2024 SURFACE WATER MONITORING OVERVIEW

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Monitoring activities of the Watershed Planning Program
[Watershed Planning Program file photos]

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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.

Disclaimer

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Introduction

The Massachusetts Department of Environmental Protection (MassDEP), through the Watershed Planning Program (WPP), plans and implements surface water quality monitoring in accordance with the following ten-year monitoring strategy: *A Strategy for Monitoring and Assessing the Quality of Massachusetts' Waters to Support Multiple Water Resource Management Objectives, 2016 – 2025* (MassDEP 2018). The strategy supports various Clean Water Act (CWA) objectives, including reporting on the condition of rivers, lakes, and coastal waters of the Commonwealth. This report provides a brief overview of the surface water quality monitoring activities performed in 2024.

The main programmatic objectives of the WPP surface water quality monitoring program are to collect data to achieve the following:

- Assess the degree to which designated uses established in the Massachusetts Surface Water Quality Standards (314 CMR 4.00), such as aquatic life, primary and secondary contact recreation, fish consumption, and aesthetics, are supported in the waters of the Commonwealth;
- Support the analysis and development of total maximum daily loads (TMDLs) and other plans to reduce pollutant loads to waters of the Commonwealth;
- Support public health risk assessments by screening fish tissue in select waterbodies for known contaminants (metals, polychlorinated biphenyls [PCBs], and organochlorine pesticides);
- Locate pollution sources and promote and facilitate timely corrective actions, to the extent feasible;
- Identify and assess new and emerging water contaminants of concern;
- Evaluate trends in parameter concentrations and/or loads;
- Support the establishment or revision of surface water quality standards and policies; and
- Measure the effectiveness of water quality management projects or programs such as the effectiveness of implementing TMDLs or watershed-based plans.

WPP administers a robust data Quality Management Program to ensure that monitoring networks are effectively and efficiently designed to meet multiple programmatic goals and deliver data that meet specific data quality objectives. The U.S. Environmental Protection Agency (EPA) has approved a comprehensive Quality Assurance Program Plan (QAPP) that applies to the generation and use of surface water quality data by WPP for a five-year period (2020 – 2024). This five-year *programmatic* QAPP is annually supplemented by project-specific Sampling and Analysis Plans (SAPs), which provide detailed information regarding individual project organization, tasks, background, sampling design and non-direct measurements. More information pertaining to WPP's Quality Management Program and the 2020 – 2024 QAPP can be found at https://www.mass.gov/guides/water-quality-monitoring-quality-management-program.

WPP initiated a new seven-year rotating watershed schedule for targeted assessment monitoring (TAM) in 2021. The use of the watershed as a fundamental planning unit for water quality management was a guiding principle in the development of the ten-year monitoring strategy, and it remains a goal to perform monitoring and assessment activities on a rotating watershed schedule. However, the need exists to maintain enough flexibility within that schedule to perform additional monitoring to meet other water management program needs. WPP has adopted a sequential, cyclical schedule that provides the opportunity for monitoring to be conducted in each watershed at least once every seven years yet allows for monitoring resources to be applied disproportionately within each watershed to fulfill specific water resource management objectives. The TAM schedule calls for monitoring to be performed in the watersheds of central Massachusetts over two years (2023 and 2024). Most assessment monitoring efforts in 2024 were focused on the Millers, Deerfield and Westfield watersheds. The TAM and other monitoring activities performed in 2024 are summarized below.

Monitoring Project Descriptions

Targeted Assessment Monitoring (TAM) – Millers, Deerfield, and Westfield Watersheds: The primary goal of the 2024 TAM project was to collect water quality and biological community data to determine whether waterbodies in the selected watersheds meet surface water quality standards and support the following beneficial designated uses: aquatic life, primary contact recreation, secondary contact recreation, and aesthetics. WPP developed a general approach for prioritizing waters for monitoring that focuses on strengthening the categorization of waters included in the *Final Massachusetts Integrated List of Waters for the Clean Water Act 2022 Reporting Cycle*, or Integrated Report (IR), (MassDEP 2023). Highest priority was given to gathering data and information on waterbodies currently listed as impaired that may not be and, therefore, could be delisted, as well as on waterbodies that are not currently identified as impaired but there is some evidence to suggest that they are impaired and should be listed as such.

A total of 93 stream sites and six lakes were sampled in 2024. Monitoring consisted of the collection of water samples for physicochemical analyses; continuous measurements of selected variables using deployed sondes and data loggers; and fish community and macroinvertebrate community assessments. Fish toxics monitoring was performed at the six TAM lake sites. Sampling site descriptions for the streams and lakes are presented in Appendices A and B, respectively. More detail pertaining to each component of the TAM is presented below.

Water Quality – Streams: Water samples were collected from each stream site monthly from May through September, field preserved as appropriate, and delivered to either the Senator William X. Wall Experiment Station (WES) in Lawrence or a commercial laboratory, for the following analyses: total phosphorus, total nitrogen, nitrate-nitrogen, nitrite-nitrogen, ammonia-nitrogen, chloride, trace elements (calcium, magnesium, and sodium), dissolved hardness, and dissolved organic carbon. Samples for the analysis of *E. coli* bacteria were collected from each site on six occasions (approximately every two weeks) within a 90-day window between June 1 and September 30 (i.e., the primary contact recreation season). The samples for *E. coli* analysis were analyzed at the WPP laboratory. Field measurements of dissolved oxygen, temperature, pH, and conductivity were taken during all but the "bacteria only" sampling events. Finally, sondes and data loggers were deployed for eight weeks between July and September to obtain long-term, continuous temperature and dissolved oxygen data.

Biological Monitoring – Streams: Macroinvertebrate community assessments, along with associated habitat evaluations, were performed to inform the determination of the aquatic life use attainment status

for CWA section 305(b) reporting requirements. Macroinvertebrates integrate environmental conditions over time and provide an excellent measure of a waterbody's overall condition. The benthic macroinvertebrate community was sampled once at 87 sites (see Appendix A) during the period from July through September using standard operating procedures applicable to the available habitat (i.e., high-gradient versus low-gradient streams). The remaining six sites were not suitable for macroinvertebrate sampling primarily due to difficult stream conditions (e.g., high flow). Specimens were preserved in the field and transported to the WPP laboratory in Worcester for further processing. The services of a contract laboratory were secured to perform sorting and taxonomic identifications on the samples.

Fish community and habitat analysis was carried out during the period from July through October at 44 sites (see Appendix A). An additional four sites were previously designated as Cold Waters in the Massachusetts Surface Water Quality Standards (SWQS) and were not surveyed. Fish were collected within a 100-meter reach using backpack electrofishing equipment, then held in plastic buckets containing stream water. Fish were identified at the species level and up to 25 individuals of each species were measured. Fish were then redistributed throughout the sampled reach.

