Stormwater Management's Role in Community Health and Prosperity

NJ League of Municipalities Conference

November 14, 2016

Stormwater Management's Role

Presiding Mayor:

The Honorable Dana Redd, Mayor of Camden

Panelist:

- Donna Drewes, Co-Director Sustainable Jersey
- Jennifer Gonzalez, Principal Planner, City of Hoboken
- Chris Obropta, Ph.D., P.E., Associate Extension Specialist in Water Resources, Rutgers Cooperative Extension Water Resources Program
- Edward Confair, RLA, PE, Project Manager, Engineering & Land Planning Assoc., Inc.

Introducing

Smart infrastructure. Strong communities.

Collaborative Structure

Network Email List

Sign up for the Jersey Water Works Network email list to receive a monthly newsletter with updates and and information.

Member

Members work together across boundaries to support, endorse and implement strategies identified by the collaborative.

Committee Member

Committees engage actively in the work of the collaborative and contribute to advancing the yearly objectives and longer term goals.

Steering Committee Member

Jersey Water Works is led by it's Steering Committee, a broad cross-section of individuals working together to upgrade New Jersey's water infrastructure.

Become a member today!

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#JWWMember

Shared Goals

Effective Green and Gray Infrastructure

Urbanized communities maintain and improve drinking water, wastewater and stormwater infrastructure systems to reduce flooding, protect the environment, and deliver quality water services in a way that maximizes community benefits.

Smart Combined Sewer Overflow (CSO) Plans

Municipalities and utilities adopt innovative CSO Long Term Control Plans (LTCPs) with cost-effective solutions and multiple community benefits that meet or exceed permit requirements.

Financially Sustainable Systems

Operating budgets and capital investment for drinking water, wastewater and stormwater infrastructure are adequate and affordable, resulting in systems that operate efficiently and in a state of good repair.

Empowered Stakeholders

Well-informed decision makers, community partners and ratepayers participate actively and influence the planning and management of their water infrastructure.

Committees

- Best Practices
  - ***Green Infrastructure***
- Municipal Outreach
- Finance
- Community Engagement
- CSO Network

GI Committee Purpose

The Green Infrastructure subcommittee works to promote and advance construction of green infrastructure projects in CSO communities and across the state.

GI Committee Goals & Subgoals

Effective Green and Gray Infrastructure

Urbanized communities maintain and improve drinking water, wastewater and stormwater infrastructure systems to reduce flooding, protect the environment, and deliver quality water services in a way that maximizes community benefits.

1.1. Installing Green Infrastructure

The public and private sectors integrate green stormwater infrastructure into new projects and existing facilities to reduce flooding and improve water quality, local economies, community health and long-term resiliency.

Smart Combined Sewer Overflow (CSO) Plans

Municipalities and utilities adopt innovative CSO Long Term Control Plans (LTCPs) with cost-effective solutions and multiple community benefits that meet or exceed permit requirements.

2.1. Balancing Pipes and Parks

LTCPs incorporate and commit to an optimized balance of green and gray infrastructure to achieve the goals of the Clean Water Act.

2.3. Serving Host Communities

Implementation of the LTCPs delivers significant additional community benefits including improved public health, green space, economic revitalization and local jobs.

GI Committee 2016 Actions

Work Plan Action Items	Volunteers
Action 1: Sustainable Jersey Actions	**Chris Obropta, Jen Gonzalez, Maureen Krudner, Jennifer Duckworth, Maria Watt, Russ Dudley**
Action 2: Green Infrastructure in Parks	Dan Van Abs, Chris Sturm
Action 3: Green Infrastructure Monitoring Database	Nick Tufaro, Heather Fenyck, Maria Watt
Action 4: Green Streets	Rob Pirani, Jen Gonzalez, Jennifer Duckworth, Maureen Krudner, David Antonio
Action 5: Green Infrastructure in Construction/Development	Kandyce Perry, Louise Wilson
Action 6: Citizen's Handbook for Green	Ashwani Vasishth , Tim Van Epp

Sustainable Jersey Green Infrastructure Actions

Jersey Water Works Green Infrastructure Subcommittee

Planning Action

Tier 1. Impervious Cover Assessment [5 pts]

Tier 2. Green Infrastructure Action Plan [10 -15 pts]

Tier 3. Green Infrastructure Strategic Plan [20 pts]

Planning Action

Tier 1. Impervious Cover Assessment

- Establishes baseline for Tiers 2 and 3
- Assemble GIS data by watershed and sewershed (if available)
- Analyze data, create charts and maps
- Calculate the impervious cover area
- Calculate the stormwater runoff volumes

Planning Action

Tier 2. Green Infrastructure Action Plan

- Requirements of Tier 1
- Engage the Community
- Set short-term Impervious cover management goal (% or acreage)
- Identify sites for immediate and short-term GI projects
- Determine feasibility
- Develop concept plans and project sheets
- Identify costs, benefits, and funding
- Link to Stormwater Mitigation Plan

Planning Action

Tier 3. Green Infrastructure Action Plan

- Requirements of Tiers 1 & 2
- Identify siting opportunities and constraints
- Set long-term Impervious cover management goal (% or acreage)
- Use opportunities and constraints to identify sites for long-term GI projects and policy recommendations
- Assess the water quantity and quality benefits (modeling)
- Develop an implementation agenda
- Link to Stormwater Mitigation Plan

Technical Resources

- New Jersey Green Infrastructure Guidance Manual
- New Jersey Rain Garden Manual
- Rutgers Water Resources Introduction to Green Infrastructure
- Rutgers Water Resources Green Infrastructure Fact Sheets
- US EPA Green Infrastructure Information
- NJDEP Green Infrastructure Information

Mapping Resources

- NJ Flood Mapper
- NJ ADAPT
- Getting To Resilience
- NJGIN New Jersey Geographic Information Network
- NJDEP GeoWeb Environmental Mapping Tool
- NJDEP 3.0 HUD Environmental Review Tool
- NJDEP Municipal recreation and open space inventory
- EPA Stormwater Calculator
- USGS Web Soil Survey
- Climate Central Surging Seas
- NOAA Sea Level Rise Viewer
- Environmental Protection Agency Climate Ready Water Utilities

Sample Planning Documents

- Sample Impervious Cover Assessments:
  - New Brunswick Impervious Cover Assessment
  - Hillsborough Impervious Cover Assessment
  - Impervious Cover Assessments and Reduction Action Plans for Raritan River Basin Municipalities
- Sample Green Infrastructure Action Plans:
  - Camden Green Infrastructure Feasibility Study
  - Newark Green Infrastructure Feasibility Study
  - Paterson Green Infrastructure Feasibility Study
  - Impervious Cover Assessments and Reduction Action Plans for Raritan River Basin Municipalities
- Sample Green Infrastructure Strategic Plans:
  - New York City Green Infrastructure Plan
  - Milwaukee Metropolitan Sewerage District Fresh Coast Green Solutions Plan
  - Hoboken Green Infrastructure Strategic Plan

Implementation Action

Tier 1. Implementation of green infrastructure demonstration projects [10 pts]

Tier 2. Implementation of short-term green infrastructure projects [15 pts]

Tier 3. Implementation of policy changes and long-term green infrastructure projects [20 pts]

HOBOKEN

Green Infrastructure in Hoboken, NJ

Case Study

New Jersey League of Municipalities

November 15, 2016

HOBOKEN

Green Infrastructure Planning and Policy

TOGETHER NORTH JERSEY.

CONNECTING PEOPLE, PLACES, AND POTENTIAL.

HOBOKEN GREEN INFRASTRUCTURE STRATEGIC PLAN

HOBOKEN, NJ

OCTOBER 2013

FINAL REPORT





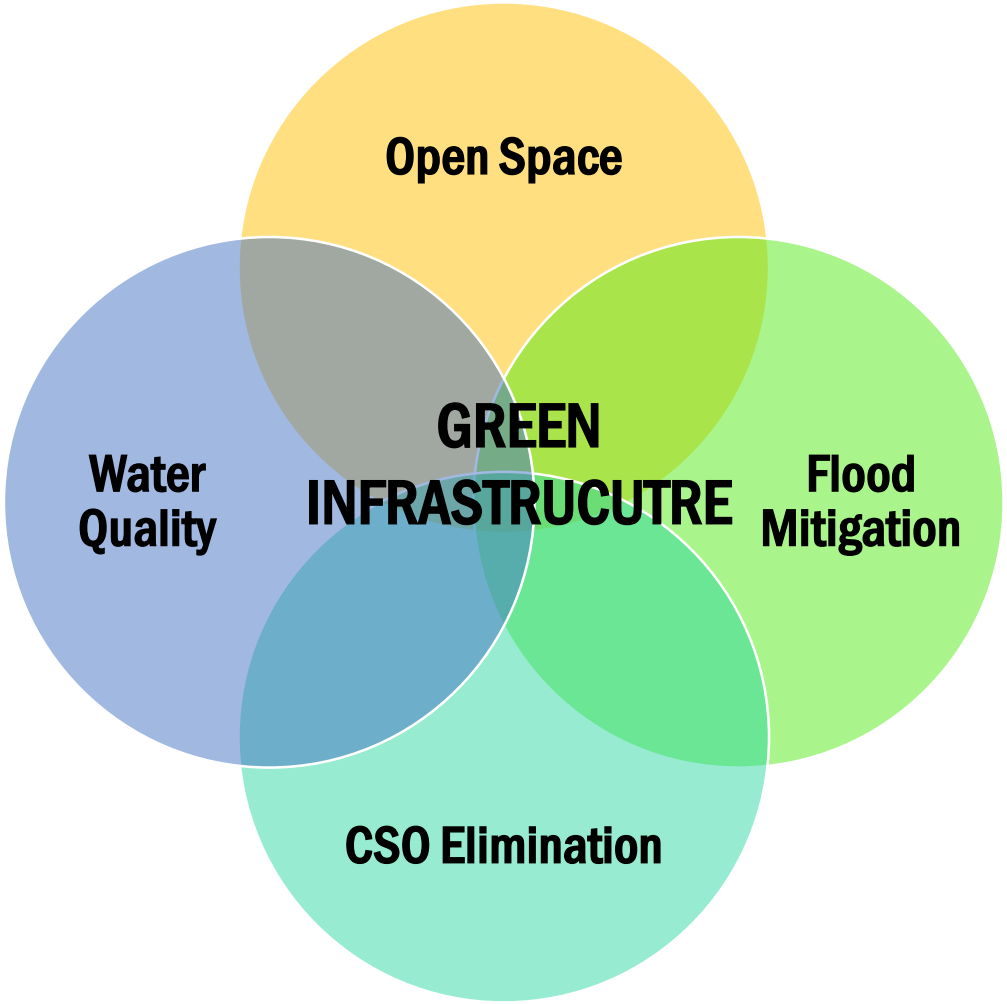
HOBOKEN Quality Of Life Coalition

STEVENS

NJTRANSIT The Way To Go

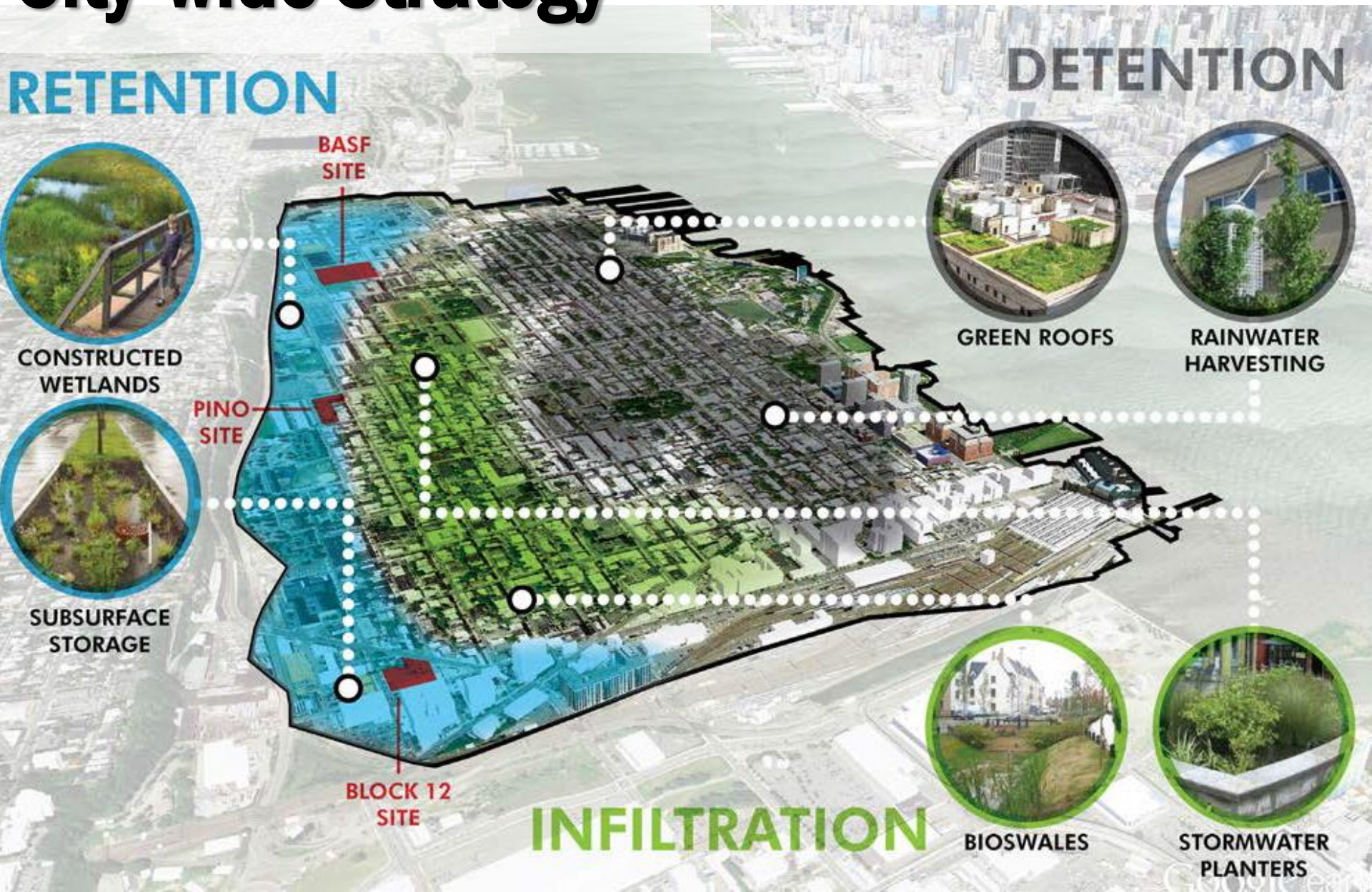
Green Infrastructure BMPs Considered

- Subsurface Storage
- Greenroofs
- Raingardens
- Rainwater Harvesting
- Stormwater Tree pits
- Vegetated Swales (right-of-way bioswales)
- Constructed Wetlands
- Basins or Ponds
- Permeable Pavements
- Stormwater Infiltration Planters



