EPA's Water Quality Report on the Lower Charles River 2007- 2008

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Prepared By

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Background

In 1995, the U.S. Environmental Protection Agency - New England (EPA) established the Clean Charles Initiative to restore the lower Charles River (from Watertown to Boston harbor) to a swimmable and fishable condition by Earth Day in the year 2005. The initiative incorporated a comprehensive approach for improving water quality through: Combined Sewer Overflow (CSO) controls, illicit sanitary connection removals, stormwater management, public outreach, education, monitoring, enforcement, technical assistance, and the development of a Total Maximum Daily Load (TMDL) to address nutrient impacts for the Lower Charles.

Introduction

In 1998, EPA's Office of Environmental Measurement and Evaluation (OEME) initiated the Clean Charles Core Monitoring Program. The purpose of the program was to track water quality improvements in the lower Charles River and to identify where further pollution reductions or remediation actions were necessary to meet the Clean Charles Initiative goals. The program was designed to sample during the summer months, coinciding with peak recreational uses.

The target date for achieving swimmable and fishable conditions was originally Earth Day 2005. The Clean Charles initiative has achieved significant improvements in water quality during the past thirteen years. Water quality, however still falls short of the goals. The Lower Charles continues to suffer from nutrient enrichment and sections of the river continue to exceed bacteria standards.

In 2005, EPA modified the Core Monitoring Program to reflect changes in the initiative and existing trends in water quality conditions. The monitoring program was changed to monitor key parameters during dry weather conditions at seven trend stations (Figure 6). These stations were a subset of the original twelve Core Monitoring Program stations. On each monthly sampling event, the following field parameters were measured: temperature, DO, pH, specific conductance, salinity, turbidity, Secchi disk transparency, chlorophyll, and transmissivity. In addition to these field measurements, samples were collected for fecal coliform, *E.coli*, total phosphorus, ortho-phosphate, and chlorophyll a.

In 2008, the annual EPA Core Monitoring Program was discontinued. Currently, monitoring is being conducted in the basin by the Charles River Watershed Association (CRWA) and the Massachusetts Water Resources Authority (MWRA), which serves to provide annual data. EPA may continue monitoring in future years to track trends as TMDLs are implemented and pollutant reductions occur.

In 2007 and 2008, EPA conducted temperature monitoring using deployable loggers. These loggers, which measured temperature every half hour, were deployed at locations between Boston University Bridge and the Charles River locks (Figure 7). Temperature is an important parameter for evaluating thermal discharges, algal blooms, and climate change.

Discussion of Results

The summary below reflects the EPA water quality monitoring data collected during 2007 and 2008. In 2007, core monitoring and temperature monitoring was conducted. In 2008, only temperature monitoring was conducted. The majority of this report will focus on the core monitoring data collected in 2007 and comparing these to previous year's data.

In addition to point source and non-point source pollutant loadings, water quality was influenced by yearly fluctuations in weather and river flows, making short-term trends difficult to determine. Weather conditions and river flow affect the transport of pollutants in the watershed. Flow data collected at the Waltham USGS gaging station reveal that the 2007 mean summer flow[1] was less than the mean summer flow (1931 – 2007). In 2007, the lowest mean summer flow was recorded since EPA began regular monitoring in 1998 (Figure 1). During the summer of 2007, September recorded the lowest monthly mean flow (20.9 cfs). The highest mean flow rate

1The mean summer flow was calculated from averaging the mean monthly flows from September –June during the summer of 2007 was recorded in June (218 cfs). In 2007, each months mean flow from June – September was less than the corresponding monthly mean from 1931- 2007.

In 2008, the mean summer flow[1] was greater than the mean summer flow[1] (1931 – 2007).

When comparing the core monitoring 2007 data to the past eight years of data, the following conclusions can be made. The majority of the time, bacteria was lower and clarity higher near the mouth of the River (downstream of the Longfellow Bridge; CRBL11, & CRBL12). This part of the river met the swimming standards more often than any other part of the lower Charles River.

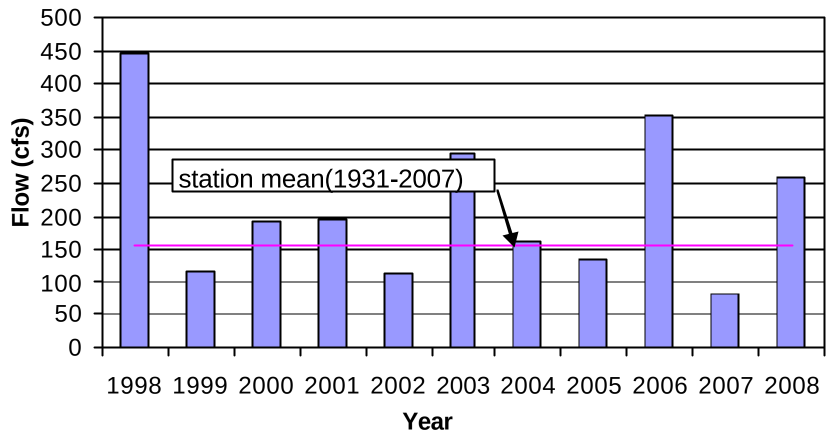

Figure 1: June - September Mean Monthly Stream Flow at the USGS Gaging Station in Waltham, MA (2008 data are provisional)

Elevated levels of phosphorus have been measured in the Charles River from 1998 - 2007. EPA and the Massachusetts Department of Environmental Protections (Mass DEP) have taken steps to reduce levels of phosphorus in the River. In October 2007, EPA and Mass DEP announced Total Maximum Daily Load (TMDL) phosphorus targets to reduce phosphorus loading to the River. The TMDL determines how much phosphorus can be put into the lower Charles River and still maintain its designated uses as a recreational water body. The targets in the TMDL are being used by agencies to guide clean up and nutrient reduction efforts.

