



# A Happy Marriage?



## A CASE FOR INTEGRATING THE MANAGEMENT OF WASTEWATER & STORMWATER PROGRAMS



2018 Maine Sustainability & Water Conference



ZACH HENDERSON | WOODARD & CURRAN  
FRED DILLON | CITY OF SOUTH PORTLAND



# Who We Are



## Fred Dillon

- SoPo Stormwater Program Coordinator
- Municipal WW, scientific research and consulting for watershed restoration projects
- Most of career dedicated to protecting water resources



# Who We Are



**Zach  
Henderson**

- 17 years stormwater management, municipal compliance, design and planning



## On the Importance of Municipal Piping...

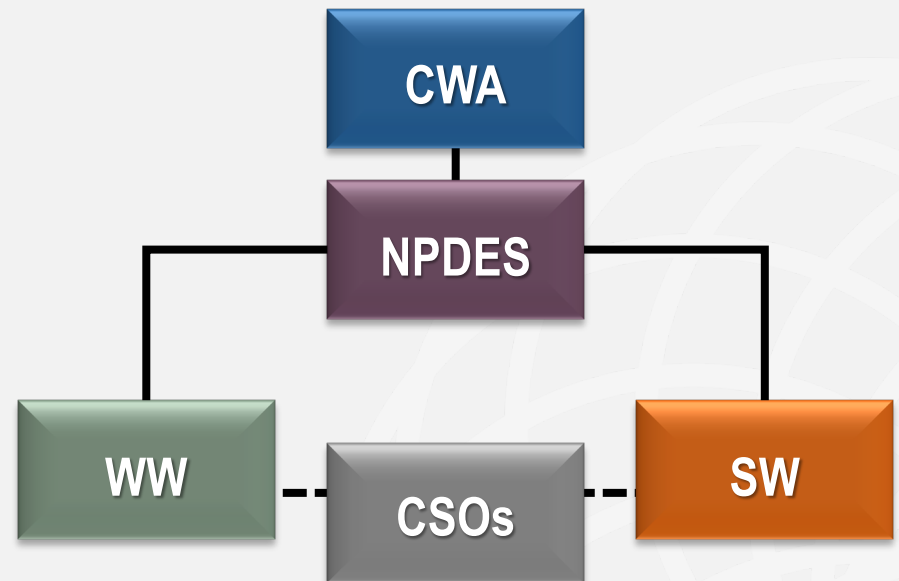
*“...these fetid streams of subterranean slime which the pavement hides from you, do you know what all this is? It is the flowering meadow, it is the green grass, it is the marjoram and thyme and sage, it is game, it is cattle, it is the satisfied low of huge oxen at evening, it is perfumed hay, it is golden corn, it is bread on your table, it is warm blood in your veins, it is health, it is joy, it is life.”*

*Victor Hugo ~ Les Misérables*

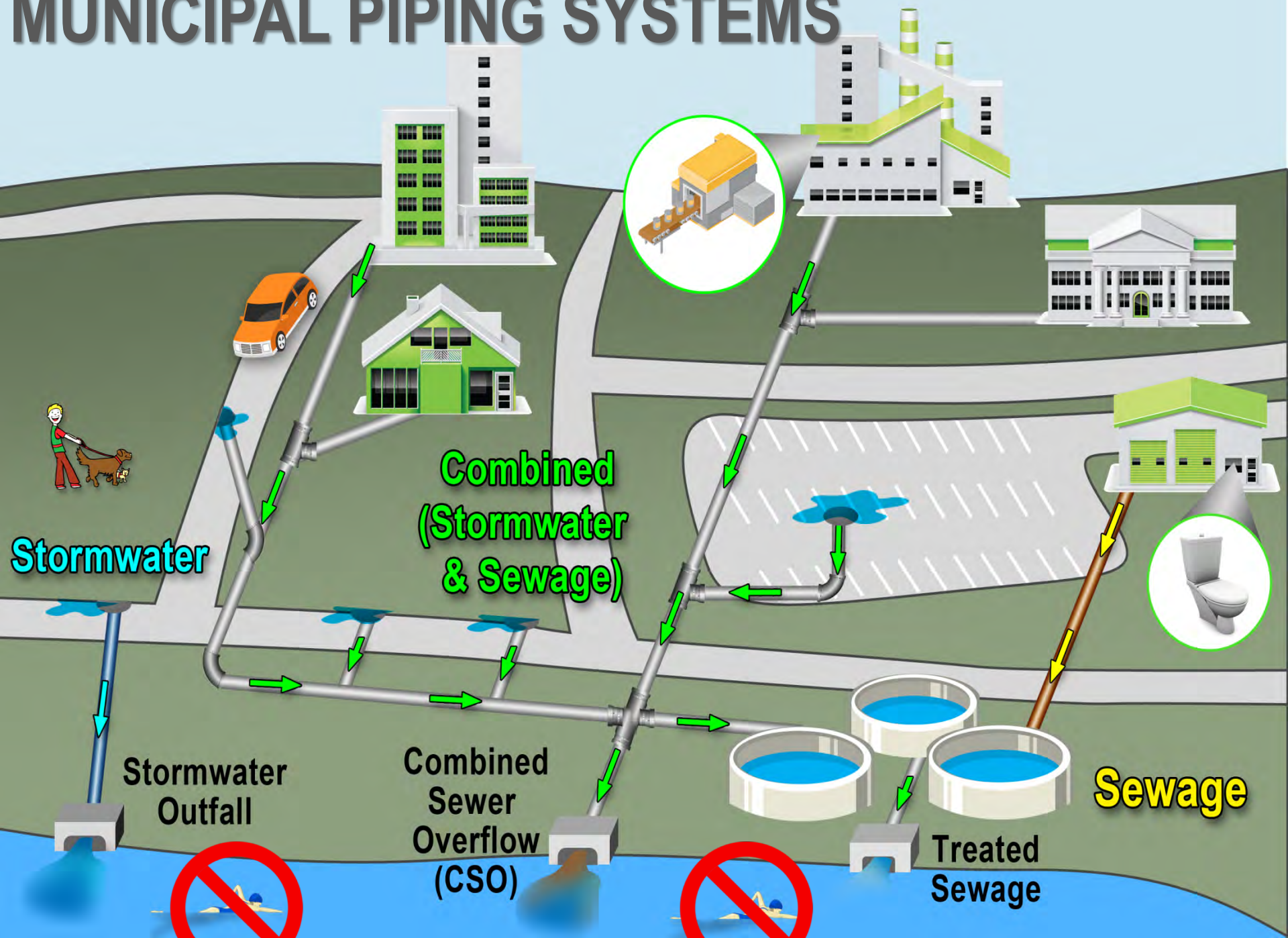


# CWA & Municipal Infrastructure Management

- Main “branches” of CWA / NPDES are WW & SW
- Potential areas of WW-SW overlap
  - Administration/Management/Long-Term Planning
  - Collection System Monitoring & Maintenance
  - Operations
  - Public Engagement
- **Most municipalities currently manage WW & SW systems separately**



