BLACKSTONE RIVER WATERSHED
SMART MONITORING PROGRAM 2000-2004

Technical Memorandum TM-51-16

Blackstone River near the Triad Bridge, Millville

Prepared By:
Therese Beaudoin
December 2013

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
Richard Sullivan, Secretary
Massachusetts Department Of Environmental Protection
Ken Kimmel, Commissioner
Bureau of Resource Protection
Beth Card, Assistant Commissioner
Division of Watershed Management
Rebecca Weidman, Director
Watershed Planning Program
Kim Groff, Director

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

7Q10	streamflow that spans 7 consecutive days and occurs once every 10 years
BHC	Blackstone Headwaters Coalition
BRC	Blackstone River Coalition
BRP	Bureau of Resource Protection
ºC	degree 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
MDL	Method Detection Limit
mg/L	milligrams per liter
mi^2	square mile
NH_3-N	Ammonia Nitrogen
NOAA	National Oceanic and Atmospheric Administration
NO_3NO_2-N	Nitrate-nitrite Nitrogen
NTU	Nephelometric Turbidity Unit
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
RDL	Reporting Detection Limit
RI	Rhode Island
RPD	Relative Percent Difference
QAPP	Quality Assurance Project Plan
SMART	Strategic Monitoring and Assessment for River basin Teams
SOP	Standard Operating Procedure
SU	Standard Unit
T	Temperature
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
UBWPAD	Upper Blackstone Water Pollution Abatement District
uS/cm	microsiemen per centimeter
USGS	United States Geological Survey
WES	Wall Experiment Station
% sat	percent oxygen saturation

LIST OF LATIN NAMES

Latin Name	Common Name
Brasenia schreberi	watershield
Bidens sp.	beggar's tick
Chara sp.	muskgrass
Elodea sp.	waterweed
Ilex verticillata	winterberry
Juncus sp.	sedges
Lemna sp.	duckweed
Lobelia cardinalis	cardinal flower
Myriophyllum sp.	milfoil
Peltandra virginica	arrow arum
Polygonum sp.	smartweed
Potamogeton spp.	pondweeds
Rorippa sp.	water cress
Sagittaria sp.	arrowhead
Scirpus sp.	sedges
Typha latifolia	common cattail
Vallisneria americana	wild celery
Zizania aquatica	wild rice

Cover photo by Therese Beaudoin, MassDEP. 24 June 2004.
All photos in document taken by Therese Beaudoin. MassDEP. CERO.
SMART monitoring logo designed by Robert Kimball and Barbara Kimball.

INTRODUCTION

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 http://www.mass.gov/dep/water/resources/51wqar2.doc (MassDEP 2001). 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 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.

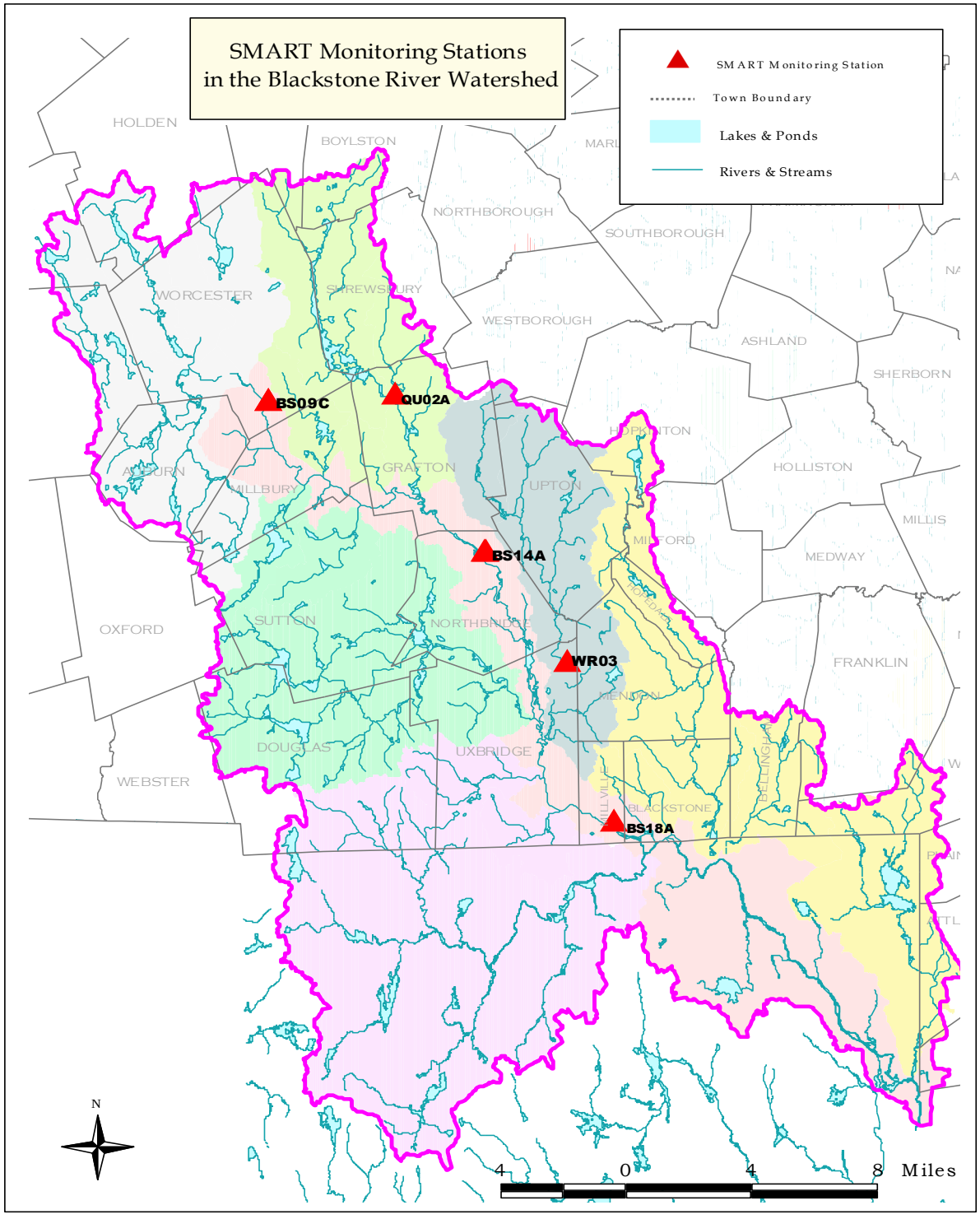
The purpose of this technical memo is to present observations and data collected in the SMART program in the Blackstone watershed. Bimonthly water quality monitoring began in March 2000. The sampling plan matrix for the SMART monitoring program Years 2000-2004 is presented in Table 1; the locations of sampling stations are presented in Figure 1. Sampling components at all stations included *in situ* measurements, physical/chemical and nutrient sampling, flow measurements (at existing gaging stations), and general field observations. Each sampling component is described in the sections that follow.

The quality assurance/control plan (QAPP) for the SMART program is presented in CN 12.1*: 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 2010). The QAPP presents data quality objectives, quality assurance procedures, and other program-specific information.

Table 1 Blackstone Basin SMART Sampling Summary – 2000 through 2004

Location and Segment Numbers	Station Name	Dates Sampled[1]
Blackstone River @ Millbury Street (3/15/00-6/26/02) and @ Blackstone Valley Bikeway (10/30/02 – 10/27/2004), Worcester MA51-03	BS09C	2000: 3/15/00, 5/17/00, 7/19/00, 9/20/00, 11/29/00 2001: 3/14/01, 4/25/01, 6/27/01, 8/22/01, 11/7/01 2002: 3/6/02, 4/24/02, 6/26/02, 8/28/02, 10/30/02 2003: 1/39/03, 4/2/03, 5/21/03, 7/23/03, 9/24/03, 11/20/03 2004: 3/3/04, 4/28/04, 6/23/04, 8/25/04, 10/27/04 [1]The SMART program began monitoring in the Blackstone basin in March 2000.
Blackstone River @ USGS flow gaging station, Sutton Street, Northbridge MA51-04	BS14A	
Blackstone River @ P&W railroad trestle, Millville MA51-05	BS18A	
Quinsigamond River @ historic Bridge Street, Grafton MA51-09	QU02A	
West River @ East Hartford Ave, Uxbridge MA51-12	WR03	

Figure 1 MassDEP SMART Monitoring Blackstone River Watershed Water Quality Station Locations 2000-2004



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);
- 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 and basin plans; quantifying nutrient loadings for load allocations (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 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 River Watershed under the SMART program from 2000-2004. An assessment of the data will be presented in future reports.

METHODS

Water quality samples were collected in the Blackstone basin on the dates shown in Table 1 and for the parameters described below; station locations are shown in Figure 1. The parameters 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, turbidity;
- nutrients: ammonia-nitrogen, nitrate-nitrite-nitrogen, total Kjeldahl nitrogen (which was changed to total nitrogen in 2004), and total phosphorus; and
- Microtox from July 12, 2000 through August 15, 2001.

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 DEP 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 (included in the Appendix), photographs, and field notebooks. Field observations included date/time, location, crewmembers, snow cover, canopy cover, water odors, colors, sheens, foams, estimated water quantity and velocity, weather conditions, observed uses, wildlife, aquatic algae and macrophytes, potential pollution sources, and any unusual conditions. Number and type of samples were recorded, as well as the last set of *in situ* data collected.

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 DEP Division of Watershed Management (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 level review. The project coordinator, as identified in the QAPP for the SMART program, reviews the data for reasonableness, completeness and acceptability; see CN 83.0, CN149.0, CN202.0, CN211.0, and CN265.0 for the DWM data validation reports of 2000-2004 SMART Blackstone data (MassDEP 2003, 2004b, 2005b, 2005a, 2006).

Due to resource limitations at the WES laboratory, samples collected for nutrient analyses were frozen, and later analyzed for total phosphorous only, from October 2003 through June 2004.

Although samples were collected for Microtox analyses during the time period noted above, continuous manufacturer's product contamination issues with the assay's growth media produced invalid results and therefore, prevented use of the data.

STATION OBSERVATIONS

Station BS09C – Blackstone River at Millbury Street, Worcester, MA (2000-6/20/2002, river mile 29.442); Blackstone River at Blackstone River Road and Tobias Boland Way, on the Blackstone Valley Bikeway, Worcester, MA (10/30/2000-2004, river mile 29.508)

Figure 2 Google Earth view of BS09C area

Figure 3 BS09C upstream 3/15/2000 – 6/20/2002

Figure 4 BS09C upstream 10/30/2002 – 10/27/2004

This location was accessed downstream of the Millbury Street Bridge, Worcester on March 15, 2000 (Station BS09B). However, by the next sampling date, poison ivy had rendered the river banks impassable, and the river in this reach was accessed from the upstream side of the Millbury Street Bridge from May 17, 2000 through June 20, 2002 with the station renamed BS09C (Figure 3). At that time, extensive highway reconstruction activities made this location permanently inaccessible, and the station was relocated to a point approximately 500 feet upstream, retaining the site name BS09C (Figure 4). From October 2002 through 2004, the station was accessed from the Blackstone Valley Bikeway off Blackstone River Road and Tobias Boland Way, Worcester (sampling was not conducted in August, 2002 due to access limitations associated with highway construction). All locations are considered to be representative of the water quality in this reach. Station BS09C serves as an impact station.

The surrounding land use immediately upstream of this station is comprised of urbanized areas within Worcester and Auburn (Figure 2) (Google Earth 2011a). The Worcester CSO treatment facility discharge is 1.25 miles upstream, in the (underground) Mill Brook culvert. Other than the infrequent discharges from the CSO facility, sources of pollution to this segment of the Blackstone River are non-point in origin, 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 less than 3 feet deep and roughly uniform across the channel throughout the year. Deciduous trees provide canopy cover over much of the channel upstream and downstream of the Blackstone River Road Bridge. During the sampling period the bottom was mainly embedded gravel and cobble, with silt noted occasionally. No macrophytes were noted at Station BS09C during this 5-year period. There was a consistent moderate to dense coverage of periphyton which included filamentous grey or green algae attached to rocks. Samples were collected by wading in or from shore.

Water column observations indicated highly turbid conditions on most events (88%). The water color was most often grey; other colors include clear, “heavily” green, coffee and brown. Strong effluent was the most common water odor; other observations included none and raw sewage. Foams and sheens were observed on approximately one-third of the monitoring events. Trash was abundant, both in the stream bed and on the banks, and included floatables, tires, buckets, shopping carts, reflectorized orange highway barricades, cigarette butts, miscellaneous metal and wood objects, chain link fencing, hay bales, silt fencing, and discarded cables.

Station BS14A - Blackstone River downstream from Sutton Street, at the USGS gage, Northbridge, MA (river mile 17.677)

Figure 5 Google Earth view of BS14A area

Figure 6 BS14A upstream

Station BS14A was accessed from shore near the USGS flow gaging station downstream of Sutton Street, Northbridge (the first event was conducted from the upstream side of the Sutton Street Bridge due to access limitations). The land use upstream of this area includes several village centers: Millbury, Wilkinsonville (Sutton), Fisherville and Farnumsville (Grafton), and Rockdale (Northbridge) (Figure 5) (Google Earth 2011b). Outside of these centers, however, the land is mostly forested, with sparse to moderate predominately residential development. Station BS14A serves as an impact station.

Upstream, the river flows through several existing and historic impoundments that are known to contain sediments contaminated with heavy metals, polynuclear aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), petroleum products, and/or other pollutants from historic discharges, spills and releases (USACOE 1994). At this location, the Blackstone River receives municipal discharges from three major wastewater treatment plants (WWTP), including: the Upper Blackstone Water Pollution Abatement District (UBWPAD) which has pumped its discharge to the Upper Blackstone WPAD system since January 2005 (Chen 2008); and the Grafton WWTP.

In addition to upstream activities, Station BS14A is influenced by downstream hydropower operations which result in daily or more frequent fluctuations in water levels. Such fluctuations cause periods of backwater in this segment, usually when flows are less than about 500 cfs, which result in changes to the stage-discharge relation concurrent with impounded conditions. Although the USGS gage records river height for all stages, discharges records are only computed for flows of 500 cfs or greater (Socolow 2011). Station BS14A serves as a trend station.

The river at this location is approximately 65 feet wide, and shaded along the shorelines (Figure 6). During the sampling period the bottom, when visible, consisted mainly of sand and gravel, and some cobble and silt, with boulders near the USGS station (to protect gaging apparatus). Periphyton, when visible, included very dense green, orange or brown filamentous and/or filmy (scum) algae on submerged surfaces; on two occasions, the bottom was completely covered in a reddish brown floc (8/28/2002, 5/21/2003). No macrophytes were recorded at this station during this time period. Samples were collected near the USGS station by wading in or from shore.

Turbidity was a chronic issue at this station, with high turbidity noted on 69% of the 27 events in this time frame (slight to moderate conditions 31%). A high level of suspended materials was noted on numerous occasions. The water color was most often grey, and infrequently green. Effluent was the most common water odor; others included petroleum, chlorine and raw sewage. Foam was observed on 4 events and sheens on 2. When visible, the stream bed exhibited a moderate density of trash, including miscellaneous metal and wooden objects, cement blocks, bricks and floatables.

