Clean Charles 2005 Water Quality Report
2002 Core Monitoring Program
November 2003

Prepared By

US EPA
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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

TABLE

FIGURES

APPENDIX

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1.0 EXECUTIVE SUMMARY

Purpose and Scope

In 1995, the U.S. Environmental Protection Agency - New England (EPA) established the Clean Charles 2005 Initiative to restore the Charles River Basin to a swimmable and fishable condition by Earth Day in the year 2005. The ongoing initiative incorporates a comprehensive approach for improving water quality through: Combined Sewer Overflow (CSO) controls, illicit sanitary connection removals, stormwater management, public outreach, education, monitoring, enforcement and technical assistance.

In 1998, EPA's Office of Environmental Measurement and Evaluation (OEME) initiated the Clean Charles 2005 Core Monitoring Program that will continue until 2005. The purpose of the program is to track water quality improvements in the Charles River Basin (defined as the section between the Watertown Dam and the New Charles River Dam) and to identify where further pollution reductions or remediation actions are necessary to meet the Clean Charles 2005 Initiative goals. The program is designed to sample during the summer months that coincide with peak recreational uses.

The program monitors twelve "Core" stations. Ten stations are located in the Basin, one station is located on the upstream side of the Watertown Dam and another is located immediately downstream of the South Natick Dam (to establish upstream boundary conditions). Five of the ten sampling stations are located in priority resource areas, which are identified as potential wading and swimming locations (see Figure 1:). Six of the twelve stations are monitored during wet weather conditions. The following parameters are measured for the Core Monitoring Program: dissolved oxygen, temperature, pH, specific conductance, turbidity, clarity, transmissivity, chlorophyll a, total organic carbon, total suspended solids, apparent and true color, nutrients, bacteria, and dissolved metals.

In the year 2002, modifications were made to the Program to support the development of a three-dimensional hydro-dynamic linked water quality model. The model will be used for the development of a eutrophication Total Maximum Daily Load (TMDL) to address low dissolved oxygen, numerous aesthetic impairments, algae blooms and pH violations in the Basin. Sampling stations, sampling parameters, and additional sampling dates were added to provide data for the model development. Seven additional (TMDL) stations were added between the BU Bridge and the Museum of Science (Figure 1). Total Kjeldahl Nitrogen (TKN) and algal analysis were added to the parameter list. Three additional (TMDL) sampling dates were added between June and September. Depth samples were collected at some stations to determine pollutant concentrations above and below the pycnocline (the interface between water of different densities). In addition to these modifications, the Core Monitoring station inside the pond at the esplanade (CRBL08) was relocated to the main stem of the Charles and designated as CRBLA8. This station was repositioned to evaluate an alternative priority resource area. The previous station measured consistently poor water quality and did not meet the initiatives goals.

In 2002, additional bacteria sampling was conducted during the Fourth of July and at selected "Hot Spot" locations. This work was conducted with the assistance of Roger Frymire. This Cambridge resident volunteer, conducted all the sampling for these two projects. These data were summarized separately and are not included in this summary.

Conclusions of the 2002 Core Monitoring Program

The conclusions below summarize the 2002 Core Monitoring Program data and use these data to evaluate the water quality conditions from 1998 to 2002. **At this time, no short-term trends were observed from the past five years of data.** A more comprehensive statistical analysis will be conducted in future reports, as more data are available.

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. The weather conditions and river flow affect the transport of pollutants in the watershed. In 2002, from the middle of June through the first week in September, the flows at the Waltham gaging station were generally less than the flows recorded during 1998, 2000, and 2001. During this same time period, with the exception of some selected periods, the flows were greater than the low flows of 1999. The flows during 1998 and 1999 (from the middle of June through the first week in September) were generally the high and low flow years, respectively. In 1998, the summer conditions were generally wetter with correspondingly higher flows; in 1999, summer conditions were drier with correspondingly lower flows.

Six dry weather and three wet weather events were sampled from June through October 2002. Comparing these data to the past four years' data revealed no definitive trends. However, the following conclusions can be made. The five years of data show a pattern of the best water quality occurring near the mouth of the River (Mass Ave. Bridge to the New Charles River Dam). This part of the river met the swimming standards more often than any other part of the Basin.

The greatest clarity was recorded during the lower flow years of 1999 and 2002 at the stations near the mouth of the Basin. During 2002, elevated nutrient concentrations were measured in the water below the pycnocline.

Clarity, Color and Transmissivity

Water clarity was directly measured in the field using a Secchi disk. Mean Secchi disk readings downstream of Magazine Beach were greater than the means from the last two years and similar to the means from 1999. The greatest clarity was recorded between the Esplanade and the New Charles River Dam on July 9 and August 20. From Daly field to the BU Bridge, the mean Secchi disk value was 1.0 meter while the stations monitored between the Esplanade to the New Charles River Dam recorded a mean Secchi disk value of 1.5 meters. The Massachusetts Department of Environmental Protections primary contact (swimming) use support criterion specifies a Secchi disk reading of greater than or equal to 1.2 meters.

True and apparent color were measured during the Core Monitoring dry and wet weather sampling events. These parameters were not measured during the TMDL sampling days of June 13, July 30, and August 20. The highest true and apparent color values were measured during July 9. Mean color values were generally lower than mean values measured during the previous years. As identified in a previous report (EPA 2002), it appears that part of the color was associated with particulate matter. This implies that controlling algae growth and preventing particulates from being discharged could enhance the clarity.

Transmissivity, a measurement of water clarity, was measured at selected stations. The greatest transmissivity was recorded near the mouth of the Basin. The mean values from the two stations where transmissivity was measured in 2001 and 2002, showed an average increase in 2002 of 10%. The transmissivity measurements correlated well with Secchi disk measurements.

Bacteria

During dry weather, approximately 31% of the core monitoring fecal coliform samples exceeded the swimming criterion[1] of less than 200 colonies/100ml, (compared to 35%, 23%, 8%, and 17% in 2001, 2000, 1999and 1998, respectively). During wet weather, approximately 46% of the core monitoring samples exceeded the criterion[1] (compared to 44%, 63%, and 50% in 2001, 2000, and 1999, respectively).

Fecal coliform concentrations were lower near the mouth of the Basin (Mass Ave. Bridge to the New Charles River Dam; CRBL07 - CRBL12). This is a consistent pattern, which has occurred in the previous four years of data. The dry weather Core Monitoring samples collected at stations CRBL07 - CRBL12 exceeded the swimming criterion[1] 9% of the time. Upstream at stations CRBL02 – CRBL06 the criterion[1] was exceeded 53% of the time. The area from station CRBL07- CRBL12 is the most heavily recreated parts of the River. The area contains the MIT Sailing

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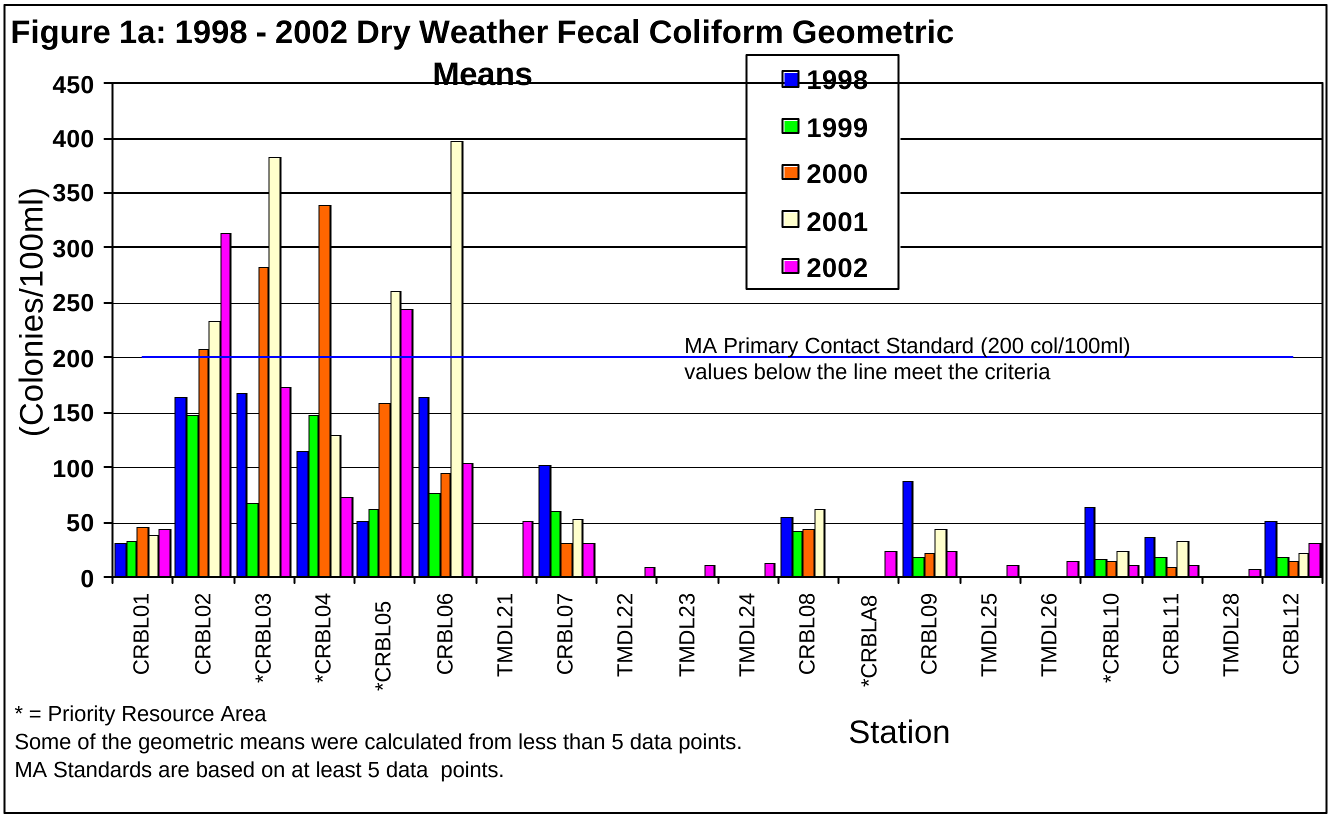
[1]The Massachusetts fecal coliform swimming criterion of less than 200 colonies/100ml is actually based on a geometric mean of five samples or more. For this report, individual concentrations were compared to this criterion.

Pavilion and Community Boating where much sailing, kayaking, windsurfing, and occasional contact with the water occurs.



The 2002 dry weather fecal coliform geometric means[1] were similar to those collected during previous years. At station CRBL02, the geometric means[1] have increased over the past three years (Figure 1a).

E. coli bacteria was sampled during all sampling events. As observed with the fecal coliform measurements, the E. coli concentrations were lower near the mouth of the Basin (Mass Ave. Bridge to the New Charles River Dam; CRBL07 - CRBL12). For these Core Monitoring stations, all calculated geometric means met the Department of Public Health (DPH) Bathing Beach criterion[2] and one sample collected at station CRBL12 (or 2% of the samples) was greater than the DPH bathing beach criterion for individual samples[2]. At stations CRBL02 – CRBL06 the individual sample criterion was exceeded 30% of the time and the geometric mean criterion[2] was exceeded at two of the five stations (Figure 2a).

Fourteen or approximately 17% of the dry weather core monitoring samples exceeded the E. coli bathing beach criterion for individual samples, compared to 19% in 2001 and 35% in 1998 (Figure 2a). The fecal coliform and E. coli bacteria concentration from the six TMDL station between the Mass Ave. Bridge and the Museum of Science showed similar counts. For these stations the fecal coliform geometric means ranged from 7 to 10 and the E.coli geometric means ranged from 6 to 12.

