STREAM SYSTEMS TECHNOLOGY CENTER

STREAM NOTES

To Aid in Securing Favorable Conditions of Water Flows

October 1994

A Classification of Natural Rivers

The long awaited update of Dave Rosgen's stream classification system is now available with the publication of "A Classification of Natural Rivers" in the June 1994 issue of *Catena*.

Rivers are classified by Rosgen to:

- Predict a river's behavior from its appearance
- Develop specific hydraulic and sediment relations for a given morphological channel type and state
- Provide a mechanism to extrapolate site-specific data collected on a given stream reach to those of similar character, and
- Provide a consistent and reproducible frame of reference of communication for those working with river systems in a variety of professional disciplines.

The original Rosgen classification system was published in 1985. Since then the system has evolved and changed with increased understanding as more data became available. The four major stream types recognized in 1985 (A, B, C, and D) have evolved into seven major stream type categories (A, B, C, D, E, F, & G) and the dominant bed material modifier numbers (e.g., A1) have been standardized across types so that 1 is always bedrock, 2 is boulder, 3 is cobble, 4 is gravel, 5 is sand, and 6 is silt/clay. The result is 42 major stream types (see figure next page).

The delineation criteria for various stream types remain roughly the same as the original version to include entrenchment, width/depth ratio, sinuosity, channel materials, and slope; however, they are explained in greater detail to assure consistency of application.

"A Classification of Natural Rivers" introduces a hierarchy of river inventories from broad level morphological characterization through detailed verification involving direct measurements and observations of channel processes. The paper is heavy on application of the classification system, which includes predicting the evolution of stream types, guiding stream restoration and fish habitat improvement work, estimating Manning's roughness coefficients for channels, characterizing sediment and hydraulic geometry relations, and providing management interpretations by stream type.

STREAM NOTES *is produced quarterly by the Stream Systems Technology Center, Fort Collins, Colorado.*

The PRIMARY AIM *is to exchange technical ideas and transfer technology among scientists working with wildland stream systems.*

CONTRIBUTIONS *are voluntary and will be accepted at any time. They should be typewritten, single-spaced, limited to two pages in length. Graphics and tables are encouraged.*

Ideas and opinions expressed are not necessarily Forest Service Policy. Trade names do not constitute endorsement by the USDA Forest Service.

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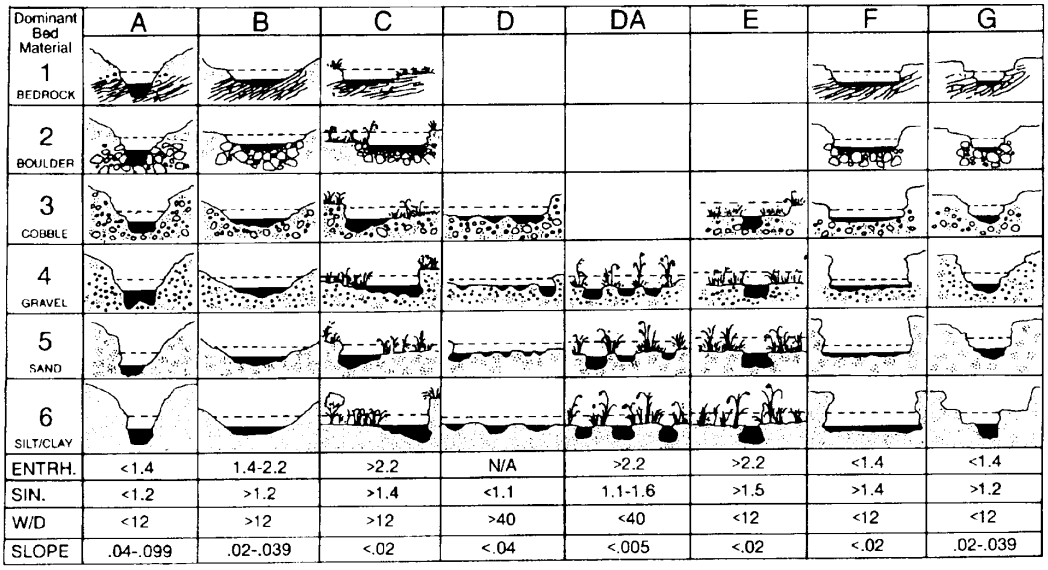

Dominant Bed Material	A	B	C	D	DA	E	F	G
1 BEDROCK								
2 BOULDER								
3 COBBLE								
4 GRAVEL								
5 SAND								
6 SILT/CLAY								
ENTRH.	<1.4	1.4-2.2	>2.2	N/A	>2.2	>2.2	<1.4	<1.4
SIN.	<1.2	>1.2	>1.4	<1.1	1.1-1.6	>1.5	>1.4	>1.2
W/D	<12	>12	>12	>40	<40	<12	<12	<12
SLOPE	.04-.099	.02-.039	<.02	<.04	<.005	<.02	<.02	.02-.039

Figure: Illustrative guide showing cross-sectional configuration, composition and delineative criteria of major stream types. Courtesy of Catena, Elsevier Science B.V.

