

# Glossary

This glossary is a compilation of geologic, geophysical, and hydrological terms used in this report which are found in the public domain. Geologic terms are from Bates and Jackson (1980). Geophysical terms also are from Bates and Jackson (1980) and from <http://www.geotech.org/survey/geotech/>. Hydrological terms are from previously published USGS reports and from Weight and Sonderegger (2001). The terms herein are not necessarily the only valid definitions for these terms.

**acre-foot (acre-ft, ac-ft).**—The volume of water required to cover 1 acre to a depth of 1 foot and is equal to 43,560 cubic feet or 325,851 gallons or 1,233.49 cubic meters.

**Active Management Area.**—A geographical area that has been designated by the Arizona state legislature as requiring active management of ground-water withdrawals from pumping.

**aeromagnetic.**—Relating to the study of the earth's magnetic fields, especially in relation to air surveys used to map local anomalies caused by variations in rock magnetization.

**alkali basalt.**—Critically silica-undersaturated basalt, containing normative nepheline, diopside, and olivine, with no normative hypersthene. Basalts with nepheline and/or acmite fall in this category.

**andesite.**—A dark-colored, fine-grained extrusive rock that, when porphyritic, contains phenocrysts composed primarily of zoned sodic plagioclase (esp. andesine) and one or more mafic minerals (e.g. biotite, hornblende, pyroxene), with a groundmass composed generally of the same minerals as the phenocrysts, although the plagioclase may be more sodic and quartz is generally present; the extrusive equivalent of *diorite*. Andesine grades into *latite* with increasing alkali feldspar and quartz.

**analcime.**—A mineral:  $\text{NaAlSi}_2\text{O}_6 \cdot \text{H}_2\text{O}$ . It is an isometric zeolite, commonly found in diabase and alkali-rich basalts.

**aquifer.**—A geologic formation, group of formations, or part of a formation that contain sufficient saturated permeable material to yield significant quantities to springs and wells.

**artesian.**—*See* confined aquifer.

**background concentration.**—A concentration of a substance in a particular environment that is indicative of minimal influence by human (anthropogenic) sources.

**basalt.**—A general term for dark-colored mafic igneous rocks, commonly extrusive but locally intrusive (e.g. dikes), composed chiefly of calcic plagioclase and clinopyroxene; the fine-grained equivalent of *gabbro*. Nepheline, olivine, and orthopyroxene, and quartz may be present, but not all simultaneously.

**bloedite.**—A white or colorless monoclinic mineral:  $\text{Na}_2\text{Mg}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ .

**base flow.**—The sustained low flow of a stream, usually ground-water inflow to the stream channel.

**carbonate rocks.**—Rocks (such as limestone or dolostone) that are composed primarily of minerals (such as calcite and dolomite) containing the carbonate ion ( $\text{CO}_3^{2-}$ ).

**cienaga (cienega).**—A marshy area where the ground is wet due to the presence of seepage or springs.

**cgs.**—is the system of units based on measuring lengths in centimeters, mass in grams, and time in seconds. It is a *metric system*, although not the flavor of the metric system used most commonly. It was introduced by the British Association for the Advancement of Science in 1874, and was immediately adopted by many working scientists.

**clastic.**—Rock, such as sandstone, or sediment composed principally of broken fragments that are derived from preexisting rocks which have been transported from their place of origin.

**clinoptilolite.**—A zeolite mineral:  $(\text{Na}, \text{K}, \text{Ca})_{2-3}\text{Al}_3(\text{Al}, \text{Si})_2\text{Si}_{13}\text{O}_{36} \cdot 12\text{H}_2\text{O}$ . It is a potassium-rich variety of *heulandite*.

**columnar jointing.**—A phenomenon that occurs as lava contracts to form a solid. During the cooling process, polygonal prismatic shapes form to accommodate the escaping heat. The polygonal prismatic shapes extend down through the thickness of the lava flow to form columns.

**concentration.**—The ratio of the quantity of any substance present in a sample of a given volume or a given weight compared to the volume or weight of the sample.

**conductance.**—The product of conductivity and thickness. Indication of ease of current flow in a medium.

**conductivity.**—The ability of a material to conduct electrical current. In isotropic material, the reciprocal of resistivity. Units are in siemens per meter.