Methodology

City-wide Strategy



Rainwater Harvesting

Code §136-2

- Legalized use of rain barrels in 2011
- Rain barrels were previously considered a nuisance
- Any container maintained for the short-term collection of rainwater must have a properly fitting lid, be access-resistant to insects and rodents and must be maintained in good working order at all times and must be kept in a clean and sanitary way

City Hall

Green Roofs

Code §196-28

- Incentivized use of green roofs in 2015
- Green roofs are encouraged wherever possible (especially on roofs with surface area of ≥ 5,000 SF)
- If a green roof is provided on at least 50% of the roof surface, the remainder may be utilized for a roof deck
- Rooftop gardens are considered a green roof and may cover up to 90% of a roof's surface area

14th & Park Street

Proposed Amendment to Stormwater Management Plan / Ordinance

Code §166

- Current Stormwater Management Plan (2007)
  - Only applies to major development projects (≥ 1 acre disturbance) in the MS4 area
- Proposed amendment sets broad stormwater design and performance standards for stormwater retention, runoff quantity and runoff quality
  - Applies to new development, redevelopment and disturbance ≥3,000 SF across the entire City
  - Ensures that individual property owners are not limited in how they fulfill regulatory requirements
  - Fosters innovation
- Requires using nonstructural BMPs or green infrastructure to the maximum extent practicable before using structural BMPs
- References, and supersedes, latest NHSA Technical Requirements for Stormwater Management:

HOBOKEN

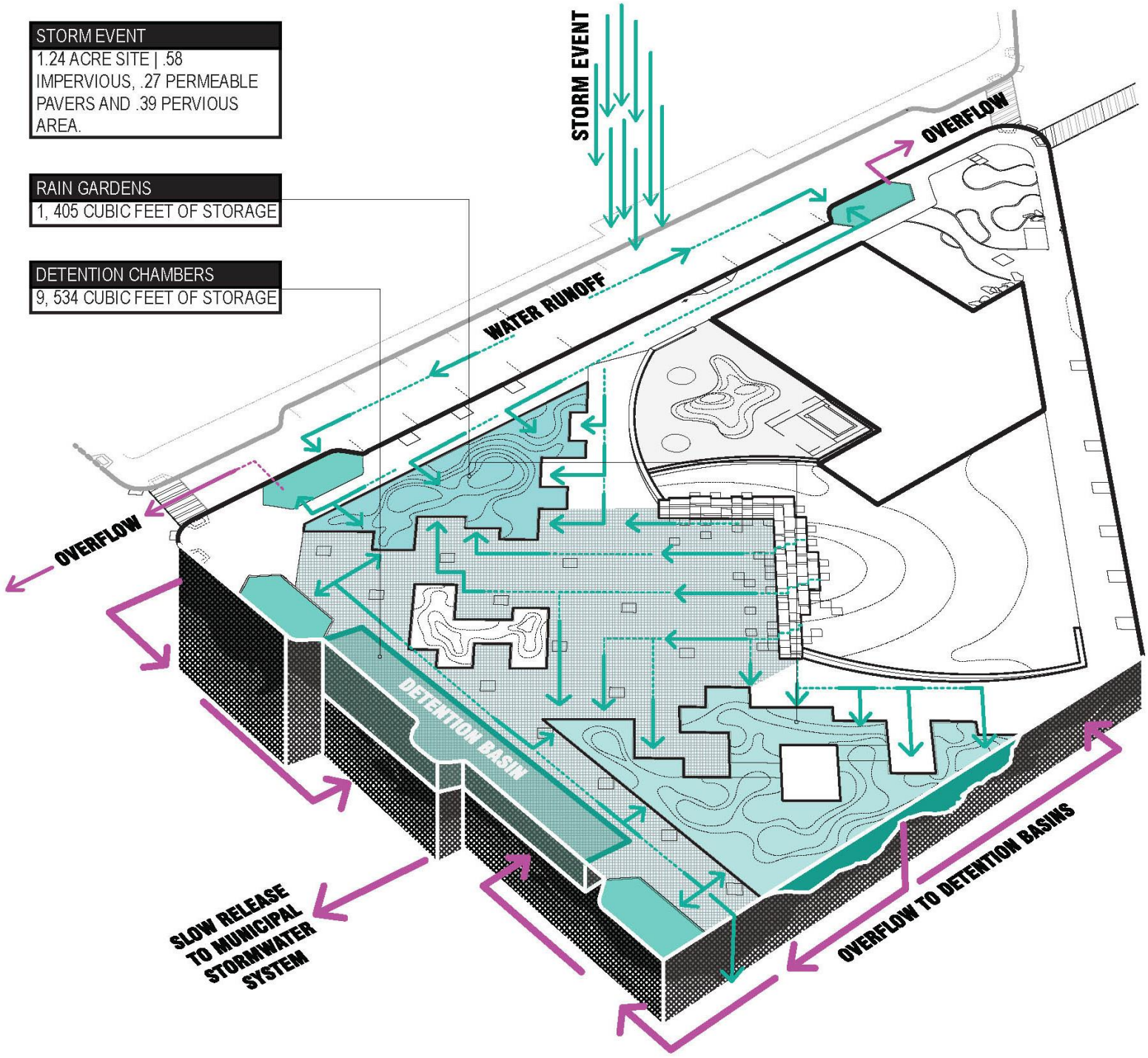
Green Infrastructure Implementation

Southwest Park

STORM EVENT
1.24 ACRE SITE | .58 IMPERVIOUS, .27 PERMEABLE PAVERS AND .39 PERVIOUS AREA.

RAIN GARDENS
1, 405 CUBIC FEET OF STORAGE

DETENTION CHAMBERS
9, 534 CUBIC FEET OF STORAGE



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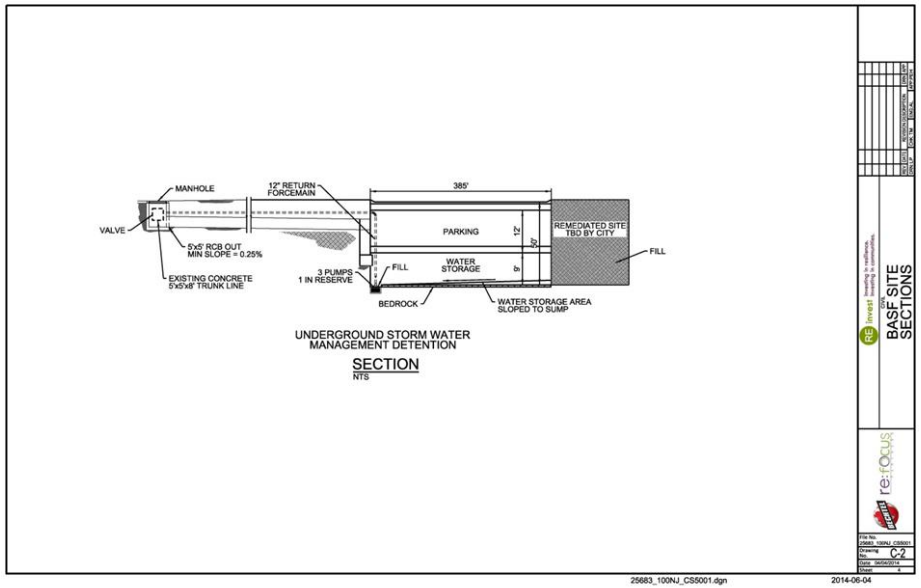
H1 and H5 Pump Stations

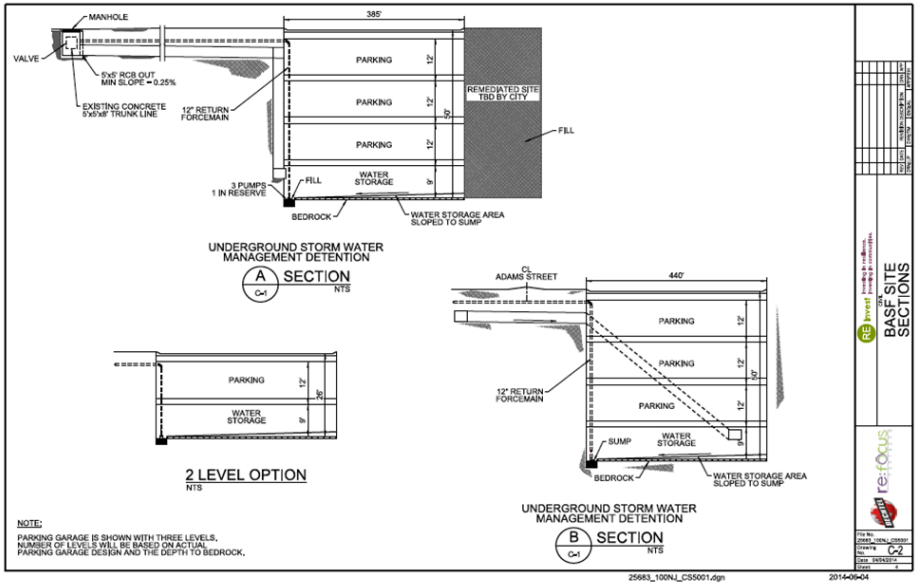
Washington Street Redesign

City Hall Green Infrastructure


Northwest Park
Adams Street
12th Street
Resiliency Park
Resiliency Park
Parking Garage
13th Street
Madison Street
N

- Integrated flood management solutions to complement RBD
- Proposed a combined surface and sub-surface plan to utilize 4 contiguous acres of the 6-acre BASF site that would include:
  - Stormwater detention facility
  - Underground parking garage
  - Surface park space
  - Integrated green infrastructure





NHSA Eco-Zone

- Create an “ecological zone” in part of the H6 and H7 drainage areas
- Would install new storm sewer infrastructure to separate the currently combined system
- Stormwater would flow to the BASF site where solids and floatables would be removed
- Stormwater would be detained under BASF site until the detention facility is at capacity
- New stormwater pump station on BASF site would pump to a new outfall in Weehawken Cove
- Engineered wetlands in Cove would filter stormwater

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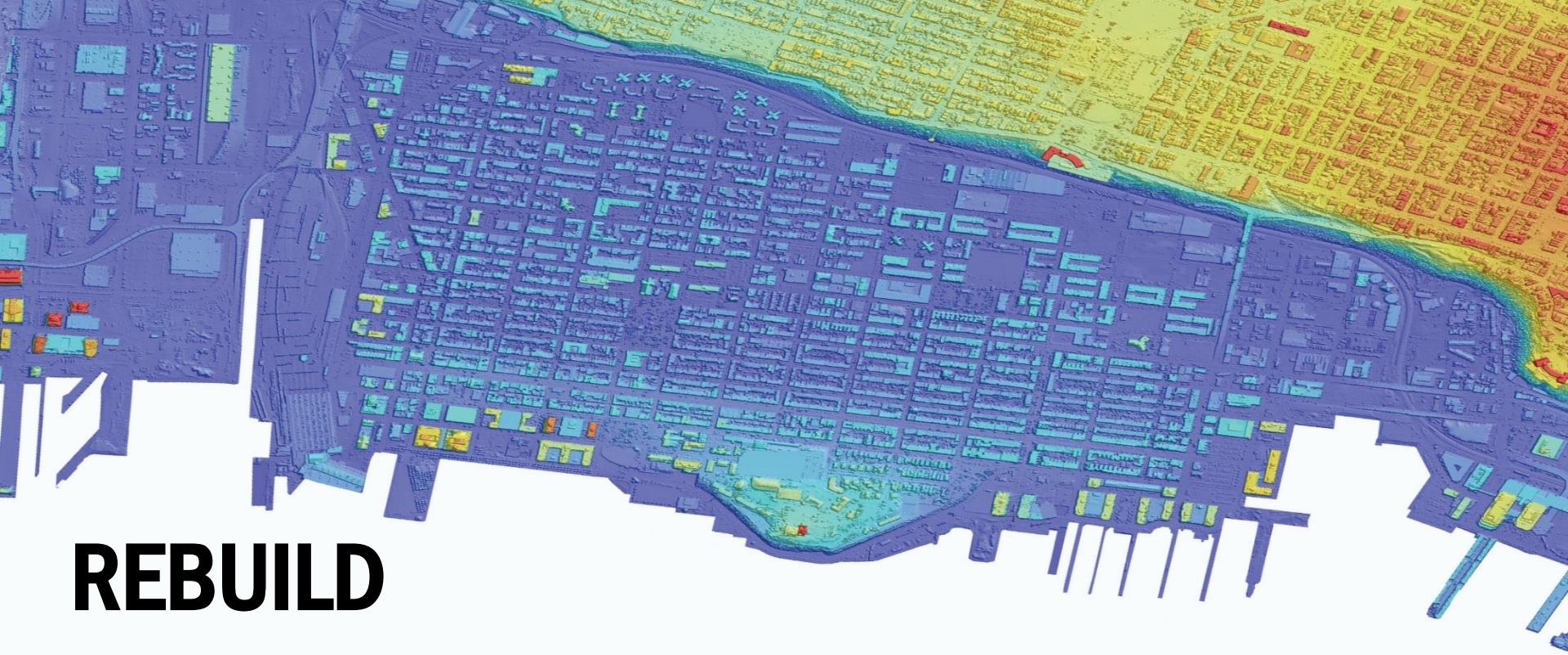


REBUILD BY DESIGN

RESIST DELAY STORE DISCHARGE

HUDSON RIVER

HOBOKEN WEEHAWKEN JERSEY CITY | NEW JERSEY

Rebuild by Design Vision

Dewberry

State of New Jersey Department of Environmental Protection

Delay, Store, Discharge: Drainage Area

Proposed underground detention facilities with green/open space on ground surface with discharge features such as pumps to manage rainfall runoff volume

ROW Green/Grey Infrastructure Practices

- Total of 61 sites to manage street drainage for approx. 13 acres

NJ Transit site

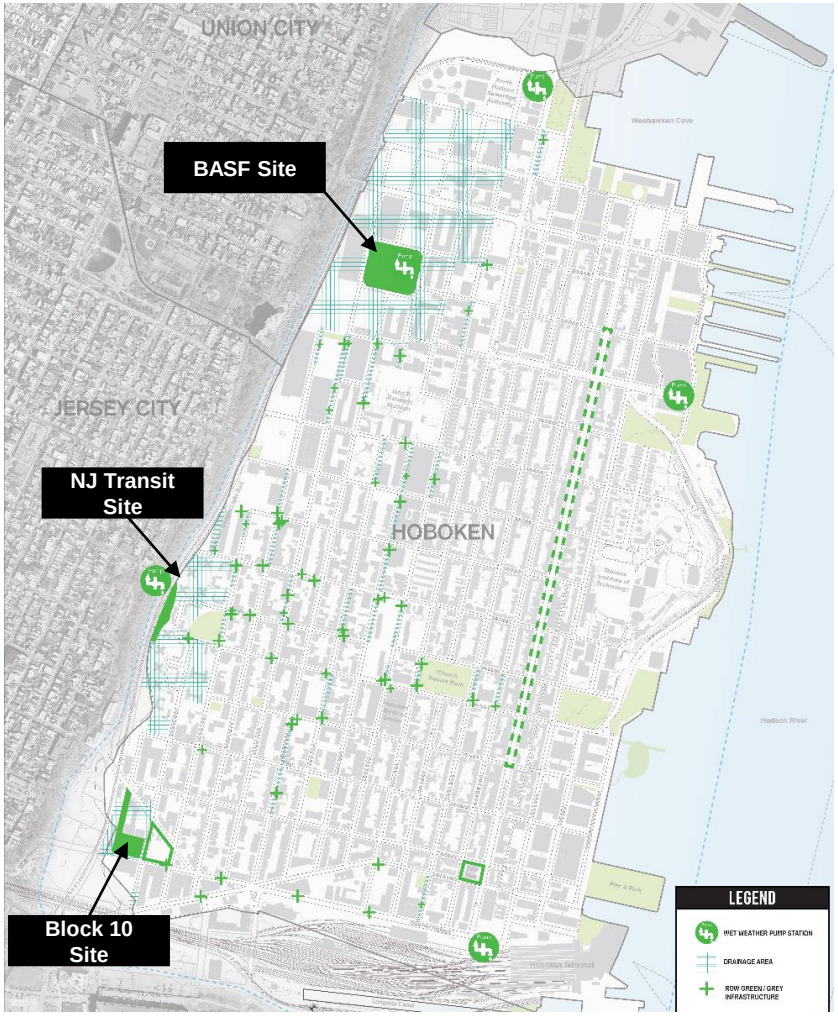
- Manages rainfall runoff for approx. 15 acres

Block 10 site

- Manages rainfall runoff for approx. 8 acres

BASF site

- Manages rainfall runoff for approx. 55 acres



Dewberry

State of New Jersey Department of Environmental Protection

Thank you!

