Rain Gardens and Stormwater Management

Upper Darby Rain Gardens

Hav-a-Rain Garden

Funding for this project has been provided by the William Penn Foundation through the Delaware River Watershed Initiative

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Stormwater and Your Property

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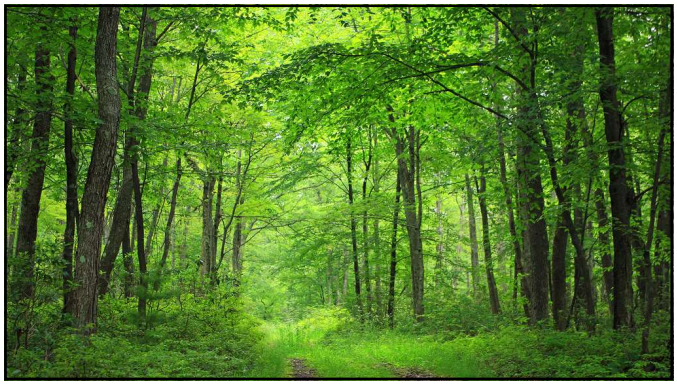

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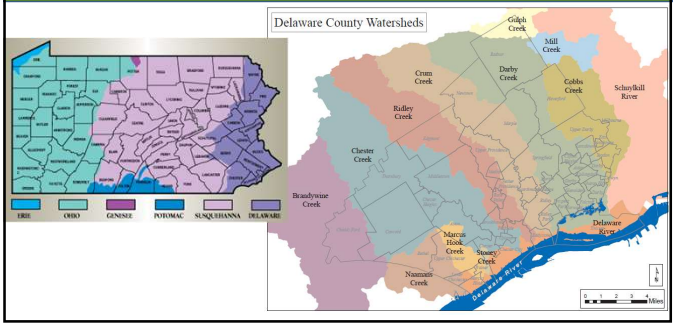
What is your watershed address?



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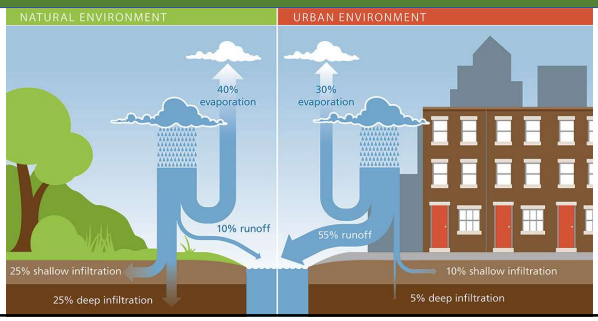
Pre Development Versus Post Development



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How Much Rain Water?

- **1" of rain** that falls **over 1 sq. ft**. of impervious surface creates **0.6 gallon** of water
- So, 1" of rainfall on a 1,000 sq. ft. roof will produce 100 gallons of rainwater (1,000 sq. ft. x 0.6 gal. = 600 gal.)
- The Philadelphia area averages 42.05 inches of rain annually.
- A roof this size in this area yields 5,256 gal. of run off / year.
  (0.6 gal. x 42.05 in. x 1,250 sq. ft.= 31,538 gal.)

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When it Rains it Drains

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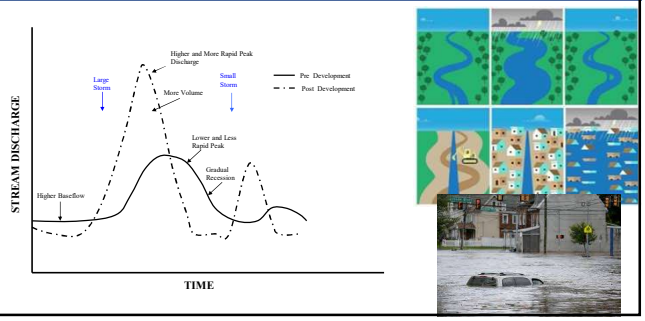
Increased Discharge = Flooding



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Urbanization and Stream Channels

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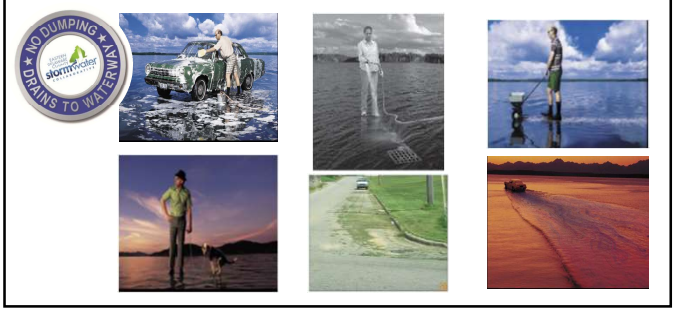
Common Practices that Result in Stormwater Pollution



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Common Practices that Result in Stormwater Pollution

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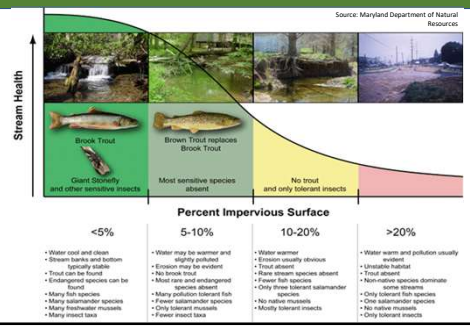
Uncontrolled Stormwater Runoff = Impaired Streams



