

2014 Green Infrastructure Webcast Series

Case Studies: Implementing Green Infrastructure under Enforcement Orders

**Tuesday, March 4th, 2014
1:00 – 2:30pm EST**

Speakers:

Andy Shively, Kansas City Water Services
Kyle Dreyfuss-Wells, Northeast Ohio Regional Sewer District

Sponsored by U.S. EPA Office of Wastewater Management

Logistics

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 - Call GoToWebinar support number [800 263-6317], and give conference ID# 478735057

Webcast Agenda

- **Introduction**
- **Andy Shively**, Kansas City Water Services
- **Q&A session**
- **Kyle Dreyfuss-Wells**, Northeast Ohio Regional Sewer District
- **Q&A session**
- **Wrap up from EPA**



Now to our speakers!

MARCH 4, 2014

Investing in Kansas City:

Improving Water Quality With Green Solutions



KANSAS CITY
MISSOURI



KC WATER
SERVICES

Overview

- Introduction to Kansas City and Water Services
- Kansas City's Overflow Control Program
- Green Infrastructure Program & Pilot Project
- Maximizing Green Investments Through Partnership



INTRODUCTION

Kansas City & Water Services

Goin' to Kansas City...



Kansas City, Missouri

City of Fountains

Home of Sporting KC, Chiefs, Royals

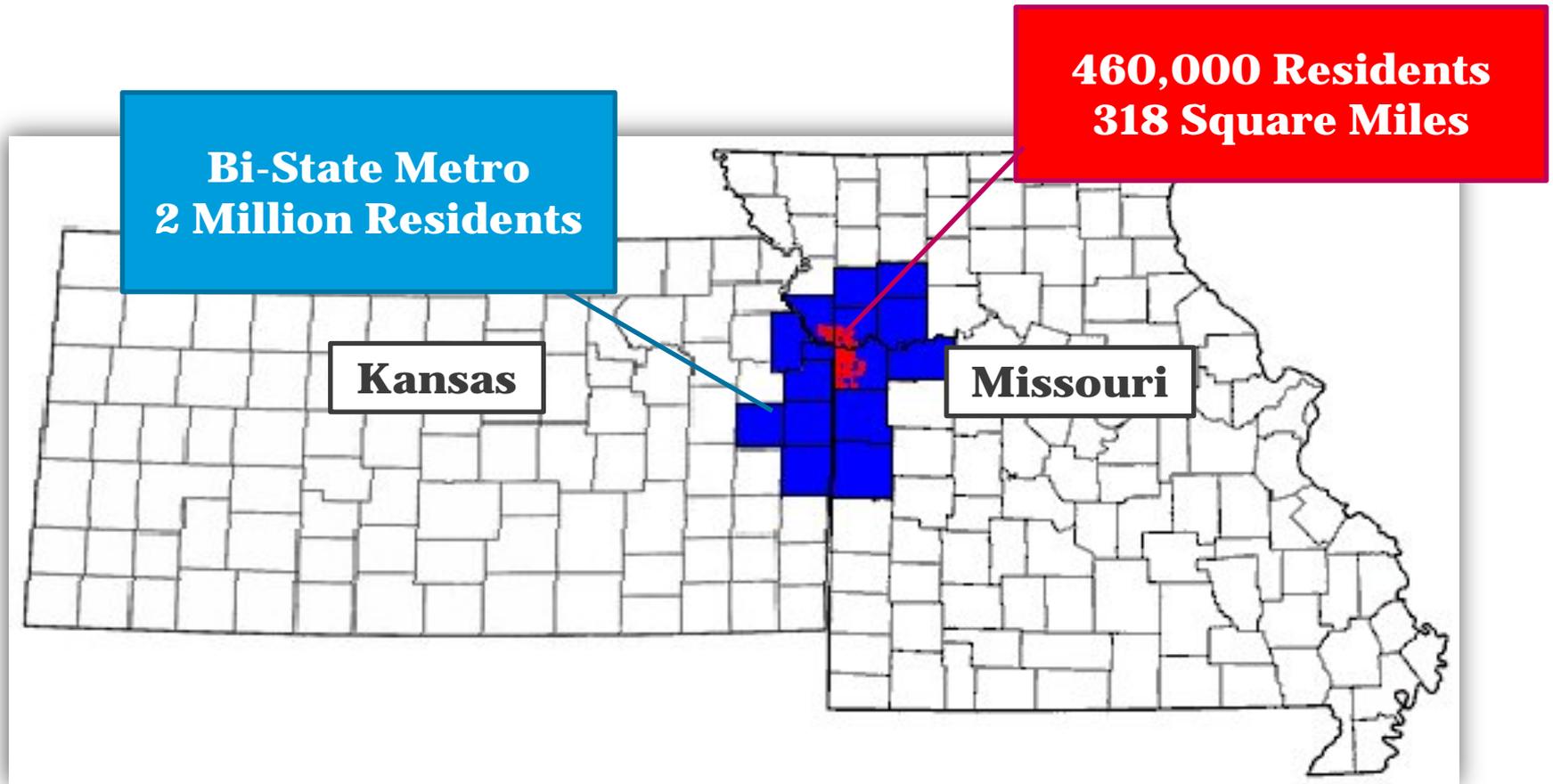
Jazz and Barbecue

Liberty Memorial- WWI Museum

Plaza Shopping District



Kansas City Metro



Water Services Department

FY13-FY14 Budget	\$307 million
Water	\$148 million
Wastewater	\$144 million
Stormwater	\$15 million

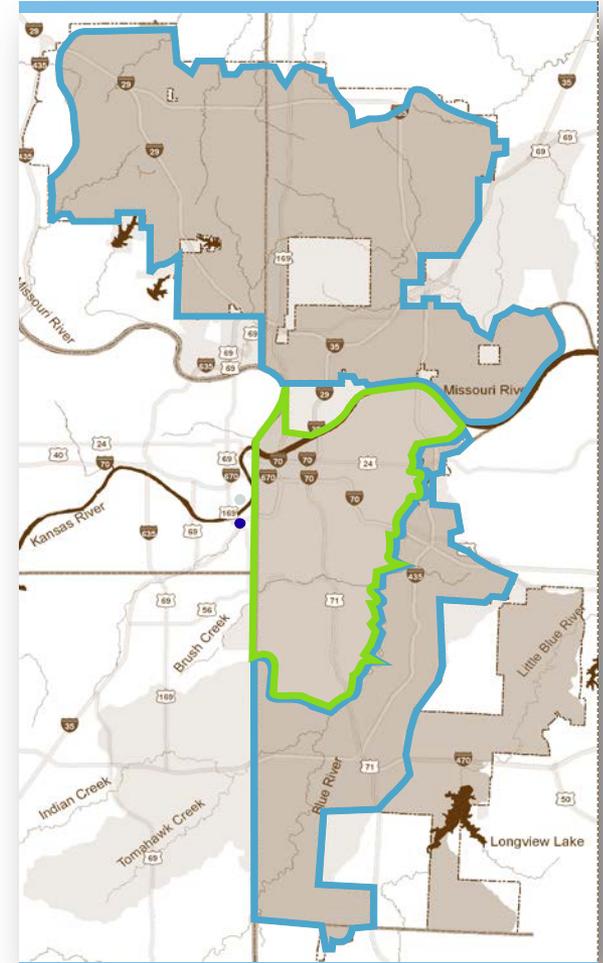
Average Monthly Residential Bill	
Water	\$40.52
Wastewater	\$39.44
Stormwater	\$2.50
TOTAL	\$82.46



Kansas City's Wastewater Utility

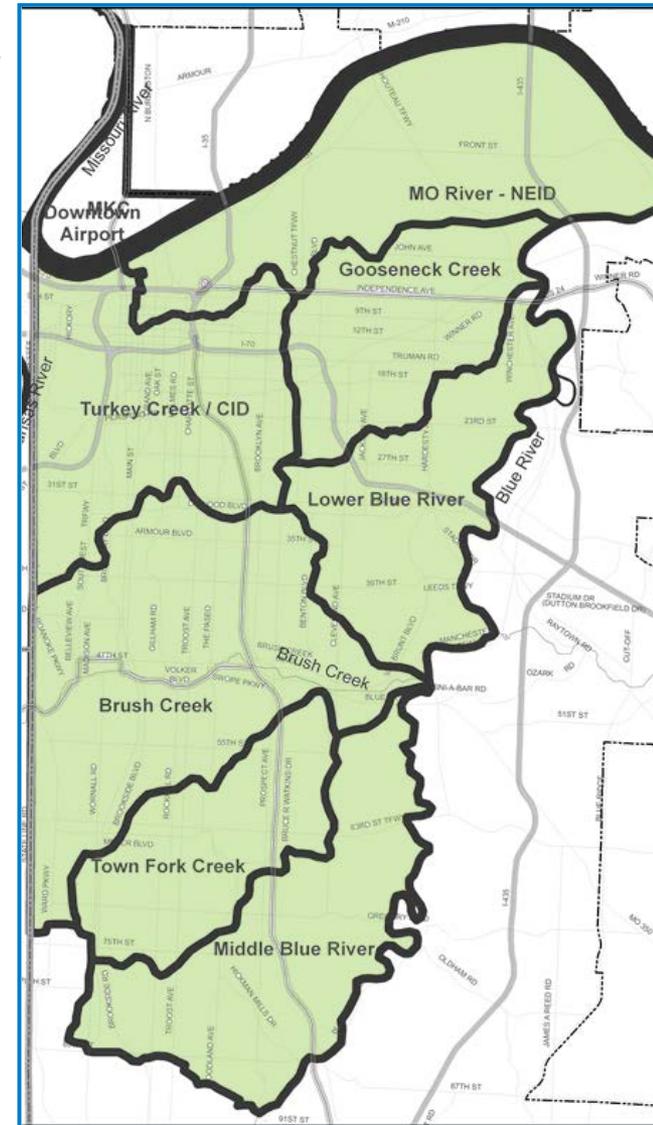
- Over 650,000 people are served by Kansas City's sewer system
- Combined sewers in older areas
- Separate sewers in the south, east, and north
- Aging infrastructure; underfunding of maintenance & repairs

Combined Sewer System
Separate Sewer System



KC's Combined Sewer System

- 90 outfalls
- 6.4 billion gallons of overflow in a typical year
- **Overflow Control Plan Goals:**
 - Evaluate green infrastructure
 - Capture 88% of wet weather flows
 - Reduce number of overflows by 65%





KANSAS CITY'S

Overflow Control Program

Kansas City's Overflow Control Program

\$4.5-\$5.0 billion
Investment

25 Year Plan,
Largest Program in
KC's History

**Improving
Water
Quality**

First Federal Consent
Decree to include
Green Infrastructure
Solutions

City-wide approach to
address sewer
overflows

Kansas City's Overflow Control Plan

Programmatic Elements

Improved Water Quality

Consent
Decree

Overflow Control Program

Kansas City's OCP Strategy

Maximize

• Benefit to our Customers

Fix

• The System We Have

Reduce

• The Problem Before Solving it

Facilitate

• Green Infrastructure Development

Measure

• Performance & Adjust the Plan

Build

• Only What is Needed



Green Infrastructure Program & Pilot Project

Green Infrastructure Development

- First to include green as part of consent decree
- Allowed an additional five years for implementation of pilots
- \$68+ million allocated
- 744 acre project to test BMP types and sizes



Green Infrastructure Development

Meet Federal Requirements

Reduce volume of stormwater

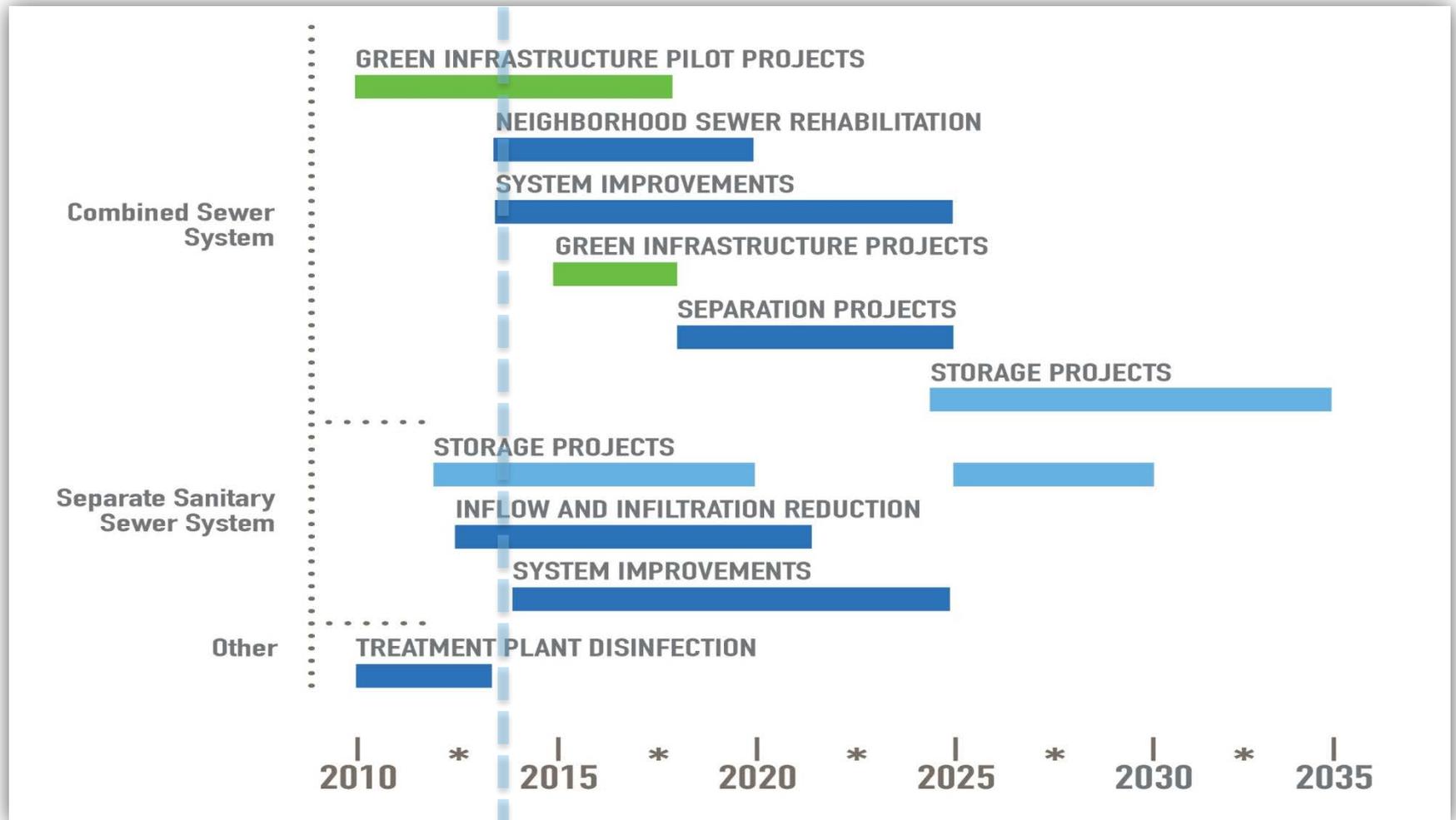
Create amenities

Replace Gray with Green

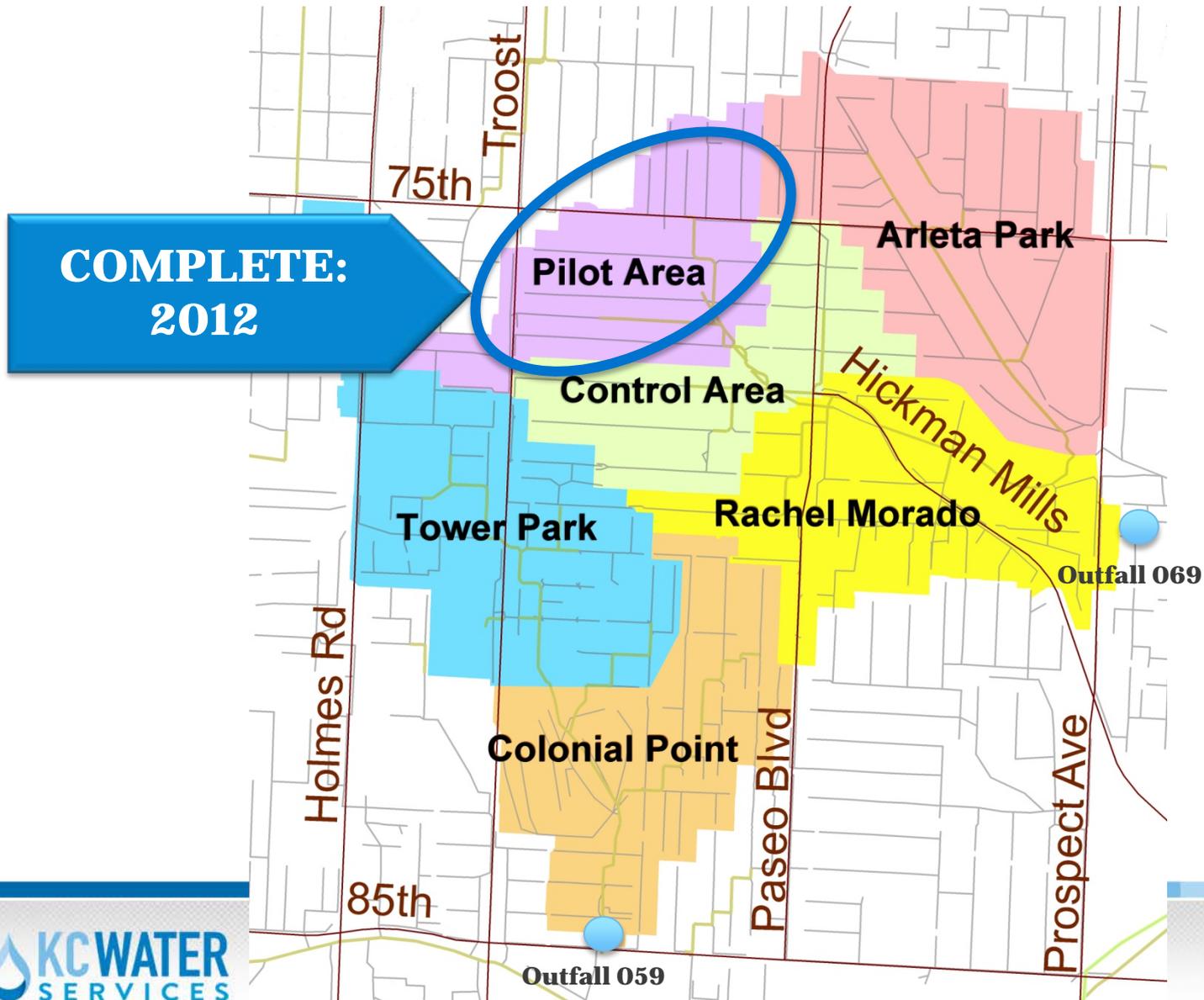
- Similar in cost
- Similar in performance