Station BS18A- Blackstone River at the Providence and Worcester Railroad trestle near MA122, Millville (river mile 3.271)

Figure 7 Google Earth view of BS18A area

Figure 8 BS18A upstream 3/15/2000 – 10/27/2004

Station BS18A was accessed from the Providence and Worcester railroad trestle approximately 0.6 mi downstream of the Center Street Bridge, Millville (off MA122). The land use above this station includes the small town center of Millville, with the proximal watershed area characterized by forest, and sparse residential and commercial development (Figure 7)(2011c). Samples were collected by bucket drop from the channel north of the center trestle abutment; due to safety issues, monitoring was conducted from the downstream side of the trestle. Station BS18A serves as a loading station.

Sources of water quality degradation at this station are both point and nonpoint in nature. Point sources include the municipal discharges noted above, in addition to the Northbridge and Uxbridge WWTPs, and two smaller facilities on the Mumford (Douglas) and West (Upton) Rivers. Additional nonpoint sources include more impoundments with contaminated sediments, particularly Rice City Pond, Northbridge/Uxbridge, and village centers (Riverdale, Uxbridge, Millville).

The river at both locations is approximately 100 feet wide, and although heavily shaded along both shores, most of the channel is open to the sky (Figure 8). This section of river is impounded by the Rolling Dam, Blackstone (at the head of the Blackstone Gorge) and is affected by operations at the hydropower facility located at the former Tupperware plant. The depth across the stream channel is undetermined. Visibility was often limited to shallow depths near shore due to the angle of light on the surface, high turbidity and brownish color, and conditions were rarely clear enough to determine the substrate composition or periphytic and macrophytic communities during this time period. Aquatic macrophytes were rarely noted and were limited to *Lemna* sp. (duckweed) and *Elodea* sp. (waterweed; a single sprig caught against a cable during one event).

The water column observations noted at this station were highly turbid on most sampling events (73%); conditions were slightly to moderately turbid on 27% of events, and never clear. The water color was typically brown, and on occasion, clear or green. The river usually lacked odor, with infrequent observations of a musty scent. There were sparse patches of foam noted on only two sampling dates; no sheens were observed.

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

Figure 9 Google Earth view of QU02A area

Figure 10 QU02A upstream

Station QU02A was accessed from the northern shore above the historic Bridge Street Bridge in Grafton, MA; samples were collected by wading in, with a sampling pole from shore, or by pole or bucket drop from the bridge. The station is located below 3 large water bodies, including Lake Quinsigamond, Flint Pond, and Hovey Pond. The upstream land use is dominated by urbanization in Worcester and areas of Shrewsbury, Millbury and Grafton; development is moderately dense in much of the contributing watershed (Figure 9) (Google Earth 2011d). There are no municipal discharges upstream thus water quality threats are solely nonpoint in nature. Station QU02A serves as a trend station.

The river channel varies from 15-40 feet wide in this reach (the greater width includes the northern cove above the bridge) and is heavily shaded (Figure 10). Although it was usually difficult to see through the water column due to the angle of light on the surface, the bottom, when visible, consisted mainly of gravel embedded in dark sand, with silt, muck, sand and a few cobble-size rocks in the cove. Periphyton, when present, included brown scum and green filamentous algae on bottom surfaces. Few aquatic macrophytes were observed at this station; these include *Sagittaria* sp. (arrowhead) and *Peltandra virginica* (arrow arum).

The water column observations noted that turbidity at QU02A was usually clear on all monitoring events, with the occasional exception where it was slightly turbid. The water color was typically clear, with brown noted infrequently. Water odors observed included none, pond/vegetation/organic, and fishy, with a lack of odor most common. A sparse coverage of foam was noted on only 3 events; no sheens were observed. The bed of the main channel (not the small “cove”) above the bridge is covered with broken glass, metals, plastics and other miscellaneous debris, as well as many empty mussel shells. Granite blocks from a stone wall have fallen from the bridge into the cove.

Since this was the last station sampled on the Blackstone River SMART Monitoring events, field blank samples were collected here.

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

Figure 11 Google Earth view of WR03 area

Figure 12 WR03 upstream

Station WR03 was accessed from the eastern shore upstream of East Hartford Ave., Uxbridge, MA. The land use upstream of this area is largely forested, with long segments of the river flowing through riverine wetlands within the USACOE West Hill Flood Control Project corridor (Figure 11) (2011e). The West River has one municipal discharge, approximately 5.5 miles upstream from Station WR03, in Upton, MA. WR03 serves as a reference station for the Blackstone River Watershed.

The river channel at this location is approximately 25 feet wide, and flows through a riverine wetland. During the sampling period the stream bed consisted mainly of muck and sand, with some gravel and silt, and a few submerged flat granite blocks anchoring the bottom midstream. Periphyton, when observed, included green filamentous algae attached to submerged surfaces, as well as brown periphytic growth on vegetation. Macrophytes were diverse and abundant at this station; plants observed during this period include included *Myriophyllum* sp. (milfoil), *Potamogeton* spp. (pondweeds), *Typha latifolia* (common cattail), *Juncus* sp. (sedges), *Vallisneria americana* (wild celery), *Lobelia cardinalis* (cardinal flower), *Polygonum* sp. (smartweed), *Lemna* sp. (duckweed), *Rorippa* sp. (water cress), *Zizania aquatica* (wild rice), *Bidens* sp. (beggar's tick), *Chara* sp. (muskgrass), *Brasenia schreberi* (watershield), and *Ilex verticillata* (winterberry). Samples were collected from the eastern shore near the upstream culvert (under East Hartford Ave.) by wading in or from shore.

The water column was typically clear at this station, with a tannic color, and a lack of odor, sheens, or foam. Trash/debris was consistently absent here.

SURVEY CONDITIONS

Stream discharge and precipitation data are used to determine hydrologic conditions and define whether there is a dry or wet weather event occurring during the water quality survey. 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 of the survey date 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: http://www.erh.noaa.gov/box/dailystns.shtml; NOAA 2010. Worcester, MA is the location of the weather station closest to the Blackstone River watershed sampling stations; hence data collected in Worcester were utilized in this report.

The USGS operates numerous stream gaging stations on the Blackstone River and tributaries; those with a nexus with the SMART program include:

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

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 station is used as an estimate of discharge, rather than exact conditions, at Station BS18A.

Statistical streamflow values are based on 74-75 years of record (10/1/1928-9/30/2006) at the USGS Blackstone River gage in Woonsocket, RI (USGS station number 01112500). Daily data are reported online at: http://waterdata.usgs.gov/ma/nwis/annual/?referred_module=sw&site_no=01112500&por_01112500_2=1268186,00060,2,1929,2009&year_type=W&format=html_table&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list (2010a). The point of record daily statistics are reported at http://waterdata.usgs.gov/nwis/dvstat?referred_module=sw&site_no=01112500&por_01112500_2=1268186,00060,2,1929-02-22,2008-05-07&start_dt=1929-02-22&end_dt=2003-12-01&format=html_table&stat_cds=mean_va&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list. The monthly mean discharge data are found at http://waterdata.usgs.gov/nwis/monthly/?referred_module=sw&site_no=01112500&por_01112500_2=1268186,00060,2,1929-02,2008-05&format=html_table&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list (2010c).

The discharge values were also examined relative to the 7Q10 low flow (streamflow that spans 7 consecutive days and occurs once every 10 years). The 7-day, 10-year (7Q10) low flow values were obtained 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, MA = 45 cfs
- Blackstone River at Woonsocket, RI = 101 cfs
- West River at West Hill Dam, Uxbridge, MA = 1.5 cfs

At some of the Blackstone River 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.

March 15, 2000 – The first survey of the SMART Monitoring Program in the Blackstone watershed was conducted during a period in which 1.52" of rain fell within the 5 day period preceding the event, and data from both the Northbridge, MA and Woonsocket, RI gages indicate that storm flows peaked on March 12. Streamflow data show that stream discharge during the sampling event was greater than flows before the storm. Field observations at the Worcester station on the mainstem include "strong flows noted" and high turbidity. Therefore, based on a combination of field observations, precipitation and discharge data, samples collected during this event reflect wet weather conditions. Air temperature during the sampling event ranged from 57 to 66 degrees Fahrenheit (°F), and sky conditions were partly cloudy.

Station BS14A on the Blackstone River in Northbridge, MA was inaccessible on this date, due to a fatal fire that occurred in the early morning hours. Therefore, sampling was conducted from the upstream side of the Sutton Street Bridge, approximately 140 feet upstream of the permanent location (at the gaging station). There are no major changes in land use or additional sources of point or non-point source pollution between these two places; they are considered to represent the same water quality conditions, and will be assessed as the same location.

May 17, 2000 – The May 2000 Blackstone survey was conducted during a relatively wet period, with 0.52 inches of total precipitation recorded at Worcester on May 13th. Field observations at several stations on the Blackstone River note slightly- to highly-turbid, coffee-colored water. Precipitation and field observations indicate wet weather/runoff conditions on this event. Air temperature ranged from 65 to 72 degrees Fahrenheit (°F) with cloud cover increasing from 0 to approximately 50% during the event.

July 19, 2000 – This summer survey occurred during a relatively wet period. Approximately 1.14" of rain fell during the five days preceding this event. Discharge measurements corroborate that data collected on this date reflect wet weather/runoff conditions. Air temperature ranged from 70° to 74°F with sunny skies throughout the event. Cloud conditions ranged from mostly cloudy to 100% overcast.

September 20, 2000 – This monitoring event followed a large thunderstorm, which began the previous evening and ended around 8:00 am, approximately one hour before sampling began, and released 1.16 inches of rainfall. Discharge data corroborate wet weather/runoff conditions. Sampling was conducted at the Quinsigamond River first on this date to allow monitoring at Station BS09C (Blackstone River, Worcester) to coincide with the Blackstone Expedition 2000, a four-day paddling excursion on the Blackstone River from the headwaters in Worcester, MA to the confluence with the Providence River in Providence, RI. Air temperature ranged from 72° to 78°F and cloud cover decreased from 30 to 100% during the sampling event.

November 29, 2000 – The late fall sampling event occurred 3 days after a storm that resulted in 0.89 inches of rainfall, with a total precipitation during the previous 5 days of 0.94 inches. Stream discharge measurements at both the Northbridge and Woonsocket gages confirm that data collected during this event reflect wet/runoff conditions. Air temperature ranged from 40 to 48°F, and cloud cover ranged from 0 to 5%.

March 14, 2001 – This winter sampling event took place during a wet period, with 1.06 inches of precipitation (as snow, rain and fog) recorded in the preceding 5 days, and mist/light rain falling at the first station. Discharge data at the Quinsigamond River, Blackstone River Northbridge, MA and Woonsocket, RI gages all indicate storm-driven flows; discharge at the West River gage indicate artificial manipulation of river flows at the Army Corps flood control project at West Hill (Uxbridge, MA). Field observations at all Blackstone and Quinsigamond River stations reflect turbid flows. Therefore, data collected during this event reflect wet weather conditions. Air temperature ranged from 38° to 39°F and cloud cover from 65 to 100%.

April 25, 2001 – This spring sampling event took place during a month of little total precipitation (0.76 inches), and only 0.04 inches falling in the previous five days. Stream discharges measured at the watershed gages indicated

an absence of runoff. Data collected during this event reflect dry weather conditions. Air temperature ranged from 47° to 54°F with 100% cloud cover during the sampling event.

High turbidity was observed at the West River station, which exhibited turbidity levels below the detection limit of the instrument in previous monitoring events. We surveyed the watershed immediately upstream of the station, in conjunction with Army Corps of Engineers staff from the West Hill Dam Project. Eventually, a chocolate-colored stream was noted flowing down the hillside on the east side of the West River. Upstream reconnaissance noted a pig farm at the upstream end; pigs were rooting in the wetland from which the stream flowed, and a partially eaten pig carcass lay in the streambed. The Army Corps was notified, as well as the local Animal Control department. A subsequent investigation in June found that this intermittent stream was no longer flowing. Turbidity readings at the West River station returned to low levels by the next sampling date.

June 27, 2001 – This early summer sampling event took place during a relatively dry period, with a total of 0.21 inches of precipitation falling during the previous 5 days. Discharge data for gages throughout the watershed show decreasing flows. Therefore, these data reflect dry weather conditions. Air temperature ranged from 79° to 94°F and conditions remained sunny throughout the sampling event.

August 22, 2001 – Summer sampling occurred during a dry period, with a total of 0.08 inches of rainfall within the 5 days prior to the survey. Flow data indicate decreasing discharge in this period. Data collected during this event reflect dry weather conditions. Ambient temperature ranged from 71° to 82°F and cloud cover ranged from 0 to 40% during the survey.

November 7, 2001 – Fall sampling fell within a generally dry period, with light precipitation occurring several times within 5 days prior to the event. The mainstem was highly turbid, with a brownish/greenish color noted at Station BS09C, possibly associated with upstream highway reconstruction activities. The daily mean streamflow at the Blackstone River at the Woonsocket, RI gage is 561 cfs, while the mean streamflow on this date was 170 cfs, and little change in flow was noted during this period. Therefore, based on available data, water quality reflects dry weather conditions. Air temperature ranged from 53° to 57°F and cloud cover ranged from 0 to 100% during the survey.

December 17, 2001 – This late fall/early winter sampling event occurred during a wet period within a dry season, with 0.56 inches of snow recorded at the Worcester, MA weather station between December 13-16, and another 0.53 inches falling during and after the sampling event on December 17. The daily mean flow at the Blackstone River station in Woonsocket, RI is 865 cfs, although the flow at the time of sampling was approximately 199 cfs. Due to the precipitation events immediately before and during the monitoring event, the data collected reflect wet weather/runoff conditions. Air temperature ranged from 30° to 34°F and cloud cover was 100%.

March 6, 2002 - This late winter sampling event took place during a wet period, with 1.01 inches of precipitation (as rain and fog) recorded in the previous 5 days, and snow flurries falling at the first two stations. All mainstem stations were highly turbid, according to field observations. Discharge data at the time of sampling indicate storm-driven flows. Based on all available data, this event reflects wet weather conditions. Air temperature ranged from 36° to 48°F and cloud cover remained at 100% throughout the event.

April 24, 2002 - Spring monitoring occurred during a dry period, with approximately 0.04 inches of precipitation (as rain, snow and fog) falling within the previous 5 days. Field observations again indicate highly turbid conditions at all 3 mainstem stations. The discharge data do not indicate runoff flows. Based on the precipitation and discharge data, water quality during this event reflects dry weather conditions. Air temperature ranged from 50° to 60°F, and cloud cover from 0 to 90% during the event.

June 26, 2002 - Early summer conditions in 2002 were characterized by little precipitation, with 0.13 inches of rain, fog and hail falling 4 days prior to this event. Field observations at the mainstem stations indicate turbid conditions persisted. The daily mean flow at the Woonsocket, RI gage is 185 cfs; the mean of measured flows on June 26, 2002 was 345 cfs. Both the precipitation and discharge measurements indicate that data collected on this date reflect dry weather conditions. Air temperature ranged from 77° to 93°F and cloud cover was steady at 100% haze during the event.

August 28, 2002 –Late summer monitoring also took place during dry weather; 0.19 inches of rain/fog fell during the 5 days preceding the event. The daily mean flow at the Woonsocket, RI gage is 115 cfs; the mean discharge on August 28, 2002 was 76 cfs. The 7Q10 value for Woonsocket, RI is 101cfs; measured flows were well below

this value preceding the sampling event. Based on precipitation and flow data, water quality on this date reflect dry weather conditions. Air temperature ranged from 67° to 74°F and cloud cover was 100% during the event.

Sampling was not conducted at the upper Blackstone River Station, BS09C, on this date due to ongoing bridge demolition activities, and the lack of a representative, accessible site nearby.