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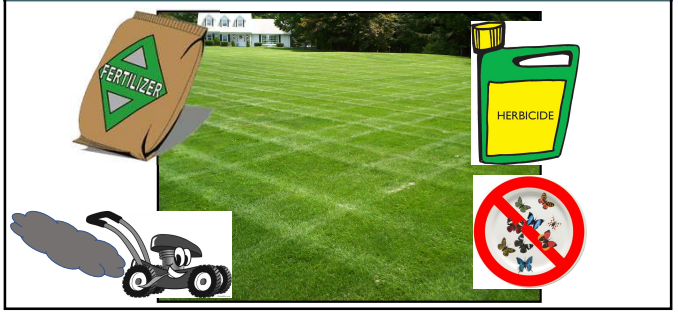
The American Ideal?



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Use Creek Friendly Lawn Care

- Lawn grasses do not infiltrate rainwater well and modern lawn care practices use too much fertilizer and too many toxic chemicals that make their way into our waterways harming water quality.
- Mow High – requires less water, shades out weeds.
- Leave the grass clippings on the lawn, they will breakdown and fertilize lawn.
- Test your soil before you apply fertilizer.
- Use organic fertilizers, only what you need, and only if your lawn needs it.
- Water longer and less often. A
- Aerate early in spring and the fall. Reduces compaction, allows more air flow around roots and better water penetration.
- Do **NOT** put your leaves in a stream!!!

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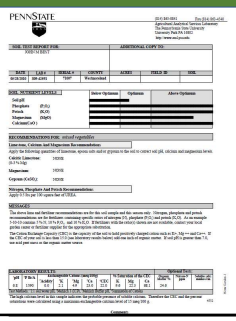
What's in Your Soil?? Test before you treat

- **Penn State Extension**
- **http://www.aasl.psu.edu/ssft.htm**
- **Standard Individual Soil Test Kit $9.00**



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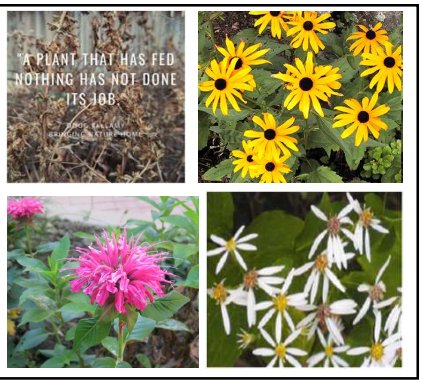
Go Native!!

- Consider replacing some lawn area with native flowers, shrubs and trees.
  - Drought tolerant, adapted to this area, climate and conditions.
  - Require less watering, fertilizers and pesticides
  - Provide better habitat and serve as a food source (berries and seeds) for insects, birds and other wildlife. Good Biodiversity.
- *Bringing Nature Home* by Doug Tallamy
- https://www.dcnr.pa.gov/Conservation/WildPlants/LandscapingwithNativePlants/Pages/default.aspx



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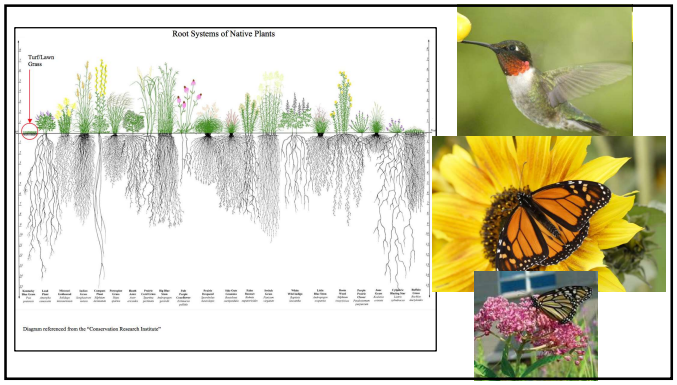

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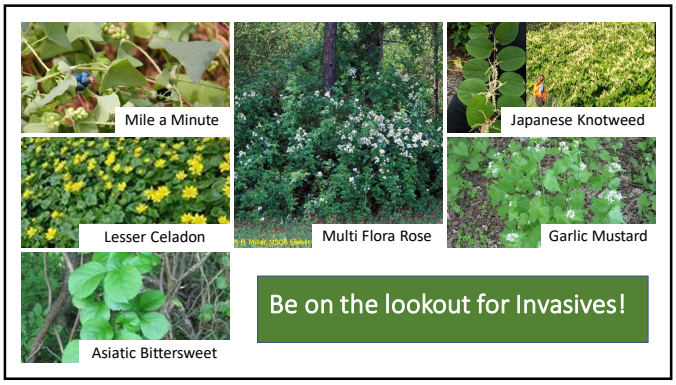

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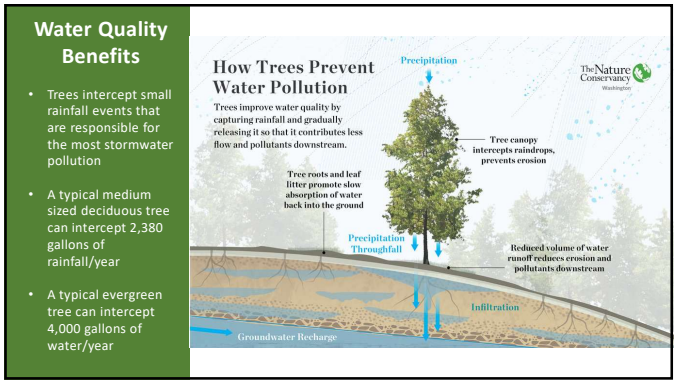

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RIPARIAN BUFFERS

Let nature do the work of stabilizing your streambanks and filtering pollutants!