**conductivity, effective hydraulic.**—The rate of flow of water through a porous medium measured in gallons per day through a cross-section of one square foot under a unit hydraulic gradient.

**confined aquifer (artesian).**—An aquifer that is isolated by having confining layers to maintain the pressure in the system at a pressure greater than atmospheric pressure. This causes the water levels in cased wells to rise above the top of the aquifer. The pressure results from the weight of the water elevation near the recharge area to be propagated through the entire system.

**confining layers.**—Layers that have hydraulic conductivity two or three orders of magnitude less than a layer above or below.

**conglomerate.**—A coarse-grained sedimentary rock composed of fragments larger than 2 millimeters in diameter.

**contributing area.**—The area in a drainage basin that contributes water to streamflow or recharge to an aquifer.

**constituent.**—A chemical or biological substance in water, sediment, or biota that can be measured by an analytical method.

**consumptive use.**—The quantity of water that is not available for immediate reuse because it has been evaporated,

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transpired, or incorporated into products, plant tissue, or animal tissue. Also referred to as “water consumption”.

**core sample.**—A sample of rock, soil, or other material obtained by driving a hollow tube into the undisturbed medium and withdrawing it with its contained sample.

**crystalline rocks.**—Rocks (igneous or metamorphic) consisting wholly of crystals or fragments of crystals.

**cubic foot per second (ft<sup>3</sup>/s, or cfs).**—Rate of water discharge representing a volume of 1 cubic foot passing a given point during 1 second, equivalent to approximately 7.48 gallons per second or 448.8 gallons per minute or 0.02832 cubic meter per second. In a stream channel, a discharge of 1 cubic foot per second is equal to the discharge at a rectangular cross section, 1 foot wide and 1 foot deep, flowing at an average velocity of 1 foot per second.

**dacite.**—A fine-grained extrusive rock with the same general composition as *andesite* but having a less calcic plagioclase and more quartz; according to many, it is the extrusive equivalent of *granodiorite*.

**degree (° or deg).**—the standard unit of angle measure, equal to 1/360 circle, 60 minutes, 3600 seconds, or about 0.017 453 293 *radian*.

**density.**—The mass per unit volume of a substance, commonly expressed in grams/ cubic centimeter.

**detection limit.**—The concentration of a constituent or analyte below which a particular analytical method cannot determine, with a high degree of certainty, the concentration.

**direct runoff.**—The runoff entering stream channels promptly after rainfall or snowmelt.

**discharge.**—The volume of fluid passing a point per unit of time, commonly expressed in cubic feet per second, million gallons per day, gallons per minute, or seconds per minute per day. Ground-water outflow or streamflow, as in a stream, canal, or from a pumped well.

**dissolved constituent.**—Operationally defined as a constituent that passes through a 0.45-micrometer filter.

**dissolved oxygen.**—Oxygen dissolved in water; one of the most important indicators of the condition of a water body. Dissolved oxygen is necessary for the life of fish and most other aquatic organisms.

**diurnal.**—Having a daily cycle; showing periodic alteration of conditions with day and night.

**diversion.**—A turning aside or alteration of the natural course of a flow of water, normally considered physically to leave the natural channel. In some States, this can be a consumptive use direct from another stream, such as by livestock watering. In other States, a diversion must consist of such actions as taking water through a canal, pipe, or conduit.

**downgradient.**—The direction water flows by force of gravity.

**drainage area.**—The drainage area of a stream at a specified location is that area, measured in a horizontal plane, which is enclosed by a drainage divide.

**drainage basin.**—The land area drained by a river or stream.

**drought.**—A prolonged period of less-than-normal precipitation such that the lack of water causes a serious hydrologic imbalance.

**emu/cm<sup>3</sup> or emu/cc.**—a CGS unit of magnetization. In SI units, one emu/cm<sup>3</sup> can be interpreted either as 4pi/10 milliteslas (1.256 637 mT) as a unit of magnetic polarization or excess magnetic induction, or as 1000 *amperes* per meter as a unit of magnetic dipole moment per unit volume.

**endangered species.**—A species that is in imminent danger of becoming extinct.

**ephemeral stream.**—A stream or part of a stream that flows only in direct response to precipitation; it receives little or no water from springs, melting snow, or other sources; its channel is at all times above the water table.

