

Glossary

303(d). Part of the *Clean Water Act*. If monitoring and assessment indicate that for some uses and/or parameters, a water body or segment is not meeting water quality standards, then that water is considered “impaired” and goes on a special list called the “303(d) list,” named after the section of the *Clean Water Act* that calls upon states, approved tribes, and territories to create such lists.

305(b). Part of the *Clean Water Act*. Refers to a required national water quality inventory that provides information on which pollutants (chemicals, sediments, nutrients, metals, temperature, pH) and other stressors (altered flows, modification of the stream channel, introduction of exotic invasive species) are the most common causes of impairment to water bodies and what are the most common sources of those stressors.

Accuracy. A data quality indicator that shows the extent of agreement between an observed value (the sample) and the accepted, or *true, value* of the parameter being measured.

Algae. Microscopic organisms/aquatic plants that use sunlight as an energy source.

Algal bloom. Population explosion of algae in surface waters due to an increase in plant nutrients such as nitrates and phosphates.

Alkalinity. Capacity of a lake to neutralize acid.

Analyte. A property or substance to be measured, such as pH, dissolved oxygen, bacteria and heavy metals.

Bacteria. The overall recreational value of a surface water body (river, stream or lake) can be measured partially by its suitability for swimming (all water contact activities) as determined by the presence of fecal coliform bacteria. These bacteria are found in the wastes of warm-blooded animals, such as people, dogs, cattle, etc. Bacteria levels with a monthly average below 200 bacteria colonies/100 ml of water are generally considered safe for human contact.

Benthic. Refers to being on the bottom of a lake. **Benthic fauna** are organisms attached to or resting on the bottom or living in the bottom sediments of a water body.

Biological monitoring (or biomonitoring). The use of a biological entity as a detector and its response as a measure to determine environmental conditions. Toxicity tests and biological surveys are common biomonitoring methods.

Biological survey (or biosurvey). Consists of collecting, processing, and analyzing representative portions of a resident aquatic community to determine the community structure and function.

Biological Oxygen Demand (BOD). Amount of dissolved oxygen needed to break down (oxidize) organic materials to carbon dioxide, water and minerals in a given volume of water at a certain temperature over a specified time period.

Biometrics. The automated use of physiological or behavioral characteristics to determine or verify identity.

Chlorophyll. Green pigment in plants that transforms light energy into chemical energy in photosynthesis.

Clarity. Transparency of water; routinely estimated by the depth at which you can no longer see a Secchi disk. The Secchi disk is a 20 cm (8 inch) diameter weighted metal plate with alternating quadrants painted black and white that is used to estimate water clarity (light penetration). The disk is lowered into water until it disappears from view. It is then raised until just visible. An average of the two depths, taken from the shaded side of the boat, is recorded as the Secchi depth.

Cfs. Cubic feet per second.

Clean Water Act. Growing public awareness and concern for controlling water pollution led to enactment of the Federal Water Pollution Control Act Amendments of 1972. As amended in 1977, this law became commonly known as

the Clean Water Act. The Act established the basic structure for regulating discharges of pollutants into the waters of the United States. It gave USEPA the authority to implement pollution control programs such as setting wastewater standards for industry. The Clean Water Act also continued requirements to set water quality standards for all contaminants in surface waters. The Act made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions. It also funded the construction of sewage treatment plants under the construction grants program and recognized the need for planning to address the critical problems posed by nonpoint source pollution.

Common protocol/standard protocol. See *Protocols*.

Comparability. Degree to which different methods, data sets and/or decisions agree or are similar.

Completeness. The amount of valid data obtained compared to the amount of data planned. Usually expressed as a percentage.

Compliance monitoring. A type of monitoring done to ensure the meeting of immediate statutory requirements, the control of long-term water quality, the quality of receiving waters as determined by testing effluents, or the maintenance of standards during and after construction of a project.

Composite sample. A combined water sample consisting of a series of discrete water samples taken over a given period of time and mixed according to a specified weighting factor, such as stream flow. A composite sample is often collected by an automated sampler during a runoff event.

