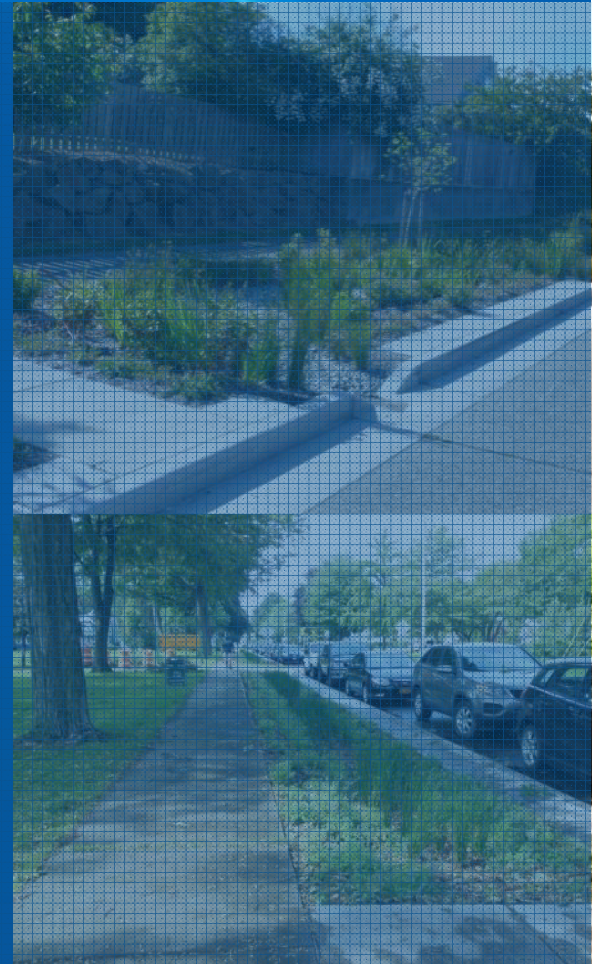


General Session III - Breaking the Mold on Wet Weather Compliance Strategies

NACWA Winter Conference

Santa Fe, NM

2/5/2014



Breaking the Mold on Wet Weather Compliance Strategies

- Managing impacts of CSO and SSO extremely costly challenges
- Increasing # of new challenges requires innovative approaches
 - MS4 Permitting
 - Nutrient TMDL Implementation
 - Flooding & Climate Resilience
- Discuss a few case studies that include
 - ways to achieve compliance goals while controlling costs
 - collaborative approaches with EPA, states, satellite communities, and other stakeholders
 - Move towards adaptive management with an implementation focus
- Case study areas
 - Lancaster, PA
 - Louisville, KY
 - Onondaga County, NY (Syracuse)

Integrated Planning Approach allows for more affordable *compliance* of water infrastructure needs

- EPA Integrated Municipal Planning Approach offers a framework for Prioritizing wet weather investments beyond CSO / SSO to include

- MS4
- Nutrient TMDLs
- Asset Rehab
- Flood Risk
- Climate Resilience

What is an Integrated Approach?

- Under an integrated approach, EPA and States would use the flexibility of EPA's existing regulations and policies and allow municipalities to evaluate how best to meet all of their CWA requirements and their financial capability to better allow—
 - sequencing wastewater and stormwater projects in a way that allows the highest priority environmental projects to come first, and
 - innovative solutions, such as green infrastructure

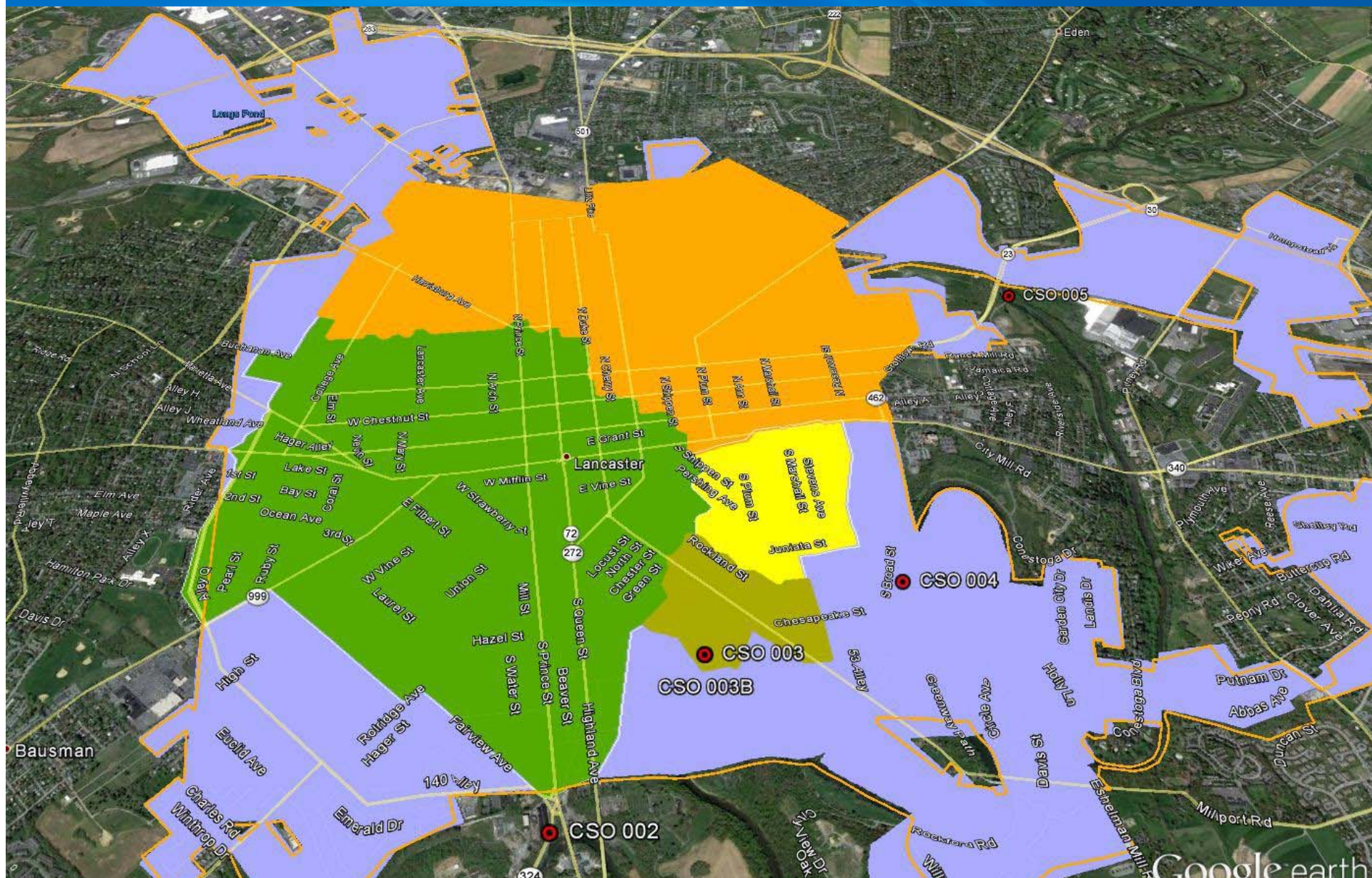
Lancaster, PA partnering with EPA to implement an integrated planning approach

- ~60,000 residents (2010 census)
- 7.34 square miles
- CSO Administrative Order
- Evaluating watershed based solutions for
 - MS4 & CSO discharges
 - Nutrient Reduction Requirements of Chesapeake Bay
- Driving the program by *building the CWA infrastructure with other urban assets renewal projects*
 - (e.g. Roads, Parks, Buildings, Water / Sewer Rehab)