**evapotranspiration.**—The process by which water is discharged to the atmosphere as a result of evaporation from the soil and surface-water bodies, and transpiration by plants.

**fanglomerate.**—A sedimentary rock consisting of slightly water-worn, heterogeneous fragments of all sizes, deposited in an alluvial fan and later cemented into a firm rock; it is characterized by persistence parallel to the depositional strike and by rapid thinning downdip.

**feldspar.**—A group of abundant rock-forming minerals of general formula: MAl(Al,Si)<sub>3</sub>O<sub>8</sub>, where M = K, Na, Ca, Ba, Rb, Sr, and Fe. Feldspars are the most widespread of any mineral group and constitute 60 percent of the Earth’s crust; they occur as components of all kinds of rocks and as fissure minerals in clefts and druse minerals in cavities. Feldspars are usually white or nearly white and clear and translucent (they have no color of their own but are frequently colored by impurities), have a hardness of 6 on the Mohs scale, frequently display twinning, exhibit monoclinic or triclinic symmetry, and possess good cleavage in two directions. On decomposition, feldspars yield a large part of the clay of the soil and also the mineral kaolinite.

**flowpath (flow path).**—An underground route for ground-water movement, extending from a recharge (intake) zone to a discharge (output) zone such as a shallow stream.

**flow duration.**—Flow duration of daily mean discharge, expressed in percentage of time, are specified daily flow that were equaled or exceeded during the period of record.

**gaining stream.**—A stream or reach of stream that receives water from the inflow of ground water. Discharge occurs because the head in the ground-water system is higher than the stage elevation of the stream.

**gauging (gaging) station.**—A particular site on a stream, canal, lake, or reservoir where systematic observations of hydrologic data are obtained regularly by permanently installed equipment.

**geophysics.**—the study of the *earth* by quantitative *physical* methods, especially by *seismic reflection* and

*refraction, gravity, magnetic, electrical, electromagnetic, and radioactivity methods.*

**graben.**—An elongate, relatively depressed crustal unit or block that is bounded by faults on its long sides. It is a structural form that may or may not be geomorphologically expressed as a rift valley.

**gradient, hydraulic.**—The change of pressure per unit distance from one point to another in an aquifer. When an area is said to be “downgradient” it is at a lower level and water will flow in that direction.

**gravity anomaly.**—The value of gravity left after subtracting from a gravity measurement the reference value based on latitude, and possibly the free-air and Bouguer corrections.

**gravity survey.**—The measurement of gravity at regularly spaced grid points with repetitions to control instrument drift.

**gravitation.**— is the tendency of *masses* to move toward each other.

**ground water.**—In the broadest sense, all subsurface water; more commonly that part of the subsurface water in the saturated zone.

**ground-water flow system.**—The underground pathway by which ground water moves from areas of recharge to areas of discharge.

**headwater.**—The source and upper part of a stream, especially of a large stream or river, including the upper drainage basin.

**heterogeneous.** —See homogeneity.

**homogeneity.** —Relating to the physical properties of an aquifer from point A to point B, including packing, thickness, and cementation. Homogeneous units have similar properties from point A to point B and heterogeneous units differ in physical properties from point A to point B.

**hydraulic conductivity.**—The capacity of a rock to transmit water. It is expressed as the volume of water at the existing kinematic viscosity that will move in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow.

**hydraulic gradient.**—The slope of the potentiometric surface. It is the rate of change of head per length of flow in a given direction.

**hydraulic head.**—The height of the free surface of a body of water above a given point beneath the surface.

**illite.**—A general name for a group of three-layer, mica-like clay minerals that are widely distributed in argillaceous sediments. They are intermediate in composition between *muscovite* and *montmorillonite*, and have the general formula  $(\text{H}_3, \text{O}, \text{K})_y(\text{Al}_4, \text{Fe}_4, \text{Mg}_4, \text{Mg}_6)(\text{Si}_{8-y}, \text{Al}_y)\text{O}_{20}(\text{OH})_4$ , with  $y$  less than 2 and frequently 1 to 1.5.

**impermeability.**—The condition of a rock, sediment, or soil that renders it incapable of transmitting fluids under pressure.

