2022 SURFACE WATER MONITORING OVERVIEW



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

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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

MassDEP's mission 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 Watershed Planning Program is a statewide program in the Division of Watershed Management, Bureau of Water Resources, at MassDEP. We are stewards of the water resources of Massachusetts. Together with other state environmental agencies, we share in the duty and responsibility to protect, enhance, and restore the quality and value of the waters of the Commonwealth. We are guided by the federal Clean Water Act and work to secure the environmental, recreational, and public health benefits of clean water for the residents of Massachusetts. The Watershed Planning Program is organized into five Sections that each have a different technical focus under the Clean Water Act: (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 Pollution.

Disclaimer

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Introduction

The Massachusetts Department of Environmental Protection (MassDEP) Watershed Planning Program (WPP) plans and implements surface water quality monitoring in accordance with its ten-year Monitoring Strategy to support 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 2022.

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, 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 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, 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 northeastern Massachusetts over two years (2021 and 2022). Most assessment monitoring efforts in 2022 were focused on the Charles, Ipswich, Parker, North Coastal, and Boston Harbor watersheds. However, WPP added eight lakes and ponds to the TAM network and four of these are in the Concord and Merrimack watersheds. The TAM and other monitoring activities performed in 2022 are summarized below.

Monitoring Project Descriptions

Targeted Assessment Monitoring (TAM) – Charles, Ipswich, Parker, North Coastal, and Boston Harbor Watersheds: The primary goal of the 2022 TAM was to collect water quality and biological community data to determine whether waterbodies in the selected watersheds meet 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 Massachusetts CWA section 305(b)/303(d) Integrated Report (IR). 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 67 stream sites and eight lakes were sampled in 2022. Monitoring consisted of the collection of water samples for physicochemical analyses; continuous measurements of selected variables using deployed sondes and data loggers, and macroinvertebrate community assessments. Fish community assessment was limited to a handful of stream sites (N=6), but fish toxics monitoring was performed at the eight 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, Ca^{+}; magnesium, Mg^{+}; 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 one of two commercial laboratories 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 52 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 15 sites were not suitable for sampling primarily due to extremely low or dry stream flow conditions. Specimens were preserved in the field and transported to the WPP lab 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 August-October at six sites while an additional four sites had been assessed in 2020 (see Appendix A). 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 a minimum of 25 individuals of each species were measured and weighed. 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 lab. Phytoplankton samples were shipped to a contract lab 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 WES for the analysis of *E. coli* bacteria.

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 which was preserved in the field and transported to the WPP lab 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 – August at all eight 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.

Fish Toxics Monitoring: In addition to the fish toxics monitoring performed at the eight TAM lakes described above, WPP collected fish samples from Clay Pit Pond in Belmont at the recommendation of the Inter-agency Fish Toxics Committee. Fish sampling at this pond in 1995 had led to the issuance by MassDPH of a fish consumption advisory due to the presence of chlordane in edible fish tissue. The Fish Toxics Committee received a public request to resample Clay Pit Pond in 2022. Edible fillets were analyzed for the presence of mercury and additional metals, PCB arochlors, and organochlorine pesticides. MassDPH will review the data to determine whether any modifications are needed to the existing health advisory.

Lake Monitoring in the Mystic River Watershed: In collaboration with the EPA, WPP initiated a monitoring program in 2019 at three nutrient-impaired lakes in the Mystic River Watershed: Horn Pond (Woburn), Spy Pond (Arlington), and Wedge Pond (Winchester). The purpose of this monitoring is to provide a more recent assessment of the designated use support status (i.e., aquatic life, recreational, and aesthetic uses) of these ponds and to support the calibration of a Lake Loading Response Model (LLRM) as a step toward developing phosphorus TMDLs. The second round of sampling, scheduled for 2020, was postponed due to the Covid-19 pandemic, and the only work carried out that year was a bathymetry survey of each pond. Water quality monitoring resumed in 2021 and was continued in 2022. Each pond was sampled monthly from June through October. During each sampling event, a vertical profile (dissolved oxygen, temperature, pH, and conductivity) and Secchi disk transparency measurement were obtained at the "deep hole" of the lake, and samples were collected for the analysis of total phosphorus, total nitrogen, chlorophyll a, color, and turbidity. Nutrient samples were analyzed at EPA's regional laboratory in Chelmsford and the remaining analyses were performed at the WPP lab in Worcester.