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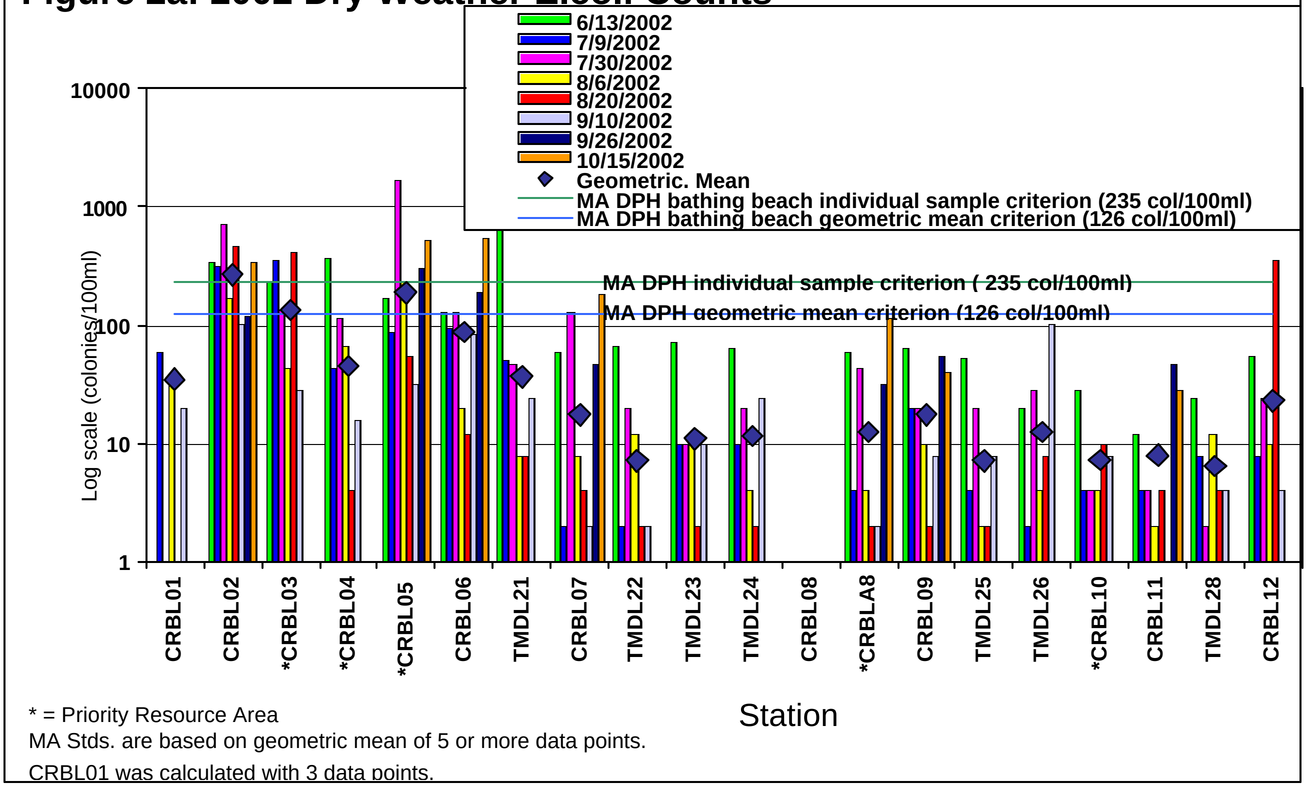
[1]Some of the dry weather geometric means were calculated from less than five data points; the actual criterion is based on a geometric mean of five samples or more.

[2] The Massachusetts DPH E. coli Bathing Beach criterion for as single sample is less than or equal to 235 colonies/100ml. The geometric mean criterion is less than or equal to 126 colonies/100ml and is based on a geometric mean of the most recent five samples within the same bathing season.

Figure 2a: 2002 Dry Weather E.coli Counts



Dissolved Oxygen (DO), pH and Temperature

Dissolved Oxygen (DO) is required for a healthy ecosystem. Fish and other aquatic organisms require DO for survival (EPA 1998). Massachusetts has established DO criterion[1] for class B waters. Two DO violations or approximately 1% of all the field measurements (compared to 0%, 0%, 3%, and 0% in 2001, 2000, 1999, and 1998, respectively) collected during the thirteen sampling events did not meet the criterion.

In 2002, anoxia was measured at the bottom during the four sampling events in which depth profiles where conducted. All DO measurements below 4.5 meters were less than the Massachusetts DO criterion[1]. These measurements were conducted at four stations downstream of the BU Bridge.

The pH of an aquatic system is an important parameter in evaluating toxicity. High acidity (a low pH) can convert insoluble metal sulfides to soluble forms, which increases the bioavailability. A high pH can cause ammonia toxicity (EPA 1998). The data from all the dry and wet weather core monitoring surface measurements showed pH violated the criterion[1] twenty times or approximately 22% of all field measurements (compared to18%, 20%, 8%, and 4% in 2001, 2000, 1999, and 1998, respectively). All surface violations were greater than 8.3 and occurred at or downstream of Herter East Park. Depth samples often had a lower pH than the surface measurements and were greater than or equal to 6.5.

Temperature is a crucial factor in maintaining a natural system. 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. Increased temperature decreases the oxygen solubility in water resulting in increased stress from oxygen-demanding waste (EPA 1998). The highest surface water temperature was recorded on August 20, between the Longfellow Bridge and the Museum of Science (CRBL11) at 29.2 °C. (84.6°F). There

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[1] The Massachusetts water quality criteria for Class B water for DO is ≥ 5 mg/l and ≥60% saturation, for pH is in the range of 6.5 through 8.3, and for temperature is ≤ 28.3°C (83°F) .

were ten recorded temperature measurements above the state criterion[1]. These measurements occurred on August 6 and August 20, in the area of Longfellow Bridge and the Museum of Science.

Nutrients

Phosphorus was the most significant nutrient in this system. Elevated phosphorus concentrations at many of the sampling stations indicated highly eutrophic conditions. Each station recorded the highest concentration during the June or July sampling events. The dry weather means from eight stations were lower than any previous years' means. The additional TMDL sampling that was conducted during 2002 involved collecting samples above and below the pycnocline at three stations. These data revealed elevated concentrations of total phosphorus, ortho-phosphorous, total kjeldahl nitrogen, and ammonia below the pycnocline. The total phosphorus median concentration above the pycnocline was 58 ug/l and the median below the pycnocline was 498 ug/l. The highest concentrations for ammonia and nitrate from the surface samples were recorded during the June and July sampling events.

Metals

No measured metals exceeded the acute Ambient Water Quality Criteria (AWQC). Lead and selenium were the only metals that exceeded the chronic AWQC. The lead exceedances occurred only during the July 9 sampling event at the ten most downstream stations. These ten exceedances represent 21% of all dry weather metals samples (compared to 33%, 27%, and 8% in 2001, 2000, and 1999, respectively). No wet weather lead exceedances were measured (compared to 0%, 25%, and 72% in 2001, 2000, and 1999, respectively). Selenium exceeded the chronic AWQC fifteen times during dry weather and fifteen times during wet weather. All exceedances occurred down stream of the BU Bridge. In past years, copper had exceeded the chronic AWQC but not selenium. There were no identified reasons for these yearly changes. The other measured priority pollutants metals (arsenic, cadmium, chromium, copper, mercury, nickel, silver, and zinc) did not exceed the AWQC.

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[1] The Massachusetts water quality criteria for Class B water for DO is $\geq$ 5 mg/l and $\geq$60% saturation, for pH is in the range of 6.5 through 8.3, and for temperature is $\leq$ 28.3^{o}C (83^{o}F) .

2.0 BACKGROUND

The Charles River watershed is located in eastern Massachusetts and drains 311 square miles from a total of 24 cities and towns. Designated as a Massachusetts class B water, the Charles is the longest river in the state and meanders 80 miles from its headwaters at Echo Lake in Hopkinton to its outlet in Boston Harbor. From Echo Lake to the Watertown Dam, the River flows over many dams and drops approximately 340 feet. From the Watertown Dam to the New Charles River Dam in Boston, the River is primarily flat water (EPA 1997). This section, referred to as "the Basin", is the most urbanized part of the River and is used extensively by rowers, sailors and anglers. A Metropolitan District Commission (MDC) park encompasses the banks of the River and creates excellent outdoor recreational opportunities with its open space and bicycle paths.

The lower basin (defined as the section between the Boston University Bridge and the New Charles River Dam), once a tidal estuary, is now a large impoundment. During low flow conditions of the summer, the basin consists of fresh water overlying a wedge of saltwater. Sea walls define a major portion of the banks and shoreline of this section.

The Charles River shows the effects of pollution and physical alteration that has occurred over the past century. The water quality in the Basin is influenced by point sources, storm water runoff and CSO's. An EPA survey identified over 100 outfall pipes in the Basin (EPA 1996).

3.0 INTRODUCTION

In 1995, EPA established the Clean Charles 2005 Initiative, with a taskforce and numerous subcommittees, to restore the Charles River to a swimmable and fishable condition by Earth Day in the year 2005. The Initiative's strategy was developed to provide a comprehensive approach for improving water quality through CSO controls, removal of illicit sanitary connections, stormwater management planning and implementation, public outreach, education, monitoring, enforcement, technical assistance, and scientific studies.

In 1998, EPA's Office of Environmental Measurement and Evaluation (OEME) implemented a water quality monitoring program (Core Monitoring Program) in the Charles River that will continue until at least 2005. EPA and its partners on the Taskforce's water quality subcommittee developed a study design to track improvements in the Charles River Basin and to identify where further pollution reductions or remediation actions were necessary to meet the swimmable and fishable goals. Members of the subcommittee included EPA-New England, U.S. Geological Survey (USGS), U.S. Army Corps of Engineers - New England District (ACE), Massachusetts Executive Office of Environmental Affairs (EOEA), Massachusetts Department of Environmental Protection (DEP), Massachusetts Department of Environmental Management (DEM), Massachusetts Water Resources Authority (MWRA), Boston Water and Sewer Commission (BWS), Charles River Watershed Association (CRWA) and the MDC. In addition to the Core Monitoring Program, EPA and its partners continue to support other water quality studies in the Charles River to further identify impairment areas and to evaluate management techniques.

EPA's Core Monitoring Program was designed to sample twelve stations during three dry weather periods and six (of the twelve) stations during three different wet weather events. The monitoring was focused in the Boston and Cambridge areas of the River during peak recreational usage in July, August and September. To establish a boundary condition, one station was located immediately downstream from the South Natick Dam or 30.5 miles upstream from the Watertown Dam. One station was located above the Watertown Dam and the other ten stations were located in the Basin. Five of these ten sampling stations were located in priority resource areas (potential wading and swimming locations). The project map (Figure 1) shows the locations of the: dry and wet weather core monitoring sampling stations, TMDL sampling stations, priority resource areas, CSO's, and stormwater discharge pipes. Table 1 describes the stations monitored in 2002.

The 1998 monitoring program included measurements of dissolved oxygen (DO), temperature, pH, specific conductance, chlorophyll a, total organic carbon (TOC), total suspended solids (TSS), apparent color, clarity, turbidity, nutrients, bacteria and total metals. Chronic toxicity was also tested during dry weather conditions. In 1999, dissolved metals and true color were added to the analyte list. Dissolved metals were added to better assess the metals concentration in relationship to the AWQC, which are based on the dissolved metals fraction. True color was added to help determine the causes of reduced clarity. In 2000, the analyte list was unchanged.

In 2001, transmissivity was added as an additional measurement of water clarity. In addition, E. coli bacteria was added and enterococcus bacteria was discontinued. This modification was made to reflect the changes to the Massachusetts Department of Public Health (DPH) Minimum Standards for Bathing Beaches regulations, which allowed the use of E. coli bacteria for determining compliance in freshwater.