**infiltration.**—The process of precipitation water migrating into the soil horizon.

**intermittent or seasonal stream.**—A stream that flows only when it receives water from rainfall runoff or springs, or from some surface source such as melting snow.

**inverse modeling.**—The process of estimating model or desired parameters from measured data.

**ion.**—A positively or negatively charged atom or group of atoms.

**isopachs.**—A line drawn on a map through points of equal true thickness of a designated stratigraphic unit, or group of stratigraphic units.

**joints.**—Undisplaced fractures in rocks that have been subjected to tectonic forces.

**karst.**—A type of topography that results from dissolution and collapse of carbonate rocks such as limestone, dolomite, and gypsum, and that is characterized by closed depressions or sinkholes, caves, and underground drainage.

**latite.**—A porphyritic extrusive rock having phenocrysts of plagioclase and potassium feldspar (probably mostly sanidine) in nearly equal amounts, little or no quartz, and a finely crystalline to glassy groundmass, which may contain obscure potassium feldspar; the extrusive equivalent of *monzonite*. Latite grades into *trachyte* with an increase in the alkali feldspar content, and into *andesite* or *basalt*, depending on the presence of sodic or calcic plagioclase, as the alkali feldspar content decreases. It is usually considered synonymous with *trachyandesite* and *trachybasalt*, depending on the color.

**limestone.**—A sedimentary rock consisting chiefly of calcium carbonate, primarily in the form of the mineral calcite.

**losing stream.**—A stream or reach of a stream that contributes water to the zone of saturation.

**magnetic anomaly.**—The value of the local magnetic field remaining after the subtraction of the dipole portion of the Earth’s field.

**magnetic susceptibility.**—is the degree of *magnetization* of a material in response to a *magnetic field*.

**major ions.**—Constituents commonly present in water in concentrations exceeding 1.0 milligram per liter. Major cations are calcium, magnesium, sodium, and potassium; the major anions are sulfate, chloride, fluoride, nitrate, and those contributing to alkalinity (see alkaline), most generally assumed to be bicarbonate and carbonate.

**mean discharge (MEAN).**—As used by the U.S. Geological Survey, the arithmetic mean of individual daily mean discharges of a stream during a specific period, usually daily, monthly, or annually. The term “average” generally is reserved for average of record and “mean” is used for averages of shorter periods, namely, daily, monthly, or annual mean discharges.

**metapelitic.**—Derived by metamorphism of an argillaceous or a fine-grained aluminous sediment, such as consolidated volcanic ash consisting of clay-sized particles.

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**method detection limit.**—The minimum concentration of a substance that can be accurately identified and measured with current laboratory technologies.

**micrograms per liter ( $\mu\text{g/L}$ ).**—A unit expressing the concentration of constituents in solution as weight (micrograms) of solute per unit volume (liter) of water; equivalent to one part per billion in most streamwater and ground water. One thousand micrograms per liter equals one milligram per liter.

**milligal (mGal or mgal).**—a unit of acceleration used in geology to measure subtle changes in gravitational acceleration. One milligal equals 10 micrometers per second per second, or  $10^{-5}$  meters per second per second.

**micrograms per liter ( $\mu\text{g/L}$ ).**—A unit expressing the concentration of constituents in solution as weight (micrograms) of solute per unit volume (liter) of water; equivalent to one part per billion in most streamwater and ground water. One thousand micrograms per liter equals one milligram per liter.

**milligrams per liter (mg/L).**—A unit expressing the concentration of chemical constituents in solution as weight (milligrams) of solute per unit volume (liter) of water; equivalent to one part per million in most streamwater and ground water.

**minimum reporting level (MRL).**—The smallest measured concentration of a constituent that may be reliably reported using a given analytical method. In many cases, the MRL is used when documentation for the method detection limit is not available.

**montmorillonite.**—A group of expanding-lattice clay minerals of the general formula  $\text{R}_{0.33}\text{Al}_2\text{Si}_4\text{O}_{10}(\text{OH})_2 \cdot n\text{H}_2\text{O}$ , where R includes one or more of the cations  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Mg}^{+2}$ , and possibly others. The minerals are characterized by a three-layer crystal lattice, and by swelling when wetting (and shrinking on drying) due to the introduction of considerable interlayer water in the *c*-axis direction.

