GROWING AREA EA

Dice Head, Castine to Head of Cape Rosier, Brooksville

Sanitary Survey Report

2014 - 2022

Final

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Sanitary Survey Officer signature: _____ Date:____12/7/2023_____

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Executive Summary

This is a Sanitary Survey report for Growing Area EA in Hancock County written in compliance with the requirements of the 2019 Model Ordinance and the National Shellfish Sanitation Program. One growing area section in Growing Area EA will be reviewed for a possible upgrade in 2023: Carpenter Cove (Penobscot). There were six pollution sources identified during the survey resulting in one new prohibited area. One of these pollution sources was already scheduled to be remediated when it was discovered. This property will need to be rechecked to ensure the remediation was successful. Four pollution sources have been investigated by the LPI. Of the four investigated pollution sources: two have been found to not be a source of fecal pollution, one was confirmed and is in the process of being remediated through the Small Community Grants program, and one requires more investigation to determine if it is a malfunction. No new stations were added or deactivated, and water quality has remained consistent overall. The next sanitary survey is due in 2034 and the next triennial in 2025.

Description of Growing Area

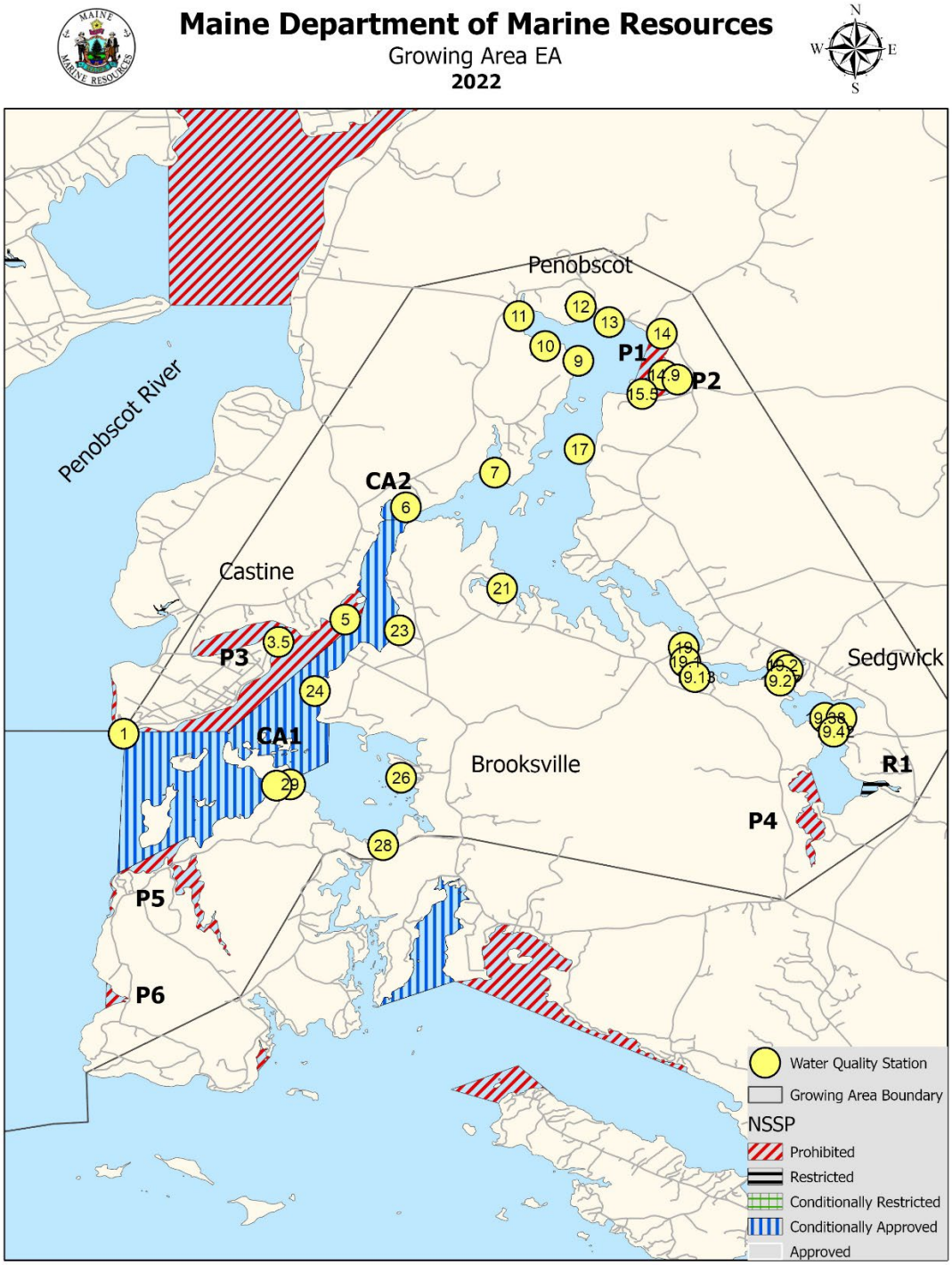
Growing Area EA encompasses the entire estuary known as the Bagaduce River. The shoreline stretches from Dice Head in Castine to Cape Rosier in Brooksville and includes the towns of Castine (pop. 1,320), Penobscot (pop. 1,136), Sedgwick (pop. 1,202), and Brooksville (pop. 935) (2020 Census). The heaviest development is found in and around the town of Castine with moderate development found in the Northern Bay area of Penobscot. Development along the shoreline is spotty with clusters of homes separated by undeveloped land. There is one municipal Wastewater Treatment Plant (WWTP) in the growing area located in the town of Castine. There are no privately licensed overboard discharges (OBDs) in the growing area.

The upland cover is primarily deciduous, some evergreens and wetland forest with minimal development. The Bagaduce River watershed drains primarily undeveloped land and several small ponds. Freshwater influence from the streams feeding the Bagaduce River is relatively small. There are no large rivers or lakes impacting the area. Wildlife in the area includes migrating birds, various rodents, deer, harbor seals, etcetera. Substantial numbers of rafted ducks are seen in the fall.

There are two shellfish aquaculture leases, and five shellfish Limited Purpose Aquaculture permits (LPAs) in this growing area. There are no wet storage permits issued to certified shellfish dealers in this area.

Below is the map with growing area boundaries. Closures within the growing area can be found in legal notices in DMR central files on the DMR website.

Figure 1. Growing Area EA Overview Map with Active Water Stations



History of Growing Area Classification

Reclassification addendums to the sanitary survey report are in the DMR central files.

Pollution Sources Survey

Summary of Sources and Location

The growing area shoreline is divided into two-mile segments that are identified using unique Growing Area Shoreline Survey Identification (GASSID) numbers. All properties and potential pollution sources within 250 feet of the shoreline are identified and inspected. The inspection includes a property description, physical address, location of the septic system and any other relevant potential or actual pollution sources. A GPS point to identify the source location(s) and the data are entered electronically in the field and stored in DMR central files.

