

## TMDLs (Total Maximum Daily Loads) – Terms and Definitions

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The definitions of TMDL-related terms presented here are intended to provide the reader with a working knowledge of terms that apply to Virginia's TMDL program. This is the first in a series of Virginia Cooperative Extension publications that deal specifically with TMDLs. The federal Clean Water Act requires States to develop TMDLs for streams, rivers, lakes and estuaries that do not or are not expected to meet applicable water quality standards. This glossary is designed to assist the reader in understanding and interpreting TMDL related information that may come from sources as varied as governmental agencies, environmental groups, consulting firms, or the news media.

### Glossary of Terms

#### A

**Acute exposure** – a single exposure to a toxic substance that results in severe biological harm or death. Acute exposures are usually characterized as lasting no longer than a day. Longer-term lower level exposures are referred to as chronic exposure.

**Acute toxicity** – an adverse effect that usually occurs shortly after exposure to a pollutant. Lethality to an organism is the usual measure of acute toxicity. Where death is not easily detected, immobilization is considered equivalent to death.

**Algae** – aquatic organisms, ranging in size from single-celled forms to the giant kelp.

**Allocations** – best estimates of current and future pollutant loads (both nonpoint and point sources) entering a waterbody. Pollutant load estimates can range from reasonably accurate measurements to gross estimates, depending on the availability of data, and the techniques used for predicting specific loads. (see Load Allocation and Waste Load Allocation)

**Allocation Scenario** – proposed combination of point source and nonpoint source pollutant loads being considered to meet a water quality goal.

**Ambient water quality** – level of water quality constituents collected as part of a routine monitoring program.

**Ammonia** – (NH<sub>3</sub>) an inorganic nitrogen compound. In water, ammonia levels in excess of the recommended limits may harm aquatic life.

**Anthropogenic** – involving the impact of humans on nature; specifically items or actions induced, caused, or altered by the presence and activities of humans.

**Antidegradation policy** – Virginia's antidegradation policy protects water quality at three levels or "tiers." Tier 1 specifies that existing instream water uses and the level of water quality to protect the existing uses shall be maintained and protected. This means that, as a minimum, all waters should meet adopted water quality standards. Tier 2 protects water that is better than specified water quality standards. Only in limited circumstances may water quality be lowered in these waters. Tier 3 are exceptional waters where no new, additional or increased

discharge of sewage, industrial wastes or other pollution are allowed. These waters must be specifically listed in Virginia's water quality standards regulation.

**Aquatic ecosystem** – the living and nonliving components of a water body, i.e. its physical, chemical, and biological components.

**Assimilative capacity** – a measure of the ability of a natural body of water to effectively degrade and/or disperse chemical substances. Assimilative capacity is used to define the ability of a waterbody to naturally assimilate a substance without impairing water quality or degrading the aquatic ecosystem. Numerically, it is the amount of pollutant that can be discharged to a specific waterbody without exceeding water quality standards. (see Loading Capacity)

## B

**Background levels** – values of parameters that describe the chemical, physical, and biological conditions in an aquatic ecosystem prior to specific anthropogenic influences; chemical, physical, and biological levels representing conditions that would result from natural processes such as weathering and dissolution.

**Bacteria source tracking (BST)** – a process used to identify probable sources of fecal coliform bacteria in a water body. For example, BST can be used to distinguish among fecal coliforms originating from humans, wildlife or cattle.

**Baseflow** – the portion of streamflow derived from groundwater flowing into a stream or river; that flow which is not affected by surface runoff.

**Benthic macroinvertebrates** – organisms living in, or on, the bottom of a waterbody that are visible without a microscope (“macro-”) and lack backbones (“invertebrates”). Benthic macroinvertebrates include larval or nymph forms for insects (e.g. stone flies, mayflies, etc.) crustaceans (e.g. crayfish), snails, mussels, clams, worms, and leeches.

**Benthic organisms** – organisms living in, or on, the bottom of a water body.

**Best management practices (BMPs)** – reasonable and cost-effective means to reduce the likelihood of pollutants entering a water body. BMPs include riparian buffer strips, filter strips, nutrient management plans, conservation tillage, etc.

