

NPDES Stormwater Permits

Green Infrastructure



U.S. EPA Region 5
July 20, 2011

Topics

EPA Stormwater Rule

State Programs and Permits

TMDLs and Stormwater

Green Infrastructure

Green Infrastructure and CSOs

EPA Stormwater Rule

Rule still in drafting phase and will likely include:

- Potential expansion of MS4 areas
- A post-construction performance standard (i.e., XX percentile storm) to be retained on the site
 - new development
 - redevelopment
 - Whether to allow for mitigation if the standard cannot be met

EPA Stormwater Rule – Next Steps

- Options Selection
- Final Agency Review
- Publish notice of proposed rulemaking in the Federal Register
- EPA plans to publish the draft rules and open comment period notice by September 30, 2011

Language In Stormwater Permits

Wisconsin

- Performance standards include requirements for total suspended solids, peak flow, **infiltration**
- **Infiltration.** This performance standard requires that, to the MEP, a portion of the runoff volume be infiltrated:
 - Residential – 90 percent of pre-development **infiltration volume** or 25 percent of the 2 year-24 hour design storm.
 - Non-residential – 60 percent of predevelopment infiltration volume or 10 percent of the 2 year-24 hour design storm.
- To protect groundwater, the WI standards identify areas where infiltration is discouraged.

Language In Stormwater Permits

Ohio – Big Darby Watershed

- **Groundwater Recharge Requirements.** The SWPPP shall ensure that the overall site post-development groundwater recharge equals or exceeds the pre-development groundwater recharge.
- The SWPPP shall describe the conservation development strategies, BMPs and other practices deemed necessary by the permittee to maintain or improve pre-development rates of groundwater recharge.

New Jersey

The New Jersey Stormwater Management Rules require that a “major development” project must comply with one of the following groundwater recharge requirements:

- *Demonstrate through hydrologic and hydraulic analysis that the site and its stormwater management measures **maintain 100 percent of the average annual preconstruction groundwater recharge volume for the site**; or*
- *Demonstrate through hydrologic and hydraulic analysis that the increase of stormwater runoff volume from pre-construction to post-construction for the 2-year storm is infiltrated*

West Virginia

Manage a 1-inch storm

West Virginia DEP has issued a small MS4 permit with performance standards for new and redevelopment projects:

*Performance Standards. The permittee must implement and enforce via ordinance and/or other enforceable mechanism(s) the following requirements for new and redevelopment: [...] Site design standards for all new and redevelopment that require, in combination or alone, **management measures that infiltrate, evapotranspirate and reuse of, at a minimum, the first one inch of rainfall from a 24-hour storm. This first one inch of rainfall must be 100% managed with no discharge to surface waters***

West Virginia – Incentives for Sustainable Development Practices

A *credit* of 0.2 inches from the one inch runoff reduction standard may be applied to any of the following types of development:

- Redevelopment**
- Brownfield redevelopment**
- High density (>7 units per acre)**
- Vertical Density (Floor to Area Ratio of 2 or >18 units per acre)**
- Mixed use and Transit Oriented Development (within ½ mile of transit)**

Reductions are additive up to a maximum reduction of 0.75 inches for a project that meets four or more criteria

Measuring/Quantifying Big Darby CGP

- Pre-development and post-development groundwater recharge shall be calculated using the following equation:

$$V_{rex} = A_x * D_{rex} / 12$$

where:

X = Represents a land use and hydrologic soil group pair

V_{rex} = Volume of total annual recharge from land use-soil group X (in acre-ft)

D_{rex} = Depth of total annual recharge associated with land-use-soil group X from Tables 1 or 2 (in inches)

A_x = Area of land use-soil group X (in acres)

Maintenance and Assurances

Language In Wisconsin CGP

- For any permanent structures, provisions shall be made for long-term maintenance with the municipality or other responsible party.
- For an NOI submitted to the Department, **a copy of the signed long-term maintenance agreement shall be submitted to the Department with the NOI** unless the Department agrees that it may be submitted by an alternative date prior to termination of permit coverage.
- The Department may withhold permit coverage until the long-term maintenance agreement is submitted to the Department.

Maintenance and Assurances

Big Darby Creek CGP

- Protection of open space (infiltration areas) shall be by binding conservation easements that identify a third party management agency, such as a homeowners association/condominium association, political jurisdiction or third party land trust.



Maintenance of BMPs

San Diego County MS4 Permit

e. TREATMENT CONTROL BMP MAINTENANCE TRACKING

- (1) Each Copermittee shall develop and utilize a watershed-based database to track and inventory approved treatment control BMPs and treatment control BMP maintenance within its jurisdiction**
- (2) Each Copermittee shall develop and implement a program to verify that approved treatment control BMPs are operating effectively and have been adequately maintained**

IL Green Infrastructure for CWA

- Public Act 096-0026
- IL General Assembly recognizes:
 - the impacts of improperly controlled storm water runoff
 - how increasing impervious surfaces increase runoff volumes and associated impacts
 - GI can minimize these impacts and enhance water quality, air quality, energy efficiency, and other positive outcomes

