New Hampshire Volunteer River Assessment Program
2006 Oyster River Water Quality Report

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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2006 Oyster River Water Quality Report

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Cover Photo: Volunteers assist with
a macroinvertebrate survey on the Oyster River

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ACKNOWLEDGEMENTS

The New Hampshire Department of Environmental Services Volunteer River Assessment Program extends sincere thanks to the volunteers of the Oyster River Watershed Association for their efforts during 2006. This report was created solely from the data collected by the volunteers listed below. Their time and dedication is an expression of their genuine concern for local water resources and has significantly contributed to our knowledge of river and stream water quality in New Hampshire.

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1.0 INTRODUCTION

1.1. Purpose of Report

Each year the New Hampshire Volunteer River Assessment Program (VRAP) prepares and distributes a water quality report for each volunteer river monitoring group that is based solely on the water quality data collected by that group during a specific year. The reports summarize and interpret the data, particularly as they relate to New Hampshire's surface water quality standards, and serve as a teaching tool and guidance document for future monitoring activities by the individual volunteer groups.

1.2. Report Format

Each report includes the following:

- **Volunteer River Assessment Program (VRAP) Overview**

  This section includes a description of the history of VRAP, the technical support, training and guidance provided by NHDES, and how data is transmitted to the volunteers and used in surface water quality assessments.

- **Monitoring Program Description**

  This section provides a description of the volunteer group's monitoring program including monitoring objectives as well as a table and map showing sample station locations.

- **Results and Recommendations**

  Water quality data collected during the year are summarized on a parameter-by-parameter basis using (1) a data summary table that includes the number of samples collected, data ranges, the number of samples meeting New Hampshire water quality standards, and the number of samples adequate for water quality assessments at each station, (2) a discussion of the data, (3) a river graph showing the range of measured values at each station and (4) a list of applicable recommendations.

  Sample results reported as less than the detection limit were assumed equal to one-half the detection limit on the river graphs. This approach simplifies the understanding of the parameter of interest, and specifically helps one to visualize how the river or watershed is functioning from upstream to downstream. In addition, this format allows the reader to better understand potential pollution areas and target those areas for additional sampling or environmental enhancements. Where applicable, the river graph also shows New Hampshire surface water quality standards or levels of concern for comparison purposes.

- **Appendix A – Water Quality Data**

  This appendix includes a spreadsheet detailing the data results and additional information such data results which do not meet New Hampshire surface water quality standards, and data that is unusable for assessment purposes due to quality control requirements.

- **Appendix B – Interpreting VRAP Water Quality Parameters**

  This appendix includes a brief description of water quality parameters typically sampled by VRAP volunteers and their importance, as well as applicable state water quality criteria or levels of concern.

- **Appendix C – Glossary of River Ecology Terms**

  This appendix contains a list of terms commonly used when discussing river ecology and water quality.

- **Appendix D – Native Shoreland/Riparian Buffer Plantings for New Hampshire**

  This appendix contains a table of over ninety suggested native shoreland/riparian buffer plantings for New Hampshire. The table contains common name(s), Latin name, height, growth rate, rooting, light preference, soil preference, and associated wildlife and food value of each tree, shrub, and groundcover/herbaceous perennial species.

2.0 PROGRAM OVERVIEW

2.1 Past, Present, and Future

In 1998, the New Hampshire Department of Environmental Services established the New Hampshire Volunteer River Assessment Program (VRAP) to promote awareness and education of the importance of maintaining water quality in New Hampshire's rivers and streams. VRAP aims to educate people about river and stream water quality and ecology and to improve water quality monitoring coverage for the protection of water resources. The water quality data collected by VRAP volunteers provides both NHDES and the program participants with invaluable information on the fluctuating conditions in rivers and streams and helps determine where improvements, restoration, or preservation may benefit the river and the communities it supports.

Today, VRAP continues to serve the public by providing services such as technical assistance, training in water quality monitoring protocols, quality assurance/quality control procedures, educational outreach, GIS assistance, and water quality reports. In 2006, VRAP supported 28 volunteer groups on numerous stream and river watersheds throughout the state. During 2006, VRAP volunteers monitored 298 river and stream stations providing over 9,000 water quality parameter measurements useable for Clean Water Act mandated water quality assessments.

2.2 Technical Support

VRAP lends and maintains water quality monitoring kits for volunteer groups throughout the state. The kits contain electronic meters and supplies for "in-the-field" measurements of water temperature, dissolved oxygen, pH, specific conductance (conductivity), and turbidity. These are the core parameters typically measured by volunteers. However, other water quality parameters, such as nutrients (total phosphorus, total Kjeldahl nitrogen, nitrate), metals, chloride and bacteria (*Escherichia coli*), can also be studied by volunteer groups. VRAP can provide limited to funds to assist groups in laboratory analysis. However due to limited VRAP funds, we encourage VRAP groups to pursue other fundraising activities such as association membership fees, special events, in-kind services (non-monetary contributions from individuals and organizations), and grant writing to assist in laboratory fees or the purchase of water quality monitoring equipment.

VRAP typically recommends sampling every other week during the summer, and volunteer groups are encouraged to organize a long-term sampling program in order to begin to determine trends in river conditions. Each year volunteers design and arrange a sampling schedule in cooperation with NHDES staff. Project designs are created through a review and discussion of existing water quality information, such as known and perceived problem areas or locations of exceptional water quality. The interests, priorities, and resources of the partnership determine monitoring locations, parameters, and frequency.

Water quality measurements repeated over time create a picture of the fluctuating conditions in rivers and streams and help to determine what trends in water quality may be occurring. Water quality results are also used to determine if a river is meeting surface water quality standards. Volunteer monitoring results, meeting NHDES Quality Assurance and Quality Control (QA/QC) requirements, supplement the efforts of NHDES to assess the condition of New Hampshire surface waters. The New Hampshire Surface Water Quality Regulations are available on-line at www.des.nh.gov/rules/desadmin_list.htm#waterq or by calling (603) 271-1975.

2.3 Training and Guidance

Each VRAP volunteer attends an annual training session to receive a demonstration of monitoring protocols and sampling techniques. Training sessions are an opportunity for volunteers to receive an updated version of monitoring techniques. During the training, volunteers have an opportunity for hands-on use of the VRAP equipment and may also receive instruction in the collection of samples for laboratory analysis. Training is accomplished in approximately two hours, after which volunteers are certified in the care, calibration, and use of the VRAP equipment. In some cases, veteran group coordinators can attend a “train the trainer” session. In these trainings the group coordinator receives an update in sampling protocols and techniques and will then train the individual volunteers of their respective group.

VRAP groups conduct sampling according to a prearranged monitoring schedule and VRAP protocols. NHDES staff from the VRAP program aim to visit each group annually during a scheduled sampling events to verify that volunteers successfully follow the VRAP protocols. If necessary, volunteers are re-trained during the visit, and the group’s monitoring coordinator is notified of the result of the verification visit. VRAP groups forward water quality results to NHDES for incorporation into an annual report and state water quality assessment activities.

2.4 Data Usage

2.4.1 Annual VRAP Water Quality Reports

All data collected by volunteers are summarized in annual VRAP water quality reports that are prepared and distributed after the conclusion of the sampling period (typically fall or winter). Each volunteer group receives copies of the report. The volunteers can use the reports and data as a means of understanding the details of water quality, guiding future sampling efforts, or determining restoration activities.

2.4.2 New Hampshire Surface Water Quality Assessments

Along with data collected from other water quality programs, specifically the State Ambient River Monitoring Program (ARMP), applicable volunteer data are used to support periodic NHDES surface water quality assessments. VRAP data are entered into NHDES's Environmental Monitoring Database (EMD) and are ultimately uploaded to the Environmental Protection Agency's database. Assessment results and the methodology used to assess surface waters are published by NHDES every two years (i.e., Section 305(b) Water Quality Reports) as required by the federal Clean Water Act. The reader is encouraged to log on to the NHDES web page to review the assessment methodology and list of impaired waters www.des.nh.gov/wmb/swqa/.

2.5 Quality Assurance/Quality Control

In order for VRAP data to be used in the assessment of New Hampshire's surface waters, the data must meet quality control guidelines as outlined in the VRAP Quality Assurance Project Plan (QAPP). The VRAP QAPP was approved by NHDES and reviewed by EPA in the summer of 2003. The QAPP is reviewed annually and is officially updated and approved every five years. The VRAP Quality Assurance/Quality Control (QA/QC) measures include a six-step approach to ensuring the accuracy of the equipment and consistency in sampling efforts.

- **Calibration:** Prior to each measurement, the pH and DO meters must be calibrated. Conductivity and turbidity meters are checked against a known standard before the first measurement and after the last one.

- **Replicate Analysis:** A second measurement by each meter is taken from the original sample at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the replicate analysis should be conducted at different stations. Replicates should be measured within 15 minutes of the original measurements.

- **6.0 pH Standard:** A reading of the pH 6.0 buffer is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the 6.0 pH standard check should be conducted at different stations.

- **Zero Oxygen Solution:** A reading of a zero oxygen solution is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the zero oxygen standard check should be conducted at different stations.

- **DI (De-Ionized) Turbidity Blank**: A reading of the DI blank is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the blank check should be conducted at different stations.

- **End of the Day Conductivity and Turbidity Meter Check:** At the conclusion of each sampling day, the conductivity and turbidity meters are re-checked against a known standard.

2.5.1 Measurement Performance Criteria

Precision is calculated for field and laboratory measurements through measurement replicates (instrumental variability) and is calculated for each sampling day. The use of VRAP data for assessment purposes is contingent on compliance with a parameter-specific relative percent difference (RPD) as derived from equation 1, below. Any data exceeding the limits of the individual measures are disqualified from surface water quality assessments. Table 1 shows typical parameters studied under VRAP and the associated quality control procedures.

