Low Impact Development Summit

April 9-10, 2014

Thank you

Alabama Cooperative Extension System

Auburn University

Alabama Soil and Water Conservation Committee

Alabama Department of Environmental Management

AU Water Resources Center

Homebuilders Association of Alabama

Alabama General Contractors

Alabama Association of Conservation Districts Urban Committee

USDA Natural Resources Conservation Service

Alabama Clean Water Partnership

Goal

Bring together a diverse group of stakeholders to explore opportunities and identify obstacles to planning, designing, implementing and maintaining voluntary Low Impact Development (LID) in Alabama

Diverse Stakeholders

Local government

State government

Federal government

Planners

Policy makers

Civil and environmental engineers

Landscape architects

Natural resource professionals

Development professionals

Consultants / private industry

Interested stakeholders

Alexander City

Atlanta, GA

Auburn

Birmingham

Calera

Columbus, GA

Daphne

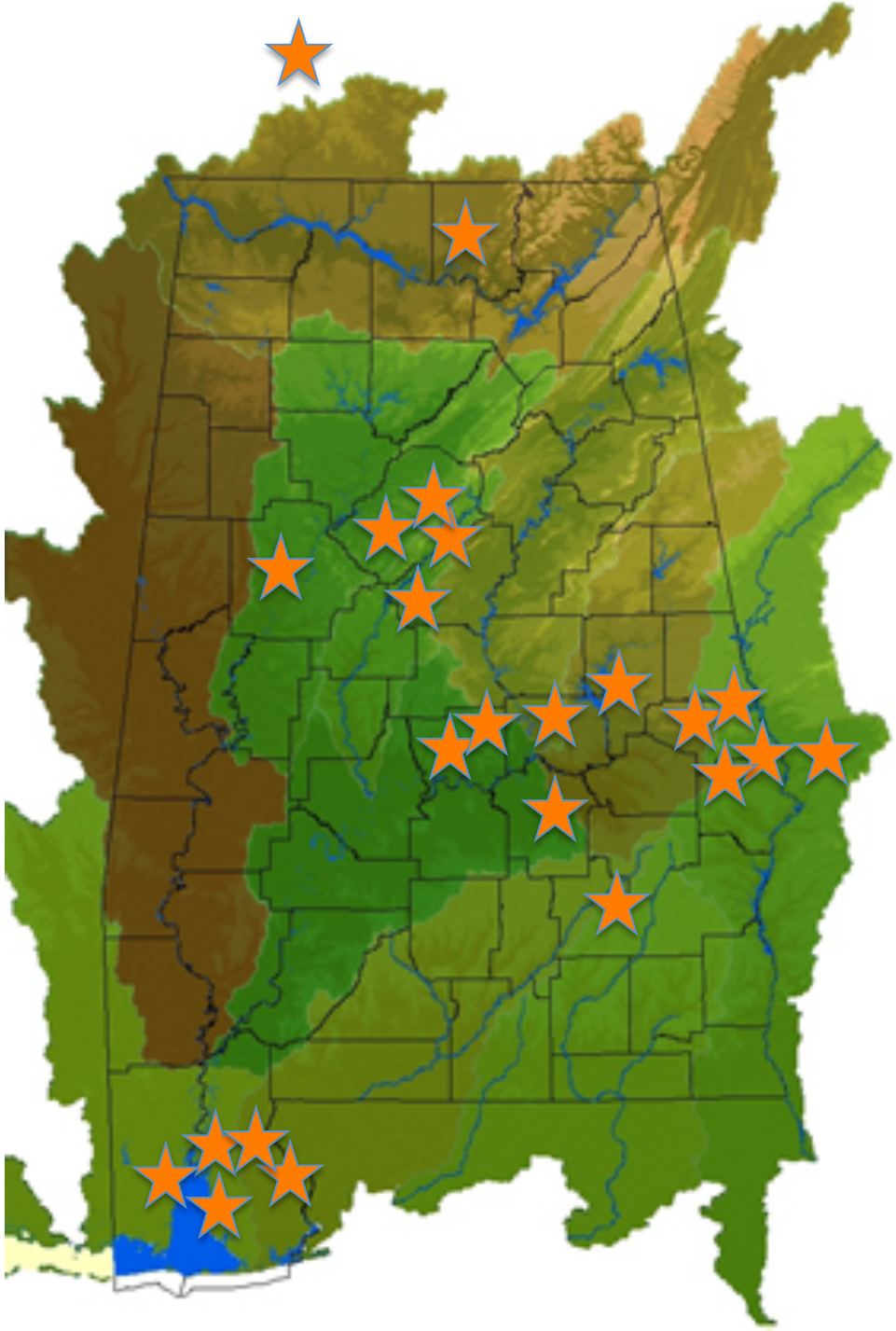
Fairhope

Foley

Hoover

Huntsville

Mobile



Montgomery

Nashville, TN

Opelika

Phenix City

Pelham

Silverhill

Smiths Station

Titus

Troy

Tuscaloosa

Wetumpka

