2010-2014

Prepared by:
F. Ryan O'Donnell
& Laurie Callahan

WATER QUALITY MONITORING PROGRAM 2014 & FIVE YEAR SUMMARY REPORT

Southeastern Vermont Watershed Alliance (FKA West River Watershed Alliance)
P.O. Box 402, Brattleboro, VT 05302 sevwa.mail@gmail.com https://sites.google.com/site/vtsevwa/

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Laura Bacon
Fred Bennett
Peter Bergstrom
Chris Blodgett
Jay Blodgett
Daniel Bougie
Susan Brace
Nelson Bruni
Albert Bupp
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Gloria Cristelli
Joe DeFelice
Anna Dewdney
Reed Duncan
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Kevin Hollebeek
Rick Holloway
Gurudharm Khalsa
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Gary Knox
Irwin Kuperberg
John Lipincott
Michael Marantz*
David Mink
Cynthia Nau
Simon Norton
Sarah Page
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ACRONYM LIST

COND – conductivity
CRWC – Connecticut River Watershed Council
E. coli - Escherichia coli
EPA - Environmental Protection Agency
GEOMEAN – calculated geometric mean
GIS - Geographic Information System
GPS – Global Positioning System
MAX – maximum value measured during season's sampling events
MEAN- arithmetic mean of values for a particular parameter
mg/L – milligrams per liter
MPN – most probable number
NO_X – combined Nitrate & Nitrite nitrogen
NTU – nephelometric turbidity unit, unit for measure of turbidity
ORG – Ottauquechee River Group
ppb – parts per billion, equivalent to ug/L (micrograms per liter)
QA – quality assurance
QAPP - Quality Assurance Project Plan
QA/QC - Quality Assurance/Quality Control
SC – Specific Conductance
SeVWA – Southeastern Vermont Watershed Alliance
TEMP – temperature
TMDL – Total Maximum Daily Load
TP - Total Phosphorous
TN – Total Nitrogen
TURB – Turbidity
uS – micro Siemens
uS/cm – micro Siemens/centimeter, unit of measure for conductivity or specific conductance
U.S. EPA – U.S. Environmental Protection Agency
USFS – U.S. Forest Service
USFWS - United States Fish and Wildlife Service
VT ANR - Vermont Agency of Natural Resources
VT DEC - Vermont Department of Environmental Conservation
WCNRCD - Windham County Natural Resources Conservation District
WQM – water quality monitoring
WQMP - water quality monitoring program
WRWA - West River Watershed Alliance

INTRODUCTION

RATIONALE FOR THE WATER MONITORING PROGRAM

Southeastern Vermont Watershed Alliance (SeVWA), formerly known as West River Watershed Alliance (WRWA), is a non-profit organization that has recognized the importance of water quality monitoring in Vermont DEC's Basin 11 watershed in southeastern Vermont. River watersheds included in WRWA/SeVWA's water quality monitoring program (WQMP) are the West River, Williams River, Saxtons River and Whetstone Brook. Whetstone Brook watershed was previously included in VT DEC's Basin 13 watershed, but is currently in Basin 11.

Data from this monitoring program has been incorporated into the Basin 11 Management Plan. The Basin 11 Management Plan is part of the rationale for the pursuance of long- and short-term water quality monitoring in the watershed basin and the data gathered from the volunteer monitoring program is an integral part of the Plan's implementation.

Vermont Watershed Basin 11 is within the Connecticut River watershed. The Connecticut River was designated as an American Heritage River in 1998 and as the county's first national Blueway in 2012. The Connecticut River Watershed Council (CRWC), as the main non-profit conservation stewardship organization for the Connecticut River (in NH, VT, MA and CT), continues to advocate for clean water standards and natural resource conservation and protection along the river's corridor and in its watershed from its northern reaches along the Canadian border to the Long Island Sound.

All rivers and streams in Basins 11 are important recreational resources in southeastern Vermont and are highly important and valued aspects of local communities.

ADVANTAGES OF THE MONITORING PROGRAM

SeVWA's WQMP follows data quality assurance protocols and data from the monitoring program is submitted to Vermont Department of Environmental Conservation's (VT DEC's) and the U.S. Environmental Protection Agency's (EPA's) long-term databases.

SeVWA's river monitoring program provides VT DEC with water quality data that can be compared with other data collected around the state by other programs as well as with historic and subsequent water quality information. The Basin 11 Management Plan is a prime example of the integrated involvement of multiple levels of groups, agencies, volunteers and organizations in the effort to promote water quality in the area. The collaboration of both professionals and volunteers coming together to identify threats to water quality enables implementation of additional actions to prevent degradation and improve ecological health.

SeVWA's WQMP is also an important public education tool. It provides opportunities for citizen involvement and promotes understanding of river and watershed processes and how they affect daily lives of residents and visitors. Over the years the volunteers for SeVWA's WQMP have developed a sense of community and strengthened their connection to, and stewardship of, the rivers that all enjoy in many ways.

Through its river monitoring effort, SeVWA seeks to develop a general public understanding of river ecology and foster a broader sense of stewardship in the region's citizenry. The monitoring program also partners with other non-profits and local and state agencies in the interest of protecting and conserving water quality and watershed resources.

BACKGROUND OF WRWA/SEVWA'S WATER QUALITY MONITORING PROGRAM

In the fall of 2002, WRWA/SeVWA's Stream Action Committee (SAC) planned and developed a three-phased stream monitoring program. Phase 1 involved bi-weekly sampling of popular swimming hole sites along the main stems and some tributaries of the West, Williams and Saxtons Rivers. Phase 2 selected sites where little or no water chemistry information had been previously reported or where suspected problems might exist and sampling would be useful to determine possible impacts. Phase 3 involved collecting stream benthic macro-invertebrate samples and conducting stream habitat assessments at sites located throughout the three rivers' watersheds. Phase 3 sampling was not continued after the fall of 2004. Sample analysis and data from Phase 3 was never completed or analyzed.

Since 2003 WRWA/SeVWA has run a volunteer based program to perform long term water quality monitoring at general water quality monitoring sites and popular swimming holes in the watersheds of the West, Williams and Saxtons Rivers, that form Basin 11. Since 2003, monitoring sites on Whetstone Brook were also added to the program. (Whetstone Brook was previously in VT DEC Basin 13, but is currently included in Basin 11.)

Due to various uncertainties in 2009 WRWA/SeVWA's monitoring program did not run. In 2010 it was reactivated. The monitoring program, with a dedicated team of volunteers, has been able to carry-out another five seasons of water quality monitoring at 20-26 sites each season. The current plan is that SeVWA will run the river monitoring program again in 2015.

In 2010-2012 *Escherichia coli* (*E. coli*), total phosphorous (TP), combined nitrate & nitrite nitrogen (NOx), turbidity (TURB), pH, conductivity (COND) and air and water temperatures were parameters measured and analyzed through SeVWA's WQMP. In 2013 and 2014 pH was not one of the program's parameters, but all of the other 2010-2012 parameters were included. In 2014, total nitrogen analysis was an added parameter.

In 2010-2014 *E. coli* data results were published in local online media, shared on social media sites, paper copies were posted at kiosks in a variety of locations and were provided to town health officers and all volunteers via email so that they could post them in their communities. In 2012-2014 the *E. coli* results charts were available at the newly created SeVWA website (https://sites.google.com/site/vtsevwa/). Public reporting of *E. coli* results provides information to help recreational users make informed decisions about using certain river sites.

In 2012-2014, at the invitation of CRWC, SeVWA's *E. coli* monitoring results were made available as public information at a new CRWC and Pioneer Valley Planning Commission (MA) website – www.connecticutriver.us. The website provides information about recreational resources in the Connecticut River watershed and part of that information is about water-based recreation and water quality.

All of WRWA/SeVWA WQMP's data have been entered into Excel spreadsheets. From 2003-2014, WRWA/SeVWA WQMP's data have been submitted to VT DEC for inclusion in their database. That data, having been determined to meet quality assurance criteria, is also eventually submitted by VT DEC to U. S. EPA's database – STORET. The compiled data can also be shared with local entities, agencies and others that are interested in the information.

Each winter following the monitoring season a general summary report, such as this one, and a separate final report specifically for the LaRosa Lab Services Partnership Program are produced. Those reports are typically completed and distributed between January and early March.

PROGRAM FUNDING SOURCES

Major costs to run the WQMP each year are: the laboratory analysis of samples; paying for a coordinator's services during the monitoring season, to perform data review, analysis and end-of-season report writing; mileage costs for coordinator and intern for training sessions, equipment and supplies distribution, sample pick-up from volunteers and delivery to labs; Green Mountain Messenger sample transport fees; purchase of calibration standards, equipment and supplies and maintenance of testing meters.

As in past years, 2010-2014 laboratory analysis services were provided by the VT DEC through the VT DEC's LaRosa Lab Services Partnership Program. Through that VT DEC program, LaRosa Lab, provided sample analysis at no charge to several qualifying volunteer monitoring groups across the state, including SeVWA/WRWA. In years prior to 2010, *E. coli* testing had been provided to SeVWA/WRWA by LaRosa Lab, but in 2010 through 2014 *E. coli* testing was provided by CRWC's laboratory in Greenfield, MA. This was made possible through CRWC grants along with services exchange agreement between CRWC and VT DEC's LaRosa Lab Services Partnership Program. The services exchange agreement between CRWC and VT DEC is set-up each year by VT DEC and CRWC staff.

Laurie Callahan, WQMP coordinator in 2010-2014, was able to obtain an incubator, through SeVWA, from EPA (Region 1) Equipment Loan Program for Volunteer Monitoring in the summer of 2010. The incubator is located at the CRWC lab in Greenfield and ensures that there will be adequate incubator space for the CRWC lab to accommodate SeVWA's and other groups' *E. coli* testing.

Additional support or funding in 2010-2014 for SeVWA's WQMP was provided by membership dues, donations by individuals, conservation and other organizations, businesses and also through contributions by some of the towns in the Basin 11 watershed. Select boards, managers, residents or representatives of those towns chose or voted to contribute town funding for the volunteer river monitoring efforts in their townships. Many volunteer hours provided by individuals – as river monitors, sample transporters, interns, committee members and board members - have been a significant factor supporting the existence and continuation of the program.

GENERAL LOCATION OF MONITORING PROGRAM ACTIVITIES

As mentioned previously, SeVWA's 2010-2014 water quality monitoring sites were located along the main stem of the West River and in its watershed, along the Saxtons and Williams Rivers and along Whetstone Brook. Also as mentioned previously, the West River, Williams River, Saxtons River and Whetstone Brook are all within state-designated watershed Basin 11. (Whetstone Brook was previously is in VT DEC's Basin 13 watershed, but is now included in Basin 11.)

Here is a link to the Basin 11 Management Plan document - http://www.vtwaterquality.org/planning/docs/pl_basin11%20Plan.6-08.pdf and appendices for that document, http://www.vtwaterquality.org/planning/docs/pl_basin11%20Plan_appendix.6-08.pdf

Currently, during spring 2015, a new five-year Basin 11 Plan is being drafted and public discussions will probably be held by VT DEC Watershed Coordinator, Marie Caduto, during the late spring of 2015.

A publication by Windham County Natural Resource Conservation District (WNRCD), The Whetstone Brook: Flooding Happens, http://www.vermontconservation.org/Buffer-Projects/The-Whetstone-Brook-Flooding-Happens-Booklet.html. This booklet describes some aspects of the Whetstone Brook watershed.

Another Whetstone Brook information resource produced by Windham Natural Resources Conservation District and available at the VT DEC website is the Whetstone Brook Watershed Corridor Plan.

See designated sections in this 2010-2014 Five-Year Summary Report for descriptions of each of the Basin 11 rivers' and Whetstone Brook's watersheds. The Basin 11 rivers' watersheds descriptions are from the 2001 VT DEC's Basin 11 West, Williams & Saxtons Rivers Assessment Report.

MONITORING PROGRAM REQUIREMENTS, ELEMENTS AND LOGISTICS

QUALITY CONTROL AND QUALITY ASSURANCE (QA/QC)

The VT DEC requires all volunteer groups accepting the LaRosa Partnership Program services to submit a Quality Assurance Project Plan (QAPP) to show that each group's sampling methods and procedures were aligned with the State's and EPA's protocols. Copies of WRWA/SeVWA's QAPP are available upon request. Aspects of the 2010-2014 water quality programs were coordinated and carried-out according to VT DEC protocols and according to WRWA/SeVWA's approved QAPP. All LaRosa Partnership Program participant groups are also required to submit a final report describing how their program and data met quality assurance objectives. Once all of the data collected by the group has been reported, scrutinized and accepted the data is then submitted back to VT DEC through its online database program.

The CRWC lab in Greenfield, where WRWA/SeVWA had its *E. coli* sample analyses performed in 2010-2014 also has a QA program in place to ensure the quality and value of its protocols and reported results.

PROGRAM LEADERSHIP, MANAGEMENT AND COORDINATION

During the monitoring seasons from 2003 through 2014, there was always someone to fill the role of WQMP coordinator – either a paid employee through a partner organization (early years), a paid contractor or a qualified volunteer. It is essential to have an experienced or qualified person in that program coordinator role to oversee the many functions and requirements of the type of monitoring program that SeVWA has run since 2003. Many of the years between 2003 and 2014 it has been a challenge to acquire the needed funds to pay for a coordinator for all of the time during the year that one is needed. Fortunately for SeVWA, there has usually been funding available to pay for a portion of the needed services, plus someone willing to volunteer their time for the remaining needs. Having a reliable source of funds to support the coordinator position would result in a more sustainable and predictable effort each year. The lead coordination role typically entails about an average of 16 hours per week – whether paid or volunteer.

The tasks that need to be performed for the monitoring program span the entire year, though the most time and attention required is during the months of May through September, when preparing for, running and ending the actual monitoring activities occurs. October through February or March are typically used for final data acquisition from LaRosa Lab, data review and verification, data analysis, report writing, information dissemination and designing the monitoring program for the next season.

During some years between 2010-2014 SeVWA has also been able to engage a paid coordinating assistant, or liaison/facilitator, at a somewhat reduced cost than a contracted coordinator. An individual in that role typically works under the direction of the coordinator. In 2010, 2011, 2013 and 2014 SeVWA was also able to collaborate with VT DEC and Ottauquechee River Group to engage an intern (sponsored by VT ANR) for the monitoring season

from mid- to late May until, typically, late August. The intern's primary role is to support the coordinator and if applicable, the coordinating assistant. The internship has typically been an unpaid internship, though occasionally a stipend has been paid. Interns are provided mileage and expenses reimbursement. All SeVWA interns in 2010-2014 have been graduate degree candidates and have been able to use the internship hours for requirements of their degree programs.

In 2013, Laurie Callahan proposed the formation of a Monitoring Program Committee within the SeVWA organization. The board of directors approved the creation of the committee and the committee was formed in order to act as a program oversight and coordinating entity. The committee was functional by late 2013. The committee is able to act as coordinating entity for parts of the year, but not the entire year and cannot be expected to coordinate the WQMP each year between May and October. It can act in a support role for the program coordinator during that timeframe.

2014 was a transitional year for "functional roles" of SeVWA's WQMP. Not only was there a functioning Monitoring Program Committee, but the committee had also designated Local Stream Teams for particular river segments and sites in close proximity to each other. Additionally, certain volunteers on those teams had also agreed to be Stream Team Leaders. Some of those Stream Team Leaders were also committee members. Marie Caduto, VT DEC Watershed Coordinator for Basin 11, was also invited to be a committee member as SeVWA's WQMP has very intricate ties to VT DEC and Marie Caduto is SeVWA's closest connection to that VT ANR department.

The hope is that the Stream Teams will create a stronger connection between SeVWA and its WQMP in local communities and that the Local Stream Teams, with their Stream Team Leaders, will provide local coordination functions for SeVWA's WQMP. Also, hopefully, the Monitoring Program Committee can provide coordination leadership for the program when a program coordinator is not available, though this should only be on a emergency or contingency basis. When a program coordinator is available the Monitoring Program Committee and the Stream Teams can support the coordinator in the performance of their duties. If an intern is engaged, he/she can assist the coordinator in various aspects of program coordination.

VOLUNTEER RECRUITMENT AND TRAINING

2010-2014 volunteer river monitor training sessions were held in May and June before the beginning of the sampling season to prepare volunteers for the monitoring program. Training covered step-by-step procedures for each sampling task. Sampling safety was also discussed. Volunteers received sampling equipment kits; field data sheets; contact info for coordinator, assistant and/or intern; chain of custody forms and procedure manuals. All volunteers were requested to attend training sessions or to arrange for an individually scheduled session if they could not attend a group session. New volunteers did not perform sampling until they received training. "Veteran" samplers were requested to complete at least a refresher session to receive updated materials and instructions.

In 2010 there were 16 regular volunteer river monitors and by 2014 there were 25 regular volunteers. During the 2010-2014 timeframe there were 5-8 volunteers that were strictly back-up samplers. When needed, new volunteers were recruited from local communities where sites were located that needed monitors.

DATA MANAGEMENT & DATA REPORTING

SeVWA's WQMP has tangible products in the form of charts, analysis reports and data files that can be shared with interested individuals, organizations and agencies. The products are important resources when working toward basin planning and maintaining or restoring water quality. Sampling results provide insight into possible impacts on water quality and the community's role in affecting those impacts. Over the long term, WRWA/SeVWA's sampling results can be used to inform policy makers and local citizens of conditions and trends in river water quality, as well as to support and implement the Basin 11 management plan.

Data generated by SeVWA's river monitoring program are reviewed by at least two individuals involved with program oversight. Those reviewers ascertain that the data have met data quality objectives as defined in the program's current QAPP document. Once that assessment is done results are used, published or submitted to VT DEC to become part of their database. See APPENDIX A of this report for SeVWA/WRWA's 2014 monitoring data. SeVWA maintains Excel spreadsheets with each year's data and a "master" spreadsheet with all years' data.

The CRWC Lab in Greenfield typically makes *E. coli* analyses results available in just over 24 hours after the tests are set-up. WRWA/SeVWA WQMP coordinator or intern has typically submitted the results and pertinent comments to volunteers and publications within 24 hours of receiving results from CRWC. Results from tests submitted to LaRosa Lab (turbidity, TP, TN and NOX) are typically available in about 4-6 weeks from submission to the lab. The LaRosa data, CRWC data and the WRWA/SeVWA generated data (pH, conductivity, temperatures and other observations) are usually compiled and shared at the end of the year in the program's summary report. A separate report to the LaRosa program that provides basic program information, data and program quality objectives and site location with coordinate information is also produced each year. All of the monitoring season's data is provided to VT DEC in appropriate format defined by that department for participants in the LaRosa Lab Services Partnership Program. Submitting the program's data to VT DEC is required of all participants in the LaRosa Lab Services Partnership Program.

One of the main goals of the WRWA/SeVWA monitoring program is to inform the public of recreational site and swimming hole *E. coli* levels to help recreational users make informed decisions about using certain swimming areas. In 2010-2014 *E. coli* data results, as they were available from the CRWC lab, were published in local print, via online media (such as www.ibrattleboro.com) and paper copies were posted at kiosks, including those at Vermont Canoe Touring, Brattleboro Visitor Information booth, Brattleboro River Park, Brattleboro Farmers Market, Retreat Meadows, Dummerston covered bridge and other local kiosks or bulletin boards. The *E. coli* results are also reported to town health officers and provided to all volunteers to post, publish or distribute within their own local communities. Starting in 2012 the *E. coli* results charts were available at the newly created SeVWA website (https://sites.google.com/site/vtsevwa/).

In 2012 through 2014, at the invitation of CRWC, SeVWA's *E. coli* monitoring results were made available as public information at a new CRWC and Pioneer Valley Planning Commission (MA) website – www.connecticutriver.us. The website provides information about recreational resources in the Connecticut River watershed and part of that information is about water-based recreation and water quality. To find *E. coli* results, by location, at the website go to http://connecticutriver.us/site/content/sites-list and scroll to a swimming hole of interest.

BASIC MONITORING PLAN FOR 2010-2014

The WRWA/SeVWA WQMP did not run in 2009, so in 2010 a focused effort was launched to reactivate the program. The program was able to run in 2010-2014 and there are plans for it to continue in 2015. The 2015 program will be similar to the 2014 program, which included 26 monitoring sites in 4 rivers watersheds in Basin 11.

In addition to a number of long-term, general water quality monitoring sites, sites with concerns regarding water quality impacts and popular river swimming holes are usually selected for the SeVWA monitoring program. Previous years' data are reviewed with Marie Caduto, VT DEC Watershed Coordinator, when selecting swimming holes or other monitoring sites. In order to sustain and generate local interest and support for the monitoring program, SeVWA tries to maintain monitoring sites in each of Basin 11 rivers' watersheds, as long as there are sites of valid interest or concern.

Beginning in 2008 and continuing in 2010, WRWA/SeVWA discontinued the designation of Phase 1 SH sites and Phase 2 GW sites that was used 2003-2007. Since 2008 sites are named using river name and approximate miles located upstream of the river's terminus. Most of the organization's monitoring sites have been swimming hole sites that were also long term water quality monitoring sites and sites where *E. coli* levels have been an issue. By 2014 all SeVWA monitoring sites were sampled for all parameters every 2 weeks through the monitoring season. [Parameters included in SeVWA's 2010-2014 monitoring programs were *E. coli*, total phosphorous (TP), combined nitrate & nitrite nitrogen (NOx), total nitrogen (TN, in 2014), turbidity (TURB), conductivity (COND), pH (2010-1012 only) and air and water temperatures.] SeVWA's monitoring seasons typically lasts about 12 weeks from early to mid-June through late August or mid-September.

