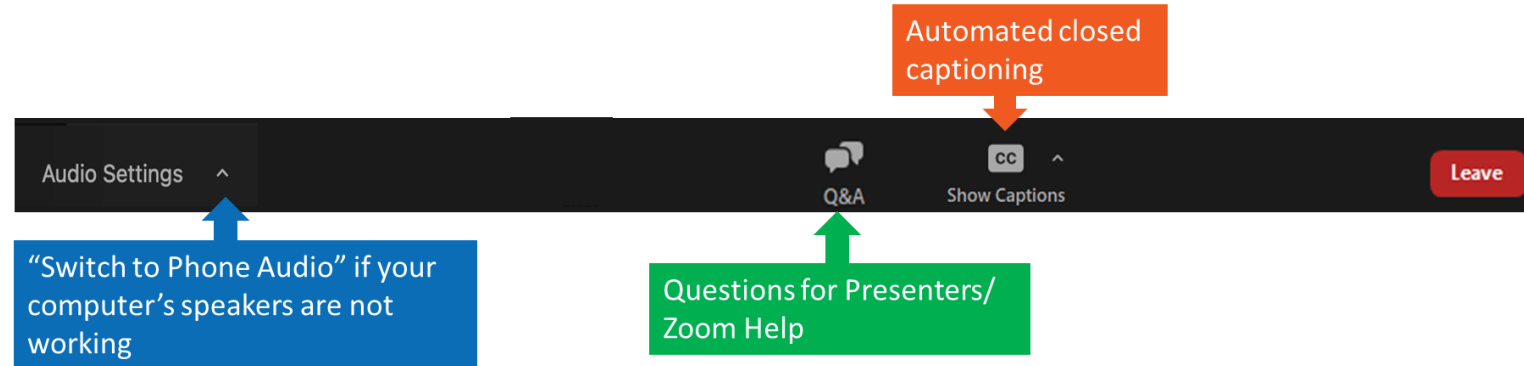




# Communities with Combined Sewers Adapting to a Changing Climate

January 16, 2024

# Webinar Logistics



- This webinar is being recorded.
- To ask a question: Type your question in the Q&A Box for the moderators to see.
- Technical difficulties: If you are having technical difficulties, please send a message through the Q&A Box or email [Kathryn.Harrison@erg.com](mailto:Kathryn.Harrison@erg.com) and the Host will assist you.
- Closed captioning is available by clicking the “CC” button in your control panel
- **Recording:** Please note that we are recording this webinar and will make it available via EPA’s website: <https://www.epa.gov/npdes/combined-sewer-overflow-training>

# Agenda: January 16, 2024

---

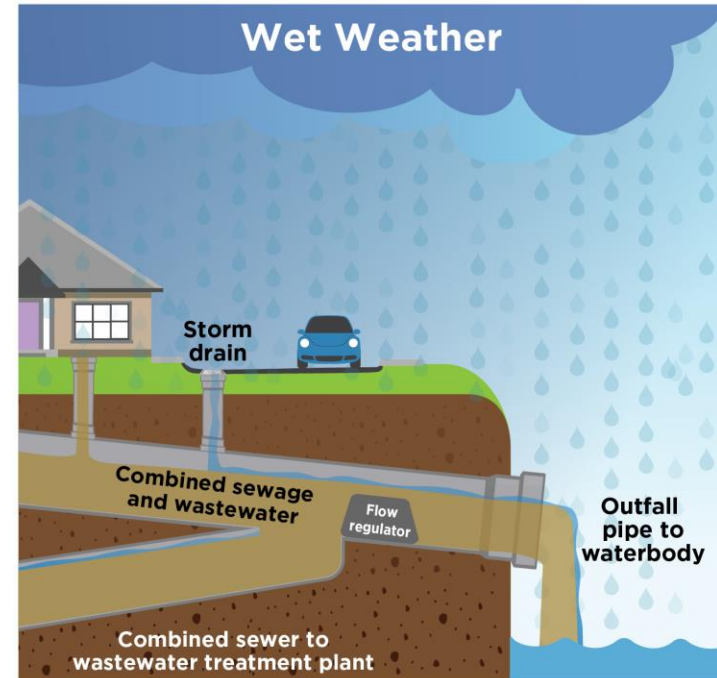
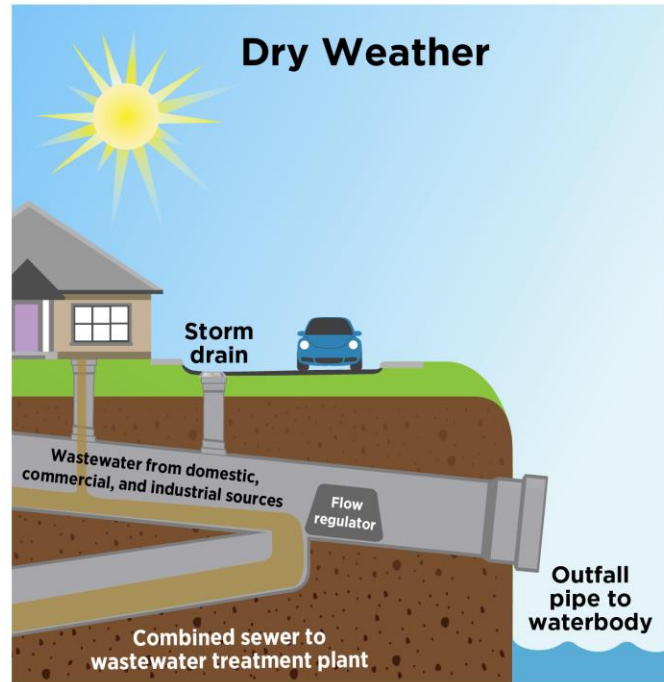
- Opening Remarks – Kathryn Kazior, USEPA
- Buffalo, NY – Rosey Nogle, Buffalo Sewer Authority
- Milwaukee, WI – Kevin Shafer, Milwaukee Metropolitan Sewer District
- Questions and Discussion

