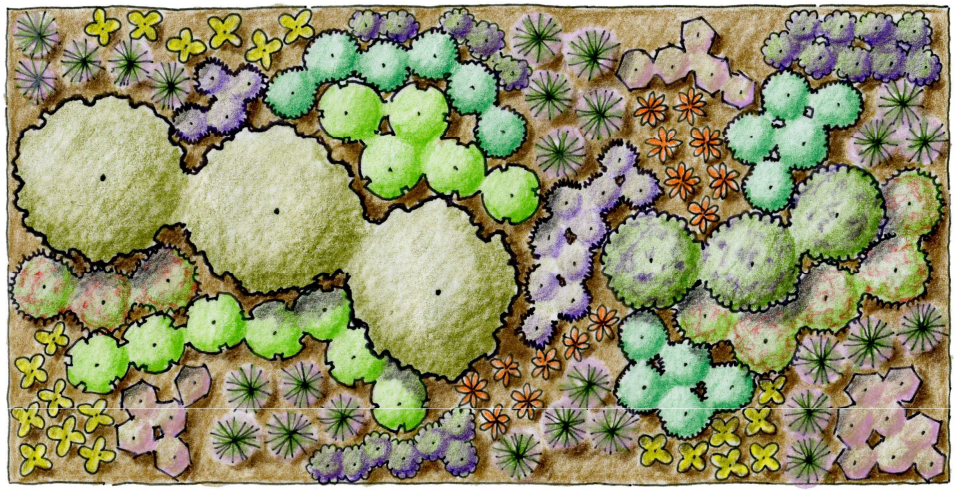
Alabama Low Impact Development Handbook



Katie Dylewski, Auburn University, ACES
Jess Brown, Rutgers University
Charlene LeBleu, Auburn University
Oliver Preus, Auburn University
Taylor French, Auburn University
Eve Brantley, Auburn University, ACES

Low Impact Development

Component of watershed planning & restoration

- Natural resource based planning
- Stormwater control measures
- Stream enhancement and restoration
- Education and outreach

More than Rain Gardens

Holistic approach to managing stormwater – **Planning** and **Practice**

- Site considerations
- Infiltration
- Native vegetation
- Potential for quantity and quality control

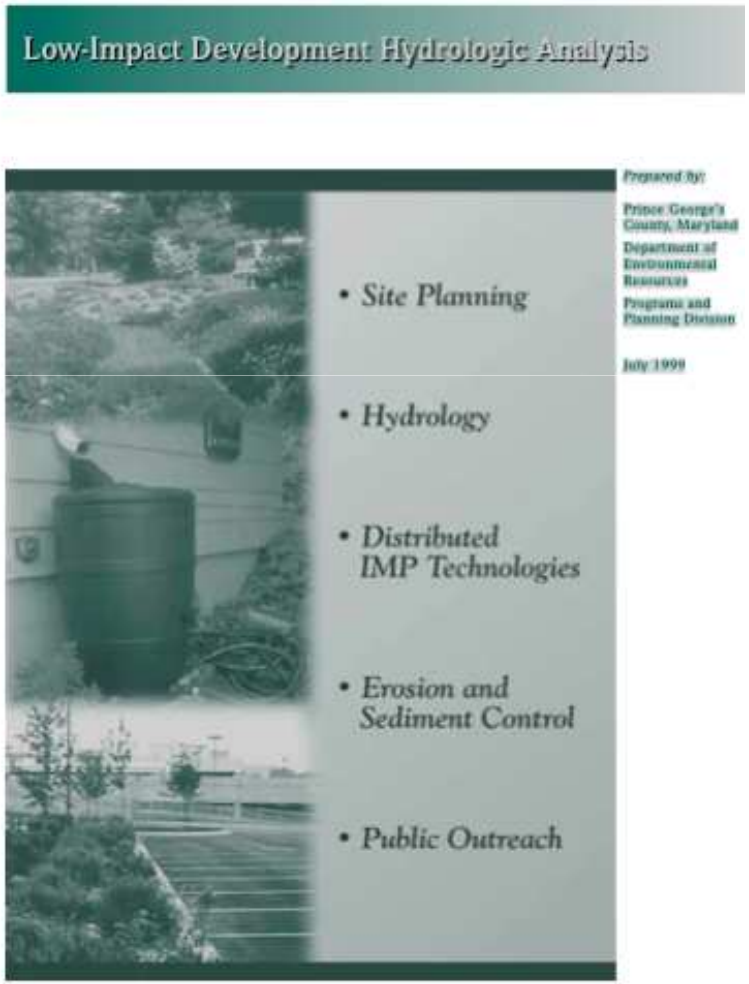
Recent Federal Support

EPA & Green Infrastructure

- "… systems and practices that use or mimic natural processes to **infiltrate**, **evapotranspirate**, or **reuse** stormwater or runoff on the site where it is generated."
- Small scale and large scale applications (individual lot to city-wide)

