

RUTGERS

New Jersey Agricultural
Experiment Station



Rain Garden Site Selection and Installation



Amy Boyajian

Program Associate

boyajian@envsci.rutgers.edu

Rutgers Cooperative Extension

Water Resources Program

<http://water.rutgers.edu>

**Rain Garden Workshop for Landscape Professionals
March 28, 2009**

- A rain garden was constructed at the Ulster Municipal Building in 2008 by the Master Gardeners of Ulster County
- **GOAL:** To have the rain garden serve as a model for county residents who are interested in controlling polluted runoff and to help recharge the groundwater



- This rain garden captures stormwater runoff from 1,566 square feet of impervious surface. For every 1.25 inches of stormwater runoff, it captures 1,200 gallons
- As of September 2008, the rain garden has received 13.24 inches of stormwater runoff.... **which equals 12,924 gallons of stormwater runoff being recharged!**

- Shallow landscaped depression that 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

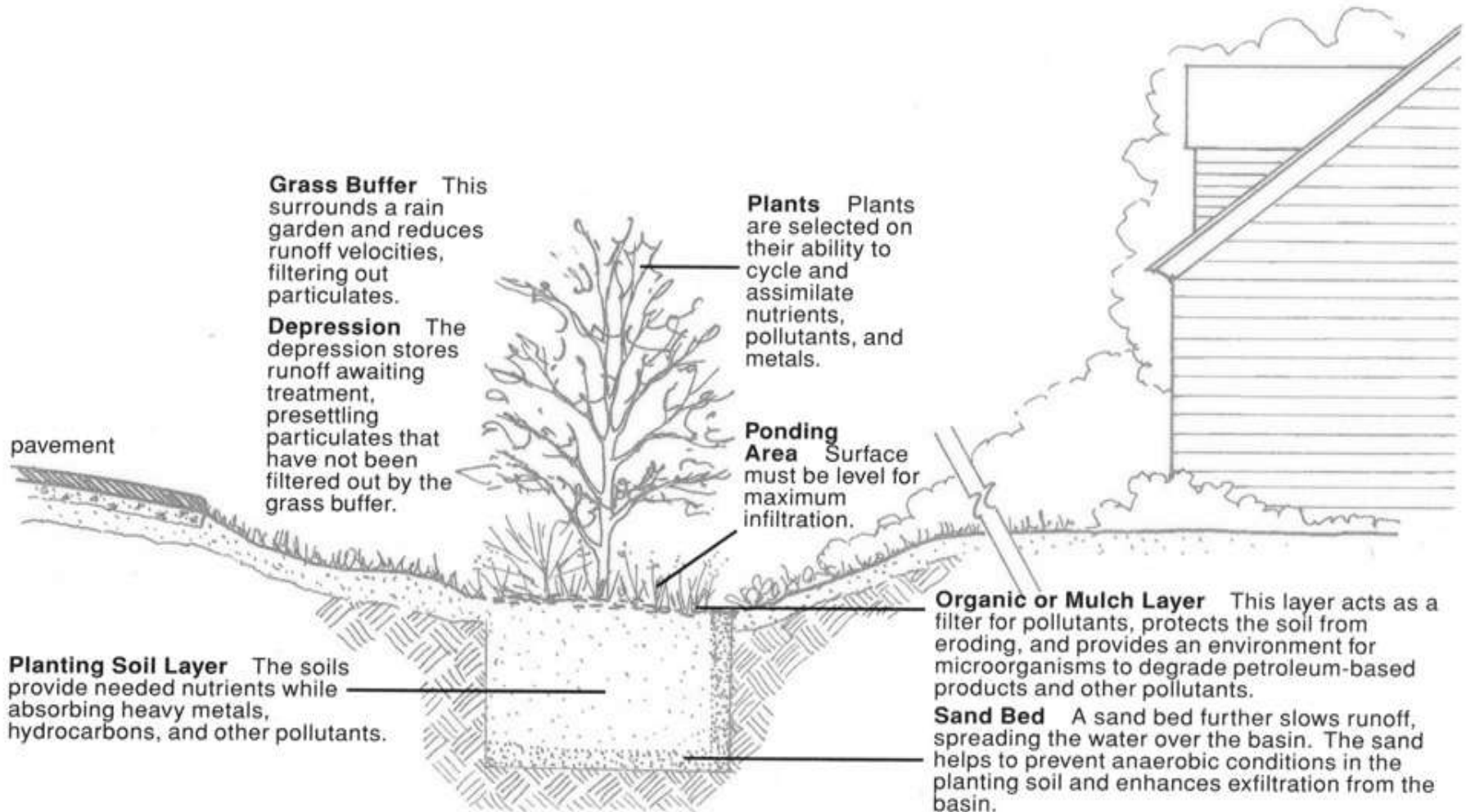


Benefits

- 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



The Parts of a Rain Garden



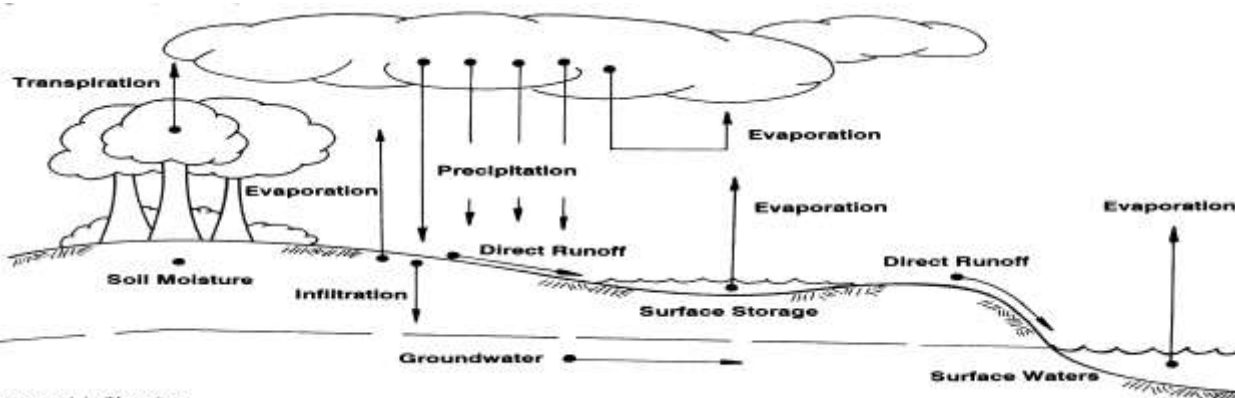
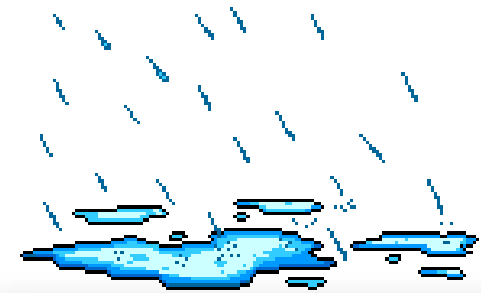