IL Green Infrastructure for CWA

- The law requires a report that addresses:
 - Nature/extent of storm water impacts
 - Potential urban storm water performance standards
 - Prevalence of GI use in IL
 - Cost/benefits of using green versus grey infrastructure
 - Exist/potential new regulatory programs for addressing urban storm water
 - Recommendation for adopting new regulatory programs that include the use of GI
 - Feasibility/consequences of devoting 20% of Water Revolving funds to GI and other innovative programs

IL Green Infrastructure for CWA

- Report to General Assembly recommends:
 - A set of volume retention performance standards that vary according to site conditions
 - Counties should develop rules and ordinances to administer performance standards and work with the municipalities to promote GI to meet the standards

IL Green Infrastructure for CWA

- Apply standard to all permitted entities first
- State can set aside 20% of CW State Revolving Fund w/o impacting traditional projects
- IEPA give priority to applicants with sustainable projects
- Use Covenants to maintain GI practices on private land
- Review emerging technologies such as urban forestry, rain barrels, cisterns, disconnected downspouts
- **Green Infrastructure Grants Program**

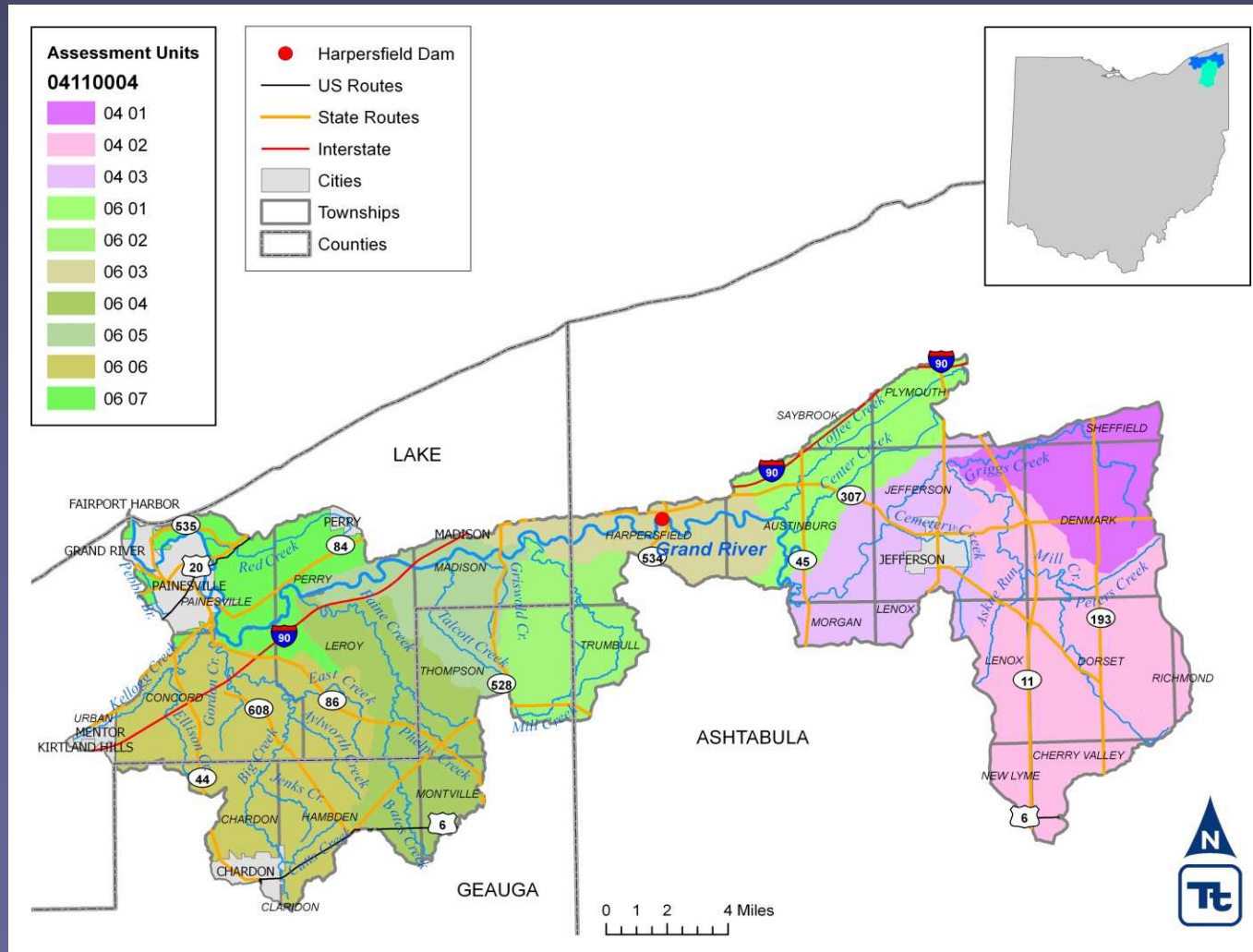
MN Minimal Impact Design Standards

- Link to antidegradation
- 93rd percentile storm
(for new development)
- 1.1 inches



