Final Massachusetts Statewide Total Maximum Daily Load for Pathogen-Impaired Waterbodies

Appendix M: Mount Hope Bay (Shore) Coastal Drainage Area

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
Rebecca L. Tepper, Secretary
Massachusetts Department of Environmental Protection
Bonnie Heiple, Commissioner
Bureau of Water Resources
Kathleen M. Baskin, Assistant Commissioner

December 2024

CN 515.1.13

Final Massachusetts Statewide Total Maximum Daily Load for Pathogen-Impaired Waterbodies

Appendix M: Mount Hope Bay (Shore) Coastal Drainage Area

Prepared by:
TMDL Section, Watershed Planning Program
Division of Watershed Management, Bureau of Water Resources
Massachusetts Department of Environmental Protection

December 2024

CN 515.1.13

Suggested Citation
MassDEP. 2024. Final Massachusetts Statewide Total Maximum Daily Load for Pathogen-Impaired Waterbodies. CN 515.1, Massachusetts Department of Environmental Protection, Bureau of Water Resources, Division of Watershed Management, Watershed Planning Program. Worcester, MA.

Available Online

https://www.mass.gov/lists/total-maximum-daily-loads-by-watershed

Massachusetts Department of Environmental Protection

The mission of the Massachusetts Department of Environmental Protection (MassDEP) is to protect and enhance the Commonwealth's natural resources – air, water, and land – to provide for the health, safety, and welfare of all people, and to ensure a clean and safe environment for future generations. In carrying out this mission MassDEP commits to address and advance environmental justice and equity for all people of the Commonwealth; provide meaningful, inclusive opportunities for people to participate in agency decisions that affect their lives; and ensure a diverse workforce that reflects the communities we serve.

Watershed Planning Program

The mission of the Watershed Planning Program (WPP) in the Massachusetts Department of Environmental Protection is to protect, enhance, and restore the quality and value of the waters of the Commonwealth. Guided by the federal Clean Water Act, WPP implements this mission statewide through five Sections that each have a different technical focus: (1) Surface Water Quality Standards; (2) Surface Water Quality Monitoring; (3) Data Management and Water Quality Assessment; (4) Total Maximum Daily Load; and (5) Nonpoint Source Management. Together with other MassDEP programs and state environmental agencies, WPP shares in the duty and responsibility to secure the environmental, recreational, and public health benefits of clean water for all people of the Commonwealth.

Acknowledgements

FB Environmental Associates, under contractual agreements with MassDEP, previously prepared two separate documents for the Watershed Planning Program: (1) *Massachusetts TMDL for Pathogen-Impaired Inland Fresh Water Rivers* and (2) *Massachusetts Statewide TMDL for Pathogen-Impaired Coastal Waterbodies*. MassDEP combined these two documents into a single statewide approach encompassing both inland fresh water and coastal impairments to prepare the *Final Massachusetts Statewide Total Maximum Daily Load for Pathogen-Impaired Waterbodies*.

Disclaimer

References to trade names, commercial products, manufacturers, or distributors in this report constituted neither endorsement nor recommendations by the Massachusetts Department of Environmental Protection.

Contact Information

Watershed Planning Program
Division of Watershed Management, Bureau of Water Resources
Massachusetts Department of Environmental Protection
8 New Bond Street, Worcester, MA 01606
Website: https://www.mass.gov/guides/watershed-planning-program
Email address: dep.wpp@mass.gov

TABLE OF CONTENTS

1. Introduction

This appendix to the Massachusetts Statewide Total Maximum Daily Load (TMDL) for Pathogen-Impaired Waterbodies provides additional information to support the determination of the TMDL for the two pathogen-impaired segments in the Mount Hope Bay (Shore) Coastal Drainage Area, hereinafter referred to as the Mount Hope Bay (Shore) watershed (Figure 1-1). The core document and appendix together complete the TMDL for each of these pathogen-impaired segments.

This appendix includes a description of the watershed and maps to identify the segments of focus for the TMDLs; the impaired uses, and the water classification and qualifiers as designated by the Massachusetts Surface Water Quality Standards (SWQS, 314 CMR 4.00); the water quality standards applicable to the impaired uses; the data supporting the pathogen impairment determination; and a description of the sources of pathogen loading with supporting maps.

This appendix also includes a summary of the allocation of the current indicator bacteria load into two categories: point sources (waste load allocation, WLA) and nonpoint sources (load allocation, LA), based on an analysis of watershed percent impervious cover. This appendix identifies the percent reduction in indicator bacteria pollutant load from current conditions required to meet the TMDL, based on the highest levels of indicator bacteria recorded in the monitoring data, if applicable. The TMDLs for the two Mount Hope Bay (Shore) segments were calculated with the flow-based equation. Refer to Tables 1-1 and 1-2.

Finally, for each impaired segment, this appendix presents existing local management efforts to reduce pathogen pollutant loading. General recommended next steps for implementation of this TMDL are provided in the Mount Hope Bay (Shore) Watershed Overview section.

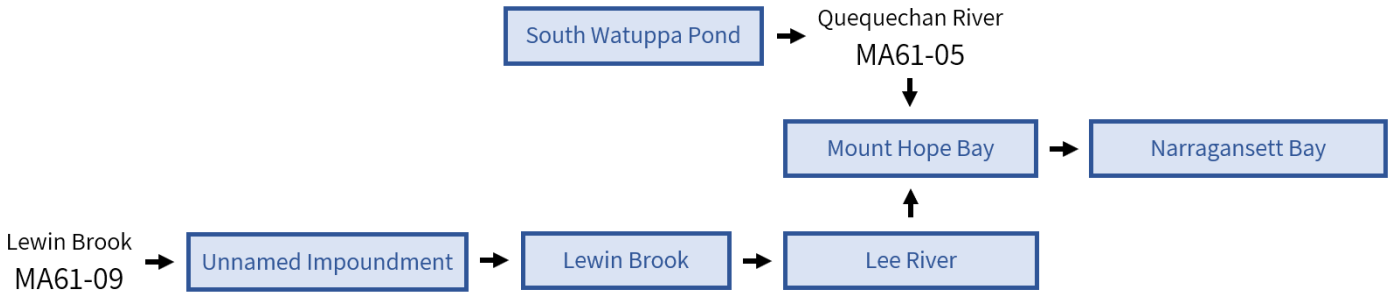


Figure 1-1. Conceptual diagram of water flow through the Mount Hope Bay (Shore) watershed for the two pathogen-impaired segments. Connections between waterbodies are shown with black arrows. Not to scale. Impaired segments are shown with the assessment unit.

Table 1-1. ***E. Coli*** Total Maximum Daily Loads (TMDLs), the percent reductions needed to meet the TMDL target (126 CFU/100ml) based on the Massachusetts Surface Water Quality Standards (SWQS), and the flow-based TMDL allocations for pathogen-impaired **freshwater** assessment units in the Mount Hope Bay Coastal Drainage Area

Waterbody & Assessment Unit	Class (Qualifier)	TMDL Type	SWQS-Based TMDL target (CFU/100ml)	Maximum Geomean (CFU/100ml)	Geomean Percent Reduction	TMDL Allocation	*Flow (cfs)* 1	10	100	1,000	10,000	100,000
							Flow-Based Target TMDL (CFU/day*10^9)					
Quequechan River		R	126	80	-	WLA (17%)	0.5	5.1	51.3	512.7	5,127.1	51,270.7
MA61-05	B (WW, CSO)			(30 day)		LA (83%)	2.6	25.7	257.0	2,570.0	25,699.7	256,997.3
Lewin Brook		R	126	303	58%	WLA (5%)	0.2	1.7	16.5	165.4	1,654.0	16,539.8
MA61-09	B			(90 day)		LA (95%)	2.9	29.2	291.7	2,917.3	29,172.8	291,728.2

Table 1-2. **Enterococci** Total Maximum Daily Loads, the percent reductions needed to meet the TMDL target (35 CFU/100ml) based on the Massachusetts Surface Water Quality Standards (SWQS), and the flow-based TMDL allocations for pathogen-impaired **freshwater** assessment units in the Mount Hope Bay Coastal Drainage Area

Waterbody & Assessment Unit	Class (Qualifier)	TMDL Type	SWQS-Based TMDL target (CFU/100ml)	Maximum Geomean (CFU/100ml)	Geomean Percent Reduction	TMDL Allocation	*Flow (cfs)* 1	10	100	1,000	10,000	100,000
							Flow-Based Target TMDL (CFU/day*10^9)					
Quequechan River		P	35	NA	-	WLA (17%)	0.1	1.4	14.2	142.4	1,424.2	14,241.9
MA61-05	B (WW, CSO)					LA (83%)	0.7	7.1	71.4	713.9	7,138.8	71,388.1
Lewin Brook		P	35	NA	-	WLA (5%)	-	0.5	4.6	45.9	459.4	4,594.4
MA61-09	B					LA (95%)	0.8	8.1	81.0	810.4	8,103.6	81,035.6