- Buffers stabilize streambanks and filter overland runoff of pollutants. They also shade a stream allowing cold water fish species to thrive.
- Can start with a no-mow zone (be careful to manage for invasives)
- Use Native shrubs and trees
- The wider the better.

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Riparian buffers protect stream habitat, filter nutrients and sediments, and disperse concentrated runoff and help to stabilize the streambanks.

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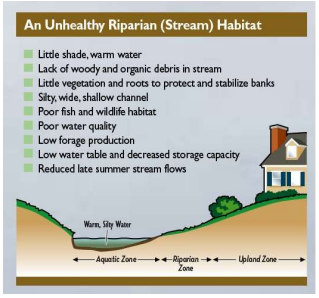
Healthy Versus Unhealthy Stream Habitat



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Downspout Flow Through Planters

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Rain Gardens

All Shapes, All Sizes benefit clean water

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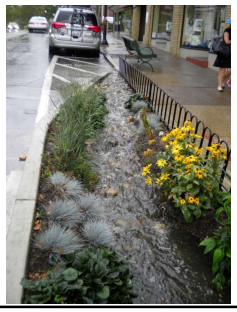
What is a Rain Garden?

- An area in a man-made landscape that captures water and holds it for a short time
- Runoff water is captured and infiltrated into the soil in an indented area where plants and soils utilize and filter the water
- An attractive addition to your landscape



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Purpose of Rain Gardens

- Captures runoff from impervious areas such as roofs, driveways, patios
- Reduce runoff leaving landscape to become storm water reducing volume entering local waterways
- Standing water should last no more than 72 hours after rain stops

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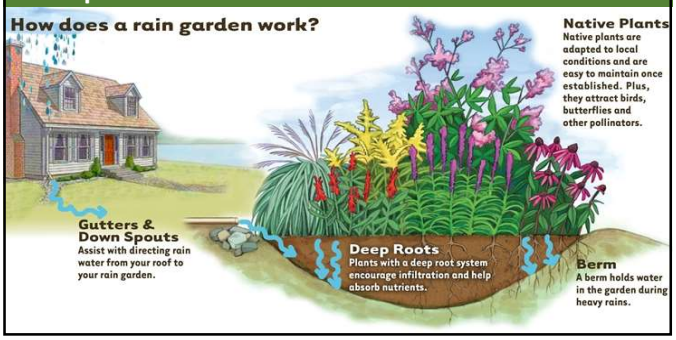
Capture that Water Before it Becomes Runoff!



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Benefits of Rain Gardens

- Beautiful landscape feature, low maintenance, low water use
- Increases infiltration of rainwater in landscapes with impervious surfaces - infiltrates as much as 30 % more water than a flat or sloped lawn area
- Reduces flooding risks and stream bank and bed erosion
- Increase habitat for birds and insects

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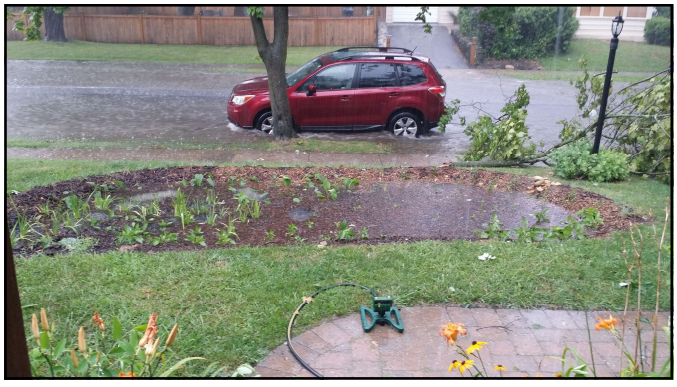

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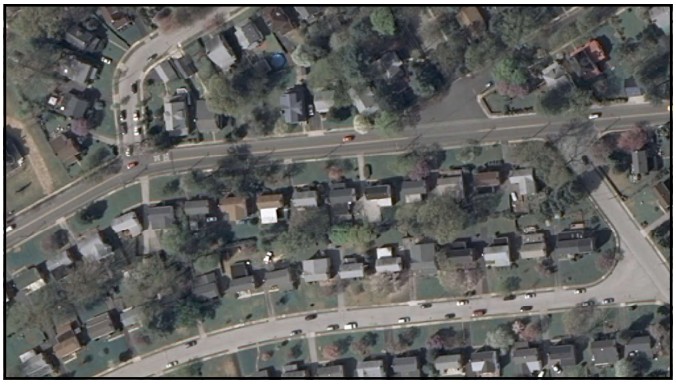

