

Dry Weather Fecal Bacteria Source Characterization in the Onondaga Lake Watershed

Abstract:

This document outlines opportunities for collaboration and cooperation between the New York State Department of Environmental Conservation (NYSDEC) and the NY Department of Health (NYSDOH) in response to documented fecal bacteria contamination, of unknown origin, in tributaries to Onondaga Lake, Onondaga County, New York. Cooperative sampling during 2008-2015 of Onondaga Creek, Harbor Brook, and Ley Creek, urban tributaries to Onondaga Lake, has documented dry weather contamination by fecal bacteria. Extensive trackdown efforts have in some cases been unable to locate or characterize fecal sources. *Bacteroides* and other genetic marker analyses are expected to clarify the nature and therefore location of these sources. This document is intended to clarify goals, procedures and responsibilities associated with the collection and analysis of dry weather fecal bacteria samples for Microbial Source Tracking (MST) analysis.

Background:

In 2007, the Onondaga Environmental Institute (OEI) alerted local and federal agencies to the presence of significant dry weather sources of fecal bacteria to Onondaga Creek and Harbor Brook. Review of their data and monitoring data collected by Onondaga County (2000-2006) as part of its Ambient Monitoring Program (AMP) indicated that fecal coliform concentrations were above New York State Water Quality Standard for fecal coliform, of 200 colony forming units (CFU)/100ml during dry weather and could not be accounted for by precipitation-driven combined sewer overflows (CSOs) and stormwater outfalls. For example, 16% (34 of 215 samples) and 75% (162 of 215 samples) on an annual average basis were above the NYS water quality standards, at a site above the CSOs and at the most downstream (urban) site on Onondaga Creek, respectively.

Onondaga County is under an Amended Consent Judgement (ACJ) to capture 95% of CSO flows and meet water quality standards for fecal coliform and other constituents by 2018. Currently, 49 CSOs discharge to Onondaga Creek, Harbor Brook, or Ley Creek in the City of Syracuse and are regulated by the NYS DEC.

During 2008 and 2009, the Phase 1 Microbial Trackdown Study was conducted in these two creeks with funding provided by the EPA. Goals of the study were to monitor the spatial and temporal trends of bacteria and locate and characterize potential dry weather bacteria sources. Work on the project was shared by OEI (fieldwork and project management) and the Onondaga County Department of Water Environment Protection (WEP; sample analysis).

A working group was formed early during the trackdown process and has continued to guide the trackdown studies. The group reviews data and work products and advises on sample site priorities. The group also facilitates communication between city and county government on trackdown and remediation when specific sources can be identified. The group includes representatives from federal, state, county, and city government, the Onondaga Nation, OEI, and the Atlantic States Legal Foundation.

Bacterial trackdown was continued in the Phase 2 Microbial Trackdown Study, funded by EPA and Onondaga County. Objectives were to monitor fecal coliform concentrations in Onondaga Creek, Harbor Brook, and Ley Creek, characterize spatial and temporal trends in bacteria concentrations and loadings, and identify bacterial sources, all during dry weather. Prior to Phase 2, little work had been done in the primarily urban Ley Creek watershed. Field sampling was conducted during 2012 and 2013.

Sampling efforts during Phases 1 and 2 have resulted in a total of twelve corrections in the Harbor Brook, Onondaga Creek, and Ley Creek water/sewersheds, eight in Onondaga Creek. Trackdown led to the identification of collapsed pipes, illicit discharges, and cross-connections. Positive effects of these corrections on in-stream bacteria levels were especially evident in Onondaga Creek; several routine sampling locations showed significant declines in fecal coliform levels between Phase 1 and Phase 2 that could be attributed to point source corrective work.

However, significant fecal bacteria concentrations continue to be detected in these urban tributaries during dry weather at problematic locations where sources have not been able to be identified, in spite of significant trackdown sampling, TV scoping, and dye testing work. In addition, in spite of considerable effort, bacterial levels appear to be increasing at some sites. Although the watershed of each site differs, most include multiple land uses and therefore potential fecal sources, including human, canine, avian (waterfowl) and bovine. As part of Phase 3, MST will be used at problematic sites on Onondaga Creek and Harbor Brook to better characterize and therefore identify the source(s) of fecal contamination following protocols described in Attachment 1.

