U.S. GEOLOGICAL SURVEY FEDERAL-STATE COOPERATIVE WATER-RESOURCES PROGRAM

FISCAL YEAR 1993

U.S. GEOLOGICAL SURVEY
Open-File Report 94-325

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by B.K. Gilbert

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Open-File Report 94-325

Reston, Virginia
1994

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U.S. GEOLOGICAL SURVEY FEDERAL-STATE COOPERATIVE WATER-RESOURCES PROGRAM, FISCAL YEAR 1993

by Bruce K. Gilbert

ABSTRACT

The Federal-State Cooperative Program is a major U.S. Geological Survey activity for the collection, analysis, and reporting of information on the quantity, quality, and use of the Nation's water resources. The fundamental characteristic of the program is that most of the work is undertaken by the U.S. Geological Survey through joint-funding agreements, with State, regional, and local agencies providing at least one-half the funds. The main objectives of the program are (1) to collect, on a systematic basis, data needed for the continuing determination and evaluation of the quantity, quality, and use of the Nation's water resources; and (2) to appraise the availability and the physical, chemical, and biological characteristics of surface and ground water through data analysis and interpretive water-resources investigations and research. During fiscal year 1993, Cooperative Program activities were underway in offices in every State, Puerto Rico, and several territories in concert with about 1,100 cooperating agencies. In fiscal year 1993, Federal funding of $63.5 million was matched by cooperating agencies, which also provided almost $23 million unmatched for a total program of about $150 million. This amounted to nearly 40 percent of the total funds for the U.S. Geological Survey's water-resources activities. This report presents examples of current (1993) investigations, as well as updated information on hydrologic investigations and research related to agriculture.

INTRODUCTION

Federal, State, regional, and local agencies share keen interests in appraising the Nation's water resources and in seeking solutions to water-related problems. Because of a variety of missions and areas of responsibility, agencies at times have diverse perceptions of need, priorities, and approaches. One of the principal strengths of the U.S. Geological Survey's (USGS) Federal-State Cooperative Program is accommodating this diversity through joint planning and funding of hydrologic data collection, investigations, and research.

The Cooperative Program, a partnership between the USGS and State and local agencies, provides a balanced approach to water-resources investigations. It is a major part of the USGS's coordinated program of water-resources investigations and research. The principal program objectives are (1) to collect, on a systematic basis, data needed for the continuing determination and evaluation of the quantity, quality, and use of water resources in the United States; and (2) to appraise the availability and the physical, chemical, and biological characteristics of surface and ground water through data analysis and interpretive water-resources investigations and research. The resulting information forms the foundation for many of the Nation's water-resources management and planning activities. In addition, the information can help identify emerging water problems at an early stage.

The Cooperative Program has contributed directly to water-resources knowledge for almost 100 years by fostering a working partnership between the Federal and State governments in the advancement of earth science, and by compiling a major part of the Nation's hydrologic information. From its earliest days, the program has been responsible directly for the development of procedures for streamgaging, concepts of surface-water and ground-water flow, and analytical techniques for investigations of water quality.

The first USGS cooperative water-resources investigation was with the State of Kansas in 1895. In 1905, Congress appropriated funds specifically for cooperative studies, marking the official beginning of the program. In 1928, Congress gave formal recognition to the Federal-State partnership and limited the Federal financial contribution for cooperative water-resources studies to no more than 50 percent of the total funds for each investigation.

During fiscal year (FY) 1993, hydrologic data collection, interpretive investigations, and research were conducted under the provisions of the Cooperative Program by USGS Water Resources Division personnel in offices in every State, in Puerto Rico, and in several territories in concert with about 1,100 cooperating agencies (see appendix A). The locations of principal Water Resources Division offices are shown in figure 1. State, county, and municipal agencies participate in the program, as do interstate-compact organizations, State universities, conservation districts, sanitary districts, drainage districts, flood-control districts, and other similar organizations. In FY 1993, Federal funding of $63.5 million was matched by cooperating agencies, which also provided almost $23 million unmatched funding, for a total of about $150 million. This total constituted nearly 40 percent of the total funds for the USGS's program of water-resources activities (figure 2).

The fundamental characteristic of the Federal-State Cooperative Program is that local and State agencies provide at least one-half the funds, but the USGS does most of the work. At times, the cooperator's contribution to the program may be partly in the form of

support known as direct expenditures, rather than funds. This refers to mutually agreed-upon work or material contributions for which dollar-value credit is given by the USGS for services rendered by the cooperator in support of program objectives.

This report has been prepared to describe some aspects of the Federal-State Cooperative Program, and to provide information on selected accomplishments in FY 1993. The report presents examples of current (1993) investigations as well as updated information on investigations related to agricultural activities.

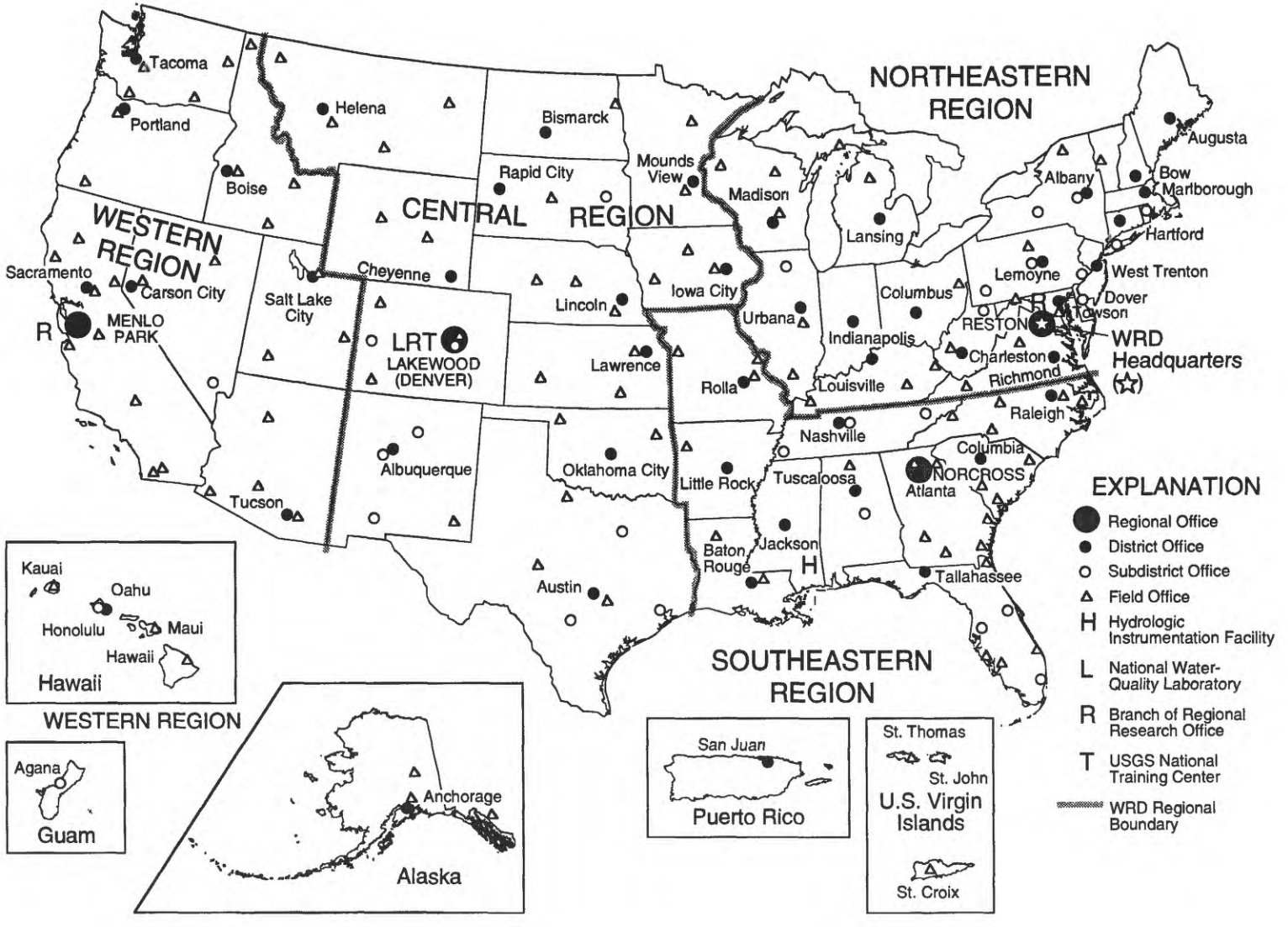

Figure 1.—U.S. Geological Survey Water Resources Division regional boundaries and location of principal offices .

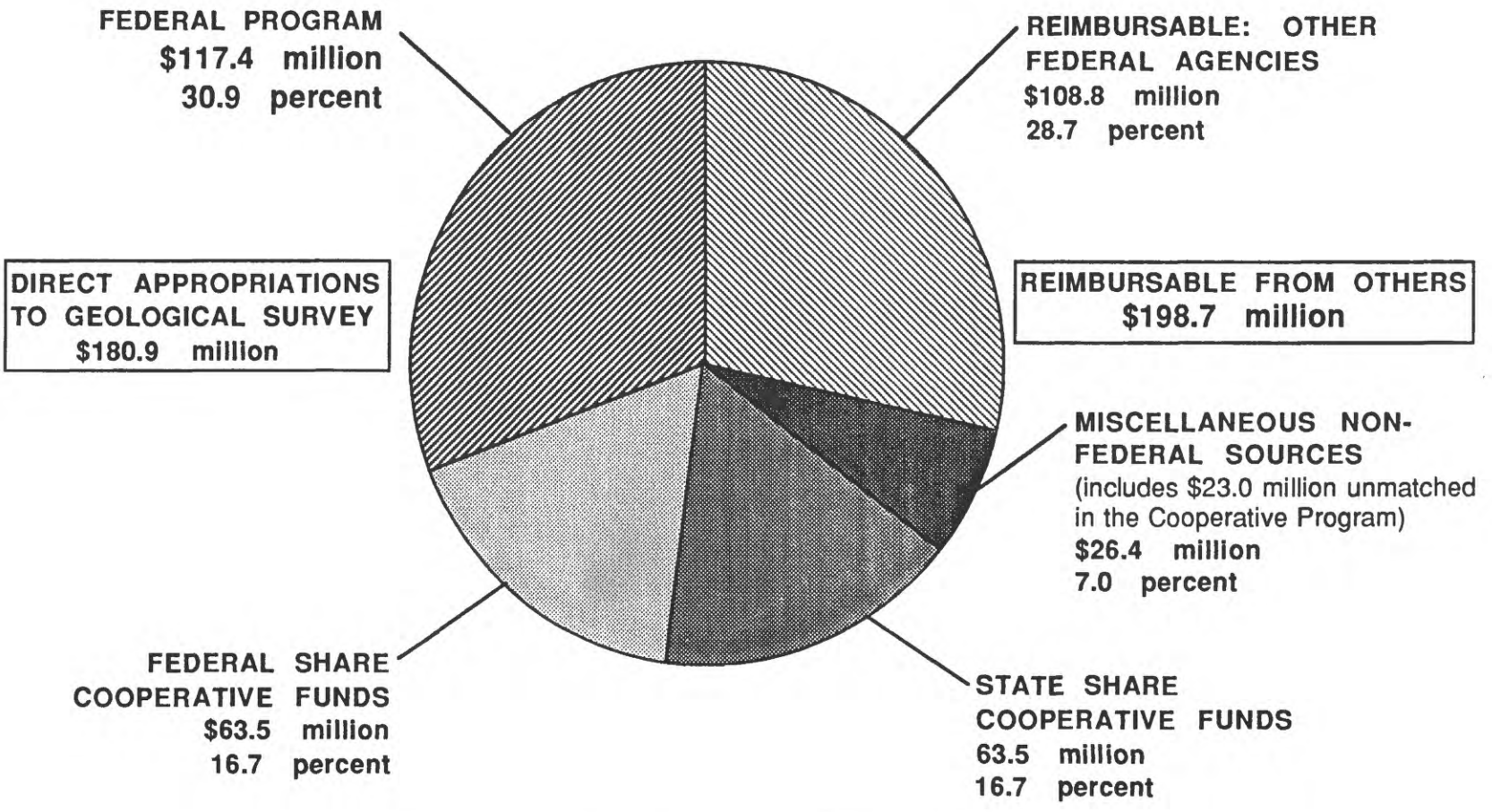

Figure 2 - Actual obligations of the U.S. Geological Survey Water Resources Division, fiscal year 1993.

