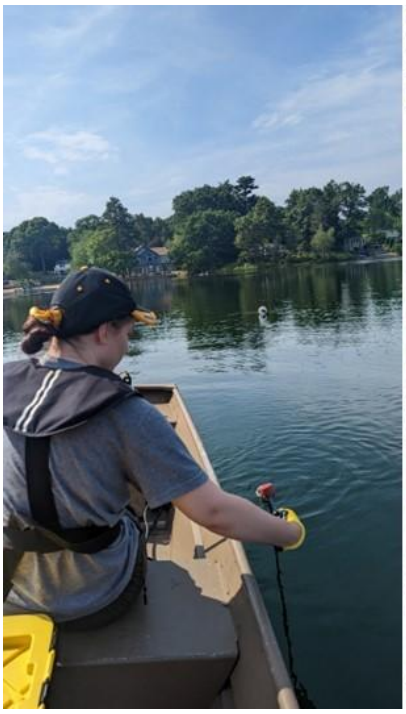
2023 SURFACE WATER MONITORING OVERVIEW



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

Notice of Availability
This report is available on the Massachusetts Department of Environmental Protection website: https://www.mass.gov/lists/annual-monitoring-summaries.

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

References to trade names, commercial products, manufacturers, or distributors in this report constituted neither endorsement nor recommendation by MassDEP.

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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 2023.

The main programmatic objectives of the WPP surface water quality monitoring program are as follows:

- Collect chemical, physical, and biological data to 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;

- Collect data to support the analysis and development of total maximum daily loads (TMDLs) and other plans to reduce pollutant loads to waters of the Commonwealth;

- Screen fish tissue in selected waterbodies for select contaminants (metals, polychlorinated biphenyls [PCBs], and organochlorine pesticides) to support public health risk assessments;

- To the extent feasible, locate pollution sources and promote and facilitate timely corrective actions;

- Identify and assess new and emerging water contaminants of concern;

- Collect water quality data to evaluate trends in parameter concentrations and/or loads;

- Collect data to 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 *program* 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 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 disproportionately applied in each watershed to fulfill specific water resource management objectives. The TAM schedule calls for monitoring to be performed in the watersheds and coastal drainage areas of central Massachusetts over two years (2023 and 2024). Most assessment monitoring efforts in 2023 were focused on the Chicopee and Connecticut watersheds. The TAM and other monitoring activities performed in 2023 are summarized below.

Monitoring Project Descriptions

Targeted Assessment Monitoring (TAM) – Chicopee and Connecticut Watersheds: The primary goal of the 2023 TAM 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 81 stream sites and six lakes were sampled in 2023. Monitoring consisted of the collection of water samples for physicochemical analyses; continuous measurements of selected variables using deployed sondes and data loggers, fish community and macroinvertebrate community assessments. Fish toxics monitoring was performed at the six lake sites. Sampling site descriptions for the streams and lakes are presented in Appendix A and Appendix 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-nitrite, ammonia, chloride, trace elements (calcium, magnesium, and sodium, Na^+), dissolved hardness, and dissolved organic carbon. Samples for the analysis of *E. coli* bacteria were collected from each site during three of the water quality sampling events and on three additional occasions to obtain six bacteria samples within a 90-day window between June 1 and September 30 (primary contact recreation season). Depending upon where they were collected, samples were delivered to WPP or to a commercial laboratory to comply with the prescribed holding time for bacteria samples. 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 in situ from July through 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 at 78 sites (see Appendix A) once during the period July-September using standard operating procedures applicable to the available habitat (i.e., high-gradient versus low-gradient). The remaining three sites were not suitable for sampling primarily due to extremely high stream flow conditions. Specimens were preserved in the field and transported to the WPP laboratory in Worcester for further processing. Sample sorting and taxonomic identifications were performed at a contract laboratory.

Fish community and habitat analysis was carried out during the period July-October at 35 sites (see Appendix A). An additional four sites were already 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 and held in plastic buckets containing stream water. Fish were identified to species and up to 25 individuals of each species were measured. Fish were then redistributed throughout the sampled reach.