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 Ipswich, Parker, Shawsheen, and Merrimack watersheds from winter through fall 2022 (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. 2022 chloride and conductivity monitoring sites.

Waterbody	Site Description	Latitude	Longitude
Ipswich River Watershed			
Maple Meadow Brook	Wildwood Street, Wilmington	42.55276	-71.15662
Ipswich River	Reading Town Forest off Strout Ave., Reading	42.55446	-71.12866
Ipswich River	Salem Road, Topsfield	42.62576	-70.94894
Ipswich River	Winthrop Street, Ipswich	42.65874	-70.89051

Table 1. 2022 chloride and conductivity monitoring sites.

Waterbody	Site Description	Latitude	Longitude
Martins Brook	Park Street, North Reading	42.57147	-71.10123
Fish Brook	River Road, Topsfield	42.634808	-70.974772
Howlett Brook	Ipswich Road, Topsfield	42.65512	-70.91711
Miles River	Route 1A, Ipswich	42.65837	-70.84333
Parker River Watershed			
Little River	Parker Street, Newburyport	42.794280	-70.890687
Parker River	Larkin Road, Newbury	42.748957	-70.939865
Parker River	West Street, Boxford	42.722876	-71.030912
Unnamed tributary to Parker River	Behind No. 6 Wayside Avenue, Newbury	42.762024	-70.937165
Wheeler Brook	End of Larkin Street and Parish Rd, Newbury	42.744504	-70.942288
Mill River	Glen Street, Rowley	42.739302	-70.899653
Mill River	Off Label Road, Rowley	42.693895	-70.956721
Ox Pasture Brook	Cross Street, Rowley	42.723781	-70.878632
Bachelder Brook	Newburyport Turnpike (Route 1), Rowley	42.706635	-70.908899
Penn Brook	North Street, Georgetown	42.729914	-70.987024
Shawsheen River Watershed			
Shawsheen River	Upstream of Route 495 (before underground culvert to the Merrimack River), Lawrence	42.70323	-71.14074
Shawsheen River	Page Road, Bedford	42.493576	-71.256339
Shawsheen River	Summer Street, Bedford	42.473616	-71.264265
Strong Water Brook	East Street, Tewksbury	42.61227	-71.20936
Spring Brook	Upstream from Route 62, Bedford	42.494780	-71.258107
Vine Brook	Behind Jos. A. Bank store, Burlington	42.486491	-71.211254
Unnamed tributary to Meadow Brook	Blanchard Street, Tewksbury	42.628878	-71.19940
Rogers Brook	Off Dundee Park Drive, Andover	42.65395	-71.14749
Merrimack River Watershed			
Fish Brook	River Road, Andover	42.679895	-71.218312
Black Brook	Westford Street, Lowell	42.629681	-71.349309
Cold Springs Brook	Richardson Road, Chelmsford	42.62829	-71.37856
Lawrence Brook	Sherburne Avenue, Tyngsborough	42.67181	-71.41152
Stony Brook	Town Farm Road, Westford	42.58439	-71.47898
Beaver Brook	Porter Road, Littleton	42.52824	-71.51675

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.

