Green Infrastructure Champion Training: Part 7

"Retrofitting traditional detention basins with green infrastructure"

May 17, 2019
Rutgers EcoComplex
Bordentown, NJ

Rutgers Cooperative Extension Water Resources Program
Christopher Obropta & Toby Horton

RUTGERS New Jersey Agricultural Experiment Station

Water Resources Program

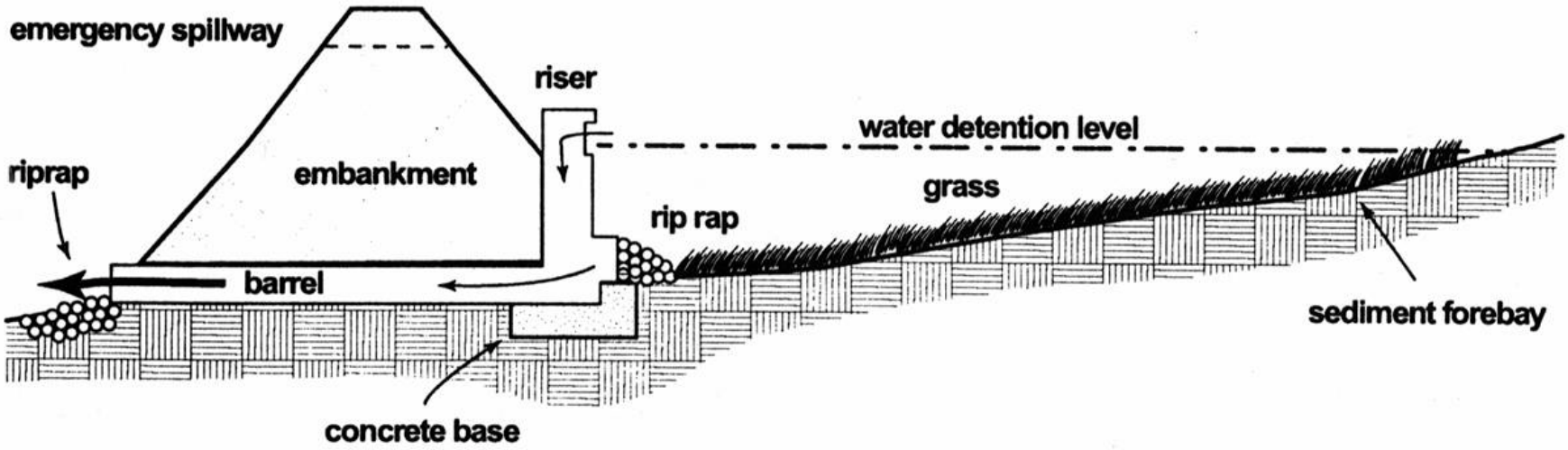
Presentation Overview

1. Overview of various basin designs
2. Common landscaping and maintenance concerns
3. Maintenance requirements
4. Typical maintenance costs
5. Ways to reduce maintenance
6. Case Studies
7. Planning for maintenance
8. NJ BMP Manual – Maintenance Plan
9. References

What is a Detention Basin?

Basins whose outlets have been designed to detain stormwater runoff for some minimum time to prevent downstream flooding. Provide quantity control, mowed regularly with concrete low-flow channels, dry except during and immediately following a storm event (typically 48 hours).

Basins can treat stormwater runoff through settling of particles.



Detention Basin

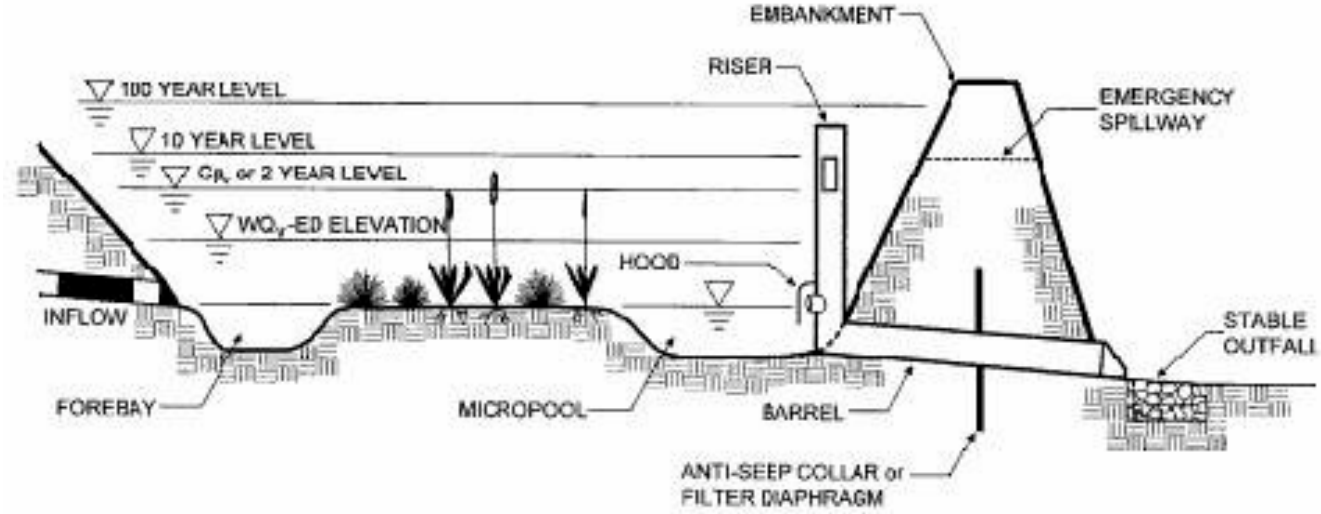
Detention Basin

What is a Retention Basin?

(a.k.a. stormwater ponds, wet retention ponds, wet ponds)

Retention basins are often used as landscape amenities with permanent pools of standing water, stormwater fills the basin during rainfall events and discharges until permanent water surface elevation is reached.

Ponds will treat incoming stormwater runoff by allowing particles to settle and algae to take up nutrients.



Traditional Retention Basin

Traditional Retention Basin

Detention Basin vs. Retention Basin

Does the basin hold a permanent pool of water?