**mountain-front recharge.**—Natural recharge that occurs at the base of mountains and which then infiltrates into a permeable rock unit.

**muscovite.**—A mineral of the mica group:  $\text{KAl}_2(\text{AlSi}_3)\text{O}_{10}(\text{OH})_2$ . It is colorless to yellowish or pale brown, and is a common mineral in gneisses and schists, in most acid igneous rocks (such as granites and pegmatites), and in many sedimentary rocks (esp. sandstones).

**nanotesla (nT).**—a unit of magnetic field strength equal to  $10^{-9}$  tesla or  $10^{-5}$  gauss. The unit is used in geology to measure small changes in the Earth's magnetic field.

**ohm meter (ohm/m).**—a unit of resistivity, measuring the extent to which a substance offers resistance to passage of an electric current. The resistivity of a conductor in ohm meters is defined to be its resistance (in ohms) multiplied by its cross-sectional area (in square meters) divided by its length (in meters).

**overland flow.**—The flow of rainwater or snowmelt over the land surface toward stream channels.

**parts per billion (ppb).**—Unit of concentration equal to one billion units of water per unit of trace element or contaminant.

**parts per million (ppm).**—Unit of concentration equal to one milligram per kilogram or one milligram per liter.

**perched aquifer.**—An aquifer that occurs above the regional ground-water system with a vadose zone beneath it.

**perennial stream.**—One that flows continuously, year-round.

**permeability.**—The ability of a porous medium to transmit fluid under a given gradient.

**phreatophyte.**—A term that refers to plants that use ground water; often used as a synonym for “riparian plant.”

**picocurie (pCi).**—One trillionth ( $10^{-12}$ ) of the amount of radioactivity represented by a curie (Ci). A curie is the amount of radioactivity that yields  $3.7 \times 10^{10}$  radioactive disintegrations per second (dps). A picocurie yields 2.22 disintegrations per minute (dpm) or 0.037 dps.

**plagioclase.**—A group of triclinic feldspars of the general formula:  $(\text{Na}, \text{Ca})\text{Al}(\text{Si}, \text{Al})\text{Si}_2\text{O}_8$ . At high temperatures it forms a complete solid-solution series from albite,  $\text{Ab}(\text{NaAlSi}_3\text{O}_8)$ , to anorthite,  $\text{An}(\text{CaAl}_2\text{Si}_2\text{O}_8)$ . Plagioclase minerals are among the commonest rock-forming minerals, have characteristic twinning, and commonly display zoning.

**playa.**—A dry, flat area at the lowest part of an undrained desert basin in which water accumulates and is quickly evaporated; underlain by stratified clay, silt, or sand and commonly by soluble salts; term used in Southwestern United States.

**phenocrysts.**—Visible crystals in an igneous rock that are conspicuously larger than the surrounding matrix material.

**porosity.**—The volume of void space within earth materials. Primary porosity occurs with the formation of a rock mass. Secondary porosity represents void spaces that occur after the rock mass formed.

**potentiometric surface.**—A surface estimated by the level to which cased wells will rise. This surface represents total head, which includes elevation head and pressure head.

**precipitation.**—Any or all forms of water particles that fall from the atmosphere, such as rain, snow, hail, and sleet.

**recharge (ground water).**—The process involved in the absorption and addition of water to the zone of saturation; also, the amount of water added.

**recurrence interval.**—The average interval of time within which the magnitude of a given event, such as a storm or flood, will be equaled or exceeded once.

**resistivity.**—The property of a material that resists the flow of electrical current. Units are ohmmeters.

**return flow.**—That part of irrigation water that is not consumed by evapotranspiration and that returns to its source or another body of water.

**rhyolite.**—A group of extrusive igneous rocks, typically porphyritic and commonly exhibiting flow texture, with

phenocrysts of quartz and alkali feldspar in a glassy to cryptocrystalline groundmass; also, any rock in that group; the extrusive equivalent of *granite*. Rhyolite grades into *rhyodacite* with decreasing alkali feldspar content and into *trachyte* with a decrease in quartz.