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). Since 2012, WPP has been collecting air and water time-series temperature data, as well as annual macroinvertebrate kick-samples. 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) 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
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 Extension, Shutesbury	42.4647	-72.3845
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

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. The five monitoring sites are described in Table 3. A former monitoring site near the headwaters of James Brook was discontinued in 2022 due to consistently stagnant flow conditions exhibited in 2021 and 2022. The 2022 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
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

Technical Support for the Assessment and Management of Cyanobacteria Blooms: Although no potentially toxic algae samples were analyzed in 2022, MassDEP continued to provide technical expertise to the investigation of potentially toxic algae (cyanobacteria) blooms. MassDEP participates on an interagency committee that manages reports of harmful algae (cyanobacteria) blooms (CyanoHABs). As part of this initiative, incoming reports of CyanoHABs are communicated to the appropriate programs or agencies that have jurisdiction over drinking water supplies and recreational waters. Work also continued with EPA's Cyanobacteria Collaborative on the further development of methods for obtaining cyanobacteria bloom information from citizens, lake associations, and other government agencies. The bloomWatch smartphone app is now in use by individuals and groups across the U.S. and Canada to report observations of cyanobacteria blooms to EPA, public health departments, or local boards of health. A new online dashboard tabulates and graphically presents reports of cyanobacteria freshwater blooms obtained from the bloomWatch app (see https://cyanos.org/bloomwatch/).

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 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. This monitoring program is scheduled to continue through September 2024.

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 facilities (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 is administered collaboratively by MassDEP and the Massachusetts Bays National Estuary Partnership (MassBays). MassBays is managing the collection and analysis of field samples and data for the MCCA. A total of 90 coastal and marine sites are included in the MCCA which will continue through 2023.

Twenty-five sites were sampled in 2022 (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 2022. (Click on the Site ID to see the location.)

Site ID	General Location	Latitude	Longitude
MAP2E-091	Cohasset Harbor	42.252914	-70.777816
MAP2E-092	Brewster Coast	41.791682	-70.050770
MAP2E-094	North River / South River	42.154337	-70.704281
MAP2E-095	Little Harbor	42.262577	-70.809972
MAP2E-096	Quivett Creek	41.766888	-70.131362
MAP2E-098	Scituate/Cohasset Coast	42.222528	-70.746727
MAP2E-099	Scorton Creek	41.760412	-70.446805
MAP2E-102	First Encounter Beach	41.823086	-70.016154
MAP2E-104	Wellfleet Harbor	41.874679	-70.088732
MAP2E-107	Cohasset Harbor	42.248961	-70.776913
MAP2E-108	North Cape	41.793361	-70.072334
MAP2E-109	Rocky Point	41.944031	-70.563632
MAP2E-110	North River / South River	42.172681	-70.733686
MAP2E-111	Scusset Beach	41.800249	-70.521022
MAP2E-112	Sesuit Creek / Sesuit Harbor	41.749072	-70.154852
MAP2E-114	Scituate/Cohasset Coast	42.209198	-70.721710
MAP2E-115	Scorton Creek	41.749317	-70.420979
MAP2E-116	Provincetown Harbor	42.040070	-70.139756
MAP2E-118	Kingsbury Beach/Cooks Brook.Beach	41.833237	-70.010538
MAP2E-119	Chase Garden Creek	41.733192	-70.250304
MAP2E-120	Wellfleet Harbor	41.906198	-70.046293
MAP2E-124	Wellfleet Harbor	41.839413	-70.050284
MAP2E-125	Beaver Dam Brook/Bartlett Pond	41.932216	-70.553046
MAP2E-126	Scituate Harbor	42.202100	-70.712754
MAP2E-130	Green Harbor	42.077552	-70.624107

Table 6. Sampling frequency of water quality and ecological variables measured at each of 25 coastal and estuarine sites in 2022.

