

AQUATIC HABITAT INVENTORY

Glossary
and
Standard Methods

Habitat Inventory Committee

Western Division
American Fisheries Society

Introduction

During the annual meeting of the Western Division of the American Fisheries Society at Teton Village, Wyoming in July, 1983 a panel discussion on standardizing habitat evaluation systems was included on the program. Panelists and members of the audience supported the concept of standardization, and suggested the Western Division form a committee to undertake the effort. The Western Division Executive Committee agreed, and appointed William T. Helm, Utah State University, to chair the committee, and Paul Brouha, U.S. Forest Service as Vice-chair. Formation of the committee was completed and the first meeting held by mid-April 1984. Both geographic distribution and employment affiliation were factors in assembly of the following committee:

Mike Aceituno, Bureau of Land Management, California
Carl Armour, U.S. Fish and Wildlife Service, Colorado
Peter Bisson, Weyerhaeuser Co., Washington
James Hall, Oregon State University, Oregon
George Holton, Department of Fish, Game, and Parks, Montana
Mark Shaw, U.S. Forest Service, Utah

Committee objectives were to assemble a glossary of aquatic habitat terms, and to describe and evaluate procedures for measuring each habitat component. Immediacy of need and magnitude of the problem dictated separation into manageable topics. Thus a glossary of stream habitat terms was selected as the first priority, followed by a chapter on standard methods for acquisition of stream habitat inventory information. A third chapter is to be a glossary of lake and reservoir habitat terms, with a fourth chapter on standard methods for acquisition of lake and reservoir habitat inventory information. Sufficient additional information pertaining to Chapter one, the stream habitat glossary, may be available by the time Chapter Three, the lake and reservoir glossary is being developed, that one joint chapter on stream, lake and reservoir terms can be published.

The philosophy behind this effort is that a standardized list of terms, definitions and methods related to habitat evaluation and development will encourage consistent use of the terms and methods, which in turn will simplify interpretation of data when exchanges between agencies and/or regions within agencies occur. Widespread use of the glossary and standard methods will make possible extensive exchanges of habitat inventory data via automatic data processing procedures. This feature would make comparative information more available, and should also result in savings in time and expenditures by avoiding duplicative inventories.

While the committee efforts may result in recommendations for a particular set of components to be measured by everyone, regardless of which evaluation method is used, in order to promote widespread use and exchange of data, there is no intent to coerce anyone into using any particular evaluation method. Rather, our hope is that the attractive features of the availability of a standard set of habitat component measurements will encourage widespread use of that standard set, thus making feasible exchanges of data via automatic data processing.

The products of the Aquatic Habitat Inventory Committee shall include:

Chapter I—Glossary of Stream Habitat Terminology

Chapter II—Standard Methods for Acquisition of Stream Habitat Inventory Information

Chapter III—Glossary of Lake Habitat Terminology

Chapter IV—Standard Methods for Acquisition of Lake Habitat Inventory Information

Possible additional chapters include:

Chapter V—Suggested (Minimum) Standards for Data Acquisition in Specific Management Situations and Habitats

Chapter VI—Suggested Land/Aquatic Classification System for Streams and Lakes

Chapter VII—Suggested Database Management Concepts to Ensure Data Sets Interface

Chapter VIII—Suggested Applications of Data to Management Processes

Table of Contents

Introduction

Chapter One—Glossary of Stream Habitat Terminology

Forward
Glossary

Chapter Two—Standard Methods for Acquisition of Stream Habitat Inventory Information

Forward
Description of Methods

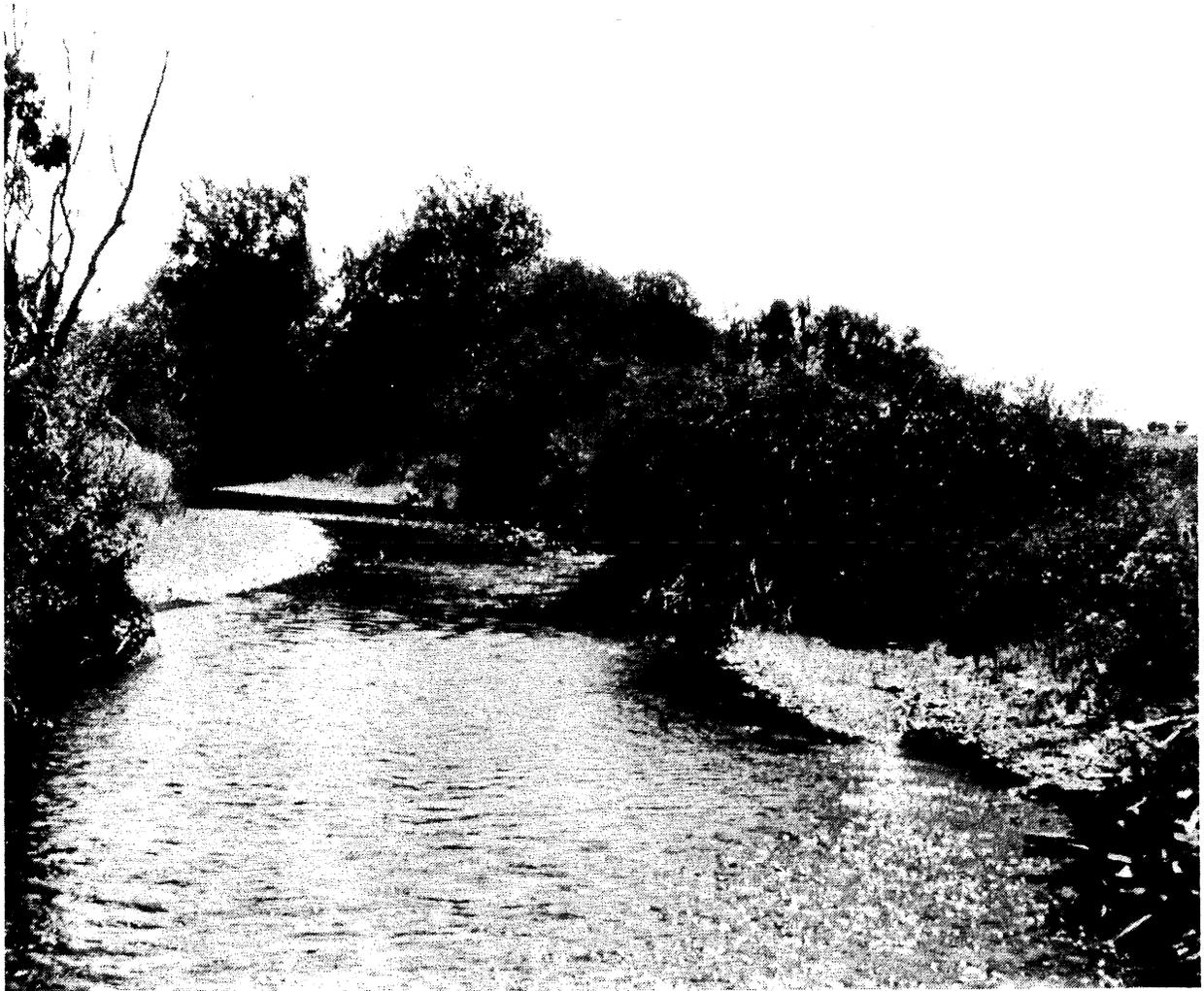
Chapter Three—Glossary of Lake and Reservoir Habitat Terminology

Forward
Glossary

Chapter Four—Standard Methods for Acquisition of Lake and Reservoir Habitat Inventory Information

Forward
Description of Methods

GLOSSARY OF
STREAM HABITAT TERMS



Habitat Inventory Committee
Western Division
American Fisheries Society

GLOSSARY OF STREAM HABITAT TERMS

William T. Helm, Editor

Compiled by the Habitat Inventory Committee of the Western Division,
AMERICAN FISHERIES SOCIETY.

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Forward

Throughout North America and internationally, methods of inventorying stream habitat have been developing without widely recognized standards. Various agencies and organizations, because of differences in missions and needs and because of the interest and biases of the personnel involved, have independently developed a variety of inventory systems. From system to system, there are variations in the habitat components measured, in the methods of measurement, and in the names and meanings applied to the components. While the attitude expressed in Alice in Wonderland that "When I use a word it means exactly what I want it to mean" may lead to some creative uses of terms, it also promotes confusion and misunderstanding. This confusion minimizes the comparison and exchange of data among scientists and organizations, and may lead to duplication of effort and erroneous interpretations. Rarely is habitat information useful only to one group of scientists and for a single purpose. Thus, it is desirable to have an inventory system that fits the needs of participating organizations, and at the same time is in a form that can be used by others.

The call for standardization of nomenclature has been heard before, without effective results. Realizing this need for standardization the Western Division, American Fisheries Society undertook this effort. This glossary is the first step of that effort to infuse understanding in this multi-disciplinary field. It has been developed to encourage consistent use of those terms utilized by workers involved in the inventory and analysis of stream habitat. Proper use of these terms and definitions would provide a common language for habitat work and ensure the applicability and accuracy of various measurement methods. Hopefully this glossary will standardize the meaning of habitat terms, yet not restrict their evolution and development. It is to be a dynamic entity, with periodic revisions and updating.

The word "stream" is commonly applied to any body of running water. Rather than attempt to distinguish rivers, streams, creeks, etc., the term stream is used throughout.

Our perceptions of stream habitat have been broadening over time. Today we include more than just the stream channel. We also include the riparian habitat and conditions and events beyond it because these all have an impact on the stream.

References are supplied, but the reader should be aware that we have often modified the original description to fit a wide range of stream types and situations. Some terms have more than one definition (e.g. slough, fill), generally because the definitions were developed by different professions, or were developed in different geographic regions. Where there are differences in meaning between the biological and physical science definitions, we have attempted to include both, in part to emphasize the potential problem of confusion in the use of such terms. There are two quite different definitions for minimum flow. We suggest a new or different term should be used for one definition (see Flow, minimum and Flow, least). A glossary of stream habitat terms should serve the spectrum of disciplines involved, which is why a variety of sources and reviewers was utilized in compiling this glossary.

We undertake this effort with due regard for Balon's (1982) concerns about committees and nomenclature. As he put it, "How much useful contribution, for example, can be expected from committees on 'standardization of nomenclature'? Nearly in all cases I know about, conclusions reached in such committees ratify parochial dogmas, many disproven [a] long time ago, rather than contribute to knowledge. Consequently, by false restriction of choices they retard future contributions." He concluded, "It is not the nomenclature that matters but the clear definitions of the contents given to terms, a truism most frequently misunderstood."

We encourage users of this glossary to provide us with suggestions for improvement. Additional terms, with definitions, and suggested modifications to or alternatives for the definitions here provided would be welcome. Suggestions can be sent to Dr. William T. Helm, Chairman, WDAFS Habitat Inventory Committee, Department of Fisheries and Wildlife, Utah State University, Logan, UT 84322.

Acknowledgements

We are indebted to the members of the six subcommittees who compiled the list of terms and definitions; to the reviewers whose suggestions immeasurably improved the glossary; to Jack Griffith for his skillful editing; to the organizations that permitted personnel to devote time and provided travel funds for committee meetings; to those individuals who expended personal funds for travel and/or lodging while attending committee meetings; and Janet Slaugh, Tamara D. Smith and Lynne Howard for patiently typing numerous revisions of this glossary. Past and present officers of the Western Division offered direction, continued support, encouragement, and assistance.

