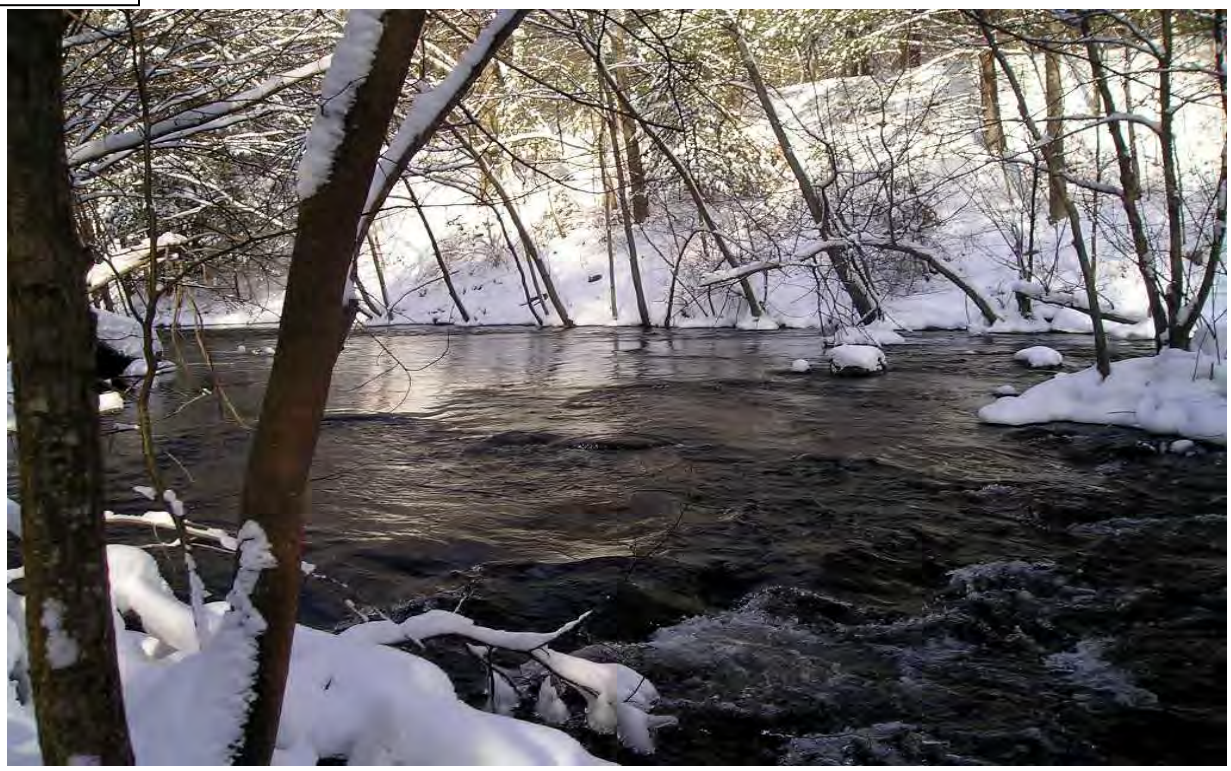
FRENCH AND QUINEBAUG RIVERS WATERSHED
SMART MONITORING PROGRAM 2005-2010
TECHNICAL MEMORANDUM CN 427.0



The Quinebaug River, Sturbridge

Prepared By:
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Commonwealth of Massachusetts
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Cover photo by Therese Beaudoin, MassDEP. 3 February 2005.
All photos in document taken by Therese Beaudoin. MassDEP. CERO.
SMART monitoring logo designed by Robert Kimball and Barbara Kimball.

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LIST OF LATIN NAMES

Latin Name	Common name	Latin Name	Common name
Anas platyrhynchos	mallard	*Micropterus dolomieu*	smallmouth bass
Callitriche sp.	water starwort	*Myriophyllum* sp.	milfoil
Cambaridae family	freshwater crayfishes	*Oncorhynchus mykiss*	rainbow trout
Carex sp.	Sedge	*Peltandra virginica*	arrow arum
Castor canadensis	North American beaver	*Phalaris arundinacea*	reed canarygrass
Chara sp.	muskwort	Plecoptera order	stoneflies
Chrosomus eos	northern redbelly dace	*Podostemum ceratophyllum*	threadfoot
Elodea canadensis	waterweed	*Potamogeton* spp.	pondweeds
Ephemeroptera order	mayflies	*Rhinichthys atratulus*	blacknose dace
Gramineae family	true grasses	*Sagittaria* sp.	arrowhead
Lemna sp.	duckweed	Simuliidae order	blackflies
Lepomis gulcosus	warmouth sunfish	Trichoptera order	caddisflies
Lepomis macrochirus	bluegill	*Vallisneria* sp.	eelgrass
Lobelia cardinalis	cardinal flower	*Wolffia* sp.	watermeal

LIST OF ACRONYMS

% sat	percent oxygen saturation
305(b)	Section 305(b), Clean Water Act
7Q10	the lowest 7-day average streamflow that occurs, on average, once every 10 years
BRP	Bureau of Resource Protection
BWR	Bureau of Water Resources
ºC	degree Celsius
CERO	Central Regional Office
CFR	Coldwater Fish Resource
cfs	cubic feet per second
cond	specific conductivity
CSO	Combined Sewer Overflow
CT	Connecticut
DO	dissolved oxygen
DWM	Division of Watershed Management
ºF	degree Fahrenheit
ft	feet
F/Q	French/Quinebaug
GPD	gallons per day
in	inch
m	meter
MA	Massachusetts
MassDEP	Massachusetts Department of Environmental Protection
MDL	method detection limit
MGD	million gallons per day
µS/cm	microsiemen per centimeter
mg/L	milligrams per liter
mi	mile
mi^2	square mile
NH_3-N	ammonia nitrogen
NOAA	National Oceanic and Atmospheric Administration
NO_3NO_2-N	nitrate-nitrite nitrogen
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Unit
NWS	National Weather Service
POR	Period of Record
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RDL	reporting detection limit
RI	Rhode Island
RPD	relative percent difference
SMART	Strategic Monitoring and Assessment for River basin Teams
SOP	standard operating procedure
SR	state road
SU	Standard Unit
SSolids	suspended solids
Temp	temperature
TDS	total dissolved solids
TMDL	Total Maximum Daily Load
TN	total nitrogen
TPhos	total phosphorus
Turb	turbidity
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WES	Wall Experiment Station
WWTP	wastewater treatment plant

INTRODUCTION

The purpose of this technical memorandum is to present observations and data collected from 2005-2010 as part of the Strategic Monitoring and Assessment for River basin Teams (SMART) program in the French/Quinebaug (F/Q) watershed, highlighting how the program supports and augments programs of the Massachusetts Department of Environmental Protection (MassDEP) Bureau of Resource Protection (BRP, now the Bureau of Water Resources, BWR) Central Regional Office (CERO) and the Division of Watershed Management (DWM).

Overview of Monitoring Plan

Bimonthly water quality monitoring began in March 1999. The sampling plan matrix for the SMART monitoring program Years 2005-2010 is presented in Table 1; the location of sampling stations is presented in Figure 1. Sampling components at all stations included:

- *in situ* measurements: dissolved oxygen (DO), percent oxygen saturation, pH, specific conductivity, temperature (T), depth and total dissolved solids (TDS);
- physical/chemical constituents: total alkalinity, chlorides, hardness, total suspended solids (TSS), turbidity;
- nutrients: ammonia-nitrogen (NH_3-N), nitrate-nitrite-nitrogen (NO_3_NO_2-N), total nitrogen (TN), and total phosphorus (TP);
- flow measurements (at existing USGS flow gaging stations); and
- general field observations.

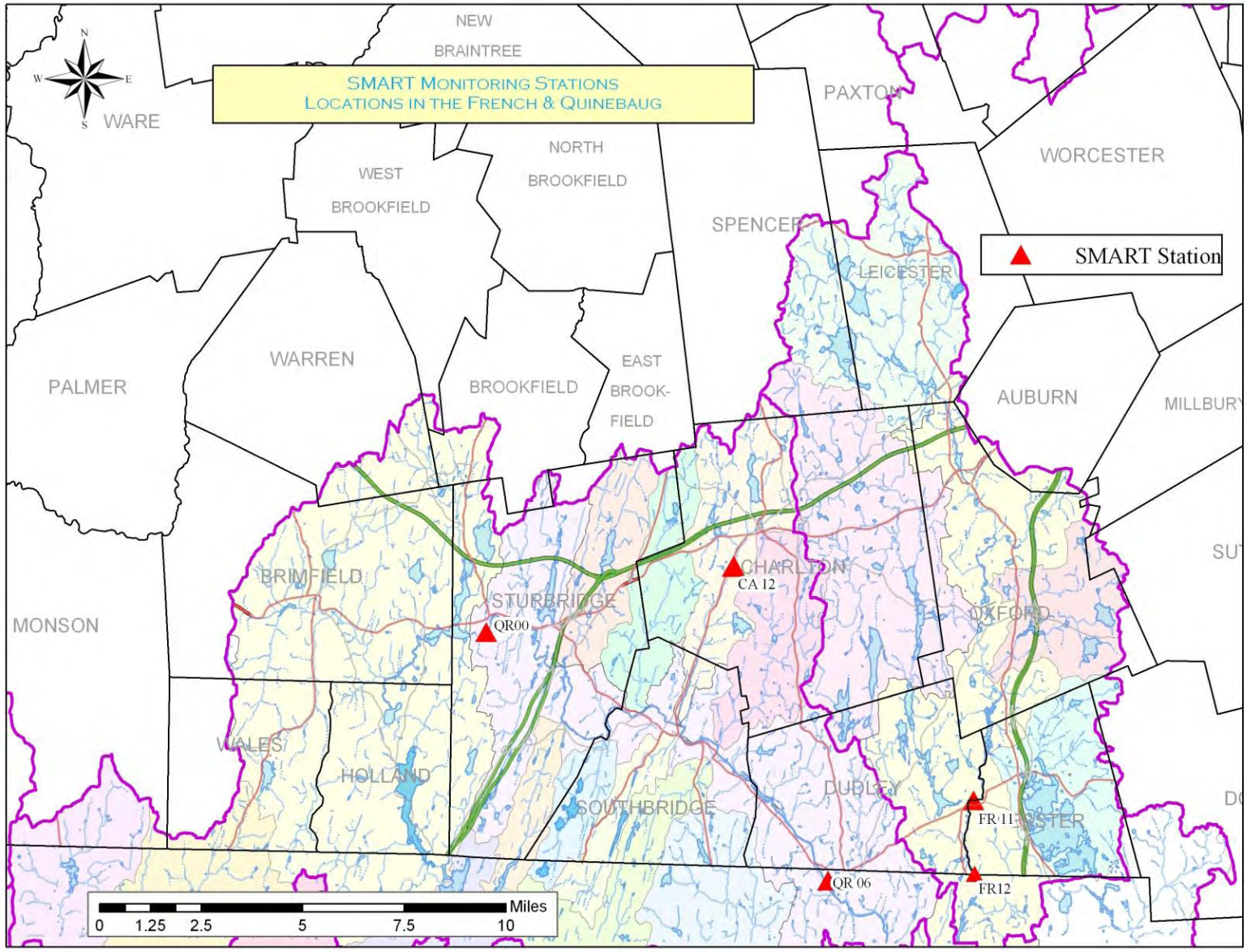
Table 1 French/Quinebaug Basin SMART Sampling Summary – 2005 through 2010

Location and Segment Numbers	Station Name	Station Type	Dates Sampled[1]
Quinebaug River @ Holland Road, Sturbridge MA41-01	QR00	Reference	2005: 3/2/05, 4/27/05, 6/22/05, 8/24/05, 10/26/05 2006: 1/25/06, 3/22/06, 5/17/06, 7/19/06, 9/27/06, 11/8/06 2007: 2/13/07, 4/18/07, 6/19/07, 8/29/07, 10/17/07 2008: 1/30/08, 3/26/08, 5/21/08, 7/23/08, 9/24/08, 11/19/08 2009: 2/24/09, 4/29/09, 6/24/09, 8/26/09, 10/28/09 2010: 2/23/10, 7/21/10, 10/6/10, 11/17/10 [1]Sampling began in the French/Quinebaug Basin on 4/21/1999; the Cady Brook station (CA12) was added on 2/26/2003, and the French River at Perryville (FR12) on 2/24/2009.
Cady Brook at gas pipeline above upper Cady Brook crossing @ State Road (SR) 169, Charlton MA41-06	CA12	Impact	
Quinebaug River @ State Road (SR) 197, Thompson, CT below MA41-04	QR06	Boundary	
French River @ Oxford Ave, Dudley MA42-05	FR11	Impact	
French River below Perryville Road, Webster, MA MA42-06	FR12	Impact	

Hydrology

The French/Quinebaug (F/Q) watershed, part of the Thames River Basin, lies in the south-central part of Massachusetts (MA). The Thames has a total drainage area of 1,474 square miles (mi^2), of which 251 mi^2 are in MA, 61 mi^2 in Rhode Island (RI) and 1,162 mi^2 in Connecticut (CT, USACE 2015). In Massachusetts, the Thames Basin is comprised mostly of the Quinebaug River and its major tributary, the French River. For a detailed description of the Quinebaug River Watershed, see French and Quinebaug Rivers Watershed Water Quality Assessment Report 2004 - 2008 (MassDEP 2009).

Figure 1 MassDEP SMART French/Quinebaug Rivers Watershed Water Quality Station Locations



The Quinebaug River flows approximately 76 miles (mi) from its beginning; either at the outlet of Goodall's Pond (also known as Little Massapoag Pond) or Mashapaug Lake (although Mashapaug Lake normally drains south to Bigelow Brook and the Shetucket Watershed, it sometimes flows to the north to the Quinebaug Watershed). The 28-mi segment of the Quinebaug River and its associated watershed within Massachusetts encompasses all or part of 14 towns. The river is characterized by long runs and three large impoundments (Hamilton Reservoir, East Brimfield Lake and West Dudley Pond) as well as several smaller ones. Numerous dams remain on the mainstem, including two United States Army Corps of Engineers (USACE) flood control projects, East Brimfield and Westville Lakes; these operate in a run-of-river mode under normal conditions. There are also two hydropower projects on the Quinebaug River: the Old Sturbridge Village Project, Sturbridge; and the West Dudley Project, Dudley.

