Massachusetts Department of ENVIRONMENTAL PROTECTION

2009 DWM ENVIRONMENTAL MONITORING OVERVIEW

(CN 332.0)

Water quality monitoring, assessment and management activities of the MassDEP are sequentially performed in accordance with a rotating five-year watershed schedule. Surface waters are typically monitored during "Year Two" of this cycle by the Division of Watershed Management's (DWM) Watershed Planning Section. Monitoring Program elements are described in more detail at http://www.mass.gov/dep/water/resources/envmonit.htm. 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 (2005 through 2009). 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.

While the DWM plans to continue monitoring in accordance with a five-year rotating schedule, the makeup of the watershed groups that will be the focus of monitoring each year is being adjusted to accommodate changes in available monitoring resources and to improve sampling efficiencies in the field. In contrast with the scattered distribution of watersheds comprising the monitoring groups used for the past several years, the watersheds of the Commonwealth will now be grouped together according to region. In fact, 2009 represented a transitional year whereby monitoring operations were focused on selected watersheds in southeastern Massachusetts that had not been monitored in many years. Accordingly, the DWM performed monitoring activities primarily within the *Mystic, Neponset, Weymouth/Weir, Narragansett Bay/Mount Hope Bay and Cape Cod* drainage systems. In consultation with appropriate agencies and organizations (e.g., USEPA, USGS, watershed associations, etc.) DWM monitoring coordinators reviewed historical data and information, examined GIS data layers, reviewed NPDES and water withdrawal permits, conducted reconnaissance and formulated individual watershed SAP's. While some of the DWM monitoring activities in 2009 were targeted at specific issues of concern, the majority of the monitoring in the "Year Two" watersheds was aimed at providing the necessary data and information to assess the extent to which water bodies are supporting their intended uses, as designated in the Massachusetts Surface Water Quality Standards. This information supports individual watershed assessments, which, in turn, inform the Massachusetts Integrated List of Waters submitted to the EPA in fulfillment of sections 305b (Summary of Water Quality) and 303d (List of Impaired Waters) of the Clean Water Act (CWA).

While the assessment monitoring described above is useful for determining the overall status of water quality conditions at the watershed scale, the data and information gained through those efforts are often insufficient for identifying with confidence the location and magnitude of the specific sources of pollution contributing to water quality impairment, and typically do not support follow-up actions aimed at restoring impaired waters. To address the need for this kind of data and information, the bacteria source tracking (BST) efforts of MassDEP's regional monitoring personnel were continued in 2009 with the goal of locating and eliminating sources of bacteria contamination to surface waters in their respective regions. These efforts are described in more detail later in this report.

Although the majority of DWM's monitoring efforts in 2009 were centered in the "Year Two" watersheds, a few miscellaneous projects were undertaken in watersheds apart from the rotating monitoring and assessment schedule. For example, the DWM performed fish toxics monitoring at four sites in response to public requests. Other special investigations are summarized below in the section entitled "Additional Monitoring Activities".

More detail pertaining to the monitoring activities accomplished in 2009 is presented below for both the "Year Two" watersheds, as well as throughout the state.

CAPE COD

The 2009 surveys of the Cape Cod Watersheds focused on obtaining information to meet the following objectives:

- Determine the water quality and biological health of rivers/streams on Cape Cod that have never been sampled directly by DWM.

- Provide biological and habitat data to document the status of benthic communities not

sampled previously by DWM. Provide biological, habitat, and dissolved oxygen, temperature, and chemical data to DWM's Environmental Monitoring and Assessment Program to be used in making *Aquatic Life* and *Aesthetics* use assessments required by Section 305(b) of the Clean Water Act; and provide data for other informational needs of Massachusetts regulatory agencies.

- Provide quality-assured *E. coli* data for the purpose of assessing *Primary* and *Secondary Contact Recreational* uses in rivers/streams.

- Provide quality-assured dissolved metals data for the purpose of assessing the *Aquatic Life* use in rivers/streams.

- Provide data to the Massachusetts Department of Public Health (MDPH) for public health risk assessment due to fish tissue contaminants (mercury).

- Provide quality-assured data to DWM's Total Maximum Daily Load Program to assist with TMDL development.

The specific sampling activities of the 2009 Cape Cod Watershed "Year Two" Survey are listed below. Monitoring stations are summarized in the table at the end of this section.

1) River Water Quality: Water quality surveys were conducted a total of 6 times (weeks of May 18, June 22, July 27, August 10 (bacteria only), August 31, and October 5) at both river stations and shoreline lake sites. Data collected at river sites included grab samples for total phosphorus, total nitrogen, ammonia nitrogen, color, turbidity, hardness (6 river sites), and *E. coli* bacteria. In-situ multi-probe measurements for temperature, dissolved oxygen, percent oxygen saturation, pH, specific conductance, and total dissolved solids were collected at 10 river water quality sites using attended multi-probe instruments. Continuous temperature and dissolved oxygen monitoring with unattended metered probes was carried out at 10 river sites.

2) Lake Monitoring: *E. coli* samples were collected from shore at each of eight lakes during the same six river water quality sampling events listed above. Algae samples were also collected (for cyanobacteria counts) at each lake at least three times depending on the occurrence of cyanobacteria blooms (see below). In addition to shoreline samples, water quality samples were collected three times at the deep hole of each lake (Hamblin Pond was only visited twice). Lake sampling efforts took place on June 24-25, July 29-30, September 9-10, September 23, and September 30-October 1. Analytes included total phosphorus, total nitrogen, ammonia, color, and turbidity from surface grabs, total phosphorus and total nitrogen from near bottom Van Dorn samples, and integrated depth chlorophyll a samples. Secchi disk readings and dissolved oxygen profiles were also measured at each deep hole. Finally, samples were obtained from tributaries/inflows to these lakes if they were flowing at the time of the site visit. Grab samples were collected at these input sites and analyzed for total phosphorus, total nitrogen, ammonia, color, turbidity, and hardness.

3) Biological Monitoring: Benthic macroinvertebrate and habitat assessments were performed at 14 stations to assess the aquatic life use status for 305(b) reporting requirements. Samples were collected June 1-2 and June 30-July 1. Due to the low-gradient nature of the streams on Cape Cod, typical RBP III kick-sampling protocols could not be used. Instead, a multi-habitat sampling method (i.e., multiple net sweeps) was employed. Representative organisms were

field sorted (roughly to family) and preserved for further identification. Periphyton samples were collected once at each of 11 sites. Of these samples, all but two were collected on June 1 and June 2. Single sites were also sampled on May 21 and May 22. Periphyton assessment consisted of an approximation of the algal coverage within the reach, and scrapes of various substrates within the riffle zone to obtain samples for taxonomic identification to genus. Fish population monitoring was conducted at seven locations (September 28-29). Backpack electro-fishing units were used to sample small streams for the presence/absence of resident fish species. All fish collected were returned to the source waterbody and a habitat assessment was produced for each sample site.