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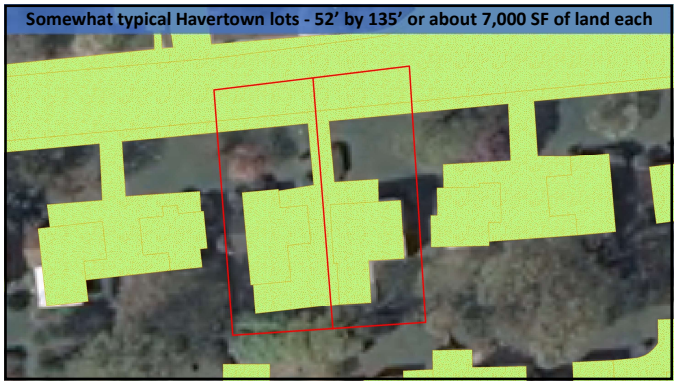

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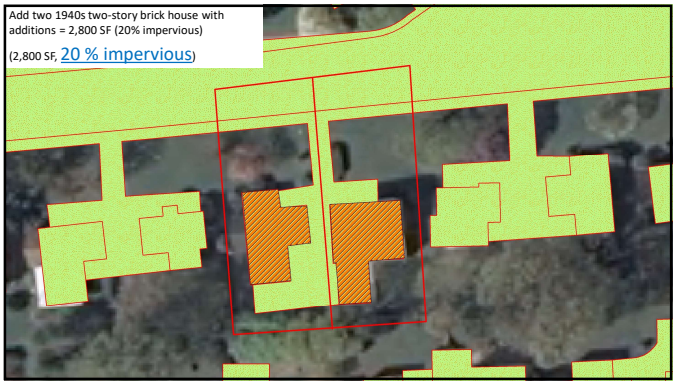

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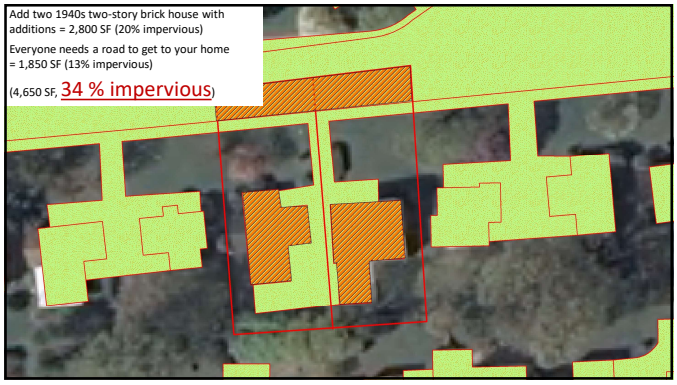

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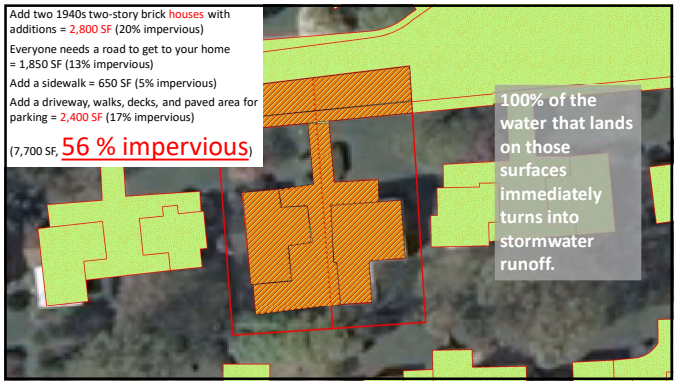
Add two 1940s two-story brick houses with additions = 2,800 SF (20% impervious)

Everyone needs a road to get to your home = 1,850 SF (13% impervious)

Add a sidewalk = 650 SF (5% impervious)

Add a driveway, walks, decks, and paved area for parking = 2,400 SF (17% impervious)

(7,700 SF, 56 % impervious)



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What Can We Do? – Build A Rain Garden

Using a 1" storm, it would generate our 0.62 gal./sq. ft. or **623 gal. of runoff per 1000 sq ft**.

Focusing on **5200 sq ft** for **2 houses, driveway, patios**, etc. this example generates **~3,200 gal**.

How can we stop **3,200 gal.** of runoff from these 2 homes getting to the streams?

A 14' by 18' rain garden (about the size of a large room) 10" deep will hold about **1,600 gal.** of water.

Then all you need is one for each house to hold all the runoff from the structures, driveway, patios, walks and other impervious up to the sidewalk.

1 front lawn rain garden each = *~3,200gal.*

There we go 1" managed!

80% of our rain storms are less than 1" of rain

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Where Should A Rain Garden Go?

- At least 10 feet from your foundation
- At least 10 ft from your neighbors property
- Where the overflow will not create problem (i.e., icing on sidewalks)
- Where it is easier to get water to garden.
- Where water can enter the rain garden via a pipe or overland runoff

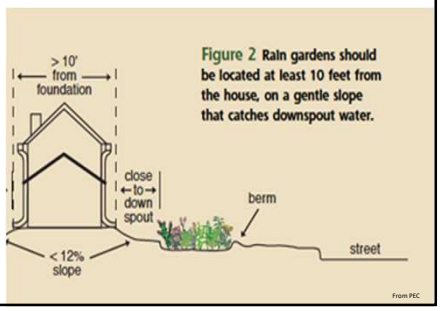

Figure 2 Rain gardens should be located at least 10 feet from the house, on a gentle slope that catches downspout water.

