

Water Data Collection and Management Subactivity

| Program | FY 2000 Estimate | Uncontrol. & Related Changes | Program Changes | FY 2001 Budget Request | Change from FY 2000 |
|---|------------------|------------------------------|------------------------------|------------------------|---------------------|
| Hydrologic Networks and Analysis | 25,428 | +827 | ⁽¹⁾ +4,459 | 30,714 | +5,286 |
| Water Information Delivery | 3,739 | +122 | +4,700 | 8,561 | +4,822 |
| Total Requirements \$000 | 29,167 | +949 | +9,159 | 39,275 | +10,108 |

¹ See Program Change section for details on Real-Time Hazards (+\$4,000), DOI Science (+\$3,250), and programmatic decrease (-\$2,791).

Hydrologic Networks and Analysis

Current Program Highlights

Data on the quantity and quality of water in the Nation's streams, lakes, and aquifers, as well as analytical studies, are necessary for the wise planning, development, utilization, and protection of our water resources. As the Federal Government's primary water resource agency, the USGS maintains national networks for collecting long-term, comprehensive data on water quantity and quality, and atmospheric deposition (such as rain and snow). Much of this work is accomplished with funding from State and local government agencies, and from other Federal agencies; nearly half of the water resources operating budget comes from these non-appropriated sources. The Federal funds appropriated through the Hydrologic Networks and Analysis Program support the parts of the national streamgaging network that are not funded by the other agencies for a specific purpose.

The data and analytical information which the USGS provides through this program are used to:

- respond to decrees of Federal courts, river basin compacts, and international treaties regarding water rights and allocation
- resolve land and resource management issues in which a strong Federal interest is evident, for example, on lands owned and managed by the Federal government
- describe short-term or severe changes in water resources, such as flooding, droughts, and widespread contamination
- monitor long-term changes in the availability and quality of selected rivers, lakes, reservoirs, and ground water to document the current conditions and changes in these systems over time
- measure the quantity and quality of small streams in pristine environments to document current conditions and changes over time in natural watersheds

Hydrologic Networks

Water Quantity -- The USGS operates nationwide hydrologic networks for the collection of surface-water, ground-water, and water-quality data. The shared funding and single-agency operation of the USGS networks provide high-quality information to all potential users, for a wide variety of uses at low cost to the Federal Government. Because a single agency operates the networks, data are collected using nationally-consistent methods, which enables comparability of data across jurisdictional boundaries and acceptance of results by water management agencies and courts at all levels of government. The USGS uses the Federal funds appropriated through this program to support the parts of the national data collection infrastructure that are not funded by the other agencies for a specific purpose. This includes the National Streamflow Information Program, which provides data that enable the National Weather Service to issue flood forecasts and warnings.

Water Quality -- The USGS operates three major water quality monitoring networks:

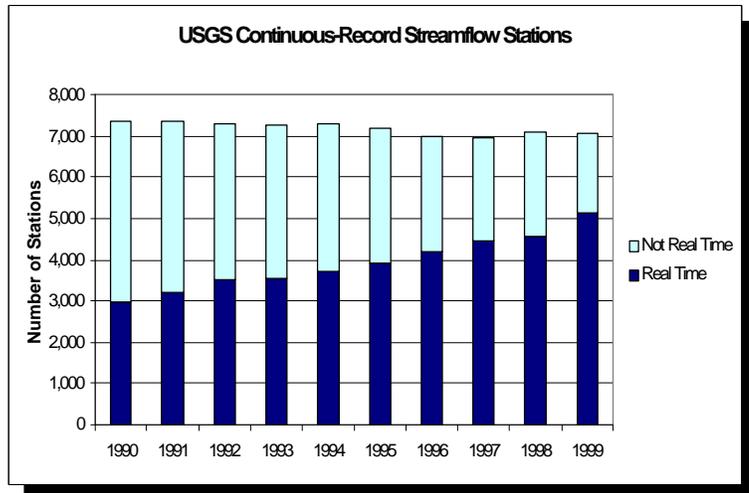
- The National Stream Quality Accounting Network (NASQAN) operates 40 stations to measure water quality and to calculate the loading of sediments and chemicals in four of the Nation's largest rivers (Mississippi, Columbia, Colorado, and Rio Grande) and their major tributaries; data from these stations aid in the planning, utilization, and protection of these major rivers that flow across interstate and international boundaries and are the subject of complex regulatory requirements. Although monitoring these four rivers continues to be a high priority for the program, planning is underway to develop a baseline characterization of water quality in the Yukon River basin. Important issues in this large Alaskan basin include melting of the permafrost (and the associated hydrologic and chemical changes) and atmospheric deposition of manmade organic pollutants. Sampling in the Yukon would begin in FY 2001 at the earliest.
- The Hydrologic Benchmark Network presently comprises 50 surface-water sites located in natural basins that are minimally altered by human influences; data collected at these sites fill a unique national function in discerning effects of long-term climatic trends on hydrologic systems and separating natural variability from human-induced change in surface-water systems.
- As the lead Federal agency for monitoring wet atmospheric deposition (chemical constituents deposited from the atmosphere via rain, sleet, and snow) in the U.S., the USGS supports 72 sites in the National Trends Network. This network provides a national scorecard with which to evaluate the effectiveness of ongoing and future regulations intended to reduce atmospheric emissions and subsequent impacts to our terrestrial and aquatic ecosystems.