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Glossary

Illustrations are placed above the corresponding definition.

Abstraction: (a) The long term to permanent removal of surface flow from the channel. (b) A simple type of stream capture.

Accretion: (a) A process of accumulation by flowing water, whether of silt, sand, pebbles, etc. (b) Channel-flow; the gradual increase in the flow of a stream due to influent seepage.

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 from other areas. It is the opposite of degradation.

Alcove: See Pool.

Alkalinity: A measure of the power of a solution to neutralize hydrogen ions (H⁺) usually expressed as mg/l CaCO₃.

Alluvial stream: Named after the silts, clays, sands, and gravels of river origin that compose their bed, banks, and flood plains, alluvial streams are characterized by a distinctive S-shaped channel pattern that is free to shift slowly (meander) in the valley. Repeated bank cavings do not widen the channel as they do in erodable bed streams. Alluvial streams have their bed materials conveyed from upstream, and they tend to be large.

Alluvium: A general term for all deposits resulting directly or indirectly from the sediment transport of streams, thus including the sediments laid down in riverbeds, flood plains, lakes, fans and estuaries.

Anchor ice: Ice formed below the surface of a stream, on the stream bed or upon a submerged body or structure.

Apparent velocity: The rate of flow of subsurface water through the substrate, expressed as the volume of water flowing per unit of time through a unit area (of solids plus voids). Also called interstitial velocity.

Armoring: (a) The formation of an erosion-resistant layer of relatively large particles on the surface of the stream bed which resists degradation by water currents, resulting from removal of finer particles by erosion. (b) The application of various materials to protect stream banks from erosion.

Attribute: See Habitat component.

Backwater: See Pool.

Bank: See Stream bank.

Bank storage: Infiltration of water into stream bank material during periods of high flow.

Bankfull discharge: The discharge corresponding to the stage at which the flood plain of a particular stream reach begins to be flooded. The point at which overbank flow begins.

Bar: (a) A ridge-like accumulation of sand, gravel, or other alluvial material formed in the channel, along the banks, or at the mouth of a stream where a decrease in velocity induces deposition. (b) An alluvial deposit or bank of sand, gravel, or other material, at the mouth of the stream or at any point in the stream itself which obstructs flow and induces depositions. Chamberlain (1980) gives a description of bar types as follows:

braiding—pattern of river bars with numerous interconnected small channels.

diamond/braiding—multiple diamond-shaped interconnected mid-channel bars characteristic of braided rivers.

dunes—wave-like bed form common in relatively active sand bed channels.

islands—bars or land segments within the stream channel that are relatively stable, usually vegetated, and normally surrounded by water.

junction bar—a bar formed at the junction of two streams, usually because sediment transported by a tributary is deposited in the slower-moving water of the mainstem.

lee bar—a bar caused by eddies and lower current velocities and formed in the lee of large immovable objects such as boulders or logs.

mid-channel bar—bar found in the mid-channel zone, not extending completely across the channel.

point bar—bar found on the inside of meander bends.

side bar—bar located at the side of a river channel, usually associated with the inside of slight curves.

transverse bar—bar that extends diagonally across the full width of the active stream channel.

Basin: See Drainage area.

Beaded Stream: A stream consisting of a series of small pools or lakes connected by short stream segments; e.g., a stream commonly found in a region of paternoster lakes or an area underlain by permafrost.

Bed load: Sediment moving on or near the stream bed and frequently in contact with it.

Bed-load discharge: The quantity of bed load passing a given point in a unit of time, expressed as dry weight.

Bed roughness: A measure of the irregularity of stream bed materials as they contribute to resistance to flow. Commonly measured in terms of Manning's roughness coefficient.

Benthos: Organisms living on or within a stream's substrate.

Berm: A levee, shelf, ledge or bench along a stream bank that may extend laterally into the channel to partially obstruct the flow, or parallel to the flow to contain the flow within its stream banks. May be natural or man-made.

Biological or biochemical oxygen demand (BOD): The amount of molecular oxygen required to stabilize decomposable matter by aerobic biochemical action.

Biological indices:

biotic condition index (BCI): A value expressed as a percent of that predicted. The predicted community tolerance quotient, which is based upon its potential as determined by natural physical and chemical characteristics, is divided by the actual community tolerance quotient from the samples. The quotient is multiplied by 100 to obtain the BCI value.

community tolerance quotient (CTQ): A value that represents a total of the tolerance quotients per sample divided by the number of taxa in the sample. Values generally range from 40 to 108; the higher numbers indicate more tolerant communities and may show stressed conditions depending upon the capability and potential of the stream.

DAT (Dominance and Taxa): A diversity index that combines dominance and the number of taxa. A dominance of one or more species often indicates stress conditions. The number of species (taxa) present also reflects the health of the aquatic habitat.

diversity index: A numerical value derived from the number of individuals per taxon (abundance) and the number of taxa present (richness).

tolerance quotient (TQ): A numerical value which indicates the relative tolerance of a taxon to natural environmental levels of physical and chemical parameters found limiting to some species. Low numbers indicate nontolerant species and higher numbers indicate tolerance, with 108 most tolerant.

Biomass: (a) The weight of a taxon or taxa per unit of stream surface; (b) Amount of substance in a population, expressed in material units, such as living or wet weight, dry weight, ash-free weight, nitrogen content, etc.; also called standing crop.

Bog: A wetland comprised of in-situ accumulations of poorly to moderately decomposed peats that are derived chiefly from sphagnum mosses. The water is acidic.

Bole: See large organic debris.

Boulder: Stream substrate particle larger than 256 mm in diameter. See Substrate particle size table.

Braided: A stream that divides into an interlacing or tangled network of several branching and reuniting channels separated from each other by branch islands or channel bars.

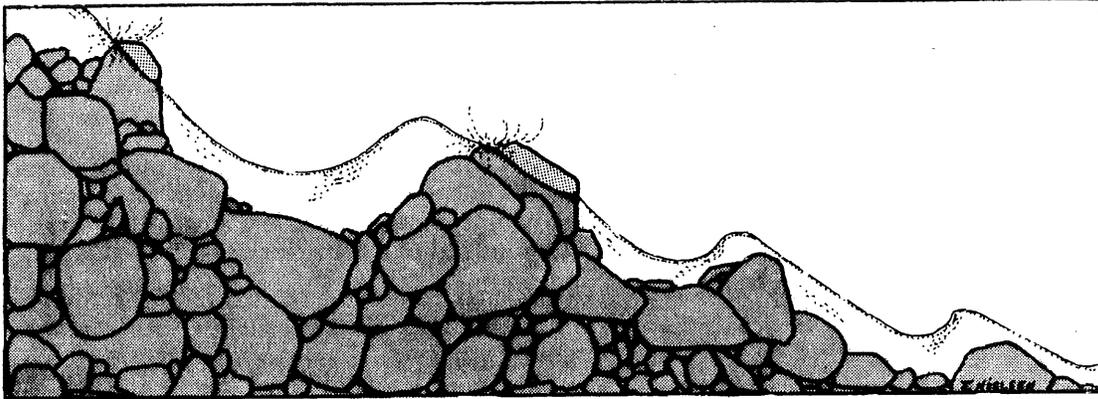
Buffer strip: Vegetation strip left intact along a stream or lake after logging.

Canopy: The overhead branches and leaves of streamside vegetation.

Canopy cover: The vegetation that projects over the stream. Can arbitrarily be divided into two levels: **Crown cover** is more than 1 m above the water surface. **Overhang cover** is less than 1 m above the water surface.

Canopy density: The percentage of the stream covered by the canopy of plants, sometimes expressed by species.

Carrying capacity: The maximum average number or biomass of organisms or a given species that can be sustained on a long term basis under a given flow regime by a stream or stream reach.



Cascade: Habitat type characterized by swift current, exposed rocks and boulders, high gradient and considerable turbulence and surface agitation, and consisting of a stepped series of drops.

Catchment area: See Drainage area.

Channel: A natural or artificial waterway of perceptible extent that periodically or continuously contains moving water. It has a definite bed and banks which serve to confine the water.

Channelization: Straightening of a stream or the dredging of a new channel to which the stream is diverted.

Channel pattern: The configuration of a stream as seen from above. Described in terms of its relative **curvature**, it includes:

straight: Very little curvature within the reach.

sinuous: Slight curvature within a belt of less than approximately two channel widths.

irregular: No repeatable pattern.

irregular meander: A repeated pattern vaguely present in the channel plan. The angle between the channel and the general valley trend is less than 90 degrees.

regular meander: Characterized by a clearly repeated pattern.

tortuous meander: A more or less repeated pattern characterized by angles greater than 90 degrees.

Channel stability: A measure of the resistance of a stream to erosion that determines how well a stream will adjust to and recover from changes in flow or sediment transport.

Channel width: The horizontal distance along a transect line from bank to bank at the high water marks, measured at right angles to the direction of flow. Multiple channel widths are summed to represent total channel width.

Check dam: A small dam designed to retard the flow of water and sediment in a channel, used especially for controlling soil erosion. Also used in channels to divert intragravel water toward surface water for interchange of dissolved gases.

Chemical oxygen demand (COD): Represents the reduction capacity of organic matter present, and is nearly proportional to its heat of formation. It is an estimate of that proportion of the sample which is susceptible to oxidation by a strong chemical oxidant.



Chute: (a) A narrow, confined channel through which water flows rapidly; a rapid or quick descent in a stream, usually with a bedrock substrate. (b) A short straight channel which by-passes a long bend in a stream, and formed by the stream breaking through a narrow land area between two adjacent bends.

Climatic year: A continuous 12-month period during which a complete annual cycle occurs. The USGS uses the period October 1 to September 30 in the publication of its records of streamflow. Also called water year.

Cobble: Stream substrate particles between 64 and 256 mm in diameter. Syn: Rubble. See Substrate particle size table.

Colluvium: A general term for loose deposits of soil and rock moved by gravity; e.g. talus.

Community indicators: See Biological indices.

Competence: The maximum size of particle that a stream can carry. This is governed by water velocity.

Conductivity: A measure of the ability of a solution to carry an electrical current dependent on the total concentration of ionized substances dissolved in the water.

Consumptive use of water: Occurs when water is taken from a stream and not returned.

Corner: See Pool.

Cover: Anything that provides protection from predators or ameliorates adverse conditions of streamflow and/or seasonal changes in metabolic costs. May be instream cover, turbulence, and/or overhead cover, and may be for the purposes of escape, feeding, hiding, or resting.

Cross-Sectional area: The area of a stream, channel, or waterway opening, usually taken perpendicular to the stream centerline.

Dammed: See Pool.

Debris: (a) Material scattered about or accumulated by either natural processes or human influences.

Debris jam: Log jam. Accumulation of logs and other organic debris.

Debris loading: The quantity of debris located within a specific reach of stream channel, due to natural processes or human activities.

Degradation: The geologic process by which stream beds and flood plains are lowered in elevation by the removal of material. It is the opposite of aggradation.

Dendritic: Channel pattern of streams with tributaries that branch to form a tree-like pattern.

Density: Number of individuals per unit area.

