

Rain Gardens 101

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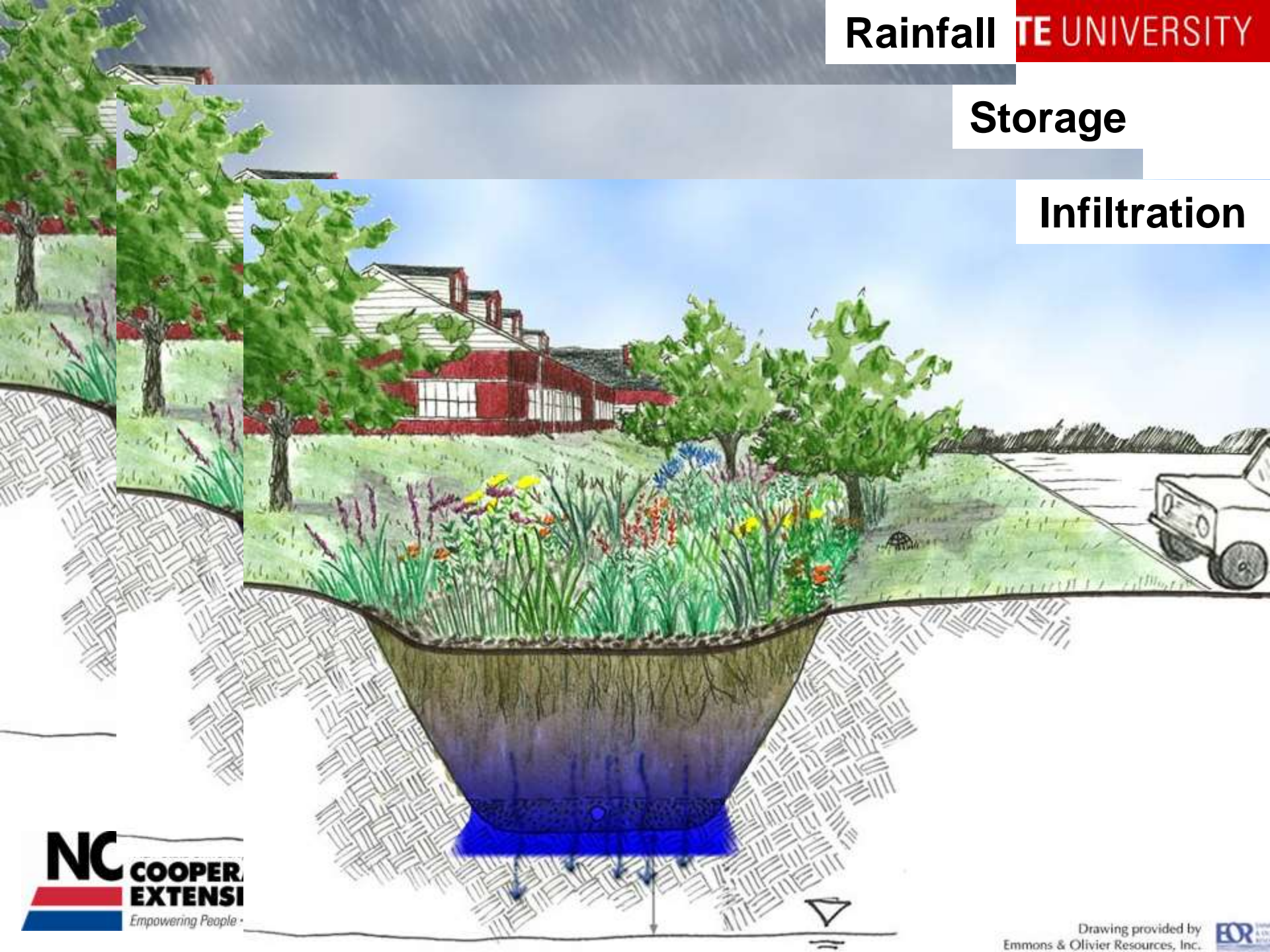


What is a Rain Garden?

- A shallow depression in a **landscape** that captures **water** and holds it a **short time**
 - Runoff water is captured and infiltrated into the **soil**
- An attractive addition to a landscape

Storage

Infiltration



Why Are Rain Gardens Needed?

As rainwater washes across yards, roads and parking lots, and flows into streams, creeks and other water bodies, it can

Pick up pollutants...

Cause erosion...

Result in flooding...