Clarity

Water clarity was directly measured in the field at six of the seven stations using a Secchi disk. Secchi disk transparency could not be measured at station CRBL02 because of shallow water depth. In 2007, the greatest clarity was measured during July 17 at four stations. The lowest clarity was record at each of the stations during the September 5 sampling event. On this date, the highest chlorophyll a values were also recorded. Half of the stations recorded chlorophyll a values greater than 100 ug/L, indicating a significant algae bloom that occurred in parts of the lower Charles River. The seasonal (June 1- October 31) chlorophyll a target established in the *Total Maximum Daily Load for Nutrients in the Lower Charles River Basin*, *Massachusetts* is 10 ug/L (MADEP, et al.

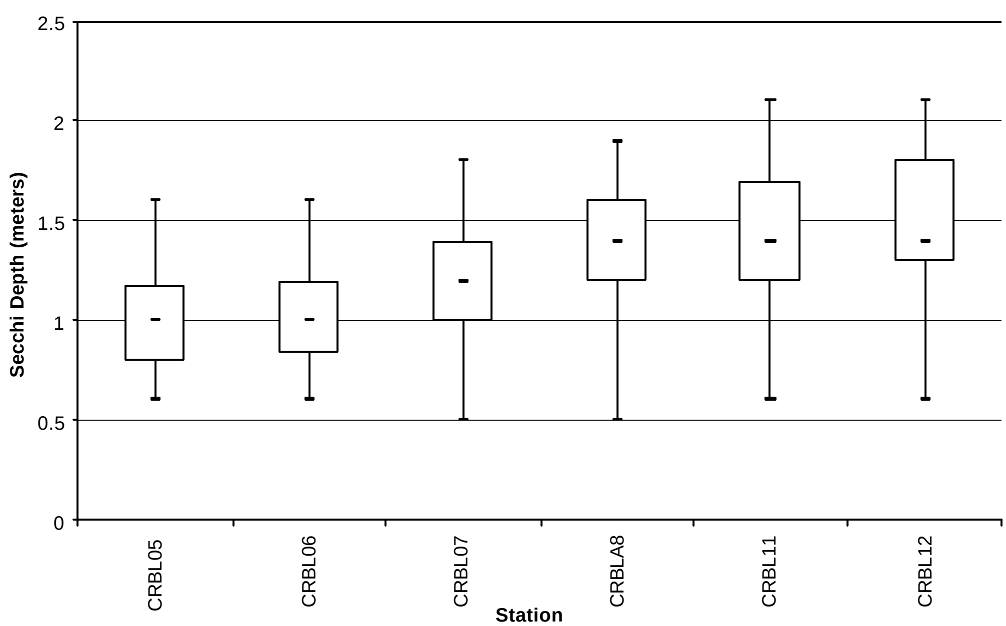

Figure 2: 1998 - 2007 Clarity Secchi Disk Measurement

1The mean summer flow was calculated from averaging the mean monthly flows from September –June

2007).

In 2007, during the June and July sampling events, all stations met the primary contact (swimming) use support criterion for Secchi disk depth of greater than or equal to 1.2 meters. During three of the five sampling events the greatest clarity was measured near the mouth of the River. Increased clarity near the mouth of the River has been a trend observed from the previous nine years of data collection (EPA 2007). The mouth of the River is associated with the wider and deeper part of the lower Charles. This deeper and wider section of the River allows for more settling to occur (with little resuspension), the process where solids in the water drop out of the water column and are deposited on the river bottom. This leads to less suspended particles and generally better water clarity. (See Figure 2 for a summary graph.)

Transmissivity and turbidity are other measurements of water clarity, but unlike Secchi disk transparency, these measurements are independent of external light. Transmissivity and turbidity measurements use their own light source to measure the absorption and scattering of light as it passes through the water column. High transmissivity or low turbidity correlates with high clarity. The lowest transmissivity and the highest turbidity were measured on September 5 and October 3 at each of the six downstream stations. On these dates the lowest Secchi disk and the highest chlorophyll a reading were also measured at these stations.

Bacteria

In 2007, all stations met the *E.coli* geometric mean swimming standard[1]. One sample at the station downstream of the BU Bridge (CRBL06) exceeded the individual *E.coli* sample criterion[1].

Bacteria concentrations were generally lower near the mouth of the River. With the exception of 2006, this trend can be observed downstream of the Mass Ave Bridge (Figure 3). In 2006, bacteria levels failed to drop off between Mass Ave and the Longfellow Bridge (CRBL07 & CRBLA8).

The section of the River from station CRBL07 - CRBL12 is the most heavily used for recreation. This area contains the MIT (Massachusetts Institute of Technology) Sailing Pavilion and Community Boating where much sailing, kayaking, windsurfing, and occasional contact with the water occurs.