Water Quality – Lakes: An index site was established at the point of maximum depth in each lake. Water quality and phytoplankton samples were collected at the index site approximately once a month between July and September for a total of three sampling events. During each sampling 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 identifications, 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. The probes were deployed at intervals along a vertical stringer with a buoy at the top and anchor at the bottom to provide data on 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 within a 90-day window between June 1 and September 30 (primary contact recreation season). Samples were delivered to the WPP laboratory for *E. coli* bacteria 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 and was described in the previous section. A list of dominant macrophyte species was compiled for each lake 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 eight 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 identifications 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 during 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, 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 for CWA reporting.

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 31 sites in the Charles and Chicopee watersheds from winter through fall 2023 (Table 1). This monitoring also included the collection of chloride grab samples to continue to verify and fine-tune the accuracy of the specific conductance-chloride regression model developed by WPP. Chloride data will also be used for assessment and may, in the future, be used to derive TMDLs for waters impaired by chlorides.

Table 1. 2023 chloride and conductivity monitoring sites.

Waterbody	Site Description	Latitude	Longitude
Charles River Watershed			
Huckleberry Brook	[approximately 425 feet south/downstream from Shadowbrook Lane, Milford]	42.16299	-71.52308
Godfrey Brook	[Vernon Street, Milford]	42.13099	-71.51550
Charles River	[Howard Street, Milford]	42.12557	-71.50915
Charles River	[Walker Street, Medway (near USGS flow gaging station #01103280) (upstream of Charles River Pollution Control District (MA0102598) discharge)]	42.13997	-71.38964
Jar Brook	[Travis Road, Holliston]	42.21957	-71.43499
Charles River	[downstream at Dover Road/Charles River Street, Dover/Needham]	42.26927	-71.29981
Charles River	[northern bank of river at MIT Pierce Boathouse, approximately 1200 feet upstream of Massachusetts Avenue, Cambridge]	42.35534	-71.09679
Charles River	[northern bank of river approximately 1350 feet west/upstream of Bridge Street, Watertown]	42.36468	-71.20869
Charles River	[Walker Street, Medway (near USGS flow gaging station #01103280, upstream of Charles River Pollution Control District (MA0102598) discharge)]	42.34122	-71.25781

Table 1. 2023 chloride and conductivity monitoring sites.

Waterbody	Site Description	Latitude	Longitude
Seaverns Brook	[approximately 1100 feet downstream from Park Road, Weston]	42.34148	-71.26679
Chicopee River Watershed			
Chicopee River	[approximately 830 feet east/upstream of the Route 116 bridge, north of Lower Grape Street, Chicopee]	42.15022	-72.60445
Cooley Brook	[Fuller Road, approximately 1100 feet northwest of Haynes Circle, Chicopee (on southerly flowing channelized diversion of Cooley Brook)]	42.16244	-72.56040
Chicopee River	[River Street/West Street bridge, Springfield/Ludlow]	42.16036	-72.51022
Calkins Brook	[approximately 80 feet west/downstream from Silver Street (and tributary to northern bank), Wilbraham]	42.15094	-72.38982
Chicopee River	[near the intersection of New Hampshire Avenue and Springfield Street, Palmer]	42.17719	-72.37546
Quaboag River	[Palmer Street bridge, Palmer]	42.17284	-72.34611
Quabaog River	[east of Route 67, (near USGS flow gaging station #01176000), Palmer/Brimfield]	42.18222	-72.26417
Penny Brook	[south of John Haley Road, approximately 200 feet southeast/upstream of Washington Road, Brimfield]	42.16864	-72.261155
Blodget Mill Brook	[Washington Road, Brimfield]	42.17025	-72.26086
Ware River	[Upper Church Street, Ware]	42.28481	-72.21608
Ware River	[Route 32 at Gibbs Crossing, Ware]	42.23872	-72.28547
Swift River	[east of East Street, Belchertown approximately 4500 feet north/upstream of Cold Spring Street, Belchertown/Old Belchertown Road, Ware]	42.253858	-72.33579
Ware River	[Route 181, Palmer]	42.19192	-72.34926
Swift River	[Route 181, Belchertown/Palmer]	42.21074	-72.34658
Jabish Brook	[field access-bridge approximately 650 feet north/upstream of South Street, Belchertown]	42.21131	-72.364811
Briggs Brook	[approximately 180 feet east/downstream from Daniel Shays Highway, Shutesbury]	42.42085	-72.39923
West Branch Swift River	[Daniel Shays Highway, New Salem]	42.457868	-72.38246
Swift River	[Orange Millington Road, New Salem]	42.53413	-72.30268

Table 1. 2023 chloride and conductivity monitoring sites.

