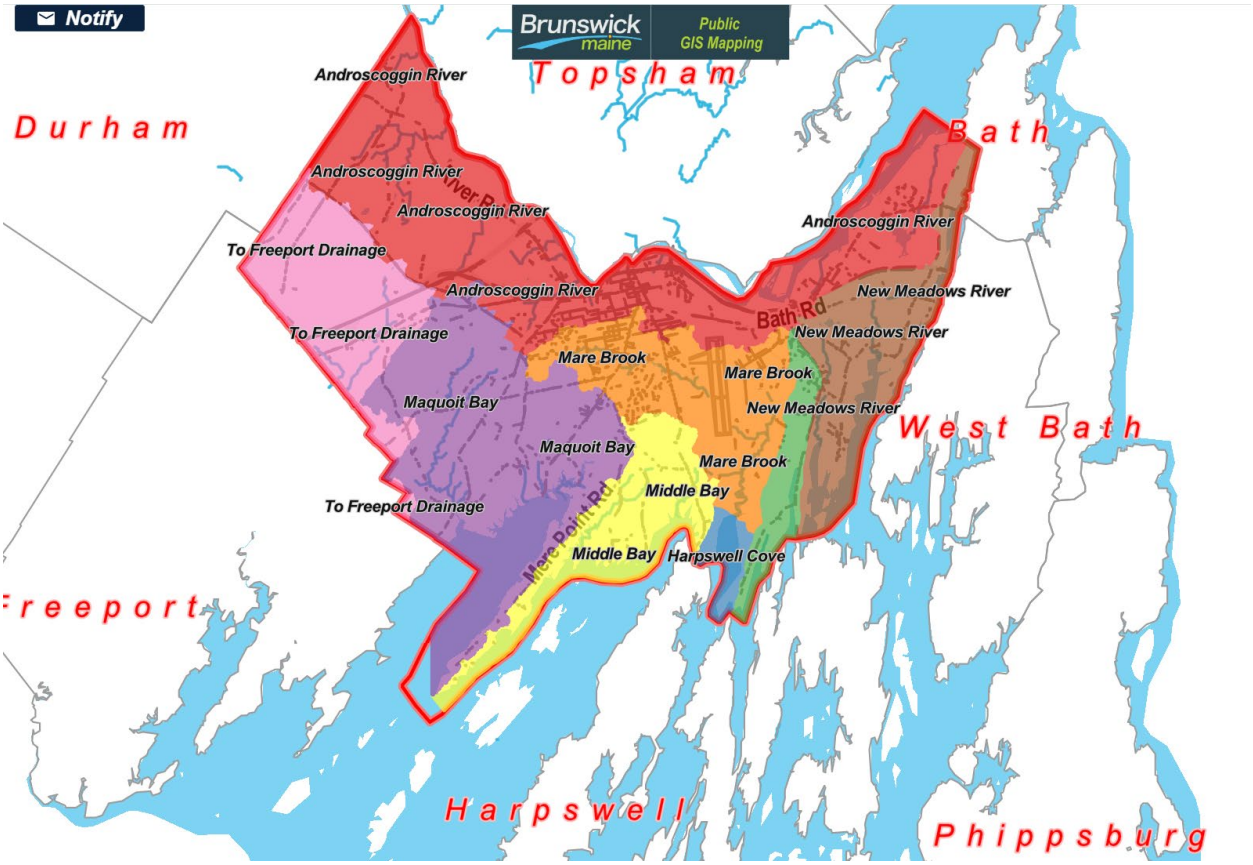
Maquoit & Middle Bay Water Quality
2025 Monitoring Plan
Shellfish Growing Area WJ



Introduction: Maquoit, Bunganuc, Mere Point and Middle Bays form part of an ecologically diverse estuarine complex in northern Casco Bay, situated near Brunswick (population 16,400) and Freeport (population 8,000), two of Maine's most developed towns.

These bays are separated by the Mere Point Peninsula and are recognized as areas of Statewide Ecological Significance due to their biodiversity importance and contain high concentrations of at-risk species and habitats. The diversity of habitats within the Maquoit and Middle Bay Focus Area provide for an extraordinary array of ecological values. This area includes several saltmarshes located at the head of Maquoit and Middle Bay. Spartina saltmarshes are considered a rare community type in Maine, although many examples occur on conservation land. Like many saltmarshes, the occurrences in Maquoit and Middle Bay were farmed for hay by early settlers. There are two major zones of vegetation within saltmarshes. The low marsh is located on the lower elevations that border the mudflats of the river and the drainage channels within the saltmarsh. This low marsh zone is dominated almost exclusively by saltwater cordgrass. There is a high marsh zone that is dominated by salt meadow cordgrass and black grass with a mix of other typical saltmarsh species including goose tongue, seaside goldenrod, sea milkwort, and sea lavender.

The area is defined to two local watershed Maquoit and Middle Bay. Maquoit Bay watershed being the biggest of all local watersheds in Brunswick. Maquoit Bay consists of 6258 acres of land that encompasses 1438 private parcels. Middle Bay Watershed is significantly smaller with 2222 acres of land and 541 private parcels.

The coastal marine region accounts for 1,075 acres of intertidal shellfish growing, of which approximately 500-700 acres productive for shellfish year to year. It is home to some of the most productive shellfish growing waters in Casco Bay. These attributes along with the historically expansive coastal bluffs, eelgrass meadows and salt marshes make this region incredibly important. These ecosystems provide critical habitats for commercially

significant species of fish and shellfish, migratory birds, waterfowl, fish, invertebrates, and other wildlife. The Town's support for increased land restrictions and progressive shellfish management have played a critical role in protecting these priceless ecosystems.

Historical and Geography

Historically, the surrounding land was dominated by large upland farms to the west, salt hay farming to the north, and seasonal camps on smaller lots along both sides of Mere Point Peninsula. Early on this area was used by Native Americans and locals as foraging area, remnants of shell heaps are often found buried deep along the shorelines. In recent years, development pressure has increased significantly, with seasonal camps being redeveloped into year-round homes and new residential developments expanding, particularly to the northwest and along the peninsula. Despite these pressures, conservation efforts by the Town and local organizations have successfully protected hundreds of acres of undeveloped land through purchases and protective easements.

Accessibility and Management

The bays are a shared resource, with no single entity holding ownership or full responsibility for their protection. Public access and resource management is facilitated by the Town. There are several public access points and public boat launches, which are critical for local shellfish harvesters to reach the mudflats. Over the past two decades, the Town of Brunswick has worked to improve water quality, shellfish populations, and public access to these waters. The town and DMR address substandard wastewater disposal systems, agricultural practices, and stricter land use standards in these zones, however, water quality continues to be a top priority for the town. Conservation projects in these areas consist of several different shellfish propagation and monitoring techniques.

Environmental Challenges

The upper intertidal zones have limited flushing capacity and are vulnerable to high nutrient loading, which increases the risk of harmful algal blooms and severe hypoxic events. The topography and complex coastal geology complicate overland pollution influence even more. Residents and officials have observed signs of a changing climate, including more frequent storm events leading to increased nutrient runoff and elevated ocean acidification. Coastal water temperatures are at their highest since the 1950s, coinciding with noticeable shifts in species distribution. Quahogs, blue crabs, and invasive green crabs are becoming more prevalent, while native soft-shell clams appear to be declining. These observations led to a local investment in development of management strategies aimed at propagating the more climate resilient hardshell clam (quahog) and conserving remaining softshell clam populations.

Furthermore, the eelgrass beds that once flourished within this region have receded to near extinction. While the exact reasons remain unclear, this decline may be tied to environmental changes, including warming waters, nutrients and pollution dynamics. The Town is committed to working with partners to identify stressors and work towards identifying and abating pollution sources.

Over the past few years, there has been a downward in trend water quality samples, likely leading to a downgrade in the current shellfish classification. These downgrades typically result in a significant loss of access by local fishermen to the shellfish resources, resulting in a loss of local revenue and jobs.

The Maine Department of Marine Resources Public Health Bureau is tasked with classifying shellfishing grounds using criteria set forth in the National Shellfish Sanitation Program. " The National Shellfish Sanitation Program (NSSP) is the federal and state cooperative program recognized by the U. S. Food and Drug Administration (FDA) and the Interstate Shellfish Sanitation Conference (ISSC) for the sanitary control of shellfish produced and sold for human consumption. The purpose of the NSSP is to promote public health protection and improve the sanitation of bivalve molluscan shellfish moving in interstate commerce through federal and state cooperation and uniformity of state shellfish programs. Participants in the NSSP include agencies from shellfish producing and non-producing states, the FDA, the EPA, the NOAA, and the shellfish industry. Under international agreements with the FDA, foreign governments also participate in the NSSP"

In accordance with the *NSSP Chapter IV. Shellstock Growing Areas* the MEDMR is required conduct random water quality sampling with defined shellfishing waters and provide a written evaluation, in the form of a sanitary survey report. This report includes an in-depth shoreline evaluation all actual and potential pollutions sources, which have a bearing on water quality. The last sanitary survey evaluation was done in 2019 and can be found here. It should be noted that upper Maquoit Bay is conditionally approved based on 1 inch of rain, already showing that Maquoit Bay water quality is influenced by upland stormwater runoff. These additional conditional harvesting restrictions can be found here.