**Bioassessment** – the process of evaluating the algal, benthic macroinvertebrate, and/or fish communities to determine whether a water body supports the state-defined designated use for aquatic life.

**Biochemical oxygen demand (BOD)** – represents the amount of oxygen consumed by bacteria as they break down organic matter in the water.

**Biological integrity** – a water body's ability to support and maintain a balanced, integrated adaptive assemblage of organisms with species composition, diversity, and functional organization comparable to that of similar natural, or non-impacted, habitat.

**Bloom** – accelerated growth of algae and/or aquatic plants in a body of water. Blooms are often the result of excessive levels of nutrients in water (generally phosphorus and nitrogen).

## C

**Calibration (of a model)** – the process of adjusting model parameters within physically reasonable ranges until the resulting predictions give a best possible fit to observed data.

**Chlorophyll a** – a photosynthetic pigment that is found in all green plants. The concentration of chlorophyll a is used as a common indicator of water quality.

**Chronic Exposure** – long-term, low-level exposure to a toxic chemical.

**Chronic toxicity** – an adverse effect that is irreversible or progressive or occurs because the rate of injury is greater than the rate of repair during prolonged exposure to a pollutant. This includes low level, long-term effects such as reduction in growth or reproduction.

**Clean Water Act (CWA)** – is commonly used to describe the series of legislative acts that form the foundation for protection of the nation's water resources. Milestones in water quality legislation include the Water Quality Act of 1965; Federal Water Pollution Control Act of 1972 (PL92-500); the Clean Water Act, itself passed in 1977; and the Water Quality Act of 1987. Sections of the CWA address different types of water pollution in different ways. *Section 305b* and *Section 303d* of the CWA deal specifically with water quality assessment and TMDL development.

**Coliform bacteria** – a group of organisms (*Colon bacilli*) usually found in the digestive tract of all warm-blooded animals and humans. The presence of coliform bacteria in water is an indicator of possible pollution by fecal material and the presence of pathogenic bacteria that can cause diseases such as intestinal infections, dysentery, hepatitis, typhoid fever and cholera. Bacteria quantities are generally reported as colonies or colony forming units (cfu) per 100 milliliters (ml) of sample. (see fecal coliform)

**Conventional pollutants** – as specified under the Clean Water Act, conventional contaminants include suspended solids, coliform bacteria, biochemical oxygen demand, pH, and oil and grease. In Virginia’s water quality assessment process, conventional pollutants encompass pH, temperature, dissolved oxygen and fecal coliform bacteria.

**Consent Decree** – a legally binding agreement that defines Virginia’s TMDL development schedule through 2010. In 1998, The American Canoe Association and the American Littoral Society filed a lawsuit against EPA for failure to comply with the provisions of *Section 303(d)* of the *Clean Water Act* in Virginia. In 1999, EPA signed a Consent Decree with the plaintiffs. The Commonwealth of Virginia has agreed to abide by the Consent Decree and its provisions.

**Conductivity** – an indirect measure of the presence of dissolved substances within water. High conductivities indicate higher concentrations of dissolved inorganic chemicals in the water. (see total dissolved solids)

**Criteria** – elements of water quality standards expressed as constituent concentrations, levels, or narrative statements, representing the quality of water that supports a particular use. When criteria are met, water quality will generally support the designated use.

**Critical condition** – the combination of environmental factors (e.g., flow, temperature, etc.) during which the water body is most vulnerable and has the lowest assimilative capacity. Federal TMDL regulations require that any allocation scenario proposed in a TMDL should meet the water quality standards under critical conditions.

## D

**Delisting** – the process by which an impaired waterbody is removed from the Section 303(d) Impaired Waters List. To remove a waterbody from the Section 303(d) list, the state must demonstrate to EPA, using monitoring or other data, that the waterbody is no longer impaired.