Annual precipitation ranges from 48 to 50 inches (in) over most of the watershed, with a section in the south-central to southeast area along the CT border averaging 50 to 52 in (Ostiguy et al 2010).

Massachusetts tributaries of the Quinebaug River include the Mill, Hobbs, McKinstry, Cady, Breakneck, Hamant, Hatchet, Cohasse, Lebanon and McIntyre Pond brooks. Coldwater Fish Resources (CFR) have been identified on twenty-seven tributaries to the Quinebaug River (including Hamant, Hatchet, and McKinstry Brooks), but not the mainstem itself (MassDFG 2015).

The French River flows approximately 26 mi from its beginning at the outlet of Greenville Pond, Leicester to its junction with the Quinebaug. The French River watershed within Massachusetts encompasses all or part of 10 towns. The river is characterized by long runs and numerous impoundments (Rochdale, Texas, and Perryville ponds, as well as a large, unnamed impoundment above North Village, Webster). The Hodges Village flood control project is a dry bed reservoir on the mainstem, and typically operates in a run-of-river mode. The Buffumville Lake project on the Little River maintains a large recreational pool (186 acres); it is operated in a run-of-river mode under most conditions. Annual precipitation ranges from 48 to 50 in over most of the watershed, with a small area averaging 50 to 52 in located on the Connecticut border in Webster and Dudley (Ostiguy et al 2010).

The French River is the largest tributary to the Quinebaug River in MA, joining the mainstem in Thompson, CT. Tributaries of the French River in Massachusetts include the Little River, Lowes and Mill Brooks, and a number of smaller streams. The French River from the North Oxford Dam upstream of Clara Barton Road, Oxford, to the dam at North Village, Webster/Dudley is designated as a coldwater fishery; Wellington Brook and an unnamed tributary have also been identified as CFRs (MassDFG 2011).

Quality Assurance/Quality Control

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

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

PROJECT OBJECTIVES

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

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

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

METHODS

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

In addition to the measurements and analytes noted above, field observations were recorded at each station on standardized field sheets, field notebooks, and as photographs. Field observations included date/time, location, crewmembers, snow cover, canopy cover, water odors, colors, sheens, foams, estimated river height and velocity, weather conditions, observed uses, wildlife, aquatic algae and macrophytes, potential pollution sources, and unusual conditions. Number and type of samples were recorded, as well as the last set of *in situ* data collected. A summary of field observations by station collected during this sampling period are presented in Table 2 through Table 5 following the station descriptions.

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

- Reference: a reference station is located in a stream segment that is minimally influenced by anthropogenic activities;
- Impact: an impact station is located where several sources of pollution come together and can be used to calibrate a mass balance model, or where critical reactions take place such as at an oxygen sag point; and

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

- Boundary: a boundary station is located at a pour point i.e., where water leaves a designated river basin, or at a state line.

Field sheets, raw data files, chain of custody forms, lab reports, and other metadata used in this report are managed and maintained by the MassDEP DWM in the Water Quality Access Database in Worcester, MA. The validation of the water quality data included data entry into DWM databases, data entry quality control checks, analysis for outliers, blank contamination, duplicates, precision, and holding time violations, followed by project level review (MassDEP 2005). The project coordinator, as identified in the QAPP for the SMART program (CN 012.2), reviews the data for reasonableness, completeness and acceptability (Beaudoin 2008).

STATION OBSERVATIONS

Station QR00 – Quinebaug River at Holland Road, Sturbridge, MA (river mile 15.202)

Figure 2 Google Earth view of Station QR00 area

Figure 3 Station QR00 upstream (8/26/2009)

Station QR00 is located on the Quinebaug River in Sturbridge, MA within the Lower Worcester Plateau ecoregion. From 2005-2010, the station was sampled 31 times, and access was gained from the southern shore upstream of the Holland Road Bridge. Samples were collected by wading to flowing water. Station QR00 serves as a reference station, minimally influenced by anthropogenic activities.

Land uses near this station included forest, rural residential, and roadways (Figure 2; Google Earth 2011a). The large recreational pool at the relatively shallow East Brimfield flood control project (420 acres at typical pool height) also influences water quality at this station. No municipal National Pollutant Discharge Elimination System (NPDES) discharges are located upstream (design flow greater than 1 million gallons per day, or MGD), nor are there any large water withdrawals (greater than 100,000 gallons per day, or GPD).

The river is a riffle in this area, approximately 55 feet (ft) wide and typically 1 to 4 ft deep (Figure 3). A small midstream island populated with woody and herbaceous vegetation lies mid-channel opposite the sampling site. Deciduous and evergreen trees provided shade along the banks, and the canopy extended over the channel upstream of the island, but not downstream. At times of low flow, very little water flows through the channel south of the island. The bottom was mostly boulder, cobble and gravel, with little sand. Aquatic macrophytes observed at Station QR00 included *Carex* sp. (sedge), Graminae (grasses), *Myriophyllum* sp. (milfoil), *Vallisneria* sp. (eelgrass), and immature emergents. Cardinal flowers (*Lobelia cardinalis)* were seen annually (late July-August) on the downstream point of the island. Periphyton, when visible, ranged from sparse to very dense (26 events, n=31). Periphytic communities typically consisted of moss, with 7 observations of filamentous algae and one of a rusty film.

Fish noted at this location included *Chrosomus eos* (northern redbelly dace), *Lepomis gulcosus (*warmouth sunfish), *Lepomis macrochirus* (bluegill) and *Oncorhynchus mykiss* (rainbow trout). Evidence of fishing was observed throughout this monitoring period (fishermen, bait containers, line/bobbers). Other aquatic life noted here included freshwater mussels (unidentified genus/species), Cambaridae (crayfish), Ephemeroptera (mayflies), Plecoptera (stoneflies), Simuliidae (blackflies), Trichoptera (caddisflies), unidentified fish and frogs, and deer.

When visible, the water column conditions were clear on most sampling events (64%, n=31). Water color was typically clear or red (42% each), and light yellow on 6 events. An absence of odor was characteristic of this station, with a musty or fishy scent noted on 2 events each (n=31). No sheens were noted during this time period. Foam was noted on 24 of 31 sampling dates (77%). When observable, trash was not present in the stream bed on most events (18, n=23); items noted included floatables, a sneaker, broken glass and metals; fishing debris (bait packaging, line) was noted on the banks frequently.

Station CA12 – Cady Brook at Southbridge Road (State Road/SR-169), Charlton, MA (river mile 3.268)

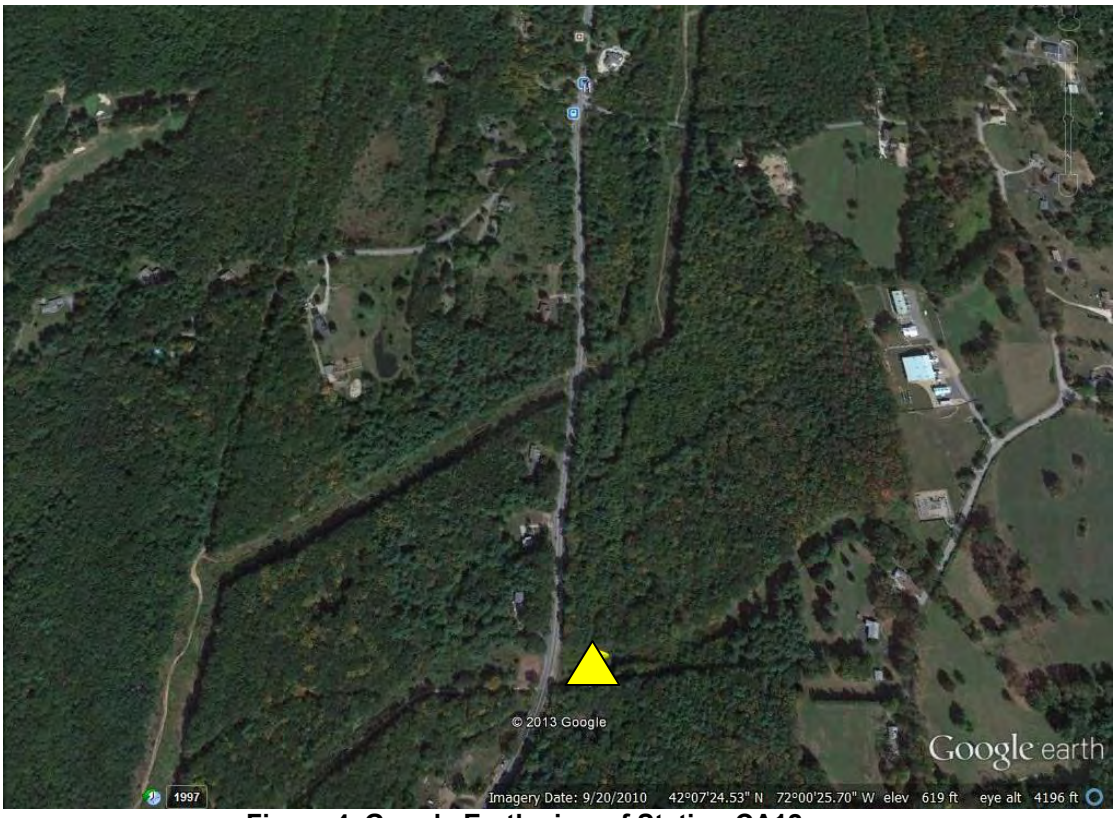


Figure 4 Google Earth view of Station CA12 area

Figure 5 Station CA12 upstream (5/21/2008)

Station CA12 is located on Cady Brook in Charlton, MA within the Southern New England Coastal Plains and Hills ecoregion. From 2005-2010, the station was sampled 30 times, and access was gained from the western shore at the downstream edge of the gas pipeline transmission corridor, north of the upstream-most of the two Cady Brook bridges on Southbridge Road (SR-169). Samples were collected by wading to flowing water or, when the flow was too high and/or fast, from shore with a sampling pole. On 2/13/2007, the brook was frozen solid from bank to bank, therefore the station was not sampled on this date. Station CA12 serves as an impact station as it is located downstream of numerous point and nonpoint sources of pollution, as described below.

Upstream land uses include forest, residential, commercial, and roadways (Figure 4; Google Earth 2011b). The Charlton Wastewater Treatment Plant (WWTP), a major municipal NPDES discharge, is located approximately 4.8 mi upstream; there are no large water withdrawals in the watershed above this station.

The river at this location is a run, approximately 12 ft wide and 1 to 3 ft deep. The shoreline is shaded by complete canopy cover up- and downstream of the gas pipeline transmission corridor, which is maintained to minimize woody vegetation (Figure 5). The stream bottom consisted of a mixture of boulder, cobble, gravel, sand and silt. Periphyton, in the form of moss (n=18), filamentous algae (12) and/or a slimy film (5) was present on most sampling dates, and absent on 3 events (n=27),. Aquatic macrophytes noted here included *Carex* sp. (sedge), Gramineae (grass) and *Phalaris arundinacea* (reed canarygrass). Aquatic organisms included *Micropterus dolomieu* (smallmouth bass), *Oncorhynchus mykiss* (rainbow trout) and *Rhinichthys atratulus* (blacknose dace). Wildlife noted here included Cambaridae (crayfish), *Castor canadensis* (North American beaver), mussels and immature fish.

The water column was clear on most dates sampled (73%), ranging from slightly turbid to murky (7, n=11). Water colors noted included clear, (18), light yellow (9), red (3) and brown (1). The river here typically lacked odor (93%), with “effluent” noted twice. The presence of foam was common (80%), but sheens were never observed. Although trash was typically absent, a minor quantity was noted on 7 events, including golf balls (upstream driving range), a bicycle tire, and floatables.

Station QR06 – Quinebaug River at Old Turnpike Road (SR-197), Thompson, CT (river mile -0.373)[2]

Figure 6 Google Earth view of Station QR06 area

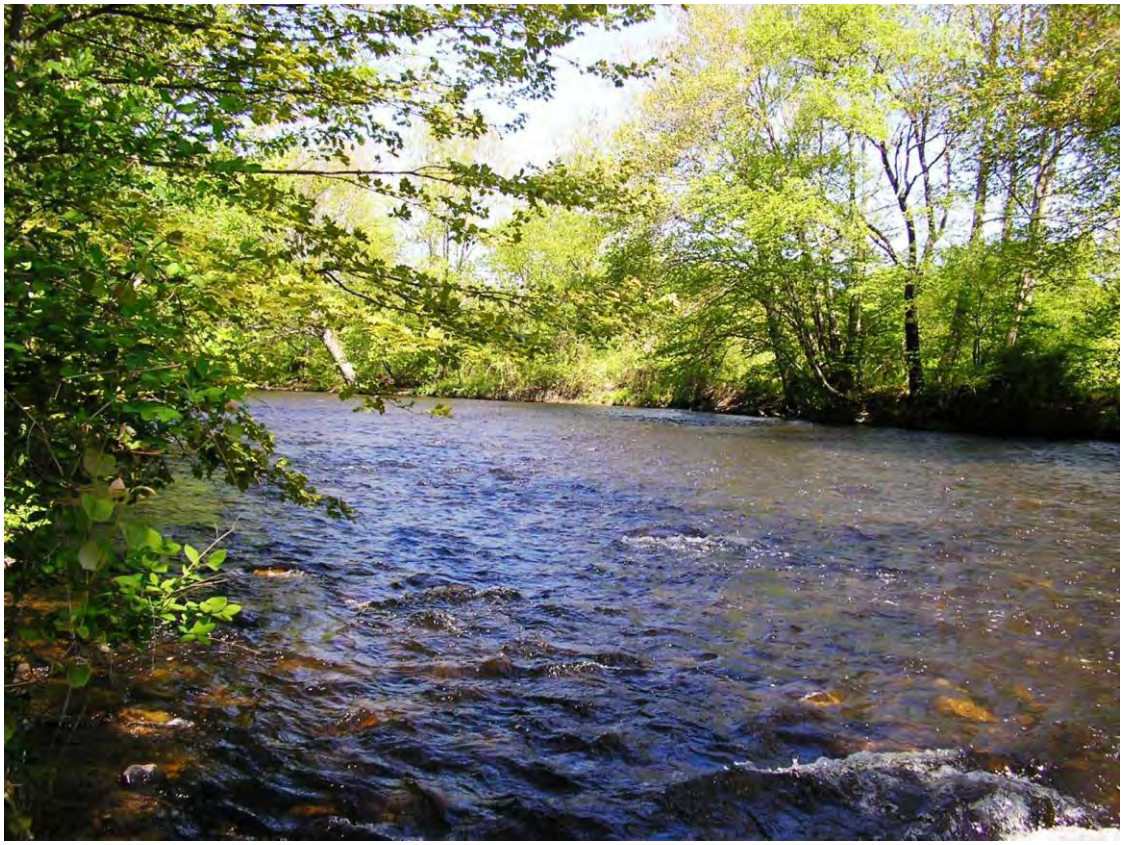


Figure 7 Station QR06 upstream (5/21/2008)

[2] River mile calculation begins at the Massachusetts state boundary; as this station is below the state boundary, the river mile is a negative value.