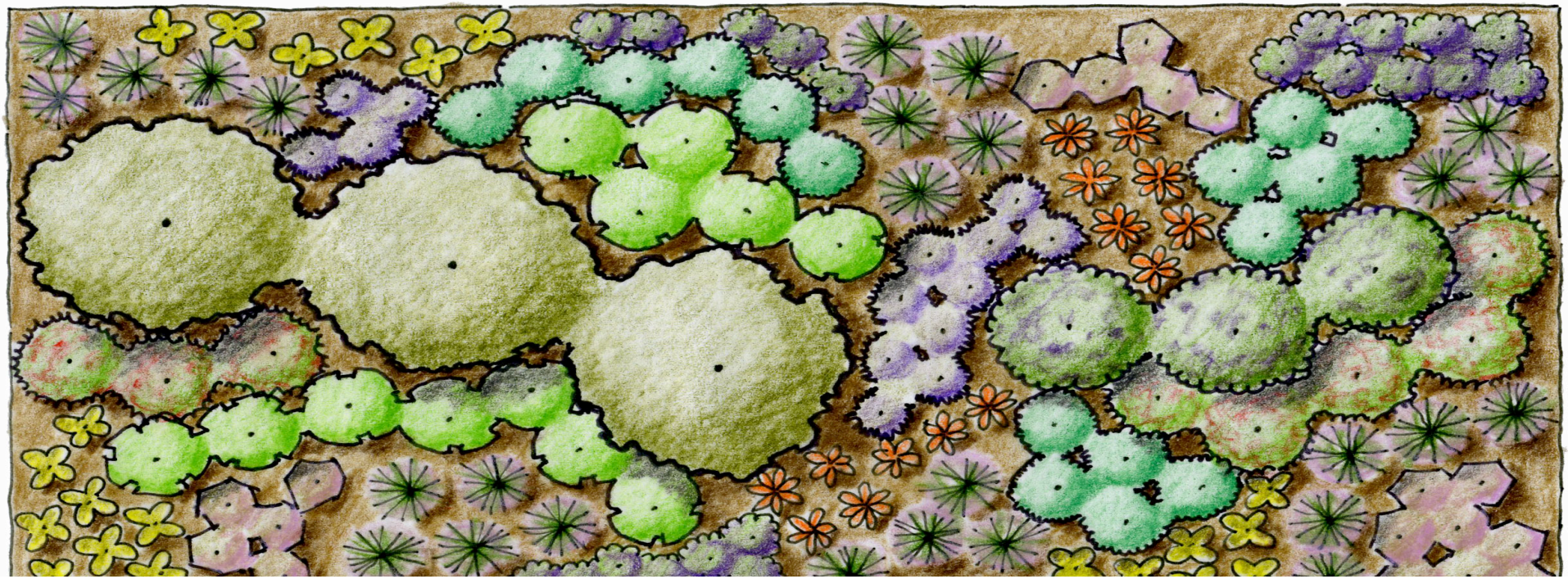
Goal

Bring together a diverse group of stakeholders to explore opportunities and identify obstacles to planning, designing, implementing and maintaining voluntary Low Impact Development (LID) in Alabama




Introductory Remarks

- Overview of LID
- Importance of Planning
- Engineering Design Considerations
- Regulatory Discussion

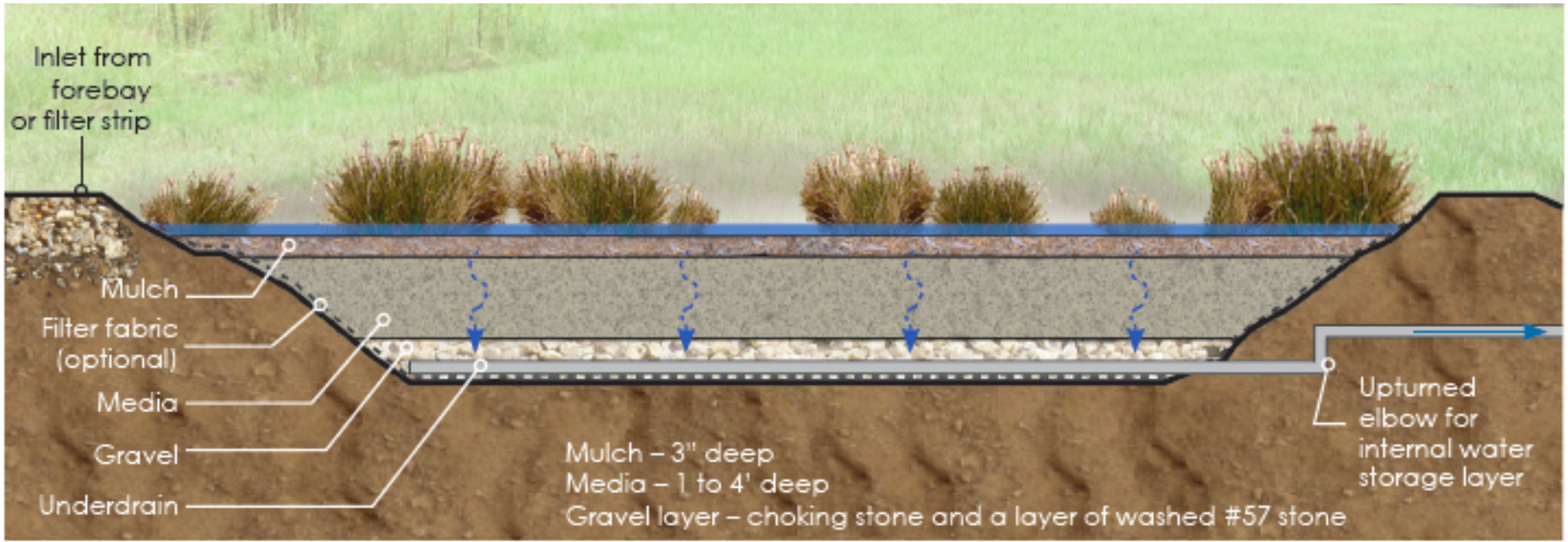


Putting Together the Pieces: AL Case Studies

- Design Engineering
- Landscape Architecture
- Project Coordination – multi-jurisdictional
- Community Planning

Breakout Sessions

- Developing a Green Infrastructure Plan
- Community Buy-In
- Designing Retrofits (Constrained Environments)
- Design & Engineering (New Developments)
- Codes, Ordinances & Planning



April 10

- Breakout Sessions – Synthesize and Report
- Lessons Learned from the City of Atlanta
- Opportunities for Funding through State Revolving Fund

What is LID?

What is LID?

Land development approach intended to reduce development impacts on water resources through stormwater management practices that infiltrate, evapotranspirate, or harvest & use stormwater on the site where it falls


What is Green Infrastructure?

