Strategies to identify sources of bacterial pollution impacting coastal beach water quality

US EPA Sanitary Survey Webinar

Keri Kaczor

UMaine Cooperative Extension

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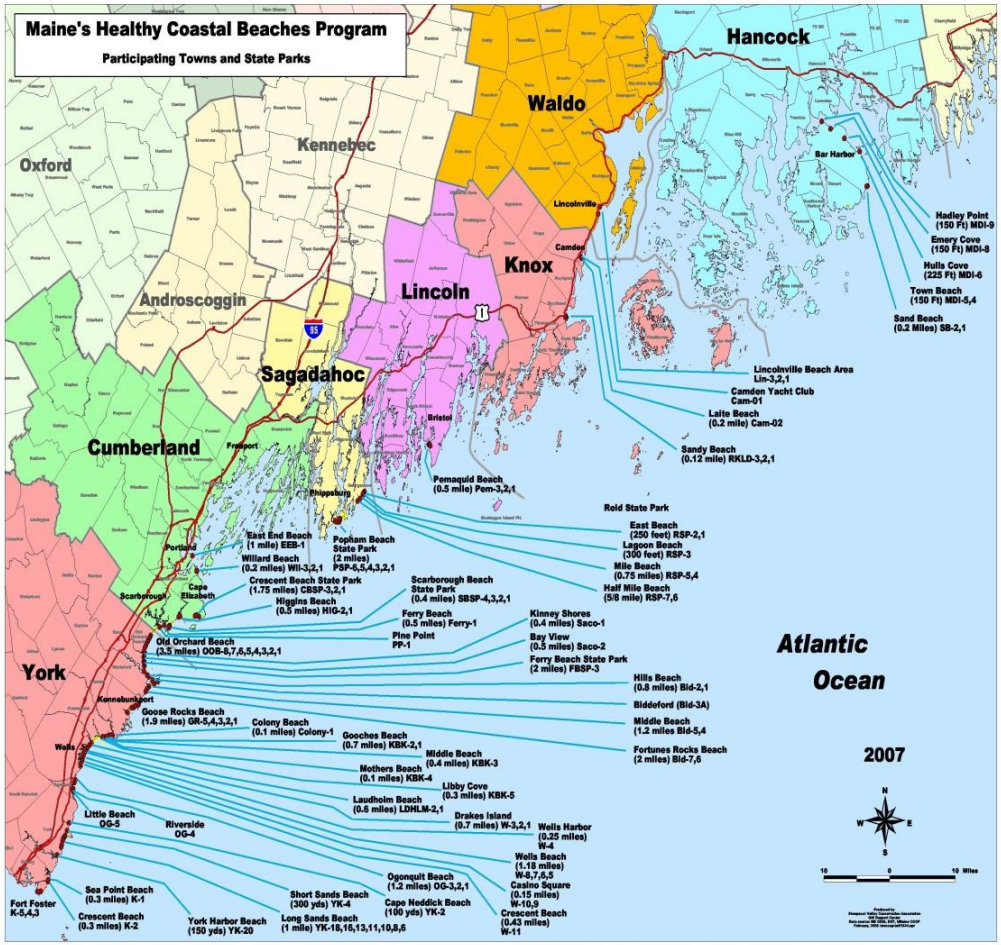
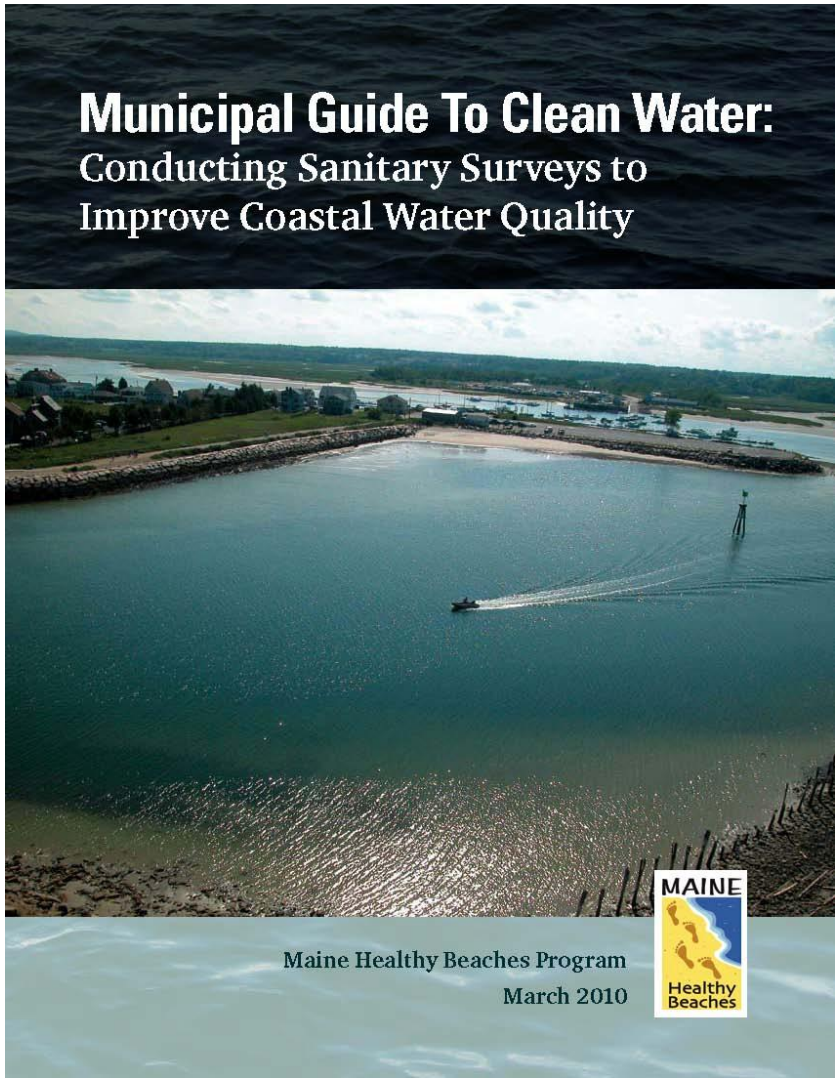
Funding provided by: US EPA/Maine DEP

