

Connecticut River Bacteria Monitoring Project

**FINAL REPORT
604b Project # 2009-13/ARRA 604**

June 30, 2011

**Pioneer Valley Planning Commission
Prepared by Anne Capra, AICP, Principal Planner**

**In Partnership with the Connecticut River Watershed Council
and
Massachusetts Water Resources Center at UMASS Amherst**

**American Recovery and Reinvestment Act Funds
From
Massachusetts Department of Environmental Protection
604b Water Quality Management Planning Program**



EXECUTIVE SUMMARY

This study focused only on potential water quality impacts related to possible disease bearing organisms (*Escheria coli*). We did not attempt to examine other issues such as nutrient loadings, toxic substances, or other potential problems. All findings, conclusions and recommendations pertain solely to water quality related to use of the river for recreational purposes.

Our major findings are that relative to *E. coli* bacteria:

- *E. coli* levels by monitoring site were posted to the project website within 24 hours of sample collection <http://www.umass.edu/tei/mwwp/ctrivermonitoring.html>
- The more urbanized southern Massachusetts reach of the Connecticut River frequently exceeded primary contact recreation limits during wet weather and occasionally did so in dry weather at some sites. Site North End/Bassett Marina (MAC1) is of particular concern, as this site usually exceeded the contact limit, regardless of weather conditions.

Actual sources of bacteria loading have been identified in three tributaries and one source on the Connecticut River main stem as follows:

- Bassett Marina/North End Bridge on Connecticut River, Springfield – failing septic system
- Fort River, Hadley – probable dairy farm on Bay Road, Hadley
- Mill River, Florence – illicit connection at 16 Meadow Street, Florence
- Maple Brook, Greenfield – leaking municipal sewer siphon under Maple Brook culvert

As noted throughout the report, on-going bacteria source tracking activities are underway on nine of the eleven tributaries monitored:

- Mill River, Springfield
- Manhan River, Easthampton
- Fort River, Hadley
- Mill River, Hadley
- Mill River, Florence
- Sugarloaf Brook, Deerfield and Whately
- Bloody Brook, Deerfield
- Maple Brook, Greenfield
- Barton Cove, Montague and Gill Deerfield

The 2011 sampling season marks the fourth consecutive year of *E. coli* monitoring on the main stem of the Connecticut River. Funding for the project in 2008 and 2009 was provided by an EPA Targeted Watershed Initiative Grant to the Pioneer Valley Planning Commission. In 2010 and early 2011, funding provided by this MA DEP 604b Water Quality Planning Grant enabled the work to continue and perform bacteria source tracking on tributaries with potential illicit connections or other non-point sources. Beginning July 1, 2011, the project will continue the source tracking program and outreach to the public

with funding provided under the EPA Targeted Watershed Grant and grant from the Community Foundation of Western Massachusetts to the Connecticut River Watershed Council.

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DISCLAIMER / ACKNOWLEDGEMENT OF SUPPORT

This project has been financed with American Recovery and Reinvestment Act Funds from the Environmental Protection Agency (EPA) to the Massachusetts Department of Environmental Protection (the Department) under Section 604(b) of the Clean Water Act. The contents do not necessarily reflect the views and policies of EPA or of the Department, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

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INTRODUCTION

The Pioneer Valley Planning Commission (PVPC), in partnership with the Connecticut River Watershed Council (CRWC) and the UMass Water Resources Research Center (WRRC), has been conducting monitoring for *E. coli* bacteria in the main stem of the Connecticut River and fourteen (14) tributaries to the river between June and October of 2010, and April to June of 2011. Funding for the project was provided by the Massachusetts Department of Environmental Protection through a Section 604b Grant.

The Connecticut River is not meeting Class B, fishable/swimmable bacteria standards in many urbanized areas, in part due to elevated bacteria levels from combined sewer overflows (CSOs) and urban stormwater¹. Little information is available to the public on whether the river is safe for water-based recreation at any given location or time. Limited water quality sampling undertaken by consultants for the Connecticut River Clean-up Committee in the Holyoke-Springfield, MA reach of the river showed average *E. coli* bacteria levels during wet weather events of 7,480 colonies in Holyoke, 1,800 in Chicopee, and 1,267 in Springfield. These results were well above the single sample water quality upper limit of 126 colonies/100ml indicating impaired river water and failure to meet Class B water quality standards for recreational uses².

Monitoring funded under this 604b grant was a continuation of two previous years of monitoring funded through a U. S. Environmental Protection Agency Targeted Watershed Initiative (EPA TWI) Grant for the Connecticut River to the Pioneer Valley Planning Commission (PVPC). The EPA TWI Grant was awarded in partnership with the Franklin Region Council of Governments (FRCOG), the Connecticut River Joint Commissions (CRJC), and the University of Massachusetts Water Resources Research Center (WRRC). The EPA TWI project sampled 16 sites twice a week in two urbanized reaches of the river during the high-use summer recreation months of 2008 and 2009 - Massachusetts: Chicopee to Holyoke and Turners Falls to Greenfield; and one mixed urban/suburban/rural reach in New Hampshire and Vermont, from Lebanon and Wilder to Cornish and Weathersfield. All sites sampled were selected due to the high degree of use for swimming, boating, fishing and other river recreation at these locations. Samples were analyzed at four local wastewater treatment plants and a private laboratory. Data from this study can be found on the EPA TWI project website at

http://www.cesd.umass.edu/TWI/TWI_Projects/Water_Quality_Monitoring/index.html .

Our current 604b project is a continuation of the EPA TWI monitoring described above, collecting *E. coli* data for a 3rd (2010) and part of a 4th (April –June 2011) year. Sampling began in May 2010 and continued through June 30, 2011. The project defines three tiers of monitoring sites:

¹ Carr, Jamie W., Laurie E. Kennedy. October 2008. Connecticut River Basin 2003 Water Quality Assessment Report.

² Metcalf and Eddy. 1988. Long Term CSO Control Plans for Springfield, Holyoke and Chicopee.

Tier 1 Sites - Include nine sites along the main stem of the Connecticut River in Franklin, Hampshire and Hampden Counties, essentially the border with Vermont to the border with Connecticut. These are the same sites sampled in 2008 and 2009 in the EPA Targeted Watershed Initiative monitoring program.

Tier 2 Sites - Are defined as those selected for initial screening via bacteria sampling.

Tier 3 Sites - Are defined as Bacteria Source Tracking (BST) sites that are monitored because results from Tier 2 sites suggest contamination in the vicinity. These Tier 3 sites may either be those initially selected as Tier 2 sites, or they may be found at locations not previously identified in Table 6 of the Quality Assurance Project Plan³; they will thus be “new” sites to be added to Table 6. This means that some Tier 2 sites may “graduate” to Tier 3 status.

Tiers 2 and 3 monitoring sites are on tributaries to the main stem of the Connecticut River that are suspected to be contributing bacteria loading to the main stem based on the land uses within the watershed and /or documented water quality impairments. These tributaries were identified based on the bacteria levels at the main stem sites, guidance from the project Advisory Committee and DEP (WERO and DWM), and the results of the 2008 and 2009 bacteria monitoring under the EPA TWI project. Most of the Tier 2 tributary sites are water bodies where little or no data about bacteria has been collected in the past and thus baseline bacteria data is of great importance. Tier 2 sites on tributaries along the entire main stem of the Connecticut River in Massachusetts were monitored at least three times per site, no less than one week apart in time per site, over a 6 month period for bacteria “screening level” sampling. Tier 3 monitoring sites were identified specifically for bacteria source tracking along those Tier 2 tributaries where bacteria screening results indicate bacteria levels in excess of secondary contact standards for *E. coli*. Tier 3 monitoring sites may include pipe discharges or in-stream grab samples, frequency of sampling dependent on results.