Urbanization



Lincoln, NE , 1850



Lincoln, NE , 2012

NC 6th fastest growing state, 10th most populous

POPULATION CHANGE BY COUNTY: 2000-2010

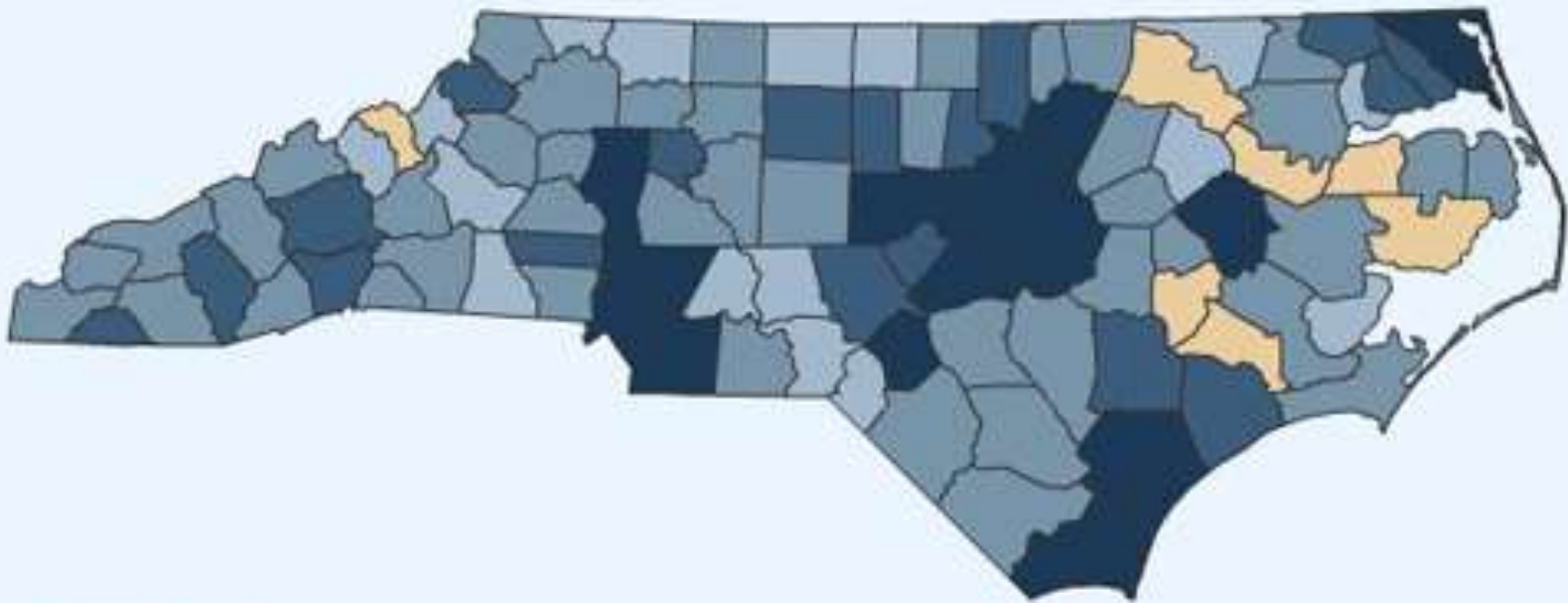
LOSS

0-5%

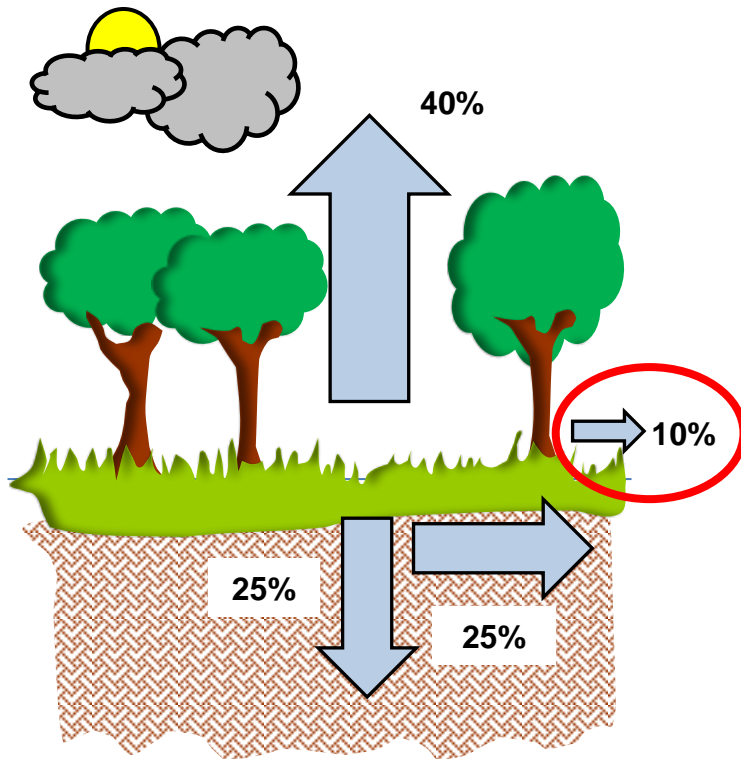
5-15%

15-25%

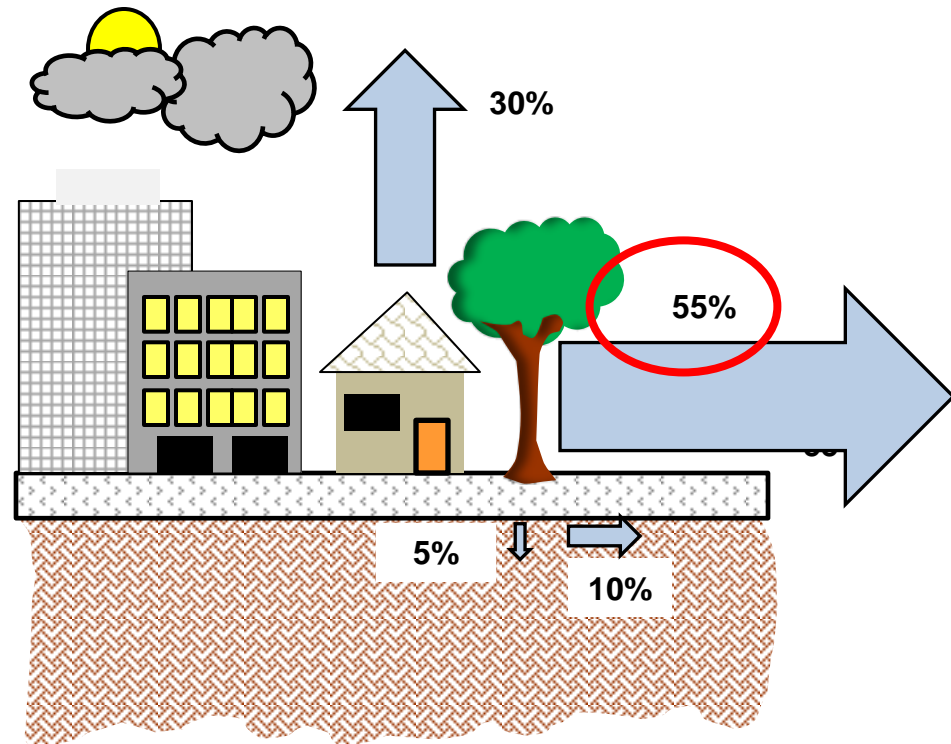
25% +



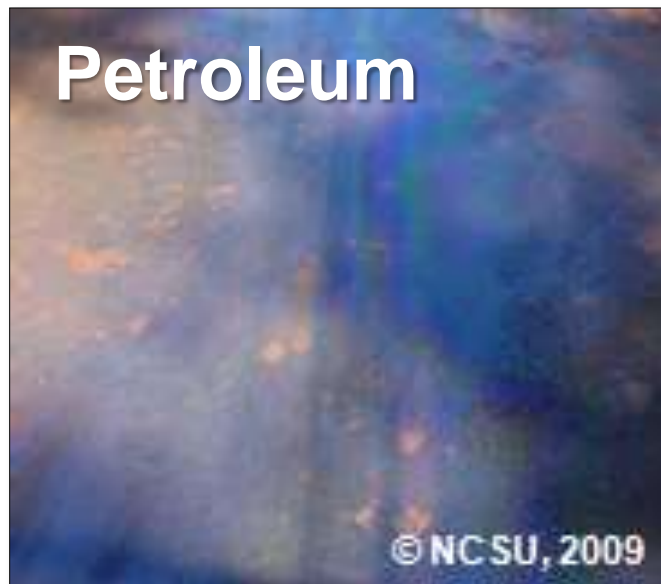
Pre- vs Post-Development Hydrology



**PRE-DEVELOPMENT
HYDROLOGIC BUDGET**



**POST-URBANIZATION
HYDROLOGIC BUDGET**



The Result



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Benefits of Rain Gardens

- Low maintenance, low water use, attractive landscape feature
- **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** downstream
- Creates **habitat** in the landscape



Creating a Rain Garden

1. Find possible location(s)
2. Determine soil drainage
3. Design the garden
4. Construct and plant the garden
5. Maintenance



Step 1:

Determine Potential Rain Garden Locations

- **Determine Constraints:**
 - Locate wells, septic systems, and utilities



Keep In Mind

Rain gardens will be very wet sometimes...