# Disclaimer

---

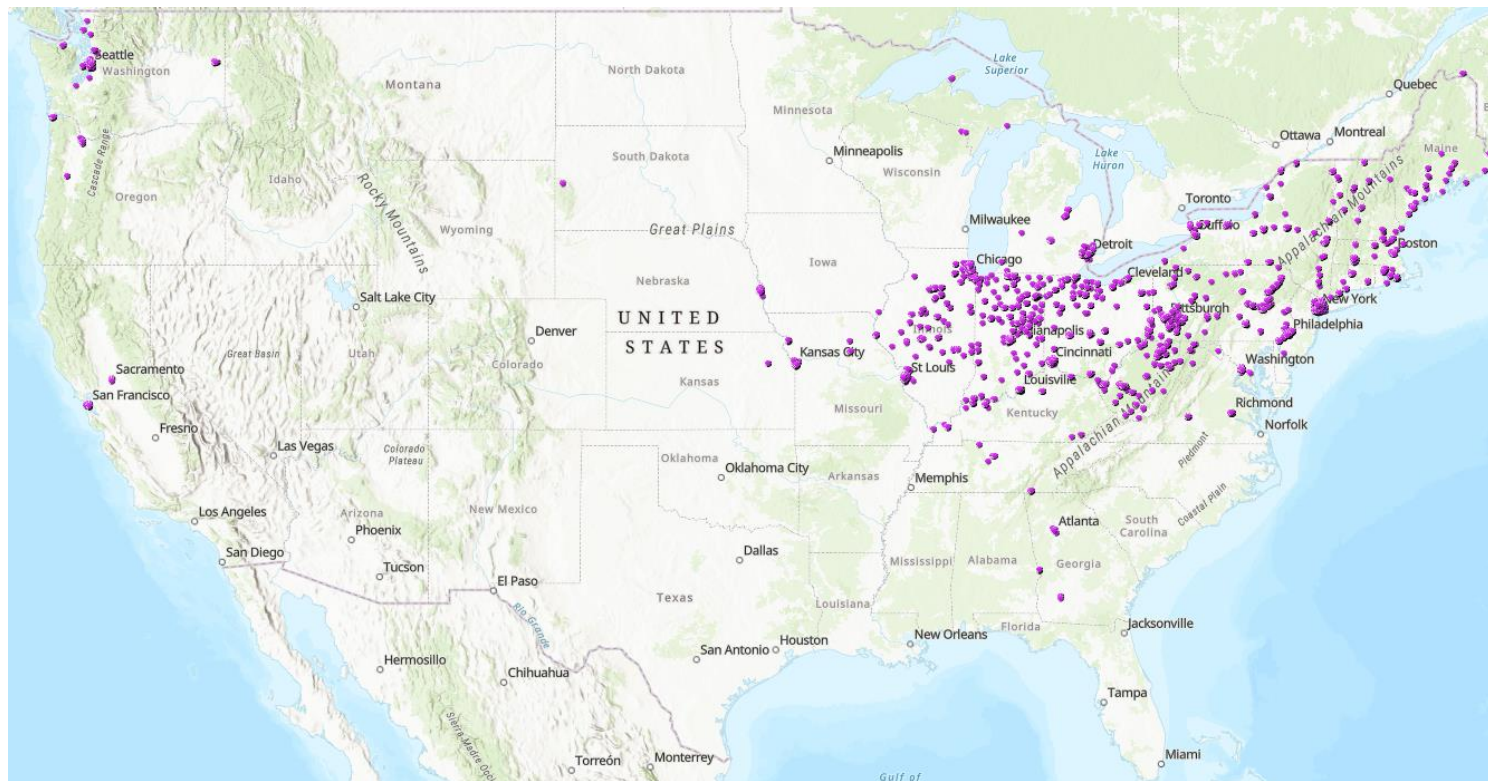
- The views expressed in these presentations are those of the author and do not necessarily represent the views or policies of the U.S. Environmental Protection Agency. Any mention of trade names, products, or services does not imply an endorsement by the U.S. Government or the U.S. Environmental Protection Agency. EPA does not endorse any commercial products, services, or enterprises.

# What are Combined Sewer Overflows (CSOs)?



- More information here: <https://www.epa.gov/npdes/combined-sewer-overflows-csos>

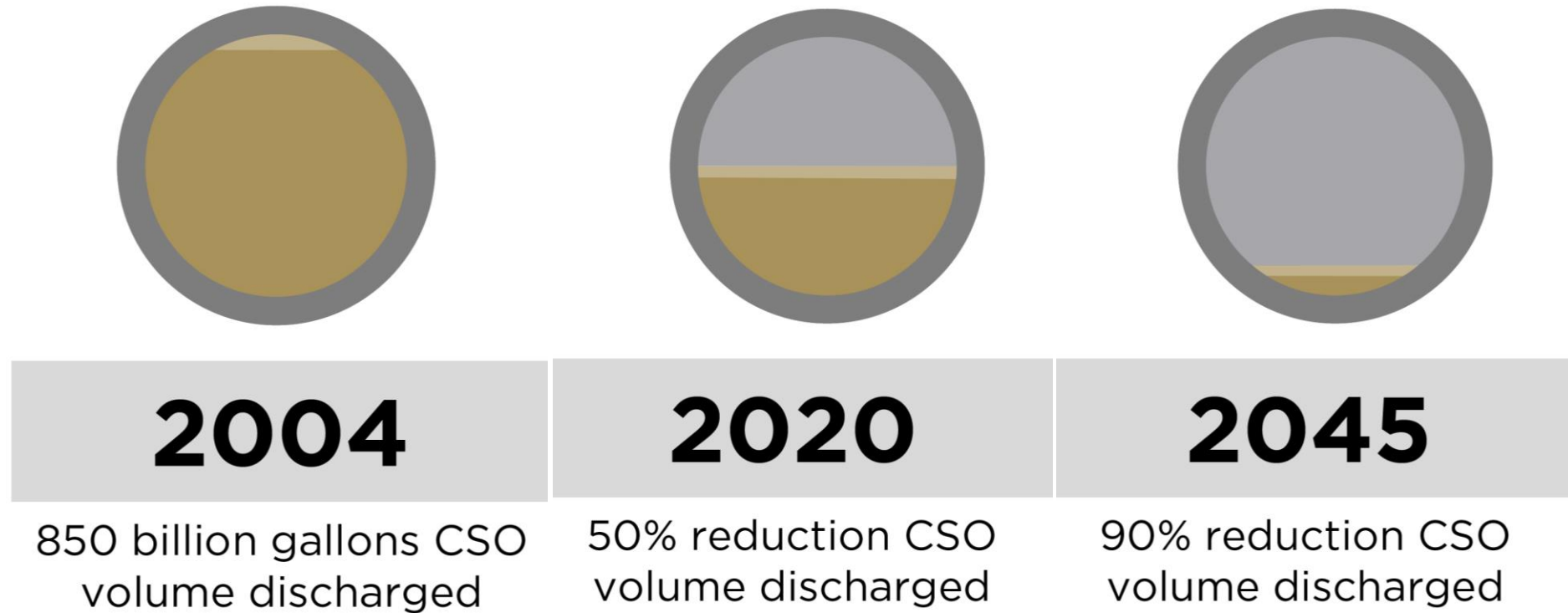
# Where are CSOs located?