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)

Monitoring PFAS Levels in Surface Waters and Fish: Water and fish tissue samples were collected at targeted lake and river sites throughout Massachusetts and analyzed for the presence of per- and polyfluoroalkyl substances (PFAS) to augment ambient PFAS data on river water samples collected in 2020. These "screening" data will be used to 1) determine levels of PFAS present in the edible tissue of the more commonly consumed freshwater fish; 2) evaluate the site-specific potential risk to human health from fish consumption due to PFAS contamination (including heavily-fished areas, potential PFAS "hot spots", reference sites, and Environmental Justice (EJ) communities); and 3) evaluate the potential impairment to aquatic life (e.g., bioaccumulation and toxicity in fish). Using a contractor, grab (water) and composite (fish) samples were obtained from a total of 52 sites (40 lakes and 12 rivers). All samples were analyzed for 40 PFAS compounds using draft EPA method 1633. Final project data will be shared with MassDEP's Office of Research and Standards (ORS), Massachusetts Department of Public Health (MDPH), EPA, and the public. The data will be compared to current MDPH threshold values for fish consumption to assess potential risk. A final project report for all waterbodies is anticipated in mid-2023. Monitoring site locations are presented in Appendix C.

Summary

This document presents a brief overview of the surface water monitoring performed by MassDEP's WPP and its contractors in 2022. Several laboratories and contractors are working to process and analyze the water and biological samples 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. Planning is currently underway for monitoring in 2023.

Appendix A
2022 Targeted Assessment Monitoring (TAM) Stream Sites

This table presents the 67 TAM stream sites that were monitored by MassDEP's Watershed Planning Program in 2022. (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 sampled in 2022

[2] Fish sampled in 2022

[3] Fish sampled in 2020 to determine cold water fishery status

Site ID	Waterbody	Site Description	Latitude	Longitude
Boston Harbor: Mystic River Watershed				
MU01[1]	Munroe Brook	[at footbridge south of Bartlett Avenue, Lexington]	42.43524	-71.19407
SG01[1]	Shaker Glen Brook	[Totman Drive, Woburn]	42.47137	-71.17419
CU01[1,2]	Cummings Brook	[approximately 75 feet downstream from Willow Street, Woburn]	42.48174	-71.17430
LB01[1]	Little Brook	[approximately 625 feet downstream from Bedford Street, Woburn]	42.47967	-71.18147
HP01[1]	Pond Brook (Horn)	[approximately 460 feet upstream of Lake Street, Winchester]	42.45775	-71.14033
Boston Harbor: Neponset River Watershed				
EL01[1]	Eel River	[Colonial Road, Hingham]	42.19491	-70.89310
UN01[1]	Unnamed Tributary	[unnamed tributary to unnamed tributary to Steep Hill Brook, Pratts Court, Stoughton]	42.12700	-71.12643
UT01[1]	Unnamed Tributary	[unnamed tributary to Steep Hill Brook, Central Street, Stoughton]	42.13066	-71.12928
MP01[1]	Massapoag Brook	[approximately 520 feet downstream from Old Shepard Street, Canton]	42.14788	-71.14845

Site ID	Waterbody	Site Description	Latitude	Longitude
UB01[1]	Unnamed Tributary	[unnamed tributary to Beaver Brook approximately 760 feet upstream of mouth at confluence with Beaver Brook, north of West Street, Sharon]	42.11280	-71.20051
TH01[1]	Traphole Brook	[approximately 1275 feet downstream from Sumner Street, Norwood]	42.16146	-71.19183
PK01[1]	Ponkapog Brook	[Elm Street, Canton]	42.20323	-71.13502
PB01[1,3]	Purgatory Brook	[approximately 580 feet upstream of Route 1 (near Everett Street), Norwood]	42.21043	-71.18588
PF01[1]	Plantingfield Brook	[approximately 700 feet downstream from Neponset Street, Norwood]	42.20484	-71.19002
HW01[1]	Hawes Brook	[approximately 600 feet upstream of Washington Street, Norwood]	42.17461	-71.21010
GM01[1]	Germany Brook	[approximately 300 feet upstream of Westover Parkway, Norwood]	42.19525	-71.22448
MK01[1,3]	Mill Brook	[TAM Arack Road, Westwood]	42.19684	-71.23854
BB01	Bubbling Brook	[Trailside Drive, Walpole]	42.19347	-71.24276
MN01[1]	Mine Brook	[upstream/north of Elm Street, Medfield]	42.17692	-71.28254
Tub[1,2]	Tubwreck Brook	[Draper Road, Dover]	42.20895	-71.26695
Boston Harbor: Weymouth & Weir River Watersheds				
PR01[1]	Plymouth River	[Ward Street, Hingham]	42.20298	-70.90146
PR02	Plymouth River	[Colonels Drive, Weymouth]	42.19944	-70.92085
OS01[1,2]	Old Swamp River	[Libbey Industrial Parkway, Weymouth]	42.19259	-70.94329
MR01	Mill River	[approximately 640 feet upstream of inlet to Whitmans Pond and approximately 925 feet downstream from Washington Street, Weymouth]	42.20270	-70.94178

