CONCORD RIVER WATERSHED
SMART MONITORING PROGRAM 2005-2010
TECHNICAL MEMORANDUM CN 426.0

Nashoba Brook Conservation Land, Acton

Prepared By:
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Cover photo by Therese Beaudoin, MassDEP. January 21, 2009.

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LIST OF LATIN NAMES

Latin Name	Common name	Latin Name	Common name
Agelaius phoeniceus	red-winged blackbird	*Lythrum salicaria*	purple loosestrife
Anas platyrhynchos	mallard duck	*Myriophyllum* sp.	milfoil
Anatidae family	ducks	*Nerodia sipedon*	Northern water snake
Anisoptera order	dragonflies	Neuroptera order	lacewings
Anura order	frogs	*Ondatra zibethicus*	muskrat
Ardea herodias	great blue heron	*Peltandra virginica*	arrow arum
Atropa belladonna	nightshade	*Pontedaria cordata*	pickerelweed
Branta canadensis	Canada goose	*Potamogeton* sp.	pondweed
Callitriche sp.	water-starwort	*Procyon lotor*	raccoon
Cambaridae order	freshwater crayfishes	*Sagittaria* sp.	*arrowhead*
Castor canadensis	North American beaver	*Scirpus* sp.	sedges
Culicidae family	mosquitoes	Simuliidae family	black flies
Elodea sp.	waterweed	Tricoptera family	caddisflies
Esox sp.	pickerel	*Typha latifolia*	common cattail
Gerridae family	water striders	Unionidae family	freshwater mussels
Gramineae family	true grasses	*Vallisneria* sp.	eelgrass, tape grass or wild celery
Juncus sp.	rushes	*Wolffia* sp.	watermeal
Lemna sp.	duckweed	Zygoptera order	damselflies
Lobelia cardinalis	cardinal flower		

All photos in document taken by Therese Beaudoin. MassDEP. CERO.
SMART monitoring logo designed by Robert Kimball and Barbara Kimball.

LIST OF ACRONYMS

% sat	percent oxygen saturation
305(b)	Section 305(b), Clean Water Act
7Q10	lowest 7-day average streamflow that occurs, on average, once every 10 years
BRP	Bureau of Resource Protection
BWR	Bureau of Water Resources
ºC	degree Celsius
CERO	CEntral Regional Office
cfs	cubic feet per second
CSO	Combined Sewer Overflow
DO	dissolved oxygen
DWM	Division of Watershed Management
ºF	degree Fahrenheit
m	meter
MassDEP	Massachusetts Department of Environmental Protection
µS/cm	microSiemen per centimeter
mg/L	milligrams per liter
mi	mile
mi^2	square miles
NH_3-N	ammonia nitrogen
NO_3NO_2-N	nitrate-nitrite nitrogen
NTU	Nephelometric Turbidity Unit
NWS	National Weather Service
POR	Point of Record
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
SMART	Strategic Monitoring and Assessment for River basin Teams
SOP	Standard Operating Procedure
SSolids	total suspended solids
SU	Standard Unit
T	temperature
TDS	total dissolved solids
TMDL	Total Maximum Daily Load
TN	total nitrogen
TPhos	total phosphorus
USGS	United States Geological Survey
WES	Wall Experiment Station
WWTP	wastewater treatment plant

INTRODUCTION

The purpose of this technical memo is to present observations and data collected in the Strategic Monitoring and Assessment for River basin Teams (SMART) program in the SuAsCo River watershed from 2005 through 2010, 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 in the Concord Watershed began in March 2000. The sampling plan matrix for the 2005-2010 SMART monitoring program 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 SuAsCo Basin SMART Sampling Summary – 2005 through 2010

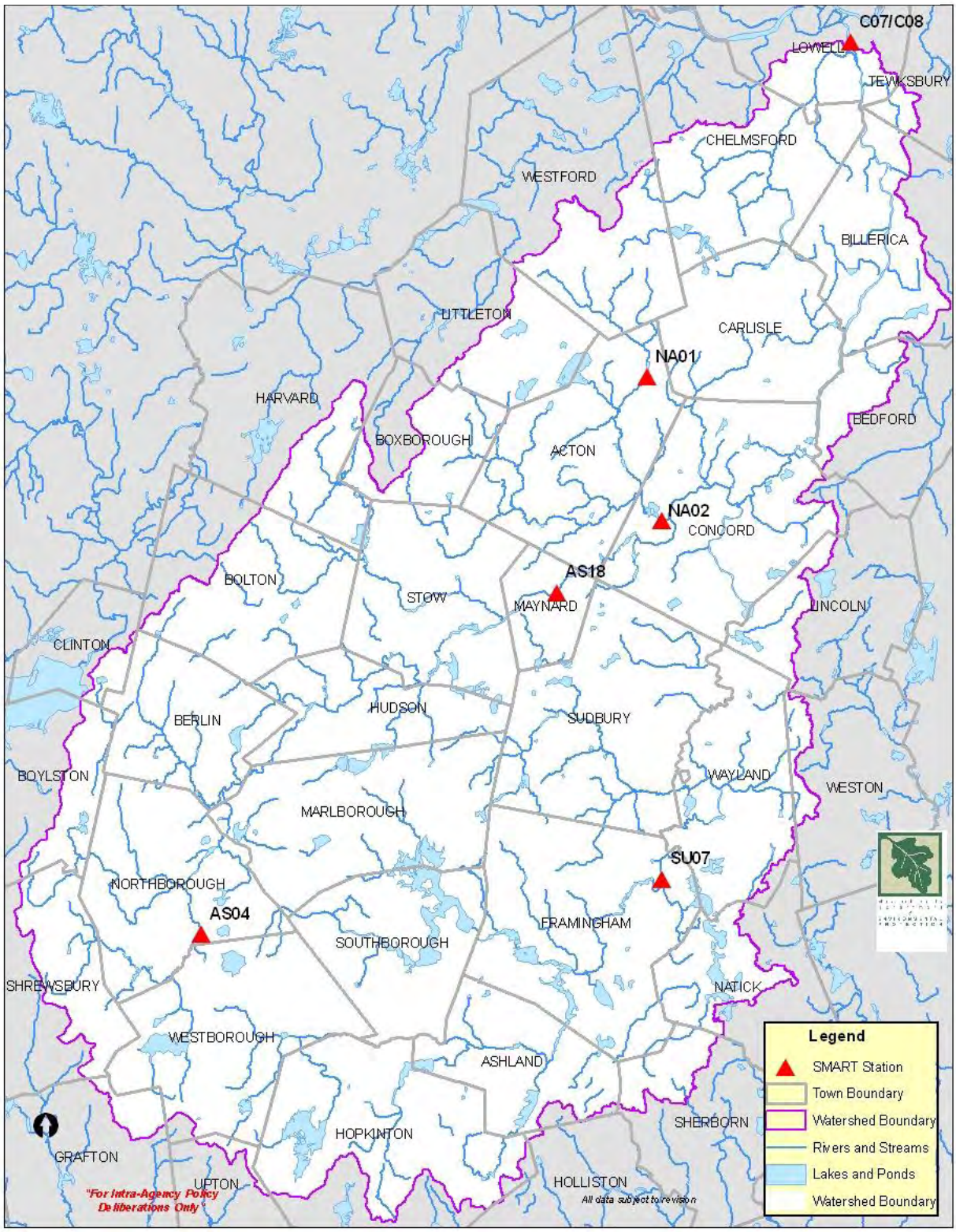
Location and Segment Numbers	Station Name	Station Type	Dates Sampled[1]
Assabet River @ School Street, Northborough MA82B-02	AS04	Impact	2005: 1/19/05, 3/16/05, 5/18/05, 7/20/05, 9/21/05, 11/8/05 2006: 2/15/06, 4/12/06,6/14/06, 8/9/06, 10/11/06 2007: 1/17/07, 3/14/07, 5/16/07, 7/18/07, 9/12/07, 11/7/07 2008: 2/27/08, 4/23/08, 6/18/08, 8/20/08, 10/22/08 2009: 1/29/09, 3/18/09, 5/20/09, 7/22/09, 9/29/09, 11/17/09 2010: 2/18/10, 8/25/10, 10/20/10
Assabet River @ USGS flow gaging station, State Roads 27/62, Maynard MA82B-05	AS18	Impact	
Nashoba Brook @ USGS flow gaging station, Wheeler Road, Acton MA82B-14	NA01	Impact	
Sudbury River @ USGS flow gaging station, Danforth Road, Framingham MA82A-03	SU07	Reference	
Concord River @ USGS flow gaging station north of Rogers Street, Lowell MA82A-08 (from 1/19/05 – 11/7/07)	CO7	Boundary	
Concord River between 140 and 142 Warren Street and above the dam, Lowell (from 2/27/08 – 10/20/10) MA82A-08	CO8	Boundary	

Hydrology

The Concord River Watershed has a total drainage area of 400 square miles (mi^2), entirely within the Commonwealth of Massachusetts. It is comprised mainly of two subwatersheds, the Assabet and Sudbury, which is why it is also called the SuAsCo watershed (Sudbury, Assabet, Concord). See SuAsCo Watershed Water Quality Assessment Report 2001 for further information (O'Brien-Clayton 2005).

The Assabet River, with a drainage area of 131 mi^2, begins at the outlet of the Assabet River Reservoir, or the "A1" site, in Westborough. From there, the river meanders approximately 31 miles (mi) through many dammed reaches until it joins the Sudbury River at Egg Rock in Concord, MA. The lower 4.4 mi were designated as Wild and Scenic by the U.S. Congress in 1999 (for further information on the Act of Congress that designated these areas, see Designation Of

Figure 1 MassDEP SMART Concord River Watershed Water Quality Station Locations



Sudbury, Assabet, And Concord Scenic And Recreational Rivers (USGPO 1999). Due to its highly impounded nature, and the nutrient input from four major wastewater treatment plant (WWTP) discharges, the Assabet River exhibits symptoms of eutrophication.

The Sudbury River, with a drainage area of 162 mi^2, flows approximately 28 miles from its headwaters at the outlet of Cedar Swamp Pond, Westborough to the Assabet River confluence. The upper watershed includes numerous large water supply reservoirs in Hopkinton, Southborough, Ashland and Framingham, which serve as emergency drinking water supplies. The river then flows through a large urbanized area in Framingham. North of the Danforth Street Bridge, the final 14.9 miles of the Sudbury have been designated as Wild and Scenic.

The Concord River drains an additional 107 mi^2 and flows approximately 15 miles to its junction with the Merrimack River in the City of Lowell. The upper 8 miles are designated Wild and Scenic. This part of the watershed is moderately to densely developed, with large areas of impervious surfaces throughout.

Quality Assurance/Quality Control

The quality assurance (QA) quality control (QC) project plan (QAPP) for the SMART program is presented in CN 012.1: *Strategic Monitoring and Assessment for River basin Teams Quality Assurance Project Plan* (Beaudoin 2008). The QAPP presents data quality objectives, quality assurance procedures, and other program-specific information. This technical memorandum will report deviations from the procedures described in the QAPP.

Aerial photos were obtained from Google Earth (2013a, 2013b, 2013c, 2013d, 2013e) 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 SuAsCo 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 photographs. Field observations included date/time, location, crewmembers, snow cover (when relevant), canopy cover, water odors, colors, sheens, foams, estimated river height and velocity, weather conditions, observed uses (e.g., boating), wildlife, aquatic algae and macrophytes, potential pollution sources, and unusual conditions. The number and type of samples were recorded, as well as the last set of *in situ* data collected. An aerial view and a photo depicting the upstream environs accompany each station description; see Figure 3 through Figure 13. A summary of field observations by station collected during this sampling period are presented in Table 2 through Table 6 following the station descriptions.

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

- Reference: a reference station is located in a stream segment that is minimally influenced by anthropogenic activities;
- Impact: an impact (or trend) 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).

In January and May, 2005, samples collected for nutrient analysis were frozen to increase the holding time in order to meet resource limitations at WES. Samples were collected for turbidity analysis at DWM. Samples were not collected for total suspended solids, total alkalinity, chlorides, and hardness. In 2010, the WES lab was closed from March through June during the construction phase of new laboratory space; SMART monitoring was not conducted during this time.

STATION OBSERVATIONS

Station AS04 – Assabet River at School Street, Northborough, MA (river mile 27.803)

Figure 2 Google Earth view of Station AS04 area

Figure 3 Station AS04 upstream (9/12/2007)

Station AS04 is located on the Assabet River near the School Street Bridge in Northborough, 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 School Street Bridge or from the northwestern shore upstream. When the abundance of poison ivy on the banks in this location prevented shoreline access, samples were collected from the bridge, center stream, with a sampling pole. When the poison ivy coverage was reduced, sampling was conducted from a point upstream of the bridge, by wading in from the left bank. Both locations are representative of water quality conditions in this reach. Station AS04 serves as an impact station as it is located downstream of numerous point and nonpoint sources of pollution, as described below.

Land uses proximal to this station included residential and forested, including a Christmas tree farm (Figure 2) (Google Earth 2013a). The Westborough WWTP discharge is located 2.25 miles upstream, as are major roads and a shopping district, with large expanses of impervious surfaces.

The river was approximately 30 feet wide at this site, typically less than 3 feet deep and roughly uniform across the channel throughout the year (Figure 3). Deciduous trees provided canopy cover over much of the channel upstream of the bridge. The bottom consisted mainly of sand, silt and mud, with sparse boulder, cobble and gravel.

During the growing season (approximately June through September), the channel was colonized with sparse to dense populations of emergent macrophytes, especially sedges (*Scirpus* sp.). Other aquatic/wetland macrophytes recorded at this station included nightshade (*Atropa belladonna*), water-starwort (*Callitriche* sp.), waterweed (*Elodea sp.),* grasses (family Gramineae), rushes (*Juncus* sp.), duckweed (*Lemna* sp.), purple loosestrife (*Lythrum salicaria*), milfoil (*Myriophyllum* sp.), arrow arum (*Peltandra virginica*), pickerelweed (*Pontedaria cordata*), pondweed (*Potamogeton* sp.) arrowhead (*Sagittaria* sp.), common cattail (*Typha latifolia*) and wild celery (*Vallisneria* sp.). Periphyton was observed on half of the dates sampled; when present, periphytic growth was most commonly composed of filamentous green algae attached to plants and rocks.