TMDLs May Drive Stormwater Controls

Example-The lower Grand River in Ohio



TMDLs for the Lower Grand

Assessment Unit	Name	Area (mi ²)	Causes	Probable Sources
04 03	Town of Jefferson – Mill Creek	28.17	Flow alteration Organic enrichment / dissolved oxygen Unknown toxicity Bacteria	Urban runoff, storm sewers (nonpoint sources) Sanitary sewer overflows (collection system failures)
06 01	Coffee Creek – Grand River	22.01	Bacteria	Failing septic systems, anthropogenic sources
06 02	Mill Creek	20.99	Bacteria	
06 06	Big Creek	50.42	Direct habitat alteration Unknown toxicity Natural limits Bacteria	Urban runoff, storm sewers (nonpoint sources) Hydromodification – development Natural
06 07	Red Creek – Grand River	26.30	Flow alteration Unknown toxicity Bacteria	Urban runoff, storm sewers (nonpoint sources)

Requirements to Manage Flow and Address Hydrology have the effect of Encouraging Green Infrastructure Solutions

Green Infrastructure Practices:

- Increase Infiltration
- Increase Evapotranspiration
- Store and reuse stormwater
- **Reduce the Volume of Runoff**

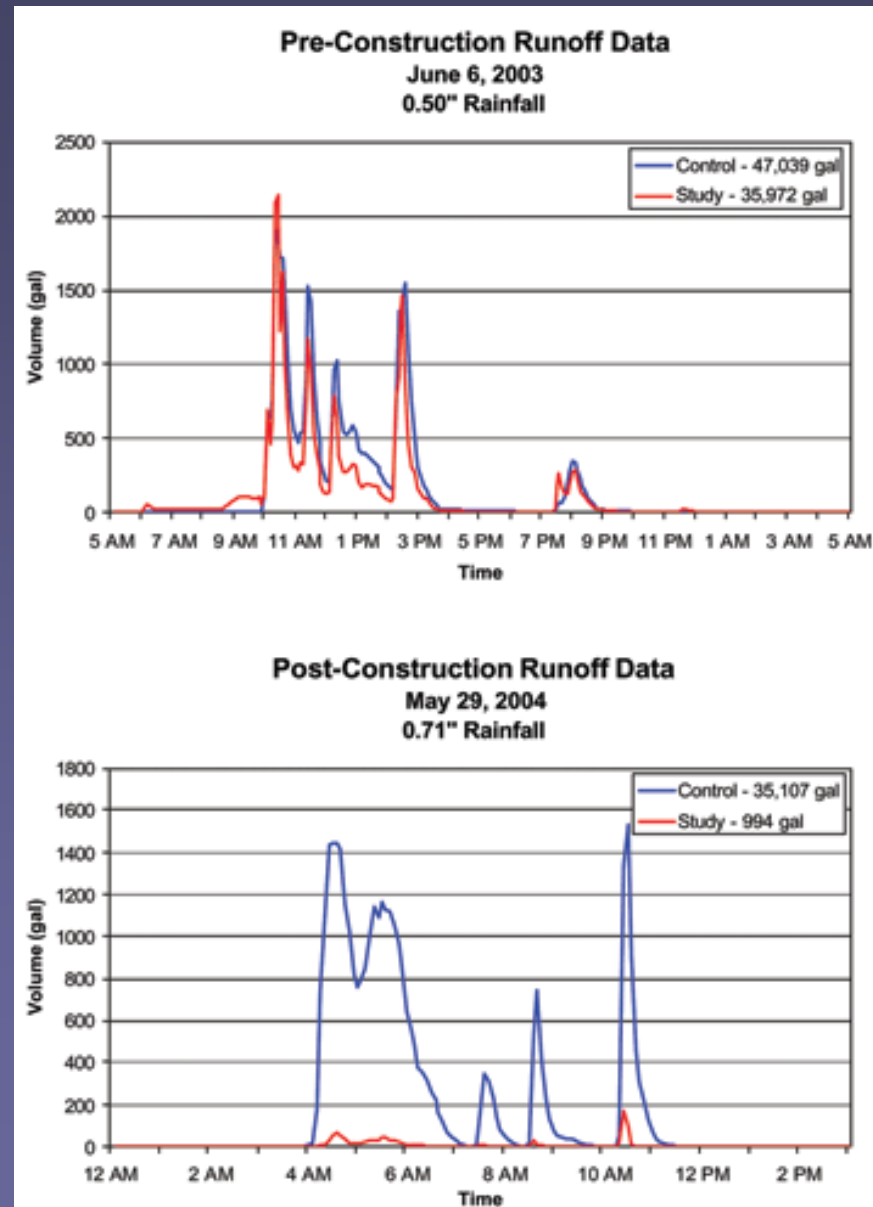




Burnsville, MN

- ✓ Rain Gardens Installed
- ✓ Monitoring Conducted

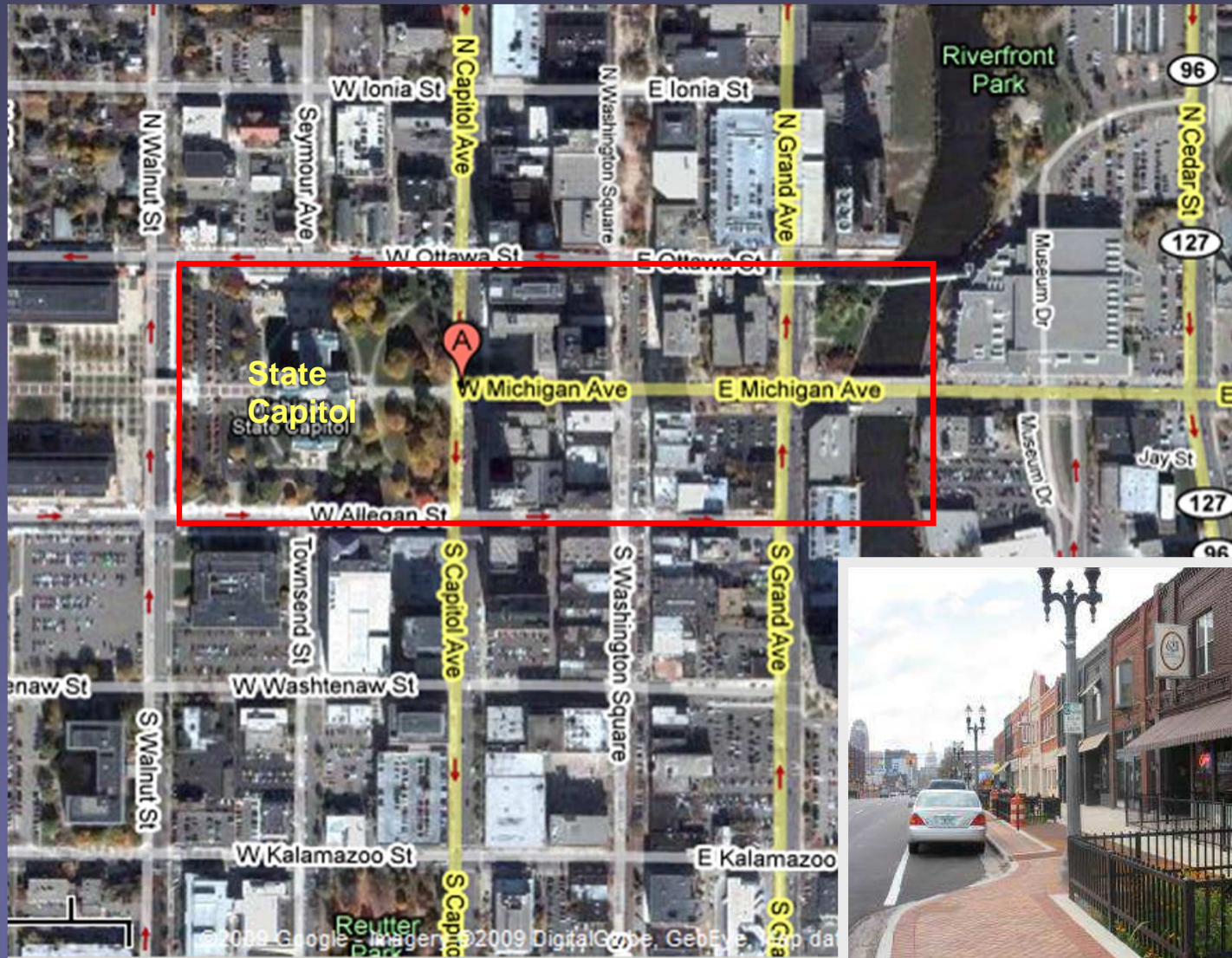
Do Rain Gardens Reduce Flow Volumes?



