Presented By
Manchester Water Works

ANNUAL
WATER QUALITY REPORT
WATER TESTING PERFORMED IN 2017

PWS ID#: NH1471010

Quality First

Once again we are pleased to present our annual water quality report. As in years past, we are committed to delivering the best-quality drinking water possible. To that end, we remain vigilant in meeting the challenges of new regulations, source water protection, water conservation, and community outreach and education while continuing to serve the needs of all of our water users. Thank you for allowing us the opportunity to serve you and your family.

We encourage you to share your thoughts with us on the information contained in this report. After all, well-informed customers are our best allies.

Where Does My Water Come From?

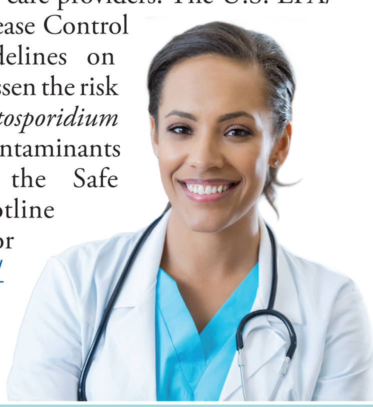
Since 1874, Lake Massabesic has served as the water supply for Manchester and portions of six surrounding communities. In order to satisfy stringent state and federal drinking water regulations, the lake water is purified at Manchester's Water Treatment Plant. This facility was completed in 1974 and has since been routinely updated with state-of-the-art equipment to improve quality control and operational efficiency and was significantly upgraded in 2003-06. Located adjacent to Lake Massabesic, the plant treats all of the city's water before it is pumped into a 500-mile piping network for distribution to homes and industries.

In the near future (approximately 2022), water from the Merrimack River will provide a much needed additional supply for our customers. A new treatment facility located in Hooksett, NH, will be constructed to produce water meeting or exceeding the high level of quality leaving our Lake Massabesic plant.

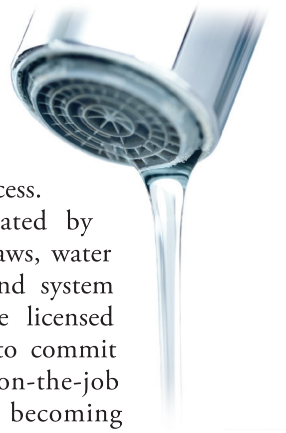
> "Water treatment is a complex, time-consuming process."

Important Health Information

Some people may be more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants may be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. The U.S. EPA/CDC (Centers for Disease Control and Prevention) guidelines on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Safe Drinking Water Hotline at (800) 426-4791 or http://water.epa.gov/drink/hotline.



Count on Us



Delivering high-quality drinking water to our customers involves far more than just pushing water through pipes. Water treatment is a complex, time-consuming process. Because tap water is highly regulated by state and federal laws, water treatment plant and system operators must be licensed and are required to commit to long-term, on-the-job training before becoming fully qualified. Our licensed water professionals have a basic understanding of a wide range of subjects, including mathematics, biology, chemistry, and physics. Some of the tasks they complete on a regular basis include:

- Operating and maintaining equipment to purify and clarify water;
- Monitoring and inspecting machinery, meters, gauges, and operating conditions;
- Conducting tests and inspections on water and evaluating the results;
- Maintaining optimal water chemistry;
- Applying data to formulas that determine treatment requirements, flow levels, and concentration levels;
- Documenting and reporting test results and system operations to regulatory agencies; and
- Serving our community through customer support, education, and outreach.

So, the next time you turn on your faucet, think of the skilled professionals who stand behind each drop.

QUESTIONS?

For more information about this report, or for any questions relating to your drinking water, please call David G. Miller, P.E., Deputy Director, Water Supply, at (603) 792-2851, or by email at dmiller@manchesternh.gov.