Wildlife observed in this stretch of river include red-winged blackbirds (*Agelaius phoeniceus*), ducks (family Anatidae), including mallards (*Anas platyrhynchos*), frogs (order Anura), Canada geese (*Branta canadensis)* and raccoon (*Procyon lotor*). Numerous insects were noted, including mosquitoes (family Culicidae), lacewings (order Neuroptera) and black flies (family Simuliidae). Fishing line and bobbers were caught in shoreline tree branches, indicating that recreational fishing occurs in this area. In addition to minnows, fish were observed breaking the surface in this reach, and a pickerel (*Esox* sp.), approximately 1 foot in length, was observed on 3/12/2006.

In general, the water column at this station lacked trash, odor, foam, sheens and turbidity. Water color was typically clear or light yellow. Numerous releases of sulphurous gases from the sediments, indicating anoxic conditions, were recorded. When disturbed, the sediments sometimes also released an oily sheen that floated on the water surface.

Data collected through the SMART program indicate that the most degraded water quality was consistently measured here, so field duplicates were collected at Station AS04 from 2001 onward.

Station AS18 – Assabet River upstream of Waltham Street (SR27), Maynard, MA (river mile 7.594)

Figure 4 Google Earth view of Station AS18

Figure 5 Station AS18 upstream (8/20/2008)

Station AS18 is located upstream of the Waltham Street bridge (State Road 27) in Maynard, MA within the Southern New England Coastal Plains and Hills ecoregion. From 2005-2010, the station was sampled 31 times, and access was gained from the eastern shore near the United States Geological Survey (USGS) flow gaging station. Samples were collected by wading in or with a sampling pole (when access to flowing water was difficult). Station AS18 serves as an impact station as it is located downstream of numerous point and nonpoint sources of pollution, as described below.

Land uses around this area include residential and commercial, with large areas of impervious surfaces (Figure 4) (Google Earth 2013b). Upstream, the river flows through several hypereutrophic impoundments, and receives the discharges of three major WWTPs, including Marlborough Westerly and Hudson (in addition to Westborough). Nonpoint sources include roads, shopping districts, and other large expanses of impervious surfaces.

The river at this location was approximately 45 feet wide, and heavily shaded (Figure 5). It was often difficult to see the bottom clearly due to turbulence and the angle of light on the surface; in addition, bottom rocks were stained a dark brown/black color, and the bottom composition was unobservable on 14 of 31 sampling dates from 2005-2010. When visible, the bottom consisted of boulder, cobble, gravel, sand and silt. Periphyton was noted on 21 events (n=31); when visible, the most common forms were moderate to dense populations of moss and/or filamentous algae. Few aquatic macrophytes were observed at this station; these included grasses (family Gramineae), duckweed (*Lemna* sp.) and water meal (*Wolffia* sp.). Wildlife observed here include mallard ducks (*Anas platyrhynchos)*, Northern water snake (*Nerodia sipedon)* and raccoon (*Procyon lotor).* Adult caddisflies (order Trichoptera) and damselflies (suborder Zygoptera) were often observed during early spring monitoring events. Fish (unidentified species) were also noted.

The water column observations noted at this station ranged from clear to highly turbid; conditions were clear to slightly turbid on most dates sampled. The water color was light yellow on half of the sampling dates, and red or clear on the other half. Observed water odors included none, musty, fishy, “strong eutrophic pond”, and septic/effluent, with a lack of odor most commonly noted. Foam was present on more than half of the sampling events, typically sparse to very sparse. Sheens were generally absent; a non-natural sheen was observed on 4/12/2006. Trash was observed on two-thirds of site visits and unobservable on most of the remaining dates. The trash consisted of bricks, broken glass, chunks of concrete, floatables, granite slabs and lengths of metal pipe.

Station NA01 – Nashoba Brook off Wheeler Lane, Acton, MA (river mile 4.305)

Figure 6 Google Earth view of NA01 area

Figure 7 Station NA01 upstream (8/20/2008)

Station NA01 is located on Nashoba Brook in Acton, MA within the Southern New England Coastal Plains and Hills ecoregion. From 2005-2010, the station was sampled 29 times, and access was gained from the eastern shore at the USGS flow gaging station near a footbridge in the Nashoba Brook Conservation Area; samples were collected from center stream by wading in or with a sampling pole. Station NA01 was expected to represent reference conditions for the Concord watershed; however, water quality data have shown that it is an impact station, influenced by numerous point and nonpoint sources of pollution, as described below.

The station is located in the upper area of the Nashoba Brook watershed, and nearby land uses include light residential and industrial/commercial development, a golf course, and woodland (Figure 6) (Google Earth 2013c). Robbins Mill Pond is located approximately 0.1 miles above the station. Although there are no surface water municipal discharges upstream, there are numerous groundwater discharges of sewage. The closest is the Acton Retirement Community (approximately 350 feet from Nashoba Brook, and 2,400 feet upstream of the station).

In mid-2006, this reach of Nashoba Brook was impounded by a downstream beaver dam, which made the water quality in this area closer to that of a lentic system than a lotic one. In August and October, 2006, we attempted to locate a new station near the point where Nashoba Brook enters the Assabet River (river mile 0.218 miles); however, the strategic nature of this station was not optimal, and when the beaver dam below Station NA01 was removed, we resumed sampling there on 1/17/2007. The data collected at the lower station will not be used by the SMART program.

The river channel was approximately 15 feet wide in this reach and heavily shaded (Figure 7). Although it was often difficult to determine the bottom composition due to the angle of light on the surface, the deep tannic color of the water column and bottom staining, the bottom (when visible) consisted mainly of cobble, gravel and sand. For the same reasons, it was often difficult to determine the presence or absence of periphyton; when visible, periphyton mainly consisted of moss. Trash was absent on all dates that the water column was visible to the bottom.

Few aquatic macrophytes were observed in the area; these included *Lemna* sp. (duckweed), cardinal flower (*Lobelia cardinalis*) and *Wolffia* sp. (water meal). Wildlife observed in this area of Nashoba Brook include geese (*Branta canadensis*), raccoon (*Procyon lotor*). Insects observed at Station NA01 include water striders (family Gerridae)

The water column was clear on more than half of all sampling events; on the remainder, the turbidity was typically moderate. The water color was red on most sampling events. The water column typically lacked odor; although a petroleum odor was noted on ten sampling events, the source appeared to be the sediments when disturbed by the sampling staff. Foam was absent on more than two-thirds of monitoring dates, and very sparse to sparse on most other site visits.

Station SU07 – Sudbury River at Danforth Street, Framingham, MA (river mile 16.320)

Figure 8 Google Earth view of Station SU07 area

Figure 9 Station SU07 upstream (10/11/2006)

Figure 10 Station SU07 crosschannel (5/20/2009)

Station SU07 is located on the Sudbury River in the village of Saxonville, Framingham, MA within the Boston Basin ecoregion. From 2005-2010, the station was sampled 31 times, and access was gained from the western shore near the Danforth Street Bridge. From 2005 through May 2007, samples were collected upstream of the bridge; in July 2007, the sampling site was relocated downstream of the historic Old Danforth Street Bridge (pedestrian traffic only) parallel to the Danforth Street Bridge, to mitigate access and backwatering issues. Samples were collected from center stream by wading in or with a sampling pole. Both sites are considered to represent water quality in this river segment. SU07 serves as a reference station, minimally influenced by anthropogenic activities.

The upper watershed includes pristine riverine areas and large impoundments managed as emergency water supplies (Figure 8) (Google Earth 2011d). The river flows through the urbanized towns of Framingham and Natick, with dense residential and industrial/commercial development, roadways and a flood control project constructed by the U.S. Army Corps of Engineers in 1979 to alleviate flooding in the village of Saxonville.

Upstream of the Danforth Street Bridge, the river channel is approximately 58 feet wide, of an unknown depth (too deep to wade); the channel is open to the sky (Figure 9). Downstream of the historic bridge, the channel is approximately 50 feet wide, 0.5 to 3 feet deep, with nearly complete canopy cover during the growing season. At both sampling points, the bottom consisted of a mix of cobble, gravel and sand. Periphyton was present on 21 (n=31) events; sparse to very dense filamentous algae was the most common form (n=13). Aquatic macrophytes were sparse at both locations; *Lythrum salicaria* (purple loosestrife) was commonly seen in the riparian area at the upstream station, and *Potamogeton* sp. (pondweed) fragments were sometimes caught against debris in the channel. Waterfowl observed in this area included ducks (Anatidae), particularly mallards (*Anas platyrhynchos),* great blue heron (*Ardea herodias*) and geese (*Branta canadensis*). Red-winged blackbirds (*Agelaius phoeniceus*) were also noted. Other fauna noted in this area included: small and large fish (species unknown); beaver (*Castor canadensis)* or muskrat (*Ondatra zibethicus*); raccoon (*Procyon lotor*); mussels (Unionidae); and emergent insects, especially dragonflies (Anisoptera). Occasionally, kayakers and canoers were observed in this stretch of river.

On most sampling events, the water column was clear (without visible turbidity) and lacked color, odor, foam and sheens. Trash was present at both locations on all sampling dates; items observed included bicycles (1-3), hot water heaters (2), metal stool, broken glass, wooden planks, shopping carts, highway cone, chair, toilet, corrugated metal sheet, storm drain cover, metals, bricks, fencing, a road sign, metal pipes, floatables and miscellaneous unidentifiable objects. Periodic river cleanups resulted in the removal of trash; however, items continued to be discarded in the river in this stretch. A layer of silt covered the bottom on most events at the site above the Danforth Street Bridge; less silt accumulated at the downstream site.

Station CO7 – Concord River at Rogers Street, Lowell, MA (river mile 0.843) and Station CO8 – Concord River at Warren Street, Lowell, MA (river mile 0.477)

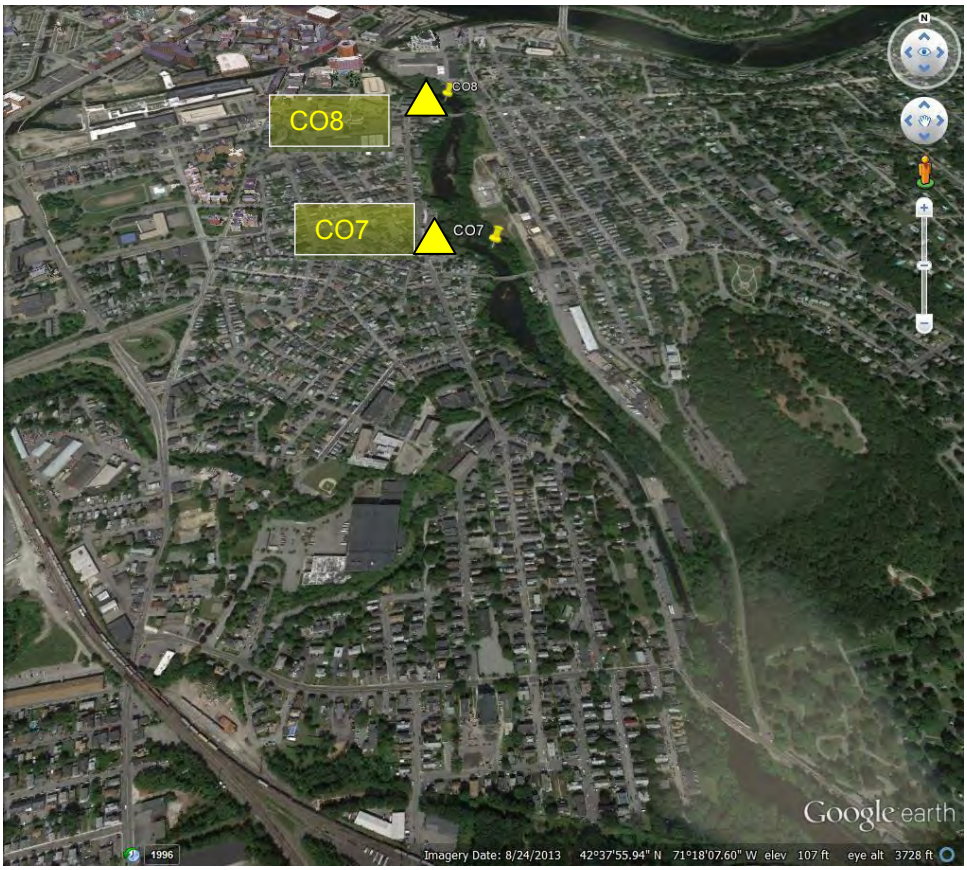


Figure 11 Google Earth view of area near Stations CO7 and CO8

Figure 12 Station CO7 upstream (5/18/2005)

Figure 13 Station CO8 upstream (5/20/2009)

Stations CO7 and CO8 are located on the lower Concord River in Lowell, MA in the Southern New England Coastal Plains and Hills ecoregion. From 2005 – November 2007, this station was sampled 17 times, from the eastern shore near the USGS flow gaging station approximately 250 ft downstream of the Rogers Street Bridge. Samples were collected by wading in or with a sampling pole. In February, 2008 this station was re-located approximately 0.4 mi downstream, north (downstream) of the SR-110 Bridge (Church Street), east of Warren Street at river mile 0.477 (due to site access issues at Station CO7). From February 2008-2010, this station was sampled 10 times, by wading in or with a sampling pole. Data at both locations represent water quality in this stretch of river. Stations CO7 and CO8 are boundary stations, where the Concord River watershed enters the Merrimack River watershed approximately 0.6 mi downstream (0.15 mi from Station CO8).

The major land use in this area is urban (Figure 11) (Google Earth 2011e). Numerous municipal discharges are located upstream, as well as large areas of impervious surfaces.

The river at both stations is approximately 125 ft wide. Although heavily shaded along both shores, most of the channel is open to the sky (Figure 12, Figure 13). The depth across the stream channel is unknown at both sites (too deep to wade). Visibility was often limited due to the angle of light, turbidity and turbulence. When visible, the stream bottom was composed largely of boulders, with sand, gravel, and cobble, and a layer of silt. Periphyton (when visible) typically consisted of moderately to highly dense filamentous algae. Few aquatic macrophytes were observed in this stretch of river; species observed included grasses (Gramineae), arrow arum (*Peltandra virginica),* pickerelweed (*Pontedaria cordata),* pondweed (*Potamogeton* sp.), arrowhead (*Sagittaria* sp.) and sedges (*Scirpus* sp.). Birds associated with aquatic habitat that were observed at this station included red-winged blackbirds (*Agelaius phoeniceus),* mallard ducks (*Anas platyrhynchos*), and great blue heron (*Ardea herodias)*.