Blue: Runoff from control neighborhood

Red: Runoff from neighborhood retrofitted with rain gardens

A Commercial Street Michigan Avenue, Lansing, MI



Tetra Tech

Michigan Avenue

TetraTech and C2AE



Before



Tetra Tech



TetraTech

Michigan Avenue

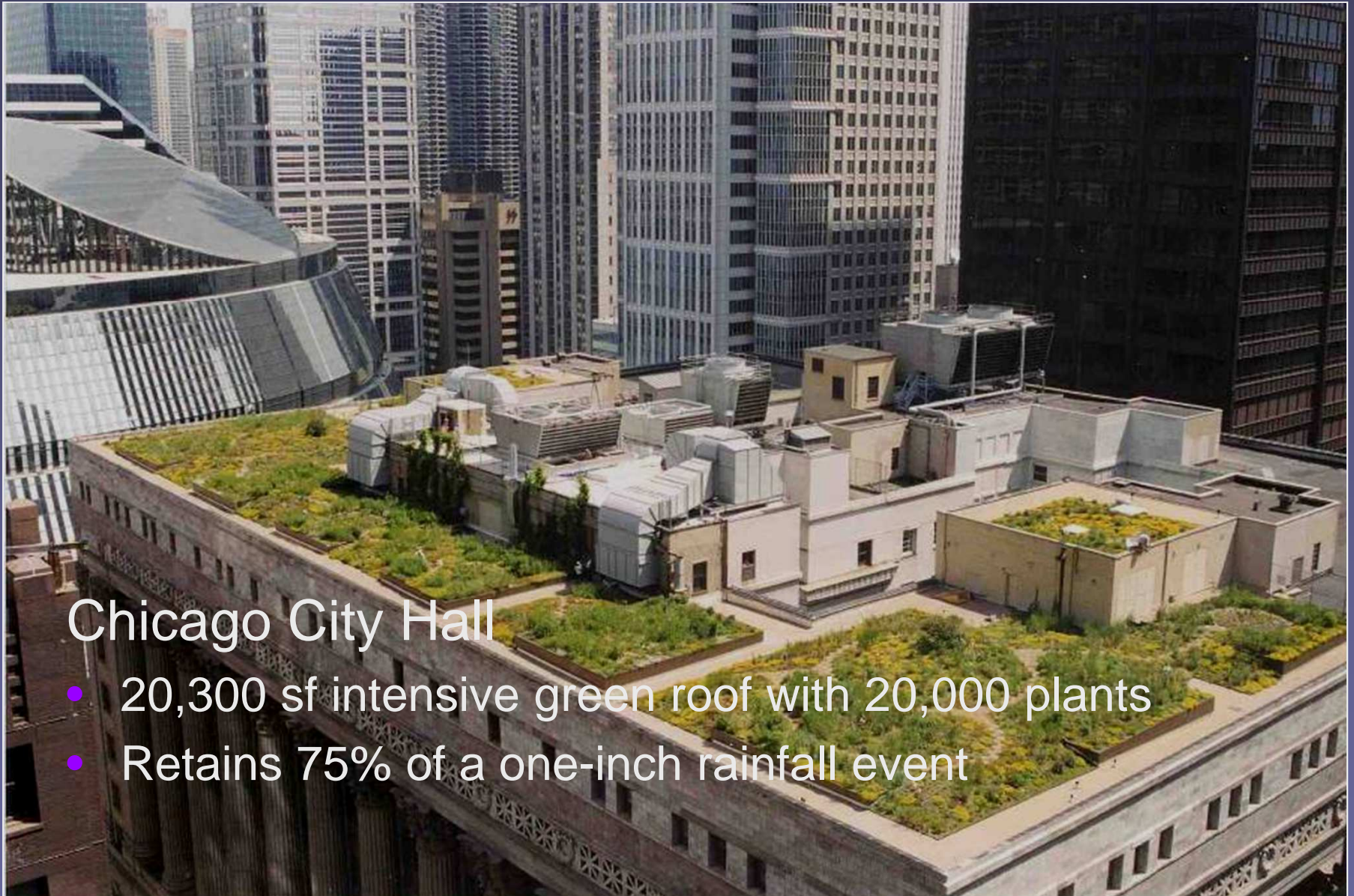
- 4 city blocks, both sides
- Typical garden, no overflow for 1-inch event
- 600 block north side, no overflow for 4.1-inches (25-year event)
- \$122/square foot

H.B.Fuller Company Parking Lot (MN)



- Reduced storm water discharges by 73%
- Reduced sediment discharge by 94%
- Reduced phosphorus loading by 70%

Green Roofs



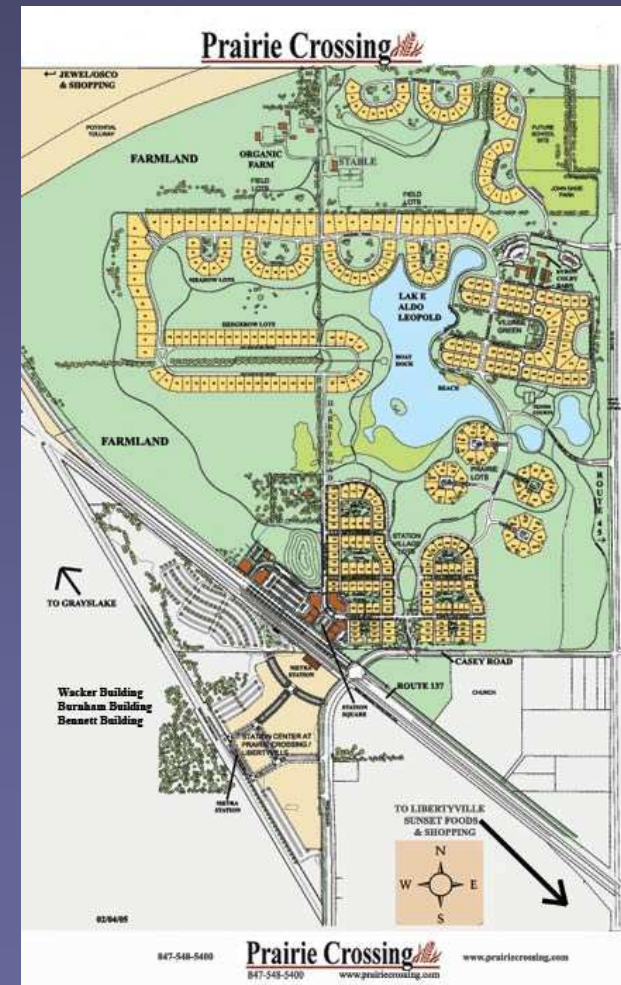
Chicago City Hall

- 20,300 sf intensive green roof with 20,000 plants
- Retains 75% of a one-inch rainfall event

EPA Study: Reducing Stormwater Costs through Low Impact Development Strategies and Practices

Key Findings

- 17 Case Studies
- In most cases LID / Green Infrastructure designs showed cost savings over traditional designs
- Capital cost savings ranged from 15%-80%



