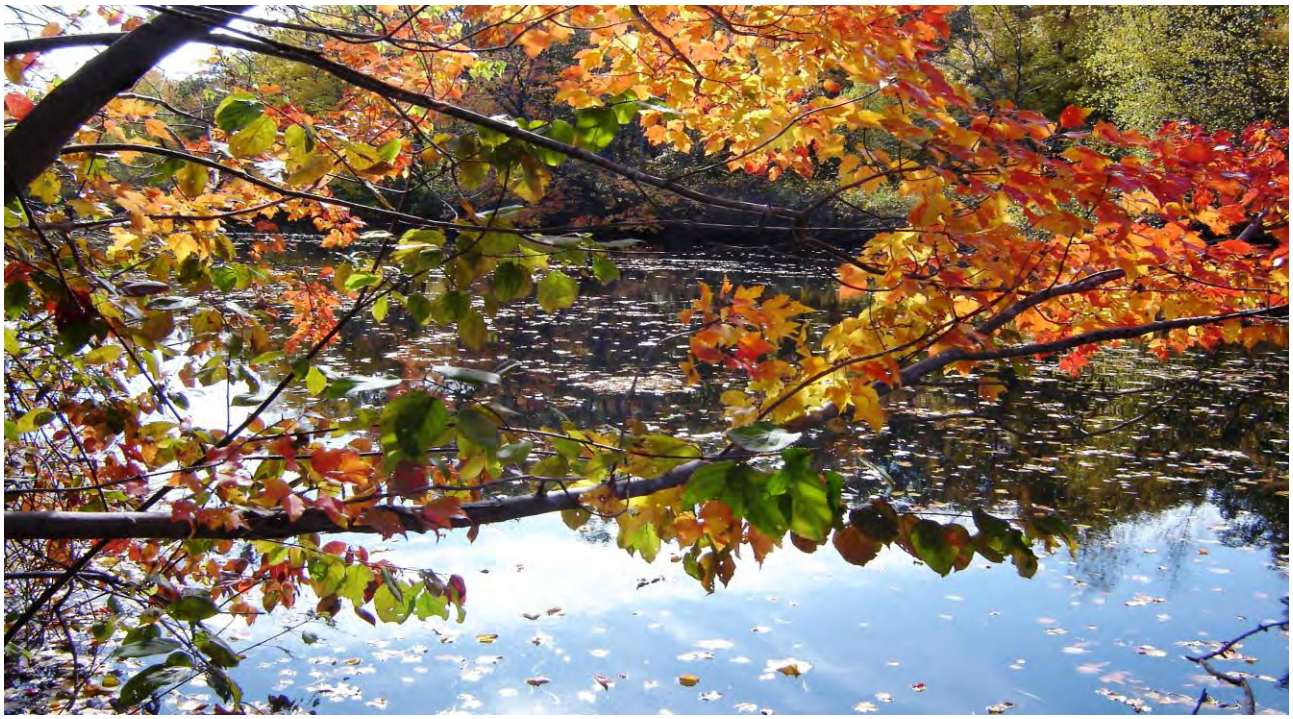
BLACKSTONE RIVER WATERSHED
SMART MONITORING PROGRAM 2005-2010

Technical Memorandum CN 424.0



Blackstone River, Millville

Prepared By:
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January 2016

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Cover by Therese Beaudoin, MassDEP. 15 October 2008.
All photos in document taken by Therese Beaudoin. MassDEP. CERO.
SMART monitoring logo designed by Robert Kimball and Barbara Kimball.

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LIST OF LATIN NAMES

Latin Name	Common name	Latin Name	Common name
Agelaius phoeniceus	red-winged blackbird	*Pandion haliaetus*	osprey
Anas platyrhynchos	mallard duck	*Peltandra virginica*	arrow arum
Ardea herodias	great blue heron	*Phalaris arundinacea*	reed canary grass
Branta canadensis	Canada goose	*Polygonum* sp.	smartweed
Brasenia schreberi	watershield	*Pontederia cordata*	pickerelweed
Bidens sp.	beggar's tick	*Potamogeton* spp.	pondweeds
Callitriche sp.	water starwort	*Procyon lotor*	raccoon
Castor canadensis	North American beaver	*Rana catesbeiana*	bullfrog
Chrysemys picta	painted turtle	*Rorippa* sp	water cress
Elodea canadensis	waterweed	*Sagittaria* sp.	arrowhead
Gramineae family	true grasses	*Scirpus* sp.	bullrush
Juncus sp.	sedges	*Typha latifolia*	common cattail
Lobelia cardinalis	cardinal flower	*Vallisneria americana*	wild celery
Lythrum salicaria	purple loosestrife	*Wolffia* sp.	watermeal
Myriophyllum sp.	milfoil	*Zizania aquatica*	wild rice

LIST OF ACRONYMS

% sat	percent oxygen saturation
305(b)	Section 305(b), Clean Water Act
7Q10	lowest 7-day average streamflow that occurs, on average, once every 10 years
BRP	Bureau of Resource Protection
BWR	Bureau of Water Resources
ºC	degrees Celsius
CERO	CEntral Regional Office
cfs	cubic feet per second
CSO	Combined Sewer Overflow
DO	Dissolved oxygen
DWM	Division of Watershed Management
ºF	degree Fahrenheit
m	meter
MA	Massachusetts
MassDEP	Massachusetts Department of Environmental Protection
mg/L	milligrams per liter
µS/cm	microsiemen per centimeter
mi^2	square mile
NH_3-N	Ammonia nitrogen
NOAA	National Ocean and Atmospheric Administration
NO_3NO_2-N	Nitrate-nitrite nitrogen
NTU	Nephelometric Turbidity Unit
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RI	Rhode Island
SMART	Strategic Monitoring and Assessment for River basin Teams
SOP	Standard Operating Procedure
SR	State Road
SU	Standard Unit
T	Temperature
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
UBWPAD	Upper Blackstone Water Pollution Abatement District
USGS	United States Geological Survey
WES	Wall Experiment Station
WWTP	wastewater treatment plant

INTRODUCTION

The purpose of this technical memo is to present observations and data collected in the Strategic Monitoring for River basin Teams (SMART) program in the Blackstone watershed, highlighting how the program supports and augments programs of the Massachusetts Department of Environmental Protection (MassDEP) Bureau of Resource Protection (BRP, now the Bureau of Water Resources, BWR) Central Regional Office (CERO) and the Division of Watershed Management (DWM).

Overview of Monitoring Plan

Bimonthly water quality monitoring began in March 2000. The sampling plan matrix for the SMART monitoring program Years 2005-2010 is presented in Table 1; the location of sampling stations is presented in Figure 1. Sampling components at all stations included:

- *in situ* measurements: dissolved oxygen (DO), percent oxygen saturation, pH, specific conductivity, temperature (T), depth and total dissolved solids (TDS);
- physical/chemical constituents: total alkalinity, chlorides, hardness, total suspended solids (TSS), turbidity;
- nutrients: ammonia-nitrogen (NH_3-N), nitrate-nitrite-nitrogen (NO_3–NO_2-N), total nitrogen (TN), and total phosphorus (TP);
- flow measurements (at existing USGS flow gaging stations); and
- general field observations.

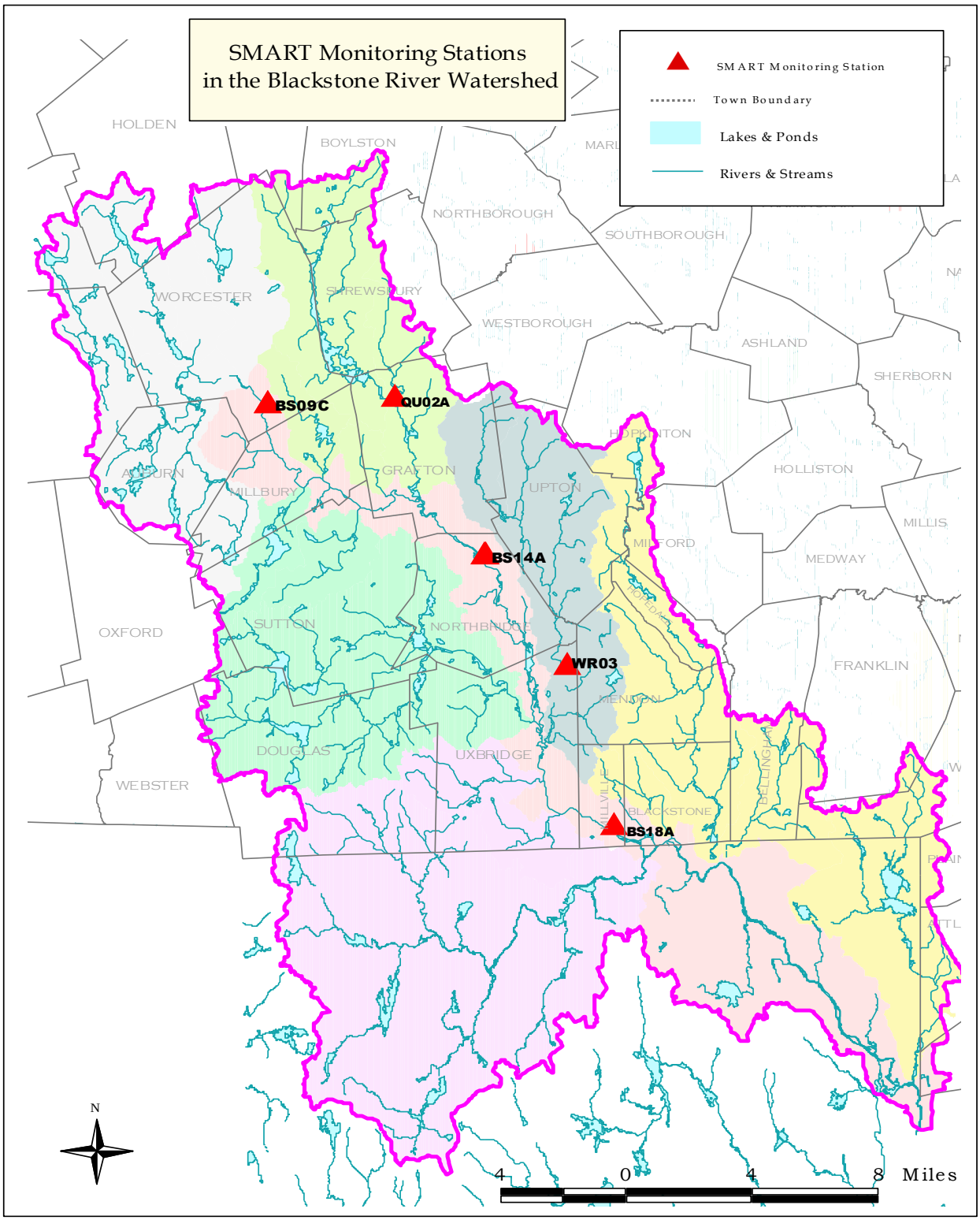
Table 1 Blackstone Basin SMART Sampling Summary – 2005 through 2010

Location and Segment Numbers	Station Name	Station Type	Dates Sampled[1]
Blackstone River @ Blackstone Valley Bikeway, Worcester MA51-03	BS09C	Impact	2005: 2/1/05, 3/23/05, 5/25/05, 7/27/05, 9/28/05, 11/16/05 2006: 2/22/06, 4/25/06, 6/21/06, 8/30/06, 10/18/06 2007: 1/24/07, 3/21/07, 5/23/07, 7/25/07, 9/19/07, 11/14/07 2008: 3/5/08, 4/29/08, 5/27/08, 6/24/08, 8/5/08, 8/26/08, 10/15/08 2009: 2/24/09, 3/25/09, 5/27/09, 7/29/09, 9/30/09, 11/18/09 2010: 2/25/10, 9/1/10, 10/27/10
Blackstone River @ USGS flow gaging station, Sutton Street, Northbridge MA51-04	BS14A	Impact	
Blackstone River @ P&W railroad trestle (2/1/2005-6/21/2006) @former USGS monitoring station (8/30/2006 – 11/14/2007),@USGS gaging station State Road (SR) 122 (3/5/2008-10/27/2010) Millville MA51-05	BS18A	Boundary	
Quinsigamond River @ historic Bridge Street, Grafton MA51-09	QU02A	Impact	
West River @ East Hartford Ave, Uxbridge MA51-12	WR03	Reference	

Hydrology

The Blackstone River flows approximately 46 miles from its beginning at the junction of Mill Brook and the Middle River, Massachusetts (MA) to the tidal Seekonk River in Pawtucket, Rhode Island (RI). The Blackstone River Watershed encompasses 540 square miles (mi^2) in these two states (approximately 335 mi^2 are in MA), and all or part of 28 towns and 2 cities. For an in-depth description of the watershed, see Blackstone River Watershed Water Quality Assessment Report 2003 - 2007 (MassDEP 2010). The river is characterized by impoundments created by dams built in the 1700 to 1800's for hydromechanical energy to power mills; at one time, there were 44 dams in 46 miles, of which 19 remain. Annual precipitation ranges from 48 to 50 inches over most of the watershed, with a

Figure 1 MassDEP SMART Monitoring Blackstone River Watershed Water Quality Station Locations 2005-2010.



region including all of Northbridge and small areas in abutting towns (Douglas, Grafton, Hopkinton, Sutton, Upton, and Uxbridge) receiving 46 to 48 inches (Ostiguy et al 2010).

The headwater streams of the Blackstone River flow through the municipalities of Auburn, Holden, Leicester, and Worcester; these include Kettle, Tatnuck, Beaver and Mill Brooks. Major Massachusetts tributaries of the Blackstone River include the Quinsigamond, Mumford, West, Mill and Peters Rivers.

Quality Assurance/Quality Control

The quality assurance/control plan (QAPP) for the SMART program is presented in CN 012.1*: Quality Assurance Project Plan Strategic Monitoring and Assessment for River basin Teams (SMART) (Blackstone, Chicopee, Concord, French/Quinebaug, Millers, and Nashua Watersheds) 2008-2012* (Beaudoin 2008). The QAPP presents data quality objectives, quality assurance procedures, and other program-specific information.

Aerial photos were obtained from Google Earth (2012, 2011a, 2011b, 2011c, 2011d) at a height of approximately 4,000 feet (ft).

PROJECT OBJECTIVES

The primary water quality objectives of the SMART monitoring program are:

- Document baseline water quality by: providing information on low flow/event flow variation, seasonal variation and frequency of selected constituents; and establishing reference distributions of key constituents for ecoregion delineation and "clean water" sites;
- Estimate loads of detected water constituents at key locations by: quantifying nitrogen loadings to coastal waters; and calculating phosphorous loads upstream/downstream of representative land use areas;
- Define long term trends in water quality by: documenting improvements associated with major abatement projects; and identifying trends at least-impacted stations (that may result from factors such as acid precipitation and climate change);
- Assess attainment of water quality uses by: comparing existing water quality with water quality standards; and by assessing use support for the fishable/swimmable goal;
- Provide support for other programs by: determining reference distributions for ecoregion stations; conducting trend analysis for the 305(b) reports[1] and basin plans; quantifying nutrient loadings for load allocations (Total Maximum Daily Loads, or TMDLs); obtaining data on nonpoint source loadings for more intensive Year 2 sampling; providing guidance for volunteer monitoring; collecting data for development of statistically-based water quality standards and for improvement of Combined Sewer Overflow (CSO) and Stormwater policies; and developing a long-term database on conditions at key locations for the development of new programs and basic research.

