



Massachusetts Water Resources Authority

JULY 20 1998

WATER QUALITY UPDATE

An Analysis of June, 1998 Sampling Data.

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June, 1998 Sampling Data pp. A-F
Special Supplement: Community Average Total Chlorine Residuals & MWRA Monthly Mineral Analysis

This is a periodic report containing important information about the quality of water supplied by MWRA. We hope this report is useful to you as a local water supplier, public health official, water consumer or observer of MWRA's system performance.

MWRA provides about 250 million gallons of water each day to 46 cities and towns in eastern and central Massachusetts. Each municipality is responsible for distributing the water in its own community. Twenty-five of the customer communities are fully supplied by MWRA. The other communities use MWRA water to augment their own supplies, either on a regular basis or in times of water shortage. More than two million people are served by the MWRA water supply system.

THE WATER SYSTEM

Quabbin Reservoir is the primary source of water for our system and one of the country's largest water supply impoundments with a capacity of 412 billion gallons. Water is transferred from the Quabbin Reservoir to the 65 billion gallon Wachusett Reservoir in Clinton via the Quabbin Aqueduct. The watersheds serving the Quabbin and Wachusett Reservoirs total 294 square miles. MWRA and the Metropolitan District Commission (MDC) are committed to protection of the water supply through aggressive watershed management as the first line of defense against water contamination.

Water is next piped from the Wachusett Reservoir to Norumbega and Weston Reservoirs in Weston via the

Hultman and Weston Aqueducts respectively. Most municipalities in the MWRA service area receive drinking water distributed directly from the Hultman Aqueduct, the Norumbega Reservoir and the Weston Reservoir. Six communities are supplied from Spot Pond and from Fells Reservoirs.

INDICATORS OF WATER QUALITY

MWRA routinely uses six general indicators of water quality:

- Microbial (bacteria and algae)
- Turbidity
- Corrosiveness (pH and alkalinity)
- Disinfectant
- Chemical (inorganic and organic)
- Radionuclides

Tests are conducted on water sampled at the source reservoirs (source water) and also on water after treatment sampled from MWRA or community lines (treated water). Testing frequencies vary by parameter.

Microbial: Algal levels in reservoirs are monitored by MDC and MWRA. These results, along with taste and odor complaints, are used to make decisions on source water treatment for algae control.

Total coliform bacteria are monitored in both source and treated water to provide an indication of overall bacteriological activity. Since many members of the coliform bacteria group originate from the non-intestinal environment, such as soil, many coliform are harmless. A subclass of the coliform group which are identified by their growth at temperatures consistent with intestinal environments, the "fecal coliform bacteria," are indicators of possible intestinal contamination. *Escherichia coli* (*E. coli*) is a specific coliform

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For further information regarding health concerns, please contact the **Department of Public Health/Division of Epidemiology at (617) 983-6800** or **Boston Health and Hospitals at (617) 534-5611**.

species that is almost always present in fecal material and whose presence indicates likely bacterial contamination of intestinal origin.

Turbidity: Turbidity is a measure of suspended and colloidal particles including clay, silt, organic and inorganic matter, algae and microorganisms. The effects of turbidity depend on the nature of the matter which causes the turbidity. Particulate matter may have a chlorine demand or may protect bacteria from the disinfectant effects of chlorine, thereby interfering with the maintenance of a disinfectant residual throughout the distribution system.

Corrosiveness: In order to minimize the leaching of lead and copper in plumbing systems, the pH, or corrosivity, is monitored and adjusted. Water provided by MWRA is basically lead free when it leaves the reservoirs but individual building service lines that carry water from street mains, as well as household plumbing fixtures, can contain lead that is susceptible to corrosion and leaching into tap water. In June 1996, MWRA's Interim Corrosion Control (ICC) facility in Marlborough went on-line. MWRA believes the ICC provides the optimal corrosion control treatment now achievable for all MWRA customer communities east of and including Marlborough. The chemicals sodium carbonate (soda ash) and CO₂ (carbon dioxide) are added to increase the pH and buffering capacity of the water which should considerably reduce the lead levels found when you first use your tap.

Disinfectant: MWRA treats the water supplied to metropolitan Boston area communities using disinfection facilities at Quabbin, Norumbega, Weston, Spot Pond and Fells Reservoirs. At Norumbega and Weston Reservoirs, chlorine is used to inactivate pathogens coming from source waters and, with the further addition of ammonia, chloramines are formed to establish a sufficient level of residual disinfectant to protect against any new contaminants that may enter the distribution system. In the communities served by the Fells Reservoir, chlorine is added to protect against contamination that may have entered the water locally at these open surface reservoirs. The water fed downstream of these sources has a free chlorine residual. Some communities in the furthest parts of the MWRA delivery system also rechlorinate as added protection.

Chemical: Inorganics and nitrates are measured at Quabbin and Wachusett Reservoirs. Analyses of disinfection byproducts such as trihalomethanes are performed at seven locations throughout the distribution system. Volatile organic compounds are measured at the distribution reservoirs: Norumbega, Weston and Spot Pond. Synthetic organic compounds are measured at Wachusett Reservoir. MWRA generally meets applicable standards.

Radionuclides: Radionuclides are measured at three distribution locations. MWRA generally meets applicable standards.

SAMPLING AND ANALYSIS

MWRA conducts all water sampling and testing required by federal and state law. We also conduct baseline and periodic research to help us improve water quality. Results of testing are compared to standards and guidelines prepared by DEP and recommendations for further action are made if reported levels are above the standards.