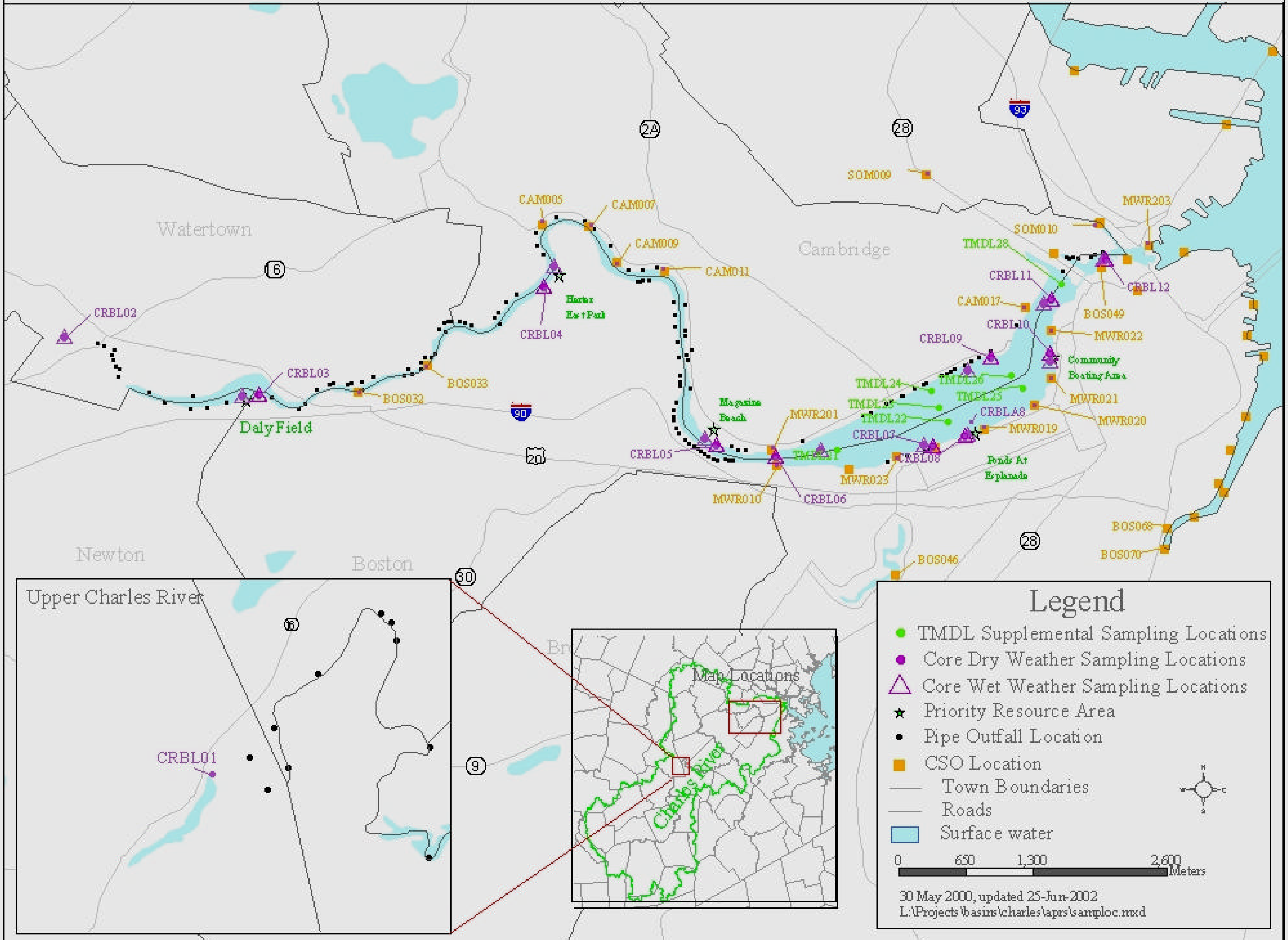
In 2002, the Core Monitoring station inside the pond at the esplanade (CRBL08) was relocated to the main stem of the Charles and designated as CRBLA8. This station was repositioned to evaluate an alternative priority resource area. The previous station measured consistently poor water quality and did not meet the initiatives goals. In addition, modifications were made to the Program to support the development of a three-dimensional hydro-dynamic linked water quality model. The model will be used for the development of a eutrophication Total Maximum Daily Load (TMDL) to address low dissolved oxygen, numerous aesthetic impairments, algae blooms and pH violations in the Basin. Sampling stations, sampling parameters, and additional sampling dates were added to provide data for the model development. Seven additional (TMDL) stations were added between the BU Bridge and the Museum of Science (Table 1 and Figure: 1).

Table 1: Sampling Station Description

PRIMARY CORE MONITORING STATION DESCRIPTIONS	STATION #
Downstream of S. Natick Dam	CRBL01
Upstream of Watertown Dam	CRBL02 WW
Daly Field, 10 m off south bank	**CRBL03**
Herter East Park, 10 m off south bank	**CRBL04**
Magazine Beach, 10 m off north bank	**CRBL05 WW**
Downstream of BU Bridge – center channel	CRBL06 WW
Downstream of Stony Brook & Mass Ave, 10 m off South shore	CRBL07 WW
~~**Pond at Esplanade**~~	~~**CRBL08**~~
Off the Esplanade (new station in 2002)	**CRBLA8**
Upstream of Longfellow Bridge, Cam. side	CRBL09 WW
Community boating area	**CRBL10**
Between Longfellow Bridge & Old Dam – center channel	CRBL11 WW
Upstream of Railroad Bridge – center channel	CRBL12
SUPPLEMENTAL SAMPLING STATIONS DESCRIPTION	
Deep hole between CRBL06 and Mass Ave Bridge	TMDL21
Southern transect station in the deep hole off the upstream lagoon	TMDL22
Center transect station between TMDL22 to TMDL24	TMDL23
Northern transect station near MIT Sailing Pavilion	TMDL24
Southern transect station in the deep hole near the Hatch Shell	TMDL25
Center transect station between TMDL25 and CRBL09	TMDL26
Off the Old Dam - center channel	TMDL28

Bold = Priority resource area station
WW = Wet weather sampling station
~~CRBL08~~ = Discontinued station

Figure 1: EPA Core Monitoring Locations and Priority Resource Areas



1.0 PROJECT DESCRIPTION

The Core Monitoring Program targets one dry weather sampling event for each month of July, August, and September and three wet weather events between July and September. If no significant storms are sampled between July and September the wet weather sampling season is extended into October.

In 2002, three additional (TMDL) sampling dates were added between June and September. These days were not targeted as dry weather sampling days but were added to gather additional data for unspecified weather conditions. These TMDL sampling days occurred on June 13, July 30, and August 20.

Depth profile sampling was conducted at four selected stations (TMDL21, TMDL22, TMDL25, and CRBL11). Sampling involved measuring temperature, DO, pH, specific conductance and salinity through the water column. Nutrients and chlorophyll a measurements were collected above and below any pycnocline (the interface between water of different densities) that was determined to exist. This was conducted to measure pollutant concentrations in the different stratified layers of water.

The dry weather sampling goal was to sample on days that were preceded by three days during which a total of less than 0.20 inches of rain occurs. Antecedent to the June 13 sampling event, 0.21 inches of rain[1] fell over the two prior days. Although the 0.20 inches in three day dry weather criterion was exceeded by one hundredth of an inch, the rainfall that occurred was of low intensity and long duration. Therefore, for the purpose of this report the June 13 sampling date will be analysed with the other dry weather sampling data. Which brings the total of dry weather sampling days to six.

Dry weather sampling was conducted on June 13, July 9, July 30, August 6, August 20 and September 10. In addition to these sampling days pre-storm sampling was conducted on September 26 and October 15. These pre-storm sampling events met the dry weather criterion and are included in the dry weather sample analysis.

The approach for each wet weather event was to sample six stations during four storm periods; pre-storm, first flush, peak flow and post-storm. The pre-storm was sampled before the rain began. The first flush sampling began when the rain became steady and one hour after the measured stage in the Laundry Brook culvert increased by at least 0.5 inches. The peak flow sampling began when rain intensity peaked and the stage reading was greatest in the Laundry Brook culvert. In previous sampling years, it was identified that peak rain intensity coincides with maximum stage or peak flow in Laundry Brook (EPA 2001). Post-storm sampling occurred when the rain ceased and the flow at Laundry Brook returned to near pre-storm conditions.

The first wet weather sampling event began on September 15. This storm, produced less rain than was anticipated (0.22 inches of rainfall was recorded[1]). Since this rain event did not meet the specified criterion (0.5 inches or greater within 24 hours) sampling was terminated after first flush samples were collected (Figure A-2 in the appendix). A second wet weather sampling event was initiated on September 26. The associated storm dropped 0.50 inches of rainfall[1] (Figure A-3 in the appendix). However, sampling was terminated after first flush since the storm appeared to have ended. A third wet weather sampling event was initiated on October 15. This storm produced 1.26 inches of rainfall.

The parameters analysed during 2002 Core Monitoring Program are listed in Table 2. Total Kjeldahl Nitrogen (TKN) and algal analysis were added to the parameter list during 2002. Except for the following notations, all parameters were measured during all sampling events. The algal analysis was performed on June 13, July 9,

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[1] Rainfall data was collected in Watertown by USGS and are reported as preliminary data.

August 6, and September 10 at selected stations. Total Organic Carbon, (TOC), TSS, true and apparent color were not measured during the TMDL sampling days. Apparent color was not measured during the August 6 dry weather sampling event. Transmissivity and Secchi disk measurements were not performed during all the wet weather sampling events. Transmissivity was measured at only the TMDL stations and stations CRBL06 and CRBL11. Depth samples were collected above and below the pycnocline for chlorophyll a and all nutrients.

The EPA's OEME and office of Ecosystem Protection (OEP) field staff conducted all the sampling and field measurements. Samples were analysed by OEME and contract laboratories.

Table 2: Parameters Analyzed During the 2002 Sampling Events

Field Measurements	Bacteria	Nutrients	Total Metal	Dissolved Metals	Other Parameters
dissolved oxygen, temperature, pH, specific conductance, turbidity, Secchi disk, transmissivity	fecal coliform E. coli.	total phosphorus(TP), ortho-phosphorus(OP), nitrate (NO_2), nitrite (NO_3), ammonia (NH_3), total kjeldahl nitrogen (TKN)	Hg	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, Zn	TSS, chlorophyll a, TOC, apparent + true color, algal analysis

5.0 DATA ANALYSIS

The fifth year of the Core Monitoring Program was completed in 2002. 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. The weather conditions and river flow affect the transport of pollutants in the watershed. Rain events can cause pollutants to be transported from the landscape and can cause an increase in river flow. Increased flow can lead to greater channel loads from the erosion and resuspension of sediments and particulates.

In 2002, from the middle of June through the first week in September, the flows at the Waltham gaging station were generally less than the flows recorded during 1998, 2000, and 2001. During this same time period, with the exception of some selected periods, the flows were greater than the low flows of 1999. The flow during 1998 and 1999 (from the middle of June through the first week in September) were generally the high and low flow years, respectively (Figure A-1). In 1998, the summer conditions were generally wetter with correspondingly higher flows; in 1999, summer conditions were drier with correspondingly lower flows.

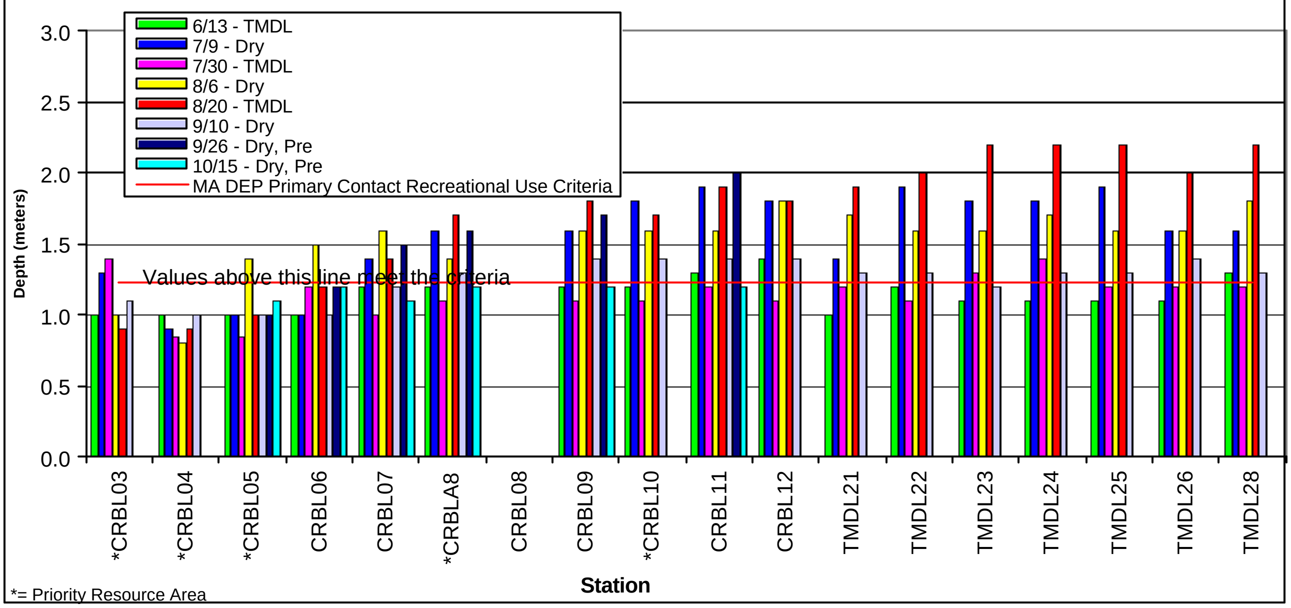
Six dry weather and three wet weather events were sampled from June through October. Comparing these data to the past four years' data revealed no short-term trends. However, the following conclusions can be made. The five years of data show a pattern of the best water quality occurring near the mouth of the River (Mass Ave. Bridge to the New Charles River Dam). This part of the river met the swimming standards more often than any other part of the Basin.