Protecting Your Water

Bacteria are a natural and important part of our world. There are around 40 trillion bacteria living in each of us; without them, we would not be able to live healthy lives. Coliform bacteria are common in the environment and are generally not harmful themselves. The presence of this bacterial form in drinking water is a concern, however, because it indicates that the water may be contaminated with other organisms that can cause disease.

In 2016, the U.S. Environmental Protection Agency (EPA) passed a new regulation called the Revised Total Coliform Rule, which requires additional steps that water systems must take in order to ensure the integrity of the drinking water distribution system by monitoring for the presence of bacteria such as total coliform and *E. coli*. The rule requires more stringent standards than the previous regulation, and it requires water systems that may be vulnerable to contamination to have procedures in place that will minimize the incidence of contamination. Water systems that exceed a specified frequency of total coliform occurrences are required to conduct an assessment of their system and correct any problems quickly. The U.S. EPA anticipates greater public health protection under the new regulation due to its more preventive approach to identifying and fixing problems that may affect public health.

Though we have been fortunate to have the highest-quality drinking water, our goal is to eliminate all potential pathways of contamination into our distribution system, and this new rule helps us to accomplish that goal.

Source Water Assessment

In compliance with a federal mandate, the NH Department of Environmental Services performed a Source Water Assessment on Lake Massabesic in September of 2002. The assessment looked at the drainage area for the lake and ranked its vulnerability to contamination. Lake Massabesic received four high and four medium vulnerability ratings, while it ranked at low vulnerability for five additional categories. Concern was raised over the detection of methyl tertiary butyl ether (MTBE), now prohibited, which came from reformulated gasoline. Concern was also raised over Potential Contamination Sources (PCSs) on the watershed, such as highways. Overall, the report presents a positive picture of Manchester's water source and its condition. While Manchester Water Works has done its best to protect Lake Massabesic, we understand more than ever that we rely heavily upon the standards and practices of each citizen and each community on the watershed for their continued efforts to preserve this precious resource.

The complete Assessment Report is available for review at our website or at the NH DES Drinking Water Source Water Assessment page at http://des.nh.gov/organization/divisions/water/dwgb/dwspp/dwsap.htm.

Fluoridation Information

Your public water supply is fluoridated. According to the Centers for Disease Control and Prevention, if your child under the age of 6 months is exclusively consuming infant formula reconstituted with fluoridated water, there may be an increased chance of dental fluorosis. Consult your child's health care provider for more information.

Substances That Could Be in Water

To ensure that tap water is safe to drink, the U.S. EPA prescribes regulations limiting the amount of certain contaminants in water provided by public water systems. U.S. Food and Drug Administration regulations establish limits for contaminants in bottled water, which must provide the same protection for public health. Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of these contaminants does not necessarily indicate that the water poses a health risk.

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals, in some cases, radioactive material, and substances resulting from the presence of animals or from human activity. Substances that may be present in source water include:

Microbial Contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, or wildlife;

Inorganic Contaminants, such as salts and metals, which can be naturally occurring or may result from urban storm-water runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming;

Pesticides and Herbicides, which may come from a variety of sources such as agriculture, urban storm-water runoff, and residential uses;

Organic Chemical Contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production and may also come from gas stations, urban storm-water runoff, and septic systems;

Radioactive Contaminants, which can be naturally occurring or may be the result of oil and gas production and mining activities.

For more information about contaminants and potential health effects, call the U.S. EPA's Safe Drinking Water Hotline at (800) 426-4791.

Lead in Home Plumbing

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. We are responsible for providing high-quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at www.epa.gov/lead.

BY THE NUMBERS

34 BILLION The number of gallons of water produced daily by public water systems in the U.S.

1 MILLION The number of miles of drinking water distribution mains in the U.S.

135 BILLION The amount of money spent annually on maintaining the public water infrastructure in the U.S.

300 MILLION The number of Americans who receive water from a pubic water system.

2 BILLION The age in years of the world's oldest water found in a mine at a depth of nearly two miles.

151 THOUSAND The number of active public water systems in the U.S.

199 THOUSAND The number of highly trained and licensed water professionals serving in the U.S.

93 The number of federally regulated contaminants tested for in drinking water.

Benefits of Chlorination

Disinfection, a chemical process used to control disease-causing microorganisms by killing or inactivating them, is unquestionably the most important step in drinking water treatment. By far, the most common method of disinfection in North America is chlorination.

