



River Monitoring Makes for Better Paddling Trips

The U.S. Geological Survey (USGS) is the principal Federal agency providing water information needed to manage the Nation's water resources. For more than 110 years, scientists have been measuring and re-recording the flow of water in the Nation's rivers. The USGS operates and maintains approximately 7,000 streamflow-gaging stations on rivers and streams across the United States. In North Dakota, streamflow is monitored continuously at more than 100 locations by the USGS. Streamflow information is used by Federal and State agencies for a number of purposes, including (1) forecasting floods and droughts, (2) managing and operating dams and reservoirs, and (3) protecting water quality. The information also is useful for recreational purposes, such as canoeing and kayaking. The USGS stream-gaging network provides information that can make for safer and more enjoyable outings for river recreationists. River sports enthusiasts can obtain information on the "conditions" of the river before planning an outing.

Streamflow data obtained and evaluated before a river trip can prevent the disappointment and loss of time associated with a long drive to a favorite river, only to find it too low for a canoe trip. On the other hand, an adventurous canoeist may be willing to travel farther for a river outing, knowing that streamflow conditions on a favorite river are optimal. By using available streamflow information, recreationists can plan safe trips to match the conditions of the water or to match their own abilities or skill levels.



Rivers highlighted in green are monitored by U.S. Geological Survey gages and have streamflow recommendations for canoeing.

How Data are Collected

Streamflow and stage data are most commonly collected at gaging stations along rivers and streams. A gage house is constructed to hold equipment that measures and records stage (the height of the water surface above a fixed reference point near the gaging station) and streamflow (the rate at which water is flowing). However,

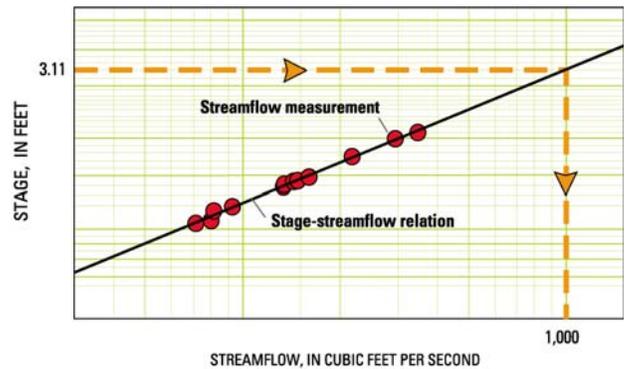
because stage is unique to each stream-gaging site and may not correspond directly to water depth, streamflow is a more reliable indicator of the conditions that river recreationists will encounter. Streamflow is determined by measuring the width, depth, and velocity of a river or stream. Streamgagers often will wade across small streams or across larger streams during low-flow conditions and make multiple depth and velocity measurements. During high-flow conditions or on large rivers, measurements usually are made from boats, cableway cars, or bridges.



U.S. Geological Survey gaging station with satellite antenna.

The streamflow measurements obtained are plotted on a graph against stage (recorded at the time of streamflow measurement) to develop a stage-streamflow relation, or rating curve, for each gaging station. The USGS measures streamflow frequently to keep the rating curves accu-

rate and up-to-date. A sample rating curve is shown in the graph at the right. In this example, when stage is 3.11 feet, the corresponding streamflow is 1,000 ft³/s. By using rating curves, a continuous record of streamflow can be maintained. River recreationists should relate river conditions to streamflows at gaging stations because the stage-streamflow relation changes with time and river recreationists who monitor only stage could be misled. For example, a beaver or debris dam downstream from a gaging station can result in a rise in stage without a corresponding change in streamflow. Likewise, erosion of a stream channel can result in a localized decrease in stage for a given streamflow, but there still may be enough water for a particular recreational use.



A sample stage-streamflow relation (rating curve).

Streamflow Data Online

All of North Dakota's continuous streamflow-gaging stations transmit near-real-time data through a satellite or telephone network directly to a computer web site. Streamflow data are updated at intervals of 4 hours or less and are available to the public through the World Wide Web at <http://nd.water.usgs.gov>. Information on specific gages of interest to canoeists and kayakers, with recommended streamflows and stages, is available at <http://nd.water.usgs.gov/canoeing>. Recreationists can select the river of interest to determine flow conditions and should consider keeping

notes or a logbook on conditions at various streamflows on a particular stretch of the river. Thus, the recreationist can "learn the river" to plan future trips that match the skill level of interest. "Learning the river" by examining conditions for a range of streamflows and stages helps the user visualize the entire flow regime of a river.



Using Streamflow Information

Streamflow information available on USGS web sites allows river recreationists to project likely conditions of a river for several days. Paddlers who are interested in high flows can monitor changing conditions to determine when the water is ideal for their skill level. By monitoring near-real-time hydrographs (plots of streamflow or stage in relation to time) on the web site, paddlers can determine whether streamflows are increasing or decreasing and make more informed decisions on when the water is ideal for their skill level.

Streamflow data at gaging stations on a river often can be used as an index to determine likely conditions on other reaches of the river. However, the recreationist must recognize that rivers differ in size, elevation, and other characteristics from upstream reaches to downstream reaches. Generally, the farther away a gaging station is from the

river reach of interest, the less reliable the data may be as an index. Also, river systems may change rapidly due to intense precipitation or the release of water from upstream dams.



All USGS streamflow data on the Web are provisional and subject to change after verification and approval by USGS personnel. Also, equipment at gaging stations can malfunction for many reasons, including ice jams and vandalism. Thus, although the USGS closely monitors data for problems with gage readings, river recreationists should always "scout" river conditions carefully upon arrival as a safety precaution. When used properly, USGS streamflow information can greatly benefit river recreationists.

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