Costs

Green vs. Grey Infrastructure

Project	Conventional vault cost estimate*	Rain garden cost
Bloedel Donovan Park parking lot (4400 ft ³ wet vault)	\$52,800	\$12,800
City Hall parking lot (2300 ft ³ wet vault)	\$27,600	\$5,600

*City of Bellingham's estimate using approximate cost of \$12.00/ft³ for an in-ground storage and treatment device and based on construction costs for similar projects in the Bellingham area

Other Economic Benefits

- The New Kensington Community Development Corporation and the Pennsylvania Horticultural Society implemented green retrofit measures in a community area in Philadelphia
- NKCDC and PHS converted unsightly abandoned lots with “clean & green” landscapes of mowed grass, ringed with trees
- Significant economic impacts from these green retrofits:
 - Vacant land improvements resulted in surrounding housing values increased by as much as 30%
 - New tree plantings increased surrounding housing values by approximately 10%
- This translated to a \$4 million gain in property values through tree plantings and a \$12 million gain through lot improvements

Green Infrastructure as a CSO Control Measure



SUSTAINABLE RAINDROPS

Cleaning New York Harbor &
Creating The Urban Landscape



Report Supervisor:
Easil Seppes
Chief Investigator, Riverkeeper

Report Author:
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***“Source Control is
the Economical and
Sustainable
Alternative.”***

Determining How Green and Gray Can Work Together to Meet WQ Goals

Baseline information

- Hydrologic modeling
 - Analysis of rainfall data and impervious area (catchments)
- Hydraulic modeling
 - Analysis of sewer system function
 - Hydrographs of the system are changed with GI controls
- Water quality assessments

Case Studies Where GI is Part of the Injunctive Relief

Settled CSO enforcement actions with green infrastructure in CDs and/or Long Term Control Plans (LTCPs):