Purpose: The purpose of this expanded investigation is to help identify any potential or actual sources that may be contributing to the increased bacteria loading Maquoit and Middle Bay have been experiencing. This includes additional fecal coliform monitoring through the Brunswick Sewer District as well as additional microbial source tracking by the University of New Hampshire. Microbial source tracking (MST) is a scientific method used to identify the origin of fecal contamination in water environments by analyzing specific microbes present in the feces of different animals, including humans, livestock, and wildlife, allowing investigators to pinpoint the source of pollution rather than just detecting the presence of generic bacteria indicating fecal contamination.

ME DMR Random Water Sample Collection: Warden Dan Sylvain conducts water quality sampling for the Maine Department of Marine Resources (MEDMR) Public Health Division at designated locations throughout the coastal waters of Brunswick. Sample dates are randomly selected in advance, with testing conducted monthly throughout the growing season (April through October), totaling six samples per location.

For this investigation, Warden Sylvain will employ the double sampling procedure for Microbial Source Tracking, as outlined below. One sample is sent to the MEDMR Public Health Bureau for the growing area classification program, while the second sample is sent to the Brunswick Sewer District for testing to determine total *E. coli* CFU (Colony Forming Units).

Samples are collected using aseptic techniques and are transported under standard cooling conditions, adhering to chain-of-custody protocols. If test results exceed the open-approved CFU threshold set by the NSSP (National Shellfish Sanitation Program), a subsample will be sent to the University of New Hampshire (UNH) for DNA analysis to identify the source species.

The following MEDMR water quality stations have been identified for double sampling protocols for microbial source tracking. Stations in red indicate growing area station locations that are positioned near shore and at the mouths of large drainage ravines or streams, requiring additional upland investigation into actual and potential pollution sources.

Middle Bay

Station WJ048.50 (Miller Creek)

Maquoit Bay

Station WJ027.30 (Freeport)
Station WJ031.50 (Bunganuc)
Station WJ032.50 (Western Field)
Station WJ033.20 (Northeast Maquoit)
Station WJ034.00 (Pulsifer Point)

Double Sampling Procedure for Microbial Source Tracking:

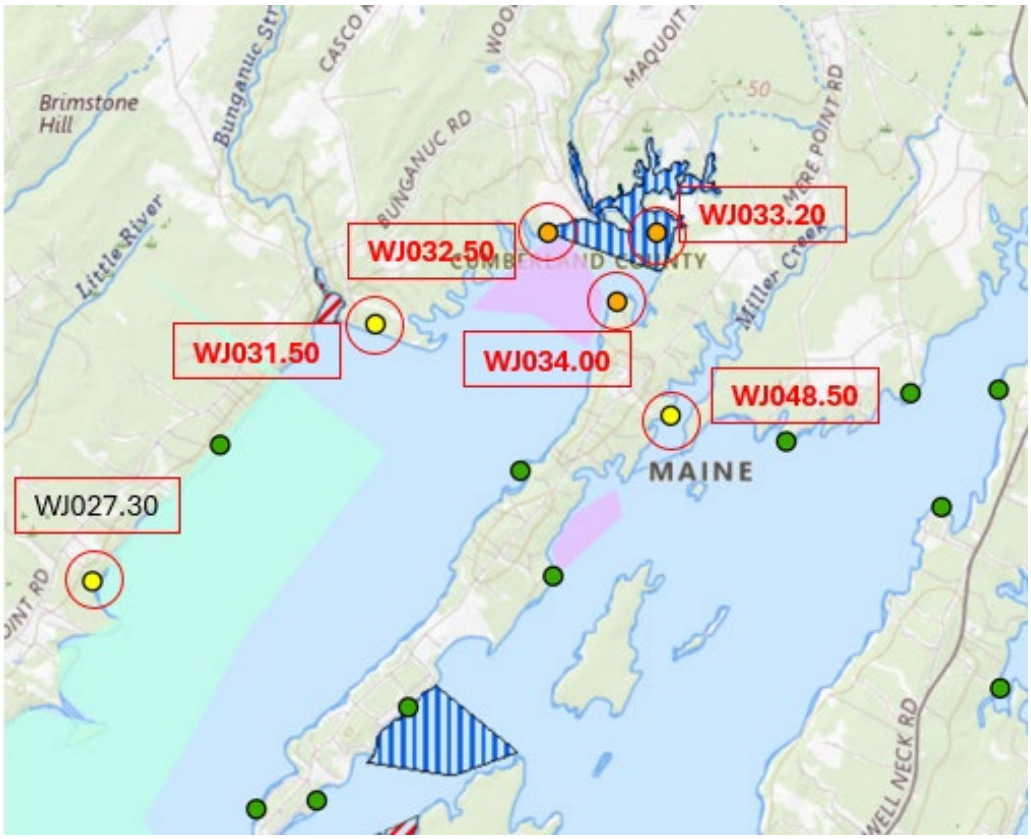
Equipment

1. Tongs
2. 100mL sterile Whirl Pak bags
3. 500ml sterile Whirl Pak bags
4. Sample rack
5. Cooler with calibrated thermometer

6. Field thermometer
7. Gel freezer packs
8. Nitrile gloves recommended

Procedure

1. Confirm the sample is being taken within a 300-foot radius of the designated site during a routine scheduled water quality run.
2. Label one 100mL sterile Whirl Pak bag with the standard DMR label information (growing area + station number, date, military time, and initials), and label the 500mL bag with any pertinent MST information.
3. Using the 500mL sterile Whirl Pak bag and tongs, take the water sample at a depth of 8 to 10 inches below the surface and fill bag with the amount necessary to satisfy the MST procedure plus 100mL for the DMR sample.
4. Shake the sample vigorously at least 25 times in a 12-inch arc in 7 seconds to homogenize sample.
5. Nitrile gloves are recommended at this step: Pour the water from the 500mL bag into the DMR labeled 100mL sterile Whirl Pak bag to the 100mL mark. a. Notes to prevent contamination: When transferring the sample to the 100mL bag, make sure to use the pull tabs to open the bags and avoid touching the opening. Make sure to avoid pouring the sample over the pull tabs during the transfer.
6. In the event of possible contamination, recollect the sample with new Whirl Pak bags.
7. Place the sterile sample bags in the cooler, ensuring the temperature is between 0-10°C.
8. Drop DMR samples off at a designated satellite fridge or schedule a pickup with a DMR staff member as usual.
9. Store or process MST sample as directed.
10. DMR will be in contact with sample score data (depending on tides, this could take around 48hrs). If sample is ≥31 CFU/100mL, it is recommended to continue on with the MST procedure for that sample.



Upland Assessments: Six distinct areas within the Maquoit & Middle Bay watershed have been identified as needing additional assessments upland and further up the watershed than MEDMR may target on their triennial sanitary surveys. Each of these areas is identified in the following pages.