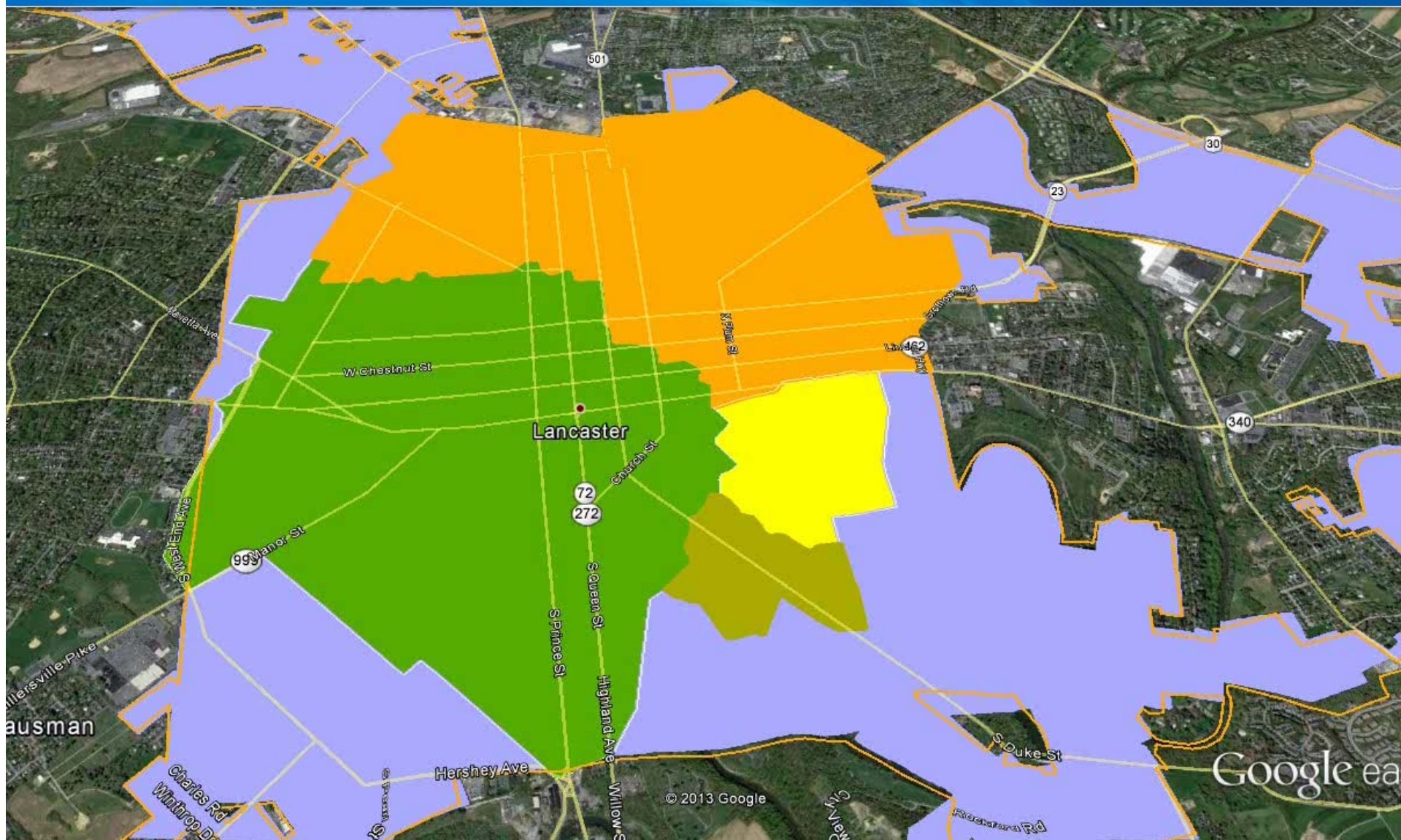


45% Combined Sewers

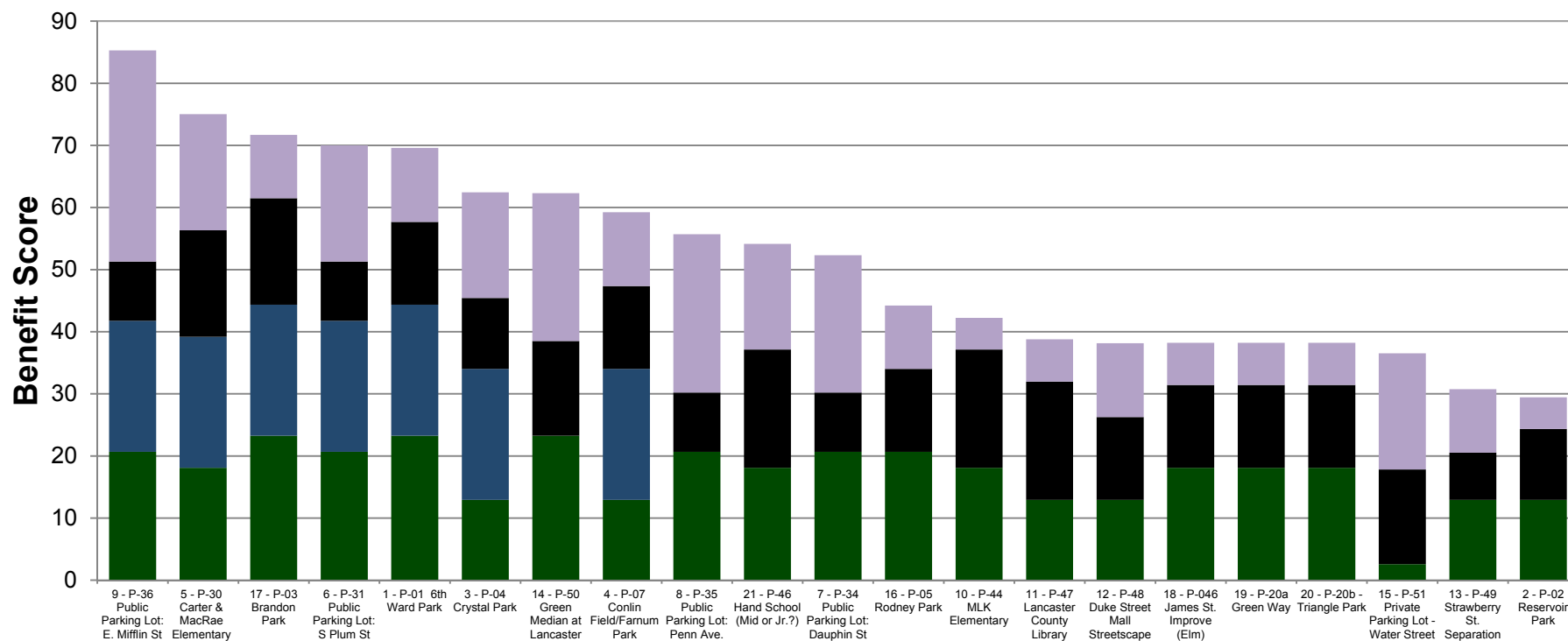
55% MS4



Discharging to Conestoga River and Chesapeake Bay



CIP Prioritization Model Selects GI Projects with Highest Total Benefit in Lancaster – GI Plan



Technology

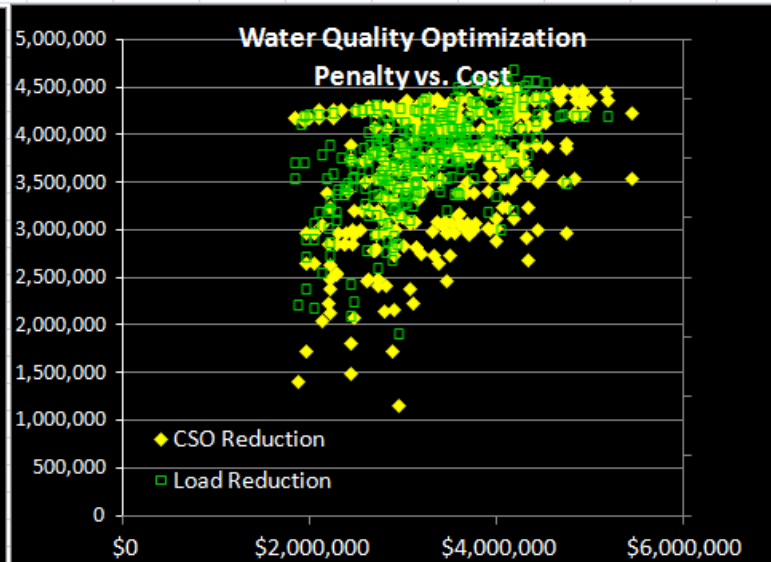
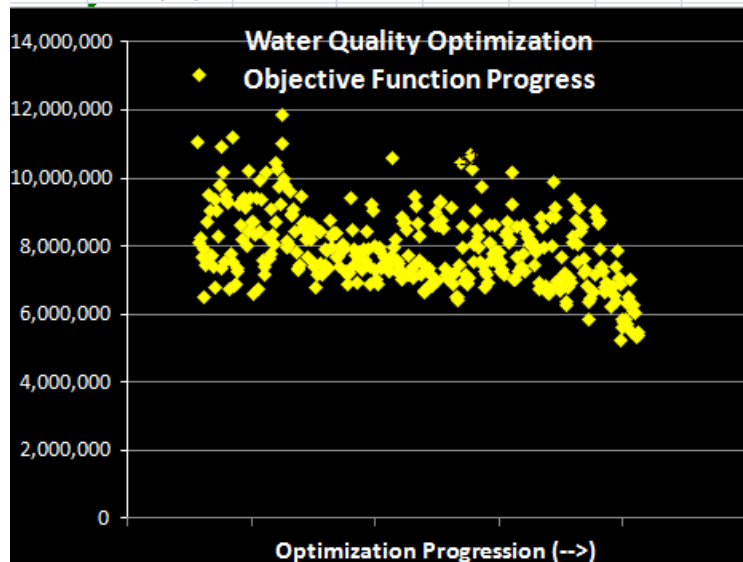
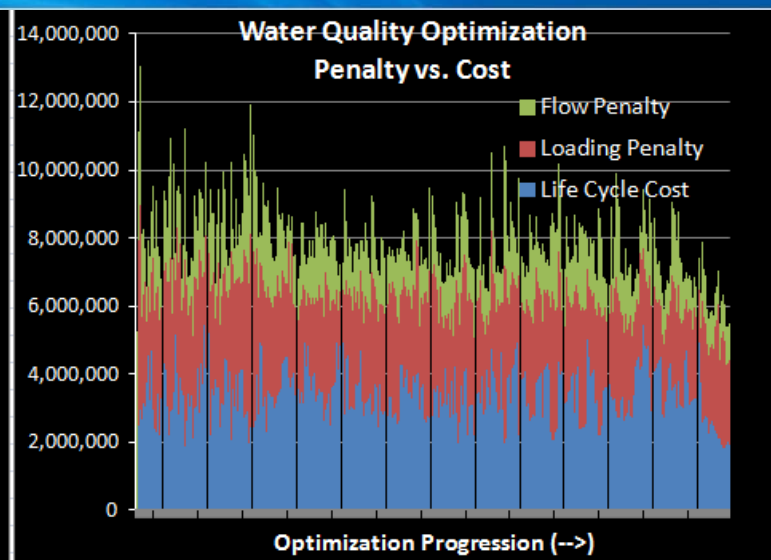
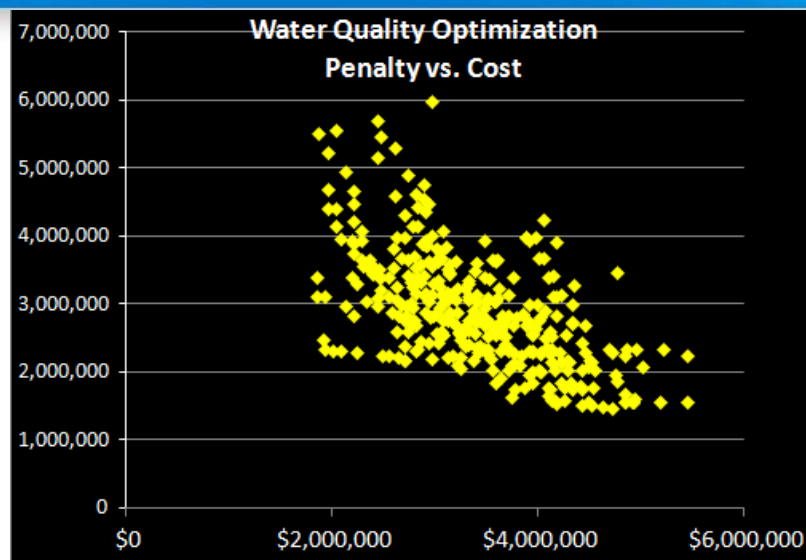
■ Integrated Infrastructure

