Green Infrastructure Planning Project: Code & Local Law Review

An in-depth look at the efforts of the Albany Pool Communities

City of Albany
City of Cohoes
City of Rensselaer
City of Troy
City of Watervliet
Village of Green Island

1

Green Infrastructure Toolkit

City of Albany
City of Cohoes
City of Rensselaer
City of Troy
City of Watervliet
Village of Green Island

Stormwater In-Lieu Fees and Credit Banking Feasibility Study

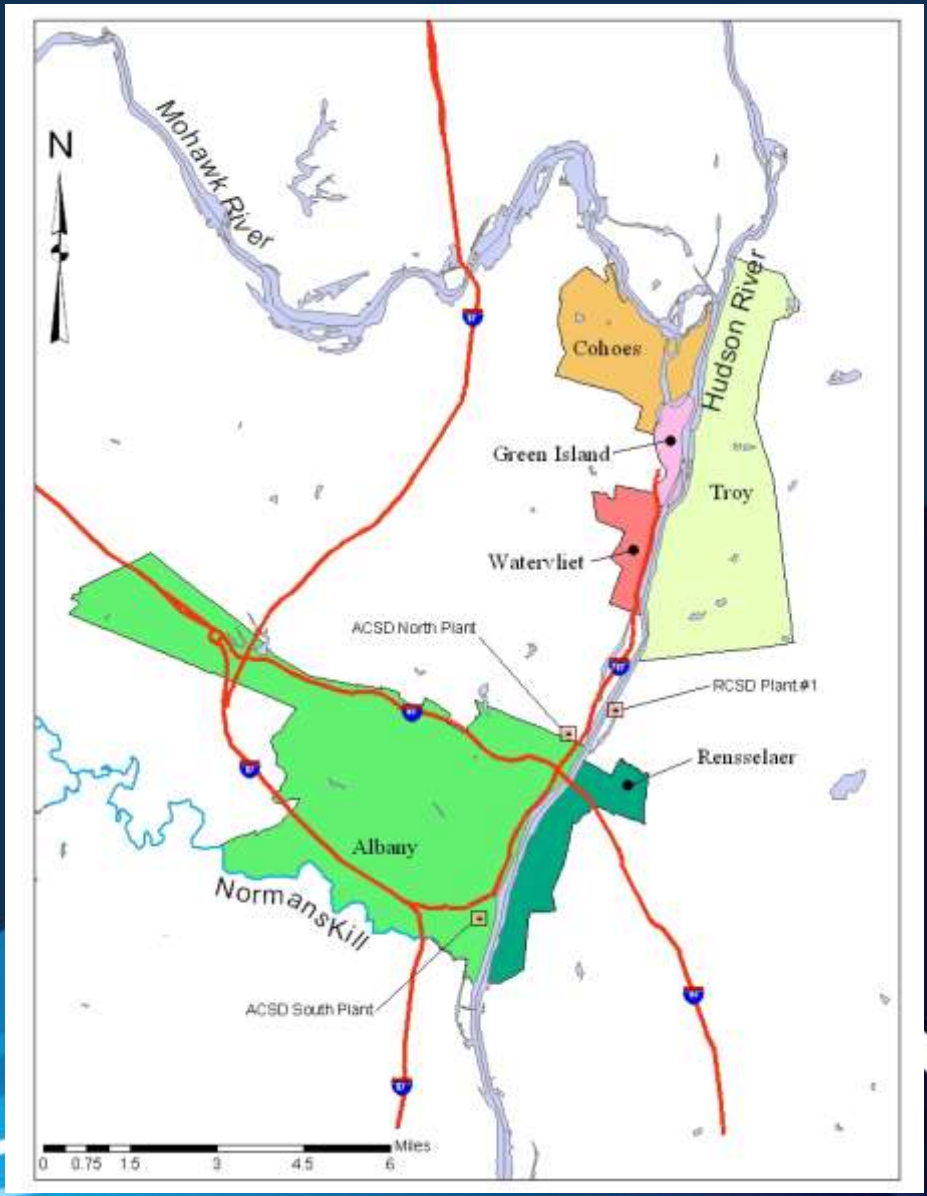
Purpose:
Assess the feasibility and suitability of in-lieu fees and credit banking to help achieve stormwater management and Green Infrastructure improvements

- Study administered by
- Completed part of the CSO Long-Term Control Plan for the Albany Pool Communities
  - Albany Water Board
  - City of Cohoes
  - City of Rensselaer
  - City of Troy
  - City of Watervliet
  - Village of Green Island
- LTCP included a requirement to consider Green Infrastructure projects and programs
- Study funded with a grant from the NYSDEC Hudson River Estuary Program

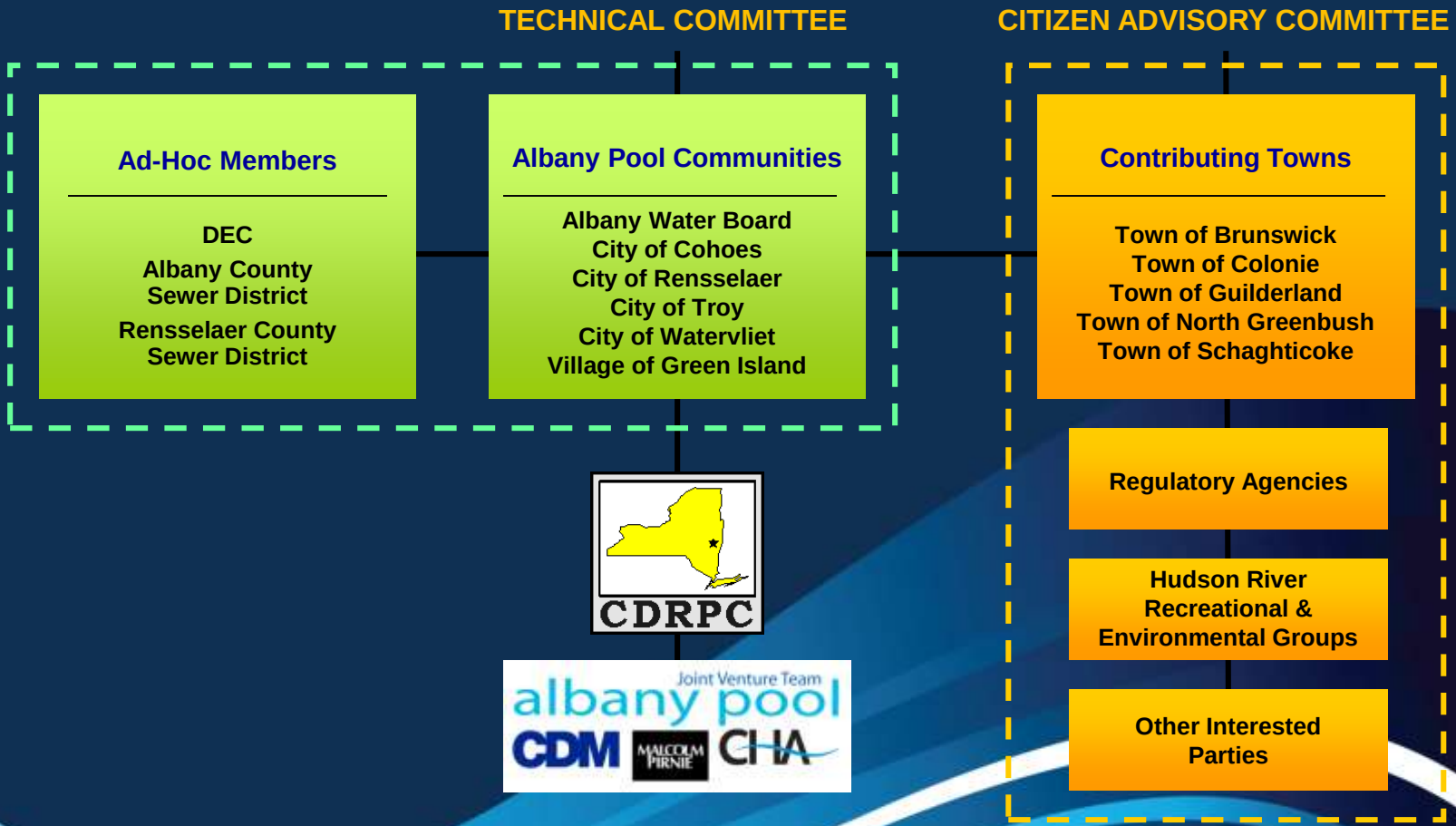
Albany Cohoes Rensselaer Troy Watervliet Green Island

Capital District Combined Sewer Systems

- **6 communities**
  - City of Albany
  - City of Cohoes
  - Village of Green Island
  - City of Rensselaer
  - City of Troy
  - City of Watervliet
- **92 discharge points**
- **2 sewer districts (Advisory role)**
  - Albany County Sewer District
  - Rensselaer County Sewer District



Project Organization Framework



Benefits of Pooled Approach

- One Long Term Control Plan
- One study to establish baseline and one program to measure success
- One party to negotiate with DEC
- Each grant dollar benefits all in the Pool
- Shared cost of maintenance and planning
- Negotiating power

Projects and Programs

•Disinfection Projects	$9.66 million
•WWTP Process Improvements	$3.62 million
•BMPs and System Optimization Projects	$35.26 million
•Sewer Separation and Storage Projects	$22.9 million
•Green Infrastructure Program	**$5.08 million**
•Satellite Treatment and Floatables Control	$55.87 million
•Tributary Enhancements	$2.13 million
•Additional Pool-Wide Projects	$2.01 million

Gross cost of program:$136.5m
Gross cost Pool Projects: $102m*

Albany Pool IMA

- Agreement to pay percentage shares of LTCP Project Costs, including:
  - Planning, design, procurement, permitting, administration, implementation, construction, and post-construction inspection and approval;
  - Management, operation and maintenance of completed projects;
  - Region-wide projects, such as management and development of plans and manuals.
- Albany Pool IMA does not include:
  - Albany and Rensselaer County Sewer District Projects; or
  - Projects separately required by a Community's individual Consent Order.

IMA: Allocation Formula

- Weighted 85% by CSO Flow from each Community, 15% by Population (2010 Census).
- Percentage shares for each Community
  - Albany – 58.68%
  - Troy – 34.76%
  - **Cohoes – 2.74%**
  - Rensselaer – 2.13%
  - Watervliet – 1.16%
  - Green Island – 0.53%

Green Infrastructure Planning Project: Code & Local Law Review

An in-depth look at the efforts of the Albany Pool Communities

City of Albany

City of Cohoes

City of Rensselaer

City of Troy

City of Watervliet

Village of Green Island

Definitions

- **Green Infrastructure** - Green infrastructure is an approach to stormwater management that protects, restores, or mimics the natural hydrologic cycle via use of natural and aesthetically pleasing green practices that promote infiltration, reuse, and uptake of stormwater that would otherwise leave the site as runoff. These practices include: porous, uncompacted surfaces such as grass, porous pavement, porous concrete, and porous pavers; bioretention areas, tree pits, tree plantings, and rain gardens; grey water cisterns, rain barrels and rooftop disconnections; green roofs, infiltration planters, vegetated swales, and other measures aimed at infiltration, reuse, and uptake of stormwater at the site of collection. These measures are further detailed, including design standards, in Chapter 5.3 of the New York State Stormwater Management Design Manual.

Communities Surveyed

Albany County Stormwater Coalition:

- Albany County
- Town of Bethlehem
- Town of Colonie
- Village of Colonie
- Town of Guilderland
- Village of Menands
- Town of New Scotland
- Village of Voorheesville
- University at Albany - State University of New York

Albany Pool Communities:

- City of Troy
- City of Rensselaer

ACSWC + APC:

- City of Albany
- Village of Green Island
- City of Cohoes
- City of Watervliet

Stormwater Coalition of Albany County
Green Infrastructure Model Local Law Project

Summary Report:
Process, Findings, and Implementation

November 2013

Capital District Regional Planning Commission
Green Infrastructure Model Local Law Project

Summary Report:
Process, Findings, and Implementation

July 2016

Barton & Loguidice

Project Phases

- Phase 1: Scorecard completion & Consultant Team review of existing documentation
- Phase 2: Identify gaps
- Phase 3: Research other GI laws/guidelines
- Phase 4: Present model local law(s)
- Phase 5: Conduct follow-up survey

GI Local Laws – Project Team

- Barton & Loguidice, DPC
- Harris Beach, PLLC
- Ryan Biggs | Clark Davis Engineering & Surveying, P.C.
- O'Brien & Gere, Inc.

