# Hot Spot Monitoring

## 2016 - Annual Report

**Neponset River Watershed Association**

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## Introduction

The Hot Spot Monitoring Program is a targeted water quality monitoring effort conducted by the Neponset River Watershed Association (NepRWA). The purpose of the Hot Spot 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 Hot Spot Program. In addition to *E.coli*, the Hot Spot 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 Hot Spot 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 hot spot investigations located: three sources of *E.coli* contamination and a potential illegal grey water connection in Milton, two potential sources of *E.coli* contamination in Canton, and areas of critically low dissolved oxygen in Foxborough and Walpole. Investigations confirmed that two sites with past issues have been fixed; one in Westwood and one in Sharon. Finally, two hot spots, one in Stoughton and one in Norwood, remain unresolved after our investigations this year. Monitoring at these locations will resume next season.

## Methods

### Hot Spot Identification and Prioritization:

The initial list of hot spots 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 hot spots. 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 hot spots. In addition to these points, other hot spots 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 hot spot list and prioritization was updated continuously as sampling missions were completed and new ambient water quality data became available.

## Hot Spot Naming Convention:

A naming convention was developed so that each sample could be easily identified and linked back to its sampling location and associated hot spot. The sample id consists of three parts: 1) Hot Spot Code 2) Sampling Site Code 3) Sample Number. The Hot Spot Code is a unique three letter code that signifies what hot spot 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] = Hot Spot Code
{Blue} = Sampling Site Code
(Orange) = Sample Number

Note: The Unquity Brook Project used a slightly different naming convention which used only the hotspot code and a two digit site number.

## Field Investigations:

Field investigations took place between May and November 2016. Each mission consisted of one or more of the following types of sampling: instream, outfall, dissolved oxygen, or optical brightener 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 optical brightener and 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).

## Optical Brightener Sampling

Optical brightener samples were collected using cotton pads placed in wire cages and zip-tied to a large weight. The pads were placed so that they were upstream of the weight to avoid contamination from any residue that may have been on the weight. Sampling pads were placed in suspected outfalls and left in place for 3-7 days of dry weather. Upon collection, the pads were immediately placed into clean opaque HDPE sampling bottles that was labeled to identify the sample. All optical brightener samples were collected according to the methods described in the "2007 CWMN Optical Brighteners Sampling Manual" (Appendix A-4).

## Lab Procedures:

Instream, outfall, and optical brightener 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. Optical brightener sampling pads were also analyzed in the laboratory using a long wave UV lamp and light box. Standard operating procedures for the aforementioned laboratory analyses can be found in Appendix A.

The Unquity Brook Project, an offshoot of the Hot Spot Monitoring program, had a slightly different protocol than other hot spot missions. The Unquity Brook Project involved wet weather and dry weather sampling, and included all of the following parameters in addition to the parameters listed above: total suspended solids, turbidity, conductivity, salinity, temperature, and microbial source tracking. Samples were analyzed for turbidity and total suspended solids by G&L Laboratory in Quincy, MA. Microbial source tracking (MST) analysis was completed by Source Molecular in Miami, FL. Standard operating procedures for the external laboratory analyses can be found in Appendix B.

Table 1: Analytical Methods

| Analyte | Units | Method |
|---|---|---|
| E. coli | MPN cfu/100 ml | SM 9223B (Colilert) |
| Surfactants | mg/l | EPA 425.1 (CHEMetrics I-2017) |
| Ammonia | mg/l | SM D1426-08 (A) (CHEMetrics V-2000, CHEMetrics K-1403) |
| Optical Brighteners | Positive, Negative, or Retest | Long Wave UV Light |
| Dissolved Oxygen | mg/l | SM 4500-O D |
| Turbidity** | NTU | EPA 180.1 (G&L Labs) |
| Total Suspended Solids** | mg/l | SM 2450 D |
| Microbial Source** | Positive, Negative | EPA Patented Method (Source Molecular) |
| Temperature* | C | SM 2550 B-2000 |
| Conductivity* | µS/cm | EPA 120.1 (Extech ExStikIIEC400) |
| Salinity* | ppm | SM 2520 D (Extech ExStikIIEC400) |