October 30, 2002 – Sampling on this date occurred during a dry period between large rainfall events although rain fell later in the day, no precipitation occurred in the 5 days before or during the monitoring event. Precipitation and flow data reflect dry weather conditions. Air temperature ranged from 38° to 42°F under cloudy skies.

Station BS09C, on the upper Blackstone River, Worcester was permanently moved to a location approximately 550 feet upstream. There are no tributaries or pipes discharging into the river between these two points, thus these two stations represent similar river conditions, and will be considered the same station for data assessment purposes.

January 29, 2003 – Light snow fell throughout this survey; however the previous 5 days were characterized by little precipitation. Flow data do not indicate runoff conditions. At the upstream Blackstone River station in Worcester, MA, the water surface exhibited occasional slight oil slicks along the eastern side of the channel, while the water itself had a slight grayish color and a slightly septic odor. Downstream, the water column in Northbridge, MA was also grey, with an absence of odor or sheens. Based on available data, water quality on this date reflects dry weather conditions. Air temperature ranged from 23° to 34°F and cloud cover remained at 100% with light snow.

The water surface was frozen from bank to bank at two stations: the Blackstone River in Millville, MA (which is often impounded by downstream hydropower operations); and the West River in Uxbridge, MA. Samples and data were not collected at these locations on this date.

April 2, 2003 – Precipitation records indicate that the days preceding this event included periods of rain, snow and mist, but discharge records do not clearly indicate precipitation-impacted flows. Field observations made at various stations include: "river running @0.5 ft higher than 'normal'" (Blackstone River station BS09C), strong flow (BS14A, BS18A, QU02A), and "river @1.5 ft higher than normal" (WR03). Field observations made on this date, as well as the precipitation data, reflect snow melt/runoff conditions. Air temperatures ranged from 46° to 54ºF, and cloud cover remained at 100% throughout the event.

May 21, 2003 – The 5 days preceding the event, as well as the morning of the sampling, were "dry"; a drizzle to light rain fell at the last two stations sampled. Discharge data reflect dry weather flow patterns until mid-day (post sampling). Therefore, data collected on this date reflect dry weather conditions. Air temperatures ranged from 62° to 72ºF, and cloud cover was completely overcast throughout the event.

July 23, 2003 –Precipitation in the 5 days leading up to this event included rain, fog, hail and thunderstorms; intermittent showers fell at the last 2 stations sampled. Field observations indicated "thunderstorms/downpours off and on since Monday [21 July 2003] night". The water columns at the 3 Blackstone River stations were described as "highly murky", "highly turbid", and "muddy-colored". Discharge records reflect stormwater runoff flows. Therefore, data collected on this date reflect wet weather/runoff conditions. Air temperature ranged from 77° to 84ºF and the sky was overcast all day.

September 24, 2003 – On September 23rd, 1.63 inches of rain fell as a heavy, 3-hour downpour. Field observations and flow data reflect stormwater runoff conditions on this date. Air temperature ranged from 67° to 77ºF and sunny skies prevailed throughout this event.

November 20, 2003 – Precipitation measured within the 5 days prior to this event totaled 0.05 inches, with an additional 0.68 inches on the monitoring date. Snowfall in this period amounted to 9+ inches, with snow on the ground decreasing from 13 inches to 1 inch, indicating snowmelt conditions. Discharge data and field observations confirm stormwater runoff conditions. Air temperature ranged from 47° to 53ºF and skies remained overcast throughout the event.

March 3, 2004 - Little precipitation fell within the 5 day period preceding this event (0.06 inches as rain and fog on March 2, 2004). However, discharge rose consistently in this time at the Woonsocket, RI USGS gage, rising from 383 cfs on 2/27/2004 to 739 cfs on the sampling date. Discharge rose at other watershed gages as well, including the Blackstone River in Northbridge, MA, the Quinsigamond River in Grafton, MA and the West River in Uxbridge, MA. Turbidity was moderate to murky at the mainstem stations. It is likely that snow melt impacted all stations on

this day, thus water quality on this event is considered to reflect wet/runoff conditions. Air temperature ranged from 46° to 54ºF and skies ranged from 55 to 85% cloud cover throughout the event.

April 28, 2004 – This event took place during a rainy spring season; the monitoring date was preceded by 2.05 inches of rainfall between April 23 and April 28th. Field observations and discharge data indicate wet weather/runoff conditions. Air temperature ranged from 50° to 59ºF and cloud cover from less than 5 to 40%.

June 23, 2004 - This early summer event was within a relatively dry period, with approximately 0.22 inches of precipitation falling within the 5 previous days. Discharge generally decreased at the USGS flow gaging stations in the watershed, falling from 300 to 202 cfs between 6/19/2004 and 6/23/2004. Water quality on this event reflects dry weather conditions. Air temperature ranged from 70° to 80ºF and cloud cover from 40% cloud cover to clear.

August 25, 2004 – A storm system dropped 2.59 inches of rainfall on this area from August 20-21, 2004. Discharge peaked at the Woonsocket, RI gage on August 22, 2004 at 647 cfs, falling to 285 cfs on the sampling date. The water column on the mainstem ranged from slightly turbid (BS09C) to highly murky (BS14A, BS18A). Flow at the Blackstone River in Woonsocket, RI, as well as the Quinsigamond and West Rivers, was above pre-storm levels during the event. Available data indicate wet weather/runoff conditions. Air temperature ranged from 6°4 to 82ºF and cloud cover from mostly sunny to 15% cloud cover while monitoring.

October 27, 2004 – This fall sampling event took place during a dry period, with 0.02 inches of precipitation recorded between 10/22/2004 and 10/27/2004. Discharge data indicate generally decreasing flows at watershed gages during this period. Data collected on this data indicate dry weather conditions. Air temperature ranged from 48° to 62ºF and cloud cover from 40% to overcast during monitoring.

Table 2 Summary of Observations at Station BS09B and B0S09C 2000-2004

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
3/15/2000	--	Very dense	--	--	--	--	--	Moderate	Wet
5/17/2000	--	Very dense	--	Coffee	--	--	--	Highly murky	Wet
7/19/2000	--	Shopping cart	--	--	--	--	--	Highly murky	Wet
9/20/2000	--	--	--	--	--	--	--	Moderate	Wet
11/29/2000	--	--	--	--	--	--	--	Slight	Wet
3/14/2001	--	Very dense	--	--	--	--	Slight petroleum	Highly murky	Wet
4/25/2001	--	Very dense	--	--	--	--	Petroleum	--	Dry
6/27/2001	--	Floatables, shopping carts	None	Brown	Musty	None	Intermittent petroleum	Suspended solids, murky	Dry
8/22/2001	--	Very dense: floatables, tires, buckets, shopping carts	None	Green	None	None	None	Slight	Dry
11/7/2001	--	Trash	Unobservable	Brown/grey/green	None	Sparse	None	Highly cloudy	Dry
12/17/2001	--	Floatables, shopping carts	Unobservable	Grey	None	None	None	Highly cloudy	Wet
3/6/2002	--	Very dense: floatables, trash, tires, shopping carts	None	brown	None	None	None	Slight	Wet
4/24/2002	--	Trash	Unobservable	Brown/dark tan	Strong septic	None	Pollen	Highly cloudy	Dry
6/26/2002	--	Floatables, shopping carts	Unobservable	Brown	None	None	None	Slight	Dry
8/28/2002	Station not sampled on this date; area not accessible due to highway construction/relocation activities								
10/30/2002	--	Trash	Unobservable	Brown	None	Sparse	None	Slight	Dry
1/29/2003	--	Trash	Moderate: filamentous	Slight green	Slight septic	None	Intermittent petroleum	Slight	Dry
4/2/2003	--	Floatables, metals	None	Grey	Septic	Sparse	None	Slight	Wet
5/21/2003	--	Trash	None	Brown	Septic	Sparse	None	Slight	Dry
7/23/2003	Boulder, cobble, gravel, sand	Very dense: floatables, metals, silt fencing, wood	Unobservable	Grey	Slight sewage	Sparse	Slight petroleum	Suspended solids, murky	Wet
9/24/2003	Unobservable	Unobservable; floatables, metals where visible	Unobservable	Grey	Slight septic	Sparse	None	Suspended solids, murky	Wet
11/20/2003	Unobservable	Unobservable; floatables where visible	Unobservable	Chocolate brown	Sewage	Sparse	None	Suspended solids, murky	Wet
3/3/2004	Cobble/gravel	Floatables, metals	Dense: filamentous	Grey	Musty	None	None	Moderate	Wet
4/28/2004	Gravel/cobble	Floatables, metals	None	Brown	Musty, petroleum	Sparse	None	Moderate	Wet
6/23/2004	Highly embedded gravel/cobble	Floatables, metals	Very dense: filamentous	Grey	Septic/petroleum	None	None	Moderate	Dry
8/25/2004	Gravel/cobble	Floatables, metals, brick	Very dense: film	Grey	Strong effluent	Sparse	None	Slight	Wet
10/27/2004	Cobble/gravel/sand	Floatables, metals, brick	Very dense: filamentous	Grey	Strong petroleum	Sparse	Sparse	Moderate	Dry
-- : Data not available									

Table 3 Summary of Observations at Station BS14A 2000-2004

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
3/15/2000	--	--	--	--	--	--	--	--	Wet
5/17/2000	--	--	--	--	--	--	--	Slight	Dry
7/19/2000	--	--	--	--	--	Sparse	--	Highly murky	W/D
9/20/2000	--	--	--	--	--	--	--	Highly murky	Wet
11/29/2000	--	--	--	--	--	--	--	Slight	Dry
3/14/2001	--	--	--	--	Effluent, strong	--	Petroleum, "bad"	Highly murky	?
4/25/2001	--	--	--	--	Sewage, strong	--	None	Moderate	Dry
6/27/2001	--	--	Brown film	--	Sewage, strong	Sparse	Pollen	Slight	Dry
8/22/2001	--	Trash	Sparse brown film	Grey/green	Effluent, strong	--	--	Highly cloudy	Dry
11/7/2001	--	Trash	Dense brown/black film	Grey/brown	Effluent, strong	None	None	Highly cloudy	Dry
12/17/2001	--	--	None	Brown	None	None	None	Slight	Wet
3/6/2002	--	Trash	Sparse brown film	Green/brown	Septic, slight	None	None	Suspended solids, murky	?
4/24/2002	--	Trash	Dense, green/mossy, slimy/filamentous	Dark tan	Septic	None	Oily, slight	Suspended solids, murky	Dry
6/26/2002	--	Trash	Dense brown slime	Brown	Septic, strong	Sparse	None	Highly cloudy	Dry
8/28/2002	Silt	Motorcycle, carpet, pipes, wooden beams, floatables	Reddish brown floc	Brown	Septic, strong	Sparse	None	Highly cloudy	Dry
10/30/2002	Silt	Moderate	Dense slime	Dark tan	Septic	None	Oily, slight	Slight	Dry
1/29/2003	--	Trash	Dense; covered with grey material	Grey	None	None	None	Slight, suspended solids, murky	Dry
4/2/2003	Unobservable	Floatables	Unobservable	Grey	Septic, strong	None	None	Highly cloudy	W/D
5/21/2003	Unobservable	--	Rust-colored floc	Brown	Septic, strong	--	--	Suspended solids, murky	Dry
7/23/2003	Boulder, cobble, gravel, sand, silt	Floatables	Very dense	Grey	Septic, chlorine, petroleum; strong	Sparse	None	Suspended solids, murky	Wet
9/24/2003	Unobservable	Unobservable	Unobservable	Grey	Septic; strong	None	None	Suspended solids, murky	Wet
11/20/2003	Boulder, gravel, sand, silt	Trash	None	Grey	Septic, strong	None	Sheen	Slight	Wet
3/3/2004	Unobservable	Unobservable	Dense filamentous green	Grey	Effluent, strong	None	None	Highly murky	Wet
4/28/2004	Unobservable	Floatables	Unobservable	Brown	Effluent, strong	None	None	Highly murky	Wet
6/23/2004	Cobble/gravel	Unobservable	Very dense filamentous, floc	Grey	Effluent, strong	None	None	Highly murky	Dry
8/25/2004	Unobservable	Unobservable	Very dense filamentous, floc	Grey	Effluent, strong	None	None	Highly murky	Wet
10/27/2004	Highly embedded gravel/cobble	Trash	Very dense filamentous	Grey	Effluent, strong	None	None	Moderate	Dry
-- : Not noted									

Table 4 Summary of Observations at Station BS18A 2000-2004

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam
3/15/2000	--	--	--	--	--	--
5/17/2000	--	--	--	--	--	--
7/19/2000	--	--	--	--	--	Sparse
9/20/2000	--	--	--	--	--	--
11/29/2000	--	--	--	--	--	--
3/14/2001	--	--	--	--	--	--
4/25/2001	--	--	--	--	--	--
6/27/2001	--	--	--	--	--	Sparse
8/22/2001	--	--	None	Deep green	Musty	None
11/7/2001	--	None	Unobservable	Brown	Slight musty	None
12/17/2001	--	Floatables, shopping carts	Unobservable	Grey	None	None
3/6/2002	--	None	Dense: rusty brown floc	Brown	None	None
4/24/2002	--	Sunken	Unobservable	Brown	None	None
6/26/2002	--	None	Unobservable	Brown	Must	None
8/28/2002	--	Unobservable	Unobservable	Grey/brown	None	Foam
10/30/2002	--	None	Sparse: slimes on plants and rocks	Red	None	Sparse
1/29/2003	Station not sampled on this date; not accessible due to snow/ice					
4/2/2003	Unobservable	None	Unobservable	Brown	None	Foam
5/21/2003	--	None	Moderate: green filamentous	Brown	None	None
7/23/2003	Unobservable	None	Unobservable	Brown	None	None
9/24/2003	--	Unobservable	Unobservable	Brown	Musty	None
11/20/2003	Unobservable	None	Unobservable	Light brown	Musty	None
3/3/2004	Unobservable	Unobservable	Unobservable	Brown	None	None
4/28/2004	Unobservable	Trash	Unobservable	Brown	Faint petroleum/musty	None
6/23/2004	Unobservable	Unobservable	Unobservable	Light yellow/tan/brown	Musty	None
8/25/2004	Unobservable	Unobservable	Unobservable	Chocolate brown	Musty	Sparse
10/27/2004	Unobservable	Unobservable	Unobservable	Light yellow/tan	None	Sparse
-- : Data not available						

