**BACTERIA SOURCE TRACKING IN THE SOUTHEAST REGION**

#### SAMPLING ANALYSIS PLAN

**2020**

**CN 523.0**

**DRAFT**

**Executive Office of Energy & Environmental Affairs**

Matthew A. Beaton, SECRETARY

**Massachusetts Department of Environmental Protection**

Martin Suuberg, COMMISSIONER

**Bureau of Water Resources**

**Division of Watershed Management**

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"Note: This Sampling and Analysis Plan (SAP) provides details related to sampling locations, frequencies, analytes, methods, etc. and is intended to augment MassDEP DWM’s multi-year programmatic QAPP approved by EPA (CN 460.0 - QAPP\_DWM Monitoring Program\_2015-2019).

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# **A1 Program/Task Organization**

The individuals involved with the program and their respective responsibilities are as follows:

* Jennifer Sheppard (DWM/SERO): Regional investigator. Perform surveys, lab analysis, data analysis, report writing, etc.
* Richard Chase (DWM/CERO): QA Officer. Provide general oversight for field and lab operations, data quality, analysis and management; report review.
* Jeff Gould: Regional contact. Review of data and recommended actions to initiate remediation
* Jane Ryder (DWM/CERO): Geo-Referencing, station identification, Arcview, and GIS

# **A2 Problem Definition and Background Information**

## **A2.1 Overview of Issues**

A large number of Massachusetts’s waters today are 303(d) listed due to violations of bacteria water quality standards. Monitoring plans completed by the Division of Watershed Management (DWM) are designed to determine surface water quality conditions and assess uses but do not:

1) Identify locations of sources of bacterial contamination; or

2) Implement follow-up actions for remediation of such sources.

To address these needs, a Bacteria Source Tracking (BST) program was initiated in 2006 in the southeast region. The southeast region includes the Boston Harbor: Neponset & Weymouth/Weir (portions of), South Coast, Taunton, Ten Mile, Narragansett/Mt. Hope Bay, Buzzards Bay, Cape Cod, and the Islands basins.

Potential sources of elevated bacteria levels in surface waters are limited (e.g., pets, wildlife, failing septic systems, sewer line leaks/spills, stormwater runoff, CSOs, farms, boat pump-out stations) and are generally associated with specific land uses. However, ambient bacteria levels can be highly variable within and between sites, often making it difficult to distinguish patterns, track differences and reach conclusions. As a result, the study approach will employ a combination of methods including:

1. Comprehensive sub-watershed characterization and reconnaissance;
2. Focused iterative bacteria sampling;
3. Selected non-library methods of human versus non-human source differentiation; and
4. Coordination with municipalities, local agencies and residents that may supply important site-specific knowledge to direct sampling, assist in identifying potential sources, and follow-up on recommended clean-up actions.

## **A2.2 Goals, Objectives and Intended Use of the Data**

This year (2020) marks the 14th year of the SERO BST program.The overall goal of this program is to improve the water quality of rivers and streams in the southeast region that are impaired due to bacterial contamination. Steps towards achieving this goal will be made by locating sources of such contamination and recommending appropriate action to initiate remediation. Follow-up sampling will be conducted to verify infrastructure repairs and any other remediation efforts. In addition, when appropriate, follow up sampling may be conducted to determine if the river/pond segment meets water quality standards to the point where consideration may be given to its removal from the Massachusetts Integrated List of Waters.