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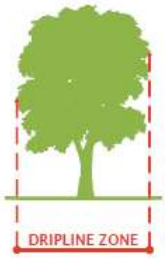
Rain Garden Locations to Avoid

- NOT over a septic tank
- NOT near a drinking water well.
- Call PA One Call to locate your utilities so you know where you cannot dig!
- Make sure to know where you might have underground wiring.
- Stay outside of the dripline of trees and avoid disturbing their roots.
- NOT in a wet area in your yard (unless you know how to design your way out of it)!



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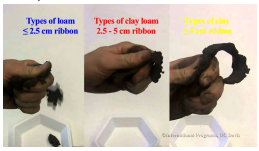
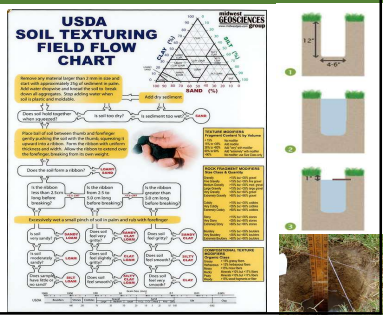
What about my soils?

- Simplified rain gardens can be constructed using native soils present **as long as** they will infiltrate water that enters the garden within **48 hours**. You can determine this using a simplified soil infiltration test.





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What About my Soils?

Time to Essentially Drain	Likely Soil Type
<6 hrs	Sandy
6-24 hrs	Silty
>24 hrs	Clayey

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How Big Should My Rain Garden Be?

- Determine the size of the impervious cover that will drain into the rain garden.
- Understand your slope
- Determine how big and how deep the garden should be.

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Finally, determine the rain garden's size:

1. Use Table 2 to determine the size factor.
2. Multiply the size factor by the drainage area. This is the recommended rain garden size.

Table 2	Depth		
Soil Type	**3-5 in**	**6-7 in**	**8 in +**
Sand	0.19	0.15	0.08
Silt	0.34	0.25	0.16
Clay	0.43	0.32	0.20

Size Factor X **Drainage Area** = **Rain Garden Area**

Note: If the rain garden is > 30 ft away from the drainage area then the area of the rain garden can be a half size smaller than calculated above. This is because a large amount of stormwater will be absorbed along the pathway that leads to the rain garden.

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Calculate the slope to determine the rain garden's depth:

1. Place one stake at the uphill end of the rain garden and another at the downhill end as illustrated in Figure 1.
2. Level the string between the two stakes.
3. Measure the total length of the string and the height of the string at the downhill stake in inches.
4. Divide the height by the length and multiply the result by 100. This is the slope.
5. Use Table 1 to determine the recommended rain garden depth.

Table 1	
Slope	**Depth**
< 4%	3-5 in
5-7%	6-7 in
8-12%	8 in+

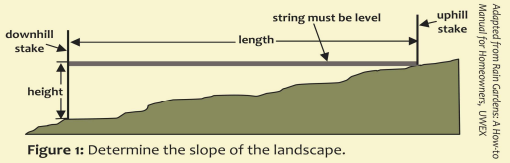

Figure 1: Determine the slope of the landscape.

Adapted from Rain Gardens: A How-to Manual for Homeowners, UWEX

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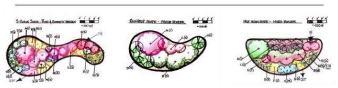
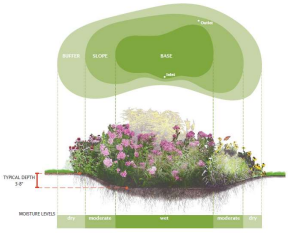
What Shape Should My Rain Garden Be?

- Whatever shape you want!
- The shape should blend into your landscaping





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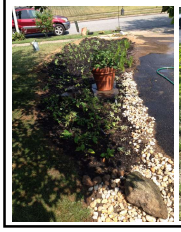
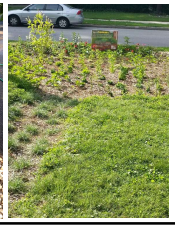
How to Get the Water Into the Garden

- Overland Flow
- Vegetated Swale
- Piping





Gutter Extensions: Specifically shaped to attach to the end of your down-spout.

PVC & Plastic Corrugated Piping: Can be attached to gutter extensions and buried to carry stormwater under-ground.

Grass-lined & Rock-lined Swales: Can be used to direct water to the rain gar-den. Swales should be sloped at a 2:1 ratio (1 ft rise for every 2 ft across). Ideal for heavy flows from roads or parking lots.

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What About an Overflow?