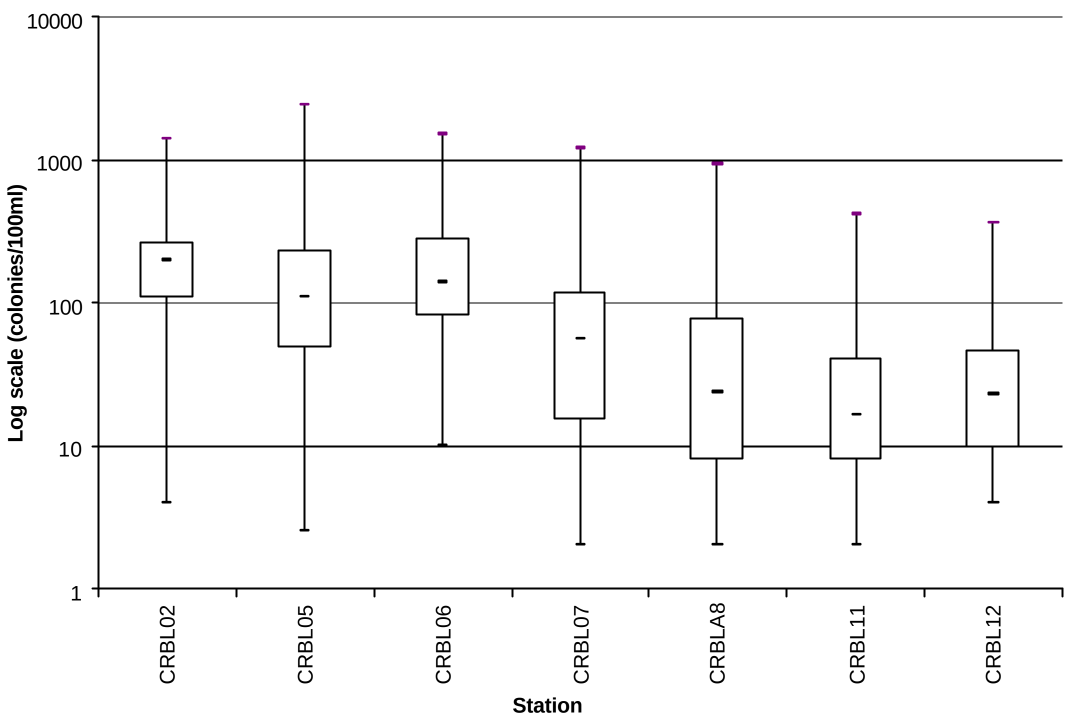

Figure 3: 1998 - 2007 Fecal Coliform Summary

[1] The Massachusetts Surface Water Quality Standards for Class B waters and the Massachusetts Minimum Standards for Bathing Beaches for *E. coli* using a single sample is ≤ 235 colonies /100ml for a geometric mean it is ≤ 126 colonies/100ml and is based on a geometric mean of the most recent five samples collected within the same bathing season or a six month period.

From 1998 to 2001 fecal coliform was the only bacteria indicator measured for the Core Monitoring Program. Figure 3 summarizes the fecal coliform bacteria data from 1998 to 2007.

Dissolved Oxygen (DO), pH and Temperature

Dissolved Oxygen (DO) is required for a healthy ecosystem as fish and other aquatic organisms require a minimal level of DO for survival and propagation. In 2007, there was one surface water DO measurement on September 5, at the station located above the Watertown Dam (CRBL02) that did not meet the DO criterion[1]. Although no below surface (depth) DO results were reported for 2007, depth profiles from previous years revealed that bottom conditions downstream of the BU Bridge were at times anoxic and failed to meet state DO criterion[1] (EPA 2006).

The pH of an aquatic system is an important parameter in evaluating toxicity, as high acidity (a low pH) can convert insoluble metal sulfides to soluble forms, which increases the bioavailability. A high pH can also cause ammonia toxicity (FISRWG 1998). In 2007, surface measurements exceeded the upper range of the Massachusetts pH criterion on three of the five sampling events, for a total of 13 exceedences or approximately 37% of all field measurements. The highest of these exceedences (9.4) occurred during the September 5 and October 3 sampling events at the stations downstream of the Mass Ave Bridge and off the Esplanade (CRBL07 and CRBLA8). These elevated values were most likely caused by the algae bloom that occurred on these date.

Temperature is a crucial factor in maintaining a natural ecosystem as changes in the temperature can alter the existing or natural aquatic community (EPA 1986). Temperature also governs many biochemical and physiological processes in cold-blooded aquatic organisms (such as fish and the organisms they feed on). Increased temperature decreases the oxygen solubility in water and this can exacerbate the impact of oxygen-demanding waste. In 2007, the surface measurements exceeded the temperature criterion[1] at two stations on August 2 (CRBL11 and CRBL12). All of the measurements from the five dry weather sampling events occurred in the morning when water temperatures have generally not reached their peak daily values.