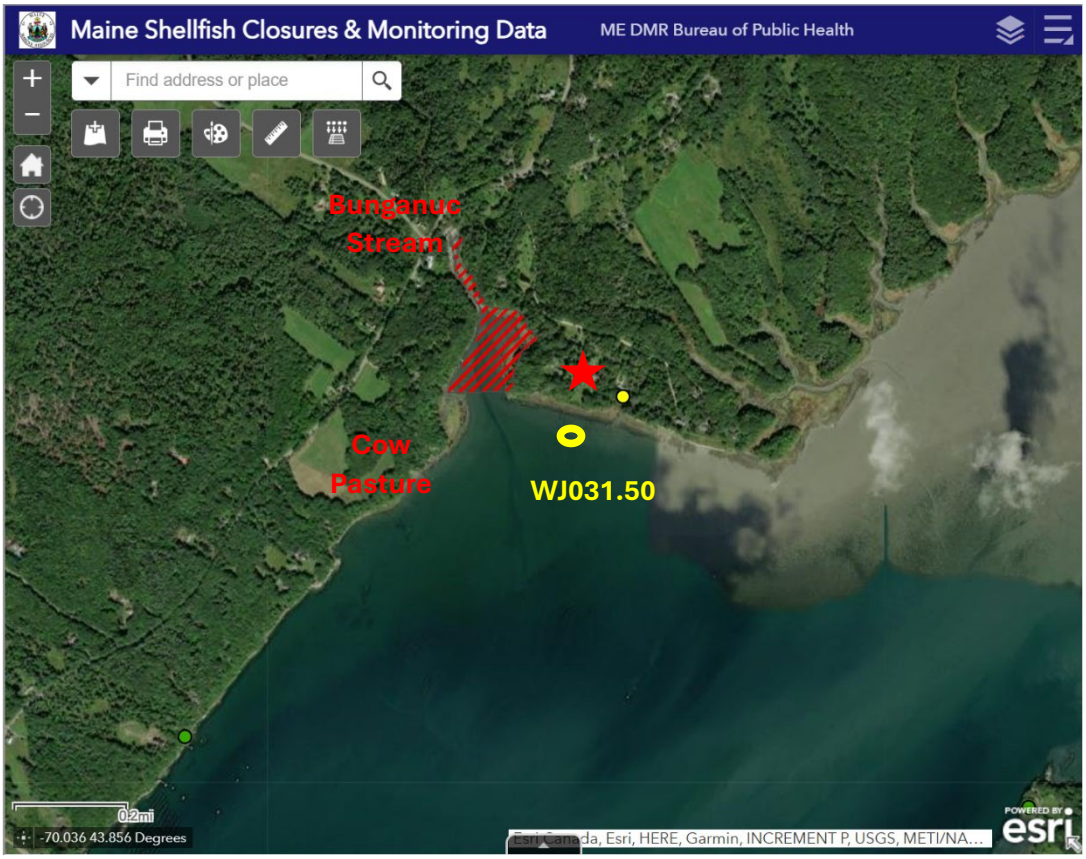
Wet Weather Water Sampling: Water samples will be collected using aspect techniques during Instances when there is an accumulation of more than .5 inches of rain within 24 hours. In certain circumstances it may be difficult collecting

samples for each wet weather event in 2025. In this case we will aim to collect a minimum of 6 samples at each site. April to October.

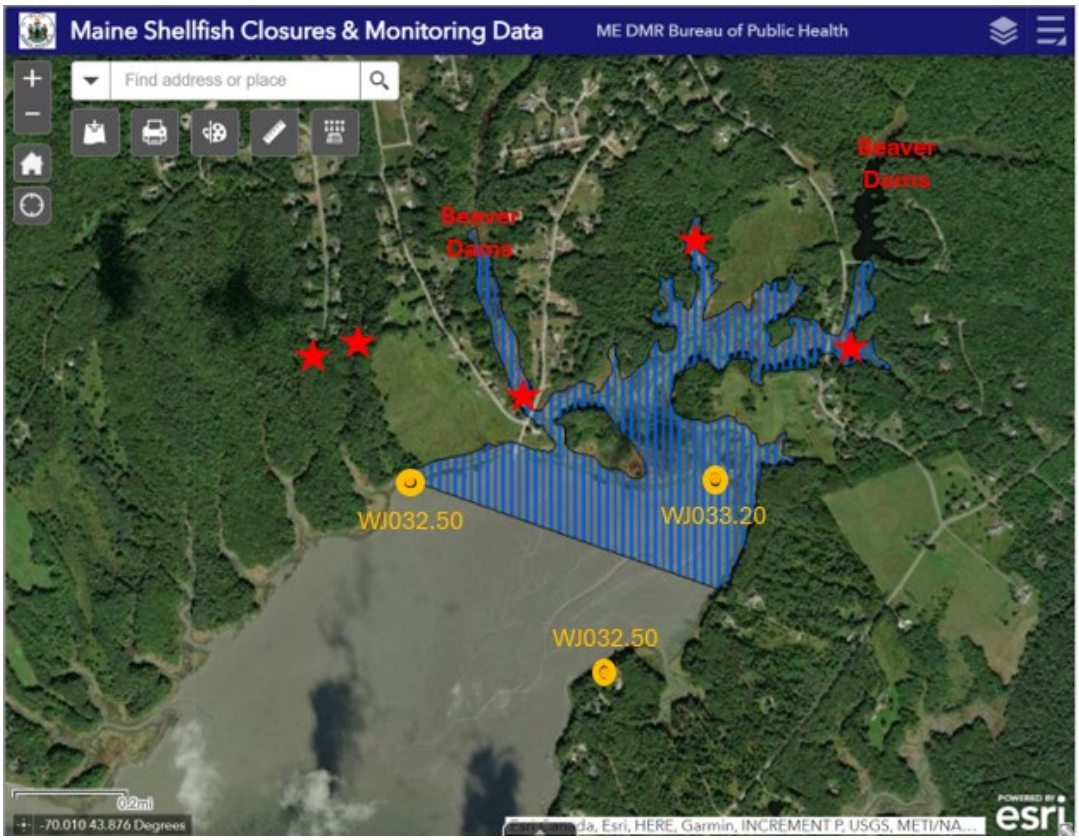
When upland water samples indicate higher CFU levels than shellfishing growing area open approved standards, a subsample will be sent to the University of New Hampshire (UNH) for DNA analysis to identify the source species.

Sample locations: Stations are noted with a red star on the map below.

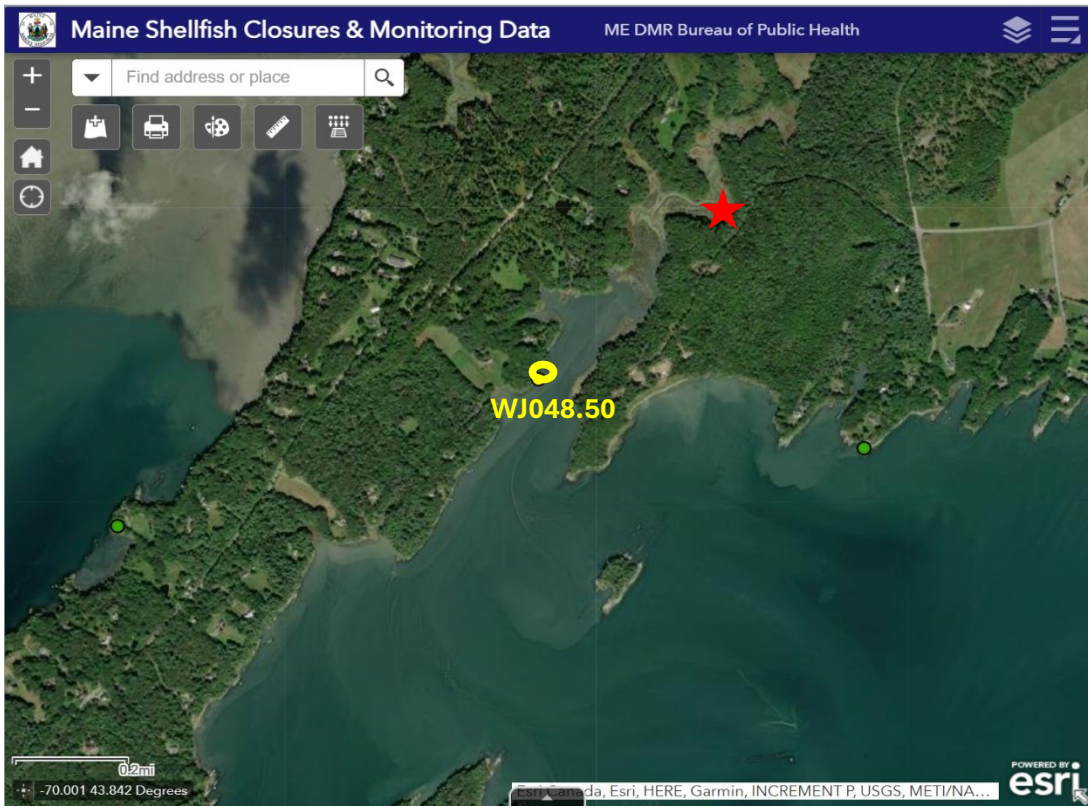
(1) **Bunganuc Landing:** This is a residential area characterized by steep coastal bluffs that are eroding at a rapid rate. It is believed that Bunganuc Stream, located to the northwest, contributes to negative water quality. Historically, this drainage area has been closed to harvesting shellfish due to water quality concerns. Cattle pasturing activities occur during the summer months atop the bluff on the western shoreline, potentially contributing to degrading water quality. A small stream adjacent to the water quality station WJ03150 will be sampled and analyzed to help determine any unforeseen impacts on coastal water quality. This is within the Maquoit Bay watershed.



