

Interpreting Your Water Quality Data

Parameter	Your data indicate:	Which may come from:	Which may be caused by:	Additional Notes:
Alkalinity: measures the water's capacity to neutralize acids in (mg/l) or (mg/l CaCO ₃)	Increase	Wastewater treatment plant effluent Surrounding geology	<ul style="list-style-type: none"> Residues from food substances and cleaning agents Weathering and erosion of limestone 	Total alkalinity of seawater averages 116 mg/l Total alkalinity of freshwater is often between 30 and 90 mg/l
	Decrease	Acid precipitation Surrounding geology Industrial effluent	<ul style="list-style-type: none"> Burning of fossil fuels Weathering and erosion of granite or igneous rocks Low pH water consumes alkalinity 	
Bacteria: measures Fecal Coliform, E. coli, or Enterococci to indicate potential fecal contamination of water in Colony Forming Units (CFU) or cells /100 ml of water	Increase	Warmblooded animal or human feces Soil Pulp and paper mill wastes	<ul style="list-style-type: none"> Leaking or failing septic and sewer systems Sewer overflows, overloaded/malfunctioning waste water treatment plant Runoff from areas containing pet and animal waste Direct defecation of animals and birds/waterfowl in waterways Many coliforms are naturally found in soil The genus <i>Klebsiella</i> of the Fecal coliform group common (harmless) 	EPA criteria for Bacteria in recreational waters Fresh water: E. coli levels shall not exceed... <ul style="list-style-type: none"> 236 cells or CFU per 100 ml of a single water sample, or 126 cells or CFU per 100 ml as a geometric mean from at least 4 water samples Marine water... Enterococci levels shall not exceed... <ul style="list-style-type: none"> 35 cells or CFU per 100 ml as a geometric mean from at least 5 water samples equally spaced over a 30-day period
	Decrease	Bacteria-free influent water	<ul style="list-style-type: none"> Springs, tributary, runoff or other clean water source that reduces the total number of coliforms per unit volume of water 	
Biochemical Oxygen Demand (BOD): measures the amount of oxygen in the water consumed by aquatic organisms and chemical reactions in (mg/l)	Increase	Organic matter	<ul style="list-style-type: none"> Microorganisms consume oxygen when decomposing animal/pet waste, leaves and woody debris, nutrients 	
	Decrease	Aeration Waste water treatment plant effluent	<ul style="list-style-type: none"> Increases the rate of decomposition of organic and inorganic material Chlorine kills decomposers (microorganisms) 	
Conductivity: measures the water's ability to conduct an electrical current in cont. next page	Increase	Urban runoff Surrounding geology Temperature	<ul style="list-style-type: none"> Chemical de-icers, salts Clay soils dissolve into ionic components Conductivity is higher in warmer water 	Conductivity of common waters in $\mu\text{mho/cm}$ Deionized water: 0-1 Distilled water: 0.5-3

Interpreting Your Water Quality Data/Cont.