4) Fish Toxics Monitoring: Fish toxics monitoring was performed at five locations: Spectacle Pond (Sandwich) on May 27, both Cliff Pond (Brewster) and Lawrence Pond on May 28, Peters Pond on May 29, and Long Pond (Brewster/Harwich) on September 23. Edible fillets from these ponds were analyzed for the presence of mercury. Fish consumption advisories will be issued by the MDPH if necessary.

5) Continuous Temperature Monitoring: Long-term temperature sondes (thermistors) were deployed at 19 sites. Of these, two were deployed at sites within the Buzzards Bay drainage. All probes were deployed June 18-19 and were recovered during the two-week period following September 22. Data were collected to determine whether waterbodies merited being classified as potential coldwater fisheries and to be used as part of the Aquatic Life Use assessment.

6) Dissolved Metals Monitoring: Samples were collected at eight stations on August 20, September 10, and October 5. Three samples were collected at each site.

7) Blue-green Algae Bloom Investigations: Cyanobacteria grab samples were taken at each of the eight lakes sampled on Cape Cod at a minimum of three times (see dates for water quality surveys above). Samples were also collected at other sites within the lakes or from the Santuit River whenever there was evidence of a cyanobacteria bloom. Samples were processed by identifying which cyanobacteria taxa were present and in what abundance. These data were passed to the MassDPH. Health advisories were issued for Santuit Pond, Lovell's Pond, Walkers Pond, and Hinckley's Pond, necessitating closure of the ponds for recreation. Lesser blooms that did not cause closure were found at Great Pond and Upper Mill Pond. Besides cyanobacteria counts, water samples collected from selected ponds were analyzed for the presence of the toxin microcystin-LR using Envirologix test kits. None of the lakes examined - Mystic Lake, Middle Lake, Lovell's Pond, and Cliff Pond - Nickerson State Park - exhibited toxicant concentrations considered by DPH to be hazardous to recreational users of the water body.

8) Phycocyanin Measurements (SCUFA Probe): Phycocyanin readings were collected at any of the eight ponds where algal blooms were ongoing. Some ponds were sampled at the shoreline water quality sampling site and others were sampled at the deep hole. Multiple collections were made for sites with varying amounts of cyanobacteria evident at different points on the pond.

9) Bacteria Source Tracking: Bacteria source tracking studies were performed by DWM SERO staff during 2009. These are summarized under "Additional Monitoring Activities" at the end of this report.

Cape Cod – 2009 Water Quality and Biological Sampling Matrix

Waterbody	Site Map Link	Site Description (sample types*)
Coonamessett River	W1905	Sandwich Road, Falmouth (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11)
Coonamessett River	W1906	Route 28, Falmouth (1, 2, 3, 4, 10, 11)
Backus River or Mill Pond	W1907	Old Barnstable Road, Falmouth (2, 3, 10)
Childs River	W1908	Carriage Shop Road, Falmouth (2, 3, 10)
Quashnet River	W1909	Martin Road, Falmouth (2, 3, 5, 7, 8, 9, 10, 11)
Quashnet River	W1910	Route 151, Mashpee (1, 2, 3, 4, 6, 7)
Mashpee River	W1911	Route 28, Mashpee (1, 2, 3, 4, 5, 6, 7, 8, 9)
Santuit River	W1912	Old Kings Road, Mashpee/Barnstable (1, 2, 3, 4, 5, 7, 8, 9, 12, 16)
Little River	W1913	Old Post Road, Barnstable (2, 3)
Unnamed Tributary to Halls Creek	W1914	Craigville Beach Road, Barnstable (2, 3)
Herring River	W1915	Route 6, Wellfleet (1, 2, 3, 4, 5, 7, 8, 10, 11)
Herring River	W1916	Bound Brook Island Road, Wellfleet (1, 2, 3, 4, 5, 7, 8, 10, 11)
Unnamed tributary to Herring River in Wellfleet	W1917	Pole Dike Road, Wellfleet (2, 3, 5, 7, 8, 10, 11)
Red River	W1918	End of Shirley Drive cul-de-sac, Chatham/Harwich (2, 3, 5, 7, 8)
Unnamed Tributary to Herring River in Harwich	W1919	Great Western Road, Harwich (2, 3, 6)
Herring River - North Harwich	W1920	Kelley Street, Harwich (1, 2, 3, 4, 5, 6, 7, 8)
Unnamed Tributary to Freemans Pond	W1921	Lower Road, Brewster - northern trib - east side of road (2, 3)
Quivett Creek	W1922	Sea Street, Brewster/Dennis - walking path past parking area (1, 4)
Chase Garden Creek	W1923	Beach Street, Dennis (2, 3, 5, 8)
White's Brook	W1924	Route 6a, Yarmouth (1, 2, 3, 4, 5, 6, 8)
Mill Creek or Hawes Creek	W1925	Near dead end of Pondview Ave., Yarmouth (2, 3, 5, 6, 8)
Quivett Creek	W1926	Top of fish ladder at exit of unnamed pond into Quivett Creek, Brewster (2, 3, 7)
Great Pond - East Beach	W1927	Great Pond Road beach area, Eastham (3)
Lower Mill Pond - Outlet	W1928	Recreation area off Setauket Road, Brewster - pond pour point (3)
Upper Mill Pond - Eastern Beach	W1929	Public boat launch off Run Hill Road, Brewster (3)
Walkers Pond - Western Boat Ramp	W1930	Boat ramp turnoff on Slough Road, Brewster (3, 16)
Hinckley's Pond - Outlet just above spillway	W1980	Top of dam down path at end of Edith Grove Road, Harwich (3)
Hamblin Pond - Southern Beach	W1981	Public beach - boat ramp on unnamed road near cemetery - off Cotuit Road, Barnstable (3, 16)
Lovell's Pond - Western Boat Ramp	W1982	At boat ramp off Newtown Road, Barnstable (3, 16)
Santuit Pond - Northwest Boat Launch	W1983	Off Tupper Road, Mashpee (3, 16)
Great Pond	W1234	Deep Hole, Eastham (1, 2, 11, 12, 13, 14, 15)
Lower Mill Pond	W0748	Deep Hole, Brewster (1, 2, 11, 12, 13, 14, 15)
Upper Mill Pond	W0747	Deep Hole, Brewster (1, 2, 11, 12, 13, 14, 15, 16)
Walkers Pond	W0746	Deep Hole, Brewster (1, 2, 11, 12, 13, 14, 15, 16)