Site ID	Waterbody	Site Description	Latitude	Longitude
MR02[1]	Mill River	[Front Street (upstream of the outfall downstream of the bridge), Weymouth]	42.19325	-70.95932
SM01	Smelt Brook	[Stetson Street, Braintree]	42.21630	-70.97235
FR01[2]	Farm River	[approximately 300 feet upstream from Pond Street, Braintree]	42.19918	-71.02405
CB01[1]	Cranberry Brook	[upstream of road and two stormwater outfalls, Route 37 (Washington Street), Braintree]	42.18379	-71.01130
MY01[1]	Mary Lee Brook	[Wilmarth Road, Randolph]	42.16013	-71.02948
Charles River Watershed				
Stony	Stony Brook	[approximately 200 feet west/upstream of the Stony Brook Reservation trailhead parking, east off Enneking Parkway, Boston]	42.25909	-71.13652
Pow	Powissett Brook	[Dedham Street, Dover]	42.25660	-71.24142
Trout[1]	Trout Brook	[Haven Street, Dover]	42.25417	-71.29337
Davis	Davis Brook	[aquaduct crossing northeast of Riverbend Drive, Natick]	42.26836	-71.33039
Bogle[1]	Bogle Brook	[approximately 825 feet northeast/upstream of Woodside Avenue, Wellesley]	42.31027	-71.32419
Seavern[3]	Seaverns Brook	[approximately 1100 feet downstream from Park Road, Weston]	42.34154	-71.26663
Stop[1]	Stop River	[Noon Hill Road, Medfield]	42.15867	-71.30281
Vine[1]	Vine Brook	[approximately 440 feet south/downstream from Main Street, Medford]	42.18405	-71.31592
Mill[1]	Mill Brook	[North Meadows Road (Route 27), Medfield (identified as North Brook on USGS 1987 Medfield quadrangle)]	42.19598	-71.33022

Site ID	Waterbody	Site Description	Latitude	Longitude
Dop[1]	Dopping Brook	[Whitney Street, Holliston]	42.21554	-71.40766
Jar[1]	Jar Brook	[Travis Road, Holliston]	42.21956	-71.43509
Huckl[1]	Huckleberry Brook	[approximately 425 feet south/downstream from Shadowbrook Lane, Milford]	42.16298	-71.52326
Misco[1]	Miscoe Brook	[South Street, Franklin]	42.04091	-71.42653
Dix[1,3]	Dix Brook	[Financial Park, Franklin]	42.06030	-71.42141
Uncas	Uncas Brook	[Elysium Street, Wrentham]	42.07149	-71.35825
Shep	Shepards Brook	[approximately 1800 feet west/downstream from Lincoln Street, Franklin]	42.11867	-71.40063
Mine[1]	Mine Brook	[Pond Street, Franklin]	42.12453	-71.43065
ChasB[1]	Charles River	[approximately 330 feet southwest/upstream of Pearl Street, Bellingham]	42.13019	-71.44490
Stall[1]	Stall Brook	[Hartford Avenue, Bellingham]	42.12393	-71.45511
ChasA[1]	Charles River	[Walker Street, Medway (near USGS flow gaging station #01103280) (upstream of Charles River Pollution Control District (MA0102598) discharge)]	42.14007	-71.38967
Chkn[1]	Chicken Brook	[approximately 550 feet southeast/downstream from Main Street, Medway]	42.14618	-71.42590
Ipswich River Watershed				
KB01	Kimball Brook	[Kimball Street, Ipswich]	42.67484	-70.84067
MR01[1]	Miles River	[approximately 710 feet upstream of Country Road, Ipswich]	42.65653	-70.84214
LC01	Long Causeway Brook	[Route 1A, Ipswich/Hamilton]	42.64726	-70.84334

