

Micro-managing Water One Site at a Time: Keeping Rain on the Land

A presentation to the Empire Chapter of the Soil and Water Conservation Society
January 21, 2010
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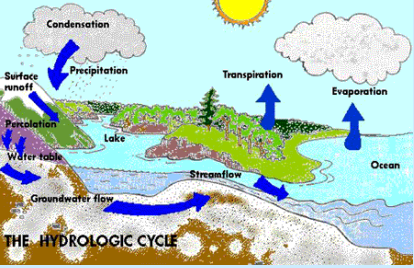
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Session Overview

- What Issues do YOU have? Large - small
- Rain can be a Resource – or Hazard
- Managing Runoff is the Law - SPDES
- How do YOU view water? – site plans/subs
- Options? Traditional or LID/BSD Practices
 - Design a Rain Garden
- Making LID/BSD Happen
 - Look at YOUR laws
- Let's Solve YOUR Problems

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Basic Premise: Rainwater is Good!



THE HYDROLOGIC CYCLE

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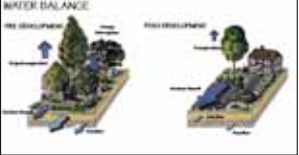
More Basic Premises

- Creative, thoughtful people design our communities....cities don't just grow there!
- We rebuild our communities.
- Water can be designed into a place as a positive feature.
- Re-routed/intercepted water can reduce urban runoff.

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Effects of Land Development on Stormwater Runoff

- Urbanization/land development changes site hydrology and stormwater runoff characteristics
- These changes can have a number of negative impacts on on-site and downstream terrestrial and aquatic resources

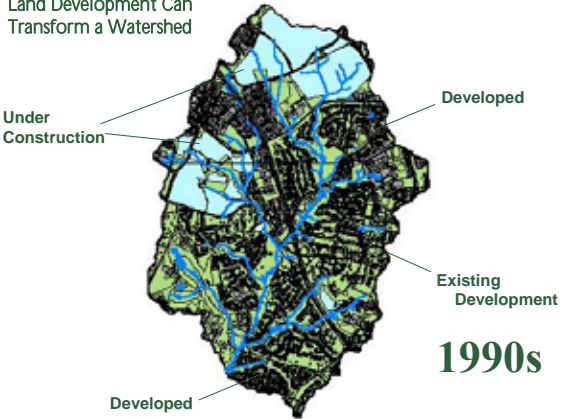


Impacts:

- Hydrologic
- Physical
- Water Quality (Chemical)
- Biological

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Land Development Can Transform a Watershed



1990s

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Impacts from Construction

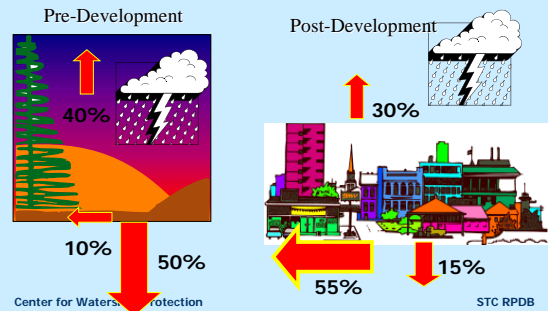
Sediment Runoff rates from construction sites are 10 to 20 times greater than from agricultural lands and 1,000 to 2,000 times greater than from forested areas.



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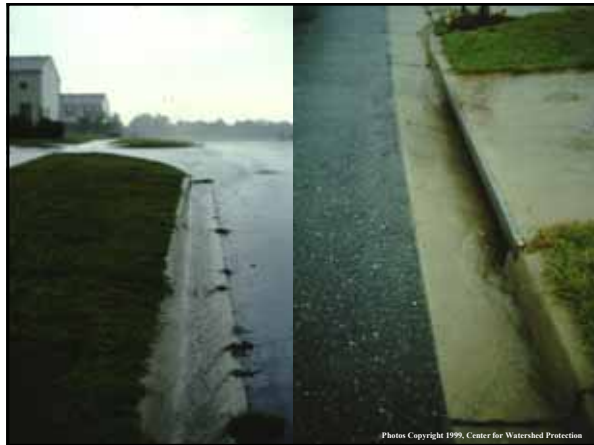
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Impacts of Development on the Water Cycle



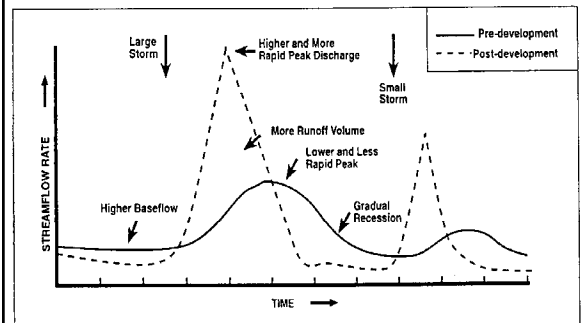
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STREAMFLOW