Station QR06 is located on the Quinebaug River in Thompson, CT, within the Southern New England Coastal Plains and Hills ecoregion. From 2005-2010, the station was sampled 30 times, and access was gained from the western shore upstream (north) of the Old Turnpike Road (SR-197) Bridge. Samples were collected by wading to flowing water or, when the flow was too high and/or fast, from shore with a sampling pole. On one event (5/17/2006), samples were collected downstream of the SR-131 (Southbridge Road) Bridge. On 2/13/2007, the station was not accessible due to ice and snow covering the river therefore it was not sampled. Station QR06 serves as a boundary station, representing water quality in the Quinebaug River as it enters the State of Connecticut.

Upstream land uses include forest, residential, industrial, commercial, and roadways (Figure 6; Google Earth 2011c). An upstream hydropower project at West Dudley Pond impacts this reach. The Southbridge WWTP, a major municipal NPDES discharge, is located 4.7 mi upstream. A large water withdrawal is located upstream at the American Optical facility, and includes the permitted withdrawal for the Millennium power plant (Charlton).

The river is a run in this area; the channel is approximately 65 ft wide and shaded along the channel edges
(
Figure 7). Banks were undercut throughout the site area. The bottom consisted mainly of cobble, gravel and sand, with a single large midstream boulder near the bridge (which disappeared between November 2010 and February 2011). Periphyton was observed here on 33% of sampling runs and included filamentous algae, moss and algal films. Aquatic macrophytes observed here were limited to sparse *Chara* sp. (muskwort) and *Podostemum ceratophyllum* (threadfoot). Other aquatic life included *Micropterus dolomieu* (smallmouth bass), *Oncorhynchus mykiss* (rainbow trout), *Rhinichthys atratulus* (blacknose dace), Plecoptera (stoneflies) and Trichoptera (caddisflies).

When visible, the water column was typically clear (20, n=30). The river at this station lacked color on 63% of monitoring dates; color observations included light yellow (8), red (2) and brown (2). The water column lacked odor on most events; fishy, effluent and eutrophic odors were each noted once. Foam was present on 80% of events; sheens were consistently absent. Trash was noted on 11 of the 25 events where the water column and stream bed were visible (44%) and included floatables, broken glass and metals.

Station FR11 – French River near Oxford Ave, Webster, MA (river mile 2.106)

Figure 8 Google Earth view of Station FR11 area

Figure 9 Station FR11 upstream (7/23/2008)

Station FR11 is located on the French River in Dudley, MA within the Southern New England Coastal Plains and Hills ecoregion. From 2005-2010 the station was sampled 31 times, and the river was accessed from the northern shore upstream of the Oxford Ave Bridge. Samples were collected by wading to flowing water or, when the flow was too high and/or fast, from shore with a sampling pole. Station FR11 serves as an impact station as it is located downstream of numerous point and nonpoint sources of pollution, as described below.

Land uses near and upstream of this station include forest, residential, commercial and industrial; an upstream hydropower project impacts the river in this reach (Figure 8; Google Earth 2011d). The nearest upstream municipal NPDES discharge is approximately 13.5 mi. above this site. Station FR11 is within the Zone II of four large water supply wells for the town of Dudley.

The river is a run in this area, approximately 40 ft wide, and the channel is typically too deep to wade (Figure 9). Trees provide shade over most of the stream corridor. The bottom consisted mainly of cobble, gravel and sand. In addition to dense patches of *Myriophyllum* sp. (milfoil), aquatic macrophytes included *Callitriche* sp. (water starwort), *Carex* sp. (sedges), Gramineae (grasses), *Peltandra virginica* (arrow arum), *Potamogeton* spp. (pondweed), *Sagittaria* sp. (arrowhead), Vallisneria sp. (eelgrass) and *Wolffia* sp. (water meal). Although unobservable on 17 of 31 sampling dates, periphytic growth was present on 8 dates, typically as filamentous algae. Other aquatic life included *Lepomis macrochirus* (bluegill), *Micropterus dolomieu* (smallmouth bass) and Trichoptera (caddisflies).

The water column and benthic environment were often difficult to observe due to turbulence and solar reflection on the water surface (55% of sampling dates). The water column was turbid on 55% of all sampling dates in this time period (unobservable on 23%), usually described as slight (8 dates) or moderate (6). Water color was typically either clear (15, n=31) or light yellow (13). The station was characterized by a lack of water odors (94%), with infrequent observations of eutrophic pond (2), musty (1) and “chemical sweet” (1). Foam was present on all but one date, while sheens were consistently absent. Trash was present on many sample dates and included a tire, shopping carts, broken glass, metals, beer cans and bottles, a ball, silt fence, cigarette butts and other floatables.

Station FR12 – French River below Perryville Road, Webster, MA (river mile 0.020)

Figure 10 Google Earth view of Station FR12 area

Figure 11 Station FR12 upstream (7/21/2010)

Station FR12 is located on the French River in Webster, within the Southern New England Coastal Plains and Hills ecoregion. Station FR12 was added to the SMART program in 2009; from 2009-2010, the station was sampled 9 times. The river was accessed from the eastern shore downstream of the Perryville Road Bridge near the Massachusetts/Connecticut border. Samples were collected by wading to flowing water or from shore with a sampling pole from 2/24/2009 through 11/17/2010. Station FR12 serves as a boundary station, representing water quality in the Quinebaug River as it enters the State of Connecticut.

Land uses near and upstream of this station include forest, residential, urban, commercial and industrial. An active rail line is adjacent to the river on the east (Figure 10; Google Earth 2012). The town of Webster NPDES discharge is approximately one mile upstream, as well as five water supply wells for the town of Dudley.

The river is a run in this area, approximately 40 ft wide, and typically too deep to wade (Figure 11). Although trees provide shade over most of the channel, the shallow, 7-acre (approximate) Perryville Pond impoundment is located approximately 200 feet upstream. The bottom consisted mainly of boulder, cobble, gravel and sand. Aquatic macrophytes observed in this location included *Elodea canadensis* (waterweed), *Lemna* sp. (duckweed), *Potamogeton* sp. (pondweed), *Vallisneria* sp. (eelgrass) and *Wolffia* sp. (water meal). Wildlife noted at this station included *Anas platyrhynchos* (mallard) and *Castor canadensis* (North American beaver).

Turbidity at this station was either clear or slight. Water color was usually light yellow (6, n=9). The station was characterized by a lack of water odors, with one observation each of effluent and musty/eutrophic pond/"chemical sweet". Foam was present on most events (8 of 9). Trash was present on all dates when the water column and bottom were visible (8 of 9 dates), and included broken glass, bricks, plastics, planks, floatables, and a section of telephone pole.

Table 2 MassDEP SMART 2005 - 2010. Station QR00. Summary of Observations.

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
3/2/2005	Boulder/cobble/gravel/sand	None	Moderate: moss	Clear	None	None	None	Clear	Wet
4/27/2005	Boulder/cobble/gravel/sand	Floatables, broken glass	Moderate: moss	Clear	None	Foam	None	Clear	Wet
6/22/2005	Boulder/cobble/gravel/sand	Minor: broken glass, metals	Very dense: moss	Red	None	Very sparse	None	Clear	Dry
8/23/2005	Cobble/gravel/sand	Minor: broken glass, metals	Sparse: green filamentous; sparse: moss	Clear	Musty	Foam	None	Clear	Dry
10/26/2005	Boulder/cobble/gravel/sand	None	Dense: moss	Light yellow	None	Sparse	None	Slight	Wet
1/25/2006	Cobble/gravel/sand	None	Moss	Clear	None	Foam	None	Clear	Wet
3/22/2006	Boulder/cobble/gravel/sand	None	Very dense: green filamentous	Clear	None	Foam	None	Clear	Dry
5/17/2006	Boulder/cobble/gravel/sand	Minor: trash	Very dense: moss	Light yellow	None	Foam	None	Clear	Wet
7/19/2006	Boulder/cobble/gravel/sand	None	Very dense: moss	Red	Fishy	Foam	None	Clear	Wet
9/27/2006	Boulder/cobble/gravel/sand; highly embedded	None	Sparse: green filamentous; very dense: moss	Clear	None	Sparse	None	Clear	Dry
11/8/2006	Unobservable	Unobservable	Very dense: moss	Red	None	Moderate	None	Slight	Wet
2/13/2007	Boulder/cobble/gravel/sand	None	Moderate: moss	Light yellow	None	Foam	None	Clear	Dry
4/18/2007	Unobservable	Unobservable	Very dense: moss	Clear	None	Foam	None	Moderate	Wet
6/19/2007	Cobble/gravel/sand	Very minor: trash	Dense: brown filamentous; dense, moss	Red	Strong fishy	Sparse	None	Clear	Dry
8/29/2007	Boulder/cobble/gravel/sand	None	Moderate, green filamentous; dense: moss	Clear	Slight musty	Sparse to moderate	None	Slight	Dry
10/17/2007	Boulder/cobble/gravel/sand	None	Sparse, green filamentous; sparse, rusty film; moderate: moss	Clear	None	Sparse	None	Clear	Dry (Wet, CA12 only)
1/30/2008	Boulder/cobble/gravel/sand	None	Dense, moss	Clear	None	None	None	Clear	Dry
3/26/2008	Boulder/cobble/gravel/sand	None	Dense, moss	Clear	None	Sparse	None	Clear	Dry
5/21/2008	Boulder/cobble/gravel/sand	None	Sparse: green filamentous; dense: moss	Very slight red	None	Sparse	None	Clear	Dry
7/23/2008	Unobservable	Unobservable	Unobservable	Red	None	Sparse	None	Unobservable	Wet
9/24/2008	Unobservable	Unobservable	Unobservable	Red	None	Sparse	None	Clear	Dry
11/19/2008	Unobservable	Unobservable	Very dense: moss	Clear	None	Sparse	None	Unobservable	Wet
2/24/2009	Unobservable	None	Very dense: moss	Light yellow	None	None	None	Clear	Wet
4/29/2009	Unobservable	Unobservable	Very dense: moss	Clear	None	None	None	Slight	Dry
6/24/2009	Boulder/cobble/gravel/sand	None	Very dense: moss	Red/light yellow	None	Sparse	None	Moderate	Wet
8/26/2009	Cobble/gravel/sand	None	Very dense: moss	Slight red	None	Sparse, natural	None	Slight	Wet
10/28/2009	Boulder/cobble/gravel/sand	None	Very dense: moss	Red	None	Sparse	None	Clear	Wet
2/23/2010	Boulder/cobble/gravel/sand	None	Dense: moss	Red	None	None	None	Clear	Dry
7/21/2010	Boulder/cobble/gravel/sand/silt	None	Sparse: moss	Light yellow	None	None	None	Clear	Dry
10/6/2010	Unobservable	Unobservable	Unobservable	Red	None	None	None	Unobservable	Wet
11/17/2010	Unobservable	Unobservable	Unobservable	Red	None	Sparse	None	Unobservable	Wet

-- : Data not available

Table 3 MassDEP SMART 2005 - 2010. Station CA12. Summary of Observations.

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
3/2/2005	Boulder/cobble/gravel/sand; highly embedded	None	Sparse: moss	Clear	None	Very sparse	None	Clear	Wet
4/27/2005	Boulder/cobble/gravel/sand/silt; embedded	None	--	Clear	None	Very sparse	None	Clear	Wet
6/22/2005	Boulder/cobble/gravel/sand; embedded	Golf balls	Moderate: green film; dense: moss	Red	None	Sparse	None	Slight	Dry
8/24/2005	Cobble/gravel/sand	Bicycle tire	Very dense: green filamentous, moss	Clear	Slight effluent	None	None	Clear	Dry
10/26/2005	Boulder/cobble/gravel/sand	None	Sparse: moss	Clear	None	Sparse	None	Clear	Wet
1/25/2006	Boulder/cobble/gravel/sand	None	Sparse: filamentous	Clear	Effluent	None	None	Clear	Wet
3/22/2006	Boulder/cobble/gravel/sand	Floatables, miscellaneous	Very dense: green filamentous	Clear	None	Very sparse	None	Clear	Dry
5/17/2006	Cobble/gravel/sand	None	None	Light yellow	None	Very sparse	None	Slight	Wet
7/19/2006	Unobservable	Trash	Dense: green filamentous; moderate: moss	Brown	None	Sparse	None	Highly turbid/murky	Wet
9/27/2006	Boulder/cobble/gravel/sand/silt; heavy silt layer	Trash	Very dense: green filamentous; moss	Clear	None	Very sparse	None	Clear	Dry
11/8/2006	Boulder/cobble/gravel/sand/silt; becoming more embedded	Minor	Sparse: green filamentous; moderate: moss	Light yellow	None	Sparse	None	Clear	Wet
2/13/2007	Station not sampled; frozen bank to bank								
4/18/2007	Unobservable	Unobservable	Unobservable	Clear	None	None	None	Moderate	Wet
6/19/2007	Boulder/cobble/gravel/sand/silt; embedded	None	Very dense: brown film; sparse: moss	Light yellow	None	Sparse	None	Clear	Dry
8/29/2007	Boulder/cobble/gravel/sand	Floatables	Dense: green film	Clear	None	None	None	Clear	Dry
10/17/2007	Boulder/cobble/gravel/sand/silt	None	Sparse: green filamentous; sparse: moss	Light yellow	None	None	None	Clear	Dry (Wet, CA12 only)
1/30/2008	Cobble/gravel/sand	None	Moderate: green filamentous; sparse: moss	Clear	None	Very sparse	None	Clear	Dry
3/26/2008	Cobble/gravel/sand; embedded	None	Very dense: green filamentous; sparse: moss	Clear	None	Very sparse	None	Clear	Dry
5/21/2008	Cobble/gravel/sand/silt	None	None	Clear	None	Very sparse	None	Clear	Dry
7/23/2008	Unobservable	Unobservable	Unobservable	Light yellow	None	Very sparse	None	Highly turbid/murky	Wet
9/24/2008	Boulder/cobble/gravel/sand/silt	None	Sparse: green filamentous	Red/light yellow	None	Sparse	None	Clear	Dry
11/19/2008	Boulder/cobble/gravel/sand/silt	None	None	Clear	None	Sparse	None	Clear	Wet
2/24/2009	Boulder/cobble/gravel/sand	None	Sparse: light brown filamentous; moderate: moss	Light yellow	None	None	None	Clear	Wet
4/29/2009	Boulder/cobble/gravel/sand	None	Dense: green film; moderate: moss	Clear	None	Very sparse	None	Clear	Dry
6/24/2009	Cobble/gravel/sand/silt; embedded	None	Sparse: moss	Light yellow	None	Very sparse	None	Clear	Wet
8/26/2009	Boulder/cobble/gravel/sand/silt; embedded	None	Moderate: moss	Light yellow	None	Sparse	None	Clear	Wet
10/28/2009	Unobservable	None	Moderate: moss	Clear	None	Very sparse	None	Slight	Wet
2/23/2010	Cobble/gravel/sand	None	Moderate: dark green filamentous	Clear	None	Very sparse	None	Clear	Dry
7/21/2010	Cobble/gravel/sand	None	Sparse: green film; sparse: moss	Clear	None	Very sparse	None	Clear	Dry
10/6/2010	Cobble/gravel/sand/silt	None	Soarse: moss	Clear	None	Sparse	None	Slight	Wet
11/17/2010	Unobservable	Unobservable	Unobservable	Red	None	Very sparse	None	Highly turbid/murky	Wet