NO – Detention

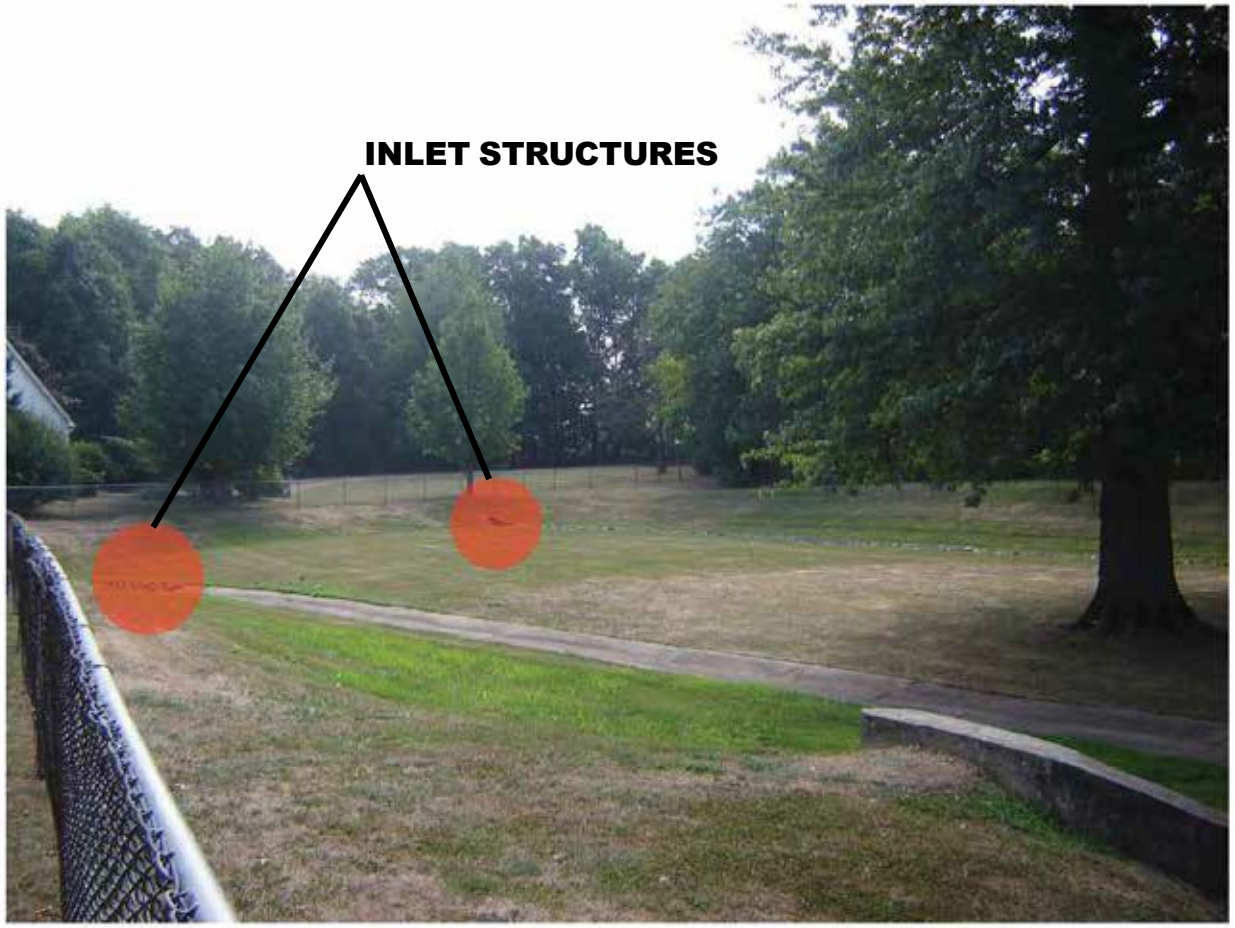
USEPA

YES – Retention

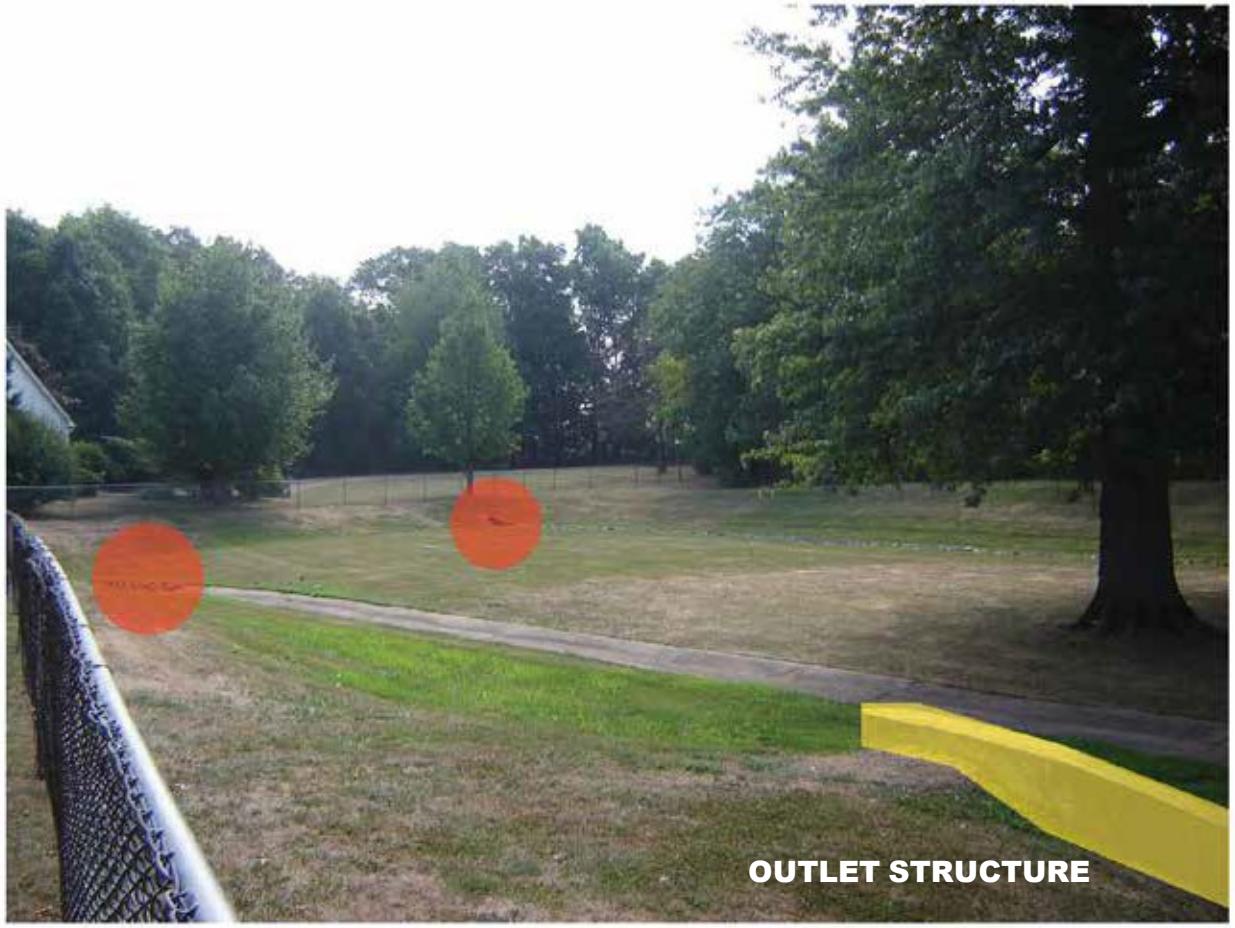
USEPA

Detention Basin Anatomy

Detention Basin Anatomy

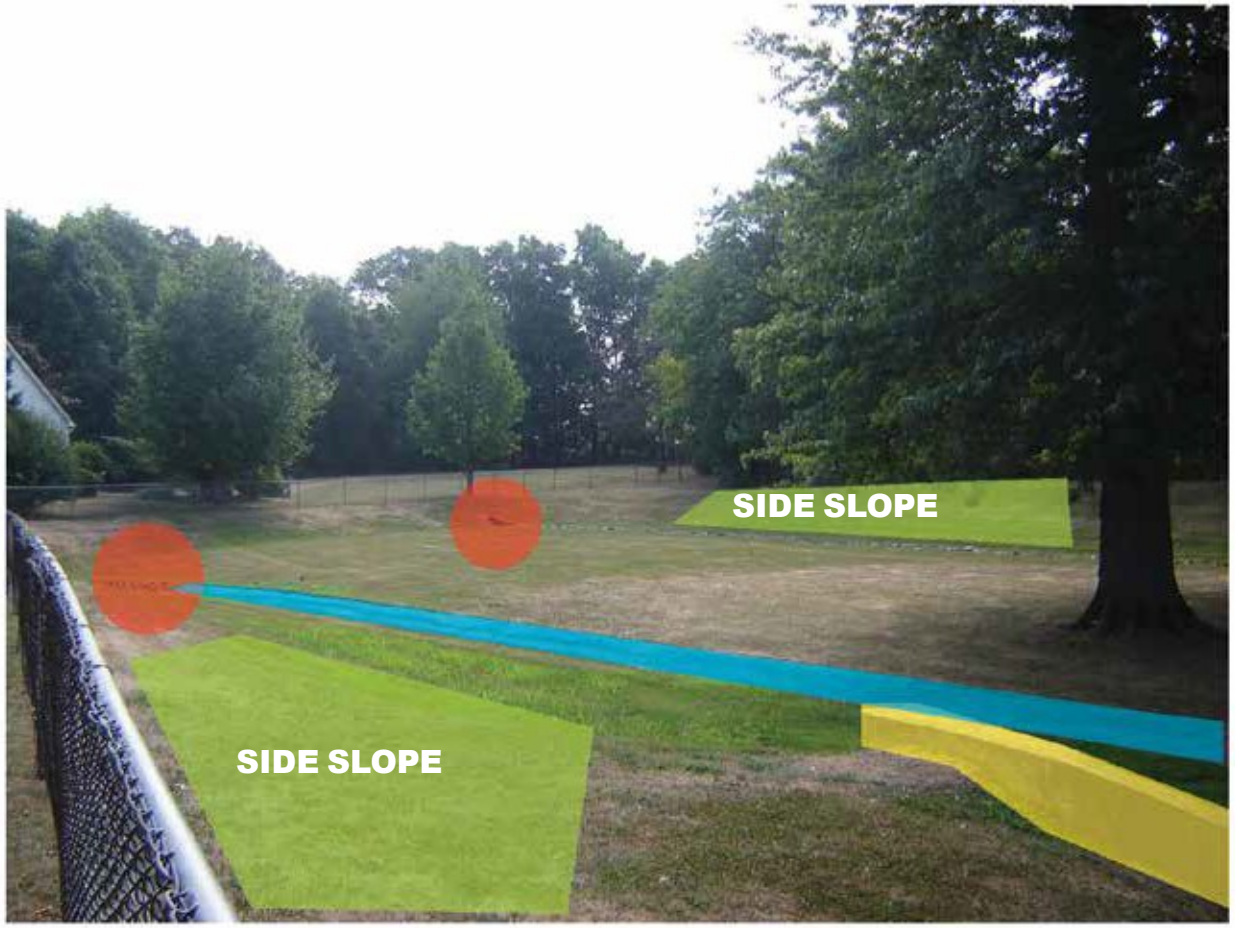


Detention Basin Anatomy

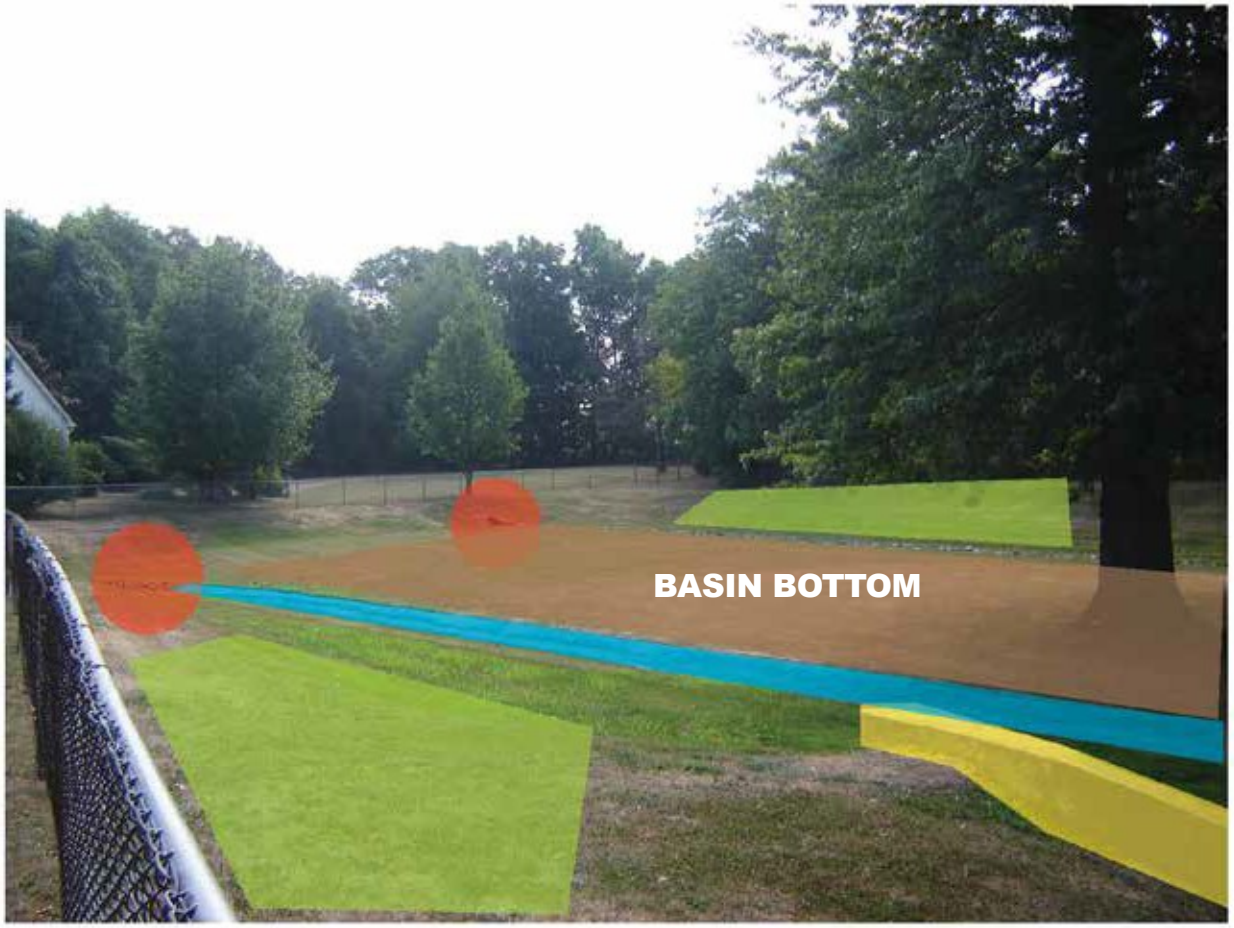


Detention Basin Anatomy

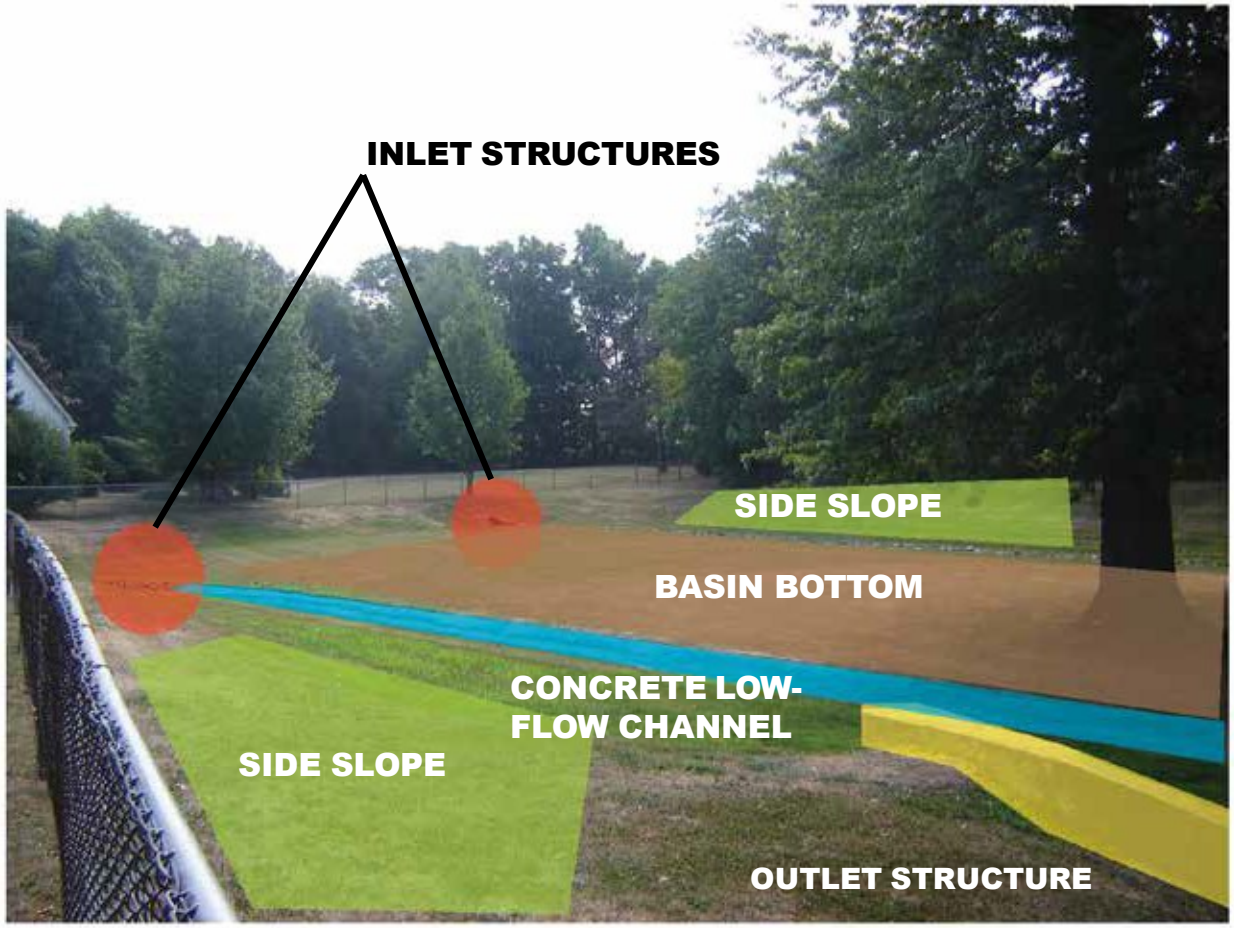
Detention Basin Anatomy



Detention Basin Anatomy



Detention Basin Anatomy



Common Concerns with Traditional Dry Detention Basins

1. Embankment and outlet stabilization
2. Sedimentation
3. Outlet blockages
4. Broken or clogged low-flow channels
5. Standing water or wet soils
6. Floatables and debris
7. Weeds or woody vegetation
8. Mowing and landscaping costs

Maintenance Considerations

Activity	Schedule
•Note erosion of pond banks or bottom	Semiannual inspection
•Inspect for damage to the embankment •Monitor for sediment accumulation in the facility and forebay •Examine to ensure that inlet and outlet devices are free of debris and operational	Annual inspection
•Repair undercut or eroded areas •Mow side slopes •Manage pesticide and nutrients •Remove litter and debris	Standard maintenance
•Seed or sod to restore dead or damaged ground cover	Annual maintenance (as needed)
•Remove sediment from the forebay	5- to 7-year maintenance
•Monitor sediment accumulations, and remove sediment when the pond volume has been reduced by 25 percent	25- to 50-year maintenance

Maintenance Requirements

- Routine Maintenance
  - Vegetation management
  - Debris and litter removal
  - Mechanical components maintenance
  - Inspections

Properly designed and maintained wet detention basins can remove 80% of the suspended solids in urban runoff.

- Non-Routine Maintenance
  - Stabilization and erosion control repairs
  - Sediment removal
  - Outlet repair or replacement

Maintenance Requirements

Routine Maintenance

Routine Maintenance

- Vegetation management
  - Mowing should be done where/when it is needed (traditionally, 10-14 times per year)
  - Effective groundcovers must be kept healthy to prevent erosion and damage to the system
- Debris and litter removal
  - Inlets and outlets should be regularly cleared of debris and litter to prevent obstructions and reduced efficiency of the system
- Mechanical components maintenance
  - All mechanical equipment, such as gates, valves, locks, or other components must be kept in working order should an emergency arise
- Inspections
  - Regular inspections by designated personnel, owner, or operator should be made and clear records kept

Routine Maintenance

Expected Costs for Annual Routine Maintenance

- Approximately 3-5% of construction cost for annual maintenance of dry detention basin or wet detention pond
- Mowing can cost between $100-$500 per visit
- Intensive maintenance including mowing, weed control, fertilization, etc. can range from $500-$3,500/acre annually

Other Cost Considerations

$$C = 12.4V^{0.760}$$

where:
C = Construction, design, and permitting cost, and
V = Volume needed to control the 10-year storm (ft^3).

