THE SPIGOT
from the NORTH DAKOTA RURAL WATER SYSTEMS ASSOCIATION

Water Quality Parameters

– What They are and Why They are Measured

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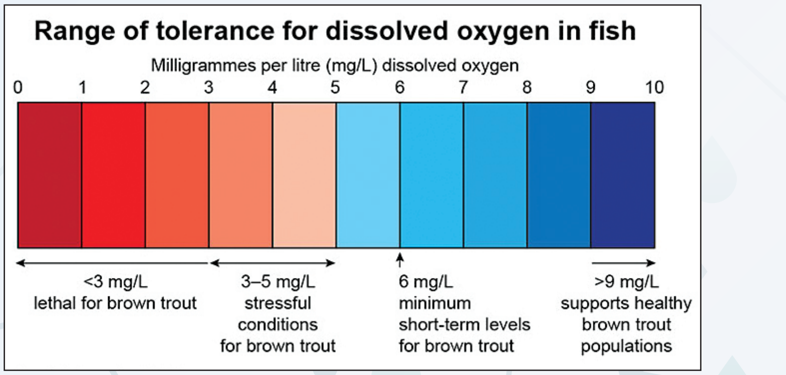
Our reliance on clean water requires us to determine water quality. Visually accessing a water body is not enough to adequately measure if it is safe. Therefore, we measure multiple parameters when accessing surface waters. Land management can also be considered for positive or negative influences on water bodies. Protecting our sources of water is essential to sustaining an abundant supply of high-quality water for drinking and recreation.

TEMPERATURE influences the physical, biological and chemical processes of aquatic environments. Increased water temperature can decrease dissolved oxygen available to aquatic life, increase the solubility of metals and other toxins and increase harmful algal blooms. Long-term increases affect species that are temperature dependent. Decreased water temperatures can also impact aquatic life and reduce the rate of photosynthesis and metabolic rates of aquatic organisms. Temperature of a water body will vary by depth, time of day and season. Many factors affect water temperature, including weather, runoff, loss of shading, cooling water discharges, dams, groundwater infiltration, evaporation, flow, and turbidity. Using temperature as a water quality parameter is challenging because it is ever-changing.

DISSOLVED OXYGEN is used to determine the overall biological health of a waterbody and is necessary to support aquatic life. Oxygen in surface water is transferred from the air and by photosynthesis from plants and algae in the water. Seasonal changes in temperature will affect the dissolved oxygen concentration. Warm water with high nutrient concentrations can cause excess algae growth which in turn reduces dissolved oxygen. Additionally, increased salinity and altitude can decrease water's ability to absorb dissolved oxygen. Waters with higher levels of dissolved oxygen are considered healthy and can support a variety of aquatic life. Low dissolved oxygen levels indicate a demand on oxygen in a water body which can be detrimental to aquatic species.

PH is used to determine the acidity of water and plays a key role in the chemical processes in water bodies. The pH level can range from 0 to 14, with 7.0 being neutral. A pH below 7.0 is considered acidic, and above 7.0 to be basic. The pH level is a major component in water chemistry and toxicity. For example, at a lower pH, metals such as lead, mercury, aluminum, copper, and arsenic become more soluble. This means these metals become more toxic to aquatic life. Typically, pH is measured with other water quality parameters. It is important to measure alkalinity along with pH, as this will show the capacity of water to neutralize acids. Nutrient enrichment and metal impacts can be reflective of pH levels. The pH levels are key factors in evaluating elevations of water quality parameters because of the sensitivity to natural and human influences.

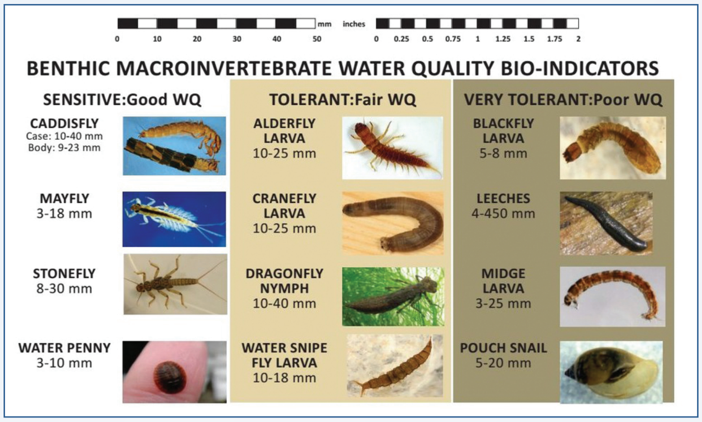
TURBIDITY is the measurement of water clarity. Total suspended solids (TSS) is a measurement of the concentration of particles (clay, silt, organic matter, algae, and microscopic organisms) in water. Increased turbidity causes water to look cloudy or muddy and can have adverse effects to aquatic ecosystems. Increased turbidity will be accompanied by higher temperatures, reduced dissolved oxygen and increased nutrient concentrations. Suspended solids can affect water chemistry and microbiology. These particles can also interfere with disinfection processes used in drinking water systems. Many natural and man-made factors increase turbidity. These include runoff, turbulence or wave action, bottom-feeding animals,