Waterbody	Site Description	Latitude	Longitude
East Branch Swift River	[Route 32A (Hardwick Road), Petersham]	42.43848	-72.20729
Unnamed Tributary to Quabbin Reservoir	[unnamed tributary to Pottapaug Pond, Hardwick Road, Petersham]	42.42147	-72.20582
Ware River	[south of Route 122, west/downstream at Gaging Station Pool Dam (NAT ID: MA02565), Barre]	42.39111 -72.06556	-72.06556

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). 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 can help facilitate a better understanding of 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 five sites in Massachusetts which have been designated for long-term monitoring for temperature regimes, flow characteristics, and stream macroinvertebrate communities (Table 2). In 2023 a sixth site, Avery Brook in Whately was added to this network. Since 2012, WPP has been collecting air and water time-series temperature data, as well as annual macroinvertebrate kick-samples. In 2023, WPP began collecting long-term conductivity data, and grab samples were collected during each site visit, and submitted to the WES laboratory for Chloride analysis. 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 USGS gages located at or near the RMN sampling sites.

Table 2. Northeast Regional Monitoring Network (RMN) stream sites in Massachusetts

Site ID	Watershed	Waterbody	Description	Latitude	Longitude
CR01ACC	Deerfield	Cold River	Approximately 70 meters upstream/north of South County Road, Florida.	42.6669	-73.0302
AVB01	Connecticut	Avery Brook	west of Conway Road, Whately approximately 825 feet upstream of mouth at inlet of Northampton Reservoir, Whately	42.4498	72.6944
HRCC	Farmington	Hubbard Brook	Approximately 245 meters upstream/northwest of West Hartland Road, Granville.	42.0654	-72.9675
BB01CC	Quinebaug	Browns Brook	Approximately 645 meters upstream from May Brook Road, Holland	42.0348	-72.1616
WSR01CC	Chicopee	West Branch Swift River	Approximately 195 meters upstream from Cooleyville Road	42.4647	-72.3845

Table 2. Northeast Regional Monitoring Network (RMN) stream sites in Massachusetts

Site ID	Watershed	Waterbody	Description	Latitude	Longitude
			Extension, Shutesbury		
PBCC	Chicopee	Unnamed, known as Parkers Brook	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 lakes (Upper Spectacle Pond and Russell Pond) in Massachusetts as part of the Northeast RMN (Table 3). WPP collects the following types of physical and chemical environmental data and information at each site to fulfill the goals of the Northeast RMN:

- 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 3. RMN lake location and general information.

Site ID[2]	Waterbody	Town	Northeast Lake and Pond Class	Index Site[1] Unique ID	General Location	
					Latitude	Longitude
RMN-001	Upper Spectacle Pond	Sandisfield	Warm to Cool, Eutrophic, Acidic	W1748	42.18135	-73.11780
RMN-002	Russell Pond	Russell	Very Cold, Oligo-Mesotrophic, Acidic	W3255	42.15464	-72.86480

1 – Index site is located at the maximum depth point in the lake.
2 – Google Maps hyperlink is the general lake location and not a specific sampling location.

Monitoring to Support the National Water Quality Initiative (NWQI): Monitoring was continued at two tributaries to the Nashua River, James Brook and Unkety Brook, 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 impaired waterbodies. 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. Monitoring is designed to track improvements in water quality resulting from BMPs and other nonpoint source controls.

Personnel from the EPA Region 1 New England Regional Laboratory (NERL) initiated the monitoring

program in the Nashua River Watershed in 2020. A new monitoring site was added in 2023 on James Brook. The five monitoring sites are described in Table 3. The 2023 water sampling effort was performed by WPP staff and NERL personnel performed the laboratory analyses. Grab samples were collected from each monitoring site every two weeks from approximately mid-May through the end of October. Samples were analyzed at NERL for nutrients (total phosphorus, orthophosphate, total nitrogen, nitrate/nitrite-N, and ammonia-N), total suspended solids, and *E. coli.* 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 to measure temperature and dissolved oxygen continuously for approximately five months.