³ *Quality Assurance Project Plan Version 1.0 for American Recovery and Reinvestment Act, Connecticut River Water Quality Monitoring Project 2009-13/ARRA 604, EPA RFA#10099, PVPC and Jerry Schoen, UMass Water Resources Research Center, April 27,2010.*

PROJECT APPROACH

Task 1 QAPP Development

The QAPP written by WRRC for the Tri-State Targeted Watershed Initiative (TWI) was used as a template and modified as follows:

- Sites and sampling schedules for bacteria and optical brightener monitoring were identified;
- A “roving site” monitoring strategy was articulated based on results from earlier sampling events to determine when and where additional follow-up sampling is advisable to locate (geographically) sources of high bacteria levels.
- SOPs for optical brighteners are included.

The QAPP, approved April 2010, is included in the Appendices.

Task 2 Volunteer Coordination and Training

WRRC, PVPC and CRWC held 2 training sessions for volunteer monitors, one for Franklin County reach and one for Hampden County reach, in early May of each of the two monitoring seasons (2010 and 2011). Training involved assembling monitoring kits for the volunteers and instructional packets including standard operating procedures for data collection. The trainings were held a few days prior to the first scheduled sampling event, and conducted partly as instruction in sampling methods and partly to schedule sampling dates and hand out equipment to volunteers. For volunteers unable to attend one of the two sessions each Spring, CRWC or PVPC staff provided one on one training.

PVPC oversaw coordination of the volunteers including solicitation of volunteers and monitoring site assignment for the main stem weekly sampling. CRWC coordinated volunteers for the Tier 2 and 3 sampling sites on tributaries in Northampton and sites in Franklin County.

For CRWC Tier 2 and 3 sites, volunteers were grouped into one of three “teams” based on geography of the sites: Maple Brook and Barton Cove was one group, Bloody Brook and Sugarloaf Brook was another group of sites, and the unnamed stream and Mill River in Northampton was the third site. Andrea Donlon accompanied volunteers on the first round of sampling for a given set of Tier 2 sample locations. After that first time, CRWC alerted volunteers to favorable weather conditions and they were able to go out themselves. On many occasions, however, the entire volunteer team was not available, so Andrea Donlon accompanied a volunteer.

Task 3 Site Selection

All sampling sites were selected due to the high degree of use for swimming, boating, fishing and other river recreation at these locations, and/or past recent E. coli results in excess of Massachusetts primary contact single sample standards (> 235 colonies / 100ml). Table 2 provides the location of CSOs on the Connecticut and Chicopee Rivers. This information was relevant to sampling site selection. Maps of the main stem sampling locations and all Tier 2 tributary sampling locations are included in the Appendices.

Prior to finalizing the Tier 2 sites, PVPC and CRWC contacted the local Departments of Public Works and/or Conservation Commissions to notify them of the project and seek input about monitoring sites, potential illicit connections, and location of stormwater outfalls.

Table 1 Main Stem Connecticut River Monitoring Sites

Site #	Site Name	Town	Site Rationale	Latitude*	Longitude
MAH1	Pioneer Valley Yacht Club	Longmeadow	Boat launch	42.063513	-72.59329
MAH2	Pynchon Point Park	Agawam	Fishing, picnic area, informal boat launch	42.0833	-72.585449
MAC1	North End Bridge/ Bassett Marina	Springfield	Boat Launch	42.1100833	-72.6128833
MAC2	Davitt Bridge/Granby Road	Chicopee	Fishing, boat launch	42.1504	-72.6069167
MAC3	Medina Street Boat Ramp	Chicopee	Boat launch	42.1533833	-72.6253833
MAH3	Jones Ferry River Access Center	Holyoke	Boat launch	42.172379	-72.629898
MAC4	Berchulski Fisherman Access	South Hadley	Boat launch	42.1945333	-72.59985
MAH4	Brunelle's Marina	South Hadley	Boat launch	42.2632	-72.5996333
MAG4	Barton Cove	Gill	Boat launch, picnic area, fishing	42.6015667	-72.5315

*Geo Coordinates Datum NAD83 / WFS84

Table 2 CSO Discharge on Main Stem of Connecticut River⁴

Town/City	Receiving River	# of CSO Regulators discharging Untreated CSO with no "CSO Level of Control" *	# of other CSO Regulators designed to meet "CSO Level of Control"*	Estimated Annual Volume of <i>Untreated</i> CSO Discharge, Million Gallons (MG)/year
Franklin County				
Montague	Connecticut River	0	3 (3 MG/yr of <i>Treated</i> CSO)	<1 MG
Hampshire County <i>The last 3 CSO regulators (South Hadley) were eliminated as of December 31, 2007</i>				
Hampden County				
Ludlow**	Chicopee River	1	0	< 1 MG
Palmer***	Ware River	5	0	< 1 MG
	Quabog River	1	0	< 1 MG
Chicopee	Chicopee River	16	0	116 MG
	Connecticut River	12	1 (150 MG/yr of <i>Treated</i> CSO)	111 MG
Springfield	Chicopee River	0	4	< 1 MG
	Mill River	0	7	2-20 MG
	Connecticut River	12	0	423 MG
Holyoke	Connecticut River	12	2 (300 MG/yr of <i>Treated</i> CSO)	255 MG
TOTAL		59	17 (Including 453 MG/yr of <i>Treated</i> CSO to CT River)	790 MG/yr - CT River 120 MG/yr – Chicopee River

* "CSO Level of Control", for the purposes of this Table, is 4 Untreated CSO Discharge events per year, or less.

**K. Boisjolie noted that the one remaining CSO in Ludlow was eliminated July 1, 2010.

***The 6 remaining CSO's in Palmer are scheduled to be eliminated in 2011.

⁴ Western MA Combined Sewer Overflow (CSO) Regulators, Status as of March 2010, MA DEP – WERO, K. Boisjolie

Task 4 Sample Collection and Source Tracking

Tier 1 sites were sampled on Wednesday mornings between 6 and 9:30 am during wet or dry weather. Samples were delivered to lab at the Holyoke Waste Water Treatment Plant for analysis by 10am. Sampling results were posted to the project website by the following Thursday afternoon at www.umass.edu/tei/mwwp/ctrivermonitoring.html. The sampling day was selected due to the availability of the lab to process samples on Wednesdays. Posting the data by Thursday afternoon then provided end of the week / weekend river recreational users to be informed about recent *E. coli* levels.

Tier 2 sites were sampled during dry weather events only, as defined as <0.1" of rain within 24 hours prior to sampling. PVPC and CRWC tracked precipitation rates to determine dry versus wet weather sampling events. For purposes of distinguishing wet weather sample collections from dry weather events, a value of 0.1" rain in the 24 hours prior to sampling was chosen as the minimum qualifying amount. Rainfall data was obtained from records contained on the weather underground web site (www.wunderground.com). Data from these stations was reviewed for day of sampling (taking care to note start time and duration of rainfall, in order to ascertain that rainfall occurred prior to time of sampling) and the previous day. Wet/dry designations were assigned to each site. In almost all cases, wet/dry conditions for sites within a reach were uniformly wet or dry for a given sample date. Out of nineteen sample events on the main stem of the Connecticut River, three were wet weather and sixteen were dry weather.

Table 3 Weather Stations

Weather Station	Station Code	Sample Site Location
North Thompsonville, Enfield, CT	KCTENFIE5	Longmeadow & Agawam
Easthampton	KMAEASTH2	Holyoke
South Hadley & Surrounded by Trees	KMASOUTH10	South Hadley
Near Szot Park, Chicopee	KMACHICO6	Chicopee
Weather at NMH, Northfield Mount Hermon	KMAMTHER2	Gill

Tier 2 sites were sampled at least three times during the 2010 and spring of 2011 sampling season. If sampling results exceeded single sample *E. coli* levels on one or more sampling event, source tracking measures were instituted. Source tracking involve: 1) sampling at Tier 3 sites to bracket the source; 2) limited visual stream surveys; and, 3) communications with the local Conservation Commission, Department of Public Works, or other town board/department to gain insight about land uses and probable bacteria sources. Results of all source tracking activities are discussed in detail under the Results Section of this report.

