Maine Statewide Bacteria TMDL: APPENDIX II

Marine & Estuarine Waters

Prepared by:

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Prepared for:

US EPA New England, Region 1

&

Maine Department of Environmental Protection

August 2009
Report #: DEPLW-1004

Maine Bacteria TMDL:

APPENDIX II

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Acknowledgements

Many thanks to the following individuals who provided valuable input, data, and assistance:

Jennie Bridge, *US EPA*
Tim Bridges, *US EPA*
Anna Bourakovsky, *Maine DMR*
Matthew Craig, *Casco Bay Estuary Partnership*
Melissa Evers, *Maine DEP*
Amy Fitzpatrick, *Maine DMR*
Phyllis Ford, *Spruce Creek Association*
Diane Gould, *US EPA*
Keri Lindberg, *Maine Healthy Beaches*
Sarah Mosley, *Maine Healthy Beaches*
Stuart Rose, *Maine DEP*
Alison Sirois, *Maine DMR*
James Stahlnecker, *Maine DEP*
Paula Thomson, *Maine SPO*
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Aerial view of Kittery, ME and Portsmouth, NH. *Spruce Creek flows through Kittery, Maine (left) before draining into the Piscataqua River Estuary (center), near the Portsmouth Naval Shipyard. Portsmouth, New Hampshire can be seen on the right side of the photo.*

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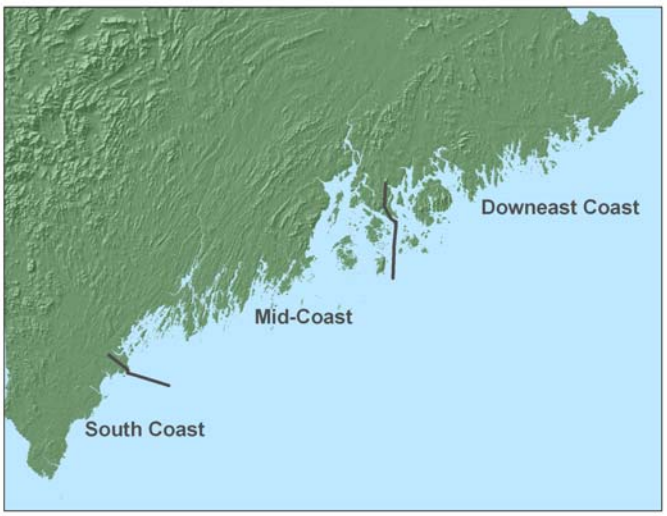
1. Impaired Segment Locations and Recent Data

There are 3 distinct regions to Maine's coastal landscape: south coast, mid-coast, and downeast. The definitions for each region follow, and the numbers of impaired segments in each are summarized in Table 1.

- The **south coast**, with its sandy beaches and rocky cliffs, is defined as the area that stretches from the Piscataqua River at the New Hampshire border, to south of Cape Elizabeth.
- The **mid-coast region**, a series of narrow, rocky peninsulas begins in Cape Elizabeth, inclusive of Casco Bay, and ends to the east of Penobscot Bay.



Maine's coastal landscape is divided into three distinct regions: south coast, mid-coast, and downeast.

- The **downeast coast** begins at the east end of Penobscot Bay and extends to the Canadian border.

These coastal divisions also reflect ecological considerations, such as substrate composition and function, which affect bacteria survival rates. Waters in the south coastal region generally have a sandy substrate, while the mid-coast has a muddy substrate, and the downeast region is defined by heavy currents.

The largest number of impaired marine and estuarine segments is located in the mid-coast region, followed by the downeast coast and the south coast, respectively. Table 1 lists the number of impaired sites within each listing category for each of the three coastal regions.

Table 1: *Numbers of Impaired Segments within each Listing Category, by Coastal Region*

	Coastal Region		
Listing Category	**South Coast**	**Mid-Coast**	**Downeast Coast**
Waters Impaired Only by Bacteria (Category 5-B-1)	17	57	52
Waters Impaired by CSOs (Category 5-B-2)	2	9	2
Waters Impaired by Other Pollutants (Category 5A)	2	2	0
Totals:	***19***	***66***	***54***

Figures 1, 2, and 3, respectively, show the locations of marine and estuarine waters impaired by CSOs (Category 5-B-2), bacteria and other pollutants (Category 5A), and bacteria only (Category 5-B-1), within each of Maine's coastal regions.

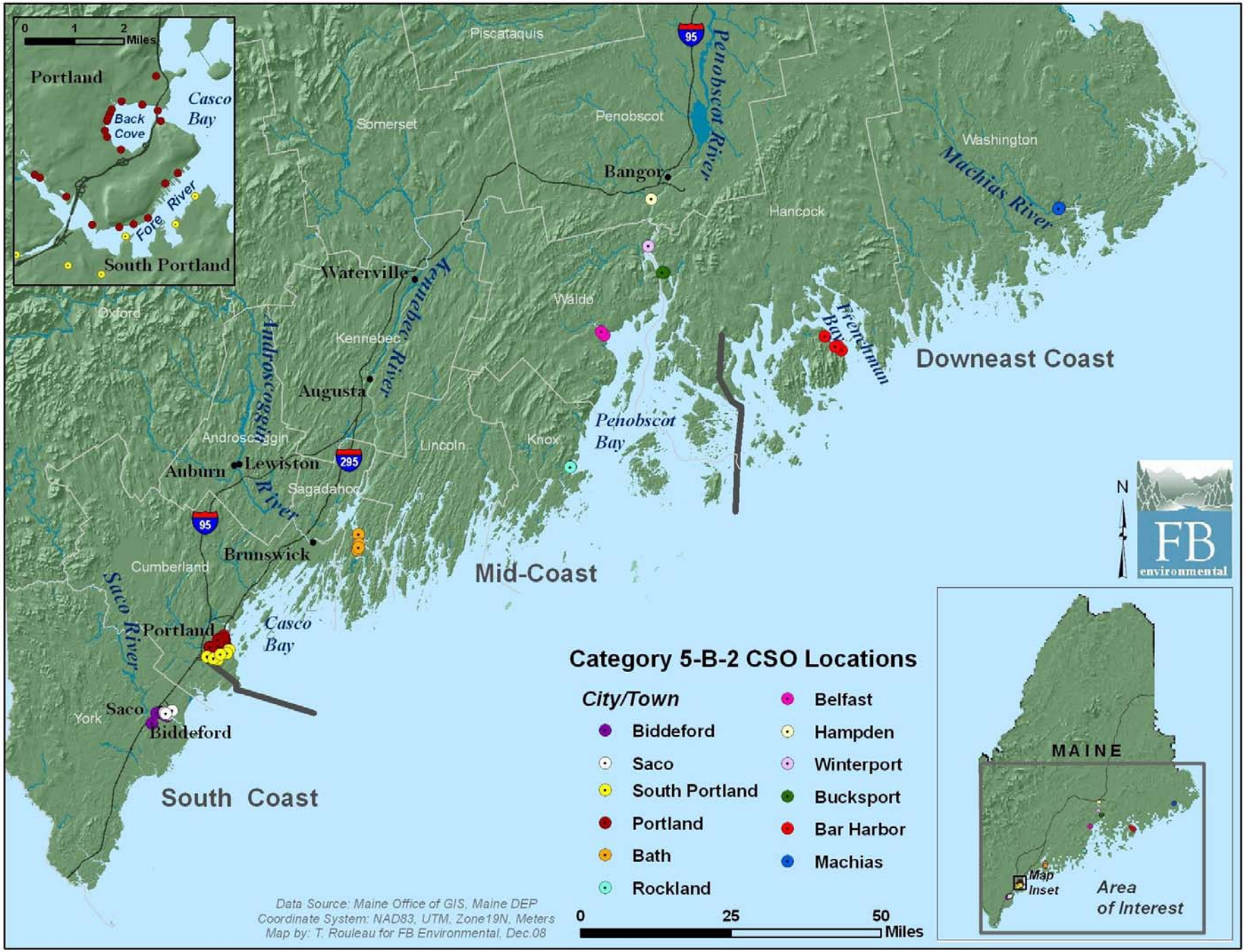


Figure 1: *Locations of Estuarine & Marine Waters Impaired by Combined Sewer Overflows (2008 Listing Category 5A)*

1.1 Waters Impaired by CSOs (Category 5-B-2)

During dry weather, the sewage in a combined system is conveyed to a treatment plant. However, during rainstorms or snow-melt periods, stormwater mixes with the sanitary sewage, causing flows that exceed the capacity of the sewer system. This results in combined sewer overflows (CSOs), which vary extensively in pollutant types, concentrations and loads, as well as in volume of overflow and severity of impact to the receiving waterbodies.

In coordination with US EPA's CSO program, Maine has established a program to assist communities in evaluating the design, condition, activity, and effects of combined sewer systems and overflows. Maine DEP issues CSO permittees a wastewater discharge license that requires them to implement nine minimum Best Management Practices (BMPs) as required by the US EPA, develop a Long Term Control Plan (LTCP), or Master Plan, to eliminate or abate their overflows, and to implement the plan and bring them into compliance with EPA's CSO Control Policy. All of Maine's CSO Communities currently have completed or are working on comprehensive CSO studies or facilities plans.

Statewide, there are thirty-seven Maine communities served by combined sewer systems, which convey a combination of sanitary and storm water flows to wastewater treatment facilities (Maine DEP, 2008). Thirteen of these communities have CSOs that discharge to coastal waterbodies.

CSOs in Southern Coastal Waters

There are two towns in the southern coastal region with coastal waterbodies impaired by CSOs: Biddeford and Saco (Maine DEP, 2008). Biddeford is home to 9 active outfalls, licensed to the Biddeford Waste Water Treatment Facility, which discharge to the Saco River (Figure 1, previous page). There are 4 active outfalls in Saco. These outfalls also discharge to the Saco River, and are licensed to the Saco Waste Water Treatment Facility. As of 2007, the yearly CSO discharge volume of the CSOs in Biddeford was over 150 million gallons, compared to a yearly rate of 2 million gallons for the CSOs in Saco (True, 2008).

CSOs in Mid-Coastal Waters

There are nine communities in the mid-coastal region with coastal waterbodies impaired by CSOs, impacting twelve individual waterbodies (Table 2). As of 2007, Portland had the largest CSO overflow discharge volume of all CSO communities in Maine at over 589 million gallons per year, 39% of the combined discharge in all CSO communities (True, 2008).

Table 2: *CSO Locations and Waterbodies in the Mid-Coast Region*

Location	Waterbody
Bath	Kennebec River
Belfast	Passagassawakeag River
Bucksport	Penobscot River
Cape Elizabeth	Atlantic Ocean
Hampden	Soudabscook Stream
Portland	Portland Harbor, Back Cove, Fore River, Casco Bay
Rockland	Rockland Harbor
South Portland	Fore River Channel, Long Creek, Portland Harbor
Winterport	Penobscot River

CSOs in Downeast Coastal Waters

There are two towns in the downeast coastal region with coastal waterbodies impaired by CSOs: Bar Harbor and Machias (Maine DEP, 2008). Bar Harbor is home to 4 active outfalls, licensed to the Town, which discharge to Frenchman's Bay and Eddie Brook (Figure 1). There are 2 active outfalls in Machias. These outfalls discharge to the Machias River, and are licensed to the Machias Waste Water Treatment Facility. As of 2007, the yearly CSO discharge volume of the CSOs in Bar Harbor was about 8.7 million gallons, compared to a yearly rate of 2.3 million gallons for the CSOs in Machias (True, 2008).

Because water quality data related to the marine and estuarine waters impaired by CSOs was not readily available, data for Category 5-B-2 impaired waters are not included in this appendix.

1.2 Waters Impaired by Bacteria and Other Pollutants (Category 5A)

As shown in Figure 2 (next page), there are four coastal waters impaired by bacteria and other pollutants, two in the south coast region, and two in the mid-coast region.

Category 5A listings in the south coast region include the Mousam River Estuary and the Saco River Estuary. According to the 2008 303(d) List, causes of impairment for the Mousam River Estuary include dissolved oxygen, elevated fecals, and non-point source pollution while sources for the Saco River Estuary include toxicity, copper, and elevated fecals (Maine DEP, 2008). Both have a TMDL priority date of 2008. No recent monitoring data was available for either impaired segment. As such, no data for these Category 5A waters are included in this appendix. Related data for the Saco River can be found in Tables 4 and 6.

Mid-coast Category 5A waters include the Fore River Estuary and the Royal River Estuary. According to the 2008 303(d) List, causes of impairment for the Fore River Estuary include aquatic life, toxics, elevated fecals and non-point source pollution, while sources for the Royal River Estuary include dissolved oxygen, elevated fecals, and non-point source pollution (Maine DEP 2008). The Fore River Estuary has a TMDL completion date of 2010, while the Royal River Estuary has a completion date of 2012. No recent monitoring data was available for the Fore River Estuary. As such, no data for that impaired segment are included in this appendix. Data for the Royal River Estuary can be found in Table 9.

The ice-covered Webhannet Estuary in Wells, Maine. (Photo: Cayce Dalton)

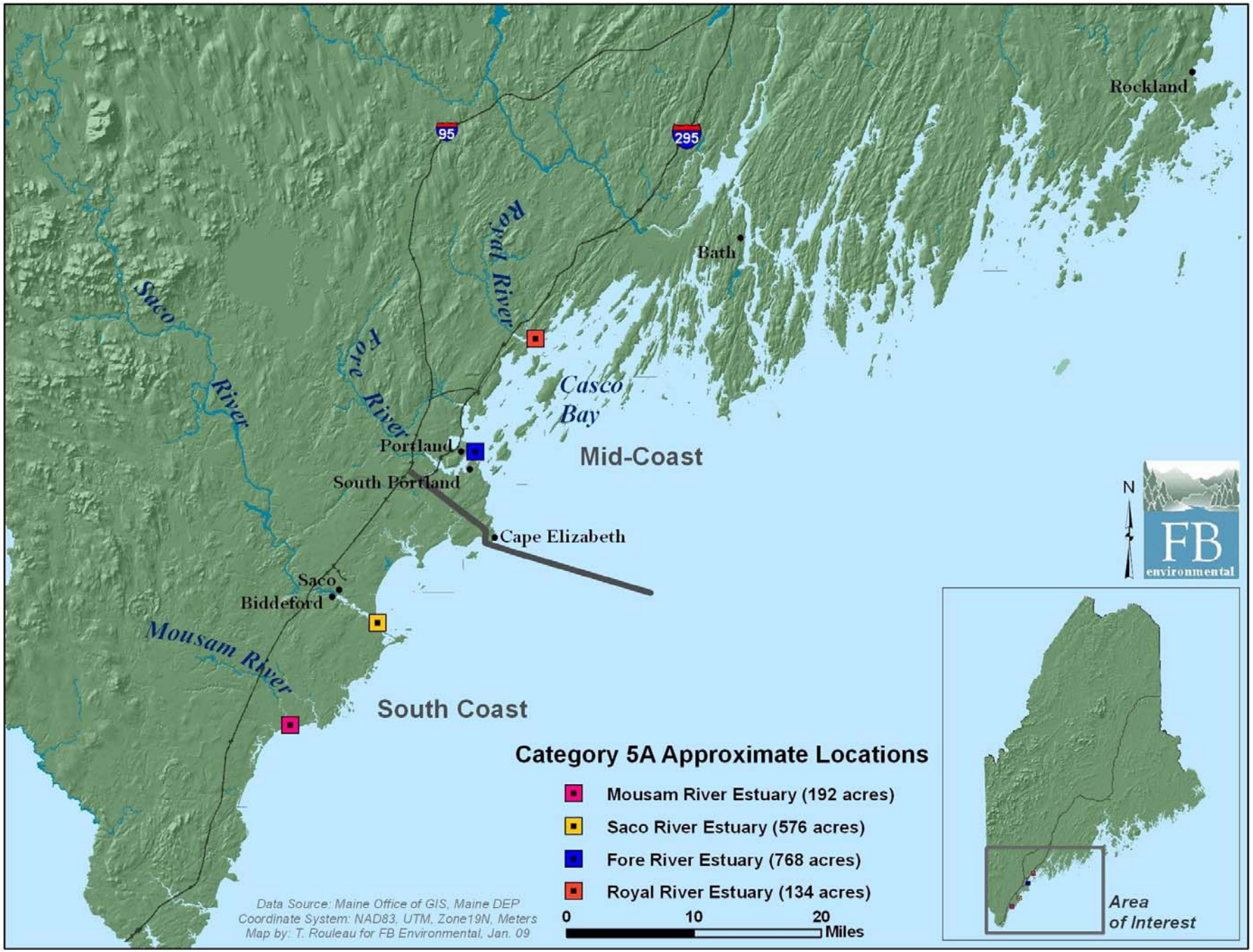


Figure.2: *Locations of Estuarine & Marine Waters Impaired by Other Pollutants (2008 Listing Category 5A)*