LID Resources

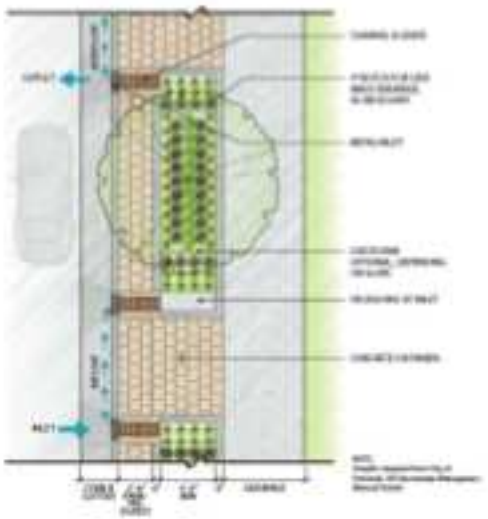
- Prince Georges County, Maryland
  - Low Impact Development Design Strategies: An Integrated Design Approach
  - Low Impact Development Hydrologic Analysis



LID Resources

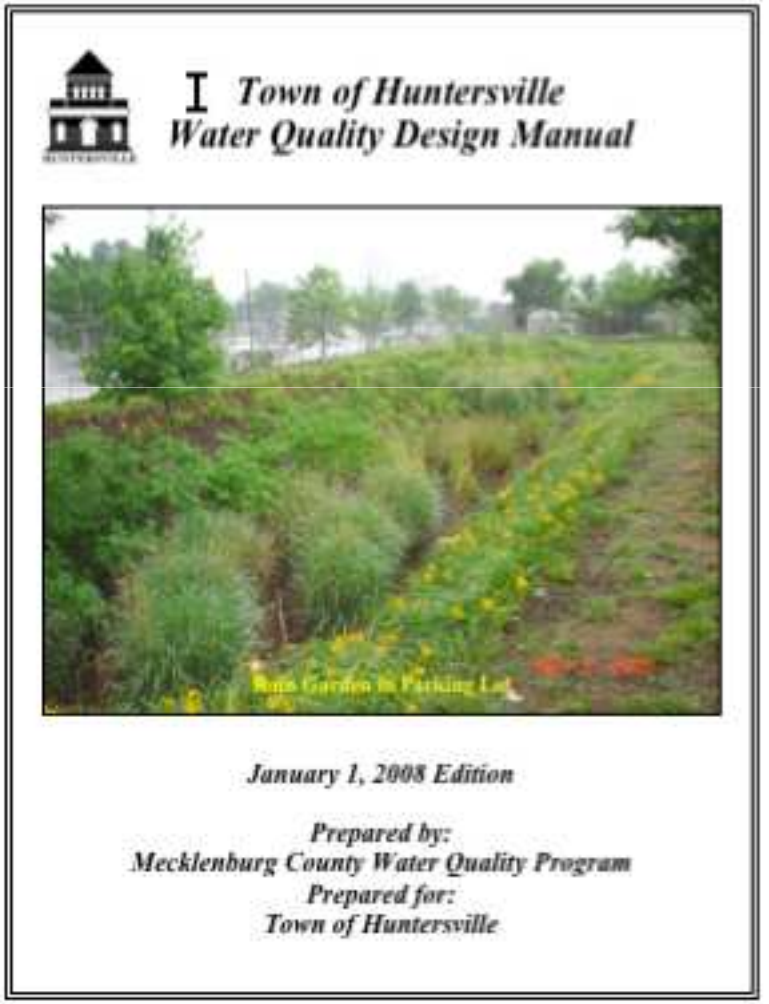
- Seattle, Washington
  - Revision of LID Technical Guidance Manual (2012)

3-2: Bioretention planter integrated into the streetscape (Portland, OR).