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Impacts to Streams

- Changes in Stream Shape or "Geomorphology"
- Sedimentation in the stream bed
- Loss of stream-side forest
- Loss of in-stream habitat
- Poor water quality
- Degradation of stream biota

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Water Quality Impacts - Pollutants in Urban & Industrial Stormwater:

- Oil & Greases
- Metals
- Nutrients
- Bacteria
- Pesticides
- Herbicides
- Temperature
- Sediment

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Stormwater Management is Required!

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New York State SPDES Permits

Two Permits:

- “Municipal Separate Storm Sewer System” (MS4) primarily regulates communities in urbanized areas of the state.
- Construction permit regulates construction site owner/operators



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MS4 Permit - Certain Areas: Population Center of 50,000 with surrounding area of 1,000 people per square mile or more



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Applies to ALL of New York State



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Part 1/Basic SWPPP:
Erosion & Sediment Control Plan - Controlling stormwater **DURING** construction:



▪**All** construction projects disturbing **1 acre or more of soil**



Part 2 of SWPPP – Water Quality & Quantity – controlling stormwater after development is complete

(Parts 1 + 2 = Full SWPPP)



- **1 acre or more soil disturbance FOR:**
 - Multifamily, Commercial, Industrial
 - 303(d) listed (impaired) waters
 - Total maximum daily load (TMDL) watersheds

Breakin' the Law!

Problem:

Even if a site doesn't need any permit, it can cause a water quality violation.

Bottom line:

All sites should practice erosion and sediment control and “good housekeeping.”



Turbidity Violation:
A “substantial visible contrast to natural conditions”

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The Role of Local Government

Local government has all of the power in land use decisions.



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Some Potential Roles for Stormwater Management

- Review and approve plans for development
- See plans very early in the planning stages
- Inspect most sites
- Regulate sites smaller than 1 acre
- Find out about projects that don't submit an NOI to DEC.

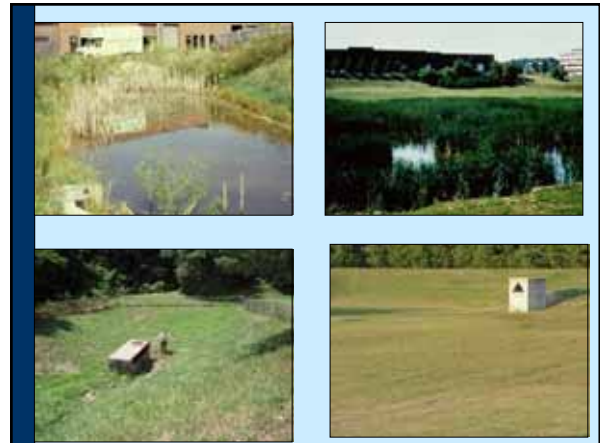
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So, what do you ask for??

- Traditional stormwater management?
- Low Impact Development / Better Site Design?

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Solution: Better Site Design Development design that seeks to:



◀ Preserve undisturbed areas

NYSDEC "Better Site Design"

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Solution: Better Site Design Development design that seeks to:



◀ Reduce impervious cover

- Roads
- Parking lots
- Driveways

NYSDEC "Better Site Design"

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Solution: Better Site Design



Development design that seeks to:

- ◀ **Better integrate stormwater treatment**

NYSDEC "Better Site Design" STC RPDB

BSD & Impacts of Development

- **Preserving Natural Features and Using Conservation Design** → **Avoid the impacts**
- **Reducing Impervious Cover** → **Reduce the impacts**
- **Source Control for Stormwater Management** → **Manage the impacts**

NYSDEC "Better Site Design" STC RPDB

Guidance for Better Site Design

- **NYSDEC "Better Site Design" Guidance Paper – on DEC website (18 principles)**
- **Center for Watershed Protection Book and Code & Ordinance Worksheet (1998)**
- **NYSDEC Hudson River Estuary Program REVISED Code & Ordinance Worksheet for NYS (2008)**

NYSDEC "Better Site Design" STC RPDB

What is LID?