(Equation 1)

$$RPD = \frac{|x_1 - x_2|}{\frac{x_1 + x_2}{2}} \times 100 \ \%$$

where x_1 is the original sample and x_2 is the replicate sample

Table 1. Field Analytical Quality Controls

Water Quality Parameter	QC Check	QC Acceptance Limit	Corrective Action	Person Responsible for Corrective Action	Data Quality Indicator
Temperature	Measurement Replicate	RPD < 10% or Absolute Difference <0.8 C.	Repeat Measurement	Volunteer Monitors	Precision
Dissolved Oxygen	Measurement Replicate	RPD < 10%	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (Zero O_2 Sol.)	RPD < 10% or Absolute Difference <0.4 mg/L	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Relative Accuracy
pH	Measurement Replicate	RPD < 10% or Absolute Difference <0.3 pH units	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (pH = 6.0)	± 0.1 std units	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Specific Conductance	Measurement Replicate	RPD < 10% or Absolute Difference <5µS/cm	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Method Blank (Zero Air Reading)	± 5.0 µS/cm	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Turbidity	Measurement Replicate	RPD < 10% or Absolute Difference <0.5 NTU	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Method Blank (DI Water)	± 0.1 NTU	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Laboratory Parameters	Measurement Replicate	RPD < 20% or Absolute Difference less than ½ the mean value of the parameter in NHDES's Environmental Monitoring Database	Repeat Measurement	Volunteer Monitors	Precision

3.0 METHODS

Volunteers from the Oyster River Watershed Association began monitoring water quality in the Oyster River watershed in 2001. The goal of this effort was to provide water quality data from the Oyster River watershed relative to surface water quality standards and to allow for the assessment of the river for support of aquatic life and primary contact recreation (swimming). The establishment of a long-term monitoring program allows for an understanding of the river's dynamics, or variations on a station-by-station and year-to-year basis. The data can also serve as a baseline from which to determine any water pollution problems in the river and/or watershed. The Volunteer River Assessment Program has provided field training, equipment, and technical assistance.

During 2006, trained volunteers from the Oyster River Watershed Association monitored water quality at 12 stations in the Oyster River Watershed (Figure 1, Table 2). In addition, two stations on Pettee Brook and one on College Brook were monitored by NHDES using submersible dataloggers. In order to provide more comprehensive data for the Oyster River watershed, data is included in this report from one station (05-OYS) that is monitored by the NHDES Ambient River Monitoring Program.

Station IDs are designated using a three letter code to identify the waterbody name plus a number indicating the relative position of the station. The higher the station number the more upstream the station is in the watershed.

The Oyster River and all its tributaries in the towns of Barrington, Durham, Lee, and Madbury from their sources to the crest of the Durham Reservoir water supply dam are designated as Class A waters. All other portions of the Oyster River downstream of the water supply dam are designated as Class B waters. These classifications are used to apply the appropriate water quality standards.

Water quality monitoring was conducted from April to November. In-situ measurements of water temperature, air temperature, dissolved oxygen, pH, turbidity and specific conductance were taken using handheld meters provided by NHDES. Samples for *E.coli* were taken using bottles supplied by the NHDES laboratory and were stored on ice during transport from the field to the lab. Table 3 summarizes the parameters measured, laboratory standard methods, and equipment used.

Table 2. Sampling Stations for the Oyster River Watershed, NHDES VRAP, 2006

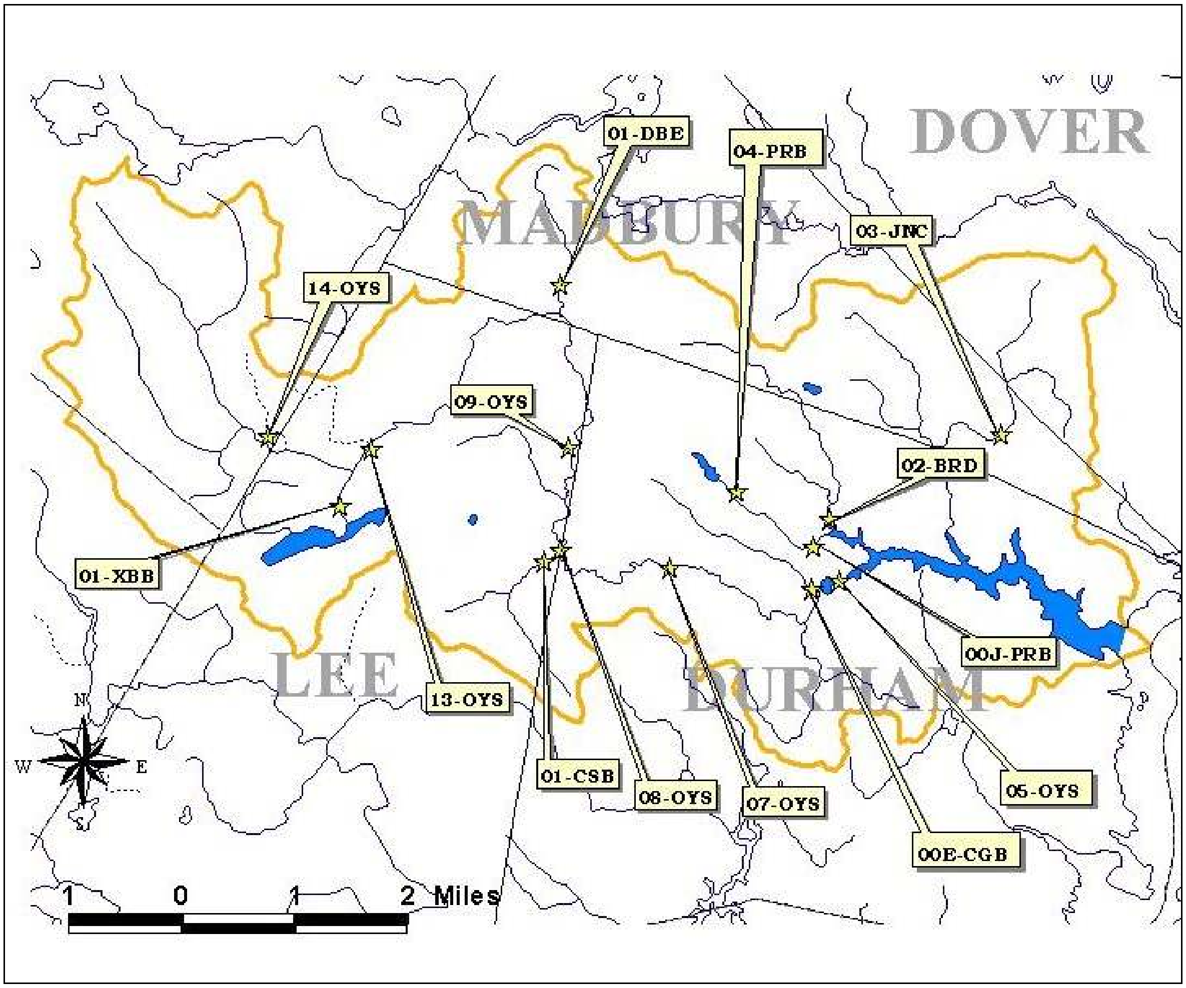
Station ID	Class	Waterbody Name	Location	Town	Elevation*
14-OYS	**A**	**Oyster River**	Jennison Driveway	Barrington	100
01-XBB	**A**	**Unnamed Tributary to Oyster River**	Wheelright Pond Outlet, Stepping Stone Road Bridge	Lee	100
13-OYS	**A**	**Oyster River**	Route 4 Bridge, East of Lee Traffic Circle	Lee	100
01-DBE	**A**	**Dube Brook**	Cherry Lane Bridge	Madbury	100
09-OYS	**A**	**Oyster River**	Rt. 155A Bridge, USGS Gaging Station	Lee	100
08-OYS	**A**	**Oyster River**	Mast Road Bridge	Durham	100
01-CSB	**A**	**Chelsey Brook**	Packers Falls Road Bridge	Lee	100
07-OYS	**A**	**Oyster River**	Footbridge, College Woods	Durham	100
01-HML	**B**	**Hamel Brook**	Route 108 Bridge	Durham	0
05-OYS	**B**	**Oyster River**	Route 108 Bridge	Durham	0
00E-CGB	**B**	**College Brook**	Mill Pond Road Bridge	Durham	0
04-PRB	**B**	**Pettee Brook**	Gables Road Bridge	Durham	0
00J-PRB	**B**	**Pettee Brook**	End of Sauer Terrace	Durham	0
02-BRD	**B**	**Beards Creek**	Coe Drive Bridge	Durham	0
03-JNC	**B**	**Johnson Creek**	Freshet Road Bridge	Durham	0

*Elevations have been rounded off to 100-foot increments for calibration of dissolved oxygen meter

Table 3. Sampling and Analysis Methods

Parameter	Sample Type	Standard Method	Equipment Used	Laboratory
Temperature	In-Situ	SM 2550	YSI 95	------
	Datalogger	SM 2550	YSI XLM 6000	------
Dissolved Oxygen	In-Situ	SM 4500 O G	YSI 95	------
	Datalogger	SM 4500 O G	YSI XLM 6000	------
pH	In-Situ	SM 4500 H+	Oakton pH 11	------
	Datalogger	SM 4500 H+	YSI XLM 6000	------
Turbidity	In-Situ	EPA 180.1	LaMotte 2020e	------
Specific Conductance	In-Situ	SM 2510	YSI 30	------
	Datalogger	SM 2510	YSI XLM 6000	------
E.coli	Bottle (Sterile)	SM 19 9213 D.3	------	NHDES

Figure 1. Oyster River Watershed and Monitoring Stations 2006



4.0 RESULTS AND RECOMMENDATIONS

4.1 Dissolved Oxygen

Between one and nine measurements were taken in the field for dissolved oxygen concentration at 15 stations in the Oyster River watershed (Table 4). Of the 107 measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

The Class A New Hampshire surface water quality standard for dissolved oxygen is a minimum concentration of 6.0 mg/L **and** a minimum daily average saturation of 75 %. The Class B New Hampshire surface water quality standard for dissolved oxygen includes a minimum concentration of 5.0 mg/L **and** a minimum daily average of 75 % of saturation. In other words, there are criteria for both concentration and saturation that must be met before the river can be assessed as meeting dissolved oxygen standards. Table 4 reports only dissolved oxygen concentration as more detailed analysis is required to determine if instantaneous dissolved oxygen saturation measurements are above or below water quality standards.