- Absorption to soil particles
 - *Removes dissolved metals and soluble phosphorus*
- Plant uptake
 - *Removes small amounts of nutrients*
- Microbial processes
 - *Removes organics and pathogens*
- Exposure to sunlight and dryness
 - *Removes pathogens*
- Sedimentation and filtration
 - *Removes total suspended solids, floating debris, trash, soil-bound phosphorus, some soil-bound pathogens*
- Infiltration of runoff
 - *Provides flood control, groundwater recharge, and nutrient removal*

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).

How much water does a typical rain garden treat in a year?

- 90% of rainfall events are less than 1.25"
- New Jersey has approx. 44" of rain per year
- The rain garden will treat and recharge:
 $0.9 \times 44" = 40"/\text{year} = 3.3 \text{ ft}/\text{year}$
- The rain garden receives runoff from 1,000 sq.ft.
- Total volume treated and recharged by the rain garden is
 $1,000 \text{ sq. ft.} \times 3.3 \text{ ft}/\text{year} = 3,300 \text{ cubic feet}/\text{year}$,
 which is 25,000 gallons/year
- ***Build 40 rain gardens and we have treated and recharged 1 million gallons of water per year!***



How To Install a Rain Garden



3. Maintenance



2. Installation



1. Planning





- Identify Site
- Site Visit
- Design Calculations

1. Planning



Things to Remember

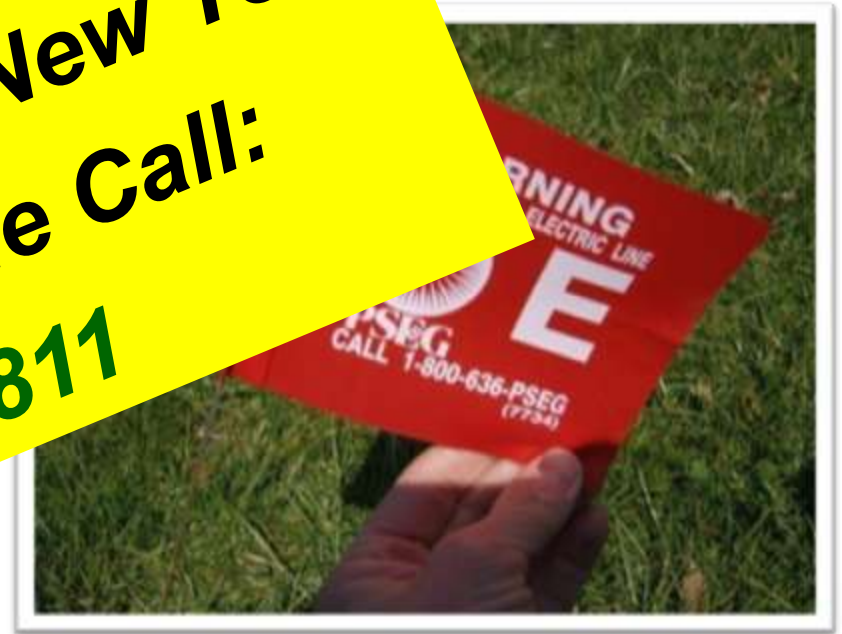
- The rain garden should be at least 10 feet from the house so infiltrating water doesn't seep into the foundation.
- Do not place the rain garden directly over a septic system.
- Do not put rain garden in places where the water already ponds or the lawn is always soggy.
- Place in full or partial sunlight as a first option
- Select a flat part of the yard for easier digging as a first option.
- Avoid large tree roots.

