

**City of Cambridge, Water Department**  
 250 Fresh Pond Parkway, Cambridge, MA 02138  
 Monthly Water Quantity and Quality Report  
 June 2010



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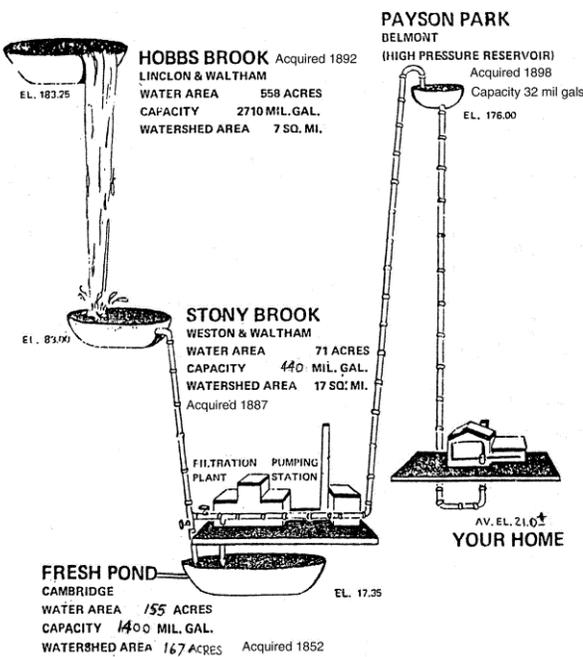
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The data contained in this report is for informational purposes only subject to verification and not intended for regulatory compliance.

**SOURCE of  
 CAMBRIDGE  
 WATER SUPPLY**



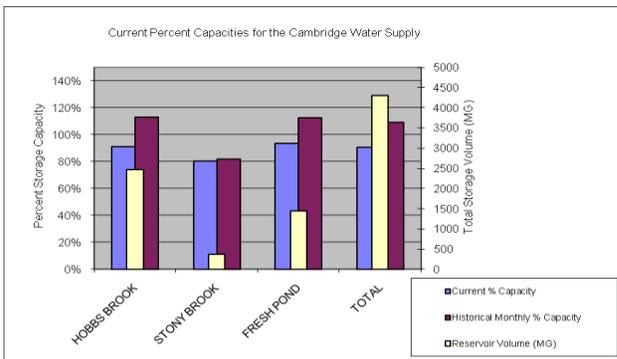
**Water Supply**

The Cambridge water supply system consists of four reservoirs and their tributaries located in Lexington, Waltham, Lincoln, Weston, Cambridge and Belmont. The two primary water sources, Hobbs Brook Reservoir and Stony Brook Reservoir, flow to the terminal reservoir, Fresh Pond, located in Cambridge, via the Stony Brook conduit. The water is then purified and pumped to Payson Park Reservoir, two 16 million gallon drinking water clearwells located in Belmont at a maximum elevation of 181 feet, where it is further disinfected with chloramines and distributed to the city by gravity. The largest of the reservoirs, Hobbs Brook, reaches its maximum elevation at 181.3 feet above sea level, its maximum depth at approximately 25 feet, and at full capacity, holds approximately 2.5 billion gallons of water. Stony Brook Reservoir reaches its maximum elevation at 80.6 feet above sea level, its deepest point is at approximately 35 feet, and at full capacity, it contains roughly 455 million gallons of water-revised 2009. Fresh Pond Reservoir reaches its maximum elevation at 17 feet above sea level, its maximum depth at 50 feet, and at full capacity, holds roughly 1.5 billion gallons.

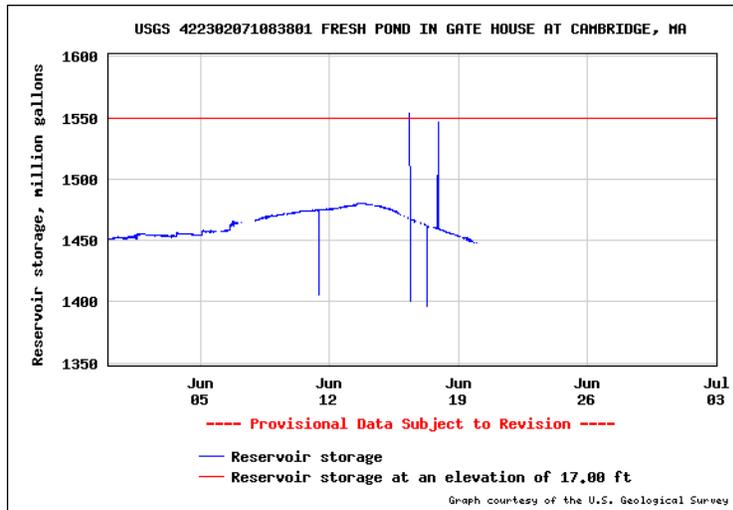
While the Watershed's primary storage reservoir is Hobbs Brook, in the winter and spring months it is largely unused. Due to its vast size, and relatively small watershed, Hobbs Brook is slow to fill up. This winter hiatus is necessary for Hobbs to regain the water it uses in the summer months. Conversely, Stony Brook is relatively small compared to its large watershed and fills much faster than Hobbs Brook. Due to this condition, Stony Brook is used in place of Hobbs during the winter months. During times of high water flow, the Cambridge Watershed, via Stony Brook, overflows its surplus water into the Charles River.