Deposition: The settlement or accumulation of material out of the water column and onto the stream bed. Occurs when the energy of flowing water is unable to support the load of suspended sediment.

Depth: The vertical distance from the water surface to the stream bed.

Detritus: (a) A non-dissolved product of disintegration or wearing away. Pertains to organic or inorganic matter. (b) A collective term for loose rock or mineral matter that is worn off or removed directly by mechanical means; especially fragmental material such as sand, silt, and clay, moved from place of origin.

Discharge: Volume of water flowing in a given stream at a given place and within a given period of time, usually expressed as m^3/sec .

Dissolved oxygen: The concentration of oxygen dissolved in water, expressed in mg/l or as **percent saturation**, where saturation is the maximum amount of oxygen that can theoretically be dissolved in water at a give altitude and temperature.

Diversion: A temporal removal of surface flow from the channel.

Diversity index: The relationship of the number of taxa (richness) to the number of individuals per taxon (abundance) for a given community. See Habitat quality index.

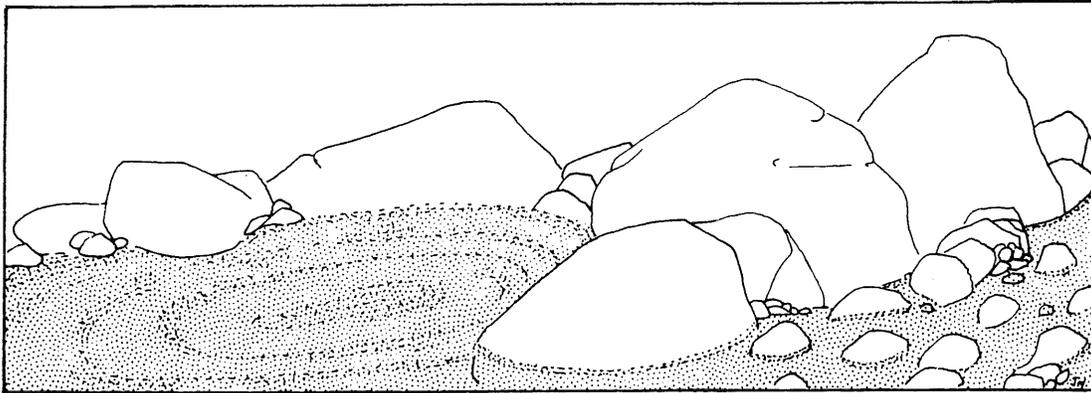
Dominant discharge: The cycle of rising and falling flows in the vicinity of bankfull flows, sustained over a long enough period that it alters a natural channel by dislodging, transporting, and distributing bed materials.

Drainage area: Total land area draining to any point in a stream, as measured on a map, aerial photo or other horizontal plane. Also called catchment area, watershed, and basin.

Drainage density: The relative density of natural drainage channels in a given area, expressed as kilometers of stream channel per square kilometer of drainage area. Syn: stream density.

Drift: (a) Voluntary or accidental dislodgement of aquatic invertebrates from the stream bottom into the water column where they move or float with the current. (b) Any detrital material transported in the water current.

Dynamic equilibrium: A condition of a system in which there is a balanced inflow and outflow of material.



Eddy: A circular current of water, sometimes quite strong, diverging from and initially flowing contrary to the main current. It is usually formed at a point at which the flow passes some obstruction or on the inside of river bends. Often forms backwater pools or pocket water in riffles.

Embeddedness: The degree that larger particles (boulders, rubble, or gravel) are surrounded or covered by fine sediment. Usually measured in classes according to percentage of coverage of larger particles by fine sediments.

Enhancement: An improvement of conditions that provide for the betterment over natural conditions of the aquatic, terrestrial, and recreational resources.

Ephemeral stream: See Stream, Ephemeral.

Fall: (a) A free fall or precipitous descent of water. The plural, falls, may apply to a single waterfall or to a series of waterfalls. (b) A very fast white water cascade.

Fen: Peat land fed by relatively fast moving, nutrient-rich water. Water usually neutral to basic and rich in calcium. The peat is mainly made up of decaying sedges and rushes.

Fill: (a) The localized deposition of material eroded and transported from other areas, resulting in a change in bed elevation. This is the opposite of scour. (b) The deliberate placement of (generally) inorganic materials in a stream, usually along the bank.

Fine sediment: The fine grained particles in stream banks and substrate. These have been defined by diameter, varying downward from 6 mm.

Fish depth: See Fish elevation.

Fish elevation: The elevation of a fish above the stream bed measured at the tip of the fish's snout. See Focal point.

Fish habitat: The aquatic environment and the immediately surrounding terrestrial environment that, combined, afford the necessary biological and physical support systems required by fish species during various life history stages.

Fish habitat indices: See Habitat quality indices.

Flat: See Pool

Flood: Any flow that exceeds the bankfull capacity of a stream or channel and flows out on the flood plain; greater than bankfull discharge.

Flood level: The elevation of the water surface of a stream during a particular flood.

Flood plain: Any flat, or nearly flat lowland that borders a stream and is covered by its waters at flood stage. Also floodplain, flood-plain.

Flood recurrence interval: See Recurrence interval.

Flow: (a) The movement of a stream of water and/or other mobile substances from place to place. (b) The movement of water, and the moving water itself. (c) The volume of water passing a given point per unit of time. Syn: Discharge.

base flow: The portion of the stream discharge that is derived from natural storage i.e., groundwater outflow and the draining of large lakes and swamps or other source outside the net rainfall that creates surface runoff; discharge sustained in a stream channel, not a result of direct runoff and without the effects of regulation, diversion, or other works of man. Also called sustaining, normal, ordinary or groundwater flow.

duration flow: A curve which expresses the relation of all the units of some item such as head, flow, etc., arranged in order of magnitude along the ordinate, and time, frequently expressed in percentage, along the abscissa. A graphical representation of the number of times given quantities are equaled or exceeded during a certain period of record.

enhancement flow: An improvement of flow conditions that provides improvement over natural conditions for the aquatic, terrestrial, and other recreation resources. See improvement flow.

flushing flow: That discharge (natural or man-caused) of sufficient magnitude and duration to scour and remove fines from the stream bed gravel to maintain intragravel permeability.

improvement flow: That discharge which will improve upon **existing** aquatic organisms and/or related recreational activity by correcting for water quality deterioration and/or utilization pressures. See enhancement flow.

index flow: The discharge at the time of measurement.

instantaneous flow: That discharge measured at any instant in time, applied to any recommended flow term when modified by the appropriate adjective.

instream flow: Streamflow regime required to satisfy a mixture of conjunctive demands being placed on water while it is in the stream.

instream flow requirements: That amount of water flowing through a stream course needed to sustain instream values at an acceptable level.

interstitial flow: See intragravel flow.

intragravel flow: That portion of the surface water that infiltrates the stream bed and moves through the substrate pores.

laminar flow: That type of flow in a stream of water in which each particle moves in a direction parallel to every other particle.

least flow: Negotiated lowest flow in a regulated stream that will sustain an aquatic population at agreed upon levels. This flow may vary seasonally. See **minimum flow**.

low flow: The lowest discharge recorded over a specified period of time. Also called minimum flow.

mean flow: The average discharge at a given stream location, usually expressed in m³/sec, computed for the period of record by dividing the total volume of flow by the number of days, months, or years in the specified period.

minimum flow: (a) The lowest discharge recorded over a specified period of time (preferred definition). (b) Negotiated lowest flow in a regulated stream that will sustain an aquatic population at agreed upon levels. This flow may vary seasonally. (This recently developed definition is in conflict with the older definition (a) and to avoid confusion should not be used. A suggested alternative is to apply this definition to the term **least flow**.)

modified flow: The discharge at a given point in a stream resulting from the combined effects of all upstream and at-site operations, diversions, return flows, and consumptive uses.

natural flow: The flow as it occurs under natural unregulated conditions at a given stream location.

optimum flow: The discharge regime that allows for the maximum expression of the carrying capacity of any specified use in a stream. Any flow above or below this flow becomes limiting to the use under consideration.

peak flow: The highest discharge recorded over a specified period of time. Often thought of in terms of spring snowmelt, summer, fall or winter rainy season flow. Also called maximum flow.

regime: (a) The condition of a stream with respect to the rate of its average flow as measured by the volume of water passing different cross sections in a specified period of time. In this unspecialized sense, the term is incorrectly used as a syn. of regimen. (b) The existence in a stream channel of a balance or grade between erosion and deposition over a period of years.

regimen: The flow characteristics of a stream; specifically the habits of an individual stream (including low flows and floods) with respect to such quantities as velocity, volume, form of and changes in the channel, capacity to transport sediment, and amount of material supplied for transportation.

regulated flow: The flow in a stream that has been subjected to regulation by reservoirs, diversions, or other works of man.

return flow: That portion of the water previously diverted from a stream, and subsequently returned to that stream, or to another body of ground or surface water.

seven day/Q 10 (7 day/Q 10): That low flow which has occurred for seven consecutive days within a ten year period. A specific critical low flow.

subsurface flow: That portion (part or all) of the water that infiltrates the stream bed and moves horizontally through and below it. It may or may not return to the stream channel at some point downstream.

Survival flow: That instantaneous discharge required to prevent death of aquatic organisms in a stream during specified short periods of time (e.g. 7 days) of extremely low flow.

turbulent flow: That type of flow in which any particle of water may move in any direction with respect to any other particle.

uniform flow: A flow in which the velocities are the same in both magnitude and direction from point to point. Uniform flow is possible only in a channel of constant cross section and gradient.

Fluvial: Pertaining to streams or produced by stream action.

Focal point: The location, and the conditions at that location, occupied by an organism. Microhabitat measurements are thus focal point measurements.

Frazil ice: Fine spicules of ice formed in water too turbulent for the formation of sheet ice. Frazil forms in supercooled water when the air temperature is far below freezing (most often below -8°C).

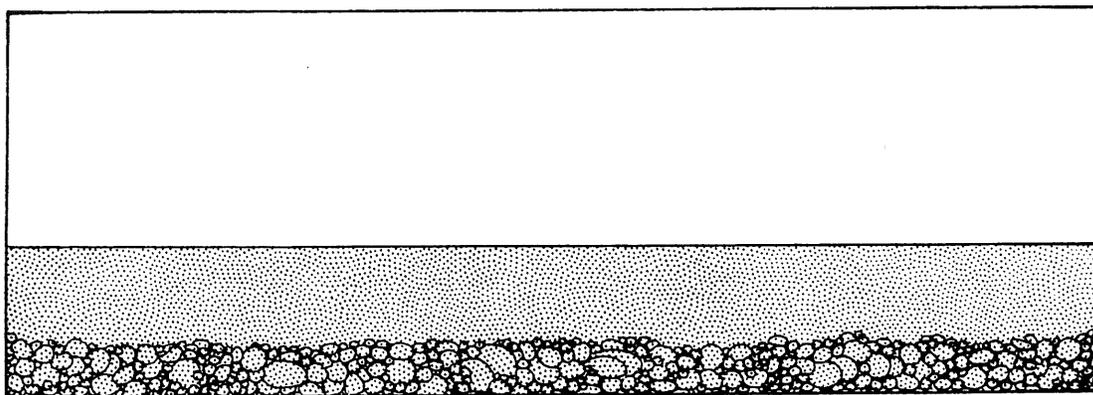
Fredle index: An index of the quality of spawning gravel obtained by dividing geometric mean diameter of particle size by the sorting coefficient.