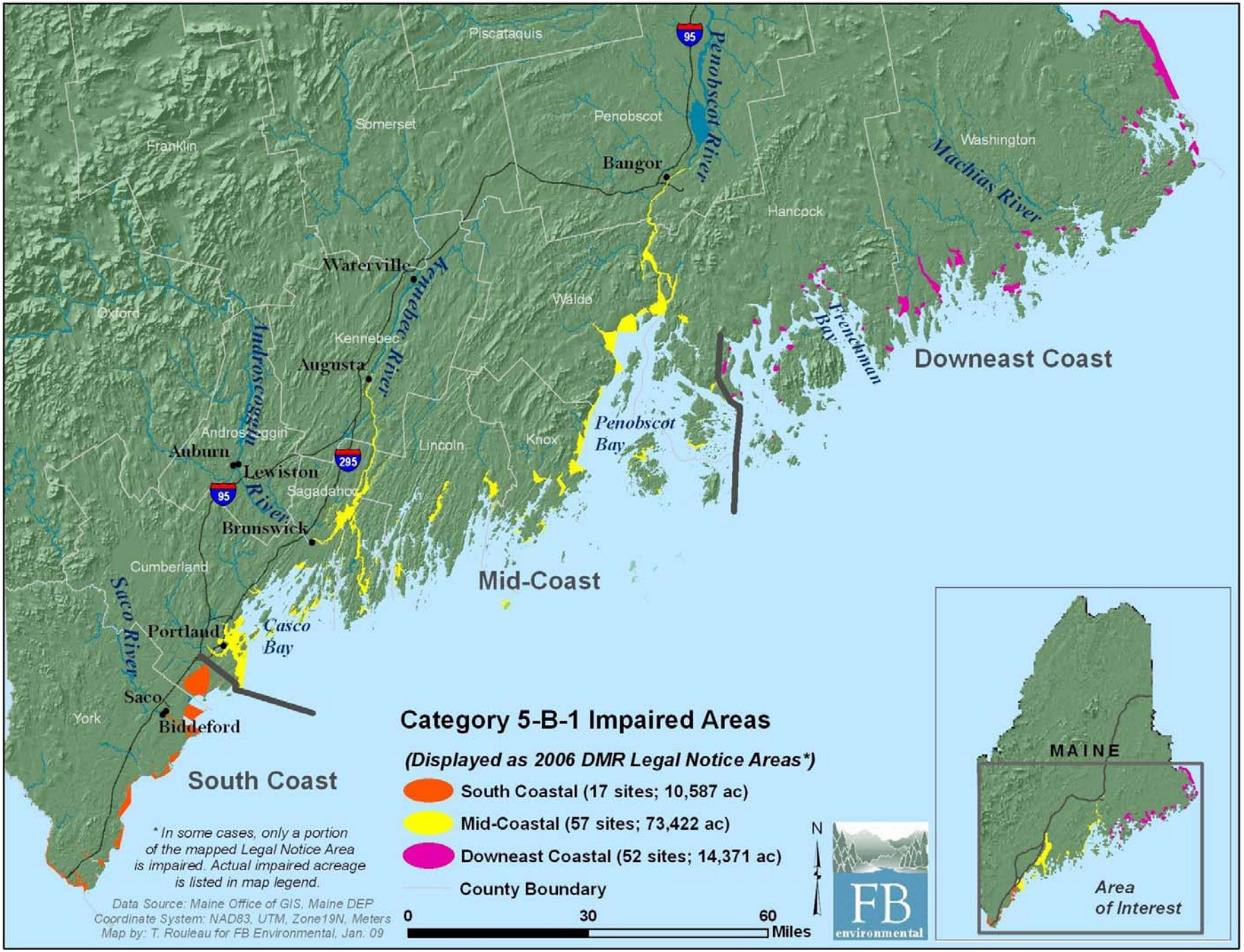


Figure 3: *Locations of Estuarine & Marine Waters Impaired Only by Bacteria (2008 Listing Category 5-B-1)*

1.3 Waters Impaired only by Bacteria (Category 5-B-1)

Data used in this appendix were obtained from the Maine Department of Marine Resources and the Maine Healthy Beaches Program. The five most recent years of available data were used to present results from different sites sampled by each program, using different indicator organisms, for two distinct purposes. Maine DMR monitors fecal coliform to protect shellfishing areas, and Maine Healthy Beaches Program (MHB) monitors *Enterococci* bacteria to protect recreational uses and swimming at coastal beaches.

Department of Marine Resources Data: An average of five years of data from DMR sampling stations in or immediately adjacent to the 2006 DMR legal notice areas (as listed under Category 5-B-1 on the 2008 303(d) List) was used in the following data presentations for each major coastal section. For each fecal coliform sampling station, the 5-year geometric mean and 90th percentile values were calculated. For each DMR area, two corresponding stations were then selected: the station with the highest geometric mean value, and the station with the highest maximum value. These values represent the "worst case" scenario for each DMR area. Results are displayed in table format, and are compared to the approved shellfish growing area standard of 14/100mL for geometric means and 31/100mL for the estimated 90th percentile (Maine DMR 2008). Maps showing nearby sampling stations for the impaired legal notice areas and the highest geometric mean stations corresponding to each area are also included.

Geometric mean *is a measure of central tendency, similar to a median. Geometric means are often useful summaries for highly skewed data*

90th Percentile *is that position in a data set which has 90% of data points below it, and 10% above it*

Maine Healthy Beaches Data: For each MHB monitoring station, the geometric mean was calculated for a minimum of five *Enterococci* samples collected over each 30-day period. Geometric mean and single sample results were then compared with Maine's water quality criteria for coastal bacteria which are the basis for the coastal bacteria TMDLs.

Please note that, in presenting their own data, the MHB compare coastal bacteria results to the following marine US EPA bacteria guidelines for *Enterococci* (EPA, 1986) which are less stringent than Maine's water quality standards of 54 colonies/100 mL or a geometric mean of 8 colonies per 100mL for Class SB waters, and 94 colonies/100 mL or a geometric mean of 14 colonies/100 mL for class SC waters;:

- MHB Marine guidelines: 104 colonies per 100 mL of sample water for single samples, or a geometric mean of 35 colonies per 100 mL of water in at least five samples collected over a 30-day period.

The resulting data tables summarize single sample and geometric mean exceedances.

1.3.1 Southern Coastal Waters Data Presentation

Figure 4: *Nearby DMR Sampling Stations: Piscataqua River Estuary to Little River (Category 5-B-1)*

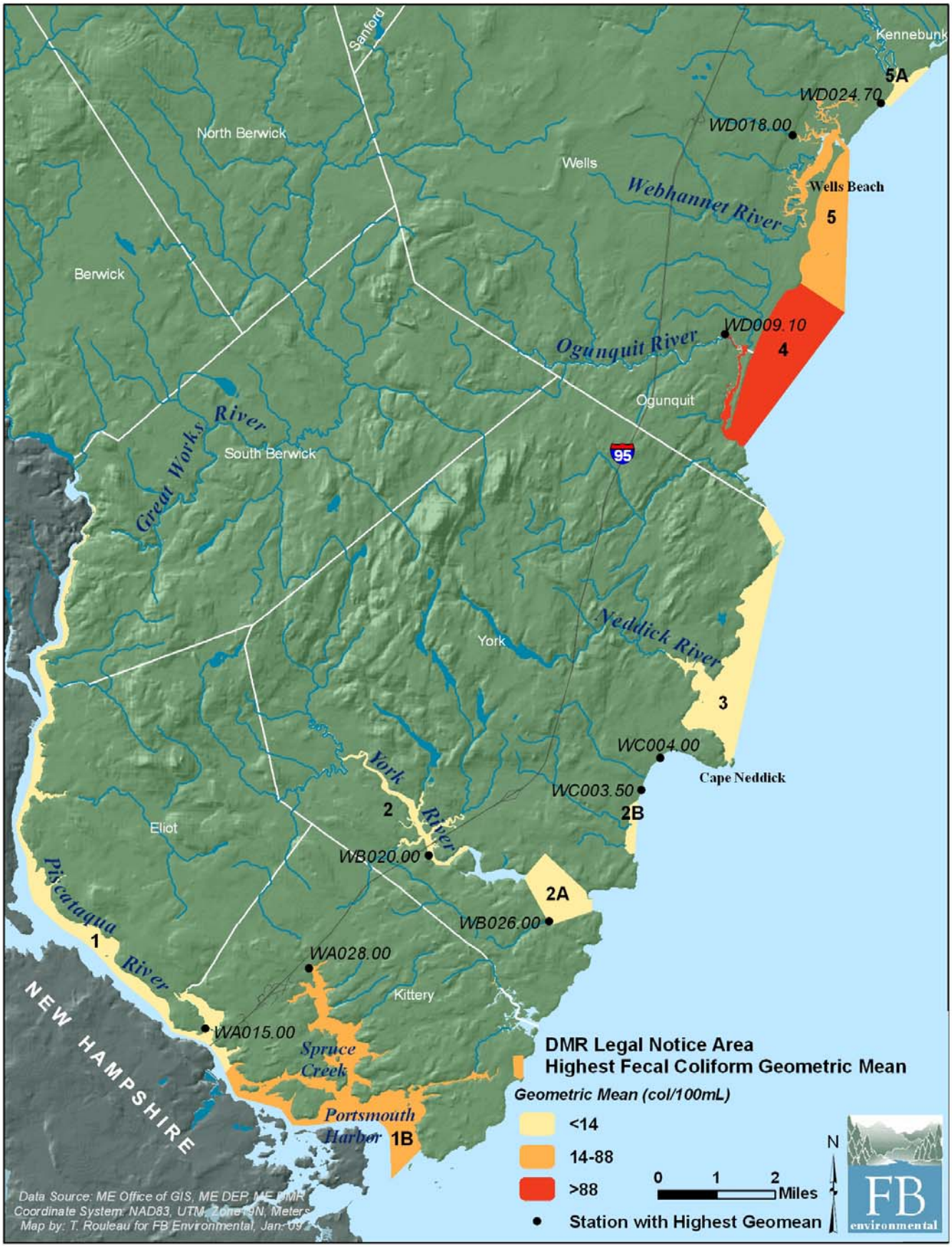


Figure 5: *Stations with Highest Geometric Mean: Piscataqua River Estuary to Little River (Category 5-B-1)*

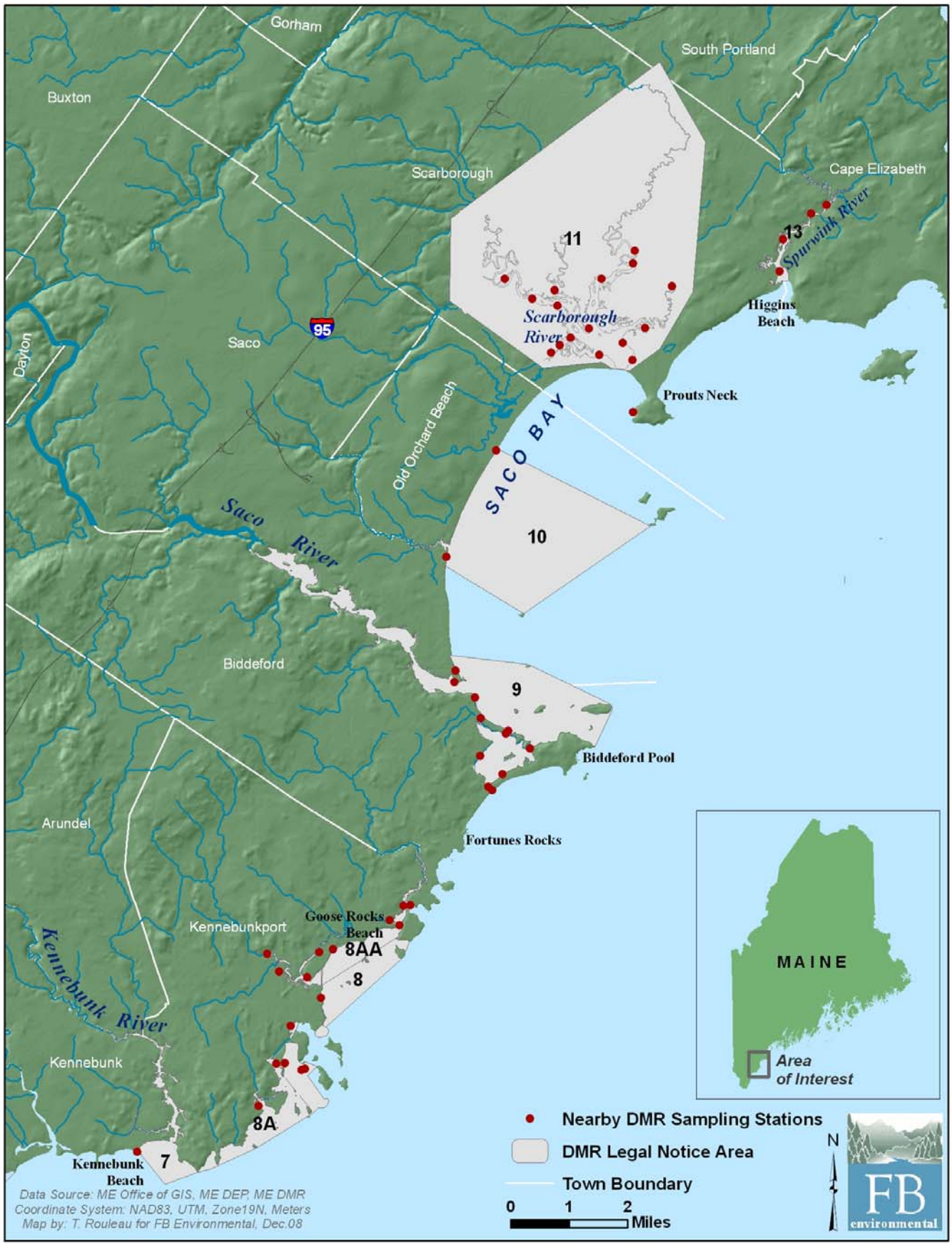


***Figure 6**: Nearby DMR Sampling Stations: Kennebunk River to Spurwink River (Category 5-B-1)*

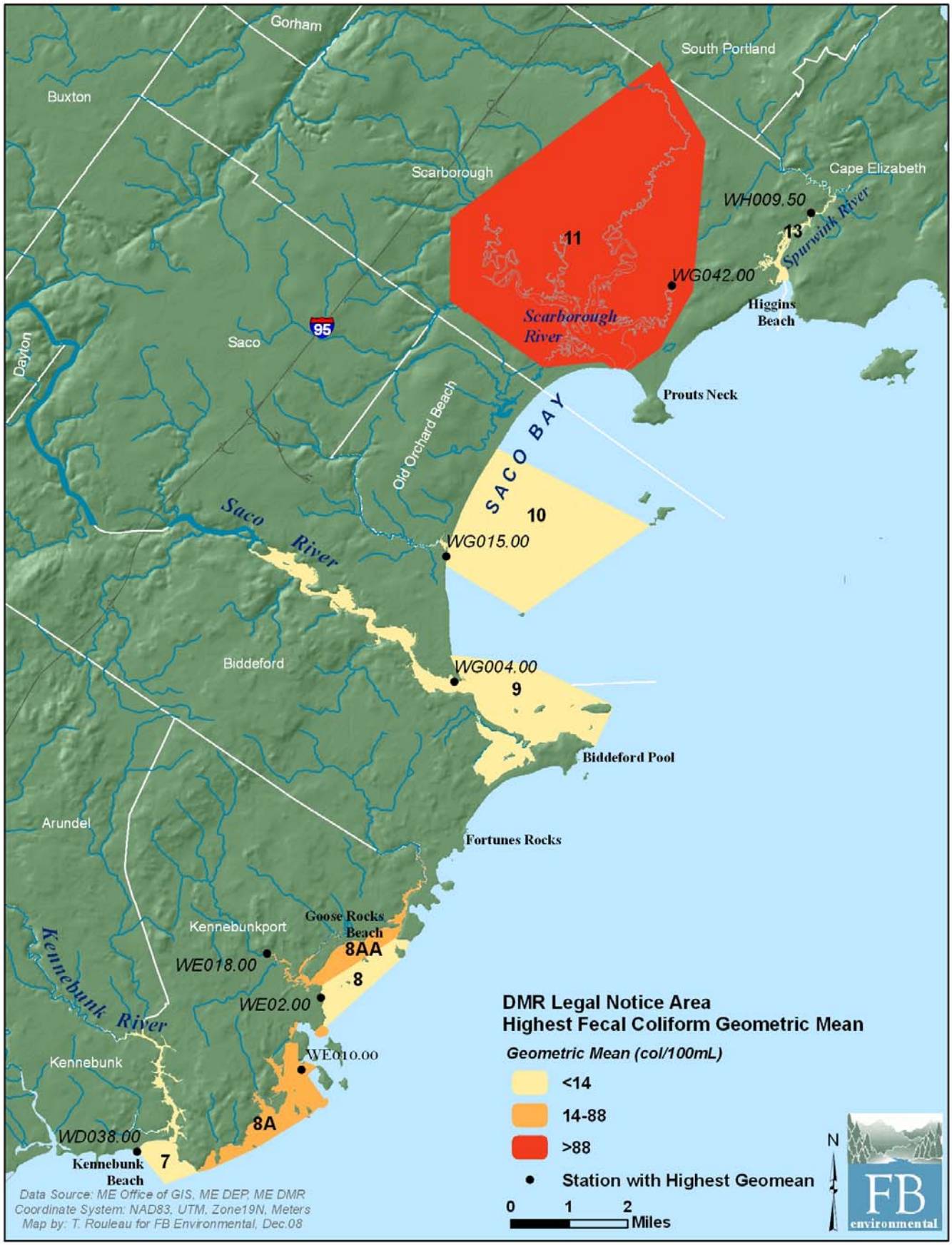


Figure 7: *Stations with Highest Geometric Mean: Kennebunk River to Spurwink River (Category 5-B-1)*

Table 3: *DMR Fecal Coliform Data for South Coastal Waters Impaired only by Bacteria: Piscataqua River Estuary to Little River (Category 5-B-1)*

Location: Piscataqua River Estuary to Little River

Water Quality Standard: geometric mean: 14/100mL AND estimated 90th percentile: 31/100mL (Maine DMR 2007)