■ Public Acceptance & Education

■ Grant Funded

■ Cost Efficiency (e.g. per gallon)

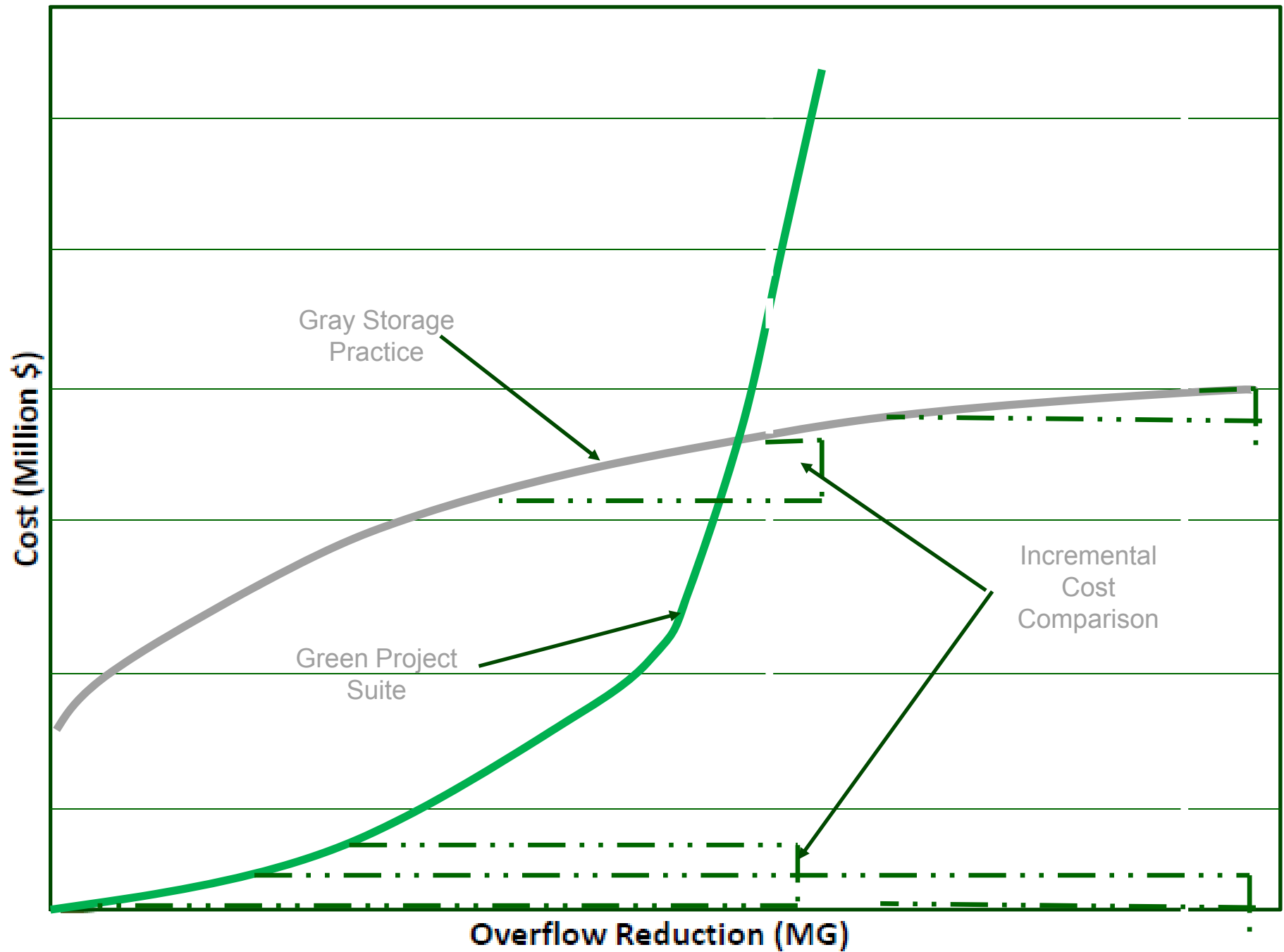
Optimization tools will be used to ID lowest cost solution meeting CSO, water quality and flood control objectives



Louisville MSD - Continuous Improvement to CSO Program through Adaptive Management

- Green Infrastructure Right-sizing
 - CSO 130 and 190 basin eliminations
 - Cooperative evaluation with EPA ORD
- Flow Monitoring and Model Re-calibration
 - Continue to expand flow monitoring to allow right-sizing
 - Optimizing operational parameters – RTC optimization
 - Review every project using original cost/benefit approach
- Project resizing and re-prioritization
 - Improve overall system performance
 - Respond to public comments
 - Maintain original cash flow and rate projections
- Key Principle is incremental cost analysis to make a *business* decision about where to invest more or less

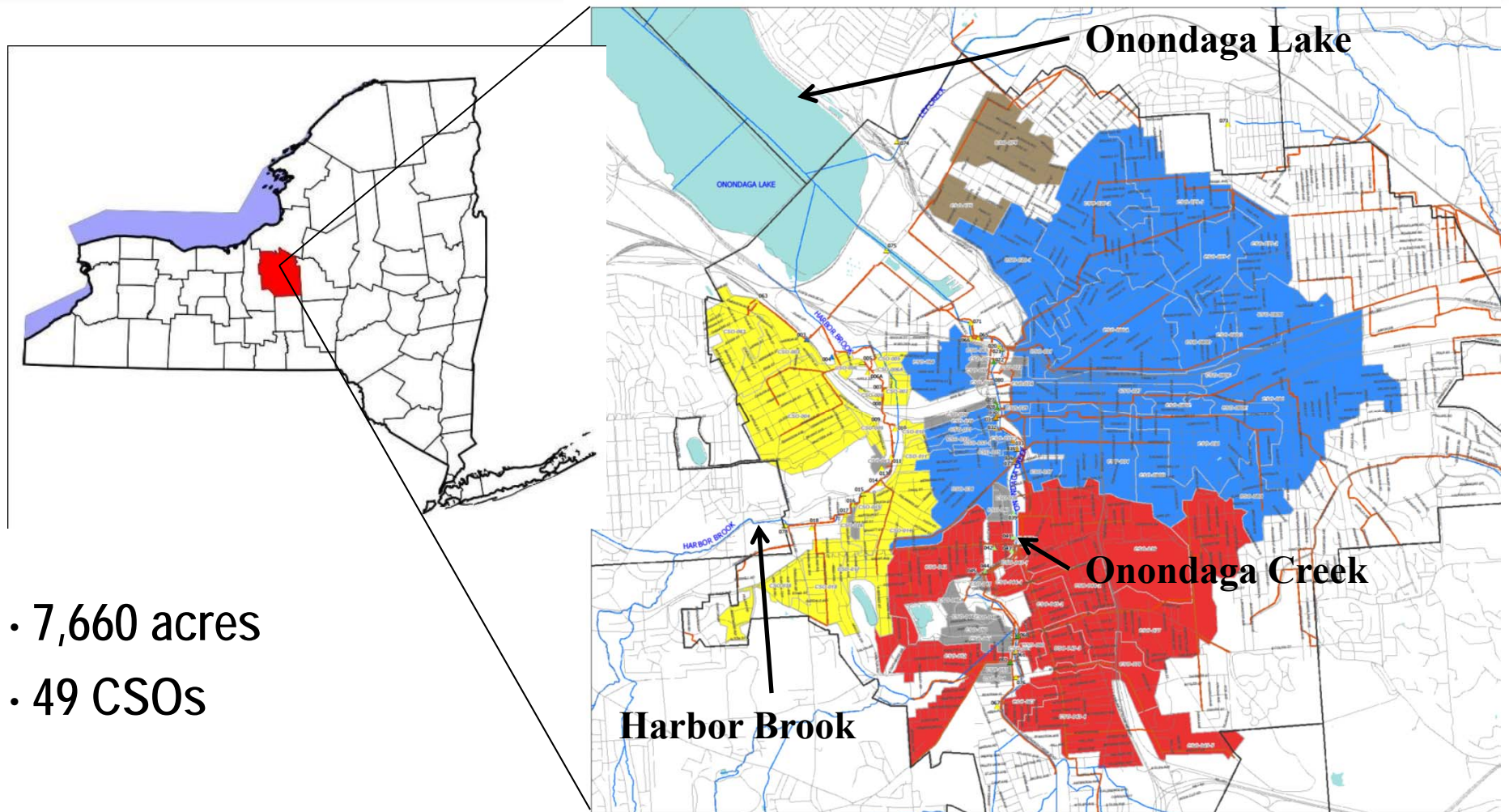
Gray to Green Right Sizing Trend



Onondaga County, New York

4/30/13

11



- 7,660 acres
- 49 CSOs

City of Syracuse

4th Stipulation to Amended Consent Judgment (ACJ)