As stated in the Introduction, this document presents observations and data collected in the Blackstone Watershed under the SMART program from 2005-2010. An assessment of the data will be presented in future reports.

METHODS

Water quality sampling procedures are included in *Grab Collection Techniques for DWM Water Quality Sampling, Standard Operating Procedure* (MassDEP 1999b). Use of the *in situ* monitoring equipment followed procedures set forth in *CN 4.0 Water Quality Multi-probe Instrument Use, Standard Operating Procedure* (MassDEP 1999a). Physical/chemical and nutrient samples were analyzed at the Senator William X. Wall Experiment Station (WES), the MassDEP analytical laboratory located in Lawrence, Massachusetts. All samples were collected, transported, analyzed, and discarded according to chain-of-custody procedures.

In addition to the measurements and analytes noted above, field observations were recorded at each station on standardized field sheets, field notebooks, and as photographs. Field observations included date/time, location, crewmembers, snow cover, canopy cover, water odors, colors, sheens, foams, estimated river height and velocity, weather conditions, observed uses, wildlife, aquatic algae and macrophytes, potential pollution sources, and unusual conditions. Number and type of samples were recorded, as well as the last set of *in situ* data collected. A summary of field observations by station collected during this sampling period are presented in Table 2 through Table 6 following the station descriptions.

Each station selected for the SMART Monitoring program is described according to key characteristics associated with water quality at that location, as follows:

- Reference: a reference station is located in a stream segment that is minimally influenced by anthropogenic activities;
- Impact: an impact station is located where several sources of pollution come together and can be used to calibrate a mass balance model, or where critical reactions take place such as at an oxygen sag point; and
- Boundary: a boundary station is located at a pour point i.e., where water leaves a designated river basin, or at a state line.

Field sheets, raw data files, chain of custody forms, lab reports, and other metadata used in this report are managed and maintained by the MassDEP DWM in the Water Quality Access Database in Worcester, MA. The validation of the water quality data included data entry into DWM databases, data entry quality control checks, analysis for outliers, blank contamination, duplicates, precision, and holding time violations, followed by project

[1] The 305(b) reports are the biannual reports to the U. S. Congress on water quality that are required under Section 305(b) of the Clean Water Act.

level review (MassDEP 2005). The project coordinator, as identified in the QAPP for the SMART program (CN 012.2), reviews the data for reasonableness, completeness and acceptability (Beaudoin 2008).

Due to resource limitations at the WES laboratory, SMART samples were collected only for nutrient analyses from January through February 1, 2005 and May 18 through May 25, 2005; these were frozen and analyzed at a later date. During these periods, samples were not collected for alkalinity, hardness, total suspended solids and chloride analyses, while turbidity samples were analyzed at the DWM laboratory (instead of WES). These analyses were not conducted on samples collected on September 13, 2006 as well. In 2010, the WES lab was closed from March through June during the construction phase of the new lab space; SMART monitoring was not conducted during this time.

STATION OBSERVATIONS

Station BS09C – Blackstone River at Blackstone River Road, Worcester, MA (river mile 29.508)

Figure 2 Google Earth view of BS09C area

Figure 3 BS09C upstream 9/1/2010

Station BS09C is located on the Blackstone River in Worcester, MA within the Southern New England Coastal Plains and Hills ecoregion. From 2005-2010, Station BS09C was sampled 33 times, and the river was accessed from the Blackstone Valley Bikeway off Blackstone River Road at Tobias Boland Way. Samples were collected by wading into the stream near the outlet of the stormwater detention basin located across the bikeway. Station BS09C serves as an impact station as it is located downstream of numerous point and nonpoint sources of pollution, as described below.

The dominant land use upstream of this station is the urban municipalities of Worcester and Auburn (Figure 2) (Google Earth 2011a). With some storm events, the Worcester CSO treatment facility discharges to the Mill Brook (underground culvert) approximately 1.25 miles upstream of Station BS09C. The station is upstream of the Upper Blackstone Water Pollution Abatement District (UBWPAD) in Millbury which discharges 1.5 miles downstream, the most upstream of the major municipal discharges to the Blackstone River. Other than infrequent CSO facility discharges, the major sources of pollution to this segment of the Blackstone River are non-point, particularly urban runoff (the City of Worcester is comprised of approximately 65% impervious surfaces).

The river is channelized at this point, approximately 30 feet wide, typically 1 foot deep and roughly uniform across the channel throughout the year. The banks are undercut throughout this stretch. Deciduous trees provide canopy cover over much of the channel up- and downstream of the Blackstone River Road Bridge. The bottom consisted mainly of embedded cobble, gravel and sand, with silt and boulders noted occasionally. Macrophytes recorded at Station BS09C during this 5-year period were limited to a few sprigs of *Elodea canadensis* (waterweed) caught against a midstream rock. There was a consistent dense to very dense coverage of film or filamentous brown, green or grey algae. Samples were collected by wading in or from shore. Wildlife noted at this station included crayfish, various birds, and unidentified small mammals (tracks on channel edge, scat)

Turbid conditions were observed on most events, ranging from very slight/slight (15 events, n=33) to highly murky (5); the water column was clear on 15% of the dates sampled. The water color was typically grey or yellow. Petroleum was the most common water odor noted (12 events), as well as the absence of odor (11). Foam, when present, was typically very sparse/sparse (15), with no foam noted on 16 monitoring dates; no sheens were observed during this time period. Trash was present on all but one event (in the stream channel and on the banks), and ranged from minor to very dense. Trash commonly included floatables, metals and miscellaneous unidentifiable objects; silt fencing, chunks of pavement/curbing, hay bales, bricks, clothes, rope, a rubber mat, a soccer ball, a bucket and broken glass were also observed.

Station BS14A – Blackstone River at Sutton Street, Northbridge, MA (river mile 17.716)

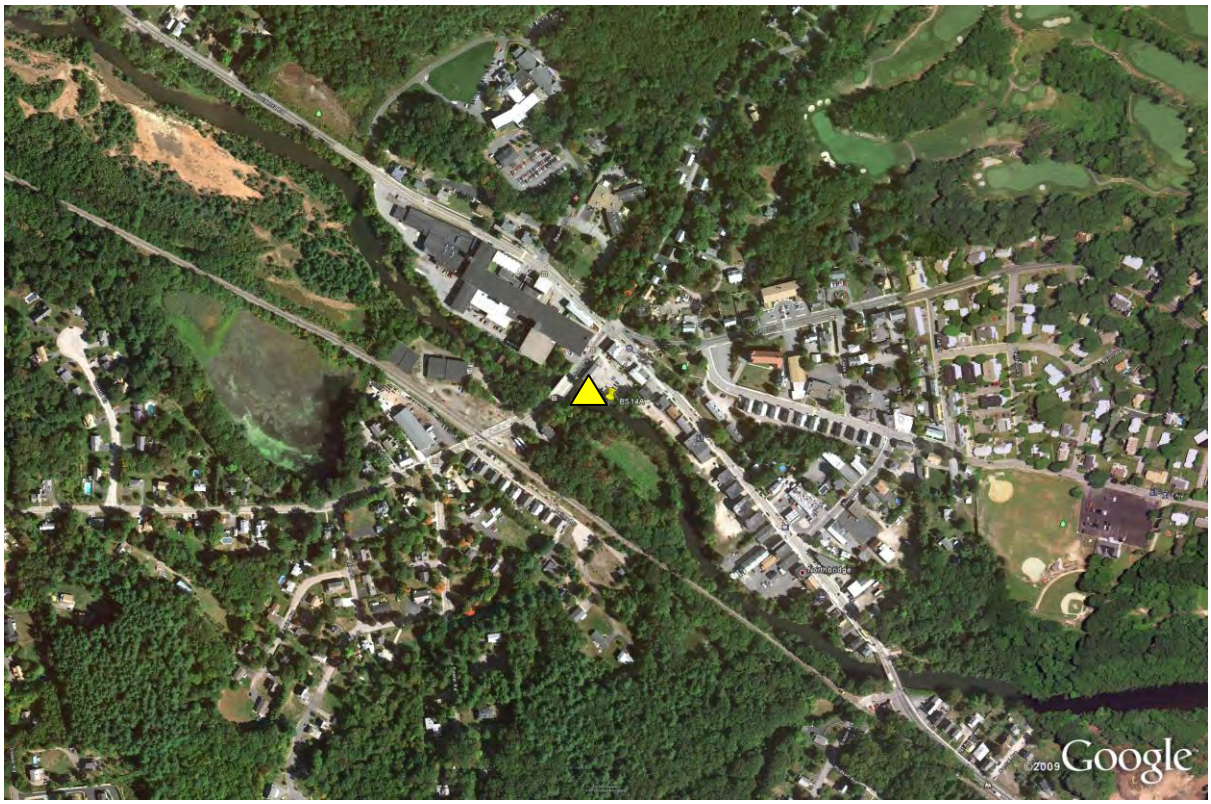


Figure 4 Google Earth view of BS14A area

Figure 5 BS14A upstream 9/1/2010

Station BS14A is located on the Blackstone River in Northbridge, MA within the Southern New England Coastal Plains and Hills ecoregion. From 2005-2010, the station was sampled 33 times, and the river was accessed from shore near the United States Geological Survey (USGS) flow gaging station downstream of Sutton Street. Station BS14A serves as an impact station as it is downstream of numerous point sources of pollution, including the Upper Blackstone Water Pollution Abatement District and the Grafton Wastewater Treatment Plant.

Station BS14A is also downstream from significant nonpoint sources of pollution. In addition to those described for Station BS09C, legacy pollutants retained in impoundment sediments are another nonpoint source. Above Station BS14A, the Blackstone River flows through several existing and former impoundments known to contain sediments contaminated with metals, polynuclear aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), petroleum and other pollutants from historic discharges, spills and releases (USACOE 1994).

The land uses upstream of Station BS14A consist mainly of forest and sparse to moderate residential development (Figure 4) (Google Earth 2011b).

In addition to upstream activities, Station BS14A is influenced by downstream hydropower operations which result in periods of backwater in this segment and changes to the stage-discharge relationship concurrent with impounded conditions. The USGS gage at this location records river height for all stages; discharges records are only computed for flows of 500 cubic feet per second (cfs) or greater (Socolow 2011).

The river at this location is approximately 65 feet wide, and shaded along the shorelines (Figure 5). Elevated turbidity was ongoing, and was noted as moderate to highly murky on 27 of 33 events in this time period. As a result, substrate composition, as well as the presence/absence of macrophytes, periphyton, and trash was typically unobservable. When visible, the substrate consisted mainly of highly embedded cobble, gravel, sand and silt, with boulders near the USGS station (to protect gaging apparatus). Periphyton (when visible) was typically composed of dense to very dense grey filamentous algae. No macrophytes were recorded at this station during this time period although, as noted, the water column was not sufficiently clear to view the channel clearly on most events. Samples were collected between the USGS station and the Sutton Street Bridge by wading in or from shore.

Infrequent algal blooms were observed at Stations BS14A and BS18A (Blackstone River, Millville). At the Blackstone River in Northbridge, blooms were observed on 4 dates during this time period, including January 24 and March 20, 2007; March 25, 2009; and September 1, 2010. Turbidity was a chronic issue at this station, as noted above. The water color was often grey (11 of 33 events) or yellow (10). Effluent was the most commonly noted water odor (21). Foam was observed on 61% of events, and ranged from very sparse/sparse (10) to moderate (10). An oily sheen was noted on one event (4/25/2006). Trash included cement blocks, broken glass, metals and floatables on 17 of the 18 events where the bottom was visible.

Station BS18A – Blackstone River near Main Street, Millville, MA (river mile 3.271)

Figure 6 Google Earth view of BS18A area

Figure 7 BS18A upstream 2/1/2005 – 6/21/2006

Figure 8 BS18A upstream 8/30/2006 – 11/14/2007

Figure 9 BS18A upstream 3/5/2008 – 10/27/2010

Station BS18A is located on the Blackstone River in Millville, MA within the Southern New England Coastal Plains and Hills ecoregion. The station was sampled 32 times from 2005-2010, and the river was accessed from the Providence and Worcester railroad trestle approximately 0.6 mi downstream of the Center Street Bridge (off MA122) from February 2005 through June 2006 (Figure 7). Samples were collected by bucket drop from the channel north of the center trestle abutment from the downstream side of the trestle. In August 2006, the station was moved to the site of the former USGS monitoring gage approximately 1150 feet downstream to address ongoing safety issues (Figure 8). However, due to backwatering and a steep drop-off near shore, it was difficult to access flowing water, and the station was again moved in March of 2008, to the recently constructed USGS gaging station off Rte. 122, approximately 800 feet upstream of the second location, between both stations (Figure 9). Station BS18A serves as a boundary station, located approximately 1.2 mi upstream of the Massachusetts border with the State of Rhode Island.

The land uses above Station BS18A are mainly forest and sparse residential and commercial development (Figure 6) (2011c).

Sources of water quality degradation at this station are both point and nonpoint in nature. Point sources include the municipal discharges noted above, as well as the Northbridge and Uxbridge WWTPs, and two smaller facilities on the Mumford (Douglas) and West (Upton) Rivers. Additional nonpoint sources include legacy pollutants retained in sediments of impoundments in Northbridge and Uxbridge, as well as impervious surfaces in the lower watershed.

The river at this station is approximately 100 feet wide, and although heavily shaded along both shores, most of the channel is open to the sky (Figure 9). This section of river is impounded by the Rolling Dam at the head of the Blackstone Gorge, Blackstone and is affected by operations at the hydropower facility in the former Tupperware manufacturing facility. The depth across the stream channel is unknown (too deep to wade). Visibility was often limited due to the solar reflection and high turbidity (20, n=31); when visible, periphyton was typically absent (9), with two observations of suspended filamentous algae and orange floc. The substrate composition (when visible) consisted mainly of gravel, sand and silt. Aquatic macrophytes were noted infrequently, and included Gramineae (grasses), *Juncus* sp. (sedges), *Sagittaria* sp. (arrowhead), and *Vallisneria americana (*wild celery). Wildlife noted included *Ardea herodias (*great blue heron), *Branta canadensis (*Canada goose), *Castor canadensis* (beaver*)*, ducks, frogs and fish.

Infrequent algal blooms were observed at Stations BS18A and BS14A (Blackstone River, Northbridge). At the Blackstone River in Millville, blooms were observed on 3 dates during this time period, including July 27 and September 28, 2005; and March 25, 2009. The water column was moderate to highly turbid on 62% (19, n=31) of sampling events in this time period, slightly turbid 23% and clear twice. The water color was typically light yellow (12, n=31), brown (8) or clear (6). The river usually lacked odor (16 events, n=31), with infrequent observations of musty and effluent odors. Foam was absent on 17 events (n=31), sparse on 10 dates, and moderate on 4. Manganous sheens were noted twice.