Water Quality – Lakes: Prior to conducting water quality and phytoplankton sampling, an index site was established at the point of maximum depth in each lake. Samples were collected at the index site approximately once a month between July and September for a total of three sampling events. During each event, *in situ* measurements of dissolved oxygen, temperature, pH, and conductivity were made at multiple depths throughout the water column. Water samples were field preserved, as appropriate, and delivered to either WES or a commercial laboratory for the following analyses: total phosphorus, total nitrogen, chloride, alkalinity, hardness, and dissolved organic carbon. Samples to be analyzed for chlorophyll *a*, turbidity, and true color were delivered to the WPP laboratory. Phytoplankton samples were shipped to a contract laboratory for phytoplankton taxonomic identification, enumeration, and biovolume. Multiprobe (dissolved oxygen and temperature) and temperature-only probes were deployed on a long-term continuous basis from June through September at the index site of each lake. Probes were deployed at 0.5- or 1-meter intervals (based on total depth) on a vertical stringer with a buoy at the top and anchor at the bottom; data illustrate thermal stratification and dissolved oxygen changes over time.

A shoreline site was designated for each lake at a bathing beach, if one was present, or at a location along the shore where the lake was easily accessible by the public for recreation. Samples were collected for bacteriological analyses at the shoreline site on six occasions (approximately every two weeks) within a 90-day window between June 1 and September 30. Samples were delivered to the WPP laboratory for *E. coli* analysis.

Biological Monitoring – Lakes: Biological monitoring consisted of habitat assessment, phytoplankton, macrophyte and macroinvertebrate community assessments, and fish tissue assays for the presence of selected heavy metals. Phytoplankton sampling was performed at the index site of each lake as described in the previous section. A list of dominant macrophyte species was compiled at four of the six lakes by identifying specimens obtained from periodic, spatially diverse rake drags until no new species were encountered. The littoral macroinvertebrate community was sampled once at all six lakes during late summer or early fall. A semi-quantitative, multi-habitat sampling method was employed whereby the dominant habitat type at each of ten evenly spaced points around the perimeter of the lake was sampled using a D-frame net. The ten individual samples were then combined to create a single composite sample that was preserved in the field and transported to the WPP laboratory in Worcester for further processing. Sample sorting and taxonomic identification were performed at a contract laboratory. Results of all the community assessments will inform aquatic life use attainment determinations.

Fish samples for tissue analyses were collected once from May – June at all six lakes using electrofishing techniques. Composite samples, consisting of edible filets from three individual fish of legal size and representing from 3 – 5 target species, were analyzed at WES for mercury, and at a contract lab for arsenic, cadmium, and selenium. Data will be used by the Massachusetts Department of Public Health (MassDPH) to determine the risk to human consumers presented by the consumption of fish from these waterbodies and, if appropriate, health advisories will be issued. Results will also inform the assessment of the fish consumption use attainment status of these lakes.

Monitoring the Effects on Water Quality of Road Salt Application: WPP continued to monitor seasonal chloride levels in selected waters at risk of contamination by chlorides originating from road salt application. Continuous conductivity loggers were deployed at a total of 32 sites in the Millers, Deerfield, Connecticut, and Westfield watersheds from winter through fall 2024 (Figure 1 & Appendix C). This monitoring also included the collection of chloride grab samples to continue refining, as necessary, the specific conductance-chloride regression model developed by WPP (MassDEP 2024). Chloride data will also be used for assessment and may, in the future, be used to inform the development of TMDLs for waters impaired by excess chloride levels.

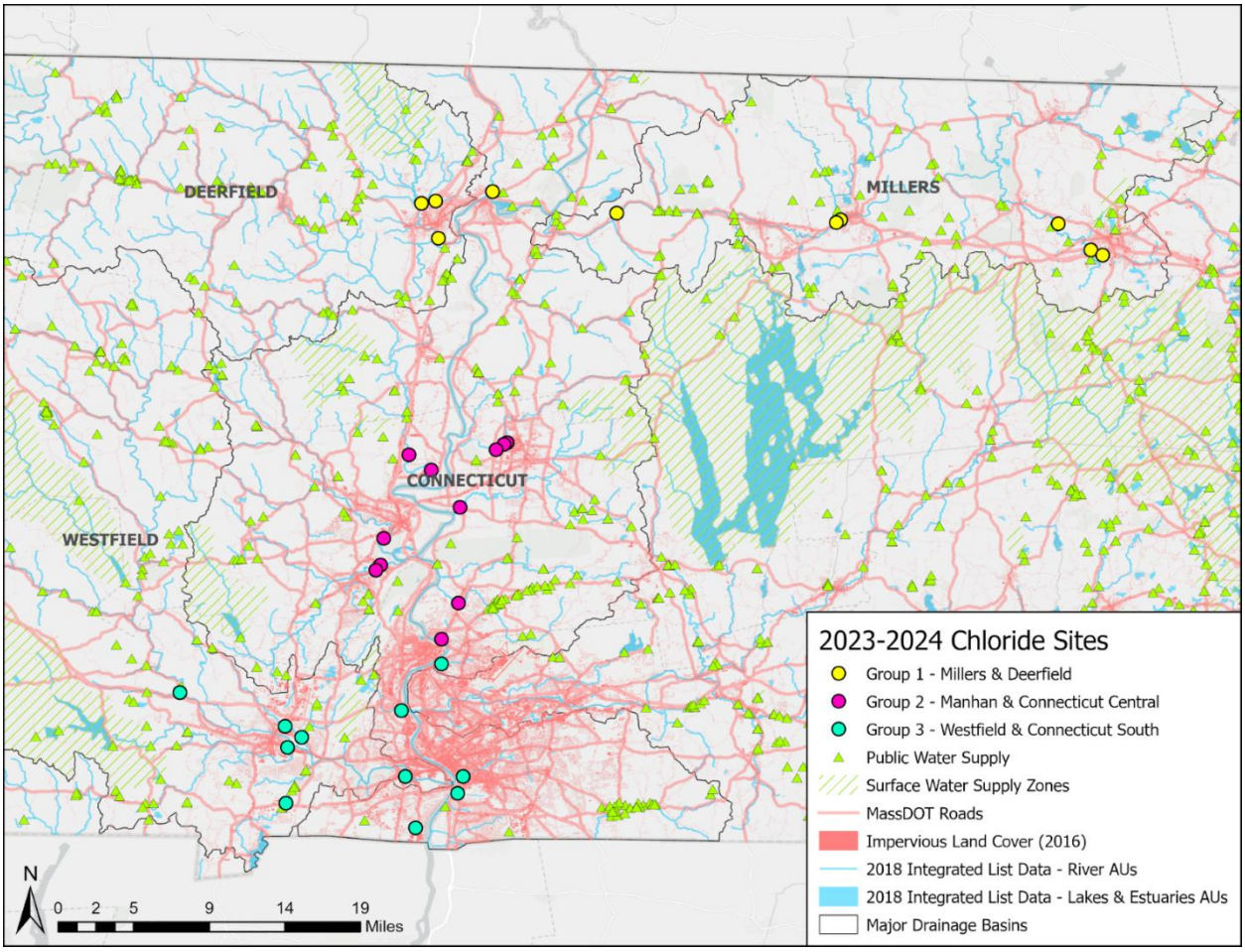

Figure 1. Overview of the 2023-2024 Chloride Monitoring Sites in the Millers, Deerfield, Connecticut, and Westfield watersheds.