FUNCTIONS OF THE COOPERATIVE PROGRAM

In fulfilling its water-resources mission, the USGS performs four principal functions:

- It collects data needed for the continuing determination and evaluation of the quantity, quality, and use of the Nation's water resources.

- It conducts analytical and interpretive appraisals to describe the occurrence, availability, and physical, chemical, and biological characteristics of surface and ground water.

- It conducts research in hydraulics, hydrology, and related scientific and engineering fields.

- It disseminates water data and the results of investigations and research.

The collection of surface-water and ground-water data on a systematic basis under the provisions of the Federal-State Cooperative Program is a major part of the USGS's coordinated water-resources activities. The resulting information provides a continuing record of the quantity, quality, and use of the Nation's water resources. In FY 1993, the Federal-State Cooperative Program served as the sole source of funding for the operation of more than 4,100 continuous streamflow stations and partially funded an additional 550 continuous streamflow stations. These stations constitute about 64 percent of the continuous streamflow stations operated by the USGS. The program also provided funds for the collection of ground-water levels at approximately 26,700 wells and the collection of water-quality data at about 2,100 surface-water stations and 4,300 ground-water well and spring stations. These data provide information necessary for the determination of water suitability for various uses, identification of trends, and evaluation of the effects of stresses on the Nation's surface- and ground-water resources.

Within the Cooperative Program, typically about half of the funds support the collection of hydrologic data; the remaining half support hydrologic investigations and research. During FY 1993, the USGS was involved in about 490 research projects and investigations as part of the Cooperative Program. Investigations encompass areas that range in size from a square mile or less to multistate regions. In these investigations, USGS scientists bring together information to define, characterize, and evaluate the areal extent, quality, and availability of the water resource. Since the early 1970's, there has been an increase in the number of investigations that have emphasized water-quality issues, such as aquifer contamination, river quality, storm runoff quality, and the effects of acid rain, mining, and agricultural chemicals and practices on the hydrologic system.

In 1977, the Congress of the United States recognized the need for uniform, current, and reliable information on water use and directed the USGS to establish a National Water-Use Information Program to complement the Survey's data on the availability and quality of the Nation's water resources. Thus, the National Water-Use Information Program became part of the USGS's Federal-State Cooperative Program (Mann and others, 1982). As of 1993, all 50 States and Puerto Rico participate in the program at various levels of involvement.

All data and results of analytical studies are made available to cooperating agencies and to the public through published reports (about 1,500 in FY 1993), and through

computerized information programs, such as the National Water Information System (NWIS) and the National Water Data Exchange (NAWDEX) Program. Abstracts of completed reports are made available through the USGS Water Resources Scientific Information Center (WRSIC). Hydrologic data can be accessed by computer terminals at offices in every State.

In many places, the Cooperative Program provides the only source of support for water-data collection and investigations required to assess, on a continuing basis, the status of the Nation's water resources. Information developed in the Cooperative Program has relevance to potential and emerging long-term problems, such as water supply, waste disposal, energy development, and environmental management and protection. Because common analytical methods and techniques are used, the information also is relevant to problems having interstate, regional, national, or international significance. The information furnishes the basis required to abide by interstate and international compacts and Federal law and court decrees, and to carry out congressionally mandated studies, regional and national water-resources assessments, and planning activities.

PROGRAM PRIORITIES

Program priorities are based on national needs that have been identified by the President and Administration advisors, by the Congress, by the Department of the Interior, by other Federal agencies, and from information the USGS has received from cooperating agencies and other interested parties. Issues that are identified through the National Water Summary (U.S. Geological Survey, 1984, 1985, 1986, 1988, 1990, 1991, and 1993) also are taken into consideration. As a result, the priorities are developed in response to mutual Federal, regional, State, and local requirements.

Thus, the USGS and its cooperating agencies work together in a continuing process that leads to adjustments in the program each year. The number of requests for scientific and technical assistance continues to grow from State agencies responsible for ground-water protection and for controlling and mitigating contamination. State offerings typically exceed Federal matching funds by as much as $20 million or more each year (almost $31 million in FY 1993) and reflect the increasing emphasis on water-quality issues, as well as other concerns regarding the availability, distribution, and use of the resource.

The strong linkage between the Cooperative Program, the Federal Program, and the Other Federal Agency Program is clearly reflected in the program priorities identified for FY 1994. The National Water-Quality Assessment (NAWQA) Federal Program, for example, will continue to build on water-quality information developed over many decades within the Cooperative Program. Data collection supported by the Federal Program and by other Federal agencies provides additional information. Ground-water contamination studies funded by military and civilian Federal agencies are providing valuable hydrologic information and research in basic physical processes. The USGS's National Research Program helps develop and refine hydrologic principles and methods for use in the Federal-State Cooperative Program. These are but a few examples of the interdependence among programs.

The following topics have been identified as highest priority in developing the FY 1994 Cooperative Program:

GROUND-WATER QUALITY--Concern continues over the vulnerability of the Nation's ground water to contamination from point sources, such as waste-disposal activities, as well as nonpoint sources, such as agricultural chemicals and practices. An improved knowledge of ground-water processes, including flow dynamics, solute-transport, and the geochemical and biological reactions that can alter, add, or remove contaminants, is needed to enhance the evaluation of and capability to forecast the effects of human activities. In some areas, improved definition of current ground-water quality is needed as a baseline for evaluation of future changes.

WATER SUPPLY AND DEMAND--The future health and economic welfare of the Nation's population depend on a continuing supply of uncontaminated freshwater. Many sources of supply are stressed by increasing withdrawals, use, diversion, and increasing demands for instream flow. Recent drought in some areas of the country has accentuated the need for better water supply and demand information. More comprehensive water-use information is needed to quantify the stress on existing supplies and to improve the evaluation of possible demand-management options to supplement the traditional supply approaches. Improved flow-system definition and simulation also are needed for the management of many aquifers that serve as important local or regional sources of water supply, and the management and support of watershed ecosystems.

STREAM QUALITY--The quality of the Nation's streams continues to be a priority concern of the Cooperative Program. Additional water-quality information is needed to evaluate the relative effects of runoff from various land use areas and ground-water contributions on overall stream quality, fluvial and bed-sediment chemistry, and stream biota. Investigations of the effects of nonpoint sources, particularly those related to agriculture and urbanization, are of special interest. Models of surface-water quality that simulate chemical and biological processes are needed to quantify these effects and to evaluate management alternatives.

WETLANDS, LAKES, RESERVOIRS, AND ESTUARIES--These valuable ecosystems merit special attention because of their importance as fish and wildlife habitat, sources of water supply, and recreational areas. Wetlands, in particular, are areas where important water treatment and purification processes can occur naturally. Despite their relative sensitivity to human activities, these areas continue to be subject to development pressures. Studies that contribute to an improved understanding of the physical, chemical, and biological processes typical of wetlands, lakes, reservoirs, and estuaries are needed to insure proper management and protection of these valuable resources.

HYDROLOGIC DATA COLLECTION--The hydrologic data program constitutes the foundation for many other USGS activities and for watershed and aquifer management nationwide. Large amounts of data and specialized interpretation are required to resolve conflicts among State and Federal agencies regarding water rights; thus, enhancement of the hydrologic data program continues to be high priority for the Cooperative Program.

HYDROLOGIC HAZARDS--Economic losses from floods, lake-level changes, mud and debris flows, erosion and sedimentation, and other hydrologic hazards can total several billions of dollars annually. Studies of the basic processes underlying these hazards are needed to improve the ability to forecast the probabilities of occurrence and the likely magnitudes of hydrologic hazards.

INDIAN WATER RIGHTS--The USGS has long assisted in appraising the water resources of Indian lands as part of the Cooperative Program. The protection and management of the Indian tribes' natural resources are essential elements of the Secretary of the Interior's trust responsibility to the tribes. Cooperative activities that concern these resources will continue to be given high priority.

UPDATE ON ACTIVITIES RELATED TO AGRICULTURE

Because of agriculture's dependence on the availability and quality of water, many hydrologic data-collection efforts and investigations conducted by the USGS are important to agricultural interests. In 1888, an Act authorized the USGS to identify irrigable lands in arid regions and areas that could provide adequate water for irrigation. Thus, almost since the USGS was founded, activities related to agriculture have been included in its responsibilities.

At various times during FY 1970-89, the USGS had in progress about 280 investigations related to agriculture (Gilbert and Mann 1989 and 1990). Of these, almost 70 percent were supported by the Cooperative Program. Recent information shows that approximately 140 investigations related to agricultural activities were underway at various times during 1990-93, more than 60 percent of which were supported by the Cooperative Program; the USGS Federal Program and the Other Federal Agency Program provided support for the remainder.

A list of selected USGS investigations related to agricultural activities and underway at various times during FY 1990-93 is given in Appendix B. The types of studies include the investigation of the--

- Effects of agricultural chemicals on water quality
- Availability of water for irrigation
- Effects of irrigation drainage on water quality
- Consumptive use of water by agriculture
- Effects of agricultural practices on sedimentation
- Relation of agricultural chemicals to nonpoint-source contamination
- Relation of ground-water pumping for irrigation to land subsidence.

EXAMPLES OF CURRENT INVESTIGATIONS

Several additional examples of recent cooperative investigations follow:

- ARIZONA--Urban Storm Water, Maricopa County

In 1992, the USGS and the Arizona Department of Environmental Quality began a 3-year study in Maricopa County to (1) characterize the acute toxicity and chemistry of storm water from residential, industrial, commercial, and undeveloped land uses; (2) identify which phases (trace metals, organics, suspended solids, and oil and grease) of storm water are toxic; and (3) characterize the acute toxicity and chemistry of bed material in streams receiving urban runoff. Storm-water samples and bed-material samples are being collected and analyzed from five basins. Bed-material samples also are being collected from the receiving ephemeral streams. The sampled basins are the same basins concurrently being monitored to characterize the quality and quantify of urban runoff. The concurrent monitoring is a USGS cooperative study with the Flood Control District of Maricopa County.

- CALIFORNIA--Contaminant Transport in Fractured Rock, Penn Mine

The USGS is conducting a study in cooperation with the California State Water Resources Control Board and the East Bay Municipal Utility District to (1) verify ground-water flow paths and quantify ground-water flow in the fractured metavolcanic-rock aquifer, connecting unlined mining waste-water ponds to Camanche Reservoir; (2) quantify the water-rock interactions that control the geochemistry of the ground-water system; (3) determine the residence time of dissolved sulfate in the acidic ground water between the mine and the reservoir and evaluate mixing of water from underground mine workings and surface impoundments; and (4) quantify transport of major chemical constituents and trace elements along ground-water flow paths from the mine to the reservoir. This study represents one of the first attempts at modeling contaminant transport in fractured rock, and will serve to advance knowledge and understanding of fractured-rock hydrogeology.