Using this equation, typical construction costs are:

$ 41,600	1 acre-foot pond
$ 239,000	10 acre-foot pond
$ 1,380,000	100 acre-foot pond

Source: USEPA
http://cfpub.epa.gov/npdes/stormwater/menuofbmps/

Reducing Routine Maintenance

- Vegetation management
  - Reduce need for mowing
  - Eliminate any use of commercial fertilizers and pesticides in stormwater management facilities
- Debris and litter removal
  - Install simple low cost retrofits on catch basins near the discharge to the detention system
- Mechanical components maintenance
  - Regular inspections and immediate repairs will reduce need for major replacements
- Inspections
  - Clearly identify appropriate personnel and have same individual conduct inspections at regular intervals

Vegetation Management

Meadow Management

- Reduce mowing frequency of the basin bottom and embankments to a single monthly mowing at a height of 6-8 inches during the months of May through September

Meadow Management

Vegetation Management

No mow zones

- In wet pond systems, eliminating regular mowing of the shoreline edge for a minimum of 5-10 feet and allowing vegetation to grow to a height of 24 to 30 inches is recommended for several reasons:
  - Reducing mowing will promote deeper root growth and soil stability at the pond edge,
  - The vegetation will filter runoff from surrounding areas reducing nutrients and other pollutants in the pond, and
  - The vegetation will deter use of the facility by unwanted Canada geese through the physical and visual barrier.

No Mow Zones

No Mow Zones

Vegetation Management

Naturalized Plantings

- Install native plantings adapted to flood plain and wetland conditions and eliminate regular mowing.
- Requires upfront funds to design, purchase materials and install vegetation.
- Often these costs can be offset through the use of local volunteers or nonprofit environmental organizations.
- This approach requires careful planning and a commitment to maintain new plantings during the establishment period.
- These plantings can often be done in conjunction with basin repairs and/or retrofits.
- This approach is the “preferred” design option in the new BMP manual as it improves the effectiveness of the stormwater facility to treat water quality as well as water quantity.

Naturalized Plantings

Naturalized Plantings

- Seed in the spring or fall at a minimum rate of 10-15 lbs/acre
- Can be applied via broadcasting, hydroseeding, or with a native 'TRUAX' seed drill
- Need to be mulched during establishment with weed free straw or wood fiber mulch
- Can be applied to bare soil, over-seeded, or sites treated with glysophate herbicide
- Seed mix should contain warm-season companion grasses in combination with wildflowers
- Require a single annual mowing at a height of no less than 6 inches

Cherry Hill Township saved $20,000 per year on mowing costs by naturalizing detention basins.

Naturalized Plantings

Common Wildflowers	
Botanical Name	*Common Name*
Asclepias incarnata	Swamp Milkweed
Aster novae-angliae	New England Aster
Aster novi-belgi	New York Aster
Eupatorium perfoliatum	Boneset
Iris pseudacorus	Yellow-Flag
Iris versicolor	Blue-Flag
Lobelia cardinalis	Cardinal Flower
Lobelia siphilitica	Great Lobelia
Vernonia noveboracensis	New York Ironweed

Common Wetland Plants	
Botanical Name	*Common Name*
Carex stricta	tussock sedge
Carex vulpinoidea	fox sedge
Carex crinita	fringed sedge
Juncus effusus	Soft Rush

Aquatic Vegetation for Wet Ponds	
Botanical Name	*Common Name*
Pontederia cordata	pickerelweed
Sagittaria latifolia	duck-potato
Saururus cernus	lizard tail
Scirpus atrovirens	green bulrush
Sparganium americanum	lesser bur-reed

Warm Season Grasses	
Botanical Name	*Common Name*
Agrostis alba	Red Top
Agrostis palustris	Creeping Bentgrass
Andropogon scoparius	Little Bluestem
Andropogon virginicus	Broomsedge
Calamogrostis canadensis	Canada Wild Rye
Elymus canadensis	Canada Wild Rye
Poa palustris	Fowl Bluegrass
Puccinellia distans	Alkaligrass
Tripsacum dactyloides	Eastern Gamagrass

NOTE:

Native wildflower and grass seed mixes available from Ernst Conservation Seeds in Meadville, PA

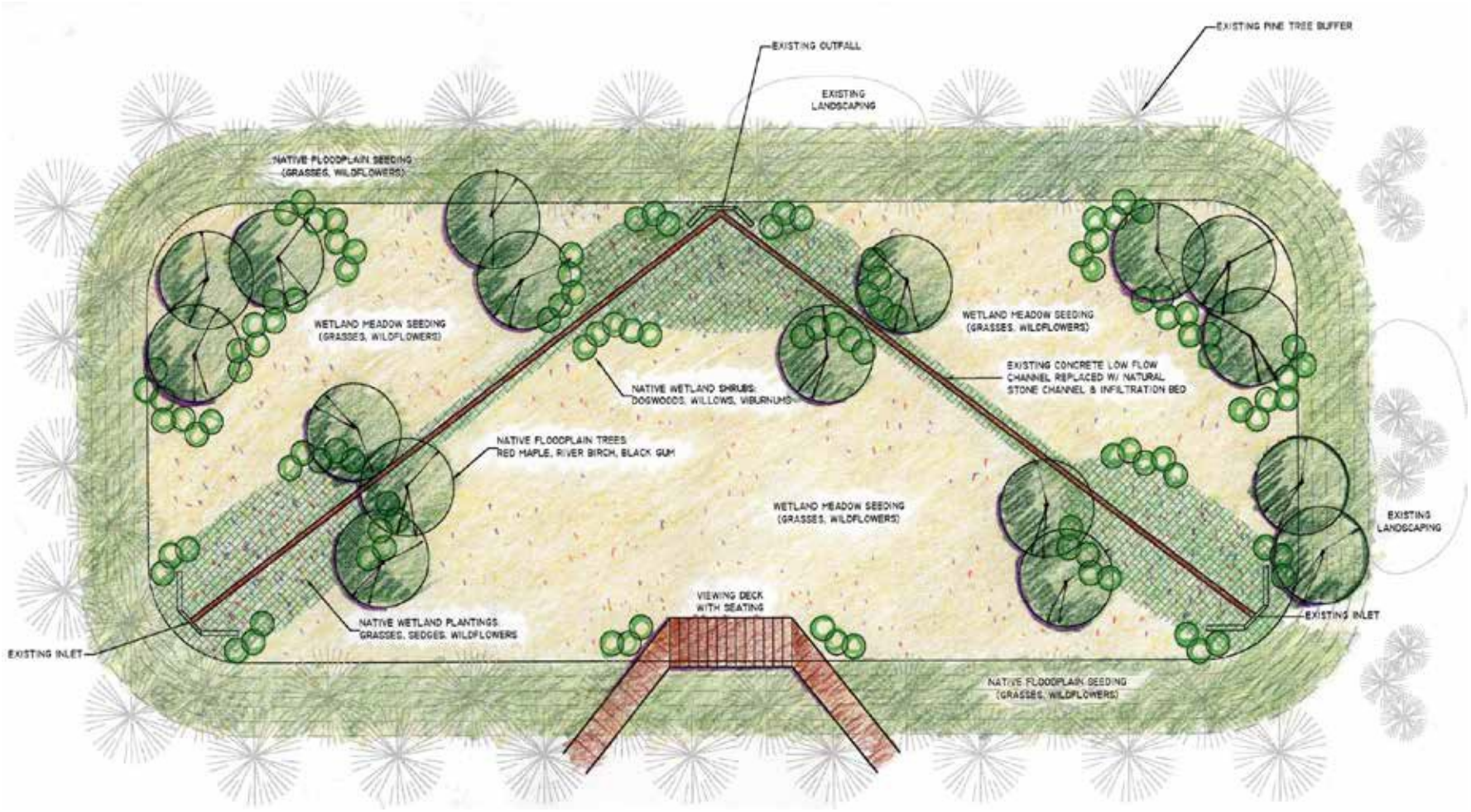
Native plant material available from Pinelands Nursery in Columbus, NJ

Naturalized Plantings

Egg Harbor Township
New Jersey

Naturalized Plantings

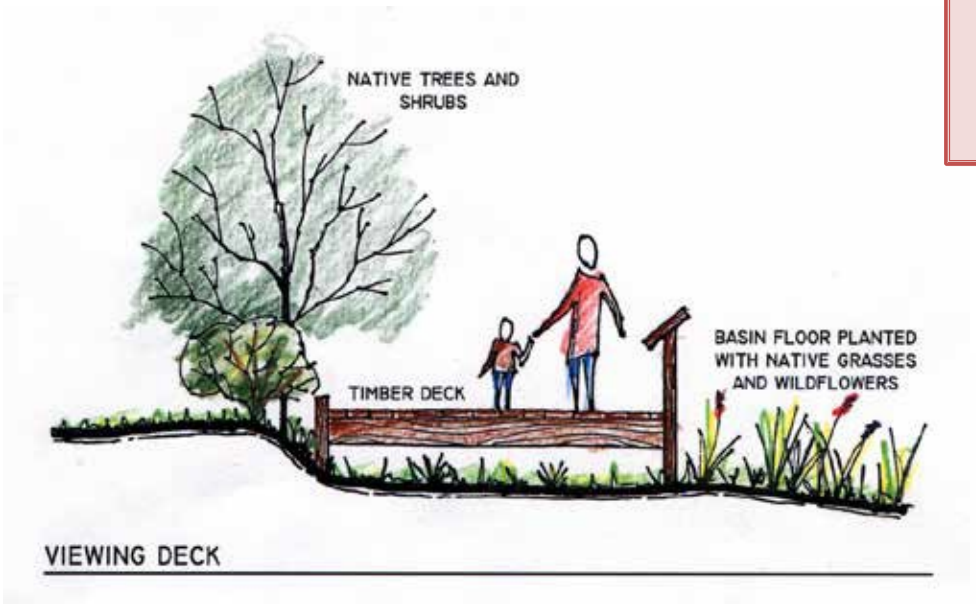
Naturalized Detention Plan

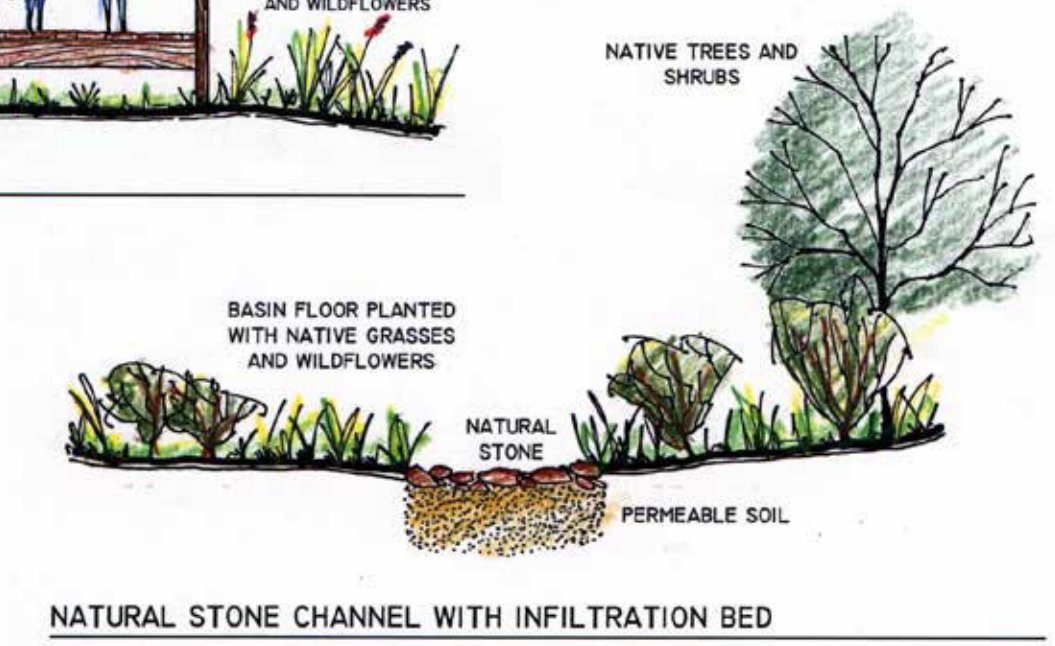


Naturalized Plantings

Vegetated Basin

Hillsborough Township estimated they could save 200 man hours per year on mowing by implementing a naturalized detention basin program.