* Analyzed in-house for the Unquity Brook Project only
**Analyzed by external labs for Unquity Brook Project only

## 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.

It was discovered in October that one of the bulbs in our ammonia meter had burnt out. Subsequently we have flagged all of our ammonia data collected before 10/3/2016. We replaced the broken meter and bought a new surfactants meter that used the same method as we were already using. Measurements collected prior to replacement of the ammonia meter, may be an underestimate of actual ammonia concentrations. The new surfactants test utilizes a benchtop instrument rather than a visual comparator to generate results. This new instrument reduces the amount of observer subjectivity and provides a much greater resolution of results. In addition to upgrading our instrumentation, we also began using a 1 mg/L standard as a lab spike after each mission to test the accuracy of the ammonia meter, and we added a surfactants spike to confirm that the new surfactants meter was operating properly.

# Results and Discussion

A map containing the location and all of the hot spot 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 2016 Hot Spot 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

*__*Important Note*__: the results of the Unquity Brook Assessment Project are not included in the table below. To view the Unquity Brook results refer to Appendix C.

| Field ID | Instream /Outfall | Date | E.Coli MPN | Surfactants mg/L | $NH_3$ mg/L | Optical Brighteners | Flagged |
|---|---|---|---|---|---|---|---|
| PTB_A1 | Outfall | 7/28/2016 | 70.8 | 0.25 | 0.64 | ND | Ammonia |
| PTB_B1 | Outfall | 7/28/2016 | 3.1 | 0.25 | 0.02 | ND | Ammonia |
| PTB_C1 | Outfall | 7/28/2016 | 0 | 0.25 | 0.25 | ND | Ammonia/ E.coli reagent wasn't added to sample |
| PTB_D1 | Instream | 7/28/2016 | 689.3 | 0.25 | 1.044 | ND | Ammonia |
| PTB_E1 | Instream | 8/4/2016 | 37.4 | 0 | 0.241 | ND | Ammonia |
| PTB_F1 | Instream | 8/4/2016 | 155.3 | 0 | 0.485 | ND | Ammonia |
| PTB_G1 | Instream | 8/4/2016 | 178.5 | 0.5 | 0.594 | ND | Ammonia |
| PTB_H1 | Instream | 8/4/2016 | 139.6 | 0 | 0.193 | ND | Ammonia |
| PTB_I1 | Instream | 8/4/2016 | 648.8 | 0 | 0.18 | ND | Ammonia |
| PTB_J1 | Instream | 8/4/2016 | 115.3 | 0 | 0.228 | ND | Ammonia |
| PTB_K1 | Instream | 8/4/2016 | 613.1 | 0.5 | 0.141 | ND | Ammonia |
| PTB_L1 | Instream | 8/4/2016 | 727 | 0 | 0.169 | ND | Ammonia |
| PTB_C2 | Outfall | 8/4/2016 | 816.4 | 0.25 | 0.053 | ND | Ammonia |
| PTB_C3 | Outfall | 8/16/2016 | 648.8 | 0 | 0 | ND | Ammonia |
| PTB_G2 | Instream | 8/16/2016 | 29.5 | 0.25 | 0.122 | ND | Ammonia |
| PTB_H2 | Instream | 8/16/2016 | 117.8 | 0.25 | 0.003 | ND | Ammonia |
| PTB_I2 | Instream | 8/16/2016 | 137.6 | 0 | 0.29 | ND | Ammonia |
| PTB_J2 | Instream | 8/16/2016 | 68.3 | 0.25 | 0.233 | ND | Ammonia |
| PTB_K2 | Instream | 8/16/2016 | 166.4 | 0.25 | 0.175 | ND | Ammonia |
| PTB_L2 | Instream | 8/16/2016 | 344.8 | 0 | 0.191 | ND | Ammonia |
| PTB_M1 | Outfall | 8/16/2016 | 139.6 | 0 | 0.128 | ND | Ammonia |
| PTB_M1 | Outfall | 10/5/2016 | ND | ND | ND | Negative | N/A |
| PTB_M2 | Outfall | 10/5/2016 | ND | ND | ND | Positive | N/A |
| PTB_N1 | Outfall | 10/5/2016 | ND | ND | ND | Negative | N/A |
| PTB_N2 | Outfall | 10/5/2016 | ND | ND | ND | Negative | N/A |
| PTB_M2 | Outfall | 11/14/2016 | ND | ND | ND | Positive | N/A |

