Designation: D4410 – 03

Terminology for Fluvial Sediment[1]

This standard is issued under the fixed designation D4410; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These terms are to be used by persons involved in collecting, reporting, and interpreting information pertaining to sedimentation and hydrologic processes as they apply in the development, use, control, and conservation of water and land resources.

2. Terminology

2.1 *Definitions:*

accelerated erosion—erosion at a rate greater than geologic or natural erosion.

DISCUSSION—Accelerated erosion is usually associated with anthropogenic activities and usually reduces plant cover and increases runoff.

accretion—a process of sediment accumulation.

aggradation—the geologic process by which stream beds, flood plains, and the bottoms of other water bodies are raised in elevation by the deposition of material eroded and transported by water from other areas.

alluvial deposit—sediment deposited by the action of moving water.

alluviation—the process of accumulating sediment deposits at places where the flow is retarded.

alluvium—a general term for all fluvial deposits resulting directly or indirectly from the sediment transport of (modern) streams, thus including the sediments laid down in riverbeds, flood plains, lakes, fans, and estuaries.

armoring—the formation of a resistant layer of relatively large particles by erosion of the finer particles.

avulsion—a sudden, natural change of a stream channel, so that the water flows elsewhere than in its previous course.

bag sampler—a sampler that utilizes a collapsible bag as the sample collection container.

base flow—stream flow that is sustained by ground water and other delayed sources.

bed-load—material moving on or near the stream bed by rolling, sliding, and skipping.

bed-load discharge—the quantity of bed-load passing a cross section of a stream in a unit of time.

bed-load sampler—a device for sampling the bed-load.

bed material—the sediment mixture of which the stream bed is composed.

bed-material discharge—that part of the total sediment discharge composed of grain sizes occurring in appreciable quantities in the bed material.

bed-material load—that part of the total load which is composed of particle sizes present in appreciable quantities in the shifting portions of the stream bed.

boulder size (fluvial sediment)—larger than 256 mm in diameter.

braided river—a wide- and shallow-river where the flow passes through a number of small interlaced channels separated by bars or shoals.

channel—a natural or artificial waterway that periodically or continuously contains moving water.

clay size (fluvial sediment)—0.00024 to 0.004 mm in diameter.

cobble size (fluvial sediment)—64 to 256 mm in diameter.

cohesive sediments—that material whose resistance to initial movement or erosion depends upon the strength of the bond between particles.

colloids (fluvial sediment)—smaller than 0.00024 mm in diameter.

colluvial deposits—that material accumulated along valley margins by mass movements from the adjacent hillsides.

composite sample—a sample formed by combining two or more individual samples or representative portions of the samples.

concentration (volume)—the ratio of the volume of dry sediment to the volume of the water-sediment mixture.

concentration of sediment (by mass)—the ratio of the mass of dry sediment in a water-sediment mixture to the mass of the mixture.

critical flow—open channel flow in which the energy, expressed in terms of depth plus velocity head, is a minimum for a given flow rate and channel. The Froude number is unity at critical flow. **D5614**

[1] This terminology is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.07 on Sediments, Geomorphology, and Open-Channel Flow.

Current edition approved Aug. 10, 2003. Published September 2003. Originally approved in 1984. Last previous edition approved in 1998 as D4410 – 98. DOI: 10.1520/D4410-03.

debris—as applied to geologic debris flows, a mixture of loose, poorly-sorted rock fragments or soil material, or both, potentially ranging from clay to boulder-size particles that may include fragmental organic matter and other exotic detritus.

degradation—the geologic process by which stream beds, flood plains, the bottoms of other water bodies, and other land surfaces are lowered in elevation by the removal of material by fluids.

delivery rate—use **sediment delivery ratio** or sediment yield, whichever is meant.

delta—a sediment deposit formed where moving water is slowed by a slower moving body of water.

density current—the movement of one fluid under, through, or over another fluid of differing density.

deposition—the chemical, mechanical, or biological processes through which sediments accumulate in a resting place.

diameter, sedimentation—the diameter of a hypothetical sphere of the same specific gravity and the same settling velocity as the given particle in the same fluid.

direct-measuring bed-load sampler—a device which physically collects and holds bed load.