Data: Maine Department of Marine Resources (2003-2008)

DMR Legal Notice Area	Segment Description	Station with Highest Geometric Mean	Highest Geometric Mean (col/100mL)	# of Samples	Station with Highest 90th Percentile	Highest 90th Percentile (col/100mL)	# of Samples
1	Piscataqua R. Estuary, Kittery, Eliot, So. Berwick	WA015.00	14	42	WA016.00	260	39
1B	Jaffrey Point, N. H. to Brave Boat Harbor, York	WA028.00	20	39	WA028.00	168	39
2	York River	WB020.00	12	35	WB020.00	85	35
2A	York Harbor	WB026.00	7	45	WB026.00	63	45
2B	Lobster Cove	WC003.50	5	48	WC003.50	23	48
3	Cape Neddick	WC004.00	5	35	WC004.00	17	35
4	Ogunquit River	WD009.10	97	8	WD009.10	410	8
5	Webhannet River	WD018.00	18	43	WD018.00	158	43
5A	Little River	WD024.70	3	17	WD024.70	9	17

Shaded cells indicate exceedance of geometric mean and/or 90th percentile

Table 4: *DMR Fecal Coliform Data for South Coastal Waters Impaired only by Bacteria: Kennebunk River to Spurwink River (Category 5-B-1)*

Location: Kennebunk River to Spurwink River

Water Quality Standard: geometric mean: 14/100mL AND estimated 90th percentile: 31/100mL

Data: Maine Department of Marine Resources (2003-2008)

DMR Legal Notice Area	Segment Description	Station with Highest Geometric Mean	Highest Geometric Mean (col/100mL)	# of Samples	Station with Highest 90th Percentile	Highest 90th Percentile (col/100mL)	# of Samples
7	Kennebunk River	WD038.00	3	36	WD038.00	4	36
8	Cape Porpoise	WE02..00	5	37	WE022.00	23	37
9	Saco River	WG004.00	14	37	WG004.00	112	37
10	Saco Bay	WG015.00	5	37	WG019.50	24	21
11	Scarborough River	WG042.00	108	20	WG042.00	508	20
13	Spurwink River	WH009.50	12	39	WH009.50	82	39
8A	Cape Porpoise Harbor	WE010.00	17	31	WE010.00	240	31
8AA	Goosefare Bay	WE018.00	24	31	WE027.00	93	42

Shaded cells indicate exceedance of geometric mean and/or 90th percentile

Table 5: *MHB Enterococci Data: York River (DMR Area 2)*

Location: York
Associated DMR Area: 2
Water Quality Standard (SB): Between May 15th and Sept. 30th,
Enterococci not to exceed a geometric mean of 8/100mL or an instantaneous level of 54/100mL.
Data: Maine Healthy Beaches (2004-2008)

Group Name	Station Name	Total Number of Samples	Highest Single Sample (col/100mL)	Highest Geometric Mean (col/100mL)
York	YK-02	95	852	73

Shaded cells indicate exceedance of WQ standard for class SB waters.

Table 6: *MHB Enterococci Data: Saco River (DMR Area 9)*

Associated Beach: Ferry Beach
Associated DMR Area: 9
Water Quality Standard (SB): Between May 15th and Sept. 30th,
not to exceed a geometric mean of 8/100mL or an instantaneous level of 54/100mL.
Water Quality Standard (SC): Between May 15th and Sept. 30th,
Enterococci not to exceed a geometric mean of 14/100mL or an instantaneous level of 94/100mL.
Data: Maine Healthy Beaches (2003-2008)

Group Name	Station Name	Total Number of Samples	Highest Single Sample (col/100mL)	Highest Geometric Mean (col/100mL)
Saco River	SACO-05	96	860	52

Shaded cells indicate exceedance of WQ standard for class SB waters.

Table 7: *MHB Enterococci Data: Cape Neddick River (DMR Area 9)*

Associated Beach: Cape Neddick
Associated DMR Area: 9
Water Quality Standard (SB): Between May 15th and Sept. 30th,
Enterococci not to exceed a geometric mean of 8/100mL or an instantaneous level of 54/100mL.
Water Quality Standard (SC): Between May 15th and Sept. 30th,
not to exceed a geometric mean of 14/100mL or an instantaneous level of 94/100mL.
Data: Maine Healthy Beaches (2007-2008)

Group Name	Station Name	Total Number of Samples	Highest Single Sample (col/100mL)	Highest Geometric Mean (col/100mL)
Cape Neddick River	CNR-01	14	913	21
Cape Neddick River	CNR-02	14	2143	615
Cape Neddick River	CNR-06	7	1039	N/A
Cape Neddick River	CNR-07	7	480	N/A
Cape Neddick River	CNR-08	7	571	N/A
Cape Neddick River	CNR-09	7	670	N/A
Cape Neddick River	CNR-10	7	403	N/A

Shaded cells indicate exceedance of WQ standard for class SB waters.

Table 8: *MHB Enterococci Data: Spurwink River (DMR Area 13)*

Associated Beach: Higgins Beach
Associated DMR Area: 13
Water Quality Standard (SB): Between May 15th and Sept. 30th,
Enterococci not to exceed a geometric mean of 8/100mL or an instantaneous level of 54/100mL.
Water Quality Standard (SA): As naturally occurs.
Data: Maine Healthy Beaches (2007-2008)

Group Name	Station Name	Total Number of Samples	Highest Single Sample (col/100mL)	Highest Geometric Mean (col/100mL)
Spurwink River	Hig-0	31	5750	82

Shaded cells indicate exceedance of WQ standard for class SB waters.

1.3.2. Mid-Coastal Waters Data Presentation

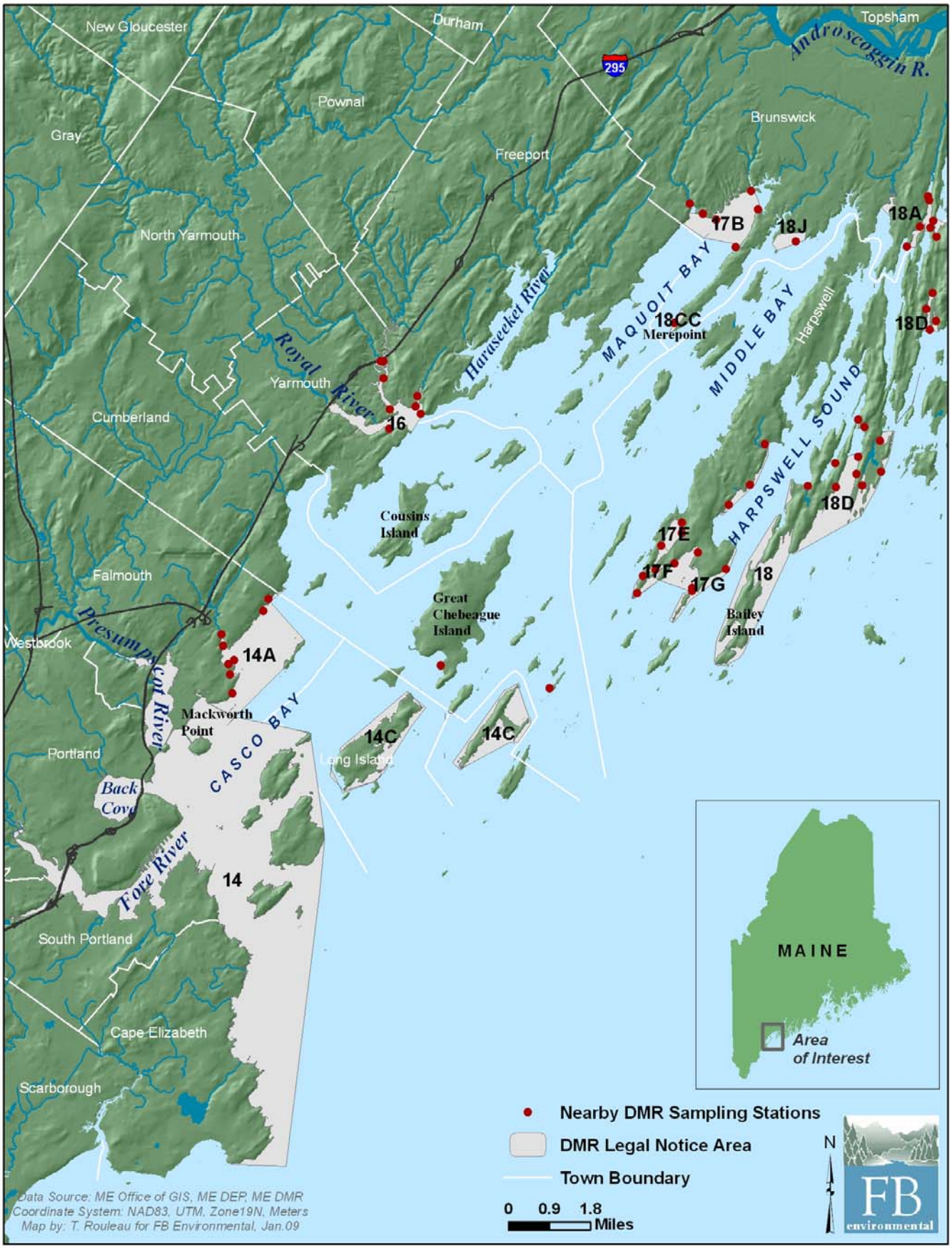


Figure 8: *Nearby DMR Sampling Stations: Portland-Falmouth Area to Middle Bay (Category 5-B-1)*

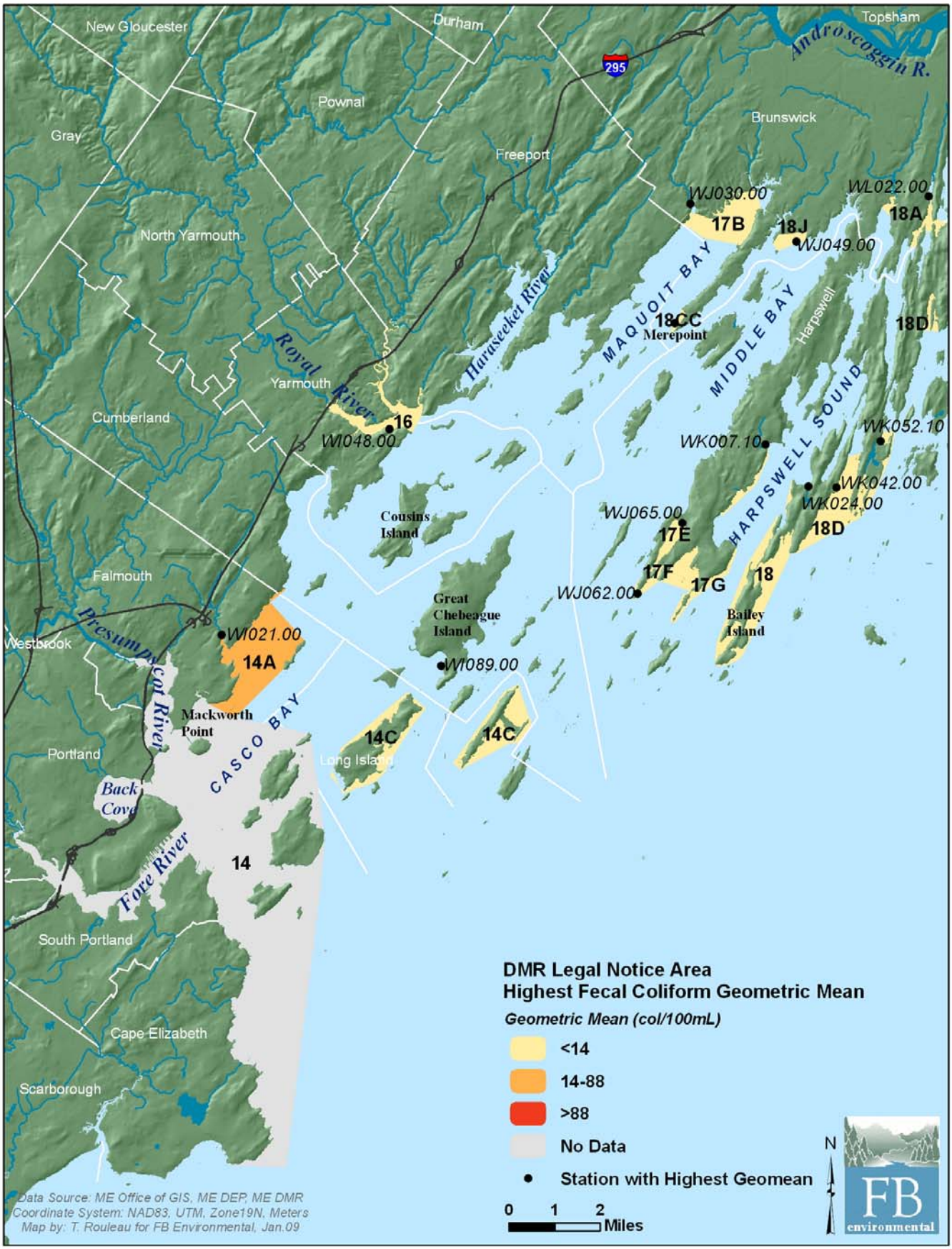


Figure 9: *Stations with Highest Geometric Mean: Portland-Falmouth Area to Middle Bay (Category 5-B-1)*

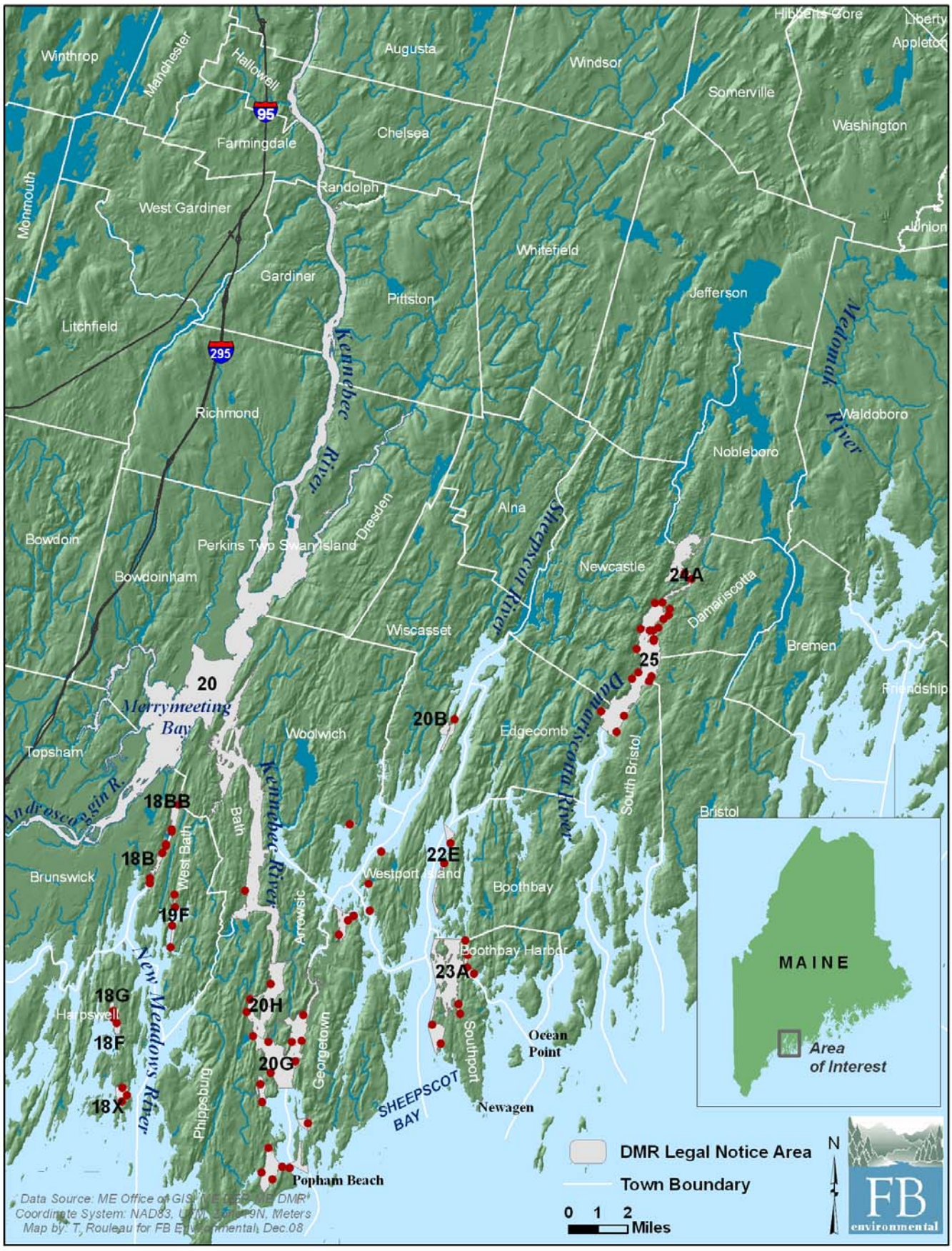


Figure 10: *Nearby DMR Sampling Stations: New Meadows River to Damariscotta (Category 5-B-1)*

