Massachusetts Department of ENVIRONMENTAL PROTECTION

2013 DWM ENVIRONMENTAL MONITORING OVERVIEW

(CN 411.0)

A brief overview of the surface water monitoring performed in 2013 by personnel of the MassDEP's Division of Watershed Management (DWM) is presented here. Information pertaining to the individual components of DWM's Surface Water Monitoring Program is presented at http://www.mass.gov/eea/agencies/massdep/water/watersheds/water-quality-monitoring-program.html#1.

The main programmatic objectives of the DWM related to surface water quality monitoring are to:

- 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 being met in waters of the Commonwealth;
- Collect chemical, physical and biological data to support analysis and development of implementation plans to reduce pollutant loads to waters of the Commonwealth;
- Screen fish in selected waterbodies for fish tissue contaminants (metals, PCBs and organochlorine pesticides) to provide for public health risk assessment;
- To the extent feasible, locate pollution sources and promote and facilitate timely correction;
- Over the long term, collect water quality data to enable the determination of trends in parameter concentrations and/or loads;
- Develop new or revised standards, which may require short-term research monitoring directed towards the establishment or revision of water quality policies and standards; and to
- Measure the effectiveness of water quality management projects or programs such as the effectiveness of implementing TMDLs, Best Management Practices (BMP) for the control of nonpoint pollution, or a state-wide policy or permitting program.

Quality assurance is maintained for DWM's watershed monitoring program to ensure implementation of an effective and efficient sampling design, to meet programmatic goals and to provide data meeting specific data quality objectives. The U.S. Environmental Protection Agency (USEPA) has approved a comprehensive Quality Assurance Program Plan (QAPP) that applies to the generation and use of surface water quality data by DWM for a five-year period (2010 – 2014). 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 the DWM's Quality Management Program and the 2010 – 2014 QAPP can be found on-line at

http://www.mass.gov/eea/agencies/massdep/water/watersheds/environmental-monitoring-quality-management-program.html.

Since 1992, water quality monitoring, assessment and selected management activities of the MassDEP have been sequentially performed in accordance with a rotating five-year watershed schedule. Surface waters are typically monitored during "Year Two" of this cycle by the DWM Watershed Planning Section. While the DWM continues to monitor surface waters on a rotating basis, the makeup of the watershed groups that are the focus of monitoring each year was adjusted in 2009 to more efficiently focus limited resources in the field and laboratory, and to respond to evolving requirements of the Environmental Protection Agency (EPA) for surface water data and related information to support reporting under the Clean Water Act (CWA). An explanation of how and why the new watershed alignment was established is presented at http://www.mass.gov/eea/agencies/massdep/water/watersheds/adjustments-to-surface-water-monitoring-program.html. While the watersheds were originally arranged to evenly distribute the administrative workload (i.e., permit issuance) from year to year, the water resources to be monitored (i.e., river miles) were not equitably distributed and were scattered throughout the Commonwealth. The new alignment balances the allocation of monitoring resources each year and focuses them more efficiently in one region.

The 2013 surface water monitoring program continued the implementation of the statistically valid sampling design for Massachusetts' shallow (i.e., "wadable") streams that was initiated in 2010. The EPA strongly encourages states to adopt this approach for one or more waterbody types. The probabilistic survey design provides for the assessment of 100% of waters in a target population by monitoring a random sample of those waters. The ultimate goal of the DWM is to expend about 35% of annual monitoring resources on the probabilistic monitoring effort to satisfy the reporting requirements of CWA Section 305(b) while allotting the remaining 65% to deterministic or targeted data collection efforts such as the identification of pollution sources or the development of TMDLs. With the loss of full-time monitoring personnel in recent years, however, DWM's surface water monitoring efforts in 2013 focused primarily on the implementation of the probabilistic wadable stream survey, with less consideration given to deterministic monitoring activities. All of the monitoring activities of the DWM in 2013 are briefly described below.

PROBABILISTIC MONITORING & ASSESSMENT PROGRAM (MAP2) – The goals of the probabilistic survey are to provide an unbiased assessment (Support/Impaired) of aquatic life, recreational and aesthetic uses in wadable (i.e., 1st – 4th Strahler Order), non-tidal perennial streams of Massachusetts, and, over time, to provide an analysis of trends in the use assessments of those streams. The random sampling design allows for the determination, with a known statistical confidence, the percentage of wadable stream miles supporting and not supporting their designated uses. To implement the survey, Massachusetts' 1st – 4th order streams were apportioned into five separate groups or strata, one of which – the "Southeastern" – was the focus of monitoring in 2013. The "Southeastern Group" comprises the Mystic, Neponset, Weymouth/Weir and Taunton watersheds and the Buzzards Bay, Cape Cod, Islands, Narragansett Bay/Mount Hope Bay and South Shore coastal drainage systems.