**Current Conditions: (7/02/10)**

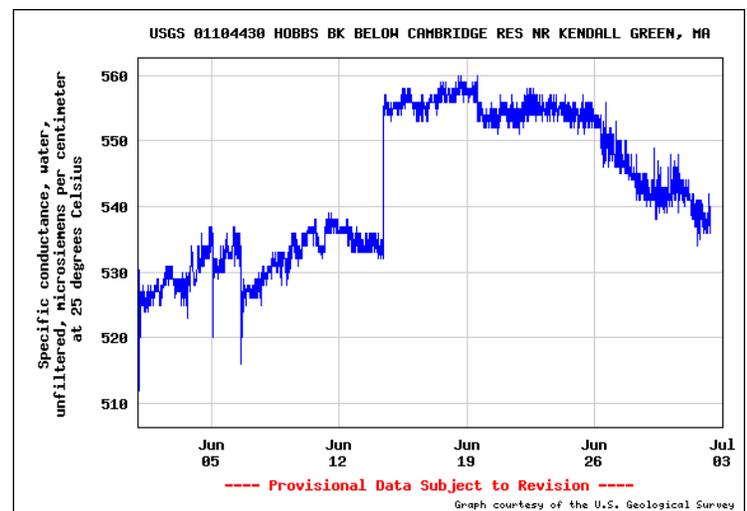
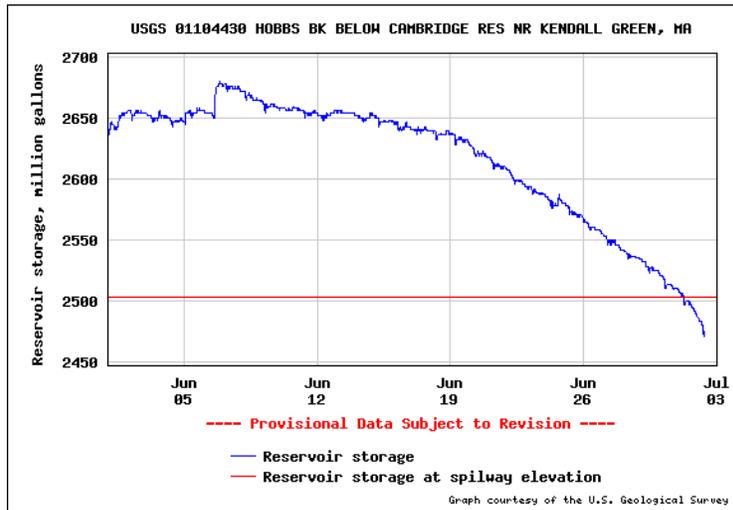
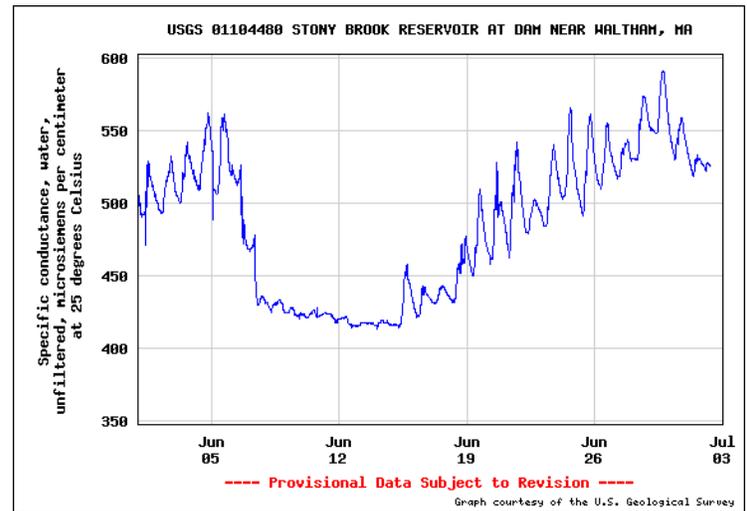
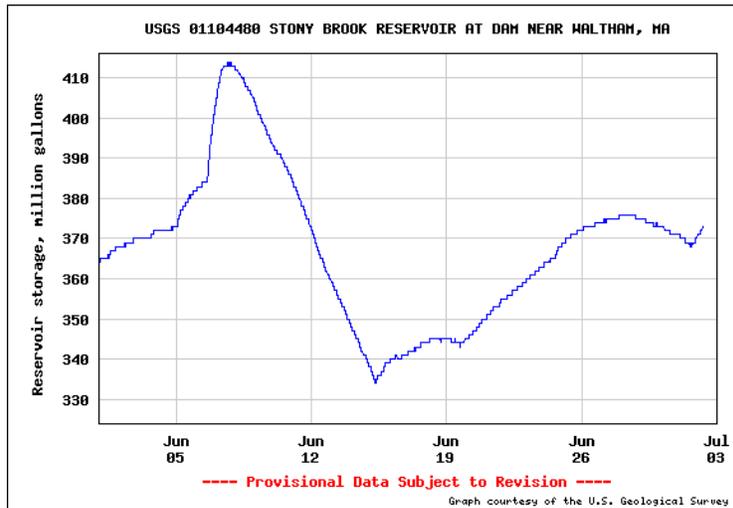
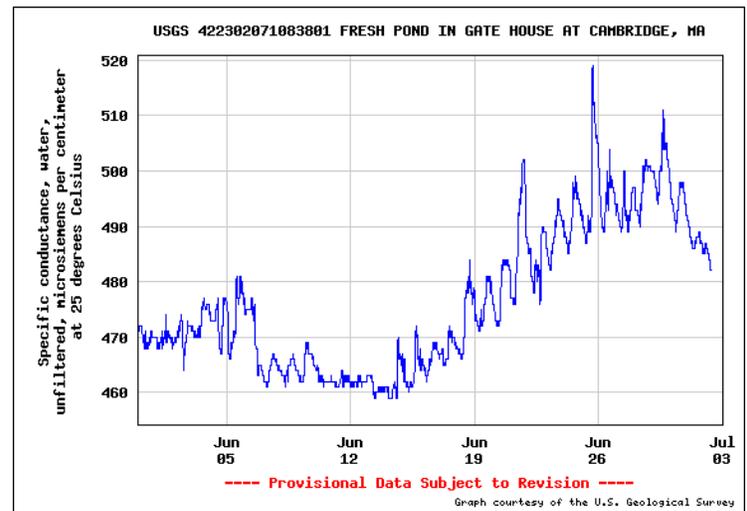
The reservoir system is at 91% capacity. The reservoir system is currently at 113% of historical capacity for this time of year. Hobbs Brook Reservoir current storage volume is 2,475 Million Gallons (MG) or 91%. Stony Brook Reservoir has a current storage volume is 373 MG or 80% and is filling with water coming from the Hobbs Brook watershed. Fresh Pond Reservoirs current storage volume is 1,448 MG or 93%. The average daily demand is 14.45 Million Gallons per Day (MGD). Days of supply remaining without recharge: 226 or 7.5 months.



