Green Infrastructure and Rain Gardens

RUTGERS
New Jersey Agricultural Experiment Station

Sea Grant
NJ Sea Grant Consortium

The Geraldine R. DODGE FOUNDATION
IMAGINE A BETTER NEW JERSEY

JERSEY WATER WORKS
Smart infrastructure. Strong communities.

WILLIAM PENN FOUNDATION

Welcome and Introduction

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Rutgers Cooperative Extension

Rutgers Cooperative Extension (RCE) helps the diverse population of New Jersey adapt to a rapidly changing society and improves their lives through an educational process that uses science-based knowledge.

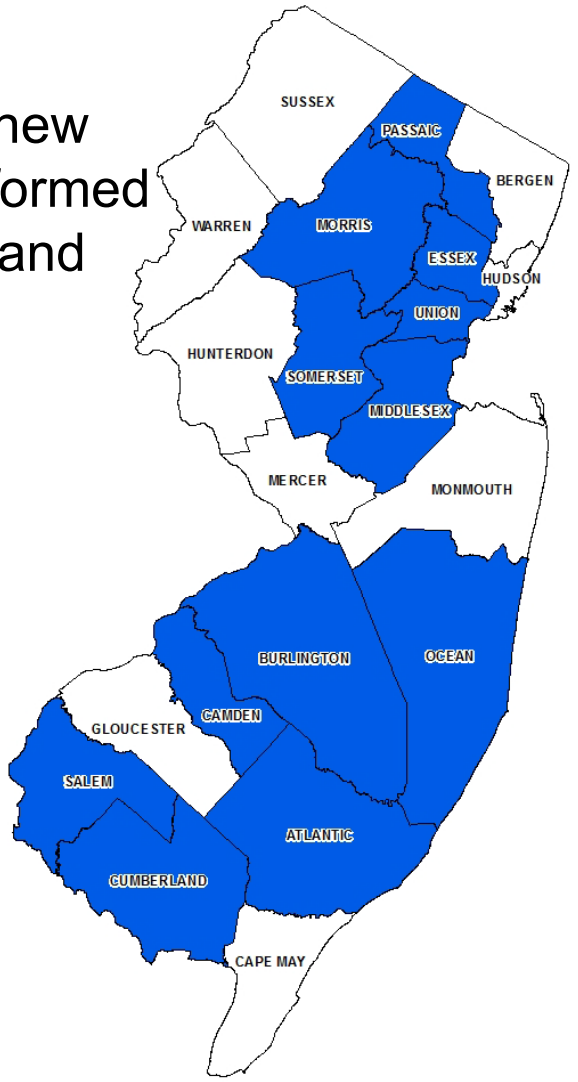
Water Resources Program

www.water.rutgers.edu

Our mission is to identify and address water resources issues by engaging and empowering communities to employ practical science-based solutions to help create a more equitable and sustainable New Jersey.

Environmental County Agents

The Environmental County Agents teach people new skills and information so they can make better informed decisions and improvements to their businesses and personal lives.



- Michele Bakacs, Middlesex and Union
- Pat Rector, Morris and Somerset, **RETIRED**
- Amy Rowe, Essex and Passaic
- Mike Haberland, Camden and Burlington
- Sal Mangiafico, Salem and Cumberland
- Steve Yergeau, Ocean and Atlantic

New Jersey

- Most densely populated state
- 21 Counties, 565 municipalities
- 95% of our waterways are impaired
- Harmful Algal Blooms (HABS) in many of our lakes
- Hammered by Ida, Henri, Sandy, and a bunch of Nor'easters
- Climate change is real – more severe storms and sea level rise

Water Quality Impairments in NJ

- In 2002, 95% of NJ's waterways were impaired
- Lots of new laws were passed:
  - 2004 New Stormwater Management Regulations
  - 2004 Municipal Separate Storm Sewer System (MS4) Permits issued
  - 2011 New Jersey Fertilizer Law
  - 2021 Updated Stormwater Management Regulations
- In 2022, 95% of NJ's waterways are impaired
- Population increased by 724,000
- Urban Land Uses increased by 57,203 acres

Insight to current problem

- Stringent stormwater regulations on new development has not improved water quality
- We must retrofit existing older development with stormwater management to reduce impairments to our waterways
- Green infrastructure is a great tool to retrofit existing older development
- Local champions are needed to advocate for green infrastructure retrofits
- We need to create these champions where they don't already exist

Green Infrastructure Champion

Green Infrastructure Champions are key players in implementing green infrastructure as a stormwater management approach in their community.

Rutgers inputs to the Green Infrastructure Champion Program

- Training classes on various aspects of green infrastructure planning and implementation
- Professional staff to provide technical support to develop a design for a green infrastructure demonstration project
- Networking opportunities with other Green Infrastructure Champions for mutual support
- Assistance with grant writing and submission

Short-term results/impacts
Green Infrastructure Champions will:

- Increase their knowledge and awareness about green infrastructure practices, planning, and implementation
- Gain a skill set to allow them to engage community leaders, schools, and non-governmental organizations (NGOs) and advocate for green infrastructure as a stormwater management solution
- Identify funding opportunities and secure funding for green infrastructure

Long-term results/impacts

- Green infrastructure practices are installed throughout the community
- Green infrastructure becomes a standard in the community for addressing stormwater problems
- Localized flooding is reduced
- Water quality improves
- Community become more resilient to extreme weather events

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Water Resources Program

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News

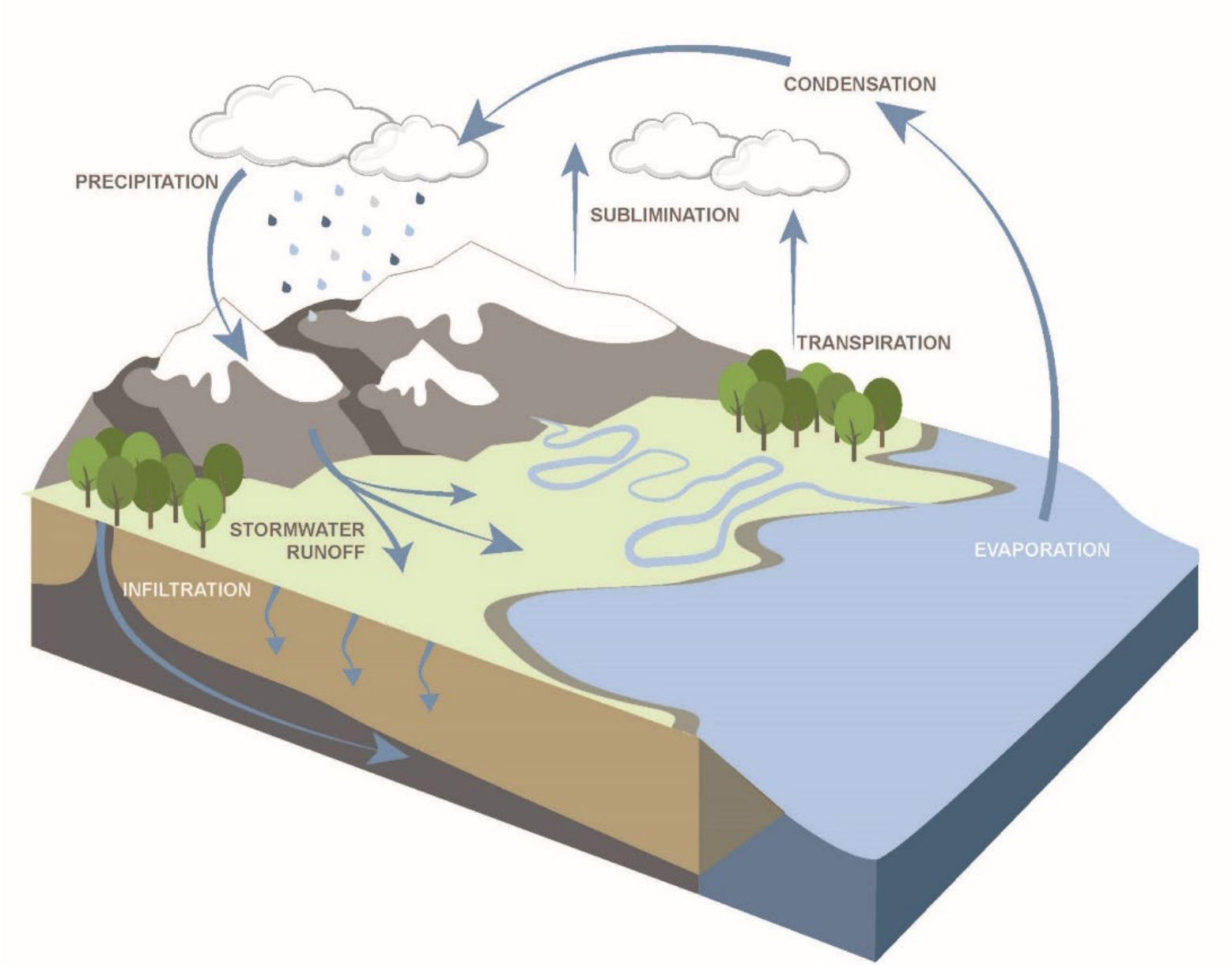
- In the News - March 14, 2023
- SEBS/NJAES Newsroom
- Registration for the 2023 Green Infrastructure Champions Training Program is OPEN!
  - CLICK HERE TO REGISTER!
  - ***Registration for the 2023 program will close by 10AM, Friday, March 24, 2023****
- NIWR is sponsoring travel awards for students to attend the UCOWR conference from June 13-15,

Stormwater Basics / Stormwater Management

What is stormwater?

Stormwater is the water from rain or melting snows that can become “runoff,” flowing over the ground surface and returning to lakes and streams.

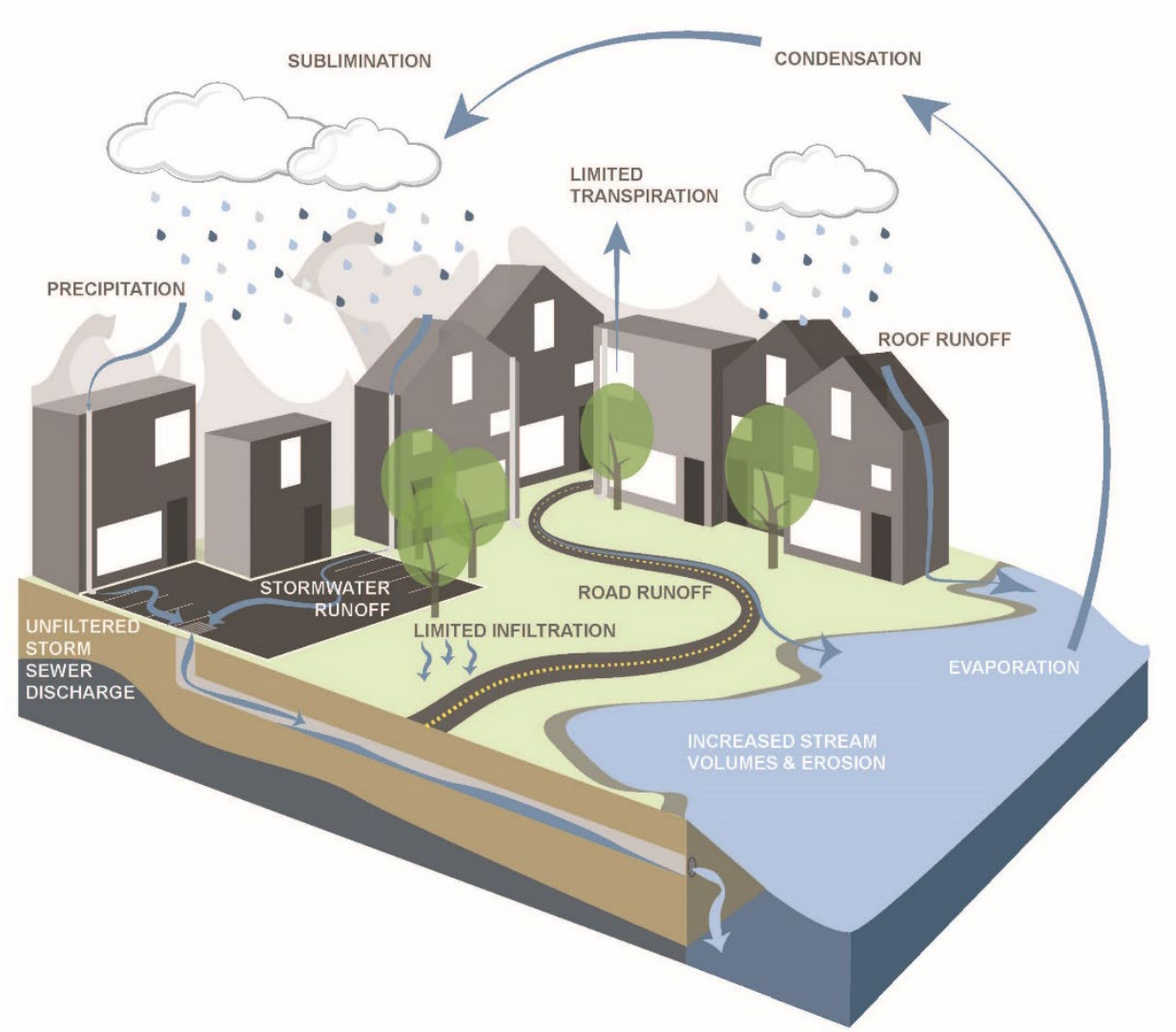
The Natural Hydrologic Cycle



The Impact of Development on Stormwater Runoff

More development → *More impervious surfaces* → *More stormwater runoff*

The Urban Hydrologic Cycle



Examples of Nonpoint Source Pollution

- Oil and grease from cars
- Fertilizers
- Animal waste
- Grass clippings
- Septic systems
- Sewage leaks
- Household cleaning products
- Litter
- Agriculture
- Sediment

History of Stormwater Management

1st Attempt at Stormwater Management

Capture all runoff, pipe it, and send it directly to the river . . .prior to mid 1970's

2nd Iteration of Stormwater Management

Capture runoff, detain it, release it slowly to the river…mid 1970's to 2004

- Detain peak flow during large storm events for 18 hours (residential) or 36 hours (commercial)
- Reduce downstream flooding during major storms
- Use concrete low flow channels to minimize erosion, reduce standing water, quickly discharge low flows
- Does not manage runoff from smaller storms allowing stormwater to pass through the system
- Directly discharges stormwater runoff to nearby stream, waterway, or municipal storm sewer system (at a controlled/managed rate)

3rd Generation of Stormwater Management

- Reduce stormwater runoff volume
- Reduce peak flows and flooding

…and….

- Maintain infiltration and groundwater recharge
- Reduce pollution discharged to local waterways

ABC Action News, August 27, 2012

4th Generation of Stormwater Management (Started March 2, 2021)

- All major development must use green infrastructure to comply with the New Jersey Stormwater Regulations

Green Infrastructure

…an approach to stormwater management that is cost-effective, sustainable, and environmentally friendly.

Green Infrastructure projects:

- capture,
- filter,
- absorb, and
- reuse

stormwater to maintain or mimic natural systems and treat runoff as a resource.

Green Infrastructure

Stormwater management practices that protect, restore, and mimic the native hydrologic condition by providing the following functions:

- Infiltration
- Filtration
- Storage
- Evaporation
- Transpiration

Green Infrastructure Practices

Bioretention Systems

- Rain Gardens
- Bioswales
- Stormwater Planters
- Curb Extensions
- Tree Filter Boxes

Permeable Pavements

Rainwater Harvesting

- Rain Barrels
- Cisterns

Dry Wells

Rooftop Systems

- Green Roofs
- Blue Roofs









Parker Urban Greenscapes. 2009.

TYPES OF BIORETENTION

Bioretention Cells

- Single-family lots
- Commercial areas
- Parking lots

Planters & Planter Boxes

- Highly urban areas
- Right-of-way and adjacent to buildings

Rain Gardens

- Single-family lots
- Small commercial areas

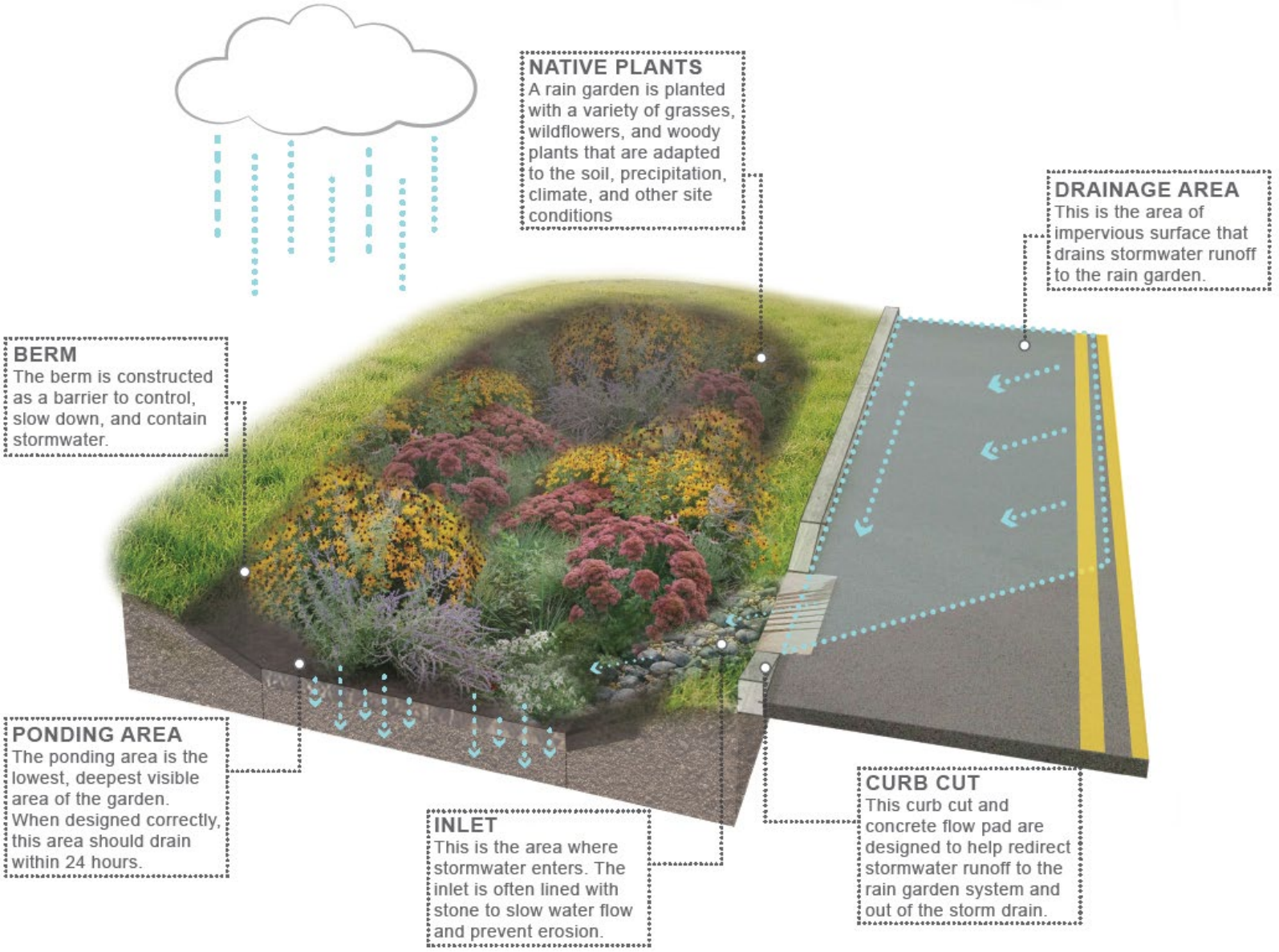
Bioretention Swales/ Bioswales/Vegetated Swales