Naturalized Plantings & Mosquitoes

- Mosquitoes can breed in almost any wet area containing standing water, including:
  - Containers/old tires
  - Catch basins
  - Gutters
  - Low wet spots in lawns
- Healthy naturalized systems provide habitat to many mosquito predators, including:
  - Dragonflies
  - Damselflies
  - Water Striders
  - Backswimmers
  - Predacious Diving Beetles
- Always provide and maintain access for inspection and treatment

Mechanical Components Maintenance

- Regular inspections and immediate repairs will reduce need for major replacements

Regular Inspections

At a minimum, regular inspections should:

- Document any erosion or sedimentation and identify any needs for repair or replacement
- Provide review of the inlet and outlet structures and note any deterioration, evidence of malfunctions, or collection of debris
- Document condition of the vegetation, noting any evidence of poor health, establishment of exotic species or weeds, woody growth on embankments, or need for any replacement
- Note any standing water or evidence of extended ponding not intended in the design or function of the system
- Note whether clear access to the facility is being maintained as per the design plans
- Document current and recent weather conditions and include a digital photograph of the facility

Maintenance Requirements

Non-Routine Maintenance

Non-Routine Maintenance

- Stabilization and erosion control repairs
  - If vegetation fails on embankments or in the basin, soil replacement, reseeding and stabilization should occur immediately
- Sediment removal
  - During the establishment of a new basin, the basin should be inspected for excessive sedimentation. After establishment, the basin should be inspected twice a year and excessive sediment accumulated in the basin should be removed.
- Outlet repair or replacement
  - Should the system stop functioning as designed the outlet structure may require repair or replacement

Expected Costs for Non-Routine Maintenance

- Sediment removal estimated to be needed:
  - Every 5-15 years for wet pond
  - Every 2-10 years for a dry pond
- Expected costs for sediment removal:
  - Mobilization $2,500 - $5,000 (dependent on size of project)
  - Dredging work $10/cy - $20/cy (dependent on depth of sediment)
  - Disposal off-site $45/cy - $75/cy (extremely variable and dependent on hauling distance, quality of material, and disposal requirements)
- Expected costs for pre-cast concrete replacement outlet structure:
  - $5,000 - $15,000 depending on size of structure, access, and complexity of the installation

Non-Routine Maintenance

Reducing Costs for Non-Routine Maintenance

- Stabilization and erosion control repairs
  - Ensure basin designs do not incorporate steep embankments (greater than 3:1)
  - Maintain healthy groundcovers by not mowing basin areas to less than 4 inches in height
- Sediment removal
  - Install manufactured pre-treatment device prior to stormwater discharging to basins
  - Install a settling forebay near inlets where access can be provided and reached with available excavation equipment
  - Retrofit system for water-quality treatment
- Outlet repair or replacement
  - Conduct regular inspections to ensure system is functioning properly and debris and litter are not clogging the outlet
  - Provide and maintain clear access to all structures of the system

Stabilization and Erosion Control Repairs

- Ensure basin designs due not incorporate steep embankments (greater than 3:1)
- Maintain healthy groundcovers by not mowing basin areas to less than 4 inches in height

Sediment Removal

Manufactured Pre-Treatment Systems

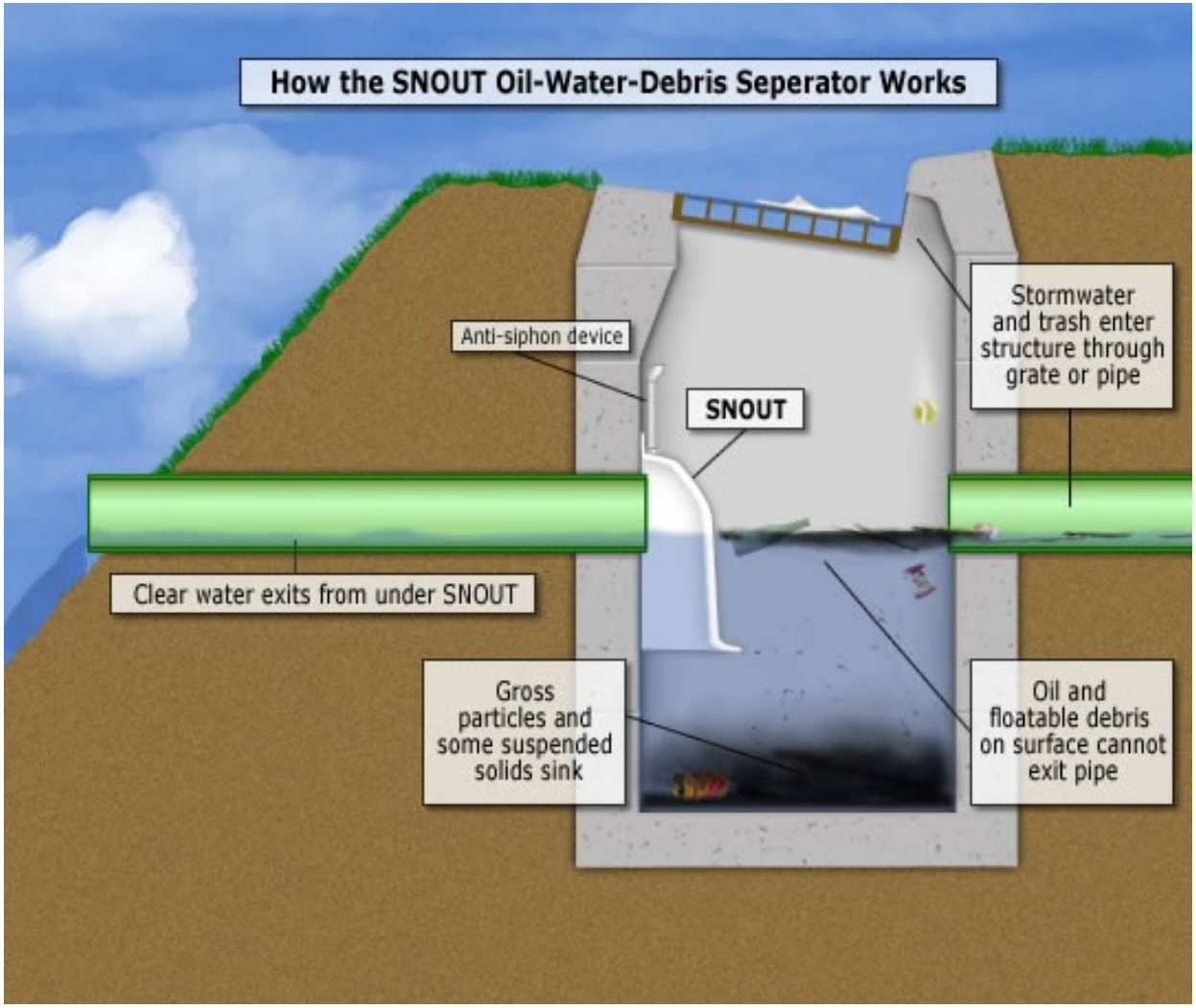
- Intended to capture sediments, metals, hydrocarbons, floatables, and/or other pollutants in stormwater runoff before being conveyed to a storm sewer system, additional stormwater quality treatment facility, or waterbody.

- Adequate for small drainage areas that contain a predominance of impervious cover that is likely to contribute high hydrocarbon and sediment loadings, such as small parking lots and gas stations. For larger sites, multiple devices may be necessary.

- Devices are normally used for pre-treatment of runoff before discharging to other, more effective stormwater quality treatment facilities.