Table 1: Massachusetts Class B Surface Water Quality Standards and Guidelines for Warm Waters

Parameter	MA Surface Water Quality Standards (314 CMR 4.00) and Guidelines
Dissolved oxygen	$\geq$ 5 mg/l
Temperature	$\leq$ 83^{o}F (28.3^{o}C) and change 3^{o}F (1.7^{o}C) in Lakes, change 5^{o}F (2.8^{o}C) in Rivers
pH	Between 6.5 and 8.3
E.coli (bacteria)*	Individual sample $\leq$235 colonies/100ml Geometric mean of $\leq$126 col/100ml (within bathing season or previous 6 months)
Secchi disk depth	Lakes $\geq$ 1.2 meters (for primary contact recreation use support)
Solids	Narrative and TSS $\leq$ 25.0 mg/l (for aquatic life use support)
Color and turbidity	Narrative Standard
Nutrients	Narrative “Control of Eutrophication” Site Specific

Note
* Also specified in MA DPH Minimum Standards for Bathing Beaches (105 CMR 445)

[1] The Massachusetts Surface Water Quality Standards for Class B water for DO is $\geq$ 5 mg/l, for pH is in the range of 6.5 through 8.3, and for temperature is $\leq$ 28.3^{o}C (83^{o}F).

Temperature loggers were used to monitoring the temperature during summer months in 2007 and 2008 to capture the warmest temperatures in the Lower Charles. Monitoring locations were selected based on previous temperature monitoring locations (EPA 2007). A map of the stations is presented in Figure 7. Continuous temperature monitoring at each station was conducted by deploying temperature loggers which recorded temperature every half hour. Temperature loggers were deployed at depths of 0.3, 1.0 and 3.0 meters. The monitoring timeframe was chosen to measure the warmest summer river temperatures, which generally coincide with prolonged warm air temperature and lower river flows. In 2007, temperature loggers were deployed from July 19 to October 9 and in 2008, from June 26 to October 8. Although, the attempt was to measure the warmest water temperatures, there may have been some elevated temperatures that occurred prior to the logger deployments. In particular, during the time period of June 25 – 29, 2007 elevated ambient air temperatures occurred in Boston.

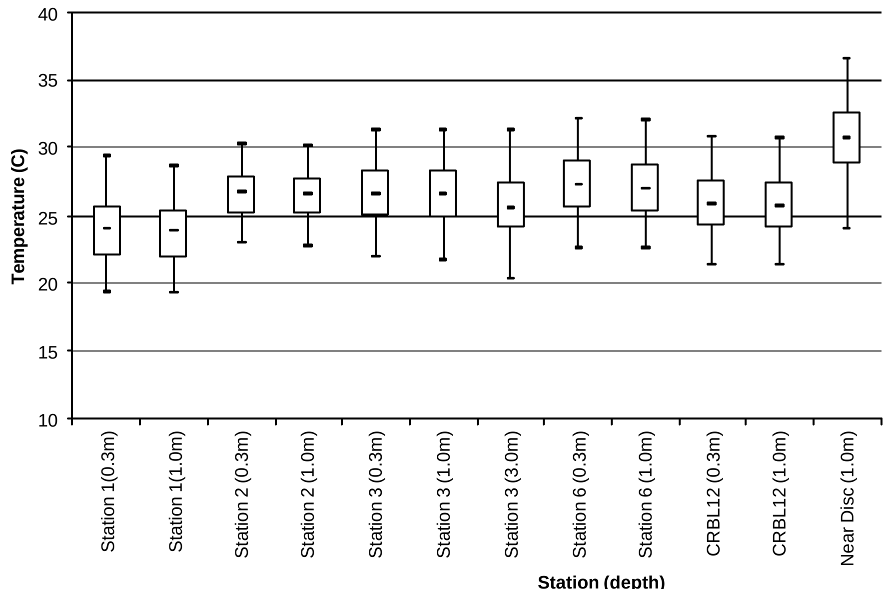

Figure 4: 2007 Temperature Logger Monitoring

In 2007, temperature loggers at stations 1, station 2 and station 3 were suspended from a floating buoy. Temperature loggers at station 6, CRBL12, and Near Discharge were mounted on fixed locations and were not floating. The highest temperature (36.5 ^{o}C) was recorded near the Mirant Kendall power plant thermal discharge (Identified as "Near Discharge") on August 4 at 13:30 (Figure 4, Table A-2). This station recorded the highest temperature 97% of the time. At this station, one logger was deployed one meter below the waters surface in the discharge plume. The second highest temperature (32.1 ^{o}C) was measured at Station 6 (0.3 meter depth) on August 3 at 16:00. On this day, nine of the twelve temperature loggers recorded their highest temperature for the deployment period (7/19/07 to 10/09/07). In 2007, all stations recorded temperature values above Massachusetts Surface Water Quality Standards for Class B Waters (28.3 ^{o}C)

