Glossary

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Wastewater Treatment & Collection System Terms

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absorption	The taking up of one substance into the body of another by chemical or molecular action after the adsorbtion process.
accuracy	In physical measurements, it is the degree of agreement between the quantity measured and the actual quantity. It should not be confused with 'precision,' which denotes the reproducibility of the measurement.
acid	A substance that yields hydrogen ions when dissolved in water resulting in a pH of less than 7; it can react with bases and certain metals to form salts.
acid-forming bacteria	Microorganisms that can metabolize complex organic compounds under anaerobic conditions and produce organic acids.
acre-foot	The volume of liquid one acre in area and one foot deep; equal to 43,560 cubic feet or 326,000 gallons.
activated carbon	Adsorptive particles or granules usually obtained by heating carbonaceous material in the absence of air or in steam; possesses high capacity to selectively remove trace and soluble components from solution.
activated carbon treatment	Treatment process in which water is brought into contact with activated carbon to remove soluble components; used with raw water, primary effluent or chemically-clarified wastewater to remove nonspecific organics and as a polishing process to remove specific organics from secondary effluent.
activated sludge	Sludge floc produced in an aeration tank by the growth of organisms in the presence of dissolved oxygen; 'activated' means the sludge is teaming with active, or living, micro-organisms.
activated sludge loading	The pounds (kilograms) of BOD or other constituent in the applied liquid per unit volume of aeration capacity or per pound (kilogram) of activated sludge per day.
activated sludge-related processes	• **Contact stabilization process –** A modification of the activated sludge process in which wastewater is aerated for a short period, usually less than 60 minutes, to obtain BOD removal. Solids are subsequently separated by sedimentation and transferred to a stabilization (re-aeration) tank where aeration is continued, starving the activated sludge before returning it to the aeration basin. • **Conventional process –** Activated sludge process using plug-flow through the aeration basin, with wastewater and return sludge fed at the head end and uniform aeration throughout. • **Extended aeration –** A modification of the activated sludge process using very long aeration periods, i.e., 18-24 hours. • **Oxidation ditch –** A modification of the extended aeration activated sludge process.

adsorption	The attachment of material onto the surface of an organism.
advanced waste treatment	Any physical, chemical or biological treatment process used to accomplish a degree of treatment greater than that achieved by secondary treatment.
aerated pond	A wastewater treatment pond in which mechanical or diffused-air aeration equipment is used to supply the dissolved oxygen.
aeration	The process of adding air to liquid by one or more of these methods: • spraying the liquid in the air • bubbling air through the liquid • agitating the liquid to promote surface absorption of air
aeration tank	A tank in which wastewater or other liquid is aerated.
aerator	A device that adds dissolved oxygen into a liquid.
aerobic	A condition in which 'free' or dissolved oxygen is present in the aquatic (water) environment.
aerobic bacteria	Bacteria that require free dissolved oxygen for growth.
aerobic digestion	The process of microorganisms breaking down waste in the presence of dissolved oxygen. Waste sludge is placed in a large aerated tank where aerobic micro-organisms decompose the organic matter in the sludge.
aerobic pond	An oxygen-containing pond, often equipped with mechanical aerators, in which wastewater is partially stabilized by the metabolic activities of bacteria and algae. Shallow ponds (typically less than six feet) may remain aerobic without mechanical aeration.
aerosols	Microscopic droplets dispersed in the atmosphere.
air diffuser	Devices of various design that transfer oxygen from air into a liquid.
air gap	The unobstructed vertical distance through the free atmosphere between the lowest opening from a pipe or outlet supplying water to a tank, plumbing fixture or other device, and the flood-level rim of the receptacle.
air-lift pump	A pump used for lifting water or sludge from tanks from which fine air bubbles are discharged into the water at the bottom of the tank at the intake pipe. The bubbles reduce the density of the water at the bottom, allowing the denser surrounding water to push it up in the discharge pipe to the outlet. Also called an *air lift*.
air release	A valve set-up at the high point in a forcemain to allow air to escape.

air test	A method of inspecting a sewer pipe for leaks: inflatable plugs are placed in the line; the space between these plugs is pressurized with air - a drop in pressure indicates leaks in the line being tested.
algae	Primitive one-celled plants, usually aquatic, that produce their food from carbon dioxide and water through photosynthesis and give off oxygen.
algae blooms	Large masses of microscopic and macroscopic plant life, such as green algae, occurring in bodies of water.
algicide	Any substance or chemical applied to kill or control algal growths.
alkaline	The condition of water, wastewater or soil that contains a sufficient amount of alkali substances to raise the pH above 7.0.
alkalinity	The capacity of water or wastewater to neutralize acids. This capacity is caused by the water's content of carbonate, bicarbonate, hydroxide and occasionally borate, silicates and phosphate. Alkalinity is a measure of how much acid can be added to a liquid without causing a great change in pH.
alum, aluminum sulfate [$(Al_2(SO_4)_3 \cdot 3\ 18H_2O$]	Chemical used as a coagulant in filtration; when dissolved in alkaline water, it hydrolyzes into $Al(OH)_2$ and sulfuric acid (H_2SO_4), precipitating the hydroxide as needed for coagulation; also used for phosphorus removal.
ambient	Refers to the prevailing dynamic environmental conditions in a given area.
ammonia nitrogen	The quantity of elemental nitrogen present in the form of ammonia (NH_3).
amoeba	A group of simple protozoans, some of which produce diseases, such as dysentery, in humans.
amperage	The strength of an electric current measured in amperes (amps).
ampere	A unit of measurement of electrical current proportional to the quantity of electrons flowing through a conductor past a given point in one second (analogous to cubic feet of water flowing per second); the current produced in a circuit by one volt acting through a resistance of one ohm.
amperometric	Pertaining to measurement of electric current flowing or generated, rather than by voltage.
amperometric titration	An electrometric method of detecting chlorine residual.
anaerobic	A condition in which 'free' or dissolved oxygen (O_2) is not present.
anaerobic bacteria	Bacteria which grow in the absence of free dissolved oxygen and must obtain their oxygen by chemically breaking down organic compounds that contain combined oxygen.

anaerobic digestion A process whereby wastewater solids are placed in a large tank where bacteria decompose the solids in the absence of dissolved oxygen.

anaerobic pond A wastewater or sludge treatment process that involves retention under anaerobic conditions.

anionic Negatively charged (as opposed to cationic or positively charged).

annual crop A crop which completes its entire life cycle and dies within one year or less.

anoxic Greatly deficient in, or totally lacking, free oxygen, but still containing combined oxygen (i.e. nitrate — NO_3). Anoxic sections in an activated-sludge plant may be used for denitrification by anaerobic and facultative bacteria stripping the oxygen off the nitrate molecule and releasing nitrogen gas to the atmosphere.

appurtenance Machinery, appliances, apparatus and other accessory parts necessary to allow the main structure to operate as intended, but not considered a part of the main structure.

aquifer A porous, water-bearing geologic formation generally restricted to materials capable of yielding an appreciable supply of water.

asphyxiation An extreme condition, often resulting in death, due to a lack of oxygen and an excess of carbon dioxide in the blood. Also called *suffocation*.

automatic sampling Collecting samples of prescribed volume over a defined time period by a device designed to operate remotely.

autotrophic organisms Organisms, including nitrifying bacteria and algae, that use carbon dioxide as a source of carbon for cell synthesis; they can consume dissolved nitrates and ammonium salts.

available chlorine A measure of the total oxidizing power of chlorinated lime, hypochlorites and other materials used as a source of chlorine, as compared with that of elemental chlorine.

available water capacity Soil's capacity to hold water against the force of gravity expressed as inches of water per inch of soil.

average Arithmetic mean obtained by adding quantities and then dividing the sum by the number of quantities.

average daily flow

1. The total quantity of liquid tributary to a point divided by the number of days of flow measurement.
2. In water and wastewater, the total flow past a point over a period of time divided by the number of days in that period.

backfill
1. Material used to fill in a trench or excavation.
2. The act of filling a trench or excavation, usually after a pipe or some type of structure has been placed in the trench or excavation.

backflow preventer A device on a water supply pipe to prevent the backflow of water into the water supply system from the connections on its outlet end.

bacteria Primitive one-celled or many-celled organisms, microscopic in size that use organic matter for their food.

baffle Short wall, usually in a clarifier, to distribute flow and minimize short circuiting. Also used to keep scum from floating out with the effluent.

balling A method of hydraulically cleaning a sewer or storm drain by using the pressure of a water head to create a high-cleansing velocity of water around the ball. The method is used for cleaning grease, grit, and other debris.

bar screen A screen, usually consisting of equally spaced parallel bars, for trapping roots, branches, rags, and other large material that may be in the wastewater flow.

barminutor A bar screen of standard design fitted with an electrically operated shredding device that sweeps vertically up and down the screen cutting up material retained on the screen.

barrel
1. The cylindrical part of a pipe that may have a bell on one end.
2. The cylindrical part of a manhole between the cone at the top and the shelf at the bottom.

base A compound that dissociates in aqueous solution to yield hydroxyl ions, resulting in a pH above 7.0.

bedding The prepared base of a trench or excavation on which a pipe or other underground structure is supported.

beggiatoa A filamentous organism whose growth is stimulated by H_2S — hydrogen sulfide.

bell The recessed, over-enlarged female end of a pipe into which the male end fits. Also called a *hub*.

bioassay

1. An assay method using a change in biological activity as a qualitative or quantitative means of analyzing a material's response to biological treatment.
2. A method of determining the toxic effects of industrial wastes and other wastewaters by using viable organisms; exposure of fish to various levels of a chemical under controlled conditions to determine safe and toxic levels of that chemical.

biochemical

1. Pertaining to chemical change resulting from biological action.
2. A chemical compound resulting from fermentation.
3. Pertaining to the chemistry of plant and animal life.

biochemical oxygen demand (BOD)

1. The quantity of oxygen required by microscopic organisms for stabilizing, or using as food, organic materials in wastewater in a specified time and at a specified temperature (normally five days at 20°C).
2. A standard test used in evaluating wastewater strength.

Also see *carbonaceous biochemical oxygen demand (CBOD)*

biofilm

Accumulation of microbial growth on the surface of a support material or media.

biological contactors

Inert surfaces engineered to provide a high specific surface area on which a biofilm can develop; usually designed so that the surface is cyclically moved through the medium to be biologically oxidized and through the open air so that oxygen transfer occurs.

biological denitrification

The transformation of nitrate nitrogen to inert nitrogen gas by microorganisms in an anoxic environment in the presence of an electron donor to drive the reaction.

biological filtration

The process of passing a liquid through a biological filter containing fixed media on the surfaces of which develop zoogleal films that absorb and adsorb fine suspended, colloidal, and dissolved solids and release end products of biochemical action.

biological process

1. The process by which metabolic activities of bacteria and other microorganisms break down complex organic materials into simple, more stable substances (self-purification of polluted streams, sludge digestion, and all the so-called secondary wastewater treatments depend on this process).
2. Process involving living organisms and their life activities. Also called *biochemical process*.

biological wastewater treatment — A form of wastewater treatment in which microbial or biochemical action is intensified to stabilize the unstable organic matter present and to remove non-settling solids.

biomass — A living mass of organisms.

biosolids — The organic by-product of municipal wastewater treatment that can be stabilized and beneficially used.

blinding

1. Clogging of the filter cloth of a vacuum filter, belt press, belt thickener, or pressure filter.
2. Obstruction of the fine media of a sand filter.

breakpoint chlorination — Addition of chlorine to water or wastewater until the chlorine demand has been satisfied, with further additions resulting in a residual that is directly proportional to the amount added beyond the breakpoint.

brush aerator — A surface aerator that rotates about a horizontal shaft with metal blades or brushes attached to it; commonly used in oxidation ditches.

