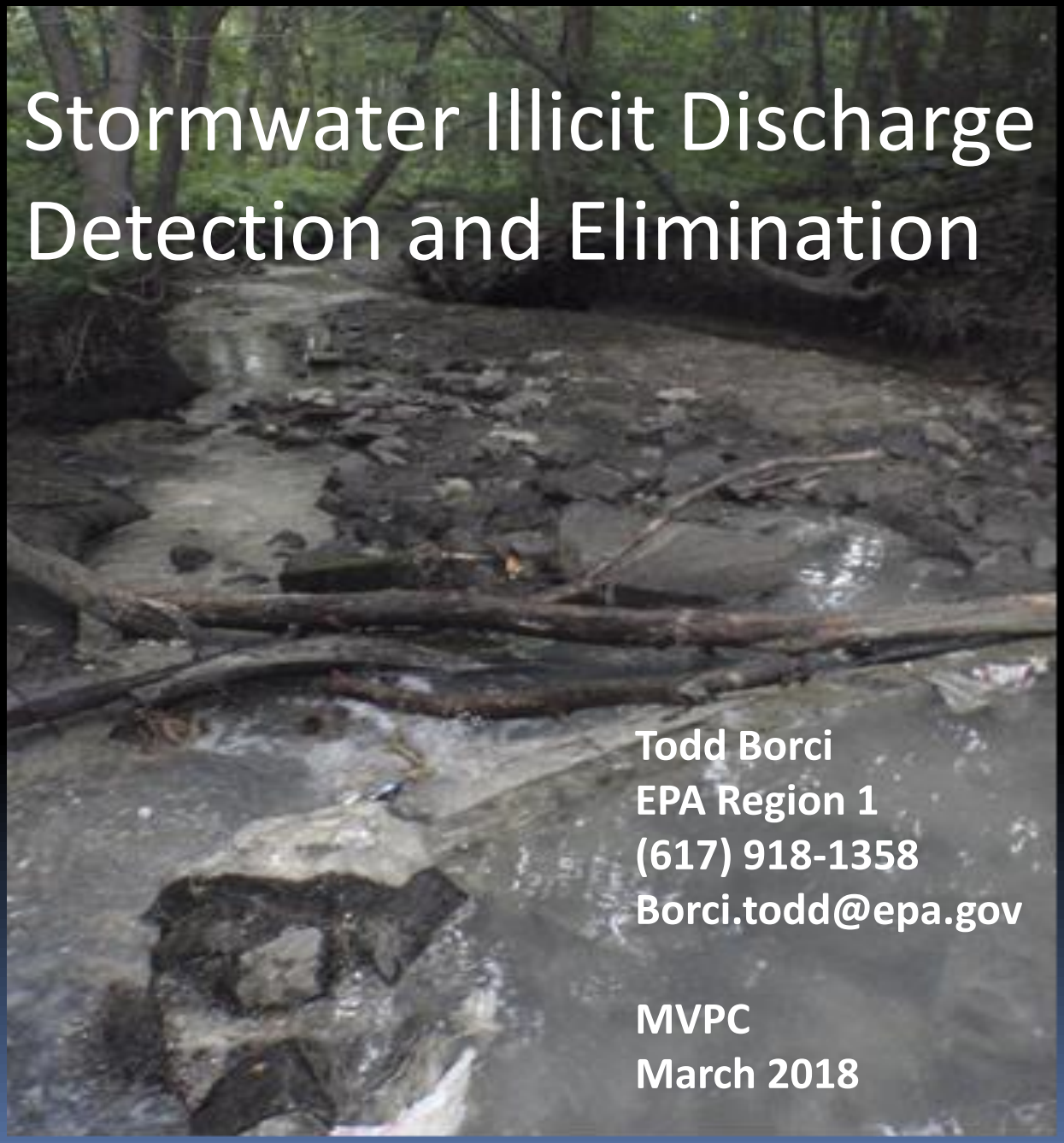
Stormwater Illicit Discharge Detection and Elimination