The greatest clarity was recorded during the lower flow years of 1999 and 2002 at the stations near the mouth of the Basin. During 2002, elevated nutrient concentrations were measured in the water below the pycnocline. Continued monitoring will help identify trends in the River.

5.1 Clarity, Apparent color, True color, TSS, Turbidity, TOC, Transmissivity and Chlorophyll a

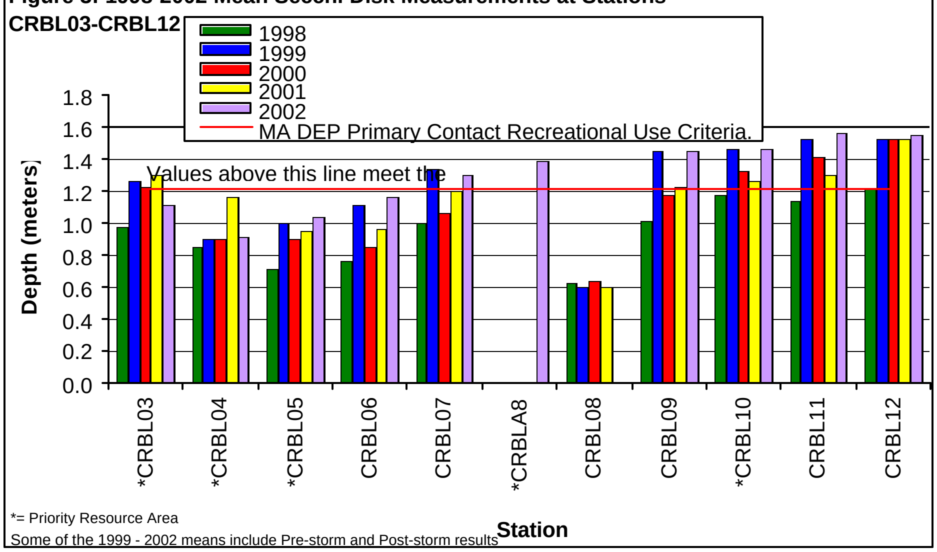
Secchi disk was used in the field to measure visibility/clarity. The Massachusetts Department of Environmental Protection uses a 1.2 meter (4 foot) criterion to assess primary contact (swimming) use support. Clarity could not be measured at the South Natick Dam (CRBL01) and Watertown Dam (CRBL02) because of the shallow water at these stations. The greatest clarity was generally recorded near the mouth of the Basin from the Esplande to the New Charles River Dam; (CRBLA8 - CRBL12 and TMDL22 - TMDL28) during the July 9 and August 20 sampling events. Except for one sample, these stations met the 1.2 meter swimming criterion during the July 9, August 6, August 20, and September 10 sampling events (Figure 2).

Figure 2: Clarity - Secchi Disk Measurements at Station CRBL03 - CRBL12



From Daly field to the BU Bridge (stations CRBL03, CRBL04, and CRBL05), the mean Secchi disk value was 1.0 meters while the stations monitored between the Esplanade to the New Charles River Dam (stations CRBLA8 - CRBL12 and TMDL 22 - TMDL28) recorded a mean Secchi disk value of 1.5 meters (Figure 2). Mean Secchi disk readings downstream of Magazine Beach were greater than the means from the last two years and similar to the means from 1999. The means from 1998 to 2002 show a pattern of improved water clarity closer to the mouth of the Basin (Figure 3).

Figure 3: 1998-2002 Mean Secchi Disk Measurements at Stations CRBL03-CRBL12



Total suspended solids, TOC, true and apparent were measured only during the Core Monitoring dry and wet sampling events. Apparent color measures the color of the water which may contain suspended matter. Apparent color values were highest in July and decreased throughout the summer. This relationship was also evident in the data collected during 2000 and 2001.

True color measures the stain in the water after the suspended particulates have been removed by centrifuging. As with apparent color, true color values were highest in July and decreased throughout the summer. The true color mean value was 10% to 52% lower than the apparent color mean value. As identified in the 1999 Core Monitoring Program Report (EPA 2000) it appears that part of the color was associated with suspended matter. This implies that reducing suspended matter and nutrients that stimulate algae growth could enhance the clarity of the water. Other sources of suspended matter include non-point, point sources (such as storm water and CSO's), resuspended bottom sediments, bank erosion, and other natural sources.

All measured TSS concentrations were less than the Massachusetts water quality standard (Table 3). Total Suspended Solids mean values were highest at the station above and below the BU Bridge; station CRBL05 and CRBL06, respectively. During previous years, the highest mean values were recorded at these locations and at the stations at Herter East park and in the Lagoon.

Turbidity and Total Organic Carbon (TOC) were additional measurements of suspended and dissolved matter in the water. As with TSS, the highest turbidity mean values were recorded at the station above and below the BU Bridge; station CRBL05 and CRBL06, respectively. At each station, the highest TOC values were recorded during the July sampling event. This was consistent with the data collected in 2001 and 2000.

Transmissivity was measured at stations CRBL06, CRBL11 and at all TMDL stations. Transmissivity was not measured during the wet weather sampling events. The lowest transmissivity was recorded during the June and September sampling events. Generally, the greatest transmissivity was recorded near the mouth of the Basin. The transmissivity measurements correlated well with Secchi disk measurements and a 1.2 meter Secchi disk reading corresponds to a transmissivity of approximately 51% (R^2 = 0.8855).

Chlorophyll a was one of the parameters measured to assess eutrophication in the Basin. Because Massachusetts does not have numeric nutrient or chlorophyll a criteria for assessing eutrophication of lakes and rivers, the total phosphorus and chlorophyll a concentrations were compared to the State of Connecticut's Lake Trophic Classifications - Water Quality Standards[1]. Twenty seven percent of the chlorophyll a samples collected in the Basin were considered highly eutrophic (greater than 30 ug/l). For lakes, ponds and

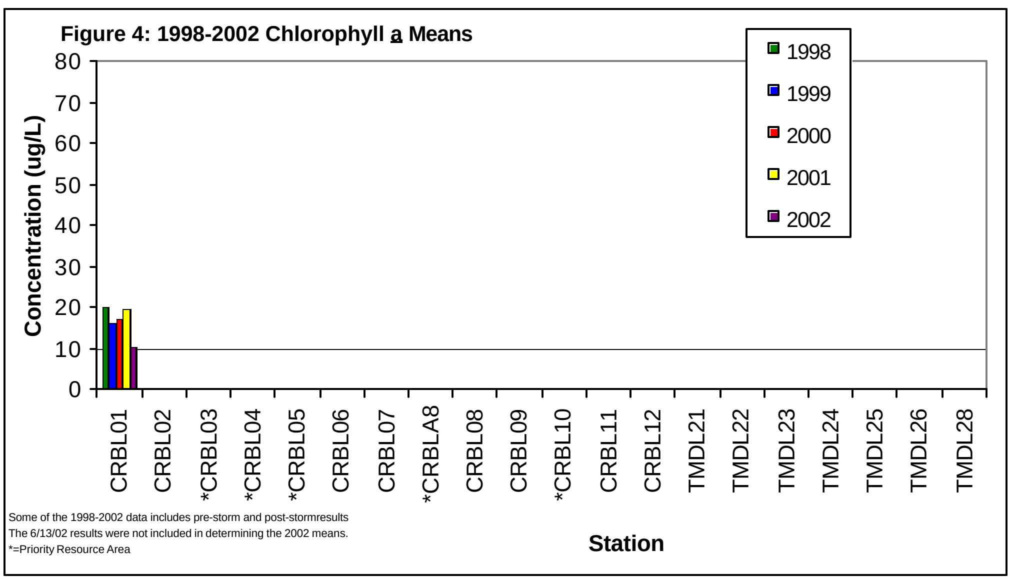


Figure 4: 1998-2002 Chlorophyll a Means

1 The Connecticut Water Quality Lake Trophic Classification Criteria during mid summer conditions for chlorophyll a: Oligotrophic (0 - 2 ug/l), Mesotrophic (2 - 15 ug/l), Eutrophic (15 - 30 ug/l), and Highly Eutrophic (>30 ug/l).

reservoirs in the North Eastern Coastal Zone the recommended criterion for chlorophyll a is approximately 2.5 ug/l (NEIWPCC, 2000).

The highest chlorophyll a values generally occurred on the July 30 sampling event with values downstream of Herter East Park ranging from 41 ug/l to 65 ug/l. The mean values from 2002 were similar to the mean values of previous years (Figure 4)

At stations CRBL06 and CRBL11, chlorophyll a samples were collected using two different techniques during each of the six dry weather sampling events. In addition, the two techniques were also evaluated on June 13 at station TMDL28. The surface grab method, which has been used through out the Core Monitoring Program, was compared to a 1-meter depth integrated sample collected with a pre-cleaned Teflon bailer. Excluding the one not detected value, the twelve results showed that the relative percent difference ranged from 10% to 0% with the mean difference being 3%. For the purpose of this report, the data collected at the TMDL sampling stations from the depth-integrated samples will be considered equivalent to the surface grab samples collected at the Core Monitoring Program Stations.

Depth samples were collected at stations TMDL22, TMDL25 and CRBL11 for Chlorophyll a during the six dry weather sampling events. Although, chlorophyll a values generally were similar at the surface and above the pycnocline, values deceased below the pycnocline. The mean value at the three stations monitored above the pycnocline was 22.1 ug/l and below the pycnocline was 4.4 ug/l.

Table 3: 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	≥ 5 mg/l and ≥ 60% saturation
Temperature	≤ 83°F (28.3°C) and ?3°F (1.7°C) in Lakes, ?5°F (2.8°C) in Rivers
pH	Between 6.5 and 8.3
Bacteria	See Table 4
Secchi disk depth	Lakes ≥ 1.2 meters (for primary contact recreation use support)
Solids	Narrative and TSS ≤ 25.0 mg/l (for aquatic life use support)
Color and turbidity	Narrative Standard
Nutrients	Narrative “Control of Eutrophication” Site Specific

5.2 Bacteria

The Massachusetts Department of Public Health (DPH) Minimum Standards for Bathing Beaches and the DEP Surface Water Quality Standards (314 CMR 4.00) establish maximum allowable bacteria criteria. These are summarized in Table 4.

Table 4: Massachusetts Freshwater Bacteria Criteria

Indicator Organism	MA DPH Minimum Criteria for Bathing Beaches (105 CMR 445.00)	MA DEP Surface Water Quality Standards (314 CMR 4.00) and water quality guidelines	
	Bathing beaches	Primary contact	Secondary contact
E. coli or	≤235 colonies/100ml and a geometric mean of most recent five samples ≤126 col/100ml	NA	NA
Enterococci	≤61 colonies/100ml and a geometric mean of most recent five samples≤33 col/100ml	NA	NA
Fecal coliform	NA	a geometric mean ≤200 col/100ml for ≥5 samples ≤400/100ml for not more than 10 % of the samples	a geometric mean ≤1000 col/100ml for ≥5 samples ≤2000/100ml for not more than 10 % of the samples
		≤400 col/100ml for <5 samples	≤2000 col/100ml for <5 samples

Note: NA = not applicable

Fecal coliform and E. coli bacteria concentrations were measured during each sampling event. For the purpose of this report, the fecal coliform counts of individual samples were compared to the Massachusetts DEP geometric mean criteria of less than or equal to 200 colonies/100ml for primary contact recreation (swimming) and less than or equal to 1000 colonies/100ml for secondary contact recreation (boating).