Waterbody	Site Map Link	Site Description (sample types*)
Hinckley's Pond	W1237	Deep Hole, Harwich (1, 2, 11, 12, 13, 14, 15, 16)
Hamblin Pond	W1984	Deep Hole, Barnstable (1, 2, 12, 13, 14, 15)
Lovell's Pond	W1214	Deep Hole, Barnstable (1, 2, 11, 12, 13, 14, 15, 16)
Santuit Pond	W0739	Deep Hole, Mashpee1, 2, 11, 12, 13, 14, 15, 16)
Unnamed tributary of Hinckley's Pond	W1238	Unnamed tributary of Hinckley's Pond, Harwich, northwest bog inlet (2)
Unnamed tributary of Hinckley's Pond	W1239	Unnamed tributary of Hinckley's Pond, Harwich, southeast bog inlet (2, 11, 16)
Unnamed Tributary of Lovell's Pond	W1985	Unnamed Tributary of Lovell's Pond, Barnstable, northern trib of site W1215 (approx lat-long) (2, 11)
Unnamed Tributary of Lovell's Pond	W1986	Unnamed Tributary of Lovell's Pond, Barnstable, southern trib upstream of site W1215 (approx lat-long) (2, 11)
Unnamed tributary of Lovell's Pond	W1217	Unnamed tributary of Lovell's Pond, Barnstable, northeast bog inlet (2, 11)
Unnamed tributary to Upper Mill Pond	W1277	Unnamed tributary of the southeastern end of Upper Mill Pond, Brewster (2, 11)
Childs River	W2071	Above Barrows Street, Mashpee/Falmouth - some tidal influence (5, 8, 9)
Pocasset River	W2072	Upper River Road, Bourne, by old hatchery (9)
Skunknet River	W2073	Old Mill Site on Skunknet River Wildlife Sanctuary, Barnstable - Audubon property (9)
Marstons Mill River	W2074	Below Route 28 and Route 149, Barnstable (5, 8, 9)
Red Brook	W2075	Below Red Brook Road, Mashpee (9)
Fresh Brook	W2076	Former Trout Stream on Cape Cod National Seashore, Wellfleet (9)
Quaker Run	W2077	Off golf cart path, Mashpee (9)
Herring Brook	W2078	Bridle Trail Crossing, Falmouth (9)
Backus River	W2079	Below Handy Cranberry bogs, Falmouth (9)
Herring River	W2080	Below Route 6, Harwich (9)
Scorton Creek Tributaries	W2082	Below Railroad tracks off Spring Hill Road, Sandwich (9)
Bumps River	W2084	Above Route 28, Barnstable (9)
"Blue Stream Hatchery Outflow"	W2085	Willow Street, Barnstable (9)
"Sandwich Hatchery Outflow"	W2086	Just above Main Road and Route 6A, Sandwich (9)
"Old East Sandwich Hatchery Outflow"	W2087	Below Old County Road, Sandwich - Nye Pond outlet (9)
Spectacle Pond	Spectacle Pond	Sandwich (18)
Cliff Pond	Cliff Pond	Brewster (18)
Lawrence Pond	Lawrence Pond	Sandwich (18)
Peters Pond	Peters Pond	Sandwich (18)
Long Pond	Long Pond	Brewster/Harwich (18)

***Sample Types**

1 – Attended multi-probe (DO, temperature, pH, conductance), 2 – Nutrients (total phosphorus, total

nitrogen, ammonia), color, turbidity, 3 – E. coli bacteria samples, 4 – Unattended continuous dissolved oxygen and temperature, 5 – Multi-habitat macroinvertebrate sampling (sweeps), 6 – Fish population, 7 – Periphyton, 8 – Habitat assessment, 9 – Unattended continuous temperature (thermistor), 10 – Dissolved metals, 11 – Hardness, 12 – Phytoplankton, 13 – Nutrients at depth (Van Dorn – total phosphorus, total nitrogen), 14 – Dissolved oxygen temperature pH, conductance profiles and Secchi Disk, 15 – Chlorophyll *a* (integrated tube sample), 16 – Pycocyanin (SCUFA), 17 – Total Suspended Solids, 18 – Fish tissue

MYSTIC

The 2009 surveys conducted in the Mystic Watershed focused on obtaining information (i.e. water quality, bacteria, and benthic macroinvertebrate populations) at a total of 19 stations. The specific objectives of this monitoring were to:

- Determine the water quality and biological health of rivers/streams within the watershed that have never been sampled directly by DWM.

- Provide biological and habitat data to document the status of benthic and fish communities over time (trend monitoring).

- Provide biological, habitat, and dissolved oxygen, temperature, and chemical data to DWM's Watershed Assessment Program to be used in making *Aquatic Life* and *Aesthetics* use assessments required by Section 305(b) of the Clean Water Act; and to provide data for other informational needs of Massachusetts regulatory agencies.

- Provide quality assured *E. coli* bacteria data for the purpose of assessing *Primary* and *Secondary Contact Recreation* uses.

Individual monitoring elements are described below. Water quality and biological monitoring sites are summarized in the matrix at the end of this section.

1) River Water Quality: Water quality surveys were conducted a total of six times (April 21, May 26, June 30, July 23 – bacteria only, August 4 and September 8). Samples for total phosphorous, total nitrogen, ammonia nitrogen, total suspended solids, color, turbidity, bacteria counts (*E. coli*), dissolved oxygen and other field measurements were obtained from a total of 16 stations. All water quality parameters were collected on five occasions; on a sixth occasion only *E.coli* was collected. Additionally, continuous temperature and dissolved oxygen monitoring with unattended multiprobes was carried out for a period of 96 hours at 10 sites. Continuous temperature monitoring was recorded from early July through September at 7 sites.

2) Biological Monitoring: Macroinvertebrate sampling, fish population monitoring, and habitat assessments were performed to assess the aquatic life use status for 305(b) reporting requirements. The macroinvertebrate sampling procedures utilized Rapid Biomonitoring Protocols (RBPs) and were conducted at 6 stations. Periphyton assessments were performed at all 6 sites where macroinvertebrate sampling was conducted. Habitat assessments were also conducted at 12 stations. Finally, fish population monitoring was conducted at 6 stations.

Mystic – 2009 Water Quality and Biological Sampling Matrix

Waterbody/ Site Map Link	Site Description (sample types*)
Aberjona River	Upstream of Washington St. bridge, Winchester (2,3,4,6,8,17)
Aberjona River	Mystic Pkwy @ USGS Gaging Station, Winchester
Aberjona River	450 feet downstream of Olympia Ave, Woburn (2,3,4,6,8,9,17)
Aberjona River	Washington Circle, Winchester (5,7,8)
Alewife Brook	Upstream of Broadway Bridge, Somerville (2,3,4,8,9,17)
Alewife Brook	Rte 2 offramp to Alewife T Station, Arlington/Cambridge (2,3,17)
Cummings Brook	Downstream of Lexington Ave., Woburn (1,2,3,8,17)
Horn Pond Brook	Upstream of Palmer Road, Winchester (5,6,7,8)
Malden River	Medford St., Malden, MA (2,3,4,9,17)
Meetinghouse Brook	Outlet into Mystic River just downstream of Winthrop St. bridge, Medford (2,3,9,17)
Mill Brook	In Mt. Pleasant Cemetery, upstream of weir, Arlington (2,3,4,6,8,17)
Mill Brook	Upstream of Mill St. in Arlington at Arlington High School (5,8,7)
Munroe Brook	At end of Bartlett Ave at footbridge, Lexington (2,3,4,17)
Mystic River	Winthrop St. bridge, Medford (2,3,17)
Mystic River	Downstream (South) end of Riverside Yacht Club boat docks, Medford (2,3,4,9,17)
Mystic River	Upstream (west) end of Winter Hill Yacht Club boat docks, Somerville (2,3,4,9,17)
Shaker Glen Brook	Totman Drive, Woburn (1,2,3,5,6,7,8,17)
Spot and Ell Pond Bk	At end of Fairlawn Street, Malden (2,3,4,8,17)
Wellington Brook	Behind the Belmont Library, Belmont (2,3,5,7,8,17)

