WESTFIELD RIVER WATER QUALITY MONITORING PROJECT

FINAL REPORT
2008-04/604b

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Prepared By
Pioneer Valley Planning Commission

DISCLAIMER

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We would like to acknowledge the Biology Department at Westfield State College for use of their laboratory space and equipment for this project, and the President's Office for their support. The College's enthusiastic commitment and support of this project and the health of the Westfield River watershed is a tremendous resource. We are also greatly indebted to our volunteer monitors for their time and enthusiastic commitment to understanding our watershed:

Sheryl Becker
Jeff Brannharr
Tom Condon
Heather Comee
Dave Fillion
Lu Feorino
Barbara and Doug James
John Jones
Marjory Lehan
Brian Lussier
Burt Prokop
Christine Prost
Lindsay Roberts
Linda Williams

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EXECUTIVE SUMMARY

The Westfield River Watershed encompasses a total of 517 square miles in Hampshire, Hamden, and Berkshire Counties of western Massachusetts and is bordered by the Deerfield, Hoosic, Housatonic, Farmington, and Connecticut River Watersheds. The Westfield River is a major tributary to the Connecticut River made up of three branches, the East, Middle and West Branches.

Under a MassDEP FY08 604b grant to the Pioneer Valley Planning Commission (Project Number 604/2008-04), monthly water quality monitoring was performed at 21 locations in Windsor, Huntington, Russell, Westfield and West Springfield from April to November 2009. Monitoring was performed by a core of volunteers trained at the outset of the project. Of these sites, 12 of them were monitored for E. coli, and 11 of the 12 (92%) had E. coli values one or more times in excess of primary contact standards (235 MPN/100 mls, single sample). Of the 11 sites with single sample E. coli exceedances, 7 sites (64%) also exceeded the geometric mean (126 MPN/100 mls) for primary contact during the prime recreational season (June to October). Although there appears to be a correlation between wet weather and elevated E. coli counts for some sites, other sites (Little River, Jack's Brook, Ashley Brook, and Pond Brook) also tested high during dry weather events.

Several MA DCR beaches on the East Branch of the Westfield River that have been permanently closed since 2006 due to consistently elevated E. coli levels. Both of these beaches are within the National Wild and Scenic designated areas including Gardner State Park Beach on the lower East Branch and Windsor State Forest on the upper East Branch in Windsor. Sampling on the East Branch upstream of the Westfield River Beach at Windsor State Forest resulted in one high E. coli value of 260 MPN/100 mls on 9/27/09. Although there may be a bacteria source upstream, the data collected at Windsor State Forest beach suggests the possibility for re-opening the beach for public use. However, further downstream on the East Branch at Gardner State Park, water quality continues to be poor. Results for Gardner State Park beach had high E. coli levels on 5/18/09 and 10/25/09. MA DCR suspects an upstream septic system at a local restaurant to be the source of the problem.

Figure 1 East Branch Gardner State Park Beach

Given these results, additional E. coli bacteria monitoring is needed at these locations as part of a larger source tracking program. Temperature data collected at the two sites on Pond Brook (PNDB3.3 and PNDB0.01) indicated that the brook may not meet its proposed designation as a Cold Water Fishery. Daily temperature should be collected at these locations to ensure the site is suitable for such a designation.

Figure 2 Bradley Brook

Figure 3 Cook Brook

INTRODUCTION

The Westfield River Watershed encompasses a total of 517 mi^2 in Hampshire, Hamden, and Berkshire Counties of western Massachusetts. The Westfield River Watershed is bordered by the Deerfield, Hoosic, Housatonic, Farmington, and Connecticut River Watersheds. The Westfield River is a major tributary to the Connecticut River. The main stem Westfield River originates in Savoy and Windsor. It flows in a generally southerly direction for 27 miles. There are a total of 850 miles of rivers, streams, and brooks and 4,200 acres of lakes and ponds in the watershed. The Westfield River corridor encompasses many valuable features and resources, including: the first designated National Wild and Scenic River in Massachusetts (forty-three miles of the river); the longest uncontrolled river in the state (West Branch of the Westfield River); Massachusetts' only regenerating Atlantic salmon habitat; and, an active corps of volunteer and professional planners, government officials, environmentalists, developers, advocates, builders and citizens.

Although municipalities, state and federal agencies, and several citizen groups have a keen interest in the health and vitality of the watershed, this is the first volunteer water quality monitoring program with an approved quality assurance project plan for the watershed. This project has fulfilled a 2005 Five Year Watershed Action Plan for the Westfield River recommendation to develop and implement a water quality monitoring program within the watershed. Based on the bacteria monitoring results, it is recommended that this project be continued in 2010 and source tracking activities initiated.

Project Partners

The primary project partners included Pioneer Valley Planning Commission (PVPC) and the Westfield River Environmental Center and Biology Department at Westfield State College (WSC). The following additional agencies and organizations were involved in site selection and technology transfer: Massachusetts Department of Environmental Protection's Western Regional Office, the Westfield River Watershed Association, the Westfield River Wild and Scenic Advisory Committee, the Massachusetts Department of Fish and Game Riverways Program, and local Conservation Commissions.

The project received matching funds from the U.S. Environmental Protection Agency in the form of an EPA Equipment Loan Grant to Westfield State College for water quality monitoring equipment. The equipment purchase valued at $5,420 included: a Hach digital titrator, Ohaus Pioneer balance, certified thermometer, oven thermometer, YSI H/temp meter, and 8 YSI pH meters. Documentation regarding the match is provided in the Appendices.