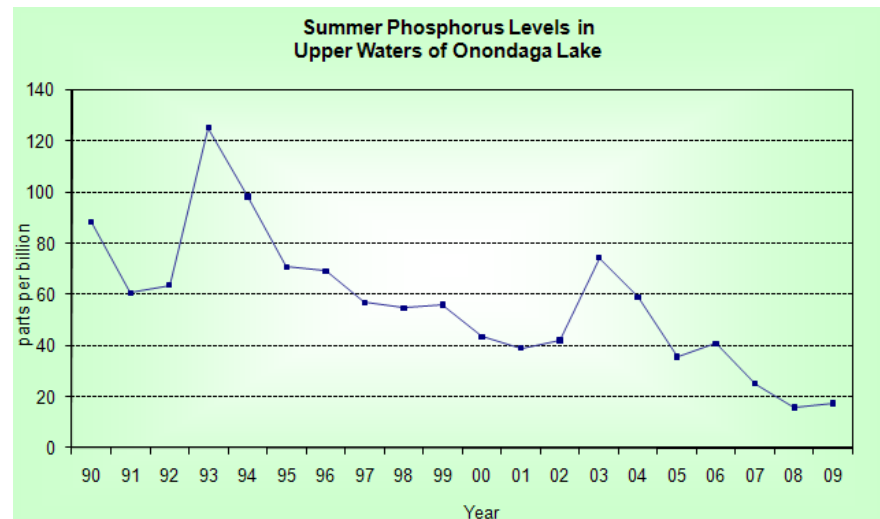
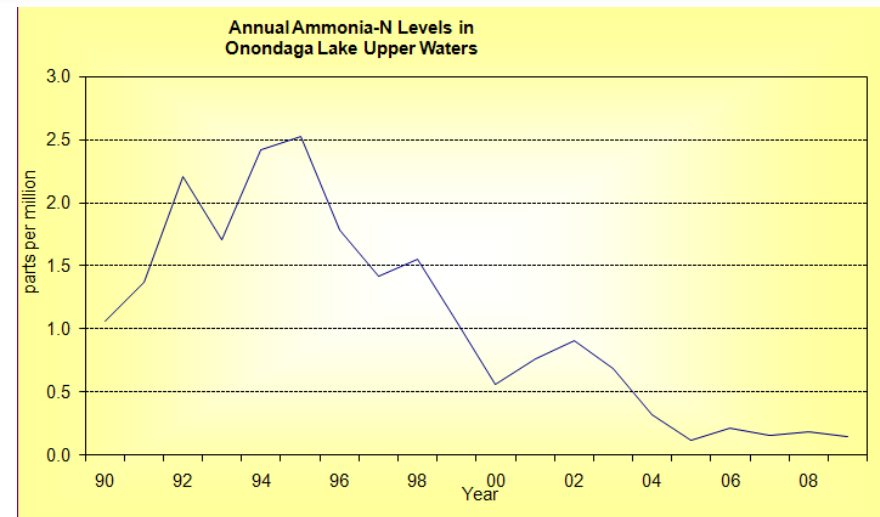
- Agreed to by all impacted parties [State, Atlantic States Legal Foundation (Plaintiff), County]
- Authorized use of Gray and Green infrastructure
- Requires Storage Facilities in place of RTFs
 - RTFs included vortex separation, storage and disinfection
- Includes time extension for Construction, and Metro phosphorus effluent limit
- Balanced program provides additional water quality and community benefits through goals to:
 - Improve quality of life
 - Promote Sustainability
 - Ensure cost effectiveness in compliance with ACJ milestones

Green Infrastructure Program Builds on 10 Years/\$346 million of Gray System Improvements



Gray Improvements Results

- Decreased Ammonia from 8,000 to less than 50 ppd
- Decreased Phosphorus from 300 to less than 50 ppd



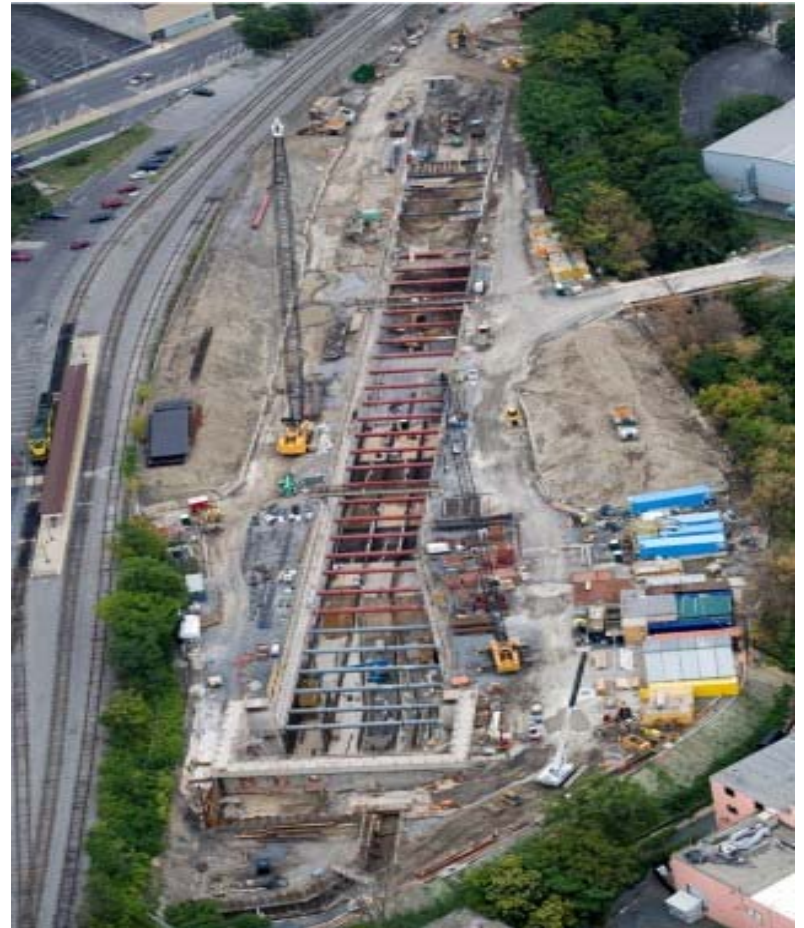
Gray Infrastructure Program Summary

Gray Projects

- Harbor Brook Interceptor
- Midland Conveyance
- Clinton Storage Facility (photo)
- Harbor Brook Storage Facility and Conveyances
- Erie Boulevard Storage System (EBSS) Gate Chamber #3 Improvement
- Sewer separation projects
 - Includes water quality treatment

Facilities Planning

- Floatable Controls



Green Infrastructure Program Summary : 1st Consent Order to require Green Infrastructure

- Over 100 projects throughout sewersheds
- Compliments Gray Program w/ Green
- Total Gray + Green annual volume wet weather capture requirements:
 - 89.5% by Dec 2013
 - 91.4% by 2015
 - 93.0% by 2016
 - 95.0% by Dec 2018
- Extensive monitoring & reporting required