Determine Existing Utility Lines

<http://www.digsafelynewyork.com/>



Dig Safely New York
NY One Call:
811



Identify the Drainage Area



Union County Vocational School

Before



Hockman Farm, Winchester, Virginia



**Parking Lot/
Driveway**

Union County Vocational School

After



Roof

Hockman Farm, Winchester, Virginia

Parking Lot/ Driveway with a Curb Cut



Determine Current Stormwater Flow



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

Identify Drainage Problems



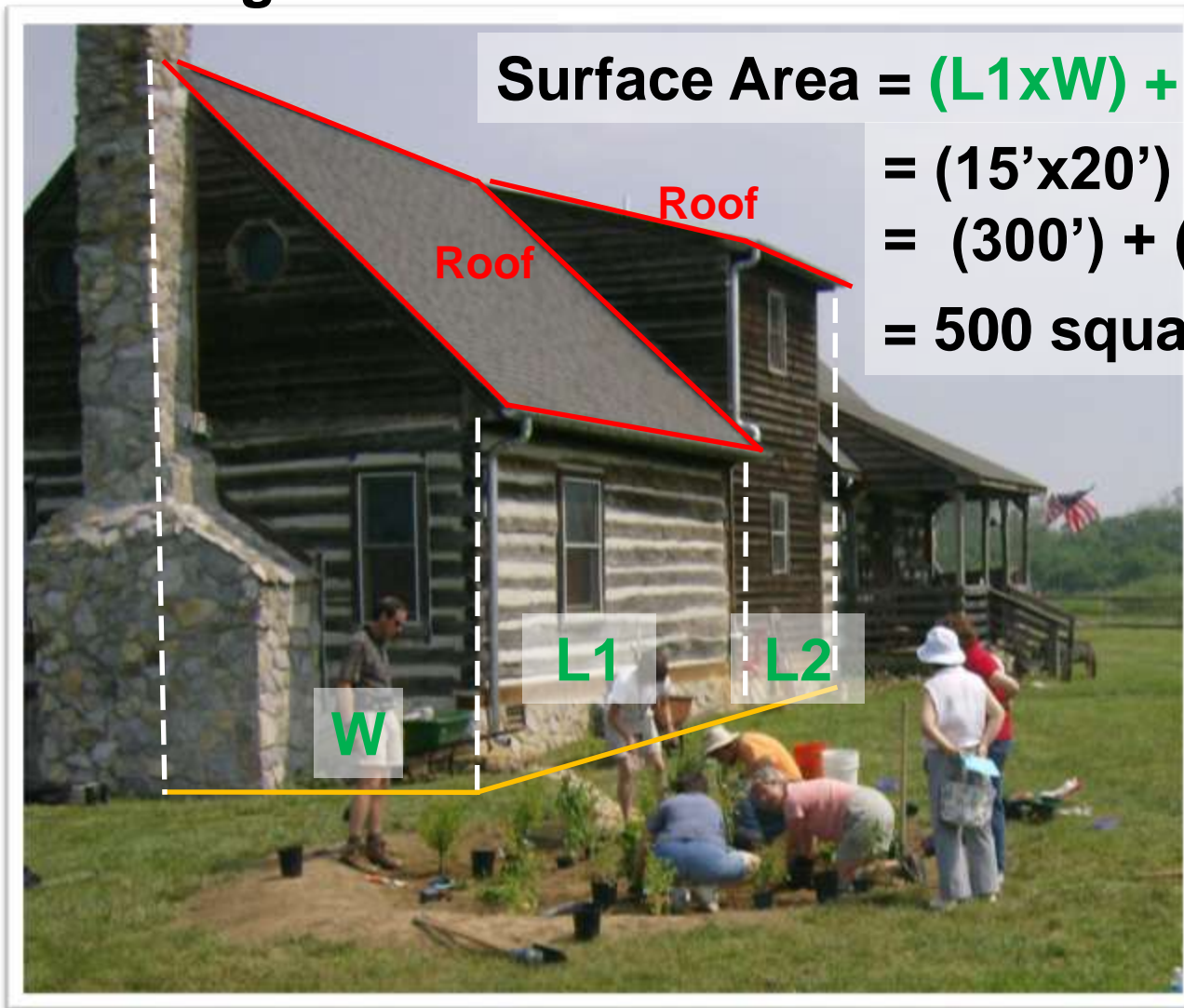
Union County Vocational School

Current Landscaping Practices



Union County Vocational School

Measure Drainage Area



$$\text{Surface Area} = (L1 \times W) + (L2 \times W)$$

$$= (15' \times 20') + (10' \times 20')$$

$$= (300') + (200')$$

$$= 500 \text{ square feet}$$

Hockman Farm, Winchester, Virginia

**Make observations
during storms to
estimate the
drainage area**

**Or use survey
equipment**





Measure Drainage Area

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

Surface Area of Impervious Surface to be Treated (sq. ft.) or (LxW)	Size of 6" deep Rain Garden (sq. ft.) or (LxW)
500 sq. ft.	100 sq. ft. or 10'x10'
750 sq. ft.	150 sq. ft. or 15'x10'
1,000 sq. ft.	200 sq. ft. or 20'x10'
1,500 sq. ft.	300 sq. ft. or 30'x10'
2,000 sq. ft.	400 sq. ft. or 20'x20'

Determine Slope

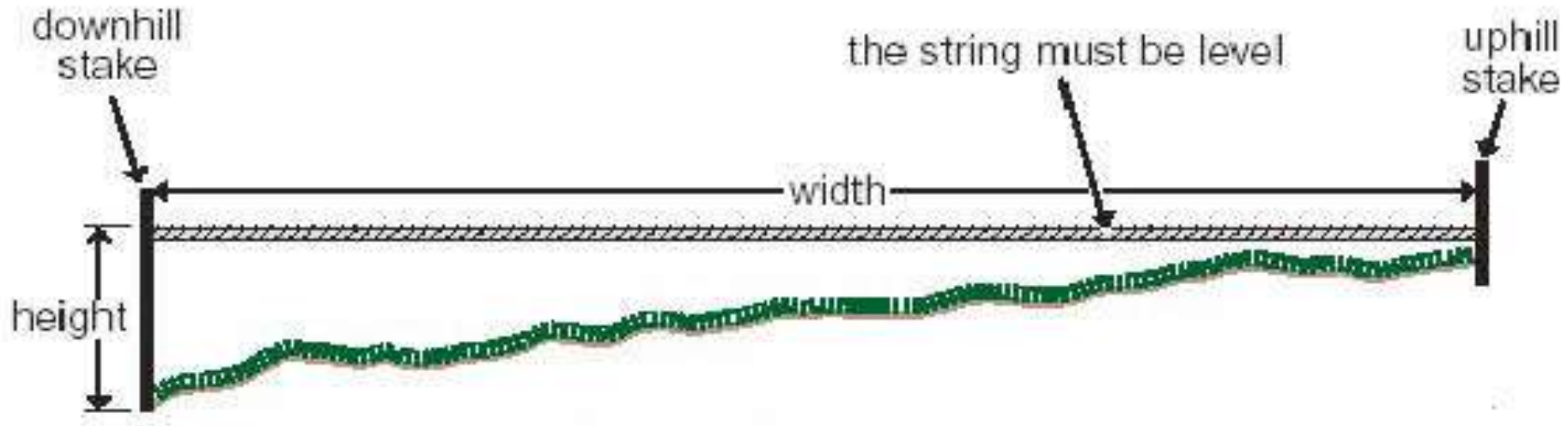


Figure 3 The string should be tied to the base of the uphill stake, then tied to the downhill stake at the same level.

$$\text{Slope} = \frac{H1 - H2}{L} \times 100 = \frac{9'' - 3''}{10'} = \frac{0.75' - 0.25'}{10'} \times 100 = 5\% \text{ slope}$$



Determine Slope

The depth of your rain garden depends upon the slope of your lawn.