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HOBOKEN

RUTGERS
THE STATE UNIVERSITY
OF NEW JERSEY

Resources for Implementing Stormwater Management

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November 15, 2016

www.water.rutgers.edu

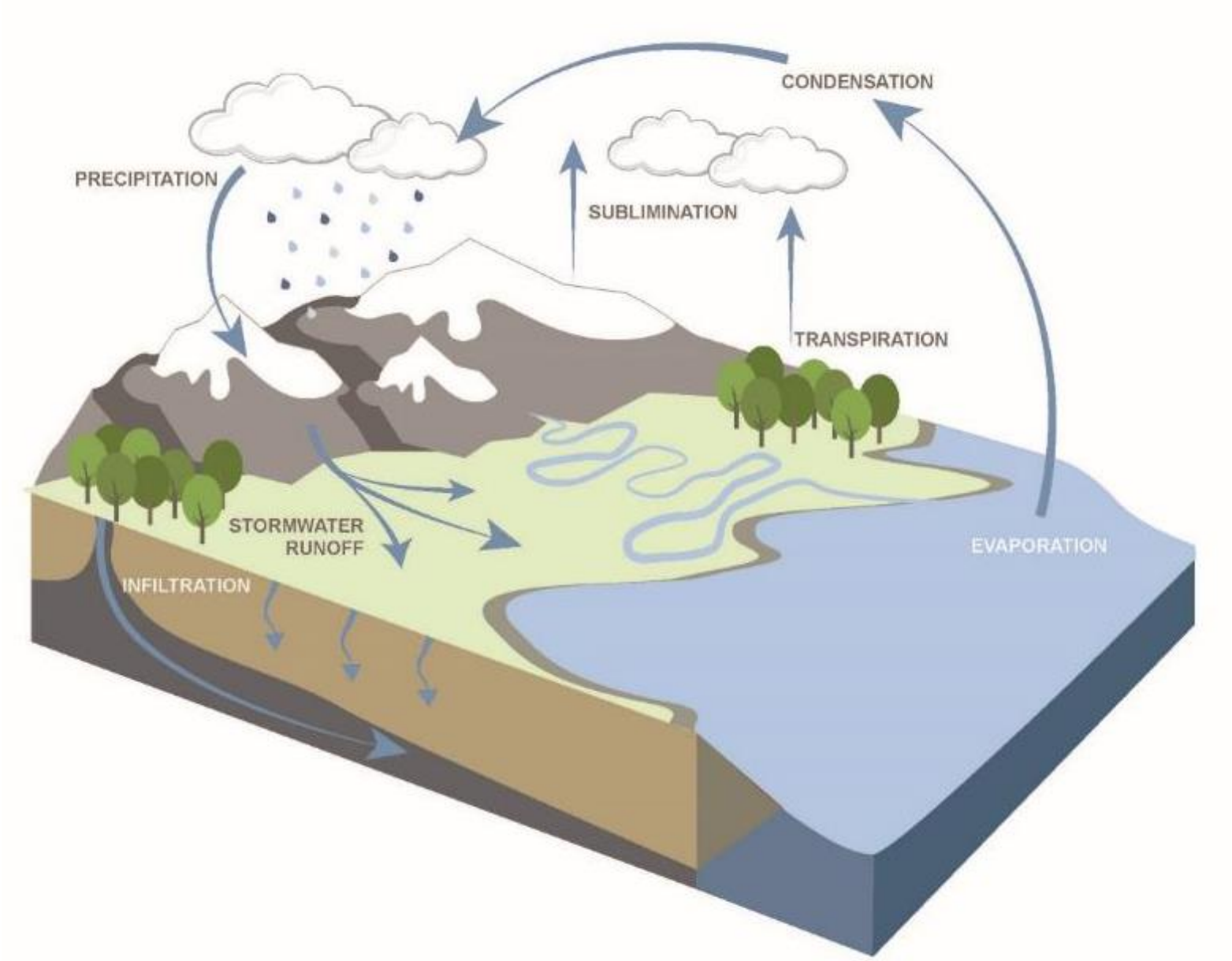
Rutgers Cooperative Extension

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.

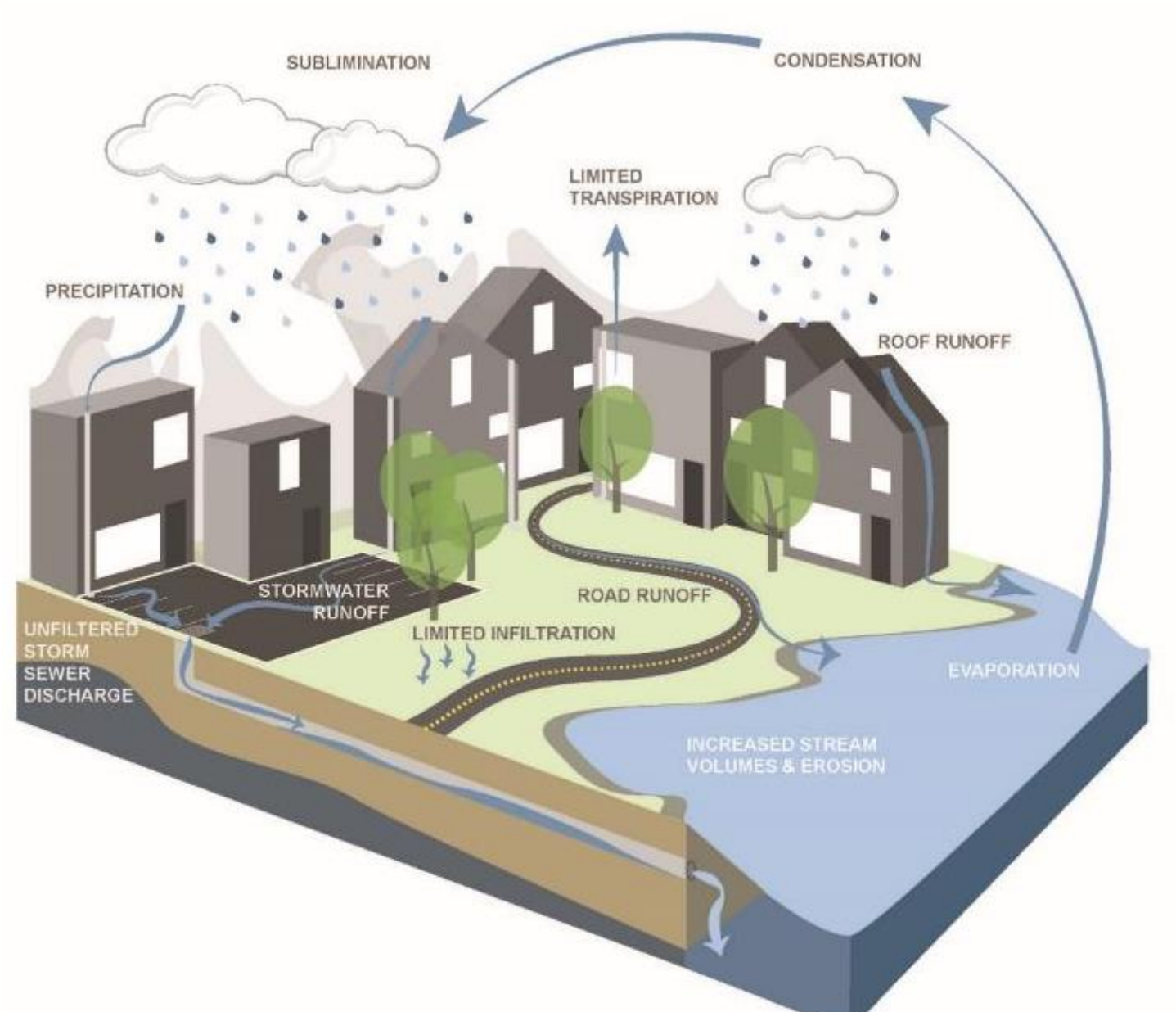
Water Resources Program

Our Mission is to identify and address community water resources issues using sustainable and practical science-based solutions.

The Natural Hydrologic Cycle



The Urban Hydrologic Cycle



A Brief 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
- Reduce downstream flooding during major storms
- Use concrete low flow channels to reduce standing water
- Allows stormwater from small storms to pass through the system
- Directly discharges stormwater runoff to nearby stream, waterway, or municipal storm sewer system

3rd Generation of Stormwater Management

- Reduce peak flows and flooding

…and….

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

abc Action News, August 27, 2012

What is Green Infrastructure?

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

Green Infrastructure projects:

- capture
- filter
- absorb
- reuse

stormwater to help restore the natural water cycle.

How does Green Infrastructure work?

Green Infrastructure practices use *soil* and *vegetation* to recycle stormwater runoff through infiltration and evapotranspiration.

Why Green infrastructure?

- Remediates flooding
- Improve water quality
- Reduces combined sewer overflows
- Cost-effective
- Small-scale systems that capture runoff near its source
- Mimic and help restore the natural hydrologic cycle
- Enhances aesthetics
- Cleans the air
- Reduces heat island effect

GREEN INFRASTRUCTURE TECHNOLOGIES

Green Infrastructure Systems:

- *Vegetative Systems*
  - Bioretention Systems/Rain Gardens
  - Stormwater Planters
- *Harvesting Systems*
  - Cistern/Rain Barrel
  - Downspout Planter Boxes
- *Storage Systems*
  - Street Trees/Stormwater Tree Pits
  - Pervious Pavement

Difference between the types of systems:

- *Vegetative Systems*: focus on reducing water quality impacts. These systems are typically located close to the sources of runoff and can manage the smaller storms of several inches. The main treatment mechanisms are infiltration, filtration, and evapotranspiration.

- *Harvesting Systems*: focus on the conservation, capture, storage, and reuse of rainwater. These systems are located close to residential and commercial buildings.

- *Storage Systems*: provide storage of stormwater, quantity control, and infiltrate stormwater runoff. These systems are typically located close to runoff sources within residential, commercial, and industrial landscapes. The main treatment mechanism is reducing peak flows of stormwater by storing it before it enters the sewer system.

Bioretention Systems/Rain Gardens



Landscaped, shallow depression that captures, filters, and infiltrates stormwater runoff.

Vegetative System

Bioretention Systems / Rain Gardens

How it works:

These systems capture, filter, and infiltrate stormwater runoff using soils and plant material. They are designed to capture the first few inches of rainfall from rooftops, parking areas, and streets.

Benefits:

Removes nonpoint source pollutants from stormwater runoff while recharging groundwater

Restore/"mimic" predevelopment site hydrology

- Infiltration
- Evapotranspiration

Improve water quality

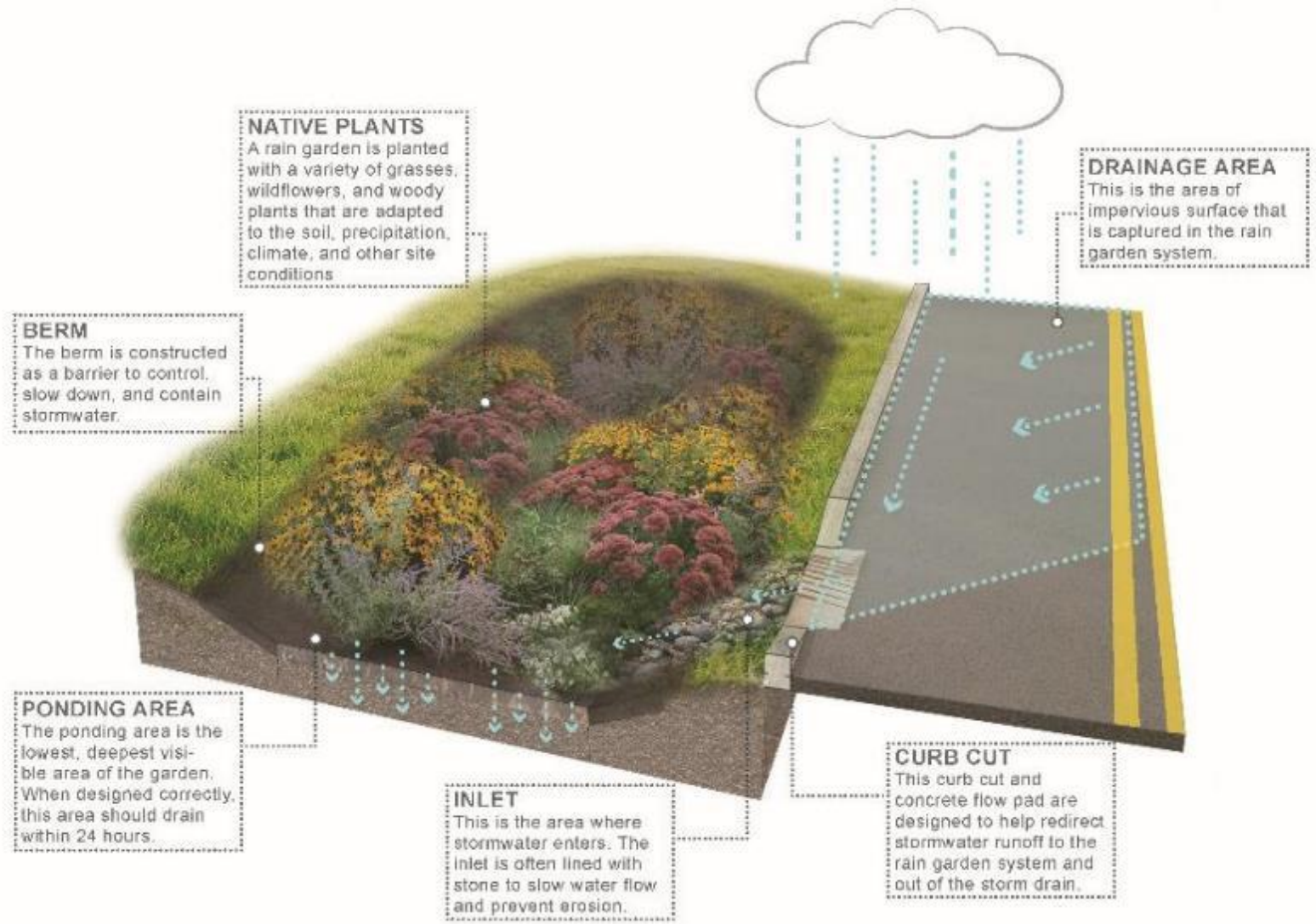
- Sedimentation, filtration, & plant uptake
- Microbial Activity

