NORTHEAST OHIO REGIONAL SEWER DISTRICT

SEWER U

SEWER UNIVERSITY

The history of sewers and the future of clean water in Greater Cleveland

Northeast Ohio Regional Sewer District

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Presentation available at
neorsd.org/sewerU

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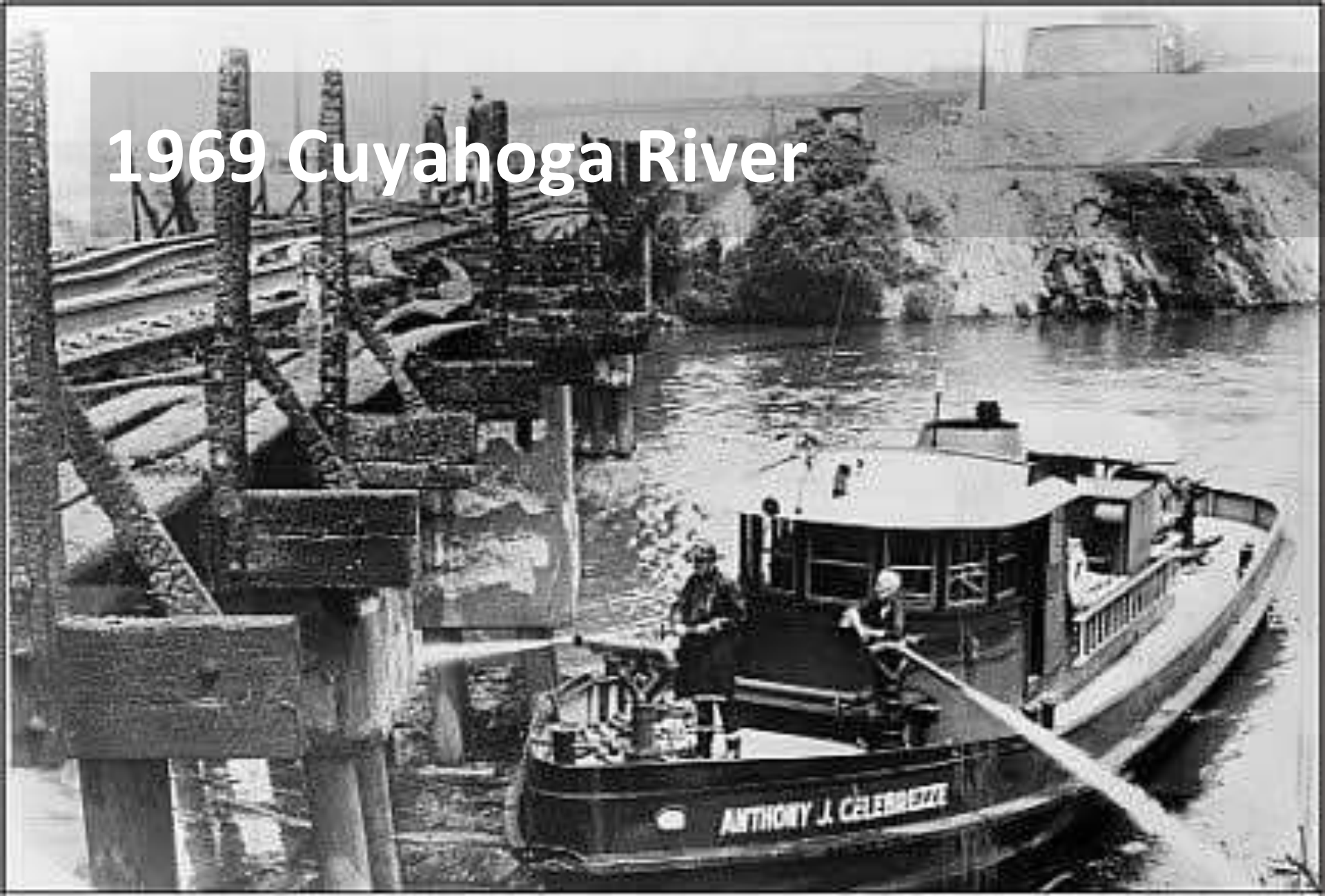
1952 Cuyahoga River

Trivia Question…

How many times did the Cuyahoga River catch on fire?


1960s Cuyahoga River

1969 Cuyahoga River



The aftermath of the June 22, 1969 fire as the fire boat continues to break up oil slicks. (Photo courtesy of The Cleveland Public Library Photograph Collection.)

Your SewerU syllabus

- Our place in the urban water cycle
- Sewers 101: History and challenges
- Solutions: Gray and green
  - Project Clean Lake
  - Regional Stormwater Management Program
- Green: Policy, past, present and future

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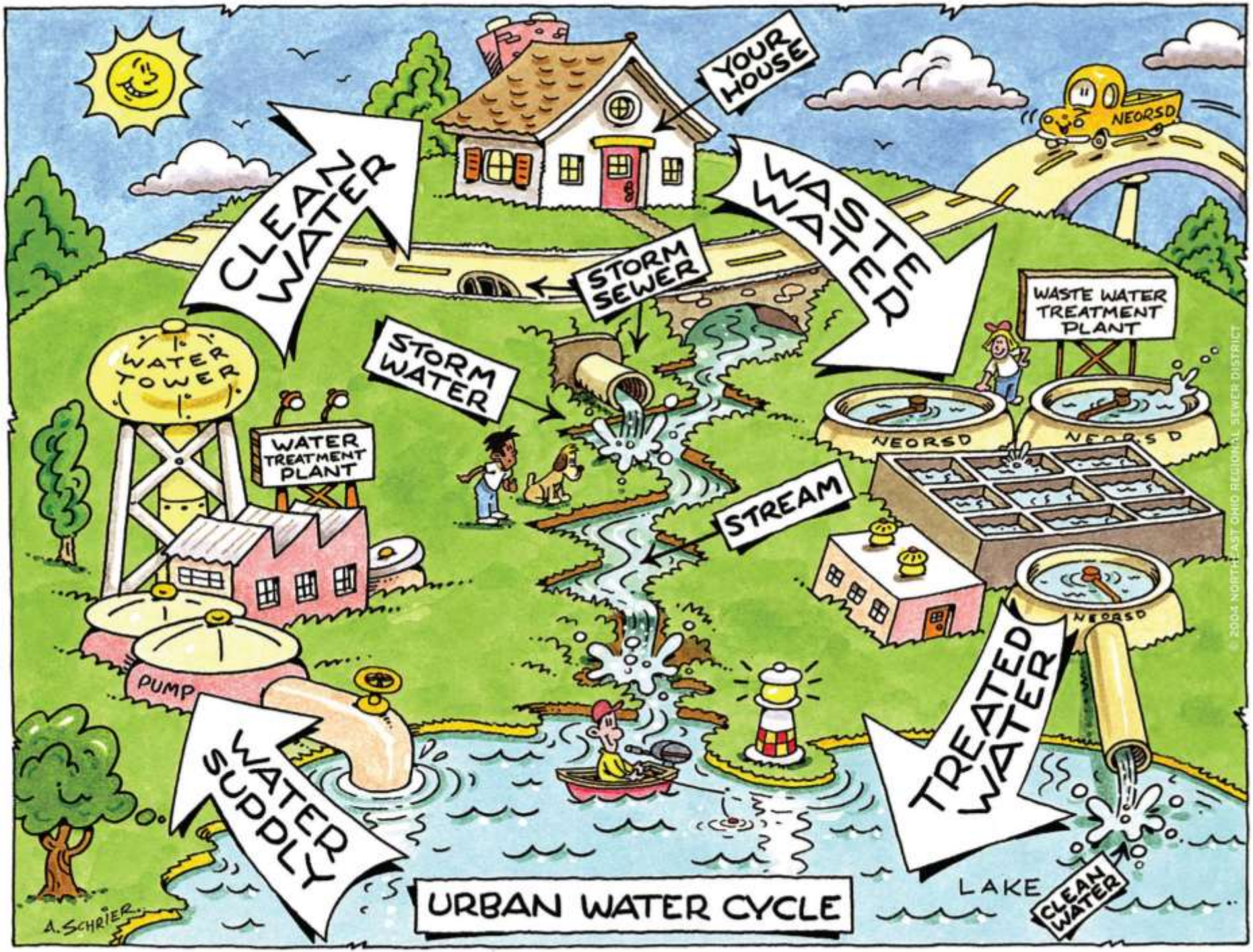

YOUR HOUSE
CLEAN WATER
WASTE WATER
STORM SEWER
STORM WATER
WATER TOWER
WATER TREATMENT PLANT
WASTE WATER TREATMENT PLANT
NEORSD
NEORSD
NEORSD
NEORSD
STREAM
PUMP
WATER SUPPLY
TREATED WATER
LAKE
CLEAN WATER
A. SCHRIER
URBAN WATER CYCLE
© 2004 NORTHEAST OHIO REGIONAL SEWER DISTRICT

Trivia Question…

What is the place of origin for the word “sewer”?

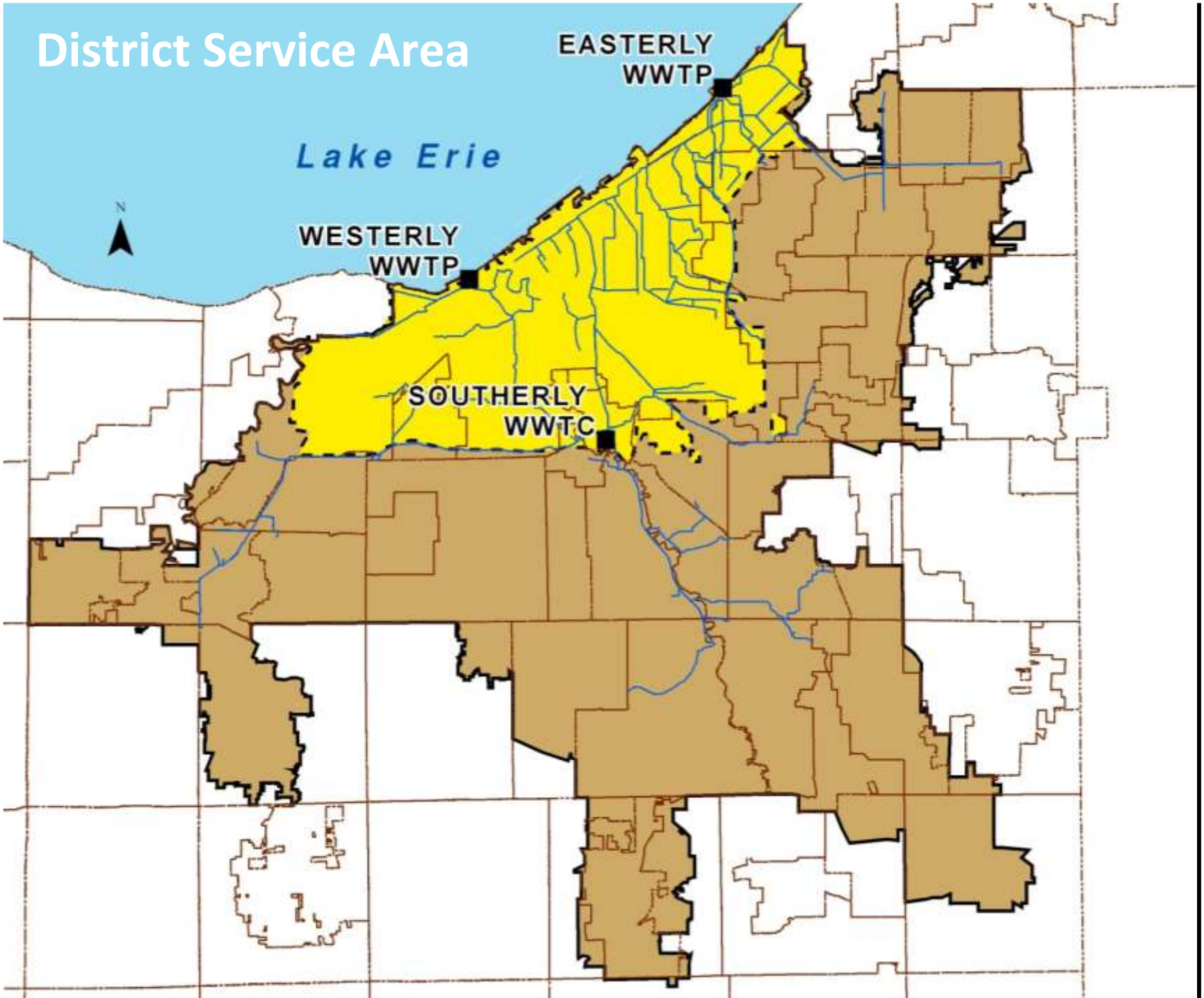
Who We Are…

- Created in 1972 by Court Order
- Servicing all or part of 62 communities
- 1 million customers
- 90+ billion gallons wastewater treated each year

Key Responsibilities

- Wastewater treatment plants
  - Easterly, Southerly, Westerly
- Combined and separate sewers
  - Construction, Operation and Maintenance
- Combined Sewer Overflow (CSO) Control
- Regional Stormwater Management

Wastewater Treatment Plants


District Service Area
EASTERLY WWTP
Lake Erie
WESTERLY WWTP
SOUTHERLY WWTC

Over 40 years of investment

- Since 1972: **$4+ billion**
  - Wastewater treatment plants
  - Interceptor and relief sewers
  - CSO control and interceptor rehab
  - Other facility upgrades

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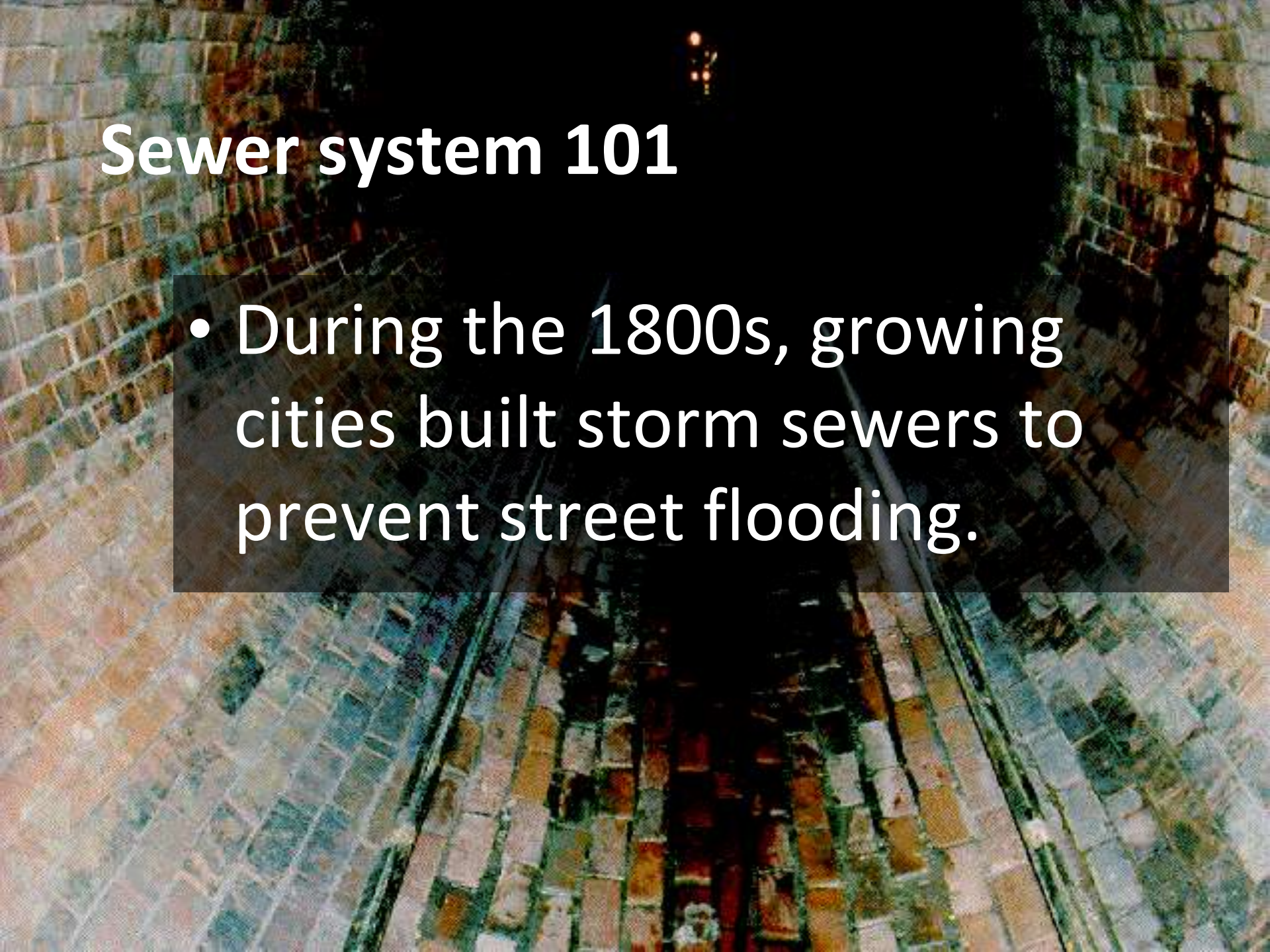
Trivia Question…

What is the oldest historical time period sewers were recognizable infrastructure?