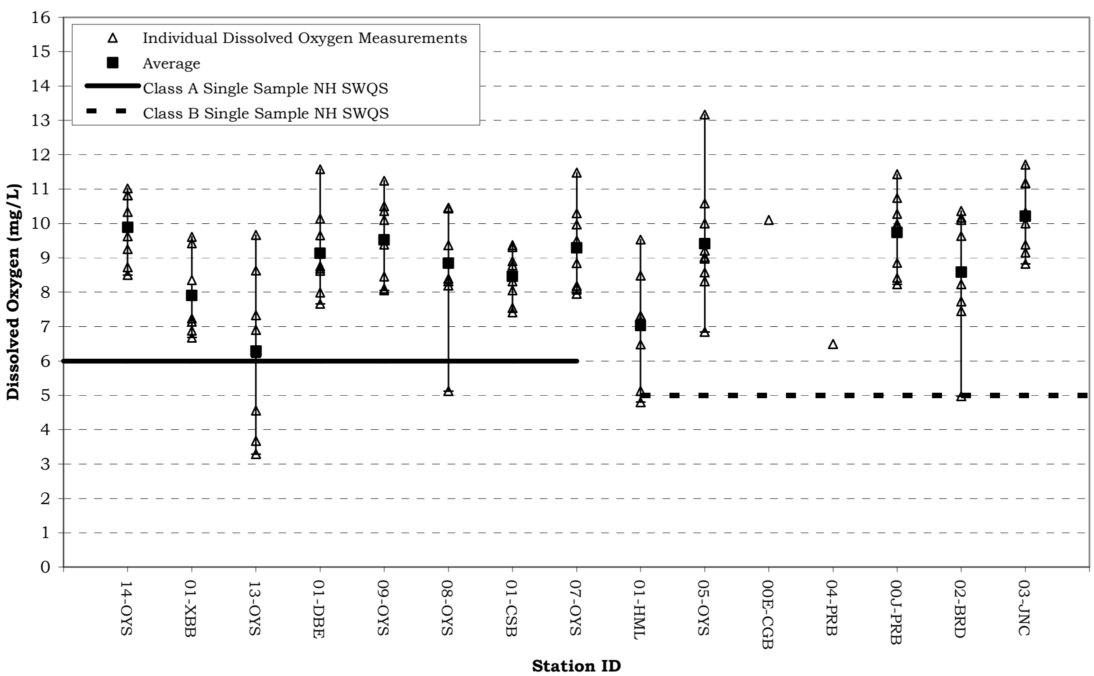
Table 4. Dissolved Oxygen Concentration Data Summary – Oyster River Watershed, 2006

Station ID	Class	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class A/B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
14-OYS	**A**	8	8.50 - 11.02	0	8
01-XBB	**A**	7	6.68 - 9.61	0	7
13-OYS	**A**	8	3.29 - 9.66	3	8
01-DBE	**A**	8	7.66 - 11.58	0	8
09-OYS	**A**	8	8.05 - 11.24	0	8
08-OYS	**A**	8	5.12 - 10.46	1	8
01-CSB	**A**	8	7.41 - 9.37	0	8
07-OYS	**A**	8	7.95 - 11.48	0	8
01-HML	**B**	8	4.80 - 9.53	1	8
05-OYS	**B**	9	6.84 - 13.17	0	9
00E-CGB	**B**	1	10.10	0	1
04-PRB	**B**	1	6.49	0	1
00J-PRB	**B**	9	8.23 - 11.43	0	9
02-BRD	**B**	8	4.97 - 10.36	0	8
03-JNC	**B**	8	8.82 - 11.71	0	8
Total	_____	**107**	_____	**5**	**107**

Dissolved oxygen concentration levels were above the relevant New Hampshire surface water quality standard on all occasions at twelve of the stations monitored. Station 13-OYS had three measurements that were below the Class A standard for dissolved oxygen concentration (Figure 2). One measurement at stations 08-OYS, 01-HML, and 02-BRD were below the relevant dissolved oxygen concentration water quality standard. The average concentration of dissolved oxygen was consistently above the Class A and Class B standard at all stations ranging from 6.28 mg/L to 10.22 mg/L.

Levels of dissolved oxygen sustained above the standards are considered adequate for the support of aquatic life and other desirable water quality conditions. Stations where the instantaneous dissolved oxygen standard was not met could potentially have a dissolved oxygen problem and further investigation is warranted. Low dissolved oxygen levels can be the result of natural conditions (e.g., the presence of wetlands or stagnant water caused by a beaver dam).

Figure 2. Dissolved Oxygen Statistics for the Oyster River Watershed
April 14 - November 11, 2006, NHDES VRAP



Figures 3 and 4 illustrate the results of dissolved oxygen concentration and saturation levels obtained at three stations in the Oyster River watershed using submersible dataloggers that were deployed from October 2 through October 9. The meters were programmed to take dissolved oxygen readings every 15 minutes. Data from this meter is generally analyzed in 24 hour sections. During this deployment six full 24-hour periods were measured (station 00E-CGB only measured three full days due to the batteries failing on 10/6/06).

Figure 3. Dissolved Oxygen Saturation Statistics for the Oyster River Watershed October 2 - 9, 2006, NHDES VRAP

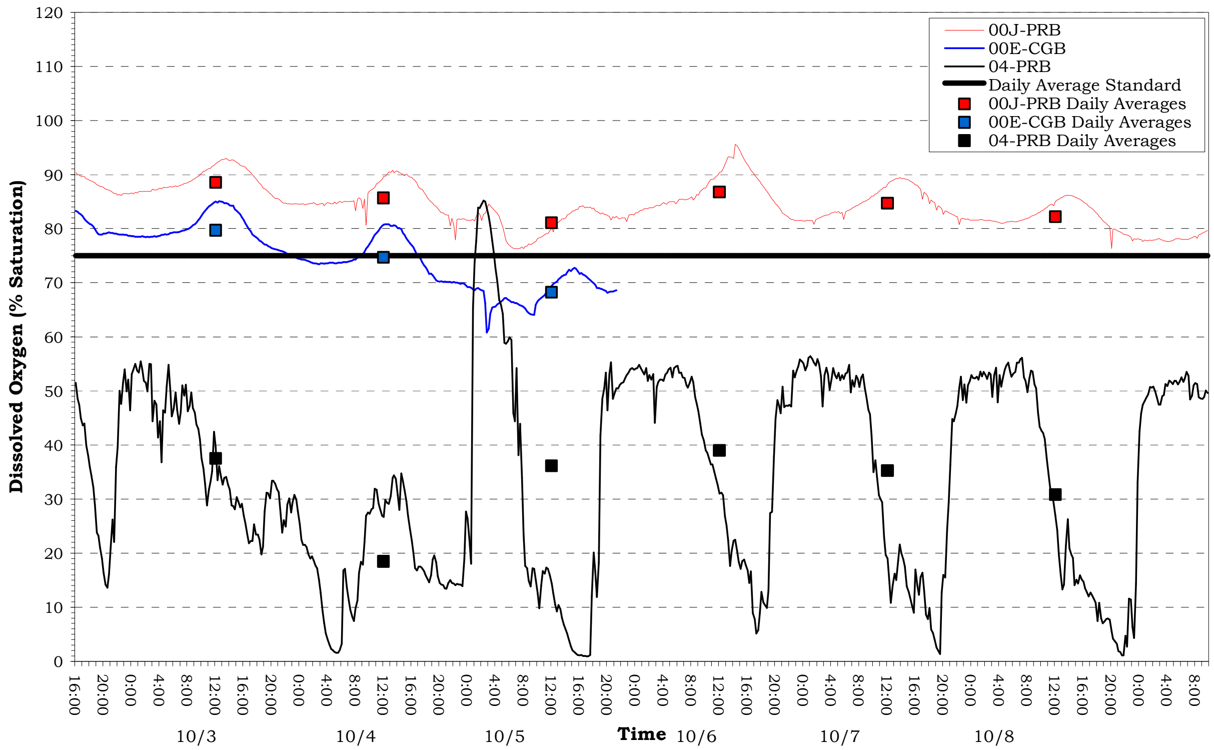
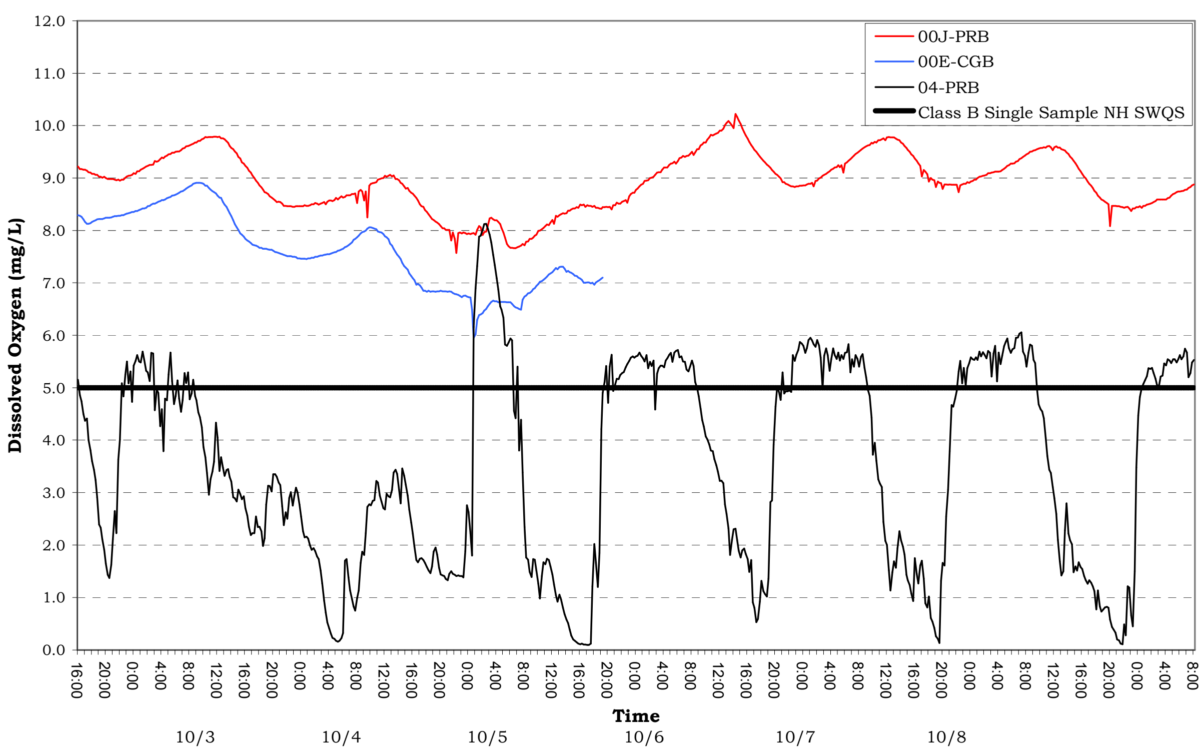


Figure 4. Dissolved Oxygen Concentration Statistics for the Oyster River Watershed October 2 - 9, 2006, NHDES VRAP



Station 04-PRB had daily averages of dissolved oxygen that were below the Class B standard on all five days and dissolved oxygen concentration levels that were often below the instantaneous standard of 5.0 mg/L. Station 00E-CGB was variable with two of the daily averages calculated being below the standard and one above. Dissolved oxygen concentration levels were always above the standard at 00E-CGB. Station 00J-PRB had daily averages above the standard on all five days and was always above the standard for dissolved oxygen concentration.