**Designated use** – those uses specified in water quality standards for each water body or segment. All Virginia waters are designated for the following uses: recreational uses, e.g., swimming and boating; the propagation and growth of a balanced, indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources, e.g., fish and shellfish. Taken together, these uses are generally stated as “fishable and swimmable.” Through the protection of these uses, other uses such as industrial water supply, irrigation and navigation also are protected.

**Die-off (of fecal coliform)** – reduction in the fecal coliform population due to predation by other bacteria as well as by adverse environmental conditions (e.g. UV radiation, high or low pH, etc.).

**Direct nonpoint sources** – nonpoint sources that discharge directly into the stream, such as direct deposits of fecal material to streams from livestock and wildlife.

**Discharge** – the volume of water that passes a given point during a given period. Generally expressed in units such as cubic feet per second (cfs) or millions of gallons per day (MGD). It describes a variety of flows such as from a pipe outlet to a stream, from a well or spring to a stream or river, and from a stream or river to a lake or ocean. For streams and rivers, the following terms are used when assessing discharge related criteria like minimum or maximum concentrations of a given chemical.

*1Q10* – the lowest discharge (flow) averaged over a period of one day which, statistically, can be expected to occur only once every 10 years.

*7Q10* – the lowest discharge (flow) averaged over a period of seven consecutive days that, statistically, can be expected to occur only once every 10 years.

*30Q5* – the lowest discharge (flow) averaged over a period of 30 consecutive days that can be statistically expected to occur once every 5 years.

**Dissolved oxygen (DO)** – the amount of oxygen dissolved in water (usually reported in milligrams per liter, mg/l or parts per million, ppm). DO is a measure of the amount of oxygen available for biochemical activity in a waterbody. Dissolved oxygen levels are considered an important measure of water quality and an indicator of a water body’s ability to support desirable aquatic life.

**Drainage basin** – the land area that drains to, or contributes water to, a particular point, stream, river, lake or ocean. Drainage basins range in size from a few acres for a small stream, to large areas of the country like the Chesapeake Bay Basin that includes parts of six states. (see watershed)

## E

**E-911 digital data** – emergency response database prepared by counties in Virginia that contains graphical data on road centerlines and buildings. The database contains approximate outlines of buildings, including dwellings and poultry houses.

**E. coli (*Escherichia coli*)** – a subgroup of fecal coliform bacteria that are present in the intestinal tracts and feces of warm-blooded animals. E. coli are used as an indicator of the potential presence of pathogens.

**Ecosystem** – an interactive community of animals, plants, and bacteria, and their associated physical and chemical environment.

**Ecoregion** – a region defined in part by its shared characteristics. These characteristics include meteorological factors, elevation, plant and animal speciation, landscape position, and soils.

**Effluent** – (1) Something that flows out or forth, (2) Discharged wastewater such as the treated wastes from animal production facilities, industrial facilities, or wastewater treatment plants.

**Endpoint** – a measurable goal or target. Assessment endpoints and measurement endpoints are two distinct types of endpoints commonly used by resource managers. An assessment endpoint is the formal expression of a valued environmental characteristic and should have societal relevance (an indicator). A measurement endpoint is the expression of measured response to a stress or disturbance. It is a measured value that is related to a specific environmental characteristic chosen as the assessment endpoint. The numeric criteria that are part of traditional water quality standards are good examples of measurement endpoints (targets).

**Enterococci** – a subgroup of fecal streptococci bacteria (mainly *Streptococcus faecalis* and *Streptococcus faecium*) that are present in the intestinal tracts and feces of warm-blooded animals. Enterococci are used as an indicator of the potential presence of pathogens.

**Environmental Protection Agency (EPA)** – A federal agency created in December 1970 to address the nation's urgent environmental problems and to protect the public health.

**Erosion** – the detachment and transport of soil particles by water and wind. Sediment resulting from soil erosion represents the single largest source of nonpoint source pollution in the United States.

**Eutrophication** – the process of enrichment of water bodies by nutrients. Eutrophication is normally a slow aging process during which a lake, estuary, or bay evolves into a bog or marsh and eventually disappears. Waters receiving excessive nutrients may become prematurely eutrophic, are often undesirable for recreation, and may not support normal fish populations.