Sewer system 101

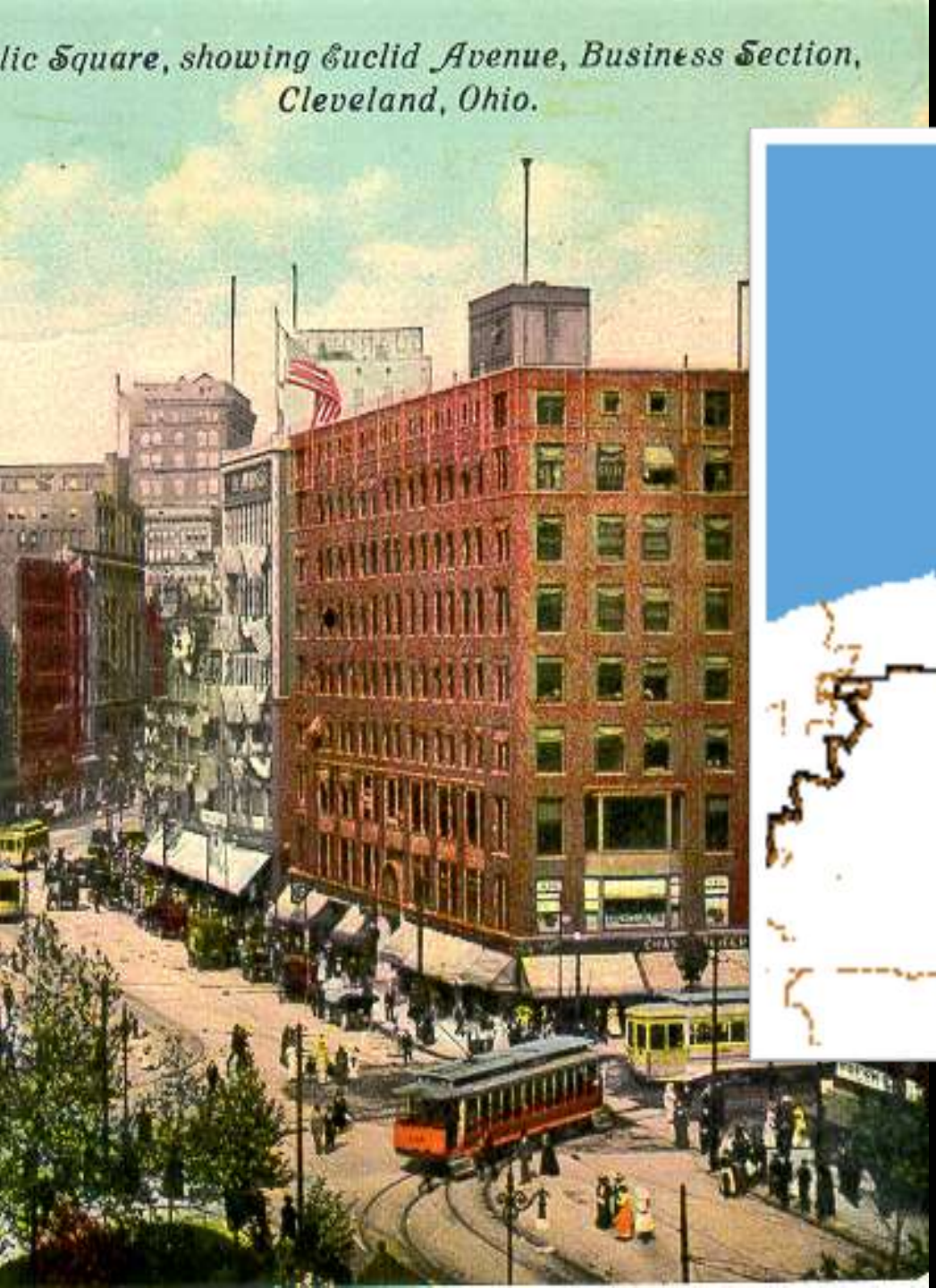
- During the 1800s, growing cities built storm sewers to prevent street flooding.

Sewer system 101

- 1880s-90s: Sanitary sewers from houses connected to existing storm drains
- **Combined sewers**
  - "separate system not recommended" (1882)

Sewer system 101

- 1899-1939: “Intercepting Sewers” collect sanitary flow, deliver it to Lake Erie and Cuyahoga River at three outfall locations (consolidate water quality problems)

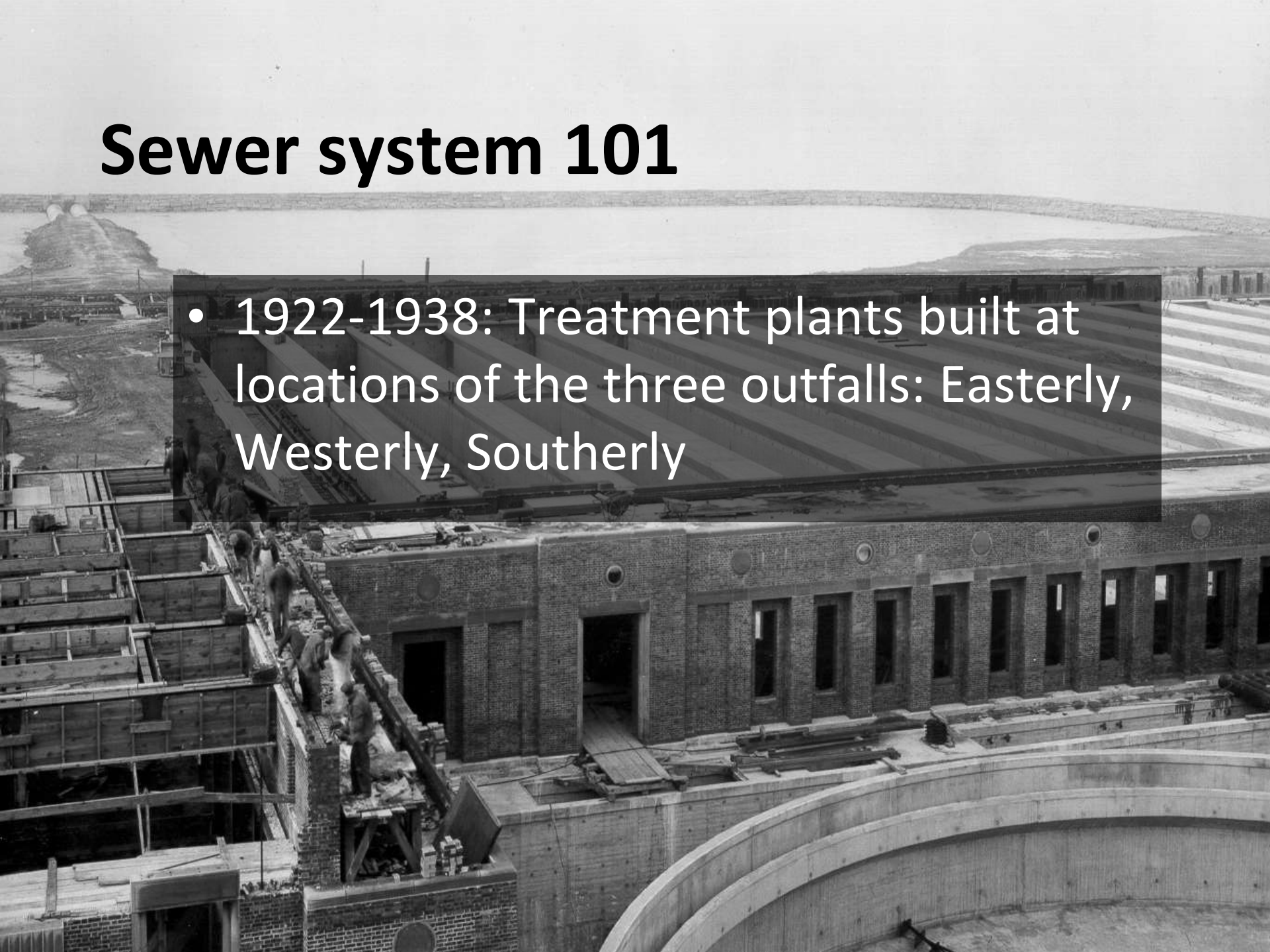

lic Square, showing Euclid Avenue, Business Section,
Cleveland, Ohio.


EASTERLY
WESTERLY
SOUTHERLY

Interceptor sewers

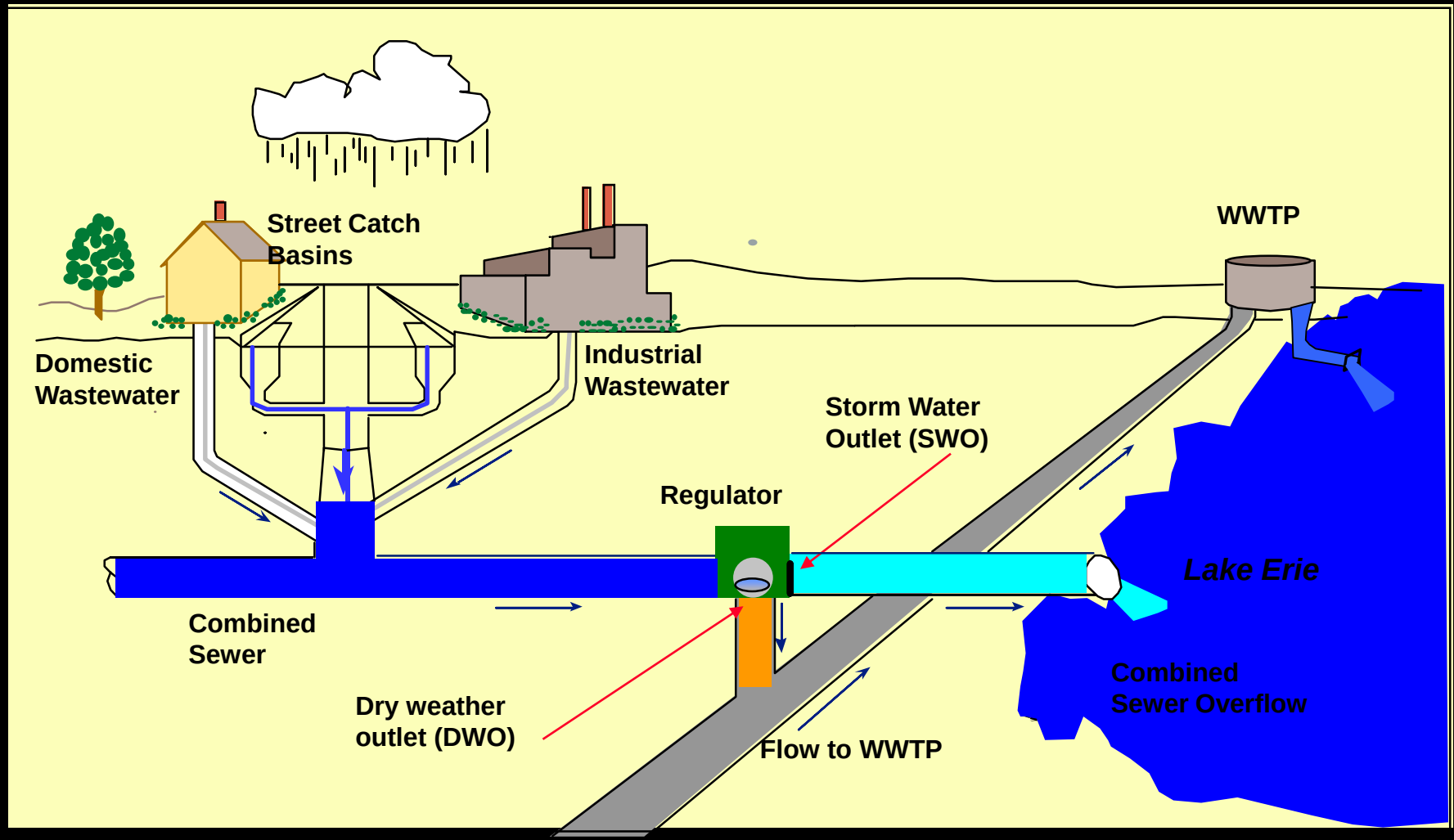
- Collect wastewater from smaller sewers serving individual streets

Sewer system 101



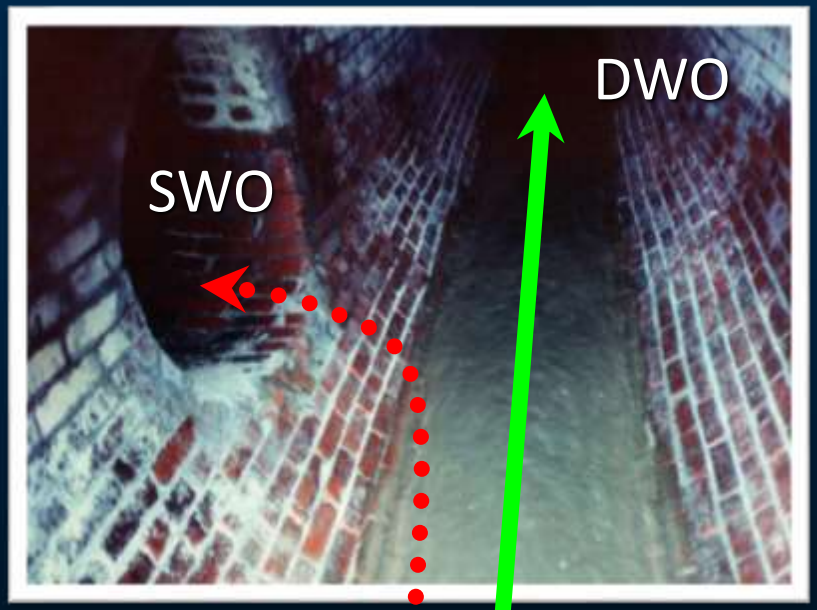
- 1922-1938: Treatment plants built at locations of the three outfalls: Easterly, Westerly, Southerly