***Sample Types**
1 – Attended multi-probe (DO, temperature, pH, conductance), 2 – Nutrients (total phosphorus, total nitrogen, ammonia), color, turbidity, 3 – E. coli bacteria samples, 4 – Unattended continuous dissolved oxygen and temperature, 5 – Benthic macroinvertebrate community, 6 – Fish population, 7 – Periphyton, 8 – Habitat assessment, 9 – Unattended continuous temperature (thermistor), 10 – Dissolved metals, 11 – Hardness, 12 – Phytoplankton, 13 – Nutrients at depth (Van Dorn – total phosphorus, total nitrogen), 14 – Dissolved oxygen temperature pH, conductance profiles and Secchi Disk, 15 – Chlorophyll a (integrated tube sample), 16 – Pycocyanin (SCUFA), 17 – Total Suspended Solids, 18 – Fish tissue

NARRAGANSETT BAY and MOUNT HOPE BAY

The 2009 surveys of the Narragansett Bay and Mount Hope Bay watersheds focused on obtaining information to meet the following objectives:

- Collect chemical data to document the current status of water quality conditions within the watersheds.

- Provide biological, habitat, and dissolved oxygen, temperature, and chemical data to DWM's Watershed Assessment Program to be used in making *Aquatic Life* and *Aesthetics* use assessments required by Section 305(b) of the Clean Water Act; and to provide data for other informational needs of Massachusetts regulatory agencies.

- Provide quality assured *E. coli* bacteria data for the purpose of assessing *Primary* and *Secondary Contact Recreation* uses.

- Provide data to the Massachusetts Department of Public Health (MDPH) for public health risk assessment related to fish tissue contaminants (metals, polychlorinated biphenyls (PCBs) and pesticides).

The specific sampling activities of the 2009 Narragansett and Mount Hope Bays Watershed "Year Two" Surveys are listed below. Monitoring stations are summarized in the table at the end of this section.

1) River Water Quality: Water quality surveys were conducted a total of six times (May 12, June 16, July 21, August 25, September 17 – bacteria only, September 29). Samples for total phosphorous, total nitrogen, ammonia, color, turbidity and bacteria (*E. coli*) were collected on five occasions at 18 stations. Dissolved oxygen and temperature probes were deployed at eight stations for a minimum of 48 hours on four occasions. Continuous temperature monitoring was performed at five stations from June 19 through September 28.

2) Biological Monitoring: Benthic macroinvertebrate, fish population, and habitat examinations were performed at eight stations. Rapid Biomonitoring Protocols (RBP) were employed during the collection of benthic macroinvertebrate samples and habitat data. Standardized electrofishing protocols were employed during all fish population examinations.

3) Fish Toxics Monitoring: Fish toxics monitoring was performed at two locations: Sawdy Pond (Fall River) on June 25 and South Watuppa Pond (Fall River/Westport) on July 3. Edible fillets from these ponds were analyzed for the presence of mercury. Fish consumption advisories will be issued by the MDPH if necessary.

4) Bacteria Source Tracking: Bacteria source tracking studies were performed by DWM SERO staff during 2009. These are summarized under "Additional Monitoring Activities" at the end of this report.

Narragansett and Mount Hope Bays – 2009 Water Quality and Biological Sampling Matrix

Waterbody	Site Map Link	Site Description (sample types*)
Quequechan River	QUE1	Plymouth Ave., Fall River (2,3,4)
Kickimuit River	KICK1	Bushee Road, Swansea (2,3,4)
Cole River	COLE1	Milford Road, Swansea (2,3,4)
Lewin Brook	LEW1	Robin Brook Road, Swansea (2,3,4)
Cole River	COLE2	Hortonville Road, Swansea (2,3,4,5,6,9)
Rocky Run	ROCK1	Davis Street, Rehoboth (2,3,4)
Torrey Creek	TOR1	Old Barney Ave., Rehoboth (2,3,4)
Runnins River	RUN1	School Street, Seekonk (3)
Clear Run Brook	CRUN1	Providence Street, Rehoboth (2,3,4)
Oak Swamp Brook	OAK1	Providence Street, Rehoboth (2,3,4)
Bad Luck Brook	BAD1	Elm Street, Rehoboth (2,3,4,6,9)
West Branch Palmer River	WPALM2	Ash Street, Rehoboth (2,3)
Bliss Brook	BLIS1	Ash Street, Rehoboth (2,3)

Waterbody	Site Map Link	Site Description (sample types*)
West Branch Palmer River	WPALM1	Carpenter Street, Rehoboth (2,3,4,9)
East Branch Palmer River	EPALM1	Beckwith Middle School, Rehoboth (2,3,4,9)
Palmer River	PALM1	Wilmarth Bridge Road, Rehoboth (2,3,4,9)
Fuller's Brook	FUL1	Route 44, Rehoboth (2,3,4)
Runnins River	RUN2	Arcade Street, Seekonk (2,3,4)
South Watuppa Pond	SWAT	Fall River/Westport (18)
Sawdy Pond	SAWD	Westport/Fall River (18)
West Branch Palmer River	WPALM3	Danforth Street, Rehoboth (5,6)
Rocky Run	ROCK2	Martin Street, Rehoboth (5,6)
East Branch Palmer River	EPALM2	Route 118, Rehoboth (6)

***Sample Types**
1 – Attended multi-probe (DO, temperature, pH, conductance), 2 – Nutrients (total phosphorus, total nitrogen, ammonia), color, turbidity, 3 – E. coli bacteria samples, 4 – Unattended continuous dissolved oxygen and temperature, 5 – Benthic macroinvertebrate community, 6 – Fish population, 7 – Periphyton, 8 – Habitat assessment, 9 – Unattended continuous temperature (thermistor), 10 – Dissolved metals, 11 – Hardness, 12 – Phytoplankton, 13 – Nutrients at depth (Van Dorn – total phosphorus, total nitrogen), 14 – Dissolved oxygen temperature pH, conductance profiles and Secchi Disk, 15 – Chlorophyll a (integrated tube sample), 16 – Pycocyanin (SCUFA), 17 – Total Suspended Solids, 18 – Fish tissue

NEPONSET

The 2009 surveys of the Neponset River Watershed focused on obtaining information to meet the following objectives:

- Provide biological, habitat, dissolved oxygen, temperature, and chemical data for the purpose of assessing *Aquatic Life* and *Aesthetics* uses as required by Section 305(b) of the Clean Water Act and documenting biological, chemical, and physical changes over time (trend monitoring); provide data for other informational needs of Massachusetts regulatory agencies such as NPDES permitting and TMDL development.