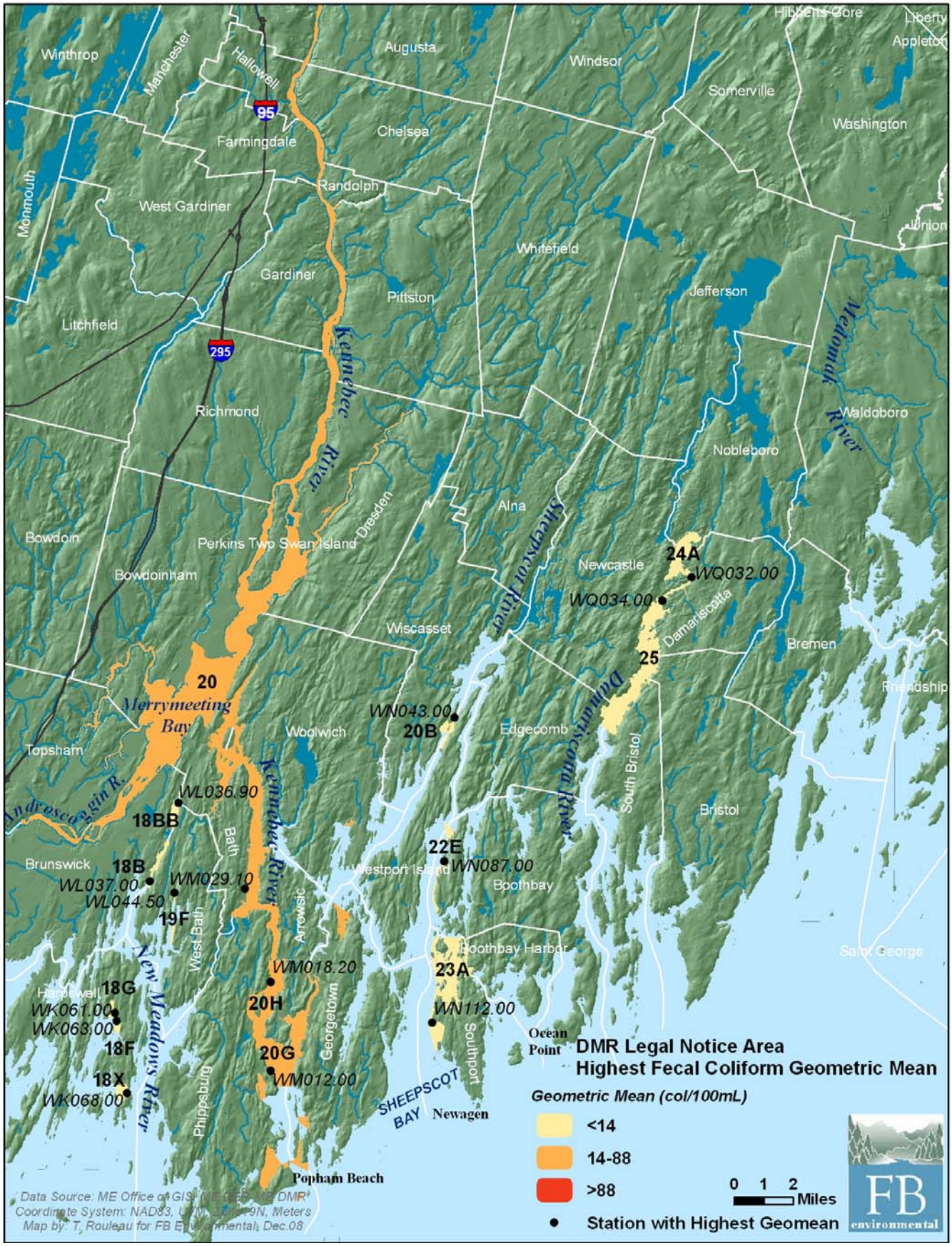


Figure 11: *Stations with Highest Geometric Mean: New Meadows River to Damariscotta (Category 5-B-1)*

Figure 12: *Nearby DMR Sampling Stations: Medomak River to Ducktrap Harbor (Category 5-B-1)*

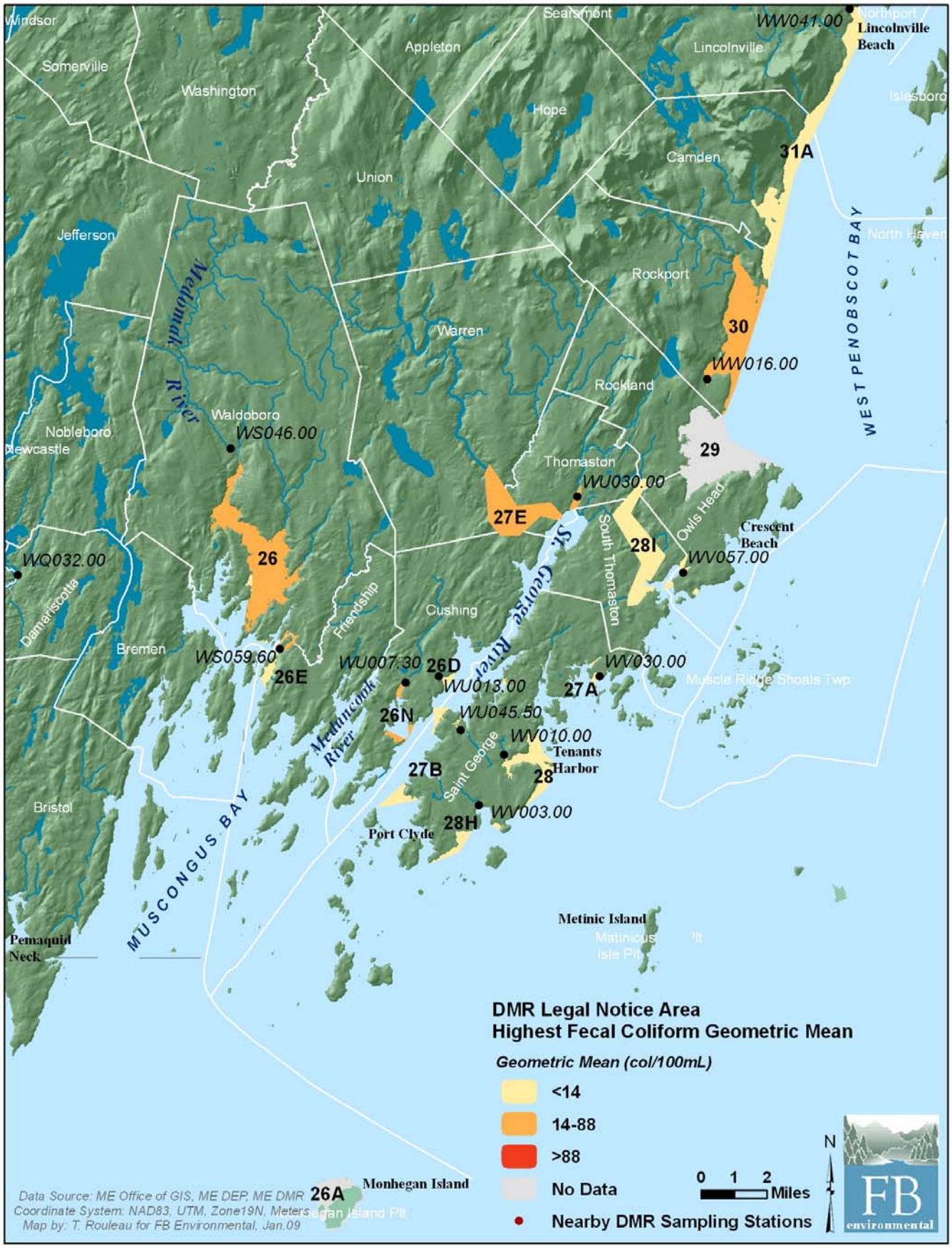


Figure 13: *Stations with Highest Geometric Mean: Medomak River to Ducktrap Harbor (Category 5-B-1)*

Figure 14: *Nearby DMR Sampling Stations: Vinalhaven to Benjamin River (Category 5-B-1)*

Figure 15: *Stations with Highest Geometric Mean: Vinalhaven to Benjamin River (Category 5-B-1)*

Table 9: *DMR Fecal Coliform Data for Waters Impaired Only by Bacteria: Portland-Falmouth Area to Middle Bay (Category 5-B-1***)**

Location: Portland-Falmouth Area to Middle Bay

Water Quality Standard: geometric mean: 14/100mL AND estimated 90th percentile: 31/100mL

Data: Maine Department of Marine Resources (2003-2008)

DMR Legal Notice Area	Segment Description	Station with Highest Geometric Mean	Highest Geometric Mean (col/100mL)	# of Samples	Station with Highest 90th Percentile	Highest 90th Percentile (col/100mL)	# of Samples
14A	Falmouth to Cumberland	WI021.00	17	41	WI019.00	240	41
14C	Long Island Cliff Island, Portland	WI089.00	4	39	WI089.00	23	39
16	Royal & Cousins R. Estuaries	WI048.00	12	61	WI051.00	222	73
17B	Maquoit Bay, Brunswick and Freeport	WJ030.00	8	47	WJ033.00	93	71
17E	Basin, Ash and Stover Coves, Harpswell	WJ065.00	5	45	WJ065.00	37	45
17F	Orrs and Bailey Island, Harpswell	WJ062.00	5	46	WJ063.00	24	46
17G	Harpswell Sound, Harpswell	WK007.10	6	41	WK007.00	39	41
18	Potts Harbor	WK024.00	9	47	WK024.00	152	47
18A	Gurnet Strait, Harpswell	WL022.00	6	44	WL022.00	42	44
18CC	Merepoint, Brunsick	WJ038.00	4	46	WJ038.00	23	46
18D	Eastern Bailey Orr's Island, Western Quahog Bay	WK042.00	10	36	WK042.00	107	36
18J	Middle Bay	WJ049.00	6	48	WJ049.00	84	48

Shaded cells indicate exceedance of geometric mean and/or 90th percentile

Table 10: *DMR Fecal Coliform Data for Waters Impaired Only by Bacteria: New Meadows River to Damariscotta (Category 5-B-1)*

Location: New Meadows River, Brunswick, West Bath, Harpswell to Damariscotta River, Newcastle & Damariscotta

Water Quality Standard: geometric mean: 14/100mL AND estimated 90th percentile: 31/100mL

Data: Maine Department of Marine Resources (2003-2008)

DMR Legal Notice Area	Segment Description	Station with Highest Geometric Mean	Highest Geometric Mean (col/100mL)	# of Samples	Station with Highest 90th Percentile	Highest 90th Percentile (col/100mL)	# of Samples
18B	New Meadows Lake, Brunswick, West Bath	WL037.00	6	37	WL037.00	84	37
18BB	New Meadows River, Brunswick, West Bath, Harpswell	WL036.90	6	44	WL036.90	59	44
18F	Card Cove and Orrs Cove, Harpswell	WK063.00	6	42	WK063.00	63	42
18G	Northern Quahog Bay	WK061.00	9	36	WK061.00	61	36
18X	Little Hen Island and Big Hen Island, Harpswell	WK068.00	13	35	WK068.00	232	35
19F	Long Cove, West Bath	WL044.50	6	36	WL044.50	28	36
20	Upper Kennebec River and Tributaries	WM029.10	40	73	WM029.10	280	73
20B	Back River, Wiscasset and Westport	WN043.00	3	35	WN043.00	7	35
20G	Middle Kennebec River	WM012.00	10	64	WM012.00	93	64
20H	Lower Kennebec, Phippsburg/Georgetown	WM018.20	15	49	WM003.00	195	96
22E	Western Barters Island, Boothbay	WN087.00	6	37	WN087.00	43	37
23A	Ebencook Harbor, Southport	WN112.00	7	38	WN112.00	72	38
24A	Lower Salt Bay	WQ032.00	6	62	WL036.90	59	44
25	Damariscotta River, Newcastle and Damariscotta	WQ034.00	11	74	WQ036.00	93	49

Shaded cells indicate exceedance of geometric mean and/or 90th percentile

Table 11: *DMR Fecal Coliform Data for Waters Impaired Only by Bacteria: Medomak River to Ducktrap Harbor*

Location: Medomak River, Waldoboro and Friendship to Ducktrap Harbor, Lincolnville

Water Quality Standard: geometric mean: 14/100mL AND estimated 90th percentile: 31/100mL

Data: Maine Department of Marine Resources (2003-2008)

DMR Legal Notice Area	Segment Description	Station with Highest Geometric Mean	Highest Geometric Mean (col/100mL)	# of Samples	Station with Highest 90th Percentile	Highest 90th Percentile (col/100mL)	# of Samples
26	Medomak River, Waldoboro and Friendship	WS046.00	56	34	WS046.00	460	34
26D	Wiley Cove, Cushing	WU013.00	9	35	WU013.00	181	35
26E	Dutch Neck and Back River	WS059.60	5	43	WS059.60	40	43
26N	Maple Juice Cove, Cushing	WU007.30	15	35	WU007.20	95	14
27A	Eastern Wheeler Bay, St. George	WV030.00	10	35	WV030.00	756	35
27B	Deep Cove Otis Cove, St. George	WU045.50	8	35	WU045.50	87	35
27E	Upper St. George and Mill River	WU030.00	19	57	WU030.00	162	57
28	Tenants Harbor to Mosquito Head, St. George	WV010.00	10	35	WV008.00	66	36
28H	Marshall Point Mosquito Head, St. George	WV003.00	6	35	WV001.00	27	35
28I	Weskeag River, So. Thomaston and Owls Head	WV057.00	10	36	WV057.00	146	36
30	Rockport	WW016.00	21	37	WW016.00	240	37
31A	Rockport Harbor to Ducktrap Harbor, Lincolnville	WW041.00	7	36	WW041.00	41	36

Shaded cells indicate exceedance of geometric mean and/or 90th percentile

Table 12: *DMR Fecal Coliform Data for Waters Impaired Only by Bacteria: Vinalhaven to Benjamin River (Category 5-B-1)*

Location: Vinalhaven to Benjamin River, Sedgwick

Water Quality Standard: geometric mean: 14/100mL AND estimated 90th percentile: 31/100mL

Data: Maine Department of Marine Resources (2003-2008)

DMR Legal Notice Area	Segment Description	Station with Highest Geometric Mean	Highest Geometric Mean (col/100mL)	# of Samples	Station with Highest 90th Percentile	Highest 90th Percentile (col/100mL)	# of Samples
30D	Vinalhaven	WZ054.00	11	35	WZ054.00	240	35
30H	Kent Cove, North Haven	WZ046.00	15	35	WZ046.00	121	35
30J	Vinal Cove Starboard Rock, Vinalhaven	WZ015.00	6	29	WZ015.00	27	29
30K	Southern Harbor, North Haven	WZ027.00	12	35	WZ029.00	204	35
30M	Roberts Harbor, Vinalhaven	WZ022.00	17	35	WZ022.00	93	35
32	Belfast Bay	WW051.00	11	34	WW051.00	202	34
33	Searsport Stockton Springs	WW071.00	9	66	WW070.00	118	34
34	Stockton Springs	WW078.00	14	35	WW080.00	240	39
35	Penobscot River	WX017.00	22	36	WX017.00	277	36
36A	Northern Bay, Penobscot	EA015.00	10	37	EA013.00	93	36
37D	Long Cove, Deer isle	EC017.70	4	44	EC017.70	9	44
38	Stonington Harbor & NW Crocket Cove, Deer Isle & Stonington	EC028.00	10	35	EC028.00	127	35
39A	Center Harbor and Brooklin	EB019.00	4	62	EB019.00	27	62
39F	Benjamin River, Sedgwick	EB016.00	6	71	EB016.00	43	71

Shaded cells indicate exceedance of geometric mean and/or 90th percentile

Table 13: *MHB Enterococci Data: Ducktrap River (DMR Area 31A)*

Location: Duck Trap River
Associated DMR Area: 31A
Water Quality Standard (SB): Between May 15th and Sept. 30th,
Enterococci not to exceed a geometric mean of 8/100mL or an instantaneous level of 54/100mL.
Data: Maine Healthy Beaches (2008)

Group Name	Station Name	Total Number of Samples	Highest Single Sample (col/100mL)	Highest Geometric Mean (col/100mL)
Ducktrap River Special Study	DT-1	14	2481	256.7
Ducktrap River Special Study	DT-2	14	3654	297.8
Ducktrap River Special Study	DT-3	14	9804	N/A
Ducktrap River Special Study	DT-4	14	6488	379.9

Shaded cells indicate exceedance of WQ standard for class SB waters.

Table 14: *MHB Enterococci Data: Frohock Brook (DMR Area 31A)*

Location: Frohock Brook
Associated Beach: Lincolnville
Associated DMR Area: 31A
Water Quality Standard (SB): Between May 15th and Sept. 30th,
Enterococci not to exceed a geometric mean of 8/100mL or an instantaneous level of 54/100mL.
Data: Maine Healthy Beaches (2004-2008)

Group Name	Station Name	Total Number of Samples	Highest Single Sample (col/100mL)	Highest Geometric Mean (col/100mL)
Frohock Brook	Lin 2.1	10	3654	146
Frohock Brook	Lin 2.2	11	9804	45
Frohock Brook	Lin 2.3	10	12997	528
Frohock Brook	Lin 2.31	9	1842	41
Frohock Brook	Lin 2.4	9	960	N/A
Frohock Brook	Lin 2.5	10	1664	N/A
Frohock Brook	Lin 2.7	9	>24192	215
Frohock Brook	Lin 2.8	8	>24192	321
Frohock Brook	Lin 2.9	9	>24192	382

Shaded cells indicate exceedance of WQ standard for class SB waters.