Figures 3 and 4 also depict the typical cyclical variations in dissolved oxygen measurements one would expect to see during a 24-hour period in the summer. In general, dissolved oxygen levels are lowest in the early morning when there is low photosynthetic activity and a peak in respiration from organisms throughout the water column. This is the time of least oxygen production and greatest carbon dioxide emission. Peak dissolved oxygen levels occur when photosynthetic activity is at its peak. The greater the amount of photosynthetic activity the greater the production of oxygen as a byproduct of photosynthesis.

Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- If possible, take measurements between 5 a.m. and 10 a.m., which is when dissolved oxygen is usually the lowest, and between 2 p.m. and 7 p.m. when dissolved oxygen is usually the highest. In general, dissolved oxygen levels are lowest in the early morning when there is low photosynthetic activity and a peak in respiration from organisms throughout the water column. This is the time of least oxygen production and greatest carbon dioxide emission. Peak dissolved oxygen levels occur when photosynthetic activity is at its peak. The greater the amount of photosynthetic activity the greater the production of oxygen as a byproduct of photosynthesis.
- Continue to incorporate the use of in-situ dataloggers to automatically record dissolved oxygen saturation levels during a period of several days. Deployment of dataloggers for dissolved oxygen should be targeted at those stations suspected of not meeting the daily average standard.

4.2 pH

Between one and nine measurements were taken in the field for pH at 15 stations in the Oyster River watershed [Table 5]. Of the 103 measurements taken, 98 met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

The Class A and B New Hampshire surface water quality standard is 6.5 - 8.0, unless naturally occurring.

Table 5. pH Data Summary - Oyster River Watershed, 2006

Station ID	Class	Samples Collected	Data Range (standard units)	Acceptable Samples Not Meeting NH Class A/B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
14-OYS	**A**	8	5.27 - 6.14	8	8
01-XBB	**A**	7	6.26 - 6.75	4	7
13-OYS	**A**	7	5.88 - 6.23	7	6
01-DBE	**A**	7	6.08 - 6.99	4	6
09-OYS	**A**	7	6.11 - 7.02	4	6
08-OYS	**A**	8	6.13 - 6.88	3	8
01-CSB	**A**	7	6.37 - 6.79	4	6
07-OYS	**A**	8	6.33 - 6.94	1	7
01-HML	**B**	8	6.11 - 6.90	6	8
05-OYS	**B**	9	6.52 - 7.26	0	9
00E-CGB	**B**	1	7.27	0	1
04-PRB	**B**	1	6.78	0	1
00J-PRB	**B**	9	6.66 - 7.57	0	9
02-BRD	**B**	8	6.38 - 7.08	1	8
03-JNC	**B**	8	6.49 - 7.21	1	8
Total	_____	**103**	_____	**43**	**98**

A majority of stations had one or more pH measurements that were below the minimum New Hampshire surface water quality standard (Figure 5). Stations 05-OYS, 00E-CGB, 04-PRB, and 00J-PRB met the pH standard on all occasions.

Lower pH measurements are likely the result of natural conditions such as the soils, geology, or the presence of wetlands in the area. Rain and snow falling in New Hampshire is relatively acidic, which can also affect pH levels; after the spring melt or significant rain events, surface waters will generally have a lower pH.

Figure 5. pH Statistics for the Oyster River Watershed
April 14 - November 11, 2006, NHDES VRAP

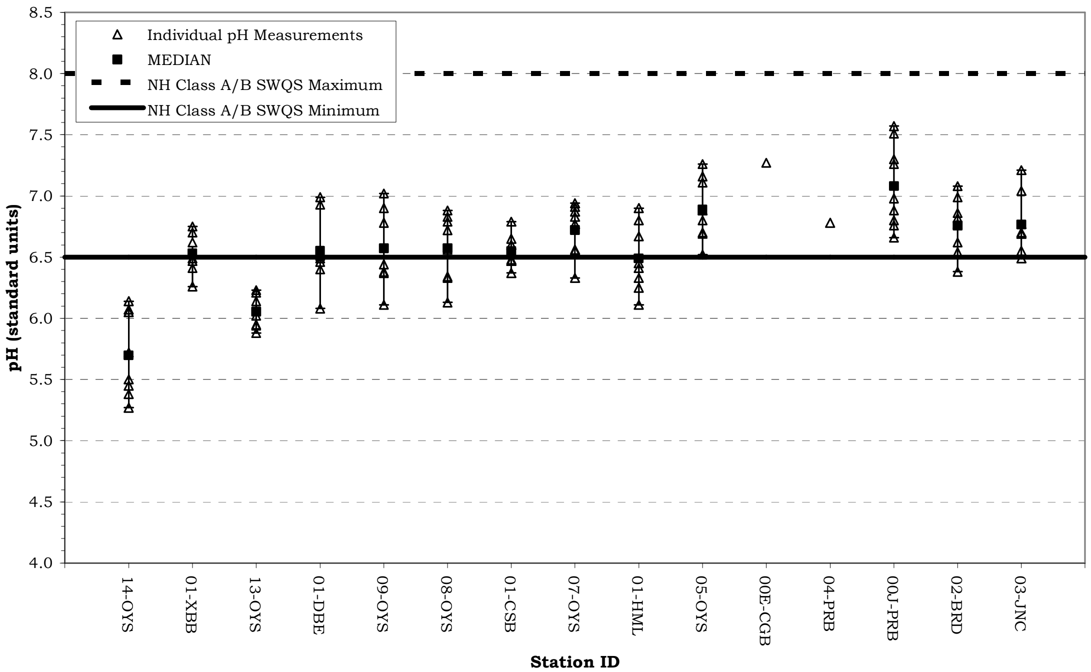
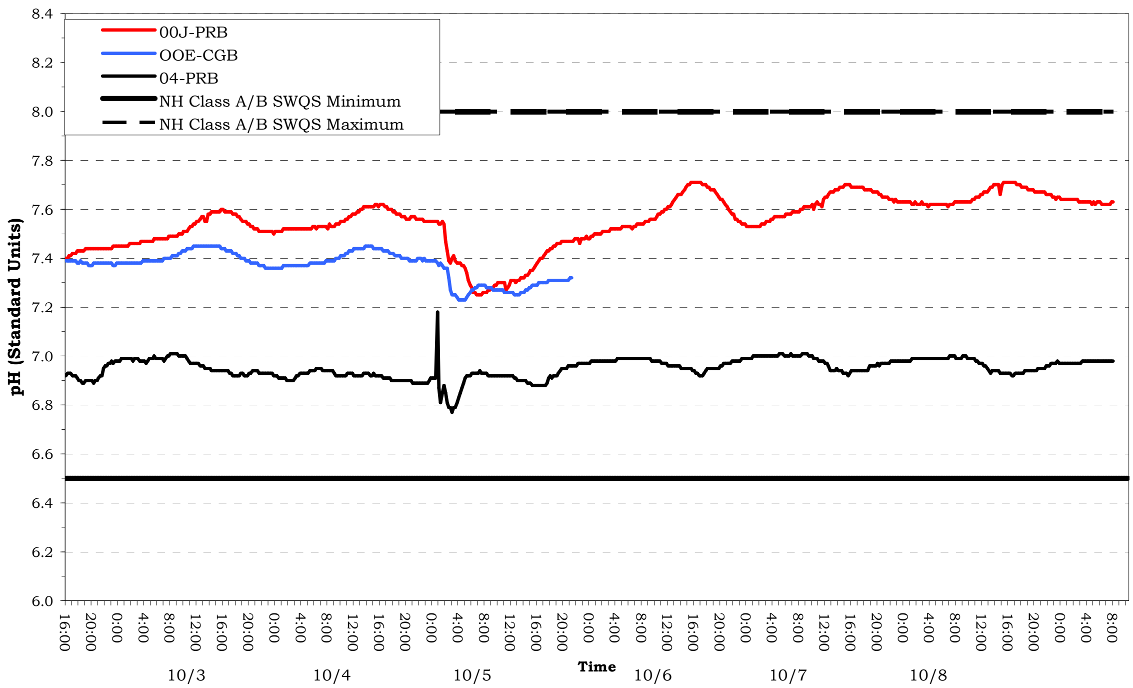


Figure 6 illustrates the results of pH measurements obtained at three stations in the Oyster River watershed using submersible dataloggers that were deployed from October 2 through October 9. The meters were programmed to take pH readings every 15 minutes over a multiple day period. During this deployment six full 24-hour periods were measured (station 00E-CGB only measured three full days due to the batteries failing on 10/6/06). On all occasions and at all three stations during the deployment, pH measurements met water quality standards.

Figure 6. pH Statistics for the Oyster River Watershed
October 2 - 9, 2006, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- Consider sampling for pH in some of the tributaries and wetland areas that are influencing the pH of stations with measurements below state standards. Site conditions are considered along with pH measurements because of the narrative portion of the pH standard. RSA 485-A:8 states that pH of Class B waters *shall be between 6.5 and 8.0, except when due to natural causes*. Wetlands can lower the pH of a river naturally by releasing tannic and humic acids from decaying plant material. If the sampling location is influenced by wetlands or other natural conditions, then the low pH measurements are not considered a violation of water quality standards. It is important to note that the New Hampshire water quality standard for pH is fairly conservative, thus pH levels slightly below the standard are not necessarily harmful to aquatic life. In this case, additional information about factors influencing pH levels is needed.

4.3 Turbidity

Either eight or nine measurements were taken in the field for turbidity at 13 stations in the Oyster River watershed [Table 6]. Of the 105 measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

New Hampshire Surface Water Quality Standards state that turbidity of Class A waters *shall be as naturally occurring*. The Class B New Hampshire surface water quality standard for turbidity is less than 10 NTU above background.