A total of 38 sites were monitored in 2013 (Table 1). The sites were divided into six groups that were visited on a weekly rotation to facilitate survey logistics and balance the sample load to the respective analytical laboratories. The primary objective at each sampling site was to collect sufficient data to assess, using the DWM's existing assessment methodology, the status (support/impaired) of aquatic life, recreational and aesthetic uses. All sampling and

QA/QC was performed in accordance with the DWM's standard operating procedures, QAPP and SAP. A list of the water quality and ecological variables measured at each site, along with their sampling frequencies, is presented in Table 2.

Table 1. Location of randomly selected sites in the southeastern region of Massachusetts that were sampled in 2013 as part of the probabilistic wadable stream survey.

Site	Watershed	Waterbody	Site Description
MAP2-402	Taunton	Nemasket River	[approximately 1500 feet downstream/north of Interstate 495, Middleborough]
MAP2-345	Taunton	Puddingshear Brook	[approximately 335 feet downstream/southwest from Clayton Road, Middleborough]
MAP2-413 [a]	Taunton	Pine Swamp Brook	[approximately 1770 feet downstream/east from Route 138 (Broadway), Raynham]
MAP2-322	Taunton	Mill River	[approximately 220 feet downstream/southeast from Route 44 (Winthrop Street), Taunton]
MAP2-381	Taunton	Mill River	[approximately 2800 feet upstream/north of Route 140 (Washington Street), Taunton]
MAP2-407 [b]	Narragansett Bay	East Branch (Palmer River)	[approximately 1600 feet upstream/north from Williams Street, Rehoboth]
MAP2-347 [b]	Narragansett Bay	Palmer River	[approximately 830 feet upstream/east from Danforth Street, Rehoboth]
MAP2-385	Cape Cod	Herring River	[approximately 1400 feet upstream/north of Route 6 (Mid Cape Highway), Harwich]
MAP2-384	Cape Cod	Santuit River	[east of Route 130, approximately 1400 feet downstream/south of the outlet of Santuit Pond, Mashpee]
MAP2-328	Buzzards Bay	Doggett Brook	[approximately 2380 feet upstream/southwest from Route 105 (Marion Road/Front Street), Rochester/Marion]
MAP2-380	Buzzards Bay	Mattapoisett River	[approximately 5250 feet upstream/north of Acushnet Road, Mattapoisett (approximately 350 feet upstream of confluence of unnamed tributary, outlet of Tinkham Pond)]
MAP2-404	Buzzards Bay	Mattapoisett River	[approximately 3350 feet upstream/north of New Bedford Road, Rochester]
MAP2-341	Taunton	Salisbury Brook	[west of Carleton Street, just upstream/south of Ellsworth Street, Brockton]
MAP2-339	Taunton	Rumford River	[approximately 675 feet downstream/south from Cocasset Street, Foxborough]
MAP2-423	Taunton	Rumford River	[approximately 1450 feet upstream/north from the Route 140 ramp to Route 495 north bound, Mansfield]
MAP2-391	Taunton	Unnamed Tributary	[unnamed tributary to Canoe River, south of Interstate 495, approximately 430 feet downstream/southeast of Newcomb Street, Norton]

Table 1. Location of randomly selected sites in the southeastern region of Massachusetts that were sampled in 2013 as part of the probabilistic wadable stream survey.

Site	Watershed	Waterbody	Site Description
MAP2-439	Taunton	Wading River	[approximately 1150 feet downstream/northeast from Route 140 (Taunton Avenue), Norton]
MAP2-327	Taunton	Wading River	[approximately 340 feet upstream/northwest from Route 123 (West Main Street), Norton]
MAP2-443	Narragansett Bay	Runnins River	[approximately 50 feet downstream/southwest from Arcade Avenue, Seekonk (upstream of unnamed tributary on northwestern bank)]
MAP2-349	Taunton	Hockomock River	[at the West Bridgewater/Bridgewater border approximately 600 feet from the confluence with Town River]
MAP2-365	Taunton	Hockomock River	[approximately 770 feet downstream/west from Manley Street, West Bridgewater]
MAP2-429	Taunton	Town River	[approximately 25 feet upstream/west from Hayward Street, Bridgewater]
MAP2-333 [a]	Taunton	Satucket River	[approximately 1840 feet downstream/west from Washington Street, East Bridgewater]
MAP2-362	Taunton	Poor Meadow Brook	[Main Street, Hanson]
MAP2-373	Taunton	Shumatuscacant River	[approximately 3200 feet upstream/northwest of Route 27 (Franklin Street), Whitman]
MAP2-437	Taunton	Salisbury Plain River	[approximately 1300 feet downstream/south from Grove Street, Brockton]
MAP2-360	Taunton	Fall Brook	[approximately 5220 feet upstream/south from Chace Road, Freetown]
MAP2-428	Buzzards Bay	Paskamanset River	[approximately 2500 feet downstream/south from Route 6 (State Road), Dartmouth]
MAP2-396	Buzzards Bay	Unnamed Tributary	[unnamed tributary to Bread and Cheese Brook approximately 75 feet downstream/east of Gifford Road, Westport]
MAP2-335 [b]	Narragansett Bay	Kickamuit River	[approximately 1630 feet upstream/east from Bushee Road, Swansea]
MAP2-379	Narragansett Bay	Cole River	[approximately 2200 feet upstream/east from Hortonville Road, Swansea]
MAP2-363 [b]	Narragansett Bay	Clear Run Brook	[approximately 1750 feet downstream/southeast from Miller Street, Seekonk]
MAP2-382 [a,b]	Boston Harbor	Unnamed Tributary	[unnamed tributary to the Aberjona River approximately 700 feet downstream/east of Wildwood Road, Woburn (where stream exits culvert under parking area/driveway)]
MAP2-414 [b]	Boston Harbor	Mill Brook	[approximately 45 feet downstream/east from Brattle Street, Arlington]
MAP2-366	Boston Harbor	Pine Tree Brook	[approximately 500 feet upstream/south from Canton Avenue, Milton]