- COLORADO--Sources of Contamination, South Platte River

A cooperative study between the Metro Wastewater Reclamation District (Metro) and USGS examined the quantity and quality of ground-water discharge to the South Platte River downstream from Denver, Colorado, from August 1992 through July 1993. Because flow in this segment of the South Platte River is dominated by effluent discharge from the Metro wastewater-treatment plant, water-quality problems in the river (e.g., low concentrations of dissolved oxygen and high concentrations of nitrate and ammonia) have been attributed to effluent discharges from Metro. Results from this study indicate that (1) substantial quantities of ground water were being discharged to the river, (2) the ground water had low concentrations of dissolved oxygen throughout the study area, and (3) discharging ground water had high concentrations of nitrate and ammonia along specific reaches of the study area. Ground water with high concentrations of nitrate generally discharged to the river in agricultural areas, whereas ground water with high concentrations of ammonia discharged to the river in urban areas. In general, results from this study demonstrate that effluent discharge from the Metro plant was not the only factor that degraded water quality in the South Platte River downstream from Denver.

- FLORIDA--Development of Flow Models for Wetlands, Date County

The USGS, in cooperation with the South Florida Water Management District, is investigating methods of improving existing ground-water flow models used to simulate hydrologic conditions in wetlands. Hydrologic data collected in Dade County will be used

to construct and calibrate models of the Biscayne aquifer that will include simulations of the interactions between surface water, ground water, and wetlands. This study will help improve an understanding the hydrologic relations in the South Florida Everglades area.

- FLORIDA--Flood-Plain Habitats, Apalachicola River

The current controversy over water allocation in the Apalachicola-Chattahoochee-Flint (ACF) Rivers involving the City of Atlanta, the States of Georgia, Alabama, and Florida, and the U.S. Army Corps of Engineers is a strong signal that water resources in this basin are limited and competition for water is increasing. Florida's needs for the water resources of the ACF basin are primarily ecosystem based and relate to the healthy maintenance of the river, flood plain wetlands, and estuary. Relations between river flow and flood-plain habitats need to be defined to understand the potential effects of increased upstream water withdrawals on the Apalachicola River flood-plain system. The USGS, in cooperation with the Northwest Florida Water Management District, is conducting an investigation to describe how Apalachicola River flood-plain habitats and indigenous biological communities might be expected to change if river flows are altered by upstream withdrawals.

- IOWA, KANSAS, MINNESOTA, MISSOURI, NORTH AND SOUTH DAKOTA, AND NEBRASKA--Midwest Floods, 1993

The record floods in 1993 were monitored by the USGS. Approximately 70 percent of the USGS streamgaging stations used in monitoring were operated in cooperation with various State and local government agencies. This ongoing monitoring of the cooperative data network was critical in providing flood-stage and discharge data during the flooding. The information gathered was used for public safety and disaster response efforts that potentially saved lives and property. This hydrologic information also is being used in many States to establish river stage and discharge at bridge sites. With this information, transportation planners can design bridges and roadways of the appropriate size and configuration to minimize scour and to allow for the safe passage of vehicles during future floods. The mapping of floodplain inundation provides information useful in establishing the recurrence interval of flooding. This information is used for setting valid zoning and insurance regulations that protect people and property from future flooding.

- MASSACHUSETTS--Movement of Wastewater in a Coastal Marsh, Orleans

The siting of wastewater-treatment plants is an environmental challenge in the coastal zone of the United States. Directing effluent discharges to land-disposal areas near the coastline is a potential alternative to using direct ocean outfalls, but the processes governing the subsurface transport of chemical constituents in wastewater through coastal-sedimentary environments have not been well studied. The USGS, in cooperation with the Massachusetts Department of Environmental Protection, is investigating the movement of a large, well-characterized plume of wastewater-contaminated ground water toward a Cape Cod coastal marsh. The study focuses on the transport of dissolved nitrogen in ground water to seepage zones in the marsh, where large nitrogen losses from denitrification and plant uptake may be occurring. Results from the study will be relevant to other coastal wetland areas strongly affected by ground-water discharge from regional aquifers.

- PENNSYLVANIA--Contaminated Sediments in the Lower Susquehanna River

The processes of deposition and scour of nutrient- and metals-laden bottom sediments in three hydroelectric reservoirs of the lower Susquehanna River, Pennsylvania, are poorly understood. Instantaneous or slug release of these sediments, notably during flood conditions, is thought to be a serious threat to aquatic ecosystems downstream in Chesapeake Bay. The USGS, in cooperation with the Pennsylvania Department of Environmental Resources, is investigating the current distribution of bottom sediments in

the reservoirs and assessing changes since the last investigation in 1990. The updated information on bathymetry and thickness of bottom sediments will provide a reliable baseline for evaluating future sediment deposition and scour in the reservoirs and for estimating quantities of contaminated sediments transported by the Susquehanna River to Chesapeake Bay.

- SOUTH CAROLINA--Rates of Petroleum Hydrocarbon Degradation

The USGS, in cooperation with the South Carolina Water Resources Commission, is investigating an extensively contaminated shallow water-table aquifer underlying a fuel-tank farm in Hanahan, South Carolina. Data collected to date have revealed that petroleum hydrocarbons in the aquifer are being degraded anaerobically in a complex pattern of zones dominated by iron-reducing, sulfate-reducing, and methanogenic conditions that change dynamically in both time and space. Further investigation is designed to determine relative rates of hydrocarbon degradation under these conditions and how degradation rates are affected by changes in conditions. This information should benefit the design of bioremediation strategies at this and similar sites nationwide.

- TENNESSEE--Effects of Agricultural Practices on Water Quality in the Beaver Creek Drainage Basin

Agricultural operations have been identified as the largest contributor to water quality degradation in the intensively farmed areas of west Tennessee. The purposes of this investigation, which is being conducted by the USGS in cooperation with the Tennessee Department of Agriculture, Shelby County Soil Conservation District, Tennessee Department of Environment and Conservation, Tennessee Association of Conservation Districts, University of Tennessee Agriculture Extension Service, and Memphis State University, are to document the effects of various agricultural practices on surface and subsurface water quality and to assess the effectiveness of implementing various best management practices (BMP's). The study will determine the current quality of surface and subsurface waters in the Beaver Creek drainage basin of western Tennessee, and will document changes in sediment, nutrient, and pesticide concentrations following implementation of BMP's. The results are expected to show the effectiveness of different agricultural BMP's in improving water quality and may be transferable to other agricultural areas of Tennessee and the United States.

- TEXAS--Areas of High Risk from Contamination, Edwards Aquifer

In cooperation with the Edwards Underground Water District in San Antonio, Texas, outcrops of the Edwards aquifer (sole source of water for San Antonio and surrounding area) were mapped by the USGS in norther Bexar, Comal, and Hays counties. The resulting hydrogeologic maps show areas most susceptible to contamination of surface sources, such as spills or stormwater runoff from residential or commercial development on or adjacent to the aquifer outcrops. This information is essential for land-use planning to protect the "sole source" Edwards aquifer in the rapidly urbanizing outcrop area. In addition, the hydrogeologic maps are useful for determining relative fault displacement, which, when combined with the defined "most sensitive to pollution" areas, aids in inferring the path of ground-water flowpath from the outcrop into the aquifer.

- WASHINGTON--Ground Water and Water Quality, Long Beach Peninsula

Planning and health agencies in the Long Beach area are concerned that leachate from septic systems and pesticides from cranberry-growing areas may be degrading the water quality in the shallow aquifer, and that ground water containing pesticides, nutrients, and bacteria may be discharging to Willapa Bay and affecting oyster production. There are claims that the water quality of Willapa Bay ranks among the best in the world with respect to oyster production. In 1991 the USGS, in cooperation with the Pacific County

Department of Community Development, began a 3-year ground-water study that included an inventory of 170 wells, monthly water-level measurements for 1 year at 103 wells and 28 stage gages in lakes and drainage canals; synoptic water-quality sampling at 42 wells and 13 surface-water sites; and slug tests at 58 shallow wells. The collected data will define current conditions and will be analyzed with historical data to determine whether or not changes in the quality of water in the shallow aquifer have occurred over time.

SUMMARY AND CONCLUSIONS

The USGS's Federal-State Cooperative Program has responded to national needs for hydrologic information since 1895. During FY 1993, water-resources data collection, investigations, and research were conducted in cooperation with about 1,100 State, regional, and local agencies in every State, Puerto Rico, and several Territories. Cooperative Program funding in FY 1993 totaled about $150 million and accounted for nearly 40 percent of the total obligations for the USGS's Water Resources Division. The Cooperative Program provides much of the information required by those responsible for water-resources planning and management, water-supply development, and environmental improvement through hydrologic data collection, investigations, and research. The program is a unique activity in that the cooperating agencies provide more than half the funds, but the USGS performs most of the work. The program is also a primary source for knowledge concerning techniques for collecting and analyzing data on the quantity, quality, use, and flow of surface water and ground water.

Because the availability of high-quality water is a fundamental limiting factor to population growth, a comprehensive and forward-looking program of hydrologic data collection and investigations is needed to provide the information necessary for the wise development and use of the Nation's water resources. The job is too large to be supported at either Federal or State level alone. The jointly planned and funded Cooperative Program provides convincing assurance that the work is designed to meet national and local needs.

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Appendix A.--Cooperators by State, Fiscal Year 1993

Alabama:
- Alabama Department of--
  - Conservation
  - Economic and Community Affairs
  - Emergency Management
  - Environmental Management
  - Highways, Departments No. 1, 2, and 6
- Anniston, City of
- Baldwin County Commission
- Birmingham, City of
- Coffee County Commission
- Geological Survey of Alabama
- Huntsville, City of
- Jefferson County Commission
- Mobile, City of
- Montgomery, City of
- Parrish, Town of
- Sumter, County of
- Tuscaloosa, City of

Alaska:
- Alaska Department of--
  - Fish and Game
  - Natural Resources, Division of Water
  - Transportation
- Alaska Energy Authority
- Anchorage, Municipality of
- Cordova, City of
- Juneau, City and Borough of
- Kenai Peninsula Borough
- Sitka, City and Borough of
- University of Alaska, Fairbanks

Arizona:
- Arizona Department of--
  - Environmental Quality
  - Water Resources
- Gila Valley Irrigation District
- Gila Water Commissioner, Office of
- Hualapai Indian Tribe
- Hopi Tribe Department of Natural Resources
- Maricopa County--
  - Flood Control District
- Metropolitan Water Dist. of Southern California
- Navajo Nation
- Pima County Department of Transportation
- Safford, City of, Water, Gas, & Sewer Dept.
- Salt River Project
- Show Low Irrigation Company
- Tucson, City of

Arkansas:
- Arkansas Department of--
  - Parks and Tourism
  - Pollution Control and Ecology
- Arkansas Game & Fish Comm., Fisheries Div.
- Arkansas Geological Commission
- Arkansas Soil & Water Conservation Comm.
- Arkansas State Highway & Trans. Dept.
- Arkansas-Oklahoma: Arkansas River Compact Comm.