British thermal unit (BTU or Btu) — The amount of heat required to raise the temperature of one pound of water 1°F.

bucket machine — A powered winch machine that controls the movement of buckets used to clean sewers; designed for operation over a manhole.

buffer

1. A substance that resists a change in pH.
2. A liquid sample of a known pH used for pH meter calibration.

bulking — Inability of activated-sludge solids to separate from the liquid under quiescent conditions; may be associated with the growth of filamentous organisms, low DO, or high sludge loading rates (bulking sludge typically has an SVI of greater than 150 mL/g).

bulking sludge — Sludge that settles poorly.

butterfly valve — A valve in which the disk, as it opens or closes, rotates about a spindle supported by the frame of the valve (the valve is opened at a stem); at full opening, the disk is in a position parallel to the axis of the conduit.

bypass — A pipe or conduit that allows wastewater to flow around a wastewater treatment plant or any unit of the plant. In a National Pollution Discharge Elimination System (NPDES) permit, this is called a *release*.

calcium hypochlorite [$Ca(OCl)_2 \cdot 4H_2O$] A solid that, when mixed with water, liberates the hypochlorite ion OCl^2 and can be used for disinfection or pH adjustment.

calibration
1. The determination, checking, or rectifying of the graduation of any instrument giving quantitative measurements.
2. The process of taking measurements or of making observations to establish the relationship between two quantities.

carbon
1. A chemical element essential for growth.
2. A solid material used for adsorption of pollutants.

carbon adsorption The use of either granular or powdered carbon to remove organic compounds from wastewater or effluents (organic molecules in solution are drawn to the highly porous surface of the carbon by intermolecular attraction force).

carbonaceous biochemical oxygen demand (CBOD) A modified BOD procedure in which a nitrification inhibitor is used to prevent measuring oxygen uptake due to ammonia reduction (the results from this procedure measure only the oxygen used by the microorganisms to break down the wastewater's carbonaceous organic material).
Also see *biochemical oxygen demand (BOD).*

cascade aerator An aerating device built in the form of steps or an inclined plane on which are placed staggered projections arranged to break up the water and bring it into contact with air.

catch basin A chamber or well used with storm or combined sewers to remove grit which might otherwise enter and be deposited in sewers.

cathodic protection An electrical system for prevention of rust, corrosion, and pitting of steel and iron surfaces in contact with water (a low-voltage current is made to flow through a liquid or a soil in contact with the metal in such a manner that the external electromotive force renders the metal structure cathodic and concentrates corrosion on auxiliary anodic parts used for that purpose).

cation An ion or molecule which has a positive electrical charge.

cation exchange capacity The number of exchangeable cations that a soil can adsorb expressed in milliequivalents per 100 grams of soil.

caustic A high pH substance that can burn, eat away or destroy living tissue by chemical action; corrosive.

cavitation Changing of a liquid into a vapor and then back to a liquid on the blade of a pump impeller. The collapse of the gas bubble drives water into the impeller with enough force to cause pitting on the impeller surface. Normal causes: total dynamic head is too low or too high or suction vacuum is too high.

celsius/centrigrade (C) Thermometer temperature scale in which 0° marks the freezing point and 100° the boiling point of water at 760-mm Hg barometric pressure. To convert temperature on this scale to Fahrenheit, multiply by 1.8 and then add 32.

centrate Liquid removed by a centrifuge; typically contains high concentrations of suspended, non-settling solids.

centrifugal pump A pump consisting of an impeller fixed on a rotating shaft and enclosed in a casing having an inlet and discharge connection. A rotating impeller creates pressure in the liquid from centrifugal force.

centrifuge A mechanical device in which centrifugal force is used to separate solids from liquids or to separate liquids of different densities.

centrifuge test Method of estimating amount of solids in a sample by the use of a centrifuge; spin test.

cfs (cu ft/sec) The rate of flow of a material in cubic feet per second. Used for measurement of water, wastewater, or gas.

check valve A valve with a disk hinged on one edge so that it opens in the direction of normal flow and closes with reverse flow. An approved check valve is of substantial construction and suitable materials, is positive in closing, and permits no leakage in a direction opposite to normal flow.

chelating properties The property of certain chemical compounds in which a metallic ion is firmly combined with a compound by multiple bonds (chelate means *claw*).

chemical coagulation The destabilization and initial aggregation of colloidal and finely divided suspended matter by the addition of an inorganic coagulant.
Also see *flocculation.*

chemical oxygen demand (COD) A quantitative measure of the amount of oxygen required for the chemical oxidation of carbonaceous (organic) material in wastewater using inorganic dichromate or permanganate salts as oxidants in a 2-hour test.

chemical precipitation

1. Formation of particulates by the addition of chemicals.
2. The process of softening water by the addition of lime or lime and soda to form insoluble compounds; usually followed by sedimentation or filtration to remove the newly created suspended solids.

chloramines Compounds of organic or inorganic nitrogen formed during the addition of chlorine to wastewater.
Also see *breakpoint chlorination.*

chlorination	The application of chlorine to water or wastewater for the purpose of disinfection, oxidation, odor control, or other effects • prechlorination = before treatment • post-chlorination = after treatment • in-process chlorination = during treatment
chlorinator	Any metering device used to add chlorine to water or wastewater.
chlorine	An element with strong disinfecting and oxidizing properties.
chlorine contact chamber	A detention basin provided in a treatment facility primarily to make sure that chlorine has enough time to disinfect the water.
chlorine demand	The amount of chlorine that must be added to water or wastewater before a residual of free chlorine can be obtained.
chlorine dosage	The amount of chlorine added to the wastewater.
chlorine residual, total	The total amount of free chlorine and available combined chlorine. Available combined chlorine may be in the form of chloramines, which is not as potent a disinfectant as free chlorine.
chlorine residual, free	The amount of chlorine added to water or wastewater in excess of the demand.
chlorine room	A separate room or building for housing chlorine and chlorination equipment, with arrangements for protecting personnel and plant equipment.
chloroganic	Organic compounds combined with chlorine – generally result from or are associated with living or dead organic material.
ciliates	A class of protozoans distinguished by short hairs on all or part of their bodies.
circuit	The complete path of an electric current, including the generating apparatus or other source, or a specific segment or section of the complete path.
circuit breaker	A safety device in an electrical circuit that automatically shuts off the circuit when it becomes overloaded.
clarification	Any process or combination of processes whose primary purpose is to reduce the concentration of suspended matter in a liquid; used as a synonym for settling or sedimentation.

clarifier A settling tank, sedimentation tank or basin in which wastewater is held for a period of time in which the heavier solids settle to the bottom and the light solids float to the water surface.

clean-out A point of access to a wastewater collection system or force mains and in-plant piping for insertion of tools, rods or snakes to allow sewer cleaning.

coagulant A chemical added to destabilize and bind together colloids and solids to improve their settling characteristics.

coagulation The conversion of colloidal (0.001 mm) or dispersed (0.001 to 0.1 mm) particles into small visible coagulated particles (0.1 to 1 mm) by the addition of a coagulant, compressing the electrical double layer surrounding each suspended particle, decreasing the magnitude of repulsive electrostatic interactions between particles, and thereby destabilizing the particle. Also see *flocculation.*

coliform-group bacteria A group of bacteria predominantly inhabiting the intestines of man or animal, but also occasionally found elsewhere; includes:

- all aerobic and facultative anaerobic, gram-negative, non-spore-forming, rod-shaped bacteria that ferment lactose with the production of gas.
- all bacteria that produce visible colonies by the membrane filter technique used for coliform identification.

collection system A network of pipes, manholes, cleanouts, traps, siphons, lift stations and other required structures for collecting all wastewater in an area and transporting it to a treatment plant or disposal system (includes land, wastewater lines and appurtenances, pumping stations, and general property).

colloids Very small solids (particulates or insoluble material) in a finely divided form that remain dispersed in a liquid for a long time due to their small size and electrical charge.

colony A discrete clump of microorganisms on a surface as opposed to dispersed growth throughout a liquid culture medium.

color Any dissolved solids that impart a visible hue to water.

combined sewer Sewer intended to receive both wastewater and storm water.

comminutor A device used to reduce the size of solids in wastewater by shredding (comminuting).

compaction test Any method of determining the weight that a compacted material is able to support without damage or displacement – usually stated in pounds per square foot.

complete mix Activated sludge process in which wastewater is rapidly and evenly distributed throughout the aeration tank.

composite samples Samples collected at regular intervals in proportion to flow and then combined to form a sample representative for the entire period.

concentration

1. The amount of a given substance dissolved in a discrete unit volume of solution or applied to a unit weight of solid.
2. The process of increasing the dissolved solids per unit volume of solution, usually by evaporation of the liquid.
3. The process of increasing the suspended solids per unit volume of sludge by sedimentation or dewatering.

conditioning The chemical, physical, or biological treatment of sludge to improve its dewaterability.

coning A condition that may occur in a sludge hopper during sludge withdrawal: Part of the sludge moves toward the outlet while the remainder tends to stay in place, developing a cone or channel of moving liquid surrounded by relatively stationary sludge.

contact stabilization Modification of the activated-sludge process involving a short period of contact between wastewater and sludge for rapid removal of soluble BOD by adsorption, followed by a longer period of aeration in a separate tank where sludge is oxidized and new sludge synthesized.

contact tank A tank used in water or wastewater treatment to promote contact between treatment chemicals or other materials and the liquid treated.

contact time The time that the material processed is exposed to another substance (such as activated sludge or activated carbon) for completion of the desired reaction.
Also see *detention time.*

control structure A shallow, manhole-like structure used to regulate the flow of water in a stabilization pond system.

controlled discharge Regulation of effluent flow rates to correspond with flow variations in receiving waters to maintain established water quality.

conventional aeration Process design configuration in which the aeration tank organic loading is higher at the influent end than at the effluent end (flow passes through a tank system, typically side-by-side, before passing on to the secondary clarifier). Also called *plug flow.*

conversion factor A numerical constant by which a quantity with its value expressed in units of one kind is either multiplied or divided to express the value in units of another kind.

core sampler A long, slender clear plastic pole with a foot valve at the bottom end that allows the depth of the sludge blanket to be measured in feet. Sometimes called a *sludge judge*.

cover crop A crop grown to add organic matter to the soil, protect it from erosion, or to adsorb nutrients.

cradle A device used to support a pipe, cylinder or tank.

cross braces Shoring members placed across a trench to hold other horizontal and vertical members in place

cross connection

1. A connection between a storm sewer system and a sanitary sewer collection system.
2. A connection through which a supply of potable water could be contaminated or polluted.

curb inlet An opening at the curbline of a street for admitting gutter flow to the stormwater collection system.