Concentration units (mg/l or µg/l). The amount of chemical dissolved in water. Most common is milligrams per liter (mg/l) and micrograms per liter (µg/l). One milligram per liter is equal to one part per million (ppm).

Conductivity. Measures water's ability to conduct an electric current and is directly related to the total dissolved salts (ions) in the water. Called EC for electrical conductivity and is reported in micromhos per centimeter (umhos/cm) which has been recently renamed as uS/cm (microSiemens per centimeter). EC is temperature sensitive and increases with increasing temperature. Most modern probes automatically correct for temperature and standardize all readings to 25°C

and then refer to the data as *specific EC*.

Contaminant. A material added by humans or natural activities that may, in sufficient concentrations, render the environment unacceptable for biota. The mere presence of these materials is not necessarily harmful.

Critical habitat. Those areas designated as critical for the survival and recovery of threatened or endangered species.

Data analysis. Using monitoring results to answer your question(s) and using your quality control data to evaluate whether you met your data quality goal and objectives.

Data quality objectives. In the context of water- quality monitoring, the characteristics or goals that are determined by a monitoring or interpretive program to be essential to the usefulness of the data. They would include, but not be limited to, the specification or delineation of the limits of precision and bias of measurements, the completeness of sampling and measurements, the representativeness of sites relative to program objectives, the validity of data and so forth.

Data users. The group(s) that will apply the data results for some purpose, such as the monitors themselves, government agencies, schools, universities, industries, *watershed* organizations and community groups.

Detection limit. The lowest concentration of a target *analyte* that a given method or piece of equipment can reliably ascertain and report as greater than zero.

Dimictic. If a lake mixes completely twice a year, in the spring and fall, it is said to be dimictic. (See *oligomictic* and *polymictic*.)

Dissolved oxygen (DO). The concentration of free (not chemically combined) molecular oxygen (a gas) dissolved in water, usually expressed in milligrams per liter, parts per million, or percent of saturation. Adequate concentrations of dissolved oxygen are necessary for the life of fish and other aquatic organisms and the prevention of offensive odors. DO levels are considered the most important and commonly employed measurement of water quality and indicator of a water body's ability to support desirable aquatic life.

Drainage area. The area contributing runoff to a single point that is enclosed by a ridgeline.

Duplicate samples. Two samples taken at the same time from, and representative of, the same site and are carried through assessment and analytical procedures in an identical manner. Duplicate samples measure natural variability and precision of a method, monitor and/or analyst. More than two duplicate samples are called replicate samples.

Ecoregion. An environmental area characterized by a specific land use, soil types, land surface form and potential natural vegetation.

Ecosystem. A system formed by the interaction of a community of organisms with each other and with the chemical and physical factors making up their environment.

Education. Using water monitoring to provide knowledge and training.

Environmental sample. A specimen of any material collected from an environmental source, such as water or macroinvertebrates collected from a stream or lake.

Epilimnion. The upper, wind-mixed layer of a thermally stratified lake. This water is turbulently mixed throughout at least some portion of the day and because of its exposure, can freely exchange dissolved gases (such as O₂ and CO₂) with the atmosphere.

Equipment or rinsate blank. Types of *field blanks* used to check specifically for carryover contamination from reuse of the same sampling equipment. Same as sampler blank.

Erosion. The process of particle detachment and transport due to the forces of wind and rain.

Eutrophic lake. A nutrient-rich lake, usually shallow, “green” and with limited oxygen in the bottom layer of water.

Eutrophication. The process by which lakes and streams are enriched by nutrients (usually phosphorus and nitrogen) which leads to excessive plant growth - algae in the open water, periphyton (*attached algae*) along the shoreline, and macrophytes (the higher plants we often call *weeds*) in the nearshore zone. This remains the biggest pollution problem for Minnesota’s lakes. The extent to which this process has occurred is reflected in a lake’s trophic classification: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile). The less productive a lake is naturally, the more sensi-

tive it is to increased nutrient loads from human-caused disturbances in the watershed.