## Reservoir storage levels



## Reservoir Water Specific Conductance



**Water Demand**

-Cambridge City Population: 101,355

Million Gallons (MG) - Gallons per Minute (GPM)

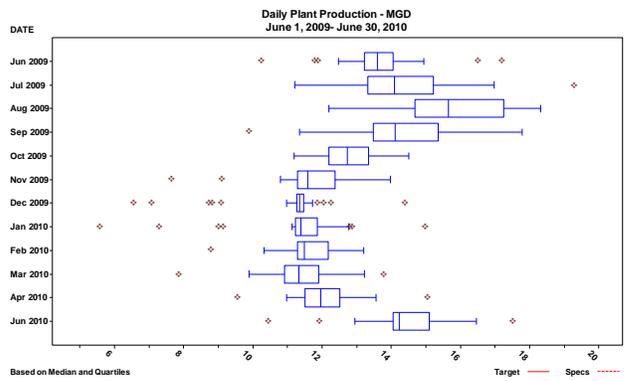
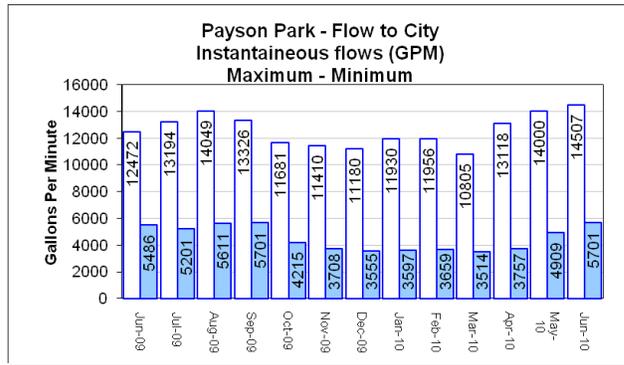
Maximum instantaneous demand:

06/29/10 at 07:45 am: 14,507 GPM  
Hydrant flushing program

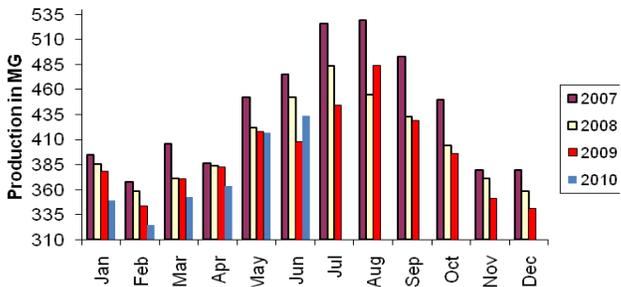
Minimum instantaneous demand:

06/10/10 at 03:23 am: 5,701 GPM

Average daily water demand for 2010 (to date): 12.40 MG  
 Average daily water demand 2009: 13.00 MG  
 Average daily water demand June 2010: 14.45 MG  
 Average daily water demand June 2009: 13.60 MG  
 Monthly Water Demand June 2010: 433 MG  
 Monthly Water Demand June 2009: 408 MG  
 Total water produced for 2010(to date): 2,240 MG  
 Total water produced for 2009: 4,748 MG



**Monthly Plant Production**



**Source Water Quality**

**Hobbs Brook Reservoir at intake**

E-Coli Bacteria- Average: 23 CFU/100mL  
 TOC Average: 4.07 mg/L  
 UV 254 Average: 0.140 A/cm  
 Alkalinity(as CaCO<sub>3</sub>): Average: 151 mg/L  
 Sodium Average: 94 mg/L  
 Chloride Average: 135 mg/L  
 Bromide Average: 0.083 mg/L  
 Turbidity- Average: 1.11 NTU  
 Conductivity- Average: 522 umhos/cm  
 pH- Average: 7.42

**Stony Brook Reservoir at intake**

E-Coli Bacteria- Average: 8 CFU/100mL  
 TOC Average: 4.30 mg/L  
 UV 254 Average: 0.158 A/cm  
 Alkalinity(as CaCO<sub>3</sub>): Average: 26.0mg/L  
 Sodium Average: 63 mg/L  
 Chloride Average: 107 mg/L  
 Bromide Average: 0.054 mg/L  
 Turbidity Average: 1.2 NTU  
 Conductivity- Average: 400 umhos/cm  
 pH- Average: 7.62