D

decant To separate a liquid from solids or from a liquid of higher density by drawing off the upper layer after the heavier material has settled.

dechlorination The partial or complete reduction of residual chlorine by any chemical or physical process (sulfur dioxide is frequently used for this purpose).

declining growth phase Time between the log-growth phase and the endogenous phase, where the amount of food is in short supply, leading to ever-slowing bacterial growth rates.

decomposition (decay) Generally, any biological process that converts unstable materials into more stable forms through chemical or biological action.

deflected pipe

1. A pipe that has been forced out of round by external pressures; mainly applies to fiberglass and plastic pipes where backfill compaction has caused unequal pressures on all sides of the pipe.
2. A pipe whose direction has been changed either to the left, right, up, or down.

defoamer

A material having low compatibility with foam and a low surface tension Defoamers are used to control, prevent, or destroy various types of foam, the most widely used being silicone defoamers. A droplet of silicone defoamer contacting a bubble of foam will cause the bubble to undergo a local and drastic reduction in film strength, thereby breaking the film. Unchanged, the defoamer continues to contact other bubbles, thus breaking up the foam. A valuable property of most defoamers is their effectiveness in extremely low concentration. In addition to silicones, defoamers for special purposes are based on polyamides, vegetable oils, and stearic acid.

degreasing

1. The process of removing greases and oils from waste, wastewater, sludge, or solids.
2. The industrial process of removing grease and oils from machine parts or iron products.

demand

1. The rate at which electrical energy is delivered to a piece of power-consuming equipment or system.
2. Chlorine demand.

denitrification

A biological process by which bacteria, under low DO conditions, use nitrates for their source of oxygen in their metabolic processes; nitrogen gas is released in the process and can result in floating sludge on clarifiers following secondary treatment.

deoxygenation

The depletion of the dissolved oxygen in a liquid either under natural conditions associated with the biochemical oxidation of the organic matter present or by addition of chemical reducing agents.

depth of blanket

Level of sludge in the bottom of a secondary clarifier, typically measured in feet.

design criteria

1. Engineering guidelines specifying construction details and materials.
2. Objectives, results, or limits that must be met by a facility, structure, or process in performance of its intended functions.

design flow

Engineering guidelines that typically specify the amount of influent flow that can be expected on a daily basis over the course of a year. Other design flows can be set for monthly or peak flows.

design loadings Flow rates and constituent concentrations that determine the design of a process unit or facility necessary for proper operation.

detention time The period of time that a water or wastewater flow is retained in a basin, tank, or reservoir for storage or completion of physical, chemical, or biological reaction.
Also see *contact time, retention time.*

dewater
1. To drain or remove water from an enclosure.
2. Draining or removing water from sludge to increase solids concentration.

diffused air aeration The process by which air is compressed and discharged below the water surface level through some type of air diffusion device.

diffuser A device (porous plate, tube, bag, etc.) used to break the air stream from a blower system into small bubbles in a liquid.

digester A tank in which sludge is placed to further break down the organic matter and reduce the number of pathogens.

discharge Any flow of effluent from a treatment unit or treatment facility.

discharge head A measure of the pressure exerted by a fluid at the point of discharge from a pump. Measured from the centerline of pump suction to the point of free discharge or the highest point in the piping system.

disinfection The process by which pathogenic (disease-causing) microorganisms are reduced. Chlorination or ultraviolet light are the most frequently used disinfection methods in wastewater treatment.

dispersion
1. Scattering and mixing.
2. The mixing of polluted fluids with a large volume of water in a stream or other body of water.
3. The repelling action of an electric potential on fine particles in suspension in water, as in a stream carrying clay.
4. In a continuous-flow treatment unit, the phenomenon of short-circuiting.

displacement pump A type of pump in which the water is induced to flow from the source of supply through an inlet pipe and valve and into the pump chamber by a vacuum created therein by the withdrawal of a piston or piston-like device which, on its return, displaces a certain volume of the water contained in the chamber and forces it to flow through the discharge valves and pipes.

dissolved air flotation (DAF) A separation process in which air bubbles emerging from a supersaturated solution become attached to suspended solids in the liquid undergoing treatment and float them up to the surface where they are removed. Also see *diffused air aeration.*

dissolved oxygen Free or chemically uncombined oxygen existing in solution (dissolved) with water or other liquid; normally expressed as milligrams per liter.

dissolved solids Solids in solution that cannot be removed by filtration; for example, sodium chloride and other salts that must be removed by evaporation or bacterial activity.
Also see *total dissolved solids.*

distributor The rotating mechanism that distributes wastewater evenly over the surface of a trickling filter.

diurnal Having a daily cycle.

domestic wastewater Human wastewater originating from residences, business buildings, institutions, etc.

dosing tank Any tank used in applying a dose; specifically used for intermittent application of wastewater to subsequent processes.

DPD method An analytical method for determining chlorine residual using the reagent DPD (n-diethyl-p-phenylenediamine). This is a common and officially-recognized test for free chlorine residual.

drawdown

1. The magnitude of the change in surface elevation of a body of water as a result of the withdrawal of water.
2. The magnitude of the lowering of the water surface in a well, and of the water table or piezometric surface adjacent to the well, resulting from the withdrawal of water from the well by pumping.
3. In a continuous water surface with accelerating flow, the difference in elevation between downstream and upstream points.

dry well A dry room or compartment in a lift station, separate from the wet well, where pumps are located.

drying beds Confined, shallow layers of sand or gravel on which wet sludge is distributed for draining and air drying; also applied to underdrained, shallow, diked, earthen structures used for drying sludge.

dry weather flow

1. The flow of wastewater when ground water is at or near normal and a runoff condition is not occuring.
2. The flow of water in a stream during dry weather, usually contributed entirely by groundwater.

dual-media filters

Deep-bed filters using discrete layers of dissimilar media, such as anthracite and sand, placed one on top of the other.

duplex pump

A reciprocating pump consisting of two cylinders placed side by side and connected to the same suction and discharge pipe; the pistons move so that one exerts suction while the other exerts pressure resulting in continuous discharge from the pump.

dynamic head

1. Sometimes referred to as *total dynamic head*.
2. The distance between the source of water supply and the point of discharge plus friction losses within the piping system.

E

E. Coli (Escherichia Coli)

One of the species of bacteria in the fecal coliform group; found in large numbers in the gastrointestinal tract and feces of warm-blooded animals and man. Its presence is considered indicative of fresh fecal contamination, and it is used as an indicator organism for the presence of less easily detected pathogenic bacteria.

easement

Land owned by others, which a utility agency has a legal right to use to install and maintain a line – such as a sewer line.

effervescence

The vigorous escape of small gas bubbles from a liquid, especially as a result of chemical action.

efficiency

The relative results obtained in any operation in relation to the energy or effort required to achieve such results; the ratio of the total output to the total input, expressed as a percentage.

effluent

Wastewater or other liquid flowing *from* a basin, treatment process, or treatment plant.

ejector

A device for moving a fluid or solid by entraining it in a high-velocity stream or air or water jet.

electrical conductivity

The readiness or ease with which an electrical impulse flows through water or soil.

electromotive force The property of a physical device that tends to produce an electrical current in a circuit; the moving force that causes current to flow.
Also see *volt*.

elutriation A process of sludge conditioning whereby the sludge is washed with either fresh water or plant effluent to reduce the demand for conditioning chemicals and to improve the settling or filtering characteristics of the solids; excessive alkalinity is removed in this process.

end point Samples titrated to the end point; this means that a chemical is added, drop by drop, to a sample until a certain color change (blue to clear, for example) occurs, which is called the end point of titration. In addition to a color change, an end point may be reached by forming a precipitate or by reaching a specific pH. An end point may also be detected by using an electronic device such as a pH meter.

endogenous respiration The process whereby a living organism uses its own stored cellular materials as an energy source in the absence of fresh food supplies.

entrainment The carryover of drops of liquid during processes such as distillation; the trapping of bubbles in a liquid produced either mechanically through turbulence or chemically through a reaction.

enzyme A catalyst produced by bacteria that speeds up chemical changes and is used in their digestion process; all enzymes are proteins, but not all proteins are enzymes.

equalization In wastewater systems, the storage and controlled release of wastewaters to treatment processes at a rate determined by the capacity of the processes, or at a rate proportional to the flow in the receiving stream; used to smooth out variations in temperature and composition as well as flow.

equalizing basin A holding basin in which variations in flow and composition of a liquid are averaged. Such basins are used to provide a flow of reasonably uniform volume and composition to a treatment unit. Also called *balancing reservoir*.

Escherichia coli (E. coli) One of the species of bacteria in the fecal coliform group; found in large numbers in the gastrointestinal tract and feces of warm-blooded animals and man. Its presence is considered indicative of fresh fecal contamination, and it is used as an indicator organism for the presence of less easily detected pathogenic bacteria.

eutrophication The process in which the rate of planktonic algae and rooted plant growth is faster than the rate of organic material decomposition – caused by an abundance of nutrients in the water (nitrogen, phosphorus, potassium and minor nutrients).

evapotranspiration The combined loss of water to the atmosphere from plant transpiration and surface evaporation.

exfiltration Liquid wastes and liquid-carried wastes that unintentionally leak out of a sewer-pipe system and into the environment.

extended aeration A modification of the activated-sludge process using long aeration periods to promote aerobic digestion of the biological mass by endogenous respiration. The process includes stabilization of organic matter under aerobic conditions and disposal of the gaseous end products into the air; effluent contains finely divided suspended matter and soluble matter.

extraction The process of dissolving and separating out particular constituents of a liquid by treatment with solvents specific for those constituents; extraction may be liquid–solid or liquid–liquid.

F

facultative bacteria Bacteria that can grow and metabolize in the presence, as well as in the absence, of dissolved oxygen.

fahrenheit A temperature scale in which 32° marks the freezing point and 212° the boiling point of water at 760-mm Hg. To convert to centigrade (Celsius), subtract 32 and then multiply by 0.5556.

fallow land Land that is not cropped but is kept cultivated during the growing season.

fecal coliform bacteria Bacterial organisms present as a result of direct fecal contamination; those bacteria which normally inhabit the intestines of warm-blooded vertebrates. They are used as indicators of pathogens.

fermentation Changes in organic matter or organic wastes brought about by anaerobic microorganisms and leading to the formation of carbon dioxide, organic acids, or other simple products.

ferric chloride ($FeCl_3$) A soluble iron salt often used as a sludge conditioner to enhance phosphorus precipitation or bind up sulfur compounds in wastewater treatment.
Also see *coagulant.*

ferric sulfate [$Fe_2(SO_4)_3$] A water-soluble iron salt formed by reaction of ferric hydroxide and sulfuric acid or by reaction of iron and hot concentrated sulfuric acid; also obtainable in solution by reaction of chlorine and ferrous sulfate; used in conjunction with lime as a sludge conditioner and to precipitate phosphorus.

ferrous chloride ($FeCl_2$) A soluble iron salt used as a sludge conditioner to precipitate phosphorus or bind up sulfur.
Also see *coagulant.*

ferrous sulfate ($FeSO_4 \cdot 7H_2O$) A water-soluble iron salt, sometimes called *copperas*. Used in conjunction with lime as a sludge conditioner to enhance precipitation.

filamentous bacteria Organisms that grow in an intertwined thread-like filamentous form; large masses will not settle and may reduce dewaterability. Some are necessary as the 'backbone' of a floc particle.

filter A device or structure for removing solid or colloidal material, usually of a type that cannot be removed by sedimentation, from water, wastewater, or other liquid; the liquid is passed through a filtering medium, usually a granular material but sometimes finely woven cloth, unglazed porcelain, or specially prepared paper.

filter bed

1. A type of treatment consisting of layers of filtering medium of which the particles gradually increase in size from the bottom upward. Such a filter allows the groundwater to flow freely, but it prevents even the smallest soil particles from being washed out.
2. A tank for water filtration that has a false bottom covered with sand, such as a rapid sand filter.
3. A pond with sand bedding, as a sand filter or slow sand filter.
4. The media that comprise a trickling filter.

filter press A plate and frame press operated mechanically to produce a semisolid cake from a slurry.

filtrate The liquid that has passed through a filter.

filtration The process of contacting a dilute liquid suspension with filter media for the removal of suspended or colloidal matter, or for the dewatering of concentrated sludge.

flap gate Gate that opens and closes by rotation around a hinge or hinges at the top side of the gate.

flame arrester

1. A device incorporating a fine-mesh wire screen or tube bundle inserted in a vent or pipe and designed to resist the flashback of flame.
2. Device consisting of a multiple number of corrugated stamped sheets in a gas-tight housing; as a flame passes through the sheets, it is cooled below the ignition point.

flash mixer A device for uniform, quick dispersal of chemicals throughout a liquid.

flash point The temperature at which a gas, volatile liquid, or other substance ignites.

flights Scraper boards, usually made from redwood or other rot-resistant wood, used to collect and move settled sludge or floating scum.

float A device used to measure the elevation of the water surface. A float rests on the surface of the water and rises or falls with it; elevation of the water surface is measured by a rod, chain, rope or tape attached to a float.

float line A length of rope or heavy twine attached to a float, plastic jug, or parachute to be carried by the sewer flow from one manhole to the next.

floating cover A gas-tight metal cover floating on the sludge in a digestion tank, with guides to assist in smooth vertical travel as the sludge level changes.

floc Collections of smaller particles agglomerated into larger, more easily settleable particles through chemical, physical, or biological treatment.

flocculant Water-soluble organic polyelectrolytes that are used alone or in conjunction with inorganic coagulants, such as aluminum or iron salts, to agglomerate the solids present to form large, dense floc particles that settle rapidly.

flocculation Clumping of fine particles to form larger particles.

flood plain Any area adjacent to a water course that is subject to flooding during periods of high water flows. *Flood plain* is often used with numbers (5-, 10-, 50-, 100-year) to indicate the frequency of flooding at a given elevation.

flow recording Documentation of the rate of flow of a fluid past a given point; the recording is normally accomplished automatically.

fluidized bed reactor A pressure vessel or tank that is designed for liquid–solid or gas–solid reaction; the liquid or gas moves upward through the solids particles at a velocity sufficient to suspend the individual particles in the fluid (applications include ion exchange, granular activated carbon adsorbers, and some types of furnaces, kilns, and biological contactors).

flume An open conduit of wood, masonry, metal or plastic constructed on a grade and sometimes elevated, called an aqueduct or channel. Normally used to measure flow rate.