Export coefficient. An estimate of the expected annual amount of a nutrient or water transported from a unit of land to a receptor. Expressed in terms of mass per area per unit of time.

Field blank. A “clean” sample (e.g. distilled water) that is otherwise treated the same as other samples taken from the field. They are submitted to the analyst with all other samples and are used to detect any contaminants that may be introduced during sample collection, storage, analysis and transport.

Flow rate. The rate at which water moves by a given point; in rivers it is usually measured in cubic meters per second (m³/sec) or cubic feet per second (cfs).

Flow weighted mean concentration. Dividing total mass or load of a pollutant by the total flow.

Free oxygen. Oxygen in its molecular forms, O₂ (normal diatomic oxygen) or O₃ (ozone), uncombined with other elements. Free oxygen is a requirement of all aerobic organisms.

Geographic Information System (GIS). A computer system that allows for input and manipulation of geographic data to allow researchers to manipulate, analyze and display the information in a map format.

Grab sample. All of the test material is collected at one time. As such, a grab sample reflects performance only at the point in time that the sample was collected, and then only if the sample was properly collected.

Groundwater. Water contained in or flowing through the ground.

Hot spots. Area where land use or activities have generated highly contaminated runoff, with concentration of pollutants in excess of those typically found in stormwater.

Hydrograph. A graph of stream flow during a given time frame, such as seasonal or annual.

Hydrology. The study of water, especially its natural occurrence, characteristics, control and conservation.

Hypereutrophic. Refers to a lake or other body of water characterized by excessive nutrient concentrations such as phosphorus or nitrogen and resulting in high productivity. Such waters are often shallow, with algal blooms and periods of oxygen deficiency. Slightly or moderately eutrophic water can be healthful and support a complex web of plant and animal life; however, it is undesirable for drinking water and other needs.

Hypolimnion. The bottom, and most dense layer of a stratified lake. It is typically the coldest layer in the summer and warmest in the winter. It is isolated from wind mixing and typically too dark for much plant photosynthesis to occur.

Impact. A change in the chemical, physical, or biological quality or condition of a water body caused by external sources.

Impairment. A detrimental effect on the biological integrity of a water body caused by impact that prevents attainment of the designated use.

Index of Biotic Integrity (IBI). A synthesis of diverse biological information that numerically depicts associations between human influence and biological attributes. It is composed of several biological attributes or ‘metrics’ that are sensitive to changes in biological integrity caused by human activities.

Intermittic. If a lake mixes completely intermittently, it is said to be intermittic.

Isopleth. A line on a map connecting points with the same value for variables such as temperature or air pressure.

Kjeldahl. Kjeldahl’s method is an analytical method (TKN – Total Kjeldahl Nitrogen) for determination of nitrogen in certain organic compounds. The method was developed by the Danish chemist Johan Kjeldahl (1849-1900). It involves addition of a small amount of anhydrous potassium sulfate to the test compound, followed by heating the mixture with concentrated sulfuric acid, often with a catalyst such as copper sulfate. As a result ammonia is formed. After alkalyzing the mixture with sodium hydroxyde, the ammonia is separated by distillation, collected in standard acid, and the nitrogen determined by back-titration.

Lake management. A process that involves study, assessment of problems and decisions on how to maintain a lake as a thriving ecosystem.

Land use. Type of development and use of a land area, such as agriculture or commercial.

Limnology. Scientific study of fresh water, especially the history, geology, biology, physics and chemistry of lakes.

Load. Refers to the mass of material passing through a stream during a given period. It reflects the combined contributions of surface runoff and ground water discharge from a specific watershed as measured at the monitoring station.

Macroinvertebrate. An aquatic invertebrate animal large enough to see with the naked eye, such as crayfish, snails and clams. The analysis of the types and numbers of macroinvertebrates is referred to as a “biological index” and is a useful indicator of water quality and habitat conditions.