Participation in the Northeast Regional Monitoring Network (RMN): In collaboration with states, tribes, and other interested parties, the EPA has established Regional Monitoring Networks (RMNs) across the nation. The goal of the RMNs is to help EPA and their partners collect current, baseline biological, thermal, and hydrologic data from freshwater wadable streams. Over time, these data may facilitate a better understanding of the relationships between biological, thermal, and hydrologic data; ecosystem responses and recovery from extreme weather events; and effects of climate change and regional phenomena such as drought and pollutant/nutrient deposition on aquatic ecosystems.

RMN Streams: As part of the Northeast RMN, WPP has established six sites in Massachusetts for long-term monitoring of temperature regime, flow characteristics, and stream macroinvertebrate communities (Table 1); the program is ongoing. Since 2012, WPP has been collecting air and water time-series temperature data, as well as annual macroinvertebrate community samples. In 2023, WPP began collecting long-term conductivity data with grab samples being collected during each site visit and submitted to the WES laboratory for chloride analysis. In 2024, WPP began collecting grab samples for nutrient analysis (total nitrogen, total phosphorous, nitrate-nitrogen, nitrite-nitrogen and ammonia-nitrogen) at the WES laboratory and a contract laboratory. Time-series streamflow data are obtained from Brown's and Parkers brooks by the Massachusetts Division of Ecological Restoration. Flow data are available for the other three streams from U.S. Geological Survey (USGS) gages located at or near the RMN sampling sites.

Table 1. Northeast Regional Monitoring Network Stream Monitoring Sites in Massachusetts

Waterbody	Watershed	Site ID	Description	Latitude	Longitude
Cold River	Deerfield	CR01ACC	Approximately 70 meters upstream/north of South County Road, Florida	42.6669	-73.0302
Avery Brook	Connecticut	AVB01	West of Conway Road, Whately approximately 825 feet upstream of mouth at inlet of Northampton Reservoir, Whately	42.4498	-72.6944
Hubbard Brook	Farmington	HRCC	Approximately 245 meters upstream/northwest of West Hartland Road, Granville	42.0654	-72.9675
Browns Brook	Quinebaug	BB01CC	Approximately 645 meters upstream from May Brook Road, Holland	42.0348	-72.1616
West Branch Swift River	Chicopee	WSR01CC	Approximately 195 meters upstream from Cooleyville Road Extension, Shutesbury	42.4647	-72.3845
Unnamed, known as Parkers Brook	Chicopee	PBCC	Approximately 160 meters west (downstream) of Coldbrook Road, Oakham (due south of Route 122)	42.3943	-72.0492

RMN Lakes: In 2023, WPP established long-term monitoring sites on two Massachusetts lakes (Upper Spectacle Pond in Sandisfield and Russell Pond in Russell) as part of the Northeast RMN (Table 2). WPP collects the following types of physical and chemical environmental data and information at each site to fulfill the goals of the Northeast RMN program:

- Discrete vertical profile (dissolved oxygen, temperature, pH, conductivity)
- Continuous vertical profile (dissolved oxygen, temperature)
- Secchi disk transparency
- Nutrients (total phosphorus, total nitrogen)
- Water chemistry (alkalinity, hardness, turbidity, chloride, dissolved organic carbon)
- Chlorophyll *a*

- Phytoplankton community
- Littoral macroinvertebrate community
- Water level
- Ice cover duration

Table 2. RMN lake locations and general information						
Waterbody	Site ID	Town	Northeast Lake and Pond Class	Index Site[1] Unique ID	Location	
					Latitude	Longitude
Upper Spectacle Pond	RMN-001	Sandisfield	Warm to Cool, Eutrophic, Acidic	W1748	42.18135	-73.11780
Russell Pond	RMN-002	Russell	Very Cold, Oligo-Mesotrophic, Acidic	W3255	42.15464	-72.86480
1 – Index site is located at the maximum depth point in the lake.						

Monitoring to Support the National Water Quality Initiative (NWQI): Monitoring shifted from the Unkety Brook – Nashua River subwatershed to the Upper Manhan River subwatershed, in support of the NWQI, a cooperative program among the U. S. Department of Agriculture's Natural Resources Conservation Service (NRCS), U.S. Environmental Protection Agency (EPA), and state water quality agencies that promotes voluntary conservation efforts to restore waterbodies impaired, at least in part, by agricultural sources. The NRCS provides financial and technical assistance to farmers, to implement best management practices (BMPs) in small watersheds to control erosion and reduce pollutant runoff from agricultural practices. Monitoring is designed to characterize background conditions and track improvements in water quality resulting from the implementation of BMPs. This reach of the Upper Manhan River was selected for monitoring under the NWQI program because it is identified as impaired by pathogens (MassDEP 2023), and land uses include a minimum 10% agricultural activities.

MassDEP WPP initiated the monitoring program in the Upper Manhan River subwatershed in May 2024; all monitoring was conducted by WPP staff. The study reach extends from the outlet of the Tighe Carmody Reservoir Dam (Southampton) to the confluence with the North Branch Manhan River (Easthampton). The eight monitoring sites, including five on the mainstem and three on key tributaries, are described in Table 3. Grab samples were collected from each monitoring site every two weeks from approximately mid-May through the end of September. Samples were analyzed at the EPA New England Regional Laboratory (NERL) for nutrients (total phosphorus, orthophosphate, total nitrogen, nitrate/nitrite-N, and ammonia-N) and total suspended solids; *E. coli* samples were analyzed at the WPP lab. During one of the sampling events each month, measurements were taken *in situ* for temperature, dissolved oxygen, pH, total dissolved solids, and specific conductance. Finally, sondes and dataloggers were deployed at two sites on the Manhan River, at the upstream and downstream ends of the study area, to measure temperature and dissolved oxygen continuously for approximately three months.

