Technical Bulletin No. 53
DEPARTMENT OF NATURAL RESOURCES
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CHEMICAL ANALYSES OF SELECTED PUBLIC DRINKING WATER SUPPLIES (INCLUDING TRACE METALS)

ABSTRACT

Drinking water supplies utilizing ground and surface water sources were sampled for trace elements in addition to the standard chemical analysis. None of the raw water samples exceeded the Public Health Service Drinking Water Standards for chemical quality, and only one sample from a distribution system exceeded the standards. The one parameter exceeded was lead (.06 mg/l reported, .01 mg/l higher than the standard) which leached from a service line because of corrosive water in the distribution system. Corrosive water in other systems also caused increased concentrations of copper and zinc.

CHEMICAL ANALYSES OF SELECTED PUBLIC DRINKING WATER SUPPLIES (INCLUDING TRACE METALS)

By

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INTRODUCTION

Use of metals with known toxic effects has increased greatly in Wisconsin and the United States during the past 20 years and will undoubtedly continue to increase in the future. Nationwide, over 9,000 synthetic compounds are now in commercial use in amounts of over 1,000 pounds per year each. In 1968 they totaled nearly 120 billion pounds--a 15 percent increase over 1967, and a 161 percent increase over 1960. A recently completed survey by the Department of Natural Resources disclosed 725 instances of admitted discharges of heavy metals or toxic substances in Wisconsin (594 claimed discharges of less than 25 pounds per year). These discharges totaled slightly less than 1 million pounds of chemicals released into the soil, water and air (Ostrander, 1971). As one would expect, the majority of discharges are in industrial areas with the largest concentration in southeastern Wisconsin.

With the ultimate disposal of these chemicals within our environment there must be concern for those that may enter surface waters or ground water aquifers which are used for drinking water.

In January, 1971, a detailed study of chemical constituents in raw and treated public drinking water was initiated with three purposes in mind:

(1) To determine if raw water sources and treated water being distributed by public water supplies meet the chemical quality of the Public Health Service drinking water standards.

(2) To establish baseline chemical concentrations of water sources so comparisons can be made in future years.

(3) To investigate the efficiency of various treatment processes in trace element removal by comparison of raw and treated water analyses.

The emphasis of the study was on the heavy metals and trace elements although the standard chemical analyses were also performed for additional background data on corrosiveness, hardness and other factors that could affect the finished water quality. Results and discussions that follow will generally be limited to the heavy metals and trace elements.

The Public Health Service drinking water standards provide generally accepted standards for toxic substances in public water supplies. These standards offer mandatory limits which, if exceeded, may result in adverse effects on health, and recommended limits which should not be exceeded whenever more suitable supplies are, or can be made available at reasonable cost. Reference to standards in this report will mean the U.S. Public Health Service Drinking Water Standards (1962). Since the toxic effects of chemical substances to man are discussed in the drinking water standards, they will be only briefly referred to here.

METHODS

The survey included raw and treated water samples from all of the treatment plants in the state that utilize a surface water source and samples from ground water sources selected to obtain a representative sampling of all major ground water aquifers in Wisconsin. Figure 1 shows the geographical distribution of the sampling locations and Figure 2 shows the location of the ground water supplies relative to the geologic formations. A total of 53 ground water supplies and 23 surface water supplies were sampled.

District Engineers of the Department of Natural Resources obtained the samples and fixed or acidified them as necessary. Glass bottles were used for the heavy metal samples and plastic bottles for the remainder. Composite samples were obtained at the surface water supplies when the necessary arrangements could be made, whereas the ground water samples were mostly grab samples.