Table 6. Turbidity Data Summary - Oyster River Watershed, 2006

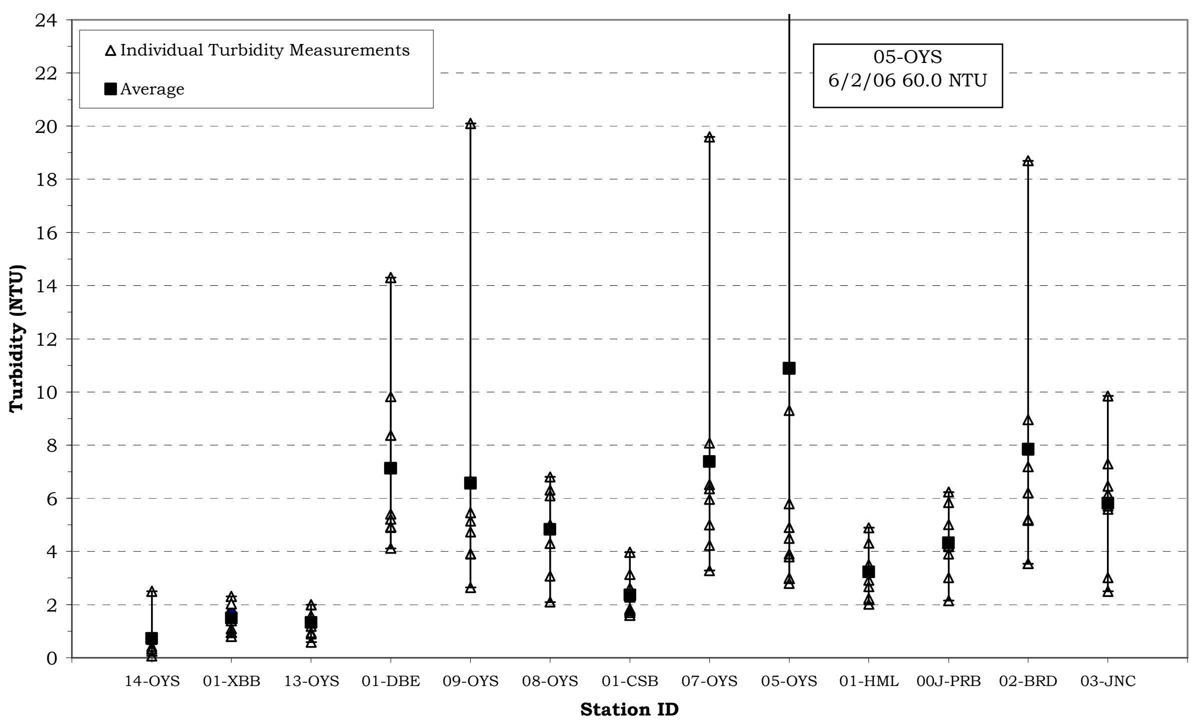
Station ID	Class	Samples Collected	Data Range (NTU)	Acceptable Samples Not Meeting NH Class A/B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
14-OYS	**A**	8	0.07 - 2.5	0	8
01-XBB	**A**	8	0.8 - 2.31	0	8
13-OYS	**A**	8	0.59 - 2.0	0	8
01-DBE	**A**	8	4.12 - 14.3	0	8
09-OYS	**A**	8	2.64 - 20.1	1[a]	8
08-OYS	**A**	8	2.1 - 6.8	0	8
01-CSB	**A**	8	1.59 - 3.97	0	8
07-OYS	**A**	8	3.28 - 19.6	1[a]	8
01-HML	**B**	8	2.01 - 4.89	0	8
05-OYS	**B**	9	2.8 - 60.0	1[a]	9
00J-PRB	**B**	8	2.15 - 6.23	0	8
02-BRD	**B**	8	3.54 - 18.7	1[a]	8
03-JNC	**B**	8	2.5 - 9.85	0	8
Total	_____	**105**	_____	**3**	**105**

[a] Number of samples > 10 NTU over average of the season

A majority of turbidity measurements were relatively low at all stations and on most occasions with the average ranging from 0.7 NTU to 10.8 NTU (Figure 7). Stations 09-OYS and 07-OYS had high turbidity levels on 5/13/06. These samples were collected the day before the Mothers Day flood and at the time the samples were collected, the University of New Hampshire weather station had already recorded over five inches of rain in the watershed. Stations 05-OYS and 02-BRD had elevated turbidity measurement on 6/2/06 and 10/13/06 respectively. As with the previous samples, a significant amount of rainfall (>2.5 inches) had recently fallen in the watershed. These rain events were the likely cause of the elevated turbidity levels recorded during 2006.

Although clean waters are associated with low turbidity there is a high degree of natural variability involved. Precipitation often contributes to increased turbidity by flushing sediment, organic matter and other materials from the surrounding landscape into surface waters. However, human activities, such as removal of vegetation near surface waters and disruption of nearby soils, can lead to dramatic increases in turbidity levels. In general it is typical to see a rise in turbidity in more developed areas due to increased runoff.

Figure 7. Turbidity Statistics for the Oyster River Watershed
April 14 - November 11, 2006, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

- Continue to collect samples during wet weather. This will help us to understand how the river responds to runoff and sedimentation.

- If a higher than normal turbidity measurement occurs, volunteers can investigate further by moving upstream and taking additional measurements. This will facilitate isolating the location of the cause of the elevated turbidity levels. In addition, take good field notes and photographs. If human activity is suspected or verified as the source of elevated turbidity levels, volunteers should contact NHDES.

4.4 Specific Conductance

Between one and nine measurements were taken in the field for specific conductance at 15 stations in the Oyster River watershed [Table 7]. Of the 108 measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

New Hampshire surface water quality standards do not contain numeric limits for specific conductance.

Table 7. Specific Conductance Data Summary - Oyster River Watershed, 2006

Station ID	Class	Samples Collected	Data Range (µS/cm)	Acceptable Samples Not Meeting NH Class A/B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
14-OYS	**A**	8	42.6 - 106.5	Not Applicable	8
01-XBB	**A**	8	80.3 - 109.8	N/A	8
13-OYS	**A**	8	58.8 - 108.9	N/A	8
01-DBE	**A**	8	57.7 - 140.1	N/A	8
09-OYS	**A**	8	67.1 - 182.8	N/A	8
08-OYS	**A**	8	65.2 - 213.4	N/A	8
01-CSB	**A**	8	112.8 - 250.2	N/A	8
07-OYS	**A**	8	83.2 - 213.6	N/A	8
01-HML	**B**	8	86.8 - 263.4	N/A	8
05-OYS	**B**	9	86.9 - 256.8	N/A	9
00E-CGB	**B**	1	1153.0	N/A	1
04-PRB	**B**	1	450.5	N/A	1
00J-PRB	**B**	9	177.5 - 1073	N/A	9
02-BRD	**B**	8	138.6 - 311	N/A	8
03-JNC	**B**	8	126.3 - 353.4	N/A	8
Total	____	**108**	____	**N/A**	**108**

Specific conductance levels were variable with the average ranging from 84.4 µS/cm to 536.8 µS/cm (Figure 8). Stations 00J-PRB and 00E-CGB had specific conductance levels that were high enough to indicate that these stations may have corresponding chloride levels that are above surface water quality standards. Higher specific conductance levels can be indicative of pollution from sources such as urban/agricultural runoff, road salt, failed septic systems, or groundwater pollution. Thus, the variable specific conductance levels indicate low pollutant levels at some stations and higher levels at others.

The influence of urbanization on specific conductance is apparent by the increased levels from the more rural upstream areas in Madbury and Lee to the more developed areas in Durham. Anions (negatively charged elements such as chloride) and cations (positively charged ions such as calcium) are typically found in rivers flowing through more developed areas. Pettee Brook and College Brook had significantly higher specific conductance levels compared to other areas of the watershed.

Figure 8. Specific Conductance Statistics for the Oyster River Watershed April 14, 2005 - November 11, 2006, NHDES VRAP