Table 3. National Water Quality Initiative Monitoring Sites in the Nashua River Watershed

Site ID	Waterbody	Description	Latitude	Longitude
JB02	James Brook	Old Ayer Road, north of Peabody Street, Groton, MA	42.5977	-71.5694
JB03	James Brook	North of Old Ayer Road near Smith Road, Groton, MA	42.5821	-71.5720
JB04*	James Brook	Route 111/Park St, Ayer MA	42.5794	-71.5882
JB09	James Brook	James Brook Way, Ayer, MA	42.5814	-71.5983
UNK01	Unkety Brook	Groton Street, Dunstable, MA	42.6575	-71.5203
UNK02*	Unkety Brook	River Street, Dunstable, MA	42.6896	-71.5480

*included long-term continuous temperature and dissolved oxygen measurements

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 updated water quality assessments and support future development and implementation of pollution control measures. This network consists of three sampling sites on the mainstem Merrimack River and nine sites on major tributary streams (Table 4). Eleven sites are sampled monthly year-round while a single open-water site in the Merrimack River estuary is sampled at the surface and off the bottom twice monthly from May to October. Standard field parameters are measured during each site visit and discrete water samples are collected for the analysis of nutrients, major ions, metals, and *E. coli*. Chlorophyll *a* and pheophytin analyses are added from May to September. During this same timeframe, continuous measurements of pH, specific conductance, temperature, and dissolved oxygen are collected at the open-water estuary site using multi-parameter sondes deployed near the surface and off the bottom. Finally, stream discharge measurements are performed at the time of sampling at four sites that are 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
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 maintains two YSI marine water quality monitoring buoys in the Massachusetts portion of Mount Hope Bay (MHB) that are part of the more extensive Narragansett Bay Fixed-Site Monitoring Network (NBFSMN) currently administered by the Rhode Island Department of Environmental Management (RIDEM) and the University of Rhode Island Graduate School of Oceanography (URI). Data from the MHB buoys are helping to define 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.

Massachusetts Coastal Condition Assessment: The EPA encourages states to adopt networks of randomly selected sampling sites that will allow for statistically unbiased assessments that can be applied at larger scales (e.g., statewide). During 2011 – 2015, the WPP surface water monitoring program carried out probabilistic monitoring and assessment surveys of Massachusetts' shallow streams. This was followed by a statistically-valid (probabilistic) sampling program for Massachusetts' lakes and ponds from 2016 – 2018. In 2019, a probabilistic monitoring network was designed with the overall goal of providing an unbiased assessment of the condition of Massachusetts coastal and marine waters. Known as the Massachusetts Coastal Condition Assessment, or MCCA, this network was designed to obtain the data needed to assess aquatic life use attainment (i.e., "suitable habitat for fish, other aquatic life and wildlife"). The random sampling design allows for the determination, with known statistical confidence, of the percentage of coastal waters that are supporting and not supporting this use. Additionally, the MCCA will establish a baseline to measure trends in conditions through future surveys.

The MCCA was administered collaboratively by MassDEP and the Massachusetts Bays National Estuary Partnership (MassBays). MassBays managed the collection and analysis of field samples and data at 90 coastal and marine sites for the MCCA. Monitoring activities for the MCCA concluded in 2023.

Twenty-five sites were sampled in 2023 (Table 5). A contractor was selected to perform sample collection and record ambient data at each site once per month from June through September. During each sampling event field crews recorded ambient environment conditions, collected water column profile data, and collected water samples from each site. Sediment samples for chemical analyses and the assessment of the benthic infauna community were collected once at each site. Finally, the presence/absence of eelgrass was surveyed once in July. Water quality and ecological variables measured at each MCCA monitoring site are listed along with their sampling frequencies in Table 6.

Table 5. Location of the Massachusetts Coastal Condition Assessment coastal and estuarine sites monitored in 2023. (Click on the Site ID to see the location.)