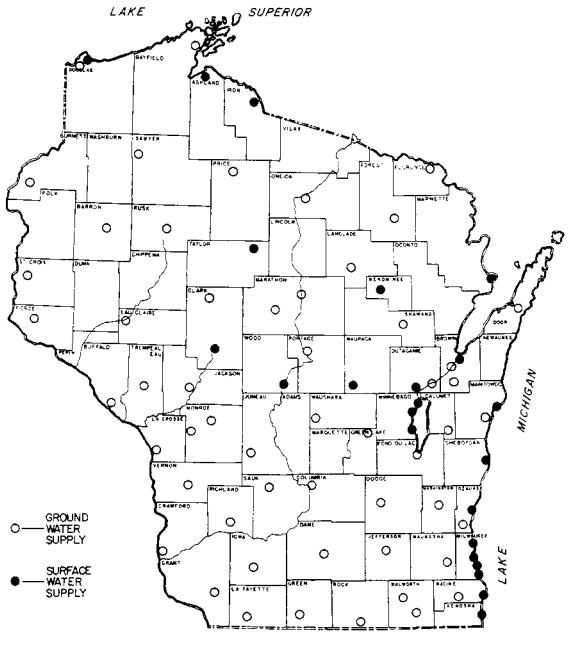

FIGURE 1. *Sampling locations for trace element survey.*

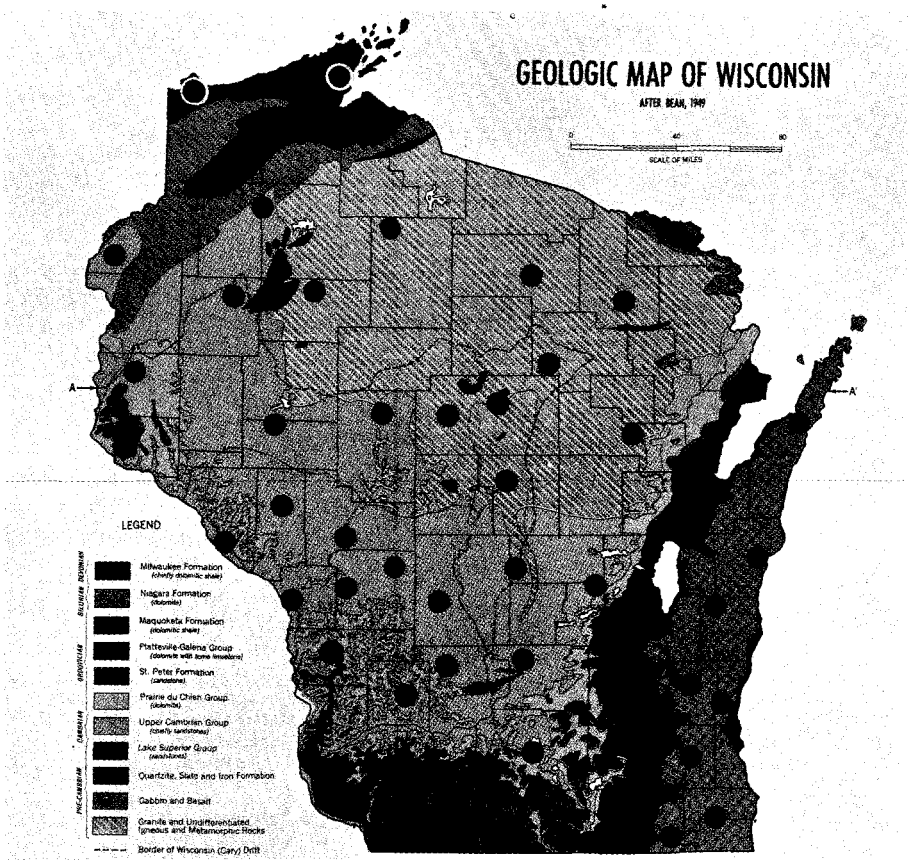

FIGURE 2. *Location of ground water supplies sampled in respect to geologic formations.*

RESULTS AND DISCUSSION

Following is a summation and discussion of the sampling results for the major parameters. Data on individual analyses are presented in Appendix B.

Methylene-blue-active substances (MBAS)

These substances are principally indications of synthetic detergents. In 1965 the detergent industry converted from ABS to the more biodegradable LAS compounds.

Recommended Standard: .5 mg/l

Survey Results and Comment: 97 percent of samples contained less than .1 mg/l while the remaining 3 percent contained less than .2 mg/l. This indicates that detergents are not a significant factor in the water.

Ammonia (N)

Ammonia is frequently an indicator of recent sewage pollution and is significant in raw water sources since it reacts with chlorine to form compounds with markedly less disinfecting efficiency than free chlorine. Ammonia in treated water is indicative of ammonia addition in the treatment process for combined residual chlorination.

Recommended Standard: The permissible criterion developed by the National Technical Advisory Committee on Public Water Supplies is .5 mg/l (N), and the desirable criterion is less than .01 mg/l.

Survey Results and Comment: Only surface water supplies were sampled. Values ranged from .03 to .19 mg/l in raw water with an average of .11 mg/l. Treated water samples varied from .03 to .54 mg/l with an average of .14 mg/l. All raw water samples were within the permissible criterion but exceeded the desirable criterion.

Arsenic

The use of inorganic arsenic in insecticides and its presence in animal foods, tobacco and other sources, make it necessary to maintain the surveillance of arsenic in drinking water. Toxicity of arsenic is well known.

Mandatory Standard: .05 mg/l

Survey Results and Comment: All samples were less than .02 mg/l, which is well below the standard.

Barium

In addition to occurring naturally as the carbonate salt, barium may also appear in certain types of industrial wastes.

Mandatory Standard: 1.0 mg/l

Survey Results and Comment: All but two of the samples contained less than .5 mg/l. The other two samples were reported as .5 and 1.0 mg/l. Since both samples were from deep sandstone wells which should not be subject to industrial pollution, the results seem questionable. Therefore, both supplies are being resampled.

Boron

Boron may occur naturally in ground and surface waters with concentrations of 5 to 15 mg/l in the western United States, whereas concentrations of less than 1.0 mg/l are

normally found elsewhere. In addition to occurring naturally, boron may also be introduced to a watercourse by certain industrial waste effluents.

Mandatory Standard (Proposed): 1.0 mg/l

Survey Results and Comment: 97 percent of the samples contained less than .02 mg/l, 2 percent at 0.2 mg/l and 1 percent greater than 0.2 but less than 1.0 mg/l. The proposed standard (to be included in the next edition of the drinking water standards) was not exceeded in any of the samples.

Cadmium

Cadmium may be found in the effluents of industrial plants, such as those doing electroplating and in water being transported in zinc-galvanized iron pipes which contain cadmium as a contaminant. Only minute quantities are found in natural waters. As the result of some cases of food poisoning in the United States, cadmium is regarded as having serious toxic potential.

Mandatory Standard: .01 mg/l

Survey Results and Comment: All samples contained less than .01 mg/l which is the sensitivity of the analytical method used.

Chromium (Hexavalent)

Chromium salts are used extensively in industrial processes and frequently added to cooling water for corrosion control.

Mandatory Standard: .05 mg/l

Survey Results and Comment: The standard was not exceeded as all samples contained less than .03 mg/l. Toxicity studies have indicated that the standard of .05 mg/l is sufficiently low to cause no effect on health.

Copper

Copper service lines and brass and bronze fittings containing copper are used extensively in most water distribution systems.

Recommended Standard: 1.0 mg/l

Survey Results and Comment: 75 percent of the samples contained less than .03 mg/l, 18 percent between .03 and .1 mg/l, and 7 percent between .1 and 1.0 mg/l. None of the samples exceeded the standard. Concentrations greater than 1.0 mg/l may cause undesirable tastes and blue-green stains on plumbing fixtures. It is interesting to note that all but two of the samples which contained between .1 and 1.0 mg/l were from distribution systems. Further investigation reveals that all but one of those supplies containing concentrations in the .1 to 1.0 mg/l range have corrosive water as indicated by the Langelier Index method. This supports the theory that the copper concentrations are due to corrosion of copper service lines and plumbing and points out the importance of maintaining a stable or noncorrosive water in the distribution system.

Cyanide

Due to the lengthy analytical procedure only nine finished water samples from surface water supplies were analyzed.

Mandatory Standard: .2 mg/l

Survey Results and Comment: 67 percent were less than .02 mg/l and 33 percent were less than .01 mg/l. None exceeded the standard.

Lead

The presence of lead in a water supply generally arises from industrial discharges or dissolution of lead plumbing. With the exception of the lead ore area in southwestern Wisconsin, natural water does not normally contain any appreciable amount of lead.

Mandatory Standard: .05 mg/l

Survey Results and Comment: 99 percent of the samples contained less than .05 mg/l, 51 percent less than .04 mg/l, and 1 percent or one sample at .06 mg/l. The one sample that exceeded the standard was from a distribution system with a portion of the service line being of lead material. Computations using the Langelier Index indicate that the water is quite corrosive. Further sampling will be done to determine if this condition still exists or whether it was caused by the water being in contact with the lead service line over a period of time.

Mercury

In early 1970 the discovery of high mercury residues in fish taken from the Wisconsin River downstream of a mercury cell chlorine-caustic plant caused much concern. Consumption of the fish was discouraged since the "action level" of .5 mg/l as established by the Food and Drug Administration was exceeded. Studies of surface water sources used for drinking water revealed mercury concentrations less than .0002 mg/l in all cases.