Table 5 Summary of Observations at Station QU02A 2000-2004

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
3/15/2000	--	--	--	--	--	--	--	--	Wet
5/17/2000	--	--	--	--	--	--	--	--	Wet
7/19/2000	--	--	--	--	--	--	--	--	Wet
9/20/2000	--	--	--	--	--	--	--	--	Wet
11/29/2000	--	--	--	--	--	--	--	None	Wet
3/14/2001	--	--	--	--	--	--	--	Slight	Wet
4/25/2001	--	--	--	--	--	--	--	--	Dry
6/27/2001	--	None	Moderate: brown scum	Brown	Musty	None	None	Slight	Dry
8/22/2001	--	Yard waste	None	Brown	Musty	None	None	Clear	Dry
11/7/2001	--	Granite bridge slabs	None	Clear	None	None	None	Slight	Dry
12/17/2001	--	Trash	Unobservable	Brown	None	None	None	Slight	Wet
3/6/2002	--	Sparse	None	Brown	None	Very sparse	None	Slight	Wet
4/24/2002	--	Trash	Sparse: brown mossy filamentous	Clear	None	None	Pollen	Clear	Dry
6/26/2002	--	Yard waste	Unobservable	Red	None	Very sparse	None	Clear	Dry
8/28/2002	--	Very dense: broken glass, old metal, other	None	Brown	Musty	None	Pollen	Slight	Dry
10/30/2002	--	Very dense: metals, broken glass	None	Clear	None	None	None	Clear	Dry
1/29/2003	--	Trash	None	Clear	None	None	None	Clear	Dry
4/2/2003	--	Floating garbage/trash	Unobservable	Brown	Musty	Sparse	None	Slight	Wet
5/21/2003	--	Metals, broken glass	None	Brown	Strong fishy	None	None	Slight	Dry
7/23/2003	Boulder/cobble/gravel/sand/silt	Metals, broken glass	None	Clear	Fishy	None	None	Clear	Wet
9/24/2003	Cobble/gravel/sand/silt/mud	Metals, broken glass	None	Clear	None	None	None	Clear	Wet
11/20/2003	Silt/mud	Metals, broken glass, floatables	None	Clear	None	None	None	Clear	Wet
3/3/2004	Gravel/silt/mud	Metals, broken glass, floatables	None	Clear	None	None	None	Clear	Wet
4/28/2004	Cobble/gravel/sand/silt/mud	Metals, broken glass	None	Clear	None	Sparse	None	Slight	Wet
6/23/2004	Cobble/gravel/sand/silt/mud	Metals, broken glass	None	Clear	None	None	Pollen	Clear	Dry
8/25/2004	Boulder/cobble/gravel/sand/silt/mud	Tires, metals, broken glass	None	Clear	Slight organic	None	None	Clear	Wet
10/27/2004	Cobble/gravel/sand/silt/mud	Metals, broken glass	None	Clear	None	None	None	Clear	Dry
-- : Data not available									

Table 6 Summary of Observations at Station WR03 2000-2004

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
3/15/2000	--	--	--	--	--	--	--	--	Wet
5/17/2000	--	--	Filamentous	Tannic	--	--	--	--	Wet
7/19/2000	--	--	--	--	--	--	--	--	Wet
9/20/2000	--	--	--	--	--	--	--	--	Wet
11/29/2000	--	--	--	--	--	--	--	None	Wet
3/14/2001	--	--	--	--	--	--	--	Clear	Wet
4/25/2001	--	Sparse	--	Tannic	--	--	--	Highly murky	Dry
6/27/2001	--	None	None	Brown	Musty	None	None	Slight	Dry
8/22/2001	--	None	Moderate: brown films	Brown/red/tannic	Musty	None	None	Clear	Dry
11/7/2001	--	None	Sparse: brown/black film	Brown	None	None	None	Slight	Dry
12/17/2001	--	None	None	Brown	None	None	None	Slight	Wet
3/6/2002	--	None	Sparse: brown mossy film	Brown	None	None	None	Slight	Wet
4/24/2002	--	None	Sparse: green filamentous	Clear	None	None	None	Clear	Dry
6/26/2002	--	None	Sparse: cyanobacteria	Red	None	None	None	Slight	Dry
8/28/2002	--	None	Sparse: green filamentous	--	Musty	None	None	Slight	Dry
10/30/2002	--	Sparse	Sparse: slime	Red	None	None	None	Clear	Dry
1/29/2003	Station not sampled on this date; not accessible due to snow/ice								
4/2/2003	--	None	Moderate: green filamentous	Clear	None	None	None	Clear	Wet
5/21/2003	--	None	None	--	--	None	None	Slight	Dry
7/23/2003	Gravel/sand	None	None	Slight red	None	None	None	Clear	Wet
9/24/2003	Gravel/sand/silt	Sparse: bucket	None	Clear	None	None	None	Clear	Wet
11/20/2003	Bedrock/cobble/sand/silt	None	Moderate: brown spots	Slight red	None	None	None	Clear	Wet
3/3/2004	Cobble/gravel/sand/silt	None	None	Clear	None	None	None	Slight	Wet
4/28/2004	Boulder/cobble/gravel/sand/silt	None	None	Red	None	None	None	Clear	Wet
6/23/2004	Boulder/cobble/gravel/sand/silt	None	Moderate: black film, moss	Clear	None	None	None	Clear	Dry
8/25/2004	Boulder/sand/silt	None	None	Clear	None	None	None	Clear	Wet
10/27/2004	Cobble/gravel/sand/silt/mud	None	Moderate: dark brown filamentous	Clear	None	None	None	Clear	Dry
-- : Data not available									

Table 7: Blackstone Basin Precipitation Data Summary 2000-2004 (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***
3/15/2000	0.00	1.05	0.47	0.00	0.00	0.00	Wet
5/17/2000	0.00	0.51	0.01	0.00	0.00	0.00	Wet
7/19/2000	0.00	0.45	0.57	0.01	0.11	0.00	Wet
9/20/2000	1.05	0.00	T	0.00	0.96	0.20	Wet
11/29/2000	T	0.00	0.89	T	T	0.05	Wet
3/14/2001	0.26	0.03	T	T	0.70	0.07	Wet
4/25/2001	0.00	T	T	0.00	0.04	0.00	Dry
6/27/2001	0.03	0.12	0.06	T	0.00	0.00	Dry
8/22/2001	0.07	0.01	T	T	0.00	T	Dry
11/7/2001	0.00	0.07	T	0.14	0.00	0.00	Dry
12/17/2001	0.00	0.07	0.40	0.09	0.00	0.53	Wet
3/6/2002	0.00	0.07	0.94	0.00	0.00	T	Wet
4/24/2002	0.05	T	0.00	T	0.04	0.00	Dry
6/27/2002	0.00	0.13	T	0.00	0.00	0.00	Dry
8/28/2002	T	0.19	T	0.00	0.00	0.00	Dry
10/23/2002	T	T	0.00	0.00	0.00	0.25	Dry
1/23/2003	T	0.00	T	0.05	0.00	T	Dry
4/2/2003	0.00	0.75	0.41	T	0.05	0.19	Wet
5/21/2003	0.20	T	0.17	1.73	0.01	0.20	Dry
7/23/2003	0.39	0.39	0.00	0.02	0.51	0.36	Wet
9/24/2003	0.47	0.00	0.00	0.00	1.63	0.00	Wet
11/20/2003	0.00	0.00	0.03	0.00	0.02	0.68	Wet
3/3/2004	0.00	0.00	0.00	0.00	0.06	0.00	Wet
4/28/2004	0.79	T	0.06	1.00	0.20	0.00	Wet
6/23/2004	0.02	0.20	0.00	0.00	T	0.00	Dry
8/25/2004	0.13	2.46	0.00	0.00	0.00	0.00	Wet
10/27/2004	0.01	0.00	0.00	0.01	0.00	0.00	Dry

*Unofficial data from the NOAA National Weather Service station in Worcester, MA and reported at http://www.weather.gov/climate/index.php?wfo=box (NOAA 2010)
**T= trace amount
***Based on streamflow and precipitation data.

Table 8 Discharge at the Blackstone River at Woonsocket, RI*
USGS Flow Data Summary Discharge (cfs) 2000-2004

Survey Dates	5 Days Prior	4 Days Prior	3 Days Prior	2 Days Prior	1 Day Prior	Sample Date	Monthly Mean	POR** Mean
3/15/2000	728	778	1,810	2,040	1,560	1,250	1,374	1,470
5/17/2000	1,190	1,010	1,200	1,130	959	841	1,028	879
7/19/2000	159	151	327	430	306	242	313.0	267
9/20/2000	245	339	224	176	175	348	188.3	420
11/29/2000	258	242	304	579	563	461	394.4	806
3/14/2001	628	671	724	746	1,030	1,460	2,323	1,440
4/25/2001	1,160	1,060	1,010	933	869	820	1,920	1,240
6/27/2001	1,210	980	798	678	581	529	1,015	427
8/22/2001	261	276	244	247	261	232	238.6	351
11/7/2001	183	184	167	166	182	170	157.3	566
12/17/2001	126	126	143	200	225	199	222.2	865
3/6/2002	307	286	568	865	711	582	622.3	1,320
4/24/2002	438	442	426	392	430	436	674.6	1,200
6/27/2002	495	461	431	365	345	318	699.1	427
8/28/2002	90	85	87	86	79	76	101.9	265
10/23/2002	450	370	352	332	315	303	276.6	472
1/23/2003	498	462	443	460	503	443	891.9	1,140
4/2/2003	1,980	1,690	2,790	3,670	2,790	2,240	1,740	1,750
5/21/2003	582	538	504	472	443	421	923.8	840
7/23/2003	277	353	395	304	296	824	420.4	379
9/24/2003	376	425	312	252	322	661	311.3	381
11/20/2003	690	655	616	583	559	596	732.6	606
3/3/2004	383	389	414	468	582	739	723.8	1,140
4/28/2004	1,540	1,990	1,710	1,740	2,700	2,580	2,364	1,160
6/23/2004	243	300	267	227	209	202	376.7	514
8/25/2004	218	352	647	552	370	285	267.3	297
10/27/2004	609	555	554	527	490	443	578.4	460

***Gage # 01112500 data found at Daily Data at Blackstone River, Woonsocket RI**
****POR*-Period of Record, monthly mean value based on entire 74-75 year record (10/1/1928-9/30/2004) found at Surface-Water Data Statistics for USGS 01112500 Blackstone River at Woonsocket, RI**

7Q10 = 101 cfs @ USGS gaging station, Blackstone River at Woonsocket, RI

RESULTS AND QUALITY ASSURANCE/QUALITY CONTROL

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. Ambient field blank and duplicate sample data are presented in Table 19 and Table 20, respectively. 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 (uS/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 DWM 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, *Summary of Current DWM Data Validation Procedures* (MassDEP 2004a). Specific validation criteria used for 2002 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 multiprobe 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 – relative percent difference) 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 2000-2004 Blackstone Watershed *In Situ* Multiprobe Data. Station BS09B/C

BLACKSTONE RIVER (Saris: 5131000)

Unique_ID: 687 Station: BS09B, Mile Point: 47.2

Description: Millbury Street bridge, Worcester (prior to October 2002 at old Millbury Street location approximately 350 feet downstream/south of current Blackstone River Road Bridge, see April 2001 color ortho photo).

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
3/15/2000	SM-0008	9:17	0.1i	5.3	7.0	345	221	13.1	101

Unique_ID: 680 Station: BS09C, Mile Point: 47.3

Description: Millbury Street bridge, Worcester (prior to October 2002 at old Millbury Street location approximately 350 feet downstream/south of current Blackstone River Road Bridge, see April 2001 color ortho photo).

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
5/17/2000	SM-0055	8:53	1	15.7	7.0	313	201	9.6	95
7/19/2000	SM-0102	9:11	1.2	20.6	7.1c	454	291	7.8	86
9/20/2000	SM-0150	10:02	1.3	19.6	7.0	239	153	8.6	93
11/29/2000	SM-0189	9:19	1.2	4.3	6.9	391	250	12.6	95
3/14/2001	SM-0227	9:38	0.9	2.0	6.5	1,250c	800c	13.5	97
4/25/2001	SM-0267	9:18	0.6	14.8	7.2c	433	277	10.5	101
6/27/2001	SM-0307	9:24	0.9	23.6	6.7iu	513	328	7.9i	90i
8/22/2001	SM-0347	8:53	1	21.8	7.1c	535	342	7.5i	83i
11/7/2001	SM-0387	8:53	1.1	8.2	6.9cu	448	287	11.6	97
12/17/2001	SM-0427	9:15	0.4	3.7	6.8	529	338	12.6	93
3/6/2002	SM-0466	9:10	0.9	3.3	6.9	588	376	13.3	97
4/24/2002	SM-0506	9:00	1.2	9.6	7.1 c	529	339	11.1	95
6/26/2002	SM-0546	9:00	1	21.3	7.0 c	535	342	8.3	92
10/30/2002	SM-0626	8:52	0.2	7.8	7.2 c	412	264	11.6	95
1/29/2003	SM-0666	8:50	0.1 i	0.9	6.8	692	443	13.2	94
4/2/2003	SM-0707	8:49	0.6	5.6	6.5 u	403	258	12.4	100
5/21/2003	SM-0748	8:44	0.3	16.6	7.3 cu	570	365	8.8	91
7/23/2003	SM-0789	8:51	0.4	22.4	7.0 c	463	296	7.6	89
9/24/2003	SM-0841	8:40	0.8	18.4	7.1 cu	385	250	8.9	95
11/20/2003	SM-0884	8:30	0.8	10.2	6.7	303	197	10.6	94
3/3/2004	SM-5926	9:17	0.5	4.8	7.2 c	544	354	13.6	106
4/28/2004	SM-5967	9:21	0.7	12.5	7.1 c	316	205	10.9	103
6/23/2004	SM-6008	9:13	0.3	19.0	7.2	673	438	8.4	91
8/25/2004	SM-6050	9:06	0.4	20.3	7.3	485	315	8.6	95
10/27/2004	SM-6091	9:01	0.4	9.0	7.2	431	280	11.6	101

Table 10 MassDEP SMART 2000-2004 Blackstone Watershed *In Situ* Multiprobe Data. Station BS14A

BLACKSTONE RIVER (Saris: 5131000)

Unique_ID: 506 Station: BLK07-A, Mile Point: 17.5

Description: upstream/northwest of the Sutton Street bridge, Northbridge.