Before communities began routinely treating drinking water with chlorine (starting with Chicago and Jersey City in 1908), cholera, typhoid fever, dysentery, and hepatitis A killed thousands of U.S. residents annually. Drinking water chlorination and filtration have helped to virtually eliminate these diseases in the U.S. Significant strides in public health are directly linked to the adoption of drinking water chlorination. In fact, the filtration of drinking water plus the use of chlorine is probably the most significant public health advancement in human history.

How chlorination works:

Potent Germicide Reduction in the level of many disease-causing microorganisms in drinking water to almost immeasurable levels.

Taste and Odor Reduction of many disagreeable tastes and odors such as foul-smelling algae secretions, sulfides, and odors from decaying vegetation.

Biological Growth Elimination of slime bacteria, molds, and algae that commonly grow in water supply reservoirs, on the walls of water mains, and in storage tanks.

Chemical Removal of hydrogen sulfide (which has a rotten egg odor), ammonia, and other nitrogenous compounds that have unpleasant tastes and hinder disinfection. It also helps to remove iron and manganese from raw water.

Community Participation

You are invited to attend our Water Board meetings and participate in discussions about your drinking water. A schedule of meeting times is posted on our website at www.manchesternh.gov/wtr. Please call our office at (603) 792-2803 to confirm your intent to attend.

Excellence in Water Treatment

Manchester Water Works (MWW) was established in 1871 and now serves a population of about 160,000 in the greater Manchester area. The 50 million gallons/day (MGD) conventional treatment facility was first commissioned in 1974 and significantly upgraded in 2006. MWW employs 11 full-time operators to run a highly complex, state-of-the-art treatment facility 24/7/365 on three daily 8-hour shifts.

Well before the 2006 facility upgrade, MWW became a charter member of the Partnership for Safe Water. "The Partnership is an unprecedented alliance of six prestigious drinking water organizations. The Partnership's mission is to improve the quality of water delivered to customers by optimizing water system operations. The Partnership offers self-assessment and optimization programs so that operators, managers and administrators have the tools to improve performance above and beyond even proposed regulatory levels."*

In early 2012, MWW was recognized as only the 11th utility in the nation to achieve the challenging Partnership for Safe Water award for "Excellence in Water Treatment". In 2017, MWW was further recognized at the American Water Works Association Annual Conference and Exhibition in Philadelphia, PA, for maintaining optimized performance for five consecutive years and is among a very small group of optimized water treatment facilities nationwide.

These significant accomplishments would not be possible without the tireless dedication of MWW operators and other department employees who demonstrate and maintain a quality-first culture on a daily basis. The bottom line: MWW provides sustained, optimized treatment along with one of the lowest customer water rates in the region.

We are working hard to keep our aging infrastructure viable and up to date. This work includes annual pipeline replacement and/or rehabilitation; improvements to our Cohas Avenue Pump Station that lifts water from the Low Service System into the Londonderry System (completion in early 2019), design and construction of a new three-million-gallon water storage tank in Londonderry (completion in late 2018), and design and construction of a new Merrimack River Water Treatment Facility (completion in 2022).

*https://www.awwa.org/resources-tools/water-and-wastewater-utility-management/partnership-for-safe-water.aspx

Water Main Flushing

Distribution mains (pipes) convey water to homes, businesses, and hydrants in your neighborhood. The water entering distribution mains is of very high quality; however, water quality can deteriorate in areas of the distribution mains over time. Water main flushing is the process of cleaning the interior of water distribution mains by sending a rapid flow of water through the mains.