**Fresh Pond Reservoir at intake**

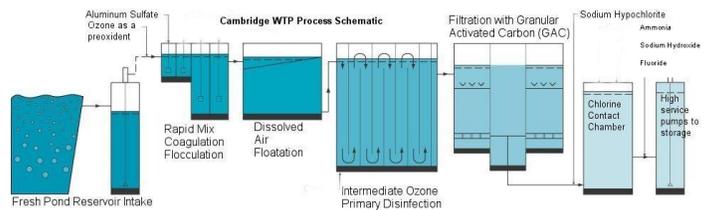
E-Coli Bacteria- Average: 20 CFU/100mL  
 TOC Average: 3.50 mg/L  
 UV254 Average: 0.107 A/cm  
 SUVA Average: 3.6  
 Sodium Average: 59.5 mg/L  
 Chloride Average: 111 mg/L  
 Bromide Average: 0.065 mg/L  
 Alkalinity (as CaCO<sub>3</sub>) Average: 29.0 mg/L  
 Turbidity- Average: 0.85 NTU  
 Conductivity- Average: 438umhos/cm  
 pH- Average: 7.46  
 Temperature: Average: 17°C

**Cryptosporidium and Giardia**

As part of the Long Term 2 Enhanced Surface Water Treatment Rule monitoring Cambridge has collected 24 samples for *Cryptosporidium* and *Giardia* since February 2006. The monitoring is population based. Hence systems with populations >100,000 must collect 24 raw water samples over a two year period. The *Cryptosporidium* results are the basis for *bin assignment* on the Running Annual Average (RAA). Bin Classification: Systems with an RAA *Crypto* concentrations of <0.75 (Oo) cysts per liter are placed in Bin 1 for which no additional treatment is required. To date none of the samples have detected any *Cryptosporidium* and one sample out of 24 detected *Giardia* at 0.1 cysts/L.

**Endocrine Disruptors, Pharmaceuticals, Personal Care Products**

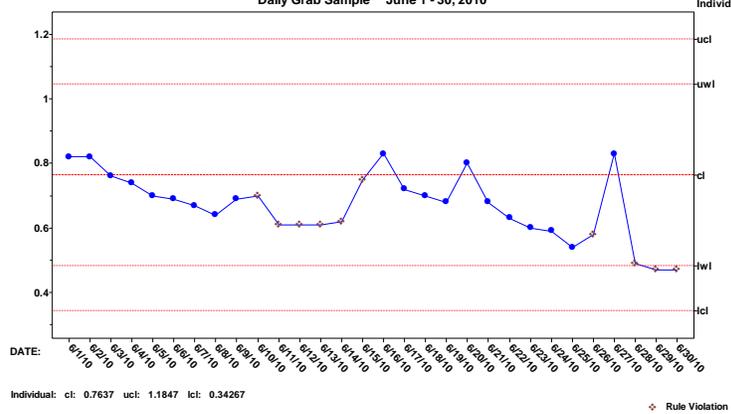
In response to the concern about the possibility of these unregulated compounds in municipal tap water, the Water Department tested the tap water in March 2008 for 86 compounds and did not detect any in the tap water. Follow up sampling in September 2008 detected the following compounds in the tap water: Acetaminophen at 0.019 micrograms per liter (ug/L) and Nicotine at 0.007 ug/L, Monitoring will continue twice a year. March 2009: Cotinine at 0.001 ug/L. September 2009: No Detects, March 2010 0.003 ug/L Atenolol



## Turbidity

Turbidity is a measure of suspended and colloidal particles including clay, silt, and inorganic matter, algae, and microorganisms. Turbidity is determined by a technique involving the measurement of light scattered at right angles in a water sample. The more of the source light that is scattered the more (the higher) the turbidity. The units of measurement for turbidity are Nephelometric Turbidity Units (NTU's).

Fresh Pond Reservoir Untreated Water Turbidity - NTU  
Daily Grab Sample June 1 - 30, 2010



## Finished Water Quality

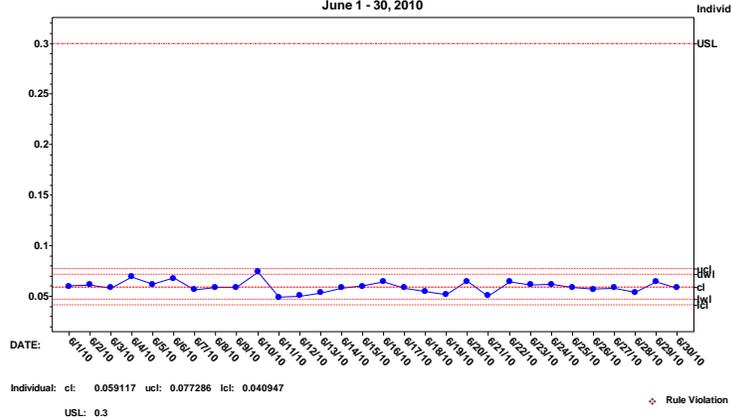
### Turbidity

The Surface Water Treatment Rule (SWTR) establishes performance goals for finished water turbidity. The pretreatment turbidity goal is to be less than 1 NTU. A conventional filtration plant is considered in compliance if the filtered water turbidity is less than 0.3 NTU in 95 % of its samples.

Turbidity is measured through the treatment process as a measure of treatment effectiveness. In the watershed and in the reservoirs turbidity may indicate the presence of silt from storm events or the presence of algae. In the pretreatment e.g. rapid mix, flocculation, and Dissolved Air Flotation (DAF) portion of the plant turbidity is used indicator of process efficiency. Turbidity of the filter effluent is used both as a process efficiency and regulatory indicator of performance.

The effects of turbidity depend on the nature of the matter that causes the turbidity. High levels of particulate matter may have higher chlorine demand or may protect bacteria from the disinfectant effects of ozone and chlorine, thereby interfering with the disinfectant residual throughout the distribution system. The turbidity through the cycle of each filter run is an indicator of the overall effectiveness of the filter process.