Arkansas--continued
- Fort Smith, City of
- Independence, County of
- Little Rock--
  - Municipal Water Works
  - Public Works Department
- Rogers, City of, Water Utilities Department
- University of Arkansas--
  - at Fayetteville
  - at Little Rock

California:
- Adelanto, City of
- Alameda County--
  - Flood Control & Water Cons. Dist. (Hayward)
  - Water District
- Antelope Valley-East Kern Water Agency
- Atherton, City of
- Barstow, City of
- California Department of--
  - Boating and Waterways
  - Conservation
  - Parks and Recreation
  - Transportation
  - Water Resources
- California Polytechnical U.-San Luis Obispo
- California Water Resources Control Board
  - Division of Water Quality
- Calleguas Municipal Water District
- Carpinteria County Water District
- Casitas Municipal Water District
- Coachella Valley Water District
- Contra Costa County Flood Control & Water Conservation District
- Contra Costa Water District
- Crestline-Lake Arrowhead Water Agency
- Desert Water Agency
- East Bay Municipal Utility District
- Eastern Municipal Water District
- Georgetown Divide Public Utility District
- Hopland Band of Pomo Indians
- Humboldt Bay Municipal Water District
- Imperial County Department of Public Works
- Imperial Irrigation District
- Indian Wells Valley Water District
- Los Angeles, County of
- Louisiana State University and A&M College
- Madera Irrigation District
- Marin Municipal Water District
- Mendocino County Water Agency
- Merced, City of
- Merced Irrigation District
- Mojave Water Agency
- Mono, County of
- Montecito Water District
- Monterey County Water Resources Agency
- Monterey Peninsula Water Mgmt. District
- Morongo Band of Mission Indians
- Orange County Water District
- Palmdale, City of

California--continued
- Palo Alto, City of
- Pechanga Indian Reservation
- Riverside County Flood Control & Water Conservation District
- Sacramento Municipal Utility District
- Sacramento County Department of Public Works
- San Benito County Water district
- San Bernardino County Flood Control District
- San Bernardino Valley Municipal Water District
- San Diego, City of
- San Diego County Department of Public Works
- San Francisco, City and County of
- San Francisco Water Department
- San Luis Obispo County Engng. Department
- San Mateo County Dept. of Public Works
- Santa Barbara, City of, Dept. of Public Works
- Santa Barbara County--
  - Flood Control & Water Conservation Dist.
  - Water Agency
- Santa Clara Valley Water District
- Santa Cruz, City of
- Santa Cruz County Flood Control & Water Conservation District
- Santa Maria Valley Water Conservation District
- Santa Ynez River Water Conservation District
- Scotts Valley Water District
- Sonoma County--
  - Planning Department
  - Water Agency
- Tulare County Flood Control District
- Turlock Irrigation District
- United Water Conservation District
- Ventura County Public Works Agency
- Water Master--Santa Margarita River Watershed
- Water Replenishment District of So. California
- Woodbridge Irrigation District
- Yolo County Flood Control & Water Conservation District
- Yuba County Water Agency

Colorado:
- Arapahoe County Water and Wastewater
- Arkansas River compact Administration
- Aspen, City of
- Aurora, City of
- Boulder, City of
- Boulder, County of
- Breckenridge, Town of
- Centennial Water and Sanitation District
- Cherokee Water and Sanitation District
- Colorado Department of--
  - Health
  - Minerals and Geology
  - Transportation
- Colorado Division of--
  - Wildlife
- Colorado Office of the State Engineer
- Colorado River Water Conservation District
- Colorado Springs, City of--
  - Engineering Division
- Colorado Springs Utilities

Colorado--continued
- Colorado Water Conservation Board
- Delta Board of Water Commissioners
- Denver Board of Water Commissioners
- Eagle County Board of Commissioners
- East Cherry Creek Valley Water & Sanitation District
- East Grand County Water Quality Board
- Englewood, City of
- Evergreen Metropolitan District
- Fort Collins, City of, Water & Wastewater Utility
- Fountain Valley Authority
- Fremont Sanitation District
- Garfield, County of
- Glendale, City of
- Glenwood Springs, City of
- Lakewood, City of
- Lamar, City of
- Las Animas, City of
- Longmont, City of
- Loveland, City of
- Lower Fountain Water-Quality Mgmt. Assn.
- Metropolitan Wastewater Reclamation District
- Moffat, County of
- Northern Colorado Water Conservation District
- Pueblo Board of Water Works
- Pueblo, City of, Department of Utilities
- Pueblo County Commissioners
- Pueblo West Metropolitan District
- Rio Blanco, County of
- Rio Blanco Water Conservation District
- Rio Grande Water Conservation District
- Rocky Ford, City of
- Routt, County of
- St. Charles Mesa Water District
- Southern Ute Indian Tribe
- Southeastern Colorado Water Cons. Dist.
- Southwestern Colorado Water Cons. District
- Steamboat Springs, City of
- Teller-Park Soil Conservation District
- Thornton, City of
- Trinchera Water Conservation District
- Uncompahgre Valley Water Users Association
- Upper Arkansas Council of Governments
- Upper Arkansas River Water Cons. District
- Upper Eagle Regional Water Authority
- Upper Gunnison River
- Upper Yampa Water Conservancy District
- Urban Drainage and Flood Control District
- Ute Mountain Indian Tribe
- Vail Valley Consolidated Water District
- Willows Water District
- Westminster, City of
- Yellow Jacket Water Conservancy District

Connecticut:
- Connecticut Department of--
  - Environmental Protection
  - Transportation, Bureau of Engineering and Highway Operations
- Fairfield, Town of, Conservation Department
- Lake Waramaug Interlocal Commission
- Lake Waramaug Task Force, Inc.
- Meriden, City of

Connecticut--continued
- New Britain, City of, Board of Water Commissioners
- South Central CT Regional Water Authority
- Torrington, City of

Delaware:
- Geological Survey
- University of Delaware
- Delaware River Basin Commission

District of Columbia:
- Dept. of Consumer & Regulatory Affairs, Environmental Control
- Department of Public Works

Florida:
- Bay County Utilities
- Boca Raton, City of
- Bradenton, City of
- Broward, County of--
  - Natural Resources Protection
  - Water Resources Management Division
- Cape Coral, City of
- Charlotte, County of
- Cocoa, City of, Utilities and Public Works
- Daytona Beach, City of
- Deerfield Beach, City of
- Florida Department of--
  - Environmental Protection
  - Natural Resources--
    - Bureau of Marine Resource & Eval.
  - Transportation
- Florida Keys Aqueduct Authority
- Fort Lauderdale, City of
- Game and Freshwater Fish Commission
- Hallandale, City of
- Highland Beach, Town of
- Hillsborough, County of
- Hollywood, City of
- Jacksonville, City of, Dept. of Public Utilities
- Jacksonville Electric Authority
- Joshua Water Control District
- Lake, County of, Water Authority
- Lake Mary, City of, Public Works
- Lee, County of
- Manatee County--
  - Board of County Commissioners
  - Environmental Action Commission
- Metropolitan Dade County
- Miami-Dade Water and Sewer Authority
- North Port Water Control District
- Northwest Florida Water Management District
- Orange County Public Works Division
- Perry, City of
- Pinellas, County of
- Pompano Beach, City of
- Reedy Creek Improvement District
- Sarasota, City of
- Sarasota, County of
- South Florida Water Management District--
  - Department of Research and Evaluation
- Southwest Florida Water Management District
- St. Johns River Water Management District

Florida--continued
- St. Petersburg, City of
- Stuart, City of
- Suwannee River Water Management District
- Tallahassee, City of--
  - Electric Department
  - Water Quality Laboratory
- Tampa, City of
- Tampa Bay Regional Planning Council
- Volusia, County of
- Walton, County of
- West Coast Regional Water Supply Authority
- Winter Park, City of

Georgia:
- Albany Water, Gas, and Light Commission
- Athens-Clarke County
- Attapulgus, City of
- Bibb, County of
- Blairsville, Town of
- Brunswick, City of
- Chestatee-Chattahoochee Resource Conservation & Development Center
- Clayton County Water Authority
- Coastal Georgia, Regional Development
- Covington, City of
- Dekalb County Public Works Department
- Georgia Department of--
  - Natural Resources--
    - Water Quality Management Program
    - Geologic Survey
  - Transportation--
    - at Atlanta
    - at Forest Park
- Georgia Forestry Commission
- Georgia Mountain Reg. Development Center
- Gwinnett, County of, Preconstruction Division
- Helena, City of
- Macon Water and Sewage Authority
- Monroe Water, Light, and Gas Commission
- Moultrie, City of
- South Florida Water Municipal Department
- Springfield, City of
- St. Johns River Water Municipal Department
- Thomaston, City of
- Thomasville, City of
- Tift County Commission
- Tifton, City of
- Valdosta, City of

Hawaii:
- Hawaii, County of, Dept. of Water Supply
- Hawaii Department of--
  - Agriculture, Div. of Ag. Resource Mgmt.
  - Land and Natural Resources--
    - Comm. on Water Resources Mgmt.
  - Transportation
- Honolulu, City and County of--
  - Board of Water Supply
  - Department of Public Works
- Kauai, County of, Department of Water Supply
- Maui, County of, Department of Water Supply

Idaho:
- Ada County Highway District
- Boise, City of
- Bonner County Commissioners
- Coeur d"alene Tribe of Idaho
- Idaho Department of--
  - Health and Welfare
  - Water Resources
- Salmon River Canal Co., Ltd.
- Shoshone-Bannock Indian Tribes
- Shoshone, County of
- Southwest Irrigation District
- Teton, County of, Board of Commissioners
- Water District No. 01 (Idaho Falls)
- Water District No. 31 (Dubois)
- Water District No. 32D (Dubois)

Illinois:
- Bloomington and Normal Sanitary District
- Boneyard Creek Commission
- Cook County Forest Preserve District
- Danville Sanitary District
- Decatur, City of
- Dekalb, City of, Public Works Department
- DuPage County Forest Preserve, Planning & Development Section
- DuPage County Department of Environmental Concerns
- Illinois Department of--
  - Conservation, Planning Division
  - Energy and Natural Resources--
    - State Water Survey
  - Transportation--
    - Division of Water Resources
- Illinois Environmental Protection Agency
- Kane, County of--
  - Forest Preserve Commission
  - Development Dept., Stormwater Mgmt.
- Kankakee Soil and Water Conservation District
- Lake County Stormwater Mgmt. Commission
- Metro. Water Reclamation Dist. of Greater Chicago
- Monticello City of
- Springfield, City of
- Vermilion County Conservation District
- Winnebago, County of, Dept. of Public Works
- Wisconsin Department of Natural Resources

Indiana:
- Carmel, Town of, Utilities
- Elkhart, City of, Water Works
- Indiana Department of--
  - Environmental Management
    - Office of Water Management
    - Office of Solid & Hazardous Waste Management
  - Natural Resources, Division of Water
  - Transportation
- Indiana Office of the State Chemist
- Indianapolis, City of, Dept. of Public Works
- Muncie Sanitary District, Bu. of Water Quality
- Purdue University
- St. Joseph River Basin Commission

Iowa:
- Ames, City of
- Cedar Rapids, City of, Engng. Dept.
- Clinton, City of
- Davenport, City of
- Des Moines, City of
- Fort Dodge, City of
- Iowa Department of--
  - Transportation, Highway Division
  - Nat. Resources, Geological Survey Bureau
- Iowa State University
- Muscatane Water and Light Board
- University of Iowa--
  - Department of Preventive Medicine
  - Institute of Hydraulic Research
  - Hygienic Laboratory

Kansas:
- Arkansas River Compact Administration
- Brazos River Authority
- Cameron, City of
- Emporia, City of, Department of Public Works
- Equus Beds Groundwater Mgmt. District No. 2
- Harvey County Conservation District
- Hays, City of
- Iowa Tribe of Kansas and Nebraska
- Johnson, County of
- Kansas Department of Transportation
- Kansas Geological Survey
- Kansas St. Board of Ag., Div. of Water Res.
- Kansas State Conservation Commission
- Kansas State University Dept. of Agronomy
- Kansas University Center for Research, Inc.
- Kansas Water Office
- Lake Resion Resources Conservation Council
- Sac and Fox Tribe of Missouri
- Topeka, City of
- University of Iowa
- Wichita, City of

Kentucky:
- Bullitt, County of
- Campbellsville Municipal Water
- Elizabethtown, City of
- Georgetown, City of
- Glasgow Water Company
- Kentucky Department of Health Services
- Kentucky Dept. of Natural Resources & Environmental Protection Cabinet
- Kentucky State University
- Madison County Conservation District
- Metropolitan Sewer District
- Middlesboro, City of
- University of Louisville