-- : Data not available

Table 4 MassDEP SMART 2005 - 2010. Station QR06. Summary of Observations.

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
3/2/2005	Cobble/gravel/sand; highly embedded	None	None	Clear	None	None	None	Clear	Wet
4/27/2005	Cobble/gravel/sand	Floatables	None	Clear	None	Sparse	None	Clear	Wet
6/22/2005	Boulder/cobble/gravel	Minor: broken glass, floatables	Moderate: green filamentous	Red	None	Moderate	None	Slight	Dry
8/24/2005	Boulder/cobble/gravel/sand/silt	Broken glass	Dense: filamentous	Clear	Slight effluent	Sparse	None	Clear	Dry
10/26/2005	Unobservable	Broken glass, floatables	Unobservable	Brown/light yellow	None	Sparse to moderate	None	Slight	Wet
1/25/2006	Boulder/cobble/gravel/sand	None	None	Clear	None	Sparse	None	Clear	Wet
3/22/2006	-- ; deeply embedded	None	None	Clear	None	Foam	None	Clear	Dry
5/17/2006	Gravel/sand	None	None	Brown	None	Sparse	None	Moderate	Wet
7/19/2006	Boulder/cobble/gravel/sand	Broken glass, metals	None	Light yellow	None	Sparse	None	Clear	Wet
9/27/2006	Boulder/cobble/gravel/sand; embedded	None	Very dense: green filamentous; very dense: moss	Clear	Fishy	Very sparse	None	Clear	Dry
11/8/2006	Unobservable	Trash	Unobservable	Light yellow	None	Foam	None	Slight	Wet
2/13/2007	Station not sampled on this date; not accessible due to snow/ice								
4/18/2007	Unobservable	Unobservable	Unobservable	Clear	None	Sparse	None	Moderate	Wet
6/19/2007	Boulder/cobble/gravel/sand; embedded	Minor	Very dense: green filamentous; sparse: moss	Light yellow	None	Moderate	None	Clear	Dry
8/29/2007	Boulder/cobble/gravel/sand/silt	None	Very dense: green film	Clear	Slight eutrophic pond	Sparse	None	Clear	Dry
10/17/2007	Boulder/cobble/gravel/sand	Broken bottles	Dense: dark green filamentous; very dense: moss	Light yellow	None	Sparse	None	Clear	Dry (Wet, CA12 only)
1/30/2008	Cobble/gravel/sand	None	None	Clear	None	Very sparse	None	Clear	Dry
3/26/2008	Cobble/gravel/sand	None	Moderate: green filamentous	Clear	None	Very sparse	None	Clear	Dry
5/21/2008	Cobble/gravel/sand	Floatables, broken glass	Brown filamentous	Clear	None	Foam	None	Clear	Dry
7/23/2008	Unobservable	Unobservable	Unobservable	Light yellow	None	Very sparse	None	Highly turbid/murky	Wet
9/24/2008	Cobble/gravel/sand	Minor	None	Clear	None	Sparse	None	Clear	Dry
11/19/2008	Cobble/gravel/sand; embedded	None	None	Clear	None	None	None	Clear	Wet
2/24/2009	Cobble/gravel/sand	None	None	Clear	None	None	None	Clear	Wet
4/29/2009	Cobble/gravel/sand	None	None	Clear	None	None	None	Clear	Dry
6/24/2009	Unobservable	None	None	Clear	None	Sparse	None	Clear	Wet
8/26/2009	Cobble/gravel/sand	None	Dense: green film	Light yellow	None	Sparse	None	Slight	Wet
10/28/2009	Unobservable	Unobservable	Unobservable	Light yellow	None	Sparse	None	Slight	Wet
2/23/2010	Boulder/cobble/gravel/sand	Minor	None	Clear	None	None	None	Clear	Dry
7/21/2010	Cobble/gravel/sand/silt	None	Moderate: green filamentous	Clear	None	None	None	Clear	Dry
10/6/2010	Unobservable	Unobservable	Unobservable	Clear	None	Sparse	None	Unobservable	Wet
11/17/2010	Unobservable	Unobservable	Unobservable	Red	None	Sparse	None	Unobservable	Wet
-- : Data not available									

Table 5 MassDEP SMART 2005 - 2010. Station FR11. Summary of Observations.

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
3/2/2005	Cobble/gravel/sand/silt	Trash	None	Clear	None	None	None	Clear	Wet
4/27/2005	Cobble/gravel/sand	Cigarettes, shopping cart, floatables, silt fence	None	Clear	None	Sparse	None	Clear	Wet
6/22/2005	Unobservable	Floatables, shopping cart, tire	Unobservable	Grey	None	Moderate	None	Highly turbid/murky	Dry
8/24/2005	Cobble/mud	Dense: floatables	Moderate: green filamentous	Green	None	Foam	None	Slight	Dry
10/26/2005	Unobservable	Unobservable; rip rap eroding into stream	Unobservable	Slight red	None	Sparse	None	Moderate	Wet
1/25/2006	Cobble/gravel/sand/mud	Floatables	None	Clear	None	Sparse	None	Clear	Wet
3/22/2006	Boulder/cobble/gravel/sand	Dense: tires, floatables	Very dense: green filamentous	Clear	None	Sparse	None	Clear	Dry
5/17/2006	Unobservable	Trash	Unobservable	Light yellow	None	Very sparse	None	Slight	Wet
7/19/2006	Boulder/cobble/gravel/sand	Floatables	None	Very light yellow	None	Moderate	None	Slight	Wet
9/27/2006	Boulder/cobble/gravel/sand/silt	Minor	Very dense in quiescent area, green filamentous	Clear	None	Sparse	None	Clear	Dry
11/8/2006	Unobservable	Unobservable; rip rap eroding into stream	Unobservable	Light yellow	None	Sparse	None	Unobservable	Wet
2/13/2007	Cobble/sand	Glass, metals	None	Clear	None	Foam	None	Clear	Dry
4/18/2007	Unobservable	Unobservable	Unobservable	Clear	None	Sparse	None	Moderate	Wet
6/19/2007	Cobble/gravel/sand/silt	Floatables	Dense: brown filamentous	Light yellow	None	Moderate	None	Moderate	Dry
8/29/2007	Cobble/gravel/sand/silt/mud	Floatables, beer bottles	Very dense: green film	Clear	None	Sparse	None	Moderate	Dry
10/17/2007	Unobservable	Beer cans, floatables, shopping cart, ball	Unobservable	Clear	None	Very sparse	None	Clear	Dry (Wet, CA12 only)
1/30/2008	Unobservable	Floatables	Unobservable	Light yellow;dark tan	None	Moderate	None	Highly turbid/murky; café latte	Dry
3/26/2008	Unobservable	Floatables	Unobservable	Clear	None	Sparse	None	Unobservable	Dry
5/21/2008	Cobble/sand/silt/mud	Shopping cart, floatables	Sparse: green filamentous	Clear	None	Moderate	None	Moderate	Dry
7/23/2008	Unobservable	Shopping cart, floatables	Unobservable	Light yellow	None	Moderate	None	Highly turbid/murky	Wet
9/24/2008	Unobservable	Unobservable	Unobservable	Light yellow	Musty, eutrophic	Moderate	None	Unobservable	Dry
11/19/2008	Unobservable	Cigarette butts, empty beverage containers	Unobservable	Clear	None	Sparse	None	Slight	Wet
2/24/2009	Unobservable	Shopping carts	Unobservable	Light yellow	None	Sparse	None	Slight	Wet
4/29/2009	Unobservable	Shopping cart, floatables	Unobservable	Clear	None	Sparse	None	Slight	Dry
6/24/2009	Unobservable	Floatables	None	Light yellow	None	Sparse	None	Moderate	Wet
8/26/2009	Unobservable	Moderate: shopping cart, floatables	Moderate: green filamentous	Light yellow	None	Sparse	None	Slight	Wet
10/28/2009	Unobservable	Floatables	Unobservable	Light yellow	None	Moderate	None	Unobservable	Wet
2/23/2010	Unobservable	Moderate: shopping cart, floatables	Unobservable	Clear	None	Sparse	None	Unobservable	Dry
7/21/2010	Cobble/gravel/sand/silt	Floatables, miscellaneous	Dense: bright green filamentous; loose floc	Clear	None	Moderate	None	Slight	Dry
10/6/2010	Unobservable	Moderate: floataables	Unobservable	Light yellow	Eutrophic pond; "chemical sweet" component	Sparse	None	Unobservable	Wet
11/17/2010	Unobservable	Unobservable; floatables where	Unobservable	Light yellow	None	Sparse	None	Unobservable	Wet
-- : Data not available									

Table 6 MassDEP SMART 2009 - 2010. Station FR12. Summary of Observations.

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
2/24/2009	Cobble/gravel/sand/silt; embedded, rocks black	Minor: broken glass	None	Light yellow	None	Sparse	None	Clear	Wet
4/29/2009	Cobble/gravel/sand	Minor: broken glasss, bricks	Moderate: green filamentous	Clear	None	Dense	None	Clear	Dry
6/24/2009	Cobble/gravel/sand	Minor: broken glass, bricks	Moderate: moss	Light yellow	None	Moderate	None	Slight	Wet
8/26/2009	Cobble/gravel/sand	Broken glass	Sparse: moss	Light yellow	None	Very sparse	None	Slight	Wet
10/28/2009	Unobservable	Unobservable	Unobservable	Light yellow	Effluent	Moderate	None	Unobservable	Wet
2/23/2010	Boulder/cobble/gravel/sand/silt	Minor: plastics, bricks, broken glass	None	Clear	None	Very sparse	None	Clear	Dry
7/21/2010	Cobble/gravel/sand/silt	Broken glass, miscellaneous	Moderate: brown film; sparse: moss	Red, slight	None	None	None	Clear	Dry
10/6/2010	Cobble/gravel/sand/silt	Minor: planks, floatables, broken glass, telephone pole segment	Dense: moss	Light yellow	Musty, strong; eutrophic pond; "chemical sweet" component	Sparse	None	Slight	Wet
11/17/2010	Boulder/cobble/gravel/sand/silt	Minor: broken glass, floatables	Dense: green film; sparse: moss	Light yellow	None	Sparse	None	Slight	Wet

-- : Data not available

SURVEY CONDITIONS

Stream discharge and precipitation data are used to determine hydrologic conditions and, consequently, if water quality surveys should be described as dry- or wet weather-influenced events. Precipitation data for each monitoring event 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 the National Weather Service (NWS) data located on their website NOAA Climatological Data Publications (NOAA 2015). The weather station closest to the French/Quinebaug watershed sampling stations is located in Southbridge, MA; precipitation data collected here were utilized in this report. However, temperature data were not available, therefore data collected at the Worcester station were utilized. Precipitation ranges from 48 to 50 inches (in) throughout most of the basin in Massachusetts; a small area ranges from 50 to 52 inches in the south-central area along the CT border (Ostiguy et al 2010).

During dry weather, trace amounts of precipitation may fall, but there is no measurable change in stream flow. The United States Geological Survey (USGS) operates four real time stream gaging stations in the French/ Quinebaug Watershed that are applicable to this water quality data set, as shown below:

- Quinebaug River below East Brimfield Dam at Fiskdale, MA (USGS 2012a)
- Quinebaug River below Westville Dam near Southbridge, MA (USGS b)
- Quinebaug River at Quinebaug, CT (USGS 2012c) and
- French River at Webster, MA (USGS 2012d).

Discharge data (in cubic feet per second, or cfs) from the stations in Massachusetts can be accessed at Daily Data for Massachusetts: Stage and Streamflow (USGS 2012e) and for Connecticut at Daily Data for Connecticut: Stage and Streamflow (USGS 2012f).

The period of record (POR) mean streamflow values are the mean of daily mean values for each day for 79 years of record at the USGS Quinebaug River gage at Quinebaug, CT (USGS station number 01124000), recorded in cubic feet per second (cfs). The daily mean data are reported at Daily mean data (USGS 2012g). The monthly mean discharges are found at Monthly mean data (USGS 2012h).

Wet weather is defined as precipitation within a five-day antecedent period that leads to more than a slight increase in stream discharge at the four stations listed above. Under dry weather conditions, trace amounts of precipitation may fall, but no measurable change in stream flow occurs. All of the French/Quinebaug Watershed gaging stations were affected by flow manipulation and were difficult to distinguish from precipitation-related fluctuations on some dates.

