

Table 2. Water Quality Standards and Guidelines

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For a copy of the full report, go to:

<https://deertailscientific.wordpress.com/moran-report/>



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Table 2. Water Quality Standards and Guidelines*

Constituent T = Total D = Dissolved	Units	United States		Great Lakes Initiative		Canada					Wisconsin								
		Drinking Water Standard ^{1,2}	Fresh Water Aquatic Life Criteria ³		Fresh Water Aquatic Life Criteria ⁴		Drinking Water Guide ⁵	Irrigation Guide ^{6,7}	Livestock Guide ^{6,7}	Fresh Water Aquatic Life Guide ^{7,8}		Ground Water ⁹		Drinking Water (All Sources) ¹⁰		Surface Waters ¹²			
			Acute	Chronic	Acute	Chronic				Acute	Chronic	Enforcement Standard	Preventive Action Limit ¹¹	Enforcement Standard	Maximum Contam. Level Goal	Fresh Water Aquatic Life Criteria ¹³			
																Warm Water Fishery	Cold Water Fishery		
Acute	Chronic	Acute	Chronic	Acute	Chronic	Acute	Chronic	Acute	Chronic	Acute	Chronic	Acute	Chronic						
Alkalinity	mg/l			20 ¹⁷								100 over Baseline							
Aluminum	µg/l	50 - 200 ²	750 (T) ¹⁸	87 (T) ¹⁸			200 (D) ¹⁹	5000 (T)	5000 (T) ¹⁹	100 (D) ^{19,20}	100 (T) ²⁰ 50 (D) ^{19,20}	200	40						
Ammonia (as N)	mg/l		17 (T) ²¹	1.9 (T) ²¹						19.2 (T) ^{19,22}	1.2 (T) ^{19,22}	9.7	0.97			20 ²³	4.4 ²⁴	13 ²³	4.4 ²⁴
Antimony	µg/l	6					6					6	1.2	6	6				
Arsenic	µg/l	10	340	150			10 ²⁵	100 (T)	25 (T)		5 (T) ²⁶	10	1	10	0				
Arsenic III	µg/l				340	148										340 (T)	152 (T)	340 (T)	148 (T)
Asbestos	MFL	7 ²⁷										7	0.7	7 ²⁷	7 ²⁷				
Barium	mg/l	2					1					2	0.4	2	2				
Beryllium	µg/l	4						100	100			4	0.4	4	4				
Boron	mg/l						5 (T) ¹⁹	0.5 - 6 (T) ¹⁹	5 (T) ¹⁹	29	1.2 (T) ¹⁹	1	0.2						
