GROWING AREA EN

Cape Split, South Addison to Henry Point, Jonesport Including Beals, Great Wass and Head Harbor Islands

Washington County, Maine

SANITARY SURVEY REPORT 2015

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Executive Summary

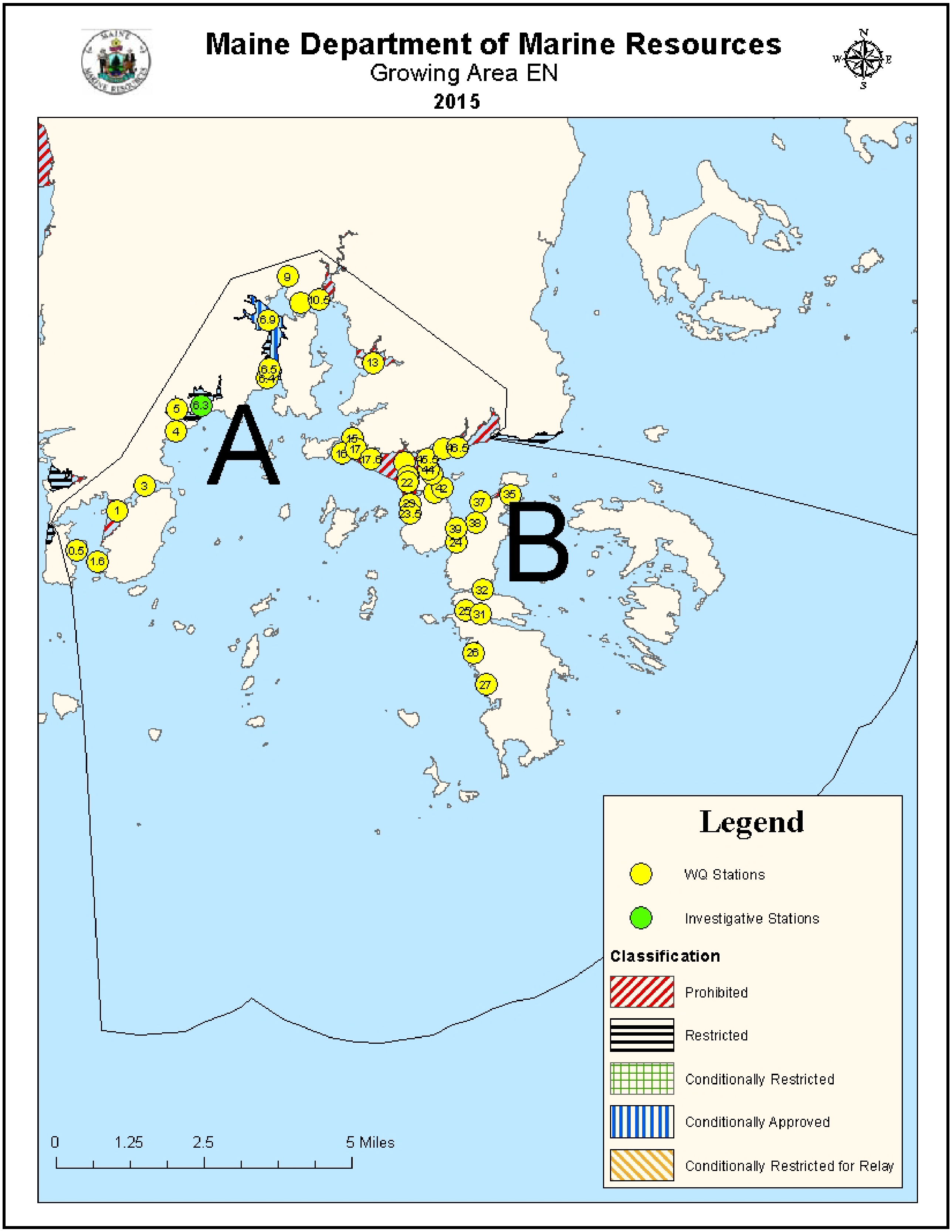
This is a Sanitary Survey report for growing area EN written in compliance with the requirements of the 2013 Model Ordinance and the National Shellfish Sanitation Program (NSSP). No changes in classification are needed at this time. In 2013-2015 one new station was added and six stations were deactivated. During the last triennial review period, pollution area two new restricted areas were created and one new prohibited area was promulgated based on the results of the 2015 Shoreline Survey. The next sanitary survey is due in 2026 and the next Triennial in 2017. The last sanitary survey was done in 2008 so this report covers 2009-2014 only. Sanitary survey reports were redistributed in 2013 to even workloads for the current staff, resulting in some sanitary survey reports being done in less than 12 years. All sanitary surveys are being done at a minimum every 12 years in compliance with the NSSP.

The villages of South Addison (Addison pop-1,248), Jonesport (pop-1,367) and Beals (pop-590) have the largest population concentrations (2006-2007 Maine Municipal Directory). Development along these shores is spotty with clusters of homes separated by undeveloped land. Heavier development is found at the head of the numerous harbors including Eastern Harbor, Jonesport and Beals and Great Wass Islands. All dwellings within 500 feet of the shore, water conduits-ditches or streams or pollution sources were surveyed. In this manner the locations of the pollution problems were identified. Descriptions of all properties and their septic situations are included in the shoreline survey (see Sanitary Survey MARVIN files).

The growing area includes the near sub-tidal waters, inter-tidal flats and shore property that extends inland to a definite up-land boundary. The shoreline included in this report stretches from Cape Split, Addison to Henry Point, Jonesport and includes Beals, Great Wass and Head Harbor Islands. The shoreline is typical to the convoluted shoreline of this section of Maine, with a series of shallow harbors with muddy and gravel bottoms separated by rock-bound points of land, bold shoreline and inhabited offshore islands. The up-land boundary of the growing area is enclosed by a line beginning at the tip of Cape Split; then northeast to the Mooseneck-Cape Split Road intersection; then continues northeast to Bryants Corner; then southeast to Mason Bay Road; and then south to the tip of Henry Point.

The upland land cover is predominately evergreen, deciduous and wetland forest with minimal development. Much of upland Jonesport is wetland and sandy glacial till. Blueberry fields are scattered throughout eastern Addison and Jonesport. The Harbors most likely to contain significant populations of soft and hard shell clams and mussels are: Eastern Harbor, Carrying Place Cove, West Bay, Indian River, Snare Creek, Hay Creek, Alley Bay and Head Harbor Island. Sub-tidal waters are frequently fished for blue mussels (*Mytilus edulis*). Fresh water influence along these shores is predominately from numerous brooks and small streams throughout the growing area. There are no significant rivers draining into this area. These streams have been evaluated microbiologically.

Figure 1. Area EN overview Map



History of Growing Area Classification

2009: November 16, 2009- Area No. 54B, Indian-West Rivers; the rule amendment re-opened the seasonal conditional area in the Indian and West Rivers (Jonesport and Addison) and reduced the size of the conditionally approved area by reclassifying a portion along Ralph Beal Beach, (so called) West River (Addison) as restricted due to intermittent bacterial pollution.

2010: There were no classification changes in growing area EN in 2010.

2011: Sample station EN 27 was reclassified approved to restricted January 6, 2011. Area 54 (B1.)

2012: The western section expanded due to Station EN6.5 no longer meeting approved standards as the boundary station for C54-B(B). A Z station was put in as the new boundary EN6.4. Stations EN 7, 9, 10, and 10.5 meet approved standards during all seasons and were reclassified from conditionally approved to approved.