Precipitation and discharge data as well as field observations were used to determine if samples were impacted by surface water runoff. Table 7 (precipitation) and Table 8 (stream discharge) report survey conditions during each sampling event. Precipitation data utilized in this tech memo were reported at the Southbridge, MA National Weather Service (NWS) station; in the absence of data at the Southbridge station, data were used from the Buffumville (Charlton, MA) NWS station. Discharge data were collected at the USGS stream gaging station on the Quinebaug River in Quinebaug, CT. Low flows were compared to the 7Q10 flow (the lowest 7-day average streamflow that occurs, on average, once every 10 years) at the Quinebaug River, Quinebaug, CT (16.64 cfs) (USGS 2012i); the 7Q10 at the French River upstream of the Webster-Dudley WWTP is 14.8 cfs (USGS 2012j). Air temperature was recorded at each station in degrees Fahrenheit (ºF).

March 2, 2005 – Little precipitation was recorded at the Buffumville NWS station in the 5 days prior to this event (0.21 inches, or in); discharge fell steadily at the Quinebaug River gages at East Brimfield and Quinebaug, CT and flows were well below the daily and monthly mean values. Of the recorded precipitation, 4.0 inches (or in) of snow fell at Buffumville on February 25th, with 6 inches (or in) on the ground on that date (snowfall and snow on the ground data are unavailable for that location from February 26 – March 2). Snowfall at East Brimfield Lake in this period totaled 12.1 in with snow on the ground decreasing from 7 to 3 in from February 25-28, then rising to 8 in by March 2nd. Southbridge snowfall data was not reported. Maximum daily temperature ranged from 28 to 35ºF at East Brimfield Lake and from 28 to 34ºF at Buffumville in this 5 day period. Based on snowfall, snow on the ground and temperature data, water quality on this date reflects wet weather/snowmelt conditions. Air temperature ranged from 26 to 33 ºF and cloud cover from 40 to 100%.

April 27, 2005 – This mid-spring event fell during a wet period, with 2.61 in of rainfall recorded at Southbridge. Discharge generally rose at the Quinebaug River gage during the 5 days preceding this even; overall flows were well above the daily and monthly mean values. Field observations note elevated water levels at all stations, as well as the absence of foliage. Water quality data collected on this date reflect wet weather/runoff conditions. Air temperature ranged from 53 to 57ºF throughout monitoring activities; precipitation was constant, and ranged from drizzle to rain.

June 22, 2005 – This summer event followed a four-day dry period with consistently decreasing discharge and low water levels throughout the watershed. Field observations note rain fell at the last station, located in Webster, although no precipitation was recorded on this date at the Southbridge Airport NWS station. Based on precipitation and discharge data, water quality on this date reflects dry conditions. Air temperature ranged from 68 to 70ºF with overcast skies developing to rain by the end of monitoring activities.

August 24, 2005 – Precipitation recorded at the Southbridge gage totaled 0.84 in the 5 days preceding this summer monitoring event (August 22). Discharge at the Quinebaug gage increased from August 19-22, then decreased to the lowest level recorded in this period. Field observations noted low to very low water levels at all stations. Based on discharge data and field observations, water quality data collected on this date reflect dry weather conditions. Air temperature increased from 65 to 74°F and cloud cover ranged from 60 to 90% throughout monitoring activities.

October 26, 2005 – Fall sampling in 2005 was conducted within a wet period largely associated with Hurricane Wilma; 3.40 in precipitation was recorded in Southbridge from October 21st through 26th. Discharge at the Quinebaug gage generally reflected precipitation. Field observations note elevated water levels throughout the watershed. Foliage had begun to change but most leaves remained on the trees. Based on precipitation and discharge, the data collected on this event reflect wet weather/runoff conditions. Air temperature increased from 38 to 44°F with cloud cover ranging from 40 to 100%.

January 25, 2006 – Winter sampling in the F/Q watershed was preceded by 0.74 in (recorded at Southbridge) of precipitation from January 23-24, with an additional 0.11 in on the sampling date. Of the recorded precipitation, 5.0 in was as snow. Maximum daily temperature measured in this five-day period ranged from 35 to 57ºF. Stream discharge fell steadily at the Quinebaug, CT gage throughout the preceding week. Based on snowfall and temperature, water quality data on this date reflect wet weather/snowmelt conditions. Air temperature ranged from 32 to 40ºF; cloud cover ranged from 30% to overcast during monitoring activities.

March 22, 2006 – This early spring event fell within a dry period (no precipitation recorded at Southbridge), with steadily decreasing discharge. Water quality data on this date reflect dry weather conditions. Air temperature ranged from 34 to 41ºF under overcast skies.

May 17, 2006 – This mid-spring monitoring event followed a wet period, with 4.09 in of rain recorded from May 12-17. Discharge at the Quinebaug, CT gage rose steadily during this time. Based on precipitation and discharge, water quality data collected on this date reflect wet weather/runoff conditions. Air temperature ranged from 60 to 67ºF with skies ranging from sunny to 65% cloud cover. Trees and shrubs were in full foliage.

July 19, 2006 – An overnight thunderstorm the day before monitoring activities brought 0.38 in of rainfall to the watershed. Discharge at area gages fell from July 14-18, then rose from approximately midnight through noon on the day of sampling activities. Based on precipitation and discharge, water quality data reflect wet weather/runoff conditions. Air temperature ranged from 74 to 78ºF with skies ranging from sunny to overcast.

September 27, 2006 – This early fall event fell within a dry period, with 0.03 inches of precipitation recorded in the 5 preceding days. Discharge at the Quinebaug River, Quinebaug, CT gage was consistently below the 7Q10 during this period. Field observations depict low to very low water levels throughout the watershed. Foliage had just begun to change, and most leaves remained on the trees on this event. Based on precipitation, discharge and field observations, water quality data collected on this date reflect dry weather conditions. Air temperature ranged from 49 to 61ºF with cloud cover ranging from >60% to overcast.

November 8, 2006 – A storm brought 1.03 in precipitation to the area on November 7-8 (as recorded at Southbridge); discharge rose during this period. Foliage had changed and most leaves were down in the watershed. Based on precipitation and discharge, water quality data collected on this date reflect wet

weather/runoff weather conditions. The air temperature ranged from 55 to 57ºF; weather conditions included fog, drizzle and rain.

February 13, 2007 – This winter sampling event fell within a dry period; in the five days prior to this spring sampling event, an absence of precipitation was recorded at the three weather stations in the watershed. Snow on the ground data were only available at the East Brimfield Lake station, indicating that snowpack decreased from 2 in on February 8th to 1 in on February 9th, and remained at 1 in through the sampling date. Discharge generally decreased during this time. Field observations show few patches of snow on the ground at sampling sites. Based on precipitation and discharge, water quality data collected on this date reflect dry weather conditions. Air temperature ranged from 10 to 13ºF under overcast skies.

April 18, 2007 – A very wet period preceded this sampling event, with a total of 4.32 in of precipitation measured at the Southbridge airport. Discharge at the Quinebaug River at Quinebaug, CT gage rose on April 15 and remained well above pre-storm levels through the sampling date. Field observations indicate high water levels at all stations; foliage had not yet emerged throughout the watershed. Based on precipitation, discharge and field observations, data reflect wet weather/runoff conditions. Air temperature ranged from 40 to 42ºF with skies ranging from overcast to drizzle/rain.

June 19, 2007 – A storm brought 0.57 in of precipitation to the area on June 17-18. Discharge at area gages reflected little variation in the preceding 7-day period at the East Brimfield Lake, and some non-natural fluctuations at other area gages (Quinebaug River at Westville and Quinebaug, CT and the French River, Webster). Field observations indicate foliage was fully leafed out at area stations. Based on discharge and field notes, water quality data reflect dry conditions for this event. Air temperature ranged from 67 to 83ºF under sunny skies.

August 29, 2007 – No precipitation was measured at the East Brimfield Lake weather station from August 24-2; flow varied little at area gages during this period. Discharge was well below the 7Q10 at the Quinebaug River gages in East Brimfield and Quinebaug, CT, as well as the French River at Webster. Field observations indicate very low water levels and exposed substrates at all stations. Based on precipitation, discharge and field observations, water quality data reflect dry weather conditions on this event. Air temperature ranged from 67 to 81ºF and cloud cover from 0 to <5% during this event.

October 17, 2007 - Minimal precipitation was recorded in the 5 days preceding this winter monitoring event (0.28 in on October 12). Discharge varied little from October 12-17, and was below the 7Q10 during most of this period. Field observations indicated very low water levels throughout the watershed, with the exception of Cady Brook; a 4-ft drawdown upstream at Glen Echo Lake began on October 15, and was likely the source of the elevated water levels observed at this station (GEIA 2012). Foliage was changing and largely down throughout the watershed. Based on precipitation, discharge and field observations, data collected during this event are considered to reflect dry weather conditions, with the exception of Cady Brook. Glen Echo Lake is impaired for organic enrichment/low DO (MassDEP 2009), and the lake drawdown is a potential source of organic pollutants to Cady Brook. Thus, water quality on Cady Brook on this date reflects wet weather/runoff. Air temperature ranged from 46 to 56ºF; cloud cover varied from 60 to 100%.

January 30, 2008 – Winter sampling was also preceded by a dry period, with 0.05 in precipitation noted at the Southbridge airport weather station in the previous 5 days in the form of 1 inch of snow. Snow on the ground during this period decreased from 4 to 3 inches January 29-30, coinciding with maximum daily temperatures above freezing (39 to 45ºF). At the Quinebaug River gages in Sturbridge and Southbridge, discharge decreased steadily from January 25-29, then increased slightly on the sampling date at approximately mid-day (after the conclusion of sampling activities). The Quinebaug River at Quinebaug, CT and French River, Webster gages reflected non-natural flow fluctuations. Based on snowfall, snow on the ground and discharge, water quality data collected on this event reflect dry weather conditions. Air temperature ranged from 40 to 44ºF; overcast skies progressed to rain/drizzle after the first station.

March 26, 2008 – This early spring sampling event also followed a dry period, with an absence of precipitation noted at area weather stations in the previous 5 days, and marginal rainfall only on the day of monitoring. Discharge on the Quinebaug River decreased steadily during this period. Based on precipitation and discharge, data collected during this event reflect dry weather conditions. Air temperature ranged from 45 to 57ºF with cloud cover ranging from 10 to 100%. Trees and shrubs had not yet begun to bud.

May 21, 2008 – Within the five days preceding this summer event, 0.85 inches of rain were recorded at Southbridge (May 17-18). Discharge decreased steadily during this period at the Quinebaug River gage at East Brimfield Lake, while the Quinebaug River in Southbridge and Quinebaug, CT reflected non-natural fluctuations. Field observations noted trees and shrubs were fully leafed out. Normal water levels were noted at all stations. Based on precipitation and field observations, data collected on this date reflect dry weather conditions. Air temperature ranged from 59 to 72ºF under sunny skies (cloud cover <5%)

July 23, 2008 – Precipitation in the 5 days preceding this early fall event included 0.41 in recorded at Southbridge, with an additional 1.22 inches on the sampling date (overnight thunderstorms with heavy rain began before sampling activities commenced)**.** Discharge reflected precipitation patterns at area gages (the French River, Webster discharge again reflected non-natural fluctuations). Field observations note murky conditions at Cady Brook, the Quinebaug River at Quinebaug, CT and the French River stations. Based on precipitation, discharge and field observations, data collected on this date reflect wet weather/runoff conditions. Air temperature ranged from 68 to 72ºF; skies ranged from overcast to drizzle/rain. Turbidity and alkalinity data are not available for this date.

September 24, 2008 – Early fall monitoring fell within a dry period in which an absence of precipitation was recorded at area weather stations and discharge decreased steadily throughout the watershed (September 19-24). Field observations indicate that water levels were lower than typical at all stations except Cady Brook. Based on precipitation, discharge and field observations, water quality data collected on this event reflect dry weather conditions. Air temperature ranged from 52 to 63ºF under sunny skies. Foliage was beginning to change, while most leaves remained on trees and shrubs.

November 19, 2008 – In the five days preceding this fall monitoring event, 1.01 in of precipitation was recorded at the Southbridge airport. Discharge on the Quinebaug River below East Brimfield Lake reflected flow manipulations, most likely associated with flood control operations. All other area gages reflected non-natural manipulation as well. Foliage was completely down. Field notes indicate normal to elevated water levels. Based on precipitation, data collected on this event are considered to reflect wet weather/runoff conditions. Air temperature ranged from 28 to 32ºF under sunny skies.

February 24, 2009 – Precipitation at the Southbridge airport totaled 1.12 in from February 19-24; of this, 2.5 in was as snow. Although 3 in snow was recorded on the ground on February 19, none remained by the following day. Maximum daily temperature was generally above freezing during this period. Discharge patterns reflect precipitation at area gages, with non-natural fluctuations at the Quinebaug River, Quinebaug, CT and French River, Webster gages. Field notes indicate snow throughout the area, with slopes bare of snow in areas most exposed to sunlight. Water levels were normal at all stations. Based on precipitation and discharge, data collected on this event reflect wet weather/runoff conditions. Air temperature ranged from 22 to 32ºF under sunny skies.

April 29, 2009 – This spring monitoring event followed a five-day period with no measurable precipitation at the Southbridge Airport weather station. In general, discharge decreased steadily during this time (man-made fluctuations were observed at all area gages). Field observations noted normal water levels at the Quinebaug watershed stations. Trees and shrubs were just beginning to leaf out. Based on precipitation and discharge, data collected on this event are considered to reflect dry weather conditions. Air temperature ranged from 51 to 61ºF under mostly cloudy skies (85 to 100% cloud cover).

June 24, 2009 – A wet period preceded this early summer monitoring event (1.41 in precipitation at Southbridge). Flow fluctuations were observed at all stations, although discharge was elevated (above both the daily and monthly mean values) throughout the watershed during this time. Based on precipitation and discharge, data collected on this event reflect wet weather/runoff conditions. Air temperature ranged from 67 to 67ºF; drizzly/rainy skies became overcast by the last station.