Kansas City's Program Implementation



Middle Blue River Basin Green Infrastructure



Transforming the Neighborhood



Photo: URS Corporation

Transforming the Neighborhood

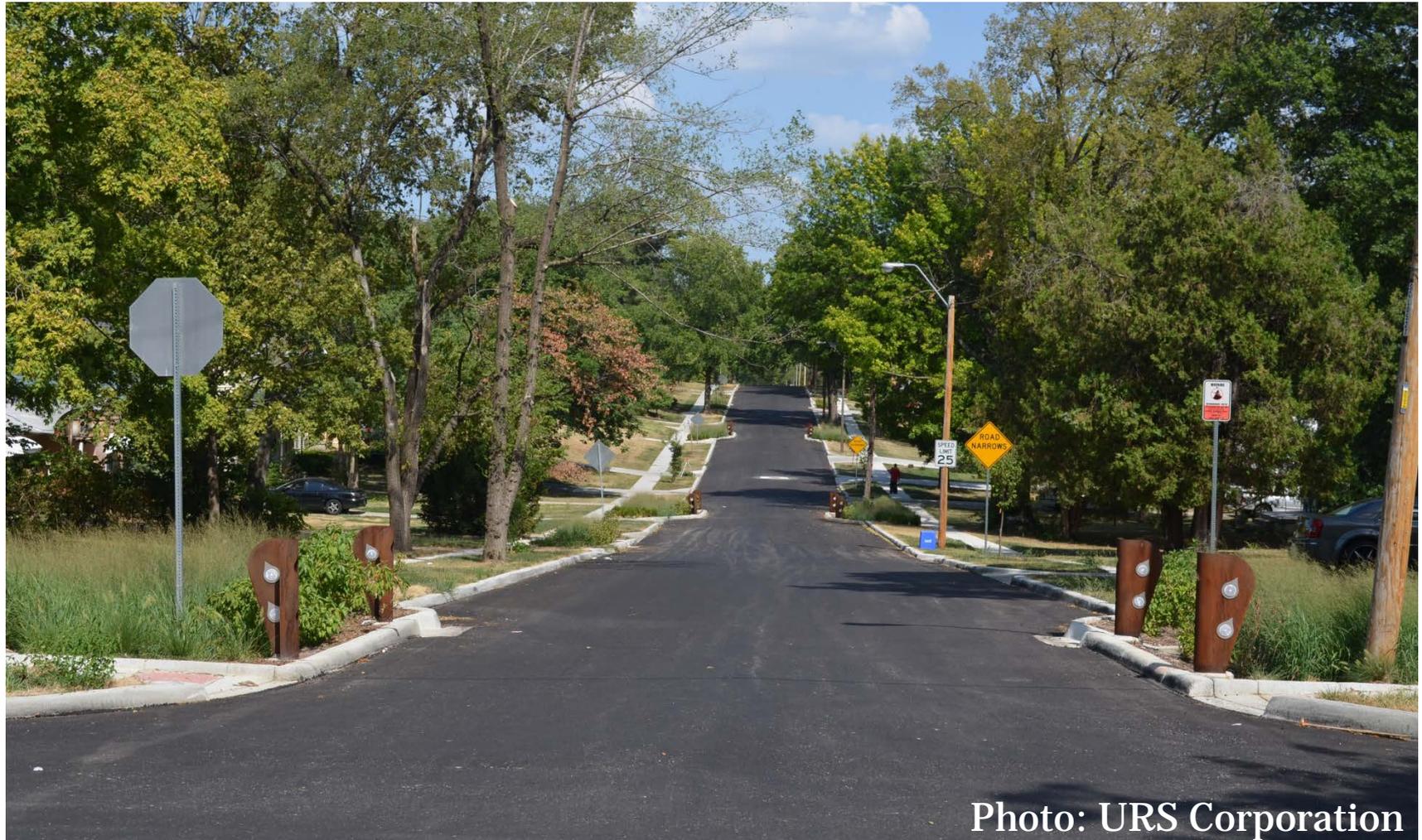
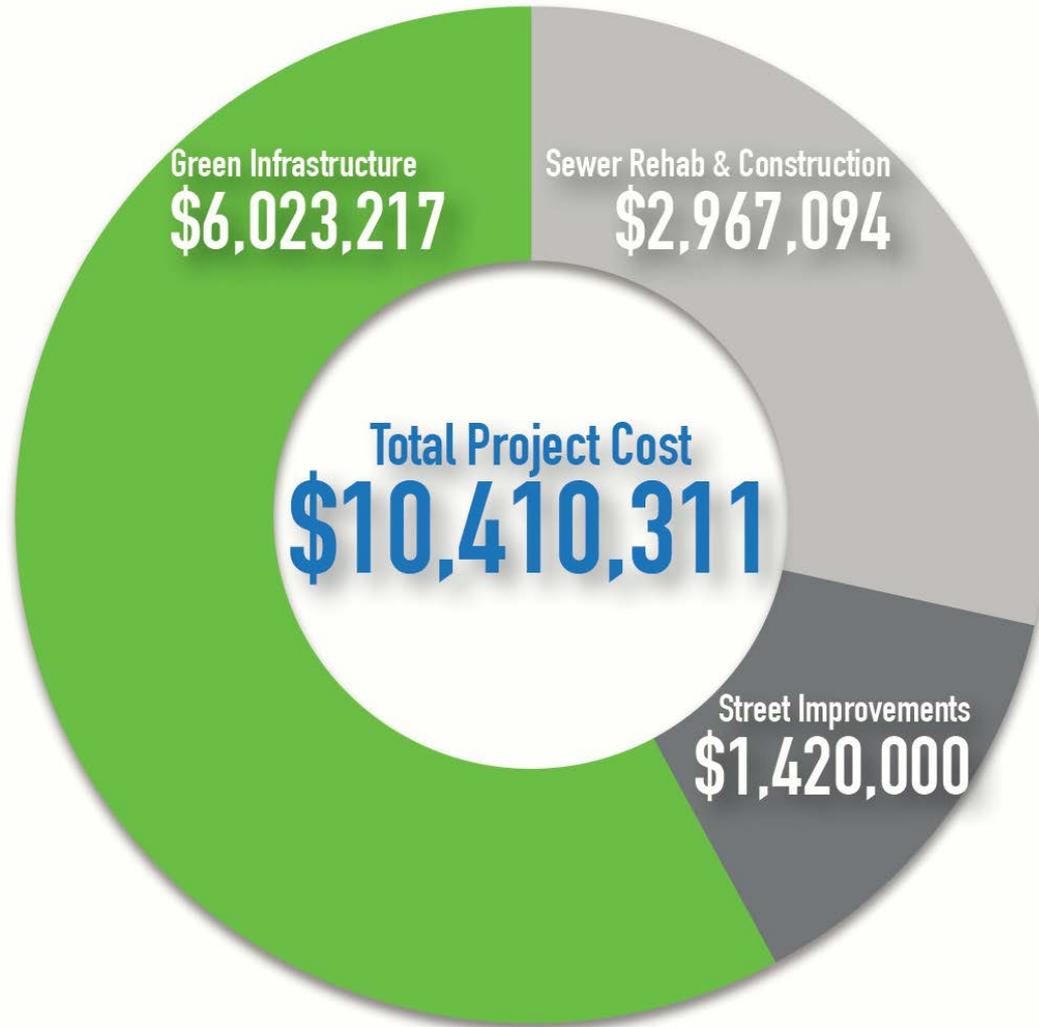


Photo: URS Corporation

Pilot Project: Investing in Kansas City



Pilot Project: Green Improvements

1,100
Linear Feet
Permeable Pavers



4,300
Linear Feet
Porous Sidewalk



67
Rain Gardens



2
Cascade
Rain Gardens



28
Curb Extension
Rain Gardens



36
Bioretention
Rain Gardens



Pilot Project: Results

360,320 Gallons

Constructed Storage

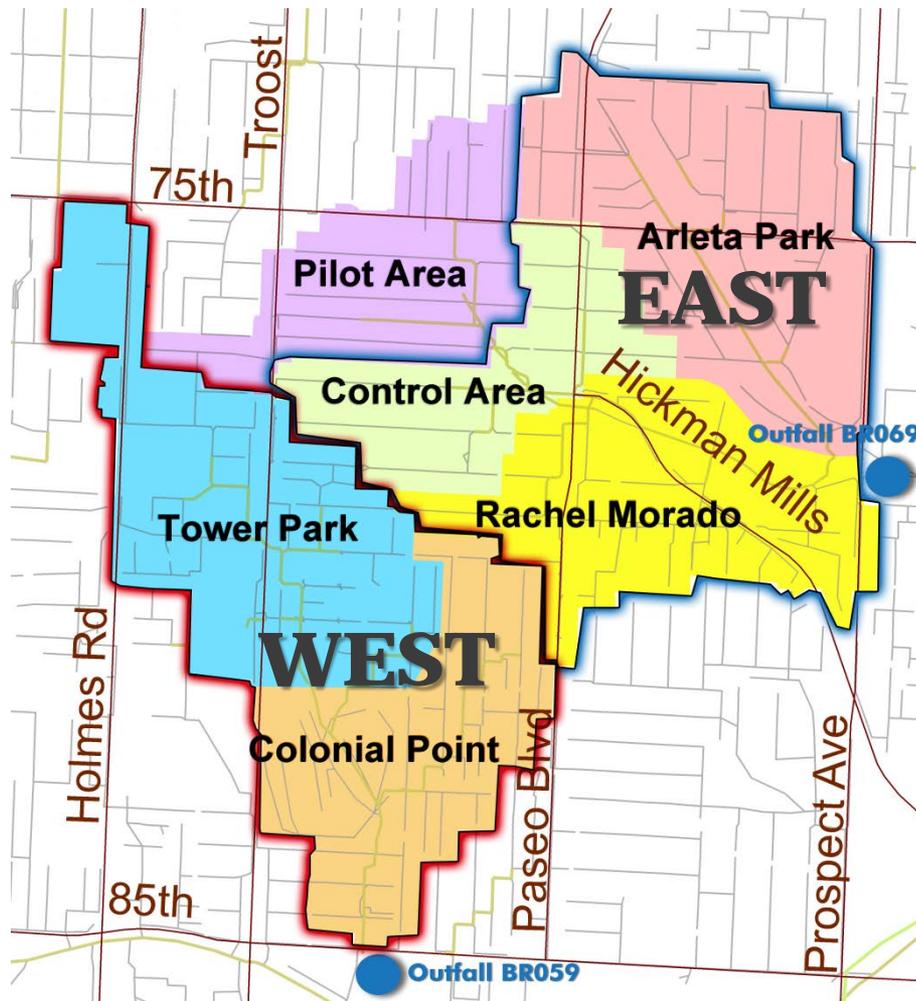
76% Reduced Peak Flow at Pilot Area Outlet

36% Reduced Peak Volume at Pilot Area Outlet

Pilot Project: Community Benefits

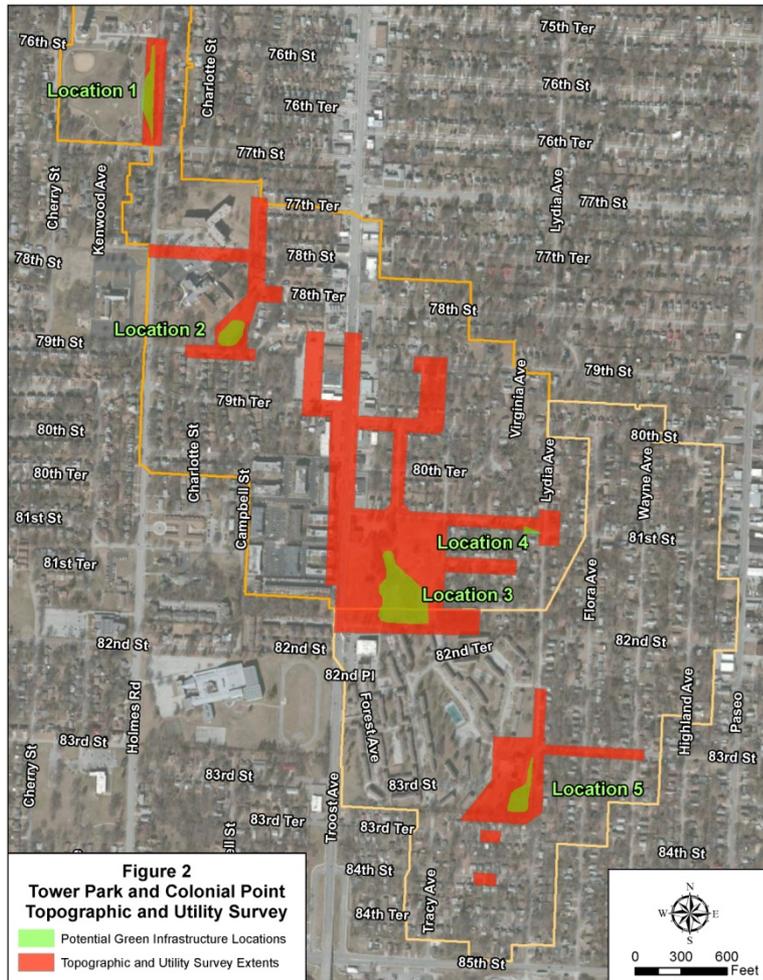


Next Steps: Middle Blue River Basin



- Design underway for remaining 644 acres
- Divided into two projects areas by outfall
- 4.7 million gallons of total storage
- Strategic sewer separation

Target Green: Marlborough West



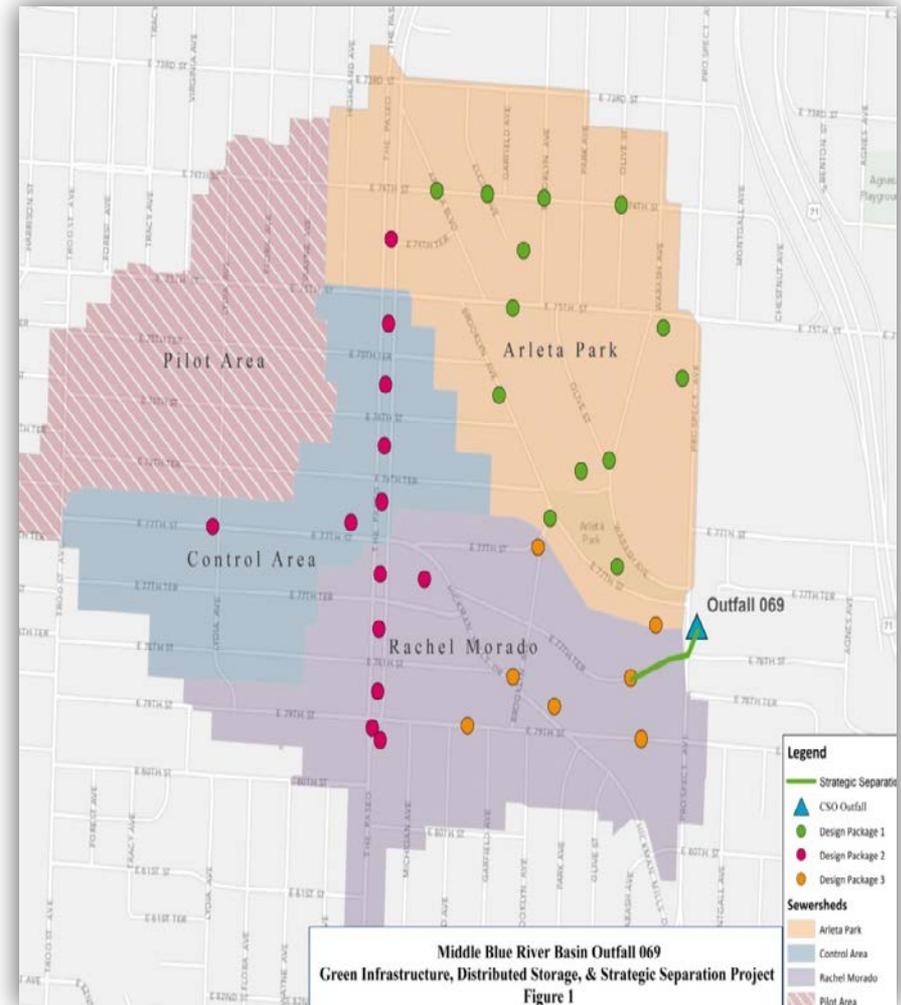
- 5 locations; 258 acres
 - Extended wet detention
 - Bioretention
 - Extended detention wetlands

Target Green: Marlborough West



Target Green: Marlborough East

- 32 locations; 386 acres
 - Medians/Rights-Of-way
 - Parks
 - Vacant Properties
- Large open spaces & small neighborhood connectors
 - Extended dry and wet detention
 - Bioretention Ponds
 - Bioswales
 - Vegetated submerged beds



Target Green: Marlborough East



Upcoming Green Infrastructure



- Two additional pilot projects
 - Northeast Industrial District
 - Central Industrial District



Maximizing Green Investments Through Partnership



Partnership: Neighborhood & Residents

“We wanted to talk about the CSOs, but the residents wanted to talk about sidewalks and maintenance.”

