What is it we are sampling and assessing? There are 9 parameters; **pH, nitrate-nitrogen, phosphate, dissolved oxygen, alkalinity, turbidity, temperature, conductivity, and TDS.** The following is information from The Adopt-A-Stream Foundation: *Streamkeeper's Field Guide, Watershed Inventory and Stream Monitoring Methods*.

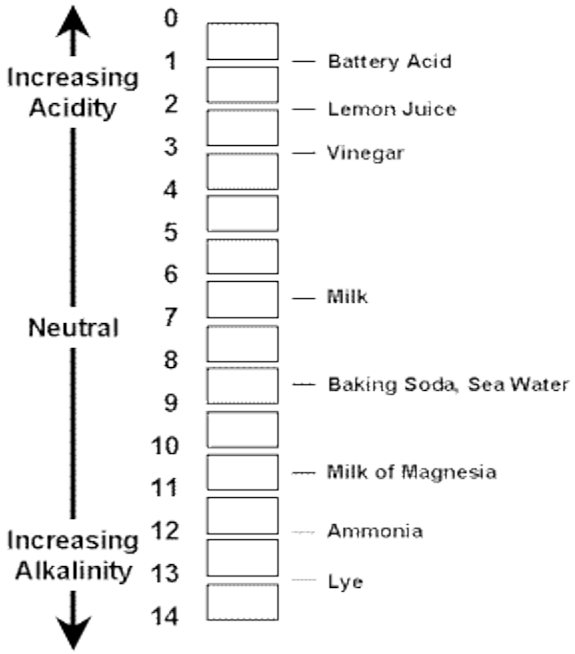
Understanding the chemistry of our streams is an important step toward determining the potential hazards to our water quality and discovering solutions for a healthier environment for humans and aquatic species alike. Evaluating the chemical water quality of a stream involves looking at the concentration of dissolved and suspended substances in the water. The chemical water quality of a stream is good if naturally occurring substances are present in the concentrations appropriate for the stream ecosystem. Problems occur when human activities alter the concentrations of naturally occurring substances or introduce substances that may be toxic to stream life.

pH

pH is a measure of how acidic or basic the water is. Acids and bases are defined by the activity of two very reactive ions: hydrogen ions (H+) and hydroxyl ions (OH-). A solution that has more hydrogen ion activity than hydroxyl activity is considered acidic; one that has more hydroxyl ion activity than hydrogen ion activity is considered basic.

pH is an important limiting chemical factor for aquatic life. If the water in a stream is too acidic or too basic, the H+ or OH- ion activity may disrupt crucial biochemical reactions, harming or killing stream organisms.

pH is expressed in a scale which ranges from 1 to 14. A solution with a pH value less than 7 has more H+ activity than OH-, and thus is considered acidic. A solution with a pH value greater than 7 has more OH-activity than H+, and thus is considered basic. A solution with a pH of 7 is considered neutral; the H+ and OH- activity is balanced.



pH levels in the Leading Creek Watershed range from neutral to very acidic. Areas with more acidic waters are found in the southern areas of the watershed, particularly in the Thomas Fork and Cato's subwatershed areas. A recent 2010 sample at a Casto's tributary site showed a pH of about 3.

Nitrate-Nitrogen

Nitrogen promotes aquatic plant growth and occurs in natural waters in various forms, including nitrate, nitrite, and ammonia. Nitrate is the most common form tested. Test results are usually expressed as nitrate-nitrogen, which simply means nitrogen in the form of nitrate. Measuring nitrate requires a chemical reaction that yields cadmium, a toxic metal that requires special disposal. The treated sample can then be analyzed colorimetrically, which means the color of the sample reflects the concentration of the parameter being measured. The darker the color, the greater the concentration of the parameter.

The national drinking water standard for nitrate-nitrogen in the United States is 10 milligrams per liter (mg/l). However, polluted waters generally have a nitrate-nitrogen level below 1 mg/l.

Phosphate

Phosphorus usually occurs in nature as phosphate, which is a phosphorus atom combined with four oxygen atoms. Phosphate that is bound to plant or animal tissue is known as organic phosphate. Phosphate that is not associated with organic material is known as inorganic phosphate. Both forms are present in aquatic systems and may be either dissolved in the water or suspended (attached to particle in the water column).

Phosphorus is often the limiting nutrient for plant growth, meaning it is in short supply relative to nitrogen. Very small amounts of phosphorus – even as low as 0.01 mg/l – can have a significant impact on the plant growth in a stream, especially slower moving areas.