Louisiana:
- Caddo Parish
- Capital-Area Groundwater Cons. Comm.
- East Baton Rouge Parish
- Louisiana Department of--
  - Environmental Quality
    - Office of Water Resources

Louisiana--continued
- Natural Resources, Coastal
  - Coastal Restoration Division
- Transportation and Development
  - Bridge Hydraulics
- Louisiana Office of Emergency Preparedness
- Minden, City of
- Plaquemines Parish
- Sabine River Compact Administration
- St. John the Baptist Parish
- Terrebonne Parish
- West Monroe, City of

Maine:
- Aroostock County Water & Soil Mgmt. Board
- Greater Portland Council of Governments
- Jay, Town of
- Maine, Department of--
  - Environmental Protection
  - Conservation, Geological Survey
  - Human Services
  - Transportation
- North Kennebec Valley Reg. Planning Comm.
- Northern Maine Regional Planning Comm.
- Penobscot Indian Nation
- University of Maine

Maryland:
- Baltimore, City of, Water Quality Management
- Hyndman, Borough of
- Interstate Commerce Commission
- Maryland Geological Survey
- Maryland Department of Environment
- Maryland State Highway Administration
- Prince Georges County Government
- Salisbury, City of

Massachusetts:
- Berkshire, County of
- Cape Cod Commission
- Massachusetts Department of--
  - Environ. Mgmt., Div. of Resource Cons.
  - Environmental Protection--
    - Division of Water Pollution Control
    - Division of Water Supply
    - Bureau of Waste Site Cleanup
- Massachusetts Highway Department
- Metropolitan District Commission--
  - Parks, Engng. and Construction Division
  - Watershed Management Division
- University of Rhode Island

Michigan:
- Adrian, City of
- Ann Arbor, City of
- Antrim County Drain Commission
- Battle Creek, City of
- Beaverton, City of
- Cadillac, City of
- Clare, City of
- Cliffs Mining Services Co.
- Coldwater, City of, Board of Public Utilities
- Consumers Power Company
- Delta Charter Township

Michigan--continued
- Elsie, Village of, Department of Public Works
- Flint, City of, Water Plant
- French Paper Company
- Higgins Lake Foundation
- Huron-Clinton Metropolitan Authority
- Huron County Board of Commissioners
- Imlay, City of
- Indiana Michigan Power Co.
- Kalamazoo, City of, Dept. of Public Works
- Keweenaw Bay Indian Community
- Lancing, City of, Board of Water and Light
- Macomb, County of
- Mead Paper Company
- Michigan Department of--
  - Natural Resources
    - Office of Budget and Federal Aid
  - Transportation
    - Design Division
- Negaunee, City of, Water & Wastewater Treatment Plant
- Norway, City of
- Oakland County Drainage Commission
- Otsego County Rd. Comm., Lake Level Control
- Portage, City of
- Portland, City of
- Roscommon County Board of Commissioners
- STS Hydropower, Ltd.
- Schoolcraft County Board of Commissioners
- Southeast Michigan Council Governments
- Sturgis, City of
- Tri-County Regional Planning Commission
- Upper Peninsula Power Company
- Wayne, County of, Div. of Environ. Health
- Wisconsin Electric Power Company
- Wolverine Hydroelectric
- Wolverine Power Supply Cooperative
- Ypsilanti Community Utility Authority

Minnesota:
- Beltrami County Soil & Water Cons. District
- Elm Creek Cons. Mgmt. & Planning Comm.
- Grand Portage Band of Chippewa Indians, Tribal Council
- Hubbard County Soil and Water
- Lower Red River Watershed Mgmt. Board
- Mille Lacs Reservation Band Government
- Minnesota Department of--
  - Natural Resources
  - Transportation
- Minnesota Pollution Control Agency
- Northwest Minnesota Ground Water Steering Committee
- Pine County Soil & Water Conservation District
- Snake River Watershed Planning Committee
- University of Minnesota, Dept. of Soil Science

Mississippi:
- Harrison County Development Commission
- Jackson, City of
- Jackson County Port Authority
- Mississippi Department of--
  - Agriculture and Commerce

Mississippi--continued
- Environmental Quality--
  - Office of Land and Water Resources
  - Office of Pollution Control
- Transportation
- Pat Harrison Water District
- Pearl River Basin Development District
- Pearl River Valley Water Supply District
- Yazoo MS Delta Joint Water Mgmt. Dist.

Missouri:
- Cape Girardeau, City of
- Cass County Soil and Water Cons. District
- Columbia, City of
- Independence, City of
- Jackson County Parks and Recreation
- Mid-America Regional Council
- Missouri Department of--
  - Conservation
  - Health
  - Natural Resources--
    - Division of Environmental Quality
- Missouri Highway & Transportation Comm.
- Rolla, City of
- Springfield, City of, City Utilities
- St. Francois County Environmental Corp.
- Watershed Commission of the Ozarks

Montana:
- Beaverhead County Water and Sewer
- Blackfeet Nation
- Fort Peck Reservation
- Greenfield Irrigation District
- Helena, City of
- Judith Basin Conservation District
- Lewis and Clark County Health Department
- Montana Bureau of Mines and Geology
- Montana Department of--
  - Fish, Wildlife, and Parks
  - Health and Environmental Sciences
  - Natural Resources and Conservation
  - Transportation
- Northern Cheyenne Tribe
- Office of the Governor
- Salish & Kootenai Tribes of Flathead Res.
- Wyoming State Engineer

Nebraska:
- Central Platte Natural Resources District
- Kansas-Nebraska Blue River Compact Admin.
- Lincoln, City of
- Little Blue Natural Resources District
- Lower Elkhorn Natural Resources District
- Lower Platte North Natural Resources District
- Lower Platte South Natural Resources District
- Lower Republican Natural Resources District
- Middle Republican Natural Resources District
- Nebraska Department of--
  - Environmental Quality
  - Water Resources
- Nebraska Natural Resources Commission
- Nemaha Natural Resources District
- North Platte Natural Resources District
- Omaha, City of

Nebraska--continued
- Papio-Missouri River Natural Resources Dist.
- South Platte Natural Resources District
- Univ. of Nebraska, Conservation & Survey Div.
- Upper Elkhorn Natural Resources District
- Upper Loup Naural Resources District
- Upper Niobrara-White Natural Resources Dist.

Nevada:
- Carson City/County Dept. of Public Works
- Clark County Regional Flood Control District
- Clark County Sanitation District
- Douglas, County of
- Duck Valley Reservation
- Henderson, City of
- Las Vegas Valley Water District
- Nevada Bureau of Mines and Geology
- Nevada Department of--
  - Conservation and Natural Resources--
    - Division of Environmental Protection
    - Division of Water Resources
  - Transportation
  - Wildlife
- Summit Lake Paiute Indian Tribe
- Tahoe Regional Planning Agency
- Truckee-Carson Irrigation District
- Washoe County Planning Department

New Hampshire:
- Lincoln, Town of
- New Hampshire Department of--
  - Environmental Services
    - Water Resources Division
    - Water Supply & Pollution Control Div.

New Jersey:
- Atlantic Highlands, Borough of
- Bergen, County of
- Brick Township Municipal Utility Authority
- Gloucester County Planning Commission
- Hackensack Meadowlands Dev. Comm.
- Medford, Township of
- Mercer County Park Commission
- Morris County Municipal Utility Authority
- New Brunswick, City of
- New Jersey Department of--
  - Environmental Protection and Energy
  - Transportation
- New Jersey Water Supply Authority
- North Jersey District Water Supply Comm.
- Passaic Valley Water Commission
- Pinelands Commission
- Rutgers Environmental Health and Safety
- Somerset County Board of Chosen Freeholders
- Washington Township Municipal Utility Auth.
- West Windsor, Township of

New Mexico:
- Albuquerque, City of
  - Public Works Department--
    - Hydrology Division
    - Utility Planning Division
    - Waste Water Utility

New Mexico--continued
- Albuquerque Metro. Arroyo Flood Control Auth.
- Arizona Department of Environmental Quality
- Bernalillo, County of
- Canadian River Municipal Water Authority
- Costilla Creek Compact Commission
- Elephant Butte Irrigation District
- El Paso Water Utilities & Public Service Board
- Jornada Reservation, Conservation & Dev.
- Las Cruces, City of--
  - Water Department
- New Mexico Department of--
  - Environment
  - Highways and Transportation
- New Mexico State University, Bd. of Regents
- Office of the State Engineer
- Pecos River Commission
- Picuris Pueblo
- Pueblo of Laguna
- Pueblo of Zuni
- Raton, City of
- Rio Grande Compact Commission
- Rio San Jose Flood Control District
- Ruidoso, Village of
- Santa Rosa, City of
- Texas Water Development Board

New York:
- Amherst, Town of, Engineering Department
- Auburn, City of
- Central New York Regional Planning Board
- Chautauqua, County of, Dept. of Plan. & Dev.
- Cheektowaga, Town of
- Cornell University, Department of Utilities
- Cortland, County of, Planning Department
- Hudson-Black River Regulating District
- Monroe, County of, Department of Health
- Nassau, County of--
  - Department of Public Works
    - Div. of Sanitation and Water Supply
- New England Interstate Water Pollution Control
- NY City Dept. of Environmental Protection--
  - Bureau of Water Supply
- New York State Department of--
  - Environmental Conservation--
    - Bureau of Monitoring & Assessment
  - Transportation
- NY State Energy Research Develop. Auth.
- New York State Power Authority
- Nyack, Village of, Bd. of Water Commissioners
- Onondaga, County of--
  - Department of Public Works
  - Water Authority
- Onondaga Lake Management Conference
- Orange County Water Authority
- Saratoga Springs, City of--
  - Office of Commissioner of Public Works
- Suffolk, County of--
  - Department of Health Services
  - Water Authority
- Ulster, County of

North Carolina:
- Asheville, City of
- Bethel, Town of
- Brevard City of
- Chapel Hill, Town of
- Charlotte, City of
- Danville, VA, City of
- Durham, City of
- Fayetteville, City of
- Gaston, County of
- Greensboro, City of
- Jackson, County of
- Lexington, City of
- Lumber River Council of Governments
- Mecklenburg, County of
- Morganton, City of
- North Carolina Coop. Extension Service Dallas & Raleigh
- North Carolina State Department of--
  - Environment, Health, & Natural Resources
  - Transportation
- Orange, County of
- Raleigh, City of
- Rocky Mount, City of
- Triangle Area Water Supply Monitoring, Project Steering Comm.
- Western Piedmont Council of Governments

North Dakota:
- Devils Lake Sioux Tribe
- Dickinson, City of
- Lower Heart Water Resources District
- Minot, City of
- North Dakota Department of--
  - Game and Fish
  - Health, Water Supply, & Pollution Control
  - Parks and Recreation
  - Transportation
- State Water Commission
- Three Affiliated Tribes

Ohio:
- Akron, City of
- Canton, City of
- Columbus, City of
- Cuyahoga River Community Planning Org.
- Eastgate Development Company
- Franklin, County of
- Fremont, City of
- Lima, City of
- Madison, County of
- Miami Conservancy District
- N.E. Ohio Regional Sewer District
- Ohio Department of--
  - Natural Resources
  - Transportation
- Ohio Environmental Protection Agency
- Ohio State University Research Foundation
- Pickaway, County of
- Ross, County of
- Seneca Coil and Water District
- Summit, County of
- University of Toledo
- Washington, County of

Oklahoma:
- Ada, City of
- Cheyenne and Arapaho Tribes
- McGee Creek Authority
- Oklahoma City, City of
- Oklahoma Water Utilities Trust
- Oklahoma Conservation Commission
- Oklahoma Department of--
  - Health
- Oklahoma Geological Survey
- Oklahoma State Univ., Div. of Agri. Sciences
- Oklahoma Water Resources Board
- Sac and Fox Nation

