

Water Resources Assessment and Research Subactivity

Program	1999 Estimate	Uncontrol. & Related Chgs	Program	Program Changes	FY 2000 Budget Request	Change from 1999
Ground-Water Resources	3,170	96	-851	0	2,415	-755
National Water-Quality Assessment	71,593	2,165	-12,532	0	61,226	-10,367
Toxic Substances Hydrology	14,659	433	-3,284	474	12,282	-2,377
Hydrologic Research & Development	15,011	450	-2,786	-300	12,375	-2,636
Total Requirements \$000	104,433	3,144	-19,453	174	88,298	-16,135

Note: The Program Redirect column reflects the redirection of funds to the Integrated Science, Science Support, and Facilities activities.

National Water-Quality Assessment

Current Program Highlights

Consistent information across the Nation on water-quality conditions provided by the NAWQA Program continues to be of critical interest to national, State, and local agencies for decision making. For example, in the past year, data on 83 pesticides or pesticide degradation compounds from more than 8,000 samples collected in 36 study units has been made available over the Internet. Agencies such as the EPA have increasingly relied on NAWQA data to provide a national perspective of the occurrence of pesticides in the environment. States have relied on NAWQA information on volatile organic compounds, such as the fuel oxygenate methyl-tert butyl ether (MTBE) which has been found in ground water systems. Notably the States of California and Maine are making decisions about the use of this compound, and have used NAWQA data sets to help determine where the compound is found. Increasing interest has been expressed in the ecological information developed within the Program. Fish community data from NAWQA has been used at the State level to develop indices intended to improve fish habitat. In 1998, agencies have used information from NAWQA for environmental management, from forest management plans, to State pesticide management plans and drinking source-water protection plans.

Since implementation of the full-scale program in 1991, NAWQA has been organized around study units where an understanding of water-quality conditions of major river basins and aquifers is developed. Understanding is gained through interpretation of existing information and new data collected at multiple spatial scales ranging from small stream reaches and parts of aquifers to collections of large aquifers and river basins with similar land use and climatic conditions. There are four major elements to the NAWQA Program; taken together, these elements provide a unique approach using multiple lines of evidence across various scales and political jurisdictions to reach a consistent perspective on water-quality conditions.

NAWQA has been designed as an efficient program, taking advantage of other USGS programs and the existing USGS infrastructure. Over the last 9 years, inflation has had an impact on the Program. Instead of operating all 59 of the planned study units by 1998, the USGS had only initiated 49. In 1998, the USGS began a study that focuses on the High Plains aquifer--an area of the country with 7 study units where work had been postponed. This study is different from most because it covers a larger area and the data collection effort will be twice as long as the usual 3-year period. Also, in 1999 data collection began for the second time in two of the original NAWQA pilot study units (Delmarva Peninsula and the Yakima River Basin).

While adding these two new study units in 1999 was important, even with their addition, program activities still do not meet the planned operational level of about 20 study units per cycle. Additionally, decreased activity in other USGS programs supporting NAWQA, resulting from uncontrollable costs and budget decreases, have required the NAWQA Program to redirect resources to ensure that crucial supporting activities are maintained. As a result, NAWQA must continually adjust program resources and the number of operational study units. These adjustments have limited the geographical extent of NAWQA information, one of the key elements that makes NAWQA results crucial to other agencies.

The table shown below (Figure W-1, page 167) shows that the number of study units where work has actually begun has been substantially below the planned level since 1995. For 2000 and subsequent years, the number of study units the program continues to operate must be evaluated annually.

Major Elements of the NAWQA Program

- Study unit investigations
- Regional and national syntheses of findings aggregated from these and related investigations
- Supporting research and methods development
- Extensive coordination at local, State, regional, and national levels with environmental and natural resource managers and other users of water-quality information

Multi-Year Program Plan, National Water-Quality Assessment Program

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>
Number of study-units:										
Planned	27	27	27	40	40	40	59	59	59	59
Underway	27	27	27	40	35	36	49	49	51	

Figure W-1

Study Unit Investigations

All of NAWQA is built on the foundation of study unit investigations. NAWQA study units typically are about 20,000 square miles in size, cover about 45 percent of the Nation's land area, and encompass two-thirds of the population and water use. At full implementation, the program has 59 study units; within the resources available, work has begun in 51 study units - see Figure W-2. Remaining study units (8 yet to be scheduled) will be evaluated and prioritized (in FY 2000) along with the 20 begun in FY 1991 to determine resource allocations for FY 2001.