Site ID	General Location	Latitude	Longitude
MAP2E-181	Hyannis Harbor	41.630495	-70.296950
MAP2E-182	Buzzards Bay	41.561152	-70.896358
MAP2E-184	Menemsha Pond	41.338130	-70.781938
MAP2E-185	Seapuit River	41.608435	-70.408719
MAP2E-187	Saquatucket Harbor	41.667329	-70.058974
MAP2E-188	Nantucket Sound	41.356614	-69.998960
MAP2E-189	Vineyard Sound	41.546369	-70.545856
MAP2E-191	Nantucket Sound	41.557866	-69.959744
MAP2E-192	Taunton River	41.775411	-71.116388
MAP2E-193	Outer New Bedford Harbor	41.594799	-70.890253
MAP2E-195	Cape Poge Bay	41.384029	-70.455514
MAP2E-197	Nantucket Sound	41.599936	-70.284528
MAP2E-198	Buzzards Bay	41.567314	-70.907398
MAP2E-204	Nantucket Harbor	41.324474	-70.015618
MAP2E-205	Nantucket Sound	41.527492	-70.467541
MAP2E-207	Nantucket Sound	41.314670	-70.340220
MAP2E-208	Taunton River	41.746870	-71.132074
MAP2E-209	Nasketucket Bay	41.625777	-70.846807
MAP2E-211	Edgartown Harbor	41.406623	-70.484430
MAP2E-212	Mount Hope Bay	41.721859	-71.215402
MAP2E-213	Hyannis Inner Harbor	41.646037	-70.271422
MAP2E-214	Buzzards Bay	41.571216	-70.929200
MAP2E-216	Vineyard Sound	41.403159	-70.958770
MAP2E-222	Falmouth Inner Harbor	41.544466	-70.605293
MAP2E-223	Nantucket Sound	41.446985	-70.524949

Table 6. Sampling frequency of water quality and ecological variables measured at each of 25 coastal and estuarine sites in 2023.

Medium	Variable	Sample Frequency
Water	Vertical profile (Temperature, Salinity, Dissolved oxygen, pH, Turbidity)	Monthly (June, July, August)
	Light attenuation/photosynthetic active radiation (PAR)	Monthly (June, July, August)
	Water clarity/Secchi depth	Monthly (June, July, August)
	Nutrients (Total phosphorus, Orthophosphate, Total nitrogen, Dissolved inorganic nitrogen, Total Kjeldahl nitrogen)	Monthly (June, July, August)
	Chlorophyll a	Monthly (June, July, August)
Sediment	Grain size	Once (July)
	Total organic carbon	Once (July)
	Chemistry (metals, mercury, PAHs, PCBs, organochlorine pesticides)	Once (July)
	Toxicity (estuarine amphipod, *Leptocheirus plumulosus)*	Once (July)
Biological	Benthic macroinvertebrates	Once (August)
	Submerged aquatic vegetation	Once (July)

Summary

This document presents a brief overview of the surface water monitoring performed by MassDEP's WPP and its contractors in 2023. The services of several laboratories and contractors were secured to process and analyze the water and biological samples that were collected. 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.

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.

Appendix A

2023 Targeted Assessment Monitoring (TAM) Stream Sites

This table presents the 81 TAM stream sites that were monitored by MassDEP's Watershed Planning Program in 2023. (Click on the Site ID to see the location.) Discrete water samples and continuous probe data were collected at all sites. Macroinvertebrate and fish community assessments were performed as indicated on their Site IDs as follows:

[1] Macroinvertebrates not sampled in 2023

[2] Fish not sampled in 2023

Site ID	Waterbody	Site Description	Latitude	Longitude
Chicopee River Watershed				
BSR12	Burnshirt River	[Route 62 (Hubbardston Road), Barre]	42.43629	-72.05267
WBW11 [2]	West Branch Ware River	[Brigham Road, Hubbardson]	42.43568	-72.01722
UES13	Unnamed Tributary	[unnamed tributary to East Branch Swift River, Choate Road, Petersham]	42.45921	-72.17716
SVB14	Silver Brook	[Glen Valley Road, Petersham]	42.44529	-72.18122
PLB15	Pleasant Brook	[east of Glen Valley Cemetery (east off Valley Road, Barre) approximately 2000 feet northeast of mouth at confluence with Prince River, Barre]	42.41934	-72.08898
GLB16	Galloway Brook	[South Barre Road, Barre]	42.40858	-72.09808
PRR17 [1,2]	Prince River	[South Barre Road, Barre]	42.39946	-72.10133
UBB18	Unnamed Tributary	[unnamed tributary to Bell Brook, approximately 200 feet southwest/upstream of Crocker Nye Road, Oakham]	42.35764	-72.09737
BLB19	Bell Brook	[Old Turnpike Road, Oakham]	42.36025	-72.09209
SVR21 [1,2]	Sevenmile River	[approximately 200 feet upstream of Route 9 (West Main Street) bridge, Spencer]	42.23246	-72.01638