The general approach of planning and conducting bacteria source tracking will follow a sequence of standardized steps. However, it is expected that each case will present a unique situation that will require a flexible sampling plan directed by ongoing decision-making. Specific objectives to accomplish bacteria source tracking goals are as follows:

1. Identify sub-watersheds in the southeast region requiring “follow-up” from previous BST efforts (such as continued source tracking, post repair/remediation follow-up, delisting assessment);
2. Conduct screening or follow up bacteria sampling in the selected sub-watersheds (*E. coli* and/or *Enterococcus* spp., during dry conditions;
3. Conduct extensive sub-watershed characterization based on screening level results (field recon, stream and beach walks, identifying locations of stormwater outfalls, communication with local contacts etc);
4. Review data from screening level stations and the information collected during sub-watershed characterization. Refine sampling plan and implement iterative source tracking sampling using various analysis techniques including Colilert® (*E*. *coli*) method, Enterolert® (*Enterococcus* spp.) method, optical brighteners, surfactants, and further field observation;
5. When bacteria concentrations are significant but other techniques yield conflicting results, employ the State Lab-Wall Experiment Station’s “Human Marker Analyses” to help determine the continued levels of effort that should be spent source tracking in that area.
6. Identify sources of bacteria to DEP jurisdictional level;
7. Notify appropriate authorities of the suspected sources(s);
8. Recommend appropriate action (e.g. further source tracking, immediate clean up, municipal or DEP enforcement) to initiate remediation and coordinate with local authorities as needed;
9. Document bacteria source tracking conducted within the selected sub-watersheds.

# **A3 Program Scheduling and Coordination**

It is planned that this program will be implemented from May through October 2020. Coordination with local contacts regarding selected sub-watersheds, segment reaches and outfalls and reconnaissance of prospective sample stations by DWM regional staff shall take place in April and May 2020. Sampling will occur predominantly within the primary contact recreation season, which occurs from May 1 through to October 15, i.e. when primary contact state standards are in effect. This time period also typically coincides with the warmest weather of the year, which is when the potential for high bacteria counts is greatest. If necessary, additional sampling will take place in late October and November. Analysis of the data shall be ongoing and a final report shall be generated by early 2021 if possible.

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# **B1 Sampling Process Design**

The sampling process design for the 2020 bacteria source tracking program in the southeast region is based on the sampling process established during previous years of the bacteria source tracking program in the southeast region (Refer to SEROBST Tech memo’s 2006-2017: CN237.5, CN291.5, CN328.0, CN346.5; CN371.0; CN 327.0; CN403.5; CN422.5; CN433.5; CN449.0, CN472.5, CN516.0).

The following design has been organized into three sections:

1. Identification, characterization and prioritization of contaminated sub-watersheds,
2. Screening level sampling and
3. Source tracking monitoring.

It is expected that each sub-watershed will present a unique situation that will require a flexible sampling plan directed by ongoing decision making by a source tracking advisory team.

## **1) Identification, Characterization and Prioritization of Contaminated Sub-watersheds**

1. Sub-watersheds in the southeast region requiring “follow-up” from previous BST efforts (e.g. continued source tracking, post repair/remediation follow-up, delisting assessment for segments on the “Integrated List of Waters”) were identified and prioritized;
2. Watersheds are not immediately eliminated based on size. For instances where large sub-watersheds are selected for BST, rather than conducting a comprehensive sub-watershed wide BST effort (as detailed in section 2 of this report), sampling efforts are modified to focus on:
3. Sampling within “targeted” tributaries and/or “reaches” (Targeted Reach), or

2) Dry weather outfall sampling at target outfalls (Outfalls). “Outfall sampling” rather than “sub-watershed screening sampling” will also take place in sub-watersheds where pathogen problems have already been linked to specific outfall pipes, or in the case of the support of municipalities with IDDE work at suspect outfalls (as mentioned in section “c” above).

1. The list of sub-watersheds selected for BST work in 2020 is listed in Table 1. They are all (except for the shellfish concern areas mentioned in point d) below), considered to be “follow-up sub-watersheds” i.e. they have been sampled during previous years of the program. Refer to the Southeast Region BST Program technical memos (CN#’s listed above) for a summary of sampling efforts and future plans for these sub-watersheds.
2. A “special focus project” for 2020 involves following up on some specific areas of concern highlighted by the shellfish program (with the Division of Marine Fisheries). This focus project is a result of regional interest.
3. Proposed sample locations for 2020 are listed in Table 2. Note that these locations and identifications are provisional. They will be “cross checked” with existing MA DEP sample stations and finalized following standard MA DEP procedures following field reconnaissance. Additional stations may also be added as needed.