- Typically in right-of-way

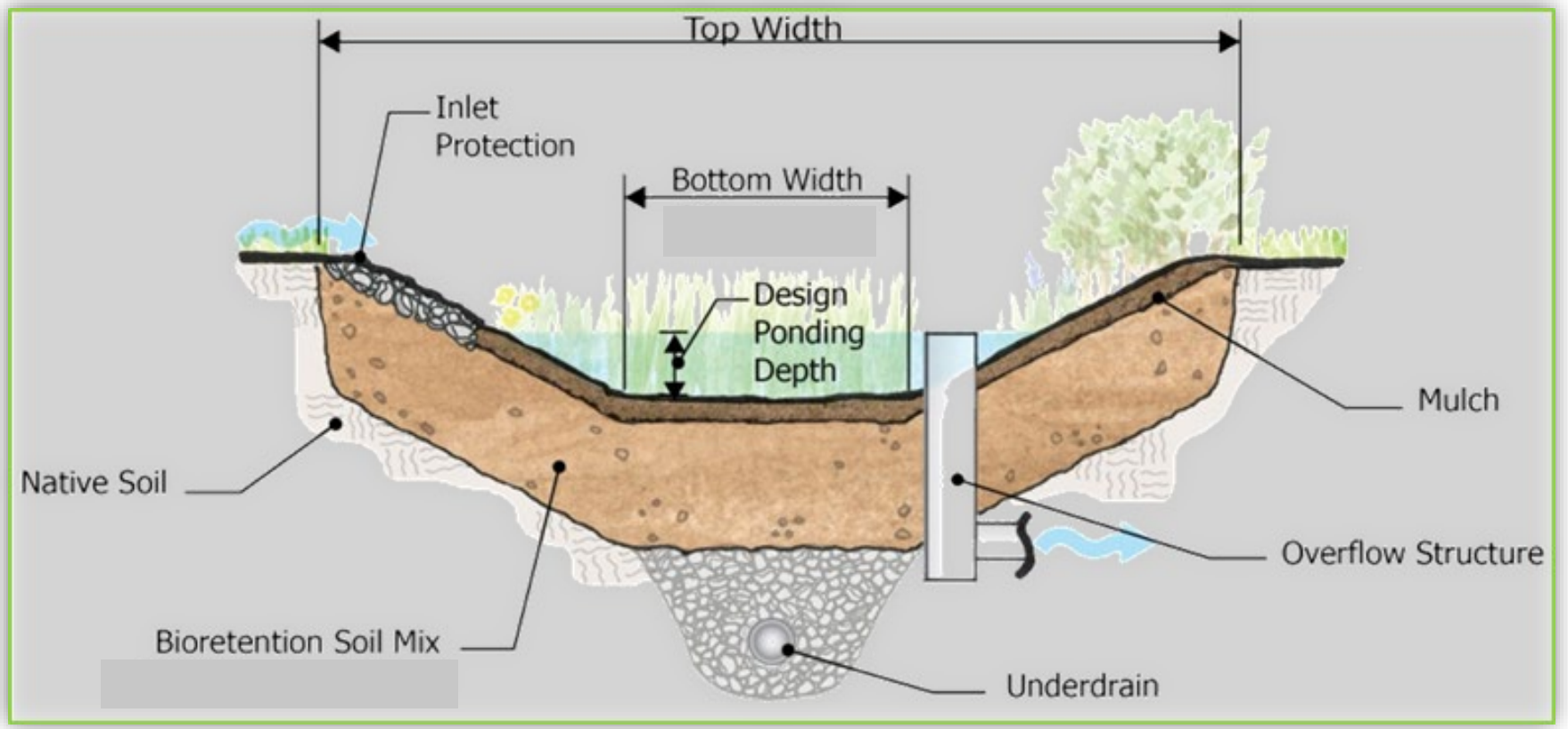
Vegetated Curb Extensions

- Bioretention incorporated into right-of-way in urban and suburban areas

Rain Gardens



Rain Garden Cross-Section

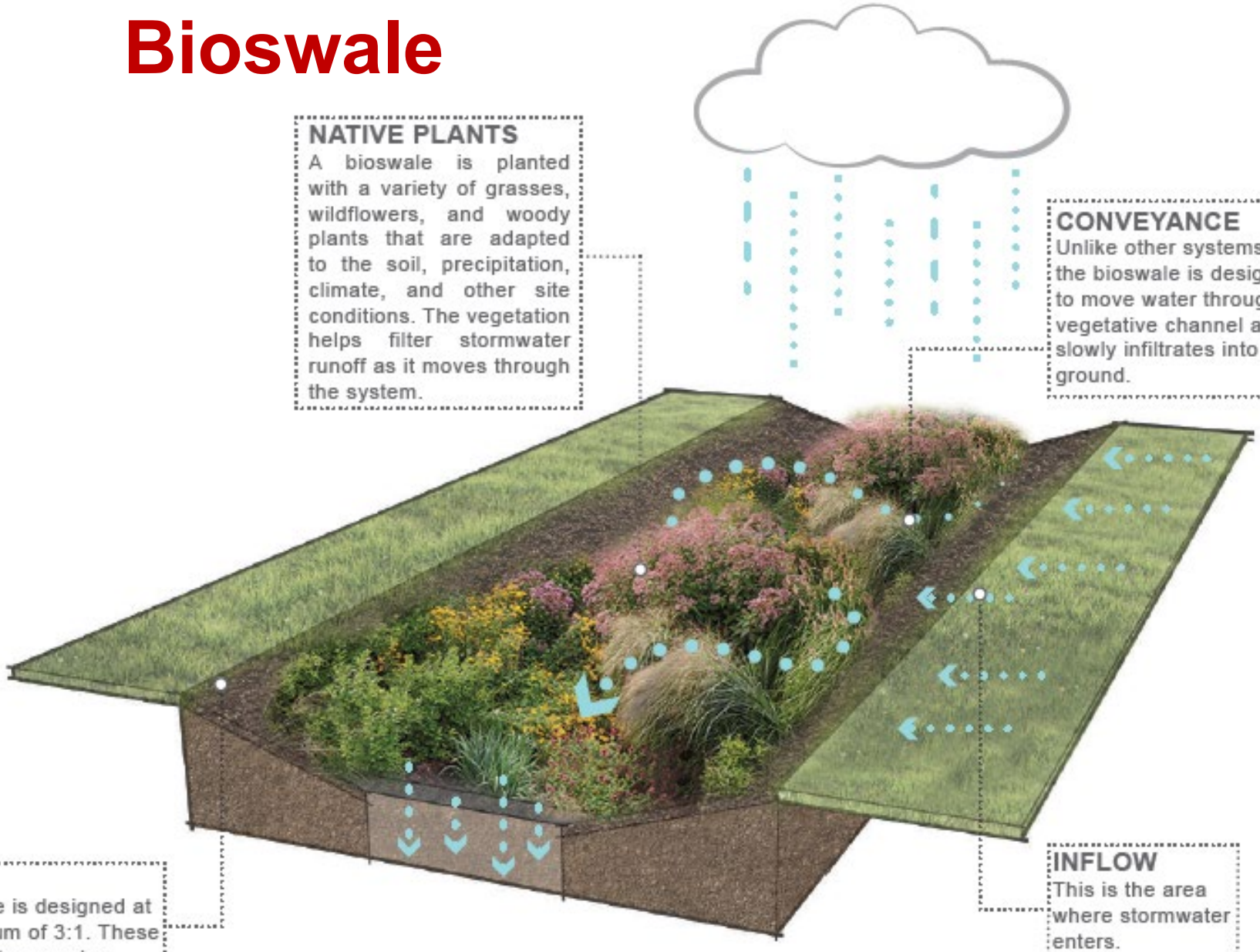



8.2.2004

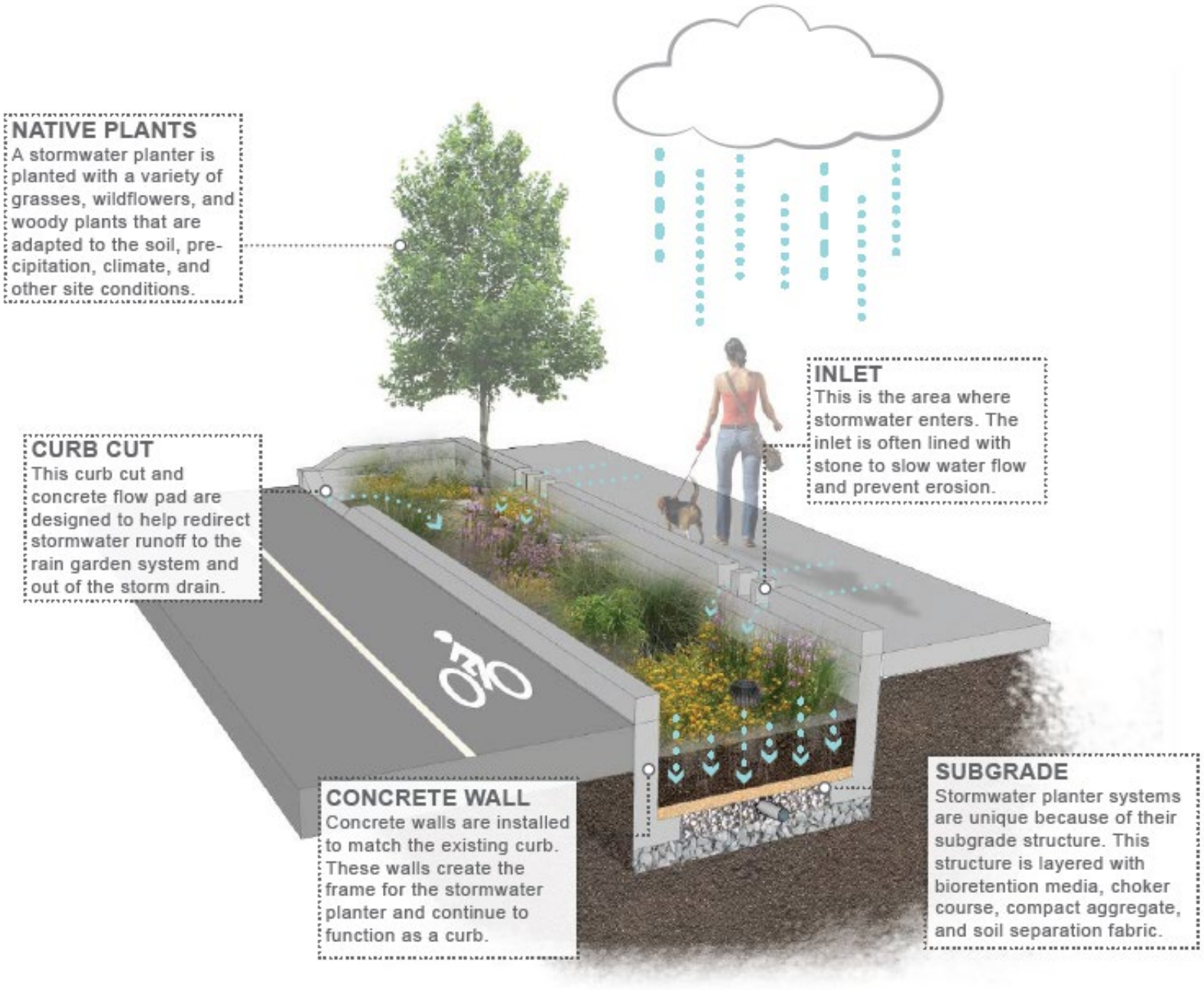
Lots of Rain Gardens


116

Bioswale


NATIVE PLANTS
A bioswale is planted with a variety of grasses, wildflowers, and woody plants that are adapted to the soil, precipitation, climate, and other site conditions. The vegetation helps filter stormwater runoff as it moves through the system.
CONVEYANCE
Unlike other systems, the bioswale is designed to move water through a vegetative channel as it slowly infiltrates into the ground.
SLOPE
The slope is designed at a maximum of 3:1. These slopes often require erosion control materials for stabilization.
INFLOW
This is the area where stormwater enters.

Stormwater Planters



OTES:

3 AND OTHER
CTIONS (E.G. SCUPPER,
RUNNEL) FROM BUILDING
GN PONDING ELEVATION.
E SAN FRANCISCO DBI
NCE CONNECTION

F EXISTING SUBGRADE
INFILTRATION FACILITIES.

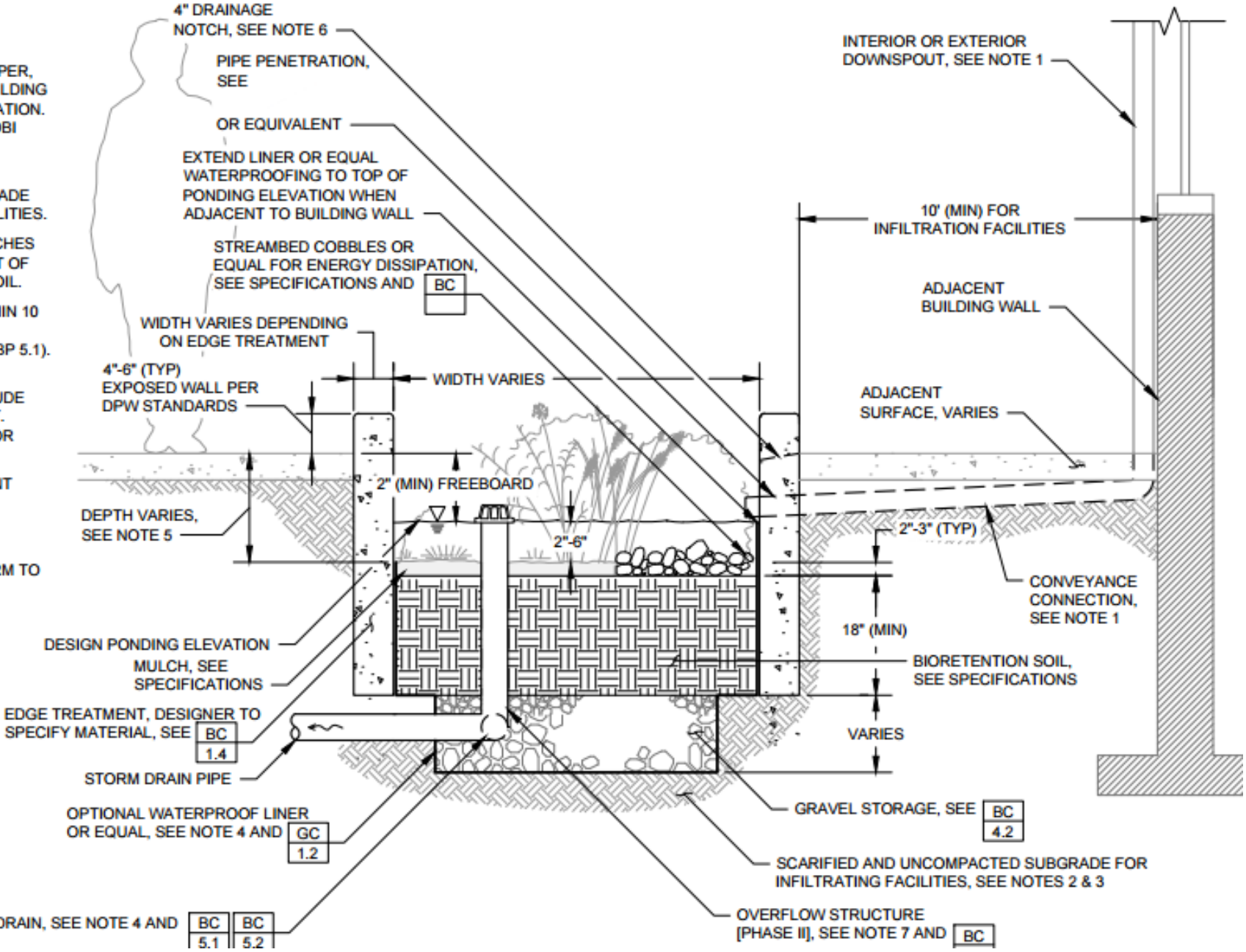
O A DEPTH OF 6 INCHES
IOR TO PLACEMENT OF
O BIORETENTION SOIL.

ER REQUIRED WITHIN 10
/ELOPE UNLESS
INER NOTE 8 (SEE BP 5.1).

TOP OF WALKING
MULCH SHALL INCLUDE
SOIL SETTLEMENT.
ISCO DBI CODES FOR
REQUIREMENTS.

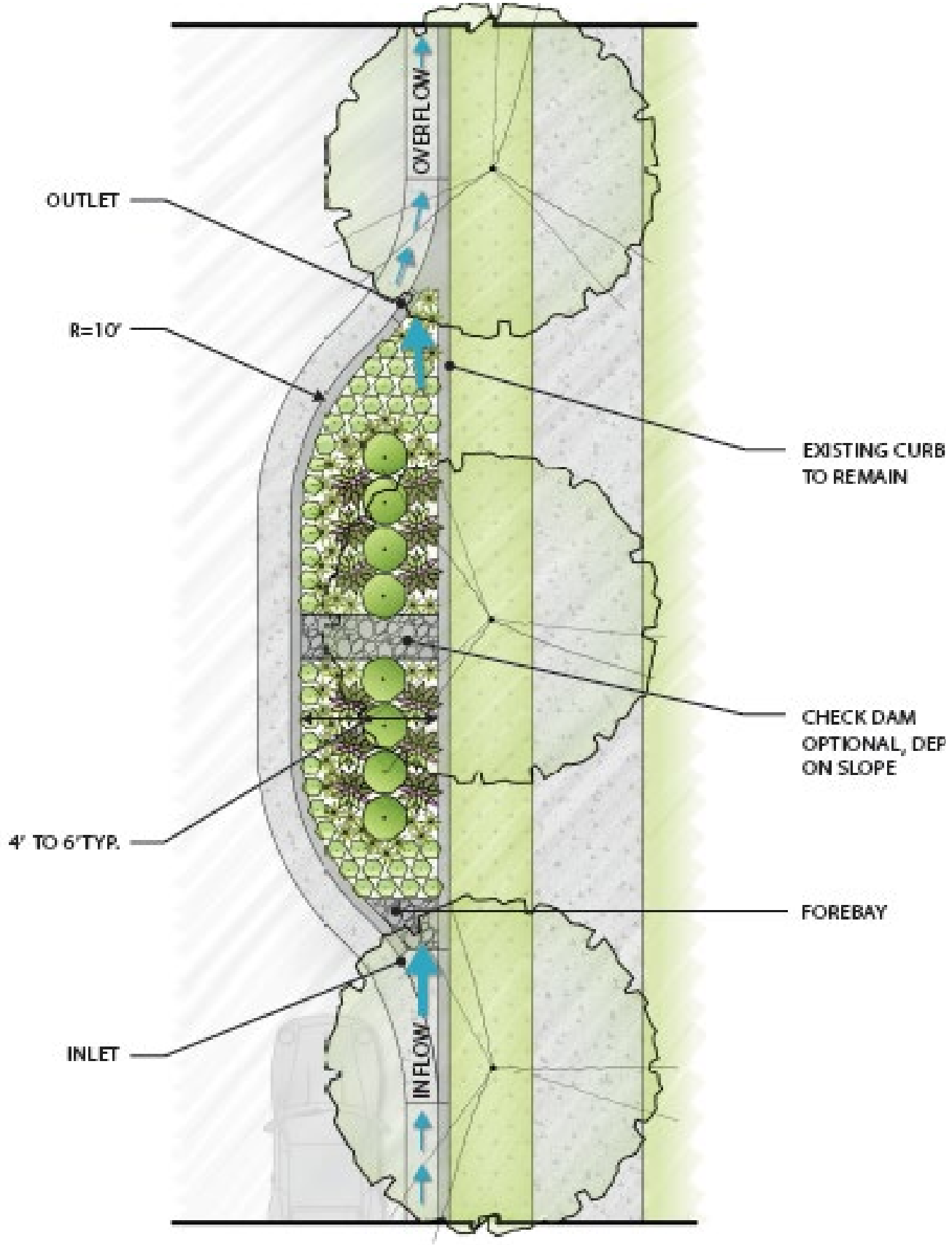
OTCHES TO PREVENT
NTER WALL. SLOPE
O PLANTER.

ORKMANSHIP FOR
RES SHALL CONFORM TO
NCISCO DBI CODES.

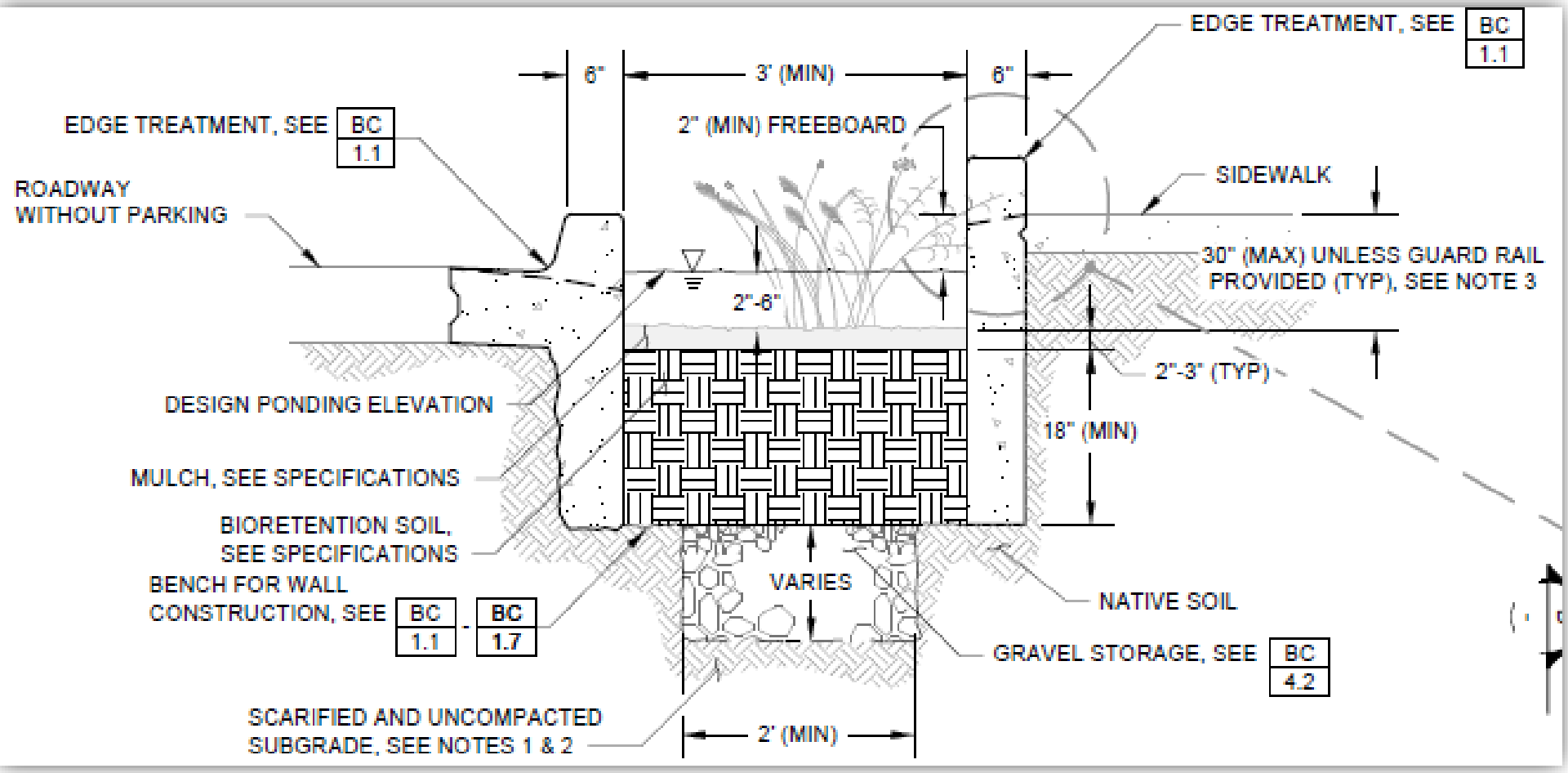


Stormwater Planter Cross-section

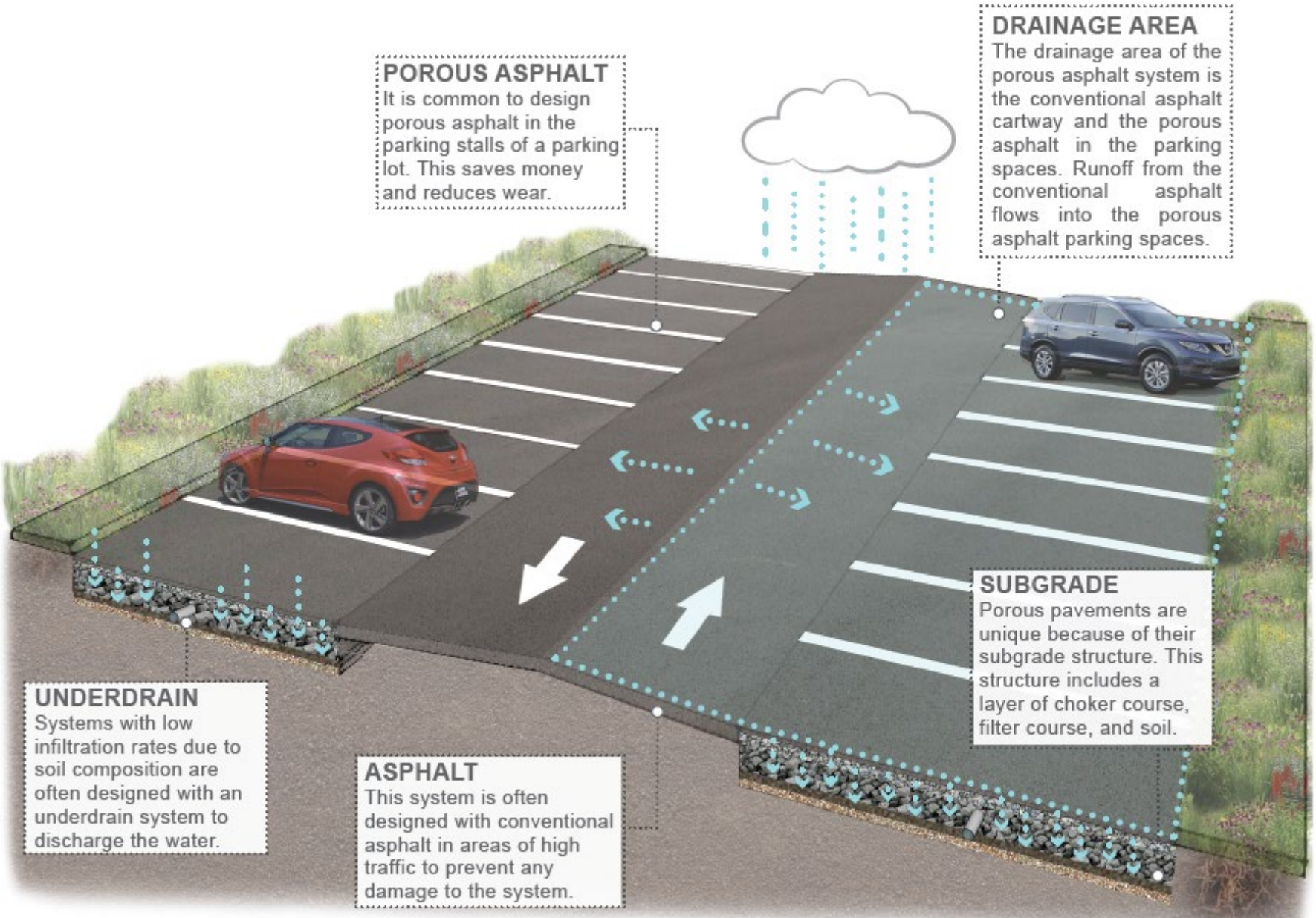
Curb Extensions



NOTE:
Graphic adapted fi
Portland, OR Storm
Manual Details

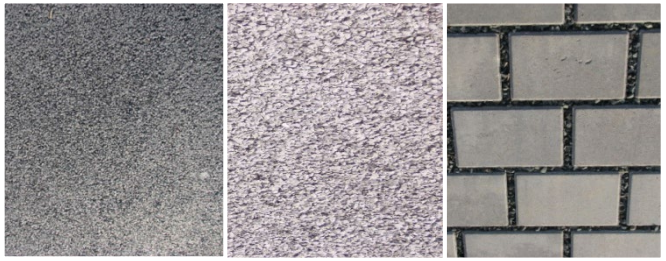

6"
3' (MIN)
6"
EDGE TREATMENT, SEE BC 1.1
EDGE TREATMENT, SEE BC 1.1
2" (MIN) FREEBOARD
ROADWAY WITHOUT PARKING
SIDEWALK
30" (MAX) UNLESS GUARD RAIL PROVIDED (TYP), SEE NOTE 3
2"-6"
2"-3" (TYP)
DESIGN PONDING ELEVATION
18" (MIN)
MULCH, SEE SPECIFICATIONS
BIORETENTION SOIL, SEE SPECIFICATIONS
BENCH FOR WALL CONSTRUCTION, SEE BC 1.1 - BC 1.7
VARIES
NATIVE SOIL
GRAVEL STORAGE, SEE BC 4.2
SCARIFIED AND UNCOMPACTED SUBGRADE, SEE NOTES 1 & 2
2' (MIN)