2010-2014 MONITORING SITES

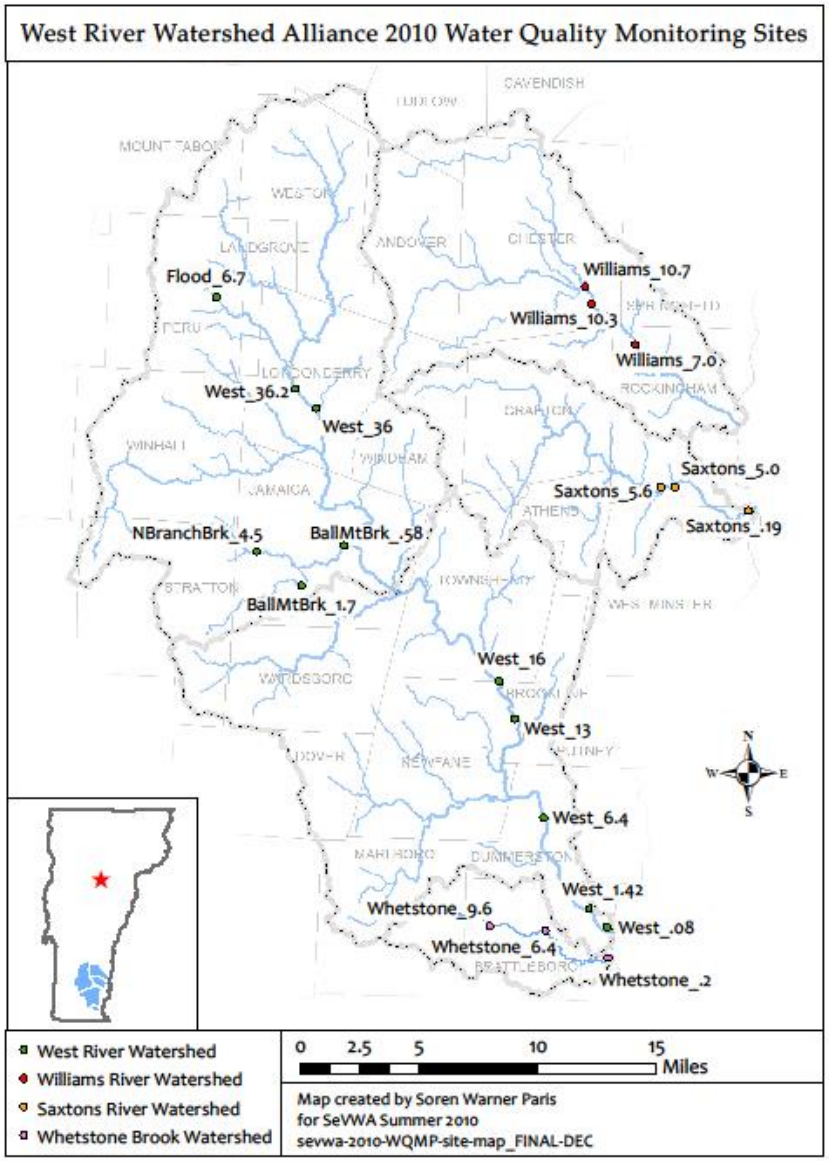
The following sites were monitored in 2010, 2011, 2012, 2013, and 2014. Not all sites were monitored all five years; see designations below in Table 1. There were 20 monitoring sites in 2010, 22 in 2011 & 2012, 23 in 2013, and 26 in 2014.

Table 1A - 2010-2014 Monitoring Sites

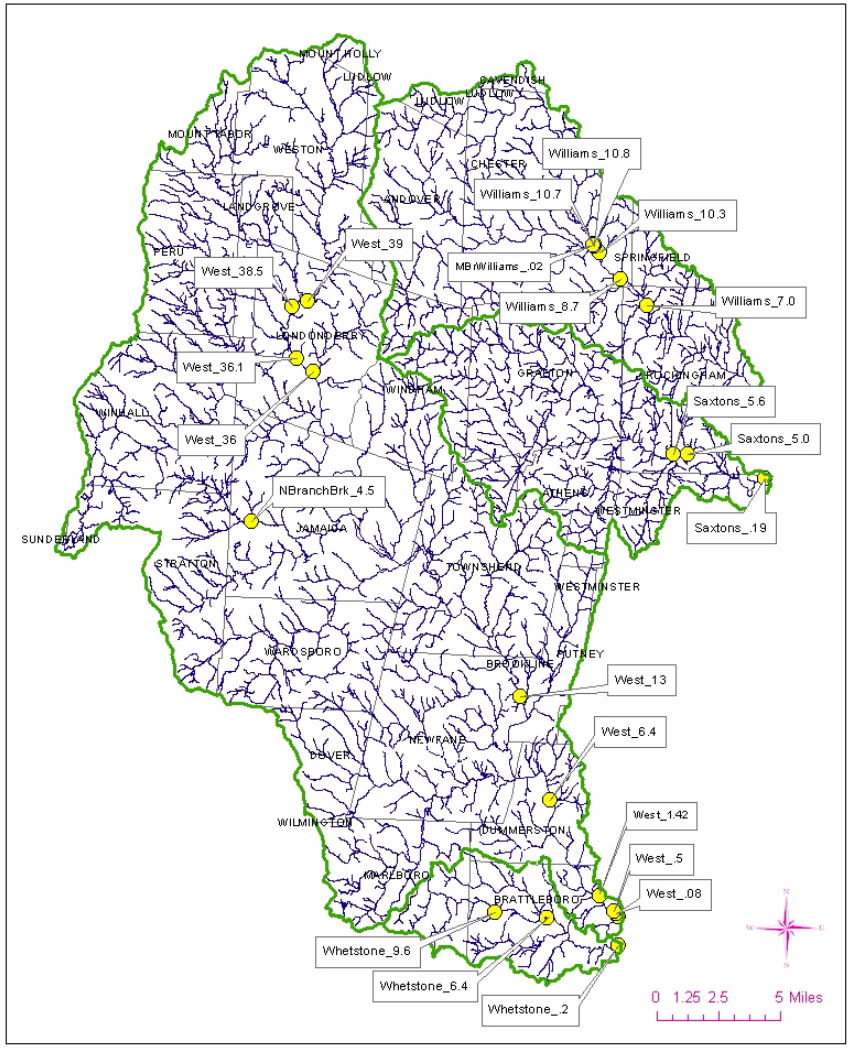
RIVERS or WATERSHEDS	SITES	CITY/TOWN	SITE DESCRIPTION	2010	2011	2012	2013	2014
WEST RIVER	West_ 39	Londonderry	Below dam & Rte 100 bridge		X			
	West_38.5	Londonderry	Below Mountain Marketplace on Rte 100		X	X	X	X
	West_38.5A	Londonderry	Rte 100 below Rte 100 bridge					X
	West_36.2	South Londonderry	Cobb's swim hole, Winhall Hollow Rd.	X				
	West_36.1	South Londonderry	Just below West_36.2, above Rte 100 bridge		X	X	X	
	West_36	South Londonderry	Rowes Rd.	X	X	X	X	X
	West_16	Townsend	Ellen Ware Road	X		X	X	X
	West_13	Brookline	Brookline bridge	X	X	X	X	X
	West_6.4	Dummerston	Just above Dummerston covered bridge	X	X	X	X	X
	West_1.42	Brattleboro	Behind B'boro Professional Center, Rte. 30	X	X	X	X	X
	West_.5	Brattleboro	Just above West_.08		X			
	West_.08	Brattleboro	Milk House Meadows, just above Marina	X	X	X	X	X
	Rock_.38	Newfane	Vicinity of Indian Love Call, upstream of Rte. 30	X		X	X	X
	NBranchBrk_4.5	Jamaica	Pikes Falls swim hole	X	X	X	X	X

Table 1B - 2010-2014 Monitoring Sites

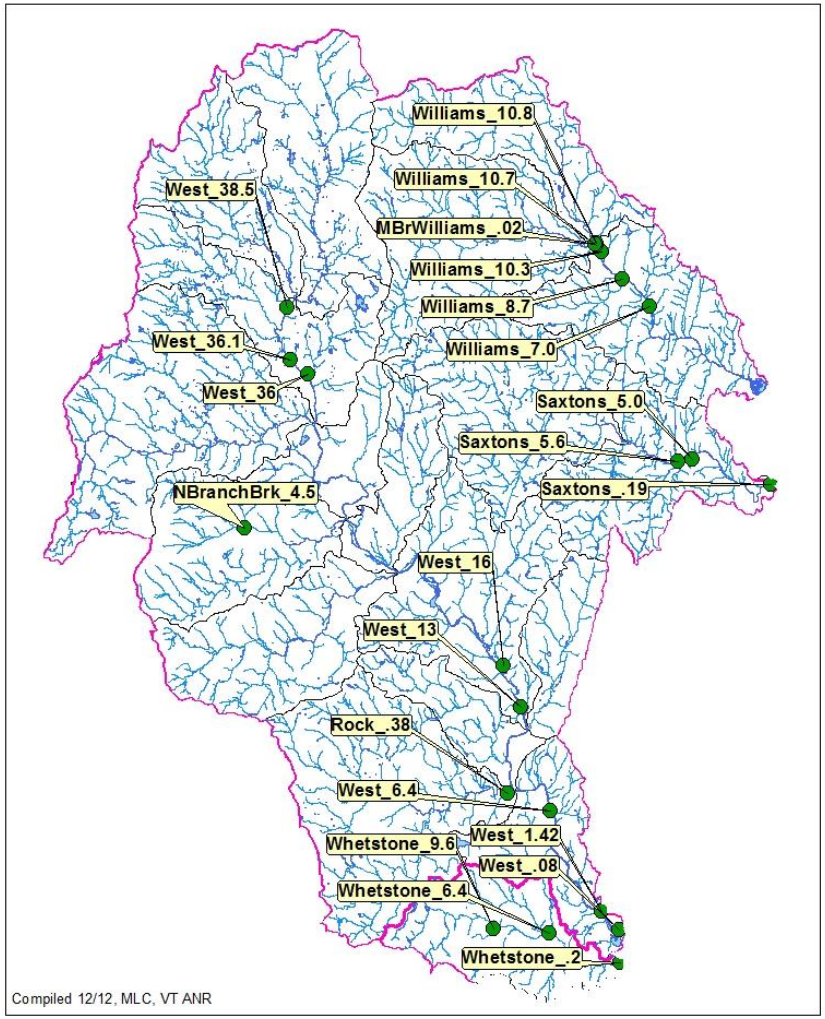
RIVERS or WATERSHEDS	SITES	CITY/TOWN	SITE DESCRIPTION	2010	2011	2012	2013	2014
WILLIAMS RIVER	Williams_11.85	Chester	Just above Flamstead Rd. crossing					X
	MBrWilliams_2.1	Chester	Middle Branch Williams R., Blue Hill Rd crossing					X
	MBrWilliams_.02	Chester	Middle Branch Williams R., just above confluence with Williams R. & Williams_10.7		X	X	X	X
	Williams_10.8	Chester	Just above confl. with Middle Branch Williams R.		X	X	X	
	Williams_10.7	Chester	Rainbow Rock swim hole, just below Williams_10.8	X	X	X	X	X
	Williams_10.3	Chester	Below Chester village WWTF	X	X	X	X	X
	Williams_8.7	Chester	Just above Missing Link Rd. bridge		X	X	X	
	Williams_8.6	Chester	At RR bridge below Missing Link Rd. & just below Halls Brook					X
	Williams_7.0	Rockingham	Just above Bartonsville bridge	X	X	X	X	X
	Williams_.92	Rockingham	Golden Hill Rd., below I-91 bridge				X	X
	Williams_.24N	Rockingham	Herricks Cove Rd., unimproved access at field				X	
SAXTONS RIVER	Saxtons_5.6	Saxtons River	Stickney's field, above Saxtons R. village	X	X	X	X	X
	Saxtons_5.15	Saxtons River	Just above Saxtons River village WWTF					X
	Saxtons_5.0	Saxtons River	Below WWTF in Saxtons River village	X	X	X	X	X
	Saxtons_.19	Westminster	"Sandy beach", just south of BF town line	X	X	X	X	X
WHETSTONE BROOK	Whetstone_9.6	Brattleboro	Stark Rd., off of Rte. 9 & just above bridge	X	X	X		
	Whetstone_6.4	Brattleboro	Dettman Dr., just above bridge	X	X	X	X	
	Whetstone_3.3	Brattleboro	Above Farmers Market , off Glen St.					X
	Whetstone_2.4	Brattleboro	Brattleboro Farmers Market, Western Ave.				X	X
	Whetstone_1.35	Brattleboro	Williams St. crossing, downstream side of bridge at Crosby St.					X
	Whetstone_.2	Brattleboro	Downtown, behind Co-op	X	X	X	X	X



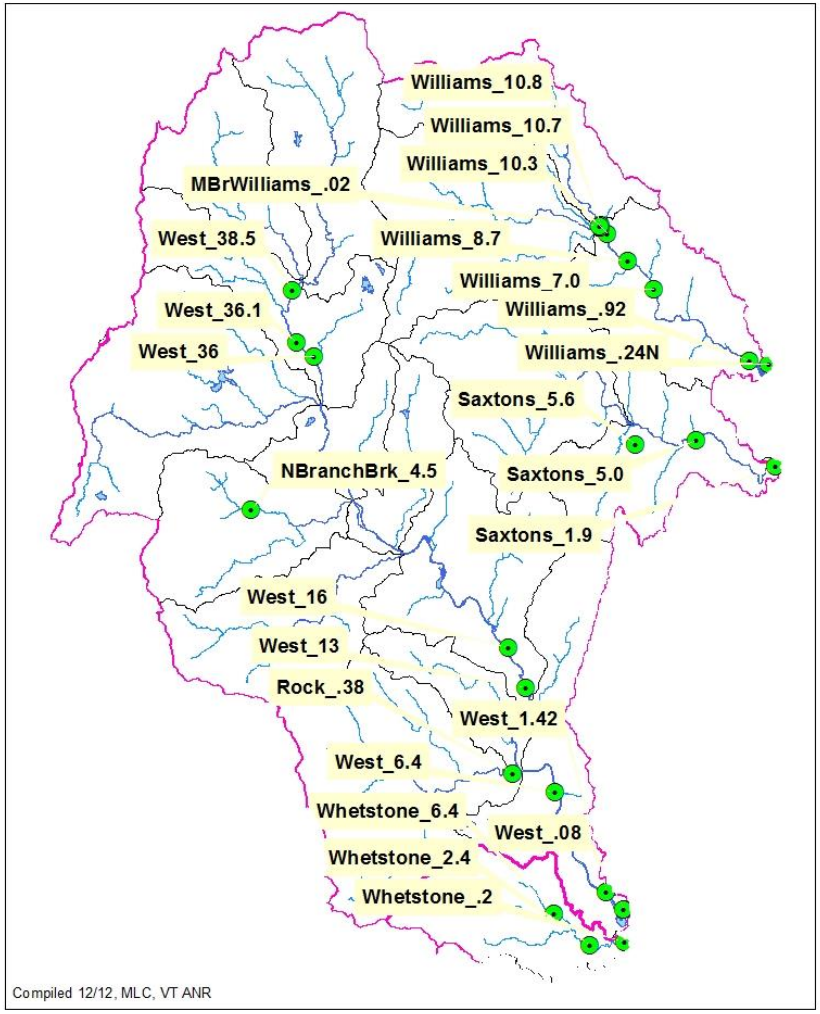
Southeastern Vermont Watershed Alliance Monitoring Sites 2011



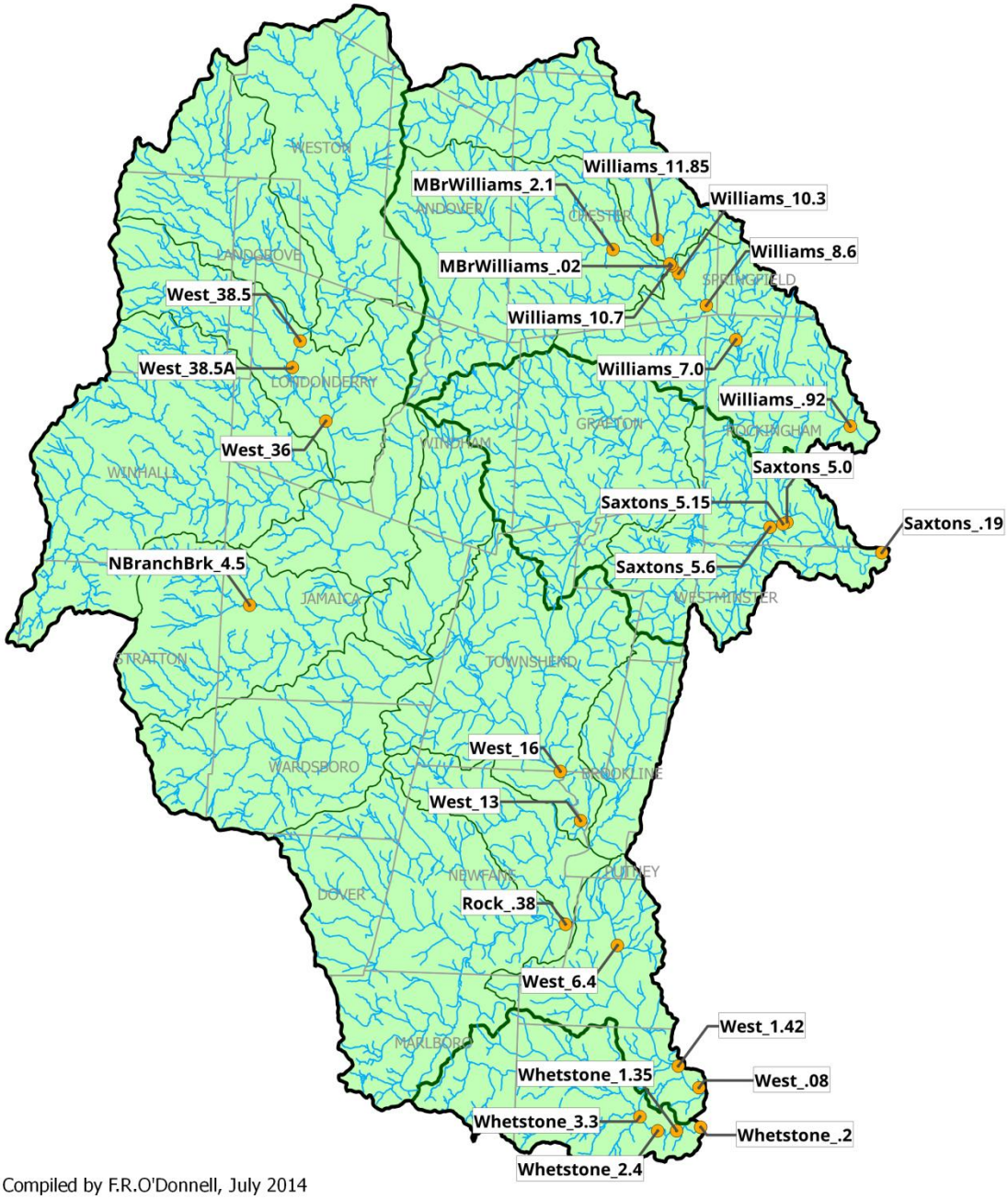
SeVWA 2012 Monitoring Sites



SeVWA 2013 Monitoring Sites



SeVWA 2014 Sites



Compiled by F.R.O'Donnell, July 2014

SUMMARY OF RESULTS

SUMMARY OVERVIEW

This portion of SeVWA/WRWA's 2014 and 2010-2014 combined report provides summaries, descriptions, tables and graphs of information and results from those five years of water quality monitoring. Data descriptions and analysis (with graphs and tables), river flows/discharge information and precipitation data appear in each watershed or river segment on the following pages. To go directly to a specific section of interest, please refer to the report's table of contents on page 3.

The data appearing in the following sections generally represent some of the most significant results of SeVWA's WQMP for 2010-2014. The data presentation and discussion is a cursory summary and is presented in this report as a starting point for discussion, further analysis and follow-up monitoring or action.

Data for all years of SeVWA/WRWA's monitoring program are available as an Excel file and one or more year's data can be requested. Please see the Program Contact Information on the next to the last section of this report to request data files. The data are also available via the VT DEC database or EPA's STORET. See APPENDIX A of this report for SeVWA/WRWA's 2014 monitoring data.