##### Table 1. Priority Sub-watersheds in the Southeast Region. *[Watersheds shaded in green are priority. Shellfish program focus areas are also a priority and are marked in blue. Yellow watersheds also are priority but will only be worked in if time allows and field support staff can be secured.]*

|  |  |  |  |
| --- | --- | --- | --- |
| **Basin** | **Segment** | **Name** | **Type of BST Work** |
| Narragansett | MA53-17 | Torrey Creek | Fixed Station Monitoring & Targeted Reach, further BST |
| Mount Hope Bay | MA61-04 | Coles River | Targeted reach |
| Taunton | MA62-02 | Taunton River | Post-repair (ongoing) |
| Taunton | MA62-05 | Salisbury Plain River | Targeted outfalls, further BST and Post-repair |
| Taunton | MA62-07 | Trout Brook | Targeted outfalls, further BST and Post-repair |
| Taunton | MA62-46 | Lovett Brook | Post-repair and further BST (ongoing) |
| Buzzards Bay | MA95-32 | Acushnet River | Targeted reach/outfall (Tarkiln Hill Rd) |
| Buzzards Bay | MA95-37 | Dunhams Brook | Targeted reach, Human Markers? |
| Cape Cod | MA96-02 | Bumps River | Shellfish closure follow-up. Targeted outfalls and tributaries |
| Cape Cod | MA96-04 | Centerville River | Shellfish closure follow-up. Targeted outfalls and tributaries |
| Cape Cod | MA96-63 | Cotuit Bay | Shellfish closure follow-up. Targeted outfalls and tributaries |
| Islands | MA97-11 | Lagoon Pond | Shellfish closure follow-up. Targeted outfalls and tributaries |

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## **2) Preliminary/Screening Sampling**

In instances where bacteria data currently available are limited spatially and/or are several years old, screening level sampling will be conducted prior to some of the more extensive sub-watershed characterization methods (described in section 3). The primary reason for this is that the bacteria data currently available for many of the selected sub-watersheds is limited spatially and in some cases is older than five years. It is anticipated that the screening level sampling will provide a more complete and recent data set to better characterize the current nature and extent of bacterial contamination, thus allowing for more efficient use of the characterization methods mentioned above. In addition, screening level sampling may serve to direct and focus the bacteria source tracking monitoring efforts in each of the selected sub-watersheds.

Samples will be collected according to standard protocols developed by DWM:

* CN 001.21 – SOP\_Field Sampling;
* CN 001.3 – SOP\_Sample Collection Pole;
* CN 001.4 – SOP\_Bottle Basket Sampler;
* CN 001.55 – SOP\_Sampling Collection Techniques for Stormwater Manholes

A good supply of field sampling equipment is present in the southeast regional office, which will enable regional investigators to prepare all necessary sampling materials before each survey. The field sampling crew will consist (when possible) of one regional investigator and one regional aid (such as a seasonal intern). Samples will be delivered to the southeast regional lab within six hours of collection, and the regional investigator will perform any analysis (DWM’s SOP for Colilert®, and Enterolert®, as needed, (CN 198.0) in the regional lab.

A minimum of three dry weather bacteria samples will be collected at each preliminary station. Source tracking monitoring will be triggered when:

1. Sample bacteria counts are “high” during dry weather conditions. The programmatic “rule of thumb”, (also dependent on size of waterbody): for freshwater >500MPN E. coli and/or >130MPN Enterococcus.
2. Stations indicate discernible evidence of bacterial pollution (i.e. sewage fungus, sewage odor, sewage waste).

In order to better track intermittent sources, when possible attention will be given to varying the time and day of the week samples are collected. The selection of additional sampling stations (i.e. tracking stations) at sites of documented contamination and/or at potential “hot spots” will take place during the source tracking sampling phase of this program (see section 3).