Mandatory Standard (Proposed): .05 mg/l

Survey Results and Comment: All samples showed concentrations of less than .0002 mg/l which is considerably below the proposed standard.

Silver

In nature, silver is found in the elemental state and combined in several ores. Traces of silver could also be expected to reach natural waters from various manufacturing processes such as electroplating and in the processing of food and beverages.

Mandatory Standard: .05 mg/l

Survey Results and Comment: All samples contained less than .04 mg/l.

Zinc

Zinc most commonly enters the supply from the deterioration of galvanized iron pipe and brass. Since cadmium and lead are common contaminants of zinc used in galvanizing, there is concern when concentrations approach the standard.

Recommended Standard: 5.0 mg/l

Survey Results and Comment: 78 percent of the samples contained less than .1 mg/l, 16 percent between 0.1 and 1.0 mg/l, and 6 percent between 1.0 and 1.4 mg/l. A Langelier Index determination for those supplies with zinc concentrations over .5 mg/l revealed that all but one of the supplies were distributing a water that had corrosive tendencies. The samples with zinc concentrations up to 1.4 mg/l did not contain any significant amounts of cadmium or lead.

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Values obtained in this survey were similar to those reported by the U.S. Geological Survey in their 1970 survey of surface waters in the United States, and by the Public Health Service in their analysis of Wisconsin interstate carrier drinking water.

The attempt to investigate the efficiencies of various treatment processes in trace element removal was inconclusive. A comparison of the raw and treated water analyses showed slight reductions of copper and zinc in several cases when the raw water contained greater than .1 mg/l of the element. In most cases, both the raw and treated water concentrations were so low the sensitivity of the analytical method did not indicate any change due to the treatment process.

SUMMARY AND CONCLUSIONS

The survey shows that there are low concentrations of trace elements distributed throughout the state. Present water sources, however, do not contain any appreciable quantities that would affect the water quality to the consumer. All of the water sources meet the drinking water standards of the Public Health Service. Increased concentrations of copper, zinc and lead point toward the deterioration of water quality in distribution systems with corrosive water. Concentrations of these elements may exceed the standards unless proper corrosion control or stabilization is practiced.

FUTURE PLANS

Surveillance of trace elements in Wisconsin water supply sources will be continued. A number of surface water supplies will be monitored year around to determine if there are water quality changes due to changing wind directions, season of the year, etc. This should provide more accurate information than grab or short-term composite samples. Future sampling will also be coordinated with other Bureaus within the Department as surveillance of industrial waste discharges receives increased emphasis. For instance, those supplies near industrial areas will be checked for the particular chemicals utilized by those industries. Additional parameters will be included in the analyses as the necessary laboratory equipment is obtained.

APPENDIX A: Analytical Procedures

ABS (MBAS): Methylene blue reacts with alkyl Benzene sulfonates to form a colored complex which is soluble in chloroform. The acidified sample to which methylene blue has been added is extracted once with chloroform. The color intensity of the chloroform layer is proportional to the MBAS and is compared visually to standard solutions of copper sulfate.

Alkalinity: Titration is with 1/50 normal sulfuric acid to pH values of 8.3 and 4.6 for the phenolphthalein and total alkalinities respectively, using a pH meter. Results are expressed as the equivalent concentration of calcium carbonate.

Ammonia: Distilled from solution adjusted to pH 7.4 and collected in distilled water, the concentration is determined by nesslerization and use of a spectrophotometer.

Arsenic: Reduced to arsine by zinc in sulfuric acid. The arsine is passed into a tube containing silver diethyldithiocarbamate dissolved in pyridine forming a red complex which is measured spectrophotometrically.

Barium: Atomic absorption, wave length at 5536 A.

Boron: A sample of water containing boron is acidified and evaporated in the presence of curcumin. A red-colored product is formed called rosocyamine which is dissolved in ethyl alcohol and determined spectrophotometrically.

Cadmium: Sample aspirated directly into the flame of an atomic absorption spectrophotometer and measured at a wave length of 2288 A.

Calcium: Complexed with EDTA using powdered murexide as end-point indicator.

Chloride: Titrated with silver nitrate using chromate as the end-point indicator.

Chromium: Atomic absorption, wave length at 357.9 A.

Copper: Atomic absorption, wave length at 324.7 A.

Cyanide: Distilled into sodium hydroxide, then treated with phenolphthalin which is converted to phenolphthalein by cyanide. The resulting color is determined spectrophotometrically.

Fluoride: Sample is treated with SPADNS solution in an Auto-Analyzer and fluoride determined colorimetrically.

Hardness: Calcium and magnesium are complexed with EDTA and the end-point determined with chrome black T. Sodium sulfide is used as in inhibitor.

Iron: Iron is brought into solution with HCl, reduced to the ferrous state with hydroxylamine and treated with 1, 10-phenanthroline at pH 3.2-3.3. The resulting color is read in a spectrophotometer.

Lead: Sample is concentrated by evaporation and run by atomic absorption at 2833 A.

Magnesium: Calculated as the difference between the hardness and calcium content.

Manganese: Atomic absorption at 2795 A.

Mercury: Reduced to the elemental form by the action of stannous chloride and the vapor formed analyzed by flameless atomic absorption at 2536 A.

Nitrate and Nitrite: The sum of these is determined by an Auto-Analyzer. Nitrate is reduced to nitrite by copper and hydrazine sulfate. Reaction with sulfanilamide yields a diazo compound which couples with N-1-naphthylenediamine to form a dye, which is measured spectrophotometrically.

pH: Values were obtained electrometrically.

Silver: Atomic absorption at 3281 A.

Sodium: Atomic absorption at 5890 A.

Sulfate: Sulfate ion is precipitated in a hydrochloric acid medium with barium chloride. The absorbance of the resulting suspension of barium sulfate is measured in a spectrophotometer.

Total Solids: An aliquot is dried at 103 C in a platinum dish and weighed.

Zinc: Atomic absorption at 2139 A.