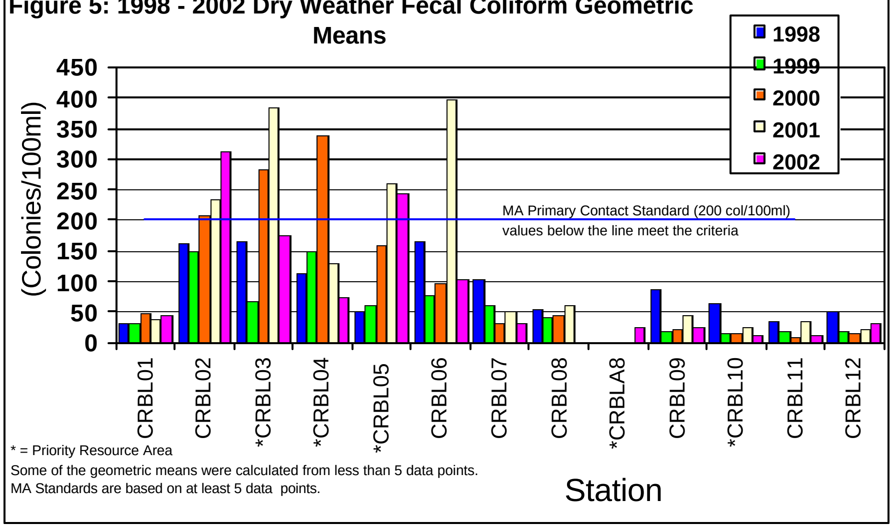


Figure 5: 1998 - 2002 Dry Weather Fecal Coliform Geometric Means

During dry weather, approximately 31% of the core monitoring fecal coliform samples exceeded the swimming criterion[1] of less than 200 colonies/100ml, (compared to 35%, 23%, 8%, and 17% in 2001, 2000, 1999 and 1998, respectively). During wet weather, approximately 46% of the core monitoring samples exceeded the criterion[1] (compared to 44%, 63%, and 50% in 2001, 2000, and 1999, respectively).

Fecal coliform concentrations were lower near the mouth of the Basin (Mass Ave. Bridge to the New Charles River Dam; CRBL07 - CRBL12). This is a consistent pattern, which has occurred in the previous four years of data. The dry weather Core Monitoring samples collected at stations CRBL07 - CRBL12 exceeded the swimming criterion[1] 9% of the time. Upstream, at stations CRBL02 – CRBL06 the criterion[1] was exceeded 53% of the time. The area from station CRBL07- CRBL12 is the most heavily recreated parts of the River. The area contains the MIT Sailing Pavilion and Community Boating where much sailing, kayaking, windsurfing, and occasional contact with the water occurs.

The 2002 dry weather fecal coliform geometric means[2] were similar to those collected during previous years. At station CRBL02, the geometric means[2] have increased over the past three years (Figure 5).

E. coli bacteria was sampled during all sampling events. As observed with the fecal coliform measurements, the E. coli concentrations were lower near the mouth of the Basin (Mass Ave. Bridge to the New Charles River Dam; CRBL07 - CRBL12). For these Core Monitoring stations, all calculated geometric means met the Department of Public Health (DPH) Bathing Beach criterion[3] and one sample collected at station CRBL12 (or 2% of the samples) was greater than the DPH bathing beach criterion for individual samples[3]. At stations CRBL02 – CRBL06 the individual sample criterion was exceeded 30% of the time and the geometric mean criterion was exceeded at two of the five stations.

Fourteen or approximately 17% of the dry weather core monitoring samples exceeded the E. coli bathing beach criterion for a single sample[3], compared to 19% in 2001 and 35% in 1998. The fecal coliform and E. coli bacteria concentration from the six TMDL stations between the Mass Ave. Bridge and the Museum of Science showed similar counts. For these stations the fecal coliform geometric means ranged from 7 to 10 colonies/100 ml and the E.coli geometric means ranged from 6 to 12 colonies/100 ml.

5.3 Dissolved Oxygen, pH, and Temperature

Massachusetts has established criteria for class B waters for dissolved oxygen, pH, temperature, and turbidity (Table 3). One instrument was used to measure temperature, specific conductance, DO, pH, and turbidity. Data that did not meet the quality control criteria were not reported**.**

Dissolved Oxygen (DO) is required for a healthy ecosystem. Fish and other aquatic organisms require DO for survival (EPA 1998). Massachusetts has established DO criterion[4] for class B waters. Two DO violations or approximately 1% of all the field measurements (compared to 0%, 0%, 3%, and 0% in 2001, 2000, 1999, and 1998, respectively) collected during the thirteen sampling events did not meet the criterion.

Dissolved Oxygen (DO) depth profile measurements were conducted at four stations downstream of the BU Bridge (stations TMDL21, TMDL22, TMDL 25 and CRBL11). Anoxia was measured at the bottom during the five sampling events in which DO depth profiles where conducted. Except for one sampling event on June 13, all DO measurements below 4.5 meters were less than the Massachusetts DO criterion [4].

The pH of an aquatic system is an important parameter in evaluating toxicity. High acidity (a low pH) can convert insoluble metal sulfides to soluble forms, which increases the bioavailability. A high pH can cause ammonia toxicity (EPA 1998). The data from all the dry and wet weather core monitoring surface

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[1]The Massachusetts fecal coliform swimming criterion of less than 200 colonies/100ml is actually based on a geometric mean of five samples or more. For this report, individual concentrations were compared to this criterion.

[2]Some of the dry weather geometric means were calculated from less than five data points; the actual criterion is based on a geometric mean of five samples or more.

[3] The Massachusetts DPH E. coli Bathing Beach criterion for as single sample is less than or equal to 235 colonies/100ml. The geometric mean criterion is less than or equal to 126 colonies/100ml and is based on a geometric mean of the most recent five samples within the same bathing season.

[4] The Massachusetts water quality criteria for Class B water for DO is $\geq$ 5 mg/l and $\geq$60% saturation, for pH is in the range of 6.5 through 8.3, and for temperature is $\leq 28.3^{o}C$ ($83^{o}F$) .

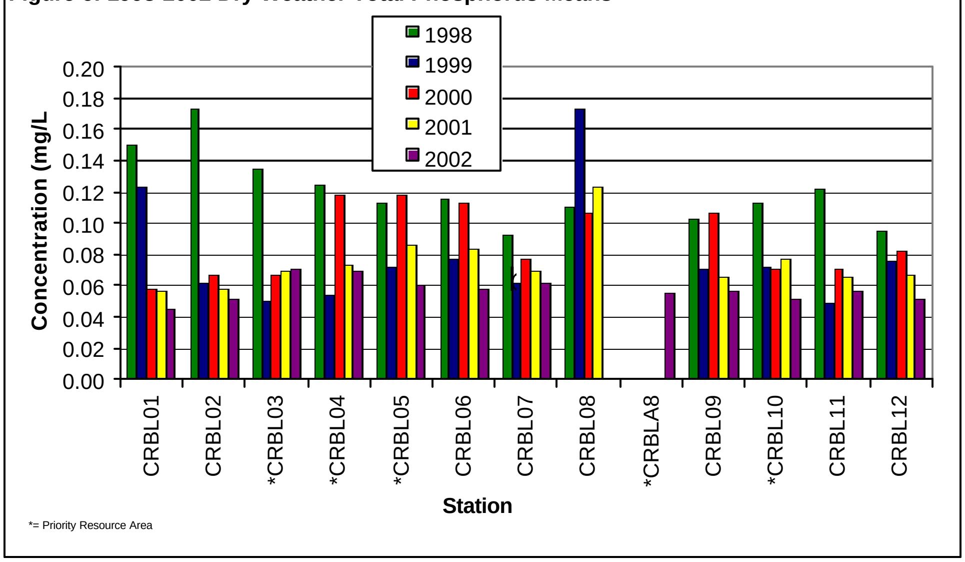
measurements showed pH violated the criterion[1] twenty times or approximately 22% of all field measurements (compared to 18%, 20%, 8%, and 4% in 2001, 2000, 1999, and 1998, respectively). All surface violations were greater than 8.3 and occurred at or downstream of Herter East Park. The cause of these elevated values was unable to be determined but may be, in part, by the photosynthesis of algae and the uptake of carbon dioxide from the water. Depth samples often had a lower pH than the surface measurements. All depth measurements were greater than or equal to 6.5.

Temperature is a crucial factor in maintaining a natural system. 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. Increased temperature decreases the oxygen solubility in water resulting in increased stress from oxygen-demanding waste (EPA 1998). The highest surface water temperature was recorded on August 20, between the Longfellow Bridge and the Museum of Science (CRBL11) at 29.2 ^{o}C. (84.6^{o}F). There were ten recorded temperature measurements above the state criterion[1]. These measurements occurred on August 6 and August 20, in the area of Longfellow Bridge and the Museum of Science.

5.4 Nutrients

Nutrient analyses included measurements of total phosphorus, ortho-phosphorus, nitrate, nitrite, ammonia and TKN. Elevated phosphorus concentrations at many of the sampling stations indicated highly eutrophic conditions. Each station recorded the highest dry weather concentration during the June or July sampling event. Since Massachusetts uses narrative site-specific water quality criteria for total phosphorus, measured concentrations were compared to Connecticut's numeric Lakes Trophic Classifications[2]. These classifications indicated that approximately 56 % of the total phosphorus dry weather Core Monitoring samples (compared to 75% in 2001 and 80% in 2000 and 1999) were associated with highly eutrophic waters. For lakes, ponds and reservoirs in the North Eastern Coastal Zone the recommended criterion for total phosphorus is between 0.009 and 0.011 mg/l (NEIWPCC, 2000).

Figure 6: 1998-2002 Dry Weather Total Phosphorus Means



The dry weather means from eight stations were lower than any previous years' means (Figure 6). At the South Natick Dam station (CRBL02), the dry weather data showed a reduction in the total phosphorus when compared to data collected over the past four years. Upstream point sources include wastewater treatment plants operated

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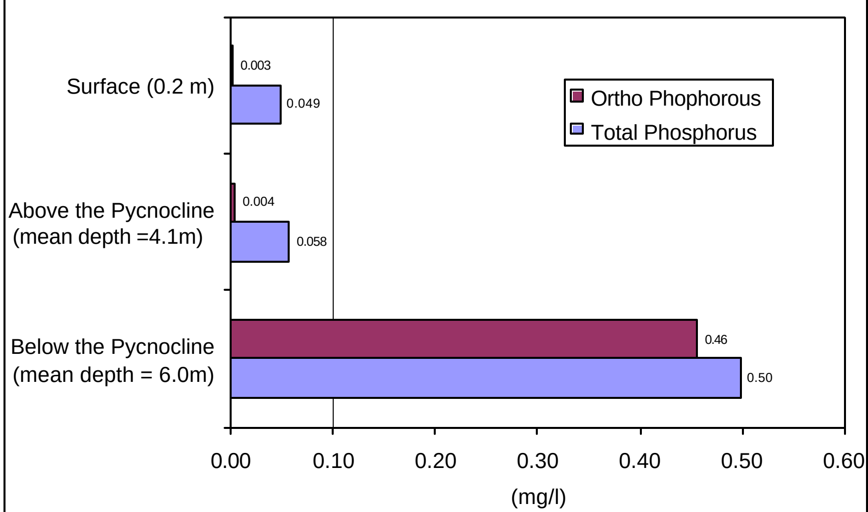
1 The Massachusetts water quality criteria for Class B water for DO is ≥ 5 mg/l and ≥60% saturation, for pH is in the range of 6.5 through 8.3, and for temperature is ≤ 28.3^{o}C (83^{o}F) .

2 The Connecticut Water Quality Lake Trophic Classification Criteria during the spring and summer conditions for total phosphorus are: Oligotrophic (0 - 0.010 mg/l), Mesotrophic (0.010 - 0.030 mg/l), Eutrophic (0.030 - 0.050 mg/l), and Highly Eutrophic (>0.050 mg/l).

by: Charles River Pollution Control District, the Massachusetts Correctional Institute (MCI) in Norfolk, Wrentham State School, and the towns of Medfield and Milford. In the 2001 report it was noted that no direct correlation could be made between reported loadings from the wastewater treatment plants and concentrations measured in the River (EPA2002).