Maine Healthy Beaches



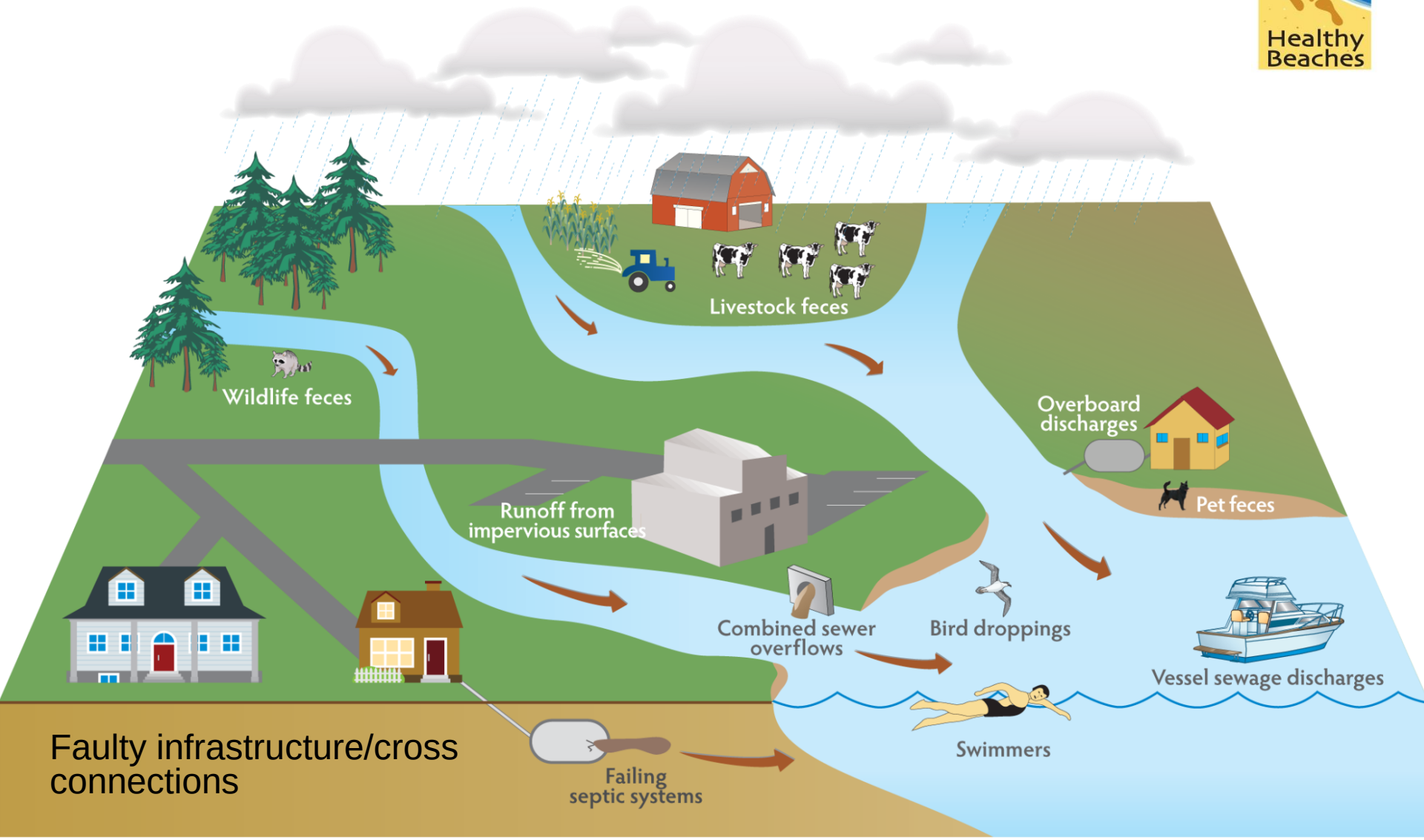
- 60 beach management areas
- Diverse partners
- “Home Rule” state; voluntary program