Table 1. Location of randomly selected sites in the southeastern region of Massachusetts that were sampled in 2013 as part of the probabilistic wadable stream survey.

Site	Watershed	Waterbody	Site Description
MAP2-410	South Coastal	Pudding Brook	[approximately 175 feet upstream/north from Spring Street, Pembroke]
MAP2-426	Boston Harbor	Accord Brook	[approximately 2250 feet upstream/south from south Pleasant Street, Hingham]
MAP2-398	Boston Harbor	Weir River	[approximately 110 feet upstream/south of Route 228 (East Street), Hingham]

a – Fish population data not collected
b – Periphyton community assessed

Table 2. Sampling frequency of water quality and ecological variables measured at probabilistic sites.

Variable	Sample Frequency (Minimum)
Bacteria (*E. coli*)	5
Nutrients (TN,TP, Nitrate/Nitrite, Ammonia)	5
Color	5
Turbidity	5
Chloride	5
Metals	3
Dissolved Oxygen Probe Deploys (varying duration)	1
Temperature Probe Deploys (May-September)	1
Habitat Assessment	1
Fish Community	1
Macroinvertebrate Community	1
Periphyton Community	1

Individual components of the wadable stream survey are described below.

***Water Quality (Chemical, Microbiological and Physical)*:** Each month, from May to September, grab water samples were collected at each site, field preserved, as appropriate, and delivered to the Senator William X. Wall Experiment Station in Lawrence (WES) for nutrient (total phosphorus, total nitrogen, nitrate/nitrite nitrogen and ammonia nitrogen) and chloride analysis and one of two commercial laboratories for bacterial (*E. coli)* analysis. Samples were also collected and transported to the DWM's Worcester Office where they were analyzed for turbidity and true color.

Multi-probed water quality sondes were deployed *in-situ* for various lengths of time to obtain continuous analyses for temperature, dissolved oxygen, percent oxygen saturation, pH, specific conductance, and total dissolved solids. In addition, temperature sensors were deployed at all sites from May through September to obtain long-term, continuous water temperature data.

Samples for the analysis of dissolved metals were collected from each site on three occasions using wade-in, clean-hands techniques. Samples were filtered in the field and transported to the USEPA's New England Regional Laboratory (NERL) in Chelmsford for analysis.

***Biological Monitoring (Macroinvertebrates, Fish, Periphyton, Habitat)*:** Benthic macroinvertebrate, fish and periphyton (selected sites) community assessments, along with associated habitat evaluations, were performed to assess the *Aquatic Life Use* status. These communities integrate environmental conditions (chemical – including nutrients and toxics, and physical – including flow and water temperature) over extended periods of time and are an excellent measure of a waterbody's overall "health".

The benthic macroinvertebrate community was sampled at each site once during the index period July through August, using Rapid Bioassessment Protocols (RBP) III or a modification thereof, depending upon available habitat. For example, typical RBP III kick-sampling protocols could not be used at low-gradient sites so a multi-habitat sampling method (i.e., multiple net sweeps) was employed. Specimens were preserved in the field and transported to the DWM lab for further processing. Where applicable, benthic macroinvertebrate functional feeding group, community composition, biotic index using pollution tolerance, and abundance metrics will be calculated to determine biological condition and *Aquatic Life Use* status.

Fish community sampling for the presence/absence of resident fish species was performed once at all but three sites during the late summer. Fish were collected within a 100-meter reach using a backpack or tote barge-mounted electro-fishing 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 reach.