FOG Fats, oils and greases.

food chain crop Crops grown for direct human consumption or for animal feed whose products are consumed by humans .

food-to-microorganism (F:M) ratio — In the activated-sludge process, the loading rate expressed as pounds of BOD5 per pound of mixed liquor or mixed liquor volatile suspended solids per day (lb BOD_5/d/lb MLSS or MLVSS).

forage crops — A crop such as hay, pasture grass, alfalfa or other that is grown primarily for animal feed.

force main — A pipe that conveys wastewater under pressure from the discharge side of a pump to a point of gravity flow.

free available chlorine — The amount of chlorine available as dissolved gas, hypochlorous acid, or hypochlorite ion that is not combined with an amine or other organic compound.

freeboard — The vertical distance from the normal water surface to the top of a confining wall or dike.

free-swimming ciliate — Mobile, one-celled organisms using cilia (hair-like projections) for movement.

friction head / friction loss — The head loss resulting from water flowing in a stream or conduit as the result of the disturbances set up by the contact between the moving water and its containing conduit and by intermolecular friction.

fungi — Small, nonchlorophyll-bearing plants that lack roots, stems, or leaves; occur (among other places) in water, wastewater, or wastewater effluents; and grow best in the absence of light and low pH. Their decomposition may cause disagreeable tastes and odors in water; in some wastewater treatment processes they are helpful and in others they are detrimental.

G

gallon per day (GPD or gpd) — The daily rate of water, wastewater or other flow measured in gallons per day.

gasification — The transformation of soluble and suspended organic materials into gas during waste decomposition.

gate valve — A valve in which the closing element consists of a disk or gate that slides over the opening or cross-sectional area through which water passes.

glacial outwash — Soils that result from glaciers melting and depositing soil which has similar texture in layers.

glacial till A mixture of soil textures that were deposited by glaciers as they receded. Particle textures and sizes are mixed with no distinct layers.

gpd The rate of water, wastewater, or other flow measured in gallons per day.

gpm The rate of water, wastewater, or other flow measured in U.S. gallons per minute.

grab sample A single sample of wastewater taken at one time from one place.

grade
1. The elevation of the bottom of a pipeline, canal, culvert, sewer, or similar conduit.
2. The slope of a sewer, conduit, stream channel, or natural ground surface – usually expressed in terms of the vertical rise or fall per unit of horizontal distance.

gradient The rate of change of any characteristic per unit of length or slope. The term is usually applied to such things as elevation, velocity, or pressure.
Also see *slope.*

grit The heavy inorganic material present in wastewater, such as sand, coffee grounds, eggshells, gravel, and cinders. Grit tends to settle out at flow velocities below one foot/second.

grit chamber A detention chamber or an enlargement of a collection line designed to reduce the flow velocity to permit separation of grit from organic solids by sedimentation.

ground A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and earth, or to some conducting body that serves in place of earth.

ground water Subsurface water occupying the saturation zone that feeds wells and springs. In a strict sense, the term applies only to water below the water table.

ground water recharge Any area where surface waters are returned to the ground water.

ground water table The average depth or elevation of ground water over a selected area.

grout A substance in a paste or liquid form that solidifies after placement or treatment; used to fill spaces, holes or voids in other materials.

hardness A characteristic of water imparted primarily by salts of calcium and magnesium, such as bicarbonates, carbonates, sulfates, chlorides, and nitrates, that causes curdling and increased consumption of soap, deposition of scale in boilers, damage in some industrial processes, and sometimes objectionable taste. It may be determined by a standard laboratory titration procedure or computed from the amounts of calcium and magnesium expressed as equivalent calcium carbonate.

head A head of water may be measured in either height (feet) or pressure [pounds/square inch (psi)]. A way of expressing pressure in terms of the height of a vertical column of water.

head loss Resistance to flow or reduction in pressure in a pipe due to friction from pipes, elbows, pumps, etc.

header

1. A structure installed at the head or upper end of a gully to prevent overfall cutting.
2. A supply ditch for the irrigation of a field.
3. A large pipe installed to intercept the ends of a series of pipes; a manifold.
4. The closing plate on the end of a sewer lateral that will not be used immediately.

headworks

1. All the structures and devices located at the head or diversion point of a conduit or canal. The term as used is practically synonymous with diversion works; an intake heading.
2. The initial structures and devices of a water or wastewater treatment plant.

heat exchanger A device providing for the transfer of heat between two fluids.

heavy metals Certain elements found in wastewater or sludge which may destroy crops or enter the food chain through crops (e.g., mercury, cadmium, nickel, copper, zinc and lead).

high-velocity cleaner A machine designed to remove grease and debris from sewer pipes with jets of high-velocity water – also called a *jet cleaner*, *jet rodder*, *hydraulic cleaner*, or *high-pressure cleaner*.

humus Organic matter in the soil which has reached the advanced stages of decomposition. It is usually dark colored, has high nitrogen content, holds water and has a high cation exchange capacity.

hydrated lime Limestone that has been 'burned' and treated with water under controlled conditions until the calcium oxide portion has been converted to calcium hydroxide.

hydraulic loading The total volume of water flowing through a facility or structure over a specified time period.

hydrocarbon Any of the class of compounds consisting solely of carbon and hydrogen (usually derived from petroleum).

hydrogen sulfide gas (H_2S) A flammable, explosive, poisonous gas with a rotten-egg odor found in wastewater collection systems.

hydrology The science concerned with the waters of the earth in all their states – their occurrence, distribution and circulation through the unending hydrologic cycle of precipitation, stream flow, infiltration, storage, runoff, evaporation and re-precipitation.

hypochlorination The use of sodium hypochlorite ($NaOCl_2$) for disinfection.

I

Imhoff cone A cone-shaped graduated vessel used to measure the volume of wastewater settleable solids.

impeller A rotating set of vanes in a pump designed to pump or lift water.

incineration Combustion or controlled burning of volatile organic matter in sludge and solid waste reducing the volume of the material while producing heat, dry inorganic ash and gaseous emissions.

industrial wastewater Liquid waste originating from industrial processing.

infiltration Extraneous water entering a sanitary sewer system through joints and cracks in the sewer from groundwater.

infiltration/inflow (I/I) The total quantity of water from both infiltration and inflow without distinguishing the source.

inflow Extraneous water entering a sanitary sewer system by direct connection from roof drains, basement sumps, manhole covers, etc.

influent Wastewater or other liquid flowing *into* a reservoir, basin, treatment process or treatment plant.

inorganic All combinations of elements that do not include organic carbon.

interceptor A sewer that receives flow from a number of other large sewers or outlets and conducts the water to a point for treatment or disposal.

invert The lowest point inside a pipe or manhole.

inverted siphon A pressure pipeline used to carry wastewater flowing in a gravity collection system under a depression, such as a valley or roadway, or under a structure such as a building and up to the original line of flow.

iodometric titration (chlorine) The determination of residual chlorine by adding potassium iodide and by titrating liberated iodine with sodium thiosulfate. Starch solution is used as a colorimetric indicator to determine the end point.

ion A charged atom, molecule, or radical that affects the transport of electricity through an electrolyte or, to a certain extent, through a gas; an atom or molecule that has lost or gained one or more electrons.

ion exchange

1. A chemical process involving reversible interchange of ions between a liquid and a solid, but no radical change in structure of the solid.
2. A chemical process in which ions from two different molecules are exchanged.
3. The reversible transfer or sorption of ions from a liquid to a solid phase by replacement with other ions from the solid to the liquid.

Also see *regeneration.*

irrigation The artificial application of water to land to meet the water needs of growing plants not met by rainfall.

J

jar test A laboratory procedure for evaluating coagulation, flocculation, and sedimentation processes in a series of parallel comparisons.

jet The stream of water under pressure issuing from an orifice, nozzle, or tube.

K

Kjeldahl nitrogen (TKN) The combined amount of organic and ammonia nitrogen.

lag growth phase The initial period following bacterial introduction during which the population grows slowly as the bacteria acclimates to the new environment.

land application The recycling, treatment, or disposal of wastewater or wastewater solids to the land under controlled conditions.

lateral sewer A sewer that discharges into a branch or other sewer and has no other common sewer tributary to it; used to collect wastewater from individual homes.

launder Trough(s) in clarifiers that collect effluent and allow it to flow out of the clarifier.

leachate Liquid that has percolated through solid waste or other permeable material and extracted soluble dissolved or suspended materials from it.

leaching The process by which soluble materials are washed out of the upper soil layer and down to a lower layer by percolating water.

lift station A wastewater pumping station that lifts the wastewater to a higher elevation. It is used when the continuance of the gravity sewer would involve excessive depths or when pumping wastewater from areas too low to drain by gravity into available sewers.

lime Any of a family of chemicals consisting essentially of calcium hydroxide made from limestone (calcite) composed almost wholly of calcium carbonate or a mixture of calcium and magnesium carbonate; used to increase pH to promote precipitation reactions or for lime stabilization to kill pathenogenic organisms.

loading A quantity of material applied to a device or a process at one time. Loading to a wastewater treatment plant can be hydraulic, organic, or inorganic.

log growth phase Stage of bacterial growth, during which there is an ample food supply, causing bacteria to grow at their maximum rate.

M

main sewer Sewer line that receives wastewater from many tributary branches and sewer lines and serves as an outlet for a large territory.

mandrel

1. A special tool used to push bearings in or to pull sleeves out.
2. A gauge used to measure excessive deflection in a flexible conduit.

manhole A structure in a sewer provided to permit workers or equipment to enter or leave.

manometer A glass tube filled with a liquid and used to measure the difference in pressure across a flow-measuring device such as an orifice or a Venturi meter.

masking agents Chemicals that are dripped into wastewater, sprayed into the air, or evaporated into the air to make undesirable odors less noticeable.

mean
1. The arithmetic average of a group of data.
2. The statistical average (50% point) determined by probability analysis.

mean cell residence time (MCRT) The average time that a given unit of cell mass stays in the activated-sludge aeration tank; it is usually calculated as the total mixed liquor suspended solids in the aeration tank divided by the combination of solids in the effluent and solids wasted.

mechanical aeration A process by which the surface of an aeration tank is mechanically agitated resulting in aeration and mixing of the liquid.

media The material in a trickling filter over which settled water is sprayed during treatment. Organisms grow on the surface of the media and treat wastewater. In a rotating biological contactor, the media rotates through flowing wastewater.

median In a statistical array, the value having as many cases larger in value as cases smaller in value.

membrane filter test A sample of water is passed through a sterile filter membrane. The filter is removed and placed on a culture medium and then incubated for a preset period of time. Coliform colonies, which have a pink to dark-red color with a metallic sheen, are then counted using the aid of a low-power binocular wide-field dissecting microscope. The membrane filter test is used to test for the presence and relative number of coliform organisms.

meniscus The curved surface on the top of a column of liquid (water, oil, mercury) in a small tube. Water will form a valley when the liquid wets the walls of the tube, while mercury will form a mound when the walls of the tube are not wetted.

mercaptans Organic compounds that contain sulfur. They are noted for their disagreeable odor and are found in certain industrial wastes.