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
3/15/2000	SM-0012	11:47	0.1i	7.0	7.2c	429	274	13.0	104

Unique_ID: 767 Station: BS14A, Mile Point: 34.8

Description: at USGS gage #01110500 downstream/southeast of Sutton Street bridge, Northbridge

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
5/17/2000	SM-0059	11:37	** i	16.7	6.9	412	263	9.1	92
7/19/2000	SM-0106	11:43	0.3	21.2	7.1c	491	314	8.0	88
9/20/2000	SM-0154	12:49	0.5	21.1	6.7	329	211	7.6	84
11/29/2000	SM-0193	11:54	0.4	6.4	7.1c	412	264	12.0	96
3/14/2001	SM-0231	12:54	0.4	3.8	6.9cu	1,055c	675c	13.4u	102u
4/25/2001	SM-0271	13:56	0.1i	14.9	7.6c	523	334	11.3	110
6/27/2001	SM-0311	12:21	0.6	24.8	6.9i	520	333	8.4i	99i
8/22/2001	SM-0351	11:14	0.6	23.8	7.2cu	550	352	8.6i	100
11/7/2001	SM-0391	11:42	0.4	10.2	7.0c	498	319	10.5	93
12/17/2001	SM-0431	12:29	0.3	5.0	6.9c	568	363	11.6u	88u
3/6/2002	SM-0470	12:07	0.2	4.6	7.1 c	648	415	12.9	97
4/24/2002	SM-0510	11:26	0.5	11.1	7.1 c	592	379	11.1	99
6/26/2002	SM-0550	11:42	0.5	22.8	7.1 c	553	354	9.0	103
8/28/2002	SM-0590	11:08	0.3	21.0	7.2 c	680	435	8.3	91
10/30/2002	SM-0630	11:16	0.3	9.2	6.8	504	323	11.0	94
1/29/2003	SM-0670	10:47	0.3	1.7	7.1 c	722 c	462 c	13.1	96
4/2/2003	SM-0711	11:17	0.6	7.1	6.7	496	317	12.2 u	103 u
5/21/2003	SM-0752	10:54	0.4	16.8	6.7	654	419	7.5	79
7/23/2003	SM-0793	11:07	0.2	22.5	7.0 c	504	323	7.6	89
9/24/2003	SM-0845	11:30	0.5	19.0	7.0 c	361	235	8.3	89
11/20/2003	SM-0888	10:48	0.7	10.3	7.1 c	494	321	10.7	96
3/3/2004	SM-5930	11:24	0.6	6.9	7.5 cu	600	390	13.6	112
4/28/2004	SM-5971	12:11	0.8	13.1	7.2 c	407	265	11.0	105
6/23/2004	SM-6012	12:04	0.5	21.4	7.4	625	406	9.6	108
8/25/2004	SM-6054	12:12	0.5	21.4	7.5	591	384	10.0	113
10/27/2004	SM-6095	11:25	0.6	10.1	7.3	498	324	11.3	101

Table 11 MassDEP SMART 2000-2004 Blackstone Watershed *In Situ* Multiprobe Data. Station BS18A

BLACKSTONE RIVER (Saris: 5131000)

Unique_ID: 688 Station: BS18A, Mile Point: 19.7

Description: downstream/east off Conrail railroad trestle, Millville. (center of northern channel - south off Route 122 approximately 0.5 miles southeast of the Central Street,/Route 122 intersection)

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
3/15/2000	SM-0010	10:22	0.2	6.1	6.8	302	193	12.0	94
5/17/2000	SM-0057	9:53	1.9	15.7	6.6	286	183	8.3	82
7/19/2000	SM-0104	10:18	2.2	22.2	7.0	346	221	7.4	83
9/20/2000	SM-0152	11:34	2.4	19.8	6.8	327	210	7.8	84
11/29/2000	SM-0191	10:26	1.9	4.6	6.8	309	198	12.0	91
3/14/2001	SM-0229	10:52	0.6	2.6	6.7	1,062c	680c	12.7	93
4/25/2001	SM-0269	10:28	1.2	15.7	7.0c	389	249	8.9	87
6/27/2001	SM-0309	10:33	1.8	24.0	6.6i	353	226	7.4i	86i
8/22/2001	SM-0349	9:54	1.6	23.1	6.9c	412	264	6.8i	78i
11/7/2001	SM-0389	10:04	2	8.2	6.7	415	266	9.8	82
12/17/2001	SM-0429	10:39	1.5	4.1	6.7	570	365	11.0u	82u
3/6/2002	SM-0468	10:22	1.5	3.4	6.8	467	299	12.7	93
4/24/2002	SM-0508	10:06	1.7	9.6	6.9 c	454	290	10.2	87
6/26/2002	SM-0548	10:08	1.7	22.2	6.8	405	259	7.8	88
8/28/2002	SM-0588	9:28	1.8	20.6	7.0 c	541	346	6.9	76
10/30/2002	SM-0628	9:58	1.3	7.9	6.7	406	260	10.7	88
1/29/2003	Ice Out	**	--	--	--	--	--	--	--
4/2/2003	SM-0709	9:53	2	6.2	6.4	361	231	11.5	94
5/21/2003	SM-0750	9:40	1.3	16.7	6.6	483	309	7.7	80
7/23/2003	SM-0791	9:47	2.2	22.7	6.9 c	383	245	7.1	85
9/24/2003	SM-0843	9:52	1.9 u	18.3	7.1 c	503	327	7.8	83
11/20/2003	SM-0886	9:26	1.3 u	8.8	6.9	353	230	10.8	93
3/3/2004	SM-5928	10:06	0.9	5.7	7.2 c	418	271	12.6	100
4/28/2004	SM-5969	10:25	0.5	12.7	6.9 c	288	187	10.0	94
6/23/2004	SM-6010	10:10	1.8	20.3	7.2	462	300	8.1	90
8/25/2004	SM-6052	10:19	0.4	20.4	7.2	425	276	8.0	89
10/27/2004	SM-6093	9:58	2.2	8.8	7.1	377	245	10.9	94

Table 12 MassDEP SMART 2000-2004 Blackstone Watershed *In Situ* Multiprobe Data. Station QU02A

QUINSIGAMOND RIVER (Saris: 5132425)

Unique_ID: 689 Station: QU02A, Mile Point: 3.7

Description: off upstream side of abandoned Bridge Street bridge west of Route 140, Grafton. (see 1997 ortho photo)

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
3/15/2000	SM-0013	12:21	0.6	5.7	7.1c	413	265	12.8	99
5/17/2000	SM-0060	12:12	0.7	18.0	7.2c	421	269	9.5	98
7/19/2000	SM-0107	12:12	0.7	22.7	7.0	415	265	7.8	89
9/20/2000	SM-0149	9:20	0.8	18.9	6.8	385	247	8.4	90
11/29/2000	SM-0194	12:30	0.6	3.8	7.0	365	234	12.8	95
3/14/2001	SM-0232	13:38	0.8	1.4	6.4	640	410	12.7	90
4/25/2001	SM-0272	14:38	0.7	16.8	7.3c	558	357	9.3	94
6/27/2001	SM-0312	12:58	0.5	27.6	6.8i	511	327	7.2i	88i
8/22/2001	SM-0352	11:51	0.7	24.1	7.0c	510	327	7.5i	87
11/7/2001	SM-0392	12:14	0.3	6.9u	6.6	552	353	7.1	57
12/17/2001	SM-0432	13:16	0.4	3.6	7.0c	575u	368u	12.5	92
3/6/2002	SM-0471	12:45	0.5	3.2	7.1 c	614	393	13.1	96
4/24/2002	SM-0511	12:00	0.6	11.1	7.2 c	604	387	10.6	94
6/26/2002	SM-0551	12:23	0.6	24.9	6.9 c	590	378	7.4	88
8/28/2002	SM-0591	11:43	0.1 i	17.6	7.0 c	724 c	463 c	7.8	81
10/30/2002	SM-0631	11:49	0.3	7.8	6.9 c	504	323	11.5	95
1/29/2003	SM-0671	11:24	0.3	1.4	6.6 u	684 u	438 u	13.3 u	96 u
4/2/2003	SM-0712	11:50	1	5.9	6.7	597	382	11.9	97
5/21/2003	SM-0753	11:24	0.3	19.5	6.9 c	691	442	8.4	93
7/23/2003	SM-0794	11:41	0.2	24.2	6.9 c	521 u	334 u	7.3	89
9/24/2003	SM-0846	12:03	0.6	19.3	7.0 c	487	316	8.4	91
11/20/2003	SM-0889	11:21	0.7	8.4	7.2 c	543	353	11.7	100
3/3/2004	SM-5931	11:55	0.6	5.7	7.4 c	544	353	13.0	104
4/28/2004	SM-5972	12:48	0.7	13.8	7.3 c	556	361	10.8	104
6/23/2004	SM-6013	12:35	0.6	22.8	7.3	566	368	8.0	93
8/25/2004	SM-6055	12:56	0.5	23.1	7.1	533	346	8.0	94
10/27/2004	SM-6096	11:57	0.6	9.0	7.3	518	337	11.7	102

Table 13 MassDEP SMART 2000-2004 Blackstone Watershed *In Situ* Multiprobe Data. Station WR03

WEST RIVER (Saris: 5131800)

Unique_ID: 515 Station: WR03, Mile Point: 3.3

Description: upstream/north, of East Hartford Street bridge, Uxbridge.

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
3/15/2000	SM-0011	11:00	0.6	5.3	5.9	165	106	11.7	90
5/17/2000	SM-0058	10:44	0.3	15.5	6.2	180	115	9.0	88
7/19/2000	SM-0105	11:01	0.4	21.1	6.3	198	127	5.6	62
9/20/2000	SM-0153	12:13	0.5u	19.2	6.3	324	207	7.5	81
11/29/2000	SM-0192	11:06	0.3	2.9	6.2	229	147	11.5	84
3/14/2001	SM-0230	11:59	0.5	0.5	5.7	326	209	11.8	82
4/25/2001	SM-0270	11:30	0.4	15.2	6.3	238	152	7.2	70
6/27/2001	SM-0310	11:34	0.3	23.5	6.0i	210	135	4.9i	56i
8/22/2001	SM-0350	10:37	0.6	22.7u	6.4	246	157	5.9i	67
11/7/2001	SM-0390	10:45	0.1i	7.4u	6.5	243	155	10.4	86
12/17/2001	SM-0430	11:30	0.1i	2.1	6.3	316	202	11.8u	83u
3/6/2002	SM-0469	11:11	0.3	2.4	6.2	268	172	12.6	90
4/24/2002	SM-0509	10:49	0.4	9.1	6.5	293	188	10.8	91
6/26/2002	SM-0549	11:00	0.4	22.0	6.3	243	155	7.3	82
8/28/2002	SM-0589	10:20	0.1 i	20.7	6.7	249	159	6.8	74
10/30/2002	SM-0629	10:43	0.2	6.2	6.1	313	201	10.0	79
1/29/2003	Ice Out	**	--	--	--	--	--	--	--
4/2/2003	SM-0710	10:40	0.7	8.2	5.5	184	117	10.4	90
5/21/2003	SM-0751	10:22	0.3	16.8	6.3	280	179	8.3	87
7/23/2003	SM-0792	10:31	0.4	21.8	6.0	230	147	2.3 u	27 u
9/24/2003	SM-0844	10:40	0.8	16.8	6.4	244	159	5.3	55
11/20/2003	SM-0887	10:16	0.8	8.5	6.5 u	249	162	9.7	83
3/3/2004	SM-5929	10:48	1	3.1	6.8 u	239	155	11.6	86
4/28/2004	SM-5970	11:25	1	13.1	6.2	179	116	8.2	78
6/23/2004	SM-6011	11:17	0.4	20.5	6.7	253	164	7.6	85
8/25/2004	SM-6053	11:21	0.4	20.0	6.6	257	167	6.2	68
10/27/2004	SM-6094	10:45	0.8	7.5	6.5	250	163	9.5	80

Table 14: MassDEP SMART 2000-2004. Blackstone Watershed Nutrients, Chlorides, Hardness, Total Alkalinity, Total Suspended Solids and Turbidity Data. Station BS09B/C.

BLACKSTONE RIVER (Saris: 5131000)

Unique_ID: 687 Station: BS09B, Mile Point: 47.2

Description: downstream/south at the old Millbury Street bridge location (removed in 2002, the old bridge was approximately 350 feet downstream of the Blackstone River Road Bridge, Worcester; see April 2001 color ortho).

Date	OWMID	QAQC	Time	Alkalinity	Hardness	Chloride	SSolids	Turb	TKN	TN	NH3-N	NO3-NO2-N	TPhos
			(24hr)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
3/15/2000	SM-0008	SM-0009	9:17	22	50	77	1.9	3.3	0.24	--	<0.02	0.56	0.033
3/15/2000	SM-0009	SM-0008	9:22	21	49	76	2.1	3.1	0.24	--	<0.02	0.58	0.029

BLACKSTONE RIVER (Saris: 5131000)

Unique_ID: 680 Station: BS09C, Mile Point: 47.3

Description: Blackstone River Bridge, Worcester (prior to October 2002 at Millbury Street location approximately 350 feet downstream/south of current bridge; see April 2001 color ortho photo).

Date	OWMID	QAQC	Time	Alkalinity	Hardness	Chloride	SSolids	Turb	TKN	TN	NH3-N	NO3-NO2-N	TPhos
			(24hr)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
5/17/2000	SM-0055	SM-0056	8:53	25	46	63	3.1	2.2	0.47	--	0.05	0.38	0.046
5/17/2000	SM-0056	SM-0055	8:58	25	47	62	3.2	2.3	0.47	--	0.05	0.4	0.044
7/19/2000	SM-0102	SM-0103	9:11	38	70	105 b	5.9	6	0.73	--	0.11	0.43	0.088
7/19/2000	SM-0103	SM-0102	9:16	38	71	95 b	6.1	6	0.74	--	0.09	0.45	0.091
9/20/2000	SM-0150	SM-0151	10:02	17	31	53	9.9	5.9	0.54	--	0.11	0.32	0.094
9/20/2000	SM-0151	SM-0150	10:07	20	31	54	9.7	6	0.61	--	0.11	0.32	0.095
11/29/2000	SM-0189	SM-0190	9:19	26	51	87	1.9	3.2	0.38	--	0.11d	0.36	0.044
11/29/2000	SM-0190	SM-0189	9:24	27	50	87	2	3.2	0.37	--	0.07d	0.35	0.042
3/14/2001	SM-0227	SM-0228	9:39	21m	69m	350m	8.1m	11m	0.91m	--	0.20m	0.68m	0.062m
3/14/2001	SM-0228	SM-0227	9:44	21m	69m	340m	10m	9.5m	0.83m	--	0.16m	0.65m	0.056m
4/25/2001	SM-0267	SM-0268	9:18	25m	62m	97m	3.5m	2.9m	0.42m	--	<0.02m	0.50m	0.038m
4/25/2001	SM-0268	SM-0267	9:23	24m	63m	97m	3.5m	2.9m	0.41m	--	<0.02m	0.50m	0.040m
6/27/2001	SM-0308	SM-0307	**	37m	72m	110m	3.2m	3.0m	0.59m	--	0.26bdm	0.49m	0.075m
6/27/2001	SM-0307	SM-0308	9:15	37m	72m	110m	3.8m	2.9m	0.64m	--	0.38bdm	0.52m	0.074m
8/22/2001	SM-0348	SM-0347	**	56m	89m	120m	1.9m	2.9m	0.44m	--	##dm	0.53m	0.053m
8/22/2001	SM-0347	SM-0348	8:50	56m	89m	130m	2.2m	2.9m	0.43m	--	##dm	0.53m	0.054m
11/7/2001	SM-0388	SM-0387	**	27m	59m	100m	##dm	4.0m	0.63m	--	##dm	0.09m	0.050m
11/7/2001	SM-0387	SM-0388	8:50	26m	59m	100m	##m	4.1m	0.61m	--	##dm	0.11dm	0.053m
12/17/2001	SM-0428	SM-0427	**	30hm	63m	130m	5.1m	3.8m	0.57m	--	0.12m	0.37m	0.13dm
12/17/2001	SM-0427	SM-0428	9:00	30hm	59m	120m	4.7m	4.2m	0.56m	--	0.12m	0.38m	0.092dm

Table 14 continued. MassDEP SMART 2000-2004 Blackstone Watershed Nutrients, Chlorides, Hardness, Total Alkalinity, Total Suspended Solids and Turbidity Data. Station BS09B/C.

