



Hotspot Monitoring

2017 Annual Report

Prepared by:

Andres Ripley, Environmental Science Fellow

Chris Hirsch, Environmental Scientist

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Introduction

The Hotspot Monitoring Program is a targeted water quality monitoring effort conducted by the Neponset River Watershed Association (NepRWA). The purpose of the Hotspot Program is to locate pollution sources discharging into waterbodies that have suspected contamination according to ambient water quality data, previous staff investigations, and anecdotal observations. *E.coli* pollution and associated pathogens are a major issue in the Neponset watershed. Sewage contamination via illicit discharges, sanitary sewer overflows, and sewer failures is the main source of *E.coli* during dry weather, and thus, eliminating these sources is a main focus of the Hotspot Program. In addition to *E.coli*, the Hotspot Program focuses on investigating points with chronically low dissolved oxygen or where illicit discharges, other than sewage, may be discharging from the MS4.

Once a pollution source has been located, it is verified through follow up investigations, and the findings are reported to the Department of Public Works for the town in which the problem is found. The purpose of the Hotspot Program is not to replace any town's outfall screening obligations, but instead is to be used as an additional source of information to help guide outfall and catchment investigation prioritizations.

This year's hotspot investigations located: three possible sources of *E. coli* contamination in Norwood, one major source of *E. coli* contamination in Dedham, and areas of critically low dissolved oxygen in Canton. A broken drinking water pipe was discovered bubbling up from underground in Norwood and was immediately fixed by the town. Finally, three hotspots in Milton, Stoughton and Westwood, remain unresolved after our investigations this year. Monitoring at these locations will resume next season.

Methods

Hotspot Identification and Prioritization:

The initial list of hotspots was generated from analysis of NepRWA's ambient water quality data. Sampling locations that were consistently above MassDEP's single sample *E.coli* concentration (235 cfu/100ml) threshold for recreational contact during dry weather were listed as hotspots. Sampling locations that regularly dropped below MassDEP's dissolved oxygen threshold for warm water fisheries (5 mg/L) during dry weather were also included as hotspots. In addition to these points, other hotspots were added to the list based on the findings of previous optical brightener studies, pollution report follow-up studies, areas where SSO's and illicit discharges had been previously reported, and anecdotal reports by both staff and concerned citizens.

Sites were prioritized based on severity of water quality impairment, age of report, and quality of information available. Preference was given to sites that had poorer water quality, newer reports, and more precise information in the reports. The hotspot list and prioritization was updated continuously as sampling missions were completed and new ambient water quality data became available.

Hotspot Naming Convention:

A naming convention was developed so that each sample could be easily identified and linked back to its sampling location and associated hotspot. The sample id consists of three parts: 1) Hotspot Code 2) Sampling Site Code 3) Sample Number. The Hotspot Code is a unique three letter code that signifies what hotspot the sample is associated with. The Sampling Site Code is a single letter that signifies where the sample was collected. The Sample Number is a numerical code that denotes each unique sample taken at a given location.

Example: [ABC]_{A}(1)

[Green] = Hotspot Code

{Blue} = Sampling Site Code

(Orange) = Sample Number

Field Investigations:

Field investigations took place between May and November 2017. Each mission consisted of one or more of the following types of sampling: instream, outfall, or dissolved oxygen sampling. Sampling missions typically involved wading upstream during dry weather while collecting instream samples at regular intervals and sampling from any outfalls that were discharging. In the case of dissolved oxygen sampling, targeted outfalls and sampling locations were predetermined in the office and staff collected samples directly from those locations only.

GPS coordinates, descriptions of the sampling conducted, and photographs of the sampling location were recorded for each sample taken. These data were recorded using the ArcGIS Collector App and stored in an ArcGIS Online map. All samples were collected and analyzed according to the methods described in the NepRWA's EPA/MassDEP Approved QAAP document (Appendix A-1).

Instream/Outfall Sampling

Instream and outfall samples were collected using sterile 250 mL high-density polyethylene (HDPE) bottles. Special care was taken to avoid contamination of the sample with sediments. Where sediment contamination was unavoidable due to low water levels, the contamination was noted in the field and the results were flagged. All water was drawn according to the EPA approved methods outlined in the "2016 CWMN Water Monitoring and Sampling Manual" (Appendix A-2). All samples were immediately placed on ice to be taken back to the lab for analysis within the six-hour hold time.

Dissolved Oxygen Sampling

Dissolved oxygen measurements were taken in the field using a YSI Pro20 DO meter. The meter was inspected and calibrated according to the manufacturer's specifications prior to each mission, and a calibration and maintenance record was kept and updated accordingly. All dissolved oxygen readings were taken according to the methods described in the "2016 CWMN Dissolved Oxygen Sampling Manual" (Appendix A-3).

