Rain Gardens for Beginners

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Home Gardener’s School
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The urban water cycle

Condensation

Evaporation

Much less infiltration
Roofs, roads & paths stop infiltration

More runoff:
More

No rain: streams dry up
Rain: streams flood

Low groundwater flow

Bedrock
40% evapotranspiration
10% runoff
25% shallow infiltration
25% deep infiltration
Natural Ground Cover

38% evapotranspiration
20% runoff
21% shallow infiltration
21% deep infiltration
10%-20% Impervious Surface

35% evapotranspiration
30% runoff
20% shallow infiltration
15% deep infiltration
35%-50% Impervious Surface

30% evapotranspiration
55% runoff
10% shallow infiltration
5% deep infiltration
75%-100% Impervious Surface

Slide credit: Laura Rozumalski, Philadelphia Water Department
What is a Rain Garden?

Photo credit: Beltrami Soil and Water Conservation District, Minnesota
What is a Rain Garden?

• Shallow landscaped depression that collects and treats stormwater runoff

• Designed to merge two important goals: aesthetics and water quality

• Can be blended into the landscape and made to look natural

• Water is directed into them by pipes, swales, or curb openings
Benefits

• Designed to intercept, treat, and infiltrate stormwater at the source before it becomes runoff

• Provides very high pollutant removal efficiencies

• Can be incorporated into the landscapes of many locations
Where do Rain Gardens go?

- It depends on the surface you are collecting the runoff from
  - Rooftop
  - Driveway
  - Road
- Do not put it in a place where water already ponds or is soggy
- Keep at least 10 feet away from building
- Do not place over a septic system
- Place in full or partial sunlight
- Avoid large tree roots
- Select a flat part of your yard for easier digging
The Parts of a Rain Garden

- Inlet/Splash Pad
- Berm
- Depression
- Ponding Area
- Depression
- Berm
NOTE: 90% of all storm events produce less than 1 inch of rain. Therefore, the key to reducing pollutant loads is to treat the runoff associated with the first 1 inch of rain (Clayton & Schueler, 1996).

• Absorption to soil particles
  – Removes dissolved metals and soluble phosphorus

• Plant uptake
  – Removes small amounts of nutrients

• Microbial processes
  – Removes organics and pathogens

• Exposure to sunlight and dryness
  – Removes pathogens

• Sedimentation and filtration
  – Removes total suspended solids, floating debris, trash, soil-bound phosphorus, some soil-bound pathogens

• Infiltration of runoff
  – Provides flood control, groundwater recharge, and nutrient removal
Rain Garden Basics
Steps

1. Planning

2. Installation

3. Maintenance

Mendham Township Elementary School, Morris County
Planning Steps

1. Planning

- **Identify Site**
- **Site Visit**
- **Design Calculations**
Determine Existing Utility Lines

http://www.nj1-call.org

NJ One Call: 811
Planning Steps
Identify Site

Identify the Drainage Area

Parking Lot/Driveway
Roof

Union County Vocational School

Before

Hockman Farm, Winchester, Virginia
Roof

Parking Lot/Driveway

Union County Vocational School

Hockman Farm, Winchester, Virginia
Planning Steps
Identify Site

Parking Lot/Driveway with a Curb Cut

Before

After

Rutgers Cooperative Extension of Monmouth County, Freehold, NJ
Determine Current Stormwater Flow

If the area is prone to flooding, it may be difficult to improve the drainage.
Identify Drainage Problems

Property Flooding

Union County Vocational School
Current Landscaping Practices
Measure Drainage Area

Surface Area = (L1xW) + (L2xW)
= (15’x20’) + (10’x20’)
= (300’) + (200’)
= 500 square feet
Measure Drainage Area

Make observations during storms to estimate the drainage area

Or use survey equipment
Determine Slope

Slope = \( \frac{H}{W} \times 100 = \frac{6''}{10'} = \frac{0.5'}{10'} \times 100 = 5\% \text{ slope} \)
Determine Slope