**Exceedence** – a violation, e.g., of a permit limit or a water quality standard.

**Existing Use** – the use actually attained in the water body on or after November 28, 1975, whether or not the use is included in the water quality standards.

## F

**Failing septic system** – septic systems in which the drain field has failed such that effluent (wastewater) that is supposed to percolate into the soil, rises to the surface and ponds on the surface where it can run into streams or rivers and pollute them.

**Fate of pollutants** – physical, chemical, and biological changes that pollutants experience once in the environment.

**Fecal coliform** – an organism of the coliform bacteria group originating in the intestinal tract of warm-blooded animals that passes into the environment in feces. Fecal coliform bacteria are often used as an indicator of pathogens in water. Generally reported as colonies or colony forming units (cfu) per 100 milliliters (ml) of water sample.

**Flow** – see discharge.

## G

**Geometric mean** – the  $n^{\text{th}}$  root of the product of  $n$  values. Mathematically the geometric mean is expressed as:

$$\text{Geometric Mean} = \sqrt[n]{x_1 \times x_2 \times \dots \times x_n}$$

where  $n$  is the number of samples, and  $x_1, x_2, \dots$  are the values of some parameter, i.e. *E. coli* concentrations. Compared to an average or simple mean, the geometric mean lessens the impact of extremely high or low values greater than zero. For example, consider the following set of five *E. coli* measurements with units of cfu/100ml, 150, 600, 50, 120, 195. A simple mean of these values produces:

$$\text{Simple Mean} = \frac{150+600+50+120+195}{5} = 223$$

The geometric mean for these measurements would be:

$$\text{Geometric Mean} = \sqrt[5]{150 \times 600 \times 50 \times 120 \times 195} = 160 \text{ cfu/100ml}$$

**Geographic Information System (GIS)** – a system of hardware, software, data, people, organizations and institutional arrangements for collecting, storing, analyzing and disseminating information about areas of the earth. An example of a GIS is the use of spatial data for Emergency Services response (E-911). Dispatchers use GIS to locate the caller’s house, identify the closest responder, and even determine the shortest route. All these activities are automated using the electronic spatial data in the GIS.

## H

**Hydrologic cycle** – describes the constant movement of water above, on, and below the earth’s surface. Processes such as precipitation, evaporation, condensation, infiltration, and runoff comprise the cycle.

**Hydrology** – the study of the distribution, properties, and effects of water on the earth’s surface, in the soil and underlying rocks, and in the atmosphere.

## I

**Impaired waters** – those waters with chronic or recurring monitored violations of the applicable numeric and/or narrative water quality standards.

**Implementation Plan** – a document required by Virginia statute (see WQMIRA) detailing the suite of pollution control measures needed to remediate an impaired water body. Once fully implemented, the plan should result in the previously impaired water achieving a “fully supporting” status. (see use support)

**Indicator** – a qualitative or quantitative surrogate measure that can be used to evaluate the relationship between pollutant sources and their impact on water quality. For example, the number and type of fish in a stream may be indicative of the stream’s water quality.

**Indicator organism** – (1) any organism that by its presence or absence, its frequency, or its vigor indicates a particular property of its surrounding environment. (2) an organism used to indicate the potential presence of other (usually pathogenic) organisms. Indicator organisms are usually associated with the other organisms, but are usually more easily sampled and measured.

## L

**Limiting factor** – any factor such as temperature, light, water, or chemical that limits the existence, growth, abundance, or distribution of an organism. For example, an increase in phosphorus loading to a lake, stream, or river can trigger the growth of algae.

**Load, Loading, Loading rate** – the total amount of material (pollutants) entering a water body from one or multiple sources. Measured as a rate in weight per unit time or per unit area (e.g., pounds/year, pounds/acre).

**Load allocation (LA)** – the portion of the loading capacity attributed to 1) the existing or future nonpoint sources of pollution, and 2) natural background sources. Whenever possible, nonpoint source loads and natural loads should be distinguished.

**Loading capacity (LC)** – the greatest amount of pollutant loading a waterbody can receive without violating water quality standards. (see assimilative capacity)

## M

**Macrophyte** – plants, especially those that thrive in water, that are large enough to be visible without a microscope.