Combined Filter Effluent - Daily Grab Sample - NTU  
June 1 - 30, 2010

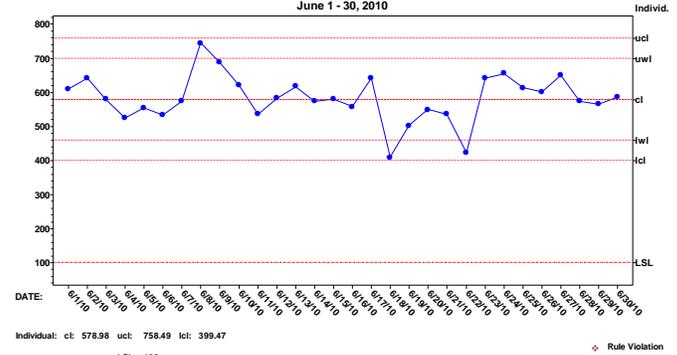


## Primary Disinfection - Ozone

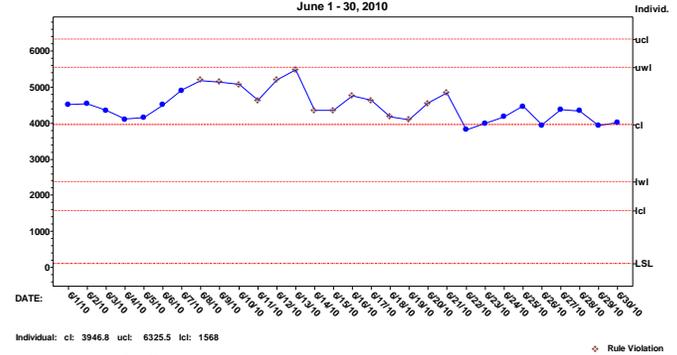
The CWD provides disinfection to achieve the EPA requirement for 99.9% inactivation of Giardia cysts and 99.99% inactivation of viruses in drinking water. Instead of measuring or counting Giardia and viruses, compliance is determined by a system operational standard, the measurement of the disinfection process. EPA has established a set of criteria for each disinfectant (ozone, free chlorine, and chloramines).

They are stated as CT values where C is concentration and T is time. The concentration C of the disinfectant in the water over time T yields a measure of the effectiveness of disinfection, CT. The required CT varies with the disinfectant type, water temperature, pH, and other factors. CWD measures CT in three places, intermediate ozone, free residual chlorine in the clearwell, and chloramines through the Payson Park Reservoir. The goal is to meet the minimum CT requirements with the intermediate ozone system at a concentration of 1.5 mg/L (milligram per liter) Ozone. The CT credited from the other two sources provides redundancy to the system. The following two graphs show the combined ozone and free chlorine CT.

Giardia CT Achievement  
Combined Ozone and Chlorine CT  
June 1 - 30, 2010



Virius CT Achievement  
Combined Ozone and Chlorine CT  
June 1 - 30, 2010



## Secondary Disinfection - Chloramines

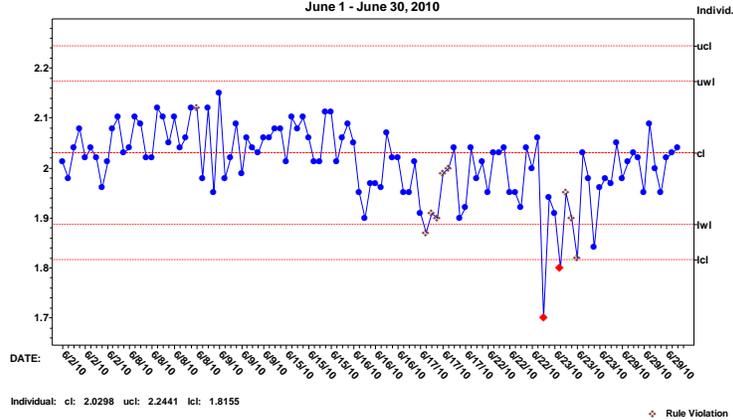
Regulations require a minimum of a 0.2 mg/L concentration of disinfectant throughout the distribution system. The higher values reflect the operational need for disinfection with free chlorine after the biological filters. A 15% solution of Sodium Hypochlorite is added at a concentration of 3.5 mg/L at the entrance the clearwell. The typical chlorine demand is approximately 1 mg/L this leaves a free residual chlorine concentration of 2.5 mg/L available for disinfection in the clearwell. It is this concentration of chlorine that's mixed with ammonia to create the level of chloramines measured as total residual chlorine using the HACH DPD Method.

## Chloramination

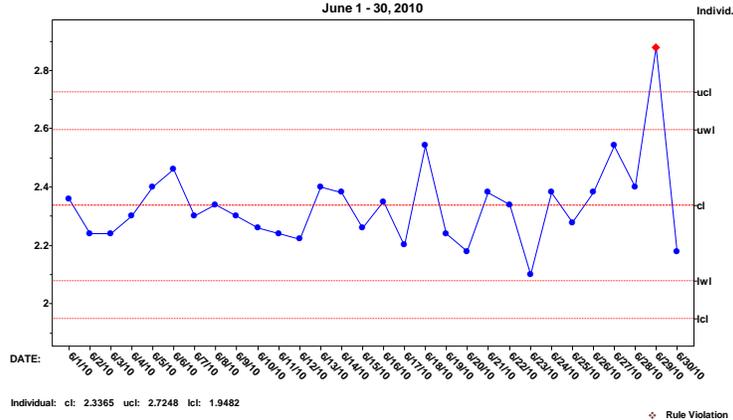
The practice of adding ammonia to chlorinated water is called Chloramination. This process is recognized for taste and odor control to reduce the undesirable medicinal taste of chlorinated water. It was first used in Greenville, Tennessee in 1926. This process can contribute to taste and odor control problems if not properly controlled. The formation of di- and tri-chloramines species is minimized by controlling the chlorine and ammonia ratios (3 to 4:1). A 30 % solution of Ammonium Hydroxide is added at a concentration of 0.5 mg/L. CWD's target chlorine to ammonia ratio is 4.5:1