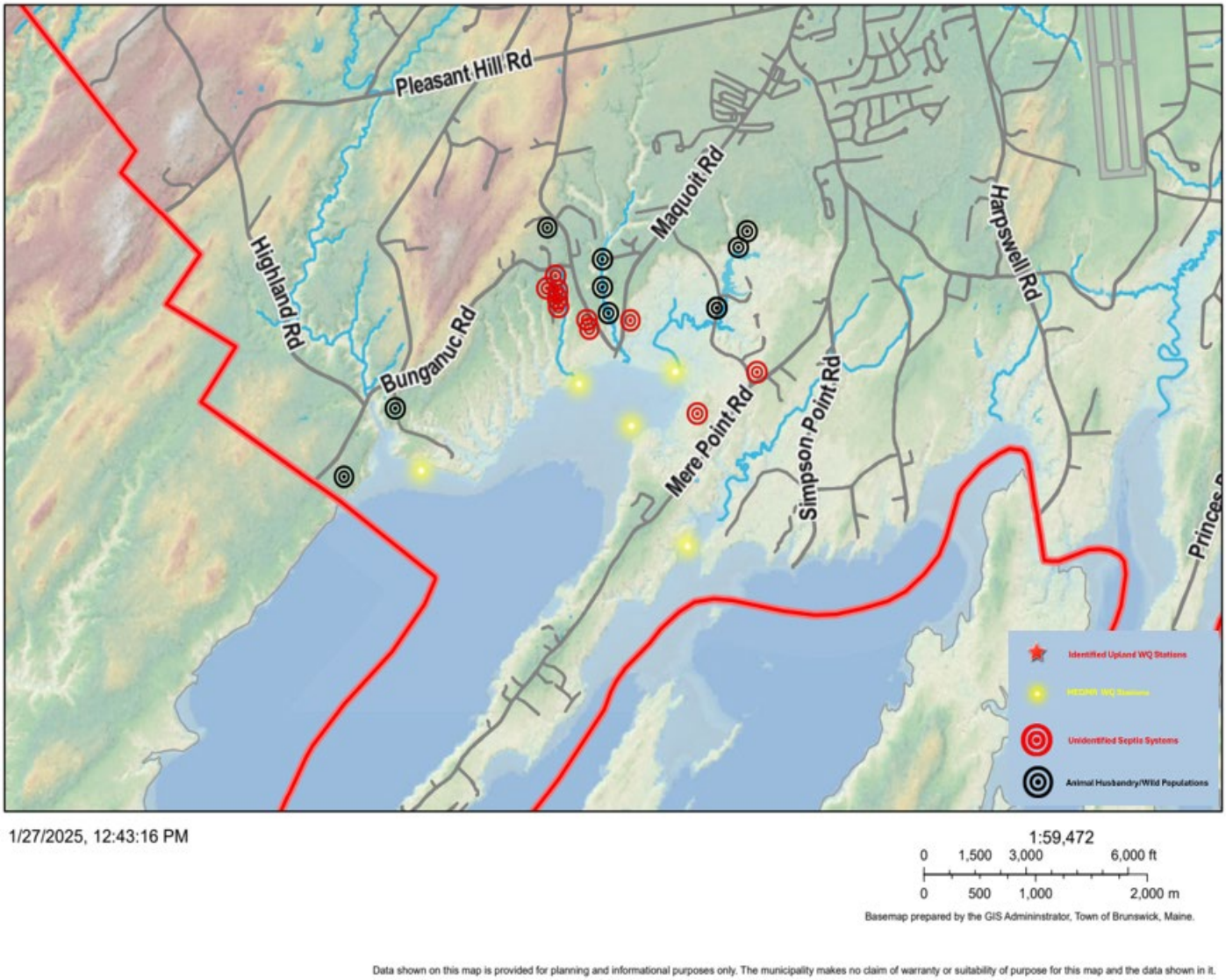
(2) **Northeast Maquoit Bay:** This residential area is defined by numerous homes situated along the head of the bay and extending down the Mere Point Peninsula. The region features steep coastal drainages, high ledges, and expansive salt marshes. In recent years, water quality has noticeably degraded at three DMR water quality stations: WJ032.50, WJ033.20, and WJ034.00. These stations have recorded higher CFU (colony-forming unit) levels, indicating poorer water quality. Northeast Maquoit Bay is also an important wildlife corridor and birding area, hosting diverse wildlife populations. This includes large flocks of migrating birds and extensive beaver activity, with dams present in upland streams and salt marshes. Five sampling areas have been identified within this region. Samples will be collected from each site during wet weather events and tested following the specified protocol in this report to further assess and monitor water quality.



(3) **Miller Creek:** This rural residential area shares similar coastal characteristics with Maquoit Bay and the Mere Point Peninsula. It is part of a local wildlife corridor and is considered a high-value waterfowl habitat. Miller Creek serves as the primary drainage area for the Middle Bay watershed. One specific site within this area has been identified for more in-depth testing. Samples from this site will be collected during wet weather events, following the sampling protocols outlined in this report.



Sanitary Survey Investigation



1/27/2025, 12:43:16 PM

1:59,472

0 1,500 3,000 6,000 ft

0 500 1,000 2,000 m

Basemap prepared by the GIS Admininstrator, Town of Brunswick, Maine.

Data shown on this map is provided for planning and informational purposes only. The municipality makes no claim of warranty or suitability of purpose for this map and the data shown in it.

A sanitary survey is a written evaluation report that examines all environmental factors, including actual and potential pollution sources, affecting water quality in a shellfish growing area. This watershed survey is specifically designed to identify pollution sources, both actual and potential. It is not intended to be solely used for the classification of shellfish growing areas.

As part of this survey, an in-depth desk review was conducted to assess all documented septic systems within the shoreland drainage area. Several septic systems near the degrading water quality stations lack proper documentation. These properties are marked with red circles on the map above and will be visited and inspected during the summer of 2025. Where necessary, additional testing—such as dye tracing—may be conducted to detect any fecal seepage into natural drainage areas.

The survey will also assess potential impacts from animal husbandry operations and concentrated wildlife populations that may contribute to water quality degradation in shellfish growing waters. Known domestic and wild animal areas are identified with black circles on the map above.

Budget

Sampling Budget

Brunswick Sewer District		$	Qty			
	Fecal Coliform Kit 98-29001-01 WQC-FC x 2	200	2		400	
	Colilert-18:98-08876-00-WP 0201-10 x 2 (20 per pack)	250	2		500	
	Quanti -Tray 2000: WQT-2K x 1 (100 per pack)	800	1		800	
	Labor -				0	
				SUB TOTAL	1700	
UNH Microbial Source Tracking	Detection Targets	$	Qty.			
	Presence/Absence PCR					
	Mammal or target choice	125	20		2500	
	Additional Targets	15	20		300	
	Detection Targets					
	Quantitative qPCR	25	20		500	
	Mammal or target choice	140	20		2800	
	Target Quanative Distinction	25	20		500	
				SUB TOTAL	6600	
Shipping & Supplies	ice packs/postage/boxes				750	
unforeseen expenditures	Unforeseen additional DNA anaylsis	150	10		1500	
				TOTAL COST	**10,550**	
*Figures are estimated based on the number of samples collected. The amount of samples is likely to change slighty once						
sampling begins.						

At the conclusion of this water quality investigation, we will understand specific impacts to the water quality and what species are contributing to the degrading water quality. The town should also be able to document any actual and potential pollution sources. A full report of the work conducted, and the sampling results will be available when by April 2026.

Supporting Documents

Double Sampling Procedure for Microbial Source Tracking:

Equipment

1. Tongs
2. 100mL sterile Whirl Pak bags
3. 500ml sterile Whirl Pak bags
4. Sample rack
5. Cooler with calibrated thermometer
6. Field thermometer
7. Gel freezer packs
8. Nitrile gloves recommended

Procedure

1. Confirm the sample is being taken within a 300-foot radius of the designated site during a routine scheduled water quality run.
2. Label one 100mL sterile Whirl Pak bag with the standard DMR label information (growing area + station number, date, military time, and initials), and label the 500mL bag with any pertinent MST information.
3. Using the 500mL sterile Whirl Pak bag and tongs, take the water sample at a depth of 8 to 10 inches below the surface and fill bag with the amount necessary to satisfy the MST procedure plus 100mL for the DMR sample.
4. Shake the sample vigorously at least 25 times in a 12-inch arc in 7 seconds to homogenize sample.
5. Nitrile gloves are recommended at this step: Pour the water from the 500mL bag into the DMR labeled 100mL sterile Whirl Pak bag to the 100mL mark.
    a. Notes to prevent contamination: When transferring the sample to the 100mL bag, make sure to use the pull tabs to open the bags and avoid touching the opening. Make sure to avoid pouring the sample over the pull tabs during the transfer.
6. In the event of possible contamination, recollect the sample with new Whirl Pak bags.
7. Place the sterile sample bags in the cooler, ensuring the temperature is between 0-10°C.
8. Drop DMR samples off at a designated satellite fridge or schedule a pickup with a DMR staff member as usual.
9. Store or process MST sample as directed.
10. DMR will be in contact with sample score data (depending on tides, this could take around 48hrs). If sample is ≥31 CFU/100mL, it is recommended to continue on with the MST procedure for that sample.