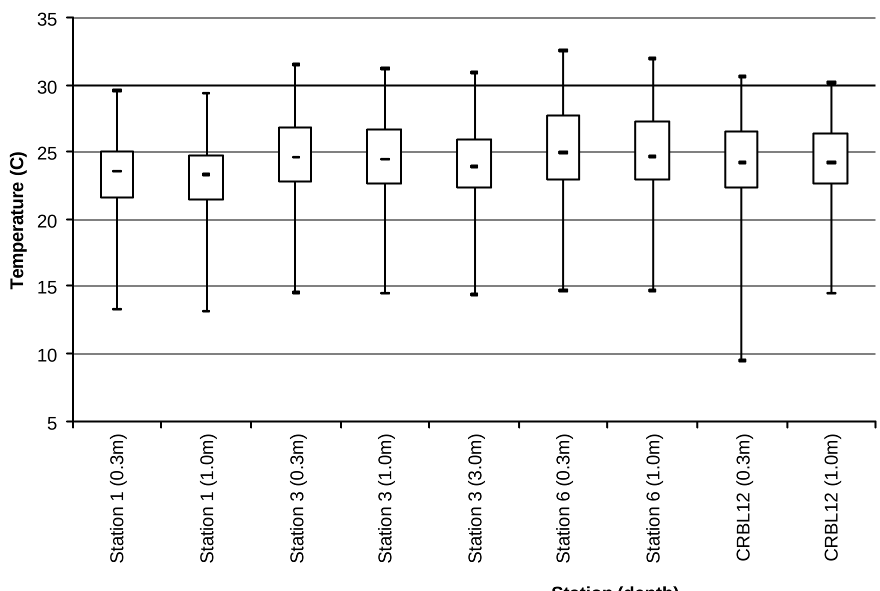

Figure 5: 2008 Temperature Logger Monitoring

In 2008, temperature loggers at stations 1, station 3, and station 6 were suspended from a floating buoy. Temperature loggers at CRBL12 were mounted on a fixed location and were not floating. A location was not established near the Mirant Kendall power plant thermal discharge because a boom was blocking access at the time of deployment. In 2008, the highest temperature (32.5 ^{o}C) was measured at station 6 (0.3 meter depth) on

July 19 at 16:30. On this day, four of the nine temperature loggers recorded their highest temperature for the deployment period (6/26/08-10/08/08). In 2008, all stations recorded temperature values above Massachusetts Surface Water Quality Standards for Class B Waters (28.3 ^{o}C)

Phosphorus

Elevated levels of nutrients in the water can lead to excessive growth of algae and other instream plants. This can cause nuisance conditions, reduced oxygen in the water during times of respiration, and algae blooms that can be harmful to animals or people in contact with water. Phosphorus is the most significant nutrient in this system. Elevated phosphorus concentrations at many of the sampling stations indicated highly eutrophic conditions.

In 2007, at most of the sites, the lowest total phosphorus concentrations were recorded during the August sampling event and the highest concentrations were recorded during the October sampling event. All total phosphorus sample results exceeded the EPA recommended Ambient Water Quality Criterion (AWQC) for Rivers and Streams[1] and the EPA recommended criterion for lakes and reservoirs[2] (EPA, 2001).

Data collected from 1998 - 2005 showed declining total phosphorus concentrations. A longitudinal analysis conducted on the data from 1998-2005 using the dry weather yearly means shows there to be a significant rate of reduction (Rate ~ -.0081/year) (Heltshe). This rate of reduction however, is not evident in the in data collected from 2005-2007.

In 2002, additional samples were collected at selected stations from various depths to support the development of a water quality model for the Total Maximum Daily Load (TMDL). The pycnocline is the interface between water of different densities. It is primarily caused in the Charles River by the salt water wedge that occurs on the bottom of the river near the mouth. The results from this sampling showed elevated concentrations of total phosphorus, ortho-phosphorous, total kjeldahl nitrogen, and ammonia below the pycnocline. The concentrations measured below the pycnocline were significantly higher than concentrations measured above the pycnocline and at the surface (EPA, 2003).

Data Usability

Quality control criteria were established to insure data quality. For the Core Monitoring Program, criteria were specified for holding times, sample preservation, and precision and accuracy goals. The quality control requirements for this project were documented in the Project Work/QA Plan – Clean Charles River Clean 2005 – 2010 Water Quality Study dated June 7, 2005. Quality control criteria for the continuous temperature monitoring were documented in an addendum to the Project Work/QA Plan. The Charles River Temperature Monitoring Plan addendum dated June 29, 2007 documents the temperature logger quality control criteria.

Laboratory results that did not meet laboratory quality control parameters, or concentrations that were less than the associated reporting limit were reported as estimated values. All estimated data were identified with a swung dash (~) preceding the value. The holding times specified in the Project Work/QA Plan were met for all samples. All data that did not meet field or collection quality control parameters are described below.

Instruments used in the field to measure temperature, DO, pH, specific conductance, salinity, turbidity, and transmissivity were calibrated prior to sampling and verified after use. Field instrument monitoring data that did not meet all the established quality control criteria were not presented in this report and are summarized below. Duplicate field measurements (temperature, DO, pH, specific conductance, salinity, turbidity, and transmissivity) were collected during each of the five sampling events. The Project Work/QA Plan did not

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[1] The EPA recommended total phosphorus criterion for rivers and stream in ecoregion XIV subecoregion 59 is 0.0237 mg/L.

[2] The EPA recommended total phosphorus criterion for lakes and reservoirs in ecoregion XIV subecoregion 59 is 0.008 mg/L.

specify Relative Percent Difference (RPD) goals between the regular and duplicate samples for any of these measurements. All calculated RPDs between the regular and duplicate field samples were less than 30%. None of the field measurement data were qualified based on duplicate sampling results.

Field duplicate samples were collected during each of the five main sampling events to evaluate sampling and analytical precision. During two of the sampling events fecal coliform and *E. coli* bacteria did not meet the field duplicate samples precision quality control goals established in the Project Work/QA Plan. Since the regular and duplicate sample data from these two sampling events were within the same magnitude of each other, and because large variations of bacteria often exist in the environment which can lead to these differences, the use of these data was not limited in this report. The duplicate sample collected on July 17, for orthophosphate did not meet the field duplicate sample precision quality control goals established in the Project Work/QA Plan. Since this criterion was not met, the orthophosphate data collected during this event was reported as estimated.