Figure 2. Growing Area EA, Pollution Map A

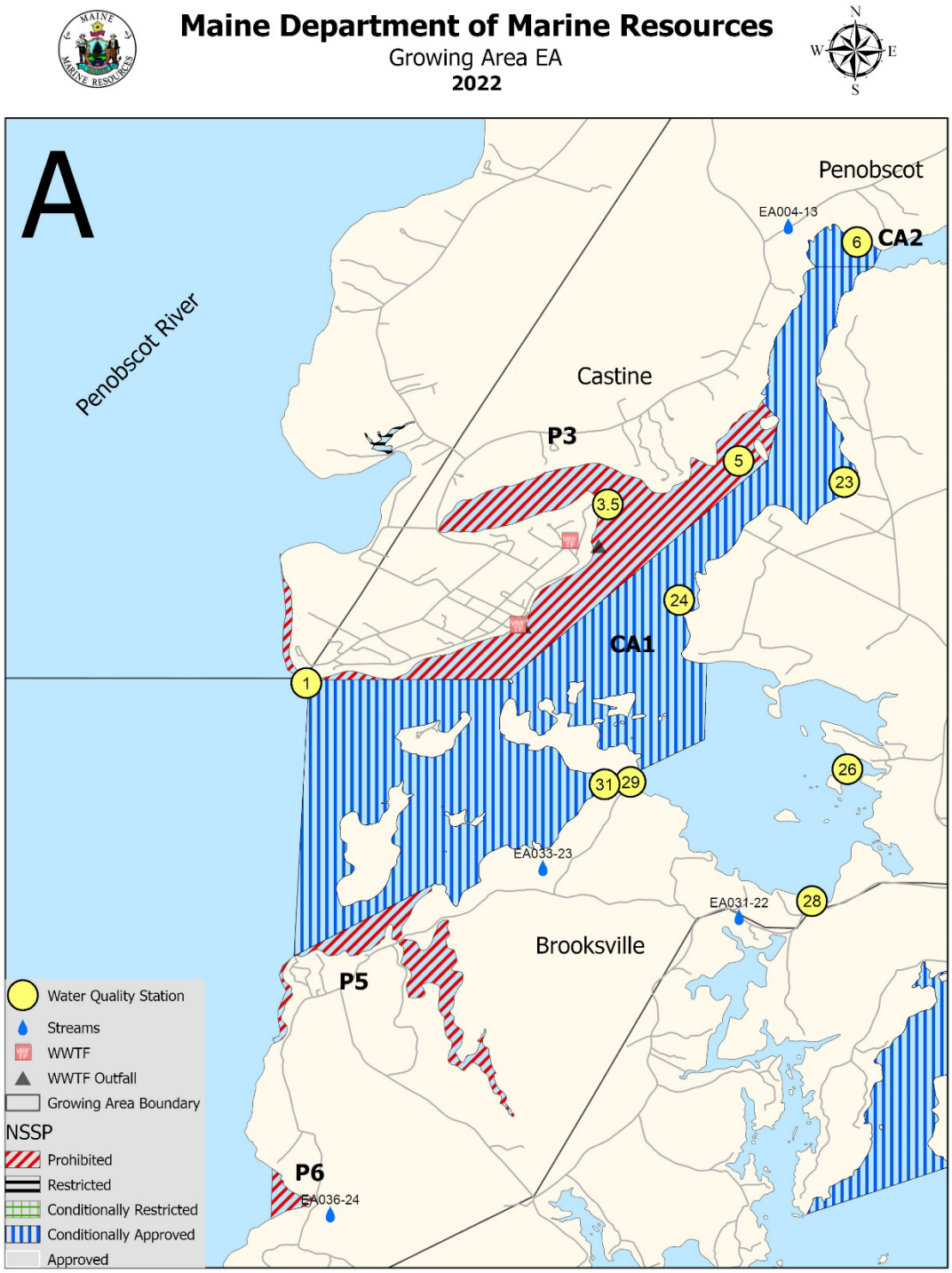


Figure 3. Growing Area EA, Pollution Map B

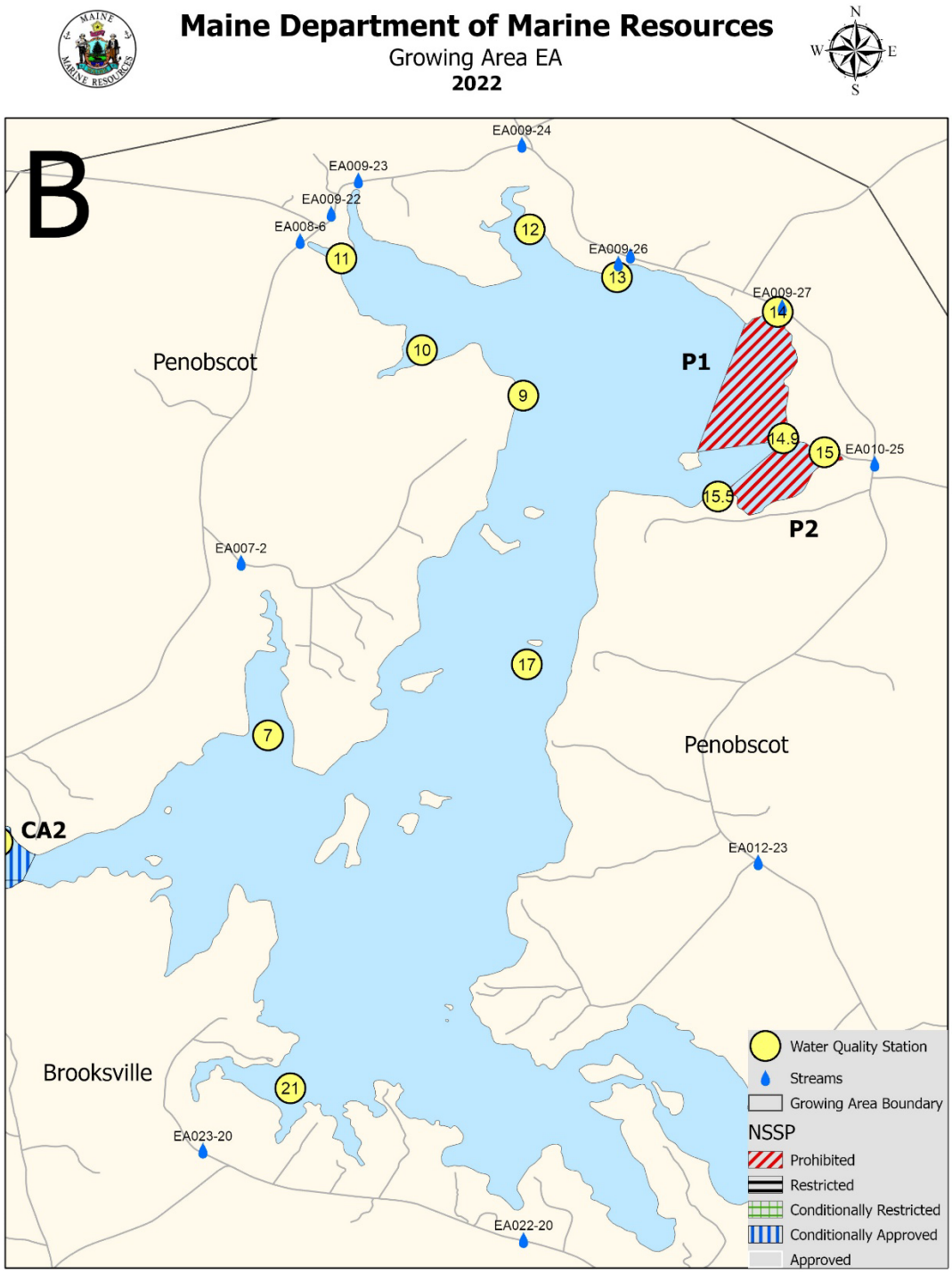
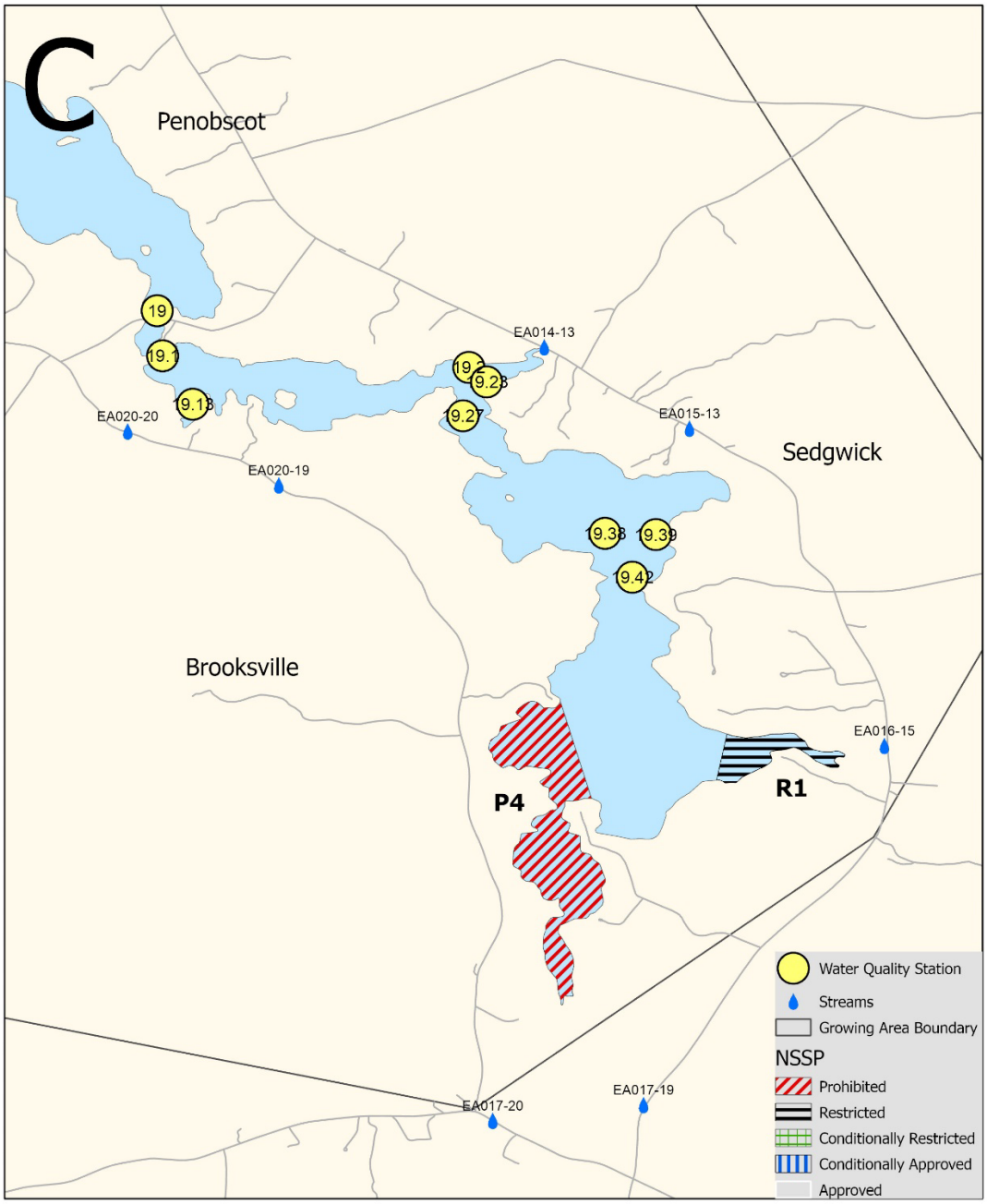