Add aesthetic value

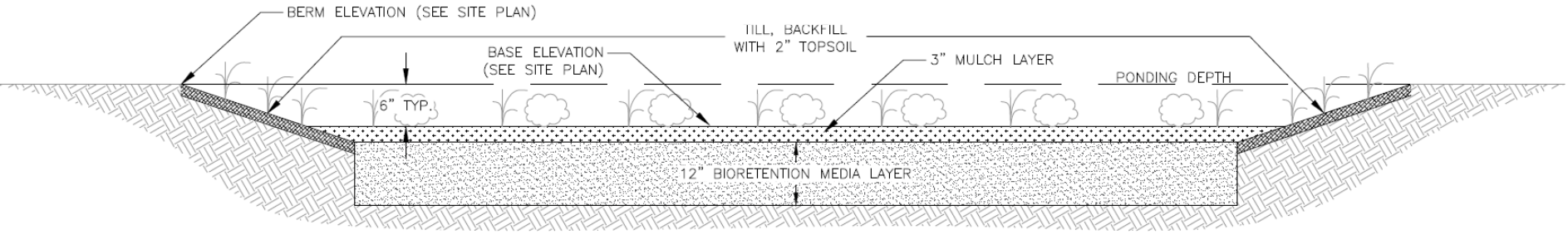
- Plant selection

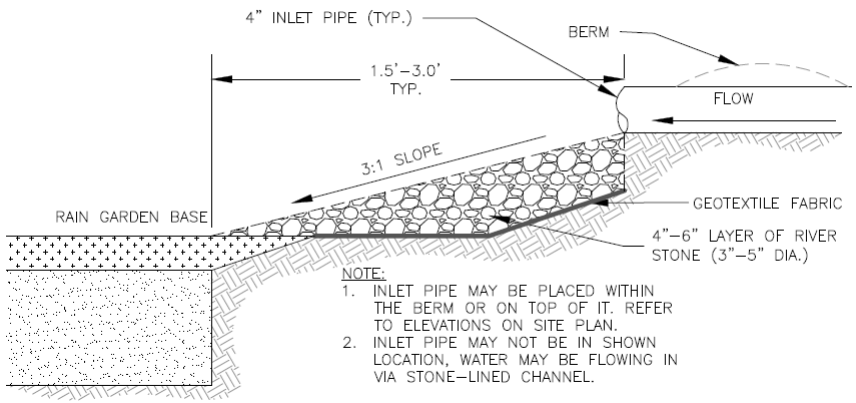
Vegetative System

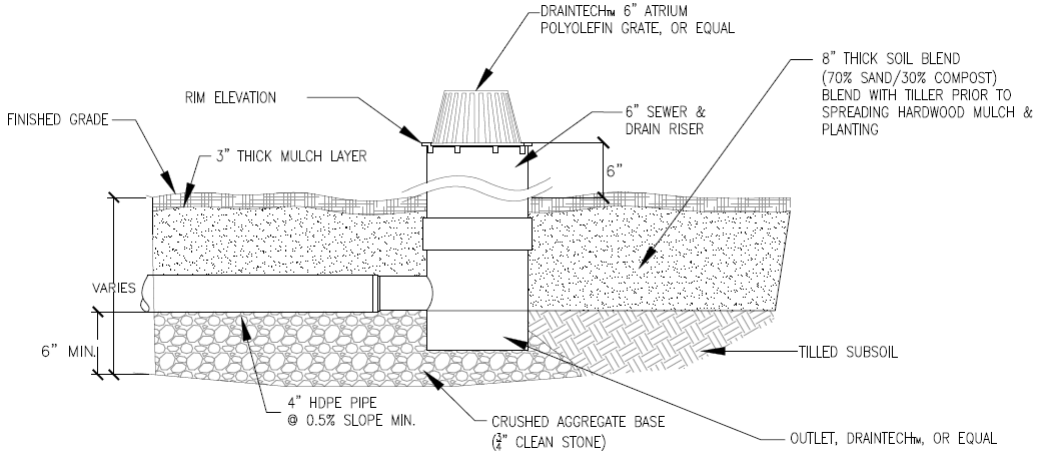
Bioretention System/Rain Garden



Bioretention Systems / Rain Gardens







Vegetative System

Rain garden at Catto School in Camden, NJ

Vegetative System

Rain garden installation at Ferry Avenue Library in Camden, NJ

Vegetative System

Stormwater Planters

Vegetated structures that are built into the sidewalk to intercept stormwater runoff from the roadway or sidewalk.

Stormwater Planters

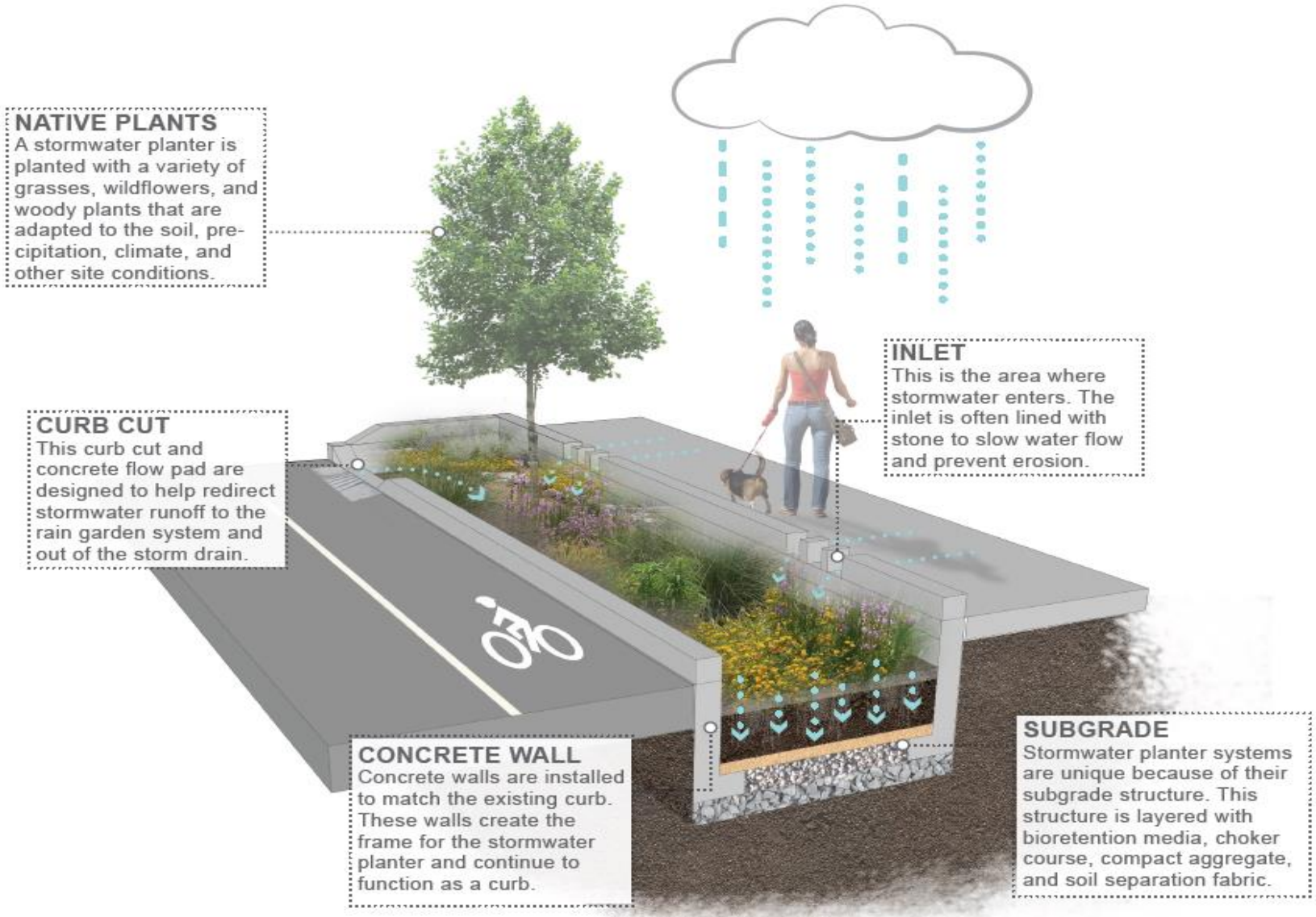
How it works:

- It is a structural bioretention system that is installed in a sidewalk
- Contains a layer of stone that is topped with bioretention media and plants or trees
- Captures stormwater runoff from the roadway and sidewalk
- Once the system fills up, runoff flows back into the street or into an overflow drain which connects to the sewer system

Benefits:

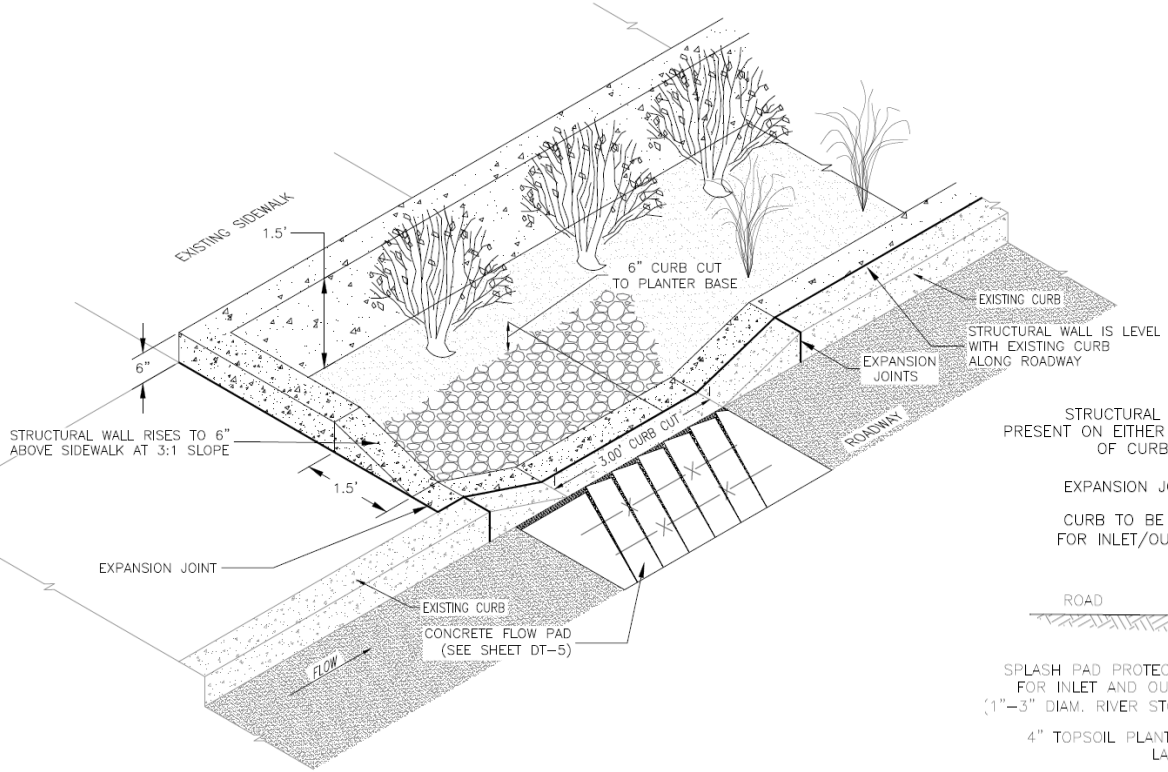
- Allows water to infiltrate into the ground

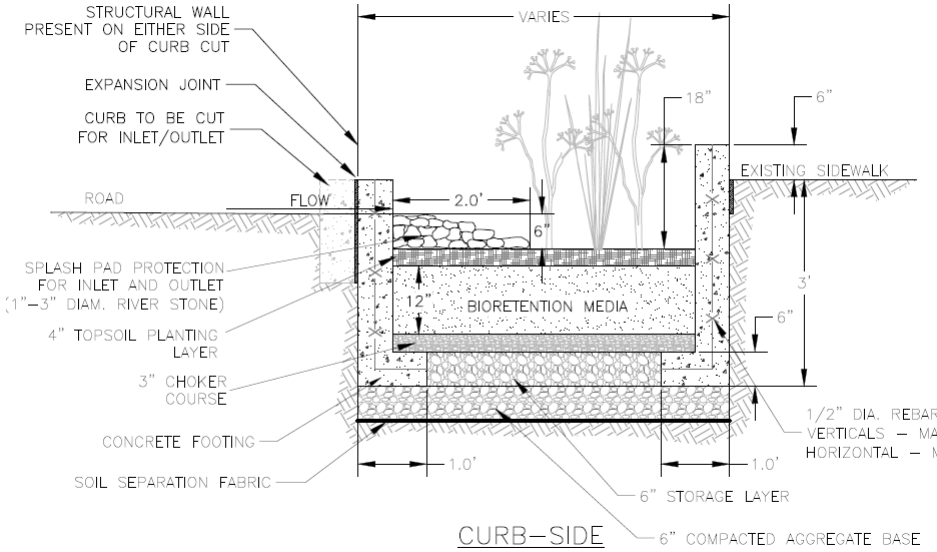
Stormwater Planter



Stormwater Planters

Typically, 4 feet wide by 20 feet long





Vegetative System

Stormwater Planter at the Brimm School in Camden, NJ

Vegetative System

Stormwater Planters at Community Garden in Camden, NJ

Vegetative System

Cisterns/ Rain Barrels

These systems capture rainwater, mainly from rooftops, in cisterns or rain barrels. The water can then be used for water garden, washing vehicles, or for other *non-potable* uses.