Source water: MWRA collects samples from the source water supply and reservoirs which are tested for coliform bacteria, turbidity, pH, chemical constituents and radionuclides.

Treated water: MWRA collects treated water samples throughout the system and conducts tests for pH, temperature, primary disinfectant levels, disinfectant residual and coliform bacteria. In addition, customer communities routinely collect treated water samples in compliance with federal Safe Drinking Water Act (SDWA) testing requirements including the Total Coliform Rule. These samples are analyzed for disinfectant residual and coliform bacteria.

Communities may bring their samples to the MWRA Water Quality Laboratory for analysis, or they may have samples analyzed elsewhere. MWRA Laboratories test samples for all customer communities except Bedford, Cambridge, Canton, Chicopee, Clinton, Leominster, Lynn, Marlborough, Northborough, Peabody, South Hadley, Wilbraham, Woburn and Worcester. Community data for these communities are not presented in this report.

MWRA

**SOURCE WATER - CHICOPEE VALLEY AQUEDUCT
FECAL COLIFORM LEVELS AT QUABBIN (AS MEASURED AT WINSOR
POWER STATION) AND NASH HILL RESERVOIRS**

June 1998

Target

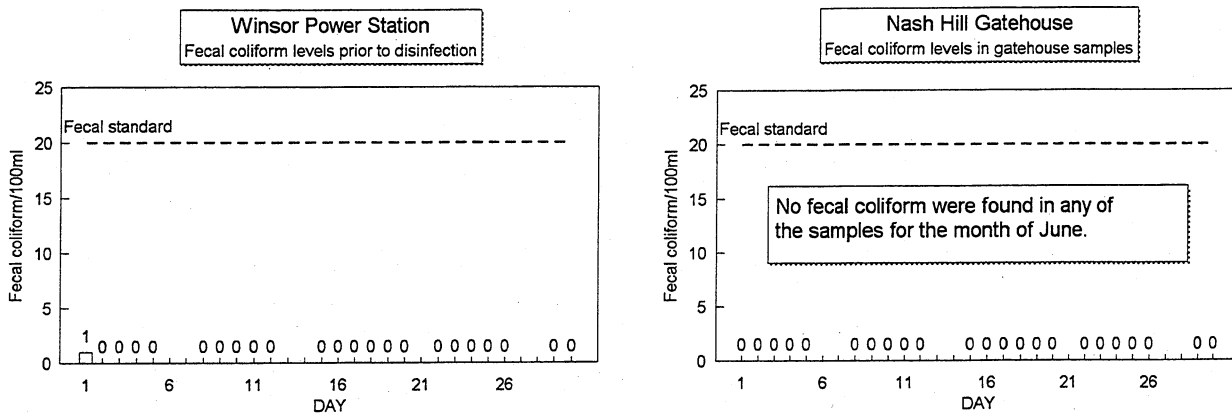
Quabbin Reservoir water is sampled at Winsor Power Station prior to chlorination and represents reservoir water entering the Chicopee Valley Aqueduct (CVA).

Samples from Nash Hill Reservoir are collected at a point where CVA water enters the gatehouse. Depending on whether the reservoir is filling or discharging, this sample may or may not contain a mix of aqueduct water with reservoir water. If the reservoir is filling, the sample will contain a chlorine residual from chlorination that occurs at Winsor Power Station.

The SDWA standard is that no more than 20 fecal coliform/100ml be present in 10% of samples over a 6-month period.

Highlights

Fecal coliform levels were well below the SDWA standard at Winsor Power Station. No fecal coliform were detected at Nash Hill Reservoir.



**SOURCE WATER - CHICOPEE VALLEY AQUEDUCT
TURBIDITY LEVELS AT QUABBIN RESERVOIR (AS MEASURED AT
WINSOR POWER STATION)**

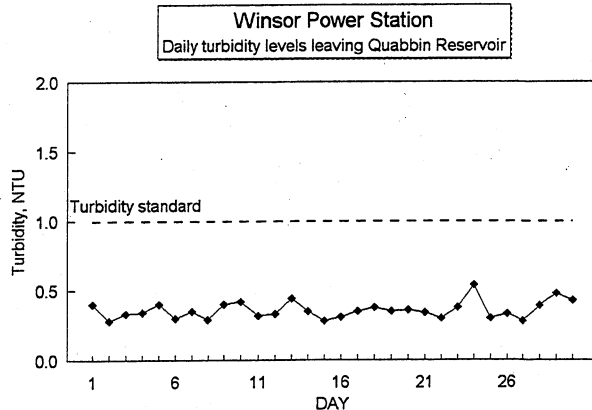
June 1998

Target

Quabbin reservoir samples for turbidity are collected at Winsor Power Station prior to chlorination and represent reservoir water entering the CVA. The Massachusetts Department of Environmental Protection standard for source water turbidity is 1.0 NTU.

Highlights

Turbidity levels at Winsor Power Station have remained well below the DEP standard and averaged 0.36 NTU over the month.