A trip blank was used to evaluate any contamination caused by: the sample container, sample preservation, sampling method, transportation to the laboratory, and/or laboratory processing. The trip blank collected on June 12, 2007 for chemistry analysis showed no contamination and all values were reported as "ND" (non detect). Therefore, none of the presented data were limited based on the trip blank results.

Temperature logger quality control criteria were met for each of the loggers used during 2007 and 2008 and none of the presented data were limited for this project. In 2007 and 2008, prior to the temperature logger deployment all the temperature loggers were checked at two (bracketing) temperatures against an NIST traceable thermometer. All loggers met the specified quality control criteria (less than $\pm$ 0.2^{o}C). The loggers were also checked pre-deployment and post-deployment against a second instrument and these values met the adjacent instrument check criterion of (less than $\pm$ 0.5^{o}C). In 2007 and 2008, one location was monitored in duplicate. The duplicate measurements met the specified criterion of (less than $\pm$ 0.5^{o}C).

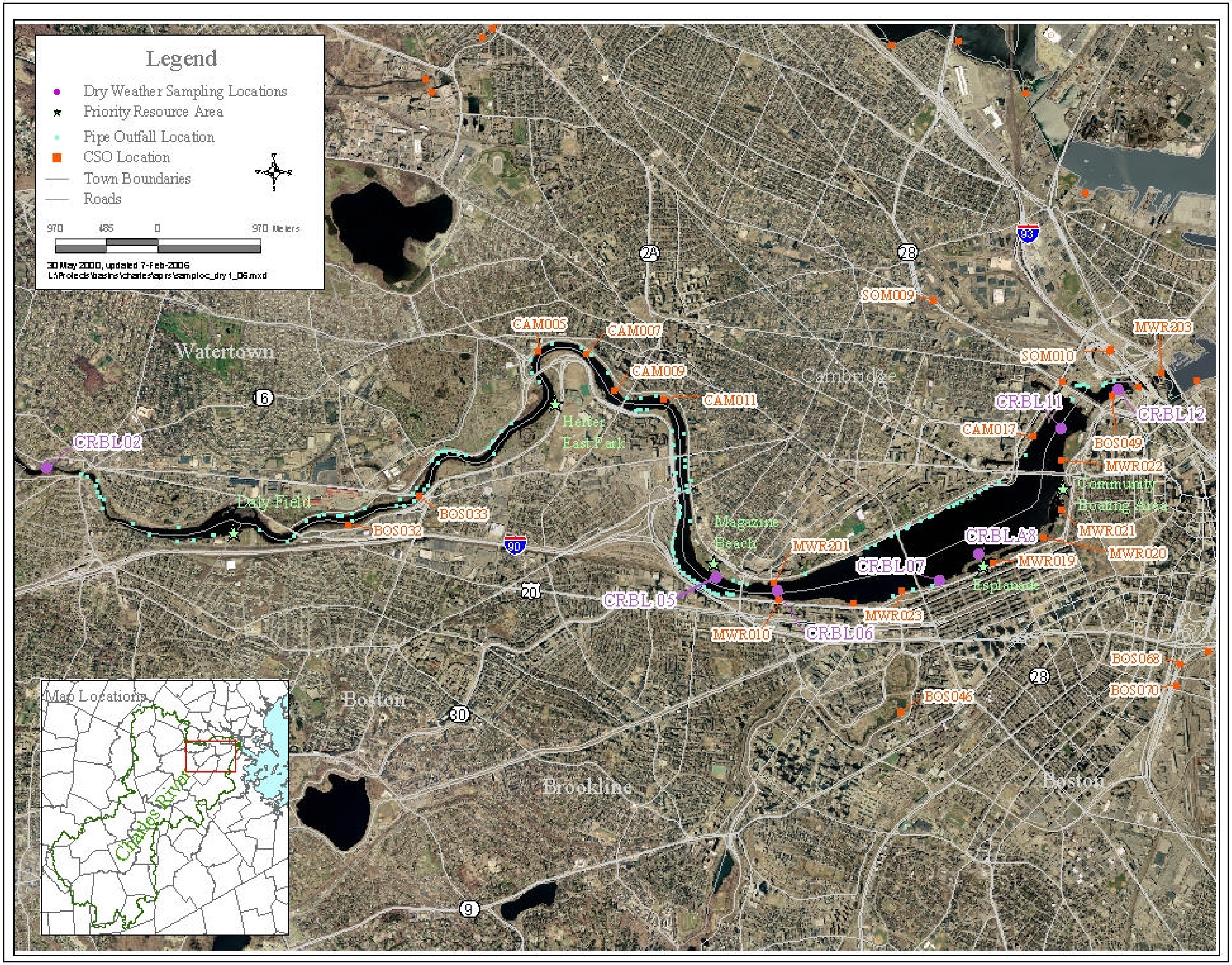

Figure 6: EPA Charles River Dry Weather Trend Station Locations

Figure 7: 2007 and 2008 Temperature Logging Locations in the Charles River

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Table A-1 EPA Charles River Annual Monitoring Data - 2007