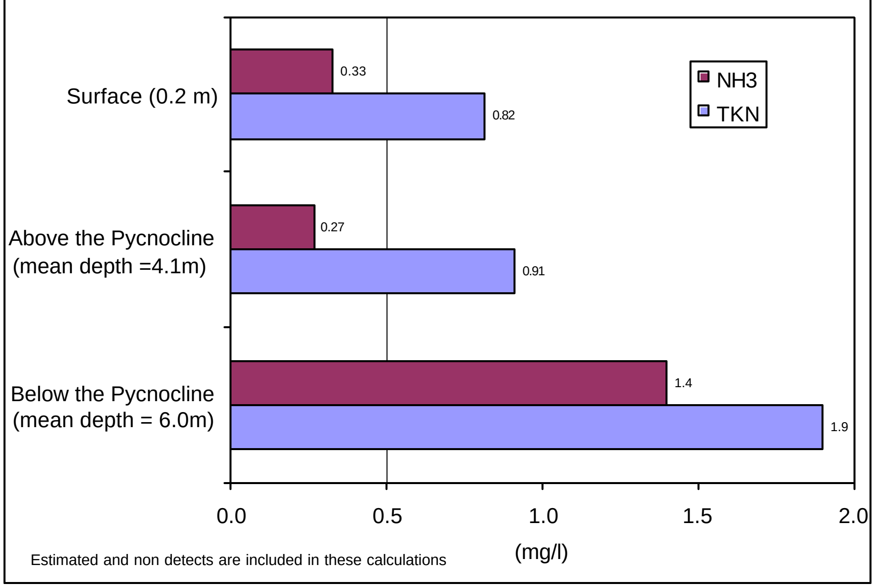
The additional TMDL sampling that was conducted during 2002 involved collecting samples above and below the pycnocline at three stations. This data revealed elevated concentrations of total phosphorus, ortho-phosphorous, total Kjeldahl nitrogen, and ammonia below the pycnocline (Figure 7 and 8). The total phosphorus median concentration above the pycnocline was 0.058 mg/l and the median below the pycnocline was 0.50 mg/l (Figure 8).

Figure 7: Total and Ortho Phosphorus Depth Concentrations - Median Values



Many of the ortho-phosphorus samples were reported as less than 0.005 mg/l (not detected), although, as with total phosphorus, each station recorded the highest dry weather concentration during the June or July sampling event. At most stations the highest concentrations for ammonia, TKN, and nitrate from the surface samples were recorded during the June and July sampling event.

Figure 8: Total Kjeldahl Nitrogen (TKN) and Ammonia (NH3) Depth Concentrations - Median Values



5.5 Metals

Twenty-one elements were included in the dissolved metal analyses. In addition, total recoverable mercury was analyzed. Ten of these were EPA priority metals and have associated Ambient Water Quality Criteria (AWQC)[1]. Seven of these AWQC's were dependent on the water hardness. Hardness dependent AWQC were calculated using the hardness of the water at the time of sampling. The hardness was calculated using the dissolved fraction of calcium and magnesium. Except for mercury, all AWQC's were based on the dissolved metals fraction. Because only total recoverable mercury was measured,

[1] EPA=s Clean Water Act Section 304(a) Criteria for Priority toxic Pollutants (40 CFR Part 131.36)

the AWQC's for mercury were presented as total recoverable. The metals concentrations and the associated criteria are presented in Tables 5 and 6 for dry and wet weather, respectively. The concentrations of all the metals analyzed are presented in Appendix A.

No measured metals exceeded the acute Ambient Water Quality Criteria (AWQC). Lead and selenium were the only metals that exceeded the chronic AWQC. The lead exceedances occurred only during the July 9 sampling event at the ten most downstream stations. These ten exceedances represent 21% of all dry weather metals samples (compared to 33%, 27%, and 8% in 2001, 2000, and 1999, respectively). No wet weather lead exceedances were measured (compared to 0%, 25%, and 72% in 2001, 2000, and 1999, respectively). Selenium exceeded the chronic AWQC fifteen times during dry weather and fifteen times during wet weather. All exceedances occurred down stream of the BU Bridge. In past years, copper had exceeded the chronic AWQC but not selenium. There were no identified reasons for these yearly changes. The other measured priority pollutants metals (arsenic, cadmium, chromium, copper, mercury, nickel, silver, and zinc) did not exceed the AWQC.

TABLE 5: Priority Pollutant Metals Dry Weather Concentrations and the Ambient Water Quality Criteria (AWQC)

STATION	Arsenic conc. (ug/l)	Arsenic AWQC Acute (ug/l)	Arsenic AWQC Chronic (ug/l)	Cadmium conc. (ug/l)	Cadmium AWQC Acute (ug/l)	Cadmium AWQC Chronic (ug/l)	Chromium conc. (ug/l)	Chromium AWQC Acute (ug/l)	Chromium AWQC Chronic (ug/l)	Copper conc. (ug/l)	Copper AWQC Acute (ug/l)	Copper AWQC Chronic (ug/l)	Lead conc. (ug/l)	Lead AWQC Acute (ug/l)	Lead AWQC Chronic (ug/l)
7/9/02 Core Dry Weather Sampling															
CRBL01	ND(.50)	340	150	ND(.20)	2.6	1.6	1.7	392	51	2.5	8.7	6.1	0.6	39.2	1.5
CRBL02	1.1	340	150	ND(.20)	2.9	1.7	2.4	427	56	2.4	9.6	6.6	1.6	43.9	1.7
CRBL03	1.1	340	150	ND(.20)	3.0	1.7	2.7	432	56	3.3	9.8	6.7	2.4	44.6	1.7
CRBL04	1.1	340	150	ND(.20)	3.0	1.8	2.6	435	57	3.1	9.9	6.8	4.0	45.1	1.8
CRBL05	1.1	340	150	ND(.20)	2.9	1.7	2.5	421	55	3.8	9.5	6.5	3.6	43.1	1.7
CRBL06	1.2	340	150	ND(.20)	2.9	1.7	2.6	430	56	4.0	9.7	6.7	4.5	44.4	1.7
CRBL07	1.3	340	150	ND(.20)	3.0	1.8	2.7	441	57	4.8	10.0	6.8	6.2	45.8	1.8
CRBLA8	1.2	340	150	ND(.20)	3.1	1.8	1.8	451	59	5.3	10.3	7.0	5.6	47.3	1.8
CRBL09	1.2	340	150	ND(.20)	3.3	1.9	2.5	470	61	6.2	10.8	7.3	5.4	49.9	1.9
CRBL10	1.2	340	150	ND(.20)	3.7	2.0	2.4	513	67	6.9	11.9	8.0	4.9	56.2	2.2
CRBL11	1.3	340	150	ND(.20)	3.7	2.0	1.9	514	67	7.2	11.9	8.0	4.7	56.3	2.2
CRBL12	1.5	340	150	ND(.20)	4.4	2.3	2.3	580	75	7.4	13.7	9.1	4.3	66.2	2.6
8/6/02 Core Dry Weather Sampling															
CRBL01	0.5	340	150	ND(.20)	3.5	2.0	1.8	495	64	2.4	11.4	7.7	ND(.20)	53.6	2.1
CRBL02	0.9	340	150	ND(.20)	3.4	1.9	1.9	479	62	2.8	11.0	7.5	0.3	51.3	2.0
CRBL03	1.0	340	150	ND(.20)	3.4	1.9	2.0	485	63	3.7	11.2	7.6	1	52.1	2.0
CRBL04	0.9	340	150	ND(.20)	3.0	1.8	1.7	438	57	3.2	9.9	6.8	0.5	45.5	1.8
CRBL05	1.2	340	150	ND(.20)	4.1	2.2	2.3	552	72	3.9	13.0	8.7	0.6	61.9	2.4
CRBL06	1.6	340	150	ND(.20)	5.5	2.7	2.4	692	90	4.8	16.8	11.0	0.7	83.5	3.3
CRBL07	1.8	340	150	ND(.20)	6.2	2.9	1.8	754	98	6.1	18.5	12.0	0.9	93.5	3.6
CRBLA8	1.9	340	150	ND(.20)	6.4	3.0	2.1	775	101	6.3	19.2	12.4	0.9	97.0	3.8
CRBL09	1.8	340	150	ND(.20)	6.6	3.0	2.1	790	103	6.6	19.6	12.6	0.9	99.4	3.9
CRBL10	2.0	340	150	ND(.20)	7.0	3.1	2.1	829	108	7.3	20.7	13.2	0.9	105.9	4.1
CRBL11	2.1	340	150	ND(.20)	6.8	3.1	1.6	815	106	7.4	20.3	13.0	0.9	103.5	4.0
CRBL12	2.2	340	150	ND(.20)	7.5	3.3	2.0	873	114	7.8	22.0	14.0	0.7	113.3	4.4
9/10/02 Core Dry Weather Sampling															
CRBL01	ND(.50)	340	150	ND(.20)	3.7	2.0	1.9	511	66	2.8	11.9	8.0	ND(.20)	55.9	2.2
CRBL02	0.7	340	150	ND(.20)	3.6	2.0	2.1	499	65	2.9	11.5	7.8	ND(.20)	54.1	2.1
CRBL03	0.7	340	150	ND(.20)	3.7	2.0	2.1	515	67	2.9	12.0	8.1	ND(.20)	56.5	2.2
CRBL04	0.7	340	150	ND(.20)	4.0	2.1	1.9	539	70	3.3	12.6	8.4	ND(.20)	59.9	2.3
CRBL05	1.1	340	150	ND(.20)	4.7	2.4	1.9	611	80	3.9	14.6	9.6	ND(.20)	70.9	2.8
CRBL06	1.4	340	150	ND(.20)	6.2	2.9	1.9	754	98	5.3	18.5	12.0	ND(.20)	93.5	3.6
CRBL07	2.3	340	150	ND(.20)	9.4	3.8	2.0	1040	135	7.1	26.8	16.8	0.2	142.2	5.5
CRBLA8	2.4	340	150	ND(.20)	9.7	3.9	1.9	1063	138	7.3	27.5	17.2	ND(.20)	146.4	5.7
CRBL09	2.6	340	150	ND(.20)	9.6	3.9	1.8	1055	137	7.4	27.3	17.0	ND(.20)	144.9	5.6
CRBL10	2.8	340	150	ND(.20)	10.5	4.1	1.8	1128	147	8.1	29.5	18.3	ND(.20)	158.0	6.2
CRBL11	2.7	340	150	ND(.20)	10.3	4.1	2.0	1106	144	8.1	28.8	17.9	ND(.20)	154.1	6.0
CRBL12	2.9	340	150	ND(.20)	10.6	4.2	1.8	1136	148	8.8	29.7	18.4	ND(.20)	159.5	6.2

[yellow highlight] = meets or exceeds the chronic criterion

ND=not detected above the associated detection limit.

TABLE 5: Priority Pollutant Metals Dry Weather Concentrations and the Ambient Water Quality Criteria (AWQC) - continued

STATION	Arsenic conc. (ug/l)	Arsenic AWQC Acute (ug/l)	Arsenic AWQC Chronic (ug/l)	Cadmium conc. (ug/l)	Cadmium AWQC Acute (ug/l)	Cadmium AWQC Chronic (ug/l)	Chromium conc. (ug/l)	Chromium AWQC Acute (ug/l)	Chromium AWQC Chronic (ug/l)	Copper conc. (ug/l)	Copper AWQC Acute (ug/l)	Copper AWQC Chronic (ug/l)	Lead conc. (ug/l)	Lead AWQC Acute (ug/l)	Lead AWQC Chronic (ug/l)
9/26/02 Core Dry Weather Pre-storm Sampling															
CRBL02	0.6	340	150	ND(.20)	3.5	1.9	1.0	489	64	2.7	11.3	7.6	0.2	52.7	2.1
CRBL05	1.1	340	150	ND(.20)	4.7	2.4	0.9	617	80	4.2	14.7	9.7	ND(.20)	71.8	2.8
CRBL06	1.4	340	150	ND(.20)	5.9	2.8	0.8	732	95	5.4	17.9	11.6	ND(.20)	90.0	3.5
CRBL07	2.5	340	150	ND(.20)	9.3	3.8	1.0	1026	133	7.9	26.4	16.5	ND(.20)	139.8	5.4
CRBL09	3.2	340	150	ND(.20)	11.3	4.3	1.0	1189	155	10.0	31.3	19.3	ND(.20)	169.1	6.6
CRBL11	3.5	340	150	ND(.20)	10.6	4.2	1.2	1136	148	10.0	29.7	18.4	ND(.20)	159.5	6.2
10/15/02 Core Dry Weather Pre-Storm Sampling															
CRBL02	0.5	340	150	ND(.20)	3.6	2.0	~1.0	501	65	2.5	11.6	7.8	0.2	54.4	2.1
CRBL05	1.2	340	150	ND(.20)	5.6	2.7	1.3	695	90	4.9	16.9	11.0	0.3	84.1	3.3
CRBL06	1.4	340	150	ND(.20)	6.5	3.0	1.8	779	101	5.6	19.3	12.4	0.2	97.6	3.8
CRBL07	2.3	340	150	ND(.20)	9.3	3.8	1.6	1030	134	7.9	26.5	16.6	ND(.20)	140.4	5.5
CRBL09	2.5	340	150	ND(.20)	10.5	4.1	1.7	1123	146	9.3	29.3	18.2	ND(.20)	157.1	6.1
CRBL11	3.3	340	150	ND(.20)	12.3	4.6	1.7	1273	166	11.1	33.9	20.7	ND(.20)	184.6	7.2

= meets or exceeds the chronic criterion

ND=not detected above the associated detection limit.