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MVPC
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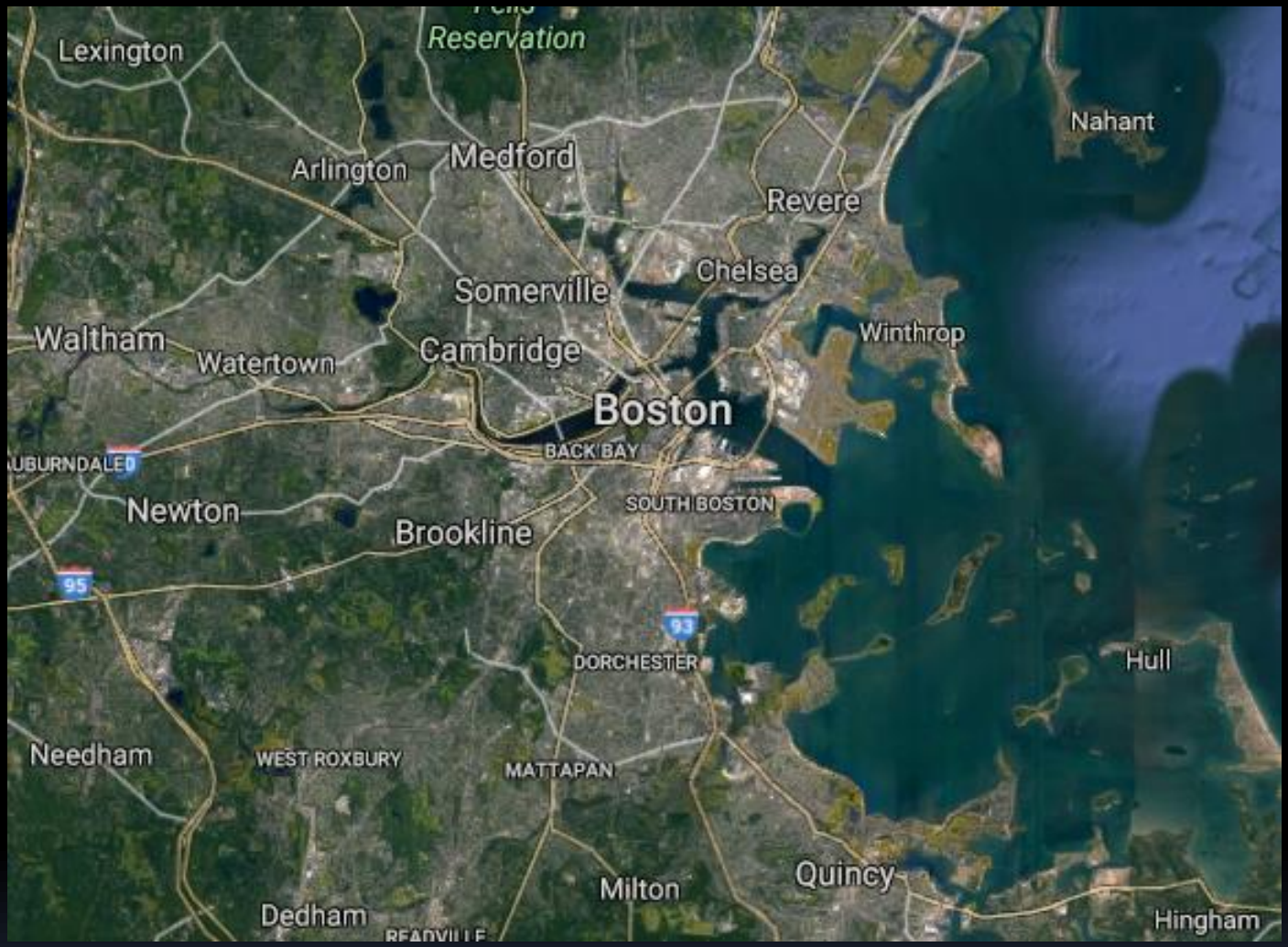
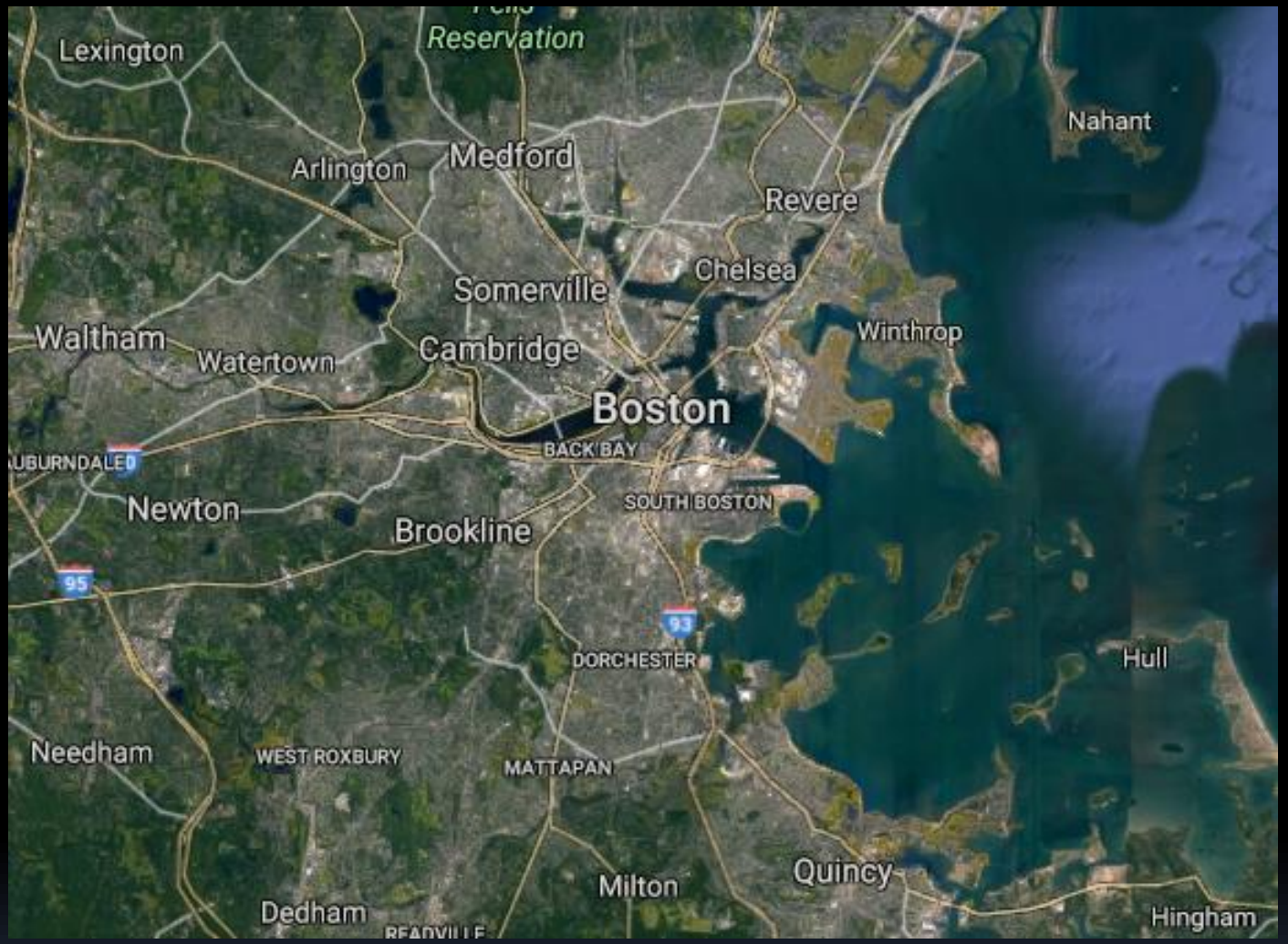