<https://www.epa.gov/npdes/where-combined-sewer-overflow-outfalls-are-located>

# Progress

---



# Challenges for CSO Communities

---

- Complexity
- Water Quality
- Climate Change
- Environmental Justice





# Solutions

---

- Gray infrastructure
- Green infrastructure
- Integrated Planning
- Smart Sewers



# Technical Assistance and Funding

---

## Funding

- Clean Water State Revolving Funds (SRF)
- Water Infrastructure Finance and Innovation Act (WIFIA)
- Water Infrastructure Improvements for the Nation (WIIN) Act Grants
- Clean Water Indian Set Aside (CWISA)

## Technical Assistance (TA)

- EPA Water TA
  - Environmental Finance Centers
  - Direct Technical Assistance
  - Preliminary Engineering Support
  - Cybersecurity Technical Assistance
  - Creating Resilient Water Utilities

More information here: <http://www.epa.gov/WaterTA>

# Creating Resilient Water Utilities (CRWU)

---



- EPA's CRWU initiative provides water sector utilities with the following tools, training, technical assistance, and funding:
  - Resilient Strategies Guide
  - Climate Resilience Evaluation and Awareness Tool
  - Climate Data Maps
  - Adaptation Case Studies
  - Climate Risk and Resilience Trainings
  - Climate Adaptation Funding

Visit <https://www.epa.gov/crwu> for more information.