Figure 4. Growing Area EA, Pollution Map C



State and Federal Licensed Waste Discharge Permits

Overboard Discharges (OBDs)

There are no overboard discharges (OBDs) that discharge their treated effluent into the waters of Growing Area EA. One OBD was removed in 2018.

An overboard discharge (OBD) is the discharge of wastewater from residential, commercial, and publicly owned facilities to Maine's streams, rivers lakes, and the ocean. Commercial and residential discharges of sanitary waste have been regulated since the mid-1970's when most direct discharges of untreated waste were banned. Between 1974 and 1987 most of the "straight pipes" were connected to publicly owned treatment works or replaced with standard septic systems. Overboard discharge treatment systems were installed for those facilities that were unable to connect to publicly owned treatment works or unable to install a septic system because of poor soil conditions or small lot sizes.

All overboard discharge systems include a process to clarify the wastewater and disinfect it prior to discharge. There are two general types of treatment systems: mechanical package plants and sand filters. Sand filter systems consist of a septic tank and a sand filter. In such systems, the wastewater is first directed to a holding tank where the wastewater solids are settled out and undergo partial microbial digestion. The partially treated wastewater then flows from the tank into a sand filter, consisting of distribution pipes, layers of stone and filter sand, and collection pipes within a plastic liner. The wastewater is biologically treated as it filters down through the sand and is then collected and discharged to a disinfection unit. Mechanical package plants consist of a tank, where waste is mechanically broken up, mixed and aerated; mechanical systems require electric power, and must have an operating alarm on a separate electrical circuit that will activate if the treatment unit malfunctions due to a power failure. The aerated treated wastewater is held in a calm condition for a time, allowing for solids to settle and for the waste to be partially digested by naturally occurring bacteria. The clarified water from the tank is then pumped off the top into a disinfection unit. There are two types of disinfection units, UV and chlorinators (most common). In a chlorinator, the treated water contacts chlorine tablets and remains in a tank for at least 20 minutes where bacteria and other pathogens are killed. The treated and disinfected water is discharged from the disinfection unit to below the low water mark of the receiving waterbody (the ocean, a river, or a stream) via an outfall pipe.

OBDs are licensed and inspected by the Maine Department of Environmental Protection. At each inspection, DEP looks for tags on each treatment unit identifying the service contractor and the last date of service. 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 each closure is determined based on a dilution, using the permitted flow rate of the OBD (in gallons per day, GPD), and the depth of the receiving water that each OBD discharges to; the fecal concentration used for this dilution calculation is $1.4X10^5$ FC /100 ml. Single OBD systems associated with more than one residence will have multiple permit IDs. All current closures are of adequate size to protect public health.

National Pollutant Discharge Elimination System (NPDES)

Table 1. NPDES Permitted Discharges

Closure Area	Permit ID	Type	Facility	Water Body
P3	ME0101192	WWTP	Castine	Bagaduce River
P3	ME0002739	Non-contact cooling water	Maine Maritime Academy	Castine Harbor

There is one wastewater treatment plant/facility (WWTP/WWTF) in growing area EA. Since 2017 the WWTP inspection reports have been available in DMR central files. The facility is in Castine, and it discharges into a prohibited and conditionally approved area that is larger in area than the calculated dilution zone for the effluent.

Castine-
The plant is a secondary treatment system that discharges into Castine Harbor. Influent is domestic and commercial wastewater with no significant industrial users contributing to the flow. Licensed monthly average flow is 0.2 million gallons per day (MGD).

The facility consists of a headworks grinder and a bypass bar screen which can be used when the grinder is taken offline for repairs. Following the headworks grinder, the influent is conveyed to a 7,100-gallon anoxic selector. Flows from the selector are then conveyed to a 97,000-gallon aeration basin fitted with coarse-bubble diffusers. Following aeration, the mixed liquor is conveyed to two 55,000-gallon secondary clarifiers. Secondary clarifier effluent is disinfected with sodium hypochlorite in a 10,000-gallon chlorine contact tank. The effluent is dechlorinated using sodium
Bisulfite and then discharged to the tidewaters of Castine Harbor via a 12-inch pipe which has nine feet of water over the crown of the pipe at mean tide and is exposed at mean low water. There is 5.5 miles of collection system piping with no combined sewage overflows.

The regulation Prohibited closure size exceeds the computed effluent dilution zone (dilution calculation=306 acres / closure size= 623 acres). In the event of a plant bypass there is an additional 2143-acre conditionally approved area that closes.

Residential

All residential pollution sources are reported to the local plumbing inspector (LPI). Once the system has been documented as being fixed, staff members from DMR can re-assess the water quality data and shoreline survey information to determine if the area is safe for shellfish harvest. Table 2 shows all new and pre-existing pollution sources in area EA that are considered discharges into the Growing Area and effect water quality.

Table 2. Growing Area EA Residential Pollution Sources.