April 17, 2012: This amendment reclassifies the Indian River and the eastern side of the West River from conditionally approved to approved based on updated shoreline survey and water quality meeting the approved standards.

October 10, 2012, a reduction in the size of the prohibited area occurred on the North End of Beals Island due to water quality meeting approved standards.

2013: No changes.

2014: No changes.

2015: Restricted area created in Black Duck Hbr due to failing WQ Area 54 (B3.)
New Restricted area in Hicks, Long and Mill Creek was promulgated due to failing WQ Area 54 B (B2.). New prohibited area due to failing septic identified during 2015 Shoreline Survey Area 53 H (A2.).

Current Classification(s)

Please visit the DMR website to view Legal Notices:
http://www.maine.gov/dmr/rm/public_health/closures/closedarea.htm

Approved: All shores and waters of the growing area not specifically described below.

Restricted: Area 54, (B1.), Station Harbor, Great Wass; Area 54 (B3.), Black Duck Cove, Great Wass; Area 54 B (B1.), West River, Addison, Area 54 B (B2.), Hicks and Long Creek, Addison.

Conditionally Approved: Area 54 B (D1) West River, Addison Open November through June

Prohibited: Area 54 (A1) Reach, Jonesport, Area 54 (A2) Indian Point, Jonesport, Area 54 (A3) Hixey Head, Beals, 53 H (A2) Cape Split Harbor, Addison, Area 54 B (A1) Indian River, Jonesport, Area 54 B (A2) Snare Creek, Jonesport

Activity during Review Period

2009: Two new pollution sources were identified within this review period. An animal pasture with four head of cattle and three pigs located at Carrying Place Cove, South Addison, has fencing that rims the head of the cove approximately 75 feet from the shore Concerns have been raised by the local shellfish committee that the animal waste may be impacting the cove. Sample station EN 3, approximately 300 feet east from the head of the cove, meets the approved standards with a P90 of 3.9 and no elevated score after rainfall or runoff. The area is currently classified approved and no downgrades in classification are recommended at this time. The area will continue to be monitored and any downward classification made if necessary.

2010: There were no new stations created; no stations were deactivated; and one station was reclassified from approved to restricted due to water quality not meeting approved standards.

2011: Sample station EN 27 no longer met approved standards but does meet restricted classification. No pollution sources were observed in the area during the routine six random samplings in 2011 or during an April 27, 2011 survey.

2012: Drive through surveys were conducted the same days as sample collections. No issues were found.

2013: Drive through survey was completed on 3/18/2013, 4/24/2013 and 6/19/2013. A hot spot survey was conducted on 2/21/13 in Beals Island and in Jonesboro. Two problems were found and problem forms were summited.

2014: Drive through survey was completed on 10/15/2014.

2015: Complete 12 year Sanitary Survey conducted from June through August. Four point source pollution problems were identified resulting in the promulgation of three closures two of these closures have since been repealed as the identified issues were corrected. One closure Area 53 H (A2.) remains in effect.

Pollution Source Survey

The following sections include information on pollution sources which do or may impact water quality in growing area EN. Pollution sources that are reviewed in this section include domestic waste, both private inground systems and over board discharges (OBDs), marinas and mooring fields, stormwater and pollution from non-point sources (streams), farms and other agricultural activities, domestic animals and wildlife areas, and recreational areas.

Table 1. Area EN Pollution Source Table

GASS ID	Pollution Area	Major P source	PROBLEM_FLAG	Impact	Description
EN004-316	53 H (A1)	Septic	Y	PD	straight pipe
EN004-315	53 H (A1)	Septic	Y	PD	straight pipe
EN011-10	none repealed after system was fixed	Septic	N	PD	breakout

GASS ID	Pollution Area	Major P source	PROBLEM_FLAG	Impact	Description
EN018-2	54 B (A1)	Septic	Y	PD	breakout
EN050-2	54 (A3)	Septic	Y	PD	breakout