<table>
<thead>
<tr>
<th>Percent Slope</th>
<th>Typical Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 4%</td>
<td>3”-5”</td>
</tr>
<tr>
<td>5% - 7%</td>
<td>6”-7”</td>
</tr>
<tr>
<td>8% - 12%</td>
<td>8” maximum depth</td>
</tr>
<tr>
<td>&gt; 12%</td>
<td>Consider another location</td>
</tr>
</tbody>
</table>

**Exception:** Sites with poor percolation or high percentage of clay soils will be shallower with a larger surface area since they percolate slowly
## 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</th>
<th>Size of 6” Deep Rain Garden</th>
<th>Size of 8” Deep Rain Garden</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>300 ft²</td>
<td>150 ft²</td>
<td>112 ft²</td>
</tr>
<tr>
<td>1000 ft²</td>
<td>400 ft²</td>
<td>200 ft²</td>
<td>149 ft²</td>
</tr>
<tr>
<td>1500 ft²</td>
<td>600 ft²</td>
<td>300 ft²</td>
<td>224 ft²</td>
</tr>
<tr>
<td>2000 ft²</td>
<td>800 ft²</td>
<td>400 ft²</td>
<td>299 ft²</td>
</tr>
</tbody>
</table>
Percolation Test

*Steps*:

1. Dig a hole 12 inches deep by 6 inches in 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 inch of water draining per hour is good
Percolation Test

Water should be completely drained within 24 hours.
Soil Test

• Sample the soil and send to the Rutgers Soil Testing Lab for:
  • Nutrient analysis/ recommendations
  • pH analysis/ recommendations
  • Percent sand/ silt/ clay

• Soil Texture Test
  Roll soil into a ball in hand and see how it forms
  • Hard ball – Clay/Silt soil
  • Soft ball – Loamy soil
  • No ball – Sandy soil

But, don’t worry – clay/silt and sandy soils can be amended to get the preferred loamy soil texture
Planning Steps
Site Visit

Take Photographs

Burlington County Community Agricultural Center
General Soil Amendments Amounts for a 100 sq ft Rain Garden that is 6 Inches Deep

<table>
<thead>
<tr>
<th>Soil Amendment</th>
<th>Amount for 100 sq ft Rain Garden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>1 cubic yard</td>
</tr>
<tr>
<td>Compost</td>
<td>1 cubic yard</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>Follow Soil Test Result Recommendations</td>
</tr>
<tr>
<td>Lime</td>
<td>Follow Soil Test Result Recommendations</td>
</tr>
</tbody>
</table>
### Approximate Amount of Plants Based on Future Mature Size

<table>
<thead>
<tr>
<th>Size of Rain Garden</th>
<th>Approximate Amount of Plants</th>
</tr>
</thead>
</table>
| 100 square feet     | 1 Small Tree (Optional)  
                     | 7 Shrubs                  
                     | 24 Herbaceous Species     |
| 200 square feet     | 1 Small Tree (Optional)  
                     | 14 Shrubs                 
                     | 48 Herbaceous Species     |

Leonard Park, Morris County
Types of Plants

Facultative Wetland (FACW)

Lowest Zone/Ponding Area

Facultative Wetland (FACW), Facultative (FAC), Facultative Upland (FACU)

Middle Zone/Depression Area

Facultative Upland (FACU)

Highest Zone/Upland Area

http://plants.usda.gov
Lowest Zone/Ponding Area Native Plants

Marsh Marigold
*Caltha palustris*

Rose Mallow
*Hibiscus palustris*
Middle Zone/Depression Area Native Plants

Joe Pye Weed
*Eupatorium purpureum*

Obedient Plant
*Physostegia virginiana*
Highest Zone/Upland Area Native Plants

Black Eyed Susan
*Rudbeckia hirta*

Bee Balm
*Monarda didyma*
Amount of Mulch Required for a Three Inch Thick Layer

<table>
<thead>
<tr>
<th>Size of Rain Garden</th>
<th>Approximate Amount of Mulch</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 square feet</td>
<td>0.25 cubic yard</td>
</tr>
<tr>
<td>50 square feet</td>
<td>0.50 cubic yard</td>
</tr>
<tr>
<td>100 square feet</td>
<td>1.0 cubic yard</td>
</tr>
<tr>
<td>200 square feet</td>
<td>2.0 cubic yards</td>
</tr>
</tbody>
</table>