Figure W-2

Water Resources Assessment & Research Subactivity

Investigations within study units are conducted on a recurring cycle involving 4-5 years of intensive assessment activity followed by several years of less intensive monitoring and reporting (Figure W-3, below). As discussed above, the design of the NAWQA study unit investigations depends heavily on an infrastructure of historical and current hydrologic data, much of which is funded and conducted by other parts of the USGS Water Program, and especially the Federal-State Cooperative Water Program. For example, an operating principle of NAWQA is that most surface-water chemistry monitoring must be linked to the measurement of streamflow at gages. Most of the gages that NAWQA depends on are funded through partnerships between the USGS and State and local agencies, through the Federal-State Cooperative Water Program, and by other Federal agencies.

Figure W-3

Study unit activities underway in FY 1999 include the following:

- Initiation of work in the Delmarva Peninsula and the Yakima River basin. These study units are important because they were part of the pilot NAWQA efforts; thus, activities within each will allow the USGS to revisit these areas and establish trends since they were sampled in the late 1980's. Activities in these study units will be similar to what the USGS is doing in the study units where work began in 1997, but the extent and scope of work will be diminished.
- Improvements to NAWQA's database infrastructure. Databases have not been facile in handling the breadth of diverse data NAWQA generates. Thus the USGS has had to develop processes and database structures that allow use of all the data, but have not been efficient. These improvements will significantly increase the efficient use and storage of data.

- Increased modeling activities. With improved data handling capabilities, the USGS is also increasing the use of modeling within NAWQA. Modeling efforts are focused on landscape models that are applicable at regional and national scales, so that model results will provide better understanding for areas like the Mississippi River Basin--for example, where contaminants come from and where they end up. Eventually, these modeling efforts will have at least two major benefits. First is facilitating effectiveness in larger environmental improvement efforts, such as decreasing nitrogen reaching coastal or estuarine environments. Second is extending NAWQA understanding to areas outside the NAWQA study units themselves. That will allow the USGS to test our understanding of the most important influences on water-quality conditions.
- Increased data collection in National Parks within NAWQA study units. The USGS has initiated 13 new water-quality studies in 11 Parks. These additional efforts will both provide the Program with additional information in key areas, and provide Park management with needed insights on conditions.

Plans for FY 2000 include the following:

- The first set of 20 study units, begun in FY 1991, will continue low-level sampling activity at a small number of selected sites; these additional data collected between high intensity sampling efforts form a data bridge that makes it easier to understand any changes that may be identified when NAWQA returns to those initial study units in 2001. During 1998 each of these study units published a non-technical summary report of their findings. More than 35,000 copies of these summary reports have been distributed.
- The second set of 16 study units, begun in FY 1994, will concentrate on report writing and continuing low level data collection at a few sites. This will be the last year of intensive report writing, and will culminate with non-technical summary reports similar to those produced by the first set of study units during 1998. These study units will also work to ensure the data collected from 1996-1998 is added to the large national data base enabling national synthesis.
- The third set of study units began activity in FY 1997; during FY 2000, they will begin the second year of intensive surface water and ground water sampling. These 15 study units also include three pilot study areas (Upper Illinois River Basin, Delmarva Peninsula, and Yakima River Basin) where work was conducted between 1986 and 1991; thus, those areas provide the first opportunity to revisit and update water-quality information using NAWQA methodology. As these third cycle of study units conclude their intensive sampling in 2001, the program's first complete evaluation of occurrence and distribution of water-quality constituents will be feasible for 51 study units. Included with these study unit activities is ground water sampling in the High Plains aquifer, an area where 6 uninitiated study units are located. FY 2000 is the second of 6 years needed to sample the large High Plains aquifer (about 165,000 square miles).
- Communication and coordination between the USGS and other local, State, and Federal agencies continues to be crucial to the success of the NAWQA Program. The third set of study unit activities, including 15 study units and the regional ground-water study of the

High Plains, will meet with their liaison committees once or twice a year. These liaison committees include representatives from Federal, State, and local water management agencies along with Indian nations, universities, and citizen groups.

National Synthesis

The unique characteristic of the NAWQA Program that lends itself to national synthesis is the coordinated application and use of consistent methods and approaches nationwide. The current topics addressed by the national synthesis component are pesticides, nutrients, volatile organic compounds, trace elements, and ecology. Both the trace element and ecology components are the most recent additions to synthesis activities. Efforts in these new areas are not as comprehensive or intense as in the other three topics because of resource constraints.