Site ID	Waterbody	Site Description	Latitude	Longitude
EBR23 [1,2]	East Brookfield River	[below all Lake Lashaway outlet structures, approximately 100 feet downstream of Route 9 bridge, East Brookfield]	42.22571	-72.05000
THB28 [2]	Turkey Hill Brook	[Wire Village Road/Hastings Road crossing, Spencer]	42.26298	-71.99318
SVR22 [1,2]	Sevenmile River	[approximately 150 feet west/downstream from Cove Street, East Brookfield]	42.22703	-72.03673
BDB25 [1,2]	Bradish Brook	[upstream at Old Wickaboag Valley Road, West Brookfield]	42.24142	-72.14393
MLB26 [2]	Mill Brook	[Shea Road, West Brookfield]	42.26386	-72.15871
EBR27 [1.2]	East Brookfield River	[northeast off Shore Road, East Brookfield (approximately 750 feet upstream of the inlet of Quaboag Pond)]	42.2028	-72.05959
THB29 [2]	Turkey Hill Brook	[approximately 200 feet northeast/upstream of Pine Acres Road, Paxton]	42.30389	-71.96531
DNB24 [2]	Dunn Brook	[approximately 100 feet northwest/upstream of Route 9 (upstream of drainage to western bank), Brookfield/East Brookfield]	42.21498	-72.07882
BVB31 [2]	Beaver Brook	[Old Belchertown Road, Ware]	42.24127	-72.30511
JBB32 [2]	Jabish Brook	[Bardwell Street, Belchertown]	42.21632	-72.36614
WRR34 [1,2]	Ware River	[river bend northeast of Norbell Street, Palmer]	42.18609	-72.36158
SWR33 [1,2]	Swift River	[east of Railroad Street, Belchertown (near the Belchertown/Palmer corporate boundary, approximately 400 feet upstream of mouth at confluence with Ware River)]	42.18996	-72.35928
UWR35 [2]	Unnamed Tributary	[unnamed tributary to Ware River, upstream at North Street, Palmer]	42.18601	-72.36585
SPB36	Spear Brook	[approximately 190 feet upstream of Boston Road, Wilbraham (approximately	42.15240	-72.41075

Site ID	Waterbody	Site Description	Latitude	Longitude
		75 feet upstream of culvert entrance on northwestern side of driveway)]		
QBR37 [1,2]	Quaboag River	[approximately 1000 feet northwest/downstream from Palmer Road, Palmer]	42.17581	-72.34707
USF38	Unnamed Tributary	[unnamed tributary to Foskett Mill Stream south of Dean Pond Road, approximately 60 feet from mouth at confluence with Foskett Mill Stream, Brimfield]	42.10374	-72.26595
CH-23-01	Unnamed Tributary	[unnamed tributary (locally Sibley Brook) to the West Branch Swift River, powerline/forest road/trail approximately 1/2 mile north/upstream of Cooleyville Road, Shutesbury]	42.47114	-72.38202
CH-23-02	Unnamed Tributary	[unnamed tributary to West Branch Swift River, northeast off Mount Mineral Road, approximately 0.6 miles northwest of mouth at confluence with West Branch Swift River, Shutesbury]	42.50278	-72.40392
CH-23-06	Unnamed Tributary	[unnamed tributary to the Chicopee River (locally known as Poor Brook), Route 141 (East Main Street) bridge, Chicopee]	42.15593	-72.55752
CH-23-03 [2]	Harris Brook	[Rood Street, Ludlow]	42.19003	-72.47800
CH-23-04	Higher Brook	[Center Street, Ludlow]	42.17607	-72.47268
CH-23-05 [2]	Cooley Brook	[approximately 115 feet north/upstream of Fuller Road, Chicopee]	42.1642	-72.56441
Connecticut River Watershed				
CT-23-05 [2]	Mill River	[Mill River Lane, Hadley]	42.3864	-72.55039
CT-23-01	Sawmill River	[southeast off North Leverett Road approximately 1000 feet northeast/upstream of Dudleyville Road, Leverett]	42.49528	-72.46522

