Green Infrastructure for Municipalities in New York's Lake Champlain Basin

Introduction: What Is Green Infrastructure?

New York – Lake Champlain Basin – Green Infrastructure for Municipalities

Changes in Hydrology From Developed Sites

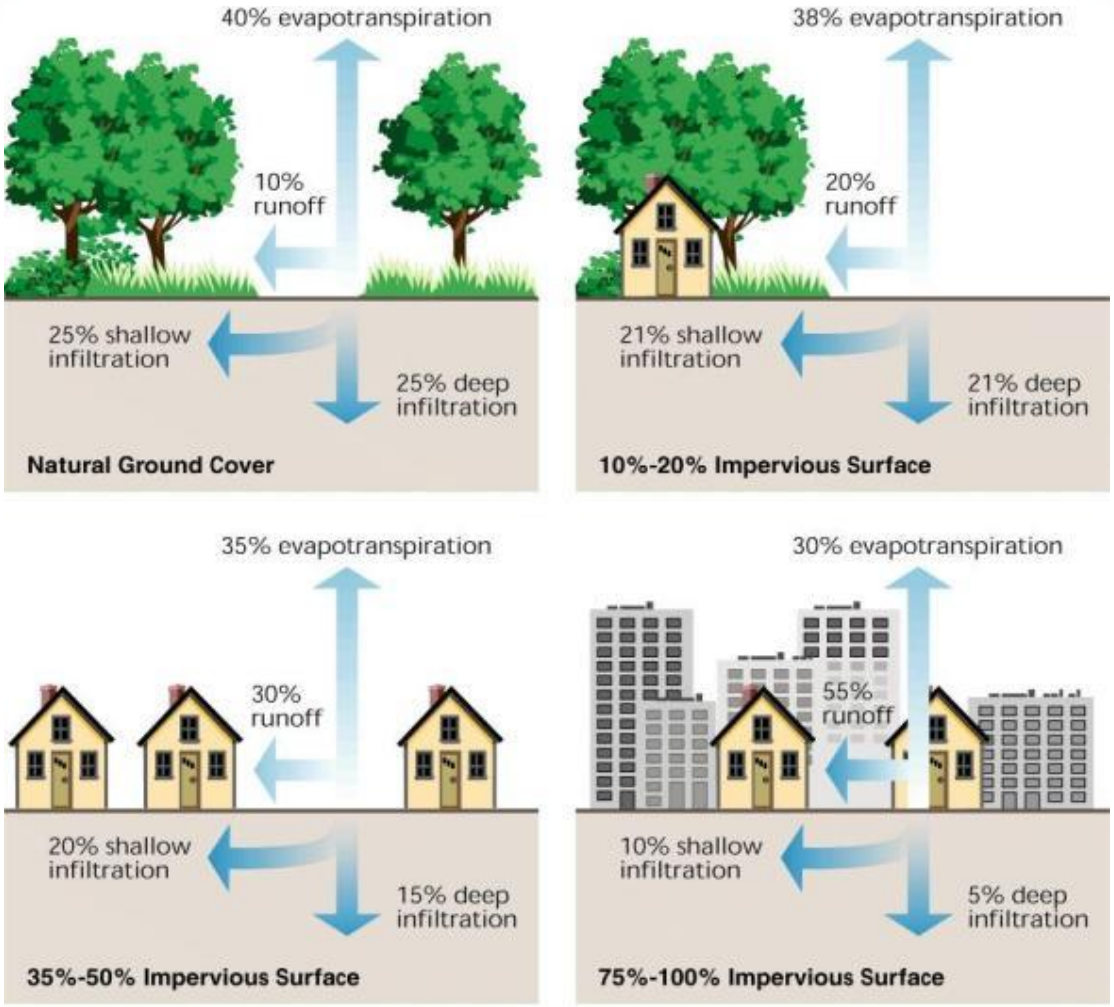


Fig. 3.21 -- Relationship between impervious cover and surface runoff. Impervious cover in a watershed results in increased surface runoff. As little as 10 percent impervious cover in a watershed can result in stream degradation.
In Stream Corridor Restoration: Principles, Processes, and Practices (10/98).
By the Federal Interagency Stream Restoration Working Group (FISRWG) (15 Federal agencies of the U.S.)

What Is Green Stormwater Infrastructure

- Toolbox of methods and practices to manage stormwater runoff from developed land and **mimic natural hydrology**.
- **Complimentary system** that seeks to improve water quality and reduce water quantity by capturing runoff as **close to the source** as possible (i.e. where the rain drop falls) and infiltrating, filtering, detaining, or otherwise storing runoff for reuse.

U.S. EPA Definition

- Green infrastructure is a cost-effective, resilient approach to managing wet weather impacts that provides many community benefits. While single-purpose gray stormwater infrastructure—conventional piped drainage and water treatment systems—is designed to move urban stormwater away from the built environment, green infrastructure reduces and treats stormwater at its source while delivering environmental, social, and economic benefits.