Air and water temperatures were collected at the sites as well as visual observations about the sampling location, i.e. water color, smell, turbidity, trash, wild fowl, etc. These observations were noted on the field data sheets and are included in the Appendices.

Task 5 Lab Analysis

Escherichia coli

All Tier 1 samples were analyzed for E. coli bacteria at the municipal wastewater treatment plant lab in Holyoke (HWWTP), operated by Suez/United Water, utilizing EPA SOP 1603 for membrane filtration. Tier 2 and 3 sites collected by CRWC were analyzed at CRWC's lab in Greenfield utilizing the Colilert system, from Standard Methods 9223B. Tier 2 and 3 sites collected by PVPC were analyzed at the HWWTP during May – September 2011, and at CRWC in October 2011 through June 2012.

Participating labs sent electronic copies of sampling results to WRRRC upon completion of sample analyses. WRRRC posted water quality data on the project web site within one day of completion of laboratory analyses.

Optical Brighteners

Optical brightener testing is a way of determining whether or not laundry detergents are entering a water body-either through a direct discharge or after traveling through the ground from a septic system that may be functioning poorly. Optical brightener testing can be used as a screening tool to separate areas with elevated bacterial counts due to inputs from human sources (septic systems or cross connections) as opposed to domestic animals, pastured animals or wildlife. Human from animal waste sources can be screened using OB by deploying the test pads in storm drains or small feeder streams.

Besides laundry detergents some other materials may also cause positive results. These include metal particles, bleached materials, cotton dust, or paper products. It is important that the unbleached cotton pads are not exposed to these contaminants via aerial deposition or by physical contact-such as placing the pad down on paper, particularly if either is wet, which allows the optical brighteners to leach out.

Dry weather flows at piped outfalls may be field screened for optical brighteners (OBs). A tentative list is provided in Table 6.1 of the QAPP, but specific sites are to be determined via prior field inspection, and during Tier 3 sampling.

CRWC completed a single round of optical brightener testing along the underground portion of Maple Brook in Greenfield. CRWC River steward worked with one of the CRWC volunteers to identify sites, place the pads in catch basins, and retrieve them after a period of four days. Standard operating procedures (SOPs) as identified in the QAPP were followed. White cotton pads without optical brightener from VWR Inc. were used. Pads were inserted into an 8½ x 12½-inch plastic mesh bag (typically used for vegetables or shellfish) purchased from Volm Companies, Inc. of Wisconsin. Pads were weighed down with small rocks, and the pads were stapled onto the mesh. The staples were determined to be inconvenient during the removal process. A bag with a pad was lowered down a

storm drain using fishing monofilament, and affixed to the metal grate of the catch basin by tying. Prior to going out in the field, all supplies and equipment were tested for optical brightener contamination by shining a black UV light over each item.

Task 6 Outreach and Education / Technology Transfer

In March of 2010, PVPC and CRWC sent letters to the Department of Public Works and Conservation Commissions in each town within the target sampling areas. Letters informed local officials about the start of the project, the type of data to be collected, sites/ivers to be monitored and requested any information they may have about potential illicit connections as well as their stormwater drainage systems. PVPC and CRWC followed up with phone calls and interviews to review local maps and gather pertinent information.

Sampling results were posted to the project website at www.umass.edu/tei/mwwp/ctrivermonitoring.html . As noted above, this website was established under the EPA TWI grant and also included data for the main stem Connecticut River sites from 2008 and 2009. Numerous press releases were issued throughout the project duration to promote awareness of the project website and the availability of the data. Although we do not know the extent to which this data reached recreational river users in the target area, we do know the data was being used by professionals in the region. For example, at an open space and recreation plan visioning session for the Town of Williamsburg on September 28, 2010, a representative of the Mill River Greenway Coalition referenced the *E. coli* data collected for the section of the Mill River in Florence. The representative further informed the audience that there is “lots of *E. coli* data for other rivers in the region including the Connecticut River on the project website”.⁵ WRRRC received calls from Turners Falls High School and Northampton High School about using the data for school projects.

⁵ Capra, Anne. Pioneer Valley Planning Commission. Noted while facilitating the Williamsburg Open Space and Recreation Plan Visioning Session.

RESULTS

Quality Control Results

Quality control results can be found in the Appendices. CRWC ran field replicate samples and lab duplicates for each sampling event. Of 13 field replicates, all were <24.9% relative percent difference (RPD) with most < 10%. For two sites, the result was 1 or less and the replicate was 13 or less, resulting in a RPD of 200%. However, given the actual counts were only 1 to 13 colonies, this does not indicate any quality concerns.

All main stem samples were analyzed by the Holyoke Waste Water Treatment plant (HWWTP). A field duplicate and lab blank were run for quality control. Except for the first sample event on 6/2/10, the RPD for the field duplicates were <28%.

As part of the quality control program to ensure results were comparative between the two labs and different methods being utilized for e. coli analysis, split samples were run on 7/19/10 and 10/12/10. In the July QC split, the RPD between the CRWC lab and HWWTP lab remained within an acceptable RPD which did not exceed 19.5% for the three sampling sites (FRH1, FRH7 and FRH9). However, it was noted that results from HWWTP were consistently lower than CRWC's results.

To ensure that results and methodologies were producing consistent results between the two labs, we ran another split on October 12, 2010. This time we also engaged a third lab, the Greenfield Waste Water Treatment Plant (WWTP). Greenfield participated as the analysis lab in 2008 and 2009 for E. coli analysis under the EPA TWI grant. The Greenfield WWTP lab utilizes the same EPA 1603 method that the Holyoke WWTP utilizes, therefore eliminating any inconsistencies that might exist between the Colilert method and the EPA 1603 method. One 500 ml sample was collected in the field at each location. The sample was taken back the Greenfield WWTP, shaken to ensure a well-mixed sample, and poured off into three sample bottles, one for each lab. This method ensured a homogenous sample for each of the labs to analyze.

Results from QC split amongst the three labs indicated a significant under counting at the Holyoke WWTP lab as noted in the results found in Table 4.

Table 4 Split QC Results

10/12/2010	Blank	FRH1	FRH2	FRH5	Method
CRWC		461.1	2419.6	93.3	Colilert
Holyoke WWTP	0	255	835	84	E. coli Enumeration via m-TEC, EPA 1603
Greenfield WWTP	0	300	2533	73.3	E. coli Enumeration via m-TEC, EPA 1603
7/19/2010		FRH1	FRH7	FRH9	
CRWC		547.5	307.6	119	Colilert
Holyoke WWTP		178	123	172	E. coli Enumeration via m-TEC, EPA 1603

PVPC discussed the results with the Holyoke WWTP lab director and technician to determine how such significant discrepancies in a field duplicate could have occurred. It appears that Holyoke was not adhering to the SOP for EPA 1603 and did not “prep” agar plates to result in counts of 80 cfu or less. Instead they have consistently been counting full 100ml samples. According to the EPA 1603 method, counts over 80 cannot accurately be counted. It was therefore determined that results from the Holyoke lab were likely accurate for lower counts. However, for higher counts, limit undetermined, it is not possible to know exactly how high those counts were. Although this discrepancy does call into question the validity of the data from the WWTP lab, the project partners believe that the data does reflect a trend indicative of whether or not a water quality violation exists at a site. How severe the violation may be at any given sample event cannot be accurately determined based on the lab’s violation of standard operating procedure. Due to this occurrence, PVPC will no longer be utilizing the Holyoke WWTP lab and will be sending all samples to the CRWC’s lab in Greenfield for the 2011 sampling season.