Discussion

Pine Tree Brook in Milton was added to the hot spot list this year because of high *E.coli* concentrations recorded at all three of our ambient water quality monitoring stations located along the brook. The dry weather geometric mean for the site at the Brook Road bridge was 975 cfu/100mL. Three sampling missions were conducted to try and find the cause of the high *E. coli* values. In addition to these sampling missions, two optical brightener studies were conducted as follow up to an optical brightener report made by a former staff person, Bill Guenther.

PTB_C is an outfall located under the Brook Road bridge that had consistent dry weather flow. The first time it was tested, the *E.coli* analysis failed because a key reagent was not added to the sample before incubation. Follow-up samples taken from the outfall indicated high levels of *E.coli* but no surfactants or ammonia. While the *E.coli* levels were above the threshold, they were well below the values that were recorded in the ambient data, and therefore it is unlikely that this is the sole source of contamination causing the high readings. Regardless, we recommend investigating the catchment for this outfall in order to determine the source of the bacteria discharging from this outfall.

PTB_M is an outfall located under the Central Avenue bridge just upstream of Turners Pond. This outfall was reported to have optical brighteners present in a previous study conducted by Bill Guenther. Our follow up sampling confirmed that there is still an optical brighteners issue at this outfall. The sampler was deployed during a period of dry weather and, no dry weather flow was observed at the site. This would suggest that there may be a grey-water or wash-water connection to this section of the drain infrastructure or another intermittent illicit connection. The fact that the same result was found twice this year, and at least once several years ago, suggests that something other than car washing may be going on in this catchment. We recommend that this outfall's catchment be investigated for the possibility of an illegal connection.

The results of the Unquity Brook Project are not fully presented here. Please refer to Appendix C for a detailed analysis. Investigations in Unquity Brook uncovered sewage contamination coming from the Milton Police station and an outfall within the Brook Road culvert. Milton DPW has located the points of contamination within the drain system and is working with the responsible parties to fix the issues.

## Canton

| Field ID | Date | Instream/ Outfall | E.Coli MPN | Surfactants mg/L | $NH_3$ mg/L | Flagged |
|---|---|---|---|---|---|---|
| PQB_A1 | 8/24/2016 | Instream | 547.5 | 0 | 0.103 | Ammonia |
| PQB_B1 | 8/24/2016 | Instream | >2419.6 | 0.25 | 0.061 | Ammonia |
| PQB_A2 | 9/22/2016 | Instream | 307.6 | 0 | 0.212 | Ammonia |
| PQB_B2 | 9/22/2016 | Instream | >2419.6 | 0 | 0.021 | Ammonia |
| PQB_C1 | 9/22/2016 | Instream | 648.8 | 0.25 | 0.004 | Ammonia |
| PQB_D1 | 9/22/2016 | Outfall | >2419.6 | 0.5 | 0.056 | Ammonia |
| PQB_E1 | 9/22/2016 | Instream | 1413.6 | 0.25 | 0 | Ammonia |
| PQB_F1 | 9/22/2016 | Instream | 31.7 | 0.25 | 0.001 | Ammonia |
| PQB_B3 | 10/25/2016 | Instream | 56.5 | 0.21 | 0 | N/A |
| PQB_D2 | 10/25/2016 | Outfall | 461.1 | 0.15 | 0.031 | N/A |
| PQB_Z1 | 10/25/2016 | Instream | 195.6 | 0.09 | 0.049 | N/A |

Discussion

Pecunit Brook was added as a hot spot because of unusually high bacteria levels recorded in our ambient water quality data for July (631 CFU/100ml), August (2,600 CFU/100ml),

September (5,170 CFU/100ml), and October (766 CFU/100ml). We sampled all along the brook in hopes of locating a source of bacterial contamination. Two of the sites seemed suspicious for possible sewage contamination.