- Mayor Pro Tem Cindy Circo

Result:
**Broadened scope of project
improvements**



Partnerships: City & Government

Office of Environmental Quality

Parks and Recreation

Planning & Community Development

Neighborhood & Housing Services

Public Works

Water Services

UMKC

Center School District

Kansas City Power & Light

Missouri Gas Energy

EPA Region VII & EPA ORD

New Reflections KC

Blue River Watershed Assoc.

Result:

- Efficiency in Resources
- Expanded Ideas
- Minimized Disruptions

Partnerships: Local Contractors



Result:
Investing in Local Workforce
Expanding Green Skills

Green Infrastructure & Urban Planning

- Furthering community improvements
- Revitalizing neighborhoods
- Supporting economic growth





Questions?

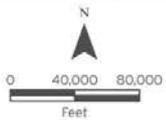
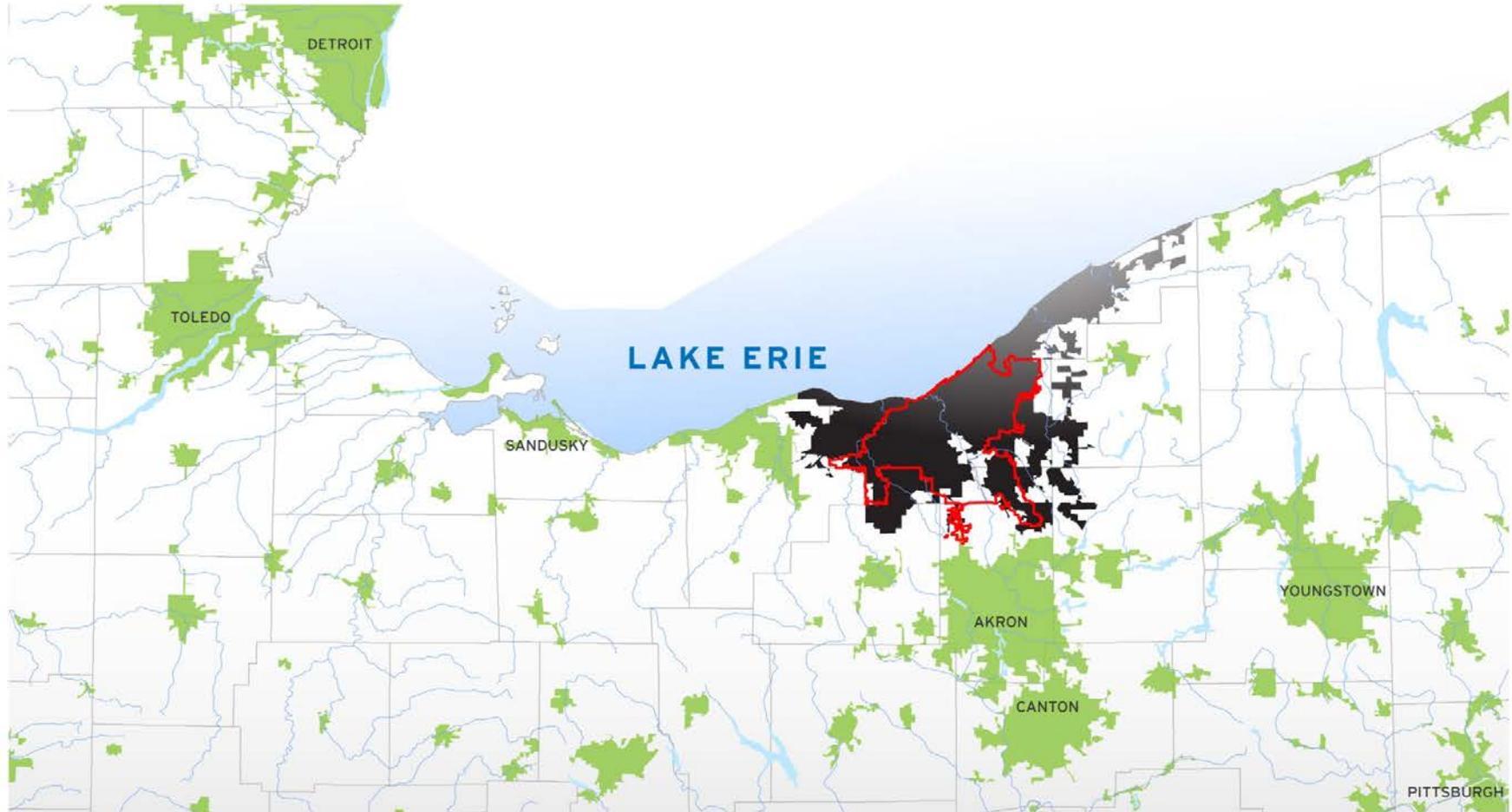
Second Chances: *Retooling a Great Lakes City with Green Infrastructure*



**EPA 2014 GI Webcast Series
March 3, 2014**



Northeast Ohio Regional Overview



- District Service Area
- Urban Area
- County Boundary
- Cleveland Metropolitan Area

NORTHEAST OHIO REGIONAL SEWER DISTRICT



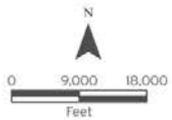
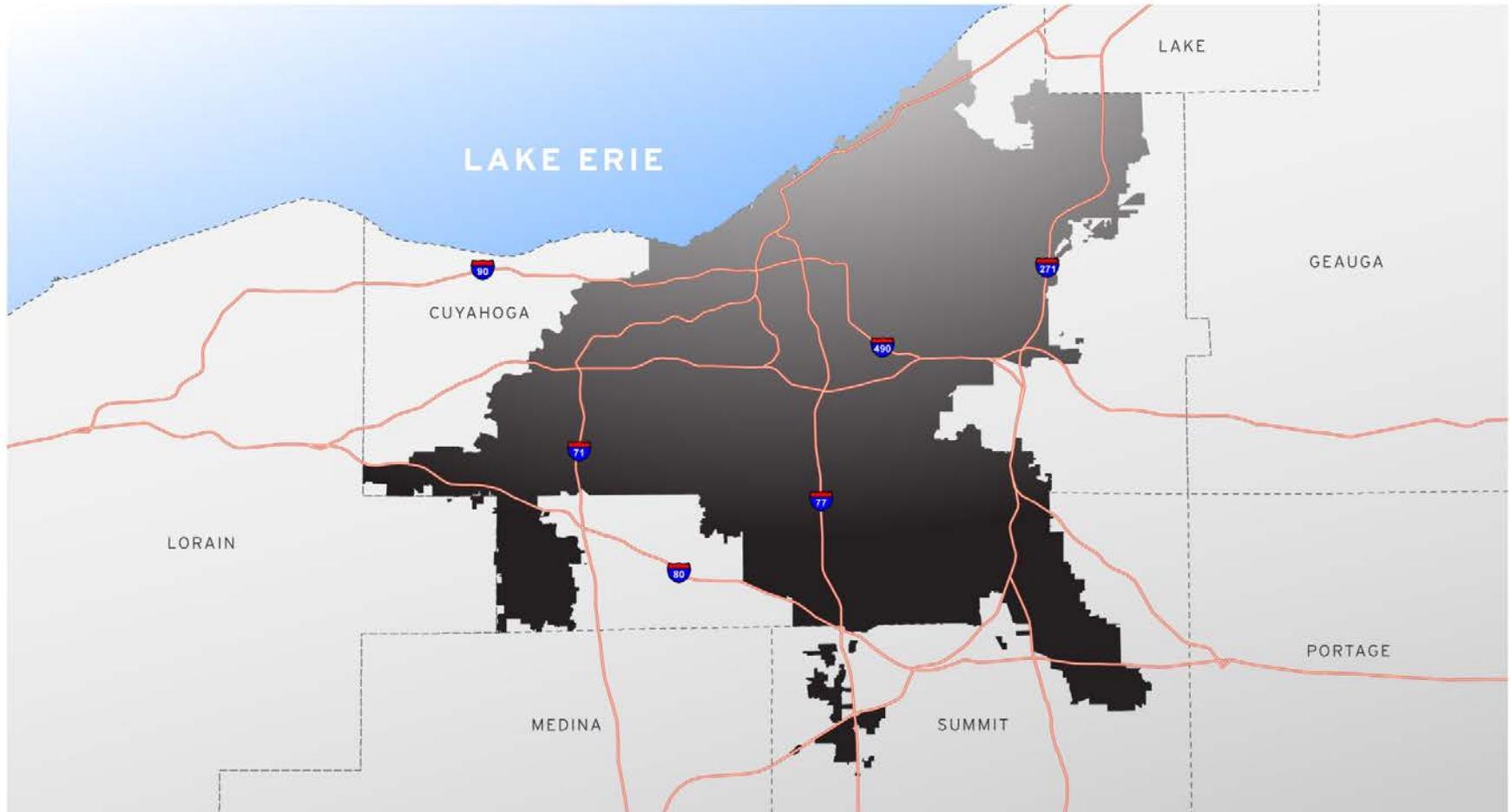
Your Sewer District Keeping our Great Lake great.



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District Overview

Service Area: 355 square miles



-  District Service Area
-  Interstate
-  County Boundary

NORTHEAST OHIO REGIONAL SEWER DISTRICT



Your Sewer District Keeping our Great Lake great.



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Who We Are...

- Political subdivision of Ohio
- Created in 1972 by Court Order
 - Code of Regulations
 - Governed by seven Trustees
- Separate and distinct from the City of Cleveland and Cuyahoga County

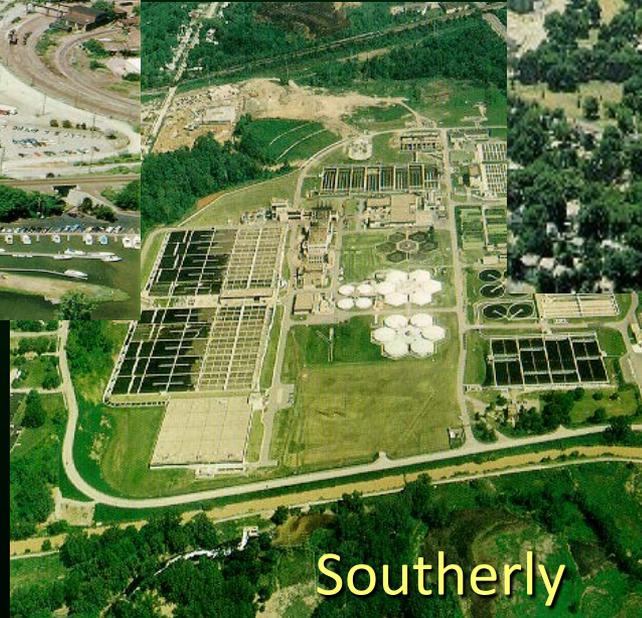
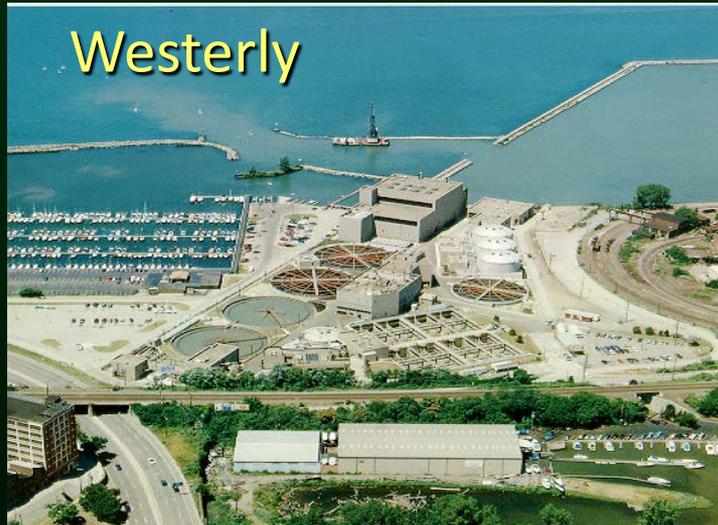


What We Do...

- Sanitary & regional stormwater services to Cleveland and 61 member communities
 - 1 million customers
 - 90+ billion gallons treated each year
- Water quality monitoring
- Lake Erie beach monitoring and maintenance



We Own and Operate 3 Wastewater Treatment Plants



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Northeast Ohio Regional Sewer District Responsibility



- \$3 billion in 25 years
- CSO control
- Sewer fees
- Regional flooding and erosion issues
- Impervious surface fee



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Northeast Ohio Regional Sewer District Responsibility



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Northeast Ohio Regional Sewer District Project Clean Lake: The gray and the green of CSO control

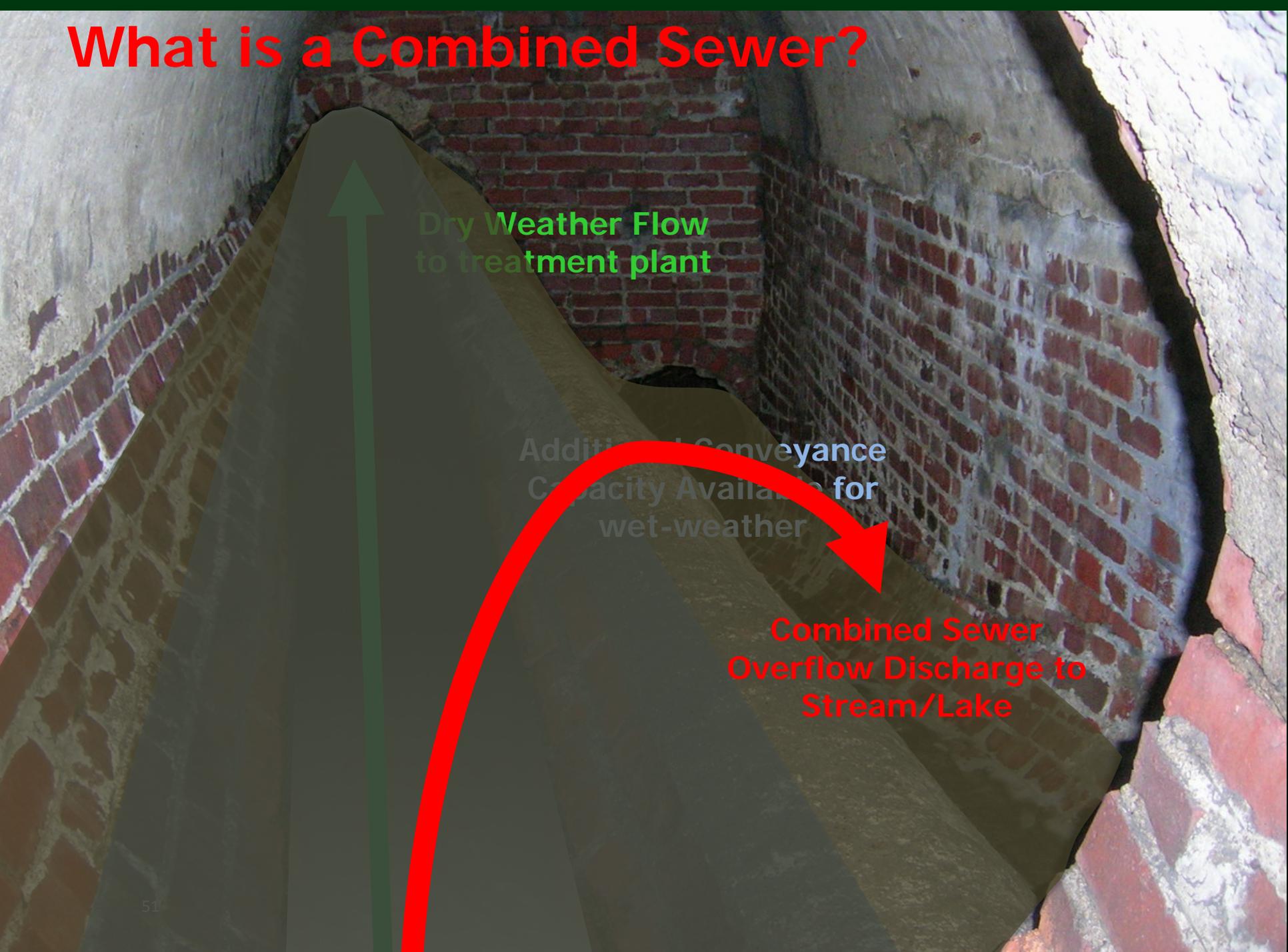


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What is a Combined Sewer?