Cistern/ Rain Barrel

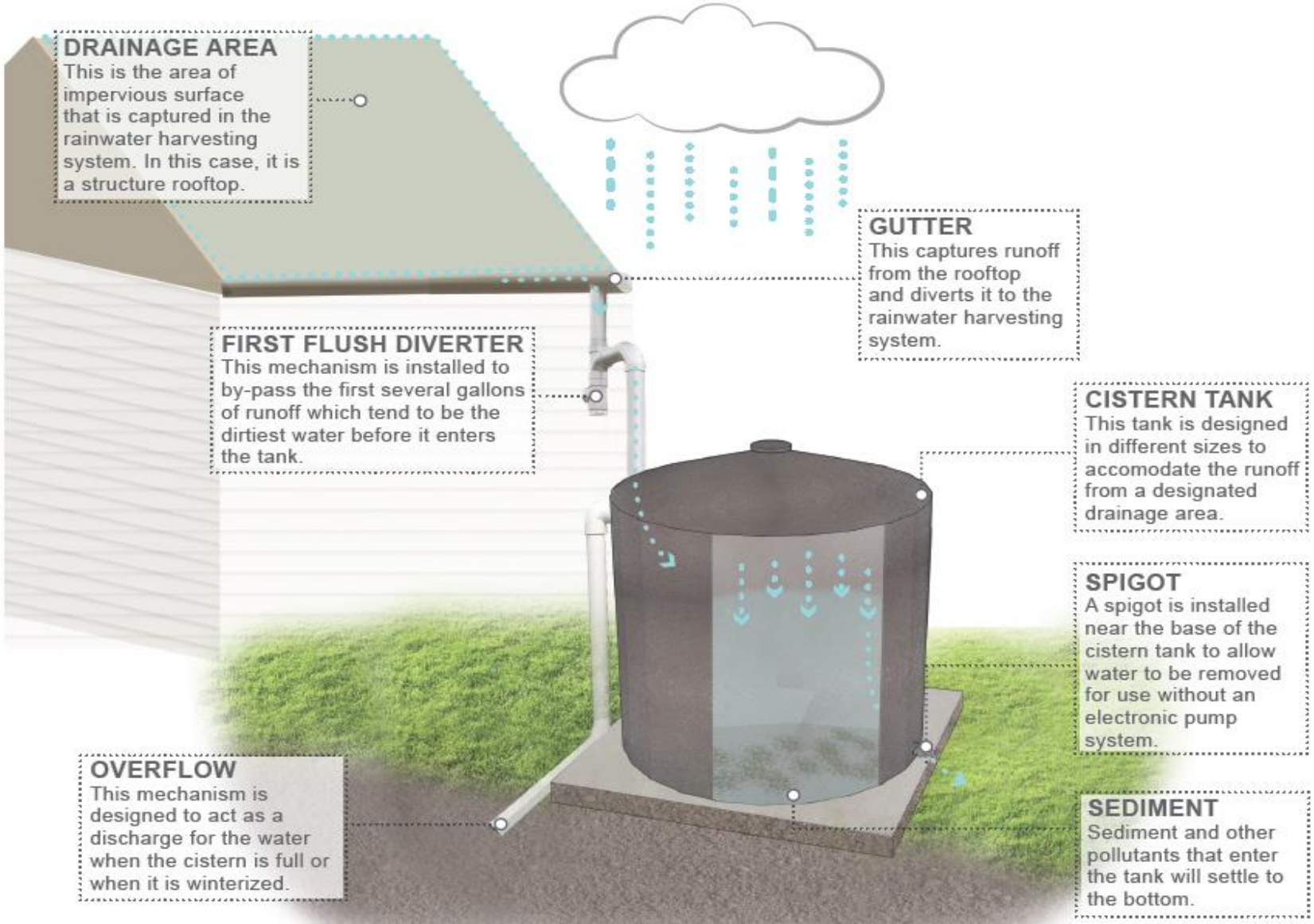
How it works:

- Capture, diversion, and storage of rainwater

Benefits:

- Eliminates need for complex and costly distribution systems
- Provides additional water source
- Landscape irrigation
- Reduces flow to stormwater drains
- Reduces non-point source pollution
- Delays expansion of existing water treatment plants
- Reduces consumers' utility bills

Rainwater Harvesting



Cistern at the Neighborhood Center in Camden, NJ

Harvesting System

Cistern at St. Bartholomew's Church in Camden, NJ

Harvesting System

Cistern at Front Street Community Garden in Camden, NJ

Harvesting System

Downspout Planters

Wooden or concrete boxes with plants installed at the base of the downspout that provide an opportunity to beneficially reuse rooftop runoff.

Downspout Planter: Harvesting System

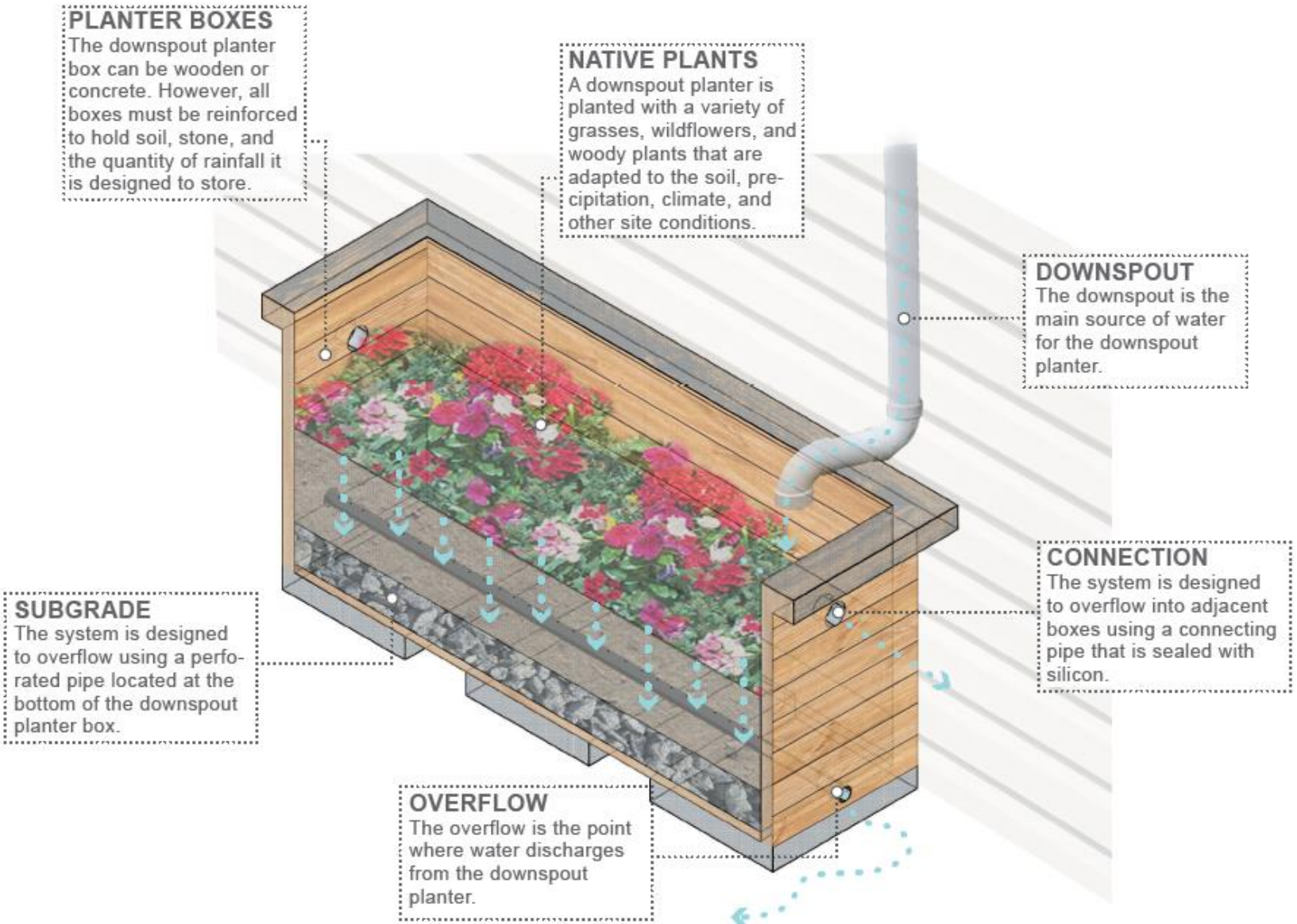
How it works:

- Constructed boxes placed against buildings
- Contains stone/gravel topped with sandy compost mixture and plants
- Designed with underdrain and overflows
- Disconnects downspouts

Benefits:

- Aesthetics
- Provide some rainfall storage

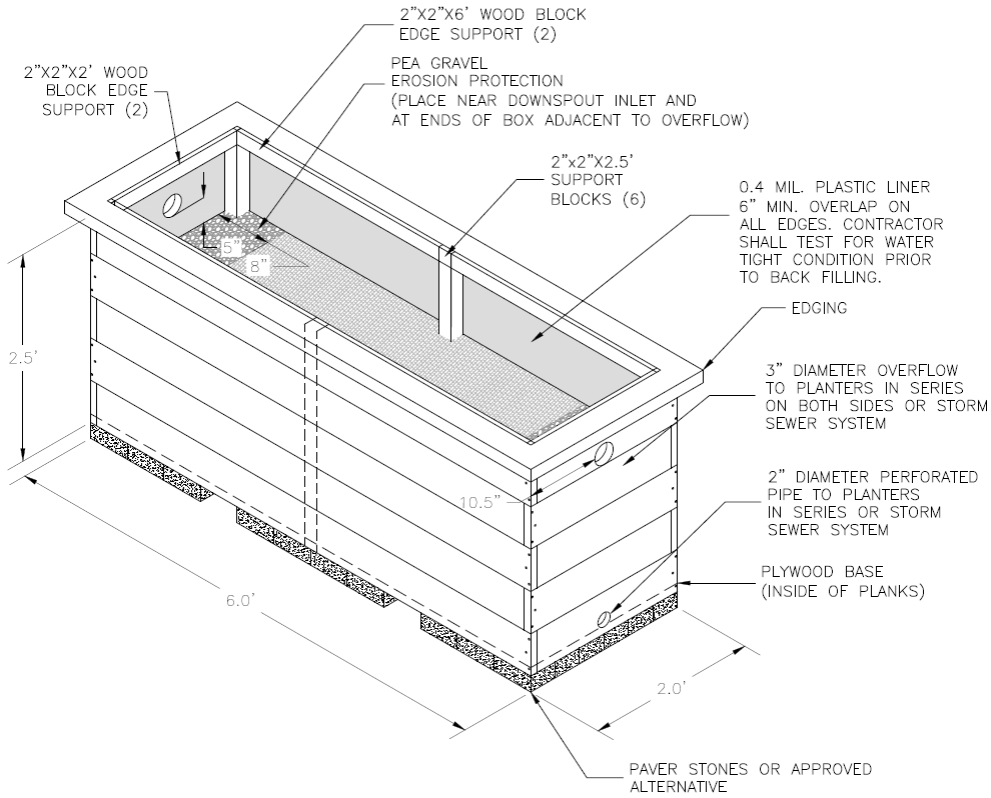
Downspout Planter

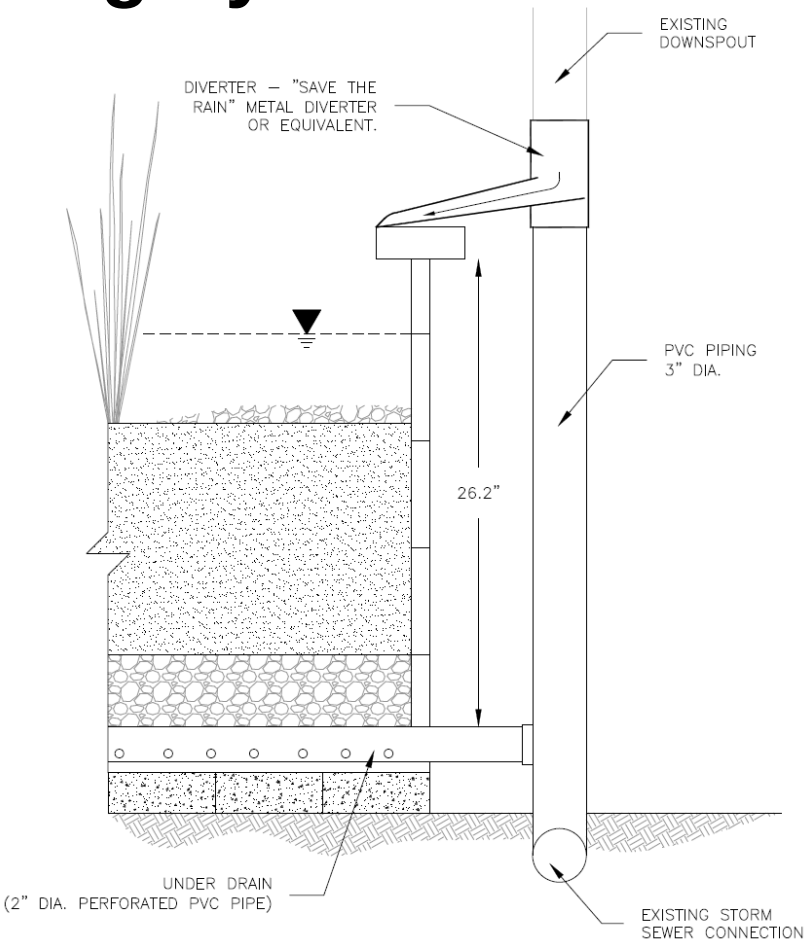


Design Parameters for Downspout Planters:

- Planter box must be adequately reinforced to hold soil, stone, and plants
- Limited capacity for stormwater retention – mostly infiltration
- Soil infiltration rate is 5.0 inches per hour
- Underdrains are installed to drain the water after the storm event

Downspout Planter: Harvesting System





Harvesting System

Downspout Planter Boxes at Acelero Learning Center in Camden, NJ

Harvesting System

Downspout Planter Boxes at Davis School in Camden, NJ

Harvesting System

Stormwater Tree Pits/Street Trees

Pre-manufactured concrete boxes or enhanced tree pits that contain a special soil mix and are planted with a tree or shrub. They filter stormwater runoff and provide limited storage capacity.