APPENDIX B: Data on Individual Analyses

County and Community	ASHLAND Ashland		BARRON Rice Lake	BAYFIELD Bayfield	BROWN De Pere	BROWN Green Bay
Source of Sample	Raw Water/ L. Superior	Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System	Raw Water/ L. Michigan
Treatment	-	Purification Plant	None	None	None	-
CHEMICAL ANALYSES mg/l						
MBAS	<.1	<.1	<.1	<.1	<.1	<.1
Ammonia(N)	-	-	-	-	-	.12
Arsenic	<.02	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5	<.5
Boron	<.2	<.2	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	<.03	<.03	<.05	<.03	.35	<.03
Cyanide	-	-	-	-	-	-
Lead	-	<.04	<.04	<.04	<.04	<.04
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	1.2	1.0	.86	.75	.01	<.01
Alkalinity Tot.($CaCO_3$)	48	46	112	76	206	110
Calcium	15	17	35	15	54	34
Chlorides	3	8	8	1	18	8
Fluorides	.10	1.15	.20	.10	2.2	.20
Hardness(Tot.)	56	60	128	76	244	136
Iron	.32	.22	.10	.12	.26	.06
Magnesium	4	5	10	9	25	13
Manganese	<.04	<.04	.04	<.04	<.04	<.04
Nitrite + Nitrate-(N)	.3	.2	<.2	<.2	<.2	0.2
Sodium	2	4	3	2	15	4.5
Sulfates	5	6	5	1	48	19
Total Solids	82	90	110	104	318	158
pH (Lab) su	7.3	7.4	8.0	7.8	7.9	8.1
pH (Field) su	7.1	7.0	6.9	7.3	-	-
Comments		Lead & galvanized service	Galvanized & copper service	Galvanized service	Copper service line	

County and Community	BROWN — Cont. Green Bay	Greenleaf	BUFFALO Fountain City	BURNETT Grantsburg	CALUMET New Holstein	CLARK Neillsville
Source of Sample	Finished Water	Ground Water/ Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System	Raw Water/ Black River
Treatment	Purification Plant	None	None	None	None	
CHEMICAL ANALYSES mg/l						
MBAS	<.1	<.1	<.1	<.1	<.1	<.1
Ammonia(N)	.07	.08	-	-	-	.06
Arsenic	<.02	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5	<.5
Boron	<.2	<1.0	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	<.03	.05	<.02	<.03	<.02	<.03
Cyanide	-	-	-	-	-	-
Lead	<.04	<.04	<.05	<.04	<.05	<.04
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	<.01	.03	.05	.6	.02	<.01
Alkalinity Tot.($CaCO_3$)	104	262	258	180	286	60
Calcium	34	105	60	42	71	15
Chlorides	8.5	6	1	11	8	7
Fluorides	1.15	.95	.15	1.30	1.25	.2
Hardness(Tot.)	132	470	268	156	340	56
Iron	<.04	.4	.44	.26	.04	.44
Magnesium	12	50	29	12	40	5
Manganese	<.04	<.04	<.04	.22	<.04	.04
Nitrite + Nitrate-(N)	<.2	0.3	<.08	<.16	2.4	.1
Sodium	5	18.5	2	17	6	9
Sulfates	22	260	16	1	48	6
Total Solids	160	680	280	226	400	118
pH (Lab) su	8.2	7.8	7.7	7.7	7.7	8.0
pH (Field) su	-	-	-	7.2	7.6	-
Comments		Copper service line	Copper service	Galvanized & copper service	Copper service line	Tot. Org. N - .51

County and Community	CLARK Neillsville	CLARK Owen	COLUMBIA Portage	CRAWFORD, Prairie du Chien	DANE Madison
Source of Sample	Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System
Treatment	Purification Plant	None	Lime Softening	None	None
CHEMICAL ANALYSES mg/l					
MBAS	<.1	<.1	<.1	<.1	-
Ammonia(N)	-	-	-	-	-
Arsenic	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5
Boron	<.2	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03
Copper	<.02	.03	<.03	<.02	<.03
Cyanide	-	-	-	-	-
Lead	<.05	<.05	<.05	<.05	<.04
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04
Zinc	.05	.02	<.01	0.01	<.01
Alkalinity Tot.($CaCO_3$)	58	98	60	258	172
Calcium	30	29	20	67	55
Chlorides	12	9	11	6	0
Fluorides	1.15	.25	1.0	.20	1.3
Hardness(Tot.)	100	124	92	284	276
Iron	.18	.14	<.04	0.12	.04
Magnesium	6	12	10	28	34
Manganese	<.04	<.04	<.04	<.04	.04
Nitrite + Nitrate-(N)	.8	.72	0.9	.28	.3
Sodium	9.5	8.5	9.0	3.5	20
Sulfates	40	22	24	20	45
Total Solids	162	190	124	320	266
su pH (Lab)	8.4	7.6	9.6	7.7	8.5
su pH (Field)	-	-	-	-	-
Comments	Copper and cast iron service	Copper service		Galvanized service	Copper service line

County and Community	DODGE Beaver Dam	DOOR Sturgeon Bay	DOUGLAS Superior		EAU CLAIRE Eau Claire	
Source of Sample	Ground Water/ Distribution System	Ground Water/ Distribution System	Raw Water/ L. Superior	Distribution System (Well Water)	Raw Water/ (Wells No. 2, 11, 13, 14)	Ground Water/ Distribution System
Treatment	Lime Softening	None	-	Purification Plant	-	Iron & Manganese Removal
CHEMICAL ANALYSES mg/l						
MBAS	<.1	<.1	<.1	<.1	<.1	<.1
Ammonia(N)	-	.03	-	-	-	-
Arsenic	<.02	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5	<.5
Boron	<.2	<.2	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	<.03	.07	<.03	.2	<.02	.04
Cyanide	-	-	-	<.01	-	-
Lead	<.05	<.04	<.04	.06	<.05	<.05
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	<.01	.03	.84	0.8	.03	<.01
Alkalinity Tot.($CaCO_3$)	84	264	42	44	52	54
Calcium	18	66	13	13	15	18
Chlorides	2	14	2.5	3	4	7
Fluorides	1.4	1.20	.10	.10	.20	1.3
Hardness(Tot.)	108	300	48	48	72	72
Iron	.82	0.2	0.14	0.54	1.0	.1
Magnesium	15	33	4	4	8	7
Manganese	<.04	<.04	<.04	<.04	.9	.04
Nitrite + Nitrate-(N)	<.2	2.5	0.2	0.2	1.0	1.2
Sodium	4.5	6	1.5	1.5	2.5	3
Sulfates	25	23	4	3	7	6
Total Solids	126	338	52	66	114	116
su pH (Lab)	9.5	8.0	7.5	7.1	7.5	7.7
su pH (Field)	-	-	7.1	7.0	-	-
Comments		Tot. Org. N - .13	Color - 10	Color - 5 Lead & cop. service		Copper service line