Phase I

GI Scorecard

Consultant Team Review

- B&L and Harris Beach researched existing codes, guidance, plans, and other documents (including those in progress) These included:
  - Stormwater Management Codes
  - Zoning Codes
  - Storm Sewer Codes
  - Comprehensive Plans
  - Local Waterfront Revitalization Program Plans
  - Other supporting documents

Local Law Survey - Scorecard

- CDRPC revised the Albany County Stormwater Coalition scorecard for use or this project
- Purpose was to evaluate existing municipal zoning ordinances, comprehensive plans, review procedures, and local laws against recognized green infrastructure practices
- Resulted in an overall "Green Score"
- In addition to overall scores, the total score was broken out into sub-categories for:
  - Reduction of Impervious Cover
  - Preservation of Natural Areas and Conservation Design
  - Design Elements for Stormwater Management
  - Promotion of Efficient, Compact Development Patterns and Infill

Scorecard Methodology

- Communities were provided with a scorecard and instructions
- Were asked to identify all development rules that apply in municipality
- Also asked to identify the local, state, and federal authorities that administer or enforce development rules
- The scorecard was completed and scored by each MS4, giving CDRPC and the Consultant Team specific indications of the respective municipal needs and desired areas of code revisions to be pursued

Category I: Reduction of Impervious Cover					
Street width and length	Yes	No	Score	Local Law ID reference: code name/section/page #	Clarification / notes
1. What is the minimum pavement width allowed for streets in low density residential developments that have less than 500 daily trips, average daily trips (ADT)? *If your answer is between 18-22 feet, give yourself 1 point.*					
2. At higher densities are parking lanes allowed to also serve as traffic lanes (i.e., queuing streets)? *If your answer is YES, give yourself 1 point.*					
3. Do street standards promote the most efficient street layouts that reduce overall street length? (e.g. a grid plan) *If your answer is YES, give yourself 1 point.*					
Right-of-Way Width					
4. What is the minimum right of way (ROW) width for a residential street? *If your answer is less than 55 feet, give yourself 1 point.*					
5. Does the code allow utilities to be placed under the paved section of the ROW? *If your answer is YES, give yourself 1 point.*					
Cul-de-Sacs					
6. What is the minimum radius allowed for cul-de-sacs? *If your answer is less than 35 feet, give yourself 1 point.* *If your answer is between 35 feet to 45 feet, give yourself .5 point.*					
7. Can a landscaped island be created within the cul-de-sac? *If your answer is YES, give yourself 1 point.*					
8. Are alternative turnarounds such as "hammerheads" allowed on short streets in low density residential developments? *If your answer is YES, give yourself 1 point.*					
Page 1 Subtotal					

Phase II

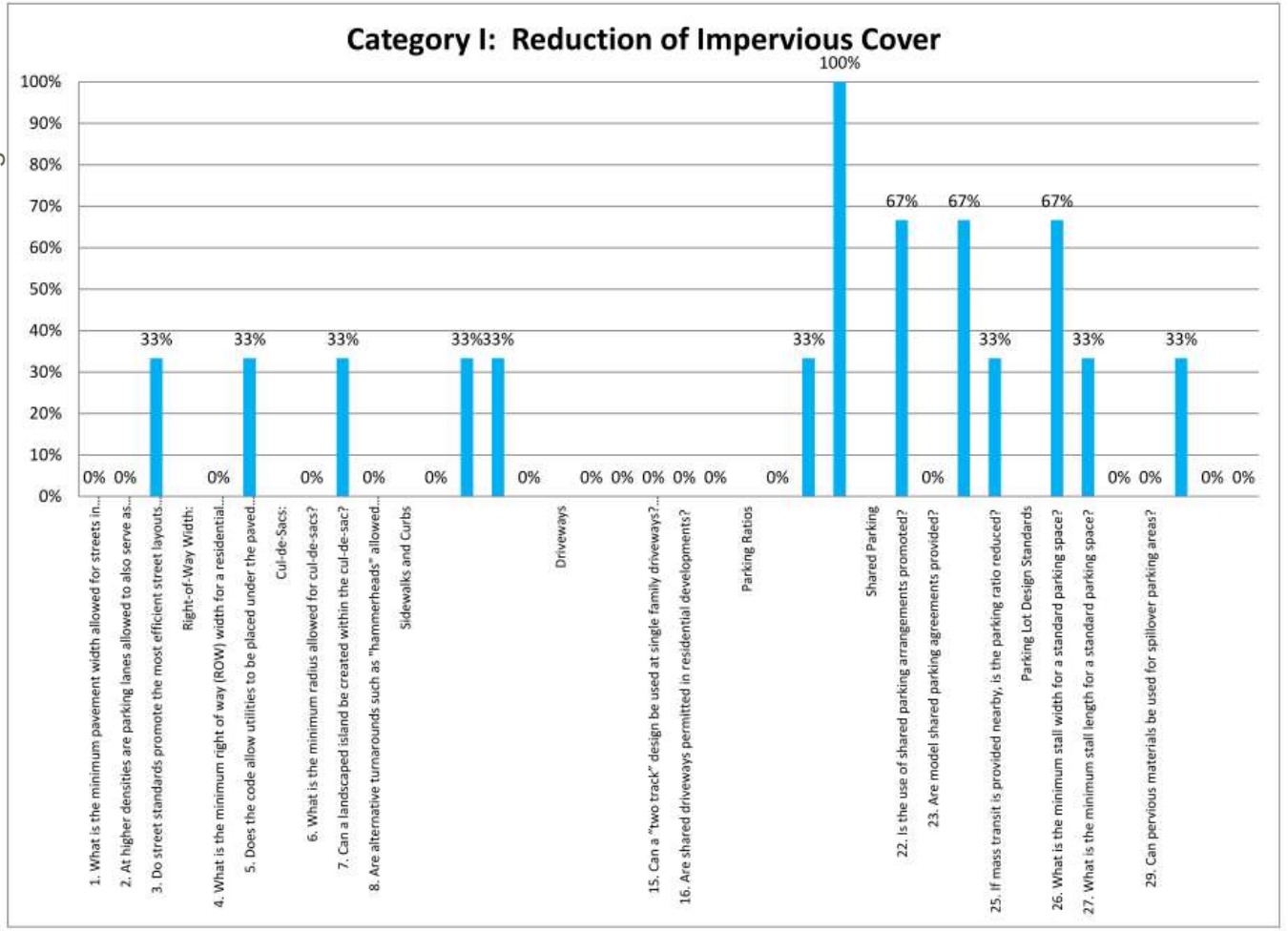
Gap Selection

Scorecard Analysis and Gap Selection

- Consultant Team checked, and corrected if necessary, the math on scorecard subtotals
- Consultant Team listed all scorecard questions that received a score of "0" from one or both municipalities, and grouped them according to similarity.
- These groupings were provided to CDRPC for review and comment, leading to modifications in groupings.
- The twelve groupings were provided to each community for priority ranking

Sampling of Actual Results

% Municipalities that successfully achieved the GI goal.



Cat 1 Gaps_Reduction of Imp Cover_Cities.xlsx

Ranking Spreadsheet

- The 4 scorecard categories contained multiple subcategories (topics)
- Within topics, scorecard questions were grouped according to likeness
- Groupings (gaps) were determined to be best addressed by law OR guideline
- 12 gaps were identified, of which 8 were to be selected
- Communities were asked to rank gaps according to priority
- Average ranking became final ranking

Ranking Spreadsheet

Scorecard Category	Topic	Gap ID	Format	Minimum Scorecard Items to Address	Ranking
Category 1: Reduction of Impervious Cover	Driveways	Gap 1	Code	13. What is the minimum driveway width specified in the municipality? 17. Are driveways allowed to be sloped to drain to yard areas instead of the street?	
		Gap 2	Guideline	14. Can pervious materials be used for single family home driveway (e.g., grass, gravel, porous pavers, etc.)? 15. Can a "two track" design be used at single family driveways? (grass in between) 16. Are shared driveways permitted in residential developments?	
	Shared Parking	Gap 3	Code	23. Are parking ratios reduced if shared parking arrangements are in place? 24. If mass transit is provided nearby, is the parking ratio reduced?	
		Gap 4	Guildeline	21. Is the use of shared parking arrangements permitted? 22. Are model shared parking agreements provided? (i.e. plowing and maintenance)	
	Parking Lot Design	Gap 5	Code	18. What is the minimum parking ratio for a professional office building (per 1,000 ft2 of gross floor area)? 19. What is the minimum required parking ratio for shopping centers (per 1,000 ft2 gross floor area)? 27. Are at least 30% of the spaces at larger commercial parking lots required to have smaller dimensions for compact	
		Gap 6	Guideline	28. Can pervious materials be used for spillover parking areas? 29. Is a minimum percentage of a parking lot required to be landscaped? 30. Is the use of bioretention areas and other stormwater practices within landscaped areas or setbacks allowed?	
Category 2: Preservation of natural features and conservation design	Locating Sites in Less Sensitive Areas	Gap 7	Code	34. Does the municipality have a steep slope, grading, or erosion and sediment control law that requires avoidance of development on steep slope areas and minimizes grading and flattening of hills and ridges? 35. Does the municipality require avoidance and protection of highly erodible soils through a steep slope, grading, or erosion and sediment control law?	
Category 3: Design Elements for Stormwater Management	Open Channels and Rooftop Runoff	Gap 8	Code	62. Are curb and gutters required for most residential street sections?	
		Gap 9	Guildeline	63. Does your ordinance encourage the use of dry swales, biofilters, or grass swales in lieu of gutters? 65. Do current grading or drainage requirements allow for temporary ponding of stormwater on front yards or rooftops?	
Category 4: Promotion of efficient, compact development patterns and infill	Density Incentives	Gap 10	Code	74. Does your ordinance establish minimum lot coverage within infill areas to increase density?	
		Gap 11	Guideline	75. Does your ordinance permit accessory dweilling units within infill areas to increase density?	
	Infill	Gap 12	Code	76. Do local stormwater management regulations provide a requirement that reduces on-site management requirements for projects that decrease total imperviousness on previously developed sites? 78. Does your ordinance differentiate between previously undisturbed, adaptive reuse, and infill sites?	

Selected Gaps, in order of ranking

- Of the 12 options, the following 8 were ranked highest, by average, and renamed as listed below:
  - Gap 1: Infill (specifically requested that the language require small sites to adhere to GI principles)
  - Gap 2: Locating Sites in Less Sensitive Areas
  - Gap 3: Parking Lot Design (porous, landscaping, GI)
  - Gap 4: Density (Accessory Dwelling Units in infill areas)
  - Gap 5: Parking Lot Design (parking ratios and compact cars)
  - Gap 6: Open Channels and Rooftop Runoff (alternatives to gutters and grey infrastructure)
  - Gap 7: Parking Lot Design (shared parking)
  - Gap 8: Density (minimum lot coverage requirements)

Phase III

Research of GI local laws/documents

Gap Research

- The Consultant Team researched relevant guidance, laws, and design standards throughout the Country, as well as to document those learned or developed through industry experience

Research Resources

- Codes Developed through Albany County Stormwater Coalition GI project
- Follow-up survey results from APC communities who participated in the Albany County Stormwater Coalition GI project
- City of Chicago, IL "Green Alleys" and Stormwater/GI Code
- Maryland:
  - "Models and Guidelines for Infill Development":
- EPA:
  - "Smart Growth And Economic Success: Investing In Infill Development"
  - "Attracting Infill Development In Distressed Communities: 30 Strategies"
- Georgia (Department of Community Affairs): "Infill Development Program"
- Nashville, TN: Low Impact Development GI Design Sheets and Infill GI and Stormwater requirements
- City of Portland, OR: Accessory Dwelling Unit Standards
- Washington State Municipal Research and Services Center
  - Accessory Dwelling Unit guidance
- City of Seattle, WA: Accessory Dwelling Unit standards
- Pima County, AZ: Guest House Code
- Alexandra, VA: "Del Ray Parking Study" Sample Shared Parking Agreement
- Utica, NY: Long Term Control Plan
- NewYork, NY: GI Language (Construction Code, Zoning, GI Program)
- City of Philadelphia Stormwater Management Guidance Manual, Version 3.0, Dated July 2015
- Buffalo Sewer Authority Stormwater Program

Phase IV

Present model laws/guidelines

Code/Guideline Reviews

- B&L prepared draft language for each of the eight gaps
- Draft gap language was distributed to the CDRPC and the Project Team for review and comment
- Draft gap language was then distributed to Communities for review and comment
- B&L met one-on-one with Communities to discuss GI wishlist and expected project outcome
- Comments were addressed as appropriate by B&L

Drafting of Laws

- After addressing the comments, Consultant Team organized much of the language to ensure a flexible "tiered" approach
- Included separating the various requirements identified in each local law into one of three categories based on level of progressiveness in the industry and other local governments
  - Minimum Action Level
  - Best Management Action Level
  - Model Community Action Level