LID Communities

- Huntersville, North Carolina
  - Post-Construction Storm Water Ordinance (2007)
  - Water Quality Design Manual (2008)



http://charmeck.org/stormwater/regulations/Pages/LIDHuntersville.aspx

LID Communities

- Griffin, Georgia
  - Stormwater Design Manual Chapter 9 – Low Impact Development

City of Griffin
StormWater Department

Overall Goal – Alabama Handbook

- Develop a user-friendly technical guidance manual for LID practices
- Incorporate attractive and informative graphics

Grass Filter Strip Cross Section

Alabama LID Handbook

1. Develop a statewide guidance for LID practice design elements.
2. Develop a list of vegetation that is suitable for LID practices in different regions of Alabama.

Alabama LID Handbook

Resource guide

- Current research results
- Compilation of LID design guidance
- Survey of LID practices implemented in Alabama

Alabama LID Handbook

1. Introduction
2. Site selection
3. Stormwater hydrology
4. Native vegetation
5. Stormwater control measures
6. Retrofits and alternatives
7. Community planning – Codes and Ordinances
8. Maintenance

EPA List of LID Practices

- Many to choose from
- Selected most commonly implemented in southeast

Images from www.epa.gov/owow/NPS/lid

Stormwater Control Measures

- Green roof
- Bioretention
- Constructed stormwater wetlands
- Permeable pavement
- Vegetated filter strips
- Vegetated swales
- Level spreaders
- Riparian buffers

Bioretention

Railroad Park; Birmingham, AL

A bioretention cell utilizes plants and specialized soil media for the removal of pollutants in stormwater runoff through adsorption, filtration, sedimentation, volatilization, ion exchange, and biological decomposition. Bioretention can be an amenity to the landscape by enhancing habitat and aesthetics.

- General characteristics
- Pollutant removal
- Constraints
- Specific siting
- Design guidance
- Construction / Timing
- Vegetation
- Maintenance

Site Selection

Quantity Control	possible
Drainage Area	small
Space Required	large
Works with:	
Steep Slopes	✔
Shallow Water Table	---
Poorly Drained Soils	---

General Significance

Construction Cost	med/high
Maintenance	med/high
Community Acceptance	med/high
Habitat	med
Soils	pref. sandy
Sun / Shade	sun/p.shade

Pollutant Removal Table

Sediment	Nutrients		Metals	Pathogens	Temperature
	N	P			
a[1].85%	60%	60%	No Data	High Potential	Moderate Potential
a[2].85%	40%	45%	No Data	High Potential	Moderate Potential
a[3].85%	35%	45%	No Data	High Potential	Moderate Potential
b.80%	50%	60%	MOD	No Data	No Data
c.80%	50%	60%	MOD	No Data	No Data

a. North Carolina Department of Environment and Natural Resources, 2007
b. City of Auburn, 2009
c. Georgia Manual, 2001

a[1]. - Pollutant removal for a bioretention cell with internal water storage (IWS) in the Coastal Plain.
a[2]. - Pollutant removal for a bioretention cell with IWS in the Piedmont and Mountains.
a[3]. - Pollutant removal for a bioretention cell with no IWS.

"The design pollutant removal rates listed in the pollutant removal table are conservative average pollutant reduction percentages derived from the specific locality's sampling data, modeling, and professional judgment (GA Manual 2001, ISU 2008)."

Constraint	Recommendations
Water Table	*Locations with water table greater than 6' from the surface*
Slope	*Locations with less than 20% slopes, flatter locations work best*
Utilities	*Call 811 before construction to locate utilities*
Unstable Soils	*Locations that are not going to be under active construction or changing soil conditions; clayey soils can clog media*
High Sediment Loads	*Locations that will not experience high sediment loads that risk clogging system; clayey soils can clog media*
Non-native Invasive Vegetation	*Non-native invasive vegetation can be difficult to eradicate; native vegetation that is both tolerate of wet and drought conditions should be used*
Continuous Flow	*Locations that will not experience continuous flow and are allowed to drain*
Cold Climates	*Site locations in regions that will not experience frequent freezing*