Slope	Rain Garden Depth
< 4%	3" – 5"
5% – 7%	6" – 7"
8% – 12%	8"
> 12%	Consider Another Location



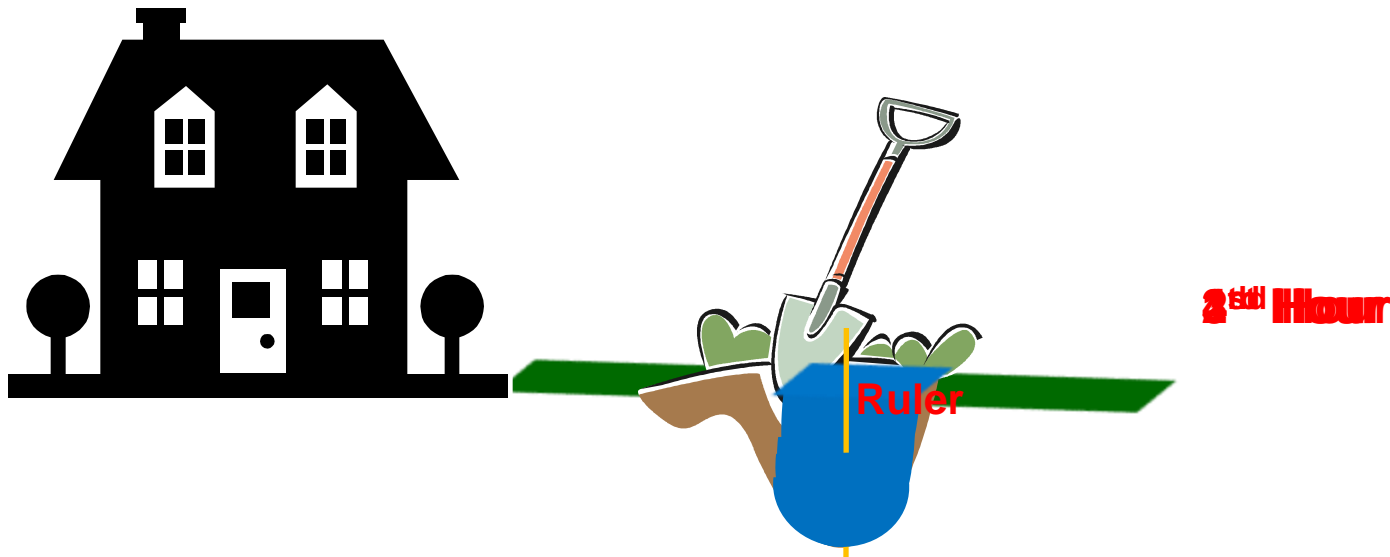
Percolation Test

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



Loamy soil is the BEST soil for a rain garden



Gloucester County 4-H Fairgrounds

But, don't worry – clay/silt and sandy soils can be amended to get the preferred loamy soil texture

Take Photographs

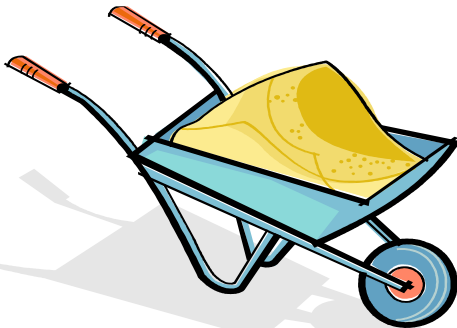


Burlington County Community Agricultural Center

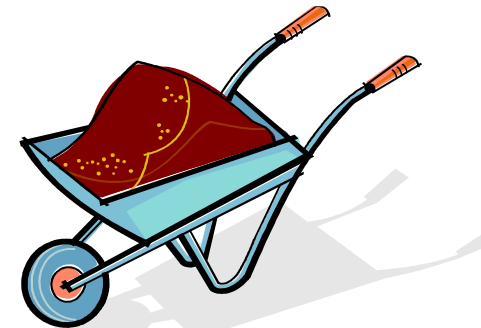


General Soil Amendments Amounts for a 100 sq ft Rain Garden that is 6 Inches Deep

Soil Amendment	Amount for 100 sq ft Rain Garden
Sand	1 cubic yard
Compost	1 cubic yard
Fertilizer	Follow Soil Test Result Recommendations
Lime	Follow Soil Test Result Recommendations



Gloucester County 4-H Fairgrounds



Approximate Amount of Plants Based on Future Mature Size

Size of Rain Garden	Approximate Amount of Plants
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

<http://plants.usda.gov>

Types of Plants

Your Rain Garden is composed of woody plants (trees and shrubs) and herbaceous species (flowers, grasses, and ground covers) planted in three wetness zones.

Facultative Wetland (FACW)

The lowest zone supports plant species that can tolerate standing water and fluctuating water levels.

**Lowest Zone/
Ponding Area**



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



**Middle Zone/
Depression Area**

The middle zone is slightly drier, but also supports plant species that can tolerate fluctuating water levels.

Facultative Upland (FACU)

The outer edge or highest zone generally contains plant species that prefer drier conditions.