Boston Harbor Cleanup – Since 2005, EPA enforcement of IDDE has resulted in excess of 185,000 gallons of sewage per day removed from stormwater outfalls (over 67 MG/year)



Investigations in the Boston Harbor watershed alone have resulted in 15 Administrative Orders and Four Consent Decrees that include IDDE since 2005 – this number will increase.

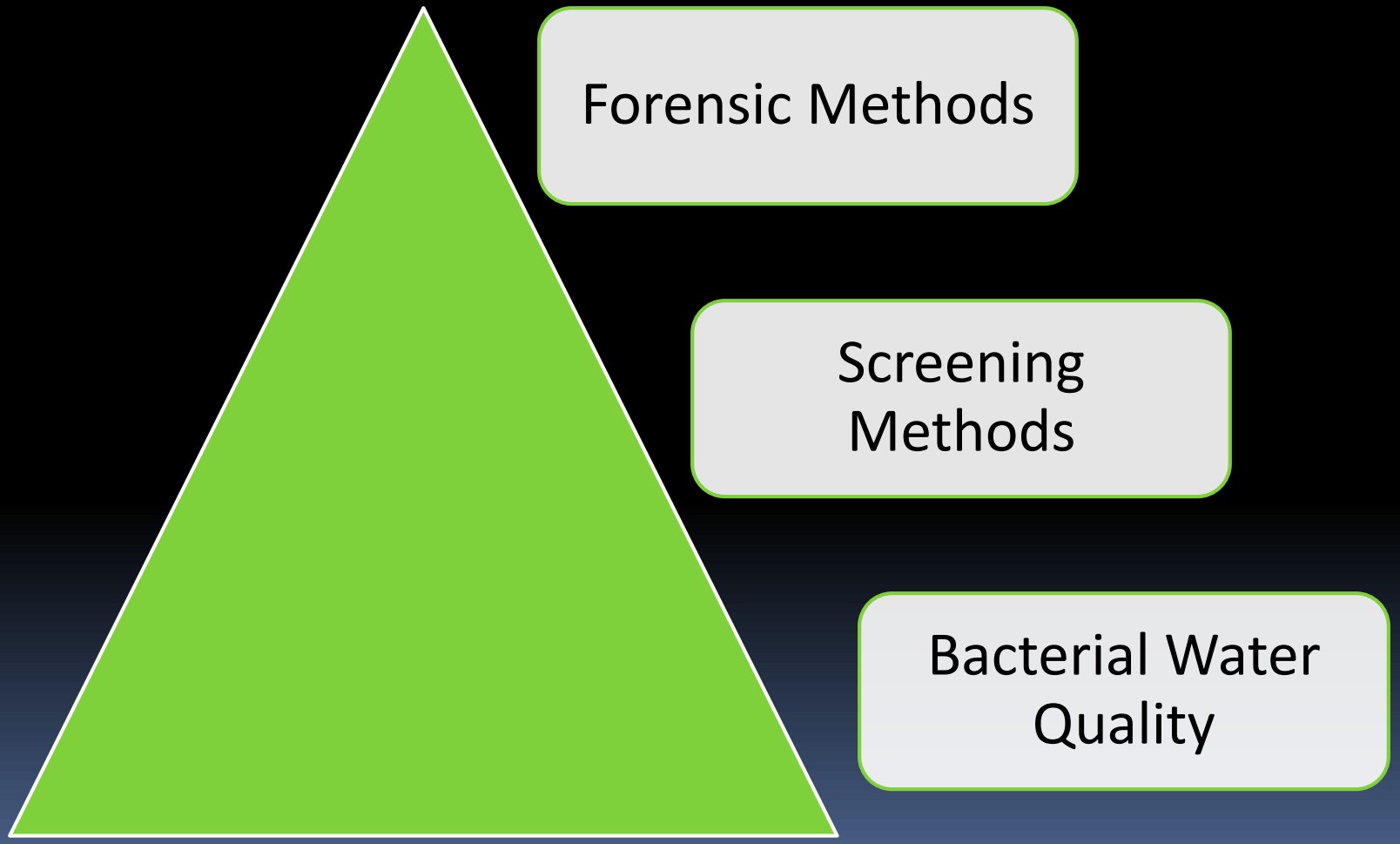
Illicit Discharges

- Most often sanitary sewage entering a municipal stormwater system
- Either through aging infrastructure or incorrectly-plumbed connections
- A significant source of pollutants
- Sewer Problems (often) = Illicit Discharges
- Identify through a weight-of-evidence approach (EPA R1 uses bacteria, surfactants, ammonia, and selected pharmaceutical compounds)

The “Raccoon Defense” . . .

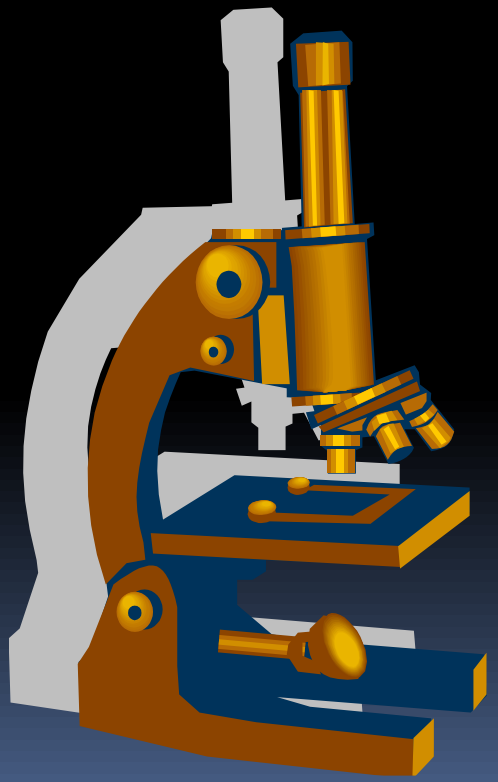
The “Raccoon Defense” . . .