1.3.3 Downeast Coastal Waters Data Presentation

Figure 16: *Nearby DMR Sampling Stations: Eastern Flye Point to Northwest Cove (Category 5-B-1)*

Figure 17: *Stations with Highest Geometric Mean: Eastern Flye Point to Northwest Cove (Category 5-B-1)*

Figure 18: *Nearby DMR Sampling Stations: Jellison Cove to Bunker Cove (Category 5-B-1)*

Figure 19: *Stations with Highest Geometric Mean: Jellison Cove to Bunker Cove (Category 5-B-1)*

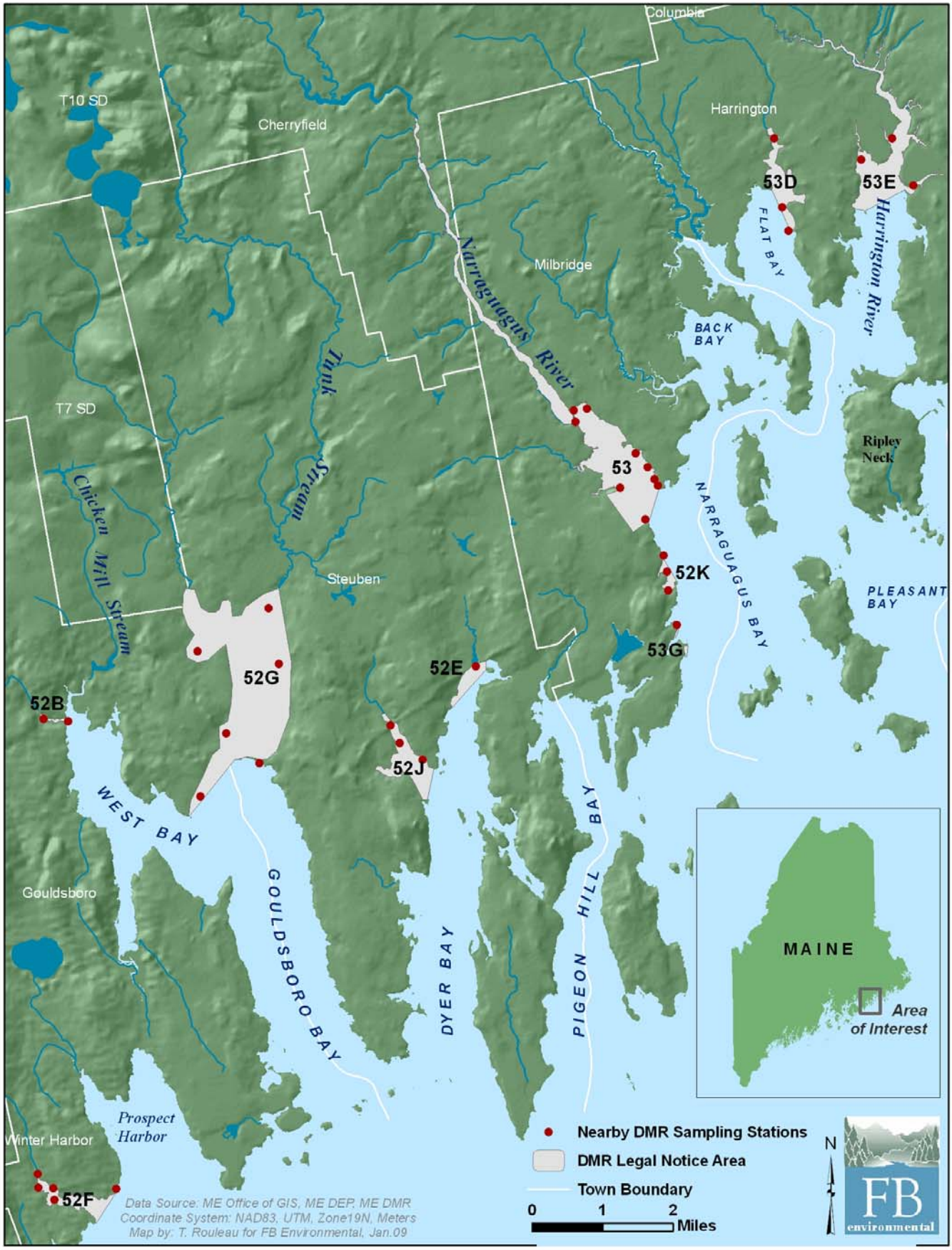


Figure 20: *Nearby DMR Sampling Stations: Mill Pond Stream to Narraguagus Bay (Category 5-B-1)*

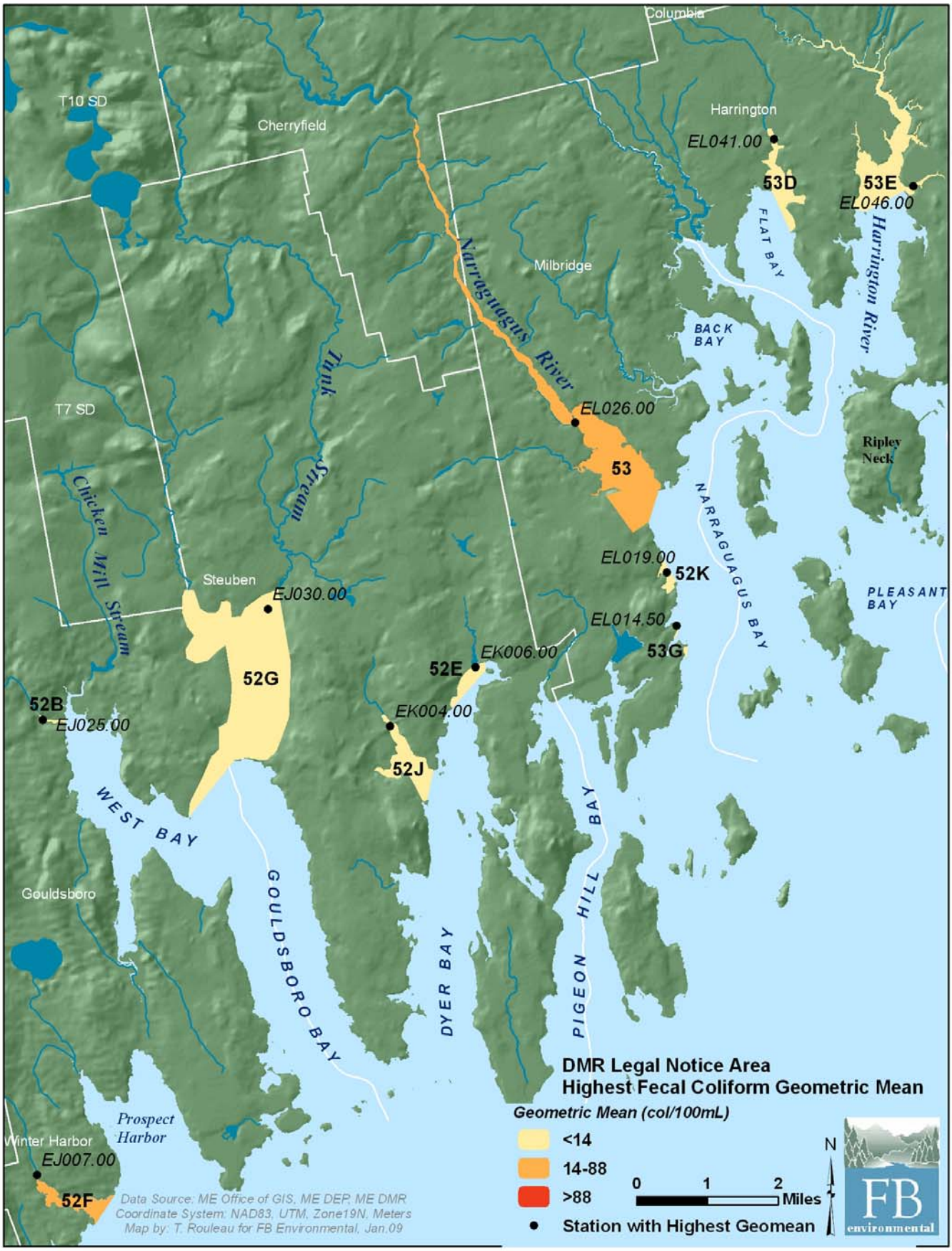


Figure 21: *Stations with Highest Geometric Mean: Mill Pond Stream to Narraguagus Bay (Category 5-B-1)*

Figure 22: *Nearby DMR Sampling Stations: Jonesport and West Jonesport to Indian Head (Category 5-B-1)*

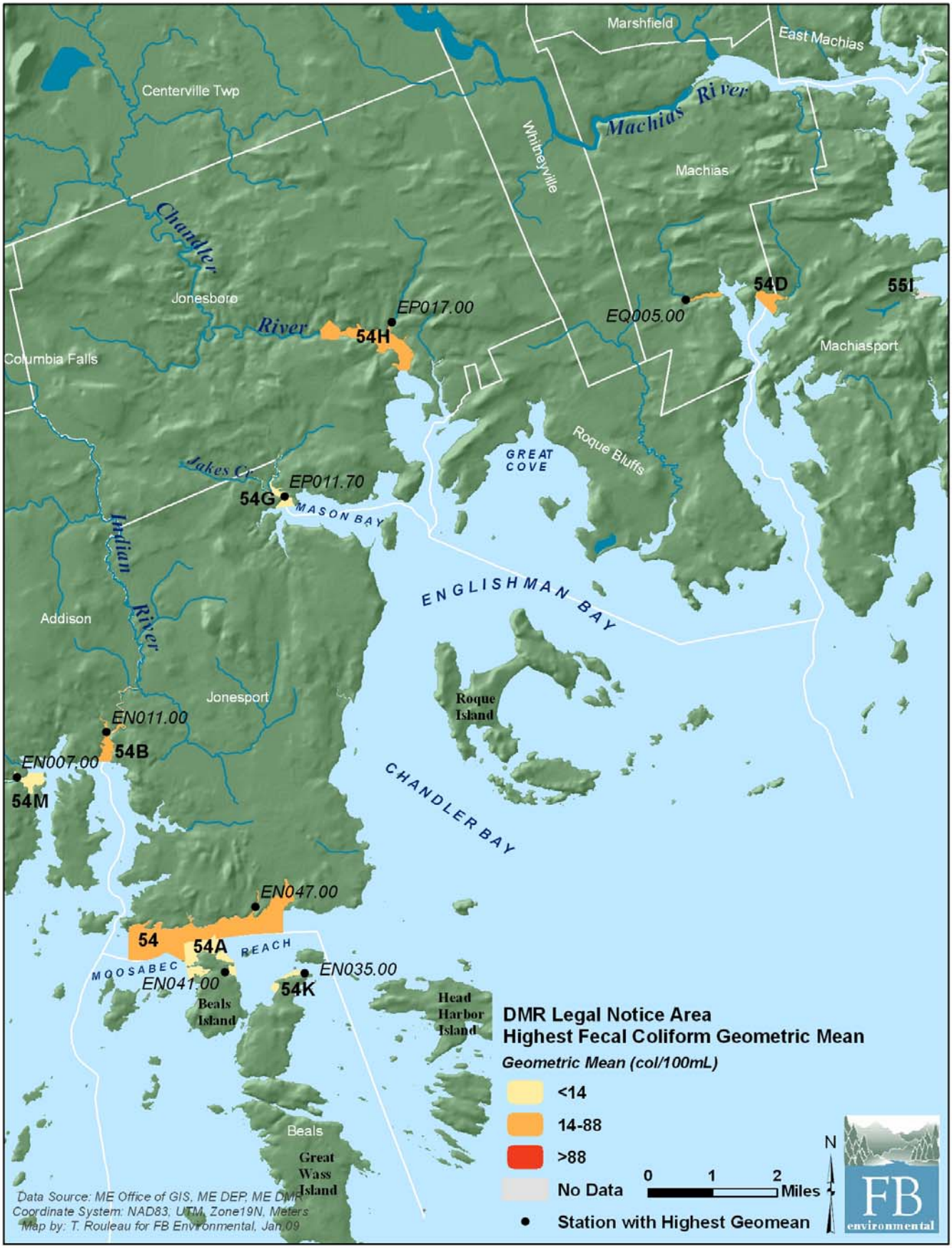


Figure 23: *Stations with Highest Geometric Mean: Jonesport and West Jonesport to Indian Head (Category 5-B-1)*

Figure 24: *Nearby DMR Sampling Stations: Money Cove to St. Croix River & Passamaquoddy Bay (Category 5-B-1)*

Figure 25: *Stations with Highest Geometric Mean: Money Cove to St. Croix River & Passamaquoddy Bay (Category 5-B-1)*

Table 15: *DMR Fecal Coliform Data for Waters Impaired Only by Bacteria: Eastern Flye Point to Northwest Cove (Category 5-B-1)*

Location: Eastern Flye Point, Brooklin to Northwest Cove, Bar Harbor

Water Quality Standard: geometric mean: 14/100mL AND estimated 90th percentile: 31/100mL

Data: Maine Department of Marine Resources (2003-2008)

DMR Legal Notice Area	Segment Description	Station with Highest Geometric Mean	Highest Geometric Mean (col/100mL)	# of Samples	Station with Highest 90th Percentile	Highest 90th Percentile (col/100mL)	# of Samples
39B	Eastern Flye Point, Brooklin	EF004.00	5	36	EF004.00	27	36
39E	Salt Pond, Sedgwick and Brooklin	EF011.00	9	36	EF010.00	90	40
39G	Northern Morgan Bay	EF002.00	8	37	EF001.90	81	25
39H	Northwest Herrick Bay, Brooklin	EF025.00	7	37	EF025.00	66	37
39I	Bragdon Brook, Blue Hill	EF014.00	13	45	EF014.00	460	45
42E	Mackerel Cove, Swans Island	EE002.00	3	36	EE002.00	5	36
48A	Goose Cove, Trenton	EG020.00	8	36	EG020.00	43	36
48B	Pretty Marsh Harbor, Mount Desert	EG030.00	7	35	EG030.00	131	35
48C	Northwest Cove, Bar Harbor	EG025.00	6	35	EG025.00	43	35

Shaded cells indicate exceedance of geometric mean and/or 90th percentile

Table 16: *DMR Fecal Coliform Data for Waters Impaired Only by Bacteria: Jellison Cove to Bunker Cove (Category 5-B-1***)**

Location: Jellison Cove, Hancock to Bunker Cove, South Gouldsboro

Water Quality Standard: geometric mean: 14/100mL AND estimated 90th percentile: 31/100mL

Data: Maine Department of Marine Resources (2003-2008)

DMR Legal Notice Area	Segment Description	Station with Highest Geometric Mean	Highest Geometric Mean (col/100mL)	# of Samples	Station with Highest 90th Percentile	Highest 90th Percentile (col/100mL)	# of Samples
49A	Jellison Cove, Hancock	EI064.00	11	39	EI064.00	62	39
49B	Carrying Place, Hancock	EI070.30	12	38	EI070.30	93	38
49C	Kilkenny Cove, Hancock	EI048.00	10	35	EI048.00	56	35
49D	Eagle Point, Sullivan	EI047.00	5	35	EI047.00	24	35
50A	US Rt. 1 Bridge, West Sullivan and Long Cove, Sullivan	EI075.90	5	39	EI075.90	26	39
50B	Springer Brook, Mill Brook and West Brook, W. Franklin	EI072.00	13	38	EI070.70	93	37
50C	Johnny's Brook and Card Mill Stream, Franklin	EI073.70	18	38	EI073.70	93	38
50D	Evergreen Point, Sullivan	EI075.60	7	37	EI075.60	63	37
50E	Egypt Bay, Hancock and Franklin	EI070.50	15	40	EI070.50	226	40
51C	Bunker Cove, South Gouldsboro	EI105.00	5	36	EI105.00	26	36

Shaded cells indicate exceedance of geometric mean and/or 90th percentile

Table 17: *DMR Fecal Coliform Data for Waters Impaired Only by Bacteria: Mill Pond Stream to Narraguagus Bay (Category 5-B-1)*

Location: Mill Pond Stream, Gouldsboro to Smith Cove, Narraguagus Bay, Milbridge

Water Quality Standard: geometric mean: 14/100mL AND estimated 90th percentile: 31/100mL

Data: Maine Department of Marine Resources (2003-2008)

DMR Legal Notice Area	Segment Description	Station with Highest Geometric Mean	Highest Geometric Mean (col/100mL)	# of Samples	Station with Highest 90th Percentile	Highest 90th Percentile (col/100mL)	# of Samples
52B	Mill Pond Stream, Gouldsboro	EJ025.00	10	48	EJ025.00	84	48
52E	Dyer Harbor Pinkham Bay, Steuben	EK006.00	5	36	EK006.00	30	36
52F	Birch Harbor, Gouldsboro	EJ007.00	18	39	EJ007.00	240	39
52G	Joy Bay, Gouldsboro and Steuben	EJ030.00	11	36	EJ030.00	93	36
52J	Dyer Harbor, Steuben	EK004.00	14	36	EK004.00	135	36
52K	Mitchell Point, Milbridge	EL019.00	12	56	EL019.00	112	56
53	Narraguagus River, Milbridge	EL026.00	17	64	EL032.00	133	64
53D	Curtis Creek, Flat Bay, Harrington	EL041.00	9	35	EL041.00	73	35
53E	Upper Harrington River	EL046.00	6	43	EL046.00	40	43
53G	Smith Cove, Narraguagus Bay, Milbridge	EL014.50	7	42	EL014.50	44	42

Shaded cells indicate exceedance of geometric mean and/or 90th percentile

Table 18: *DMR Fecal Coliform Data for Waters Impaired by Bacteria Only: Jonesport and West Jonesport to Indian Head (Category 5-B-1)*

Location: Jonesport and West Jonesport to Indian Head, Machiasport

Water Quality Standard: geometric mean: 14/100mL AND estimated 90th percentile: 31/100mL

Data: Maine Department of Marine Resources (2003-2008)