**riparian.**—Pertaining to or situated on the bank of a natural body of flowing water.

**runoff.**—That part of precipitation or snowmelt that appears in streams or surface-water bodies.

**safe yield.**—A ground-water management goal which attempts to achieve and thereafter maintain a long-term balance between the annual amount of ground water withdrawn in an Active Management Area and the annual amount of natural and artificial recharge within a designated area.

**saturated zone (zone of saturation).**—A subsurface zone in which all the interstices or voids are filled with water under pressure greater than that of the atmosphere. See also *Water table*.

**shale.**—A fine-grained sedimentary rock formed by the consolidation of clay, silt, or mud.

**solution.**—Formed when a solid, gas, or another liquid in contact with a liquid becomes dispersed homogeneously throughout the liquid. The substance, called a solute, is said to dissolve. The liquid is called the solvent.

**sorption.**—General term for the interaction (binding or association) of a solute ion or molecule with a solid.

**sources.**—Contributions of water to a ground-water system, such as natural recharge from an aquifer unit or geographical area, precipitation, injection wells, or imported water.

**spring.**—A point where ground water intersects the land surface; a ground-water discharge point.

**standard deviation.**—Statistical measure of the dispersion or scatter of a series of values. It is the square root of the variance, which is calculated as the sum of the squares of the deviations from the arithmetic mean, divided by the number of values in the series minus 1.

**stream reach.**—A continuous part of a stream between two specified points.

**streamflow.**—The discharge of water in a natural channel.

**subbasin.**—An area which encloses a relatively hydrologically distinct body of ground water within a ground-water basin and which is described horizontally by surface description.

**surface runoff.**—Runoff that travels over the land surface to the nearest stream channel.

**surface water.**—An open body of water such as a pond, lake, river, or stream.

**synoptic survey.**—A detailed stream-gauging survey along a reach of stream, accounting for every gain or loss from diversion ditches or tributary inflows along a path. One can identify gaining or losing reaches if the values exceed the error limitations of the equipment. It is performed as a flux balance

approach to streamflow. Also, a short-term investigation of specific water-quality conditions during selected seasonal or hydrologic conditions, to provide improved spatial resolution for critical water-quality conditions.

**synoptic sites.**—Sites sampled during a short-term investigation of specific water-quality conditions during selected seasonal or hydrologic conditions, to provide improved spatial resolution for critical water-quality conditions.

**tholeiite.**—A silica-oversaturated (quartz-normative) basalt, characterized by the presence of low-calcium pyroxenes in addition to clinopyroxene and calcic plagioclase. Olivine may be present in the mode, but neither olivine nor nepheline appear in the norm.

**trace element.**—A chemical element that is present in minute quantities in a substance.

**tracer.**—A stable, easily detected substance or a radioisotope added to surface or ground water to follow the location of the substance in the environment to estimate hydraulic or hydrochemical properties.

**trachyte.**—A group of fine-grained, usually porphyritic, extrusive rocks having alkali feldspar and minor mafic minerals (biotite, hornblende, or pyroxene) as the main components, and possibly a small amount of sodic plagioclase; also, any member of that group; the extrusive equivalent of *syenite*.

**transmissivity.**—The rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of an aquifer under a unit hydraulic gradient. It equals the hydraulic conductivity multiplied by the aquifer thickness.

**unconfined aquifer.**—An aquifer whose upper surface is a water table free to fluctuate under atmospheric pressure.

**unconsolidated deposit.**—Deposit of loosely bound sediment that typically fills topographically low areas.

**unsaturated zone.**—A subsurface zone above the water table in which the pore spaces may contain a combination of air and water.

**upgradient.**—Of or pertaining to the place(s) from which ground water originated or traveled through before reaching a given point in an aquifer.

**upland.**—A general term for nonwetland; elevated land above low areas along streams or between hills; any elevated region from which rivers gather drainage.

**water budget.**—An accounting of the inflow to, outflow from, and storage changes of water in a hydrologic unit.

**water demand.**—Water requirements for a particular purpose, such as irrigation, power, municipal supply, plant transpiration, or storage.

**water table.**—The top of the saturated zone of an unconfined aquifer where the pressure is at atmospheric pressure.

**watershed.**—The region or area drained by a river and its tributaries.

## **References**

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