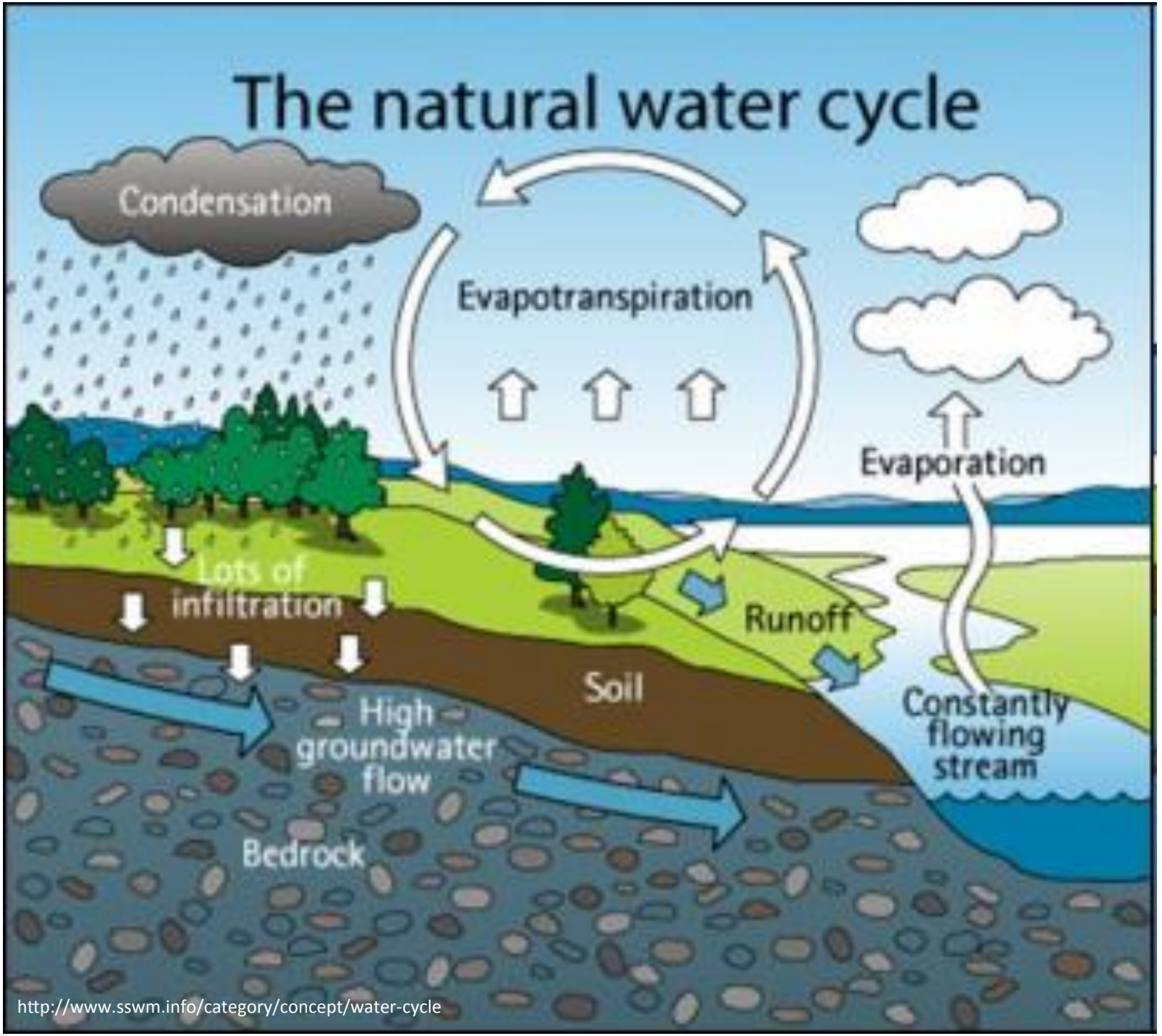
Natural and man-made landscape and features that can be used to manage runoff – network of practices