PROJECT APPROACH

Site Selection

Recommendations for monitoring locations were made based on input from the following organizations and studies: the Pioneer Valley Planning Commission, the Massachusetts Department of Environmental Protection, faculty members of the Westfield State College Westfield River Environmental Center (WREC), the Westfield River Watershed Association (WRWA), the Westfield River Wild and Scenic Committee, Massachusetts Riverways personnel, *Westfield River Watershed 2001Water Quality Assessment Report*[1], and the *Westfield River Five Year Watershed Action Plan*[2]. Input was also solicited from local Conservation Commissions, Boards of Health and chief elected officials via notice mailed August 4, 2008. The goal of the QAPP was to design an approach that would provide useful data and generate awareness of water quality problems to better identify sources of contamination. While the *Watershed Action Plan* stresses bacterial monitoring, the QAPP committee identified the additional need for monitoring selected physical and chemical parameters at almost monthly intervals for at least a year at traditional sites such as the four USGS gauging stations in the watershed as well as sites of concern identified in the *Water Quality Assessment Report* and the *Watershed Action Plan*. While local groups and students at Westfield State College have conducted sporadic samplings in the watershed and DEP conducts a concentrated sampling of many parameters at selected sites once every five years, there is no consistent data at specific sites at monthly intervals for consecutive years. The only study that comes close is the acid rain monitoring project organized by the Mass Water Watch Partnership at UMass, which has samples selected sites for pH and alkalinity in April and October/November. A small number of the sites are also analyzed for anions and cations. The development of the QAPP for this project was separate from these other monitoring efforts.

Figure 4 Jack's Brook

[1] *Water Quality Assessment Report*, Massachusetts Department of Environmental Protection, 2001
[2] *Westfield River Five Year Watershed Action Plan*, Pioneer Valley Planning Commission, June 2006.

The *2001 MassDEP Westfield River Watershed Water Quality Assessment Report* states that several sections of the Westfield River and a number of its tributaries are impaired due to bacteria contamination from stormwater runoff. Bacteria contamination has led these stretches of river to fail to meet designated uses such as primary and secondary contact recreation. MassDEP recommended additional bacteria sampling at targeted locations to identify the sources of contamination. The *Watershed Action Plan* cites the Main Stem of the Westfield River (MA32-04) in the vicinity of the two DCR state beaches as being highly impacted by bacteria contamination and both beaches were closed to swimming. The Gardner State Park area was closed to swimming in 2006. DCR uses Enterococcus as the indicator bacteria for monitoring swimming water quality at this beach and the weekly monitoring here frequently exceeded Enterococcus standards for bathing beaches[3]. MassDEP conducted targeted sampling to locate possible sources upstream of the Gardner beach in 2005. Intensive sampling was conducted int eh river as well as nearby upstream tributaries but no elevated dry weather counts were detected during these surveys and a potential source was never identified. Impacted areas also are found in the Little River (MA32-08) in the City of Westfield. This section is impaired for primary recreational contact because of bacteria contamination. Two tributaries of the Little River, Ashley Brook and Jack's Brook, are suspected as possible bacteria sources based on information provided by the Westfield Water Resources Department. Pond Brook (MA32-24) in the City of Westfield has also been identified as impacted based on past water quality data provided by the Westfield Water Resources Department withelevated levels of fecal coliform contamination. Data from Pond Brook will also be important in the near future as a developer is planning to put a mall on the over 200-acre site that includes a large segment of the brook. Two sites in Russell will bracket the proposed Russell Biomass project which proposes to take 800,000 gallons of