Freshet: A rapid temporary rise in stream discharge and level caused by heavy rains or rapid melting of snow and ice.

Gabion: A wire basket filled with stones, used to stabilize banks and for habitat enhancement.

Geometric mean diameter (d_g): A measure of the central tendency of particle size composition of substrate materials sometimes used as an index of the quality of spawning gravels. Also referred to as D50 size.

Glacial flour: Inorganic material pulverized to silt and clay size particles by the movement of glaciers and ice sheets.



Glide: A slow moving, relatively shallow type of run. See Run. Calm water flowing smoothly and gently, with moderately low velocities (10-20cm/sec), and little or no surface turbulence.

Graded stream: A geomorphic term used for streams that have apparently achieved, throughout long reaches, a state of practical equilibrium between the rate of sediment transport and the rate of sediment supply. Such a stream is in regimen. Syn: a mature stream.

Gradient: (a) The general slope, or rate of change in vertical elevation per unit of horizontal distance, of the water surface of a flowing stream. (b) The rate of change of any characteristic per unit of length.

Gravel: Substrate particle size between 2 and 64 mm in diameter. See Substrate particle size table.

Habitat: The place where a population lives and its surroundings, both living and nonliving; includes the provision of life requirements such as food and shelter.

Habitat component: A single element (velocity, depth, cover, etc.) of the habitat or environment in which a fish or other aquatic species or population may live or occur. Syn: Attribute.

Habitat quality indices: A number of numerical indices have been devised to give an overall rating of the quality or quantity of habitat in a stream. These indices often integrate many habitat elements such as flow characteristics, substrate, cover, and water quality. They are frequently used in stream condition assessments/evaluations and in predicting environmental impacts.

Habitat type: A land or aquatic unit, consisting of an aggregation of habitats having equivalent structure, function, and responses to disturbance.

Hardness: The total concentration of calcium and magnesium ions expressed as mg/l calcium carbonate. Syn: Total hardness.

Humus: Partially decomposed organic material found in soil and water.

Hydraulic control point: The top of an obstruction to which stream flow must rise before passing over, or a point in the stream where the flow is constricted.

Hydraulic gradient: (a) The slope of the water surface. (b) The drop in pressure head per length in the direction of stream flow.

Hydraulic radius: The cross sectional area of a stream divided by the wetted perimeter.

Hydraulics: Refers to water, or other liquids, in motion and their action.

Hydrograph: A graph showing, for a given point on a stream, the discharge, stage, velocity, or other property of water with respect to time.

Hyporheic zone: The layer of stream channel substrate extending as deep as there is interstitial flow.

Incident light: Visible light reaching the water surface.

Indicator organisms: Organisms that respond predictably to various environmental changes, and whose presence or absence, and abundance, are used as indicators of environmental conditions. See Water quality indicators.

Instream cover: Areas of shelter in a stream channel that provide aquatic organisms protection from predators or competitors and/or a place in which to rest and conserve energy due to a reduction in the force of the current.

Instream flow requirements: See Flow, instream flow requirements.

Intermittent stream: See Stream.

Interrupted stream: See Stream.

Interstitial velocity: See Apparent velocity.

Large organic debris: Any large piece of relatively stable woody material having a least diameter greater than 10 cm and a length greater than 1m that intrudes into the stream channel. Syn: LOD, large woody debris, log. Specific types of large organic debris include:

affixed logs: Single logs or groups of logs that are firmly embedded, lodged or rooted in a stream channel.

bole—Term referring to the stem or trunk of the tree.

large bole—10 m or more in length; often embedded, remain in the stream for extended periods.

small bole—less than 10 m, usually sections of bole; seldom stable, usually move downstream on high flows.

deadheads: Logs that are not embedded, lodged, or rooted in the stream channel, but are submerged and close to the surface.

digger log: Log anchored to the stream banks and/or channel bottom in such a way that a scour pool is formed.

free logs: Logs or groups of logs that are not embedded, lodged or rooted in the stream channel.

rootwad: The root mass of the tree. Syn: butt ends.

snag: (a) A standing dead tree. (b) Sometimes a submerged fallen tree in large streams. The top of the tree is exposed or only slightly submerged.

sweeper log: Fallen tree whose bole or branches form an obstruction to floating objects.

Types of large organic debris accumulation:

clumps: Accumulations of debris at irregularly spaced intervals along the channel margin, not forming major impediments to flow.

jams: Large accumulations of debris partially or completely blocking the stream channel, creating major obstructions to flow.

scattered: Single pieces of debris at irregularly spaced intervals along the channel.

Lateral scour: See Pool.

Least flow: Negotiated lowest flow in a regulated stream that will sustain an aquatic population at agreed upon levels. See Flow, minimum.

Macroinvertebrate: An invertebrate animal (without backbone) large enough to be seen without magnification.

Macroinvertebrate community indicators: See Water quality indicators.

Madicolous habitat: Thin sheets of water flowing over rock faces, found at the edge of stony streams, at the sides of waterfalls and on rocky chutes.

Mainstem: The principal, largest, or dominating stream or channel of any given area or drainage system.

Manning's n: An empirical coefficient for computing stream bottom roughness used in determining water velocity in stream discharge calculations.

Marsh: A water-saturated, poorly drained wetland area, periodically or permanently inundated to a depth of up to 2 m, that supports an extensive cover of emergent, non-woody vegetation, essentially without peat-like accumulations.

Microhabitat: That specific combination of habitat elements in the locations selected by organisms for specific purposes and/or events. Expresses the more specific and functional aspects of habitat and cover. Separated from adjoining microhabitats by distinctive physical characteristics such as velocity, depth, cover, etc.

Movable bed: A stream bed made up of materials readily transportable by the streamflow.

Muskeg: A bog, usually a sphagnum bog, frequently with tussocks of deep accumulations of organic material, growing in wet, poorly drained boreal areas, often areas of permafrost.

Normal high water: A water level attained commonly during the runoff season. Distinguished from extreme high water.

Nutrient spiraling: The recycling of nutrients between the streambed and the water column along a stream course.

Off-channel pond: A pond, not part of the active channel, but connected to the main stream by a short channel. Generally in old flood terraces, but called wall-based channel ponds when located near the base of a valley wall.

Organic debris: Debris consisting of plant or animal material.

Organic materials:

Coarse particulate organic matter (CPOM): Organic material having a least dimension ranging from 1 mm to 10 cm. Technically includes both living and dead material, but often used more specifically to refer to detritus.

Dissolved organic matter (DOM) or Dissolved organic carbon (DOC): Organic material having a least dimension smaller than 0.45μ (Passes through a 0.45μ filter).

Fine particulate organic matter (FPOM): Organic material having a least dimension ranging from 0.45μ to 1 mm.

Orientation: An organism's position relative to the direction of stream flow.

Overbank storage: Flow of water out of the stream channel and onto the valley floor flood plain during flood flows.

Overhead cover: Material (organic or inorganic) that provides protection to fish or other aquatic animals from above; generally includes material overhanging the stream less than a particular distance above the water surface. Values of less than 0.5 m and less than 1 m have been used.

Percent fines: Percentage of fine sediments in substrate samples, expressed as a percentage by weight or volume less than some specified diameter. See Fine sediment.

Perennial stream: See Stream.

Periphyton: Algae and associated microorganisms growing attached on any submerged surface.

Permeability: A measure of the rate at which water can pass through a given substrate. Depends upon composition and degree of compaction of the substrate (usually gravel). The apparent velocity per unit of hydraulic gradient. Units: cm/hr.

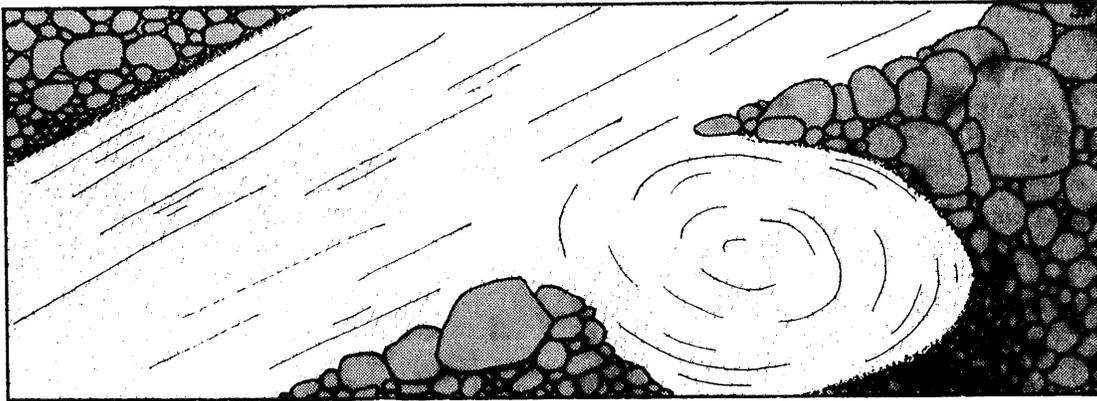
pH: A measure of the hydrogen-ion activity in a solution, expressed as the negative \log_{10} of hydrogen ion concentration on a scale of 0 (highly acidic) to 14 (highly basic) with a pH of 7 being neutral.

Plunge: See Pool.

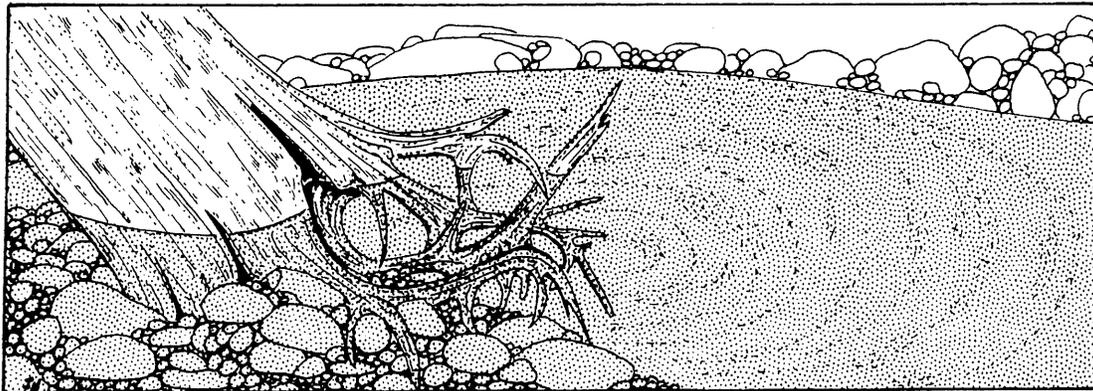
Pocket water: See Pool.

Ponding: An increase in water surface elevation upstream of a blockage or an obstruction.

Pool: (a) A portion of the stream with reduced current velocity, often with water deeper than the surrounding areas, and which is frequently usable by fish for resting and cover. (b) A small body of standing water, e.g., in a marsh or on the flood plain.