**2-3 days
(max)**

Step 1:

Determine Potential Rain Garden Locations

- > 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



Downhill from home, well, and septic field

Step 1: Potential Locations

Your rain garden should be between **runoff source:**

- downspout, roof, driveway

And **runoff destination:**

- curb, stormwater drain
- creek, ditch



Best Source of Water for your RG?



DOWNSPOUTS

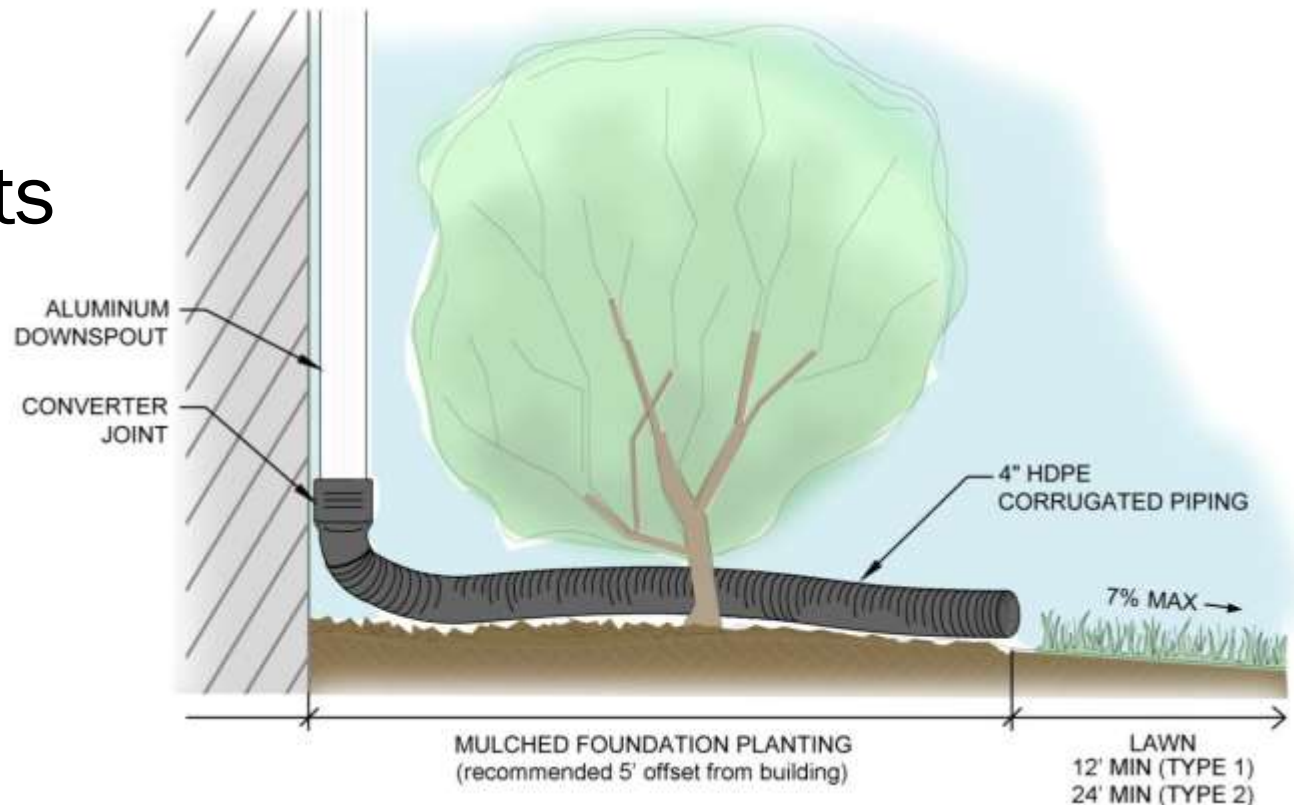


Redirecting Flow: Typical Flow Patterns



Capture Runoff Onsite

- Redirect downspouts to lawn



Alter Downspout to Redirect Flow



Report a problem

Intercept Flow With A Rain Garden!



Rain Garden

Step 2: Determine Soil Drainage

Ideally, soils should drain within 3 days.

Drainage will determine:

1. “Wetness” period
2. Plant selection



Step 2: Determine Soil Drainage



Infiltration Test

Dig a hole to
a depth of
1 foot and fill
with water;
Repeat **2-3**
times

Infiltration Test: The Results

Drain Time	Appropriate BMP
< 12 hours	Quick-Draining R.G.
12 hrs – 3 days	Standard Rain Garden
> 3 days	Wetland Garden

Note:

**These are small-scale rain gardens and wetlands.
Larger projects designed for regulatory purposes require
design and approval by a P.E./R.L.A.**

Wetland Soils: BAD for Rain Gardens!