The diagram shows a cross-section of a brick-lined sewer pipe. A green arrow points upwards from the bottom center, representing the flow of wastewater during dry weather. A red arrow curves from the bottom right towards the center, representing the overflow of combined sewage during wet weather. The pipe is divided into two sections: a lower section for overflow and an upper section for dry weather flow.

Dry Weather Flow
to treatment plant

Additional Conveyance
Capacity Available for
wet-weather

Combined Sewer
Overflow Discharge to
Stream/Lake

What is a Combined System Overflow?



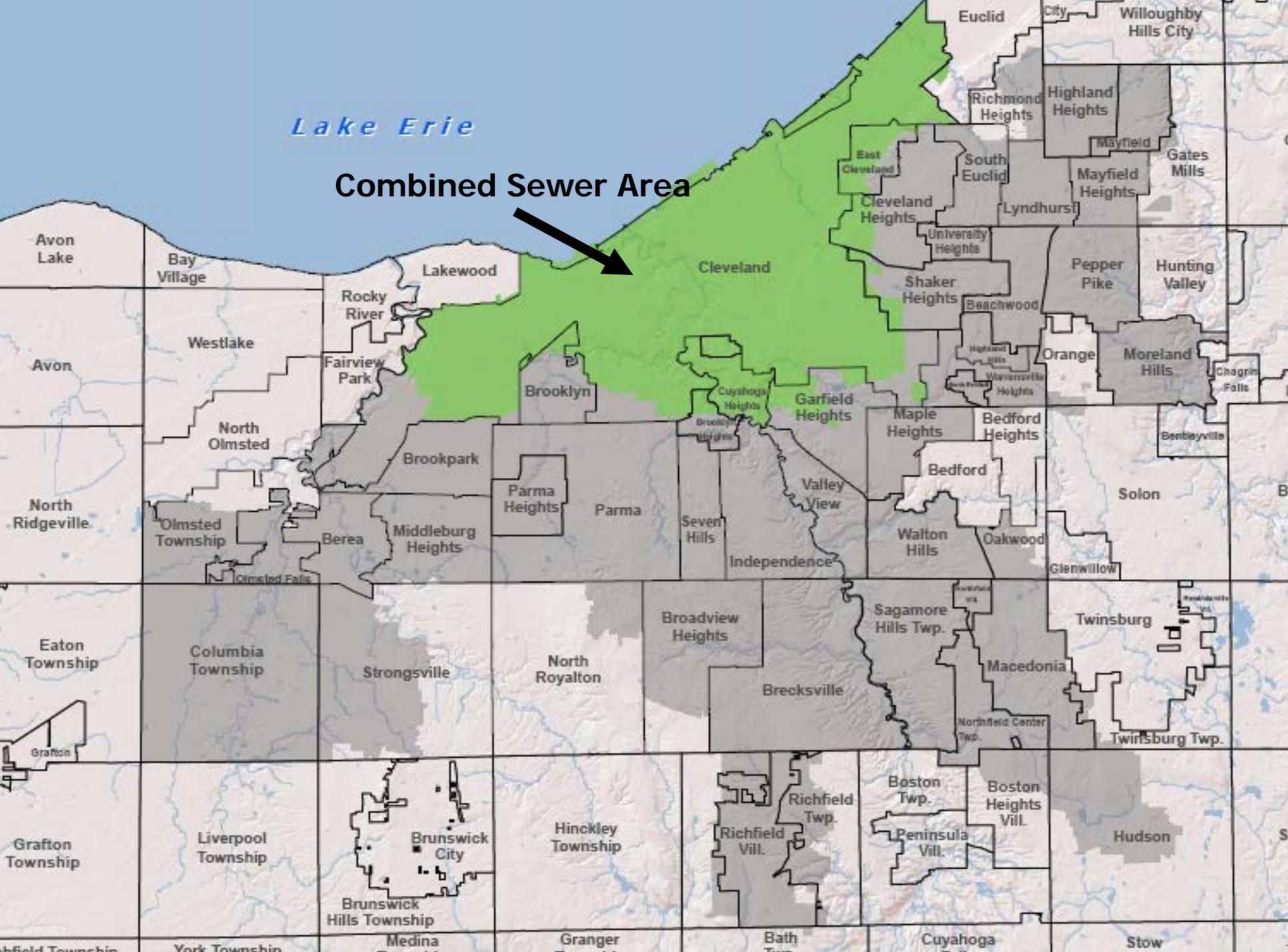
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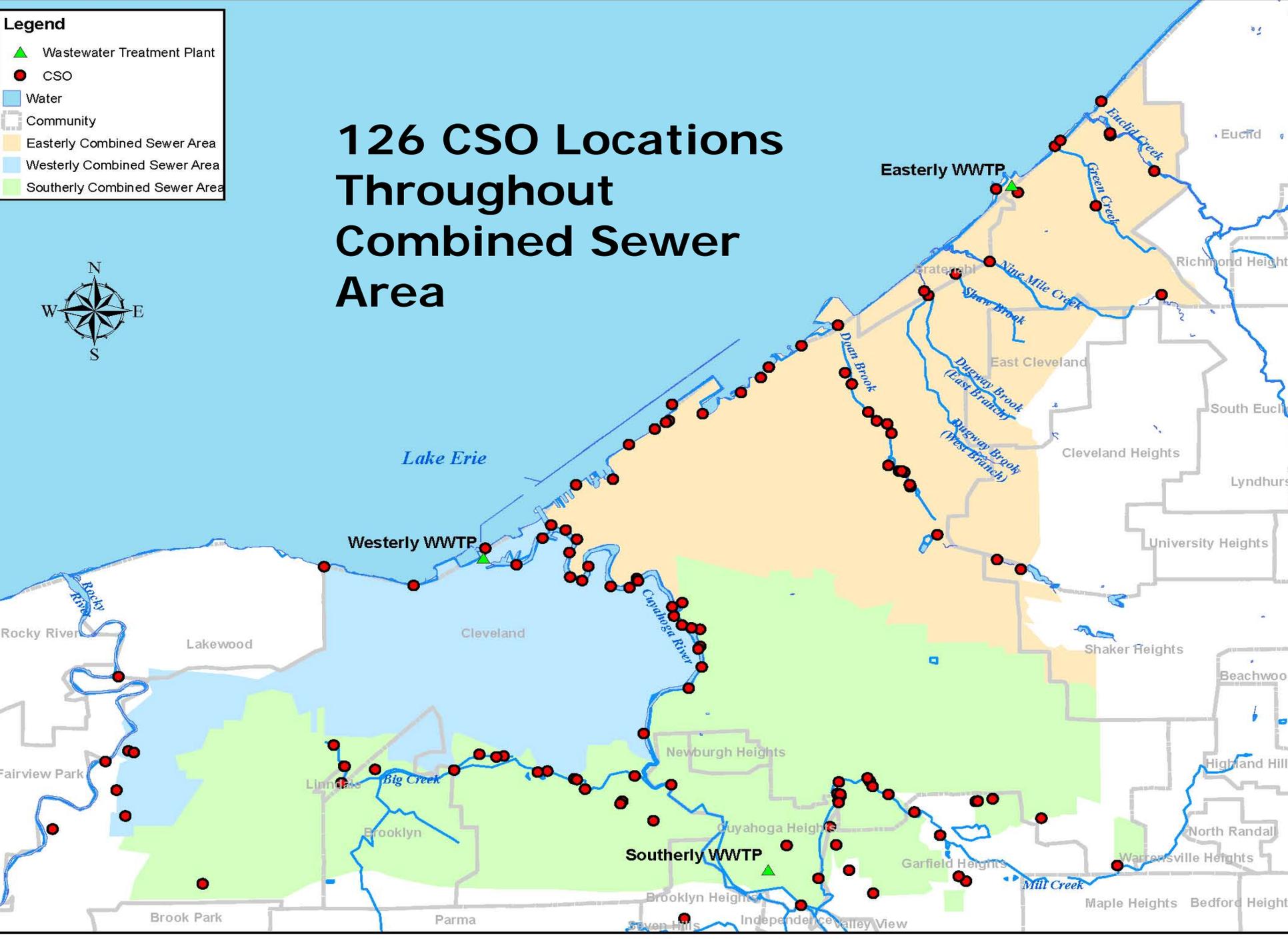
Water quality impacts of Combined Sewer Overflow....



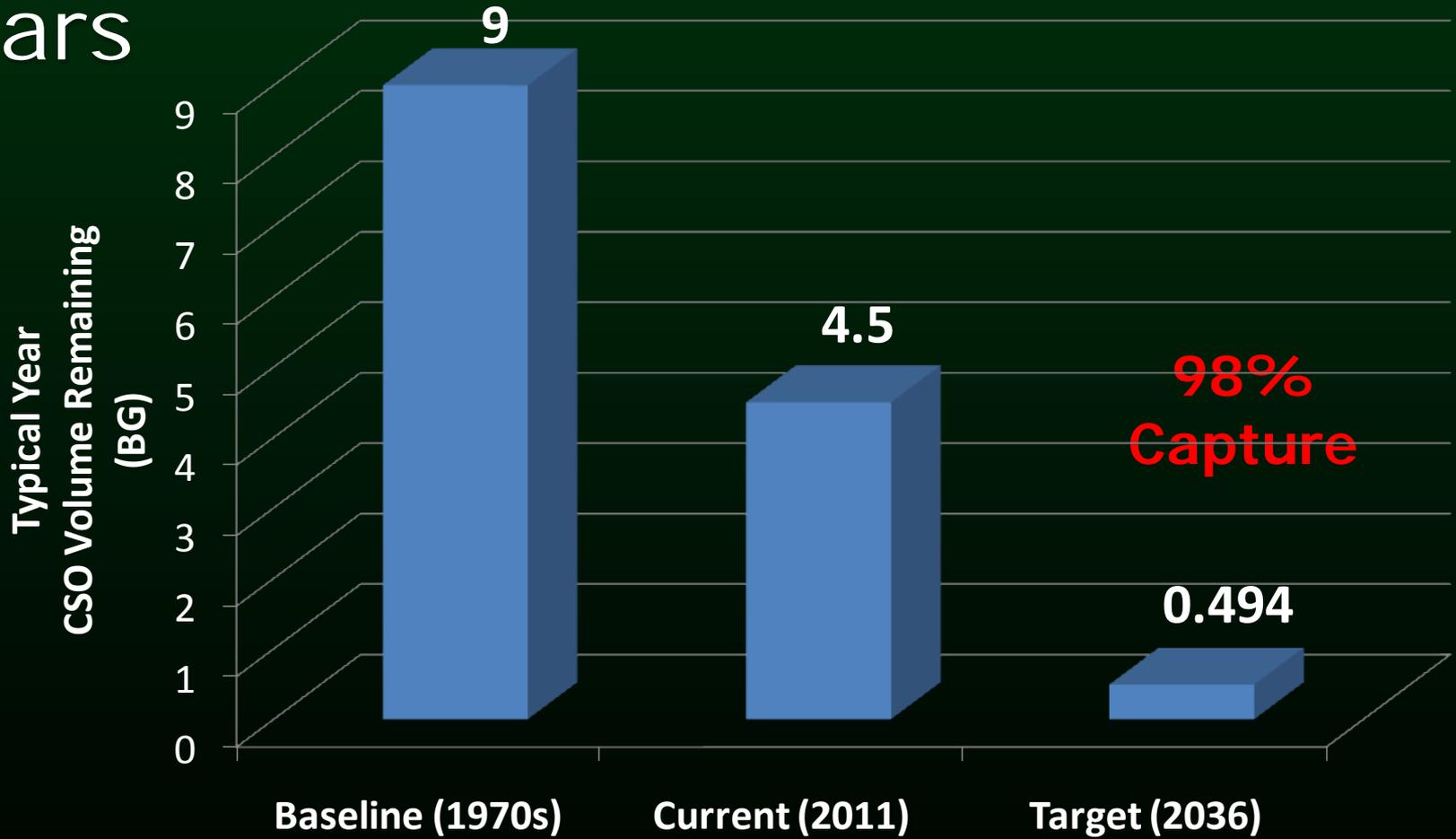


- Legend**
- ▲ Wastewater Treatment Plant
 - CSO
 - Water
 - Community
 - Easterly Combined Sewer Area
 - Westerly Combined Sewer Area
 - Southerly Combined Sewer Area

126 CSO Locations Throughout Combined Sewer Area



Consent Decree Requires Northeast Ohio's CSO Problem Reduced in 25 Years



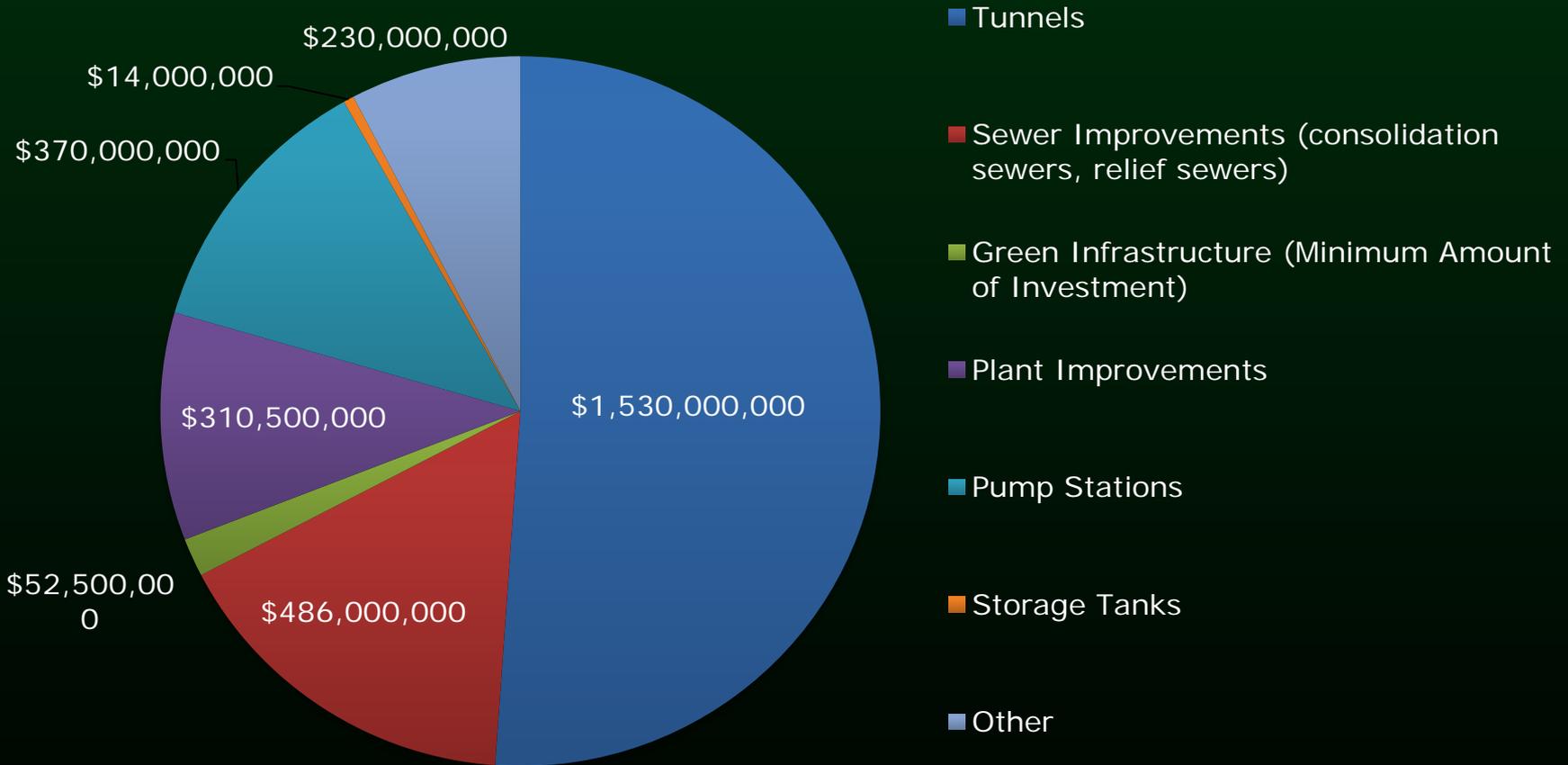
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CSO Long-Term Control Plan Consent Decree

\$3B Investment in CSO Control Measures over 25 Years



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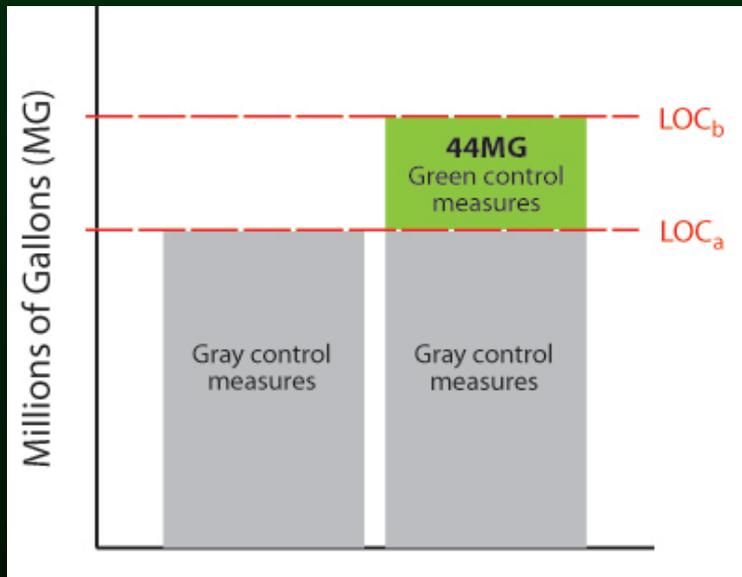
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NEORSD CSOs "By the numbers"

