



# Massachusetts Water Resources Authority

AUGUST 20 1998

## WATER QUALITY UPDATE

An Analysis of July, 1998 Sampling Data.

### In this Issue. . .

July, 1998 Sampling Data pp. A-D  
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.

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

For more information, please contact **MWRA Public Affairs at (617) 242-6000**  
100 First Avenue, Charlestown Navy Yard, Boston, MA 02129.

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**.

**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 CO<sub>2</sub> (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 using disinfection facilities at Quabbin, Wachusett, Norumbega and Weston Reservoirs. At Wachusett Reservoir, chlorine is added to provide primary disinfection necessary to inactivate pathogens that may be present in the source water. At Norumbega and Weston Reservoirs, chlorine also provides some additional primary disinfection. 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.

**Chemical:** Inorganics 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 and Weston. 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, 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.

## **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, watershed protection, disinfection byproducts 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.





**MWRA**

**TREATED WATER  
DISINFECTANT LEVELS IN HULTMAN AQUEDUCT AT NORUMBEGA DISINFECTION FACILITY AND  
COMMONWEALTH AVENUE PUMP STATION (ENTRY POINT INTO CUSTOMER DISTRIBUTION SYSTEMS)  
JULY 1998**

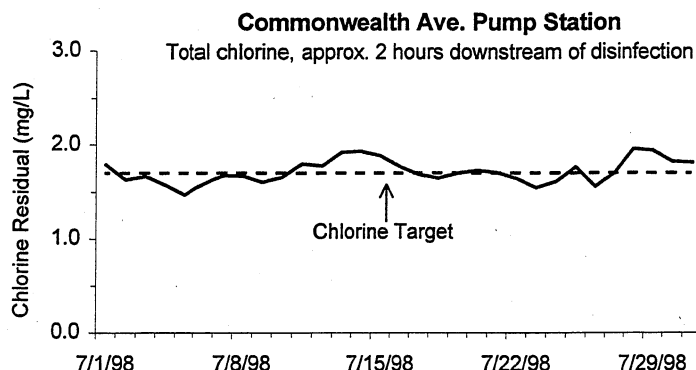
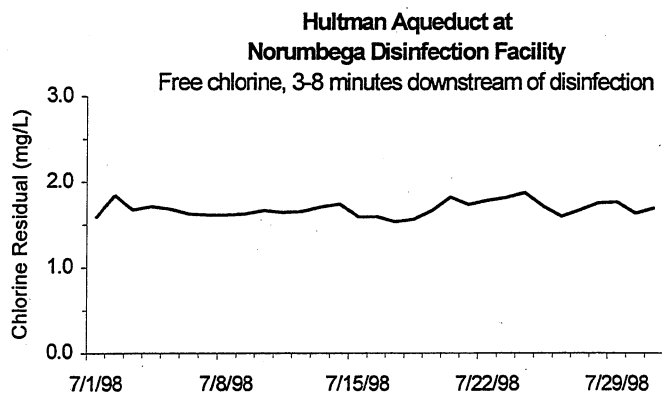
**Target**

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 Avenue Pump Station has been adjusted to 1.7 mg/L. This change has occurred to minimize concerns with nitrification, taste and odor, and DBP formation.

**Highlights**

Free chlorine residuals averaged 1.7 mg/L over the month at a sampling point about 3-8 minutes downstream of disinfection. Total chlorine residuals also averaged 1.7 mg/L at Commonwealth Avenue Pumping Station, the entry point to customer distribution systems.



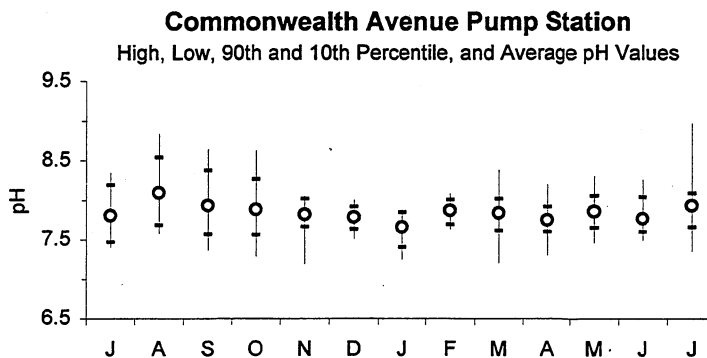
**TREATED WATER  
pH LEVELS AT COMMONWEALTH AVENUE PUMP STATION**

**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. On July 27, the pH target was increased to 9.0.

**Highlights**

During the month of July, eighty percent of samples taken ranged between 7.7 and 8.1 pH units. Average pH for the month was 7.9.



MWRA

**WATER QUALITY UPDATE FOR COMMUNITIES PARTICIPATING IN  
MWRA TESTING PROGRAM**

JULY 1998

**Target**

Thirty-two cities and towns use the MWRA Laboratory for Total Coliform Rule compliance testing. These 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**

Twenty-nine of the thirty-two communities listed below submitted samples with no coliform bacteria during the month of July. Positive total coliform results were identified in samples collected in Boston, Southboro, and Wellesley. Public notification was not required for Boston or Wellesley. No E. coli colonies were identified in any samples collected.