The water column at this station ranged from clear to highly turbid; conditions were slightly to moderately turbid on most dates. Typically, water color was red or light yellow and lacked odor and sheens. There were sparse patches of foam noted on more than half of the sampling dates. When visible, trash was present, including large (unidentified) items, metals, plastics, broken glass, bricks, pipes and floatables.

Ambient field blank samples were collected at Stations CO7 and CO8.

Table 2 MassDEP SMART 2005 - 2010. Station AS04. Summary of Observations.

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
1/19/2005	Cobble/gravel/sand/silt	Sparse	None	Clear	None	None	None	Clear	Wet
3/16/2005	Boulder/cobble/gravel/sand/silt	Trash	Dense: brown/green filamentous	Clear	Effluent	None	None	Clear	Wet
5/18/2005	Cobble/gravel/sand/silt	None	None	Light yellow	None	None	None	Slight	Dry
7/20/2005	Cobble/gravel/sand/silt	Sparse: floatables	Moss	Clear	Septic	None	None	Slight	Dry
9/21/2005	Cobble/gravel/sand/silt	None	None	Clear	Septic	None	None	Clear	Wet
11/8/2005	Cobble/gravel/sand/silt/mud	None	None	Light yellow	None	None	None	Clear	Dry
2/15/2006	Cobble/sand	None	None	Clear	None	None	None	Clear	Wet
4/12/2006	Sand/silt	Sparse	Sparse, green filamentous	Clear	Effluent	None	None	Clear	Dry
6/14/2006	Sand/silt/mud	None	Sparse, filamentous; Moderate, brown film	Red/light yellow	Effluent	None	None	Clear	Wet
8/9/2006	Sand/silt/mud	None	None	Light yellow	None	None	None	Clear	Dry
10/11/2006	Cobble/sand/silt	None	Very dense, brown filamentous	Clear	Sulfide	None	None	Clear	Dry
1/17/2007	Sand/silt/mud	None	None	Light yellow	None	None	None	Clear	Wet
3/14/2007	Sand/silt/mud	None	None	Light yellow	None	None	None	Clear	Wet
5/16/2007	Sand	None	Patches, green filamentous	Light yellow	None	None	None	Clear	Dry
7/18/2007	Sand/silt/mud	None	None	Clear	None	None	None	Clear	Dry
9/12/2007	Sand/silt/mud	None	Dense, brown filamentous	Light yellow	Effluent, slight	None	None	Moderate	Wet
11/7/2007	Sand/mud	None	None	Light yellow	None	None	None	Clear	Wet
2/27/2008	Sand/mud	None	Moderate, brown filamentous	Light yellow	None	None	None	Clear	Wet
4/23/2008	Sand/silt/mud	None	None	Light yellow	None	None	Oily	Clear	Dry
6/18/2008	Sand/silt/mud	None	Dense, filamentous	Light yellow	Effluent, slight	None	None	Slight	Wet
8/20/2008	Sand	None	Moderate, brown film	Clear	None	None	None	Clear	Dry
10/22/2008	Unobservable	None	None	Clear	None	None	None	Clear	Dry
1/21/2009	Sand/silt/mud	None	None	Clear	None	None	None	Clear	Wet
3/18/2009	Sand/silt	None	None	Clear	None	None	None	Clear	Dry
5/20/2009	Sand/silt	None	Dense, filamentous	Clear	Effluent	None	None	Slight	Dry
7/22/2009	Silt/mud	None	Sparse, blue/green filamentous, "luxuriant growth"	Light yellow	None	None	None	Clear	Wet
9/29/2009	Sand/mud	None	Moderate, brown film	Clear	Effluent	None	None	Moderate	Wet
11/17/2009	Sand	None	Sparse, green filamentous	Light yellow	Effluent	None	None	Clear	Wet
2/18/2010	Sand/silt/mud	None	None	Clear	None	None	None	Clear	Wet
8/25/2010	Gravel/sand/silt	None	Moderate, brown film	Clear	Effluent, strong	Very sparse	None	Moderate	Wet
10/20/2010	Sand	None	None	Clear	Musty, faint	None	None	Clear	Dry
-- : Not noted									

Table 3 MassDEP SMART 2005 - 2010. Station AS18. Summary of Observations.

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
1/19/2005	Boulder/cobble/gravel/sand	Trash	None	Light yellow	None	Sparse	None	Clear	Wet
3/16/2005	Boulder/cobble/gravel/sand/silt/mud	Trash	Dense: green/brown filamentous	Clear	None	Very sparse	None	Slight	Wet
5/18/2005	Boulder/cobble/gravel/sand/silt/mud	Broken glass, floatables, concrete chunks, pipes	Moderate: brown filamentous	Red	Musty	Foam	None	Slight	Dry
7/20/2005	Boulder/cobble/gravel/sand/silt	Broken glass, concrete	Dense: green filamentous; very dense: brown floc	Clear	Musty	Very sparse	None	Clear	Dry
9/21/2005	Boulder/cobble/gravel/sand/silt	Floatables, concrete	Dense: moss	Clear	Fishy/septic	None	None	Clear	Wet
11/8/2005	Unobservable	Unobservable	Unobservable	Clear	None	Sparse	None	Clear	Dry
2/15/2006	Boulder/cobble/gravel/sand/silt	Trash	None	Clear	Eutrophic pond, strong	None	None	Clear	Wet
4/12/2006	Cobble/gravel/sand/silt/mud	Floatables, concrete blocks, granite slabs	Very dense, green filamentous	Clear	None	Very sparse	Non-petroleum	Clear	Dry
6/14/2006	Boulder/cobble/gravel/sand/silt	Concrete, metal pipes, floatables	None	Red	None	Sparse/mode	None	Moderate	Wet
8/9/2006	Boulder/cobble/gravel/sand/silt	Concrete blocks	Very dense, moss	Light yellow	Eutrophic pond	None	Pollen	Clear	Dry
10/11/2006	Cobble/gravel/sand/silt	Trash	Dense, moss	Light yellow	None	Very sparse	None	Clear	Dry
1/17/2007	Boulder/cobble/gravel/sand/silt	Chunks of concrete, metals	Dense, moss	Clear	None	Sparse	None	Clear	Wet
3/14/2007	Unobservable	Concrete blocks, metal poles	Very dense, moss	Light yellow, very	None	Sparse	None	Moderate	Wet
5/16/2007	Unobservable	Cement, pipes	Unobservable	Red, light yellow	Eutrophic pond	Sparse	None	Slight	Dry
7/18/2007	Cobble/gravel/sand/silt	Trash	Moderate, moss	Light yellow	None	None	None	Slight	Dry
9/12/2007	Unobservable	Unobservable	Unobservable	Light yellow	None	Very dense	None	Unobservable	Wet
11/7/2007	Unobservable	Chunks of concrete	Sparse, green filamentous	Light yellow	None	None	None	Clear	Wet
2/27/2008	Cobble/gravel/sand	Trash	None	Light yellow	Effluent	Sparse	None	Clear	Wet
4/23/2008	Boulder/cobble/gravel/sand/silt	Trash	Moderate, brown filamentous	Clear	None	Sparse	None	Moderate	Dry
6/18/2008	Unobservable	Concrete chunks	Sparse, green filamentous; very dense, green film	Light yellow	Effluent, strong; eutrophic pond	Very sparse	None	Slight	Wet
8/20/2008	Unobservable	Cement chunks	Unobservable; in shallows: green filamentous, moderate moss	Red	None	Sparse	None	Moderate	Dry
10/22/2008	Unobservable	Unobservable	Unobservable	Red	Eutrophic pond	Sparse	None	Slight	Dry
1/21/2009	Cobble/gravel/sand	None	None	Light yellow	None	None	None	Clear	Wet
3/18/2009	Cobble/gravel/sand/silt	Sparse; bricks, broken glass, concrete	Dense, grey/brown filamentous	Light yellow	None	Moderate	None	Slight	Dry
5/20/2009	Unobservable	Unobservable; chunks of cement (where	Dense, green filamentous	Red, slight	Lawn/eutrophic pond	Sparse	None	Slight	Dry
7/22/2009	Unobservable	Unobservable	Moderate, moss	Red	None	Sparse	None	Slight	Wet
9/29/2009	Cobble/gravel/sand/silt	Concrete chunks	Very dense, dark green filamentous	Light yellow	None	Sparse	None	Moderate	Wet
11/17/2009	Unobservable	Chunks of concrete, floatables	Unobservable	Red	None	Moderate	None	Slight	Wet
2/18/2010	Unobservable	Unobservable	None	Light yellow	None	None	None	Clear	Wet
8/25/2010	Unobservable	Unobservable	Dense, moss	Light yellow	Eutrophic pond	Unobservable	Unobservable	Highly murky	Wet
10/20/2010	Unobservable	Unobservable	Moderate: green filamentous on rocks; moderate: moss	Light yellow	Musty, "chemical, sweet"	Sparse	None	Clear	Dry

-- : Not noted

Table 4 MassDEP SMART 2005 - 2010. Station NA01. Summary of Observations.

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
1/19/2005	Cobble/gravel/sand/silt	None	None	Slight red	None	None	None	Clear	Wet
3/16/2005	Boulder/cobble/gravel/sand/silt	None	None	Clear	None	Very sparse	None	Clear	Wet
5/18/2005	Boulder/cobble/gravel/sand/silt	None	Moss	Red	None	Sparse	None	Slight	Dry
7/20/2005	Boulder/cobble/gravel/sand/silt	None	Moss	Red	None	None	None	Clear	Dry
9/21/2005	Cobble/gravel/sand/silt	None	Moss	Clear	Slight petroleum, musty	None	None	Clear	Wet
11/8/2005	Cobble/gravel/sand	None	Dense: moss	Red	Petroleum	Very sparse	None	Clear	Dry
2/15/2006	Cobble/gravel/sand	None	None	Red, slight	None	None	None	clear	Wet
4/12/2006	Boulder/cobble/gravel/sand/silt	None	Moderate, green filamentous; very dense moss	Red, strong	Petroleum	None	Oily	Clear	Dry
6/14/2006	Unobservable	Unobservable	Unobservable	Red	None	Moderate	None	Unobservable	Wet
8/9/2006	Station NA01 not sampled due to impounding from beaver dams; Station NA02, Nashoba Brook at Commonwealth Ave, Concord sampled								
10/11/2006	Station NA01 not sampled due to impounding from beaver dams; Station NA02, Nashoba Brook at Commonwealth Ave, Concord sampled								
1/17/2007	Cobble/gravel/sand/silt/mud	None	Moderate, green filamentous; dense moss	Red	None	Very sparse	None	clear	Wet
3/14/2007	Cobble/gravel/sand	None	Moderate, moss	Red	None	Wispy	None	clear	Wet
5/16/2007	Gravel/sand/silt	None	Dense, green filamentous; dense, moss	Red	None	None	None	clear	Dry
7/18/2007	Boulder/cobble/gravel/sand	None	Sparse, moss	Red	None	None	None	Moderate	Dry
9/12/2007	Unobservable	Unobservable	Unobservable	Grey/brown; "fire soot"	Petroleum	None	None	Highly murky	Wet
11/7/2007	Unobservable	Unobservable	Unobservable	Red	Petroleum	None	Pollen	Moderate	Wet
2/27/2008	Gravel/sand	None	None	Red	None	Sparse	None	clear	Wet
4/23/2008	Boulder/cobble/gravel/sand/silt	None	Sparse, moss	Red	Petroleum	None	Pollen	clear	Dry
6/18/2008	Unobservable	Unobservable	Unobservable	Red	None	None	None	Slight	Wet
8/20/2008	Unobservable	Unobservable	Unobservable	Red	None	None	None	Moderate	Dry
10/22/2008	Unobservable	Unobservable	Sparse, moss	Red	None	None	None	clear	Dry
1/21/2009	Unobservable	Unobservable	None	Red	None	None	None	Unobservable	Wet
3/18/2009	Cobble/gravel/sand	None	Moderate, green filamentous; moderate, moss	Red	None	None	None	clear	Dry
5/20/2009	Unobservable	Unobservable	None	Red	Petroleum	Very sparse	None	Slight	Dry
7/22/2009	Unobservable	Unobservable	Dense, moss	Red, deep	Petroleum	None	None	Moderate	Wet
9/29/2009	Unobservable	None	Moderate, moss	Red	Petroleum	None	Pollen	Moderate	Wet
11/17/2009	Unobservable	Unobservable	Unobservable	Red	Petroleum (sediment release)	None	None	Moderate	Wet
2/18/2010	Unobservable	None	None	Red	None	None	None	clear	Wet
8/25/2010	Unobservable	Unobservable	Unobservable	Red	None	None	None	Unobservable	Wet
10/20/2010	Unobservable	Unobservable	None	Red	None	None	None	clear	Dry
-- : Not noted									

Table 5 MassDEP SMART 2005 - 2010. Station SU07. Summary of Observations.