Drafting of Laws

- Several numbers (dimensions, ratios, percentages, etc) within the local law language are bolded
  - Indicates that the number represents a progressive standard
  - Can be modified to best suit Communities
- Local law language represents a collection of codes that can be pulled from as deemed applicable, or used as a whole
- Sections can be relaxed or made more stringent, and not all sections are necessary to use if not pertinent
- Each section represents a stand-alone suggested practice/language, and Communities can decide which to implement

Implementation

- Communities were encouraged to take the language back to their governing boards for review and consideration
- A decision matrix was provided to solicit feedback as to whether they intend to adopt the local law/guidance language

CITY OF WATERVLIET	Minimum Action Level						Best Management Action Level						Model Community Action Level						No Action Level	Implementation Status	Implementation Successes & Strategies
Gap 1 Parking Lot Design	Yes	No	Maybe	Convert to Guideline(s)	Start when?	Previous Comments	Yes	No	Maybe	Convert to Guideline(s)	Start when?	Previous Comments	Yes	No	Maybe	Convert to Guideline(s)	Start when?	Previous Comments	Previous Comments		
EXAMPLE (Anywhere, USA)	x								x					x					We are currently in the process of updating our codes to include language on shared parking, yet language provided here is insightful and necessitates further review of our planned updates. Current code is progressive in terms of parking ratios, so no change anticipated. Other language presented in this document will be strongly considered.	Complete, with exceptions as noted.	Implementation of shared parking regulations required additional survey of both urban core business owners and residents, as well as a thorough review of vacant/abandoned parcels available for shared use as needed. This additional effort, and coordinating between parties, was necessary for buy-in and feasibility yet significantly added to the implementation schedule and required deviations from the original language. Final language is attached. Reducing minimum off-street parking was met with friction by some business owners and several residents, specifically within the downtown core. For this reason, we are undergoing additional strategic meetings with a small group of stakeholders to determine, on a case-by-case basis, whether their needs can be met via the shared parking ordinance. If met, we may forego implementation of this device. Attached are stakeholder meeting minutes. All other measures were implemented, as previously noted, and all relevant language is attached.
1.0 Purpose and Objectives																			The City of Watervliet was in the process of updating the zoning while these model local laws were being developed. Watervliet was able to use some of the language from this and apply it to their zoning	Did not use wording in new Zoning Ordinance	
2.0 Parking Ratios.																			The City of Watervliet was in the process of updating the zoning while these model local laws were being developed. Watervliet was able to use some of the language from this and apply it to their zoning	Did not use wording in new Zoning Ordinance	
2.1 Determination of Required Off-Street Parking.																			The City of Watervliet was in the process of updating the zoning while these model local laws were being developed. Watervliet was able to use some of the language from this and apply it to their zoning	Did not use exact wording but used some concepts that fit the city's needs.	Similar concepts used in the city's zoning were linking seat capacity, # of employees, floor area to # of spaces needed.
Schedule A Required Off Street Parking Spaces																			The City of Watervliet was in the process of updating the zoning while these model local laws were being developed. Watervliet was able to use some of the language from this and apply it to their zoning	Did not use exact wording but used some concepts that fit the city's needs.	The city used these ratios as a starting point but ended up conforming them to better fit the city's structure.
Notes to Schedule A:																			The City of Watervliet was in the process of updating the zoning while these model local laws were being developed. Watervliet was able to use some of the language from this and apply it to their zoning	Did not use	
2.2 Shared Parking.																			The City of Watervliet was in the process of updating the zoning while these model local laws were being developed. Watervliet was able to use some of the language from this and apply it to their zoning	Did not use exact wording but used some concepts that fit the city's needs.	A Version of the Written Binding agreement was used along with added verbiage from the city
2.3 Maximum Off-Street Parking.																			The City of Watervliet was in the process of updating the zoning while these model local laws were being developed. Watervliet was able to use some of the language from this and apply it to their zoning	2.3 (a) was used and city's own similar version with respect to credit for bicycle parking	2.3 (a) was used as written by this analysis. Also added was encouragement to used green practices in place of 2.3 (a). Bicycle Parking incentives used in new Zoning.
2.4 Proximity to Mass Transit.																			The City of Watervliet was in the process of updating the zoning while these model local laws were being developed. Watervliet was able to use some of the language from this and apply it to their zoning	Did Not Use	
2.5 Credits for On-Street Parking.																					
2.6 Reduction of Minimum Off-Street Parking for Certain Residential Uses.																					
2.7 Land Banked Parking.			X	X																	
3.0 Parking Lot Design.			X	X																	
3.1 Bicycle Parking.		X	X																		
Schedule B Required Bicycle Parking Spaces																					
4.0 Landscaping.																			developed. Watervliet was able to use some of the language from this and apply it to their zoning	incorporate any other aspects.	

1.0 Purpose and Objectives

2.0 Parking Ratios.

2.1 Determination of Required Off-Street Parking.

Did not use exact wording but used some concepts that fit the city's needs.	Similar concepts used in the city's zoning were linking seat capacity, # of employees, floor area to # of spaces needed.
Did not use exact wording but used some concepts that fit the city's needs.	The city used these ratios as a starting point but ended up conforming them to better fit the city's structure.
Did not use	

Green Infrastructure Toolkit

City of Albany

City of Cohoes

City of Rensselaer

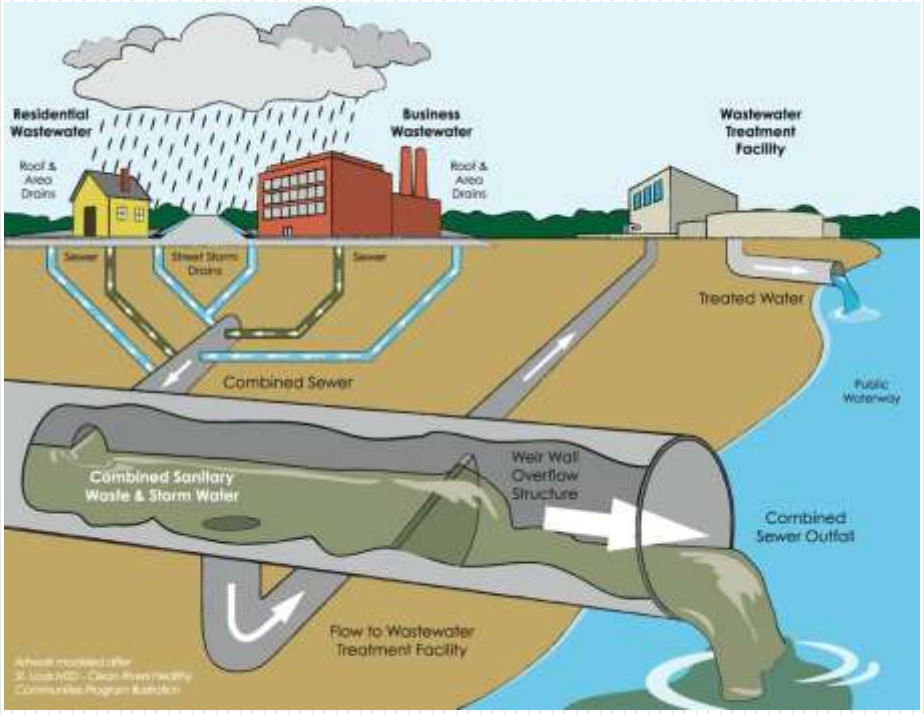
City of Troy

City of Watervliet

Village of Green Island

Mission Statement

- To provide customizable green alternatives to traditional stormwater management on small sites to promote:
  - greener landscapes
  - reduction of heat island effect
  - removal of stormwater pollutants
  - reduction in the incidences of combined sewer overflows



Use and Objectives

- This Toolkit is intended for use on non-residential projects that disturb less than or equal to 1 acre.

- The New York State Department of Environmental Conservation (NYSDEC) and the local Municipal Separate Storm Sewer (MS4) requirements apply to projects that disturb more than 1 acre. http://www.dec.ny.gov/chemical/43150.html

- This Toolkit is intended to supplement the NYSDEC Stormwater Management Design Manual (Design Manual). Practices and definitions included in the Design Manual are acceptable for use on some smaller sites. http://www.dec.ny.gov/chemical/29072.html

- Some of the Design Manual requirements have been relaxed or modified to make green infrastructure (GI) practices easier to adopt for small and challenging sites, particularly urban redevelopment projects.

Use and Objectives

- The Albany Pool Communities (APC) are comprised of five Cities and one Village, each with their own local land use codes. This GI Toolkit is intended to serve as an aid to wider adoption of GI Infrastructure, but local requirements will continue to remain in effect.
- As a parallel project to this GI Toolkit, the Capital District Regional Planning Commission and Barton & Loguidice have reviewed the APC local laws and guidance documents in an effort to promote green infrastructure. This project included:
  - Research of best practices used in other communities.
  - Identified gaps in the local laws and guidelines.
  - Drafted a model local law for consideration by the Albany Pool Communities
- The City of Albany adopted a Unified Sustainable Development Ordinance (USDO) in May 2017. Of note, this ordinance requires:
  - Projects that disturb more than ¼ acre must comply with the NYSDEC Design Manual.
  - Post development peak runoff must not exceed the existing peak runoff for the10 year storm event.
  - Properties ¼ acre or smaller must either; detain the first 1 inch of rainfall and direct 100% of the rooftop and 75% of surface stormwater flows to a tree well, drainage swale, raingarden, or underground cistern; or install a green or blue roof.

GI Practices

- **Impervious Area Reduction Practices:**
  - Tree Planting
  - Disconnect Impervious Areas
  - Green Roofs
  - Porous Pavement
- **Infiltration Only Practices**
  - Infiltration Basin
  - Infiltration Trenches
  - Infiltration Chambers and Drywells
  - Shallow Soil System
- **Vegetated Swale**
- **Infiltration or Flow Through Practices**
  - **Porous Pavement**
  - **Vegetated Swale**
  - **Bioretention Practices**
    - **Rain Gardens**
    - **Stormwater Planters**
    - **Bioretention Areas**
- **Rainwater Harvesting**
  - **Rain Barrels and Cisterns**
- **Flow Through Only Practices**
  - **Dry Swale**

Changes from NYS DEC Stormwater Design Manual

- Only Applies to sites 1 acre or less.
- Applies to both new and redevelopment sites.
- Focuses on reduction of the runoff volume (RRv). The RRv calculation is simplified to 1" of rain times the directly connected impervious areas of the site.
- Establishes a hierarchy for GI practice selection:
  - Reduce Impervious areas.
  - Use infiltration practices where feasible.
  - Use Flow through practices only where infiltration is not feasible.
- RRv requirements can be met by reducing the existing impervious area by 15%.
- Increases impervious area reduction credit for tree planting from 100 ft^2 to 150 ft^2.
- Reduces pretreatment requirements.

Changes from NYS DEC Stormwater Design Manual

- Reduces separation distance to groundwater from 3' to 2'.
- Reduces minimum infiltration rate required for infiltration practices from 0.5"/hour to 0.2"/hour.
- Increases maximum time to drain practices to 3 days.
- Increases allowed ponding depth for bioretention areas from 6″ to 1'.
- Requires flow through practices to slowly release the RRv over 72 hours if possible.
- Reduces minimum orifice size to ½" diameter when using underdrains to allow for slower release rates.
- Allows infiltration to area of shallow permeable soils, including engineered fill soils.
- Relaxes requirements for disconnected runoff.

Runoff Reduction Sizing

- ***Water Quality Volume (WQv)*** is the volume of runoff from the site that must be captured and treated to reduce downstream pollution from stormwater.
- The rainfall used to calculate the WQV is based on the 90%, 24 hour rainfall event (only 10% of rainfall events exceed this value).
- ***Runoff Reduction Volume (RRv)*** is the portion of the WQv treated by GI practices. The RRv is calculated as follows:

RRv = 1"/12 x Aic

Where:

RRv = is the stormwater volume to be managed through GI.

Aic = Area of directly connected impervious cover (new and/or redeveloped) in square feet.

Runoff of 1" is divided by (12"/1 ft) to obtain the volume in cubic feet.

Practice Selection Flow Chart
Let's get started…..

1
- Plan to reduce area of roofs, parking lots and other impervious surfaces.
- Maintain grass areas, buffers, sensitive resources.
- See Planning Tips.

2
- Determine the Runoff Reduction Volume (RRv) for the site.
- The RRv is the amount of stormwater to be collected and managed through green infrastructure practices to reduce pollution and downstream impacts.

3
- Check Soils. If Hydraulic Soil Group (HSG) A or B then maximize use of infiltration practices.
- HSG C or D soils may not be suitable for infiltration. See Soils and Infiltration Testing.

4
- Apply other GI practices to manage the remaining RRv after applying infiltration practices have been utilized to the maximum extent feasible.

Impervious Area Reduction

- Reducing the area of impervious cover directly reduces both the volume of runoff and the peak discharge from the site for all storm events.