All but two of the thirty-two communities submitting chlorine residual data maintained an average disinfectant residual of at least 0.2 mg/L. Twenty-four communities had one or more samples with a disinfectant residual lower than 0.2 mg/L. Chlorine residuals remained significantly above last year's levels.

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	70				0.37	0.00
BELMONT	32				0.52	0.05
BOSTON	258	1.2		No (b)	1.00	0.11
BROOKLINE	68				1.17	0.05
CHELSEA	32				0.80	0.01
EVERETT	40				1.51	0.50
FRAMINGHAM (e)	72				0.35	0.10
LEXINGTON	36				1.22	0.80
LYNNFIELD	14				0.56	0.05
MALDEN	60				0.81	0.00
MARBLEHEAD	24				0.97	0.21
MEDFORD	68				0.42	0.10
MELROSE	36				0.63	0.10
MILTON	32				0.41	0.20
NAHANT	10				0.37	0.05
NEEDHAM (c)	43				0.24	0.01
NEWTON	88				1.03	0.24
NORWOOD	40				0.48	0.10
QUINCY	115				0.63	0.10
REVERE	65				0.66	0.10
SAUGUS	32				0.43	0.20
SOMERVILLE	100				0.81	0.05
SOUTHBORO (e)	22	27.3		Yes	0.15	0.10
STONEHAM	35				0.82	0.00
SWAMPSCOTT	18				1.03	0.40
WAKEFIELD (c)	55				0.70	0.03
WALTHAM	83				1.07	0.40
WATERTOWN	50				0.51	0.10
WELLESLEY (c)	41	2.4		No (b)	0.52	0.10
WESTON (e)	13				0.14	0.03
WINCHESTER (c)	20				0.49	0.06
WINTHROP	24				0.44	0.05
Total:	1728					

- (a) The number of samples collected depends on the population served and the number of repeat samples required.
- (b) Less than 5% total coliform positive, therefore public notification not required.
- (c) These communities are partially supplied, and may mix their chlorinated supply with MWRA chloraminated supply.
- (d) Public notification is not required when only one sample is positive for total coliform and less than 40 samples per month are collected.
- (e) These communities re-chloraminate (since July/August 1998).

## 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	

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.

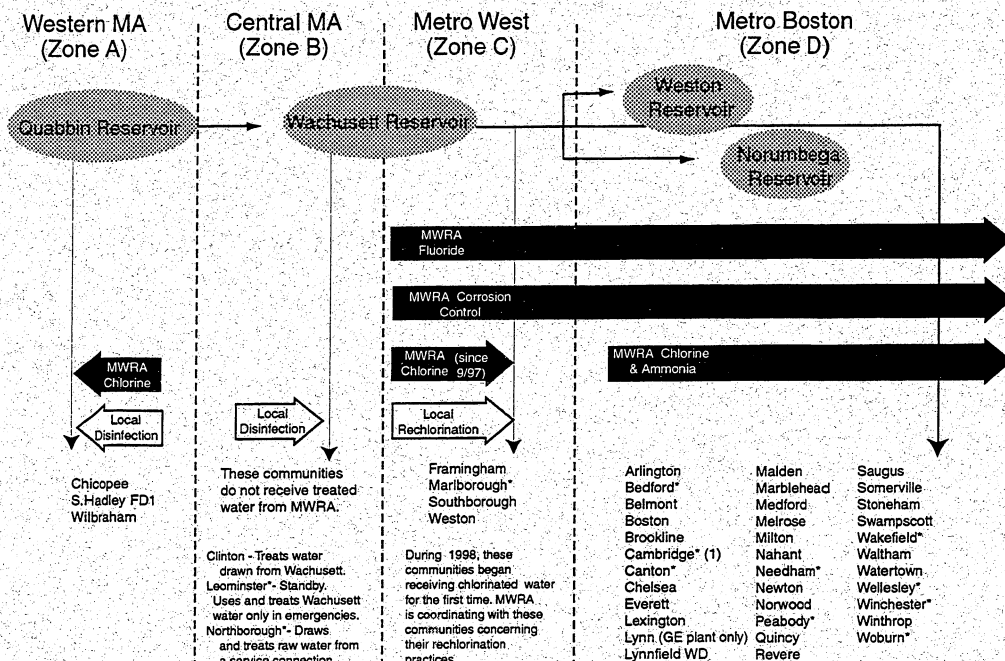
**SAFE DRINKING WATER ACT (SDWA):** Federal drinking water quality regulations.

**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.



\* Partially supplied communities mix their supplies with MWRA chloraminated supply.  
 (1) Cambridge: Standby. Uses MWRA water only in emergencies; however, during reconstruction of its water treatment plant, the city will be fully supplied by MWRA water.  
 August 1998

Prepared under the direction of: **Douglas B. MacDonald**, Executive Director  
**William A. Brutsch**, Waterworks Director, **D. Kelly O'Day**, Operations Director, Waterworks