Rosgen recognizes the dynamic nature of classification systems when he states, "The classification presented here may be the first approximation of a system that undoubtedly will be refined over the years with continued experience and knowledge. This stream classification system hopefully can be a vehicle to provide better communication among those studying river systems and promote a better understanding of river processes, helping put principles into practice." Improved communication about the nature of streams based on their physical appearance may well be the most valuable contribution of this system to the diverse disciplines working with rivers.

"A Classification of Natural Rivers" appeared in Catena 22 (1994) 169-199. Catena is a copyrighted publication of Elsevier Science B.V. and is available in many libraries. Forest Service employees may request copies of Rosgen's paper through FS INFO. Private individuals can purchase copies from the Article Clearing House Information Store, San Francisco, CA (800-248-0360) for $26.75 or the Institute for Scientific Information, Genuine Article Delivery Service, Philadelphia, PA (215-386-0100) for $23.80.

Parshall Flume Correction Program for Submergence and Settlement Conditions

The Parshall flume is the most commonly used flow measurement device in the world. The original flume was developed by Ralph L. Parshall in 1926 at Colorado A & M College to accurately measure flow in open channels and irrigation canals. The flume measures flow within ± 3 percent when correctly installed.

Parshall flumes may settle over time thereby affecting the accuracy of flow measurements. The flumes are typically installed outdoor, exposed to the elements, and continually subject to numerous wetting/drying, freezing/thawing, and heating/cooling cycles. In addition, vibrations and/or contact with equipment and machinery may impact a flume's calibration. Settlement slopes of 5 percent, for

example, have introduced flow inaccuracies of up to 28 percent. In addition, the flume's accuracy diminishes when submergence conditions exist.

The Colorado State Agricultural Experiment Station, Colorado State University has developed the ***Parshall Flume Discharge Correction Program*** (PFDC) to correct for submergence and settlement conditions. The purpose of the computer program is to provide users of Parshall flumes with a means to evaluate and correct flow measurements should existing conditions warrant. The evaluation process requires the user to obtain several field measurements. Based upon the evaluation, the user may decide to (a) simply correct the flow measurement without modification of the existing flume, (b) properly re-install the existing flume, or (c) install a new flume.

The program, prepared by Steven R. Abt and C. Bradley Florentin of the Colorado State University Engineering Research Center Hydraulics Laboratory, is based on over 380 laboratory experiments and numerous field observations. The PFDC program operates on IBM compatible microcomputers. Based on user provided input data, it advises the user when the submergence and/or settlement conditions impact flow measurement. The program is capable of calculating the correct flow measurement adjusting for submergence and settlement to an accuracy within ± 3 percent. If appropriate adjustments cannot be made, corrective action is advised.

For additional information or a copy of the program and users manual, contact:

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Ask DOCTOR Hydro

Dear Doc Hydro: I've been reading some books on sediment transport lately and noticed that bedload is listed in units of "tons/day" most of the time and "tonnes/day" sometimes. What's the difference between *tons* and *tonnes*?

A ***tonne*** is a *metric ton* equal to 1,000 kilograms and equivalent to 2,204.64 pounds. It is based on the metric system, which is a system of weights and measures adopted first in France but now widespread over the world. The metric system is used universally by most scientific disciplines, mandatory in many countries, and permitted for use in most (as in the United States).

A ***ton*** *is* based on the so-called English, or avoirdupois system of weights that Great Britain and the United States use. A ton is equivalent to 2,000 pounds in the United States and is also known as a *short ton*. A ton is equivalent to 2,240 pounds in Great Britain and is also known as a *long ton*.

In the United States, many scientists continue to work in both English and metric units. A ton in English units applied to bedload refers to a short ton of 2,000 pounds (that's 0.907 metric tons).

To avoid confusion, scientists are encouraged to use the identifier *metric ton* in place of the archaic *tonne*, which is no longer listed in many dictionaries. So if you see tons/day, that's 2,000 pounds while tonnes/day (or preferably metric tons/day) is 2,205 pounds.

New Publication on Beavers

Beavers can be an asset or a liability, depending on their compatability with human interests and activities in a particular situation. The University of Wyoming recently produced a publication, ***Beaver: Water Resources and Riparian Habitat Manager*** by Rich Olson and Wayne Hubert that describes the beneficial aspects of beaver as a tool to enhance water resources and riparian habitat through proper management techniques and and provides management guidelines to minimize damage problems.

Copies are available free from: Rich Olson, Rangeland Wildlife Habitat Extension Specialist, Department of Range Management, University of Wyoming, P.O. Box 3354 - University Station, Laramie, WY 82071. Telephone: (307) 766-6198, or FAX requests to (307) 766-3379.

Editorial Policy

To make this newsletter a success, we need **voluntary contributions** of relevant articles or items of general interest. YOU can help by taking the time to share innovative approaches to problem solving that you may have developed.

Please submit typed, single-spaced contributions limited to two pages. Include graphics and photos that help explain ideas.

We reserve editorial judgments regarding appropriate relevance, style, and content to meet our objectives of improving scientific knowledge. Send all contributions to: Stream Systems Technology Center, Attention: STREAM NOTES Editor.

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