Station QU02A – Quinsigamond River at the historic Bridge Street Bridge, Grafton, MA (river mile 4.480)

Figure 10 Google Earth view of QU02A area

Figure 11 QU02A upstream 7/29/2009

Station QU02A is located on the Quinsigamond River in Grafton, MA within the Southern New England Coastal Plains and Hills ecoregion. From 2005-2010, the station was sampled 32 times. The river was accessed from the northern shore above the historic Bridge Street Bridge; samples were collected by wading in or by sampling pole from the bridge. The station is located downstream of 3 large water bodies, including Lake Quinsigamond, Flint Pond, and Hovey Pond. Station QU02A serves as an impact station as it is located downstream of numerous nonpoint sources of pollution, mainly urban runoff.

The upstream land use is dominated by urbanization in the City of Worcester and areas of Shrewsbury, Millbury and Grafton; development is moderately dense in much of the contributing watershed (Figure 10) (Google Earth 2011c).

The river channel varies from 15 to 40 feet wide in this reach (the greater width includes the northern cove above the bridge) and heavily shaded (Figure 11). Although it was usually difficult to see the bottom clearly due to staining and solar reflection, when visible, the substrate consisted mainly of embedded cobble, gravel and sand, often covered in a layer of silt. Periphyton was absent on 18 of 32 sampling events conducted at this station during this time frame; when present, sparse to moderate populations of green filamentous algae were noted on 5 dates, and dense to very dense filamentous green/blue-green algae three times. Sparse aquatic macrophytes were observed in the cove above the stone arch bridge, including *Myriophyllum* sp. (milfoil), *Lythrum salicaria (*purple loosestrife), *Peltandra virginica (*arrow arum), *Pontederia cordata* (pickerelweed), *Sagittaria* sp. (arrowhead), *Scirpus* sp. (bulrush), and *Wolffia* sp. (watermeal).

The turbidity was usually clear, with occasionally slight turbidity, and highly murky conditions twice. The water color was typically clear and lacking odor. Foam was absent 56% of the events sampled, and sparse 44%. The substrate of the main channel (not including the small “cove”) above the bridge is covered with broken glass and metals; floatables, tires and a shopping cart were also observed. Wildlife observations included a pair of mallard ducks (*Anas platyrhynchos)* and raccoon tracks (*Procyon lotor*).

Station WR03 – West River at East Hartford Ave, Uxbridge, MA (river mile 3.409)

Figure 12 Google Earth view of WR03 area

Figure 13 WR03 upstream 8/26/2008

Station WR03 is located on the West River in Uxbridge, MA within the Southern New England Coastal Plains and Hills ecoregion. From 2005-2010, the station was sampled 31 times, and access was gained from the eastern shore upstream or at the top of the culvert (under conditions of high water) at East Hartford Ave. Station WR03 serves as a reference station for the Blackstone Watershed, with minimal anthropogenic activities upstream.

The major land use upstream of this area is forested, with long segments of the river flowing through riverine wetlands within the USACOE West Hill Flood Control Project corridor (Figure 12) (2011d). The West River has one major municipal discharge (Upton WWTP), approximately 5.5 miles upstream.

The river channel at this location is approximately 25 feet wide within a riverine wetland system. The stream bed consists mainly of muck and sand, with some gravel and silt, and a few submerged granite blocks anchoring the bottom midstream. Periphyton was typically absent (18, n=32); when observed, growth ranged from very sparse/sparse green filamentous algae (5) to very dense green/blue-green filamentous (3). Macrophytes were diverse and abundant at this station; plants observed during this period include included *Bidens* sp. (beggar's tick), *Brasenia schreberi* (watershield), *Callitriche* sp. (water starwort), Gramineae (grasses), *Juncus* sp. (sedges), *Lobelia cardinalis* (cardinal flower), *Phalaris arundinacea (*reed canary grass*), Polygonum* sp. (smartweed), *Potamogeton* spp. (pondweeds), *Rorippa* sp. (water cress), *Typha latifolia* (common cattail), *Vallisneria americana* (wild celery), and *Zizania aquatica* (wild rice). Wildlife observations note red-winged blackbird (*Agelaius phoeniceus*), osprey (*Pandion haliaetus*), bullfrog (*Rana catesbeiana*), mallard duck (*Anas platyrhynchos)*, great blue heron (*Ardea herodias)*, painted turtle (*Chrysemys picta),* and beaver (*Procyon lotor).*

The water column was typically clear at this station, light yellow or red in color, and lacking odor, sheens, or foam. Trash/debris was never observed.

SURVEY CONDITIONS

Stream discharge and precipitation data are used to determine hydrologic conditions and, consequently, if water quality surveys should be described as dry or wet weather events. During dry weather, trace amounts of precipitation may fall, but there is no measurable change in stream flow (discharge). Wet weather is defined as precipitation within a five-day antecedent period that leads to more than a slight increase in stream discharge.

Precipitation data were obtained from the National Oceanic and Atmospheric Administration (NOAA). The presence/absence of precipitation during the five days prior to each sampling event was based on NOAA data available on their website NOAA Climatological Data Publications (NOAA 2015). Worcester, MA is the location of the weather station closest to the Blackstone watershed sampling stations, hence climate data collected in Worcester were utilized in this report.

The USGS operates numerous stream gaging stations on the Blackstone River and tributaries; those relevant to the geographic area of the SMART program include:

- Blackstone River, W. Main St., At Millbury, MA (USGS 2010a) (http://waterdata.usgs.gov/ma/nwis/dv/?site_no=01109730&PARAmeter_cd=00060,00065)
- Blackstone River at Northbridge, MA (USGS 2010b) (http://waterdata.usgs.gov/ma/nwis/uv?site_no=01110500)
- Blackstone River, Rte. 122 Bridge near Uxbridge, MA (USGS 2010c) (http://waterdata.usgs.gov/ma/nwis/dv/?site_no=01111212&PARAmeter_cd=00060,00065)
- Blackstone River at Woonsocket, RI (USGS 2010d) (http://waterdata.usgs.gov/ma/nwis/dv/?site_no=01112500&PARAmeter_cd=00060,00065)
- Quinsigamond River at North Grafton, MA (USGS 2010e) (http://waterdata.usgs.gov/ma/nwis/dv/?site_no=01110000&PARAmeter_cd=00060,00065)
- West River below West Hill Dam near Uxbridge, MA (USGS 2010f) (http://waterdata.usgs.gov/ma/nwis/uv?site_no=01111200)

The USGS station on the Blackstone River in Woonsocket, RI is located several miles downstream of Station BS18A. There are numerous small streams, several large tributaries (the Branch, Mill, and Peters Rivers), and two hydropower generating facilities (the Tupperware Dam in Blackstone, MA and Thundermist in Woonsocket, RI) located on the Blackstone river mainstem between Station BS18A and the Woonsocket gaging station. Therefore, this gaging station is used as an estimate of discharge, rather than exact conditions, at Station BS18A.

Statistical streamflow values are based on 85-86 years of record (10/1/1928-9/30/2014) at the USGS Blackstone River gage in Woonsocket, RI (USGS station number 01112500). Daily discharge data are reported online at Daily mean discharge (2012a). The monthly data are reported at Monthly mean discharge (2012b). The point of record mean daily discharge statistics based on 85-86 years of record (10/1/1928-9/30/2014) are found at USGS Surface-Water Daily Statistics for Massachusetts USGS 01112500 BLACKSTONE RIVER AT WOONSOCKET, RI (2015).

The discharge values were also examined relative to the 7Q10 low flow (lowest 7-day average streamflow that occurs, on average, once every 10 years) from the *Gazetteer of Hydrologic Characteristics of Streams in Massachusetts – Blackstone River Basin* (Wandle and Phipps, 1984), and are as follows:

- Blackstone River at Northbridge = 45 cfs
- Blackstone River at Woonsocket = 101 cfs
- West River at West Hill Dam, Uxbridge = 1.5 cfs

At some of the Blackstone flow gaging stations, precipitation-related stream fluctuations were difficult to distinguish from manipulated fluctuations on some occasions (e.g., hydropower operations, wastewater discharges).

Table 2-6 (field observations), Table 7 (precipitation) and Table 8 (stream discharge) contain information on survey conditions during each sampling event. Both the precipitation and the stream discharge data were used to estimate hydrological conditions during water quality sampling. Air temperature was measured at each station and recorded as degrees Fahrenheit (ºF).

February 1, 2005 – SMART Monitoring in the Blackstone watershed was conducted during a period with no measurable precipitation at the Worcester airport climate station during the previous five days; stream discharge decreased steadily during this period. Samples collected during this event reflect dry weather conditions. Air

temperature ranged from 15 to 36 °F under sunny skies. Stations BS18A on the Blackstone River in Millville and Station WR03 on the West River in Uxbridge were inaccessible on this date due to ice cover.

March 23, 2005 – This early spring survey occurred during a relatively dry period, with trace precipitation measured during the five days preceding this event. Discharge rose approximately 200 cfs at the Woonsocket gage during this period; similar discharge patterns were observed at the Blackstone River, Millbury and the Quinsigamond River, Grafton gages as well. Field observations note that the rivers appear to reflect snow melt conditions, with little snow remaining in the watershed. Maximum air temperature measured at Worcester during this period ranged from 39 to 49ºF. Discharge and field observations indicate wet weather /runoff conditions. Air temperature in the field ranged from 40 to 47°F under overcast skies.

May 25, 2005 – Sampling fell within a storm front that dropped 1.64 inches (in) of rain from May 22-25. Discharge rose concurrently. Field observations note turbidity ranging from slight to highly murky at all stations. Samples collected on this date reflect wet weather/runoff conditions. Air temperature ranged from 44 to 46ºF under rainy skies.

July 27, 2005 – This summer survey occurred during a dry period, with little precipitation measured during the five days preceding this event; discharge fell consistently during this period. Samples collected on this date reflect dry weather conditions. Air temperature ranged from 82 to 94°F with sunny skies throughout the event. Cloud conditions ranged from approximately <5% to 45% overcast.

September 28, 2005 – Rainfall totaling 0.30 in fell in the area two days before this monitoring event; discharge rose the next day. Turbidity at the three stations on the Blackstone River ranged from moderate to highly turbid. Data collected reflect wet weather/runoff conditions. Air temperature ranged from 54 to 69°F under sunny skies.

November 16, 2005 – This mid-fall sampling event occurred within a storm that brought 0.83 in of rainfall to the area on November 15-16, 2011. Stream discharge rose on the sampling date. Data collected during this event reflect wet weather/runoff conditions. Air temperature ranged from 47 to 66°F, and cloud cover ranged from overcast to intermittent drizzle.

February 22, 2006 – This winter sampling event took place during a relatively dry period, with 0.13 in of rain on February 17th. Discharge decreased at the Woonsocket gage during this period. Data collected during this event reflect dry weather conditions. Air temperature ranged from 28 to 47°F and sunny skies that gave way to approximately 45% at the last station sampled.

April 25, 2006 – This spring sampling event took place within a storm event that brought 0.69 in to the area from April 22-25. Discharge rose concurrently with precipitation. Data collected during this event reflect wet weather/runoff conditions. Air temperature ranged from 53 to 66°F with cloud cover ranging from sunny to overcast.

June 21, 2006 – This early summer sampling event followed a storm that brought 0.11 in of rainfall to the area on the night before monitoring. However, discharge data for gages throughout the watershed reflected steadily decreasing flows from June 16-21. Field observations noted turbidity throughout the watershed ranged from none (Quinsigamond River) to highly murky (Blackstone River, Northbridge and Millville). Conductivity ranged from 167 µS/cm at the reference station (West River, Uxbridge) to 489 µS/cm at the Blackstone River, Northbridge. Based on precipitation and field observations, these data reflect wet weather/runoff conditions. Air temperature ranged from 70 to 82°F and conditions ranged from sunny to 15% cloud cover.

August 30, 2006 – Summer sampling occurred during a wet period, with a total of 1.87 in of rain from August 25-30. Flow data generally indicate increasing discharge in this period at the Woonsocket gage. Data collected during this event reflect wet weather/runoff conditions. Ambient temperature ranged from 64 to 73°F and skies ranged from overcast to 75% cloud cover during the survey.

October 18, 2006 – A storm system brought 0.53 in of rain to the area from October 17-18; discharge at the Woonsocket gage rose concurrently. Water quality measured on this event reflects wet weather/runoff conditions. Air temperature ranged from 62 to 67°F under overcast skies with drizzle developing by the last station (Quinsigamond River, Grafton).

January 24, 2007 – This winter sampling event occurred during a period with little precipitation measured at the Worcester weather station between January 19-24 (0.11 in); this was mostly as snowfall, with 1.8 in recorded on

January 22. Photos taken on this date show snow remaining on the banks at each station. Maximum daily temperature recorded in Worcester ranged from 21 to 34ºF during this 6-day period. Discharge at area stations generally decreased from January 19-24. Data collected on this date reflect dry weather conditions. Air temperature ranged from 26 to 41°F, with skies ranging from sunny to <20% cloud cover.

March 21, 2007 – In the five-day period preceding this late winter sampling event, 1.30 in of precipitation fell at the Worcester weather station, most during a storm event from March 16-17 (snowfall data were unavailable at the Worcester weather station). Turbidity on the Blackstone River ranged from highly murky in the upper and central reaches to moderately turbid at the Millville station. Discharge at area stations generally decreased from March 16-21, some with a small increase from March 17-18. Based on all available information, data collected during this event reflect dry weather conditions. Air temperature ranged from 27 to 40°F under sunny skies

May 23, 2007 - Approximately 1.37 in of precipitation fell in the watershed within the 5 days prior to this spring monitoring event, most from May 18-20; discharge increased May 18-19, then decreased through May 23rd. Field observations indicate moderate turbidity at the two upper mainstem stations only, while conductivity levels were within the range typically seen in the watershed. Based on the precipitation and discharge data, water quality during this event reflects dry weather conditions. Air temperature ranged from 57 to 73°F, and cloud cover from <5 to 100% during the event.

July 25, 2007 - Early summer monitoring followed 0.31 in of rain in the 5 preceding days; discharge varied little during this period. Both the precipitation and discharge measurements indicate that data collected on this date reflect dry weather conditions. Air temperature ranged from 72 to 84°F and cloud cover varied from 35 to 90%.

September 19, 2007 – Precipitation measured during the 5 days preceding the event included 0.29 in of rain on September 15. Discharge at the Woonsocket gage on the sampling date (107 cfs) was only slightly above the 7Q10 value (101cfs). Based on precipitation and flow data, water quality on this date is considered to reflect dry weather conditions. Air temperature ranged from 48 to 67°F and cloud cover ranged from clear to <10%.

November 14, 2007 – Sampling on this date was preceded by 0.26 in of rain from Nov 12-13; discharge increased from November 13-14. Moderate to highly murky conditions were noted at all mainstem stations. Precipitation, discharge and field data reflect wet weather/runoff conditions. Air temperature ranged from 46 to 64°F and cloud cover ranged from <5 to <25% during the event.