UNH Microbial Source Tracking Analysis Costs
Steve Jones- 254 Rudman Hall – UNH
2024

We use two types of assays- One (PCR) yields presence/absence results, the other (qPCR) is semi-quantitative.

The cost framework is based on capturing the major up-front (filtration†/DNA extraction) costs for each sample with identification of one pollution source, in most cases we recommend that being Mammal, but it could be any source. Conducting The Mammal assay allows us to confirm that fecal contamination related DNA is present. The cost for other targets beyond Mammal, or whatever is chosen as the initial source to be assayed, is on a per-target basis- see below:

†*If filtration is conducted by the client, then we would charge $5 less per sample. Filtration by clients should be run with 0.45-micron pore-size membrane filters and try to filter up to 300 ml. The filter can be stored in a sterile container (small vial) and frozen at -20°C until shipping.*

1. **Presence/Absence PCR**

Cost	Detection targets
$125	Mammal, or target of choice
$15/target	Human, Dog, Ruminant, Bird, Gull, Horse, Cow, Canada goose

2. **Quantitative qPCR**

Cost	Detection targets: $25 each
$140*	Mammal, or target of choice
$25 each	Human, Bird

*Subtract $115 if #1 presence/absence assay is conducted.

Total for one sample with all (PCR & qPCR) analyses: 125 + (8*15) + 75 = $320
Fecal indicator costs: fecal coliform (FC), E. coli (Ec) & Enterococci (Ent) = $40/sample; FC only = $23/sample

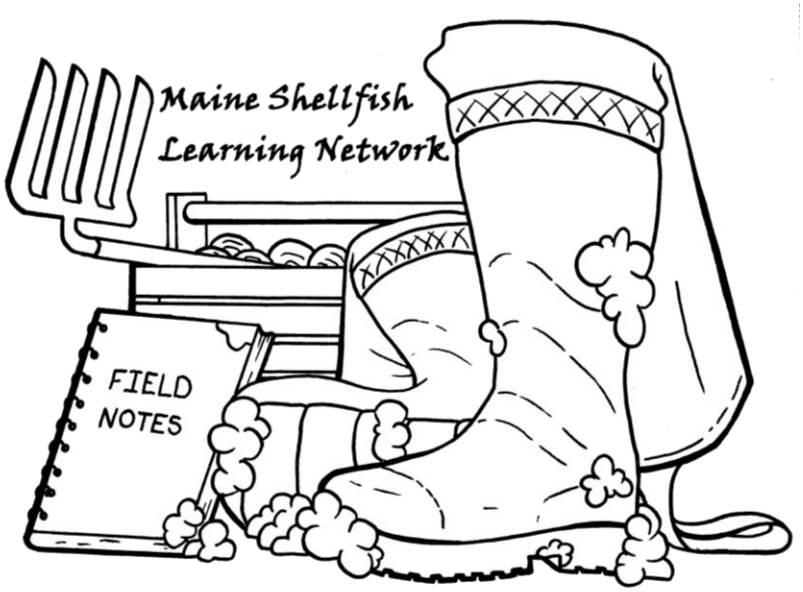
In many studies, the goal is to determine what types of fecal pollution sources are present, in which case PCR assays are run for the types of sources suspected of being in the study area. In other studies, determining the relative amount of a given source (Mammal, Human, Bird) in water samples may also be a goal. In those studies, qPCR analysis often follows positive PCR analyses for any of the three sources we include in qPCR assays. For the Human marker, EPA suggests a threshold result for Human qPCR results of 4200 copy number/100 ml above which they consider the sample to reflect unacceptable public health risk for that site/time.

Finally, we expect clients to ship or deliver samples to us so that we do not have to add transportation/shipping costs. Depending on the local situation, water samples can be shipped/delivered within a day of collection in coolers kept ≤45°/>32°F. If samples can be filtered locally, frozen filters can be shipped or delivered frozen in batches.

Please contact Steve Jones for more details:
Stephen.jones@unh.edu 603-862-5124

Brunswick Sewer Department

From: Rob Pontau
To: Daniel Devereaux
Cc: Jennifer Nicholson; Jason Prout; Emily Stone
Subject: Coliform Testing
Date: Wednesday, January 8, 2025 10:47:27 AM
Hi Dan,
The district is testing our water bath right now to ensure it will hold correct temps to incubate
the samples, but assuming that is good we will have the equipment needed in-house to run the
40 or so tests we discussed this morning. The town would need to purchase the supplies. I'd
recommend getting them directly from Idexx. Here is what is needed:
Fecal Coliform Kit: 98-29001-01 WQC-FC (~$200)
Colilert-18: 98-08876-00 WP 0201-10 (~$250 per 20 pack)
Quanti-Tray 2000: WQT-2K (~$800 per pack of 100)
Overall it would be around $1,500 for the supplies to run 40 tests.
Don't order anything until the spring so we can ensure the supplies don't expire before we get
to run the tests.
Let me know how it goes and if you'll be moving forward. We're happy to help.
Rob
Robert A. Pontau Jr., PE
General Manager
Brunswick Sewer District
*All emails associated with the Brunswick Sewer District are considered public information and subject to the State of Maine Freedom of
Access Act (FOAA).*
This email has been scanned



Water Quality Project Support Tool

Completed in collaboration from the Maine Shellfish Learning Network (MSLN)

Table of Contents

For questions about this workbook or how it works please contact:

Gabrielle Hillyer
gabrielle.hillyer@maine.edu

Bridie McGreavy
bridie.mcgreavy@maine.edu

Acknowledgements

There were many people involved in creating this document. First, the MSLN would like to thank all of the participants and partners at the September 2019 MSLN meeting who were able to highlight this need in the shellfish community and direct our focus. The MSLN would also like to thank Bryant Lewis (DMR), Geoffrey Shook (DMR), Meryl Grady (DMR), Brent Lawson (DHHS), Matt Randall (DACF), Pam Parker (DEP), and Kendall Marden (MDIFW) for all their help, guidance, and time spent on developing this workbook.

Introduction to Workbook

This water quality decision support tool functions as a guide for local communities in Maine who want to improve water quality scores and open closed clam flat areas. This is in no way a guarantee, however, this provides a realistic view of the multiple steps needed to reopen flats impacted by non-point source pollution and point-source pollution. It should be used as a guide to understand the complexity of water quality issues in Maine, and serve as a starting point for communities to understand what steps to take to try to mitigate those issues. This workbook is also available online, at the web address below.

https://mudflatsinmaine.wordpress.com/water-quality-decision-support/

The idea for this workbook was generated by a priority action item meeting held in September 2019 by the Maine Shellfish Learning Network (MSLN). At that meeting, it was determined that the number one priority for the MSLN should be connecting key actors in water quality decision making and shellfish project permit regulation. This is described in the snapshot from meeting notes below:

1. **Connect key actors in water quality decision making and shellfish project permit regulation.**

There are a number of people and organizations who need to be involved in decision making about water quality management and shellfish projects. Some of these actors have not been as involved in municipal and regional water quality projects to date, such as representatives from the Department of Health and Human Services (DHHS), the state plumbing inspector, representatives from the Department of Environmental Protection (DEP) and also possibly the Department of Agriculture. Further, the Army Corps of Engineers (ACOE) needs to be engaged to help facilitate a faster review process for the applied shellfish projects.

Addressing this action item, the MSLN convened a meeting between multiple state agency representatives to discuss the issue of water quality projects around the coast of Maine. From there, it was determined that the goal for the “Water Quality Group” should be to develop a decision support tree for communities, which progressed into this workbook, and subsequent online resources.

This workbook represents a collaboration between the MSLN, the Maine Department of Marine Resources (DMR), the Maine Department of Environmental Protection (DEP), the Maine Department of Health and Human Services (DHHS), the Maine Department of Inland Fisheries and Wildlife, and the Maine Department of Agriculture, Conservation and Forestry. Please visit each of their websites, listed below, for any additional information specific to these agencies.

The Maine Department of Marine Resources
https://www.maine.gov/dmr/

The Maine Department of Environmental Protection
https://www.maine.gov/dep/

The Maine Department of Health and Human Services
https://www.maine.gov/dhhs/

The Maine Department of Inland Fisheries and Wildlife
https://www.maine.gov/ifw/

The Department of Agriculture, Conservation and Forestry
https://www.maine.gov/dacf/

Using the Workbook

This workbook is a support document, meaning it should be a first step for communities to understand water quality issues. It is recommended that after reviewing this document thoroughly, shellfish committees should reach out to town offices for additional information, as well as their area biologists.

Information

The first few sections of this workbook describe what pollution is, possible sources for pollution, and what non-point and point source pollution means. It also describes the various governmental agencies involved in water quality work. As a starting point, there are many different resources to further describe each of these themes in detail, particularly governmental websites (previous page).