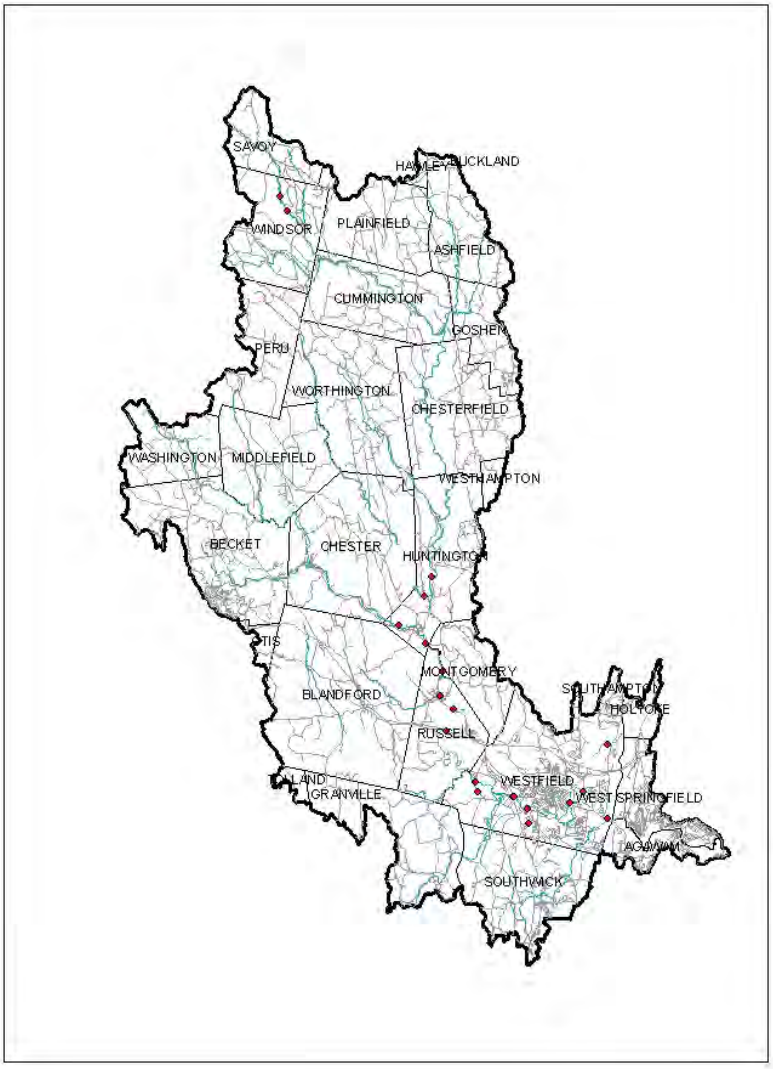

Figure 5 Westfield River Watershed

[3] *Enteroccocus* standards for bathing beaches is 33 colonies/100 ml calculated from a geomean of 5 or more samples or 61 colonies /100 ml single sample

water from the river per day and return only 100,000 gallons of heated water. Two other sites in Russell, Potash Brook and Bradley Brook, were chosen because they drain water from Blandford where, recently, there have been problems with failing septic systems according to input from the Blandford Board of Health.

Figure 5 is a map of the monitoring sites for the entire watershed. The Appendix contains topographic maps by region of the watershed with the sampling locations identified.

Quality Assurance Project Plan

The QAPP Committee included: Robert Thompson (WREC coordinator), David Doe (Biology Dept. WSC), Michael Vorwerk (WSC Environmental Science coordinator), Michael Young (WSC Physical Science chairman and WRWA board member), Anne Capra (PVPC), Christine Duerring (MassDEP), and Carrie Banks (Westfield River Wild and Scenic Committee). The Committee reviewed existing water quality data and previous sample collection locations for the watershed, discussed proposed sampling locations with stakeholders, and selected sampling locations in targeted sub-watersheds for a total of twenty-one (21) baseline sampling locations, used to gather physical and chemical data from April to November, 2009. Data included air and water temperature, pH, alkalinity, and total suspended solids. Using the 2001 MassDEP Water Quality Report, the 2005 Watershed Action Plan, the 2006 MassDEP Westfield Watershed Sampling and Analysis Plan, and information from MassDEP WERO Bacteria Source Tracking Program, twelve (12) sites were identified for monthly sampling for *E. coli* using the IDEXX Colilert system. These 12 sites are described below:

East/Main Branch Westfield River – Two (2) sites in the vicinity of Windsor State Park beach, one at the Gardner State Park beach, and one at the USGS Knightville Dam gauging station

Middle Branch Westfield River - USGS Goss Hill gauging station, below the Littleville dam

West Branch Westfield River - USGS gauging station in Huntington.

Westfield River Main Stem – Three (3) sites between Huntington and Westfield along Rt. 20, at the rest area opposite the Huntington Health Center, at the rest area opposite the Countryside Woodcraft, and at the rest area opposite the former Wippernon Golf Course; USGS gauge station in Westfield along Route 20 near the Westfield/West Springfield boundary.

Potash Brook - Approximately 1 mile from the junction of Routes 20 and 23 in Russell

Bradley Brook - Behind the post office in Russell

Little River – At Northwest Road crossing, at Horton's Bridge (Granville Road), and about 50 meters above the confluence of the Little River and the Westfield River (Main Street, Westfield).

Cook Brook - Northwest Road crossing

Jack's Brook - City View Road crossing

Ashley Brook - Hillside Road crossing

Pond Brook – Just below storage pond outlet at East Mountain Country Club and, just above confluence with Powdermill Brook along Union Street in Westfield

Volunteer Recruitment, Training and Coordination

The Pioneer Valley Planning Commission (PVPC) worked with the Westfield State College Westfield River Environmental Center (WREC) to recruit, train, and coordinate volunteers for water quality monitoring. Recruitment of volunteers began with an announcement of the project at the Westfield River Symposium in April, 2008 and continued with an article published in the *Springfield Republican* in August of 2008. The existing organizations within the watershed, specifically the Westfield River Watershed Association and Westfield Wild and Scenic Advisory Committee, provided a critical base from which to recruit volunteers.

A calibration monitoring event was held in November 2008. For this event, PVPC and WREC conducted a volunteer training on October 23, 2008. Eight volunteers attended and learned about the rationale and framework for the monitoring program, and sampling procedures in the QAPP. Three of the volunteers participating in the calibration monitoring received more detail on the sampling. WERC's Laboratory Coordinator accompanied volunteers to sites to collect water samples, take field temperature measurements and measure pH *in situ* with meters supplied by an EPA Equipment Loan Grant to Westfield State College, as well as field observations noted on field data sheets.

For the 2009 season, 14 people volunteered to cover the project's 21 monitoring sites. PVPC worked with WREC to provide a complete training for this large group on March 26, 2009. Five of the participants had attended the fall training. PVPC and WREC provided an overview of the monitoring effort, after which the laboratory coordinator at WREC provided hands on instruction on the use of monitoring equipment, particularly the pH meters, according to the sampling procedures in the QAPP. PVPC issued volunteers site assignments before the training session so that the training could be used for actual sampling and procedural instruction rather than trying to work out site assignments.