March 5, 2008 – This late winter event followed a five-day period in which a total of 1.76 in of rain fell in the area. Discharge rose 1600 cfs from March 3-5. Water quality on this date reflects wet weather /runoff conditions. Air temperature ranged from 42 to 60°F under overcast skies with occasional drizzle.

April 29, 2008 – A storm front brought 2.16 in of rain to the area from April 27-29; discharge increased more than 1600 cfs during this time. Data collected during this effort reflect wet weather/runoff conditions. Air temperature ranged from 54 to 61ºF, and cloud cover was overcast with frequent drizzle/rain throughout the event.

May 27, 2008 – The 5 days preceding the event, as well as the morning of the sampling, were dry (0.01 in of rainfall) ; 0.43 in of precipitation recorded on May 27th fell after sampling activities were concluded. Flow data reflect dry weather conditions. Therefore, data collected on this date are considered to reflect dry weather conditions. Air temperatures ranged from 65 to 80ºF, and overcast skies cleared to mostly sunny (<5% cloud cover).

June 24, 2008 – A storm front dropped 2.80 in of rain in the area on the day before sampling. Discharge rose concurrently, from 185 to 755 cfs at Woonsocket. Data collected on this date reflect wet weather/runoff conditions. Air temperature ranged in the 70's and 80's (ºF) under mostly sunny skies.

August 5, 2008 – The 5 days preceding this mid-summer event included 1.56 in of rain. Discharge rose with precipitation events, but had decreased to below pre-storm levels by August 5th at all area gages. Data collected on this event reflect dry weather conditions. Air temperature ranged from 72 to 76ºF under overcast skies.

August 26, 2008 – This summer sampling event followed a 5-day period with no measured precipitation at the Worcester gage. Discharge data confirm dry weather conditions on this date. Air temperature ranged in the 60's to 80's (ºF), with skies developing from mostly cloudy to mostly sunny.

October 15, 2008 – Fall sampling was also preceded by a period with no measurable precipitation in the preceding 5 days. Discharge fell consistently during this period. Data collected during this event reflect dry weather conditions. Air temperature ranged from 57 to 65ºF while skies ranged from <5% to approximately 70% cloud cover.

February 4, 2009 – Snowfall at the Worcester gage totaled 3.3 in on February 3rd, with trace snow on the morning of February 4th (before monitoring activities). Maximum air temperature on February 3rd was 31ºF; and 21ºF on February 4th. Discharge at area gages do not reflect runoff flows. Due to below-freezing air temperature and the lack of change in discharge patterns, data collected reflect dry weather conditions. Air temperature ranged from 21 to 23ºF and skies ranged from 20 to 30% cloud cover.

March 25, 2009 – This early spring event fell within a 5-day period with only trace precipitation noted in the area. Discharge at area gages confirm dry weather conditions. Air temperature ranged from 39 to 48ºF with sunny skies.

May 27, 2009 - Approximately 0.23 in of rain fell on the sampling date, with precipitation beginning overnight (approximately 4:00 am). Discharge at area gages did not rise until mid-day, after monitoring activities concluded. Field observations note high turbidity at all mainstem stations. Based on discharge, water quality on this event reflects dry weather conditions. Air temperature ranged from 48 to 52ºF under overcast/drizzling/rainy skies.

July 29, 2009 – A storm system dropped 2.12 in of rainfall on the area on July 24th. Discharge peaked at the Woonsocket gage on July 25th, then fell steadily to approximately pre-storm levels on the sampling date. Available data indicate dry weather conditions. Air temperature ranged from 77 to 83ºF under cloudy skies.

September 30, 2009 – This early fall sampling event was preceded by a storm that brought 1.06 in of rain to the area on September 27-28. Discharge data indicate increasing flows at watershed gages during this period. Data collected on this data indicate wet weather/runoff conditions. Air temperature ranged from 56 to 59ºF under overcast skies with intermittent sprinkles.

November 18, 2009 – A November 14-15 storm brought 1.64 in of rain to the watershed. Discharge at area gages peaked on November 15th, then decreased steadily. Flow had not reached pre-storm levels at the Woonsocket gage by the monitoring date. Water quality on this date reflects wet weather/runoff conditions. Air temperature ranged from 38 to 51ºF under overcast skies with intermittent sprinkles.

February 25, 2010 – A storm event from February 23-25 dropped 10.7 in of snow in the area. Maximum daily air temperature ranged from 32 to 37ºF during this period. Discharge at area gages confirm wet weather/ runoff conditions. Air temperature during monitoring activities ranged from 39 to 42ºF under overcast skies with occasional rain and drizzle.

September 1, 2010 – This late summer monitoring event was preceded by a 5-day period with no precipitation measured at the Worcester gage. Discharge (134 cfs) was near the 7Q10 flow on the sampling date (101 cfs) patterns reflect dry weather conditions. Air temperature ranged from 74 to 89ºF under sunny/hazy skies.

October 27, 2010 – This mid-fall event fell within a storm with a total of 0.32 in or precipitation recorded at the Worcester gage; rain fell sporadically throughout monitoring activities. Discharge at area gages rose on the sampling date, beginning approximately mid- to late morning. Water quality data on this event reflect wet weather/runoff conditions. Air temperature ranged from 67 to 70ºF under overcast skies with periods of rain and drizzle.

Table 2 MassDEP SMART 2005 – 2010. Station BS09C. Summary of Observations.

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
2/1/2005	Cobble/gravel/sand; highly embedded	--	Very dense: filamentous	Slight yellow	None	None	None	Slight	Dry
3/23/2005	Cobble/gravel/sand/silt	Very dense	Very dense: filamentous	Grey	None	None	None	Slight	Wet
5/25/2005	Unobservable	Unobservable	Unobservable	Grey/brown	Petroleum	Sparse	None	Moderate	Wet
7/27/2005	Boulder/cobble/gravel/sand; highly embedded	Trash	Dense: film	Grey	Musty, petroleum	Very sparse	None	Slight	Dry
9/28/2005	Cobble/gravel/sand; highly embedded	Very dense: metals, floatables	Film	Grey	Slight petroleum	Very sparse	None	Moderate	Wet
11/16/2005	Cobble/gravel/sand/mud	Trash	Very dense: film	Grey	None	None	None	Slight	Wet
2/22/2006	Boulder/cobble/gravel/sand/silt	--	Very dense: filamentous	Clear	None	None	None	Clear	Wet
4/25/2006	Cobble/gravel/sand/silt; highly embedded	Minor	Very dense: filamentous	Grey	Effluent, petroleum	Sparse	None	Slight	Wet
6/21/2006	Cobble/gravel/sand; highly scoured	Floatables	Very dense: filamentous	Red/brown	Strong petroleum	Very sparse	None	Moderate	Wet
8/30/2006	Cobble/gravel/sand/silt; embedded	Trash	Very dense: filamentous	Grey	Strong effluent	Very sparse	None	Very slight	Wet
10/18/2006	Cobble/gravel/sand/silt; highly embedded	Floatables	Very dense: filamentous	Light grey	Strong petroleum	Moderate	None	Moderate	Wet
1/24/2007	Cobble/gravel/sand/silt	Trash	Dense: filamentous	Very light yellow	None	None	None	Clear	Dry
3/21/2007	Unobservable	Floatables, rubber mat, miscellaneous	Unobservable	Brown	Sewage	None	None	Highly murky	Dry
5/23/2007	Cobble/gravel/sand	Very dense: floatables, miscellaneous	Very dense: filamentous	Red/brown	Sewage, oil, musty	None	None	Moderate	Dry
7/25/2007	Cobble/gravel/sand/silt; highly embedded	Floatables, metals, broken glass	Very dense: filamentous	Grey	Strong musty, sewage	Sparse	None	Slight	Dry
9/19/2007	Cobble/gravel/sand	Floatables	Very dense: filamentous	Clear	Petroleum, musty	Very sparse	None	Clear	Dry
11/14/2007	Cobble/gravel/sand/silt	Floatables, bricks,chunks of paving/curbing	Dense: film	Clear	None	Very sparse	None	Slight	Wet
3/5/2008	Unobservable	Unobservable	Unobservable	Grey/café latte	Strong sewage	None	None	Highly murky	Wet
4/29/2008	Unobservable	Unobservable; trash where visible	Unobservable	Brown	Sewage, musty	Sparse	None	Moderate	Wet
5/27/2008	Cobble/gravel/sand	Floatables, bucket, silt fence	Very dense: grey filamentous	Strong yellow	Very strong petroleum,musty	Very sparse	None	Clear	Dry
6/24/2008	Unobservable	Unobservable	Unobservable	Brown	Sewage	Moderate	None	Highly murky	Wet
8/5/2008	Cobble/gravel/sand/silt	Floatables, silt fence, rope	Very dense: grey filamentous	Light yellow	Heavy petroleum, musty	None	None	Slight	Dry
8/26/2008	Cobble/silt	Unobservable	Sparse moss	Clear	None	None	None	Slight	Dry
10/15/2008	Cobble/gravel/sand	Moderate: floatables, metals, broken glass	Very dense: brown filamentous	Light yellow	None	Sparse	None	Clear	Dry
2/4/2009	Cobble/gravel/sand; highly embedded	Minor	Very dense: grey/brown film	Light yellow	None	None	None	Slight	Dry
3/25/2009	Cobble/gravel/sand	None	Very dense: grey filamentous	Light yellow	None	None	None	Slight	Dry
5/27/2009	Unobservable	Unobservable; broken glass, metals, soccer ball, floatables where visible	Unobservable; grey filamentous where visible	Grey	Musty	None	None	Highly murky	Dry
7/29/2009	Unobservable	Moderate: silt fence, floatables, bricks, broken glass, miscellaneous	None	Yellow/red	Petroleum, musty	Sparse	None	Moderate	Dry
9/30/2009	Cobble/gravel/sand	Minor	Dense: brown filamentous	Light yellow	Strong effluent	Sparse	None	Slight	Wet
11/18/2009	Unobservable; covered in leaves	Unobservable; floatables where visible	Dense: green film	Light yellow	Slight chemical	Sparse	None	Slight	Wet
2/25/2010	Unobservable	Unobservable	Unobservable	Café latte	None	None	None	Highly murky	Wet
9/1/2010	Cobble/gravel/sand	Moderate: bricks, metals, clothes, floatables	Sparse: moss; dense: filmy algae	Light yellow	Musty, urine	None	None	Slight	Dry
10/27/2010	Cobble/gravel/sant	Minor: floatables	Filmy scum on rocks; green in shallows, otherwise bottom coated with oil	Light yellow	Strong petroleum	None	None	Moderate	Wet

-- : Data not available

Table 3 MassDEP SMART 2005 – 2010. Station BS14A. Summary of Observations.

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
2/1/2005	Boulder/cobble/gravel/sand/silt; highly embedded	Trash	Dense: "lush" bright green filamentous	Grey	Effluent	None	None	Slight	Dry
3/23/2005	Boulder/cobble/gravel/sand/silt	Trash	Dense: green filamentous	Grey	Strong effluent	None	None	Moderate	Wet
5/25/2005	Unobservable	Broken glass, metal, floatables	Moderate: rust, green film	Brown/grey	Strong effluent	Sparse	None	Highly murky	Wet
7/27/2005	Boulder/cobble/gravel/sand; highly embedded	Trash	Very dense: filamentous	Grey	Strong effluent	Very sparse	None	Slight	Dry
9/28/2005	Silt	Trash	None	White/grey	Strong effluent	Sparse	None	Highly murky	Wet
11/16/2005	Boulder/cobble/gravel/sand/silt	Trash	Moderate: filamentous; very dense: film	Grey	Strong effluent	Very sparse	None	Moderate	Wet
2/22/2006	Boulder/cobble/gravel/sand/silt	Floatables, cement	Dense: bright green filamentous	None	Strong effluent	None	None	Slight	Wet
4/25/2006	Boulder/cobble/gravel/sand/silt	Trash	Dense: dark green filamentous	Grey	Strong effluent	Very sparse	Sheen	Moderate	Wet
6/21/2006	Boulder/cobble/gravel/sand/silt	None	Dense: filamentous; moderate: film on plants	Grey	Effluent	Sparse	None	Highly murky	Wet
8/30/2006	Unobservable	Trash	Very dense: filamentous	Light yellow	Strong effluent	Moderate	None	Highly murky	Wet
10/18/2006	Unobservable	Unobservable	Unobservable	Grey/brown	Strong effluent, musty	Moderate	None	Moderate	Wet
1/24/2007	Boulder/cobble/gravel/sand/silt	Trash	Very dense: filamentous	Green/yellow	None	None	None	Moderate	Dry
3/21/2007	Unobservable	Trash	Unobservable	Green; algae bloom in progess	None	None	None	Highly murky	Dry
5/23/2007	Unobservable	Unobservable	Unobservable	Light yellow	None	Moderate	None	Moderate	Dry
7/25/2007	Unobservable	Unobservable	Unobservable; thick "furry" algal growth where visible	Light yellow	None	Moderate	None	Moderate	Dry
9/19/2007	Unobservable	Trash	Very dense: filamentous	Yellow	Strong effluent	Moderate	None	Highly murky	Dry
11/14/2007	Unobservable	Unobservable: metals near shore	Unobservable	None	None	Sparse	None	Highly murky	Wet
3/5/2008	Unobservable	Unobservable	Unobservable	Grey/café latte	None	Sparse	None	Highly murky	Wet
4/29/2008	Unobservable	Unobservable	Unobservable	Red/yellow	Effluent	None	None	Highly murky	Wet
5/27/2008	Unobservable	Unobservable	Unobservable; very dense: grey filamentous where visible (in shallows)	Yellow	Effluent	Moderate	None	Highly murky	Dry
6/24/2008	Unobservable	Unobservable	Unobservable	Brown	Effluent	None	None	Highly murky	Wet
8/5/2008	Unobservable	Unobservable	Unobservable	Yellow	Effluent	Moderate	None	Highly murky	Dry
8/26/2008	Boulder/cobble/gravel/sand	Unobservable	Sparse: filamentous	Clear	Effluent	None	None	Slight	Dry
10/15/2008	Unobservable	Unobservable; metals, floatables where visible	Unobservable	Clear	Slight effluent	None	None	Clear	Dry
2/4/2009	Boulder/cobble/gravel/sand/silt/mud	Moderate: metals, blocks	Very dense: silty brown film	Light yellow	None	Sparse	None	Moderate	Dry
3/25/2009	Unobservable	Unobservable	Unobservable; very dense grey filamentous and sparse dark green filamentous where visible	Pea soup green; algae bloom in progress	Musty	None	None	Highly murky	Dry
5/27/2009	Unobservable	Unobservable; trash along edge	Unobservable	Grey	Effluent	Moderate	None	Highly murky	Dry
7/29/2009	Unobservable	Unobservable	Unobservable	Red	Musty, effluent	None	None	Highly murky	Dry
9/30/2009	Unobservable	Unobservable	Unobservable	Grey	None	Moderate	None	Highly murky	Wet
11/18/2009	Unobservable	Unobservable	Unobservable	Brown	Effluent	Sparse	None	Moderate	Wet
2/25/2010	Unobservable	Unobservable	Unobservable	Café latte	None	None	None	Highly murky	Wet
9/1/2010	Unobservable	Unobservable	Unobservable	Green/dark tan	Strong musty	Moderate	None	Highly murky	Dry
10/27/2010	Boulder/cobble/gravel/sand/silt	Moderate: metals, floatables	None	Light yellow	Strong musty	None	None	Slight	Wet

-- : Data not available

Table 4 MassDEP SMART 2005 – 2010. Station BS18A. Summary of Observations.