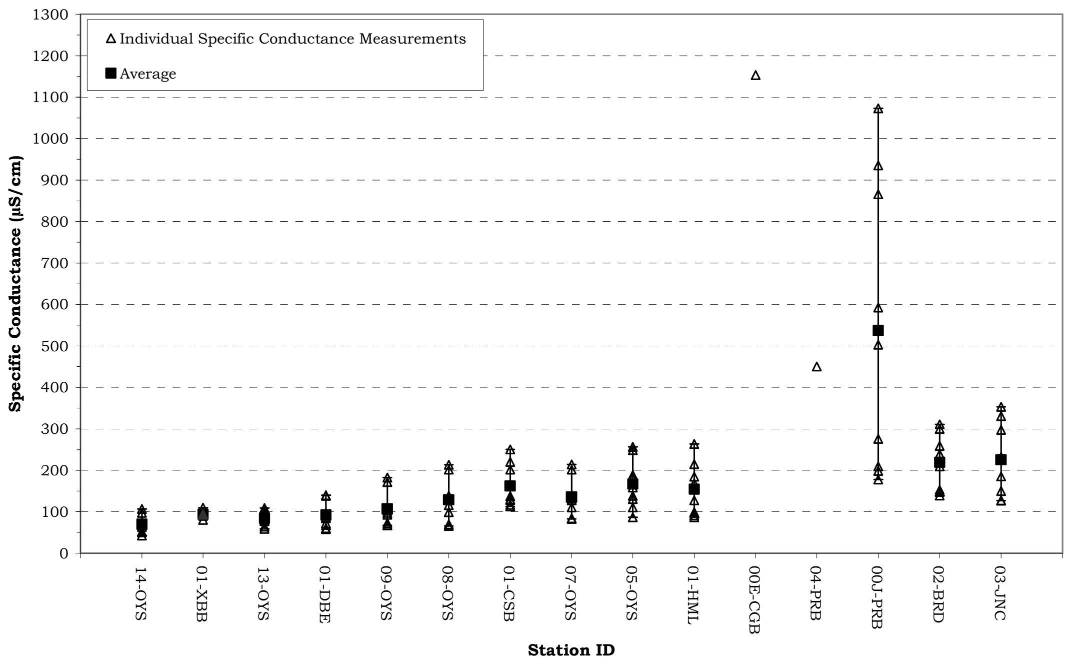


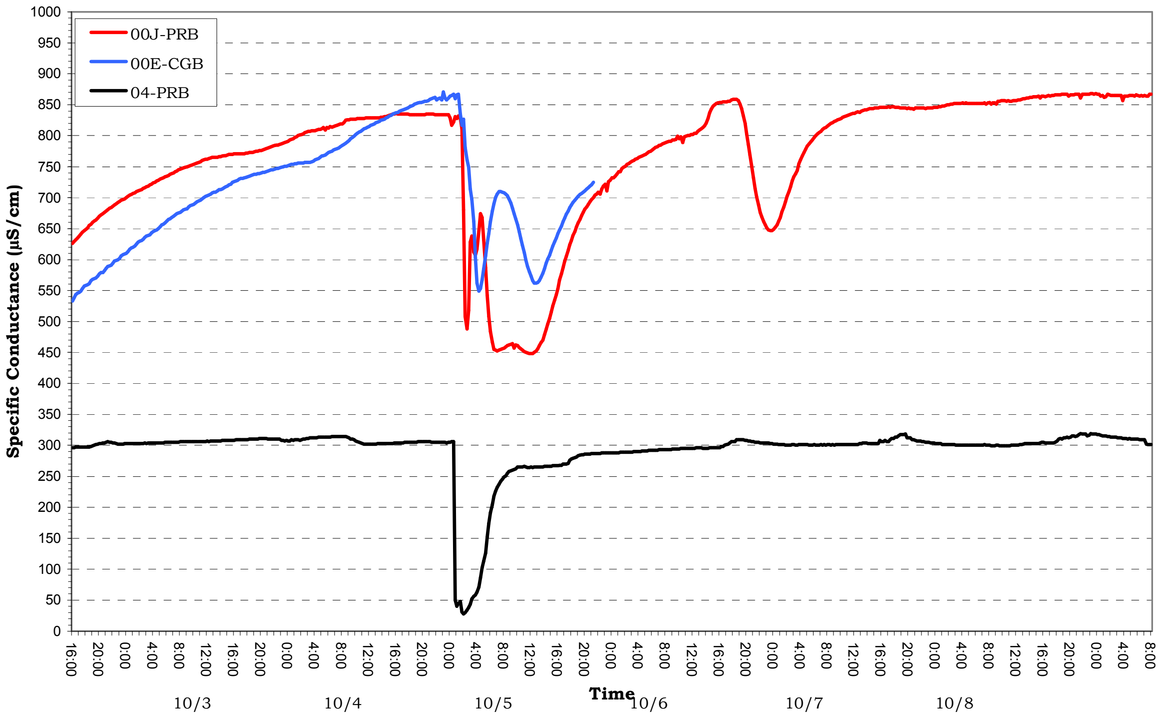
Figure 9 illustrates the results of specific conductance measurements obtained at three stations in the Oyster River watershed using submersible dataloggers that were deployed from October 2 through October 9. The meter was programmed to take specific conductance readings every 15 minutes. During this deployment six full 24-hour periods were measured (station 00E-CGB only measured three full days due to the batteries failing on 10/6/06).

Specific conductance levels were high at stations 00J-PRB and 00E-CGB with maximum measurements of 867µS/cm and 871µS/cm respectively. Previous sampling in the Oyster River watershed and statewide by NHDES have indicated a very close relationship between specific conductance and chloride levels. The 230 mg/L chronic chloride level is correlated with a specific conductance level of approximately 900 µS/cm; thus it is likely that stations 00J-PRB and 00E-CGB do at times have chloride levels that exceed surface water quality standards. Station 04-PRB had lower but still moderately high specific conductance levels with a maximum of 319 µS/cm.

All three stations showed a precipitous drop in specific conductance levels on October 5. This coincides with precipitation that was recorded by the University of New Hampshire weather station. The rainwater has a much lower concentration of cations and anions than the baseflow in Pettee Brook and College Brook and thus via dilution, we see a lowering of specific conductance.

Once the precipitation is flushed through the brooks we see a steady rise back towards baseflow specific conductance levels.

Figure 9. Specific Conductance Statistics for the Oyster River Watershed October 2 - 9, 2006, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

- Collect specific conductance measurement and a few chloride samples during snowmelt periods. It is likely that road salt is a primary contributor to the higher specific conductance levels seen at some stations. By measuring specific conductance during the snowmelt period it will more accurately depict what maximum specific conductance levels occur in a given waterbody.

4.5 Water Temperature

Between one and nine measurements were taken in the field for water temperature at 15 stations in the Oyster River watershed [Table 8]. Of the 108 measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

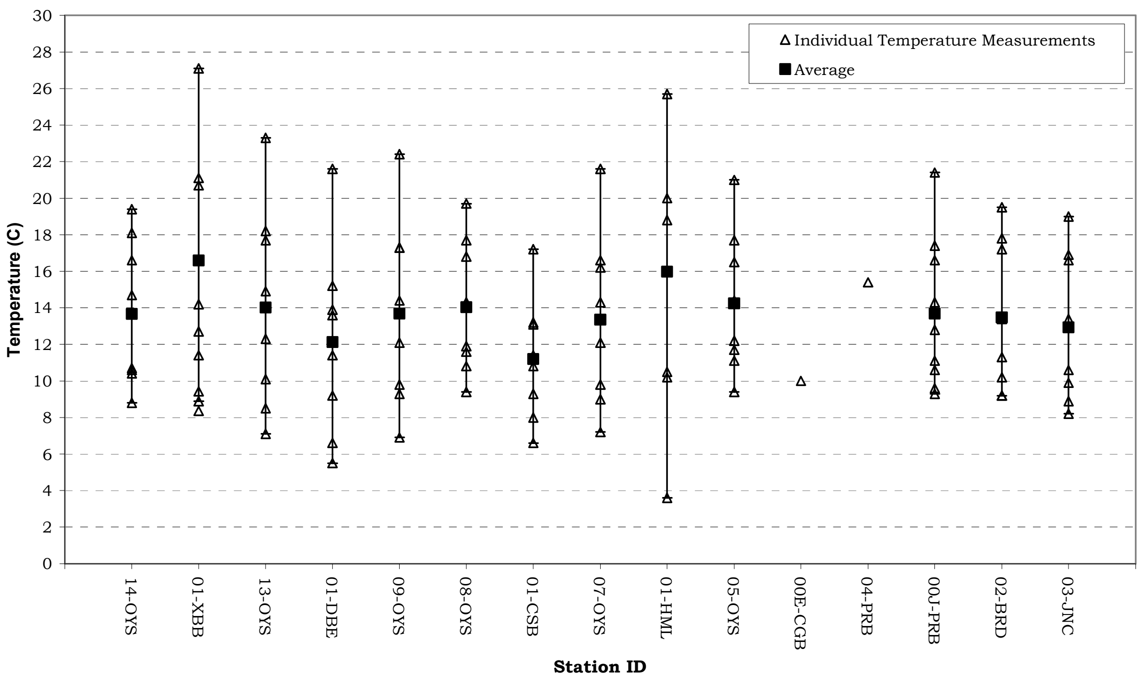
Although there is currently no numerical water quality criteria for water temperature, NHDES is in the process of collecting biological and water temperature data that will contribute to the development of a procedure for assessing rivers and stream based on water temperature and its corresponding impact to the biological integrity of the waterbody.

Table 8. Water Temperature Data Summary – Oyster River Watershed, 2006

Station ID	Class	Samples Collected	Data Range (°C)	Acceptable Samples Not Meeting NH Class A/B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
14-OYS	**A**	8	8.8 - 19.4	Not Applicable	8
01-XBB	**A**	8	8.9 - 27.1	N/A	8
13-OYS	**A**	8	7.1 - 23.3	N/A	8
01-DBE	**A**	8	5.5 - 21.6	N/A	8
09-OYS	**A**	8	6.9 - 22.4	N/A	8
08-OYS	**A**	8	9.4 - 19.7	N/A	8
01-CSB	**A**	8	6.6 - 17.2	N/A	8
07-OYS	**A**	8	7.2 - 21.6	N/A	8
01-HML	**B**	8	9.4 - 21	N/A	8
05-OYS	**B**	9	3.6 - 25.7	N/A	9
00E-CGB	**B**	1	10.0	N/A	1
04-PRB	**B**	1	15.4	N/A	1
00J-PRB	**B**	9	9.3 - 21.4	N/A	9
02-BRD	**B**	8	9.2 - 19.5	N/A	8
03-JNC	**B**	8	8.2 - 19.0	N/A	8
Total	_____	**108**	_____	**N/A**	**108**

Figure 10 shows the results of instantaneous water temperature measurements taken at 15 stations in the Oyster River watershed. The average water temperature varied from 10.0 °C. to 16.0 °C. Maximum water temperature varied from 10.0 °C to 27.1°C (10.0 °C maximum is based a single measurement taken at station 00E-CGB on October 9th).

Figure 10. Water Temperature Statistics for the Oyster River Watershed
April 14 - November 11, 2006, NHDES VRAP



Water temperature is a critical parameter for aquatic life and has an impact on other water quality parameters such as dissolved oxygen concentrations, and the activity of bacteria in the water. Water temperature controls the metabolic and reproductive processes of aquatic species and can determine which fish and macroinvertabrate species can survive in a given river or stream.

A number of factors can have an impact on water temperature including the quantity and maturity of riparian vegetation along the shoreline, the rate of flow, the percent of impervious surfaces contributing stormwater, thermal discharges, impoundments and the influence of groundwater.

Recommendations

- Continue collecting water temperature data via instantaneous readings and consider long-term deployment of NHDES temperature dataloggers.

4.5 *Escherichia coli*/Bacteria

Five samples were taken for *Escherichia coli* (*E. coli*) at 12 stations in the Oyster River watershed (Table 9). Of the 59 samples taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

Class A New Hampshire surface water quality standards for *E.coli* are as follows:

<153 cts/100 ml, based on any single sample, or
<47 cts/100 ml, based on a geometric mean calculated from three samples collected within a 60-day period.

Class B New Hampshire surface water quality standards for *E.coli* are as follows:

<406 cts/100 ml, based on any single sample, or
<126 cts/100 ml, based on a geometric mean calculated from three samples collected within a 60-day period.

Table 9. *E.coli* Data Summary - Oyster River Watershed, 2006

Station ID	Class	Samples Collected	Data Range (cts/100ml)	Acceptable Samples Not Meeting NH Class A/B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
14-OYS	**A**	5	< 10 - 660	2	5
01-XBB	**A**	5	20 - 80	0	5
13-OYS	**A**	5	20 - 130	0	5
01-DBE	**A**	5	60 - 140	0	5
09-OYS	**A**	5	20 - 170	1	5
08-OYS	**A**	5	20 - 250	1	5
01-CSB	**A**	5	10 - 530	1	5
07-OYS	**A**	5	10 - 170	1	5
01-HML	**B**	5	20 - 440	1	5
00J-PRB	**B**	5	70 - 240	0	5
02-BRD	**B**	5	420 - 890	5	5
03-JNC	**B**	5	50 - 700	2	5
Total	_____	**60**	_____	**14**	**60**

A majority of stations had at least one *E.coli* measurement that exceeded the relevant single sample water quality standard (Figure 11). Station 02-BRD exceeded the standard on all occasions. Stations 01-XBB, 13-OYS, 01-DBE, and 00J-PRB met water quality standards for *E.coli* on all occasions.