August 26, 2009 – This summer monitoring event fell within a relatively wet period, with 0.72 in of precipitation in the preceding five days (Southbridge) from August 21-26. Discharge generally reflected precipitation at the Quinebaug River gages in Southbridge and Quinebaug, CT; in addition, the gages on the Quinebaug River below East Brimfield Lake and the French River in Webster exhibited non-natural fluctuations. Based on precipitation and discharge, data collected on this event reflect wet weather/runoff conditions. Air temperature ranged from 71 to 81ºF under sunny skies.

October 28, 2009 – A fall storm on October 24-25 dropped 1.13 in of precipitation on the area; an additional 0.38 inches fell on the sampling date, beginning mid-morning. Discharge at area gages reflected non-natural fluctuations in addition to precipitation events; in general, flow during monitoring activities was higher than pre-storm conditions. Field observations noted documented water levels at all stations. Foliage had changed and most leaves were down. Based on precipitation, discharge and field observations, data from this event reflect wet weather/runoff conditions. Air temperature ranged from 50 to 52ºF; overcast skies became drizzly by the 4th and 5th sampling locations (both French River stations).

February 23, 2010 – In the 5 days preceding this event, an absence of precipitation was recorded at the Southbridge Airport. Discharge varied little at area gages, with non-natural flow fluctuations recorded at the French River, Webster. Although 4 inches of snow was measured on the ground at Southbridge on February 18, it was completely melted by February 20th. Maximum daily temperatures were above freezing during this time period. Field observations note snow along the banks at most stations, but patchy overall. Data from this event reflect dry weather conditions. Air temperature rose from 36 to 43ºF with heavy snowfall becoming light by the end of monitoring activities.

July 21, 2010 – This summer event followed a five-day period in which 0.17 in precipitation was measured at the Southbridge Airport. In general, discharge varied little at area gages, with rapid non-natural fluctuations at the Quinebaug River, Southbridge and the French River, Webster. Field observations note low water levels at all stations. Based on precipitation, discharge and field observations, data collected on this event reflect dry weather conditions. Air temperature ranged from 73 to 83ºF under mostly cloudy to overcast skies.

October 6, 2010 – A slow-moving front brought 3.94 in of rain to the area on October 1-2 and an additional 0.54 in from October 4-6; area gages reflected the precipitation events. Data collected on this event reflect wet weather/runoff conditions. Air temperature ranged from 57 to 60ºF, with rain/drizzle throughout.

November 17, 2010 – Although no precipitation fell in the area during the 5 days preceding this fall event; 1.28 in was recorded at Southbridge on the sampling date. Field notes indicate that rainfall began the night prior to monitoring. Increases in flow at area gages generally mirror precipitation input. Data collected on this event reflect wet weather/runoff conditions. Air temperature ranged from 54 to 63ºF with overcast/foggy skies becoming mostly cloudy by the end of sampling activities (cloud cover 60%).

Table 7 French/Quinebaug Basin Precipitation Data Summary 2005-2010							
Survey Dates	**5 Days**	**4 Days**	**3 Days**	**2 Days**	**1 Day**	**Sample**	**Wet/Dry****
March 2, 2005***	0.21	0.00	0.00	0.00	–	0.00	Wet
April 27, 2005	0.00	0.08	2.33	0.19	0.01	0.00	Wet
June 22, 2005	0.38	0.00	0.00	0.00	0.00	0.00	Dry
Aug 24, 2005	0.00	0.00	0.00	0.84	0.00	0.00	Dry
Oct 26, 2005	0.00	0.00	1.03	0.02	1.22	1.12	Wet
Jan 25, 2006	0.00	0.00	0.00	0.21	0.53	0.11	Wet
March 22, 2006	0.00	0.00	0.00	0.00	0.00	0.00	Dry
May 17, 2006	0.07	1.70	0.49	0.54	0.10	1.19	Wet
July 19, 2006	0.00	0.00	0.00	0.00	0.38	0.00	Wet
Sept 27, 2006	0.00	0.00	0.03	0.00	0.00	0.00	Dry
Nov 8, 2006	0.00	0.00	0.00	0.00	0.31	1.72	Wet
Feb 13, 2007	0.00	0.00	0.00	0.00	0.00	0.00	Dry
April 18, 2007	0.00	0.01	4.23	0.35	0.21	0.05	Wet
June 19, 2007	0.00	0.00	0.00	0.55	0.02	0.00	Dry
Aug 29, 2007***	0.00	0.00	0.00	0.00	0.00	0.00	Dry
Oct 17, 2007	0.28	0.00	0.00	0.00	0.00	0.00	Dry/Wet****
Jan 30, 2008	0.00	0.00	0.00	0.05	0.00	0.00	Dry
Mar 26, 2008	0.00	0.00	0.00	0.00	0.00	0.01	Dry
May 21, 2008	0.00	0.84	0.01	0.00	0.00	0.00	Dry
July 23, 2008	0.00	0.05	0.00	0.34	0.02	1.22	Wet
Sept 24, 2008	0.00	0.00	0.00	0.00	0.00	0.00	Dry
Nov 19, 2008	0.27	0.08	0.65	0.01	0.00	0.00	Wet
Feb 24, 2009	0.60	0.02	0.00	0.00	0.50	0.00	Wet
April 29, 2009	0.00	0.00	0.00	0.00	0.00	0.00	Dry
June 24, 2009	1.18	0.02	0.02	0.12	0.07	0.00	Wet
Aug 26, 2009	0.00	0.28	0.12	0.30	0.02	0.00	Wet
Oct 28, 2009	0.00	0.21	1.03	0.00	0.00	0.38	Wet
Feb 23, 2010	0.00	0.00	0.00	0.00	0.00	0.00	Dry
July 21, 2010	0.00	0.13	0.00	0.00	0.04	0.00	Dry
Oct 6, 2010	0.59	3.35	0.00	0.20	0.13	0.21	Wet
Nov 17, 2010	0.00	0.00	0.00	0.00	0.00	1.28	Wet

*Official data in inches of precipitation from the National Weather Service station in Southbridge, MA available at NOAA Climatological Data Publications (NOAA 2015).
**Based on precipitation, streamflow and other relevant data.
*** In the absence of qualified data at the Southbridge station, data are reported from Buffumville (Charlton), MA
****Wet conditions at Cady Brook, Station CA12 only; drawdown at upstream Glen Echo Lake
– No record. Data not recorded, determined unreliable by quality control check, or not received in time for publication.

Table 8 USGS Flow Data Summary Discharge 2005-2010
Quinebaug River at Quinebaug, CT*

Survey Dates	5 Days	4 days	3 Days	2 Days	1 Day	Sample	Monthly**	Daily***
March 2, 2005	325[e]	312[e]	295[e]	280[e]	281[e]	276[e]	385.4	357
April 27, 2005	209	372	926	841	941	952	729.2	443
June 22, 2005	113	103	102	87	79	74	100.4	171
Aug 24, 2005	37	34	39	39	32	29	31.8	98
Oct 26, 2005	1,260	1,090	892	1,160	1,660	1,550	1,072	200
Jan 25, 2006	1,280	1,160	884	743	716	680	707.6	424
March 22, 2006	225	202	184	172	157	156	188.3	631
May 17, 2006	236	540	647	704	902	1,030	432.5	306
July 19, 2006	192	186	173	144	134	158	218.8	81
Sept 27, 2006	13	12	10	10	8.0	7.9	67.7	123
Nov 8, 2006	294	265	263	234	207	297	528.5	197
Feb 13, 2007	409[e]	401[e]	375[e]	370[e]	314[e]	319[e]	308.8	301
April 18, 2007	681	585	763	2,730	1,810	1,920	967.8	525
June 19, 2007	130	121	128	137	126	109	127.7	194
Aug 29, 2007***	12	12	11	11	11	11	15.5	70
Oct 17, 2007	45	10	12	37	17	15	27.0	201
Jan 30, 2008	210[e]	198[e]	179[e]	178[e]	174	196	304.5	394
Mar 26, 2008	718	647	561	473	427	404	807.4	593
May 21, 2008	202	314	300	279	244	217	272.6	290
July 23, 2008	43	38	35	58	62	257	206.9	123
Sept 24, 2008	265	222	195	178	160	134	464.9	126
Nov 19, 2008	268	232	315	285	240	254	355.3	221
Feb 24, 2009	307	332	303	317	365	323	310.5	360
April 29, 2009	518	470	492	491	377	307	428.7	417
June 24, 2009	331	295	267	235	217	191	171.1	161
Aug 26, 2009	91	101	108	135	134	125	232.9	81
Oct 28, 2009	159	195	255	252	261	315	144.6	190
Feb 23, 2010	202[e]	202[e]	201[e]	200[e]	199[e]	198[e]	395.9	350
July 21, 2010	37	35	33	31	32	31	39.4	92
Oct 6, 2010	178[p]	194[p]	198[p]	175[p]	128[p]	158[p]	142.3	125
Nov 17, 2010	240[p]	222[p]	188[p]	169[p]	161[p]	335[p]	198.8	239

*Gage # 0112400 data (cfs) found at http://waterdata.usgs.gov/ct/nwis/dv/?site_no=01124000&PARAmeter_cd=00060,00065 (USGS 2012c); all data were approved for publication; processing and review completed.
**Mean of monthly mean discharge (cfs) based on data collected from 10/1/1931 to 9/30/2010 found at Monthly mean discharge at Quinebaug River, Quinebaug, CT (USGS 2012h)
***POR= Period of Record, mean of daily mean discharge based on data collected from 10/1/1931 to 9/30/2010 found at Mean of daily mean values at Quinebaug River, Quinebaug, CT (USGS 2012g)
[e] = Estimated value
[P] = Provisional data subject to revision
7Q10 = 16.640 cfs @ USGS gaging station, Quinebaug River near Quinebaug, CT (USGS 2012i)

RESULTS AND QUALITY ASSURANCE/QUALITY CONTROL

The results of SMART monitoring conducted in the French/Quinebaug watershed from 2005 through 2010 are included below. *In situ* multiprobe readings, including temperature, pH, dissolved oxygen, percent oxygen saturation, depth, specific conductivity, and total dissolved solids, are presented for each station in Table 9 through Table 13. Nutrient and chemistry data are presented in Table 14 through Table 18. Most results are expressed as milligrams per liter (mg/L). Exceptions include: depth in meters (m); temperature in degrees Celsius (ºC); pH in Standard Units (SU); conductivity in microsiemens per centimeter (µS/cm); dissolved oxygen saturation in percent (%); and turbidity, in Nephelometric Turbidity Units (NTU).

Field sheets, field notebooks, chain of custody forms, raw data files, lab reports and other metadata are maintained by the Massachusetts Department of Environmental Protection (MassDEP) Bureau of Resource Protection (BRP) CEntral Regional Office (CERO) in Worcester, MA and data are stored electronically in the Division of Watershed Management's (DWM) water quality database. Detailed information regarding the data validation process is explained in the separate document, *CN 56.2 Standard Operating Procedure Data Validation and Usability* (MassDEP 2005). Specific validation criteria used for 2005-2010 data include, but are not limited to: conformance to the SMART Monitoring Quality Assurance Project Plan (Beaudoin 2008) and DWM standard operating procedures (SOPs), precision, accuracy, representativeness, holding times, sample preservation, frequency of field QC samples, contamination of field blanks, stability of multiprobe readings and documentation. The following data qualifiers were applied as needed:

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

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

Table 9 MassDEP SMART 2005-2010. Station QR00. *In Situ* Multiprobe Data.

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(us/cm)	(mg/l)	(mg/l)	(%)
3/2/2005	SM-6155	8:56	0.4	0.9	6.2	131	85	14.7	103
4/27/2005	SM-6196	9:08	0.5	13.0	6.2	121	79	10.1	96
6/22/2005	SM-1371	9:02	0.1	22.2	6.7	143	93	8.0	92
8/24/2005	SM-1453	8:45	0.1	23.0	7.0	151	98	7.6	89
10/26/2005	SM-1523	9:09	0.4	9.9	5.9	79	52	9.8	87
1/25/2006	SM-1593	9:01	0.4	1.4	6.0	98	--	13.6	--
3/22/2006	SM-1663	8:49	0.3	3.0	6.8	118	77	13.9	103
5/17/2006	SM-1733	9:12	0.6	11.7	6.3	116	75	10.2	94
7/19/2006	SM-1803	8:53	0.2	27.4	7.0	109	71	7.2	92
9/27/2006	SM-1861	9:05	0.0	16.7	7.0	120	78	9.4	96
11/8/2006	SM-1943	8:45	0.2	6.8	6.5	103	67	12.4	102
2/13/2007	SM-2013	8:50	0.1	1.2 u	6.4 u	117 u	76 u	14.6 u	103 u
4/18/2007	SM-2083	8:47	0.5	5.7	5.8	74	48	12.0	96
6/19/2007	SM-2153	8:48	0.2	22.4	6.9	114	74	8.2	94
8/29/2007	SM-2223	8:59	0.1	21.0	7.0	136	88	7.9	88
10/17/2007	SM-2293	9:03	0.1	12.8	7.1	154	100	10.1	96
1/30/2008	SM-2363	8:46	0.1	1.6	6.4	146	95	13.9	100
3/26/2008	SM-2433	8:56	0.2	4.9	6.4	119	78	13.6	106
5/21/2008	SM-2503	8:57	0.3	14.7	6.8	120	78	10.1	100
7/23/2008	SM-2609	8:46	0.2	25.1	6.9	129	84	7.5	91
9/24/2008	SM-2715	8:50	0.3	16.6	6.7	101	65	9.4	96
11/19/2008	SM-2785	8:56	0.3	5.7	6.6	114	74	11.4	91
2/24/2009	SM-2855	8:32	0.3	1.2	6.3	129	84	14.9	105
4/29/2009	SM-2927	8:36	0.3	17.5	6.7	129	84	9.6	100
6/24/2009	SM-2999	8:47	0.2	19.1	6.5	122	79	8.6	94
8/26/2009	SM-3071	8:27	## i	25.1	6.9	121	79	7.3	88
10/28/2009	SM-3143	8:48	0.3	10.4	6.7	113	74	11.2	100
2/23/2010	SM-3215	8:42	0.1	2.0	6.3	117	76	13.7	99
7/21/2010	SM-3287	8:24	0.1	25.0	7.0	138	89	7.0	85
10/6/2010	SM-3359	9:07	## i	14.9	6.8	135	88	9.6	95
11/17/2010	SM-3431	8:34	0.3	7.3	6.6	124	81	11.8	98

Table 10 MassDEP SMART 2005-2010. Station CA12. *In Situ* Multiprobe Data.