Cadmium	µg/l	5	0.94 ^{28,29}	0.43 ^{28,29}	2.1 ^{28,30}	1.4 ^{28,30}	5	5.1	80	0.288 (D) ^{19,28}	0.127 (D) ^{19,28}	5	0.5	5	5	4.6 (T) ²⁸	1.4 (T) ²⁸	2.0 (T) ²⁸	1.4 (T) ²⁸
Calcium	mg/l												25 over Baseline						
Chloride	mg/l	250 ²	860	230			250 ³¹	100 ¹⁹	600 ¹⁹	600 ¹⁹	150 ¹⁹	250	125			757	395	757	395
Chlorine	mg/l	4 ³²	.019	.011			See ³³				.0005 ³⁴			4 ³²	4 ³²	.019 (T) ³⁵	.007 (T) ³⁵	.019 (T) ³⁵	.007 (T) ³⁵
Chromium (tot)	µg/l	100					50					100	10	100	100				
Chromium (III)	µg/l		323 ^{28,36}	42 ^{28,36}	1022 ^{28,30}	49 ^{28,30}		5	50		8.9 (T)					1022 (T) ²⁸	75 (T) ²⁸	1022 (T) ²⁸	49 (T) ²⁸
Chromium (VI)	µg/l		16	11	16	11		8	50		1.0 (T)					16 (T)	11 (T)	16 (T)	11 (T)
Cobalt	µg/l							50	1000	110 (T) ¹⁹	4 (T) ¹⁹	40	8						
Coliforms (fecal)		See ³⁷					0	100 per 100 ml							0				
Coliforms (tot)		5.0% ³⁷					0	1000 per 100 ml				0	0						
Conductivity (field sp.)	µS/cm												200 over Baseline						
Copper	µg/l	1300 ³⁸	4.7 ³⁹	2.9 ³⁹	7.3 ^{28,30}	5.2 ^{28,30}	500 (T) ¹⁹	200 (T) ¹⁹	300 (T) ¹⁹	7 (T) ^{19,28}	2 (T) ²⁸	1300	130	1300 ⁴⁰	1300	8.1 (T) ²⁸	5.7 (T) ²⁸	8.1 (T) ²⁸	5.7 (T) ²⁸
Cyanide (free)	µg/l	200	22	5.2	22	5.2					5	200	40	200	200	46	11.5	22	5.2
Cyanide (weak-acid dissociable)	µg/l									10 (T) ⁴¹	5 (T) ⁴¹								
Fluoride	mg/l	4.0					1.5 (T)(acute) ¹⁹ 1.0 (T)(chron) ¹⁹	2.0 (T)(acute) ¹⁹ 1.0 (T)(chron) ¹⁹	2.0 (T)(acute) ¹⁹ 1.0 (T)(chron) ¹⁹	0.4 (T) ^{19,42}	0.12	4	0.8	4	4				
Hardness	mg/l												100 over Baseline						
Iron	µg/l	300 ²		1000 ¹⁴			300 ³¹	5000 (T)		1000 (T) ¹⁹ 350 (D) ¹⁹	300 (T)	300	150						
Lead	µg/l	15 ³⁸	30 ^{28,36}	1.2 ^{28,36}			50 (T)(acute) ¹⁹ 10 (chronic) ⁵	200 (T)	100 (T) ¹⁹	34 (T) ^{19,28}	1 (T) ²⁸ - 5 (T) ^{19,28}	15	1.5	15 ⁴⁰	0	55 (T) ²⁸	14 (T) ²⁸	55 (T) ²⁸	14 (T) ²⁸