Site ID	Waterbody	Site Description	Latitude	Longitude
CT-23-02	Chestnut Hill Brook	[Laurel Hill Drive, Leverett]	42.51344	-72.48691
CT-23-03	Unnamed Tributary	[unnamed tributary to Mill River, approximately 85 feet west/downstream from Montague Road (downstream of drainage to northern bank), Amherst]	42.41759	-72.52751
CT-23-04 [2]	Unnamed Tributary	[unnamed tributary to Mill River, Meadow Street, Amherst]	42.40808	-72.53964
CT-23-06 [2]	Weston Brook	[Rural Street, Belchertown]	42.27113	-72.45305
CT-23-09	Unnamed Tributary	[unnamed tributary to Hop Brook, Warren Wright Road, Belchertown]	42.32885	-72.46255
CT-23-07 [2]	Lampson Brook	[George Hannum Street, Belchertown]	42.27966	-72.43392
CT-23-08 [2]	Bachelor Brook	[George Hannum Street, Belchertown]	42.27899	-72.45627
CT-23-10 [2]	Plum Brook	[West Street, Amherst]	42.34344	-72.52043
CT-23-11 [2]	Fort River	[South Maple Street, Hadley]	42.34143	-72.55023
CT-23-12 [2]	Harts Brook	[Moody Bridge Road, Hadley]	42.33427	-72.56836
CT-23-13	Unnamed Tributary	[unnamed tributary to Bachelor Brook, north of Burnett Street, approximately 1500 feet from mouth at confluence with Bachelor Brook, Granby]	42.27472	-72.54697
CT-23-14	Unnamed Tributary	[unnamed tributary to Stony Brook, approximately 1025 feet east/upstream of Kellogg Street, Granby]	42.25603	-72.5298
CT-23-15	Unnamed Tributary	[unnamed tributary to North Branch Mill River approximately 260 feet north/upstream of mouth at confluence with North Branch Mill River east of the eastern end of Grayson Drive, Springfield]	42.13273	-72.50706
CT-23-16	North Branch Mill River	[approximately 2200 feet northeast/upstream of Fox Road (upstream of drainage to northern bank), Springfield]	42.13199	-72.50679

Site ID	Waterbody	Site Description	Latitude	Longitude
CT-23-17 [2]	Unnamed Tributary	[unnamed tributary to Noonan Cove, approximately 155 feet north/upstream of mouth at inlet to Noonan Cove, east of Norfolk Street, Springfield]	42.10877	-72.54853
CT-23-19	Schneelock Brook	[South Branch Parkway, Springfield]	42.10086	-72.51815
CT-23-18 [2]	South Branch Mill River	[Bradley Road, Springfield]	42.10005	-72.51873
CT-23-20	Pecousic Brook	[Dickinson Street, Springfield]	42.07141	-72.55235
LOUIS	Louisiana Brook	[approximately 200 feet east/upstream of Main Street, Northfield]	42.71779	-72.44611
MILL	Millers Brook	[Captain Beers Plain Road, Northfield]	42.68537	-72.45270
BEMED	Beaver Meadow Brook	[south off Simon Keets Road, approximately 600 feet west/upstream of mouth at confluence with Shattuck Brook, Leyden]	42.72307	-72.61008
ASHU	Ashuela Brook	[approximately 250 feet southeast/downstream from unnamed road east off Boyle Road and north of the Gill Elementary School, Gill]	42.65022	-72.49568
UNTDRY	Unnamed Tributary	unnamed tributary to Dry Brook, River Road, Gill]	42.64041	-72.49948
POLE [2]	Pole Swamp Brook	[approximately 60 feet northwest/upstream of River Road, Deerfield]	42.53681	-72.57109
UNTCON	Unnamed Tributary	[unnamed tributary to Mill River, south/upstream of South Deerfield Road, approximately 130 feet from confluence with Mill River, Conway]	42.51112	-72.66677
WEST	West Brook	[Chestnut Plain Road/Pantry Road, Whately/Hatfield]	42.41430	-72.62908
MOO [2]	Cow Bridge Brook	[approximately 100 feet south/upstream of Main Street, Hatfield]	42.39448	-72.59420