TABLE 5: Priority Pollutant Metals Dry Weather Concentrations and the Ambient Water Quality Criteria (AWQC) - continued

STATION	Mercury conc. (ug/l)	Mercury AWQC Acute (ug/l)	Mercury AWQC Chronic (ug/l)	Nickel conc. (ug/l)	Nickel AWQC Acute (ug/l)	Nickel AWQC Chronic (ug/l)	Selenium conc. (ug/l)	Selenium AWQC Chronic (ug/l)	Silver conc. (ug/l)	Silver AWQC Acute (ug/l)	Zinc conc. (ug/l)	Zinc AWQC Acute (ug/l)	Zinc AWQC Chronic (ug/l)
7/9/02 Core Dry Weather Sampling													
CRBL01	0.002	1.40	0.770	2.0	318	35	ND(1.0)	5.00	ND(.20)	1.6	5.1	80	80
CRBL02	0.002	1.40	0.770	1.9	347	39	ND(1.0)	5.00	ND(.20)	1.9	ND(5.0)	87	88
CRBL03	0.004	1.40	0.770	1.9	352	39	ND(1.0)	5.00	ND(.20)	1.9	ND(5.0)	88	89
CRBL04	0.003	1.40	0.770	1.9	355	39	ND(1.0)	5.00	ND(.20)	2.0	ND(5.0)	89	89
CRBL05	0.008	1.40	0.770	1.9	343	38	ND(1.0)	5.00	ND(.20)	1.8	ND(5.0)	86	86
CRBL06	0.005	1.40	0.770	2.0	350	39	ND(1.0)	5.00	ND(.20)	1.9	ND(5.0)	88	88
CRBL07	0.007	1.40	0.770	2.0	359	40	1.4	5.00	ND(.20)	2.0	5.5	90	91
CRBLA8	0.007	1.40	0.770	1.9	368	41	1.4	5.00	ND(.20)	2.1	5.9	92	93
CRBL09	0.007	1.40	0.770	2.0	384	43	1.5	5.00	ND(.20)	2.3	7.2	96	97
CRBL10	0.005	1.40	0.770	2.0	421	47	2.0	5.00	ND(.20)	2.8	6.3	105	106
CRBL11	0.006	1.40	0.770	2.0	421	47	2.2	5.00	ND(.20)	2.8	7.5	105	106
CRBL12	0.005	1.40	0.770	2.0	477	53	2.9	5.00	ND(.20)	3.6	7.6	119	120
8/6/02 Core Dry Weather Sampling													
CRBL01	0.002	1.40	0.770	2.9	405	45	ND(1.0)	5.00	ND(.20)	2.6	ND(5.0)	101	102
CRBL02	0.002	1.40	0.770	2.1	391	43	ND(1.0)	5.00	ND(.20)	2.4	ND(5.0)	98	99
CRBL03	0.005	1.40	0.770	2.1	397	44	ND(1.0)	5.00	ND(.20)	2.5	ND(5.0)	99	100
CRBL04	0.005	1.40	0.770	1.9	357	40	ND(1.0)	5.00	ND(.20)	2.0	ND(5.0)	89	90
CRBL05	0.005	1.40	0.770	2.1	453	50	1.6	5.00	ND(.20)	3.2	ND(5.0)	113	114
CRBL06	0.008	1.40	0.770	2.2	572	64	3.5	5.00	ND(.20)	5.2	ND(5.0)	143	144
CRBL07	0.006	1.40	0.770	2.5	625	69	4.3	5.00	ND(.20)	6.2	ND(5.0)	157	158
CRBLA8	0.005	1.40	0.770	2.2	644	71	4.5	5.00	ND(.20)	6.6	ND(5.0)	161	162
CRBL09	0.003	1.40	0.770	2.5	656	73	4.8	5.00	ND(.20)	6.8	ND(5.0)	164	166
CRBL10	0.003	1.40	0.770	2.4	690	77	5.0	5.00	ND(.20)	7.6	ND(5.0)	173	174
CRBL11	0.003	1.40	0.770	2.2	677	75	5.2	5.00	ND(.20)	7.3	ND(5.0)	170	171
CRBL12	0.004	1.40	0.770	2.5	727	81	5.9	5.00	ND(.20)	8.4	ND(5.0)	182	184
9/10/02 Core Dry Weather Sampling													
CRBL01	ND(.001)	1.40	0.770	2.5	419	46	ND(1.0)	5.00	ND(.20)	2.7	ND(5.0)	105	106
CRBL02	ND(.001)	1.40	0.770	1.8	408	45	ND(1.0)	5.00	ND(.20)	2.6	ND(5.0)	102	103
CRBL03	0.003	1.40	0.770	1.9	422	47	ND(1.0)	5.00	ND(.20)	2.8	ND(5.0)	106	106
CRBL04	0.004	1.40	0.770	1.7	442	49	ND(1.0)	5.00	ND(.20)	3.1	ND(5.0)	111	111
CRBL05	0.002	1.40	0.770	1.7	503	56	1.9	5.00	ND(.20)	4.0	ND(5.0)	126	127
CRBL06	0.004	1.40	0.770	1.9	625	69	3.7	5.00	ND(.20)	6.2	ND(5.0)	157	158
CRBL07	0.002	1.40	0.770	2.1	871	97	6.9	5.00	ND(.20)	12.2	ND(5.0)	218	220
CRBLA8	0.002	1.40	0.770	2.1	892	99	7.4	5.00	ND(.20)	12.8	ND(5.0)	223	225
CRBL09	0.002	1.40	0.770	2.3	885	98	8.0	5.00	ND(.20)	12.6	ND(5.0)	222	223
CRBL10	0.002	1.40	0.770	2.3	948	105	8.9	5.00	ND(.20)	14.5	ND(5.0)	238	239
CRBL11	0.002	1.40	0.770	2.2	929	103	8.7	5.00	ND(.20)	13.9	ND(5.0)	233	235
CRBL12	0.002	1.40	0.770	2.2	955	106	9.4	5.00	ND(.20)	14.7	ND(5.0)	239	241

= meets or exceeds the chronic criterion

ND=not detected above the associated detection limit.

TABLE 5: Priority Pollutant Metals Dry Weather Concentrations and the Ambient Water Quality Criteria (AWQC) continued

STATION	Mercury conc. (ug/l)	Mercury AWQC Acute (ug/l)	Mercury AWQC Chronic (ug/l)	Nickel conc. (ug/l)	Nickel AWQC Acute (ug/l)	Nickel AWQC Chronic (ug/l)	Selenium conc. (ug/l)	Selenium AWQC Chronic (ug/l)	Silver conc. (ug/l)	Silver AWQC Acute (ug/l)	Zinc conc. (ug/l)	Zinc AWQC Acute (ug/l)	Zinc AWQC Chronic (ug/l)
9/26/02 Core Dry Weather Pre-storm Sampling													
CRBL02	0.001	1.40	0.770	2.1	400	44	ND(1.0)	5.00	ND(.20)	2.5	ND(5.0)	100	101
CRBL05	0.008	1.40	0.770	1.8	508	56	1.8	5.00	ND(.20)	4.1	ND(5.0)	127	128
CRBL06	0.004	1.40	0.770	1.9	607	67	3.1	5.00	ND(.20)	5.8	ND(5.0)	152	153
CRBL07	0.004	1.40	0.770	2.3	860	95	7.1	5.00	ND(.20)	11.9	ND(5.0)	215	217
CRBL09	0.003	1.40	0.770	2.3	1001	111	10.0	5.00	ND(.20)	16.2	ND(5.0)	251	253
CRBL11	0.002	1.40	0.770	2.2	955	106	11.0	5.00	ND(.20)	14.7	ND(5.0)	239	241
10/15/02 Core Dry Weather Pre-Storm Sampling													
CRBL02	0.002	1.40	0.770	2.1	410	46	ND(1.0)	5.00	ND(.20)	2.6	ND(5.0)	103	103
CRBL05	0.004	1.40	0.770	2.2	575	64	2.8	5.00	ND(.20)	5.2	ND(5.0)	144	145
CRBL06	0.004	1.40	0.770	2.2	647	72	3.7	5.00	ND(.20)	6.7	ND(5.0)	162	163
CRBL07	0.004	1.40	0.770	2.3	863	96	6.9	5.00	ND(.20)	12.0	ND(5.0)	216	218
CRBL09	0.003	1.40	0.770	2.3	944	105	8.1	5.00	ND(.20)	14.3	ND(5.0)	236	238
CRBL11	0.004	1.40	0.770	2.5	1075	119	10.5	5.00	ND(.20)	18.7	ND(5.0)	269	271

(highlighted) **= meets or exceeds the chronic criterion**

ND=not detected above the associated detection limit.

Table 6: Priority Pollutant Metals <u>Wet Weather</u> Concentrations and the Ambient Water Quality Criteria (AWQC)