Addressing Bacterial Contamination



- **Identify**
- Eliminate
- Prevent

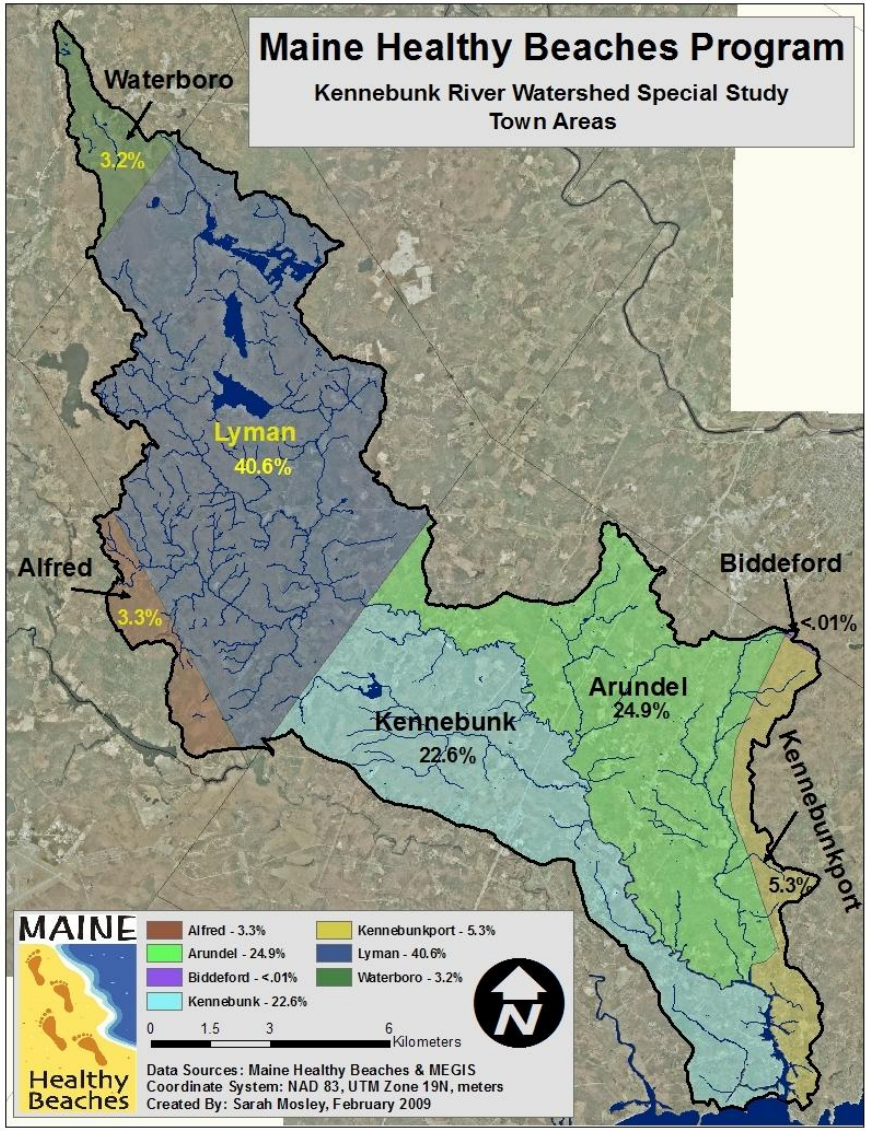
Sources of Bacterial Pollution

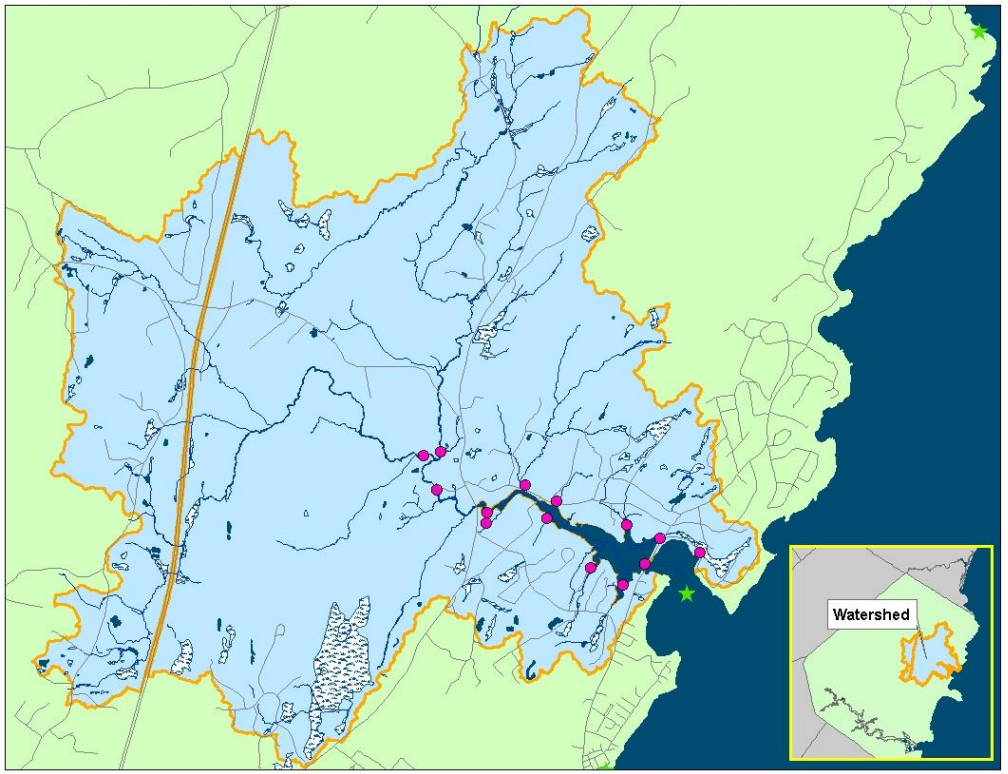


Disease-causing pathogens can enter Casco Bay coastal waters from multiple sources, leading to potential public health risks.

Illustration by Waterview Consulting including symbols adapted from the Integration and Application Network, University of Maryland Center for Environmental Science.

Watershed Health = Beach Health





Addressing Bacterial Contamination

- Risk Assessment Matrix
- Circulation studies
- Pollutions source tracking toolbox
- GIS risk analysis
- Sanitary (wastewater) surveys

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Risk Assessment Matrix

- Similar to US EPA Sanitary Survey
- Focus on shoreline
- 60 completed by local managers/MHB staff
- Informs tiered monitoring plan
- Identifies priority areas