# Buffalo Sewer Authority

---



Rosaleen (Rosey) B. Nogle  
Principal Sanitary Engineer, Buffalo Sewer Authority

# Why the combination of Seiche, Climate Change, and CSOs keep me awake at night

ROSALEEN B. NOGLE, PE, BCEE, BC. WRE, CFM

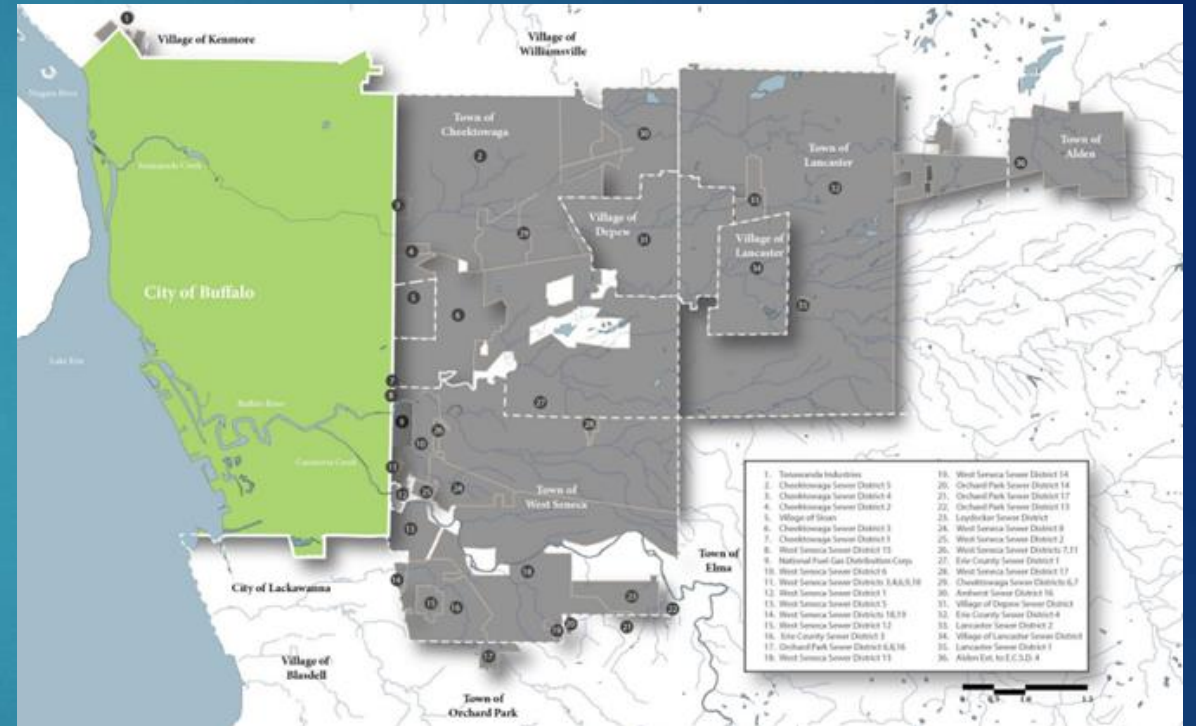
PRINCIPAL SANITARY ENGINEER

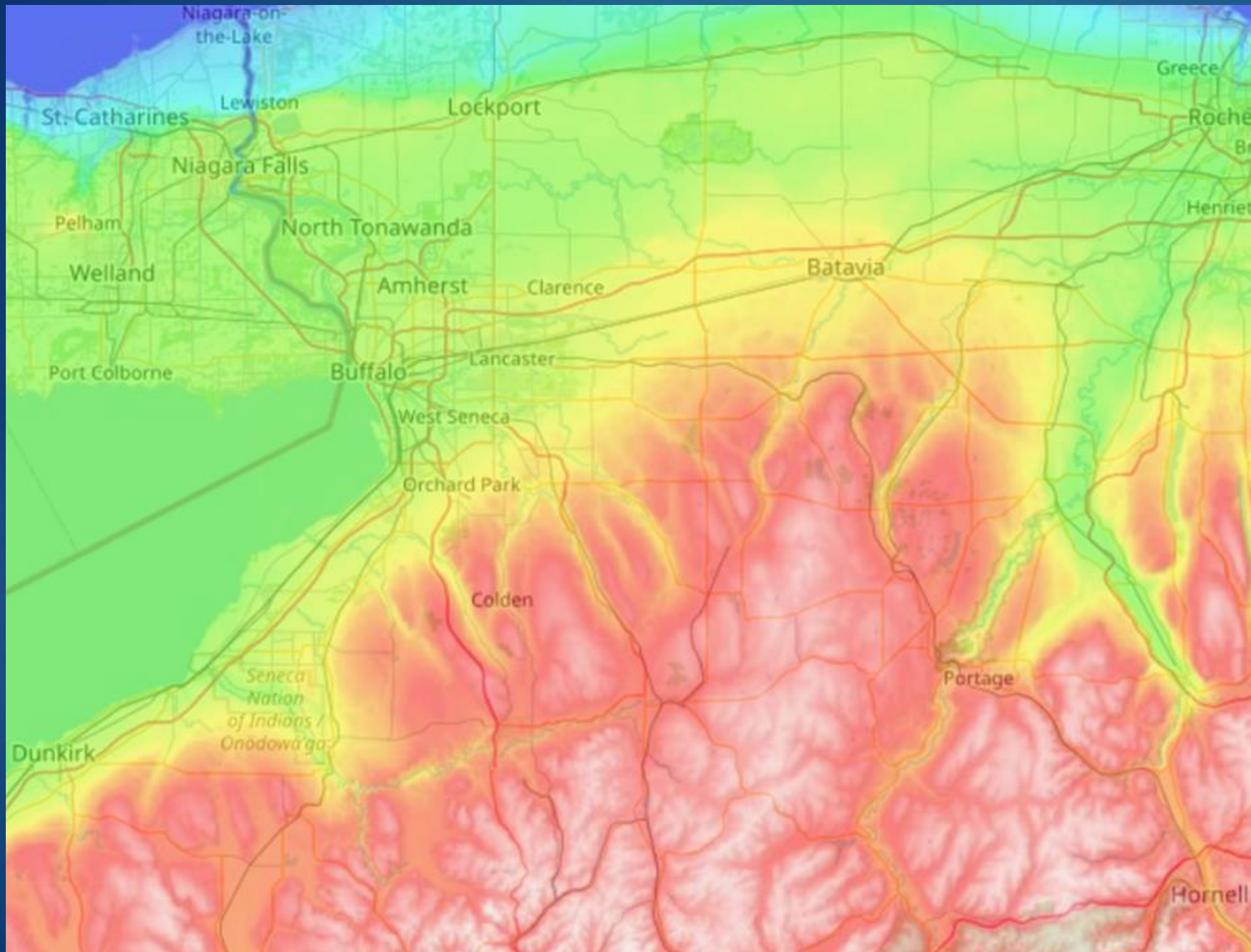
JANUARY 16, 2024

**B U F F A L O**  
SEWER AUTHORITY

# Buffalo Sewer Authority

- ▶ Founded on April 8, 1935
- ▶ Created to “provide an effectual means for relieving the Niagara River, Buffalo River and Lake Erie from pollution by sewage and waste”
- ▶ Approximately 200 employees
- ▶ Serves Buffalo and 11 Outlying Communities





# Topography

# Combined Sewer Systems

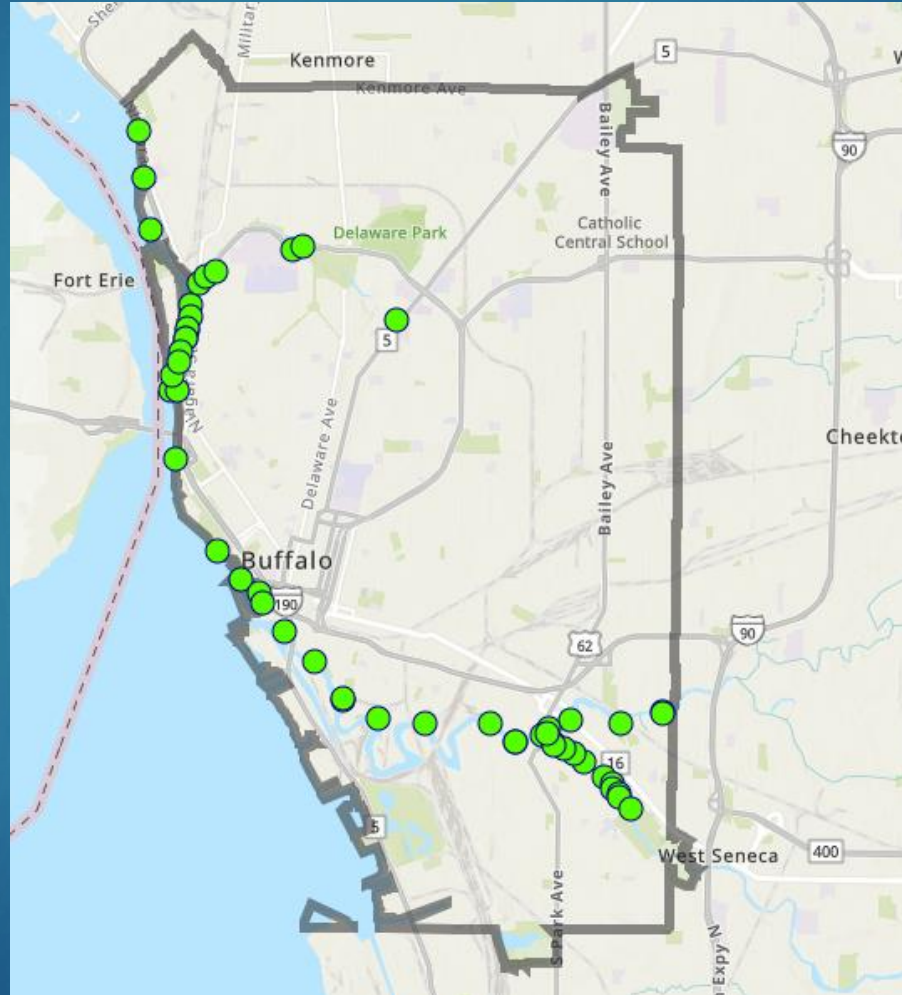
- ▶ Stormwater and wastewater in one pipe
- ▶ Typical of older cities
- ▶ During dry weather all flows go to treatment facility
- ▶ During wet weather, first flush generally gets to treatment facility, but as storm progresses, more flows overflow to receiving waters
- ▶ Over 90% of City of Buffalo's landmass



# Separate Storm Sewer Systems

- ▶ Typical of systems constructed after World War II
- ▶ Parallel pipes for wastewater and stormwater
- ▶ Designed to carry wastewater to treatment facility
- ▶ Stormwater directly discharges to surface waters
- ▶ New construction since 2003 may have some treatment of stormwater
- ▶ Inflow and infiltration can lead to sanitary sewer overflows