The first being site PQB_B which is located just upstream of the culvert that passes under Elm Street. This is the same location as our CWMN site. There is a large sanitary sewer main that runs down the center of Elm Street. Samples taken at this location contained elevated concentrations of *E.coli* for two of the three missions as well as modestly elevated surfactant concentrations and variable ammonia concentrations.

One possible explanation for the elevated *E.coli* levels in Pecunit Brook is this year's drought. This segment of the stream essentially became an isolated very shallow pond that emerged from the streambed approximately 150 yards upstream and dried up just on the other side of Elm Street. It is possible that the semi-stagnant water in this stream reach was breeding and concentrating *E.coli* bacteria. The fact that the stream went dry immediately after crossing under Elm Street may suggest the possibility of sewer system infiltration and inflow at this location. We recommend an inspection of the sanitary sewer main at this location to confirm that there is no groundwater infiltration or sewage surcharge occurring.

The other suspicious site was PQB_D which is a partially submerged outfall emerging from the side yard of 23 Standish Drive. This site contained high levels of bacteria and modestly to significantly elevated levels of surfactants both times it was sampled. Instream samples at sites PQB_E and PQB_C were taken downstream of this outfall and both contained high concentrations of *E.coli* along with modestly elevated surfactants. An instream sample was taken upstream of the outfall at PQB_F. This sample had low concentrations of *E.coli* which would suggest that the submerged outfall is the source of bacterial contamination in the lower section of the brook. This section of the stream was disconnected completely from PQB_B thus the high bacteria levels were unrelated.

PQB_A was located directly upstream of the culvert that passes under the road leading to the Canton Water Treatment Plant. Samples from this location came back with elevated levels of bacteria, but none of the other supporting parameters were elevated. There were no obvious sources of contamination at this site.

## Sharon

| Field ID | Date | Instream/Outfall | Optical Brighteners | Flagged |
|---|---|---|---|---|
| MAN_A1 | 10/5/2016 | Outfall | NEG | N/A |

Discussion:
An outfall that discharges to the spillway of the Mann's Pond dam in Sharon (MAN_) was screened for optical brighteners as a follow up to reports of a soapy discharge coming from that outfall. A cotton pad was placed in the outfall and left for 4 days during a period of dry weather. The pad did not fluoresce under UV light suggesting that there may no longer be an issue at this outfall. A follow up investigation at this outfall will occur again next year to confirm this finding.

## Foxborough

| Field ID | Date | Instream/Outfall | DO mg/L | Flagged |
|---|---|---|---|---|
| CRP_A1 | 8/23/2016 | Instream | 0.7 | N/A |

Discussion

A hot spot investigation was conducted at Crack Rock Pond (CRP_) in Foxborough after we received results from our ambient water quality monitor who recorded dissolved oxygen saturation at less than 1mg/l. Upon investigation we found that the pond was showing obvious signs of eutrophication. The entire surface was covered in bright green duckweed and wolffia. Eutrophication within the pond was likely exacerbated by the drought due to abnormally high temperatures, lack of flushing, and a concentration effect caused by evaporation along with known sources of historical pollution to the pond.

Our follow up dissolved oxygen readings confirmed that the pond had less than 1 mg/l oxygen saturation, a condition that is deadly for most aquatic organisms. Next year, we will install dissolved oxygen data loggers for extended periods of time in order to monitor the situation.

## Westwood

| Field ID | Date | Instream/ Outfall | E.Coli MPN | Surfactants mg/L | $NH_3$ mg/L | Flagged |
|---|---|---|---|---|---|---|
| MLB_A2 | 5/26/2016 | Outfall | <1 | 0 | 0.001 | Ammonia |
| WIP_A1 | 5/26/2016 | Instream | 88.6 | 0.25 | 0.026 | Ammonia |
| WIP_A2 | 5/26/2016 | Instream | 6.3 | 0.25 | 0.046 | Ammonia |
| MLB_A3 | 7/7/2016 | Outfall | 6.3 | 0.25 | 0.014 | Ammonia |
| MLB_A1 | 7/7/2016 | Outfall | 33.6 | 0 | 0.029 | Ammonia |

Discussion

Two separate hot spots were investigated in Westwood: Mill Brook (MLB_) and an unnamed tributary of Willet Pond (WIP_). The Mill Brook investigation was a follow up to repair work that was done to remove an illicit connection several years ago. Samples taken from nearby outfalls confirmed that the repairs corrected the issue and that the hot spot has been resolved.