- https://www.epa.gov/green-infrastructure/what-green-infrastructure

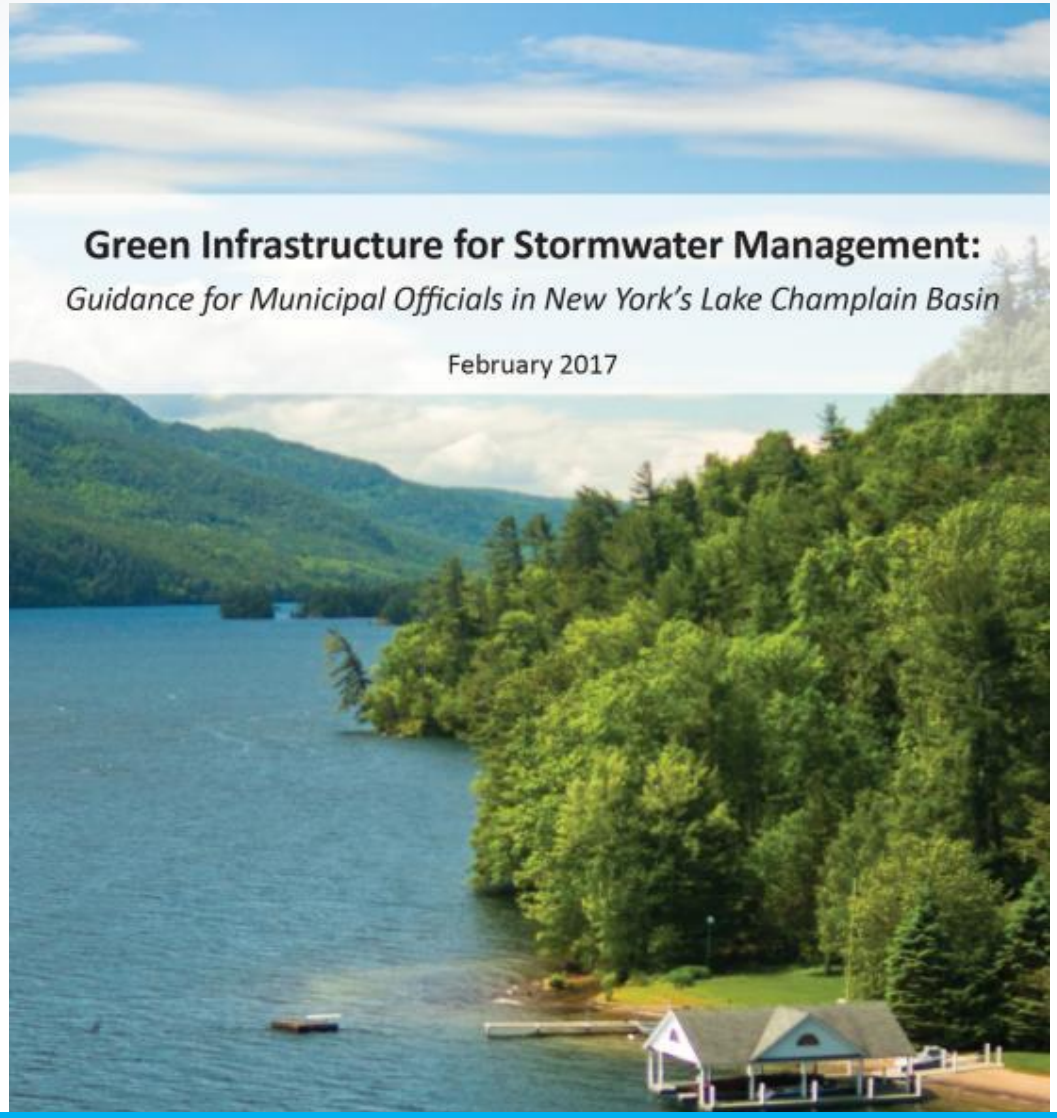
Stormwater Retrofits?

Stormwater retrofits are stormwater management practices in locations where stormwater controls did not previously exist or were ineffective