National Streamgaging Program Evaluation

In 1999 the USGS completed an evaluation of the ability of the streamgaging network to meet Federal needs for streamflow information. The evaluation found that the network's ability to meet long-standing Federal needs has declined because of an absolute loss of critical stations and the declining ability of the USGS to continue to operate high-priority stations when partners decide to discontinue funding. A subsequent report, "Streamflow Information for the Next Century -- A Plan for the National Streamflow Information Program of the U.S. Geological Survey," provides a vision for meeting the Nation's streamflow information needs. It includes enhancements to the streamgaging infrastructure, a new funding mechanism, supplemental measurements of floods and droughts, ongoing assessments of streamflow characteristics and trends, improved systems for disseminating streamflow information and enhancing the reliability of the delivery system, and research on new technology for measuring the Nation's rivers and streams.

Real-Time Flood Warning for Safer Communities

In FY 2000 the USGS received an increase of \$2 million to augment and upgrade the existing streamgaging network. These additional funds are being used to build new streamgaging stations, reactivate some stations which were previously discontinued due to funding constraints, upgrade instrumentation at some stations to make them capable of real-time reporting, and strengthen or "flood harden" some stations which are vulnerable to being damaged or destroyed during large-scale floods. In addition, some funds will be used to develop alternative methods of measuring streamflow, and to strengthen data delivery systems so that power failures or computer malfunctions will not inhibit the flow of data to USGS customers during times of crisis.



Hydrologic Analysis

Studies of Climate Variability and Change -- The USGS is working to identify what atmospheric and oceanic patterns are most responsible for variations in hydrologic conditions (streamflow, lake levels, snowpack, and glacier mass), particularly extreme events such as the flooding which affected the eastern seaboard after Hurricane Floyd and the drought which affected the eastern States during 1999. These investigations depend upon the primary surface water databases collected by the USGS, as well as on modeling studies conducted in conjunction with climate modeling centers. The studies are aimed at developing improved planning and management information for operators of water resource systems, as well as providing for more efficient USGS data collection operations. Work also includes paleoclimate studies that differentiate the effect of human activities from effects caused by natural climate variations; these studies are leading to a better understanding of the causes, intensity, duration, and timing of ice ages.

Watershed Modeling -- Competition among water-resource users in many basins in the western U.S. has resulted in a need for near-real-time assessments of water availability and use. The use of coupled hydrologic and water-management models can provide these assessments with substantial benefits for water-resource planning and operation. Advancements in computer hardware and modeling software have enabled the development of such water-resource models. The USGS and the Bureau of Reclamation have been working collaboratively since 1995 on a project called the Watershed and River Systems Management Program (WARSMP). The goal of the program is to first couple watershed and river-reach models that simulate the physical hydrologic setting with routing and reservoir management models that account for water availability and use. The coupled models are then to be applied to Reclamation projects in the western U.S. The coupling provides a database-centered decision support system for use by WARSMP and other projects. In FY 2000 WARSMP is wrapping up final model documentation in Washington's Yakima River basin, and beginning a new study of the Rio

Grande basin to provide planning tools for the Federal and State agencies which manage water resources for the cities of Albuquerque, Santa Fe, and El Paso.

USGS Science to Aid National Park Service -- In FY 1999 the USGS began water-quality studies in the National Parks as part of the Clean Water Action Plan. A National Park Superintendent, in a letter to the USGS Director, eloquently stated the potential for this type of collaboration. "USGS scientists' abilities are essential to develop, integrate and interpret scientific information and provide professional interdisciplinary opinions regarding potential effects to water quantity and quality and associated biologic resources. The USGS brings a reputation for trustworthy and unbiased science and professional advice that is essential for the credibility of our often controversial resource management decisions The USGS work . . . provides concrete examples of multidisciplinary science the USGS can provide the National Park Service in park management planning, interpretation, public education and day-to-day resource management decisions."