The unnamed tributary of Willet Pond flows through New England Forestry Foundation property and into Willet Pond. It was added as a hot spot because of reports of the stream containing abnormally high amounts of filamentous green algae coating the stream bed. Water samples taken from the stream did not suggest sewage contamination at the site. It is possible that the excessive eutrophication is due to agricultural or yard fertilizer runoff.

## Norwood

| Field ID | Date | Instream/ Outfall | E.Coli MPN | Surfactants mg/L | $NH_3$ mg/L | Flagged |
|---|---|---|---|---|---|---|
| NEP_A1 | 7/7/2016 | Outfall | 172.2 | 0.25 | 0.015 | Ammonia |
| HAB_A1 | 7/20/2016 | Instream | 210.5 | 0.25 | 0.001 | Ammonia |
| HAB_B1 | 7/20/2016 | Outfall | 1 | 0 | 0 | Ammonia |
| HAB_C1 | 7/20/2016 | Outfall | 90.9 | 0.5 | 0.043 | Ammonia |
| HAB_D1 | 7/20/2016 | Instream | 8.6 | 0.25 | 0.132 | Ammonia |
| HAB_D2 | 7/20/2016 | Instream | 516.2 | 0.25 | 0.03 | Ammonia |

Discussion

Hawes Brook in Norwood was investigated this year partly in follow up to the fire that occurred over the brook earlier in the summer and in part due to high *E.coli* values recorded in our ambient water quality data over the past several years. All but one of the stations came back below the indicator threshold for *E.coli*. HAB_C1 indicated high levels of surfactants only. This may have been due to the fact that there were wipes of some sort in the outfall pipe at the time that we sampled, although other stations exhibited modestly elevated surfactant levels.

HAB_D2 was taken on the upstream side of the railroad bridge just downstream of the confluence of an unnamed tributary. Previous investigations conducted by Bill Guenther suggested that there may be an illicit discharge issue somewhere along that unnamed tributary, and our results support that possibility. Unfortunately, the stream was completely overgrown with shrubs and vines, and we were unable to access the unnamed tributary. Investigations of this unnamed tributary will continue early next sampling season in hopes of finding the source of the *E.coli* contamination. While incomplete, these results seem to indicate improvement over past sampling in Hawes Brook.

We received a report of strong sewage smell and dry weather discharge coming from a very large outfall located beyond the outfield fence at Eliot Park. A sample taken at NEP_A_1 found that the dry weather discharge coming from the outfall was clean of contaminants. Further investigations upstream found that the strong sewage smell was coming from a large sewer junction vent. Given these findings we feel that this hot spot is resolved.

## Stoughton

| Field ID | Date | Instream /Outfall | E.Coli MPN | Surfactants mg/L | $NH_3$ mg/L | Flagged |
|---|---|---|---|---|---|---|
| SHB_A1 | 10/12/2016 | Instream | 95.9 | 0.08 | 0.382 | N/A |
| SHB_B1 | 10/12/2016 | Instream | 218.7 | 0.06 | 0.042 | N/A |
| SHB_C1 | 10/12/2016 | Instream | 209.8 | 0.14 | 0.158 | N/A |
| SHB_D1 | 10/12/2016 | Instream | 344.8 | 0.14 | 0.083 | N/A |
| SHB_E1 | 10/12/2016 | Outfall | 41 | 0.16 | 0.53 | N/A |
| SHB_F1 | 10/12/2016 | Instream | 290.9 | 0.15 | 0.007 | N/A |
| SHB_G1 | 10/12/2016 | Instream | 461.1 | 0.09 | 0 | N/A |

Discussion:
Steep Hill Brook was investigated because of consistently high *E.coli* values during dry weather. Investigations of the stretch between Bolivar Pond and Pinewood Pond revealed high *E.coli* at three locations along the brook with no other indicators present. The majority of the outfalls that we encountered had no flow suggesting that the *E.coli* contamination was not coming from the storm sewer system. Only one outfall had flow present SHB_E1 and its discharge contained high levels of ammonia but no other indicators. It is unclear where the high levels of *E.coli* are coming from at this time. Further investigations are needed.