Drainage Time > 3 Days

3 options:

- 1) Look for another location
- 2) Work with it!
Install a backyard wetland
- 3) Install soil media & under-drain (\$\$\$)



Step 3: Design Your Rain Garden

1. Determine the watershed size
2. Use “10/10” method to estimate size of rain garden ponding area
3. Design garden shape and size
4. Place the overflow weir



© NCSU, 2009

Watershed Size:

How much rain should a rain garden hold?

- Typically designed to capture first 1" of rainfall
- Use 10 and 10 rule
 - 10% of watershed
 - Ponding 10" deep



The “First-Flush” Phenomenon



stormh2o.com

PHOTO: GORDON ENGLAND



lithocrete.com

Watershed Size

- Which impermeable surfaces (roof, driveway) will drain to the rain garden?
- Measure length (L) and width (W)
- Multiply $L \times W$ to determine watershed area in square feet



Watershed Size

Area A:

$$25 \times 10 = 250 \text{ ft.}^2$$

Area B:

$$20 \times 15 = 300 \text{ ft.}^2$$

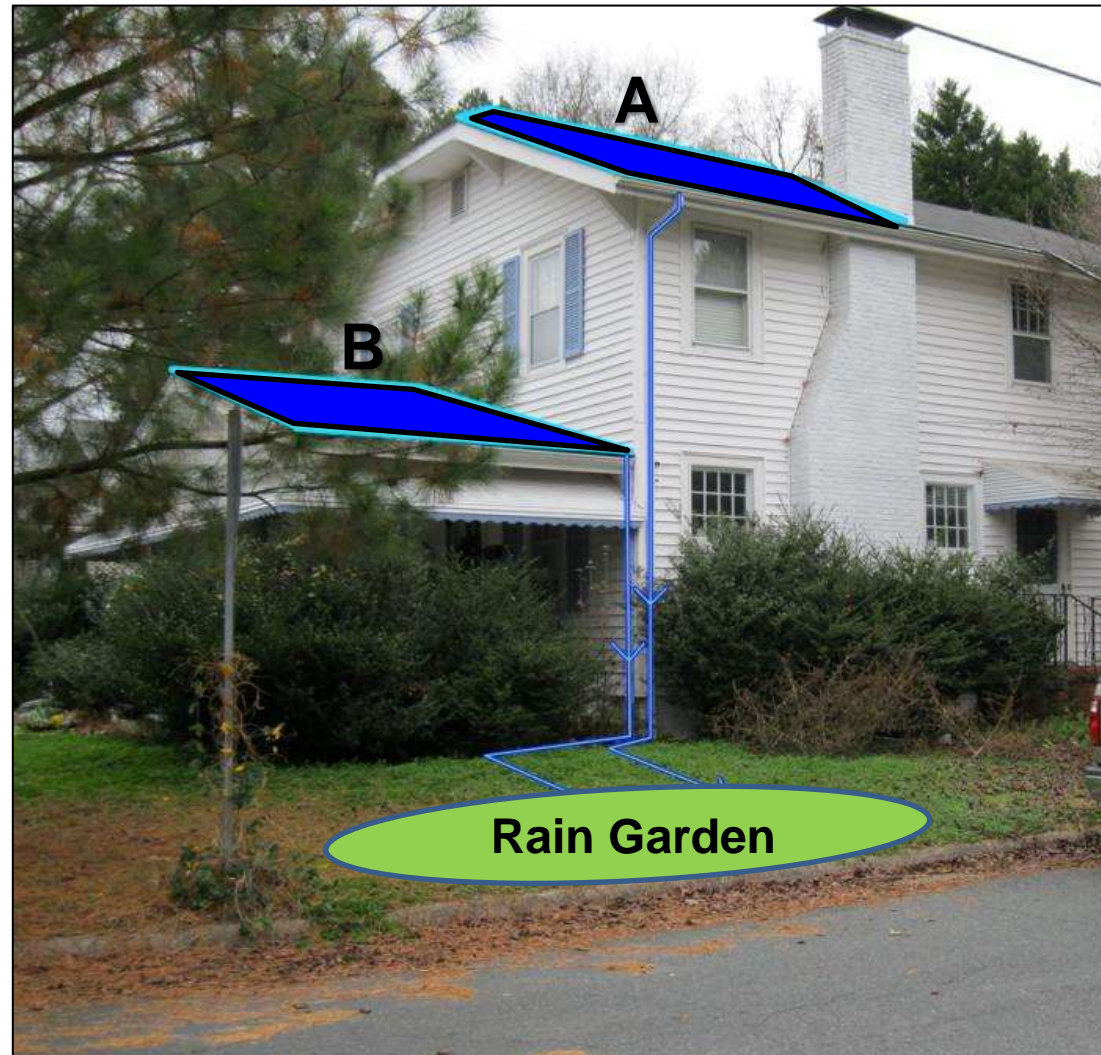
Watershed size:

$$250 + 300 = 550 \text{ ft.}^2$$

Ponding area size:

$$550 \times 0.1 = 55 \text{ ft.}^2,$$

10" deep



Ponding Area

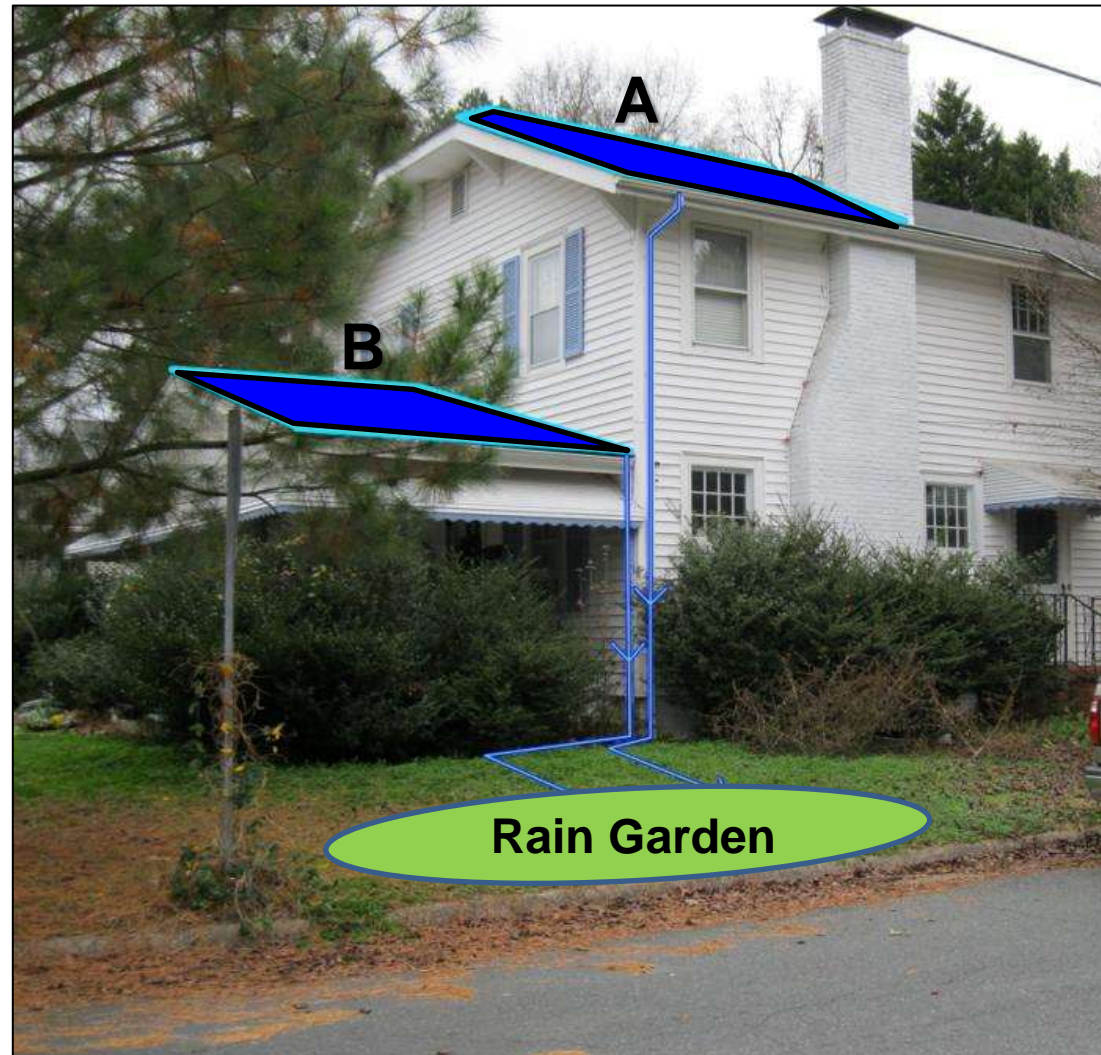
Minimum ponding
area size:

$550 \times 0.1 = 55 \text{ ft.}^2$,
10" deep

Ponding area can be:

- 5' x 11'
- 3' x 18'
- 7' x 8'

Shaped to fit
available space



What Happens When It Fills Up?