# Combined System Vulnerabilities



# Seiche Events

## Historic Crests

(Station Established 4/1/1860)

1. 12.08 ft 12/2/1985

2. 11.12 ft 11/15/2020

3. 11.06 ft 1/30/2008

4. 10.67 ft 12/23/2022

5. 10.65 ft 11/1/2019

6. 10.65 ft 4/6/1979

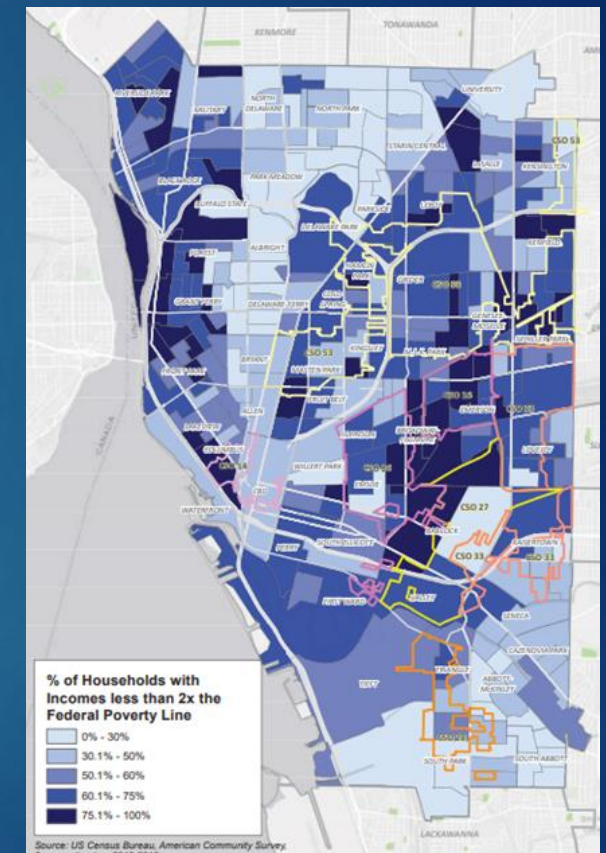
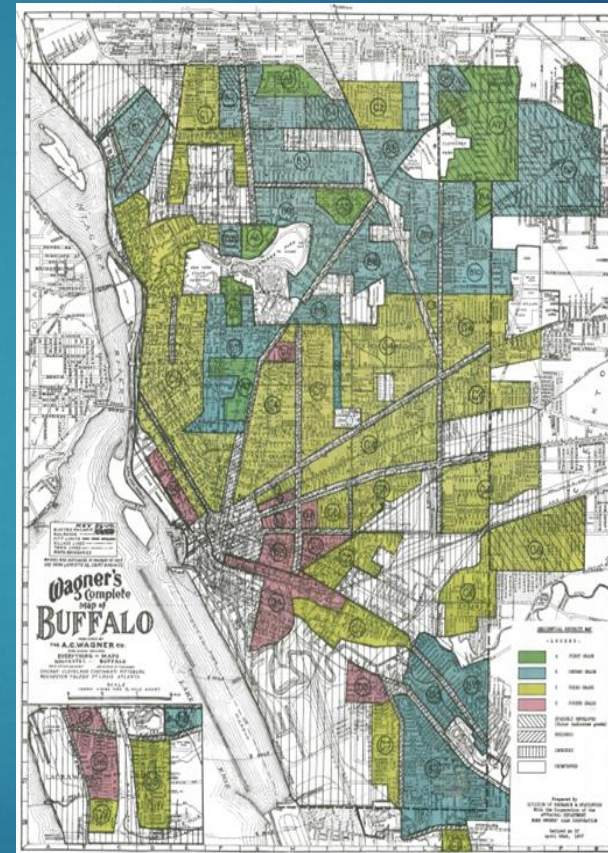
7. 10.57 ft 12/11/2021