- **Low Impact Development:** The integration of site ecological and environmental goal and requirements into all phases of urban planning and design from the individual residential lot level to the entire watershed.
– www.lowimpactdevelopment.org

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Facets of LID

- integrate stormwater management early in site planning activities
- use natural streams and drainage patterns as framework
- focus on prevention rather than mitigation
- emphasize simple, nonstructural, low-tech, and low cost methods

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More LID Characteristics

- manage as close to the source as possible
- distribute small-scale practices throughout the landscape
- rely on natural features and processes
- create a multifunctional landscape

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LID SAMPLER

- Show variety of techniques in region
- Prove LID works in northern climates
- Provide info so reader can decide
- Encourage LID use so that rainwater becomes a resource not burden
- Present info in easy-to-read format

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Vegetated Buffers & Strips



("Designing Buffers" Handbook)

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- Natural vegetation lining streams or roads
- Catch and filter runoff and pollutants
- Cut down on floods
- Prevent stream bank erosion
- Habitat for aquatic life
- Provide shade; cool water temperatures
- Restore natural conditions

Vegetated Swales



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(Rhodes 1-3)

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- Long dip, usually along road, acts as a channel for stormwater
- Dry swales can be mowed
- Inexpensive and easy to build
- Vegetation slows water down and filters out nutrients / pollutants
- Wet swales encourage wildlife

Swales concerns

- Slope and design important – too steep a slope can cause erosion
- Homeowners decide to fill
- Identify as drainage system
 - on plans
 - on site



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(Rhodes 4)

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Bioretention



(Davis)

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- Wide concept
- Shallow basin filled with soil/sand
- Soil provides infiltration
- Native plants filter pollutants
- Reduce impervious surface area
- Aesthetically pleasing

Bioretention (cont'd)

Nine Points of a Bioretention Facility:

- Pretreatment
- Flow entrance
- Ponding area
- Plants
- Organic layer/mulch
- Planting soil, filter media
- Pea gravel diaphragm
- Underdrain and outlet
- Surface overflow



(Boyd 1)

(Davis 1)

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Bioretention (cont'd)

Two types of bioretention:

- End-of-pipe
- On-site

Ideal uses for bioretention:

- Parking lot island (curb cuts)
- Highway median
- Rain garden
- Small lots

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Soil Amendments

- Mix into soil
- Improve soil quality
- Increase soil's aeration, infiltration, and capacity to hold water and nutrients



("What is Soil?" NRCS Soils)

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Soil type	Permeability	Water retention
sand	high	low
loam	medium	medium
silt	low	high
clay	low	high

• Use a soil amendment to change physical properties of soil.

Amendment	Permeability	Water retention
Fibrous		
Peat	low-medium	very high
Wood chips	high	low-medium
Hardwood bark	high	low-medium
Humus		
Compost	low-medium	medium-high
Aged manure	low-medium	medium
Inorganic		
Vermiculite	high	high
Perlite	high	low

(Davis & Wilson 4)

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Rooftop Gardens

- Reduce impervious area
- Eliminate most/all of roof's runoff
- Shield and protect roof
- Lower energy costs
- Reduce "heat island" effect, improve air quality

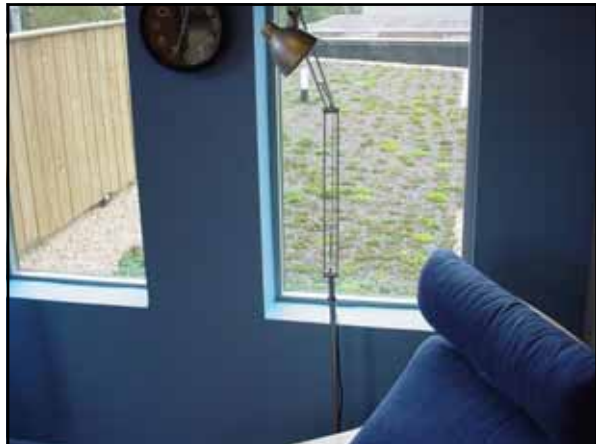


("Green Roofs," NEMO)

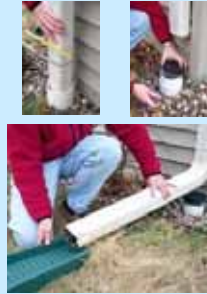
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Roof Leader Disconnection



- Roof leaders connected to storm sewer
- Cut off end of downspout, cap sewer standpipe, attach elbow and extension to downspout; splashblock
- Attach to soaker hoses
- Connect to water features

("Downspout Disconnection Program")
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Rain Barrels & Cisterns



- Collect rainwater
- Use to water garden
- Install filter (more \$) for household use
- Cut down on water bills
- Connect to downspout
- Mosquito-proof lid
- Angled runoff pipe
- Spigot
- 1" rain on 1,000 ft² roof = 600 gal water

(Rain Barrel Guide)

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Buildings Design

Downspouts Disconnect / Water Use



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An **Infiltration Rain Garden** is a form of bioretention facility designed to have aesthetic appeal as well as a stormwater function. Rain gardens are commonly a concave landscaped area where runoff from roofs or paving infiltrates into deep constructed soils and subsoils below. On subsoils with low infiltration rates, Rain Gardens often have a drain rock reservoir and perforated drain system to convey away excess water.