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
2/1/2005	Station not sampled on this date; not accessible due to snow/ice								
3/23/2005	Unobservable	Unobservable	Filamentous, suspended	Light yellow/tan	Effluent	Very sparse	None	Slight	Wet
5/25/2005	Unobservable	Unobservable	Unobservable	Brown	None	Sparse	None	Moderate	Wet
7/27/2005	Unobservable	Unobservable	Unobservable	Light yellow/green; algae bloom in progess	Organic	None	None	Highly murky (algal)	Dry
9/28/2005	Unobservable	Unobservable	Unobservable	Green	Musty	Sparse	None	Highly murky	Wet
11/16/2005	Sand/mud	None	None	Not noted	--	None	Oily; manganous?	Slight	Wet
2/22/2006	Boulder/sand/mud	Bricks, floatables	None	Clear	None	Sparse	None	Slight	Wet
4/25/2006	Unobservable	Unobservable	Unobservable	Light yellow	None	Sparse	None	Unobservable	Wet
6/21/2006	Unobservable	Unobservable	Unobservable	Brown	None	Sparse	Pollen	Highly murky	Wet
8/30/2006	Cobble/gravel/sand/silt	None	None	Light yellow	None	None	Pollen, manganese sheen	Slight	Wet
10/18/2006	Gravel/sand/silt	None	None	Light yellow	None	None	None	Slight	Wet
1/24/2007	Gravel/sand/silt	None	Sparse: filamentous; orange floc	Clear	None	None	None	Clear	Dry
3/21/2007	Gravel/sand/silt	None	None	Light yellow	None	Very sparse	None	Moderate	Dry
5/23/2007	Gravel/sand/silt	None	None	Clear	None	None	None	Clear	Dry
7/25/2007	Gravel/sand/silt	None	None	Light yellow	Musty	None	None	Moderate	Dry
9/19/2007	Gravel/sand/silt	None	None	Light yellow	Strong fishy	Very sparse	None	Moderate	Dry
11/14/2007	Unobservable	Unobservable	None	Clear	None	None	None	Moderate	Wet
3/5/2008	Unobservable	Unobservable	Unobservable	Grey/café latte	None	None	None	Highly murky	Wet
4/29/2008	Unobservable	Unobservable	Unobservable	Red	Effluent	None	None	Highly murky	Wet
5/27/2008	Unobservable	Unobservable	Unobservable	Clear	None	None	Pollen	Moderate	Dry
6/24/2008	Unobservable	Unobservable	Unobservable	Brown	Effluent	None	None	Highly murky	Wet
8/5/2008	Unobservable	Unobservable	Unobservable	Light yellow	Effluent	Moderate	None	Highly murky	Dry
8/26/2008	Boulder/cobble/gravel/silt	Unobservable	Unobservable	Clear	None	None	None	Highly murky	Dry
10/15/2008	Unobservable	Unobservable	Unobservable	Clear	Slight effluent	Sparse	Pollen	Slight	Dry
2/4/2009	Station not sampled on this date; not accessible due to snow/ice								
3/25/2009	Unobservable	Unobservable	Unobservable	Brown/green; possible algae bloom in progress	Musty	Sparse	Pollen	Highly murky	Dry
5/27/2009	Unobservable	Unobservable	Unobservable	Brown	None	Moderate	None	Highly murky	Dry
7/29/2009	Unobservable	Unobservable	Unobservable	Brown	Eutrophic pond	None	None	Highly murky	Dry
9/30/2009	Unobservable	Unobservable	Unobservable	Light yellow	Eutrophic pond	Moderate	None	Highly murky	Wet
11/18/2009	Unobservable	Unobservable	Unobservable	Light yellow	None	None	None	Unobservable	Wet
2/25/2010	Unobservable	Unobservable	Unobservable	Red, slight	None	None	None	Slight	Wet
9/1/2010	Unobservable	Unobservable	Unobservable	Green/dark tan	Slight musty	Moderate	Pollen/dust	Highly murky	Dry
10/27/2010	Unobservable	Unobservable	Unobservable	Light yellow	Slight musty	None	None	Unobservable	Wet
-- : Data not available									

Table 5 MassDEP SMART 2005 – 2010. Station QU02A. Summary of Observations.

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
2/1/2005	Cobble/gravel/sand/silt	Trash	None	Clear	None	Very sparse	None	Clear	Dry
3/23/2005	Cobble/gravel/sand/silt/mud	Trash	None	Clear	None	None	None	Clear	Wet
5/25/2005	Boulder/cobble/gravel/sand/silt	Metals, broken glass	None	Light yellow	Fishy	Very sparse	None	Slight	Wet
7/27/2005	Cobble/gravel/sand; highly embedded	Metals, broken glass, floatables	None	Light yellow	None	None	None	Clear	Dry
9/28/2005	Cobble/gravel/sand/silt/mud	Metals, broken glass, floatables, tires	None	Clear	None	None	None	Clear	Wet
11/16/2005	Cobble/gravel/sand/silt/mud	Trash	None	Clear	None	None	None	Clear	Wet
2/22/2006	Cobble/gravel/sand/silt	Metals, broken glass	None	Clear	None	None	None	Clear	Wet
4/25/2006	Sand/silt/mud	Very dense: metals	Sparse: green filamentous	Clear	Fishy	Sparse	None	Clear	Wet
6/21/2006	Cobble/gravel/sand/silt/mud	Metals, broken glass, floatables	None	Clear	Fishy	None	None	Clear	Wet
8/30/2006	Gravel/sand/silt/mud	Trash	Sparse: green loose floc	Clear	None	None	Pollen	Clear	Wet
10/18/2006	Cobble/gravel/sand/silt	Metals, broken glass	None	Clear	None	None	None	Clear	Wet
1/24/2007	Gravel/sand/silt/mud	Metals, broken glass	None	Very light yellow	None	None	None	Clear	Dry
3/21/2007	Cobble/gravel/sand/silt	Metals, miscellaneous	None	Clear	None	None	None	Slight	Dry
5/23/2007	Boulder/cobble/gravel/sand/silt	Metals, broken glass	None	Light yellow	None	Sparse/ moderate	None	Slight	Dry
7/25/2007	Cobble/gravel/sand/silt	Metals, broken glass, tires	Sparse: green filamentous	Clear	Musty	None	None	Clear	Dry
9/19/2007	Cobble/gravel/sand/silt	Metals, broken glass, floatables, algal mat	Moderate: green filamentous	Clear	None	Very sparse	None	Clear	Dry
11/14/2007	Unobservable; covered with leaves	Metals, broken glass, tire	None	Clear	None	None	None	Clear	Wet
3/5/2008	Unobservable	Unobservable	Unobservable	Grey/brown	None	Very sparse	None	Murky	Wet
4/29/2008	Unobservable	Metals, broken glass, floatables	None	Clear	Algae/fishy	Very sparse	None	Unobservable	Wet
5/27/2008	Cobble/gravel/sand/silt	Minor: shopping cart	Sparse: green filamentous	Clear	Musty	Very sparse	None	Clear	Dry
6/24/2008	Cobble/gravel/sand/silt	None	--	Light yellow	Musty	Very sparse	None	Slight	Wet
8/5/2008	Cobble/gravel/sand/silt	Metals, broken glass	Dense: blue-green filamentous	Clear	None	Very sparse	None	Clear	Dry
8/26/2008	Cobble/gravel/sand/silt	None	Sparse: green filamentous	Clear	None	None	None	Clear	Dry
10/15/2008	Cobble/gravel/sand/silt	Floatables, metals, broken glass	Very dense: green filamentous; sparse: moss	Clear	None	Very sparse	None	Clear	Dry
2/4/2009	Station not sampled on this date; not accessible due to snow/ice								
3/25/2009	--	Floatables	None	Clear	None	None	None	Clear	Dry
5/27/2009	Cobble/gravel/sand/silt	Metals, broken glass, floatables	None	Clear	None	None	None	Clear	Dry
7/29/2009	Gravel/sand/silt/mud	Metals, broken glass, floatables	Sparse: moss	Red	Musty	Very sparse	None	Slight	Dry
9/30/2009	Unobservable; covered in algae	Unobservable	Very dense: dark green algal mats	Clear	None	None	None	Clear	Wet
11/18/2009	Unobservable	Unobservable	Unobservable	Red	None	Sparse	None	Unobservable	Wet
2/25/2010	Unobservable	Unobservable	Unobservable	Café latte	None	None	None	Highly murky	Wet
9/1/2010	Cobble/gravel/sand/silt	Miscellaneous metals	None	Clear	Slight musty	Sparse	None	Clear	Dry
10/27/2010	Unobservable	Unobservable	None	Light yellow	None	None	None	Slight	Wet
-- : Data not available									

Table 6 MassDEP SMART 2005 – 2010. Station WR03. Summary of Observations.

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
2/1/2005	Station not sampled on this date; not accessible due to snow/ice								
3/23/2005	Boulder/sand/silt/mud	None	None	Light yellow/tan	None	None	None	Clear	Wet
5/25/2005	--	None	None	Clear	None	None	None	Clear	Wet
7/27/2005	Boulder/cobble/gravel/sand/silt/mud	None	None	Light yellow	None	None	None	Clear	Dry
9/28/2005	Sand/silt/mud	None	--	Clear	None	None	None	Clear	Wet
11/16/2005	Gravel/sand/mud	None	None	Clear	"Pond"/vegetation	None	None	Clear	Wet
2/22/2006	Boulder/cobble/gravel/sand/silt	None	None	Clear	None	None	None	Clear	Wet
4/25/2006	Sand/silt	None	None	Clear	None	None	None	Clear	Wet
6/21/2006	Sand/mud	None	Moderate: brown film	Red	None	None	None	Slight	Wet
8/30/2006	Gravel/sand/silt	None	None	Light yellow	None	None	None	Clear	Wet
10/18/2006	--	None	None	Clear	None	None	None	Clear	Wet
1/24/2007	Sand/mud	None	None	Very light yellow	None	None	None	Clear	Dry
3/21/2007	Sand	None	None	Clear	None	None	None	Clear	Dry
5/23/2007	Sand/silt/mud	None	None	Red	None	None	None	Clear	Dry
7/25/2007	Boulder/sand/silt	None	None	Light yellow	None	None	None	Clear	Dry
9/19/2007	Bedrock/sand/silt/mud	None	--	--	None	None	None	Moderate	Dry
11/14/2007	Unobservable; covered in algae, plants	None	Very dense: green filamentous	Clear	None	None	None	Clear	Wet
3/5/2008	Sand/aquatic vegetation	None	None	Clear	None	None	None	Clear	Wet
4/29/2008	Sand/mud	None	None	Red/yellow	None	None	None	Slight	Wet
5/27/2008	Boulder/cobble/sand/silt/aquatic vegetation	None	Moderate: green filamentous	Clear	None	None	None	Clear	Dry
6/24/2008	Boulder/cobble/sand/silt/mud	None	None	Red	None	None	None	Clear	Wet
8/5/2008	Unobservable	Unobservable	Unobservable	Light yellow	None	None	None	Clear	Dry
8/26/2008	Aquatic vegetation	Unobservable	Moderate: filamentous	Red	None	None	None	Clear	Dry
10/15/2008	Boulder/sand/mud/silt	None	Brown film patches on plants	Clear	None	None	None	Clear	Dry
2/4/2009	Station not sampled on this date; not accessible due to snow/ice								
3/25/2009	Sand/aquatic vegetation	None	None	Clear	None	None	None	Clear	Dry
5/27/2009	Sand/aquatic vegetation	None	None	Clear	None	None	None	Clear	Dry
7/29/2009	Sand	None	None	Deep red	None	None	None	Slight	Dry
9/30/2009	Unobservable	Unobservable	Unobservable	Red	None	None	None		Wet
11/18/2009	Unobservable	Unobservable	Unobservable	Red	None	None	None	Clear	Wet
2/25/2010	Unobservable	Unobservable	Unobservable	Red, slight	None	None	None	Unobservable	Wet
9/1/2010	Unobservable	Unobservable	Unobservable	Deep red	Eutrophic pond			Slight	Dry
10/27/2010	Unobservable	Unobservable	Unobservable	Red, slight	None	None	None	Unobservable	Wet
-- : Data not available									

Table 7 Blackstone Basin Precipitation Data Summary 2005-2010* (inches of precipitation) **

Survey Dates	5 Days Prior	4 Days Prior	3 Days Prior	2 Days Prior	1 Day Prior	Sample Date	Wet/Dry Conditions***
2/1/2005	0.01	0	0	0	0	0	Dry
3/23/2005	0	0	T	T	0	0.08	Wet
5/25/2005	0	T	0.13	0.24	0.52	0.75	Wet
7/27/2005	0.03	0	0	0	0	0.30	Dry
9/28/2005	0	0	0	0.30	T	0	Wet
11/16/2005	0	0	0	T	0.11	0.72	Wet
2/22/2006	0.12	T	0	0	0	0	Wet
4/25/2006	0	0	0.03	0.55	0.06	0.05	Wet
6/21/2006	T	0.06	0	T	0.11	0	Wet
8/30/2006	0.67	T	0.95	0.02	0.23	T	Wet
10/18/2006	0.01	0	0	0	0.34	0.19	Wet
1/24/2007	0.02	T	0	0.09	T	T	Dry
3/21/2007	0.61	0.63	T	0.04	0.02	0	Dry
5/23/2007	0.64	0.38	0.35	T	0	0	Dry
7/25/2007	0.09	0	0	0.22	0	0	Dry
9/19/2007	T	0.29	0	0	0	0	Dry
11/14/2007	0	0	0	0.06	0.20	0	Wet
3/5/2008	0	0.57	0	0	0.48	0.71	Wet
4/29/2008	0	0	0	0.02	1.65	0.49	Wet
5/27/2008	T	0.01	0	0	0	0.43	Dry
6/24/2008	0	0.14	0	0.01	2.80	0.20	Wet
8/5/2008	0.56	0	0.73	0.20	0.07	0.08	Dry
8/26/2008	0	0	0	0	0	T	Dry
10/15/2008	0	0	0	0	0	0	Dry
2/4/2009	T	T	0	0	0.16	T	Dry
3/25/2009	0	0	T	0	0	0	Dry
5/27/2009	0	T	0.04	0	0	0.23	Dry
7/29/2009	2.12	0	0.05	0.02	0	0.08	Dry
9/30/2009	0	0	0.65	0.41	T	0	Wet
11/18/2009	T	1.58	0.06	0	0	0	Wet
2/25/2010	0	0	0	0.30	1.48	1.95	Wet
9/1/2010	0	0	0	0	0	0	Dry
10/27/2010	0	T	T	0.04	0.02	0.30	Wet

*NOAA National Weather Service station in Worcester, MA reported at (NOAA Climatological Data Publications NOAA 2015).
**T= trace amount
***Based on precipitation, streamflow and other relevant data.