Weather Data

A major study question was the impact that wet weather has on bacteria levels in the Connecticut River, particularly at the high-use recreational access points selected as sampling sites. For purposes of distinguishing wet weather sample collections from dry weather events, a value of 0.1” rain in the 24 hours prior to sampling was chosen as the minimum qualifying amount. Rainfall data was obtained from records contained on the weather underground web site (www.wunderground.com). Out of nineteen sample events on the main stem of the Connecticut River, three were wet weather and sixteen were dry weather.

E. coli Data Results

Collectively, the data supports the finding that the Connecticut River is adversely affected by polluted runoff during wet weather events in the Southern Massachusetts reaches, preventing the river from supporting contact recreation during wet weather. Table 6 notes the number of times the primary contact level for a single sample was exceeded (>235 colonies /100ml). As identified in Table 6, site MAC1 known as Bassett Marina/North End Bridge consistently violated water quality standards in both dry and wet weather. PVPC began source tracking activities at this location in August 2010.

Table 5 Massachusetts Criteria for E. coli (Escherichia coli; units = colonies/100ml)

Geometric mean¹	Single sample maximum	Appropriate Recreational Use
≤ 126	235	Suitable for primary and secondary contact (Class B)
> 630	1260	Unsuitable for primary and secondary contact recreation (Class C)

1. Geometric mean of 5 or more samples taken within the same bathing season for bathing beaches, otherwise samples taken within most recent 6 months.

Table 6 Number of times primary contact limit exceeded

SITE	2010	
	WET	DRY
MAH1	1/3	0/16
MAH2	1/3	1/16
MAC1	3/3	7/16
MAC2	1/3	0/16
MAC3	0/3	1/16
MAC4	0/3	1/15
MAH3	0/2	0/16
MAH4	0/2	0/15
MAG4	0/3	0/14

**number of exceedances / number of sampling events (dry or wet)*

Dry Weather

Table 7 E. coli Levels at Tier 1 Sites During 2010 Dry Weather Monitoring Events (colonies/100ml)

Tier 1 Sites Dry Weather	Site Codes	6/2/10	6/9/10	6/16/10	6/30/10	7/7/10	7/14/10	7/21/10	7/28/10	8/4/10	8/11/10	8/18/10	8/25/10	9/1/10	9/8/10	9/15/10	9/22/10
Pioneer Valley Yacht Club, Longmeadow	MAH1	21	65	51	146	27	122	37	38	26	108	18	48	154	21	26	5
Pynchon Point Park, Agawam	MAH2	170	108	107	290	126	85	29	31	111	96	6	170	134	80	46	104
North End Bridge/Bassett Marina Boat Launch, Springfield	MAC1	159	113	136	TNTC	433	190	139	223	90	120 6	41	555	275	467	425	100
Davitt Bridge / Granby Rd, Chicopee	MAC2	102	114	89	82	117	150	129	126	106	109	3	77	100	81	57	57
Medina St. Boat Ramp, Chicopee	MAC3	25	86	43	162	51	43	46	35	24	110	18	44	31	348	12	15
Berchulski Fisherman Access, South Hadley	MAC4	63	115	51	91	110	52	58	67	43	121	85	NS	108	300	41	33
Jones Ferry, Holyoke	MAH3	17	42	18	133	25	39	30	22	25	54	51	84	37	50	40	20
Brunelle's Marina, South Hadley	MAH4	84	63	33	58	19	7	12	13	9	NS	12	53	20	4	3	7
Barton Cove, Gill	MAG4	63	65	80	17	98	114	23	12	35	224	2	NS	NS	21	3	9

Wet Weather

Table 8 E. coli Levels at Tier 1 Sites During 2010 Wet Weather Monitoring Events (colonies/100ml)

Tier 1 Sites Wet Weather	Site Codes	6/23/2010	9/29/2010	10/6/2010
Pioneer Valley Yacht Club, Longmeadow	MAH1	242w	126w	28w
Pynchon Point Park, Agawam	MAH2	369w	200w	78w
North End Bridge/Bassett Marina Boat Launch, Springfield	MAC1	TNTCw	TNTCw	TNTCw
Davitt Bridge / Granby Rd, Chicopee	MAC2	145w	121w	450w
Medina St. Boat Ramp, Chicopee	MAC3	140w	115w	107w
Berchulski Fisherman Access, South Hadley	MAC4	131w	86w	144w
Jones Ferry, Holyoke	MAH3	71w	NS	89w
Brunelle's Marina, South Hadley	MAH4	180w	230w	NS
Barton Cove, Gill	MAG4	186w	171w	33w

Bassett Marina/North End Bridge, Springfield (MAC1)

In August 2010, PVPC contacted the Springfield Water and Sewer Commission (SWSC) to discuss the high E. coli results at Bassett Marina. This site is known to be downstream of several CSOs in Holyoke, Chicopee and Springfield. Given this, wet weather water quality violations were expected but not dry weather violations as well. It was suspected that a possible dry weather overflow may be occurring, so the investigation started with closest CSO sources since upstream sites did not exhibit this high level of bacteria contamination. It was also believed that the marina was privately owned and on city sewer.

In September 2010, SWSC conducted deed research to determine the owner of the marina and performed dye testing at the marina boat house to determine if the facility was connected to the municipal sewer system. The dye testing indicated that the site was not connected to the sewer system, however no dye turned up in the river indicating that an on-site septic system existed and was functioning. SWSC also determined per its deed research that this site was owned by the City of Springfield and that Bassett Marina held a long term lease that was due to expire in 2011.

In November 2010, the City of Springfield hired GZA consultants to locate the septic system and perform a full inspection for the facility. The tank was unearthed and found to be full of solid materials with little free water. The leach field is located under the driveway and not vented. In conclusion, GZA determined the septic system was in poor condition, does not meet current State environmental codes, and is in close proximity to the Connecticut River. Due to the proximity to the river and the permitting challenges repair or replacement of the septic system would incur, GZA recommended the City pursue connection to the sewer operated by SWSC long the adjacent West Street. The City of Springfield has adopted GZA's recommendations and has currently initiated design for the construction of a sewer connection for this location. Design was completed in June 2011. The sewer connection is planned for August/September 2011.

Plan for 2011

PVPC will continue to monitor MAC1 during and post sewer connection to determine if the proposed remediation efforts conclusively identify the septic system as the source, and improved water quality is observed.

Tributary Monitoring Sites (Tier 2 and 3)

Barton Cove, Montague and Gill

Barton Cove was selected as a “tributary” site because weekly sampling at the state boat ramp at Barton Cove during 2008 and 2009 under the EPA Targeted Watershed Initiative indicated that the site had intermittently high bacteria levels. Project partners thought it would be useful to try to identify bacteria sources in Barton Cove. Four sites around the cove were selected, as follows:

CTRG1: Franklin County Boat Club, most downstream dock, Gill

CTRG2: First Light dock at Barton Cove campground access road, Gill

CTRG3: Unity Park, furthest upstream location, Montague

CTRG4: Unity Park parking area near former bridge abutment, Montague

CRWC visited each site three times during the 2010 season, results in Table 9.

Table 9 Barton Cove Bacteria Sampling Results 2010

Site ID	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL
CTRG1	7/7/10	<1.0	8/12/10	1	9/1/10	2
CTRG2	7/7/10	1	8/12/10	6.3	9/1/10	2
CTRG3	7/7/10	30.5	8/12/10	67.7	9/1/10	38.4
CTRG4	7/7/10	9.7	8/12/10	10.7	9/1/10	4.1

All samples had surprisingly low bacteria results. No further source tracking activities were deemed necessary. Weekly sampling at the state boat ramp also had very low bacteria results, even during wet weather. We don’t know if a bacteria source was eliminated between 2009 and 2010. The only other major thing that we know that was different about 2010 was that Northfield Mountain Pumped Storage Project was off line between May 1 and November 22, 2010. This meant that the Connecticut River above Turners Falls was not fluctuating as widely on a daily basis, but it is unclear how this would have affected bacteria levels in this area.