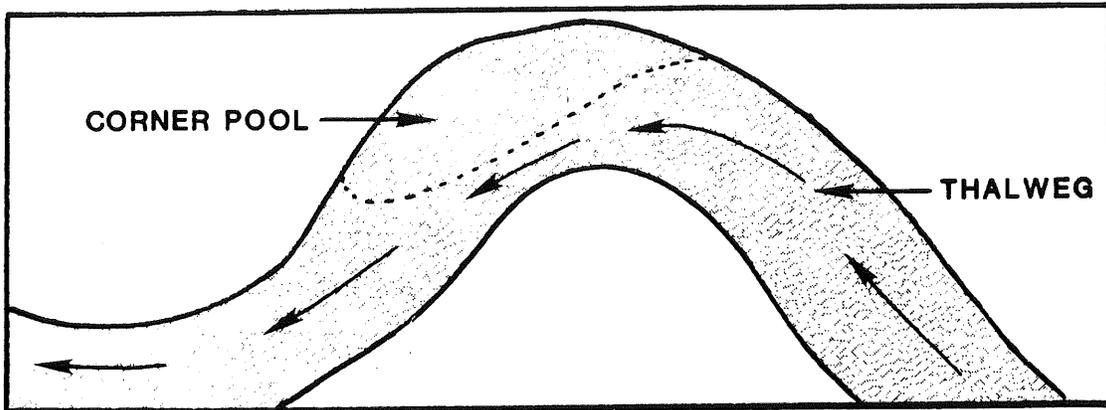


alcove: A backwater along the shoreline where the stream is generally wider than above or below.

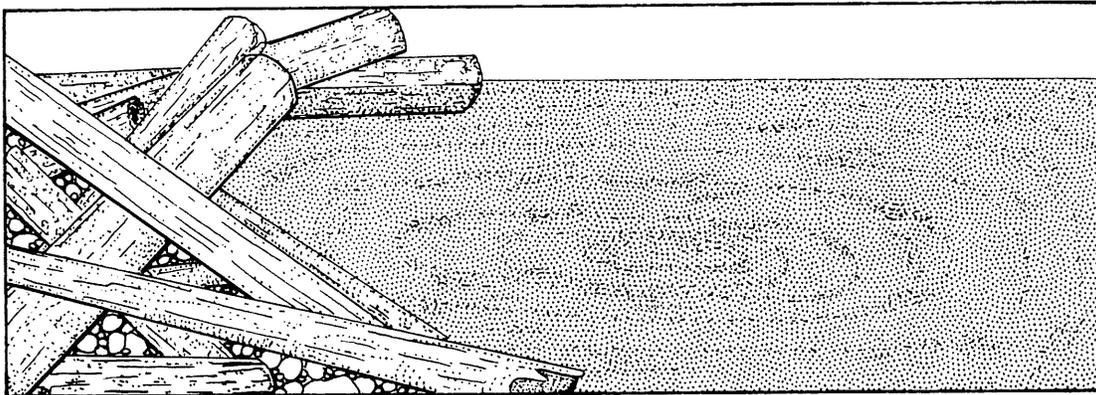


backwater: (a) A pool type formed by an eddy along channel margins downstream from obstructions such as bars, rootwads, or boulders, or resulting from back-flooding upstream from an obstructional blockage. Sometimes separated from the channel by sand/gravel bars.

(b) A body of water, the stage of which is controlled by some feature of the channel downstream from the backwater, or in coves or covering low-lying areas and having access to the main body of water.

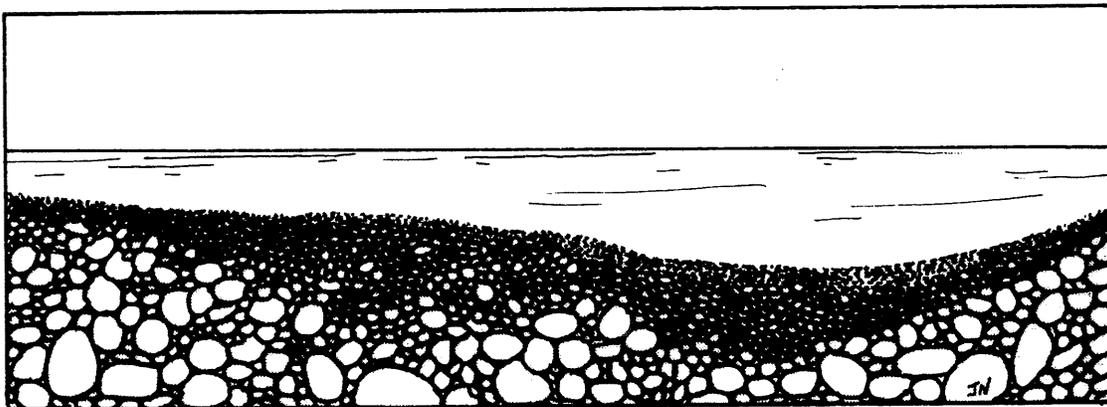


corner: A lateral scour pool resulting from a shift in channel direction.

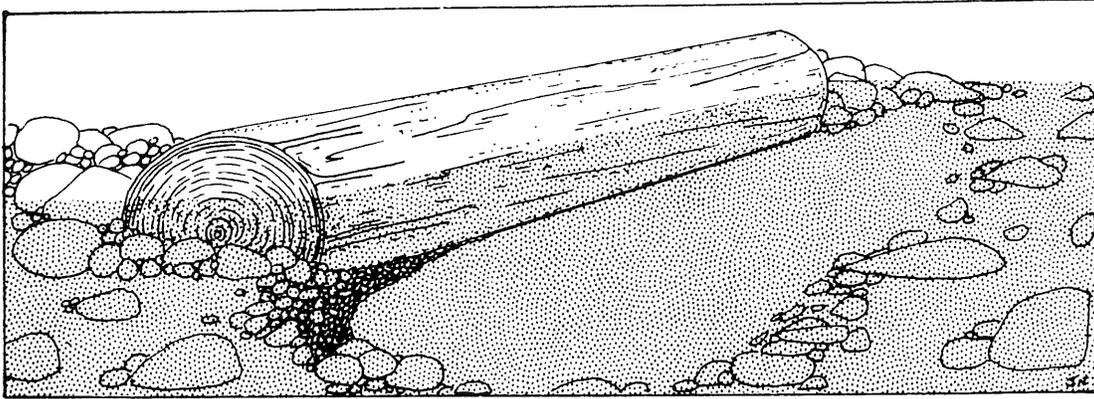


dammed: Water impounded upstream from a complete or nearly complete channel blockage, typically caused by a log jam, beaver dam, rockslide, or stream habitat improvement device (boulder berm, gabion, log sill, etc.)

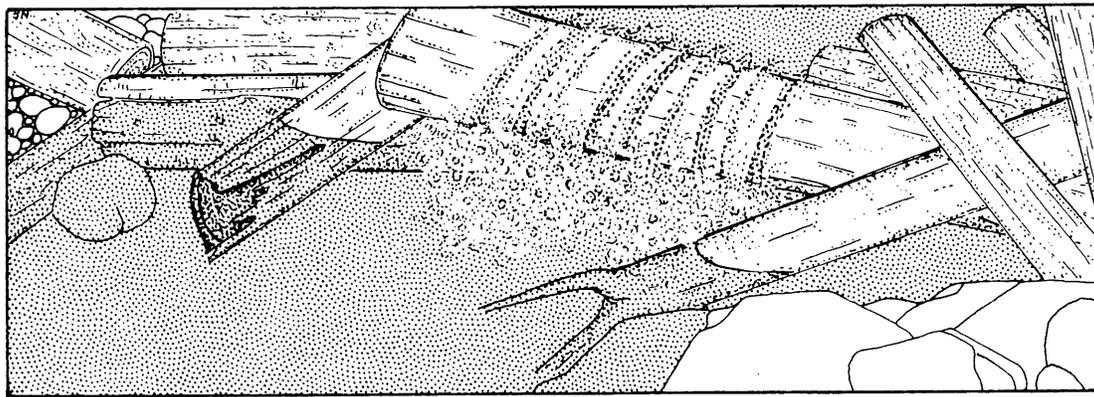
eddy: See Eddy



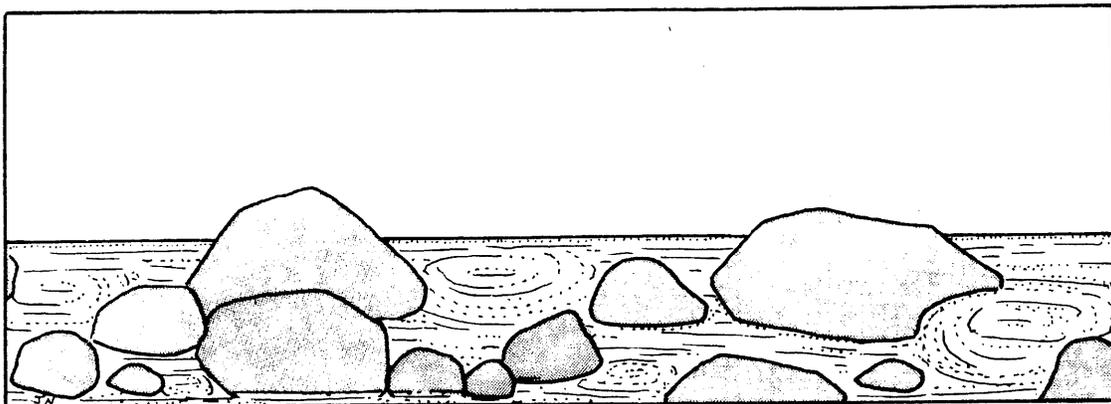
flat: A wide shallow pool of low turbulence. Sometimes used synonymously with glide.



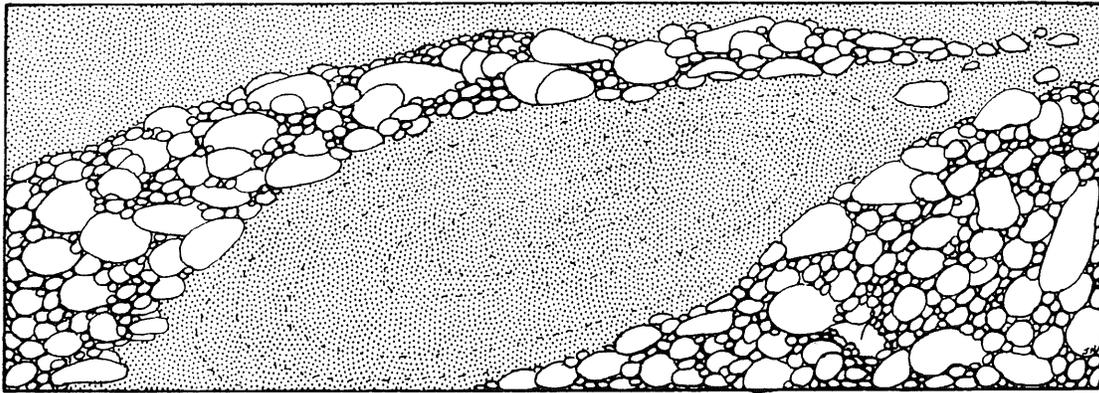
lateral scour: Formed by the scouring action of the flow as it is directed laterally or obliquely to one side of the stream by a partial channel obstruction, such as a gravel bar or wing deflector.



plunge: (Also falls pool, plunge basin.) A pool created by water passing over or through a complete or nearly complete channel obstruction, and dropping vertically, scouring out a basin in which the flow radiates from the point of water entry.