For the purposes of this Tool Kit, a project that reduces the impervious cover area by 15% from existing conditions has satisfied the RRv Requirements.

Green Roofs in the Capital Region

Doane Stuart School, Troy, NY

- **22,000ft^2 multi-use green roof system**
- **Project design and construction funded through a $1.4 million EFC GIGP grant**
- **Stormwater runoff reduction of 50%-90%**
- **http://www.doanestuart.org/academics/green-roof-2/**

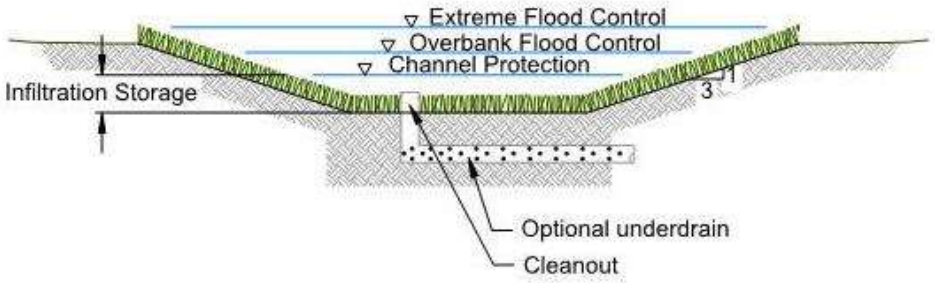
Infiltration Practices

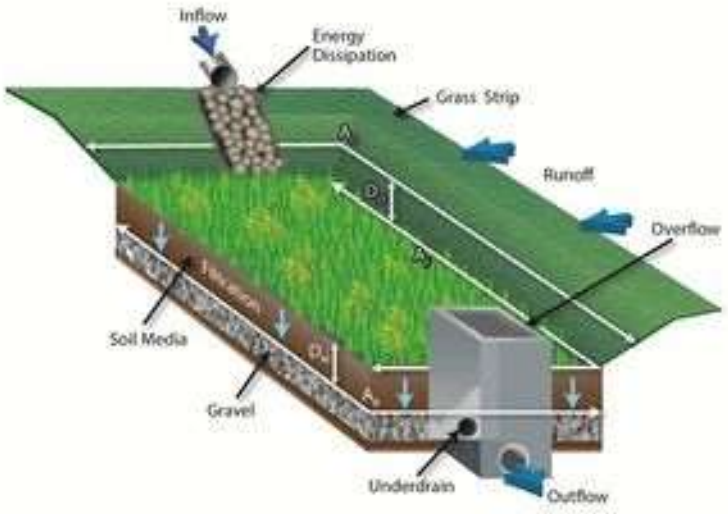
- In addition to these practices, there are a number of GI practices can be designed as either infiltration systems or flow through systems with underdrains. Use the infiltration type systems whenever possible:
  - Porous Pavement with infiltration
  - Bioretention Area with infiltration
  - Stormwater Planter with infiltration
- Underdrains from Flow Through GI practices can be directed to infiltration practices.
- Design guidance:
  - All infiltration practices require suitable soils with a minimum infiltration rate of 0.2"/hour. (reduced from Design Manual minimum of 0.5"/hour).

  Refer to Soils and Infiltration Testing.
  - Maintain a minimum of 2' separation to groundwater or bedrock. May not be permitted or greater separation distance may be required for "hot spots", over aquifers, or as required by local requirements.
  - Keep infiltration practices 10' away horizontally from buildings and foundations and 100' from onsite wells. The separation distance to buildings can be reduced with careful design to prevent water from entering basement areas.

Infiltration

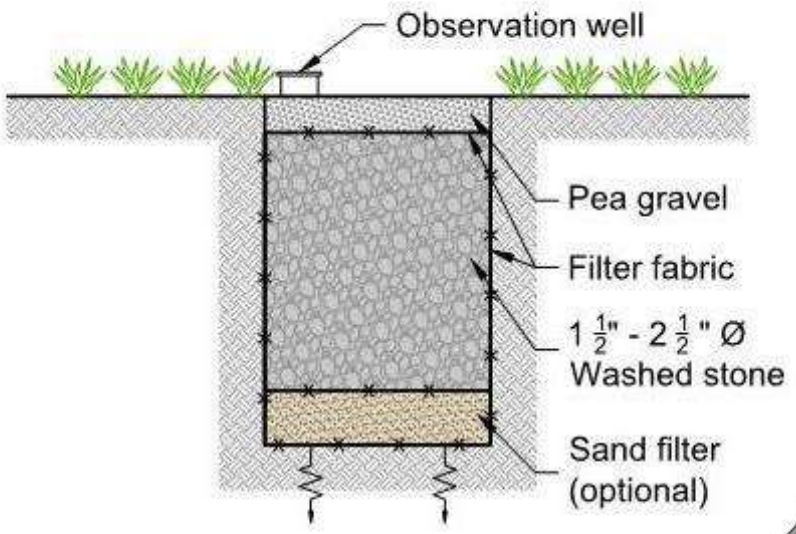
INFILTRATION BASIN



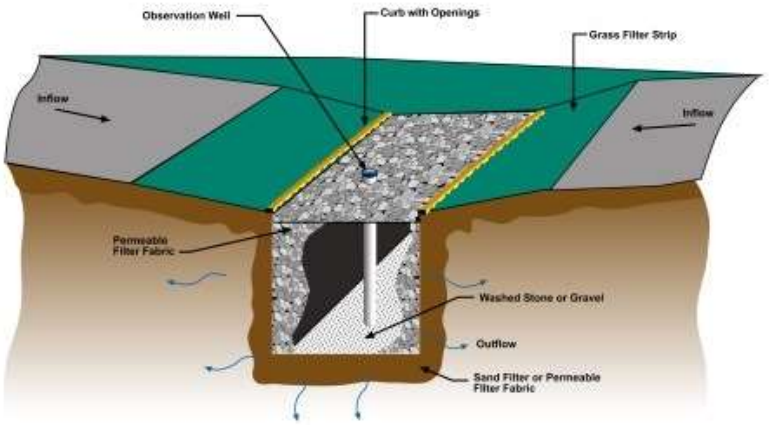


Infiltration

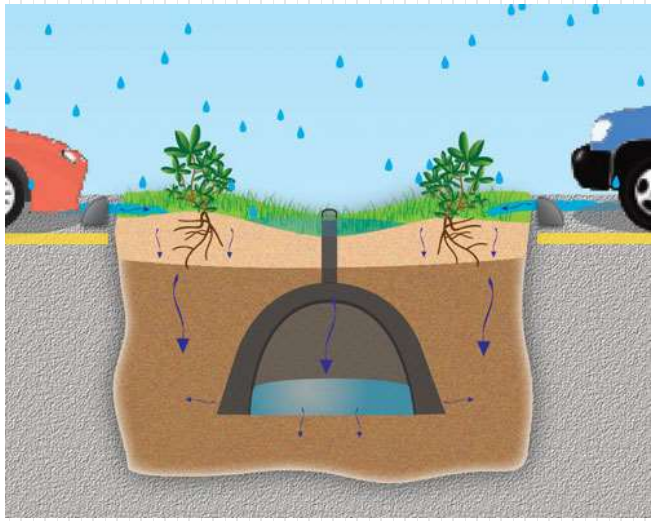
INFILTRATION TRENCH



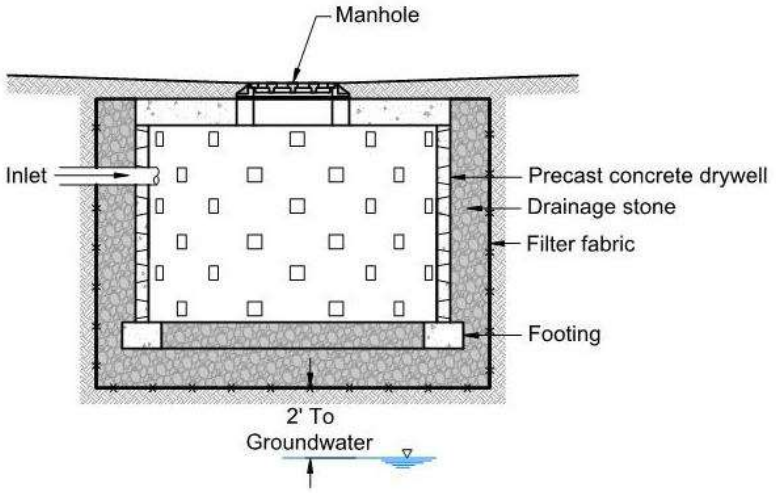
Runoff through undisturbed subsoils with a min. rate of 0.2 in/hr



Infiltration Chambers & Drywells



Storm Chambers

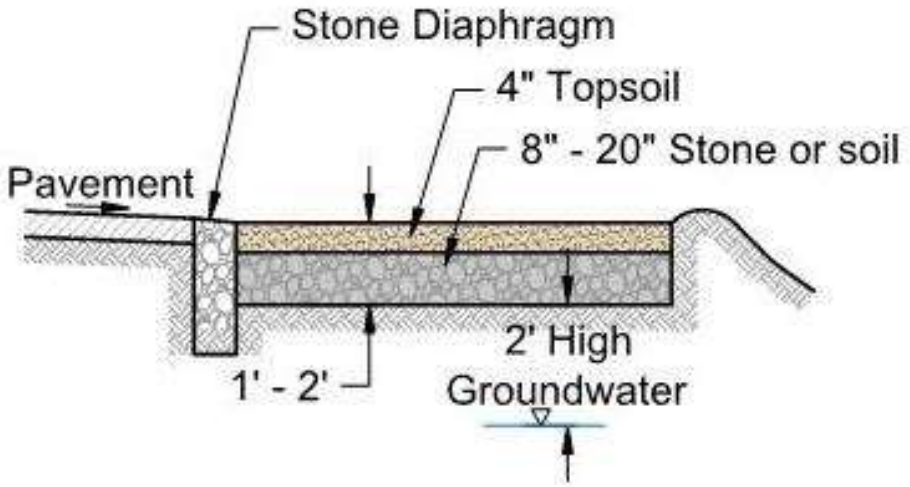


Drywell

Infiltration Practices

- **Shallow Soil System**
  - Stormwater from small impervious areas can be directed to a shallow soil system.
  - A shallow soil system consists of a 1' to 2' layer of soil, either native or imported fill. (This is a variance from the Design Manual which does not allow infiltration in fill).
  - Existing disturbed soils should be restored (see Design Manual, 5.1.6).
  - The upper 4" layer is topsoil to support turf. The soil below can be native permeable soils or imported fill.
  - The shallow soil system is designed to store the RRv within the void spaces in the 1' to 2' depth of soil. Porosities will vary from 0.2 for topsoil to 0.4 for drainage stone.
  - Underdrains and/or surface overflows will be needed where the underlying soils are poor (< 0.2"/hour infiltration).

Shallow Soil System



Local Infiltration Project: Ryckman and Hansen Overflow Abatement Project, City of Albany, NY

Project Included:

- **Modifications to existing stormwater conveyance.**
- **Utilization of existing underground detention system.**
- **New constructed wetland for stormwater management.**
- **New underground infiltration gallery.**

Collectively, these practices provide for the storage of over a million gallons.