Oregon:
- Albany, City of
- Ashland, City of
- Bend, City of
- Coos, County of
- Coos Bay-North Bend Water Board
- Douglas, County of
- Eugene, City of
- Gresham, City of
- Jackson, County of
- McMinnville, City of
- Oregon Department of--
  - Energy
  - Environmental Quality
  - Human Resources, State Health Division
  - Transportation, Highway Division
  - Water Resources
- Metropolitan Service District
- Portland, City of--
  - Department of Utilities
  - Bureau of--
    - Environmental Services
- Portland State University
- Tualatin Valley Water District
- Unified Sewerage Agency
- Warm Springs Tribal Council

Pennsylvania:
- Allentown, City of, Engineering Department
- Alliance for the Chesapeake Bay
- Bethlehem, City of
- Bucks, County of
- Chester, County of, Water Resources Authority
- Cumberland, Maryland, City of
- Delaware County Solid Waste Authority
- Delaware, State of, Geological Survey
- Delaware River Basin Commission
- Harrisburg, City of
- Hazelton City Authority Water Department
- Joint Planning Comm., Lehigh-Northampton Counties
- Letort Regional Authority
- Media Borough Water Department
- New York State Dept. of Environmental Cons.
- North Penn Water Authority
- Philadelphia, City of
- Pennsylvania Department of--
  - Environmental Resources--
    - Bureau of Comm. Environ. Control
    - Bureau of Water Supply & Community Health

Pennsylvania--continued
- Bureau of Mining and Reclamation
- Bureau of Land & Water Conservation
- Bureau of Topographic & Geol. Survey
- Bureau of Water Quality Management
- Transportation
- Pennsylvania State University
- Reading, City of, Dept. of Streets & Public Improvements
- Somerset Conservation District
- Sunbury, City of, Municipal Authority
- Susquehanna River Basin Commission
- Tinicum, Township of
- University Area Joint Authority
- West Bradford, Township of
- Williamsport, City of

Rhode Island:
- Narragansett Bay Commission
- Providence, City of, Water Supply Board
- Rhode Island State Dept. of Environ. Mgmt--
  - Division of Water Resources
- Rhode Island Water Resources Board

South Carolina:
- Beaufort-Jasper County Water & Sewer Auth.
- Camden, City of
- Charleston Harbor Project
- Charleston Public Works
- Clarendon/Sumter Soil & Water Conservation District
- Clemson, City of, Department of Engineering
- Clemson Univ., College of Agri. Sciences
- Grand Strand Water and Sewer Authority
- Greer Commission of Public Works
- Myrtle Beach, City of
- Oconee County Sewer Commission
- South Carolina State--
  - Department of Health & Environ. Control
  - Department of Highways & Public Trans.
  - Public Service Authority
  - Water Resources Commission
  - Wildlife & Marine Resources Department
- South Carolina Sea Grant Consortium
- Spartanburg Sanitary Sewer District
- Spartanburg Water System
- University of South Carolina--
  - Dept. of Environmental & Health Services
- Waccamaw Regional Planning & Dev. Council
- Western Carolina Regional Sewer Authority

South Dakota:
- Area II Minnesota River Basin
- Belle Fourche Irrigation District
- Cheyenne River Sioux Tribe
- East Dakota Water Development District
- Lake Kampeska Water Project District
- Lower Brule Sioux Tribe
- Mellette, County of
- North Central Resource Conservation & Dev.
- Oglala Sioux Tribe, Water Resources Division
- Pennington Co. Drainage Commission
- Rapid City, City of
- Rosebud Sioux Tribe
- Sioux Falls, City of

South Dakota--continued
- South Dakota Department of--
  - Environment and Natural Resources--
    - Geological Survey Division
    - Water Rights Division
  - Game, Fish and Parks
  - Transportation
- South Dakota School of Mines and Technology
- South Dakota State University
  - Civil Engineering Department
  - Horticulture, Forestry, Landscape & Parks Department
- Spearfish, City of
- Stanley County Conservation District
- Watertown, City of
- West Dakota Water Development District
- West River Water Development District
- Wyoming State Engineer

Tennessee:
- Alcoa, City of
- Alpha Talbott Utility District
- Bartlett, City of
- Brentwood, City of
- Camden, City of
- Chattanooga, City of, Dept. of Public Works
- Clemson University Dept. of Environmental Toxicology
- Columbia, City of
- Crossville, City of
- Dickson, City of
- Eastside Utility District
- Franklin, City of
- Gatlinburg, City of
- Germantown, City of
- Hamilton County Office of Emergency Mgmt.
- Harriman Utility Board
- Harpeth Valley Utility District
- Johnson City, City of, Public Works Dept.
- Knoxville, City of
- Lincoln, County of
- Memphis, City of, Light, Gas, & Water Division
- Memphis State University
- Metropolitan Governments, Nashville, City of, & Davidson, County of
- Murfreesboro, City of, Water & Sewer Dept.
- Red Boiling Springs, Town of
- Rogersville, Town of
- Savannah Valley Utility District
- Sevierville, City of
- Shelby County Government
- Shelby County Soil Conservation District
- Tennessee Department of--
  - Agriculture
  - Environment & Conservation, Office of Water Programs
  - Transportation--
    - Division of Planning
    - Division of Structures
- Tennessee State Planning Office
- Tennessee Wildlife Resources Agency
- Tullahoma Utilities Board
- Union City, City of
- University of Tennessee

Tennessee--continued
- Upper Duck River Development Agency
- Wartrace, City of

Texas:
- Abilene, City of
- Arlington, City of
- Austin, City of
- Barton Springs/Edwards Aquifer Conservation District
- Bexar-Medina-Atascosa Counties
- Brazos River Authority
- Canadian River Muncipal Water Authority
- Coastal Water Authority
- Colorado River Municipal Water District
- Corpus Christi, City of
- Dallas, City of
- Dallas, City of, Public Works Department
- Edwards Underground Water District
- El Paso, City of, Public Service Board
- Fort Bend Subsidence District
- Fort Worth, City of
- Gainesville, City of
- Galveston, County of
- Garland, City of
- Georgetown, City of
- Graham, City of
- Greenbelt Municipal & Industrial Water Auth.
- Guadalupe-Blanco River Authority
- Harris, County of, Flood Control District
- Harris-Galveston Coastal Subsidence District
- Houston, City of
- Houston-Galveston Area Council
- Lavaca-Navidad River Authority
- Lower Colorado River Authority
- Lower Neches Valley Authority
- Lubbock, City of
- Nacogdoches, City of
- North Central Texas Council of Governments
- North Central Texas Municipal Water Authority
- North Texas Municipal Water District
- North East Texas Municipal Water District
- Orange, County of
- Pecos River Commission
- Red River Authority of Texas
- Sabine River Authority of Texas
- Sabine River Compact Administration
- San Angelo, City of
- San Antonio, City of--
  - City Public Service
  - Water Systems
- San Antonio River Authority
- San Jacinto River Authority
- Somerville County Water District
- Tarrant, County of, Water Control & Improvement District No. 1
- Texas Soil and Water Conservation Board
- Texas State Department of Transportation
- Texas Water Commission
- Texas Water Development Board
- Titus, Co. of, Fresh Water Supply Dist. No. 1
- Trinity River Authority
- University of Texas at Austin
- Upper Guadalupe River Authority

Texas--continued
- Upper Neches River Municipal Water Authority
- West Central Texas Municipal Water District
- Wichita, Co. of, Water Improvement Dist. No. 2
- Wichita Falls, City of

Utah:
- Bear River Commission
- Central Utah Water Conservation District
- Ogden River Water Users Association
- Salt Lake, County of, Division of Flood Control
- Tooele, City of
- University of Utah
- Utah Department of--
  - Natural Resources--
    - Oil, Gas and Mining Division
    - Water Resources Division
    - Water Rights Division
- Utah Geological Survey
- Weber Basin Waer Conservancy District
- Weber River Water Users Association

Vermont:
- Department of Environmental Conservation
  - Water Supply Division
  - Water Quality Division

Virginia:
- Accomack-Northampton Planning Dist. Comm.
- Alexandria, City of
- Danville, City of
- Delaware GeologicalSurvey
- Hampton Roads Planning District Commission
- James City, County of
- Maryland, Department of--
  - Environment
  - State Highway Administration
- Newport News, City of
- Northern Virginia Planning District Commission
- Prince William Health District
- Prince William Public Works
- Roanoke, City of
- Southeastern Public Service Authority of VA
- University of Virginia, Dept. of Environmental Sciences
- Virginia Department of--
  - Environmental Quality
  - Transportation

Washington:
- Aberdeen, City of
- Bellevue, City of
- Chelan, County of, Public Utility District No. 1
- Cowlitz, County of
- Douglas, County of, Public Utility District No. 1
- Hoh Indian Tribe
- Jamestown S'Klallam Tribe
- Kent, City of
- King, County of, Department of Public Works
- Lewis, County of, Board of Commissioners
- Makah Indian Tribe
- Nisqually Indian Tribe
- Oregon Department of Fish and Wildlife
- Pacific, County of

Washington--continued
- Pierce, County of
- Quileute Tribal Council
- Quinault Indian Business Committee
- Seattle, City of
- Skagit, County of, Department of Public Works
- Skagit Conservation District
- Snohomish, County of--
  - Board of Commissioners
  - Public Works
- Tacoma, City of, Department of--
  - Public Utilities
  - Public Works
- Thurston, County of, Department of--
  - Public Works
- Umatilla Indian Tribal Council
- Washington Department of--
  - Ecology
  - Fisheries
  - Natural Resources
  - Transportation
- Washington state Community Development
- Yakima Indian Nation

West Virginia:
- Morgantown, City of, Utility Board
- New Martinsville, City of
- West Virginia Division of--
  - Highways
  - Environmental Protection
    - Office of Water Resources
    - Abandoned Mine Land Reclamation
- West Virginia Geological & Economic Survey

Wisconsin:
- Alma/Moon Lake District
- Balsam Lake Protection & Rehab. District
- Baraboo, Town of
- Barron, City of
- Bear Lake, Town of
- Beaver Dam, City of
- Big Muskego Lake District
- Brookfield, City of
- Brown County Planning Commission
- Cedar Lake, Town of
- Dane, County of--
  - Department of Public Works
  - Lakes and Watershed Management
  - Regional Planning Commission
- Darboy Sanitary District No. 1
- Delavan, Town of
- Druid Lake Inland Protection & Rehab. District
- Eagle Spring Lake Management
- East Central Wisconsin Reg. Planning Comm.
- Elkhart Lake Improvement Association
- Fond Du Lac, City of
- Fowler Lake Management District
- Green Bay Metropolitan Sewerage District
- Green Lake Sanitary District
- Hillsboro, City of
- Hills Lake Management District
- Hooker Lake District
- Hubbard, Township of
- Illinois Department of Transportation

Wisconsin--continued
- Kansasville, Town of
- Kaukauna Electric and Water Utilities
- Kimberly Water Works Department
- Lac Du Flambeau Band of Lake Superior Chippewa
- Lake Keesus Management District
- Lake Nebagamon, Village of
- Little Arbor Vitae Protection & Rehab. District
- Little Chute, Village of
- Little Green Lake Protection & Rehab. District
- Little Muskego Lake District
- Little St. Germain Lake District
- Loon Lake/Wescot Management District
- Madison, City of, Engineering Department
- Madison Metropolitan Sewerage District
- Marinette County Land Conservation Dept.
- Mead, Township of
- Menasha, Town of, Sanitary District No. 4
- Menominee Indian Tribe of Wisconsin
- Muskego, City of
- Norway, Town of
- Oconomowoc Lake, Village of
- Okauchee Lake Management District
- Oneida Tribe of Indians of Wisconsin
- Park Lake Management District
- Peshtigo, City of
- Pretty Lake Management District
- Potters Lake Rehabilitation & Protection Dist.
- Powers Lake Management District
- Rock County Public Works Department
- St. Germain, Town of
- Southeastern Wisconsin Regional Planning Commission
- Sparta, City of
- Stockbridge-Munsee Band of Mohican Indians
- Summit, Town of
- Thorp, City of
- Troy, Town of
- Upper Nemahbin Lake Management District
- Waupun, City of
- Whitewater-Rice Lake Management District
- Wind Lake Management District
- Wisconsin Department of--
  - Justice
  - Natural Resources
  - Transportation
- Wittenberg, Village of
- Wolf Lake Management District