Pollution Help

Later sections describe steps communities can take to find and fix pollution sources. It should be noted there is no guarantee clam flats will be reopened after completing these steps. However, these have proven success in towns like Waldoboro, ME. This process can be long, over many years, and there is no one-size-fits all solution. Instead, this is a loose guide which should help committees determine which projects could be profitable.

Pollution

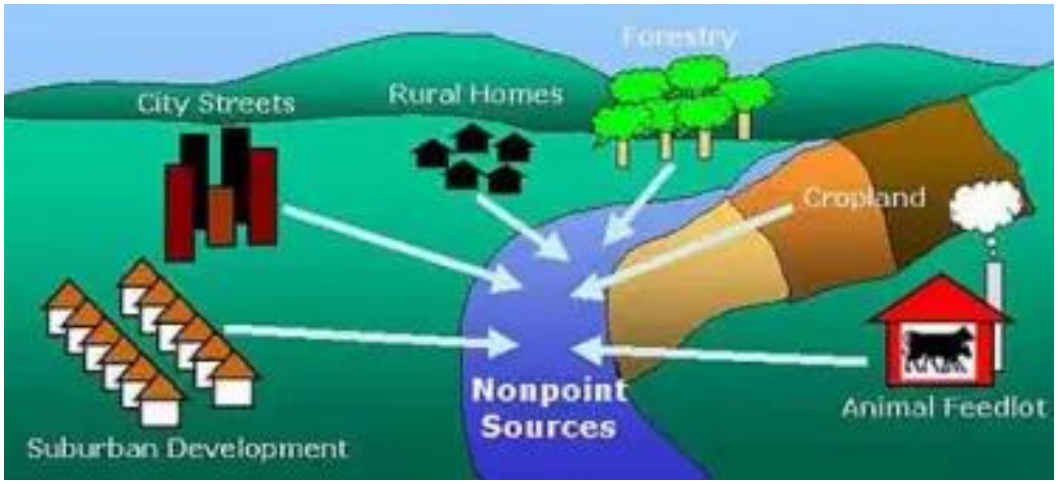
What is Pollution?

Pollution in this context is any material that is entering the river and increasing bacteria counts. The Department of Marine Resources (DMR) measures water quality throughout the year, taking samples from specific stations, and adjusting shellfish closures types from those samples.

Types of Pollution

Non-Point Source

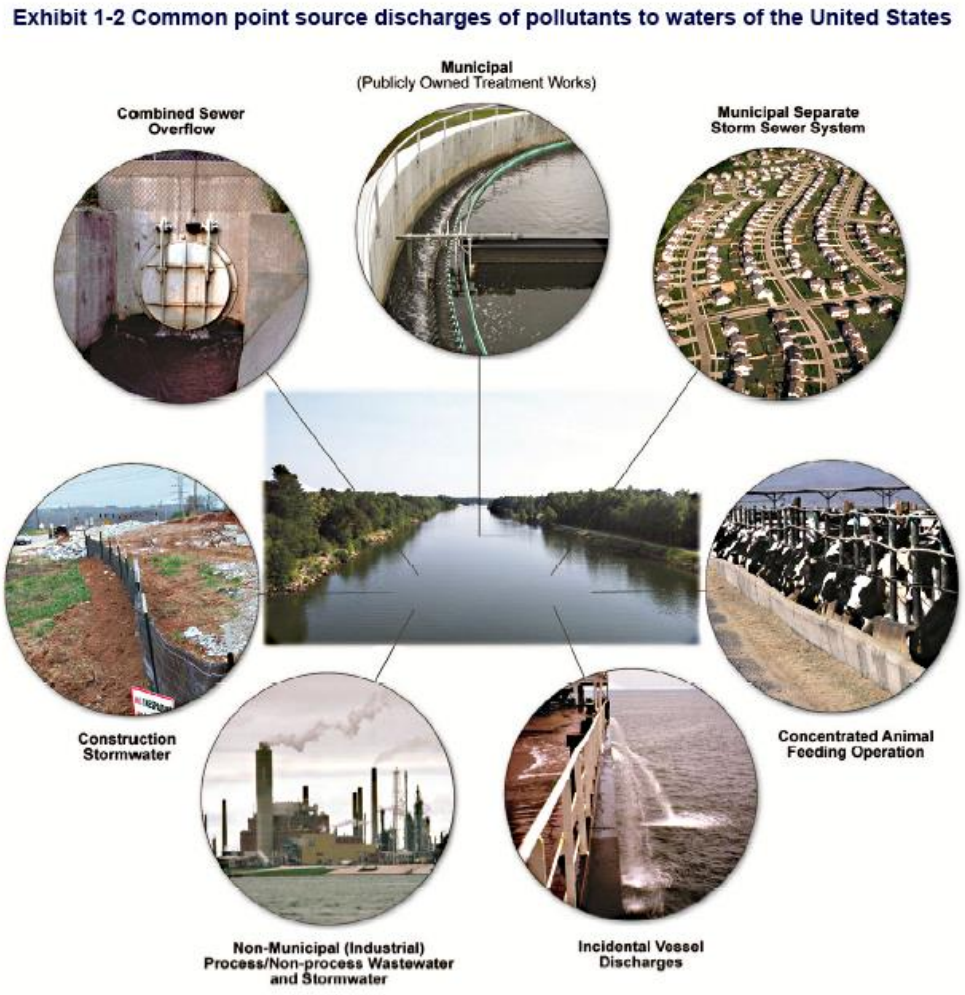
Non-point source pollution occurs as a result of runoff. Water runs through multiple spaces and picks up bacteria, animal waste, chemicals, and other harmful substances. This water then ends up in rivers and estuaries, impacting clam flats. This type of pollution is particularly difficult to manage because it comes from so many different places. The amount of harmful substances may be relatively low compared to point sources. After further exploration in an area where the source of pollution is unknown, it is possible to find a point source, which is described in the next section. For example, if one cove has pollution problems, a shoreline survey in the area can lead to the discovery of a broken sewer system from a nearby home. The picture below describes non-point source pollution, and how it can be very difficult to determine where it is coming from.



https://oceanservice.noaa.gov/education/tutorial_pollution/welcome.html

Point Source

Point source pollution is any pollution that has an easily identifiable source. This pollution is usually easier to fix because you are able to monitor the source. Point source pollution can include drain pipes, ditches, sewer outfalls, factories, power plants, and others. There are multiple grants and state agency departments that can help once a point-source has been identified. Below, there is a diagram with common discharges of point source pollution in the United States.



U.S. Environmental Protection Agency, Washington, D.C. – U.S. Environmental Protection Agency, ***"NPDES Permit Writers Manual."*** *EPA 833-K-10-001. p. 1-8.*
Photos depicting common types of ***point source*** *dischargers to surface waters in the United States. These facilities are required to obtain discharge permits from the* ***National Pollutant Discharge Elimination System*** *(NPDES).*

Who is Involved?

There are many different state agencies involved in water quality management. This short guide provides a bit of detail on each of the different agencies, people to contact for specific questions, as well as an outline of the responsibilities of each agency.

Shellfish Communities

There are over 60 coastal communities with shellfish ordinances in Maine. Generally, this requires the creation of the marine resource or shellfish committee, and a shellfish ordinance that discusses species harvested, specific localized restrictions, and licensing information. Shellfish communities are generally responsible for a lot of the leg work in terms of resolving water quality issues. This is done through extensive scientific projects, either increased water testing, surveying shorelines for any specific pollution problems or other methods.

State Agencies

The Maine Department of Marine Resources (DMR)

The DMR is an organization established to conserve and develop marine and estuarine resources and advise and cooperate with local, state, and federal officials concerning activities in coastal waters. The DMR oversees water quality testing and regulation, and makes decisions around water quality closures. The DMR also advises the Shellfish Advisory Council on different legislative proposals to State management.

The Maine Department of Environmental Protection (DEP)

The DEP is an organization focused on environmental protection. In shellfish management, DEP focuses on enforcement around rivers and sewage systems. Members of the DEP have often collaborated with towns to facilitate waste discharge restoration projects as well as others.

The Maine Department of Health and Human Services (DHHS)

The Department of Health and Human Services (DHHS) through the Maine Subsurface Wastewater Team, works to test and determine if subsurface sewage systems are depositing fecal coliform bacteria into nearby soils, estuaries, or rivers.

The Maine Department of Inland Fisheries and Wildlife (MDIFW)

The Department of Inland Fisheries and Wildlife (MDIFW) does not have any direct management over the soft-shell clam fishery or other coastal fisheries. However, they should be consulted if wildlife is determined to be the source of water quality issues, in order to find if remediation is possible. For example, if a town were to find a flock of geese or beaver dam were

creating a water quality issue, the MDIFW should be consulted to understand how to approach that problem.