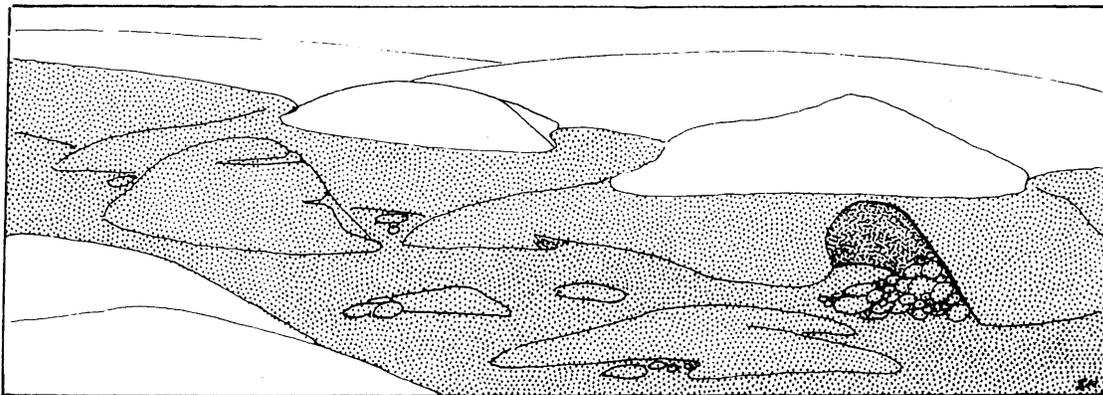


pocket water: A series of small pools surrounded by swiftly flowing water, usually caused by eddies behind boulders, rubble, or logs, or by potholes in the stream bed.

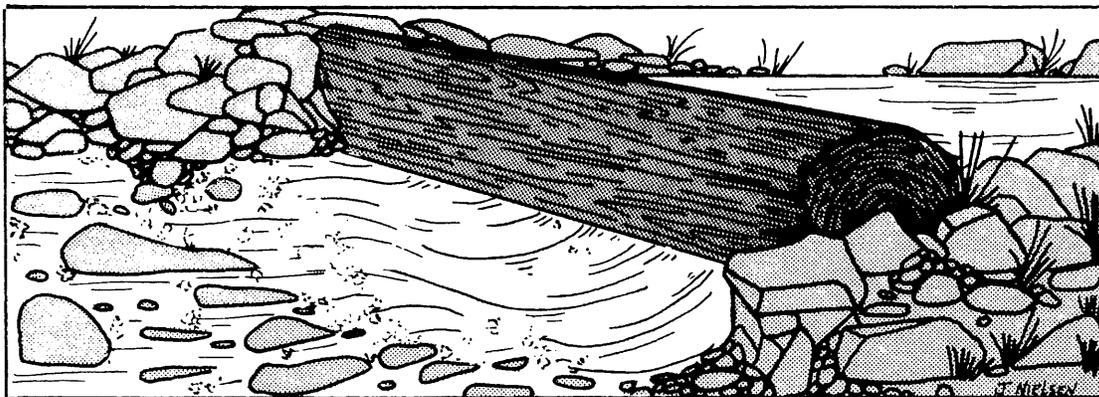


secondary channel: (Also side channel) Relatively small, sometimes isolated pools in a smaller braid of the mainstem and usually associated with gravel bars.

slack water: Pool-like depressions along the stream margin and on the floodplain that contain water only during high flow or after floodwaters recede; more transient in nature than secondary channel pools, they may contain water for only a few days or weeks.



trench: A pool characterized by a relatively long, slot-like depression in the stream bed, often found in bedrock dominated channels.



under scour: Formed by scouring under a stream obstruction, such as a log. Sometimes called upsurge pool.

Pool feature: That condition or object that characterizes a pool's formation. These include: logs, trees, roots, stumps, brush, debris, channel meanders, sediment, culverts, bridges or other man-made objects, beaver dams or tunnels.

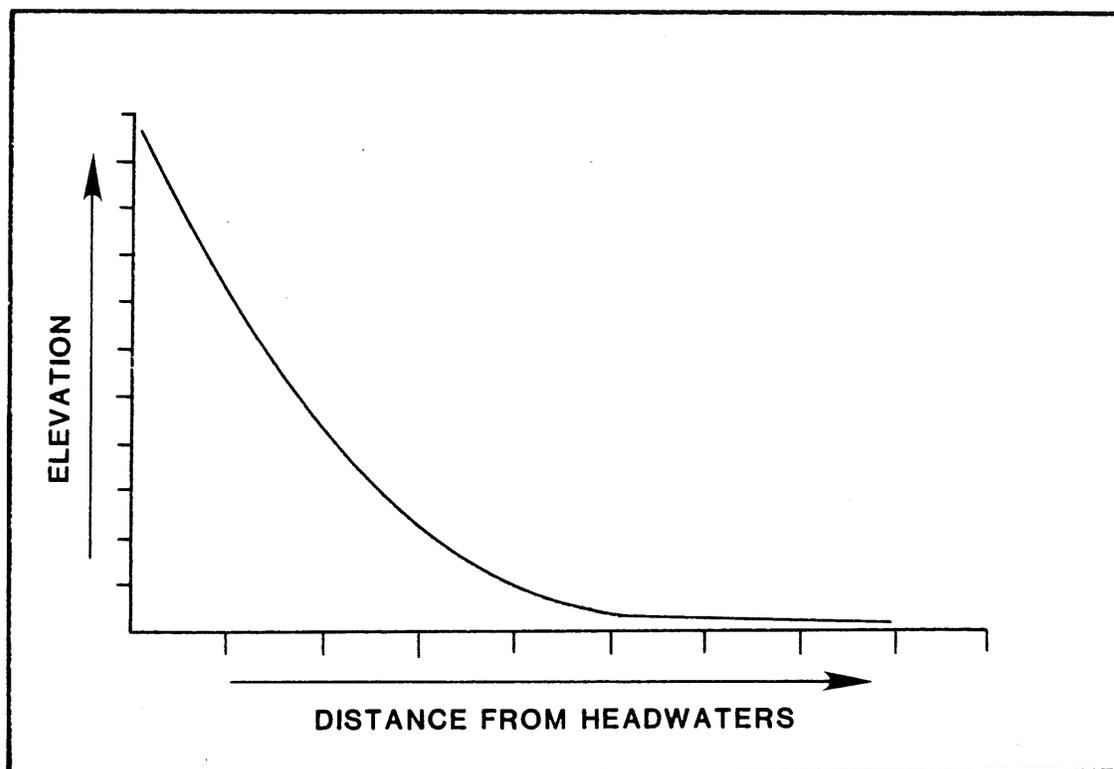
Pool-riffle ratio: The ratio of the surface area or length of pools to the surface area or length of riffles in a given stream reach, frequently expressed as the relative percentage of each category.

Pool quality: An index (usually an integer from 1-5) of the estimated ability of a pool to support fish, based on measurements of length, width, depth, velocity, and cover. (Dunham & Collotzi 1975; Platts et al. 1983).

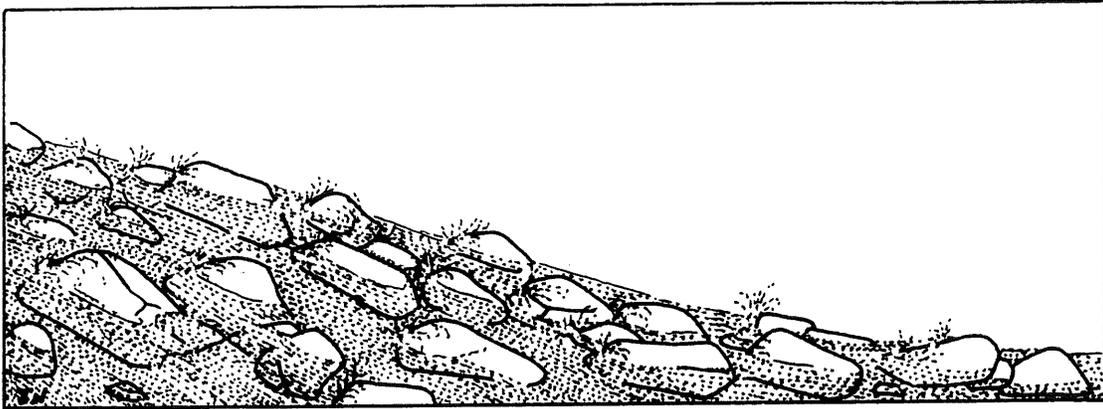
Porosity: The ratio of the volume of the pores or interstices in a gravel substrate to the total volume of solids plus voids.

Production: (a) The process of producing organic material. (b) The quantity of organic material produced.

Productivity: (a) Rate of new tissue formation or energy utilization by one or more organisms. (b) Capacity or ability of an environmental unit to produce organic material. (c) The ability of a population to recruit new members by reproduction.



Profile: A graphical presentation of elevation vs distance, as in channel cross sections and longitudinal sections. In open channel hydraulics, it is a plot of water surface elevation against channel distance.



Rapids: A relatively deep stream section with considerable surface agitation and swift current. Some waves may be present. Rocks and boulders may be exposed at all but high flows. Drops up to one meter.

Reach: (a) Any specified length of stream. (b) A relatively homogeneous section of a stream having a repetitious sequence of physical characteristics and habitat types. (c) A regime of hydraulic units whose overall profile is different from another reach.

critical reach: A segment of the stream that is required for the development and/or survival of a particular aquatic organism, or to a particular life stage of an aquatic organism.

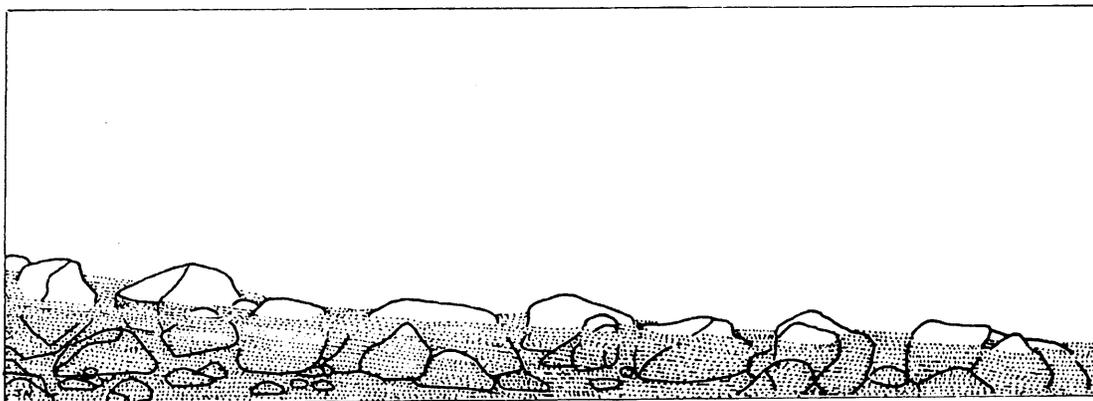
representative reach: A length of stream which represents a large section of the stream with respect to area, depth, discharge, and slope.

Specific reach: A length of channel uniform with respect to selected habitat characteristics or elements (discharge, depth, area, slope, population of hydraulic units), fish species composition, water quality, and type and condition of bank cover.