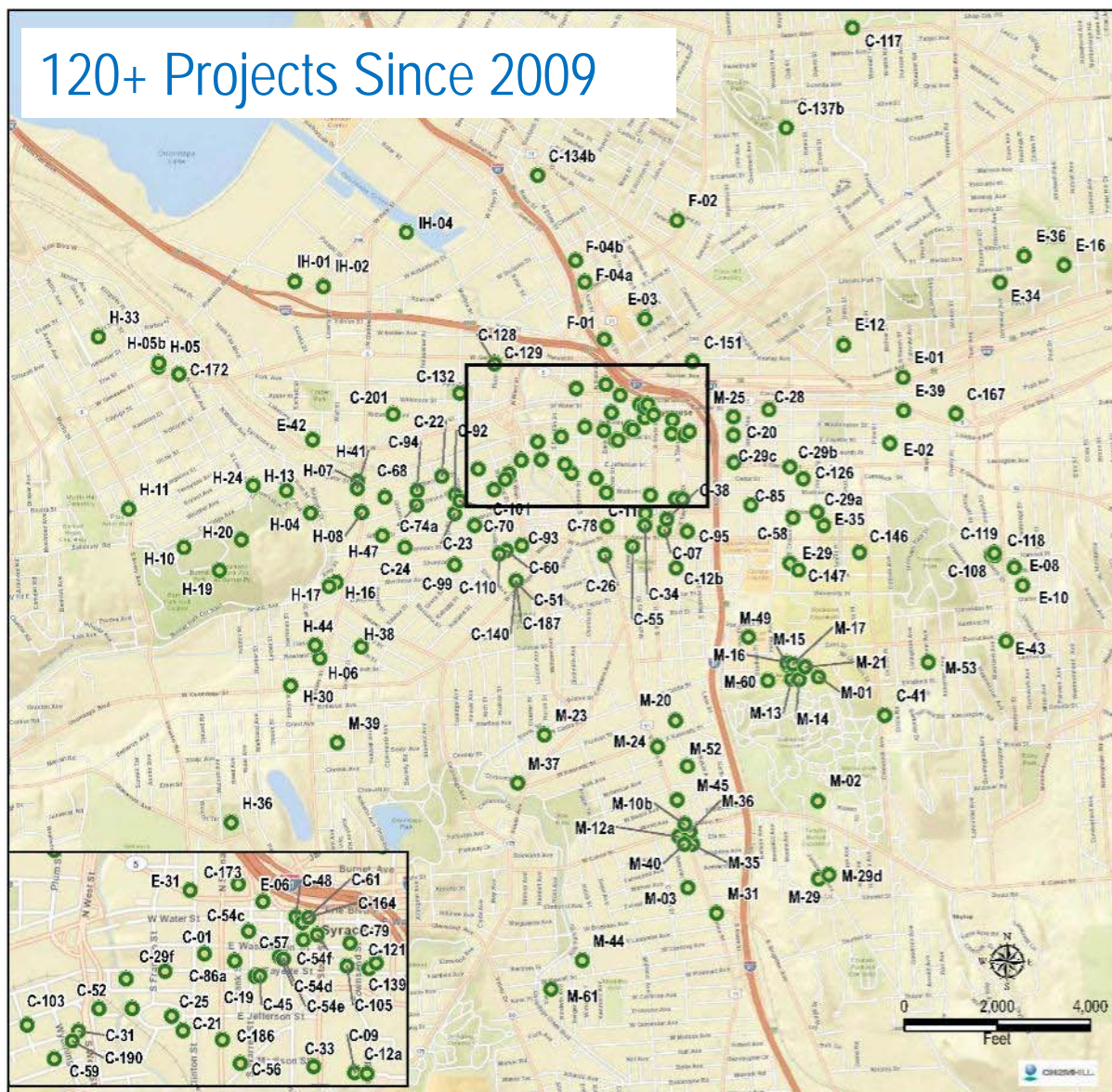
300 Block of East Water Street, Completed 2011-12

GI Program Elements Completed to Date

- Public Projects: 123 projects complete (2010-13) demonstrating scalability and lower costs with critical mass of GI
- Green Improvement Fund: Onondaga County's Public-Private-Partnership for Incentivizing GI (59 projects complete)
- Legislative Agenda (City and County Partnership):
 - Multiple Inter Municipal Agreement (IMA's)
 - Organizational / Responsibility changes
 - Proposed Revisions to Existing City Ordinances: Stormwater, Tree
- Vacant Lot Program improving neighborhoods: 4 Vacant Lots renovated with GI
- Grant Funding: Federal / State successes

Onondaga County CSO Program is one of the first in the US with significant utilization of green infrastructure

120+ Projects Since 2009



Save the Rain...



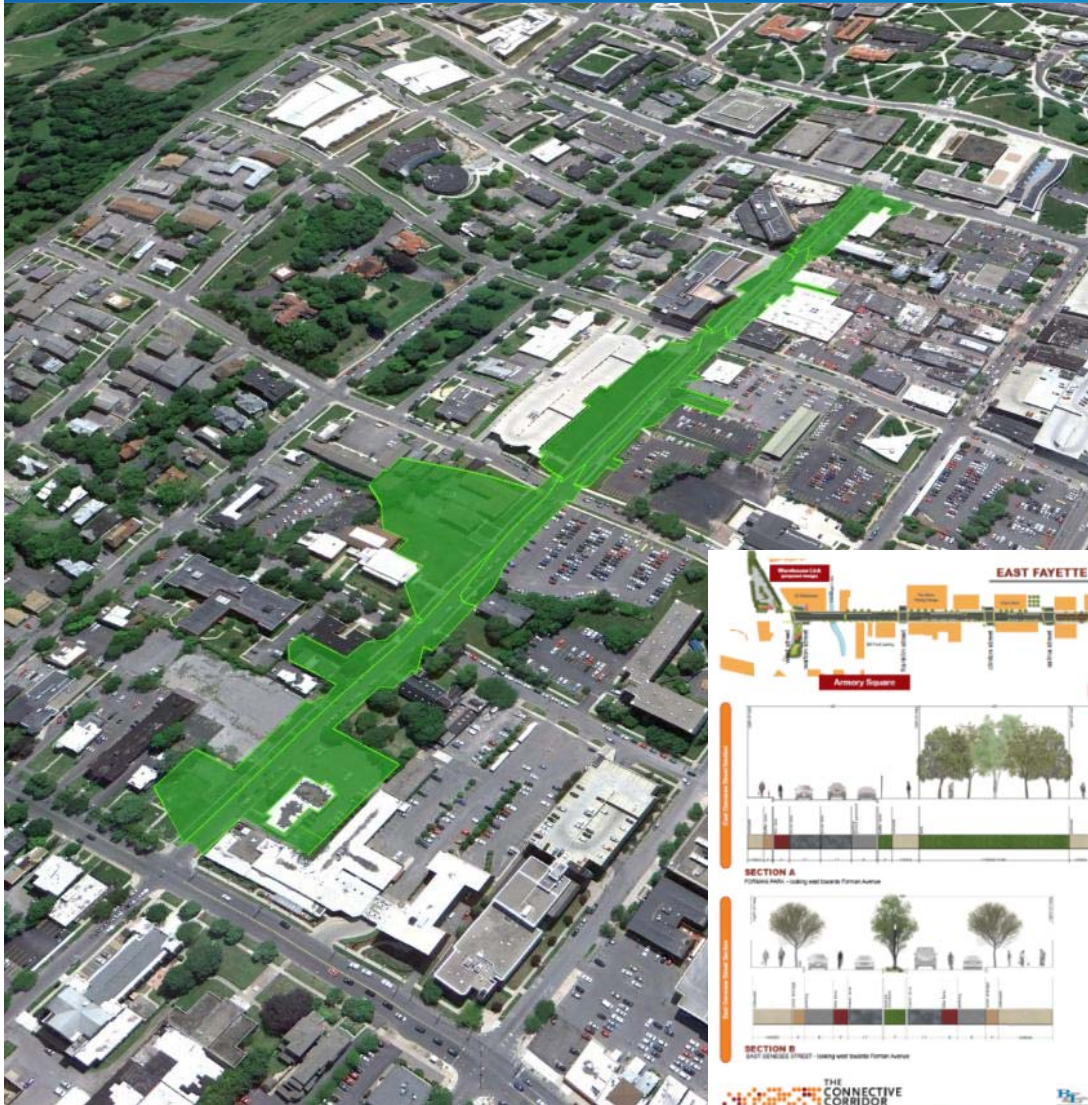
Green Infrastructure Projects Constructed August 2013