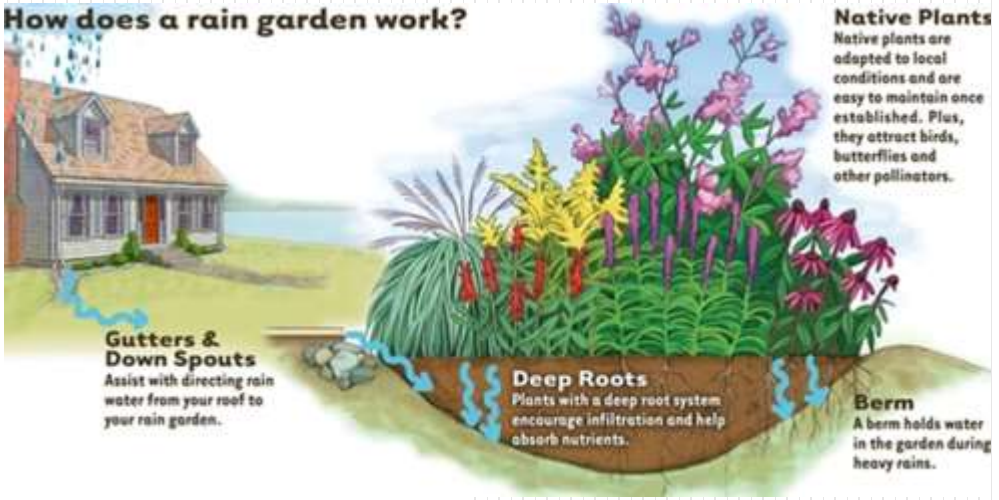
Bioretention Practices

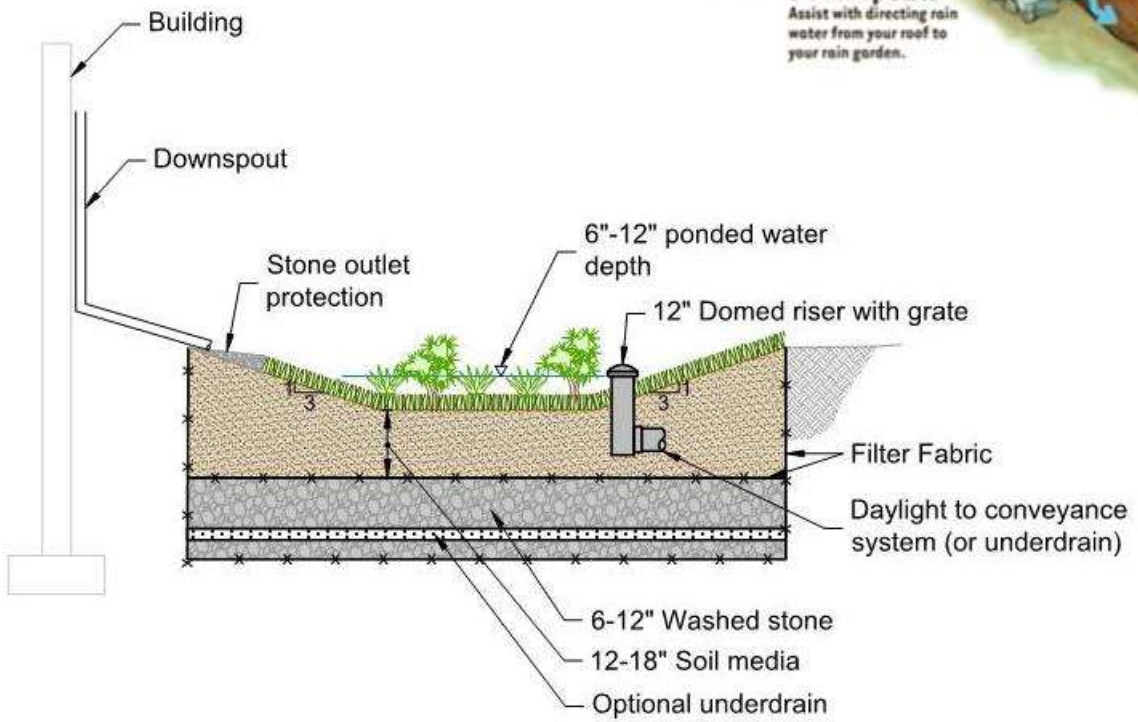
- Overview
  - Selected plants & soils used to retain and treat stormwater.
  - Can be infiltration type (preferred) or flow through type.
  - The Design Manual describes bioretention areas, rain gardens and stormwater planters. These are all bioretention practices. The terminology may vary between references.
- Where to use
  - Use for roof runoff, paved plazas or sidewalk areas, parking lot medians and along drives.
- Bioretention – Infiltration Type
  - Use as first choice if soils are suitable (infiltration rate > 0.2 inches/hour).
  - Keep infiltration practices 10' away horizontally from buildings and foundations. The separation distance to buildings can be reduced with careful design to prevent water from entering basement areas.

Bioretention – Flow Through Type

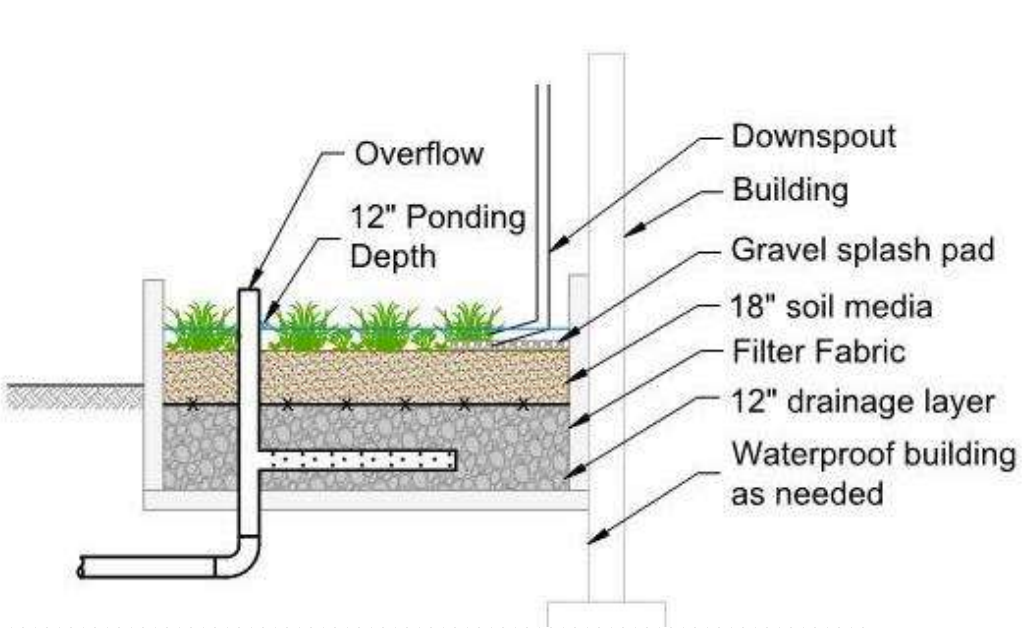
- Requires underdrain with discharge to storm system or separate infiltration practice.
- Provides water quality treatment, temporary storage of the RRv and some reduction in peak runoff when the release rates are controlled.

Rain Gardens

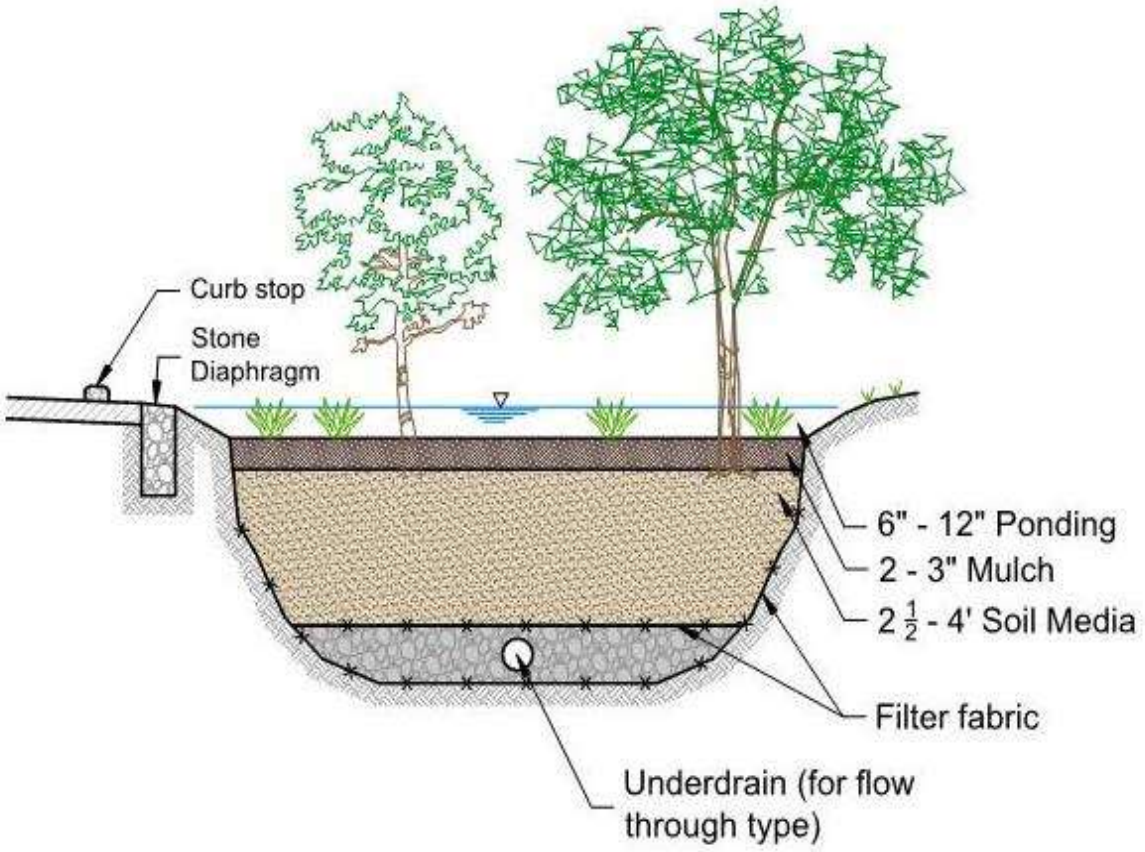




Stormwater Planter – Flow Through Type



Bioretention Area



Bioretention Area

City of Pittsfield, Ma.

City of Watervliet

Bioretention Sizing Example – Flow Through

Bioretention Area - Flow Through			
Area of practice is sized to store the RRv as ponding above soil media			
Required Area, A = (RRv)/dp			
Average height water above bed, havg= dp/2			
Hydraulic gradient, i=(ds+havg)/ds			
Flow through filter, Q = (k)(i)(A)			
Time to Drain, t = RRv/Q			
Item	**Input**	**Units**	**Notes**
Runoff Reduction Volume, RRv	1000	ft^3	
Depth of Ponding, dp	1	ft	Maximum 1’
Required Area, A =	1000	ft^2	
Depth Soil Media, ds	2.5	ft	Typically 2.5'-4'
Soil Permeability, k	0.5	ft/day	Typically 0.5 to 2 ft/day
Avg. height water above bed, havg	.5	ft	
Hydraulic gradient, i	1.2		
Flow through Practice, Q	600	ft^3/day	
Time to Drain, t	1.67	days	Maximum 3 days

Capital Roots Cistern

Capital Roots in Troy, NY has an insulated cistern that holds 5,200 gallons of stormwater, collected from the rooftop. The water is used year round for flushing toilets and landscaping and has resulted in a 50% reduction in water needs at the facility.

An aerator prevents the cistern from freezing and automatic valve, with a backflow preventer, ensures that there is a back-up municipal water supply on hand in the event of the system runs dry or there is a power outage. After several months of use, the system is reportedly working well with only a few small modifications. Small particles of organic material do collect in the rainwater creating a tan, greyish color.

There was some alarm about the color of water in the toilets, as folks unfamiliar with the rainwater system believed something was amiss with the water supply. Although the discoloration from organic material in the harvested rainwater is normal, the project manager thought this could easily be rectified by posting a sign and switching out the system filter to a smaller micron rating. Only rarely has the cistern ever filled beyond capacity. An overflow is built in and this drains to a bioretention practice.

For more information go to: http://www.capitalroots.org/

Outlet Control For Flow Through Practices

- The release rate is calculated as follows:

  Q=V/T

  Where:

  Q = release rate flow in cfs

  V = Volume stored in practice (RRv)

  T = release time. Target = 3 days.

- Using an orifice for outlet control, the release rate or orifice flow is calculated as follows:

$$Qf = C \times A \times \sqrt{2gh}$$

  Where:

  Qf = orifice flow in cfs

  C = Orifice Coefficient, typically 0.6

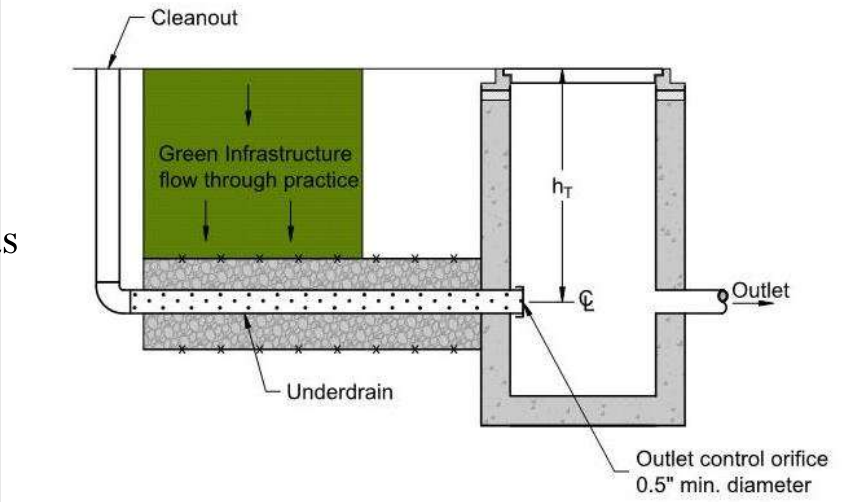
  A = area of orifice, ft^2

  g = acceleration constant 32.2 ft/s^2

  h = average head from center of orifice. = $(h_t-h_0)/2$

  h_t = total maximum head (see sketch)

  H_0 = minimum head (when drained=0) measured from center of orifice.