During FY 2000, national synthesis projects will be analyzing the data base (using data from the 36 study units where work began in 1991 and 1994), making comparisons across the country and identifying relations between land use and water-quality conditions. These comparisons will refine insights into factors causing the existing water-quality conditions which should subsequently lead to management insights for water-quality improvement. Especially important issues to be addressed through continuing national synthesis activity include the impacts from MTBE usage and environmental factors that influence behavior of MTBE in the subsurface, and identification of the important factors influencing the occurrence of pesticides in urban and agricultural settings. Pesticide and trace metal data is particularly useful in developing consistent and comparable occurrence information for the 1996 Amendments to the Safe Drinking Water Act and the Food Safety Protection Act administered by the EPA. Preliminary insights developed in 1998 have already given the EPA useful insights for management and identified their additional data needs.

While NAWQA results have been used to inform managers, at the same time, the USGS is gaining insights on the relations between many environmental compartments such as air, soil, and water. Because influencing factors are not constant, management policy must accommodate known variations to be effective and efficient. NAWQA data can be used by management agencies to develop adaptive management strategies influencing environmental conditions in an effective manner. One of the best examples of this is management decisions that are now accounting for the effect of MTBE (which was used to improve the atmosphere) on drinking water sources. Managers are thinking of the environmental compartments as a system (integrated or linked together), and making adaptive changes to benefit the entire system. NAWQA insights have helped foster these management perspectives.

One additional data need the USGS has identified that would be helpful to the EPA is pesticide data from reservoirs that are used as drinking water sources. Even though reservoir sampling is not a focus of the NAWQA Program because of resource constraints, the EPA and the USGS have agreed to work together using NAWQA sampling infrastructure to collect additional data. The sampling, supported financially by the EPA, will be in a small number of reservoirs as a pilot effort.

Supporting Research and Methods Development

To ensure NAWQA data collection and analyses are relevant to emerging issues, research and methods development activities are part of the NAWQA Program's developing state-of-the-science capabilities. About 10 percent of program resources are devoted to developing new methods of sample collection and analysis, and to continuously evaluating, upgrading, and applying improved assessment techniques throughout the studies.

Research activities have focused on fuel oxygenate impacts, trends in contaminants associated with sediment particles, trends in water quality conditions, and new sampling approaches for microbial contaminants. When NAWQA was implemented in 1991, sampling methods for microbial contaminants were still focused on indicator bacteria. As a consequence, the USGS decided the NAWQA program would not include indicator bacteria because State agencies and others were already providing useful information that NAWQA could not improve on or add significantly to their results. Now, the USGS is developing and testing new methods for *Cryptosporidium* and giardia. Also, new methods for enteric viruses are being developed for widespread usage. Given the results of this research, the USGS thinks in a couple of years methods will be developed adequately to add them into the NAWQA program. These new methods will significantly add to the information available from State agencies and will be a good use of the NAWQA sampling capability to provide relevant data for an important water-quality issue.

Coordination with Others

Nationally, over the past year NAWQA coordination has increased significantly with both the EPA and the NPS. NAWQA has provided direct service to the EPA Office of Pesticide Programs, assisting in the timely and relevant application of NAWQA data to that Office's decision making process. This association has made millions of dollars of field pesticide data available in a useful form for their decision making. With the NPS, the USGS has developed a process to identify NPS water-quality information needs and have initiated projects to supply the data and insight that NPS managers have identified as crucial to their management of Park lands in NAWQA study units.

At the study unit level and nationally, NAWQA Program personnel continue to meet with environmental and resource managers, and other water information users at all levels of government. Through liaison committees at the national and study unit level, nearly 1,500 individuals represent their agencies or constituents in discussions on NAWQA Program progress, data, and products.

The NAWQA Program continues to add information to the Internet. NAWQA has established a Home Page on the WWW to provide rapid access to NAWQA data, reports, and methods documents. Also available is an up-to-date listing of current developments that allows interested parties to get new information in a timely fashion. The NAWQA Home Page on the WWW is: http://wwwrvares.er.usgs.gov/nawqa/nawqa_home.html.

Through access to the NAWQA Internet site, one can also gain access to the information being developed through synthesis activities. The Pesticide National Synthesis Internet site is one of the most frequently visited NAWQA sites. At present the site contains a statistical summary of occurrence data for the 5,000 samples collected by 1991 study units for 85

pesticides. Companies and other interested parties have been using the summary information to determine where compounds show up in the water versus where they are applied.