County and Community	FLORENCE Florence	FOND DU LAC Fond du Lac	FOREST Laona	GREEN Monroe	GREEN LAKE Berlin	IRON Hurley
Source of Sample	Ground Water/ Distribution System	Ground Water/ Main Station	Ground Water/ Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System	Raw Water/ L. Lavina
Treatment	None	None	None	None	None	-
CHEMICAL ANALYSES mg/l						
MBAS	<.1	<.1	<.1	.1	<.1	<.1
Ammonia(N)	-	-	-	-	-	-
Arsenic	<.02	<.02	<.02	<.01	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5	<.5
Boron	<.2	<.2	<.2	<.1	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	.08	<.03	<.03	.02	<.03	<.03
Cyanide	-	-	-	-	-	-
Lead	<.04	<.04	<.05	<.05	<.04	<.04
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	0.2	.05	.18	.05	-	.6
Alkalinity Tot.($CaCO_3$)	150	194	110	272	246	18
Calcium	35	87	27	50	52	12
Chlorides	3	70	2	1	7.5	14
Fluorides	.15	.75	.5	1.3	1.1	.30
Hardness(Tot.)	168	376	112	276	256	48
Iron	<.04	.26	.08	.04	<.04	1.64
Magnesium	20	39	11	37	31	4
Manganese	<.04	<.04	.35	<.03	.06	0.1
Nitrite + Nitrate-(N)	.2	<.2	.44	.16	<.2	<.2
Sodium	3	37	4.2	2.6	7	2
Sulfates	22	190	6	18	23	17
Total Solids	180	606	140	284	284	104
su						
pH (Lab)	8.3	7.7	7.8	7.8	7.9	6.3
pH (Field)	7.8	-	7.2	-	-	-
Comments	Galvanized service line	Galvinized & copper service line	Asbestos-cement mains copper service	Cast iron service	Copper Serv. line - galv. plumbing	Color-100 Samp. downstream of chlorine & ammonia addition, aeration

County and Community	IRON Hurley	IOWA Dodgeville	JACKSON Black R. Falls	JEFFERSON Johnson Creek	JUNEAU New Lisbon	KENOSHA Kenosha
Source of Sample	Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System	Raw Water/ L. Michigan
Treatment	Purification Plant	None	None	None	None	-
CHEMICAL ANALYSES mg/l						
MBAS	.1	<.1	<.1	<.1	.1	<.1
Ammonia(N)	-	-	-	-	-	-
Arsenic	<.02	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	.5	<.5	<.5
Boron	<.2	<.2	<.2	<.2	<.2	.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	<.03	<.02	.03	.04	1.0	.06
Cyanide	-	-	-	-	-	-
Lead	<.04	<.05	<.05	<.04	<.05	<.04
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	1.4	.08	.01	.09	<.01	.16
Alkalinity Tot.($CaCO_3$)	8	286	98	282	106	110
Calcium	22	55	13	60	34	35
Chlorides	14	4	10	12	0	10
Fluorides	.2	1.7	1.2	1.3	.2	.20
Hardness(Tot.)	76	308	60	292	116	136
Iron	1.36	.18	.36	.18	.2	.18
Magnesium	5	41	7	35	7.5	12
Manganese	0.1	<.04	<.04	.05	<.04	<.04
Nitrite + Nitrate-(N)	<.2	.3	1.6	<.2	.2	.3
Sodium	2	2.5	31	6.0	4	5.5
Sulfates	51	23	17	13	11	21
Total Solids	130	325	166	330	74	180
su						
pH (Lab)	6.1	7.5	7.9	7.6	8.0	8.3
pH (Field)	-	-	-	-	6.7	8.1
Comments	Color-10 lead & galv. service	Copper service	Cast iron service	Galvanized iron service line	Iron service line, copper plumbing	

County and Community	KENOSHA Kenosha	LA CROSSE La Crosse	LAFAYETTE Shullsburg	LANGLADE Antigo		MANITOWOC Manitowoc
Source of Sample	Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System	Raw Water/ Well #9	Ground Water/ Distribution System	Ground Water/ Distribution System
Treatment	Purification Plant	None	None	-	Lime Softening	None
CHEMICAL ANALYSES mg/l						
MBAS	<.1	<.1	<.1	<.1	<.1	<.1
Ammonia (N)	-	-	-	-	-	-
Arsenic	<.02	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5	<.5
Boron	.2	<.2	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	<.03	<.02	<.02	<.03	<.03	<.02
Cyanide	<.02	-	-	-	-	-
Lead	<.04	<.05	<.05	<.05	<.05	<.05
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	.24	0.7	<.01	.35	.3	.04
Alkalinity Tot.($CaCO_3$)	100	232	268	144	32	158
Calcium	34	67	59	37	17	50
Chlorides	12	11	3	30	28	14
Fluorides	1.15	.20	1.7	.25	1.1	.85
Hardness(Tot.)	132	280	280	188	80	208
Iron	.18	.06	0.12	.08	.26	.32
Magnesium	12	27	32	23	4	20
Manganese	<.04	<.04	<.04	1.13	<.03	<.04
Nitrite + Nitrate-(N)	.3	2.7	<.1	1.04	1.36	<.2
Sodium	5.5	6	3.5	11	9	6.5
Sulfates	24	39	14	24	21	42
Total Solids	166	340	295	232	120	256
su						
pH (Lab)	7.8	7.8	7.5	7.4	9.2	7.9
pH (Field)	7.4	-	-	-	9.2	7.4
Comments	Copper service line	Iron service, galvanized plumbing	Copper service		Galvanized piping	

County and Community	MANITOWOC Two Rivers		MARATHON Edgar	MARATHON Wausau	MARINETTE Marinette	
Source of Sample	Raw Water/ L. Michigan	Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System	Raw Water/ L. Michigan	Distribution System
Treatment	-	Purification Plant	None	Lime Softening	-	Purification Plant
CHEMICAL ANALYSES mg/l						
MBAS	<.1	<.1	<.1	<.1	<.1	<.1
Ammonia(N)	.05	<.03	-	-	.18	.07
Arsenic	<.02	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5	<.5
Boron	<.2	<.2	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	.03	<.02	<.03	<.03	.1	<.03
Cyanide	-	<.02	-	-	-	-
Lead	<.05	<.05	<.05	<.05	<.04	<.04
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	.1	<.01	.04	.01	<.01	.06
Alkalinity Tot.($CaCO_3$)	112	100	118	58	102	82
Calcium	34	34	37	22	30	32
Chlorides	7	9	10	11	4	10
Fluorides	.20	1.05	.25	1.15	.25	.30
Hardness(Tot.)	136	136	136	76	124	128
Iron	.54	.06	.04	.08	.18	.14
Magnesium	12	12	11	5	12	12
Manganese	<.04	<.04	<.04	<.04	<.04	<.04
Nitrite + Nitrate-(N)	<.2	<.2	.64	.32	<.2	<.2
Sodium	4.5	5	7.5	5	3.5	4
Sulfates	19	28	17	10	17	40
Total Solids	192	146	154	124	156	158
su						
pH (Lab)	8.1	8.2	7.2	8.1	7.5	7.4
pH (Field)	8.5	-	7.0	8.0	7.3	-
Comments		Lead service	Copper service	Copper & galvanized service	Tot. Org. N -.29 cop. serv.	Copper service