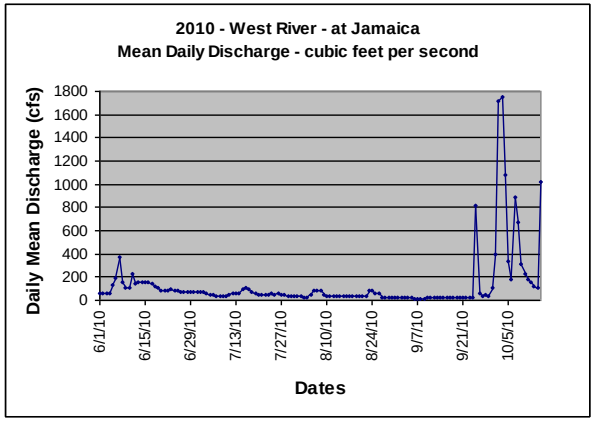
WEST RIVER WATERSHED SUMMARY

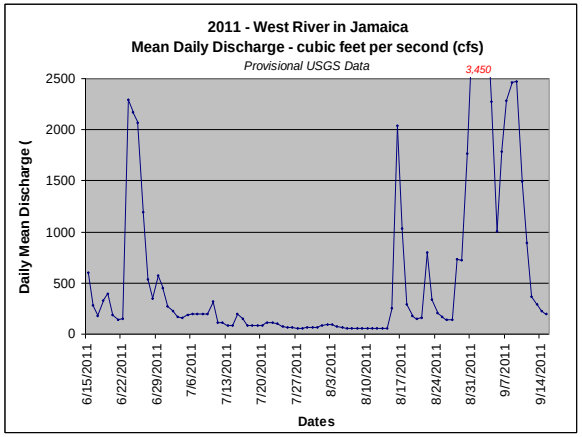
The 423-square mile West River watershed is heavily forested with three percent of the land in agricultural use. Surface water comprises approximately 5 percent of the watershed area and transportation use comprises 4 percent. Wetlands and developed land each cover one percent of the watershed area according to the 1991-1993 satellite photograph analysis. The main stem of the West River originates in the south part of Mount Holly, 2400 feet above sea level. The river flows generally south through the towns of Weston and Londonderry, then southeast through Jamaica, Townshend, Newfane, Dummerston and Brattleboro, to its confluence with the Connecticut River. The length of the main stem is 46 miles. The West's larger tributaries include the Rock River, Wardsboro Brook, Winhall River, Ball Mountain Brook, and Grassy Brook.

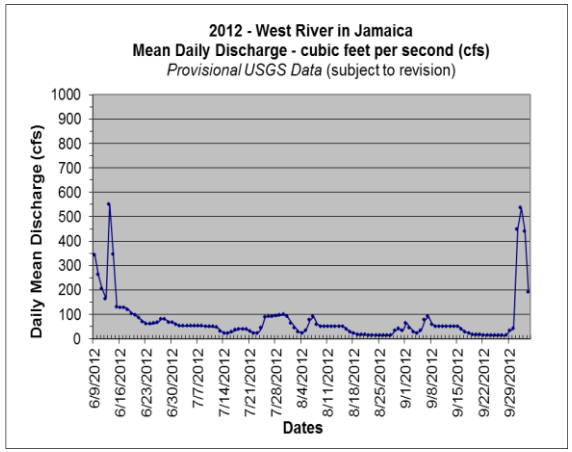
This section is organized as upper West River sites (in Londonderry and South Londonderry), middle and lower West River sites (that are in Townsend, Brookline, Dummerston and Brattleboro); those are followed by North Branch Brook sites and Rock River (Indian Love Call) monitoring sites.

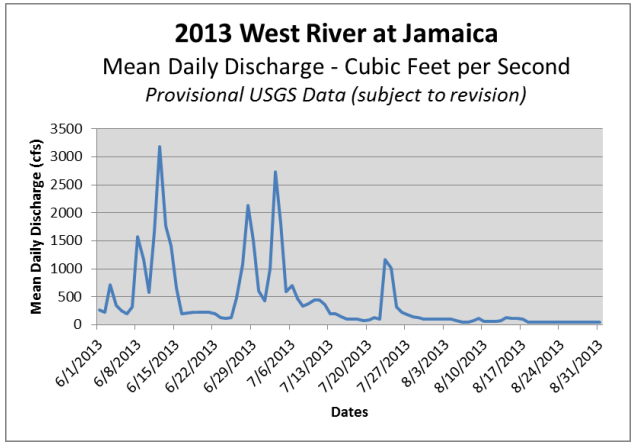
Two sites on Ball Mountain Brook, in Jamaica, and a site on Flood Brook, in Peru, were also part of SeVWA's monitoring program in 2010. Information related to those three sites, all in the West River watershed, for 2010 can be found in the 2010, 2011 and 2013 summary reports.

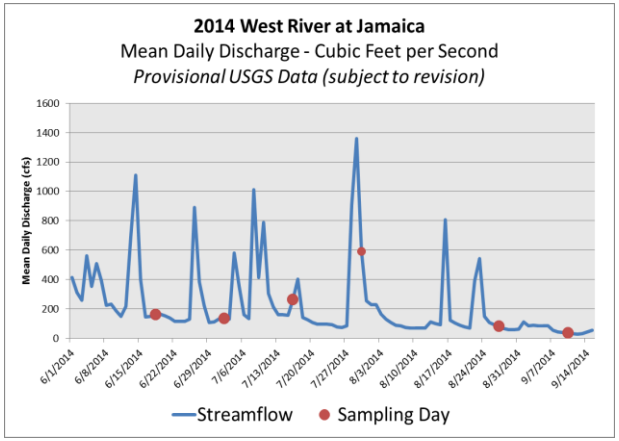
The mean daily discharge[1] graphs that appear below can be used for the entire West River watershed. They are intended to provide a sense of the volume of water moving through the streams and rivers of the watershed through the 2010-2014 sampling seasons. The bottom right graph shows the regional rain data[2] for 2014:

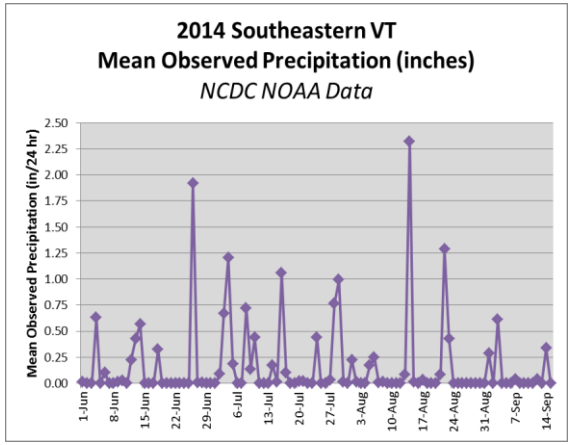












[1] Mean Daily Discharge or flow rate data available from the USGS National Water Information System at: http://waterdata.usgs.gov/usa/nwis/ or http://waterdata.usgs.gov/vt/nwis/dv/?referred_module=sw

[2] Mean observed precipitation data created from data sets in the sampling area found using the National Climactic Data Center from NOAA at: http://gis.ncdc.noaa.gov/map/viewer/#app=cdo&cfg=cdo&theme=daily&layers=111

WEST RIVER – UPPER SITES: SOUTH LONDONDERRY AND LONDONDERRY

SITES	CITY/TOWN	SITE DESCRIPTION	2010	2011	2012	2013	2014
West_ 39	Londonderry	Below dam & Rte 100 bridge		X			
West_38.5A	Londonderry	Rte 100 below Rte 100 bridge					X
West_38.5	Londonderry	Below Mountain Marketplace on Rte 100		X	X	X	X
West_36.2	South Londonderry	Cobb's swim hole, Winhall Hollow Rd.	X				
West_36.1	South Londonderry	Just below West_36.2, above Rte 100 bridge		X	X	X	
West_36	South Londonderry	Rowes Rd.	X	X	X	X	X

Currently, there is a statewide TMDL project underway in Vermont to address waters impaired by bacterial pollution. A segment of the West River in South Londonderry is included in that project. WRWA's WQMP was instrumental in providing data for recognizing the impairment and will continue to collect data for the project's use in order to help remedy the impact.

Due to elevated bacteria measurements during the past few years, the West River from approximately half a mile above to about one mile below South Londonderry's village center did not meet Vermont's water quality standards. The segment was identified as impaired and placed on the 303(d), impaired waters list. The Clean Water Act requires that all 303(d) listed waters undergo a TMDL (Total Maximum Daily Load) assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all water bodies to comply with state water quality standards. For more information and recommendations to address the possible impacts see the VT DEC online publications, VT DEC Water Quality Division, Vermont Statewide Total Maximum Daily Load (TMDL) for Bacteria-Impaired Waters and Vermont Statewide Total Maximum Daily Load (TMDL) for Bacteria – Appendix 15, West River.

E. COLI RESULTS:

2010 *E. coli* results [MPN (most probable number of) *E. coli* per 100 milliliters of water]

SITE	6/30/10	7/14/10	7/28/10	8/11/10	8/25/10	9/8/10	9/22/10	GEOMEAN	MAX	N
West_36.2	101.7	1986.3	116.9	166.4	152.9	98.7	63.1	167.8	1986.3	7
West_36	50.4	866.4	161.6	133.4	95.8	122.3	135.4	147.1	866.4	7

2011 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/22/11	7/6/11	7/20/11	8/3/11	8/17/11	8/31/11[1]	9/14/11	GEOMEAN	MAX	N
West_39	160.7	77.1	150.0	62.4	228.2	NT	66.3	109.8	228.2	6
West_38.5	65	52.8	101.7	41.4	139.6	NT	41.0	66.0	53	6
West_36.1	60.9	47.3	73.8	39.9	161.6	NT	26.2	57.4	161.6	6
West_36	67.0	79.4	98.7	387.3	325.5	NT	23.3	107.5	387.3	6

[1]Sampling did not occur on scheduled sampling date 8/31/11 due to effects of Tropical Storm Irene.

2012 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/13/12	6/27/12	7/11/12	7/25/12	8/8/12	8/22/12	9/5/12	GEOMEAN	MAX	N
West_38.5	727.0	272.3	86.0	547.5	52.1	27.2	52.0	131.7	727.0	7
West_36.1	920.8	298.7	108.6	770.1	156.5	162.4	143.9	261.7	920.8	7
West_36	920.8	344.1	93.3	686.7	88.4	90.9	117.8	212.0	920.8	7

2013 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/19/13	7/3/13	7/17/13	7/31/13	8/14/13	8/28/13	GEOMEAN	MAX	N
West_38.5	36.4	383.0	178.2	53.8	816.4	29.9	121.8	816.4	6
West_36.1	33.1	765.3	90.8	123.6	686.7	56.5	149.2	765.3	6
West_36	36.9	456.2	98.8	298.7	613.1	34.5	148.0	613.1	6

2014 *E. coli* results [MPN *E.coli* per 100 milliliters of water]

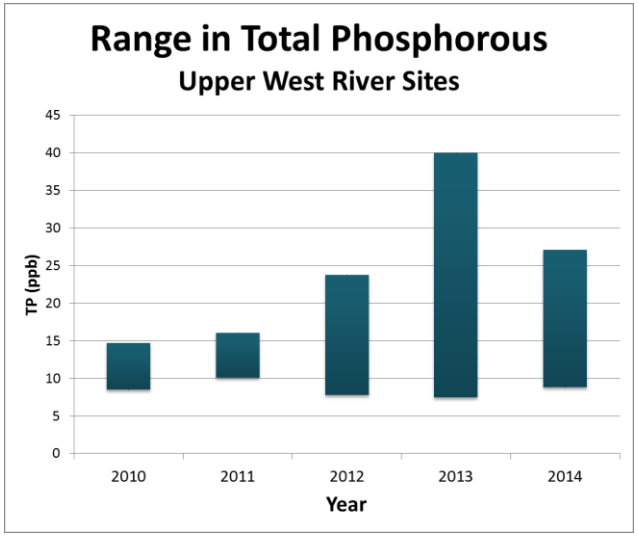
SITE	6/18/14	7/2/14	7/16/14	7/30/14	8/13/14[1]	8/27/14	GEOMEAN	MAX	N
West_38.5A	579.4	79.4	325.5	143	NT	43.7	156.4	579.4	5
West_38.5	272.3	142.1	191.8	113.7	NT	67.7	141.7	272.3	5
West_36	365.4	93.4	365.4	151.5	NT	36.4	147.1	365.4	5

[1]Sampling did not occur on scheduled samplingdate 8/13/14 due to Flood Watch.

GEOMEAN = geometric mean, **MAX** = maximum value of season's samples collected,
N = total number of samples collected during the sampling season, **NT** = Not tested
(VT Class B E. coli standard: single sample or GEOMEAN = 77 E. coli per 100 mL;
VT DOH "suitable for swimming" standard (single sample) = 235 per 100 mL;
US EPA standard: single sample = 235 per 100 mL, GEOMEAN = 126 per 100 mL)

TOTAL PHOSPHOROUS (TP) RESULTS:

It is possible for TP levels greater than 10 ppb to have an impact on freshwater stream ecosystems. The chart below shows the range of results from Upper West River monitoring sites.



Year	Low TP (ppb)	High TP (ppb)
2010	8.5	14.7
2011	10.1	16.1
2012	7.82	23.8
2013	7.47	40
2014	8.81	27.1

WATER TEMPERATURE:

Temperatures above 20°C can have a negative impact on cold water fish species.
SeVWa's measurements were typically made between 7-8 AM on sampling days. Sites' water temperatures on other days or other times later in the day on sampling days probably reached higher temperatures than our measurements indicate.

2011 - At West_36 and West_36.1 in South Londonderry and West_38.5 and West_39 in Londonderry, the maximum water temperature measured during sampling was **20°C**.
2012 - At West_36 and West_36.1 in South Londonderry, the maximum water temperature measured during sampling was **20°C**.
2013 – At West_36 in South Londonderry and West_38.5 in Londonderry, the maximum water temperature measured during the sampling season was **20.5^{o}C**.
2014 – At West_38.5A and West_38.5 in Londonderry, the maximum water temperature measured during the season was **21°C**

WEST RIVER – MIDDLE & LOWER SITES: TOWNSEND, BROOKLINE, DUMMERSTON, AND BRATTLEBORO

SITES	CITY/TOWN	SITE DESCRIPTION	2010	2011	2012	2013	2014
West_16	Townsend	Ellen Ware Road	X		X	X	X
West_13	Brookline	Brookline bridge	X	X	X	X	X
West_6.4	Dummerston	Just above Dummerston covered bridge	X	X	X	X	X
West_1.42	Brattleboro	Behind B'boro Professional Center, Rte. 30	X	X	X	X	X
West_.5	Brattleboro	Just above West_.08		X			
West_.08	Brattleboro	Milk House Meadows, just above Marina	X	X	X	X	X

In 2010 *E. coli* values were elevated at West_.08, the Milkhouse Meadows site just above the convergence with the Connecticut River and The Marina Restaurant in Brattleboro. In 2011 a site was added just above West_.08, at West_.5, to help determine the possible direction of the *E. coli* source. Several possible sources, including an increase in the presence of geese, a beaver colony, private septic systems, a public wastewater pumping station, runoff from roads, and backflow from the Connecticut River, were identified. In 2011 West_.08 and the newly selected site West_.5 *E. coli* GEOMEANS were less than the VT standard of 77, so the West_.5 site was only monitored in 2011.

In general, for the middle and lower West River sites in 2011 and 2012, the *E. coli* GEOMEAN values were less than or just barely above the VT Class B standard of 77. In 2013 and 2014, all middle and lower West River sites' *E. coli* GEOMEAN values exceeded the VT Class B standard of 77. However, only about 1/3 of individual samples exceeded either the VT "suitable for swimming" standard or EPA single sample standard of 235.

West_1.42 was included in the monitoring program in 2010 as there is a riverside town park being developed in the vicinity and a public hand-carry boat access will be located in close proximity to the monitoring site. The sampling site is also in close proximity to a popular swimming hole that has been monitored in past years. There was an unusually high *E. coli* result on 7/25/12 at the West_1.42 site. A possible cause for the remarkably unusual result is elusive. The source of the elevated *E. coli* may have been a very brief, locally isolated event. 7/16/14 and 7/30/14 saw results that were significantly higher at West_1.42 than upstream and downstream results but were timed with significant runoff events as discussed below.

Other elevated *E. coli* results on particular days appear to be related to "wet" sampling events. There had probably been a significant amount of rain in the previous 2-3 days, so conditions were above base flow, and there appears to be bacteria laden run-off making it to the river. Other possible explanations for increased *E. coli* levels along the middle and lower stretches of the West River were addressed in the first paragraph above.

E. COLI RESULTS

2010 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/30/10	7/14/10	7/28/10	8/11/10	8/25/10	9/8/10	9/22/10	GEOMEAN	MAX	N
West_16	42.2	NT	52.9	NT	69.1	NT	33.1	47.5	69.1	4
West_13	52.0	25.6	52.0	66.3	95.9	272.3	21.8	59.4	272.3	7
West_6.4	18.7	12.0	30.9	58.3	93.4	51.2	34.1	35.1	93.4	7
West_1.42	22.8	51.2	49.6	71.7	143.9	39.1	17.5	45.6	143.9	7
West_.08	39.3	88.4	127.4	648.8	21.3	866.4	579.4	163.1	866.4	7

2011 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/22/11	7/6/11	7/20/11	8/3/11	8/17/11	8/31/11[1]	9/14/11	GEOMEAN	MAX	N
West_13	32.7	40.4	52.8	45.0	517.2	NT	NT	69.5	517.2	5
West_6.4	39.3	34.5	25.9	35.5	NT	NT	NT	33.4	39.3	4
West_1.42	96.0	25.6	NT	24.1	579.4	NT	NT	76.5	579.4	4
West_.5	30.5	38.9	44.8	69.1	387.3	NT	NT	67.7	387.3	5
West_.08	42.0	52.8	42.8	78.5	307.6	NT	NT	74.5	307.7	5

[1]Sampling did not occur on scheduled sampling date 8/31/11 due to effects of Tropical Storm Irene.

2012 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/13/12	6/27/12	7/11/12	7/25/12	8/8/12	8/22/12	9/5/12	GEOMEAN	MAX	N
West_16	79.4	68.3	40.4	166.4	93.3	50.4	67.6	73.5	166.4	7
West_13	133.3	56.3	33.2	189.1	85.7	79.8	76.3	81.8	189.1	7
West_6.4	115.3	54.8	17.1	NA	62.4	34.1	129.6	55.7	129.6	6
West_1.42	150.0	95.9	24.7	1,046.2	69.7	30.9	38.4	84.5	1,046.2	7
West_.08	156.5	59.1	9.7	68.3	59.8	63.1	178.5	63.4	178.5	7

2013 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/19/13	7/3/13	7/17/13	7/31/13	8/14/13	8/28/13	GEOMEAN	MAX	N
West_16	47.9	727.0	36.9	29.5	477.4	26.9	89.0	727.0	6
West_13	NT	488.4	55.6	47.1	387.3	56.3	122.8	488.4	5
West_6.4	24.9	410.6	32.7	49.5	298.7	77.6	85.2	410.6	6
West_1.42	42.2	613.3	33.1	60.5	365.4	30.5	91.3	613.1	6
West_.08	72.3	613/2	42.0	48.8	648.8	72.3	110.0	648.8	6

2014 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

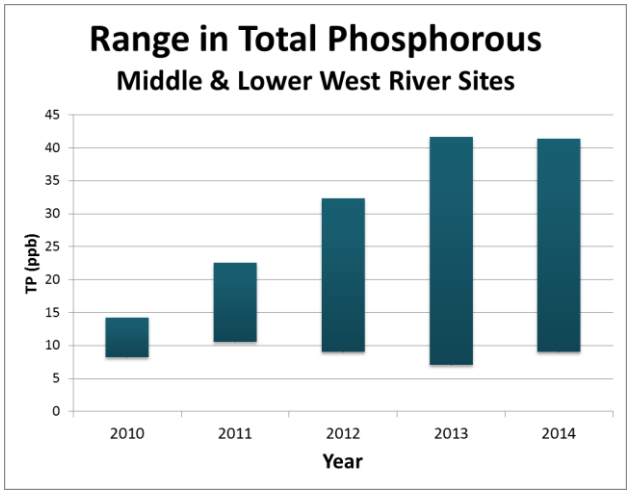
SITE	6/18/14	7/2/14	7/16/14	7/30/14	8/13/14[1]	8/27/14	GEOMEAN	MAX	N
West_16	101.2	31.3	307.6	410.6	NT	37.3	108.3	410.6	5
West_13	58.3	55.6	193.5	365.4	NT	16.1	81.9	365.4	5
West_6.4	456.2	31.7	810.6	461.1	NT	26.2	169.9	810.6	5
West_1.42	79.8	74.9	1413.6	1299.7	NT	32.7	204.7	1413.6	5
West_.08	47.3	50.4	1203.3	517.2	NT	52.9	151.0	1203.3	5

[1]Sampling did not occur on scheduled sampling date 8/13/14 due to Flood Watch.

GEOMEAN = geometric mean, **MAX** = maximum value of season's samples collected,
N = total number of samples collected during the sampling season, **NT** = Not tested
(VT Class B E. coli standard: single sample or GEOMEAN = 77 E. coli per 100 mL;
VT DOH "suitable for swimming" standard (single sample) = 235 per 100 mL;
US EPA standard: single sample = 235 per 100 mL, GEOMEAN = 126 per 100 mL)

TOTAL PHOSPHOROUS (TP) RESULTS:

It is possible for TP levels greater than 10 ppb to have an impact on freshwater stream ecosystems. The chart below shows the range of results from Middle and Lower West River monitoring sites.



Year	Low TP (ppb)	High TP (ppb)
2010	8.2	14.2
2011	10.5	22.5
2012	8.98	32.3
2013	7.06	41.6
2014	9.01	14.04

WATER TEMPERATURE:

Temperatures above 20°C can have a negative impact on cold water fish species.
SeVWa's measurements were typically made between 7-8 AM on sampling days. Sites' water temperatures on other days or other times later in the day on sampling days probably reached higher temperatures than our measurements indicate.

The tree canopy along the lower stretch of the West River is very open, or is not present, and the river is much wider than most of the other rivers and streams in Basin 11 and 13. There are also many shallow, rocky, bouldery areas which heat-up in the summer sun and warm the water.