Figure 2. Pollution Source Map A

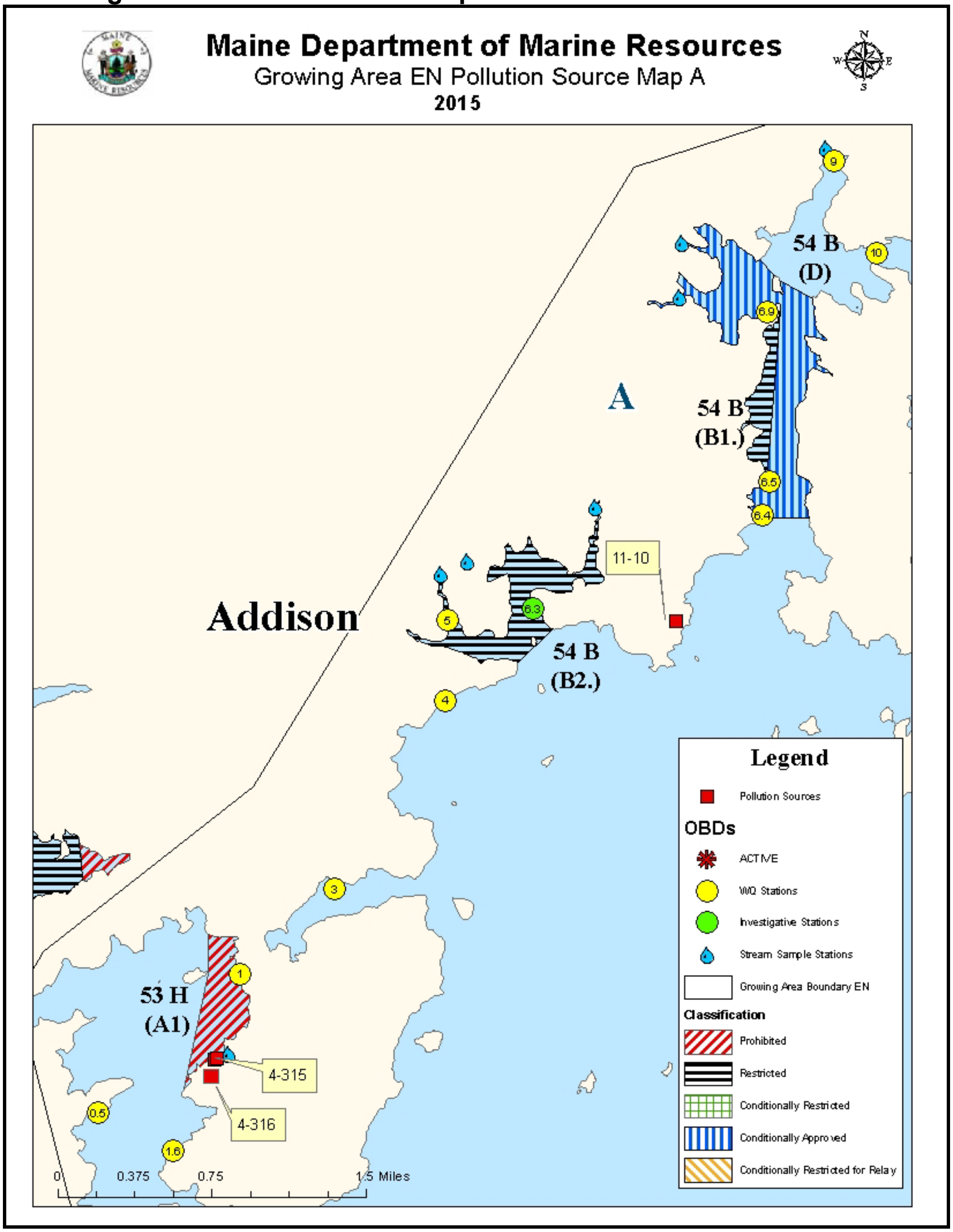
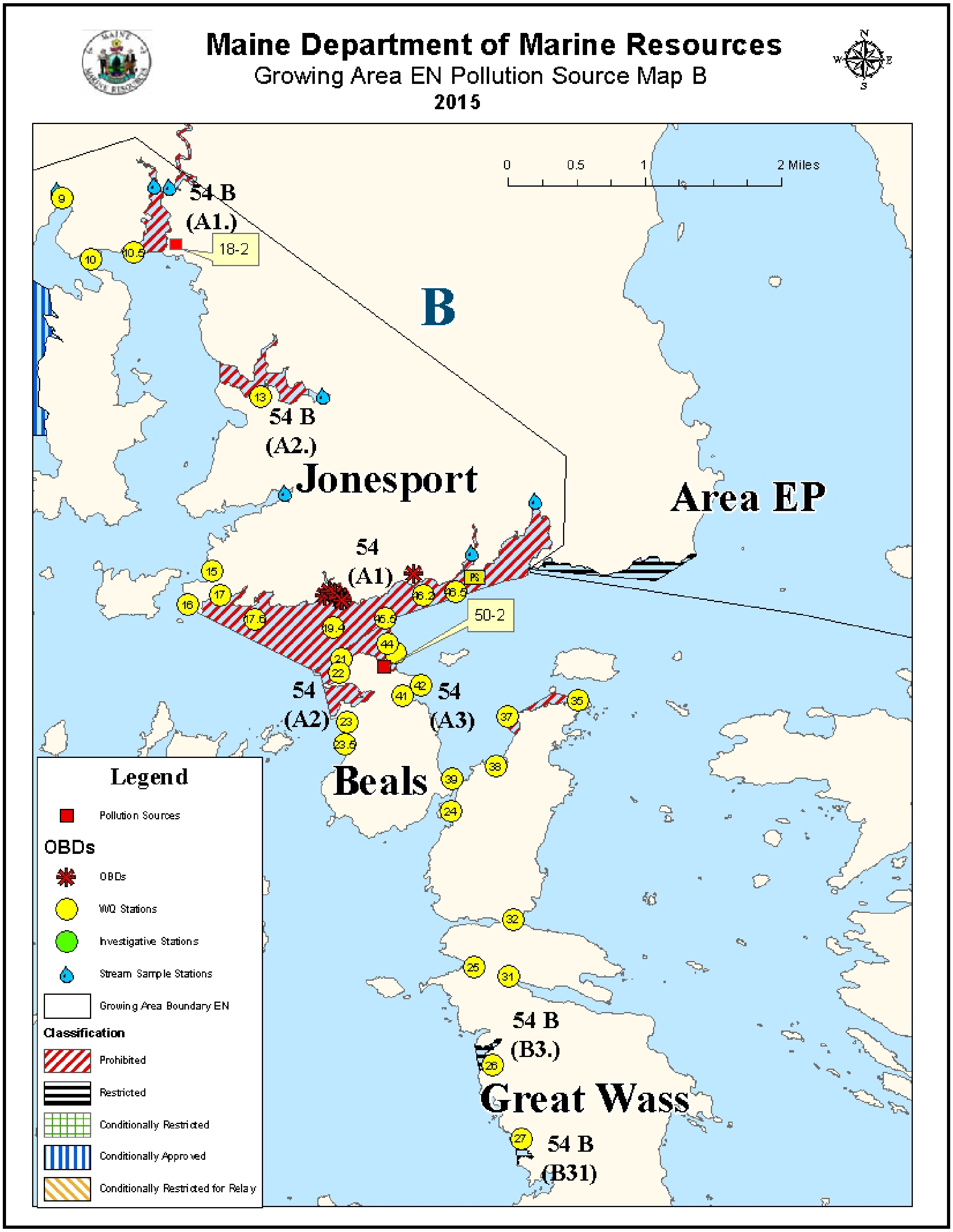


Figure 3. Pollution Source Map B



Domestic Waste (IG Systems and OBDs)

Growing area EN consists of 51 two mile segments (GASS IDs) all within the towns of Addison and Jonesport. The growing area consists of 257 residential in ground septic systems. All domestic waste systems were last visited in 2015 during the shoreline survey. There are 5 known issues with residential septic systems. Problem forms were filed with the towns in this growing area for all identified septic system issues. This area also has 8 licensed OBD's. All OBD's are located in the Reach in Jonesport in Prohibited area 54 A1.

Municipal Wastewater Treatment Facilities

There are no wastewater treatment facilities in Growing Area EN.

Residential Licensed Overboard Discharges

There are 8 residential licensed overboard discharges in Growing Area EN. OBDs are licensed and inspected by the Maine Department of Environmental Protection. If an OBD is not properly maintained, or if the OBD malfunctions, it has the potential to directly discharge untreated wastewater to the shore; therefore, preventative closures are implemented surrounding every OBD. The size of the closure is based on a dilution calculation, based on the permitted flow rate of the OBD, and the depth of the receiving water; the fecal concentration used for this dilution calculation is 1.4X10^5 fc/100 ml.

The dilution zones for the OBDs have been calculated and the actual size of the prohibited area for which they are enclosed is approximately 270 acres. The prohibited area around these OBD's is adequate to protect public health.

Table 2. OBD Dilution Zone

Dep ID	GASS ID	Area #	TOWN	STATUS	Mid Tide Depth	FLOW	Dilution in Acres
6735	EN 23	54 (A1)	Jonesport	A	4	600	4.6
6736	EN 23	54 (A1)	Jonesport	A	4	600	4.6
6752	EN 23	54	Jonesport	A	4	600	4.6
6753	EN 23	54	Jonesport	A	4	600	4.6
6755	EN 23	54	Jonesport	A	4	600	4.6
6756	EN 23	54	Jonesport	A	4	600	4.6
6757	EN 23	54	Jonesport	A	4	600	4.6
8013	EN 24	54	Jonesport	A	8	2000	154
						Total Acres	**186.2**

Marinas and Mooring Fields

Several locations with 4-6 moorings are scattered throughout the growing area with the largest number of boats at the Reach (Jonesport), Cape Spilt Harbor (Addison) and Pig island Gut (Beals). All of these mooring clusters are in prohibited areas with the exception of Cape Split Harbor which is classified as approved. The majority of boats are commercial fishing boats (lobster boats, trawling vessels) without heads or through hull discharges. There are small boats launching facilities at all these mooring areas. These ramps are crude gravel beach ramps used as launching sites primarily for shellfish harvesters, duck hunters and skiffs tending larger boats.

Storm Water Discharges

Stormwater runoff is generated when precipitation from rain and snowmelt events flows over land or impervious surfaces and does not percolate into the ground. As the runoff flows over the land or impervious surfaces (paved streets, parking lots, and building rooftops), it accumulates debris, chemicals, sediment or other pollutants that could adversely affect water quality if the runoff is discharged untreated (US EPA 2009). Thus, stormwater pollution is caused by the daily activities of people within the watershed. Currently, polluted stormwater is the largest source of water quality problems in the United States.

The primary method to control stormwater discharges is the use of best management practices (BMPs). In addition, most major stormwater discharges are considered point sources and require coverage under an NPDES permit. In 1990, under authority of the Clean Water Act, the U.S. EPA promulgated Phase I of its stormwater management program, requiring permitting through the National Pollution Discharge Elimination System (NPDES). The Phase I program covered three categories of discharges: (1) “medium” and “large” Municipal Separate Storm Sewer Systems (MS4s) generally serving populations over 100,000, (2) construction activity disturbing 5 acres of land or greater, and (3) ten categories of industrial activity. In 1999, US EPA issued Phase II of the stormwater management program, expanding the Phase I program to include all urbanized areas and smaller construction sites.