- In large storm events the rain garden will fill, and need to overflow.
- The overflow should be directed away from any structures and not be directed into a neighbors yard.
- The water can be directed back to the path it took before the garden

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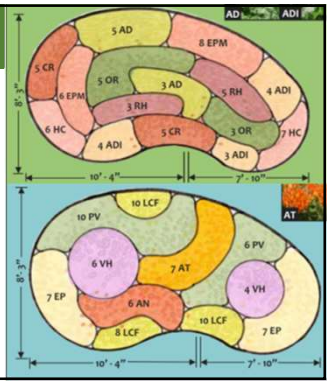
Developing a Planting Plan

- Consider light – is it shady or sunny
- The plants on the bottom will need to be tolerant of wet conditions
- The plants on the sides and the berm will be in dry conditions



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DESIGN TIPS

- Plants native to the Mid-Atlantic Piedmont are recommended because they are well-adapted to the region and will provide high ecological value.
- Rain gardens manage flowing water, so plant spacing needs to be more dense than typical gardens.
- Space and plant perennials so that their canopies will grow together and cover the ground to minimize weeds. Plant spacing should be about 25% closer than typically recommended.
- Consider plant maintenance when designing and planting the rain garden. Allow room for a mulch path that allows access to all the plant groups.
- Plant shrubs and perennials in groups of three to five of the same species. Avoid complex planting plans. Simpler plant palettes make plant identification for maintenance easier.
- If a tree is used, generally plant the tree at one edge of the garden. Use only small understory trees. Large canopy trees should be avoided within the garden because their roots will take up too much space.
- Groundcovers are good to add under trees and shrubs. (See RainScapes plant handouts for ideas.)
- Select perennials with winter basal rosette to maintain winter coverage.
- Consider how the rain garden will fit into the surrounding landscape and how it will look from different positions, including views from the house and neighboring properties.
- Consider the color selection, such as warm versus cool colors, and the relationship they have to existing plantings and the house.
- Consider seasonal changes to color and texture in the garden. Select plants to provide visual interest in each season.
- Consider complementary mixtures of textures: fine textures mixed with coarser foliage textures creates interest and contrast.
- Label larger groups of each species to allow desirable vegetation to be distinguished from weeds.

Montgomery County RainScapes — Rain Garden Planting Design Templates

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Rain Garden Property Assessment and Construction Steps Examples

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Accellerated Percolation Test (4 to 6" dia., 12" Deep)

Address:

Performed By: Date:

Presat. Start Time: End Time/Net Hrs: 0:00

Excel will calculate shaded cells. Presaturate hole by filling to top and allow to drain if feasible. If zero level is found the next day, enter 0.001 and note it was zero at bottom (last avg. inches/hr reading will not be valid).

NOTES: Ended perc early due to slow drain and rain in preceding days, wet soil.

Time (min)		Water Level		
Real Time	Net (min)	Reading (inches)	Drop in Wtr Level	Inches/Hr
	0 (Starting Reading)		0 (Starting Reading)	

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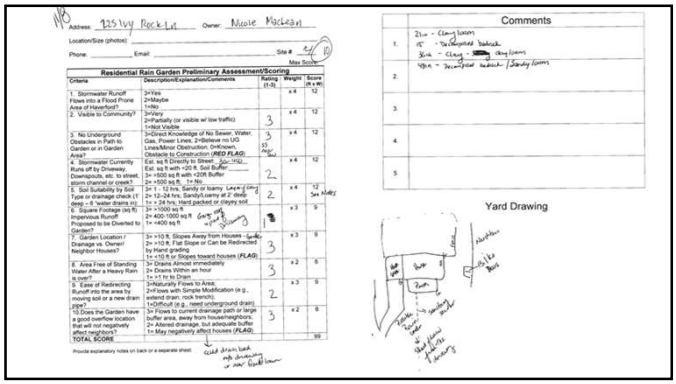

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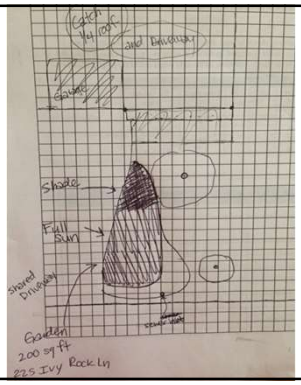

Sometimes Redirecting Water is Easy

Driveway is crowned in the middle and pitched toward the front lawn. Sitng garden at edge of driveway allowed runoff flow from downspout to driveway to Rain Garden

How Can You Tell?

- Go out in the rain
- Do a water test with hose - pick 3-4 uphill spots and run a gentle stream of water and watch gravity do the rest

Doesn't Work If

- Flat driveway, concave in the middle, sloped to run to fast to the street

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Soil Type: Drainage Area (Draw on Property Sketch):

Rain Garden Depth	
Slope	Depth
<4%	3-5 inches
5-7 %	6-7 inches
8-12 %	8+ inches

FACTOR	Depth		
Soil Type	3-5 in	6-7 in	8+ in
Sand	0.19	0.15	0.08
Silt	0.34	0.25	0.16
Clay	0.43	0.32	0.20

1076.89 sq ft
45 roof
45 Driveway
(=900 sq ft)

Factor: Garden Size (Drainage Area * Factor): ~225

General Shape: Length (ft): Width (ft):

Total depth to dig: Finished Depth: ~10" Height of Berm: ~10"

Inlet & Overflow Locations/Description: In at edge of driveway
@ rock overflows to adjacent rock garden

Other sizing Information: ~200 sf available - could not dig at old tree stump remains.