Flushing maintains water quality in several ways. For example, flushing removes sediments such as iron and manganese. Although iron and manganese do not pose health concerns, they can affect the taste, clarity, and color of the water. Additionally, sediments can shield microorganisms from the disinfecting power of chlorine, contributing to the growth of microorganisms within distribution mains. Flushing helps remove stale water and ensures the presence of fresh water with sufficient dissolved oxygen, disinfectant levels, and an acceptable taste and smell.

During flushing operations in your neighborhood, some short-term deterioration of water quality, though uncommon, is possible. You should avoid tap water for household uses at that time. If you do use the tap, allow your cold water to run for a few minutes at full velocity before use, and avoid using hot water to prevent sediment accumulation in your hot water tank.

Please contact us if you have any questions or if you would like more information on our water main flushing schedule.

Water Treatment Process

Raw Water Pumping

Raw water from Lake Massabesic is conveyed through a 60-inch high-density polyethylene pipeline intake that extends 430 feet from the shoreline into a new low lift pump station constructed in 1997. The original intake and pump station, built in 1906 and renovated for raw water service in 1974, is maintained for redundancy. A combination of four variable-speed pumps delivers raw water through a 48-inch pipeline to the rapid mix chambers. This pipeline is equipped with a soda ash feed point where pH and alkalinity are adjusted prior to coagulation.

Rapid Mixing

In the rapid mix chamber, the primary treatment chemical, aluminum sulfate, is added to begin the process of coagulation. Two rapid mix chambers are configured in series with the capability of adding the coagulants into either or both chambers. High-speed mixers ensure complete dispersion of these chemicals, enabling them to react with the natural dissolved and particulate matter in the water, which causes them to collide and form larger particles.

Flocculation

Flow from the rapid mix chambers is distributed evenly into each of the four flocculation basins. The flocculation basins are configured in two stages separated by a baffle wall, with the second-stage mixers set at a slightly slower speed than the first-stage mixers.

Sedimentation

The sedimentation process is achieved by allowing the water to flow slowly through a long, deep, quiescent basin that allows sufficient time for the floc particles to settle to the bottom, forming sludge, a treatment process by-product. Sludge is periodically removed by isolating one of the four basins each week, decanting, and pumping the sludge layer to a lagoon where it is eventually dried and moved to a permitted landfill.

Intermediate Ozone

Settled water flows into an intermediate pump station where it is lifted into the ozone contact chambers. Ozone is a powerful oxidant and disinfectant that removes color, taste and odor, along with killing or inactivating harmful organisms in the water. Ozone is generated on-site by passing a high-voltage electric current across a dielectric discharge gap through a pure oxygen stream. A combination of three 500-pound-per-day ozone generators produces the required ozone gaseous stream that is injected into each of four ozone contact chambers through fine bubble diffusers. The contact chambers provide the necessary time for completion of the ozone reaction. Residual (excess) ozone is removed from the water by applying sodium bisulfite prior to exiting the contact chambers and continuing on to the filters. Excess ozone gas that accumulates above the ozone contact chambers is removed under vacuum through a thermal-catalytic ozone destruct process and vented to the atmosphere.

Granular-Activated Carbon Filtration

Following intermediate ozone, the water passes through one of eight deep-bed granular-activated carbon (GAC) filters. Each filter contains six feet of biologically active media that completes the physical removal process.

Chemical Addition

After filtration, sodium hypochlorite is added before, and aqueous ammonia is added into the hydraulic control structure in a closely controlled ratio (approximately 4.5 parts chlorine to 1 part ammonia) to form monochloramine. Monochloramine is a residual disinfectant that prevents bacterial growth as water travels throughout the distribution system. Soda ash is added once again to raise the pH to help control pipe corrosion and to provide additional alkalinity. Phosphoric acid is also added for corrosion control. Finally, fluorosilicic acid is added for dental protection.