In order to fully determine whether a waterbody is meeting surface water standards for *E.coli* a geometric mean must be calculated. A geometric mean is calculated using three samples collected within a 60-day period. At all 12 stations three geometric means were calculated. Almost all of the geometric means calculated exceeded the relevant standards.

Several factors can contribute to elevated *E. coli* levels, including, but not limited to rain storms, low river flows, the presence of wildlife (e.g., birds), and the presence of septic systems along the river.

Figure 11. *Escherichia coli* Statistics for the Oyster River Watershed
June 19 - October 10, 2006, NHDES VRAP

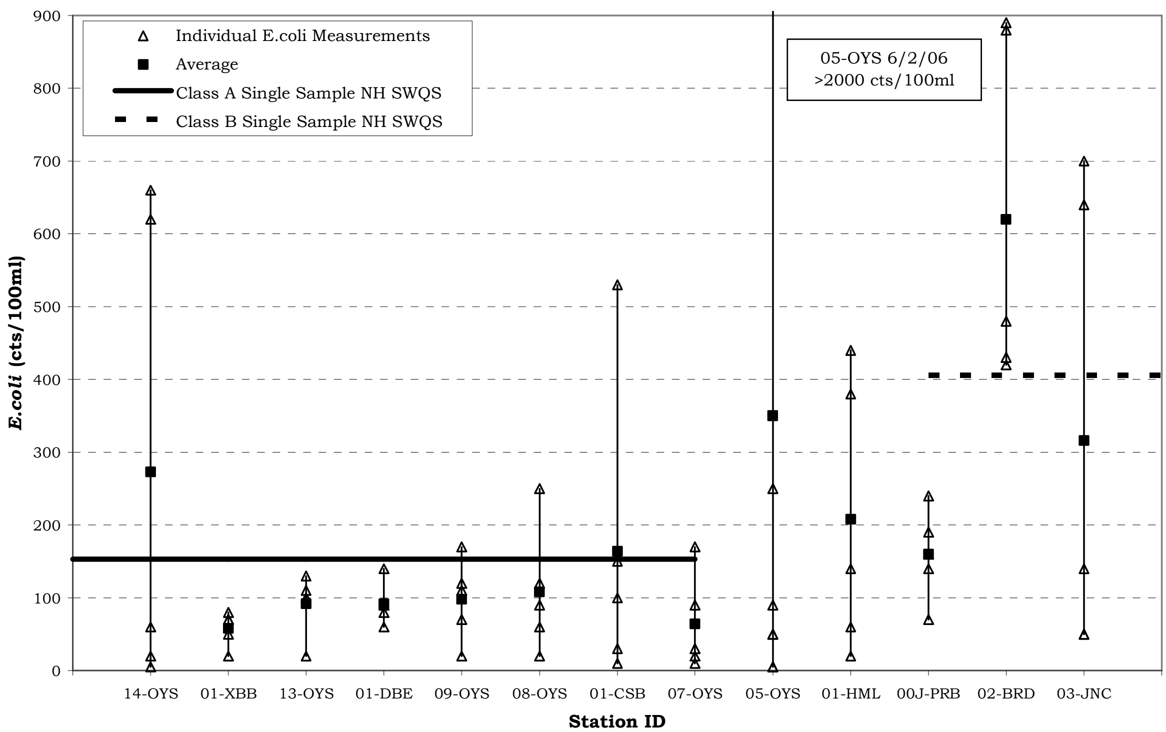


Table 10. *E. coli* Geometric Mean Data Summary – Oyster River Watershed, 2006

Station ID	Class	Geometric Means Calculated	Geometric Means Not Meeting NH Class A/B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
14-OYS	**A**	3	3	3
01-XBB	**A**	3	3	3
13-OYS	**A**	3	3	3
01-DBE	**A**	3	3	3
09-OYS	**A**	3	3	3
08-OYS	**A**	3	3	3
01-CSB	**A**	3	2	3
07-OYS	**A**	3	2	3
01-HML	**B**	3	3	3
05-OYS	**B**	2	1	2
00J-PRB	**B**	3	3	3
02-BRD	**B**	3	3	3
03-JNC	**B**	3	2	3
Total	_____	**38**	**34**	**38**

Recommendations

- Continue collecting three samples within any 60-day period during the summer to allow for determination of geometric means.

- Continue to document river conditions and station characteristics (including the presence of wildlife in the area during sampling).

- At stations with particularly high bacteria levels volunteers can investigate further by moving upstream and taking additional measurements. This will facilitate isolating the location of the cause of the elevated bacteria levels. Those sampling should also look for any potential sources of bacteria such as emission pipes, failed septic systems, farm animals, pet waste, wildlife and waterfowl.

APPENDIX A

2006 Oyster River Watershed Water Quality Data

2006 OYSTER RIVER VRAP DATA

(blue)	Measurements not meeting New Hampshire surface water quality standards
(diagonal line)	Measurements not meeting NHDES quality assurance/quality control standards
(yellow)	Turbidty measurement > 10 NTU over season average

[A] Data collected by NHDES staff during deployment of dataloggers

14-OYS, Jennison Driveway, Lee - Class A

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean
Standard	NA	>6.0	>75% Daily Average	NA	NA	6.5 - 8.0	As naturally occuring	NA	<153	<47
04/14/06	10:45	10.82	97.3	10.6	19.5	5.50	2.5	73.8		
05/12/06	10:20	10.82	96.7	10.4	9.6	5.72	0.4	71.2		
06/09/06	10:25	9.62	94.5	14.7	18.8	5.45	0.1	42.6		
06/19/06	08:25								20	
07/14/06	10:25	8.50	92.6	19.4	22.8	6.05	0.3	50.2		
07/18/06	07:56								60	
08/11/06	10:40	8.72	92.4	18.1	21.9	6.07	0.7	106.5		
08/17/06	08:20								620	91
09/08/06	10:40	9.25	95.0	16.6	19.0	6.14	0.3	97.1		
09/14/06	08:38								660	291
10/10/06	08:45								5	127
10/13/06	10:30	10.33	93.0	10.7	8.8	5.27	0.7	63.6		
11/10/06	10:10	11.02	94.8	8.8	11.3	5.38	0.8	51.9		

01-XBB - Wheelright Pond Outlet, Stepping Stone Road Bridge, Lee - Class A

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean
Standard	NA	>5.0	>75% Daily Average	NA	NA	6.5-8.0	<10 NTU above backgrd	NA	<153	<47
04/15/06	10:30			14.2	15.6	6.26	0.8	109.8		
05/13/06	10:41	9.61	88.4	11.4	9.8	6.70	1.6	95.6		
06/10/06	10:46	7.14	73.5	16.6	16.3	6.49	2.3	80.3		
06/19/06	08:35								50	
07/15/06	10:52	6.88	86.8	27.1	26.8		1.4	90.2		
07/18/06	08:15								70	
08/12/06	10:10	6.68	74.8	21.1	17.3	6.41	0.9	95.4		
08/17/06	08:30								80	65
09/09/06	10:17	7.23	80.5	20.7	20.2	6.75	1.1	95.3		
09/14/06	08:44								70	73
10/10/06	09:00								20	48
10/14/06	10:20	8.35	78.6	12.7	10.2	6.62	1.9	92.7		
11/11/06	10:37	9.42	80.7	8.9	9.3	6.47	2.0	93.9		

13-OYS, Route 4 Bridge, East of Lee Traffic Circle, Lee, NH - Class A

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean
Standard	**NA**	**>6.0**	**>75% Daily Average**	**NA**	**NA**	**6.5 - 8.0**	**As naturally occuring**	**NA**	**<153**	**<47**
04/15/06	10:10	6.23	62.4	12.3	16.6	5.94	0.9	96.6		
05/13/06	10:24	8.63	77.0	10.1	9.1	6.21	1.2	86.5		
06/10/06	10:25	6.90	69.3	14.9	15.7	6.02	0.6	58.8		
06/19/06	08:45								100	
07/15/06	10:38	4.56	53.6	23.3	25.1		2.0	78.8		
07/18/06	08:05								110	
08/12/06	10:00	3.29	34.5	17.7	15.3	~~5.95~~	2.0	103.9		
08/17/06	08:40								100	103
09/09/06	09:58	3.67	39.1	18.2	19.3	6.23	1.4	108.9		
09/14/06	08:29								130	113
10/10/06	09:10								20	64
10/14/06	10:05	7.33	62.8	8.5	11.2	5.88	1.6	77.2		
11/11/06	10:16	9.66	79.9	7.1	9.1	6.14	1.0	64.3		

01-DBE, Dube Brook, Cherry Lane Bridge, Madbury - Class A

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean
Standard	**NA**	**>6.0**	**>75% Daily Average**	**NA**	**NA**	**6.5 - 8.0**	**As naturally occuring**	**NA**	**<153**	**<47**
04/15/06	09:45	8.68	79.4	11.4	12.3	6.08	5.4	86.6		
05/13/06	09:52	9.65	83.9	9.2	9.3	6.49	14.3	60.2		
06/10/06	09:54	8.75	84.6	13.6	14.3	6.40	5.2	57.7		
06/19/06	08:10								80	
07/15/06	10:18	7.66	87.6	21.6	23.6		9.8	96.3		
07/18/06	07:40								140	
08/12/06	09:40	7.99	77.1	13.9	13.9	~~6.46~~	8.4	138.5		
08/17/06	08:05								90	100
09/09/06	09:46	8.62	85.4	15.2	17.1	6.99	4.9	140.1		
09/14/06	08:14								60	91
10/10/06	08:30								90	79
10/14/06	09:35	10.14	82.7	6.6	6.6	6.93	4.9	84.5		
11/11/06	09:40	11.58	91.8	5.5	7.4	6.51	4.1	72.2		

09-OYS, Route 155A Bridge (USGS Gaging Station), Lee - Class A

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean
Standard	**NA**	**>6.0**	**>75% Daily Average**	**NA**	**NA**	**6.5 - 8.0**	**As naturally occuring**	**NA**	**<153**	**<47**
04/15/06	09:20	10.10	94.3	12.1	12.8	6.11	3.9	67.7		
05/13/06	09:32	10.50	92.3	9.8	9.4	6.78	20.1	97.3		
06/10/06	09:15	9.38	92.1	14.4	15.2	6.37	5.1	67.1		
06/19/06	07:55								170	
07/15/06	09:58	8.10	93.8	22.4	25.4		5.5	102.7		
07/18/06	07:29								110	
08/12/06	09:20	8.05	83.7	17.3	17.3	~~6.44~~	6.7	182.8		
08/17/06	07:50								120	131
09/09/06	09:26	8.45	87.8	17.3	16.6	7.02	4.7	171.7		
09/14/06	08:02								70	97
10/10/06	08:20								20	55
10/14/06	09:13	10.36	90.0	9.3	9.2	6.90	3.9	92.7		
11/11/06	09:16	11.24	92.4	6.9	8.0	6.38	2.6	72.5		