- Louisville, KY
- Cincinnati, OH
- Kansas City, MO
- Cleveland, OH





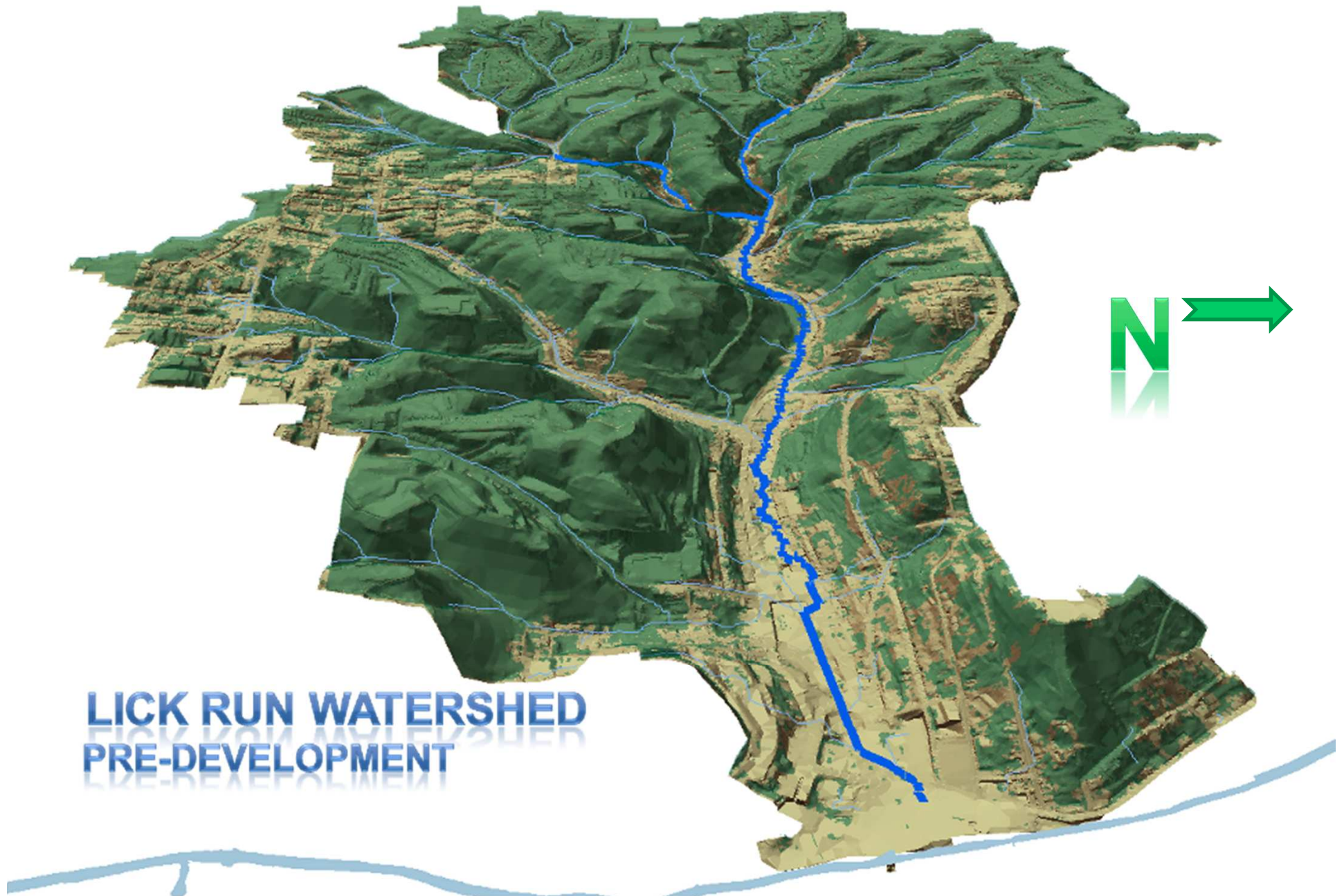
Louisville, KY

- CD allows for “innovative projects” in LTCP
- 19 Green Demonstration Projects in LTCP initially, funded by Louisville Municipal Sewer District
- \$40 million projected savings on Green Demonstration Projects compared to traditional controls
- Six years to monitor performance of GI projects, then reevaluate the mix of green/gray controls
- Projects include green roofs, green streets, urban reforestation bioswales, rain gardens, permeable alleys, green parking lots

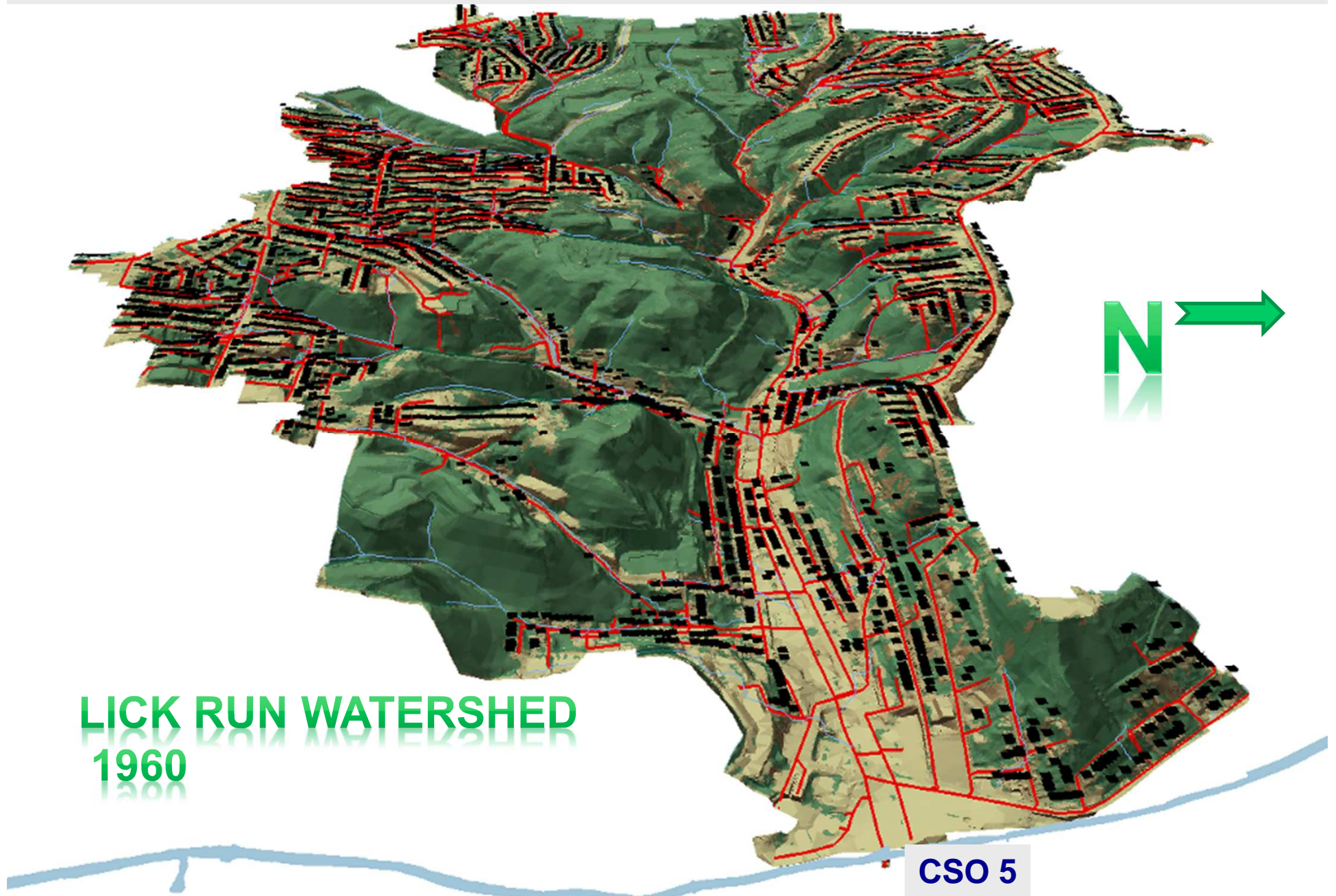
Metropolitan Sewer District of Greater Cincinnati

- Approved wet weather plan allows for proposal of an alternative plan for the Lower Mill Creek sewersheds, which could include source control and green infrastructure, and also allows for proposals to substitute specific green measures for planned gray infrastructure control measures
 - Currently in a 3 year study and design period
- Lick Run project in Mill Creek

Lick Run, Cincinnati



Lick Run, Cincinnati



Concept Plan for Lick Run Watershed, Cincinnati



"Source Control is the Economical and Sustainable Alternative."