Recurrence interval: Expected or observed time intervals between hydrological events of a particular magnitude described by stochastic or probabilistic models (log-log plots).

Regime: See Flow, regime.

Revetment: See riprap.



Riffle: A shallow rapids where the water flows swiftly over completely or partially submerged obstructions to produce surface agitation, but standing waves are absent.

Rill: One of the first and smallest channels formed by surface runoff.

Riparian: Pertaining to anything connected with or immediately adjacent to the banks of a stream or other body of water.

Riparian Vegetation: Vegetation growing on or near the banks of a stream or other body of water on soils that exhibit some wetness characteristics during some portion of the growing season.

Riparian vegetation erosion control rating: A system for ranking the relative effectiveness of riparian vegetation for controlling bank erosion (Platts et al. 1983).

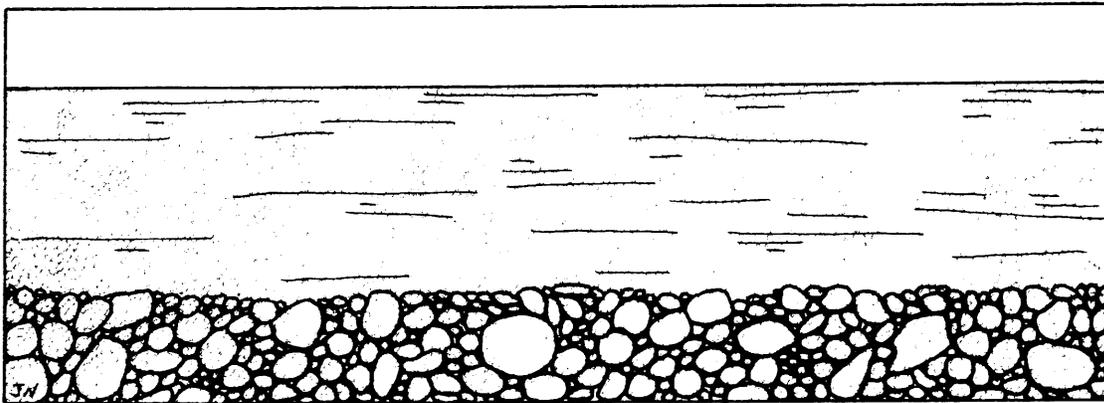
Riparian area: The area between a stream or other body of water and the adjacent upland identified by soil characteristics and distinctive vegetation. It includes wetlands and those portions of floodplains and valley bottoms that support riparian vegetation.

Riprap: A layer of large, durable materials (usually rock but sometimes car bodies, broken concrete, etc.) used to protect a stream bank from erosion. May also refer to the materials themselves. Syn: revetment.

Rock-fill dam: A dam composed of large, broken, and loosely placed or pervious rocks with either an impervious core or upstream facing or surface layer.

Roughness coefficient: See Manning's *n*.

Rubble: Stream substrate particles between 64 and 256 mm in diameter. Syn: cobble. See Substrate particle size table.



Run: An area of swiftly flowing water, without surface agitation or waves, which approximates uniform flow and in which the slope of the water surface is roughly parallel to the overall gradient of the stream reach.

Scour: The localized removal of material from the stream bed by flowing water. This is the opposite of fill.

Secondary channel: See Pool.

Sediment: Fragmental material that originates from weathering of rocks and decomposition of organic material that is transported by, suspended in, and eventually deposited by water or air, or is accumulated in beds by other natural phenomena.

Sediment discharge: The mass or volume of sediment (usually mass) passing a stream transect in a unit of time. The term may be qualified, for example, as suspended-sediment discharge, bedload discharge, or total-sediment discharge, usually expressed as tons per day.

Sediment load: A general term that refers to sediment moved by a stream, whether in suspension (suspended load) or at the bottom (bedload). It is not synonymous with either discharge or concentration. (See bedload).

Seep: An area of minor groundwater outflow onto the land surface or into a stream channel. Flows are too small to be a spring.

Side channel: Lateral channel with an axis of flow roughly parallel to the mainstem and which is fed by water from the mainstem; a braid of a river with flow appreciably lower than the main channel. Side channel habitat may exist either in well-defined secondary (overflow) channels, or in poorly defined watercourses flowing through partially submerged gravel bars and islands along the margins of the mainstem.

Sinuosity: (a) The ratio of channel length between two points on a channel to the straight line distance between the same two points. (b) The ratio of channel length to down valley length. Channels with sinuosities of 1.5 or more are called "meandering".

Slack water: A quiet part of, or a still body of water in, a stream; e.g., on the inside of a bend, where the current is slight. See also Pool.

Slick: Glassy smooth flow of water, **sometimes** used interchangeably with glide.

Slough: (a) Low, swampy ground or overflow channels where water flows sluggishly for considerable distances. (b) Side channel slough formed by channelization. (c) A sluggish channel of water, such as a side channel of a stream, in which water flows slowly through low, swampy ground, or a section of an abandoned stream channel containing water most or all of the year, but with flow only at high water, and occurring in a flood plain or delta. (d) A marsh tract lying in a shallow, undrained depression on a piece of dry ground. (e) A term used for a creek or sluggish body of water in a bottomland.

Solar radiation: Electromagnetic energy from the sun in all wavelengths.

Arc of the sun: The distance the sun travels on any given day in degrees from when it first strikes the water until it leaves the water. The arc of the sun on August 1st is used as a standard.

Direct solar radiation: Radiation that reaches the water surface in an unobstructed straight line.

Reflected solar radiation: Radiation that does not penetrate the water surface, but is redirected away from that surface.

Refracted solar radiation: Radiation that penetrates the water surface, and is bent or deflected from its original path.

Total solar radiation: The sum of direct, reflected and refracted radiation reaching any one point.

Sorting coefficient: A measure of the distribution or variability of particle sizes in the substrate. The usual measure, computed as d_{75}/d_{25} is equivalent to the standard deviation of the log transformed frequency curve, hence a measure of dispersion of particle sizes. A substrate with a large sorting coefficient is termed "well sorted". The terms d_{75} and d_{25} are those diameters for which 75% and 25% of the cumulative size-frequency distributions are larger.

Specific reach: See Reach.

Spring creek: A stream that derives most of its flow from ground water, with relatively constant flow and temperature.

Stability rating: An index of the resistance or susceptibility of the stream channel and banks to erosion (Platts et al. 1983).

Stage: The elevation of a water surface above or below an established datum or reference.

Standing crop: The abundance, total weight or energy content of organisms existing in an area at a given time. See Biomass.

Standing stock: The number of organisms (usually fish) present in an area at a particular time. Smaller sizes not susceptible to capture may sometimes be excluded.

Stratified stream segment: A portion of a stream that is relatively homogeneous based on geomorphology, stream flow, geology, and sinuosity. It is frequently bounded by significant tributaries, diversions, reservoirs, etc. It also may be thought of as a series of short reaches with a common morphology.

Stream: A natural water course containing flowing water, at least part of the year, supporting a community of plants and animals within the stream channel and the riparian vegetation zone. Streams in natural channels may be classified as follows:

a) Relation to time:

Ephemeral: One that flows briefly only in direct response to precipitation in the immediate locality and whose channel is at all times above the water table.

Intermittent or seasonal: One in contact with the ground water table that flows only at certain times of the year as when the ground water table is high and/or when it receives water from springs or from some surface source such as melting snow in mountainous areas. It ceases to flow above the stream bed when losses from evaporation or seepage exceed the available streamflow.

Perennial: One that flows continuously throughout the year. Syn: Permanent stream.

b) Relation to space:

Continuous: One that does not have interruptions in space.

Interrupted: One that contains alternating reaches that are either perennial, intermittent, or ephemeral.

c) Relation to ground water:

Insulated: A stream or reach of stream that neither contributes to nor receives water from the zone of saturation. It is separated from the zones of saturation by an impermeable bed.

Gaining: A stream or reach of stream that receives water from the zone of saturation.

Losing: A stream or reach of stream that contributes water to the zone of saturation.

Perched: Either a losing stream or an insulated stream that is separated from the underlying groundwater by a zone of aeration.

d) Other

Incised: A stream that has, through degradation, cut its channel into the bed of the valley.

Stream bank: The portion of the channel cross section that restricts lateral movement of water at normal water levels. The bank often has a gradient steeper than 45° and exhibits a distinct break in slope from the stream bottom. An obvious change in substrate may be a reliable delineation of the bank.

Lower bank: The periodically submerged portion of the channel cross section from the normal high water line to the water's edge during the summer low flow period.

Upper bank: That portion of the topographic cross section from the break in the general slope of the surrounding land to the normal high water line.

Stream bed: The substrate plane, bounded by the stream banks, over which the water column moves. Also called stream bottom.

Stream bottom: See Stream bed.

Stream capacity: (a) Total volume of water that a stream can carry within the normal high water channel. (b) The maximum sediment load a stream can carry.

Stream classification: Various systems of grouping or identifying streams possessing similar features according to geomorphic structure (e.g., gradient), water source (e.g., spring creek), associated biota (e.g., trout zone) or other characteristics. A hierarchical classification. Two concepts are in use: (a) Management use-related, based almost entirely on value to fish populations (b) A geomorphic-habitat classification system (e.g. interagency effort at Ft. Collins).

Stream corridor: A stream corridor is usually defined by geomorphic formation, with the corridor occupying the continuous low profile of the valley. The corridor contains a perennial, intermittent, or ephemeral stream and adjacent vegetative fringe.

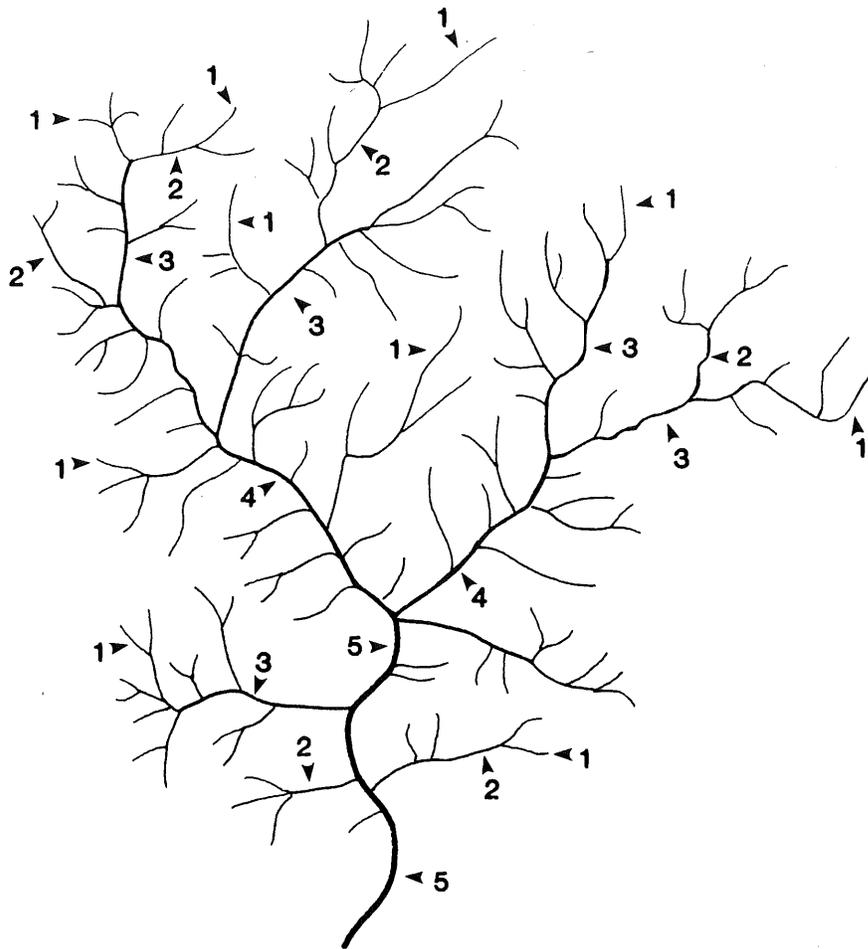
Stream density: Kilometers of stream per square kilometer of area. Syn: Drainage density.