Growing Area Section	Location ID	Date Surveyed	Direct or Indirect	Problem	Description	Town
P1	EA009	2022	Indirect	Y	Potential breakout in tall grass to right of house; Found to be a cellar drain by LPI	Penobscot
P1	EA009	2022	Indirect	Y	Potential breakout front left of house in brush; Found to be a graywater system by LPI	Penobscot
P2	EA010	2022	Indirect	Y	Breakout at base of leach field under raspberry bushes; LPI confirmed malfunction, system in process of being replaced through Small Community Grants program	Penobscot
P4	EA018	2022	Indirect	Y	Potential breakout on downhill side of leach field; LPI in process of investigating	Brooksville
P4	EA017	2022	Indirect	Y	Breakout at downhill side of leach field. Fill scheduled to be brought in 10/10/2022	Sedgwick
P6	EA036	2022	Indirect	Y	Outhouse full or not properly dug.	Brooksville

Industrial Pollution

There is one major industrial pollution site in growing area EA: The Callahan Mining Corp Superfund site in Brooksville, Maine. This mine began in the 1800s and was primarily for copper and zinc. Since then, the mining has occurred periodically on-site; the latest mining effort was from 1968 to 1972. At that time the Goose Pond Estuary was drained to allow for excavation of an open pit mine in the estuary. The estuary, located adjacent to the site, has been impacted by heavy metal contaminants from the site. The following quote from the 2003 ATSDR media announcement summarizes the possible impact this site has on the growing area (www.atsdr.cdc.gov/NEWS/brooksvilleme050203.html accessed 3/14/10)

"The Callahan Mining Corp. site is a former zinc/copper open-pit mine on the Cape Rosier peninsula in the town of Brooksville, Maine. The mine was operated adjacent to and beneath Goose Pond, which was dammed and drained during operations to allow the mining to take place. The open-pit mining operation and processes contaminated the site with metals. Since the mine ceased operations in 1972, dams preventing water from entering Goose Pond have been removed, and the pit currently is under water. Elevated levels of heavy metals, including cadmium, copper, lead and zinc, have been measured in surface water, sediments, biota, soil and waste piles on the site.

- The site contains physical hazards and elevated levels of heavy metals. Physical hazards could cause injury to people visiting the site.
- Because of the low frequency and duration of likely exposures, people exposed to heavy metals and other contaminants at the site are not expected to experience adverse health effects. Further data collected during the U.S. Environmental Protection Agency's (EPA's) remedial investigation process might modify this conclusion.
- Several contaminants found at the site are known to accumulate in fish and shellfish. Not enough current information exists on potential contaminant levels to fully determine whether adverse health effects are possible from eating fish or shellfish collected from on or near the site. On the basis of limited samples, people who occasionally eat mussels from Goose Cove are not likely to experience adverse health effects. However, collecting or eating shellfish (including clams, mussels and oysters) from Goose Pond, Goose Cove, and other nearby areas is banned because of elevated levels of metals and other pollution."

At this point the total impact and the longevity of the impact are not fully known. There is currently a closure (P5) in place as a cautionary measure from the possible effects of the toxins from the Callahan Mine on shellfish. Cleanup of the sight is ongoing and is expected to continue for the next several years.

None of the smaller industries in the growing area (small boat builders and boat storage yards, an inactive international ferry wharf, and wildlife nature boat tour businesses) were identified as pollution sources during the 2022 survey. All the shellfish areas adjacent to the businesses meet their present area classifications.

Marinas

The marina community in Maine only operates for a portion of the year due to adverse winter weather conditions. The management of marinas in Maine allows for shellfish growing areas to be available to harvesters, for at least a portion of the year, to direct market harvest by utilizing conditional area management plans. Small mooring fields are scattered throughout the growing area with the largest number (groups of 10 or more moorings) of boats at in Castine Harbor and at Seal Ledge Marina in Penobscot. There is a boat pump out facility at Seal Ledge Marina and the marina in Castine also has a pipeline to the town's sewage treatment plant to discharge wastewater from Maine Maritime Academy's ships. The primary ship, the State of Maine, has multiple toilet facilities onboard which are used during the ten months that the ship is docked at Castine.

Seal Ledge Marina is a seasonal facility for pleasure boats and has a pump-out facility as well as a shore side head. The marina operates May 1 to October 15 and is contained in a seasonal Conditional Area that is closed May 1 to October 31. The water quality station monitoring this area, EA6, meets conditionally approved standards showing this area has little impact on the adjacent waters.

The marina in Castine operates seasonally for pleasure and workboats. It also includes Maine Maritime Academy's pier for docking its two training ships. This area is included in the prohibited area around Castine Harbor.

Storm water

Storm water 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, storm water pollution is caused by the daily activities of people within the watershed. Currently, polluted storm water is the largest source of water quality problems in the United States.

The primary method to control storm water discharges is the use of best management practices (BMPs). In addition, most major storm water discharges are considered point sources and require coverage under a NPDES permit. In 1990, under authority of the Clean Water Act, the U.S. EPA promulgated Phase I of its storm water 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 five acres of land or greater, and (3) ten categories of industrial activity. In 1999, US EPA issued Phase II of the storm water management program, expanding the Phase I program to include all urbanized areas and smaller construction sites.

Although it is a federal program, EPA has delegated its authority to the Maine DEP to administer the Phase II Small MS4 General Permit. Under the Small MS4 GP, 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 storm water management, and (6) Pollution prevention/good housekeeping. The permit requires each city or town to develop a draft Storm Water Management Plan that establishes measurable goals for each of the Minimum Control Measures. The City or Town must document the implementation of the Plan and provide annual reports to the Maine DEP. Currently the discharge of storm water from 30 Maine municipalities is regulated under the Phase II Small MS4 General Permit however, no municipalities located within the boundaries of growing area EA fall under these regulations. Additionally, the Maine Storm Water Management Law provides storm water standards for projects located in organized areas that include one acre of more of disturbed area (Maine DEP 2009).

Along roadways several stormwater pipes and ditches of varying diameters were identified during the shoreline surveys. The town of Castine has a storm water system that drains into the Castine Harbor Prohibited area. Water sampling stations on the margins of these closures meet Approved criteria. No specific impact from the storm drains has been identified.

Non-Point Pollution Sources

Non-point source (NPS) pollution is water pollution affecting a water body from diffuse sources, such as polluted runoff from agricultural areas draining into a river, significant rainfall, high river flows or

astronomical high tides. Nonpoint source pollution can be contrasted with point source pollution, where discharges occur to a body of water at a sole location, such as discharges from a chemical factory, urban runoff from a roadway storm drain or from ships at sea. NPS may derive from various sources with no specific solution to rectify the problem, making it difficult to regulate. Freshwater streams, drainage from rainstorm runoff and tidal creeks are the major source of non-point discharge into Growing Area EA. A total of 181 samples were taken from freshwater streams during the review period (Table 3, Figure 2, Figure 4). Streams associated with consistently high scores are monitored to determine if they affect the water quality of growing area waters.

Table 3. Stream Samples in Growing Area EA 2014-2022; Scores > 163 cfu/100ml are highlighted in red.

Growing Area Section	Location ID	Sample Date	Pollution Type	Score cfu/100ml
A	EA014-13	5/5/2014	Stream	10
A	EA015-13	5/5/2014	Stream	<2
R1	EA016-15	5/5/2014	Stream	<2
P4	EA017-19	5/5/2014	Stream	<2
P4	EA017-20	5/5/2014	Stream	12
CA2	EA004-13	6/26/2014	Stream	>1600
A	EA014-13	6/26/2014	Stream	>1600
R1	EA016-15	6/26/2014	Stream	1340
P4	EA017-19	6/26/2014	Stream	1260
P4	EA017-20	6/26/2014	Stream	>1600
A	EA014-13	9/17/2014	Stream	118
A	EA015-13	9/17/2014	Stream	15
R1	EA016-15	9/17/2014	Stream	70
P4	EA017-19	9/17/2014	Stream	<2
P4	EA017-20	9/17/2014	Stream	7.3
A	EA015-13	9/29/2014	Stream	10
R1	EA016-15	9/29/2014	Stream	20
P4	EA017-19	9/29/2014	Stream	4
P4	EA017-20	9/29/2014	Stream	<2
A	EA009-23	10/16/2014	Stream	<2
A	EA009-25	10/16/2014	Stream	4
A	EA009-25	4/15/2015	Stream	4
P1	EA009-27	4/15/2015	Stream	<2
P2	EA010-25	4/15/2015	Stream	<2
A	EA014-13	4/15/2015	Stream	<2
A	EA015-13	4/15/2015	Stream	<2
R1	EA016-15	4/15/2015	Stream	<2