County and Community	MENOMINEE Neopit		MILWAUKEE Cudahy		MILWAUKEE Glendale (N. Shore Wtr. Comm.)	
Source of Sample	Raw Water/ Wolf River	Distribution System	Raw Water/ L. Michigan	Distribution System	Raw Water/ L. Michigan	Distribution System
Treatment	-	Purification Plant	-	Purification Plant	-	Purification Plant
CHEMICAL ANALYSES mg/l						
MBAS	<.1	<.1	<.1	<.1	<.1	<.1
Ammonia(N)	.03	.08	-	-	.06	<.03
Arsenic	<.02	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5	<.5
Boron	<.2	<.2	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	<.03	<.03	<.03	<.03	<.02	<.02
Cyanide	-	-	-	<.02	-	-
Lead	<.04	<.04	<.04	<.04	<.05	<.05
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	.02	.02	<.01	.7	<.01	<.01
Alkalinity Tot.($CaCO_3$)	156	146	118	102	112	100
Calcium	35	13	37	37	35	35
Chlorides	1	4	17	13	10	13
Fluorides	.35	1.0	.25	1.05	.20	.70
Hardness(Tot.)	160	84	140	140	132	132
Iron	.24	.08	.3	.1	.12	.04
Magnesium	18	12	12	12	11	11
Manganese	<.04	<.04	<.04	<.04	<.04	<.04
Nitrite + Nitrate-(N)	.7	.7	.4	.4	.28	.8
Sodium	2	42	9.5	9	5	6
Sulfates	8	8	25	29	20	27
Total Solids	168	164	198	216	162	174
su						
pH (Lab)	8.1	8.0	8.1	7.9	8.1	7.9
pH (Field)	-	-	8.15	7.5	7.8	7.6
Comments	Galvanized tap	Tot. Org. N - .21 galv. serv.		Copper service line		Copper service line

County and Community	MILWAUKEE Milwaukee			MILWAUKEE South Milwaukee	
Source of Sample	Raw Water/ (Linwood Intake) L. Michigan	Raw Water/ (Texas Ave. Int.) Lake Michigan	Distribution System	Raw Water/ L. Michigan	Distribution System
Treatment	-	-	Purification Plant	-	Purification Plant
CHEMICAL ANALYSES mg/l					
MBAS	<.1	<.1	<.1	<.1	<.1
Ammonia(N)	-	-	-	-	-
Arsenic	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5
Boron	<.2	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03
Copper	.04	<.03	<.03	<.03	<.03
Cyanide	-	-	<.02	-	-
Lead	<.04	<.04	<.04	<.04	<.04
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04
Zinc	<.01	.03	.05	<.01	.08
Alkalinity Tot.($CaCO_3$)	106	114	100	118	88
Calcium	34	35	34	37	37
Chlorides	8	14	13	16	16
Fluorides	.20	.25	.95	.25	1.10
Hardness(Tot.)	132	140	136	140	136
Iron	.06	.2	.14	.56	.04
Magnesium	12	12	12	12	11
Manganese	<.04	<.04	<.04	<.04	<.04
Nitrite + Nitrate-(N)	<.2	.3	.4	0.4	0.3
Sodium	4.5	7.5	6	9	8.5
Sulfates	17	23	26	25	44
Total Solids	172	172	174	204	186
su					
pH (Lab)	8.2	7.9	7.9	8.1	7.9
pH (Field)	8.2	8.4	7.5	8.3	7.5
Comments			Copper service line	Temp (C°) 3	Temp (C°) 6 Copper serv.

County and Community	MONROE Sparta	MONROE Tomah	ONEIDA Rhinelander	OUTAGAMIE Kaukauna	
Source of Sample	Ground Water/ Distribution System	Ground Water/ Raw	Ground Water/ Distribution System	Ground Water/ Distribution System	Raw Water at Filter Plant	Ground Water/ Distribution System
Treatment	None	-	Iron Removal	None		Iron Removal
CHEMICAL ANALYSES mg/l						
MBAS	<.1	<.1	<.1	<.1	<.1	<.1
Ammonia(N)	-	-	-	-	.19	.12
Arsenic	<.02	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5	<.5
Boron	<.2	<.2	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	.02	.05	<.02	0.2	<.03	<.03
Cyanide	-	-	-	-	-	-
Lead	<.05	<.05	<.05	<.05	<.04	<.04
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	0.1	.03	.06	.01	.01	.01
Alkalinity Tot.($CaCO_3$)	98	38	42	46	190	180
Calcium	27	12	14	15	220	202
Chlorides	3	1	7	4	8	6
Fluorides	1.00	.10	.10	.95	2.30	3.15
Hardness(Tot.)	116	48	60	76	630	640
Iron	1.56	.3	0.1	.04	.54	.1
Magnesium	12	4	4	9	19.5	33
Manganese	.08	<.04	<.04	<.03	<.04	<.04
Nitrite + Nitrate-(N)	.36	2.2	2.2	.44	<.2	<.2
Sodium	2.5	2	5	3.8	12	12.5
Sulfates	14	5	12	10	445	450
Total Solids	146	80	120	92	836	836
su pH (Lab)	7.4	6.8	6.9	7.0	7.8	8.0
pH (Field)	-	-	-	6.7	-	-
Comments	Galvanized service		Cast iron serv. galv. bldg. piping	Cast iron serv. copper & galv. plumbing		Copper service line