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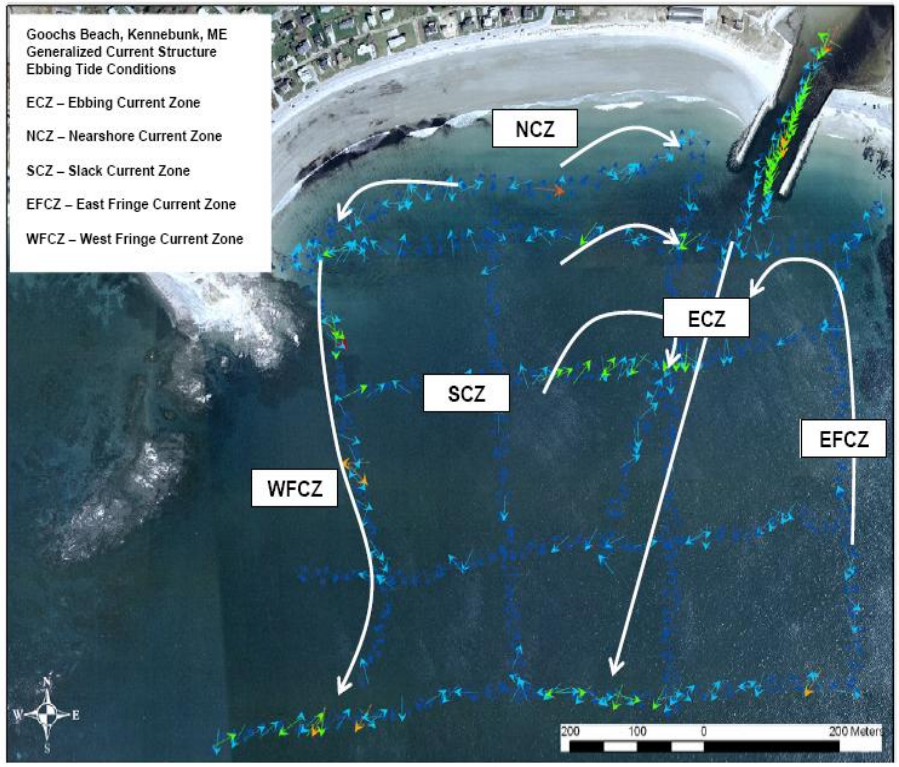
Circulation Studies

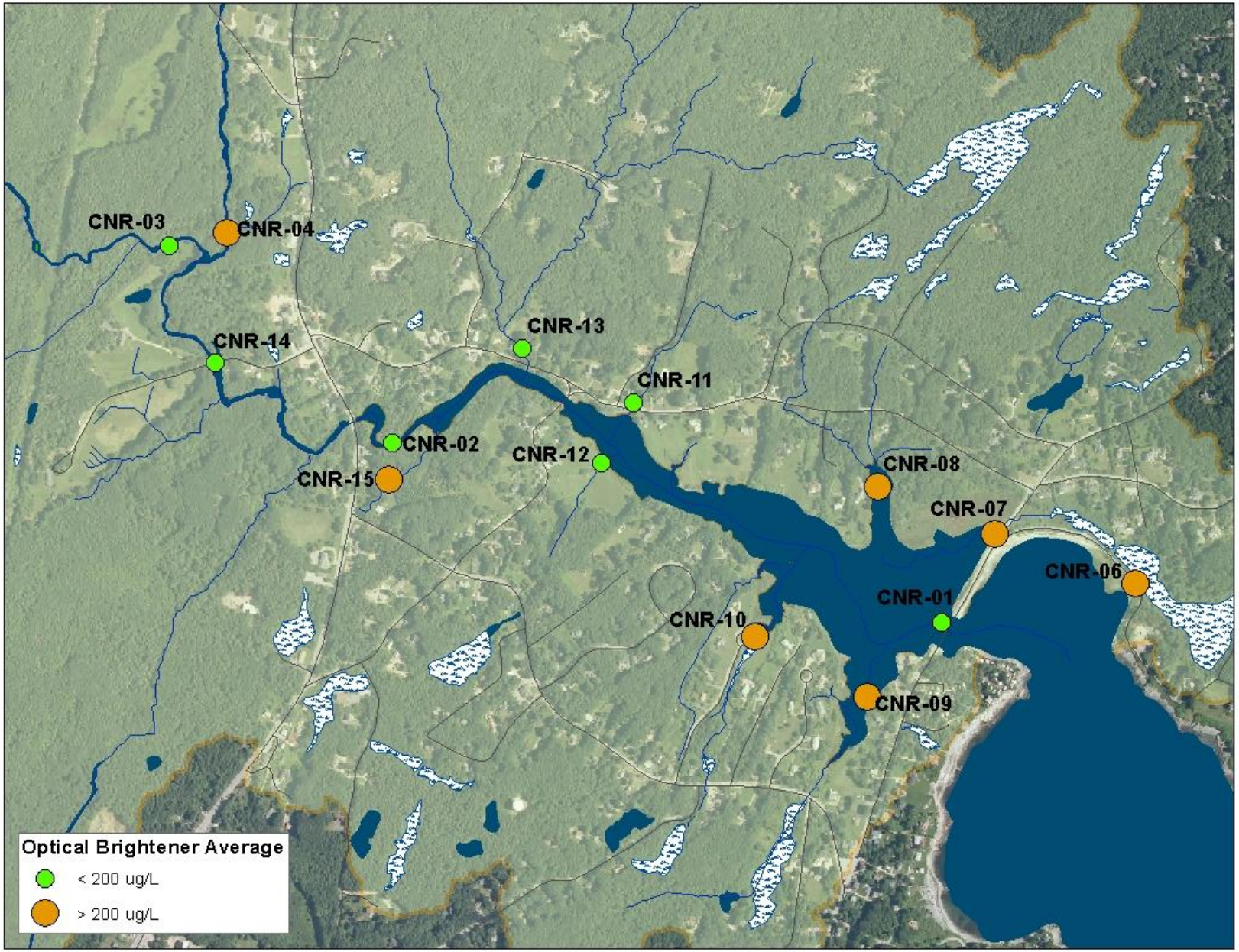


Pollution Source Tracking Toolbox

Pollution Source Tracking Toolbox

	High Bacteria	Low Bacteria
High Optical Brightener	Black water (e.g. human sources- malfunctioning septic system, sanitary sewer cross connection)	Grey or Gray water (e.g. laundry, wash water)
Low Optical Brightener	Human or non-human sources	Potentially low or no fecal contamination