**Margin of safety (MOS)** – a required component of the TMDL that accounts for the uncertainty in calculations of pollutant loading from point, nonpoint, and background sources.

**Mean** – the simple mean is the sum of the values in a data set divided by the number of values in the data set.

**Methemoglobinemia (blue baby syndrome)** – a condition that limits the oxygen-carrying capacity of red blood cells. The resulting oxygen starvation causes a bluish discoloration of the body. The condition is largely confined to infants less than 9 months old. To prevent methemoglobinemia, the EPA has set a nitrate-nitrogen ( $\text{NO}_3\text{-N}$ ) MCL of 10 part mg/l for public water supplies.

**Metrics** – indices or parameters used to measure some aspect or characteristic of a water body's biological integrity. The metric changes in some predictable way with changes in water quality or habitat condition.

**Micrograms per liter ( $\mu\text{g/l}$ )** – a measure of concentration, equivalent to parts per billion (ppb). One thousand micrograms per liter is equivalent to 1 milligram per liter.

**Milligrams per liter (mg/l)** – a measure of concentration, equivalent to 1 part per million (ppm).

**Mixing zone** – a limited area or volume of the receiving water where the initial dilution of a permitted or authorized discharge is allowed to occur. The purpose of the mixing zone is to dilute or reduce pollutant concentrations below applicable water quality standards.

**Model** – a system of mathematical expressions that describe both hydrologic and water quality processes. When used for the development of TMDLs, models can estimate the load of a specific pollutant to a water body and make predictions about how the load would change as remediation steps are implemented. Examples of models being used to develop TMDLs in Virginia include HSPF (Hydrological Simulation Program-Fortran) and GWLF (Generalized Watershed Loading Function).

**Monitoring** – periodic or continuous sampling and measurement to determine the physical, chemical, and biological status of a particular media like air, soil, or water.

## N

**Narrative criteria** – non-numeric, qualitative guidelines that describe a desired water quality goal or goals.

**Nitrate** – ( $\text{NO}_3^-$ ) an inorganic nitrogen compound. Nitrate may be naturally present in water, but high concentrations (greater than 2 or 3 ppm) are most likely due to fertilizer runoff, livestock facilities, sanitary

wastewater discharges, and/or atmospheric deposition (nitrate dissolved in precipitation). High levels of nitrate in drinking water (greater than 10 mg/l) are associated with methemoglobinemia and possibly an increased risk for some cancers.

**Nitrogen** – an essential nutrient to the growth of organisms. However, excessive amounts of nitrogen in water can contribute to abnormally high growth of algae reducing light and oxygen in aquatic ecosystems.

**Nonpoint source (NPS) pollution**– pollution originating from diffuse sources on and above the landscape. Examples include runoff from fields, stormwater runoff from urban landscapes, roadbed erosion in forestry, and atmospheric deposition. Estimates indicate that NPS pollution accounts for more than one-half of the water pollution in the United States today. (contrast with point source pollution)

**Numeric criteria** – a measurable value determined for the pollutant of concern which, if achieved, is expected to result in the attainment of water quality standards in the listed waterbody.

**Nutrient** – (1) an element or compound essential to life, including carbon, oxygen, nitrogen, phosphorus, and many others; (2) as a pollutant, any element or compound, such as phosphorus or nitrogen that in excessive amounts contributes to abnormally high growth of algae reducing light and oxygen in aquatic ecosystems.

## O

**Organic matter** – plant and animal residues, or substances made by living organisms.

**Orthophosphate** – ( $\text{PO}_4^{3-}$ ) often referred to simply as phosphate. Most phosphorus exists in water in the orthophosphate form. Plants utilize orthophosphate as a phosphorus source. Like nitrates, excessive amounts of phosphate can cause abnormally high growth of algae reducing light and oxygen in aquatic ecosystems.

## P

**Pathogen** – a disease-causing agent, especially microorganisms such as bacteria, protozoa, and viruses.

**pH** – a numerical measure of acidity or alkalinity. The pH scale ranges from 1 (acidic) to 14 (alkaline). A pH of 7 is neutral.