Permeable Pavement



Permeable Pavements

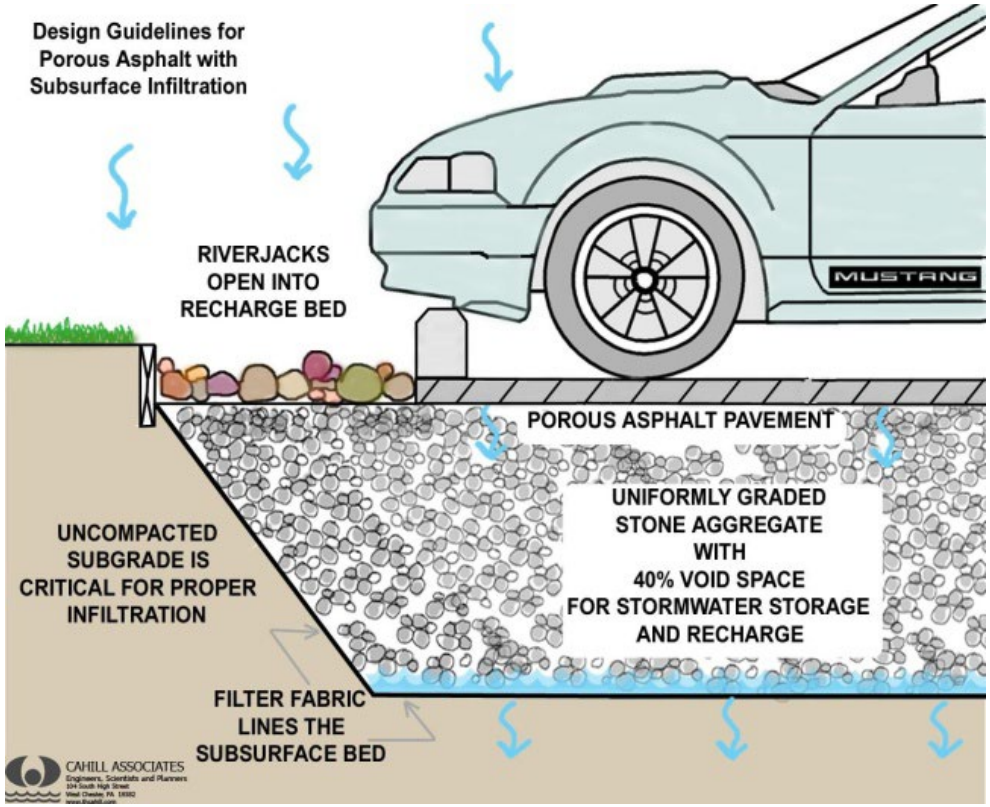
- Underlying stone reservoir
- Porous asphalt and pervious concrete are manufactured without "fine" materials to allow infiltration
- Grass pavers are concrete interlocking blocks with open areas to allow grass to grow
- Permeable paver systems are concrete pavers with infiltration between the spaces of the pavers
- Ideal application for porous pavement is to treat a low traffic or overflow parking area



ADVANTAGES

- Manage stormwater runoff
- Minimize site disturbance
- Promote groundwater recharge
- Low life cycle costs, alternative to costly traditional stormwater management methods
- Mitigation of urban heat island effect
- Contaminant removal as water moves through layers of system

COMPONENTS



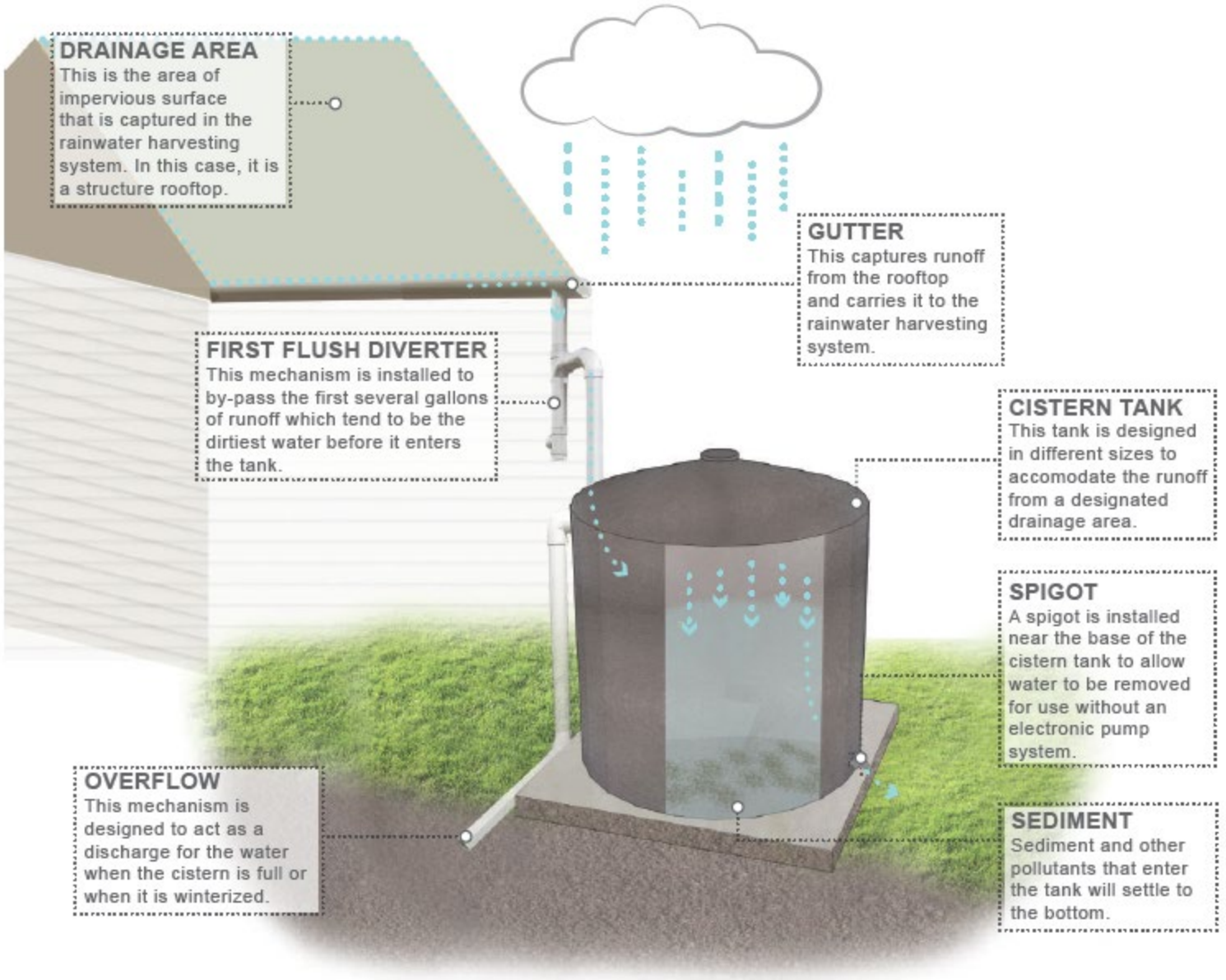
Porous Asphalt


Pervious Concrete


Permeable Pavers

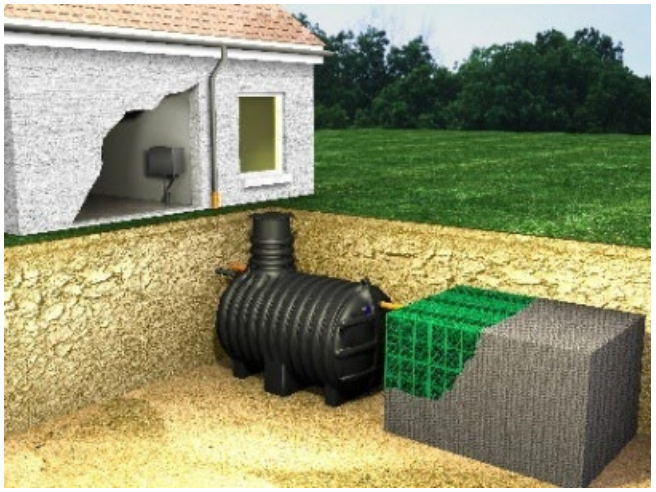

Grass Pavers

Rainwater Harvesting Systems

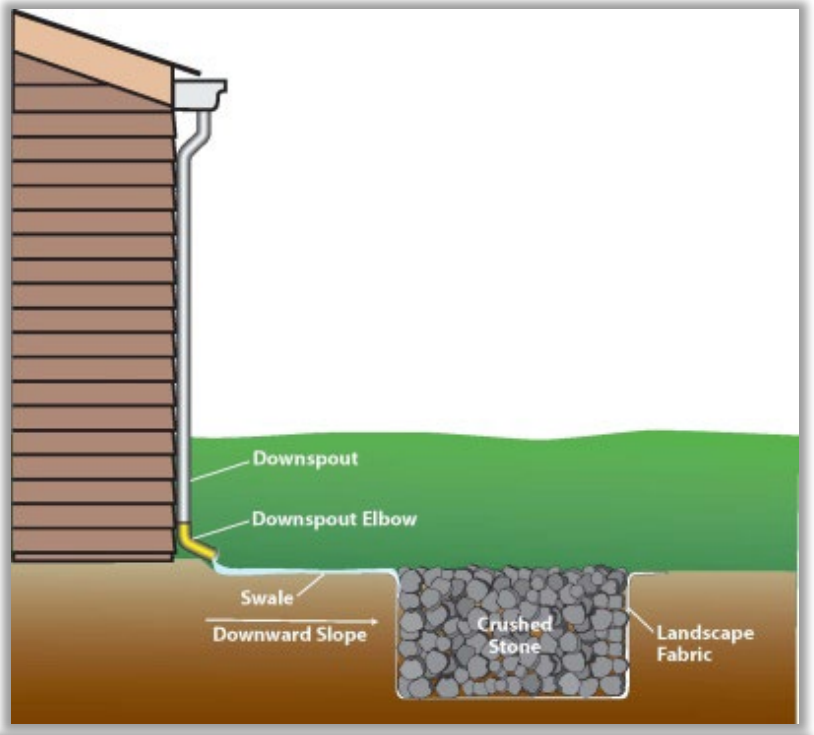


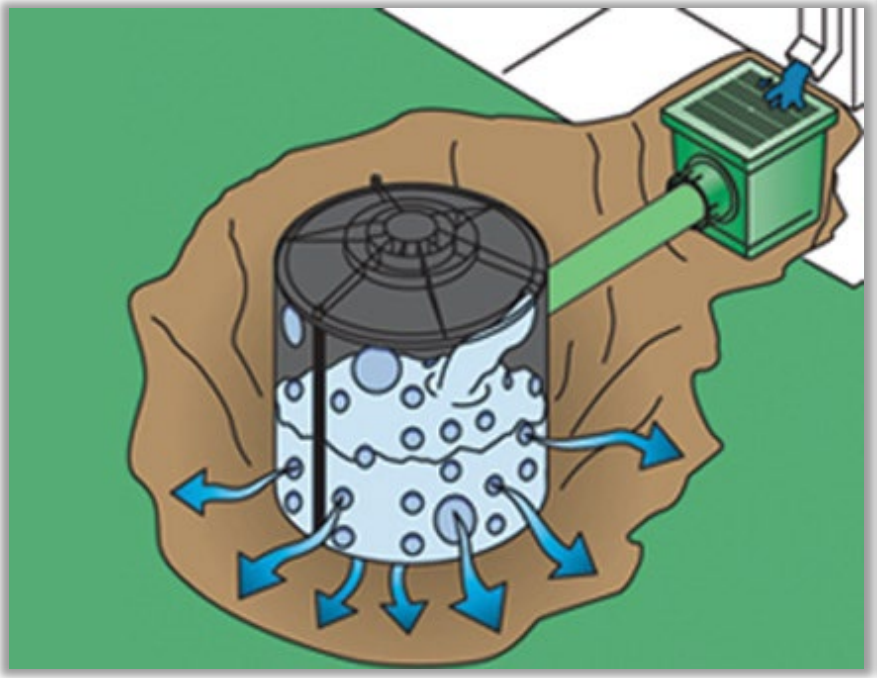
Rain Barrels

Cisterns

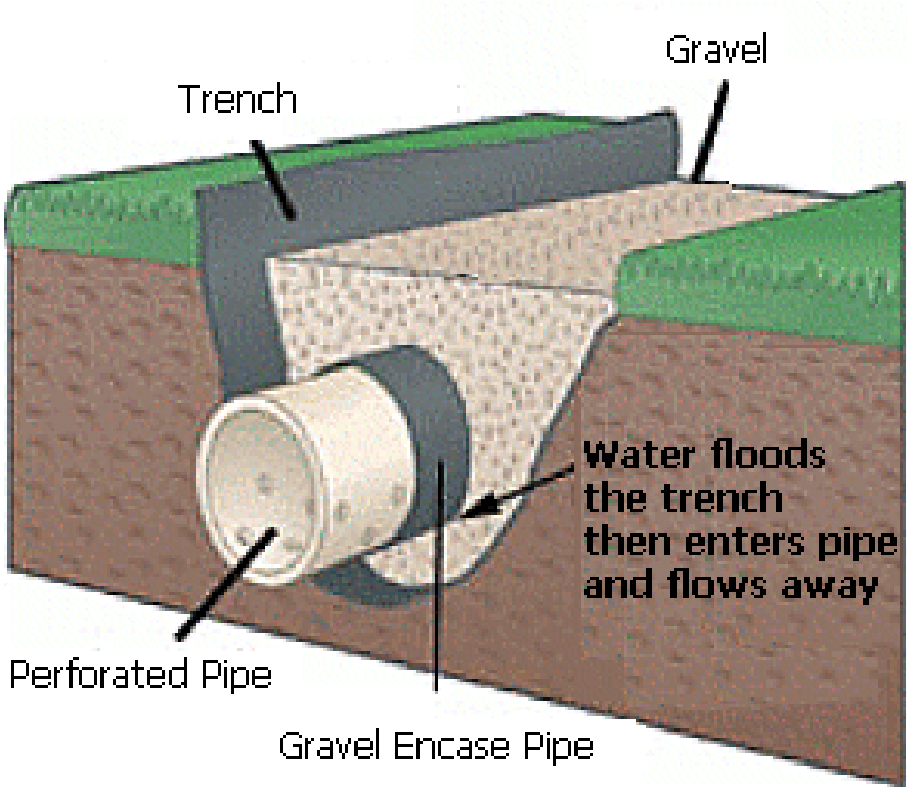


Dry Wells


Downspout
Downspout Elbow
Swale
Downward Slope
Crushed Stone
Landscape Fabric

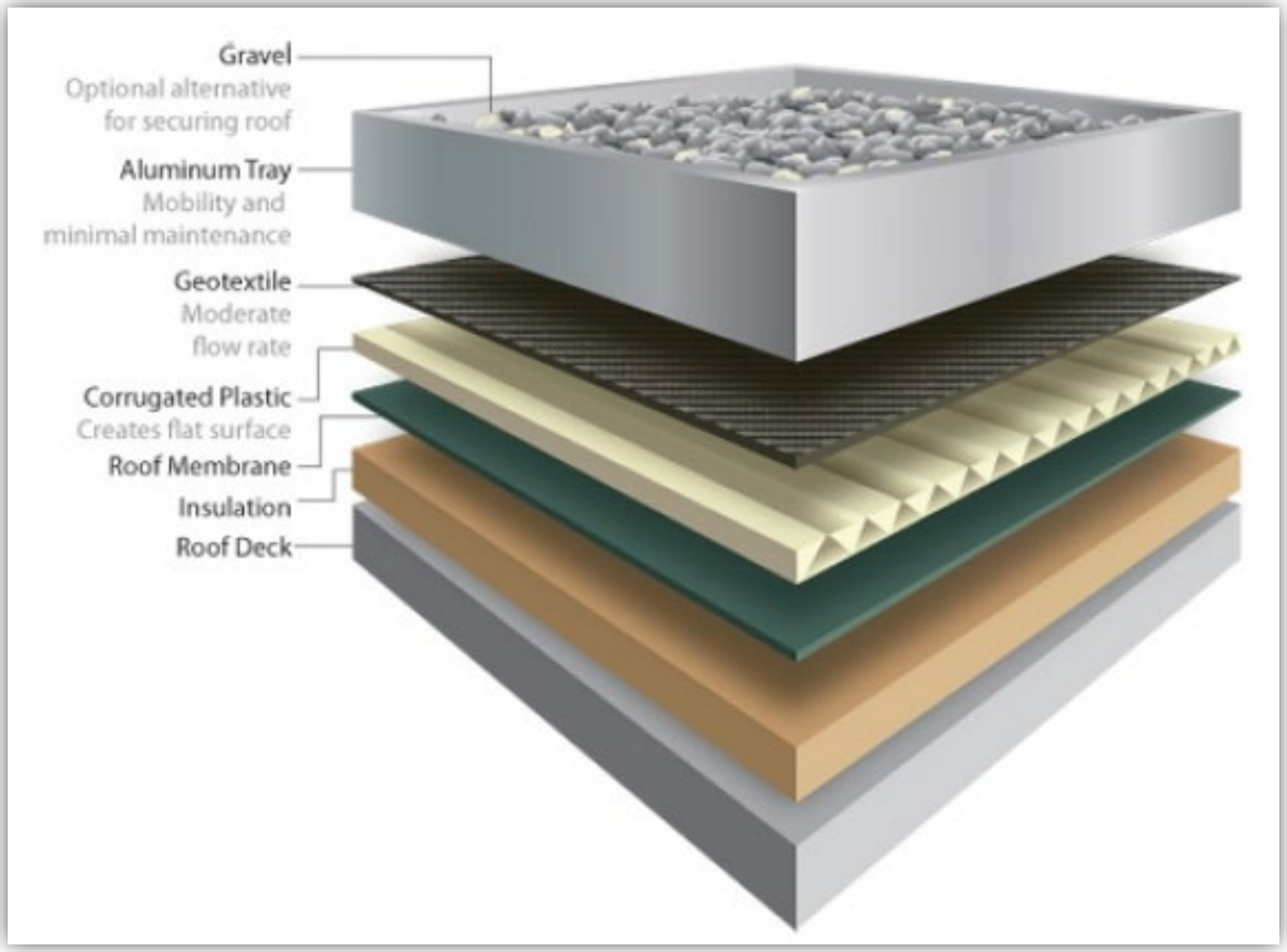


Infiltration Trench



Rooftop Practices – Green Roof

Rooftop Practices – Blue Roof




Stormwater Wetlands

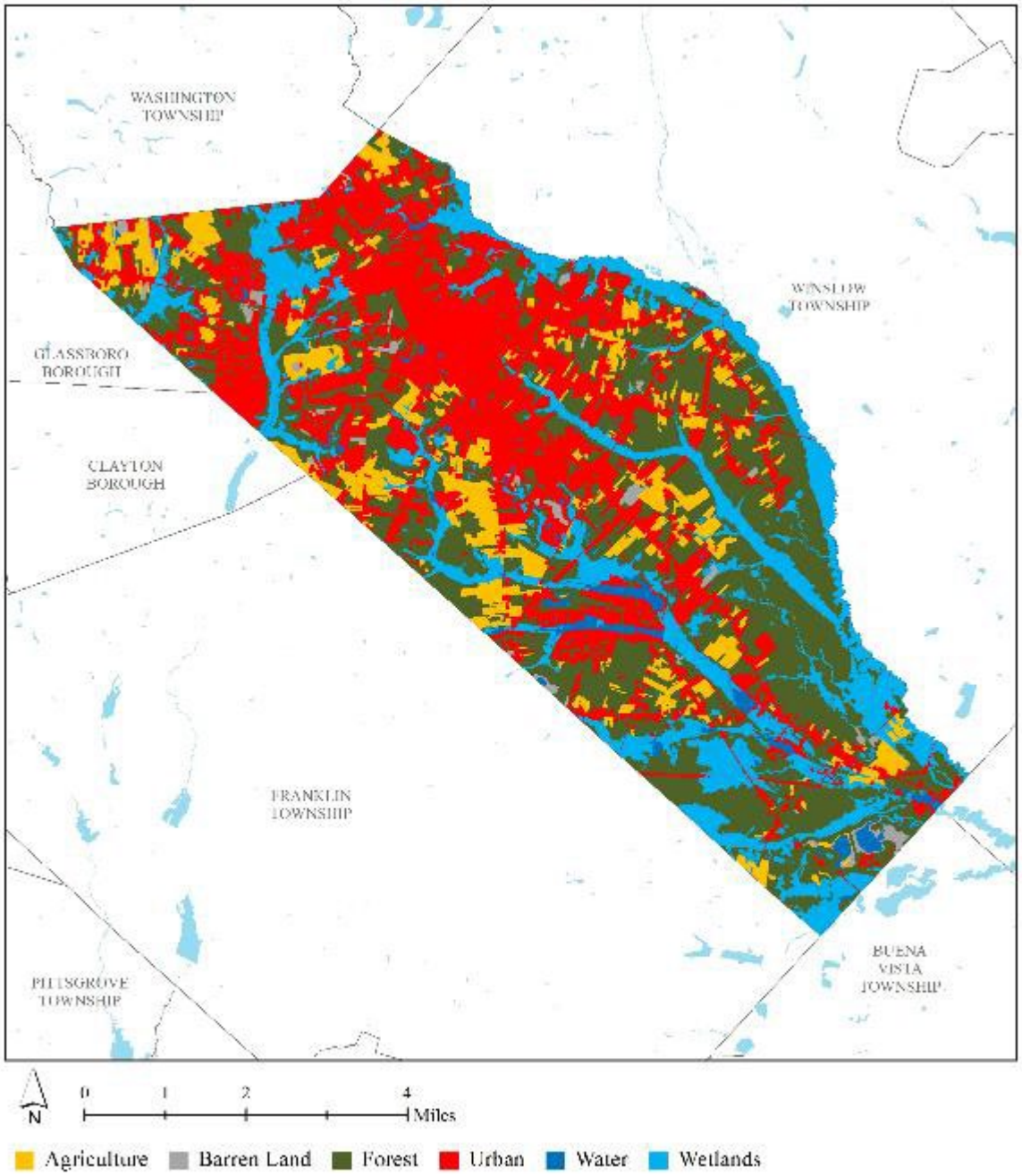
Impervious Cover Assessment (ICA), Impervious Cover Reduction Action Plan (RAP), and Green Infrastructure Feasibility Study