Periphyton assessments were performed at each of six sites to support resource assessment and ongoing nutrient criteria development. Standard habitat measurements included stream velocity determinations and estimates of light available to the benthic algae (e.g., canopy cover). For each sampling event, algal percent coverage was measured and diatom samples were collected and shipped to a commercial laboratory for taxonomic identifications, counts, biovolumes and statistical analysis.

DETERMINISTIC ("TARGETED") MONITORING PROGRAM (TMP) – Several waterbodies were selected, or "targeted", for monitoring activities designed to fulfill the needs for specific data and information to support such program elements as TMDL development and implementation, criteria development and human health risk assessment. While some targeted monitoring activities were focused in the Southeastern Group of watersheds in accordance with the rotating watershed schedule, other monitoring work was carried out in watersheds throughout Massachusetts. More detail pertaining to the targeted monitoring activities of the DWM in 2013 is presented below.

Reference Site Network (RSN): The DWM has identified the need to characterize the reference condition for Massachusetts' surface waters to support multiple program objectives including, but not limited to, the interpretation of biological data obtained from the probabilistic monitoring network as well as the development of biocriteria and nutrient criteria. For example, the DWM is currently exploring the development of tiered aquatic life uses that will increase the accuracy of aquatic life use assessments and improve water quality goal-setting processes. An understanding of the inter-year and intra-year variation within the indices of biotic integrity used for assessment is a critical initial step toward the development and implementation of biocriteria and tiered aquatic life use.

Least-disturbed reference sites were selected from the two most prominent Level III ecoregions (Northeastern Highlands, Northeastern Coastal Plain) in Massachusetts through the application of a Human Disturbance Index that was derived from six individual streamflow and landscape disturbance indicators. A total of ten (10) sites were chosen for intensive study over three years,

beginning in 2011. Over time, the number of sites in this network expanded until, in 2013, a total of 22 sites were sampled (Table 3). The primary objective at each sampling site was to collect sufficient data to begin evaluating inter-year and intra-year variation in the biological communities. Monitoring activities included habitat assessment; macroinvertebrate and fish population assessments; and physicochemical sampling. All sampling and QA/QC was performed in accordance with the DWM's standard operating procedures, QAPP and SAP. A list of the water quality and ecological variables measured at each site, along with their sampling frequencies, is presented in Table 4. More detail pertaining to each component of the RSN is presented below.

Table 3. Location of selected "reference/least disturbed" sites that were sampled in 2013 as part of the reference site network.

Site	Watershed	Waterbody	Site Description
CP01 [a]	Deerfield	Chapel Brook	[approximately 300 feet upstream of Main Poland Road, Conway]
CR01 [a]	Deerfield	Cold River	[approximately 325 feet upstream of Mohawk Trail (Route 2), Florida/Savoy (upstream of Black Brook confluence)]
DU01	Deerfield	Dunbar Brook	[west of River Road, approximately 1400 feet upstream from the Dunbar Brook Dam (MA00222), Florida]
GR01	Deerfield	Green River	[east of Green River Road, Colrain approximately 50 feet upstream/north of the confluence of Thorne Brook, Leyden]
TB01	Deerfield	Thorne Brook	[east of Green River Road, approximately 100 feet upstream of confluence with the Green River, Leyden]
BH01	Bash Bish	Bashbish Brook	[south of Falls Road, approximately 200 feet upstream of the confluence of Wright Brook, Mount Washington]
YB02 [a]	Housatonic	Yokun Brook	[approximately 1800 feet upstream of Edgewood Drive, Lenox]
FB01	Westfield	Factory Brook	[east off Town Hill Road, approximately 4400 feet upstream of confluence with the Westfield River, Middlefield]
SB01	Westfield	Sanderson Brook	[Sanderson Brook Road bridge nearest Route 20, Chester]
PB01 [a]	Westfield	Pond Brook	[approximately 275 feet upstream of Beech Hill Road, Blandford]
WB01	Millers	Whetstone Brook	[approximately 160 feet downstream of Kentfield Road (Kempfield Road), Wendell]
WSR01	Chicopee	West Branch Swift River	[approximately 640 feet upstream from Cooleyville Road Extension, Shutesbury]
EBT01 [a]	Millers	East Branch Tully River	[approximately 2000 feet upstream from Route 68 (Warwick Road), Royalston]
MS01 [a]	Nashua	Mason Brook	[approximately 1450 feet upstream/north from Brooks Crossing, Townsend]

Table 3. Location of selected "reference/least disturbed" sites that were sampled in 2013 as part of the reference site network.