Photo: Conservation Design Forum, West Union, IA

Residential Scale Retrofits

Photo Credits: Watershed Stewards Academy



http://www.lcbp.org/2017/05/green-infrastructure-webinar-series/

How The Manual Fits In

New Development, Redevelopment ≥ 1 acre disturbed;
Certain industrial sites

↓

NYDEC Regulations

Stormwater Management Design Manual

Retrofits; Integration With Other Infrastructure Projects

↓

LCBP GSI Manual +

Stormwater Management Design Manual

http://www.dec.ny.gov/chemical/29072.html

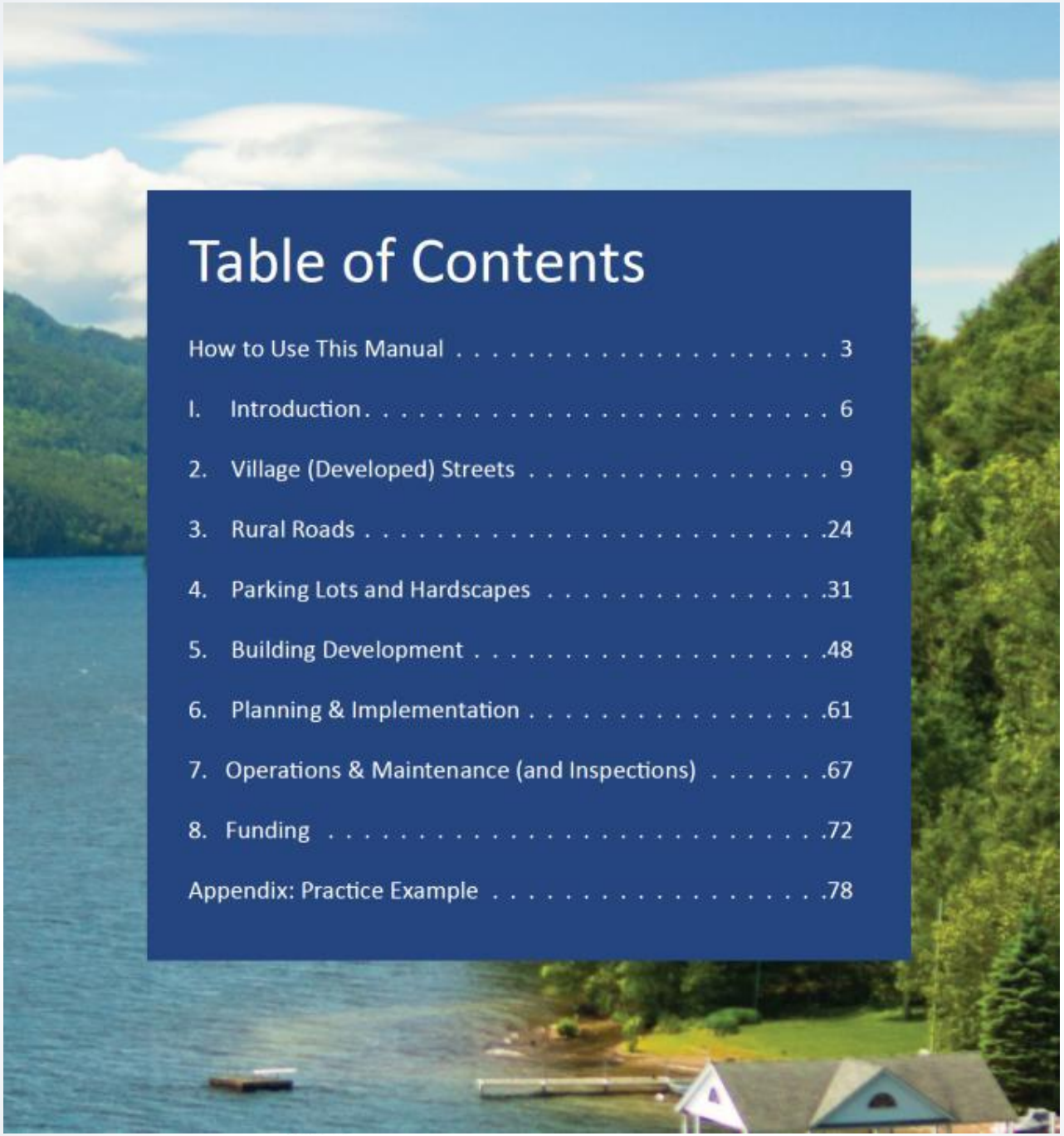
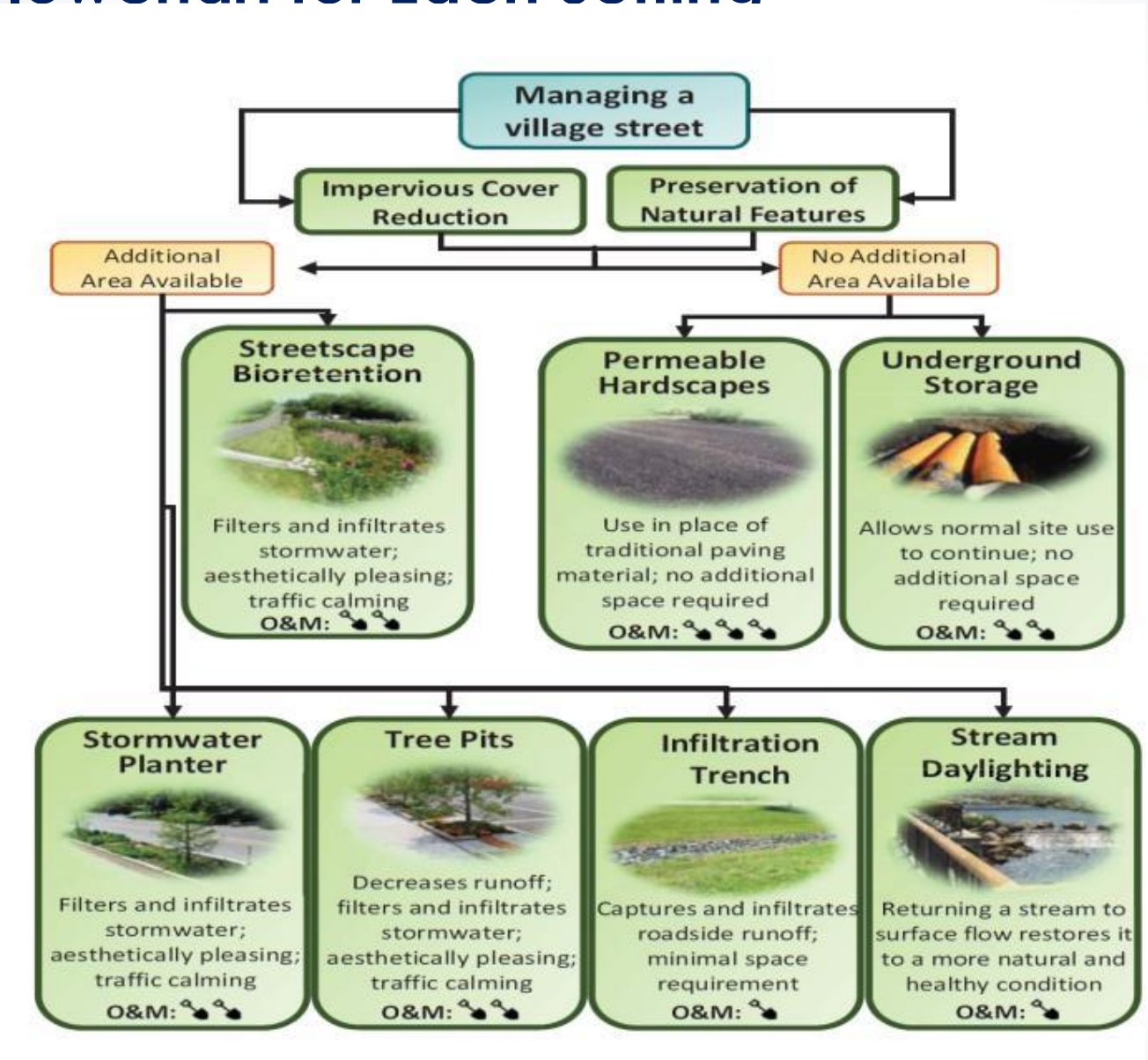


Table of Contents

GSI Settings

- Village (Developed) Streets
- Rural Roads
- Parking Lots & Hardscapes
- Buildings

Flowchart for Each Setting



Various Settings

Image 1-2. Typical parking lot bioretention practice.