# MUNICIPAL PIPING SYSTEMS



**Stormwater**

**Combined  
(Stormwater  
& Sewage)**

**Stormwater  
Outfall**

**Combined  
Sewer  
Overflow  
(CSO)**

**Treated  
Sewage**

**Sewage**



# Municipal Piping Systems

Combined sewer



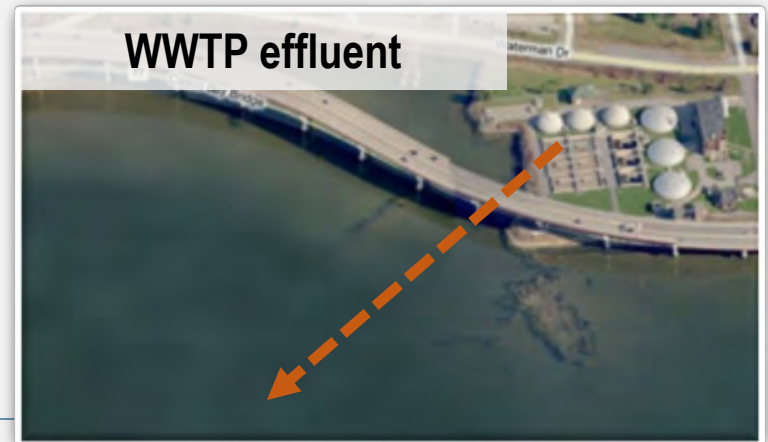
Sanitary sewer



Stormwater outfall



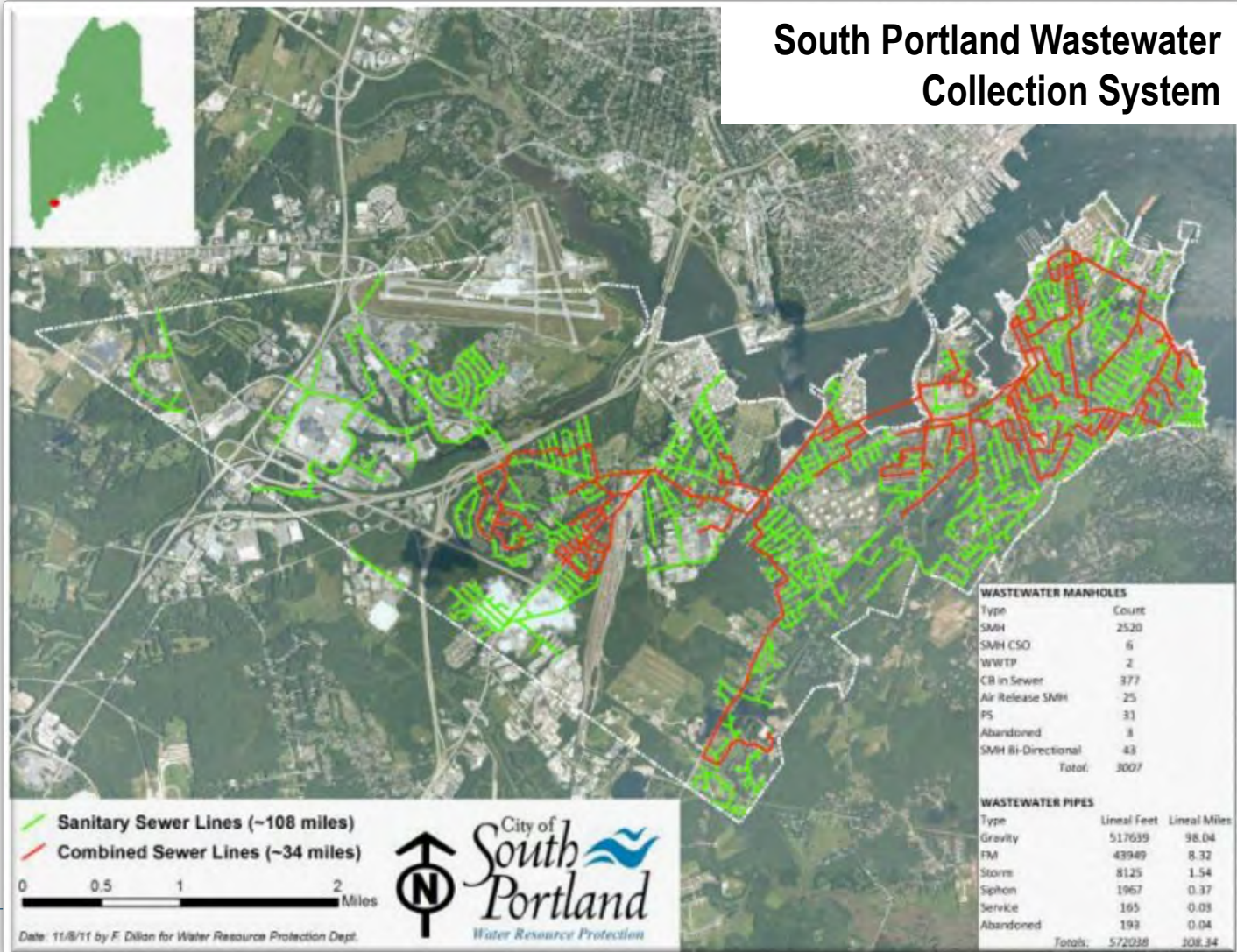
WWTP effluent





# Municipal Wastewater Systems

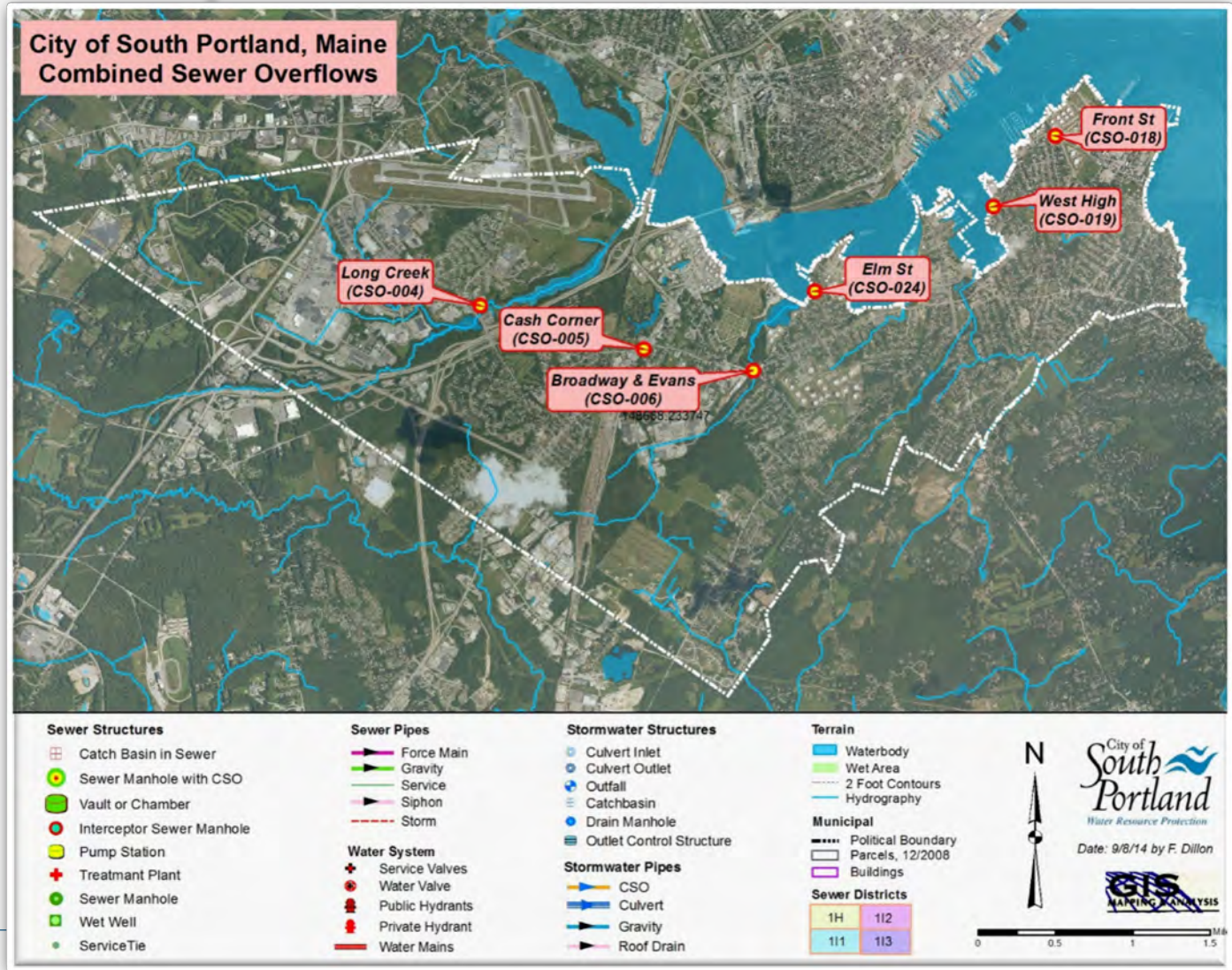
## South Portland Wastewater Collection System





