Rain Garden Site Selection and Design

Andrew Anderson, E.I.T.
Extension Associate Engineer
Biological & Agricultural Engineering
NCSU
Outline

• What to look for around your property
• How do the soils drain?
• Choosing a rain garden type
• Sizing RG
• Overflow/bypass
Rain Garden Location

- Considerations
  - Topography
  - Downspouts
  - Ponding
  - Existing Landscape

- Constraints
  - Utilities
  - Soil Type
  - Water Table
Best Source of Water for your RG?

DOWNSPOUTS
Rain Garden Location
Rain Garden Location

[Image of a person holding a black hose next to a brick wall with plants and grass.]
Rain Garden Location
Rain Garden Location

“Pinch Point”
Rain Garden Location

Potential Collection Points
Rain Garden Location

*Observe your yard during a rainfall event*

- Where does water flow from?
- Where does water travel to or collect?
Rain Garden Location

- Place your garden between runoff source and destination
- We want to intercept water before it reaches surface waters or the storm drain network!
Identifying a RG Location
Rain Garden Location

Integrate into existing landscaping
Locate Rain Garden with Topography in Mind to Minimize Digging and Berm Construction

Existing Yard Slope

Ponding depth
Rain Garden Construction Sequencing

- Add garden after other construction is finished
- Take note of potential or active construction
Rain Garden Construction Sequencing

Ensure that watershed is stable and is not going to produce sediment

If it is not stable, seed and straw “bare” areas before construction of rain garden
Rain Garden Location: Determine Constraints

- Locate wells, septic systems, and utilities
- Ask the owner (trust, but verify!)
Rain Garden Location: Site Constraints

- Stay away from utility lines
- Locate utilities before digging
Rain Garden Location: Site Constraints

SITING GUIDELINES:

• > 10 ft from house crawl space or basement
  • NEVER uphill

• > 10 ft from wellhead
  • NEVER uphill

• > 25 ft downhill or laterally from septic system drain field
  • NEVER uphill

• In full to partial sun if possible
Infiltration Test

1. Dig a 1-foot hole at 2-3 potential locations based on drainage, utilities, and landscape aesthetics
2. Fill holes to top with water
3. Measure drainage time at each test hole
4. Repeat 2-3 times *per hole*
5. Record drainage times
6. Determine *longest* drain time for each hole
7. This rate determines type of rain garden
# Infiltration Test

<table>
<thead>
<tr>
<th>Drain Time</th>
<th>Appropriate BMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 12 hours</td>
<td>Quick-Draining Rain Garden</td>
</tr>
<tr>
<td>12 hours – 3 days</td>
<td>Standard Rain Garden</td>
</tr>
<tr>
<td>&gt; 3 days</td>
<td>Wetland Garden</td>
</tr>
</tbody>
</table>
Evaluate Soils and Drainage

Signs of an impermeable soil

- Water remains in test pit three days after rainfall
- Ponded water on surface for extended periods
- Wetland soils – grey matrix mixed with areas of brown color
Evaluate for Wetland Soils
Soil Test

- After installation
- Can now enter BMP code on soil test sheet
- Ensure good plant growth and quality
  - Determine lime requirements

Don’t guess: Soil test
Soil Test Interpretation

Soil Test Recommendations

<table>
<thead>
<tr>
<th>Lime</th>
<th>N</th>
<th>B</th>
<th>K</th>
<th>Mg</th>
<th>Cu</th>
<th>Zn</th>
<th>B</th>
<th>Mn</th>
<th>See Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 M</td>
<td>Note 14</td>
<td>0.5 M</td>
<td>5.5 M</td>
<td>$0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>14</td>
</tr>
</tbody>
</table>

Add lime if needed
Final Siting Considerations

- Get P.E. or RLA help for larger rain gardens, bioretention, or for steep slopes
- Don’t concentrate runoff towards neighbors property
- Designed to capture first 1” of runoff
- Won’t necessarily solve standing water or poor drainage
- Not a solution for curing increased stormwater runoff from additional developments uphill – sediment filling a rain garden will cause clogging and kill plants
Rain Garden Types

Two major differences:
1. “Wetness”
2. Plant selection
What drainage time is acceptable?

> 3 days  Wetland Garden

3 options:

1) Look for another location.
2) Work with it! (Install a backyard wetland.)
3) Using soil media & under-drain. ($$$)
A backyard wetland / raingarden combo!

Working with wet conditions
Important!