Macrophyte. A plant large enough to be studied and observed using the unaided eye, especially an aquatic plant.

Mesotrophic. Pertains to a lake or other body of water characterized by moderate nutrient concentrations.

Metadata. Information that describes the content, quality, condition, and other characteristics of data.

Morphometry. Relating to the shape of a lake basin; includes parameters needed to describe the shape of the lake such as volume, surface area, mean depth, maximum depth, maximum length and width, shoreline length and shoreline development.

Nonpoint source pollution. A source of pollution that comes from no single identifiable point of discharge, e.g., pollution that results from water runoff from urban areas, construction sites and agricultural operations.

Nutrient. Element or substance such as nitrogen and phosphorus necessary for plant growth. Large amounts of these substances can become a nuisance by promoting excessive aquatic plant growth.

Nutrient budget. Measurement of the amount of nutrients coming into a lake or stream, flowing out and staying in

the water and bottom sediments. Usually expressed as pounds per year.

Oligotrophic lake. A relatively nutrient-poor lake, it is clear and deep with bottom waters high in dissolved oxygen. Lakes that mix infrequently and at irregular intervals (many deep tropical lakes) are called **oligomictic** lakes. (See *dimictic* and *polymictic*.)

Outliers. Data points that lie outside of the normal range of data. Ideally, outliers must be determined by a statistical test before they can be removed from a data set.

Parameter. Whatever it is you measure, whether it is physical, chemical or biological.

Phosphorus. Key nutrient influencing plant growth in lakes. Soluble reactive phosphorus is the amount of phosphorus in solution that is available to plants.

pH. Measure of the concentration of hydrogen ions of a substance. It ranges from 1=very acid (high concentration) to 14=very alkaline (low concentration) of hydrogen ions.

Point source. A well-defined source of pollutants, such as a pipe from a municipal wastewater treatment plant, industry or a stormwater pipe.

Polymictic. A lake that does not thermally stratify in the summer but tends to mix periodically throughout summer via wind and wave action. Shallow lakes which mix frequently are called **polymictic** lakes. (See *dimictic* and *oligomictic*.)

ppm. Parts per million equal to milligrams per liter (mg/L).

Precision. Measures the level of agreement or variability among a set of repeated measurements, obtained under similar conditions. Usually expressed as a standard deviation in absolute or relative terms.

Protocols. Detailed, written, standardized procedures for field and/or laboratory operations.

Rating curve. A continuous record of stream discharge or flow can be established by developing a mathematical relationship between the water stage and discharge. To properly develop a rating curve, discharge measurements should be made at a variety of water stages, from low to high. Using a rating curve, all water stages continuously measured at the

monitoring station can be converted to flows. That establishes a flow record (hydrograph) for a given time period.

QA/QC. QA is an integrated management system designed to ensure that a product or service meets defined standards of quality with a stated level of confidence. QC is the overall system of technical activities designed to measure quality and limit error in a product or service.

Quality Assurance Project Plan (QAPP). A formal written document describing the detailed quality control procedures that will be used to achieve a specific project's data quality requirements.

Relative standard deviation (RSD). The standard deviation of a parameter expressed as a percentage and used in the evaluation of precision.

Relative percent difference (RPD). An alternative to standard deviation, expressed as a percentage used to determine precision when only two measurement values are available.

Replicate samples. See *Duplicate Samples*.

Representativeness. The degree to which data accurately and precisely portray the actual or true environmental condition measured.

Retention time. Turnover rate or flushing rate. The average length of time water resides in a water body.

Sampler blank. See *Equipment or rinsate blank*.

Secchi disk. A device measuring the depth of light penetration in water, it has a 4-6 inch radius that is divided into four equal quadrants of alternating black and white colors. It is lowered into a section of shaded water until it can no longer be seen and then lifted back up until it can be seen once again. Averaging the two depths gives the clarity of the water.