Storage System

Stormwater Tree Pits/Street Trees

How it works:

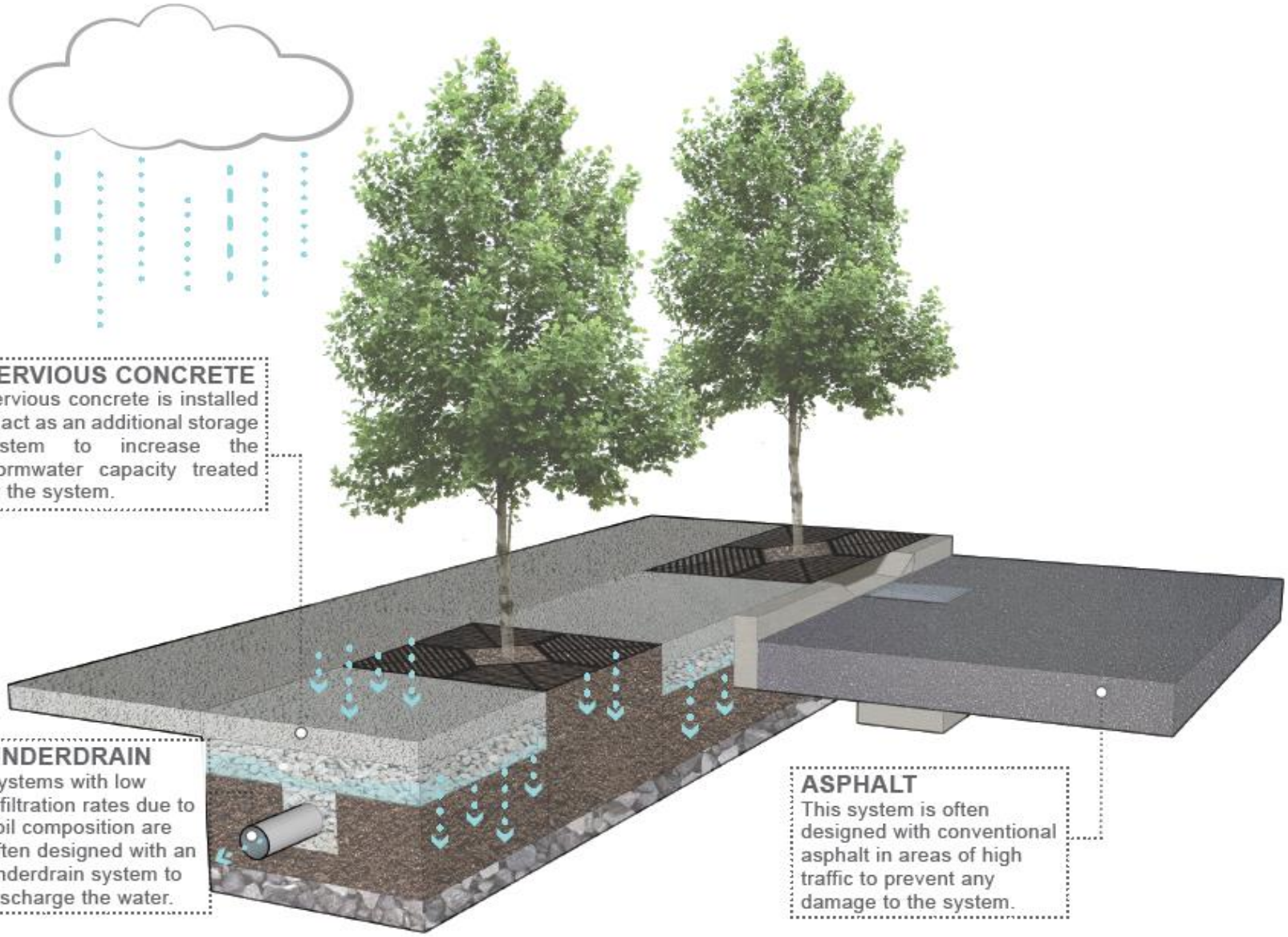
- Pervious concrete is installed to act as an additional storage system to increase the stormwater capacity treated by the system.
- Systems with low infiltration rates due to soil composition are often designed with an underdrain system to discharge the water.
- This system is often designed with conventional asphalt in areas of high traffic to prevent any damage to the system.

Benefits:

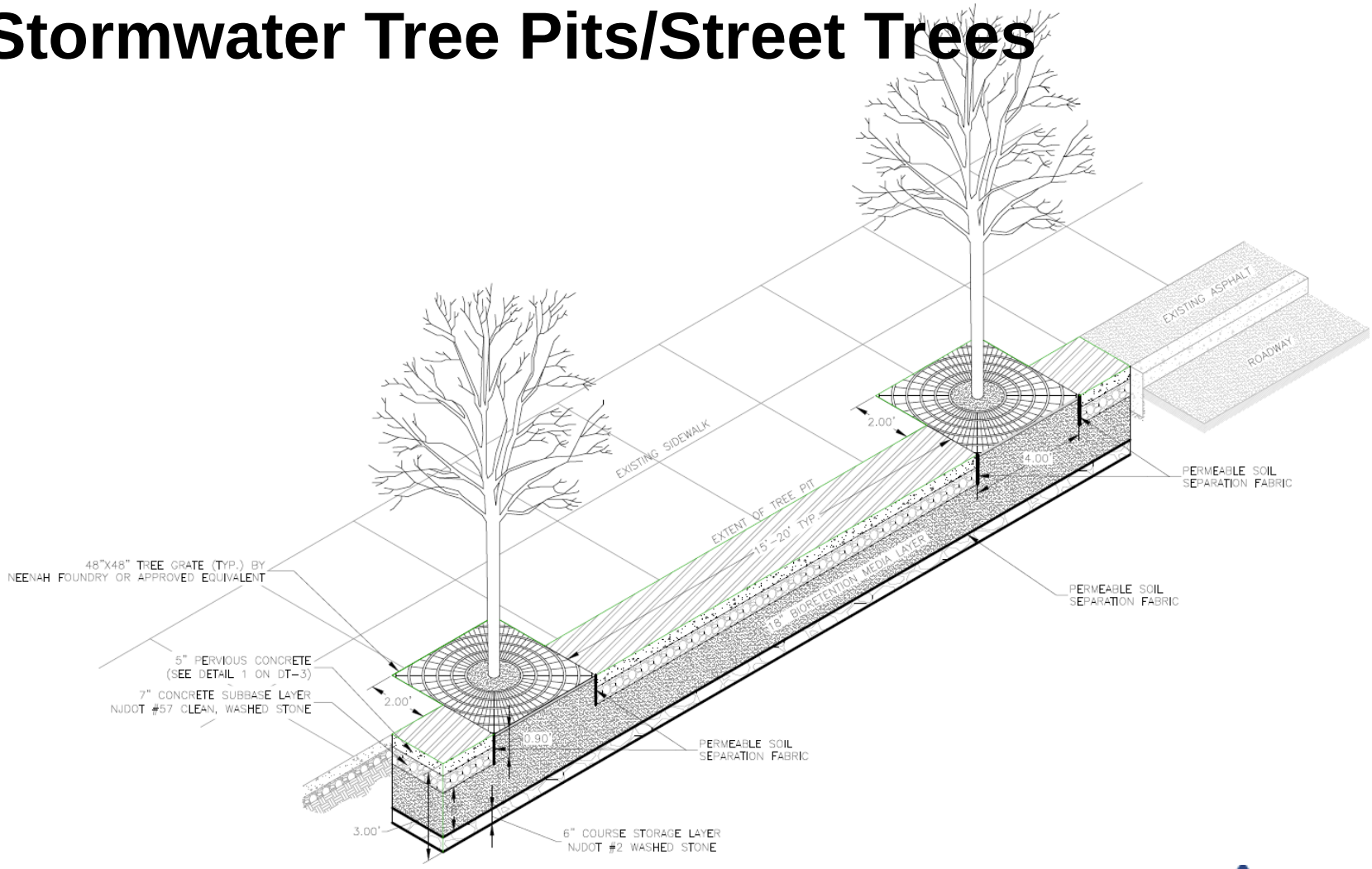
- Improved aesthetics
- Healthier trees
- Reduced heat island effect

Storage System

Stormwater Tree Pit/Street Trees



Stormwater Tree Pits/Street Trees



Storage System

Pervious Pavements



These surfaces include pervious concrete, porous asphalt, interlocking concrete pavers, and grid pavers. These materials allow water to quickly pass through the material into an underlying layered system of stone that holds the water, allowing it to infiltrate into the underlying uncompacted soil.

Pervious Pavement

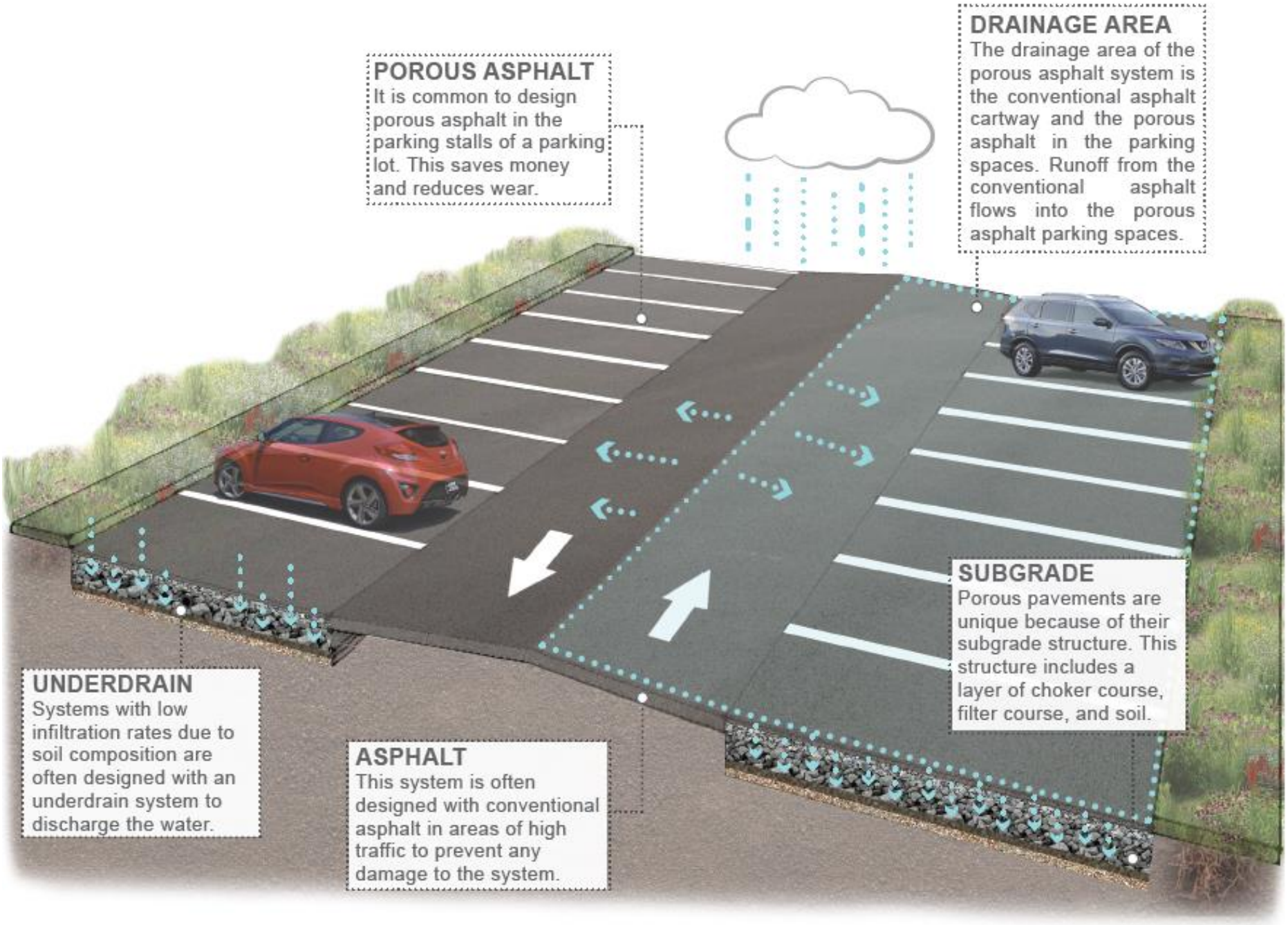
How it works:

- 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
- Ideal application for porous pavement is to treat a low traffic or overflow parking area

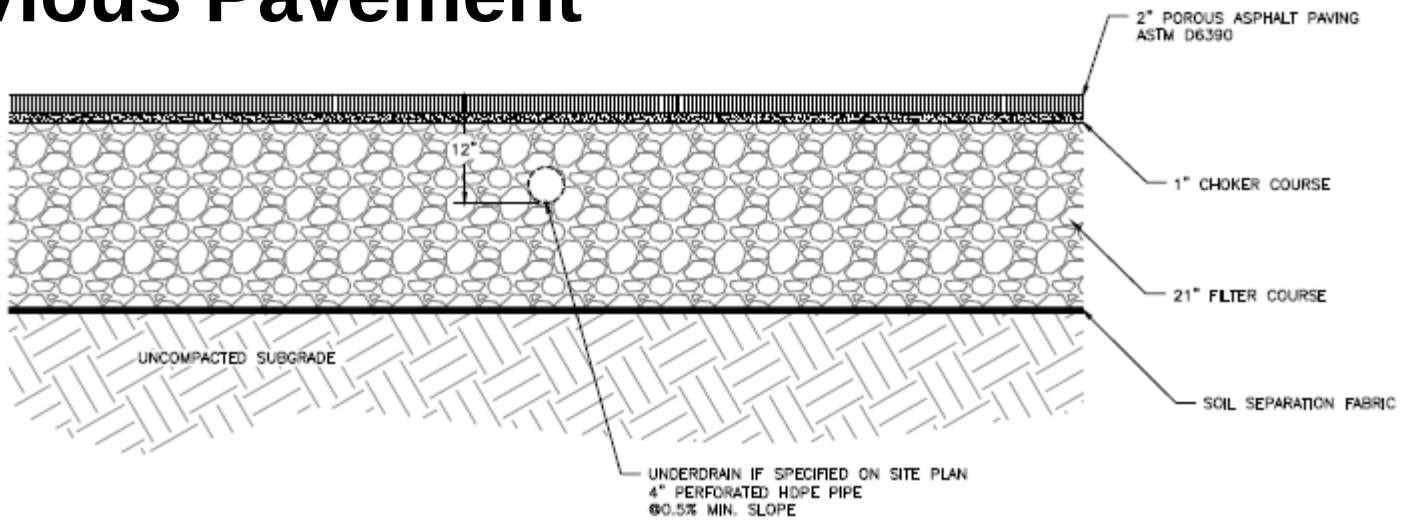
Benefits:

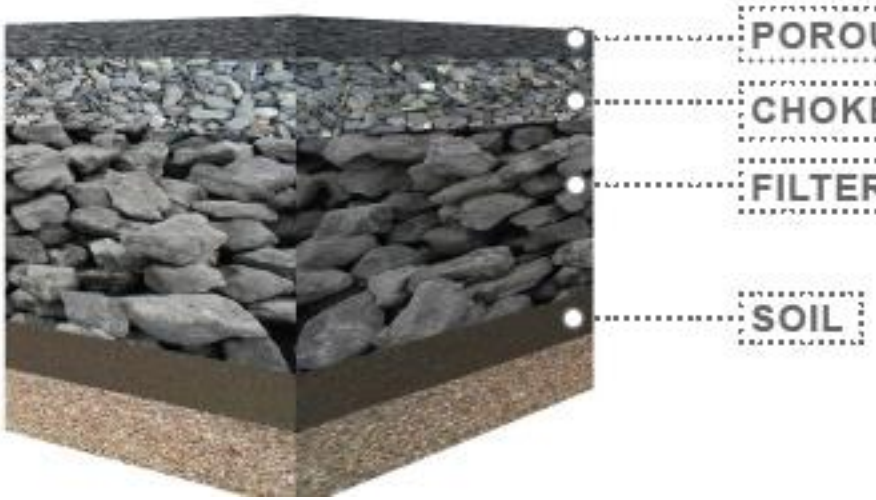
- Manage stormwater runoff, minimize site disturbance, promote groundwater recharge
- Low life cycle costs, alternative to costly traditional stormwater management methods
- Contaminant removal as water moves through layers of system
- Allows runoff to flow through the surface to an underlying storage layer

Storage System


POROUS ASPHALT
It is common to design porous asphalt in the parking stalls of a parking lot. This saves money and reduces wear.
DRAINAGE AREA
The drainage area of the porous asphalt system is the conventional asphalt cartway and the porous asphalt in the parking spaces. Runoff from the conventional asphalt flows into the porous asphalt parking spaces.
SUBGRADE
Porous pavements are unique because of their subgrade structure. This structure includes a layer of choker course, filter course, and soil.
UNDERDRAIN
Systems with low infiltration rates due to soil composition are often designed with an underdrain system to discharge the water.
ASPHALT
This system is often designed with conventional asphalt in areas of high traffic to prevent any damage to the system.