Site	Watershed	Waterbody	Site Description
PHB01 [a]	Nashua	Pearl Hill Brook	[approximately 2775 feet downstream/north from Vinton Pond Road, Townsend]
TR01	Nashua	Trout Brook	[approximately 140 feet upstream of Manning Street, Holden]
WBW01	Buzzards Bay	West Branch Westport River	[east of Route 81, Tiverton RI approximately 3500 feet upstream of the inlet of Grays Mill Pond, Little Compton, Rhode Island]
BCB01 [a]	Buzzards Bay	Bread and Cheese Brook	[approximately 980 feet downstream of Route 177, Westport]
RS01 [a]	Taunton	Rattlesnake Brook	[approximately 570 feet upstream/east from Route 24/79 (Amvets Memorial Highway), Freetown]
EB01	Blackstone	Emerson Brook	[approximately 200 feet upstream of the Route 146 southbound off-ramp to Chocolog Road, Uxbridge]
RTB01	Blackstone	Roundtop Brook	[approximately 1400 feet downstream/south from the confluence of Tinkerville Brook, Burriville, Rhode Island (approximately 1600 feet from MA/RI border)]
BB01	Quinebaug	Browns Brook	[approximately 2120 feet upstream from May Brook Road, Holland]

a – Periphyton community assessed

Table 4. Sampling frequency of water quality and ecological variables measured at RSN sites.

Variable	Sample Frequency (Minimum)
Nutrients (TN,TP, Nitrate/Nitrite, Ammonia)	5
Color	5
Turbidity	5
Chloride	5
DO andTemperature Probe Deploys (May-September)	1
Habitat Assessment	1
Fish Community	1
Macroinvertebrate Community	1
Periphyton Community	1

***Water Quality (Physico-chemical)*:** Approximately monthly, from May to September, grab water samples were collected at each site, field preserved, as appropriate, and delivered to the Senator William X. Wall Experiment Station in Lawrence (WES) for nutrient (total phosphorus, total nitrogen, nitrate/nitrite nitrogen and ammonia nitrogen) and chloride analysis and the DWM lab in Worcester for turbidity and color analysis. In addition, temperature sensors were deployed at all sites from May to September to obtain long-term, continuous water temperature data.

***Biological Monitoring (Macroinvertebrates, Fish, Periphyton, Habitat)*:** Benthic macroinvertebrate, fish and periphyton (selected sites) community assessments, along with associated habitat evaluations, were performed to assess the *Aquatic Life Use* status. These communities integrate environmental conditions (chemical – including nutrients and toxics, and physical – including flow and water temperature) over extended periods of time and are an excellent measure of a waterbody's overall "health".

The benthic macroinvertebrate community was sampled at each site once during the index period July through August using Rapid Bioassessment Protocols (RBP) III or a modification thereof, depending upon available habitat. For example, typical RBP III kick-sampling protocols could not be used at low-gradient sites so a multi-habitat sampling method (i.e., multiple net sweeps) was employed. Specimens were preserved in the field and transported to the DWM lab for further processing. Where applicable, benthic macroinvertebrate functional feeding group, community composition, biotic index using pollution tolerance, and abundance metrics will be calculated for analysis.

Fish community sampling for the presence/absence of resident fish species was performed once at each site during the late summer. Fish were collected within a 100-meter reach using a backpack or tote barge-mounted electro-fishing 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.

Periphyton assessments were performed at each of nine sites to support resource assessment and ongoing nutrient criteria development. Standard habitat measurements included stream velocity determinations and estimates of light available to the benthic algae (e.g., canopy cover). For each sampling event, algal percent coverage was measured and diatom samples were collected and shipped to a commercial laboratory for taxonomic identifications, counts, biovolumes and statistical analysis.

Long-term Monitoring of Contaminant Loads at Strategic Sites: MassDEP's strategic plan for water monitoring identifies the need for a monitoring program to determine loads of contaminants carried by major rivers in Massachusetts at strategic locations. This information is needed at the mouths of major rivers to quantify loads delivered to coastal waters and major inland waterways. Information is also needed at state boundaries to determine contaminant loads entering and leaving Massachusetts. The sampling approach suited to this monitoring objective is fixed-station monitoring, where the same sites are sampled repeatedly over time and over a range of hydrologic conditions. Repeated sampling over time also generates data that may be suitable for determining trends in water-quality conditions.

For approximately fifteen years a fixed-site network encompassing six watersheds in central Massachusetts was monitored by DWM-CERO personnel to serve as a pilot study for potential implementation state-wide at some future time. In 2013 the pilot study was discontinued after two or three final rounds of sampling and the design and implementation of a state-wide fixed-station monitoring network devolved to the DWM's Watershed Planning Program (WPP). Five sites from the original pilot study were selected to be monitored regularly as resources allow. These sites, presented in Table 5, will provide information pertaining to pollutant loads to neighboring states and/or will be used to track progress with the implementation of TMDLs. One additional round of sampling was completed during late summer at these five sites only.