Throughout the 2009 monitoring season, PVPC sent out e-mail reminders to volunteers in advance of equipment and cooler pick up dates and monitoring dates. Equipment was available for pick up the week prior to the sampling date as well as the morning of sampling. This framework established with volunteers at the outset of the project and regular e-mail contact with volunteers led to good coverage of all sites throughout the season. Volunteers provided ample notice about dates where they needed help covering his or her site so that other volunteers or PVPC staff could easily plan to help take on an additional site for a monitoring event. Preparation and organization of coolers, monitoring equipment, and instruction materials by WREC also helped immensely in making volunteer work go smoothly.

To acknowledge the tremendous work of the volunteers, PVPC and WREC provided all volunteers with a framed certificate of appreciation signed by the directors of the two organizations along with a USGS topographical map of the Westfield River.

Water Quality Monitoring

Monthly water quality monitoring was performed at 21 locations in Windsor, Huntington, Russell, Westfield and West Springfield from April to November 2009. Samples for the analysis of pH, alkalinity, total suspended solids, and *E. coli* bacteria were collected, water and air temperature were field-measured, and accompanying visual observations of weather, river use, etc. were recorded on a field data sheet. Samples were stored on ice in coolers and transported to the Westfield State College Environmental Center for analysis of alkalinity, total suspended solids, and bacteria. To ensure safety for the volunteers we obtained sample collection poles for situations of high flow or a steep bank. Sampling was done monthly regardless of rainfall. Sampling days are specified as dry weather or wet weather days in the data. Dry weather days occurred only when the antecedent weather has lacked any measurable precipitation for 72 hours (less than 0.1 inch of rain). Monitoring results are discussed below under Results.

Figure 6 Pond Brook at Union Street

Laboratory Analysis

All samples were delivered to the laboratory within six hours of collection. Westfield State College labs and equipment were used for the analyses. The college purchased an IDEXX Colilert system for the bacterial analysis with the 604b grant funds. The QAPP contains the approved SOP's for the analyses, which included the appropriate quality controls. Upon the recommendation of Matt Poach, a DEP environmental analyst in the Springfield office, we adopted a different quality control measure for the *E. coli* sample. We used the 95% Confidence Limits published by IDEXX, the supplier of the Colilert system. Samples for alkalinity were analyzed by Dr. David Doe, who has done these analyses for the Mass Water Watch Acid Rain Monitoring Project for several years. Total suspended solids were analyzed by Dr. Michael Vorwerk, who is an environmental scientist with expertise in water resource management and has experience conducting TSS analysis. The bacterial analysis was conducted by Ms. Michelle Coach, an adjunct professor in the WSC Biology Department. She has extensive experience in private microbiology labs. Waste material from the bacteria analyses was sterilized with an autoclave and disposed of properly.

Technology Transfer

The data gathered during the project has been posted on the GIS server of the WREC and is available to the public at http://envcenter.wsc.ma.edu/water-quality-monitoring . Notification of the server website was sent to all watershed communities and public and private agencies interested in the watershed. Technical assistance in setting up the server was provided by Mr. Michael Oklin, the GIS

administrator for the Town of Amherst, MA. The server site also provided maps which include the sampling site locations. Project data was also submitted to EPA's Central Data Exchange via STORET.

Monthly data results were forwarded to the list of community contacts inlcuded in the Appendices. The City of Westfield was the only community that responded to the project outreach. Westfield is a NPDES MS4 regulated community, and as such, conducted a dry weather stormwater outfall monitoring program in July and August 2009 as part of their Illicit Discharge and Detection Program. Charles Darling, City of Westfield Water Resources Department, met with project manager Anne Capra in September 1, 2009 to review the results of the dry weather monitoring relative to Jack's Brook, Ashley Brook, Pond Brook and the Little river.

In July and August 2009, the Westfield Water Resources Department performed dry weather sampling on all 150 (approximate) of their stormwater outfalls. Only 16 of the 150 outfalls had data results of concern. Approximately 30 of the 150 outfalls sampled during dry weather had flows at the time of sampling. City tested for *E. coli*, potassium, conductivity, chlorine, pH, and MBAS (surfactants). The following is a discussion of the City's results relative to the monitoring sites sampled under this project:

- *Jack's Brook* - No outfalls upstream of sampling site (JACB0.01) at City View Road. City sampled downstream outfall #526. Although septic systems exist in the area, visual inspections performed by the Westfield Health Department have not indicated any problems.

- *Ashley Brook* - No outfalls exist on Ashley Brook. There is a condo development with a possible septic system in watershed.

- *Pond Brook* - No outfalls with data of concern. Some outfalls on Powdermill Brook did have high potassium and high pH. Powdermill Brook crosses road at the same area as sampling location through separate culvert. Given this data, there is some concern that volunteers may have been sampling the confluence of Powdermill Brook rather than Pond Brook.

- *Little River* - Outfall #35 at South Meadow Street, at the confluence with the Westfield River, had high potassium levels (4,200 mg/L). DEP WERO's bacteria source tracking program on the Little River identified a storm drain in this area with dry weather flows indicative of raw sewage.

Regular project updates were also provided to the Westfield River Watershed Association and the Westfield River Wild and Scenic Advisory Committee (WRWSAC) by Robert Thompson and David Doe as part of their regular attendance at organizational meetings. On March 18, 2010, project results were presented formally to the WRWSAC.

RESULTS

Monthly water quality monitoring was performed at 21 locations in Windsor, Huntington, Russell, Westfield and West Springfield from April to November 2009. The data collected is located in Table 1 and 3 on the following pages.