Image 1-3. Permeable hardscapes, like porous pavers, can help manage stormwater runoff.

Image 1-4. Underground storage and infiltration chambers let site use continue without taking up space.

Image 1-5. Stone armoring in rural road ditches can help prevent erosion into water bodies.

Village Streets

Webinar:
June 8, 12 -- 1

I-87, Exit 22 Cloverleaf. Source: Jarrett Engineers, PLLC

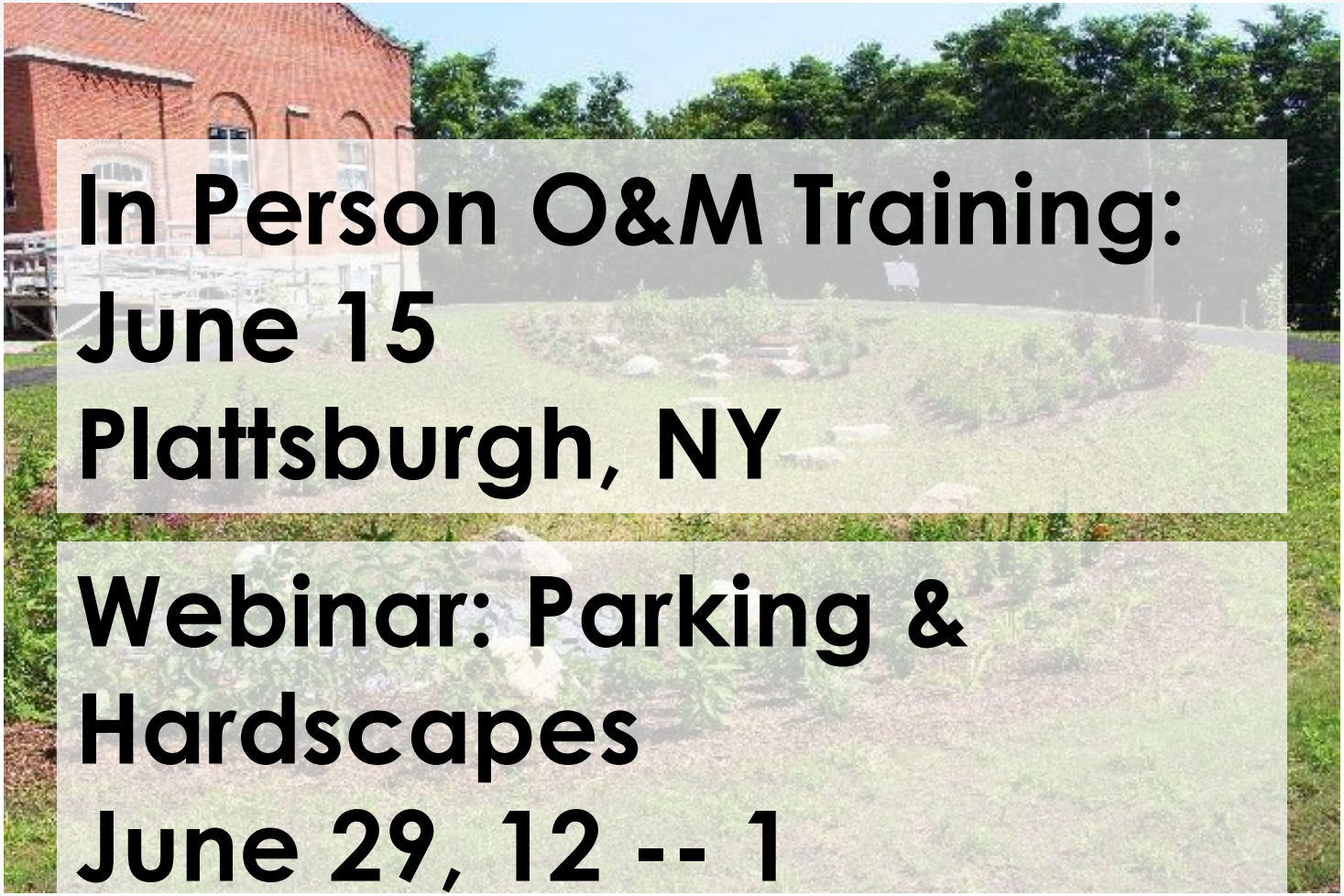
Village Streets

Town of Bolton Dry Well. Source: Warren County SWCD

Rural Roads

Source: VT Better Backroads Program

Parking Lots & Hardscapes



U.S. Oval Bioretention. Source: City of Plattsburgh, CDM Smith

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Buildings

Above: Syracuse War Memorial Arena Cistern. Source: Onondaga County, CH2M Hill. Right: Golden Arrow Hotel Green Roof, Lake Placid. Source: Weston Solutions

Integration with Other Infrastructure: Dig Once Strategy

Lake George Porous Asphalt Steet, Source: Barton & Loguidice, D.P.C.