Date	OWMID	QAQC	Time	Alkalinity	Hardness	Chloride	SSolids	Turb	TKN	TN	NH3-N	NO3-NO2-N	TPhos
			(24hr)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
3/6/2002	SM-0466	SM-0467	9:00	22 m	59 m	150 m	2.4 m	3.6 m	0.41 m	--	<0.02 m	0.40 m	0.046 m
3/6/2002	SM-0467	SM-0466	9:00	22 m	60 m	150 m	2.1 m	3.7 m	0.39 m	--	<0.02 m	0.39 m	0.041 m
4/24/2002	SM-0506	SM-0507	8:50	35	82	130	3.3	3.1	0.54	--	0.12	0.42	0.048
4/24/2002	SM-0507	SM-0506	8:50	36	82	130	3.3	3.2	0.55	--	0.1	0.4	0.04
6/26/2002	SM-0546	SM-0547	8:50	37 m	79 m	120 m	4.1 m	3.1 m	0.49 m	--	0.06 m	0.56 m	0.031 dm
6/26/2002	SM-0547	SM-0546	8:50	36 m	79 m	120 m	4.0 m	3.1 m	0.48 m	--	0.06 m	0.54 m	0.058 dm
10/30/2002	SM-0626	SM-0627	8:50	29	61	92	1.5	2.4	0.51	--	0.06	0.38	0.037
10/30/2002	SM-0627	SM-0626	8:50	27	62	92	1.5	2.6	0.49	--	0.07	0.35	0.036
1/29/2003	SM-0666	SM-0667	8:45	36	88	170	1.7	2.8	0.5	--	0.22	1	0.028
1/29/2003	SM-0667	SM-0666	8:45	36	88	170	1.8	3	0.52	--	0.16	0.98	0.029
4/2/2003	SM-0707	SM-0708	8:50	17	50	95	2	2.1	0.37	--	<0.06	0.61	0.028
4/2/2003	SM-0708	SM-0707	8:50	17	50	94	2.2	2.2	0.34	--	<0.06	0.62	0.028
5/21/2003	SM-0748	SM-0749	8:45	33	82	130	4.1	2.8	0.53 b	--	<0.06	0.51	0.044
5/21/2003	SM-0749	SM-0748	8:45	32	81	130	4.3	2.6	0.51 b	--	<0.06	0.5	0.05
7/23/2003	SM-0789	SM-0790	8:45	27	62	100	6.6	7.5 b	0.57	--	0.09	0.53	0.079
7/23/2003	SM-0790	SM-0789	8:45	29	62	100	7	7.5 b	0.59	--	0.08	0.5	0.085
9/24/2003	SM-0841	SM-0842	8:40	27	52	86	12	12 b	--	## h	## bh	0.22 h	0.084 h
9/24/2003	SM-0842	SM-0841	8:40	27	51	84	13	12 b	--	## h	## bh	0.20 h	0.082 h
11/20/2003	SM-0884	SM-0885	8:30	22	37	66	37 h	17	--	## bh	0.29	0.36	0.33
11/20/2003	SM-0885	SM-0884	8:30	22	41	68	34 h	16	--	## bh	0.2	0.35	0.33
3/3/2004	SM-0926	SM-0927	8:55	--	--	--	--	6.0*	--	1.1 dj	0.04 j	0.62 j	0.07
3/3/2004	SM-0927	SM-0926	8:55	--	--	--	--	6.1*	--	0.93 dj	<0.04 j	0.51 j	0.064
4/28/2004	SM-0967	SM-0968	9:05	--	--	--	--	4.4*	--	0.77 j	<0.01	0.45 j	0.045 j
4/28/2004	SM-0968	SM-0967	9:05	--	--	--	--	4.5*	--	0.77 j	<0.01	0.45 j	0.043 j
6/23/2004	SM-1008	SM-1009	8:50	--	--	--	--	6.2*	--	1.2 dj	0.05 j	0.70 dj	0.06
6/23/2004	SM-1009	SM-1008	8:50	--	--	--	--	6.2*	--	1.0 dj	0.04 j	0.56 dj	0.056
8/25/2004	SM-1050	SM-1051	9:00	34	74	110	3.8	4.1	--	0.9	0.04	0.39	0.057
8/25/2004	SM-1051	SM-1050	9:00	35	73	110	3.7	3.9	--	0.89	0.04	0.4	0.053
10/27/2004	SM-1091	SM-1092	8:50	30	65	93	2.3	3	--	0.79	0.09 hj	0.44	0.042
10/27/2004	SM-1092	SM-1091	8:50	32	70	85	2.1	3.2	--	0.8	0.09 hj	0.44	0.042

Table 15 MassDEP SMART 2000-2004 Blackstone Watershed Nutrients, Chlorides, Hardness, Total Alkalinity, Total Suspended Solids and Turbidity Data. Station BS14A.

BLACKSTONE RIVER (Saris: 5131000)
Unique_ID: 506 Station: BLK07-A (BS14A), Mile Point: 17.5
Description: upstream/northwest of the Sutton Street bridge, Northbridge.

Date	OWMID	QAQC	Time	Alkalinity	Hardness	Chloride	SSolids	Turb	TKN	TN	NH3-N	NO3-NO2-N	TPhos
			(24hr)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
3/15/2000	SM-0012		11:47	31	55	93	4.4	2.9	1.7	--	1.5	0.83	0.3

BLACKSTONE RIVER (Saris: 5131000)

Unique_ID: 767 Station: BS14A, Mile Point: 34.8

Description: at USGS gage #01110500 downstream/southeast of Sutton Street bridge, Northbridge

Date	OWMID	QAQC	Time	Alkalinity	Hardness	Chloride	SSolids	Turb	TKN	TN	NH3-N	NO3-NO2-N	TPhos
			(24hr)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
5/17/2000	SM-0059		11:37	31	50	82	26	3	2	--	1.7	1.2	0.45
7/19/2000	SM-0106		11:43	35	67	105 b	12	5.4	0.88	--	0.1	2	0.49
9/20/2000	SM-0154		12:49	21	37	56	40	9.7	1.9	--	0.69	1.7	0.77
11/29/2000	SM-0193		11:54	29	51	82	3.2	3.1	1.5	--	1.1	1.8	0.5
3/14/2001	SM-0231	--	12:54	27	66	280	16	9.6	2.7	--	1.8	0.68	0.38
4/25/2001	SM-0271	--	13:56	30	64	110	6.5	2.6	2.1	--	1.7	0.76	0.22
6/27/2001	SM-0311	--	12:10	27	63	110	8.9	5.2	1	--	0.35b	2.2	0.41
8/22/2001	SM-0351	--	11:10	35	70	110	6.7	3.3	0.69	--	<0.02	2.8	0.44
11/7/2001	SM-0391	--	11:35	32	61	98	5.3	2.9	##h	--	0.84	3.4	0.29
12/17/2001	SM-0431	--	12:25	32h	59	120	5.2	3.4	2.2	--	1.5	3.9	0.54
3/6/2002	SM-0470	--	12:00	28	64	160	15	--	1.7	--	1.4	1.5	0.39
4/24/2002	SM-0510	--	11:25	30	77	140	6.2	3	1.2	--	0.76	2.4	0.33
6/26/2002	SM-0550	--	11:35	28	71	120	6	3.1	0.66	--	<0.06	2.4	0.24 d
8/28/2002	SM-0587	SM-0590	11:00	35	84 d	140	7.4	4.8	1.4	--	0.14	7	1.8
8/28/2002	SM-0590	SM-0587	11:00	36	102 d	130	7.5	4	1.4	--	0.12	7	1.8
10/30/2002	SM-0630	--	11:15	30	65	75	3	2	1.6	--	1	2	0.33
1/29/2003	SM-0670	--	10:40	52	82	170	7	3.6	4.6	--	4.6	1.2	0.26
4/2/2003	SM-0711	--	11:15	20	57	120	3.3	2	1.3	--	0.8	0.79	0.13
5/21/2003	SM-0752	--	10:55	34	79	150	40	3.8	2.4 b	--	1.7	2.1	0.58
7/23/2003	SM-0793	--	11:05	22	61	110	14	7.2 b	1.2	--	0.21	1.9	0.35
9/24/2003	SM-0845	--	11:30	21	44	72	28	23 b	--	## h	## bh	1.1 h	0.46 h
11/20/2003	SM-0888	--	10:50	29	60	110	7.1 h	2.5	--	## bh	0.66	2.2	0.36
3/3/2004	SM-0930	--	11:15	--	--	--	--	8.0*	--	4.1 j	2.4 j	1.0 j	0.5
4/28/2004	SM-0971	--	11:55	--	--	--	--	7.5*	--	1.9 j	0.46	0.61 j	0.18 j
6/23/2004	SM-1012	--	11:55	--	--	--	--	4.2*	--	3.5 j	0.06 j	2.4 j	0.48
8/25/2004	SM-1054	--	12:05	34	77	130	7.5	3.8	--	3.7	0.12	2.9	0.34
10/27/2004	SM-1095	--	11:20	33	72	98	2.2	2	--	2.9	0.48 hj	2.1	0.27

Table 16 MassDEP SMART 2000-2004 Blackstone Watershed Nutrients, Chlorides, Hardness, Total Alkalinity, Total Suspended Solids and Turbidity Data. Station BS18A.

BLACKSTONE RIVER (Saris: 5131000)

Unique_ID: 688 Station: BS18A, Mile Point: 19.7

Description: downstream/east off Conrail railroad trestle, Millville (center of northern channel - south off Rte 122 approximately 0.5 miles southeast of the Central Street,/Route 122 intersection)

Date	OWMID	QAQC	Time	Alkalinity	Hardness	Chloride	SSolids	Turb	TKN	TN	NH3-N	NO3-NO2-N	TPhos
			(24hr)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
3/15/2000	SM-0010		10:22	15	39	66	3.5	2.6	0.76	--	0.5	0.71	0.1
5/17/2000	SM-0057		9:53	17	36	59	5.7	2.5	0.87	--	0.2	1.1	0.19
7/19/2000	SM-0104		10:18	25	47	70 b	5.7	3.2	0.61	--	<0.02	1.2	0.23
9/20/2000	SM-0152		11:34	20	39	64	6.5	2.6	0.58	--	0.06	2.2	0.26
11/29/2000	SM-0191		10:26	18	37	65	3.7	3	0.77	--	0.34	1.3	0.29
3/14/2001	SM-0229	--	10:52	22m	55m	280m	11m	7.5m	2.4m	--	1.8m	0.71m	0.22m
4/25/2001	SM-0269	--	10:28	18m	47m	85m	4.9m	2.2m	1.0m	--	0.52m	0.85m	0.15m
6/27/2001	SM-0309	--	10:20	17m	43m	73m	7.8m	5.6m	0.61m	--	0.23bm	1.3m	0.35m
8/22/2001	SM-0349	--	9:55	26m	51m	88m	6.0m	2.9m	0.55m	--	<0.02m	2.2m	0.19m
11/7/2001	SM-0389	--	9:55	26m	54m	83m	3.4m	2.2m	0.95m	--	0.32m	2.9m	0.31m
12/17/2001	SM-0429	--	10:25	27hm	51m	130m	5.3m	3.9m	1.5m	--	0.92m	2.8m	0.68m
3/6/2002	SM-0468	--	10:15	18 m	46 m	110 m	3.7 m	3.0 m	0.82 m	--	0.45 m	1.0 m	0.21 m
4/24/2002	SM-0508	--	10:00	19 m	58 m	100 m	3.2 m	2.6 m	0.82 m	--	0.30 m	2.0 m	0.18 m
6/26/2002	SM-0548	--	10:05	20 m	51 m	91 m	5.8 m	3.2 m	0.50 m	--	<0.02 m	1.5 m	0.17 dm
8/28/2002	SM-0588	--	9:25	33 m	66 m	100 m	3.4 m	2.6 m	0.90 m	--	<0.06 m	4.1 m	0.31 m
10/30/2002	SM-0628	--	9:55	22 m	52 m	85 m	6.7 m	4.3 m	0.88 m	--	0.30 m	1.6 m	0.26 m
1/29/2003	Ice Out	--	**	--	--	--	--	--	--	--	--	--	--
4/2/2003	SM-0709	--	9:50	14 m	41 m	84 m	4.3 m	1.7 m	0.88 m	--	0.52 m	0.67 m	0.096 m
5/21/2003	SM-0750	--	9:40	19 m	58 m	110 m	4.3 m	2.7 m	0.82 bm	--	0.19 m	2.0 m	0.23 m
7/23/2003	SM-0791	--	9:45	18 m	46 m	78 m	21 m	11 bm	0.69 m	--	<0.06 m	1.3 m	0.27 m
9/24/2003	SM-0843	--	9:32	27 m	61 m	110 m	65 m	15 bm	--	## hm	## bhm	2.6 hm	0.89 hm
11/20/2003	SM-0886	--	9:30	19 m	43 m	77 m	4.3 hm	2.5 m	--	## bhm	0.19 m	1.5 m	0.17 m
3/3/2004	SM-0928	--	10:05	--	--	--	--	6.0* m	--	2.6 jm	1.1 jm	1.00 jm	0.19 m
4/28/2004	SM-0969	--	10:15	--	--	--	--	5.1* m	--	1.3 jm	0.17 m	0.58 jm	0.095 jm
6/23/2004	SM-1010	--	10:07	--	--	--	--	3.1* m	--	2.3 jm	<0.01 jm	1.7 jm	0.18 m
8/25/2004	SM-1052	--	10:10	26 m	56 m	93 m	6.2 m	3.7 m	--	1.9 m	<0.01 m	1.5 m	0.22 m
10/27/2004	SM-1093	--	9:55	23 m	52 m	73 m	2.9 m	2.7 m	--	2.3 m	0.26 hjm	1.6 m	0.27 m

Table 17 MassDEP SMART 2000-2004 Blackstone Watershed Nutrients, Chlorides, Hardness, Total Alkalinity, Total Suspended Solids and Turbidity Data. Station QU02A.

QUINSIGAMOND RIVER (Saris: 5132425)

Unique_ID: 689 Station: QU02A, Mile Point: 3.7

Description: off upstream side of abandoned Bridge Street bridge west of Route 140, Grafton. (see 1997 ortho photo)

Date	OWMID	QAQC	Time	Alkalinity	Hardness	Chloride	SSolids	Turb	TKN	TN	NH3-N	NO3-NO2-N	TPhos
			(24hr)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
3/15/2000	SM-0013		12:21	22	53	98	1.3	1.5	0.27	--	0.03	0.31	0.014
5/17/2000	SM-0060		12:12	22	49	97	1.7	1.1	0.5	--	0.04	0.24	0.021
7/19/2000	SM-0107		12:12	23	53	100 b	<1.0	0.65	0.43	--	<0.02	0.1	0.039
9/20/2000	SM-0149		9:20	25	48	80	1.8	0.94	0.42	--	0.02	<0.02	0.021
11/29/2000	SM-0194		12:30	24	49	84	<1.0	0.88	0.35	--	0.05	0.12	0.019
3/14/2001	SM-0232	--	13:38	24m	65m	170m	1.2m	1.9m	0.81m	--	0.14m	0.37m	0.017m
4/25/2001	SM-0272	--	14:38	22m	62m	130m	2.6m	1.8m	0.67m	--	<0.02m	0.26m	0.025m
6/27/2001	SM-0312	--	12:50	23m	58m	120m	<1.0m	1.3m	0.56m	--	0.25bm	<0.06m	0.032m
8/22/2001	SM-0352	--	11:35	27m	63m	130m	<1.0m	0.45m	0.32m	--	<0.02m	<0.06m	0.017m
11/7/2001	SM-0392	--	12:05	33m	76m	130m	<1.0m	5.1m	0.29m	--	<0.02m	0.06m	0.012m
12/17/2001	SM-0432	--	13:05	36hm	69m	130m	1.4m	1.1m	0.41m	--	<0.02m	0.06m	0.033m
3/6/2002	SM-0471	--	12:35	22 m	61 m	160 m	2.0 m	1.7 m	0.33 m	--	<0.02 m	0.12 m	0.018 m
4/24/2002	SM-0511	--	11:55	26	72	150	1	1.4	0.59	--	<0.06	<0.06	0.016
6/26/2002	SM-0551	--	12:10	25 m	67 m	150 m	<1.0 m	0.70 m	0.46 m	--	<0.06 m	0.06 m	0.020 dm
8/28/2002	SM-0591	--	11:55	38	102	180	86	0.7	1.2	--	<0.06	0.43	0.28
10/30/2002	SM-0631	--	11:45	23	63	120	1.4	1.6	0.57	--	<0.02	<0.06	0.018
1/29/2003	SM-0671	--	11:20	31 m	81 m	180 m	2.7 m	1.4 m	0.54 m	--	0.19 m	0.40 m	0.015 m
4/2/2003	SM-0712	--	11:50	18 m	67 m	150 m	1.8 m	1.8 m	0.50 m	--	0.09 m	0.47 m	0.021 m
5/21/2003	SM-0753	--	11:25	24	74	180	2.6	1.8	0.62 b	--	<0.06	0.16	0.026
7/23/2003	SM-0794	--	11:35	19	61	110	1.5	## bh	0.44	--	<0.06	0.11	0.025
9/24/2003	SM-0846	--	12:05	22	60	110	1.5	1.2 b	--	## h	## bh	<0.06 h	0.021 h
11/20/2003	SM-0889	--	11:20	24	65	140	1.1 h	0.8	--	## bh	<0.02	0.22	0.022
3/3/2004	SM-0931	--	11:45	--	--	--	--	1.6*	--	0.71 j	0.04 j	0.34 j	0.028
4/28/2004	SM-0972	--	12:30	--	--	--	--	1.8*	--	0.74 j	<0.01	0.40 j	0.023 j
6/23/2004	SM-1013	--	12:25	--	--	--	--	1.2*	--	0.36 j	<0.01 j	0.06 j	0.019
8/25/2004	SM-1055	--	12:40	26	69	130	<1.0	0.51	--	0.28	<0.01	0.08	0.015
10/27/2004	SM-1096	--	11:52	24	70	120	<1.0	0.43	--	0.29	<0.06 hj	0.1	0.01

Table 18 MassDEP SMART 2000-2004 Blackstone Watershed Nutrients, Chlorides, Hardness, Total Alkalinity, Total Suspended Solids and Turbidity. Station WR03.