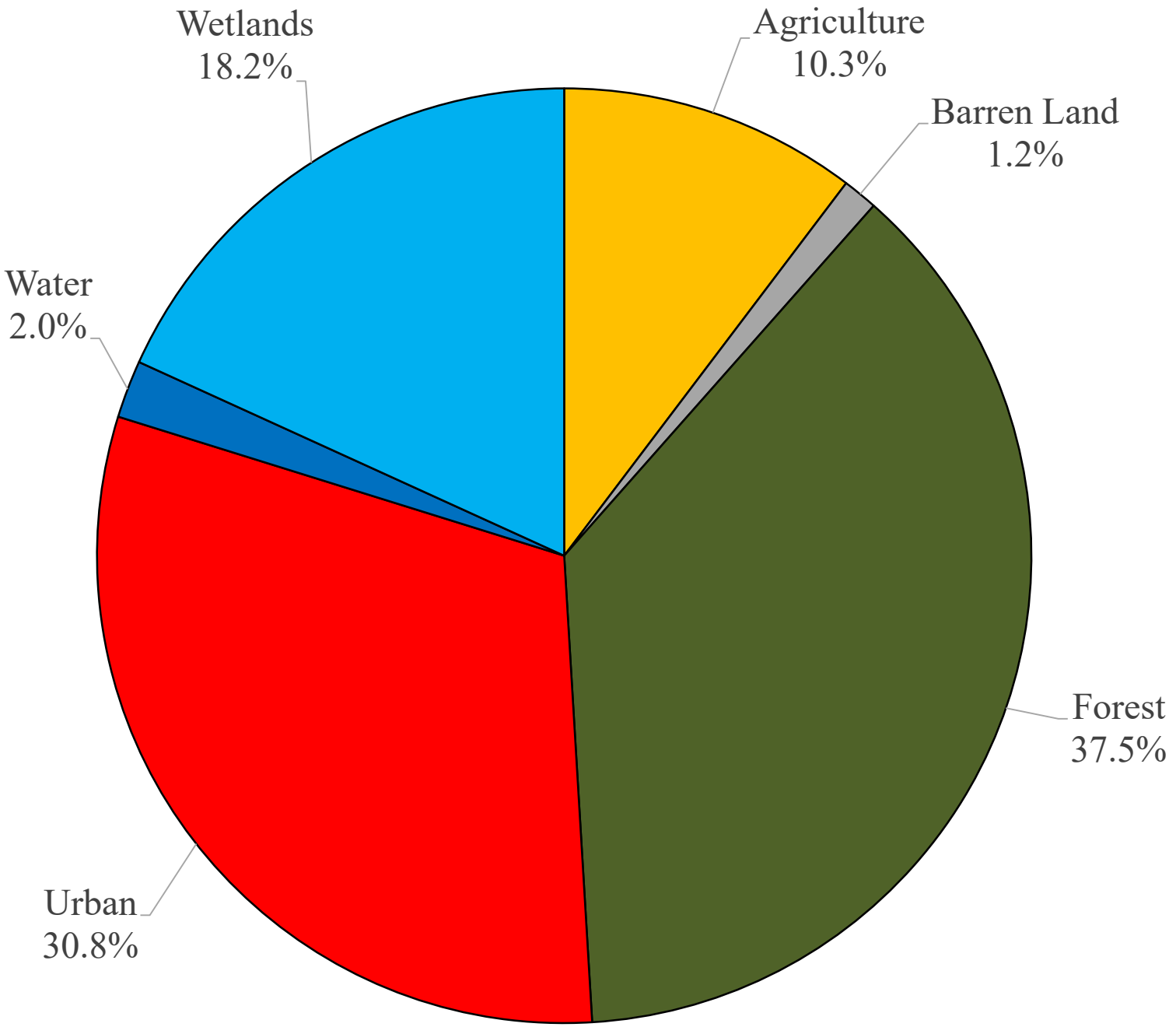
Impervious Cover Assessment (ICA)

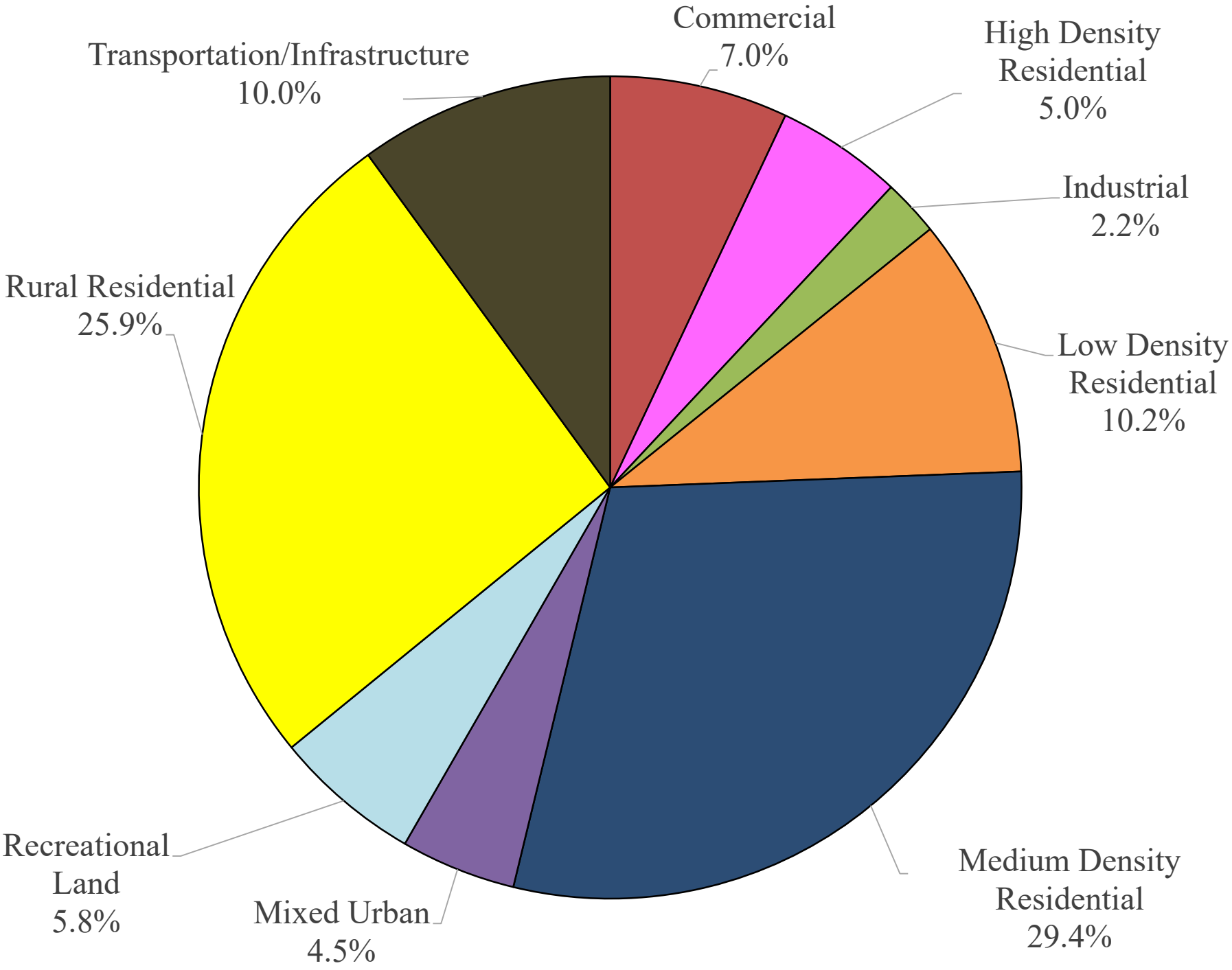
Impervious Cover Assessment

- Analysis completed by watershed and by municipality
- Use 2015 Impervious Cover GIS Layer from NJDEP
- Calculate runoff volumes for water quality, 2, 10 and 100-year design storm and annual rainfall
- Contain three concept designs

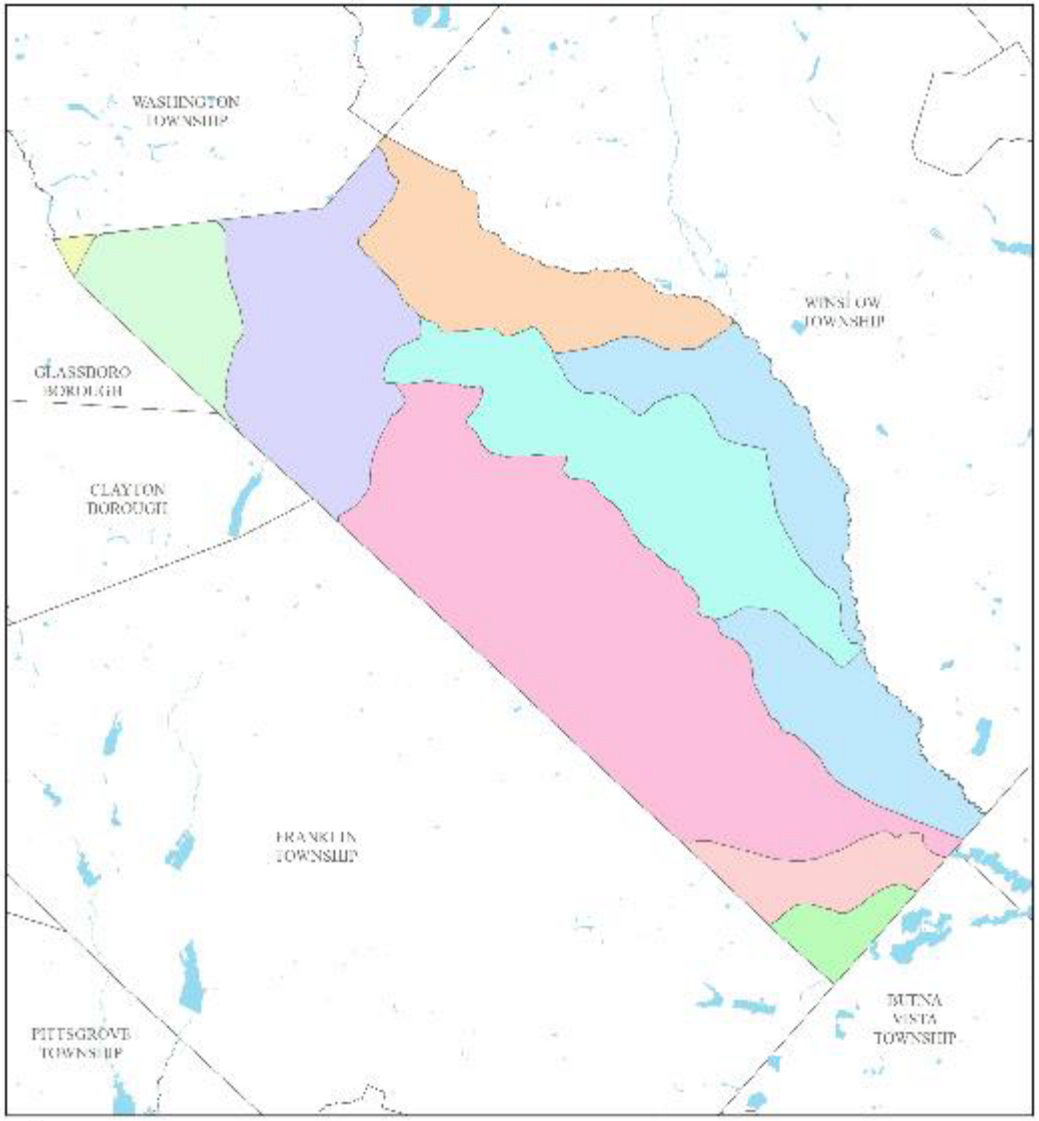
Land Use Types for Monroe




Wetlands
18.2%
Agriculture
10.3%
Barren Land
1.2%
Water
2.0%
Forest
37.5%
Urban
30.8%


Commercial
7.0%
High Density
Residential
5.0%
Industrial
2.2%
Low Density
Residential
10.2%
Medium Density
Residential
29.4%
Mixed Urban
4.5%
Recreational
Land
5.8%
Rural Residential
25.9%
Transportation/Infrastructure
10.0%

Subwatersheds of Monroe



Watershed	Total Area (ac)	Impervious Cover (ac)	%
Big Timber Creek South Branch	2.2	0.0	24.8%
Collings Lakes Tributaries	598.8	2.0	0.3%
Four Mile Branch (GEHR)	3,002.1	453.6	15.2%
Greater Egg Harbor River	4,601.0	90.2	2.0%
Hospitality Branch	9,818.6	603.30	6.4%
Little Ease Run	1,780.7	99.01	5.6%
Mantua Creek	82.1	3.09	3.8%
Scotland Run	4,214.8	462.68	11.1%
Squankum Branch	4,785.4	553.54	11.6%
White Oak Branch	1,145.1	4.24	0.4%
Total	30,030.8	2,271.74	7.7%

Subwatershed	NJ Water Quality Storm (MGal)	Annual Rainfall of 44" (MGal)	2-Year Design Storm (3.3”) (MGal)	10-Year Design Storm (5.0”) (MGal)	100-Year Design Storm (8.2”) (MGal)
Big Timber Creek South Branch	0.0	0.0	0.0	0.0	0.0
Collings Lakes Tributaries	0.1	2.4	0.2	0.3	0.5
Four Mile Branch (GEHR)	15.4	542.0	40.6	61.6	104.7
Greater Egg Harbor River	3.1	107.8	8.1	12.2	20.8
Hospitality Branch	20.5	720.8	54.1	81.9	139.2
Little Ease Run	3.4	118.3	8.9	13.4	22.9
Mantua Creek	0.1	3.7	0.3	0.4	0.7
Scotland Run	15.7	552.8	41.5	62.8	106.8
Squankum Branch	18.8	661.3	49.6	75.2	127.8
White Oak Branch	0.1	5.1	0.4	0.6	1.0
Total	77.1	2,714.1	203.6	308.4	524.3

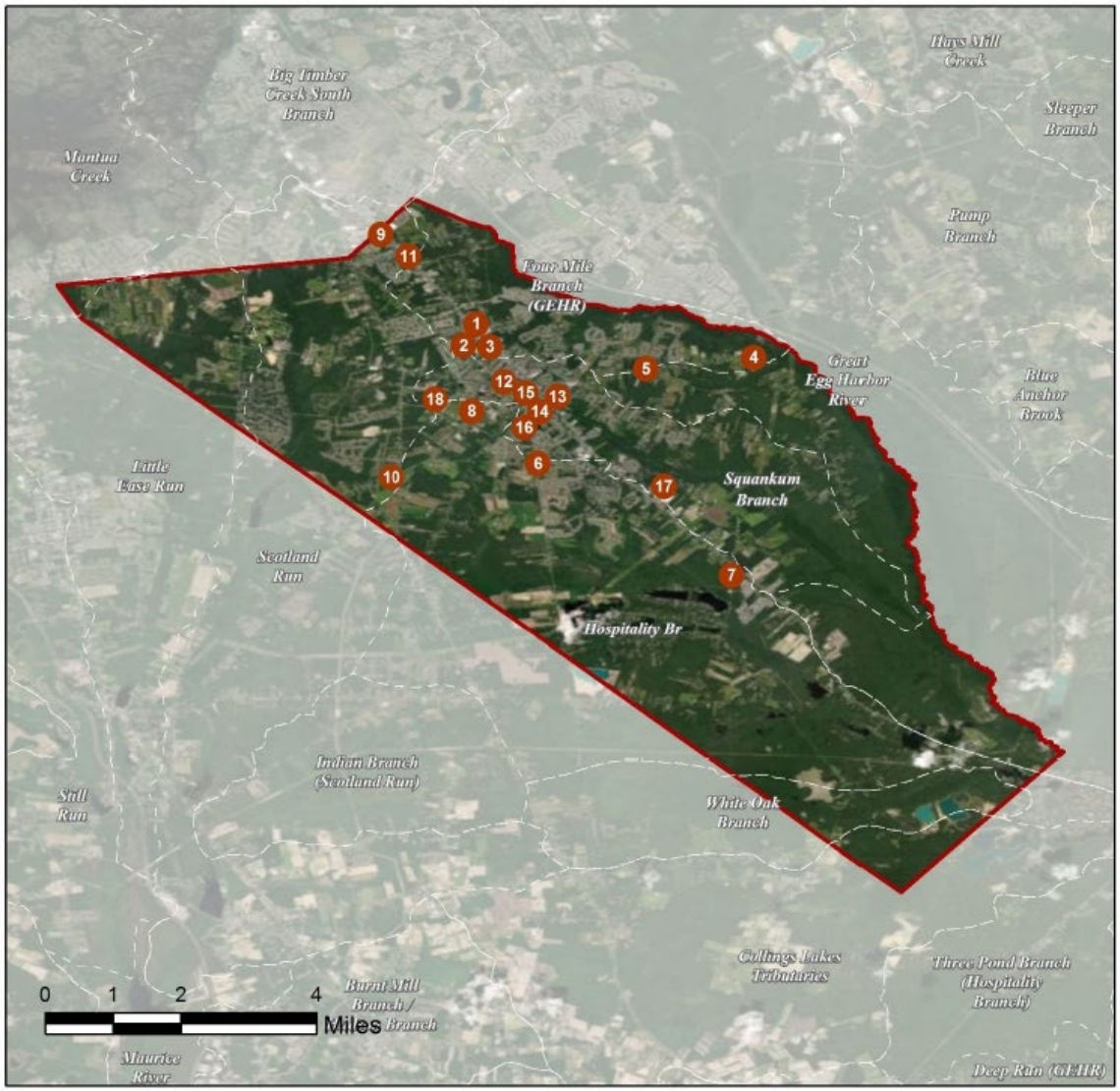
WE LOOK HERE FIRST:

- ✓Schools
- ✓Churches
- ✓Libraries
- ✓Municipal Building
- ✓Public Works
- ✓Firehouses
- ✓Post Offices
- ✓Elks or Moose Lodge
- ✓Parks/ Recreational Fields

- 20 to 40 sites are entered into a PowerPoint
- Site visits are conducted

Impervious Cover Reduction Action Plan (RAP)

MONROE TOWNSHIP: GREEN INFRASTRUCTURE SITES



[1] Connected impervious cover

[2] Half disconnected half connected impervious cover

[3] Disconnected impervious cover

[4] Connected impervious cover with basin

[5] Half disconnected half connected impervious cover with basin

SITES WITHIN THE FOUR MILE SUBWATERSHED

1. First Bank [4]
2. Holly Glen Elementary [5]
3. Monroe Township Public Library [1]
4. New Brooklyn United Methodist Church [3]
5. Open Bible Baptist Church [2]

SITES WITHIN THE HOSPITALITY BRANCH SUBWATERSHED

6. Monroe Township Ambulance Association [4]
7. Whitehall Elementary School [2]
8. Williamstown Middle School [4]

SITES WITHIN THE SCOTLAND RUN SUBWATERSHED

9. Cross Keys Animal Hospital [3]
10. Gloucester County Veterans Memorial Cemetery [1]
11. Veterans of Foreign Wars [3]

SITES WITHIN THE SQUANKUM BRANCH SUBWATERSHED

12. American Legion Post 252 [2]
13. Center for Family Services [2]
14. First Presbyterian Church [1]
15. Monroe Municipal Utilities Authority [3]
16. Monroe Township Municipal Court [1]
17. Williamstown Assembly of God [1]
18. Williamstown High School [4]

Cross Keys Animal Hospital

Subwatershed: Scotland Run

Site Area: 21,079 sq. ft.

Address: 2071 North Black Horse Pike
Williamstown, NJ 08094

Block and Lot: Block 201, Lot 60

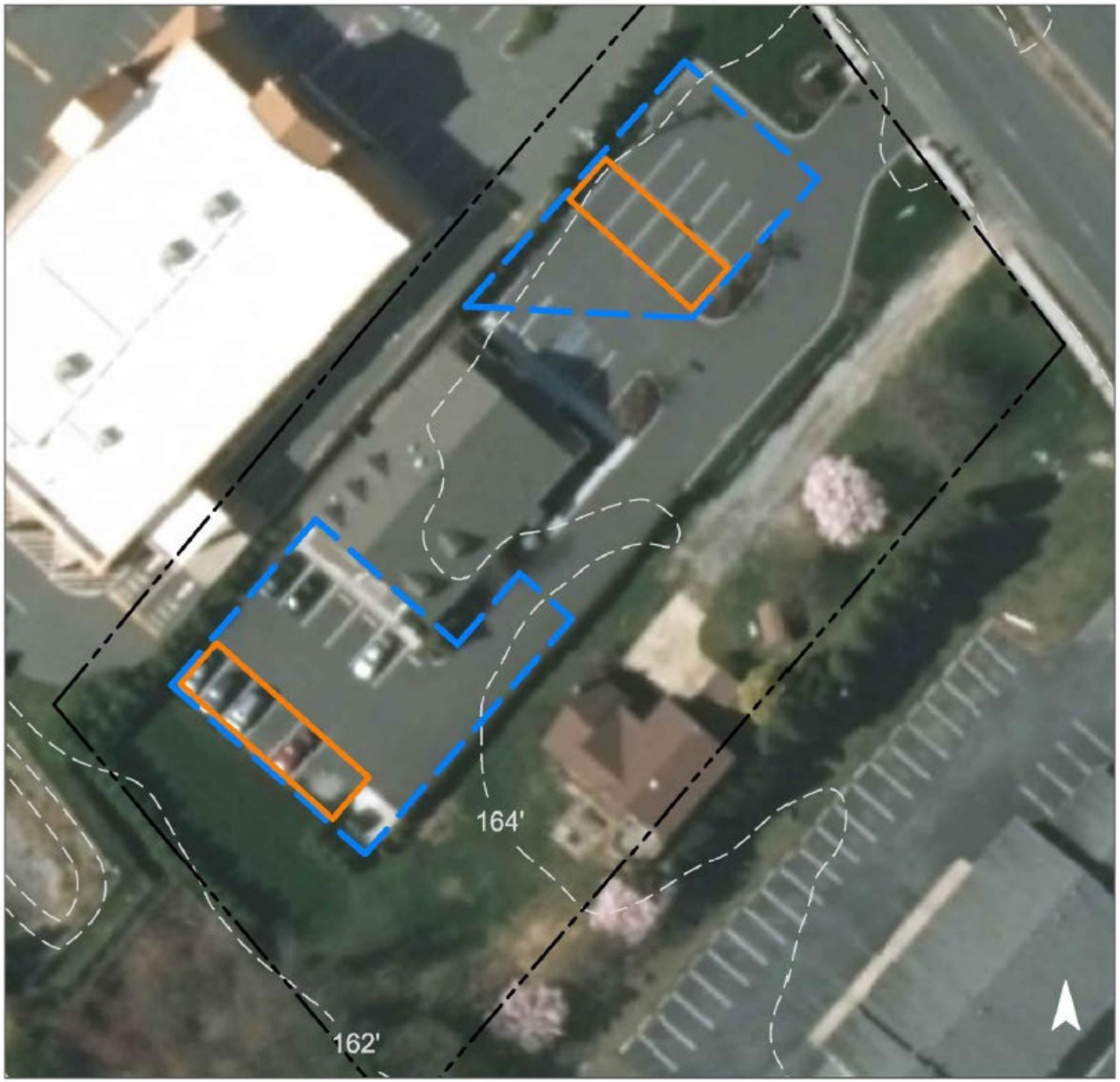
Priority Level: 3 Disconnected impervious cover

Porous pavement can be installed in parking spaces to capture runoff from the parking lot before entering the catch basin. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
73	15,283	0.7	7.7	70.2	0.012	0.42

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Pervious pavement	0.304	51	22,290	0.84	2,170	$54,250

GREEN INFRASTRUCTURE RECOMMENDATIONS



Cross Keys Animal Hospital

- pervious pavement
- drainage area
- property line
- 2015 Aerial: NJOIT, OGIS

0 25' 50'

Before:

After:

Gloucester County Veterans Memorial Cemetery

Subwatershed: Scotland Run

Site Area: 2,848,533 sq. ft.