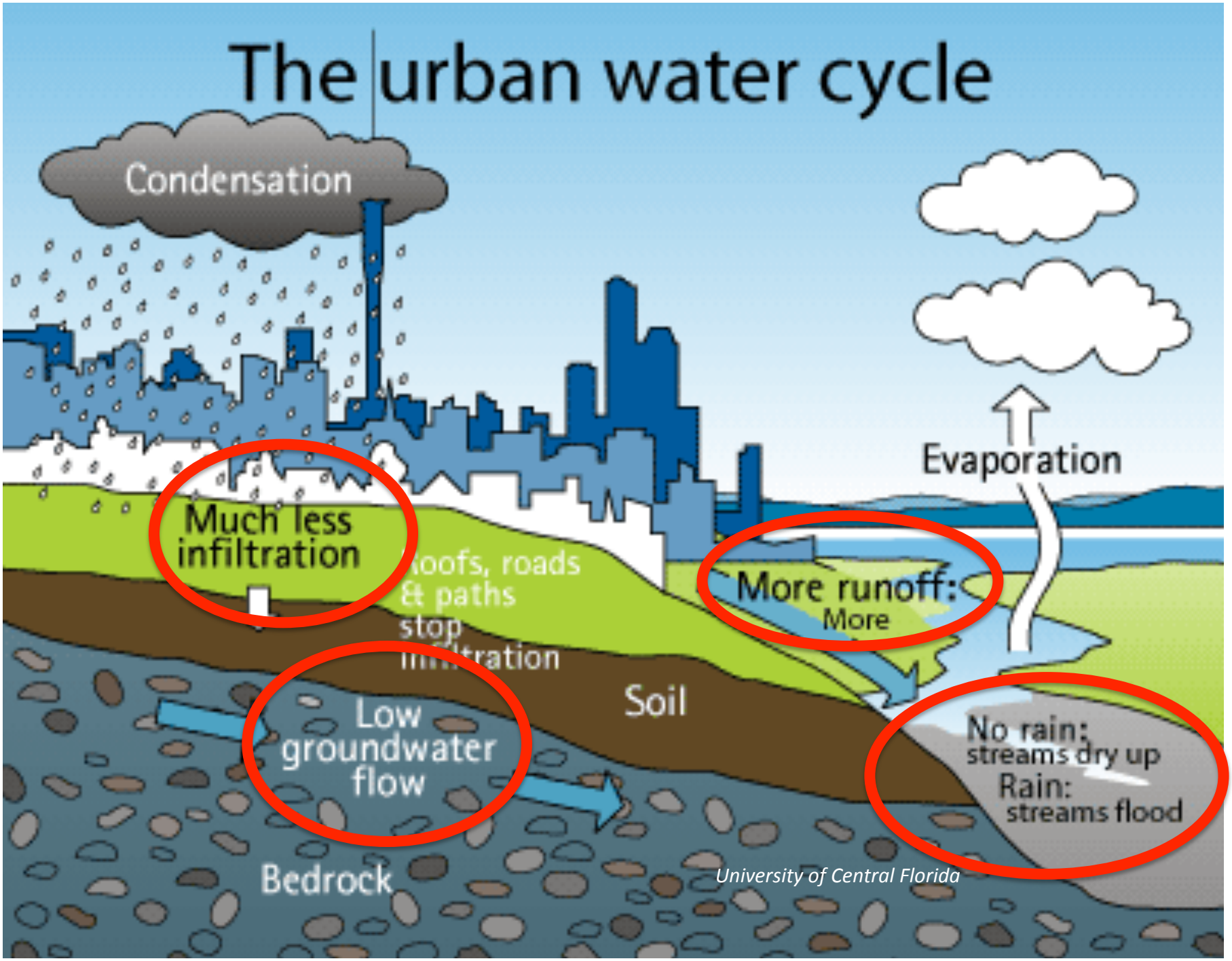
Why Consider LID?


Photo: Dan Ballard

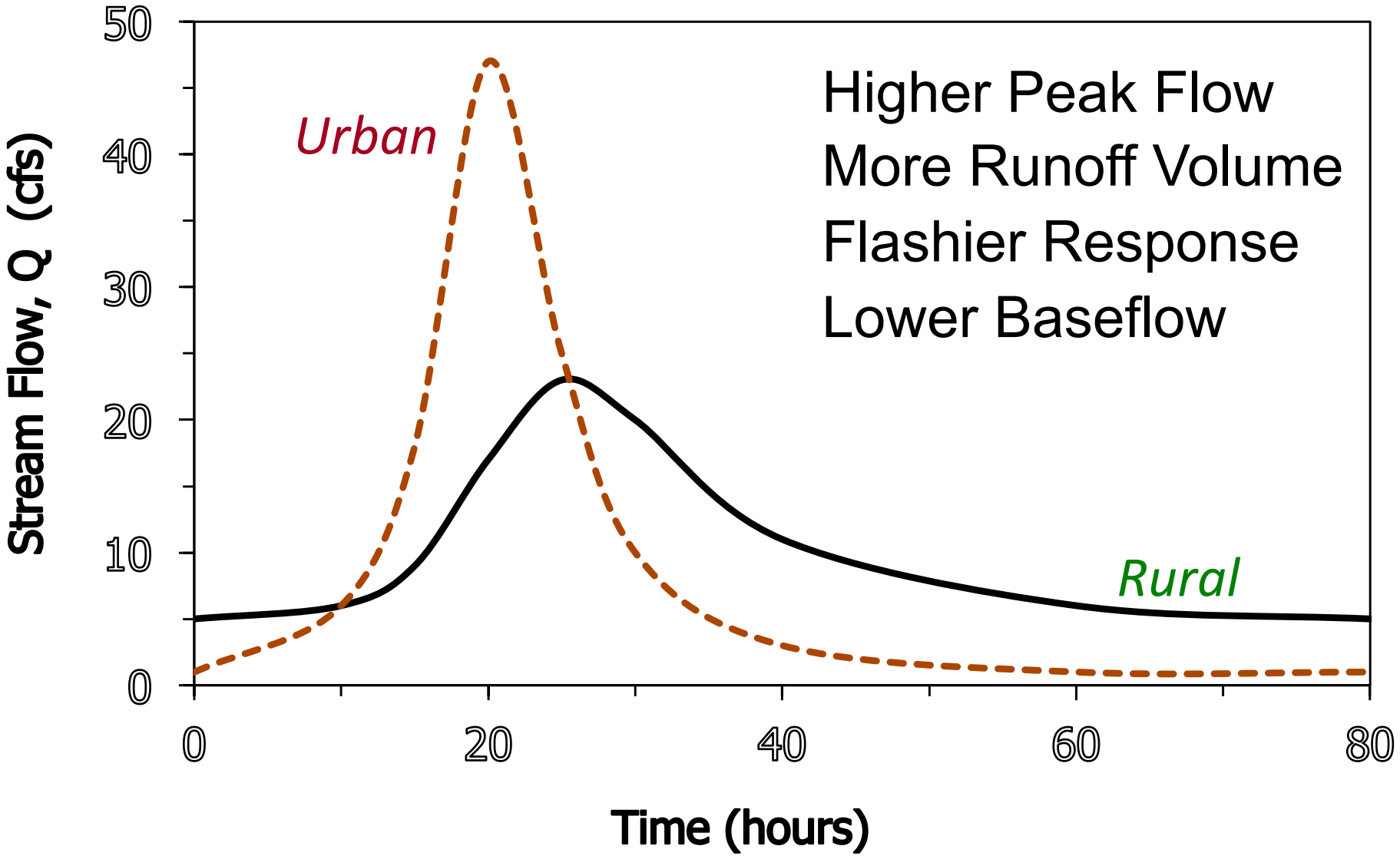
Photo: Dan Ballard

Photo: Dan Ballard


The natural water cycle
Condensation
Evapotranspiration
Evaporation
Lots of infiltration
Runoff
Soil
High groundwater flow
Constantly flowing stream
Bedrock
http://www.sswm.info/category/concept/water-cycle