Pollution Source Tracking Toolbox



Pollution Source Tracking Toolbox

MAINE Healthy Beaches

Pharmaceutical and personal care products

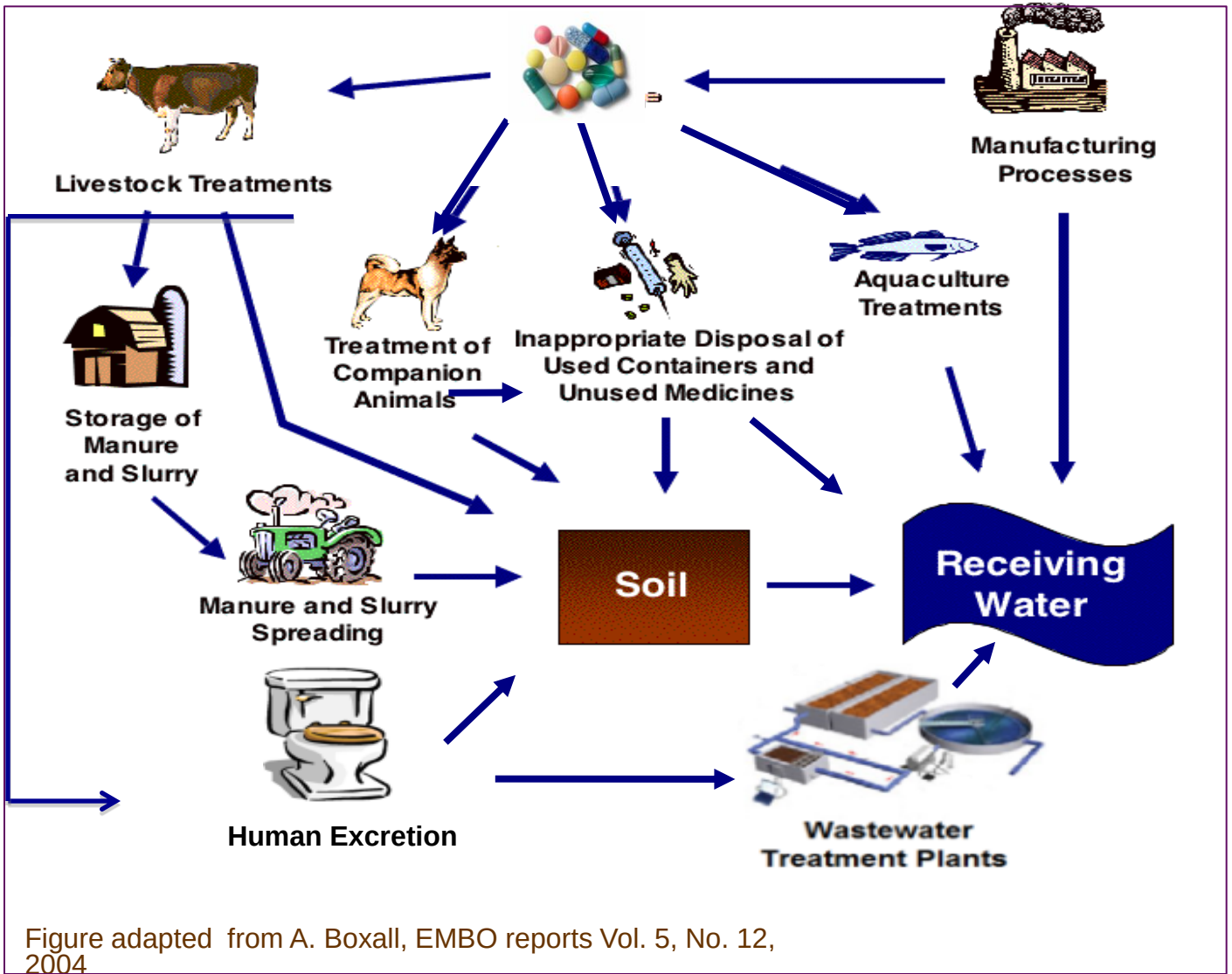


Figure adapted from A. Boxall, EMBO reports Vol. 5, No. 12, 2004

Pollution Source Tracking Toolbox

Microbial Source Tracking

500 mL water sample

Filter – discard water

DNA Isolation

Detect human Polyomavirus DNA

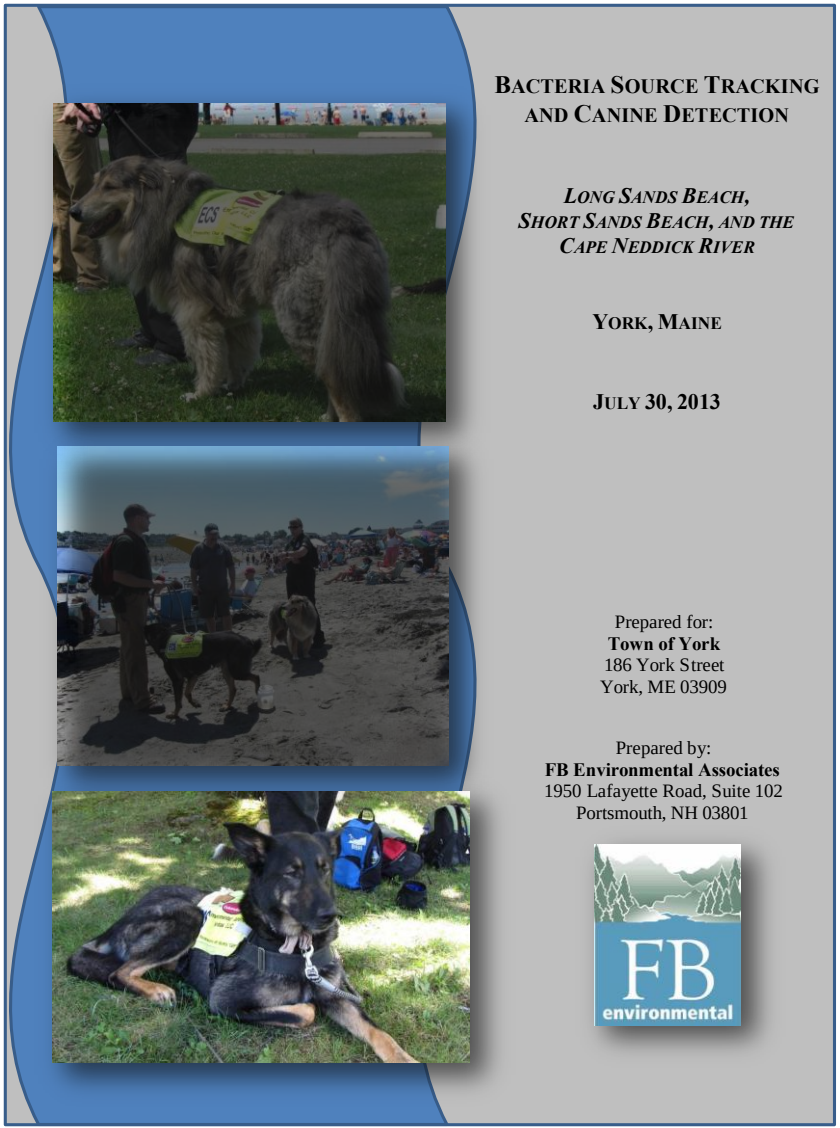
Detect human *Bacteriodales* bacterial DNA