Parameter:	Your data indicate:	Which may come from:	Which may be caused by:	Additional Notes:																						
micromhos/cm or microsiemens/cm ($\mu\text{S}/\text{cm}$)	Increase	Wastewater treatment plant effluent Mining operations	<ul style="list-style-type: none"> Ions such as chloride, phosphate, and nitrate Ions such as sulfate, copper, cadmium, or arsenic in mine drainage 	Rivers in the US: 50-1500 Healthy streams: 150-500 Some industrial effluent: 10,000 Seawater: 50,000																						
	Decrease	Agricultural runoff Surrounding geology Industrial effluent Urban runoff	<ul style="list-style-type: none"> Ions such as nitrate, phosphate, and salts Granite and igneous rocks often do not dissolve into ionic components Oils, alcohols, sugar, and many hazardous organic compounds reduce the number of charged ions per unit volume of water Oils 																							
Dissolved oxygen (DO): measures the amount of oxygen dissolved in water in (mg/l)	Increase	Aeration Photosynthesis Temperature	<ul style="list-style-type: none"> Waterfalls, rapids, rocks, and turbines add oxygen to water Plants give off oxygen Colder water is able to dissolve more oxygen than warmer water 	Dissolved oxygen levels required for aquatic organisms <table border="1" style="width: 100%;"> <tr><td>0</td><td>Prolonged</td></tr> <tr><td>1</td><td>exposure</td></tr> <tr><td>2</td><td>lethal</td></tr> <tr><td>3</td><td></td></tr> <tr><td>4</td><td>Stressful</td></tr> <tr><td>5</td><td>to most</td></tr> <tr><td>6</td><td>aquatic organisms</td></tr> <tr><td>7</td><td></td></tr> <tr><td>8</td><td>Usually required</td></tr> <tr><td>9</td><td>for growth</td></tr> <tr><td>10</td><td>and activity</td></tr> </table> Note: DO levels can fluctuate greatly with depth, especially in lakes and reservoirs	0	Prolonged	1	exposure	2	lethal	3		4	Stressful	5	to most	6	aquatic organisms	7		8	Usually required	9	for growth	10	and activity
	0	Prolonged																								
1	exposure																									
2	lethal																									
3																										
4	Stressful																									
5	to most																									
6	aquatic organisms																									
7																										
8	Usually required																									
9	for growth																									
10	and activity																									
Decrease	Respiration, decomposition, and chemical reactions Turbidity Ground water influent Elevation above sea level Reservoir bottom-water influent Nutrients	<ul style="list-style-type: none"> Plants, animals, and microorganisms consume oxygen during these processes Blocks sunlight from plants, decreasing photosynthesis and increasing decay and decomposition Causes water temperature to rise by increasing absorption of solar radiation Low in dissolved oxygen because it is not exposed to the atmosphere while underground As atmospheric pressure decreases, less oxygen is dissolved in the water Low in DO due to reservoir stratification Fuel overgrowth of algae, which die and decompose 																								
Hardness: measures the concentration of dissolved minerals by measuring polyvalent cations in (mg/l of CaCO_3)		Surrounding geology Waste water treatment plant effluent Mining operations Surrounding geology	<ul style="list-style-type: none"> Weathering and erosion of limestone Residues from food substances and cleaning agents Expose rocks containing calcium and magnesium Weathering and erosion of granite or igneous rocks 	Water hardness levels in mg/l of CaCO_3 0-60 = soft water 61-120 = moderately hard 121-180 = hard water 181 and greater = very hard																						

Interpreting Your Water Quality Data/Cont.

Parameter:	Your data indicate:	Which may come from:	Which may be caused by:	Additional Notes:
Nitrate: measures the organic or fertilizer matter in water in (mg/l)	Increase	Nutrients Human and animal wastes Burning of fossil fuels	<ul style="list-style-type: none"> • Runoff from agricultural land, residential lawns, and golf courses • Wastewater treatment plant effluent, runoff from areas containing pet or animal waste • Direct defecation of animals and birds/waterfowl in waterways • Releases long-term store of nitrogen 	The EPA suggests that unpolluted waters shall contain less than 1 mg/l of nutrients
	Decrease	Nutrient-free influent water Plant use	<ul style="list-style-type: none"> • Springs, tributary, runoff or other clean water source that reduces the level of nutrients per unit volume of water • Nitrates are used by aquatic organisms for growth 	
pH: measures the hydrogen ion concentration or activity on a logarithmic scale (no units)	Increase	Photosynthesis Mining operations	<ul style="list-style-type: none"> • Plants use carbon dioxide, which reacts with water to form carbonic acid • Acid mine drainage 	acidic ↑ 0 1 2 3 4 5 6 neutral 7 8 9 10 11 12 13 basic ↓ 14
	Decrease	Respiration Surrounding vegetation	<ul style="list-style-type: none"> • Plants give off carbon dioxide, which reacts with water to form carbonic acid • Sphagnum moss and pine needles are slightly acidic (bogs, marshes, and pine forests) • Decaying vegetation produces organic acids 	
		Burning fossil fuels	<ul style="list-style-type: none"> • Emissions react with the atmosphere to form acid precipitation 	
Phosphate: Measures the organic or fertilizer matter in water	Increase	Surrounding geology Human and animal wastes Nutrients	<ul style="list-style-type: none"> • The mineral apatite contains phosphates • Waste water treatment plant effluent, runoff from areas containing pet or animal waste • Direct defecation of animals and birds/waterfowl in waterways • Runoff from agricultural land, residential lawns, and golf courses 	The EPA suggests that greater than 0.1 mg/l of total phosphates stimulates plant growth to surpass natural eutrophication rates
	Decrease	Nutrient-free influent water Plant use	<ul style="list-style-type: none"> • Springs, tributary, runoff or other clean water source that reduces the level of nutrients per unit volume of water • Phosphates are used by aquatic organisms for growth 	
	Increase	Weather/seasonal	<ul style="list-style-type: none"> • Water temperature varies with air temperature: 	
Temperature: measures the average amount of heat in the water in degrees Fahrenheit (°F) or degrees Celsius (°C)		Removal of vegetation Impoundments	<ul style="list-style-type: none"> • Stream-bank vegetation provides shade and reduces runoff (turbidity) • Impoundments increase the surface area of the water that is exposed to 	Many plants, bass, crappie, bluegill, carp, sucker, caddisfly, larvae, many fish diseases at temperatures around 20°C (68°F)