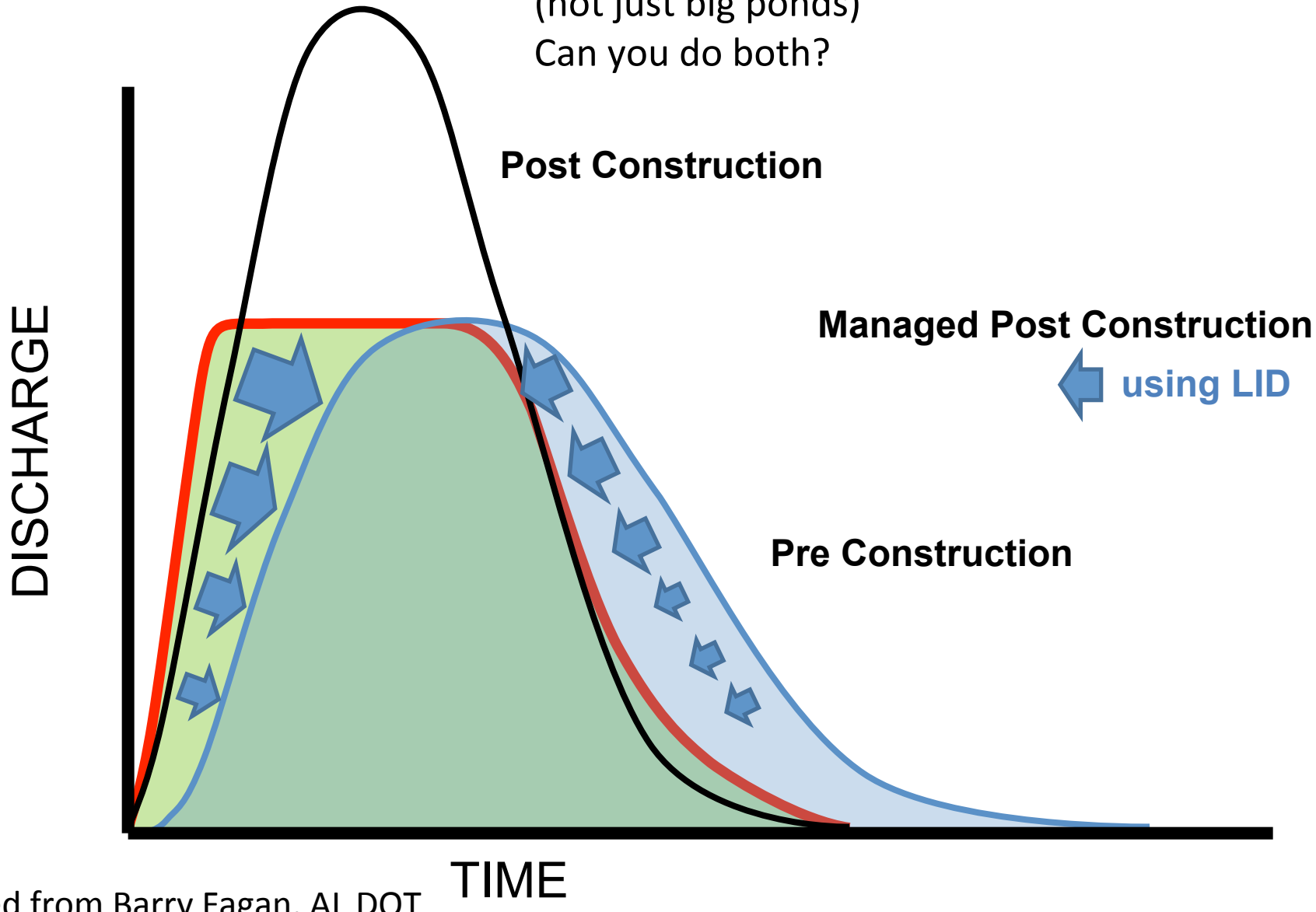

The urban water cycle
Condensation
Evaporation
Much less infiltration
Roofs, roads & paths stop infiltration
More runoff: More
Soil
Low groundwater flow
No rain: streams dry up
Rain: streams flood
Bedrock
University of Central Florida

Hydrograph Changes Due to Urbanization



Courtesy Greg Jennings

Important to control **peak flow**
Need to include **volume control** to reduce stress on downstream systems
(not just big ponds)
Can you do both?



Adapted from Barry Fagan, AL DOT

How do we achieve this?

Planning

Better Site Design (minimize impervious surfaces)