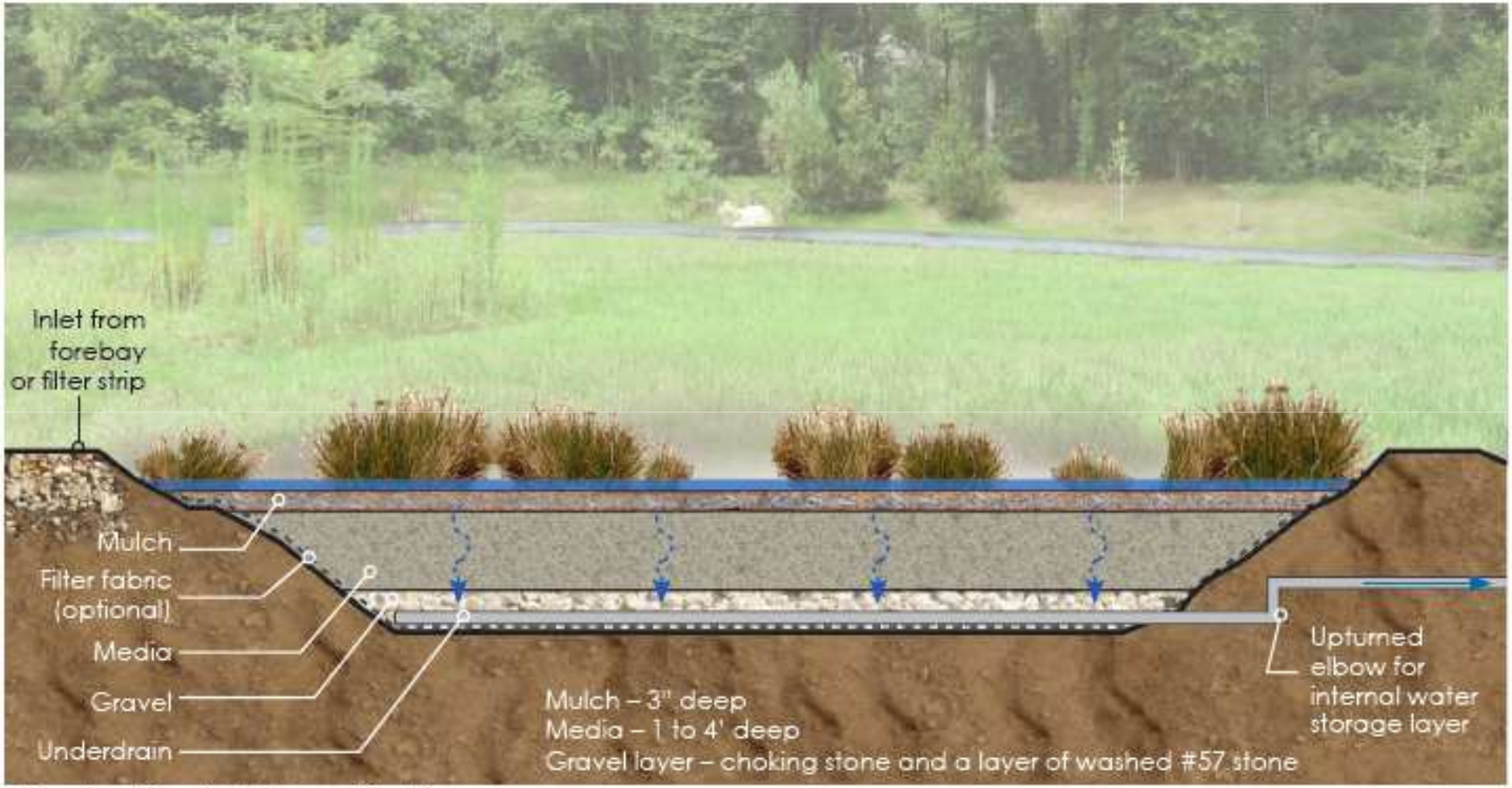
Target Pollutant	Media Depth (ft)
Metals and Oils	1
Pathogens	2
Nutrients	3
Temperature	4

**There is no recommended media depth for TSS removal because sedimentation occurs before runoff infiltrates the bioretention cell (Hunt and Lord, 2006).

Alabama updates will be incorporated as we learn more …

Material	Recommended Depth (in)
Bioretention Media	36 or pollutant dependent
Washed Sand	4
Choking Stone	2
#57 Stone	6

Vegetation Type	Recommended Depth (in)
Herbaceous perennials and grasses	≤24
Shrubs	≥24
Small trees	≥36



Bioretention Cell Cross Section

Bioretention Plant List

This is a suggested plant list for Bioretention in Alabama.