Although it is a federal program, in the state of Maine, the Phase II Stormwater permit is issued and regulated by the Maine DEP (Chapter 500 and 502). Under the MS4 regulations, each municipality must implement the following six Minimum Control Measures: (1) Public education and outreach, (2) Public participation, (3) Illicit discharge detection and elimination, (4) Construction site storm water runoff control, (5) Post-construction stormwater management, and (6) Pollution prevention/good housekeeping. The permit required each city or town to develop a draft Stormwater Management Plan by September 3, 2003 that will establish measurable goals for each of the Minimum Control Measures. The Town must document the implementation of the Plan, and provide annual reports to the Maine DEP. Currently the discharge of stormwater from 28 Maine municipalities is regulated under the Phase II permit requirements, however, no municipalities located within the boundaries of growing area EA fall under these regulations. Additionally, the Maine Stormwater Management Law provides stormwater standards for projects located in organized areas that include one acre of more of disturbed area (Maine DEP 2009).

None of the towns in EN have storm water systems.

Tidal Creeks, Streams, and Wetland Discharges

Many of the bays have freshwater streams draining to the saltwater from upland areas. Sampling of freshwater sources was conducted during low to medium runoff conditions. Streams are considered to be actual or potential, direct pollution sources impacting the growing area. Table 3 lists all the streams in the area that have been sampled in over the review period.

Table 3: Streams Sampled in Growing Area EN

Stream ID	Date	Fc/100ml	Flow (CFS)	Area Name
EN004-309	29-Sep-09	120	0	53 H (A2)
EN009-310	29-Jun-15	24	60	54 B (B2)
EN009-310	31-Oct-12	66	0	54 B (B2)
EN009-310	29-Sep-09	320	0	54 B (B2)
EN010-311	29-Sep-09	280	0	54 B (B2)
EN010-311	31-Oct-12	128	0	54 B (B2)
EN010-311	29-Jun-15	29	392	54 B (B2)
EN010-312	29-Sep-09	340	0	54 B (B2)
EN010-312	29-Jun-15	20	22	54 B (B2)
EN010-312	31-Oct-12	148	0	54 B (B2)
EN013-313	31-Oct-12	120	0	54 B (D1)
EN013-313	29-Sep-09	126	0	54 B (D1)
EN013-313	29-Jun-15	36		54 B (D1)
EN014-314	31-Oct-12	140	0	54 B (D1)
EN014-314	29-Jun-15	33	96	54 B (D1)
EN014-314	29-Sep-09	70	0	54 B (D1)
EN014-315	31-Oct-12	280	0	na
EN014-315	29-Jun-15	18	80	na
EN014-315	29-Sep-09	320	0	na
EN015-316	29-Sep-09	158	0	54 B (A1)
EN016-317	29-Sep-09	540	0	54 B (A1)
EN019-318	29-Jun-15	108	5.9	54 B (A2)
EN019-318	31-Oct-12	100	0	54 B (A2)
EN019-318	29-Sep-09	1140	0	54 B (A2)
EN021-319	29-Jun-15	16	12	na
EN021-319	31-Oct-12	132	0	na
EN021-319	29-Sep-09	13	0	na
EN023-320	29-Sep-09	1380	0	54 (A1)
EN024-321	29-Sep-09	1280	0	54 (A1)
EN025-322	29-Sep-09	100	0	54 (A1)

None of the sampled streams listed in Table 2 are used for dilution calculations. Sampling of all the streams in the growing area will continue in the future.

Agricultural Sources

No significant sources of agricultural pollution were identified in the growing area. There are no identified slaughter houses, large scale manure spreading operations or garden centers in the area.

Wildlife Areas

The salt marshes and mudflats of the growing area do provide valuable habitat to a variety of wildlife. Mammals living within the growing area include dogs, cats, whitetail deer, muskrat, squirrels, chipmunks, rabbits, moles, mice, bats, shrews, weasels, skunks and raccoons. Commonly observed bird species include a variety of gulls, sea and inland ducks, cormorants, geese, great blue herons, egrets, swans, and others. Maine Inland Fish and Wildlife surveys indicate that migratory waterfowl numbers begin to increase in the early summer months, and typically peak in late fall or early winter. Staging shorebirds need feeding areas with high concentrations of inter-tidal invertebrates. Although large numbers of birds can pose a threat the growing area water quality, such occurrences are very difficult to document. No such significant water quality impacts have been documented from wildlife to date.

Recreation, Conservation

The concern for actual or potential pollution from recreational areas is because many of them allow dogs and some recreational areas have bathroom facilities. In and of themselves, they aren't a pollution source but activities at the recreational areas may contribute to water quality problems by placing added pressure on the watershed. For instance, they may contribute to erosion (trails, building footbridges, etc.), dog waste not picked up may accumulate and wash off after rainfall, new trails may be put into areas that didn't have human activity before and they may put added pressure on wildlife to congregate in other places where we may see water quality decline, etc. The mere presence of humans and dogs doesn't necessarily mean there is an actual pollution source, but it is a potential pollution source.

There are no day use beaches and picnic areas in the area. Although there are a few gravel beaches in the area, swimming in the ocean in this area is relatively rare, as the water temperatures rarely exceed 65°F.

Industrial Wastes

There is no heavy industrial activity such as chemical plants, ship building, oil refineries or manufacturing plants in the growing area.

Dredging

There has been no dredging activity in Growing Area EN since the last survey in 2009.

Fishing Wharves and Aquaculture Sites

Wharves in the review area are small privately owned piers for the loading or unloading of equipment, bait or catch and most are for lobster fishermen.

Land Based Chemicals

(Information from the Pesticides Board of Maine in Augusta) "Inland blueberry fields close to the marine environment use several chemicals that may have some effect temporarily on fish or shellfish. *Guthion* is sprayed on blueberry fields in July and August to control the fruit fly larva. The half-life is variable around

21 days in aerobic soils and about 62 days in anaerobic soils. The soils in our area are generally considered to be aerobic. *Guthion* is short lived in water, however heavy rain after application causes high runoff of the chemical. *Guthion* is not very persistent in the environment. The chemical is degraded to many other compounds by microorganisms found in soil and water, by sunlight and by reacting with water. *Guthion* does not evaporate very quickly from soil and water. It attaches strongly to soil surfaces and does not easily move into groundwater below the soil surface. *Valpar* (Hexazinone) is a chemical used for the control of weeds and grasses. Hexazinone has a half-life of one month in blueberry soils. Breakdown varies depending on temperature and moisture with the main reason for degradation by soil microorganisms. Other factors affecting half-life include soil leaching, uptake by plants and breakdown by sunlight. Hexazinone has a low acute toxicity. It has an acute oral LD50 for mice (dose to kill 50 percent of test animals) of 1,690 mg/kg (or 0.026 oz/lb of body weight). Aspirin has the same toxicity level. Hexazinone is a class D compound - not classifiable as to human carcinogenicity. Hexazinone has been detected at low levels, in the parts per billion (ppb), range in ground-water in Maine that is under or near to blueberry fields that have been treated with *Velpar*. All detections were well below the maximum exposure guides of 210 ppb set by the Maine Department of Health and Human Services. The EPA "believes that water containing Hexazinone at or below the *Health Advisory Level* of 400 ppb is acceptable for drinking over the course of one's life, and does not pose any health risk. *Round-Up* is used for weeds resistant to *Valpar*. There are large blueberry fields directly adjacent to the western arm of Little Kennebec and north of Mill Pond. Published data and use regulations support minimal health risk from the use of these pest sprays. This information supports a minimal health risk for consumers of shellfish from chemicals used on blueberry fields. Possible or potential adverse impacts are associated with the immediate “footprint” of the field or application zone.