**Phased approach** – under the phased approach, pollutant load reduction management strategies are implemented gradually with the most cost effective best management practices being implemented first. Monitoring continues throughout the implementation process to assess water quality improvement. This approach can be used where great uncertainty exists, either in load estimation or in the effectiveness of a chosen management strategy. (See also Staged Implementation)

**Phosphate** – see Orthophosphate

**Phosphorus** – an essential nutrient to the growth of organisms. However, excessive amounts of phosphorus in water can contribute to abnormally high growth of algae reducing light and oxygen in aquatic ecosystems.

**Photosynthesis** – the manufacture by plants of carbohydrates and oxygen from carbon dioxide and water in the presence of chlorophyll using sunlight as an energy source.

**Plankton** –plants (phytoplankton) and animals (zooplankton) that live in open water, either suspended or floating. Zooplankton feed on phytoplankton, bacteria and detritus (dead organic matter).

**Point source pollution** – pollutant loads discharged at a specific location. Point source discharges are generally regulated through the Virginia Pollution Discharge Elimination System (VPDES) permitting procedures. Point sources can also include pollutant loads contributed by tributaries to the main receiving stream or river. During TMDL development, permitted point sources are assigned a waste load allocation for the pollutant in question.

**Pollutant** – any substance of such character and in such quantities that when it reaches a body of water, it degrades the receiving water, rendering it unfit for some specified designated use. Specifically as defined in Section 502(6) of the CWA a pollutant means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water

**Pollution** – alteration of the physical, biological, chemical, and radiological integrity of water due to human activities – any unwanted contaminating property that renders a water supply unfit for its designated use. Specifically as defined in Section 502(19) of the CWA, pollution means the man-made or man-induced alteration

of the physical, biological, chemical, and radiological integrity of water.

**Public comment period** – the time allowed for the public to express its views and concerns regarding action proposed by a state or federal agency.

## R

**Rapid Bioassessment Protocol (RBP)** – a suite of measurements based upon a quantitative assessment of benthic macroinvertebrates and a qualitative assessment of their habitat. RBP scores are compared to reference conditions to determine to what degree a water body may be biologically impaired.

**Reach** – a section of a river or stream that generally extends from the confluence of one tributary with another, or sometimes from a tributary to an outlet, lake, or other feature.

**Receiving water** – creeks, streams, rivers, lakes, estuaries, groundwater formations, or other bodies of water into which surface water and/or treated or untreated waste are discharged.

**Reference conditions** – the chemical, physical, or biological quality or condition exhibited at either a single site or an aggregation of sites that are representative of non-impaired conditions for a watershed of a certain size, land use distribution, and other related characteristics. Reference conditions are used to describe reference sites.

**Reference site** – a benchmark against which the water quality in a specific watershed is compared; for example, a biological evaluation in the watershed would be compared with that from a reference site (unimpaired) to determine the level of impairment.

**Residence time** – length of time that a pollutant remains within a section of a stream or river. The residence time is determined by the streamflow and the volume of the reach in question.

**Riparian** – pertaining to the banks of a river, stream, pond, lake, etc., as well as to the plant and animal communities along such bodies of water

**Runoff** – that part of rainfall or snowmelt that does not infiltrate but flows over the land surface, eventually making its way to a stream, river, lake or an ocean. It can carry pollutants into receiving waters.

## S

**Section 305(b)** – section of the Clean Water Act that requires states to submit a biennial report in even numbered years to EPA describing the quality of the state’s waters. The 305(b) report describes the overall water quality conditions and trends in the state.

**Section 303(d)** – section of the Clean Water Act that requires states to periodically identify waters that do not or are not expected to meet applicable water quality standards. These waters are identified on the 303(d) Impaired Waters List. A TMDL must be developed for each water on the 303(d) list. If a listed water has multiple impairments (multiple reasons for degraded water quality), a TMDL must be developed for each impairment.