Address: 240 North Tuckahoe Road
Williamstown, NJ 08094

Block and Lot: Block 12701, Lot 1

Priority Level: 1 Connected impervious cover

Two twin rain gardens can be installed on both east and west sides of the building, each capturing and infiltrating half of the roof's total stormwater runoff via downspouts. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
5	134,692	6.5	68.0	618.4	0.105	3.69

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.081	14	5,920	0.22	780	$3,900

GREEN INFRASTRUCTURE RECOMMENDATIONS

Gloucester County Veterans Memorial Cemetery

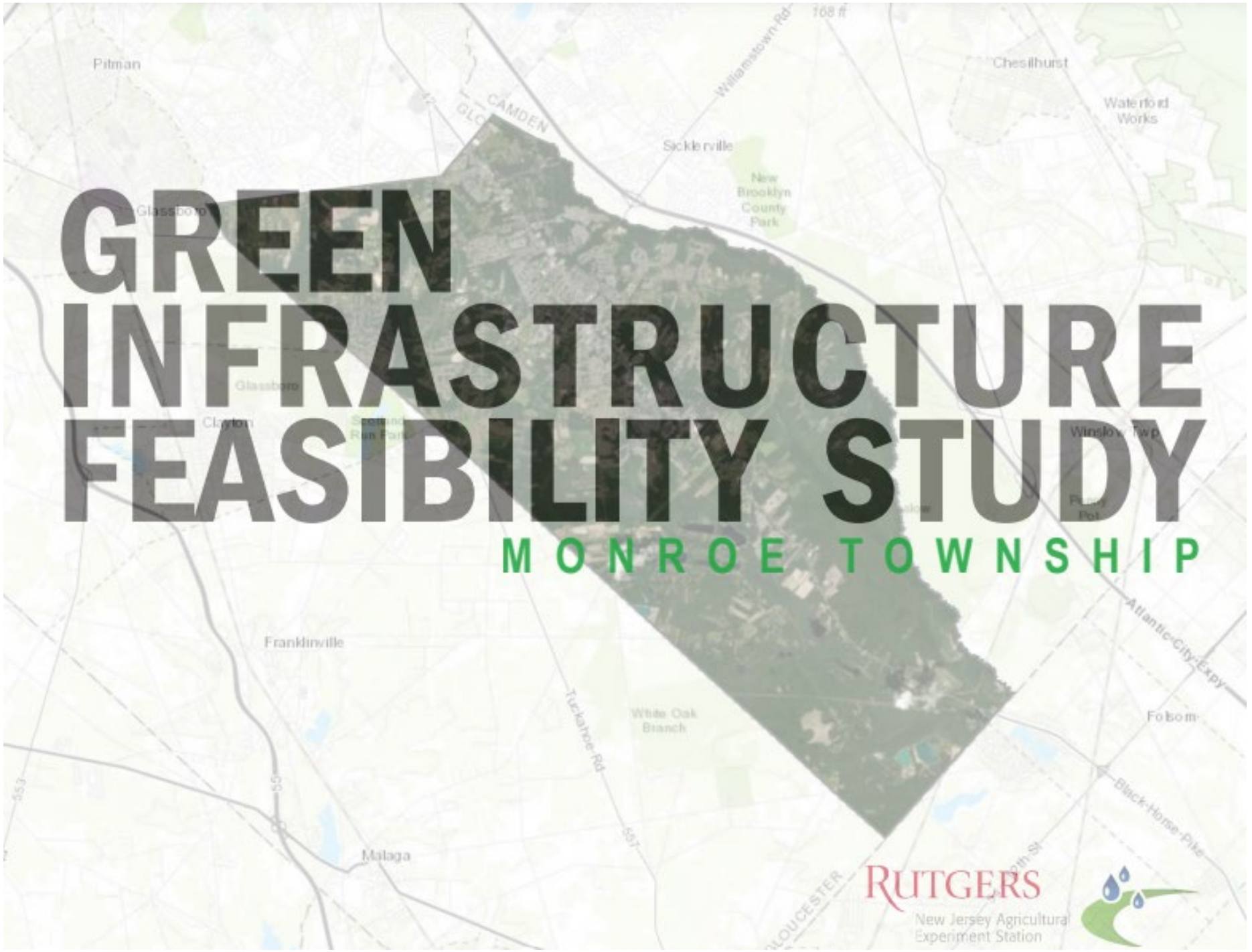
- bioretention system
- drainage area
- property line
- 2015 Aerial: NJOIT, OGIS

0 20' 40'

Before:

After:

Green Infrastructure Feasibility Study



GREEN INFRASTRUCTURE FEASIBILITY STUDY

MONROE TOWNSHIP

TABLE OF CONTENTS

4 Glossary Of Terms

7 Introduction

19 Green Infrastructure Practices

35 Green Infrastructure in Monroe Township

83 ***Appendix A***: Community Engagement & Education

87 ***Appendix B***: Maintenance Procedures

Monroe

ALL SITES | FOUR MILE BRANCH | HOSPITALITY BRANCH | SCOTLAND RUN | SQUANKUM BRANCH


1 First Bank


2 Holly Glen Elementary School


3 Monroe Township Public Library


4 New Brooklyn United Methodist Church


5 Open Bible Baptist Church


6 Monroe Township Ambulance Association


7 Whitehall Elementary School


8 Williamstown Middle School


9 Cross Keys Animal Hospital


10 Gloucester County Veterans Memorial Cemetary


11 Veterans of Foreign Wars


12 American Legion Post 252


13 Center for Family Services Inc

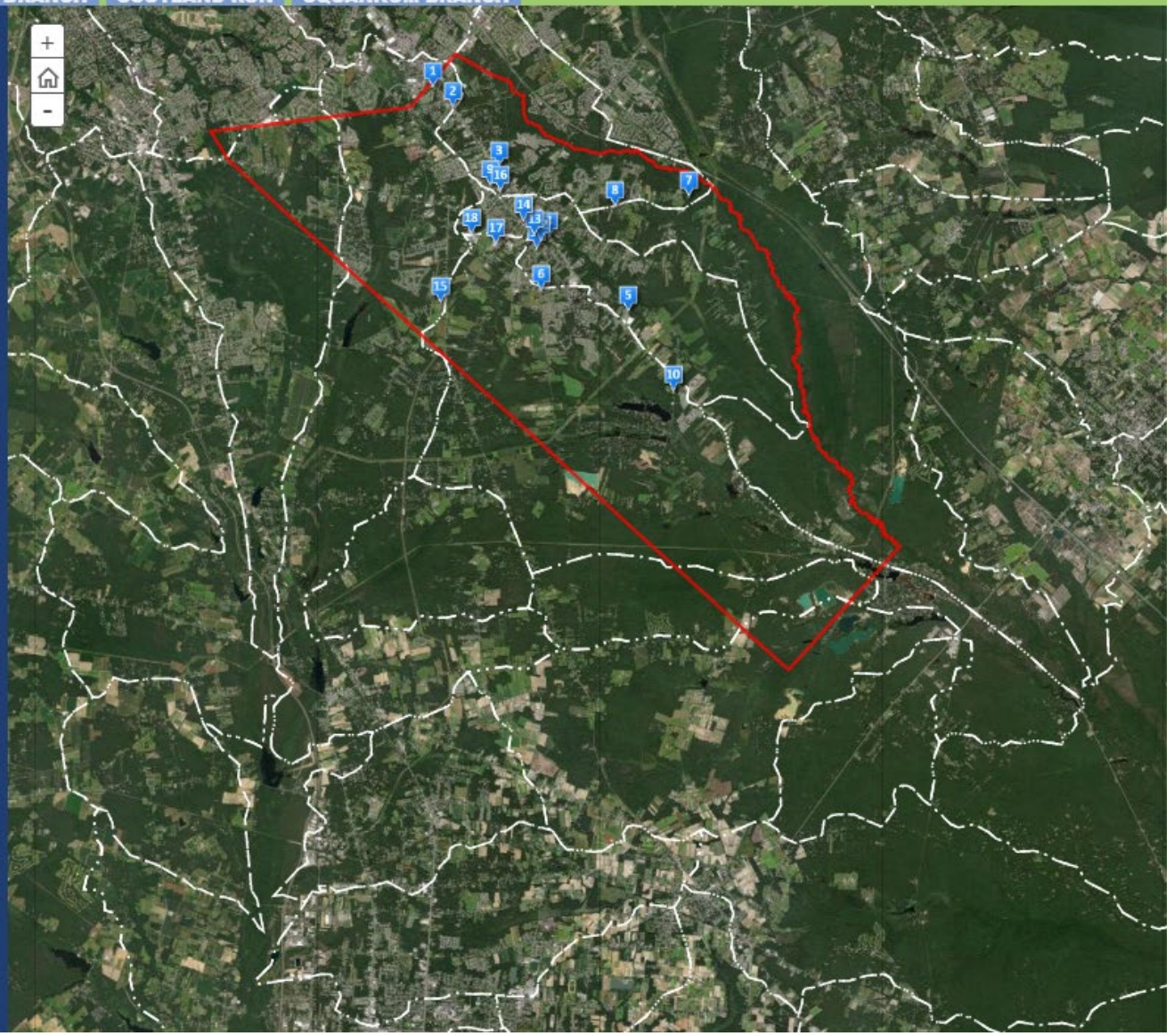

14 First Presbyterian Church


15 Monroe Municipal Utilities Authority


16 Monroe Township Municipal Court


17 Williamstown Assembly of God


18 Williamstown High School



Monroe

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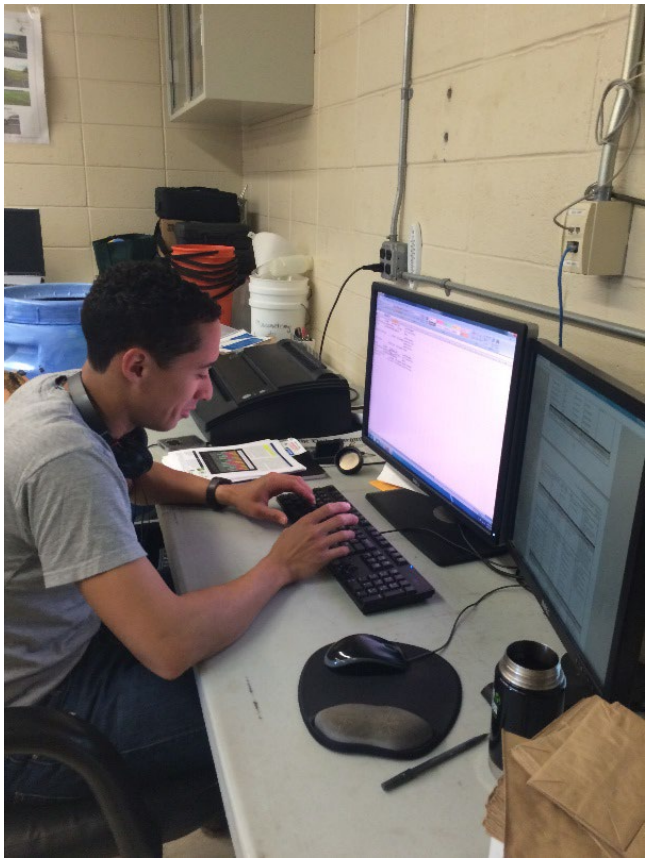
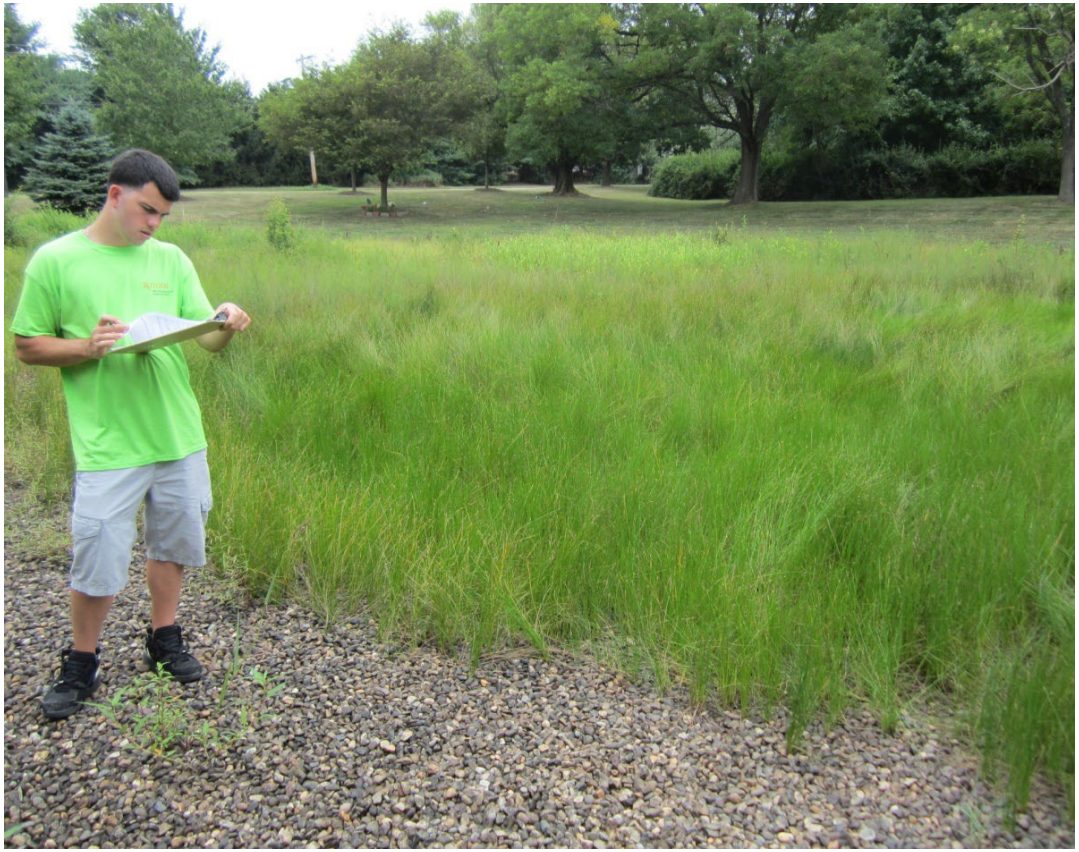
15 Monroe Municipal Utilities Authority

Final Thoughts

- Plans promote action and earn Sustainable Jersey Points
- Plans are a conduit for funding
- Impervious cover reduction action plan provide sites for developers to offset impacts
- Wide range in cost of projects (Eagle Scout projects to economic stimulus money projects)
- Foundation for stormwater utilities, watershed restoration plans, stormwater mitigation plan, and/or integrated water quality plans

Green Infrastructure Implementation Part 1





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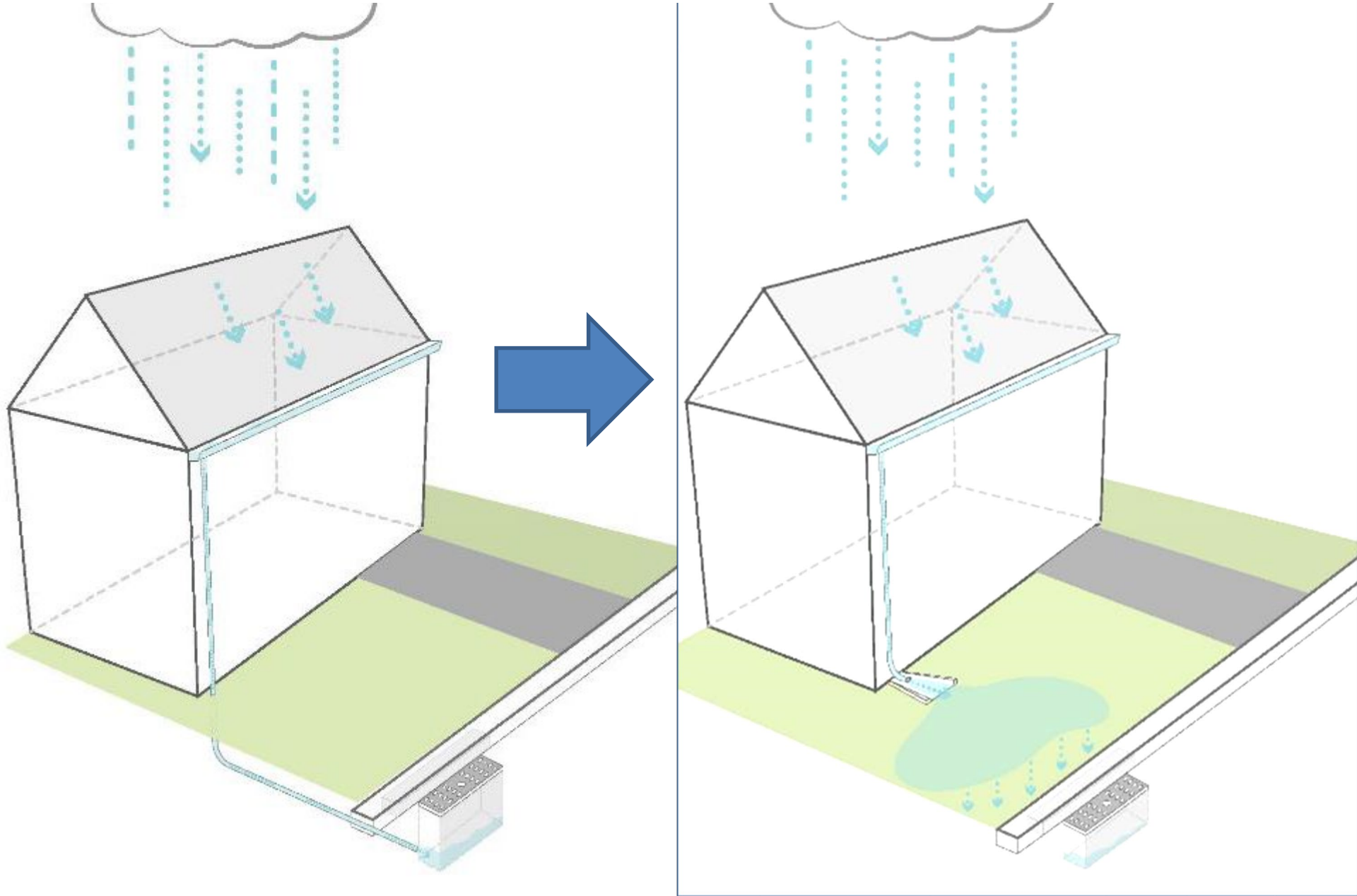
New Jersey Agricultural Experiment Station

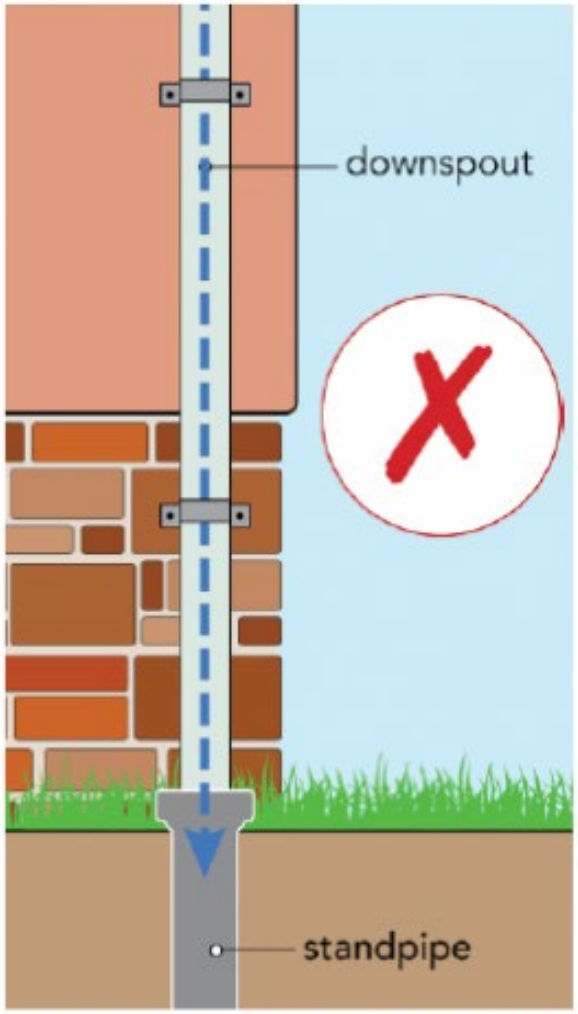
It is all about controlling runoff from impervious surfaces

Connected or Disconnected?