Bacteria Levels

Twelve (12) sites were monitored for E. coli (Table 1). Eleven (11) of these (92%) had E. coli values one or more times in excess of primary contact standards (235 MPN/100 mls, single sample). Of the 11 sites with single sample E. coli exceedances, 7 sites (64%) also exceeded the geometric mean (126 MPN/100 mls) for primary contact during the prime recreational season (June to October). Although there appears to be a correlation between wet weather and elevated E. coli counts for some sites, others (Little River, Jack's Brook, Ashley Brook, and Pond Brook) also tested high during dry weather events.

There are two MA DCR beaches on the East Branch of the Westfield River that have been permanently closed since 2006 due to consistently elevated *E. coli* levels. Both of these beaches are within the Wild and Scenic designated areas including Gardner State Park Beach on the lower East Branch and Windsor State Forest on the upper East Branch in Windsor. Sampling on the East Branch upstream of the Westfield River Beach at Windsor State Forest resulted in one high dry weather value of 260 MPN/100 mls on September 27, 2009. Although there may be a bacteria source upstream, the data collected at Windsor State Forest beach suggests the possibility for re-opening the beach for public use. However, further downstream on the East Branch at Gardner State Park, water quality continues to be poor. Results for Gardner State Park beach had high *E. coli* wet weather levels on May 18, 2009 ((461.1 MPN/100 mls) and October 25, 2009 (866.4 MPN/100 mls). The other 3 wet weather sampling events at this location did result in a violation of primary contact recreation standards for E. coli. Hence, 40% of wet weather sampling at this location violated these standards. Upstream bacteria sources remain unidentified.

Table 1 E. coli Results (MPN/100 mls)								
Site	**26-Apr**	**18-May**	**28-Jun**	**26-Jul**	**23-Aug**	**27-Sep**	**25-Oct**	**22-Nov**
WREB27.8	<1	38.4	23.5	52.9	95.9	190.4	76.7	21.1
WREB28.6	1	37.3	39.3	48.7	98.5	260.3	53.7	60.8
WREB0.78	1	461.1	43.5	90.8	224.7	35.9	866.4	15.5
BRB0.16	3.1	17.5	27.8	30.1	613.1	187.2	58.8	1
PTB1.3	53.8	161.6	44.1	248.9	>2419.6	224.7	201.4	27.9
LTR4.8	21.6 and 1.0	209.8 and 27.9	214.2	178.5	2419.6	225	1203.3	46.4
LTR0.01	1986.3	1553.1 and 204.6	185	344.8	>2419.6	1374	2382	325.5
COB0.47	3	19.9	74.9	64.4	>2419.6	43.5	112.6	7.5
JACB0.01	1413.6	104.3 and 17.1	80.9	117.8	517.2	>2419.6	547.5	76.2
ASHB0.3	224.7	143.9	866.4	387.3	1732.9	>2419.6	1299.7	517.2
PNDB3.3	12	209.8	29.5	54.8	547.5	290.9	1553.1	12.2
PNDB0.01	6.3	209.8	70.3	72.8	209.8	435.2	67.7	111.9

Sampling with two values include data for a normal sample (first value) and a 1:10 dilution (second value)

Green data represent dry weather days with 48 hours of less than 0.1" of precipitation

Red data represent wet weather days in which >.1 inch of rain falls within the past 48 hrs

Data values of <1 were graphed as 0.5.

Data values of >2419.6 were graphed as 2450.

Temperature

All sampling sites were Class B waters, with 9 out of 21 designated Cold Water Fisheries and the remaining 12 designated Warm Water Fisheries (Table 4). Temperature is based on the mean of the daily maximum temperature over a seven day period for Class B Cold Water Fisheries, which must be • 68° F (20° C). Temperature standards for Warm Water Fisheries in rivers are based on the minimum expected flow for the month, at which the temperature must be • 83° F (28.3° C). These standards vary slightly due to the change in temperature caused by known, permitted discharges.

Table 2 MA Water Quality Standards for Temperature

Class	MA Surface Water Quality Standard for Temperature
Class BCWF	• 68° F (20° C) based on the mean of the daily maximum temperature over a seven day period in al cold water fisheries, unless naturally occurring, and • T due to discharge • 3° F (1.7° C)
Class BWWF	• 83° F (28.3° C) and • T due to discharge • 5° F (2.8° C) in rivers (based on the minimum expected flow for the month)

It is not possible to determine from the temperature monitoring data from this project whether the water temperature was meeting the designated standards for each river segment. Temperature was not monitored daily over a seven day period for cold water fisheries, nor was it monitored at the expected low flow for the month for warm water fisheries.

However, water temperature data for Pond Brook in Westfield (Table 3) suggests further temperature monitoring should be performed to determine if the water meets its proposed Class B Cold Water Fisheries standard. At PNDB3.3 (Pond Brook at East Mountain Country Club), temperature exceeded 20° C in June, July, and August on the single sample dates. At PNDB0.01 (Pond Brook at Union Street) temperature exceeded 20° C in July and August on the single sample dates.