Growing Area Section	Location ID	Sample Date	Pollution Type	Score cfu/100ml
P4	EA017-19	4/15/2015	Stream	4
P4	EA017-20	4/15/2015	Stream	<2
A	EA009-24	6/29/2015	Stream	140
P2	EA010-25	6/29/2015	Stream	116
A	EA014-13	6/29/2015	Stream	240
A	EA015-13	6/29/2015	Stream	66
R1	EA016-15	6/29/2015	Stream	120
P4	EA017-20	6/29/2015	Stream	27
P4	EA017-19	6/30/2015	Stream	360
A	EA014-13	8/23/2015	Stream	46
A	EA015-13	8/23/2015	Stream	80
R1	EA016-15	8/23/2015	Stream	80
P4	EA017-20	8/23/2015	Stream	27
R1	EA016-15	5/24/2016	Stream	42
P4	EA017-19	5/24/2016	Stream	10
P4	EA017-20	5/24/2016	Stream	2
A	EA009-24	6/22/2016	Stream	26
P1	EA009-27	6/22/2016	Stream	146
P2	EA010-25	6/22/2016	Stream	10
A	EA029-21	6/22/2016	Stream	420
R1	EA016-15	7/25/2016	Stream	5.5
P4	EA017-19	7/25/2016	Stream	80
P4	EA017-20	7/25/2016	Stream	760
R1	EA016-15	9/26/2016	Stream	14
P4	EA017-19	9/26/2016	Stream	9.1
P4	EA017-20	9/26/2016	Stream	4
P4	EA017-20	11/30/2016	Stream	56
R1	EA016-15	12/14/2016	Stream	4
P4	EA017-19	12/14/2016	Stream	<2
R1	EA016-15	1/30/2017	Stream	2
P4	EA017-19	1/30/2017	Stream	6
P4	EA017-20	1/30/2017	Stream	4
R1	EA016-15	4/18/2017	Stream	32
P4	EA017-19	4/18/2017	Stream	8
P4	EA017-20	4/18/2017	Stream	2
R1	EA016-15	7/25/2017	Stream	400
P4	EA017-19	7/25/2017	Stream	220

Growing Area Section	Location ID	Sample Date	Pollution Type	Score cfu/100ml
P4	EA017-20	7/25/2017	Stream	900
R1	EA016-15	10/11/2017	Stream	100
P4	EA017-19	10/11/2017	Stream	28
P4	EA017-20	10/11/2017	Stream	33
A	EA009-26	12/6/2017	Stream	>1600
R1	EA016-15	1/22/2018	Stream	2
P4	EA017-19	1/22/2018	Stream	6
P4	EA017-20	1/22/2018	Stream	7.3
R1	EA016-15	4/19/2018	Stream	6
P4	EA017-19	4/19/2018	Stream	<2
P4	EA017-20	4/19/2018	Stream	<2
R1	EA016-15	7/18/2018	Stream	35
P4	EA017-19	7/18/2018	Stream	27
P4	EA017-20	7/18/2018	Stream	52
R1	EA016-15	10/30/2018	Stream	24
P4	EA017-19	10/30/2018	Stream	18
P4	EA017-20	10/30/2018	Stream	140
P1	EA009-27	3/27/2019	Stream	<2
R1	EA016-15	3/27/2019	Stream	2
P4	EA017-19	3/27/2019	Stream	<2
P4	EA017-20	3/27/2019	Stream	<2
R1	EA016-15	5/13/2019	Stream	25
P4	EA017-19	5/13/2019	Stream	4
P4	EA017-20	5/13/2019	Stream	2
CA2	EA004-13	5/21/2019	Stream	33
A	EA007-2	5/21/2019	Stream	18
A	EA008-6	5/21/2019	Stream	52
A	EA009-22	5/21/2019	Stream	46
A	EA009-23	5/21/2019	Stream	11
A	EA009-24	5/21/2019	Stream	18
A	EA009-25	5/21/2019	Stream	12
P1	EA009-27	5/21/2019	Stream	8
P2	EA010-25	5/21/2019	Stream	31
A	EA012-23	5/21/2019	Stream	14
P1	EA009-27	8/21/2019	Stream	142
R1	EA016-15	8/21/2019	Stream	12
P4	EA017-19	8/21/2019	Stream	64

Growing Area Section	Location ID	Sample Date	Pollution Type	Score cfu/100ml
P4	EA017-20	8/21/2019	Stream	3.6
P1	EA009-27	12/30/2019	Stream	2
R1	EA016-15	12/30/2019	Stream	18
P4	EA017-19	12/30/2019	Stream	6
P4	EA017-20	12/30/2019	Stream	8
P1	EA009-27	3/30/2020	Stream	4
A	EA014-13	3/30/2020	Stream	<2
A	EA015-13	3/30/2020	Stream	<2
R1	EA016-15	3/30/2020	Stream	2
P4	EA017-19	3/30/2020	Stream	22
P4	EA017-20	3/30/2020	Stream	2
A	EA014-13	6/24/2020	Stream	68
A	EA015-13	6/24/2020	Stream	35
R1	EA016-15	6/24/2020	Stream	4
P4	EA017-19	6/24/2020	Stream	6
P4	EA017-20	6/24/2020	Stream	13
P1	EA009-27	7/8/2020	Stream	380
P3	EA001-1	9/15/2020	Stream	200
P3	EA001-1	9/22/2020	Stream	40
P1	EA009-27	9/30/2020	Stream	360
A	EA014-13	9/30/2020	Stream	48
A	EA015-13	9/30/2020	Stream	40
R1	EA016-15	9/30/2020	Stream	102
P4	EA017-19	9/30/2020	Stream	64
P4	EA017-20	9/30/2020	Stream	500
P1	EA009-27	12/28/2020	Stream	12
A	EA014-13	12/28/2020	Stream	6
A	EA015-13	12/28/2020	Stream	6
R1	EA016-15	12/28/2020	Stream	2
P4	EA017-19	12/28/2020	Stream	2
P4	EA017-20	12/28/2020	Stream	2
P1	EA009-27	3/24/2021	Stream	36
A	EA014-13	3/24/2021	Stream	8
A	EA015-13	3/24/2021	Stream	4
R1	EA016-15	3/24/2021	Stream	2
P4	EA017-19	3/24/2021	Stream	3.6
P4	EA017-20	3/24/2021	Stream	<2

Growing Area Section	Location ID	Sample Date	Pollution Type	Score cfu/100ml
P3	EA001-1	4/21/2021	Stream	22
P1	EA009-27	10/19/2021	Stream	122
A	EA014-13	10/19/2021	Stream	66
A	EA015-13	10/19/2021	Stream	31
R1	EA016-15	10/19/2021	Stream	26
P4	EA017-19	10/19/2021	Stream	15
P4	EA017-20	10/19/2021	Stream	140
P1	EA009-27	11/17/2021	Stream	15
A	EA014-13	11/17/2021	Stream	8
A	EA015-13	11/17/2021	Stream	<2
R1	EA016-15	11/17/2021	Stream	8
P4	EA017-19	11/17/2021	Stream	<2
P4	EA017-20	11/17/2021	Stream	31
P1	EA009-27	12/20/2021	Stream	<2
A	EA014-13	12/20/2021	Stream	<2
A	EA015-13	12/20/2021	Stream	2
R1	EA016-15	12/20/2021	Stream	<2
P4	EA017-19	12/20/2021	Stream	<2
P4	EA017-20	12/20/2021	Stream	20
P1	EA009-27	3/14/2022	Stream	<2
A	EA014-13	3/14/2022	Stream	<2
A	EA015-13	3/14/2022	Stream	<2
R1	EA016-15	3/14/2022	Stream	<2
P4	EA017-19	3/14/2022	Stream	<2
P4	EA017-20	3/14/2022	Stream	4
P1	EA009-27	7/18/2022	Stream	420
A	EA014-13	7/18/2022	Stream	18
A	EA015-13	7/18/2022	Stream	44
R1	EA016-15	7/18/2022	Stream	26
P4	EA017-19	7/18/2022	Stream	6
P4	EA017-20	7/18/2022	Stream	107
A	EA014-13	9/27/2022	Stream	106
A	EA015-13	9/27/2022	Stream	15
R1	EA016-15	9/27/2022	Stream	70
P4	EA017-19	9/27/2022	Stream	52
P4	EA017-20	9/27/2022	Stream	114
P1	EA009-27	11/30/2022	Stream	44

