Appendix 1.

The following tables are a summary of the water quality standards for each state in the US. All states are required to follow the guidelines set for water quality by the US Environmental Protection Agency (EPA). However, many of the regulations associated with salts are secondary regulations, therefore each state can set their own limits, and determine if regulations act as secondary limits or have legal consequences. Furthermore, each state can determine site-specific standards. This means that limits for each water quality parameter can be site specific, given historical data. Each state must submit their water quality guidelines to the US EPA for approval, and all water quality regulations and guidelines can be found on the EPA website (www.epa.gov). The regulations found on the EPA website for reach state were checked for accuracy by reviewing current government documents for each state. Importantly, most states have separate regulations and guidelines for fresh water and water used for public supplies or drinking. We thoroughly searched for the most up-to-date fresh water and drinking water regulations for each state, but must acknowledge that some inconsistencies could be present in the following tables. Additionally, it is worth noting that the only federal regulations in the US pertaining to specific ions in drinking water are secondary, although total salinity or total dissolved solids should be limited to 250 mg/L. There are limits for the protection of freshwater organisms, including chronic (250 mg/L) and acute (860 mg/L) limits for chloride, and a lower limit for alkalinity of 20 mg/L (CaCO3). However, many states have regulations that differ from these limits.

Many states have regulations that are site specific, or have complicated regulations associated with limits. In those cases, we have elected to put “site specific standards exist”. In most cases, states with site specific standards are setting limits based on historic concentrations of ions, although some states set limits based on the purposed of the water being used.

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| **State** | **Total dissolved solids (TDS; mg/L)** | | | **Salinity** | **Sp. conductance** |
| *Fresh water* | *Drinking water* | *Other* | *(mg/L)* | *(μmhos/cm)* |
| Alabama |  |  |  |  |  |
| Alaska |  | 500 | 1000 (Ag. and aquaculture); Site specific standards | No increase of 1000, 2000, or 4000, given historic concentrations |  |
| Arizona | Site specific standards exist |  |  |  |  |
| Arkansas | 500 |  |  |  |  |
| California | Site specific standards exist | 500 (rec.); 1000 (max); 1500 (temporary) | Site specific standards exist | Site specific standards exist | 900 (recreation); 1600 (max); 2200 (temporary) |
| Colorado | Historically below 400 cannot exceed 500; 500-10000 cannot increase more than 25%. |  |  |  |  |
| Connecticut |  |  |  |  |  |
| Delaware | No increase of 133% of background or <500mg/L; Site specific standards exist |  | 1000 (effluent) |  |  |
| Florida |  |  |  |  | No increase 50% above background or <1275 |
| Georgia |  |  |  |  |  |
| Hawaii | 500 |  |  |  |  |
| Idaho |  |  |  |  |  |
| Illinois | 1500 | 500 | Special rules for Lake Michigan |  |  |
| Indiana | 750 | 500 | Special rules for Lake Michigan |  | 1200 (25°C) |
| Iowa |  |  |  |  |  |
| Kansas |  |  |  |  |  |
| Kentucky |  | 250 |  |  | Changes must not affect organisms |
| Louisiana | 500 |  | Site specific standards exist |  |  |
| Maine |  |  |  |  |  |
| Maryland |  |  |  |  |  |
| Massachusetts |  | 500 |  |  |  |
| Michigan | 500 (750 from point source pollution) |  |  |  |  |
| Minnesota | 500 |  | 700 (total dissolved salts) | 1000 (livestock) | 1000 μmhos/cm (25°C) |