Figure 7 Pond Brook at East Mountain Country Club

Table 3 Monthly Water Temperature By Site (°C)

Segment	Class	4.26.09	5.17.09	6.28.09	7.26.09	8.23.09	9.27.09	10.25.09	Mean
WREB27.8	BCWF	15	10.5	15	18	18	12	6	13.5
WREB28.6	BCWF	15	11	15.5	18	18	12	6	13.6
WREB0.78	BCWF	16	12	18	19	20	13	6	14.9
WREB2.4	BCWF	16	14	16	19	20	13	6	14.9
WRMB0.3	BWWF	14	13	20	20	19	13	8.5	15.4
WRWB1.5	BCWF	13	12.3	18.2	19.5	20	13	10	15.1
WR24.1	BWWF	13	13	19	20	21	13	10.5	15.6
WR22.6	BWWF	14	14	19	21	22	14	10	16.3
WR20.1	BWWF	14	14	19	21	22	14	11	16.4
WR8.3	BWWF	16	16	20	20	23	16	10	17.3
WR Canoe Access	BWWF	NS	13	20	22	24	18	11	18
BRB0.16	B (Proposed for BCWF)	13.5	12	18	18	21	12	10	14.9
PTB1.3	B (Proposed for BCWF)	14.1	11	17	18	20	12	11	14.7
LTR7.5	BWWF	16	11	16.9	13.7	20	12.8	11.1	14.5
LTR4.8	BWWF	17	13	18	20	23	15	12	16.9
LTR0.01	BWWF	18	13	17	12	20	13	9	14.6
COB0.47	BWWF	17	11	18	19	21	12.6	12	15.8
JACB0.01	BWWF	12	11.5	15.5	17.7	19	12.1	11.3	14.2
ASHB0.3	BWWF	17	15	16	18	19	13.6	11.2	15.7
PNDB3.3	B (proposed BCWF)	20	17	22	28.9	25	16	11	20
PNDB0.01	B (proposed BCWF)	19	14	19	22	22	12.8	10	17

* Highlighted values exceed standards for Class B Cold Water Fisheries

Table 4 Surface Water Quality Classification by Site

Site Number	Site Name	Surface Water Quality Classification	DEP River Segment
MAINSTEM			
WREB27.8	*East Branch/Windsor State Forest beach*	BCWF	MA32-04
WREB28.6	*East Branch/Windsor State Forest, East Branch*	BCWF	MA32-04
WREB0.78	*East Branch/Gardner State Park beach*	BCWF	MA32-04
WREB2.4	East Branch/Knightville Dam gage station	BCWF	MA32-04
WRMB0.3	Middle Branch/Goss Heights gage station	BWWF	MA32-03
WRWB1.5	West Branch gage station	BCWF	MA32-01
WR24.1	Westfield River rest area opposite Huntington Health Center	BWWF	MA32-05
WR22.6	Westfield River rest area opposite Countryside Woodcraft	BWWF	MA32-05
WR20.1	Westfield River rest area opposite former Whippernon Golf Course	BWWF	MA32-05
WR8.3	Westfield River gage station near West Springfield	BWWF	MA32-05
No site number	Westfield River Canoe and Fishing Access Trail	BWWF	MA32-05
TRIBUTARIES			
BRB0.16	*Bradley Brook behind post office*	B (Proposed for BCWF)	MA32-21
PTB1.3	*Potash Brook along Rte 23, below Turnpike overpass*	B (Proposed for BCWF)	MA32-22
LTR7.5	Little River at Northwest Road bridge	BWWF	MA32-36
LTR4.8	*Little River at Horton's Bridge*	BWWF	MA32-36
LTR0.01	*Little River near Westfield River confluence*	BWWF	MA32-08
COB0.47	*Cook Brook at Northwest Road*	BWWF	MA-32-36
JACB0.01	*Jack's Brook at City View Road*	BWWF	MA32-08
ASHB0.3	*Ashley Brook at Hillside Road*	BWWF	MA32-08
PNDB3.3	*Pond Brook at East Mountain Country Club*	B (proposed BCWF)	MA32-24
PNDB0.01	*Pond Brook at Union Street*	B (proposed BCWF)	MA32-24

Total Suspended Solids

Total Suspended Solids (TSS) is comprised of organic and mineral particles that are transported in the water column. TSS is closely linked to land erosion and to erosion of river channels, and therefore can be a good indicator of whether or not land disturbances within the watershed can be affecting aquatic life. TSS can be extremely variable, ranging from less than 5 mg/L to extremes of 30,000 mg/L in some rivers. TSS is an important measure of erosion in river basins, and is closely linked to the transport of nutrients (especially phosphorus), metals, and a wide range of industrial and agricultural chemicals through river systems. In most rivers TSS is primarily composed of small mineral particles and is often referred to as “turbidity”. Higher TSS (>1000 mg/L) may greatly affect water use by limiting light penetration and can limit aquatic life through sedimentation of suspended matter. TSS levels and fluctuations influence aquatic life, from phytoplankton to fish. TSS, especially when the individual particles are small (< 63µm), carry many substances that are harmful or toxic. As a result, suspended particles are often the primary carrier of these pollutants to lakes and to coastal zones of oceans where they settle. In rivers, lakes and coastal zones these fine particles are a food source for filter feeders which are part of the food chain, leading to biomagnification of chemical pollutants in fish and, ultimately, in humans. In river basins where erosion is a serious problem, suspended solids can blanket the river bed, thereby destroying fish habitat.

TSS results (Appendices) were either low (below 10 mg/L) throughout the season at all sites except for a single high value of 156.4 mg/L at ASHB0.3 (Ashley Brook at Hillside Road). TSS at this site was less than 2 mg/l on all other sampling dates. TSS at all sites did not indicate major problems associated with erosion or other sources of land disturbance.