Table 8 Discharge at the Blackstone River at Woonsocket, RI
USGS Flow Data Summary Discharge (cfs) 2005-2010*

Survey Dates	5 Days Prior	4 Days Prior	3 Days Prior	2 Days Prior	1 Day Prior	Sample Date	Monthly Mean**	POR Mean***
2/1/2005	1,190	1,170	1,130	1,040	1,010	980	1,369	896
3/23/2005	977	1,010	1,030	1,080	1,110	1,170	1,380	1,860
5/25/2005	687	659	630	608	696	1,180	1,235	783
7/27/2005	192	177	165	153	146	140	390.0	338
9/28/2005	151	135	121	131	162	144	155.1	381
11/16/2005	1,470	1,260	1,120	1,070	950	1,010	1,472	679
2/22/2006	1,660	1,810	1,490	1,330	1,150	1,100	1,749	1,040
4/25/2006	302	286	262	291	637	657	460.8	1,250
6/21/2006	1,770	1,470	1,270	1,090	1,010	989	2,458	536
8/30/2006	252	280	272	455	477	424	241.8	304
10/18/2006	828	557	426	378	354	387	491.2	527
1/24/2007	964	972	885	793	767	747	987.7	988
3/21/2007	1,560	1,740	1,800	1,460	1,310	1,320	1,637	1,660
5/23/2007	2,120	2,780	2,730	2,300	1,800	1,440	1,199	778
7/25/2007	162	158	138	159	144	134	186.1	486
9/19/2007	139	167	157	144	123	107	102.7	392
11/14/2007	198	181	166	161	182	191	208.9	706
3/5/2008	1,660	1,470	1,490[e]	1,290	1,460	2,890	2,224	2,270
4/29/2008	577	577	614	460	615	1,980	1,089	1,180
5/27/2008	577	533	485	445	410	369	760.4	829
6/24/2008	278	227	205	200	185	755	299.0	499
8/5/2008	460	452	400	470	406	328	524.7	250
8/26/2008	390	324	307	271	244	210	524.7	286
10/15/2008	571	536	513	490	477	440	678.0	519
2/4/2009	1,080	952	840	793	794	776	1,048	1,120
3/25/2009	957	891	830	792	749	723	1,214	1,650
5/27/2009	376	348	328	347	330	343	575.2	829
7/29/2009	2,560	4,310	2,760	2,000	1,590	1,210	1,425	304
9/30/2009	153	143	169	249	331	317	240.4	394
11/18/2009	423	950	2,230	1,740	1,280	1,040	882.0	672
2/25/2010	598	604	598	599	1,500	3,740	1,309	1,150
9/1/2010	218	190	168	150	138	125	128.4	287
10/27/2010	364	361	391	413	402	415	448.3	511

***Blackstone River at Woonsocket (01112500) daily discharge data found at Daily Discharge Data at Blackstone River, Woonsocket RI**
****Monthly mean statistics available through May 2008 only; data found at Monthly Statistics at Blackstone River at Woonsocket, RI**
*****POR-Period of Record daily mean value based on 85-86 years of record (10/1/1928-9/30/2014) found at Daily mean discharge Woonsocket RI**
7Q10 = 101 cfs @ USGS gaging station, Blackstone River at Woonsocket, RI

RESULTS AND QUALITY ASSURANCE/QUALITY CONTROL

The results of SMART monitoring conducted in the Blackstone watershed from 2005 through 2010 are included below. Table 9 through Table 13 present *in-situ* multiprobe readings and Table 14 through Table 18 contain nutrient (ammonia-nitrogen, nitrate-nitrite-nitrogen, total phosphorus and either total Kjeldahl nitrogen or total nitrogen) and total suspended solids data. Most results are expressed as milligrams per liter (mg/L). Exceptions include: depth in meters (m); temperature in degrees Celsius (ºC); pH in standard units (SU); conductivity in microsiemens per centimeter (µS/cm); dissolved oxygen saturation in percent (%); and turbidity, in Nephelometric Turbidity Units (NTU).

Field sheets, chain of custody forms, raw data files, lab reports and other metadata are maintained by the CERO SMART Monitoring Manager in Worcester, MA and data are stored electronically in DWM's water quality database. Detailed information regarding the data validation process is explained in the separate document, *CN 56.2. Standard Operating Procedure. Data Validation and Usability* (MassDEP 2005). Specific validation criteria used for 2005-2010 data include, but are not limited to: conformance to DWM's Quality Assurance Project Plan and standard operating procedures, precision, accuracy, representativeness, holding times, sample preservation, frequency of field QC samples, contamination of field blanks, stability of multiprobe readings and documentation. The following data qualifiers were applied as needed:

Multiprobe data qualifiers:

** = Missing data.
-- = No data.
= Censored data (data that have been discarded for some reason).
c = Greater than calibration standard used for pre-calibration, or outside the acceptable range about the calibration standard.
i = Inaccurate readings from multiprobe likely.
m = Method not followed; one or more protocols contained in the DWM Multi-probe SOP not followed.
r = Data not representative of actual field conditions.
s = Field sheet recorded data were used to accept data, not data electronically recorded in the Multi-probe surveyor unit, due to operator error or equipment failure.
u = Unstable readings.

Laboratory sample data qualifiers:

** = Missing data.
-- = No data.
= Censored data (data that have been discarded for some reason).
[ ] = A result reported inside brackets has been censored, but is shown for informational purposes.
b = Blank contamination in lab reagent blanks and/or field blank samples.
d = Precision of field duplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP.
h = Holding time violation (usually indicating possible bias low).
j = 'Estimated' value; used for lab-related issues where certain lab QC criteria are not met and re-testing is not possible (as identified by the WES lab only). Also used to report sample data where the sample concentration is less than the reporting detection limit (RDL) and greater than the method detection limit (MDL) (RDL > x > MDL). Also used to note where values have been reported at levels less than the MDL.
m = Method SOP not followed, only partially implemented or not implemented at all, due to complications with sample matrix (e.g. sediment in sample, floc formation), lab error (e.g. cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, lost/unanalyzed samples, and missing data.

Table 9 MassDEP SMART 2005-2010. Station BS09C. *In Situ* Multiprobe Data.

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(us/cm)	(mg/l)	(mg/l)	(%)
2/1/2005	SM-6133	9:21	0.4	0.7	7.1	568	369	15.4	108
3/23/2005	SM-6176	9:09	0.5	4.6	7.4	640	416	14.6	113
5/25/2005	SM-1326	8:17	0.3	10.6	6.9	370	241	11.0	99
7/27/2005	SM-1406	8:31	0.1	23.1	7.3	795 i	517 i	7.3	86
9/28/2005	SM-1488	8:45	0.3	16.2	7.3	601	390	9.6	98
11/16/2005	SM-1558	8:49	0.2	8.4	6.9	357	232	11.8	101
2/22/2006	SM-1628	8:37	0.3	2.5	6.8	425	276	14.3	105
4/25/2006	SM-1698	8:46	0.3	10.0	7.2	516	336	11.2	99
6/21/2006	SM-1768	8:36	0.2	22.0	7.2	449	292	7.9	91
8/30/2006	SM-1838	8:38	0.3	18.1	7.3	404	263	9.0	96
10/18/2006	SM-1908	8:30	0.2	12.5	7.2	444	289	10.0	94
1/24/2007	SM-1978	8:42	0.2 i	1.7 u	7.1 u	490 u	319 u	13.8 u	99 u
3/21/2007	SM-2048	8:43	0.5	2.1	6.8	595	387	## i	## i
5/23/2007	SM-2118	8:29	0.3	15.6	7.0	318	207	10.1	102
7/25/2007	SM-2188	8:27	0.2	20.4	7.3	676	439	8.1	90
9/19/2007	SM-2258	8:17	0.1	14.2	7.4	604	393	9.6	94
11/14/2007	SM-2328	9:18	0.2	5.9	7.1	384	249	12.9 i	103 i
3/5/2008	SM-2398	8:51	0.9	2.7	6.6	635	412	14.2	105
4/29/2008	SM-2468	8:58	0.7	12.3	7.0	363	236	10.6	100
5/27/2008	SM-2514	8:22	0.3	17.4	7.2	632	411	9.0	94
6/24/2008	SM-2574	8:20	0.5	20.0	7.0	329	214	8.6	94
8/5/2008	SM-2620	8:23	0.3	22.1	7.2	413	268	8.2	95
8/26/2008	SM-2680	8:52	0.3	19.0	7.4	577	375	8.8	95
10/15/2008	SM-2726	8:24	0.1	14.2	7.2	421	274	9.9	97
2/4/2009	SM-2820	8:36	0.1	0.2	7.0	1294 c	841 c	14.6	101
3/25/2009	SM-2892	8:21	0.3	4.5	7.1	563	366	12.2	94
5/27/2009	SM-2964	8:26	0.2	15.5	7.1	620	403	8.9	90
7/29/2009	SM-3036	8:49	0.4	23.2	7.1	386	251	8.2	96
9/30/2009	SM-3108	8:05	0.2	15.4	7.2	484	315	9.6	96
11/18/2009	SM-3180	8:17	0.3	7.8	7.2	335	218	13.6	114
2/25/2010	SM-3252	8:23	0.2	2.1	6.9	1017 c	661 c	13.7	100
9/1/2010	SM-3324	8:08	0.2	22.5	7.3	594	386	7.3	85
10/27/2010	SM-3396	8:01	0.3	14.7	7.0	401	261	9.5	94

Table 10 MassDEP SMART 2005-2010. Station BS14A. *In Situ* Multiprobe Data.

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(us/cm)	(mg/l)	(mg/l)	(%)
2/1/2005	SM-6137	10:53	0.5	1.3	7.3	614	399	15.1	107
3/23/2005	SM-6179	12:09	0.5	5.8	7.7	667	434	15.2	122
5/25/2005	SM-1332	10:24	0.5	11.1	7.0	515	335	9.8	89
7/27/2005	SM-1412	11:00	0.5	25.4	7.4	683 i	444 i	8.3	101
9/28/2005	SM-1494	11:26	0.4	17.6	7.4	580	377	9.9	104
11/16/2005	SM-1564	10:56	0.5	10.0	7.1	437	284	11.3	100
2/22/2006	SM-1634	11:09	0.6	3.6	7.3	524	341	14.3	108
4/25/2006	SM-1704	11:25	0.5	11.6	7.2	543	353	11.0	102
6/21/2006	SM-1774	11:06	0.2	22.2	7.2	486	316	8.1	93
8/30/2006	SM-1844	11:13	1.2	19.4	7.2	488	317	8.6	93
10/18/2006	SM-1914	10:48	1.3	13.7	7.2	516	335	9.8	94
1/24/2007	SM-1984	10:56	1.2 i	2.8	7.2	530	345	13.7	102
3/21/2007	SM-2054	11:07	1.1	3.3	7.0	891 c	579 c	## i	## i
5/23/2007	SM-2124	10:43	1.0	15.7	7.0	395	257	9.8	99
7/25/2007	SM-2194	11:20	1.3	22.5	7.5	638	415	0.8 u	9 u
9/19/2007	SM-2264	10:32	1.2	15.4	7.3	625	406	9.2	92
11/14/2007	SM-2334	11:15	1.3	8.5	7.2	444	288	11.8 u, i	101 u, i
3/5/2008	SM-2402	9:59	1.5	3.2	6.9	523	340	14.2	106
4/29/2008	SM-2472	10:09	1.2	11.8	7.0	377	245	10.3	95
5/27/2008	SM-2518	9:45	1.0	18.2	7.0	623	405	6.7	72
6/24/2008	SM-2578	9:45	1.1	20.4	7.0	394	256	8.1	90
8/5/2008	SM-2624	9:46	0.7	22.2	7.2	524	340	7.7	88
8/26/2008	SM-2684	10:20	0.3	19.9	7.3	612	398	8.4	93
10/15/2008	SM-2730	9:39	0.6	15.2	7.2	466	303	9.3	93
2/4/2009	SM-2824	9:27	0.4	1.4	7.4	769 c	500 c	14.1	100
3/25/2009	SM-2896	9:35	0.6	5.5	7.4	633	411	12.1	96
5/27/2009	SM-2968	9:38	0.5	15.9	7.0	621	404	7.5	76
7/29/2009	SM-3040	10:04	1.3	23.1	7.2	456	296	8.1	95
9/30/2009	SM-3112	9:08	1.0	16.3	7.4	474	308	9.4	96
11/18/2009	SM-3184	9:37	1.3	8.3	7.3	412	268	13.2	112
2/25/2010	SM-3256	10:05	0.9	2.7	7.1	778 c	506 c	13.8	102
9/1/2010	SM-3328	9:48	1.0	23.7	7.6	718	466	7.0	83
10/27/2010	SM-3400	9:20	0.7	16.0	7.3	482	313	8.9	90

Table 11 MassDEP SMART 2005-2010. Station BS18A. *In Situ* Multiprobe Data.

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(us/cm)	(mg/l)	(mg/l)	(%)
2/1/2005	**	**	**	**	**	**	**	**	**
3/23/2005	SM-6177	10:07	0.9	5.0	7.1	471	306	13.6	107
5/25/2005	SM-1328	9:06	0.6	11.1	6.8	413	268	9.6	87
7/27/2005	SM-1408	9:35	2.1	24.8	7.2	563 i	366 i	6.6	80
9/28/2005	SM-1490	9:42	1.3	16.6	7.1	561	365	8.4	87
11/16/2005	SM-1560	9:42	0.9	8.9	6.9	340	221	11.2	97
2/22/2006	SM-1630	9:40	0.2	2.0	6.9	373	243	13.9	101
4/25/2006	SM-1700	9:53	0.4	10.3	6.9	419	273	9.9	89
6/21/2006	SM-1770	9:44	0.6	22.3	6.9	312	203	7.6	87
8/30/2006	SM-1840	9:37	2.2	18.2	7.1	309	201	8.3	88
10/18/2006	SM-1910	9:27	1.6	11.6	7.1	345	224	9.7	89
1/24/2007	SM-1980	9:32	0.6 i	1.0 u	7.0 u	374 u	243 u	13.3 u	94 u
3/21/2007	SM-2050	9:42	0.7	2.0	6.9	476	310	## i	## i
5/23/2007	SM-2120	9:17	0.5	15.2	6.9	305	198	9.3	93
7/25/2007	SM-2190	9:24	0.8	21.7	7.2	524	341	6.8	78
9/19/2007	SM-2260	9:12	1.5	14.5	7.3	510	332	8.9	88
11/14/2007	SM-2330	10:05	1.8	6.2	7.1	424	275	11.6 i	94 i
3/5/2008	SM-2407	11:25	1.6	3.9	6.9	492	320	13.6	103
4/29/2008	SM-2477	11:24	1.8	12.4	6.9	410	267	9.1	85
5/27/2008	SM-2523	11:08	1.0	18.2	6.9	474	308	7.6	81
6/24/2008	SM-2583	11:13	1.5	20.6	6.8	322	209	6.9	77
8/5/2008	SM-2629	11:15	1.2	22.3	7.1	439	285	7.6	87
8/26/2008	SM-2689	11:50	1.4	20.2	7.2	495	321	8.6	95
10/15/2008	SM-2735	10:57	1.9	14.7	7.0	384	250	9.0	89
2/4/2009	SM-2829	**	**	**	**	**	**	**	**
3/25/2009	SM-2901	11:15	2.8	4.9	7.0	446	290	13.6	106
5/27/2009	SM-2973	10:59	0.7	16.4	6.9	489	318	7.7	78
7/29/2009	SM-3045	11:20	1.9	23.9	6.9	324	211	7.4	88
9/30/2009	SM-3117	10:28	1.5	16.1	7.3	458	298	8.8	89
11/18/2009	SM-3189	10:57	1.4	7.9	7.1	298	194	12.8	108
2/25/2010	SM-3261	11:40	0.5	2.1	6.9	748 c	487 c	13.5	98
9/1/2010	SM-3333	11:06	1.4	23.4	7.4	532	346	7.4	88
10/27/2010	SM-3405	10:36	0.5	15.4	7.1	413	268	8.4	84

Table 12 MassDEP SMART 2005-2010. Station QU02A. *In Situ* Multiprobe Data.