MWRA

SOURCE WATER FECAL COLIFORM LEVELS AT WACHUSETT RESERVOIR

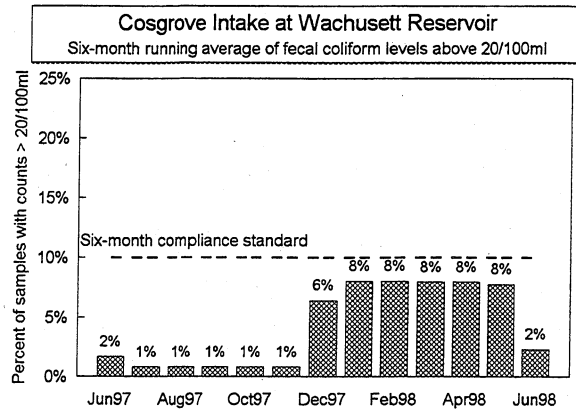
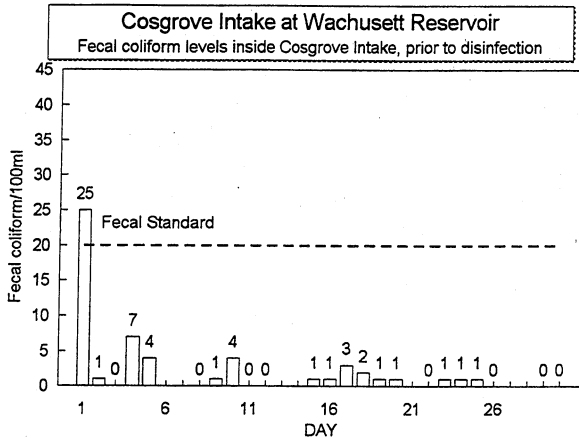
June 1998

Target

Samples from Wachusett Reservoir are collected at a location inside the Cosgrove Intake facility and represent water entering the Cosgrove Tunnel/Aqueduct. The Surface Water Treatment Rule (SWTR) standard of the SDWA for unfiltered surface supplies is that no more than 20 fecal coliform/100 ml be present in 10% of the samples over a 6-month period. The six month running average results present the percent of samples exceeding the standard during the previous 6 month period.

Highlights

Fecal coliform levels exceeded the SDWA standard on one occasion. Otherwise, levels remained below the standard at Wachusett Reservoir.



SOURCE WATER FECAL COLIFORMS IN NORUMBEGA RESERVOIR AND TURBIDITY LEVELS IN HULTMAN AQUEDUCT AT NORUMBEGA DISINFECTION FACILITY

June 1998

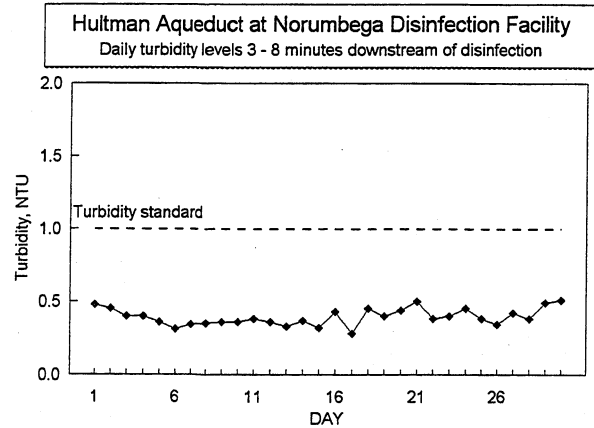
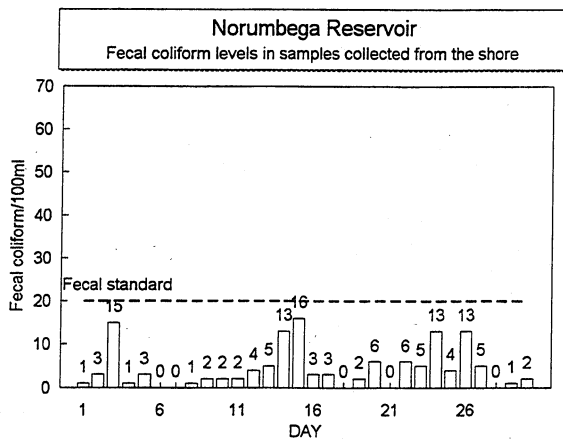
Target

Fecal coliform samples from Norumbega Reservoir are collected from the shore near the gatehouse. Flow from Norumbega Reservoir supplements flows from Wachusett Reservoir during periods of high demand. The SDWA standard is that no more than 20 fecal coliform/100 ml be present in 10% of the samples over a 6-month period.

Samples for turbidity are measured after chlorination in the Hultman Aqueduct. The Massachusetts Department of Environmental Protection standard for source water turbidity is 1.0 NTU.

Highlights

Fecal coliform levels remained below the SDWA standard at Norumbega Reservoir. Turbidity levels in the aqueduct have remained well below the DEP standard and averaged 0.39 NTU over the month.



TREATED WATER DISINFECTANT LEVELS IN HULTMAN AQUEDUCT AT NORUMBEGA DISINFECTION FACILITY AND COMMONWEALTH AVENUE PUMP STATION (ENTRY POINT INTO CUSTOMER DISTRIBUTION SYSTEMS)

June 1998

Target

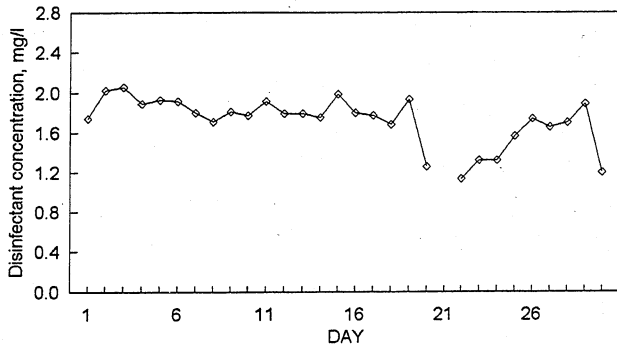
Disinfection at Norumbega Disinfection Facility has been improved to allow 3-8 minutes of contact time with free chlorine before adding ammonia. The disinfectant inactivates bacteria that may be present in the water as it leaves the Wachusett and Norumbega Reservoirs.