Marine Biotoxins

The Marine Biotoxin Monitoring Program is administered by the Maine Marine Resource’s Bureau of Public Health. It uses the standards outlined in the National Shellfish Sanitation Program (NSSP) to monitor levels of PSP (“Red Tide”) and other marine biotoxins in the shellfish of the State of Maine. When toxin is found at levels near or above where human illness may occur, closures to the harvest of shellfish areas are implemented. Maine has historically had high levels of Paralytic Shellfish Poison (PSP), more commonly known as “Red Tide” during the warmer periods of the year. Shellfish samples are collected statewide between March and October and evaluated at the PSP laboratory Boothbay Harbor, in the western portion of the state. Data is then transmitted to the Growing Area Supervisor at the Boothbay and Lamoine facilities for interpretation and appropriate closures are made when necessary. This growing area is frequently impacted by near shore biotoxin closures in eastern Maine during summer months. Emergency closures for biotoxin by species affected are maintained in the DMR central files.

Hydrographic and Meteorological Characteristics

Tides and Currents

Coastal Maine experiences a mixed, semi-diurnal tide, with diurnal inequalities that are more pronounced on spring tides. National Oceanic and Atmospheric Administration data for a station at Jonesport indicate a mean tidal range of 12.4 ft, a spring tidal range of 14.1 ft.

Currents in the area are predominantly driven by the tides. All along the coast of eastern Maine, the tide generally floods to the north and east and ebbs to the south and west. Along the coast and in the wider bays, the current seldom exceeds 2 knots. Weather conditions affect tidal ranges and current speeds, sometimes very strongly. Strong winds may reverse the direction of currents.

To examine the effects that tidal stage might have on fecal coliform concentrations, data collected under the Systematic Random sampling strategy (all months, all samples) were queried for all active sample sites (2010-2015). Then the average score for each station was calculated based on the following tide groupings; Ebb; Flood; H. HF, HE; and L. LF, LE (Table 4). The results can be seen in Table 5.

Table 4: Tide Stage Breakdown

Tide stage	Minutes from Low tide
Low	-30-30
LF	31-90
Flood	91-270
HF	271-329
High	330-360; (-330)- (-360)
HE	(-270) - (-331)
Ebb	(-90) - (-269)
LE	(-30) - (-89)

Table 5: Growing Area EN Average FC Score by Tidal Stage 2010 - 2015

Station	L	LE	LF	H	HE	HF	F	E
EN000.50	3	4.6	1.9	7.7	3.8	6	2.9	41.8
EN001.00	11	31	7	71	1.9	15	20.4	32.2
EN001.60	4	16	2	2.3	15	5	18.8	12.4
EN003.00				1.9	168	2	2.1	7.7
EN004.00	2.6		2.8	1.9	15	2	7.6	3.6
EN005.00				24	9.1	4	102.1	14.5
EN006.40	1.9			8.2	4.95	48	1.9	2.2
EN006.50	2	12	1.9	146	2.3	20	8.6	8.6
EN006.90	5.3		2.95	50.8	1.9	572	5.4	21.8
EN009.00				15.7	3	197	9.6	12.2
EN010.00				157.8	5.9	20	20.5	10.7
EN010.50				194	6.3	30	4.7	11.3
EN013.00				432	2.8	5	4.1	2.2
EN015.00				2.9	6.1	55	2.8	1.9
EN016.00	5.8	1.9	3.54	8	2.5	5	8.2	3.1
EN017.00	6	1.9	1.9	6.2	6.4	5	10.6	1.9
EN017.60	4	1.9	1.9		1.9		3.7	1.9
EN019.40	1.9	1.9	1.9		1.9		6.6	2.3
EN021.00	4.6		1.9		16	2	6.7	2.2
EN022.00			1.9	20.3	4.5	6	10.4	1.9
EN023.00		1.9	3.7	15.16	5.2	4	45.2	3.4
EN023.50	1.9		5	11.96	5.8	2	4.8	3.0
EN024.00	14		3	2.4	16.8	4	21.4	2.6
EN025.00	2.6			3.4	3.14	6	3.7	18.4
EN026.00	1.9		1.9	27.2	29.5	2	30.2	65.9

Station	L	LE	LF	H	HE	HF	F	E
EN027.00			121	24.6	7.85	6	20.4	40.1
EN031.00				9.9	21.2	12	8.3	4.1
EN032.00			1.9	32.5	2.6	2	1.9	3.6
EN035.00			2.6	20.4	3.1	2	11.9	3.3
EN037.00			1.9	19	1.9		7.1	6.9
EN038.00				6.4	7.85	2	4.6	5.6
EN039.00				4.2	19	2	7.7	6.5
EN041.00				11	12.3	6	16.0	5.9
EN042.00				3.3	21		20.4	10.4
EN043.00	174	34	5	7.9	35.95	46	12.1	23.4
EN044.00	2.75	1.9	1.9		1.9		5.4	1.9
EN045.50	1.9		1.9		1.9		49.9	1.9
EN046.20	1.9	2	1.9		1.9	2	78.3	1.9
EN046.50	1.9		1.9	1.9			74.1	2.0
EN047.40	1.9	2.75	1.9		1.9		5.1	2.4
EN047.60	2.6	1.9	1.9		1.9		4.5	2.2

Tide groupings with only one sample were excluded from this table. All of the average scores greater than 31 CFU/100ml were highlighted in yellow in Table 5 above. Sixteen of the twenty-two scores greater than 31 occurred during the higher tide stages of H, HF, HE, and F. The other 6 scores occurred at the L, LF, or E tide stage.

Rainfall

The mean annual precipitation in growing area EN is approximately 44 inches. The precipitation is not evenly distributed throughout the year. The wettest months are November and April. August is typically the driest month. Much of the precipitation in the winter comes as snow and may affect runoff rates in spring upon melting. It is likely that after prolonged periods of dry weather, significant rainfall (>1" over 24 hours) will cause some pollution from non-point runoff. It is unclear how much of an effect major rainfall events have on water quality due to variability of ground water saturation, history of recent significant rainfall that may have washed non-point pollution sources away, hard ground or ledge or wildlife or agriculture activity. Rainfall is monitored locally at the Machias Wastewater Treatment Plant.

To analyze rain and its effects on the growing area, 72-hour rain data for each station from 2010-2015 was binned into dry data; rain between 0.01-0.50”; 0.51-1.00”; 1.01-2 and >2”. The median fecal score for each binned rain amount can be found in Table 6. If a station did not have a minimum of three samples for the rain amount no median was calculated. All the stations with median scores greater than 14 CFU/100ml are highlighted in yellow in table.