Recent Accomplishments

Pesticides

- The Hawaii State Department of Agriculture has included NAWQA protocols in their Statewide ground-water monitoring program for pesticides to obtain consistent spatial information. The State will use data from their program to make decisions on registering pesticides.
- In Oregon, the local environmental community has become interested in developing a comprehensive pesticide use reporting process. The incentive for this interest stems from an inability, identified by NAWQA, to obtain quantities of pesticides applied.

Environmental Management

- NAWQA data and reports were used by the U.S. Forest Service in preparing the Aquatic Conditions report for updating forest management plans including the Ozark, St. Francis, Mark Twain, and Ouachita National Forests in Missouri and Arkansas.
- The Missouri Department of Natural Resources, has incorporated NAWQA surface-water quality data into their database for Statewide 305 (b) water-quality standards compliance monitoring and will use these data to direct management problem identification efforts for natural resource management.
- The Pennsylvania Department of Agriculture has used NAWQA pesticide results leading to a Quality Assurance and Statewide Assessment project by the Department. Results will be used by the State for developing a Pesticides and Ground Water Strategy.
- In the Gore Creek watershed, near the Town of Vail, Colorado, using NAWQA data and additional assessments modeled on NAWQA, local planners are making land-use decisions such as riparian buffer needs, and other Best Management Practices to protect their water-quality.
- In the Upper Gunnison Colorado watershed, towns, county, water and sanitation districts, National Park Service, and river districts have used NAWQA data to determine the health of their watershed as it is affected by increasing urbanization. Decisions on requiring wastewater treatment facilities rather than the traditional septic systems are being made based on NAWQA data.
- NAWQA data and methods have been used to develop maps predicting the probability of atrazine/desethyl-atrazine detections in ground water of the upper Snake River Basin. These probability maps will be used by the Idaho Department of Agriculture in their State Pesticide Management Plan.

Ecology

- U.S. Army Corps of Engineers uses NAWQA methods for fish community assessments; for the second year, NAWQA biologists and protocols were used to assess fish community composition at the inflow streams and outflows from Corps reservoirs in north-central Pennsylvania.
- The States of Minnesota and North Dakota use NAWQA fish data to establish an Index of Biotic Integrity scoring system in the Red River of the North Basin; the index procedures were adopted by the States to improve water quality evaluation.

Microbial Contamination

- After the release of a NAWQA report documenting the extent of bacteria in Pennsylvania ground water, the State Department of Environmental Protection has instructed the State Department of Agriculture to collect bacteria samples whenever teams are collecting pesticide samples in agricultural areas.
- Ground-water data collected in suburban Minneapolis, Minnesota are being used by Hennepin County Conservation District to construct a ground-water-flow model. The model will be used to manage ground-water withdrawals in the metropolitan Twin Cities area.

Monitoring Networks

- Recently, NAWQA network designs were integrated into both the New Jersey Statewide surface and ground water-quality monitoring networks. These networks collect data to evaluate the status of the State's water resources, measure long-term trends in water-quality, assess contaminant levels associated with various land uses, and provide pollutant concentration and load estimates for use in the State's Watershed and Total Maximum Daily Load programs.

Volatile Organic Compounds

- The U.S. Senate Environment and Public Works Committee is concerned about impacts to ground-water quality and drinking-water supplies from the gasoline oxygenate MTBE. Knowledge from NAWQA's broad-scale monitoring of MTBE in ground water across the Nation has provided key information. The USGS gave field testimony on NAWQA's findings to the Senate Environment and Public Works Committee member, Barbara Boxer, on December 9, 1997, at Sacramento, California.
- The State of Maine has been concerned about MTBE, and NAWQA's scientists assisted the State in designing a comprehensive study of MTBE levels in domestic wells and community water-supply wells. This study's findings were used by Maine's Governor to request the removal of MTBE from gasoline Statewide.

Drinking-Water Studies

Water Resources Assessment & Research Subactivity

- High concentrations of 1,2-dichloropropane (a fumigant-derived compound) in ground water sampled by NAWQA in the Puget Sound Basin have resulted in local health agency and public interest in determining the extent and cause of drinking-water contamination in northern Whatcom County, Washington. Sampling showed that 1,2-dicholorpropane, was present throughout the area, and in some instances, concentrations exceeded drinking-water standards.