The target for total chlorine residual at Commonwealth Ave P.S. has been adjusted down to 1.7 mg/l to minimize concerns with nitrification, taste & odor, and DBP formation.

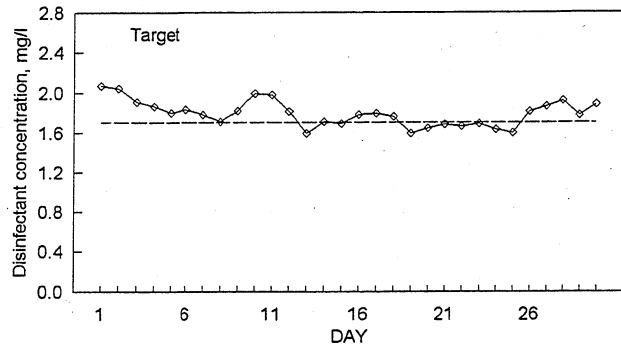
Highlights

Free chlorine levels have averaged 1.7 mg/l 3-8 minutes downstream of disinfection. The total chlorine residual measured at Commonwealth Avenue Pumping Station, the entry point to customer distribution systems, has averaged 1.8 mg/l over the month.

Hultman Aqueduct at Norumbega Disinfection Facility
Free chlorine residual 3-8 minutes downstream of primary disinfection



Commonwealth Avenue Pump Station
Total chlorine residual approx. 2 hours downstream of disinfection



TREATED WATER pH LEVELS AT COMMONWEALTH AVENUE PUMP STATION

June 1998

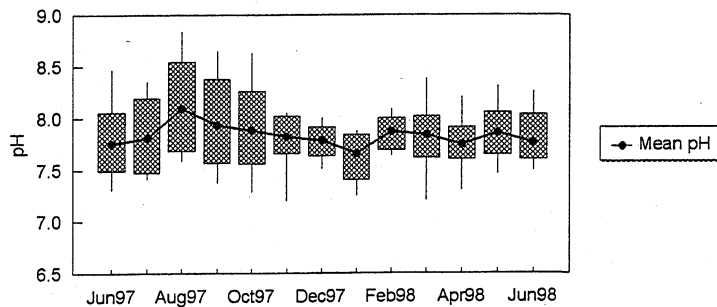
Target

MWRA adjusts the alkalinity and pH of Wachusett water to reduce its corrosivity in order to minimize the leaching of lead and copper from service lines and home plumbing systems into the water. In June 1996, the Interim Corrosion Control (ICC) facility went on-line and is providing corrosion control to communities east of and including Marlborough. The target pH is 7.8 (target range between 7.6 and 8.0 pH units).

Highlights

During the month of June, eighty percent of samples ranged between 7.6 and 8.0 pH units. The average pH was 7.8.

Commonwealth Avenue Pump Station pH
High, Low, 90th and 10th Percentile pH Values



MWRA

WATER QUALITY UPDATE FOR COMMUNITIES PARTICIPATING IN MWRA TESTING PROGRAM

June 1998

Target

Thirty-two cities and towns use the MWRA Laboratory for Total Coliform Rule compliance testing. The communities collect samples for bacteriological analysis and measure chlorine residual at the time of collection. The other 14 MWRA customer communities have their samples tested elsewhere and these towns should be contacted directly for their results.

The SDWA requires that no more than 5% of all samples may be total coliform positive in a month (or no more than 1 positive when less than 40 samples are collected each month). Public notification is required if this standard is exceeded.

If E. coli are detected in a drinking water sample, this is considered evidence of a critical public health concern. Additional testing is conducted immediately and joint corrective action by DEP, MWRA, and the community are undertaken. Public notification is required if follow-up tests confirm the presence of E. coli or total coliform.

A disinfectant residual of 0.2 mg/l is considered a minimum target level at all points in the distribution system.

Highlights

During the month of June, thirty of the thirty-two communities submitted samples with no coliform bacteria. Positive total coliform were identified in samples collected in Wellesley and Weston. No public notification was required. No E. coli were identified in any samples collected.

Thirty-one of the thirty-two communities submitting chlorine residual data maintained an average disinfectant residual of at least 0.2 mg/l. Twenty-three communities had 1 or more samples with a disinfectant residual of less than 0.2 mg/l. Chlorine residuals have increased significantly as compared to last year.

TOWN	Samples Tested for Coliform (a)	Total Coliform % Positive	E. coli % Positive	Public Notification Required?	Average Chlorine Residual, mg/l	Minimum Chlorine Residual, mg/l
ARLINGTON	56				0.43	0.01
BELMONT	40				0.55	0.10
BOSTON	256				1.01	0.04
BROOKLINE	85				1.35	0.30
CHELSEA	40				0.98	0.05
EVERETT	50				1.39	0.20
FRAMINGHAM * (b)	82				0.24	0.10
LEXINGTON	45				1.32	0.80
LYNNFIELD	14				0.79	0.30
MALDEN	75				0.89	0.00
MARBLEHEAD	24				1.15	0.14
MEDFORD	85				0.48	0.10
MELROSE	45				0.59	0.10
MILTON	40				0.65	0.30
NAHANT	10				0.33	0.05
NEEDHAM* (d)	53				0.24	0.01
NEWTON	88				1.10	0.18
NORWOOD	50				0.49	0.10
QUINCY	92				0.62	0.10
REVERE	52				0.59	0.10
SAUGUS	40				0.41	0.30
SOMERVILLE	80				0.76	0.20
SOUTHBORO * (b)	8				0.26	0.05
STONEHAM	28				1.06	0.20
SWAMPSCOTT	18				1.01	0.10
WAKEFIELD * (d)	44				0.58	0.04
WALTHAM	67				1.46	0.80
WATERTOWN	40				0.50	0.10
WELLESLEY * (d)	48	2.0		No (c)	0.47	0.10
WESTON *	19	5.2		No (e)	0.15	0.01
WINCHESTER * (d)	25				0.58	0.02
WINTHROP	24				0.50	0.05
Total:	1739					

(a) The number of samples collected is dependent on the population served and the number of repeat samples required.