Table 6: Median FC score in relation to rainfall amount (2010-2015)

Station	Median dry	dry count	Median .01-.5	.01-.5 count	Median .51-1	.51-1 count	Median 1.01-2	1.01-2 count	Median>2	.2 count
0.5	1.9	10	1.9	17			2	5		
1	1.9	10	2	17			2.95	4	2	3
1.6	1.9	9	1.9	18			1.9	4	1.9	3
3	1.9	12	2	15			2	6		

Station	Median dry	dry count	Median .01-.5	.01-.5 count	Median .51-1	.51-1 count	Median 1.01-2	1.01-2 count	Median>2	.2 count
4	1.9	10	1.9	17			1.9	4	1.9	3
5	1.9	11	1.95	15			6	6		
6.4	1.9	9	1.9	23			6	3		
6.5	1.9	20	1.9	37	1.9	5	6.65	6		
6.9	1.9	19	1.9	36	1.9	4	20	7	18	3
9	1.9	13	3.6	25	13	6	8	7		
10	1.9	14	1.9	27	22	5	6	7		
10.5	1.95	14	2	27	12	6	10	7		
13	1.9	13	1.9	26	4.95	4	3.7	8		
15	1.9	10	1.9	15			1.9	9		
16	1.9	10	1.9	14	1.95	4	3.8	8		
17.6	1.9	10	1.9	22						
19.4	1.9	10	1.9	22						
21	1.9	10	1.9	22						
23	1.9	9	1.9	15	6.55	4	7.65	8		
25	1.9	8	2	19	1.9	3	1.9	9		
26	1.9	12	1.9	12	1.9	5	1.9	8		
27	1.9	11	1.9	14	2	4	18.7	8		
31	1.9	8	1.9	16	1.95	4	10	10		
32	1.9	10	1.9	14	1.9	4	1.9	8		
35	1.9	12	2	13	1.9	4	3.95	8		
37	1.9	11	1.9	13	1.9	4	11	8		
38	1.9	9	1.9	15	1.9	5	4	8		
39	1.9	7	1.95	16	2	5	6	8		
41	1.9	8	1.9	15	1.9	5	21	8		
42	1.9	10	1.9	14	1.9	4	23.5	8		
43	1.9	12	1.9	13	1.95	4	16	8		
44	1.9	10	1.9	22						
45.5	1.9	10	1.9	22						
46.2	1.9	10	1.9	22	1.9	3				
46.5	1.9	10	1.9	21	1.9	3				
47.4	1.9	10	1.9	22	1.9	3				
47.6	1.9	10	1.9	22	1.9	3				

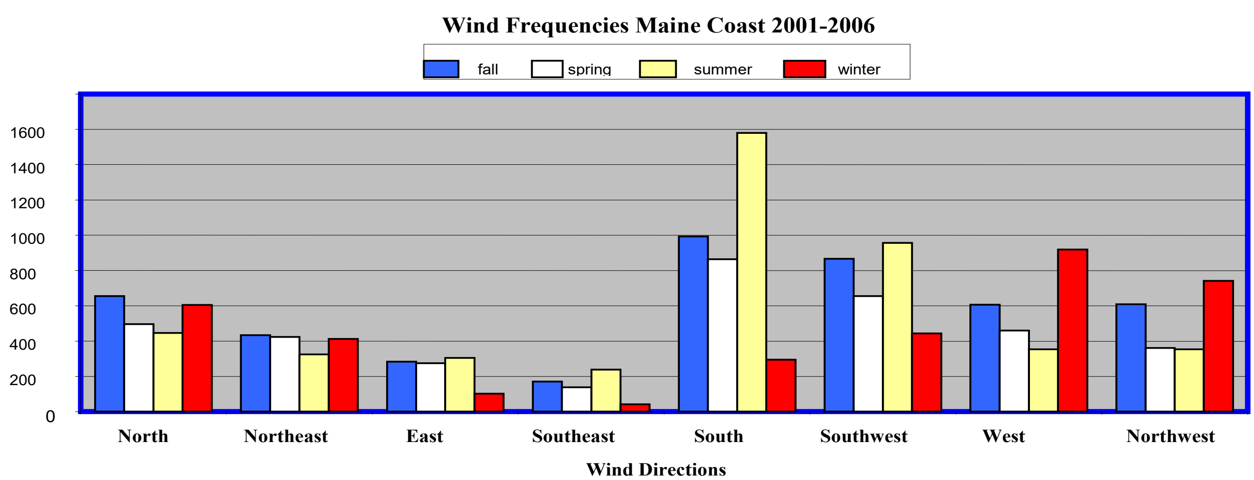
As seen in Table 6 most of growing area EN is not negatively impacted by rain. Only three stations showed median values exceeding 14 CFU/100ml; station EN 10, EN 27, and EN 42. EN 10 showed an impact from rain events of between .5-1”, while stations EN 27 and 42 showed elevated medians after 1-2” of rain.

Winds

Migratory weather systems cause winds that frequently change in strength and direction. Gulf of Maine winds are generally westerly, but often take on a northerly component in winter and a southerly one in summer. Strongest winds are generated by lows and cold fronts in fall and winter and by fronts and thunderstorms during spring and summer. Extreme winds are usually associated with a hurricane or severe northeaster and can reach 125 knots. Sustained winds of 100 knots occur about every 50 years on average; gusts are usually about 30 percent higher.

Coastal winds are complex since they are influenced by the topography. Over land speeds are reduced, however, channels and headlands can redirect the wind and even increase the speed by funneling the wind. In general, winds have southerly components in summer and northerly ones in winter. In sheltered waters near Rockland, Portland, and Brunswick, there are a large percentage of calms, particularly during the morning hours. When the existing circulation is weak and there is a difference between land and water temperatures, a land-sea breeze circulation may be set up. As the land heats faster than the water, a sea breeze is established during the day; this onshore flow may reach 15 knots or more. At night, the land cools more rapidly, often resulting in a weak breeze off the land. In many locations, the sea breeze serves to reinforce the prevailing summer wind. Analysis of GOMOOS data (2001-2006) show winter winds along coastal Maine are typically from the west-northwest during clear periods and from the northeast during storms. In the spring, summer and fall, predominant winds are from the south-southwest. West, northwest and north winds are common during fall and winter. Although less frequent, winds from the northeast, north and northwest directions are typically stronger than winds from the south. In the summer, winds tend to be on shore due to heated, rising air over land and cooler ocean air flowing into the void.

Figure 4: Wind Direction Frequencies Maine Coast 2001-2006



River Discharges

This area is not impacted by any river discharges, only smaller creeks and streams. Stream flow in downeast Maine exhibits seasonal variation, with the highest flows occurring in the spring (due to snowmelt, spring rains, and low evapo-transpiration) and the mid-to late fall (due to fall rains and low evapo-transpiration).

Salinity

Salinity generally tends to be lowest in the spring, due to spring rains and snowmelt/runoff and in late fall from rainfall. Summer and early autumn show the highest values of salinity, due to the relatively low stream flows at this time of year. Salinity data, taken from routine (random/prescheduled) ambient monitoring data from sites near the mouths of rivers or streams approximate the stream flow patterns and influence of fresh water inputs on the growing area. However, partial salinity stratification can occur during times of heavy rainfall and runoff. It is well recognized that freshwater influence from runoff can contribute to elevated bacterial loading near shore. Queries of the sample data in Area EN for average salinity by month (2010-2015) shows sample sites with their average salinities broken down by month (Table 7). The lowest average salinity was 19 ppt for station EN 9 in April. Low salinities do not impact this growing area.