Dig Once. . .Pave Once

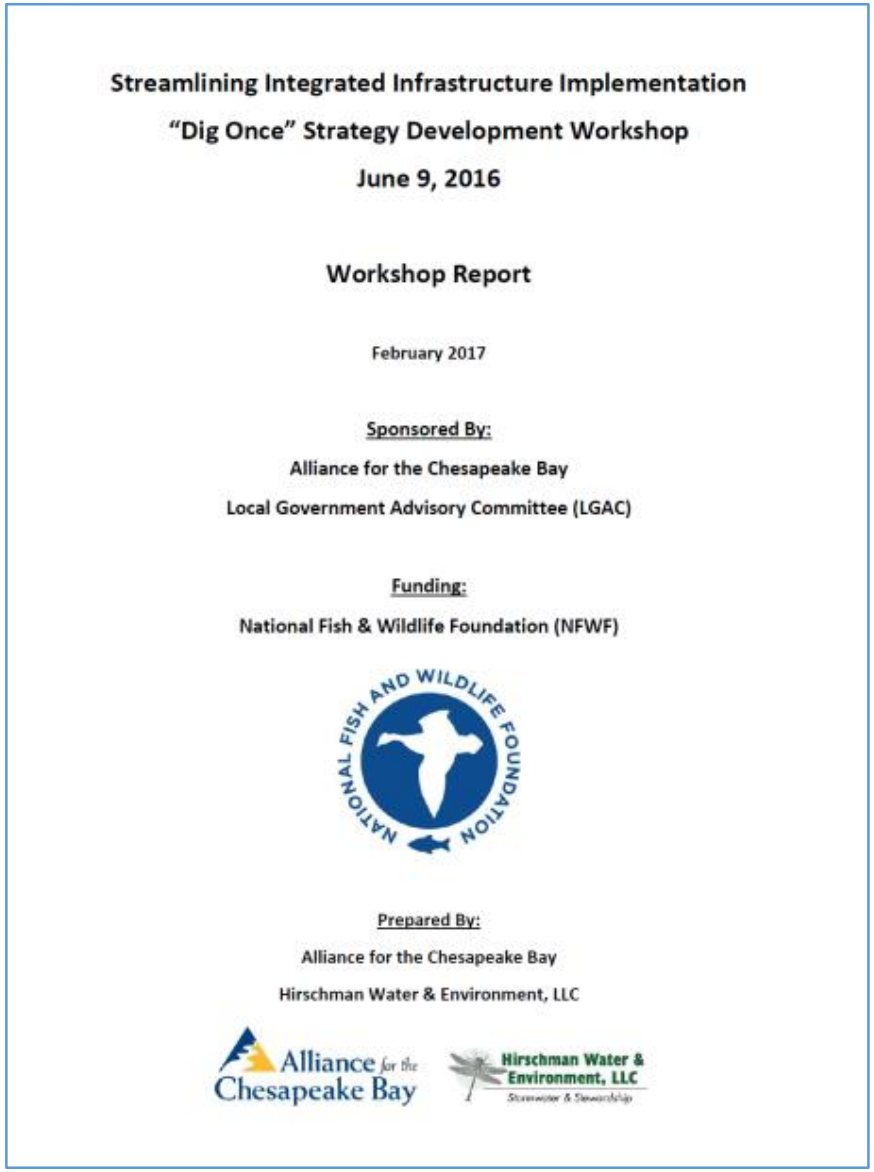
Lewis Park, Porous Basketball Court, Syracuse. Source: CH2M Hill

Advantages of Dig Once

- Cost-Effective, Cost Sharing
- Streamlined Procurement
- More Widespread GSI

Challenges of Dig Once

- Funding/Grant Cycles May Not Line Up With Project Timelines
- Available Guidance
- Must Consider Maintenance at Front End
- Municipal Processes & Codes
- Planning, Feasibility, Prioritizing
- Working Regionally



Streamlining Integrated Infrastructure Implementation

"Dig Once" Strategy Development Workshop

June 9, 2016

Workshop Report

February 2017

Sponsored By:

Alliance for the Chesapeake Bay

Local Government Advisory Committee (LGAC)

Funding:

National Fish & Wildlife Foundation (NFWF)

Prepared By:

Alliance for the Chesapeake Bay

Hirschman Water & Environment, LLC

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Chapter 6: Planning & Implementation

- Pre-requisites
- The Early Process
- Planning & Design
- Project Construction
- Maintenance

What is the most important part of stormwater planning?

A. **Free BBQ at stakeholder meetings**
B. **Estimating load and/or volume reductions**
C. **Getting out in the field to identify sources and solutions**
D. **Building implementation support from the beginning**
E. **Documenting findings**

Will Municipal Codes ALLOW GSI?

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Parking Lot Imperviousness?

Identify & Promote Co-Benefits of GSI

- Drainage/Flooding
- Drinking Water
- Community Health
- Recreation
- Green Jobs
- Neighborhood Investment
- Etc.

Lake Champlain Basin Program

New England Interactive Water Pollution Control Consortium

Environment, LLC

CONSULTING ASSOCIATES, LLC

Lake Champlain Basin Program

NEIWPCC

New England Interstate Water Pollution Control Commission

Hirschman Water & Environment, LLC

VWATERSHED CONSULTING ASSOCIATES, LLC

PRIORITIZE!!! (& Verify Feasibility)

Table PS8-2. Example of Simple Ranking Based on Four Screening Factors & High, Medium, Low Scale [1]					
Candidate Project	**Cost-Effectiveness**	**Outreach & Education**	**Community Benefits**	**Design & Permitting**	**Score**
Stormwater retrofit of dive area parking lot	L (1)	M (2)	M (2)	H (3)	8
Reforestation of badland area	M (2)	M (2)	H (3)	M (2)	9
Plant riparian buffer along Stinky Gut at elementary school	H (3)	H (3)	H (3)	M (2)	11
Train erosion control inspectors	L (1)	M (2)	L (1)	L (1)	5
Education campaign to reduce illegal dumping	M (2)	H (3)	M (2)	L (1)	8

[1] In this table, assigning High, Medium, or Low ratings correlates to a numerical scores: L = 1; M = 2; H = 3

Comparative BMP Cost Efficiencies

Table 5. Urban BMPs Applicable in City of Richmond, Sorted by Cost-Effectiveness for TSS Removal			
Urban BMP	TN Cost Effectiveness (dollars per pound removed)	TP Cost Effectiveness (dollars per pound removed)	TSS Cost Effectiveness (dollars per pound removed)
Erosion and Sediment Control	83.17	235.02	0.30
Urban Stream Restoration (recommended interim efficiencies)	261.32	768.59	0.96
Illicit Discharge Elimination: sewer repair	17.14	68.54	1.71
Retrofit of Existing Dry Pond (conversion to wet pond or wetland)	610.74	1,862.38	3.10
Vegetated Open Channels, C/D soils, no underdrain	1,407.46	9,656.75	4.29
Bioswale (new)	333.85	2,137.87	4.45
Infiltration Practices w/o Sand, Veg. (new)	498.22	2,572.90	4.76

"Not everything that can be counted counts, and not everything that counts can be counted."
-Albert Einstein






Project Feasibility

- Access
- Soils
- Utilities
- Trees
- Neighborhood Acceptance
- Traffic Control
- Etc.