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(us/cm)	(mg/l)	(mg/l)	(%)
2/1/2005	SM-6138	10:09	0.9	0.2	7.0	596	387	15.2	105
3/23/2005	SM-6180	12:45	0.8	6.1	7.3	603	392	13.2	107
5/25/2005	SM-1335	10:53	0.5	11.5	7.2	596	388	10.7	99
7/27/2005	SM-1415	11:34	0.7	26.5	7.1	574 i	373 i	7.0	87
9/28/2005	SM-1497	12:03	0.3	17.4	7.1	532	346	9.0	94
11/16/2005	SM-1567	11:31	0.4	8.7 s	7.0 s	476 s	310 s	11.6 s	100 s
2/22/2006	SM-1637	11:39	0.4	2.0	7.1	574	373	14.3	104
4/25/2006	SM-1707	11:57	0.4	11.6	7.3	485	315	10.8	100
6/21/2006	SM-1777	11:40	0.4	25.6	7.2	480	312	7.5	92
8/30/2006	SM-1847	11:47	0.3	## u, m	## u, m, i	## u, m, i	## u, m, i	## u, m, i	## u, m, i
10/18/2006	SM-1917	11:17	0.3	11.4 u	7.2 u	458 u	297 u	10.5 u	97 u
1/24/2007	SM-1987	11:26	0.3 i	0.5 u	7.2 u	511 u	332 u	14.1 u	98 u
3/21/2007	SM-2057	11:38	0.4	2.4	7.1	492	320	## i	## i
5/23/2007	SM-2127	11:18	0.5	17.6	7.1	454	295	9.6	101
7/25/2007	SM-2197	11:58	0.4	23.2	7.2	492	320	7.8	92
9/19/2007	SM-2267	11:03	0.2	14.6	7.3	491	319	8.4	83
11/14/2007	SM-2337	11:42	0.3	5.7	7.4	479	311	13.2 i	105 i
3/5/2008	SM-2400	9:23	0.1	2.9	6.8	565	368	14.0	104
4/29/2008	SM-2470	9:29	0.5	12.6	7.0	578	375	10.4	98
5/27/2008	SM-2516	9:00	0.3	20.1	7.2	615	400	8.4	92
6/24/2008	SM-2576	9:06	0.3	21.8	7.0	559	364	8.0	91
8/5/2008	SM-2622	9:10	0.4	24.6	7.1	532	346	7.7	92
8/26/2008	SM-2682	9:33	0.0 i	21.8	7.1	511	332	8.0	92
10/15/2008	SM-2728	9:03	0.4	15.5	7.2	475	309	9.4	94
2/4/2009	SM-2822	**	**	**	**	**	**	**	**
3/25/2009	SM-2894	8:57	0.4	4.4	7.2	586	381	12.5	96
5/27/2009	SM-2966	9:01	0.8	19.1	7.1	619	402	8.1	87
7/29/2009	SM-3038	9:24	0.8	25.9	7.0	474	308	7.5	92
9/30/2009	SM-3110	8:37	0.4	17.1	7.2	466	303	9.2	96
11/18/2009	SM-3182	8:53	0.6	7.6	7.2	478	310	13.3	111
2/25/2010	SM-3254	9:13	1.3	1.6	7.0	580	377	13.6	97
9/1/2010	SM-3326	9:18	0.3	23.6	7.2	522	339	7.0	82
10/27/2010	SM-3398	8:39	0.4	14.2	7.0	477	310	9.3	91

Table 13 MassDEP SMART 2005-2010. Station WR03. *In Situ* Multiprobe Data.

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(us/cm)	(mg/l)	(mg/l)	(%)
2/1/2005	**	**	**	**	**	**	**	**	**
3/23/2005	SM-6178	11:12	0.9	3.8	6.3	246	160	13.1	99
5/25/2005	SM-1330	9:50	0.6	9.6	6.4	231	150	9.8	86
7/27/2005	SM-1410	10:21	0.5	25.5	6.6	248 i	161 i	4.7	58
9/28/2005	SM-1492	10:39	0.3	15.6	6.8	292	190	7.8	78
11/16/2005	SM-1562	10:20	0.7	7.7	6.1	199	129	9.2	77
2/22/2006	SM-1632	10:35	0.7	0.9	6.4	203	132	13.2	93
4/25/2006	SM-1702	10:47	0.6	9.8	6.4	227	148	9.9	87
6/21/2006	SM-1772	10:31	0.8	21.9	6.2	167	108	4.2	48
8/30/2006	SM-1842	10:23	0.6	## u, m	## u, m, i	## u, m, i	## u, m, i	## u, m, i	## u, m, i
10/18/2006	SM-1912	10:08	0.5	10.0	6.6	253	164	8.2	72
1/24/2007	SM-1982	10:16	0.6 i	0.1 u	6.6 u	191 u	124 u	12.5 u	86 u
3/21/2007	SM-2052	10:29	0.8	0.9	6.1	198	129	## i	## i
5/23/2007	SM-2122	10:03	1.0	15.0	6.4	168	109	7.8	78
7/25/2007	SM-2192	10:28	0.2	22.4	6.7	217	141	5.6	65
9/19/2007	SM-2262	10:02	0.4	13.4	6.8	222	145	7.5	71
11/14/2007	SM-2332	10:43	0.6	4.1	6.9	327	213	11.4 i	88 i
3/5/2008	SM-2404	10:41	0.4	2.7	6.3	217	141	13.4	99
4/29/2008	SM-2474	10:45	0.8	11.4	6.3	214	139	8.3	76
5/27/2008	SM-2520	10:26	0.6	18.7	6.7	243	158	7.8	84
6/24/2008	SM-2580	10:27	0.5	21.6	6.5	272	177	5.5	62
8/5/2008	SM-2626	10:26	0.6	21.8	6.3	275	179	3.6	40
8/26/2008	SM-2686	10:58	0.5	19.4	6.4	244	159	5.0	54
10/15/2008	SM-2732	10:13	0.7	13.1	6.4	236	153	6.4	61
2/4/2009	SM-2826	**	**	**	**	**	**	**	**
3/25/2009	SM-2898	10:29	0.8	3.3	6.5	229	149	13.4	100
5/27/2009	SM-2970	10:18	0.6	16.1	6.4	253	164	6.0	61
7/29/2009	SM-3042	10:42	1.0	23.6	6.2	177	115	2.8	33
9/30/2009	SM-3114	9:51	0.9	15.0	6.3	248	161	0.4	4
11/18/2009	SM-3186	10:18	0.7	6.2	6.4	181	117	10.2	82
2/25/2010	SM-3258	10:50	0.9	0.2	6.3	218	142	13.1	90
9/1/2010	SM-3330	10:29	0.7	19.7	6.3	167	108	0.3	3
10/27/2010	SM-3402	9:54	0.5	8.9	6.0	248	161	<0.2	<2

Table 14 MassDEP SMART 2005-2010. Station BS09C. Chemistry Data.

Date	OWMID	Time	Alkalinity	Hardness	Chloride	E_coli	Ssolids	Turb	TN	NH3-N	NO3-NO2-N	TPhos
		(24hr)	(mg/l)	(mg/l)	(mg/l)	(MPN/100ml)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
2/1/2005	**	**	**	**	**	**	**	**	**	**	**	**
3/23/2005	SM-1175	8:50	24	69	160	**	2.8d	2.2	0.91	0.03	0.71b	0.025
5/25/2005	SM-1324	8:00	**	**	**	**	**	14.0	0.68h	0.08h	0.27h	0.080h
7/27/2005	SM-1404	8:20	52	120	180	**	2.8	2.8	1.1	0.11	0.60	0.054
9/28/2005	SM-1486	8:25	33	72	140	**	4.0	2.3	0.61	0.05	0.29	0.046
11/16/2005	SM-1556	8:35	24	55	78	**	3.9	3.7	0.87b	0.08	0.45	0.055
2/22/2006	SM-1626	8:20	23	61	110	**	1.7	1.8	0.92	0.07	0.66	0.026
4/25/2006	SM-1696	8:20	31	75	120	**	##d	3.4	0.85	0.06	0.42	0.055
6/21/2006	SM-1766	8:20	32	64	100	**	6.0	3.3d	0.88	0.09	0.46	0.054
8/30/2006	SM-1836	8:20	31	62	89	**	5.4	3.1h	0.85	0.10	0.40	0.053
10/18/2006	SM-1906	8:15	31	68	100	**	8.6	7.2	1.1	0.15	0.46	0.12
1/24/2007	SM-1976	8:25	27	66	110	**	2.3	2.4h	1.3	0.20	0.74	0.052
3/21/2007	SM-2046	8:25	18	52	150	**	6.9d	2.1	0.88	0.08	0.51	0.035
5/23/2007	SM-2116	8:15	20	45	70	**	4.3	2.6	0.83	0.09	0.44	0.038
7/25/2007	SM-2186	8:20	48	110	150	517	3.8d	3.3h	1.3	0.07	0.84	0.045
9/19/2007	SM-2256	8:05	42	91	140	613	2.2d	2.3h	0.86	0.07	0.48	0.033
11/14/2007	SM-2326	9:00	26	59	84	>2419.6	3.4	3.0	0.68	0.05	0.32	0.042
3/5/2008	SM-2396	8:40	12	45	170	1410	100	48.0	1.5	0.21	0.57	0.30
4/29/2008	SM-2466	8:40	19	45	94	770	14	3.5	0.62	0.05	0.20	0.062
5/27/2008	SM-2512	8:10	34	90	150	1050	3.7	2.3h	0.88	0.08	0.48	0.038
6/24/2008	SM-2572	8:15	19	44	77	##h	16	6.1d	0.87	0.17	0.29	0.087
8/5/2008	SM-2618	8:10	**	61	89	488	5.0a	4.0d	0.77h	0.07	0.39	0.049h
8/26/2008	SM-2678	8:40	**	86	130	722	2.6d	2.7	0.85	0.06	0.48	0.032
10/15/2008	SM-2724	8:13	28	61	91	579	##a,d	3.5	0.65	0.05	0.34	0.032
2/4/2009	SM-2818	8:25	##d	79	310	>2420	##d	2.5	0.99	0.16	0.64	##d
3/25/2009	SM-2890	8:10	25	69	130	435	3.2d	2.4	0.72	0.03	0.55	0.024
5/27/2009	SM-2962	8:10	32	80	130	>2420d	21	8.2	1.1	0.23	0.40	0.14
7/29/2009	SM-3034	8:35	27	56	88	461	4.5	2.8	0.73	0.06	0.36	0.047
9/30/2009	SM-3106	7:55	34	71	120	>2420	4.5	2.9	0.58	0.04	0.29	0.038
11/18/2009	SM-3178	8:05	25	50	73	326	2.6	2.8	0.58	0.06	0.24	0.036
2/25/2010	SM-3250	8:10	16	**	240	1120	12	13.0	0.77	0.13	0.42	0.048
9/1/2010	SM-3322	8:05	44	94	150	261	2.3d	2.2	##h	0.06	0.57	##h
10/27/2010	SM-3394	7:50	26	54h	91	>2419.6	6.8	4.4	0.61	0.05	0.16	0.040

Table 15 MassDEP SMART 2005-2010. Station BS14A. Chemistry Data.

Date	OWMID	Time	Alkalinity	Hardness	Chloride	E_coli	Ssolids	Turb	TN	NH3-N	NO3-NO2-N	TPhos
		(24hr)	(mg/l)	(mg/l)	(mg/l)	(MPN/100ml)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
2/1/2005	SM-1137	10:50	**	**	**	**	**	**	3.7d,h	2.5h	0.84h	0.37h
3/23/2005	SM-1179	11:55	32	71	160	**	4.7	3.0	3.1	1.5	0.99b	0.25
5/25/2005	SM-1331	10:15	**	**	**	**	**	12.5	3.2h	1.5h	1.2h	0.42h
7/27/2005	SM-1411	10:55	36	89	150	**	3.9	2.5	4.3	0.06	4.2	1.0
9/28/2005	SM-1493	11:15	32	68	130	**	5.4	2.5	**	**	**	**
11/16/2005	SM-1563	10:50	20	45	74	**	4.4	2.5	1.8b	0.25	0.86	0.14
2/22/2006	SM-1633	10:58	27	65	120	**	2.3	1.6	3.3	2.3	0.63	0.32
4/25/2006	SM-1703	11:10	30	67	120	**	##d	4.4	3.9	1.2	2.0	0.57
6/21/2006	SM-1773	10:55	29	62	110	**	7.4	2.2	2.7	0.39	1.8	0.31
8/30/2006	SM-1843	10:55	28	67	110	**	11	2.5h	3.8	0.55	2.6	0.69
10/18/2006	SM-1913	10:36	29	70	110	**	8.1	3.2	4.3	0.49	2.8	0.70
1/24/2007	SM-1983	10:40	31	66	120	**	1.8	1.8h	3.6	1.3	1.8	0.33
3/21/2007	SM-2053	10:52	27	66	210	**	3.7	2.9	2.7	1.3	1.1	0.16
5/23/2007	SM-2123	10:30	24	51	86	**	6.6	2.4	2.0	0.76	0.83	0.22
7/25/2007	SM-2193	11:15	38	87	130	90	6.6	2.5h	4.8	0.11	3.9	1.0
9/19/2007	SM-2263	10:26	32	80	130	153	6.3	3.1h	8.0	0.17	6.7	1.5
11/14/2007	SM-2333	11:14	34	64	89	980	5.3	2.5	3.7	0.66	2.4	0.67
3/5/2008	SM-2401	9:55	16	44	130	2420	28	16.0	1.9	0.62	0.65	0.27
4/29/2008	SM-2471	10:00	21	45	87	1300	27	7.2	2.3	1.0	0.48	0.34
5/27/2008	SM-2517	9:35	28	75	130	108	6.6	2.8h	4.9	1.7	2.4	0.53
6/24/2008	SM-2577	9:40	20	50	90	##h	26	10.0	2.3	0.45	0.85	0.54
8/5/2008	SM-2623	9:35	**	66	110	2420	9.1a	5.4	2.8h	0.32	1.9	0.29h
8/26/2008	SM-2683	10:10	**	80	120	1120	5.7	3.5	3.5	0.22	2.5	0.68
10/15/2008	SM-2729	9:30	26	62	96	387	2.9a,d	2.0	2.8	0.21	2.2	0.50
2/4/2009	SM-2823	9:15	38d	73	170	770	2.4d	1.7	3.9	2.7	0.70	0.13d
3/25/2009	SM-2895	9:25	42	73	130	2420	5.7	4.0	4.9	3.5	0.66	0.29
5/27/2009	SM-2967	9:30	34	76	130	144	7.9	3.0	3.7	0.86	2.1	0.21
7/29/2009	SM-3039	9:55	27	61	100	148	11	2.5	1.6	0.10	1.1	0.15
9/30/2009	SM-3111	9:00	35	66	100	129	7.1	2.9	1.7	0.15	1.1	0.33
11/18/2009	SM-3183	9:27	29	57	91	>2420	4.0	2.3	1.5	0.13	0.91	0.077
2/25/2010	SM-3255	9:56	19	**	210	>2419.6	12	8.8	1.5	0.56	0.56	0.11
9/1/2010	SM-3327	9:42	61	83	140	178	8.5	2.7	##h	0.20	3.7	##h
10/27/2010	SM-3399	9:10	39	61h	92	238	6.1	2.7	2.1	0.20	1.6	0.38

Table 16 MassDEP SMART 2005-2010. Station BS18A. Chemistry Data.