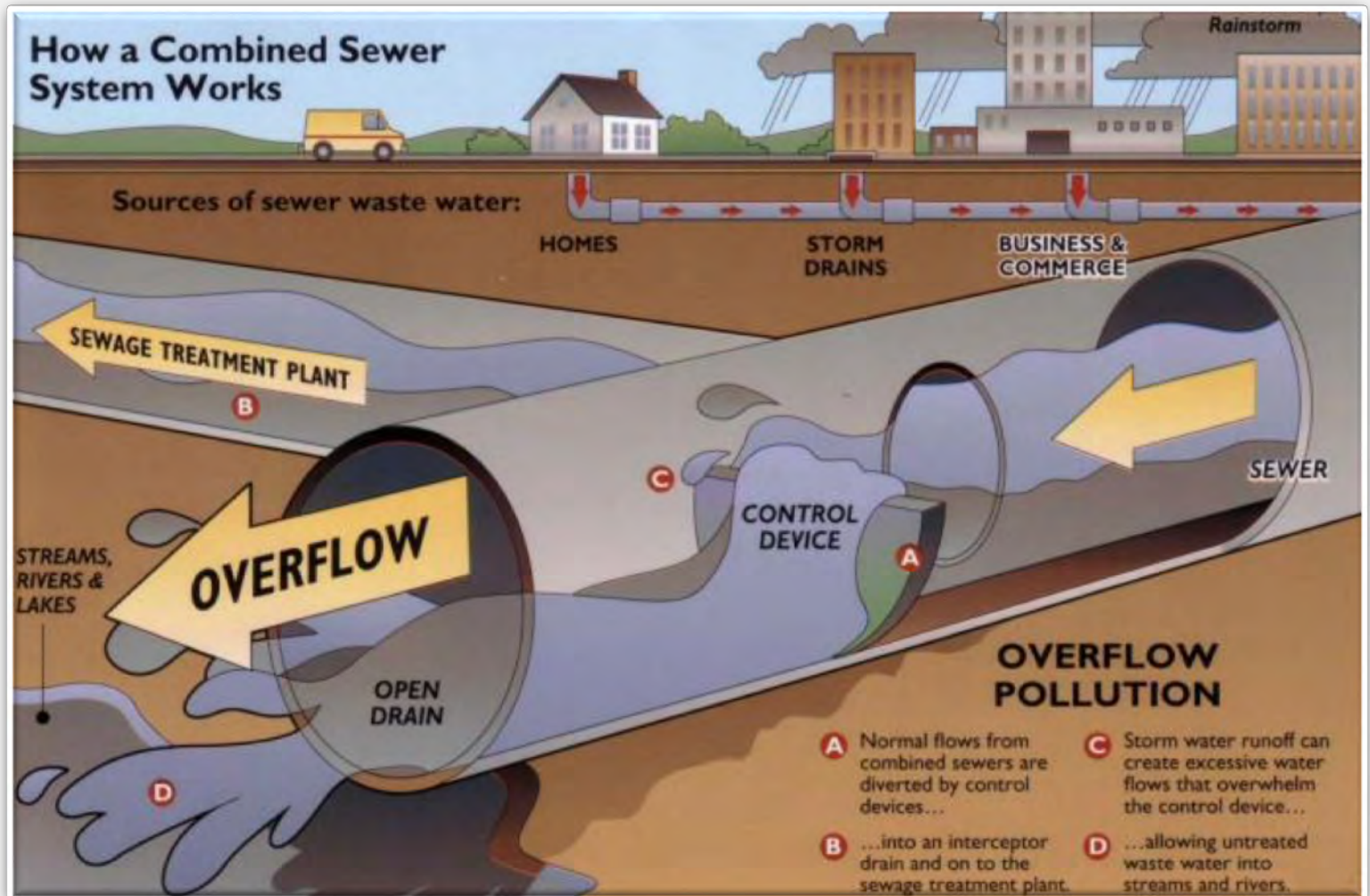


# Municipal CSOs



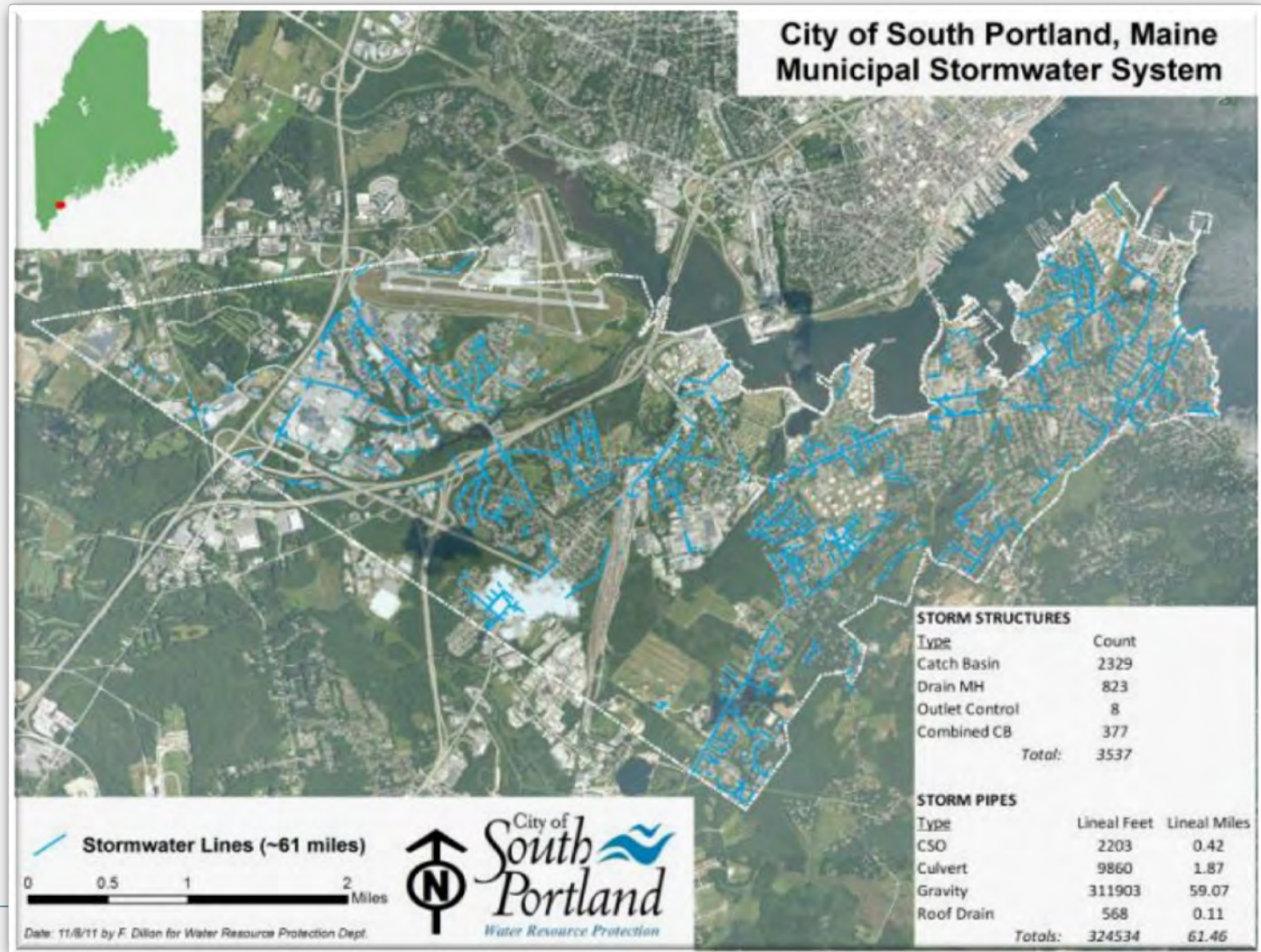


# Municipal CSOs



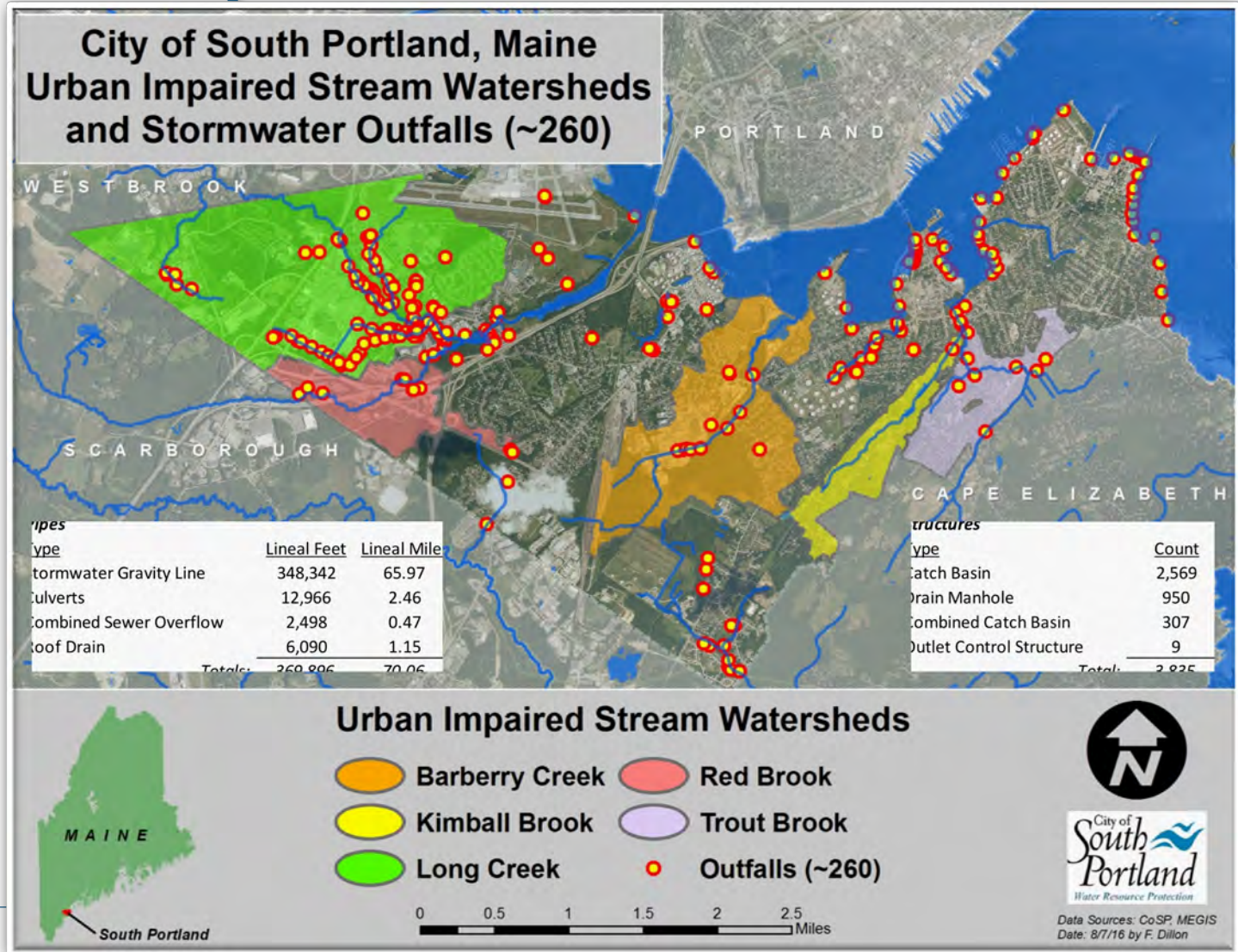


# Municipal Stormwater Systems





# Municipal Stormwater Outfalls





# Implications – Stormwater

- Polluted stormwater runoff is one of the largest remaining sources of pollution for the Nation's waters
- "...remains one of the great challenges of modern water pollution control" – *National Research Council*
- Polluted stormwater is "only increasing source of water pollution in many watersheds" – *Seth Brown, WEF Stormwater Program Director*