Planning Guide - GI Banking and Vacant Lots

- The APC has completed a Feasibility Study for a **Green Infrastructure Banking System**.
- Implementation of this program would provide alternatives for difficult sites that are unable to meet stormwater management requirements.
- The Albany County Land Bank Corp., and the Troy Community Land Bank, acquire vacant, abandon and tax foreclosed lots and sells them to eligible buyers.
- Vacant lots present a great opportunity to implement GI practices that can be incorporated into a GI banking program.
- From a stormwater management perspective, particularly in CSO areas, redevelopment of vacant lots should:
  - Encourage uses that maximize pervious surfaces such as pocket parks and community gardens.
  - Minimize impervious surfaces. Porous pavement options should be used where feasible for redeveloping vacant lots for parking.

Cost of Selected GI Practices

GI Practice	Range - $/treated ft^3
Rain Gardens	$3-$6
Stormwater Planters	$21-$41
Bioretention Areas	$9-$46
Infiltration Trench/Drywell	$12-$15
Permeable Pavers	$109-$164
Rain Barrels	$7-$28
Cisterns	$14-$26

From: Water Environment Federation (WEF), Green Infrastructure Implementation, 2014. Costs in 2012 dollars.

Construction Considerations

- Develop and implement an erosion and sediment control plan to protect downstream properties and waterways.
- Proper construction sequencing is critical to make sure the site is stabilized prior to exposing infiltration areas to sediments that can clog these areas.
- Keep heavy equipment off of pervious areas to avoid over compaction.
- Restore Soils in pervious areas –Till to 12" depth See: Soils and Infiltration Testing.

Maintenance Considerations

- General
  - Check for erosion.
  - Integrity of structures and pipes.
  - Flows maintained as intended, soil/infiltration not clogging.
- Pretreatment
  - Remove debris and accumulated sediments.
- Vegetation
  - Water & fertilizer.
  - Weed.
  - Replant as needed.
- Rain barrels and cisterns
  - Need active management to make sure vessel is emptied in advance of storm events.
- Proprietary systems
  - Generally higher maintenance.
  - May include mechanical components.
  - Consult manufacturer's O&M manuals.

Maintenance Tasks

Maintenance Task	Recommended Frequency	Description
Porous Pavement Vacuuming	Semi-annually (2x/year) for concrete, asphalt and flexible pavement; annually in spring for pavers	Porous pavement surfaces require vacuuming to remove debris that may clog the permeable layers/voids prevent infiltration.
Porous Pavement Power Washing	Once every three years (or as necessary)	Power washing restores permeability and should follow porous pavement vacuuming. Porous pavers should not be power washed.
Porous Paver Maintenance (Restoring Aggregate)	As needed when gravel infill is not within 1/2 inch of the paver surface, immediately following vacuuming	Refilling of voids between pavers with additional aggregate material to replace any material that has been lost by vacuuming and/or due to natural migration, settlement, and erosion.
Winter Maintenance for Porous Pavements	As necessary during Winter	Porous pavement surfaces require modified plowing and salting practices during the winter months when snow is present.
Stormwater Structure Cleaning	Semi-annually (2x/year)	Stormwater Structure Cleaning refers to removing debris or clogged materials and vacuuming the interior of the structure.
Inlet Filter Insert Cleaning or Filter Insert Pouch Replacement	Clean Quarterly (4x/year) until it is determined a particular inlet requires less frequent cleaning; Replace annually	Filter inserts need to be cleaned with an industrial vacuum to remove debris and prevent clogging.

Reference: City of Rochester & Monroe County, GI Retrofit Manual, Barton & Loguidice, DPC, 2016 Draft

Maintenance Costs

Maintenance Cost Estimates vary widely, and because systematic GI use is relatively new there are limited records of existing programs. Below is an estimate of maintenance costs for a recent Green Infrastructure Project

GI TYPE	REQUIRED MAINTENANCE	FREQUENCY	ESTIMATED ANNUAL COST ($)
Porous pavements	Vacuuming of surface Inspection & Cleaning of drainage structures	2 times per year	Avg. $0.15 / SF
Rain Gardens	Water & Care Establishment Weeding, Pruning, Mulching Inspect & Clean overflow drainage Remove litter, debris, sedimentation	4 times per year (Spring & Fall critical)	Avg. $0.30 / SF
Bioretention	Water & Care Establishment Weeding, Pruning, Mulching Inspect & Clean overflow drainage Remove litter, debris, sedimentation Erosion Control, stone apron repairs	3 times per year (Spring & Fall critical)	Avg. $0.75 / SF

Reference: City of Rochester & Monroe County, GI Retrofit Manual, Barton & Loguidice, DPC, 2016 Draft

Local GI Projects

Stormwater Coalition of Albany County
September 24, 2013 Green Infrastructure Tour
11:30am to 5:00pm

Registration and Lunch
Cook Park, Village of Colonie, New York


Stormwater Coalition Green Infrastructure Local Law Advisory Committee (GILLAC) —planning, registration, lunch coordination, troubleshooting

Helping Out For The Day: Jeremy Cramer, Town of New Scotland; Melissa Ashline-Heil, City of Cohoes; Leslie Lombardo, Albany County; Marjella Davenport, City of Albany; Mike Lyons, Town of Colonie.

Tour Host (Registration and Lunch): Village of Colonie, Carl Flestman and Randy Rivera ...waiting for the buses!

Introductions
Green Infrastructure Explained...

Nancy Heiruen
Stormwater Coalition of Albany County
Program Coordinator

Welcome!

Daniel P. McCoy, County Executive, Albany County

Getting Around—School Buses!

Antoinette Eslaires

Top of Rapp Road landfill

End of Tour! Cook Park

Tour Funding: *NYSDEC Environmental Protection Fund Stormwater Implementation Grant (Round 10)*
Stormwater Coalition of Albany County: *112 State Street, Room 720, Albany, NY 12207. www.albanycountystormwater.org*

1

Site 1: Rain Garden (Cook Park, Village of Colonie)

Background: The purpose of the rain garden is to treat small volumes of stormwater runoff using a conditioned planting soil bed and planting materials to filter runoff stored within a shallow depression. This garden receives runoff from a portion of a parking lot and was built in November, 2011. Albany County Cornell Cooperative Extension Master Gardeners designed the garden; Albany County Soil and Water Conservation District provided labor and planting material, and the Village of Colonie Department of Public Works provided equipment and helped dig the garden. The garden is maintained by the Village of Colonie. The Stormwater Coalition of Albany County monitors rain garden performance and facilitates coordination and training as needed. This is one of eight demonstration rain gardens throughout Albany County. Estimated cost of each demonstration rain garden: $3,500 (labor, equipment, materials). Plant supplier: Project Natives, Fiddlehead Creek Nursery, Helderledge, splits of plants from other rain gardens. Multiple sources of funding for all eight demonstration rain gardens.

Presenter: Susan Pezzolla, Cornell Cooperative Extension of Albany County Master Gardeners

Presenter: Randy Rivera, Village of Colonie, Stormwater Program Coordinator

Presenter: Susan Lewis, Albany County Soil and Water Conservation District (right of Randy Rivera)

Site 3: Green Roof (University at Albany-SUNY, Uptown Campus, Liberty Terrace Dorm)

Background: This green roof was installed in 2012 and was one of several natural and sustainable elements incorporated into the Liberty Terrace project. This LEED-Gold project also includes a ground source heat pump, rain gardens, daylight maximization, and the use of recycled and locally-sourced materials. The roof garden supplier was Carlisle/S & L Roofing and from top to bottom the roof components include: Carlisle's vegetated sedum mats; Carlisle's 2.5" growth media; Carlisle's Miradrain G8; .060 White EPDM; EPDM Bonding; 1/2" securock cover-board; Tapered insulation; 725 TR vapor barrier; 700 Primer; 1/2" DENS deck prime; wood deck. Carlisle's pressure-sensitive molded walkway pads surround the vegetated area. An authorized contractor installed the green roof.

Presenter: Diana Daly, Registered Architect, Project Manager, University at Albany-SUNY

Presenter: Peter Spoor, Construction Manager, University at Albany-SUNY (available for questions)

2

Local GI Projects

Site 2: Porous Pavement, Downspout Disconnect, Soil Restoration, and Reduction of Impervious Cover (Antoinette Estates, Town of Colonie)

Background: As originally planned this was a 15 lot residential sub-division resulting in a total disturbance of 4.8 acres. The original Basic SWPPP (Erosion and Sediment Control Plan) included small rear lots and deed restricted areas. After construction commenced, to address changing market conditions, the developer favored larger lots. This resulted in a redesign of the site to include post construction stormwater practices.

Given site opportunities and constraints, various green infrastructure practices were proposed which met the needs of the developer and addressed the Town's interest in testing out and promoting green infrastructure. These practices included porous pavement for both the Town road and individual lot driveways, plus roof top disconnection. While porous asphalt had been used elsewhere in Albany County, this application involved residential, rather than commercial property and a Town road, rather than the more typical parking lot, or foot/bike path. This novel application resulted in heightened oversight of the project and careful attention to all design, construction and maintenance details. A variety of individuals participated in this project and presentation: John Drlaio, Town of Colonie Stormwater Program Coordinator; Dan Hershberg, PE, Stormwater Design Engineer; Anthony Giubarelli, Owner, Giubarelli Construction, Inc.; Bob Higgins, Town of Colonie Stormwater Inspector; Adam Wands, Town of Colonie, Stormwater Inspector.

While this site was primarily an example of porous pavement and downspout disconnection, two other green infrastructure practices were discussed as well, soil decompaction and the reduction of impervious area (i.e. via Town law...reduce street width).

Dan Hershberg, explaining the project. John Drlaio and Anthony Giubarelli available for questions.

John Drlaio, Town of Colonie, Stormwater Program Coordinator

1. What our test pits showed...well drained soils, suitable for porous asphalt
2. Decompact pavement sub-grade utilizing methods as described in Deep Ripping and Decompaction (April, 2008 NYSDEC) ...VERY IMPORTANT!
3. Maintenance agreements with homeowners—critical. They need to know how to maintain their porous asphalt driveway.

This is the third Tour demonstration of the day. John is spraying about ~ 200 gallons of water onto the porous asphalt pavement.

After ~ 30 seconds, this is what it looks like.

Adam Wands and Bob Higgins explaining street width dimensions...this site 32' wide (wing to wing). Town standard had been 36'. Town might consider 28' wing to wing. EPA Water Quality Scorecard recommends 18—22' street width.

Downspout Disconnection —Antoinette Estates

3

Site 4: Stream and Habitat Restoration (City of Albany Rapp Road Landfill & Albany Pine Bush Preserve)

Background: June, 2009 NYSDEC issued a permit to expand the Rapp Road landfill (23-acre overfill; 15 acre lateral landfill expansion; extend life of landfill by 7 years assuming currently approved maximum daily tipping rates). Permit requires several actions to minimize and mitigate adverse environmental impacts. One action "...the City fully implement an Albany Pine Bush Ecosystem, Habitat Restoration Plan..." Restoration Plan: create ~20 acres of wetlands; 3200 feet of stream, native plant nursery. Phasing: restore ~ 130 acres of Preserve lands surrounding landfill; test native plant restoration on a closed portion of landfill; restore ~ 130 acres on the closed landfill

Stream and Habitat Restoration Albany Pine Bush Preserve

Presenters:

Left to Right:

Joe Giebelhaus, City of Albany Landfill, Solid Waste Manager

Neil Gifford, Albany Pine Bush Preserve Conservation Director

Top of Rapp Road landfill

Solid waste

As the landfill closes, the NYSDEC Permit requires the restoration of closed portions (cap and contour with native sand and plant natives)

4

Additional References

General References that include extensive stormwater tools and resources:

- US Environmental Protection Agency (USEPA)
- University of New Hampshire Stormwater Center
- The Center for Watershed Protection
- Low Impact Development Center
- The Water Environment Federation
- National Association of City Transportation Officials, *Urban Street Stormwater Guide*.