Overflow Weir



Overflow Weir

- Allows water to overflow
- Must be 10" above bottom of garden
- Minimum length = 1'
- Use rocks, blocks or other hardscape materials to prevent erosion





Inflow

Overflow

Overflow in Bioretention



Rain Garden Design

- **Location** determined by stormwater flow
- **Size of ponding area** determined by watershed area
- **Shape** – work with existing plantings and contour to blend into landscape



Intercept stormwater before it leaves the landscape

Plantings can extend beyond the ponding area



If rain garden is “on its own”, make large enough to be a landscape feature, in scale with size of yard



Too small, stranded in middle of yard



Step 4: Construct and plant your rain garden

- Locate all utilities, septic tanks and drainfields before construction!
- Take note of construction in the area
- Add rain garden after all other construction and soil disturbance is complete



Clay and silt clog rain gardens!

Step 4: Construct and plant your rain garden

- Mark outline with hose, chalk or spray paint
- Remove sod – set aside for use on berm
- Excavation is the hardest part!



Step 4: Construction

- Excavation Depth = 13"
 - 10" ponding + 3" mulch
- Bottom typically bowl shaped/rounded
- Cultivate bottom 4"-6" to improve plant growth
 - NO compost
 - Lime if recommended by soil test



Are Plants Necessary?

Alternative
to plants in
the ponding
area:

- Mulch
- Stone
- Turf



Purpose of Plants in Rain Gardens

- Nutrient and some heavy metal uptake
- Transpiration
- Enhance infiltration
- Soil stabilization
- **Provide wildlife habitat** – pollinators and beneficial insects
- Provide aesthetic appeal



Plants suitable for rain gardens...

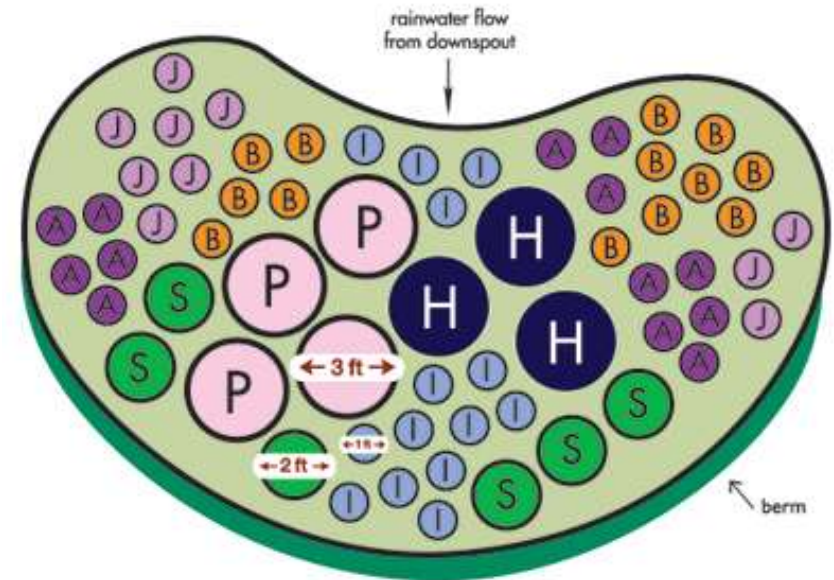
- Tolerate periods of saturated soil, yet also thrive under drier conditions
- Persistent, long lived
- Low Maintenance
- Require little fertilization or irrigation once established
- Native or non-invasive



Texas Star,
Hibiscus coccineus

Rain Garden Planting Design

- Groups of plants look better than 1 of this, 1 of that
 - Also provide better foraging habitat for pollinators
- Plan for something in bloom each season
- Generally, taller plants in middle or towards back



Match Plants to Expected Moisture Level

- **Quick Draining Rain Garden**, drain < 12 hours
 - Need greater drought tolerance, especially in deep sandy soils
- **Standard Rain Garden**, drain in 12 hours - 3 days
 - Plants tolerant of moist soil and “wet feet”
- **Wetland Garden**, drain > 3 days
 - Plants tolerant of extended flooding



Plants for Rain Gardens in NC

- Shrubs, Perennials
- For ponding area
- All for sun to part shade
- Natives and non-invasive non-natives
- Commercially available



Trees in Rain Gardens

- Place with care – increase shading over time
- Difficult for most perennials and ornamental grasses to grow within tree root zone
- Best placed outside of ponding area



Shrubs in Rain Gardens

- Most moisture tolerant shrubs are **deciduous**
- Plant **evergreens** outside of ponding area winter interest
- Too many shrubs may look overgrown



Too many shrubs – planted too close together

Beautyberry

Callicarpa americana

- Native
- 6' x 6' if cut back to 1' every year in Feb/March
- Quick, standard



Virginia Sweetspire

Itea virginica

- Native
- Standard, wetland
- Suckering roots
- Cultivars:
 - ‘Henry’s Garnet’,
4’-6’ x 4’-6’
 - ‘Little Henry’, dwarf
- 3’ x 3’
- Deer Love It!