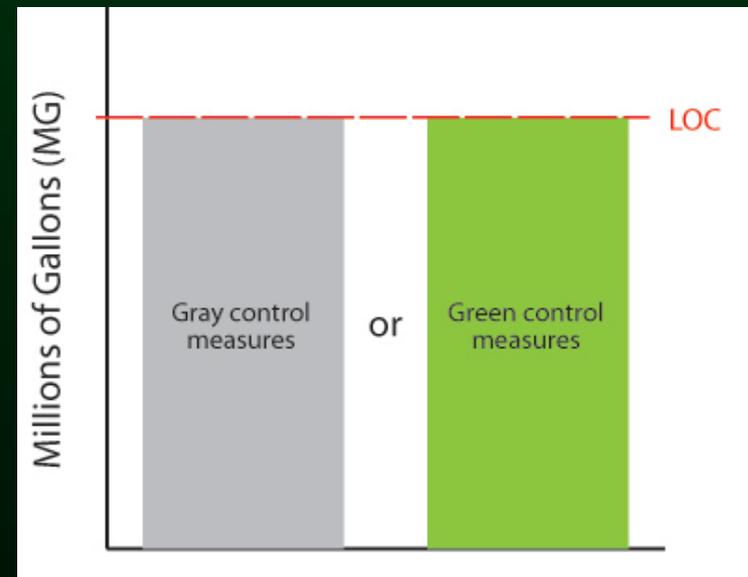
Component	Baseline	Original Plan (2002)	Consent Decree Plan (2010)
Level of Control	Up to 80 overflows/year (some outfalls)	<4 overflows/year	<2 overflows/year (priority CSOs) <3 overflows/year
Remaining Overflow Volume (Typ. Year)	4,531,000,000 (reduced from 9 BG since 1970's)	1,097,000,000	
Implementation Schedule	~40 Years	30 Years	
Costs	~\$1B invested to-date	\$2.3 B	
Percent Capture	N/A	97%	
Green Infrastructure	N/A	N/A	



CSO Consent Decree includes two options for Green Infrastructure



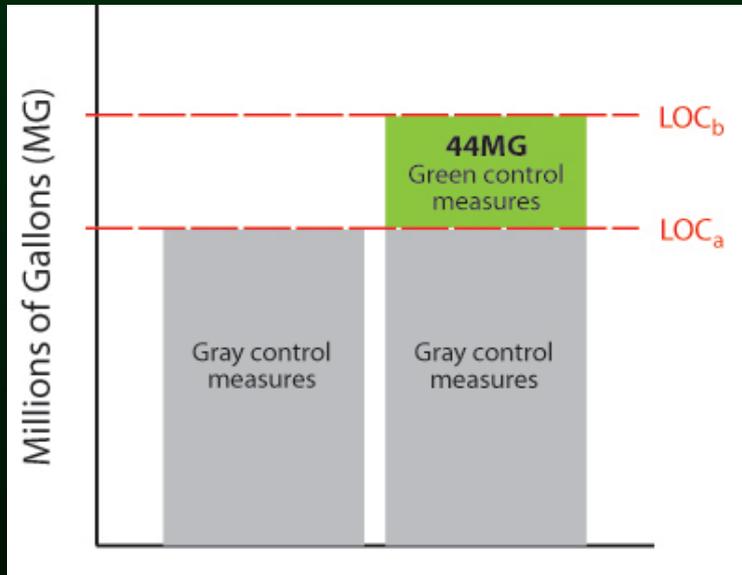
Appendix 3: "Gray plus Green"
(District GI Plan, 2011)



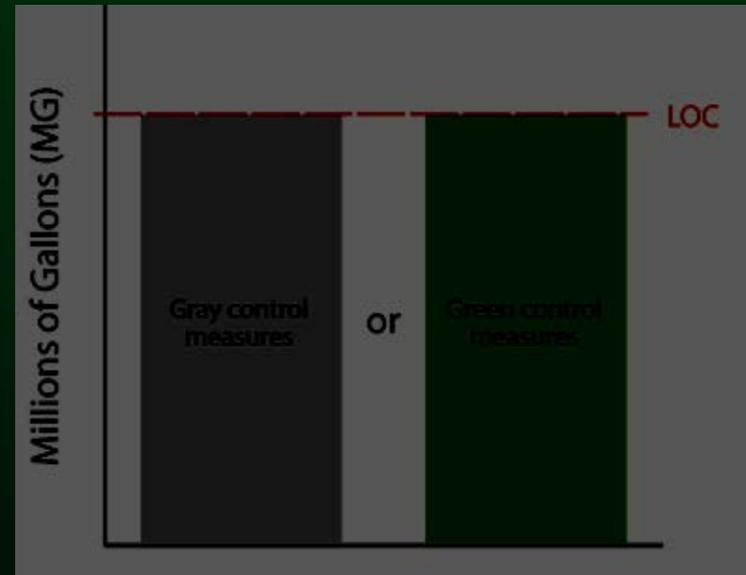
Appendix 4: "Gray vs. Green"
(Right-size gray using green)



CSO Consent Decree includes two options for Green Infrastructure



Appendix 3: Gray & Green



Appendix 4: Gray vs. Green

Appendix 3 Green Infrastructure

\$42 Million for 44 Million Gallons in 8 Years with Green Infrastructure

Consent Decree



Enter into
Consent
Decree

Green Infrastructure Design + Construction – 8 years

Monitoring

Compliance

2011

2012

2013

2014

2015

2016

2017

2018

2019

2020

2021

2022

2023

July 7, 2011

Green Infrastructure Monitoring
Plan Submittal

Compliance
Deadline

2011

GRAY INFRASTRUCTURE TIMELINE

2036



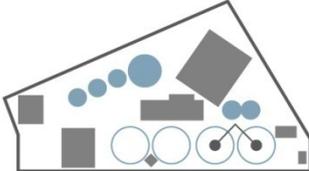
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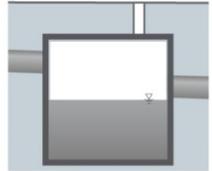
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Components of the Long-Term Control Plan

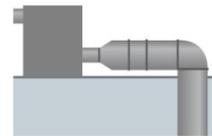
Improve the Collections System



Increased WWTP Capacity
Treatment & Disinfection

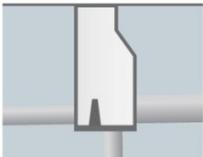


Storage Tanks

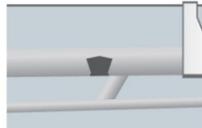


Pump Station Upgrades

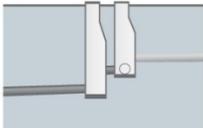
Optimize the Existing Sewer System



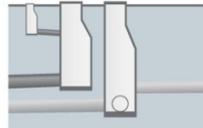
Regulator modifications



In-Line Storage

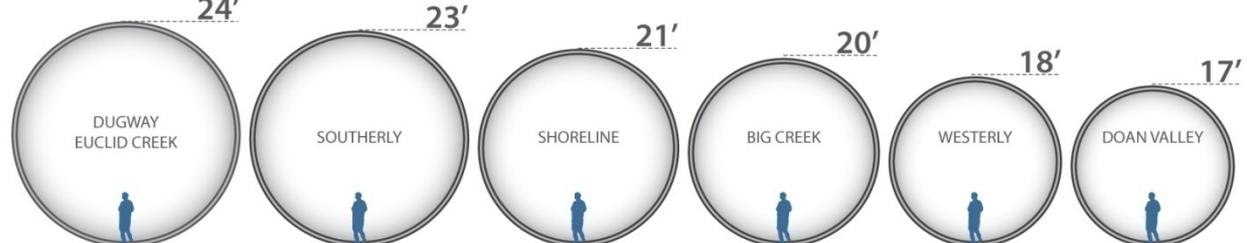


Relief Sewers



Separation

Store/Convey for Treatment

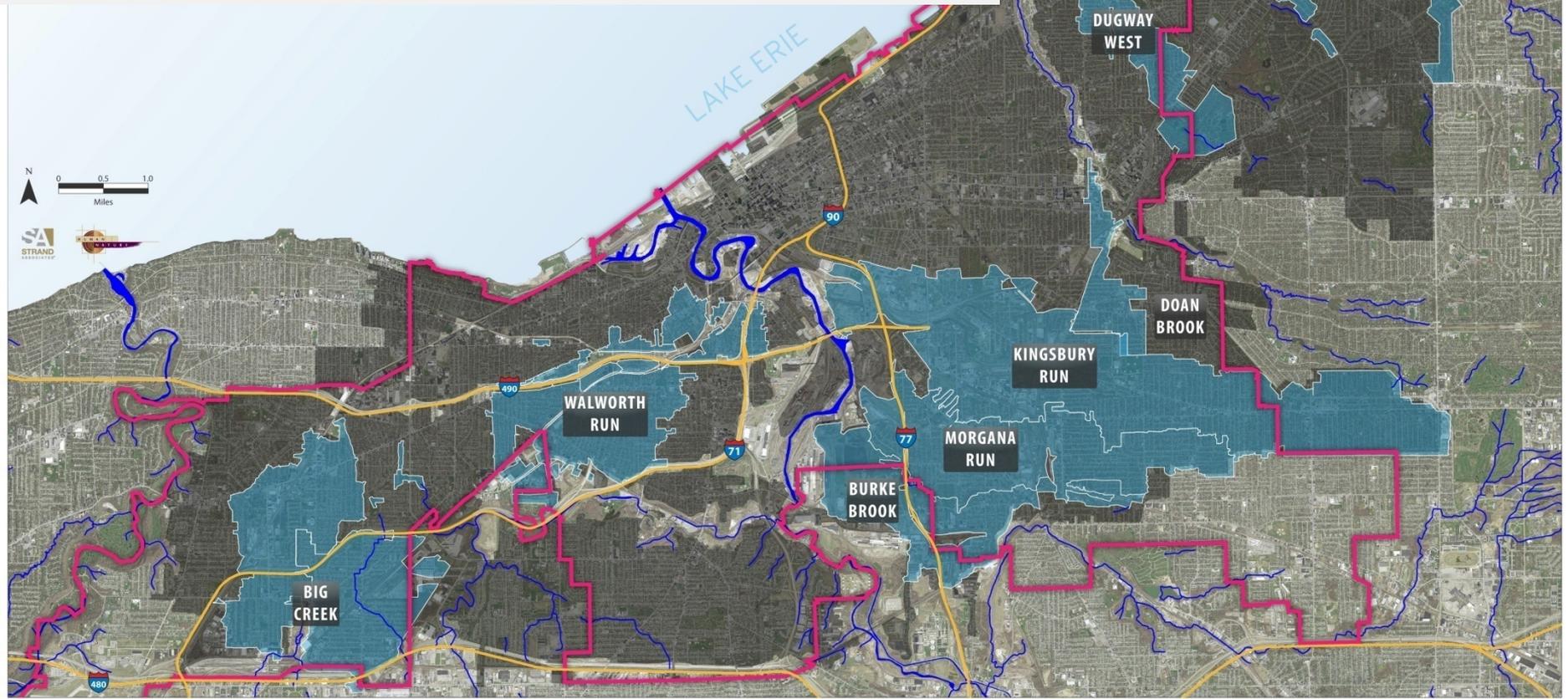


GRAY

TYPICAL YEAR CSO REDUCTION
4,037 MG

NEORSD GREEN INFRASTRUCTURE

Looking across combined sewer area for opportunities to manage stormwater before it enters combined system

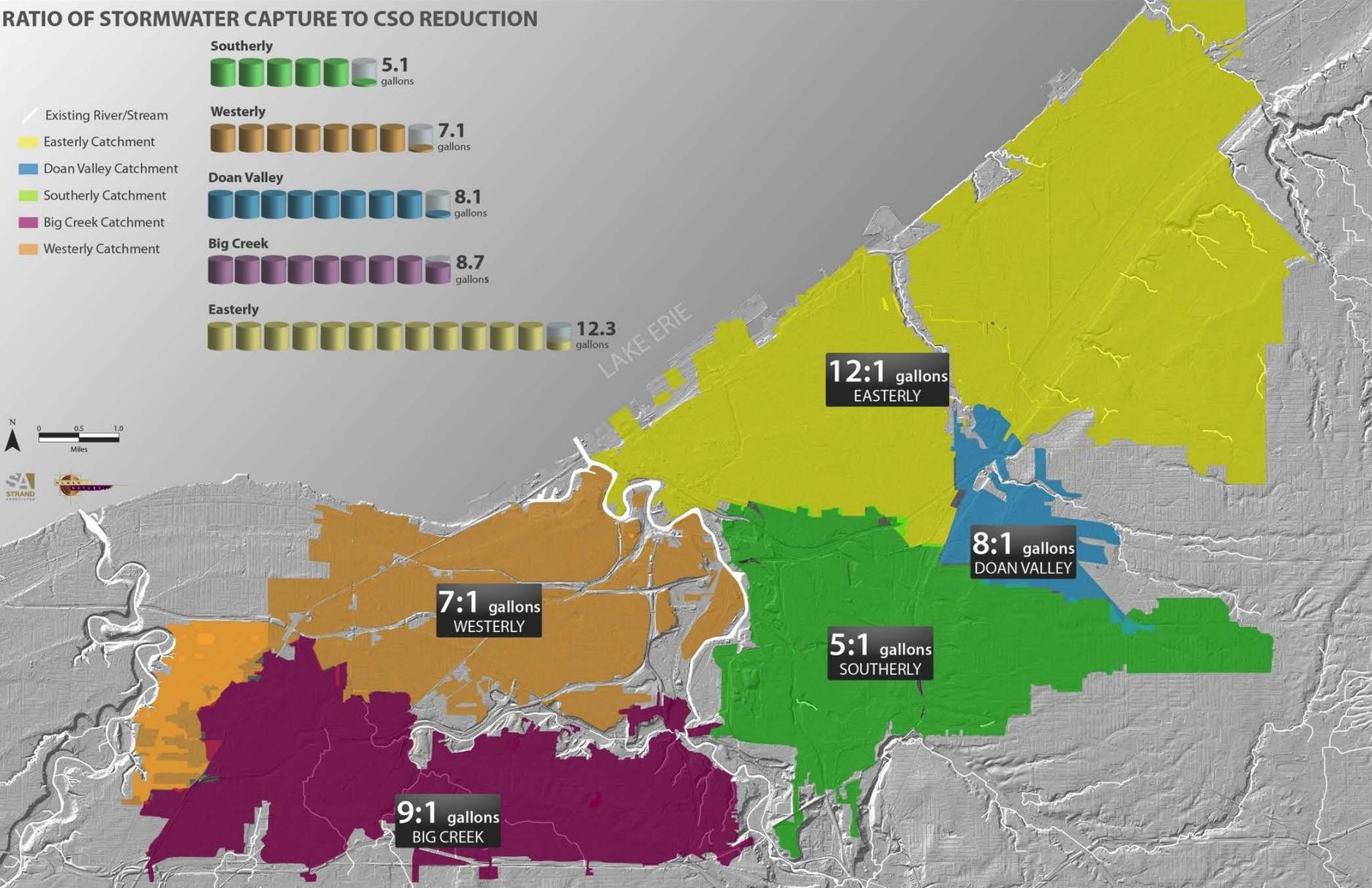
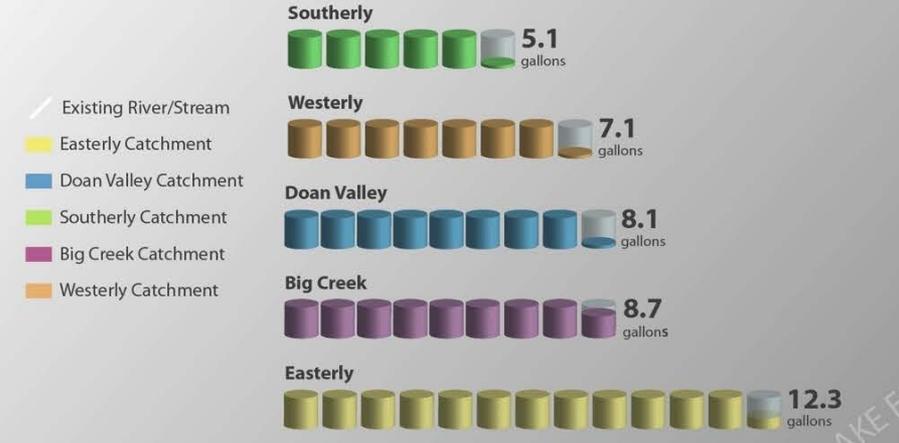


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CSO Catchments: Stormwater/CSO Ratios