(b) Framingham and Southborough report free chlorine residuals. The remaining communities report total chlorine residuals.

(c) Less than 5% total coliform positive, therefore public notification not required.

(d) These communities are partially supplied.

(e) Public notification is not required when only one sample is positive for total coliform and less than 40 samples per month are collected.

* These communities provide chlorination.

MWRA

SOURCE WATER FECAL COLIFORM LEVELS AT FELLS RESERVOIR

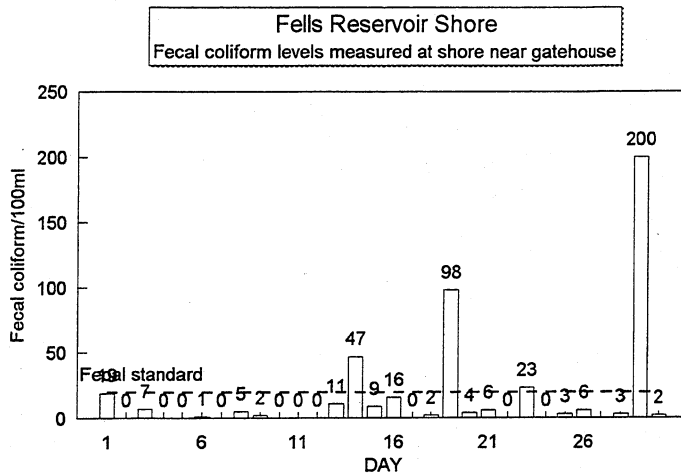
June 1998

Target

Fells Reservoir samples are collected from the shore at a point near the gatehouse. If Fells Reservoir is filling, samples may contain a chloramine residual from the treated water supplied by the James L. Gillis P.S. The SDWA standard is that no more than 20 fecal coliform/100 ml be present in 10% of samples over a 6 month period.

Highlights

Fecal coliform levels exceeded the SDWA standard at Norumbega Reservoir on several occasions. Construction work at this location is likely responsible for these exceedances. This reservoir will be taken off-line in July.



SOURCE WATER TURBIDITY LEVELS AT FELLS RESERVOIR

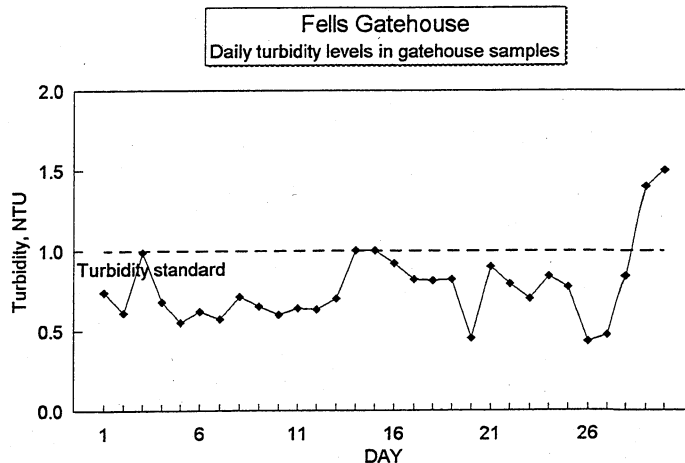
June 1998

Target

Fells Reservoir samples are collected in the gatehouse. The Massachusetts Department of Environmental Protection standard for source water turbidity is 1.0 NTU average for the month.

Highlights

Turbidity levels at Fells Reservoir have remained below the DEP standard and averaged 0.77 NTU over the month.



MWRA

TREATED WATER DISINFECTANT LEVELS AT FELLS RESERVOIR

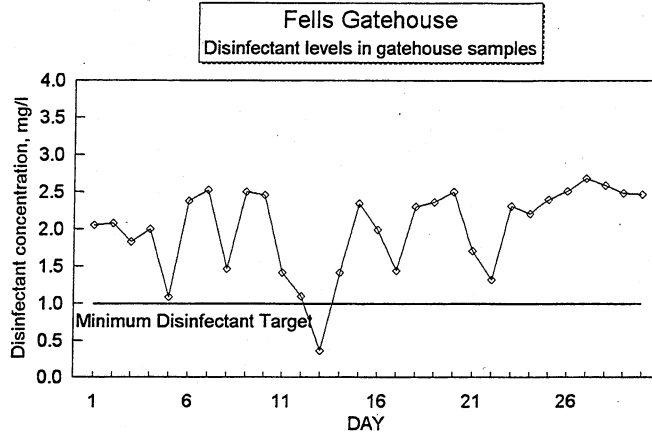
June 1998

Target

Target levels are difficult to maintain due to the type of chlorine feed equipment used and the highly variable flow at this location. Residuals are measured at a point immediately after disinfection.

Highlights

Free chlorine is added to water as it leaves Fells Reservoir and levels are variable due to difficulty in obtaining representative samples at this location. The average chlorine residual leaving Fells Reservoir was 2.0 mg/l.