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
1/19/2005	Boulder/cobble/gravel/sand/silt	Sparse: floatables	None	Clear	None	None	None	Clear	Wet
3/16/2005	Cobble/gravel/sand/silt/mud	Bicycle, metal stool, floatables	Brown filamentous	Clear	None	None	None	Slight	Wet
5/18/2005	Cobble/gravel/sand/silt/mud	Bicycles, metals, broken glass, floatables	Moderate: green filamentous; moderate: moss	Light yellow	None	None	None	Slight	Dry
7/20/2005	Cobble/silt/mud	Metals, floatables	Very dense: brown filamentous	Clear	None	None	None	Slight	Dry
9/21/2005	Cobble/sand/silt/mud	Very dense: bicycles, planks, shopping carts	Very dense: black floc	Clear	None	Very sparse	None	Clear	Wet
11/8/2005	Cobble/sand/silt/mud	Large items	Dense: film	Red	None	None	None	Clear	Dry
2/15/2006	Cobble/silt/mud	Metals, floatables	None	Clear	None	None	None	Clear	Wet
4/12/2006	Cobble/silt/mud	Very dense; bicycles, glass, highway cone, chair	Very dense: silty filamentous	Clear	None	Very sparse	None	Slight	Dry
6/14/2006	Cobble/silt/mud	Sparse; floatables	None	Light yellow	None	Very sparse	None	Slight	Wet
8/9/2006	Cobble/sand/silt/mud	Dense, metal and other large objects	Very dense: green filamentous; moss	Clear	None	Sparse	None	Clear	Dry
10/11/2006	Cobble/gravel/sand/silt/mud	Lots of large metal objects	Very dense: brown filamentous	Clear	None	None	None	Slight	Dry
1/17/2007	Cobble/gravel/sand/silt/mud	Trash	None	Clear	None	None	None	Clear	Wet
3/14/2007	Cobble/sand/silt	Metals, toilet	Moderate: brown filamentous	Light yellow	None	None	None	Slight	Wet
5/16/2007	Cobble/gravel/sand/silt	3 Bicycles, corrugated metal sheet, miscellaneous	Very dense: brown filamentous	Red/light yellow	None	None	None	Slight	Dry
7/18/2007	Cobble/gravel/sand/silt	Broken glass, metals, recyclables	Moderate: brown filamentous	Light yellow	None	None	None	Clear	Dry
9/12/2007	Cobble/gravel/sand	Metals, floatables	Very dense: brown filamentous	Light yellow	None	None	None	Clear	Wet
11/7/2007	Cobble/gravel/sand	Pipes and other metals, cans, bricks, broken glass	Sparse: green filamentous	Clear	None	None	None	Clear	Wet
2/27/2008	Cobble/gravel/sand	Bricks, broken glass	None	Light yellow	None	None	None	Clear	Wet
4/23/2008	Cobble/gravel/sand/silt	Broken glass, metals, wood planks, bicycle	Moderate: green filamentous	Clear	None	Sparse	None	Clear	Dry
6/18/2008	Cobble/gravel/sand/silt	Bicycle, storm drain cover, broken glass, metals	Sparse: moss	Light yellow	Fishy	Very sparse	None	Slight	Wet
8/20/2008	Cobble/gravel/sand	Moderate to dense, miscellaneous metals, broken glass, unknown broken "stuff"	Moderate: brown film	Red	None	None	None	Clear	Dry
10/22/2008	Cobble/gravel/sand/silt	Metals, floatables, broken glass	None	Red	None	None	None	Clear	Dry
1/21/2009	Cobble/gravel/sand	Broken glass, metals	None	Light yellow	None	None	None	Clear	Wet
3/18/2009	Cobble/gravel/sand/silt	Very dense, metals, brick, broken glass	Grey filamentous	Light yellow	None	None	None	Slight	Dry
5/20/2009	Cobble/gravel/sand/silt	Dense; brick chunks, fencing, pipes, broken glass, miscellaneous broken "stuff"	Sparse: filamentous	Clear	Chemical (sweet)	None	Pollen	Slight	Dry
7/22/2009	Cobble/gravel/sand	Very dense; miscellaneous metals, bricks, unknown	None	Light yellow	None	None	None	Moderate	Wet
9/29/2009	Cobble/gravel/sand	Moderate; miscellaneous chunks of metals, brick, plastic, broken glass	Very dense: brown filamentous	Clear	None	None	None	Clear	Wet
11/17/2009	Unobservable	Unobservable	Unobservable	Red	None	Very sparse	Pollen	Highly murky	Wet
2/18/2010	Cobble/gravel/sand/silt	Very dense; bricks, broken glass, road sign, miscellaneous	None	Clear	None	None	None	Clear	Wet
8/25/2010	Cobble/gravel/sand	Moderate, metals, bricks, broken glass	Moderate: film	Clear	None	None	None	Moderate	Wet
10/20/2010	Cobble/gravel/sand/silt	Moderate: metals, broken glass, bricks, unknown	None	Clear	Fishy, strong	Very sparse	None	Clear	Dry

-- : Not noted

Table 6 MassDEP SMART 2005 - 2010. Station CO7/CO8. Summary of Observations.

Survey Dates	Substrate	Trash	Periphyton	Color	Odor	Foam	Sheen	Turbidity	Wet/Dry Conditions
1/19/2005	Boulder/cobble/gravel/sand	None	None	Light yellow	None	Foam	None	Clear	Wet
3/16/2005	Boulder/cobble/gravel/sand/silt	Large items, floatables	Very dense: brown filamentous	Clear	Musty	None	None	Clear	Wet
5/18/2005	Unobservable	Broken glass	Moderate: brown filamentous	Red	Musty	Sparse	None	Slight	Dry
7/20/2005	Unobservable	Trash	Very dense: brown filamentous; moss	Brown	Petroleum, ashes	None	None	Moderate	Dry
9/21/2005	Boulder/cobble/gravel/sand/silt	Large metal objects	Moderate: green film; very dense: moss	Brown	None	None	Pollen	Moderate	Wet
11/8/2005	Unobservable	Unobservable	Unobservable	Light yellow	None	Sparse	Petroleum	Unobservable	Dry
2/15/2006	Boulder/cobble/silt	Metals	None	Clear	None	Moderate	None	Clear	Wet
4/12/2006	Unobservable	Unobservable	Unobservable	Brown	None	None	None	Highly murky	Dry
6/14/2006	Unobservable	Unobservable	Unobservable	Red	None	Moderate	None	Unobservable	Wet
8/9/2006	Unobservable	Unobservable	Unobservable	Milk chocolate	None	None	None	Highly murky	Dry
10/11/2006	Unobservable	Trash	Unobservable	Red	None	None	None	Slight	Dry
1/17/2007	Boulder/cobble/gravel/sand	Trash	Dense, green filamentous	Light yellow	None	Very sparse	None	Clear	Wet
3/14/2007	Unobservable	Unobservable	Unobservable	Light yellow	None	Sparse	None	Unobservable	Wet
5/16/2007	Unobservable	Unobservable	Unobservable	Red	None	None	None	Slight	Dry
7/18/2007	Unobservable	Unobservable	Unobservable	Red	Eutrophic pond	None	None	Highly murky	Dry
9/12/2007	Unobservable	Unobservable	Unobservable	Brown/light yellow	None	None	None	Highly murky	Wet
11/7/2007	Unobservable	Unobservable	Unobservable	Light yellow	Musty	None	None	Moderate	Wet
2/27/2008	Unobservable	Unobservable	Unobservable	Not noted	None	Sparse	None	Unobservable	Wet
4/23/2008	Unobservable	Floatables, broken glass, bricks	Unobservable	Clear	None	Sparse	None	Moderate	Dry
6/18/2008	Boulder/cobble/gravel/sand	Very dense, pipes, metals, bricks, floatables, unidentifiables	Very dense, brown filamentous; moderate, moss	Red	Fishy	Sparse	None	Moderate	Wet
8/20/2008	Unobservable	Moderate to dense; broken glass, bricks, miscellaneous pieces of "stuff", plastics, fabrics, floatables, cement chunks	Unobservable	Red	None	Sparse	None	Highly murky	Dry
10/22/2008	Unobservable	Trash	Unobservable	Red	None	None	None	Slight	Dry
1/21/2009	Station not sampled; access/time issues								
3/18/2009	Unobservable	Broken glass, bricks	Moderate, green filamentous	Light yellow	None	None	None	Slight	Dry
5/20/2009	Cobble/gravel/sand	None	Sparse, green filamentous	Clear	Eutrophic pond	Sparse	None	Clear	Dry
7/22/2009	Unobservable	Unobservable	Very dense, moss	Red	Musty, strong	Moderate	None	Slight	Wet
9/29/2009	Unobservable	Unobservable	Very dense, moss	Red	Petroleum, eutrophic pond	Moderate	None	Moderate	Wet
11/17/2009	Unobservable	Unobservable	Unobservable	Red	None	None	None	Unobservable	Wet
2/18/2010	Station not sampled; access issues due to steep snowy banks, ice shelves over water column								
8/25/2010	Station not sampled; access issues due to steep wet banks								
10/20/2010	Unobservable	Moderate: miscellaneous; heavy on banks	Unobservable	Light yellow	Musty	Moderate (east side of channel only)	None	Moderate	Dry
-- : Not noted									

SURVEY CONDITIONS

Stream discharge and precipitation data are used to determine hydrologic conditions and, consequently, if water quality surveys should be described as dry or wet weather events. Precipitation data were obtained from the National Oceanic and Atmospheric Administration (NOAA). The presence/absence of precipitation during the five days prior to each sampling event was based on the National Weather Service (NWS) data located on their website NOAA Climatological Data Publications (NOAA 2015). Bedford, MA is the location of the weather station closest to the SuAsCo watershed sampling stations; however, climatic data were not available for the entire period covered in this tech memo. The next closest weather stations are in Lowell, Reading and Worcester. Reading has the same average annual precipitation as most of the basin, while Worcester receives a greater volume and Lowell a smaller volume. Therefore, climatological data collected at Reading were utilized in this report. On average, precipitation varies little across the watershed, approximately 44 to 46 inches/year (Ostiguy et al 2010). The northern area receives slightly less, with an average of 42 to 44 inches/year in Chelmsford and Lowell, and the northern sections of Westford and Billerica; while the southwest area, including portions of the towns of Bolton, Berlin, Northborough and Westborough, received 46 to 48 inches/year.

During dry weather, trace amounts of precipitation may fall, but there is no measurable change in stream flow. The USGS operates five real time stream gaging stations in the Concord River Watershed, applicable to this water quality data set, as shown below:

- Assabet River, Mill Road near Westborough, MA (10/1/2006 – 9/30/2007) (USGS 2015a)
- Assabet River at Maynard, MA (USGS 2015b)
- Nashoba Brook near Acton, MA (USGS 2015c)
- Sudbury River at Saxonville, MA (USGS 2015d) and
- Concord River below River Meadow Brook at Lowell, MA (USGS 2015e).

The mean streamflow values are based on 71 years of record at the USGS Concord River gage below River Meadow Brook, Lowell (USGS station number 01099500). The daily data are reported at USGS Mean Discharge at Concord River gage Daily Data (USGS 2015f). The monthly mean discharges are found at USGS Mean Discharge at Concord River gage Monthly Data (USGS 2015g).

Wet weather is determined to impact water quality when precipitation within a five-day antecedent period leads to more than a slight increase in stream discharge. Under dry weather conditions, trace amounts of precipitation may fall, but no measurable change in stream flow occurs. In addition to precipitation, discharge values were examined relative to the 7Q10 low flow (the lowest 7-day average streamflow that occurs, on average, once every 10 years) which is 32.2 cubic feet per second (cfs) at the USGS gaging station on the Concord River below River Meadow Brook in Lowell (Wandle and Fontaine 1984). At some of the SuAsCo flow gaging stations, precipitation-related stream fluctuations were difficult to distinguish from manipulated fluctuations on some events.

Table 7 through Table 14 present additional climate data needed to determine wet weather/runoff or dry weather conditions for winter surveys (January – March). Table 2 through Table 6 present field observations at SMART stations from 2005-2010. Table 16 (precipitation) and Table 17 (stream discharge) contain information on survey conditions for each sampling event; these data were used to estimate hydrological conditions for each data set. When precipitation and discharge data were not sufficient to determine wet or dry conditions, additional data were considered e.g., maximum daily temperature, snowfall, snow on the ground, specific conductivity, turbidity and bacteria.

January 19, 2005 – Small amounts of precipitation were recorded in the 5 days before this winter survey, including 2 inches of snow (the precipitation measured on the sampling date fell after the survey); see Table 7 for climate data for this period. Discharge at the gages on the Assabet River in Maynard and the Concord River in Lowell rose in conjunction with rain/snow events. On the survey date, discharge at the Maynard gage had begun to decline, but not to pre-storm levels; discharge at the Lowell gage continued to rise, but showed non-precipitation related fluctuations. Data collected during this event reflect wet weather/runoff conditions. Air temperature during the sampling event ranged from 4 to 14 degrees Fahrenheit (°F) under overcast skies.

Table 7 Climate Conditions at Reading, MA from January 14-19, 2005

Parameter	Jan 14	Jan 15	Jan 16	Jan 17	Jan 18	Jan 19
Max Temperature (ºF)	62	30	29	25	13	25
Precipitation (inches as water)	0.72	0	0.11	0.04	0	0.13
Snowfall (inches)	T	0	1.5	0.5	0	2.2
Snow on the ground (inches)	T	T	1	1	1	3
Data obtained at NOAA Climatological Data Publications (NOAA 2015).						

March 16, 2005 – Over an inch of precipitation (nearly 6 inches of snow) fell between March 11-13, 2005; see Table 8 for climate data for March 11-16, 2005. The discharge pattern at the Assabet River gage (Maynard) showed fluctuations not associated with precipitation or snow melt but, in general, flows were near the mean daily values for the preceding week. Discharge at the Concord River gage was also near the mean daily values and varied little in this time period. In Table 8, snowmelt conditions are reflected in the decrease in snow on the ground from March 12-16, therefore samples collected during this event reflect wet weather/runoff weather conditions. Air temperature ranged from 41 to 45°F with cloud cover ranging from 0 to 35%.

Table 8 Climate Conditions at Reading, MA from March 11-16, 2005

Parameter	March 11	March 12	March 13	March 14	March 15	March 16
Max Temperature (ºF)	35	34	40	41	45	45
Precipitation (inches as water)	0.07	1.05	0.01	0	0	0
Snowfall (inches)	0.8	5.0	0.1	0	0	0
Snow on the ground (inches)	7	11	10	9	8	7
Data obtained at NOAA Climatological Data Publications (NOAA 2015).						

May 18, 2005 – This spring survey fell within a wet period; over a half-inch of rain fell in the area between May 14-18, 2005. Precipitation on May 18th fell after the conclusion of sampling activities. Discharge at the Maynard gage decreased steadily from May 11-15, rose through May 17, then fell through the sampling event to near pre-storm levels. Discharge at the Concord River gage generally decreased from May 11-18, with several rapid fluctuations not associated with precipitation. Data reflect dry weather conditions. Air temperature ranged from 55 to 61°F; overcast skies throughout the survey brightened at the last station (approximately 60% cloud cover).