> Clayey soil shallow, but sandy deep & percolated pretty well

> Used middle soil factor of 0.25 times about 900 sq ft drainage area to yield 225 sq ft garden area

> Notice tree stump - could be a problem for construction, depending on age, location and type of tree

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Planting Plan

- **Considers Sun / Shade**

Grading Plan

- **Water flow in upper left side by cutting ~ 12" soil out on uphill side**
- **Berm on downhill side**
- **Berm tapers so top of berm is level**
- **Bottom of the garden is almost level, with a very small slope to the downhill side**
- **Rototill the bottom before planting**
- **Cut an overflow in the berm on the down hill side and line with stone**

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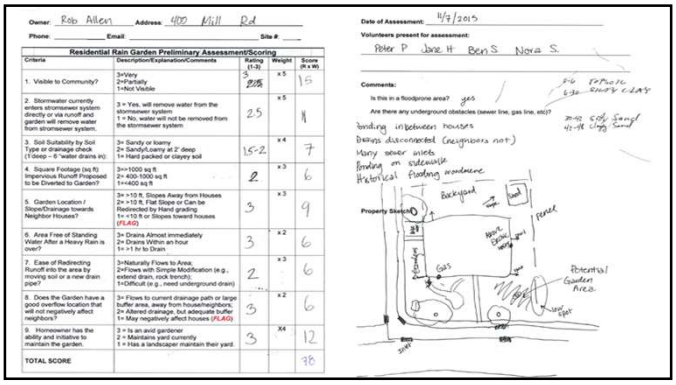

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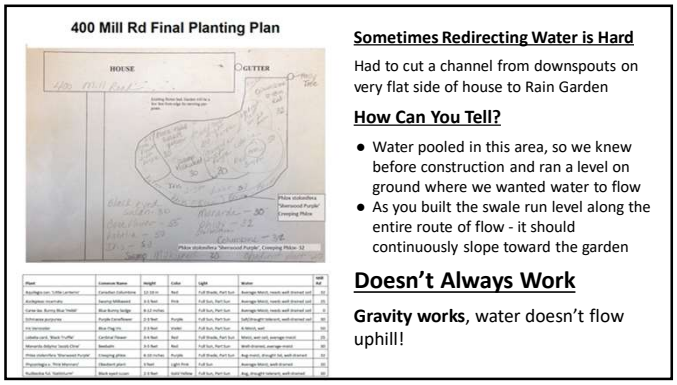

Sometimes Redirecting Water is Hard

Had to cut a channel from downspouts on very flat side of house to Rain Garden

How Can You Tell?

- Water pooled in this area, so we knew before construction and ran a level on ground where we wanted water to flow
- As you built the swale run level along the entire route of flow - it should continuously slope toward the garden

Doesn't Always Work

Gravity works, water doesn't flow uphill!

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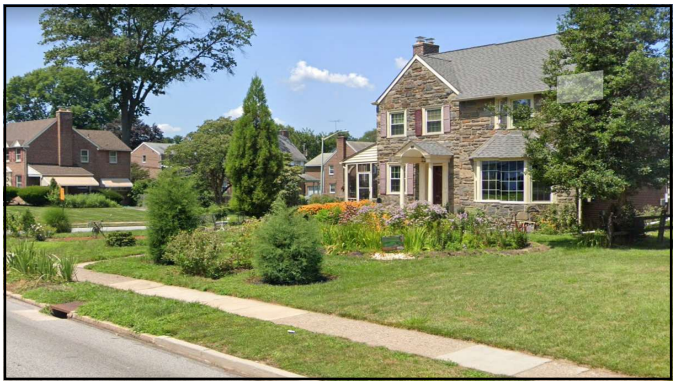

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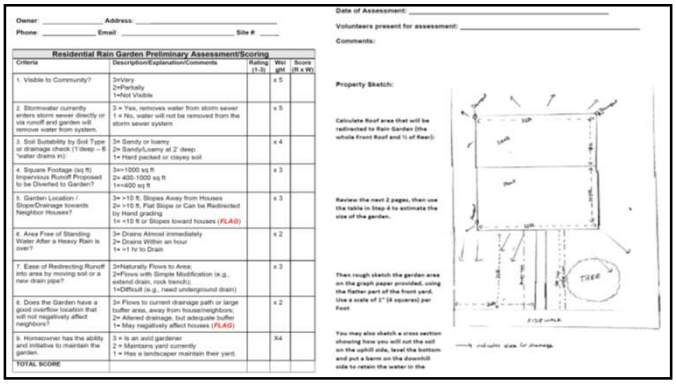