Site ID	Waterbody	Site Description	Latitude	Longitude
IR01[1]	Ipswich River	[Willowdale Road, Ipswich/Winthrop Street, Hamilton]	42.65895	-70.89068
HW01[1,2]	Howlett Brook	[Ipswich Road, Topsfield (near confluence with Ipswich River)]	42.65506	-70.91707
MB01[1]	Mosquito Brook	[approximately 200 feet upstream of Blue Ridge Road, North Andover (upstream of power corridor crossing)]	42.66981	-71.08110
UI01	Unnamed Tributary	[unnamed tributary to Ipswich River at Mt. Vernon Street, Middleton]	42.59309	-71.01092
NB01[1]	Norris Brook	[Russell Street, Peabody]	42.55381	-71.00364
UI02	Unnamed Tributary	[unnamed tributary to the Ipswich River, Elm Street (near intersection with Willow Street), North Reading]	42.57710	-71.07092
ML01[1]	Mill Brook	[Church Street, Wilmington]	42.55245	-71.16880
North Coastal Watersheds				
CB01[1]	Crane Brook	[approximately 150 feet downstream from Pine Street, Danvers]	42.55962	-70.94786
UB01[1,2]	Unnamed Tributary	[unnamed tributary to Beverly Cove, Hale Street, Beverly]	42.55461	-70.84993
HB01[1]	Hawkes Brook	[southwest of the Route 129 and Route 1 cloverleaf, approximately 200 feet upstream of mouth at confluence with Saugus River, Saugus]	42.48718	-71.01989
PB01[1]	Shute Brook	[approximately 180 feet downstream from Central Street, Saugus]	42.46206	-71.00875

Site ID	Waterbody	Site Description	Latitude	Longitude
BP01[1]	Bennetts Pond Brook	[southeast of the Lynn Falls Parkway and Route 1 coverleaf, approximately 150 feet upstream of mouth at confluence with the Saugus River, Saugus]	42.47976	-71.02007
Parker River Watershed				
LR01[1]	Little River	[Parker Street, Newburyport/Scotland Road, Newbury]	42.79435	-70.89092
OP01[1]	Ox Pasture Brook	[Cross Street, Rowley]	42.72372	-70.87884

Appendix B

2022 Targeted Assessment Monitoring (TAM) Lake Sites

This table presents the eight (8) TAM lakes that were monitored by MassDEP's Watershed Planning Program in 2022. The Site ID is the general lake location and not a specific sampling site.

Site ID	Waterbody	Shoreline Site Description	Latitude	Longitude
North Coastal Watershed				
TAM-001	Beck Pond	[southwestern tip of pond, east of Chebacco Road, Hamilton]	42.60075	-70.82154
TAM-002	Round Pond	[northwestern corner of northern lobe, east of Chebacco Road, Hamilton]	42.60156	-70.81632
Charles Watershed				
TAM-003	Morses Pond	[at town beach in southeastern corner of pond, west of Morses Pond Access Road, Wellesley]	42.29642	-71.31799
TAM-004	Dug Pond	[southeastern edge of pond, at beach west of West Street, Natick]	42.27467	-71.36254
Concord Watershed				
TAM-005	Learned Pond	[eastern edge of pond, at beach southwest of Shawmut Terrace, Framingham]	42.28811	-71.41750
Merrimack Watershed				
TAM-006	Lake Mascuppic	[northwestern edge of pond, at beach south of Mascuppic Trail, Tyngsborough]	42.67844	-71.39140
TAM-007	Long-Sought-for Pond	[northeastern edge of pond, at beach south of Summer Village Road, Westford]	42.62479	-71.45557
TAM-008	Keyes Pond	[northeastern edge of pond, west of Keyes Road, Westford]	42.61538	-71.46157