Kansas City, MO

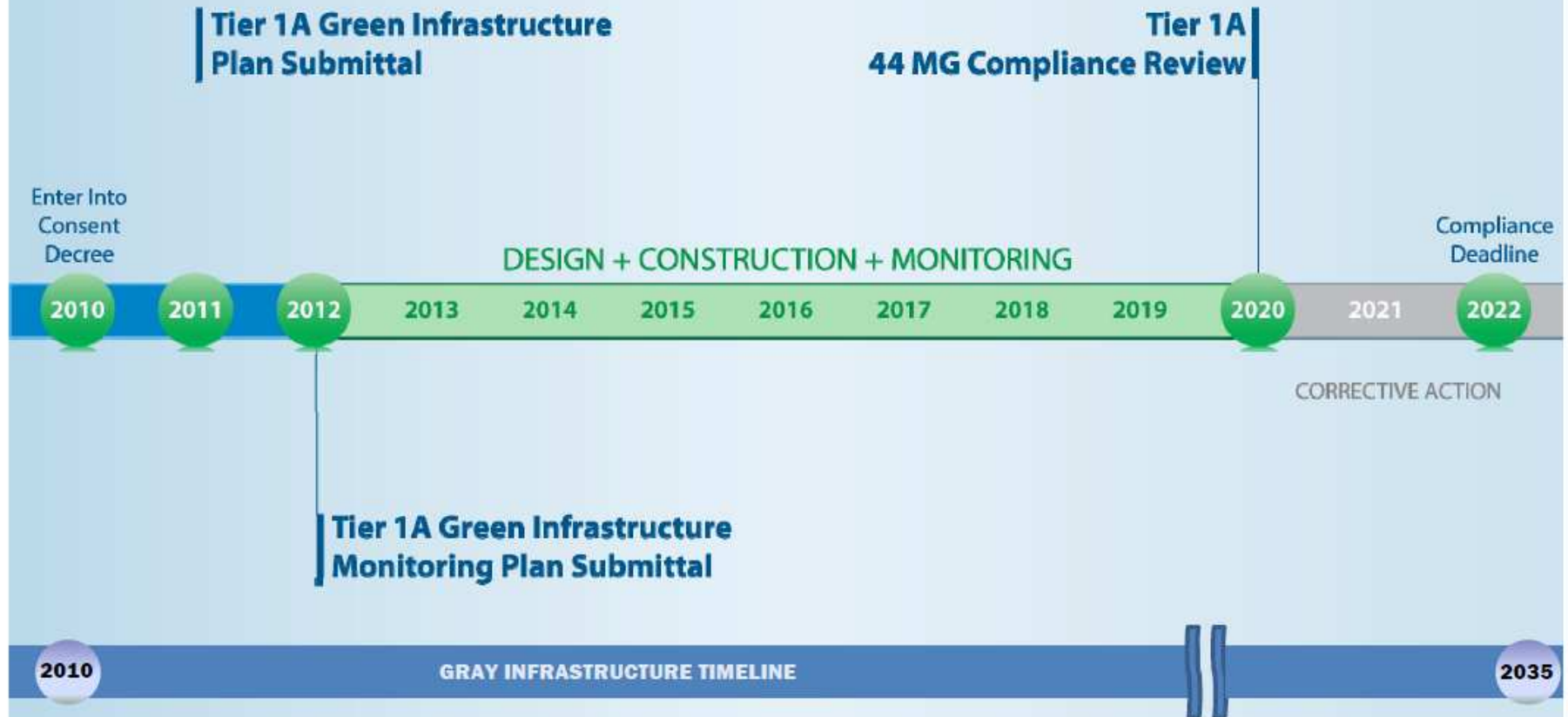
- Adaptive management approach to extensively utilize GI in lieu of and in addition to gray controls
- Middle Blue River 100-acre GI pilot project
- 744-acre Marlborough neighborhood GI implementation based on pilot project results
- The City will submit a plan for GI throughout the system based on pilot project results
- GI technologies to be implemented: catch basin retrofits in road and street rights-of-way, curb extension swales, street trees, permeable pavement, green roofs, stormwater planters

Northeast Ohio Regional Sewer District

- Minimum of \$42 million on GI
- Minimum 44 million gal/year reduction in CSO discharges in a typical year from GI (over and above reductions from gray)
- Emphasis on relatively larger practices on vacant land parcels
- Opportunity for other green for gray substitutions



The District's Consent Decree



Source: Appendix 3 to Consent Decree in *United States and State of Ohio v. Northeast Ohio Regional Sewer District*, N.D. Ohio – 11/12/10 Pre-Approval Draft.

NORTHEAST OHIO REGIONAL SEWER DISTRICT

Monitoring and Tracking Performance

- **Monitoring of individual GI practices / sites**
 - Particular emphasis on early implementation and representation across sewersheds
- **Sewershed-scale monitoring**
 - Collections of practices
- **Post-construction monitoring and evaluation**
 - After all elements in place
- **Evaluation of co-benefits**

Questions/Contact Information

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