dispersed system—in laboratory analysis of grain sizes, an initial condition whereby the particles begin to settle from a stirred mixture; when stirring stops, each particle settles independently of other particles.

dissolved load—the part of the stream load that is carried as dissolved solids.

dissolved solids—the mass of constituents in a filtered water sample. For operational purposes, the filter pore is usually 0.00045 mm.

drainage basin—See **watershed**.

ephemeral gully—a channel that is formed by gully erosion on cropland and that is routinely but temporarily obscured by mechanical operations such as tilling.

fall velocity—the settling rate of a particle in a given medium.

filtrate—the fluid that has passed through a filter.

filtration—the process of passing a liquid through a porous medium for the removal of suspended matter.

fine-material load—that part of the total sediment load that is composed of particles of a finer size than the particles present in appreciable quantities in the bed material; normally, the fine-material load consists of material finer than 0.062 mm.

flocculant—an agent that produces flocs or aggregates from small suspended particles.

flocculating agent—a coagulating substance such as alum, ferrous sulfate, or lime which, when added to water, forms a precipitate that expedites the settling of suspended matter.

fluvial sediment—particles derived from rocks, biological materials, or chemical precipitants, that are transported by, suspended in, or deposited by flowing water.

gage height—the height of a water surface above an established or arbitrary datum at a particular gaging station; also termed stage. **D5674**

gaging station—a particular site on a stream, canal, lake, or reservoir at which systematic observations of hydrologic data are obtained. **D5674**

geologic erosion—the erosion process on a given land form that is not associated with the activities of man.

graded stream—a stream in which a steady state has been reached such that over a period of time the discharge and sediment load entering the system are balanced by the discharge and sediment load leaving the system.

grading—the degree of mixing of size classes in sedimentary material.

gravel size (fluvial sediment)—between 2.0 and 64 mm in diameter.

gross erosion—the total of all sheet, gully, and channel erosion in a watershed.

hydraulic jump—an abrupt transition from supercritical flow to subcritical or tranquil flow, accompanied by considerable turbulence or gravity waves, or both. **D5614**

isokinetic sampling—to sample in such a way that the water-sediment mixture moves with no change in velocity as it leaves the ambient flow and enters the sampler intake.

lateral accretion deposits—See **point bar.**

maximum transit rate—the maximum speed at which the sampler can be lowered and raised in the sampling vertical and still have the sample collected isokinetically.

median diameter—the grain diameter such that half of the sediment by mass is composed of particles of larger size and half by mass is composed of particles of smaller size; commonly denoted by the symbol "D_{50}".

naturally dispersed sample—a sample having sediment that will not settle in about 4 h due to the character of fineness of particles or due to the nature of the dissolved constituents, or both.

nephelometer—an instrument that measures the amount of light scattered in a suspension.

overland flow—rainfall runoff from a surface containing concentrated flow no larger than rill flow.

plane bed—a sedimentary stream bed without elevations or depressions larger than the maximum size of the bed material.

point bar—one or a series of low ridges, usually of coarse sediment, deposited on the inner (convex) side of a river bend.

point-integrated sample—a sample of water-sediment mixture collected at a relatively fixed point in accordance with the technique of point integration. A point-integrated sample is discharge weighted. However, because the sample is obtained from a single point, the concentration of any component of the mixture that is transported exactly at stream velocity can be considered as either a spatial or a discharge-weighted concentration. Samples collected with instruments that instantaneously capture a quantity of water-sediment mixture are not true point-integrated samples. (See **point sample**.)

point integration—a method of sampling at a relatively fixed point whereby the water-sediment mixture is withdrawn isokinetically for a specified period of time.

pollution—the condition caused by the presence of substances of such character and in such quantities that the quality of the

environment is impaired.

reservoir—a man-made impounded body of water or controlled lake where water is collected and stored.

reynolds number—a dimensionless number expressing the ratio of inertia forces to viscous forces in a moving fluid. The number is given by VLr/m where "V", is the fluid's velocity, "L" is a characteristic length or distance such as pipe diameter, "r" is the fluid's mass density, and "m" is the fluid's dynamic viscosity.

ripple—small, triangular-shaped bed forms that are similar to dunes but smaller.