**Sediment** – in the context of water quality, soil particles, sand, and minerals dislodged from the land and deposited into aquatic systems as a result of erosion.

**Segment** – a water body or portion of a water body that has relatively homogeneous chemical, physical, and hydrological characteristics.

**Septic system** – an on-site system designed to treat and dispose of domestic sewage. A typical septic system consists of a tank that receives waste from a residence or business and a drain field or subsurface absorption system consisting of a series of percolation lines for the disposal of the liquid effluent. Solids (sludge) that remain after decomposition by bacteria in the tank must be pumped out periodically.

**Sewer** – a channel or conduit that carries wastewater and storm water runoff from the source to a treatment plant or receiving stream. Sanitary sewers carry household, industrial, and commercial waste. Storm sewers carry runoff from rain or snow. Combined sewers handle both.

**Simulation** – with respect to water quality, simulation is the use of mathematical models to approximate the behavior of a natural water system in response to a specific set of known inputs or conditions. Once validated, simulation models can be used to predict the response of a natural water system to specific changes to model inputs, i.e. changes in land use.

**Staged Implementation** – a process that allows for the evaluation of the adequacy of the TMDL in achieving the water quality standard. As stream monitoring

continues to occur, staged or phased implementation allows for water quality improvements to be recorded as they are being achieved. It also provides a measure of quality control, and it helps to ensure that the most cost effective practices are implemented first.

**Stakeholder** – (in this context) any person or organization with a vested interest in TMDL development and implementation in a specific watershed.

**State Revolving Fund (SRF)** – a program that makes loans for specific water pollution control purposes and uses money from loan repayment, including interest, to make new loans for additional water pollution control activities. Under the State Revolving Fund program, states and municipalities are primarily responsible for financing, constructing, and managing wastewater treatment facilities. The SRF program is based on the 1987 Amendments to the Clean Water Act.

**STORET** – EPA’s STOrage and RETrieval database used nationally for water quality data storage.

**Straight pipe** – delivers wastewater directly (without treatment) from a building, e.g., house, or milking parlor, to a nearby stream, pond, lake, or river.

**Streamflow** – see Discharge.

**Stream order** – a measure of the relative size of streams. The smallest perennial tributaries are referred to as first-order streams, while the largest river in the world, the Amazon, is a twelfth-order waterway. First- through third-order streams are called headwater streams. Over 80% of the total length of Earth’s waterways is comprised of headwater streams. Streams classified as fourth- through sixth-order are considered medium streams. A stream that is seventh-order or larger constitutes a river.

**Stressor** – any substance or condition that adversely impacts the aquatic ecosystem, e.g., elevated levels of nutrients or sediment.

**Substrate** – sediment and rock that constitute the material in the stream bottom of a natural water system.

**Surface water** – all water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors directly influenced by surface water.

**Suspended solids** – usually fine sediment and organic matter. Suspended solids limit sunlight penetration into the water, inhibit oxygen uptake by fish, and alter aquatic habitat.

## T

**Technology-based effluent limitations** – effluent limitations for permitted point sources calculated from technology-based controls. Technology-based controls include best practicable control technology currently available as defined in the Clean Water Act.

**Total dissolved solids (TDS)** – a measure of the concentration of dissolved inorganic chemicals in water. TDS can be measured indirectly by how water conducts electricity. A water quality analysis will sometimes report electrical conductivity (EC), usually in units of micromhos per centimeter (mmho/cm). To estimate parts per million (ppm) of dissolved solids multiply, the EC reading in mmho/cm by 0.64. Dissolved solids commonly found in Virginia are calcium, magnesium, sodium, potassium, bicarbonate, sulfate, chloride and silica.

**Total Maximum Daily Load (TMDL)** – a pollution “budget” that is used to determine the maximum amount of pollution a water body can assimilate without violating water quality standards. The TMDL includes pollution from permitted point sources (Waste Load Allocations, WLAs), and nonpoint and natural background sources (Load Allocations, LAs). In addition to the load allocations, the TMDL includes a margin of safety (MOS). The MOS accounts for any uncertainty associated with estimating the load allocations. Mathematically, a TMDL is written as follows

$$TMDL = LC = WLAs + LAs + MOS$$

A TMDL is developed for a specific pollutant and can be expressed in terms of mass per time, toxicity, or other appropriate measures that relate to the water quality standard being violated.