Combined sewer system



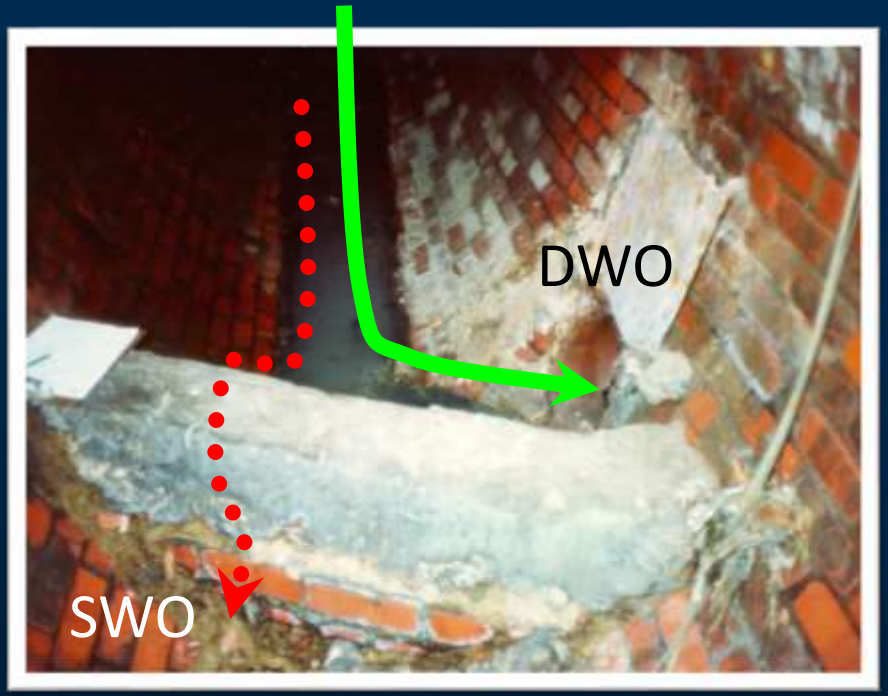
Combined sewer system

- Regulating structures allow excess stormwater to overflow



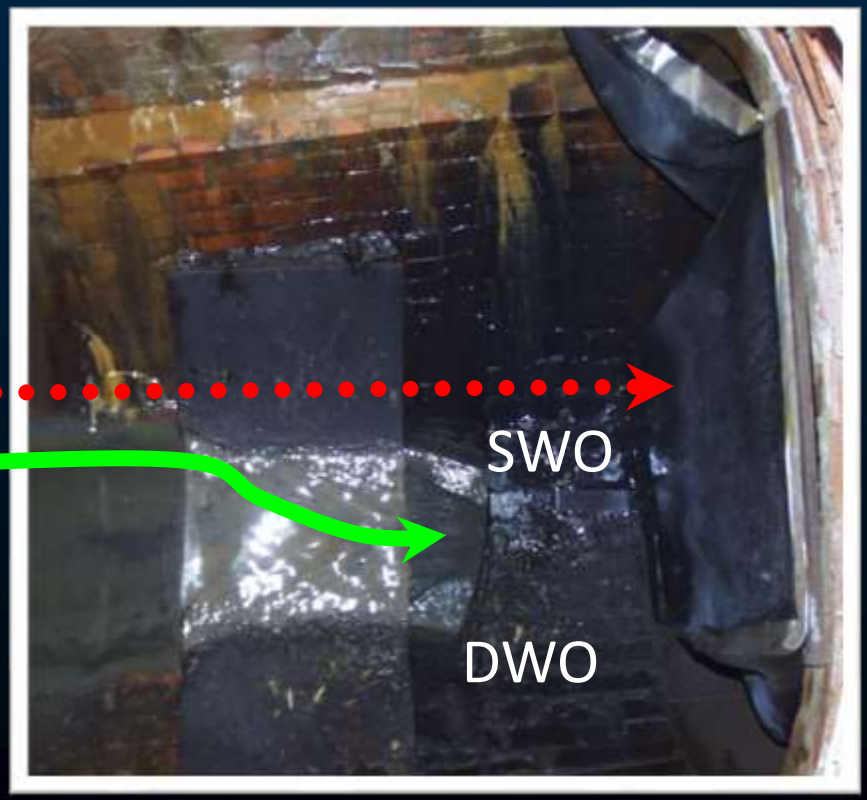
Overflow pipe

Side-spill weir

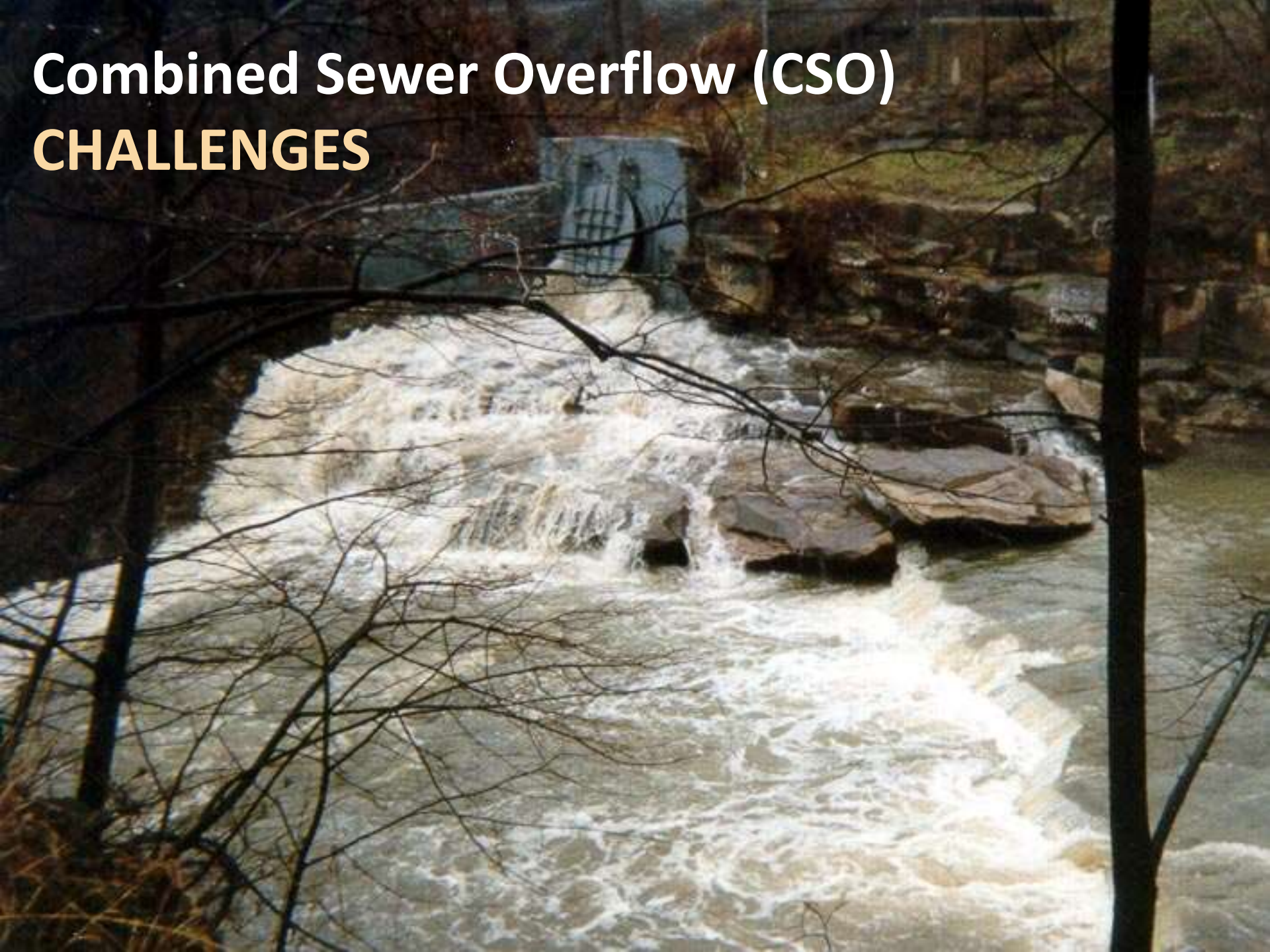


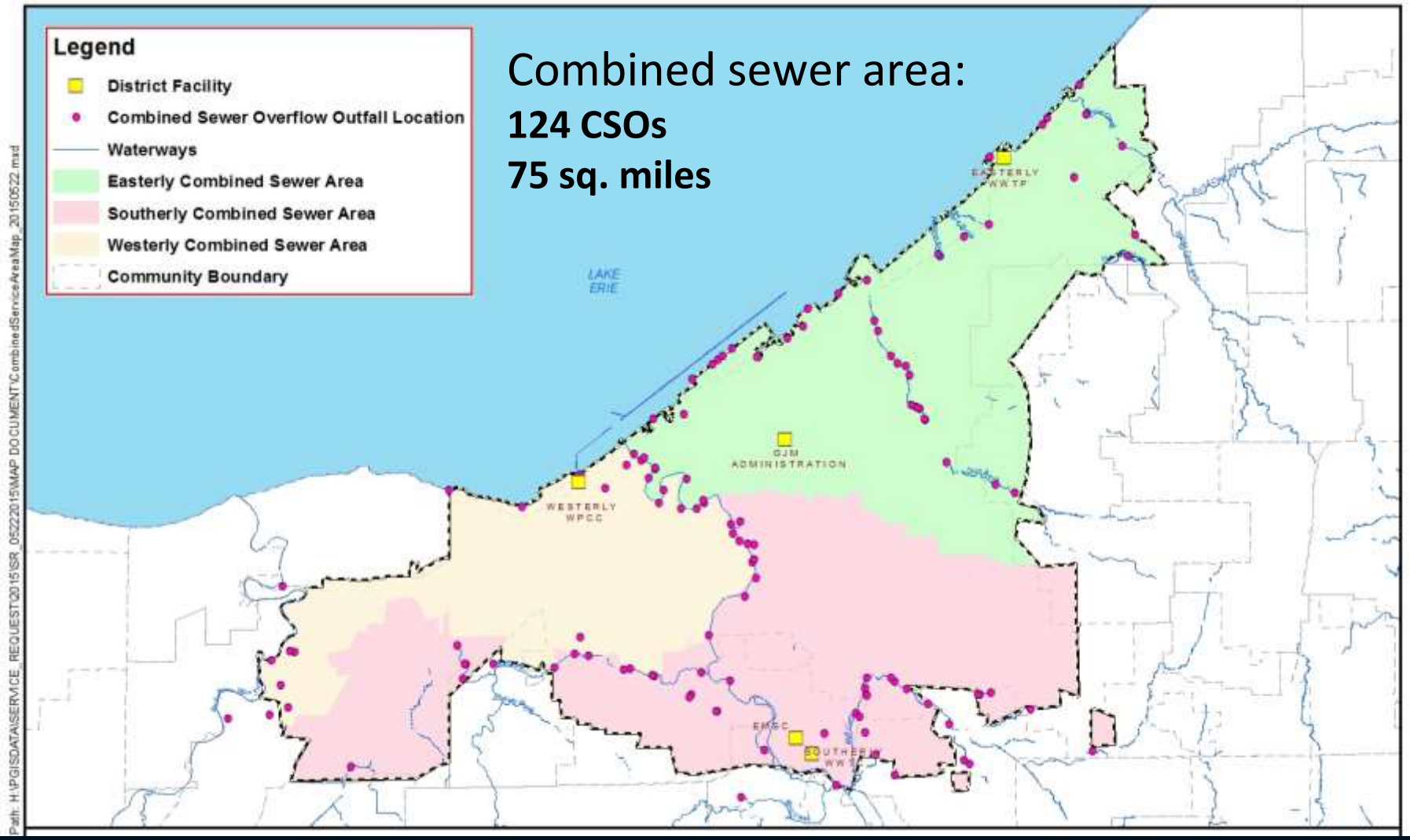
Perpendicular weir

Leaping weir



Combined Sewer Overflow (CSO) CHALLENGES

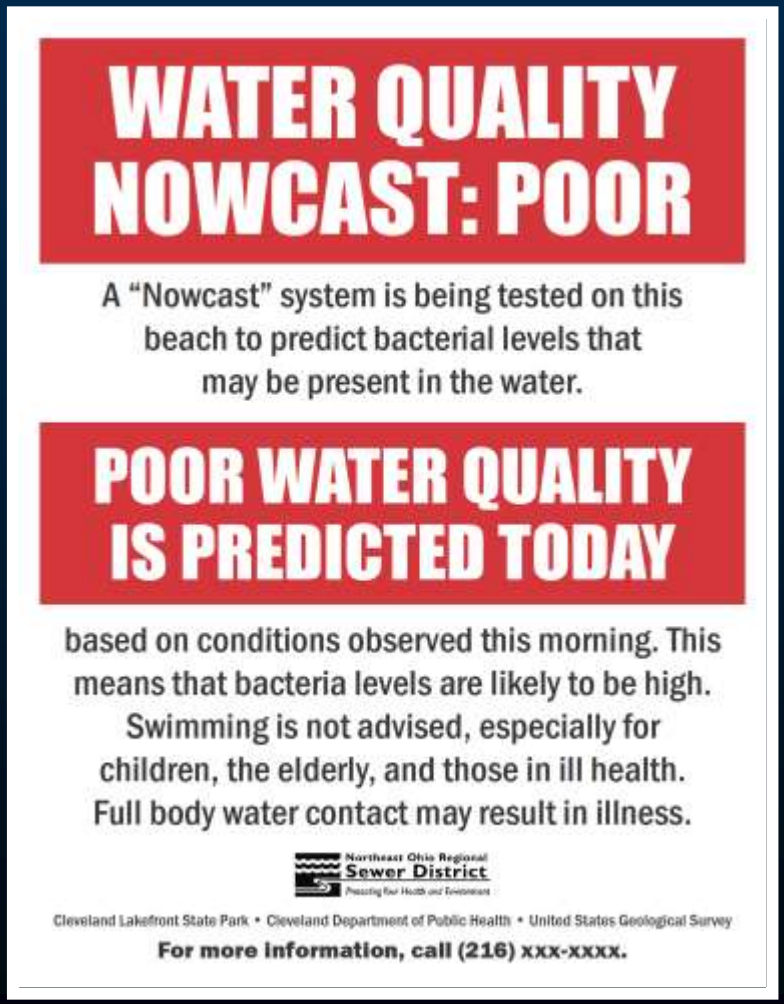



Legend
District Facility
Combined Sewer Overflow Outfall Location
Waterways
Easterly Combined Sewer Area
Southerly Combined Sewer Area
Westerly Combined Sewer Area
Community Boundary
Combined sewer area:
124 CSOs
75 sq. miles
LAKE ERIE
EASTERLY WWTP
OJM ADMINISTRATION
WESTERLY WPCC
EMSC
SOUTHERLY WWTP
Path: H:\PGISDATA\SERVICE_REQUEST\2015\SR_05222015\MAP DOCUMENT\CombinedServiceAreaMap_20150522.mxd

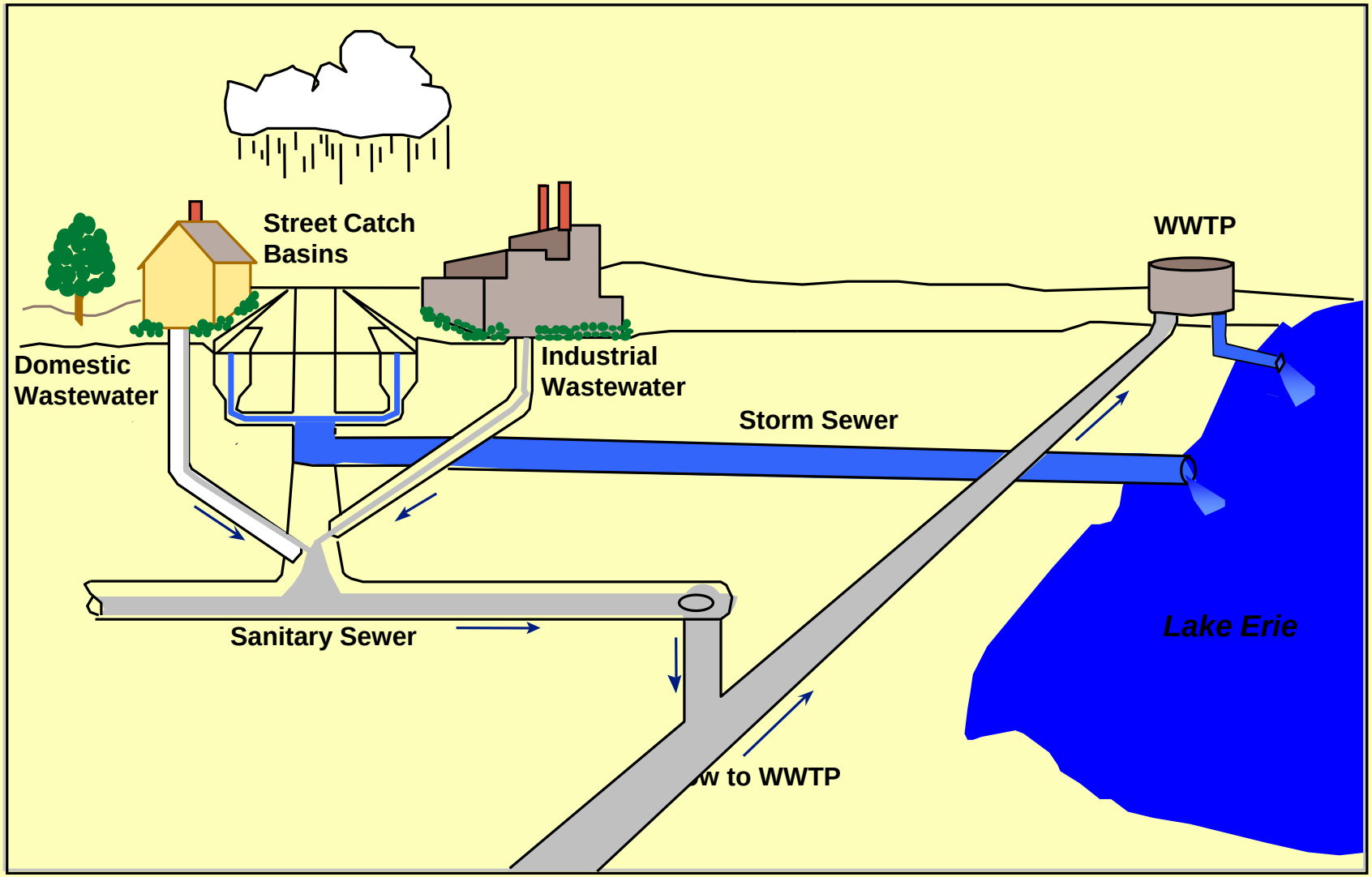
CSOs impact water quality

- When it rains, the bacteria levels at local beaches and streams will be elevated