WEST RIVER (Saris: 5131800)

Unique_ID: 515 Station: WR03, Mile Point: 3.3

Description: upstream/north, of East Hartford Street bridge, Uxbridge.

Date	OWMID	QAQC	Time	Alkalinity	Hardness	Chloride	SSolids	Turb	TKN	TN	NH3-N	NO3-NO2-N	TPhos
			(24hr)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
3/15/2000	SM-0011		11:04	3	19	39	<1.0	0.65	0.22	--	<0.02	0.17	0.013
5/17/2000	SM-0058		10:44	7	19	41	2.6	1.3	0.39	--	<0.02	0.14	0.032
7/19/2000	SM-0105		11:01	13	23	45 b	<1.0	0.9	0.36	--	<0.02	0.2	0.039
9/20/2000	SM-0153		12:13	15	26	73	<1.0	1	0.39	--	<0.02	0.81	0.026
11/29/2000	SM-0192		11:06	7	22	56	1.2	1.2	0.34	--	0.02	0.32	0.031
3/14/2001	SM-0230	--	12:00	4	26	88	1.4	1.8	0.35	--	<0.02	0.44	0.022
4/25/2001	SM-0270	--	11:30	7	23	57	3	1.4	0.33	--	<0.02	0.16	0.034
6/27/2001	SM-0310	--	11:25	9	22	45	2.1	2.6	0.62	--	0.45b	0.17	0.074
8/22/2001	SM-0350	--	10:30	13	26	65	1	1	0.34	--	<0.02	0.24	0.035
11/7/2001	SM-0390	--	10:35	19	28	53	1.4	2.1	0.22	--	<0.02	0.53	0.025
12/17/2001	SM-0430	--	11:25	14h	29	74	1.7	1.7	0.34	--	<0.02	1.1	0.035
3/6/2002	SM-0469	--	11:00	4 m	26 m	66 m	1.0 m	1.0 m	0.35 m	--	<0.02 m	0.27 m	0.025 m
4/24/2002	SM-0509	--	10:45	7	29	74	1.8	1.3	0.36	--	<0.02	0.23	0.021
6/26/2002	SM-0549	--	10:55	11	24	57	2	2.1	0.49	--	<0.06	0.25	0.045 d
8/28/2002	SM-0589	--	10:20	18	25	58	<1.0	1.3	0.38	--	<0.02	<0.06	0.028
10/30/2002	SM-0629	--	10:40	8	33	75	<1.0	1.2	0.42	--	<0.02	0.27	0.021
1/29/2003	Ice Out	--	**	--	--	--	--	--	--	--	--	--	--
4/2/2003	SM-0710	--	10:35	3	18	44	<1.0	0.46	0.31	--	<0.02	0.22	0.015
5/21/2003	SM-0751	--	10:20	9	28	68	3	2.1	0.40 b	--	0.08	0.26	0.036
7/23/2003	SM-0792	--	10:30	8	21	100	1.5	## bh	0.54	--	<0.02	0.1	0.055
9/24/2003	SM-0844	--	10:45	16	26	54	1.9	1.6 b	--	## h	## bh	0.18 h	0.026 h
11/20/2003	SM-0887	--	10:15	10	26	60	1.5 h	1.7	--	## bh	0.12	0.41	0.029
3/3/2004	SM-0929	--	10:40	--	--	--	--	2.3*	--	0.68 j	0.08 j	0.37 j	0.031
4/28/2004	SM-0970	--	11:05	--	--	--	--	1.1*	--	0.45 j	<0.01	0.13 j	0.022 j
6/23/2004	SM-1011	--	11:05	--	--	--	--	4.0*	--	0.62 j	<0.03 j	0.28 j	0.03
8/25/2004	SM-1053	--	11:10	15	27	59	<1.0	1.4	--	0.59	<0.01	0.14	0.035
10/27/2004	SM-1094	--	10:38	13	30	55	1.3	1.7	--	0.63	<0.06 hj	0.31	0.021

Table 19 MassDEP SMART 2000-2004. Blackstone Watershed Ambient Field Blanks.

SMART Monitoring: Blackstone, 2000

Field Blank Sample/Field Blank Sample (Palis: 00000)

Unique_ID: -8 Station: BLANK

Description: QAQC: Field Blank Sample

Date	OWMID	QAQC	Time	Alkalinity	Hardness	Chloride	SSolids	Turb	TKN	TN	NH3-N	NO3-NO2-N	TPhos
			24hr	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
3/15/2000	SM-0014	BLANK	12:26	<2	<0.66	<1.0	<1.0	<0.1	<0.10	--	<0.02	<0.02	<0.005
5/17/2000	SM-0061	BLANK	12:17	<2	<0.66	<1.0	<1.0	<0.1	0.11b	--	<0.02	<0.02	<0.010
7/19/2000	SM-0108	BLANK	12:17	<2	<0.66	2.0b	<1.0	<0.1	<0.10	--	<0.02	<0.02	<0.010
9/20/2000	SM-0155	BLANK	12:54	<2	<0.66	<1.0	<1.0	<0.1	<0.10	--	<0.02	<0.02	<0.010
11/29/2000	SM-0195	BLANK	12:35	<2	<0.66	<1.0	<1.0	<0.1	<0.10	--	<0.02	<0.02	<0.010
3/14/2001	SM-0233	Blank	13:43	<2	<0.66	<1	<1.0	<0.10	<0.10	--	<0.02	<0.06	<0.010
4/25/2001	SM-0273	Blank	14:43	<2	<0.66	<1	<1.0	<0.10	<0.10	--	<0.02	<0.06	<0.010
6/27/2001	SM-0313	Blank	**	<2	<0.66	<1	<1.0	<0.10	<0.10	--	0.18b	<0.06	<0.005
8/22/2001	SM-0353	Blank	**	<2	<0.66	<1	<1.0	<0.10	<0.10	--	<0.02	<0.06	<0.005
11/7/2001	SM-0393	Blank	**	<2	<0.66	<1	<1.0	<0.10	<0.10	--	<0.02	<0.06	<0.005
12/17/2001	SM-0433	Blank	**	<2.0h	<0.66	<1.0	<1.0	<0.10	<0.10	--	<0.02	<0.06	<0.005
3/6/2002	SM-0472	Blank	12:25j	<2.0	<0.66	<1.0	<1.0	<0.10	<0.10	--	<0.02	<0.02	<0.005
4/24/2002	SM-0512	Blank	11:50j	<2.0	<0.66	<1.0	<1.0	<0.10	<0.10	--	<0.02	<0.02	<0.005
6/26/2002	SM-0552	Blank	12:00j	<2.0	<0.66	<1.0	<1.0	<0.10	<0.10	--	<0.02	<0.02	<0.005 d
8/28/2002	SM-0592	Blank	11:55j	<2.0	<0.66	<1.0	<1.0	<0.10	<0.10	--	<0.02	<0.06	<0.005
10/30/2002	SM-0632	Blank	11:35j	<2.0	<0.66	<1.0	<1.0	<0.10	<0.10	--	<0.02	<0.02	<0.005
1/29/2003	SM-0672	Blank	10:30j	<2	<0.66	<1	<1.0	<0.10	<0.10	--	<0.02	<0.02	<0.005
4/2/2003	SM-0713	Blank	11:40j	<2	<0.66	<1	<1.0	<0.10	<0.10	--	<0.02	<0.02	<0.005
5/21/2003	SM-0754	Blank	11:15j	<2	<0.66	<1	<1.0	<0.10	0.16 b	--	<0.06	<0.02	<0.005
7/23/2003	SM-0795	Blank	11:30j	<2	<0.66	<1	<1.0	0.11 b	<0.10	--	<0.02	<0.02	<0.005
9/24/2003	SM-0847	Blank	12:01j	<2	<0.66	<1	<1.0	0.11 b	--	[<0.040] h	[0.67] h	<0.02 h	<0.005 h
11/20/2003	SM-0890	Blank	11:15j	<2	<0.66	<1	<1.0 h	<0.10	--	[0.17] bh	<0.06	<0.06	<0.005
3/3/2004	SM-0932	Blank	11:50	--	--	--	--	<0.5*	--	0.049 bj	<0.01 j	<0.02 j	<0.005
4/28/2004	SM-0973	Blank	12:35	--	--	--	--	<0.5*	--	0.067 bj	<0.01	<0.02 j	<0.005 j
6/23/2004	SM-1014	Blank	12:20	--	--	--	--	<0.5*	--	0.051 bj	<0.01 j	<0.02 j	<0.005
8/25/2004	SM-1056	Blank	12:45	<2	<0.66	<1	<1.0	<0.10	--	<0.040	<0.01	<0.02	<0.005
10/27/2004	SM-1097	Blank	11:55	<2	<0.66	<1	<1.0	<0.10	--	<0.040	<0.02 hj	<0.06	<0.005

Table 20 MassDEP SMART 2000-2004 Blackstone Watershed Field Duplicate Results.

Date	OWMID	QAQC	Time	Alkalinity	Hardness	Chloride	SSolids	Turb	TKN	TN	NH3-N	NO3-NO2-N	TPhos
			(24hr)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
3/15/2000	SM-0008	SM-0009	9:17	22	50	77	1.9	3.3	0.24	--	<0.02	0.56	0.033
3/15/2000	SM-0009	SM-0008	9:22	21	49	76	2.1	3.1	0.24	--	<0.02	0.58	0.029
Relative	*Percent*	*Difference*		*4.70%*	*2.00%*	*1.30%*	*10.00%*	*6.20%*	*0.00%*	--	*0.00%*	*3.50%*	*12.90%*
5/17/2000	SM-0055	SM-0056	8:53	25	46	63	3.1	2.2	0.47	--	0.05	0.38	0.046
5/17/2000	SM-0056	SM-0055	8:58	25	47	62	3.2	2.3	0.47	--	0.05	0.4	0.044
Relative	*Percent*	*Difference*		*0.00%*	*2.20%*	*1.60%*	*3.20%*	*4.40%*	*0.00%*	--	*0.00%*	*5.10%*	*4.40%*
7/19/2000	SM-0102	SM-0103	9:11	38	70	105 b	5.9	6	0.73	--	0.11	0.43	0.088
7/19/2000	SM-0103	SM-0102	9:16	38	71	95 b	6.1	6	0.74	--	0.09	0.45	0.091
Relative	*Percent*	*Difference*		*0.00%*	*1.40%*	*10.00%*	*3.30%*	*0.00%*	*1.40%*	--	*20.00%*	*4.50%*	*3.40%*
9/20/2000	SM-0150	SM-0151	10:02	17	31	53	9.9	5.9	0.54	--	0.11	0.32	0.094
9/20/2000	SM-0151	SM-0150	10:07	20	31	54	9.7	6	0.61	--	0.11	0.32	0.095
Relative	*Percent*	*Difference*		*16.20%*	*0.00%*	*1.90%*	*2.00%*	*1.70%*	*12.20%*	--	*0.00%*	*0.00%*	*1.10%*
11/29/2000	SM-0189	SM-0190	9:19	26	51	87	1.9	3.2	0.38	--	0.11d	0.36	0.044
11/29/2000	SM-0190	SM-0189	9:24	27	50	87	2	3.2	0.37	--	0.07d	0.35	0.042
Relative	*Percent*	*Difference*		*3.80%*	*2.00%*	*0.00%*	*5.10%*	*0.00%*	*2.70%*	--	*44.40%*	*2.80%*	*4.70%*
3/14/2001	SM-0227	SM-0228	9:39	21m	69m	350m	8.1m	11m	0.91m	--	0.20m	0.68m	0.062m
3/14/2001	SM-0228	SM-0227	9:44	21m	69m	340m	10m	9.5m	0.83m	--	0.16m	0.65m	0.056m
Relative	Percent	Difference		0.00%	0.00%	2.90%	21.00%	14.60%	9.20%	--	22.20%	4.50%	10.20%
4/25/2001	SM-0267	SM-0268	9:18	25m	62m	97m	3.5m	2.9m	0.42m	--	<0.02m	0.50m	0.038m
4/25/2001	SM-0268	SM-0267	9:23	24m	63m	97m	3.5m	2.9m	0.41m	--	<0.02m	0.50m	0.040m
Relative	Percent	Difference		4.10%	1.60%	0.00%	0.00%	0.00%	2.40%	--	0.00%	0.00%	5.10%
6/27/2001	SM-0308	SM-0307	**	37m	72m	110m	3.2m	3.0m	0.59m	--	0.26bdm	0.49m	0.075m
6/27/2001	SM-0307	SM-0308	9:15	37m	72m	110m	3.8m	2.9m	0.64m	--	0.38bdm	0.52m	0.074m
Relative	Percent	Difference		0.00%	0.00%	0.00%	17.10%	3.40%	8.10%	--	37.50%	5.90%	1.30%
8/22/2001	SM-0348	SM-0347	**	56m	89m	120m	1.9m	2.9m	0.44m	--	##dm	0.53m	0.053m
8/22/2001	SM-0347	SM-0348	8:50	56m	89m	130m	2.2m	2.9m	0.43m	--	##dm	0.53m	0.054m
Relative	Percent	Difference		0.00%	0.00%	8.00%	14.60%	0.00%	2.30%	--		0.00%	1.90%

Table 20 continued. MassDEP SMART 2000-2004. Blackstone Watershed Field Duplicate Results.