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(us/cm)	(mg/l)	(mg/l)	(%)
3/2/2005	SM-6156	9:34	0.4	0.4	7.0	621	404	15.3	106
4/27/2005	SM-6197	9:47	0.2	11.6	6.9	371	241	11.0	101
6/22/2005	SM-1373	9:48	0.2	17.1	7.2	618	401	9.6	99
8/24/2005	SM-1455	9:30	0.2	16.6	7.6	786	511	10.1	104
10/26/2005	SM-1525	9:55	0.5	8.6	6.8	210	136	11.4	97
1/25/2006	SM-1595	9:41	0.2	2.1	6.8	376	--	13.6	--
3/22/2006	SM-1665	9:26	0.3	2.4	7.1	447	291	15.9	116
5/17/2006	SM-1735	9:57	0.4	11.5	6.9	295	192	10.9	100
7/19/2006	SM-1805	9:36	0.3	22.7	7.5	409	266	8.6	100
9/27/2006	SM-1863	9:46	0.2	10.6	7.5	627	407	11.6	104
11/8/2006	SM-1945	9:19	0.2	8.6	7.1	206	134	11.9	102
2/13/2007	SM-2015	**	**	**	**	**	**	**	**
4/18/2007	SM-2085	9:41	0.4	5.2	6.6	225	146	12.4	98
6/19/2007	SM-2155	9:36	0.4	17.6	7.2	452	294	9.3	98
8/29/2007	SM-2225	9:35	0.1	16.1	7.3	1052 c	684 c	9.4	96
10/17/2007	SM-2295	9:45	0.2	10.1	7.3	282	183	11.2	100
1/30/2008	SM-2365	9:31	0.3	2.8	7.0	215	139	13.7	102
3/26/2008	SM-2435	9:56	0.2	4.2	7.0	258	168	14.0	107
5/21/2008	SM-2505	9:46	0.2	12.0	7.2	379	247	10.9	101
7/23/2008	SM-2611	9:31	0.3	22.4	7.3	381	248	8.3	96
9/24/2008	SM-2717	9:30	0.3	12.1	7.2	381	248	10.5	98
11/19/2008	SM-2787	9:44	0.3	3.5	7.2	212	138	13.4	101
2/24/2009	SM-2857	9:14	0.3	-0.4	6.8	761 c	495 c	16.1	109
4/29/2009	SM-2929	9:28	0.3	13.8	7.2	363	236	10.6	103
6/24/2009	SM-3001	9:24	0.4	16.9	7.2	398	259	9.2	96
8/26/2009	SM-3073	9:00	## i	20.2	7.4	345	224	8.7	96
10/28/2009	SM-3145	9:30	0.4	10.1	7.2	209	136	11.2	100
2/23/2010	SM-3217	9:22	0.3	1.9	7.2	489	318	14.0	101
7/21/2010	SM-3289	9:10	0.1	20.3	7.6	624 u	405 u	9.0	100
10/6/2010	SM-3361	9:47	0.3	14.0	7.4	462	300	9.9	96
11/17/2010	SM-3433	9:17	0.4	8.9	7.0	298	194	11.0	95

Table 11 MassDEP SMART 2005-2010. Station QR06. *In Situ* Multiprobe Data.

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(us/cm)	(mg/l)	(mg/l)	(%)
3/2/2005	SM-6157	10:15	0.4	0.8	7.0	256	166	15.1	106
4/27/2005	SM-6198	10:21	0.9	12.8	6.7	154	100	10.7	101
6/22/2005	SM-1375	10:31	0.1	20.9	7.3	247	160	9.0	100
8/24/2005	SM-1457	10:04	0.1	21.1	7.4	296	192	8.8	100
10/26/2005	SM-1527	10:43	1.3	8.5	6.6	134	87	11.8	101
1/25/2006	SM-1597	10:29	0.7	1.6	6.6	159	--	14.0	--
3/22/2006	SM-1667	10:10	0.4	4.2	7.1	204	133	14.4	110
7/19/2006	SM-1807	10:16	0.3	26.6	7.3	194	126	8.0	100
9/27/2006	SM-1865	10:25	0.3	14.8	7.5	269	175	10.8	107
11/8/2006	SM-1947	9:53	0.4	7.7	7.1	171	111	12.3	103
2/13/2007	SM-2017	**	**	**	**	**	**	**	**
4/18/2007	SM-2087	10:18	1.1	5.5	6.5	135	88	12.4	98
6/19/2007	SM-2157	10:17	0.3	21.6	7.3	210	137	9.1	104
8/29/2007	SM-2227	10:26	0.1	20.3	7.5	407	265	9.1	101
10/17/2007	SM-2297	10:19	0.1	10.8	7.5	414	269	11.3	102
1/30/2008	SM-2367	10:09	0.2	1.0	7.0	238	155	14.8	105
3/26/2008	SM-2437	10:39	0.3	5.3	6.9	175	114	13.6	108
5/21/2008	SM-2507	10:41	0.3	14.5	7.1	198	128	10.2	100
7/23/2008	SM-2613	10:09	0.3	24.1	7.2	244	159	7.6	91
9/24/2008	SM-2719	10:08	0.1	15.2	7.2	189	123	10.0	99
11/19/2008	SM-2789	10:23	0.3	3.6	7.2	159	103	13.4	101
2/24/2009	SM-2859	9:52	0.4	-0.4	7.0	268	174	16.3	110
4/29/2009	SM-2931	10:03	0.3	17.4	7.1	190	124	9.8	102
6/24/2009	SM-3003	10:07	0.2	18.1	7.1	199	130	9.2	97
8/26/2009	SM-3075	9:38	## i	23.6	7.3	228	148	8.3	98
10/28/2009	SM-3147	10:06	0.2	9.7	7.1	163 u	106 u	11.2	99
2/23/2010	SM-3219	10:00	0.1	1.9	7.0	208	135	14.0	101
7/21/2010	SM-3291	9:51	0.1	24.6	7.6	394	256	8.6	103
10/6/2010	SM-3363	10:26	0.2	14.6	7.2	212	138	9.8	96
11/17/2010	SM-3435	9:52	0.3	8.7	7.0	193	125	11.4	98

Table 12 MassDEP SMART 2005-2010. Station FR11. *In Situ* Multiprobe Data.

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(us/cm)	(mg/l)	(mg/l)	(%)
3/2/2005	SM-6158	10:55	0.4	1.2	6.8	241	156	14.6	104
4/27/2005	SM-6199	10:55	0.9	12.9	6.6	179	116	10.3	98
6/22/2005	SM-1379	11:17	0.9	19.9	7.0	229	149	8.7	95
8/24/2005	SM-1461	10:44	0.6	21.8	7.0	249	162	7.9	90
10/26/2005	SM-1531	11:23	0.7	9.0	6.5	142	93	11.1	96
1/25/2006	SM-1601	11:07	0.8	1.9	6.5	219	--	13.5	--
3/22/2006	SM-1671	10:41	0.6	4.6	6.9	230	150	13.6	106
5/17/2006	SM-1741	11:14	0.7	11.8	6.7	165	107	10.8	100
7/19/2006	SM-1811	11:02	0.9	26.6	7.1	205	133	7.7	95
9/27/2006	SM-1869	10:59	0.6	15.8	7.2	234	152	10.0	101
11/8/2006	SM-1951	10:27	0.3	7.6	6.8	155	101	12.3	103
2/13/2007	SM-2021	10:38	0.5	0.4 u	6.8 u	191 u	124 u	15.3 u	106 u
4/18/2007	SM-2091	11:02	0.7	5.8	6.6	133	87	12.1	96
6/19/2007	SM-2161	11:05	1.2	22.5	7.1	182	118	8.4	97
8/29/2007	SM-2231	11:03	0.8	21.5	7.2	242	157	7.8	88
10/17/2007	SM-2301	11:02	0.6	11.9	7.1	258	168	9.2	86
1/30/2008	SM-2371	10:52	0.5	1.3	6.9	463	301	14.4	102
3/26/2008	SM-2441	11:17	0.4	5.8	6.8	172	112	13.2	106
5/21/2008	SM-2511	11:33	0.5	15.2	7.1	198	128	10.2	101
7/23/2008	SM-2617	10:47	0.5	24.4	7.1	228	148	7.7	92
9/24/2008	SM-2723	10:51	0.4	16.2	6.8	178	116	9.3	95
11/19/2008	SM-2793	11:03	0.6	4.3	7.0	161	105	12.6	97
2/24/2009	SM-2865	11:05	0.3	0.4	6.8	266	173	15.5	108
4/29/2009	SM-2937	11:24	0.3	18.8	6.9	184	120	9.3	99
6/24/2009	SM-3009	11:24	0.9	18.5	6.9	192	125	8.9	95
8/26/2009	SM-3081	10:46	## i	24.2	7.1	217	141	7.9	94
10/28/2009	SM-3153	11:21	0.6	9.5	6.9	157	102	11.0	96
2/23/2010	SM-3225	11:19	0.3	2.6	7.0	223	145	13.8	102
7/21/2010	SM-3297	11:01	0.5	25.5	7.2	258	168	7.8	95
10/6/2010	SM-3369	11:33	0.5	## u, m	## u, m, i	## u, m, i	## u, m, i	## u, m, i	## u, m, i
11/17/2010	SM-3441	11:12	0.4	8.8	6.9	195	127	11.4	98

Table 13 MassDEP SMART 2009-2010. Station FR12. *In Situ* Multiprobe Data.

Date	OWMID	Time	Depth	Temp	pH	Cond@ 25C	TDS	DO	SAT
		(24hr)	(m)	(C)	(SU)	(us/cm)	(mg/l)	(mg/l)	(%)
2/24/2009	SM-2863	10:38	0.4	0.8	6.8	270	175	15.7	110
4/29/2009	SM-2935	10:44	0.5	18.3	7.1	202	131	9.5	101
6/24/2009	SM-3007	10:49	0.6	18.4	7.1	211	137	9.1	96
8/26/2009	SM-3079	10:18	## i	23.6	7.3	245	159	8.1	96
10/28/2009	SM-3151	10:44	0.2	9.8	7.1	168	109	11.3	100
2/23/2010	SM-3223	10:41	0.1	3.0	7.0	232	151	13.6	101
7/21/2010	SM-3295	10:29	0.3	24.4	7.3	390 u	254 u	7.9	95
10/6/2010	SM-3367	10:56	0.2	14.3	7.3	253	164	10.0	98
11/17/2010	SM-3439	10:35	0.2	9.4	7.0	175	114	11.1	97

Table 14 MassDEP SMART 2005-2010. Station QR00. Chemistry Data.

Date	OWMID	Time	Alkalinity	Hardness	Chloride	E_coli	Ssolids	Turb	TN	NH3-N	NO3-NO2-N	TPhos
		(24hr)	(mg/l)	(mg/l)	(mg/l)	(MPN/100ml)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
3/2/2005	SM-1155	8:49	7	18	27	**	<1.0	1.1	0.36	0.03	0.22	0.009
4/27/2005	SM-1196	8:55	6	16	24	**	1.6	1.4	0.31	0.03	0.05	0.021
6/22/2005	SM-1370	8:55	9	21	29	**	1.6	2.1	0.43d	0.03	<0.02	0.028
8/24/2005	SM-1452	8:35	11	22	31	**	1.4	1.6	0.35	0.03	<0.02	0.019
10/26/2005	SM-1522	9:00	5	12	12	**	1.3	1.7	0.40	<0.02d	<0.02	0.023
1/25/2006	SM-1592	8:45	8h	15	18	**	<1.0	1.1h	0.25	<0.02	0.16	0.008
3/22/2006	SM-1662	8:35	6	16	24	**	1.1	1.0	0.27	<0.02	0.14	0.008
5/17/2006	SM-1732	8:55	6	18	21	**	2.3	1.5h	0.27	<0.02	0.02	0.014
7/19/2006	SM-1802	8:45	9	17	19	**	2.4	1.7	0.43	0.03	0.04	0.027
9/27/2006	SM-1860	8:45	10	19	24	**	1.8	0.8h	0.28	<0.02	<0.02	0.012
11/8/2006	SM-1942	8:33	7	16	20	**	1.3	1.6	0.28	<0.02	0.03	0.013
2/13/2007	SM-2012	8:40	8	20	20	**	1.1	1.2	0.35	0.05	0.18	0.011
4/18/2007	SM-2082	8:30	4	10	13	**	15	2.8	0.30	<0.02	0.09	0.028
6/19/2007	SM-2152	8:25	12	18	20	**	1.8	1.1	0.28	0.04	0.02	0.016
8/29/2007	SM-2222	8:45	10	21	27	54	2.6d	1.4	0.31	<0.02	0.04	0.014
10/17/2007	SM-2292	8:45	13	23	30	15	<1.0	0.6	0.25	<0.02	<0.02	0.007
1/30/2008	SM-2362	8:30	6	22	29	<1	<1.0	0.9	0.31	<0.02	0.12	0.007
3/26/2008	SM-2432	8:40	4	16	23	<1	1.5	0.6	0.20	<0.02	0.09	<0.005
5/21/2008	SM-2502	8:40	6	18	24	6	1.5	1.1	0.28	<0.02	<0.02	0.012
7/23/2008	SM-2608	8:40	**	22	21	51	2.9	**	0.36	0.03	<0.02	0.019
9/24/2008	SM-2714	8:40	8	19	17	20	<1.0	1.4	0.30	<0.02	<0.02	0.017
11/19/2008	SM-2784	8:40	6	20	20	19	1.3	1.4	0.28	0.02	0.03	0.011
2/24/2009	SM-2854	8:20	6	19	25	2	<1.0	0.8	0.34	0.03	0.19	0.007d
4/29/2009	SM-2926	8:25	7	19	26	3	<1.0	0.8	0.23	<0.02	0.04	0.014
6/24/2009	SM-2998	8:35	9	19	23	11	1.4	1.6b	0.31	0.03	<0.02	0.017
8/26/2009	SM-3070	8:10	11	22	22	6	1.5	1.3	0.33	0.02	<0.02	0.018
10/28/2009	SM-3142	8:40	8	20	21	23	1.4	1.4	0.26	<0.02	<0.02	0.013
2/23/2010	SM-3214	8:30	6		19	3	1.3	1.1h	0.28	<0.02	0.15	0.007
7/21/2010	SM-3286	8:15	14	23	26	17	<1.0	1.7	0.33	0.03	0.04	0.013
10/6/2010	SM-3358	8:45	7	22	25	50	2.0	2.2j	0.34	0.02	<0.02	0.021
11/17/2010	SM-3430	8:17	6	21	21	16	1.6	1.7	0.44	<0.02	<0.02	0.012

Table 15 MassDEP SMART 2005-2010. Station CA12. Chemistry Data.