Wyoming:
- Cheyenne, City of
- Colorado State University
- Evanston, City of
- Freemont, County of, Weed and Pest District
- Joint Business Council
- Midvale Irrigation District
- Sheridan Water Supply Board
- Star Valley Conservation District
- Teton, County of
- Water Development Commission
- Water Resources Research Institute
- Wind River Environmental Quality Commission

Wyoming--continued
- Wyoming Department of--
  - Agriculture
  - Environmental Quality
  - Game and Fish
  - Highways
- Wyoming State Engineer

American Samoa:
- Environmental Protection Agency of American Samoa
- Power Authority

Guam:
- Guam, Government of, Environmental Protection Agency

Puerto Rico:
- Municipality of Manati
- Puerto Rico Aqueduct and Sewer Authority
- Puerto Rico Civil Defense
- Puerto Rico Department of Natural Resources
- Puerto Rico Electric Power Authority
- Puerto Rico Environmental Quality Board
- Puerto Rico Industrial Development Company
- Virgin Islands Water and Power Authority

Trust Territory of the Pacific Islands:
- Commonwealth Utilities Corp., Saipan
- Northern Mariana Islands, Commonwealth of
  - Division of Environmental Quality
- Office of the Governor, Saipan
  - Municipality of Tinian
- Pohnpei State Government
- Republic of Palau

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture that were in progress fiscal years 1990-93.
[Note: Principal emphasis--GW, ground water; SW, surface water. Source of funding--C, Federal-State Cooperative Program; F--Federal Program; OFA--Other Federal Agency Program.]

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
Central Region					
CR87-309	Sediment-transported pollutants in the Mississippi River	2/87 to 9/93	SW	Effects of agriculture on water quality	F
CR89-317	Mid Continent Triazine Herbicide Reconnaissance	3/89 to 10/97	GW - SW	Occurrence and transport of pesticides	F
Alabama					
AL90-077	Streamflow, water quality, and time of travel, Big Creek Lake, and water quality at Mobile River at Bucks	3/90 to 9/93	SW	Effects of agriculture on water quality	C
AL90-078	An assessment of hydrological problems associated with aquaculture in west-central Alabama	6/90 to 9/91	GW - SW	Effects of aquaculture on hydrologic environment	C
Arkansas					
AR86-055	Definition of the ground-water flow system and application of methodologies to optimize ground-water management in the alluvial aquifer of eastern Arkansas	10/85 to 6/93	GW	Availability of water for irrigation	C
AR91-067	National Water-Quality Assessment Program, Ozark Plateaus	10/90 to 9/99	GW - SW	Effects of agriculture on water quality	F
Arizona					
AZ78-053	Monitoring land subsidence and determining earth fissuring potential in the Tucson Basin, Pima County	9/78 to 9/93	GW	Relation of ground-water pumping for irrigation to land subsidence	C

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
AZ--con't.					
AZ85-085	Development of an accounting system for water and consumptive use in the lower Colorado River, Lake Meade to Mexico	10/84 to 9/93	GW - SW	Consumptive use of water by agriculture	F, OFA
AZ88-111	Mapping vegetation water use calculated from remotely-sensed data as a function of soil moisture, Maricopa Farms	6/88 to 9/90	GW	Relation of evapotranspiration to soil moisture	C
California					
CA84-441	An assessment of quality and contaminant transport in the soils and ground water of the San Luis Project service area	10/83 to5/90	GW	Effects of irrigation drainage on water quality	F
CA88-453	Irrigation drainage field-screening study of Sacramento Refuge Complex	10/87 to 3/92	SW	Effects of irrigation drainage on water quality	F
CA85-456	Western San Joaquin Valley hydrologic studies	10/84 to 9/90	GW - SW	Effects of irrigation drainage on water quality	F, OFA
CA88-460	Irrigation drainage field-screening study of Klamath Basin Refuge Complex	10/87 to 9/92	SW	Effects of irrigation drainage on water quality	F
CA86-462	Irrigation drainage field-reconnaissance study, Salton Sea area	5/86 to 9/89	SW	Effects of irrigation drainage on water quality	F

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
CA--con't.					
CA87-466	Evaluation of ground-water contamination from agricultural irrigation, Lompoc	10/86 to 9/93	GW - SW	Effects of irrigation on water quality	C
CA88-470	Detailed study and assessment of irrigation drainage in the Salton Sea area	10/87 to 9/94	GW	Effects of irrigation drainage on water quality	F, OFA
CA90-479	Evaluation of subsidence rates and processes in surficial peat, Sacramento-San Joaquin Delta	10/89 to 9/94	GW	Relation of lowering water table for crop production to subsidence	C
CA90-480	Nitrates in the Hemet ground-water subbasin	1/90 to 9/93	GW	Effects of agricultural activities on nitrate concentrations in ground water	C
CA90-481	Process governing the distribution and mobility of dissolved solids and selected trace elements in shallow ground water, Tulare Lake basin	10/89 to 9/94	GW	Effects of agricultural drainage on water quality	C
CA90-484	San Francisco Bay estuary toxic contaminant study	3/90 to 9/95	SW	Effects of agricultural chemicals on water quality	F
CA91-485	National Water Quality Assessment Program, San Joaquin-Tulare Basins	12/90 to 9/99	GW - SW	Effects of agriculture on water quality	F
CA92-489	Irrigation drainage detailed study of Klamath basin, California and Oregon	10/91 to 9/93	GW	Effects of irrigation drainage on water quality	F

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
Colorado					
CO84-180	Evaluation of nonpoint-source contamination of the Fountain Creek alluvial aquifer	4/84 to 9/90	GW	Role of agriculture in nonpoint-source contamination of ground water	F
CO85-197	Ground-water quality effects of soil application of sewage sludge on farmland near Denver	10/84 to 9/91	GW	Effects on ground water of sewage sludge applied to farmland	C
CO85-198	Comprehensive water-quality evaluation of Pueblo Reservoir, including the effects of potential contamination	3/85 to 9/90	SW	Effects of agricultural activities on water in Pueblo Reservoir	C
CO89-238	Conjunctive water use and canal-seepage losses in an extensive irrigation system, southeastern Colorado	5/89 to 10/92	GW - SW	Relation of irrigation to water use	C
CO90-250	Additional water-quality investigations of the Dolores Project and Mancos River basin, southwestern Colorado	4/90 to 9/94	SW	Effects of irrigation on water quality	F
CO91-260	The effects of agricultural application of sewage sludge on the unsaturated zone and saturated zone of farmland near Denver	10/90 to 9/99	GW	Effects on ground water of sewage sludge applied to farmland	C
Delaware					
DE88-022	The occurrence of pesticides in the shallow ground water of two agricultural areas in Delaware	1/88 to 9/90	GW - SW	Effects of agriculture on concentrations of pesticides in ground water	C

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
Florida					
FL84-422	Impacts of selected developmental activities on the quality of water in the Floridian aquifer system, central Florida	4/84 to 9/93	GW	Effects of agricultural chemicals on the quality of ground water	F
FL85-432	Effects on ground-water quality from the application of domestic wastewater-treatment sludge to soils overlying the Biscayne aquifer, Dade County	10/84 to 9/91	GW	Effects of agricultural practices on ground-water quality	C
FL86-451	Nutrient loads in the Apopka-Beauclair Canal, upper Oklawaha basin, central Florida	5/86 to 9/91	SW	Effects of muck farming on water quality	C
FL87-459	Sources of nitrogen in ground water from areas subject to the application of wastewater by spray irrigation and commercial fertilizers near Tallahassee	10/86 to 9/90	GW	Effects of agricultural practices on ground water quality	C
FL87-475	Use of an existing data base to investigate factors related to the occurrence of ethylene dibromide in ground water	3/87 to 9/90	GW	Occurrence of pesticide in ground water	F
FL90-503	Ground-water quality at selected north Florida dairy farms	2/90 to 9/94	GW	Effects of dairy farming on ground-water quality	C
FL91-511	An evaluation of the effects of nonpoint-source pollution from swine and poultry operations on ground- water and surface-water quality in north Florida	10/90 to 3/93	GW - SW	Relation of swine and poultry operations to nonpoint-source contamination	C
FL91-518	Influence of municipal reclaimed water on the leaching of pesticides from golf courses in Florida	1/91 to 9/95	GW	Effects of pesticides applied to golf courses on water quality	C

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
FL--con't.					
FL91-527	Measurements of nonpoint-source nutrient loading from East Bay to Hillsborough Bay	9/91 to 3/94	SW	Effects of fertilizer loading operations on water quality	C
Georgia					
GA85-087	Movement and fate of agricultural chemicals in the subsurface, southwest Georgia	10/84 to 9/94	GW - SW	Movement of agricultural chemicals in the ground-water system	F, OFA
GA93-109	Geostatistical evaluation of vadose-zone flow and transport processes	10/92 to 9/94	GW - SW	Movement of agricultural chemicals in the vadose zone	C
Idaho					
ID79-137	A hydrologic assessment of the Snake River Plain regional aquifer, southern Idaho	6/79 to 9/91	GW - SW	Effects of agricultural practices on water quality	F
ID88-157	Department of the Interior irrigation drainage reconnaissance study of American Falls Reservoir	10/87 to 9/90	GW - SW	Effects of irrigation drainage on water quality	F
ID89-171	Effects of water use on recharge/ discharge relations in the Mud Lake area, southeastern Idaho	1/89 to 9/91	GW - SW	Effects of irrigation on water quality and availability	C
ID90-175	National Water Quality Assessment Program, upper Snake River basin	1/90 to 10/97	GW - SW	Effects of agricultural practices on water quality	F
Indiana					
IN87-118	National Water Quality Assessment Program, White River basin	10/86 to 9/99	GW - SW	Effects of agricultural practices on water quality	F

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
IN--con't.					
IN90-134	Analysis of agricultural chemicals in Indiana ground water	3/90 to 9/93	GW	Concentrations and distribution of agricultural chemicals in ground water	C
IOWA					
IA88-057	Evaluation of factors influencing the occurrence of agricultural chemicals in shallow ground water in the central midwest	10/87 to 9/95	GW	Effects of agricultural chemicals on ground water	F, OFA
IA88-058	Hydrologic analysis of water quality and the flow system in the Big Spring basin, Clayton County	10/87 to 9/94	GW - SW	Effects of agricultural chemicals on the ground- and surface-water systems	C
IA88-061	Cedar River pesticide study	5/88 to 9/92	SW - GW	Movement of pesticides between surface water and ground water	F
IA90-066	Effects of grain-storage facilities on ground-water quality in Iowa	1/90 to 9/91	GW	Effects of grain storage on ground-water quality	OFA
IA91-067	Water flow processes and related agricultural chemical loadings in the Walnut Creek watershed near Ames	10/90 to 9/94	GW - SW	Effects of agricultural chemicals on water quality	F, OFA
IA91-068	Agricultural chemicals in a water-supply reservoir in south-central Iowa	10/90 to 9/95	SW	Effects of agricultural chemicals on water quality	C
IA91-069	The occurrence and flux of inert pesticide ingredients in shallow ground water	3/91 to 9/93	GW	Effects of agricultural chemicals on water quality	C