**Highest Zone/
Upland Area**



Amount of Mulch Required for a Three Inch Thick Layer

Size of Rain Garden	Approximate Amount of Mulch
25 square feet	0.25 cubic yard
50 square feet	0.50 cubic yard
100 square feet	1.0 cubic yard
200 square feet	2.0 cubic yards

Triple-shredded Hardwood with No Dye

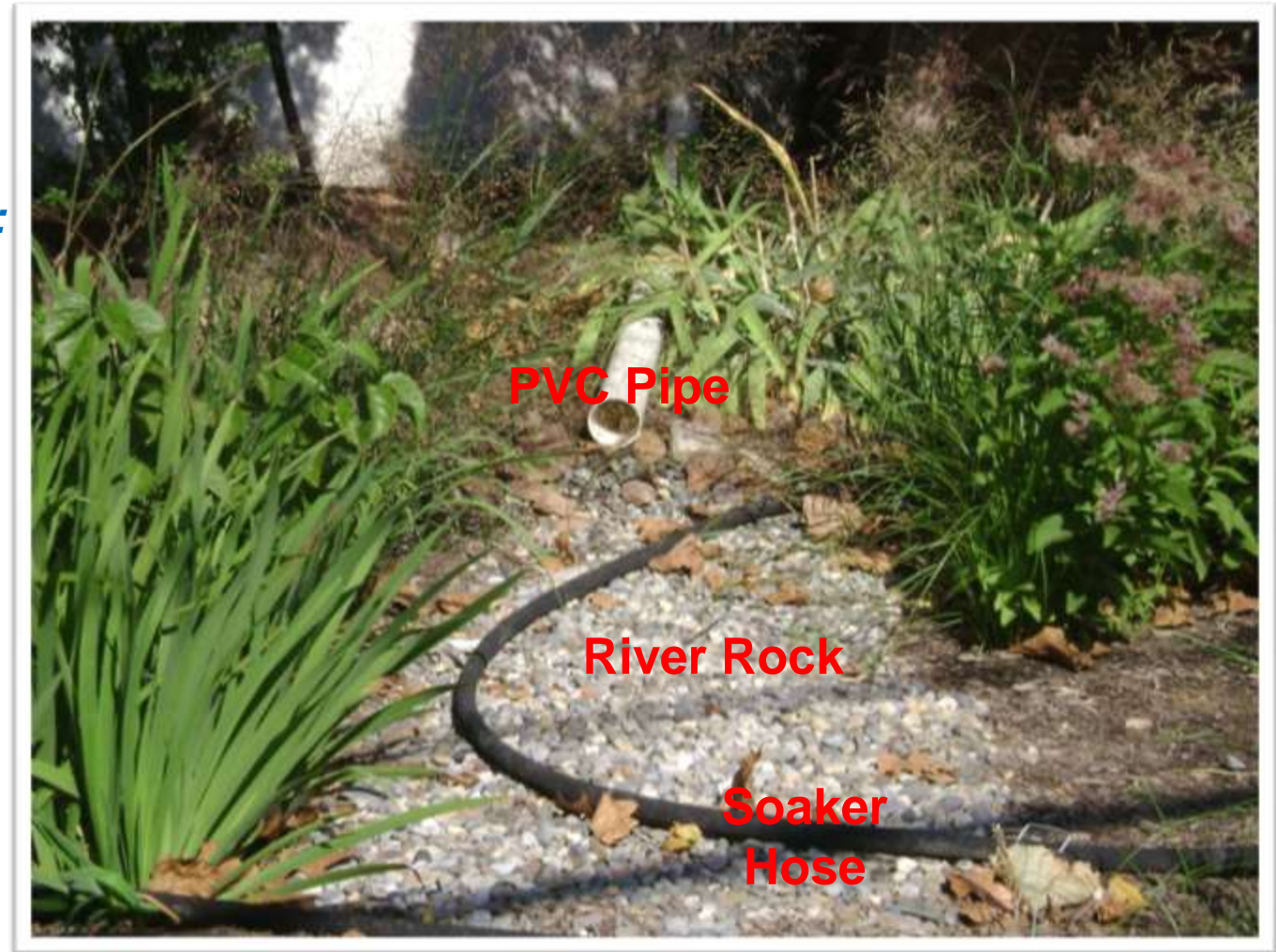


Springfield Municipal Annex Building, Union County

Optional Supplies

Supplies may include:

- River rock
- PVC pipe
- Deer fencing



- Remove existing grass
- Excavate to the desired elevation and grade
- Add soil amendments
- Prepare the berm