- Provide biological, habitat, dissolved oxygen, temperature, and chemical data to confirm Category 5 303(d) listings and findings of external organizations.

- Provide quality-assured *E. coli* data for the purpose of assessing *Primary and Secondary Contact Recreational* uses and documenting changes in pathogen levels over time (trend monitoring).

- Provide data to the Massachusetts Department of Public Health (MDPH) for public health risk assessment due to fish tissue contaminants (metals, polychlorinated biphenyls (PCBs) and pesticides).

The specific sampling activities of the 2009 Neponset River Watershed "Year Two" Surveys are listed below. Monitoring stations are summarized in the table at the end of this section.

1) River Water Quality: Water quality surveys were conducted a total of six times (weeks of

April 27, June 1, July 6, August 10, August 24, and September 14). Grab samples for *E. coli* were collected at a total of 30 stations. Grab samples for total phosphorus, total nitrogen, ammonia-nitrogen, color and turbidity were collected at 20 stations. Continuous temperature and dissolved oxygen monitoring with unattended metered probes was carried out at 20 sites. These unattended probes were deployed during the months of June, July, August, and September on Friday of the weeks preceding the water sampling surveys for that month and retrieved two to five days later. Finally, long-term temperature-only data loggers were deployed at 11 sites.

2) Biological Monitoring: Benthic macroinvertebrate sampling and associated habitat surveys were conducted at 12 stations. The macroinvertebrate sampling procedures utilized Rapid Biomonitoring Protocols (RBPs). Periphyton sampling (relative taxon abundance, percent algal coverage, and chlorophyll-a) was conducted at 11 sites. Fish population surveys using a backpack electrofisher and associated habitat assessments were conducted at eight sites.

3) Fish Toxics Monitoring: Fish tissue monitoring was performed at three locations: Mother Brook on June 4, Ponkapoag Pond (Canton/Randolph) on June 11 and Reservoir Pond (Canton) on June 23. Edible fillets were analyzed for the presence of mercury (all sites) and PCB and organochlorine pesticides (Mother Brook, only). Fish consumption advisories will be issued by the MDPH if necessary.

4) Lake Monitoring: Water quality surveys were conducted twice (July 23 and August 20) at Ponkapoag Pond (Canton/Randolph) and Reservoir Pond (Canton). Grab samples for total phosphorus and depth-integrated samples for chlorophyll a were collected at the deep hole of each lake.

5) Dissolved Metals: Dissolved metals sampling was conducted four times (June 4, July 6, August 10, and September 17) at five stations on the Neponset River and the East Branch Neponset River.

6) Bacteria Source Tracking: Bacteria source tracking studies were performed by DWM SERO staff during 2009. These are summarized under "Additional Monitoring Activities" at the end of this report.

Neponset – 2009 Water Quality and Biological Sampling Matrix

Waterbody	Site Map Link	Site Description (sample types*)
Traphole Brook	TH02	Cooney Street, Walpole (2,3,4,5,6,7,8,9)
Neponset River (MA73-01)	NR01	approximately 3200 feet downstream of Route 1, north of the eastern end of Vanderbuilt Avenue, Norwood (2,3,4,9,10)
E. Branch Neponset	NE12C	Approximately 260 feet downstream of Neponset Street, Canton (2,3,4,9,10)
Pequid Brook	PQ01	Sherman Street, Canton (2,3,4)
Massapoag Brook	MP01	Mechanic Street, Canton (3)
Beaver Brook	BB01	Upland Road, Sharon (2,3,4,6,9)

Waterbody	Site Map Link	Site Description (sample types*)
Unnamed Tributary	UTSH01	Unnamed tributary to Steep Hill Brook, approximately 950 feet upstream of Erin Road, Stoughton (3)
Steep Hill Brook	SH01	West of the northern end of Erin Road, approximately 2400 feet downstream of Route 27, Stoughton (3,5,8)
Beaver Meadow Brook	BM02	Boston Drive, Canton (2,3,4)
Pecunit Brook	PC01	Approximately 360 feet upstream of Interstate 95, Canton (2,3,4,5,7,8)
Ponkapog Brook	POB040	Elm Street, Canton (2,3,4,5,8)
Neponset River	NE12B	Green Lodge Street, Canton (2,3,4,9,10)
Unquity Brook	UQ01	Rowe Street (just south of Adams Street), Milton (2,3,4,5,8)
Pine Tree Brook	PTB047	Eliot Street crossing, (Milton Village) Milton (2,3,4)
School Meadow Brook	SM02	Washington Street, Walpole (3)
Unnamed Tributary	UT01	Unnamed tributary to the Neponset River west of Neponset View Terrace, locally considered part of Spring Brook, approximately 420 feet upstream from confluence with the Neponset River, Walpole (2,3,4,5,7,8)
Neponset River	NE11	Parking area crossing southeast of the Robbins Road, Route 27 intersection, Walpole (2,3,4,9,10)
Mine Brook	MN01	Stream crossing off the northern end of Mill Pond Road, Walpole (3)
Mill Brook	MB01	Mill Brook Road crossing nearest Nebo Street, Medfield (2,3,4,5,6,7,8,9)
Tubwreck Brook	TK01	Draper Road, Dover (2,3,4,6,9)
Bubbling Brook	BB02	Trailside Drive, Walpole (3,5,6,7,8)
Mill Brook	MB02	Tamarack Road crossing nearest Briar Lane, Westwood (3,6,9)
Germany Brook	GB02	Westover Parkway crossing nearest Leyton Road, Norwood (2,3,4,6)
Hawes Brook	HAB010	Upstream of Washington Street, Norwood (above influence of pool discharge pipe on southern bank) (2,3,4)
Unnamed Tributary	ME01	Unnamed tributary to the Neponset River locally known as 'Meadow Brook', approximately 400 feet upstream of Dean Street, Norwood (3,5,7,8)
Purgatory Brook	PU03	Everett Street, Norwood (3,6,9)
Plantingfield Brook	PF01	Route 1, Norwood (3)
Unnamed Tributary	MOB032	Unnamed tributary to the Neponset River locally known as 'Mother Brook', Reservation Road, (Hyde Park) Boston (2,3,4)
Neponset River	NR03	Footbridge near eastern end of B Street, (Hyde Park) Boston (2,3,4)
Neponset River	NER185	Approximately 3000 feet east of Route 28, behind the baseball field off the western end of Meadowbank Avenue, (Mattapan) Boston (2,3,4,7,9,10)