County and Community	OUTAGAMIE Appleton		OZAUKEE Cedarburg	OZAUKEE Port Washington		PIERCE Ellsworth
Source of Sample	Raw Water/ L. Winnebago	Distribution System	Ground Water/ Distribution System	Raw Water/ L. Michigan	Distribution System	Ground Water/ Distribution System
Treatment	-	Purification Plant	None	-	Purification Plant	None
CHEMICAL ANALYSES mg/l						
MBAS	<.1	<.1	<.1	<.1	<.1	<.1
Ammonia(N)	.14	.54	-	.03	.09	-
Arsenic	<.02	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5	<.5
Boron	<.2	<.2	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	.32	<.03	<.02	<.03	<.03	.07
Cyanide	-	-	-	-	-	-
Lead	<.04	<.04	<.05	<.05	<.05	<.05
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	.01	<.01	.15	.02	.04	.02
Alkalinity Tot.($CaCO_3$)	146	72	288	108	96	294
Calcium	37	22	81	36.5	36.5	84
Chlorides	15	14	9	6.5	10	15
Fluorides	.45	.85	.9	.20	1.25	1.05
Hardness(Tot.)	176	116	356	132	132	336
Iron	.1	.04	<.04	0.50	.08	.08
Magnesium	20	15	37	10	10	31
Manganese	<.04	<.04	<.04	<.04	.05	<.03
Nitrite + Nitrate-(N)	.3	0.5	.32	<.2	<.2	3.2
Sodium	6	7.5	5	4.5	4.5	7.1
Sulfates	16	34	70	18	25	27
Total Solids	244	166	430	154	156	410
su pH (Lab)	7.9	9.2	7.9	8.0	8.2	7.8
pH (Field)	-	-	7.2	7.6	-	-
Comments		Lead serv. line	Lead serv. line-copper plumbing	Copper service	Copper service	Copper service line

County and Community	PORTAGE Stevens Point	PRICE Park Falls	RACINE Racine		RACINE Union Grove	RICHLAND Richland Center
Source of Sample	Ground Water/ Distribution System	Ground Water/ Distribution System	Raw Water/ L. Michigan	Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System
Treatment	None	None		Purification Plant	None	None
CHEMICAL ANALYSES mg/l						
MBAS	<.1	<.1	<.1	<.1	<.1	<.1
Ammonia(N)	-	-	-	-	-	-
Arsenic	<.02	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5	<.5
Boron	<.2	<.2	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	<.03	<.03	.05	<.03	.04	<.02
Cyanide	-	-	-	<.02	-	-
Lead	<.05	<.04	<.04	<.04	<.04	<.05
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	.01	1.1	.04	<.01	<.01	<.01
Alkalinity Tot.($CaCO_3$)	136	112	116	106	250	216
Calcium	32	34	35	37	62	49
Chlorides	4	1	16	16	7	2
Fluorides	.20	.20	0.25	1.10	1.15	1.00
Hardness(Tot.)	144	120	140	140	240	224
Iron	.06	.14	0.04	.04	1.04	.12
Magnesium	15	8	12	12	21	25
Manganese	<.04	<.04	<.04	<.04	<.04	<.04
Nitrite + Nitrate-(N)	1.1	<.2	0.5	0.4	<.2	.32
Sodium	2	3	8.5	9	20	1.5
Sulfates	7	7	25	27	54	13
Total Solids	184	132	230	184	352	224
su pH (Lab)	7.7	7.8	8.0	8.0	8.1	8.3
su pH (Field)	7.5	6.9	8.6	-	7.5	-
Comments	Temp (C°) 5 galv. serv.	Galvanized service	Sample from copper serv.	Temp (C°) 6 galv. serv.		

County and Community	ROCK Beloit	RUSK Ladysmith	SAUK Reedsburg	SAWYER Hayward	SHAWANO Shawano	SHEBOYGAN Sheboygan
Source of Sample	Ground Water/ Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System	Ground Water/ Distribution System	Raw Water/ L. Michigan
Treatment	None	None	None	None	None	-
CHEMICAL ANALYSES mg/l						
MBAS	<.01	<.1	<.1	<.1	<.1	<.1
Ammonia(N)	-	-	-	-	-	.04
Arsenic	<.02	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5	<.5
Boron	<.2	<.2	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	<.03	<.02	<.02	<.03	.05	<.02
Cyanide	-	-	-	-	-	-
Lead	<.04	<.05	<.05	<.04	<.05	<.05
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	.05	.08	<.1	1.1	.08	.05
Alkalinity Tot.($CaCO_3$)	260	120	174	124	220	112
Calcium	64	40	39	34	47	34
Chlorides	24	14.5	2	3	3	8
Fluorides	.3	1.0	1.40	1.20	.15	.20
Hardness(Tot.)	316	156	172	124	240	136
Iron	.04	.08	.08	.44	.04	.26
Magnesium	38	14	18	10	30	12
Manganese	<.04	.09	<.04	.8	<.04	<.04
Nitrite + Nitrate-(N)	1.5	1.0	.64	<.2	1.7	<.2
Sodium	10.5	5	2	3	1.5	4.5
Sulfates	43	18	4	1	10	17
Total Solids	378	204	184	162	254	188
su pH (Lab)	7.8	7.5	8.3	8.0	7.8	8.0
su pH (Field)	-	6.9	7.0	7.1	7.3	8.0
Comments	Copper service line	Copper service	Copper service	Lead & galvanized service	Copper service	

County and Community	SHEBOYGAN Sheboygan	ST. CROIX New Richmond	TAYLOR Rib Lake		TREMPEALEAU Whitehall	
Source of Sample	Distribution System	Ground Water/ Distribution System	Raw Water/ Rib Lake	Finished Water	Ground Water/ Raw	Ground Water/ Distribution System
Treatment	Purification Plant	None	-	Purification Plant	-	Zeolite Softening & Iron Removal
CHEMICAL ANALYSES mg/l						
MBAS	<.1	<.1	<.2	<.1	<.1	<.1
Ammonia(N)	.09	-	-	-	-	-
Arsenic	<.02	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5	<.5
Boron	<.2	<.2	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	<.02	<.02	<.03	<.03	.11	<.02
Cyanide	<.02	-	-	-	-	-
Lead	<.05	<.05	<.04	<.04	<.05	<.05
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	.05	.02	1.0	0.04	.07	.01
Alkalinity Tot.($CaCO_3$)	100	192	8	42	90	112
Calcium	34	44	5	7	22	20
Chlorides	9	<1	0	4	5	4
Fluorides	1.10	1.8	.15	.25	.55	1.05
Hardness(Tot.)	136	200	24	24	100	88
Iron	.06	<.04	.28	.52	5.65	0.22
Magnesium	13	22	3	1	11	9
Manganese	<.04	<.04	<.04	<.04	0.2	.14
Nitrite + Nitrate-(N)	0.3	.64	<.2	<.2	<.1	.16
Sodium	6	2.5	1	30	5	21
Sulfates	30	4	6	30	23	16
Total Solids	162	210	36	150	156	164
su						
pH (Lab)	7.7	8.2	6.9	8.0	7.6	8.4
pH (Field)	-	-	6.1	8.1	-	-
Comments	Copper service	Copper service	Color 40	Color 20 Copper service		Galvanized serv. copper bldg. pipe