Table 5. Five sites in the central portion of Massachusetts that were selected in 2013 for long-term monitoring to measure pollutant loadings and monitor the progress of TMDL implementation.

Watershed	Waterbody	Site Description
Blackstone	Blackstone River	[approximately 500 feet downstream from railroad trestle nearest to Route 122, Millville (at USGS gage 01111230 site)]
Concord	Assabet River	[at USGS flow gauging station #01097000 near the Route 27/62 bridge, Maynard]
Concord	Concord River	[Rogers Street, Lowell]
Thames	Quinebaug River	[Route 197 bridge, Thompson, Connecticut]
Nashua	Nashua River	[approximately 1/2 mile downstream/east from covered bridge at Groton Street near abandoned railroad trestle supports, Pepperell]

Sampling in the Westfield River Watershed to Support Nutrient Criteria Development: The Westfield River was selected for study in the summer of 2012 to inform the nutrient management plan being developed as part of the Massachusetts Surface Water Quality Standards. In 2013 benthic macroinvertebrate and periphyton community assessments, along with associated habitat evaluations, were performed at the following two sites as a follow-up to the more comprehensive study completed in 2012:

1) Westfield River, approximately 1200 feet upstream of Route 20 (East Main Street), Westfield
2) West Branch Westfield River, approximately 920 meters upstream from Route 112, Huntington

Field and Lab Support for the Assessment and Management of Cyanobacteria Blooms: MassDEP continued to provide technical expertise and laboratory support for the investigation of potentially toxic algae (cyanobacteria) blooms. Working from MassDEP's DWM-Worcester and Southeast Regional (SERO) offices, respectively, and in collaboration with MassDPH, staff biologists performed cyanobacterial counts and identifications on water samples to determine whether cell counts exceeded MassDPH advisory levels for recreational waters. Lab services and technical support were provided to State and Federal agency personnel and local public health officials. Numerous samples were collected throughout the summer from most water bodies and taxonomic identifications and counts were forwarded to MassDPH for risk assessment and management. A list of water bodies from which MassDEP processed samples is presented in Table 6.

Table 6. Water bodies from which algae samples were obtained for taxonomic identifications and counts. Results were submitted to MassDPH.

Waterbody	Municipality	Sampling Events
East Monponsett Pond	Halifax	20
West Monponsett Pond	Halifax/Hanson	26
Silver Lake	Kingston, Pembroke, Plympton	1
White Island Pond	Plymouth	15
Santuit Pond	Mashpee	18
Long Pond Reservoir	Falmouth	9
Queen Sewell Pond	Bourne	2

Fish Toxics Monitoring: DWM completed fish sampling at Sargent Pond (Leicester) and Forest Lake (Methuen) at the recommendation of the Inter-agency Fish Toxics Committee. Edible fillets from fish collected at both waterbodies were analyzed for the presence of mercury. If necessary, fish consumption advisories will be issued by the Massachusetts Department of Public Health (MassDPH).

DWM staff also assisted MassDEP's Bureau of Waste Site Cleanup (BWSC) with fish sampling in the Indian Head River as part of the ongoing assessment and remediation of the National Fireworks Company waste site in Hanover.

Fish Kill Response: On June 28, 2013, DWM staff assisted the MassDEP Central Regional Office (CERO) Incident Response Team with an investigation of a fish kill in the Charles and Stop rivers in the vicinity of Medfield, MA. Multiprobe water quality measurements (i.e., dissolved oxygen, temperature, pH and specific conductance) were taken at several locations along these rivers.

Lake Monitoring: A study of the effects of a whole-lake alum + aluminate treatment on the East basin of White Island Pond in Plymouth was conducted in late February and early March 2013. A privately funded treatment of the lake was monitored in three visits (before, during and after treatment) to document any changes in pH, alkalinity, dissolved and total aluminum, as well as dissolved and total phosphorus and total nitrogen. Secchi disk transparency, color, dissolved organic carbon, hardness (calcium and magnesium), and multi-probe data were also collected. General observations of impacts on fish and freshwater mussels were also made.

Baseline lakes sampling in the summer of 2013 focused on follow-up monitoring of the East and West White Island Pond in Plymouth as part of the implementation of the TMDL for phosphorus. In addition, DWM sampled East and West Monponsett ponds in Halifax as the next likely targets for TMDL development. Data from this sampling effort will support a pre-draft TMDL for these lakes and also may be used for regulatory purposes. Sampling consisted of three monthly visits to each lake and samples were also collected from inlet streams and observations were made of duckweed on White Oak Reservoir. Data collection focused on total phosphorus and total nitrogen. Secchi disk transparency, color, chlorophyll *a* and multi-probe data were also collected. Blooms of cyanobacteria were identified and counted and results passed on to MassDPH for evaluation and, where applicable, public advisories against swimming or contact due to toxic cyanobacteria. A single sampling trip was also taken to Silver Lake in Pembroke to collect nutrient and chlorophyll samples and Secchi disk transparency to evaluate potential for impacts of water diversions from the Monponsett Ponds.