Pervious Pavement

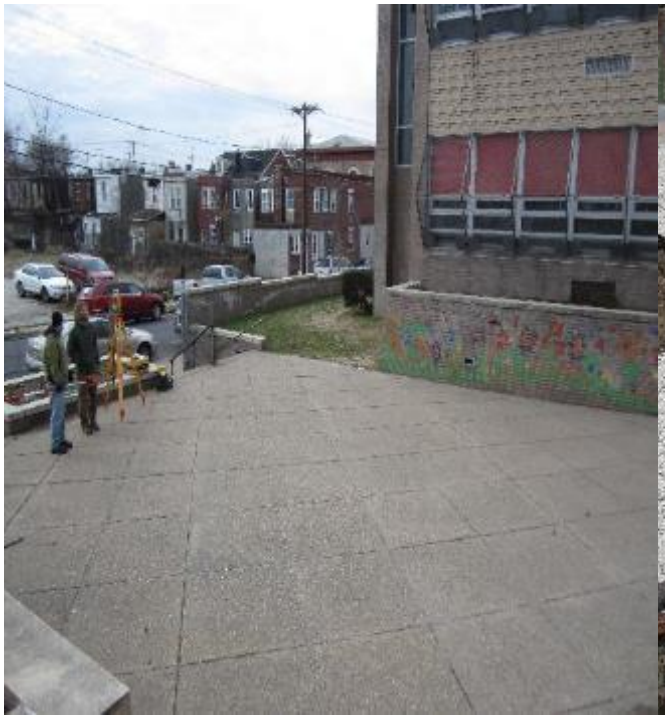




Storage System

Porous Pavement (Asphalt) at Yorkship School in Camden, NJ

Storage System



Porous Pavement (Concrete) at Wiggins School in Camden, NJ

Storage System

Green Infrastructure Manual for New Jersey

http://water.rutgers.edu/GreenInfrastructureGuidanceManual.html

RUTGERS
THE STATE UNIVERSITY
OF NEW JERSEY

QUESTIONS?

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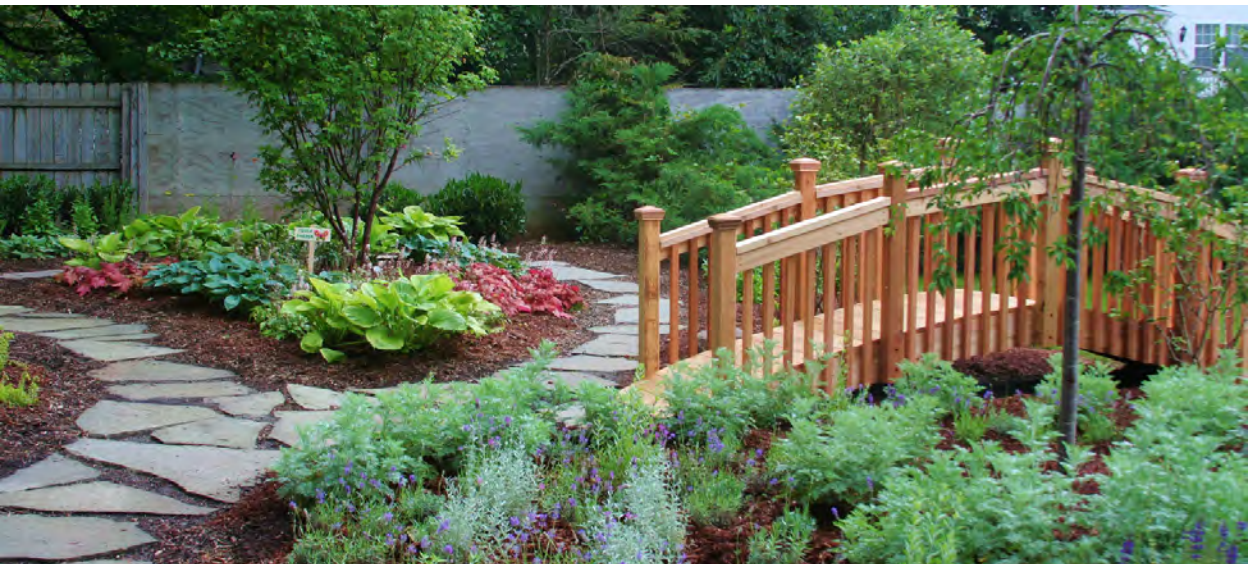
obropta@envsci.rutgers.edu

www.water.rutgers.edu

NEW JERSEY STATE LEAGUE OF MUNICIPALITIES

STORMWATER MANAGEMENT'S ROLE IN COMMUNITY HEALTH AND PROSPERITY

Image Credit: E&LP Associates



Ed Confair, RLA, PE

Registered Landscape Architect
Professional Engineer

E&LP Associates

Engineers
Landscape Architects
Planners
Environmental Engineers

Our mission is to create sites that inspire through the innovation of natural and built environments.

University of Pennsylvania

Lecturer in the Graduate School of Design
Department of Landscape Architecture
Workshop 3: Technical Site Design, Site Engineering + Water Management
Summer Institute: Landscape Operations

Organizations

NJ Future Mainstreaming Green Infrastructure Task Force

Greater Philadelphia Sustainable Business Network GSI Partners

Philadelphia Community Design Collaborative

Building Industry Association of Philadelphia Green Committee

Image Credit: E&LP Associates

PRIVATE DEVELOPMENT

RESIDENTIAL COMMUNITIES
Village, Cottage, and Multi-Unit

BUSINESS & COMMERCIAL

EDUCATIONAL INSTITUTIONS
Pres-school Through College

ENVIRONMENTAL & CONSERVATION
Watershed Associations & Research Centers

MEDICAL & HEALTHCARE
Hospitals, Clinics, Research Campuses

Image Credit: E&LP Associates

Image Credit: RGS Associates

Landis Homes Retirement Community

Location:
Manheim Tonwship, Lancaster, PA

Design Team:
RGS Associates, Inc. - Landscape Architects, Civil Engineers
RLPS Architects - Architect
Land Studies - Envionrmental Consultants
ARM Group - Geologist

Project Highlights:
40 acre expansion of 114 acre campus
Six (6) Three story apartment buildings - 75 units
70 cottages
LEED Certification

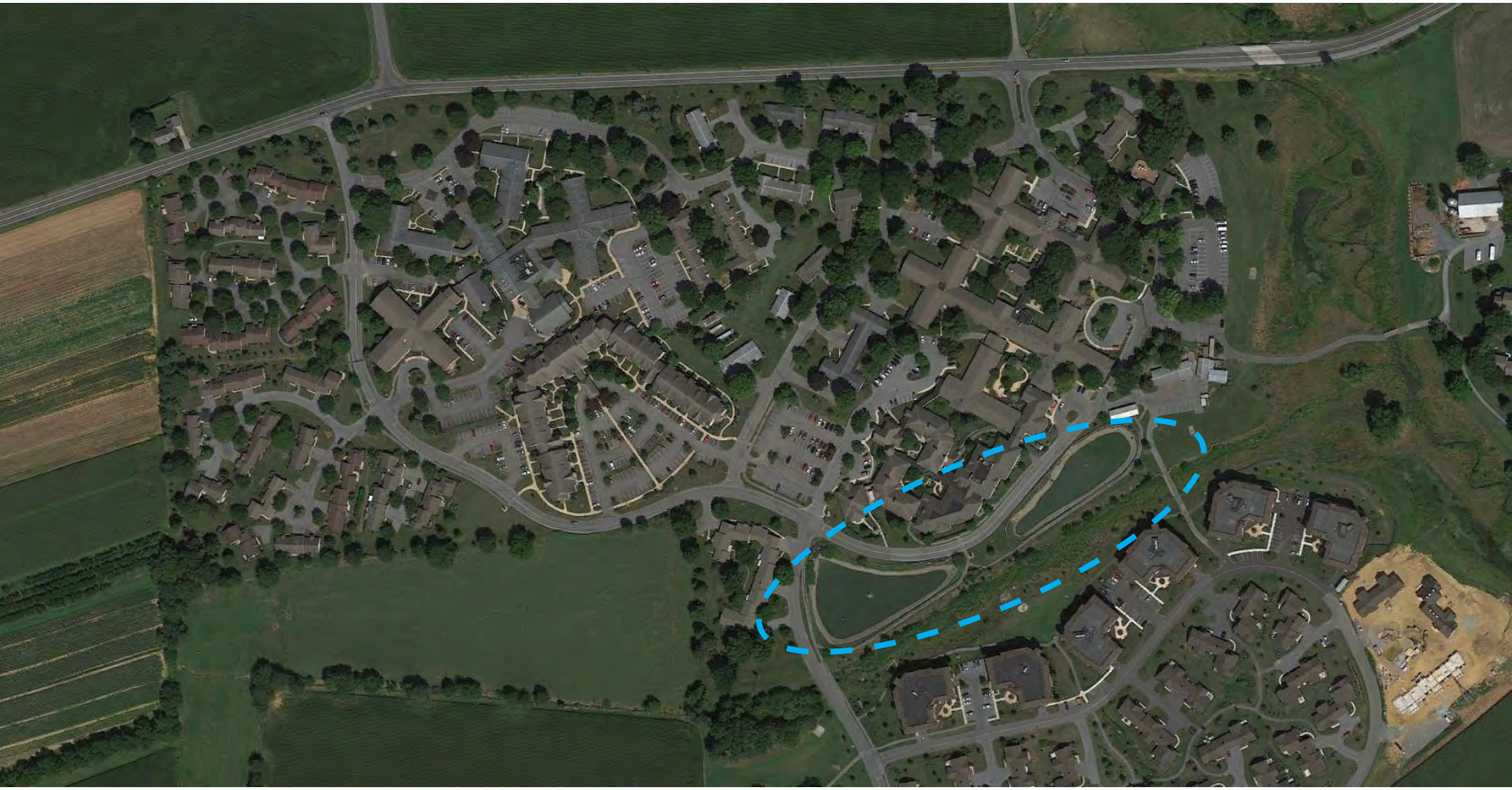
Green Infrastructure:
Rainwater capture and reuse
Native plant palette
Raingardens & bioswales
Porous Asphalt
Stream Corridor and Floodplain Restoration

Restoration of the adjacent stream and floodplain eliminated the need for three additional stormwater basins in the development.

Additional Information:
ASLA Stormwater Case Studies
PA-DE ASLA 2008 Award Winner

Image Credit: RGS Associates

LANDIS HOMES RETIREMENT COMMUNITY



LANDIS HOMES RETIREMENT COMMUNITY
NORTH CAMPUS

LANDIS HOMES RETIREMENT COMMUNITY
NORTH CAMPUS STORMWATER BASINS

LANDIS HOMES RETIREMENT COMMUNITY
NORTH CAMPUS STORMWATER BASINS

Image Credit: RGS Associates

LANDIS HOMES RETIREMENT COMMUNITY
SOUTH CAMPUS MASTER PLAN

Image Credit: RGS Associates

LANDIS HOMES RETIREMENT COMMUNITY
SOUTH CAMPUS MASTER PLAN

Image Credit: RGS Associates

LANDIS HOMES RETIREMENT COMMUNITY
RAINWATER REUSE & POROUS PAVING

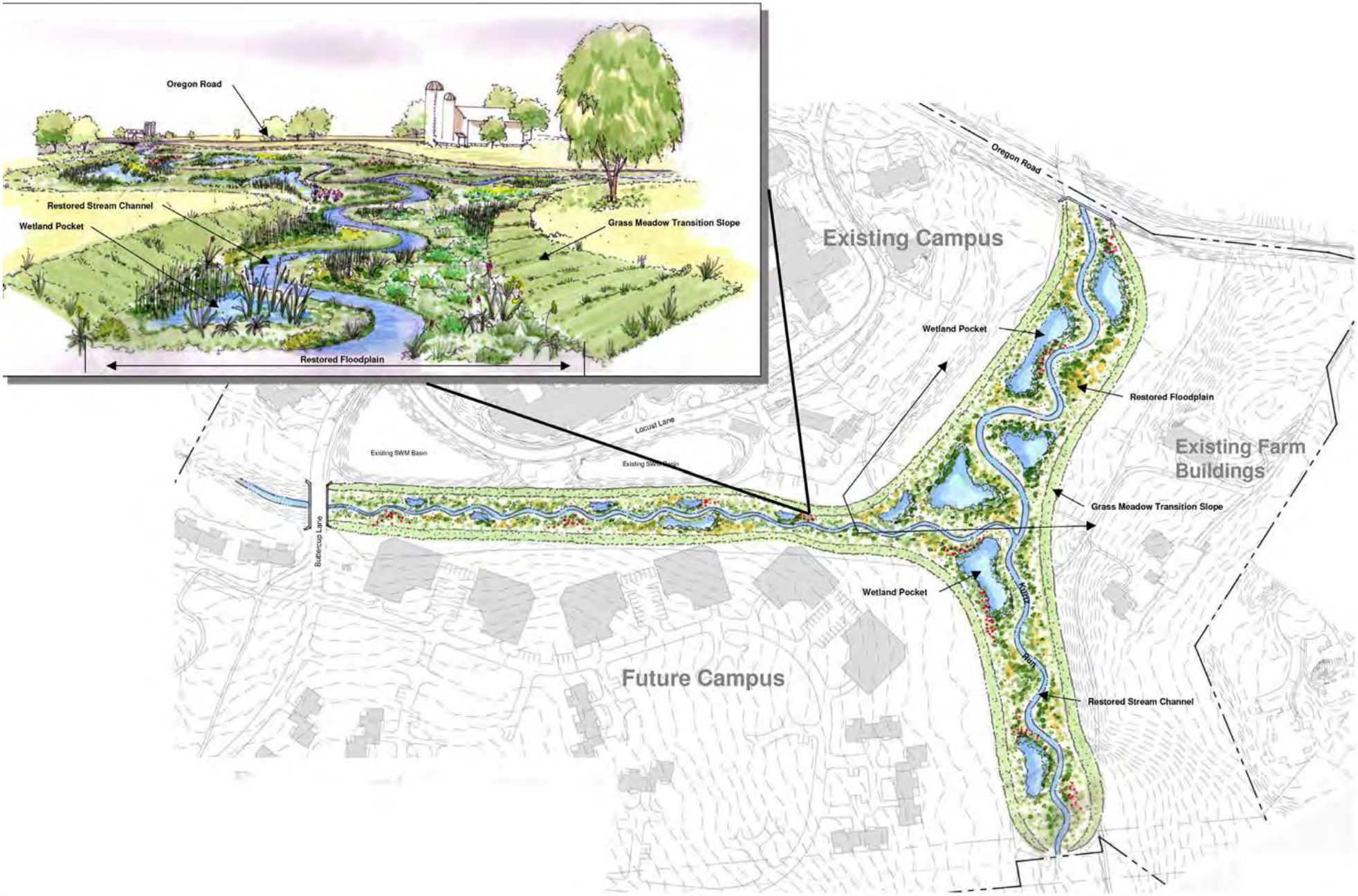


Image Credit: RGS Associates

LANDIS HOMES RETIREMENT COMMUNITY
STREAM CHANNEL & FLOODPLAIN RESTORATION

Image Credit: RGS Associates

LANDIS HOMES RETIREMENT COMMUNITY
STREAM CHANNEL & FLOODPLAIN RESTORATION

Image Credit: RGS Associates

LANDIS HOMES RETIREMENT COMMUNITY
STREAM CHANNEL & FLOODPLAIN RESTORATION

Image Credit: RGS Associates

LANDIS HOMES RETIREMENT COMMUNITY
STREAM CHANNEL & FLOODPLAIN RESTORATION

Image Credit: Sikora Wells Appel

Pennswood Village Retirement Community

Location:
Newtown, PA

Design Team:
Sikora Wells Appel - Landscape Architects
Pickering, Corts & Summerson - Civil Engineers
Princeton Hydro - Hydrologists & Ecologists
Mellon Biological - Wetland Scientist