Table 3. National Water Quality Initiative Monitoring Sites in the Upper Manhan River Watershed				
Site ID	**River Name**	**Description**	**Latitude (°N)**	**Longitude (°W)**
MR01*	Manhan River	Manhan Road approximately 0.2 miles downstream of the Tighe Carmody Reservoir Dam, Southampton, MA	42.209587	-72.773004
MR02	Manhan River	Approximately 40 ft upstream of the confluence with Brickyard Brook, Southampton, MA	42.191244	-72.74666
MR03	Manhan River	near Brickyard Road Extension, Southampton, MA	42.218017	-72.725207
MR04	Manhan River	Approximately 200 ft upstream of Gunn Road, Southampton, MA	42.241127	-72.705327
MR05b*	Manhan River	Whittemore Conservation Area, Southampton, MA	42.261215	-72.698367
BRB01	Brickyard Brook	Approximately 60 ft upstream of the confluence with the Manhan River, Southampton, MA	42.188895	-72.746425
MO01	Moose Brook	Approximately 100 ft upstream of Brickyard Road Extension, Southampton, MA	42.217652	-72.723963
PB01	Potash Brook	Downstream of abandoned railroad crossing, Southampton, MA	42.229545	-72.719543
*Continuous temperature and dissolved oxygen data were collected from June-September 2024.				

Merrimack River - Monitoring to Estimate Contaminant Loadings: Massachusetts' long-term monitoring strategy identifies, as one of its key monitoring objectives, monitoring to support the development, implementation, and evaluation of pollution control strategies, and indicates that "limited fixed-site monitoring may be required to quantify pollutant loadings." Through a joint-funding agreement with USGS, WPP initiated a monitoring network in 2021 to estimate contaminant loadings in the Merrimack River watershed through September 2024, to inform water quality assessment updates and support future development and implementation of pollution control measures. This network consisted of three sampling sites on the mainstem Merrimack River and nine sites on major tributary streams (Table 4). Eleven sites were sampled monthly year-round while a single open-water site in the Merrimack River estuary was sampled at the surface and near the bottom twice monthly from May to October. Standard field parameters were measured during each site visit and discrete water samples were collected for the analysis of nutrients, major ions, metals, and *E. coli*. Samples were also analyzed for chlorophyll *a* and pheophytin from May to September. During this same timeframe, continuous measurements of pH, specific conductance, temperature, and dissolved oxygen were collected at the open-water estuary site using multi-parameter sondes deployed near the surface and off the bottom. Finally, stream discharge measurements were performed at the time of sampling at four sites that were not co-located or near established USGS stream gages.

Table 4. Contaminant loading study sites in the Merrimack River Watershed		
Site Description	**Latitude**	**Longitude**
Nashua River at East Pepperell, MA	42.6675	-71.5756
Assabet River at West Concord, MA	42.4564	-71.3899
Sudbury River at Saxonville (Framingham), MA	42.3253	-71.3981
Concord River downstream from River Meadow Brook at Lowell, MA	42.6367	-71.3025

Table 4. Contaminant loading study sites in the Merrimack River Watershed		
Site Description	**Latitude**	**Longitude**
Merrimack River downstream from Concord River at Lowell, MA	42.6458	-71.2989
Spicket River at Lawrence, MA	42.7136	-71.1608
Shawsheen River at Andover, MA	42.6714	-71.1497
Beaver Brook at Lowell, MA	42.6600	-71.3194
Stony Brook at Chelmsford, MA	42.6351	-71.3800
Powwow River at Amesbury, MA	42.8573	-70.9300
Merrimack River at Groveland, MA	42.7636	-71.0332
Open waters of Merrimack River estuary, Newburyport, MA	42.8127	-70.8598

Monitoring Water Quality in Mount Hope Bay: WPP maintained two marine water quality monitoring buoys in the Massachusetts portion of Mount Hope Bay (MHB), part of the more extensive Narragansett Bay Fixed-Site Monitoring Network (NBFSMN) currently co-administered by the Rhode Island Department of Environmental Management (RIDEM) and the University of Rhode Island Graduate School of Oceanography (URI-GSO). Data from the MHB buoys support the identification of ambient water quality conditions for dissolved oxygen, nitrate-nitrogen, algal abundance, temperature, and other parameters. Specifically, the data may be used to assess trends over time, identify impaired waters, assess the effectiveness of management decisions (i.e., wastewater treatment facility (WWTF) upgrades, TMDL efforts, and stormwater management), and support refinement, calibration, and validation of water quality models. During the deployment of the buoys (May to November), grab water samples are collected for chemical analysis every two weeks at each buoy location within one meter of the deployed sensors. Instantaneous grab sample data are compared to corresponding sensor data to verify the accuracy of sensor measurements. Vertical water quality profiles are monitored for dissolved oxygen, temperature, pH, and specific conductance/salinity every two weeks at the buoy locations and at other locations in the Narragansett Bay estuary to assess spatial variability.

Buzzards Bay Synoptic Project: Similar to recent monitoring in Mount Hope Bay, WPP partnered with USGS to identify optimal long-term monitoring sites within two Buzzards Bay embayments. The objective of this study is to characterize water-quality conditions in Mattapoisett Harbor (six sample locations) and Sippican Harbor (seven sample locations). This will be accomplished through the collection of samples for nutrient analysis, and the measurement of vertical water quality profiles, at multiple locations. A synoptic study design was adopted to meet the project objectives. In 2024, USGS finalized the QAPP, and collected samples monthly from May through October at each site to quantify the relative temporal variability in water quality over the growing season. In addition, USGS monitored spatial variability within each embayment, and measured physical parameters throughout the water column, from near surface to near bottom, to quantify the presence/absence and persistence of stratification of key water-quality conditions (e.g., temperature, oxygen, salinity). Following the monitoring season, USGS performed quality assurance/quality control (QA/QC) analysis on the data collected and generated vertical profile plots for WPP. Data generated from this study will be used to determine appropriate locations for long-term monitoring.

HABs Monitoring: During the summer of 2024, WPP initiated a pilot cyanobacteria harmful algal bloom (c-HABs) sampling project with support from EPA New England Regional Lab (NERL) and input from the Massachusetts Department of Public Health (MADPH). The data collected will help assess recreational use impairments and other potential stressors to aquatic life, such as hypoxia as the blooms die off and decompose, and the release of toxins that can be present in cyanobacteria taxa.

Between July and September 2024, WPP staff collected 12 algal samples at nine lakes where MADPH had posted HAB advisories. In the field, EPA's Bloom Watch application was used to report potential blooms, record bloom locations (by GPS), and record pictures of the bloom. Repeat sampling was conducted at three lakes 20-30 days after the initial sampling to determine the bloom duration. Algal species identification and cell counts were performed on the samples. Potentially toxic cyanobacteria were identified in 11 of the 12 samples. One sample had a bloom of green algae, which can alter habitat and are considered a nuisance, but is not considered potentially toxic like c-HABs. Five of the samples containing cyanobacteria had cell counts over the MADPH 70,000 cells/mL maxima for recreational waters. Samples from these five locations were submitted to the EPA NERL for toxin analysis (microcystin, cylindrospermopsin, anatoxin, and/or saxitoxin).