1. Tree, Shrub and Groundcover Plantings
2. Growing Medium Minimum 450mm Depth
3. Drain Rock Reservoir
4. Flat Subsoil - scarified
5. Perforated Drain Pipe 150mm Dia. Min.
6. Geotextile Along All Sides of Drain Rock Reservoir
7. Overflow (standpipe or swale)
8. Flow Restrictor Assembly
9. Secondary Overflow Inlet at Catch Basin
10. Outflow Pipe to Storm Drain or Sewer System
11. Trench Dams at All Utility Crossings

Full Infiltration
Where all inflow is intended to infiltrate into the underlying subsoil. Candidate in sites with subsoil permeability > 30mm/hr. An overflow for large events is provided by pipe or swale to the storm drain system.

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Rain Gardens

- Dish-shaped depression
- Gathers runoff
- Plants filter out pollutants
- Advantages:
 - Good for individuals
 - Can be low-cost, easy
 - Beautify land
 - Significantly reduce runoff

("Rain Garden History" 2)

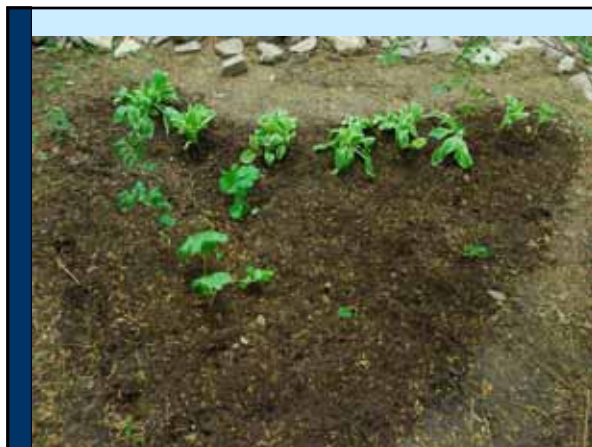
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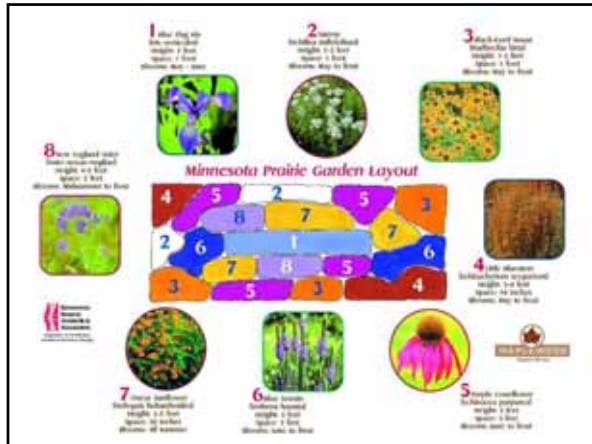
Rain Garden Principles

Rain gardens should be located at least 10 feet from the house, on a gentle slope that catches downspout water.

- Size and site correctly
- Slope and berms
- Plantings

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- Long Term Maintenance Concerns
 - Homeowners move
 - Building & Grounds priorities change
 - Weeding and replanting
 - Wash outs

- Long Term Maintenance
 - Functionality
 - Design/build correctly
 - Identify with onsite marker
 - Plant correctly
 - Native plants not annuals
 - Low maintenance
 - Resources
 - Printed material
 - Industry
 - Stormwater Coalitions
 - Workshops

Permeable Pavers



(James 2)

- Granular and porous or made of interlocking blocks
- Traps rainwater instead of acting as conduit
- Reduces runoff

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Stormwater BMP Quiz



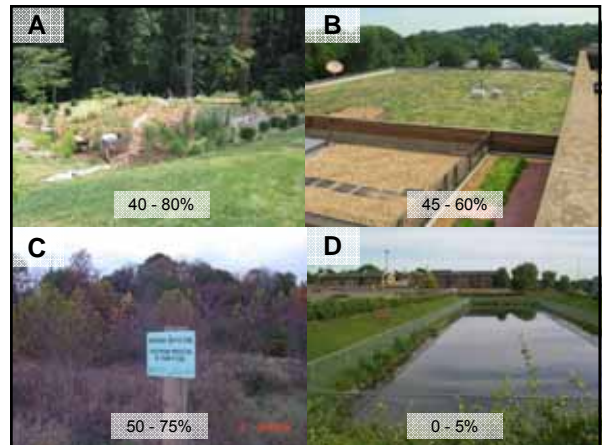
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1. Which BMP Does the Best Job of Reducing Annual Stormwater Runoff Volumes?