Stream/estuary ecotone: An area near the stream mouth extending from the upper limit of tidal influence seaward to the lower limit of marsh vegetation. Its size depends on stream gradient and range of tidal heights.

Stream Flow: See Flow (a).

Stream/forest ecotone: An area of the stream directly influenced by riparian vegetation, including the stream bank and upland area adjacent to the stream. Its size depends on the stream width, type of vegetation, and the physical characteristics of the adjoining uplands.

Stream frequency: The number of streams per square kilometer of area.

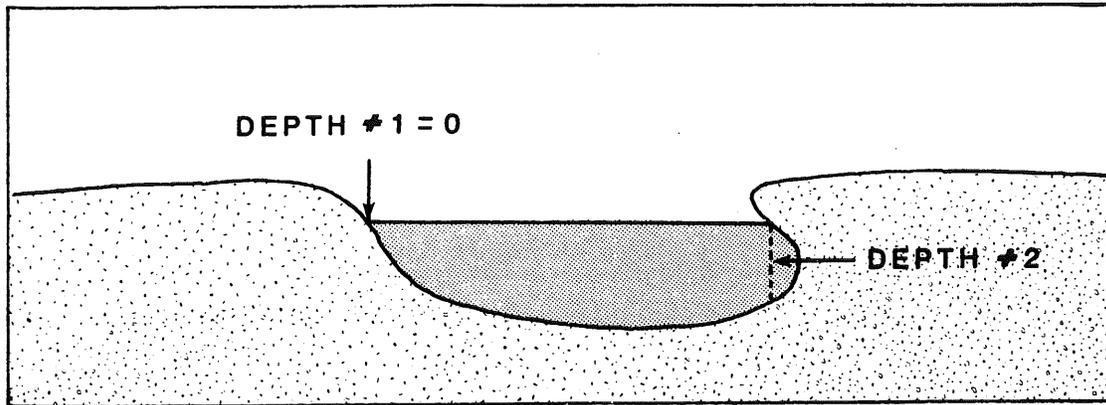


STREAM ORDERS

Stream order: The designations (1, 2, 3, etc) of the relative position of stream segments in a drainage basin network: the smallest, unbranched, perennial tributaries, terminating at an outer point, are designated order 1; the junction of two first-order streams produces a stream segment of order 2; the junction of two second-order streams produces a stream segment of order 3, etc. Use of small-scale maps (<2"/mile) may cause smaller streams to be overlooked, leading to gross errors in designation. Ideally designation should be determined on the ground or from large-scale air photos.

Stream pattern: See Channel pattern.

Stream power: The rate of doing work, or a measure of the energy available for moving rock, sediment particles, or woody or other debris in the stream channel, as determined by discharge, water surface slope, and the specific weight of water.



Stream shore water depth: The water depth at the stream shoreline or at the edge of a bank overhanging the shoreline. This depth could be greater than 0 if the bank is undercut.

Stream width: See wetted width.

Structure: (a) Any object, usually large, in the stream channel that controls water movement. (b) The diversity of physical habitat within a stream. (c) When applied to a biological community, the organization of taxa into various functional or trophic groups.

Substrate: The mineral and/or organic material that forms the bed of the stream.

Substrate Particle-Size Table¹:

Name of particle	Size Range	
	Millimeters	Inches
Large boulder	>1,024	40-160
Small boulder	256-1,024	10-40
Large cobble (rubble)	128-256	5-10
Small cobble (rubble)	64-128	2.5-5
Gravel	2-64	0.08-2.5
Sand	0.062-2	
Silt	0.004-0.062	
Clay	<0.004	

¹Adapted from Platts et al. (1983).

Suspended load: The portion of the total sediment load that moves in suspension, free from contact with the stream bed, and is made up of particles having such density or grain size as to permit movement disassociated from the stream bed. Density and grain size vary according to the amount of turbulence. Only unusually swift streams are turbulent enough to lift particles larger than medium-sized sand from their beds. See Bed load.

Suspended sediment: See Suspended load.

Swamp: Tree or tall shrub dominated wetlands that are characterized by periodic flooding and nearly permanent subsurface water flow through mixtures of mineral sediments and organic materials, essentially without peatlike accumulation.

Swimming speed: Swimming speeds of stream fish vary from essentially zero to over six meters per second, depending upon species, size and activity. Three categories of performance are generally recognized:

Cruising speed: The speed that a fish can maintain for an extended period of time without fatigue. This implies a lack of stress, and is the maximum speed traveled by undisturbed individuals.

Sustained (prolonged) speed: The speed that a fish can maintain for a prolonged period, but which ultimately results in fatigue. At this speed the fish is under some degree of stress.

Burst (darting) speed: The speed that a fish can maintain for a very short time, generally 5-10 seconds, without gross variation in performance. Burst speed would be employed for feeding or escape, and represents maximum swimming speed.

Tail: A transition between habitat types, it is the downstream section of a pool, usually shallow and with velocity increasing with shallowing. Syn: Tailout.

Taxon: Any formal taxonomic unit or category of organisms; e.g. species, genus, family, order, etc. Plural Taxa.

Thalweg: The line connecting the lowest or deepest points along a stream bed.

Torrent: A temporary flow condition in streams created by heavy rainfall or rapid snowmelt; characterized by near bankful discharge, sizable increase in velocity, standing waves, and loss of the typical stepped profile and hydraulic diversity of habitat.

Total dissolved solids (TDS): A measure of inorganic and organic materials dissolved in water (passing through a 0.45 μ filter); often referred to as Filterable Residue (F.R.) and expressed as mg/l F.R. Sometimes considered similar to conductivity as an indicator of potential production in habitat quality indices.

Total suspended solids: The organic and inorganic material left on a standard glass fiber filter (0.45 μ) after a water sample is filtered through it; often referred to as Non-Filterable Residue (N.F.R.).

Trash collector dam: A fence-like structure or grillwork of heavy wire, metal, or logs placed across a stream to intercept and hold debris flowing downstream, creating a dam or blockage. Used to protect bridge crossings, create pools, and store gravel for spawning habitat. Syn: Debris catcher, grizzly.

Trench: See Pool.

Tributary: A stream feeding, joining, or flowing into a larger stream. Syn: Feeder stream, side stream. Tributary types based on watershed geomorphology include:

lower valley wall tributaries: Characterized by moderately steep gradients and occur at the slope break between the valley wall and valley floor.

terrace tributaries: Result from spring networks on the valley floor, and from tributaries draining the valley side slopes and continuing across the terraces to the main stream.

upper valley wall tributaries: Possess very steep gradients, high velocities, and flow over a stepped profile of alternating pools and cascades.

wall based tributaries: Run along the base of the valley wall, parallel to the main stream channel.

Turbidity: (a) Relative water clarity. (b) A measure of the extent to which light passing through water is reduced due to suspended materials. Measured by several non-equivalent standards (e.g., Nephelometric Turbidity Units, NTU; Formazin Turbidity Units, FTU; Jackson Turbidity Units, JTU).

Turbulence: The motion of water where local velocities fluctuate and the direction of flow changes abruptly and frequently at any particular location, resulting in disruption of laminar flow. It causes surface disturbance and uneven surface level, and often masks subsurface areas because air bubbles are entrained in the water.

Undercut bank: A bank that has had its base cut away by the water or has been man-made and overhangs part of the stream.

Under scour: See Pool.

Vegetation-soil use rating: A means of evaluating the impacts of consumptive and nonconsumptive animal (ungulates) activity on riparian vegetation and soils (Platts et al. 1983.).

Vegetative fish cover: Vegetation materials such as algal mats and organic debris capable of providing protection for fish and other aquatic organisms.

Velocity: The time rate of motion; the distance traveled divided by the time required to travel that distance.

critical velocity: (a) The maximum swimming speed that a fish can sustain over a specified distance or length of time, or the maximum water velocity against which a fish can sustain a position over a specified length of time. (b) The velocity in a channel at which flow changes from laminar to turbulent. (c) Velocity through which a fish will not swim, creating a velocity barrier.

fish velocity or focal point velocity: Represents the velocity at the location occupied by a fish, measured at the fish's snout. Syn: Snout velocity, facing velocity.

mean column velocity: The average velocity of the water measured on an imaginary vertical line at any point in a stream. A measurement at 60% of the depth, measured from the surface, closely approximates the average velocity for the water column. In water greater than 76 cm in depth, the average of measurements made at 20% and 80% of the depth approximates the mean column velocity.

mean cross sectional velocity: Represents the mean velocity of water flowing in a channel at a given cross-section. It is equal to the discharge divided by the cross-section area of the cross section.

profile: A curve representing the velocity of flow along a given line.

swimming velocity: See Swimming speed.

thalweg velocity: The mean column velocity at the thalweg.

V-notch: (a) Narrow, steep-sided ravine or valley with V-shaped cross section whose bottom usually contains a watercourse. (b) A type of weir containing a V-shaped notch used for gaging discharge in small streams.

Wash load: The load that because of its fine size has such a small settling velocity that it would be held in suspension. It is essentially synonymous with suspended load.

Water width: See Wetted width.

Water year: See Climatic year.

Water yield: The total outflow from all or a part of a drainage basin through either surface channels or subsurface aquifers within a given time (i.e. a year).

Watershed: See Drainage area

Weighted Usable Area (WUA): (a) An index of the capacity of a stream reach to support the species and life stage being considered, expressed as actual area or percentage of habitat area predicted to be available per unit length of stream at a given flow. (b) The total surface area having a certain combination of hydraulic and substrate conditions, multiplied by the composite probability of use by fish for the combination of conditions at a given flow.

Weir: (a) A notch or depression in a levee, dam, embankment, or other barrier across or bordering a stream, through which the flow of water is measured or regulated. (b) A barrier constructed across a stream to divert fish into a trap. (c) A dam (usually small) in a stream to raise the water level or divert its flow.

Wetland: An area subjected to periodic inundation, usually with soil and vegetative characteristics that separate it from adjoining non-inundated areas.

Wetted perimeter: The length of the wetted contact between a stream of flowing water and the stream bottom in a vertical plane at right angles to the direction of flow.

Wetted width: The width of the water surface measured at right angles to the direction of flow and at a specific discharge. Widths of multiple channels are summed to represent total wetted width.

White water: Occurs where flows are sufficiently fast and turbulent to entrain air bubbles in the water.

Woody debris: See Large organic debris.

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