2. Installation



- 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

Excavate to the Desired Elevation and Grade



Leonard Park, Morris County



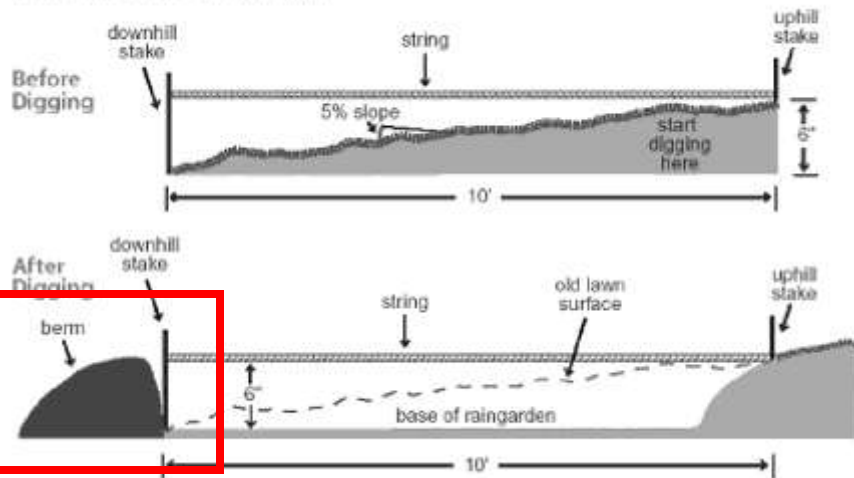
Gloucester County 4-H Fairgrounds

Add Soil Amendments

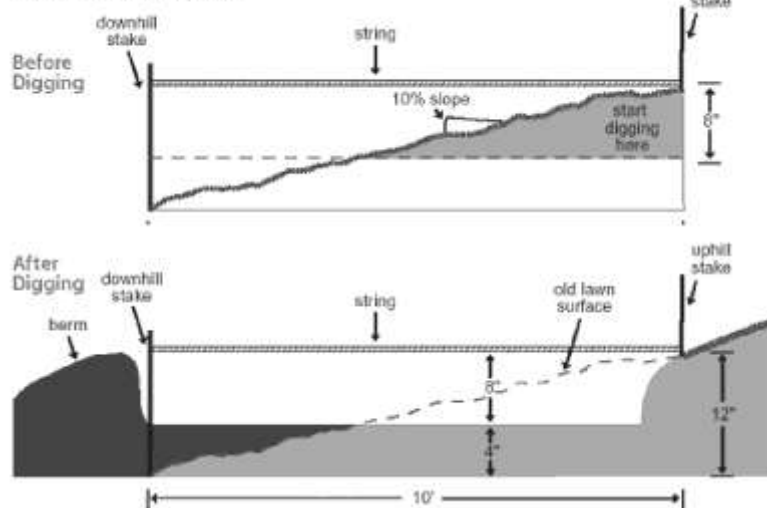


Prepare the Berm

a. Between 3% and 8% slope lawn



b. Greater than 8% slope lawn



Leonard Park, Morris County

Prepare the Overflow



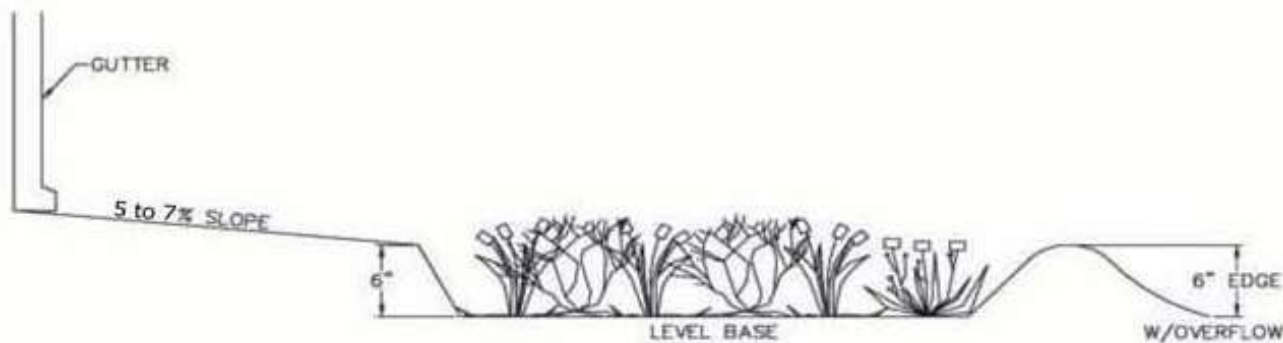
Gloucester County 4-H Fairgrounds



Leonard Park, Morris County

Level the Lowest Zone/ Ponding Area

Figure 4. Plants at base of a 6-inch deep Rain Garden



Wheaton Arts and Cultural Center, Cumberland County

RUTGERS

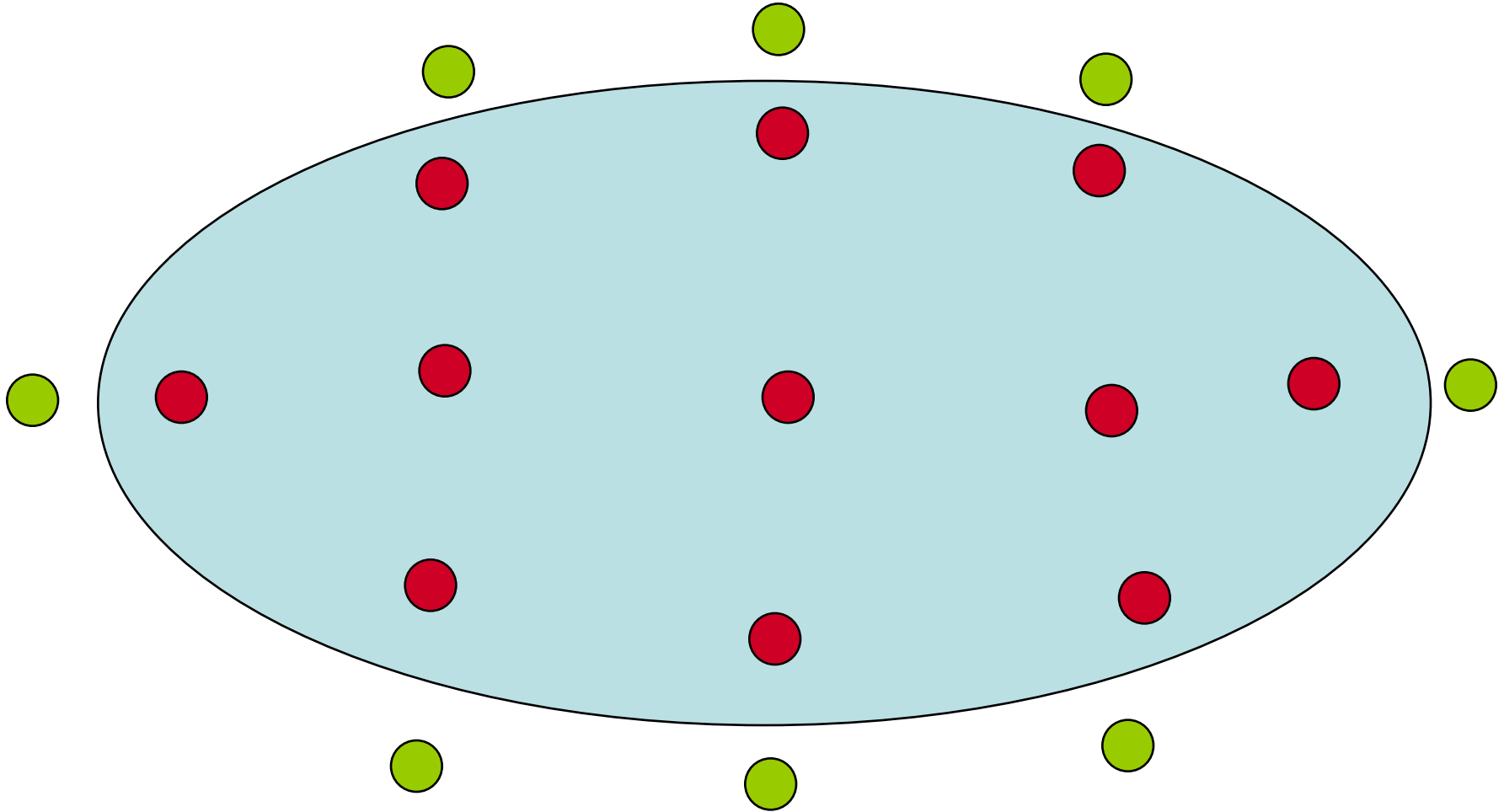
New Jersey Agricultural
Experiment Station