*Triple-shredded Hardwood with No Dye*
Optional Supplies

Supplies may include:

- River rock
- PVC pipe
- Deer fencing
Installation Steps

- Remove existing grass
- Excavate to the desired elevation and grade
- Add soil amendments
- Prepare the berm
- Prepare the overflow
- Level the lowest zone/ponding area
- Plant the native plants
- Apply the mulch
- Water the native plants
Remove Existing Grass

Gloucester County 4-H Fairgrounds
Installation Steps

Excavate to the Desired Elevation and Grade

Leonard Park, Morris County

Gloucester County 4-H Fairgrounds
Add Soil Amendments

Installation Steps
Prepare the Berm

- Between 3% and 8% slope lawn
- Greater than 8% slope lawn

**Before Digging**
- downhill stake
- string
- start digging here

**After Digging**
- berm
- downhill stake
- string
- old lawn surface
- uphill stake

Leonard Park, Morris County
Installation Steps

Prepare the Overflow

Gloucester County 4-H Fairgrounds

Overflow

Leonard Park, Morris County
Installation Steps

Level the Lowest Zone/ Ponding Area

Wheaton Arts and Cultural Center, Cumberland County
Level the Lowest Zone/ Ponding Area
Plant the Native Plants

Installation Steps

Cut the Root Ball

Ulster County, New York
Plant the Native Plants

Installation Steps

Planting Hole
Same Depth as Root Ball

Ulster County, New York

Hockman Farm, Winchester, Virginia
Apply the Mulch

Installation Steps

Ulster County, New York

Protect Small Plants when Mulching
Water the Native Plants

Hockman Farm, Winchester, Virginia
Maintenance Steps

3. Maintenance

Short-Term Maintenance

Long-Term Maintenance
Watering

Hanson House/Hanson Park Conservancy, Union County
Weeding

• Weeding more often will limit the amount of time you will have to spend weeding in the end

• Watch for overly-competitive species

• Some weeds can be aggressively spreading underground by rhizomes
Fertilizing

Fertilize at the very beginning or end of the growing season based on soil test results.

Soil should be tested every 3 years if necessary.

- Soil Test Kits can be purchased at your county Rutgers Cooperative Extension office for a nominal fee.

Soil amendments should ONLY be added when NO storms are expected.

http://njaes.rutgers.edu/soiltestinglab
Observing the Rain Garden

Observe the rain garden during rain events and note any problems or successes

Problem: Gullying after rain event
Solution: Add a berm and/or plants

Success: Withstood rain event

Walnut Avenue Elementary School, Union County
Hanson House/Hanson Park Conservancy, Union County
Replacing Mulch that has Washed Away

Walnut Avenue Elementary School, Union County
Caring for Native Plants

Care for any newly-planted native plants that may have been uprooted immediately following rain events.
Preparing a Photographic Journal

Installation

Take photographs from the same location for consistency

Fanwood Memorial Library, Union County
Weeding

Watch for Invasive Species!

Invasive Species

- Wisteria
- Japanese Knotweed
- Wild Cucumber
- Thistle

Invasive Species Photographs by Betty Ann Kelly
Pruning

Pruning directs growth of plants, improves health, and increases production of flowers and fruits.

Types of Pruning:

**THINNING**: basically, thinning out. This type of pruning removes entire branches back to the main trunk or major branches to the ground.

–  *Expected result*: large, open shrub

**HEADING**: also known as heading back. This type of pruning removes only part of a branch

–  *Expected result*: growth of multiple branches in place of single branch, thus a more dense shrub

In a rain garden, dense shrub growth is encouraged to provide increased filtering capacity.
Removing Debris, Litter, and Sediment
Cutting Down/Mowing the Rain Garden

• Mowing **native grasses** should occur 2 times a year in your rain garden.
  – Initial mowing can be done after the first few weeks of growth – *early Spring*
  – Final mowing can be completed after ground nesting birds have hatched the next generation – *usually near mid-May*

• After the growing season, it will be necessary to remove stems and seedheads. These can be left for habitat and in some areas, aesthetics.