Appendix C

2022 PFAS Monitoring Sites

This table presents the river (12) and lake (40) sites from which water and fish tissue samples were collected in 2022 and analyzed for the presence of PFAS.

Waterbody	Municipality	Latitude	Longitude
Flint Pond	Tyngsborough	42.67405	-71.426333
Lake Boon	Stow	42.4050757	-71.5000568
Connecticut River	Chicopee	42.147517	-72.621117
Upper Spectacle Pond	Sandisfield	42.17905	-73.11789
Ashumet Pond	Mashpee	41.629167	-70.534633
Asnacomet Pond	Hubbardston	42.454333	-71.981217
Buck Pond	Westfield	42.1717	-72.7026
Congamond Lake	Southwick	42.03174	-72.75804
Crocker Pond	Westminster	42.569964	-71.8856
Hardwick Pond	Hardwick	42.313436	-72.238537
Falls Pond	North Attleborough	41.9587	-71.3244
Forge Pond	Westford	42.5779	-71.489033
Hathaway Ponds	Barnstable	41.68573	-70.31368
Hopedale Pond	Hopedale	42.1415	-71.557
Jamaica Pond	Boston	42.31645	-71.11842
Lake Attitash	Amesbury	42.851467	-70.98725
Lake Cochituate	Wayland	42.311617	-71.3706
Lake Mirimichi	Plainville	42.025833	-71.288817
Lake Quannapowitt	Wakefield	42.51025	-71.07712
Lake Ripple	Grafton	42.210251	-71.697978
Lake Sabbatia	Taunton	41.94648	-71.11324
Lake Winthrop	Holliston	42.188867	-71.425667
Long Pond	Lakeville	41.78315	-70.93016
Long Pond	Yarmouth	41.668204	-70.200487
Mascuppic Lake	Tyngsborough	42.674915	-71.387479
Moores Pond	Warwick	42.65713	-72.34896
Mossy Pond	Clinton	42.415147	-71.706389
Nutting Lake	Billerica	42.535971	-71.267895
Merrimack River	Methuen	42.70275	-71.2142
Pelham Lake	Rowe	42.6996	-72.8891
Pontoosuc Lake	Pittsfield	42.485417	-73.24758
Robbins Pond	East Bridgewater	42.000537	-70.90481
Sandy Pond	Ayer	42.56105	-71.55239
Snake Pond	Sandwich	41.68061	-70.52094
Studleys Pond	Rockland	42.120247	-70.918553
Wachusett Reservoir	West Boylston	42.37072	-71.7797

Waterbody	Municipality	Latitude	Longitude
Webster Lake	Webster	42.05496	-71.85631
West Lake	Sandisfield	42.12971261	-73.1618894
Blackstone River	Northbridge	42.12883	-71.63677
Bungay River	Attleboro	41.95521	-71.2786
Charles River	Waltham	42.36291	-71.24547
Chicopee River	Wilbraham	42.17765	-72.4068
Concord River	Lowell	42.62546	-71.29596
Deerfield River	Florida	42.65449	-72.95571
Hoosic River	Williamstown	42.728695	-73.205901
Oxbow Pond	Easthampton	42.28855	-72.6195
Millers River	Orange	42.58903	-72.30789
Nashua River	Pepperell	42.6287	-71.59355
Ware River	Ware	42.266421	-72.227435
South Watuppa Pond	Westport	41.66812	-71.11721
Whitman's Pond	Weymouth	42.20642	-70.94267
Lake Cochichewick	North Andover	42.69129	-71.098