Update for 2011

The weekly monitoring results for the Barton Cove state boat ramp have had several high readings in 2011, after being consistently low in 2010. CRWC collected one round of samples at Tier 2 sites around the cove as well as at the weekly site (MAG4). All samples had low bacteria counts, except for MAG4 that day. CRWC then sampled at three additional sites on the state boat ramp property on a weekly

sampling day to get a better sense of the on-site bacteria readings. All were high, with some variation. CRWC observed a storm drain structure at one edge of the property, and we will try to find out more information about this unit. If this drainage structure is not a source, it is possible that there is a failed septic system nearby, or that there is something about the configuration of the Cove in that location in which bacteria from geese and other sources tends to congregate there and not elsewhere. This bacteria source remains unidentified at the end of the 604b grant period, but CRWC may do some further work under a different grant later in 2011.

Maple Brook, Greenfield

Maple Brook is a tributary to the Green River in Greenfield. It is a natural stream, but is underground through most of its distance and it also receives the majority of stormwater runoff from the urbanized portion of central Greenfield. Therefore, sewer lines and other utilities cross through it or run along the inside of it underground. Maple Brook daylight close to its confluence with the Green River off Colrain Street just downstream of the former Wedgewood Gardens trailer park, a parcel now owned by the Town of Greenfield and the site of a future car-top access point. Historically, Maple Brook has had consistently high bacteria levels, with some sources being fixed by the town. In 2009, the MassDEP bacteria source tracking team measured high bacteria here. A 1998 bacteria source tracking study also identified Garfield Street as a definite source. This study was performed by J. Skalka at UMass (Masters Project) for the Deerfield Watershed Team.

CRWC wanted to confirm that levels were still high and try to help the town identify any bacteria sources. One site was selected for sampling, as follows:

MBG1: Maple Brook near the confluence with the Green River.

CRWC visited this site three times during the 2010 season. Results are shown below.

Table 10 Maple Brook Bacteria Sampling Results 2010

Site ID	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL
MBG1	7/7/10	>2,419.6	8/12/10	986.7	9/1/10	>24,196

This site had consistently high bacteria levels. As an attempt to better identify bacteria source areas, optical brightener testing was initiated in the underground portion of Maple Brook. CRWC met with a staff person of the Greenfield Department of Public Works who provided CAD maps of good sampling locations along the main stem of Maple Brook. Cotton pads were set out at eight storm catch basins on Thursday, August 26, 2010 and retrieved four days later on Monday, August 30, 2010. Pads were hung to dry and read using a hand-held UV lamp to determine if they fluoresced. Results are summarized in Table 11.

Table 11 Optical brightener results, Maple Brook, August 26-30, 2010

Site ID	Location	OB Result	Notes
MBG-OB-01	53 Conway St., E side of St.	Negative	Rank odor
MBG-OB-02	1 Arch Place in front of Unity in the Pioneer Valley	Negative	
MBG-OB-03	159 Davis St., E side of St.	Negative	
MBG-OB-04	14 &16 Garfield St., S side of St.	Definite positive	Sewer smell and pad soiled with sewage
MBG-OB-05	131 Franklin St., E side of St.	Negative	
MBG-OB-06	Near 19 North St. & Baystate parking lot	Negative	Pad stained reddish
MBG-OB-07	101 Maple St, N side of St.	Mottled positive	
MBG-OB-07dup	101 Maple St, N side of St.	Mottled positive	
MBG-OB-08	W of 37 Beacon St., N side of St.	Negative	

Figure 1. Dried optical brightener pads ready for analysis on September 2, 2010



There was one clear “hit” at Garfield Street and one potential positive at Maple Street. During a meeting with the Greenfield DPW, it was determined that a red-stained pad found on North Street may have been due to a former rouge factory in that area. The DPW thought that all rouge sediments had been removed, and they planned on investigating this further.

Plans for 2011

CRWC met with staff from the Greenfield Department of Public Works (DPW) in February of 2011 and presented the bacteria and optical brightener testing results from Maple Brook. DPW staff felt that dry weather winter testing at catch basins would help identify certain problem areas and would minimize any effect of wildlife bacteria skewing results (less wildlife activity in the winter).

CRWC did extensive testing along Maple Brook during the spring of 2011, with the assistance of Greenfield DPW staff for sample site identification using CAD drawings and opening manholes and storm drain grates. After several rounds of sampling, a bacteria source was identified within a short distance between the CVS parking lot off Federal Street and a manhole near 3 Maple Street. All samples of Maple Brook downstream of Maple Street tested very high. Greenfield DPW did televising and dye testing in that area, and identified a sewer siphon leaking under the Maple Brook culvert. Greenfield is in the process of getting a short section of that sewer lined. Sandy Shields, Greenfield’s DPW director, has informed MassDEP’s western regional office of this situation. Once that section of sewer is lined, CRWC will do another round of testing (under a different grant) downstream to see if there are other sources in Maple Brook.

Bloody Brook, Deerfield

Bloody Brook is a tributary to the Mill River (Hatfield) and runs through much of South Deerfield. MassDEP collected several samples at the BBD1 site (Whately Road) and got a reading of 960 counts/100mL on September 9, 2009. Other earlier studies had also identified bacteria being a problem along Bloody Brook. Five Tier 2 sites were selected, and four Tier 3 sites were later sampled, as follows:

Tier 2 sites

BBD1: Whately Road, along N-S running segment. Upstream side of the bridge

BBD2: A northern tributary of Bloody Brook at Conway Street, north side of street

BBD3: Routes 5 &10, west side of road

BBD4: Pleasant Street, south side of road

BBD5: Captain Lathrop Drive, south side of street

Tier 3 sites

BBD2.1: Northern tributary of Bloody Brook, upstream side of Route 116 near field

BBD2.2: Northern tributary of Bloody Brook, east side of Routes 5 & 10

BBD3.1: Bloody Brook behind library, upstream of culvert to school

BBD4.1: Bloody Brook, just downstream of Kelleher Drive

CRWC visited each Tier 2 site three times during the season, and tier 3 sites once. Results are in Table 12.

Table 12 Bloody Brook Bacteria Results 2010

Site ID	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL
BBD1	8/4/10	71.7	9/1/10	152.9	9/21/10	67
BBD2	8/4/10	>2,419.6	9/1/10	7,269.9	9/21/10	1,202.3
BBD2.1	10/20/10	139.6				
BBD2.2	10/20/10	235.9				
BBD3	8/4/10	727.0	9/1/10	547.5	9/21/10	206.4
BBD3.1	10/20/10	866.4				
BBD4	8/4/10	579.4	9/1/10	488.4	9/21/10	461.1
BBD4.1	10/20/10	517.2				
BBD5	8/4/10	N.S.	9/1/10	275.9	9/21/10	248.1

Note: N.S. = not sampled

BBD1, a site that the MassDEP bacteria source tracking team had identified as having high readings, was consistently low. We later found out through the Deerfield Health Agent, Richard Calisewski, that two nearby failed septic systems had been repaired in 2008 and 2009, and he attributed the difference to these repairs. BBD2 was consistently high. This is along a northern tributary to Bloody Brook. Tier 3 sampling upstream of this site produced low results. We suspect that there is a failing septic system at the house adjacent to the sampling site. BBD3 and 4 had fairly high readings. One round of tier 3 sampling indicated high readings at these sites, but identified no particular source area. More work in this area will happen in 2011. BBD5 had two readings that were slightly higher than the MA state water quality criteria for E. coli.