mesophilic digestion Digestion by biological action at 68-113°F; a common mesophilic digester operation temperature is 95°F.

metazoan	A group of aquatic organisms having bodies composed of cells differentiated into tissues and organs and usually having a digestive cavity lined with specialized cells. Rotifers, water bears and daphnia are metazoa.
methane	A colorless, odorless, inflammable gaseous hydrocarbon formed by the decomposition of organic matter.
methane bacteria	A specialized group of obligate anaerobic bacteria that decompose organic matter to form methane.
mgd	Million gallons per day; a measure of flow equal to 1.547 cu ft/sec.
mg/L	Milligrams per liter; a measure of concentration equal to and replacing ppm in the case of dilute concentrations.
micro-organisms (bugs)	Very small organisms that can be seen only through a microscope. Some microorganisms use the wastes in wastewater for food and thus remove or alter much of the undesirable matter.
milligrams/liter (mg/L)	A standard expression of concentration pertaining to substances found in water or wastewater; can be considered equivalent to parts per million in wastewater applications (1 mg/L = 1 ppm).
million gallons per day (MGD)	The daily rate of water, wastewater or other flow in units of million gallons per day. One MGD equals 1,000,000 gallons per day.
mixed liquor	A mixture of activated sludge (bugs) and wastewater in an aeration tank.
mixed liquor suspended solids (MLSS)	Suspended solids or nonfilterable solid particles in mixed liquor.
mixed liquor volatile suspended solids (MLVSS)	That portion of the mixed liquor suspended solids which are volatile (organic). This test more accurately estimates the microorganism concentration than the MLSS test.
mixed-media filter	A filter containing filtering media of different particle size or density.
most probable number (MPN)	Number of bacterial organisms per unit volume, which, in accordance with statistical theory, is most likely to yield the test result.
moving average	Trend analysis tool for determining patterns or changes in treatment process. For example, a 7-day moving average would be the sum of the datum points for 7 days divided by 7.
multiple-hearth incinerator	A countercurrent-type of incinerator used to dry and burn partially dried sludges; heated air and products of combustion pass by finely pulverized sludge that is continuously raked to expose fresh surfaces.

National Pollutant Discharge Elimination System (NPDES)
A wastewater treatment plant discharge permit that is the basis for the monthly monitoring reports and compliance schedule required by most states in the United States.

nematode
Member of the phylum (Nematoda) of elongated cylindrical worms parasitic in animals or plants or free-living in soil or water.

nephelometric turbidity unit (NTU)
Units of a turbidity measurement using a nephelometer.

nitrate (NO_3)
An oxygenated form of nitrogen.

nitrification
The biochemical conversion of unoxidized nitrogen (ammonia and organic N) to oxidized nitrogen (usually nitrate).

nitrifying bacteria
Bacteria capable of oxidizing nitrogenous material.
Also see *Nitrobacter* and *Nitrosomonas.*

nitrite (NO_2)
An oxygenated form of nitrogen intermediate between ammonia and nitrate.

Nitrobacter
A rod-shaped bacteria that convert nitrites into nitrates (after Nitrosomonas bacteria first convert ammonia into nitrites); optimum pH is 7.3-7.5; will die at temperatures above 120°F or below 32°F.

nitrogen (N)
A gaseous element that is a major plant nutrient; often present in wastewater as ammonia, nitrate, nitrite, and organic nitrogen.

- **Available nitrogen**: The nitrogen present in inorganic forms (NH_3 - N and Nitrate) that is available for plant growth.
- **Ammonia nitrogen**: (NH_3-N) inorganic nitrogen.
- **Kjeldahl nitrogen**: A measure of the total nitrogen present in a sample. Organic nitrogen plus ammonia nitrogen equals Kjeldahl nitrogen.
- **Organic nitrogen**: Represents the nitrogen present in a sample that is combined in organic matter and is slowly released by decaying organics.

nitrogen cycle
A graphical presentation of the conservation of matter in nature showing the chemical transformation of nitrogen through various stages of decomposition and assimilation. The various chemical forms of nitrogen as it moves among living and nonliving matter are used to illustrate general biological principles that are applicable to wastewater and sludge treatment.

nitrogenous oxygen demand (NOD)
A quantitative measure of the amount of oxygen required for the biological oxidation of nitrogenous material, such as ammonia nitrogen and organic nitrogen, in wastewater; usually measured after the carbonaceous oxygen demand has been satisfied.

Nitrosomonas A rod-shaped bacteria that oxidizes ammonia into nitrate; prefers a pH of 6.0-9.0 and a temperature of 20-30°C.

Nocardia Irregularly bent, short filamentous organisms that are characterized in an activated-sludge system when a dark chocolate mousse foam is present.

nutrients Elements essential to support life such as carbon, hydrogen, oxygen, nitrogen, sulfur, and phosphorus (nitrogen and phosphorus are of major concern because they tend to recycle and are hard to separate because of their solubility in water).

- **Macronutrients:** Major nutrients which plants need to grow – includes nitrogen, phosphorus and potassium
- **Micronutrients:** Minor nutrients which plants need to grow – includes zinc, copper, manganese and other minerals.

O

off-peak power That part of the available load or energy that can be produced at off-peak hours outside the load curve when the combined primary and secondary load has fallen below plant capacity.

ohm A unit of electrical resistance – the resistance of a conductor in which one volt produces a current of one ampere.

open channel Any natural or artificial water conduit in which water flows with a free surface.

organic Refers to volatile, combustible, and sometimes biodegradable chemical compounds containing carbon atoms (carbonaceous) bonded together with other elements; the principal groups of organic substances found in wastewater are proteins, carbohydrates, and fats and oils.

organic loading The amount of organic materials applied to a treatment process in a specified length of time – often expressed as pounds of BOD per unit times per unit volume.

organic nitrogen Nitrogen chemically bound in organic molecules such as proteins, amines, and amino acids.

orifice An opening in a plate, wall or partition. An orifice plate set in a pipe that consists of a slot or hole smaller than the pipe diameter. The difference in pressure in the pipe above and below the orifice plate can be related to flow in the pipe.

orthophosphate

1. A salt that contains phosphorus as PO_4.
2. A product of hydrolysis of condensed (polymeric) phosphates.
3. A nutrient required for plant and animal growth.

osmosis

The process of diffusion of a solvent through a semipermeable membrane from a solution of lower concentration to one of higher concentration.

outfall

1. The point, location, or structure where wastewater or drainage discharges from a sewer, drain or other conduit.
2. The conduit leading to the ultimate disposal area.

overflow rate

One of the criteria in the design of settling tanks for treatment plants; expressed as the settling velocity of particles that are removed in an ideal basin if they enter at the surface. It is expressed as a volume of flow per unit water surface area.

overland flow

1. The flow of water over the ground before it enters some defined channel.
2. A type of wastewater irrigation.

overturn

The phenomenon of vertical circulation that occurs in large bodies of water and wastewater ponds because of the increase in density of water above and below 39.2 °F (4 °C). In the spring, as the surface of the water warms above the freezing point, the water increases in density and tends to sink, producing vertical currents; in the fall, as the surface water becomes colder, it also tends to sink (wind may also create such vertical currents).

oxidant

A chemical substance capable of promoting oxidation (e.g., hydrogen peroxide, potassium permanganate and chlorine).

oxidation

The addition of oxygen to a compound.

oxidation ditch

A secondary wastewater treatment facility that uses an oval channel with a rotor placed across it to provide aeration and circulation. The screened wastewater in the ditch is aerated by the rotor and circulated at approximately 1 to 2 ft/sec.

oxidation pond

A relatively shallow body of wastewater contained in an earthen basin of controlled shape in which biological oxidation of organic matter is effected by natural or artificially accelerated transfer of oxygen. Sometimes referred to as a *stabilization pond*.

oxidation–reduction potential (ORP)

The potential required to transfer electrons from the oxidant to the reductant and used as a qualitative measure of the state of oxidation in wastewater treatment systems.

oxygen (O) A necessary chemical element that constitutes approximately 21% of the atmosphere; typically found as O_2 and used in biological oxidation.

oxygen deficiency
1. The additional quantity of oxygen required to satisfy the oxygen requirement in a given liquid; usually expressed in milligrams per liter (mg/L).
2. Lack of oxygen.

oxygen transfer
1. Exchange of oxygen between a gaseous and a liquid phase.
2. The amount of oxygen absorbed by a liquid compared to the amount fed into the liquid through an aeration or oxygenation device; usually expressed as percent.

oxygen uptake rate The oxygen used during biochemical oxidation, typically expressed as milligrams of oxygen per liter per hour in the activated sludge process.

ozonation The process of contacting water, wastewater, or air with ozone for purposes of disinfection, oxidation, or odor control.

ozone (O_3) Oxygen in a molecular form with three atoms of oxygen forming each molecule.

P

packing ring Ring made of asbestos or metal, which may be lubricated with Teflon or graphite, and which forms a seal between the pump shaft and its casing.

parachute A device that fills with wastewater flow and is used to pull a float line between manholes.

parallel operation A condition in which the flow is divided proportionally among similar units.

parameter A specific subject or control area having variable values, which is used with other parameters to define a situation or larger subject area.

parasites Organisms capable of causing disease in a host, including viruses, bacteria, fungi and worms.

parshall flume A calibrated device developed by Parshall for measuring the flow of liquid in an open conduit consisting essentially of a contracting length, a throat (sill), and an expanding length. At the throat is a sill over which the flow passes at Belanger's critical depth. The upper and lower heads are each measured at a definite distance from the throat (sill). The lower head need not be measured unless the throat (sill) is submerged more than about 67%.

parts per million (ppm) A unit of concentration signifying parts of some substance per million parts of the dispersing medium on a weight basis. For example, 1 ppm = 1 pound of sugar in 1 million pounds of water (119,904 gallons).

pathogenic bacteria Bacteria or viruses that cause disease in the host organism by their parasitic growth (e.g., typhoid, cholera, dysentery).

peak hourly flow The largest volume of flow to be received during a one-hour period.

peak hourly wet weather flow The flow of wastewater during the peak hour of the day at a time when the groundwater is high and a five-year, one-hour storm event is occurring.

peak load

1. The maximum average load carried by an electric generating plant or system for a short time period such as one hour or less.
2. The maximum demand for water placed on a pumping station, treatment plant, or distribution system; expressed as a rate.
3. The maximum rate of flow of wastewater to a pumping station or treatment plant. Also called *peak demand*.

percent removal The percent of material removed from processed water in terms of the material entering – sometimes referred to as reduction.

perennial Crops that do not need to be replanted each year. This includes grasses such as clover, alfalfa and hay.

pH A measure of the relative alkalinity/acidity of a material that ranges from 0 to 14 with 7 being neutral; it is the measure of the negative log of hydrogen ions present in a substance.

phase

1. Any portion of a physical system separated by a definite physical boundary from the rest of the system. The three physical phases are solid, liquid, and gas; colloids are the dispersed phase and liquids are the continuous phase.
2. In electrical systems, three-phase electrical systems have at least three conductors.

phosphate A material that contains compounds of phosphorus that are available for plant growth; too many phosphates may cause eutrophication of waters.

phosphorus An essential chemical element and nutrient for all life forms; occurs in orthophosphate, pyrophosphate, tripolyphosphate, and organic phosphate forms (Each of these forms and their sum (total phosphorus) is expressed as milligrams per liter (mg/L) elemental phosphorus).

photosynthesis A process in which plants use sunlight and chlorophyll (a green pigment found in algae and higher plants) to convert carbon dioxide and inorganic substances to oxygen and additional plant material).

physical-chemical treatment Treatment of wastewater by unit processes other than those based on microbiological activity (unit processes commonly included are precipitation with coagulants, flocculation with or without chemical flocculents, filtration, adsorption, chemical oxidation, air stripping, ion exchange, reverse osmosis, and several others).

phytoplankton Plankton consisting of plants, such as algae.

pin floc Very fine floc particles with poor settling characteristics.

piston pump A reciprocating pump in which the cylinder is tightly fitted with a reciprocating piston.
Also see *reciprocating pump*.