Station	Time	Temp (Deg C)	Sp Cond. (uS/cm)	Salinity (ppth)	DO (%)	DO (mg/l)	pH	Turbidity (NTU)	Sonde (in-situ) Chlorophyll (ug/L)	Secchi (meters)	Transmissivity (%)	Fecal coliform (cfu/100ml)	E.coli (cfu/100ml)	Chlorophyll a (ug/L)	Orthophosphate as P (ug/L)	Total Phosphorus (ug/L)
Results from 6/12/07 Dry Weather Sampling																
CRBL02	11:00 AM	22.0	383	0.18	90.9	8.0	7.3	2.1	NA	N/A	63	183	163	4	18.0	71
CRBL05	9:40 AM	21.6	399	0.19	78.7	6.9	7.1	2.4	NA	1.4	56	160	132	7	13.0	72
CRBL06	9:20 AM	21.5	403	0.19	77.2	6.8	7.1	2.4	NA	1.5	58	226	158	7	15.0	66
CRBL07	9:10 AM	21.9	422	0.2	81.5	7.1	7.2	3.6	NA	1.3	52	136	120	14	9.3	73
CRBLA8	9:00 AM	21.7	443	0.21	83.6	7.4	7.3	2.2	NA	1.6	58	96	88	13	8.1	62
CRBL11	8:40 AM	22.8	489	0.24	78.7	6.8	7.3	1.6	NA	1.7	60	58	42	10	11.0	65
CRBL12	8:20 AM	22.1	674	0.33	75.4	6.6	7.3	1.5	NA	1.7	62	58	53	8	11.0	59
CRBL12 (dup)	8:20 AM	22.0	665	0.32	75.5	6.6	7.3	1.5	NA	1.7	62	72	55	9	12.0	65
CRBL00 (blank)	5:50 AM	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND (4)	ND (4)	ND(2)	ND(5.0)	ND(5.0)
Results from 7/17/07 Dry Weather Sampling																
CRBL02	11:45 AM	25.4	518	0.25	69.7	5.7	7.1	0.4	3.5	NA	83	39	36	ND(2)	~6.1	51
CRBL05	10:20 AM	26.5	753	0.37	118.6	9.5	7.9	2.8	26.8	1.3	54	11	11	33	~ND(5.0)	54
CRBL06	10:10 AM	26.4	913	0.45	117.3	9.4	8.0	2.9	17.2	1.5	60	28	28	28	~ND(5.0)	62
CRBL07	9:50 AM	26.2	1442	0.72	118.3	9.5	8.4	4.3	8.7	1.6	66	ND (4)	ND (4)	44	~ND(5.0)	48
CRBLA8	9:35 AM	26.8	1729	0.87	121.7	9.7	8.6	4.8	8.9	1.8	70	ND (4)	ND (4)	27	~ND(5.0)	46
CRBL11	9:15 AM	28.1	1888	0.95	114.1	8.9	8.3	4.4	7.2	2.0	71	22	22	19	~ND(5.0)	35
CRBL12	8:50 AM	27.5	2092	1.06	111.7	8.8	8.2	3.8	6.8	2.0	71	42	42	30	~ND(5.0)	36
CRBL02 (dup)	11:45 AM	25.4	518	0.25	69.7	5.7	7.1	0.3	3	1.9	83	22	22	ND(2)	~17	54
Results from 8/2/07 Dry Weather Sampling																
CRBL02	11:30 AM	26.5	533	0.26	93.4	7.5	7.3	0.7	2.5	NA	85	96	88	ND(2)	10.0	44
CRBL05	9:45 AM	27.1	786	0.38	101.6	8.1	7.3	3.0	10.9	1.3	52	47	33	11	ND(5.0)	42
CRBL06	9:05 AM	27.1	918	0.45	100.8	8.0	7.3	2.8	13.5	1.3	53	140	132	15	ND(5.0)	40
CRBL07	8:55 AM	27.3	1431	0.71	NA	NA	8.3	4.9	13.9	1.2	55	58	42	17	ND(5.0)	42
CRBLA8	8:45 AM	27.2	1435	0.72	NA	NA	8.3	4.8	12.6	1.3	56	25	6	11	ND(5.0)	36
CRBL11	8:30 AM	29.3	2095	1.06	NA	NA	8.3	4.1	7.6	1.6	65	17	11	21	ND(5.0)	30
CRBL12	8:15 AM	28.5	2295	1.17	NA	NA	8.2	4.0	7.1	1.7	68	28	14	19	ND(5.0)	29
CRBL 06 (dup)	9:05 AM	NA	NA	NA	NA	NA	NA	NA	NA	1.3	53	144	128	18	ND(5.0)	36
Results from 9/5/07 Dry Weather Sampling																
CRBL02	10:40 AM	21.3	656	0.32	47.7	4.2	7.0	0.5	2.7	NA	89	22	9	2	37.0	73
CRBL05	9:20 AM	22.6	1981	1.01	113.6	9.8	8.6	8.6	10.6	0.7	28	53	20	67	ND(5)	78
CRBL06	9:10 AM	22.9	2657	1.37	125.2	10.7	9.1	8.1	11.1	0.7	26	100	69	89	ND(5)	75
CRBL07	8:55 AM	23.0	3101	1.62	133.1	11.3	9.3	9.2	11.1	0.5	22	50	43	106	ND(5)	85
CRBLA8	8:40 AM	23.2	3277	1.72	141.8	12.0	9.4	9.4	9.7	0.5	20	3	3	102	ND(5)	76
CRBL11	8:25 AM	26.4	4029	2.13	134.8	10.7	9.3	8.4	8.9	0.6	22	9	6	103	ND(5)	64
CRBL12	8:10 AM	24.9	4094	2.17	128.5	10.5	9.3	8.2	9.6	0.6	25	4	4	92	ND(5)	54
CRBL12 (Dup)	8:10 AM	24.8	4094	2.17	128.8	10.5	9.3	8.3	8.9	0.6	25	19	15	97	ND(5)	56
Results from 10/03/07 Dry Weather Sampling																
CRBL02	11:40 AM	18.9	649	0.32	67.8	6.3	7.2	0.6	2.0	NA	91	80	80	ND(2)	10.0	28
CRBL05	10:15 AM	19.8	2565	1.33	87.8	8.0	7.8	4.6	18.9	1	39	124	112	37	ND(5)	79
CRBL06	9:55 AM	19.8	2752	1.43	100	9.0	8.4	4.6	14.9	1	42	649	622	44	ND(5)	74
CRBL07	9:40 AM	21.6	3970	2.11	140.5	12.2	9.4	9.7	8.1	0.7	32	6	ND(4)	82	ND(5)	88
CRBLA8	9:25 AM	21.9	4030	2.14	134.7	11.7	9.4	9.5	7.3	0.7	33	ND(4)	ND(4)	84	5.3	86
CRBL11	9:10 AM	23.9	4238	2.25	127.5	10.6	9.3	9.2	7.5	0.8	34	4	4	79	ND(5)	85
CRBL12	8:50 AM	23.0	4283	2.28	128.9	10.9	9.3	9.2	7.3	0.8	35	4	4	83	ND(5)	85
CRBL 06(Dup)	9:55 AM	19.9	2791	1.45	100.3	9.1	8.5	4.9	14.4	1	42	370	330	33	ND(5)	70