Class *defined in the Massachusetts Surface Water Quality Standards (SWQS) at 314 CMR 4.02.*
Qualifiers *that identify segments with special characteristics are defined at 314 CMR 4.06(1)(d).*
CSO *= Combined Sewer Overflow; waters identified as impacted by the discharge of CSOs without a long-term control plan approved or fully implemented*
WW *= Warm Water; waters that meet the warm water fisheries (WWF) definition at 314 CMR 4.02 and are subject to WWF dissolved oxygen and temperature criteria*
Pathogen bacteria units are presented in colony-forming units or CFU per 100 milliliter or ml.
TMDL Type *identifies the restorative or protective action approach:*
R *= Restorative TMDL addressing a pathogen impairment identified in the 2018/2020 Integrated List of Waters*
R* *= Restorative TMDL addressing a historic impairment of former indicator bacteria for which no current applicable criteria are available See Section 2.3 of the core document for summary of water quality criteria and designated uses.*
P *= Protective TMDL addressing all applicable uses, regardless of impairment status, for the associated pathogen (refer to the Massachusetts SWQS: 314 CMR 4.00)*
Target TMDL or Total Maximum Daily Load is presented as both SWQS-Based and Flow-Based.
SWQS-Based TMDL Target *is the target concentration applicable to the TMDL pollutant indicator bacteria based on the Surface Water Quality Standards (314 CMR 4.00).* ***Flow-Based Target TMD****L is the target concentration (CFU/100mL) multiplied by the standard flow volume (cubic feet per second or cfs). See Section 4.2.2 in core document for full equation and conversion factors.*
Maximum Geomean *is the highest calculated 30- or 90- day rolling geometric mean for TMDL pollutant indicator bacteria associated with the segment.*
Geomean Percent Reduction *is the percent reduction from the highest calculated 30- or 90 day rolling geomean needed to achieve the target concentration. Percent reductions are for planning purposes only.*

2. Mount Hope Bay (Shore) Watershed Overview

The Mount Hope Bay (Shore) Watershed covers an area of approximately 118 square miles (mi^2) in southeastern Massachusetts and eastern Rhode Island (Figure 2-1). Major rivers in the watershed that drain into Mount Hope Bay include the Lees, Cole, and Kickamuit rivers. Major lakes in the watershed include North Watuppa Pond in Fall River that covers an area of 1,700 acres, and South Watuppa Pond in Westport that covers an area of 1,283 acres. The Taunton River also drains into Mount Hope Bay and is considered to be a separate watershed; it is situated entirely within Massachusetts (MassDEP, 2009).

Mount Hope Bay is an estuary that forms the northeast arm of the greater Narragansett Bay. The Bay is known for being a productive fishing ground for flounder, lobster, and shellfish. As such, the National Oceanic and Atmospheric Administration (NOAA) designated the area an Essential Fish Habitat due to its importance as a spawning and nursery area for many species (MassDEP, 2009).

The Mount Hope Bay (Shore) watershed overlaps a portion of six municipalities in Massachusetts and three municipalities in Rhode Island. Of the six in Massachusetts, the majority of the city of Fall River and the town of Swansea are located within the watershed, and small portions of Dighton, Rehoboth, Somerset, and Westport lie therein. See Figure 2-1 for a map showing impaired segments and watershed municipalities.

All municipalities in the watershed operate and maintain municipal separate storm sewer systems (MS4s) in urban areas. The networks of drains and pipes in MS4 systems convey polluted runoff from streets and developed areas to waterbodies. In addition, these networks are sometimes subject to direct wastewater inflows through illegal cross-connections, leaks from sewer pipes or septic systems, dumping, or other unauthorized wastewater sources, and together these sources are termed illicit discharges.

EPA and MassDEP jointly issued the General Permits for Stormwater Discharges from MS4s, which became effective on July 1, 2018, with modifications effective on January 6, 2021. Communities that discharge to pathogen-impaired waterbodies with approved TMDLs are required to implement enhanced best management practices (BMPs) for public education and designate the catchments as Problem Catchments or High Priority under the Illicit Discharge Detection and Elimination (IDDE) Program, in addition to the MS4 requirement to reduce pollutants to the Maximum Extent Practicable (USEPA, 2020).

The geographic range of one Regional Planning Agency (RPA) includes the Mount Hope Bay (Shore) watershed. RPAs are public organizations advising municipalities, private business groups, and state and federal governments on a range of matters. Their research, coordination and technical assistance are especially valuable in addressing watershed-level issues such as pathogen pollutants and stormwater that cross town boundaries. The one Mount Hope Bay (Shore) watershed RPA is:

- Southeast Regional Planning & Economic Development District (SRPEDD; SRPEDD, 2022)

The following RPA initiatives and tools utilized in the Mount Hope Bay (Shore) watershed are especially noteworthy:

- SRPEDD assists in developing watershed management plans for waterbodies in the region (SRPEDD, 2022)
- SRPEDD is involved in watershed enhancement in the (upstream) Taunton watershed through a grant from the Southeast New England Coastal Watershed Restoration Program (SNEP).

Beyond these activities, the Massachusetts Statewide Municipal Stormwater Coalition (MSMSC), composed of about 10 stormwater groups around the state, further coordinates with and assists municipalities on pathogen pollutant concerns through their “Think Blue” campaign (Think Blue Massachusetts, 2019).

Additional watershed-scale initiatives are carried out by several organizations, including:

- **EPA Southeast New England Program (SNEP)** whose mission is to “foster collaboration among regional partners across southeast New England's coastal watersheds to protect and restore water

quality, ecological health, and diverse habitats by sharing knowledge and resources, promoting innovative approaches, and leveraging economic and environmental investments to meet the needs of current and future generations" (USEPA, 2022).

- **Narragansett Bay Estuary Program** (NBEP) whose mission is to "catalyze scientific inquiry and collective action to restore and protect our water quality, wildlife, and quality of life" (NBEP, 2022)
- **Save The Bay** (STB) is an independent, nonprofit organization whose mission is "to protect and improve Narragansett Bay" (STB, 2022).
- **Trout Unlimited (TU)** operates two chapters in the geographic area of the Mount Hope Bay watershed in Massachusetts, including the Narragansett and Southeastern Mass (SEMASS). Their mission is to conserve, protect and restore our country's coldwater fisheries and their watersheds; some of their activities include river cleanups, scientific assessments (e.g., trout habitat, culvert connectivity) and restoration projects (TU, 2022).

The following actions by identified stakeholders will help reduce pathogen loads to the impaired segments. The list represents a starting point and is not intended to be comprehensive. For a more detailed discussion of pollutant reduction actions, see Section 5, "Implementation" of the Pathogen TMDL core document.

- **Municipalities:** Continue to implement the MS4 permit, which includes specific requirements for waterbodies with an approved Bacteria/Pathogen TMDL, such as prioritization and reporting, enhanced BMPs, IDDE, and education (USEPA, 2020).
- **Regional Planning Agencies (RPAs) and municipalities:** Continue and expand collaboration on MS4 and stormwater issues. Cooperatively develop tools and share knowledge to reduce costs, increase innovation, and generate consistent and effective stream restoration efforts at the watershed scale.
    - Two tools developed by MAPC are potentially valuable in all MS4 communities across the state; municipalities and other RPAs (with permission from MAPC) should consider adapting and/or expanding these tools in their area:
        - Stormwater Utility/Funding Starting Kit (MAPC, 2014); and
        - a GIS toolkit to calculate MS4 outfall catchments, which is a requirement under the MS4 General Permit, created by MAPC and the Neponset River Watershed Association (MAPC, 2018).
- **USDA NRCS and landowners:** Develop comprehensive nutrient management plans for agriculture, reaching farmers through local connections.
- **Parks departments, schools, private landowners, and others** who maintain large, mowed fields with direct connections to surface water should consider maintaining a vegetated buffer along the shoreline. Buffers slow and filter stormwater runoff, provide a visual screen that can discourage large aggregations of waterfowl, and offer many other water quality benefits at low cost.