## Distribution Chlorine Residual – mg/L

Distribution System Total Chlorine Residual as Chloramines - mg/L  
June 1 - June 30, 2010



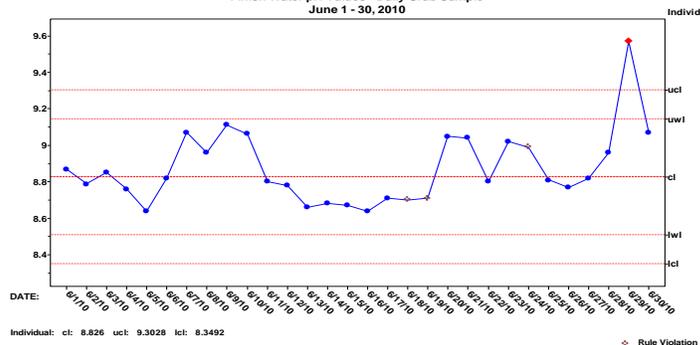
Finish Water Total Chlorine Residual as Chloramines - mg/L  
June 1 - 30, 2010



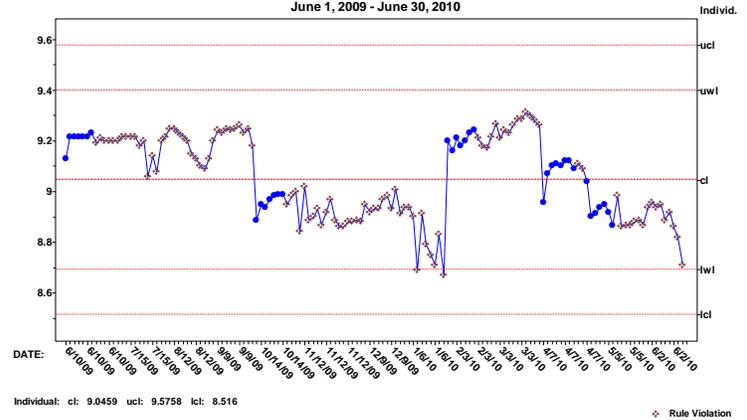
## Corrosion Control – pH adjustment

The National Primary Drinking Water Regulations (NPDWR) - Lead and Copper Rule establishes limits to the amount of lead and copper that may be in drinking water at the consumers tap. The Action Level for Lead is 15 ug/L (micrograms per liter). CWD is in compliance with the 2008 round of reduced sampling. CWD's 90<sup>th</sup> percentile is 9 ug/L. The Action Level for Copper is 1300 ug/L. CWD's 90<sup>th</sup> percentile was 32ug/L. Cambridge meets the requirements by reducing corrosiveness of the water by adjusting the to pH 9 with a 50% solution of Sodium Hydroxide (as of 1/26/09) at a concentration of 22 mg/L. This combined with the natural occurring alkalinity, hardness and dissolved minerals in the water minimizes the leaching of lead and copper from service lines and home plumbing systems, the source of lead and copper at the consumer tap. The target for distribution system pH is 9.1. On 9/24/09 Finish Water pH Set point reduced to 8.8. The High Lift Pumps Seized due to Calcium Carbonate scaling. This scale forms when the water temperature is over 20° C. Lowering Caustic addition at this time reduces this scaling.

Finish Water pH Values - Daily Grab Sample  
June 1 - 30, 2010



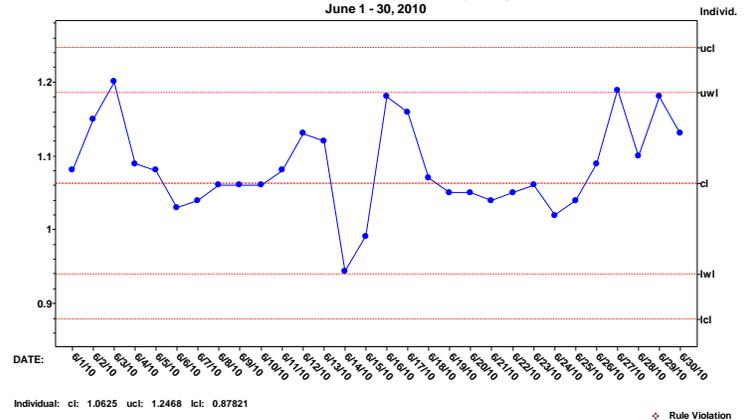
Distribution System pH Values - Samples Collected at TCR Sites  
June 1, 2009 - June 30, 2010



## Fluoridation

The Massachusetts Department of Health mandates that Drinking Water Systems fluoridate for the prevention of dental cavities. CWD adds a solution of 23% Hydrofluocyclic acid at a concentration of 1.0 mg/L. CWD targets the concentration at 1.1 mg/L. The Fluoride addition was stopped to determine the length of time the fluoride remains in the system. Estimated maximum water age is 12 days

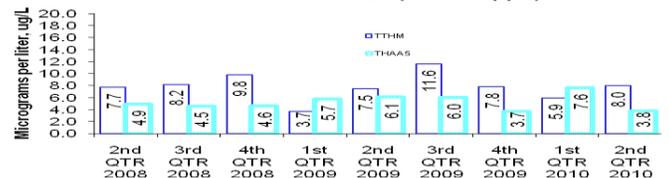
Finish Water Fluoride - Daily Grab Sample - mg/L  
June 1 - 30, 2010



## Disinfection By-Products

The incidence of waterborne diseases has been greatly reduced since the widespread implementation of drinking water disinfection. While a measurable public health benefit has been achieved, other potential risks may have been introduced. The presence of chloroform and other trihalomethanes (THMs) in finished drinking water was first associated with the chlorination of drinking water in 1974. It was discovered that in, addition to killing microorganisms disinfectants react with organic and inorganic substances naturally present in the water to produce a variety of disinfection by-products (DBPs), which include THMs. The DBPs associated with chlorination are THMs, haloacetic acids, haloacetonitriles and halopicrins. Ozonation may result in bromate formation. Nitrosodimethylamine (NDMA) is a by product of chloramination.