Table 1. Water chemistry data summer 1996

Parameters (unit)	Upstream (256)	Downstream (257)	Water Quality Criteria	
Total Phosphorus (mg/L)	0.012	0.148	0.031	
Total Suspended Solids (mg/L)	5.5	2.5	NC	
<b>Heavy metals</b>				
			CMC <sup>a</sup>	CCC <sup>b</sup>
Cadmium (µg/L)	ND 0.5	ND 0.5	0.64	0.32
Copper (µg/L)	2.8	3.8	3.89	2.99
Iron (µg/L)	280	610	NC	1,000
Lead (µg/L)	<2	<2	10.52	0.41
Zinc (µg/L)	ND 4	ND 4	29.9	27.1
Manganese (µg/L)	13	75	NC	NC
Nickel (µg/L)	<1	1.3	36.4	41.4




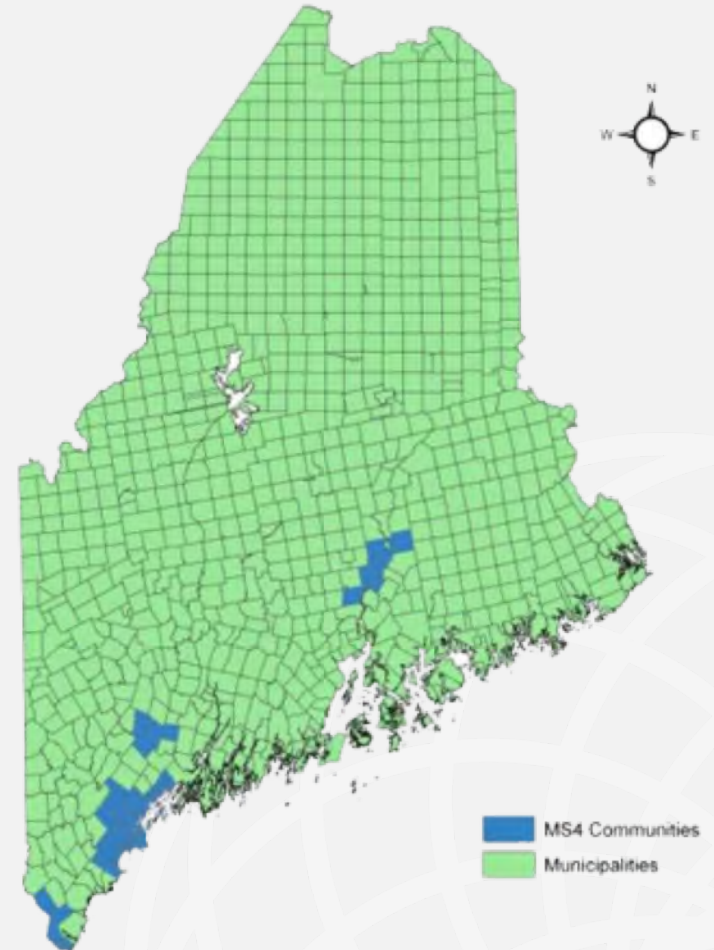
Table 2. Results of water chemistry monitoring and quality standards

Parameter	Water Quality Standard	Upstream (256)		Downstream (257)		Water Quality Criteria
		25-Jul-96	25-Aug-96	25-Jul-96	25-Aug-96	
Total Phosphorus (mg/L)	0.031	0.012	0.012	0.148	0.148	0.031
Total Suspended Solids (mg/L)	5.5	5.5	5.5	2.5	2.5	NC
Cadmium (µg/L)	0.64	ND 0.5	ND 0.5	ND 0.5	ND 0.5	0.64
Copper (µg/L)	3.89	2.8	2.8	3.8	3.8	3.89
Iron (µg/L)	1,000	280	280	610	610	1,000
Lead (µg/L)	10.52	<2	<2	<2	<2	10.52
Zinc (µg/L)	27.1	ND 4	ND 4	ND 4	ND 4	27.1
Manganese (µg/L)	NC	13	13	75	75	NC
Nickel (µg/L)	41.4	<1	<1	1.3	1.3	41.4



# Implications – Stormwater MS4 General Permit

- Full compliance with 6 “minimum control measures”
- Improvement & protection of priority water bodies
- Added scrutiny from DEP, EPA & environmental groups
- Higher costs than non-regulated municipalities





# Implications – Wastewater

## New England's Infrastructure is Old!

**47**

average AGE of  
sewer pipes in  
the US

**92**

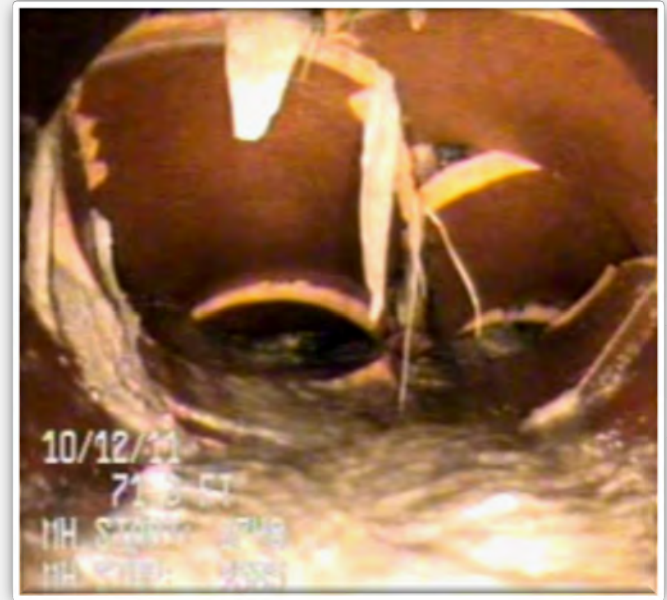
average AGE of  
sewer pipes in  
Quincy, MA

**94**

Average AGE of  
sewer pipes in  
Lawrence, MA

**70**

miles of Portland, ME  
sewer pipe that is  
greater than 70 years old





# America's Wastewater & Stormwater Infrastructure Grade

D

Our nation's wastewater infrastructure is aging and at risk.