Detect ALL *Bacteriodales* bacterial DNA

K. Borges 2012

Pollution Source Tracking Toolbox

Canine Detection Services



BACTERIA SOURCE TRACKING AND CANINE DETECTION

LONG SANDS BEACH, SHORT SANDS BEACH, AND THE CAPE NEDDICK RIVER

YORK, MAINE

JULY 30, 2013

Prepared for:
Town of York
186 York Street
York, ME 03909

Prepared by:
FB Environmental Associates
1950 Lafayette Road, Suite 102
Portsmouth, NH 03801

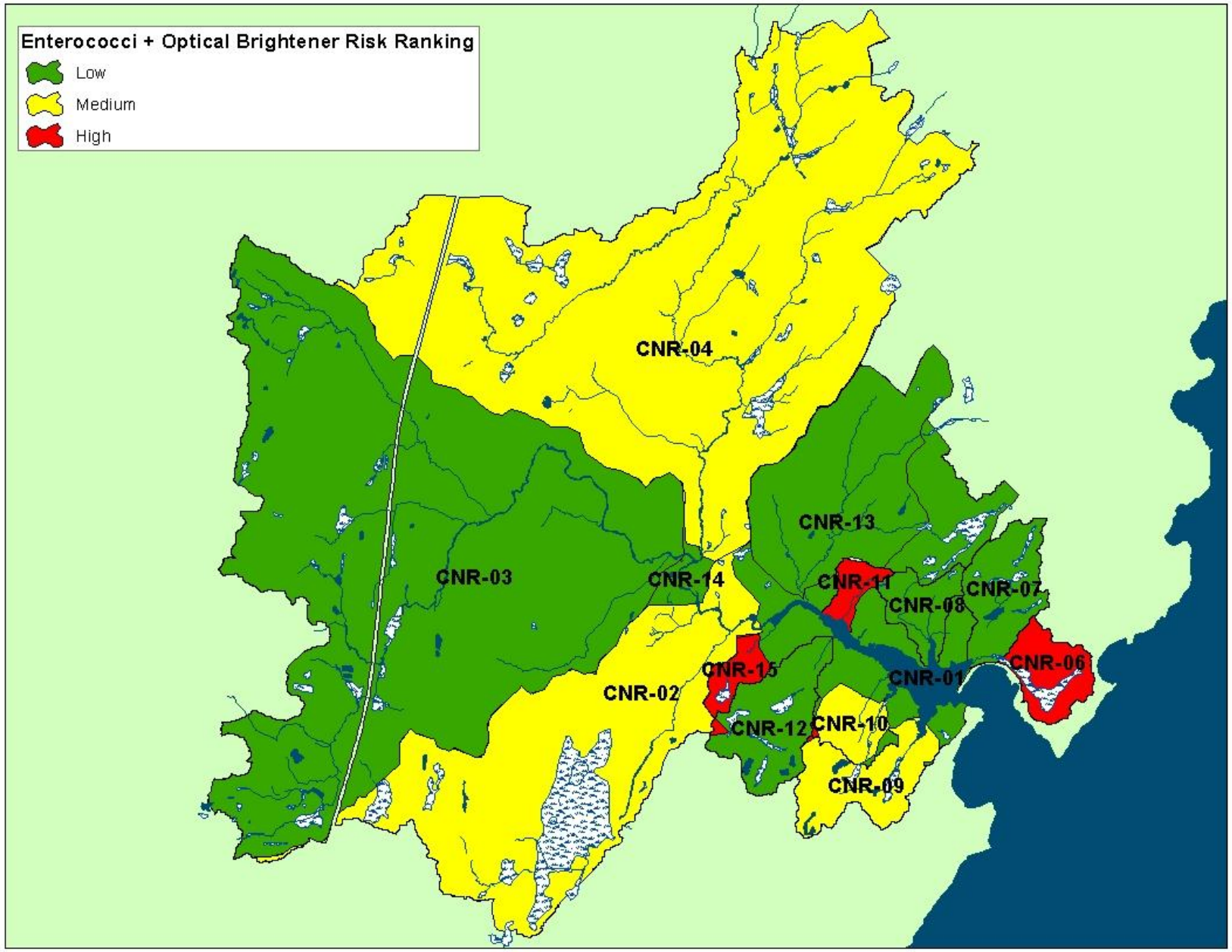
Pollution Source Tracking Toolbox

Pharmaceutical & Personal Care Products

PPCP	Description
Atenolol	Control high blood pressure
Acetaminophen	Pain killer
Cotinine	Metabolite of nicotine
1,7-Dimethylxanthine	Caffeine breakdown (after goes through body)
Caffeine	Stimulant
Carbamazepine	Control seizures
Metoprolol	Control high blood pressure