Cambridge Water Department  
Quarterly Trihalomethanes (limit 80 ppb) and Total Haloacetic acids (limit 60 ppb)



Total Organic Carbon(TOC) Survey																
CWD - TOC Removal Performance Summary																
Date	a. Raw		b. DAF Train 1		c. DAF Train 2		d. Filter Influent		e. Filter Influent		f. Finished Water		In/Out	Pretreatment	Filter	Alum dose
	mg/L	mg/L	1-b/a*100	mg/L	mg/L	1-c/a*100	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Percent Removal Efficiency	Percent Removal Efficiency	Percent Removal Efficiency	
			%			%						%	%	%	(in/out -pretreat)	
6/1/2009	3.69	1.97	47	1.98	46	1.94	1.4	1.91	3.5	1.63	56	49	6.8	26		
6/29/2009	3.54	1.82	48	1.88	47	1.70	7.0	1.73	8.0	1.49	58	55	2.7	33		
7/31/2009	3.77	1.81	52	1.80	52	1.69	6.7	1.69	5.9	1.41	63	58	4.3	30		
9/1/2009	3.80	1.81	52	2.01	47	1.56	13.8	1.50	25.4	1.36	64	69	-5.1	27		
9/29/2009	3.91	2.09	47	1.99	49	1.91	8.6	1.81	9.0	1.61	59	57	2.2	32		
10/19/2009	3.87	2.22	43	2.08	46	2.15	3.2	1.79	13.9	1.58	59	53	6.2	29		
11/30/2009	4.03	1.96	51	1.83	55	1.92	2.0	1.82	0.55	1.51	63	54	8.3	32		
12/31/2009	4.04	2.21	45	2.06	49	2.00	9.5	2.09	-1.5	1.62	60	51	8.7	30		
1/25/2010	4.07	2.13	48	2.16	47	2.05	3.8	2.12	1.9	1.63	60	50	9.8	31		
2/25/2010	3.75	2.00	47	1.96	48	1.87	6.4	1.91	2.5	1.50	60	52	8.3	27		
3/30/2010	3.10	1.37	56	1.43	54	1.47	-7.3	1.43	0.0	1.12	64	51	12.7	26		
4/28/2010	3.03	1.48	51	1.38	54	1.37	7.4	1.36	1.4	1.08	64	57	7.1	27		
5/13/2010	3.43	1.67	51	1.58	54	1.51	9.6	1.28	19.0	1.28	63	67	-4.2	27		
6/15/2010	3.70	2.04	45	1.94	48	1.78	12.7	1.77	8.8	1.57	58	57	0.6			
<b>Average</b>	<b>3.7</b>	<b>1.9</b>	<b>48.8</b>	<b>1.9</b>	<b>49.7</b>	<b>1.8</b>	<b>6.1</b>	<b>1.7</b>	<b>7.0</b>	<b>1.5</b>	<b>60.7</b>	<b>55.8</b>	<b>4.9</b>	<b>29.0</b>		

Units: Milligrams per Liter(mg/L)

Percentages do not add up to 100%

TOC samples a grab samples taken across the plant at a single time and not a single cohort of water

SUVA means the UV absorption at 254 nanometers (measured in 1/meters) divided by the dissolved organic carbon concentration (measured in mg/L).

### Cambridge Water Department Compliance Report for Enhanced Coagulation

Month	a. Treated TOC, mg/L	b. Source TOC, mg/L	c. Actual Removal(%) (1-a./b.)x100	Source Water Alkalinity	d. Required TOC Removal(%)	Compliance must be >1 e. c./d.
Jul-09	1.4	3.8	63	29.5	40	1.56
Aug-09	1.4	3.8	63	31.0	40	1.56
Sep-09	1.6	3.9	59	30.5	40	1.47
Oct-09	1.6	3.9	59	31.5	40	1.48
Nov-09	1.5	4.0	63	30.5	45	1.39
Dec-09	1.6	4.0	60	30.0	45	1.33
Jan-10	1.6	4.1	60	30.0	45	1.33
Feb-10	1.5	3.8	60	30.0	40	1.50
Mar-10	1.1	3.1	64	27.0	40	1.60
Apr-10	1.1	3.0	64	28.0	40	1.61
May-10	1.3	3.4	63	29.0	40	1.57
10-Jun	1.6	3.7	58	28.5	40	1.44
AVG last twelve mos.	1.4	3.7	61.5	30.0	41.4	1.5

If average last twelve months > 1.0, the system is in compliance.