In all 4 years, the highest water temperatures recorded on sampling mornings were from West_.08 at 24.5^{o}C. In 2014, West_6.4 also reached 24.5^{o}C.

WEST RIVER TRIBUTARIES - ROCK RIVER AND NORTH BRANCH BROOK

SITES	CITY/TOWN	SITE DESCRIPTION	2010	2011	2012	2013	2014
Rock_.38	Newfane	Vicinity of Indian Love Call, upstream of Rte. 30			X	X	X
NBranchBrk_4.5	Jamaica	Pikes Falls swim hole	X	X	X	X	X

In 2011 Cris White, a Newfane property owner in the vicinity of Indian Love Call on the Rock River in Newfane, spearheaded an independent effort to re-activate *E. coli* monitoring at the Indian Love Call swimming hole site. WRWA had monitored in the vicinity for a few years, but more recently the site has not been part of the WRWA/SeVWA WQMP. Since the Rock River site was not a part of the SeVWA 2011 WQMP Cris and Rock River Preservation, via Thom Chiofalo, paid for the CRWC *E. coli* analysis. SeVWA was glad to be able to facilitate Cris' effort to re-activate the monitoring at Indian Love Call. The site has been included in SeVWA's WQMP since 2012.

The NBranchBrk_4.5 site was not monitored for *E. coli* in 2010 and was only scheduled to be sampled on a monthly basis during 2011 and 2012. Other parameters were sampled on a monthly basis during those years. In 2013 and 2014, all parameters were sampled biweekly.

Two sites on Ball Mountain Brook, in Jamaica, were also part of SeVWA's monitoring program in 2010. Information related to those two sites for that year can be found in the 2010, 2011 and 2013 summary reports.

E. COLI RESULTS:

2010 E. coli results [MPN *E. coli* per 100 milliliters of water]

SITE	6/30/10	7/14/10	7/28/10	8/11/10	8/25/10	9/8/10	9/22/10	GEOMEAN	MAX	N
NBranchBrk_4.5	NT	NT	NT	NT	NT	NT	NT	NA	NA	0

2011 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/22/11	7/6/11	7/20/11	8/3/11	8/17/11	8/31/11[1]	9/14/11	GEO-MEAN	MAX	N
Indian Love Call*	NT	24.1	13.4	10.9	118.7	NT	NT	25.4	118.7	4
NBranchBrk_4.5	13.4	NT	10.9	NT	95.9	NT	NT	24.1	95.9	3

[1]Sampling did not occur on scheduled sampling date 8/31/11 due to effects of Tropical Storm Irene.

*This site was not officially part of SeVWA's WQMP in 2011. Data from CRWC lab provided by Cris White.

2012 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/13/12	7/11/12	7/25/12	8/8/12	8/22/12	9/5/12	10/3/12	GEOMEAN	MAX	N
Rock_.38	307.6	81.6	28.2	58.3	22.3	88.2	206.4	77.5	307.6	7
NBranchBrk_4.5	NT	2.0	NT	42.2	NT	344.1	9.7	24.1	344.1	4

2013 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/19/13	7/3/13	7/17/13	7/31/13	8/14/13	8/28/13	GEOMEAN	MAX	N
Rock_.38	23.3	272.3	13.5	9.6	125.9	16	34.4	272.3	6
NBranchBrk_4.5	18.9	307.6	10.9	20.1	139.6	2.0	26.6	307.6	6

2014 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/18/14	7/2/14	7/16/14	7/30/14	8/17/15[1]	8/27/14	GEOMEAN	MAX	N
Rock_.38	83.9	17.1	1986.3	77.1	NT	11.9	76.5	1986.3	5
NBranchBrk_4.5	275.5	214.2	137.4	83.6	NT	93.3	144.6	275.5	5

[1]Sampling did not occur on scheduled sampling date 8/13/14 due to Flood Watch.

GEOMEAN = geometric mean, **MAX** = maximum value of season's samples collected,
N = total number of samples collected during the sampling season, **NT** = Not tested
(VT Class B E. coli standard: single sample or GEOMEAN = 77 E. coli per 100 mL;
VT DOH "suitable for swimming" standard (single sample) = 235 per 100 mL;
US EPA standard: single sample = 235 per 100 mL, GEOMEAN = 126 per 100 mL)

ROCK RIVER

The highest *E. coli* values from all four years were from "wet" sampling days. On 8/17/11, 6/13/12 , 9/5/12, 7/3/13, 8/14/13, and 7/16/14 all of the *E. coli* values exceeded the VT Class B waters standard of 77, though only the 6/13/12, 7/3/13, and 7/16/14 results exceeded the VT "suitable for swimming" and EPA standards of 235. The GEOMEANS of 2011, 2013, and 2014 were well below the VT Class B standard while 2012 basically met the standard.

At this site and upstream of it are a series of popular swimming holes along the Rock River. There are concerns that there are inadequate sanitary facilities at this heavily used stream location. On hot summer weekends this location is visited by hundreds of people. There are no public restrooms or sanitary facilities available.

NORTH BRANCH BROOK

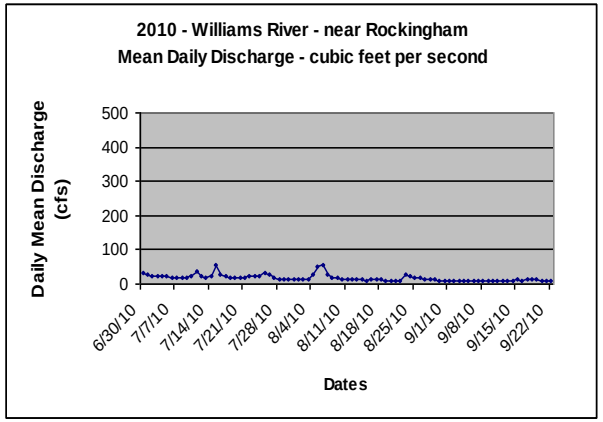
NBranchBrk_4.5 is located at Pikes Falls, a popular swimming hole in Jamaica, is a site selected by VT DEC for long term water quality monitoring and is also a long term monitoring site for SeVWA. *E. coli* levels at the North Branch Brook site in 2011 and 2012 typically tested below the VT Class B standard of 77, sometimes they have run approximately at or slightly above the VT standard. *E. coli* GEOMEAN values at these sites have typically been below the VT standard. Of the six 2013 sampling days, two days tested above the VT standard and both were considered "wet" sampling days after heavy rains. One of those two high samples was under the EPA standard for a single sample of 235.

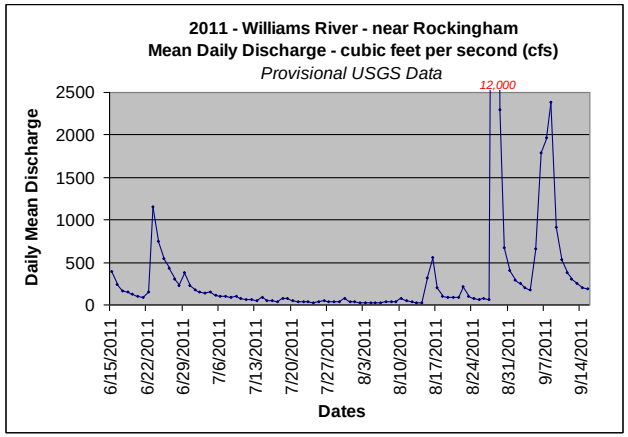
Conductivity readings typically run higher – around 200 µS/cm – at the NBranchBrk_4.5 site than at most of the other program sites. This may be due to upstream influences or character of local geology. The maximum water temperature recorded at the North Branch Brook site was 15°C in 2012, 19.5^{o}C in 2013, and 18°C in 2014.

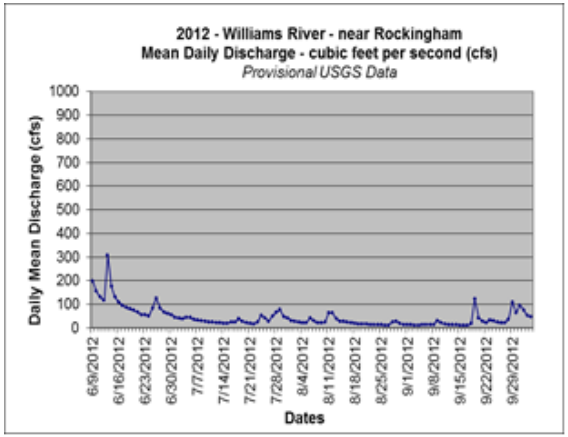
WILLIAMS RIVER SUMMARY

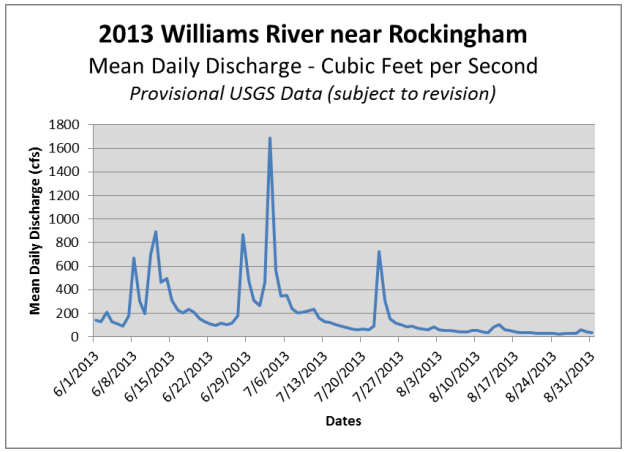
The **Williams River** originates at the eastern edge of the southern Green Mountains and flows easterly then southeasterly, through Southern Vermont Piedmont before joining the Connecticut at Herrick's Cove. The main stem of the Williams River is 25 miles long, and its watershed covers 117 square miles. Much of the basin is rugged, hilly land with steep slopes and poor drainage. Similar to the West River, the Williams River is largely forested, with 82 percent coverage. A slightly higher percentage from that of the West River watershed is in agricultural use and roads and other transportation uses cover 4 percent of the Williams watershed area. The main tributary to the Williams River is the Middle Branch Williams River. Lyman's Brook, Andover Branch and the South Branch are tributaries to the Middle Branch Williams River.

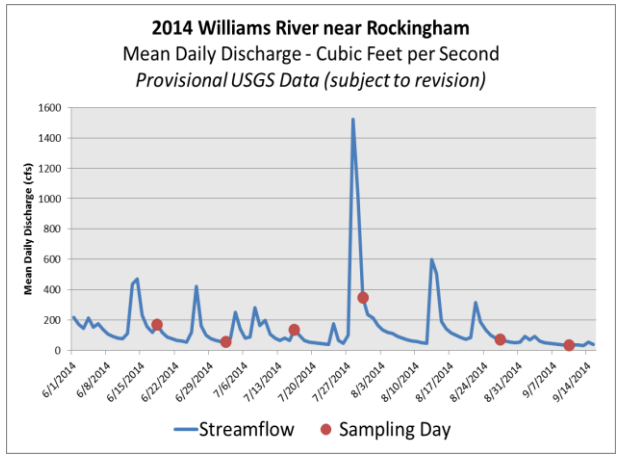
The mean daily discharge[1] graphs that appear below can be used for the entire West River watershed. They are intended to provide a sense of the volume of water moving through the streams and rivers of the watershed through the 2011-2014 sampling seasons. The bottom right graph shows the regional rain data[2] for 2014:

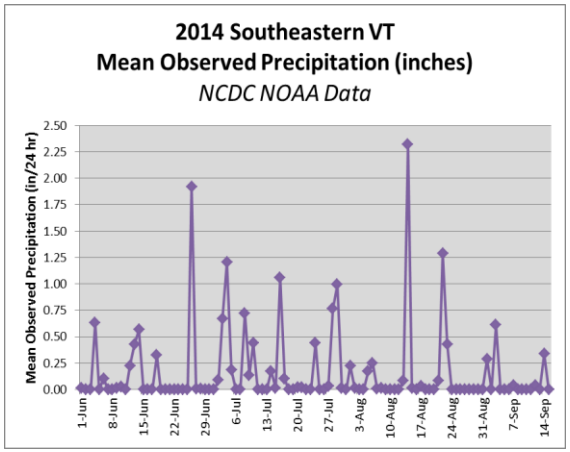












[1] Mean Daily Discharge or flow rate data available from the USGS National Water Information System at: http://waterdata.usgs.gov/usa/nwis/ or http://waterdata.usgs.gov/vt/nwis/dv/?referred_module=sw

[2] Mean observed precipitation data created from data sets in the sampling area found using the National Climactic Data Center from NOAA at: http://gis.ncdc.noaa.gov/map/viewer/#app=cdo&cfg=cdo&theme=daily&layers=111

WILLIAMS RIVER WATERSHED SITES (WILLIAMS R. & MIDDLE BRANCH WILLIAMS R.), CHESTER AND ROCKINGHAM

SITES	CITY/TOWN	SITE DESCRIPTION	2010	2011	2012	2013	2014
Williams_11.85	Chester	Just above Flamstead Rd. crossing					X
MBrWilliams_2.1	Chester	Middle Br. Williams, Blue Hill Rd crossing					X
MBrWilliams_.02	Chester	Middle Br. Williams, Just above Rainbow Rock		X	X	X	X
Williams_10.8	Chester	Just above confl. of Mid.Br.Williams R. & 10.7		X	X	X	
Williams_10.7	Chester	Rainbow Rock swim hole	X	X	X	X	X
Williams_10.3	Chester	Below Chester village WWTF	X	X	X	X	X
Williams_8.7	Chester	Just above Missing Link Rd. bridge		X	X	X	
Williams_8.6	Chester	At RR bridge below Missing Link Rd. & just below Halls Brook					X
Williams_7.0	Rockingham	Just above Bartonsville bridge	X	X	X	X	X
Williams_.92	Rockingham	Golden Hill Rd., below I-91 bridge				X	X
Williams_.24N	Rockingham	Herricks Cove Rd., unimproved access at field				X	

In 2012, construction at the Bartonsville bridge site, Williams_7.0 required moving the monitoring location upstream slightly.

In 2010 *E. coli* results at the 3 Williams River sites seemed to regularly exceed the VT Class B waters standard of 77 *E. coli* per 100 mL of water. Because of that 2 additional sites were added in Chester above Rainbow Rock (Williams_10.7) and an additional site was added above the Bartonsville bridge site (Williams_7.0). Two sites (Williams_10.8 and Williams_8.7) were not monitored in 2014 and two different sites (Williams_11.85 and Wiliams_8.6) were added to the program instead. In 2011, there was not a very dramatic difference in the *E. coli* values compared to 2010, but in 2012 the individual sites' results and the geomeans for each site appear to have had significant increases. The results and geomeans in 2014 were even higher than in 2012. Please see the discussion and graphs below for more information.

In 2013, two lower Williams River sites were added, Williams_.92 and Williams_.24N, but only one of the lower sites, Williams_.92, continued to be monitored in 2014.

E. COLI RESULTS

2010 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/30/10	7/14/10	7/28/10	8/11/10	8/25/10	9/8/10	9/22/10	GEOMEAN	MAX	N
Williams_10.7	111.9	290.9	NT	143.9	206.4	304.4	54.6	158.9	304.4	6
Williams_10.3	NT	NT	93.3	NT	NT	NT	34.5	56.7	93.3	2
Williams_7.0	204.6	137.6	96.0	>2419.6	165.8	133.4	33.1	173.8	>2419.6	7

2011 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/22/11	7/6/11	7/20/11	8/3/11	8/17/11	8/31/11[1]	9/14/11	GEOMEAN	MAX	N
MBrWilliams_.02	31.8	90.6	86.2	45.7	104.3	NT	NT	65.3	104.3	5
Williams_10.8	410.6	83.3	122.3	101.2	NT	NT	NT	143.4	410.6	4
Williams_10.7	76.7	108.1	88.4	75.4	142.1	NT	NT	95.3	142.1	5
Williams_10.3	90.8	107.6	116.2	66.3	129.6	NT	38.9	85.1	129.6	6
Williams_8.7	83.3	67.7	127.4	46.4	201.4	NT	NT	92.3	201.4	5
Williams_7.0	63.1	79.4	175.2	88.0	222.4	NT	42.6	94.9	222.4	6

[1]Sampling did not occur on scheduled sampling date 8/31/11 due to effects of Tropical Storm Irene.

2012 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/13/12	6/27/12	7/11/12	7/25/12	8/8/12	8/22/12	9/5/12	GEOMEAN	MAX	N
MBrWilliams_.02	NT	517.2	325.5	298.7	160.7	228.2	124.6	247.5	517.2	6
Williams_10.8	NT	214.2	209.8	488.4	224.7	461.1	1299.7	378.8	1299.7	6
Williams_10.7	NT	328.2	129.6	NA	228.2	290.9	517.2	271.0	517.2	5
Williams_10.3	1553.1	>2419.6	125.9	224.7	116.2	290.9	360.9	285.0	>2419.6	7
Williams_8.7	1986.3	248.9	275.5	325.5	116.9	224.7	461.1	341.1	1986.3	7
Williams_7.0	1,046.2	>2419.6	155.3	686.7	206.4	117.8	201.4	285.9	>2419.6	7

2013 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/19/13	7/3/13	7/17/13	7/31/13	8/14/13	8/28/13	GEOMEAN	MAX	N
MBrWilliams_.02	22.3	NT	160.7	53.7	161.6	118.7	81.9	161.6	5
Williams_10.8	228.2	NT	68.3	65.3	325.5	272.3	155.3	325.5	5
Williams_10.7	90.6	1299.7	141.4	83.6	228.2	160.7	192.6	1299.7	6
Williams_10.3	88.2	NT	151.5	67.0	325.5	111.2	126.5	325.5	5
Williams_8.7	46.4	816.4	235.9	85.7	261.3	161.6	178.5	816.4	6
Williams_7.0	52.8	770.1	275.5	69.1	275.5	114.5	170.3	770.1	6
Williams_.92	110.6	866.4	95.9	52.8	648.8	105.0	179.1	866.4	6
Williams_.24N	34.5	128.1	27.9	10.9	68.9	151.5	49.1	151.5	6

2014 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/18/14	7/2/14	7/16/14	7/30/14	8/17/15[1]	8/27/14	9/10/14[2]	GEOMEAN	MAX	N
Williams_11.85	547.5	117.8	579.4	135.4	NT	98.4	NT	218.5	579.4	5
MBrWilliams_2.1	770.1	98.8	1299.7	93.2	NT	37.9	NT	203.5	1299.7	5
MBrWilliams_.02	1986.3	104.6	517.2	101.7	NT	27.9	NT	198.1	1986.3	5
Williams_10.7	1732.9	178.9	517.2	133.4	NT	98.5	NT	291.6	1732.9	5
Williams_10.3	1986.3	224.7	727.0	125.9	NT	133.3	NT	352.5	1986.3	5
Williams_8.6	727	186	727	129.1	NT	131.4	NT	241.9	488.4	5
Williams_7.0	866.4	218.7	410.6	152.9	NT	69.7	NT	278.2	866.4	5
Williams_.92	275.5	70.3	290.9	142.1	NT	NT	26.2	116.0	290.9	5

[1]Sampling did not occur on scheduled sampling date 8/13/14 due to Flood Watch. [2]Make-up sampling day scheduled for 9/10/14

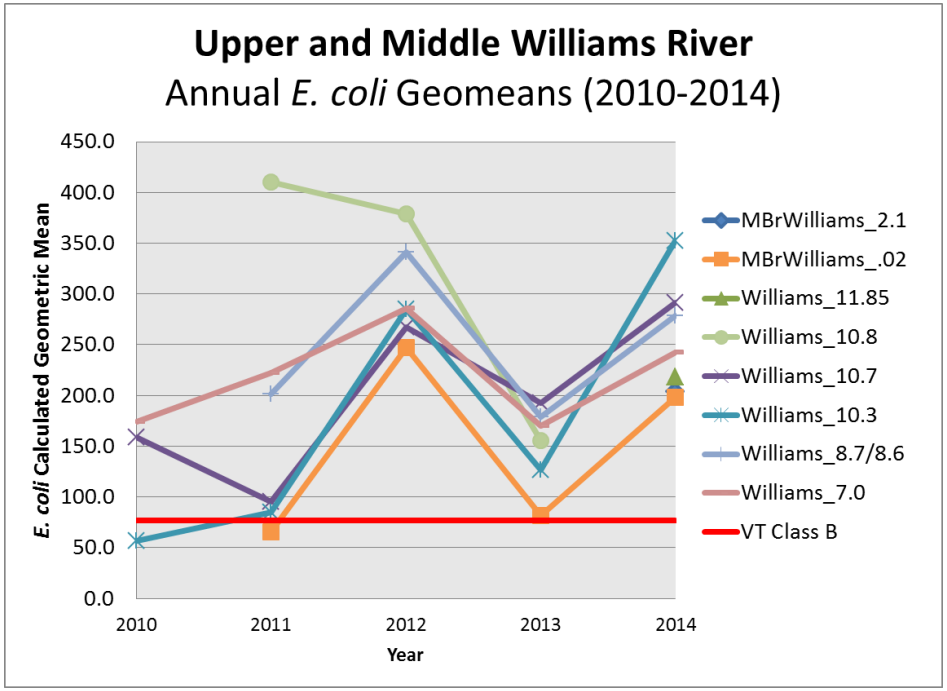
GEOMEAN = geometric mean, **MAX** = maximum value of season's samples collected,
N = total number of samples collected during the sampling season, **NT** = Not tested
(VT Class B E. coli standard: single sample or GEOMEAN = 77 E. coli per 100 mL;
VT DOH "suitable for swimming" standard (single sample) = 235 per 100 mL;
US EPA standard: single sample = 235 per 100 mL, GEOMEAN = 126 per 100 mL)

As discussed at the beginning of the section, sites have been added in 2011 and 2014 to help identify potential sources of high *E. coli* values. There is an unfortunate trend of rising geomeans in the Williams River. There was a dip in values in 2013, but it may be important to note that many Williams River sites were not sampled on an extremely wet sampling day due to unsafe conditions for our volunteers. It is somewhat likely that those results would have had the maximum *E. coli* value for the season and driven the geomeans higher.