Growing Area Section	Location ID	Sample Date	Pollution Type	Score cfu/100ml
A	EA014-13	11/30/2022	Stream	46
A	EA015-13	11/30/2022	Stream	33
R1	EA016-15	11/30/2022	Stream	11
P4	EA017-19	11/30/2022	Stream	15
P4	EA017-20	11/30/2022	Stream	40
P1	EA009-27	12/6/2022	Stream	16

Agricultural Activities

There are no large-scale agriculture activities in Growing Area EA. A smaller hobby farm was noted at Winslow Stream in Penobscot (Sheep and chickens) which was referred to the Department of Agriculture to help the owners reduce the impact of this farm on water quality. Pollution from small agriculture operations can be introduced into the growing area as nonpoint source pollution transported by runoff from large rainfall or snowmelt events. Smaller farms are encouraged to follow best management practices to help avoid effects animal waste and agricultural pollutants can have on water quality.

Wildlife Activity

The salt marshes and mudflats of the growing area provide valuable habitat to a variety of wildlife. Commonly observed bird species include a variety of gulls, sea and inland ducks, cormorants, geese, great blue herons, egrets, swans, and others. Mammals living within the growing area include dogs, cats, whitetail deer, muskrat, squirrels, chipmunks, rabbits, moles, mice, bats, shrews, weasels, skunks, raccoons, and others. Maine Inland Fish and Wildlife surveys indicate that migratory waterfowl numbers begin to increase in the early autumn months, and typically peak in late fall or early winter. Although large numbers of birds can, in theory, pose a threat the growing area water quality, such occurrences are very difficult to document.

Recreation Areas (parks, beaches, trails, campgrounds, etc.)

This section of the coast of Maine is considered a significant tourism area, especially in the vicinity of Castine. There is one state park on Cape Rosier in Brooksville. This typically serves day-users. There are no known commercial or public campgrounds in Area EA. 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 60°F.

The entire growing area is subject to a heavy influx of visitors during summer months. Hunting also represents a form of recreation in this part of Maine. These activities take place primarily in the fall.

Hydrographic and Meteorological Assessment

Tides

Coastal Maine experiences a mixed, semi-diurnal tide, with diurnal inequalities that are more pronounced on spring tides. Except for very few isolated areas with extensive saltwater marshes, tides are not considered to be contributors to fecal contamination. The National Oceanic and Atmospheric Administration data for a station at Eastport indicate a mean tidal range of 18.35 ft. The mean tidal range for most of Maine is nine feet to 13 feet. Unlike areas with small diurnal tides, this extreme volume exchange results in significant bacterial dilutions. Currents in the area are predominantly driven by the tides.

Rainfall

The mean annual precipitation in growing area EA is approximately 44 inches and the precipitation is not evenly distributed throughout the year. The wettest months are generally April and November while 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. Flood closures are implemented when areas receive greater than two inches of rainfall in a twenty-four-hour period. Rainfall is monitored by numerous rain gauges located along the entire Maine coast and reported primarily through the Weather Underground website. Some areas of Maine have documented fecal influences resulting from rainfall of three-quarters inch to greater than one inch in a twenty-four-hour period. These areas are considered rainfall conditional areas and are Conditionally Approved based on a three-quarters or one-inch closure trigger. No rainfall areas have been identified in growing area EA.

Maine DMR is working collaboratively with the University of Maine on a statewide coastal project determining how various watershed characteristics influence fecal contamination of marine waters during rainfall events. This research clusters watersheds based on similar characteristics then models how rainfall and associated pollution is distributed. The model is being refined to incorporate margin watershed influences.

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 nor'easter and can reach 125 knots. In Maine, wind is not a contributor to fecal pollution because marine currents are primarily influenced by the size and duration of the normal tidal cycle.

River Discharge

Stream flow in Maine exhibits seasonal variation, with the highest flows occurring in the spring (due to snowmelt, spring rains, and low evapotranspiration) and the mid-to late fall (due to fall rains and low evapotranspiration). There are no large river discharges into growing area EA. The Bagaduce River is essentially a long tidal estuary whose inlet is Walkers Pond. There are many small streams that discharge into the growing area and these streams are discussed in the section about nonpoint source pollution.

The Penobscot River is one of Maine largest rivers and flows past the mouth of the Bagaduce at Castine. This large river has little or no impact on the Bagaduce system and data from water quality station EA 1, located at the mouth of the Bagaduce where the Penobscot flows by, supports this statement.

Hydrographic Influence

Water circulation in growing area EA is dominated by tides. The average tidal range at Castine is ten feet. Tides are caused by the gravitational effects of the moon and sun on the ocean; other influences are heavy rainfall, low barometric pressure and strong onshore winds which will increase tides. Tide levels fluctuate during the month based on the positions of the sun, moon and earth. These fluctuations and the speed and direction of the tidal currents constantly change during a tidal cycle. Tidal currents have the greatest energy when water is pushed in and out of bays and channels during the highest and lowest tide levels. Growing area EA is subject to a semidiurnal tidal cycle with two high tides and two low tides per day. The tidal cycle is 12 hours and 25 minutes long, so that high and low tides are 50 minutes later each day.

Water Quality Studies

Map of Sampling Stations

Most marine fecal pollution of Maine waters comes from non-point sources. DMR uses Systematic Random Sampling (SRS) to monitor this influence and uses a pre-established schedule at an adequate frequency to capture all meteorological, hydrographic and/or other pollution events that trigger non-point pollution contribution. Using SRS will detect intermittent and unfavorable change in water quality and the program accepts the estimated 90th percentile (P90) as the standard to measure variance of a data set.

There are presently 31 active water sampling sites in Growing Area EA. It is recognized that access, icing, and safety considerations prevent some stations from being sampled on scheduled dates. Currently all stations in Growing Area EA meet their current NSSP classification standard. One water quality station (EA 14) has water quality that meets approved standards and will be evaluated for an upgrade in 2023.

Water Quality Discussion and Classification Determination

P90s for all active stations with a minimum of 30 samples were calculated and all stations meet their classification standards (Table 4, Table 6). Overall, the water quality in growing area EA appears to be improving or remaining constant.

Table 4. P90 calculations for stations with a minimum of 30 samples. Geomeans and P90s not meeting current classifications are highlighted in red.