plankton Drifting organisms (animals, plants, bacteria) that are a food source for fish.

plastic media Honeycomb-like products, manufactured from plastics of various compositions, with high surface area:volume ratios that are used in trickling filters in place of crushed stone. The product is available in large modules fabricated from sheets that may be cut to size on-site, and small discrete pieces to be loosely packed in the filter bed.
Also see *trickling filter.*

plate press A filter press consisting of a number of parallel plate units lined with filter cloth that rests on drainage channels in the plates. Pressure is exerted by the pumping of solids into chambers created between the cloths. The operation is carried out in batches.

plug flow Flow in which fluid particles are discharged from a tank or pipe in the same order in which they entered it; particles retain their discrete identities and remain in the tank for a time equal to the theoretical detention time.

plunger pump A reciprocating pump with a plunger that does not come in contact with the cylinder walls, but enters and withdraws from it through packing glands (packing may be inside or outside the center, depending on pump design).

pneumatic ejector A device for raising wastewater, sludge or other liquid by alternately admitting it through an inward-swinging check valve into the bottom of an airtight pot. It is then discharged through an outward-swinging check valve by admitting compressed air to the pot above the wastewater.

polishing A general term for those treatment processes that are applied after conventional ones to further treat wastes.

pollution Materials in water that produce harmful, objectionable or nuisance effects in the water, such as sewage, industrial wastes, heat, solids, etc.

polychlorinated biphenyls (PCBs) A class of aromatic organic compounds with two six-carbon unsaturated rings, with chlorine atoms substituted on each ring and more than two such chlorine atoms per molecule of PCB. Typically stable, they resist both chemical and biological degradation, and are toxic to many biological species.

polyelectrolyte flocculants Polymeric organic compounds used to induce or enhance the flocculation of suspended and colloidal solids and thereby facilitate sedimentation or the dewatering of sludges.

polymer A high-molecular-weight synthetic organic compound used to aid coagulation.

polyvinyl chloride (PVC) An artificial polymer made from vinyl chloride monomer (CH_2:CHCl); frequently used in pipes, sheets, and vessels for transport, containment, and treatment in water and wastewater facilities.

ponding

1. A trickling filter condition in which voids in the media become plugged to the extent that the wastewater will not flow through it.
2. Hydraulic overloading of soil where liquids collect on the surface of the earth. Ponding is created by any number of conditions that prevent moisture from percolating into the soil.

population equivalent A means of expressing the concentration of material in wastewater in terms of number of people. Domestic wastewater on the average contains approximately 0.17 pound of biochemical oxygen demand (BOD) and 0.2 pound of total suspended solids (TSS) per person per day.

pore space Open space in rock or granular material.

positive-displacement pump Pump type in which liquid is induced to flow from the supply source through an inlet pipe and inlet valve. Water is brought into the pump chamber by a vacuum created by the withdrawal of a piston or piston-like device, which, on its return, displaces a certain volume of water contained in the chamber and forces it to flow through the discharge valve and pipe.

potable water Water that does not contain objectionable pollution, contamination, minerals, or infectious agents and is considered satisfactory for human consumption.

preaeration A wastewater preliminary treatment process consisting of aeration to remove gases, add oxygen, promote flotation of grease and aid coagulation.

prechlorination The application of chlorine to wastewater at or near the treatment plant entrance. Often used after bar screens and grit chambers to control odors in primary settling tanks.

precipitate The solids that settle out of a liquid as a result of the precipitation process.

precipitation

1. The total measurable supply of water received directly from clouds as rain, snow, hail, or sleet – usually expressed as depth in a day, month or year and designated as daily, monthly or annual precipitation.
2. The phenomenon that occurs when a substance held in solution in a liquid passes out of solution into solid form.

preliminary treatment Treatment preceding normal primary and secondary treatment. It is usually considered to include screens, grit removal or comminution, may include flocculation or disinfection; generally for the protection of subsequent treatment units and equipment.

pressure-relief valve Valve that opens automatically when the pressure reaches a preset limit to relieve stress on a pipeline.

pretreatment Treatment of industrial wastewater at its source before discharge to municipal collection systems.

primary sludge Sludge obtained from a primary sedimentation tank.

primary treatment The first major unit in a treatment plant that uses physical sedimentation to remove the greatest percentage of suspended and floatable solids.

probe

1. A T-shaped tool or rod that is pushed or driven down through the soil to locate underground pipes and utility conduits.
2. Testing instrument immersed or partially immersed in a sample for measurement of DO or pH.

propeller pump A centrifugal pump that develops most of its head by the propelling or lifting action of the vanes on the liquid. Also called an *axial-flow pump*.

protozoa A group of microscopic one-celled animals that feed upon bacteria, other small animal cells and bits of plant life.

psi Pound-force per square inch – a measure of pressure or stress.

POTW Publically-owned treatment works – a wastewater treatment plant.

pump curve A curve or curves showing the interrelation of speed, dynamic head, capacity, brake horsepower, and efficiency of a pump.

pumping head The sum of the static head and friction head on a pump discharging a given quantity of water.

putrefaction Biological decomposition of organic matter, with the production of ill-smelling products associated with anaerobic conditions.

putrescible Describes material that will decompose under anaerobic conditions and produce nuisance odors.

Q

quicklime A calcined material, the major part of which is calcium oxide, or calcium oxide in natural association with a lesser amount of magnesium oxide that is capable of combining with water (being 'slaked').

R

radial flow The direction of flow across a tank from center to periphery or vice versa.

raw sludge Settled sludge promptly removed from primary clarifiers before decomposition has advanced. Frequently referred to as *undigested sludge*.

raw wastewater Wastewater as it is received from the collection system before it has received any treatment.

reactor The container, vessel, or tank in which a chemical or biological reaction is carried out.

reagent A substance that takes part in a chemical reaction and is used to measure, detect or examine other substances.

receiving water A stream, river, lake or ocean into which treated or untreated wastewater is discharged.

reciprocating pump A type of displacement pump consisting essentially of a closed cylinder containing a piston or plunger as the displacing mechanism. Liquid is drawn into the cylinder through an inlet valve and forced out through an outlet valve. When the piston acts on the liquid in one end of the cylinder, the pump is termed single-action; when it acts in both ends, it is termed double-action.

recirculation The return of part of the effluent from a treatment unit to the influent of the unit or a preceding unit.

reclaimed wastewater Wastewater used for some beneficial purpose usually after some degree of treatment.

rectangular weir A weir having a notch that is rectangular in shape used to measure flow.

recycle

1. To return water after some type of treatment for further use; generally implies a closed system.
2. To recover useful values from segregated solid waste.

regeneration

1. In ion exchange, the process of restoring an ion exchange material to the state used for adsorption.
2. The periodic restoration of exchange capacity of ion exchange media used in water treatment.

relay

An electrical device designed to interpret input conditions in a prescribed manner and, after specified conditions are met, to respond to cause electrical operation or similar abrupt change in associated control circuits. The most common form of relay uses a coil and set of contacts. When current flows in the coil, contacts are opened or closed, depending on their arrangement. Relays are said to be normally open or normally closed.

relief valve

A valve that releases air from a pipeline automatically without loss of water, or introduces air into a line automatically if the internal pressure becomes less than that of the atmosphere.

removal efficiency

A measure of the effectiveness of a process in removing a constituent, such as BOD or TSS. Removal efficiency is calculated by subtracting the effluent value from the influent value and dividing it by the influent value. Multiply the answer by 100 to convert to a percentage.

representative sample

A portion of material or water identical in content to that in the larger body of material or water being sampled.

resistance

The property of an electrical circuit or device that opposes current flow, thereby causing conversion of electrical energy to heat or radiant energy.

respiration

The physical and chemical processes by which an organism supplies its cells and tissues with oxygen needed for metabolism and relieves them of carbon dioxide.

respiration rate

The rate of oxygen uptake by microorganisms. In activated sludge, a measure of the oxygen uptake rate per gram of MLSS.

retention time

The theoretical time required to displace the contents of a tank or unit at a given rate of discharge (volume divided by the rate of discharge). Also called *detention time*.

return activated sludge (RAS)

Settled activated sludge returned from a final clarifier to mix with incoming raw or primary settled wastewater.

reverse osmosis An advanced method used in water and wastewater treatment that relies on a semipermeable membrane to separate the water from its impurities. An external force is used to reverse the normal osmotic flow resulting in movement of the water from a solution of higher solute concentration to one of lower concentration. Also called *hyperfiltration*.

riprap Broken stone or boulders placed compactly or irregularly on dams, levees, dikes, or similar embankments for protection of earth surfaces against the action of waves or currents.

rodding machine Machine designed to feed a rod into a pipe while rotating it; used to clean out blockages in sewer.

rotary pump A type of displacement pump consisting essentially of elements rotating in a pump case that is closely fit. The rotation of these elements alternately draws in and discharges the water being pumped. Such pumps act with neither suction nor discharge valves, operate at almost any speed, and do not depend on centrifugal forces to lift the water.

rotating biological contactor (RBC) A rotating bed of synthetic media that is partially submerged and rotates in a tank through which wastewater flows. A zoogleal film on the media breaks down the organic matter in the wastewater.

rotifer Minute, multicellular aquatic animals with rotating cilia on the head and forked tails. Rotifers help stimulate microfloral activity and decomposition, enhance oxygen penetration, and recycle mineral nutrients.

rotometer A device used to monitor or meter the flow or application of chemicals.

roughing filter A trickling filter used to remove an initial portion of the soluble BOD, usually about 50%, but not to provide complete removal.

row crop A crop such as corn, beans, or beets, usually grown or cultivated in rows.

runoff That part of rain or other precipitation that runs off the surface of a drainage area and does not enter the soil.

S

saddle connection A building service connection made to a sewer main with a device called a saddle. This device makes a tight seal against the main pipe by use of a clamp, adhesive or gasket and prevents the service pipe from protruding into the main.

safety valve A valve that automatically opens when prescribed conditions, usually pressure, are exceeded in a pipeline or other closed receptacle containing liquids or gases. It prevents such conditions from being exceeded and causing damage.

Salmonella A genus of aerobic, rod-shaped, usually motile bacteria that are pathogenic for man and other warm-blooded animals.

sand filter A bed of sand through which water is passed to remove fine suspended particles. Commonly used in tertiary wastewater treatment plants and sludge drying beds.

sand trap A device that can be placed in the outlet of a manhole to cause settling in the manhole invert, thus trapping sand, rocks and similar inorganic debris.

sanitary sewer Sewer designed to receive and convey household, commercial or industrial wastewater.

saprophytic organisms Organisms living on dead matter that help natural decomposition of organic solids in wastewater.

saturated air Air containing all the water vapor that it is capable of holding at a given temperature and pressure.

saturated soil Soil which has its void spaces filled with water to the point at which runoff occurs.

screen A device with openings generally uniformly sized to retain or remove suspended or floating objects in wastewater larger than the openings.

screenings Materials, consisting largely of rags and paper, which are removed from wastewater by means of bar screens, basket screens or other types of straining devices.

screw-feed pump A pump with either a horizontal or vertical cylindrical casing in which operates a runner with radial blades like those of a ship's propeller.

scrubbing Removal of suspended solids and undesirable gases from gaseous emissions.

scum

1. The layer or film of foreign matter, particularly grease, that rises to the surface of water or wastewater.
2. A residue deposited on the ledge of a sewer, channel or wet well at the water surface.
3. A mass that floats on the surface.

scum baffle A vertical baffle dipping below the surface of wastewater in a tank to prevent the passage of floating matter.