**TMDL Implementation Plan**– a document required by Virginia statute (see WQMIRA) detailing the suite of pollution control measures needed to remediate an impaired stream segment. The plans are also required to include a schedule of actions, costs, and monitoring. Once implemented, the plan should result in the previously impaired water meeting water quality standards and achieving a “fully supporting” use support status.

**Transport of pollutants (in water)** – involves two main processes: (1) advection, resulting from the flow of water itself, and (2) dispersion, or transport due to turbulence in the water.

**Tributary** – a lower order-stream compared to a receiving waterbody. A tributary will be upstream from, and flow into, the receiving waterbody, i.e. the Missouri is a tributary to the Mississippi.

**Turbidity** – a measure of the cloudiness or opacity of the water expressed in nephelometric turbidity units (ntu). The turbidity is influenced by the amount and nature of suspended organic and inorganic material in water. Typically, higher concentrations of suspended material equals greater turbidity. The source of turbidity could be sediment, organic material, particles of iron and manganese or other metal oxides, rust from corroding piping, algae, carbonate precipitates, etc.

## U

**Urban Runoff** – runoff originating from an urban drainage area including streets, parking lots, rooftops, and lawns.

**Use Attainability Analysis (UAA)** – a structured scientific assessment of the physical, chemical, biological, and economic factors that affect the attainment of a designated use. If a UAA shows that attaining a designated use is not feasible, the state, after considering public opinion, may choose to modify the use to make it less stringent.

**Use support** – the degree to which a water body will support its designated use. Use support criteria vary depending on the designated use. The degree of use support is reported in the Section 305(b) and Section 303(d) reports. The four use support categories are Fully Supporting, Fully Supporting but Threatened, Partially Supporting, Not Supporting. Waters classified as Partially Supporting or Not Supporting are deemed to be “impaired.”

## V

**Validation (of a model)** – process of determining how well the predictions of a mathematical model describe the actual behavior and physical process under investigation.

# W

**WQMIRA** – the Water Quality Monitoring, Information, and Restoration Act of 1997. This Virginia statute directs the Virginia Department of Environmental Quality (DEQ) to produce a list of impaired waters and develop TMDLs for these waters. The statute also directs DEQ to develop Implementation Plans for the TMDLs.

**Wasteload allocation (WLA)** – the portion of a receiving water’s loading capacity that is allocated to one of its existing or future permitted point sources of pollution. WLAs constitute a type of water quality-based effluent limitation.

**Wastewater treatment** – chemical, biological, and mechanical procedures applied to an industrial or municipal discharge or to any other sources of contaminated water to remove, reduce, or neutralize contaminants. Treatment facilities are often referred to by the acronyms STP (sewage treatment plant) or POTW (publicly owned treatment works) or WWTP (waste water treatment plants).

**Water quality** – the biological, chemical, and physical conditions of a waterbody. It is a measure of a waterbody’s ability to support beneficial uses.

**Water quality – based effluent limitations** – effluent limitation applied to dischargers when mere technology-based limitations would cause violations of water quality standards. Waste load allocations constitute a type of water quality-based effluent limitation.

**Water quality criteria** – include general narrative statements that describe good water quality and specific numeric criteria that are based on specific levels of pollutants that, if exceeded, would result in a water body not supporting a designated use. The numerical and narrative criteria taken together describe water quality necessary to protect designated uses.

**Water quality standards** – a group of statements that constitute a regulation describing specific water quality requirements. Virginia’s water quality standards have the following three components: *designated uses*, *water quality criteria* to protect designated uses, and an *antidegradation policy*.

**Watershed** – area that drains to, or contributes water to, a particular point, stream, river, lake or ocean. Larger watersheds are also referred to as basins. Watersheds range in size from a few acres for a small stream, to large areas of the country like the Chesapeake Bay Basin that includes parts of six states (see, drainage basin).

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