Station	Class	Count	GM	SDV	MAX	P90	Min_Date
EA001.00	A	30	2.2	0.21	13	4.2	5/23/2018
EA003.50	P	30	2.3	0.2	8	4.3	5/23/2018
EA005.00	P	30	2.1	0.17	9.1	3.6	5/23/2018
EA007.00	A	30	2.1	0.14	6	3.2	5/23/2018
EA009.00	A	30	3.2	0.39	74	10.3	5/23/2018
EA010.00	A	30	3.2	0.43	76	11.9	5/23/2018
EA011.00	A	30	3.3	0.34	31	9.2	5/23/2018
EA012.00	A	30	4.9	0.44	48	18.2	5/23/2018
EA013.00	A	30	3.9	0.43	42	14.5	5/23/2018
EA014.00	P	30	5.4	0.46	60	21.5	5/23/2018
EA014.90	A	30	4.1	0.4	29	13.6	5/23/2018
EA015.00	P	30	8.2	0.46	90	32.2	5/23/2018
EA015.50	A	30	3.4	0.42	108	12	5/23/2018
EA017.00	A	30	2.2	0.22	15	4.4	5/23/2018
EA019.00	A	30	3.4	0.36	44	10.1	5/9/2018
EA019.10	A	30	3.3	0.35	66	9.5	5/9/2018
EA019.13	A	30	4	0.44	144	15	5/9/2018
EA019.20	A	30	5.2	0.54	360	25.9	5/9/2018
EA019.23	A	30	4.6	0.53	122	22.3	5/9/2018
EA019.27	A	30	3.8	0.45	114	14.7	5/9/2018
EA019.38	A	30	4.1	0.46	280	16.2	5/9/2018
EA019.39	A	30	4.2	0.51	460	19.4	5/9/2018
EA019.42	A	30	4.2	0.51	260	19.2	5/9/2018
EA021.00	A	30	2.6	0.33	22	7.1	5/23/2018
EA026.00	A	30	2.7	0.3	22	6.7	5/23/2018
EA028.00	A	30	2.4	0.34	108	6.7	5/23/2018

Emergency Closures: The reports summarizing emergency closures such as flood and biotoxin closures for the entire state are in the DMR central files.

Reclassifications: Reclassification addendums to the sanitary survey report are in the DMR central files.

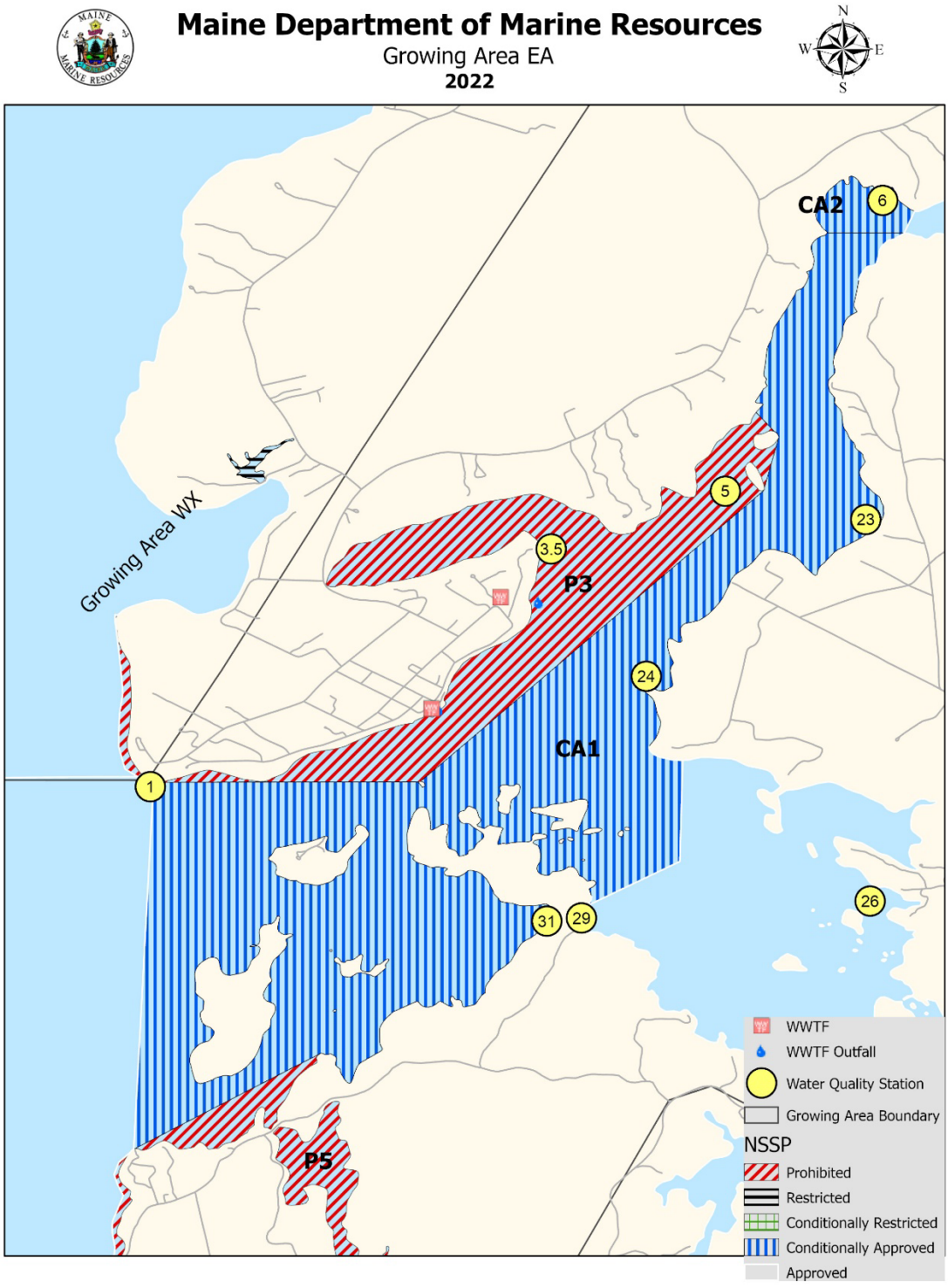
CAMP Reviews, Inspection Reports, and Performance Standards

Annual Review of CA1 Bagaduce River, Castine WWTP Conditional Area Management Plan

Scope

Growing Area CA1 Bagaduce River in Castine and Brooksville is classified as Conditionally Approved based on operation of the Castine WWTP (Figure 5). This area is east of a line beginning at the southern tip of Dice Head, Castine running south to the northwest point of Harborside, Brooksville; AND north and west of a line beginning at the northwest point of Harborside, Brooksville running northeast to a red painted post on the western tip of land in Tom Cod Cove, Brooksville; AND north and west of a line beginning at the northwest end of Indian Bar, Brooksville running northeast to the Coast Guard navigational aid Nun “2”; then north to the southern tip of Henry Point, Brooksville; AND south of a line beginning at a red painted post on Jones Point, Brooksville running west to the opposite shore in Castine; AND east of a line beginning at a red painted post on the western shore of the Bagaduce River northwest of Upper Negro Island running southeast to the eastern point of Upper Negro Island, then running south to the southern tip of Lower Negro Island, then running southwest to the northern tip of High Tide Island, Castine, then running west to the southern tip of Dice Head. This Conditional Area is monitored by water quality stations EA23, EA24, EA29, and EA31.

Figure 5. CA1 Bagaduce River, Castine WWTP Conditionally Approved area



Compliance with management plan
The Castine WWTP Conditional Area remains in compliance with the current conditional area management plan (CAMP). The area is closed during a failure of the Castine WWTP and so the area does not pose a risk to public health during regular operation of the WWTP. See CAMP annual reviews for information on annual compliance with the current CAMP.

Adequacy of reporting and cooperation of involved persons
Castine WWTP staff have reported all malfunctions at the WWTP adequately according to the MOU.

Compliance with restricted growing area criteria
The area continues to meet the criteria for Approved harvest during the open status based on P90 calculations during the open status and no other known sources of pollution in the area (Table 5).

Water sampling compliance history
Water samples are collected at least monthly during the open status and throughout the year (Table 7). The P90 value meets the standard for Approved harvest during the open status (Table 5).

Analysis-Recommendations
The Castine WWTP Conditionally Approved area continues to meet the standards for Approved harvest during the open status and remains in compliance with the CAMP. Recommend continued water quality monitoring and open communication with the WWTP staff to ensure continued compliance with the CAMP.

Table 5. P90s for Conditional Area stations calculated using data from the open status. Geomeans and P90s not meeting current classifications are highlighted in red.