Note:

ND = not detected above the associated detection limit

NA = not available

~ = estimated data

Table A-2 EPA Charles River Temperature Monitoring Data Summary 2007- 2008

Data collected in 2007						
Location	Station 1	Station 2	Station 3	Station 6	CRBL12	Near Discharge
Monitoring Period	7/19/07 - 10/9/07	7/1907 - 9/13/07	7/19/07 - 10/9/07	7/19/07 - 10/9/07	7/19/07 - 10/9/07	7/19/07 - 10/9/07
Depth (m)	0.3	0.3	0.3	0.3	0.3	1
Maximum Temp (°C)	29.4	30.2	31.3	32.1	30.7	36.5
Max Temp date and time	7/31/2007 15:30	8/3/2007 17:00	8/3/2007 18:00	8/3/2007 16:00	8/3/2007 20:30	8/4/2007 13:30
Minimum Temp (°C)	19.3	22.9	21.8	22.6	21.3	24.0
Median Temp (°C)	24.0	26.7	26.6	27.2	25.8	30.7
Mean Temp (°C)	23.9	26.5	26.6	27.3	25.9	30.6
Depth (m)	1	1	1	1	1	
Maximum Temp (°C)	28.6	30.1	31.3	32.0	30.7	
Max Temp date and time	8/1/2007 17:30	8/3/2007 18:30	8/3/2007 18:00	8/3/2007 20:30	8/3/2007 20:30	
Minimum Temp (°C)	19.2	22.7	21.7	22.5	21.3	
Median Temp (°C)	23.8	26.5	26.5	27.0	25.7	
Mean Temp (°C)	23.7	26.4	26.6	27.0	25.8	
Depth (m)			3			
Maximum Temp (°C)			31.3			
Max Temp date and time			8/3/2007 18:30			
Minimum Temp (°C)			20.3			
Median Temp (°C)			25.6			
Mean Temp (°C)			25.7			
Data collected in 2008						
Location	Station 1	Station 3		Station 6	CRBL12	
Monitoring Period	6/26/08 - 10/8/08	6/26/08 - 10/8/08		6/26/08 - 10/8/08	6/26/08 - 10/8/08	
Depth (m)	0.3	0.3		0.3	0.3	
Maximum Temp (°C)	29.6	31.5		32.5	30.5	
Max Temp date and time	7/17/2008 17:00	7/22/2008 15:30		7/19/2008 16:30	7/20/2008 14:00	
Minimum Temp (°C)	13.2	14.5		14.7	9.4	
Median Temp (°C)	23.5	24.5		24.8	24.2	
Mean Temp (°C)	23.0	24.2		24.7	23.8	
Depth (m)	1	1		1	1	
Maximum Temp (°C)	29.3	31.2		31.9	30.2	
Max Temp date and time	7/17/2008 18:00	7/19/2008 23:00		7/19/2008 16:30	7/20/2008 10:00	
Minimum Temp (°C)	13.1	14.4		14.7	14.4	
Median Temp (°C)	23.3	24.4		24.6	24.2	
Mean Temp (°C)	22.8	24.1		24.4	23.9	
Depth (m)		3				
Maximum Temp (°C)		30.8				
Max Temp date and time		7/19/2008 16:00				
Minimum Temp (°C)		14.3				
Median Temp (°C)		23.8				
Mean Temp (°C)		23.6				