July 20, 2005 – Summer sampling in 2005 fell within a relatively dry period (approximately 0.03 inches of rain), and discharge at gages in the watershed decreased throughout the preceding week (Sudbury River at Saxonville, Assabet River at Maynard, Concord River at Lowell). Data reflect dry weather conditions. Air temperature ranged from 78 to 86°F and sunny skies developed to partly sunny (approximately 35% cloud cover).

September 21, 2005 – This survey, which fell on the last day of summer in 2005, was preceded by a 5-day period with a total precipitation of <0.2 inches. Discharge at the Assabet River gage (Maynard) rose rapidly on Sept. 15, continued to rise through Sept. 18, then declined through Sept. 21, but not to pre-storm levels. Discharge at the Sudbury River gage (Saxonville) followed a similar pattern through Sept. 19, then decreased rapidly through Sept. 21 to a level slightly above pre-storm flows. And at the Concord River gage, discharge rose steadily from Sept. 15-19, then decreased through Sept. 21 but again, not to pre-storm levels. Data collected during this event reflect wet weather/runoff conditions. Air temperature ranged from 63 to 74°F under sunny skies.

November 8, 2005 – Approximately 0.3 inches of precipitation was recorded at the Reading weather station between November 6-7, 2005, just before this mid-fall survey (none as snow). However, discharge at area gages generally decreased from Nov. 1-8, with a slight increase that mirrored the precipitation event at the Sudbury River gage that quickly decreased to below pre-storm levels. Therefore, data reflect dry weather conditions. Air temperature ranged from 56 to 60°F and cloud cover from 30 to 95%.

February 15, 2006 – A storm dropped 16 inches of snow on the area on February 12, 2006 (0.7 inches as water). As shown in Table 9 below, the air temperature was above freezing from Feb. 13-15, and snow on the ground decreased from 12 to 4 inches. The discharge pattern varied at area gages. At the Assabet River/Maynard and Concord River/Lowell gages, flows steadily decreased from Feb. 8-15. At the Sudbury River/Saxonville gage, discharge decreased from Feb. 8-11, then rose through Feb. 15. Field observations noted that the water level was high at 3 of 5 stations, including Station AS18 (Assabet River, Maynard), NA01 (Nashoba Brook, Acton) and CO7

(Concord River, Lowell). Based on field observations, precipitation and the 8 in reduction in snow on the ground, these data reflect wet weather/runoff conditions. Air temperature ranged from 39 to 56°F under sunny skies.

Table 9 Climate Conditions at Reading, MA from February 10-15, 2006

Parameter	Feb 10	Feb 11	Feb 12	Feb 13	Feb 14	Feb 15
Max Temperature (ºF)	29	31	26	34	41	56
Precipitation (inches as water)	0	0	0.70	0	0	0
Snowfall (inches)	0	0	16.0	0	0	0
Snow on the ground (inches)	0	0	12	8	7	4
Data obtained at NOAA Climatological Data Publications (NOAA 2015).						

April 12, 2006 – Little precipitation fell on the area in the 5 days preceding this spring survey (Σ=0.15 inches, April 7-8, 2006). Overall, discharge at the Assabet River/Maynard and Sudbury River/Saxonville gages decreased from April 5-12, while discharge at the Concord River/Lowell gage increased from April 5-7, then decreased from April 10-12. Streamflow conditions indicate that these data reflect dry weather conditions. Air temperature ranged from 57 to 69°F under sunny to mostly sunny skies.

June 14, 2006 – Over 1.3 inches of precipitation was recorded at the Reading weather station from June 9-10, 2006; precipitation on June 14 began after the conclusion of monitoring activities. In general, discharge at area gages rose from June 7-9, then decreased from June 12-14. Data collected during this event reflect wet weather/runoff conditions. Air temperature ranged from 72 to 77°F and cloud cover from 40 to 100%.

August 9, 2006 – In the five-day period before this mid-summer survey, approximately 0.4 inches of rain was recorded at the Reading weather station on August 4, 2006, and 0.07 inches on August 7. Discharge at the Assabet River/Maynard gage indicated rapid flow fluctuations that were not associated with precipitation events. At the other watershed gages (Nashoba Brook/Acton, Sudbury River/Saxonville, Concord River/Lowell), discharge generally reflected the pattern of rainfall. Data reflect dry weather conditions. Air temperature ranged from 63 to 78°F under sunny skies.

October 11, 2006 – This fall sampling event followed a 5-day dry period (although nearly an inch of rain fell on the area on this date, rainfall began after the survey had concluded). Discharge generally varied little and/or decreased slightly at area gages during this period. Data reflect dry weather conditions. Air temperature ranged from 56 to 60°F under overcast skies.

January 17, 2007 – Winter sampling in 2007 occurred after a storm event brought 0.84 inches of precipitation (0.1 inches as snow) to the area from January 13-16 (see Table 10 for climate data for January 12-17, 2007). Discharge at area gages rose from Jan. 15-16. Flows did not return to pre-storm levels before the survey. Data reflect wet weather/runoff conditions. Air temperature ranged from 10 to 18 ºF under clear skies.

Table 10 Climate Conditions at Reading, MA from January 12-17, 2007

Parameter	Jan 12	Jan 13	Jan 14	Jan 15	Jan 16	Jan 17
Max Temperature (ºF)	48	50	36	36	35	19
Precipitation (inches as water))	0	0.02	0.13	0.64	0.05	0
Snowfall (inches)	0	0	0	0	0.1	0
Snow on the ground (inches)	0	0	0	0	T	0
Data obtained at NOAA Climatological Data Publications (NOAA 2015).						

March 14, 2007 – This late winter survey in 2007 occurred within a slightly wet period, with trace to 0.2 inches of rain noted on 3 of the 5 days preceding this event as shown in Table 11 below. At all area gages I(Assabet River/Westborough, Assabet River/Maynard, Sudbury River/Saxonville, Concord River/Lowell), mean daily discharge increased from March 10-14. Based on discharge data, water quality reflected wet weather/runoff conditions. Air temperature ranged from 53 to 64ºF under cloudy skies.

Table 11 Climate Conditions at Reading, MA from March 14-19, 2007

Parameter	March 19	March 10	March 11	March 12	March 13	March 14
Max Temperature (ºF)	34	51	51	56	62	72
Precipitation (inches as water)	0	T	0.21	0	T	T
Snowfall (inches)	0	0	0	0	0	0
Snow on the ground (inches)	2	1	1	T	T	0
Data obtained at NOAA Climatological Data Publications (NOAA 2015).						

May 16, 2007 – A thunderstorm brought approximately 0.2 inches of rain to the area on the night before this spring survey; the storm that brought nearly 1.7 inches of rain to the area on May16, 2007 began after monitoring activities had concluded. Discharge at area gages did not rise with the precipitation on May 15. Data reflect dry weather conditions. Air temperature ranged from 64 to 70ºF; although skies were mostly cloudy to overcast, high, wispy clouds allowed weak sunlight to filter through.

July 18, 2007 – Rainfall over the 5 days before this summer event totaled 0.32 inches. Discharge at area gages generally decreased throughout this period. Although discharge increased at some gages on July 18th, the rise in flow did not begin until after the conclusion of monitoring activities. Data reflect dry weather conditions. Air temperature ranged from 69 to 71ºF with intermittent/light rain throughout the event.

September 12, 2007 – This late summer survey followed a wet period, with over 2½ inches of precipitation recorded at reading from Sept. 8-11, 2007, of which over 1.3 inches on Sept. 11th. Discharge at area gages rose rapidly on Sept. 11th and did not return to pre-storm levels prior to the survey. Data collected on this date reflect wet weather/runoff conditions. Air temperature ranged from 59 to 65ºF, and cloud cover ranged from <5 to 70%.

November 7, 2007 – Two storms in the 5 days prior to this fall survey brought over 1.6 inches of precipitation to the area. Discharge at area gages generally reflected the precipitation pattern, and had not returned to pre-storm levels prior to the survey. Based on the above, data reflect wet weather/runoff conditions. Air temperature ranged from 47 to 54ºF; clear skies became partly cloudy by the end of the survey.

February 27, 2008 – This winter survey fell within a wet period, with over 11 inches of snow (1.52 inches as water) recorded at the Reading weather station within the preceding 5 days (see Table 12). Snow on the ground decreased from 10 inches on Feb. 22, 2008 to 5 inches on Feb. 26, and did not decrease further on Feb. 27. Maximum daily temperature was above freezing from Feb. 23-Feb. 27. Discharge decreased from Feb. 20-26, then rose through the period encompassing monitoring activities on Feb. 27. Data reflect wet weather/runoff conditions. Air temperature ranged from 36 to 40ºF under overcast skies.

Table 12 Climate Conditions at Reading, MA from February 22-27, 2008

Parameter	Feb 22	Feb 23	Feb 24	Feb 25	Feb 26	Feb 27
Max Temperature (ºF)	30	34	39	46	40	39
Precipitation (inches as water)	0.76	0.02	0	0	0.74	0.05
Snowfall (inches)	10.0	0.2	0	0	1.1	0.8
Snow on the ground (inches)	10	9	8	6	5	5
Data obtained at NOAA Climatological Data Publications (NOAA 2015).						

April 23, 2008 – A dry period preceded this spring survey, with no precipitation recorded at the Reading weather station from April 18-22; trace precipitation on the survey date fell after the conclusion of monitoring activities. Discharge at area gages decreased steadily through the previous week. Data reflect dry weather conditions. Air temperature ranged from 69 to 84ºF under sunny skies.

June 18, 2008 –A three-day wet period brought approximately 0.8 inches of rain to the area from June 14-17, 2008; discharge at area gages generally mirrored the pattern of precipitation (with apparent non-natural flow manipulation seen at the Concord River/Lowell gage). Data reflect wet weather/runoff conditions. Air temperature ranged from 62 to 70ºF and cloud cover from 0 to 95%.

August 20, 2008 – A storm dropped over 0.6 inches of rain on the area on August 15, 2008; only trace precipitation was recorded from Aug. 16-20. Flow at area gages generally reflected the precipitation pattern. Data reflect dry weather conditions. Air temperature ranged from 60 to 69ºF under sunny skies.

October 22, 2008 – A small storm brought approximately 0.2 inches of rainfall to the area, beginning on Oct. 21, 2008 and continuing during this fall monitoring event. Stream discharge data, however, showed a generally decreasing flow throughout the 5 days preceding and including the sampling date, with a short-term increase at some gages from mid-day October 21, returning to pre-storm levels prior to the survey. Data reflect dry conditions. Air temperature ranged from 45 to 48ºF and skies were overcast with occasional drizzle during monitoring activities.

January 21, 2009 – Winter sampling in 2009 occurred two days after a storm dropped 16 inches of snow (1.03 inches as water) on the area (see Table 13). Maximum daily temperature was above freezing on (1) day in the preceding 5-day period (Jan. 19); however, snow on the ground decreased from 18 inches on Jan. 18 to 14 inches on the sampling date. The discharge pattern varied at area gages. At the Assabet River and Nashoba Brook gages, discharge rose from Jan. 16-17, then varied little through Jan. 21 (not returning to pre-storm flows). At the Sudbury River gage, discharge rose slightly on Jan. 18-19, and again on Jan. 20. Data reflect wet weather/runoff conditions. Air temperature ranged from 11 to 26ºF under sunny skies.

Table 13 Climate Conditions at Reading, MA from January 16-21, 2009

Parameter	Jan 16	Jan 17	Jan 18	Jan 19	Jan 20	Jan 21
Max Temperature (ºF)	19	21	23	34	30	26
Precipitation (inches as water)	0	0	0.67	0.36	T	0
Snowfall (inches)	0	0	11.4	4.6	T	0
Snow on the ground (inches)	6	6	18	16	15	14
Data obtained at NOAA Climatological Data Publications (NOAA 2015).						

March 18, 2009 – Spring 2009 monitoring occurred within a dry period; no precipitation was recorded within the 5 days preceding this event (see Table 14). Streamflow fell consistently within this time frame, and data collected on this date reflect dry conditions. Air temperature ranged from 47 to 68ºF; cloud cover ranged from 0 to 85%.

Table 14 Climate Conditions at Reading, MA from March 13-18, 2009

Parameter	March 13	March 14	March 15	March 16	March 17	March 18
Max Temperature (ºF)	37	52	59	41	48	64
Precipitation (inches as water)	0	0	0	0	0	0
Snowfall (inches)	0	0	0	0	0	0
Snow on the ground (inches)	T	T	0	0	0	0
Data obtained at NOAA Climatological Data Publications (NOAA 2015).						

May 20, 2009 – This late spring event was preceded by a 5-day period with approximately 0.2 in of rain recorded at the Reading weather station. Discharge at area gages fell during the previous week, with a small transient increase that coincided with the rain event on May 17. Flow at area gages was well below pre-storm discharge throughout the watershed by the morning of monitoring activities. Data reflect dry conditions. Air temperature ranged from 63 to 81ºF and cloud cover from 0 to 65%.

July 22, 2009 – A wet period preceded this mid-summer event, with over 0.9 inches of rainfall recorded at Reading from July 17-22. Stream discharge patterns reflect the precipitation and runoff input. Data collected on this date reflect wet weather/runoff conditions. Air temperature ranged from 69 to 74ºF under cloudy skies.

September 29, 2009 – Early fall 2009 monitoring was conducted within a wet period, with 0.6 inches of rainfall recorded during the preceding 2 days, and an additional 0.57 in on the sampling date prior to the commencement of sampling activities. Streamflow at area gages generally reflected the precipitation pattern, and data collected on this date reflect wet weather/runoff conditions. Air temperature ranged from 60 to 51ºF with 67 under sunny skies.

November 17, 2009 – An intense storm brought over 3.2 inches of rainfall to the area on November 14-15, 2009. Discharge at area gages generally reflected the precipitation input. Data collected on this date reflect wet weather/runoff conditions. Air temperature ranged from 47 to 52°F under sunny skies.

February 18, 2010 – A winter storm event dropped over 6.7 inches of snow (0.71 inches as water) on the area from February 16-17, 2010 (see Table 15). During this period, the maximum air temperature in the area was above freezing every day; the snow on the ground decreased from 7 inches on Feb. 16 to 3 inches on Feb. 18; discharge patterns at area gages varied little. Water quality data reflect wet weather/runoff conditions. Air temperature ranged from 39 to 45°F; cloud cover ranged from 50 to 100%.