The following page contains a condensed look at the geomeans information for the upper and middle Williams River sites. The lower Williams River sites are not included in these charts, but their geomeans have exceeded the VT EPA standard for Class B Waters in 2013 and 2014.

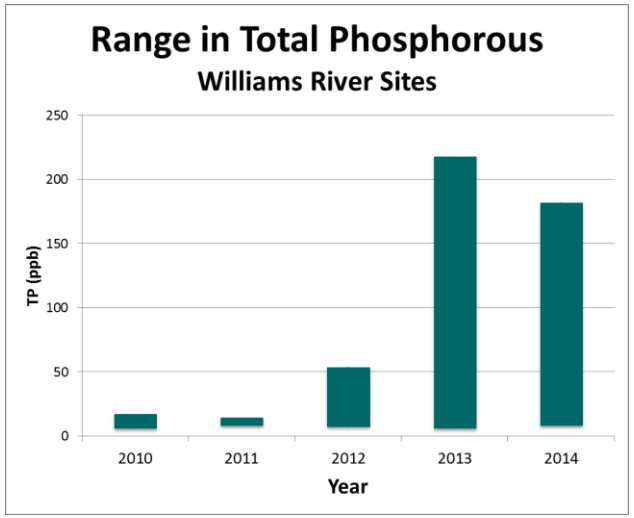
SITE	GEOMEANS				
	2010	2011	2012	2013	2014
Williams_11.85					218.5
MBrWilliams_2.1					203.5
MBrWilliams_.02		65.3	247.5	81.9	198.1
Williams_10.8		410.6	378.8	155.3	
Williams_10.7	158.9	95.3	267.0	192.6	291.6
Williams_10.3	56.7	85.1	285.0	126.5	352.5
Williams_8.7		201.4	341.1	178.5	
Williams_8.6					278.2
Williams_7.0	173.8	222.4	285.9	170.3	241.9

The graph (left) is a visual representation of the chart (above).
In general, the geomeans are trending upward, despite dipping in 2013.



TOTAL PHOSPHOROUS (TP) RESULTS:

It is possible for TP levels greater than 10 ppb to have an impact on freshwater stream ecosystems. The chart below shows the range of results from Williams River monitoring sites.



Year	Low TP (ppb)	High TP (ppb)
2010	5.9	17.0
2011	8.1	14.5
2012	6.96	53.7
2013	6.6	218
2014	8.09	182

A closer look at the ranges for individual sites shows that TP values appear to have increased in 2012 from below the Chester WWTF to the 2 sites further downstream. 2013 saw unprecedented high levels during a high water event in July, possibly attributable to the WWTF. There is significant agricultural use of this part of the watershed and also a number of tributaries that feed into the Williams River along this reach from Williams_10.3 to Williams_7.0. The Middle Branch Williams experienced some significantly elevated TP results in 2014 compared to 2013

SITES	Total Phosphorous Range (ppb)									
	2010		2011		2012		2013		2014	
	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi
Williams_11.85									9.10	19.80
MBrWilliams_2.1									8.62	182.00
MBrWilliams_.02			8.60	11.20	7.35	8.55	6.68	12.60	8.09	118.00
Williams_10.8			9.00	9.80	7.65	10.90	7.68	15.30		
Williams_10.7	5.9	8.8	8.50	11.50	6.96	8.68	6.68	140.00	8.39	32.30
Williams_10.3	6.9	12.2	8.10	12.20	7.87	28.90	6.60	22.10	8.14	91.10
Williams_8.7			11.20	14.00	10.70	53.70	8.17	198.00		
William_8.6									10.50	110.00
Williams_7.0	11.2	17.3	11.40	14.50	9.86	34.40	7.57	200.00	11.00	105.00
Williams_.92							8.56	218.00	8.69	91.80

NITRATE-NITRITE NITROGEN (NO_X) RESULTS:

NOx samples appear to have higher values at the 2 middle sites – Williams_8.7 (8.6 in 2014) & 7.0. The lower Williams site, Williams_.92 appears to be elevated in 2014 as well. All values are well below the 5.0 mg/L VT standard for nitrate-nitrogen in Class B waters.

SITES	NO_x Range (mg/l)									
	2010		2011		2012		2013		2014	
	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi
Williams_11.85									0.15	0.33
MBrWilliams_2.1									< 0.1	0.19
MBrWilliams_.02			0.11	0.13	0.09	0.19	0.07	0.14	0.12	0.33
Williams_10.8			0.16	0.18	0.27	0.33	0.07	0.38		
Williams_10.7	0.09	0.13	0.06	0.15	0.12	0.22	0.05	0.16	0.19	0.33
Williams_10.3	0.12	0.13	0.06	0.15	0.05	0.24	0.07	0.23	0.19	0.28
Williams_8.7			0.11	0.41	0.08	0.8	0.05	0.49		
Williams_8.6									0.29	0.68
Williams_7.0	0.41	0.69	0.11	0.4	0.1	0.78	0.05	0.51	0.36	0.68
Williams_.92							0.05	0.35	0.34	0.65

WATER TEMPERATURE:

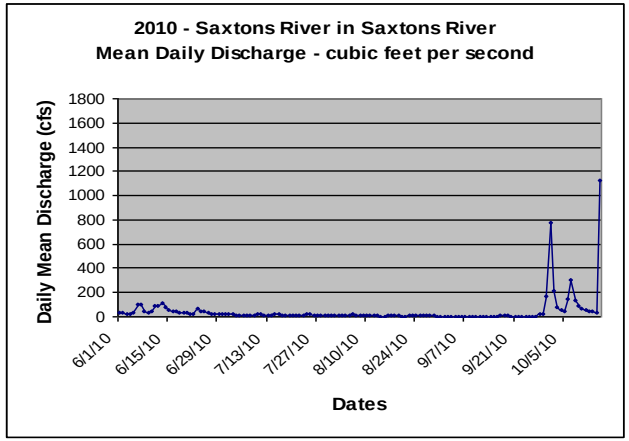
Temperatures above 20°C can have a negative impact on cold water fish species.
SeVWA's measurements were typically made between 7-8 AM on sampling days. Sites' water temperatures on other days or other times later in the day on sampling days probably reached higher temperatures than our measurements indicate.

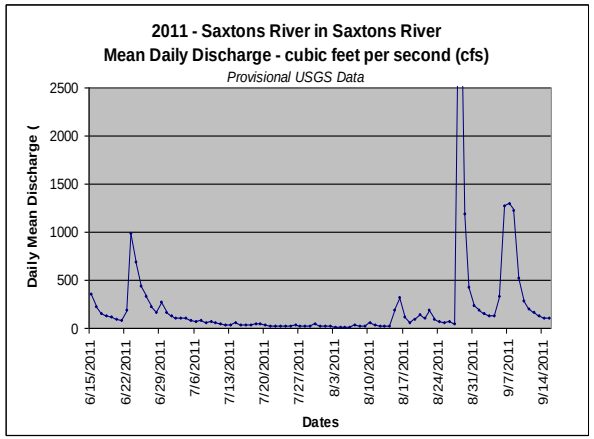
SITES	Maximum Seasonal Temperature Value (sampling typically occurs between 7-8 am)				
	'10	'11	'12	'13	'14
MBrWilliams_2.1					18.5
MBrWilliams_.02		17.0	18.0	19.5	20.0
Williams_11.85					19.0
Williams_10.8		17.0	19.0	18.5	
Williams_10.7	21.0	17.0	18.5	19.0	19.0
Williams_10.3	16.0	19.0	17.5	18.0	19.0
Williams_8.7		18.0	19.0	22.5	
Williams_8.6					19.0
Williams_7.0	21.0	17.0	18.0	19.0	19.5
Williams_.92				20.0	21.0

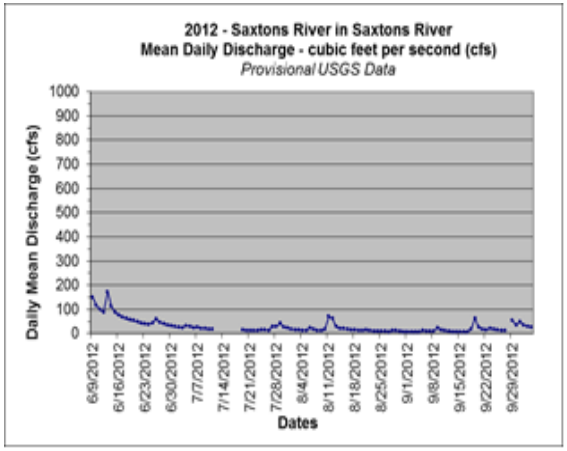
SAXTONS RIVER SUMMARY

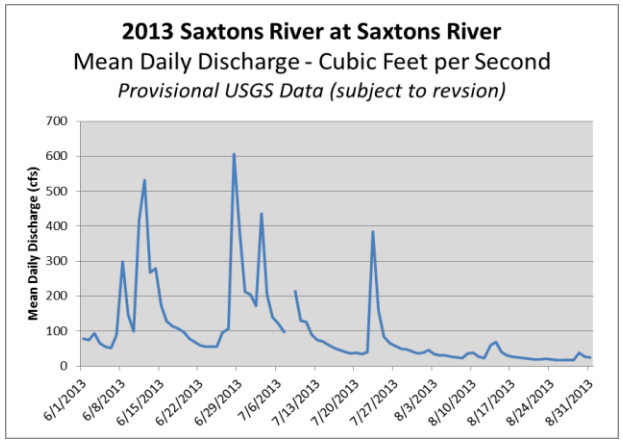
The **Saxtons River** rises on the eastern slopes of the southern Green Mountains in the town of Windham and flows 20 miles southeasterly across the Vermont Piedmont to the Connecticut River. The Saxtons River watershed drains an area of 78 square miles. This watershed is characterized by narrow steep gorges cut through rugged hilly uplands and outcropping bedrock offering poor drainage. Again at 82 percent, forests are the dominant land cover, with 4 percent of the area used for transportation activities. Its main tributary is the South Branch which joins the Saxtons River from the south at Grafton.

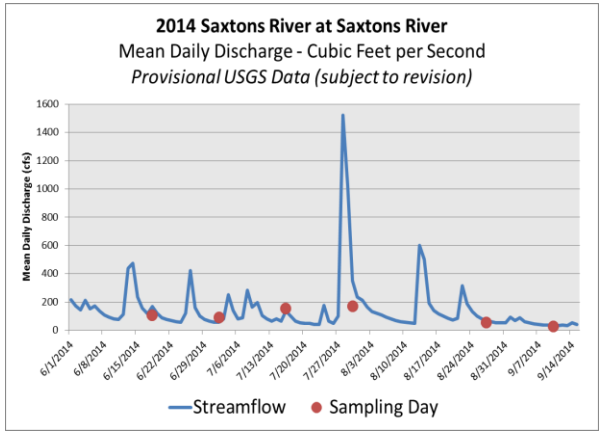
The mean daily discharge[1] graphs that appear below can be used for the entire West River watershed. They are intended to provide a sense of the volume of water moving through the streams and rivers of the watershed through the 2011-2014 sampling seasons. The bottom right graph shows the regional rain data[2] for 2014:

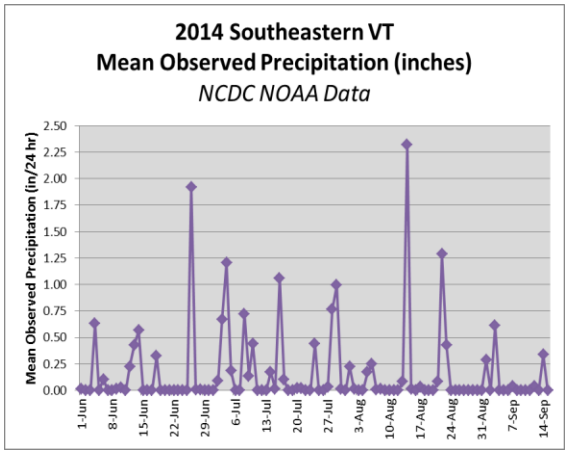












[1] Mean Daily Discharge or flow rate data available from the USGS National Water Information System at: http://waterdata.usgs.gov/usa/nwis/ or http://waterdata.usgs.gov/vt/nwis/dv/?referred_module=sw

[2] Mean observed precipitation data created from data sets in the sampling area found using the National Climactic Data Center from NOAA at: http://gis.ncdc.noaa.gov/map/viewer/#app=cdo&cfg=cdo&theme=daily&layers=111

SAXTONS RIVER SITES, SAXTONS RIVER AND WESTMINSTER

SITES	CITY/TOWN	SITE DESCRIPTION	2010	2011	2012	2013	2014
Saxtons_5.6	Saxtons River	Stickney's field, above Saxtons R. village	X	X	X	X	X
Saxtons_5.15	Saxtons River	Just above Saxtons River village WWTF					X
Saxtons_5.0	Saxtons River	Below WWTF in Saxtons River village	X	X	X	X	X
Saxtons_.19	Westminster	"Sandy beach", just south of BF town line	X	X	X	X	X

E. COLI RESULTS:

2010 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/30/10	7/14/10	7/28/10	8/11/10	8/25/10	9/8/10	9/22/10	GEOMEAN	MAX	N
Saxtons_5.6	53.8	145.0	52.9	NT	52.8	NT	9.7	46.2	145.0	5
Saxtons_5.0	66.3	NT	73.8	NT	93.4	NT	14.8	51.0	93.4	4
Saxtons_.19	64.4	209.8	42.8	55.6	145.0	NT	21.1	67.9	209.8	6

2011 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/22/11	7/6/11	7/20/11	8/3/11	8/17/11	8/31/11	9/14/11	GEOMEAN	MAX	N
Saxtons_5.6	46.7	71.2	91.0	63.7	214.2	NT	63.1	79.9	214.2	6
Saxtons_5.0	45.5	NT	91.0	NT	204.6	NT	90.6	93.6*	204.6	4
Saxtons_.19	116.2	88.2	156.5	193.5	261.3	NT	101.7	142.1	261.3	6

*Value in 2012 was incorrect and has been corrected this year.

2012 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/13/12	6/27/12	7/11/12	7/25/12	8/8/12	8/22/12	9/5/12	GEOMEAN	MAX	N
Saxtons_5.6	435.2	261.3	108.1	131.4	114.5	60.9	NT	149.7	435.2	6
Saxtons_5.0	NT	248.9	123.6	105.0	88.2	123.6	1,413.6	191.8	1413.6	6
Saxtons_.19	770.1	238.2	285.1	260.3	186.0	178.9	260.3	274.7	770.1	7

2013 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/19/13	7/3/13	7/17/13	7/31/13	8/14/13	8/28/13	GEOMEAN	MAX	N
Saxtons_5.6	61.3	613.1	235.9	52.9	461.1	21.8	150.1	613.1	6
Saxtons_5.0	172.2	1119.9	248.9	35.0	613.1	74.9	196.8	1119.9	6
Saxtons_.19	123.6	920.8	325.5	410.6	11119.9	155.3	336.4	1119.9	6

2014 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/18/14	7/2/14	7/16/14	7/30/14	8/17/15[1]	8/27/14	9/10/14[2]	GEOMEAN	MAX	N
Saxtons_5.6	365.4	90.5	488.4	61.7	NT	23.3	23.3	124.9	488.4	6
Saxtons_5.15	866.4	48.7	488.4	33.1	NT	20.1	NT	106.5	866.4	5
Saxtons_5.0	365.4	61.7	488.4	96.0	NT	42.0	218.7	146.1	488.4	6
Saxtons_.19	461.1	172.3	488.4	307.6	NT	191.8	NT	296.4	488.4	5

[1]Sampling did not occur on scheduled sampling date 8/13/14 due to Flood Watch. [2]Make-up sampling day scheduled for 9/10/14

GEOMEAN = geometric mean, **MAX** = maximum value of season's samples collected,
N = total number of samples collected during the sampling season, **NT** = Not tested
(VT Class B E. coli standard: single sample or GEOMEAN = 77 E. coli per 100 mL;
VT DOH "suitable for swimming" standard (single sample) = 235 per 100 mL;
US EPA standard: single sample = 235 per 100 mL, GEOMEAN = 126 per 100 mL)

2010-2014 Saxtons River *E. coli* GEOMEANS & Discussion:

SITE	2010	2011	2012	2013	2014
Saxtons_5.6	46.2	79.9	149.7	150.1	124.9
Saxtons_5.15	NT	NT	NT	NT	106.5
Saxtons_5.0	51.0	93.6	191.8	196.8	146.1
Saxtons_.19	67.9	142.1	274.7	336.4	296.4

In 2010 *E. coli* GEOMEAN levels at all three monitoring sites along the Saxtons River were below the VT (77) and EPA (126) GEOMEAN standards. Some of the single sample results in 2010 exceeded the VT single sample standard(77) , but none of those exceeded the EPA single sample standard (235). Please keep in mind that 2010 was an unusually dry year.

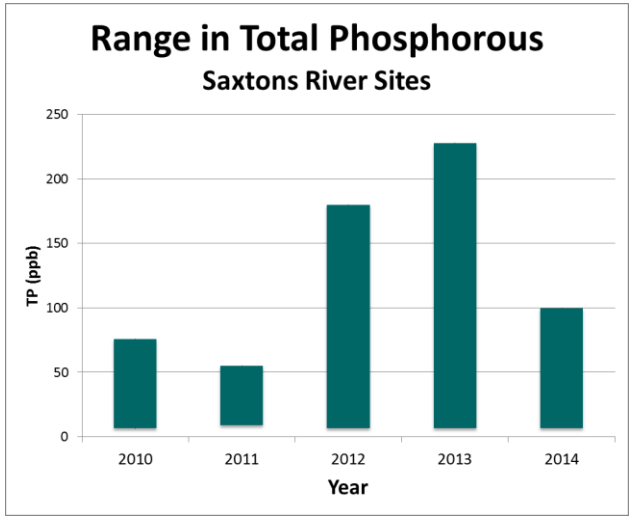
In 2011, only one sample, on 8/17/11 from Saxtons_.19, exceeded the EPA single sample standard and VT "suitable for swimming" standard of 235 *E. coli* per 100 mL of water. In 2012 two samples from Saxtons_5.6, two samples from Saxtons_5.0 and five samples from Saxtons_.19 exceeded the EPA single sample standard. In 2014, two samples each from Saxtons_5.6 and Saxtons_5.15, and three samples each from Saxtons_5.0 and Saxtons_.19 exceeded the EPA single sample standard.

During the 2011 , 2012, 2013, and 2014 monitoring seasons all three sites' *E. coli* GEOMEAN values exceeded the VT standard of 77 (one site just slightly in 2011).

"Wet" sampling events, or rain in the preceding 24-72 hours prior to sampling, cannot always explain elevated *E. coli* results. There are dates when higher *E. coli* values have occurred at some sites with little preceding precipitation – as on 7/14/10 at Saxtons_.19.

TOTAL PHOSPHOROUS (TP) RESULTS:

It is possible for TP levels greater than 10 ppb to have an impact on freshwater stream ecosystems. The chart below shows the range of results from Saxtons River monitoring sites.



Year	Low TP (ppb)	High TP (ppb)
2010	6.63	75.9
2011	9.36	55.1
2012	7.08	180
2013	7.53	228
2014	7.38	100

In 2010-2014, **total phosphorous (TP)** levels were unusually high at only one monitoring location on the Saxtons River (Saxtons_5.0) and the values ranged from a low of 6.21 ppb in 2010 to a high of 228 ppb in 2013. In all five years, TP at sites above and below this site of concern (Saxtons_5.0) were significantly lower. TP Mean values can be seen in the bottom left chart while individual results for Saxtons_5.0 can be seen in the bottom right chart. The Saxtons_5.0 site is located downstream of the Saxtons River WWTF. Steps are being taken to address that elevated TP situation.

SITE	Mean TP (ppb)				
	2010	2011	2012	2013	2014
Saxtons_5.6	8.3	11.0	15.1	47.3	19.2
Saxtons_5.15					14.0
Saxtons_5.0	47.7	30.7	162	81.5	47.3
Saxtons_.19	10.7	11.6	12.9	31.1	16.8

Year	Saxtons_5.0 Individual Values (ppb)				Mean	N
	Jun	Jul	Aug	Sept		
2010	6.21	161.1	75.9	33.6	47.7	4
2011	34.9	21.2	55.1		30.7	3
2012	180			144	162	2
2013	45.2	101, 228	8.44, 24.9		81.5	5
2014	25.7	100, 37.3	26.9	79.2	47.3	5

NITRATE-NITRITE NITROGEN (NO_X) RESULTS:

NOx values appeared to be more elevated at the Saxtons_5.0 site in 2012-2014. TP and NO_x are both nutrients that can impact water quality and aquatic habitats if levels are elevated. All values are well below the 5.0 mg/L VT standard for nitrate-nitrogen in Class B waters.