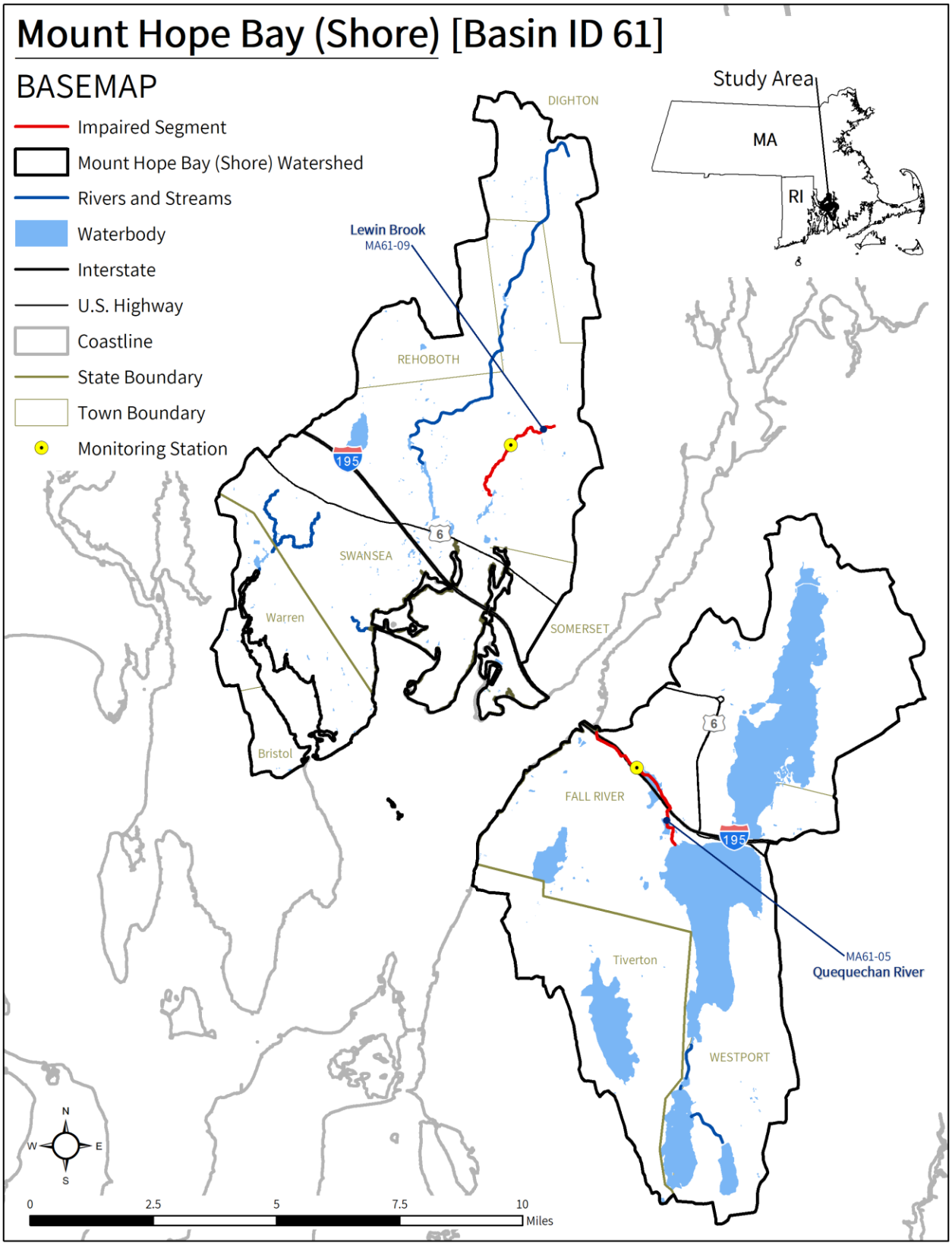


Figure 2-1: Map of all pathogen-impaired segments, water quality monitoring stations, municipal borders, waterbodies, and major roads in the Mount Hope Bay (Shore) watershed. Massachusetts municipalities are shown in upper case text while Rhode Island municipalities are shown in lower case text.

3. MA61-05 Quequechan River

3.1. Waterbody Overview

The Quequechan River segment MA61-05 is 2.4 miles long and begins at the outlet of South Watuppa Pond in Fall River, MA. The segment flows northwest before ending at its confluence with Mount Hope Bay at the mouth of the Taunton River (just upstream of the Braga Bridge) in Fall River, MA.

There are a few unnamed tributaries to the Quequechan River segment MA61-05. Lakes and ponds in the watershed include Devol Pond, North Watuppa Pond, Sawdy Pond, South Watuppa Pond, and Stafford Pond. Most of the segment flows through highly developed areas.

Key landmarks in the Rhode Island portion of the watershed include Tiverton High School; Tiverton Middle School; Tiverton Public Library; Bally's Tiverton Casino; Pocasset Cedar Swamp; and Basket Swamp Preserve. Key landmarks in the Massachusetts portion of the watershed include the city center of Fall River; Bishop Connolly High School, BMC Durfee High School, Bristol Community College, Diman Regional Vocational Tech High School; Charlton Memorial Hospital, Saint Anne's Hospital; Oak Grove Cemetery, Notre Dame Cemetery; Freetown-Fall River State Forest; Watuppa Reservation; and Headwaters Conservation Area. From upstream to downstream, segment MA61-05 is crossed by Brayton Avenue, MA-24, I-195 (three times), Quequechan Street, Plymouth Avenue, Fourth Street, Sullivan Drive, Third Street, South Main Street, Pocasset Street, Milliken Boulevard, Davol Street/MA-138, and Central Street, all in Fall River.

The Quequechan River (MA61-05) drains a total area of 30.2 square miles (mi^2), of which 24.0 mi^2 (80%) are located within Massachusetts. Of these 24.0 mi^2 in Massachusetts, 4.0 mi^2 (17%) are impervious and 2.7 mi^2 (11%) are directly connected impervious area (DCIA). The watershed is served by a public sewer system in Fall River[1]; and 57% of the land area in Massachusetts is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (USEPA, 2020). In Massachusetts, there are two additional NPDES

Reduction from Highest Calculated Geomean: NA

Watershed Area (Acres): 15,358

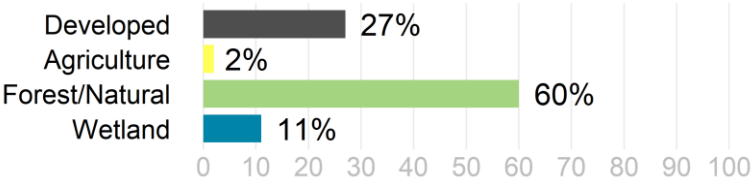
Segment Length (Miles): 2.4

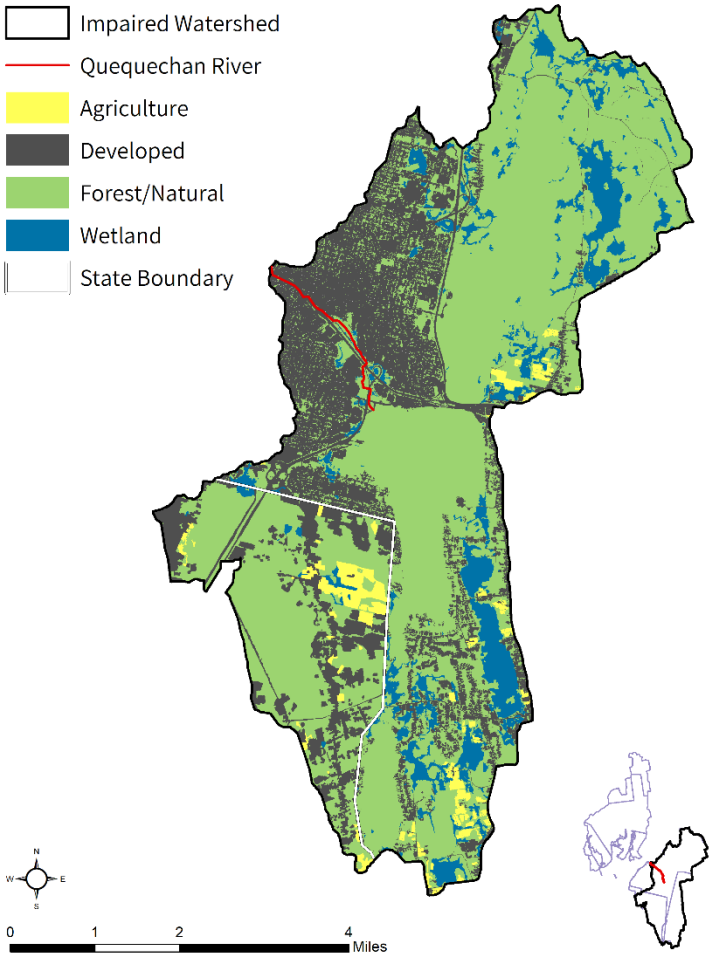
Impairment(s): *E. coli* (Primary Contact Recreation)

Class (Qualifier): B (Warm Water, CSO Receiving Water)

Impervious Area (Acres, %): 2,554 (17%)

DCIA Area (Acres, %): 1,743 (11%)





[1] Estimated percentage of developed areas with wastewater infrastructure in the watershed was based on available information: MWRA service areas, MassDEP's Water Utility Infrastructure Mapping Project (MassDEP, 2021b), MS4 reports, and local knowledge.

permits on file governing point source discharges of pollutants to surface waters. Of these two permits, neither are considered to be sources of pathogens to this segment. There is one MassDEP discharge-to-groundwater permit for an on-site wastewater discharge within the watershed (Table 3-1). In Massachusetts, there are six combined sewer overflows (CSOs) within the watershed (Table 3-2). There are no landfills or unpermitted land disposal dumping grounds within the Massachusetts portion of the watershed. There is one Industrial Stormwater discharge permit within the Massachusetts portion of the watershed for this segment (Table 3-3). See Figure 3-1.