Maintenance

- Who?
- Training (Certification?)
- Tools
- Access
- Frequency
- Vegetation
- **Link to Design!**

It's Always Pretty in the Beginning, But. . .

You Need To Keep It Looking Good!

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

MAINTENANCE GUIDANCE

Stormwater Management Practices

March 31, 2017

FINAL

Maintenance Hierarchy

Figure 1.1 The SMP Maintenance Hierarchy Pyramid

New York – Lake Champlain Basin – Green Infrastructure for Municipalities

NYDEC O&M Chapter: Practices

- Rainwater harvesting
- Impervious disconnection
- Swales
- Tree planting
- Bioretention
- Geen roof
- Permeable pavement
- Ponds & wetlands
- Infiltration
- Sand & organic filters

O&M Checklists

Table 2.5.1 SW Drainage Area	
Problem (Check if Present)	**Follow-Up Actions**
 ☐ Bare soil, erosion of the ground (rills washing out the dirt)	☐ Seed and mulch or sod areas of bare soil to establish vegetation. ☐ Fill in erosion areas with soil, compact, and add seed and straw to establish vegetation. ☐ If a rill or small channel is forming, try to redirect water flowing to this area by creating a small berm or adding topsoil to areas that are heavily compacted. ☐ Other: ☐ Kick-Out to Level 2 Inspection: Large areas of soil have been eroded, or larger channels are forming. May require rerouting of flow paths

- ☐ The bottom of the Bioretention cell is not flat, and the water pools at one end, along an edge, or in certain pockets. The whole bottom is not uniformly covered with water. See design plan to verify that Bioretention surface is intended to be flat. Check during or immediately after a rainstorm.

- ☐ If the problem is minor (just small, isolated areas are not covered with water), try raking the surface OR adding mulch to low spots to create a more level surface. You may need to remove and replace plantings in order to properly even off the surface.
- ☐ Check the surface with a string and bubble level to get the surface as flat as possible.
- ☐ Other:

- ☐ Kick-Out to Level 2 Inspection: Ponding water is isolated to less than half of the Bioretention surface area, and there seem to be elevation differences of more than a couple of inches across the surface.

Table 2.9.2 PP Surface	
Problem (Check if Present)	**Follow-Up Actions**
 ☐ Dirt and grit accumulating on pavement surface	☐ For small areas (e.g., driveways, patios), try a leaf blower or sweep the area to remove the dirt/grit from the Permeable pavement and properly dispose of the material. ☐ If dirt/grit remain in the joint areas between paver blocks, agitate with a rough brush and vacuum the surface with a wet/dry vac. ☐ Remove and replace clogged blocks in segmented pavers. ☐ For larger areas (e.g., parking lots, courtyards), hire a vacuum sweeper to restore the surface to a cleaner condition. ☐ Other: ☐ Kick-Out to Level 2 Inspection: Grit is widespread and cannot be removed by manual sweeping.

Problem #2: Flow is obstructed in or out of the practice

General Approach for All Practices:

- Flow can bypass an SMP when there is too much sediment/debris buildup near the inlets or due to grading changes in the drainage area (e.g., repaving of parking lot). If the cause of blockage or bypass is not obvious, inspect the practice during rainfall to watch the flow paths. (See **Section 4.6 – Improper Flow Pathways** for additional guidance.)
- Obstruction of overflow or emergency spillway structures is most often due to buildup of debris, such as trees, sticks, trash. It is *very* important to keep these structures clear of such blockages in order to avoid flooding or a dam breach (**avoid conditions caused by beaver activity - top photo**).
- Where debris cannot easily be cleared by hand, special equipment and skills may be needed. An obstructed riser structure in a wet pond may need to be accessed by boat **(bottom photo)**. In cases where large sticks, tree branches, trash, or other debris obstruct the overflow or spillway, they may need to be cut up by chainsaw. Large debris will usually need to be hauled away with a truck.

Helpful Skills:

- Chainsaw skills
- Muscle strength to haul large debris
- Boating capabilities

Equipment Typically Used to Clear Obstructions:

- Gloves, shovels, pruners, rakes, and other hand tools
- Waders for wetlands
- Chainsaw for large sticks and branches
- Cable puller (come-along) to remove large branches that cannot be pulled out by hand
- Boat and personal floatation device for riser structures in wet ponds
- Truck to haul away debris

In Person O&M Training: June 15 Plattsburgh, NY

U.S. Oval Bioretention. Source: City of Plattsburgh, CDM Smith

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Practice Profile Sheets: 21 Practices

VILLAGE STREETS

Stream Daylighting

NY Stormwater Manual Ch. 5 - pages 5-68 - 5-70

Primarily Intended For: Urban Streets (can also be used in Parking Lots and Hardscapes)

What Is It?

Stream Daylight previously-culverted/piped streams to restore natural habitats, better attenuate runoff by increasing the storage size, promoting infiltration, and help reduce pollutant loads where feasible and practical. Daylighting streams may also help to reduce impervious cover.

How does it work?

By daylighting streams, the stream is returned to its original, natural function – this can improve flood capacity, ecological functioning, and promote the removal of pollutants through natural processes. The formerly culverted stream will have to be restored – digging it up usually isn't enough. Planting riparian vegetation and placing natural stream bed materials will be necessary to complete the daylighting.