8. 10.36 ft 12/20/2020

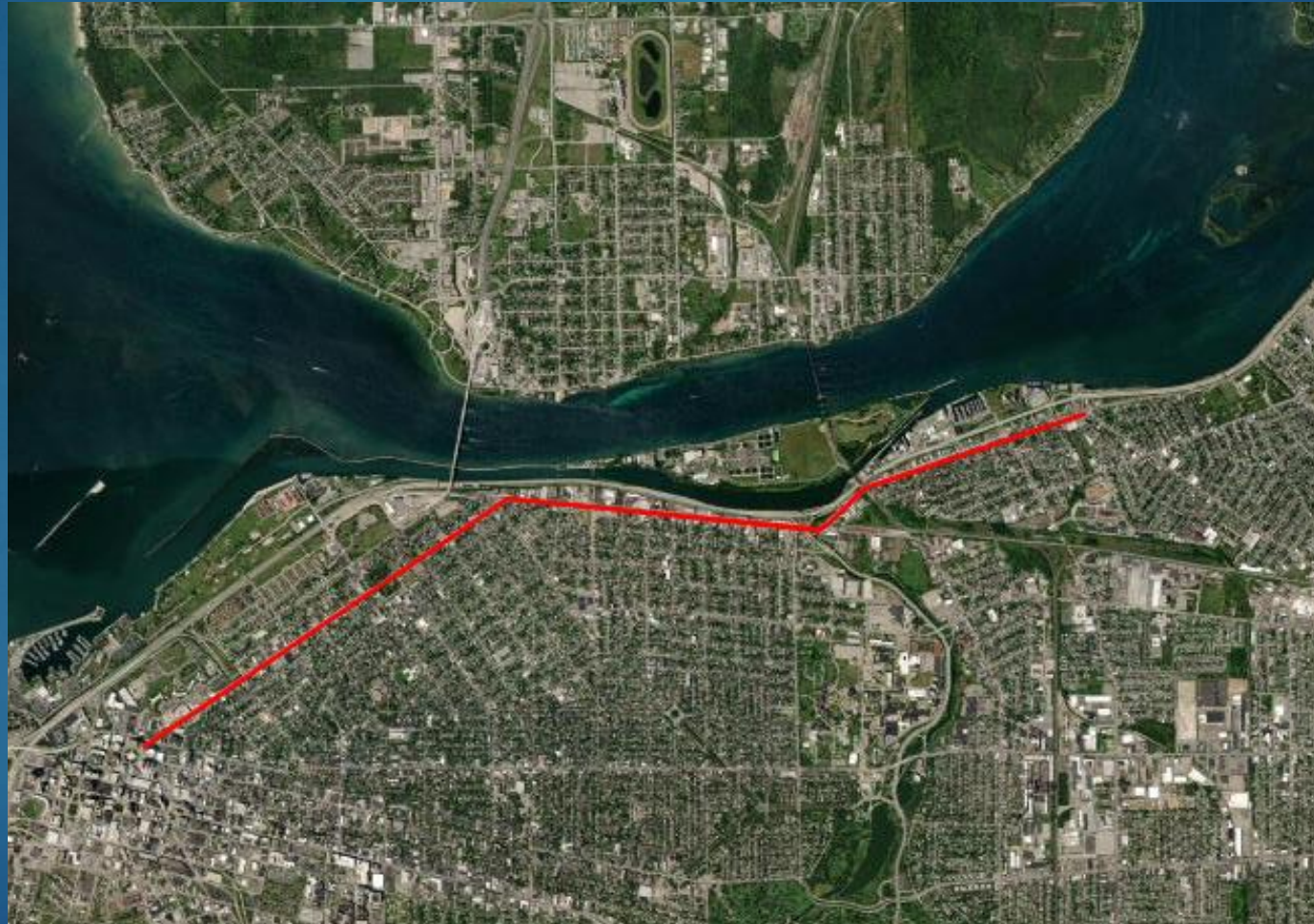
# Equity Issues

- ▶ History of Environmental Justice Issues
- ▶ One of the Most Segregated Metropolitan Areas in the United States

Instructions to HOLC Agents: Any threat of infiltration of foreign-born, negro or lower grade population? If so, indicate these by nationality and rate of infiltration like this: "Negro-rapid."



# Location: Niagara Street, Buffalo



# Scajaquada Creek



# Niagara Street Corridor Work



# Niagara Street Corridor Work





# Niagara Street Corridor Work



# Niagara Street Corridor Work



# Surface Site Limitations

- ▶ Bicycle track
- ▶ Three driving lanes
- ▶ Two parking lanes
- ▶ Sidewalks



# Subsurface Site Limitations

- ▶ Major watermains
- ▶ Fiberoptic lines
- ▶ Underground electrical
- ▶ Gas mains
- ▶ Old combined sewers
- ▶ Deep interceptors

# Designs

- ▶ Geomatrix
- ▶ Underdrain piping
- ▶ Underground filtration and storage
- ▶ Vegetation primarily aesthetic

# Outcomes

## ▶ Benefits

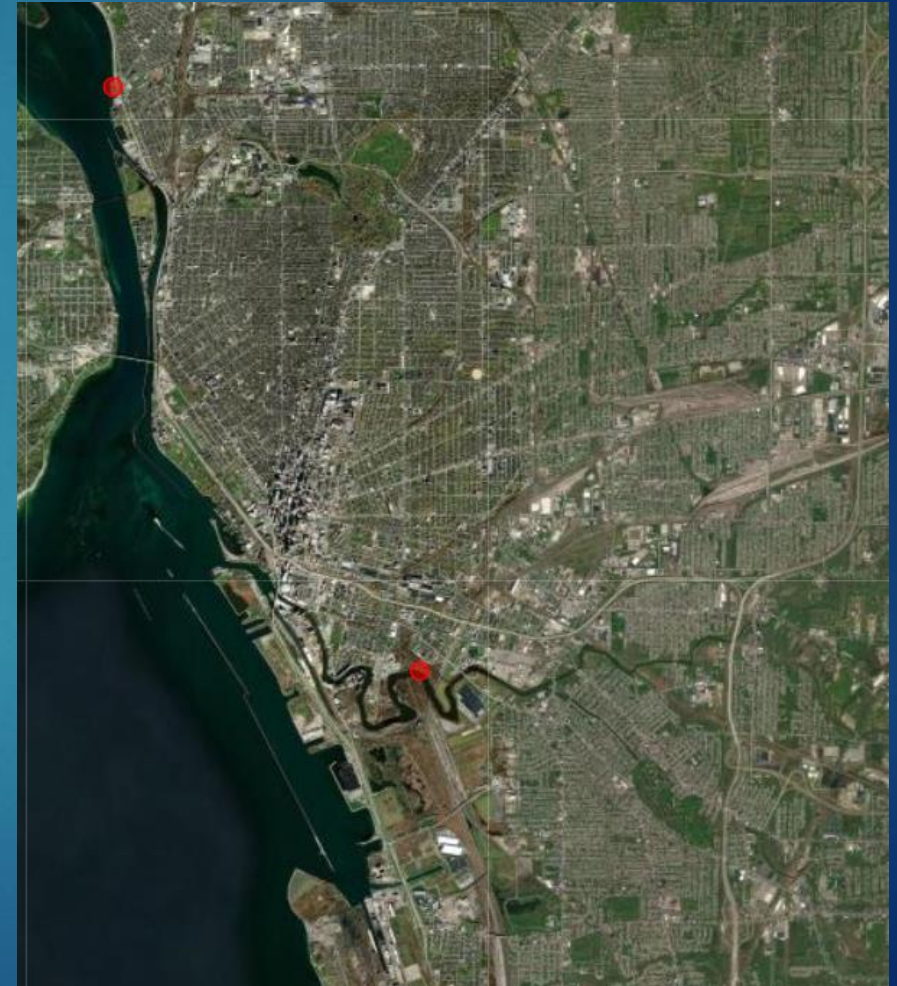
- ▶ Air quality and heat island impacts
- ▶ Water treatment
- ▶ Surcharge relief for Creek and Street

## ▶ Cautions

- ▶ Green Infrastructure is not Gray Infrastructure
- ▶ Differences of opinion in aesthetics
- ▶ Functionality and form
- ▶ Safety considerations

# Cornelius Creek and Smith Street

- ▶ Two of the Largest Combined Sewer Overflow Basins and Outfalls in Buffalo
- ▶ History of Seiche-driven Flooding
  - ▶ Exacerbated by Climate Change
  - ▶ High Poverty Neighborhoods Most Impacted
- ▶ Near-term fix possible for Smith
- ▶ Larger Project Necessary for Cornelius Creek
- ▶ FEMA Hazard Mitigation Grant Funding