Interpreting Your Water Quality Data/Cont.

Parameter:	Your data indicate:	Which may come from:	Which may be caused by:	Additional Notes:
Temperature: cont.		Thermal pollution Urban runoff	<ul style="list-style-type: none"> solar radiation • Warm-water discharge from power plants and other cooling waters • Water is heated by asphalt and pavement 	Some plant life, trout, walleye, northern pike, stonefly nymph, caddis fly larvae, water beetles, water striders, some fish diseases 14°C (57°F)
	Decrease	Cold water inflow Depth	<ul style="list-style-type: none"> • Groundwater, tributary, springs, and reservoir bottom water can be colder than the receiving water • Seasonal stratification, especially in lakes 	Few plants, trout, caddisfly larvae, stonefly nymph, mayfly nymph, few fish diseases ?°C (?°F)
Total dissolved solids (TDS): measures ions and particles that will pass through a filter with pores of about 2-4 microns (0.002-0.004 cm) in size in (mg/l)	Increase	Seasonal/weather Erosion Waste water treatment plant effluent Surrounding geology Organic matter Urban runoff	<ul style="list-style-type: none"> • Runoff from rain and snowmelt carries dissolved constituents • Agricultural, road-building, construction, and logging all increase erosion rates. • Many dissolved constituents are not removed • Limestone or sedimentary rocks dissolve easily, releasing ions • Decaying plants and animals • Chemical de-icers, salts, fertilizers (nutrients), and chemicals 	According to the World Health Organization, TDS of natural water sources varies greatly from less than 30 mg/l to as much as 6,000 mg/l
	Decrease	Surrounding Geology	<ul style="list-style-type: none"> • Granite and igneous rocks often do not dissolve easily 	
Turbidity: measures either the clarity of water using a Secchi Disk, or the amount of light reflected by suspended particles using a Turbidimeter in either a Secchi Depth (meters) or a Turbidimeter reading in Nephelometric Turbidity Units (NTU)	Increase	Erosion Nutrients Weather/seasonal Urban runoff Forest fires/flooding Waste water treatment plant effluent	<ul style="list-style-type: none"> • Agriculture, road-building, construction, and logging all increase erosion rates • Increased algal growth • Runoff from snowmelt or rainfall • Salts, fertilizers (nutrients), chemicals, sediment • Increases stream-bank erosion since pavement prevents slowseepage of water into the ground • Temporarily increases erosion and therefore turbidity • Nutrients increase algal growth • Carries dissolved and suspended solids 	Typical groundwater has a turbidity of less than 1 NTU
	Decrease	Erosion prevention measures	<ul style="list-style-type: none"> • Stream-bank vegetation; Best Management Practices for agriculture, road-building, construction and logging 	