Statewide Bathymetry Project: The inaugural year of the Statewide Bathymetry Project was 2024. The project is designed to systematically collect digital bathymetric data for the approximately 2,500 Massachusetts freshwater lakes and impoundments. Currently, digital data are available for less than 2% of these waterbodies. Existing data were produced due to efforts by the Massachusetts Department of Fish and Game (DFG) and MassDEP WPP. The data are collected using boat-mounted Lowrance bathymetry units with transducer arrays capable of collecting depth, biovolume, and bottom hardness information. Logged data are uploaded for processing to the online BioBase system to create maps and associated data tables. The data are also shared with DFG for inclusion in their bathymetric coverage of state waterways. MassDEP uses the data to inform TMDL development, water quality assessments, and surface water quality standards development. These data are also available to residents, municipalities, interest groups, and other state agencies such as DFG and the Department of Conservation and Recreation (DCR). Bathymetric surveys are scheduled for early spring and late fall each year to limit potential impacts of high biovolume on data quality. A total of 26 lakes and ponds were surveyed during 2024, as shown in Table 5.

Table 5. Lakes for which bathymetry data was collected in 2024

Waterbody Name	Town	Acreage	Latitude	Longitude	Map Link
Blackstone River Watershed					
Brierly Pond	Millbury	20.4	42.17657	-71.77624	Map
Dark Brook	Auburn	179.6	42.19478	-71.86204	Map
Pout Pond	Uxbridge	12.1	42.08845	-71.61029	Map
Silver Lake	Grafton	27.0	42.19355	-71.65490	Map
Tinker Hill Pond	Auburn	38.0	42.18460	-71.87414	Map
Waite Pond	Leicester	54.9	42.24912	-71.89161	Map
Deerfield River Watershed					
Ashfield Lake	Ashfield	40.3	42.53174	-72.80117	Map
Plainfield Pond	Plainfield	61.2	42.54241	-72.95678	Map
French River Watershed					

Hayden Pond	Dudley	44.9	42.07612	-71.91903	Map
New Pond	Dudley	34.1	42.06988	-71.91875	Map
Millers River Watershed					
Dunn Pond	Gardner	17.9	42.57852	-71.97157	Map
Kendall Pond	Gardner	22.6	42.56307	-72.01825	Map
Lake Ellis	Athol	49.8	42.57748	-72.20509	Map
Moores Pond	Warwick	29.4	42.65634	-72.34744	Map
Newton Reservoir	Athol	20.2	42.59861	-72.17576	Map
Reservoir Number One	Athol	12.3	42.57685	-72.18673	Map
Sheomet Lake	Warwick	32.9	42.67885	-72.28269	Map
Silver Lake	Athol	11.8	42.60101	-72.22861	Map
White Pond	Athol	66.5	42.55081	-72.25826	Map
Taunton River Watershed					
Big Bearhole Pond	Taunton	40.1	41.86382	-70.98408	Map
Johns Pond	Carver	22.3	41.90670	-70.78506	Map
Rico Lake	Taunton	185.0	41.87488	-70.99731	Map
Loon Pond	Lakeville	26.3	41.85336	-70.95748	Map
Middle Pond	Taunton	27.5	41.86769	-70.99026	Map
Ten Mile River Watershed					
Whiting Pond	Plainville	24.8	41.99366	-71.33522	Map
Westfield River Watershed					
Center Pond	Becket	118.2	42.29699	-73.06777	Map

PFAS Monitoring Project: Characterizing PFAS concentrations in various environmental media is a critically important component of protecting both MA surface waters and public health. Following WPP's investigations of PFAS in rivers in 2020, and in rivers and lakes in 2022 (pfas-in-surface-water-and-fish-tissue), WPP initiated a new project in 2024 to monitor PFAS concentrations in water and recreationally-caught fish and shellfish tissue in coastal systems, as well as in water, whole-body fish, and aquatic invertebrates in freshwater. The project data will be used to meet the following primary project objectives:

- Determine levels of PFAS present in edible tissues of the more commonly consumed coastal (marine) fish and shellfish at twenty-six (26) recreational fishing locations along the Massachusetts coastline;
- Determine levels of PFAS present in (whole) fish and benthic invertebrates at ten (10) freshwater locations;
- Evaluate the site-specific potential risk to human health from marine fish/shellfish consumption due to PFAS contamination (and compare results to EPA's draft human health criteria recommendations for PFAS);
- Evaluate potential impairment to freshwater aquatic life due to PFAS bioaccumulation and related toxicity, in comparison to EPA's final aquatic life criteria recommendations for PFOA and PFOS (e.g., PFAS body burden in freshwater fish and invertebrates); and
- Expand information related to PFAS in marine and fresh waters of the Commonwealth.

Sample collection was conducted at 36 sites from May to November 2024; see Figure 2 for site locations. The final report for the *PFAS Concentrations in Fish, Shellfish, Invertebrates, and Surface Water from Selected Coastal and Freshwater Locations in Massachusetts* project is anticipated for publication in 2025. Project data will allow for improved use attainment determinations by WPP for the aquatic life, recreation, and fish consumption uses in these waters. Data will be shared with MADPH for their evaluation of the potential risk to consumers posed by PFAS-contaminated fish and shellfish, and the possible need for fish consumption advisories in recreational marine and other surface waters.