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| --- | --- | --- | --- | --- | --- |
| **State** | **Total dissolved solids (TDS; mg/L)** | | | **Salinity** | **Sp. conductance** |
| *Fresh water* | *Drinking water* | *Other* | *(mg/L)* | *(μmhos/cm)* |
| Mississippi | Recreation/fish/wildlife 750 (avg) or 1500 (max) | 500 | N. Vicksburg 425; S. Vicksburg 400 (Mississippi river) |  | Drinking 500; recreation/fish/ wildlife 1000 |
| Missouri |  |  |  |  |  |
| Montana |  | 500 |  |  |  |
| Nebraska | 500 |  |  |  | 2000 (Apr.-Nov. for agriculture) |
| Nevada | 500 (site specific 250-1000) | 1000 (secondary) |  | Site specific standards exist | Lake Tahoe - 95 (avg.); 105 (single time) (at 20°C) |
| New Hampshire |  | 500 |  |  |  |
| New Jersey | 500 | 500 | Cannot harm wildlife |  |  |
| New Mexico |  | 500 |  |  |  |
| New York | A-Special 200; all others 500 |  | Effluent cannot exceed 1000 |  |  |
| North Carolina | 500 |  |  |  |  |
| North Dakota | 10,000 (class 1 groundwater) |  |  |  |  |
| Ohio |  | 500 (30 day avg); 750 max |  |  | 800 (30 day avg); 1250 max (25°C) |
| Oklahoma |  |  | Lower limits on regulations |  | Must be similar to historic values |
| Oregon | Site specific standards exist | 500 |  |  |  |
| Pennsylvania | 500 (30 day avg); 750 (max) | 500 |  |  |  |
| Rhode Island |  |  |  |  |  |
| South Carolina |  | 500 |  |  |  |
| South Dakota | 2500 (avg); 4375 (max) | 1000 (avg); 1750 (max). |  |  | Irrigation 2500 (avg); 4375 (max). Recreation/fish 4000 (avg); 7500 (max) (25°C) |
| Tennessee | 500 (max). >10,000 prohibited from use | 500 |  |  |  |
| Texas | Site specific standards exist | 500 |  |  |  |
| Utah | 1200 (site specific standards exist) | 500 |  |  |  |
| Vermont |  | 500 |  |  |  |
| Virginia |  | 500 |  |  |  |
| Washington |  | 500 |  | fresh water is 1000 |  |
| West Virginia |  |  |  |  |  |
| Wisconsin |  | 500 |  |  |  |
| Wyoming |  |  |  |  |  |

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| **State** | **Chloride (mg/L)** | | | | **Sulphate** |
| *Chronic (FW)* | *Acute (FW)* | *Other* | *Drinking* | *mg/L* |
| Alabama |  |  |  | 250 |  |
| Alaska | 230 | 860 | Specific site standards exist | 250 |  |
| Arizona |  |  |  | 250 |  |
| Arkansas | 250 |  | Specific site standards exist. No increase greater than 15% | 250 | 250 |
| California | Site specific standards exist for ground water and surface water | | Secondary, regulations are for taste only | 250 (avg.); 500 (max); 600 (temp.) | 250 (avg); 500 (max); 600 (temporary); Site specific standards exist |
| Colorado |  |  |  | 250 | 250 |
| Connecticut | 230 | 860 |  | 250 |  |
| Delaware |  |  | Site specific (180 zone 3 avg) | 250 |  |
| Florida |  |  | 250 mg/L; <10% increase from inputs | 250 | 250 |
| Georgia |  |  |  | 250 |  |
| Hawaii |  |  |  | 250 |  |
| Idaho |  |  |  | 250 |  |
| Illinois |  |  | Special rules for Lake Michigan | 250 | Site specific standards exist |
| Indiana |  |  |  | 250 | 250 |
| Iowa | 389 | 629 |  | 250 | Hardness and chloride specific |
| Kansas |  | 860 |  | 250 | 1000 (for livestock) |
| Kentucky | 600 | 1200 |  | 250 | 250 (drinking) |
| Louisiana |  |  | Specific site standards exist | 250 | 250 (site specific standards exist) |
| Maine | 230 | 860 |  | 250 |  |
| Maryland |  |  |  | 250 |  |
| Massachusetts |  |  |  | 250 | 250 |
| Michigan |  |  | 50 (great lakes) | 125 |  |
| Minnesota | 230 | 860 (Except when 1720) | Industrial 3A - 50 Industrial 3B - 100 | 250 | 250 (10 if used for food/rice) |