Table 2. Water Quality Standards and Guidelines (cont.)

Constituent T = Total D = Dissolved	Units	United States		Great Lakes Initiative		Canada					Wisconsin								
		Drinking Water Standard ^{1,2}	Fresh Water Aquatic Life Criteria ³		Fresh Water Aquatic Life Criteria ⁴		Drinking Water Guide ⁵	Irrigation Guide ^{6,7}	Livestock Guide ^{6,7}	Fresh Water Aquatic Life Guide ^{7,8}		Ground Water ⁹		Drinking Water (All Sources) ¹⁰		Surface Waters ¹²			
			Acute	Chronic	Acute	Chronic				Acute	Chronic	Enforcement Standard	Preventive Action Limit ¹¹	Enforcement Standard	Maximum Contam. Level Goal	Fresh Water Aquatic Life Criteria ¹³			
																Warm Water Fishery	Cold Water Fishery		
Magnesium	mg/l											25 over Baseline							
Manganese	µg/l	50 ²				50 ³¹	200 (T)		1100 (T) ^{19,28}	800 (T) ^{19,28}	50 ⁴³	25 ⁴³							
Mercury	µg/l	2	1.4	0.77						.002 (T) ^{19,44}	2	0.2	2	2					
Mercury II	µg/l				1.69	0.91									0.83 (T)	0.4 (T)	0.83 (T)	0.4 (T)	
Molybdenum	µg/l																		
Nickel	µg/l		270 ^{28,36}	29 ^{28,36}	261 ^{28,30}	29 ^{28,30}													
Nitrate (as N)	mg/l	10	Total N = 0.38 ⁴⁵				10		100 ¹⁹	33 ¹⁹	10	10	10	10					
Nitrite (as N)	mg/l	1					1		10 ¹⁹	.06 ^{19,46}	1	1	1	1					
pH	s.u.	6.5 - 8.5 ²		6.5 - 9.0 ¹⁴			7.0 - 10.5 ¹⁵												
Radionuclides-Gross Alpha		15 pCi/l					0.5 Bq/l							15 pCi/l ¹⁶	0 ¹⁶				
Radionuclides-Gross Beta		4 mrem/yr					1.0 Bq/l							4 mrem/yr	0				
Radium		5 pCi/l ⁴⁷					0.5 Bq/l							5 pCi/l ⁴⁷	0 ⁴⁷				
Selenium	µg/l	50		1.5 - 3.1 ⁴⁸		5	10 (T) ¹⁹	10 (T) ¹⁹	30 (T) ¹⁹										
Silver	µg/l	100 ²	1.0 ^{28,36}																
Sodium	mg/l						200 ³¹												
Sulfate	mg/l	250 ²		10 ⁵⁰			500 ³¹		1000										
Sulfide	mg/l			.002			.05 ³¹												
Total Dissolved Solids	mg/l	500 ²					500 ³¹	500 - 3500	3000					200 over Baseline					
Thallium	µg/l	2																	
Turbidity	NTU/FTU	0.3 - 5 NTU ⁵¹	1.3 FTU ⁴⁵				5 NTU ^{19,52}	Increase over baseline of 10 NTU or 20% ^{19,53}	Increase over baseline of 5 NTU or 10% ^{19,54}	8 NTU over baseline ^{19,55}									
Uranium	µg/l	30					20	10 (T)	200	33 (T)				30	0				
Vanadium	µg/l							100 (T)	100										
Zinc	µg/l	5000 ²	70 ^{28,36}	70 ^{28,36}	67 ^{28,30}	67 ^{28,30}	5000 (T) ¹⁹	1000 - 5000 (T) ¹⁹	2000 (T) ¹⁹	33 (T) ^{19,57}									

* Please note the following:

- Any concentrations clearly designated as Total (T) or Dissolved (D) by government authorities in regulatory documents have been so indicated.
- In cases where aquatic life criteria are not clearly designated as Total or Dissolved, there is disagreement in the technical literature as to whether total or dissolved constituent concentrations should be compared to the criteria. EPA metals criteria recommendations have varied inconsistently over decades as to the use of total vs. dissolved concentrations. Since fish and macroinvertebrates are capable of ingesting both dissolved and particulate forms of chemicals discharged into aquatic environments, recommendations to compare dissolved constituent concentrations to aquatic life criteria have been met with controversy.
- In cases where drinking water standards are not clearly designated as Total or Dissolved, dissolved constituent concentrations typically are compared to the standards even though water from private wells normally is not filtered prior to consumption.
- In the present table, hardness-dependent standards and criteria, unless otherwise indicated, were normalized to a hardness of 50 mg/l to allow the presentation of representative values.