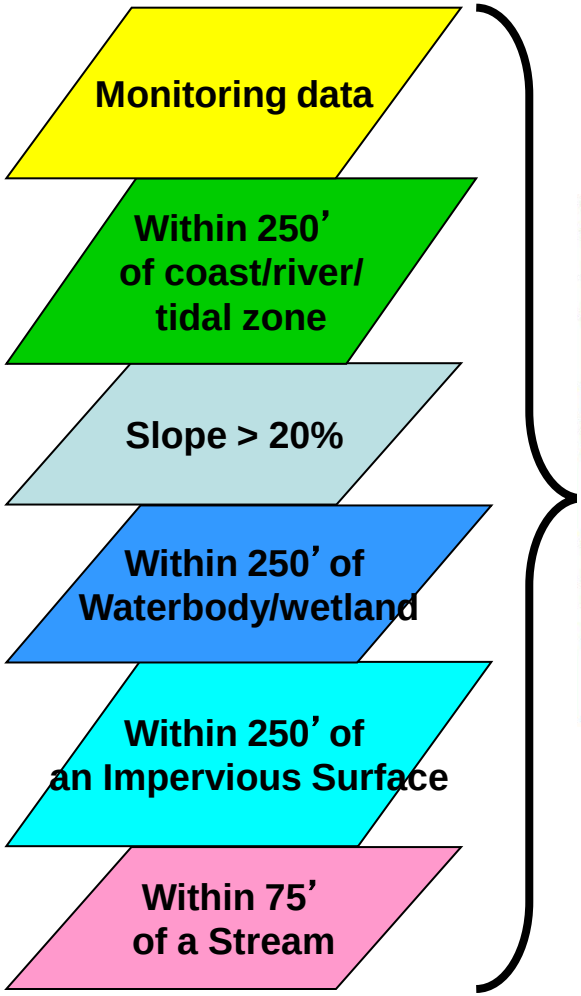
MONITORING STATION	ENT ≥ 33 MPN/100ml	OB ≥100 µg/l	+ Dev. from ENT Mean	+ Dev. from OB Mean	≥4 PPCPs ng/l	+ Canine Det.
GFB-01	Y	N	Y	Y	N	Y
GFB-01-0	Y	Y	Y	Y	N	N
GFB-01-0B	Y	Y	Y	Y	N	-
GFB-01-1	Y	Y	N	Y	N	N
GFB-04	Y	N	Y	Y	-	N
GFB-04-0	Y	N	N	N	N	N
GFB-04-0-1	Y	N	Y	N	Y	Y
GFB-04-1	Y	N	Y	N	-	N
GFB-04-2	Y	N	Y	N	N	N
GFB-04-3	Y	N	N	N	N	N
GFB-05	Y	Y	Y	Y	-	N
GFB-05-0	Y	Y	Y	Y	Y	N
GFB-05-1	Y	Y	Y	Y	Y	Y
GFB-05-2	Y	N	N	N	N	N
Saco-00	Y	N	N	N	-	N

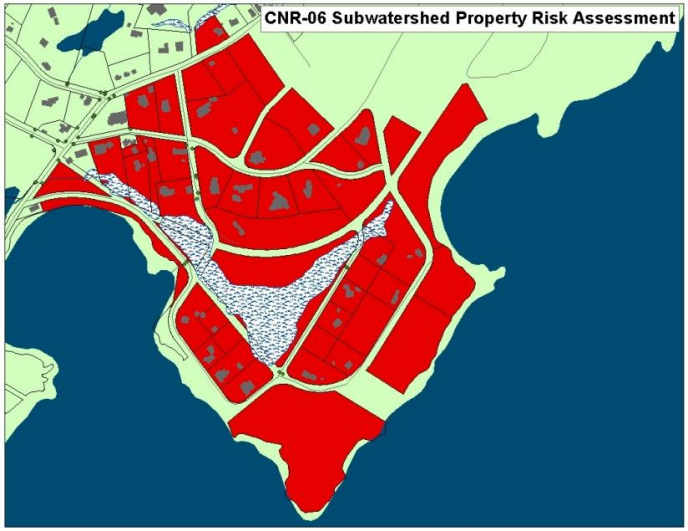
GIS: Risk Analysis



GIS: Risk Analysis

- Transforms data to usable information
- Priority survey areas





Sanitary Survey

- *Explore ALL bacterial pathways*
- Target humans sources first!
- Tiered approach
- **Malfunctioning septic systems**
- **Leaky sewers/cross connection**