• A string trimmer can be used to maintain over-competitive growths.

• Dead plant materials can also be removed by a string trimmer or mower, if the mowing deck can be raised to cut at 6”-8”. 
Keeping up with Photographic Journal

Fanwood Memorial Library, Union County

6 Months

1 Year 6 Months

The Future
Removing/Replacing Plants

*Remove and replace plants that have not survived or that are diseased*

- Re-seed the berm if there are areas of exposed soil
- Replace rocks that may be diverting flow out of the garden
- Build up areas where more protection is needed
Harvest Cuttings

- Collect seeds and cuttings from successful plants in the rain garden and use them for the new season
- Plant more of the successful species in the rain garden as necessary
Apply New Mulch
Frequently Asked Questions

• Will my rain garden cause a mosquito problem?

• Will my rain garden cause flooding?

• What about deer?

• How do I slow down the speed of water as it enters the garden?

• How much does a typical rain garden cost?
Will my rain garden cause a mosquito problem?

- There shouldn’t be a mosquito problem if the garden is properly sited and designed. Rain gardens should drain in less than two days.
- Mosquitoes have a 10 day life cycle from egg to adult.
- Mosquitoes that carry most diseases do not live in ponds. They prefer small amounts of standing water such as holes in trees, old tires or bird baths.
Will my rain garden cause flooding?
If your rain garden does not drain out the water after ~24 hours, it is time to re-evaluate your rain garden. Maybe try:

• Building berms and/or adding plants

• Adding COARSE sand (not sandbox sand) with topsoil/compost to help with infiltration
What about deer?
Try fencing, deer resistant plants, or deer retardant sprays.
How do I slow down the speed of water as it enters the garden?

Try one or more of the following:

(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.
How much does a typical rain garden cost?

<table>
<thead>
<tr>
<th>Items for 100 Square Foot Rain Garden</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rutgers Soil Test Kit for nutrients and pH</td>
<td>$15.00</td>
</tr>
<tr>
<td>Rutgers Soil Test Kit for soil texture analysis</td>
<td>$60.00</td>
</tr>
<tr>
<td>White Mark-Out Paint</td>
<td>$5.00</td>
</tr>
<tr>
<td>1 yard of concrete or bank run sand (~$30.00/yard)</td>
<td>$30.00</td>
</tr>
<tr>
<td>1 yard of compost (~$30.00/yard)</td>
<td>$30.00</td>
</tr>
<tr>
<td>5 pound bag of fertilizer</td>
<td>$5.00</td>
</tr>
<tr>
<td>Native Plants (does not include shipping)</td>
<td>$305.00</td>
</tr>
<tr>
<td>1 yard of mulch (~$30.00/yard)</td>
<td>$30.00</td>
</tr>
<tr>
<td>1 roll of landscape fabric</td>
<td>$10.00</td>
</tr>
<tr>
<td>Landscape pins</td>
<td>$4.00</td>
</tr>
<tr>
<td>8 bags of 1.0”-1.5” river rock</td>
<td>$28.00</td>
</tr>
<tr>
<td>Soaker hose</td>
<td>$13.00</td>
</tr>
<tr>
<td>PVC pipe (~$2.00/linear foot)</td>
<td>$20.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$555.00</strong></td>
</tr>
</tbody>
</table>
Rain gardens are designed to intercept, treat, 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, inexpensive and low-maintenance gardens that you can install at home.
Rutgers Cooperative Extension’s *Stormwater Management in Your Backyard* program

- Rain Garden Programming for Various Audiences
  - Rutgers Master Gardeners
  - Rutgers Environmental Stewards
  - Homeowners
  - Children

I Want to Learn More
• Pilot Programs
  • Rain Garden Specialist & Rain Garden Specialist and Trainer Certification
  • Build A Rain Barrel Workshop
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