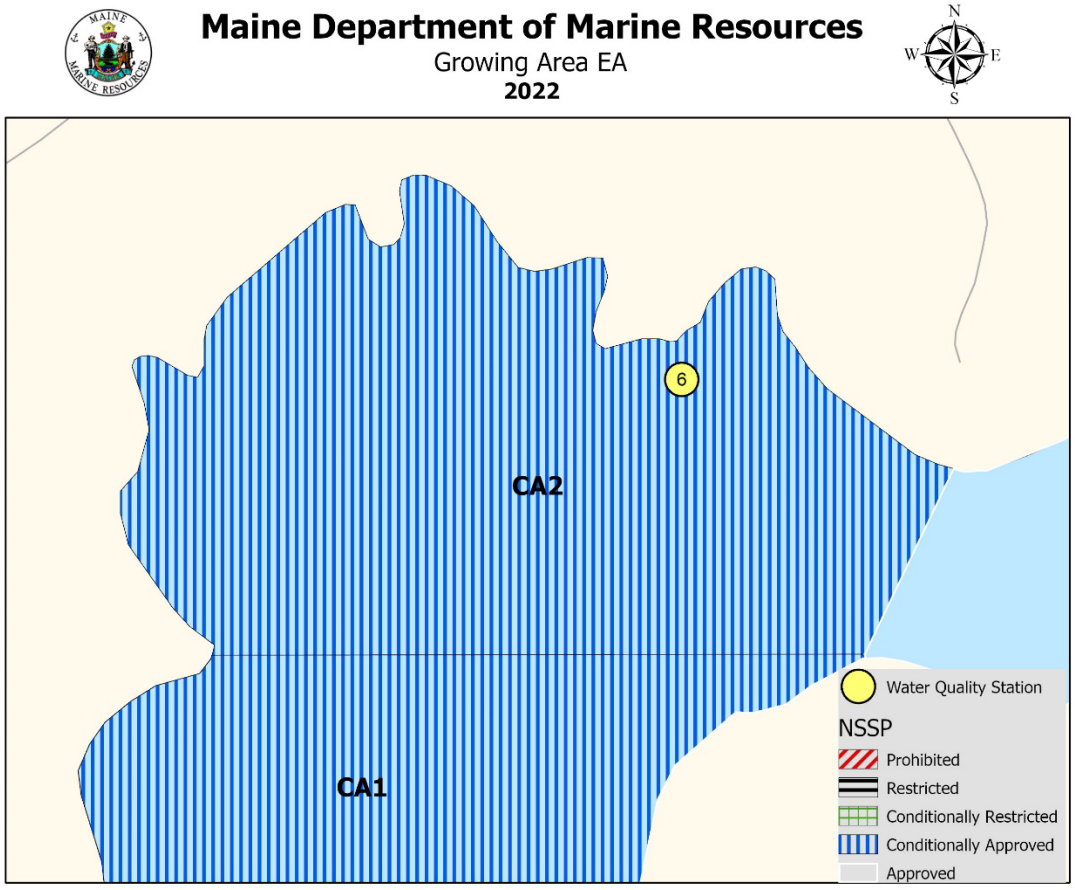
Station	Class	Count	GM	SDV	MAX	P90	Min_Date
EA023.00	CA	30	3.5	0.53	180	17.1	7/6/2020
EA024.00	CA	30	3.3	0.47	160	13.6	7/6/2020
EA029.00	CA	30	2.3	0.26	25	4.9	7/6/2020
EA031.00	CA	30	2.5	0.26	16	5.4	7/6/2020

Annual Review of CA2 Bagaduce River, Seal Ledge Marina Conditional Area Management Plan

Scope
Growing Area CA2 Bagaduce River in Castine, Penobscot, and Brooksville is classified as Conditionally Approved seasonally and is closed from May 1st to October 31st (Figure 6). This area is north of a line beginning at a red painted post on Jones Point, Brooksville, then running west across the Bagaduce River to the opposite shore in Castine; AND west of a line running from the same red-painted post on Jones Point then running north across the “narrows” of the Bagaduce River to the nearest opposite Penobscot

shore. This Conditional Area is based on marina operation. This Conditional Area is monitored by water quality station EA6.

Figure 6. CA2 Bagaduce River, Seal Ledge Marina Conditionally Approved area



Compliance with management plan
The Castine WWTP Conditional Area remains in compliance with the current conditional area management plan (CAMP). The area is closed while the marina is in operation. See CAMP annual reviews for information on annual compliance with the current CAMP.

Adequacy of reporting and cooperation of involved persons
There is no reporting required for this CAMP.

Compliance with restricted growing area criteria
The area continues to meet the criteria for Approved harvest during the open status based on P90 calculations during the open status and no other known sources of pollution in the area (Table 6).

Water sampling compliance history
Water samples are collected at least monthly during the open status and throughout the year (Table 7). The P90 value meets approved standards during the open status (Table 6).

Analysis-Recommendations
The Seal Ledge Marina Conditionally Approved area continues to meet approved standands during the open status and remains in compliance with the CAMP. Recommend continued water quality monitoring and open communication with the marina to ensure continued compliance with the CAMP.

Table 6. P90s for Conditional Area stations calculated using data from the open status. Geomeans and P90s not meeting current classifications are highlighted in red.

Station	Class	Count	GM	SDV	MAX	P90	Min Date
EA006.00	CA	30	2.9	0.46	150	11.3	1/24/2018

Recommendation for Future Work

Water quality station EA14 (Carpenter Cove) meets approved standards at end of year 2022 and will be evaluated for a possible upgrade in 2023. No stations in growing area EA required a downgrade due to end of year 2022 P90 scores.

Table 7. Count table of samples collected in growing area EA during the 2022 season.

Station	Class	Closed	Open	Total	Samples Required	Comments
EA001.00	A		6	6	6	
EA003.50	P	6		6	6	
EA005.00	P	6		6	6	
EA006.00	CA	1	6	7	6	
EA007.00	A		6	6	6	
EA009.00	A		6	6	6	
EA010.00	A		6	6	6	
EA011.00	A		6	6	6	
EA012.00	A		6	6	6	
EA013.00	A		6	6	6	
EA014.00	P	6		6	6	
EA014.90	A		6	6	6	
EA015.00	P	6		6	6	
EA015.50	A		6	6	6	
EA017.00	A		6	6	6	
EA019.00	A	15	6	21	6	

Station	Class	Closed	Open	Total	Samples Required	Comments
EA019.10	A		6	6	6	
EA019.13	A		6	6	6	
EA019.20	A		6	6	6	
EA019.23	A		6	6	6	
EA019.27	A		6	6	6	
EA019.38	A		6	6	6	
EA019.39	A		6	6	6	
EA019.42	A		6	6	6	
EA021.00	A		6	6	6	
EA023.00	CA		12	12	12	
EA024.00	CA		12	12	12	
EA026.00	A		6	6	6	
EA028.00	A		6	6	6	
EA029.00	CA		12	12	12	
EA031.00	CA		12	12	12	

References

National Shellfish Sanitation Program: Guide for the Control of Molluscan Shellfish, 2015 Revision;

Tide and Wind data, GOMOSS Internet site, West Penobscot Bay Buoy, 2001-2003.

Climatic and hydrographic information, US Coast Guard Coastal Pilot, 2005 edition

U.S. Food and Drug Administration (2001). Applied Concepts in Sanitation Surveys of Shellfish Growing Areas: Course #FD2042 (Training Manual), Volumes I and II.

Town information, 2007-2008 Maine Municipal Directory, Maine Municipal Association, Augusta, Maine 04330

Licensed discharge information, Maine Department of Environmental Protection, Augusta, Maine

Data Layers, Maine Office of GIS, Augusta, Maine

Rainfall data, National Weather Service, Caribou, Maine

Maine Combined Sewer Overflow 2016 Status Report, Maine Department of Environmental Protection, April 2017

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.
GM = 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, Approved standard is 31, Restricted standard is 163
Min_Date = oldest date sampled included in the calculations.
X = investigative station

Reference Material

An interactive map is available on the DMR website for reference. This map includes water quality station locations, end of year P90 scores, current classifications, and other information. Shellfish Closures and Aquaculture Leases Map | Department of Marine Resources (maine.gov)