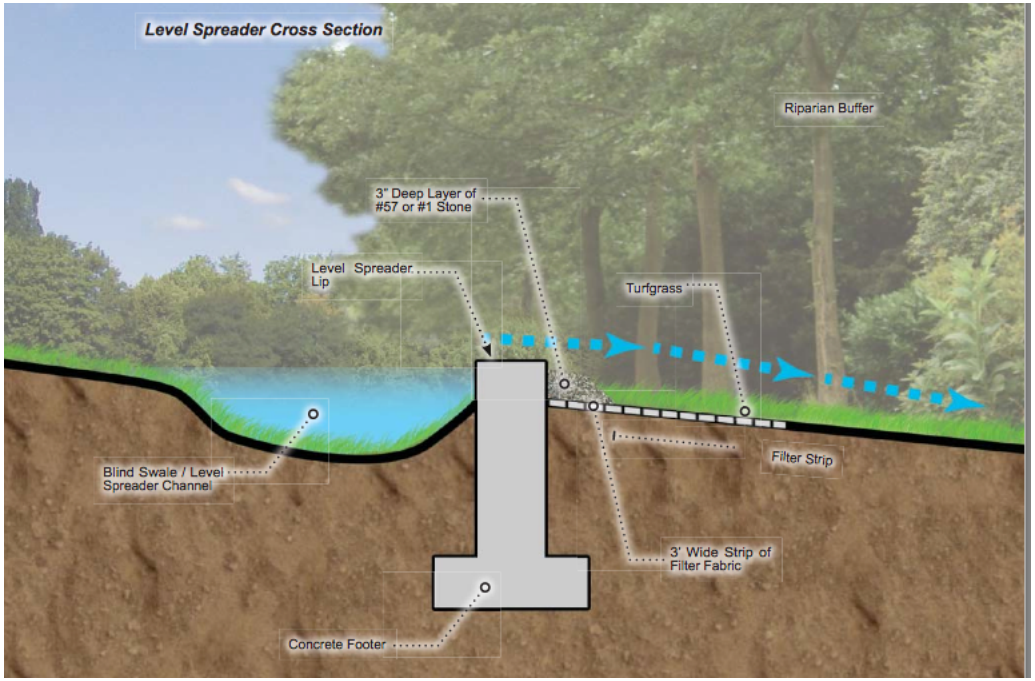
Proper Erosion and Sediment Control

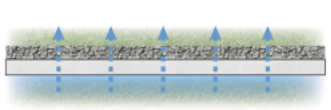
Stormwater Control Measures

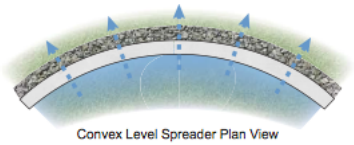
Restoration and Enhancement

Alabama LID Handbook

1. Guidance for stormwater control measure planning, design, construction and maintenance elements.
2. List provided of vegetation suitable for LID measures for different regions of Alabama.




Straight Level Spreader Plan View


Convex Level Spreader Plan View

Alabama LID Handbook

1. Overview
2. Site selection
3. Community Planning
4. Stormwater control measures
5. Retrofits and alternatives
6. Appendices: Stormwater Hydrology; Model Codes and Ordinances; Maintenance; Vegetation

www.aces.edu/lid

Stormwater Control Measures

Bioretention

Constructed stormwater wetlands

Permeable pavement

Grassed Swales, Infiltration Swales, & Wet Swales

Level spreaders and Grassed filter strips

Rainwater Harvesting

Green Roofs

Riparian Buffers

- General characteristics
- Site selection
- Constraints
- Design Guidance
- Design Example
- Construction
- Vegetation
- Vegetation Design
- Maintenance
- Pollutant Removal

Bioretention (BRC)

Bioretention in Railroad Park; Birmingham, AL

Synonyms: Bioretention basin

Site Selection	
Quantity Control	possible
Drainage Area	small-med
Space Required	med
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
Sun / Shade	sun to p.shade

Bioretention cells (BRCs) remove pollutants in stormwater runoff through adsorption, filtration, sedimentation, volatilization, ion exchange, and biological decomposition. A BRC is a depression in the landscape that captures and stores runoff for a short time, while providing habitat for native vegetation that is both flood and drought tolerant. BRCs are stormwater control measures (SCMs) that are similar to the homeowner practice, rain gardens, with the exception that BRCs have an underlying specialized soil media and are designed to meet a desired stormwater quantity treatment storage volume. Peak runoff rates and runoff volumes can be reduced and groundwater can be recharged when bioretention is located in an area with the appropriate soil conditions to provide infiltration. Bioretention is normally designed for the water quality or "first flush" event, typically the first 1"-1.5" of rainfall, to treat stormwater pollutants. In certain situations, BRCs can also provide stream channel protection through minimizing peak discharges.

Site Selection

Quantity Control	possible
Drainage Area	small-med
Space Required	med
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
Sun / Shade	sun to p.shade

www.aces.edu/lid

Table 4.1.1

Site Selection: Constraints & Limitations for Bioretention

Shallow Water Table	Locations where the seasonally high water table is less than 6' from the surface or less than 2' from the bottom of the cell are not suitable
Slope	Locations with 5% or less slope are recommended and flatter locations work best
Utilities	Call Alabama 811 before construction to locate utilities (for more information, visit: www.al1call.com)
Unstable Soils or High Sediment loads	Locations that are not under active construction, changing soil conditions, or will not experience high sediment loads are recommended; clayey soils can clog media
Continuous Flow	Locations that will not experience continuous flow and are allowed to drain are recommended
Regional Stormwater Control	Bioretention is best suited in small drainage areas; if regional stormwater control is necessary, another SCM should be selected

Table 4.1.10
Pollutant Removal Table

Sediment	Nutrients		Metals	Pathogens
	N	P		
a.85%	40%	45%	No Data	No Data
b.80%	50%	60%	MOD	No Data
c.80%	50%	60%	MOD	No Data

a. NCDENR, 2007*
b. City of Auburn, 2011
c. Georgia Manual, 2001

* Research has demonstrated pollutant removal efficiencies of 60% for both N and P in the Coastal Plains.