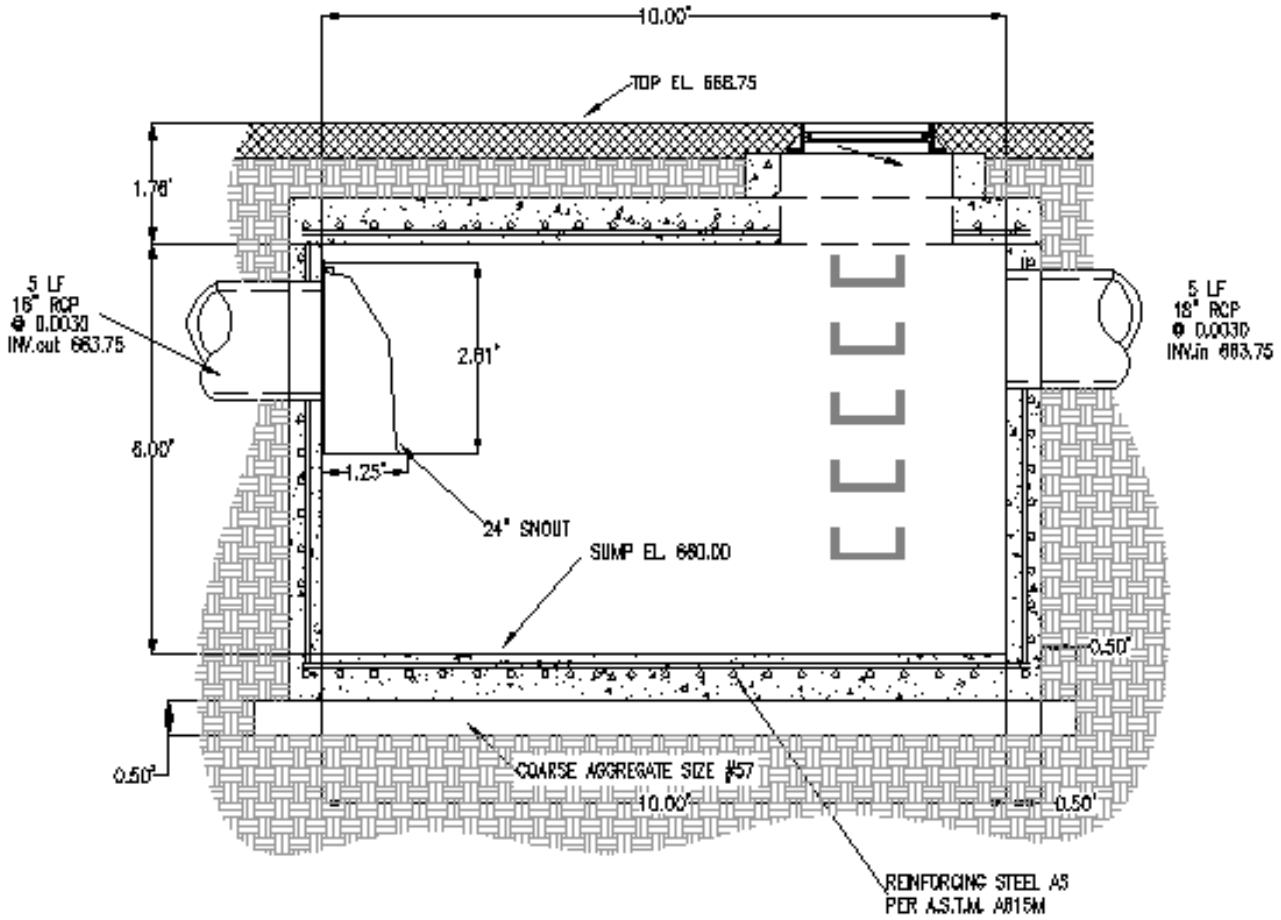
Debris and Litter Removal

Low Cost “Snout” Debris Separator

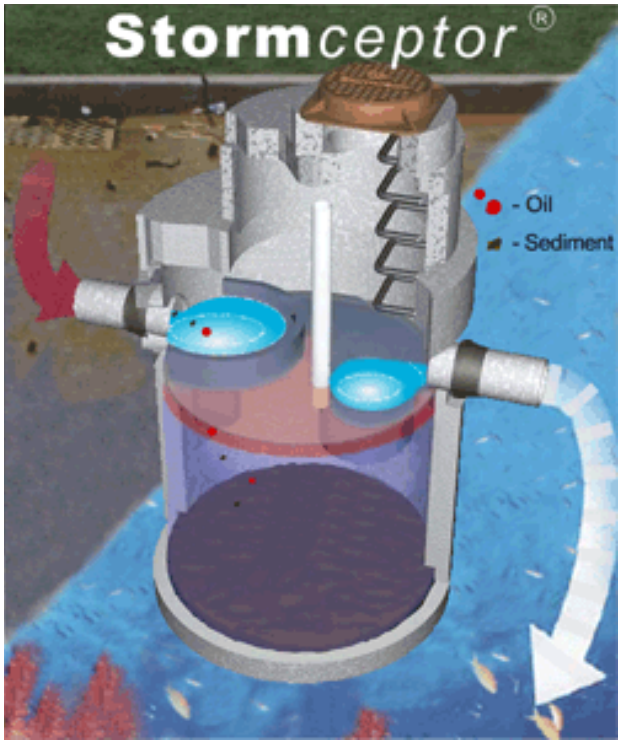


Debris and Litter Removal

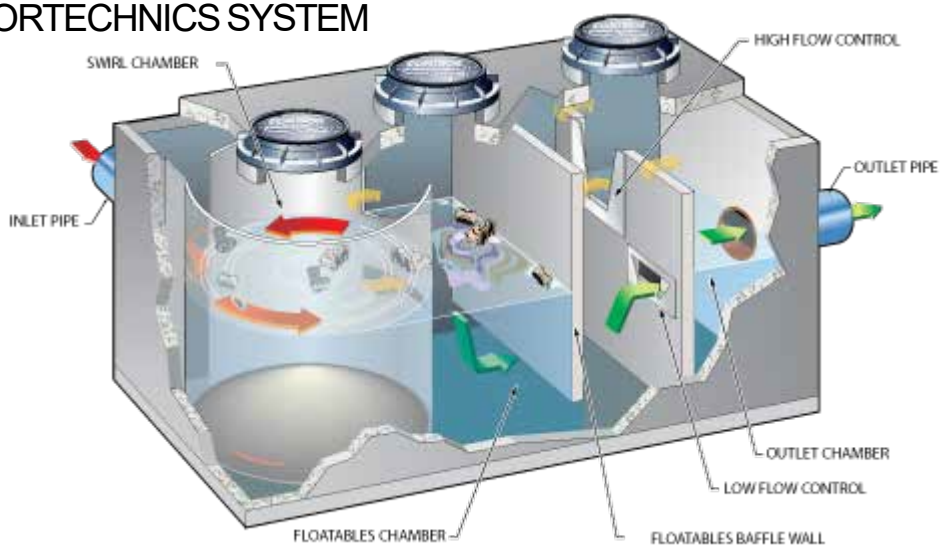
Low Cost “Snout” Debris Separator

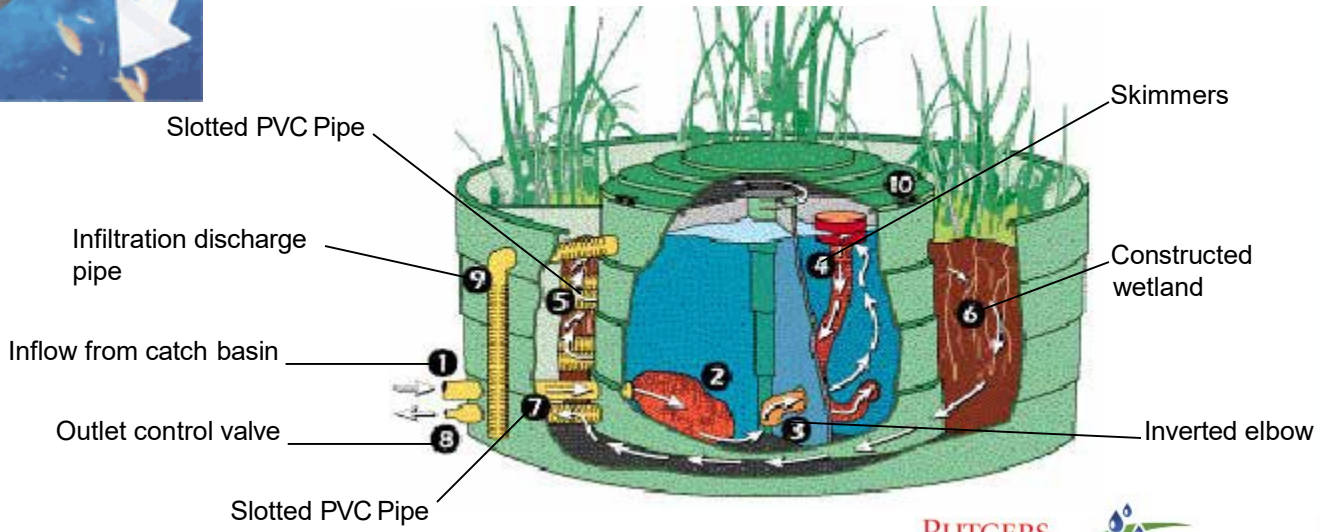


Manufactured Pre-Treatment Systems



VORTECHNICS SYSTEM

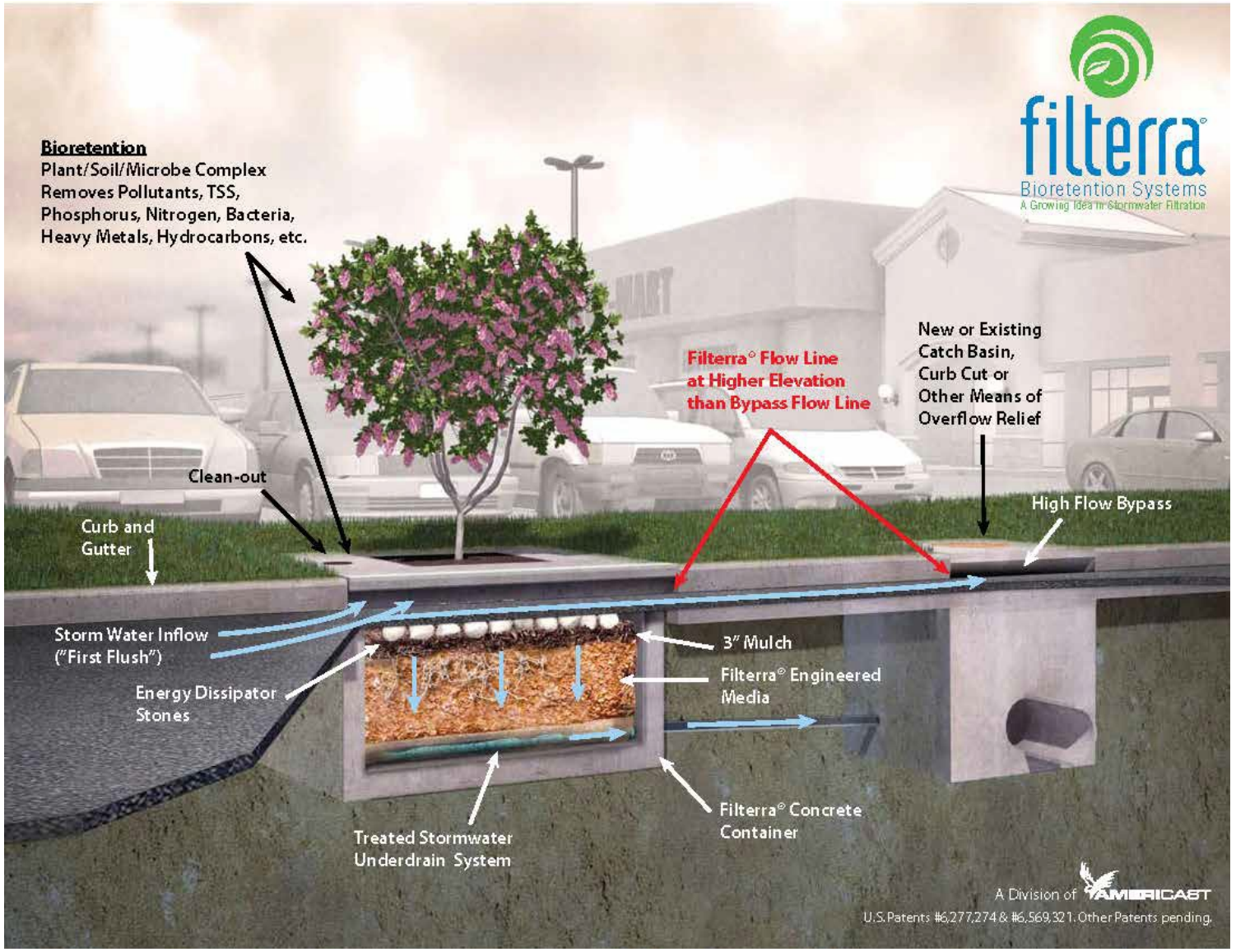




RUTGERS New Jersey Agricultural Experiment Station

Water Resources Program

Manufactured Pre-Treatment Systems



Outlet Repair or Replacement

- Conduct regular inspections to ensure system is functioning properly and debris and litter are not clogging the outlet
- Provide and maintain clear access to all structures of the system

RETROFIT

1. Extended Detention Basin
2. Outlet
3. Water Quality

Retrofit: Extended Detention Basin

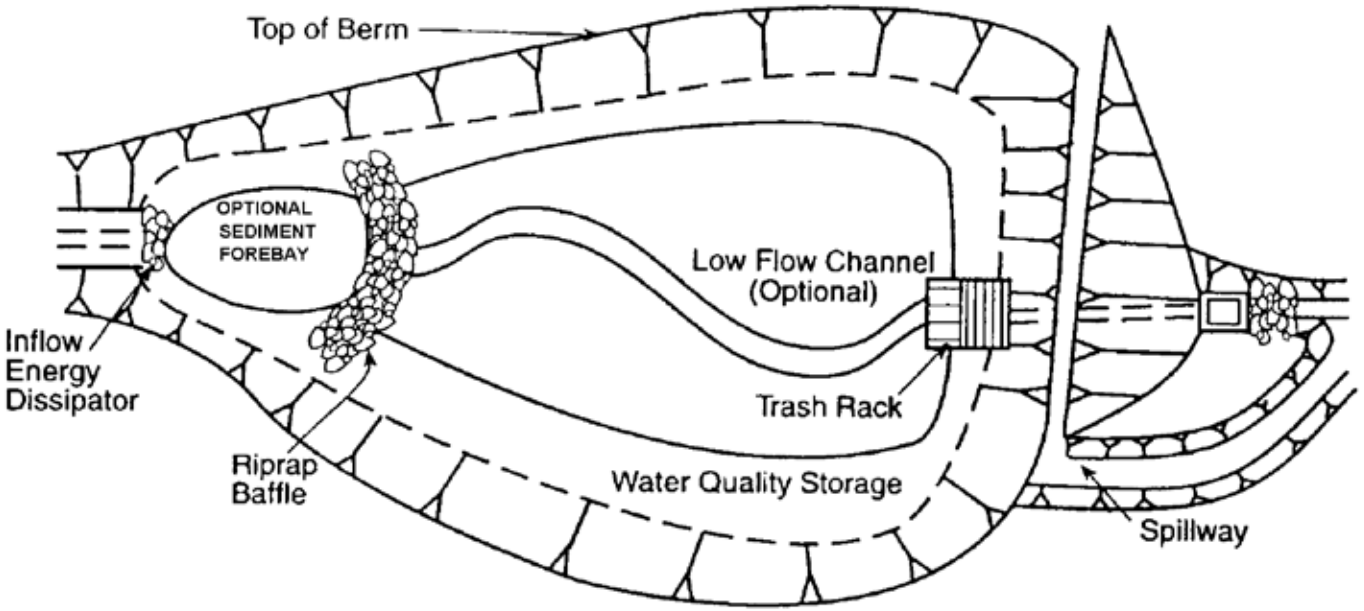
- Extended detention can address both the stormwater runoff quantity and quality impacts of land development.
- The lower stages of an extended detention basin can detain runoff from the Stormwater Quality Storm for extended periods of time, thereby promoting pollutant removal through sedimentation.
- Higher stages in the basin can also attenuate the peak rates of runoff from larger storms for flood and erosion control.
- Extended detention basins are designed for complete evacuation of runoff and normally remain dry between storm events.
- To enhance soluble pollutant removal, the lower stages of an extended detention basin may also be designed with a permanent pool and partially function as either a wetland or retention basin.

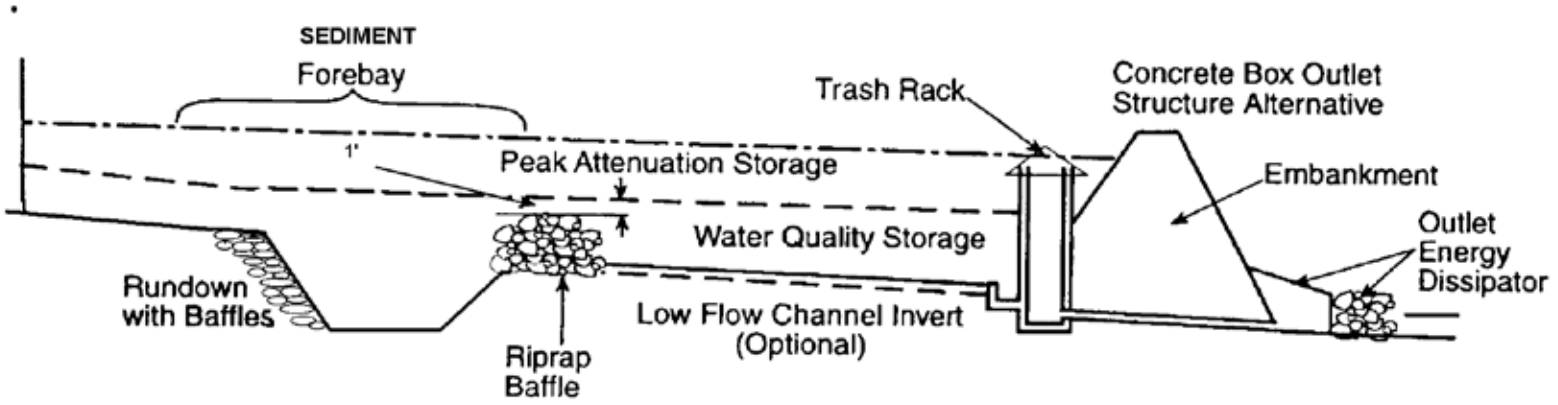
Keys for Extended Detention Basin

- The basic design parameters for an extended detention basin are its ***storage volume*** and ***detention time***.

- An extended detention basin must have the correct combination of storage volume and outflow capacity to contain and ***slowly*** discharge the design runoff volume over a prescribed period of time.