Table 15 Climate Conditions at Reading, MA from February 13-18, 2010

Parameter	Feb 13	Feb 14	Feb 15	Feb 16	Feb 17	Feb 18
Max Temperature (ºF)	38	40	41	34	35	48
Precipitation (inches as water)	0	0	0	0.71	T	0
Snowfall (inches)	0	0	0	6.7	T	0
Snow on the ground (inches)	T	T	T	7	6	3
Data obtained at NOAA Climatological Data Publications (NOAA 2015).						

August 25, 2010 – Summer sampling in 2010 fell within a wet period; 1.41 inches of rain was recorded from August 22-24, and an addition 2.55 inches on August 25th. Discharge at area gages reflect the precipitation pattern during this period. Data collected on this date represent wet weather/runoff conditions. Air temperature ranged from 63 to 65°F, while precipitation during monitoring activities ranged from drizzle to heavy rain.

October 20. 2010 – A storm brought 2.32 inches of rain to the area from October 15-16. Discharge at area gages rose during that period. From October 17-20, flow at most gages dropped to near or below pre-storm levels (Assabet River at Hudson and at Maynard, Nashoba Brook at Acton, Sudbury River at Saxonville). Flow at the Concord River gage at Lowell continued to be elevated (more than triple pre-storm flows); however, the discharge pattern indicates non-precipitation based events, possible due to dam manipulation upstream of the gage. Data collected on this date reflect dry weather conditions. Air temperature ranged from 41 to 55°F; cloud cover ranged from clear to overcast.

Table 16 SuAsCo Basin Precipitation Data Summary 2005-2010							
Survey Dates	**5 Days Prior***	**4 Days Prior**	**3 Days Prior**	**2 Days Prior**	**1 Day Prior****	**Sample Date**	**Wet/Dry Conditions*****
1/19/2005	0.72	0	0.11	0.04	0	0.13	Wet
3/16/2005	0.07	1.05	0.01	0	0	0	Wet
5/18/2005	0	T	0.07	0.17	0.01	0.33	Dry
7/20/2005	0	0	0	0.03	T	0	Dry
9/21/2005	0.09	0.07	T	0	0.03	0	Wet
11/8/2005	0	0	0	0.31	0.01	0	Dry
2/15/2006	0	0	0.70	0	0	0	Wet
4/12/2006	0.11	0.04	0	0	0	T	Dry
6/14/2006	0.64	0.72	0	0	0	1.07	Wet
8/9/2006	0.43	0	0	0.07	0	0	Dry
10/11/2006	0	0	0	0	0	0.92	Dry
1/17/2007	0	0.02	0.13	0.64	0.05	0	Wet
3/14/2007	0	T	0.21	0	T	T	Wet
5/16/2007	0.31	0	0	0	0.18	1.50	Dry
7/18/2007	0	T	0.13	0	0	0.19	Dry
9/12/2007	0	0.37	0.61	0.20	1.34	0	Wet
11/7/2007	0	1.15	0	0	0.51	0	Wet
2/27/2008	0.76	0.02	0	0	0.74	0.05	Wet
4/23/2008	0	0	0	0	0	T	Dry
6/18/2008	0	0.1	0.44	0.34	T	0	Wet
8/20/2008	0.61	T	0	0	T	0	Dry
10/22/2008	0	0	0	0	0.06	0.11	Dry
1/21/2009	0	0	0.67	0.36	T	0	Wet
3/18/2009	0	0	0	0	0	0	Dry
5/20/2009	0	T	0.20	T	0	0	Dry
7/22/2009	0.01	0.26	0	0	0.59	0.06	Wet
9/29/2009	0	0	0	0.37	0.23	0.57	Wet
11/17/2009	0	0	3.08	0.13	0	0	Wet
2/18/2010	0	0	0	0.71	T	0	Wet
8/25/2010	0	0	0.29	0.52	0.60	2.55	Wet
10/20/2010****	1.32	1.00	0	0	0	0	Dry

*Unofficial data from the National Weather Service station in Reading, MA and reported at NOAA Climatological Data Publications (NOAA 2015); all values in inches of precipitation.

**T= trace amount

*** Based on precipitation, streamflow and other relevant data.

****Data were unavailable at the Reading station for this time period; data from the Lowell station were used.

Table 17 Discharge at the Concord River below River Meadow Brook, Lowell, MA 2005-2010*								
Survey Dates	**5 Days Prior**	**4 Days Prior**	**3 Days Prior**	**2 Days Prior**	**1 Day Prior**	**Sample Date**	**Monthly Mean**	**POR** Mean**
1/19/2005	1,440	1,700	1,890	2,020	2,010	1,950	1,380	693
3/16/2005	1,070	1,060	1,040	1,030	1,010	1,000	1,180	1,300
5/18/2005	1,260	1,210	1,140	1,090	1,060	1,030	1,294	828
7/20/2005	880	812	750	694	645	596	577.7	226
9/21/2005	107	193	237	253	245	198	112.7	268
11/8/2005	***	***	***	***	***	***	***	***
11/8/2005	1,940	1,760	1,600	1,460	1,380	1,280	1,355	485
2/15/2006	2,060	1,960	1,850	1,740	1,640	1,560	1,566	805
4/12/2006	806	821	815	794	760	726	594.2	1,400
6/14/2006	2,890	3,360	3,130	2,980	2,870	2,710	1,979	620
8/9/2006	303	275	240	228	213	188	244.8	218
10/11/2006	229	233	213	193	175	171	404.5	314
1/17/2007	1,000	964	924	951	980	988	849.7	703
3/14/2007	1,010	937	959	987	1,010	1,110	1,230	1,220
5/16/2007	1,090	1,080	1,030	985	930	933	1,509	840
7/18/2007	387	344	295	256	202	156	248.1	235
9/12/2007	26	25	47	31	92	134	68.9	218
11/7/2007	93	137	290	323	314	300	203.4	480
2/27/2008	2,840	2,710	2,530	2,350	2,180	2,140	2,061	975
4/23/2008	1,230	1,170	1,110	1,060	1,010	978	1,255	1,170
6/18/2008	211	197	193	194	225	240	305.5	562
8/20/2008	1,150	1,140	1,120	1,060	979	894	782.6	248
10/22/2008	423	390	351	345	341	358	687.1	400
1/21/2009	1,060[e]	1.010[e]	955	889	890	866[e]	1,176	693
3/18/2009	1,670	1,650	1,590	1,530	1,460	1,400	1,245	1,360
5/20/2009	747	679	668	618	580	551	653.6	815
7/22/2009	1,300	1,220	1,120	1,030	970	928	1,287	239
9/29/2009	260	226	197	178	181	230	358.6	302
11/17/2009	342	331	534	944	1,100	1,210	787.6	569
2/18/2010	630	614	595	574	572	571	1,054	844
8/25/2010	31	30	30	36	43	192	85.1	255
10/20/2010	333	438	493	494	475	414	287.2	369

*Gage # 01099500 data found at Real-Time Data for USA: Build Custom Table; all data approved for publication

**POR*-Period of Record, monthly mean value based on entire point of record (Jan 1, 1937-Feb 28, 2003)

***Station CO7 not sampled on this date

[e] = estimated value

7Q10 = 32.2 cfs @ USGS gaging station, Concord River below River Meadow Brook at Lowell, MA (Wandle and Fontaine 1984).

RESULTS AND QUALITY ASSURANCE/QUALITY CONTROL

The results of SMART monitoring conducted in the SuAsCo watershed from 2005 through 2010 are included below. Table 18 through Table 22 present *in-situ* multiprobe readings, including temperature, pH, dissolved oxygen, percent oxygen saturation, depth, specific conductivity, and total dissolved solids. Table 23 through Table 27 contain nutrient (ammonia-nitrogen, nitrate-nitrite nitrogen, total nitrogen or total Kjeldahl nitrogen, and total phosphorus), chlorides, hardness, total alkalinity, total suspended solids and turbidity data. Most results are expressed as milligrams per liter (mg/L). Exceptions include: depth in meters (m); temperature in degrees Celsius (ºC); pH in Standard Units (SU); conductivity in microsiemens per centimeter (µS/cm); dissolved oxygen saturation in percent (%); and turbidity, in Nephelometric Turbidity Units (NTU).

Field sheets, field notebooks, chain of custody forms, raw and electronic data files, lab reports and other metadata are maintained by DWM. 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 with 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 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 is 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 18 MassDEP SMART 2005-2010. Station AS04. *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)	(%)
1/19/2005	SM-6126	8:53	0.8	1.6	6.6	468	304	12.9	92
3/16/2005	SM-6168	9:22	0.6	2.6	6.7	623	405	13.2	97
5/18/2005	SM-1314	8:58	0.4	14.4	6.7	612	398	8.6	84
7/20/2005	SM-1394	9:09	0.2	22.5	6.8	879	571	5.7	66
9/21/2005	SM-1476	8:51	0.3	19.1	6.8 i	769	500	6.5	71
11/8/2005	SM-1546	9:11	0.6	10.2	6.6	457	297	9.2	82
2/15/2006	SM-1616	9:08	0.4	2.2	6.6	325	211	12.6	92
4/12/2006	SM-1686	9:05	0.4	10.0	6.6	589	383	9.3	83
6/14/2006	SM-1756	9:03	0.3	18.8	6.6	438	285	7.8	84
8/9/2006	SM-1826	8:49	0.3	20.2	6.8	1114 c	724 c	5.5	61
10/11/2006	SM-1896	9:09	0.5	15.1	6.6	649	415	6.6 i	66 i
1/17/2007	SM-1966	8:38	0.3	0.8 u	6.6 u	459 u	298 u	13.0 u	91 u
3/14/2007	SM-2036	8:59	0.6	3.7	6.4	374	243	12.0	91
5/16/2007	SM-2106	8:46	0.4	16.0	6.6	698	454	7.2	73
7/18/2007	SM-2176	8:22	0.2	20.6	6.7	1024 c	666 c	6.2	69
9/12/2007	SM-2246	8:48	0.3	18.0	6.9	693	450	6.6	70
11/7/2007	SM-2316	8:53	0.4	7.5	6.6	565	367	10.1	84
2/27/2008	SM-2386	8:25	0.5	2.4	6.4	569	370	12.4	91
4/23/2008	SM-2456	8:55	0.2	14.2	6.6	569	370	8.1	79
6/18/2008	SM-2562	8:47	0.2	17.3	6.7	666	433	## i	## i
8/20/2008	SM-2668	8:30	0.3	18.7	6.8	547	355	7.2	77
10/22/2008	SM-2750	8:45	0.4	11.7	6.5	806 c	524 c	7.3	67
1/21/2009	SM-2796	9:14	0.4	0.3	6.5	626	407	12.3 i	85 i
3/18/2009	SM-2880	8:46	0.5	5.3	6.5	557	362	11.3	90
5/20/2009	SM-2952	8:35	0.1	14.5	6.7	812 c	528 c	7.8	76
7/22/2009	SM-3024	8:40	0.3	18.8	6.7	476	310	7.0	75
9/29/2009	SM-3096	8:41	0.3	16.1	6.8	611	397	7.1	72
11/17/2009	SM-3168	8:33	0.3	8.6	6.7	342	222	10.4	89
2/18/2010	SM-3240	8:38	0.3	2.9	6.6	854 c	555 c	11.7	87
8/25/2010	SM-3312	8:28	0.3	18.8	6.9	903 c	587 c	7.5	81
10/20/2010	SM-3384	8:05	0.3	11.6	6.4	795	517	8.0	74

Table 19 MassDEP SMART 2005-2010. Station AS18. *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)	(%)
1/19/2005	SM-6129	10:29	0.8	0.0	6.7	419	272	15.4	105
3/16/2005	SM-6171	11:11	0.6	3.0	7.1	560	364	15.6	116
5/18/2005	SM-1318	10:43	0.4	15.6	7.1	464	301	10.0	100
7/20/2005	SM-1398	10:47	0.3	27.1	7.3	466	303	7.7	97
9/21/2005	SM-1480	10:42	0.3	20.7	7.4 i	769	500	8.2	92
11/8/2005	SM-1550	11:03	0.5	10.1	6.8	383	249	10.8	96
2/15/2006	SM-1620	11:00	0.6	0.8	6.8	403	262	14.8	104
4/12/2006	SM-1690	10:46	0.3	11.8	7.7	411	267	12.8	118
6/14/2006	SM-1760	10:43	0.7	20.3	6.7	294	191	8.3	92
8/9/2006	SM-1830	10:42	0.3	25.2	7.5	495	322	7.9	96
10/11/2006	SM-1900	11:03	0.6	15.2	7.2	501	320	9.0 i	91 i
1/17/2007	SM-1970	10:31	0.5	0.6 u	7.0 u	324 u	211 u	14.5 u	101 u
3/14/2007	SM-2040	10:45	0.5	3.2	6.9	331	215	13.8	103
5/16/2007	SM-2110	10:36	0.3	18.4	7.1	392	255	9.2	98
7/18/2007	SM-2180	10:19	0.1	24.8	7.5	487	317	7.1	86
9/12/2007	SM-2250	10:36	0.3	19.6	7.5	698	453	8.1	89
11/7/2007	SM-2320	10:27	0.3	7.6	7.2	606	394	12.0	101
2/27/2008	SM-2390	10:26	0.4	1.3	6.8	399	260	14.6	104
4/23/2008	SM-2460	10:46	0.3	17.3	7.5	428	278	11.2	116
6/18/2008	SM-2566	10:37	0.3	21.2	7.2	581	378	## i	## i
8/20/2008	SM-2672	10:17	0.3	20.8	7.0	346	225	8.5	95
10/22/2008	SM-2754	10:31	0.2	10.0	7.1	474	308	11.1	98
1/21/2009	SM-2800	11:19	0.3	-0.3	6.7	458	298	14.2 i	97 i
3/18/2009	SM-2884	10:22	1.1	5.8	6.9	406	264	13.3	106
5/20/2009	SM-2956	10:29	0.2	17.1	7.2	446	290	9.7	100
7/22/2009	SM-3028	10:24	0.4	21.2	7.0	358	233	8.2	92
9/29/2009	SM-3100	10:25	0.4	17.2	7.3	582	378	9.3	97
11/17/2009	SM-3172	10:18	0.5	9.3	6.7	271	176	11.1	96
2/18/2010	SM-3244	10:30	0.3	1.0	7.0	499	324	14.6	103
8/25/2010	SM-3316	10:15	0.2	19.8	7.6	872 u, c	567 u, c	8.4	92
10/20/2010	SM-3388	9:57	0.3	10.4	7.1	517	336	10.6	95