Table 7: Average Salinity by Month

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EN000.50	31	31	30	30	31	30	29	31	30	31	31	31
EN001.00	29	31	30	29	30	30	30	31	31	31	31	31
EN001.60	31	32	31	31	30	30	29	31	31	31	32	31
EN003.00	32	30	30	27	30	30	30	31	31	31	31	29
EN004.00	30	31	31	29	29	30	29	31	31	31	31	32
EN005.00	31	32	30	25	32	23	26	28	30	32	27	28
EN006.40	30	32	30	29	30	28	30	31	27	31	31	31
EN006.50	30	31	30	28	30	30	31	31	31	30	30	31
EN006.90	32	30	26	26	29	30	31	30	26	28	30	28
EN009.00	29	25	25	19	26	29	29	31	30	30	32	21
EN010.00	31	29	24	23	28	22	29	27	30	28	31	23
EN010.50	28	29	22	20	28	26	29	29	31	30	31	26
EN013.00	29	29	27	26	28	28	30	30	30	30	24	28
EN015.00	32	30	29	29	30	30	30	31	32	30	27	
EN016.00	31	30	30	30	30	30	29	31	32	30	31	29
EN017.60				31	31	31	31	31	32	32	34	
EN019.40				31	30	31	31	31	31	32	34	
EN021.00				30	30	30	31	31	32	32	34	30
EN023.00	32	30	30	30	31	31	31	31	32	32	32	
EN025.00		31	26	29	29	30	30	31	32	31	26	
EN026.00	30	32	30	29	29	31	30	32	32	30	27	
EN027.00	31	31	28	31	30	29	30	31	32	31	32	
EN031.00	32	31	28	27	29	30	30	30	32	29	28	
EN032.00	31	31	30	29	30	31	30	31	32	30	30	
EN035.00	30	31	31	30	30	31	31	30	32	31	31	
EN037.00		32	31	32	31	31	31	32	32	32	32	
EN038.00	32	31	30	31	30	31	31	32	32	32	30	

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EN039.00	32	30	31	29	30	31	30	31	31	31	30	
EN041.00		30	31	30	29	31	30	29	31	31	31	
EN042.00	31	31	31	30	30	31	31	30	31	32	31	
EN043.00	31	32	31	30	31	31	31	31	32	32	32	31
EN044.00				31	31	31	31	31	32	32	34	
EN045.50		31	32	30	30	31	31	31	31	32	32	30
EN046.20		31	31	31	30	30	31	31	31	32	34	30
EN046.50		31	31	31	30	31	31	31	31	32	34	29
EN047.00		30	15	25	21	26	29	30	30	31	28	27
EN047.40		31	30	31	30	30	31	31	31	32	34	29
EN047.60		31	31	30	30	31	31	31	31	32	32	28

Seasonal Effects on FC Concentrations

To examine the effects that seasons may have on fecal coliform levels in Growing Area EN, the historical fecal coliform data of the ambient sites were grouped according to season:

Winter was defined as December, January, and February
Spring was defined as March, April, and May
Summer was defined as June, July, and August
Fall was defined as September, October, and November

This analysis includes fecal coliform results collected from 2003 to 2015 (Table 8). The collection dates were queried to conform to the seasonal groupings discussed above. Any adverse flood data was excluded. Next the P90 score for each station per season was calculated and can be seen in the table below.

Table 8: Seasonal Average P90 Scores (2003-2015)

Station	Winter Avg.	Winter Count	Spring Avg.	Spring Count	Summer Avg.	Summer Count	Fall Avg.	Fall Count
EN000.50	2.0	7	2.1	16	29.1	25	2.3	18
EN001.00	2.2	7	3.1	23	43.7	26	9.5	23
EN001.60	1.9	2	1.9	13	3.0	16	25.4	11
EN003.00	2.2	7	2.2	23	4.9	27	26.5	22
EN004.00	4.4	6	3.0	22	3.6	28	5.7	23
EN005.00	2.8	5	3.2	23	38.8	27	20.6	23
EN006.40	1.9	8	1.9	11	6.6	11	1.9	7
EN006.50	2.6	24	2.1	33	55.7	36	24.5	31
EN006.90	2.3	25	3.7	29	118.2	30	34.5	27
EN009.00	3.9	12	4.6	34	58.3	32	4.9	28
EN010.00	3.1	16	3.9	31	58.6	34	7.9	28
EN010.50	2.8	12	5.9	28	40.0	31	7.5	26
EN011.00	4.8	5	18.5	17	172.7	21	48.8	18
EN013.00	2.0	12	2.6	29	5.0	33	5.0	29

Station	Winter Avg.	Winter Count	Spring Avg.	Spring Count	Summer Avg.	Summer Count	Fall Avg.	Fall Count
EN015.00	2.1	6	3.4	22	16.0	28	22.5	23
EN016.00	2.1	6	2.1	18	10.2	23	4.2	19
EN017.00	2.1	6	2.5	22	9.8	27	61.8	23
EN021.00	2.9	1	2.1	16	2.4	27	4.7	22
EN022.00	1.9	3	2.0	17	6.4	24	10.1	15
EN023.00	2.2	4	2.2	23	28.5	29	15.8	23
EN023.50	1.9	4	3.1	14	5.2	21	4.3	15
EN024.00	2.1	5	2.6	23	14.1	27	8.0	23
EN025.00	2.3	4	9.6	21	13.9	32	7.4	24
EN026.00	2.1	6	12.6	22	12.4	28	82.9	23
EN027.00	2.1	6	5.4	21	46.5	29	44.8	23
EN031.00	2.1	6	2.2	19	8.4	29	11.0	26
EN032.00	2.1	6	2.7	22	2.7	27	7.8	23
EN035.00	2.1	6	3.2	22	58.2	28	18.9	23
EN037.00	1.9	3	1.9	15	9.6	18	144.9	13
EN038.00	2.1	6	5.7	22	3.5	26	75.0	25
EN039.00	5.5	5	3.5	20	5.7	27	5.4	26
EN041.00	5.5	5	4.5	21	11.2	26	49.9	26
EN042.00	2.1	6	23.2	22	7.3	26	20.0	24
EN043.00	2.1	6	12.2	22	14.8	28	14.0	23
EN045.50	2.9	4	2.2	18	2.4	40	17.0	33
EN046.00	163.4	11	29.0	16	118.7	28	161.8	25
EN046.20	2.9	4	2.2	19	2.5	40	25.3	33
EN046.50	9.2	4	2.3	20	4.8	40	23.7	34
EN047.00	43.6	8	117.9	18	51.6	29	99.3	25
EN047.40	3.3	4	2.2	20	2.8	40	3.4	34
EN047.60	7.9	4	2.2	19	2.9	40	4.6	34

As evidenced by the data most stations showed an increase in average score during the summer and fall months. This fits with an increase in human habitation during the summer months as well as increased waterfowl activity during the late summer and fall period.

Discussion of Hydrographic and Meteorological Characteristics

The most important aspects of hydrographic and meteorology and its influence on pollutant transport in growing area EN is the impact of seasonality in the summer and fall period. Even during low salinity and higher tides the unacceptable fecal scores begin in June and go into November. There is no data between January and mid-April, but data in April and May does not have high fecal scores. Sample stations near significant fresh water inflow sources are many times in Prohibited areas due to the stream impacts.

High salinities at sample stations near freshwater inflows show that there is not a significant contribution of fresh water into the estuaries. Lower tide stages have less ocean water to dilute the impact from the runoff.

Tides along the coast are significant enough in the volume of water moving between ebbing and flooding that pollution dispersion is rapid. Any elevated fecal testing results are more likely a localized pollution source instead of tidal transport issues.

Water Quality Discussion and Classification Determination

A review of the three year P90 trend for this area shows declining water quality with 21 out of the 40 stations showing at least a 15% decline in P90. Even with this decline only one station went from a passing P90 score to a failing score. That was station EN 1 and is currently located in a prohibited zone that was promulgated due to a failing septic system identified during this survey.