Date	OWMID	Time	Alkalinity	Hardness	Chloride	E_coli	Ssolids	Turb	TN	NH3-N	NO3-NO2-N	TPhos
		(24hr)	(mg/l)	(mg/l)	(mg/l)	(MPN/100ml)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
2/1/2005	**	**	**	**	**	**	**	**	**	**	**	**
3/23/2005	SM-1177	10:05	19	49	110	**	3.6	2.0	1.9	0.64	0.89b	0.13
5/25/2005	SM-1327	9:00	**	**	**	**	**	6.3	1.7h	0.34h	1.1h	0.19h
7/27/2005	SM-1407	9:25	29	70	120	**	3.5	2.3	2.9	<0.02	2.2	0.31
9/28/2005	SM-1489	9:35	29	67	120	**	4.6	2.4	4.4	0.03	3.2	0.55
11/16/2005	SM-1559	9:35	6	22	45	**	<1.0	0.9	0.67b	0.03	0.30	0.020
2/22/2006	SM-1629	9:35	19m	46m	90m	**	1.7m	1.3m	1.8m	0.79m	0.69m	0.088m
4/25/2006	SM-1699	9:35	20m	50m	90m	**	##d,m	3.4m	2.9m	0.56m	1.9m	0.35m
6/21/2006	SM-1769	9:30	18m	38m	68m	**	9.2m	1.9m	1.3m	0.06m	0.87m	0.18m
8/30/2006	SM-1839	9:25	19	45	74	**	8.9	2.5h	1.9	0.08	1.6	0.22
10/18/2006	SM-1909	9:15	23	48	73	**	3.0	2.0	2.0	0.20	1.4	0.26
1/24/2007	SM-1979	9:16	21	46	82	**	1.5	1.5h	2.1	0.64	1.2	0.16
3/21/2007	SM-2049	9:30	15	41	120	**	2.9	1.4	1.6	0.54	0.78	0.078
5/23/2007	SM-2119	9:10	18	39	69	**	5.6	2.1	1.2	0.16	0.76	0.10
7/25/2007	SM-2189	9:20	33	72	110	30	3.2	2.0h	2.9	<0.02	2.3	0.32
9/19/2007	SM-2259	9:00	32	65	100	96	5.0	2.1h	3.5	0.03	2.8	0.47
11/14/2007	SM-2329	10:00	30	59	85	299	5.0	2.5	3.7	0.54	2.5	0.49
3/5/2008	SM-2405	11:20	15	43	120	>2419.6	15	6.3	1.9	0.81	0.65	0.21
4/29/2008	SM-2475	11:11	21	49	95	1200	33	6.1	3.2	1.5	0.86	0.38
5/27/2008	SM-2521	10:55	18	59	110	46	3.3	2.1h	2.6	0.11	2.0	0.19
6/24/2008	SM-2581	11:02	15	41	70	##h	32	12.0	2.9	0.51	1.4	0.61
8/5/2008	SM-2627	11:02	**	54	93	115	7.3a	5.5	2.0h	0.04	1.5	0.20h
8/26/2008	SM-2687	11:40	**	64	100	86	3.9	2.6	2.3	<0.02	1.8	0.22
10/15/2008	SM-2733	10:45	19	49	79	127	1.9a,d	1.7	1.9	<0.02	1.5	0.25
2/4/2009	SM-2827	**	**	**	**	**	**	**	**	**	**	**
3/25/2009	SM-2899	11:10	25	50	96	236	3.0	2.3	2.8	1.4	0.81	0.096
5/27/2009	SM-2971	10:45	22	59	110	93	5.7	2.5	2.6	0.11	1.8	0.15
7/29/2009	SM-3043	11:10	21	43	71	172	8.8	2.1	0.99	0.05	0.54	0.14
9/30/2009	SM-3115	10:18	32	57	100	96	4.8	2.2	1.8	0.09	1.4	0.23
11/18/2009	SM-3187	10:50	19	39	66	1200	4.3	2.2	0.99	0.07	0.56	0.083
2/25/2010	SM-3259	11:30	12	**	200	>2419.6	19	9.2	1.2	0.32	0.44	0.12
9/1/2010	SM-3331	11:00	43	64	110	**	6.6	2.5	##h	<0.05	1.6	##h
10/27/2010	SM-3403	10:24	29	51h	78	99	4.7	2.5	1.8	0.06	1.5	0.10

Table 17 MassDEP SMART 2005-2010. Station QU02A. Chemistry Data.

Date	OWMID	Time	Alkalinity	Hardness	Chloride	E_coli	Ssolids	Turb	TN	NH3-N	NO3-NO2-N	TPhos
		(24hr)	(mg/l)	(mg/l)	(mg/l)	(MPN/100ml)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
2/1/2005	SM-1135	9:55	**	**	**	**	**	**	0.79h	0.11h	0.47h	0.017h
3/23/2005	SM-1180	12:40	23	71	150	**	1.3	1.1	0.84	0.07	0.61b	0.015
5/25/2005	SM-1333	10:47	**	**	**	**	**	3.3	0.66h	0.09h	0.22h	0.025h
7/27/2005	SM-1413	11:30	26	72	140	**	2.2	0.5	0.43	0.03	0.03	0.019
9/28/2005	SM-1495	11:50	27	68	130	**	<1.0	0.4	0.33	0.04	0.04	0.011
11/16/2005	SM-1565	11:20	21	62	120	**	1.5	1.3	0.63b	0.04	0.29	0.015
2/22/2006	SM-1635	11:30	21	73	140	**	1.2	1.0	0.90	0.05	0.72	0.011
4/25/2006	SM-1705	11:45	26	69	140	**	##d	1.4	0.62	0.06	0.07	0.030
6/21/2006	SM-1775	11:30	23	59	120	**	1.9	0.8	0.56	0.08	0.20	0.022
8/30/2006	SM-1845	11:35	26	59	110	**	<1.0	0.4h	0.32	0.02	0.02	0.013
10/18/2006	SM-1915	11:10	25	62	110	**	<1.0	0.6	0.31	<0.02	0.03	0.014
1/24/2007	SM-1985	11:10	22	66	120	**	1.3	1.1h	0.72	0.13	0.43	0.009
3/21/2007	SM-2055	11:27	22	62	120	**	1.7	1.0	0.74	0.12	0.38	0.016
5/23/2007	SM-2125	11:10	21	57	110	**	3.1	1.3	0.69	0.07	0.31	0.019
7/25/2007	SM-2195	11:55	29	66	120	22	<1.0	0.5h	0.40	0.02	0.05	0.013
9/19/2007	SM-2265	10:53	33	66	110	>2419.6	7.6	1.4h	0.57	0.02	0.12	0.041
11/14/2007	SM-2335	11:35	27	62	110	47	1.2	0.8	0.39	<0.02	0.02	0.013
3/5/2008	SM-2399	9:15	18	59	140	32	5.1	3.1	0.83	0.06	0.54	0.023
4/29/2008	SM-2469	9:17	22	61	150	866	4.2	1.8	0.61	0.07	0.14	0.027
5/27/2008	SM-2515	8:45	22	67	150	3	1.1	1.3h	0.51	0.07	0.11	0.018
6/24/2008	SM-2575	9:01	20	65	140	##h	2.4	1.3	0.49	0.07	0.04	0.027
8/5/2008	SM-2621	9:00	**	61	130	135	1.1a	0.9	0.34h	0.02	0.02	0.017h
8/26/2008	SM-2681	9:25	**	63	120	18	<1.0	1.0	0.36	0.02	<0.02	0.018
10/15/2008	SM-2727	8:53	23	59	110	32	1.1a,d	0.6	0.31	<0.02	<0.02	0.012
2/4/2009	SM-2821	**	**	**	**	**	**	**	**	**	**	**
3/25/2009	SM-2893	8:50	20	65	140	<1	3.1	1.4	0.63	0.03	0.41	0.016
5/27/2009	SM-2965	8:55	26	71	140	130	1.9	1.0	0.54	0.11	0.12	0.023
7/29/2009	SM-3037	9:15	21	58	110	41	1.7	1.0	0.42	0.05	0.11	0.016
9/30/2009	SM-3109	8:30	24	59	120	61	<1.0	0.6	0.29	<0.02	<0.02	0.014
11/18/2009	SM-3181	8:45	22	61	120	7	1.9	1.1	0.43	0.06	0.07	0.017
2/25/2010	SM-3253	9:05	17	**	140	91	5.5	5.7	0.80	0.13	0.41	0.025
9/1/2010	SM-3325	9:15	28	65	130	29	4.8	0.6	##h	0.04	0.04	##h
10/27/2010	SM-3397	8:31	23	62h	110	42	1.3	0.9	0.38	0.03	<0.02	0.032

Table 18 MassDEP SMART 2005-2010. Station WR03. Chemistry Data.

Date	OWMID	Time	Alkalinity	Hardness	Chloride	E_coli	Ssolids	Turb	TN	NH3-N	NO3-NO2-N	TPhos
		(24hr)	(mg/l)	(mg/l)	(mg/l)	(MPN/100ml)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
2/1/2005	**	**	**	**	**	**	**	**	**	**	**	**
3/23/2005	SM-1178	11:00	10	24	54	**	1.0	0.7	0.55	<0.02	0.40b	0.023
5/25/2005	SM-1329	9:40	**	**	**	**	**	2.0	0.52h	0.07h	0.23h	0.022h
7/27/2005	SM-1409	10:15	16	28	55	**	2.1	1.8	0.58	0.04	0.21	0.037
9/28/2005	SM-1491	10:25	25	31	64	**	1.0	1.2	0.48	0.03	0.17	0.047
11/16/2005	SM-1561	10:15	30	62	93	**	4.6	1.9	2.2b	0.81	1.1	0.19
2/22/2006	SM-1631	10:25	11	22	52	**	1.3	0.6	0.51	<0.02	0.39	0.010
4/25/2006	SM-1701	10:35	7	23	50	**	##d	1.2	0.67	0.03	0.34	0.021
6/21/2006	SM-1771	10:20	9	18	36	**	2.2	1.8	0.59	0.07	0.17	0.037
8/30/2006	SM-1841	10:18	14	26	58	**	<1.0	1.2h	0.79	0.03	0.43	0.025
10/18/2006	SM-1911	9:57	13	30	58	**	<1.0	1.5	0.45	0.04	0.15	0.019
1/24/2007	SM-1981	10:04	9	21	41	**	<1.0	0.9h	0.60	0.03	0.40	0.014
3/21/2007	SM-2051	10:20	5	19	44	**	1.5	0.8	0.49	0.02	0.34	0.011
5/23/2007	SM-2121	9:50	8	18	38	**	1.6	0.8	0.38	<0.02	0.09	0.018
7/25/2007	SM-2191	10:20	16	28	52	27	1.7	2.1h	0.43	0.02	0.10	0.032
9/19/2007	SM-2261	9:55	19	28	44	23	1.7	1.4h	0.31	0.02	0.04	0.017
11/14/2007	SM-2331	10:36	19	35	73	1	<1.0	1.1	0.51	<0.02	0.24	0.014
3/5/2008	SM-2403	10:33	5	22	52	12	1.1	0.6	0.56	<0.02	0.39	0.009
4/29/2008	SM-2473	10:30	8	23	50	326	2.9	1.2	0.65	0.05	0.23	0.028
5/27/2008	SM-2519	10:12	8	26	56	47	2.1	1.6h	0.60	0.03	0.22	0.027
6/24/2008	SM-2579	10:15	15	29	64	##h	<1.0	1.5	0.59	0.06	0.16	0.028
8/5/2008	SM-2625	10:15	**	31	62	55	1.5a	1.5	0.62h	0.04	0.07	0.028h
8/26/2008	SM-2685	10:50	**	29	53	96	1.1	1.2	0.63	0.04	0.14	0.030
10/15/2008	SM-2731	10:02	10	27	52	20	<1.0a,d	0.9	0.57	0.03	0.21	0.019
2/4/2009	SM-2825	**	**	**	**	**	**	**	**	**	**	**
3/25/2009	SM-2897	10:12	6	23	50	4	2.4	0.8	0.57	<0.02	0.36	0.013
5/27/2009	SM-2969	10:05	12	28	56	345	1.9	2.0	0.73	0.11	0.20	0.034
7/29/2009	SM-3041	10:33	10	21	40	105	1.7	1.6	0.69	0.04	0.08	0.046
9/30/2009	SM-3113	9:45	14	27	58	77	1.4	1.8	0.63	<0.02	0.23	0.038
11/18/2009	SM-3185	10:10	6	21	43	133	2.8	1.6	0.53	0.03	0.12	0.027
2/25/2010	SM-3257	10:35	5	**	53	82	2.6	3.2	0.57	0.06	0.30	0.024
9/1/2010	SM-3329	10:20	20	30	24	8	2.8	2.2	##h	0.04	<0.02	##h
10/27/2010	SM-3401	9:43	13	30h	60	26	1.4	0.9	0.42	<0.02	<0.02	0.029

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