scum trough	A trough placed in a primary sedimentation tank to intercept scum and convey it out of the tank.
Secchi disk	A circular disk used to measure the transparency (clarity) of water.
secondary effluent	The liquid portion of wastewater leaving secondary treatment.
secondary treatment	The process by which dissolved and suspended organic materials are converted to settleable forms that are removed from the wastewater. This is usually accomplished by using biological treatment processes such as activated sludge, trickling filters, stabilization ponds, rotating biological contactors, etc.
second-stage BOD	That part of the oxygen demand associated with the biochemical oxidation of nitrogenous material. As the term implies, the oxidation of the nitrogenous materials usually does not start until a portion of the carbonaceous material has been oxidized during the first stage.
sedimentation	The process of settling suspended solids by gravity.
seed sludge	In biological treatment, the inoculation of the unit process with biologically active sludge resulting in acceleration of the initial stage of the process.
self-cleansing velocity	The minimum velocity (usually two ft/sec) necessary to keep solids in suspension in sewers, thus preventing their deposition and subsequent nuisance from stoppages and odors of decomposition. Also called *scouring velocity*.
separate sewer system	A sewer system carrying sanitary wastewater and other water-carried wastes from residences, commercial buildings, industrial plants, and institutions, as well as minor quantities of ground, storm, and surface water that are not intentionally admitted. Also see *combined sewer*, *wastewater*.
septage	The sludge produced in individual on-site wastewater disposal systems such as septic tanks and cesspools.
septic	A condition produced by the lack of aerobic conditions. If severe, the wastewater turns black, giving off foul odors and creating a heavy oxygen demand.
septic tank	A tank that allows solids in the wastewater to settle and decompose by anaerobic bacterial action and allows the liquids in wastewater to exit from the tank for further treatment.
sequencing batch reactor (SBR)	A form of activated sludge process in which the waste is treated in batches. SBRs have no separate final clarifiers; all stages are completed in one tank. The stages are typically: fill, react, settle and draw off.

series operation A method of operation in which the flow from one unit goes to a similar second unit, as in two-stage trickling filters and stabilization pond systems.

service connection Any single pipe, gate, valve or similar means of transfer to a main collection system from any individual building.

settleable solids
1. That matter in wastewater that will not stay in suspension during a preselected settling period, such as one hour, but settles to the bottom.
2. In a 30-minute settling test, the volume of matter that settles to the bottom of the cylinder in 30 minutes.
3. Suspended solids that can be removed by conventional sedimentation.

settleometer test Settling test conducted in a 1,000 ml cylinder for 30 minutes that indicates the settling in a final clarifier.

sewage The used water and water-carried solids from homes and industries that flow in sewers to a treatment plant. The preferred term is *wastewater*.

sewer A pipe or conduit that carries wastewater or storm water.

sewer ball A spiral-grooved, inflatable, semi-hard rubber ball designed for hydraulic cleaning of sewer pipes.

sewer gas
1. Gas in collection lines (sewers) caused by the decomposition of organic matter in the wastewater.
2. Any gas present in the wastewater collection system, even though it is from such sources as gas mains, gasoline, cleaning fluid, etc.

sewer jack A device placed in manholes supporting a yoke or pulley that keeps wires or cables from rubbing against the sewer inlet or outlet.

sheeting Solid material, such as wooden sheets or metal plates used to hold back soil and prevent cave-ins during excavation.

shock load A situation in which the influent wastewater flow contains waste of a toxic nature or with very high organic or hydraulic content, or when the pH either drops or rises drastically – usually detrimental to the treatment process.

shoring Material such as boards, planks or plates and hydraulic jacks, used to hold back soil around trenches and to protect workers in a trench from cave-ins.

short-circuiting The hydraulic condition in a tank, chamber or basin in which time of travel is less than that of the intended flow-through period.

side-water depth The depth of water measured along a vertical exterior wall.

single-stage digestion Digestion limited to a single tank for the entire digestion period.

sinkhole A closed depression in an area of Karst topography that is formed by washing away of the underlying limestone; acts as a recharge area for ground water.

skimming

1. The process of diverting water from the surface of a stream or conduit by means of a shallow overflow.
2. The process of diverting water from any elevation in a reservoir by means of an outlet at a different elevation or by any other skimming device in order to obtain the most palatable drinking water.
3. The process of removing grease or scum from the surface of wastewater in a tank.

slake To become mixed with water so that a true chemical combination takes place, as in the slaking of lime.

slope Grade or inclination of a sewer or trench excavation. The ratio of the vertical to the horizontal distance, or 'rise over run.'

sloughings Trickling-filter or rotating biological contactor zoogleal film that has been 'washed off' the filter media.

sludge The settleable solids separated from liquids during processing, or accumulated deposits on the bottom and edges of wastewater collection lines and appurtenances.

sludge age Average residence time of suspended solids in a biological treatment system equal to the total weight of suspended solids in the system divided by the total weight of suspended solids leaving the systems.

sludge blanket Layer of sludge settled within an enclosed body of wastewater, such as a clarifier.

sludge collector A mechanical device for scraping the sludge on the bottom of a settling tank to a sump from which it can be drawn.

sludge density index (SDI) A measure of the degree of compaction of a sludge after settling in a graduated container, expressed as mL/g. The sludge volume index (SVI) is the reciprocal of the sludge density index.

sludge thickener A tank or other equipment designed to concentrate wastewater sludge.

sludge thickening The increase in solids concentration of sludge in a sedimentation tank, dissolved air flotation, gravity thickener, centrifuge or gravity belt thickener.

sludge volume index (SVI)	The ratio of the volume (in milliliters) of sludge settled from a 1000 mL sample in 30 minutes multiplied by 1000 to the concentration of mixed liquor (in milligrams per liter) .
slurry	A thick, watery mud or any substance resembling it, such as lime slurry.
smoke test	A method of blowing smoke into a sanitary sewer system to locate sources of inflow.
snake	A stiff yet flexible cable inserted into sewers to clear stoppages.
soda ash	A common name for commercial sodium carbonate (Na_2CO_3).
sodium bisulfite ($NaHSO_3$)	A salt used for reducing chlorine residuals; a strong reducing agent; typically found in white powder or granular form in strengths up to 44%. At a strength of 38%, 1.46 parts will consume 1 part of chlorine residual.
sodium hydroxide (NaOH)	A strong caustic chemical used in treatment processes to neutralize acidity, increase alkalinity, or raise the pH value. Also known as caustic soda, sodium hydrate, lye, and white caustic.
sodium hypochlorite (NaOCl)	A water solution of sodium hydroxide and chlorine in which sodium hypochlorite is the essential ingredient.
sodium metabisulfite ($Na_2S_2O_5$)	A cream-colored powder used to conserve chlorine residual; 1.34 parts of $Na_2S_2O_5$ will consume 1 part of chlorine residual.
soil	A porous mixture with varying amounts of mineral particles, biological organisms and water.
soil absorption capacity	In subsurface effluent disposal, the ability of the soil to absorb water.
soil horizon	A layer of soil approximately parallel to the land surface and different from layers either above or below that layer.
soil infiltration rate	The maximum rate at which a soil, in a given condition at a given time, can absorb water.
soil porosity	The percentage of the soil (or rock) volume that is not occupied by solid particles, including all pore space filled with air and water. The total porosity may be calculated from the following formula: percent pore space = (1 - volume weight/specific gravity) × 100.
soil profile	A vertical section of the soil from the surface through all of the horizons.
soil structure	The combination and physical arrangement of soil particles.

soil texture The relative proportion of the various size groups of soil grams in a soil. Sand particles are between 2 and 0.05 mm in diameter. Silt particles are between 0.05 and 0.002 mm in diameter. Clay particles are less than 0.002 mm in diameter.

soil type A body of soil having the same profile and texture. It is the lowest unit in the soil classification system.

solids A substance that has its own distinctive shape.

- **dissolved solids:**
  1. Very small, invisible, nonsettling particles in solution that cannot be removed by filtration.
  2. The difference between total and suspended solids.
- **inorganic solids:** Chemical substances of mineral origin and not readily biodegradable, e.g., sand, grit and glass.
- **organic solids:** Chemical substances of animal and vegetable origin basically with a carbon structure.
- **settleable solids:** Those solids which will settle out when a sample of wastewater is allowed to stand quietly for a one-hour period; this is measured in an Imhoff cone.
- **suspended solids:** The concentration of insoluble materials suspended or dispersed in water or wastewater, generally expressed in mg/L on a dry-weight basis and determined by filtration methods.
- **total solids:** Solids contained in dissolved and suspended forms in water – determined by weighing after drying at 103°C.
- **volatile solids:** Quantity of solids in water that represents a loss in weight upon ignition at 550°C.

solids loading Amount of solids applied to a treatment process per unit time per unit volume.

solids retention time (SRT) The average time of retention of suspended solids in a biological waste treatment system, equal to the total weight of suspended solids leaving the system, per unit time.

sparger An air diffuser designed to give large bubbles, used singly or in combination with mechanical aeration devices.

specific gravity The density of a substance relative to the density of an equal volume of pure water at 25°C. A specific gravity of 1.0 is assigned to pure water. Substances with a specific gravity of 2.0 are twice as dense as water.

specific oxygen uptake rate Measures the microbial activity in a biological system expressed in mg O_2/g·h of VSS. Also called *respiration rate*.

splitter box

1. A division box that splits the incoming flow into two or more streams.
2. A device for splitting and directing discharge from the head box to two separate points of application.

spoil

Excavated material, such as soil from the trench of a sewer.

spray irrigation

A method of disposing of wastewater by spreading it on land, usually from pipes equipped with spray nozzles.

stabilization pond

A secondary treatment system in which natural purification processes occur under controlled conditions. Interaction between algae and bacteria plays a vital role in this process.

staged digestion

The progressive digestion of waste in two or more tanks arranged in series, usually divided into primary digestion with mixed contents and secondary digestion where quiescent conditions prevail and supernatant liquor is collected.

staged treatment

1. Any treatment in which similar processes are used in series or stages.
2. In the activated-sludge process, two or more stages consisting of a clarifying stage and a biological stage, or two biological stages.
3. In anaerobic digestion, an operation in which sludge is completely mixed in the first tank and pumped to a second tank for separation of the supernatant liquor from the solids.

stalked ciliates

Small, one-celled organisms possessing cilia (hair-like projections used for feeding) that attach to floc and are not motile. They develop at lower prey densities, long SRTs, and low F:M ratios.

Standard Methods

Methods of testing prescribed by joint action of the American Public Health Association (APHA), American Water Works Association (AWWA) and Water Environment Federation (WEF).

static head

When water is not moving, the vertical distance (in feet) from a point to the water surface.

step aeration

A procedure for adding increments of settled wastewater along the line of flow in the aeration tanks of an activated-sludge plant. Also called *step feed*.

sterilization

The destruction of all living organisms ordinarily through the agency of heat, chemicals or light.

stilling well A pipe, chamber, or compartment with a relatively small inlet(s) connected to a main body of water, such as water in a wet well. The purpose of a stilling well is to dampen waves or surges while allowing the water level within the well to rise and fall with the major fluctuations of the main body of water. It is used with water-measuring flow and depth devices to improve the accuracy of measurement.

storm sewer Sewer that carries storm water and surface water, street wash and other wash waters or drainage, but not domestic wastewater and industrial wastes.

straggler floc Large (6-mm or larger) floc particles that have poor settling characteristics.

stringers Horizontal shoring members, usually square, rough-cut timber, used to hold solid sheeting, braces or vertical shoring members in place.

submerged weir A weir that, when in use, has a water level on the downstream side at an elevation equal to, or higher than, the weir crest. The rate of discharge is affected by the tailwater. Also called a *drowned weir*.

substation An assembly of equipment for switching and/or changing or regulating the voltage electrical supply.

substrate
1. Substances used by organisms in liquid suspension.
2. The liquid in which activated sludge or other matter is kept in suspension.

suction head The pressure (in feet or psi) on the suction or inlet side of a pump. Pressure is measured from the center line of the pump impeller up to the water surface elevation of the wet well when the source of water is above the centerline of the pump suction.

suction lift The negative pressure (in feet or psi) on the suction side of a pump. Measured from the centerline of the pump impeller to the water surface elevation when the source of the water is below the centerline of pump suction.

suctoreans Ciliates that are stalked in the adult stage with rigid tentacles to catch prey.