- **\$298 billion** What we need to invest over the next twenty years to keep our wastewater and stormwater drainage systems functioning. This is twice what we currently invest.
- U.S. public infrastructure spending has fallen to **20-year low** of 1.7% GDP. **Funding gap** expected to be \$126 billion by 2020.
- **Sewer pipes represent the largest costs.** Wastewater treatment facilities only represent 20%.
- **800,000 miles** of public sewer pipes in the U.S.





# Typical Sewer System Issues

- Aging sewer and drainage system
- High FOG Users
- Misunderstood Preventative Maintenance and Capital Improvement Programs

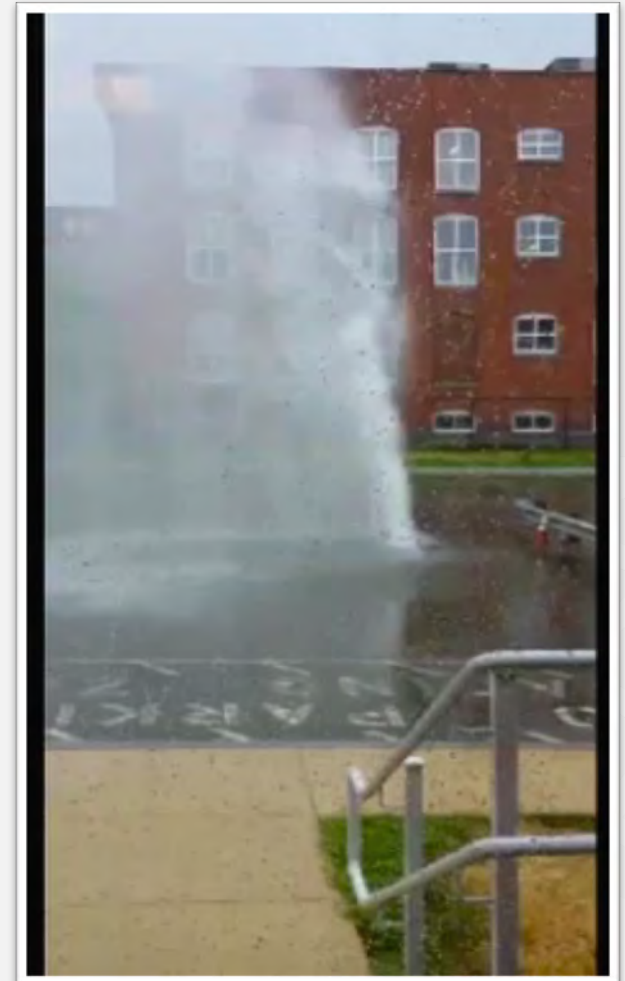
**Can lead to....**





# Sanitary Sewer “Explosions”

- SSOs and Illicit Discharges
  - Unintentional discharges of raw sewage from municipal sanitary sewers
  
- Consequences
  - Public Health & Safety
  - Environmental Contamination
  - Compliance and Financial
  
- Challenges
  - Out of sight, out of mind...
  - Remedial Maintenance not that exciting to the Public
  - **BIG** Problem





# Aging Sewer Systems Leak



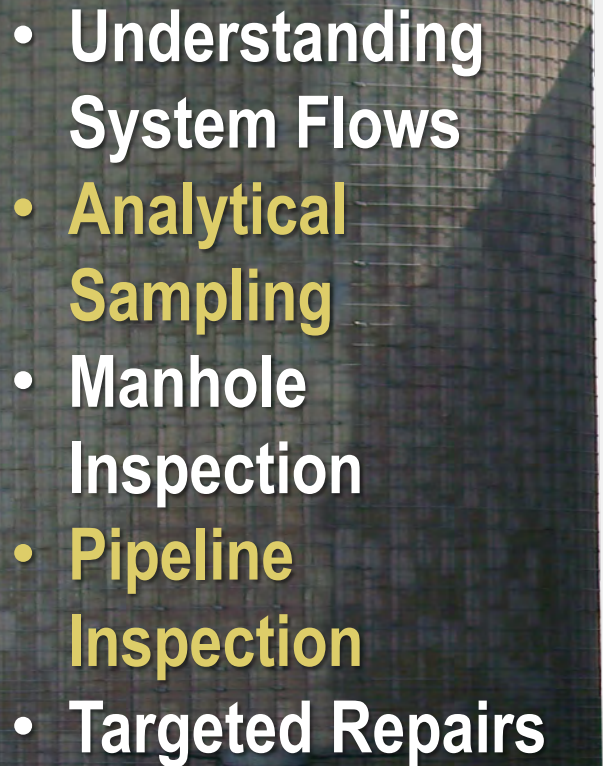
During the past 30 years in greater Boston, through the correction of aging and incorrectly connected sewer systems, over 800,000 gallons per day of untreated wastewater has been removed from Boston Harbor.

*~ EPA Region 1*



# So What Are We Doing About It?

## Integrated WW & SW Investigations

- 
- A large, cylindrical water tower with a blue, ribbed dome roof. The tower's body is made of dark, textured panels. It is positioned on the left side of the slide, partially overlapping the text.
- Understanding System Flows
  - **Analytical Sampling**
  - Manhole Inspection
  - **Pipeline Inspection**
  - Targeted Repairs
- Better Planning
  - Better Prioritization
  - Better Use of Technology