DMR Legal Notice Area	Segment Description	Station with Highest Geometric Mean	Highest Geometric Mean (col/100mL)	# of Samples	Station with Highest 90th Percentile	Highest 90th Percentile (col/100mL)	# of Samples
54	Jonesport and West Jonesport	EN047.00	20	57	EN045.00	240	59
54A	North End of Beals Island	EN041.00	5	36	EN043.00	23	36
54B	Indian River, Addison and Jonesport	EN011.00	19	37	EN011.00	240	37
54D	East & West Branches, Little Kennebec Bay, Machias and Machiasport	EQ005.00	16	37	EQ005.00	244	37
54G	White Creek, Masons Bay, Jonesport and Jonesboro	EP011.70	3	24	EP011.70	9	24
54H	Chandler River, Jonesboro	EP017.00	18	37	EP017.00	228	37
54K	Southeastern Alley Bay & Pig Island Gut, Beals	EN035.00	6	36	EN035.00	69	36
54M	Lamesen Brook in West River, Addison	EN007.00	9	49	EN007.00	76	49

Shaded cells indicate exceedance of geometric mean and/or 90th percentile

Table 19: *DMR Fecal Coliform Data for Waters Impaired Only by Bacteria: Money Cove to St. Croix River & Passamaquoddy Bay (Category 5-B-1)*

Location: Money Cove, Cutler to St. Croix River and Passamaquoddy Bay

Water Quality Standard: geometric mean: 14/100mL AND estimated 90th percentile: 31/100mL

Data: Maine Department of Marine Resources (2003-2008)

DMR Legal Notice Area	Segment Description	Station with Highest Geometric Mean	Highest Geometric Mean (col/100mL)	# of Samples	Station with Highest 90th Percentile	Highest 90th Percentile (col/100mL)	# of Samples
55G	Money Cove, Cutler	ES012.00	7	25	ES012.00	40	25
56	Denny's River and Northwest Denny's Bay, Edmunds and Pembroke	ET060.00	12	35	ET060.00	86	35
56A	Pennamaquan Bay, Pembroke	ET081.00	35	35	ET081.00	240	35
56B	East Stream, Trescott	ET042.00	11	36	ET042.00	43	36
56C	Haycock Harbor, Trescott	ES016.00	16	36	ES016.00	350	36
56D	Crane Mill Brook, Edmunds	ET050.00	6	36	ET050.00	53	36
56H	Ox Cove, Pembroke	ET068.00	4	35	ET068.00	14	35
57B	Deep Cove, Eastport	ET104.00	4	41	ET104.00	8	41
58	Lubec and South Lubec	ES022.00	10	35	ES022.00	127	35
58F	The HaulUp, South Bay, West Lubec	ET023.00	4	35	ET023.00	9	35
59	Hal Moon Cove, Eastport	ET100.10	8	39	ET100.10	47	39
62	St. Croix River and Passamaquoddy Bay	EU018.00	10	44	EU018.00	240	44

Shaded cells indicate exceedance of geometric mean and/or 90th percentile

2. Case Studies

Bacterial contamination is the one of the greatest stressors of concern in Maine's marine and estuarine waters, second only to toxics/legacy pollutants (Maine DEP, 2008). Bacterial contamination of marine and estuarine waters may result from a variety of sources including human waste, excrement from barnyard animals, pet feces and agricultural applications of manure. Bacterial contamination may also result from wildlife, including large congregations of birds and small mammals. In coastal areas, illicit discharges of boat waste are of particular concern. Inappropriate disposal of human and animal wastes can degrade aquatic ecosystems and negatively affect public health. Fecal contamination can also result in closures of shellfish beds, beaches, swimming holes and drinking water supplies. The closure of such important public resources can erode quality of life and diminish property values (Mass DEP, 2007).

Coastal waters such as Southwest Harbor (above), located on Mount Desert Island, play an important role in Maine's landscape, identity, and economy.

Maine's coastal waters play an important role in both the natural and commercial interests of the state. There are approximately 3,500 miles of coastline on the mainland (Figure 1). Including the state's nearly 3,000 offshore islands, the total length of Maine's coastline exceeds 5,000 miles (Maine DEP, 2008; Maine OGIS, 2008). More than 400 river and stream systems empty into Maine's marine and estuarine waters.

Many of Maine's coastal waters are impaired due to elevated levels of bacteria. This coastal appendix provides a characterization of bacteria impaired waters including GIS-based maps and bacteria data summaries. The goal is to document elevated bacteria problems in Maine's coastal waters and to provide guidance for implementing measures to remove impairments. A set of case studies of successful local bacteria mitigation strategies is provided below to support these goals.

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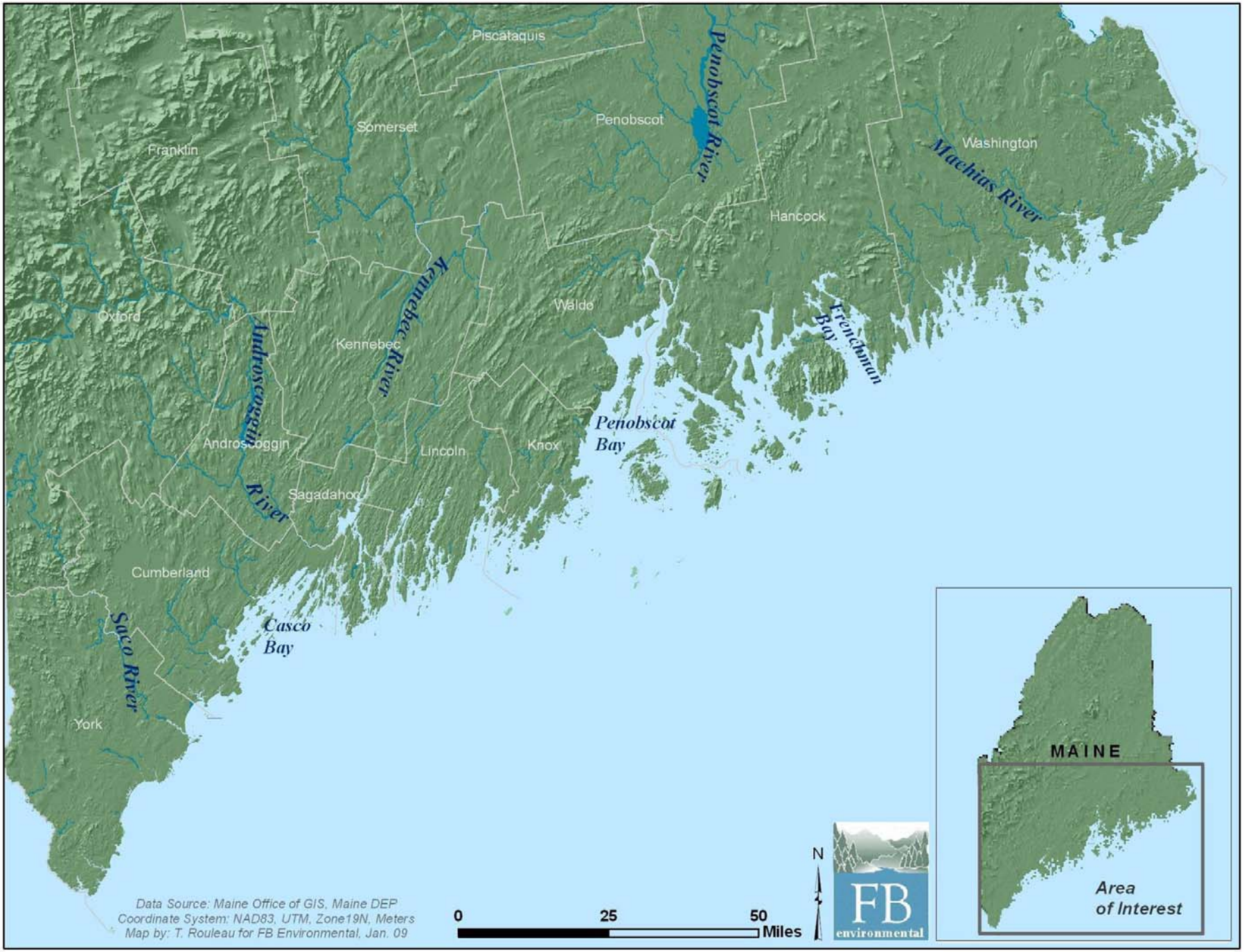


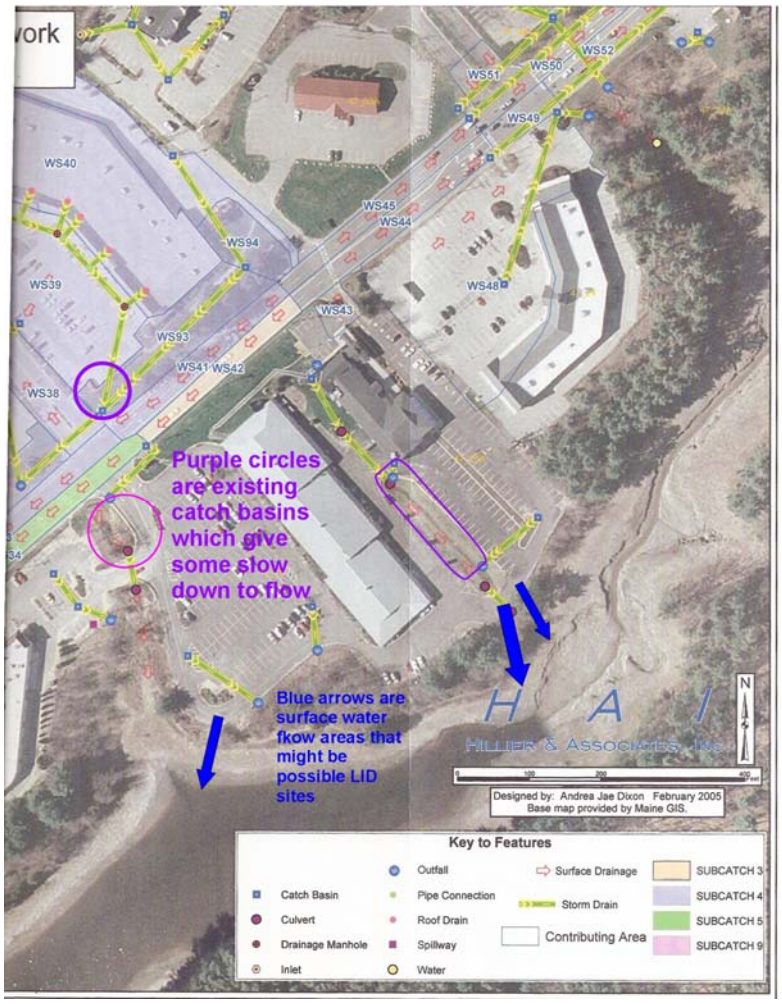
Figure 1: *Map of Maine's Coastline.*

Case Study: Spruce Creek

Low Impact Development Retrofit Projects

Waterbody:

Spruce Creek Watershed is a 9.6 square mile coastal southern Maine watershed located 90% within the Town of Kittery with the remaining 10% of the headwaters located in the Town of Eliot. The watershed empties into the Piscataqua River 1.5 miles northerly from where the Piscataqua meets the Gulf of Maine. The Spruce Creek watershed is primarily fed by 6 freshwater streams. It contains approximately 3 square miles of tidal area that consists of high salt marsh, ledge, and mud flats.



Location:

Towns of Kittery & Eliot, York County, Maine

Facilitator:

Town of Kittery and Spruce Creek Association

Timeframe:

Spring 2005 to winter 2010

Funding Provided by:

Maine Department of Transportation Surface Water Quality Protection Program and Maine Department of Environmental Protection Nonpoint Source Water Pollution Control Grant ("Section 319")

Problem

Excessive levels of fecal coliform bacteria have led to the closing of shellfish beds and the listing of Spruce Creek on the State of Maine's 303d list. The project partners have completed several assessments to track bacteria sources and several more are planned for this TMDL waterbody. One source of high fecal coliform bacteria is through untreated stormwater from developed areas in the watershed.

The retail outlets corridor stretching along US Route 1 in Kittery contains a large percentage of impervious surfaces and poses large stormwater treatment challenges and impacts directly on Spruce Creek. The Town and the Spruce Creek Association have teamed on several projects and with several funding sources to implement innovative stormwater retrofit and Low Impact Development (LID) projects in this area, both to help to reduce stormwater impacts, as well as to serve as demonstration sites to further educate other businesses, developers and homeowners.

Project Description

In the fall of 2004, the Maine State Planning Office (SPO), the Town of Kittery and the Maine DOT identified 21 possible stormwater retrofit sites within the commercial district of Route 1 in the lower Spruce Creek watershed. The study served as background to apply for the MDOT SWQPP funds (part of the Federal Transportation Enhancement Act for the 21st Century or TEA-21).

In the fall of 2005, the Town and the Spruce Creek Association successfully nominated three rain garden sites to the MDOT SWQPP program and a long process of securing legal rights-of-way and agreements between MDOT and the retail outlet owners was commenced.

In the intervening time, the Town of Kittery and the Spruce Creek Association secured funding from the Maine DEP 319 program and in summer 2008 began a two-year initiative to reduce bacteria, nutrients, toxic chemicals, sediments and habitat alterations aimed at improving the health of the Spruce Creek watershed. The Spruce Creek Watershed Improvement Project (Phase 1) with Section 319 funding is, in part, enabling project partners to determine locations for stormwater retrofit implementation based on current efforts with the Kittery Outlets future capital improvement efforts on private property, roadway maintenance activities and/or municipal planning efforts. The secondary purpose is to continue to raise community awareness in this watershed, with the long-term goal of improving and protecting the water quality of Spruce Creek and the Piscataqua River Estuary.

Under the SCWIP project, stormwater and LID specialist(s) will develop the best stormwater Best Management Practice (BMP) technologies to utilize in the selected retrofit locations. Project partners will implement two stormwater retrofit demonstration areas that will provide significant treatment of stormwater quantity and quality. Site selection is planned to be completed in year one of the project and installation will be complete within two years.

The exception to this timeline is the planned rain garden for the Kittery Premium Outlets and Super Shoes Outlet. These two sites have been designed, the legal issues straightened out, and the contracts secured with the Town of Kittery Public Works to conduct the site work. Therefore, this project is going to continue under the funding from MDOT SWQPP program with a minor addition of funding from the MDEP 319 grant to provide professional landscape design services from a local landscaper. Construction of the first LID site, the rain gardens, is set to begin in November and December 2008.

What We Did

- Were gracious recipients of Maine SPO's assessment of stormwater retrofit opportunities in this commercial zone

- Worked together to nominate the proposed site to the MDOT SWQPP program
- Waited very patiently while lawyers and engineers developed the project design
- Facilitated discussions with stakeholders (Towns, State departments, businesses)
- Coordinated efforts with the Town's SCWIP (319-funded) project to ensure success of the project
- Worked with professionals and volunteers to identify other LID sites for the SCWIP project

What We Found

- Kittery outlet owners are quite willing to assist and participate – great partners
- There are dozens, possibly hundreds of potential LID retrofit opportunities

Future Steps

- Demonstration efforts will include one press release and one tour to include commercial, municipal, agency, and citizen attendees.
- Fund installation of future LID sites – use Kittery as a "model LID community"
- Re-open the shellfish beds based on lower bacteria levels

Spruce Creek Volunteer and Stormwater Engineer, Jeff Clifford of Altus Engineering evaluates a LID site before implementation.

Case Study Source: Phyllis Ford, Spruce Creek Association

Case Study: Spruce Creek

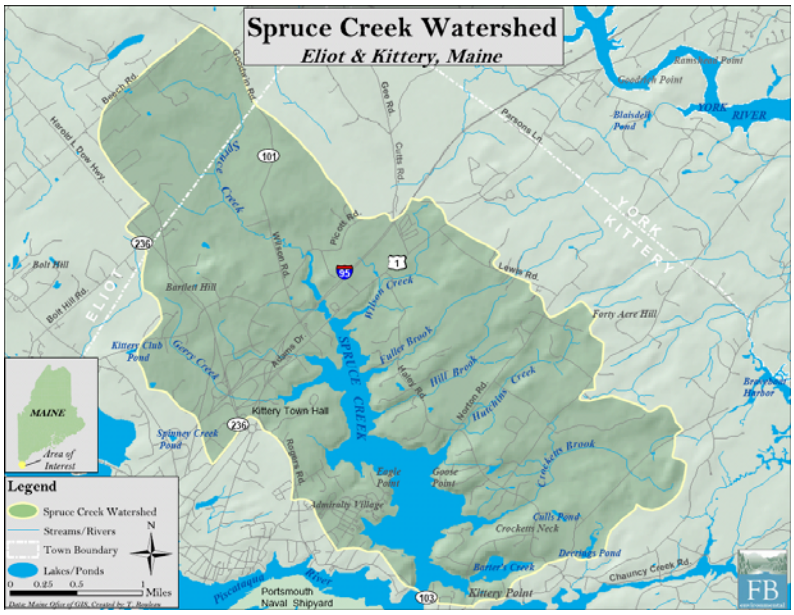
Neighborhood "Septic Socials"

Water Body:

Spruce Creek Watershed is a 9.6 square mile coastal southern Maine watershed located 90% within the Town of Kittery with the remaining 10% of the headwaters located in the Town of Eliot. The watershed empties into the Piscataqua River 1.5 miles northerly from where the Piscataqua meets the Gulf of Maine. The Spruce Creek watershed is primarily fed by 6 freshwater streams. It contains approximately 3 square miles of tidal area that consists of high salt marsh, ledge, and mud flats.