The Quequechan River segment MA61-05 watershed is located in a highly-developed part of Massachusetts. Over half of the watershed in Massachusetts consists of forest and natural lands (60%) and 11% consists of wetland areas. The Massachusetts portion of the watershed contains a small amount of agriculture (2%) that consists of pasture/hay and cultivated fields. Development accounts for just under a third (27%) of total land use, most of which is concentrated directly adjacent to the impaired segment in the city of Fall River. This development consists of dense residential areas along with large commercial and industrial centers.

In the Massachusetts portion of the Quequechan River (MA61-05) watershed, under the Natural Heritage and Endangered Species Program, there are 3,867 acres (25%) of Priority Habitats of Rare Species and no Priority Natural Vegetation Communities. There are also 866 acres (6%) under Public Water Supply protection, no Areas of Critical Environmental Concern, and 7,110 acres (46%) of Outstanding Resource Waters. There are 3,509 acres (23%) of land protected in perpetuity[2], part of 3,688 acres (24%) of Protected and Recreational Open Space[3]. See Figure 3-1.

Table 3-1. Groundwater discharge permits in the segment watershed. Only permits unique to this segment watershed are shown. PERR = permit number plus renewal number. TYPE = type of groundwater discharge. FLOW = permitted effluent in gallons per day (gpd).

PERR	NAME	TOWN	TYPE	FLOW (GPD)
711-1	EDGEWATER APARTMENTS, LLC	WESTPORT	Sanitary Discharge	11,000

Table 3-2 Combined Sewer Overflows (CSOs) discharging to the segment.

NPDES ID	NAME	TOWN	DEP OUTFALL ID
MA0100382	FALL RIVER WWTP	FALL RIVER	FAL009
MA0100382	FALL RIVER WWTP	FALL RIVER	FAL015
MA0100382	FALL RIVER WWTP	FALL RIVER	FAL016
MA0100382	FALL RIVER WWTP	FALL RIVER	FAL017
MA0100382	FALL RIVER WWTP	FALL RIVER	FAL018
MA0100382	FALL RIVER WWTP	FALL RIVER	FAL020

Table 3-3. National Pollutant Discharge Elimination System (NPDES) permits for Industrial Stormwater discharges in the segment watershed. Only permits unique to this segment watershed are shown.

NPDES ID	NAME	TOWN
MAG250017	FALL RIVER TOOL & DIE CO, INC.	FALL RIVER

[2] Land protected in perpetuity includes conservation restrictions, agricultural preservation, private deed restrictions, wetland restrictions, aquifer protection, historic preservation, etc. Refer to Mass GIS metadata for the Protected and Recreational Open Space data layer.

[3] All Protected and Recreational Open Space land is shown on the natural resources map.

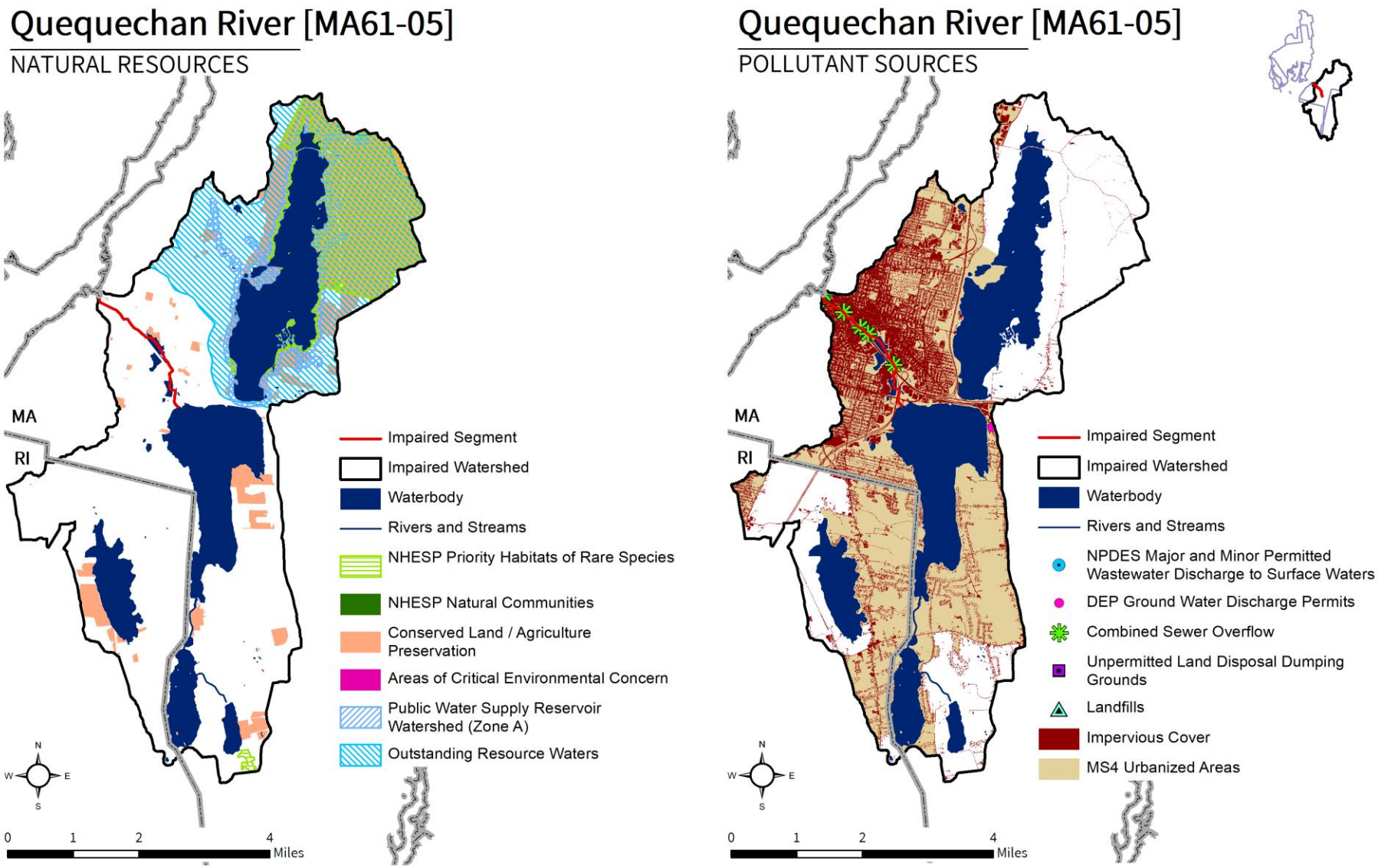


Figure 3-1. Natural resources and potential pollution sources draining to the Quequechan River segment MA61-05. The map on the left shows critical habitat, water features, and conserved land; Massachusetts-only layers include the Impaired Segment, NHESP Priority Habitats of Rare Species, NHESP Natural Communities, Areas of Critical Environmental Concern, Public Water Supply Reservoir Watershed (Zone A), and Outstanding Resource Waters. The map on the right indicates potential and known pollutant sources, including impervious cover, MS4 areas, permitted facilities, etc.; Massachusetts only layers include the Impaired Segment and all point features.

3.2. Waterbody Impairment Characterization

The Quequechan River (MA61-05) is a Class B, Warm Water, and CSO Receiving Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS at the station listed below (refer to Tables 3-4, 3-5; Figure 3-2) using the indicator bacteria *E. coli*. Data were evaluated against the SWQS geomean criterion of 126 CFU/100 mL for *E. coli* indicator bacteria and the Statistical Threshold Value (STV) criterion of 410 CFU/100 mL for *E. coli.* The geomean and STV criteria for the impaired segment apply to data on a year-round, 30-day rolling basis.

- In 2009, six samples were collected at W1962; data indicated that the 30-day rolling geomean never exceeded the criterion. Since there were no stations and years with more than 10 samples, the Statistical Threshold Value (STV) criterion was applied to single sample results. Out of six samples, none exceeded the STV criterion. A presumptive impairment decision is being applied for both the Primary and Secondary Recreational Uses since this waterbody does not have a CSO variance in place.