# Comparison of Investigation Programs

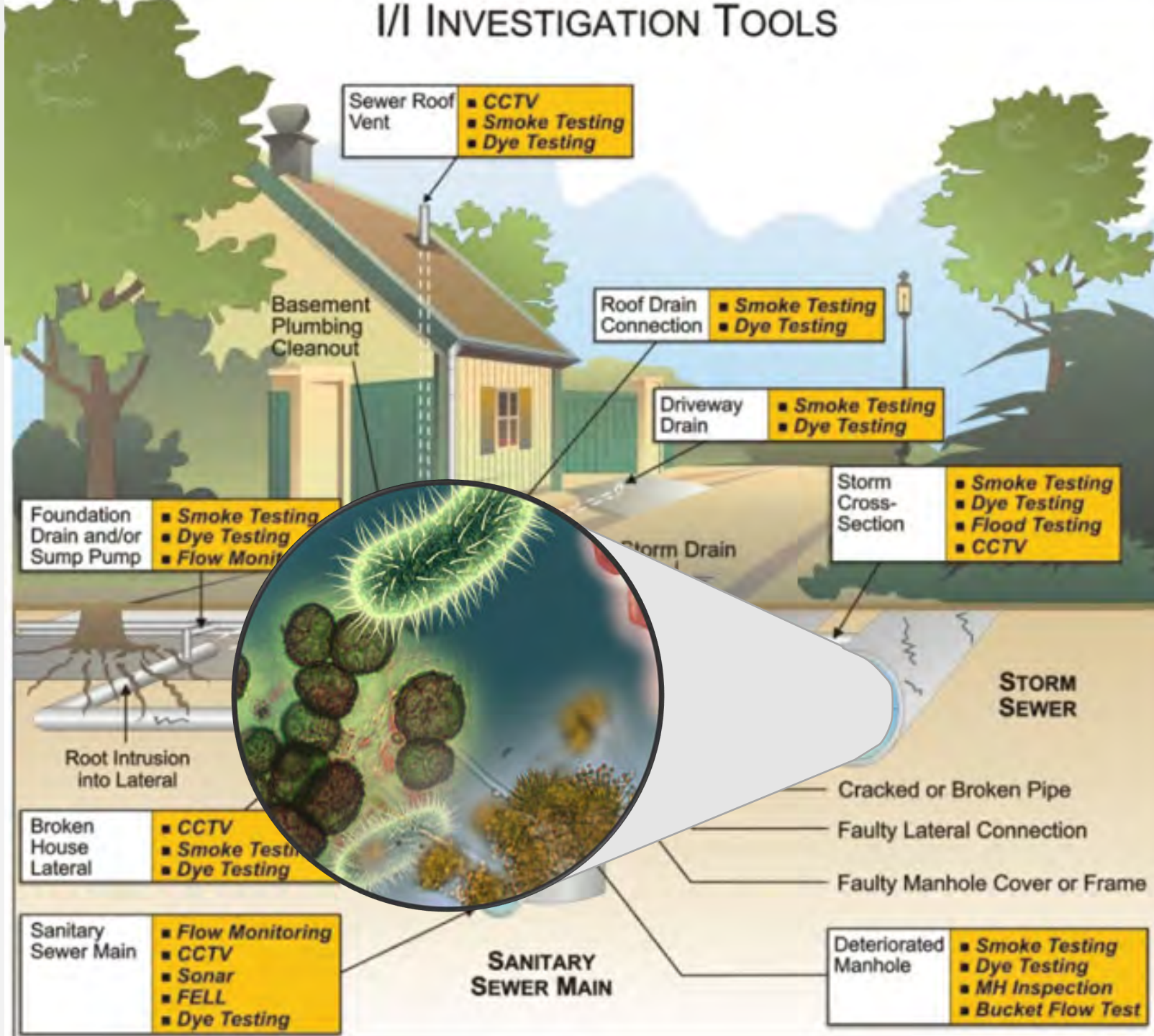
## IDDE

- Base Flow Monitoring
- **Manhole Grab Sampling**
- Structural and O&M Condition Assessment
- **Visual Inspection for Illicit Connections**
- Pipe or Illicit Repair

## SSES

- Flow Monitoring
- **Manhole Inspections**
- Structural and O&M Condition Assessment
- **Visual Inspection for Inflow & Infiltration Sources**
- Pipe/Manhole Repair

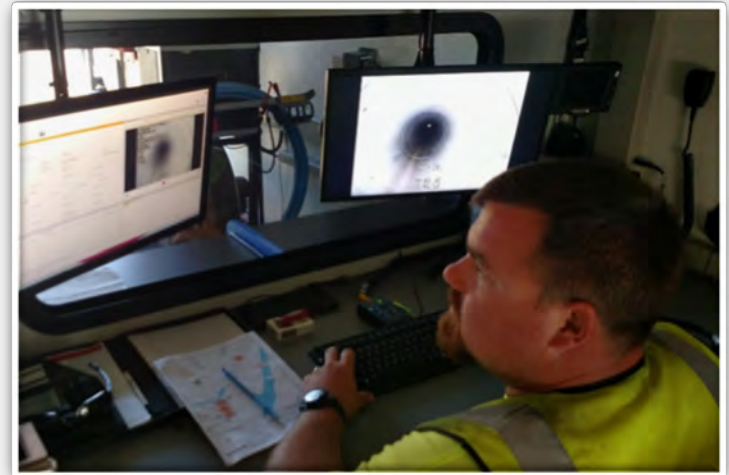
# I/I INVESTIGATION TOOLS





# Typical Sanitary Sewer Evaluation Surveys

- Asset Management and System Mapping
- Flow Metering
- Manhole Inspections
- CCTV Inspection
- Dye Tracing
- Rainfall Simulations
- Flow Isolation
- Building Inspections
- Smoke Testing





# Fundamentals of Illicit Discharge Investigations

- Mapping of the full SW system not just outfalls
- Dry & wet weather monitoring of outfalls
- Investigation within every catchment – key junction manhole sampling
  - Outfall Screening
  - Manhole Inspections
  - CCTV Inspections
  - Dye Testing
  - Building Inspections
- Detailed data management







# Outfall Inspections

Screening and sampling includes:

- A rapid visual and olfactory inspection
- Structural condition assessment, and
- Sampling for chlorine, ammonia, surfactants and bacteria





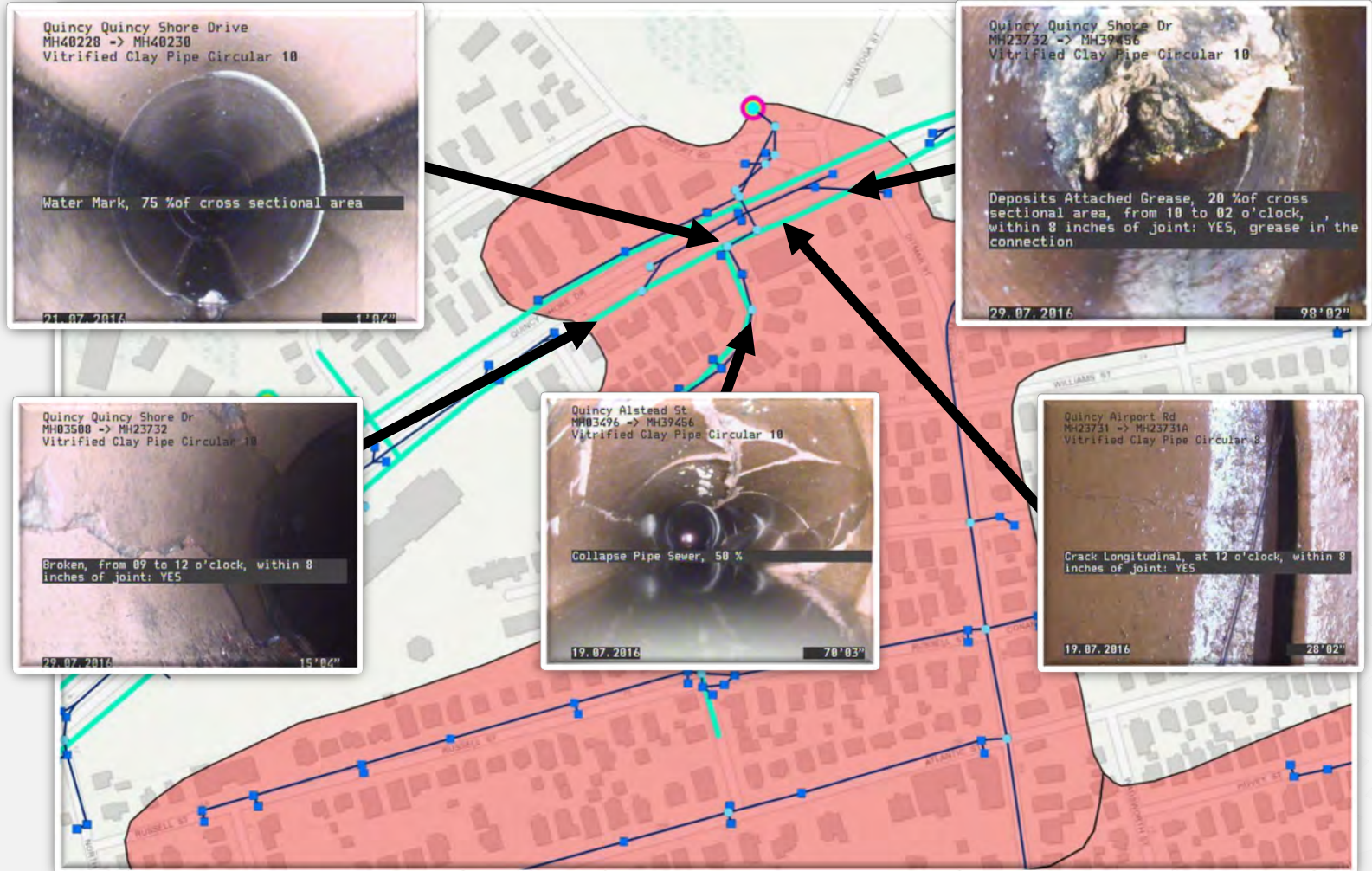
# What Are We Looking For?