Botanical Name	Common Name	Habit	Prefers
Clethra alnifolia	summersweet clethra	deciduous shrub	sun to part shade
Conoclinium coelestinum	mistflower	herbaceous perennial	sun to part shade
Fothergilla gardenii	dwarf witchalder	deciduous shrub	sun to part shade
Ilex glabra	inkberry holly	evergreen shrub	part shade
Ilex verticillata	winterberry	deciduous shrub	sun to part shade
Ilex vomitoria	yaupon holly	evergreen shrub	sun to part shade
Itea virginica	sweetspire	deciduous shrub	sun to part shade
Lindera benzoin	spicebush	deciduous shrub	sun to part shade
Morella cerifera	wax myrtle	evergreen shrub	sun to part shade
Muhlenbergia capillaris	muhly grass	herbaceous grass	sun to part shade
Panicum virgatum	switchgrass	herbaceous grass	sun to part shade
Rudbeckia fulgida	orange coneflower	herbaceous perennial	sun to part shade
Stokesia laevis	stoke's aster	herbaceous perennial	sun to part shade
Vernonia gigantea	giant ironweed	herbaceous perennial	sun
Vernonia novenboracensis	New York ironweed	herbaceous perennial	sun
Viburnum dentatum	witherod	deciduous shrub	sun to part shade
Viburnum nudum	possumhaw	deciduous shrub	sun to part shade

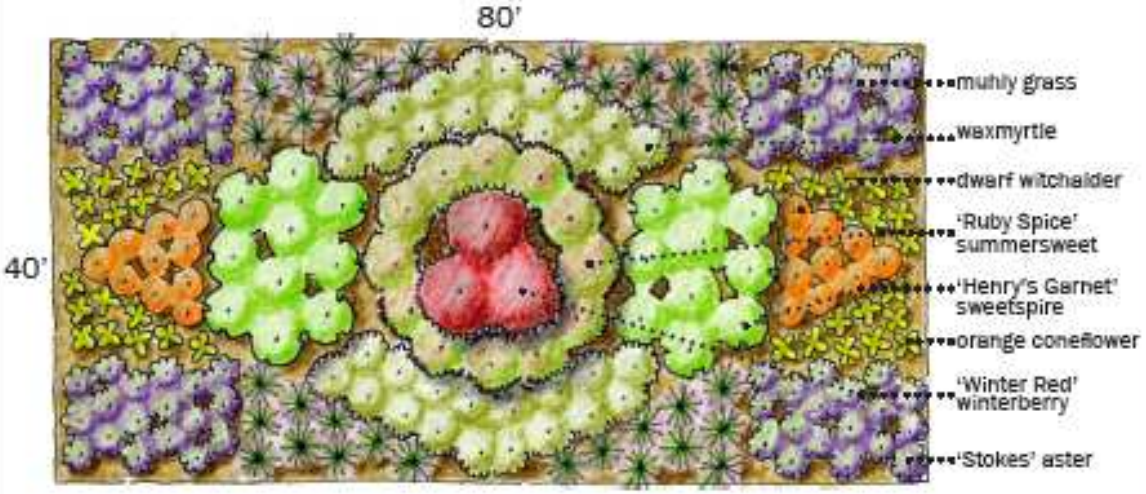
Bioretention Pl

This is a suggested pla

Botanical Name
Clethra alnifolia
Conoclinium coelestir
Fothergilla gardeni
Ilex glabra
Ilex verticillata
Ilex vomitoria
Itea virginica
Lindera benzoin
Morella cerifera
Muhlenbergia capilla
Panicum virgatum
Rudbeckia fulgida
Stokesia laevis
Vernonia gigantea
Vernonia novenborace
Viburnum dentatur
Viburnum nudum

Vegetation Design Example 1

Recall the Bioretention design example. This bioretention cell is 40' x 80' and uses a mixture of small trees, shrubs, and perennials. It is symmetrical and can be viewed from all sides. The vegetation provides year round seasonal interest.



Design 1 Plant List

Botanical Name	Common Name	Seasonal Interest	Quantity
Clethra alnifolia 'Ruby Spice'	'Ruby Spice' summersweet	Summer bloom	12
Fothergilla gardenii	dwarf witchalder	Spring bloom, orange to red fall color	20
Ilex verticillata 'Winter Red'	'Winter Red' winterberry	red berries in late fall and winter	3
Itea virginica 'Henry's Garnet'	'Henry's Garnet' sweetspire	Spring bloom, red fall color	20
Morella cerifera 'Tom's Dwarf'	'Tom's Dwarf' waxmyrtle	evergreen	34
Muhlenbergia capillaris	muhly grass	Fall bloom	36
Rudbeckia fulgida	orange coneflower	Summer and Fall bloom	36
Stokesia laevis	Stoke's aster	Spring and Summer bloom	72