TREATED WATER pH LEVELS AT FELLS RESERVOIR

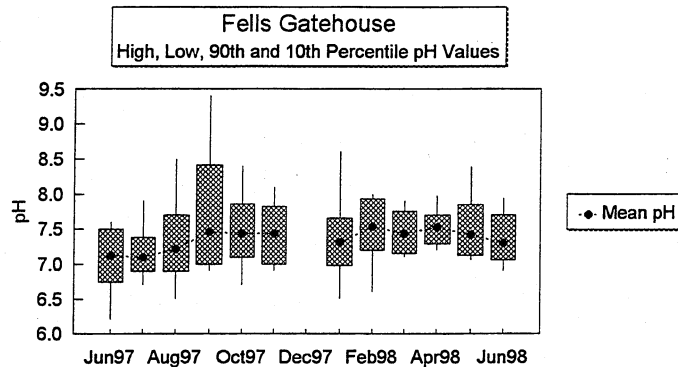
June 1998

Target

MWRA adjusts the alkalinity and pH of Wachusett water to reduce its corrosivity in order to minimize the leaching of lead and copper from service lines and home plumbing systems into the water. In June 1996, the Interim Corrosion Control (ICC) facility went on-line and is providing corrosion control to communities east of and including Marlborough. The target pH is 7.8 (target range between 7.6 and 8.0 pH units). pH is not controlled at Fells Reservoir.

Highlights

During the month of June, eighty percent of samples ranged between 7.1 and 7.7 pH units at Fells Reservoir. The average pH was 7.3.



Note: No pH values available for December, when Fells Reservoir was off-line.

**A SPECIAL SUPPLEMENT TO THE JULY 1998 ISSUE OF THE
WATER QUALITY UPDATE**

COMMUNITY AVERAGE TOTAL CHLORINE RESIDUALS

	Chlorine Complaints		
	June 1997	June 1998	June 1998
ARLINGTON	0.1	0.4	0
BELMONT	0.2	0.6	2
BOSTON	0.5	1	0
BROOKLINE	0.4	1.3	0
CHELSEA	0.2	1	0
EVERETT	0.2	1.4	0
FRAMINGHAM (b) (c)		0.2	1
LEXINGTON	0.3	1.3	0
LYNNFIELD	0.3	0.8	0
MALDEN	0.2	0.9	0
MARBLEHEAD	0.4	1.1	0
MEDFORD	0.2	0.5	0
MELROSE	0.2	0.6	0
MILTON	0.2	0.6	0
NAHANT	0.2	0.3	0
NEEDHAM (a) (b)		0.2	0
NEWTON	0.3	1.1	1
NORWOOD	0.2	0.5	1
QUINCY	0.2	0.6	0
REVERE	0.2	0.6	0
SAUGUS	0.2	0.4	0
SOMERVILLE	0.1	0.8	0
SOUTHBOROUGH (b) (c)		0.3	0
STONEHAM	0.3	1.1	0
SWAMPSCOTT		1	0
WAKEFIELD (a) (b)		0.6	0
WALTHAM	0.4	1.5	0
WATERTOWN	0.2	0.5	0
WELLESLEY (a) (b)		0.4	0
WESTON (b)		0.1	0
WINCHESTER (a) (b)	0.5	0.6	0
WINTHROP	0.2	0.5	0

Samples are collected by community samplers and reported to MWRA

(a) Partially-supplied community

(b) Provide local chlorination

(c) Framingham and Southborough report free chlorine residuals. The remaining communities report total chlorine residuals.

All of the twenty-five communities reporting on their chlorine residuals for both years showed higher levels. Operational changes have increased capacity for pathogen inactivation and residual levels. Chlorine taste and odor complaints decreased from 17 in May 1998 to 5 in June 1998.

MWRA Monthly Mineral Analysis June 1998

This monthly mineral analysis provides information on water quality at four locations in the MWRA transmission system.