**Sub-watershed Wide Studies**

When appropriate, screening level sampling stations will be selected to coincide with pour locations i.e. the mouths of major tributaries, as well as being spaced along the main stem where feasible (typically at road crossings), to apportion the sub-watershed into areas of roughly equal size. The final decision on the locations of the screening stations will be made during reconnaissance visits to the selected sub-watersheds to determine the accessibility of the sample locations. This will allow for adjustments based on access, flow or identification of pipes/outfalls with dry weather flow.

**Targeted Reach Studies**

The purpose of “target reaches” is to focus on a more manageable study area within a large sub-watershed. Target reaches are selected based on known information regarding existing hot spots (i.e. areas where numerous records of elevated bacteria counts or visual indications of bacterial contamination exist) within the selected sub-watershed. Preliminary sampling stations were selected for each of the sub-watersheds that will undergo targeted reach studies (Table 2). Preliminary sampling within targeted reaches can include screening level sampling at road crossings and/or sampling at outfalls. It is anticipated that preliminary sampling will serve to direct and focus the bacteria source tracking monitoring efforts in each of the targeted reach study sub-watersheds.

**Targeted Outfall Studies**

Preliminary sampling stations selected for each of the sub-watersheds undergoing targeted outfall studies (Table 2) were selected based on: 1) recent information indicating dry weather flow and/or elevated bacteria sample counts at specific outfalls and 2) recent strong evidence of elevated dry weather bacteria counts at a series of in-stream stations, particularly in large rivers and rivers with poor access. It is anticipated that targeted outfall sampling will be a more efficient way of tracking bacteria sources in these circumstances. In rare instances, when resources are available and recent/current bacteria data indicate a need; human marker sampling may be used as a preliminary sampling tool.

**Regional Complaint Studies**

Preliminary sampling stations selected for specific areas/sub-watersheds based upon a complaint called in to the South east Regional office. In some cases such stations may also be selected to follow up on a regional compliance concern.

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## **Source Tracking Sampling**

In general, bacteria “source tracking sampling” will be conducted in accordance with the principles of the DWM Conceptual Bacteria Source Tracking “Toolbox” (MADEP 2005). The preliminary sampling data (as described in section 2 above) will be evaluated by the “source tracking advisory team” (STAT) soon after final results are available. Due to the regional nature of the program, the STAT team will primarily consist of the principle investigator and regional contact, but may include any of the individuals identified in the “Project Organization” section (A1) of this sampling analysis plan.

Once more information regarding the nature and extent of bacterial contamination is collected in each selected sub-watershed through sampling at preliminary sample stations, focused source tracking sampling will proceed in contaminated areas, hereafter known as “focus areas”. Source tracking sampling consists of multiple rounds of sampling and bacteria analysis at “tracking stations” which are strategically placed to bracket suspected point sources (e.g., pipes, ditches, culverts) and non-point sources (e.g., specific land-use types, small tributaries, neighborhoods). Data from one round of sampling provides clues to direct the focus of the next sampling round. After each round of sampling, results are evaluated to determine if further sampling is required to conclusively identify any bacteria sources.

An extensive characterization of the focus areas will be conducted to aid in the source tracking efforts. Some of the more extensive characterization methods that could be used include stream walks, beach walks, shoreline surveys, obtaining storm water outfall maps and speaking to public works, boards of health, watershed associations, and/or local residents.

If any bacteria sources are confirmed, appropriate jurisdictional authorities will be notified to initiate recommended remedial actions.

Bacteria source tracking sampling is expected to have one of the three following outcomes:

1) Multiple rounds of preliminary level sampling do not trigger source tracking;

2) A bacteria source was identified through source tracking sampling;

3) A bacteria source could not be identified through source tracking sampling.