RATIO OF STORMWATER CAPTURE TO CSO REDUCTION



Northeast Ohio Regional Overview

SUMMARY OF OPPORTUNITY/DISTRESSED PARCELS

GREEN INFRASTRUCTURE DESIGN • APRIL 2012 • DRAFT

23,000 Number of opportunity/distressed parcels in the City of Cleveland

3,581 Acres of opportunity/distressed parcels

16,000 Number of buildings on opportunity/distressed parcels

750 Buildings on opportunity/distressed parcels (this does not include vacant buildings)



Cleveland Population Loss

1950	914,808
1990	505,616
2000	478,403
2008	431,552
2010	396,815

57%
Decline



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Project Clean Lake

Promoting GI for CSO Control in Cleveland

- Engage City of Cleveland
 - They have the land
 - We have the consent decree
- Work with Community Development Corporations and neighborhoods
- Connect to development activities





No stormwater runoff from this site through the 100-yr storm



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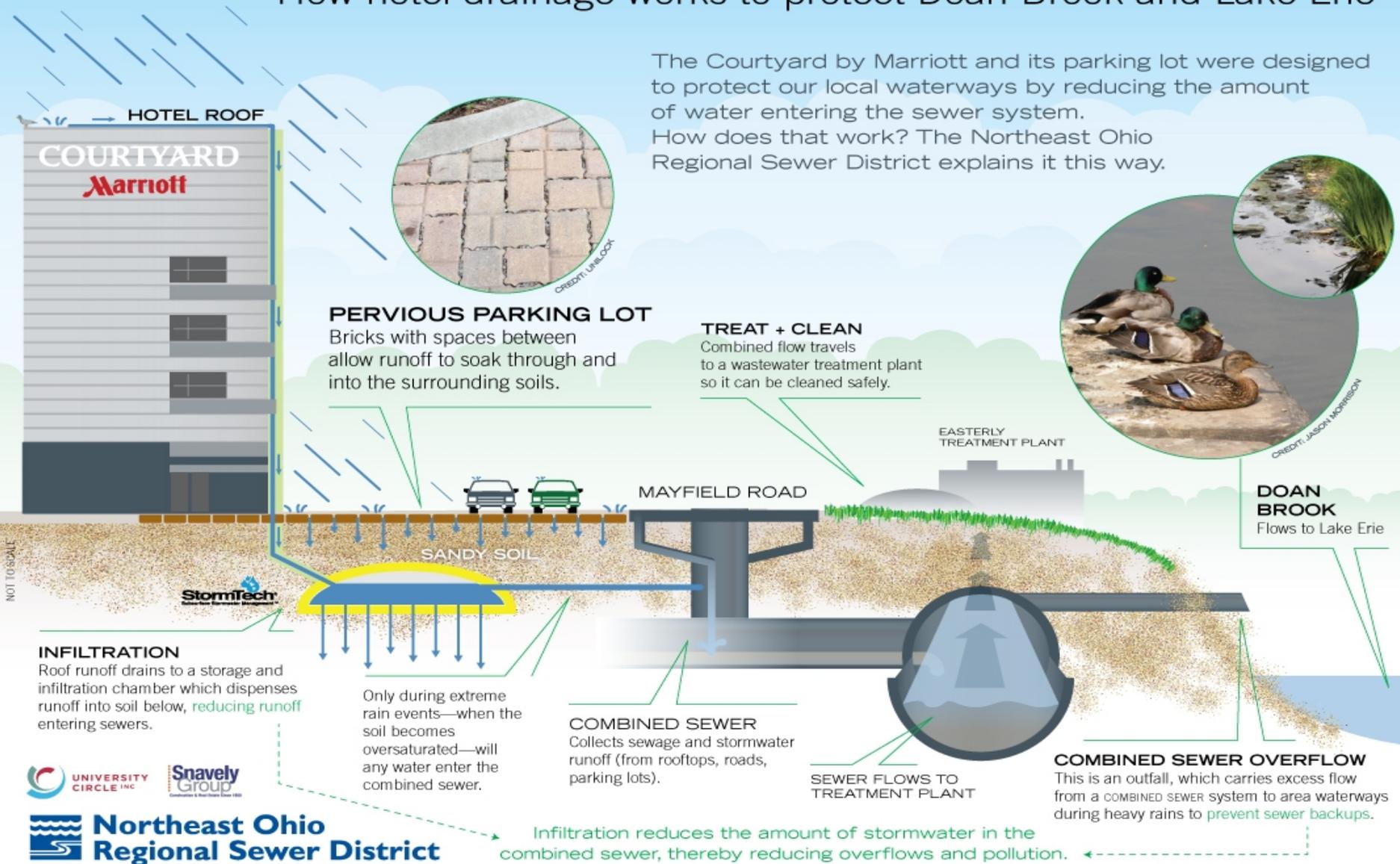
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Keeping our Great Lake great.

How hotel drainage works to protect Doan Brook and Lake Erie

The Courtyard by Marriott and its parking lot were designed to protect our local waterways by reducing the amount of water entering the sewer system.

How does that work? The Northeast Ohio Regional Sewer District explains it this way.



CREDIT: UNILOCK



CREDIT: JASON MACREISSON

PERVIOUS PARKING LOT
Bricks with spaces between allow runoff to soak through and into the surrounding soils.

TREAT + CLEAN
Combined flow travels to a wastewater treatment plant so it can be cleaned safely.

EASTERLY TREATMENT PLANT

MAYFIELD ROAD

SANDY SOIL

DOAN BROOK
Flows to Lake Erie

NOT TO SCALE

StormTech
Stormwater Management

INFILTRATION
Roof runoff drains to a storage and infiltration chamber which dispenses runoff into soil below, reducing runoff entering sewers.

Only during extreme rain events—when the soil becomes oversaturated—will any water enter the combined sewer.

COMBINED SEWER
Collects sewage and stormwater runoff (from rooftops, roads, parking lots).

SEWER FLOWS TO TREATMENT PLANT

COMBINED SEWER OVERFLOW
This is an outfall, which carries excess flow from a combined sewer system to area waterways during heavy rains to prevent sewer backups.



Infiltration reduces the amount of stormwater in the combined sewer, thereby reducing overflows and pollution.

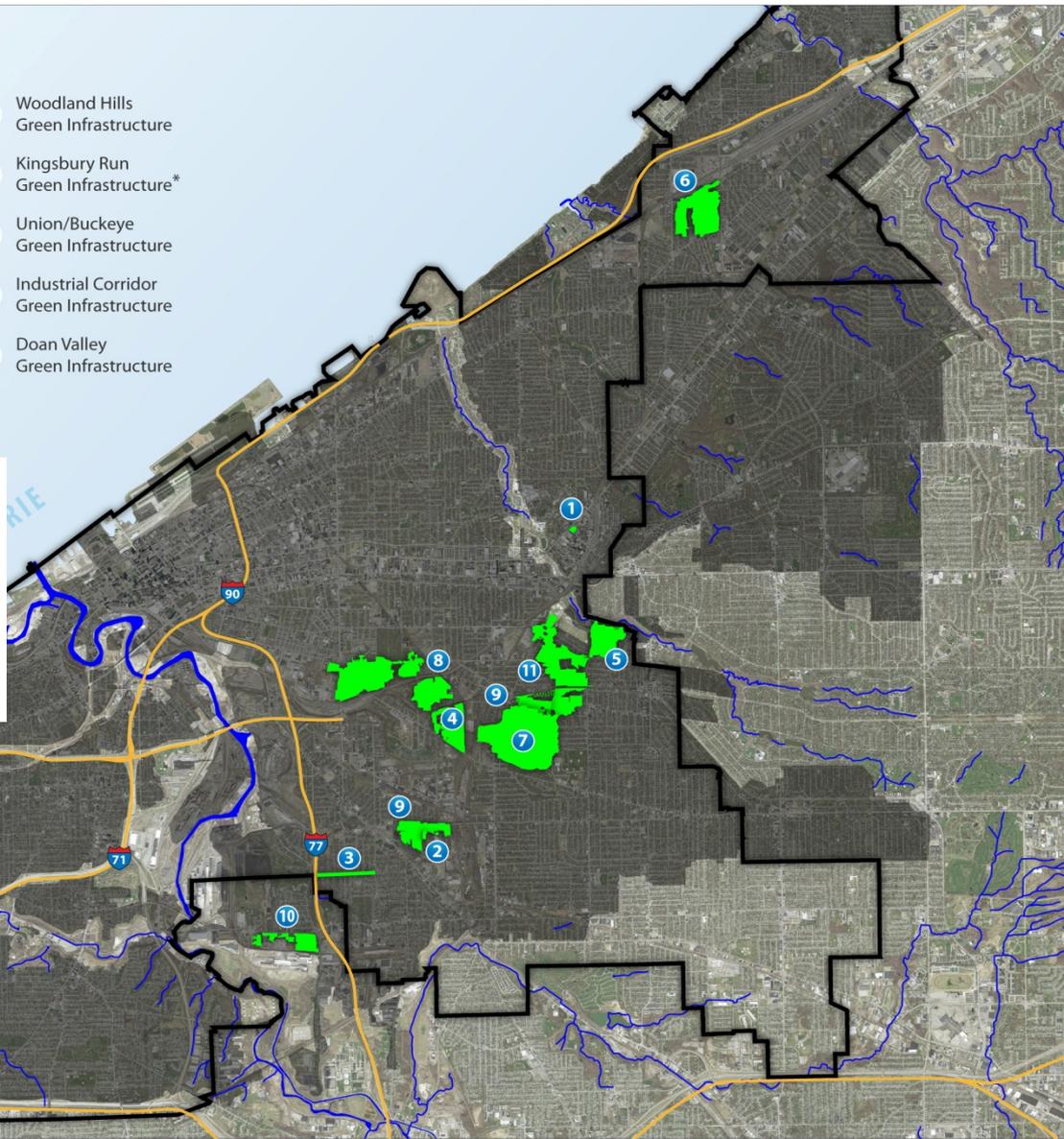


APPENDIX 3 GREEN INFRASTRUCTURE

October 2013

- Interstate
- Existing River/Stream
- Approximate Combined Sewer Service Area
- City of Cleveland Boundary

- | | |
|---|--|
| 1 University Circle Green Infrastructure Demonstration Project | 7 Woodland Hills Green Infrastructure |
| 2 Slavic Village Demonstration Projects | 8 Kingsbury Run Green Infrastructure* |
| 3 Fleet Avenue Green Infrastructure* | 9 Union/Buckeye Green Infrastructure |
| 4 Urban Agriculture | 10 Industrial Corridor Green Infrastructure |
| 5 Fairhill-MLK | 11 Doan Valley Green Infrastructure |
| 6 East 140 th Street Consolidation & Relief Sewer Project | |



Appendix 3 GI Projects:

- ≈46 MG of CSO Control
- ≈\$80 million Capital Cost
- 10 Projects: 2013-2019



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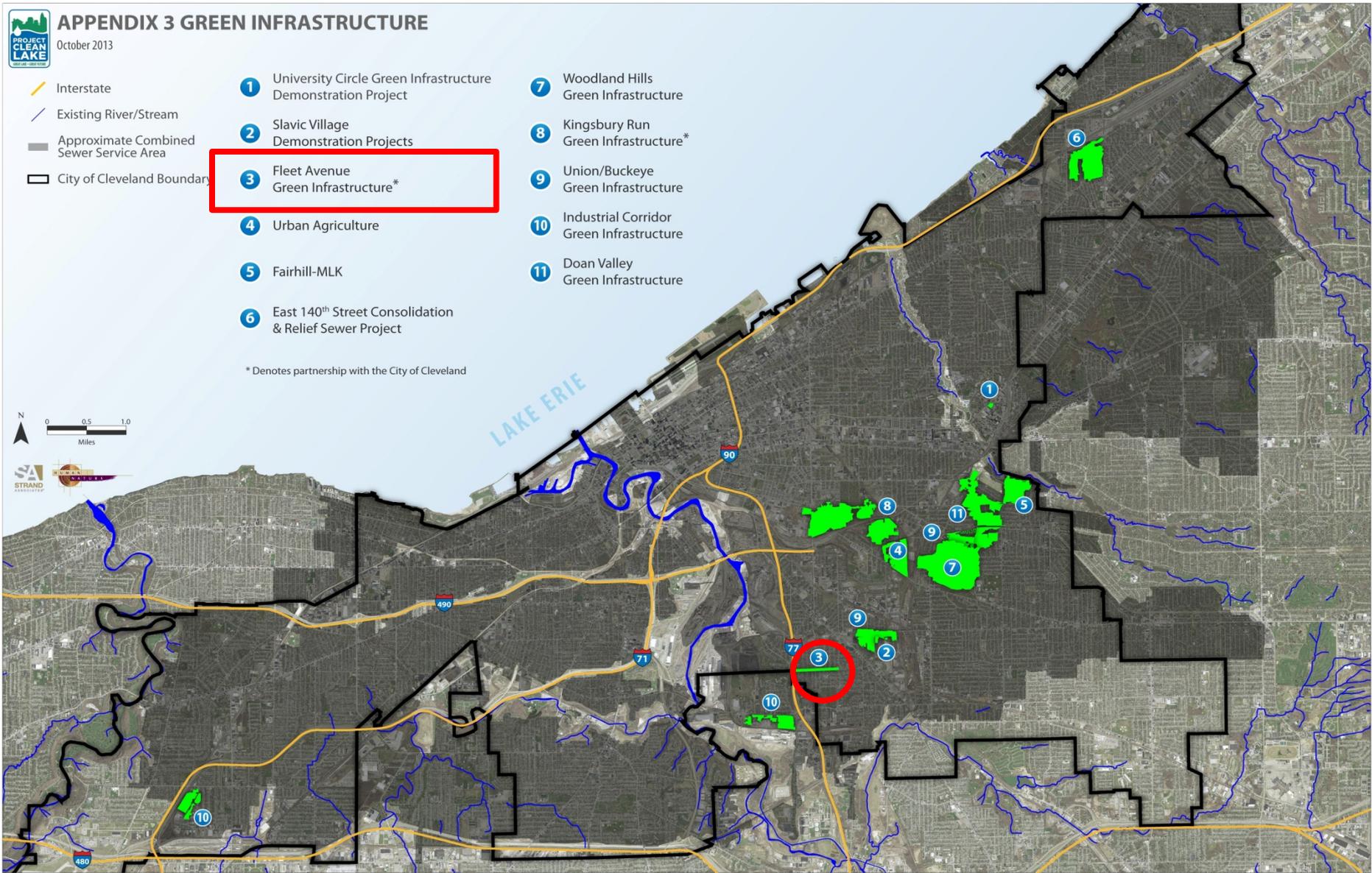
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* Denotes partnership with the City of Cleveland



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Fleet Avenue Green Infrastructure Project



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Fleet Avenue Green Infrastructure Control Measure

Existing Site

- 3 Vacant Parcels
- 0.27 total acres

Integrated with City street reconstruction

Green infrastructure result of neighborhood planning project



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Fleet Avenue Green Infrastructure Project



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GI Project	Est. Construction Start	Est. Construction Cost	Est. Stormwater Capture (MG)	Est. CSO Reduction (MG)
Fleet Avenue*	Q1 2014	\$1,300,000	9.00	0.90