STATION	Arsenic conc. (ug/l)	Arsenic AWQC Acute (ug/l)	Arsenic AWQC Chronic (ug/l)	Cadmium conc. (ug/l)	Cadmium AWQC Acute (ug/l)	Cadmium AWQC Chronic (ug/l)	Chromium conc. (ug/l)	Chromium AWQC Acute (ug/l)	Chromium AWQC Chronic (ug/l)	Copper conc. (ug/l)	Copper AWQC Acute (ug/l)	Copper AWQC Chronic (ug/l)	Lead conc. (ug/l)	Lead AWQC Acute (ug/l)	Lead AWQC Chronic (ug/l)
9/15/02 Core Wet Weather First Flush Sampling															
CRBL02	0.7	340	150	ND(.20)	4.0	2.1	2.0	543	71	2.8	12.7	8.5	ND(.20)	60.5	2.4
CRBL05	1.4	340	150	ND(.20)	6.3	2.9	2.4	766	100	4.4	18.9	12.2	ND(.20)	95.4	3.7
CRBL06	1.8	340	150	ND(.20)	7.4	3.3	2.2	867	113	5.0	21.8	13.9	ND(.20)	112.3	4.4
CRBL07	2.7	340	150	ND(.20)	11.1	4.3	2.2	1172	152	7.5	30.8	19.0	ND(.20)	166.0	6.5
CRBL09	2.9	340	150	ND(.20)	11.5	4.4	2.4	1209	157	8.8	31.9	19.6	ND(.20)	172.7	6.7
CRBL11	3.3	340	150	ND(.20)	12.6	4.7	2.5	1294	168	9.7	34.5	21.1	ND(.20)	188.5	7.3
9/27/02 Core Wet Weather First Flush Sampling															
CRBL02	0.7	340	150	ND(.20)	3.6	2.0	0.9	505	66	3.2	11.7	7.9	0.2	55.0	2.1
CRBL05	1.1	340	150	ND(.20)	4.7	2.4	1.1	617	80	4.6	14.7	9.7	ND(.20)	71.8	2.8
CRBL06	1.2	340	150	ND(.20)	4.7	2.4	0.9	617	80	4.8	14.7	9.7	ND(.20)	71.8	2.8
CRBL07	2.7	340	150	ND(.20)	10.0	4.0	1.0	1086	141	9.2	28.2	17.6	ND(.20)	150.5	5.9
CRBL09	2.9	340	150	ND(.20)	10.3	4.1	1.1	1113	145	10.0	29.0	18.0	ND(.20)	155.3	6.1
CRBL11	3.2	340	150	ND(.20)	11.5	4.4	1.0	1205	157	12.0	31.8	19.6	ND(.20)	172.1	6.7
10/16/02 Core Wet Weather First Flush Sampling															
CRBL02	0.5	340	150	ND(.20)	3.8	2.1	1.5	518	67	3.0	12.1	8.1	0.3	57.0	2.2
CRBL05	0.9	340	150	ND(.20)	4.6	2.3	1.0	600	78	4.6	14.3	9.5	0.3	69.2	2.7
CRBL06	1.4	340	150	ND(.20)	6.0	2.8	1.6	742	96	5.7	18.2	11.8	0.3	91.5	3.6
CRBL07	2.4	340	150	ND(.20)	9.8	3.9	1.6	1066	139	9.0	27.6	17.2	ND(.20)	146.9	5.7
CRBL09	2.9	340	150	ND(.20)	11.9	4.5	1.8	1235	161	11.5	32.7	20.1	ND(.20)	177.6	6.9
CRBL11	3.2	340	150	ND(.20)	12.6	4.7	1.2	1293	168	12.8	34.5	21.1	ND(.20)	188.3	7.3
10/16/02 Core Wet Weather Peak Flow Sampling															
CRBL02	0.7	340	150	ND(.20)	3.0	1.8	1.1	436	57	5.2	9.9	6.8	0.7	45.2	1.8
CRBL05	0.8	340	150	ND(.20)	4.2	2.2	1.7	560	73	5.0	13.2	8.8	0.4	63.1	2.5
CRBL06	1.1	340	150	ND(.20)	4.8	2.4	1.6	619	81	5.7	14.8	9.8	0.5	72.1	2.8
CRBL07	2.5	340	150	ND(.20)	9.7	3.9	1.7	1063	138	8.6	27.5	17.2	0.3	146.4	5.7
CRBL09	3.0	340	150	ND(.20)	11.6	4.4	1.9	1218	158	11.5	32.2	19.8	ND(.20)	174.5	6.8
CRBL11	3.0	340	150	ND(.20)	11.9	4.5	1.6	1241	161	12.0	32.9	20.2	ND(.20)	178.7	7.0
10/18/02 Wet Weather, Post-Storm Sampling															
CRBL02	0.6	340	150	ND(.20)	3.5	1.9	1.7	487	63	3.6	11.2	7.6	0.4	52.4	2.0
CRBL05	0.7	340	150	ND(.20)	3.9	2.1	1.9	536	70	5.3	12.5	8.4	0.6	59.5	2.3
CRBL06	1.1	340	150	ND(.20)	5.0	2.5	1.8	639	83	5.9	15.3	10.1	0.5	75.1	2.9
CRBL07	1.9	340	150	ND(.20)	7.4	3.3	1.9	867	113	7.4	21.8	13.9	0.4	112.4	4.4
CRBL09	2.4	340	150	ND(.20)	9.8	3.9	2.0	1066	139	9.2	27.6	17.2	ND(.20)	146.9	5.7
CRBL11	2.9	340	150	ND(.20)	11.5	4.4	1.9	1209	157	13.1	31.9	19.6	0.2	172.7	6.7

= meets or exceeds the chronic criterion

ND=not detected above the associated detection limit.

Table 6: Priority Pollutant Metals Wet Weather Concentrations and the Ambient Water Quality Criteria (AWQC) - continued

STATION	Mercury conc. (ug/l)	Mercury AWQC Acute (ug/l)	Mercury AWQC Chronic (ug/l)	Nickel conc. (ug/l)	Nickel AWQC Acute (ug/l)	Nickel AWQC Chronic (ug/l)	Selenium conc. (ug/l)	Selenium AWQC Chronic (ug/l)	Silver conc. (ug/l)	Silver AWQC Acute (ug/l)	Zinc conc. (ug/l)	Zinc AWQC Acute (ug/l)	Zinc AWQC Chronic (ug/l)
9/15/02 Core Wet Weather First Flush Sampling													
CRBL02	0.001	1.40	0.770	1.8	445	49	ND(1.0)	5.00	ND(.20)	3.1	ND(5.0)	111	112
CRBL05	0.005	1.40	0.770	2.0	635	71	3.5	5.00	ND(.20)	6.4	ND(5.0)	159	160
CRBL06	0.003	1.40	0.770	2.1	723	80	4.8	5.00	ND(.20)	8.3	ND(5.0)	181	182
CRBL07	0.003	1.40	0.770	2.2	986	110	9.3	5.00	ND(.20)	15.7	ND(5.0)	247	249
CRBL09	0.004	1.40	0.770	2.4	1018	113	9.7	5.00	ND(.20)	16.7	ND(5.0)	255	257
CRBL11	0.003	1.40	0.770	2.4	1093	121	11.6	5.00	ND(.20)	19.3	ND(5.0)	274	276
9/27/02 Core Wet Weather First Flush Sampling													
CRBL02	0.001	1.40	0.770	2.1	414	46	ND(1.0)	5.00	ND(.20)	2.7	ND(5.0)	103	104
CRBL05	0.007	1.40	0.770	1.8	508	56	1.8	5.00	ND(.20)	4.1	ND(5.0)	127	128
CRBL06	0.008	1.40	0.770	1.9	508	56	2.1	5.00	ND(.20)	4.1	ND(5.0)	127	128
CRBL07	0.005	1.40	0.770	2.2	912	101	8.1	5.00	ND(.20)	13.4	ND(5.0)	228	230
CRBL09	0.006	1.40	0.770	2.3	935	104	9.1	5.00	ND(.20)	14.1	ND(5.0)	234	236
CRBL11	0.003	1.40	0.770	2.3	1015	113	9.7	5.00	ND(.20)	16.6	ND(5.0)	254	256
10/16/02 Core Wet Weather First Flush Sampling													
CRBL02	0.002	1.40	0.770	2.0	425	47	ND(1.0)	5.00	ND(.20)	2.8	ND(5.0)	106	107
CRBL05	0.008	1.40	0.770	2.0	494	55	1.5	5.00	ND(.20)	3.8	ND(5.0)	124	125
CRBL06	0.008	1.40	0.770	2.2	615	68	3.2	5.00	ND(.20)	6.0	ND(5.0)	154	155
CRBL07	0.007	1.40	0.770	2.3	895	99	7.5	5.00	ND(.20)	12.9	ND(5.0)	224	226
CRBL09	0.004	1.40	0.770	2.4	1041	116	9.3	5.00	ND(.20)	17.5	ND(5.0)	261	263
CRBL11	0.003	1.40	0.770	2.4	1092	121	10.2	5.00	ND(.20)	19.3	ND(5.0)	274	276
10/16/02 Core Wet Weather Peak Flow Sampling													
CRBL02	0.007	1.40	0.770	2	356	39	ND(1.0)	5.00	ND(.20)	2.0	8.7	89	90
CRBL05	0.010	1.40	0.770	2.2	460	51	1.1	5.00	ND(.20)	3.3	ND(5.0)	115	116
CRBL06	0.017	1.40	0.770	2.2	510	57	2.0	5.00	ND(.20)	4.1	6.2	128	129
CRBL07	0.011	1.40	0.770	2.3	892	99	7.6	5.00	ND(.20)	12.8	ND(5.0)	223	225
CRBL09	0.005	1.40	0.770	2.6	1027	114	9.0	5.00	ND(.20)	17.0	ND(5.0)	257	259
CRBL11	0.004	1.40	0.770	2.5	1046	116	10.0	5.00	ND(.20)	17.7	ND(5.0)	262	264
10/18/02 Wet Weather, Post-Storm Sampling													
CRBL02	0.003	1.40	0.770	2.0	398	44	ND(1.0)	5.00	ND(.20)	2.5	ND(5.0)	100	100
CRBL05	0.004	1.40	0.770	2.0	440	49	ND(1.0)	5.00	ND(.20)	3.0	5.4	110	111
CRBL06	0.003	1.40	0.770	2.0	527	59	2.2	5.00	ND(.20)	4.4	ND(5.0)	132	133
CRBL07	0.006	1.40	0.770	2.1	723	80	5.3	5.00	ND(.20)	8.3	5.2	181	182
CRBL09	0.004	1.40	0.770	2.3	894	99	7.4	5.00	ND(.20)	12.9	ND(5.0)	224	226
CRBL11	0.003	1.40	0.770	2.4	1018	113	9.5	5.00	ND(.20)	16.7	ND(5.0)	255	257

(highlighted) = meets or exceeds the chronic criterion

ND=not detected above the associated detection limit.

5.6 Data Usability

Quality control criteria were established for all data presented in this report. The criteria specify: holding times, sample preservation, and precision and accuracy limits. Holding times were met for all samples. The quality control requirements for this project were documented in the Project Work/QA Plan - Charles River Clean 2005 Water Quality Study June 2,1999 and in the addendum dated June 10, 2002.

Instruments used in the field to measure temperature, DO, pH, specific conductance, salinity, turbidity, and transmissivity were calibrated prior to sampling and checked after use. Field monitoring data that did not meet the established quality control criteria were not presented in this report. Field data that partially met the criteria were reported as estimated data and identified with a swung dash (~) preceding the value. Duplicate field measurements (temperature, DO, pH, specific conductance, salinity, and turbidity) were measured during three sampling events. All the measured duplicate values recorded a relative percent difference of 12 or less. The Project Work/QA Plan did not specify goals for these parameters.

Chemistry data that partially met laboratory quality control criteria or concentrations that were less than the associated reporting limit were considered estimated values and identified with a swung dash (~) preceding the value. Field duplicate chemistry samples were collected during each of the thirteen sampling events to evaluate sampling and analytical precision. During TMDL and dry weather Core Monitoring Program sampling events each of the two teams collected duplicate samples. Twenty-three of the 193 duplicate samples (excluding metals and field measurements) analyzed during the sampling events did not meet the precision quality control goal of less than 35 relative percent difference established in the Project Work/QA Plan. The data not meeting the criteria are described below. Fifteen of the duplicate samples were for fecal coliform and E. coli, which can have large variation in the environment. All these duplicate counts were within the same magnitude as the collected sample. The use of this data was not limited for this project. Four of the duplicate samples not meeting the established criteria were for nitrate. For the purpose of this report the data use was not limited since the laboratory quality control data were well with in laboratory quality control limits. Two of the duplicate samples were for Chlorophyll a. Since there were limited laboratory quality control data for these data the associated data for these duplicated samples were reported as estimated and were identified with a swung dash (~) preceding the value. There was one field duplicate samples that was above the 35 relative percent difference for Ammonia. The ammonia laboratory duplicate data was elevated, therefore the data associated with this field duplicate were reported as estimated and were identified with a swung dash (~) preceding the value.

Nine of 220 duplicate samples for the dissolved metals and total mercury analyzed during the ten sampling events did not meet the precision quality control goal of less than 35 relative percent difference. These eight duplicate samples occurred during four different sampling events for cobalt and during two sampling events for chromium and one of the sampling events for antimony, manganese, and mercury. With the exception of one chromium sample all the laboratory quality control samples for these data were within the laboratory quality control limits. The chromium data associated with this duplicated result were reported as estimated values since the laboratory duplicate data were out of the quality control range. The project use of the other metals data where the field duplicate did not meet the goal was not limited for this project.

For the chemistry analyses, trip blanks were used to evaluate any contamination caused by: the sample container, sample preservation, sampling method, and/or transportation to the laboratory. An equipment blank was used to evaluate contamination from the above parameters and from the Teflon chlorophyll a core and the Van Dorn depth sampler. A filter blank was used to evaluate contamination to the dissolved metal samples from the filter, sampling equipment, sample container, sample preservation, sampling method, and/or transportation to the laboratory.

Sample results were evaluated using the results of the associated blank for that sampling day. If the blank result was reported as "ND" (non detect) the use of the data was not limit it any way. If a sample result was less than or equal to five times the associated positive blank value, the sample result was denoted by "ND" following the sample result. For the purpose of this report these data were evaluated as estimated values. True color, Chlorophyll a, TKN, copper and manganese were the only parameters where this occurred. No filter blank was collected on the November 16 sampling event. The data for this sampling event were evaluated using the highest blank value that was reported during all other sampling events. The Appendix contains all the validated data for this report

6.0 2003 STUDY DESIGN

In 2003, the Core Monitoring Program will continue unchanged. Although, the additional monitoring conducted during 2002 to support development of a eutrophication TMDL will be discontinued. Targeted pipe monitoring will continue in 2003 at identified hot spots in the Basin for fecal coliform and E. coli bacteria. Future monitoring may change as different data needs arise.

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