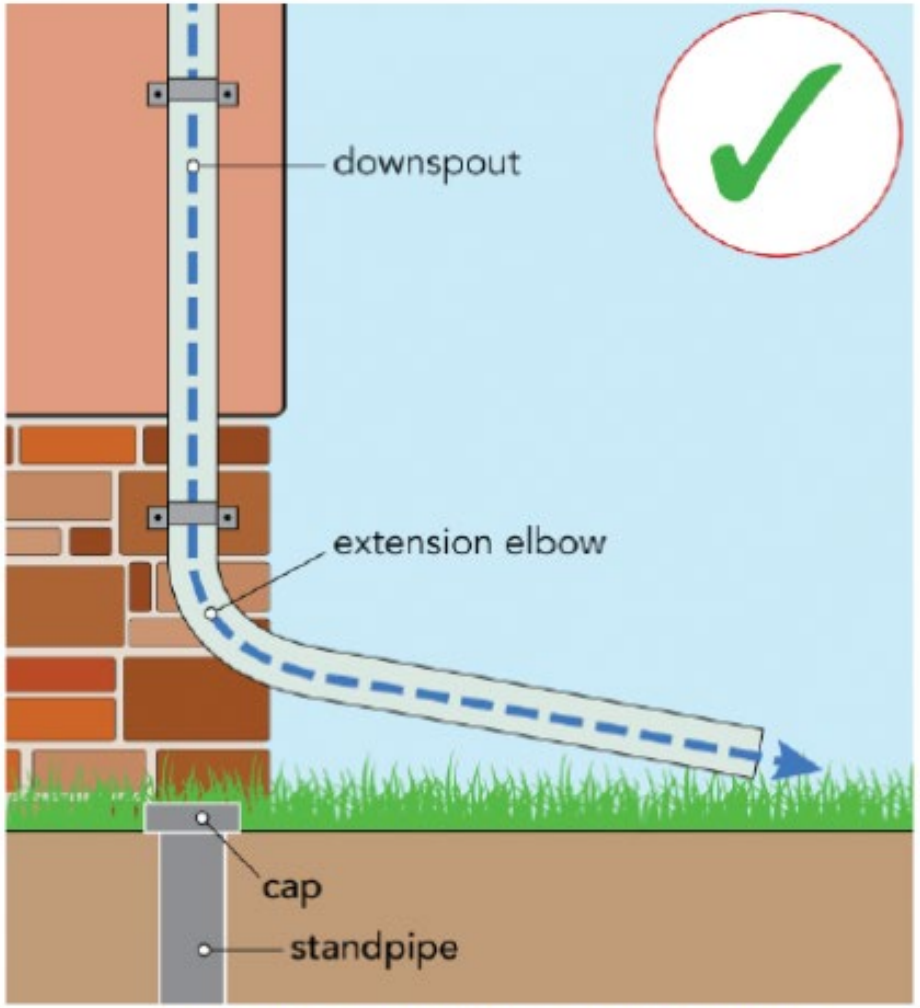
Simple Disconnection



Downspout Disconnection



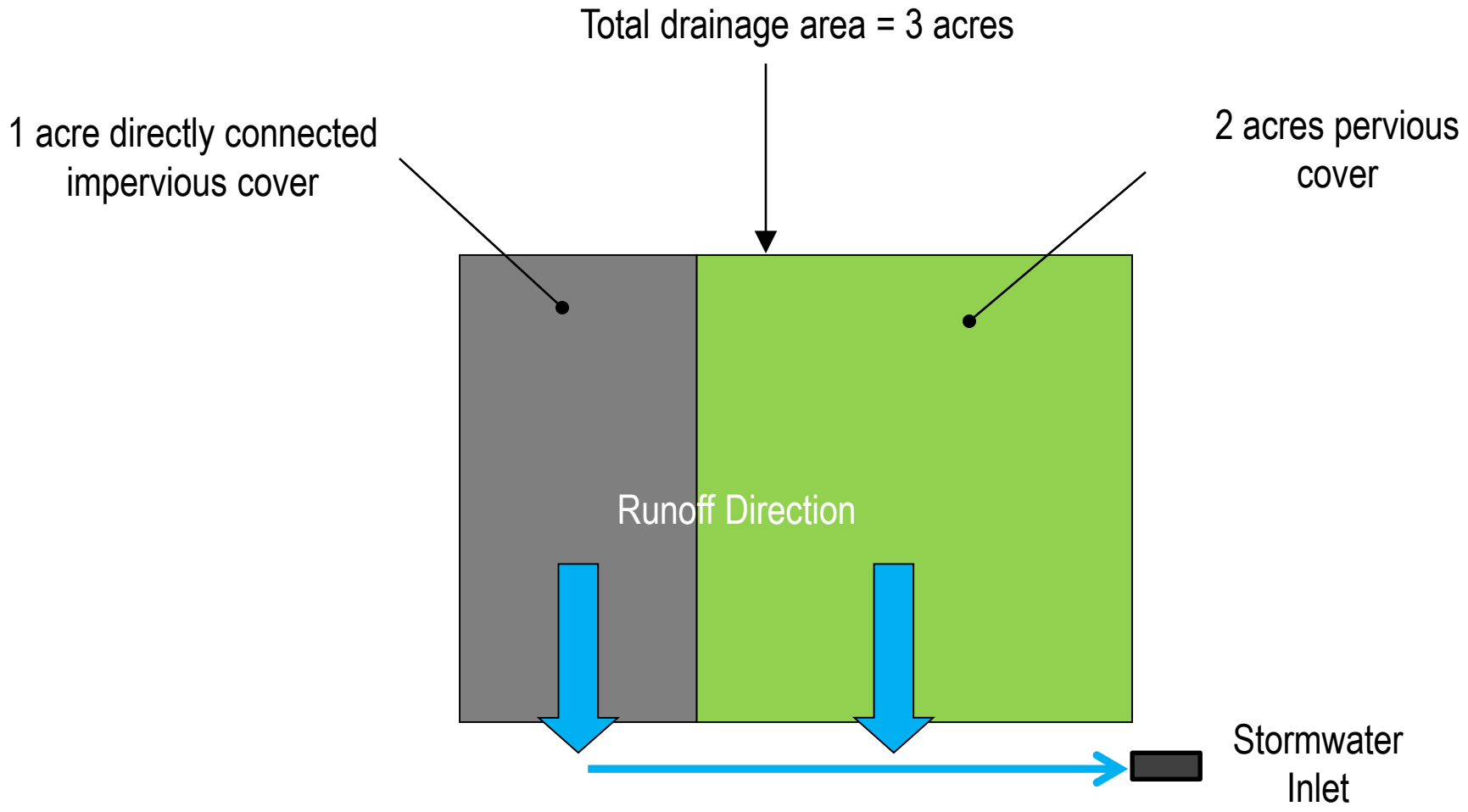
DOWNSPOUT CONNECTED TO SEWER SYSTEM



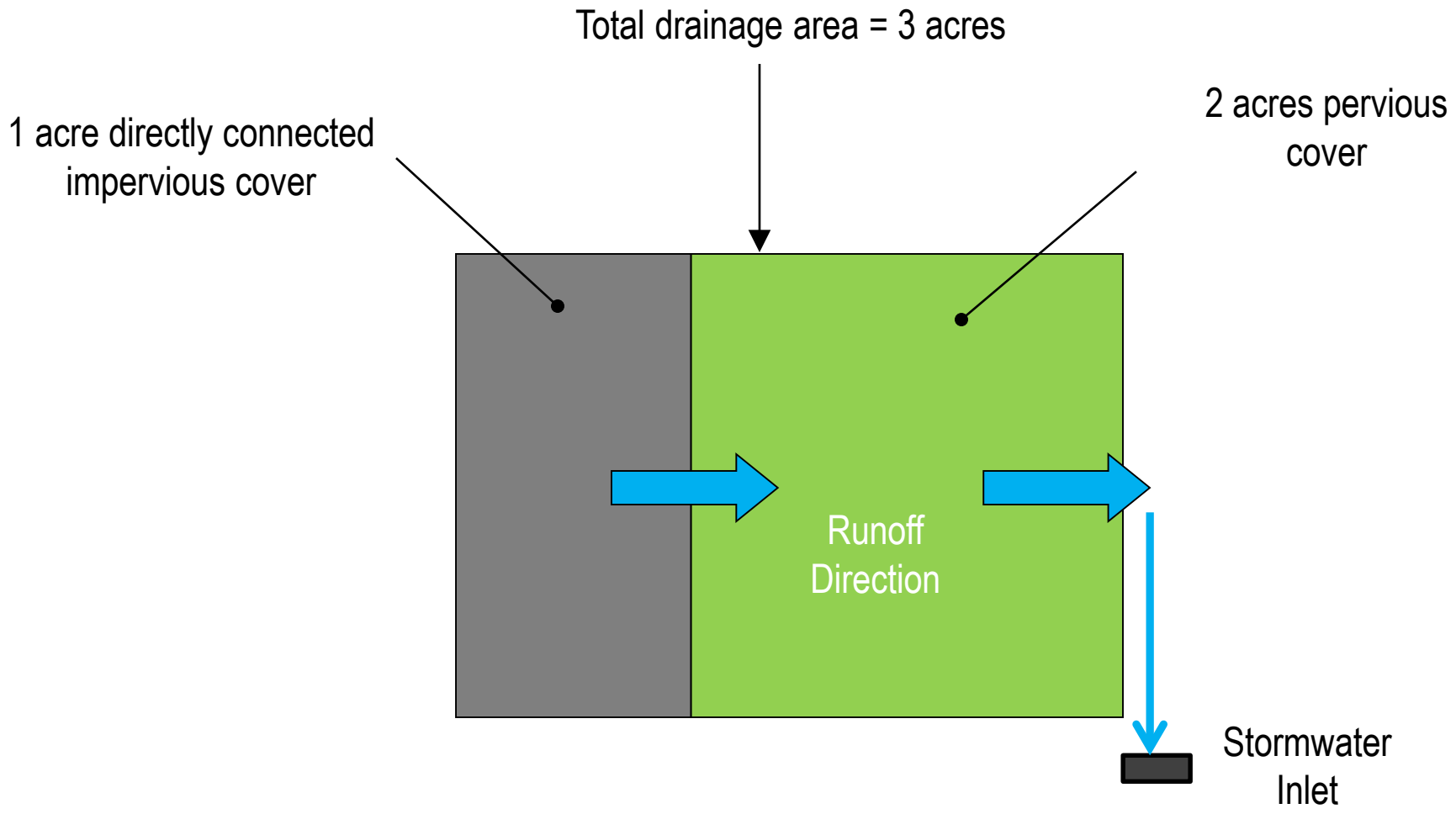
DOWNSPOUT DISCONNECTED FROM SEWER SYSTEM

Another Example of Simple Disconnection

For 1.25 inch storm, 3,811 cubic feet of runoff = **28,500 gallons**

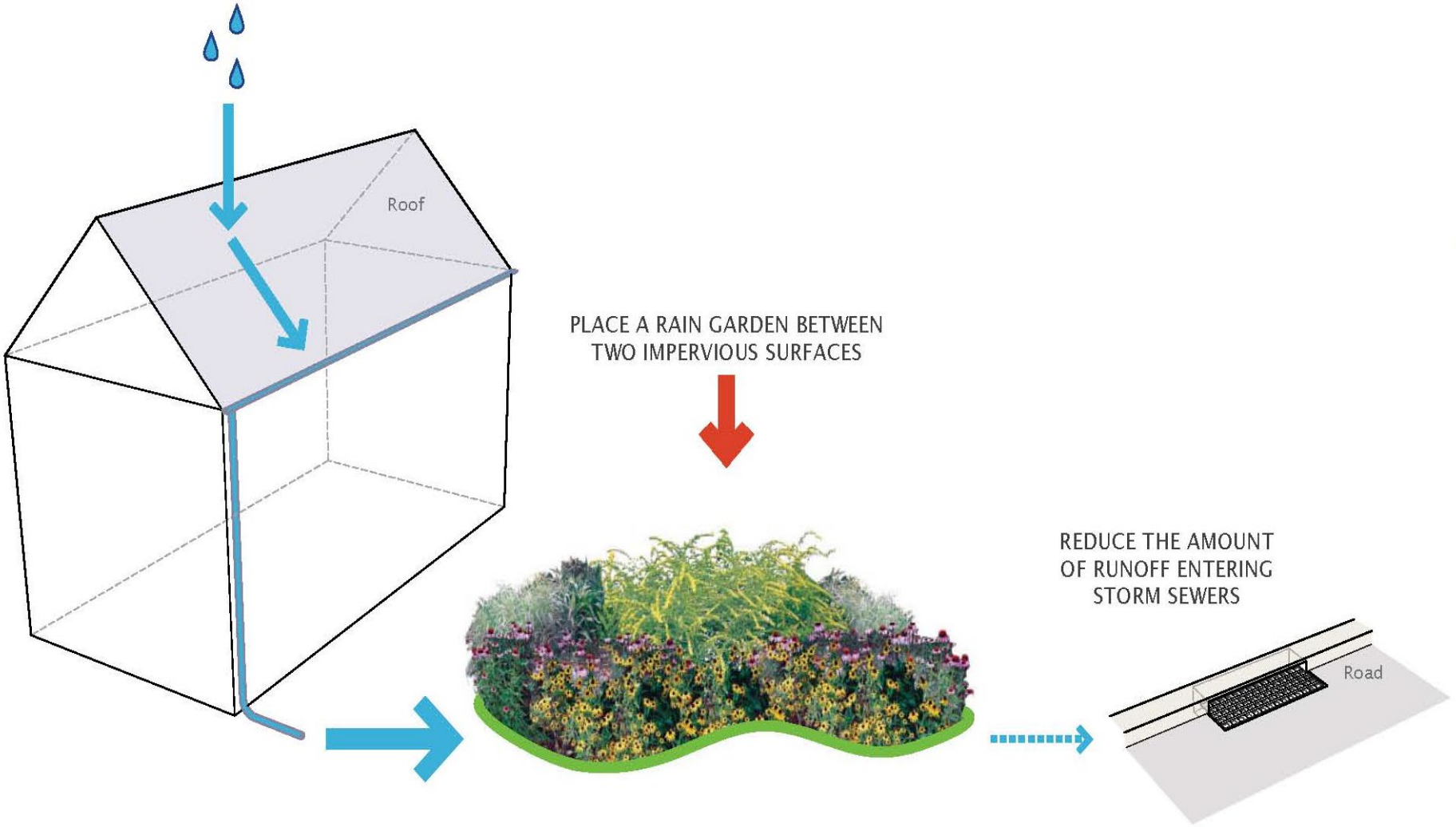


For 1.25 inch storm, 581 cubic feet of runoff = **4,360 gallons**



	Volume of Runoff		
Design Storm	**Connected (gallons)**	**Disconnected (gallons)**	**Percent Difference**
1.25 inches (water quality storm)	28,500	4,360	85%

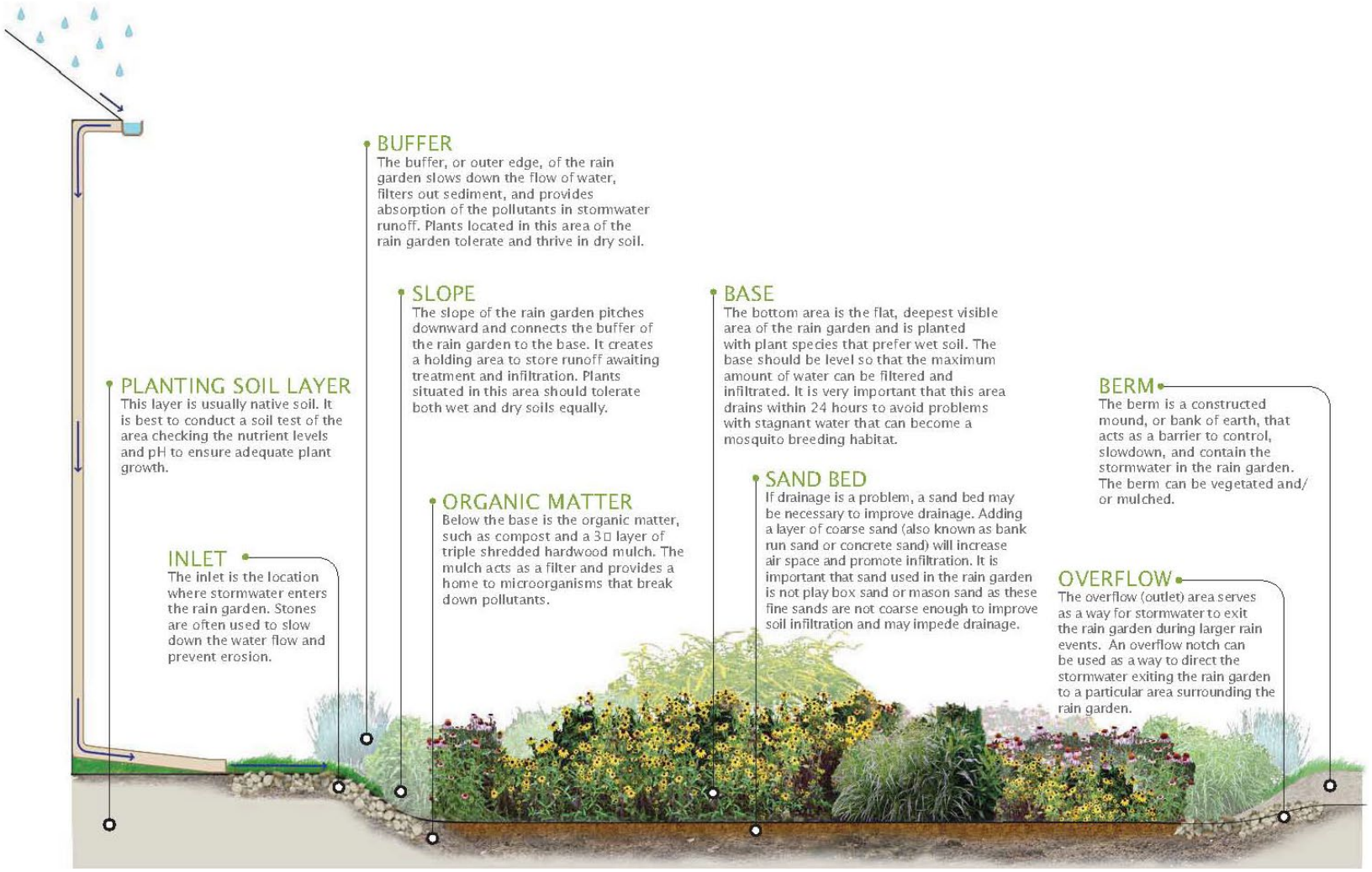
Disconnect with a rain garden



Rain Gardens

A rain garden is a landscaped, shallow depression that is designed to intercept, treat, and infiltrate stormwater at the source before it becomes runoff. The plants used in the rain garden are native to the region and help retain pollutants that could otherwise harm nearby waterways.

PARTS OF A RAIN GARDEN

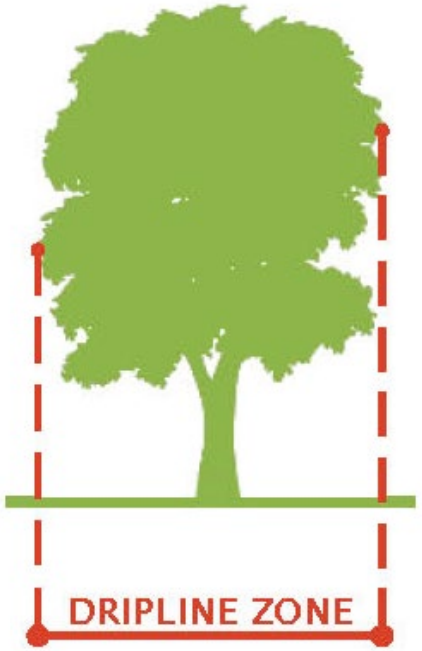


SITE SELECTION & DESIGN

PLANNING YOUR RAIN GARDEN

SITE SELECTION

1. Next to a building with a basement, rain garden should be located min. 10’ from building; no basement: 2’ from building
2. Do not place rain garden within 25’ of a septic system
3. Do not situate rain garden in soggy places where water already ponds
4. Avoid seasonably-high water tables within 2’ of rain garden depth
5. Consider flat areas first – easier digging
6. Avoid placing rain garden within dripline of trees
7. Provide adequate space for rain garden

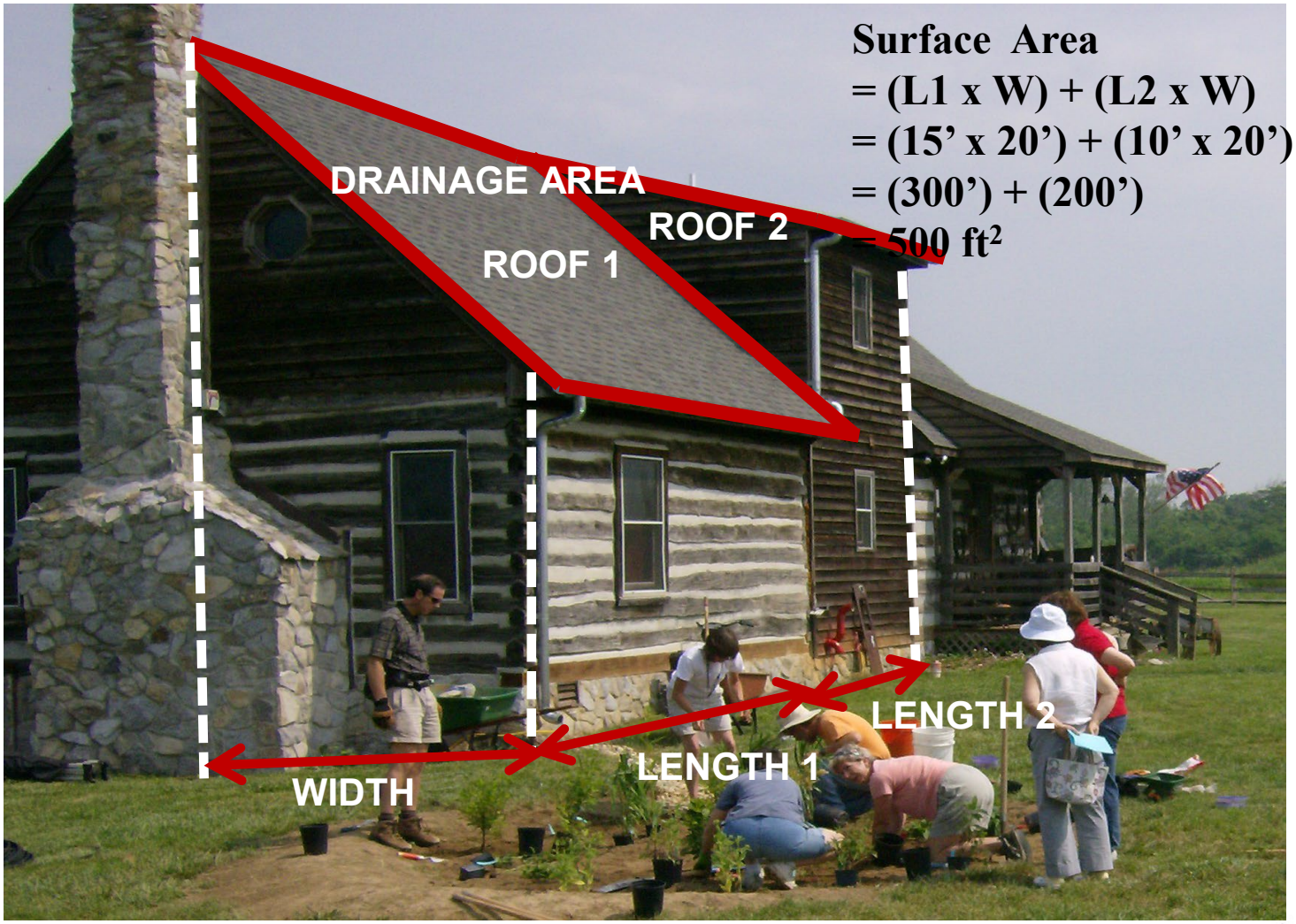



8. 2. 2004

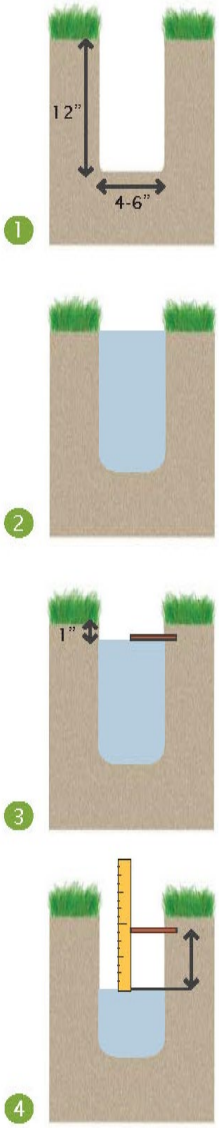
CALL BEFORE YOU DIG

- **NJ One Call: 1-800-272-1000**
- Free markout of underground gas, water, sewer, cable, telephone, and electric utility lines
- Call at least 3 full working days, but not more than 10 days, prior to planned installation date
- Do not place rain garden within 5' horizontally and 1' vertically from any utilities