| | |
|---|---|
| C-31 City Parking Lot #21 | C-66 SUNY Upstate: Inwood Commons |
| C-37 Municipal Parking Garage: OnCenter | C-69 Vacant Lot: 701 Oswego St. |
| C-39 County Parking Lot 6 at S. Townsend Street | E-01 Pavedpark at: Ross Brothers Office Building |
| C-101 Green Park: Skidby Park (Site) | E-02 Pavedpark at: Forest View Retirement Development |
| C-108 GF#021 Inwood Headquarter: Menards | E-03 St. Joseph's Hospital Campus Exp and Rediz |
| C-105 GF#041 ONY Philanthropy Center | E-06 City Parking Lot #3 |
| C-108 GF#044 Aronson Beach | E-08 Green Library: Petit Branch |
| C-111 Commercial Green Streets: Harrison Street | E-10 Road Recon: Project No. 3: Concord Place |
| C-110 Seymour Academy Parking Lot | E-12 Dr Edwin E. Weeks Elementary School |
| C-117 Tree Plantings in Court Woodlawn | E-16 Lower Sunnyside Park |
| C-116 GF#047 Germill Day | E-29 SU Rain Garden: Variety & Crouse |
| C-115 GF#048 Master Lady Day | E-31 Pocket Park at N. Clinton St. and W. Genesee St. |
| C-121 GF#051 Park Central Presbyterian Church | E-34 Rain Garden at Harrington High School |
| C-128 GF#056 Cooper Beech Commons Student Housing | E-35 SU University Ave. Parking Garage |
| C-125 GF#052 Leon Creek Properties | E-36 Upper Sunnyside Park |
| C-126 GF#059 McMahon Ryan Child Advocacy Center | E-39 East Water Street Pavement: Renovation |
| C-12a Townsend St Median Revegetation Phase 1 | E-42 County Board of Election Building |
| C-12b Townsend St Median Revegetation Phase 2 | E-43 Westcott Community Center |
| C-132 Green Park: Lawrenceville/Baker Park | E-44 City Parking Lot at Pearl Street |
| C-134b Tree Planting at Union & Oswego Parks | E-45 Green Library: White Branch |
| C-137b Tree Planting at Schiller Park | F-048 City Parking Lot #4 |
| C-138 GF#060 Kopp Billing Agency | F-049 Green Street: N State St at City Lot 4 |
| C-140 GF#061 The Spa at 503 Green Roof | F-054 Hixpave at: Private Residence #1 |
| C-146 Hixpave Parking Lot at SU | F-055 Green Roof at: Hazard Branch Library |
| C-147 Hixpave Parking Lot at SU | F-056 Green Library: Mundy Branch |
| C-151 GF#065 Housing Village | F-057 GF#061 Vibrant Syracuse Spaces |
| C-164 GF#074 Synapse Downtown | F-058 Road Recon: Project No. 3: Concord Street |
| C-167 GF#078 "Bell Center" | F-059 Tree Planting in and around Burner Park |
| C-172 GF#081 Brooklyn Plots | F-060 Avery Ave Greening at Pass Antennae |
| C-173 GF#082 100 Clinton Square | F-061 Wilbur Avenue Zoo Entrance Enhancement |
| C-186 Tree Plant Project | F-062 Porous concrete sidewalk on Grand Ave |
| C-187 MA Synapse Housing Authority | F-063 Rain Garden at Grand & Lathrop |
| C-19 Union Garden #1 | F-064 Rosemond Gifford Zoo: Elephant Exhibit |
| C-196 GF #103 Golf Quarters | F-065 Rosemond Gifford Zoo: Invertebrate Exhibit |
| C-20 Green Roof at Center of Excellence | F-066 GF#031 ARC of Onondaga County |
| C-201 Road Reconstruction: Richmond Ave | F-067 Vacant Lot: 1344-60 W. Onondaga St. |
| C-21 GF#084 Jefferson Clinton Commons | F-068 Green Park: Lewis Park Enhancement |
| C-22 Pavedpark at Horse Pedigree #1 | F-069 Green Park: Westwood Park |
| C-23 Pavedpark at Horse Pedigree #2 | F-070 Vacant Lot: 224-226 Peach Street |
| C-24 Pavedpark at Catholic Churches | F-071 GF#069 Vibrant Syracuse Spaces Green Roof |
| C-25 Pavedpark at Museum of Science & Technology | F-072 Vacant Lot: 105 Harrison Street |
| C-26 Pavedpark at SUNY Upstate Hospital Day Care | F-073 Road Recon #12: 1001 Block of Grand St |
| C-26 MA SUNY Upstate: Biotechnology Center | F-074 SUNY ESF Walker Hall Green Roof |
| C-26a Connective Corridor Phase 1 - Contract 1 | F-075 Green Church: Church of Ladder Day Saints |
| C-26b Connective Corridor Phase 1 - Contract 2 | F-076 Green Library: Beauchamp Site Improvements |
| C-26c Forman Park | F-077 Saline Street: Post Office Green Roof |
| C-26d Connective Corridor Separated Storm Sewer | F-078 Pavedpark at: SUNY ESF Black Hall |
| C-31 GF#010 New Westside Village Lincoln Supply | F-079 Pavedpark at: SUNY ESF Moon Library |
| C-33 Clean Systems at the Westside Market | F-080 IMA SUNY ESF Parking Project at Bray Hall |
| C-34 Green Roof at OnCenter | F-081 SUNY ESF Gateway Building |
| C-35 Green Parking Lot at OnCenter | F-082 GF#069 SUNY ESF: Central Hall |
| C-41 Pavedpark at: SUNY ESF Society of NY | F-083 GF#068 Dunbar Association |
| C-40 GF#018 Pavers Properties | F-084 SUNY ESF Black Hall Rain Garden |
| C-46 Green Roof at Erie Canal Museum & Visitor Center | F-085 Greening the Gray in Basin 944 |
| C-51 GF#001 The Spa at 503 W. Onondaga | F-086 GF#003 Syracuse Model Neighborhood Corp |
| C-55 GF#005 Green Roof at King & King Architects | F-087 GF#007 Create Public Art |
| C-54a Downtown Streetscape @ Water St | F-088 Hughes Wagner School Parking Lot |
| C-54b Downtown Streetscape @ Montgomery St | F-089 Arbor Day Plantings: Hughes Magnet School |
| C-54c Downtown Streetscape @ Montgomery St | F-090 GF#026 Saline Shoe Company Inc |
| C-54d Downtown Streetscape @ Montgomery St | F-091 GF#020 IMA Hepples LUX |
| C-54e Downtown Streetscape @ 120 S. State St | F-092 GF#033 Macawon Development Group |
| C-54f GF#012 The Saline Shoe Towers | F-093 Rooftop Unconnect at CSO 54b |
| C-55 GF#013 The Monroe Building | F-094 GF#046 Pavedpark at: Sunnyside |
| C-56 GF#017 Hotel Joyner | F-095 Site Improvements at Bishop Leary Corner |
| C-57 GF#015 New West Side Initiative: Artist Studio | F-096 Rain Garden at Burnham Center |
| C-58 Green School: Seymour Academy Playground | F-097 Stadium Parking Lot at SU |
| C-59 GF#020 St Lucy's Church | F-098 Road Recon #4: S State Street |
| C-60 GF#021 ONY Regional Transportation Authority | F-099 GF#040 Courthouse: Skidby Park |
| C-61 GF#022 Central New York Jazz Arts Center | F-100 Seymour School Rain Garden |
| C-62 SCSD Central Offices | F-101 GF#052 Connective Corridor: Aqueduct and BBO |
| C-63 GF#023 Central New York Jazz Arts Center | |
| C-64 GF#024 Connective Corridor: Aqueduct and BBO | |

1:2000 scale, 11/17/13, 11/17/13, 11/17/13

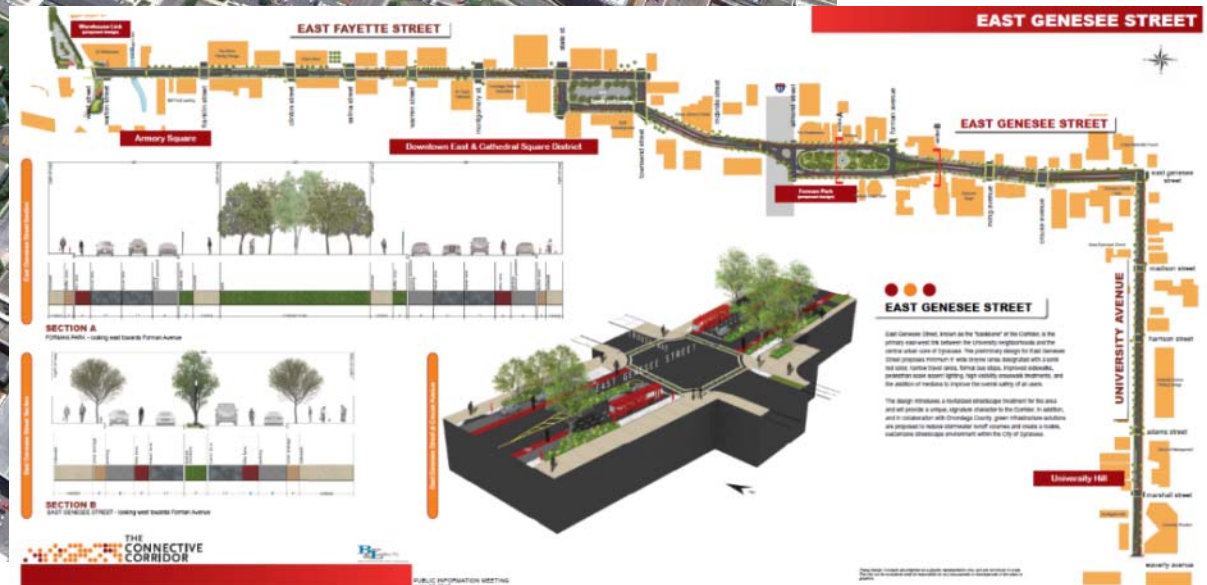
CHAMBERLAIN

Linking with major transportation reconstruction creates lower cost Green Infrastructure in Onondaga County, NY



Connective Corridor:

- Captures over 22 MG per year of stormwater runoff
- Cost effectiveness:
 - \$0.26 / gallon vs. \$0.58 / gallon for equivalent grey storage



GI Elements along Connective Corridor



Partnership between County, City and University

Image Courtesy of Syracuse University

Onondaga County Cost Sharing Agreements lowered Green Infrastructure (GI) Costs

- County funded testing, design, and construction of GI as part of their Save the Rain Program (www.savetherain.us)
 - 100% of GI-related costs not related to other project components
 - e.g., soil infiltration testing
 - Cost differential for elements modified for GI
 - e.g., porous pavement instead of traditional pavement
 - Based on actual “as-bid” costs whenever possible
- Was very cost effective integrating GI with other infrastructure improvements
- New way to build roads in County and City established to meet water quality compliance requirements
 - Model for future roadway projects to meet multiple objectives

Green Funding Agreement

Items Added by GI (fully funded by County)

- Storage Stone
- Storage Pipes
- Manufactured Treatment Device
- Filter Inserts for Water Quality
- Additional Drainage Structures Required for GI

"Deductions" to County cost share for conventional subbase, curb underdrains, pavements, etc.