SITE	Mean NO_x (mg/L)				
	2010	2011	2012	2013	2014
Saxtons_5.6	0.06	0.08	0.09	0.09	0.10
Saxtons_5.15					0.11
Saxtons_5.0	0.12	0.17	1.17	0.56	0.33
Saxtons_.19	0.26	0.38	0.23	0.14	0.14

WATER TEMPERATURE:

Temperatures above 20°C can have a negative impact on cold water fish species.
SeVWA's measurements were typically made between 7-8 AM on sampling days. Sites' water temperatures on other days or other times later in the day on sampling days probably reached higher temperatures than our measurements indicate.

SITES	Maximum Seasonal Temperature Value (sampling typically occurs between 7-8 am)				
	'10	'11	'12	'13	'14
Saxtons_5.6	20.0	18.0	18.0	19.5	19.0
Saxtons_5.15					18.0
Saxtons_5.0	19.0	19.0	19.0	20.0	19.5
Saxtons_.19	20.0	20.0	19.0	21.0	20.0

WHETSTONE BROOK SUMMARY

A publication by Windham County Natural Resource Conservation District (WNRCD), The Whetstone Brook: Flooding Happens (http://www.vermontconservation.org/Buffer-Projects/The-Whetstone-Brook-Flooding-Happens-Booklet.html) describes some aspects of the Whetstone Brook watershed, which is in VT DEC Basin 13:

The Whetstone Brook watershed covers nearly 18,000 acres, or about 28 square miles, in southeastern Vermont. Sixty-nine percent of the watershed is in Brattleboro, twenty-nine percent in Marlboro and about two percent is in the town of Dummerston.

Though dense commercial and residential land uses occupy a significant portion of the lower reaches of the watershed, about 17 percent of the watershed is protected from development. Conservation easements are held by the Vermont Land Trust on privately owned land and forests. Much of the upper watershed is forested and there is also agricultural use. The town of Brattleboro's water supply is obtained from Pleasant Valley Reservoir in the Whetstone Brook watershed and the town manages its lands in the watershed to insure a clean drinking water supply for its residents and businesses.

In the VT DEC TMDL project online publication, www.vtwaterquality.org/mapp/docs/mp_17whetstonebrook.pdf, the Whetstone Brook is described as follows: "Whetstone Brook flows west to east from the hills of Marlboro across Brattleboro before emptying into the Connecticut River in downtown Brattleboro. The brook's headwaters originate at over 1,500 feet above sea level at Hidden Lake. The brook cascades down from steep hills and follows Vermont Rte. 9 to the Connecticut River flatlands. The brook empties into the Connecticut River at 250 feet above sea level, dropping over 1,250 feet in just seven miles of stream length. Approximately 69% of the (Whetstone) watershed resides in Brattleboro with 29% of the land in Marlboro and 2% of the land within Dummerston. The watershed contains nearly 20 miles of streams and a mix of rural, residential and urban land."

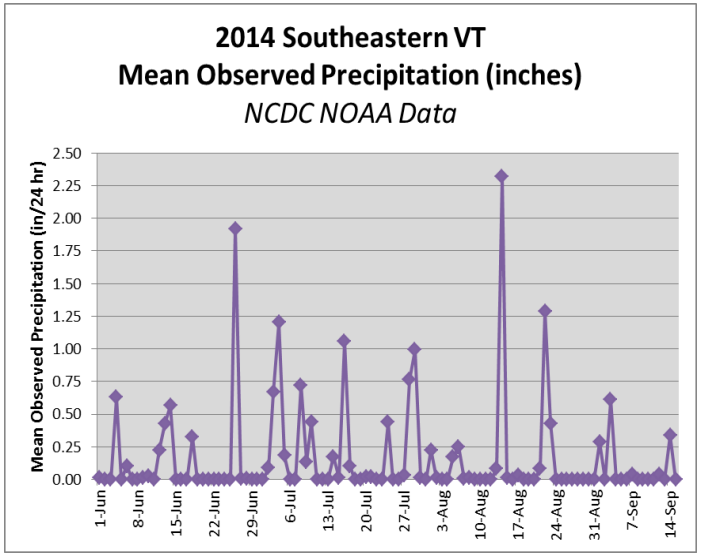
Information regarding Basin 13 at the VT DEC, Watershed Management Division website, can be found at this link – http://www.vtwaterquality.org/planning/htm/pl_deerfield.htm. (This link also contains information about Basin 12 – Deerfield River, Green River and North River watershed region.)

This is an additional link to the VT DEC plan for Basin 12 and 13 (2014): http://www.vtwaterquality.org/mapp/docs/mapp_deerfieldtacticalplanreviewdraft.pdf

Another resource produced by Windham NaturalResources Conservation District and available at the VT DEC website is the Whetstone Brook Watershed Corridor Plan.

In 2013, monitoring site Whetstone_9.6 was discontinued and replaced with the new site Whetstone_2.4. This new site is located at the Brattleboro Farmers Market on Western Ave.

There is no readily available data for mean daily discharge for the Whetstone Brook to create a graph for 2010-2014. Please note that, from previous regional flow/discharge information, the 2010 sampling season appeared to be uncharacteristically dry. The following graph shows the regional rain data[1] for 2014:



[1] Mean observed precipitation data created from data sets in the sampling area found using the National Climactic Data Center from NOAA at: http://gis.ncdc.noaa.gov/map/viewer/#app=cdo&cfg=cdo&theme=daily&layers=111

WHETSTONE BROOK SITES, BRATTLEBORO

SITES	CITY/TOWN	SITE DESCRIPTION	2010	2011	2012	2013	2014
Whetstone_.2	Brattleboro	Downtown, behind Co-op	X	X	X	X	X
Whetstone_1.35	Brattleboro	Williams St crossing, downstream side of bridge at Crosby St.					X
Whetstone_2.4	Brattleboro	Brattleboro Farmers Market, Western Ave.				X	X
Whetstone_3.3	Brattleboro	Above Farmers Market , off Glen St.					X
Whetstone_6.4	Brattleboro	Dettman Dr., just above bridge	X	X	X	X	
Whetstone_9.6	Brattleboro	Stark Rd., off of Rte. 9 & just above bridge	X	X	X		

E. COLI RESULTS:

2010 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/30/10	7/14/10	7/28/10	8/11/10	8/25/10	9/8/10	9/22/10	10/13/10	GEOMEAN	MAX	N
Whetstone_9.6	8.4	NT	5.2	NT	NT	NT	5.2	7.4	6.4	8.4	4
Whetstone_6.4	30.9	NT	44.8	NT	42.6	NT	25.3	9.8	27.1	44.8	5
Whetstone_.2	185.0	NT	307.6	NT	209.8	NT	129.6	185.0	195.6	307.6	5

2011 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/22/11	7/6/11	7/20/11	8/3/11	8/17/11	8/31/11	9/14/11	GEOMEAN	MAX	N
Whetstone_9.6	866.4	NT	19.7	NT	86.0	NT	NT	113.6	866.4	3
Whetstone_6.4	28.5	NT	37.9	NT	118.7	NT	NT	50.4	118.7	3
Whetstone_.2	99.1	NT	686.7	NT	NT	NT	517.2	327.7	686.7	3

2012 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/13/12	6/27/12	7/11/12	7/25/12	8/8/12	8/22/12	9/5/12	10/3/12	GEOMEAN	MAX	N
Whetstone_9.6	61.3	NT	15.8	NT	5.2	3.1	280.9	12.1	19.4	280.9	6
Whetstone_6.4	344.8	64.4	32.7	NT	52.0	28.5	290.9	17.3	65.9	344.8	7
Whetstone_.2	1,986.3	NT	325.5	NT	686.7	NT	2,419.6	93.3	631.2	2,419.6	5

2013 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/19/13	7/3/13	7/16/13	7/31/13	8/14/13	8/28/13	GEOMEAN	MAX	N
Whetstone_6.4	21.6	248.1	45.9	73.3	137.6	15.8	58.3	137.6	6
Whetstone_2.4	48.0	410.6	166.4	111.2	155.3	73.8	126.9	410.6	6
Whetstone_.2	261.3	727.0	117.8	770.1	201.4	193.5	295.9	770.1	6

2014 *E. coli* results [MPN *E. coli* per 100 milliliters of water]

SITE	6/18/14	7/2/14	7/16/14	7/30/14	8/17/15[1]	8/27/14	GEOMEAN	MAX	N
Whetstone_3.3	387.3	45.7	>2419.6	93.4	NT	54.5	251.7	>2419.6	5
Whetstone_2.4	547.5	48.7	>2419.6	108.6	NT	95.9	252.9	>2419.6	5
Whetstone_1.35	547.50	65.7	>2419.6	128.1	NT	46.4	266.5	>2419.6	5
Whetstone_.2	233.3	37.9	>2419.6	172.2	NT	123.4	212.8	>2419.6	5

[1]Sampling did not occur on scheduled sampling date 8/13/14 due to Flood Watch.

GEOMEAN = geometric mean, **MAX** = maximum value of season's samples collected,
N = total number of samples collected during the sampling season, **NT** = Not tested
(VT Class B E. coli standard: single sample or GEOMEAN = 77 E. coli per 100 mL;
VT DOH "suitable for swimming" standard (single sample) = 235 per 100 mL;
US EPA standard: single sample = 235 per 100 mL, GEOMEAN = 126 per 100 mL)

Currently, there is a TMDL project underway in Vermont to address waters impaired by bacterial pollution. A stretch of the Whetstone Brook in Brattleboro is included in that project.

Due to elevated bacteria measurements during the past few years, the Whetstone Brook in Brattleboro is considered impaired from the mouth of the brook upstream to Living Memorial Park, for a length of about 2.5 miles. The Whetstone_6.4 and Whetstone_9.6 sites are upstream of Living Memorial Park and not included in the impaired segment. WRWA's WQMP was instrumental in providing the data for recognizing the impairment and will continue to collect data for the project's use in order to help remedy the impact.

The 303(d) impaired waters listing states that use of Whetstone Brook for contact recreation (i.e., swimming) is impaired. The Clean Water Act requires that all 303(d) listed waters undergo a TMDL assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all waterbodies to comply with state water quality standards.

For more information and recommendations to address the possible impacts see the VT DEC online publications, VT DEC Water Quality Division, Vermont Statewide Total Maximum Daily Load (TMDL) *for Bacteria-Impaired Waters* and Vermont Statewide Total Maximum Daily Load (TMDL) *for Bacteria* – Appendix 17, Whetstone Brook.**.**

2010-2014 Whetstone Brook *E. coli* GEOMEANS & Discussion:

SITE	2010	2011	2012	2013	2014
Whetstone_9.6	6.4	113.6	19.4	NT	NT
Whetstone_6.4	27.1	50.4	65.9	58.3	NT
Whetstone_3.3	NT	NT	NT	NT	251.7
Whetstone_2.4	NT	NT	NT	126.9	252.9
Whetstone_1.35	NT	NT	NT	NT	266.5
Whetstone_.2	195.6	327.7	631.2	295.9	212.8

In 2010 Whetstone_9.6 and 6.4 were well below the VT and EPA standards for single sample and GEOMEANS for *E. coli*. Single samples and the season's GEOMEAN for Whetstone_.2 were over the VT and EPA standards for *E. coli* in 2010. Having elevated *E. coli* values at "low flow" times, especially in a populated and developed watershed such as in-town Brattleboro, indicates that there might be polluted runoff, a faulty septic system, sewer pipe or other sources contributing to the *E. coli* numbers.

The 2011 *E. coli* data for the Whetstone_.2 sites should be used carefully, especially the *E. coli* GEOMEAN value. There were 4 sampling dates tentatively scheduled for this site in 2011, but only 3 samples were actually collected. The 3 dates that samples were collected at Whetstone_.2 were not all of the same dates that samples were collected at the other 2 Whetstone Brook sites (see charts above). In 2011 the same general *E. coli* GEOMEAN pattern as in 2010 held for Whetstone_.2 and Whetstone_6.4, but in 2011 Whetstone_9.6's *E. coli* season GEOMEAN value exceeded the VT Class B standard (77), but did not exceed the EPA GEOMEAN standard (126).

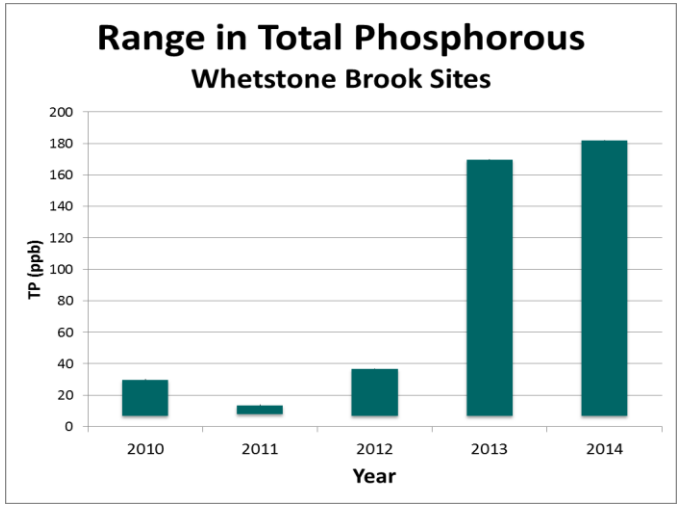
In 2012 each sampling day's *E. coli* values for the Whetstone_.2 site exceeded the VT Class B waters standard of 77 and all but one exceeded the VT "suitable for swimming" and EPA standard of 235 for a single sample. There were 5 test samples collected at that site on 5 separate days over the course of the monitoring season. The *E. coli* GEOMEAN for that site in 2012 was well-above the VT Class B standard (77) The 2012 GEOMEAN values for the other 2 Whetstone Brook sites (sites 6.4 and 9.6) were below VT Class B, VT "suitable for swimming" and the EPA standards. Whetstone_6.4 had 2 individual test values out of a total of 7 samples that exceeded the VT and EPA standards. Whetstone_9.6 had 1test values out of a total of 6 samples that exceeded the VT and EPA standards.

In 2013, the Whetstone_9.6 site was replaced with a site between Whetstone_6.4 and Whetstone_.2. The new site, Whetstone_2.4, was chosen to help identify the entry point of *E. coli* between the site that was consistently below the VT Class B standard and the site that consistently and greatly exceeds that standard. Both the Whetstone_2.4 and Whetstone_.2 GEOMEAN values exceeded the VT Class B standard of 77. All six of Whetstone_.2's and four of Whetstone_2.4's individual samples exceeded the VT Class B standard; four of Whetstone_.2's and one of Whetstone_2.4's individual samples exceeded the VT "suitable to swim" and the EPA single sample standard of 235. The Whetstone_6.4 GEOMEAN value was well below the VT Class B Standard and had only two days of sampling exceed the VT Class B standard and only one of those exceeded the VT "suitable to swim" and EPA GEOMEAN standard.

In 2014, Whetstone_6.4 was dropped and Whetstone_3.3 and Whetstone_1.35 were added, again to help identify the entry point of *E. coli* into the Whetstone Brook. All four sites monitored in 2014 exceed the VT Class B Standard of 77. All sites exceeded the VT "suitable to swim" standard on two sampling days, except Whetstone_.2 which exceeded the standard on only one sampling day.

TOTAL PHOSPHOROUS (TP) RESULTS:

It is possible for TP levels greater than 10 ppb to have an impact on freshwater stream ecosystems. The chart below shows the range of results from Saxtons River monitoring sites.



Year	Low TP (ppb)	High TP (ppb)
2010	7.8	30.3
2011	8.5	14.1
2012	7.16	37
2013	7.25	170
2014	8.09	182

WATER TEMPERATURE:

Temperatures above 20°C can have a negative impact on cold water fish species.
SeVWA's measurements were typically made between 7-8 AM on sampling days. Sites' water temperatures on other days or other times later in the day on sampling days probably reached higher temperatures than our measurements indicate.

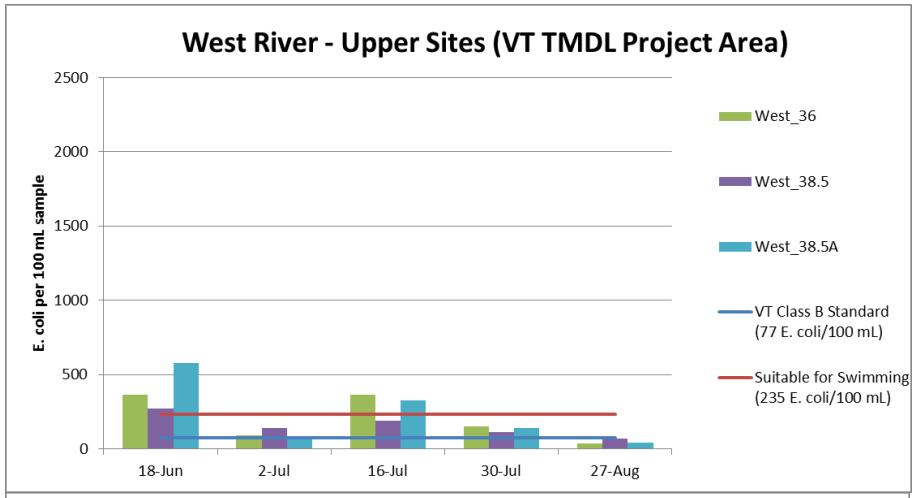
SITES	Maximum Seasonal Temperature Value (sampling typically occurs between 7-8 am)				
	'10	'11	'12	'13	'14
Whetstone_9.6	14.0	15.0	17.5		
Whetstone_6.4	16.0	14.0	17.5	17.5	
Whetstone_3.3					18.5
Whetstone_2.4				18.5	19.5
Whetstone_1.35					18.0
Whetstone_.2	17.0	17.0	18.0	18.0	19.5

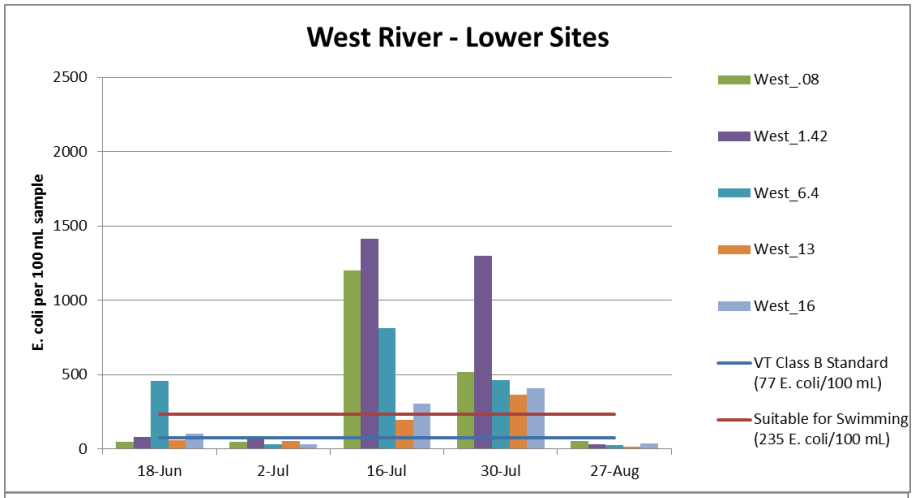
CONDUCTIVITY:

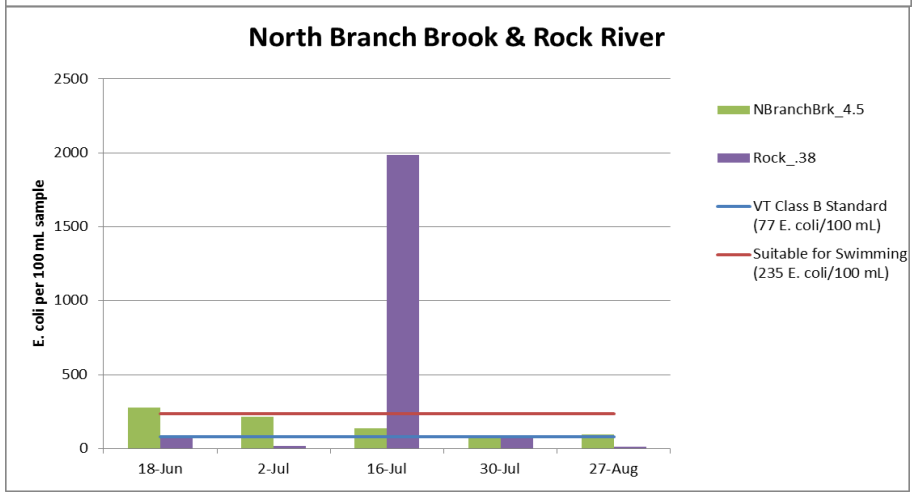
During sampling in 2010-2014, conductivity values at the Whetstone Brook sites showed a pattern of increasing as the sites approached downtown Brattleboro. Though an indication of anthropogenic sources, the highest value of 265.3 uS/cm (2010), which was at the most downstream site (Whetstone_.2), does not really indicate a serious impact at those 3 sites during the sampling dates. The lowest conductivity value on a monitoring day was 45 uS/cm at the most upstream site, Whetstone_9.6, in 2011.