Waterbody	Site Map Link	Site Description (sample types*)
Unnamed Tributary	SB01	Unnamed Steep Hill Brook tributary approx. 200 meters downstream/northwest from Central Street, Stoughton (5,8)
Beaver Brook	BB01	Approx. 200 meters downstream/northeast from Maskwonicut Street, Sharon (5,8)
Massapoag Brook	9BOB	Between Manns Pond and Billings Street, Sharon (5,7,8)
Hawes Brook	HBjb01	Walpole Street, Norwood (7)
Traphole Brook	TPjb02	Park Lane, Walpole (7)
Beaver Brook	BBjp01	Maskwonicut Road, Sharon (7)
Reservoir Pond	RESP	Deep hole, Canton (2,13,14,15,18)
Ponkapoag Pond	PONK	Deep hole, Randolph (2,13,14,15,18)
Mother Brook	--	Upstream from Knight Street Dam, Boston (18)

***Sample Types**
1 – Attended multi-probe (DO, temperature, pH, conductance), 2 – Nutrients (total phosphorus, total nitrogen, ammonia), color, turbidity, 3 – E. coli bacteria samples, 4 – Unattended continuous dissolved oxygen and temperature, 5 – Benthic macroinvertebrate community, 6 – Fish population, 7 – Periphyton, 8 – Habitat assessment, 9 – Unattended continuous temperature (thermistor), 10 – Dissolved metals, 11 – Hardness, 12 – Phytoplankton, 13 – Nutrients at depth (Van Dorn – total phosphorus, total nitrogen), 14 – Dissolved oxygen temperature pH, conductance profiles and Secchi Disk, 15 – Chlorophyll *a* (integrated tube sample), 16 – Pycocyanin (SCUFA), 17 – Total Suspended Solids, 18 – Fish tissue

WEYMOUTH and WEIR

The specific objectives of the 2009 Weymouth and Weir Watershed surveys were to:

- Collect physico-chemical data to assess *Aquatic Life Use*.
- Collect biological data (benthic macroinvertebrate, fish population, habitat assessments and algal population) to assess *Aquatic Life Use*. Use fish population data to determine whether a cold-water fishery exists in segments sampled.
- Collect bacteria data to assess *Primary and Secondary Contact Recreational Uses*. Use field observations to assess the *Aesthetics Use*.
- Screen fish to provide information to Massachusetts Department of Public Health (MDPH) for public health risk assessment due to fish tissue contaminants (mercury, PCBs and pesticides).
- Gather water quality data to determine long-term trends in water quality in the Weymouth/Weir Watershed.
- Gather stream temperature data to determine whether a cold-water fishery exists in segments sampled.

The specific sampling activities of the 2009 Weymouth and Weir Watershed "Year Two" Survey are listed below. Monitoring stations are summarized in the table at the end of this section.

1) Water Quality: Five water quality surveys, consisting of grab samples for water chemistry and *E. coli* bacteria as well as in-situ measurements, were conducted on the following dates: May 5, June 9, July 14, August 18 and September 22. In addition to these five sampling dates one additional bacteria-only sampling run was conducted on September 10. Samples for total phosphorous, total nitrogen, ammonia, color and turbidity were obtained from a total of twenty-two stations. Samples were taken for *E. coli* analysis at twenty-three stations. *In-situ* measurements of temperature, dissolved oxygen, pH, and conductivity were collected at fourteen stations. Attended in-situ measurements were also taken at a number of sites during multiprobe deployment survey days. Flow status was checked at three locations along Accord Brook on water quality sampling dates. Continuous temperature and dissolved oxygen monitoring with unattended probes was carried out for a minimum duration of 24 hours at fourteen sites. Continuous temperature monitoring was also conducted at nine stations to determine whether a cold-water fishery was supported.

2) Biological Monitoring: Benthic macroinveterbrate sampling was conducted at eleven stations in the Weymouth and Weir River Watershed. Periphyton samples were collected at six of the benthic macroinvertebrates sites. Periphyton assessment consisted of an approximation of the algal coverage within the reach, and scrapes of various substrates within the riffle zone to obtain samples for taxonomic identification. Fish population surveys using a backpack electrofisher were performed at seven stations. Habitat assessments were conducted at 13 sites during the benthic macroinvertebrate, periphyton and fish population surveys.

3) Fish Toxics Monitoring: Fish tissue monitoring was performed at two locations: Sunset Lake (Braintree) on July 15 and Ricardi Reservoir on July 30. Edible fillets were analyzed for the presence of mercury (both sites), and PCB and organochlorine pesticides (Ricardi Reservoir only). Fish consumption advisories will be issued by the MDPH if necessary.

4) Dissolved Metals: Metals sampling occurred July 6, August 10 and August 31 at two sites in the Cochato River (one upstream and one downstream of the Baird and McGuire superfund site) and at one site in Old Swamp River downstream from the naval air station in Weymouth.

Weymouth and Weir – 2009 Water Quality and Biological Sampling Matrix

Waterbody/Site Map Link	Site Description (sample types*)
Furnace Brook	Reardon Street, Quincy (2,3,4,17)
Furnace Brook	Newport Avenue, Quincy (2,3,4,5,7,8,17)
Town Brook	Elm Street, Quincy (1,2,3,17)
Town Brook	Miller Stile Road, Quincy (1,2,3,5,7,8,17)
Monatiquot River	Approximately 700 feet upstream from Commercial Street, Braintree (2,3,4,5)
Monatiquot River	River Street, Braintree (2,3,4)
Weymouth Back River	Approximately 560 feet downstream of Commercial Street, Weymouth (1,2,3,4)
Weir River	Route 228 (East Street), Hingham (1,2,3,4,5,6,7,8,9)
Weir River	Leavitt Street, Hingham (1,2,3,4,9)