Courtesy of Geography, QMUL

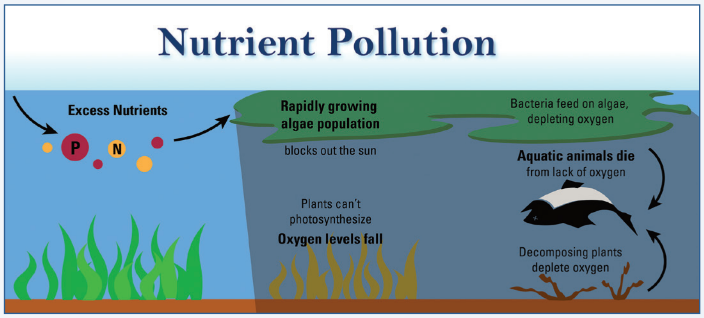
floating organisms, dead organic matter, wood ash from fires, snowmelt and precipitation, algal growth, stream bank erosion, erosion in other areas of a watershed, urban runoff, and untreated wastewater discharges. Turbidity is measured using a meter or, in deeper water bodies, a Secchi disk and is an optical property of water. Turbidity alone does not directly correlate to water quality, therefore should be assessed along with other water quality parameters.

MACROINVERTEBRATES are small organisms that can be easily seen in a water sample. Insects are the most common, visible in water as nymphs or larvae until they reach adult stages. Common insects include dragonflies, caddisflies, stoneflies, beetle, midges, and mayflies. Others include worms, leeches, crayfish, and fairy shrimp. Macroinvertebrates can reflect the long-term water quality at a specific site. They directly reflect the condition of the biological community, including pollutants, temperature and streamflow. Therefore, the abundance, or lack thereof, of macroinvertebrates does not always indicate degraded or healthy water quality. Other parameters should be evaluated to consider long-term water quality trends.



Courtesy of Beaver Water District, Lowell, Arkansas

E. COLI (ESCHERICHIA COLI) is a type of bacteria that lives in the intestines of humans and animals. Some forms of *E. coli* can make people sick. Sampling of water bodies is done to ensure waters are safe for public recreation. *E. coli* measurements are used to assess the possible presence of disease-causing bacteria and viruses. Concentrations of *E. coli* can correlate with turbidity and TSS as the bacteria can be attached with particles. Elevated levels of phosphorus, nitrate and biological oxygen demand (BOD) can also reflect higher concentrations of *E. coli*. There are many ways *E. coli* reaches water bodies, including wastewater discharge, broken or leaking sewer pipes, failing septic systems, stormwater runoff from animal feeding operations, manure storage or wildlife, and livestock allowed near or entering the water body.



Courtesy of USGS.

NUTRIENTS play a significant role in a healthy aquatic ecosystem. Two important nutrients are nitrogen and phosphorus. Increased nutrients polluting our waterbodies are becoming more common. Elevated nutrient levels cause increased biological growth and harmful algal blooms (HABs). Nutrients enter water bodies from both point source (specific point) and nonpoint source (general run-off) pollution.

HABITAT ASSESSMENT is used to access physical and water chemistry features along with the riparian area surrounding the water body. A healthy habitat supports the biological community, protects water quality and promotes a thriving aquatic ecosystem. Changes to the habitat around a water body can adversely affect the ecosystem. This includes changes to channel flow, channel alteration, plant cover and the width of vegetation.

METALS are present in all water bodies and may include aluminum, arsenic, copper, manganese, mercury nickel, selenium, and zinc. Metals in high concentration can be toxic. The toxicity of some metals varies with water chemistry. Therefore, analyzing additional parameters is necessary to see the whole picture.

Excess parameters can be tackled by implementing Best Management Practice. These are land management actions used to decrease pollution from runoff. These proactive actions keep our water sources safe.