Applying knowledge to improve water quality

National Water Program

A Partnership of USDA CSREES
& Land Grant Colleges and Universities



Plant the Native Plants



Cut the Root Ball



Ulster County, New York

Plant the Native Plants



Ulster County, New York



**Planting Hole
Same Depth
as Root Ball**



Hockman Farm, Winchester, Virginia

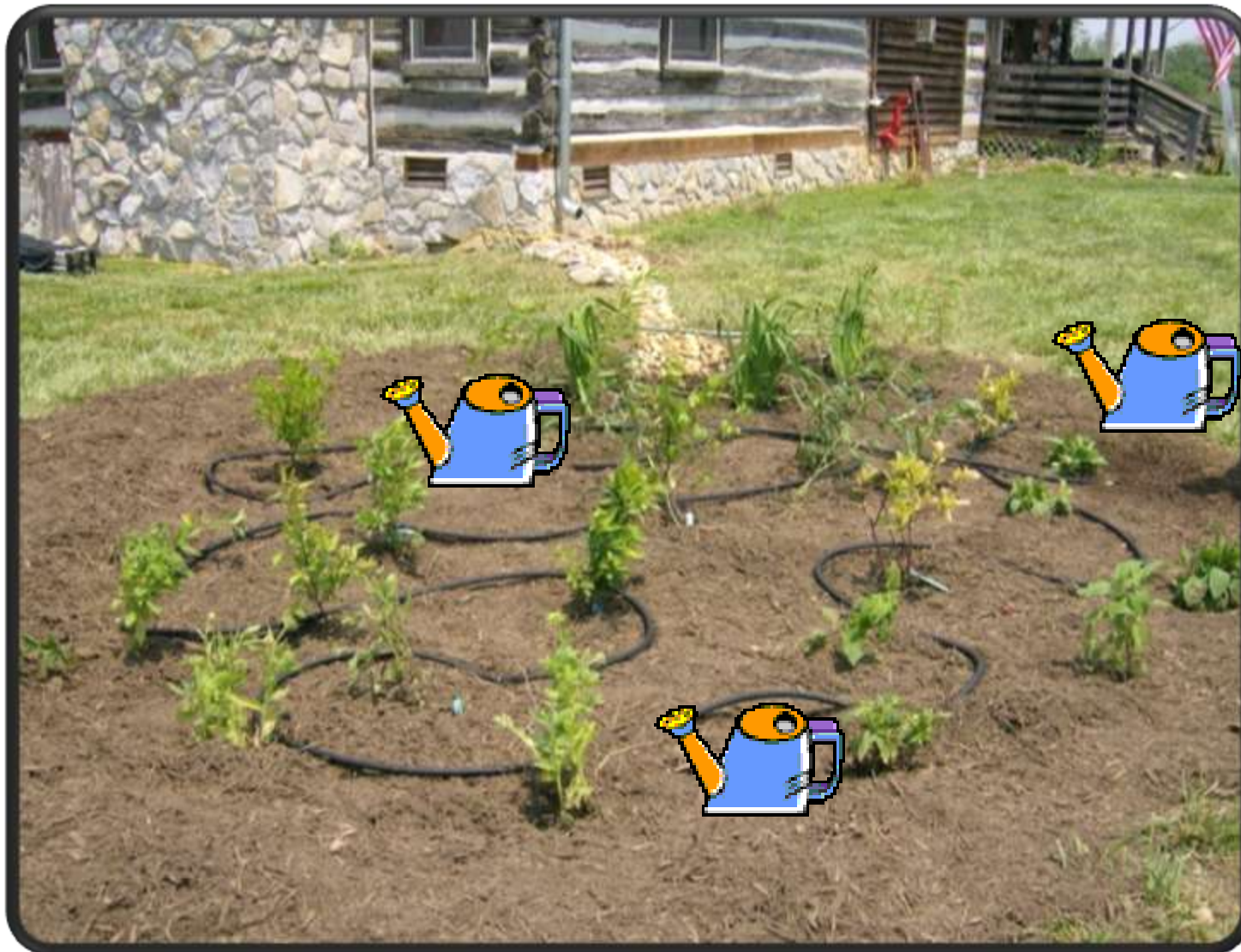
Apply the Mulch

**Protect Small Plants
when Mulching**



*Ulster County,
New York*

Water the Native Plants



Hockman Farm, Winchester, Virginia

3. Maintenance

Short-Term Maintenance

Long-Term Maintenance



Madeline will discuss this later...



Frequently Asked Questions

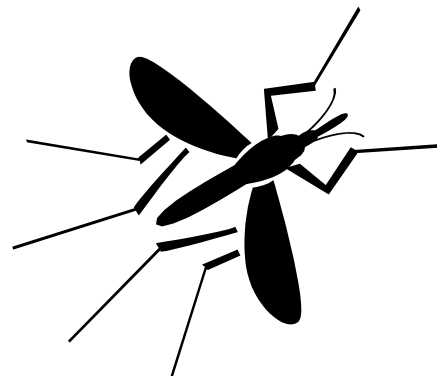
- *Will my rain garden cause a mosquito problem?*
- *Will my rain garden cause flooding?*
- *What about deer?*
- *How do I slow down the speed of water as it enters the garden?*





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?