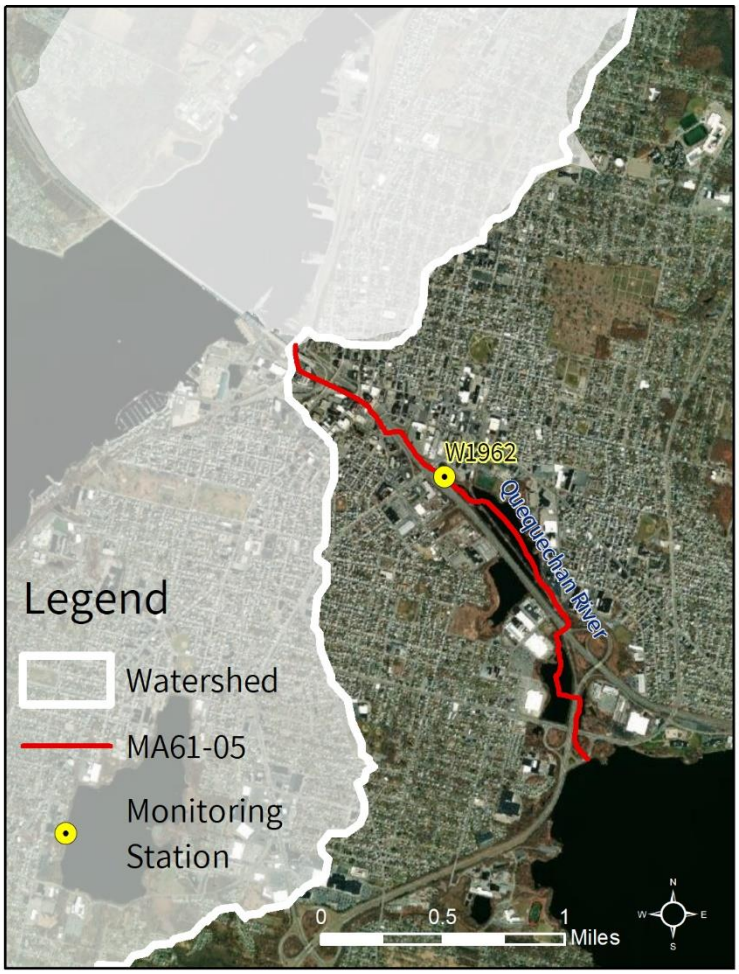


Figure 3-2. Location of monitoring station(s) along the impaired segment.

Table 3-4. Summary of indicator bacteria sampling results by station for the Quequechan River (MA61-05). The maximum 30-day rolling geometric mean (geomean), the number of days exceeding the geomean criterion of 126 CFU/100 mL for *E. coli* indicator bacteria, and the number of single samples exceeding the STV criterion of 410 CFU/100 mL for *E. coli* indicator bacteria are shown. The STV criterion is applied to the single sample results if less than 10 samples were collected within a calendar year at a site. The highest maximum 30-day rolling geomean of the site is used to calculate the percent load reduction required to meet SWQS.

Unique Station ID	First Sample	Last Sample	Count	Maximum 30-Day Rolling Geomean (CFU/100mL)	Number Geomean Exceedances	Number STV Exceedances
W1962	5/12/2009	9/29/2009	6	80	0	0

Table 3-5. Indicator bacteria data by station, indicator, and date for the Quequechan River (MA61-05). Each sample date was designated as representing wet or dry weather conditions with wet weather defined as more than 0.5 inches of precipitation in the previous 72 hours. Red text in the Results column highlights criteria exceedances of 410 CFU/100 mL (applied to single-sample "Result" since there were no more than 10 samples in a year to calculate the STV) for *E. coli* indicator bacteria; and red text in the Geomean column highlights exceedances of the 126 CFU/100 mL criterion (applied to rolling 30-day geomean) for *E. coli* indicator bacteria.

Unique Station ID	Indicator	Date	Wet/Dry	Result (CFU/100mL)	30-Day Rolling Geomean (CFU/100mL)	30-Day Rolling STV (CFU/100mL)
W1962	*E. coli*	5/12/2009	DRY	10	10	
W1962	*E. coli*	6/16/2009	DRY	20	20	
W1962	*E. coli*	7/21/2009	DRY	80	80	
W1962	*E. coli*	8/25/2009	WET	20	20	
W1962	*E. coli*	9/17/2009	DRY	40	28	
W1962	*E. coli*	9/29/2009	WET	90	60	

3.3. Potential Pathogen Sources

Comparing data collected during wet weather versus dry weather conditions provides an indication of the types of sources present, information that can be used to focus pollutant reduction activities. Pathogen levels (as estimated by indicator bacteria) are usually higher in wet weather conditions as storm sewer systems overflow and/or stormwater runoff carries fecal matter that has accumulated on the landscape to surface waters via overland flow and stormwater conduits. Wet weather sources include wildlife and domesticated animal waste (including pets), urban stormwater runoff (including MS4 areas), CSOs, and sanitary sewer overflows (SSOs). In other cases, dry weather pathogen and associated indicator bacteria concentrations can be high when there is a constant flow of pollutants during dry weather, which then becomes diluted during periods of precipitation. Dry weather sources include leaking sewer pipes, illicit connections of sanitary sewers to storm drains, failing septic systems, recreational use (such as swimmers), and direct wildlife and domesticated animal waste (including pets).

Indicator bacteria data for the Quequechan River (MA61-05) were below the criterion during both wet and dry weather. Although data were within WQS, the highest bacteria counts (80 and 90 CFU/100 mL) were observed during both wet and dry weather. Elevated results during wet weather are consistent with urban stormwater, pet waste, and wildlife pathogen sources. Certain types of septic system malfunctions, such as rainwater infiltration or saturated disposal fields which overflow during precipitation, may also result in elevated levels of indicator bacteria during wet weather events. Elevated results during dry weather suggest that baseflow sources, such as leaking pipes, illegal cross connections, other illicit discharges, and failing septic systems, are likely to be major sources of pathogens.

Each potential pathogen source is described in further detail below.

Combined Sewer Overflow (CSO): There are six CSOs in the watershed that discharge directly into the impaired segment. The City of Fall River has made significant progress in addressing CSO discharges to the Quequechan River by investment in engineering solutions e.g., stormwater storage and conveyance tunnel, new interceptor, with the result that CSO discharges to the segment have been greatly reduced (Burns, 2023). CSOs by design release untreated wastewater to surface waters when flows exceed system capacity, and therefore must be eliminated. For this reason, it is set as the highest priority pathogen source.

Urban Stormwater: There is a large amount of development in the watershed (27%), which is highly concentrated around the impaired segment. Within the watershed, 57% of the land area is subject to MS4 permit conditions, 17% is classified as impervious area, and 11% is classified as DCIA. Stormwater runoff from urban areas is likely a large source of pathogens.

Illicit Sewage Discharges: Public sewer service is available in the watershed within Fall River. Sewer-related risks to water quality include leaking infrastructure (pipes, pump stations, etc.) and sanitary sewer overflows (SSOs), which may be caused by undersized infrastructure, blockages, or excessive infiltration of groundwater

or rainwater into pipes, exceeding system capacity. Illicit connections of wastewater to stormwater conveyances are also a potential source.

On-Site Wastewater Disposal Systems: Some development in the watershed utilizes on-site septic systems for wastewater treatment, including all of Westport. Additionally, there is one MassDEP permit for on-site wastewater discharge to groundwater. In addition to this permitted point source, it is likely that some septic systems are not properly maintained and are discharging untreated waste to groundwater.

Agriculture: Agricultural activities in the watershed account for a small portion (2%) of the total land use. This agricultural land is comprised of pasture/hay and cultivated fields located far from the impaired segment. Manure storage and spreading activities, if not properly conducted, are possible sources of pathogens to waterbodies.

Pet Waste: There are many residential neighborhoods and parks near the Quequechan River segment MA61-05. Conservation lands, parks, and ballfields popular for dog-walking, especially where paths or residential neighborhoods are adjacent to rivers, ponds, or wetlands, represent possible sources of pathogens.

Wildlife Waste: A few open athletic fields and wetland areas are located directly adjacent to the impaired segment. Large mowed areas, fields, or wetlands with a clear sightline to a waterbody may attract large congregations of waterfowl, resulting in elevated indicator bacteria counts in the water.

3.4. Existing Local Management

This section identifies the major municipalities immediately surrounding the impaired segment and its contributing watershed. For a complete view of upstream municipalities and waterbodies, see the map in Figure 2-1.

City of Fall River

The majority of Fall River is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041113), and the town has an EPA-approved Notice of Intent (NOI). The town has mapped 100% of its MS4 system and the year-one and year-two Annual Reports have been submitted. In 2009, Fall River completed an illicit discharge detection and elimination (IDDE) plan, which was updated in 2019. The town completed an erosion and sedimentation control (ESC) plan in 2015 and post-construction stormwater regulations in 2018. The city also has a 2018 Stormwater Management Plan (SWMP). According to the NOI, fecal coliform-impaired MS4 receiving waters include Mount Hope Bay (six outfalls into two estuarine segments, MA61-06 and MA61-07).

Fall River has the following ordinances and bylaws, mostly accessible online via the city website at https://www.fallriverma.org/ (City of Fall River, 2021):

- Stormwater and stormwater fee ordinance
- Pet waste disposal ordinance
- Wetland Protection Bylaw: None Found

Fall River's Master Plan was adopted in 2009 and is meant to inform planning until the year 2030. This plan has an extensive section on natural resources and the environment (pg. 13). Stormwater is only mentioned in the plan's section on utilities and infrastructure (pg. 45); there is no mention of MS4 regulations or impaired waters within the town. Additionally, Fall River has a 2010 Open Space and Recreation Plan (OSRP), with a more extensive inventory of conserved lands and natural resources. The OSRP also identifies and analyzes future conservation needs within the community (City of Fall River, 2021).