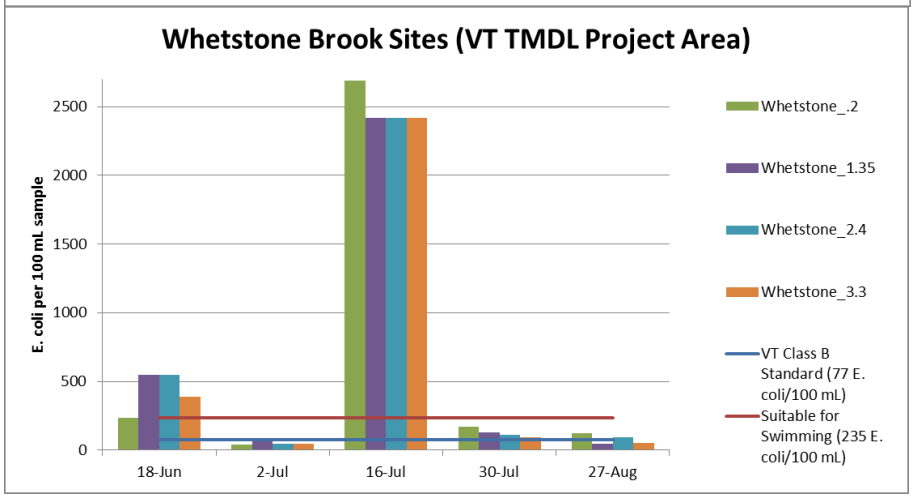
A COMPARATIVE LOOK AT 2014 *E. COLI* RESULTS

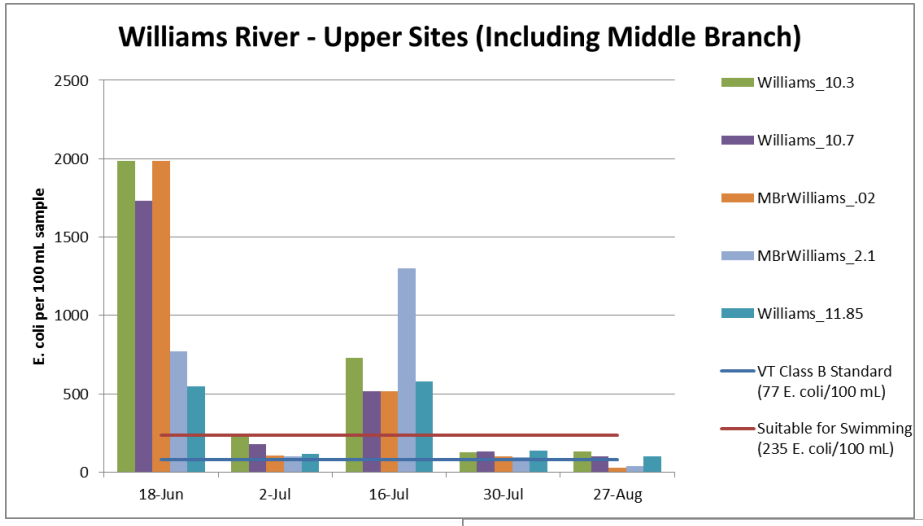
In this section, you will find graphs showing the 2014 *E. coli* results for each river or river segment. Each graph features the same scale so that the reader can easily compare results throughout the season across the rivers. Also, the VT Class B Waters standard and the VT "suitable for swimming" are marked by a blue and red line, respectively. The two sections that have been identified as VT TMDL project areas are marked as such. (See "NOTE" below.)

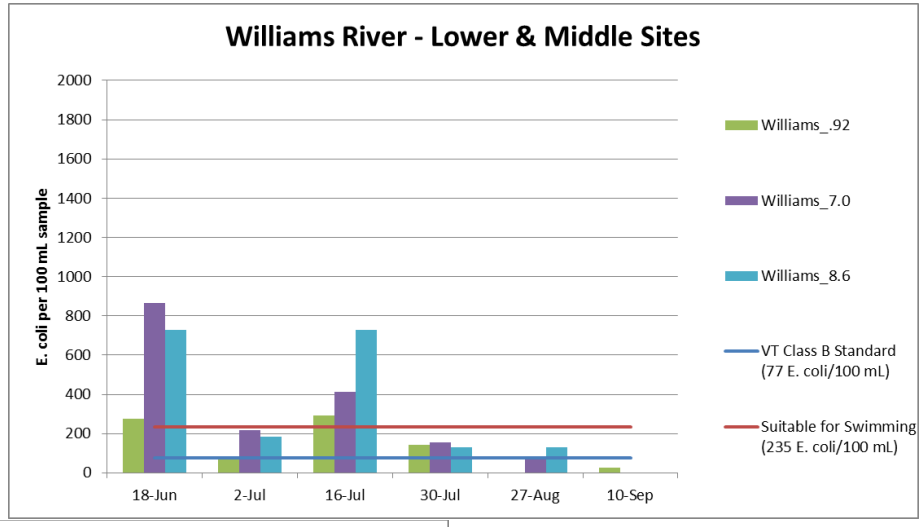


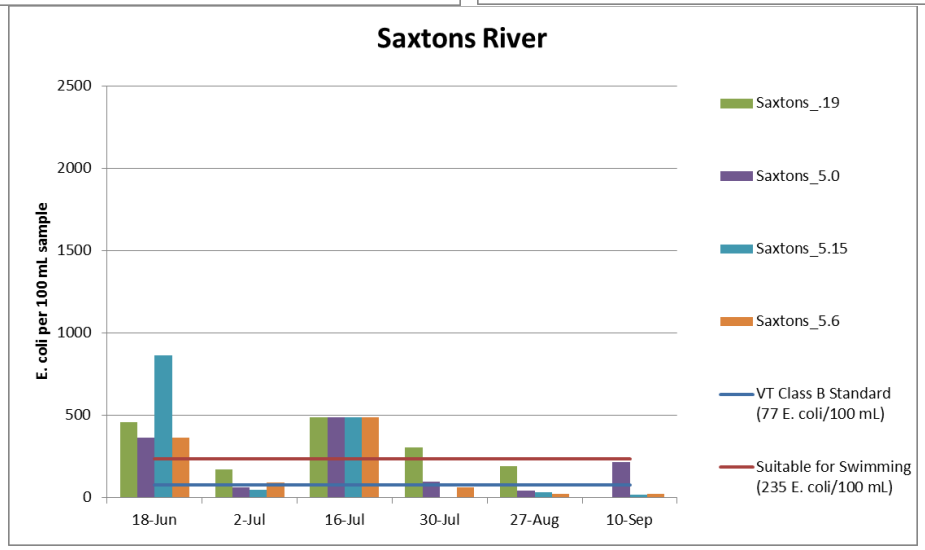












NOTE: In October 2014 the Vermont standard for *E. coli* in Class B waters changed to "*Not to exceed a geometric mean of 126 organisms /100ml obtained over a representative period of 60 days, and no more than 10% of samples above 235 organisms/100 ml.*" For the purposes of this report the *E. coli* standard for Class B waters in effect before October 2014 will be used.

DISCUSSION & FUTURE MONITORING PROGRAM PLANS

The following section presents a discussion of basic observations and issues that were recognized during SeVWA/WRWA's 2010-2014 monitoring seasons. Data for all years of SeVWA/WRWA's monitoring program are available in one or more Excel files. Please see the Program Contact Information in the next section of this report to request data files. See APPENDIX A of this report for SeVWA/WRWA's 2014 monitoring data.

Please note from the Mean Daily Discharge graphs (for stream flow information) that the 2010 sampling season generally appeared to be uncharacteristically dry. It is necessary to use caution when using flow rate or discharge information from gauges at dams where flows can be manipulated – such as the dam on the West River in Jamaica. The gauge data on the Saxtons and Williams River are more indicative of flow rates due to precipitation as there are no dams with manipulated discharges on those rivers in the areas where SeVWA's monitoring occurs. Also note, when considering precipitation, flow rates and E. coli levels that elevated E. coli results, at times, can be due to run-off that results from significant rains during the previous hours or days preceding sampling.

In 2010-2014, there were elevated E. coli bacteria results at a number of WRWA/SeVWA's monitoring sites. Through the 2014 SeVWA monitoring season the Vermont E. coli standard for Class B waters was 77 per 100 milliliters (mL) of water for a single sample or for a geometric mean. In October 2014 the Vermont standard for E. coli in Class B waters changed to "*Not to exceed a geometric mean of 126 organisms /100ml obtained over a representative period of 60 days, and no more than 10% of samples above 235 organisms/100 ml.*" Standards effective as of October 30, 2014 can be found at this link - http://www.anr.state.vt.us/dec/rulessum.htm. For the purposes of this report the E. coli standard for Class B waters in effect before October 2014 will be used. Starting in 2015, SeVWA's monitoring program will use the standard that went into effect in October 2014. In 2012 VT Department of Health (DOH) revised its E. coli standard for suitability for swimming from 77 per 100 mL to 235 per 100 mL. The US EPA standard for E. coli is 235 per 100 milliliters (mL) of water for a single sample.

Currently, there is a Total Maximum Daily Load (TMDL) project underway in Vermont to address waters impaired by bacterial pollution. A stretch of the Whetstone Brook in Brattleboro and a segment of the West River in South Londonderry are both included in that project.

There have also been some E. coli issues on the Williams River in Chester and in Rockingham. Additional sites were monitored along those sections in 2011-2014. Elevated E. coli results have also occurred along the 3 Saxtons River sites.

Additional scrutiny based on the new standards effective in late October 2014 should be applied in the future examination of the monitoring results. See more information regarding E. coli data for the specific rivers' sites and segments, along with other parameter results, in the specific watershed or river report sections that follow.

In 2010-2014 total phosphorous (TP) levels were unusually high at only one location on the Saxtons River (Saxtons_5.0). In all four years TP at sites above and below this site of concern were noticeably lower. There were also several other SeVWA WQMP sites that had TP results in the 30-50 ppb range. It is

possible for TP levels greater than 10 ppb to have an impact on the ecosystems of freshwater streams. In 2010-2013 a number of the program's monitoring sites had TP values between 10 ppb and 30 ppb.

In 2012 and 2013 there were some nitrate-nitrite nitrogen (NOx) results that were higher than what has been seen in the previous 2 years. Previous NOx results have typically been in the less than 0.05 to 0.4 milligrams per liter (mg.L) range. Some sites of possible concern – where values were 0.53-1.7 mg/L were on the Saxtons and Williams Rivers. In 2014 total nitrogen (TN) testing was added to SeVWA's monitoring program. . At times, TN values were 1.5-2.0 times greater than NOx values at the same site at the same time, but all values are well below the 5.0 mg/L VT standard for nitrate-nitrogen in Class B waters.

During 2010-2014 monitoring there were also elevated water temperature readings (approaching, reaching or exceeding 20 degrees Centigrade) at a few sites on the rivers sampled. It must be kept in mind that these measurements were typically made between 6-8:30 AM on sampling days. Sites' water temperatures on other days or other times later in the day on sampling days probably reached 20 degrees Centigrade or greater. Rivers of Basin 11 are considered waters that will possibly support cold water fish species. When water temperatures approach and reach 20 degrees Centigrade, it can be stressful or harmful to the success of cold water fish species.

Turbidity values at many of the program's sites have been running higher since 2011 than before tropical storm Irene's visit that year. Erosion and riverbank destabilization that occurred during that event are, in all likelihood, contributing to that widespread effect in Basin 11.

There were no seriously significant issues with other monitoring parameters from the samples that were collected, such as conductivity and pH though there were a couple of sites where conductivity levels were consistently higher and different than other sites in the same river watershed. 2012 was the last year that SeVWA performed pH testing at its monitoring sites.

The information provided in this report is a rudimentary summary of the 2010-2014 SeVWA/WRWA WQMP data and is a tool for continued discussion, further data analysis and follow-up monitoring, action and remediation in Vermont Basin 11 watersheds. A more thorough review and analysis of the data should occur when additional time and funds are available. It will be useful to perform a review and analysis of all the years of data – 2003 to 2008 and 2010 to 2014.

There are plans to continue SeVWA/WRWA's river monitoring program in 2015.

PROGRAM CONTACT INFORMATION

WRWA/SeVWA Board of Directors:
Southeastern Vermont Watershed Alliance (SeVWA, previously known as WRWA)
P.O. Box 402, Brattleboro, VT 05302
sevwa.mail@gmail.com
Website - https://sites.google.com/site/vtsevwa/

SeVWA Water Quality Monitoring Program Coordinator (2010-2014); Monitoring Program Committee, Chair (2013, 2014):
Laurie Callahan
61 Oak St., Brattleboro, VT 05301
(802) 258-1877
therivermist@hotmail.com

SeVWA Water Quality Monitoring Program WQMP Liaison/Facilitator (2014); Intern (2013):
Ryan O'Donnell
Greenfield, MA
(703) 216-6495
f.ryan.odonnell@gmail.com

VT DEC, Water Quality Division
Monitoring, Assessment & Planning, Basins 11 Watershed Coordinator:
Marie Levesque Caduto, 100 Mineral St., Suite 303, Springfield, VT 05156; Phone: 802-885-8958; marie.caduto@state.vt.us

VT DEC, Water Quality Division
Monitoring, Assessment & Planning, Aquatic Biologist & LaRosa Analytical Laboratory Partnership Program:
Jim Kellogg, 103 South Main St., Building 10 N, Waterbury, VT 05671; Phone: 802- 249-9370; jim.kellogg@state.vt.us

CRWC, Laboratory Manager
Peggy Savage
15 Bank Row, Greenfield, MA 01301
psavage916@gmail.com

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Basin 11 Management Plan, June 2008, VERMONT AGENCY OF NATURAL RESOURCES, Department of Environmental Conservation, Watershed Management Division; http://www.vtwaterquality.org/planning/docs/pl_basin11%20Plan.6-08.pdf

National Weather Service's Community Collaborative Rain, Hail & Snow (CoCoRHaS) Network,Daily precipitation observations, http://www.cocorahs.org/ViewData/ListDailyPrecipReports.aspx

NCDC NOAA, Daily Observational Data Mapping Tool - http://gis.ncdc.noaa.gov/map/viewer/#app=cdo&cfg=cdo&theme=daily&layers=111

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Vermont Water Quality Standards - Environmental Protection Rule Chapter 29, Effective October 30, 2014; VERMONT AGENCY OF NATURAL RESOURCES, Dept. of Env. Conservation, Watershed Management Div., http://www.anr.state.vt.us/dec/rulessum.htm

APPENDIX A

2014 SeVWA/WRWA WQMP Data:

(Request previous years' data or Excel files from SeVWA.)

LaRosa Sample Number	CRWC Sample Number	Location	Date	Time	NOx (mg-N/l)	TN (mg-N/l)	TP (ug P/L)	Turbidity (NTU)	Final E. Coli. (mpn/ 100ml)	Spec. Cond. (µS/cm)	Air Temp. °C	Water Temp °C	Wet or Dry	Sample or QA Notes:
140318-08	5-26-14	West_38.5	2014-06-18	07:27:00	0.08	0.32	37.1	9	272.3	57.1	20.0	17.0	Wet	
NA	5-27-14	LD1 of West 38.5	2014-06-18	07:40:00					387.3				Wet	
140318-07	5-09-14	West_38.5A	2014-06-18	07:40:00	0.08	0.41	29.9	4.73	579.4	70.1	20.0	17.5	Wet	
140318-06	5-08-14	West_36	2014-06-18	07:55:00	0.07	0.28	25.2	2.87	365.4	74.7	21.0	18.0	Wet	
140318-05	5-07-14	West_16	2014-06-18	07:50:00	0.05	0.17	17.4	1.81	101.2	73.3	20.0	20.0	Wet	
140318-04	5-06-14	West_13	2014-06-18	06:30:00	0.07	0.18	9.01	0.93	58.3	72.9	20.0	20.0	Wet	
140318-03	5-05-14	West_6.4	2014-06-18	08:00:00	0.08	0.17	10.5	2.16	456.2	70.9	21.0	19.0	Wet	
140318-02	5-04-14	West_1.42	2014-06-18	06:15:00	0.14	0.23	9.14	0.81	79.8	82.3	20.5	19.5	Wet	
140318-01	5-03-14	West_.08	2014-06-18	08:20:00	0.08	0.18	10.5	1.39	47.3	75.0	21.0	18.0	Wet	
140318-10	5-02-14	NBranchBrk_4.5	2014-06-18	07:00:00	0.15	0.38	24.5	7.48	275.5	226.7	17.5	15.0	Wet	
140318-09	5-01-14	Rock_.38	2014-06-18	07:15:00	0.05	0.15	11.7	3.63	83.90	60.7	20.0	16.0	Wet	
140318-27	5-13-14	Whetstone_3.3	2014-06-18	05:40:00	0.19	0.28	22.5	5.56	387.3	114.5	19.5	15.5	Wet	
140318-26	5-12-14	Whetstone_2.4	2014-06-18	05:50:00	0.21	0.3	23.3	6.18	547.5	127.6	20.5	15.5	Wet	RPD Exceeds 15%, value rejected
140318-32	5-11-14	Whetstone_1.35	2014-06-18	07:40:00	0.2	0.29	17.8	1.66	547.50	139.8	20.0	15.0	Wet	
140318-25	5-10-14	Whetstone_.2	2014-06-18	06:15:00	0.26	0.36	18.2	4.74	233.3	164.2	20.5	16.5	Wet	
140318-17	5-19-14	Williams_11.85	2014-06-18	07:05:00	0.07	0.19	19.8	4.64	547.5	72.1	21.5	15.5	Wet	
140318-16	5-18-14	Williams_10.7	2014-06-18	06:15:00	0.1	0.19	32.3	11.2	1732.9	93.2	20.0	16.0	Wet	RPD exceeds 10%, however values in low range, results accepted
140318-15	5-17-14	Williams_10.3	2014-06-18	07:40:00	0.09	0.19	23.8	4.49	1986.3	89.3	18.5	16.0	Wet	
140318-14	5-16-14	Williams_8.6	2014-06-18	06:45:00	0.2	0.29	17.6	3.37	727	99.4	25.0	17.0	Wet	
140318-13	5-15-14	Williams_7.0	2014-06-18	07:20:00	0.25	0.36	17.4	2.65	866.4	99.6	19.5	17.5	Wet	
140318-12	5-14-14	Williams_.92	2014-06-18	07:15:00	0.26	0.39	24.9	4.9	275.5	112.6	18.0	18.0	Wet	
140318-19	5-21-14	MBrWilliams_2.1	2014-06-18	07:15:00	0.07	0.17	28.6	7.02	770.1	85.4	18.0	16.0	Wet	
140318-18	5-20-14	MBrWilliams_.02	2014-06-18	06:50:00	0.08	0.33	27.8	9.53	1986.3	87.6	20.0	17.0	Wet	

140318-24	5-25-14	Saxtons_5.6	2014-06-18	07:00:00	0.09	0.19	40.6	1.93	365.4	88.9	22.0	18.0	Wet	
140318-23	5-24-14	Saxtons_5.15	2014-06-18	07:20:00	0.09	0.18	14.9	2.59	866.4	95.0	18.5	16.5	Wet	
140318-21	5-23-14	Saxtons_5.0	2014-06-18	07:45:00	0.1	0.21	25.7	2.66	365.4	99.7	17.0	16.0	Wet	
140318-20	5-22-14	Saxtons_.19	2014-06-18	08:00:00	0.13	0.21	17.1	4.53	461.1	107.1	20.0	18.0	Wet	
140318-28	5-29-14	Williams 10.7 DUPLICATE	2014-06-18	05:52:00	0.08	0.2	29.2	12.1	>2419.6	92.8			Wet	RPD exceeds 10%, however values in low range, results accepted
140318-29	5-28-14	Whetstone 2.4 DUPLICATE	2014-06-18	06:35:00	0.21	0.35	20.4	3.17	488.4	127.6			Wet	RPD Exceeds 15%, value rejected
140318-30	5-30-14	H1	2014-06-18	07:50:00	< 0.05	< 0.1	< 5	< 0.2	<1	3.1				
140318-31	5-31-14	H2	2014-06-18	08:00:00	< 0.05	< 0.1	< 5	< 0.2	<1	2.1				
140319-08	9-01-14	West_38.5	2014-07-02	07:22:00	0.1	0.27	11.9	0.8	142.1	88.5	22.0	21.0	Dry	
140319-07	9-02-14	West_38.5A	2014-07-02	07:36:00	0.1	0.27	11.6	0.88	79.4	87.5	20.5	21.0	Dry	
140319-06	9-03-14	West_36	2014-07-02	07:50:00	0.11	0.26	11.7	0.61	93.4	93.6	20.5	20.5	Dry	
140319-05	9-04-14	West_16	2014-07-02	07:50:00	0.08	0.26	12.1	1.09	31.3	77.3	21.0	22.0	Dry	
140319-04	9-05-14	West_13	2014-07-02	07:45:00	0.1	0.27	11.9	1.01	55.6	78.5	23.0	22.0	Dry	
140319-03	9-06-14	West_6.4	2014-07-02	08:00:00	0.11	0.25		0.73	31.7	78.6	26.0	24.0	Dry	No TP sample submitted to LaRosa Lab
140319-02	9-07-14	West_1.42	2014-07-02	07:05:00	0.12	0.26	10.5	0.64	74.9	81.3	23.0	22.5	Dry	
140319-01	9-08-14	West_.08	2014-07-02	07:15:00	0.1	0.3	12.1	1.57	50.4	84.7	23.0	24.0	Dry	
140319-10	9-09-14	NBranchBrk_4.5	2014-07-02	07:20:00	0.18	0.33	7.28	0.39	214.2	229.7	20.0	18.0	Dry	
140319-09	9-10-14	Rock_.38	2014-07-02	07:16:00	0.09	0.15	8.72	0.33	17.1	69.9	20.0	19.0	Dry	Results values <2, RPD exceeds 50%, results rejected
140319-27	9-11-14	Whetstone_3.3	2014-07-02	05:45:00	0.24	0.31	11.3	0.56	45.7	133.6	20.5	18.5	Dry	
140319-26	9-12-14	Whetstone_2.4	2014-07-02	06:05:00	0.27	0.37	17.9	3.63	48.7	150.4	20.5	18.0	Dry	
140319-32	9-13-14	Whetstone_1.35	2014-07-02	06:20:00	0.31	0.37	9.87	1.22	65.7	182.0	19.0	18.0	Dry	
140319-25	9-14-14	Whetstone_.2	2014-07-02	07:30:00	0.34	0.41	11	0.6	37.9	212.2	24.5	19.5	Dry	
140319-17	9-15-14	Williams_11.85	2014-07-02	07:20:00	0.11	0.33	9.1	0.87	117.8	96.2	22.5	18.5	Dry	
140319-16	9-16-14	Williams_10.7	2014-07-02	07:05:00	0.22	0.33	8.39	0.84	178.9	130.1	20.0	19.0	Dry	
140319-15	9-17-14	Williams_10.3	2014-07-02	07:30:00	0.2	0.28	9.24	0.76	224.7	129.3	23.0	19.0	Dry	
140319-14	9-18-14	Williams_8.6	2014-07-02	07:15:00	0.56	0.68	10.9	0.56	186	136.8	24.0	19.0	Dry	
140319-13	9-19-14	Williams_7.0	2014-07-02	07:10:00	0.54	0.68	11	0.57	218.7	133.2	22.5	19.5	Dry	RPD exceeds 15%, however results values <2 and RPD does not exceed 50%, value accepted
140319-12	9-20-14	Williams_.92	2014-07-02	07:10:00	0.37	0.53	12	1.46	70.3	137.0	23.0	21.0	Dry	
140319-19	9-21-14	MBrWilliams_2.1	2014-07-02	07:20:00	0.1	0.19	8.62	0.34	98.8	119.0	19.0	18.5	Dry	
140319-18	9-22-14	MBrWilliams_.02	2014-07-02	07:06:00	0.14	0.22	8.09	0.42	104.6	125.5	21.5	19.5	Dry	

