Addressing Bacteria Impairments in Coastal Watersheds

Forrest Bell, FB Environmental
Kim Reed, Rye, NH Town Planner
FB Environmental Associates

- Offices in Portsmouth, NH and Portland, ME
- Small business founded in 2001 to provide watershed assessment, protection, and restoration assistance
- Work with public sector clients located throughout New England
What is Bacterial Pollution?

Presence of fecal waste at streams, lakes, beaches
How is it Measured?

- Indicator Bacteria
  - *E. coli*
  - Enterococci
  - Fecal coliform

- Same Purpose: **Disease Risk**

- Results not instantaneous (12-24 hrs)

- Tells us amount, not source
<table>
<thead>
<tr>
<th>Source/land use</th>
<th>Operation/activity</th>
<th>Samples of management activity</th>
<th>Frequency</th>
<th>Transport process(es)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>Livestock-feedlot</td>
<td>Manure removal; leachate control; Spreading schedules; storage</td>
<td>weekly</td>
<td>runoff; erosion; seepage</td>
</tr>
<tr>
<td></td>
<td>Livestock-manure storage</td>
<td>Rotation</td>
<td>variable</td>
<td>runoff; erosion</td>
</tr>
<tr>
<td></td>
<td>Crop-manure/sludge application Pasture</td>
<td></td>
<td>variable</td>
<td>runoff; erosion; direct</td>
</tr>
<tr>
<td>Urban/Residential</td>
<td>Domestic pets</td>
<td>Waste pickup law; Management; population control; Pumpout; education</td>
<td>variable</td>
<td>runoff; direct</td>
</tr>
<tr>
<td></td>
<td>Wildlife</td>
<td>Compliance</td>
<td>constant</td>
<td>leaching; interflow</td>
</tr>
<tr>
<td></td>
<td>Septic systems</td>
<td>Disposal</td>
<td>constant</td>
<td>direct</td>
</tr>
<tr>
<td></td>
<td>Illicit connection</td>
<td></td>
<td>constant</td>
<td>runoff; leaching</td>
</tr>
<tr>
<td></td>
<td>Landfills</td>
<td></td>
<td>constant</td>
<td></td>
</tr>
<tr>
<td>Forest</td>
<td>Wildlife</td>
<td>Management; population control</td>
<td>constant</td>
<td>runoff; erosion; direct</td>
</tr>
<tr>
<td>Point Sources</td>
<td>WWTP</td>
<td>Waste treatment</td>
<td>constant</td>
<td>direct</td>
</tr>
<tr>
<td></td>
<td>Slaughterhouse</td>
<td>Waste treatment</td>
<td>variable</td>
<td>direct; rainfall-driven</td>
</tr>
<tr>
<td></td>
<td>CSCs; SSOs</td>
<td>Storage/transport redesign</td>
<td>variable</td>
<td></td>
</tr>
</tbody>
</table>

(Source: EPA 2001)
Can Lead To....Posted Beach Advisories
Shellfish Bed Closures

THIS AREA
CLOSED
TO ALL DIGGING
OF
CLAMS, MUSSELS, QUAHOGS,
OYSTERS, CARNIVOROUS WHELKS
OR SNAILS

BECAUSE OF POLLUTION
OR
PARALYTIC SHELLFISH POISON

It has been ordered by the Board of Marine Resources, Department of Marine Resources, New Hampshire, ordering the closure of digger clam areas in the state of New Hampshire. The areas are closed for the protection of digger clams and their habitat.

For further information, call:
New Hampshire Office of Fish and Game:
603-271-3547

Commissioner of Marine Resources

[Signature]
Approximately 400 NH Bacteria Impairments

2006, All Impaired Waters

NOTES:
1. See the 2006 Consolidated Assessment and Listing Methodology (CALM) for details regarding how assessments were made.
2. TMDL stands for Total Maximum Daily Load study.
3. In New Hampshire, fish/shellfish consumption advisories due to mercury are in effect for all surface waters. Waters impaired by mercury advisories were assessed as impaired and requiring a TMDL but were intentionally not shown on this map so that waters threatened or impaired by other causes and sources could be presented.
How do we find Bacteria Sources?