Table 2. Footnotes and Links

<p>1. United States Environmental Protection Agency (EPA). See Table of Regulated Drinking Water Contaminants (Oct 2016) at https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants. EPA has established enforceable water quality standards called “Maximum Contaminant Levels” (MCL) for drinking water contaminants. Note: Cited EPA drinking water standards in the present table are MCLs unless otherwise noted.</p>	<p>21. Freshwater criteria for ammonia are pH, temperature and life-stage dependent. See Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater (2013) at https://www.epa.gov/sites/production/files/2015-08/documents/aquatic-life-ambient-water-quality-criteria-for-ammonia-freshwater-2013.pdf. Reported value is for Total Ammonia Nitrogen (TAN) at pH 7.0 and temperature 20°C.</p>
<p>2. U.S. EPA. See Secondary Drinking Water Standards (Mar 2017) at https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance- nuisance-chemicals. EPA has established non-mandatory "Secondary Maximum Contaminant Levels" (SMCL) for certain contaminants with aesthetic considerations, such as taste, color, and odor.</p>	<p>22. Temperature and pH-dependent toxicity; reported value is for Total Ammonia Nitrogen (TAN) at pH 7.0 and temperature 20°C. See https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/nitrogen-overview.pdf</p>
<p>3. U.S. EPA. See National Recommended Water Quality Criteria - Aquatic Life Criteria Table (Mar 2017) at https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table#table.</p>	<p>23. Acute criterion is pH and temperature-dependent; reported value is for ammonia nitrogen at pH 7.5 (temperature not specified).</p>
<p>4. U.S. EPA. See About the Great Lakes Initiative at https://www.epa.gov/gliclearinghouse/about-great-lakes-initiative and 40 CFR Parts 9, 122, 123, 131, and 132 (7-1-13 Edition) at https://www.gpo.gov/fdsys/pkg/CFR-2013-title40-vol23/pdf/CFR-2013-title40-vol23.pdf.</p>	<p>24. Chronic criterion is pH and temperature-dependent; reported value is for ammonia nitrogen at pH 7.5 and temperature ≤ 14.5°C.</p>
<p>5. Health Canada. See Guidelines for Canadian Drinking Water Quality - Summary Table (Feb 2017) at http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum_guide-res_recom/index-eng.php. Note: Cited Health Canada drinking water guidelines in the present table are health-based “Maximum Acceptable Concentrations” unless otherwise noted.</p>	<p>25. As Low As Reasonably Achievable (ALARA).</p>
<p>6. Health Canada. See Water Quality Guidelines for the Protection of Agriculture: Irrigation, Livestock – Summary Table (2006) at http://st-ts.ccme.ca/en/index.html?chems=all&chapters=2.</p>	<p>26. See Canadian Water Quality Guidelines for the Protection of Aquatic Life – Arsenic (2001) at http://ceqg-rcqe.ccme.ca/download/en/143.</p>
<p>7. See Canadian Water Quality Guidelines (1987) at http://www.ccme.ca/files/Resources/supporting_scientific_documents/cwqg_pn_1040.pdf.</p>	<p>27. 7 million fibers per liter (MFL); fiber > 10 micrometers.</p>
<p>8. Health Canada. See Water Quality Guidelines for the Protection of Aquatic Life: Freshwater and Marine – Summary Table (2015) at http://st-ts.ccme.ca/en/index.html?chems=all&chapters=1.</p>	<p>28. Hardness-dependent toxicity; reported value was calculated for a hardness of 50 mg/l.</p>
<p>9. State of Wisconsin. See Chapter NR 140 – Groundwater Quality (Feb 2017), <u>Wisconsin Administrative Code</u> at http://docs.legis.wisconsin.gov/code/admin_code/nr.</p>	<p>29. See Aquatic Life Ambient Water Quality Criteria – Cadmium (2016) at https://www.epa.gov/sites/production/files/2016-03/documents/cadmium-final-report-2016.pdf.</p>