Town of Westport

About half of Westport is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID # MAR041174), and the town has an EPA-approved Notice of Intent (NOI). The town has mapped 20% of its MS4 system and the year-one and year-two Annual Reports have been submitted. Westport completed an illicit discharge detection and elimination (IDDE) plan in 2017, an erosion and sedimentation control (ESC) plan in 2006, and post-construction stormwater regulations in 2012. No pathogen-impaired waterbodies within the Mount Hope Bay (Shore) watershed were reported on the town's NOI.

Westport has the following ordinances and bylaws, mostly accessible online via the town website at https://www.westport-ma.com/ (Town of Westport, 2021):

- Wetland protection bylaw
- Stormwater control bylaw
- Stormwater Utility: None found
- Pet Waste: None found

Westport has a 2016 Master Plan, with a natural resources section which identifies meeting TMDL targets as a goal for the Westport River. No specific bacterial impairments are mentioned in this plan. The town lacks public water and sewer systems, which limits growth. No Open Space and Recreation Plan, outside of the section included in the 2016 Master Plan, was found online (Town of Westport, 2021).

4. MA61-09 Lewin Brook

4.1. Waterbody Overview

Lewin Brook segment MA61-09 is 1.9 miles long and begins at its headwaters west of Sharps Lot Road in Swansea, MA. The segment flows southwest before ending at the inlet of the unnamed impoundment north of Lewin Lane in Swansea, MA.

There are a few unnamed tributaries to Lewin Brook segment MA61-09. Lakes and ponds in the watershed include a few small unnamed waterbodies. Much of the river flows through forested and wetland areas.

Key landmarks in the watershed include LIFE Academy; Stoico/FIRSTFED YMCA, Swansea; and Paquette Farm Park. The segment is not crossed by any roads, pedestrian bridges, etc.

Lewin Brook (MA61-09) drains a total area of 2.7 square miles (mi^2), of which 0.14 mi^2 (5%) are impervious and 0.06 mi^2 (2%) are directly connected impervious area (DCIA). The watershed is not served by a public sewer system[4]; and 16% of the total land area is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (USEPA, 2020). There are no NPDES permits on file governing point source discharges of pollutants to surface waters, MassDEP discharge-to-groundwater permits for on-site wastewater discharge, or combined sewer overflows (CSOs) within the watershed. There are no landfills or unpermitted land disposal dumping grounds within the segment watershed. See Figure 4-1.

Lewin Brook segment MA61-09 watershed is located in a moderately-developed part of Massachusetts. Over three quarters of the watershed consists of forest and natural lands (62%) or wetland areas (18%). There is a moderate amount of agriculture in the watershed (6%), all of which consists of pasture/hay and cultivated fields. The remainder of the watershed is covered by development (14%). This development consists almost exclusively of single- and multi-family residential areas.

In the Lewin Brook (MA61-09) watershed, under the Natural Heritage and Endangered Species

Reduction from Highest Calculated Geomean: 58%

Watershed Area (Acres): 1,707

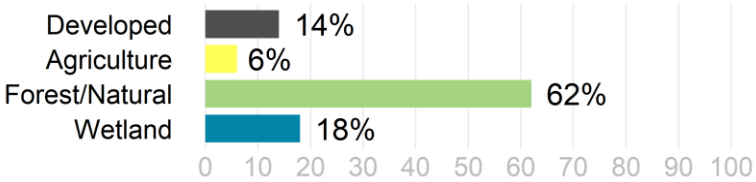
Segment Length (Miles): 1.9

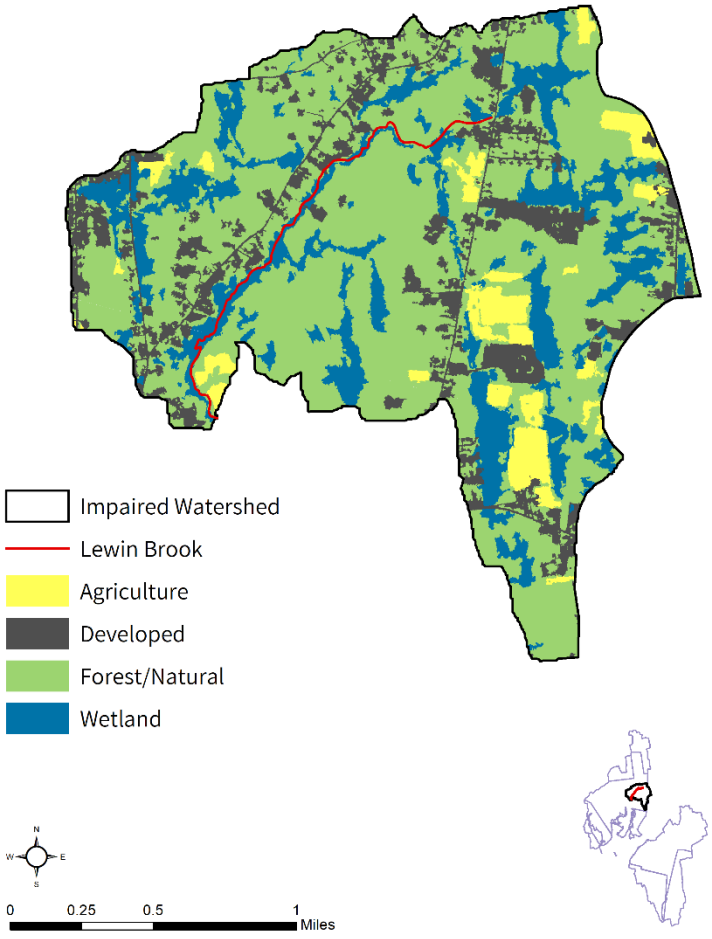
Impairment(s): *E. coli* (Primary Contact Recreation)

Class (Qualifier): B

Impervious Area (Acres, %): 92 (5%)

DCIA Area (Acres, %): 40 (2%)

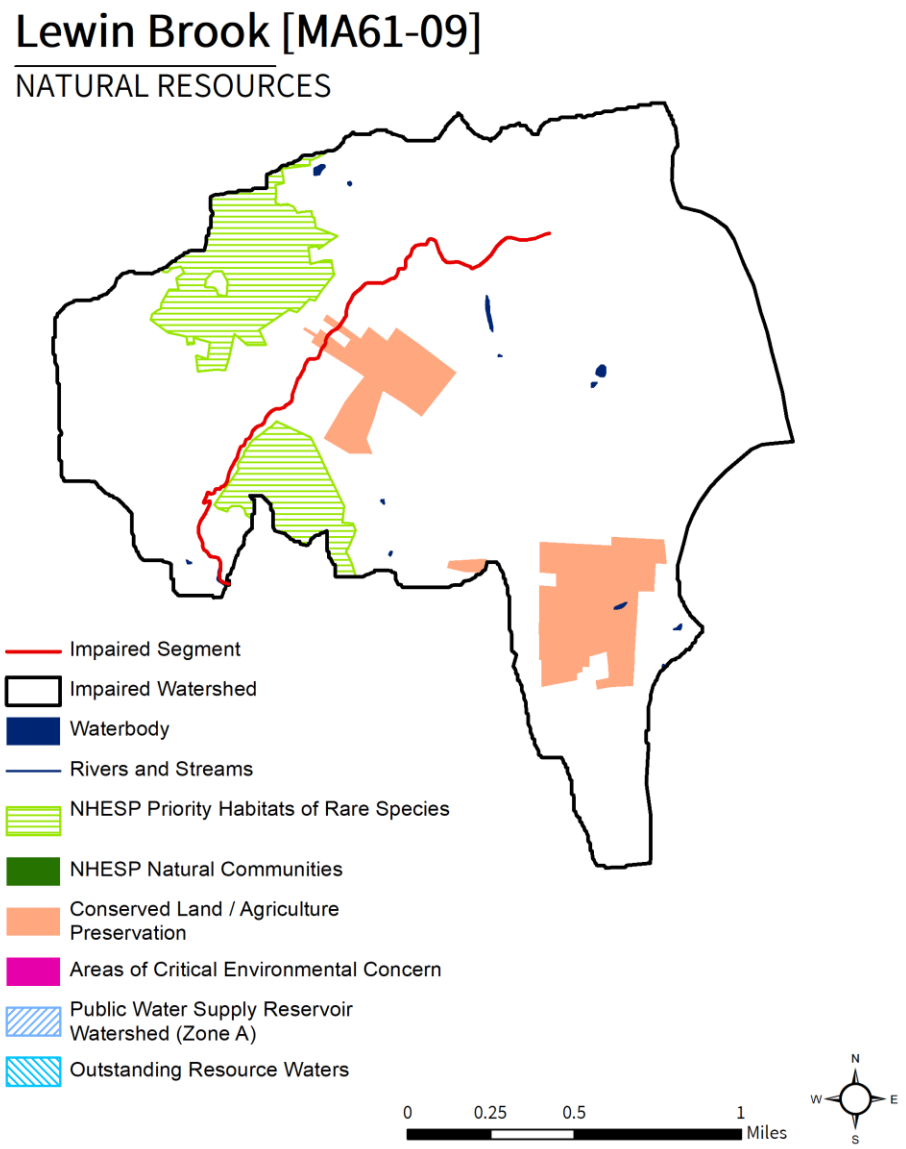




[4] Estimated percentage of developed areas with wastewater infrastructure in the watershed was based on available information: MWRA service areas, MassDEP's Water Utility Infrastructure Mapping Project (MassDEP, 2021b), MS4 reports, and local knowledge.