Bioretention Pl

This is a suggested pla

Botanical Name
Clethra alnifolia
Conoclinium coelestin
Fothergilla gardeni
Ilex glabra
Ilex verticillata
Ilex vomitoria
Itea virginica
Lindera benzoin
Morella cerifera
Muhlenbergia capilla
Panicum virgatum
Rudbeckia fulgida
Stokesia laevis
Vernonia gigantea
Vernonia novenborace
Viburnum dentatun
Viburnum nudum

Vegetation Design Exampl

Recall the Bioretention design example. Th
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Design 1 Plant List

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Clethra alnifolia 'Ruby Spice'	'Ruby Spice'
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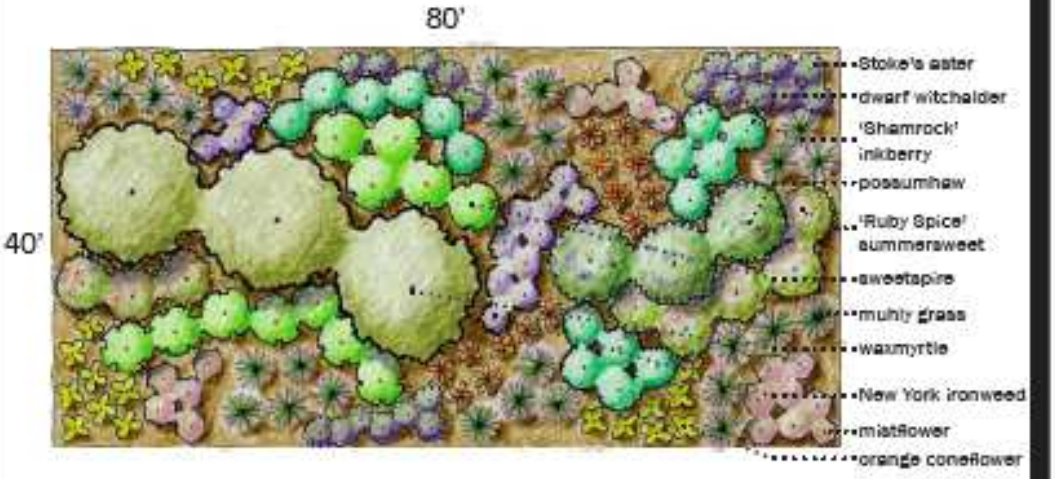
Itea virginica 'Henry's Garnet'	'Henry's Gar
Morella cerifera 'Tom's Dwarf'	'Tom's Dwa
Muhlenbergia capillaris	muhl
Rudbeckia fulgida	orange c
Stokesia laevis	Stoke

Design Example 2

The bioretention cell is 40' X 80' and again uses a mixture of small trees, shrubs, and perennials. It can be viewed from all sides and has year round seasonal interest.



Design 2 Plant List

Botanical Name	Common Name	Seasonal Interest	Quantity
Clethra alnifolia 'Ruby Spice'	'Ruby Spice' summersweet	Summer bloom	8
Conoclinium coelestinum	mistflower	Summer and Fall bloom	18
Fothergilla gardenii	dwarf witchhazel	Spring bloom, orange to red fall color	14
Ilex glabra 'Shamrock'	'Shamrock' inkberry	evergreen	16
Itea virginica	sweetspire	Spring bloom, red fall color	12
Morella cerifera	waxmyrtle	evergreen	3
Muhlenbergia capillaris	muhly grass	Fall bloom	27
Rudbeckia fulgida	orange coneflower	Summer and Fall bloom	21
Stokesia laevis	Stoke's aster	Spring and Summer bloom	21
Viburnum nudum	possumhaw	Summer bloom, berries in Fall	3
Vernonia novenboracensis	New York ironweed	Summer bloom	14