Public notification

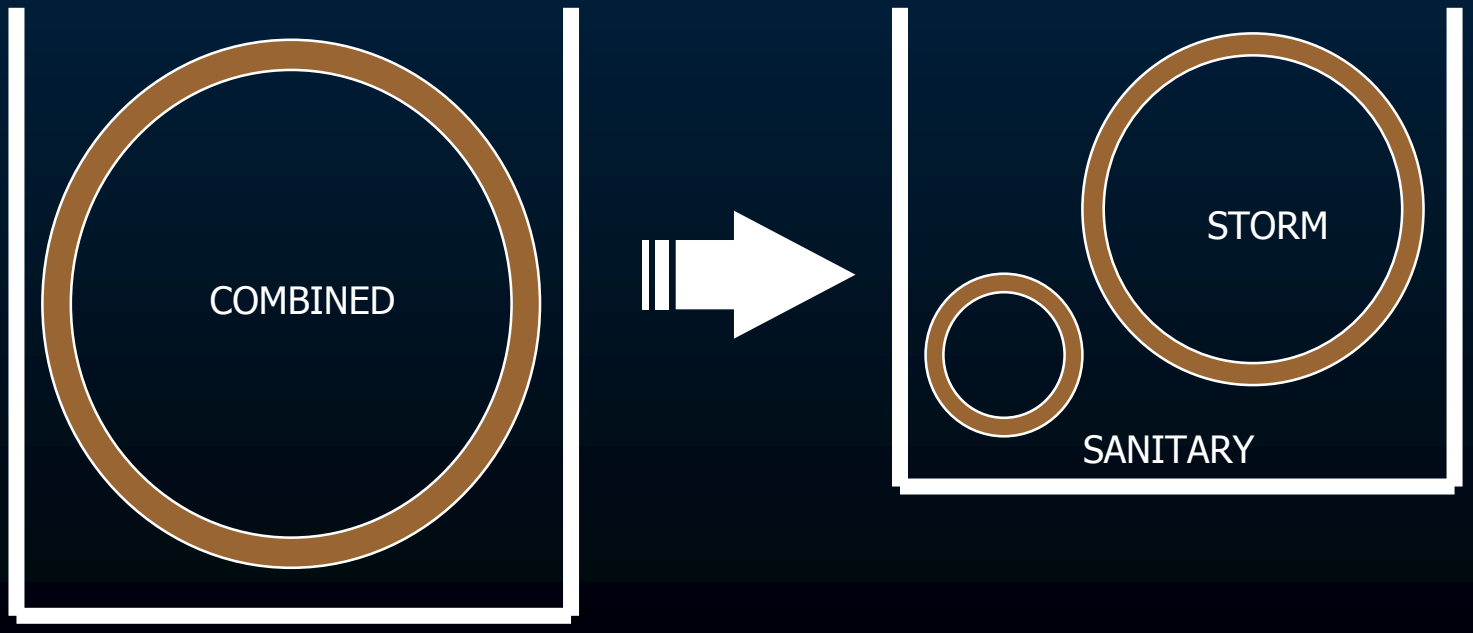


Separate Sewer System

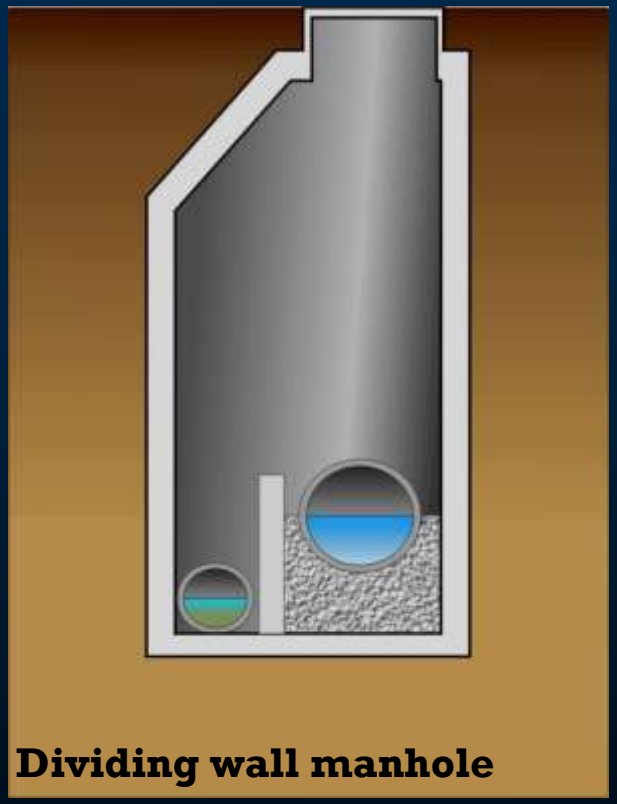


Combined vs. separate

- 1920s-1960s: evolution from combined sewers to separate sewers built in a common trench

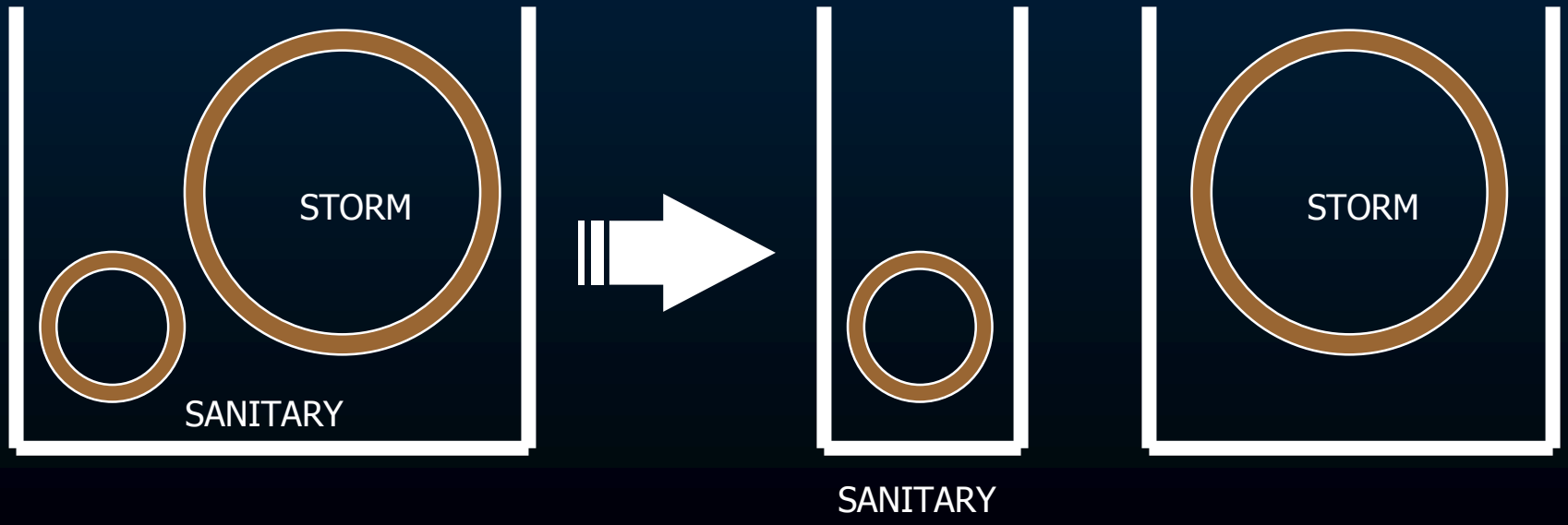


Combined vs. separate

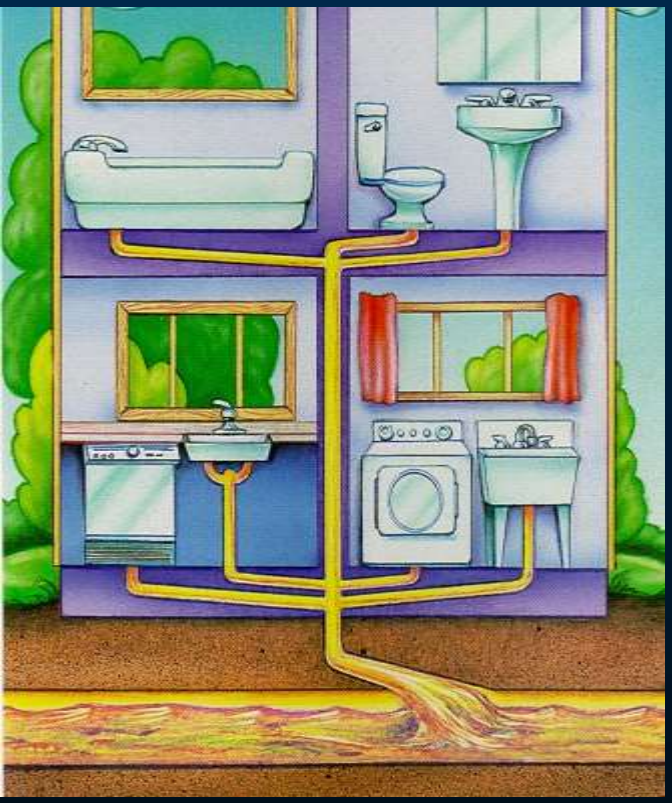


Combined vs. separate

- 1960s-today: evolution from common trench sewers to truly separate sewers in many areas



Separate sewer CHALLENGES

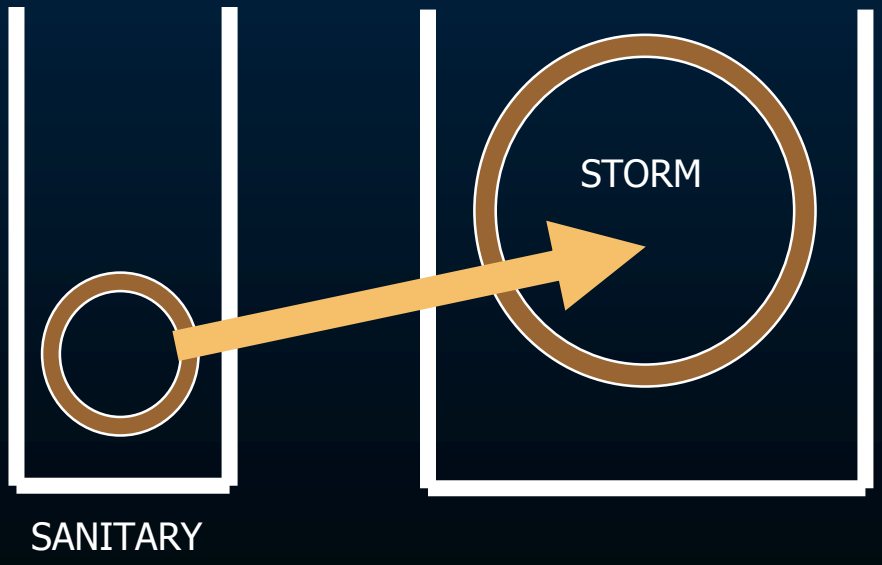


- Cross-connections (storm to sanitary or sanitary to storm)

Illicit Connections

Separate sewer CHALLENGES

- Constructed sanitary sewer overflows to relieve full sanitary sewers during rain



Sanitary Sewer Overflows

- Structures
- Basement flooding
- Surcharged sewers
- Common trench sewers

What is I & I
I & I stands for Inflow and Infiltration

Inflow
is the flow of stormwater into the sanitary sewer system through connections like roof drains, foundatiion drains, and basement sump pumps.

Infiltration
is groundwater seeping into sewer pipes, including private sewer laterals, through cracks and broken pipe joints.

Uncapped Cleanout

4" TO 6" TRANSITION

SEWER LATERAL

House

Faulty Manhole Cover or Frame

Deterioriated Manhole

STORM SEWER

SANITARY SEWER MAIN

KEY

Inflow Source

Infiltration Source

maintained by village

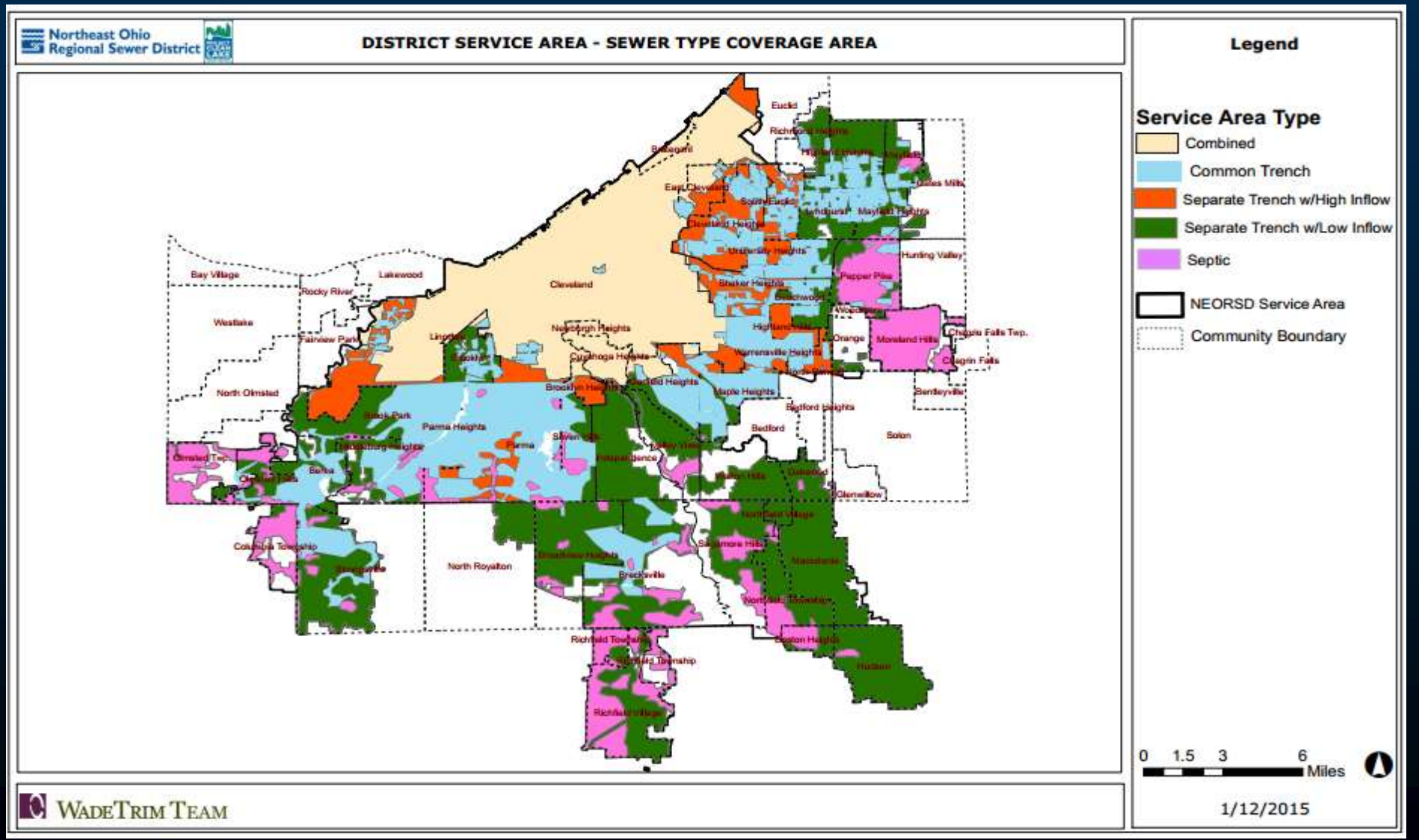
maintained by homeowner

Trivia Question…

How many miles of local sewers are located in NE Ohio?