Dissolved Oxygen

Dissolved oxygen is the amount of oxygen dissolved in the water, and thus available for aquatic organisms to use. Almost all plants and animals, whether living on land or in the water, need oxygen for their growth and survival. This life-giving gas is present in the water in a dissolved form. Aquatic organisms have devised specialized means of extracting and storing oxygen from the water. Many aquatic plants have spongy tissue that enables them to store oxygen. Most aquatic animals possess gills or other types of specialized breathing adaptations.

Oxygen enters water from the air at the surface of the stream. Oxygen also enters the water from aquatic plants and algae. It is a by-product of photosynthesis, the process by which green plants use sunlight and carbon dioxide to produce their energy source, carbohydrates.

The amount of oxygen dissolved in water is expressed as a concentration. A concentration is the amount in weight (mass) of a particular substance per a given volume of liquid. The dissolved oxygen concentration in a stream is the mass of the oxygen present, in mg/l.

The concentration of dissolved oxygen in a stream is affected by many factors. **One**, temperature; oxygen is more easily dissolved in cold water. Thus stream organisms that require high levels of dissolved oxygen, such as salmonids and many types of mayflies, stoneflies, and caddisflies, usually inhabit cold water streams. **Two**, flow; oxygen concentrations vary with the volume and velocity of water flowing in a stream. **Three**, aquatic plants; the presence of aquatic plants in a stream affects the dissolved oxygen concentration. As mentioned above, oxygen is released in water through photosynthesis. **Four**, altitude; oxygen is more easily dissolved into water at low altitudes than at high altitudes. **Five**, dissolved or suspended solids; oxygen is also more easily dissolved into water with low levels of dissolved or suspended solids.

Alkalinity

The alkalinity, or the buffering capacity or a stream refers to how well it can neutralize acidic pollution and resist changes in pH. Alkalinity measures the amount of alkaline compounds in the water, such as carbohydrates, bicarbonates, and hydroxides. These compounds are natural buffers that can remove excess hydrogen (H+) ions.

As increasing amounts of acid are added to a body of water, its buffering capacity is consumed. If surrounding soils and rocks are alkaline, they may eventually restore the buffering capacity, but a temporary decrease in alkalinity can allow the pH to drop to harmful levels. A total alkalinity of 100 – 200 mg/l will stabilize the pH level in a stream. Levels between 20 and 200 mg/l are typically found in fresh water.

Turbidity

Turbidity is a measure of the cloudiness of water. Cloudiness is caused by suspended solids (mainly soil particles) and plankton (microscopic plants and animals) that are suspended in the water column. Moderately low levels of turbidity may indicate a healthy, well-functioning ecosystem. Higher levels of turbidity pose several problems for stream systems. Turbidity blocks out light needed by aquatic species, and may increase the water's temperature above normal temperatures. Suspended soil particles may carry nutrients, pesticides, and other pollutants throughout the stream system, and they can burry eggs and benthic critters when they settle. Turbid waters may also be low in dissolved oxygen.

Temperature

Temperature is always included in water quality monitoring because it affects the concentrations and reactivity of many other parameters. As mentioned above, temperature influences the dissolved oxygen content of the water; as well as the rate of photosynthesis by aquatic plants, the metabolic rates of organisms, the sensitivity of organisms to toxic wastes, parasites and diseases, and the timing of reproduction, migration and aestivation of aquatic organisms. Factors which can affect temperature include sunlight, seasonal and daily changes, shade, air temperature, stream flow, water depth, inflow of groundwater or surface water, and the turbidity of the water. Other factors include soil erosion, storm water runoff, and alterations to stream morphology, substrate and flow.

Conductivity

Conductivity is a measure of how well water can pass an electrical current. It is an indirect measure of the presence of inorganic dissolved solids such as chloride, nitrate, sulfate, phosphate, sodium, magnesium, calcium, iron, and aluminum. The presence of these substances increases the conductivity of a body of water. They help to conduct electricity because they are negatively or positively charged ions when dissolved in water.

Dissolved solids are essential ingredients for aquatic life. They regulate the flow of water in and out of organisms' cells, and are building blocks of the molecules necessary for life. A high concentration of dissolved solids, however, can cause water balance problems for aquatic organisms and decreased dissolved oxygen levels.

TDS

TDS, or total dissolved solids, is a measure of the combined content of all inorganic and organic substances contained in a liquid in suspended form. TDS is used as an indication of the presence of a broad array of chemical contaminants.

Primary sources for TDS in receiving waters are agricultural and residential runoff, leaching of soil contamination and point source water pollution discharge from industrial or sewage treatment plants. The most common chemical constituents are calcium, phosphates, nitrates, sodium, potassium, and chloride.