## Walpole

| Field ID | Date | Instream/Outfall | DO mg/L | Flagged |
|---|---|---|---|---|
| SMB_A1 | 8/23/2016 | Instream | 1.2 | N/A |
| NEP_I1 | 8/23/2016 | Instream | 7 | N/A |

Discussion:
Preliminary investigations of low DO were carried out in Ganawatte Farm Pond (SMB_A1) and the Neponset River downstream of the South Street crossing (NEP_I1). Our ambient water quality data collected this year found extremely low DO values at these sites.

The water in Ganawatte Farm Pond was highly turbid and green, and the surface was almost entirely covered in water lilies. The eutrophication was likely exacerbated by the drought due to abnormally high temperatures, lack of flushing, and a concentration effect caused by evaporation. Our follow up dissolved oxygen readings found incredibly low dissolved oxygen saturation, a condition that is deadly for most aquatic organisms. Next year, we will install dissolved oxygen data loggers for extended periods of time in order to monitor the situation.

Investigations of the Neponset site found healthy levels of dissolved oxygen. This reading was taken several hours after the initial report. It's possible that photosynthesis conducted by aquatic plants is the cause of the higher DO levels in the afternoon. We will continue to closely monitor the ambient water quality data for this site to determine if any further follow up investigations are necessary.

## Conclusions:

**Milton** - Based on our findings we recommend that the catchments related to PTB_C and PTB_M in Milton be classified as a high priority for catchment investigation. Based on the instream *E.coli* concentration compared to the outfall *E.coli* concentrations, it seems unlikely that PTB_C is the sole source of *E.coli* contamination in the stream. 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. The Town of Milton has been prompt in their response to the illicit discharges discovered on Unquity Brook and hopefully they can be just as effective in resolving the bacteria issues in Pine Tree Brook. Additional sampling by NepRWA in the spring (i.e. non-drought conditions) may also be helpful in further prioritizing efforts in the Pine Tree Brook area. The most pressing problems located in Milton are along Unquity Brook and are discussed in that report.

**Canton** - We also recommend sewer investigations be conducted on the sewer main that runs under Elm Street in Canton to look for potential inflow and infiltration/ surcharging issues at this location. In addition to this, we recommend the catchment related to the outfall PQB_D be made a high priority catchment, and a sample should be taken by town staff at the nearest upstream manhole due to the fact that the outfall is partially submerged. Additional sampling by NepRWA in the spring (i.e. non-drought conditions) may also be helpful in further prioritizing efforts in Pecunit Brook.

**Foxborough and Walpole** - Dissolved oxygen issues in Crack Rock Pond and Ganawatte Farm Pond need to be investigated further. We plan on installing continuous DO monitoring sensors at these locations to better understand the temporal dynamics at these locations. The DO issue is likely due to major eutrophication issues in these ponds. This was likely made worse by the severe drought. Additional phosphorous sampling by NepRWA or by the town in the course of upcoming IDDE investigations would also be helpful. Potential sites for phosphorus reduction BMP retrofits should be explored by NepRWA and the towns in order to address nutrient sources within these watersheds.

**Norwood and Stoughton** - Our investigations in Norwood and Stoughton did not uncover any clear sources of contamination. However, our data suggest that the unnamed tributary of Hawes Brook in Norwood remains a likely source and that conditions overall may be improving in Hawes Brook as a result of Norwood's ongoing efforts. The unnamed tributary will be a high priority for investigation starting next season. In addition, follow up investigations of Steep Hill Brook, including investigations of the eastern branch of the brook will continue next season.

While in many cases our hotspot investigations did not uncover a clear and obvious source contamination, they did provide promising leads on potential sources that should be investigated further. These results are a first step that should be used to inform towns on areas that need to be prioritized for catchment and BMP opportunity investigations. It is our hope that these results and the results of future hot spot investigations can be utilized in a meaningful way to help clean up some of the Neponset's most polluted stream reaches.