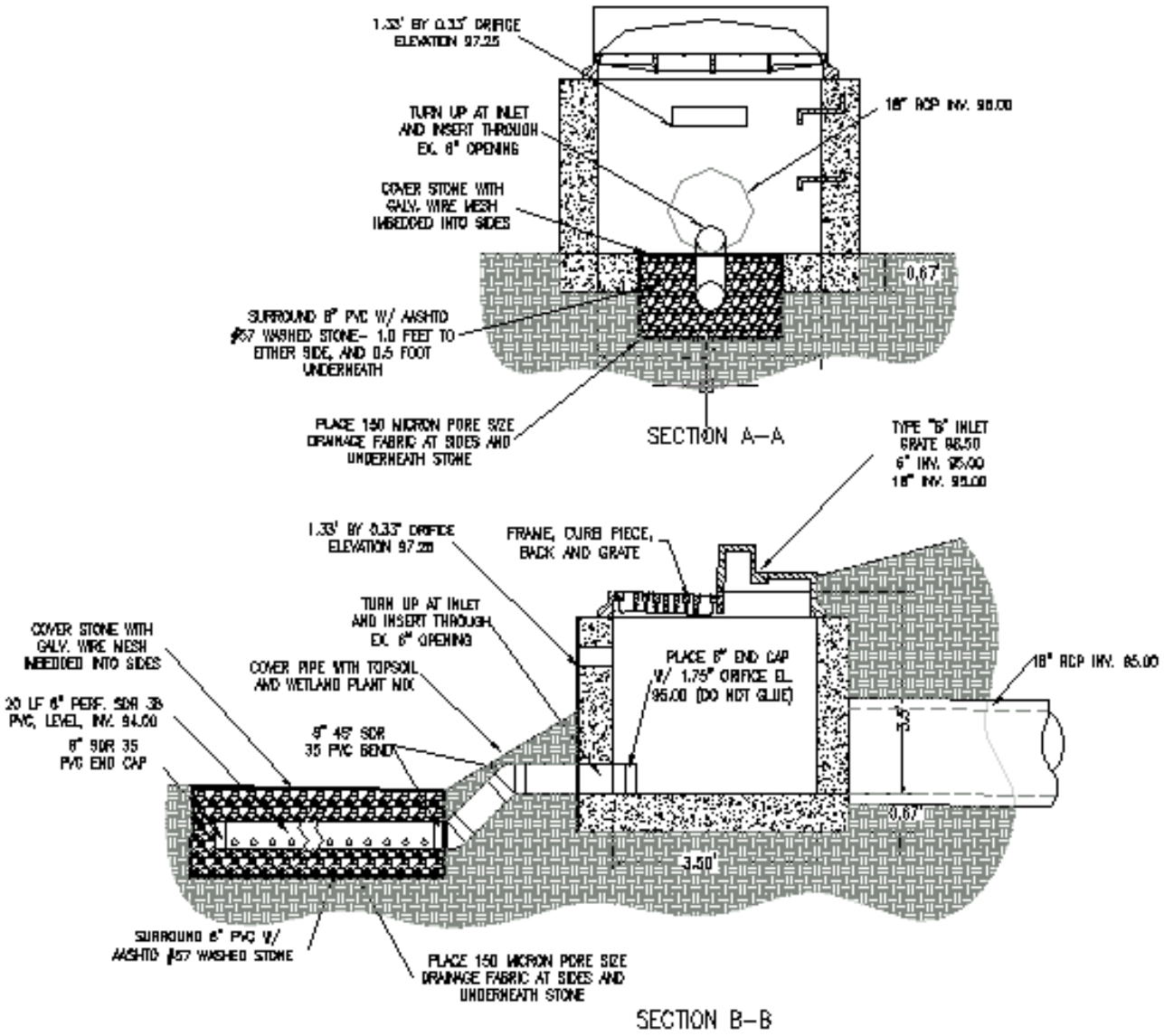
Extended Detention Basin Concept





NJ BMP Manual

Retrofit: Outlet Modification



RUTGERS New Jersey Agricultural Experiment Station

Water Resources Program

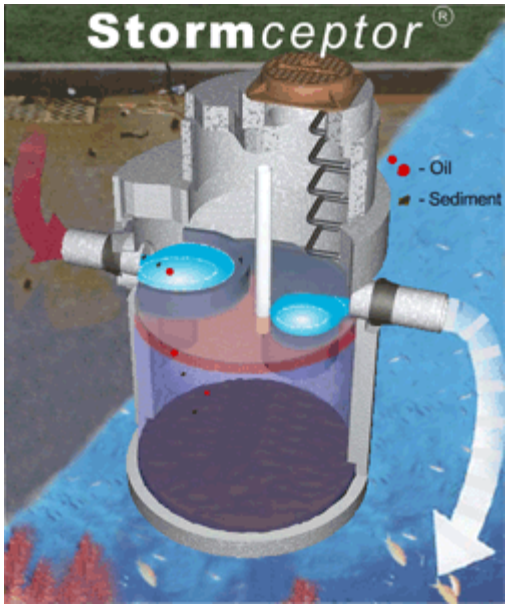
Retrofit: Outlet Modification

Retrofit: Outlet Modification

Retrofit: Water Quality

- Basins
  - Vegetate with Native Species
  - Remove Concrete Low Flow Channels
  - Install Permeable Weirs
- Storm Inlet Filtering Devices
- Manufactured Treatment Devices
- Disconnect Impervious Surfaces

Capturing, treating and infiltrating the runoff generated by the water quality storm.



Expected Costs for Naturalized Plantings and Retrofits

- Native seeding or plantings
  - Native seed costs: $25/lb - $45/lb
  - Installation costs: range from $80 - $150 per 1000 sq ft
  - Native wetland plants costs: $200 - $250 per 1000 sq ft installed
- “Snout” installation - $500
- Pre-manufactured treatment device installation
  - $10,000 - $60,000 depending on size and complexity of the installation
- Settling forebay or permeable weir Installation
  - $2,500 - $5,000 for filter fabric, rip-rap stone, and installation, depending on size and access
- Pre-cast concrete retrofit outlet structure:
  - $5,000 - $10,000 installed depending on size of structure, access, and complexity of the installation

Case Studies

Case Studies

Teaberry Run
Moorestown, NJ

EXISTING CONDITIONS

Case Studies

Teaberry Run
Moorestown, NJ

AFTER INSTALLATION

Case Studies

Teaberry Run
Moorestown, NJ

1 YEAR LATER

Case Studies

Baker Elementary School
Moorestown, NJ

EXISTING CONDITIONS

Case Studies

Baker Elementary School
Moorestown, NJ

PLANTING

Case Studies

Baker Elementary School
Moorestown, NJ

1 YEAR LATER

RUTGERS
New Jersey Agricultural Experiment Station

Water Resources Program

Case Studies

Mercer County SCD Wildflower Detention Basin Planting Program
New Jersey

- Reduce need for watering
- Eliminate use of chemical fertilizers and pesticides
- Minimize mowing
- Provide visual contrast in the landscape and provide habitat

Case Studies

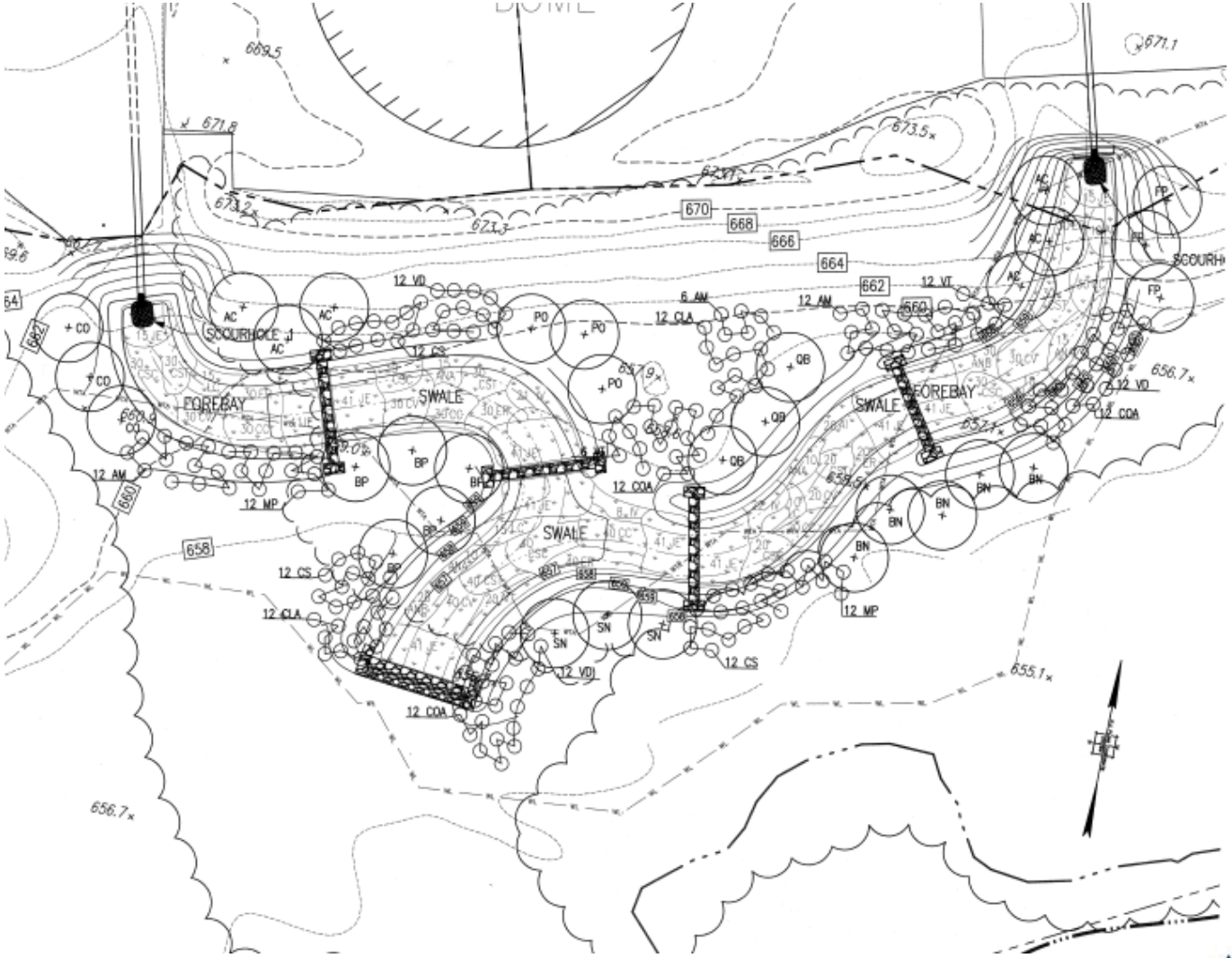
Morris County DPW Extended Detention Swale Project
Wharton, NJ

EXISTING CONDITIONS

Case Studies

Morris County DPW Extended Detention Swale Project
Wharton, NJ

PROPOSED PLAN



RUTGERS
New Jersey Agricultural Experiment Station
Water Resources Program

Case Studies

Morris County DPW Extended Detention Swale Project
Wharton, NJ

CONSTRUCTION

Case Studies

Morris County DPW Extended Detention Swale Project
Wharton, NJ

CONSTRUCTION

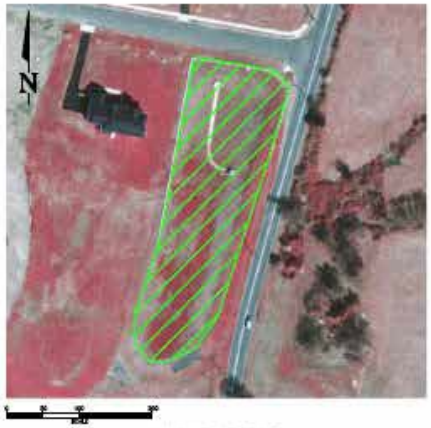
Case Studies

Morris County DPW Extended Detention Swale Project
Wharton, NJ

COMPLETED PROJECT

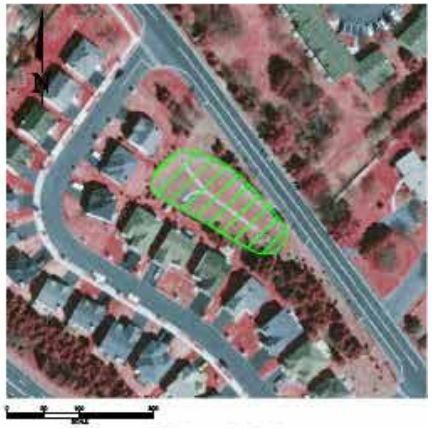
Case Studies

Hillsborough Detention Basin Retrofit Program - Somerset County, NJ



VALIS ROAD

WESCOTT ROAD



PRALL ROAD

FRANCIS ROAD

TABLE OF CONTENTS

APRIL 30, 2009

RUTGERS

New Jersey Agricultural Experiment Station

UPDIKE ROAD

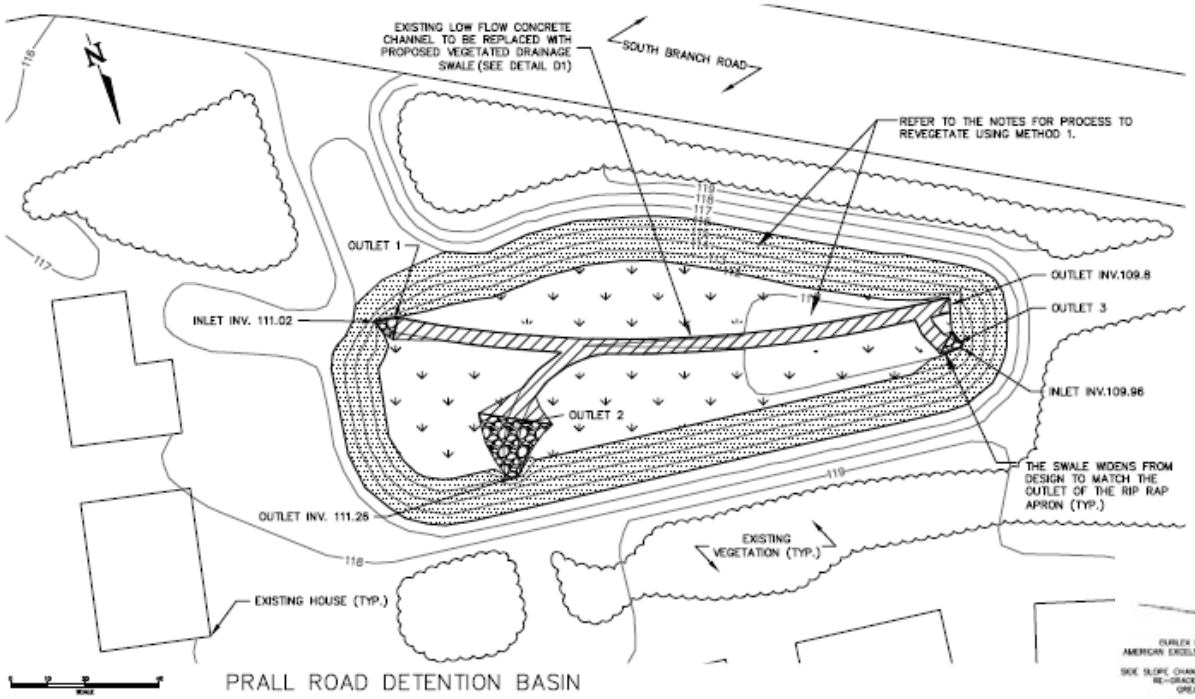
RUTGERS New Jersey Agricultural Experiment Station

Water Resources Program

Case Studies

Hillsborough Detention Basin Retrofit Program
Somerset County, NJ

Prall Road



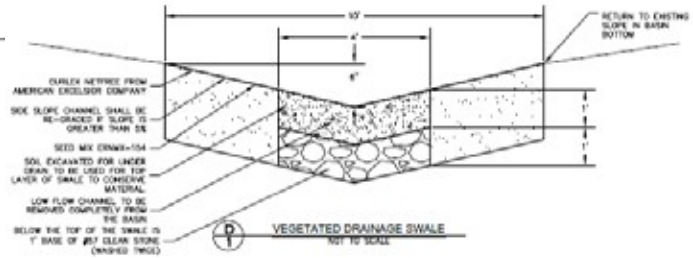
NOTES:
1. THE RIP RAP APRONS OF PRALL ROAD WILL NOT BE ALTERED FROM THEIR EXISTING DESIGN.
2. THE FIRST RESEEDING METHOD FOR THE BASINS ARE SHOWN ON SHEET S-2 AND S-3.
3. THE SECOND RESEEDING METHOD FOR EACH BASIN IS SHOWN ON SHEET S-5.