# Milwaukee Metropolitan Sewerage District

---



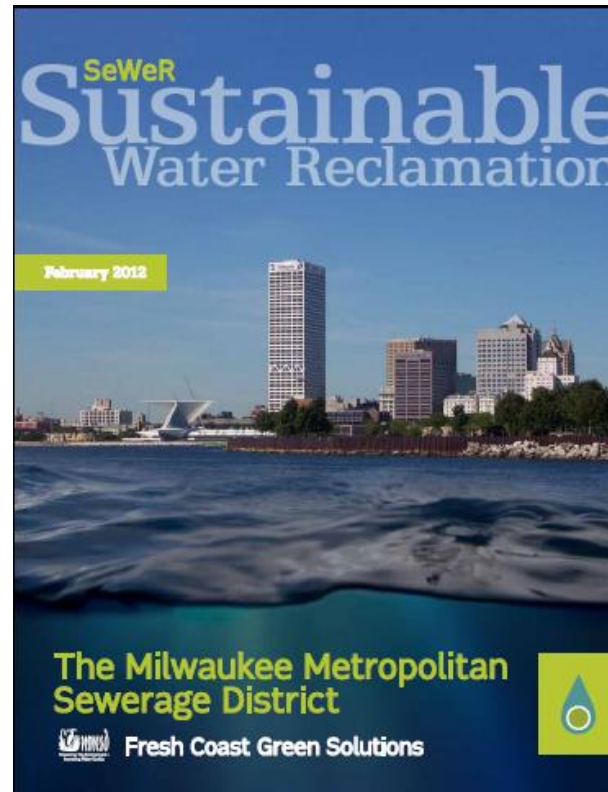
Kevin Shafer

Executive Director, Milwaukee Metropolitan Sewerage District (MMSD).



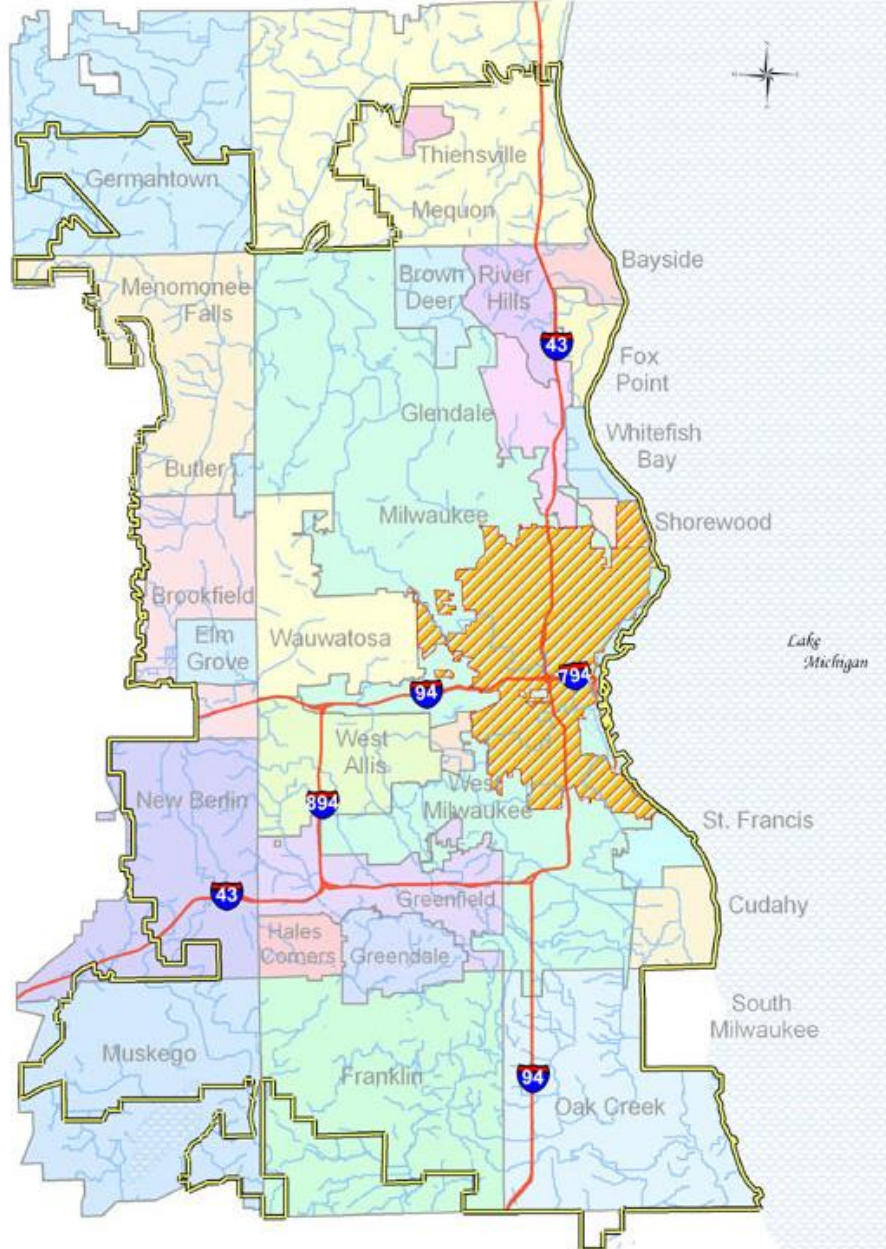
# Milwaukee Metropolitan Sewerage District's Climate Change Initiatives

Kevin L. Shafer, P.E., Executive Director



**Milwaukee Metropolitan Sewerage District**

# Milwaukee Metropolitan Sewerage District



## We Serve:

- 1.1 Million Customers
- 28 Municipalities
- 411 Square Miles

## We Protect the Public & Lake Michigan:

- Convey/Store/Reclaim Wastewater
- Manage Flooding

## We Have:

- 300 Miles of Sewers (municipalities and individuals have 6,000 miles!)
- 521 MG Tunnel System
- 2 Water Reclamation Facilities

# Water Reclamation Facilities



Jones Island



South Shore

# Deep Tunnels



300 Feet  
Below ground

521 Million  
Gallons of Storage

28.5 Miles  
Long

17- to 32-feet  
In Diameter

Designed to  
minimize basement  
backups and for 1-2  
overflows per year

# 98.5%

## Capture & Clean

Since 1993



# We've had Extreme Storms



# Local Evidence of a Changing Climate

## Kinnickinnic River Example:

### Top 5 River Crests Over the Past 35 Years:

- (1) 16.01 ft on 08/06/**1986**
- (2) 13.29 ft on 06/08/**2008**
- (3) 13.22 ft on 07/10/**2006**
- (4) 13.20 ft on 07/15/**2010**
- (5) 13.17 ft on 07/23/**2010**