University Ave, Phase 1, Contract 1
PS&E Green Infrastructure Estimate

3/31/2011

Total PS&E Engineers Construction Estimate: \$4,843,980

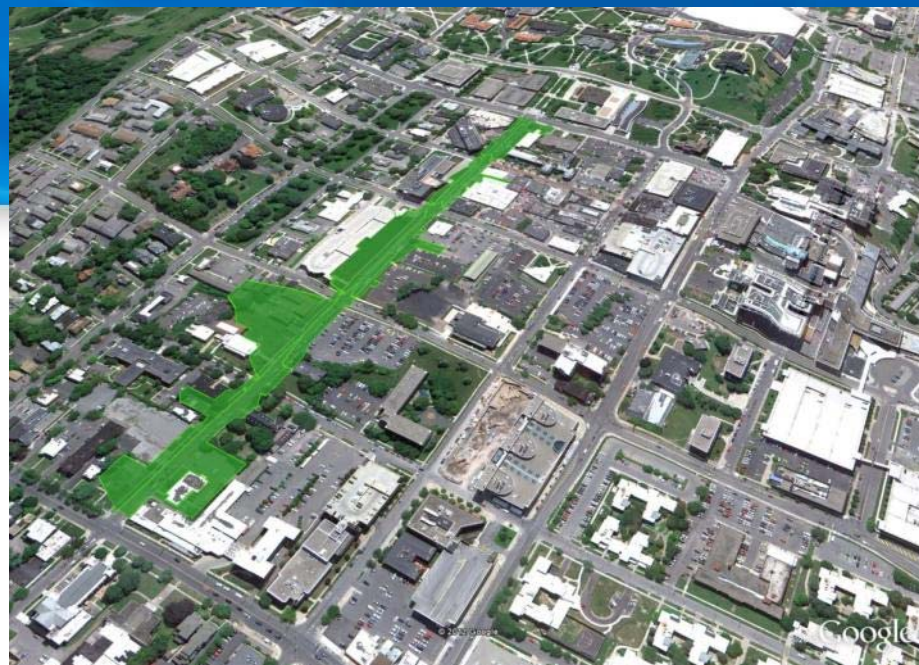
| DESCRIPTION | COST |
|--|--------------------|
| ITEMS ADDED DUE TO GREEN INFRASTRUCTURE | |
| Storage Stone (@ \$50 /CY per CH2M Hill) | \$260,000 |
| Additional Trees/Shrubs | \$102,960 |
| Additional CU Soil | \$19,000 |
| Trench Drains | \$8,610 |
| 6", 10", 24" & 36" Storage/Overflow Pipes (with deduction for underdrains) | \$101,830 |
| Additional Drainage Structures/Frame & Grates | \$114,345 |
| Silva Cell | \$97,458 |
| ITEMS MODIFIED AS A RESULT OF GREEN INFRASTRUCTURE | |
| 8" Asphalt to 8" Porous Concrete (Parking Lane) | \$63,350 |
| Porous Pavers (50% of total cost) | \$116,250 |
| Work Zone Traffic Control | \$56,629 |
| Trench & Culvert Excavation | \$73,485 |
| Subbase Deduction for Storage Stone | -\$53,010 |
| Construction Subtotal: | \$960,907 |
| Survey (1%) | \$9,609 |
| Mobilization (4%) | \$38,436 |
| Field Change Order (5%) | \$48,045 |
| Subtotal: | \$1,056,998 |
| PS&E Contingency (5%) | \$52,850 |
| Total: | \$1,109,848 |

Green Infrastructure Funding Summary – Additional cost of GI for Connective Corridor

| Phase | Final County Green Share (\$) | Total Cost | County Green Share (%) |
|------------------------------|--|---------------------|------------------------------|
| University Ave. / Contract 1 | \$927,575 | \$4,239,928 | 22% |
| E. Genesee / Contract 2 | \$535,785 | \$3,213,700 | 17% |
| Fayette Separation | --- | \$446,269 | 100% |
| Phase 2/3 | --- | \$12,013,680 | 8% |
| TOTAL | \$2,859,914 | \$19,913,577 | 14% |

Runoff Capture & Efficiency

GI Costs added 14% to total cost of roadway improvements planned



| Phase / Area | Total Area (ac) | Runoff Capture (Million Gal/yr) | GI Cost | Cost / Gallon Runoff |
|---------------------------|-----------------|---------------------------------|---------------------|----------------------|
| P1/C1 - University | 7.5 | 5.2 | \$ 927,575 | \$ 0.18 |
| P1/C2 - Genesee | 4.1 | 2.8 | \$ 535,785 | \$ 0.19 |
| P2/3 - To Salina | 7.5 | 5.1 | \$ 855,285 | \$ 0.17 |
| P2/3 - Salina to Franklin | 12 | 9.2 | \$ 541,269 | \$ 0.06 |
| Total | 31 | 22 | \$ 2,859,914 | \$ 0.13 |

Innovative Implementation Approaches for Financing - Incentive Based

- Green Improvement Funds (Onondaga)
- State Revolving Loan for Private Green Infrastructure (Lancaster)
- Public Private Partnerships – DBOF Delivery

Green Improvement Funds (GIF) stimulates commercial investment in green

GIF CALCULATOR FOR MAXIMUM RECOMMENDED FUNDING AMOUNT TOWARDS GREEN INFRASTRUCTURE (GI) COSTS

Step 1: Enter project information. The estimated annual runoff reduction is then calculated automatically.

Step 2: Compare automatically calculated "Funding Limit for Green" with the amount of GIF funding requested.

Step 3: Compare the green cost estimate provided by applicant to the average unit costs for the green technology type(s) proposed to ensure they are reasonable.

Step 4: The recommended award amount is the LESSER of the "Funding Limit for Green" or the actual green cost (assuming it is reasonable).

User Inputs Shaded Green

Global Inputs:

| | |
|---|--------|
| Average Annual Rainfall (in/yr) | 39.34 |
| Funding Limit for GI (\$/gal/yr runoff reduction) | \$0.35 |

| Project Name | Green Technology | Impervious Drainage Area (SF) | Pervious Drainage Area (SF) | Annual Runoff Volume (gal/yr) | Capture Volume (in.) | Estimated Annual Runoff Capture (%) | Estimated Annual Runoff Capture (gal) | Funding Limit for Green Infrastructure |
|---------------|------------------|-------------------------------|-----------------------------|-------------------------------|----------------------|-------------------------------------|---------------------------------------|--|
| Project Smith | Porous Pavement | 43,560 | 0 | 854,600 | 2 | 98% | 838,400 | \$293,400 |
| Project Jones | Green Roof | 1,000 | 0 | 19,600 | 1 | 90% | 17,600 | \$6,200 |
| | | 1 | 0 | 0 | 1 | 90% | 0 | \$0 |
| Total | --- | 44,568 | 0 | 874,200 | --- | --- | 856,000 | \$299,600 |

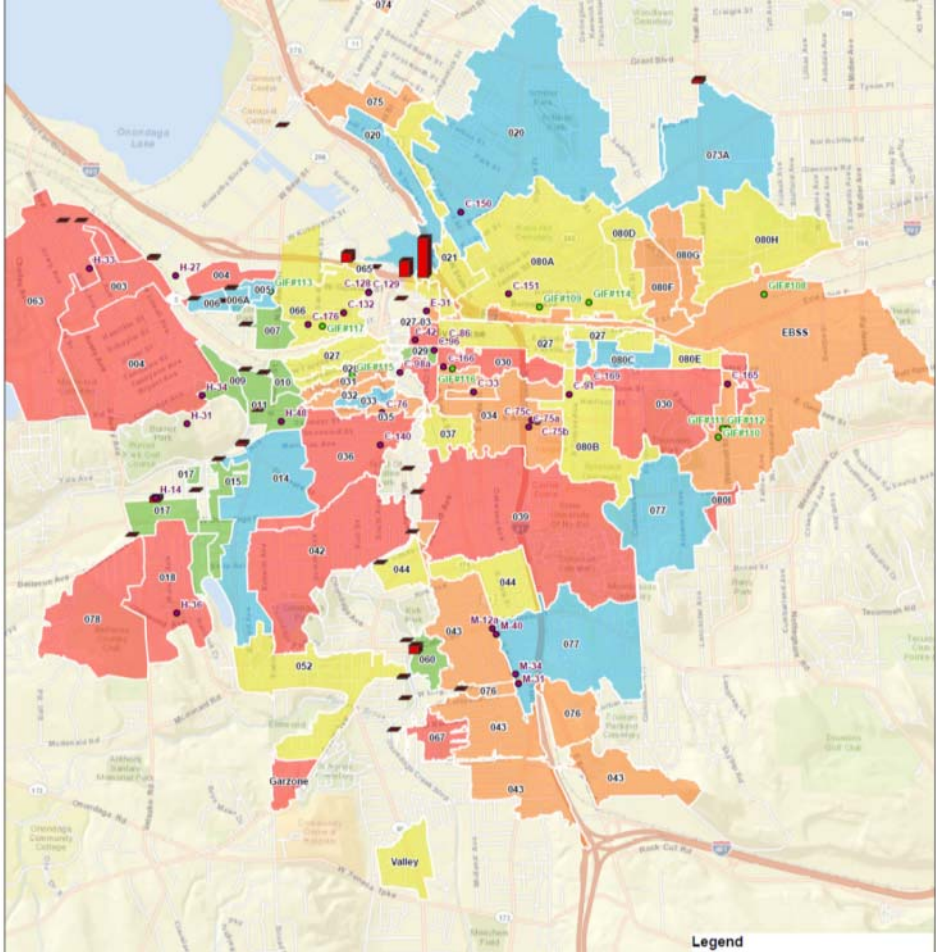


King & King, Syracuse, NY

| Where | | What | How | Who | How Much | |
|---------------------------------|--------------------------|---|------------------------------------|-------|-----------------------------------|--|
| Program | Area / Impervious Source | Primary Green Infrastructure Technology | Implementation Strategy | Owner | Target CSO Reduction Volume (gal) | Target CSO Volume Reduction (% of Total) |
| 08-Green Improvement Fund (GIF) | All | All | Review / Administer / Track Awards | OCWEP | 11,372,000 | 5% |