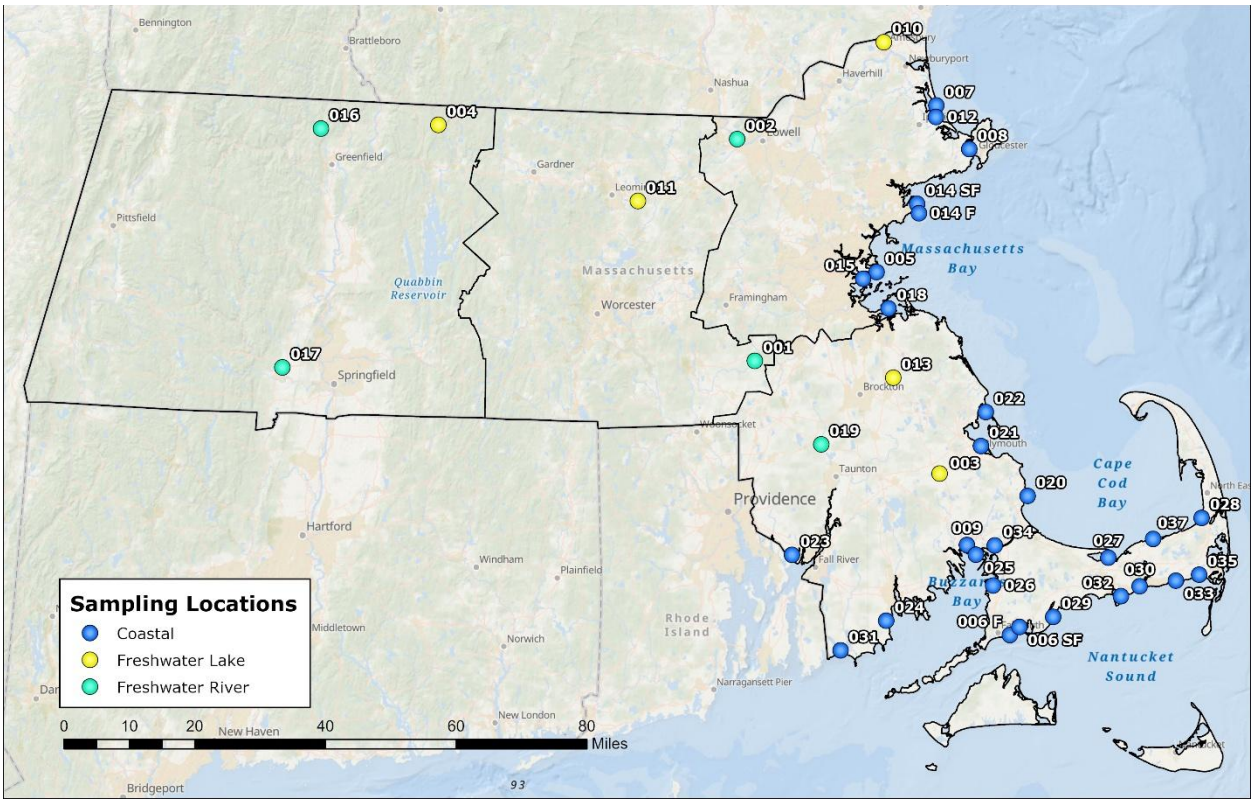

Figure 2. **Overview of 2024 sampling locations for the PFAS Monitoring Project**

Quinebaug Monitoring Project (April 2024 to June 2025):

In 2024, MassDEP and USGS collaborated to update the data on the concentrations and loads of nutrients (nitrogen and phosphorus) transported from Massachusetts to Connecticut in the Quinebaug River watershed. This cooperative project was designed to collect discrete water quality samples for nutrients monthly for one year beginning April 2024 at three locations on the Quinebaug River (one funded by CTDEEP) and one location on Cady Brook. Chlorophyll-*a* was collected monthly from April through October 2024. The river sampling sites were located downstream of the Sturbridge, Charlton, and Southbridge wastewater treatment facility discharges. The study also included the collection of continuous dissolved oxygen and temperature data at four locations on the Quinebaug River (two of the three sites were co-located with the discrete water quality sampling sites) during the growing season (June through September). Data from this study can be used in conjunction with streamflow data collected at nearby stream gages to calculate instantaneous loads, which can be used to estimate annual constituent loads.

In addition to USGS sampling, in 2024 MassDEP sampled: 1) five sites in the Quinebaug River for benthic invertebrates, 2) two sites in Cady Brook for benthic invertebrates, and 3) a number of sites for benthic algae. MassDEP also deployed dissolved oxygen probes in Cady Brook (near Violet Ave, Southbridge) and the Quinebaug River (near Farquhar Rd, Sturbridge).

Summary

This document presents a brief overview of the surface water monitoring performed by MassDEP's Watershed Planning Program (WPP) and its contractors in 2024. WPP secured the services of several laboratories and contractors to process and analyze collected water and biological samples. WPP will continue to work with these laboratories to receive the data and complete a rigorous data validation process to ensure that the prescribed data quality objectives are met. Final data will be published on MassDEP's website, although timeframes vary with individual and multi-year projects. Planning is currently underway for monitoring in 2025.

References

MassDEP. 2018. A Strategy for Monitoring and Assessing the Quality of Massachusetts' Waters to Support Multiple Water Resource Management Objectives. CN 203.5. Massachusetts Department of Environmental Protection, Bureau of Water Resources, Division of Watershed Management, Watershed Planning Program. Worcester, MA.

MassDEP. 2023. Final Massachusetts Integrated List of Waters for the Clean Water Act 2022 Reporting Cycle. CN 568.1. Massachusetts Department of Environmental Protection, Bureau of Water Resources, Division of Watershed Management, Watershed Planning Program. Worcester, MA.

MassDEP. 2024. Chloride Concentrations in Massachusetts Rivers: Data Report (2015 – 2020). CN 571.0, Massachusetts Department of Environmental Protection, Bureau of Water Resources, Division of Watershed Management, Watershed Planning Program. Worcester, MA.

Appendix A

2024 Targeted Assessment Monitoring (TAM) Stream Sites

This table presents the 93 TAM stream sites that were monitored by MassDEP's Watershed Planning Program in 2024. (Click on the Site ID to see the location.) Discrete water samples and continuous probe data were collected at all sites.

Site ID	Waterbody	Site Description	Latitude	Longitude
Millers River Watershed				
OTR16	Otter River	[Route 2A bridge, Gardner]	42.56444	-72.01154
BMB11	Bear Meadow Brook	[approximately 220 feet upstream/north of Tuckerman Road, Ashburnham]	42.69050	-71.96000
MLR12	Millers River	[River Street, Winchendon]	42.68407	-72.08298
MLR13	Millers River	[approximately 220 feet downstream/south of Sibley Road, Winchendon]	42.67175	-72.09309
MLN14	Unnamed Tributary (locally known as Mellen Brook)	[unnamed tributary to the Otter River Pool Dam (NAT ID: MA03364) impoundment, Happy Hollow Road, Winchendon]	42.60477	-72.04232
TMP15	Templeton Brook	[Ragged Hill Road, Templeton]	42.52698	-72.03195
PND17	Pond Brook	[upstream at Manca Drive, Gardner]	42.56016	-71.99746
FST18	Unnamed Tributary (locally known as Foster Brook)	[unnamed tributary to the Otter River, Mill Street, Gardner]	42.55499	-71.99486
MHN19	Mahoney Brook	[Partridge Street, Gardner]	42.55426	-71.97218
MLB21	Mill Brook	[Canal Street, Athol]	42.59158	-72.23669
MLR22	Millers River	[approximately 400 feet north/upstream of Main Street (Route 2A), Athol]	42.59358	-72.24011
TUL23	Tully Brook	[Tully Brook Road crossing nearest Royalston Road, Warwick]	42.68663	-72.28821
MOS24	Moss Brook	[Wendell Road, Warwick]	42.61448	-72.35298
OSG25	Osgood Brook	[Wendell Depot Road (crossing nearest Route 2), Wendell]	42.59367	-72.36602
ORC26	Orcutt Brook	[West Orange Road, Orange]	42.59871	-72.34013
WST27	West Brook	[Brookside Road, Athol]	42.57900	-72.26129
RIC28	Riceville Brook	[South Athol Road, Athol]	42.53797	-72.24731
NEL29	Nelson Brook	[Nelson Road, Petersham]	42.53315	-72.21116
Deerfield River Watershed				
HIN33	Hines Brook	[Green River Road, Greenfield (downstream of storm water swale and discharge pipes)]	42.62278	-72.63538
CHR38	Cherry Rum Brook	[upstream/east of Country Club Road, approximately 3 feet downstream from Paul Barger Dam (NAT ID: MA01545), Greenfield]	42.60860	-72.60072