- Water quality sampling
- Water quality data review
- Watershed surveys and Field Reconnaissance
- Mapping
- Microbial Source Tracking
- Smoke Tests
- Canine Detection
- Implementing Watershed Based Plans
Canine Scent Tracking
IDDE – Using Canine Detection in New England
What Can They Do?

- Identify **human sources** of bacteria in water

**Storm drain investigations**

**Shoreline investigations**

**Watershed-scale investigations**
Example 1: The Parsons Creek Watershed
Parsons Creek Impairments

- Listed as impaired by the NH DES
  - Enterococci bacteria
  - PCBs
  - Mercury
  - Dioxin

- Wallis Sands Beach at Wallis Road
  - “Beach Right” location near outlet
  - Multiple days over the standard
2011 Watershed Based Plan

Sources: stormwater runoff and septic systems

Actions:
- Install BMPs
- Strengthen/develop ordinances
- Educate residents and municipal staff
- Developed septic database
Water Quality Sampling

- **Watershed Scale**

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Site Location</th>
<th>2013 Geometric Mean</th>
<th>2014 Geometric Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACPS005 U15</td>
<td>Brackett Road</td>
<td>1046</td>
<td>83</td>
</tr>
<tr>
<td>Geremia</td>
<td>Geremia Road</td>
<td>714</td>
<td>117</td>
</tr>
<tr>
<td>BCH 11</td>
<td>Marsh Road</td>
<td>2840</td>
<td>174</td>
</tr>
<tr>
<td>BCH 13</td>
<td>Ocean Blvd</td>
<td>860</td>
<td>93</td>
</tr>
<tr>
<td>BCH 26</td>
<td>Wallis Road</td>
<td>799</td>
<td>211</td>
</tr>
<tr>
<td>BCH 26A</td>
<td>Wallis Road</td>
<td>346</td>
<td>92</td>
</tr>
<tr>
<td>PC OUTLET</td>
<td>Parson Creek outlet on Ocean Blvd.</td>
<td>315</td>
<td>120</td>
</tr>
</tbody>
</table>

**NH DES enterococci standard = 35 colonies/100 mL (geometric mean)**

- Higher concentrations in wet weather
- Concentrations before July were low
- 2013 data higher than 2014
- Sources are likely stormwater runoff and malfunctioning septic systems.
Beach Investigation (2013 and 2014)

- Canine Detection
- Weekly/Nightly Sampling

- Presence of human-derived bacteria
- Variable concentrations (daily, weekly, monthly)
NH DES Water Quality Grant

- 2012-2013 Parsons Creek Watershed Plan Implementation Project, Phase I
  - $42,465 grant, $30,493 in-kind match
  - Stormwater BMPs (Wallis, Brackett, Marsh, Geremia)
  - Septic database, septic social, outreach, and survey
  - Water quality sampling
<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Enterococci (CTS/100mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>RB-outlet</td>
</tr>
<tr>
<td><strong>Thursday, September 4</strong></td>
<td>0:00</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>0:30</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>1:00</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>1:30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>2:00</td>
<td>&lt;10</td>
</tr>
<tr>
<td></td>
<td>2:30</td>
<td>&lt;10</td>
</tr>
<tr>
<td></td>
<td>3:00</td>
<td>30</td>
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<tr>
<td></td>
<td>3:30</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>4:00</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>12:00</td>
<td>10</td>
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<tr>
<td></td>
<td>12:30</td>
<td>&lt;10</td>
</tr>
<tr>
<td></td>
<td>13:00</td>
<td>&lt;10</td>
</tr>
<tr>
<td></td>
<td>13:30</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>14:00</td>
<td>&lt;10</td>
</tr>
<tr>
<td></td>
<td>14:30</td>
<td>&lt;10</td>
</tr>
<tr>
<td></td>
<td>15:00</td>
<td>&lt;10</td>
</tr>
<tr>
<td></td>
<td>15:30</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>16:00</td>
<td>10</td>
</tr>
</tbody>
</table>

NH DES standard for enterococci = 104 colonies/100 mL (single sample), indicated in gray
“Septic Risk Factor”
- Town and state records
- Soils, proximity to wetlands, flooding risk, proximity to streams, etc.

600 septic systems within Parson’s Creek Watershed
200 had NH DES records
155 additional had town records
Septic Survey

- Ocean and Old Ocean Blvd.
- 123 parcels in focus area
- 107 built
  - Septic dates for 61 of 107
  - 26% installed since 2000
What’s Next?