2011 Update

CRWC met with the Deerfield Health Agent, Richard Calisewski, in February of 2011 and presented the bacteria results from Bloody Brook. He agreed with our assessment of the failed septic system on Conway Street at BBD2, and said that he could not do anything unless a formal complaint was filed, and even then, his options may be limited. He thought the high bacteria readings at BBD3, BBD3.1, BBD4, and BBD4.1 were likely due to sewer line exfiltration. He said that the municipal sewer line is roughly parallel to Bloody Brook and the sewer line has well known I/I (infiltration and inflow) problems during rain events. He thought, during dry weather like that experienced in 2010, water could go the other way

– water from the sewer pipe may leak out and get into the river. He also thought that there may be manure spread in the vicinity of BBD4.

CRWC collected one additional round of samples at all the Tier 2 sites and several tier 3 sites along Bloody Brook in 2011. One site that consistently tested low in 2010 was now high, BBD1 on Whately Road. Another site that was consistently very high last year was now low, BBD2 on Conway Street. Other sites on the main stem of Bloody Brook were not quite as high as last year. Stream levels this year are higher than last summer because we have had more rain. It is possible that the difference in water levels is contributing to this difference. For example, if infiltration from the nearby sewer line was contributing to bacteria in the stream last year, perhaps the hydrology has created different conditions this year. An east branch of Bloody Book off Hillside Road tested high in 2011 and this site is worthy of some follow up because we had never tested it before.

CRWC met again with the Deerfield Health Agent, and tried to schedule a time to go out with him in the field, but a medical condition prevented him from being able to. CRWC's phone calls to a Deerfield Select board member were not returned.

Sugarloaf Brook, Deerfield and Whately

Sugarloaf Brook is a tributary to the Connecticut River, starting in South Deerfield center and flowing towards Whately. It discharges to the Connecticut River at Herlihy Park in Whately. The MassDEP bacteria source tracking team identified this brook as one that had never been sampled, but might be interesting to look at. CRWC was aware that Chang Farms had been illegally discharging its wastewater into this brook without a NPDES permit, and in 2006 the facility was formally given a permit and required to pipe waste from their bean sprout operation to the Connecticut River. Six Tier 2 sites were selected, and one Tier 3 sites were later sampled, as follows:

Tier 2 sites

SBW1: Herlihy Park in Whately, across from the pitching cage, through the woods, and down the bank.

SBW2: Sugarloaf Street extension, Whately

SBW3: Route 116, Deerfield across road from MassHighway garage

SBW4: Thayer Street, Deerfield, downstream side of road

SBW5: Sugarloaf Street, South Deerfield. INACCESSIBLE; never sampled

SBW6: Graves Street, South Deerfield. DRY during summer; never sampled.

Tier 3 sites

SBW1.1: River Road, Whately. Downstream of culvert on east side of road.

CRWC visited each Tier 2 site (with the exception of SBW5 and 6 as explained above) three times during the season, and the tier 3 site once. Results are shown below.

Table 13 Sugarloaf Brook bacteria results 2010

Site ID	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL
SBW1	8/4/10	209.8	9/1/10	235.9	9/21/10	131.4
SBW1.1	10/20/10	238.2				
SBW2	8/4/10	325.5	9/1/10	290.9	9/21/10	80.9
SBW3	8/4/10	91.0	9/1/10	108.6	9/21/10	104.6
SBW4	8/4/10	461.1	9/1/10	155.3	9/21/10	67

Several readings were a bit higher than the MA state water quality criteria for E. coli (235 cfs/100 mL for a single sample), with the highest reading at 461.1 on 8/4/10 at SBW4 at Thayer Street. One sample along River Road also did not yield high results.

Plans for 2011

CRWC will collect at least one more sample at SBW4 and may follow the stream upstream at this location and collect between one and three additional samples. CRWC will also consult with the Deerfield Health Agent about this site.

Unnamed Stream Near Elwell Island, Northampton

“Unnamed stream near Elwell Island” is a tributary to the Connecticut River in Northampton that is underground for most of its distance and then runs into the Connecticut River near Elwell Island just upstream of the Norwottuck Trail bike path bridge. The stream flows under the industrial park in Northampton. To our knowledge, there is no name for this stream. The MassDEP bacteria source tracking team identified this stream as one that had never been sampled, but might be interesting to look at. CRWC met with the stormwater coordinator for Northampton and learned that there are two branches of this stream that come together just upstream of where it daylights. We decided to sample at the accessible location where it daylights. If we got high bacteria readings, we would call the Northampton DPW to assist with pulling manholes to sample the two branches. One Tier 2 site was sampled three times, as shown below:

Table 14 Unnamed Stream near Elwell Island bacteria results 2010

Site ID	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL
USN1	7/13/10	206.4	8/12/10	21.3	9/15/10	2

Our results varied quite a bit, but were consistently in compliance with Massachusetts Surface Water Quality standards for bacteria. On one occasion, we detected a chemical odor, but our testing for bacteria would not address that issue. We did not do any Tier 3 sampling at this location.

Plans for 2011.

We have no plans to do additional monitoring at this site.

Mill River, Hadley and Amherst

The Mill River watershed is used largely for agricultural purposes in Hadley. The portion of the Mill River in Amherst is within the UMASS campus, drains the Campus Pond, receives treated wastewater discharges from Amherst's Waste Water Treatment Plant, and drains dense residential neighborhoods in Amherst. An abundant population of Canada geese congregate at the Campus pond, potentially contributing to water quality problems. Lake Warner, located close to the Mill River's confluence with the Connecticut River is a listed impaired water body.

The lower Mill River in Hadley at Mill Site Road and North Hadley Road had three dry weather exceedances. Given the multiple potential sources, it is difficult to determine the source at this time.

Table 15 Mill River (Hadley and Amherst) Bacteria Results 2010

Site ID	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL
MRH2	6/25/10	258	7/19/10	238		
MRH5	6/25/10	318	7/19/10	191	8/9/10	42
MRH8			7/19/10	157		
MRH13	6/25/10	34	7/19/10	13	8/9/10	56

2011 Update

PVPC sampled MRH2, MRH 11, MRH12, and MRH13 on June 7, 2011. MRH2 at Mill Site Road was 248 MPN/ 100 ml, consistent with the previous samples results, just over the standard limit for the geomean. MRH11 at Meadow Street west (draining a tributary from coming from the northwest corner of Hadley and Sunderland) was 648 MPN/100ml. Further source tracking activity needs to be conducted up this tributary which appears to be a potential source.

Mill River, Florence section of Northampton

The Mill River is a tributary to the Connecticut River. Its headwaters are in Goshen and it runs through Williamsburg and then Northampton, discharging into the Oxbow of the Connecticut River in Northampton. It has multiple dams along the way, the last one at Smith College, and its lower section used to run through downtown but was re-routed by the U.S. Army Corps of Engineers after major floods in the 1930s. The Massachusetts DEP bacteria source tracking team measured high bacteria counts at the Clement Street crossing in 2008, but had one low result in 2009. DEP had found low counts at Bliss Street and Meadow Street bridges. A stormwater outfall pipe near Meadow Street had very high counts in 2009, and the City of Northampton subsequently found a house with its sewer line incorrectly connected to the storm drain line. This source had since been eliminated, but CRWC was encouraged by the Northampton DPW to sample this location again to see if there were additional sources. Four Tier 2 sites were selected, and five Tier 3 sites were later sampled, as follows:

Tier 2 sites

MRN1: Clement Street bridge crossing, sampled upstream side of bridge on river right.

MRN2: Bliss Street bridge crossing, sampled upstream of bridge on river right.

MRN3: Meadow Street bridge crossing, sampled upstream of bridge on river left

MRN3.1: Stormwater outfall downstream of Meadow Street bridge on river left

Tier 3 sites

MRN2.1: Mill River, river left off Pine St park

MRN2.2: Florence Stream, in trench near Ryan Rd

MRN2.3: Storm drain pipe off Pine St across from Arts & Industry Building loading dock

MRN2.4: Small upstream channel just upstream of dam, river left

MRN2.5: Mill River, outfall on river right just upstream of Pine St bridge

CRWC visited each Tier 2 site three times during the season, and tier 3 sites once. Results are shown below.