New York State Department of Environmental Conservation (NYSDEC)

- Stormwater Management Design Manual
- NYS Standards and Specifications for Erosion and Sediment Control (Blue Book)
- Better Site Design

New York City

- Guidelines for the Design and Construction of Stormwater Management Systems
- NYC Green Infrastructure Plan (Includes GI cost estimates)
- NYC Standards for Green Infrastructure (Includes CAD drawings)

City of Chicago

- Stormwater Management Ordinance Manual
- Green Alley Handbook

City of Philadelphia

- Stormwater management Guidance Manual
- Green Street Design Manual
- Green Streets Details (CAD drawings)
- Green Stormwater Infrastructure Standard Details (CAD Drawings)
- Green Stormwater Infrastructure Planning & Design Manual
- Green Stormwater Infrastructure Landscape Design Guidebook

City of Portland

- Stormwater Management Manual
- Presumptive Performance Details (CAD drawings)
- Stormwater Simplified Typical Details (CAD drawings)
- Green Street Typical Details (CAD drawings)

City of Rochester and Monroe County

- Green Infrastructure Retrofit Manual

Stormwater In-Lieu Fees and Credit Banking Feasibility Study

Purpose:
Assess the feasibility and suitability of in-lieu fees and credit banking to help achieve stormwater management and Green Infrastructure improvements

- Study administered by Capital District Regional Planning Commission
- Completed part of the CSO Long-Term Control Plan for the Albany Pool Communities
  - Albany Water Board
  - City of Cohoes
  - City of Rensselaer
  - City of Troy
  - City of Watervliet
  - Village of Green Island
- LTCP included a requirement to consider Green Infrastructure projects and programs
- Study funded with a grant from the NYSDEC Hudson River Estuary Program

Overview of Feasibility Study Project

Task 1: Data Collection and Review	Compile background information on Albany Pool Communities stormwater programs
Task 2: Regulatory Authority and Governance	Identify regulatory and legal factors in to be considered in developing an organizational structure that supports ILF and Banking
Task 3: Research ILF and Credit Banking Programs	Compile information from other established ILF and Credit Banking programs
Task 4: ILF and Credit Banking Concept Workshop	Discuss merits, pitfalls, lessons learned and overall applicability to Albany Pool Communities
Task 5: Feasibility Assessment and Report	Presentation of research findings and the assessment of the feasibility for the Albany Pool Communities

Stormwater In-Lieu Fees

How does it work?

1. Existing code requirements

Post Development Peak Flow Rates
< Pre-Development Conditions

2. Option: Pay fee instead of on-site mitigation

3. Determine fee amount

Fee per volume of detention typically based on average cost of mitigation measures

4. Aggregate fees and implement alternative GI projects

Stormwater Credit Banking and Trading

How does it work?

1. Developer exceeds stormwater mitigation requirements

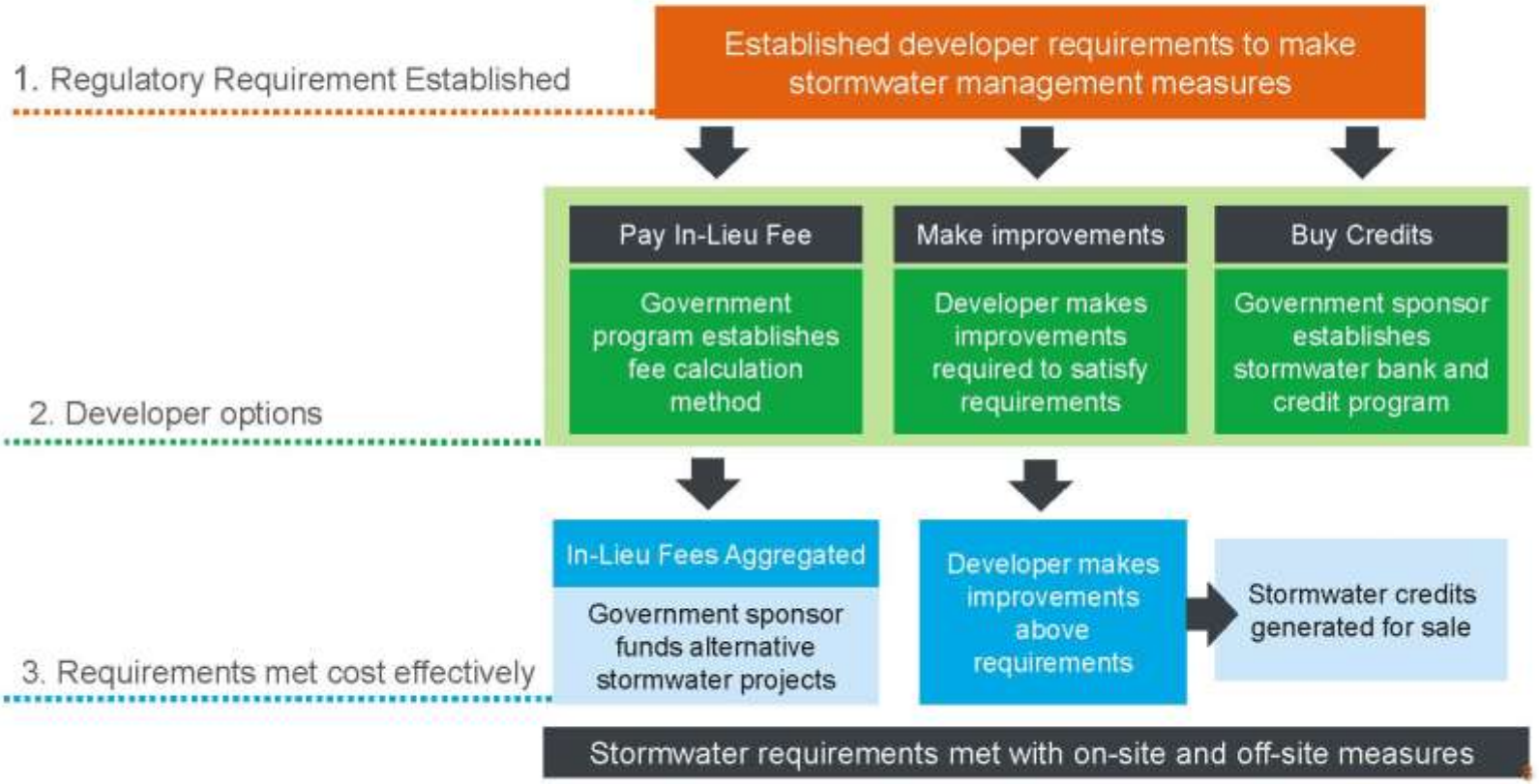
2. Mitigation credit is created

- Banking
- Credit Trading

Example green roof

- Credit can be applied to other development sites to meet stormwater requirements
- Credit can be sold to another developer

How do In-Lieu Fees and Credit Banking Programs Work Together?



Research of In-Lieu Fee and Credit Banking Programs

Location	Population	Program Name	Program Type
Aspen, CO	6,800	Fee In-Lieu Program	Stormwater ILF
Chattanooga, TN	174,000	In-Lieu Fee and Credit Coupon Program	Both
Park Ridge, IL	38,000	Stormwater Detention Fee Program	Stormwater ILF
San Antonio, TX	1,437,000	Fee In-Lieu-of (FILO) Program	Stormwater ILF
Washington, DC	7,170,000	Stormwater Retention Credit Program	Both

There have also been many successful wetlands mitigation banking programs implemented around the country.

Benefits

- Provides funds for stormwater mitigation where mitigation would not otherwise occur due to poor site conditions
- Supports cost effective, market-driven approach to stormwater mitigation
- Could help mitigate volume of CSO discharges in CSO areas or stormwater runoff issues
- Flexibility for developers in meeting stormwater mitigation requirements

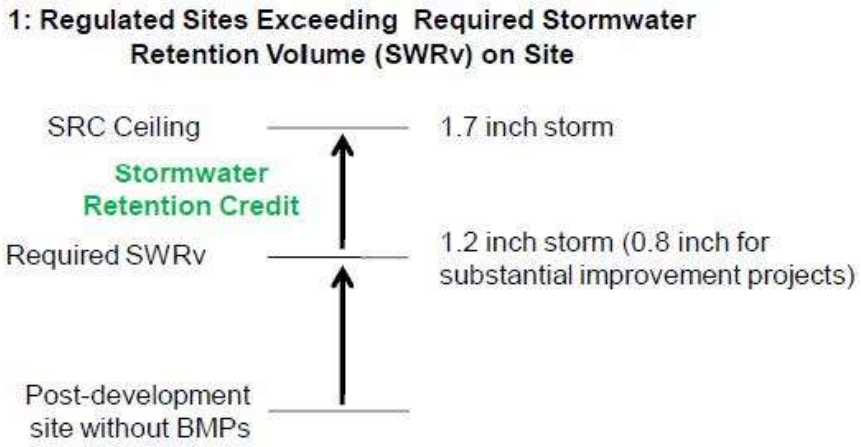
Washington D.C.

Stormwater Retention Credit Program

Program Feature	Description
In-Lieu Fee	Yes. Established in 2013
Credit Banking / Trading	Yes
Driver	Part of MS4 requirements
Stormwater mitigation requirement	Developments must retain the 90th percentile storm event (1.2 inch rainfall) onsite
Eligibility	Disturbance of greater than 5,000 sf. 50% of requirement must be met onsite, 50% can be met offsite.
Current Fee	$3.58 per gallon of retention
Current Credit Price	$2.00 to $2.55 per gallon
ILF Revenues	$134,000 (2015)
Use of Revenues	Regional stormwater drainage projects
Staffing	Approximately 2.5 FTEs

Washington D.C.
Stormwater Retention Credit Program

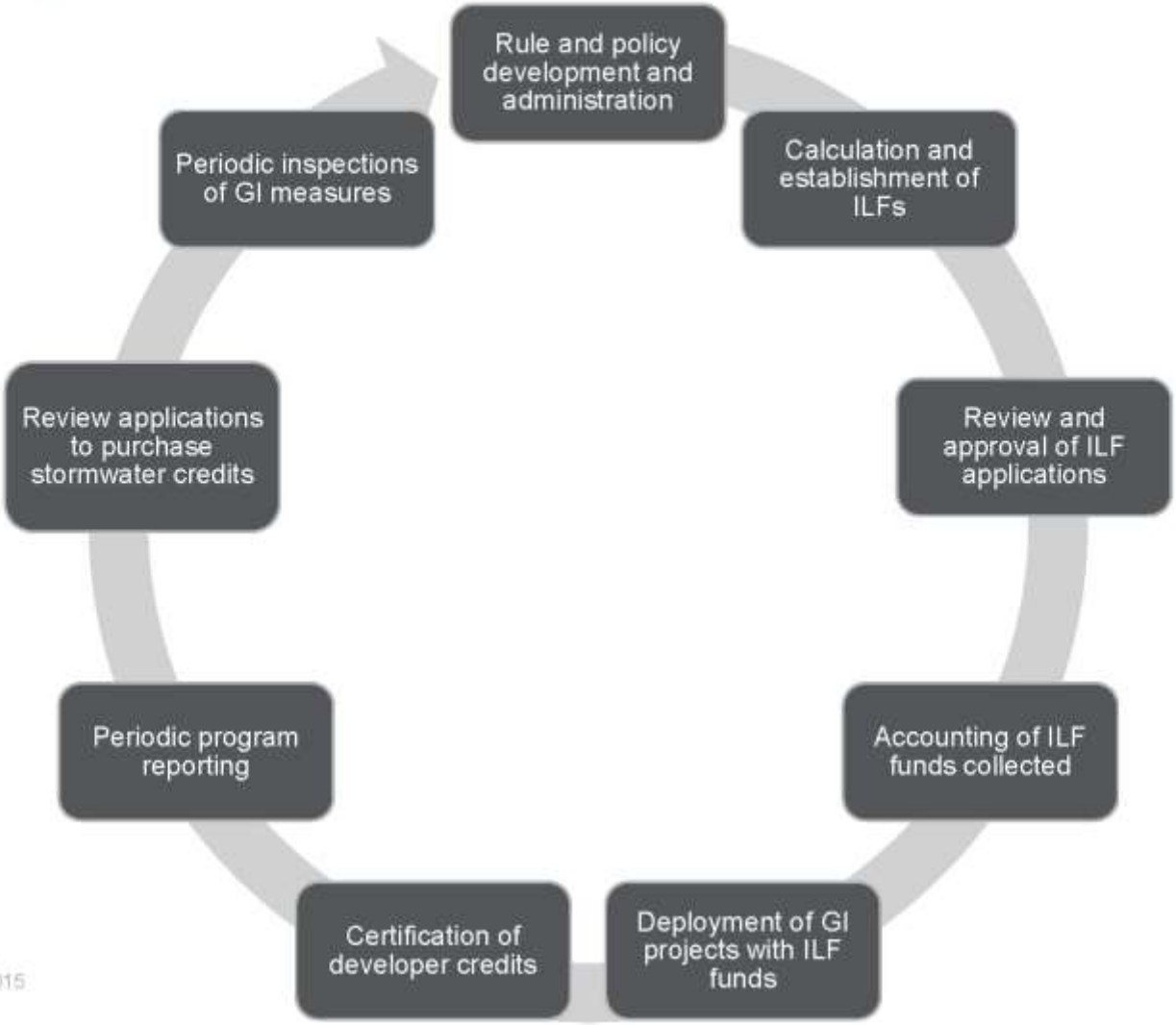
- Developers can generate Stormwater Credits for exceeding requirements