Component	Wachusett Reservoir @ Cosgrove Intake	ICC Facility/ MARLBORO	Commonwealth Avenue Pump Station/NEWTON	Shaft 9A/ MALDEN	MCL Standard or MWRA Target	Units	Exceed-ance?
ALKALINITY	4.8	30.4	29.2	29.6	30 (28-32) (a)	MG/L	NO
ALUMINUM	<110	<110	<110	167	50-200 (b)	UG/L	NO
AMMONIA	0.0213	0.0112	0.371	0.329		MG/L	
ANTIMONY	<40	<40	<40	<40		UG/L	
ARSENIC	<0.8	<0.8	<0.8	<0.8	50 (c)	UG/L	NO
BARIUM	8.3	8.1	8.6	13.4	2000 (c)	UG/L	NO
BERYLLIUM	<1	<1	<1	<1	4 (c)	UG/L	NO
CADMIUM	<2	<2	<2	<2	5 (c)	UG/L	NO
CALCIUM	4.6	4.7	4.8	4.9		MG/L	
CHLORIDE	16.2	18.8	18.6	18.5	250 (b)	MG/L	NO
CHLORINE, FREE		0.02	0.05	0.16		MG/L	
CHLORINE, TOTAL		0.3	1.9	1.8		MG/L	
CHROMIUM	<3	<3	<3	<3	100 (c)	UG/L	NO
COLIFORM, MF method	0	0	0	0	0 (c)	CFU/100 ML	NO
COLOR	17	12	10	7	15 (b)	C.U.	YES
COPPER	<12	53.7	262	111	1300 (c)	UG/L	NO
CYANIDE	<0.01	<0.01	<0.01	<0.01		MG/L	
FLUORIDE	0.07	0.75	0.11	0.08	4 (c)	MG/L	NO
HARDNESS	15.2	15.2	15.6	15.8		MG/L	
IRON	<25	28.3	30.3	148	300 (b)	UG/L	NO
LEAD	<2.4	<2.4	9.41	11.6	15 (c)	UG/L	NO
MAGNESIUM	874	882	892	905		UG/L	
MANGANESE	6.4	6.5	8.7	98.1	50 (b)	UG/L	YES
MERCURY	<0.05	<0.05	<0.05	<0.05	2 (c)	UG/L	NO
NICKEL	<8	<8	<8	<8		UG/L	
NITRATE-N	0.12	0.12	0.34	0.12	10 (c)	MG/L	NO
ORTHOPHOSPHATE	0.0054	0.0427	0.0105	0.0112		MG/L	
PH	6.9	7.8	7.2	7.6	7.8 (7.6-8.0) (a)	S.U.	NO
POTASSIUM	935	963	999	1010		UG/L	
SELENIUM	<0.9	<0.9	<0.9	<0.9	50 (c)	UG/L	NO
SILICA (SiO2)	3.14	3.65	3.09	3.46		MG/L	
SILVER	<1	<1	<1	<1	100 (b)	UG/L	NO
SODIUM	11.1	24.8	23.6	23.1		MG/L	
SPECIFIC CONDUCTANCE	117	181	170	183		UMHOS	
STANDARD PLATE COUNT, HPC (48 HRS @ 35C)	8	18	3	2	500 (c)	CFU/ML	NO
SULFATE (SO4)	6.6	6.7	6.9	7.5	250 (b)	MG/L	NO
THALLIUM	<1	<1	<1	<1	2 (c)	UG/L	NO
TOTAL DISSOLVED SOLIDS	56	88	82	84	500 (b)	MG/L	NO
TRIHALOMETHANES, TOTAL (TTHMs) (e)		22	31	42	100 (c)	UG/L	NO
TURBIDITY	0.3	0.3	0.3	0.3	1 (d)	NTU	NO
ZINC	<13	<13	107	24.5	5000 (b)	UG/L	NO

(a) = MWRA target level, after ICC Facility.

(b) = Secondary MCL standard (aesthetic related). DEP "Drinking Water Regulations", 310CMR 22.00.

(c) = Primary MCL standard (health related). DEP "Drinking Water Regulations", 310CMR 22.00.

(d) = Primary MCL standard (health related), applies to Wachusett Reservoir only (source water). DEP "Drinking Water Regulations", 310CMR 22.00.

(e) = Average of samples collected on a weekly basis.

(f) = No sample collected for this month.

MCL = maximum contaminant level

C.U. = Color unit

CFU = colony forming unit

NTU = nephelometric turbidity unit

S.U. = standard units

mg/l = milligrams per liter = parts per million

ug/l = micrograms per liter = parts per billion

Samples collected June 2, 1998 and analyzed by MWRA laboratories.

FREQUENCY OF SOURCE WATER QUALITY SAMPLING PROGRAM

PARAMETER	MWRA SAMPLES
Total and Fecal coliform	daily at source reservoirs, weekly in distribution reservoirs
Turbidity	daily at source and distribution reservoirs
pH	daily at distribution reservoirs
Chemical analyses	periodically as required under SDWA
Radionuclides	as required, currently every five years

FREQUENCY OF TREATED WATER QUALITY SAMPLING PROGRAM

PARAMETER	MWRA SAMPLES	COMMUNITY SAMPLES
Total coliform	weekly at select locations	frequency and number depends on population served
Disinfectant Residual	weekly at select locations	collected with total coliform samples
pH	weekly at select locations	

FEDERAL SAFE DRINKING WATER ACT (SDWA)

The Surface Water Treatment Rule (SWTR) of the SDWA sets standards for unfiltered use of MWRA's source waters from the Quabbin and Wachusett Reservoirs. If such standards are not met, filtration could be required. The standards relate to coliform, turbidity, color, watershed protection, disinfection and monitoring, and the absence of waterborne disease outbreaks. Quabbin Reservoir has demonstrated compliance with the standards and has therefore been found to be exempt from the filtration requirement. A decision about filtration of Wachusett source water has been deferred until 1998 as part of the consideration of treatment process technology at the new MWRA treatment plant to be constructed at Walnut Hill.

Customer communities must also meet certain standards under the SDWA concerning distribution of treated drinking water. The Total Coliform Rule (TCR) helps to alert the local water suppliers to possible local distribution system issues as well as the adequacy of residual disinfection. MWRA provides testing services for many of the communities, and tests over 1500 samples per month. Under the SDWA, a violation of the TCR occurs when greater than 5% of the samples are positive for total coliform.

DISINFECTANT RESIDUAL

The effectiveness of disinfection is calculated by determining the length of time water is in contact with a specific dosage of disinfectant. This calculated value is commonly called CT (Concentration multiplied by Time) and is derived mathematically from assumptions about the residual disinfectant dosage in the water as it reaches the user multiplied by the travel time from the point of application of the disinfectant.

The required CT to provide target inactivation varies somewhat due to ambient pH or temperature conditions, as well as the strength of the disinfectant, *e.g.* free chlorine has greater pathogen inactivation properties than chloramines in the same concentration. The calculated CT of the disinfection system is then compared to the required values necessary to achieve the desired level of inactivation of key pathogens such as bacteria, viruses, and protozoa. In this classification of pathogens, bacteria are the most prevalent and are the first focus of disinfection. Fortunately,

harmful bacteria are relatively easily inactivated by chlorination. Viruses are more resistant to chlorination. *Giardia* and *cryptosporidium* are examples of pathogenic protozoa that are particularly difficult to inactivate using normal dosages of chlorine but are less commonly found in source waters.