Table 20 MassDEP SMART 2005-2010. Station NA01. *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)	(%)
1/19/2005	SM-6130	11:09	0.6	0.0	6.5	468	304	13.1	90
3/16/2005	SM-6172	11:52	0.9	0.5	6.8	522	339	14.0	97
5/18/2005	SM-1320	11:18	0.7	13.9	6.7	438	285	8.3	80
7/20/2005	SM-1400	11:32	0.5	24.6	6.8	449	292	4.9	59
9/21/2005	SM-1482	11:19	0.3	17.5	7.0 i	347	225	6.9	73
11/8/2005	SM-1552	11:45	0.7	9.3	6.4	390	254	8.7	76
2/15/2006	SM-1622	11:41	0.6	0.4	6.5	400	260	12.5	87
4/12/2006	SM-1692	11:29	0.5	10.1	6.7	383	249	10.2	91
6/14/2006	SM-1762	11:20	0.8	18.5	6.4	285	186	7.1	76
1/17/2007	SM-1972	11:06	0.4	0.1 u	6.8 u	306 u	199 u	13.7 u	94 u
3/14/2007	SM-2042	11:21	0.8	1.1	6.6	265	172	12.7	90
5/16/2007	SM-2112	11:26	0.6	17.8	6.6	367	238	7.2	76
7/18/2007	SM-2182	10:54	0.4	22.5	6.9	440	286	5.4	62
9/12/2007	SM-2252	11:13	0.5	16.4	6.9	321	209	8.0	82
11/7/2007	SM-2322	11:10	0.6	5.9	6.8	467	303	11.4	92
2/27/2008	SM-2392	11:03	0.7	0.2	6.6	475	309	13.9	96
4/23/2008	SM-2462	11:24	0.5	15.8	6.8	448	291	8.8	89
6/18/2008	SM-2568	11:13	0.3	18.1	6.7	448	291	## i	## i
8/20/2008	SM-2674	10:51	0.5	17.3	6.7	447	291	6.6	69
10/22/2008	SM-2756	11:07	0.5	8.6	6.6	420	273	8.9	76
1/21/2009	SM-2802	11:59	0.6	-0.3	6.4	419	272	12.1 i	82 i
3/18/2009	SM-2886	11:05	0.7	3.6	6.6	404	263	12.3	93
5/20/2009	SM-2958	11:05	0.5	14.6	6.6	428	278	8.1	80
7/22/2009	SM-3030	10:58	0.5	18.3	6.7	442	287	7.4	79
9/29/2009	SM-3102	11:02	0.4	15.7	6.8	482	313	7.9	80
11/17/2009	SM-3174	10:53	0.7	6.8	6.6	303	197	11.3	92
2/18/2010	SM-3246	11:20	0.5	0.7	6.8	547	355	13.3	93
8/25/2010	SM-3318	10:49	0.3	17.4	7.0	308	200	7.9	83
10/20/2010	SM-3390	10:31	0.5	8.4	6.6	591	384	10.0	85

Table 21 MassDEP SMART 2005-2010. Station SU07. *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)	(%)
1/19/2005	SM-6128	9:50	0.7	-0.1	6.9	419	273	16.0	109
3/16/2005	SM-6170	10:26	0.7	2.2	6.9	564	367	15.1	110
5/18/2005	SM-1316	9:58	0.8	15.0	7.1	392	255	10.4	103
7/20/2005	SM-1396	10:04	0.6	26.0	7.4	310	201	8.0	99
9/21/2005	SM-1478	9:58	0.5	20.6	7.3 i	339	220	8.4	94
11/8/2005	SM-1548	10:20	0.5	10.0	6.9	303	197	11.2	99
2/15/2006	SM-1618	10:15	0.6	1.6	7.0	427	278	14.7	106
4/12/2006	SM-1688	10:03	0.5	11.6	7.2	399	259	11.8	108
6/14/2006	SM-1758	10:03	0.5	18.7	7.0	353	229	9.7	104
8/9/2006	SM-1828	10:00	0.6	23.4	7.2	448	291	7.3	86
10/11/2006	SM-1898	10:10	0.7	14.2	7.1	485	310	9.2 i	91 i
1/17/2007	SM-1968	9:47	0.5	0.9 u	7.1 u	368 u	239 u	14.7 u	104 u
3/14/2007	SM-2038	10:04	0.5	3.9	6.9	430	279	13.6	104
5/16/2007	SM-2108	9:53	0.2	17.3	7.1	381	248	9.8	102
7/18/2007	SM-2178	9:32	0.1	23.6	7.2	423	275	7.2	85
9/12/2007	SM-2248	9:50	0.2	18.9	7.3	316	205	8.6	93
11/7/2007	SM-2318	9:48	0.3	9.1	7.2	218	142	12.1	105
2/27/2008	SM-2388	9:39	0.7	2.0	6.9	480	312	14.7	107
4/23/2008	SM-2458	10:04	0.5	14.1	7.1	327	213	11.0	107
6/18/2008	SM-2564	9:57	0.3	20.0	7.1	411	267	## i	## i
8/20/2008	SM-2670	9:41	0.4	21.4	7.2	349	227	8.8	99
10/22/2008	SM-2752	9:50	0.4	10.9	7.2	367	239	11.1	100
1/21/2009	SM-2798	10:30	0.4	-0.1	6.9	485	315	14.8 i	101 i
3/18/2009	SM-2882	9:39	0.8	4.7	7.0	559	364	13.4	104
5/20/2009	SM-2954	9:46	0.4	16.8	7.2	506	329	9.8	101
7/22/2009	SM-3026	9:40	0.5	21.5	7.1	379	246	8.8	99
9/29/2009	SM-3098	9:44	0.3	16.9	7.2	422	274	9.4	97
11/17/2009	SM-3170	9:42	0.7	9.1	7.1	337	219	12.5	108
2/18/2010	SM-3242	9:36	0.3	2.0	7.1	686	446	14.1	102
8/25/2010	SM-3314	9:30	0.4	19.6	7.3	524	341	8.5	93
10/20/2010	SM-3386	9:17	0.3	11.6	7.1	453	295	10.4	96

Table 22 MassDEP SMART 2005-2010. Station CO7/CO8. *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)	(%)
1/19/2005	SM-6131	11:58	0.3	0.0	6.7	397	258	15.4	105
3/16/2005	SM-6174	12:43	1.0	2.5	7.0	513	333	15.1	111
5/18/2005	SM-1323	12:16	0.9	15.8	7.0	403	262	10.0	101
7/20/2005	SM-1403	12:23	0.8	27.6	7.1	377	245	7.5	95
9/21/2005	SM-1485	12:21	0.2	21.8	7.6 i	518	336	8.8	100
11/8/2005	SM-1555	12:33	1.1	10.5	6.6	325	211	10.5	94
2/15/2006	SM-1625	12:41	1.0	1.1	6.8	403	262	15.0	106
4/12/2006	SM-1695	12:18	0.8	11.4 m	7.2 m	409 m	266 m	11.9 m	109 m
6/14/2006	SM-1765	12:17	1.3	20.1	6.6	263	171	8.5	94
8/9/2006	SM-1835	12:36	0.5	26.1	8.2	414	269	9.8	120
10/11/2006	SM-1905	12:48	0.6	16.0	7.8	332	212	9.9 i	102 i
1/17/2007	SM-1975	11:58	## i	0.8 u	7.1 u	328 u	213 u	14.7 u	103 u
3/14/2007	SM-2045	12:18	0.9	2.0	6.9	374	243	14.2	103
5/16/2007	SM-2115	12:17	0.8	19.0	7.1	375	244	9.1	98
7/18/2007	SM-2185	11:45	0.6	25.7	7.3	378	246	7.3	89
9/12/2007	SM-2255	12:22	0.5	20.2	7.5	546	355	8.6	96
11/7/2007	SM-2325	12:01	0.5	8.8	7.3	493	320	12.0	103
2/27/2008	SM-2395	12:01	0.6	1.2	6.7	471	306	14.9	105
4/23/2008	SM-2465	12:18	0.5	17.3	7.1	410	266	10.5	109
6/18/2008	SM-2571	12:01	0.3	21.8	7.4	502	326	## i	## i
8/20/2008	SM-2677	11:40	0.7	21.6	6.9	318	207	8.4	96
10/22/2008	SM-2759	11:49	0.5	10.8	7.1	428	278	11.0	99
1/21/2009	SM-2805	**	**	**	**	**	**	**	**
3/18/2009	SM-2889	11:52	0.5	5.7	6.9	447	290	13.4	107
5/20/2009	SM-2961	11:54	0.2	18.0	7.0	459	298	9.4	99
7/22/2009	SM-3033	11:52	0.2	22.5	6.8	392	255	8.2	95
9/29/2009	SM-3105	11:50	0.2	18.3	7.4	451	293	9.7	103
11/17/2009	SM-3177	11:35	0.4	9.5	6.9	322	209	12.0	105
2/18/2010	SM-3249	**	**	**	**	**	**	**	**
8/25/2010	SM-3321	**	**	**	**	**	**	**	**
10/20/2010	SM-3393	11:25	0.5	11.2	7.2	507	329	10.9	100

Table 23 MassDEP SMART 2005-2010. Station AS04. 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)
1/19/2005	SM-1126	8:40	**	**	**	**	**	**	##b,h	0.04h	1.5h	0.22h
3/16/2005	SM-1168	9:10	19	74	160	**	2.4	1.4	2.4	0.06	2.0b	0.33
5/18/2005	SM-1312	8:49	**	**	**	**	**	3.6	1.7h	0.06h	1.2h	0.16h
7/20/2005	SM-1392	9:00	29	140	210	**	2.6	1.9	3.5	0.09	2.3b	0.19
9/21/2005	SM-1474	8:40	26	120	170	**	2.1	1.4	4.6	0.06	2.8	0.42
11/8/2005	SM-1544	9:05	21	73	110	**	1.4	1.2	1.6	0.04	1.1	0.33
2/15/2006	SM-1614	8:50	18	69	120	**	1.1	0.9	2.5	0.04	2.2	0.30
4/12/2006	SM-1684	8:45	23	89	140	**	1.6	1.0	3.3	0.04	2.6	0.14
6/14/2006	SM-1754	8:47	19	69	110	**	4.0	1.7	1.8	0.07	1.3	0.098d
8/9/2006	SM-1824	8:30	29	180	280h	**	2.9	1.4	6.1	0.07	3.5	0.81
10/11/2006	SM-1894	8:55	26	110	160	**	1.5	1.2	2.8	<0.02	1.6	0.14
1/17/2007	SM-1964	8:27	19	72	110	**	2.8	1.8	2.0	0.04	1.5	0.12
3/14/2007	SM-2034	8:44	17	55	87	**	3.8	2.2	1.7	0.09	1.2	0.070
5/16/2007	SM-2104	8:30	24	110	170	**	6.1	2.3	3.3	0.09	2.3	0.25
7/18/2007	SM-2174	8:12	22	200	240	345	3.6	1.8	9.1	0.06	8.2	0.38
9/12/2007	SM-2244	8:38	33	88	160	2420	2.5	1.9	3.8	0.07	2.9	0.30
11/7/2007	SM-2314	8:35	19	92	130	249	1.7d	2.0	3.2	0.03d	2.5	0.16
2/27/2008	SM-2384	8:05	14	61	140	32	2.6	1.5	2.3	0.08	1.7	0.10
4/23/2008	SM-2454	8:40	20	79	140	57	3.6	1.4	3.7	0.11	2.5	0.15
6/18/2008	SM-2560	8:35	28	130	190	488	4.6	2.4	3.5	0.14	2.3	0.28
8/20/2008	SM-2666	8:15	**	82	120	91	1.8	2.2	3.6	0.05	2.6	0.24
10/22/2008	SM-2748	8:30	25d	120	180	44	1.5d	1.1	6.6	0.04	5.4	0.34
1/21/2009	SM-2794	8:45	16	93	150	9	3.9	1.9	3.4	0.08	2.2	0.15
3/18/2009	SM-2878	8:35	17	78	140	1	##d	2.1	2.4	0.04	2.0	0.16
5/20/2009	SM-2950	8:20	26	130	200	152	7.7	2.1	4.1	0.07	4.0	0.21
7/22/2009	SM-3022	8:30	28	85	110	345	4.8	2.1	1.6	0.06	1.0	0.13
9/29/2009	SM-3094	8:30	33	100	150	1550	6.4	2.7	1.8	0.02	1.3	0.13
11/17/2009	SM-3166	8:25	19	58	77	24	3.2	1.9	1.9	0.05	1.3	0.10
2/18/2010	SM-3238	8:25	19	**	220	41	6.8	2.5	4.3	0.14	3.9	0.17d
8/25/2010	SM-3310	8:20	28	170	210	687	4.8	2.5	12.0	0.07	10.0	0.23
10/20/2010	SM-3382	7:55	23	120h	170	124	2.0	1.1	11.0h	0.06	10.0	0.17h