An Attempt at a Solution . . .



Project Overview

- EPA Regional Applied Research Effort (RARE) and Regional Methods (RM) funding
- Identify most effective and cost-efficient screening parameters
- Determine feasibility of using pharmaceutical compounds
- Sampling conducted throughout eastern New England



Analytes tested for…

- **E. coli**
- **Enterococcus**
- **Fecal Coliform**
- **Ammonia**
  - Commercial lab
  - Benchtop (DR-850 Hach)
  - Test kit – Hach (2 types)
  - Test strips
- **Nitrate/Nitrite**
- **Surfactants**
  - Commercial lab
  - Benchtop (DR-850 Hach)
  - Test kit – Chemetrics
- **Free and Total Chlorine**
  - Commercial lab
  - Test kit – Hach
  - Test strips
- **Total Phosphorus**
- **Potassium**
  - Commercial lab
  - Test kit – Hannna
- **Fluoride**
  - Commercial lab
  - Benchtop (DR-850 Hach)
- **Pharmaceuticals**
  - Atenolol
  - Acetaminophen
  - Cotinine
  - 1,7-Dimethylxanthine
  - Caffeine
  - Azithromycin
  - Primidone
  - Urobilin
  - Carbamazepine
  - Sulfamethazine
  - Sulfamethoxazole
- **Urine test strips**

Sample Collection Summary

- 335 sample sets collected at nearly 250 sites
- In excess of 3,650 laboratory samples
- In excess of 2,000 field kit analyses
- ➢ 80% did not meet bacterial Water Quality Standards

Sample Collection Summary

Using Field Kit Thresholds of 0.5 mg/l Ammonia and 0.25 mg/l Surfactants:

62% exceeded either the ammonia or surfactant threshold values;

24% exceeded both ammonia and surfactant threshold values;

Mill Brook - Arlington, MA

Site name: 91Mys

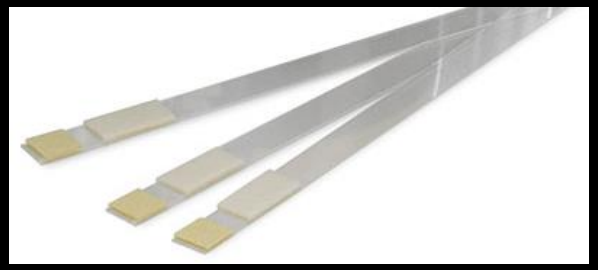
Site	Date	E.coli MPN	Surf mg/L	NH_3 mg/L	
91Mys*	6/2/09	>241,960	1.25	3	Dry
MillB*	6/2/09	550	0.2	ND	Dry

Site name: MillB

Recommended Minimum Screening Tests

Bacteria test

E. coli or Enterococcus



Ammonia test strips

Surfactant test kit

Chlorine (total) test kit

https://www3.epa.gov/region1/npdes/stormwater/ma/epa-ne-bacterial-source-tracking-protocol.pdf

EPA Modified Method 1694 LC/MS/MS Target Compounds, Uses, and Reporting Limits

Target Compound	Major Use	RL (ng/L)	Daily Dose (ng)
Caffeine	Natural Stimulant	5.0	200,000,000
1,7-DMX	Metabolite of caffeine	2.5	N/A
Acetaminophen	Pain Reliever	2.5	650,000,000
Carbamazepine	Anti- depressant / bi-polar Anti-convulsant (epilepsy)	0.5	400,000,000
Metoprolol	High Blood Pressure	2.0	100,000,000
Atenolol	Beta Blocker High Blood Pressure	2.0	50,000,000
Cotinine	Metabolite of Nicotine	0.5	3,500-7,200 (ng/mL)

Spot Pond Brook, Stoneham, MA

Analyte	Result
E. coli (MPN)	21
Surfactants	ND
Ammonia	ND
Caffeine	9.9 ng/L
1,7-Dimethylzanthine	7 ng/L
Urobilin	ND (2.0 ng/L)
Cotinine	ND (0.2 ng/L)
Acetaminophen	ND (1.0 ng/L)
Carbamazepine	ND (0.2 ng/L)
Atenolol	ND (2.0 ng/L)
Azithromycin	ND (2.0 ng/L)
Primidone	ND (2.0 ng/L)