DRAINAGE AREA CALCULATION

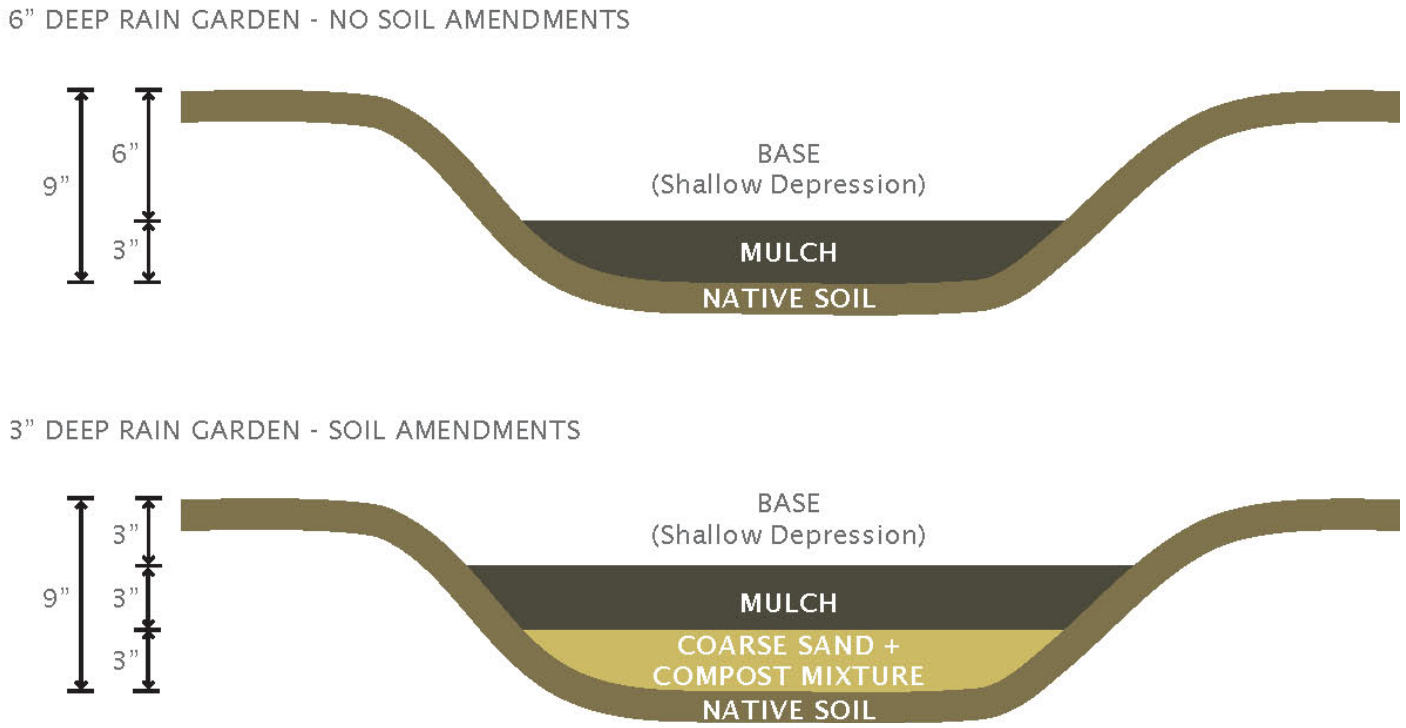


CHECK YOUR SOIL



- Infiltration/Percolation Test
  1. Dig a hole in the proposed rain garden site (12” deep, 4-6” wide)
  2. Fill with water to saturate soil and then let stand until all the water has drained into the soil
  3. Once water has drained, refill the empty hole again with water so that the water level is about 1” from the top of the hole
  4. Check depth of water with a ruler every hour for at least 4 hours
  5. Calculate how many inches of water drained per hour

DETERMINING THE DEPTH OF THE RAIN GARDEN



- Depth of rain garden is dependent upon the soil texture found at the site of the rain garden
- Depth is usually 3-8 inches

DETERMINING THE SIZE OF THE RAIN GARDEN

- The size of the rain garden is dependent upon the amount of runoff entering the rain garden

Rain Garden Sizing Table

Based on New Jersey's Water Quality Design Storm (1.25" of rain over 2 hours)

Drainage Area	Size of 3" Deep Rain Garden CLAY SOIL*	Size of 6" Deep Rain Garden SILTY SOIL	Size of 8" Deep Rain Garden SANDY SOIL
500 ft^2	200 ft^2	100 ft^2	75 ft^2
750 ft^2	350 ft^2	150 ft^2	112 ft^2
1,000 ft^2	400 ft^2	200 ft^2	149 ft^2
1,500 ft^2	600 ft^2	300 ft^2	224 ft^2
2,000 ft^2	800 ft^2	400 ft^2	299 ft^2

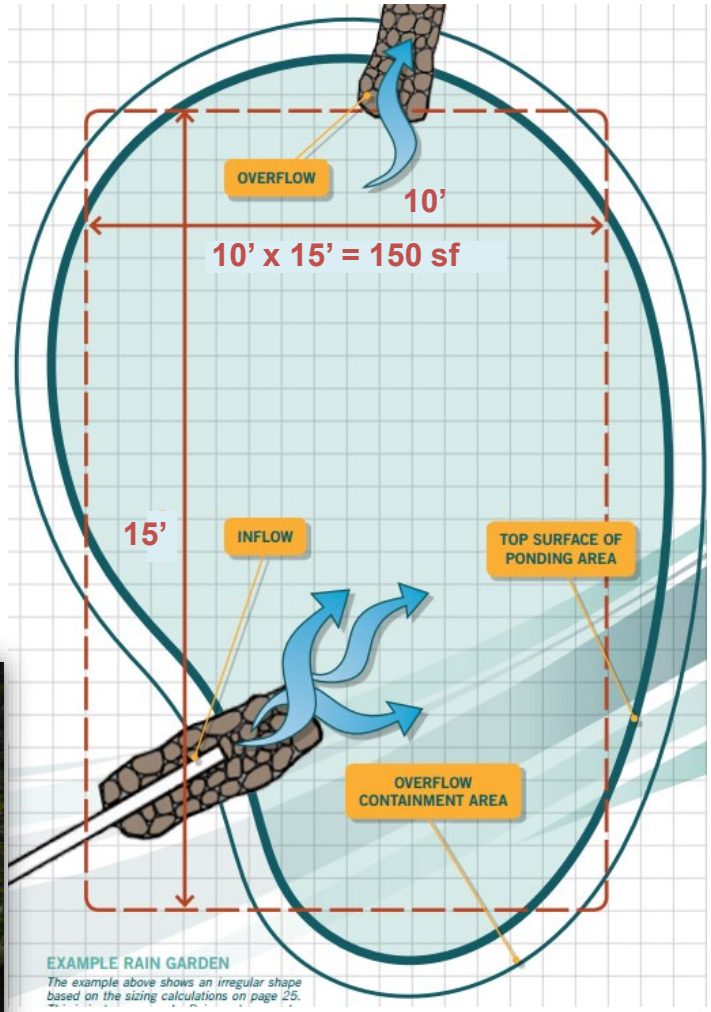
*SOIL TEXTURE AMENDMENTS NEEDED

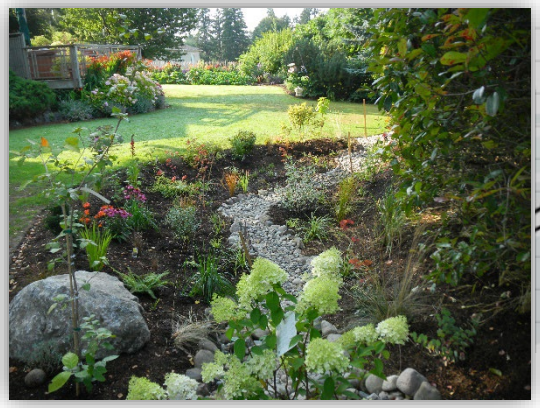
RAIN GARDENS
Typical Size

What is a typical rain garden size?

- Typically100-200 square feet.
- A 100 square feet rain garden will often receive water from an area 5 to 10 times larger than the rain garden..

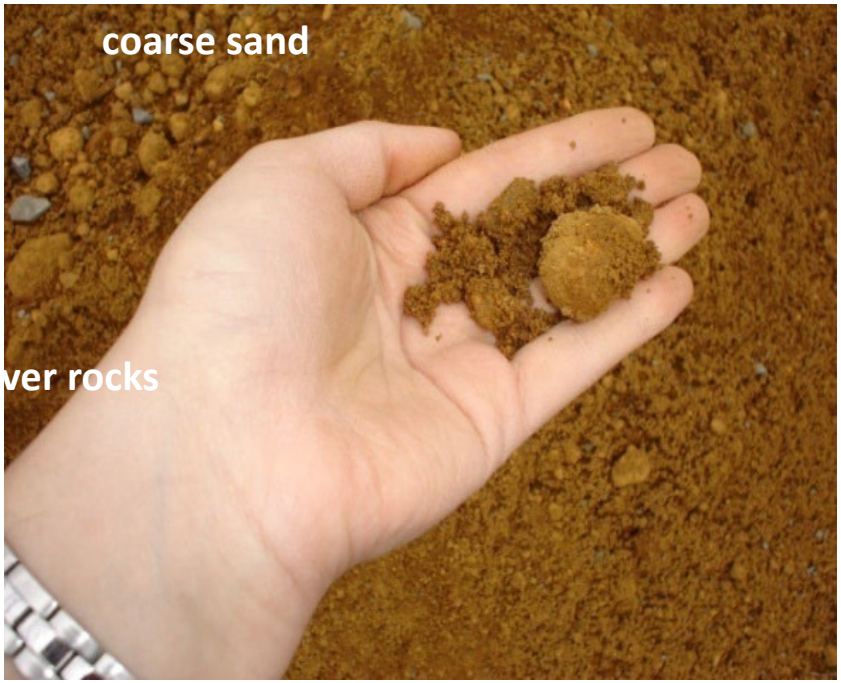
Modified from Rain Garden Handbook for Western WA





SOIL AMENDMENTS

- Soil amendments improve the rain garden's infiltration rate and help the plants grow



DETERMINING THE INLET AND OVERFLOW

- Stormwater runoff enters the rain garden from an **inlet**
- Stormwater exits through the **overflow**

PREVENTING EROSION

- Slope no greater than 3:1
- Slow down velocity of water flowing through rain garden
  - Add rocks to inlet area (River Stone)

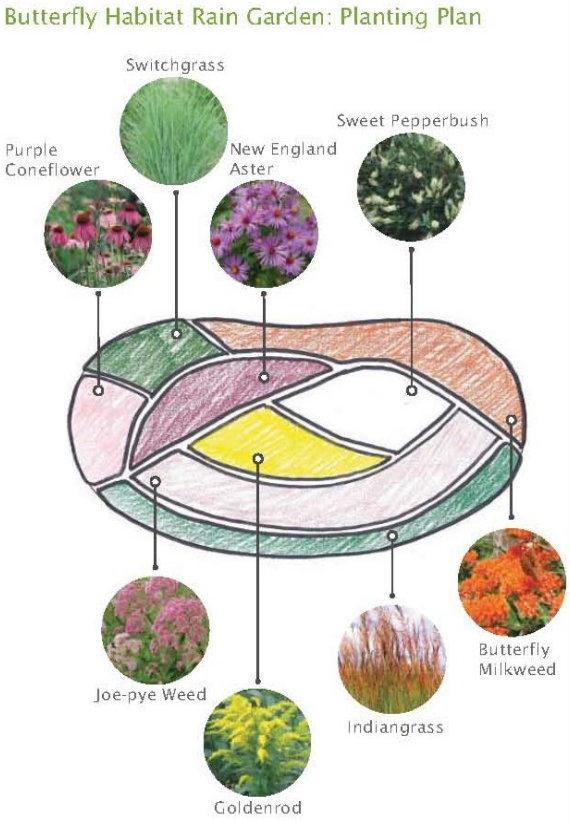
DETERMINING MULCH QUANTITY

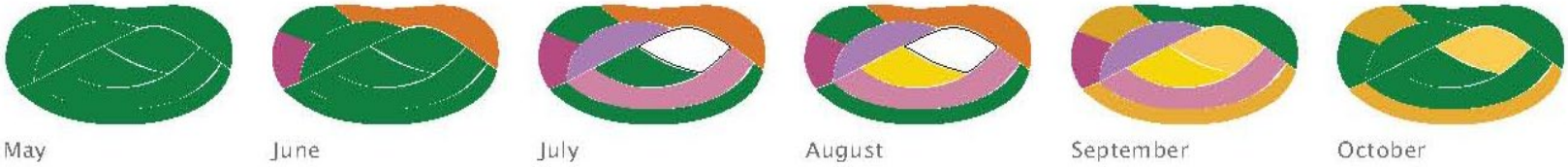
- Allow for a 3” depth mulch (triple-shredded hardwood with no dye) to be spread throughout the entire rain garden
- Every 100 square feet of rain garden needs 1 cubic yards (3” depth)

RAIN GARDEN DESIGN

SHAPING YOUR RAIN GARDEN

- Use a garden hose or rope to outline the desired shape of your rain garden on the ground
- Many rain gardens are in the shape of a circle or kidney bean, but your rain garden can take on whatever shape you prefer





THE FUN PART!

INSTALLING YOUR RAIN GARDEN

STEP ONE

- Delineate rain garden area

- Remove existing grass with a shovel or machinery

STEP TWO

- Excavate to design depth based on necessary storage and soil amendment requirements

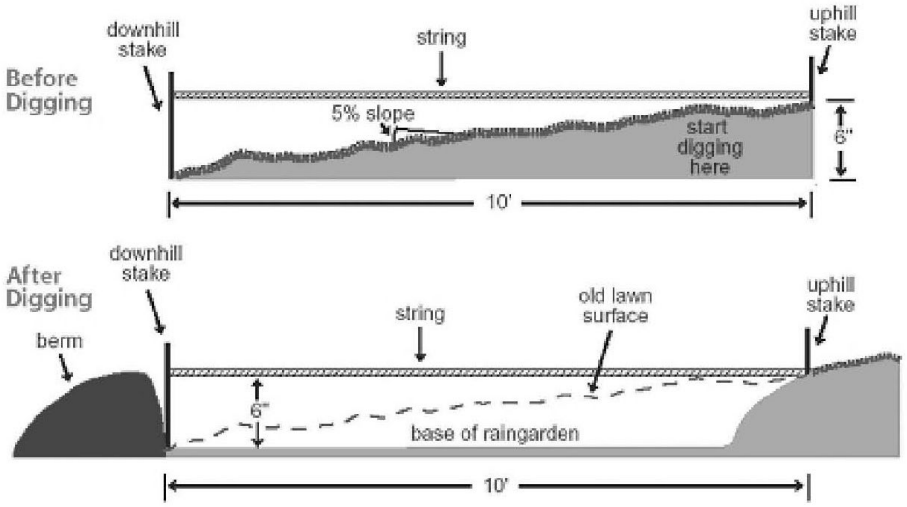
STEP THREE

- Add soil amendments, if necessary

- Combine amendments with existing soil using shovels or rototiller
- Loosen and prepare soil for grading and planting

STEP FOUR

- Prepare the berm, if necessary

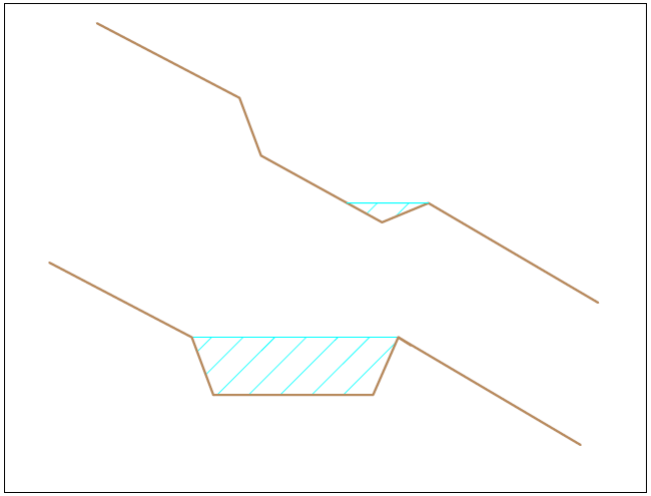


STEP FIVE

- Prepare the overflow

STEP SIX

- Level the rain garden base



STEP SEVEN

- Plant native species







STEP EIGHT

- Apply mulch

- Allow for a 3” depth mulch (triple-shredded hardwood with no dye) to be spread throughout the entire rain garden

- For every 100 square feet of rain garden, you will need about 1 cubic yard of mulch (3” depth)

STEP NINE

- Water Plants

STEP TEN

- Appreciate a job well done

RAIN GARDEN PLANTING DESIGN

DESIGN AESTHETICS

- Formal or traditional design
  - Shrub bed
  - Perennial garden
  - Hedges
- Naturalized planting & design
  - Butterfly garden
  - Meadow (warm season grasses & wildflowers)
  - Buffer plantings

SITE CONSTRAINTS

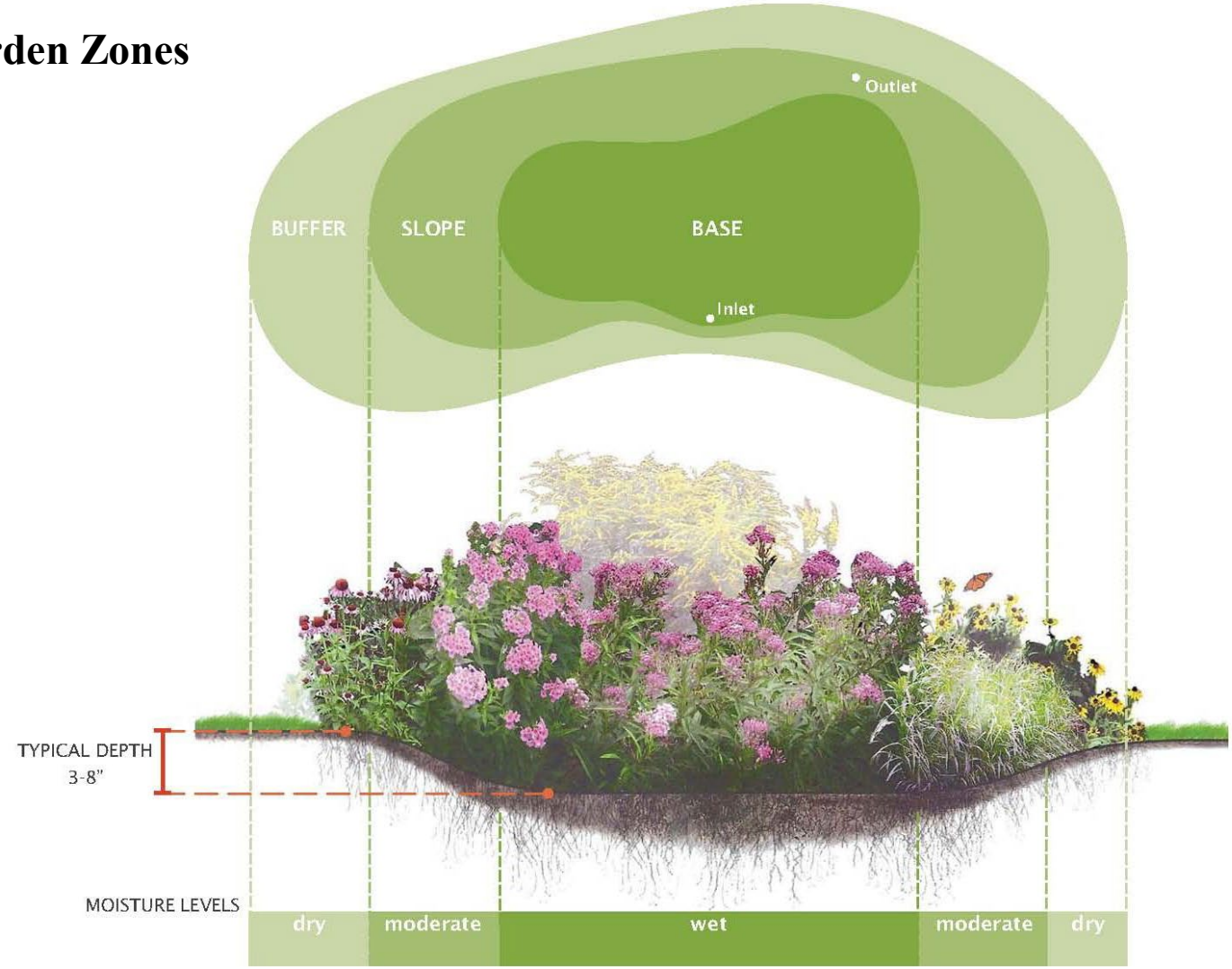
- Sun vs. shade
- Exposure/wind
- Soil characteristics
- Hydrologic conditions
- Road salts
- Vehicle/pedestrian traffic

PLANTS IN THE RIGHT PLACE…

Courtesy of Pinelands Nursery & Supply

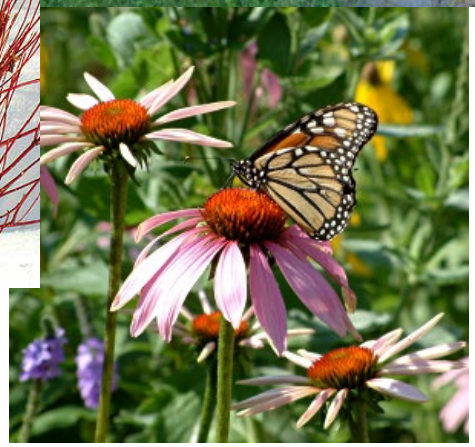
PLANTING DESIGN: Wet + Dry Conditions

Rain Garden Zones



SELECTING PLANT SPECIES

- Mature plant size
  - Proximity to buildings and utility lines
  - Pruning and shaping
- Seasonal interest
  - Flowers
  - Fall color
  - Winter character
- Beneficial wildlife
  - Flowers for butterflies
  - Fruits for song birds



GRASSES & GROUND COVERS

BUFFER

- Broomsedge
- Bearberry
- Panic grass
- Switchgrass
- Little bluestem
- Indiangrass