Clearwell and Finished Water Pumping

From the hydraulic control structure, water flows into a 700,000-gallon clearwell and finished water pumping station. A series of seven vertical turbine pumps (three for the Low Service pressure zone and four for the High Service pressure zone) lifts finished water into the distribution system.

Test Results

Our water is monitored for many different kinds of substances on a very strict sampling schedule. The information in the data tables show only those substances that were detected between January 1 and December 31, 2017. Remember that detecting a substance does not necessarily mean the water is unsafe to drink; our goal is to keep all detects below their respective maximum allowed levels. The State recommends monitoring for certain substances less than once per year because the concentrations of these substances do not change frequently. In these cases, the most recent sample data are included, along with the year in which the sample was taken.

We participated in the 3rd stage of the EPA's Unregulated Contaminant Monitoring Rule (UCMR3) program by performing additional tests on our drinking water. UCMR3 benefits the environment and public health by providing the EPA with data on the occurrence of contaminants suspected to be in drinking water, in order to determine if EPA needs to introduce new regulatory standards to improve drinking water quality. Contact us for more information on this program.

REGULATED SUBSTANCES

SUBSTANCE (UNIT OF MEASURE)	YEAR SAMPLED	MCL [MRDL]	MCLG [MRDLG]	AMOUNT DETECTED	RANGE LOW-HIGH	VIOLATION	TYPICAL SOURCE
Barium (ppm)	2017	2	2	0.01335	0.0130–0.0166	No	Discharge of drilling wastes; Discharge from metal refineries; Erosion of natural deposits
Beta/Photon Emitters[1] (pCi/L)	2017	50	0	1.7	NA	No	Decay of natural and man-made deposits
Bromate (ppb)	2017	10	0	0.64	NA	No	By-product of drinking water disinfection
Chloramines (ppm)	2017	[4]	[4]	2.11	1.9–2.43	No	Water additive used to control microbes
Chlorine (ppm)	2017	[4]	[4]	1.65	NA	No	Water additive used to control microbes
Combined Radium (pCi/L)	2017	5	0	0.2	NA	No	Erosion of natural deposits
Fluoride (ppm)	2017	4	4	0.55	0.53–0.56	No	Erosion of natural deposits; Water additive, which promotes strong teeth; Discharge from fertilizer and aluminum factories
Haloacetic Acids [HAA] (ppb)	2017	60	NA	3.1	1.4–7.5	No	By-product of drinking water disinfection
TTHMs [Total Trihalomethanes] (ppb)	2017	80	NA	2.7	1.0–4.9	No	By-product of drinking water disinfection
Total Organic Carbon (ppm)	2017	TT	NA	1.8	1.4–2.0	No	Naturally present in the environment
Turbidity[2] (NTU)	2017	TT	NA	0.051	0.045–0.051	No	Soil runoff
Turbidity (lowest monthly percent of samples meeting limit)	2017	TT = 95% of samples meet the limit	NA	100	NA	No	Soil runoff

Tap Water Samples Collected for Lead and Copper Analyses from Sample Sites throughout the Community

SUBSTANCE (UNIT OF MEASURE)	YEAR SAMPLED	AL	MCLG	AMOUNT DETECTED (90TH%TILE)	SITES ABOVE AL/TOTAL SITES	VIOLATION	TYPICAL SOURCE
Copper (ppm)	2017	1.3	1.3	0.055	0/41	No	Corrosion of household plumbing systems; Erosion of natural deposits
Lead (ppb)	2017	15	0	1.2	0/41	No	Corrosion of household plumbing systems; Erosion of natural deposits