sulfate-reducing bacteria Bacteria capable of assimilating oxygen from sulfate compounds, reducing them to sulfides. Also see *sulfur bacteria.*

sulfur bacteria Bacteria capable of using dissolved sulfur compounds in their growth; bacteria deriving energy from sulfur or sulfur compounds.

sump A tank or pit that receives drainage and stores it temporarily, and from which the discharge is pumped or ejected.

sump pump A mechanism used for removing water or wastewater from a sump or wet well; it may be energized by air, water, steam, or electric motor. Ejectors and submerged centrifugal pumps, either float or manually controlled, are often used for the purpose.

supernatant The liquid removed from settled sludge. Supernatant commonly refers to the liquid between the sludge on the bottom and the scum on the surface of any liquid. This liquid is usually returned to an influent wet well or a primary clarifier.

supersaturation The situation in which water holds more oxygen at a specified temperature than normally required for saturation at that temperature.

surface overflow rate A design criterion used for sizing clarifiers; typically expressed as the flow volume per unit amount of clarifier space (gpd/sq ft).

surfactant A surface-active agent that concentrates at interfaces, forms micelles, increases solution, lowers surface tension, increases adsorption, and may decrease flocculation.

surge suppressor A device used in connection with automatic control of pumps to minimize surges in a pipeline.

surge tank A tank or chamber located at or near a hydroelectric powerhouse and connected with the penstock above the turbine. When the flow of water delivered to the turbine is suddenly decreased, the tank absorbs the water that is held back and cushions the increased pressure on the penstock caused by the rapid deceleration of the water flowing in it; also, when the flow delivered to the turbine is suddenly increased, the tank supplies the increased quantity of water required until the flow in the penstock has been accelerated sufficiently. Also used in connection with pumping systems.

surcharge A condition in which the surface of wastewater in a manhole is above the top of a sewer pipe. The sewer is under pressure or at a head rather than at atmospheric pressure.

symbiotic cycle The symbiotic relationship between bacteria and algae in a stabilization pond system.

tag line Line, rope or cable which follows equipment through a sewer so the equipment can be pulled back out if it encounters an obstruction or becomes stuck. Equipment is pulled forward with a *pull line*.

tapered aeration The method of supplying varying quantities of air into the different parts of an aeration tank in the activated-sludge process, more at the inlet, less near the outlet, in approximate proportion to the oxygen demand of the mixed liquor under aeration.

tertiary treatment Treatment in addition to normal or conventional secondary methods. Also called *advanced treatment*.

thermophilic digestion Digestion occurring at a temperature approaching or within the thermophilic range, generally between 43°C and 60°C (110°F and 140°F).

thickeners Any equipment or process, after gravity sedimentation, that increases the concentration of solids in sludges with or without the use of chemical flocculents.

titrate To add a chemical solution of known strength drop by drop until a color change, precipitate or pH change in the sample is observed (end point). Titration is the process of adding the chemical solution up to completion of the reaction as signaled by the end point.

total carbon (TC) A quantitative measure of both total inorganic and total organic carbon as determined instrumentally by chemical oxidation to carbon dioxide and subsequent infrared detection in a carbon analyzer. Also see *total organic carbon*.

total dissolved solids (TDS) The sum of all dissolved solids (volatile and nonvolatile).

total dynamic head (TDH) See *dynamic head.*

total organic carbon (TOC) The amount of carbon bound in organic compounds in a sample. Because all organic compounds have carbon as the common element, total organic carbon measurements provide a fundamental means of assessing the degree of organic pollution.

total oxygen demand (TOD) A quantitative measure of all oxidizable material in a sample water or wastewater as determined instrumentally by measuring the depletion of oxygen after high-temperature combustion. Also see *chemical oxygen demand, total organic carbon*.

total solids (TS) The sum of dissolved and suspended solid constituents in water or wastewater.

total suspended solids (TSS) The amount of insoluble solids floating and in suspension in the wastewater. Also referred to as total nonfilterable residue.

totalizer A recorder that continuously sums flow.

toxic load A poison or acting like a poison; a material detrimental to a biological treatment process, e.g., fuel oil, chromium salts, etc.

toxicity A condition that may inhibit or destroy the growth or function of any organism.

trace nutrients Substances vital to bacterial growth. Trace nutrients are defined in this text as nitrogen, phosphorus, and iron.

trap

1. A device used to prevent a material flowing or carried through a conduit from reversing its direction of flow or movement, or from passing a given point.
2. A device to prevent the escape of air from sewers through a plumbing fixture or catch basin.

trench jack A mechanical screw device used to hold shoring in place.

trickling filter A biological treatment process in which the wastewater trickles through a bed of media and is treated by the action of microorganisms living in the zoogleal film on the filter media.

tri-halomethanes (THM) Derivatives of methane (CH_4) in which three halogen atoms (chlorine, bromine, or iodine) are substituted for three of the hydrogen atoms.

trunk sewer Sewer that receives many tributary branches and serves a large territory.

turbidity

1. A condition in water or wastewater caused by the presence of suspended matter, resulting in the scattering and absorption of light rays and causing a cloudy appearance.
2. An analytical quantity usually reported in turbidity units determined by measurements of light diffraction.

turbine pump A centrifugal pump in which fixed guide vanes partially convert the velocity energy of the water to pressure head as the water leaves the impeller.

turbulence

1. The fluid property that is characterized by irregular variation in the speed and direction of movement of individual particles or elements of the flow.
2. A state of flow of water in which the water is agitated by cross currents and eddies, as opposed to laminar, streamline, or viscous flow.

turnover The phenomenon of vertical circulation that occurs in large bodies of water. It results from the increase in density of water above and below 39.2°F (4°C), the temperature of minimum density. In the spring, as the surface of the water warms above the freezing point, the water increases in density and tends to sink, producing vertical currents; in the fall, as the surface water becomes colder, it also tends to sink. Wind may also create such vertical currents. Also called *overturn*.

two-staged digestion The biological decomposition of organic matter in sludge followed by solids–liquid separation of the digested sludge. Two-stage digestion uses two compartments or two tanks to separate the violent initial digestion period from the slower final period to enhance both the digestion and the solids–liquid separation after digestion.

U

ultraviolet radiation (UV) Light waves shorter than the visible blue-violet waves of the spectrum.

underdrains

1. A system of drain tiles which are placed deep enough to allow the covering soil to be cultivated. Underdrains keep the soil profile free of excessive moisture.
2. A system of slotted or perforated pipes placed in the soil to collect water for drainage to another area.
3. The part of a trickling filter that supports the media. It allows for air movement through the media and drains the wastewater as it passes through the media.

unloading A term pertaining to the seasonal sloughing of solids from the trickling filter media.

upflow Term used to describe treatment units in which flow enters at the bottom and exits at the top.

upflow clarifier A treatment unit in which liquid containing suspended solids is passed upward through a blanket of settling sludge; mixing, flocculation, and solids removal are all accomplished in the same unit.

upflow filter A gravity or pressure filtration system in which the wastewater flows upward, generally first through a coarse medium and then through a fine medium, before discharging.

user charge Price or fee asked of users of wastewater services.

vacuum breaker A device for relieving a vacuum or partial vacuum formed in a pipeline, thereby preventing backsiphoning.

vacuum filter
1. A filter used to accomplish sludge dewatering and consisting of a cylindrical drum mounted on a horizontal axis, covered with filter media, and revolving partially submerged in a dilute sludge mixture. A vacuum is maintained under the media for the larger part of a revolution to extract moisture. The dewatered cake that is formed is scraped off mechanically for disposal.
2. A diatomaceous earth filter open to the atmosphere and on the inlet side of a pump.

vacuum pump
1. A pump for creating a partial vacuum in a closed space.
2. A pump in which water is forced up a pipe by the difference in pressure between the atmosphere and a partial vacuum.
3. An air compressor used in connection with steam condensers and for improving the suction head on other pumps. The compressor takes its suction at low absolute pressure, performs a large number of compressions, and generally discharges at atmospheric pressure.

valves A mechanical device for regulating the flow of liquid.

vapor pressure
1. Pressure exerted by a vapor in a confined space. It is a function of the temperature.
2. The partial pressure of water vapor in the atmosphere.
3. The partial pressure of any liquid.

Venturi meter A differential meter for measuring the flow of water or other fluid through closed conduits or pipes. It consists of a Venturi tube and one of several proprietary forms of flow-registering devices. The difference in velocity heads between the entrance and the contracted throat is an indication of the rate of flow.

virus The smallest (10 to 300 mm in diameter) life form capable of producing infection and diseases in man and animals; it grows only in living cells.

viscosity The molecular attractions within a fluid that make it resist a tendency to deform under applied forces.

V-notch weir A triangular weir used to measure flow.

void A pore or open space in rock or granular material not occupied by solid matter. It may be occupied by air, water or other gaseous or liquid materials.

volatile Capable of being converted from a liquid or solid into a gas or vapor.

volatile acids Fatty acids containing six or fewer carbon atoms. They are soluble in water and can be steam-distilled at atmospheric pressure. They have pungent odors and are often produced during anaerobic decomposition.

volatile solids (VS) Materials, generally organic, that can be driven off from a sample by heating, usually to 550°C (1022°F); nonvolatile inorganic solids (ash) remain.

volatile suspended solids (VSS) That fraction of suspended solids, including organic matter and volatile inorganic salts, that will ignite and burn when placed in an electric muffle furnace at 550°C (1022°F) for 60 minutes.

volt The unit of electromotive force or electrical pressure (analogous to water pressure). It is the electromotive force that, if steadily applied to a circuit having a resistance of one ohm, will produce a current of one ampere.

voltage The electrical pressure available to cause a flow of current (amperage) when an electrical circuit is closed.

volute The spiral-shaped casing surrounding a pump impeller.

W

walers Horizontal shoring members, usually square rough-cut timbers, which are used to hold solid sheeting, braces, or vertical shoring members in place.

waste activated sludge (WAS) Solids removed from the activated-sludge process to prevent an excessive buildup in the system.

wastewater The spent or used water and water-carried solids from a community or industry.

waterborne disease Disease caused by organisms or toxic substances carried by water. Most common waterborne diseases are typhoid fever, Asiatic cholera, polio, dysentery and other intestinal disturbances.

water column

1. The water above the valve in a set of pumps.
2. A measure of head or pressure in a closed pipe or conduit.

watershed A region or land area that supplies water to a wetland, lake or river during precipitation, snowmelt and/or runoff. A catchment area or drainage basin.

water table The upper surface of ground water or that level where the soil is saturated with water. High ground waters can be estimated by observing soil color or mottling when investigating the soil profile.

watt The electrical unit of power. Power is the measure of the rate of doing work. A watt (W) is the rate of energy transfer from one ampere flowing under a pressure of one volt at a unity power factor. It is analogous to horsepower or foot-pounds per minute of mechanical power. One horsepower is equivalent to approximately 746 watts.

weir
1. A vertical obstruction such as a wall placed in an open channel and calibrated so that a flow over the weir can easily be converted to a flow rate.
2. A device used for surface overflow from a tank, basin or chamber – generally designed to smooth out discharge flows so as to minimize turbulence and currents.

weir overflow rate The amount of flow applied to a treatment process (typically a clarifier) per linear measure of weir (gpd/linear ft).

wet-air oxidation A method of sludge disposal that involves the oxidation of sludge solids in water suspension under high pressure and temperature. Also called the *wet oxidation process*.

wet weather flow For mechanical plants, the flow of wastewater for the wettest 30 consecutive days. For a controlled discharge pond, the flow of wastewater for the wettest 180 consecutive days.

wet well A compartment or room in which wastewater is collected, and to which the suction pipe of a pump is connected. Also, a submersible pump may be located in a wet well.

Z

Zooglea Jelly-like mass of microorganisms composing the trickling filter or rotating biological contactor slime.

Zoogleal growth A complex population of organisms that form a jelly-like slime growth on trickling filter media and break down the organic matter in wastewater. The slime consists of living organisms feeding on the wastes in wastewater, dead organisms, silt, and other debris. Zoogleal growth is found in both trickling filter and rotating biological contactor processes.