Lab Procedures:

Instream and outfall samples collected in the field were taken back to the NepRWA lab to be analyzed. Instream and outfall samples were analyzed for *E.coli*, surfactants and ammonia.

Standard operating procedures for the aforementioned laboratory analyses can be found in Appendix A.

Table 1: Analytical Methods

Analyte	Units	Method
<i>E. coli</i>	235 MPN cfu/100 ml	SM 9223B (Colilert)
Surfactants	0.5 mg/l	EPA 425.1 (CHEMetrics I-2017)
Ammonia	0.25 mg/l	SM D1426-08 (A) (CHEMetrics V-2000, CHEMetrics K-1403)
Dissolved Oxygen	5.0 mg/l	SM 4500-O D

QA/QC:

A duplicate sample was taken in the field at least once per trip and once every 10 samples. Duplicate samples were analyzed for the full suite of parameters, and the results were compared with the corresponding sample. Data quality objectives can be found in the NepRWA QAPP (Appendix A-1). In addition to duplicate samples, positive and negative controls were made for *E. coli* for each mission. Data quality objectives for external lab analyses can be found in Appendix B.

Results and Discussion

A map containing the location and all of the hotspot sampling results can be viewed here: <https://www.neponset.org/projects/hot-spot-program/>

The following tables contain results from all of the sampling conducted during the 2017 Hotspot season. Red values denote results that are above the indicator thresholds defined in the 2016 MS4 permit issued by the EPA. Positive results were defined using the illicit discharge indicator values in section 2.3.4.6 of the 2016 MS4 permit. Likely sewer input indicators are the following: *E. coli* values \geq 235 CFU/100ml, Surfactants values \geq 0.25 mg/l, and Ammonia values \geq 0.5 mg/l.

Milton

Field ID	Date	Instream/Outfall	<i>E. coli</i>	Surfactants	Ammonia
PTB_B_02	9/12/2017	Outfall	4.1	0.17	0.069
PTB_B_03	9/12/2017	Outfall	4.1	0.11	0.039
PTB_C_04	9/12/2017	Outfall	9.6	0.04	0.033
PBT_C_05	9/12/2017	Outfall	17.3	0.03	0.01
PTB_K_03	9/12/2017	Instream	248.1	0.11	0.049
PTB_K_04	9/12/2017	Instream	228.2	0.11	0.019
PTB_M_02	9/12/2017	Outfall	517.2	0.1	0.014

Discussion

Historically Pine Tree Brook has consistently failed to meet *E.coli* standards for primary recreation, even during dry weather. This suggests that there may be an illicit source of *E.coli* entering the brook. We were unable to locate a definite source of *E.coli* contamination through our hotspot sampling last year, and thus continued monitoring the brook in 2017. PTB_C is an outfall that is located under the Brook Road Bridge. Last year, there were high levels of *E. coli* in samples taken from this outfall, but this year's samples had much lower concentrations of *E.coli*, suggesting that there may be an intermittent discharge at this outfall or this issue has been resolved.

Samples taken from PTB_K had *E. coli* levels near the threshold, but had normal surfactant and Ammonia readings, making it hard for us to discern if there is an issue there or not. PTB_M is an outfall located under the Central Avenue Bridge just upstream of Turner's pond. The sample collected at this location contained high *E. coli* levels. This outfall tested positive for optical brighteners last year, it remains a suspicious outfall with no clear indication of what the issue is.

Canton

Field ID	Date	% Saturation DO	DO mg/L
PQT_A_01	5/12/2017	46.8	4.91
PQT_B_01	5/12/2017	38.1	3.96
PQT_C_01	5/12/2017	45.8	4.82

Discussion

Our ambient water quality data indicate that Pequit Brook has a chronic issue with low dissolved oxygen. The three readings taken in Pequit Brook had very low dissolved oxygen levels, which is harmful for fish and other aquatic species living in the brook. The low dissolved oxygen levels were consistent throughout the brook, not just at the ambient sampling location, suggesting that this may be a systemic issue throughout the brook upstream of Reservoir Pond. One possible reason for the low dissolved oxygen levels could be the high levels of phosphorous in the brook. The low dissolved oxygen levels may also be caused by the large and shallow wetland upstream of the brook, where the water flows very slowly. More research will need to be conducted to try and find the cause of the problem.