Collaborators:

- NYS Department of Environmental Conservation
Region 7
Syracuse, NY
- NYS Department of Health
Albany, NY
- Onondaga County
Department of Water Environment Protection
Syracuse, NY
- City of Syracuse
Engineering Department
Syracuse, NY
- Onondaga Environmental Institute
Syracuse, NY

Goals:

Source identification enhances the ability to identify responsible parties and ultimately, to remediate, and reduce levels of fecal coliform in Onondaga Lake and its tributaries. MST can be

used to distinguish whether the bacterial contamination originated from ruminants (cows), canines (dogs), avian (primarily waterfowl), and/or humans. Correctly identifying the source(s) is a critical first step toward remediating these sources of bacterial contamination. Goals of this project are to:

1. Apply MST techniques to samples for which bacterial trackdown has been unsuccessful and source(s) remain significant and unknown;
2. Differentiate human from other sources of bacterial contamination to clarify the role of Onondaga County contributions to dry weather tributary fecal contamination;
3. Improve understanding of the contributions of a) agriculture and other nonpoint sources, and b) in-channel storage to dry weather tributary fecal contamination.

Site Selection Guidance:

MST should be used as a tool when there is a need to further evaluate the source of the contamination. When there is uncertainty as to whether contamination is from the adjacent sewer system, or some other source including upstream non-human sources, MST may provide useful information. As such, MST is a tool to be considered in the following situations:

1. Where more than one source is logically present,
2. Where significant trackdown effort has not been able to locate the source(s) of fecal contamination,
3. Where fecal coliform levels have been high, including recently,
4. In order to better understand the role of in-channel fecal bacteria storage (in sediments),
5. At upstream sites, to better understand the role of agricultural inputs,
6. At sites where one significant non-human source is suspected, such as grassy or wetland ponds (waterfowl).

Scope of Work:

Syracuse:

OEI will collect and split all samples. A 1L sample will be sent to Wadsworth Laboratory for analysis of the agreed-upon markers (see below) in Wadsworth-provided bottles.

The remainder of the sample will be transported to the Onondaga County laboratory and analyzed for fecal coliform. Preliminary sample results will be available and provided to Wadsworth Laboratory within 24 hours.

Onondaga County will prepare sample blanks using DI water and bottles provided by Wadsworth Laboratory. A blank will be shipped with each batch of six water samples.

Ambient conditions including temp, DO, pH, conductivity, turbidity, and salinity will be recorded during sample collection using a sonde to put results in context.

Albany:

Samples will be shipped by OEI to Wadsworth Laboratory (see Attachment 1) in batches of seven (6 samples of interest plus 1 blank).

Initial sampling and analysis will be conducted according to the following guidance:

- Sites in Table 1 below
- Sites with fecal coliform levels greater than 200 cfu/100 ml
- All samples analyzed for four primer sets: human, canine, ruminant, and waterfowl.

Analysis of samples from later sampling rounds may deviate from these criteria.