Table 24 MassDEP SMART 2005-2010. Station AS18. 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)
1/19/2005	SM-1131	11:50	**	**	**	**	**	**	##b,h	<0.02h	0.68h	0.053h
3/16/2005	SM-1173	12:40	19	53	130	53	1.6	1.5	1.3	0.09	1.0b	0.056
5/18/2005	SM-1321	12:10	**	**	**	**	**	3.4	0.71h	0.04h	0.30h	0.053h
7/20/2005	SM-1401	12:15	30	48	84	48	5.4	2.2	0.94	0.04	0.49b	0.11
9/21/2005	SM-1483	12:10	43	75	110	75	5.5	2.5	1.2	0.03	2.8	0.067
11/8/2005	SM-1553	12:25	18	45	71	45	6.1	2.6	0.90	0.03	0.36	0.063
2/15/2006	SM-1623	12:30	16	48	94	**	<1.0	0.9	1.1	0.03	0.80	0.034
4/12/2006	SM-1693	12:10	19	51	94	**	8.1	2.1	1.3	0.02	0.82	0.069
6/14/2006	SM-1763	12:05	16	33	59	**	5.2	2.0	0.85	0.08	0.31	0.072
8/9/2006	SM-1833	12:20	32	56	88	**	17	7.4	1.4	<0.02	0.54	0.12
10/11/2006	SM-1903	12:35	32	70	110	**	15	5.3	1.7	<0.02	0.90	0.081
1/17/2007	SM-1973	11:50	16	43	72	**	1.7	1.6	1.2	0.09	0.86	0.059
3/14/2007	SM-2043	12:10	17	45	86	**	2.4	1.9	1.4	0.14	0.94	0.053
5/16/2007	SM-2113	12:05	24	50	87	**	8.4	3.5	1.0	0.11	0.39	0.077
7/18/2007	SM-2183	11:40	28	54	84	**	11	3.5	1.3	0.08	0.51	0.093
9/12/2007	SM-2253	12:15	36	68	110	**	11	4.1	3.7	0.36	2.3	0.11
11/7/2007	SM-2323	11:50	37	77	100	**	7.5d	3.2	2.1	0.36	1.2	0.074
2/27/2008	SM-2393	11:50	12	45	120	44	1.4	1.3	1.0	0.07	0.73	0.022
4/23/2008	SM-2463	12:07	16	50	100	11	7.2	2.8	0.92	0.04	0.39	0.051
6/18/2008	SM-2569	11:50	28	67	110	579	17	4.4	1.6	0.05	0.84	0.092
8/20/2008	SM-2675	11:30	**	45	68	98	6.8	4.0	0.97	0.04	0.36	0.081
10/22/2008	SM-2757	11:43	22	57	90	73	4.0	2.5	1.5	0.03	0.99	0.047
1/21/2009	SM-2799	**	**	**	**	**	**	**	**	**	**	**
3/18/2009	SM-2887	11:47	13	46	100	6	2.4d	1.3	0.89	0.08	0.59	0.027
5/20/2009	SM-2959	11:45	25	59	110	99	14	2.5	1.4	0.15	0.66	0.12
7/22/2009	SM-3031	11:40	23	52	93	93	6.1	2.1	0.98	0.05	0.42	0.081
9/29/2009	SM-3103	11:40	20	58	110	291	6.4	2.6	1.4	0.03	0.93	0.062
11/17/2009	SM-3175	11:30	16	44	74	727	7.8	3.8	1.4	0.06	0.77	0.085
2/18/2010	SM-3243	**	**	**	**	**	**	**	**	**	**	**
8/25/2010	SM-3315	**	**	**	**	**	**	**	**	**	**	**
10/20/2010	SM-3391	11:18	24	71h	110	84	8.6	3.4	1.7	<0.02	1.2	0.053

Table 25 MassDEP SMART 2005-2010. Station NA01. 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)
1/19/2005	SM-1130	11:05	**	**	**	**	**	**	##b,h	0.64h	0.85h	0.023h
3/16/2005	SM-1172	11:45	16	57	130	**	1.1	1.4	1.5	0.47	0.74b	0.025
5/18/2005	SM-1319	11:15	**	**	**	**	**	2.3	1.3h	0.41h	0.52h	0.041h
7/20/2005	SM-1399	11:25	34	67	98	**	1.6	1.3	1.1	0.08	0.60b	0.066
9/21/2005	SM-1481	11:10	31	57	73	**	2.9	1.6	0.69	0.08	0.30	0.053
11/8/2005	SM-1551	11:25	17	55	89	**	<1.0	1.1	1.3	0.27	0.53	0.038
2/15/2006	SM-1621	11:30	17	53	90	**	<1.0	0.6	1.7	0.60	0.91	0.017
4/12/2006	SM-1691	11:10	19	53	90	**	1.5	1.1	1.4	0.26	0.79	0.031
6/14/2006	SM-1761	11:10	15	37	63	**	2.0	1.9	1.4	0.31	0.53	0.063
8/9/2006	**	**	**	**	**	**	**	**	**	**	**	**
10/11/2006	**	**	**	**	**	**	**	**	**	**	**	**
1/17/2007	SM-1971	10:55	14	39	67	**	<1.0	1.2	1.1	0.27	0.56	0.026
3/14/2007	SM-2041	11:11	13	32	57	**	2.8	1.6	1.3	0.44	0.50	0.041
5/16/2007	SM-2111	11:05	**	53	85	**	4.3	2.1	1.8	0.54	0.64	0.068
7/18/2007	SM-2181	10:45	30	67	99	22	8.0	3.8	1.8	0.14	0.97	0.11
9/12/2007	SM-2251	11:00	25	54	56	>2419.6	13	9.4	2.4	0.78	0.84	0.17
11/7/2007	SM-2321	10:58	18	72	110	517	3.5d	2.9	1.1	0.13	0.47	0.054
2/27/2008	SM-2391	10:55	12	51	110	17	1.2	1.2	1.7	0.52	0.84	0.018
4/23/2008	SM-2461	11:10	22	59	110	36	1.2	1.4	1.4	0.34	0.57	0.039
6/18/2008	SM-2567	11:02	31	63	100	46	12	4.1	1.4	0.21	0.56	0.12
8/20/2008	SM-2673	10:40	**	61	100	25	2.7	5.1	1.3	0.12	0.67	0.060
10/22/2008	SM-2755	10:58	25	62	90	39	1.5	1.7	1.8	0.83	0.44	0.041
1/21/2009	SM-2801	11:50	19	55	98	4	1.8	1.2	1.5	0.67	0.68	0.023
3/18/2009	SM-2885	10:57	13	47	91	4	2.6d	0.9	0.95	0.29	0.48	0.017
5/20/2009	SM-2957	10:57	20	57	100	186	3.5	2.5	1.3	0.31	0.49	0.063
7/22/2009	SM-3029	10:50	24	60	110	345	4.8	3.2	1.2	0.14	0.48	0.073
9/29/2009	SM-3101	10:55	25	67	110	308	3.2	2.0	1.2	0.08	0.76	0.041
11/17/2009	SM-3173	10:45	13	43	71	115	2.9	3.0	0.96	0.10	0.16	0.057
2/18/2010	SM-3245	11:10	22	**	120	22	1.1	1.9	1.6	0.59	0.80	0.023
8/25/2010	SM-3317	10:45	26	56	64	921	3.9	4.2	0.64	0.06	0.19	0.055
10/20/2010	SM-3389	10:25	16	92h	130	82	1.2	1.2	0.97	0.19	0.36	0.023

Table 26 MassDEP SMART 2005-2010. Station SU07. 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)
1/19/2005	SM-1128	9:40	**	**	**	**	**	**	##b,h	<0.02h	0.44h	0.016h
3/16/2005	SM-1170	10:20	14	50	140	**	1.0	1.5	0.79	0.03	0.61b	0.014
5/18/2005	SM-1315	9:55	**	**	**	**	**	1.8	0.52h	0.02h	0.29h	0.014h
7/20/2005	SM-1395	9:50	26	32	62	**	1.7	1.7	0.44	0.05	0.18b	0.027
9/21/2005	SM-1477	9:50	27	35	75	**	<1.0	1.1	0.55	0.08	0.18	0.027
11/8/2005	SM-1547	10:10	15	37	73	**	1.1	1.4	0.65	<0.02	0.29	0.027
2/15/2006	SM-1617	10:00	25	43	98	**	1.1	1.1	0.76	0.02	0.58	0.013
4/12/2006	SM-1687	9:55	18	49	120	**	2.0	1.2	0.72	<0.02	0.46	0.016
6/14/2006	SM-1757	9:50	16	39	84	**	2.6	1.4	0.67	0.05	0.34	0.022
8/9/2006	SM-1827	9:45	26	54	100h	**	<1.0	1.1	0.65	0.03	0.28	0.024
10/11/2006	SM-1897	10:00	25	59	120	**	2.3	1.4	0.47	0.02	0.14	0.017
1/17/2007	SM-1967	9:35	16	42	88	**	1.8	1.5	0.61	0.03	0.34	0.015
3/14/2007	SM-2037	9:55	15	46	110	**	2.3	1.7	0.81	0.07	0.46	0.019
5/16/2007	SM-2107	9:50	19	44	93	**	1.9	1.1	0.68	0.03	0.38	0.017
7/18/2007	SM-2177	9:20	25	57	100	109	1.4	1.2	0.65	0.05	0.26	0.024
9/12/2007	SM-2247	9:40	27	56	100	1730	1.9	1.2	0.58	0.06	0.20	0.034
11/7/2007	SM-2317	12:04	19	40	75	152	1.6d	1.2	0.36	<0.02	0.08	0.017
2/27/2008	SM-2387	9:25	12	40	120	64	1.6	2.3	0.86	0.04	0.62	0.012
4/23/2008	SM-2457	9:47	10	37	86	5	2.0	0.9	0.58	<0.02	0.32	0.016
6/18/2008	SM-2563	9:43	18	49	100	155	1.7	1.5	0.67	0.10	0.26	0.032
8/20/2008	SM-2669	9:30	**	39	81	124	1.3	1.7	0.55	0.04	0.12	0.026
10/22/2008	SM-2751	9:40	17	43	85	22	<1.0	1.6	0.51	<0.02	0.16	0.020
1/21/2009	SM-2797	10:18	15	46	120	33	1.0	1.0	0.77	0.04	0.47	0.015
3/18/2009	SM-2881	9:28	17	48	130	7	1.3d	1.1	0.70	<0.02	0.52	0.013
5/20/2009	SM-2953	9:28	18	53	130	145	2.3	1.2	0.57	0.03	0.27	0.020
7/22/2009	SM-3025	9:30	28	45	92	435	3.2	2.1	0.59	0.06	0.17	0.030
9/29/2009	SM-3097	9:35	22	51	100	116	1.8	1.7	0.53	0.02	0.22	0.025
11/17/2009	SM-3169	9:35	13	39	82	75	9.6	2.6	0.49	<0.02	0.13	0.032
2/18/2010	SM-3241	9:27	17	**	170	12	1.6	1.6	0.73	0.05	0.49	0.014
8/25/2010	SM-3313	9:23	30	66	130	866	6.1	3.0	0.67	0.08	0.17	0.037
10/20/2010	SM-3385	9:10	20	50h	110	32	1.3	1.7	0.42	0.02	0.09	0.015

Table 27 MassDEP SMART 2005-2010. Station CO7/CO8. 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)
1/19/2005	SM-1131	11:50	**	**	**	**	**	**	##b,h	<0.02h	0.68h	0.053h
3/16/2005	SM-1173	12:40	19	53	130	53	1.6	1.5	1.3	0.09	1.0b	0.056
5/18/2005	SM-1321	12:10	**	**	**	**	**	3.4	0.71h	0.04h	0.30h	0.053h
7/20/2005	SM-1401	12:15	30	48	84	48	5.4	2.2	0.94	0.04	0.49b	0.11
9/21/2005	SM-1483	12:10	43	75	110	75	5.5	2.5	1.2	0.03	2.8	0.067
11/8/2005	SM-1553	12:25	18	45	71	45	6.1	2.6	0.90	0.03	0.36	0.063
2/15/2006	SM-1623	12:30	16	48	94	**	<1.0	0.9	1.1	0.03	0.80	0.034
4/12/2006	SM-1693	12:10	19	51	94	**	8.1	2.1	1.3	0.02	0.82	0.069
6/14/2006	SM-1763	12:05	16	33	59	**	5.2	2.0	0.85	0.08	0.31	0.072
8/9/2006	SM-1833	12:20	32	56	88	**	17	7.4	1.4	<0.02	0.54	0.12
10/11/2006	SM-1903	12:35	32	70	110	**	15	5.3	1.7	<0.02	0.90	0.081
1/17/2007	SM-1973	11:50	16	43	72	**	1.7	1.6	1.2	0.09	0.86	0.059
3/14/2007	SM-2043	12:10	17	45	86	**	2.4	1.9	1.4	0.14	0.94	0.053
5/16/2007	SM-2113	12:05	24	50	87	**	8.4	3.5	1.0	0.11	0.39	0.077
7/18/2007	SM-2183	11:40	28	54	84	**	11	3.5	1.3	0.08	0.51	0.093
9/12/2007	SM-2253	12:15	36	68	110	**	11	4.1	3.7	0.36	2.3	0.11
11/7/2007	SM-2323	11:50	37	77	100	**	7.5d	3.2	2.1	0.36	1.2	0.074
2/27/2008	SM-2393	11:50	12	45	120	44	1.4	1.3	1.0	0.07	0.73	0.022
4/23/2008	SM-2463	12:07	16	50	100	11	7.2	2.8	0.92	0.04	0.39	0.051
6/18/2008	SM-2569	11:50	28	67	110	579	17	4.4	1.6	0.05	0.84	0.092
8/20/2008	SM-2675	11:30	**	45	68	98	6.8	4.0	0.97	0.04	0.36	0.081
10/22/2008	SM-2757	11:43	22	57	90	73	4.0	2.5	1.5	0.03	0.99	0.047
1/21/2009	SM-2803	**	**	**	**	**	**	**	**	**	**	**
3/18/2009	SM-2887	11:47	13	46	100	6	2.4d	1.3	0.89	0.08	0.59	0.027
5/20/2009	SM-2959	11:45	25	59	110	99	14	2.5	1.4	0.15	0.66	0.12
7/22/2009	SM-3031	11:40	23	52	93	93	6.1	2.1	0.98	0.05	0.42	0.081
9/29/2009	SM-3103	11:40	20	58	110	291	6.4	2.6	1.4	0.03	0.93	0.062
11/17/2009	SM-3175	11:30	16	44	74	727	7.8	3.8	1.4	0.06	0.77	0.085
2/18/2010	SM-3247	**	**	**	**	**	**	**	**	**	**	**
8/25/2010	SM-3319	**	**	**	**	**	**	**	**	**	**	**
10/20/2010	SM-3391	11:18	24	71h	110	84	8.6	3.4	1.7	<0.02	1.2	0.053

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