SECONDARY SUBSTANCES

SUBSTANCE (UNIT OF MEASURE)	YEAR SAMPLED	SMCL	MCLG	AMOUNT DETECTED	RANGE LOW-HIGH	VIOLATION	TYPICAL SOURCE
Aluminum (ppb)	2017	200	NA	22.15	3.2–28.3	No	Erosion of natural deposits; Residual from some surface water treatment processes
Chloride (ppm)	2017	250	NA	55.25	54–57	No	Runoff/leaching from natural deposits
Color (Units)	2017	15	NA	0	0–1	No	Naturally occurring organic materials
Manganese (ppb)	2017	50	NA	9.4	2.8–13.9	No	Naturally present in the environment
pH (Units)	2017	6.5–8.5	NA	7.61	7.33–7.83	No	Naturally occurring
Sulfate (ppm)	2017	250	NA	18	16–20	No	Runoff/leaching from natural deposits; Industrial wastes
Zinc (ppm)	2017	5	NA	0.002	0.0015–0.002	No	Runoff/leaching from natural deposits; Industrial wastes

OTHER SUBSTANCES

SUBSTANCE (UNIT OF MEASURE)	YEAR SAMPLED	AMOUNT DETECTED	RANGE LOW-HIGH	TYPICAL SOURCE
Alkalinity (ppm)	2017	28.5	24–32	Drinking water treatment additive
Ammonia, as Nitrogen (ppm)	2017	0.34	0.2–0.38	By-product of drinking water disinfection
Ammonia, Free (ppm)	2017	0.055	0.04–0.06	By-product of drinking water disinfection
Calcium (ppm)	2017	5.7	5.32–6.22	Erosion of natural deposits
Magnesium (ppm)	2017	1.335	1.29–1.4	Erosion of natural deposits
PFOA (ppt)	2017	3.28	NA	Industrial pollutant
Phosphate (ppm)	2017	0.437	0.349–0.480	Corrosion control additive
Silica (ppm)	2017	2.305	1.71–2.82	Naturally present in the environment
Sodium (ppm)	2017	48.6	45.5–54	Winter deicing of roadways
Total Hardness (ppm)	2017	19.7	18.6–21.3	A measure of dissolved minerals, primarily calcium and magnesium

UNREGULATED CONTAMINANT MONITORING RULE - PART 3 (UCMR3)

SUBSTANCE (UNIT OF MEASURE)	YEAR SAMPLED	AMOUNT DETECTED	RANGE LOW-HIGH
Chlorate (ppb)	2014	180.9	32–380
Chromium [Total] (ppb)	2014	0.119	ND–0.27
Chromium-6 (ppb)	2014	0.060	0.040–0.079
Strontium (ppb)	2014	47.6	41–52
Vanadium (ppb)	2014	0.36	ND–0.56

[1] The MCL for beta particles is 4 mrem/year. U.S. EPA considers 50 pCi/L to be the level of concern for beta particles.

[2] Turbidity is a measure of the cloudiness of the water. It is monitored by surface water systems because it is a good indicator of water quality and thus helps measure the effectiveness of the treatment process. High turbidity can hinder the effectiveness of disinfectants.

Definitions

AL (Action Level): The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.

LRAA (Locational Running Annual Average): The average of sample analytical results for samples taken at a particular monitoring location during the previous four calendar quarters. Amount Detected values for TTHMs and HAAs are reported as the highest LRAAs.

MCL (Maximum Contaminant Level): The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

MCLG (Maximum Contaminant Level Goal): The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

MRDL (Maximum Residual Disinfectant Level): The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

MRDLG (Maximum Residual Disinfectant Level Goal): The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

NA: Not applicable.

ND (Not detected): Indicates that the substance was not found by laboratory analysis.

NTU (Nephelometric Turbidity Units): Measurement of the clarity, or turbidity, of water. Turbidity in excess of 5 NTU is just noticeable to the average person.

pCi/L (picocuries per liter): A measure of radioactivity.

ppb (parts per billion): One part substance per billion parts water (or micrograms per liter).

ppm (parts per million): One part substance per million parts water (or milligrams per liter).

ppt (parts per trillion): One part substance per trillion parts water (or nanograms per liter).

SMCL (Secondary Maximum Contaminant Level): SMCLs are established to regulate the aesthetics of drinking water like appearance, taste and odor.

TT (Treatment Technique): A required process intended to reduce the level of a contaminant in drinking water.