<p>10. State of Wisconsin. See Chapter NR 809 – Safe Drinking Water (Mar 2016), <u>Wisconsin Administrative Code</u> at http://docs.legis.wisconsin.gov/code/admin_code/nr. Wisconsin has adopted: (a) enforceable water quality standards called “Maximum Contaminant Levels” (MCL) for drinking water contaminants; and (b) non-enforceable “Maximum Contaminant Level Goals” (MCLG).</p>	<p>30. Reported value was calculated from formula embodied in EPA’s Great Lakes Initiative.</p>
<p>11. See Chapter 160 – Groundwater Protection Standards (Apr 2017), <u>Wisconsin Statutes</u>, s. 160.15 at http://docs.legis.wisconsin.gov/statutes/statutes/160. Exceedances of Preventive Action Limits (PAL) may trigger a variety of different regulatory responses, as defined in Chapter NR 140, <u>Wisconsin Administrative Code</u>.</p>	<p>31. Aesthetic Objective (AO) value.</p>
<p>12. The Flambeau Mine Environmental Impact Statement (1990) classified the Flambeau River as a “warm water sport fishery.” The upstream surface water station in the river had median baseline (1987-88) values of 52 mg/l for hardness and 6.8 for pH (field).</p>	<p>32. Maximum Residual Disinfectant Level (MRDL), as Cl₂. The MRDL is the highest level of a disinfectant allowed in drinking water.</p>
<p>13. State of Wisconsin. See Chapter NR 105 – Surface Water Quality Criteria and Secondary Values for Toxic Substances (July 2010), <u>Wisconsin Administrative Code</u> at http://docs.legis.wisconsin.gov/code/admin_code/nr.</p>	<p>33. Canada has no Maximum Acceptable Concentration for chlorine in drinking water, but, according to Health Canada, free chlorine concentrations in most Canadian drinking water distribution systems range from 0.04 to 2.0 mg/l.</p>
<p>14. See Quality Criteria for Water, 1986 (“Gold Book”) at http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=00001MGA.txt for narrative statement.</p>	<p>34. Guideline has been derived for reactive chlorine species.</p>
<p>15. Designated as “Other Value” (not a Maximum Acceptable Concentration).</p>	<p>35. Total residual.</p>
<p>16. Excluding radon and uranium.</p>	<p>36. Reported value was calculated from formula embodied in EPA’s Aquatic Life Criteria document.</p>
<p>17. The chronic toxicity criterion of 20mg/l is a minimum value except where alkalinity is naturally lower, in which case the criterion cannot be lower than 25% of the natural level.</p>	<p>37. No more than 5.0% samples total coliform-positive (TC-positive) in a month. For water systems that collect fewer than 40 routine samples/month, no more than 1 sample can be total coliform-positive/per month.</p>
<p>18. pH-dependent toxicity; reported value is for pH 6.5 - 9.0.</p>	<p>38. Action Level. Lead and copper are regulated by a treatment technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, water systems must take additional steps.</p>
<p>19. This criterion was established for use in British Columbia, by the Ministry of Environment, Lands and Parks. See Approved Water Quality Guidelines at https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines</p>	<p>39. Freshwater criteria are calculated using the Biotic Ligand Model (BLM). See Aquatic Life Ambient Freshwater Quality Criteria – Copper (2007) at https://www.epa.gov/wqc/aquatic-life-criteria-copper#2007. Also see Draft Technical Support Document: Recommended Estimates for Missing Water Quality Parameters for Application in EPA’s Biotic Ligand Model (Mar 2016) at https://www.epa.gov/sites/production/files/2016-02/documents/draft-tsd-recommended-blm-parameters.pdf. Reported value was calculated using available median Flambeau River baseline (1987-88) constituent concentrations for the upstream surface water station. FMC did not provide 1987-88 baseline data for its current downstream surface water station (SW-2).</p>
<p>20. Aluminum criterion is pH-dependent; reported value is for pH ≥ 6.5.</p>	<p>40. Action Level. As defined in Chapter 809, <u>Wisconsin Administrative Code</u>, “Action level” is the concentration of lead or copper in water which determines, in some cases, the treatment requirements that a public water system is required to complete.</p>