Monitoring to Assess TMDL Implementation in the Assabet River Watershed: Ongoing efforts were continued in 2013 to document changes in the amount of aquatic plant biomass in the Assabet River system as a result of municipal wastewater treatment plant upgrades to remove phosphorus. In 2004, the Total Maximum Daily Load (TMDL) for total phosphorus in the Assabet River was approved by the EPA. The goal of the TMDL was to decrease the concentration of the nutrient phosphorus and to mitigate the ecological effects of eutrophication in the river. These effects were, for the most part, direct consequences of the excessive growth of aquatic macrophytes. Specifically, the TMDL called for a 50 percent reduction in aquatic plant biomass (e.g., duckweed). A program was initiated in 2009 to monitor each summer the effectiveness of the Assabet TMDL implementation measures. Observations of duckweed coverage of both open water and bank/littoral areas were made weekly from the end of May through the beginning of October. The observations were mapped in the field onto standardized

forms indicating the percentage range of coverage from fixed vantage points around the various impoundments. Photographs were also taken from each observation point.

Monitoring to Assess Climate Change: DWM staff monitored air and water temperature and collected macroinvertebrate samples at five sites in Massachusetts as part of a larger effort undertaken by multiple federal and state agencies, NGOs, and academic institutions across New York and New England to assess climate change in the Northeast. Spearheaded by the EPA, this effort is aimed at coordinating temperature and biological data collection across the region. Similar "regional" collaborations have been established across the country.

In Massachusetts the five sites are Hubbard River in Granville, Brown's Brook in Holland, Parker's Brook in Oakham, West Branch Swift River in Shutesbury, and Cold River in Florida. UMass/Amherst and MassWildlife's Division of Ecological Restoration (DER) are the other partners on the "Massachusetts Team." DER has installed flow-gaging equipment at the three sites without USGS gages and is developing the flow rating curves for them. UMass is playing a coordinating role and also plans to address the fisheries component.

Monitoring Assistance to CERO: DWM staff assisted personnel of MassDEP's Central Regional Office (CERO) with water sampling as part of an investigation of a pollution complaint in Cooledge Brook, Northborough.

Bacteria Source Tracking Activities of the Southeast Regional Office (SERO): The DWM regional monitoring coordinator, aided by two additional regional staff members and a student intern, used the IDEXX quanti-tray system on site in the Southeast Region lab, to determine the concentration of "indicator bacteria" (*E.coli* and Enterococcus) in surface water, at stormdrain outfalls and within drainage infrastructure (manholes).

Additional source tracking tools used were:

- Hach test kits: to determine detergent concentrations.
- Ammonia and potassium meters: to determine ammonia/potassium ratios

These data were combined with field observations and in some cases, discussions with local watershed groups and/or municipal officials to refine sampling locations, in an attempt to track and isolate the dry-weather source(s) of *E. coli* and/or Enterococcus bacteria. A small number of opportunities for "Human Marker" analyses (fluorescent whitening agents, DNA, and caffeine) were made available by the WES State Lab. These analyses were utilized in cases where bacteria concentrations were high but no obvious source could be immediately located, in an attempt to determine if the bacteria were from a human or animal source.

Subwatersheds where bacteria source tracking was conducted are presented in Table 7.

Highlights of the 2013 sampling season

- The partnership with the North South River Watershed Association continued with joint bacteria source tracking efforts in the Kent Park area of the South River and in the French Stream watershed.

- The partnership with the Jones River Watershed Association and the Town of Kingston continued with a re-look at the water quality of Tussock Brook upstream and downstream of the tide-gate (and Rt.3), since in previous years a large increase in

bacteria was observed moving downstream. In addition, samples were collected for human markers analysis at a hot-spot area of the Tussock Brook watershed. In 2011 high bacteria concentrations were recorded in this tributary during dry weather conditions. The human marker analysis results will help guide future source tracking efforts and communications with the owners of this property.

- The successful multi-year partnership with the City of Brockton continued with joint source tracking efforts and corrections within the drainage infrastructures, influencing Trout Brook, Salisbury Brook, Lovett Brook and Salisbury Plain River.

- The successful multi-year partnership with the City of Norwood continued with a joint day of source tracking within the drainage infrastructure (via drain manholes) for problem watersheds throughout Norwood i.e. Plantingfield Brook, Meadow Brook and the Neponset River. SERO BST and City consultants CDM, worked together to select priority sample locations and collect samples. Results from this day of work led to additional investigations by CDM (dye testing, smoke testing and camera work), which will lead to infrastructure corrections being made by the City.