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Plant	Common Name	Height	Color	Light	Water
Amsonia 'Blue Ice'	Bluestar	12-15 in	Light Blue	Part Sun, Full Sun	Drought tolerant, Dry-Moist
Aquilegia can. 'Little Lanterns'	Columbine	12-18 in	Red	Full Shade, Part Sun	Average-Moist, needs well drained soil
Asclepieas incarnata	Swamp Milkweed	3-5 feet	Pink	Full Sun, Part Sun	Average-Moist, needs well drained soil
Asclepias verticillata	Horsetail milkweed	1-3 feet	White	Full Sun, Part Sun	Drought tolerant, Dry-Average
Aster cordifolius	Blue Wood Aster	2-3 feet	Blue	Full Shade, Part Sun	Dry-Moist
Aster n-a 'Purple Dome'	New England aster	18 inches	Purple	Full sun	Average-Moist, needs well drained soil
Carex lax. Bunny Blue 'Hobb'	Blue Bunny Sedge	8-12 inches	Full Shade, Part Sun		Average-Moist, needs well drained soil
Carex musk. 'Little Midge'	Palm Sedge?	2-3 feet	Full Shade, Part Sun		Average-Moist, likes wet soil
Carex plantaginea	Seersucker sedge	8-10 inches	Full Shade, Part Sun		Full shade, part sun, moist
Echinacea purpurea	Purple Coneflower	2-3 feet	purple	Full Sun, Part Sun	salt & drought tolerant, well-drained soil
Iris Versicolor	Blue Flag Iris	2-3 feet	Blue Violoet	Full Sun, Part Sun	Moist, salt tolerant, deer resistant
Lobelia card. 'Black Truffle'	Cardinal Flower	3-4 feet	Red	Full Shade, Part Sun	Moist, wet soil, average-moist
Matteuccia struthiopteris	Ostrich fern	3-4 feet		Full Shade, Part Sun	Moist, wetlands, well-drained
Monarda didyma 'Jacob Cline'	Beebalm	3-5 feet	Red	Full Sun, Part Sun,	Well-drained, average-moist
Monarda fistulosa	Wild bergamot	2-5 feet	Purple	Full Sun, Part Sun	Dry-Moist, drought tolerant, well-drained
Osmunda cinnamomea	Cinnamon fern	2-5 feet		Full Shade, Part Sun	salt tolerant, wet soil
Panicum vir. 'Shenandoah'	Switchgrass	2-3 feet	Red	Full Sun, Part Sun	Average-Moist, salt & drought tolerant, well-drained
Panicum virgatum	Switchgrass	3-5 feet	wheat	Full Sun, Part Sun	Average-moist, salt & drought tolerant, well-drained
Phlox pan. Peacock White	Garden phlox	18-24	White	Full Sun	average moisture, salt tolerant
Phlox paniculata 'Jeana'	Garden phlox	4-5 feet	Pink	Full Sun, Part Sun	average-moist, well-drained
Purple'	Creeping phlox	6-10 inches	Purple	Full Shade, Part Sun	Average-moist, drought tolerant, well-drained
Physostegia v. 'Pink Manners'	Obedient plant	3 feet	Light Pink	Full Sun	Average-Moist, well-drained
Rudbeckia ful. 'Goldsturm'	Black eyed susan	2-3 feet	golden yellow	Full Sun, Part Sun	Average, drought tolerant, well-drained
Rudbeckia triloba	brown eyed susan	2-3 feet	yellow	Full Sun, Part Sun	Dry-Moist, drought tolerant, well-drained

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Maintenance

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Maintaining Your Rain Garden

- **Water** weekly until plants are established
- **Weed**, especially during the first few years
- Look out for invasive plants!
- **Prune** dead vegetation and deadhead flowers each spring.
- **Check for sediment** buildup at the entrance **& erosion**
- **Mulch** as necessary until the plants grow together
- Replant as necessary

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Watering

New rain gardens will need to be watered for the first one or two years until the garden is established!

Soaker Hose

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Landscape Fabric and Mulch

Use mulch in garden, no fabric in garden except under stone

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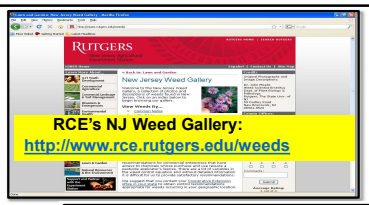
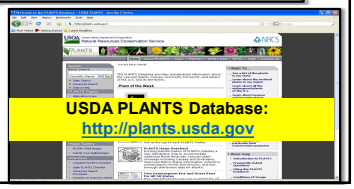
Weeding

- Weeding more often will limit the amount of time you will have to spend weeding
- Watch for overly-agressive species
- Some weeds can be spread aggressively by underground rhizomes





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Pruning

- Pruning directs growth of plants, improves health, and increases production of flowers and fruits.
- How does pruning a rain garden differ from my other gardens?
  - In a rain garden, dense shrub growth is encouraged to provide increased filtering capacity.

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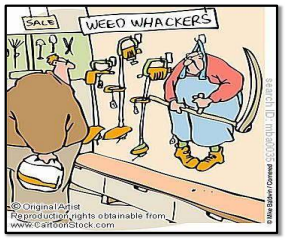
Mowing

- After season, can remove stems and seed-heads or just leave as habitat and in some areas, aesthetics.
- A string trimmer can be used to maintain over-competitive growths.
- Dead plant material can also be removed by a string trimmer or mower, if the mowing deck can be raised to cut at least 8" high.



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Re-Planting as Necessary

- After 1st season, learn what was successful and what plants did not work in your rain garden.
  - Weather / flow drastically different than the design?
  - Was flow too fast through the basin, damaging?
  - Getting too little water?
  - Not draining in spots?

Photo by Linda Brazaitis

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Re-Planting as Necessary

- Replace dead or diseased plant material
- Re-seed your berm if areas of exposed soil
- Replace rocks that may be diverting flow away from garden
- Build up areas where more height is needed

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Cleaning of Gutters

- Make sure rain gutters clear of debris.
- If the flow of water is blocked in the gutter, the rain water may not get to your rain garden.

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Harvest Plants

- Seeds /cuttings from successful plants can be used elsewhere in the garden or shared with another garden

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Questions?

Enter your questions in the Q&A
or
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