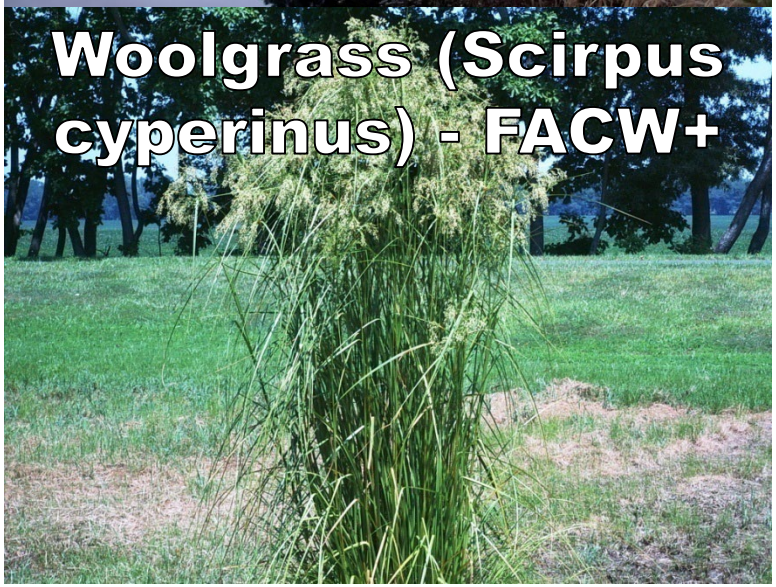
BASE

- Big bluestem
- Virginia wild-rye
- Switchgrass
- Wool grass

SLOPE

- Bluejoint grass
- Sedges
- Fowl mannagrass
- Softrush

GRASSES & GROUND COVERS



WILDFLOWERS & FERNS

BUFFER

- Butterfly milkweed
- Wild indigo
- Purple coneflower
- Beebalm
- Black-eyed susan

BASE

- New England aster
- New York aster
- Columbine
- Coreopsis
- Joe-pye weed
- Blazing star
- Sensitive fern
- Cinnamon fern
- Ironweed

SLOPE

- Swamp milkweed
- Marsh marigold
- Turtlehead
- Boneset
- Rose-mallow/hibiscus
- Blueflag iris
- Cardinal flower
- Blue lobelia
- Monkey flower

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WILDFLOWERS

TREES & SHRUBS

BUFFER

- Hackberry
- Red Bud
- Pepperbush
- American Holly
- Bayberry
- Witchhazel
- White Oak
- Red Oak
- Arrowwood Viburnum

BASE

- Red Maple
- Service Berry
- River Birch
- Silky Dogwood
- Red-twig Dogwood
- Inkberry Holly
- Winterberry
- Sweetbay Magnolia

SLOPE

- River Birch
- Buttonbush
- Silky Dogwood
- Green Ash
- Swamp White Oak
- Pin Oak
- Cranberrybush Viburnum

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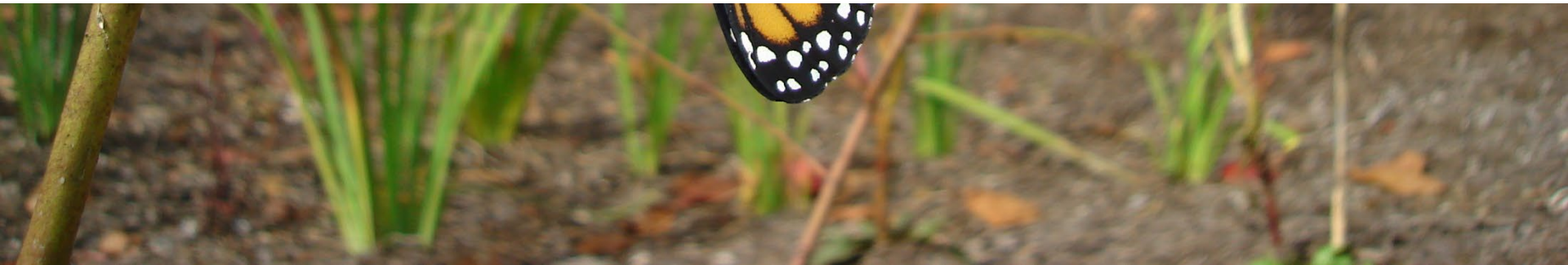
Water Resources Program

TREES & SHRUBS

INSPECTION AND MAINTENANCE

MAINTAINING YOUR RAIN GARDEN



MAINTENANCE MEASURES

WEEKLY TASKS:

1. Watering
2. Weeding
3. Inspecting

ANNUAL TASKS:

1. Mulching
2. Pruning
3. Re-planting
4. Removing sediment
5. Soil Testing
6. Harvesting Plants
7. Cleaning of Gutters
8. Replacing materials (stone, landscape fabric)

Installed Rain Gardens from the Rain Garden Rebate Program

RUTGERS
New Jersey Agricultural Experiment Station

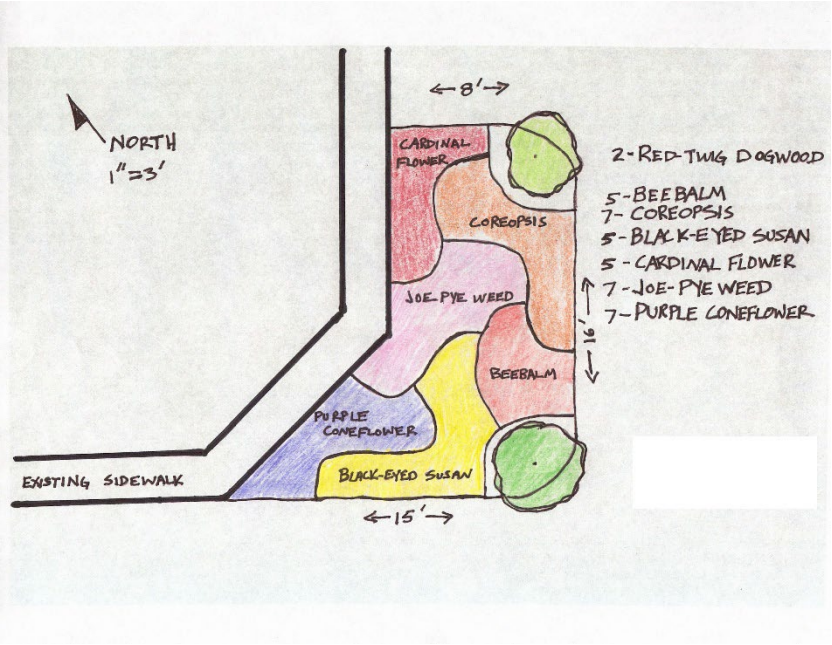
Water Resources Program

RUTGERS
New Jersey Agricultural Experiment Station

Water Resources Program

Design Example for Roof Runoff

Design



Installed Rain Garden

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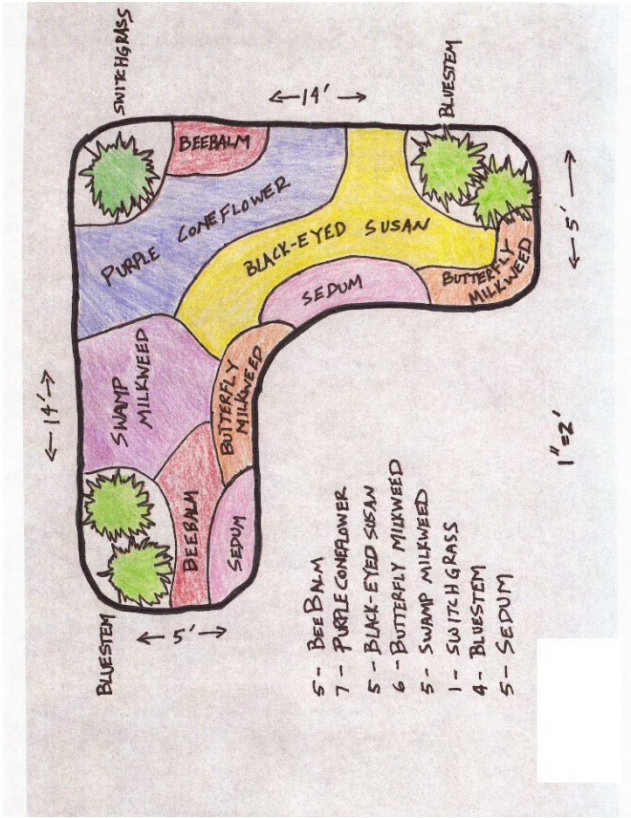
Water Resources Program

Design Example for Parking Lot Runoff

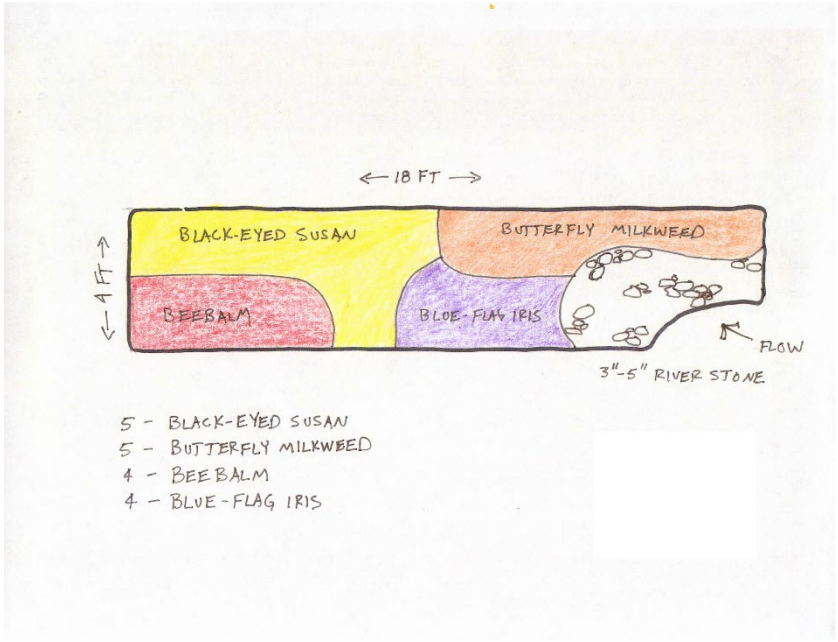
Design



Installed Rain Garden

Roof, Sump Pump and Driveway Runoff – WOW!

Design

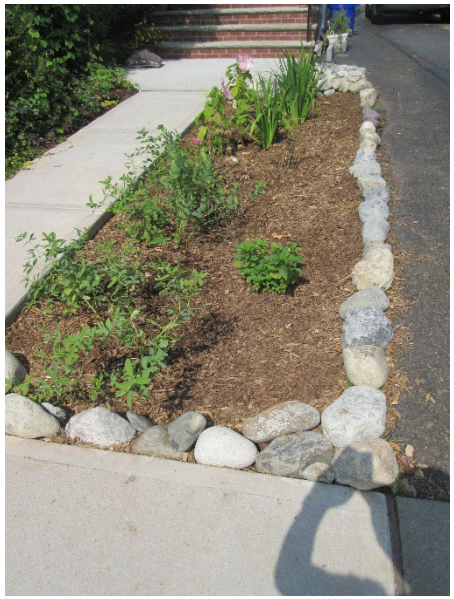


Installed Rain Garden

RUTGERS New Jersey Agricultural Experiment Station

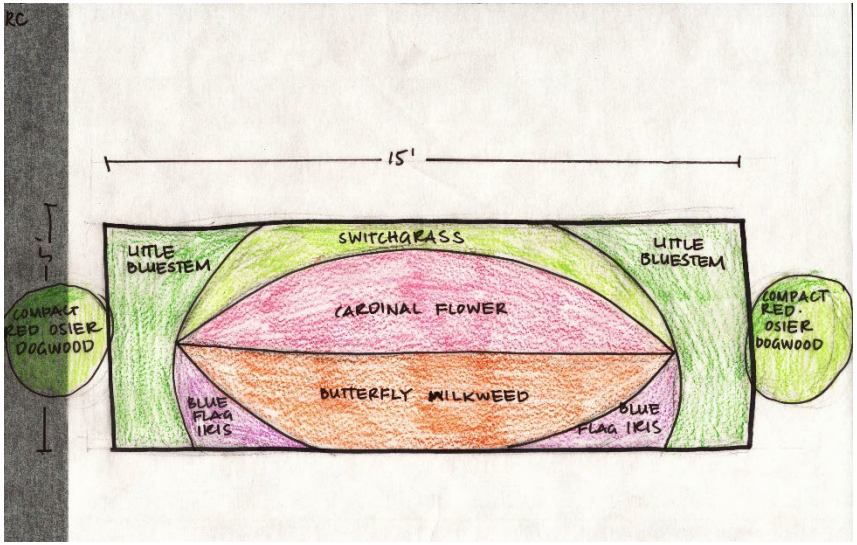
Water Resources Program


IVAN ST

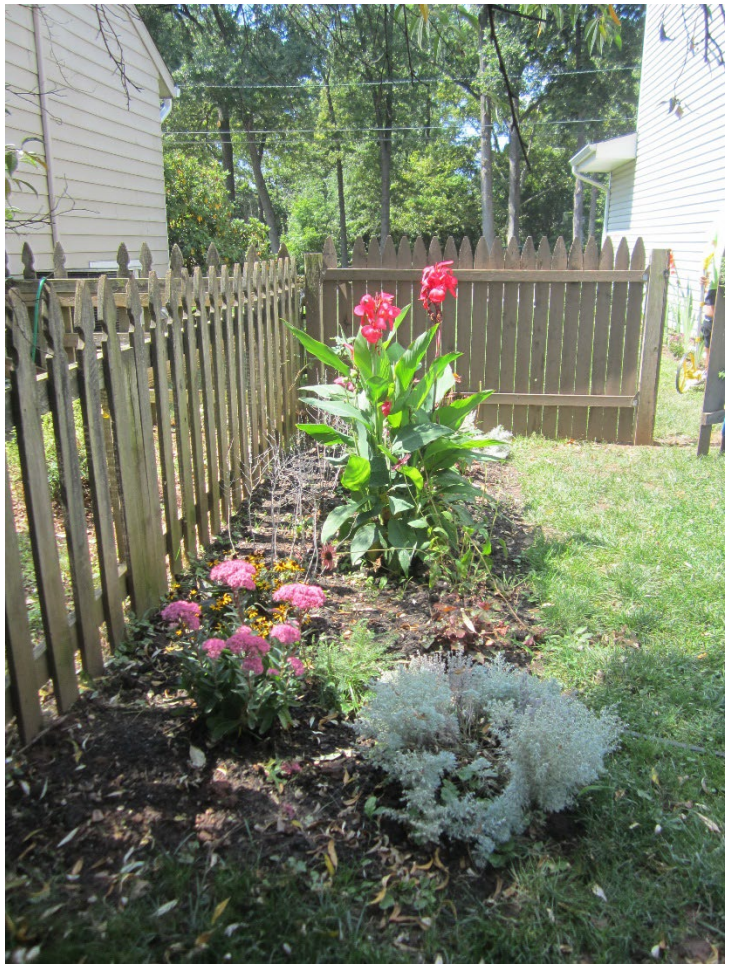


Roof Runoff from Rain Barrel Overflow

Design



Installed Rain Garden



Lots of Rain Gardens


116

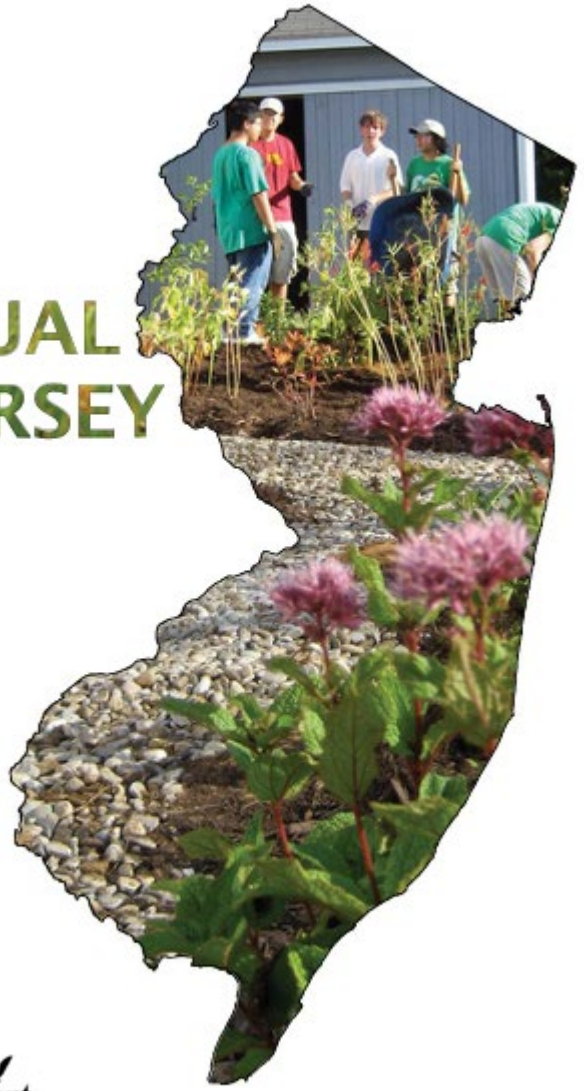

10/12/2018


10/12/2018


Season 2
10/12/2018

http://water.rutgers.edu/Rain_Gardens/RGWebsite/rginfo.html

RAIN GARDEN MANUAL OF NEW JERSEY



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Water Resources Program

Northeast States & Caribbean Islands Regional Water Center

Sea Grant NJ Sea Grant Consortium

Rain Garden 4+

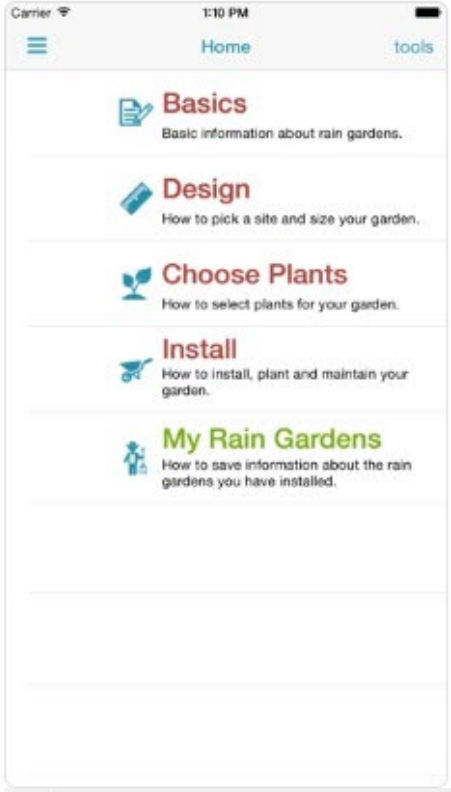
University of Connecticut

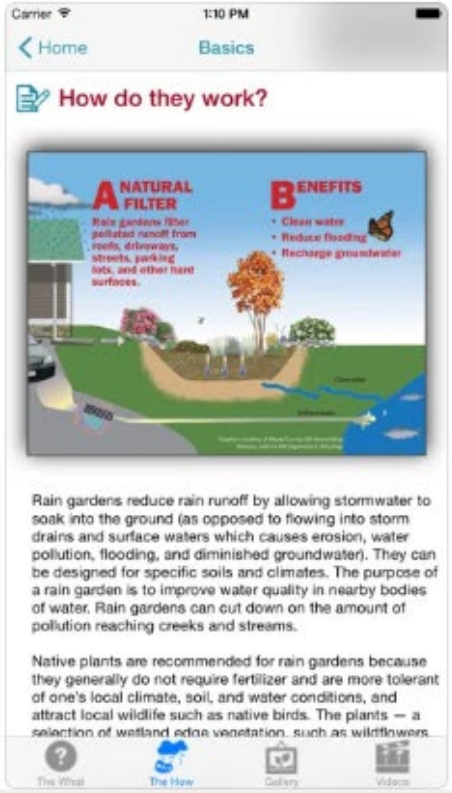
Designed for iPhone

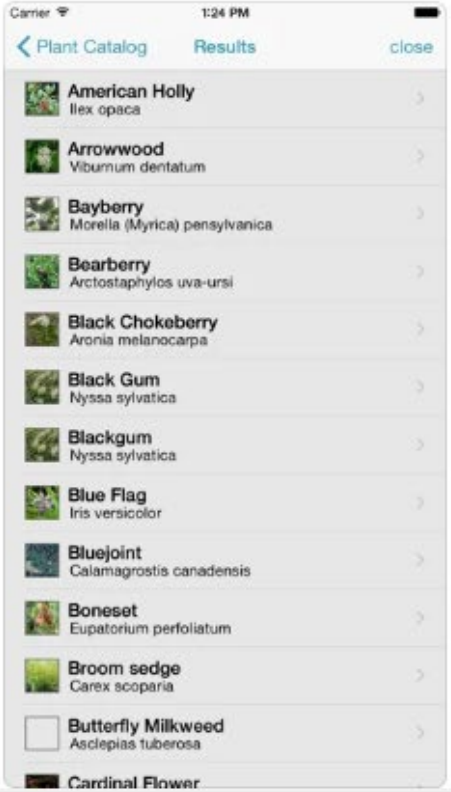
★★½☆☆ 2.6 • 11 Ratings

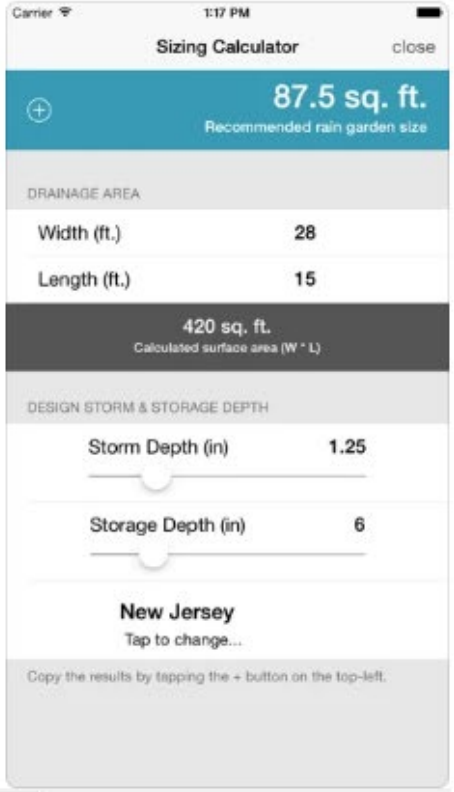
Free

iPhone Screenshots









Become a Green Infrastructure Champion Program Starts Jan. 13, 2023

Green Infrastructure Champions are key players in implementing green infrastructure as a stormwater management approach in their community.

- 10 training classes on various aspects of green infrastructure planning and implementation
- Professional staff to provide technical support to develop a design for a green infrastructure demonstration project
- Networking opportunities with other Green Infrastructure Champions for mutual support
- Assistance with grant writing and submission

Contact Hollie DiMuro for more info. hdimuro@envsci.rutgers.edu

Artistic Rendering Help Sell A Project

"Protecting Public Health and the Environment"

RUTGERS
New Jersey Agricultural Experiment Station

Artistic Rendering Help Sell A Project

"Protecting Public Health and the Environment"

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CURRENT CONDITION

CONCEPT DESIGN

RUTGERS
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