Date	OWMID	QAQC	Time	Alkalinity	Hardness	Chloride	SSolids	Turb	TKN	TN	NH3-N	NO3-NO2-N	TPhos
			(24hr)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
11/7/2001	SM-0388	SM-0387	**	27m	59m	100m	##dm	4.0m	0.63m	--	##dm	0.09m	0.050m
11/7/2001	SM-0387	SM-0388	8:50	26m	59m	100m	##m	4.1m	0.61m	--	##dm	0.11dm	0.053m
Relative	Percent	Difference		3.80%	0.00%	0.00%		2.50%	3.20%	--		20.00%	5.80%
12/17/2001	SM-0428	SM-0427	**	30hm	63m	130m	5.1m	3.8m	0.57m	--	0.12m	0.37m	0.13dm
12/17/2001	SM-0427	SM-0428	9:00	30hm	59m	120m	4.7m	4.2m	0.56m	--	0.12m	0.38m	0.092dm
Relative	Percent	Difference		0.00%	6.60%	8.00%	8.20%	10.00%	1.80%	--	0.00%	2.70%	34.20%
3/6/2002	SM-0466	SM-0467	9:00	22 m	59 m	150 m	2.4 m	3.6 m	0.41 m	--	<0.02 m	0.40 m	0.046 m
3/6/2002	SM-0467	SM-0466	9:00	22 m	60 m	150 m	2.1 m	3.7 m	0.39 m	--	<0.02 m	0.39 m	0.041 m
Relative	*Percent*	*Difference*	--	*0.00%*	*1.70%*	*0.00%*	*13.30%*	*2.70%*	*5.00%*	--	*0.00%*	*2.50%*	*11.50%*
4/24/2002	SM-0506	SM-0507	8:50	35	82	130	3.3	3.1	0.54	--	0.12	0.42	0.048
4/24/2002	SM-0507	SM-0506	8:50	36	82	130	3.3	3.2	0.55	--	0.1	0.4	0.04
Relative	*Percent*	*Difference*	--	*2.80%*	*0.00%*	*0.00%*	*0.00%*	*3.20%*	*1.80%*	--	*18.20%*	*4.90%*	*18.20%*
6/26/2002	SM-0546	SM-0547	8:50	37 m	79 m	120 m	4.1 m	3.1 m	0.49 m	--	0.06 m	0.56 m	0.031 dm
6/26/2002	SM-0547	SM-0546	8:50	36 m	79 m	120 m	4.0 m	3.1 m	0.48 m	--	0.06 m	0.54 m	0.058 dm
Relative	*Percent*	*Difference*	--	*2.70%*	*0.00%*	*0.00%*	*2.50%*	*0.00%*	*2.10%*	--	*0.00%*	*3.60%*	*60.70%*
8/28/2002	SM-0587	SM-0590	11:00	35	84 d	140	7.4	4.8	1.4	--	0.14	7	1.8
8/28/2002	SM-0590	SM-0587	11:00	36	102 d	130	7.5	4	1.4	--	0.12	7	1.8
Relative	*Percent*	*Difference*	--	*2.80%*	*19.40%*	*7.40%*	*1.30%*	*18.20%*	*0.00%*	--	*15.40%*	*0.00%*	*0.00%*
10/30/2002	SM-0626	SM-0627	8:50	29	61	92	1.5	2.4	0.51	--	0.06	0.38	0.037
10/30/2002	SM-0627	SM-0626	8:50	27	62	92	1.5	2.6	0.49	--	0.07	0.35	0.036
Relative	*Percent*	*Difference*	--	*7.10%*	*1.60%*	*0.00%*	*0.00%*	*8.00%*	*4.00%*	--	*15.40%*	*8.20%*	*2.70%*
1/29/2003	SM-0666	SM-0667	8:45	36	88	170	1.7	2.8	0.5	--	0.22	1	0.028
1/29/2003	SM-0667	SM-0666	8:45	36	88	170	1.8	3	0.52	--	0.16	0.98	0.029
Relative	*Percent*	*Difference*		*0.00%*	*0.00%*	*0.00%*	*5.70%*	*6.90%*	*3.90%*	--	*31.60%*	*2.00%*	*3.50%*
4/2/2003	SM-0707	SM-0708	8:50	17	50	95	2	2.1	0.37	--	<0.06	0.61	0.028
4/2/2003	SM-0708	SM-0707	8:50	17	50	94	2.2	2.2	0.34	--	<0.06	0.62	0.028
Relative	*Percent*	*Difference*		*0.00%*	*0.00%*	*1.10%*	*9.50%*	*4.70%*	*8.50%*	--	*0.00%*	*1.60%*	*0.00%*
5/21/2003	SM-0748	SM-0749	8:45	33	82	130	4.1	2.8	0.53 b	--	<0.06	0.51	0.044
5/21/2003	SM-0749	SM-0748	8:45	32	81	130	4.3	2.6	0.51 b	--	<0.06	0.5	0.05
Relative	*Percent*	*Difference*		*3.10%*	*1.20%*	*0.00%*	*4.80%*	*7.40%*	*3.80%*	--	*0.00%*	*2.00%*	*12.80%*

Table 20 continued. MassDEP SMART 2000-2004. Blackstone Watershed Field Duplicate Results.

Date	OWMID	QAQC	Time	Alkalinity	Hardness	Chloride	SSolids	Turb	TKN	TN	NH3-N	NO3-NO2-N	TPhos
			(24hr)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
7/23/2003	SM-0789	SM-0790	8:45	27	62	100	6.6	7.5 b	0.57	--	0.09	0.53	0.079
7/23/2003	SM-0790	SM-0789	8:45	29	62	100	7	7.5 b	0.59	--	0.08	0.5	0.085
Relative	*Percent*	*Difference*		*7.10%*	*0.00%*	*0.00%*	*5.90%*	*0.00%*	*3.40%*	--	*11.80%*	*5.80%*	*7.30%*
9/24/2003	SM-0841	SM-0842	8:40	27	52	86	12	12 b	--	## h	## bh	0.22 h	0.084 h
9/24/2003	SM-0842	SM-0841	8:40	27	51	84	13	12 b	--	## h	## bh	0.20 h	0.082 h
Relative	*Percent*	*Difference*		*0.00%*	*1.90%*	*2.40%*	*8.00%*	*0.00%*	--	--	--	*9.50%*	*2.40%*
11/20/2003	SM-0884	SM-0885	8:30	22	37	66	37 h	17	--	## bh	0.29	0.36	0.33
11/20/2003	SM-0885	SM-0884	8:30	22	41	68	34 h	16	--	## bh	0.2	0.35	0.33
Relative	*Percent*	*Difference*		*0.00%*	*10.30%*	*3.00%*	*8.50%*	*6.10%*	--	--	*36.70%*	*2.80%*	*0.00%*
3/3/2004	SM-0926	SM-0927	8:55	--	--	--	--	6.0*	--	1.1 dj	0.04 j	0.62 j	0.07
3/3/2004	SM-0927	SM-0926	8:55	--	--	--	--	6.1*	--	0.93 dj	<0.04 j	0.51 j	0.064
Relative	*Percent*	*Difference*		--	--	--	--	*1.70%*	--	*16.70%*	*0.00%*	*19.50%*	*9.00%*
4/28/2004	SM-0967	SM-0968	9:05	--	--	--	--	4.4*	--	0.77 j	<0.01	0.45 j	0.045 j
4/28/2004	SM-0968	SM-0967	9:05	--	--	--	--	4.5*	--	0.77 j	<0.01	0.45 j	0.043 j
Relative	*Percent*	*Difference*		--	--	--	--	*2.20%*	--	*0.00%*	*0.00%*	*0.00%*	*4.50%*
6/23/2004	SM-1008	SM-1009	8:50	--	--	--	--	6.2*	--	1.2 dj	0.05 j	0.70 dj	0.06
6/23/2004	SM-1009	SM-1008	8:50	--	--	--	--	6.2*	--	1.0 dj	0.04 j	0.56 dj	0.056
Relative	*Percent*	*Difference*		--	--	--	--	*0.00%*	--	*18.20%*	*22.20%*	*22.20%*	*6.90%*
8/25/2004	SM-1050	SM-1051	9:00	34	74	110	3.8	4.1	--	0.9	0.04	0.39	0.057
8/25/2004	SM-1051	SM-1050	9:00	35	73	110	3.7	3.9	--	0.89	0.04	0.4	0.053
Relative	*Percent*	*Difference*		*2.90%*	*1.40%*	*0.00%*	*2.70%*	*5.00%*	--	*1.10%*	*0.00%*	*2.50%*	*7.30%*
10/27/2004	SM-1091	SM-1092	8:50	30	65	93	2.3	3	--	0.79	0.09 hj	0.44	0.042
10/27/2004	SM-1092	SM-1091	8:50	32	70	85	2.1	3.2	--	0.8	0.09 hj	0.44	0.042
Relative	*Percent*	*Difference*		*6.50%*	*7.41%*	*9.00%*	*9.10%*	*6.50%*	--	*1.30%*	*0.00%*	*0.00%*	*0.00%*

REFERENCES

Beaudoin, T. 2010 (unpublished). *CN 12.1: Strategic Monitoring and Assessment for River basin Teams Quality Assurance Project Plan. 2008-2012.* Massachusetts Department of Environmental Protection. Central Regional Office. Worcester, MA.

Chen, Xiaoning. 2008. Personal communication with Therese Beaudoin re date of connection of Millbury sewage flows to Upper Blackstone Water Pollution Abatement District system. November 26, 2008.

Google Earth. 2011a. "BS09C". 42º13'36.97"N and 71º47'12.87"W (BS09C historic) and 42º13'30.81"N and 71º47'07.40"W (BS09C recent). September 21, 2010. April 20, 2011.

Google Earth. 2011b. "BS14A". 42º9'13.28"N and 71º39'7.34"W. September 21, 2010. April 20, 2011.

Google Earth. 2011c. "BS18A". 42º01'22.49"N and 71º34'19.68"W. June 19, 2010. April 20, 2011.

Google Earth. 2011d. "QU02A". 42º13'49.68"N and 71º42'29.00"W. June 19, 2010. April 20, 2011.

Google Earth. 2011e. "WR03". 42º6'1.84"N and 71º36'4.15"W. September 21, 2010. April 20, 2011.

MassDEP. 2006. *CN 265.0 Draft Final Data Validation Report for Year 2004 Project Data.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA. October, 2006.

MassDEP. 2005a. *CN 211.0 Data Validation Report for Year 2003 Project Data.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA. November, 2005.

MassDEP. 2005b. *CN 202.0 Data Validation Report for Year 2002 Project Data.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA. October, 2005.

MassDEP. 2004a. CN 056.1. *Summary of Current DWM Data Validation Procedures*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MassDEP. 2004b. *CN 149.0 Data Validation Report for Year 2001 Project Data.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA. December, 2004.

MassDEP. 2003. *CN 83.0 Data Validation Report for Year 2000 Project Data.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA. March 5, 2003.

MassDEP. 2001. *Blackstone River Basin 1998 Water Quality Assessment Report*. Report Number 51-AC-1. Dept. of Environmental Protection, Division of Watershed Management, Worcester, MA.

MassDEP. 1999a. *CN 4.0 Water Quality Multi-probe Instrument Use, Standard Operating Procedure.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MassDEP. 1999b. *Grab Collection Techniques for DWM Water Quality Sampling, Standard Operating Procedure.* Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

NOAA. 2010 [online]. *NWS Taunton, MA: Daily Data for 72 locations in the Northeast*. Recent (but unofficial) daily climate data for New England, Eastern and Southeastern New York and Northern New Jersey. National Oceanic and Atmospheric Administration. National Weather Service Forecast Office: Boston, MA. Available at http://www.erh.noaa.gov/box/dailystns.shtml.

Ostiguy, Lance J., Weiskel, Peter K. and Stacey A. Archfield. 2010 [Online]. *Average Annual Precipitation, in Inches, for Massachusetts as Computed over the Period 1971-2000 Using the Parameter-Elevation Regressions on Independent Slopes (PRISM) Model. Appendix 1, Figure 1-2.* February 16, 2011. Available at http://pubs.usgs.gov/sir/2009/5227/pdf/Appendix/sir2009-5227_appendix1_fig2.pdf.

Socolow, Roy. 2011. Personal communication with Therese Beaudoin re stage height and discharge at the USGS flow gaging station near Northbridge, MA. 13 April 2011.

USACOE. 1994. *Blackstone River Restoration Study*. SF 298. United States Department of the Army Corps of Engineers. New England Division. November 1994. Available at http://www.nae.usace.army.mil/projects/ma/blackstone/Historical/10-BRWRestorationStudy_111994.pdf

USGS. 2010a [online]. Daily mean discharges at the USGS Blackstone River gage @Woonsocket, RI (USGS station number 01112500). Available at http://waterdata.usgs.gov/ma/nwis/annual/?referred_module=sw&site_no=01112500&por_01112500_2=1268186,00060,2,1929,2009&year_type=W&format=html_table&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list.

USGS. 2010b [online]. Point of record daily statistics streamflow values at the USGS Blackstone River gage @Woonsocket, RI (USGS station number 01112500). Available at http://waterdata.usgs.gov/nwis/dvstat?referred_module=sw&site_no=01112500&por_01112500_2=1268186,00060,2,1929-02-22,2008-05-07&start_dt=1929-02-22&end_dt=2003-12-01&format=html_table&stat_cds=mean_va&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list.

USGS. 2010c [online]. Monthly mean discharges based on 74-75 years of record at the USGS Blackstone River gage @Woonsocket, RI (USGS station number 01112500). Available at http://waterdata.usgs.gov/nwis/monthly/?referred_module=sw&site_no=01112500&por_01112500_2=1268186,00060,2,1929-02,2008-05&format=html_table&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list.

USGS. 2010d [online]. *National Water Interface System: Web Interface. USGS 01109730 Blackstone River, West Main Street at Millbury, MA*. Provisional data subject to revision. United States Geological Survey. Available at http://waterdata.usgs.gov/ma/nwis/dv/?site_no=01109730&PARAmeter_cd=00060,00065.

USGS. 2010e [online]. *National Water Interface System: Web Interface. USGS 01110500 Blackstone River at Northbridge, MA*. Provisional data subject to revision. United States Geological Survey. Available at http://waterdata.usgs.gov/ma/nwis/uv?site_no=01110500.

USGS. 2010f [online]. *National Water Interface System: Web Interface. USGS* 01111212 *Blackstone River, Rt 122 Bridge Near Uxbridge, MA*. Provisional data subject to revision. United States Geological Survey. Available at http://waterdata.usgs.gov/ma/nwis/dv/?site_no=01111212&PARAmeter_cd=00060,00065

USGS. 2010g [online]. *National Water Interface System: Web Interface. USGS 01112500 Blackstone River at Woonsocket, RI*. Provisional data subject to revision. United States Geological Survey. Available at http://waterdata.usgs.gov/ma/nwis/dv/?site_no=01112500&PARAmeter_cd=00060,00065

USGS. 2010h [online]. *National Water Interface System: Web Interface. USGS 01099500 Quinsigamond River at North Grafton, MA*. Provisional data subject to revision. United States Geological Survey. Available at http://waterdata.usgs.gov/ma/nwis/dv/?site_no=01110000&PARAmeter_cd=00060,00065.

USGS. 2010i [online]. *National Water Interface System: Web Interface. USGS 01111200 West River below West Hill Dam near Uxbridge, MA*. Provisional data subject to revision. United States Geological Survey. Available at http://waterdata.usgs.gov/ma/nwis/dv/?site_no=01111200&PARAmeter_cd=00060,00065

Wandle, S. William, Jr. and Anita F. Phipps. 1984. *Gazetteer of Hydrologic Characteristics of Streams in Massachusetts – Blackstone River Basin.* Water-Resources Investigation Report 84-4286. U.S. Dept. of the Interior. U.S. Geological Survey. In conjunction with the Commonwealth of Massachusetts Department. of Environmental Quality Engineering, Division of Water Pollution Control. Boston, MA.