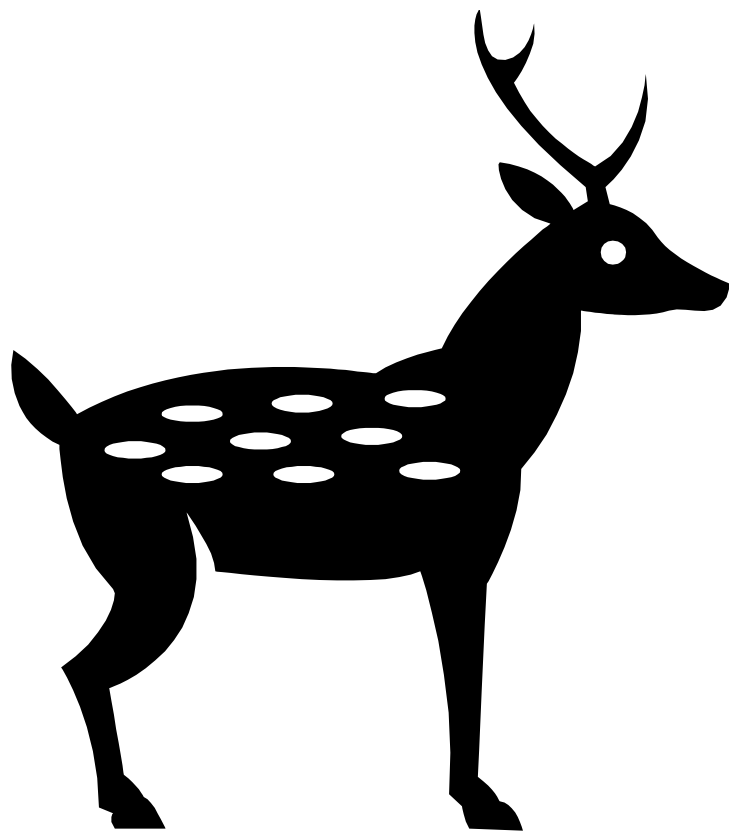
If your rain garden does not drain out the water after ~24 hours, it is time to re-evaluate your rain garden. Maybe try:

- Building berms and/or adding plants
- Adding COARSE sand (not sandbox sand) with organic mulch to the rain garden to help infiltrate the water



What about deer?

Try fencing, deer resistant plants, or deer retardant sprays.



New Jersey Highlands Council Building, Morris County

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.

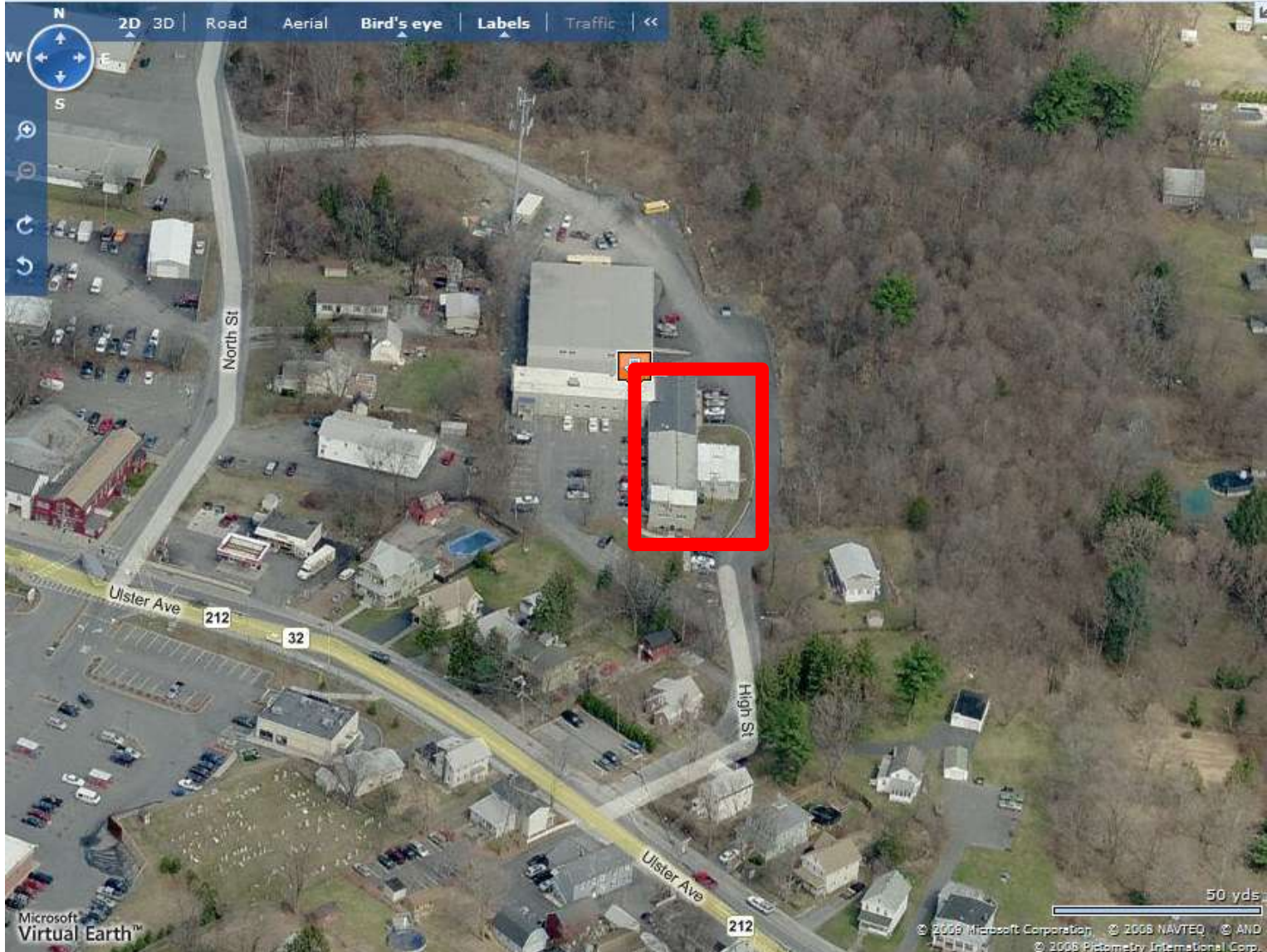




- Rain gardens are designed to intercept, treat, and infiltrate stormwater at the source, before it becomes runoff.
- The plants are native to the region and help retain contaminants that could otherwise harm nearby waterways.
- Rain gardens are beautiful, inexpensive and low-maintenance gardens that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



Future Site of Rain Garden



Saugerties Municipal Building, Town of Saugerties, NY

Any Questions?



Essex County Environmental Center, Essex County

<http://water.rutgers.edu>