Waterbody/Site Map Link	Site Description (sample types*)
Accord Brook	Union Street, Hingham (Wompatuck State Park) (1,5,7,8,19)
Accord Brook	South Pleasant Street, Hingham (Wompatuck State Park) (19)
Accord Brook	Prospect Street, Hingham (2,3,4,5,7,8,19)
Unnamed Tributary	Unnamed tributary to the Plymouth River at the most northerly Cushing Street crossing, Hingham (5,6,8,9)
Plymouth River	Ward Street, Hingham (1,2,3,9)
Eel River	Cushing Street, Hingham (9)
Eel River	Stage Coach Road crossing, Hingham (6,8)
Crooked Meadow River	Approximately 50 feet upstream of Route 228 (Main Street), Hingham (1,2,3)
Old Swamp River	Sharp Street, Hingham (2,3,4,6,8,9,10)
Old Swamp River	Ralph Talbot Street, Weymouth (1,2,3,6,8)
Old Swamp River	Elm Street, Weymouth (2,3,4,5,6,7,8,9)
Old Swamp River	Libbey Industrial Parkway, Weymouth (1,2,3)
Mill River	Front Street (upstream of the outfall downstream of the bridge), Weymouth (1,2,3)
Mill River	West Street, Weymouth (1,2,3)
Mill River	'Stormwater outfall' pipe on southern bank just downstream of Front Street, Weymouth (3)
Cranberry Brook	Upstream of road and two stormwater outfalls, Route 37 (Washington Street), Braintree (2,3,4,5,8)
Mary Lee Brook	Footbridge crossing of the western end of Joyce Circle, Randolph (1,2,3,4,5,6,8,9)
Cochato River	Downstream of road and two stormwater outfalls, Route 139 (Union Street), Holbrook (1,2,3,4)
Unnamed Tributary	Unnamed tributary to the Mary Lee Brook locally considered part of Cochato River, approximately 20 feet downstream of North Shore Road, Holbrook (10)
Cochato River	Mear Road, Holbrook (4,10)
Farm River	Approximately 300 feet upstream from Pond Street, Braintree (2,3,5,8,9)
Sunset Lake	Sunset Lake, Braintree (18)
Richardi Reservoir	Richardi Reservoir, Braintree/Randolph (18)

***Sample Types**

1 – Attended multi-probe (DO, temperature, pH, conductance), 2 – Nutrients (total phosphorus, total nitrogen, ammonia), color, turbidity, 3 – E. coli bacteria samples, 4 – Unattended continuous dissolved oxygen and temperature, 5 – Benthic macroinvertebrate community, 6 – Fish population, 7 – Periphyton, 8 – Habitat assessment, 9 – Unattended continuous temperature (thermistor), 10 – Dissolved metals, 11 – Hardness, 12 – Phytoplankton, 13 – Nutrients at depth (Van Dorn – total phosphorus, total nitrogen), 14 – Dissolved oxygen temperature pH, conductance profiles and Secchi Disk, 15 – Chlorophyll *a* (integrated tube sample), 16 – Pycocyanin (SCUFA), 17 – Total Suspended Solids, 18 – Fish tissue, 19 – Check flow status

ADDITIONAL MONITORING ACTIVITIES – Some monitoring activities were performed in watersheds that were not actually in "Year Two" of the five-year watershed cycle. These are briefly described below:

1) Fish Toxics Monitoring: In addition to the sites in the "Year Two" watersheds identified above, DWM completed fish sampling at the following sites at the recommendation of the Inter-agency Fish Toxics Committee:

Watershed	Monitoring Site Description
Nashua	Sandy Pond (Ayer)
Quinebaug	Lake George (Wales)
Connecticut	Connecticut River (Northampton, Easthampton, Hadley, Holyoke)
Connecticut	Connecticut River (Chicopee, West Springfield)

Edible fillets were analyzed for the presence of mercury, PCB, and organochlorine pesticides. If necessary, fish consumption advisories will be issued by the Massachusetts Department of Public Health. Finally, DWM assisted with fish sampling at Quabbin Reservoir in support of ongoing mercury investigations by MassDEP's Office of Research and Standards (ORS).

2) Lake Monitoring: Baseline lakes sampling in the summer of 2009 focused on sampling lakes impacted by commercial cranberry operations which included Billington Sea in Plymouth and both East and West Monponsett Ponds in Halifax. Data from this sampling effort will support a pre-draft TMDL for these lakes and also may be used by SERO for regulatory purposes. Sampling consisted of three monthly visits to each lake and samples were also collected from inlet streams and from bogs if a discharge was occurring. 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 the DPH for evaluation of Public Posting against swimming or contact due to toxic cyanobacteria. In addition, 3 monthly surface samples of TP and TN and Secchi disk were also collected from East and West White Island Pond in Plymouth to monitor effectiveness of commercial cranberry bog BMPs that are being implemented as part of the draft TMDL for those lakes. Field assistance and technical assistance was also provided to SERO staff who wished to begin lowering the lake level to increase lake flushing as a BMP.

A separate, one-visit survey of 17 lakes in the lower Blackstone River Watershed was also conducted in the fall. The purpose of this survey was to document the TP and TN concentrations and Secchi disk transparency in support of a draft TMDL for these lakes (in prep.). Occasional sampling of other lakes for toxic cyanobacteria blooms was conducted on an as-needed basis.

3) Blue-green Algae Bloom Investigations: During the summer of 2009, cyanobacterial counts and identifications were performed on samples to ensure that cyanobacteria cell counts or toxicity measurements did not exceed DPH advisory levels for recreational waters. Samples were provided for examination by the Mass. Department of Conservation and Recreation (DCR), Mass. Department of Public Health (DPH), U.S. Army Corps of Engineers, MassDEP's Southeast Regional Office (SERO), the Charles River Watershed Association and other MassDEP personnel. The water bodies sampled were: White Island Pond (Plymouth), Buffumville Reservoir (Charlton/Oxford), West Monponsett Pond (Halifax/Hanson), Holland Pond (Holland), Wampatuck Pond (Hanson) and Billington Sea (Plymouth).

4) Dam-removal Investigation: DWM continued to collaborate with other state agencies and private parties in a pre- and post-dam removal monitoring project on the Green River in

Greenfield (Deerfield Watershed). DWM deployed dissolved oxygen probes at four stations in August, and the MA Division of Fish and Game has recently completed fish population surveys above and below the dams and within the impoundments.

5) Bacteria Source Tracking: Bacteria source tracking (BST) studies were performed in 2009 in selected subwatersheds by the DWM Regional Monitoring Coordinators based at the MassDEP Western (WERO), Southeast (SERO) and Northeast (NERO) regional offices. The bacteria source tracking surveys followed protocols developed in 2004 by the DWM that provide site-specific data for the identification and abatement of specific bacterial pollution sources.

Northeast Region (NERO):
In 2009, MassDEP/NERO continued its Bacteria Source Tracking (BST) program using the same model as in previous years. In order to identify targeted sub-basins, the NERO BST program coordinators reviewed historical MassDEP data from water quality assessment reports, TMDLs, and the Integrated List of Waters, data from the Massachusetts Department of Public Health, Office of Coastal Zone Management, Massachusetts Division of Marine Fisheries, United States Environmental Protection Agency (USEPA), and a number of watershed associations. As in the past, the in-house Colilert® and Enterolert® system was used to determine *E. coli* concentrations in fresh water and *Enterococcus* spp. concentrations in brackish/marine waters. Other analyses used as screening methods to identify wastewater sources included ammonia analysis by spectrophotometer, ammonia test strips, chlorine test strips, a surfactants kit, and optical brightener pads. In addition human marker analysis, performed by MassDEP's Wall Experiment Station, was used to identify human sources of bacteria. This year, the coordinators also designed a new cage to deploy optical brightener pads in storm drain outfalls and manholes. A successful pilot study was conducted with cooperation from the Town of Arlington, and the optical brightener cages were used at other locations throughout the summer.