The reduction of residual disinfectant levels within a pipeline system is affected by a variety of factors including temperature, presence of organic matter in

the water or on the pipe surface and corrosion of the pipe surface. For residual disinfection, MWRA uses a chlorine-ammonia combination to form chloramines, a longer-lasting residual disinfectant than free chlorine alone. The level of the residual disinfectant is measured throughout the distribution system using a colorimetric test by which a color change in the sample is compared to a color chart in order to estimate the disinfectant concentration within a reasonable degree of accuracy.

GLOSSARY

CHLORINATION: Disinfection by adding chlorine.

CHLORAMINATION: Disinfection by adding a mixture of chlorine and ammonia.

COLIFORM BACTERIA: Group of bacteria that indicate the possibility of contamination in a water supply. A subclass of the coliform group, fecal coliform bacteria, indicate possible contamination from intestinal sources.

CORROSION CONTROL FACILITY: Water quality facility that helps to stabilize both the water's pH and alkalinity by adding soda ash and carbon dioxide.

CRYPTOSPORIDIUM: Microscopic protozoa which, when ingested, can result in diarrhea and other flu-like symptoms.

ESCHERICHIA COLI (E. COLI): A bacterium that is a primary indicator of fecal contamination in a water supply. *E. coli* is a member of the coliform group of bacteria.

GIARDIA LAMBLIA: Microscopic protozoa which, when ingested, can result in diarrhea and other flu-like symptoms.

NTU: Nephelometric turbidity unit. A standard measure of turbidity in a water sample.

PATHOGENS: Disease-causing organisms.

RESERVOIR: A natural or man-made basin where water is collected and stored in large quantities before being supplied to a community.

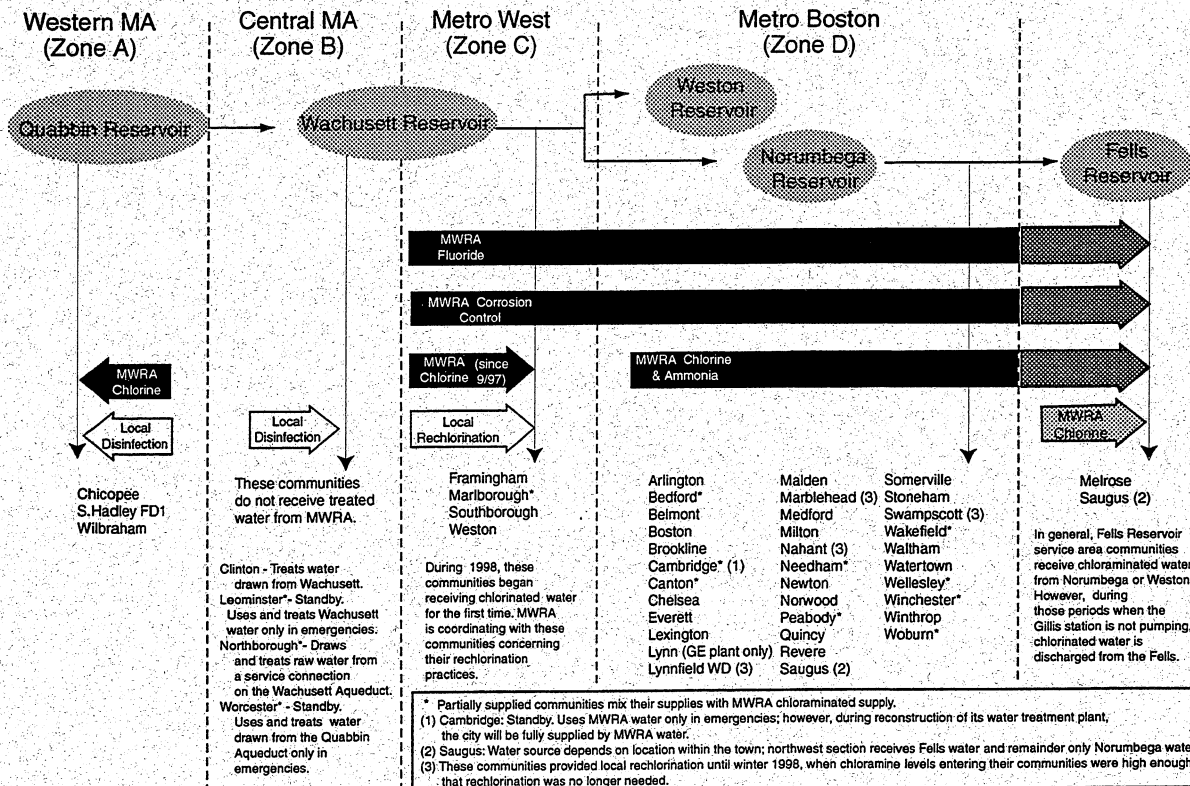
SAFE DRINKING WATER ACT (SDWA): Federal drinking water quality regulations.

TOTAL COLIFORM RULE (TCR): SDWA standard that limits the level of total coliform positive results allowed each month in a community.

TURBIDITY: Measure of the particulate matter in a water sample.

MWRA WATER SUPPLY AND TREATMENT

Communities that are fully supplied by MWRA receive water treated with chloramines. In those communities that are partially supplied by MWRA, information on treatment should be obtained from the local water department. To view the level of treatment your water has received, locate your community on the chart.



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