Program, there are 165 acres (10%) of Priority Habitats of Rare Species and no Priority Natural Vegetation Communities. There are no acres under Public Water Supply protection, within Areas of Critical Environmental Concern, or Outstanding Resource Waters. Overall, there are 83 acres (5%) of land protected in perpetuity[5], part of 133 acres (8%) of Protected and Recreational Open Space[6]. See Figure 4-1.

[5] Land protected in perpetuity includes conservation restrictions, agricultural preservation, private deed restrictions, wetland restrictions, aquifer protection, historic preservation, etc. Refer to Mass GIS metadata for the Protected and Recreational Open Space data layer.
[6] All Protected and Recreational Open Space land is shown on the natural resources map.



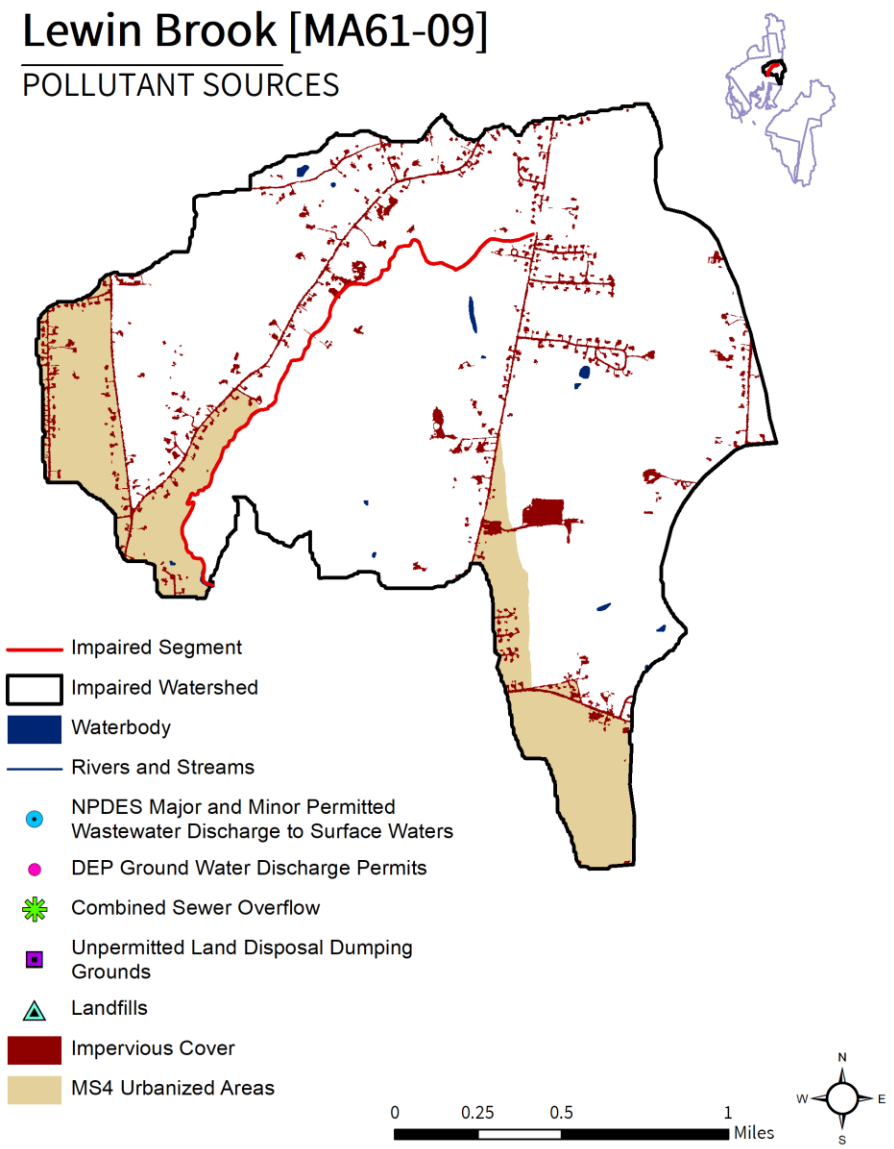


Figure 4-1. Natural resources and potential pollution sources draining to the Lewin Brook segment MA61-09. The map on the left shows critical habitat, water features, and conserved land. The map on the right indicates potential and known pollutant sources, including impervious cover, MS4 areas, permitted facilities, etc.

4.2. Waterbody Impairment Characterization

Lewin Brook (MA61-09) is a Class B Water (MassDEP, 2021a).

The Primary Contact Recreation use was assessed for attainment of SWQS at the station identified below (refer to Tables 4-1, 4-2; Figure 4-2) using the indicator bacteria *E. coli*. Data were evaluated against the SWQS geomean criterion of 126 CFU/100 mL for *E. coli* indicator bacteria and the Statistical Threshold Value (STV) criterion of 410 CFU/100 mL for *E. coli.* The geomean and STV criteria for the impaired segment apply to data on a year-round, 90-day rolling basis.

- In 2009, six samples were collected at W0654; data indicated six days when the 90-day rolling geomean exceeded the criterion. Since there were no stations and years with more than 10 samples, the Statistical Threshold Value (STV) criterion was applied to single sample results. Out of six samples, two exceeded the STV criterion during wet weather.

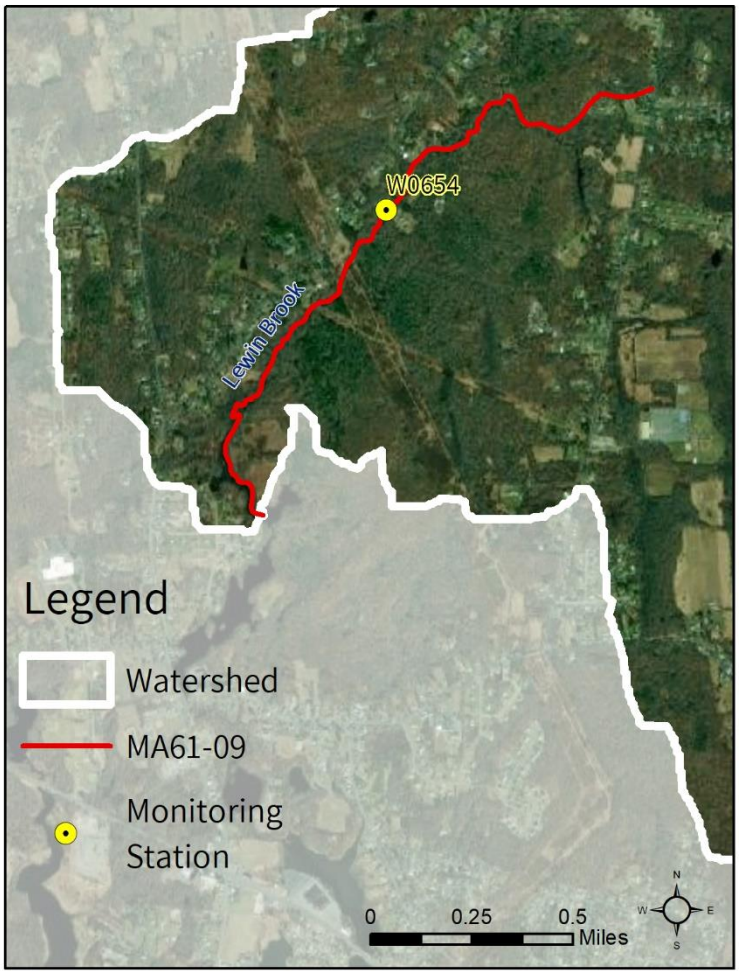


Figure 4-2. Location of monitoring station(s) along the impaired segment.

Table 4-1. Summary of indicator bacteria sampling results by station for Lewin Brook (MA61-09). The maximum 90-day rolling geometric mean (geomean), the number of days exceeding the geomean criterion of 126 CFU/100 mL for *E. coli* indicator bacteria, and the number of single samples exceeding the STV criterion of 410 CFU/100 mL for *E. coli* indicator bacteria are shown. The STV criterion is applied to the single sample results if less than 10 samples were collected within a calendar year at a site. The highest maximum 90-day rolling geomean of the site is used to calculate the percent load reduction required to meet SWQS.