140319-24	9-23-14	Saxtons_5.6	2014-07-02	06:12:00	0.12	0.22	9.75	1.38	90.5	108.0	21.0	18.0	Dry	
140319-23	9-24-14	Saxtons_5.15	2014-07-02	07:05:00	0.12	0.21	9.17	0.72	48.7	112.7	20.5	NA	Dry	
140319-21	9-25-14	Saxtons_5.0	2014-07-02	07:45:00	0.15	0.25	14.5	0.38	61.7	115.2	26.5	19.5	Dry	
140319-20	9-26-14	Saxtons_.19	2014-07-02	08:03:00	0.19	0.28	12.1	0.91	172.3	136.1	24.0	20.0	Dry	
NA	9-27-14	LD1 of Saxtons_.19	2014-07-02	06:20:00					56.5				Dry	
140319-29	9-28-14	Williams 7.0 DUPLICATE	2014-07-02	07:19:00	0.56	0.67	11.1	0.85	235.9	132.6			Dry	RPD exceeds 15%, however results values <2 and RPD does not exceed 50%, value accepted
140319-28	9-29-14	Rock .38 DUPLICATE	2014-07-02	07:15:00	0.09	0.13	8.11	0.65	22.8	69.4			Dry	Results values <2, RPD exceeds 50%, results rejected
140319-30	9-30-14	H1	2014-07-02	09:30:00	< 0.05	< 0.1	< 5	< 0.2	<1	2.7				
140319-31	9-31-14	H2	2014-07-02	06:25:00	< 0.05	< 0.1	< 5	< 0.2	<1	2.6				
140414-08	13-01-14	West_38.5	2014-07-16	07:45:00		0.24	12.3	1.53	191.8	86.9	18.0	20.0	Wet	NOx sample container was empty upon reciept by LaRosa Lab
140414-07	13-02-14	West_38.5A	2014-07-16	07:26:00	0.06	0.23	13.6	1.54	325.5	89.6	18.5	20.0	Wet	
140414-06	13-03-14	West_36	2014-07-16	07:14:00	0.06	0.24	13.8	1.76	365.4	91.8	NA	NA	Wet	
140414-05	13-04-14	West_16	2014-07-16	07:50:00	0.05	0.2	12.2	1.67	307.6	79.8	22.0	21.0	Wet	
140414-04	13-05-14	West_13	2014-07-16	06:45:00	0.06	0.22	9.88	1.49	193.5	80.1	19.0	21.0	Wet	
140414-03	13-06-14	West_6.4	2014-07-16	07:55:00	0.06	0.22	26.1	10.3	810.6	70.5	21.0	20.0	Wet	
140414-02	13-07-14	West_1.42	2014-07-16	07:35:00	0.07	0.32	41.4	16.7	1413.6	76.8	19.5	20.5	Wet	
140414-01	13-08-14	West_.08	2014-07-16	08:03:00	0.05	0.26	50.2	24.5	1203.3	78.1	NA	NA	Wet	RPD exceeds 10%, however values in low range, results accepted
140414-10	13-09-14	NBranchBrk_4.5	2014-07-16	08:14:00	0.13	0.3	11.4	1.92	137.4	229.7	17.0	NA	Wet	
140414-09	13-10-14	Rock_.38	2014-07-16	07:08:00	0.05	0.23	52.2	19.2	1986.3	56.2	19.0	18.0	Wet	
140414-26	13-11-14	Whetstone_3.3	2014-07-16	05:50:00	< 0.05	1.23	428	148	>2419.6	74.5	20.5	18.5	Wet	
140414-25	13-12-14	Whetstone_2.4	2014-07-16	06:00:00	< 0.05	1.21	488	162	>2419.6	77.2	20.5	19.5	Wet	
140414-24	13-13-14	Whetstone_1.35	2014-07-16	08:45:00	0.05	0.52	132	37.9	>2419.6	88.2	19.0	18.0	Wet	
NA	13-14-14	LD1 of Whetstone 1.35	2014-07-16	08:45:00					>2419.6				Wet	
140414-23	13-15-14	Whetstone_.2	2014-07-16	07:51:00	< 0.05	0.79	272	89.6	>2419.6	89.4	20.5	18.5	Wet	MPN Actually reported as >2688.4; number created by dilution calculation
140414-16	13-16-14	Williams_11.85	2014-07-16	07:21:00	0.11	0.25	10.7	1.26	579.4	97.8	23.5	19.0	Wet	
140414-15	13-17-14	Williams_10.7	2014-07-16	06:50:00	0.16	0.27	13.7	1.51	517.2	120.2	20.5	19.0	Wet	
140414-14	13-18-14	Williams_10.3	2014-07-16	07:37:00	0.14	0.26	15.4	2.25	727	114.8	20.0	19.0	Wet	
140414-13	13-19-14	Williams_8.6	2014-07-16	07:30:00	0.33	0.44	11.9	1.48	727	124.4	25.0	19.0	Wet	
140414-12	13-20-14	Williams_7.0	2014-07-16	07:03:00	0.38		13.5	0.86	410.6	120.3	19.5	18.5	Wet	TN sample container was empty upon reciept by LaRosa Lab

140414-11	13-21-14	Williams_.92	2014-07-16	07:18:00	0.31	0.46	12.9	1.57	290.9	132.5	19.0	NA	Wet	
140414-18	13-22-14	MBrWilliams_2.1	2014-07-16	07:34:00	0.09	0.18	19.7	6.01	1299.7	106.9	19.0	18.0	Wet	
140414-17	13-23-14	MBrWilliams_.02	2014-07-16	07:15:00	0.09	0.27	13.7	2.17	517.2	100.6	20.5	20.0	Wet	
140414-22	13-24-14	Saxtons_5.6	2014-07-16	06:55:00	0.07	0.21	27	6.09	488.4	89.6	20.0	19.0	Wet	
140414-21	13-25-14	Saxtons_5.15	2014-07-16	06:55:00		0.23	28.3	8.09	488.4	98.3	19.5	18.0	Wet	NOx sample container was empty upon reciept by LaRosa Lab
140414-20	13-26-14	Saxtons_5.0	2014-07-16	08:53:00	0.28	0.48	100	4.39	488.4	102.6	NA	NA	Wet	RPD Exceeds 15%, value rejected
140414-19	13-27-14	Saxtons_.19	2014-07-16	07:35:00	0.12	0.24	26	6.03	488.4	103.8	20.0	19.0	Wet	
140414-27	13-28-14	West .08 DUPLICATE	2014-07-16	08:13:00	0.07	0.29	52.3	27.9	1413.6	77.8			Wet	RPD exceeds 10%, however values in low range, results accepted
140414-28	13-29-14	West .36 DUPLICATE	2014-07-16	07:15:00	0.06	0.26	15.1	1.89	344.8	91.9			Wet	
140414-29	13-30-14	Saxtons 5.0 DUPLICATE	2014-07-16	08:57:00	0.31	0.5	86.4	5.69	325.5	102.0			Wet	RPD Exceeds 15%, value rejected
140414-30	13-31-14	H1	2014-07-16	09:09:00	< 0.05	< 0.1	< 5	< 0.2	<1	2.4				
140414-31	13-32-14	H2	2014-07-16	08:50:00	< 0.05	< 0.1	< 5	0.27	<1	2.7				
140415-08	17-01-14	West_38.5	2014-07-30	07:45:00	< 0.05	0.25	14.5	1.48	113.7	59.3	13.5	15.5	Dry	
140415-07	17-02-14	West_38.5A	2014-07-30	07:55:00	< 0.05	0.25	15.3	1.68	143	62.5	13.5	15.5	Dry	
140415-06	17-03-14	West_36	2014-07-30	07:25:00	< 0.05	0.26	16.9	1.6	151.5	66.9	15.0	16.0	Dry	
140415-05	17-04-14	West_16	2014-07-30	07:50:00	< 0.05	0.29	23.6	4.72	410.6	61.5	17.0	17.0	Dry	
140415-04	17-05-14	West_13	2014-07-30	06:30:00	< 0.05	0.29	23	5.22	365.4	61.6	14.0	17.0	Dry	
140415-03	17-06-14	West_6.4	2014-07-30	07:45:00	< 0.05	0.28	22.2	4.77	461.1	61.1	15.0	17.0	Dry	
140415-02	17-07-14	West_1.42	2014-07-30	07:42:00	0.05	0.37	26.9	3.85	1299.7	62.5	16.5	17.5	Dry	
140415-01	17-08-14	West_.08	2014-07-30	07:55:00	< 0.05	0.28	22.7	5.14	517.2	61.6	16.0	18.0	Dry	
140415-10	17-09-14	NBranchBrk_4.5	2014-07-30	07:54:00	0.14	0.28	9.58	1.53	83.6	209.3	14.0	15.0	Dry	RPD exceeds 15%, however results values <2 and RPD does not exceed 50%, results accepted
140415-09	17-10-14	Rock_.38	2014-07-30	07:38:00	0.05	0.14	12.7	1.62	77.1	61.4	15.0	15.0	Dry	
140415-26	17-11-14	Whetstone_3.3	2014-07-30	05:35:00	0.13	0.23	14.2	1.94	93.4	113.1	14.5	15.5	Dry	
140415-25	17-12-14	Whetstone_2.4	2014-07-30	05:40:00	0.15	0.26	13.6	1.99	108.6	124.5	13.5	15.5	Dry	
140415-24	17-13-14	Whetstone_1.35	2014-07-30	08:50:00		0.26	12.5	1.88	128.1	146.0	17.0	15.0	Dry	NOx sample container was empty upon reciept by LaRosa Lab
NA	17-14-14	LD1 of Whetstone 1.35	2014-07-30	08:50:00					104.6					
140415-23	17-15-14	Whetstone_.2	2014-07-30	09:30:00	0.19	0.28	13.1	1.89	172.2	165.5	17.0	15.0	Dry	
140415-16	17-16-14	Williams_11.85	2014-07-30	07:33:00	0.08	0.22	16.4	3.03	135.4	65.8	13.5	NA	Dry	
140415-15	17-17-14	Williams_10.7	2014-07-30	06:44:00	0.15	0.29	28.5	9.77	133.4	82.4	13.0	14.0	Dry	

140415-14	17-18-14	Williams_10.3	2014-07-30	07:19:00	0.12	0.27	91.1	60.5	125.9	81.4	13.0	15.0	Dry	
140415-13	17-19-14	Williams_8.6	2014-07-30	06:30:00	0.19	0.37	110	64.9	129.1	83.8	14.0	14.0	Dry	
140415-12	17-20-14	Williams_7.0	2014-07-30	07:10:00	0.24	0.38	105	53.6	152.9	81.8	15.5	14.5	Dry	
140415-11	17-21-14	Williams_.92	2014-07-30	07:25:00	0.19	0.34	91.8	56.6	142.1	85.6	14.0	14.0	Dry	
140415-18	17-22-14	MBrWilliams_2.1	2014-07-30	07:38:00	0.08	0.13	182	163	93.2	82.8	14.0	15.0	Dry	
140415-17	17-23-14	MBrWilliams_.02	2014-07-30	07:28:00	0.09	0.2	118	82.9	101.7	78.8	13.0	15.0	Dry	
140415-22	17-24-14	Saxtons_5.6	2014-07-30	07:15:00	0.07	0.19	16.2	2.23	61.7	65.1	14.0	15.0	Dry	
		Saxtons_5.15												Samples not collected
140415-20	17-25-14	Saxtons_5.0	2014-07-30	07:55:00	0.23	0.35	37.3	2.54	96	76.8	NA	NA	Dry	
140415-19	17-26-14	Saxtons_.19	2014-07-30	08:08:00	0.11	0.23	17.1	3.07	307.6	80.5	15.0	15.0	Dry	
140415-27	17-27-14	West 6.4 DUPLICATE	2014-07-30	07:50:00	< 0.05	0.27	22.3	5.42	435.2	61.3			Dry	
140415-28	17-28-14	NBranchBrk 4.5 DUPLICATE	2014-07-30	07:59:00	0.14	0.28	8.92	1.09	105	207.2			Dry	RPD exceeds 15%, however results values <2 and RPD does not exceed 50%, results accepted
140415-29	17-29-14	Saxtons 5.6 DUPLICATE	2014-07-30	07:20:00	0.07	0.2	15.3	2.36	88.4	65.0			Dry	
140415-30	17-30-14	H1	2014-07-30	08:40:00	< 0.05	< 0.1	< 5	< 0.2	<1	2.5				
140415-31	17-31-14	H2	2014-07-30	08:55:00	< 0.05	< 0.1	< 5	< 0.2	<1	2.3				
140450-07	24-01-14	West_38.5	2014-08-27	07:35:00	0.05	0.2	9.16	0.98	67.7	79.9	14.5	17.5	Dry	
140450-08	24-02-14	West_38.5A	2014-08-27	07:50:00	0.06	0.19	10.3	1.16	43.7	81.5	15.0	18.5	Dry	
140450-06	24-03-14	West_36	2014-08-27	07:15:00	< 0.05	0.17	8.81	0.59	36.4	83.7	14.5	18.0	Dry	
140450-05	24-04-14	West_16	2014-08-27	08:30:00	0.06	0.19	10.4	0.71	37.3	78.9	19.0	19.5	Dry	
140450-04	24-05-14	West_13	2014-08-27	06:15:00	0.09		9.83	0.79	16.1	75.2	15.0	19.0	Dry	TN sample container was empty upon reciept by LaRosa Lab
140450-03	24-06-14	West_6.4	2014-08-27	07:53:00	0.08	0.19	11.2	1.06	26.2	77.7	17.0	19.0	Dry	
140450-02	24-07-14	West_1.42	2014-08-27	07:35:00	0.09	0.2	11.6	1.16	32.7	82.2	19.0	19.5	Dry	
140450-01	24-08-14	West_.08	2014-08-27	07:20:00	0.07	0.19	12.1	2.28	52.9	81.7	20.0	21.5	Dry	
140450-10	24-09-14	NBranchBrk_4.5	2014-08-27	07:21:00	0.18	0.27	6.06	2.68	93.3	241.1	16.0	15.0	Dry	
140450-09	24-10-14	Rock_.38	2014-08-27	07:10:00	0.07	0.12	8.93	0.67	11.9	70.9	16.0	NA	Dry	
140450-26	24-11-14	Whetstone_3.3	2014-08-27	05:50:00	0.21	0.24	9.57	0.91	54.5	145.1	15.5	16.5	Dry	
140450-25	24-12-14	Whetstone_2.4	2014-08-27	06:05:00	0.24	0.3	10.8	2.06	95.9	161.2	15.5	16.5	Dry	
140450-24	24-13-14	Whetstone_1.35	2014-08-27	07:15:00	0.27	0.3	8.97	1.47	46.4	188.9	17.0	16.0	Dry	RPD exceeds 15%, however results values <2 and RPD does not exceed 50%, results accepted
NA	24-14-14	LD1	2014-08-27	07:15:00					27.5				Dry	
140450-23	24-15-14	Whetstone_.2	2014-08-27	07:40:00	0.32	0.35	8.83	0.38	123.4	220.3	21.5	16.5	Dry	

140450-16	24-16-14	Williams_11.85	2014-08-27	07:25:00	0.09	0.15	9.4	0.8	98.4	95.1	15.5	15.5	Dry	
140450-15	24-17-14	Williams_10.7	2014-08-27	06:40:00	0.14	0.2	8.48	1.52	98.5	121.2	16.0	16.0	Dry	
140450-14	24-18-14	Williams_10.3	2014-08-27	06:45:00	0.14		8.14	1.86	133.3	119.7	16.0	14.0	Dry	TN sample container was empty upon reciept by LaRosa Lab
140450-13	24-19-14	Williams_8.6	2014-08-27	06:30:00	0.52	0.58	10.5	2.1	131.4	128.4	16.0	18.0	Dry	
140450-12	24-20-14	Williams_7.0	2014-08-27	07:18:00	0.51	0.58		1.59	69.7	122.4	14.0	16.5	Dry	TP sample not submitted to LaRosa Lab; collected TP sample dropped by volunteer, not able to retrieve
		Williams_.92												Samples not collected
140450-18	24-21-14	MBrWilliams_2.1	2014-08-27	06:25:00	< 0.05	< 0.1	10.7	2.75	37.9	114.9	16.0	14.0	Dry	RPD Exceeds 15%, value rejected
140450-17	24-22-14	MBrWilliams_.02	2014-08-27	07:25:00	0.07	0.12	10.5	1.72	27.9	118.7	15.5	16.5	Dry	
140450-22	24-23-14	Saxtons_5.6	2014-08-27	06:50:00	0.12	0.19	7.38	0.99	23.3	96.3	15.0	16.0	Dry	
140450-21	24-24-14	Saxtons_5.15	2014-08-27	07:28:00	0.12	0.19	9.01	0.61	33.1	102.4	15.5	16.5	Dry	
140450-20	24-25-14	Saxtons_5.0	2014-08-27	07:45:00	0.26	0.29	26.9	0.58	42	106.4	17.5	16.5	Dry	
140450-19	24-26-14	Saxtons_.19	2014-08-27	07:20:00	0.17	0.23	11.7	0.98	191.8	118.5	17.0	17.0	Dry	
140450-27	24-27-14	MBrWilliams_2.1 DUPLICATE	2014-08-27	07:28:00	< 0.05	< 0.1	10.4	3.52	31.3	115.1			Dry	RPD Exceeds 15%, value rejected
140450-28	24-28-14	Whetstone_1.35 DUPLICATE	2014-08-27	07:15:00	0.27	0.31	9.38	1.13	48.1	187.9			Dry	RPD exceeds 15%, however results values <2 and RPD does not exceed 50%, results accepted
	24-29-14	West_16 DUPLICATE	2014-08-27	08:45:00					22.6	77.2			Dry	Samples not received by LaRosa Lab; E. coli sampled received/analyzed by CRWC & cond by SeVWA
140450-29	24-30-14	H1	2014-08-27	09:40:00	< 0.05	< 0.1	< 5	0.44	<1	2.5				
140450-30	24-31-14	H2	2014-08-27	07:20:00	< 0.05	< 0.1	< 5	0.88	<1	2.5				
140728-04	28-01-14	Williams_.92	9/10/2014	08:50:00	0.57	0.65	8.69	0.37	26.2	160.1	13.5	15.0	Dry	"Make-up" sampling day for all parameters
	28-08-14	LD1 of Williams_0.92							29.5				Dry	
140728-05	28-02-14	Saxtons_5.6	9/10/2014	07:40:00	0.1	0.16	14.3	0.46	23.3	115.5	13.0	14.0	Dry	"Make-up" sampling day for all parameters
140728-01	28-03-14	Saxtons_5.15	9/10/2014	07:35:00	0.11	0.17	8.44	0.65	20.1	121.4	10.5	12.5	Dry	"Make-up" sampling day for all parameters
140728-06	28-04-14	Saxtons_5.0	9/10/2014	07:45:00	0.96	1.04	79.2	0.61	218.7	134.3	17.0	16.5	Dry	"Make-up" sampling day for all parameters
140728-02	28-05-14	Saxtons_5.15 DUPLICATE	9/10/2014	07:40:00	0.11	0.17	7.47	0.66	21.3	121.5			Dry	"Make-up" sampling day for all parameters
140728-03	28-06-14	H1	9/10/2014	09:00:00	< 0.05	< 0.1	< 5	0.37	<1	2.7				"Make-up" sampling day for all parameters