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| **State** | **Chloride (mg/L)** | | | | **Sulphate** |
| *Chronic (FW)* | *Acute (FW)* | *Other* | *Drinking* | *mg/L* |
| Mississippi | 230 |  | Mississippi specific N. Vicksburg 60 S. Vicksburg 75 | 250 | Mississippi River N. Vicksburg 150 S. Vicksburg 120 |
| Missouri | 230 | 860 | 1000 (chloride +sulfate max) | 250 | 250 |
| Montana |  |  |  | 250 | 250 |
| Nebraska | 230 | 860 | Specific site standards exist | 250 | 250 |
| Nevada | 230 | 860 | Specific site standards exist | 400 (secondary) | 250 |
| New Hampshire | 230 | 860 |  | 250 | 250 |
| New Jersey | 230 | 860 |  | 250 | 250 |
| New Mexico |  |  |  | 250 | 250 |
| New York |  |  | 500 in groundwater effluent | 250 | 250 (500 in effluent) |
| North Carolina | 230 |  | FW is 500 | 250 | 250 |
| North Dakota | 175 |  | site specific standards exist | 250 | 450 (site specific standards exist) |
| Ohio |  |  |  | 250 | 250 |
| Oklahoma |  |  | Limits on regulations | 250 | Limits on regulations |
| Oregon | 230 | 860 |  | 250 | 250 |
| Pennsylvania |  |  |  | 250 | 250 |
| Rhode Island | 230 | 860 |  | 250 | 250 |
| South Carolina |  |  | Effluent - toxicity tests required | 250 |  |
| South Dakota | 100 | 175 | FW values are for fish propagation waters | 250 (avg); 438 (max) | 500 (30 day avg); 875 (max) |
| Tennessee |  |  |  | 250 | 250 |
| Texas |  |  | Site specific standards exist | 250 | Site specific standards exist |
| Utah |  |  |  | 250 | 1000 (must show no lower exists); 2000 (max); Site specific standards exist |
| Vermont | 230 | 860 |  | 250 | 250 |
| Virginia | 230 | 860 |  | 250 | 250 |
| Washington | 230 | 860 | Non-conventional pollutant; only applies when with sodium | 250 |  |
| West Virginia | 230 | 860 |  | 250 | 250 |
| Wisconsin | 395 | 757 |  | 250 (Enforced public welfare standard) | 250 (Enforced public welfare standard) |
| Wyoming | 230 | 860 | site specific standards exist |  |  |

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| **State** | **Magnesium** | **Calcium** | **Potassium** | **Sodium** | | |
| *mg/L* | *mg/L* | *mg/L* | *Adsorption Ratio* | *% Cation* | *mg/L* |
| Alabama |  |  |  |  |  |  |
| Alaska |  |  | >110 need to test biological effects | 2.5 | 60% (ag) |  |
| Arizona |  |  |  |  |  |  |
| Arkansas |  |  |  |  |  |  |
| California |  |  |  | Site specific standards exist for ground water and surface water | | |
| Colorado |  |  |  |  | | |
| Connecticut |  |  |  |  |  | 20 (Class AA) |
| Delaware |  |  |  |  |  | 100 (Zone 3 avg) |
| Florida |  |  |  |  |  | 160 (drinking water) |
| Georgia |  |  |  |  |  |  |
| Hawaii |  |  |  |  |  |  |
| Idaho |  |  |  |  |  |  |
| Illinois |  |  |  |  |  |  |
| Indiana |  |  |  |  |  |  |
| Iowa |  |  |  |  |  |  |
| Kansas |  |  |  |  |  |  |
| Kentucky |  |  |  |  |  |  |
| Louisiana |  |  |  |  |  |  |
| Maine |  |  |  |  |  |  |
| Maryland |  |  |  |  |  |  |
| Massachusetts |  |  |  | 20 |  |  |
| Michigan |  |  |  |  |  |  |
| Minnesota |  |  |  |  | 60% |  |

