocarbons, and other pollutants.
Parts of the Rain Garden Process

1. Plan it
2. Install it
3. Maintain it
Plan it

Investigate your property.
Rain gardens should ideally be located between the source of runoff (roofs & driveways) and the runoff destination (drains, streams, low spots).
Parking Lot/Driveway

Roof
Plan it

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

continued
Plan it: Calculate roof line runoff

Surface Area = (L1 x W)
Plan it

6. Determine location of buried lines
7. Conduct a percolation test
8. Know your soil type - conduct a soil test
9. Figure the approximate soil amendment materials needed
10. Choose correct native plants and numbers
11. Design the plant layout
Plan it: Conduct a percolation Test

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

~1” of water draining /hour is a good site
Q. How big does a rain garden have to be?

10’ x 10’ - 15’ x 20’

is typical.
House is 60’ x 40’.

Roof area is 2400 sq’

Downspout collects 25% of roof,
Downspout drainage area is equal to 600 square feet.
## Rain Garden Sizing Table

*Based on New Jersey’s Water Quality Design Storm*

<table>
<thead>
<tr>
<th>Drainage Area</th>
<th>Size of 3” Deep Rain Garden (Clay soils)</th>
<th>Size of 6” Deep Rain Garden (loamy soils)</th>
<th>Size of 8” Deep Rain Garden (sandy soils)</th>
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</thead>
<tbody>
<tr>
<td>500 ft²</td>
<td>200 ft²</td>
<td>100 ft²</td>
<td>75 ft²</td>
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<td>750 ft²</td>
<td>300 ft²</td>
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<tr>
<td>2000 ft²</td>
<td>800 ft²</td>
<td>400 ft²</td>
<td>299 ft²</td>
</tr>
</tbody>
</table>
Plan it

- 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

• Rain garden should be a level bed to allow rainfall to spread out over entire site.

• Create a lip or berm to allow rain water to infiltrate, but have a overflow for heavy storms.
Plan it

- 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 Concept Drawing
Pulaski Park
Designed by Lynda Wells, Freelance Illustrations for
The Center for Neighborhood Technology
Plan it

A Rain Garden

Design and Renderings By:
Kim Castro Nuncio
2007

Key
- Woody Perennials
- Evergreen Shrub
- Blooming Perennial
- Ornamental Grass / Fern

The Site...
...of the proposed garden is a 30' x 225' swath of storm drain pipe off the parking lot behind the Ag Building. A catch will be cut in the curb to allow storm water runoff to be managed by the new Rain Garden.

the NATIVE plants

- Virginia creeper: Actinidia deliciosa, evergreen vine. Will cover a wall or any other structure. 15'-20' H.
- Showy willow: Salix alba 'Vitellina' - large orange-red catkins in early spring followed by a mass of green leaves. Suitably used in shrubs, 2'-4' H.
- Pearly everlasting: Eupatorium inodorum, deciduous perennial with small white flowers in early summer. Drought-tolerant, 1'-2' H.
- Blue vervain: Verbena hastata, medium-tall herb with opposite lanceolate leaves and small, purple flowers in late summer. 1'-2' H.
- Scarlet larkspur: Delphinium macklinii, tall perennial flowering in June with blue flowers. 6'-7' H.
- Purple Joe Pye: Eupatorium purpureum, tall bushy plant with small purple flowers in early summer. 4'-5' H.
- Blue bonnet: Lupinus texensis, evergreen shrub with blue flowers. 2'-3' H.
- Sedum: Sedum spurium, evergreen succulent with small, yellow flowers in late spring. 1'-2' H.
- White snapdragon: Antirrhinum, tall perennial with small white flowers in late spring. 1'-2' H.

Note: The clumps are surrounded by a variety of native species, such as black-eyed susan, bluebell, and penstemon.
Plan it

Rain gardens have 3 distinct planting zones:

- Berm/lip or upland area
- The Depression
- Ponding area.

Each zone will stay wet for a different amount of time and plants need to match the wetness zone.
Plan it
Plan it
Assemble the dig team!
Install it: Remove the existing grass
Install it: Excavate to desired elevation
Install it: grade and shape
Install it: Add soil amendments
Install it: Amend the soil
Install it: amendments improve percolation and infiltration rates
Install it: Create a berm
Install it: Getting water where it needs to go
Install it: Prepare an overflow
Ready to plant
Install it: planting
• **Native plants** have deep penetrating root systems.

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

• Deep roots and tolerance for drought mean they are well adapted to the vagaries of NJ climate.
Additional benefit of good plant choice

• Winter Interest
• Fall Color
• Sun/Shade tolerance
• Nectar Source
• Screening for privacy
• Interest through the year
• Low maintenance
• Wildlife beneficial species
Choosing the Right Plants for rain gardens:

• Assess the site conditions: soil and sun/shade
• Select plants that thrive in those conditions
• Match final size & shape to site
• Avoid invasive plants
Lowest Zone/Ponding Area Native Plants
Middle Zone/Depression Area Native Plants
Red and Yellow Twig Dogwoods in the winter
Maintain it
Maintain it: Short Term maintenance

- Mulch with top dressing undyed cedar mulch
- Water plants until established-soaker hose can help water efficiently
- Remove unwanted weeds- little and often
- Fertilize at planting, and check after 3 years
- Inspect during and after rain events for issues
Maintain it: Long Term maintenance

- Troubleshoot problems - if erosion occurs, build up berm, plant more grasses or add more mulch.
- 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:

(1) Attach a perforated plastic diffuser to the end of your gutter/downspout.

(2) Use river rock at the entrance point of the rain garden.

(3) 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 Rutgers University Water Resources Page for use of their Rain garden educational materials, which were 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)
Resources

http://www.npsnj.org/rain_garden_home.htm