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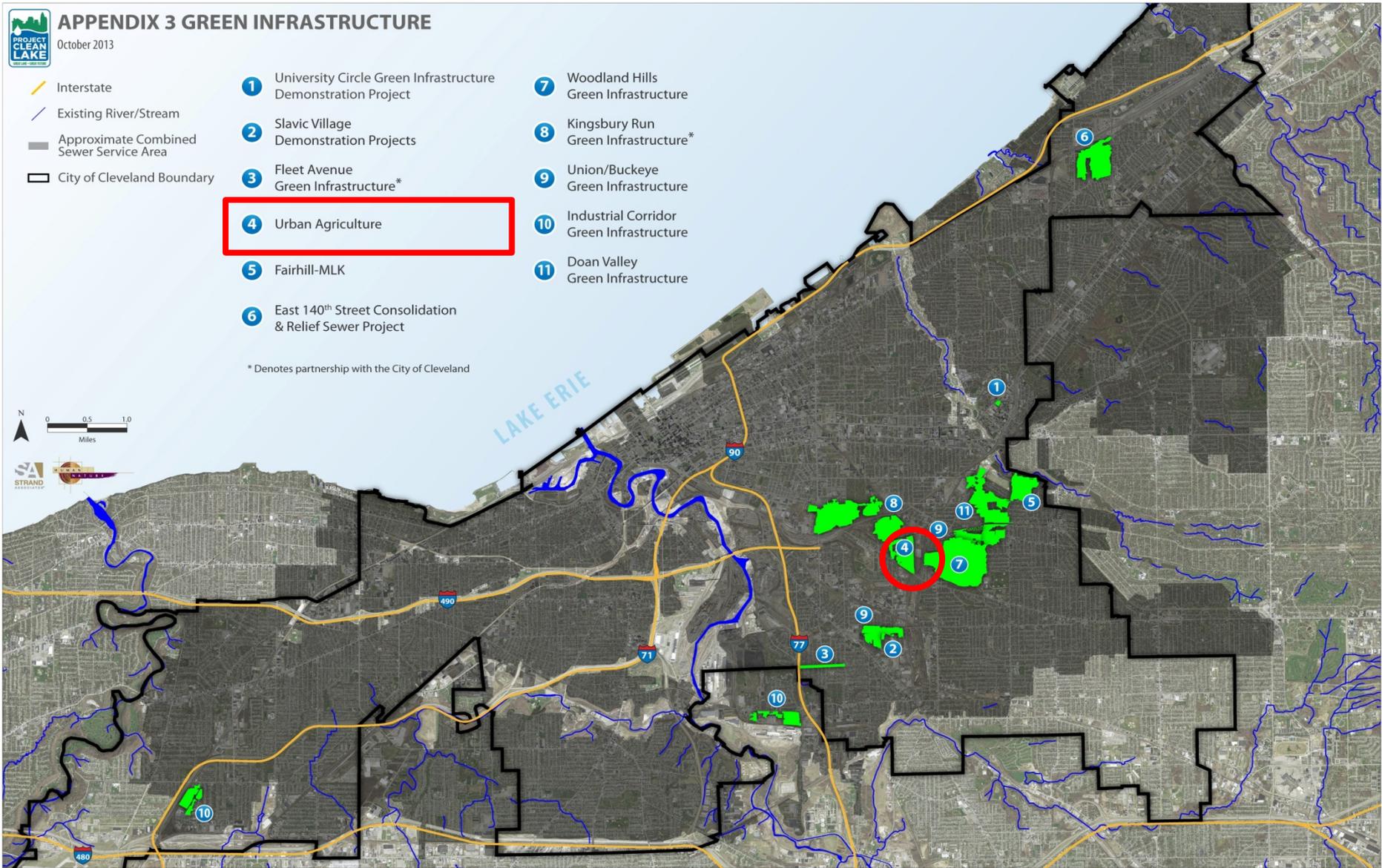
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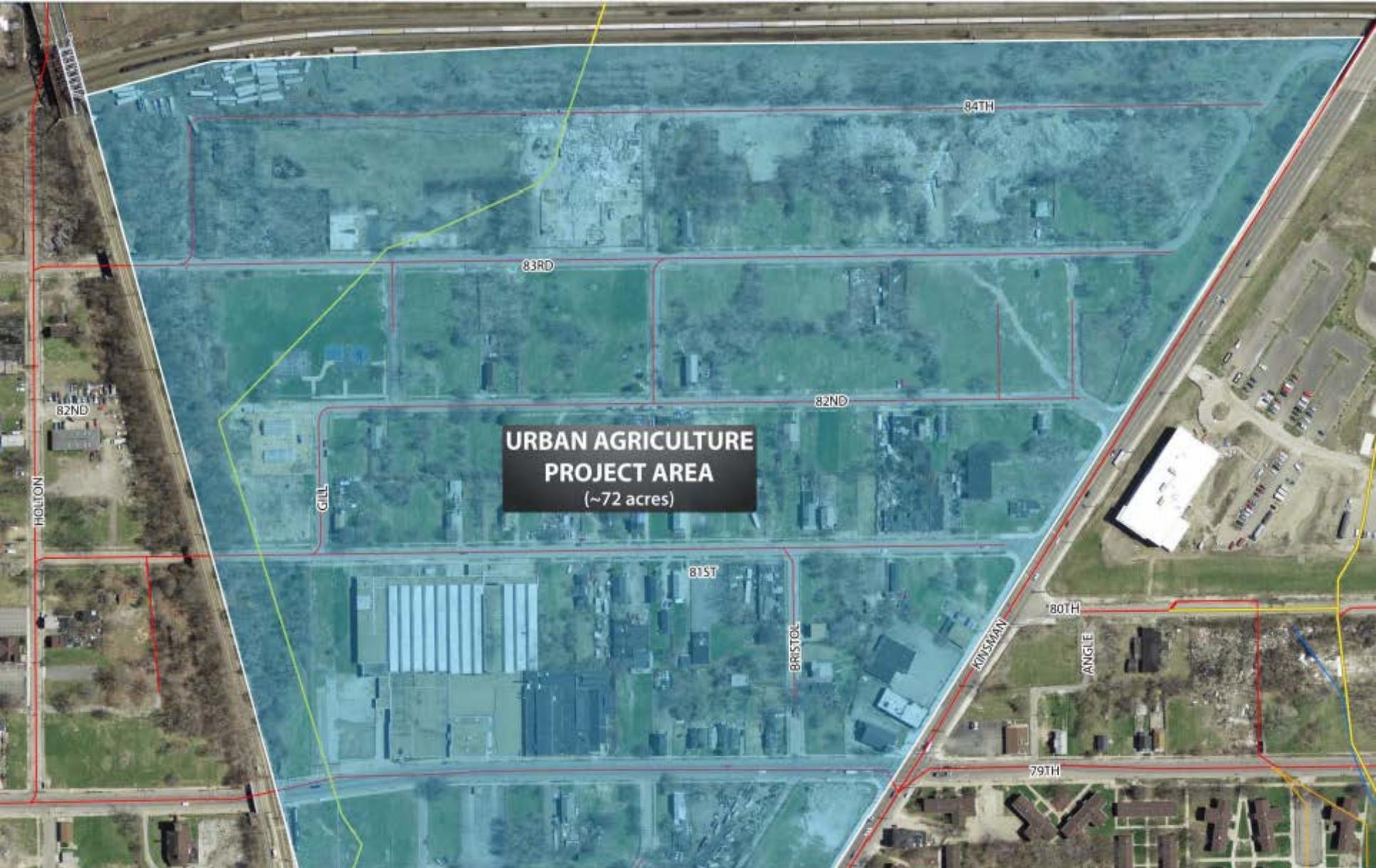
* Denotes partnership with the City of Cleveland



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**URBAN AGRICULTURE
PROJECT AREA**
(~72 acres)



Your Sewer District **Keeping our Great Lake great.**



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Site of Urban Agricultural Innovation Zone ca. 1950



84TH

83RD

82ND

GILL

82ND

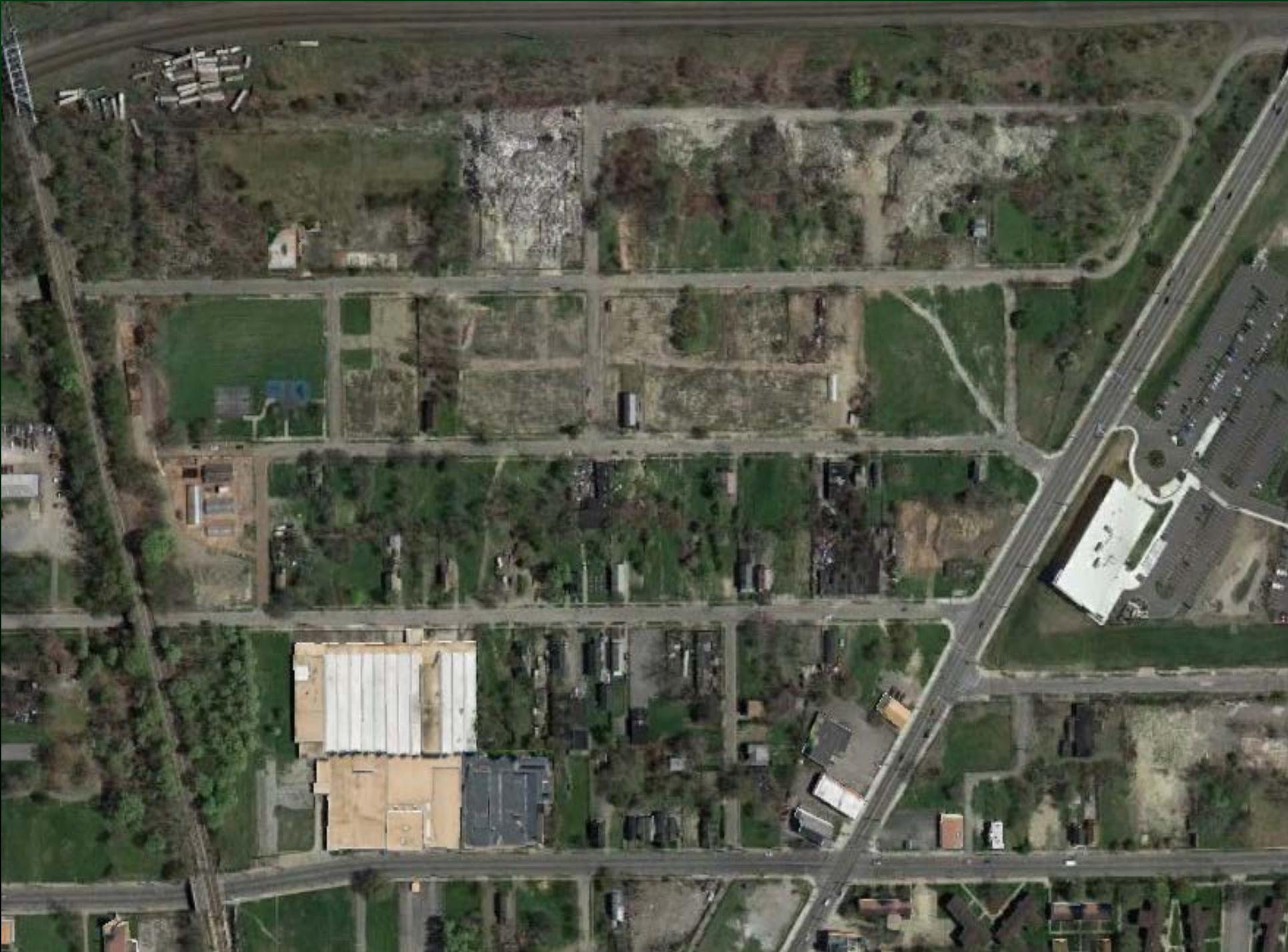
81ST

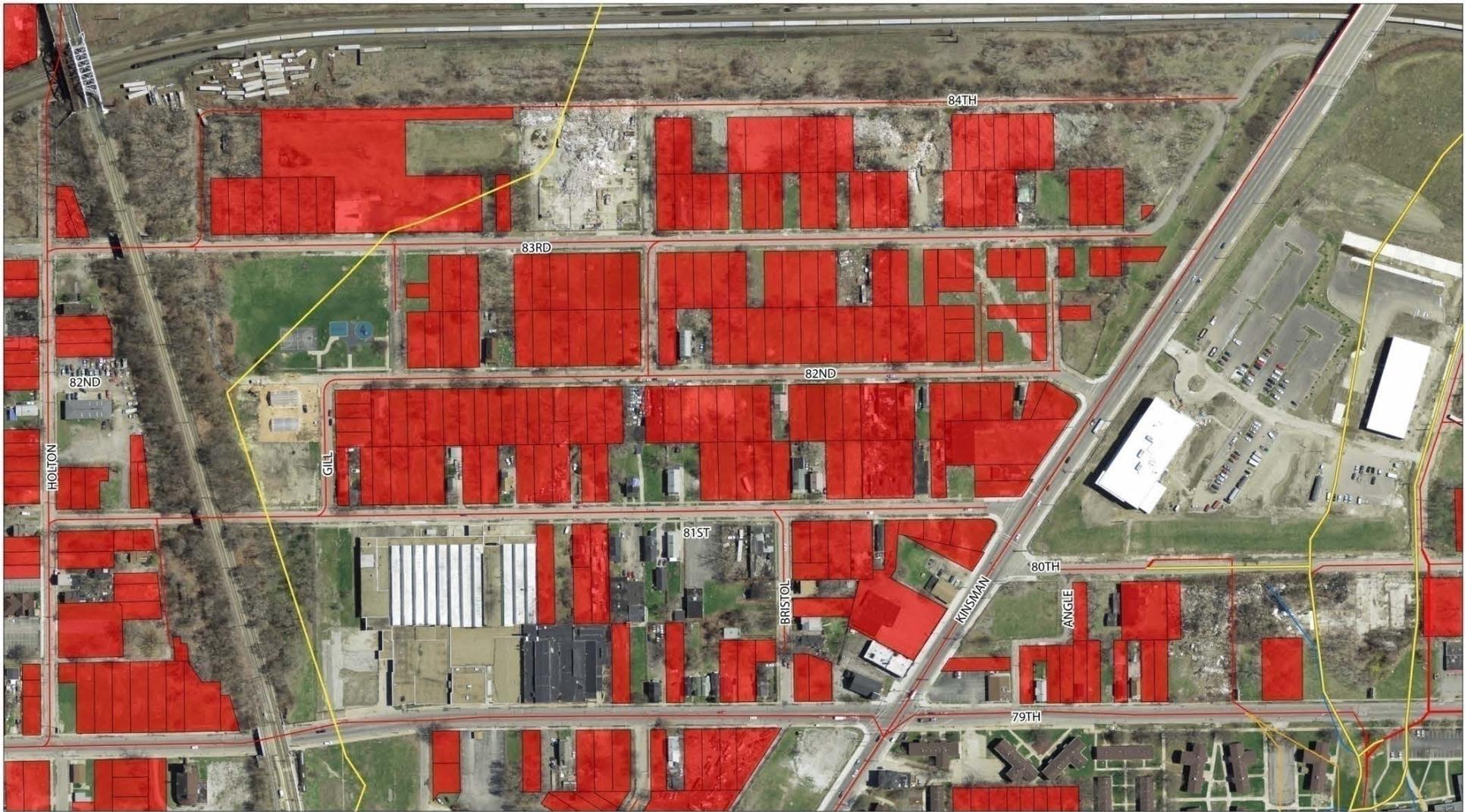
BRISTOL

KINSMAN

80TH

79TH





DATA SOURCES: NEORS

Legend

- Combined Sewer
- SWO Sewer
- Opportunity/Distressed Parcels
- Sanitary Sewer
- Storm Sewer

NORTHEAST OHIO REGIONAL SEWER DISTRICT
CANDIDATE PROJECT AREAS
URBAN AGRICULTURE



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Urban Agricultural Innovation Zone – Existing Conditions



East 82nd Street / Glade Avenue

Urban Agricultural Innovation Zone – Existing Conditions



04/19/2012 11:51



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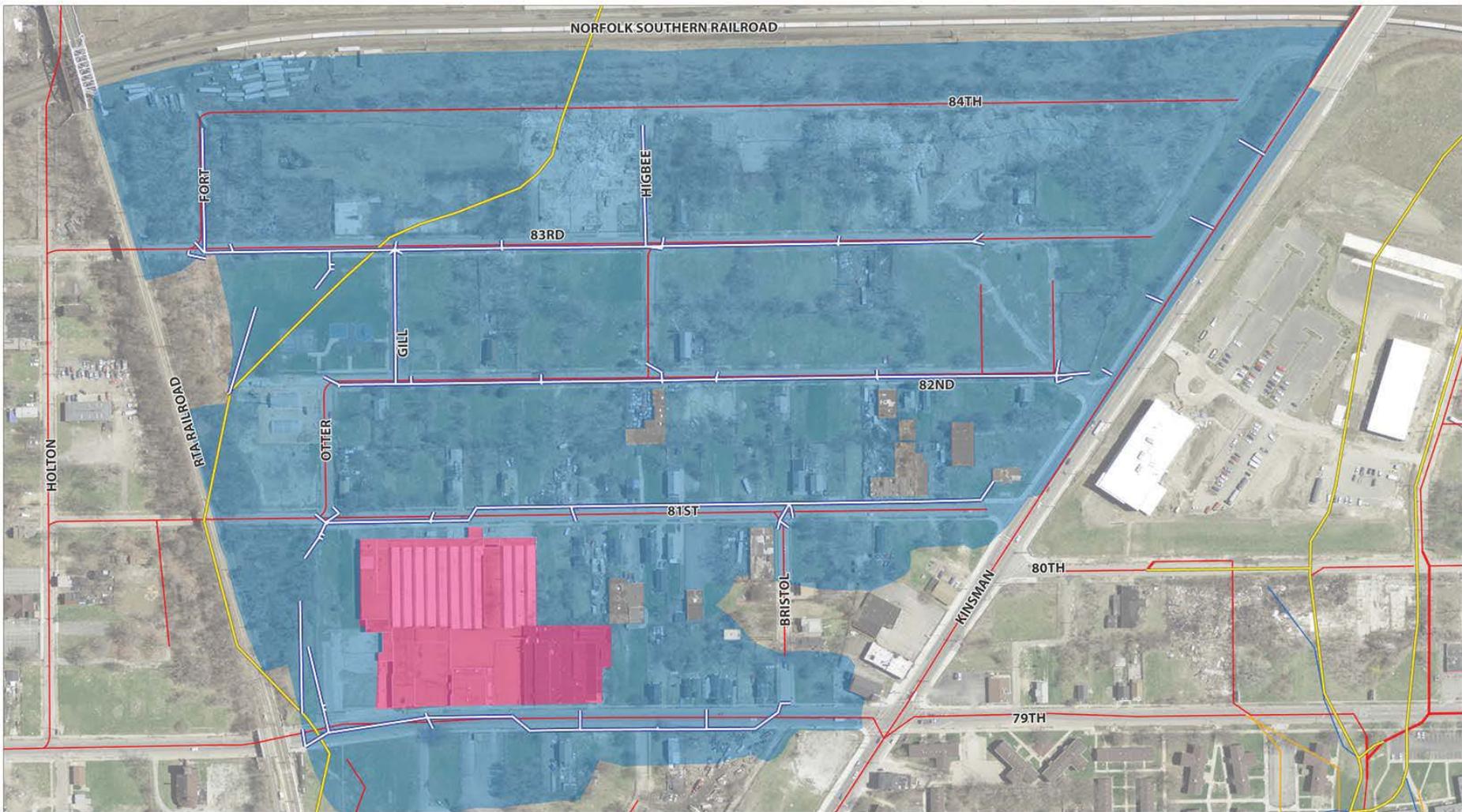
Rid-All Green Partners – Urban Agricultural Innovation Zone



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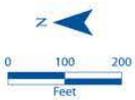
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DATA SOURCES: NEORSO