Sizing/Siting Considerations:

Ensure that daylighting the stream won't cause nuisance flooding or adversely impact property owners – extensive outreach will be necessary to facilitate this process. Ensure that any stream that is daylighted has adequate space during high flow events so that it doesn't scour its bed or continuously overtop its banks. If daylighting an entire stream isn't possible due to downstream constrictions, the practice can still be employed – daylighting a portion of the stream will still have benefits for treatment of stormwater, as well as aesthetic benefits.

Image PE-S-1. Part of the Saw Mill River in Yonkers, NY prior to stream daylighting. The river is culverted below the parking lot.

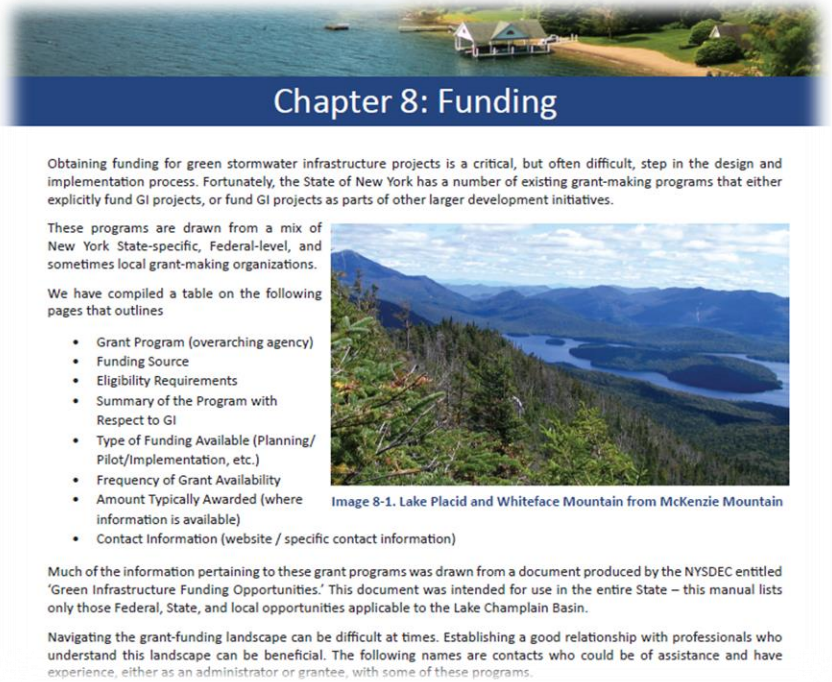
Image PE-S-2. The Saw Mill River after daylighting. In addition to improved ecological function, the river now attracts resident and visitors to its attractive public spaces.

Maintenance Considerations:

Maintenance of daylighted streams can be intensive during the first years when the stream is newly establishing. Vegetation will need to be maintained, encouraged, and at times replaced. Invasive species will need to be removed for certain sites. The stream bed material may also need to replaced or augmented as it cements into place over periods of high and low flow. Once established, maintenance becomes more routine – trash removal, mowing, and general plant maintenance are all that is necessary.

Funding Your GI Projects

- There ARE funding sources out there – don't reinvent the wheel trying to implement your project!
- Chapter 8 – Funding Sources
  - Lists local/regional Lake Champlain Basin specific project you can use



Chapter 8: Funding

Obtaining funding for green stormwater infrastructure projects is a critical, but often difficult, step in the design and implementation process. Fortunately, the State of New York has a number of existing grant-making programs that either explicitly fund GI projects, or fund GI projects as parts of other larger development initiatives.

These programs are drawn from a mix of New York State-specific, Federal-level, and sometimes local grant-making organizations.

We have compiled a table on the following pages that outlines

- Grant Program (overarching agency)
- Funding Source
- Eligibility Requirements
- Summary of the Program with Respect to GI
- Type of Funding Available (Planning/ Pilot/Implementation, etc.)
- Frequency of Grant Availability
- Amount Typically Awarded (where information is available)
- Contact Information (website / specific contact information)

Image 8-1. Lake Placid and Whiteface Mountain from McKenzie Mountain

Much of the information pertaining to these grant programs was drawn from a document produced by the NYSDEC entitled 'Green Infrastructure Funding Opportunities.' This document was intended for use in the entire State – this manual lists only those Federal, State, and local opportunities applicable to the Lake Champlain Basin.

Navigating the grant-funding landscape can be difficult at times. Establishing a good relationship with professionals who understand this landscape can be beneficial. The following names are contacts who could be of assistance and have experience, either as an administrator or grantee, with some of these programs.

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Funding Your GI Projects

- Chapter 8 has a table that contains
  - Grant Program
  - Funding Source
  - Program's Relationship to GI Implementation
  - Type of Funding (Planning/Pilot/Implementation)
  - Grant Frequency
  - Amount
  - Contact