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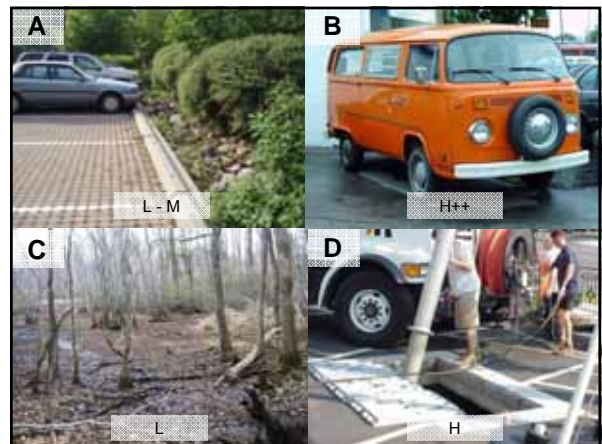
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2. Which Stormwater BMP Would You Rather Maintain?

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3. Which Stormwater BMP has the Lowest Unit Cost?

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4. Which Stormwater BMP Must Be Considered Early in the Site Planning and Design Process?

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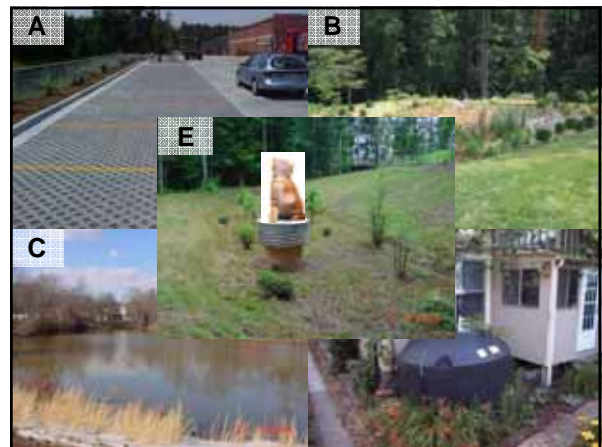
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5. Which Stormwater BMP Gives You the Warm Fuzzies?

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The Fact Is – We Ask For It!

- We encourage them with our:
 - Stormwater Codes & Ordinances
 - Stormwater Design Criteria

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Making LID/BSD Happen

- Allow flexibility in design
- Remove barriers to LID/BSD in your codes
 - see CWP Tool #4
- Stormwater criteria that explicitly encourage LID (e.g., New York State “Credits”)
- Encourage LID as a “retrofit”
- Others???

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Case Study: Town of Dryden

- Stormwater Standards include the following:
 - Require at least two “Better Site Design” practices.
 - Infiltration requirement.
 - Use of “stormwater credits” to meet the infiltration requirement.

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What are YOUR Site Solutions?

- Look at your Site Issue – write down / design which LID/BSD approach(es) would work
- Report Out

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What are YOUR Larger Solutions?

- Look at your larger issue – write down / design which LID/BSD approach(es) would work
- Report Out

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RESOURCES

- www.lowimpactdevelopment.org
- lid-stormwater.net
- epa.gov/nps/lid
- chesapeakebay.net/stormwater
- stcplanning.org then “Document Library”
- www.cwp.org

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Resources from New York State

- New York State Stormwater Management Design Manual (Includes Redevelopment Guidance)
- Better Site Design

Available at:

<http://www.dec.ny.gov/chemical/8694.html>

“The Use and Implementation of Stormwater Credits”, Available at:

<ftp://ftp.dec.state.ny.us/stormdocuments/design-guidance/credits-final.pdf>

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- Comprehensive Guide for Phase II Communities:

- Detailed guidance on program setup, creating an ordinance, sizing criteria, planning and growth, low impact development, etc.
- Includes a variety of tools, including manual builder, model ordinance, performance bond tool, self-audit tool, etc.



www.cwp.org/postconstruction

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CONTACT FOR MORE INFO

- RURAL STORMWATER COALITION
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 - Elaine Dalrymple, Schuyler SWCD 607-535-9650
 - Jeff Parker, Steuben SWCD 607-776-7398 x 3
 - Diane Fiorentino, Chemung Co. Stormwater Coalition 607-796-2216
- Center for Watershed Protection
 - Deb Caraco, 607-277-6337

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THANK YOU FOR YOUR ATTENTION!!

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