Site ID	Waterbody	Site Description	Latitude	Longitude
MIL31	Mill Brook	[Log Plain Road West, Greenfield]	42.64375	-72.58384
GLN32	Glen Brook	[Farm Road, Greenfield]	42.63399	-72.61273
ALN34	Allen Brook	[Plain Road, Greenfield]	42.61169	-72.62463
WHL35	Wheeler Brook	[Old Greenfield Road, Greenfield]	42.58909	-72.63066
SMD36	Smead Brook	[Robbins Road, Greenfield]	42.58462	-72.62437
FUL37	Fuller Swamp Brook	[Mill Village Road, Deerfield]	42.53225	-72.61124
GRNPAW	Green River	[footbridge east off Petty Plain Road, Greenfield]	42.57626	-72.59838
SRREEDS	South River	[at bridge crossing of unnamed road between Shelburne Falls Road and Reeds Bridge Road, Conway]	42.51463	-72.69396
PUMP	Pumpkin Hollow Brook	[Academy Hill Road, Conway]	42.50745	-72.69769
WHEELDS	Wheeler Brook	[Woodard Road, Greenfield]	42.58803	-72.61821
ARMS	Arms Brook	[Colrain Road, Greenfield]	42.59753	-72.61994
SR116	South River	[approximately 1,225 feet downstream from Bullitt Road, Ashfield]	42.50973	-72.75973
UNTBEAR	Unnamed Tributary	[unnamed tributary to Bear River, Baptist Corner Road, Ashfield]	42.54757	-72.76788
DMINE	Davis Mine Brook	[just upstream of the confluence with Mill Brook, Charlemont]	42.65885	-72.85754
TROUT	Trout Brook	[Mohawk Trail (Route 2), Charlemont]	42.63295	-72.93158
LEG	Legate Hill Brook	[approximately 400 feet northwest/upstream of Main Street, Charlemont]	42.62826	-72.88547
CLSN	Clesson Brook	[approximately 3800 feet south/upstream of Ashfield Road crossing nearest Depot Road intersection, Buckland]	42.60417	-72.77463
AVERY	Avery Brook	[Route 2, Charlemont]	42.61749	-72.81026
SLUICE	Sluice Brook	[Shelburne Center Road, Shelburne]	42.58324	-72.70142
UNTDRAG	Unnamed Tributary	[unnamed tributary to Dragon Brook, east of Shelburne Center Road, approximately 100 meters upstream of mouth at confluence with Dragon Brook, Shelburne]	42.58893	-72.68838
NORTHUP	North River	[Adamsville Road bridge, Colrain]	42.65821	-72.71499
EBNORTH	East Branch North River	["Lyonsville Road", Colrain (site of old Arthur Smith Covered Bridge, taken out of service 1982, replaced in 2007, reopened to traffic in 2021)]	42.66989	-72.71886
WBNORTH	West Branch North River	[Adamsville Road, Colrain]	42.66590	-72.72299
CITY	Unnamed Tributary	[unnamed tributary to East Branch North River, approximately 550 feet southeast/upstream of Greenfield Road, Colrain]	42.67053	-72.69478
MCLLN	McClellan Brook	[Call Road, Colrain]	42.64936	-72.71244
NORTHDN	North River	[Main Road, Colrain]	42.63574	-72.73243

Site ID	Waterbody	Site Description	Latitude	Longitude
MDOW	Meadow Brook	[Charlemont Road, Colrain]	42.63713	-72.73545
DF-24-01	Sheperd Brook	[Clesson Brook Road, Buckland]	42.57681	-72.81212
DF-24-02	Unnamed Tributary	[unnamed tributary to the Chickley River, approximately 50 feet upstream from mouth, east of the intersection of Scott and Hawley roads, Savoy]	42.57778	-72.97599
DF-24-03	Unnamed Tributary	[unnamed tributary to Clesson Brook, Buckland Road, Hawley]	42.57859	-72.85143
Westfield River Watershed				
WF-24-01	Center Brook	[Center Road (crossing approximately 220 feet upstream of mouth), Savoy]	42.57019	-73.03206
WF-24-02	Drowned Land Brook	[Old Main Road, Savoy]	42.56740	-73.03705
WF-24-03	Tower Brook	[just upstream of confluence with Windsor Jambs Brook, north of Schoolhouse Road, Windsor]	42.52378	-72.99178
WF-24-04	Unnamed Tributary	[unnamed tributary to the Swift River at the southern end of Watson Spruce Corner Road, Ashfield]	42.50472	-72.84677
WF-24-05	Windsor Jambs Brook	[approximately 200 feet south/downstream from Schoolhouse Road, Windsor]	42.52322	-72.99214
WF-24-13	Westfield River	[West Main Street bridge, Cummington]	42.49277	-72.97352
WF-24-08	Glendale Brook	[Clark Wright Road bridge, Middlefield]	42.34954	-72.96741
WF-24-09	Trout Brook	[Parish Road, Worthington]	42.44139	-72.99463
WF-24-06	Childs Brook	[approximately 50 feet upstream of mouth at confluence with Bronson Brook, east of Capen Street, Worthington]	42.42480	-72.91935
WF-24-07	Dead Branch (Brook)	[east of Indian Hollow Road, approximately 1375 feet from mouth at confluence with the Westfield River, Chesterfield]	42.34378	-72.84467
WF-24-10	Tuttle Brook	[Curtin Road, Peru]	42.39695	-73.01536
WF-24-11	Unnamed Tributary	[unnamed tributary to the eastern edge of the Middle Branch Westfield River (nearest Sam Hill Road), approximately 40 feet from confluence, Worthington]	42.38640	-72.97742
WF-24-12	Unnamed Tributary	[unnamed tributary to the eastern edge of the Westfield River approximately 0.7 miles upstream of the intersection of Savoy and River roads in Cummington, just upstream from mouth at confluence with Westfield River, Windsor]	42.49913	-72.98338
WF-24-16	Sanderson Brook	[off the west side of Sanderson Brook Road approximately 1000 meters south (upstream) of Route 20, Chester]	42.25017	-72.95321
WF-24-14	Coles Brook	[Ryan Road, Middlefield]	42.34164	-73.05429
WF-24-15	Goldmine Brook	[approximately 0.7 miles upstream of Huntington Road, Chester, approximately 50 feet upstream of unnamed tributary to the western bank, Chester]	42.24347	-72.93511
WF-24-17	Spark Brook	[Chester Road, Becket]	42.26652	-73.03763