Table 2. Footnotes and Links (cont.)

<p>41. This criterion was established for use in British Columbia, Canada by their Ministry of Environment, Lands and Parks. See Water Quality Criteria for Cyanide at https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/cyanide-or.pdf. The term weak-acid dissociable cyanide refers to the analytical method of the Provincial Environmental Laboratory. Weak-acid dissociable cyanide includes only free cyanide, simple cyanides and weak-acid dissociable metalocyanides such as zinc- and cadmium-cyanide complexes.</p>	<p>50. This criterion is specific for wild rice waters and was approved by U.S. EPA for: (1) State of Minnesota (1973). See Minnesota Administrative Rules, 7050.0224, Subparts 1 and 2: Specific Water Quality Standards for Class 4 Waters of the State – Agriculture and Wildlife at https://www.revisor.mn.gov/rules/7050.0224/ (2) Fond du Lac Band of Lake Superior Chippewa (2001). See Water Quality Standards Regulations: Fond du Lac Band of the Minnesota Chippewa Tribe at https://www.epa.gov/wqs-tech/water-quality-standards-regulations-fond-du-lac-band-minnesota-chippewa-tribe (3) Grand Portage Band of Lake Superior Chippewa (2005). See Water Quality Standards Regulations: Grand Portage Band of the Minnesota Chippewa Tribe at https://www.epa.gov/wqs-tech/water-quality-standards-regulations-grand-portage-band-minnesota-chippewa-tribe</p>
<p>42. Hardness-dependent toxicity; reported value was calculated for a hardness of 10 mg/l. See Ambient Water Quality for Fluoride at https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/fluoride-or.pdf</p>	<p>51. Criteria apply to <i>treated</i> drinking water. For systems that use conventional or direct filtration, at no time can turbidity go higher than 1 NTU, and samples for turbidity must be less than or equal to 0.3 NTU in at least 95 percent of the samples in any month. Systems that use filtration other than the conventional or direct filtration must follow state limits, which must include turbidity at no time exceeding 5 NTU.</p>
<p>43. The State of Wisconsin has two different groundwater quality enforcement standards for manganese: 300µg/l as a “Public Health” groundwater quality enforcement standard (PAL = 60 µg/), and 50 µg/l as a “Public Welfare” groundwater quality enforcement standard (PAL = 25 µg/).</p>	<p>52. Guideline is for <i>raw</i> drinking waters of exceptional clarity (≤ 5 NTU) which normally do not require treatment to reduce natural turbidity. Induced turbidity should not exceed 1 NTU and the total turbidity should not exceed 5 NTU at any time. See https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/turbidity-or.pdf</p>
<p>44. Toxicity is dependent on the percentage of methyl mercury present; reported value is for when MeHg constitutes 5 % of the total mercury concentration. See https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/mercury-or.pdf</p>	<p>53. Change from background of 10 NTU when background ≤ 50 NTU; Change from background of 20% when background > 50 NTU.</p>
<p>45. See Ambient Water Quality Criteria Recommendations – Nutrient Criteria for Rivers and Streams in Nutrient Ecoregion VIII (Dec 2001) at https://www.epa.gov/sites/production/files/documents/rivers8.pdf. Reported values for total nitrogen and turbidity are aggregate reference conditions for rivers and streams in Nutrient Ecoregion VIII (Nutrient Poor Largely Glaciated Upper Midwest and Northeast), which includes Rusk County, Wisconsin.</p>	<p>54. Change from background of 5 NTU when background is ≤ 50 NTU; Change from background of 10% when background is > 50 NTU. See https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/turbidity-or.pdf</p>
<p>46. Guideline varies with ambient concentration of chloride; reported value is for low chloride water (< 2 mg/L). See https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/nitrogen-overview.pdf</p>	<p>55. Stated guidelines apply to all waters during clear flows or in clear waters. When background is ≥ 8 NTU during high flows or in turbid waters, different criteria apply. See https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/turbidity-or.pdf</p>
<p>47. Radium-226 and Radium-228 combined.</p>	<p>56. For <i>treated</i> drinking water, the enforcement standard for the monthly turbidity average is 1 NTU; for public water systems that are required to filter but have not yet installed filtration, the enforcement standard for the 2-day average is 5 NTU.</p>
<p>48. See Aquatic Life Ambient Water Quality Criterion for Selenium – Freshwater (2016) at https://www.epa.gov/sites/production/files/2016-07/documents/aquatic_life_awqc_for_selenium_-_freshwater_2016.pdf. Selenium chronic criteria: 1.5 µg/l (lentic) and 3.1 µg/l (lotic).</p>	<p>57. Hardness-dependent toxicity; reported value is for a hardness ≤ 90 mg/l.</p>
<p>49. Hardness-dependent toxicity; reported value is for a hardness ≤ 100 mg/l.</p>	