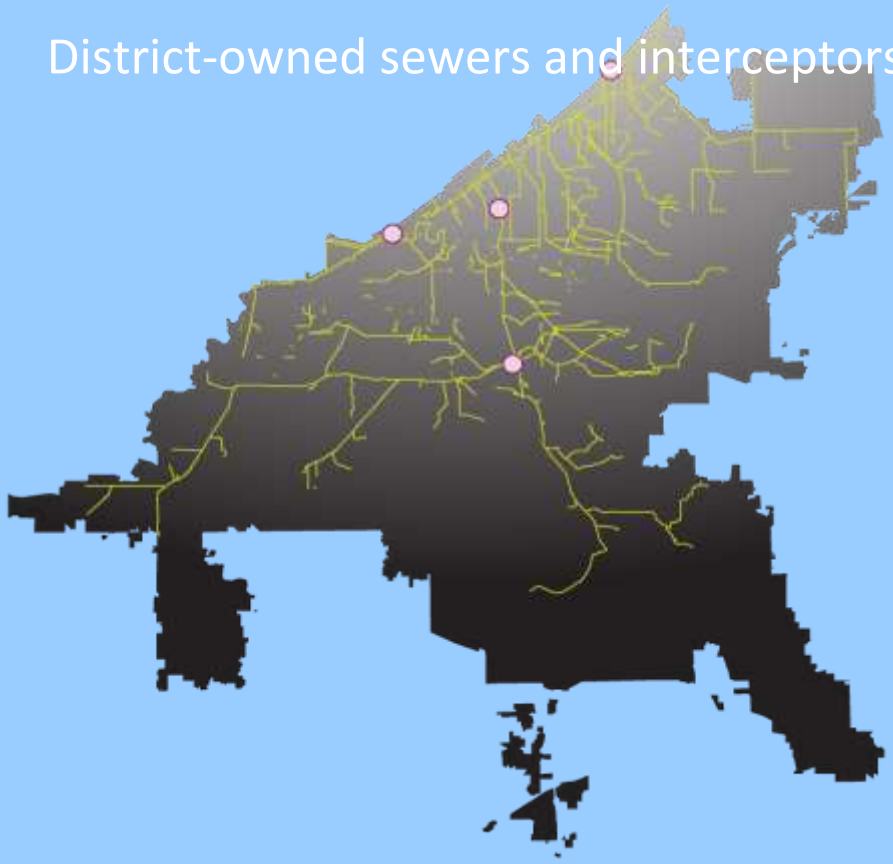
Types of sewers

District service area



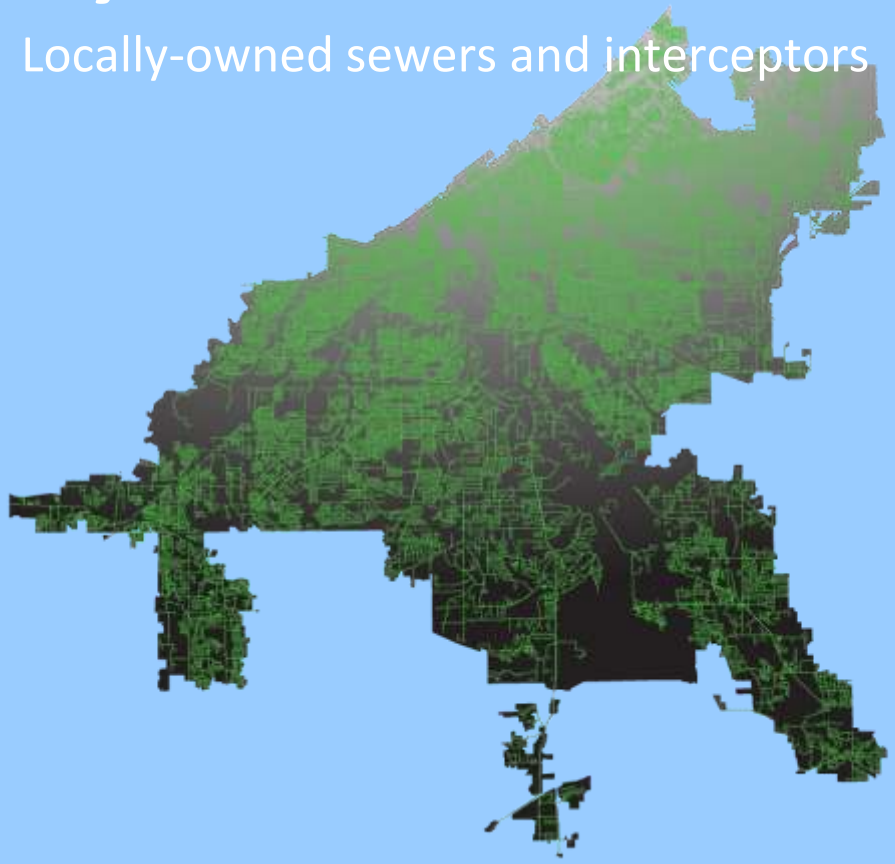
312 miles

District-owned sewers and interceptors



3,107 miles

Locally-owned sewers and interceptors



NEORSD Obligations:

- CSOs
- WWTPs

Local CWA Obligations:

- SSOs
- Illicit Discharges & Connections
- Stormwater Outfalls
- Septic Tanks

Your SewerU syllabus

- Our place in the urban water cycle
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Real challenges

- Water quality
- Public health
- Aging sewer infrastructure
- More development, less green space
  - Increased runoff to streams and sewers

PROJECT CLEAN LAKE

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REGIONAL
STORMWATER
MANAGEMENT
PROGRAM

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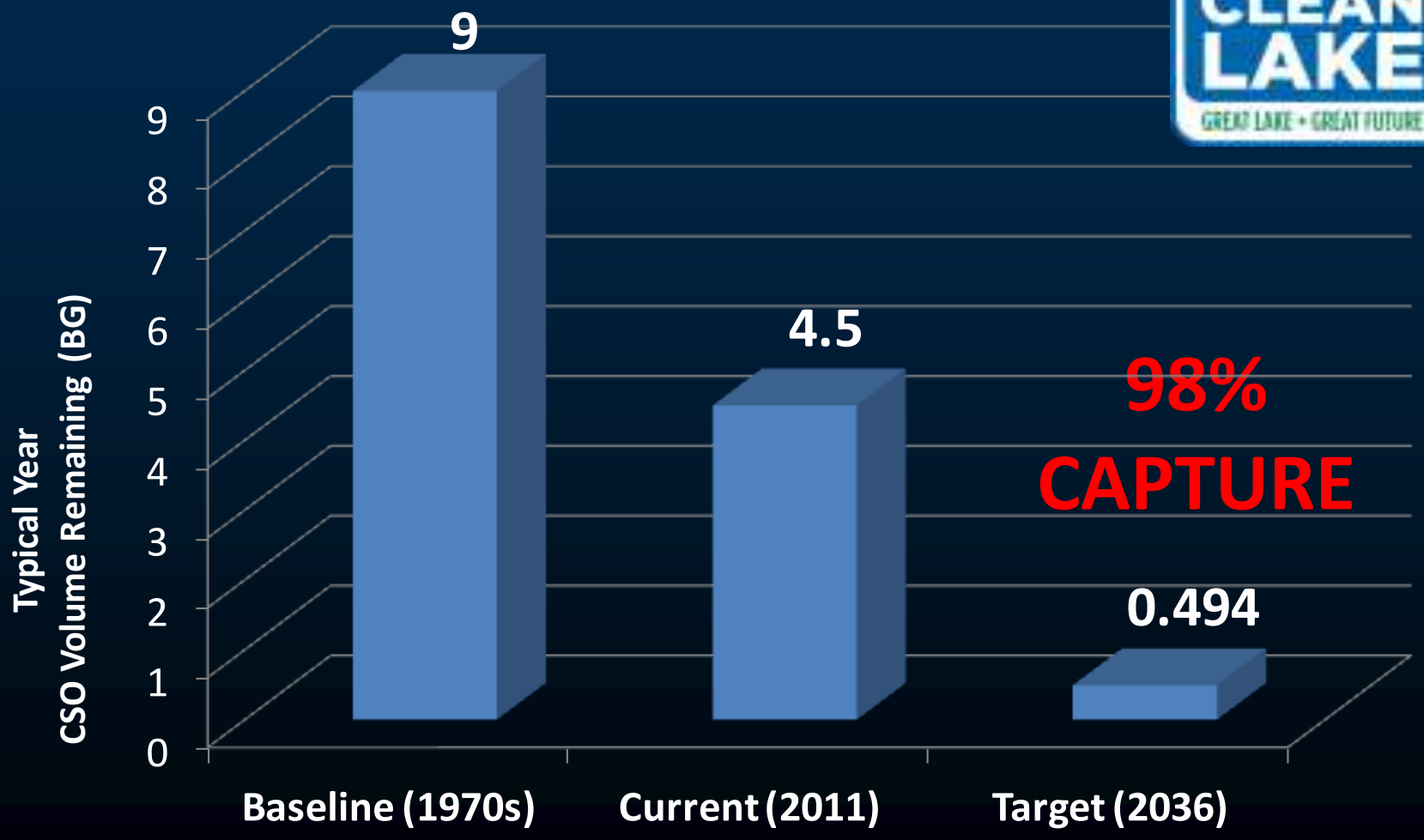
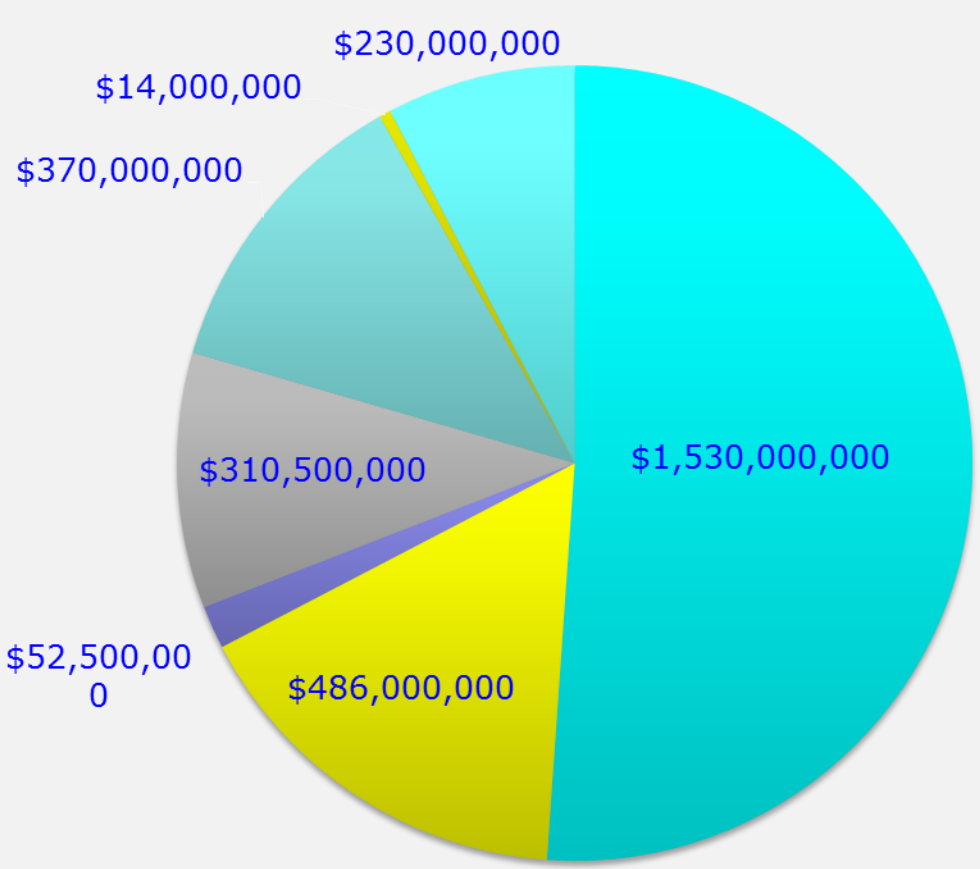
Regional Sewer District

Consent Decree to address combined sewer overflows



CSO Long-Term Control Plan Consent Decree

Estimated $3B investment in CSO control measures over 25 years




PROJECT CLEAN LAKE
TUNNELS CONSTRUCTION
SHORELINE
STORAGE TUNNEL
21' DIAMETER
16,500' LONG
2019
ADVERTISE FOR BID
WESTERLY CSO
STORAGE TUNNEL
24' DIAMETER
11,500' LONG
2018
ADVERTISE FOR BID
EUCLID CREEK & DUGWAY
STORAGE TUNNELS
24' DIAMETER
33,000+ TOTAL FT.
Euclid Creek online 2016,
Dugway online 2019
TUNNEL DEWATERING PUMP STATION
200' DEEP
160 MGD
Complete 2016
DOAN VALLEY
STORAGE TUNNEL
18' DIAMETER
10,000' LONG
2017
ADVERTISE FOR BID
BIG CREEK
STORAGE TUNNEL
18' DIAMETER
22,400' LONG
2029
ADVERTISE FOR BID
SOUTHERLY
STORAGE TUNNEL
23' DIAMETER
18,350' LONG
2024
ADVERTISE FOR BID
CLEVELAND
LINNDALE
CLEVELAND HEIGHTS
GARFIELD HEIGHTS
MAPLE HEIGHTS


Euclid Creek Tunnel
$195 million
($3 million under budget)

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REGIONAL STORMWATER MANAGEMENT PROGRAM

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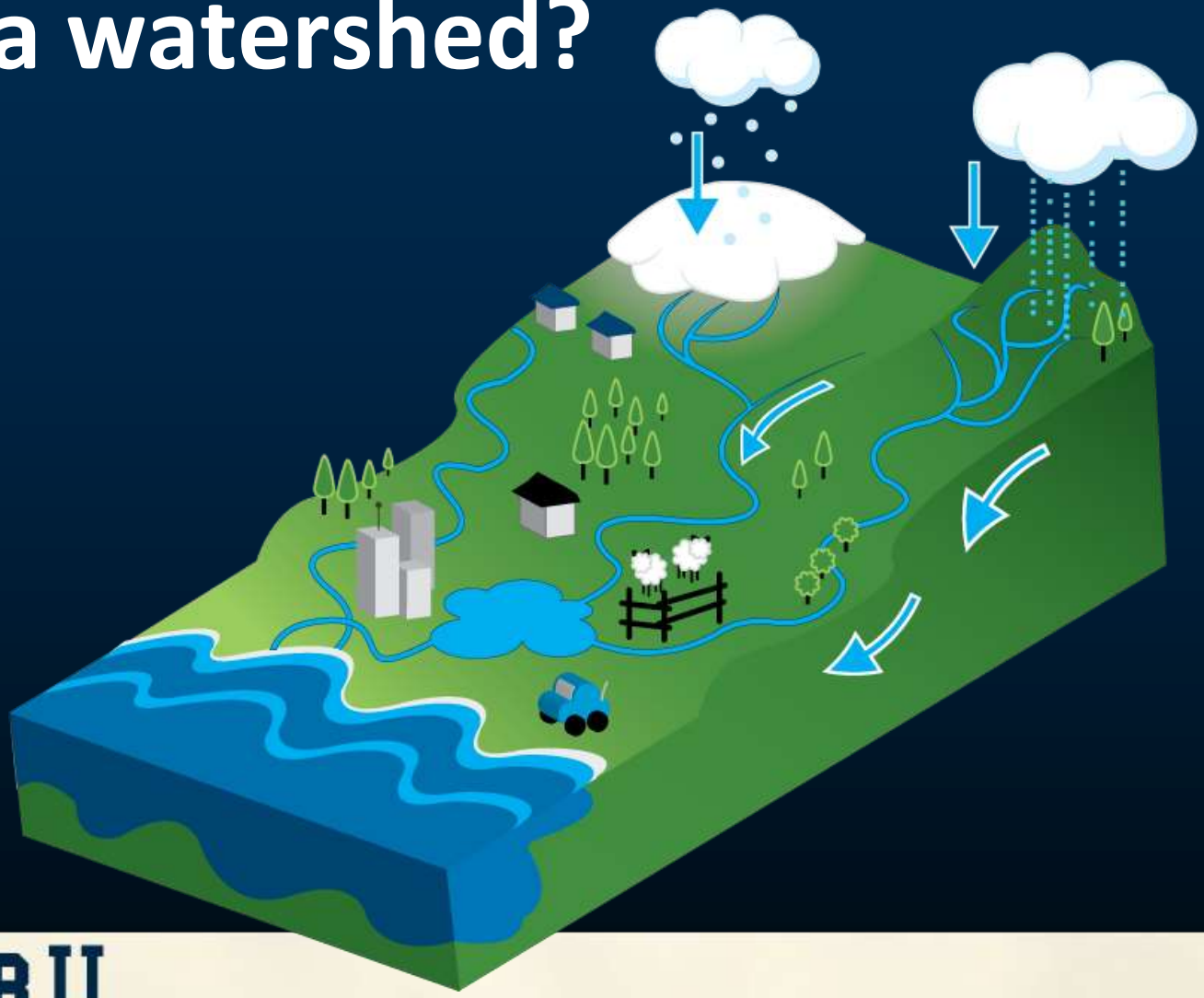
What is a watershed?