Project Highlights:
82 acre quaker-directed retirement community
Site open to study for surrounding schools

Green Infrastructure:
13 acre pollutant removal treatment chain
Native plant palette
Warm season grass meadow
Raingardens, bioswales, wet pond

Additional Information:
ASLA Stormwater Case Studies
2003 ASLA National Merit Award Winner

PENNSWOOD VILLAGE RETIREMENT COMMUNITY
AERIAL IMAGE

PENNSWOOD VILLAGE RETIREMENT COMMUNITY
AERIAL IMAGE

PENNSWOOD VILLAGE RETIREMENT COMMUNITY
MEADOW & BIORETENTION STORMWATER MANAGEMENT

Image Credit: Sikora Wells Appel

Image Credit: Sikora Wells Appel

PENNSWOOD VILLAGE RETIREMENT COMMUNITY
MEADOW & BIORETENTION STORMWATER MANAGEMENT

Image Credit: Sikora Wells Appel

PENNSWOOD VILLAGE RETIREMENT COMMUNITY
MEADOW & BIORETENTION STORMWATER MANAGEMENT

Image Credit: Sikora Wells Appel

PENNSWOOD VILLAGE RETIREMENT COMMUNITY
MEADOW & BIORETENTION STORMWATER MANAGEMENT

Avalon Tinton Falls Multi-Family Apartments

Location:
Borough of Tinton Falls, Monmouth County, NJ

Design Team:
Maser Consulting - Civil Engineers

Project Highlights:
30 plus acre site
Multi-Family Residential
216 Rental Units

Green Infrastructure:
1.5 acre wet pond
Bioswales
Low Impact Channel Stabilization
Porous Pavement

Image Credit: Maser Consulting

AVALON TINTON FALLS
POROUS PAVEMENT

Image Credit: Maser Consulting

AVALON TINTON FALLS
WET POND

Image Credit: E&LP Associates

Lamington Road Development

Location:
Bedminster Tonwship, Somerset County, NJ

Design Team:
E&LP Associates - Civil Engineers, Landscape Architects
Netta Architects - Architect

Project Highlights:
5 acre site
35 Units

Green Infrastructure:
Rainwater Reuse for Irrigation & Fountain
Native plant palette
Raingarden & Bioretention

Image Credit: E&LP Associates

LAMINGTON ROAD DEVELOPMENT MASTER PLAN

Image Credit: Princeton Hydro

Image Credit: E&LP Associates

STORMWATER RETROFITS

Locations:
Various

Design Team:
Princeton Hydro
E&LP Associates

Green Infrastructure:
Retrofitting traditional lawn basins with native bioretention plant mixes

BUSINESS & COMMERCIAL

Image Credit: E&LP Associates

Image Credit: LGA Partners

Green Forge, Inc.

Location:
Greensburg, Westmoreland County, PA

Design Team:
Westmoreland Conservation District
LGA Partners - Architects

Project Highlights:
Adaptive reuse of industrial property for commercial

Green Infrastructure:
9,000 SF green roof
5,400 SF porous pavement
1,600 SF vegetated wall
700 SF bioretention swales/gardens

Additional Information:
PA-DE 2008 ASLA Award Winner

Image Credit: Westmoreland Conservation District

GREEN FORGE, INC.
AERIAL IMAGE

Image Credit: Westmoreland Conservation District

GREEN FORGE, INC.
GREEN ROOF

Image Credit: Westmoreland Conservation District

GREEN FORGE, INC.
GREEN WALL & POROUS PAVING

Image Credit: Westmoreland Conservation District

GREEN FORGE, INC.
BIORETENTION & POROUS PAVING

Image Credit: Brick Farm Tavern

Brick Farm Tavern

Location:
Hopewell, NJ

Design Team:
E&LP Associates - Civil Engineers & Landscape Architects

Project Highlights:
Farm to Table Restaurant
Working agricultural farm land

Green Infrastructure:
1/2 acre wet pond
1000 SF bioretention basins

Image Credit: E&LP Associates

BRICK FARM TAVERN MASTER PLAN

Image Credit: E&LP Associates

BRICK FARM TAVERN
WET POND

Image Credit: Princeton Hydro

New Jersey Manufacturer's Insurance Group Campus

Location:
Hammonton, NJ

Design Team:
Princeton Hydro - Civil Engineers

Project Highlights:
55 acre corporate campus
Located in NJ Pinelands

Green Infrastructure:
Bioretention basins
Wet meadow basin
Bioswales
120,000 gallon cistern system for rainwater capture and reuse for on site irrigation

EDUCATION INSTITUTIONS

Image Credit: E&LP Associates


Image Credit: Princeton Hydro

Rowan University Parking Lot Retrofit

Location:
Glassboro, NJ

Design Team:
Princeton Hydro - Civil Engineers

Project Highlights:
Retrofit of existing parking lot with no stormwater management

Green Infrastructure:
Bioswales and bioretention islands

Image Credit: Princeton Hydro

ROWAN UNIVERSITY
PARKINGN LOT BIOSWALE

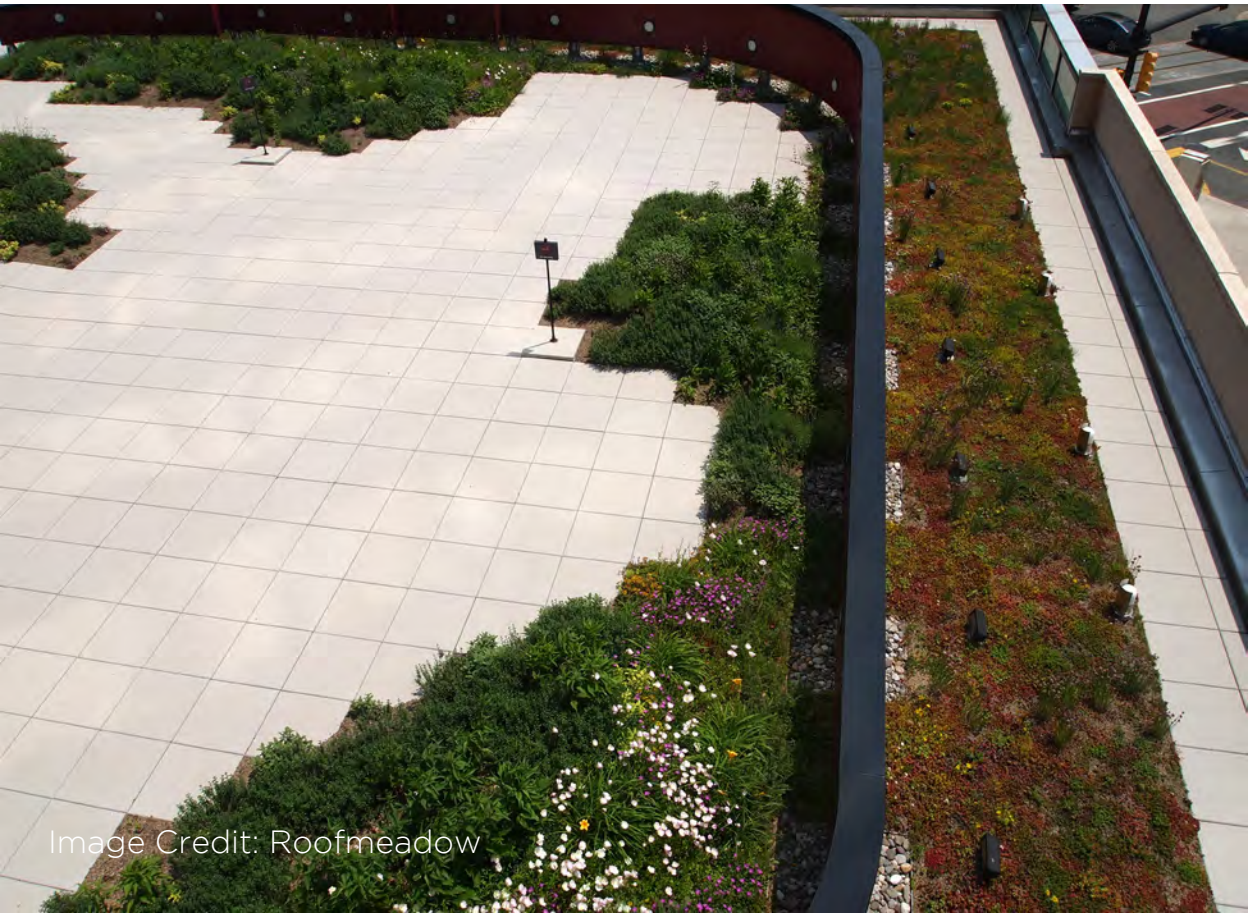


Image Credit: Roofmeadow

Rutgers University Business School

Location:
New Brunswick, NJ

Design Team:
Roofmeadow - Engineer
Es-A Architects - Landscape Architects
Epic Management - General Contractor
Furbish Company - Landscape Contractor

Project Highlights:
Rooftop Terrace

Green Infrastructure:
Green Roof

Additional Information:
NJ Future Mainstreaming Green Infrastructure Case Study

Image Credit: Edward Confair

Lea Elementary School Schoolyard Greening

Location:
Philadelphia, PA

Design Team:
Salt Design Studio

Project Highlights:
Retrofit of existing school yard

Green Infrastructure:
Porous pavement
Bioswales
Raingardens

Image Credit: Philadelphia Water

Greenfield Elementary School Schoolyard Greening

Location:
Philadelphia, PA

Design Team:
Viridian Landscape Studio
Philadelphia Water Department

Project Highlights:
Retrofit of existing school yard

Green Infrastructure:
Porous pavement
Bioswales
Raingardens

Image Credit: E&LP Associates

River Valley Waldorf School

Location:
Upper Black Eddy, PA

Design Team:
E&LP Associates - Civil Engineer & Landscape Architect

Project Highlights:
Retrofit of existing school grounds

Green Infrastructure:
Porous pavement
Bioswales
Raingardens

Image Credit: E&LP Associates

RIVER VALLEY WALDORF MASTER PLAN

Image Credit: Over the Rainbow Nursery School

Over The Rainbow Nursery School Children's Garden

Location:
Montclair, NJ

Design Team:
E&LP Associates - Landscape Architect

Project Highlights:
Five Senses Children's Garden
Ages infant to Pre-K

Green Infrastructure:
Native palette
Stumpery Raingarden
Demonstration Green Roof Garden Shed

Image Credit: Over the Rainbow Nursery School

OVER THE RAINBOW NURSERY SCHOOL
STUMPERY RAINGARDEN

Image Credit: Over the Rainbow Nursery School

OVER THE RAINBOW NURSERY SCHOOL
OVERALL VIEW OF GARDEN

ENVIRONMENTAL AND CONSERVATION

Image Credit: E&LP Associates

Image Credit: Bruce Livingston

Musconetcong Watershed Association River Resource Center

Location:
Asbury, NJ

Design Team:
E&LP Associates - Civil Engineer
Revision Architects - Architect

Project Highlights:
MWA Headquarters and Environmental Education Center
LEED Platinum Certification

Green Infrastructure:
Native palette
Porous pavement
Geothermal Heating
Riparian edge and floodplain restoration

Image Credit: Bruce Livingston

MUSCONETCONG WATERSHED ASSOCIATION BUILDING RESTORATION

Image Credit: MWA

MUSCONETCONG WATERSHED ASSOCIATION
FLOODPLAIN AND RIPARIAN EDGE RESTORATION

Raritan Headwaters Association

Location:
Bedminster Township, Somerset County, NJ

Design Team:
E&LP Associates - Civil Engineer, Landscape Architect

Project Highlights:
Reimagined Entry Drive and Arrival Garden to Headquarters

Green Infrastructure:
Native palette
Porous pavement
Raingarden
Bioswales

Image Credit: E&LP Associates

RARITAN HEADWATERS ASSOCIATION MASTERPLAN

MEDICAL & HEALTHCARE

Image Credit: E&LP Associates

Image Credit: Sikora Wells Appel

Einstein Medical Center Montgomery

Location:
East Norriton, PA

Design Team:
Sikora Wells Appel - Landscape Architect
Perkins + Will
Rick Paul Architects
Bohler Engineering
PWI Engineering
Delta Fountains
Gilbane Construction
Hammes Company
O'Donnell & Naccarato
Irrigation Consulting

Project Highlights:
90 acre hospital campus
LEED Certification
146 bed hospital and medical office buildings

Green Infrastructure:
Native palette
Constructed wetland
Raingardens
Bioswales
250 transplanted existing trees

Image Credit: Googel Earth

EINSTEIN MEDICAL CENTER
ENTRY & CONSTRUCTED WETLAND

Image Credit: Googel Earth

EINSTEIN MEDICAL CENTER
ENTRY & CONSTRUCTED WETLAND

Image Credit: Sikora Wells Appel

EINSTEIN MEDICAL CENTER PARKING LOT BIOSWALES

Image Credit: Edward Confair

Waterview Center

Location:
Hamilton Township, Mercer County, NJ

Design Team:
Fletcher Thompson Architecture Engineering
MKW Associates - Landscape Architect

Project Highlights:
40 Acre Biotechnology Campus
Two phase project still under construction

Green Infrastructure:
Native plant palette
Wet Pond
Raingardens
Bioswales
Wet Meadow

Image Credit: Google Earth

WATERVIEW CENTER
AERIAL IMAGE - SITE UNDER CONSTRUCTION

Image Credit: Edward Confair

WATERVIEW CENTER WET POND

Image Credit: Edward Confair

WATERVIEW CENTER
BIOSWALES - UNDER CONSTRUCTION

Image Credit: Edward Confair

WATERVIEW CENTER
WET MEADOW

E&LP

Stormwater Management's Role

Questions?

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