Maintenance Schedule

Task	How Often	Comments
Mulching	*As needed, full replacement every 2 to 3 years*	*Bare areas from erosion should be replaced as necessary. Mulching can be done any time of the year, but the best time is late Spring after soil has warmed (NCDENR, 2007). If in a watershed with high heavy metals, mulch should be replaced annually (NCDENR, 2007).*
Re-planting	*When plants die*	*If plants consistently suffer from mortality, consider using a more appropriate plant species for the area.*
Weeding	*Twice a year*	*Weeding should decrease over time as vegetation establishes*
Inspect plants	*Monthly until establishment, then twice a year*	*Inspect for diseased or insect infested vegetation.*
Fertilization	*Never*	*Most bioretention cells are used in nutrient sensitive watersheds. Fertilizing will increase nutrients leaving the bioretention cell.*
Flushing of underdrain pipes	*Annually*	*This will maintain infiltration of stormwater into the cell at 12 hours or less. If water remains ponded on the surface of the cell for longer than 12 hours this may indicate that the underdrain pipe or substrate is clogged.*
Pruning	*Annually*	*Pruning will help maintain plant shape. See Chapter X on Vegetation pruning*
Sediment Removal	*As needed*	*If sediment clogs the media, the top few inches may need to be removed and replaced (NCDENR, 2007). Removed sediment should be properly disposed of as it may contain toxic materials such as heavy metals.*
Trash Removal	*As needed*	*In high traffic areas, frequent trash removal will be necessary (City of Auburn, 2009).*
Mulch removal from outlets	*As needed*	*Mulch may collect in the outlet or overflow during heavy rains.*

Retrofits and Alternatives

- Rain gardens
- Curb cuts
- Rain barrels
- Disconnecting downspouts

Rain Gardens

Site Selection

Quantity Control	—
Drainage Area	small
Space Required	small
Works With	
Steep Slopes	✔
Shallow Water Table	✔
Poorly Drained Soils	✔

General Significance

Construction Cost	low
Maintenance	low
Community Acceptance	high
Habitat	med
Soils	all
Sun / Shade	sun/p.sun

A rain garden is a shallow depression in a landscape that captures water and holds it for a short period of time to allow for infiltration, filtration of pollutants, habitat for native plants, and effective stormwater treatment for small-scale areas.

Entrance to Benjamin Russel High School; Alexander City, AL

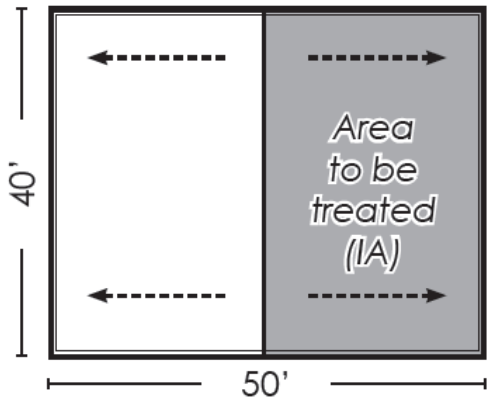
Standard Rain Garden

Design Example

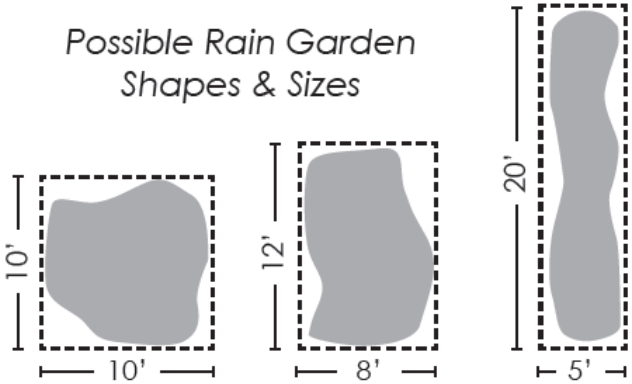
A residential rooftop is 50' by 40', for a total of 2,000ft² of impervious area. It is desired that half of the runoff from the rooftop will be directed to the rain garden. The owner prefers 3" of ponding (sandier soils) and would like to capture the first inch of rainfall.

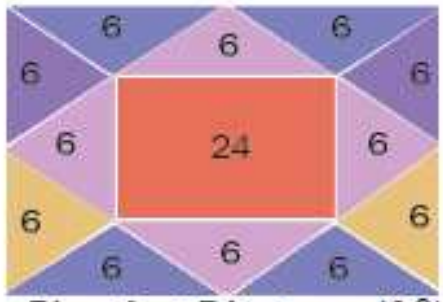
Roof area = 2,000 ft², treating ½ of the rooftop runoff
Impervious Drainage Area to be treated = 1,000 ft²
Ponding depth = 3"