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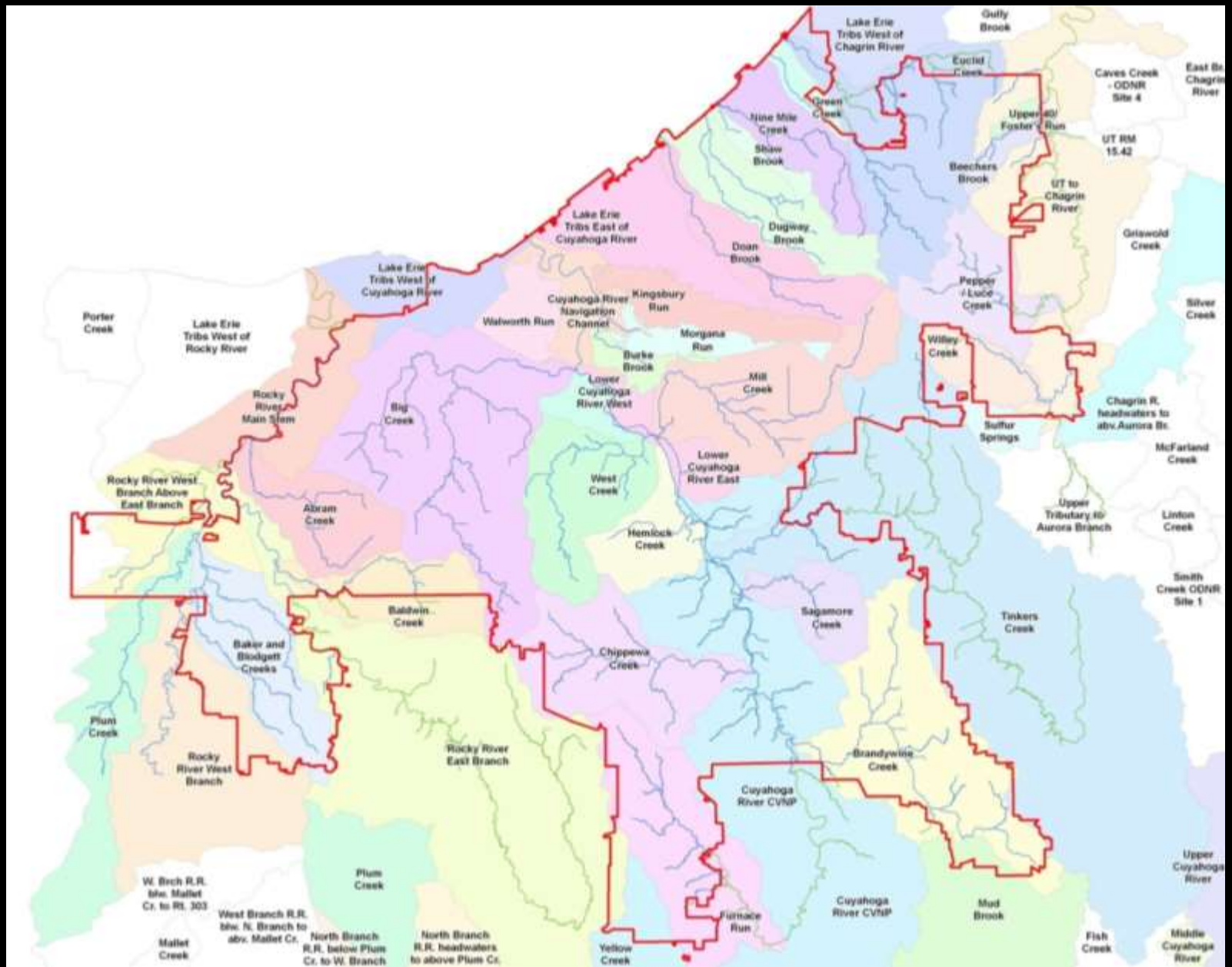
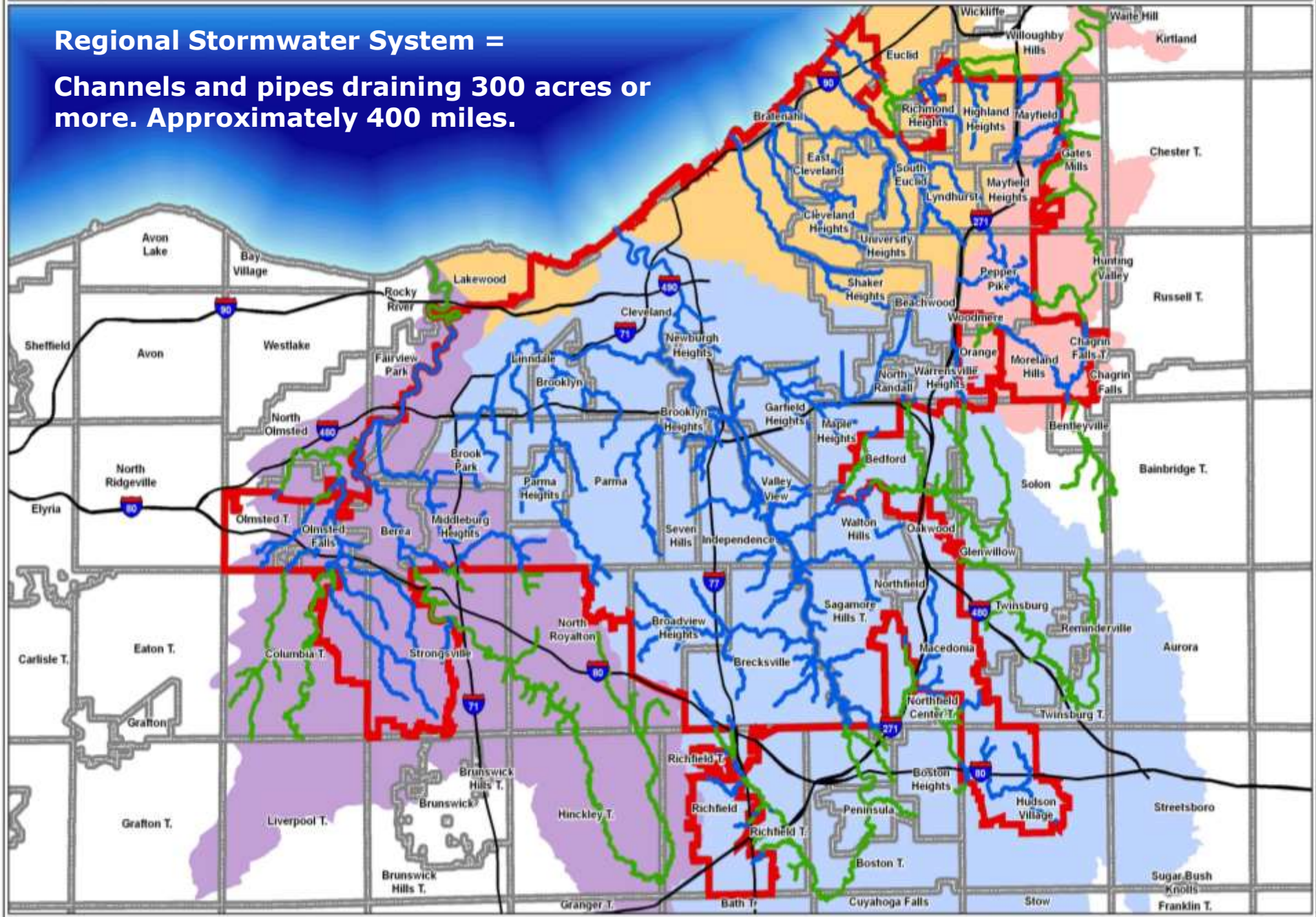
Northeast Ohio *major* watersheds

Subwatersheds



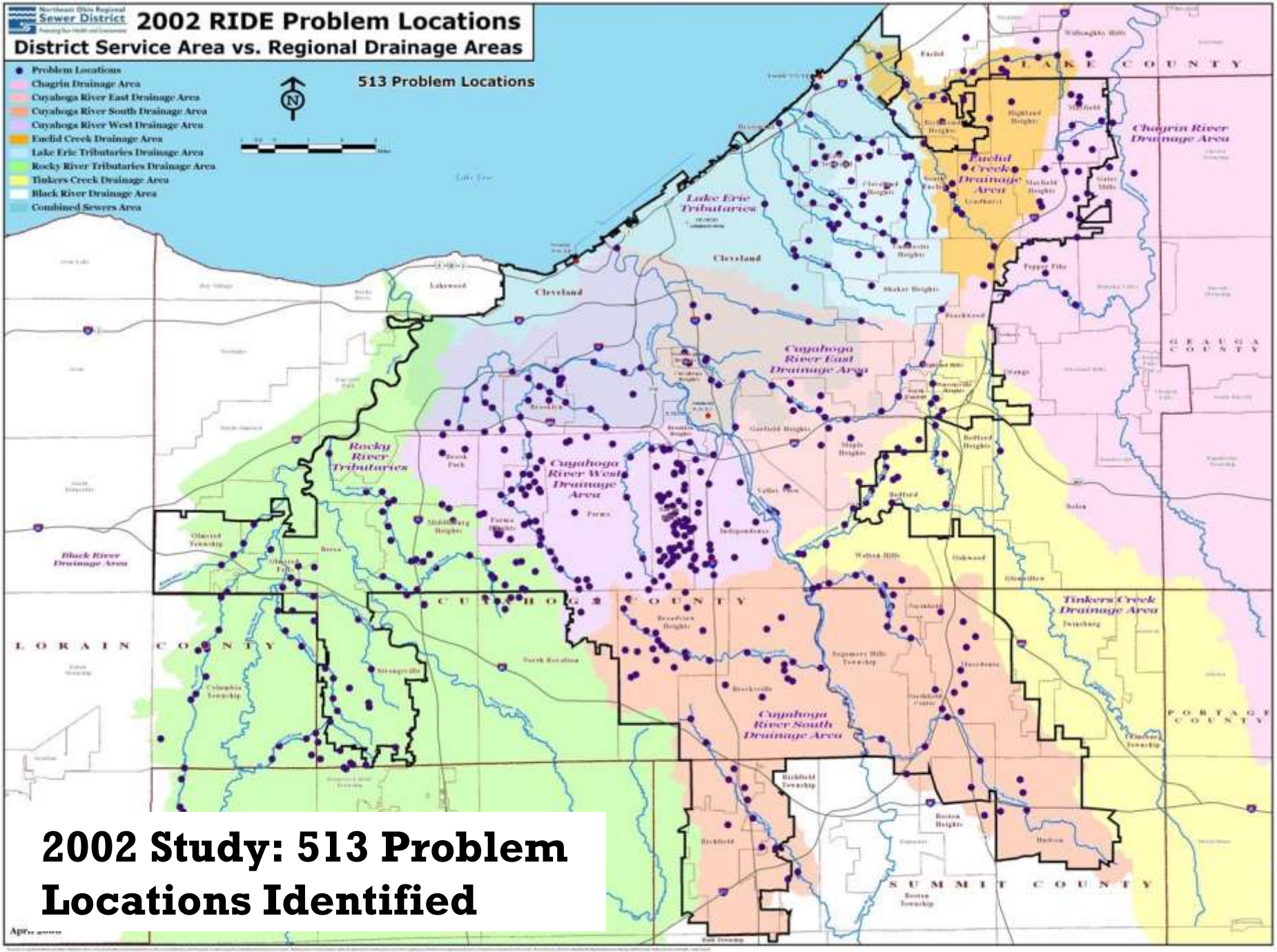
Northeast Ohio Regional Sewer District
Protecting Your Health and Environment

Regional Stormwater System - March 2012



Trivia Question…

How many culverted stream miles are located within the City of Cleveland?