County and Community	VERNON Viroqua	WALWORTH Elkhorn		WALWORTH Lake Geneva		WASHINGTON West Bend
Source of Sample	Ground Water/ Distribution System	Raw Water/ Well No. 5	Ground Water/ Distribution System	Ground Water/ Raw	Ground Water/ Distribution System	Ground Water/ Distribution System
Treatment	None	-	Zeol. Softening & Iron Removal	-	Zeol. Softening & Iron Removal	None
CHEMICAL ANALYSES mg/l						
MBAS	<.1	<.1	<.1	<.1	<.1	<.1
Ammonia(N)	-	-	-	-	-	-
Arsenic	<.02	<.02	<.02	<.02	<.02	<.02
Barium	<.5	1.0	<.5	<.5	<.5	<.5
Boron	<.2	<.2	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	<.02	<.03	.04	<.03	<.03	.03
Cyanide	-	-	-	-	-	-
Lead	<.05	<.04	<.04	<.04	<.04	<.05
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	.02	.01	.07	.02	0.1	.02
Alkalinity Tot.($CaCO_3$)	154	332	290	248	314	302
Calcium	42	54	13	49	79	82
Chlorides	13	0	10	19	19	13
Fluorides	.15	.30	.95	.30	.75	1.3
Hardness(Tot.)	200	280	72	264	366	372
Iron	.04	.5	.08	.96	1.1	.04
Magnesium	23	35	10	34	41	40
Manganese	<.04	.06	.12	.05	<.04	<.04
Nitrite + Nitrate-(N)	5.1	<.2	1.5	.7	1.9	1.3
Sodium	6.5	13	127	11	11	4
Sulfates	21	<2	<2	22	41	64
Total Solids	250	316	390	324	408	445
su						
pH (Lab)	7.9	7.7	8.9	8.0	7.9	7.7
pH (Field)	-	7.7	9.0	7.6	8.0	-
Comments	Copper service		Copper service line		Copper service line	Copper service

County and Community	WAUKESHA Waukesha	WAUPACA "King (Grand Army Home)		WAUSHARA Coloma	WINNEBAGO Menasha	
Source of Sample	Ground Water/ Distribution System	Raw Water/ Rainbow Lake	Distribution System	Ground Water/ Distribution System	Raw Water/ L. Winnebago	Distribution System
Treatment	None	-	Purification Plant	None	-	Purification Plant
CHEMICAL ANALYSES mg/l						
MBAS	<.1	<.1	<.1	<.1	<.1	<.1
Ammonia(N)	-	.05	.07	-	.19	.12
Arsenic	<.02	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5	<.5
Boron	<.2	<.2	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	<.02	<.02	<.02	.12	<.03	.04
Cyanide	-	-	-	-	-	-
Lead	<.05	<.05	<.05	<.05	<.04	<.04
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	.01	.16	<.01	.02	.01	.01
Alkalinity Tot.($CaCO_3$)	202	162	42	156	156	132
Calcium	76	34	10	34	37	35
Chlorides	4	6	9	0	9	10
Fluorides	1.05	.25	.25	.95	.35	1.05
Hardness(Tot.)	304	180	64	160	180	172
Iron	.34	.10	.06	.06	.18	.34
Magnesium	27.5	24	10	18	21	20
Manganese	<.04	<.04	<.04	<.04	<.04	<.04
Nitrite + Nitrate-(N)	<.08	.6	.6	2.1	0.4	.4
Sodium	7	3.5	7	1	6	6.5
Sulfates	80	10	17	<1	18	36
Total Solids	380	208	100	202	232	228
su						
pH (Lab)	7.9	8.2	8.2	8.0	8.0	7.5
pH (Field)	7.7	-	-	-	-	-
Comments	Copper service	Galvanized service line	Galvanized & copper serv.	Galvanized plumbing	Tot. Org. N -.55	Tot. Org. N -.41 Copper serv.

County and Community	WINNEBAGO Neenah		WINNEBAGO Oshkosh		WOOD Port Edwards	
Source of Sample	Raw Water/ L. Winnebago	Distribution System	Raw Water/ L. Winnebago	Finished Water	Raw Water/ Well & Lake Nepco	Distribution System
Treatment	-	Purification Plant	-	Purification Plant	-	Purification Plant
CHEMICAL ANALYSES mg/l						
MBAS	<.1	<.1	<.1	<.1	<.1	<.1
Ammonia(N)	.12	.21	.30	.18	-	-
Arsenic	<.02	<.02	<.02	<.02	<.02	<.02
Barium	<.5	<.5	<.5	<.5	<.5	<.5
Boron	<.2	<.2	<.2	<.2	<.2	<.2
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	<.03	<.03	<.03	<.03	<.03	<.03
Copper	<.03	.03	<.03	.05	.04	<.03
Cyanide	-	-	-	-	<.01	<.01
Lead	<.04	<.04	<.04	<.04	<.04	<.04
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
Silver	<.04	<.04	<.04	<.04	<.04	<.04
Zinc	.05	.01	.01	0.02	.04	.02
Alkalinity Tot.($CaCO_3$)	170	28	180	154	94	56
Calcium	40	13	44	42	40	17
Chlorides	9	15	9	12	42	50
Fluorides	.40	1.30	0.35	.30	.25	1.20
Hardness(Tot.)	192	72	200	208	156	88
Iron	.24	.12	0.2	0.12	1.5	.08
Magnesium	23	10	22	25	13.5	11
Manganese	.20	<.04	<.04	<.04	1.5	<.04
Nitrite + Nitrate-(N)	0.6	.5	1	0.9	1.3	1.2
Sodium	6.5	6.5	6.5	6.5	16	54
Sulfates	18	37	20	41	43	62
Total Solids	246	152	248	250	248	242
su						
pH (Lab)	7.9	9.1	7.8	7.5	8.1	8.4
pH (Field)	-	-	-	-	7.2	8.7
Comments	Tot. Org. N-.60	Tot. Org. N-.22 - Lead serv. with copper & galv. plumbing	Tot. Org. N-.32	Copper service & plumbing Tot. Org. N-.16	Lake wtr. treated alum & chlorine copper serv.	Galvanized service

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