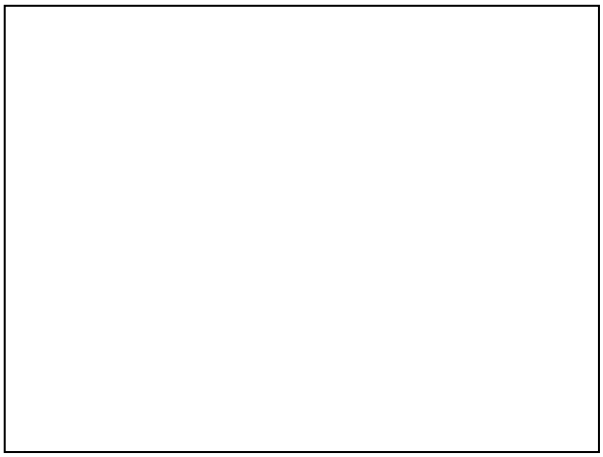

Figure 8 Ashley Brook

The accuracy and precision of the TSS data has been called into question during QA review. Potential sources of bias in TSS tests may have been due to: 1) lack of complete mixing immediately prior to sub-sampling; 2) high filter only weights; 3) too high drying temperatures; and, 4) poor standard preparation. Therefore, the TSS data presented is not considered valid.

Alkalinity and pH

Alkalinity is a measure of all the substances in water that can resist a change in pH when acid is added to the water. In other words, alkalinity describes how well water recovers from an "acidic" punch. Alkalinity is typically expressed in mg/L of calcium carbonate ($CaCO_3$) because calcium carbonate is a good acid neutralizer. Water with low alkalinity has a low capacity to neutralize or "buffer" incoming acids and is, therefore, very susceptible to acidic pollution. In contrast, water with greater alkalinity, or buffering capacity, will have the ability to neutralize more of the incoming acidity and, therefore, resist rapid changes in pH. Sufficient alkalinity in water protects

aquatic life against rapid changes in pH and makes water less vulnerable to acid rain. Alkalinity of 100-200 mg/L will sufficiently stabilize the pH in a stream.

Alkalinity of natural water is determined by the soil and bedrock through which it passes. The main sources for natural alkalinity are rocks which contain carbonate, bicarbonate, and hydroxide compounds. Borates, silicates, and phosphates also may contribute to alkalinity. Limestone is rich in carbonates, so waters flowing through limestone regions or bedrock containing carbonates generally have high alkalinity - hence good buffering capacity. Conversely, areas rich in granites and some conglomerates and sandstones may have low alkalinity and therefore poor buffering capacity.

The Westfield River Basin is largely comprised of crystalline, sedimentary, and some carbonate rocks. Sedimentary rocks, such as sandstone, siltstone, and shale, occur only in valleys and lowlands of the eastern part of the Westfield River basin.[4] Low levels of carbonate rock in the watershed result in the very low alkalinity observed. The mean alkalinity values ranged from 5.1 to 43.3 at all of the sites with an average mean value of 18 mg/L. Along the main branches of the Westfield River, there was less of a range in alkalinity values with mean values between 12 and 19.4 mg/L.

Table 5 Alkalinity (mg/L)

Segment	4.26.09	5.17.09	6.28.09	7.26.09	8.23.09	9.27.09	10.25.09	Mean
WREB27.8	8.5	9.8	11.2	11.2	12.3	13.8	21.3	12.6
WREB28.6	9.2	10.9	12.6	12.1	13.2	15.4	22.1	13.6
WREB0.78	10.9	11.4	14	11.8	14.8	17.6	9.4	12.8
WREB2.4	10.6	11.2	14	12	15.2	17.6	11	13.1
WRMB0.3	7.8	9.3	9.2	12.3	14.5	18	22.1	13.3
WRWB1.5	13.5	12.1	15	14.5	15	22.8	11.5	14.9
WR24.1	12.2	11.9	14.5	14	14.2	19.7	11.1	13.9
WR22.6	11.2	12.4	14.2	13.1	14.2	19.1	10.9	13.6
WR20.1	10.9	12.6	14	12.9	14	18.8	11.2	13.5
WR8.3	21.4	16	19.9	19.1	15.4	28.8	15.5	19.4
WR Canoe Access	NS	19.8	18	16.5	13.4	28.8	NS	19.3
BRB0.16	7.6	7.6	9.5	9.7	8.5	11.9	8.5	9
PTB1.3	11.8	13.4	16.9	15.9	15.4	19	13.8	15.2
LTR7.5	4.5	3.9	5.3	4.7	6.1	6.5	4.9	5.1
LTR4.8	8.9	10.4	11.2	10.2	11.4	14.5	11.2	11.1
LTR0.01	13.1	12.7	14	12	13.8	17.9	13.7	13.9
COB0.47	7.4	4	11.5	11	11.4	6.8	8.9	8.7
JACB0.01	31	26.8	29.8	27.8	30.4	25	18.1	27
ASHB0.3	43.3	45.8	50.4	46.9	52.1	35.9	29.6	43.4
PNDB3.3	28.7	29.8	33.1	27.2	35.4	37.9	29.1	31.6
PNDB0.01	35.8	35.1	36.5	33.8	38.9	35	30.7	35.1

[4] USGS, http://ma.water.usgs.gov/basins/westfieldgw.htm

CONCLUSIONS and LESSONS LEARNED

Water Quality

Additional water quality monitoring and bacteria source tracking is needed at the 11 sampling locations with *E. coli* single sample results in excess of primary contact standards. These rivers include: Main Stem, East Branch, West Branch, Rivulet Brook, Meadow Brook, Potash Brook, Bradley Brook, Little River, Jack's Brook, Ashley Brook, and Pond Brook.