Location:

Towns of Kittery & Eliot, York County, Maine



Facilitator:

Town of Kittery and Spruce Creek Association

Timeframe:

Summer 2008 – winter 2010

Funding Provided by:

Maine Department of Environmental Protection Nonpoint Source Water Pollution Control Grant ("319"), through the US EPA.

Problem

The towns of Kittery and Eliot have launched a two-year initiative to reduce bacteria, nutrients, toxic chemicals, sediments and habitat alterations aimed at improving the health of the Spruce Creek watershed. These pollutants are the primary sources of impairments identified by federal, state and local assessments and pose the greatest threat human and ecological health. The Spruce Creek Watershed Improvement Project (Phase 1) with Section 319 funding is, in part, enabling project partners to identify and repair failing systems. The secondary purpose is to continue to raise community awareness in this watershed,

with the long-term goal of improving and protecting the water quality of the bacteria-impaired (TMDL required) Spruce Creek and the Piscataqua River Estuary.

Project Description

The towns of Kittery and Eliot employed a public outreach approach modeled on the successful Washington Sea Grant Septic Social Program. The grant team has held the first of three planned septic socials in three separate neighborhoods that have evidence of failing septic systems. The social included a presentation by Joe Anderson (of York County Soil & Water Conservation District), then a question and answer session with a local septic designer and a local septic servicing company representative. A septic system factsheet was developed and distributed at the social.

Joe Anderson, of York County Soil & Water Conservation District, presenting a septic social.

What We Did

- Identified a social host and invited neighborhood residents
- Designed and printed social invitations
- Designed and printed septic system informational flyers
- Designed and printed optical brightener fact sheet
- Procured trial samples of organic laundry detergent as "party favors"
- Hosted a septic social with 12 neighbors in attendance (plus 7 team members)

What We Found

- Residents were very attentive during the presentation and quite willing to ask questions of guest speakers
- Attendees noted that while they felt they were fairly knowledgeable about septic systems and their maintenance, they still felt they had learned during the evening's event
- In order to ensure attendance, a combination of mailed invitation and follow-up phone call is best

Future Steps

- Solicit feedback from attendees and speakers to modify presentation and hand-out materials (including those provided by guest speakers)
- Create a press release publicizing the social and inviting others to host
- Adapt YCS&WCD presentation for more coastal (not lake) information
- Identify two additional neighborhoods to conduct additional socials
- Conduct interviews with attendees to solicit feedback and further refine outreach materials and approach

Case Study Source: Phyllis Ford, Spruce Creek Association

Case Study: Casco Bay

Shoreline Surveys

One of the goals of the Casco Bay Plan (CBEP 1996, 2006) is to open and protect shellfish areas adversely impacted by poor water quality. While much progress has been made since 1994 (when 37% of the shellfish flats in the Bay were closed), thousands of acres are still impacted or threatened by bacterial pollution. Identification and remediation of the sources of bacteria is necessary to improve water quality and open valuable beds. Shoreline Survey Training augments the capacity of the state to address bacterial pollution by enabling municipal employees to assist Maine Department of Marine Resources (DMR) and Maine Department of Environmental Protection (DEP) with pollution source identification and remediation in the near-shore zone. Training is provided through DMR and DEP with assistance from the U.S. Food and Drug Administration.

Project Description

In order to implement a two-day training session for interested Casco Bay watershed coastal communities, the Casco Bay Estuary Partnership (CBEP) agreed to provide logistical support (assistance with registration, securing space, food, supplies and AV equipment) at a cost of $1,232. The training was advertised through the web and via e-mail. The training course provided basic knowledge of pollution source identification and the steps needed to document actual and potential pollution sources. Both classroom and field instruction in shoreline survey techniques were provided.

Laura Livingstone, Maine DMR, collects a water sample during a 2005 shoreline survey.

Project Outcomes

Over 30 individuals from 12 Casco Bay communities took the training course. They included shellfish wardens, code enforcement officers, public works employees and representatives of shellfish businesses.

Information gathered by the municipal employees trained through this program is being used by the DMR and DEP to assist in their efforts to recognize and address actual and potential problems impacting shellfish areas. Several examples follow.

The Town of Brunswick and the DMR conducted shoreline surveys in areas which were slated to be closed due to expired shoreline survey, preventing the need for the closure. Several problems were identified during the shoreline survey at seasonal properties that would have necessitated the placement of prohibited areas until the issues were resolved. The town was able to ameliorate the problems before the 'season' started which eliminated the need for prohibited areas.

The Town of Yarmouth and the Royal River Conservation Trust had several members trained at the CBEP sponsored course and they have formed the Shoreline Watchers Action Team (SWAT) of Amanda Devine, Tom Connolly, and Bill Longley. The group meets regularly and helps DMR perform shoreline survey work and they do work independently in the upper reaches of their fresh water streams. They have also engaged in discussions with other industrial dischargers to get additional information on the type and quantity of discharges to marine waters.

Finally, David Cheney and Jen Casad from the John's River area in South Bristol/Bristol were in an area impacted by widespread closures due to expired shoreline survey. They worked closely with DEP and DMR to conduct shoreline surveys in teams and quickly returned areas to open status.

Next Steps

The state would be happy to have other groups sponsor the shoreline survey training sessions. Due to the DMR/DEP/FDA/DHHS time commitment for teaching and preparing the course materials, it is preferred that at least 30 people be in attendance. The costs involved would be similar for notebooks, etc. and would also include refreshments at breaks and lunches which are oftentimes provided. Contact Amy Fitzpatrick at Maine DMR for more information.

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Case Study Source: Diane Gould

Case Study: Casco Bay

Overboard Discharge Project

Problem

Harvesting shellfish is an important tradition in all of Maine, including Casco Bay. In 2002, nearly 20% of the state licenses were held by commercial harvesters in Casco Bay. Harvesting poses a significant economic benefit to the region, last estimated in 1994 at more than $4 million, with a broader economic value of the fishery (including all of those associated with the industry) between $13 and $14 million (Heinig et al. 1995). As substantial as this value may be, when this study began in 1999, bacterial contamination had caused nearly half of the harvestable areas within the Bay to be closed to harvesting. Because of the obvious potential socioeconomic benefit from opening clam flats, one of the goals of the Casco Bay Plan (CBEP 1996, 2006) is to open and protect shellfish areas adversely impacted by poor water quality.

Project Description

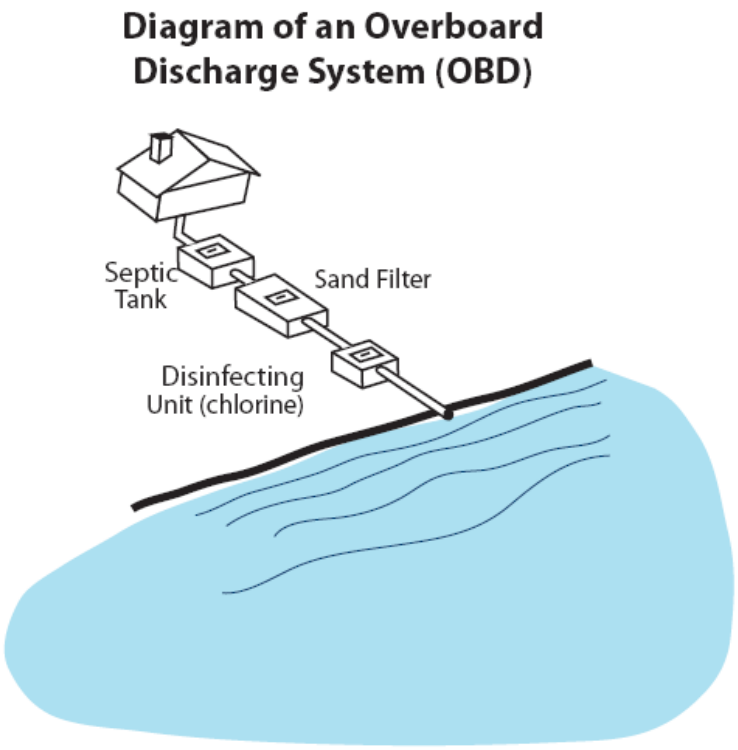
The Casco Bay Estuary Partnership (CBEP) secured a Sustainable Development Challenge grant from the U.S. Environmental Protection Agency (US EPA) with two goals: remediate pollution sources keeping clam flats closed to harvest, and investigate options for sustaining that harvest. In Phase I of this project, with the assistance of many stakeholders, clam resources in 57 closed clam flats in nine municipalities (800 acres) were reviewed and the pollution sources contributing to their closure were identified. Working closely with the municipalities, 21 flats (430 acres) were selected for remediation, based on high clam resource value, ease of remediation, and community support. This process and results for this phase of the project are described in the report Expanding and Sustaining the Shellfisheries of Casco Bay: Phase I. Ranking Clam Flats for Potential Remediation. 1999. In Phase II of this project, (described in the report Expanding and Sustaining the Shellfisheries of Casco Bay: Phases II and III, 2003) again with the assistance of other stakeholders, 3 goals were undertaken:

- ***Remediation*** – Opening clam flats to harvest by partnering with other stakeholders and
- removing pollution sources,
- ***Assessment*** – Understanding nonpoint sources of pollution that affect clam flats and
- ***Management*** –Testing management strategies for increasing and sustaining harvest.

This case study focuses on the Remediation part of the project.

Outcomes: REMEDIATION

Phase I results indicated that in 1999, nearly 430 acres of high value clam habitat in Casco Bay with good water quality were closed to harvest. Nearly half were closed simply due to the presence of a septic design called an overboard discharge (OBD); therefore, this project focused a significant amount of effort on removing these systems. An overboard discharge (OBD) system differs from a conventional subsurface wastewater disposal system because a sand filter or commercial mechanical treatment plant is used for secondary treatment rather than a leach field. As a result, OBDs require chlorination of the wastewater required prior to discharge into a body of water. NSSP regulations prohibit shellfish harvesting near OBDs because of the potential for contamination from system malfunction. In Maine, the discharge of untreated wastes was prohibited in 1973 and lots with unsuitable soils for subsurface disposal received overboard discharge licenses or installed a holding tank. The Overboard Discharge Law (38 M.R.S.A § 411-A) phases out existing non-municipal, overboard discharge systems, and, through a grant program, shares the cost of replacement. Four areas were targeted for OBD removal: Gurnet/Buttermilk Cove in Brunswick/Harpswell and Fosters Point, Birch Point, and Sabino in West Bath. In addition, several sites on the New Meadows River in West Bath were added to the list at the request of the West Bath shellfish committee. These areas contained a total of 31 Overboard Discharge (OBD) systems (8 in Brunswick, 2 in Harpswell, and 21 in West Bath).



Source: Maine DEP and Maine Dept. of Community and Economic Development, 1993, *Treat it Right: Alternative Wastewater Systems that Protect Water Quality*

Due to staff constraints at the DEP, CBEP agreed to provide project management services to remove licensed OBDs in the targeted areas. CBEP contracted with Normandeau Associates, in association with Albert Frick Associates, to facilitate the OBD removal program, which required the close coordination of several stakeholders:

- The landowner, who was heavily invested in the success of outcome, and in some cases abutters, if easements were required;
- The septic system designer;
- The construction company, who installed the new systems;

- Maine DEP, responsible for licensing (and revoking the license for) OBDs, administering the OBD removal grant program, approving (sometimes with Department of Health and Human Services) replacement systems and variances, when necessary; and
- The municipality, responsible for disbursement of funds, contract for system installation, system approval, variance granting, and negotiation with unhappy landowners.

As of the completion of the Phase II project report in 2003, the OBD removal project resulted in the elimination of 26 of the 31 targeted OBD systems. While over 243 acres of flat were opened during the course of this project, only 25 acres were the direct result of OBD removal. However, increased communication and prioritization of flats as a result of this project played an important role in the opening of the 243 acres.

Follow-up Steps

As of 2005, the project had helped to open over 300 acres (State of the Bay, 2005). The issues that remained following the project are the most difficult to resolve and require the continued efforts of DEP, DMR and the municipalities. The majority of the openings were facilitated by collaboration with DMR staff who were already working in these areas. Once staff knew where the priorities were, they were able to focus their efforts on the most important areas. The project enhanced collaboration with other stakeholders such as DEP, municipalities, and harvesters, and has continued with groups such as the New Meadows Watershed Committee.

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Case Study Source: Diane Gould

Case Study: Stanley Brook

Watershed Survey

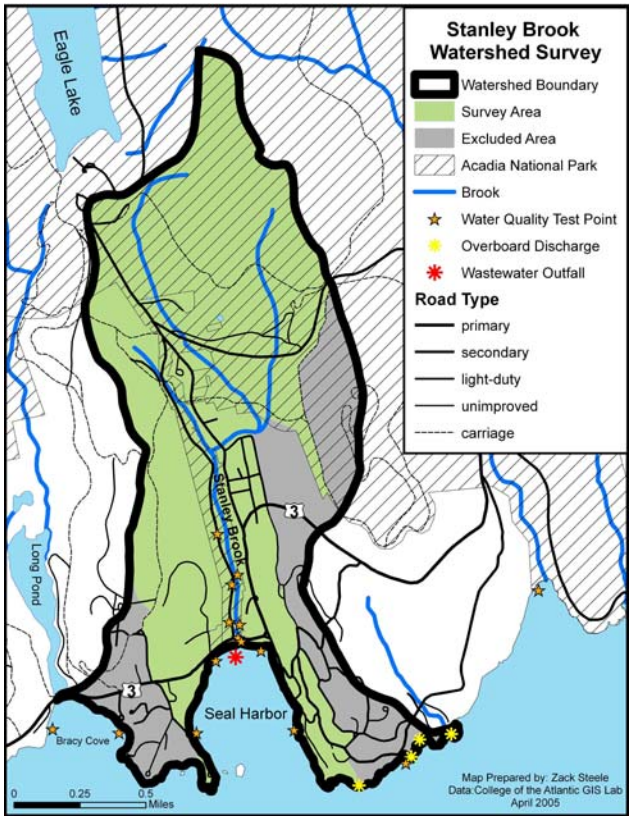
Water Body: Seal Harbor on Mount Desert Island is located in the center of this 1.9 square mile watershed over which water flows to popular Seal Harbor Beach.

Location: Hancock County, Maine

Facilitator: Mount Desert Island Water Quality Coalition

Timeframe: June-October 2005

Funding Provided by:
Maine Healthy Coastal Beaches Program**,**
Mount Desert Island Biological Laboratory**,**
Mount Desert Island Water Quality Coalition**,**
New England Grassroots Environmental Fund and
Seal Harbor Residents



Problem

Town officials were concerned about the potential for outbreaks of swimming illness because of historical high levels of bacteria at the Seal Harbor Beach. People were also upset whenever the beach was closed due to high bacterial counts. On initial investigation it was found that bacterial counts would rise and fall in Stanley Brook but were consistently high at the Route 3 Bridge from Mid-July to the end of August. The Maine Healthy Beaches Program brought together town officials and the MDI Water Quality Coalition to address pollution issues at Seal Harbor Beach.

Project Description

The goals of the watershed survey included identifying pollution sources impacting habitat integrity in Stanley Brook and locating pollution sources contributing to bacteria levels at Seal Harbor Beach. The survey combined the best features of a sanitary shoreline survey, used most often to detect pollution sources impacting shellfish growing areas, and a watershed survey, used most often to identify the types of pollutants that are running off the land into a particular body of water. By combining these approaches we identified sources of pollution and defined the types of pollutants that are impacting water quality in the Stanley Brook Watershed**.**

The goals of the watershed survey included identifying pollution sources impacting habitat integrity in Stanley Brook and locating pollution sources contributing to bacteria levels at Seal Harbor Beach. The survey combined the best features of a sanitary shoreline survey, used most often to detect pollution sources impacting shellfish growing areas, and a watershed survey, used most often to identify the types of pollutants that are running off the land into a particular body of water. By combining these approaches we identified sources of pollution and defined the types of pollutants that are impacting water quality in the Stanley Brook Watershed.

Stanley Brook flows through Seal Cove Beach, on Mount Desert Island, ME (above).

What We Did

- Recruited and trained volunteers to identify pollution sources and pollution types (bacteria, nutrients, sediments, toxics, thermal).
- Visited 210 properties in the Stanley Brook watershed, recorded data, and photographed problems.
- Talked with residents and property owners, provided informational pamphlet.
- Conducted additional water quality tests.
- Published a report which can be found at www.mdiwqc.org.

What We Found

- 52 properties had pollution sources including drains, ditches, broken sewer lines, eroding and/or chemically treated lawns, compost piles or yard waste situated close to the brook.
- 71 pollution sources were identified on these 52 properties; 17 of these were considered to be “Major” pollution problems.
- Most of the pollution types (40%) were scored as nutrient and sediment. These pollution types can severely impact the health of a brook, leading to algal blooms, oxygen problems, ruined spawning grounds, and loss of fish and other aquatic species.
- Above ground broken sewer lines and dog waste accounted for most of the bacterial pollution noted in the watershed.

Results of Survey

Due to the findings of the watershed survey, a new ordinance in Mt. Desert was passed at town meeting on March 6th 2007. The current ordinance dictates that all above ground private sanitary sewers must be inspected on or before June 1st of each year. It requires conformance with local, state, and federal

regulations and addresses sewer pipe materials and installation (HDPE, PVC, Ductile Iron Pipe). It also prohibits construction on town property.