Sweet Pepperbush

Clethra alnifolia

- Native
- 4'-6' tall and wide
- Cultivars:
 - ‘Hummingbird’, ‘Sixteen Candles’, dwarf white, 3' x 6'
 - ‘Ruby Spice’, upright pink, 8' x 5'
- Very fragrant, suckering roots
- Quick, standard



Sweet Pepperbush

'Ruby Spice'



'Sixteen Candles'

Inkberry

Ilex glabra

- Native
- 4'-5' x 3'-4'
- Evergreen
- Quick Draining, Standard



'Shamrock'

Perennials and Grasses in Rain Gardens

- For color and seasonal interest
- Most dieback in winter – cut back after frost
- Grasses add texture and are tough!
- Flowers provide food and habitat for beneficials and pollinators



Bluestar

Amsonia tabernaemontana

- Native
- Grows 2' tall and wide
- Cut back after flowering to prevent seeding
- Pollinators love it!
- Deer resistant
- Standard, wetland



Blue Flag Iris, *Iris virginica*

Native

2'-3'

Standard, wetland

Siberian Iris,
Iris sibirica,
not native, not
invasive



Yellow Flag Iris,
Iris pseudacorus,
is not native and is
potentially invasive!
Don't plant!



Black Eyed Susan

Rudbeckia fulgida

- Native
- Yellow flowers all summer, 3' tall
- Quick, standard
- Cultivar: 'Goldstrum' most common
- Deer love it!



Rose Mallow

Hibiscus moscheutos

- Native
- 4'-6' tall and wide
- Standard, wetland
- Many cultivars and hybrids, 'Disco Bell' - seed strain
- Deer?

Red Star, Texas Star

Hibiscus coccineus

Red flowers, more finely cut leaves, less bothered by Jap. Beetles and caterpillars



Swamp milkweed

Asclepias incarnata

- Native
- 3' -4' tall and wide
- Spring/early summer flowers, pink or white
- Sun to part shade
- Standard, wetland
- Monarchs! Attracts many pollinators
- Deer resistant



Joe Pye Weed

- Native
- Deer resistant
- Standard, wetland
- *Eutrochium dubium*
 - 4'-5' tall x 3'-4' wide
 - More common in coastal plain
- *E. fistulosum*
 - 5'-8' x 3'-4'
 - More common piedmont
- *E. purpureum* and *E. maculatum* in Mountains



Cardinal Flower

Lobelia cardinalis

- Native
- Height: 3'
- Standard, Wetland
- Do not mulch over evergreen leaves in winter



'Fireworks' Goldenrod

- Native
- *Solidago rugosa*
- 2'-3' tall and wide
- Pollinators love it!
- Standard



Panic Grass, Switch Grass

- *Panicum virgatum*
- Native
- Quick, standard
- ‘Shenandoah’ ‘Prairie Fire’, 3’ x 2’, burgundy leaves
- ‘Northwind’, 5’ x 2’, upright
- ‘Cloud Nine’, large, 8’ x 6’, strong stems



‘Northwind’

Sweetflag

Acorus gramineus

- Not native
- 8" – 12", evergreen
- 'Ogon' – gold leaves
- Great for edges and underplanting
- Standard, Wetland
- *Acorus calamus* – is native, taller, green leaves



Need more plant info?

Plants Database

<http://plants.ces.ncsu.edu/>

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Perennials	All Plants



Step 6: Maintenance

- All gardens need some maintenance - **Rain gardens are no exception!**
- Frequently inspect for and remove weeds, debris and trash
- Keep inflow and weir clear of debris and sediment



Watering Rain Gardens

- Right after planting
 - Every few days
- First growing season
 - Once a week
- During drought
- Soaker hoses or drip irrigation best
 - Place close to base



Do you need to fertilize???

2005

2006



Mulching Rain Garden

- Shredded hardwood or pine straw
- 3" maximum
- Don't bury plants
- Remove mulch from drains/weir



Learn More!

NCCE Backyard Rain Gardens

<http://www.bae.ncsu.edu/topic/raingarden/>

**Backyard Rain
Gardens**



NORTH CAROLINA COOPERATIVE EXTENSION

HOME	Stormwater and Your Rain Garden	Building a Rain Garden	Plant Selection
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