The landowner/homeowner MUST know that at times, rain gardens will be very wet. They can also be very dry.
Steps to sizing a rain garden:

1. Determine the watershed boundaries (i.e. “delineate”)
2. Estimate the drainage area
3. “10/10” Method
4. Design the shape and size the weir
What is a watershed?
Delineate the watershed...smaller scale
Delineate the watershed...smaller scale

- Topography & Aerial photography
  - County GIS websites
- Laser level/survey
- Landscape characteristics
- GET WET!

www.oll.state.oh.us
Calculate total watershed area.

- Mapping program
- By Hand
  - 1 adult pace ≈ 2.5 feet
  - Measuring tape
  - Aerial photograph
- Site visits should always be conducted.
Add More Watershed Area?

• Examine watershed at selected BMP location.....is there opportunity to increase drainage area?
  – Diversion berms?
  – Swales?
  – Pipes?

• Is there space for bigger BMPs?
Estimating Area

• Your rain garden’s drainage area consists of: **Impervious Area**
Estimating Area

- Your rain garden’s drainage area consists of: *Pervious Area*
Sizing the Rain Garden

• Take 10% of impervious area draining to site
• Take 1% of pervious area
• Add the two together! Result is the optimal square feet of rain garden needed
Another way to think of it....

- Rain Garden Size ($ft^2$) =
  (1% of Pervious Watershed) + (10% of Impervious Watershed)

10% Impervious Area

1% Pervious Area
What Happens When It Fills Up?
Weirs: Key to Bypassing Extra Water

CROSS-SECTIONAL VIEW

Ponding depth

Weir length

Berm
Overflow Weirs

www.pierce.wsu.edu

Pittsboro Rain Garden Certification October 2014
Weir vs. BERM

www.bluegrassrailingardenalliance.com

seagrant.oregonstate.edu
Overflow Weir

<table>
<thead>
<tr>
<th>Impervious Surface Area (ft²)</th>
<th>Overflow Weir Length (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 or less</td>
<td>1.0</td>
</tr>
<tr>
<td>3000</td>
<td>1.5</td>
</tr>
<tr>
<td>4000</td>
<td>2.0</td>
</tr>
<tr>
<td>5000</td>
<td>2.5</td>
</tr>
</tbody>
</table>

![Overflow Weir Diagram](image-url)
An Example:

The rooftop for a house is 60ft by 60 ft. One downspout (there are 4 total) will be directed to the rain garden.

Approximately 500ft\(^2\) of driveway will also drain to the rain garden.

With the “10 and 10” rule, what size should the rain garden be?
1. Determine watershed boundaries.

2. Estimate each type of contributing area

\[
\text{Roof area} = \frac{60 \times 60}{4} = 900 \text{ft}^2
\]

\[
\text{Driveway area} = 500 \text{ft}^2
\]

\[
\text{Pervious area} = 1000 \text{ft}^2
\]

\[
\text{Impervious} = 900 + 500 = 1400 \text{ ft}^2
\]
3. Impervious \times 10\%
4. Pervious \times 1\%

\[(1,400 \text{ ft}^2 \times 10\%) + (1,000 \text{ ft}^2 \times 1\%) = 150 \text{ ft}^2\]

5. Set ponding depth at 10”
4. Choose rain garden dimensions

<table>
<thead>
<tr>
<th>Effective Impervious Area</th>
<th>Rain Garden Surface Area (10” deep)</th>
<th>Potential Rain Garden Dimensions (ft x ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 ft²</td>
<td>80 ft²</td>
<td>7x12, 8x10, 9x9</td>
</tr>
<tr>
<td>1000 ft²</td>
<td>100 ft²</td>
<td>7x15, 10x10</td>
</tr>
<tr>
<td>1200 ft²</td>
<td>120 ft²</td>
<td>8x15, 10x12</td>
</tr>
<tr>
<td>1400 ft²</td>
<td>140 ft²</td>
<td>7x20, 12x12</td>
</tr>
<tr>
<td><strong>1500 ft²</strong></td>
<td><strong>150 ft²</strong></td>
<td><strong>10x15, 12x13</strong></td>
</tr>
<tr>
<td>2000 ft²</td>
<td>200 ft²</td>
<td>10x20, 14x15</td>
</tr>
<tr>
<td>2500 ft²</td>
<td>250 ft²</td>
<td>10x25, 13x20</td>
</tr>
<tr>
<td>3000 ft²</td>
<td>300 ft²</td>
<td>15x20, 12x25</td>
</tr>
<tr>
<td>4000 ft²</td>
<td>400 ft²</td>
<td>20x20, 40x10</td>
</tr>
</tbody>
</table>
Pittsboro Rain Garden Certification
October 2014

Next step???