Gary Curtis

Subsurface Wastewater Disposal

K. Kaczor

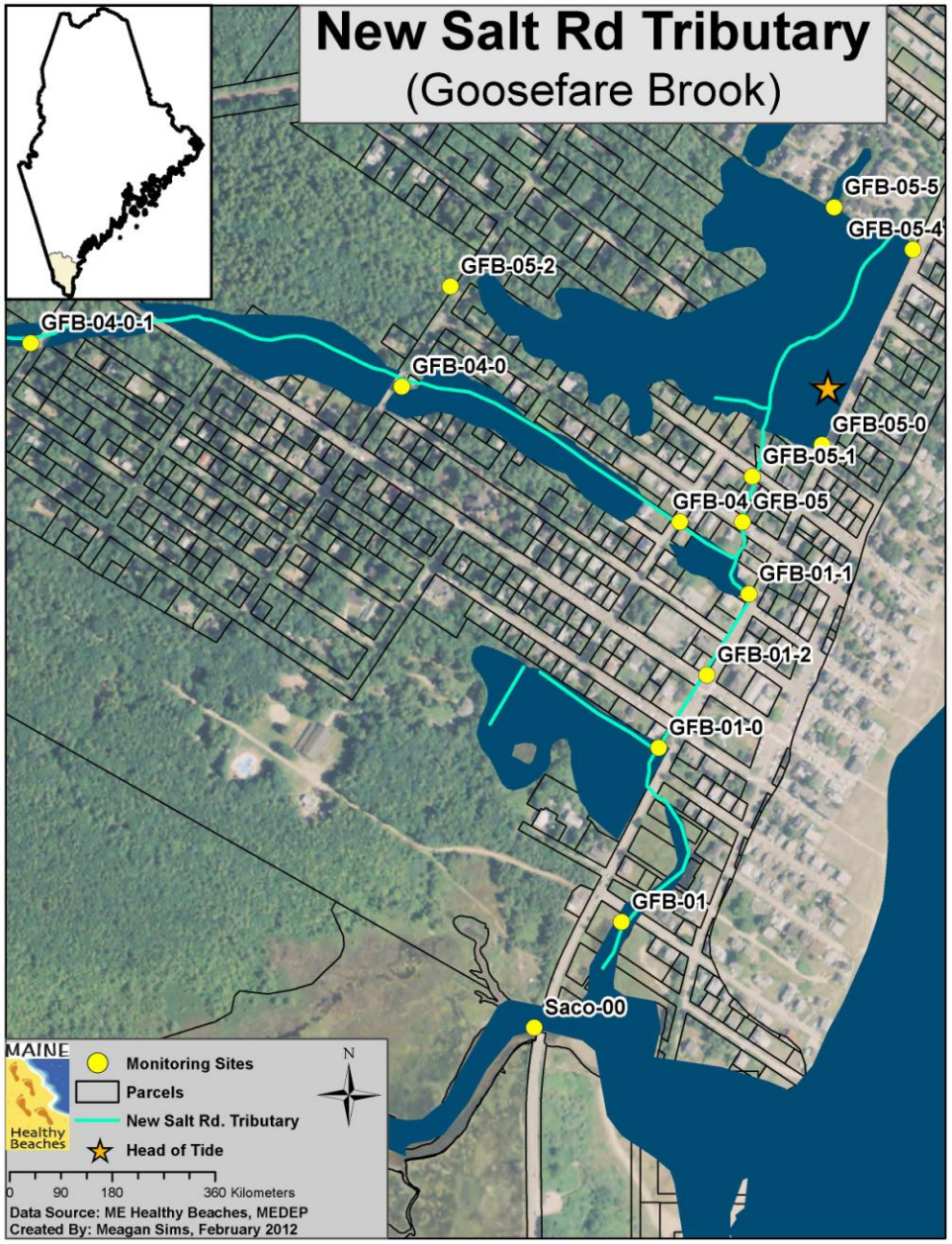
- Property surveys
- Role of trained professionals
- Best tools = eyes and nose!

Subsurface Wastewater Disposal

No Two Malfunctions Are Exactly Alike!

ME DEP

Illicit Discharge Detection and Elimination



The Path to Clean Water is Turbulent

- Sources are difficult to find
- Requires collaboration
- Wastewater disposal is costly & options are limited
- Need for monitoring, maintenance, & expansion of wastewater infrastructure

ME DEP (J. Glowa)

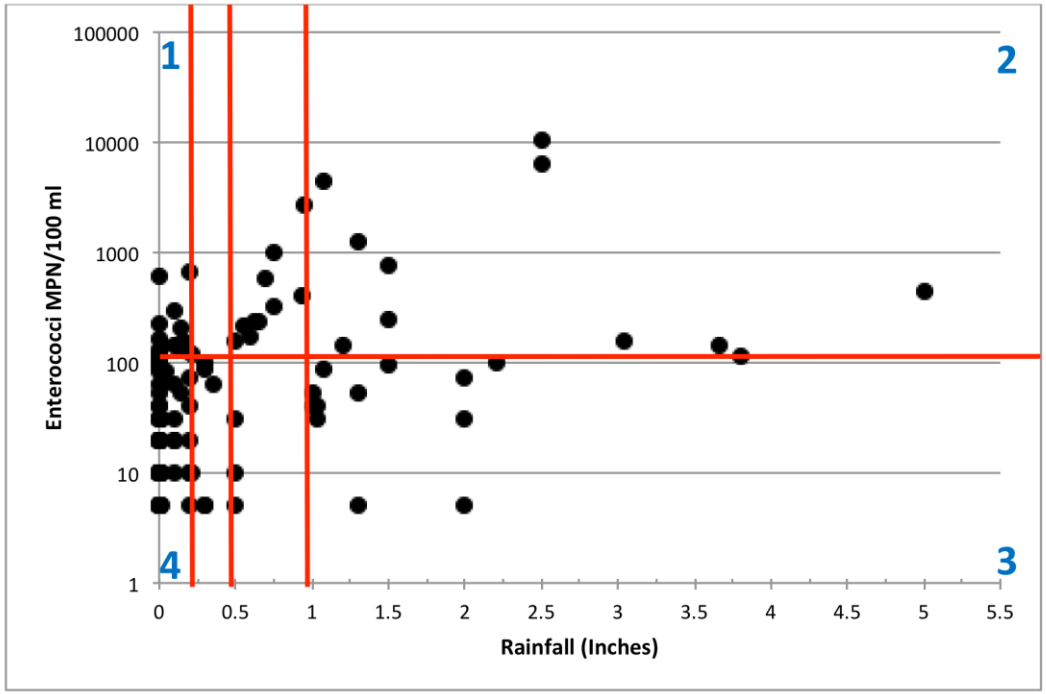
The Path to Clean Water is Turbulent

- Sources are removed, new ones emerge
- Over-development & impervious surfaces
- Warmer, wetter climate

M. Warneke

Now What?

- Intensified rainfall and source tracking studies
- Precautionary rainfall advisories
- Develop beach specific management plans
- End of pipe treatment?
- Prevention



48 hr at .25 inch threshold	48 hr at .5 inch threshold	48 hr at 1 inch threshold
1= High Bac, Low Rain: 12%	1=High Bac, Low Rain: 12%	1=High Bac, Low Rain: 21%
2=High Bac, High Rain: 19%	2=High Bac, High Rain: 19%	2=High Bac, High Rain: 10%
3-Low Bac, High Rain: 18%	3=Low Bac, High Rain: 13%	3=Low Bac, High Rain: 11%
4=Low Bac, Low Rain: 51%	4=Low Bac, Low Rain: 56%	4=Low Bac, Low Rain: 58%

Sanitary (Shoreline) Surveys

- Useful assessment tool
- Important first step!
- Informs priorities and next steps
- Standardized format = transferrable data

E. Stancioff, 2003

Questions?