Optimized Distribution of GI Funding for CSO Control

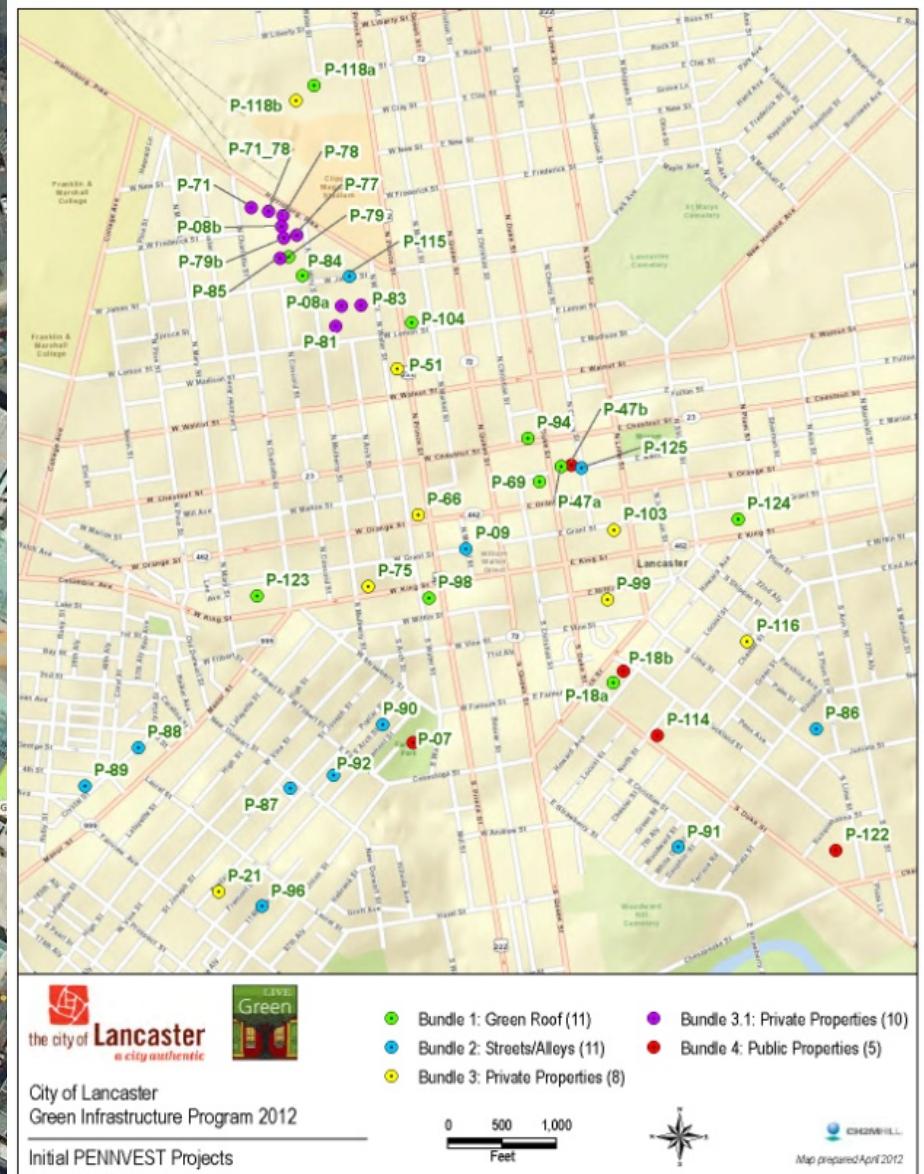
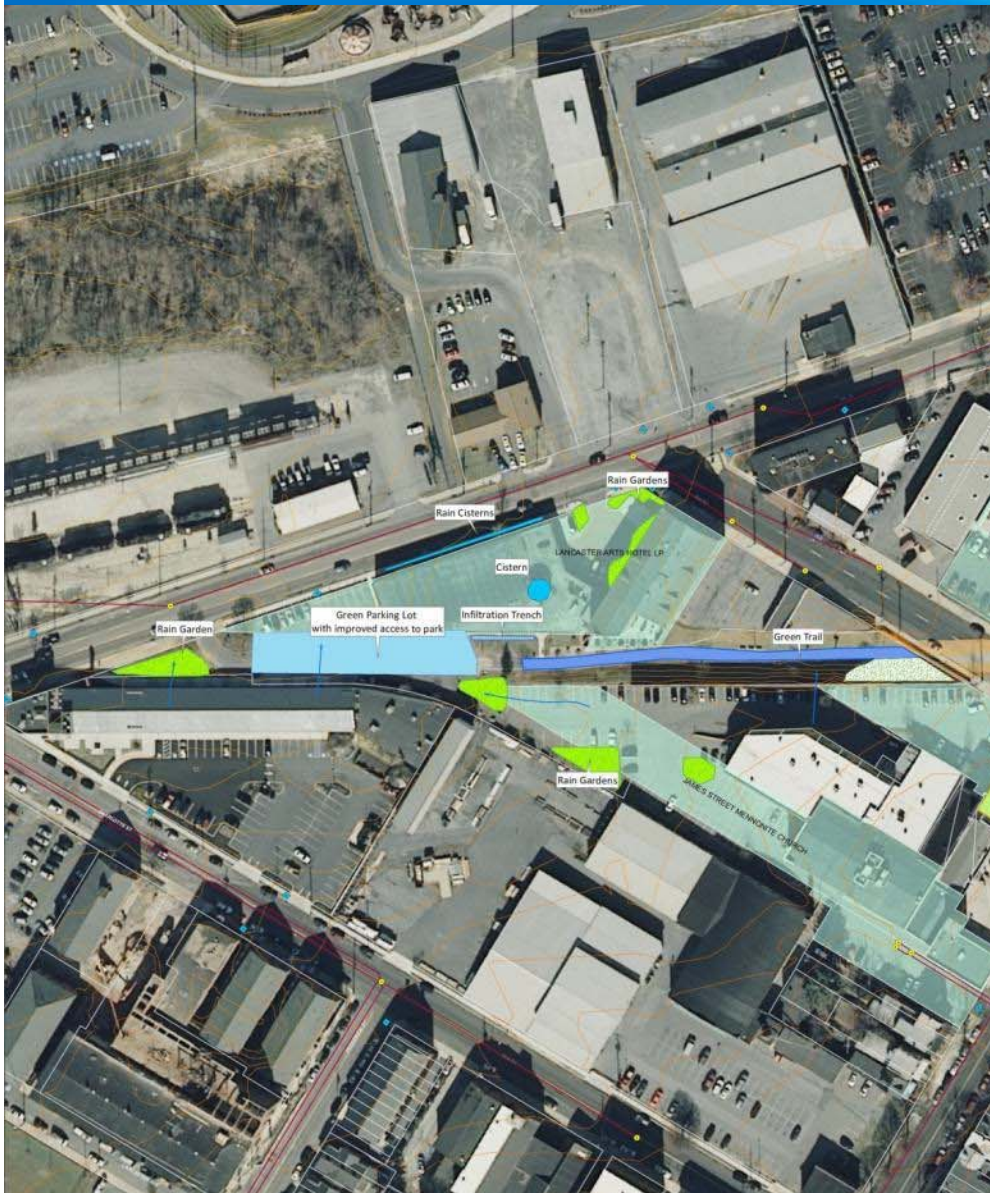
- GI funding targeted to areas with high CSO reduction potential
 - \$0.30 for high priority areas
 - \$0.20/gallon for medium priority areas
 - \$0.10/gallon low priority areas
- Some CSO areas were eliminated from program



Onondaga County Green Improvement Fund

- Adaptive implementation saves money
- GIF 1.0
 - \$3 million pilot program
 - \$100K funding limit per project/ \$250K for multiple projects
 - 25 applications submitted
- GIF 2.0
 - Full-program (pilot complete), expanded geography
 - \$200K funding limit per project
 - Greater emphasis on gallon capture
 - 60 applications submitted
- GIF 3.0
 - Funding limits eliminated
 - Revised Program Description and streamlined Application
 - Greater emphasis on efficiency in GI implementation
 - 20 applications submitted

Innovative Financing: Using the SRF to create Public-Private Partnerships in Lancaster, PA – Pilot for State



Public Private Partnerships

- Prince Georges County MD
 - First Aggressive P3 for DBOF implementation
 - 2,000 acres of impervious area retrofits for Chesapeake Bay TMDL & MS4 permit
 - Innovative involvement of the private sector
 - “contractual agreement” between a public agency and a private sector entity
 - Long Term (~30yrs) private sector participation
 - financing, planning, design, construction, operation, maintenance, rehabilitation and replacement of urban retrofit facilities.
- Public, Private Partnership Model - EPA, MDE, Prince George's County
- Accelerate Green and Support Local Job Creation
- Creates new legal entity with accountability to deliver compliance metrics

Discussion