Table 16 Mill River Northampton Bacteria Results 2010

Site ID	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL
MRN1	7/13/10	135.4	8/12/10	79.8	9/15/10	60.2
MRN2	7/13/10	488.4	8/12/10	307.6	9/15/10	770.1

MRN2.1	9/15/10	613.3	10/26/10	110		
MRN2.2	10/26/10	3.1				
MRN2.3	10/26/10	>2,419.6				
MRN2.4	10/26/10	2,419.6				
MRN3	7/13/10	74.9	8/12/10	185	9/15/10	187.2
MRN3.1	7/13/10	>2,419.6	8/12/10	Dry, N.S.	10/26/10	5,247.3

Note: N.S. = not sampled

CRWC sent results of the first sampling round to Doug McDonald, stormwater coordinator for the Northampton DPW. Of concern were the high readings at MRN2 (Bliss Street) and the Meadow Street outfall. By the end of July, Northampton Board of Health put up signs at popular swimming spots along the Mill River in Florence alerting people that high bacteria may make these areas unsafe for swimming. The DPW also investigated dry weather flow through the drainage system that outlets to the Mill River at Meadow Street. They performed manhole inspections, drain line video inspections, dye tests, and water quality sampling. By the end of July 2010, the DPW had identified one clear illicit connection at 16 Meadow Street, which was verified by dye testing. The DPW sent the owner a Violation Notice. The City and the owner have since been disagreeing as to who is legally responsible for fixing this problem. As of February 2011, the illicit connection had not been eliminated, but Doug McDonald reported that the City is going fix it in the spring, and worry about the legal responsibility later. The DPW will continue to investigate the northern end of the drainage system if possible and through dye tests if video inspection is not possible.

Tier 3 sampling identified high bacteria in the dammed up portion of the river off Pine Street on one date, but it was low the second time this site was sampled. A high bacteria count was also found at a stormwater outfall off Pine Street and in a wetland area just upstream of the dam on the river left side. We reported the results to Doug McDonald from the Northampton DPW in late October, and he responded saying that they will follow this drain system up the line and try to identify any sources. The outfall we sampled was dry when he checked, however.

2011 Update

In 2010, bacteria readings at a stormwater outfall near the Meadow Street bridge indicated a source and Northampton DPW identified an illicit connection at 16 Meadow Street. In the Spring of 2011, with a little pressure from MassDEP, the property owner came to an agreement with Northampton DPW and the building was disconnected from the storm drainage system and re-connected to the sewer system. Northampton DPW has also located another illegal connection on Sheffield Lane in Florence. Dye testing in June 2011 confirmed the source and Northampton is beginning to negotiate or bring forward enforcement actions to correct the connection.

CRWC sampled the Mill River in Florence twice in 2011 in the vicinity of Pine Street and Bliss Street where there were high readings last year. Results have been consistently low. A stormwater outfall that tested high in 2010 has not been flowing in 2011.

Former Mill River Channel, Northampton

CRWC collected a full round of samples from outfalls draining into the former Mill River channel between Old South Street and the wastewater treatment plant in 2011. The Mill River was re-routed by the U.S. Army Corps of Engineers after the devastating floods of the 1930's, and this section of the Mill River is the remnant section that still receives groundwater flow and some flow from underground tributaries and stormwater from the downtown section of Northampton. This channel discharges into the Connecticut River near where the Oxbow connects to the Connecticut River.

CRWC conducted follow-up sampling with the assistance of Northampton DPW environmental planner, Doug McDonald. CRWC sampling was able to narrow down a bacteria source within a half-block along Wright Ave near Route 5. Subsequent work by the Northampton DPW identified the source as being a building's sewer line running through a stormwater pipe and there being a leak in a joint of the sewer line. The leak is under Wright Ave and is the City's responsibility to fix. Northampton will be working on fixing that leak. Additional sampling along Pleasant Street and King Street point to problems in at least two branches of the King Street system. There are also several follow up areas that we looked into but the manhole was too deep to sample with the pole. Northampton DPW will do some follow up work in this area under their Infiltration and Inflow (I/I) study.

Fort River, Hadley and Amherst

The Fort River was included in our study because of high *E. coli* counts collected by the Massachusetts Department of Environmental Protection (DEP) at Route 47 above the Callahan Well Water Treatment Facility on September 3, 2009 (240 colonies /100 ml) and September 9, 2008 (1,500 colonies /100 ml).

In 2010 high *E. coli* levels were found in the Fort River, and very high levels in its tributary Hart's Brook along Bay Road in Hadley on October 12th and 26th, 2010. PVPC sampled this same location (site FRH1) three times between June and October, 2010. *E. coli* results during this period remained consistently higher than MA Water Quality Standards for primary contact. On October 12th, PVPC sampled at two upstream locations in an attempt to "bracket" the source of the *E. coli*. As noted in Table 1, results for Harts Brook, just before joining the Fort River had *E. coli* levels of 2,419.6 MPN/100 ml. *E. coli* counts in excess of 235 MPN/100 ml violate Water Quality Standards in Massachusetts for primary contact (swimming).

Harts Brook has several tributaries that collect water from the Bay Road area, and Chmura Road and the Holyoke Range. To better understand which branch of the tributary streams might be contributing the source, on 10/26/10, PVPC sampled several Tier 3 locations: FRHA, FRHB, FRHC, and FRHD. As noted in the results in Table 17:

- FRHA had the highest counts at >2,419.6 MPN/100ml
- FRHD, located at the outfall to the pond behind Hampshire College's Physical Plant on Bay Road had the lowest levels.

These results suggest that the source of the *E. coli* is located along Bay Road, east of the Hartsbrook School entrance and west of the Hampshire College Physical Plant. Results from the tributaries draining the Chmura Road subwatershed do not indicate that area to be the source.

Field observations for both sampling events in October noted cows and a well-grazed pasture/paddock abutting Harts Brook along Bay Road. Sampling site FRHD was selected because it was the most upstream location after which no farm animals and pasture were observed. An interview with the Hadley Department of Public Works on October 18th noted that the homes along this road are not serviced by a public sewer system and are on private septic systems.

Table 17 E. coli levels* at sampling locations on Fort River in Hadley and Amherst, MA

Sampling Site**	6/25/10	7/19/10	10/12/10	10/26/10
FRH1 – Fort River at Route 47, Hadley	394	547.5	461.1	no sample
FRH2 – Harts Brook at Moody Bridge Road, Hadley	no sample	no sample	2,419.6	290.9
FRHA – Harts Brook	no sample	no sample	no sample	>2,419.6
FRHB – Harts Brook	no sample	no sample	no sample	57.6
FRHC – Harts Brook	no sample	no sample	no sample	60.7
FRHD – Harts Brook	no sample	no sample	no sample	8.6
FRH5 – Fort River at South Maple Street, Hadley	no sample	no sample	93.3	no sample
FRH7 – Fort River at South East Street, Amherst	249	307.6	no sample	no sample
FRH9 – Fort River at Pelham Road, Amherst	182	172	no sample	no sample

**E. coli* as MPN/100 ml

**Refer to the attached map for sampling site locations

The PVPC submitted a letter to the Hadley Conservation Commission, Board of Selectmen, Board of Health and DEP-WERO on December 13, 2010 indicating we would like to work with the Town to further identify the source(s) of *E. coli* and develop a plan for addressing potential sources.

Plan for 2011

PVPC is in contact with the MA Department of Agricultural Resources' Agricultural Environmental Enhancement Program and the USDA Natural Resources Conservation Service's EQUIP Program about strategies for outreaching to farmer's to identify appropriate best management practices and potential funding options to implement these practices.