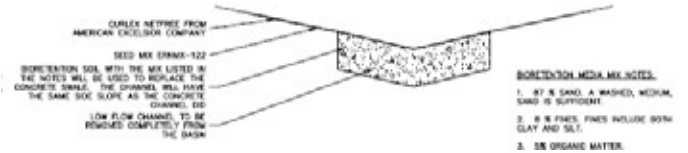
RIP RAP APRON DETAILS

OUTET	La (FT)	W (FT)	D50 (IN)
1	6	15	6
2	8	20	6
3	3	8	3

LEGEND

ERNMX-127
ERNMX-123
PROPOSED VEGETATED DRAINAGE SWALE
EXISTING RIP RAP APRON
EXISTING VEGETATION
EXISTING CONTOURS
EXISTING SW INFRASTRUCTURE
EXISTING INFRASTRUCTURE





RUTGERS New Jersey Agricultural Experiment Station
Water Resources Program

Case Studies

Prall Road Detention Basin Retrofit
Township of Hillsborough, NJ

PROPOSED PLANTS SPECIES + QUANTITIES

Herbaceous plantings 4' on center:
- BIG BLUESTEM - 110 plugs
- INDIAN GRASS - 130 plugs
- LITTLE BLUESTEM - 125 plugs
- SWITCHGRASS - 130 plugs

Herbaceous plantings 3' on center:
- FOX SEDGE - 80 plugs
- SOFT RUSH - 45 plugs

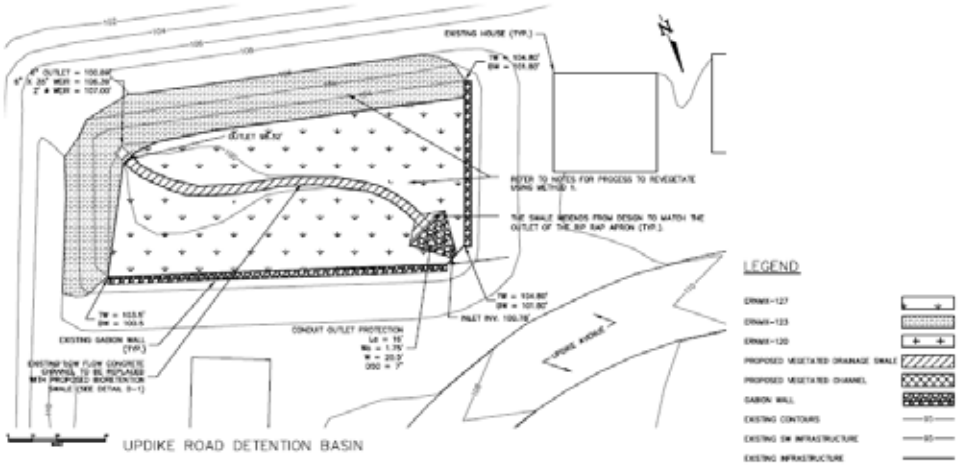
620 PLANTS TOTAL

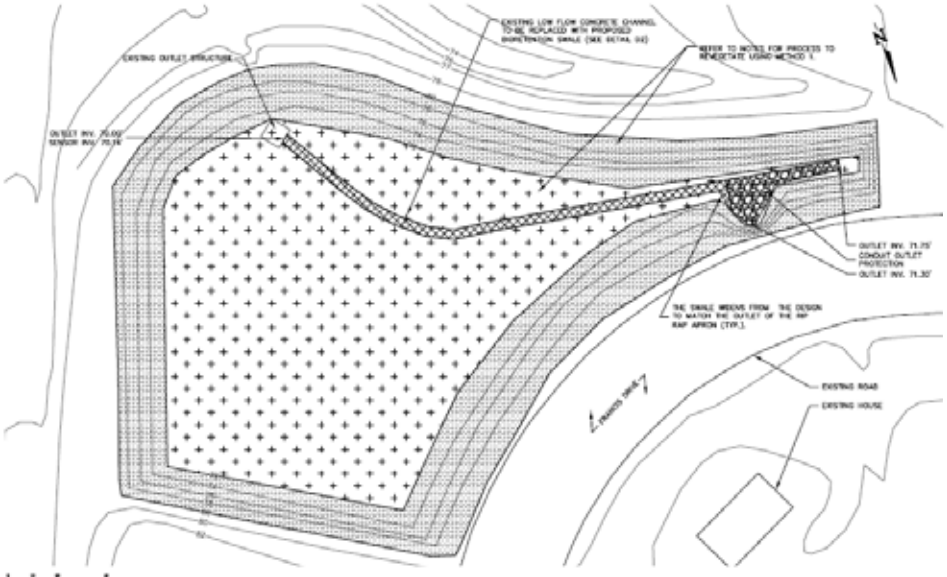
RUTGERS New Jersey Agricultural Experiment Station
Water Resources Program

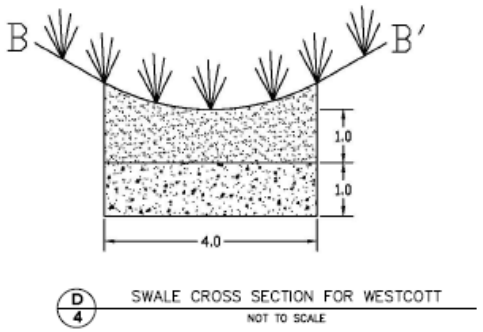
Case Studies

Hillsborough Detention Basin Retrofit Program
Somerset County, NJ

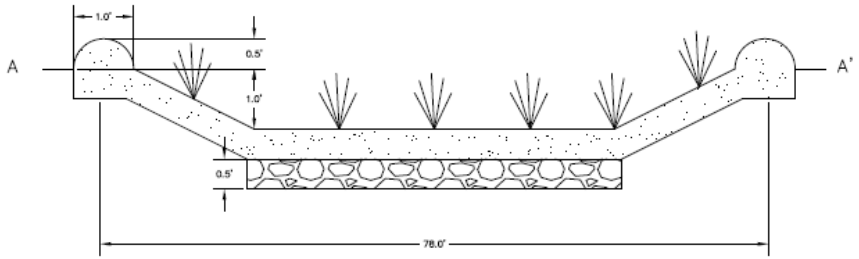
Updike Road and Francis Road







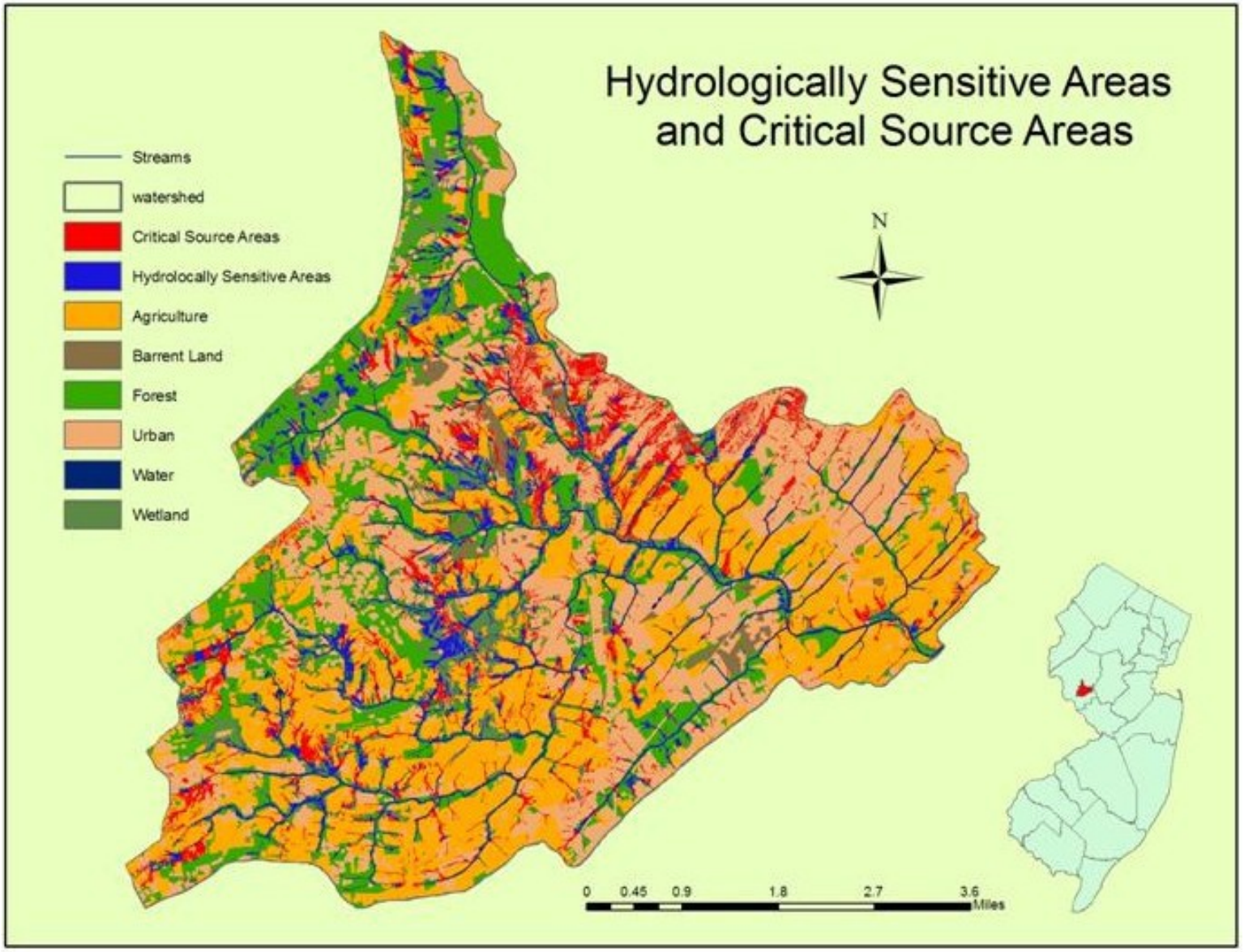
D 4 SWALE CROSS SECTION FOR WESTCOTT
NOT TO SCALE



D 3 TYPICAL CROSS SECTION OF RAIN GARDEN
NOT TO SCALE

RUTGERS New Jersey Agricultural Experiment Station
Water Resources Program

Case Studies – Neshanic River Watershed



Case Studies

Neshanic River Watershed
Hunterdon County, NJ

NESHANIC RIVER WATERSHED

MBD 003S

- PROPOSED SHRUBS - DRY CONDITIONS

[illegible]

- PROPOSED HERBACEOUS - DRY CONDITIONS
  - Bearberry
  - Big Bluestem
  - Black-eyed Susan
  - Blue Mistflower
  - Butterfly Milkweed
  - False Sunflower
  - Grey Goldenrod
  - New England Aster
  - Purple Coneflower
  - Switchgrass
  - Wild Bergamont
  - Yellow Wild Indigo

- PROPOSED SHRUBS - WET CONDITIONS

[illegible]

- PROPOSED HERBACEOUS - WET CONDITIONS

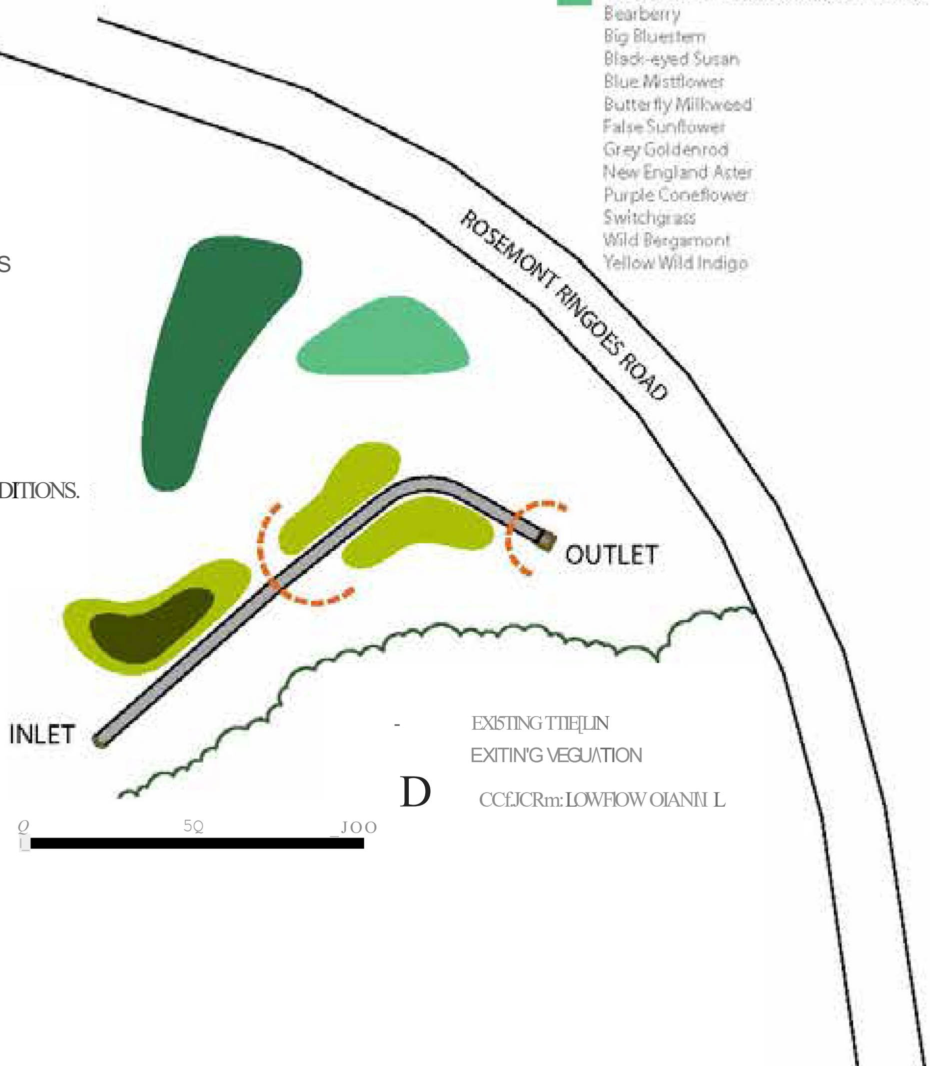
[illegible]