Site ID	Waterbody	Site Description	Latitude	Longitude
WF-24-18	Unnamed Tributary	[unnamed tributary to Depot Brook, south of Simmons Road approximately 780 feet upstream of confluence with Depot Brook, Washington]	42.37213	-73.12933
WF-24-20	Unnamed Tributary	[unnamed tributary to Sanderson Brook (nearest the State Road intersection), Sanderson Brook Road, Blandford]	42.23938	-72.95724
WF-24-21	Watson Brook	[Watson Road, Washington]	42.34306	-73.13631
Westfield	Westfield River	[Route 20, at roadside park downstream from confluence with West Branch Westfield River, Huntington]	42.22569	-72.87073
Powder	Powdermill Brook	[Russellville Road bridge, Westfield]	42.16253	-72.76310
Potash	Potash Brook	[Woronoco Road bridge, Russell]	42.16599	-72.83056
LITL	Little River	[Route 20 bridge, Westfield]	42.11665	-72.73367
Arm	Arm Brook	[approximately 75 feet downstream of Egleston Road, Westfield]	42.16055	-72.73160
Wigwam	Wigwam Brook	[at mouth, just upstream of confluence with Freeland Brook (forming headwaters of Stage Brook), Russell]	42.18199	-72.87934
Moose	Moose Meadow Brook	[northwest of northern end of Reservoir Road, Westfield, approximately 40 feet upstream of the removed Tekoa Dam, Montgomery]	42.16140	-72.80611
UNTMMB	Unnamed Tributary	[unnamed tributary to Moose Meadow Brook (the one closest to Montgomery town line, locally 'Cooley Brook'), Reservoir Road, Westfield]	42.15802	-72.79688
Great	Great Brook	[Little River Road, Westfield]	42.09865	-72.71289
LittleUp	Little River	[Northwest Road bridge, Westfield]	42.13036	-72.82266
Cook	Cook Brook	[Northwest Road, Westfield]	42.12373	-72.82050
UNTLloyd	Unnamed Tributary	[unnamed tributary to Lloyd Brook, Shepard Road, Blandford]	42.15685	-72.99788
Case	Case Brook	[approximately 2800 feet upstream of mouth at confluence with Pond Brook, south of Lloyd Road, Blandford (approximately 80 feet downstream of unnamed tributary to western bank)]	42.16720	-72.97917
Phelon	Phelon Brook	[Phelon Road, Granville]	42.12173	-72.92539
UNTWestfield	Unnamed Tributary	[unnamed tributary to the Westfield River approximately 150 feet upstream of North Westfield Street, Agawam]	42.09715	-72.68326
Dickinson	Dickinson Brook	[Sodom Street bridge, Granville]	42.06531	-72.84964
Tillotson	Tillotson Brook	[Old Westfield Road, Granville]	42.08929	-72.85661
Trumble	Trumble Brook	[Trumble Lane, Granville]	42.05764	-72.87184
Munn	Munn Brook	[approximately 250 feet upstream of Loomis Street, Westfield]	42.10049	-72.80876
Shurtleff	Shurtleff Brook	[North Loomis Street, Southwick]	42.08677	-72.81260
Johnson	Johnson Brook	[Route 10/202 (College Highway), Southwick]	42.04023	-72.78463

Site ID	Waterbody	Site Description	Latitude	Longitude
Pearl	Pearl Brook	[Southwick Acres Campground access road (256 College Highway), Southwick]	42.03137	-72.78289
Kellog	Kellog Brook	[Shaker Road, Westfield]	42.08595	-72.73066

Appendix B

2024 Targeted Assessment Monitoring (TAM) Lake Sites

This table presents the six (6) TAM lakes that were monitored by MassDEP's Watershed Planning Program in 2024. The Site ID is the general lake location and not a specific sampling site.

Site ID	Waterbody	Town	Latitude	Longitude
Millers Watershed				
TAM-015	Kendall Pond	Gardner	42.56372	-72.01791
TAM-016	Dunn Pond	Gardner	42.57762	-71.96965
TAM-018	Moores Pond	Ashfield	42.65594	-72.34762
TAM-019	Sheomet Lake	Warwick	42.67696	-72.28102
Deerfield Watershed				
TAM-017	Ashfield Pond	Warwick	42.52993	-72.79971
Westfield Watershed				
TAM-015	Center Pond	Becket	42.29336	-73.06653

Appendix C

2024 Chloride Monitoring Sites

This table presents the 32 chloride sites that were monitored by MassDEP's in 2024.

Waterbody	Site Description	Latitude	Longitude
Millers River Watershed			
Pond Brook	100m SE from end of Kinzer Dr., Gardner	42.5598	-72.0011
Otter River	Upstream from Route 2A, Gardner	42.5646	-72.0117
Otter River	Turner St., Gardner	42.5883	-72.0412
Mill Brook	Canal St., Athol	42.5916	-72.2368
Millers River	Near Jones St., Athol	42.5891	42.5891
Millers River	Bridge St., Erving	42.5978	-72.4378
Deerfield River Watershed			
Cherry Rum Brook	Country Club Road, Greenfield	42.6086	-72.6007
Mill Brook	Near Nash's Mill Rd., Greenfield	42.6065	-72.6135
Green River	Near East Greenfield Dog Park, Petty Plain Rd.	42.575	-72.5985
Connecticut River Watershed			
Fall River	Factory Hollow Road, Greenfield	42.617	-72.5498
Buttery Brook	Near Main St. South Hadley	42.2141	-72.5954
Stony Brook	Route 116. South Hadley	42.2465	-72.5805
Broad Brook	Near Manhan Rail Trail. Easthampton	42.2762	-72.6545
Manhan River	Lovefield Rd., Easthampton	42.2808	-72.6502
Mill River Diversion	Pynchon Meadow Rd., Northampton	42.3049	-72.6475
Mill River	Chestnut Plain Rd., Hatfield	42.3802	-72.6250
Mill River	Maple Street, Hatfield	42.3664	-72.6049
Fort River	Route 47, Hadley	42.3327	-72.5788
Mill River	North Hadley Rd., Hadley	42.3846	-72.5465
Mill River	Near Mullins Arena, UMass / Amherst	42.3898	-72.5393
Tan Brook	Foot path near Forestry Way, Amherst	42.3912	-72.5367
Mill River	Near Mill St., Springfield	42.0906	-72.5762
Pecousic Brook	Laurel Hill Rd., Springfield	42.0753	-72.5809
Threemile Brook	Veteran's Memorial Cemetery, Agawam	42.0442	-72.6187
Powdermill Brook	Near Greenwood St., Westfield	42.1358	-72.7360
Schoolhouse Brook	Near Riverdale St., West Springfield	42.1497	-72.6316
Unnamed Tributary to Connecticut River	Pendelton Ave., Springfield	42.1917	-72.5954
Westfield River Watershed			
Westfield River	Near River St., Westfield	42.0906	-72.6280
Great Brook	Route 57, Southwick	42.0664	-72.7356
Little River	Main St., Westfield	42.1166	-72.7339
Potash Brook	Woronoco Rd., Russell	42.166	-72.8306
Pond Brook	Near Papermill Rd., Westfield	42.1257	-72.7211