## EPA New England's draft Bacterial Source Tracking Protocol

Indicator Parameter	Benchmark Concentration	Instrumentation	Analytical Method
<b>E. coli/Enterococcus</b>	235 cfu/100 mL 61 cfu/100mL	via certified laboratory	9223 B/SM 9230
<b>Surfactants (as MBAS)</b>	≥ 0.25 mg/L	CHEMetrics K-4900 Field Kit	Methylene Blue
<b>Ammonia (NH<sub>3</sub>)</b>	≥ 0.5 mg/L	CHEMetrics K-1510 Field Kit	Direct Nesslerization
<b>Total Chlorine</b>	> 0.05 mg/L method detection limit	CHEMetrics K-2504 Field Kit	DPD

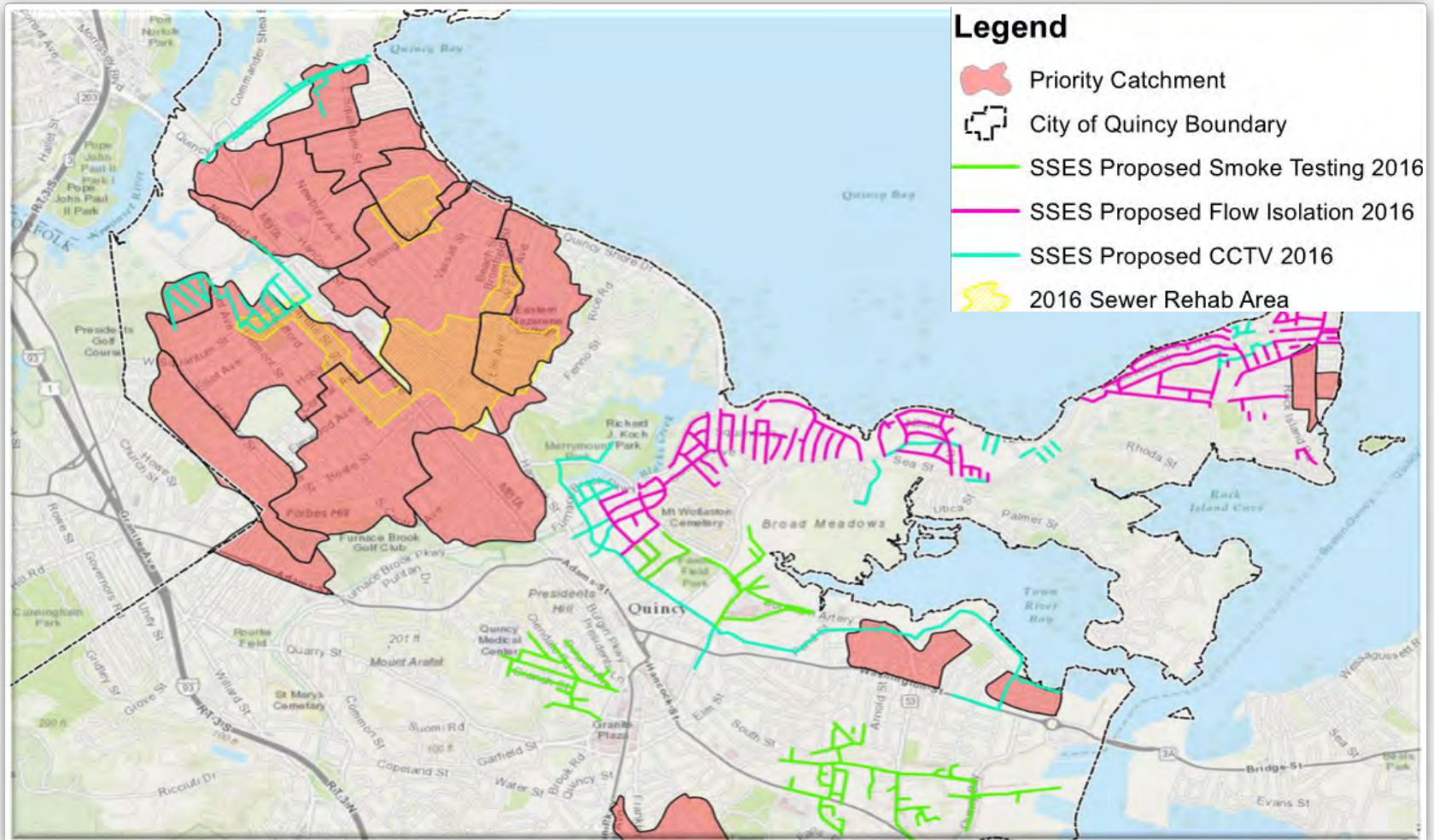


# Overlap of Sewer and Drain





# Balancing Sewer & Stormwater Needs



- CIPP Lined (2016)
- Trenchless Sewer Manhole Repair
- Rehabbed Sewer Manhole
- Sea Street Surfactant +
- Sea Street Ammonia +
- Sewer Manhole
- Sewer Gravity Main
- ⊕ Stormwater Discharge Point
- Stormwater Catchment



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# In Summary

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- Municipal SW/WW Integrated Planning is a Hot Topic – SSES and IDDE are a natural fit
- New England region – Unique infrastructure (extensive combined systems, SSO issues and old infrastructure) are driving extensive IDDE and SSES programs
- Integrated Programs, Planning and Technology Use will drive efficiencies



# Questions? Thank You!



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