08-OYS, Mast Road Bridge, Durham - Class A

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean
Standard	**NA**	**>6.0**	**>75% Daily Average**	**NA**	**NA**	**6.5 - 8.0**	**As naturally occuring**	**NA**	**<153**	**<47**
04/14/06	10:10	10.46	95.5	11.6	18.5	6.34	4.3	138.3		
05/12/06	09:50	10.45	94.2	10.8	9.3	6.83	2.1	127.4		
06/09/06	10:05	9.37	92.6	14.3	19.4	6.79	5.0	65.2		
06/19/06	07:40								250	
07/14/06	10:00	8.19	89.6	19.7	22.5	6.72	6.1	115.9		
07/18/06	07:22								120	
08/11/06	10:10	8.39	88.1	17.7	20.2	6.56	6.3	213.4		
08/17/06	07:45								90	139
09/08/06	10:25	8.31	85.7	16.8	18.5	6.88	3.1	201.2		
09/14/06	07:52								60	87
10/10/06	08:15								20	48
10/13/06	09:55	5.12	47.7	11.9	6.7	6.13	6.8	98.5		
11/10/06	09:45	10.43	91.1	9.4	11.5	6.33	5.0	69.7		

01-CSB, Chelsey Brook, Packers Falls Road Bridge, Lee - Class A

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean
Standard	**NA**	**>6.0**	**>75% Daily Average**	**NA**	**NA**	**6.5 - 8.0**	**As naturally occuring**	**NA**	**<153**	**<47**
04/15/06	09:00	9.31	83.5	10.8	12.3	6.47	1.7	112.8		
05/13/06	09:04	8.90	77.7	9.3	9.0	6.65	4.0	116.4		
06/10/06	08:50	7.54	71.9	13.2	14.9	6.47	1.6	128.2		
06/19/06	07:40								100	
07/15/06	09:10	7.41	77.3	17.2	22.3		2.6	201.7		
07/18/06	07:18								530	
08/12/06	09:05	8.78	80.5	11.4	15.4	~~6.48~~	1.8	250.2		
08/17/06	07:35								150	200
09/09/06	09:07	8.31	78.7	13.1	16.6	6.60	1.8	220.4		
09/14/06	07:44								30	134
10/10/06	08:10								10	36
10/14/06	09:00	8.05	68.0	8.0	8.0	6.79	3.1	137.3		
11/11/06	09:05	9.37	76.4	6.6	7.5	6.37	2.3	129.8		

07-OYS, Footbridge, College Woods, Durham, NH - Class A

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean
Standard	**NA**	**>6.0**	**>75% Daily Average**	**NA**	**NA**	**6.5 - 8.0**	**As naturally occuring**	**NA**	**<153**	**<47**
04/15/06	08:35	9.97	92.7	12.1	12.8	6.56	5.0	131.3		
05/13/06	08:45	10.29	91.0	9.8	10.2	6.87	19.6	127.8		
06/10/06	08:10	9.50	93.0	14.3	17.3	6.55	6.5	84.1		
06/19/06	07:20								90	
07/15/06	08:35	7.95	90.1	21.6	23.4	6.91	8.1	133.6		
07/18/06	07:05								170	
08/12/06	08:45	8.12	83.4	16.6	16.0	~~6.77~~	6.4	213.6		
08/17/06	07:20								20	67
09/09/06	08:41	8.18	82.8	16.2	15.2	6.94	3.3	201.1		
09/14/06	07:30								30	47
10/10/06	07:55								10	18
10/14/06	08:45	8.84	85.0	9.0	8.3	6.83	6.0	110.0		
11/11/06	08:34	11.48	95.2	7.2	6.5	6.33	4.2	83.2		

01-HML, Hamel Brook, Route 108 Bridge, Durham - Class B

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean
Standard	NA	>5.0	>75% Daily Average	NA	NA	6.5-8.0	<10 NTU above backgrd	NA	<406	<126
04/14/06	09:45	9.53	90.5	11.7	16.7	6.11	3.3	184.7		
05/12/06	09:30	8.48	77.2	11.1	10.0	6.67	2.2	168.8		
06/09/06	09:40	6.48	63.4	14.4	17.7	6.41	2.9	86.8		
06/19/06	07:00								20	
07/14/06	09:35	4.80	53.7	21.0	23.0	6.45	3.5	127.7		
07/18/06	06:47								440	
08/11/06	09:45	7.31	76.2	16.5	18.3	6.80	2.7	263.4		
08/17/06	07:00								380	150
09/08/06	10:05	7.16	75.2	17.7	19.3	6.90	2.0	214.9		
09/14/06	07:12								60	216
10/10/06	07:25								140	147
10/13/06	09:35	5.12	47.7	12.2	8.4	6.33	4.9	91.1		
11/10/06	09:20	7.30	63.7	9.4	11.8	6.25	4.3	98.8		

05-OYS, Route 108/Newmarket Road Bridge, Durham - Class B (ARMP DATA)

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean
Standard*	NA	>5.0	>75% Daily Average	NA	6.5-8.0	<10 NTU above backgrd	NA	<406	<126
03/22/06	10:49	13.17	99.8	3.6	7.26	3.9	110.4	<10	
04/26/06	10:27	10.58	94.2	10.2	7.11	4.9	188.9	90	
06/02/06	11:24	8.57	92.0	18.8	6.52	60.0	130.6	>2000	
06/19/06	10:48	8.32	98.1	23.7	6.80	4.5	158.2	50	
07/19/06	10:15	6.84	83.9	25.7	6.69	3.8	181.7	50	171
08/16/06	10:20	9.02	103.7	22.3	6.88	2.8	256.8	250	85
09/19/06	10:52	9.21	101.2	20.0	6.88	3.0	249.0	<10	
10/17/06	10:45	8.97	77.5	8.9	6.70	5.8	138.5	50	
11/15/06	10:21	10.00	89.7	10.5	7.16	9.3	86.9		

00E-CGB - College Brook, Mill Pond Road Bridge, Durham - Class B

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)
Standard	NA	>5.0	>75% Daily Average	NA	6.5-8.0	<10 NTU above backgrd	NA
10/9/2006[A]	09:05	10.10	90.2	10.0	7.27	N/A	1153.0

04-PRB, Pettee Brook, Gables Road Bridge, Durham - Class B

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)
Standard	NA	>5.0	>75% Daily Average	NA	6.5-8.0	<10 NTU above backgrd	NA
10/9/2006[A]	10:30	6.49	65.0	15.4	6.78	N/A	450.5

00J-PRB, Pettee Brook, Sauer Terrace, Durham - Class B

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean
Standard	NA	>5.0	>75% Daily Average	NA	NA	6.5-8.0	<10 NTU above backgrd	NA	<406	<126
04/14/06	08:30	10.74	94.3	9.6	9.8	6.76	4.2	593.0		
05/12/06	08:20	10.28	93.6	11.1	9.5	7.26	5.0	503.0		
06/09/06	08:20	9.78	95.5	14.3	19.1	6.88	6.2	198.8		
06/19/06	06:25								70	
07/14/06	08:20	8.23	93.7	21.4	21.7	6.98	3.0	275.8		
07/18/06	06:13								190	
08/11/06	08:25	8.41	88.2	17.4	15.3	7.30	2.2	935.0		
08/17/06	06:25								240	147
09/08/06	08:35	8.85	91.0	16.6	16.7	7.57	4.2	866.0		
09/14/06	6:33								160	194
10/9/2006[A]	09:48	9.92	88.6	10.6		7.51		1073.0		
10/10/06	06:55								140	186
10/13/06	08:30	9.98	94.3	12.8	7.5	6.66	3.9	177.5		
11/10/06	08:20	11.43	99.4	9.3	9.8	6.80	5.9	209.2		

02-BRD, Beards Creek, Coe Drive Bridge, Durham - Class B

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean
Standard	NA	>5.0	>75% Daily Average	NA	NA	6.5-8.0	<10 NTU above backgrd	NA	<406	<126
04/14/06	08:50	9.63	86.9	9.2	11.7	6.86	5.2	299.3		
05/12/06	08:35	10.10	90.1	10.2	9.2	7.08	3.5	258.3		
06/09/06	08:45	10.16	97.4	13.4	17.5	6.99	7.8	138.6		
06/19/06	06:35								430	
07/14/06	08:40	7.45	81.3	19.5	22.2	6.54	7.2	209.2		
07/18/06	06:20								480	
08/11/06	08:55	7.73	81.2	17.8	17.4	6.77	6.2	238.6		
08/17/06	06:35								890	568
09/08/06	09:05	4.97	51.5	17.2	18.8	6.82	5.2	311.0		
09/14/06	06:43								880	722
10/10/06	07:00								420	690
10/13/06	08:45	8.23	75.1	11.3	6.5	6.38	18.7	152.5		
11/10/06	08:35	10.36	89.9	9.2	12.1	6.62	9.0	147.7		

03-JNC, Johnson Creek, Freshet Road Bridge, Durham - Class B

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean
Standard	**NA**	**>5.0**	**>75% Daily Average**	**NA**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**<126**
04/14/06	09:20	11.71	99.4	8.2	12.9	6.55	7.3	297.2		
05/12/06	09:10	11.16	98.6	9.9	9.3	7.04	3.0	231.6		
06/09/06	09:15	10.00	95.9	13.4	17.3	6.77	9.9	127.3		
06/19/06	06:45								700	
07/14/06	09:00	8.82	94.4	19.0	21.6	6.69	5.7	184.9		
07/18/06	06:37								640	
08/11/06	09:20	9.15	94.5	16.9	17.6	6.69	5.6	353.4		
08/17/06	06:45								140	397
09/08/06	09:40	9.38	96.2	16.6	17.7	7.21	2.5	331.0		
09/14/06	06:56								50	165
10/10/06	07:10								50	70
10/13/06	09:12	10.32	92.7	10.6	6.3	6.49	6.5	150.3		
11/10/06	09:00	11.18	96.4	8.9	10.2	6.70	6.2	126.3		