The Maine Department of Agriculture, Conservation, and Forestry

The Department of Agriculture, Conservation and Forestry (DACF) does not directly manage the soft-shell clam fishery, but can help communities who believe water quality issues can be attributed to agriculture. This is rarely the case, however, this agency works well in devising plans with community members and farmers to create workable solutions.

Water Quality Management

How is water quality managed in the State of Maine? In the fields below, the MSLN hopes to provide some general information on policy regarding water quality, shellfish area closures, and different state and national programs.

Water Quality Management in Maine

National Shellfish Sanitation Program

The National Shellfish and Sanitation Program (NSSP) was developed at the federal level from the U.S. Food and Drug Administration, and created a series of nationwide laws which protect consumers from any shellfish contaminated with pollution.

Maine Department of Marine Resources

The Maine Department of Marine Resources (DMR) oversees the application of the NSSP within the context of Maine's shellfishery. Specifically, the DMR monitors for biotoxins such as "red tide", and water quality. The DMR assigns stations within mudflats and samples water at each station on an annual basis. Each water sample is tested for fecal coliform bacteria, a variety of bacteria that come from fecal pollution in the water. These scores are then processed within a p90 statistical analysis. This analysis takes 90% of 30 individual tests and assigns a final score. 30 individual tests at a station usually means about 5 years of testing. Depending on the score, the DMR will close, open, or conditionally open clam flat areas.

Types of Closures

As stated in the section above, there are multiple types of closures depending on the final score from the p90 of a station. Below, we describe each of these closures. Colony forming units (CFU) of fecal coliform bacteria are measured from water samples taken by the DMR. Closures are then determined based on these numbers.

Prohibited

A Prohibited closure means that the final p90 score is greater than 163 CFU/100 mL. This number is derived from the NSSP. Prohibited areas are not allowed to be fished in any capacity until the p90 drops lower than 163 CFU/100mL. There are also prohibited areas that are policy closures due to the presence of point source pollution, for example a dilution area around a marina or active overboard discharges. In the map above, these are areas in red.

Conditional

Conditional approved or conditionally restricted areas are areas that can be temporarily closed based on environmental conditions that can be managed. For example, in Maine, conditional closures can be managed based on rainfall, season, the presence of a marina, astronomical high tides, or river flow. Runoff, in this instance, means when rainwater flows out to the river estuary and mudflats, carrying pollution. In certain areas across the coast, clam-meat studies were done in order to change the timing of closures. For example, in the Medomak River, conditionally approved areas are closed when rainfall meets or exceeds 1″ within a 24-hour period, and are closed for 9 days. In the map above, these areas are designated by a blue grid.

Flood Closure

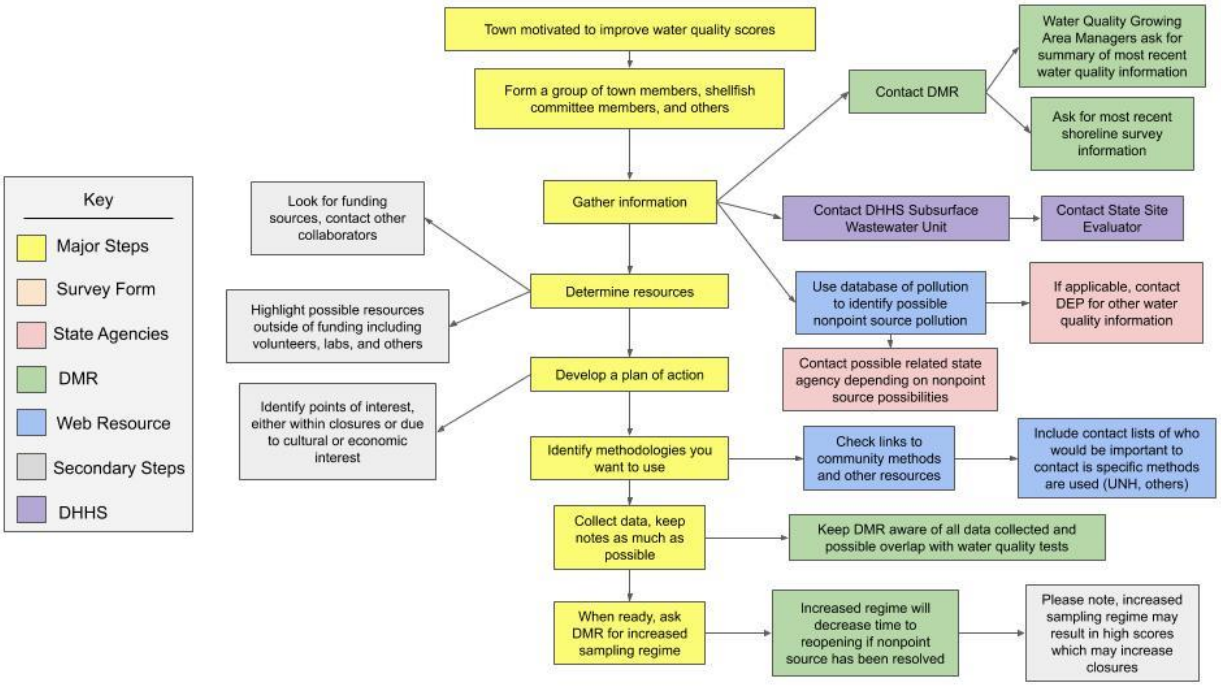
Flood closures close when rainfall meets or exceeds 2″ (5cm) in a 24-hour period due to the potential for fecal coliform pollution caused by runoff. This is a policy in Maine, so it happens throughout the state. Reopening after a flood closure is based on sampling by the DMR.

Restricted

These are areas that are greater than 31 and less than 164 CFU / 100mL, but you are able to harvest with a special DMR permit for depuration digging. In the map above, these areas are designated with a green grid.

Non-Point Source Pollution Help

This guide is intended to help communities who are working to resolve water quality issues particular to non-point source pollution. The graphic below describes briefly the different steps a community would need to take to better understand pollution sources and possibly mitigate pollution closures.



This graphic highlights the major steps any community trying to help solve water quality issues should be taking. More details are posted below.

Steps To Take

This guide outlines 8 major steps for each community to take. This is by no means exhaustive, and it should be noted there is no guarantee for clam flats to be reopened if a community or group follows all of these steps.

Form a Team

Any effort to resolve non-point source pollution will be long and may span multiple seasons or even years. So, having a group of individuals who are invested and similarly motivated helps to keep the effort moving forward. For example, a team may include representatives from the shellfish committee, local municipal leaders, a member of the MSLN team, and other invested community members.

Gather Information

Before beginning any specific actions, the group should gather as much information as possible. This may include contacting multiple state agency representatives, involving local municipal managers, and researching a number of different document types. For a breakdown of information you may be looking for, please see our Water Quality Information Guide on page 13.

Determine Resources

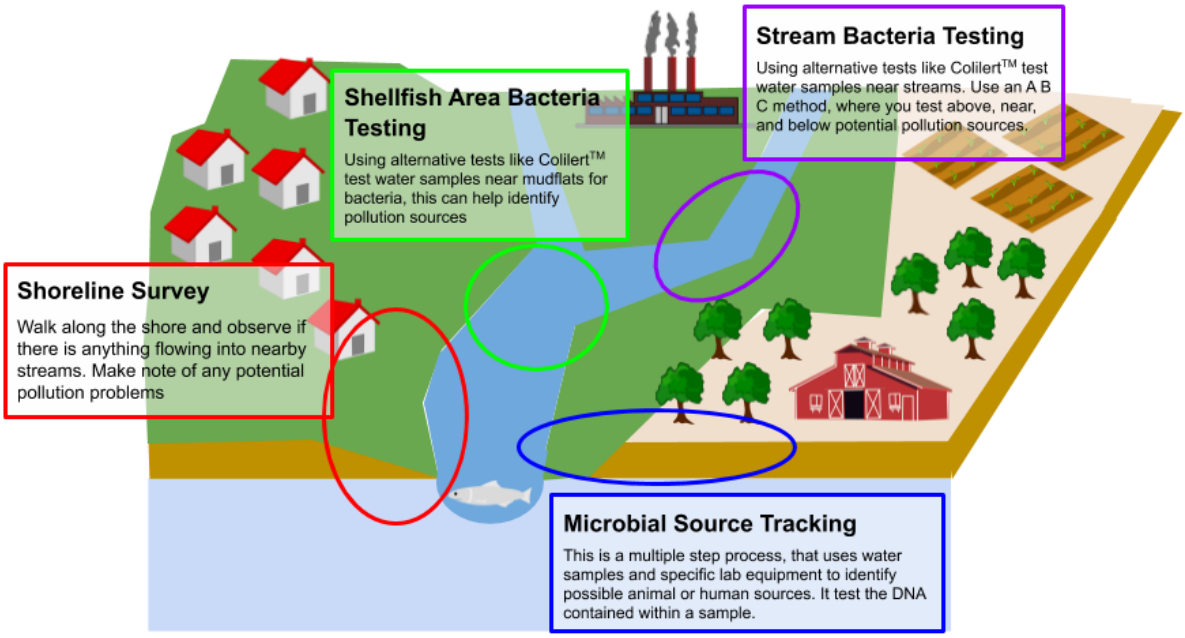
Resources are anything that can be used to a group's advantage, including funding, volunteers, laboratories and others.