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

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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

www.aces.edu/lid

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

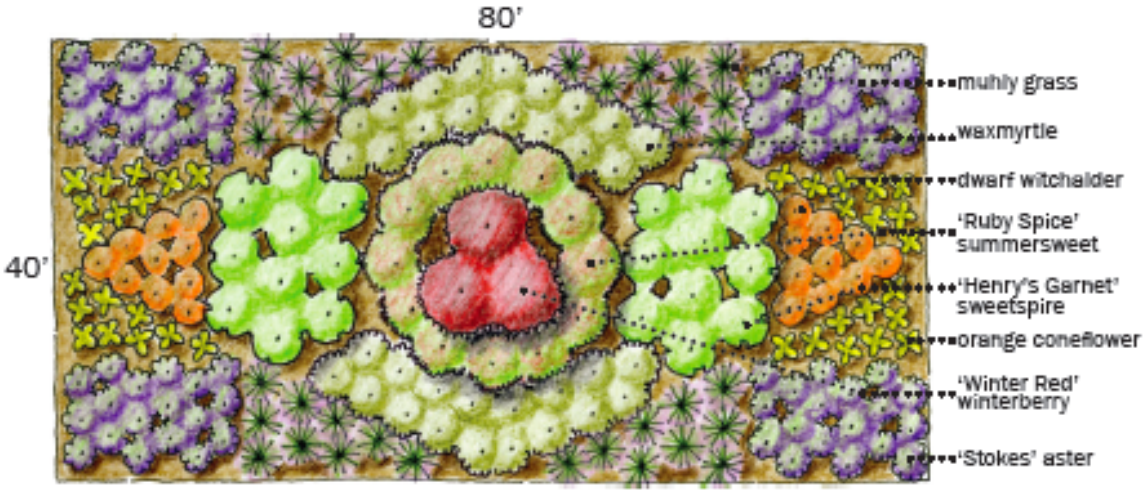
Vernonia novenborace

Viburnum dentatun

Viburnum nudum

Vegetation Design 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.

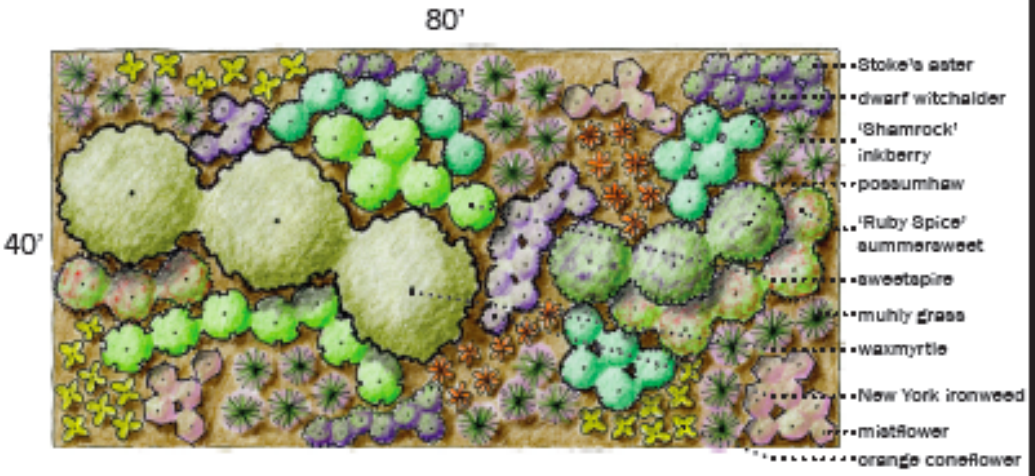


Design 1 Plant List

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

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.

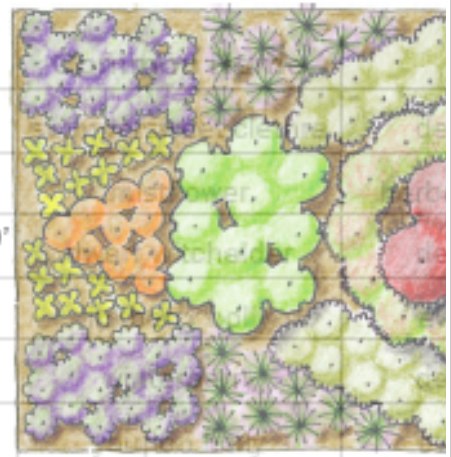


Design 2 Plant List

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

Vegetation Design Example

Recall the Bioretention design example. Th
trees, shrubs, and perennials. It is symmetri
year round seasonal interest.



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This is a suggested pla

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Panicum virgatum
Rudbeckia fulgida
Stokesia laevis
Vernonia gigantea
Vernonia novenboracen
Viburnum dentatum
Viburnum nudum

Table 4.1.9
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. Mulch should be replaced annually if the watershed is high in heavy metals.
Re-planting	When plants die	If plants consistently suffer from mortality consider using 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.
Inspection	After 0.5" or greater rainfall event	Visually inspect all components including any pretreatment, pipes, or IWS where applicable.
Fertilization	At planting	Most BRCs are used in nutrient sensitive watersheds. Fertilizing beyond plant establishment will increase nutrients leaving the BRC.
Unclog Underdrain Pipes	As needed	Ponded surface water should drain away within 12 hours or less (i.e. eliminate standing water conditions). If water remains ponded on the surface of the cell for longer than 12 hours this may indicate that the underdrain pipe or cell media is clogged.
Pruning	Annually	Pruning will help maintain plant shape. See Vegetation in Appendix D for pruning recommendations.
Sediment Removal	As needed	If sediment clogs the media, the top few inches may need to be removed and replaced. Removed sediment should be properly disposed of as it may contain toxic materials such as heavy metals. Contact the ADEM Environmental Services Branch for guidance at 334-271-7700 or 1-800-533-2336.
Trash Removal	As needed	In high traffic areas, frequent trash removal will be necessary.
Mulch removal from outlets	As needed	Mulch may collect in the outlet or overflow during heavy rains.