roundness—the ratio of the average radius of curvature of the individual edges of a particle to the radius of the maximum circle that can be inscribed within the particle.

runoff—that part of precipitation appearing in surface streams.

sampled zone—that part of a transect presumed to be wholly represented by sediment samples.

sampling vertical—an approximately vertical path from the water surface to the bottom along which one or more samples are collected to define various properties of the flow, such as sediment concentration.

sand size (fluvial sediment)—0.062 to 2 mm in diameter.

scale of particle sizes—based on AGU (American Geophysical Union) scale.

scour—the enlargement of a flow section by the removal of the boundary material by the motion of a fluid.

sediment—See **fluvial sediment.**

sediment delivery—See **sediment yield.**

sediment delivery ratio—the ratio of sediment yield to gross erosion expressed in percent.

sediment load—a general term that refers to material in suspension or in transport, or both; it is not synonymous with either discharge or concentration. (See **bed-load** and **suspended-sediment load**.)

sedimentology—the scientific study of sediment, sedimentary rocks, and the processes by which they were formed.

sediment particle—fragment of mineral or organic material in either a singular or aggregate state.

sediment transport rate—See **sediment discharge**.

settling—the process of depositing, by gravity, matter suspended in water.

silt size (fluvial sediment)—0.004 to 0.062 mm in diameter.

siltation—See **deposition.**

sloughs—a stagnant or sluggish channel of water in a flood plain.

sorting—the process by which sedimentary particles are selectively separated from associated but dissimilar particles by flowing water.

specific gravity—ratio of the mass of any volume of a substance to the mass of an equal volume of water at 4°C.

specific weight (of sediment deposits)— the dry weight of sediment solids per unit volume of deposit in place. Synonymous with **volume-weight.**

splay—deposits of flood debris, usually of sand, scattered on the flood plain.

split sample—a single sample separated into two or more individual parts in a manner that each part is representative of the original sample.

standard-fall diameter—the diameter of a sphere with a specific gravity of 2.65 and the same standard-fall velocity as the particle.

standard-fall velocity—the rate of fall that a particle would finally attain if falling alone in quiescent distilled water of infinite extent and a temperature of 24°C.

standard-sedimentation diameter—the diameter of a sphere with the same specific gravity and fall velocity as the given particle.

stream discharge—the quantity of flow passing through a cross section in a unit of time.

subcritical flow—open channel flow that is deeper and at lower velocity than critical flow for the same flow rate; sometimes called tranquil flow. A Froude number less than one exists. **D5614**

supercritical flow—open channel flow that is shallower and at higher velocity than critical flow for the same flow rate. A Froude number greater than one exists. **D5614**

supernate or supernatant—the liquid above the surface of settled sediment.

suspended sediment—sediment that is carried in suspension by the turbulent components of the fluid or by Brownian movement.

suspended-sediment concentration—See **concentration of sediment (by mass).**

suspended-sediment discharge—the quantity of suspended-sediment passing through a stream cross section per unit of time.

suspended-sediment sampler—a device that collects a representative portion of the water with its suspended-sediment load.

terminal velocity—the limiting velocity reached by a particle falling under the action of gravity in a still liquid at a specified temperature.

thalweg—the line connecting the lowest or deepest point along a stream bed, valley, or reservoir, whether underwater or not.

topset bed—a layer of sediment deposited on the top surface of an advancing delta that is continuous with the landward alluvial plain.

total-sediment discharge—the total quantity of sediment passing a section per unit of time.

total-sediment load (total load)—all of the sediment in transport; that part moving as suspended load plus that moving as bedload.

traction—transport of debris by running water in which the particles are swept along close to the bed of the stream by rolling, sliding, or saltation.

tranquil flow—see **subcritical flow**.

transit rate—the speed at which the suspended-sediment sampler is lowered and raised in the sampling vertical.

transit-rate ratio—the ratio computed by dividing the transit rate by the mean stream velocity in the vertical being sampled.

trap efficiency—the percent of the incoming sediment load that is deposited.

turbidity current—See **density current**.

turbulence—the irregular motion of a flowing fluid.

unit bed-load discharge—bed-load discharge per unit width