  - Information Table is broken into NYSDEC and Federal Funding Sources

Funding Your GI Projects

NYSDEC Funding							
Funding Source	**Eligibility**	**Summary of Program w/ Respect to GSI**	**Funding For**	**Frequency of Grant**	**Amount Awarded**	**Website**	**Contact**
Water Quality Improvement Project (WQIP) Program	Municipalities | Municipal Corporations | Soil/Water Conservation Districts	2013 - $4 million was available for green stormwater infrastructure projects. GSI projects fall under the Non-agricultural, Nonpoint Source Abatement and Control category.	Implementation	Varies	Varies	http://www.dec.ny.gov/pubs/4774.html	Susan Van Patten, Division of Water, 518-402-8179, DOWinformation@dec.ny.gov
Clean Water Act Section 604(b) Funding	Regional Planning Organizations	2014 RFP lists green infrastructure planning as an Optional Water Quality Management Planning Objective under the Baseline Planning Program category.	Planning	Every 3-5 years	Varies	http://www.dec.ny.gov/lands/53122.html	Susan Van Patten, Division of Water, 518-402-8179, DOWinformation@dec.ny.gov
Environmental Justice Community Impact Grant Program	Community Organizations (various criteria)	Green infrastructure demonstration projects, generally involving education, stewardship, and/or monitoring activities related to parks, opens space, community gardens, or green infrastructure.	Pilot Projects	Varies	Varies - ~$10-50K	http://www.dec.ny.gov/public/31226.html	Office of Environmental Justice, 518-402-8556, justice@dec.ny.gov
Environmental Facilities Corporation Green Innovation Grant Program (GIGP)	Public entities (towns/cities, etc.), as well as other organizations empowered to develop a project (subject to review).	Provides funding for permeable pavement, bioretention, green roofs and green walls, stormwater street trees/urban forestry programs, riparian buffers, floodplains and/or wetlands, downspout disconnection, stream daylighting, and stormwater harvesting and reuse specifically.	Planning, Pilot, and Implementation (must include implementation)	Annually	Varies - ~$100K or more	http://www.efc.ny.gov/Default.aspx?tabid=228	Suzanna Randall, Manager of Green Policy, Planning and Infrastructure, 518-402-7461, GIGP@efc.ny.gov

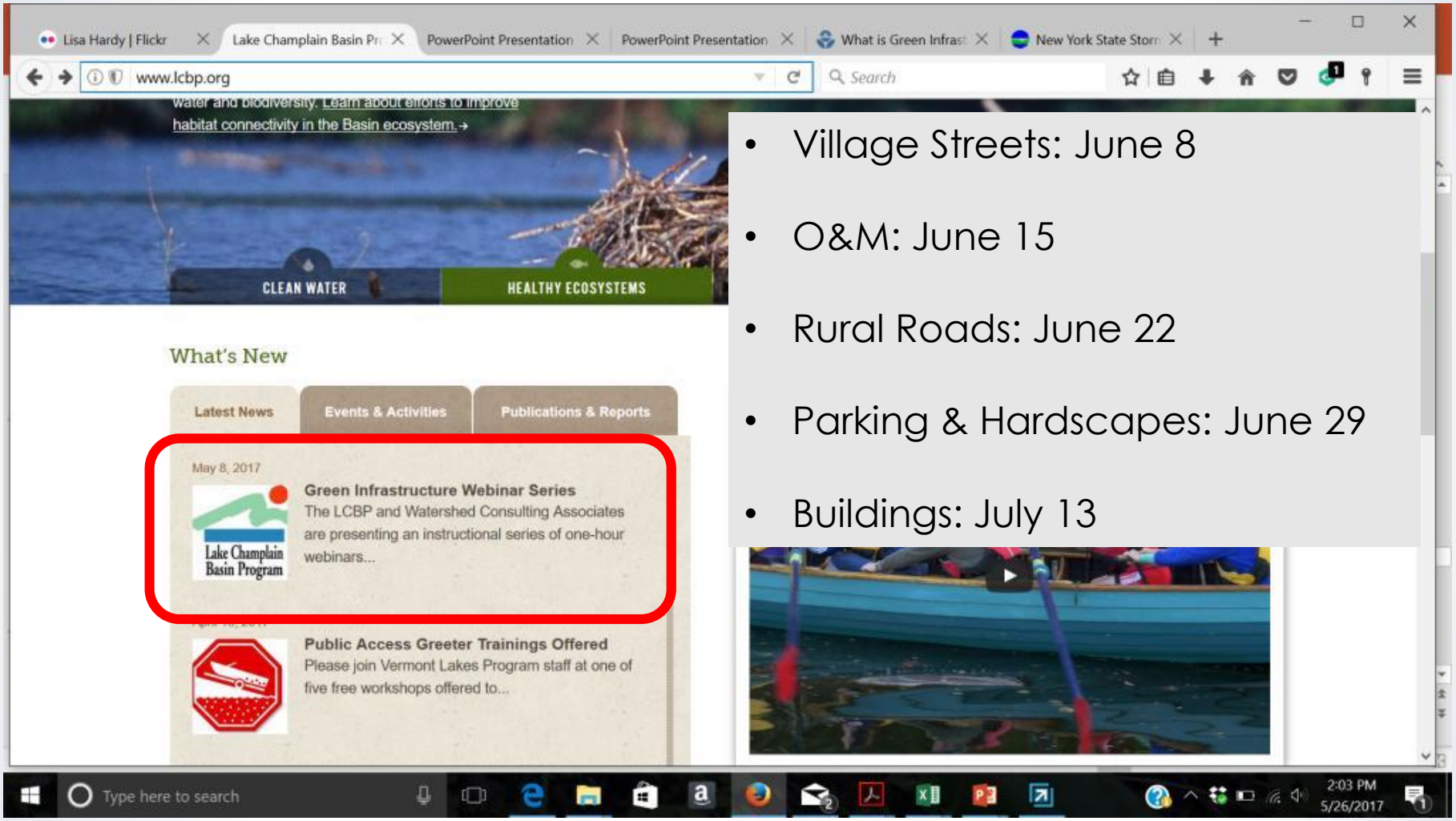


New York – Lake Champlain Basin – Green Infrastructure for Municipalities

Funding Your GI Projects

- Good Contacts To Remember
  - Ryan Waldron – NYSDEC
    - Ryan.Waldron@dec.ny.gov
  - Fred Dunlap – NYSDEC
    - Fred.dunlap@dec.ny.gov
  - Lake Champlain Basin Program – General Inquiries
    - lcbp@lcbp.org
  - Kevin Farrington – City of Plattsburgh
    - farringtonk@cityofplattsburgh-ny.gov

Register for Webinars & In-Person O&M



- Village Streets: June 8
- O&M: June 15
- Rural Roads: June 22
- Parking & Hardscapes: June 29
- Buildings: July 13

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