PERMEABLE BERM

EXISTING TREELINE

EXISTING VEGETATION

CONCRETE LOW FLOW CHANNEL

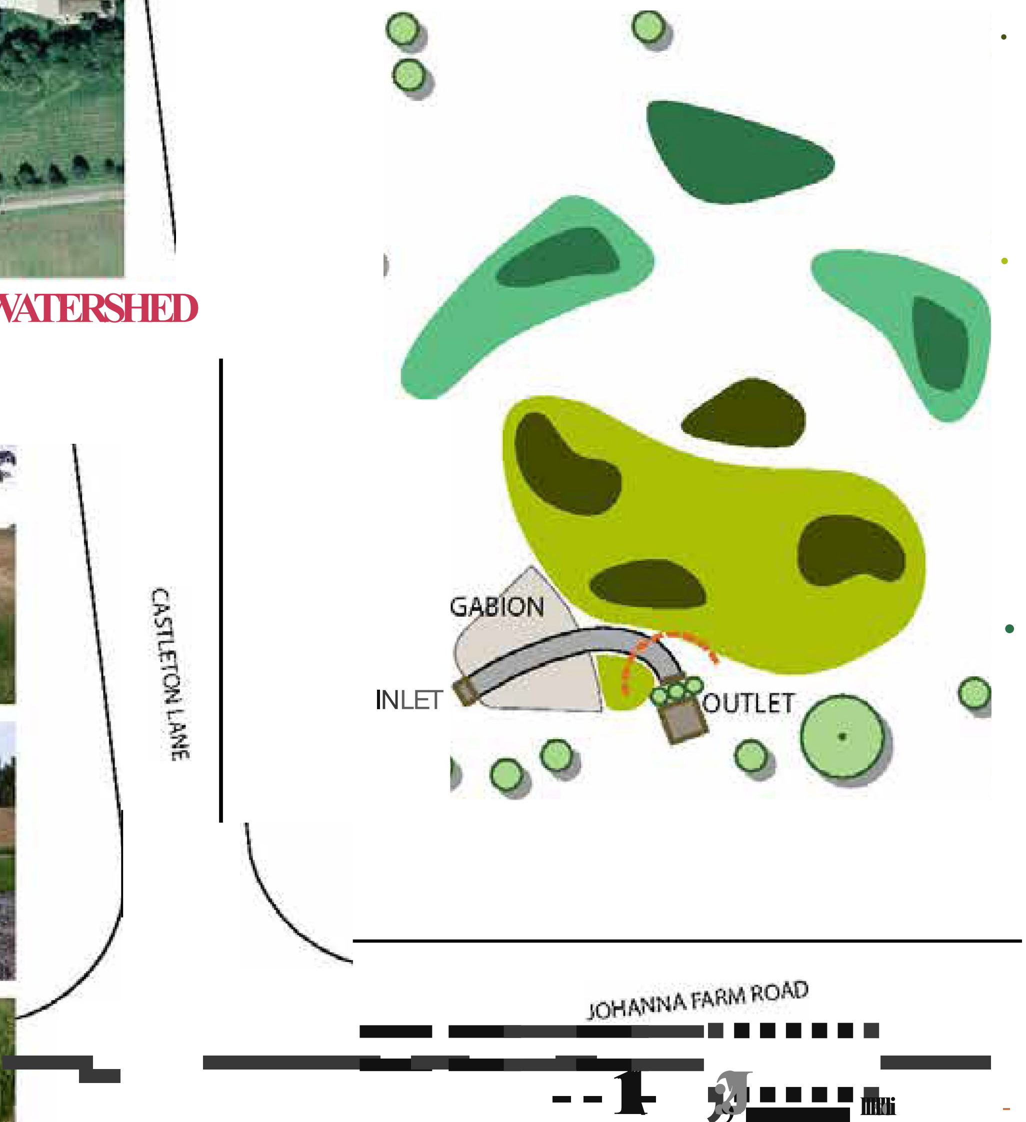


Rutgers New Jersey Agricultural Experiment Station

Water Resources Program

NESHANIC RIVER WATERSHED

MBD-0054



- I' HOPOSI:D SHHUBS - WE:I CONDrr I0Ns
  /lJto,wwood Vlburnwi-.
  Irwl:;i:fry'
  I 3rnybery
- PBOPOS·0 HERBACEOUS-WEI CONDffION
  Sc:>!:-1
  Sll c.!dti Sr.!.,!.,i
  81L,, _.I
  C .d. l ul rl. ;,,'
  rw . gc
  Longhair S@d:g,
  Mı :.Huw•
  fti!!,a'cil
  S w n ' f l M i , l
  u l t k
- 1'mmsEJD5HilUBS - t.mY CW DI1'10N S
  B a ,)"
  l?h• ·h:.," 1bu1nwm
  l,1.'lp/ .-aM im
  .ifltchh:a:z@I
- PROPOSED HER-BACEOUS- DRY CONDrllONS
  B l:-llry
  Ri9 81u t..111
  lari<'- y....j
  E.NeMi<:l'I'Oec
  Bll<:-yMliv,
  " S:.11 ow1
  G,"I' Gclci • o
  F al nd A5ier
  Purp ,:, (on o w e
  ""t.:l'J'1rJ"
  :.n 1vWild 1,,
- I' I'M EABH BfBM

EXISTING, ifIEE.ll E

D'.I TIGVEHA.Tlc«

D

m,UJiH RONCHANN L

I_UTGER

'IrAq ıcw ur I

E:,;penmi:nt 1.111on

Hamilton Township

RUTGERS
New Jersey Agricultural Experiment Station

Water Resources Program

Kristopher Drive Basin Prior to Cleaning (2011)

Kristopher Drive Basin After Cleaning (2012)

Hamilton Township (Mercer County)

Stormwater Basin Assessment Summary

(Year 1)

Developed by the Rutgers Cooperative Extension Water Resources Program
Funded by Hamilton Township, Mercer County, New Jersey

December 6, 2012

RUTGERS

Hamilton Township Stormwater Infrastructure Assessment Program
Stormwater Structure Inspection Checklist

Hamilton

GENERAL INFORMATION	Site ID:
Name(s) person inspecting the structure:	Date:
Location Address and Cross Streets:	Watershed:
Name of Creek, Stream, or area into which the structure discharges:	Property Owner / Tax Parcel Block & Lot:
Contact information:	
STRUCTURAL COMPONENTS	
Description, condition, flow present/volume, odor, etc.:	Is the structure accessible to maintain? Yes / No Is it maintained: clear of woody plants, litter, debris, sediment?
Pipe Material:	Pipe Diameter:

GENERAL OBSERVATIONS	YES	NO	NOTES/REMARKS
1) Any reports on the structure not functioning?			
2) Are there any unauthorized or malfunctioning components in the stormwater structure?			
ACCESS POINTS			
1) Signs of breakage, damage, corrosion or rusting of structure/lid/pipe?			
2) Debris or sediment accumulation in or around the inlet clogging the opening/pipe?			
3) Signs of blockage around the access point?			
4) Tree roots, woody vegetation growing close to or through the access point or a situation impacting the structure's integrity?			
DRAINS			
1) Accumulation of debris or litter within drain?			
2) Tree roots, woody vegetation growing close to or through the drain or a situation impacting the structure's integrity?			
3) Excess sediment accumulation in the drain?			
4) Is there standing water in the drain?			
5) Is the drain lining deteriorating/is there scour or damage?			
PIPES			
1) Accumulation of debris or litter within pipe?			
2) Tree roots, woody vegetation growing close to or through the pipe or a situation impacting the structure's integrity?			

RUTGERS New Jersey Agricultural Experiment Station

Water Resources Program

Hamilton Township

- Identified 13 stormwater detention basins for a pilot program for alternative maintenance approaches.
- Rutgers staff met with Township DPW staff to outline alternative maintenance practices for water quality improvement.
- Rutgers provided a letter to the Township informing residents about the benefits of this new maintenance approach.
- Diagrams defining the new practices and strategies in the 13 basins have been created and have been provided to the Township DPW.
- Recommend developing plans for an additional 10-12 basins

Planning for Maintenance

Planning for Maintenance

- Identify individual/s or organization/s responsible for inspections and maintenance:
  - Public Entity
  - Homeowner's Association
  - Property Owner
- Provide a clear procedure for recording inspections and reporting maintenance needs
- Develop a routine maintenance schedule
- Develop and use a standard inspection form
- Clearly mark access areas for inspections and maintenance
- Identify and provide any specialized equipment or tools needed to properly maintain the facility
- Develop an emergency protocol should the system fail or not function as designed

Maintenance Plan Diagram

Pilot Maintenance Program
Hamilton Township Stormwater Basins
Englewood Basin

BASIN LOCATION
Behind 125 Englewood Ave at end of street.

Legend:

- Allow basin to naturalize.
- No mow zone.
- Area to mow and keep clear.

Maintenance Notes:

- Limit monthly mowing to a 6-8 ft. perimeter area around the basin.
- Maintain 4-6 ft. clear zone around inlets and outlet on a monthly basis.
- Reduce mowing of basin bottom to once per year.

Maintenance Plan Outline

I. INTRODUCTION & OVERVIEW

II. FACILITY DESCRIPTION

III. CONSTRUCTION MANAGEMENT

- A. Sequencing
- B. Quality Control

IV. MAINTENANCE

- A. Responsibilities
- B. Schedules
- C. Access
- D. Safety
- E. Equipment, Tools, and Supplies
- F. Cleaning of Inlet and Outlet Structures
- G. Landscape Care
  1. Mowing
  2. Removal of Invasive Vegetation
  3. Replacement of Vegetation
  4. General Herbaceous Care
  5. General Shrub Care
  6. On-Site Fertilizer and Pesticide Use
  7. Wildlife Management

V. INSPECTIONS

- A. Responsibilities
- B. Schedules
- C. Inspection List
- D. Emergency Plan

NJ BMP Maintenance Manual Requirements

1. Identify person/s responsible for preventive and corrective maintenance
2. Identify specific preventive and corrective maintenance tasks and detailed information on specific structural components or nonstructural measures
3. Provide a schedule of regular inspections and tasks
4. Provide cost estimates of maintenance tasks
5. Include detailed logs of all preventive and corrective maintenance performed
6. Identify specialized tools or equipment needed
7. Recommend corrective responses if emergency arises
8. Provide guidance for safety during inspections and maintenance
9. Identify approved disposal and recycling sites and procedures for sediment, trash and debris
10. Include an as-built construction plan

Summary & Conclusion

1. With proper design and up front planning, routine maintenance of stormwater facilities can be accomplished without putting undue burden on operations personnel and budgets.
2. Non-routine maintenance requirements need to be accounted for and with regular inspections, these activities can be planned for and expected costs incorporated into operations budgets avoiding large unexpected capital expenditures.
3. Many options exist to modify existing systems to either reduce need for regular maintenance and/or improve the effectiveness of the system for both water quantity and water quality controls.

References

We recommend: ***New Jersey Stormwater Best Management Practices Manual***
Available at: http://www.njstormwater.org/bmp_manual2.htm

Design References:

1. Maintaining Your BMP, A Guidebook for Private Owners and Operators in Northern Virginia, Northern Virginia Planning District Commission, Division of Environmental Services, February 2000.
2. Sustainable Sites and Natural Landscapes, Northeastern Illinois Planning Commission, January 2004.
3. Stormwater Management Basins and Their Maintenance, Monmouth County Mosquito Extermination Commission, 1999.
4. Minnesota Urban Small Sites BMP Manual, Metropolitan Council/Barr Engineering Co.
5. Maintaining Wet Detention Ponds, Land-of-Sky Regional Council, Asheville, NC.
6. Storm Water Technology Fact Sheet, Wet Detention Ponds, USEPA, 1999.
7. Establishing Wildflowers Tip-Sheet, Mercer County Soil Conservation District, 1995.
8. Indiana Wetland Conservation Plan Fact Sheet, Did You Know?...Healthy Wetlands Devour Mosquitoes, Indiana Department of Natural Resources.
9. The Maintenance of Residential Stormwater Management Areas, USDA NRCS, January 2000.
10. Operation, Maintenance, and Management of Stormwater Management Systems, Watershed Institute, Inc. and USEPA, August 1997.