Manhan River, Easthampton

MA DEP noted high *E. coli* levels in the Manahan River at Fort Hill Road (MRE1) on 7/1/08 300 colonies/100ml, and 9/9/09 940 colonies /100ml. Several of the sampling events in 2010 slightly exceeded the single sample water quality standard. Potential sources remain undetermined.

Sampling locations and results are as follows:

Table 18 Manhan River, Easthampton Bacteria Results 2010

Site ID	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL
MRE1	6/25/10	226	7/19/10	139	8/11/10	287
MRE2	6/25/10	262			8/9/10	330
MRE3			7/19/10	3		
MRE6	6/25/10	243	7/19/10	110	8/11/10	386

2011 Update

PVPC sampled MRE1, MRE2 and MRE6 on June 7, 2011. MRE2 at the Lovefield Street bridge was 1,732 MPN/100ml. Adjacent to the sampling location – mid-stream, off the bridge – significant dry weather flow was observed at an outfall on the north bank of the river, adjacent to the sampling location. PVPC contacted the Easthampton DPW about conducting a field assessment and additional monitoring to identify a source. The DPW has begun a preliminary investigation at this site.

Buttery Brook and Stony Brook, South Hadley

Buttery Brook was sampled at two locations on 6/21 and 7/12 and 8/2/10. On 7/12/10 one of the locations was TNTC, however there was also a dead beaver nearby and evidence of recent beaver activity in the area. On 8/2/10 the location was dry and not sampled.

Although the South Hadley DPW has eliminated all known combined sewer outfalls, formerly combined infrastructure still exists in places, and the Town repairs the problems as they are identified. For example, in April 2010, a sewer pipe on Route 116 near the Purple Heart Drive on ramp backed up due to a clog in the separated sewer. The backup traveled down an abandoned service connection from a previously demolished commercial facility, discharged into a culvert along the road which drained into Buttery Brook. The DPW located the abandoned service connection and capped it to eliminate the connection permanently. This situation indicates that formerly combined infrastructure probably does exist, and does not activate unless some sort of problem triggers an investigation that allows it to be identified.

A significant portion of Buttery Brook is underground between Purple Heart Drive and Main Street, where it daylight and discharges to the Connecticut River. The underground brook in the Main Street/ Canal Street area is not well defined. Dye testing was performed by the Town of South Hadley to determine the brook's outfall location on the Connecticut River. This neighborhood, known as the South Hadley Falls, is the oldest neighborhood in town, established by industrial mills and powered by the canal and Connecticut River. It is possible that there are abandoned combined sewer lines that on the "lower side" near the canal. The DPW has also located all outfalls along the canal and noted 2 with dry weather flows. It is possible that the flows are groundwater connections. These outfalls have not been sampled.

Willamansett Brook, Chicopee

Willamansett Brook in Chicopee was sampled by MA DEP on 9/9/08 and found to have extremely high E. coli levels of 20,000 CFU/100ml. This was likely due to a CSO related event however further investigation was deemed warranted given the cities recent efforts to abate CSO overflows.

Table 19 Willamansett Brook, Chicopee Bacteria Results 2010

Site ID	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL
WBH1	6/21/10	165	7/12/10	353	8/2/10	103
WBH3	6/21/10	293	7/12/10	260	8/2/10	138

Plans for 2011

PVPC will continue to monitor these locations and determine if there are any plausible Tier 3 sites for monitoring as well. PVPC will conduct an interview the local DPW to determine if other information is available that may be relevant to source tracking.

Mill River, Springfield

The Mill River in Springfield is a highly urbanized watershed. Some segments of the Mill River do receive CSO discharges. However, the section selected for monitoring recently underwent a CSO abatement project. This segment formerly received the vast percentage of CSO/DWO into the Mill River (55 million gallons/year, activating over 80 times per year. This CSO was abated to discharge four times or less per year. Bacteria analysis in this stream segment during dry weather and wet weather events may help evaluating the effectiveness of the CSO 048 abatement.

Plans for 2011

PVPC will continue to monitor these locations and determine if there are any plausible Tier 3 sites for monitoring as well. PVPC will conduct an interview the local DPW and SWSC to determine if other information is available that may be relevant to source tracking.

Table 20 Mill River, Springfield Bacteria Results 2010

Site ID	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL	Sample date	E. coli MPN/100 mL
MRS2	6/28/10	320	7/28/10	702	10/18/10	115
MRS3	6/28/10	140	7/28/10	1017	10/18/10	15
MRS4	6/28/10	131	7/28/10	24	10/18/10	10

Scantic River, Hampden

MA DEP recorded high E. coli levels at Mill Road (SRH1) on 9/9/08 3600 cfu/100ml. Monitoring at this location is intended to determine if this problem still exists and if so, potential sources. Initial sampling on June 28, 2010 did not indicate any problems.

Table 21 **Scantic River, Hampden Bacteria Results 2010**

Site ID	Sample date	E. coli MPN/100 mL
SRH1	6/28/10	169
SRH4	6/28/10	200
SRH6	6/28/10	20

Plans for 2011

PVPC will continue to monitor these locations and determine if there are any plausible Tier 3 sites for monitoring as well. PVPC will conduct an interview the local DPW to determine if other information is available that may be relevant to source tracking if high counts are noted in 2011.

CONCLUSIONS / PROJECT SUMMARY

2011 marks the fourth consecutive year of E. coli bacteria monitoring along the main stem of the Connecticut River. Each year, increasing numbers of river users become aware of the data's availability on the project website. Similarly, a growing number of water resources planners, advocates and scientists are also utilizing the project data to inform additional research and policy decisions. On June 30, 2011 PVPC received a call from a Masters in Public Health intern at Baystate Medical Center who was utilizing the project data as part of a public health study being conducted in Springfield. The intern's summer work was to conduct interviews of surface water users throughout Springfield to better understand when and where they use the river, what types of activities they engage in (swimming, boating, fishing), and their level of awareness about water quality issues.

As a continuation of this project, PVPC is expanding distribution of the weekly E. coli results beyond the website posting to a list of organizations serving Environmental Justice populations in Holyoke, Chicopee and Springfield. It is our belief, as supported by Baystate Medical Center's current research initiative, that there is a large population of low-income urban residents having primary contact with the river at times when E. coli bacteria levels are likely to be elevated and thus unsafe for human contact. By mid-July, PVPC anticipates distributing a weekly factsheet inclusive of a color coded map and data results to area health clinics and other social service providers to better inform river users of weekly bacteria levels.

Actual sources of bacteria loading have been identified in three tributaries and one source on the Connecticut River main stem as follows:

- Bassett Marina/North End Bridge on Connecticut River, Springfield – failing septic system
- Fort River, Hadley – probable dairy farm on Bay Road, Hadley
- Mill River, Florence – illicit connection at 16 Meadow Street, Florence
- Maple Brook, Greenfield – leaking municipal sewer siphon under Maple Brook culvert

As noted throughout the report, on-going bacteria source tracking activities are underway on nine of the eleven tributaries monitored:

- Mill River, Springfield
- Manhan River, Easthampton
- Fort River, Hadley
- Mill River, Hadley
- Mill River, Florence
- Sugarloaf Brook, Deerfield and Whately
- Bloody Brook, Deerfield
- Maple Brook, Greenfield
- Barton Cove, Montague and Gill Deerfield

APPENDICES

- APPENDIX A Site Maps
- APPENDIX B Monitoring Locations
- APPENDIX C Connecticut River Main Stem Sites – Directions and Photos
- APPENDIX D Water Quality Results Tables – 2010 and 2011 (April – June, 2011)
- APPENDIX E QC Data 2010
- APPENDIX F Quality Assurance Project Plan
- APPENDIX G Field Data Sheets - 2010