Future Steps

- Form a Watershed Action Plan Steering Committee made up of members of the Stanley Brook Watershed Survey advisory committee, volunteer surveyors, residents, and other interested parties to make short term decisions and begin long term planning for the future of the Stanley Brook Watershed
- Develop a work plan with Hancock County Soil and Water Conservation District to prioritize problems, seek funding sources, and plan improvements.
- Initiate a storm event monitoring project to identify which pollution sources are most severely impacting the stream and beach.
- Expand the Stanley Brook macroinvertebrate study to pin point the most impacted sites on the brook.
- Develop a plan for inspections of all waste treatment systems and sewer lines before the start of each summer season.
- Adopt responsible practices throughout the watershed; everyone can do something; individual property owners, neighborhood groups, the town of Mt. Desert, local contractors and developers, and Acadia National Park. These practices include re-directing runoff, preventing erosion, moving compost piles, limiting fertilizer and pesticide use, repairing private sewer lines, installing and maintaining silt fences at construction sites, and implementing Best Management Practices throughout the Stanley Brook Watershed.

3. Coastal Monitoring

The Maine Department of Environmental Protection (Maine DEP), the Maine Department of Marine Resources (Maine DMR), the Casco Bay Estuary Partnership (CBEP), and a variety of volunteer monitoring groups such as the Spruce Creek Association (SCA) monitor Maine's coastal waters (Maine DEP, 2008). Below is an overview of sources of data used by Maine DEP as the basis for determining attainment of classification and designated uses for coastal waters. A list of additional monitoring groups by coastal region is included in Section 4.

The Wells National Estuarine Reserve (WNERR) conducts water quality monitoring in both the Webhannet Estuary and the Merriland/Branch Brook/Little River (MBLR) Estuary (shown above) in Wells, ME. The group conducts continuous monitoring in the MBLR Estuary during ice-free seasons.

- **Maine DMR** monitors for indicators of human pathogens, particularly fecal coliform, and performs year-round monitoring of Paralytic Shellfish Poison in molluscan shellfish. The primary purpose of DMR monitoring is to protect human health by managing shellfish harvest areas (Maine DEP, 2008). **Website:** http://www.maine.gov/dmr/index.htm

- **Gulfwatch** is a chemical-contaminants monitoring program, managed by the Gulf of Maine Council, that measures contaminants in blue mussels (*Mytilus edulis*) to assess the types and concentration of contaminants in coastal waters of the Gulf of Maine (Maine DEP, 2008). **Website**: http://www.gomoos.org/chameleon/gulfwatch/

- **Maine Healthy Beaches,** managed and coordinated by the Maine State Planning Office Coastal Program and University of Maine Cooperative Extension/Sea Grant, performs standardized monitoring of coastal swim beaches for *Enterococci* bacteria, an indicator of fecal contamination, and notifies the public if health risks are detected (Maine DEP, 2008). **Website:** http://www.mainehealthybeaches.org/

- **Casco Bay Estuary Partnership** (CBEP**,** formerly Casco Bay Estuary Project), hosted by the Muskie School at the University of Southern Maine, conducts water quality monitoring in Casco Bay and also supports other monitoring efforts in the Bay, through Friends of Casco Bay (FOCB) and other entities. With the assistance of Maine DEP and EPA Region 1, the Partnership also coordinates the National Coastal Assessment for the entire Maine coast. **Website:** http://www.cascobay.usm.maine.edu/

4. Web Resources

4.1. Statewide and New Hampshire Resources

Center for Watershed Protection
Website: http://www.cwp.org/
Description: The Center for Watershed Protection works to protect, restore, and enhance our streams, rivers, lakes, wetlands, and bays.

EPA: Surf Your Watershed
Website: http://cfpub.epa.gov/surf/state.cfm?statepostal=ME
Description: This tool lists citizen based groups that are active in each watershed in Maine, as well as the entire United States.

- ✓ This website has thumbnail watershed maps for all major watershed in Maine

Great Bay Coast Watch
Website: http://www.gbcw.unh.edu/
Description: The Great Bay Coast Watch is citizen volunteers, working within the UNH Cooperative Extension/NH Sea Grant Program, protecting the long-term health and natural resources of New Hampshire's coastal waters and estuarine systems through monitoring and education projects.

- ✓ A 10 year report (1990-1999) is available on the website.

Great Bay National Estuarine Research Reserve
Website: http://www.greatbay.org/
Description: Great Bay NERR is part of a national network of protected areas established for long-term research, education and stewardship. This program between protects more than one million acres of estuarine land and water, which provides essential habitat for wildlife; offers educational opportunities for students, teachers and the public; and serves as living laboratories for scientists.

Maine Atlantic Salmon Commission
Website: http://www.maine.gov/asc/
Description: The purpose of the Maine Atlantic Salmon Commission is to protect, conserve, restore, manage and enhance Atlantic salmon habitat, populations and sport fisheries within historical habitat in all (inland and tidal) waters of the State of Maine.

- ✓ A 10-Year Strategic Plan is available on the website

Maine Coastal Program
Website: http://maine.gov/spo/coastal/projects/livingdownsteam.htm
Description: The Maine Coastal Program is a partnership among local, regional, and state agencies dedicated to balancing conservation with human demands. In addition, the involved government agencies collaborate with many private organizations, such as local land trusts and economic development groups.

Maine Department of Marine Resources
Website: http://www.state.me.us/dmr/rm/public_health/shellfishgrowingarea.htm
Description: This department was established to conserve and develop marine and estuarine resources; to conduct and sponsor scientific research; to promote and develop the Maine coastal fishing industries; to advise and cooperate with local, state, and federal officials concerning activities in coastal waters; and to implement, administer, and enforce the laws and regulations necessary for these purposes.

Maine Healthy Beaches Program
Website: http://www.mainehealthybeaches.org
Description: This program brings together dozens of coastal and inland beach communities. Activities include monitoring of beach water quality, notifying the public if health risks are detected, and education.

- ✓ Maps of beach locations and coastal monitoring sites are available

Maine Rivers
Website: http://www.mainerivers.org/
Description: The mission of Maine Rivers is to protect, restore, and enhance the health and vitality of rivers in Maine. It is an information sharing and action network which solicits information from, and distributes information to its member groups so that everyone can better understand and advocate for rivers in Maine.

- ✓ This website has a watershed map of Maine, as well as small maps of major watersheds

Maine Stream Team
Website: http://maine.gov/dep/blwq/docstream/team/teamlisthuc.htm
Description: The Maine Stream Team Program (MSTP) is a network of people concerned about Maine's streams as well as a clearinghouse of information intended to support stream protection activities. A stream team is a group of people who have banded together to promote stewardship of their local stream.

- ✓ Has maps of all major watersheds in Maine

Project SHARE (Salmon Habitat and River Enhancement)
Website: http://www.salmonhabitat.org/outreach/default.html
Description: The mission of Project SHARE is to conserve and enhance Atlantic salmon habitat and populations in the Down east (primarily Washington County) region of Maine. Project SHARE supports cooperative resource management, research, and educational activities that will enhance the healthy functioning of these river ecosystems.

- ✓ Numerous watershed monitoring and watershed management plans are available on the website
- ✓ Maps for numerous watersheds can be accessed by clicking on the monitoring plans

SeaGrant/UMaine
Website: http://www.seagrant.umaine.edu/extension/extension.htm
Description: Maine Sea Grant is a state-federal partnership based at the University of Maine and sponsored by the National Oceanic and Atmospheric Administration (NOAA) and the State of Maine. It supports marine and coastal scientific research and education.

Surfrider Foundation Northern New England Chapter
Website: http://www.surfrider.org/nne/index.php
Description: The Surfrider Foundation is a non-profit, grassroots environmental organization dedicated to protecting and preserving oceans, waves and beaches. The group works with the Maine Healthy Beaches Program to monitor water quality on a weekly basis and also has a Beachscape project to evaluate the quality of beaches.

University of Maine Cooperative Extension: Maine Shore Stewards
Website: http://extension.umaine.edu/shorestewards/
Description: Maine Shore Stewards are citizen volunteers who care for the coast of Maine. Their efforts contribute important data and information to Maine's decision-makers to help solve pollution problems, restore clam flats, and encourage an ethic of caring for the coast in Maine communities.

4.2. Southern Coastal Resources

Great Works River Watershed Coalition
Website: http://www.gwrwc.org/volunteer.html
Description: The Great Works River Watershed Coalition is a citizen-driven and agency-supported effort whose mission is to help improve and protect the water quality of the Great Works River and its tributaries. The Coalition monitors the river each year between May and September to determine its aquatic health.

- ✓ A watershed map is available on the website

York Rivers Association
Website: http://www.yorkrivers.org/projects.html
Description: The York Rivers Association is a group of citizens, nonprofit organizations, local, state and federal agencies all working together to protect and restore the rivers of the Town of York, Maine.

- ✓ A watershed map is available on the website

Protect Kittery Waters
Website: http://www.protectkitterywaters.org/teams.html
Description: This website is dedicated to the Spruce Creek Watershed Improvement Project. The first phase of this project will address polluted runoff problems to reduce bacteria loading and the export of sediment and nutrients into Spruce Creek. The secondary purpose is to continue to raise community awareness in this watershed, with the long-term goal of improving and protecting water quality.

Saco River Corridor Commission
Website: http://www.srccmaine.org/
Description: The Saco River Corridor Commission is committed to protect public health, safety and the quality of life for the State of Maine through the regulation of land and water uses, protection and conservation of the region's unique and exceptional natural resources and through the prevention of impacts caused by incompatible development.

- ✓ A watershed map is available on the website

Spruce Creek Association
Website: http://www.sprucecreekassociation.org/
Description: The Spruce Creek organization is a group of citizens and organizations working together to provide a framework to coordinate the assessment of the Spruce Creek watershed's condition. This assessment will aid the organization with implementing and monitoring proven management practices that support environmental and economic vitality for the communities of the Spruce Creek Watershed and adjacent areas.

- ✓ A watershed management plan is available on the website
- ✓ A watershed map is available on the website

Wells National Estuarine Research Reserve
Website: http://www.wellsreserve.org/
Description: The Wells Reserve is a 2,250acre research, education, and recreation facility, a public-private partnership within the National Estuarine Research Reserve System. The Wells Reserve is dedicated to protecting and restoring coastal ecosystems of the Gulf of Maine through integrated research, stewardship, environmental learning, and community partnerships.

- ✓ Watershed management plans for Merriland River/Branch Brook/Little River are available
- ✓ Watershed maps are available in the reports on the stewardship page

4.3. Mid-Coastal Resources

Androscoggin River Watershed Council
Website: http://www.avcnet.org/arwc/awi.html
Description: The Council is a collaborative effort supported by diverse interests in the Androscoggin River Watershed, including individuals, small businesses, large businesses, municipalities, state and federal governments, and nonprofit organizations. Its mission is to continuously improve environmental quality and promote healthy and prosperous communities in the Androscoggin River Watershed.

Casco Bay Estuary Partnership
Website: http://www.cascobay.usm.maine.edu/waterquality.html
Description: Casco Bay Estuary Partnership (CBEP) is a collaborative effort of people and organizations devoted to protecting and restoring the water quality, and fish and wildlife habitat of the Casco Bay ecosystem, while ensuring compatible human uses.

Friends of Casco Bay
Website: http://friendsofcascobay.org/default.aspx
Description: Friends of Casco Bay is a marine stewardship organization dedicated to improving and protecting the environmental health of Casco Bay. Their work involves advocacy, education & outreach, water quality monitoring, and collaborative partnerships

Friends of Merrymeeting Bay
Website: http://www.friendsofmerrymeetingbay.org/
Description: The mission of Friends of Merrymeeting Bay is to preserve, protect, and improve the unique ecosystems of Merrymeeting Bay. This organization is involved in education, research, conservation, and advocacy.

Friends of the Presumpscot River
Website: http://www.presumpscotriver.org/
Description: The Friends of the Presumpscot River (FOPR) is an incorporated nonprofit organization committed to protecting and improving the water quality, wildlife habitat, recreational opportunities, and natural character of the Presumpscot River and its shorelands.

Georges River Trout Unlimited
Website: http://www.georgesrivertu.org/index.html
Description: George's River Trout Unlimited is the Mid Coast Maine Chapter of Trout Unlimited. TU's mission is to conserve, protect and restore North America's cold water fisheries and their watersheds.
- ✓ A map is available on the River Report page

Lower Penobscot Watershed Coalition
Website: http://www.covebrook.org/LPWC/index.html
Description: The Lower Penobscot Watershed Coalition is focused on ecosystem health in the communities of the Lower Penobscot River and its watershed. The coalition is involved in education, land conservation, research and monitoring, and land use and regulations.
- ✓ A large scale map of the watershed is available on the website
- ✓ A watershed map is available on the website

Presumpscot River Watch
Website: http://www.prwmaine.org/
Description: The Presumpscot River Watch is dedicated to preserving and improving the health of the Presumpscot River and its watershed by scientific monitoring, sharing data to increase awareness, and serving as a steward for the river through participation in legislative, community, and individual efforts.

Presumpscot River Watershed Coalition
Website: http://presumpscotcoalition.org/
Description: The Presumpscot River Watershed Coalition is a partnership of individuals, organizations, and agencies collaborating to restore and protect the Presumpscot River watershed. We work to realize the greatest good for the human and ecological communities that share the river's resources.
- ✓ A River Management Plan is available on the website
- ✓ A small watershed map is included in the introduction of the River Management Plan

Royal River Conservation Trust (formerly Friends of the Royal River)
Website: http://www.rrct.org/water_quality.html
Description: The Royal River Conservation Trust works to conserve the natural, historic, scenic and recreational values of the Royal River region for all residents and their visitors. It is active in land conservation and water quality improvements, and promotes stewardship.
- ✓ The Royal River Regional Conservation Plan is available on the website

Sebasticook River Watershed Association
Website: http://www.sebasticookriver.org/index.html
Description: The Mission of the Sebasticook River Watershed Association is to protect, restore and inspire stewardship of the Sebasticook River and contributing waters through community-based education, research and conservation.
- ✓ Several watershed maps are available on the website

Sheepscot Valley Conservation Association
Website: http://www.sheepscot.org/
Description: The mission of the Sheepscot Valley Conservation Association is to conserve and restore the natural and historic heritage of the Sheepscot watershed through land protection, habitat restoration, and support for compatible landuse patterns, advocacy and education.

- ✓ A watershed map is available on the website

4.4. Downeast Coastal Resources

City of Bangor - Penjajawoc Marsh Bangor Mall Management Commission
Website: http://www.bangormaine.gov/cc_planmarsh_pg.php
Description: The Commission is charged with overseeing development around the Penjajawoc Marsh by having input into zoning, development proposals, and developing a watershed management plan for the lands around the Penjajawoc Marsh.

- ✓ A watershed management plan is available on the website
- ✓ An overlay district map is available on the website

Cobscook Bay Resource Center
Website: http://www.cobscook.org/resourceCenter/mission.htm
Description: The mission of the Cobscook Bay Resource Center is to encourage and strengthen community-based approaches to resource management and sustainable economic development in the Cobscook Bay region, the Bay of Fundy, and the Gulf of Maine.

Cove Brook Watershed Council
Website: http://www.covebrook.org/
Description: The mission of the Cove Brook Watershed Council is to protect, conserve, and restore Cove Brook and its watershed; educate the community about this valuable resource; and to maintain environmentally sound traditional uses of the watershed, such as fishing, hiking, horseback riding, cross-country skiing, dog sledding, and snowmobiling.

- ✓ A watershed management plan is available on the website
- ✓ Watershed maps can be found in the watershed management plans

Friends of Blue Hill Bay
Website: http://www.fobhb.org/index.html
Description: Friends of Blue Hill Bay is a nonprofit organization dedicated to preserving the natural ecology, traditional marine fisheries and the unique aesthetic quality of Blue Hill Bay. Monitoring the expansion and effects of aquaculture are a major focus for the group.

Islesboro Land Trust
Website: http://www.islesboroislandstrust.org/getinvolved.html
Description: The mission of Islesboro Islands Trust is to enhance the quality of resident's lives through the preservation of open space, educate all residents as to the value of the island's natural ecosystems, and act as an environmental advocate on behalf of Islesboro and the surrounding Penobscot Bay region.

Marine Environmental Research Institute (MERI)
Website: http://www.meriresearch.org/
Description: The mission of MERI is to promote scientific research and education on the impacts of pollutants on marine life and human health.

Penobscot Bay Watch
Website: http://www.penbay.org/
Description: The Penobscot Bay Watch's mission is community service to both the natural marine and intertidal communities. Volunteers provides assistance in protecting near shore, intertidal and subtidal wildlife and their habitats from pollution, inappropriate aquaculture proposals, habitat destructive coastal development, marina sprawl and misguided marine resource management initiatives.

Penobscot River Restoration Trust
Website: http://www.penobscotriver.org/
Description: The Penobscot River Restoration Project is an unprecedented collaboration between hydropower company PPL Corporation, the Penobscot Indian Nation, seven conservation groups, and state and federal agencies, to restore 11 species of sea run fish to the Penobscot River, while maintaining energy production.

- ✓ A large scale map of the watershed is available on the website

St. Croix International Waterway Commission
Website: http://www.stcroix.org/
Description: The St. Croix International Waterway Commission is an independent, international body established by the Maine and New Brunswick legislatures to plan for and facilitate delivery of a heritage management plan for the St. Croix boundary corridor.

- ✓ A Management Plan from 1993 available on website
- ✓ A waterway map with a thumbnail map of the St. Croix watershed is available on the website

Union River Watershed Coalition
Website: http://www.unionriver.org/
Description: The Union River Watershed Coalition was formed by an informal group of concerned organizations to promote integrated social, economic, and ecological values of the region and raise public awareness of this river system and its importance, both ecologically and as a community resource.

- ✓ A watershed map is available on this website

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