Table 1. Sites recommended for *Bacteroides* analysis

Tributary	OEI Point Source	Location	Description	Rationale for <i>Bacteroides</i> Analysis
Onondaga Creek	Dorwin Ave	Main channel immediately downstream of drop structure	In-stream sample	<i>Bacteria levels vary during the summer months. Bacteroides analysis performed by ESF detected ruminant sources.</i>
Cold Brook	OC-PS01C	Byrne Pl	In-stream sample	<i>High levels detected during the 2015 tributary trackdown event.</i>
Spring Brook diversion	OC-PS03	Outfall; between W. Seneca Tpke & Ballantyne	Spring Brook diversion outfall; 60" storm drain	<i>Consistently flowing, high to severely high bacteria levels, source unknown</i>
City Line Brook	OC-PS04	Ballantyne Rd; outfall	36" concrete outfall	<i>Bacteria levels during tributary trackdown events consistently show a downstream increase in bacteria levels. The source(s) remain unknown. It may not be necessary to sample all of these locations, but just the ones with the highest levels (04, 04B, 04C).</i>
	OC-PS04B	Slayton Ave	In-stream sample	
	OC-PS04C	Valley Plaza, near Churchill Ave	In-stream sample	
	OC-PS04E	Behind Valley Plaza	In-stream sample	
Hopper Brook, North	OC-PS09	Hopper Brook outfall; E. of Medora Pl	Box culvert	<i>Bacteria levels during tributary trackdown events consistently show high bacteria levels at nearly all of these locations, but the source remains unknown. Sampling locations flow through residential properties and it is theorized that pet waste may be a primary contaminant. It may not be necessary to sample all of these locations, but just the ones with the highest levels (09, 09B, 09D, 09E, 09G).</i>
	OC-PS09B	Ford Ave; ~100 yd E of Valley Dr	In-stream sample	
	OC-PS09D	Valley Drive crossing	In-stream sample	
	OC-PS09E	Valley View Dr	In-stream sample	
	OC-PS09G	100' upstream of Ford Ave	In-stream sample	
Harbor Brook	HB-Velasko Rd(A)	Channel/ditch parallel to Velasko Rd on the west side. Discharges to Harbor Brook at the Velasko Rd bridge.	In-stream sample	<i>Bacteria levels are generally high at Velasko Rd during the summer months, however during the follow-up trackdown (May 2014) bacteria levels were low. Because bacteria levels tend to increase at Velasko Rd during the summer, it is theorized that wildlife waste may be contributing to bacteria levels.</i>
	HB-Velasko Rd	Main channel upstream of the Velasko Rd bridge	In-stream sample	

Responsibilities:

Descriptions of the roles and responsibilities of each collaborator are described below; contact information is provided in Attachment 2.

NYS Department of Environmental Conservation

1. Liaison between the NYS DOH and OEI on sample collection, delivery, data receipt and analysis,
2. Contract and budget management
3. Covering cost of sample shipping to Wadsworth Laboratory under this contract.

NYS Department of Health

1. Receipt, management, and *Bacteroides* (and other genetic marker analyses as necessary) for the detection of bovine, human, canine, avian contributions to fecal contamination of water samples delivered to Wadsworth Laboratory
2. Provision of sample collection bottles

Onondaga County

1. Receipt, management, and fecal coliform analysis of water samples delivered to the Onondaga County laboratory, Liverpool, NY
2. Management/archival of data generated by Onondaga County

City of Syracuse

1. Assistance in accessing potential sampling sites
2. Provision of maps and recommendations for selecting trackdown sampling sites
3. Assistance with dye testing and scoping potential contamination sources

Onondaga Environmental Institute

1. Collection and shipping of water samples from agreed-upon sites following standard and Wadsworth Laboratory protocols
2. Contacting and coordinating with NYS DEC on the collection of samples

Attachment 1

Sampling Procedures/Protocols and Sample Submission for MST analysis at the Wadsworth Center, NYSDOH

Wadsworth can analyze up to 7 MST samples per day including the field blank. Please contact the lab before you submit samples (contact information below). It is recommended that they be contacted during the evaluation of whether to sample or not.

1. It is important that samples are collected as soon as a problem is suspected. They can be stored refrigerated while appropriate agencies/staff are contacted.
2. One liter of water is required for each MST sample*.
3. One field blank is required per sampling day. Open the field blank in the field for as long as it takes to collect a sample, then close the bottle and treat as a normal sample. Again, if a lab field blank is not available, use a 1 liter bottled water bottle.
4. Refrigerate or ice samples immediately after collection and send them to lab with a Request for Analysis (DOH-246, 8/2012) form for each sample, including the field blank. The holding time for these samples is to be as little as possible, and is part of the reason the lab should be contacted as soon as MST sampling is being considered.
5. Do not send samples on Friday; Wadsworth's mailroom is closed on Saturday.

*If one-liter bottles are not available, consult with Wadsworth about using one-liter bottled water bottles. Pour out the bottle contents and fill it with sample, taking care not to touch the inside of the cap or inside of the bottle. Use a full bottled water bottle from the same production date as a field blank and treat as described in 4, above.

DOH Laboratory Contact information:

Pauline Wanjugi; 518-408-1844, Pauline.Wanjugi@health.ny.gov

If you leave a message and don't hear back from someone within 3 hours, call Christine at 518-474-4192.

Attachment 2 Contact Information

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