Other activities funded by the Hydrologic Analysis component of this program include:

- a portion of USGS place-based studies such as those in Chesapeake Bay, Mojave Desert, San Francisco Bay, South Florida, and the Platte River basin
- an interdisciplinary study of multiple natural hazards in urban areas, focusing on earthquakes, floods, and volcanoes in the Seattle-Tacoma area

Recent Accomplishments

Response to Hurricane Floyd -- The USGS provides streamflow data which Federal and local emergency management agencies use for making decisions about when to issue flood warnings or evacuation orders. Advance warning of even an hour can result in significant savings when property is moved. For example, the Somerville, New Jersey, Police Department has indicated that lives and property were saved during Hurricane Floyd, in part because of information from a streamgage that USGS operates in cooperation with Somerset County as part of the County's Flood Information System. As a result of the flood warning 500-600 people were evacuated from the area. Many vehicles were moved before they were flooded. Potential property damage was reduced by residents and businesses moving contents to a higher level. In addition, flood forecasts can lead to community or individual decisions to evacuate. These decisions can literally save lives. During Hurricane Floyd, the North Carolina Department of Corrections used data from a newly re-activated USGS gaging station to help make decisions pertaining to evacuation of prisons, some of which were in danger of being flooded.

Water quality concerns in the hurricane's wake -- There was much concern about the effects of high rainfall and runoff on the water quality and aquatic habitat of the streams flooded by Hurricane Floyd. Concentrations of sediment, nutrients, bacteria, and pesticides were measured at numerous streams in Maryland, New Jersey, North Carolina, Pennsylvania, and Virginia. Flooding of swamps in coastal areas can reduce dissolved oxygen levels for some distance downstream over many days, harming aquatic organisms. Increased nutrients can cause nuisance algal growth and contribute to low oxygen levels in streams and lakes. High sediment loads can damage aquatic habitats and fill navigation channels, lakes and reservoirs. Bacteria was of particular concern, especially in North Carolina, where many animals drowned and remained in waterlogged areas for days before they could be removed.

USGS hydrologic networks support science education -- Data from the USGS networks of water quantity, water quality, and atmospheric deposition are now available on the Internet. For example, in 1999 customers downloaded 16,000 data-sets from the USGS acid rain web site in support of their research. Customer surveys indicate that a significant portion of the users are students and educators who are incorporating the data into their classroom projects and reports. Students using the data range from grade-schoolers preparing science fair projects to PhD candidates using the data for their dissertations.

USGS networks provide critical data for Gulf of Mexico hypoxia assessment -- Data on nutrients and streamflow collected by the USGS over the past four decades in the Mississippi River basin played a central role in determining the sources of nitrogen and in identifying trends in nitrogen loading from the 1950's through the 1990's. Nitrogen loading is thought to be an important factor in causing hypoxia (a zone of low oxygen) in the Gulf of Mexico which may be harming fisheries in that region. The long-term, nationally consistent data provided by this program enabled USGS scientists to quickly respond to a request from CENR for this assessment. NASQAN currently operates 18 stations in the Mississippi River basin to determine the annual flux of nutrients and pesticides along major rivers in the basin. (Note: the Toxic Substances Hydrology Program and the Hydrologic Research and Development Program fund research related to the hypoxia issue; activities in the Hydrologic Networks and Analysis Program are primarily basic data collection.)

USGS acid rain program unites atmospheric deposition monitoring networks worldwide -- For the first time, all of the major global atmospheric deposition monitoring networks have been united in a USGS program designed to measure laboratory data quality. On June 21, 1999, USGS began measuring analytical data quality from wet deposition chemistry laboratories in Europe and Southeast Asia. These laboratories will join those representing the major North American deposition monitoring networks which are already in the program. Now it will be possible to directly compare data from all of the deposition monitoring networks in the world. As a result, the ability to compare deposition levels occurring worldwide will be improved. In addition to monitoring trends in acid rain, nitrogen deposition data from these networks are being combined as input to global circulation models to estimate the role that nitrogen deposition plays in affecting the global cycling of carbon dioxide.

Research from several studies provides a better understanding of the relationship between hydrology and climate in the West -- In the Southwestern U.S., the Pacific warm-water phenomenon known as El Niño has been found to be linked to more frequent high streamflow events. For example, in the Spring Mountains, Nevada, although high-intensity/short-duration summer storms contribute about one-third of the annual precipitation, the principal means of upland recharge was found to be from late spring snowmelt, and El Niño was found to enhance both the snowpack and recharge. Information being provided by these studies can greatly aid water-management decisions in western States.