• 2015 Parsons Creek Watershed Plan Implementation Project, Phase II
  • Additional stormwater BMPs
  • Septic Evaluation and Replacement Program
    • Septic Evaluation (up to 20 homes)
    • Septic Replacement ($5K for up to 5 homes each)
  • Septic Ordinance Development
  • Public Outreach
• Continued Bacteria Monitoring
  • At beach seeps
  • Throughout Parsons Creek
Example 2: The Spruce Creek Watershed
Watershed-Based Management Plan (2008 and 2014)

Spruce Creek Watershed-Based Management Plan

Towns of Kittery & Eliot, Maine

Prepared by:
FB Environmental
97 A Exchange St., Ste 305
Portland, ME 04101
www.fbeenvironmental.com

May 2008
ME DEP 319 Grants (2008 – present)

- Spruce Creek Watershed Improvement Project
  - Total Grant Funds: $225,300
  - Total Match: $322,118
Stormwater Runoff
62 BMPs Installed
Direct Public Education to Over 1,300 People

This yard is helping to...

PROTECT KITTERY WATERS

Spruce Creek Watershed Improvement Project invites you to

Step Aboard the Gundalow

learn more at www.ProtectKitteryWaters.org
Addressing Wastewater Socials, Smoke Tests, and Databases

Spruce Creek Needs You to Party!

Come visit with your neighbors and find out how we all unknowingly contribute pollution to the waters of Spruce Creek. We need to act together to make a difference.

Did you know that Spruce Creek is at its tipping point? The water quality continues to degrade because of storm water runoff carrying pollutants into the creek. What does that mean for all of us? It means the loss of an important natural resource for clamming, fishing, boating, swimming, and admiring nature’s wonders. It also means the possibility of devalued waterfront property.

Our guest speaker, a professional experienced in keeping estuaries like Spruce Creek healthy, will explain the issues and show us how simple and affordable it is to make our yards more creek-friendly. We will explore the different ways each of us can slow down and limit the amount of rainwater that picks up pollutants while traveling over our property. We will also explain the opportunity to volunteer your property to be considered a demonstration site where the grant covers half the cost of the project.

Spruce Creek needs your help. Please join us to learn more about what you can do.

PARTY DETAILS:

Date: Wednesday, January 14, 2008
Time: 6:30 p.m.
Your Host: Ellen Hirshberg (host), Paula Ledgett (co-host)
Location: 56 Crockett Neck Road, Kittery Point
RSVP: (207) 439-5946 or 439-2492

Sponsored by the Town of Kittery, funded by the Maine Department of Environmental Protection, and organized by Kittery residents. For more information, please visit protectkitterywaters.org

Spruce Creek 2009, 2011, and 2012 Outfall Sampling Locations

Legend
- Sampled Outfalls 2012
- Sampled Outfalls 2009 and 2011

Data Sources: Maine Office of GIS
Spruce Creek Association

Legend:
- Sampled Outfalls 2012
- Sampled Outfalls 2009 and 2011

Study Area

Spruce Creek

2009, 2011, and 2012 Outfall Sampling Locations

Legend
- Sampled Outfalls 2012
- Sampled Outfalls 2009 and 2011

Data Sources: Maine Office of GIS
Spruce Creek Association

Legend:
- Sampled Outfalls 2012
- Sampled Outfalls 2009 and 2011

Study Area

Spruce Creek
Bacteria Source Tracking Projects (2011 – 2014)

Outfall Sampling Locations and Results 2009 and 2011

2013 SPRUCE CREEK TRIBUTARY SAMPLING AND CANINE DETECTION

FORT FOSTER BEACH & THE SPRUCE CREEK WATERSHED

KITTERY, MAINE

JANUARY 2014

Prepared for:
Town of Kittery
200 Rogers Road
Kittery, ME 03904

Prepared by:
FB Environmental Associates
1950 Lafayette Road, Suite 102
Portsmouth, NH 03801
Smoke Testing and Septic/Sewer Database (2014)
**Example: Manson Avenue Outfalls**