Table 9: Area EN P90 trends

Station	Class	Count	2013 P90	2014 P90	2015P90	Percent change
EN000.50	A	30	13.5	13.3	3.9	71.1
EN001.00	P	30	17.9	28.1	41.8	-133.5
EN001.60	A	30	7.9	8.8	8.8	-11.4
EN003.00	A	30	15.5	15.8	14.2	8.4
EN004.00	A	30	4.9	4.9	4.7	4.1
EN005.00	R	30	23.2	40.5	26.3	-13.4
EN006.40	A	30	6.7	5.8	3.8	43.3
EN006.50	CA	30	23.8	4.1	7.8	67.2
EN006.90	CA	30	32	11.7	18.7	41.6
EN009.00	A	30	14.5	20.2	21.8	-50.3
EN010.00	A	30	19.3	24.6	26	-34.7
EN010.50	A	30	15	22	29.8	-98.7
EN013.00	A	30	5.4	6.1	7.6	-40.7
EN015.00	A	30	19.2	14.6	6.8	64.6
EN016.00	A	30	13.5	8.5	6.7	50.4
EN017.00	P	30	24.1	10.5	10.2	57.7
EN017.60	A	30	2.7	2.5	3.5	-29.6
EN021.00	P	30	3.4	3.4	5.1	-50.0
EN022.00	A	30	11.4	11.4	10.6	7.0
EN023.00	A	30	11.7	20.1	17.3	-47.9
EN023.50	A	30	7.1	7.3	5.9	16.9
EN024.00	A	30	14.9	18.8	10.5	29.5
EN025.00	A	30	4	7.2	12.5	-212.5
EN026.00	R	30	16.1	47.7	45.3	-181.4
EN027.00	R	30	35.8	50.1	22	38.5
EN031.00	A	30	14.7	18.4	11.4	22.4
EN032.00	A	30	3.6	7.8	9.2	-155.6

Station	Class	Count	2013 P90	2014 P90	2015P90	Percent change
EN035.00	P	30	6.6	16.3	12	-81.8
EN037.00	P	30	30.2	34.9	24.6	18.5
EN038.00	A	30	5.4	8.4	10.8	-100.0
EN039.00	A	30	8.4	12.2	10.9	-29.8
EN041.00	P	30	14.5	21.5	15.7	-8.3
EN042.00	P	30	17	25.3	17.5	-2.9
EN043.00	A	30	19.4	28.1	23.2	-19.6
EN044.00	A	30	2.2	2.2	4.4	-100.0
EN045.50	A	30	2.3	2.3	8.6	-273.9
EN046.20	A	30	2.5	2.7	10.2	-308.0
EN046.50	A	30	3.1	2.9	10.1	-225.8
EN047.40	A	30	3	2.8	4.6	-53.3
EN047.60	A	30	2.7	2.7	4.1	-51.9

Table 10. Area EN P90 Table

Station	Class	Count	MFCount	GM	SDV	MAX	P90	Appd_Std	Restr_Std
EN000.50	A	30	30	2.1	0.19	11	3.9	31	163
EN001.00	A	30	30	5.1	0.7	300	41.8	31	163
EN001.60	A	30	30	2.5	0.41	260	8.8	31	163
EN003.00	A	30	30	3.1	0.5	500	14.2	31	163
EN004.00	A	30	30	2.3	0.24	16	4.7	31	163
EN005.00	R	30	30	4.2	0.62	780	26.3	31	163
EN006.40	A	30	30	2.2	0.17	8	3.8	31	163
EN006.50	CA	30	30	2.9	0.33	33	7.8	31	163
EN006.90	CA	30	30	3.8	0.53	360	18.7	31	163
EN009.00	A	30	30	4.7	0.51	64	21.8	31	163
EN010.00	A	30	30	4.9	0.56	92	26	31	163
EN010.50	A	30	30	5.8	0.55	122	29.8	31	163
EN013.00	A	30	30	3	0.31	22	7.6	31	163
EN015.00	A	30	30	2.6	0.31	27	6.8	31	163
EN016.00	A	30	30	2.5	0.33	54	6.7	31	163
EN017.00	P	30	30	3.2	0.38	24	10.2	31	163
EN017.60	A	30	30	2	0.18	20	3.5	31	163
EN019.40	P	30	30	2.2	0.27	48	4.9	31	163
EN021.00	P	30	30	2.2	0.27	46	5.1	31	163
EN022.00	A	30	30	2.9	0.43	54	10.6	31	163
EN023.00	A	30	30	4	0.49	300	17.3	31	163
EN023.50	A	30	30	2.4	0.29	44	5.9	31	163
EN024.00	A	30	30	3.2	0.39	54	10.5	31	163

Station	Class	Count	MFCount	GM	SDV	MAX	P90	Appd_Std	Restr_Std
EN025.00	A	30	30	3.3	0.44	140	12.5	31	163
EN026.00	R	30	30	4.8	0.75	360	45.3	31	163
EN027.00	R	30	30	3.7	0.6	380	22	31	163
EN031.00	A	30	30	3.2	0.42	72	11.4	31	163
EN032.00	A	30	30	2.8	0.39	102	9.2	31	163
EN035.00	P	30	30	3	0.46	106	12	31	163
EN037.00	P	30	30	3.5	0.65	1700	24.6	31	163
EN038.00	A	30	30	3.3	0.4	42	10.8	31	163
EN039.00	A	30	30	3.4	0.38	48	10.9	31	163
EN041.00	P	30	30	3.8	0.47	64	15.7	31	163
EN042.00	P	30	30	3.9	0.5	60	17.5	31	163
EN043.00	A	30	30	4.4	0.55	160	23.2	31	163
EN044.00	A	30	30	2.1	0.24	40	4.4	31	163
EN045.50	A	30	30	2.3	0.43	480	8.6	31	163
EN046.20	A	30	30	2.4	0.48	760	10.2	31	163
EN046.50	A	30	30	2.4	0.47	720	10.1	31	163
EN047.40	A	30	30	2.2	0.24	31	4.6	31	163
EN047.60	A	30	30	2.1	0.22	25	4.1	31	163

Conclusions

Growing Area EN has environmental and human impacts similar to the remainder of the Maine coast east of Penobscot Bay. Coastal community development is expanding with homes and businesses near the mainland shores and on islands. This development increases the potential pollution risks to the traditional shellfish harvesting areas. Pollution sources have adequate prohibited zones large enough to dilute the fecal loading to < 14 CFU/100 ml. of the receiving waters. Pollution loading is most likely originating on the near shore land and impacting the harvesting areas and ocean waters by non-point wide-spread runoff from streams and ditches. Environmental factors and seasonal periods have the greatest pollution impacts on the growing area. There are no present plans to change surveying and sampling schedules in the future. This area is properly classified. There are no changes to classification required in Growing Area EN at this time.

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APPENDIX A - Key to water quality table headers.

STATION = water quality monitoring station

CLASS = classification assigned to the station; prohibited (P), restricted (R), conditionally restricted (CR), conditionally approved (CA) and approved (A).

COUNT = the number of samples evaluated for classification, must be a minimum of 30.

MFCNT = the number of samples evaluated with the MTec method (included in the total Count column)

GEO_MEAN = means the antilog (base 10) of the arithmetic mean of the sample result logarithm (base 10).

SDV = standard deviation

MAX = maximum score of the 30 data points in the count column

P90 = 90th percentile

APPD_STD = the 90th percentile, at or below which the station would meet approved criteria in the absence of pollution sources or poisonous and deleterious substances.

RESTR_STD = the 90th percentile, at or below which the station would meet restricted criteria.