$$RG\ Size = \frac{1000}{10} = 100\ ft^2$$



Possible Rain Garden Shapes & Sizes

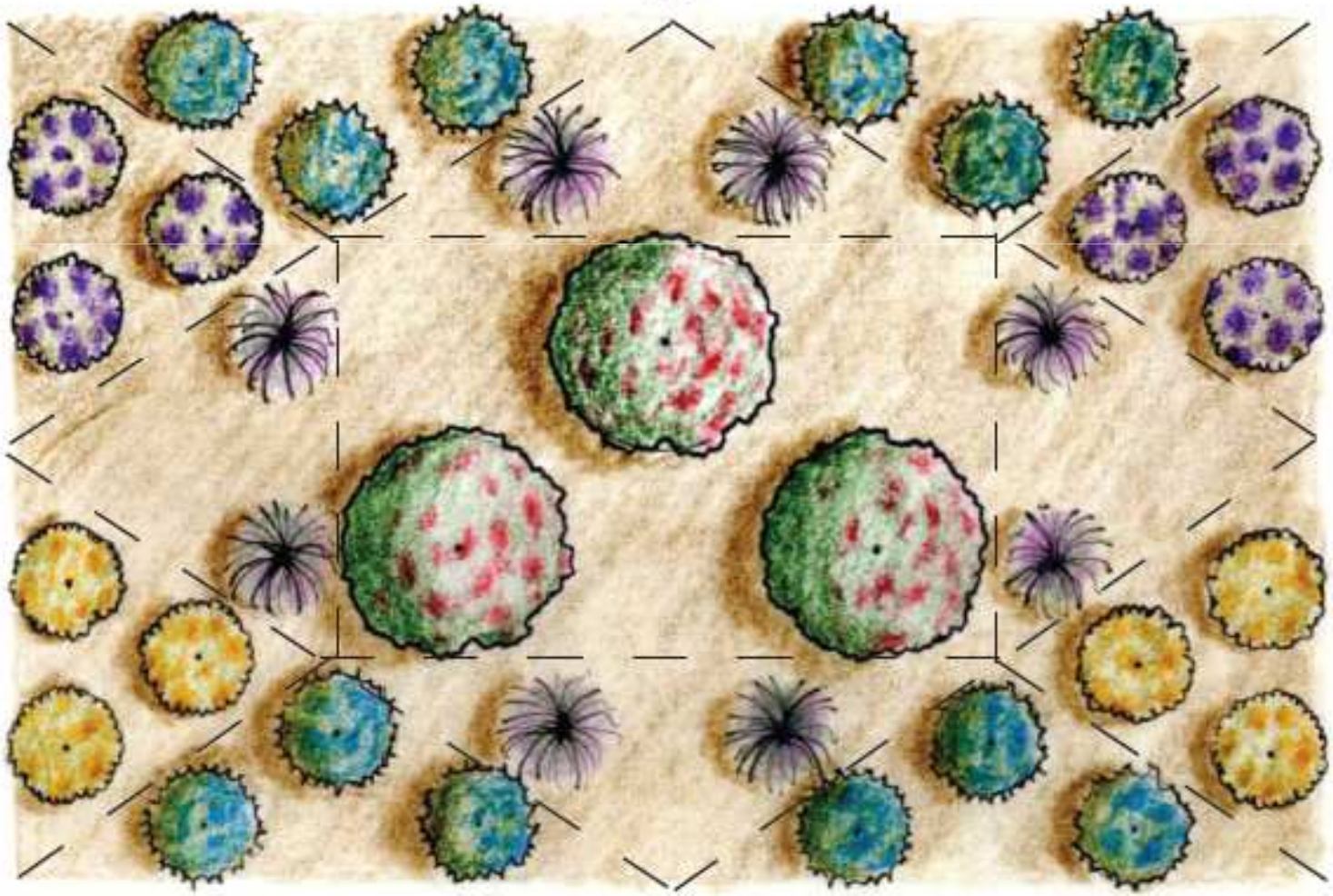




Planting Diagram (ft²)

12'

8'



Community Planning

- Enabling codes and ordinances
- Examples from Alabama, southeast, & nation

Photos Katie Dylewski

Timeline

- Spring 2012 – first draft sent to reviewers for comments
- Summer 2012 – incorporate comments
- Fall 2012 – final draft completed

Technical Seminars

- Series of technical seminars planned for 2012
- USDA Southern Region Extension Team
- Alabama LID Summit

Reference and Resource

- LID guide for range of audiences
- Reference for current design recommendations
- Pollutant removal estimates
- List of native plants appropriate for LID practices