On the East Branch at Gardner State Park, water quality continues to be poor. Results for Gardner State Park beach had high *E. coli* wet weather levels on May 18, 2009 (461.1 MPN/100 mls) and October 25, 2009 (866.4 MPN/100 mls). An upstream source has not been identified.

Daily temperature data should be collected at PNDB3.3 and PNDB0.01 on Pond Brook in Westfield to ensure it meets its proposed Class B Cold Water Fisheries designation. Single sample water temperatures above 20°C in June, July and August at PNDB3.3 and July and August at PNDB0.01 were recorded indicating it may not meet standards for Cold Water Fisheries.

Source tracking activities on the Little River should be coordinated with the City of Westfield and DEP WERO relative to Outfall #35 at South Meadow Street, at the confluence with the Westfield River due to the high potassium levels (4,200 mg/L) and *E. coli* values TNTC. DEP WERO's bacteria source tracking program on the Little River identified a storm drain in this area with dry weather flows indicative of raw sewage. A comparison of sampling site locations and data is needed to better determine if these results are from the same source.

In addition to the sites monitored under this project, the Westfield River Wild and Scenic Advisory Committee (WRWSAC) have documented through stream surveys and other observations a number of areas of concern within the watershed. Water quality monitoring relative to the following sites is also recommended:

- East Branch in Cummington: Observed excessive algae growth from Spring to Fall. Livestock and manure piles reported along river and tributaries. Informal swimming holes and river access throughout the river corridor. Tributaries to monitor include Rivulet and Meadow Brooks.
- East Branch, Chesterfield Bend: Extensive recreational use by local citizens. Stream Teams noted stenches at Rte 143 Bridge. Several homes with private septic systems in area.
- West Branch near Confluence with East Branch: Reports of stench of raw sewage at high and low flows, near Huntington center and Wastewater Treatment plant. Suspect pipe noted in 1999 Stream Team survey report. A put-in for whitewater canoe race close to this location.
- Westfield River Main Stem, Westfield: Although not in Wild & Scenic Designated reach, this location was reported to WRWSAC by an aquatic ecologist conducting mussel surveys in the Westfield River basin under contract with them. Toilet paper and

"sewage fungus" comprised of *Sphaerotilus natans*, a variety of other cells of algae (*Melosira, Fragilaria, Cymbella*), cyanobacteria filaments and a variety of ciliates confirmed at location 100 meters downstream of confluence with Little River.

Volunteer Coordination

Volunteer coordination and participation in the project was very successful. All monitoring sites were covered and good advance notification was provided by volunteers when there was a need to find substitutes due to vacation schedules, sickness or other conflict. Preparation and organization of coolers, monitoring equipment, and instruction materials by Westfield State College helped immensely in making volunteer work go smoothly. All volunteers received e-mail reminders about equipment pick up and sample drop off schedules well in advance of each sampling. One volunteer noted, "I enjoyed sampling and monitoring my sections of the river. After the first sampling run through, I had established my own routine and it was easy to do. The notebook has a good explanation of how to use the pH meter. I felt I had sufficient training and emails, the week before monitoring, were good reminders for me to schedule picking up the equipment."

Volunteers were surveyed post-sampling season to get feedback about the project from their perspective. Overall the volunteers expressed a positive experience and involvement in the project. The following comments reflect constructive feedback on how to improve upon volunteer coordination:

- Describe access to monitoring sites more fully in the QAPP, particularly including information regarding steep grades for accessing sampling locations. Similarly important, note whether beach area or other flat area exists at sampling location for convenient placement of sampling tools during sampling activities. This information can be especially helpful for volunteers who are substituting at a site for another volunteer. For example, at the Whippernon Golf Course site located 4.7 miles east of Huntington Center, there is a steep slope leading directly to deep, swiftly moving waters. At that site it is best to leave the cooler at the top of the slope above the monitoring site, and do the pH calibration there as well.

- Share water quality results directly with volunteers, via email, as data is available. Communication of data specific to a volunteer's site can engage volunteers more fully, and support development of a conservation ethic within the volunteer community.

Equipment

Minimal equipment gliches were encountered. Preparation of the sampling kits prior to pick up allowed volunteers to save time during pick up. Kits were ready and waiting 24 to 36 hours prior to the sampling date. This flexibility was important for volunteers to be able to work sampling into their schedules.

- The "Check-Mate" pH meters were very difficult to use and often did not work in the field. To address this problem, Westfield State College purchased YSI pH Meters from the U. S. EPA's Volunteer Monitoring Equipment Loan Program.

- The "freezer packs" did not hold the proper temperature. Ice was needed to retain proper temperatures in coolers until samples were brought to the lab.

- The sampling poles were very important, especially at time of high water. These were long, extractable poles with clamps at the end to hold sampling bottles securely.

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APPENDICES

APPENDIX A QAPP

APPENDIX B DATA

APPENDIX C SAMPLING LOCATIONS

APPENDIX D VOLUNTEER COORDINATION AND TRAINING

APPENDIX E PUBLIC OUTREACH AND TECHNOLOGY TRANSFER

APPENDIX F MATCHING GRANT DOCUMENTATION