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| --- | --- | --- | --- | --- | --- | --- |
| **State** | **Magnesium** | **Calcium** | **Potassium** | **Sodium** | | |
| *mg/L* | *mg/L* | *mg/L* | *Adsorption Ratio* | *% Cation* | *mg/L* |
| Mississippi |  |  |  |  |  |  |
| Missouri |  |  |  |  |  |  |
| Montana |  |  |  |  |  |  |
| Nebraska |  |  |  |  |  | 500 (drinking water) |
| Nevada | 150 (secondary) |  |  | 8 |  |  |
| New Hampshire |  |  |  |  |  | 100-250 |
| New Jersey |  |  |  |  |  | 50 (secondary) |
| New Mexico |  |  |  |  |  |  |
| New York | 35 |  |  |  |  | 20 (plus effluent tests) |
| North Carolina |  |  |  |  |  |  |
| North Dakota |  |  |  |  | 60% (site specific standards exist) |  |
| Ohio |  |  |  |  |  |  |
| Oklahoma | Cannot impede use based on historic concentrations | | | Cannot impede use based on historic concentrations | | |
| Oregon |  |  |  |  |  |  |
| Pennsylvania |  |  |  |  |  |  |
| Rhode Island |  |  |  |  |  |  |
| South Carolina |  |  |  |  |  |  |
| South Dakota |  |  |  | 10 (irrigation); 6 (Cheyenne River) |  |  |
| Tennessee | Cannot have harmful levels | | | Cannot have harmful levels | | |
| Texas |  |  |  |  |  |  |
| Utah |  |  |  |  |  |  |
| Vermont |  |  |  |  |  | 250 (secondary) |
| Virginia | Use Biotic Ligand Model (BLM) | | | Use Biotic Ligand Model (BLM) | | |
| Washington |  |  |  |  |  |  |
| West Virginia |  |  |  |  |  |  |
| Wisconsin |  |  |  |  |  |  |
| Wyoming |  |  |  |  |  |  |

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| **State** | **Carbonate** | **Bicarbonate** | **Hardness** | **Alkalinity** |
| *(milliequivalents/L)* | *(milliequivalents/L)* | *CaCO3 (mg/L)* | *CaCO3 (mg/L)* |
| Alabama |  |  |  |  |
| Alaska | 1.25 (agriculture) |  | Sulfates with magnesium and sodium cannot exceed 200 mg/L; Site specific. | 20 (min) |
| Arizona |  |  |  |  |
| Arkansas |  |  |  |  |
| California |  | Irrigation specific regulations exist |  |  |
| Colorado |  |  |  |  |
| Connecticut |  |  |  |  |
| Delaware |  |  | Site specific standards exist | Site specific standards exist |
| Florida |  |  |  | 20 (min); If <20 limited to 25% decrease; <600 for class IV waters |
| Georgia |  |  |  |  |
| Hawaii |  |  | Intake and outflow water must be similar |  |
| Idaho |  |  |  |  |
| Illinois |  |  |  |  |
| Indiana |  |  |  |  |
| Iowa |  |  |  |  |
| Kansas |  |  |  |  |
| Kentucky |  |  |  | 20 (min); no reductions >25%; any changes cannot affect aquatic life |
| Louisiana |  |  |  |  |
| Maine |  |  |  |  |
| Maryland |  |  |  |  |
| Massachusetts |  |  |  |  |
| Michigan |  |  |  |  |
| Minnesota |  | 5 | Class 3A:50; Class 3B:250; Class 3C:500 |  |

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| --- | --- | --- | --- | --- |
| **State** | **Carbonate** | **Bicarbonate** | **Hardness** | **Alkalinity** |
| *(milliequivalents/L)* | *(milliequivalents/L)* | *CaCO3 (mg/L)* | *CaCO3 (mg/L)* |
| Mississippi |  |  |  |  |
| Missouri |  |  |  |  |
| Montana |  |  |  |  |
| Nebraska |  |  |  | 20 (min), unless naturally lower |
| Nevada |  |  |  | 20 (min) |
| New Hampshire |  |  |  | 20 (min) |
| New Jersey |  |  | 250 (secondary, for drinking water only) |  |
| New Mexico |  |  |  |  |
| New York |  |  |  |  |
| North Carolina |  |  | 100 (Class WSI, WSII, WSIII, WSIV, WSV only) |  |
| North Dakota |  |  |  |  |
| Ohio |  |  |  |  |
| Oklahoma |  |  |  |  |
| Oregon |  |  | 250 (secondary for drinking water only) |  |
| Pennsylvania |  |  |  | 20 (min), unless naturally lower |
| Rhode Island |  |  |  |  |
| South Carolina |  |  |  |  |
| South Dakota |  |  |  | 750 (30 day avg); 1313 (max) |
| Tennessee |  |  |  |  |
| Texas |  |  |  |  |
| Utah |  |  |  |  |
| Vermont |  |  |  | Cannot change and affect aquatic life |
| Virginia |  |  |  |  |
| Washington |  |  |  |  |
| West Virginia |  |  |  |  |
| Wisconsin |  |  |  |  |
| Wyoming |  |  |  |  |