In 2009, the MassDEP/NERO BST Program coordinators sampled in most of the basins in the Northeast region. Although the goal of the program was to conduct iterative dry weather sampling, marginal wet weather samples were often collected due to significant precipitation throughout a large part of the summer. Bacteria source tracking was conducted in the following sub-watersheds (those denoted with a * were follow-up sites from 2008):

Constellation Wharf pipe: Boston	(Boston Harbor)
Aberjona River: Woburn, Winchester	(Boston Harbor – Mystic Watershed)
*Ell Pond manholes: Melrose	(Boston Harbor – Mystic Watershed)
Marginal line manholes: Somerville	(Boston Harbor – Mystic Watershed)
*Mill Brook manholes: Arlington	(Boston Harbor – Mystic Watershed)
*Kimball Brook: Ipswich	(Ipswich Watershed)
Labor in Vain Creek: Ipswich	(Ipswich Watershed)
Beaver Brook: Lowell, Dracut	(Merrimack Watershed)
Johnson Creek: Groveland	(Merrimack Watershed)
Merrimack River pipes: Haverhill, Lawrence, Methuen	(Merrimack Watershed)
*Powwow River pipe: Amesbury	(Merrimack Watershed)
*Spickett River pipe: Lawrence	(Merrimack Watershed)
*Frost Fish Brook: Danvers	(North Coastal Watershed)
*Derby Wharf & North River pipes: Salem	(North Coastal Watershed)
King's Beach (Stacey Brook outlet): Lynn, Swampscott	(North Coastal Watershed)

*Stramski Beach manholes: Marblehead (North Coastal Watershed)
*Little River: Newbury, Newburyport (Parker Watershed)
*Shawsheen River tributary: Lawrence (Shawsheen Watershed)
*Rogers Brook: Andover (Shawsheen Watershed)
Baiting Brook: Framingham (SuAsCo Watershed)
Eames Brook: Framingham (SuAsCo Watershed)

An aggressive enforcement approach to confirmed bacteria "hot spots" led to enforcement actions against four municipalities and a private entity. Additionally, follow-up actions were requested of two municipalities and a regional entity. Enforcement and follow-up actions were closely coordinated with USEPA staff. NERO BST coordinators have continued to track progress on enforcement actions initiated in 2007 and 2008, conduct follow-up sampling, and meet with municipal officials as appropriate.

Western Region (WERO):
Bacteria source tracking projects were performed in 2009 at selected subwatersheds in the Connecticut, Deerfield, Hoosic, Housatonic, and Quinebaug Watersheds by the DWM Regional Monitoring Coordinator (RMC) located at the MassDEP/WERO. The bacteria source tracking surveys followed protocols developed in 2004 by the DWM that provide site-specific data for the identification and abatement of specific bacterial pollution sources. The DWM regional monitoring coordinator reviewed existing bacteria data and information from the Massachusetts Integrated List of Waters, MassDEP Water Quality Assessment Reports, EPA HUC12 watershed information, recent DWM assessment monitoring bacteria data, and local watershed association volunteer monitoring data to select subwatersheds within the Western Region of MassDEP for bacteria source tracking. Pertinent information was reviewed (such as GIS land use and storm drain and sewer infrastructure maps) and field reconnaissance was conducted to prioritize selected subwatersheds and to aid in interpreting the data.

It is important to note that regional monitoring and associated follow-up activities at MassDEP/WERO were lessened in 2009 by a reduction in the MassDEP's work force. As a result, only the priority subwatersheds listed below were sampled for *E. coli* bacteria as part of the WERO bacteria source tracking program in 2009. Seven screening level sampling rounds occurred once within each of these subwatersheds and subsequent iterative source tracking sampling continued in four of these. A total of 84 stations were sampled during the period of April through September. Sampling occurred during both wet and dry conditions. All sample analysis was conducted by the RMC with an enzyme substrate testing system (IDEXX, Colilert™) in the MassDEP/WERO bacteria laboratory.

Screening level sampling was conducted in the following subwatersheds:

Mill River, Northampton	(Connecticut Watershed)
Green River subwatershed, Greenfield	(Deerfield Watershed)
Paull Brook, Adams	(Hoosic Watershed)
Hoosic River, Adams	(Hoosic Watershed)
Hubbard Brook subwatershed	(Housatonic Watershed)
Mill Brook subwatershed, Brimfield	(Quinebaug Watershed)

Multiple bacteria sampling events occurred in the following subwatersheds:

Green River subwatershed, Greenfield	(Deerfield Watershed)
Paull Brook, Adams	(Hoosic Watershed)

Hoosic River, Adams	(Hoosic Watershed)
Hubbard Brook subwatershed	(Housatonic Watershed)

Sampling identified significant bacteria contamination in three subwatersheds. MassDEP WERO is currently developing enforcement strategies or working directly with applicable municipalities to address suspected illicit sewage inputs to these waterbodies.

Southeast Region (SERO):
DWM regional monitoring coordinators used the Colilert® and Enterolert® system located in MassDEP/SERO office to analyze bacteria surface water quality samples. DWM regional monitoring coordinators reviewed the data and refined sampling locations based on bacteria "signals", field observations and, in some cases, discussions with local watershed groups and/or municipal officials. If screening sampling results revealed bacteria contamination, iterative dry weather bacteria sampling for *E. coli* (Enterococcus in brackish waters) continued in an attempt to track and isolate the dry weather source(s) of bacteria. Occasionally, follow-up analyses (such as the use of optical brighteners, DNA, and caffeine testing) were performed in an attempt to determine if the bacteria were from human or animal sources.

In the MassDEP Southeast Region bacteria source tracking was conducted in the following subwatersheds (includes the names of those municipalities where sampling took place):

Speedway Brook, Attleboro	(Ten Mile Watershed)
Runnins River, Seekonk	(Narragansett Watershed)
Taunton River, Taunton	(Taunton Watershed)
Trout Brook, Brockton	(Taunton Watershed)
Lovett Brook, Brockton	(Taunton Watershed)
Meadow Brook, East Bridgewater	(Taunton Watershed)
Mill River , Taunton	(Taunton Watershed)
Buttonwood Brook, New Bedford	(Buzzards Bay Watershed)
Mattapoisett Harbor, Mattapoisett	(Buzzards Bay Watershed)
Apponagansett Bay, Dartmouth	(Buzzards Bay Watershed)
East Branch Westport River, Westport	(Buzzards Bay Watershed)
Bread and Cheese Brook, Westport	(Buzzards Bay Watershed)
Sandwich Harbor, Sandwich	(Cape Cod Watershed)
Bucks Creek, Chatham	(Cape Cod Watershed)
Germany Brook, Norwood	(Boston Harbor Watershed)
Hawes Brook, Norwood	(Boston Harbor Watershed)
Purgatory Brook, Norwood	(Boston Harbor Watershed)
Lee River, Swansea	(Mt Hope Bay Watershed)