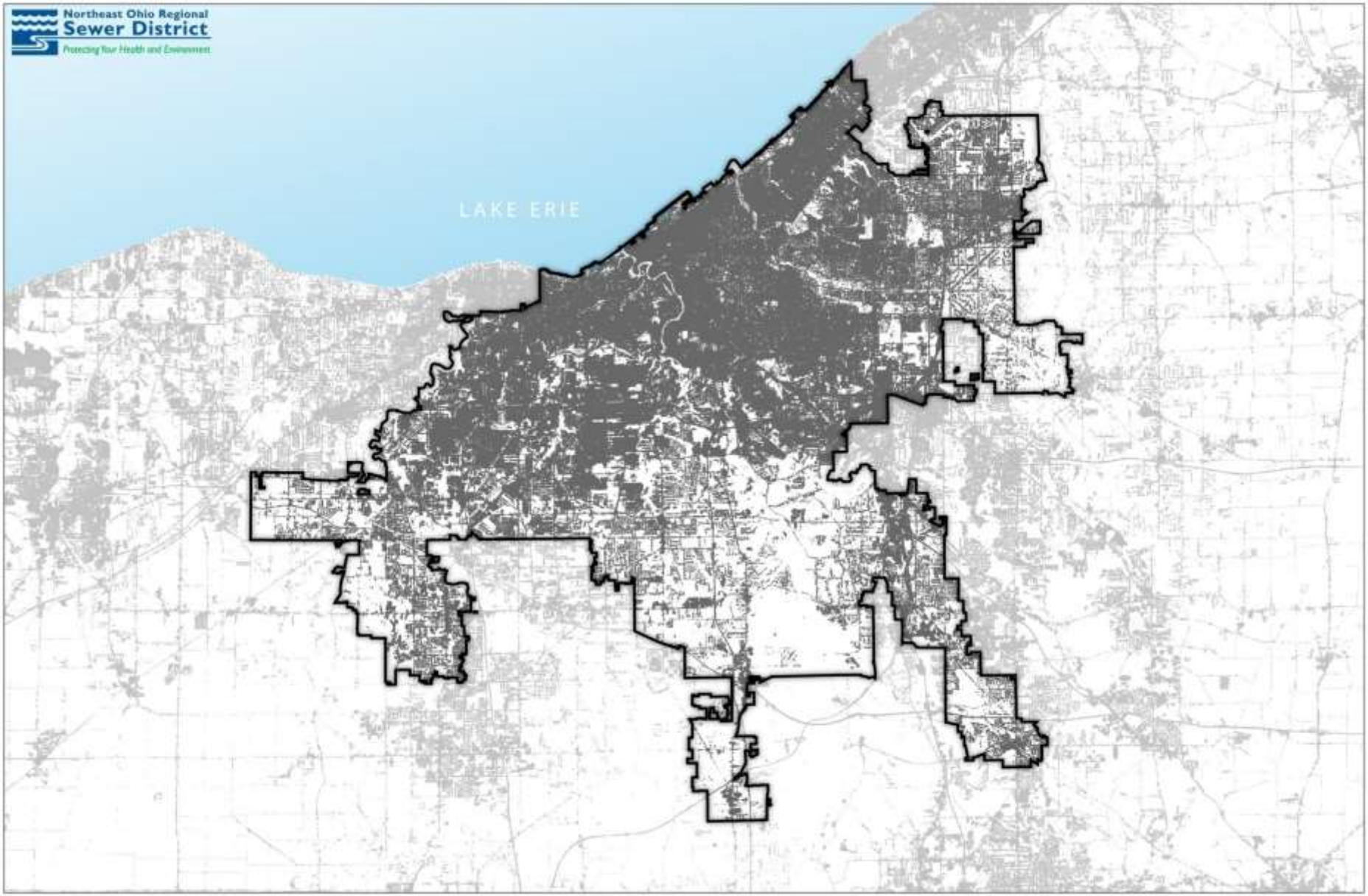


2002 Study: 513 Problem Locations Identified

Stormwater run-off

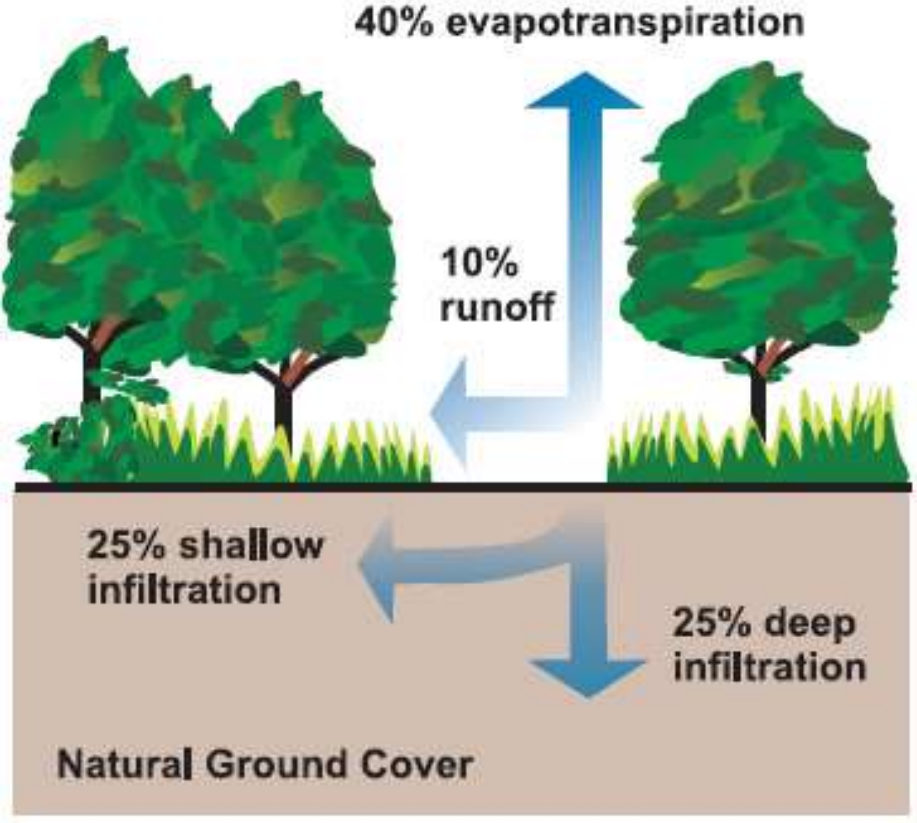
- Erosion
- Water Quality
- Flooding

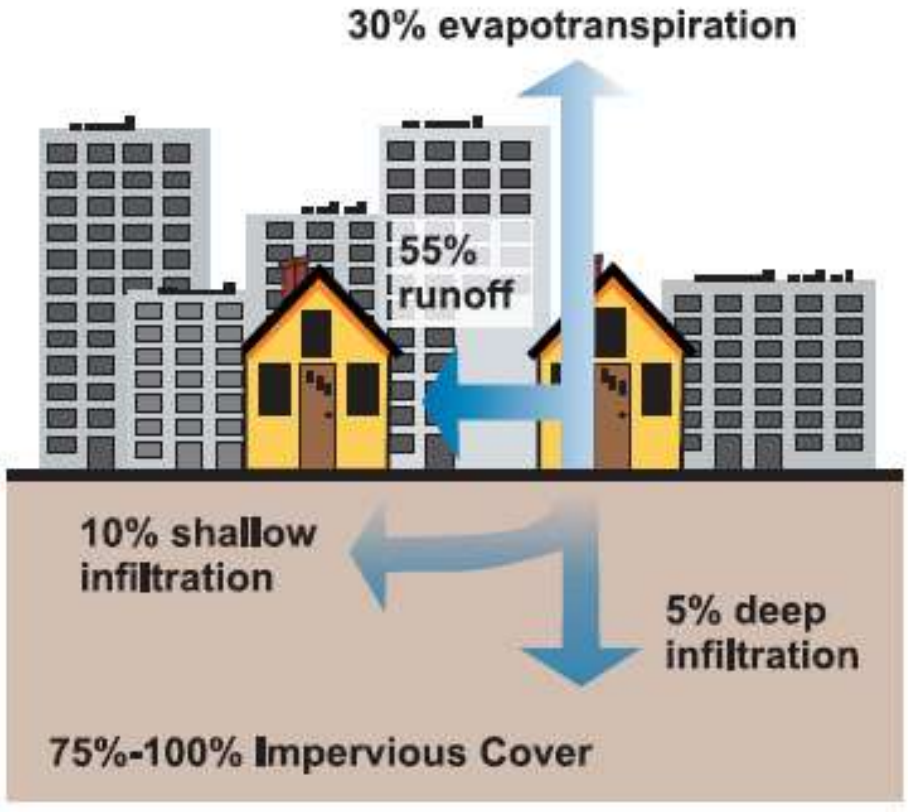
Impervious Surfaces



Trivia Question…

How many street catch basins are located within the City of Cleveland?


40% evapotranspiration
10% runoff
25% shallow infiltration
25% deep infiltration
Natural Ground Cover


30% evapotranspiration
55% runoff
10% shallow infiltration
5% deep infiltration
75%-100% Impervious Cover

Trivia Question…

What is the most common tree species in the United States?

Streambank erosion along Chippewa Creek


Middleburg Heights/Brook Park, Ohio
along Abrams Creek
Northeast Ohio
Regional Sewer District

Streambank erosion on Mill Creek
threatens Warner Road
in Garfield Heights, Ohio

Northeast Ohio
Regional Sewer District

Debris along Dugway Brook,
Cleveland Heights, Ohio

Northeast Ohio
Regional Sewer District

Streambank erosion along Stickney Creek

What Will We Do?

Master Plans

Inspect & Maintain

Construct Projects

Encourage Good Practices

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Green is a common theme

- What is green infrastructure?
- Where did it start?
- Why was it considered as a solution to…
  - Water quality challenges?
  - Public health concerns?
  - Increased runoff, stream problems?

What is green infrastructure?

- Green infrastructure is a cost-effective, resilient approach to managing wet weather impacts that provides many community benefits. *– US EPA*

NEORSD Project Clean Lake

Green Infrastructure for CSO Control

Stormwater control measures that use:

- plant/soil systems
- permeable pavement, or
- stormwater harvest and reuse to

store, infiltrate, or evapotranspirate stormwater and reduce flows to the combine sewer system.

LID / Green Infrastructure
Stormwater Source Control

Highland Park Golf Course Mill Creek Stream Restoration

Video…

Low Impact Development: Precursor to Green Infrastructure

- Infiltrating, filtering, storing, evaporating
- Hydrologic regime of watersheds
- Five Low Impact Development Principles:
  - Conserve natural areas
  - Minimize development impact on hydrology
  - Maintain runoff rate & duration
  - Decentralize controls
  - Implement pollution prevention

https://www.google.com/maps/place/Puget+Sound/@47.4877645,-122.1965729,9.5z/data=!4m5!3m4!1s0x54903e54b09738e1:0x3390a64604d67e01!8m2!3d47.7236535!4d-122.4713352

Puget Sound, Washington

Puget Sound

Washington

7 reviews

Inlet

Directions

SAVE NEARBY SEND TO YOUR PHONE SHARE

Add a photo

WRITE A REVIEW

Quick facts

Puget Sound is a [illegible] on the western coast of the U.S. state of Washington, an inlet of the Pacific Ocean, and part of the Salish Sea. Wikipedia

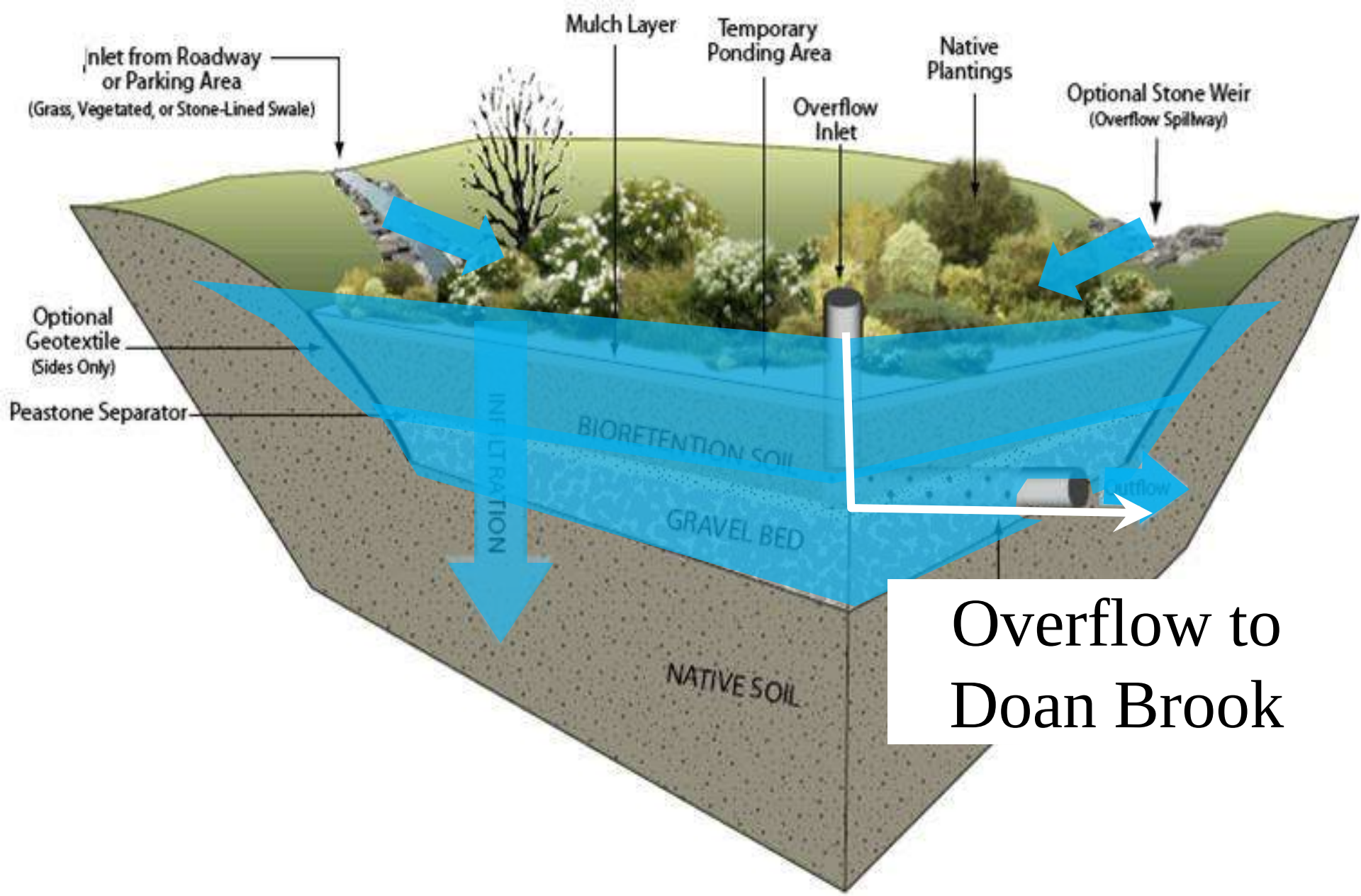
Port Townsend
Sequim
Blyn
Port Hadlock-Irondale
Whidbey Island
Marysville
Granite Fa
Everett
Port Ludlow
Snohomish
Quilcene
Lynnwood
Bothell
Poulsbo
Brinnon
Seabeck
Redmond
Bainbridge Island
Seattle
Bellevue
Bremerton
Port Orchard
Issaquah
Renton
Lilliwaup
Belfair
SeaTac
Vashon Island
Hoodsport
Kent
Union
Allyn-Grapeview
Auburn
Tacoma
University Place
Shelton
Puyallup
Lakewood
Buckley
Kamilche

Where it all began...

Low Impact Development Origins

- LID concept began in Prince George's County Maryland, 1990
- Rain gardens/bioretention emerge as best management practice in Prince George's County
- 1993 – 1st design criteria developed
- 1997 – pollutant removal studied for design optimization

Green Infrastructure Concept



Evolution Towards Green Infrastructure

- Stormwater management, climate adaptation & multi-functional greenspace
- Green infrastructure practices *reduce stress on drainage infrastructure*, i.e. storm sewers & combined sewers
- Shared stormwater control measures with low impact development

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Regional Sewer District

How was GI the right solution?

- Flood control and water quality
  - Reduces runoff
  - Improves runoff quality
- Low-impact development
- Complement gray infrastructure

- First agency to formally integrate GI in a consent decree
- Grants, expertise to empower property owners to embrace GI solutions

- GI grants reduce runoff entering combined system
- Regional approach encourages collaboration between partners

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

Defining Green Infrastructure: GI Policy expands beyond "GI for CSO" to "GI for source control"


CAPITAL IMPROVEMENT & OPERATION AND MAINTENANCE PROGRAM
GREEN INFRASTRUCTURE GRANT PROGRAM
MEMBER COMMUNITY INFRASTRUCTURE PROGRAM
Green Infrastructure Policy
WATER RESOURCES RESTORATION SPONSORSHIP PROGRAM
COMMUNITY DISCHARGE PERMIT PROGRAM
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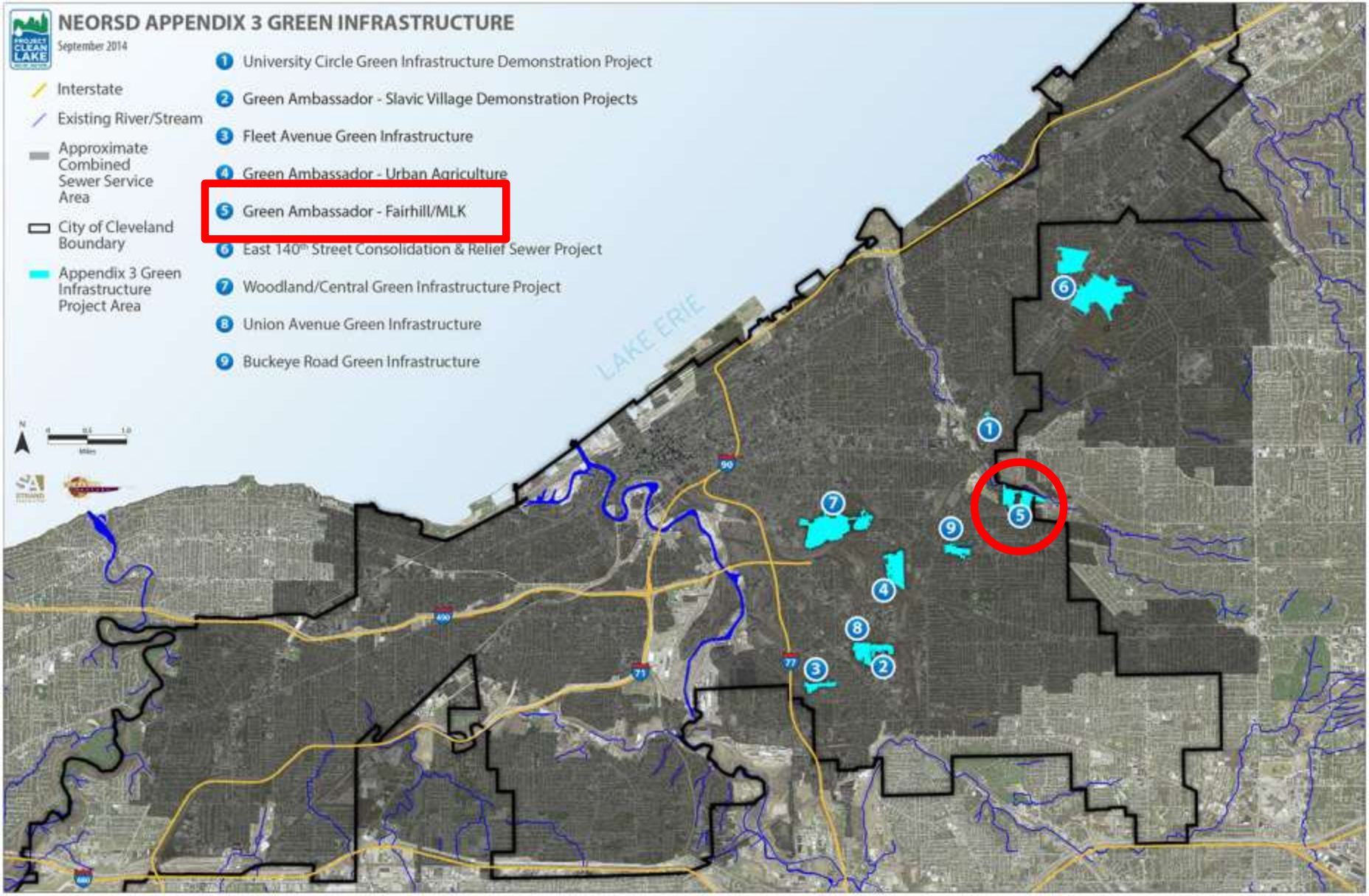

NEORSD APPENDIX 3 GREEN INFRASTRUCTURE
September 2014
Interstate
Existing River/Stream
Approximate Combined Sewer Service Area
City of Cleveland Boundary
Appendix 3 Green Infrastructure Project Area
1 University Circle Green Infrastructure Demonstration Project
2 Green Ambassador - Slavic Village Demonstration Projects
3 Fleet Avenue Green Infrastructure
4 Green Ambassador - Urban Agriculture
5 Green Ambassador - Fairhill/MLK
6 East 140th Street Consolidation & Relief Sewer Project
7 Woodland/Central Green Infrastructure Project
8 Union Avenue Green Infrastructure
9 Buckeye Road Green Infrastructure
LAKE ERIE