		Alkalinity(mg/L)		
		<60	60-120	>120
Raw Water	<2	No Action	No Action	No Action
TOC	2 - 3.9	40%	30%	20%
	4 - 7.9	45%	35%	25%
	>8	50%	40%	30%

### Cambridge Water Department Laboratory

Massachusetts Certification Number M-MA149

Year	Month	Monthly Average Chlorine Residual (mg/L)	Monthly minimum Chlorine Residual (mg/L)	Samples tested for Coliform	Total samples positive	Percent Total samples positive	Fecal Coliform positive	Public Notification required
		2009	June	2.21	1.93	100	0	0
	July	2.15	1.88	100	0	0	0	no
	August	2.02	1.48	100	0	0	0	no
	September	2.27	1.80	100	0	0	0	no
	October	2.30	1.78	100	0	0	0	no
	November	2.07	1.68	100	0	0	0	no
	December	2.00	1.60	100	0	0	0	no
2010	January	1.91	1.71	100	0	0	0	no
	February	2.01	1.97	100	0	0	0	no
	March	2.04	1.93	100	0	0	0	no
	April	2.07	1.91	100	0	0	0	no
	May	2.06	1.95	100	0	0	0	no
	June	2.01	1.70	114	0	0	0	no

Massachusetts Water Resource Authority (MWRA) Toxic Reduction And Control (TRAC) program regulates discharge to the sewer system. The TRAC program classifies CWD as a Significant Industrial User (SIU) and has three permits for discharge: 0101 Residuals, 0102 Laboratory, and 0103 Truck Wash.

The EPA regulates discharge of clarified backwash water to Fresh Pond under the National Pollution Discharge Elimination System (NPDES) Act

Parameter	Daily Maximum Limit - <b>mg/L</b> Report Max. #	Monthly	Monthly	Semi-annual	Semi-annual	Semi-annual	Semi annual	Quarterly
		Residuals - 0101	Residuals - 0101	Lab Waste - 0102	Lab Waste - 0102	Truck Wash - 0103	Truck Wash - 0103	NPDES 1st QTR 2010
Aluminum (NPDES)	NR	NR	NR	NR	NR	NR	NR	1.58
Cadmium	0.1	<0.002	<0.010	NR	NR	<0.005	<0.005	NR
Copper	1.5	0.22	0.18	<0.010	<0.010	0.026	0.028	NR
Chromium	1	0.047	0.027	NR	NR	0.006	<0.01	NR
Lead	0.2	0.026	0.024	<0.01	10	0.027	0.013	NR
Nickel	1	0.058	0.042	<0.025	<0.025	0.010	<0.025	NR
Silver	2	<0.002	<0.010	NR	NR	NR	NR	NR
Zinc	1	0.25	0.20	NR	NR	0.17	0.434	NR
Arsenic	0.5	0.027	0.041	NR	NR	NR	NR	NR
Selenium	5	0.037	<0.050	NR	NR	NR	NR	NR
Antimony	10	<0.003	<0.010	NR	NR	NR	NR	NR
Mercury	>0.001	0.00029	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	NR
Total Residual Chlorine	Report Max.	NR	NR	NR	NR	NR	NR	0.15
Total Suspended Solids	<=3%	0.63%	0.46%	NR	NR	NR	NR	NR
TSS (NPDES)	50 (max)	NR	NR	NR	NR	NR	NR	9
PH (NPDES)	8.5 (max)	NR	NR	NR	NR	NR	NR	6.45
pH	5.5 - 10.5	6.52	6.52	7.52	7.56	8.02	7.66	NR
Cyanide	0.5	NR	NR	<0.005	<0.005	NR	NR	NR
Total Fats, Oil & Grease	<= 300	NR	NR	NR	NR	3.5	18	NR
Flow - Gallons/Day	1.0 MGD NPDES Reg.	44,280	47,880	88	32.5	22	50	0.76 MG
TTO (VOC)	Any analyte not to exceed 1 mg/L	NR	NR	NR	NR	All < 1mg/L	All < 1 mg/L	NR
TTO (ABN)	Any analyte not to exceed 1 mg/L	NR	NR	NR	NR	All < 1mg/L	All < 1mg/L	NR

NR= Not Required

CWD Monthly Water Quality Analysis

COMPARISON OF CAMBRIDGE TAP WATER With EPA & STATE STANDARDS							
PARAMETER	Cambridge mg/L	Primary (Health Related) Maximum Contaminant Level(MCL) mg/L	Secondary (Aesthetic Related) MCL mg/L	PARAMETER	Cambridge mg/L	Primary (Health Related) Maximum Contaminant Level(MCL) mg/L	Secondary (Aesthetic Related) MCL mg/L
Alkalinity (as CaCO <sub>3</sub> )	31			Magnesium	4.25		
Aluminum	0.020		0.05-0.2	UV254 A/cm	0.024		
Arsenic	<0.0005	0.05		Manganese	0.02		0.05
Barium	0.037	2		Mercury	<0.0001	0.002	
Cadmium	<0.0005	0.005		Nitrate (as Nitrogen)	0.468		
Calcium	20						
Chloride	116		250	pH	8.87		
Chlorine, Free	0.08	4.0 MRDL+		Selenium	<0.0005	0.05	
Chlorine, Total	2.24	4.0 MRDL+		Silver	<0.00015		0.1
Chromium	ND	0.1		Sodium	72		
Color	0		15 color units	Specific Conductance, umhos/cm @25C	538		
Copper	0.002	1.3		Standard Plate Count	0	500 C.F.U./1ml *	250
Dissolved Solids, Total	323		500	Sulfate	25		
Fluoride	1.08	4		Total Coliform	0	0 C.F.U./100ml	
Hardness (as CaCO <sub>3</sub> )	50			Total Haloacetic acids	5.3	60 ug/L (four quarter avg.)	
Iron	0.04		0.3	Total Trihalomethanes	8.2	80 ug/L (four quarter avg.)	
Saturation Index (SI)	+0.13			Turbidity		0.5 N.T.U filtered, 1.0	5
Lead	0	0.015		Zinc	<0.001		
+ MRDL = Maximum Residual Disinfectant Level				* C.F.U./1ML = Colony Forming Units per 1 milliliter			
Hardness in grains per gallon = 3				CWD FINISHED WATER SAMPLE COLLECTED:06/02/10			
NA = Not Analyzed				Analyzed by Cambridge Lab.			