Site ID	Waterbody	Site Description	Latitude	Longitude
EBRMILL	East Branch Mill River	[south of East Main Street approximately 200 feet from confluence with West Branch Mill River, Williamsburg]	42.39209	-72.72669
WBRMILL [2]	West Branch Mill River	[Mill Street, Williamsburg]	42.39176	-72.72723
NRBMAN [2]	North Branch Manhan River	[Pomeroy Meadow Road, Easthampton/Southampton]	42.26683	-72.69715
BREW	Brewer Brook	[Chesterfield Road, Westhampton]	42.34310	-72.75569
POT	Potash Brook	[approximately 225 feet north/upstream of Adams Road, Williamsburg]	42.40352	-72.71305
UNQU [2]	Unquomonk Brook	[Roger Bisbee Road, Williamsburg]	42.38016	-72.72642
RMB	Roberts Meadow Brook	[Kennedy Road, Northampton]	42.33939	-72.72506
UNTLOOK [2]	Unnamed Tributary	[unnamed tributary to Mill River, approximately 215 feet west/upstream of Fairway Village [road], Northampton]	42.34305	-72.69358
HAN [2]	Hannum Brook	[southwest of Carillon Circle and Hannum Brook Drive intersection approximately 2500 feet northwest/upstream of West Street, Easthampton]	42.27447	-72.69861
UNTSH	Unnamed Tributary	[unnamed tributary to the North Branch Manhan River approximately 200 feet east/downstream from Miller Avenue, Southampton]	42.26060	-72.71162
MANLOVE 2	Manhan River	[approximately 1400 feet east/downstream from Lovefield Street, Easthampton]	42.28109	-72.64972
BRICK 2	Brickyard Brook	[approximately 300 feet south/upstream of Clark Street, Easthampton]	42.26411	-72.65380
MAN 2	Manhan River	[north off Brickyard Road, approximately 1800 feet east/downstream from College Highway, Southampton]	42.21884	-72.72644
MOOSE	Moose Brook	[Brickyard Road, Southampton]	42.21765	-72.72396

Site ID	Waterbody	Site Description	Latitude	Longitude
SACK	Sacket Brook	[approximately 150 feet east/downstream from Wyben Road, Southampton]	42.19962	-72.77129
TAN [2]	Tannery Brook	[approximately 50 feet west/upstream of Brightside Drive, West Springfield]	42.16236	-72.63362
SCHOOL	Schoolhouse Brook	[approximately 525 feet north/upstream of Massasoit Avenue, West Springfield]	42.15024	-72.63153
STILL [2]	Still Brook	[Barry Street, Agawam]	42.03581	-72.67818
THREE [2]	Threemile Brook	[Massachusetts Veterans Memorial Cemetery Road, Agawam]	42.04450	-72.61867
WHITE [2]	White Brook	[Nonotuck Park entrance road, Easthampton]	42.25727	-72.66986

Appendix B

2023 Targeted Assessment Monitoring (TAM) Lake Sites

This table presents the six (6) TAM lakes that were monitored by MassDEP's Watershed Planning Program in 2023. The Site ID is the general lake location and not a specific sampling site.

Site ID	Waterbody	Shoreline Site Description	Latitude	Longitude
Chicopee Watershed				
TAM-009	Whitehall Pond	[Rutland State Park beach, northwestern edge of pond, south of Whitehall Road, Rutland]	42.37169	-71.99600
TAM-010	Lake Whittemore	[Luther Hill Park beach, southern edge of pond, northeast of Lake Street, Spencer]	42.25480	-71.98860
TAM-011	Haviland Pond	[town beach, western edge of pond, east off Center Street, Ludlow]	42.17327	-72.47300
TAM-012	Nine Mile Pond	[pond access, northern edge of pond, south of the Old Bay Road and Pond Road intersection, Wilbraham]	42.14969	-72.43320
TAM-013	Fivemile Pond	[Five Mile Pond Park beach on south central edge of pond, north of Boston Road, Springfield]	42.14229	-72.51230
Connecticut Watershed				
TAM-014	Lake Lorraine	[pond access, west central edge of pond, east of Lorimer Street, Springfield]	42.14509	-72.51300