Dedham

Field ID	Date	Instream/Outfall	<i>E. coli</i> (cfus)	Surfactants	Ammonia
MOB_A_01	8/17/2017	Instream	416	0.221	0.15
MOB_B_01	8/17/2017	Instream	51.7	0.126	0.17
MOB_B_02	8/22/2017	Instream	25	0.11	0.037
MOB_C_01	8/17/2017	Outfall	> 2,419.60	3	1.09
MOB_C_02	8/22/2017	Outfall	> 24,196	2	4.34
MOB_D_01	8/17/2017	Instream	2,419.60	1.09	0.1
MOB_E_01	8/22/2017	Instream	18.1	0.1	0.175

Discussion

Mother Brook was added to the hotspot list because of chronic high *E.coli* values recorded at our Citizen Water Monitoring Network (CWMN) site MOB001. Upon exploring the brook to try and find the source of *E. coli*, an outfall (MOB_C) was discovered. This outfall was discharging discolored water with a strong foul smell. *E.coli* readings from this outfall exceeded the maximum detection limit by our test even after samples were diluted by 10:1. High levels of *E.coli* were still detectable in the brook over 100 yards downstream of the outfall (MOB_D).

The outfall is coming directly from the Dedham Transfer Station, and is believed to be causing the unusually high *E. coli* levels in the brook. We believe that the sprinkler system that is operated by the transfer station, presumably to keep dust down, is washing pollutant laden garbage residue into a catch basin that discharges at this outfall. Dedham DPW has been notified of the outfall and further action will be taken to eliminate the discharge. We will continue to monitor the situation until it is resolved.

Norwood

Field ID	Date	Instream/Outfall	<i>E. coli</i>	Surfactants	Ammonia
GEB_A_01	6/13/2017	Instream	166.4	0	.04
GEB_B_01	6/13/2017	Outfall	4.1	0	0
GEB_C_01	6/13/2017	Outfall	365.4	0.11	0.017
GEB_D_01	6/13/2017	Instream	261.3	0.11	0.243
GEB_E_01	6/13/2017	Outfall	14.5	0.08	0
GEB_F_01	6/13/2017	Outfall	30.5	0.04	0.047
GEB_G_01	7/5/2017	Instream	104.6	0.43/0.32*	0.064/0.075*
GEB_G-DUP	7/5/2017	Instream	145	0.14	0.015/0.084*
GEB_G_02	7/18/2017	Instream	108.6	0.08	0.38
GEB_H_01	7/5/2017	Outfall	>2,419.60	0.2	0.115
GEB_I_01	7/5/2017	Instream	5.2	0.12	0
GEB_J_01	7/5/2017	Outfall	>2,419.60	0.14	0.005
GEB_J_02	7/18/2017	Outfall	24.6	0.14	0
GEB_K_01	7/5/2017	Instream	>2,419.60	0.1	0.004
GEB_L_01	7/5/2017	Instream	>2,419.60	0.13	0.085
GEB_M_01	7/18/2017	Instream	198.9	0.12	0.16
GEB_N_01	7/18/2017	Outfall	1,986.30	0.09	0.006
GEB_N_01_Split	7/18/2017	Outfall	1,986.30	n/a	n/a
HAB_F_01	5/4/2017	Instream	461.1	0.17	0.177
HAB_G_01	5/4/2017	Instream	224.7	0.22	0.182
HAB_H_01	5/4/2017	Outfall	613	0.16	0.328
HAB_I_01	5/4/2017	Instream	34.7	0.21	0.022
Bub_01	5/4/2017	n/a	<1	n/a	n/a

* Two tests were run because there was concern of the accuracy of the meter reading.

Discussion

There were two hotspot locations in Norwood: Germany Brook and Hawes Brook. The majority of the outfalls along Germany Brook were clean with the exception of three outfalls near the entrance of Ellis Pond. When the town was notified, they indicated that they were aware of the issue at these outfalls, and that they are currently working on repairing the sanitary sewer in this area as part of their consent decree. We will continue to monitor the situation and keep in contact with the town about this issue.

We began investigating high levels of *E.coli* in Hawes Brook in 2016 following up on reports of high *E.coli* in an unnamed tributary of Hawes Brook. Investigations in that tributary uncovered a suspicious outfall with moderately high levels of *E.coli* contamination. It is unclear at this time what the source of the contamination is. Additional sampling at this location is needed to clarify the situation.

While investigating the unnamed tributary of Hawes Brook we discovered water bubbling up out of the ground. Suspecting that this was a water main break we tested the water for chlorine and *E.coli*. The results confirmed our suspicions. We reported this break to the town immediately, and they had it repaired within days.