Legend

- Combined Sewer
- SWO Sewer
- Drainage Area (Modeled Benefit)
- Sanitary Sewer
- Proposed Storm Sewer
- Drainage Area (Potential Benefit)
- Storm Sewer



NORTHEAST OHIO REGIONAL SEWER DISTRICT
EARLY ACTION PROJECTS
 URBAN AGRICULTURE EAP
 DRAINAGE AREA



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Urban Agricultural Innovation Zone

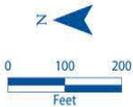


Legend

-  SWO Sewer (Kingsbury Run)
-  Proposed Storm Sewer



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DATA SOURCES: NEORSO

NORTHEAST OHIO REGIONAL SEWER DISTRICT
EARLY ACTION PROJECTS

**URBAN AGRICULTURE EAP
 CONCEPT**





URBAN AGRICULTURE INNOVATION ZONE
EAST BIORETENTION BASIN
CONCEPT RENDERING



EXISTING CONDITIONS



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GI Project	Est. Construction Start	Est. Construction Cost	Est. Stormwater Capture (MG)	Est. CSO Reduction (MG)
Urban Agriculture	Q2 2014	\$5,607,126	9.50	1.80

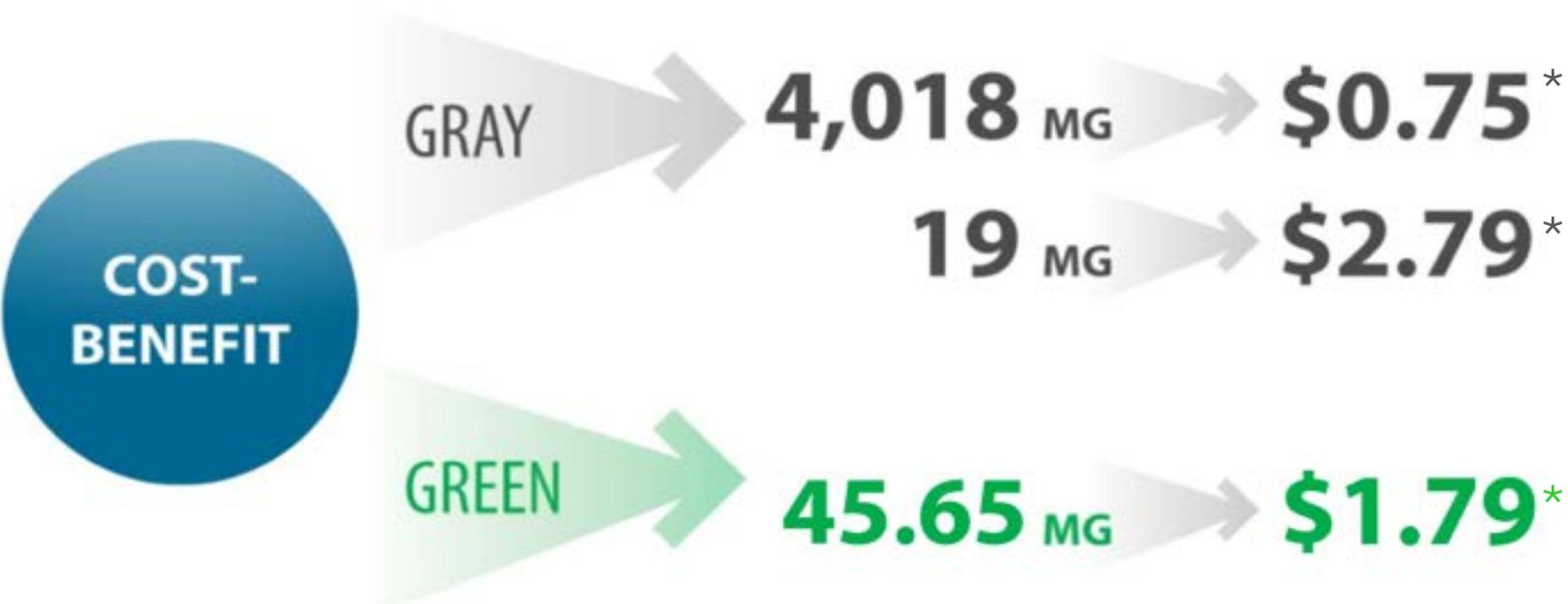


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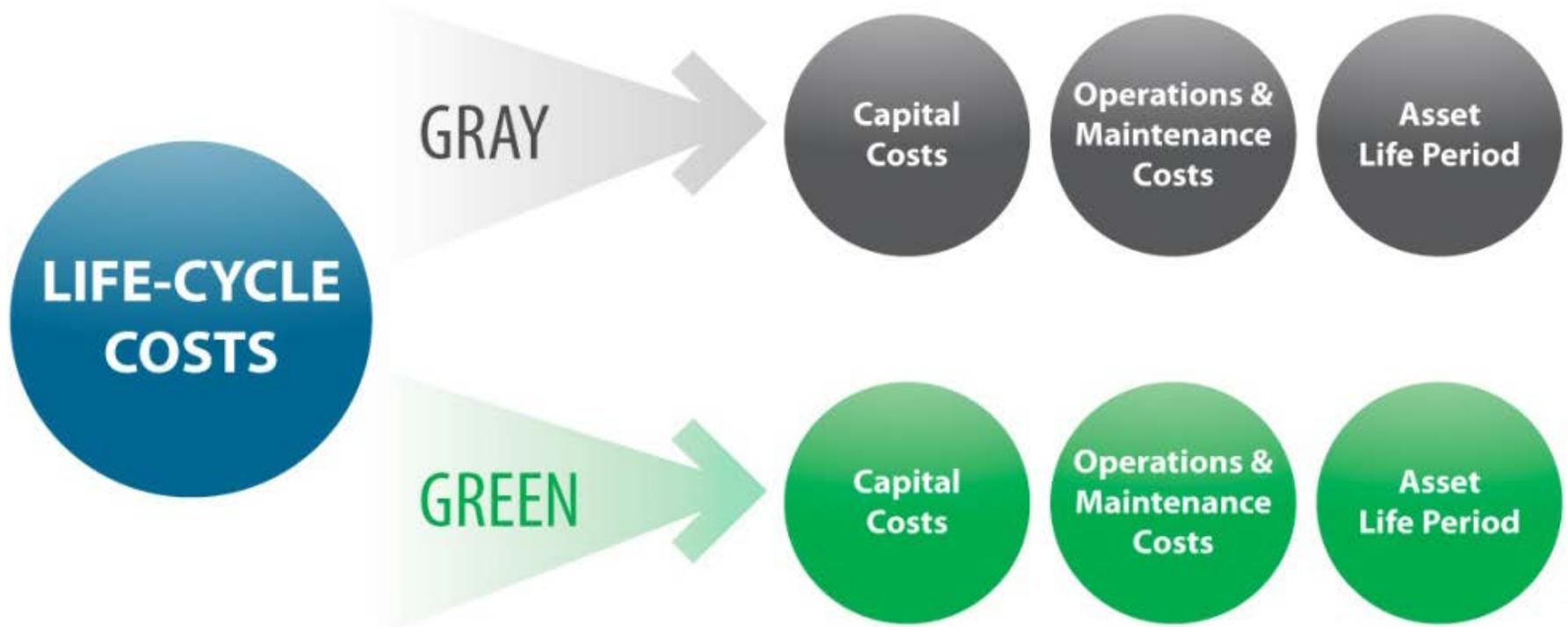
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Assessment of Benefits

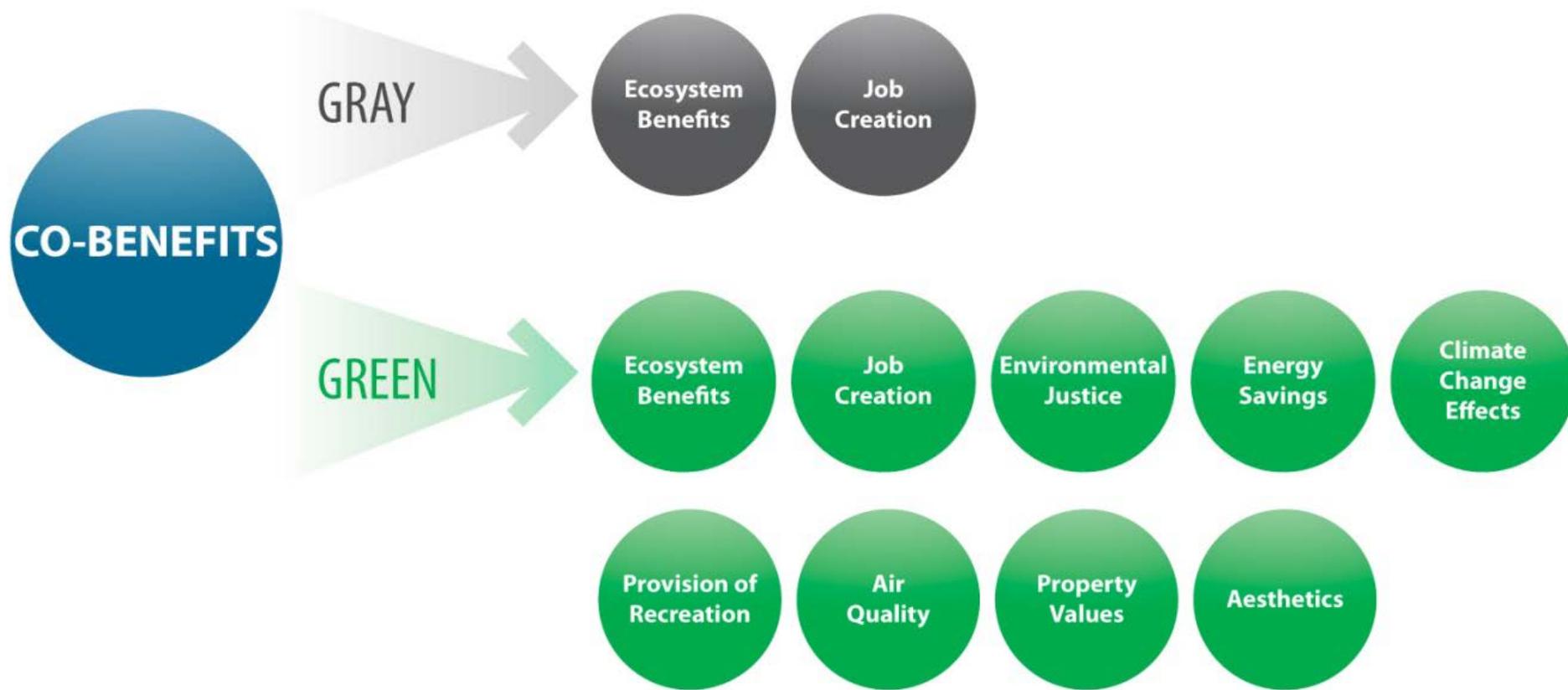


*Construction Costs only
(does not include O&M)

Assessment of Benefits



Assessment of Benefits





NORTHEAST OHIO REGIONAL SEWER DISTRICT



REGIONAL
STORMWATER
MANAGEMENT
PROGRAM

REGIONAL STORMWATER MANAGEMENT PROGRAM

Addressing flooding, erosion, and water quality



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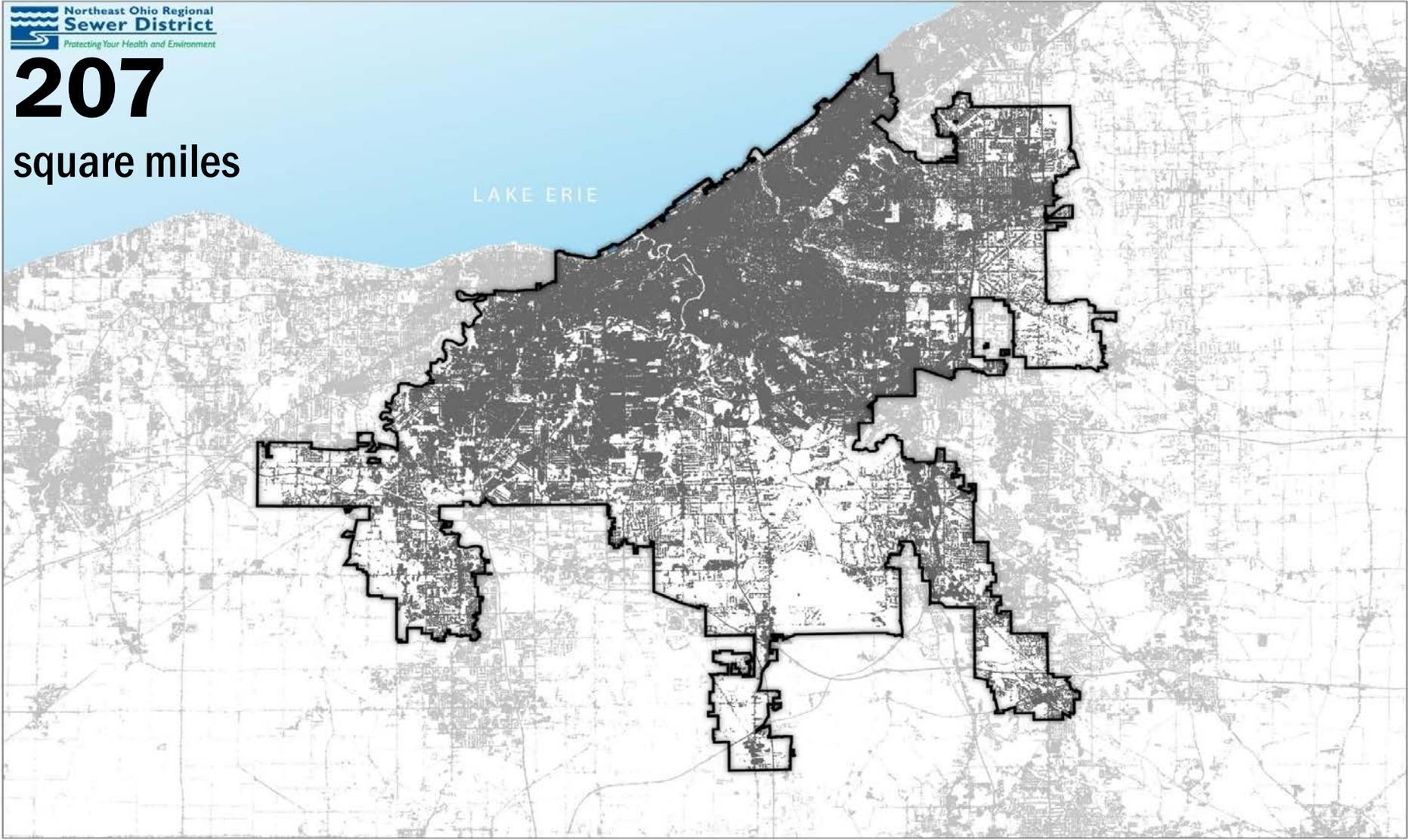


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Impervious Surfaces

Northeast Ohio Regional
Sewer District
Protecting Your Health and Environment

207
square miles



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NORTHEAST OHIO REGIONAL SEWER DISTRICT



REGIONAL
STORMWATER
MANAGEMENT
PROGRAM

**Impervious Surfaces = Stormwater Runoff
Stormwater Runoff = Flooding and Erosion**

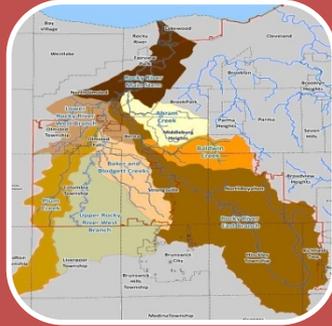


Middleburg Heights/Brook Park,
Ohio along Abram Creek

What Will We Do?



Inspect &
Maintain



SW
Master
Plans



Construct
Projects



Encourage
Good
Practices



Your Sewer District Keeping our Great Lake great.



NEORSD Stormwater Supports GI

- **\$35M/year from impervious surface fee**
 - Inspection and Maintenance
 - Construction for flooding and erosion control projects
 - Partner support/grant programs
- **Stormwater Fee Credits recognize green infrastructure**
 - Quantity Credit
 - Quality Credit
 - Education Credit
 - Individual Residential Credit

Stormwater Fee Credits



Raingarden



PerVIOUS Pavement



Cistern



Bioretention



Retention Pond



Detention Basin

Grant programs

- **Small Scale Stormwater Demonstration Project Grants:** \$756,629 since 2009
- **Watershed Operating Support Grants:** \$930,000 since 2009
- **Community Cost-Share Program:** 25% of stormwater revenue by Community, \$9 million annually



NEORSD GI for CSO Control Summary

- Project Clean Lake's GI commitment
 - Appendix 3 and Appendix 4
- Replace gray infrastructure with green
 - Actively searching for options
- Volume control
 - Stormwater capture \neq CSO reduction
- Regional Stormwater Management Program
 - Important for widespread GI



For more information

Kyle Dreyfuss-Wells

Manager of Watershed Programs

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twitter.com/neorsd

See More GI Around Cleveland

neorsd.blogspot.com/2014/01/green-78-green-infrastructure-projects.html



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Next Webcast

More Bang for the Buck: Integrating Green Infrastructure into Existing Public Works Projects

Tuesday, May 6th, 2014

1:00 – 2:30pm EST

Information and registration will be posted at

http://water.epa.gov/infrastructure/greeninfrastructure/gi_training.cfm