Sediments/sedimentation. Soil particles that have been eroded and are transported by stormwater runoff. Sedimentation is the deposition of soil particles that have been transported by water or wind.

Spiked samples. Samples to which a known concentration of the target *analyte* has been added. When analyzed, the difference between an *environmental sample* and the analyte's

concentration in a spiked sample should be equivalent to the amount added to the spiked sample.

Split sample. A sample that has been equally divided into two or more subsamples and submitted to different analysts or laboratories. Used to measure the precision of analytical methods.

Standard deviation. Used to determine precision, the most common calculation used to measure the range of variation among repeated measurements. Expressed by the positive square root of the variance of the measurements.

Standard Operating Procedures (SOPs). A written document detailing the prescribed and established methods used for performing project operations, analyses or actions.

Stratification. An effect where a substance or material is broken into distinct horizontal layers due to different characteristics such as density or temperature. (See also *Thermal Stratification*.)

Target pollutant load. A goal set to limit the amount or load of a pollutant that is being discharged from a watershed via the stream.

Taxon. (Pl. taxa) Any of the groups to which organisms are assigned according to the principles of taxonomy, including species, genus, family, order, class and phylum.

Thermal stratification. Existence of a turbulently mixed layer of warm water (*epilimnion*) overlying a colder mass of relatively stagnant water (*hypolimnion*) in a water body due to cold water being denser than warm water coupled with the damping effect of water depth on the intensity of wind mixing.

Titration. A method of calculating the concentration of a dissolved substance by adding quantities of a reagent of known concentration to a known volume of test solution until a reaction occurs.

TMDL. Total Maximum Daily Load. Refers to the Clean Water Act's 305(b) and 303(d) requirements. A calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources.

Total nitrogen. The total amount of nitrogen that is contained in the water column.

Total phosphorus. Includes the amount of phosphorus in solution (reactive) and in particulate form.

Total suspended solids. The total amount of particulate matter that is suspended in the water column.

Toxic. Lethal concentration, which may refer to conditions of a water body or concentration of a particular pollutant.

Trophic state. Eutrophication is the process by which lakes are enriched with nutrients, increasing the production of rooted aquatic plants and algae. The extent to which this process has occurred is reflected in a lake's trophic classification or state: *oligotrophic* (nutrient poor), *mesotrophic* (moderately productive), and *eutrophic* (very productive and fertile).

True value. A value that has been sufficiently well established to be used for the calibration of instruments, evaluation of assessment methods or the assignment of values to materials. Used to determine accuracy.

Turbidity. A measure of the degree to which light is scattered by suspended particulate material and soluble colored compounds in the water. It provides an estimate of the muddiness or cloudiness of the water due to clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, plankton, and microscopic organisms.

Variance. A statistical term used to calculate standard deviation. The sum of the squares of the difference between the individual values of a set and the arithmetic mean of the set, divided by one less than the numbers in the set.

Water column. Water contained in the water body. A conceptual column of water from a lake surface to bottom sediments.

Water-quality data. Chemical, biological, and physical measurements or observations of the characteristics of surface and ground waters.

Water-quality monitoring. An integrated activity for evaluating the physical, chemical, and biological character of water in relation to human health, ecological conditions and designated water uses.

Water-quality volume. The volume needed to capture and treat 90% of the average stormwater runoff volume equal to one inch times the volumetric runoff coefficient times the site area.

Watershed. The geographic region where water drains into a particular river, stream or body of water.

Wetland. Habitat that is transitional between terrestrial and aquatic where the water table is usually at or near the land surface or land that is covered by shallow water. Wetlands have one or more of the following characteristics: at least periodically, the land supports predominantly hydrophytic plants; the substrate is predominantly undrained hydric soil; and the substrate is nonsoil and is saturated with water or covered by shallow water at sometime during the yearly growing season.

Winkler method. A method for measuring the amount of dissolved oxygen in a sample of water using reagents to fix or preserve the sample and titration to create a color change that indicates the amount of dissolved oxygen in the sample.