Stoughton

Field ID	Date	Instream/Outfall	<i>E. coli</i>	Surfactants	Ammonia
SHB_B_02	8/1/2017	Instream	613.1	0.038	0.12
SHB_H_01	8/1/2017	Outfall	461.1	OVERRANGE	0.19
SHB_I_01	8/1/2017	Instream	686.7	0.195	0.07
SHB_I_DUP	8/1/2017	Instream	613.1	0.18	0.07
SHB_J_01	8/1/2017	Instream	920.8	0.026	0.07
SHB_K_01	8/1/2017	Instream	248.1	0.002	0.12

Discussion:

Steep Hill Brook was investigated because of consistently high *E.coli* values during dry weather. Instream sampling confirmed that there are high *E.coli* values throughout the brook. Curiously, the only outfall that had a discharge during dry weather had lower *E.coli* values than were recorded in the brook. SHB_H is an outfall located right along Frances Drive. The outfall was discharging orange water due to iron eating bacteria that is associated with groundwater discharges. The orange color interfered with our surfactants test, which is why the surfactant reading came back as overrange. Further research will continue in Steep Hill Brook to try and locate the source of *E. coli*.

Westwood

Field ID	Date	Instream/Outfall	<i>E. coli</i>	Surfactants	Ammonia
PUB_A_01	10/3/2017	Instream	47.3	0.13	0.001
PUB_B_01	10/3/2017	Instream	42	0.14	0.011
PUB_C_01	10/3/2017	Instream	191.8	0.11	0.02

PUB_D_01	10/3/2017	Instream	436	0.2	0.016
PUB_D_02	10/19/2017	Instream	1413.6	0.22	0.026
PUB_E_01	10/19/2017	Instream	365	0.009	0.19
PUB_E_01 dup	10/19/2017	Instream	364	0.003	0.19
PUB_F_01	10/19/2017	Outfall	>2,419.6	0.23	0.16

Discussion:

Purgatory Brook was added as a hotspot due to unusually high levels of *E.coli* recorded there from CWMN data. Upon further investigation, an outfall (PUB_F) was discovered discharging into the brook during dry weather. A sample was taken from the outfall and contained high levels of *E. coli*. There were other samples taken upstream and downstream of the outfall that also contained high levels of *E. coli*, but did not contain levels of surfactants and ammonia above the threshold. Purgatory Brook will continue to be monitored in hopes of finding the *E. coli* source.

Conclusions:

Milton – Based on our findings, we recommend more testing of the outfalls in Pine Tree Brook. Last year, there were high levels of *E. coli* in samples taken from PTB_C, but samples from this year had *E. coli* levels that were much lower. This could be interpreted a number of ways. It could indicate that there is an intermittent discharge at this site, or that the issue at this site has been resolved.

We recommend that outfalls like PTB_C be sampled in the early morning to confirm if there is or isn't an intermittent discharge at this outfall. Sewage pipes tend to be fuller in the morning, when people are at home getting ready for school and work. If there is a crack or break towards the top of the sewage pipe, it may only leak when the pipe is full, meaning high levels of *E. coli* would be discharging from the outfall only during peak usage times.

Due to the close proximity of a large sanitary sewer main that runs parallel and crosses under Pine Tree Brook, we also recommend that the town of Milton review sewer maintenance records and/or inspect sewer manholes for the stretch between Blue Hills Parkway and Brook Rd.

Canton – Dissolved oxygen issues in Pequit Brook need to be investigated further. The DO issue is likely related to high levels of phosphorous and the stagnant nature of the headwaters of the brook. We recommend targeted phosphorus monitoring to try and track down potential sources.

Dedham – We recommend that the town take immediate action to fix the outfall coming from the Dedham Transfer Station. The *E. coli* levels coming from the transfer station outfall are so high that it poses a health risk to people and wildlife utilizing that section of Mother Brook. Fixing this outfall should drastically lower the levels of *E. coli* downstream, which would make it a healthier environment for fish and other aquatic species living in the brook, and will make it safe for recreational use by the public.

Norwood and Westwood - We will continue to follow up with the town to see how they are progressing with fixing the outfalls in Germany Brook that contain high concentrations of *E. coli*. We will also continue to monitor the unnamed tributary of Hawes Brook next season to try and confirm if there is indeed a sewage issue at the suspicious outfall behind the apartment complex. In addition, follow up investigations of Purgatory Brook will continue next season to try and locate a source of pollution causing the high instream *E. coli* levels

Stoughton –Almost all of the instream samples in Steep Hill Brook contained high concentrations of *E. coli*. SHB_H, the only outfall that was discharging during dry weather, had elevated levels of *E. coli*; however, it had a lower concentration than the instream samples taken from the brook. This suggests that outfall SHB_H is not the only source of *E. coli*. More sampling next season will hopefully allow us to discover the source of contamination in the brook and report it to the town to be fixed.

While many of our hotspot investigations did not detect a clear source of contamination at these locations, they did provide leads that will allow for more focused investigations next year. These results should be used to inform the towns of what areas need to be examined for pipe leaks and other sources of contamination, and allow for continued steps in the right direction to clean up the Neponset's most polluted sections.