When bacteria sources are adequately identified or when sampling indicates contamination of the watershed yet fails to identify the source, appropriate authorities will be notified of the BST results and conclusions. Recommendations will also be also made for further source tracking/investigative work (e.g., camera, dye tests, smoke studies within storm drain systems) and for clean-up. It is very likely that additional investigations for confirmed bacteria sources will continue beyond the official end of sampling season (October 15). In such cases the bacteria count is such that it can persist into the cooler weather months, affording additional time to conclude investigations in such areas.

Annual sampling efforts will include follow-up sampling, as needed, to monitor the progress of repairs/remediation efforts in the watersheds where previous sampling identified sources of bacteria. Where appropriate, follow-up sampling may expand to constitute “assessment sampling” (five rounds of sampling within a recreation season) at designated stations, to determine whether a segment meets state surface water quality standards for pathogens, and therefore should no longer be included on the Integrated List of Waters (303d list) for pathogen contamination. Annual reporting of BST activities, results, and conclusions will take place during the winter months.

# **B2 Non-direct Measurements**

A number of sources of current project-relevant data will be used throughout the implementation of the Bacteria Source Tracking Program, namely:

* Weather data from NOAA/National Weather Service and “Weather Underground” precipitation stations, to ascertain the climatological conditions prior to and during each sampling event.
* Discharge data from the United States Geological Survey (USGS), used to estimate hydrological conditions during each sampling event.

##### Table 2. Description of Sample Stations for 2020 (some preliminary, some source tracking)

|  |  |  |  |
| --- | --- | --- | --- |
| **Sub-watershed** | **Station ID** | Station Location | |
| Torrey Creek (MA53-17) | TC08 | [At access rd off Barney Ave, approximately 630ft SSW from RT.195, Rehoboth] | |
| TC07 | [Torrey Creek @ access road off Barney Ave, Rehoboth] | |
| Coles River (MA61-04) | CR02 | [unnamed tributary to Cole River, Pearse Road (just west of Tallawanda Road), Swansea] | |
| Taunton River (MA62-02) | TRSD04 | [Drain outfall pipe upstream of Plain Street bridge, right bank, Taunton] | |
| TRSD02 | [Drain outfall pipe right bank, 145ft south of Ingell Street and 200ft east of West Water Street, Taunton] | |
| Salisbury Plain River (MA62-05) | SPSD03 | [Stormdrain outfall pipe on the left bank approximately 370ft downstream of Grove Street, Brockton] | |
| Trout Brook  (MA62-07) | TrtBK00 | [Crescent Street (Route 27) bridge, downstream side, Brockton] | |
| Lovett Brook (MA62-46) | LBMH08 | [Stormdrain manhole on Carrlyn Rd, approximately 95ft North of intersection with Pleasant Street, Brockton] | |
| LBMH10 | [Stormdrain manhole on Pleasant Street at intersection with Irving Ave, Brockton] | |
| LBSD04 | [Stormdrain outfall (24”) right bank, within S.E. “leaf” of clover leaf approximately 160 ft upstream of culvert under access roads between Rt.24 & Rt.27, Brockton] | |
| Acushnet River (MA95-32) | ACR01 | [Tarkiln Hill Rd, Acushnet/New Bedford] |
| Dunhams Brook (MA95-73) | DB05 | [Dunhams Brook, approximately 150ft downstream of the Brayton property path, Westport] |
| DB06 | [At bottom of Dunhams Brook, just upstream of Hicks Cove, Westport] |
| Bumps River (MA96-02) | BR02 | [Unnamed tributary at Bay lane, Barnstable] |
| BR01 | [Mainstem at Main Street, Barnstable] |
| Centerville River (MA96-04) | CR02 | [Mainstem at Craigville Beach Rd] |
| CR01 | [Mainstem at Long Beach Rd] |
| Cotuit Bay (MA96-63) |  | [Pirates Cove area: access unconfirmed] |
| Lagoon Pond (MA97-11) | LP01 | [Mud Creek at Lagoon Pond Road, Tisbury] |

*Stations noted in italics are to be confirmed following reconnaissance.*

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