N

0 140 280
Feet

Legend

- Combined Sewer
- Sanitary Sewer
- Storm Sewer
- SWD Sewer
- Appendix 3 Storm Sewer
- Tributary Drainage Area

NORTHEAST OHIO REGIONAL SEWER DISTRICT

GREEN AMBASSADOR

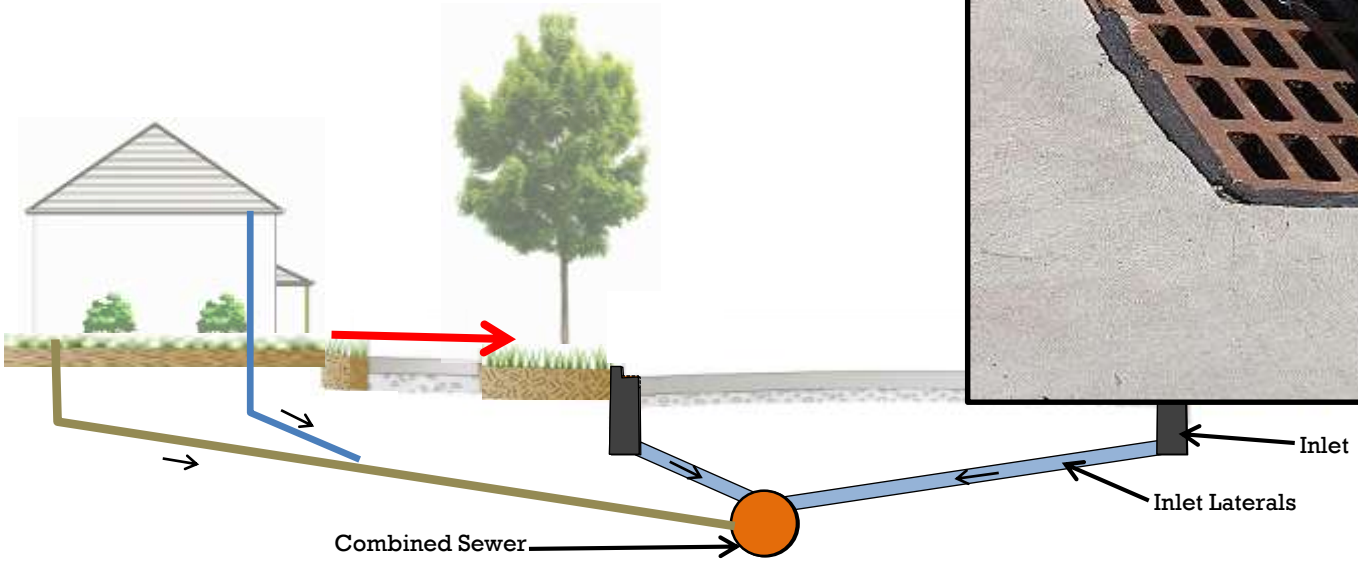
FAIRHILL/MLK DRAINAGE AREA

HUMAN NATURE

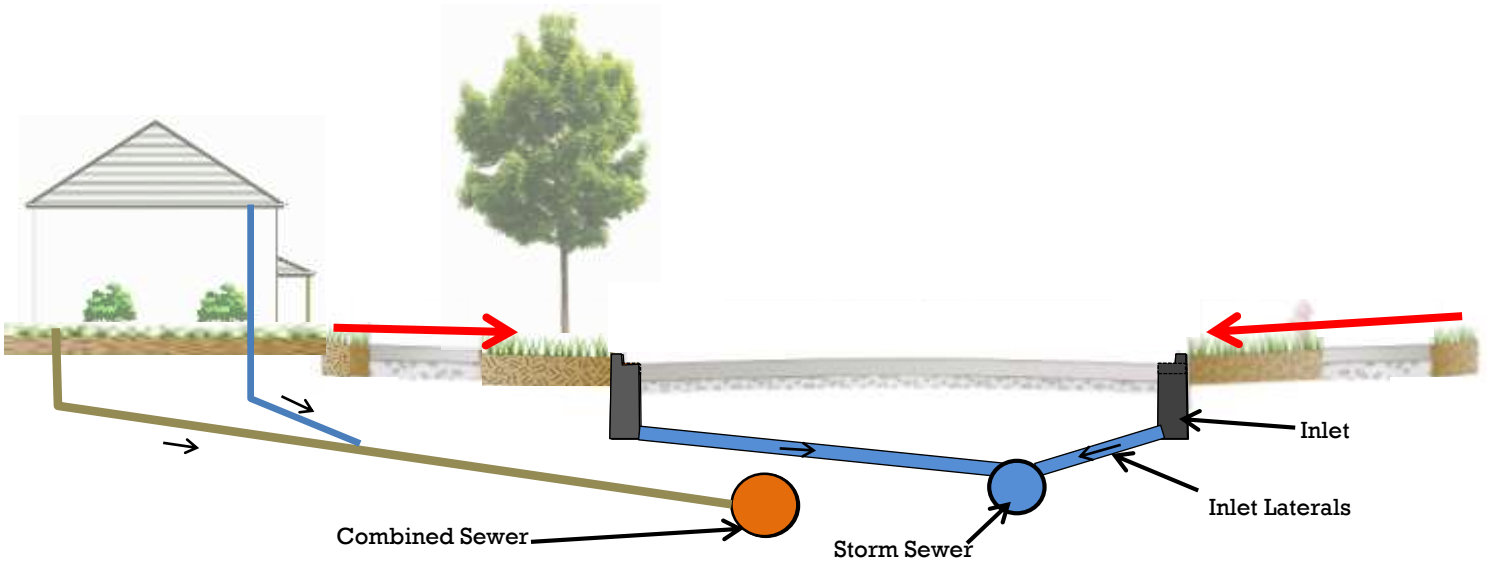
STRAND ASSOCIATES

GREEN INFRASTRUCTURE DESIGN • **SEPTEMBER 2014** • FINAL


Bioretention Basins
DOAN BROOK
PARK
MARTIN LUTHER KING
BRITTON
FAIRHILL
KEMPER
NORTHWOOD
WOODSTOCK
124TH
126TH
127TH
MOUNT OVERLOOK
WOODLAND
1ST


Inlet
Inlet Laterals
Combined Sewer


2900


Inlet
Inlet Laterals
Combined Sewer
Storm Sewer

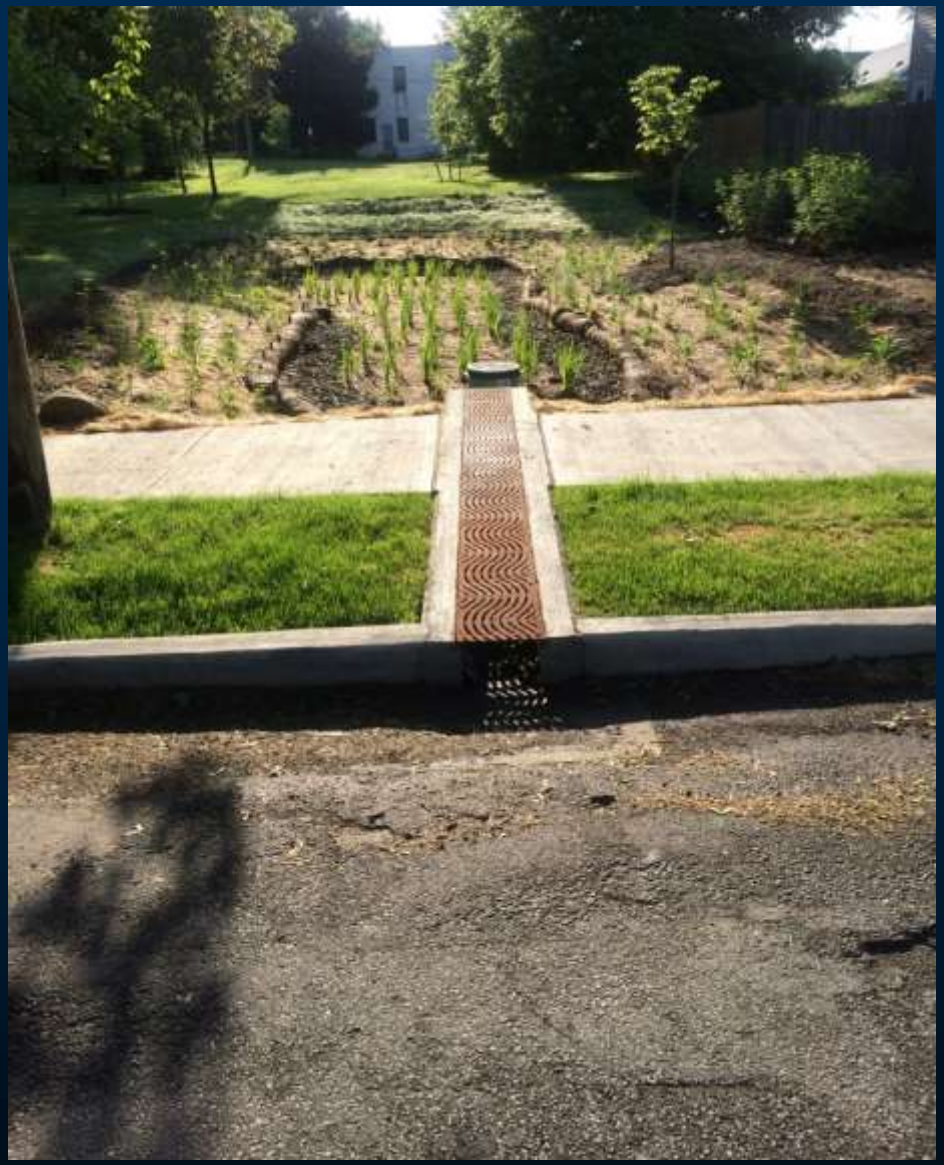

IN LUTHER KING
Discharge to Doan Brook
Bioretention Basin (Lower Basin)
Bioretention Basin (Upper Basin)
Public Plaza
DOAN BROOK
AMBLER PARK
Stormwater Pretreatment Device
Diversion Structure (to combined sewer)

A closer look: Fairhill/MLK

- 2-acre bioretention at an existing park
  - Manages 14+ million gallons/year
  - 2.4 million gallons out of combined sewers
- Restoration of eroding Doan Brook bank
- Expanded riparian corridor
- Partnership with RTA

A closer look: Slavic Village

- Three bioretention areas
- 3-acre drainage area
- 39,000 square feet of new natural space
- Designed to manage 200,000 gallons
- Detailed USGS monitoring data

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Implementing GI Policy through GI Grant Program:
Western Reserve Historical Society Green infrastructure features


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Implementing GI policy through proposed Community Infrastructure Program: Address local water quality issues

- Sanitary sewer overflows
- Basement flooding
- Surcharged sewers
- Common trench sewers
- Illicit discharges

Proposed Community Infrastructure Program:
Promoting Green Infrastructure to address local sewer issues

Green Infrastructure =
Disconnection and distribution
to on-site stormwater practice

.@neorsd blog

Official blog of the Northeast Ohio Regional Sewer District

Wednesday, January 18, 2017

NEWS: $7.2 million to improve water quality by supporting local infrastructure investments

New program to fund community sewer projects that impact public health, environment

Northeast Ohio Regional Sewer District Trustees recently awarded $7.2 million to 12 communities as part of the agency's newly-launched Member Community Infrastructure Program (MCIP).

The MCIP assists communities with local infrastructure improvements — including new sewer infrastructure, repairs to

Northeast Ohio Regional Sewer District

About our blog

The Northeast Ohio Regional Sewer District's official blog home for news, updates, features and conversation that keep our Great Lake great. | *@neorsd social media comment policy*


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Implementing GI Policy through Restoration and Protection: Water Resources Restoration Sponsorship Program for land conservation

$50+ million

facilitated since 2005


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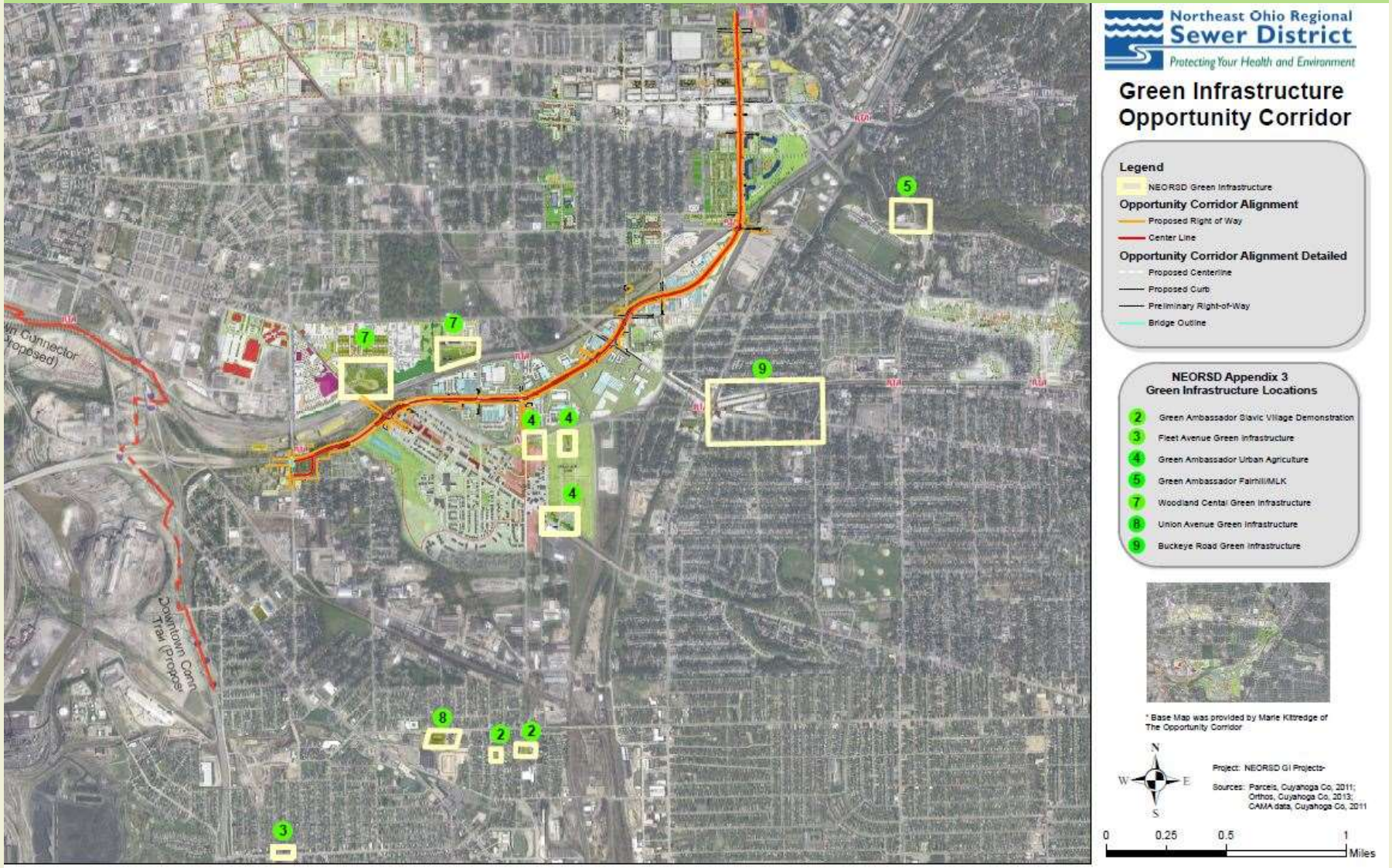
Implementing GI Policy through Title IV:

Opportunity Corridor On-site Stormwater Management Strategy



Opportunity Corridor On-site Stormwater Management Strategy: Facilitates GI as redevelopment occurs

- Coordinate with redevelopment in the Opportunity Corridor area
- Evaluate sewer system to ensure can handle inflow from redevelopment
- Facilitate compliance with Title IV
- Promote removal of stormwater from the combined sewer system through GI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Implementing GI policy through Regional Stormwater Management Program

Stormwater Master Plans

Inspect & Maintain

Construct Projects

Encourage Good Practices

Big Creek Spillway Restoration

Video…


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Your SewerU syllabus

- Our place in the urban water cycle
- Sewers 101: History and challenges
- Solutions: Gray and green
  - Project Clean Lake
  - Regional Stormwater Management Program
- Green: Policy, past, present and future

NORTHEAST OHIO REGIONAL SEWER DISTRICT

SEWER U

SEWER UNIVERSITY

The history of sewers and the future of clean water in Greater Cleveland

Northeast Ohio Regional Sewer District

@neorsd #SewerU