Boston, MA

Canterbury Brook

Analyte	Result
E. coli (MPN)	198,630
Enterococcus	34,658
Surfactants	1.5 mg/L
Ammonia	5.5 mg/L
Caffeine	5,000 ng/L
1,7-Dimethylzanthine	3,500 ng/L
Urobilin	17,000 ng/L
Cotinine	13 ng/L
Acetaminophen	27,000 ng/L
Carbamazepine	5.1 ng/L
Atenolol	150 ng/L
Azithromycin	61 ng/L
Primidone	ND (2.0 ng/L)

Laconia, NH

Human or Goose?

Analyte	Result
E. coli (MPN)	17,200
Enterococcus	26,030
Surfactants	0.2 mg/L
Ammonia	ND
Caffeine	12 ng/L
1,7-Dimethylzanthine	12 ng/L
Urobilin	ND (4.0 ng/L)
Cotinine	ND (0.4 ng/L)
Acetaminophen	ND (2.0 ng/L)
Carbamazepine	ND (0.4 ng/L)
Atenolol	ND (2.0 ng/L)
Azithromycin	ND (2.0 ng/L)
Primidone	ND (4.0 ng/L)

Conclusion - Most likely problem areas:

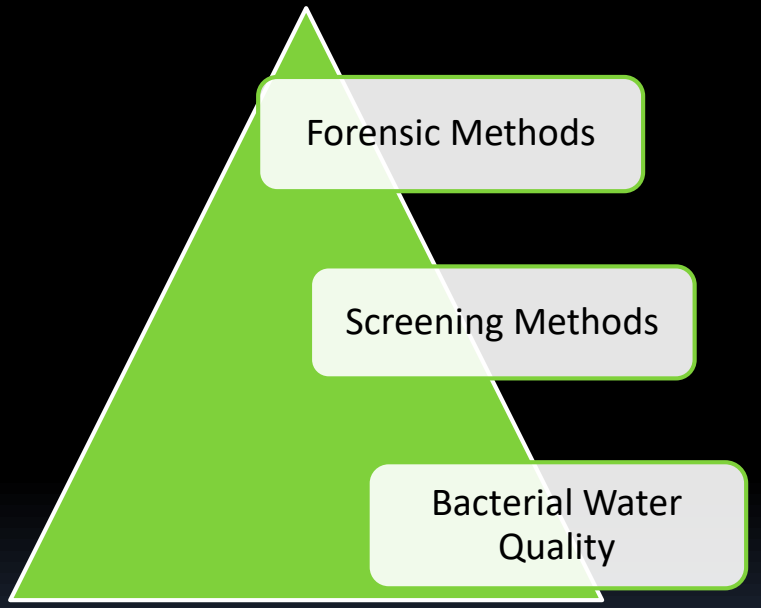
- Dense urban areas with aging infrastructure;
- Current or past sanitary sewer problems (SSOs);
- Areas with high sanitary sewer Inflow/Infiltration;
- Areas with state or watershed association data indicating water quality problems;
- Beaches with MS4 outfalls discharging onto or nearby.

A Successful Program . . .

- Knows its system:
  - Maps match up with what is in the field
  - Which outfalls have dry-weather flow
- Collects analytical data – screening or otherwise
- Understands illicit discharges and sanitary sewer issues often connected
- Tracks progress:
  - Number of illicit discharges identified
  - Number of illicit discharges removed
  - Gallons per day of sewage removed from storm drain system
  - Linear feet piping CCTV'd
  - Linear feet piping smoke tested
  - Linear feet of CIPP lining

Recommended Approach

- Bacteria analyses in addition to surfactant, ammonia, and chlorine field kits
- End-of-pipe or within drain network sampling
- Enable watershed associations, municipalities, State and Federal personnel to collect more useful data
- Use pharmaceuticals as appropriate in confirmatory, problem solving, enforcement



Additional Contact Information

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Enforcement Officer

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Outfall Observations

Salem, MA: NorRO1P

Boston, MA: NR204

Outfall Observations

Chelsea, MA: Mill2

Medford, MA: MHB

Outfall Observations

Concord, NH: Mer4120

Dorchester, MA: CantB

Arlington, MA

Grove Street Outfalls on Mill Brook -
Sewage-impacted flows not always apparent
During visual inspection