Develop a Plan of Action

This is the major planning stage. The group should collectively identify areas of interest, or any area that is socially, economically, or culturally important to the group. The group should then follow the next step of understanding how to ascertain more information about the pollution problem, and fix it.

Identify Methodologies

There are so many different ways to find pollution problems out there. The MSLN has started gathering technical briefs, which are documents that identify multiple methods communities have used, and give details such as cost, time, etc. Below, we have outlined potential methodologies in specific areas around mudflats.



This graphic highlights where different techniques could be used for different water quality efforts. Please visit the Technical Resource page to find documents highlighting these different techniques.

Collect Data

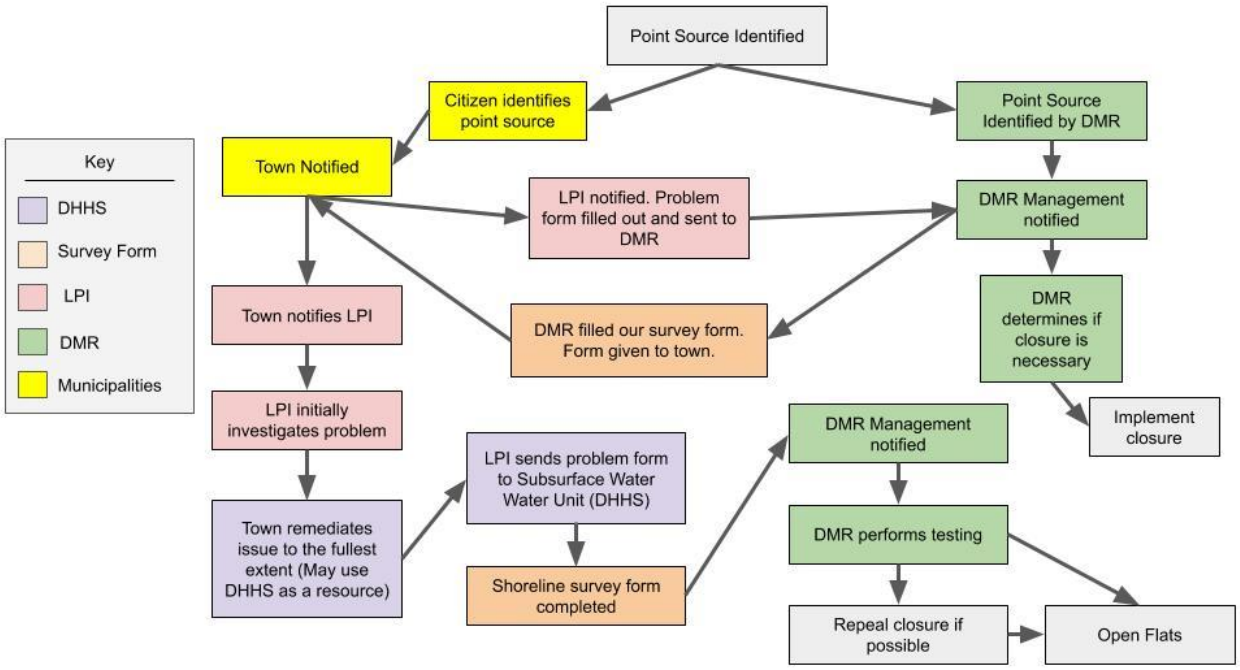
This stage is where you implement the plan of action. This can include multiple field days, extensive manual labor, or collaboration with various scientific institutions. During this stage, shellfish communities should contact their local DMR representative and keep them up to date during the data collection process.

Ask the DMR

If remediation work has been taken, DMR can be requested to take additional samples to more quickly replace pre-remediation scores in P90 calculations. This may decrease the time to reopen or reclassify a harvesting area if the non-point source has been resolved. Please note, an increased sampling may result in new high scores which may increase closures. DMR has limited capacity so these requests cannot always be met.

Point Source Pollution Help

This guide is intended to help communities who are working to resolve water quality issues particular to point source pollution.



This graphic highlights the major steps any community trying to help solve water quality issues should be taking. More details are posted below.

How are Point Source Pollution Sources Fixed?

This guide outlines how point sources are identified, how information is moved between the Department of Marine Resources (DMR), the town, the licensed plumbing inspector (LPI) and the Subsurface Wastewater Unit at the Maine Department of Health and Human Services (DHHS), and finally, how point sources can be remediated. This is by no means exhaustive, and there are many different ways to tackle this problem. This guide instead hopes to illuminate the decision making process around point sources.

Point Source Identified

Point source pollution is identified in one of two ways, either by a private citizen, or by the Department of Marine Resources (DMR) during a shoreline survey. If identified by a citizen, the issue is reported to town management, and then reported to the DMR. From there, in both instances, problem forms are generated by the DMR.

The Problem Form

A problem form is a detailed document outlining the cause of pollution (to the extent possible), the location of the cause, a general estimate of how long it has been there, and anything else pertinent to the cause. For example, if a straight pipe is found, a problem form would include where the straight pipe is, how large of a problem it is causing, and possible ways to fix it. The DMR fills out and sends the form to the town, who is then responsible for remediation.

Town and Licensed Plumbing Inspector

The town begins by contacting a state licensed plumbing inspector (LPI). This inspector works throughout the state, and is paid to investigate and get more details about the issue. With our example of the straight pipe, the LPI would visit the site, confirm what the problem form had said, and add any more details that can be discovered, such as where that straight pipe comes from.

Remediation

The town is responsible for remediation. This could include a lengthy process of fundraising, hiring construction crews, and is all highly dependent on the shape and extent of the pollution problem. Generally towns should try to consult with the LPI or the DMR before engaging in any specific remediation in order to make sure that it will in fact fix the problem. Another group the town can consult with is the Subsurface Water Unit at the Department of Health and Human Services (DHHS).

Subsurface Water Unit (DHHS)

The Subsurface Wastewater Unit at DHHS is a group of people who work with overboard discharge systems and other wastewater problems across the coast. They have a deep knowledge and understanding of potential remediation techniques, which will be effective, and to what extent the problem can be fixed. Towns should reach out to DHHS for their support and expertise throughout the process of remediation and if they have any difficulties with the LPI scheduling.

DMR - Testing and Revisiting

After remediation is performed to the fullest extent by the town, the town has to schedule another inspection with LPI to complete the problem form. The Subsurface Water Unit from DHHS can also complete the problem form. After this form is completed it needs to be sent to DMR water quality managers. When applicable, the DMR will revisit the site, perform a series of tests, and repeal closures if possible. This process can take a great deal of time, so it is important to keep the DMR, DHHS, and other organizations as up to date as possible as remediation continues.

Water Quality Information Types

This page is dedicated to providing communities with detailed information on the many sources of information around water quality in Maine. It should be noted, this is a guide that will be updated on a yearly basis with new contact information.

Shoreline Survey Information - DMR

Shoreline Survey information is recorded survey information generated every few years by the Department of Marine Resources. There should be detailed notes on areas surrounding tidal areas and clam flats. These notes contain information about any potential problems, wildlife in the area, along with general descriptions. Specific problem areas that are seen during surveys are generally written up in problems forms and submitted by the DMR to the town office. This information is a great starting point for communities to get a better lay of the land on understanding issues in the area.

P90 Scores - DMR

P90 scores are scores generated from water tests taken by the Department of Marine Resources. Each water sample is taken and tested for bacteria (fecal coliform). Based on the amount of bacteria in the sample, the sample is given a score. These scores are averaged over a multi-year period to generate closure areas (prohibited, conditional, open, and restricted). High scores mean there are large amounts of bacteria in the water at the time of sampling. Looking at these scores should give a community an idea about hot spots, or specific testing sites that have high scores. These areas are indicative of an issue, either a point source that most likely has been noted on a shoreline survey (see above) or a non-point source.

Tax Maps - DEP

These maps, along with others, can highlight where private land may influence coastal areas. This, along with an understanding of shoreline surveys and P90 scores can help shape studies to try and find and fix pollution.

Problem Forms - Town Manager’s Office

These are forms submitted to the town by the Department of Marine Resources to a town, outlining issues they have seen on shoreline surveys that require remediation. This remediation is a responsibility of the town, community, or shellfish committee to fix. After remediation has been performed, the DMR is able to test quickly and thoroughly for improvements to water quality scores.