- The partnership with EPA Region-1 and Rhode Island DEM continued into this year, with the goal of conducting bacteria source tracking throughout the Palmer River Watershed. Two rounds of dry weather screening sampling were conducted at 40 locations throughout the watershed by a team of EPA, RIDEM and SERO staff. Lab analyses were conducted by the EPA for these sample runs. In addition, a more focused sampling effort was jointly conducted by EPA and SERO staff on the stretch of river between Providence Street (Rehoboth) and Old Providence Rd in Swansea (close to the RI state line). A canoe was used to gain access to this stretch of river and all its tributaries, with nineteen samples collected in total. Lab analyses were conducted by SERO BST for this sample run. This partnership is expected to continue into next year with additional rounds of screening sampling as well as more focused source tracking sampling.

- Collaboration with the Town of Seekonk was initiated, by way of the Conservation Agent. This partnership began with an offer of help (made by SERO BST to the town) in tracking dry weather sources at outfalls in the town. The town produced a list of suspect outfalls based on previous observation of dry weather flows and together samples were collected over a period of a few different field days. Many of these outfalls influenced segments of interest to the SERO BST program, located in the Runnins River and Ten Mile River. This work will help the town meet their “Illicit discharge and elimination” goals required as part of their Stormwater Management effort. In addition, the town accompanied and lent field assistance to SERO BST in more focused sampling of Torrey Creek (to build on work completed by the Palmer River watershed-wide sampling effort, see above), as well as specific hot spot areas on the Runnins River of interest to SERO.

- A significant and elusive source was discovered on a tributary to Rocky Run Brook at Davis Street Rehoboth. Raw sewage/septic water was found to be discharging from a 4” PVC pipe coming in under the road from the wall of the culvert. SERO BST is currently working with the town health agent to ensure that the town takes action. The town is currently investigating the origins of the pipe, but may soon resort to filling the pipe to remove the source.

Table 7. Subwatersheds where bacteria source tracking was conducted over the course of approximately 40 sample days. Note: This table includes only the names of those municipalities where sampling took place and new sub-watersheds are highlighted in **bold.**

Name	Basin	Segment	Municipalities sampled	Number of sample days
Ten Mile River	Ten Mile	MA52-02	North Attleboro	4
Speedway Brook	Ten Mile	MA52-05	Attleboro	3 + Human Marker
Bungay River	Ten Mile	MA52-06	Attleboro	2
Sevenmile River	**Ten Mile**	**MA52-08**	**Attleboro**	**5**
Runnins River	Narragansett Mt. Hope Bay	MA53-01	Seekonk	4 + Human Marker
Rocky Run Brook	Narragansett Mt. Hope Bay	MA53-16	Rehoboth	3
Torrey Creek	Narragansett Mt. Hope Bay	MA53-17	Rehoboth	2 + Human Marker
Lee River	Narragansett Mt. Hope Bay	MA61-01	Swansea	2
Palmer River	Narragansett Mt. Hope Bay	Multiple	Rehoboth & Seekonk	5
Taunton River (Main & other tribs)	Taunton	MA62-02	Taunton	2
Salisbury Plain River	Taunton	MA62-05	Brockton	4
Trout Brook	Taunton	MA62-07	Brockton	4 + Human Marker
Salisbury Brook	Taunton	MA62-08	Brockton	5
Mill River	Taunton	MA62-29	Taunton	3
Shumatuscacant River	**Taunton**	**MA62-33**	**Abington**	**4**
Meadow Brook	Taunton	MA62-38	East Bridgewater	1
Lovett Brook	Taunton	MA62-46	Brockton	2
Muddy Cove Brook	Taunton	MA62-51	Dighton	2
Hawes Brook	Boston Harbor	MA73-16	Norwood	1 + Human Marker
Germany Brook	Boston Harbor	MA73-15	Norwood	2
Pequit Brook	**Boston Harbor**	**MA73-22**	**Canton**	**3**
Weymouth Back River	Weymouth & Weir	MA74-13	Weymouth	1
South River	South Coastal	MA94-09	Marshfield	1
Jones River	South Coastal	MA94-14	Kingston	1 + Human Marker
French Stream	South Coastal	MA94-03	Rockland	3
Buttonwood Brook	Buzzards Bay	MA95-13	New Bedford	1
Mattapoisett Harbor	Buzzards Bay	MA95-35	Mattapoisett	3
East Branch Westport River	Buzzards Bay	MA95-41	Westport	3
West Branch Westport	**Buzzards Bay**	**MA95-37**	**Westport**	**2 + Human Marker**
Provincetown Harbor	Cape Cod	MA96-29	Provincetown	1