Date	OWMID	Time	Alkalinity	Hardness	Chloride	E_coli	Ssolids	Turb	TN	NH3-N	NO3-NO2-N	TPhos
		(24hr)	(mg/l)	(mg/l)	(mg/l)	(MPN/100ml)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
3/2/2005	SM-1156	9:25	12	46	160	**	1.0	1.3	0.92	0.06	0.74	0.065
4/27/2005	SM-1197	9:40	12	36	91	**	2.7	2.0	0.72	0.07	0.39	0.028
6/22/2005	SM-1372	9:40	31	54	150	**	1.8	1.5	3.0d	<0.02	2.2	0.061
8/24/2005	SM-1454	9:15	29	70	170	**	1.2	1.4	8.8	<0.02	7.9	0.10
10/26/2005	SM-1524	9:45	10	26	44	**	4.7	3.1	0.56	0.06d	0.28	0.037
1/25/2006	SM-1594	9:30	8h	36	100	**	<1.0	1.0h	0.79	0.03	0.62	0.015
3/22/2006	SM-1664	9:20	10	42	110	**	1.7	1.4	1.1	<0.02	0.97	0.019
5/17/2006	SM-1734	9:40	11	32	67	**	7.0	2.2h	0.55	<0.02	0.26	0.028
7/19/2006	SM-1804	9:25	23	44	92	**	12	5.8	1.4	0.04	0.94	0.062
9/27/2006	SM-1862	9:30	46	67	140	**	<1.0	1.1h	7.0	1.1	5.4	0.070
11/8/2006	SM-1944	9:10	15	29	40	**	1.3	1.4	0.56	<0.02	0.29	0.024
2/13/2007	SM-2015	**	**	**	**	**	**	**	**	**	**	**
4/18/2007	SM-2084	9:15	8	25	50	**	7.5	2.6	0.66	<0.02	0.47	0.028
6/19/2007	SM-2154	9:25	23	45	100	**	1.0	1.4	3.2	0.04	2.7	0.040
8/29/2007	SM-2224	9:27	25	99	200	69	<1.0d	0.4	29.0	<0.02	27.0	0.025
10/17/2007	SM-2294	9:30	20	38	56	64	1.5	1.3	1.6	<0.02	1.2	0.020
1/30/2008	SM-2364	9:20	12	44	67	770	1.7	1.2	0.79	0.03	0.52	0.058
3/26/2008	SM-2434	9:45	5	34	71	101	<1.0	0.6	0.85	<0.02	0.72	0.009
5/21/2008	SM-2504	9:25	10	40	89	19	<1.0	1.2	1.2	0.03	0.99	0.020
7/23/2008	SM-2610	9:25	**	38	88	1990	11	**	0.89	0.03	0.38	0.058
9/24/2008	SM-2716	9:18	19	47	82	54	<1.0	1.0	2.4	0.03	2.0	0.018
11/19/2008	SM-2786	9:30	13	34	41	19	<1.0	1.4	0.71	0.04	0.39	0.045
2/24/2009	SM-2856	9:05	11	56	190	291	<1.0	1.2	0.85	0.05	0.72	0.061d
4/29/2009	SM-2928	9:15	15	39	89	28	1.6	0.9	0.55	<0.02	0.36	0.014
6/24/2009	SM-3000	9:12	18	43	85	147	2.5	1.4b	1.0	0.02	0.77	0.024
8/26/2009	SM-3072	8:50	21	41	81	76	2.1	2.1	1.4	<0.02	1.1	0.033
10/28/2009	SM-3144	9:22	14	33	44	32	2.5	1.5	0.51	<0.02	0.18	0.018
2/23/2010	SM-3216	9:18	13		120	1300	1.7	1.3h	1.2	0.09	0.89	0.13
7/21/2010	SM-3288	8:57	27	62	140	76	<1.0	0.7	4.9	0.02	4.3	<0.025
10/6/2010	SM-3360	9:40	22	51	110	72	<1.0	2.6j	1.4	0.02	1.0	0.024
11/17/2010	SM-3432	9:08	12	38	63	167	9.0	7.4	0.72	0.03	0.32	0.044

Table 16 MassDEP SMART 2005-2010. Station QR06. Chemistry Data.

Date	OWMID	Time	Alkalinity	Hardness	Chloride	E_coli	Ssolids	Turb	TN	NH3-N	NO3-NO2-N	TPhos
		(24hr)	(mg/l)	(mg/l)	(mg/l)	(MPN/100ml)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
3/2/2005	SM-1157	10:05	10	26	54	**	1.2	1.2	0.54	0.06	0.35	0.026
4/27/2005	SM-1198	10:20	8	20	33	**	6.4	2.3	0.39	0.05	0.08	0.036
6/22/2005	SM-1374	10:25	15	32	54	**	2.7	2.8	0.78d	0.02	0.41	0.043
8/24/2005	SM-1456	9:55	22	41	64	**	2.1	2.2	0.97	0.04	0.71	0.049
10/26/2005	SM-1526	10:35	5	19	25	**	4.4	1.9	0.48	0.06d	0.14	0.035
1/25/2006	SM-1596	10:10	7h	20	33	**	1.1	1.1h	0.41	0.03	0.26	0.013
3/22/2006	SM-1666	10:00	8	27	45	**	1.6	0.9	0.49	<0.02	0.30	0.030
5/17/2006	**	**	**	**	**	**	**	**	**	**	**	**
7/19/2006	SM-1806	10:05	15	29	38	**	1.9	1.7	0.74	<0.02	0.33	0.040
9/27/2006	SM-1864	10:15	20	41	55	**	1.0	1.4h	0.86	<0.02	0.61	0.026
11/8/2006	SM-1946	9:45	11	26	35	**	1.9	1.7	0.54	<0.02	0.26	0.026
2/13/2007	**	**	**	**	**	**	**	**	**	**	**	**
4/18/2007	SM-2086	10:05	5	16	28	**	6.3	2.6	0.42	0.03	0.21	0.021
6/19/2007	SM-2156	10:05	15	29	44	**	2.2	1.6	0.67	0.04	0.36	0.029
8/29/2007	SM-2226	10:10	21	58	83	63	<1.0d	1.0	0.84	<0.02	0.57	0.017
10/17/2007	SM-2296	10:10	24	60	82	118	1.1	1.3	1.2	0.02	0.93	0.021
1/30/2008	SM-2366	10:00	9	34	56	770	1.3	0.9	0.84	0.27	0.36	0.016
3/26/2008	SM-2436	10:30	6	24	37	55	2.4	0.7	0.44	0.08	0.22	0.009
5/21/2008	SM-2506	10:25	8	27	43	52	3.4	1.1	0.53	0.02	0.25	0.021
7/23/2008	SM-2612	10:00	**	37	44	>2419.6	17	**	1.3	0.06	0.71	0.061
9/24/2008	SM-2718	10:00	9	31	36	91	1.6	1.7	0.67	<0.02	0.42	0.021
11/19/2008	SM-2788	10:15	9	26	28	1410	1.6	1.3	0.51	0.06	0.20	0.020
2/24/2009	SM-2858	9:45	7	30	61	1050	1.5	1.4	0.57	0.13	0.31	0.016d
4/29/2009	SM-2930	9:55	16	26	41	18	2.9	1.2	0.42	0.03	0.16	0.018
6/24/2009	SM-3002	10:00	11	29	43	179	2.8	2.4b	0.55	0.03	0.24	0.027
8/26/2009	SM-3074	9:23	16	32	49	140	1.5	1.4	0.59	0.02	0.31	0.026
10/28/2009	SM-3146	9:58	10	26	34	46	2.5	1.6	0.43	<0.02	0.15	0.019
2/23/2010	SM-3218	9:48	8	**	41	461	1.1	1.2h	0.53	0.09	0.30	0.016
7/21/2010	SM-3290	9:42	21	52	85	65	1.0	1.0	1.1	0.03	0.75	0.021
10/6/2010	SM-3362	10:20	12	33	41	135	2.6	1.8j	0.66	0.03	0.35	0.022
11/17/2010	SM-3434	9:45	8	28	36	238	5.4	2.6	0.62	<0.02	0.25	0.027

Table 17 MassDEP SMART 2005-2010. Station FR11. Chemistry Data.

Date	OWMID	Time	Alkalinity	Hardness	Chloride	E_coli	Ssolids	Turb	TN	NH3-N	NO3-NO2-N	TPhos
		(24hr)	(mg/l)	(mg/l)	(mg/l)	(MPN/100ml)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
3/2/2005	SM-1158	10:45	11	30	53	**	<1.0	1.2	0.69	0.05	0.47	0.016
4/27/2005	SM-1199	10:45	8	22	40	**	2.6d	1.6	0.42	0.04	0.11	0.024
6/22/2005	SM-1376	11:10	16	33	49	**	<1.0	1.9	1.0d	<0.02	0.39	0.032
8/24/2005	SM-1458	10:35	21	41	52	**	3.3d	1.1	0.56d	0.06d	0.26	0.030
10/26/2005	SM-1528	11:05	7	20	29	**	1.6d	1.6	0.57d	0.02d	0.25	0.034
1/25/2006	SM-1598	10:50	8	24	48	**	<1.0	1.1	0.61	0.02	0.40	0.012
3/22/2006	SM-1668	10:32	12	32	50	**	<1.0	1.0	0.71	<0.02	0.54	0.014
5/17/2006	SM-1738	11:00	7	22	36	**	4.3	1.7	0.51	0.03	0.14	0.027
7/19/2006	SM-1808	10:55	17	30	41	**	1.1	1.2	0.82	0.04	0.37	0.032
9/27/2006	SM-1866	10:45	**	42	**	**	2.8d	1.0h	0.61	<0.02	0.29	0.017
11/8/2006	SM-1948	10:15	10	22	29	**	1.0	1.3	0.47	<0.02	0.19	0.015
2/13/2007	SM-2018	10:30	21d	31	38	**	1.5	1.2	0.82	0.08	0.56	0.018
4/18/2007	SM-2088	10:45	7	18	28	**	1.9	1.3	0.47	<0.02	0.27	0.014
6/19/2007	SM-2158	10:50	16	29	36	**	1.6	1.3	0.67	0.05	0.31	0.026
8/29/2007	SM-2228	10:50	22	42	49	133	##d	0.6	0.44	<0.02	0.18	0.013
10/17/2007	SM-2298	10:52	24	47	53	15	<1.0	0.8	0.38	<0.02	0.13	0.009
1/30/2008	SM-2368	10:40	10d	44	110	1120	11	10.0	0.89	0.05	0.60	0.032
3/26/2008	SM-2438	11:05	5	25	35	4	1.4	0.6	0.50	<0.02	0.34	0.009d
5/21/2008	SM-2508	11:20	8d	28	44	27	<1.0	0.8	0.53	0.02	0.23	0.016
7/23/2008	SM-2614	10:40	**	37	42	276	2.7	**	0.79	0.05	0.24	0.031
9/24/2008	SM-2720	10:35	11	29	35	49	<1.0	1.0	0.54	0.02d	0.27	0.016
11/19/2008	SM-2790	10:50	9	25	32	84	1.2	1.3	0.49	<0.02	0.18	0.017
2/24/2009	SM-2864	10:58	9	29	62	19	1.3	1.6	0.65	0.05	0.45	0.014d
4/29/2009	SM-2936	11:12	12	27	39	15	1.4	1.1h	0.43	<0.02	0.16	0.018
6/24/2009	SM-3008	11:16	14h	29	41	66	1.4	<0.10b	0.58	0.04	0.22	0.024
8/26/2009	SM-3080	10:36	18	39	44	166	<1.0	1.3	0.69	0.03	0.37	0.027
10/28/2009	SM-3152	11:07	14	25	32	26	<1.0	1.4	0.42	<0.02	0.12	0.016
2/23/2010	SM-3224	11:10	12		46	11	1.3	1.5	0.77	0.08	0.50	0.016
7/21/2010	SM-3296	10:54	36	46	53	194	<1.0	1.0	0.78	0.03	0.48	0.018
10/6/2010	SM-3368	11:30	19	35	44	816	1.3	1.6j	0.40	0.03	0.08	0.019
11/17/2010	SM-3440	11:05	11	31	34	66	<1.0	1.1	0.47	<0.02	0.17	0.012

Table 18 MassDEP SMART 2005-2010. Station FR12. Chemistry Data.

Date	OWMID	Time	Alkalinity	Hardness	Chloride	E_coli	Ssolids	Turb	TN	NH3-N	NO3-NO2-N	TPhos
		(24hr)	(mg/l)	(mg/l)	(mg/l)	(MPN/100ml)	(mg/l)	(NTU)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
2/24/2009	SM-2860	10:25	9	31	62	130	1.5	1.6	0.89	0.06	0.63	##d
4/29/2009	SM-2932	10:38	17	31	42	13	1.8	1.1	0.73	<0.02	0.41	0.023
6/24/2009	SM-3004	10:40	14	33	43	58	2.9	1.7b	0.89	0.04	0.54	0.035
8/26/2009	SM-3076	10:05	23	46	48	99	<1.0d	1.3	1.2	0.02	0.91	0.043
10/28/2009	SM-3148	10:35	14	28	32	73	1.3d	1.6	0.79	<0.02	0.44	0.036
2/23/2010	SM-3220	10:30	12	**	48	548	2.9	1.5h	1.1	0.08	0.80	0.061
7/21/2010	SM-3292	10:20	37	78	66	31	<1.0d	1.4d	4.6	0.04	4.1	0.12
10/6/2010	SM-3364	10:50	24	44	48	816	2.1	1.3j	0.94	0.03	0.59	0.036
11/17/2010	SM-3436	10:25	10	27	31	411	3.7	2.8	0.87	<0.02	0.57	0.060

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