- Online marketplace for the buying and selling of stormwater credits

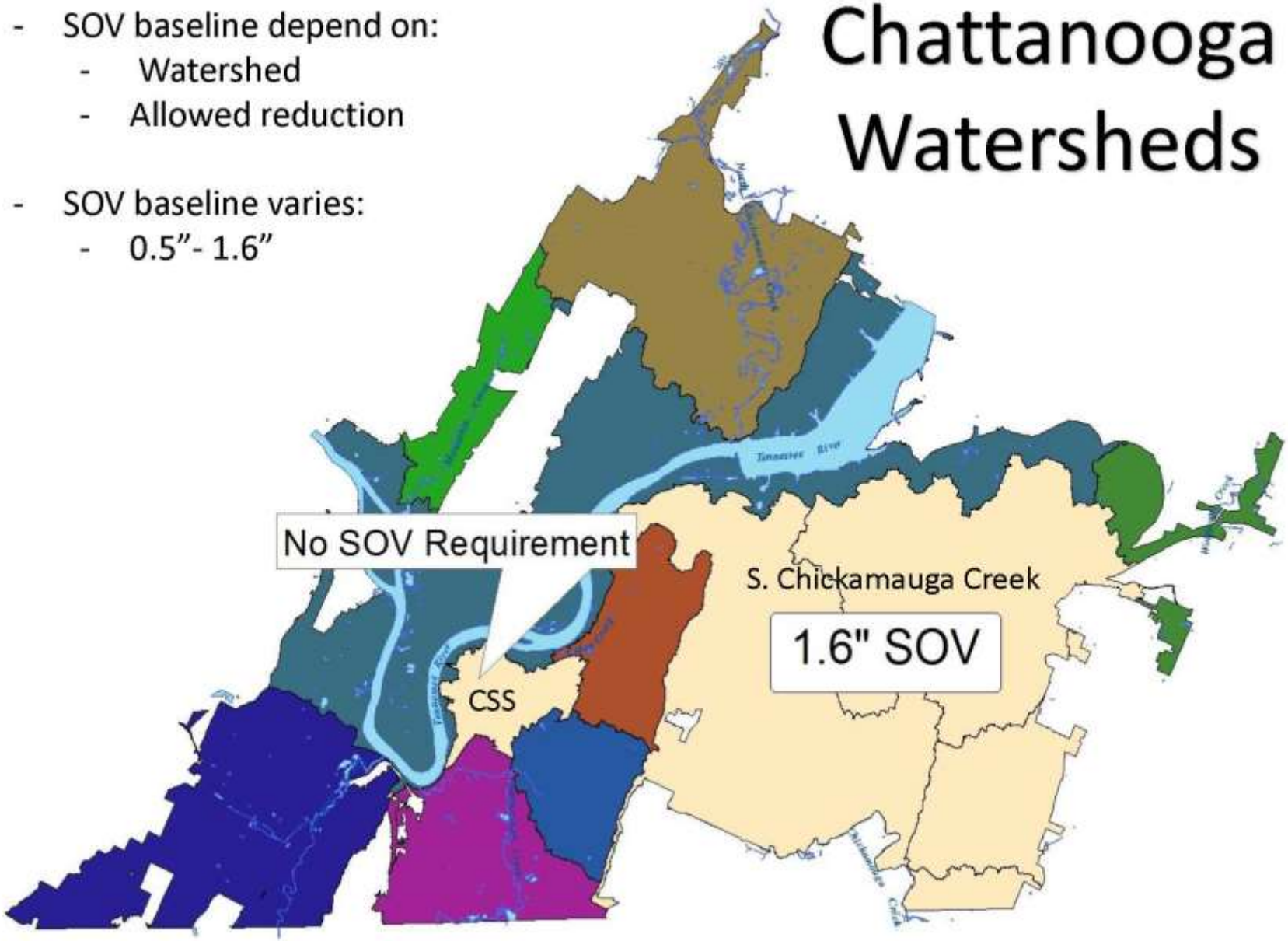
Contact name	Contact phone	Watershed where SRCs are generated	Sewershed where SRCs are generated	Asking price per SRC	Number of SRCs (tot)
Furbish Company, LLC	(443) 324-5804	Potomac	CSS	$2.55	62,685
Greg DeHaven	(202) 477-9917	Rock Creek	CSS	$2.00	1,104
Lano Parcel 12 LLC c/o CityInterest LLC	(202) 944-4729	Anacostia	MS4	$2.55	58,239
Mary Harting	(202) 965-1514	Potomac	MS4	$2.00	16,095
Matt Ritz	(202) 465-7050	Anacostia	CSS	$2.35	24,406
Ronan Heritier	(202) 944-6196	Potomac	MS4	$2.45	4,228
USP 700 6th Street LLC	(202) 756-3085	Anacostia	CSS	$2.25	8,732
Totals (7 groups)					175,489

Program Administration Activities



Chattanooga Watersheds

- SOV baseline depend on:
  - Watershed
  - Allowed reduction
- SOV baseline varies:
  - 0.5”- 1.6”



Chattanooga RRv Incentives

- SOV Reduction Incentives: Up to 50% reduction is available for type of redevelopment/development:

1) Redevelopment
2) Brownfield
3) High density (> 7 units/ac)
4) Vertical density (Floor to Area Ratio > 2)
5) Transit Oriented

- Off-site Mitigation
- Mitigation Fees (ILF)
- Credit Coupons (Banking)

Hardship Management

- Water Quality (user) Fee Discounts

Hardship

- Acceptable reasons may include:
  - <2' to limiting layer (bedrock, groundwater, etc.)
  - Contaminated soils
  - Karst features
- Unacceptable hardship
  - Economic hardship
  - lack of space
  - Self-imposed (conditions imposed solely by the site design)
- Flood Control & Water Quality still required

So… what now?!

Mitigation

- ILF & Off-site Mitigation
  - "If runoff reduction and/or pollutant removal cannot be fully accomplished on-site…, then the permittee may propose off-site mitigation and/or payment into a fund for public stormwater projects."

MS4 permit

- Credit Coupons Trading
  - Competitive to ILF and Off-site Mitigation
  - Earn SOV credits when overdesigning
  - Buy SOV credits for site hardship

Chattanooga Approach

Mix & Match

Achieving SOV can be a combination of:

- Installed BMPs
- ILF (Mitigation)
- Off-Site (Mitigation)
- Buying Credit Coupons from Marketplace (Mitigation)

ILF (MS4 Permit)

- Not meeting the onsite SOV requirement
- May be assessed on new development and redevelopment
- Must be at a minimum 1.5 times the estimated cost of on-site runoff reduction controls
- Fees are paid into a "public stormwater project fund"

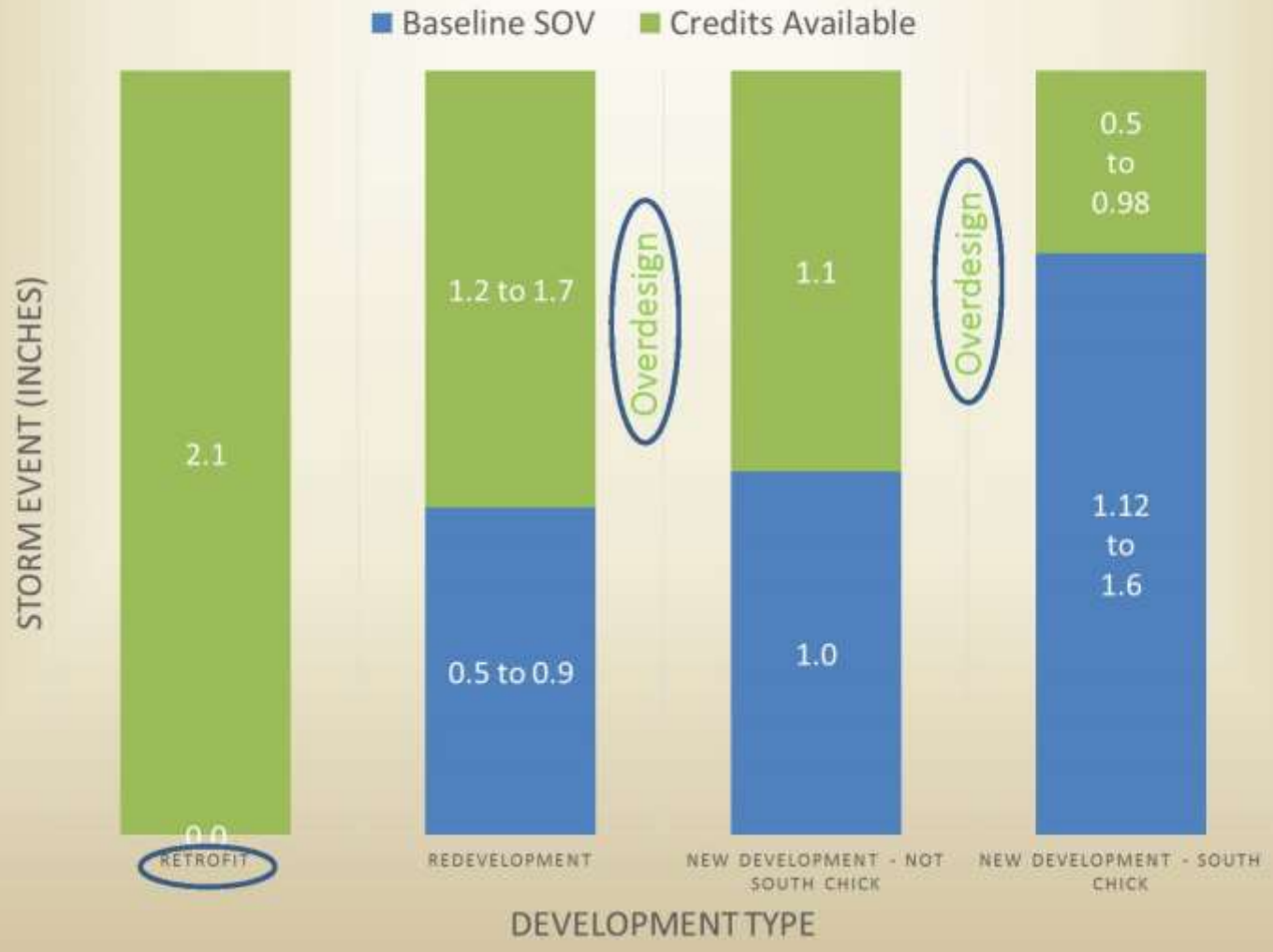
Chattanooga ILF

- 50% of fees due prior to the issuance of a Land Disturbing Permit
- Remaining balance due with receipt of certified and approved As-Built, prior to issuance of a CO

Off-site Mitigation

- Permit requires 1.5 times the unmet SOV
- Must be in the same watershed as the primary development
- Applicant responsible for land acquisition, design, construction, and long-term O&M
  - The City may identify priority areas
- Requires a surety bond in the amount of the total equivalent mitigation fee – due at issuance of LDP
- Off-site mitigation must be PERFORMED ON redevelopment or retrofit sites

Creating Credits (Banking)



Credit Coupons (Banking)

- Earned in CF of SOV > Baseline
- Issued as hard copy coupon
- Tracked in City database
- No expiration date
- 2.1" ceiling
- Installed : Earned Ratio
  - 1:1 for redevelopment & retrofit
    - Coupon CF = 100% of installed CF
  - 1.5:1 for new development
    - Coupon CF = 66% of installed CF

Credit Coupons Usage/Trading

- Watershed Usage
  - New Development = same watershed
  - Redevelopment/Retrofit = any watershed
- Demonstration of hardship needed
- City doesn't track trades
  - Only issues and receives coupons
- City doesn't purchase/sell its coupons
- Use of credits doesn't negate flood control or water quality requirements

SOV Sites to Date *

*As of 2016

http://chattanooga.gov/waterQuality

Albany Cohoes Rensselaer Troy Watervliet Green Island

For more Information

Albany Pool Communities CSO LTCP

Martin Daley
Director of Water Quality Programs
Capital District Regional Planning Commission
(518) 453-0850
mdaley@cdprc.org
www.cdrpc.org

Green Infrastructure Tool Kit

Douglas C. Clark, P.E., LEED AP
Senior Associate
RYAN BIGGS | CLARK DAVIS ENGINEERING & SURVEYING, D.P.C.
(518) 794-8613 ext 107
dclark@ryanbiggs.com
www.clarkdavis.ocm

Green Infrastructure Code Audit

Nadine Medina, P.E., CPESC, LEED-AP
Sr. Project Engineer
Barton & Loguidice, D.P.C.
(518) 218-1801
nmedina@bartonandloguidice.com
www.bartonandloguidice.com

Bradley D. Grant
Senior Project Manager
Barton & Loguidice, D.P.C.
(518) 218-1801
bgrant@bartonandloguidice.com
www.bartonandloguidice.com