# MMSD's 2035 Vision

## ***Integrated Watershed Management Goals:***

Zero sanitary sewer overflows

Zero combined sewer overflows

Zero homes in the 100-year floodplain

Acquire an additional 10,000 acres of river buffers through Greenseams®

Use green infrastructure to capture the first 0.5 inch of rainfall

Harvest the first 0.25 gallons per square foot of area of rainfall

## ***Energy Efficiency and Climate Mitigation & Adaptation Goals:***

Meet 100% of MMSD's energy needs with renewable energy sources

Meet 80% of MMSD's energy needs with internal, renewable sources

Use the Greenseams<sup>SM</sup> Program to provide for 30% sequestration of MMSD's carbon footprint

Reduce MMSD's carbon footprint by 90% from its 2005 baseline

# Menomonee River Concrete Removal



# Underwood Creek



# Greenseams® More than 5,000 Acres



# Working Soils®



# Reforestation & Wetland Restoration Program

- Work with partners to plant 6 million trees and restore 4,000 acres of wetlands over 900 square miles of urban, suburban, and rural conditions
- Large-scale nature-based solution for flood reduction, carbon sequestration, habitat creation, and investments in vulnerable communities
- 10-year program that helps meet MMSD, regional, state, and national goals





# Green Infrastructure

# 100

Since 2002

Million Gallons



# Green Roofs

Managing up to  
**1,900,000**  
Gal. Per Storm





# Rain Barrels & Cisterns

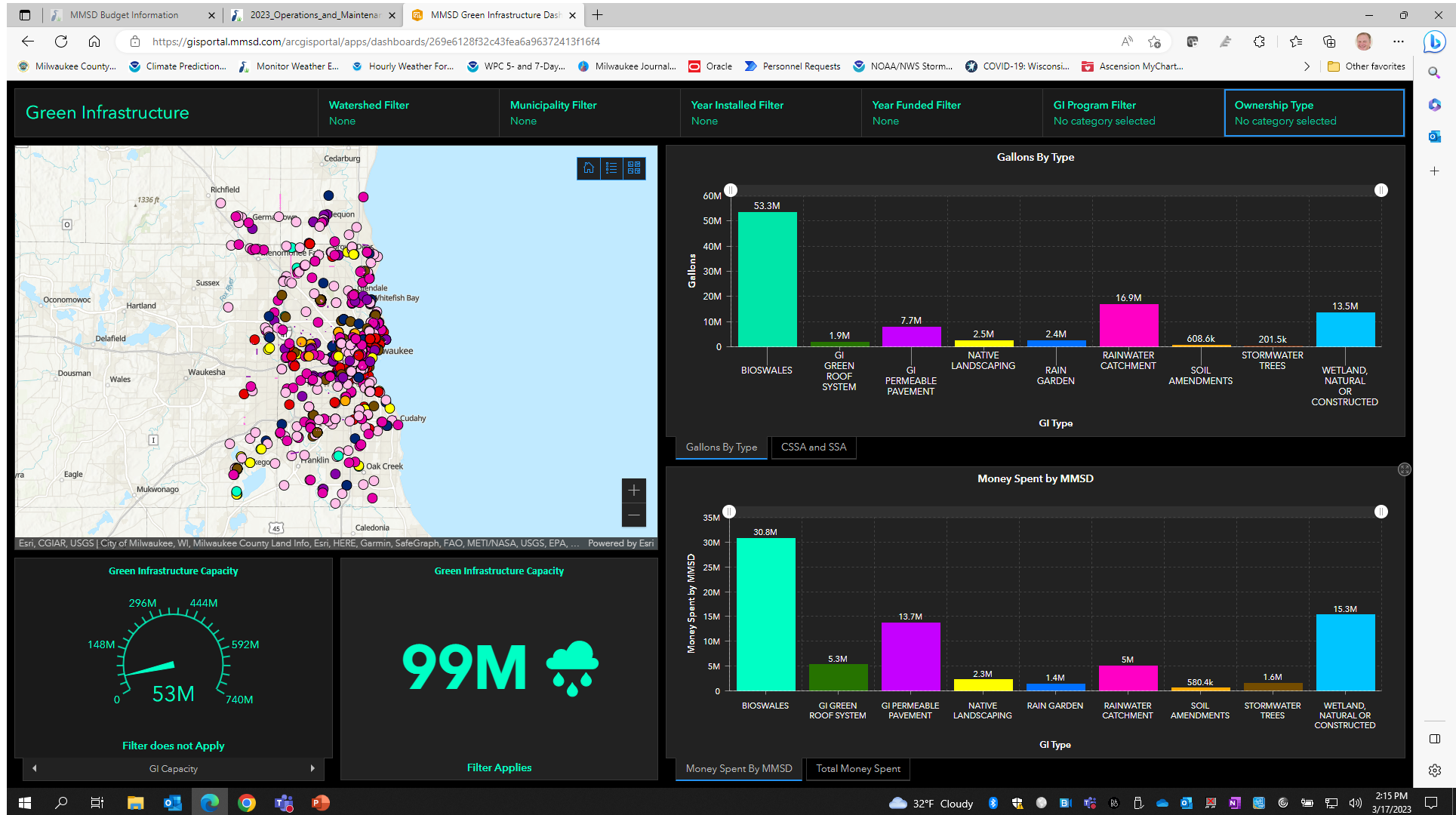
Total Storage =

**16,900,000**

Gallons



# Green Infrastructure Dashboard



# One Water, Our Water Initiative

---

- Create awareness of how water intersects with every aspect of life
- Encourage residents to make small changes
- Create pathways for deeper engagement
- Build a more inclusive community of stewards



**“I alone cannot change the world, but I can cast a stone across the waters to create many ripples.”**

- Mother Teresa



Kevin L. Shafer, P.E.

Executive Director

Milwaukee Metropolitan Sewerage District

[kshafer@mmsd.com](mailto:kshafer@mmsd.com)

414-225-2088



# Contact Information

---



Kathryn Kazior, US EPA  
[Kazior.Kathryn@epa.gov](mailto:Kazior.Kathryn@epa.gov)

Rosey Nogle, Buffalo Sewer Authority  
[rnogle@buffalosewer.org](mailto:rnogle@buffalosewer.org)

Kevin Shafer, Milwaukee Metropolitan Sewer District  
[Kshafer@mmsd.com](mailto:Kshafer@mmsd.com)