### Sample ID, Site Location, Total Geometric Mean, Canine Response

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Site Location</th>
<th>TOTAL Geometric Mean</th>
<th>CANINE RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manson Avenue Sites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEFT-MANSON OUT</td>
<td>Left culvert</td>
<td>597</td>
<td>--</td>
</tr>
<tr>
<td>RIGHT-MANSON OUT</td>
<td>Right culvert</td>
<td>519</td>
<td>--</td>
</tr>
<tr>
<td>MANSON OUT</td>
<td>Outfall at Manson Ave</td>
<td>399</td>
<td>Yes</td>
</tr>
<tr>
<td>MANSON DWN</td>
<td>Downstream of outfall in wetland/marsh</td>
<td>602</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Catch Basin Investigation
Smoke Testing and Septic/Sewer Database (2014)
Example: Shoreline Investigation
## Example: Shoreline Investigation

<table>
<thead>
<tr>
<th>Sampling Sites</th>
<th>Site Description</th>
<th>Enterococci (colonies/100mL)</th>
<th>Canine Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fort Foster Upper Marsh</td>
<td>Upstream portion of marsh near road</td>
<td>569</td>
<td>Yes</td>
</tr>
<tr>
<td>Outhouse Pipe</td>
<td>No flow</td>
<td>--</td>
<td>Yes</td>
</tr>
<tr>
<td>Fort Foster Coffer Dam</td>
<td>Downstream edge of marsh</td>
<td>109</td>
<td>Yes</td>
</tr>
<tr>
<td>Fort Foster Culvert</td>
<td>Culvert draining marsh (dry)</td>
<td>--</td>
<td>Yes</td>
</tr>
<tr>
<td>Beach Seepage K5</td>
<td>Dry area where original seep was found</td>
<td>--</td>
<td>Yes</td>
</tr>
<tr>
<td>Beach Seepage K4.5</td>
<td>Wet seep</td>
<td>146</td>
<td>Yes</td>
</tr>
<tr>
<td>Beach Seepage K4.2.5</td>
<td>Tidal pool</td>
<td>41</td>
<td>Yes</td>
</tr>
<tr>
<td>Beach Seepage K4</td>
<td>Wet seep</td>
<td>--</td>
<td>Yes</td>
</tr>
<tr>
<td>Fort Foster K5</td>
<td>Surf Zone</td>
<td>40</td>
<td>Yes</td>
</tr>
<tr>
<td>Fort Foster K4</td>
<td>Eastern Surf Zone</td>
<td>112</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Example: Shoreline Investigation
Smokin’ Gun!
### Fort Foster Re-visited

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Site Description</th>
<th>2012 Bacteria Concentration Enterococci</th>
<th>2012 Canine Response (Logan/Sable)</th>
<th>2013 Bacteria Concentration Enterococci</th>
<th>2013 Canine Response (Logan/Sable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet Seep 1</td>
<td>Seep furthest east on Fort Foster Beach</td>
<td>--</td>
<td>--</td>
<td>&gt;2420</td>
<td>No/No</td>
</tr>
<tr>
<td>Wet Seep 2</td>
<td>Seep west of ‘Wet Seep 1’</td>
<td>--</td>
<td>--</td>
<td>78</td>
<td>Yes/Yes</td>
</tr>
<tr>
<td>Wet Seep 3</td>
<td>In front of outfall on beach</td>
<td>--</td>
<td>--</td>
<td>613</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Outfall - FF</td>
<td>Outfall draining marsh</td>
<td>--</td>
<td>Yes/Yes</td>
<td>--</td>
<td>No/No</td>
</tr>
<tr>
<td>Wet Seep 5</td>
<td>Seep furthest west</td>
<td>146</td>
<td>Yes/Yes</td>
<td>31</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Upper Marsh – FF</td>
<td>South side of access road</td>
<td>569</td>
<td>Yes/Yes</td>
<td>101</td>
<td>No/No</td>
</tr>
<tr>
<td>Lower Marsh - FF</td>
<td>Above culvert to beach</td>
<td>109</td>
<td>Yes/Yes</td>
<td>29</td>
<td>No/No</td>
</tr>
<tr>
<td>Surf Zone - FF</td>
<td>Ocean</td>
<td>40</td>
<td>Yes/Yes</td>
<td>516</td>
<td>No/No</td>
</tr>
</tbody>
</table>
Questions?