Retrofits and Alternatives

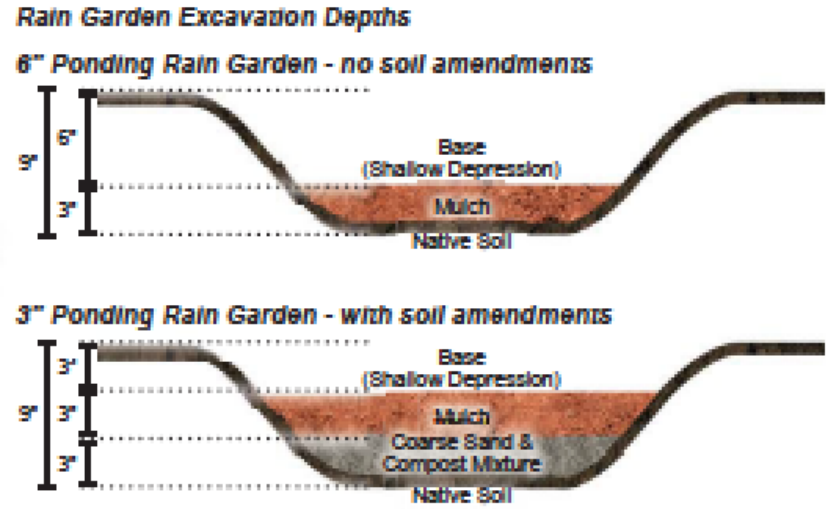
Rain gardens

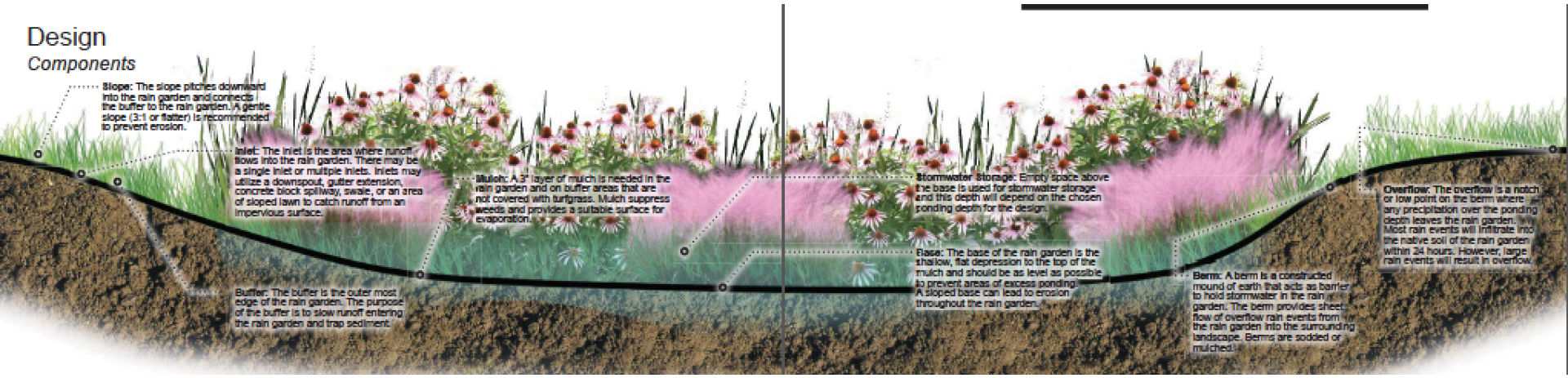
Curb cuts

Rain barrels

Disconnecting downspouts

Rain Gardens



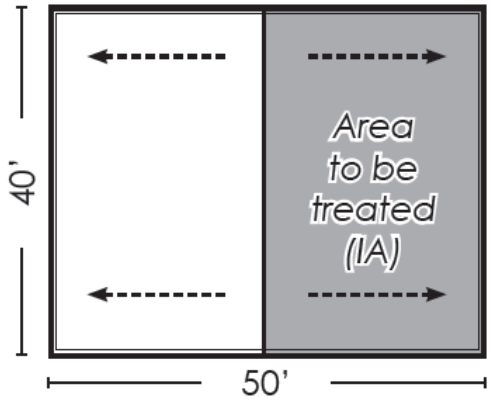


Design Example

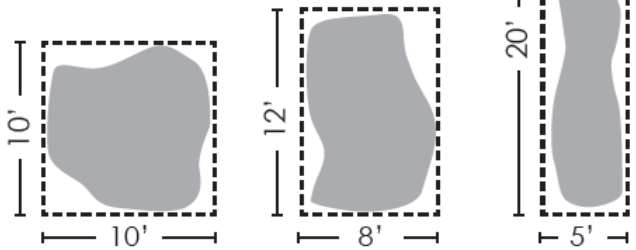
A residential rooftop is 50' by 40', for a total of 2,000ft² of impervious area. It is desired that half of the runoff from the rooftop will be directed to the rain garden. The owner prefers 3" of ponding (sandier soils) and would like to capture the first inch of rainfall.

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



Community Planning

Enabling codes and ordinances

Examples from Alabama, Southeast, & nation

Photos Katie Dylewski

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

Can it work?

Economic Benefits of LID

Lenexa, KS - Savings of tens to hundreds of thousands of dollars in site work and infrastructure costs with the application of LID for different types of developments. In most cases, savings more than offset costs associated with the systems development fees. Analysis helped to gain developer support for standards and fee.

Case Studies Analyzing the Economic Benefits of Low Impact Development and Green Infrastructure Programs – EPA August 2013

http://water.epa.gov/polwaste/green/upload/lid-gi-programs_report_8-6-13_combined.pdf

Economic Benefits of LID

Charlotte-Mecklenberg, NC - Analysis showed stream restoration is the most cost-effective way to immediately control sediment in this area. Prioritization allows the county to implement need-based, rather than opportunity-based, projects. (drinking water reservoir concerns)

http://water.epa.gov/polwaste/green/upload/lid-gi-programs_report_8-6-13_combined.pdf

Economic Benefits of LID

Alachua County, FL - Proximity to open space adds to parcel value, for an increase in property tax revenue of several million dollars per year compared to not having the added open space parcels.

http://water.epa.gov/polwaste/green/upload/lid-gi-programs_report_8-6-13_combined.pdf

What does success look like?

Photo: Dan Ballard