Unique Station ID	First Sample	Last Sample	Count	Maximum 90-Day Rolling Geomean (CFU/100mL)	Number Geomean Exceedances	Number STV Exceedances
W0654	5/12/2009	9/29/2009	6	303	6	2

Table 4-2. Indicator bacteria data by station, indicator, and date for Lewin Brook (MA61-09). Each sample date was designated as representing wet or dry weather conditions with wet weather defined as more than 0.5 inches of precipitation in the previous 72 hours. Red text in the Results column highlights criteria exceedances of 410 CFU/100 mL (applied to single-sample "Result" since there were no more than 10 samples in a year to calculate the STV) for *E. coli* indicator bacteria; and red text in the Geomean column highlights exceedances of the 126 CFU/100 mL criterion (applied to rolling 90-day geomean) for *E. coli* indicator bacteria.

Unique Station ID	Indicator	Date	Wet/Dry	Result (CFU/100mL)	90-Day Rolling Geomean (CFU/100mL)	90-Day Rolling STV (CFU/100mL)
W0654	*E. coli*	5/12/2009	DRY	150	150	
W0654	*E. coli*	6/16/2009	DRY	180	164	
W0654	*E. coli*	7/21/2009	DRY	310	203	
W0654	*E. coli*	8/25/2009	WET	480	299	
W0654	*E. coli*	9/17/2009	DRY	100	246	
W0654	*E. coli*	9/29/2009	WET	570	303	

4.3. Potential Pathogen Sources

Comparing data collected during wet weather versus dry weather conditions provides an indication of the types of sources present, information that can be used to focus pollutant reduction activities. Pathogen levels (as estimated by indicator bacteria) are usually higher in wet weather conditions as storm sewer systems overflow and/or stormwater runoff carries fecal matter that has accumulated on the landscape to surface waters via overland flow and stormwater conduits. Wet weather sources include wildlife and domesticated animal waste (including pets), urban stormwater runoff (including MS4 areas), CSOs, and sanitary sewer overflows (SSOs). In other cases, dry weather pathogen and associated indicator bacteria concentrations can be high when there is a constant flow of pollutants during dry weather, which then becomes diluted during periods of precipitation. Dry weather sources include leaking sewer pipes, illicit connections of sanitary sewers to storm drains, failing septic systems, recreational use (such as swimmers), and direct wildlife and domesticated animal waste (including pets).

Indicator bacteria data for Lewin Brook (MA61-09) were elevated during wet weather. Elevated results during wet weather are consistent with urban stormwater, pet waste, and wildlife pathogen sources, as are certain types of septic system malfunctions, such as rainwater infiltration or saturated disposal fields which overflow during precipitation.

Each potential pathogen source is described in further detail below.

Urban Stormwater: There is a moderate amount of development in the watershed (14%), consisting almost exclusively of residential areas. Within the watershed, 16% of the land area is subject to MS4 permit conditions, 5% is classified as impervious area, and 2% is classified as DCIA. Stormwater runoff from urban areas is a likely source of pathogens.

Illicit Sewage Discharges: Public sewer service is not available in the watershed. Sewer-related risks to water quality include leaking infrastructure (pipes, pump stations, etc.) and sanitary sewer overflows (SSOs), which may be caused by undersized infrastructure, blockages, or excessive infiltration of groundwater or rainwater into pipes, exceeding system capacity. Illicit connections of wastewater to stormwater conveyances are also a potential source.

On-Site Wastewater Disposal Systems: Most of the development in the watershed utilizes on-site systems for wastewater treatment. It is likely that some septic systems are not properly maintained and are discharging untreated waste to groundwater.

Agriculture: Agricultural activities in the watershed account for a moderate portion (6%) of the total land use. This agricultural land is comprised of pasture/hay fields and cultivated fields. Manure storage and spreading activities, if not properly conducted, are possible sources of pathogens to waterbodies.

Pet Waste: There are a few residential neighborhoods near the Lewin Brook segment MA61-09. Conservation lands, parks, and ballfields popular for dog-walking, especially where paths or residential neighborhoods are adjacent to rivers, ponds, or wetlands, represent possible sources of pathogens.

Wildlife Waste: There are a few small open fields and wetland areas directly adjacent to the impaired segment. Large mowed areas, fields, or wetlands with a clear sightline to a waterbody may attract large congregations of waterfowl, resulting in elevated indicator bacteria counts in the water.

4.4. Existing Local Management

This section identifies the major municipalities immediately surrounding the impaired segment and its contributing watershed. For a complete view of upstream municipalities and waterbodies, see the map in Figure 2-1.

Town of Swansea

The majority of Swansea is subject to stormwater regulations under the NPDES General MS4 Stormwater Permit (Permit ID #MAR041163), and the town has an EPA-approved Notice of Intent (NOI). The town has mapped 100% of its MS4 system and the year-one and year-two Annual Reports have been submitted. In 2017, Swansea completed an illicit discharge detection and elimination (IDDE) plan, an erosion and sedimentation control (ESC) plan, and post-construction stormwater regulations. According to the town's NOI, pathogen impaired MS4 receiving waters include ten stormwater outfalls into the Lee River (MA61-02), eight outfalls into the Cole River (MA61-04), and one outfall into the Kickamuit River (MA61-08), all impaired by fecal coliform. Additionally, there are seven stormwater outfalls into Mount Hope Bay (MA61-07), impaired by both fecal coliform and enterococci.

Swansea has the following ordinances and bylaws, mostly accessible online via the town website at https://www.town.swansea.ma.us/ (Town of Swansea, 2021):

- Wetland protection bylaw
- Stormwater control bylaw and utility fee
- Pet Waste: None found

Swansea has a 2003 Master Plan, which features a natural resources section that inventories rivers and other waterbodies within the town and identifies impaired waterbodies. Bacteria impairments are not specifically mentioned, but non-point source pollutants (specifically septic system effluent) are mentioned as a threat to water resources. No Open Space and Recreation Plan was found online (Town of Swansea, 2021).

5. References

Burns, David. (2023). Email from David Burns, MassDEP SouthEast Regional Office, Lakeville, MA to Therese Beaudoin, MassDEP Division of Watershed Management Watershed Planning Program, Worcester, MA. January 30, 2023.

City of Fall River. (2021). Retrieved from City of Fall River home page: https://www.fallriverma.org/

MAPC. (2018). Metropolitan Area Planning Council. Retrieved from MS4 Outfall Catchment Calculator: https://www.mapc.org/resource-library/ms4-outfall-catchment-calculator/

MAPC. (2014). Metropolitan Area Planning Council. Retrieved from Stormwater Financing/Utility Starter Kit: https://www.mapc.org/resource-library/stormwater-financing-utility-starter-kit/

MassDEP. (2021a). *314 CMR 4.00: Massachusetts Surface Water Quality Standards.* Massachusetts Department of Environmental Protection. Boston, MA. Available at https://www.mass.gov/regulations/314-CMR-4-the-massachusetts-surface-water-quality-standards#current-regulations

MassDEP. (2021b). Water Utility Resilience Program. Retrieved from home page: https://www.mass.gov/guides/water-utility-resilience-program

MassDEP. (2009). *Narragansett and Mount Hope Bay Watersheds: 2004-2008 Water Quality Assessment Report*. CN 172.0. Massachusetts Department of Environmental Protection. Division of Watershed Management. Worcester, MA. March 2009. Available at: https://www.mass.gov/doc/narragansettmt-hope-bay-watershed-2004-2008-water-quality-assessment-report-0/download

NBEP. (2022). Narragansett Bay Estuary Program. Retrieved from home page: https://www.nbep.org/

SRPEDD. (2022). Southeastern Regional Planning & Economic Development District. Retrieved from home page: https://srpedd.org/

STB. (2022). Save the Bay. Retrieved from home page: https://www.savebay.org/

Think Blue Massachusetts. (2019). Retrieved from About Think Blue Massachusetts: https://www.thinkbluemassachusetts.org/about-us

Town of Swansea. (2021). Retrieved from Town of Swansea home page: https://www.town.swansea.ma.us/

Town of Westport. (2021). Retrieved from Town of Westport home page: https://www.westport-ma.com/

TU (2022). Trout Unlimited. Retrieved from Trout Unlimited Chapter Location page: https://www.tu.org/find-your-chapter/

USEPA (2022). Southeast New England Program. Retrieved from home page: https://www.epa.gov/snep

USEPA (2020). General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts, United States Environmental Protection Agency. Region 1. National Pollutant Discharge Elimination System (NPDES). Issued April 4, 2016. Modified December 7, 2020. Available at: https://www3.epa.gov/region1/npdes/stormwater/ma/2016fpd/final-2016-ma-sms4-gp-mod.pdf