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
IA--con't.					
IA92-072	Effects of land use changes on stream sediment	10/91 to 9/96	SW	Effects of agricultural practices on sedimentation	C
Kansas					
KS86-151	Movement and persistence of agricultural pesticides in the saturated and unsaturated zones in Kansas	10/85 to 9/91	GW	Effects of agricultural pesticides on water quality	C
KS86-152	National Water Quality Assessment Program, lower Kansas River basin, Kansas and Nebraska	4/86 to 9/93	GW - SW	Effects of agricultural practices on water quality	F
KS82-156	Organic geochemistry of natural and polluted water--nonpoint-source contamination	9/82 to	GW - SW	Relation of agricultural chemicals to nonpoint-source contamination	C
KS88-157	Chemical and microbial degradation rates of atrazine in ground-water systems	10/87 to 9/91	GW	Degradation of atrazine in ground water	C
KS90-170	Development of digital GIS data bases for the Equus Beds aquifer area	10/89 to 10/90	GW	Effects of grain-storage facilities on water quality	OFA
KS91-173	Distinguishing atrazine occurrence in ground water: point-source versus nonpoint-source	10/90 to 9/93	GW	Sources of atrazine in ground water	C
KS91-175	Application of GIS for information retrieval and technical evaluation of agricultural water use and availability in the Kansas High Plains	12/90 to 9/93	GW - SW	Agricultural water use	C

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
KS--con't.					
KS92-176	Triazine herbicides in the unsaturated zone: an investigation of the potential vulnerability of the Equus Beds aquifer in Harvey County	10/91 to 12/93	GW	Effects of agricultural chemicals on water quality	C
Louisiana					
LA83-078	Development of methods for determining water use in rice irrigation	10/82 to 9/92	SW	Agricultural water use	C
Maryland					
MD84-080	Modeling nonpoint-source inputs to the Patuxent River estuary	5/84 to 9/93	SW	Relation of agricultural chemicals to nonpoint-source contamination	C
MD85-085	Effects of agricultural best management practices on shallow ground water in the Patuxent River basin	7/85 to 9/96	GW - SW	Effects of agricultural practices on water quality	C
MD91-103	Evaluating ground-water vulnerability factors and developing monitoring strategies for nonpoint-sources of contaminants in the Delmarva Peninsula	4/91 to 3/94	GW - SW	Effects of agricultural practices on water quality	OFA
Massachusetts					
MA92-100	National Water Quality Assessment Program, Connecticut, Housatonic, and Thames River basins	10/91 to	GW - SW	Effects of agricultural activities on water quality	F

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
Michigan					
MI84-040	Water resources of Grand Traverse County	5/84 to 9/90	GW - SW	Effects of irrigation on water quality and availability	C
MI86-046	Ground-water protection in Kalamazoo County	3/86 to 6/90	GW - SW	Effects of agricultural practices on water quality	C
MI87-048	Hydrogeology of Huron County, Michigan	10/86 to 9/90	GW - SW	Effects of agricultural practices on ground water	C
MI89-051	Hydrology, Water Quality and Effects of Drought in Monroe County, Michigan	6/89 to 5/92	GW - SW	Effects of drought on ground-water availability	C
Minnesota					
MN87-110	Impact of agricultural chemicals and tillage practices on quality of ground water in sand-plain aquifers in Minnesota	10/86 to 9/90	GW	Effects of agricultural activities on ground water	C
MN89-120	Sources and transport of sediment, nutrients, and oxygen-demanding substances in the Minnesota River	7/89 to 9/94	GW - SW	Effects of agricultural practices on water quality	C
MN90-121	Atmospheric transport and deposition of herbicides	3/90 to 9/91	SW	Transport of agricultural chemicals in precipitation	F
MN90-122	Hydrologic sensitivity of the Prairie du Chien-Jordan aquifer, Minnesota	10/89 to 9/92	GW	Effects of agricultural practices on ground-water quality	C
MN91-127	National Water-Quality Assessment Program, Red River of the North basin	12/90 to	GW - SW	Effects of agricultural activities on water quality	F

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
Missouri					
MO91-085	Use of nitrogen and oxygen isotopes to measure nitrogen-cycle processes in claypan soils and glacial-drift aquifers	1/91 to 9/94	GW - SW	Effects of agricultural chemicals on water resources	F
MO91-088	The role of preferential flow in the transport of agricultural chemicals in claypan soils near Centralia	1/91 to 9/94	GW - SW	Movement of agricultural chemicals in claypan soils	F
Montana					
MT86-108	Quantification of canal seepage on the Flathead Indian Reservation, northwest Montana	10/85 to 10/92	GW - SW	Effects of irrigation canals on the hydrologic system	C
MT90-132	Phase two irrigation drainage investigation: water quality in the Sun River area, west-central Montana	5/90 to 9/93	GW - SW	Effects of irrigation on water quality	F
Nebraska					
NE84-048	A study of nonpoint-source derived nitrate-nitrogen and organic constituents in water from selected areas of the High Plains aquifer in Nebraska	12/83 to 9/91	GW	Nonpoint-source agricultural chemicals in ground water	F
NE86-053	National Water-Quality Assessment Program, Lower Kansas River basin, Kansas and Nebraska	4/86 to 9/91	GW - SW	Effects of agricultural practices on water quality	F
NE91-063	Ground-water quality of the North Platte Natural Resources District	10/90 to 9/92	GW	Effects of agricultural chemicals on ground-water quality	C

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
Nevada					
NV88-148	Irrigation drainage investigation, Stillwater National Refuge	10/87 to 9/94	GW - SW	Effects of irrigation on water quality	F, OFA
NV90-159	Reconnaissance investigation of water quality, bottom sediment, and biota associated with irrigation drainage in and near the Humboldt Wildlife Management area	1/90 to 12/93	GW - SW	Effects of irrigation on water quality	F
NV92-173	Investigation of the ground-water aquifers in the Carson Division of the Newlands Project Area	4/92 to 9/93	GW - SW	Agricultural water use	OFA
New Jersey					
NJ90-115	Relation of agricultural pesticide usage to presence of these pesticides in surface waters used for water supply in New Jersey	10/89 to 12/93	SW	Agricultural pesticides in surface water	C
NJ91-117	Northeast nonpoint-source ground-water contamination investigation	10/90 to 9/93	GW	Relation of agricultural chemicals to nonpoint-source contamination	F
NJ92-124	Method to assess the vulnerability of public ground-water supplies to pesticides contamination	10/91 to 9/94	GW	Relation of agricultural pesticides to ground-water quality	C
New Mexico					
NM92-368	Field screening of bottom sediment and biota for concentrations of major ions, trace elements, and organo- chlorine pesticides associated with irrigation drainage in the Middle Pecos River drainage	10/91 to 2/94	SW	Effects of irrigation on water quality	F

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
New York					
NY87-169	Subsurface transport of pesticides and nitrates in fields under conventional and conservation tillage practices	1/87 to 12/91	GW-SW	Relation of agricultural chemicals and practices to water quality	C
NY90-186	Probabilistic assessment of atrazine contamination in ground water	10/89 to 9/93	GW	Movement of atrazine in ground water	F
North Carolina					
NC85-081	Effects of land-management practices on sediment and chemical transport in Guilford County	10/84 to 9/91	GW - SW	Effects of agricultural practices on water quality	C
North Dakota					
ND91-157	Effects of evapotranspiration on pesticide distribution and transport in the unsaturated zones of northern cornbelt sand plains	3/91 to 9/92	GW	Effects of evapotranspiration on the movement of pesticides in the unsaturated zone	F
ND92-163	National Water-Quality Assessment Program, Red River of the North basin	10/91 to 9/99	GW - SW	Effects of agricultural activities on water quality	F
ND93-168	Nonpoint-source assessment of the Fort Berthold Indian Reservation	5/93 to 9/94	SW	Effect of agricultural practices to nonpoint-source contamination	C
Ohio					
OH90-105	The fate and transport of atrazine in a buried river valley aquifer influenced by high, medium, and low-chemical input farming practices	3/90 to 9/94	GW	Relation of farming practices to the movement of atrazine in ground water	F

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
Oklahoma					
OK92-100	Vulnerability of water wells and springs in the Cheyenne and Arapaho tribal lands of western Oklahoma to contamination	3/92 to 12/93	GW - SW	Effect of agricultural chemicals on ground water	C
Oregon					
OR88-147	Irrigation drainage field-screening study, Malheur National Wildlife	10/87 to 9/90	GW - SW	Effects of irrigation on drainage on water quality	F
OR89-157	Role of disturbed marshland and reservoir regulation in causing excessive nutrient enrichment in Upper Klamath Lake	2/89 to 9/90	SW	Effects of converting marshland to agricultural uses	C
OR93-161	Ground-water resources of the Deschutes basin	1/93 to 9/97	GW	Availability of water for agriculture	C
PN90-356	Water quality assessment, Tualatin River basin	1/90 to 9/94	GW - SW	Effects of agricultural activities on water quality	C
PN90-360	Department of the Interior irrigation drainage reconnaissance study of the Owyhee-Vale Irrigation Projects, Oregon and Idaho	10/89 to 9/92	SW	Effects of irrigation on water quality	C
PN91-366	National Water-Quality Assessment Program, the Willamette Basin	10/90 to 9/96	GW - SW	Effects of agriculture on water quality	F
PN92-381	Assessment of nutrient loading to upper Klamath Lake	10/91 to 9/96	SW	Effects of agriculture on water quality	OFA

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
Pennsylvania					
PA81-118	Effects of agricultural best management practices on nonpoint sources in the Conestoga River basin above Lancaster	1/81 to 9/92	GW - SW	Effects of agricultural practices on water quality	C, OFA
PA85-158	Evaluation of agricultural best management practices and other innovative methods of controlling nutrient discharges in the lower Susquehanna River basin	10/84 to 9/92	GW - SW	Effects of agricultural practices on water quality	C
PA85-159	Assessment of nutrient sources in the Susquehanna River basin	10/84 to 9/90	SW	Effects of agricultural practices on water quality	C
PA88-182	Effect of land use and organochlorine insecticides on benthic-invertebrate diversity indices, Chester County	2/88 to 9/90	SW	Effects of agricultural practices on water quality	C
PA90-189	Effectiveness of agricultural best management practices in reducing nutrient loads to the Conestoga River headwaters, Lancaster County	10/89 to 9/92	SW	Effect of agricultural practices on water quality	C
PA90-193	Concentrations and loads of pesticides and nutrients in spring discharge, and relation to land use in two spring basins within Cumberland County	4/90 to 9/91	GW	Relation of agricultural chemicals to water quality of spring discharge	C
PA91-206	The effectiveness of agricultural best management practices in improving ground-water quality in a 55-acre field site near Ephrata, Lancaster County	10/90 to 9/94	GW	Effects of agricultural practices on ground-water quality	C

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
PA--con't.					
PA91-208	Transport of pesticides in the unsaturated zone overlying a carbonate rock aquifer	10/90 to 9/95	GW	Movement of pesticides in the unsaturated zone	C
PA91-211	Atmospheric deposition of nutrients and triazine herbicides in the Conodoguinet Creek basin	5/91 to 9/93	SW	Atmospheric deposition of agricultural chemicals	C
PA91-212	Hydrologic investigation of the Lake Wallenpaupack watershed	8/91 to 9/95	GW - SW	Effects of agricultural activities on water quality	C
PA92-213	Agricultural pesticides in the Conestoga River headwaters, Pequea Creek, and Mill Creek basins, Lancaster County	2/92 to 9/94	SW	Effect of agricultural chemicals on water quality	C
PA92-217	Characterizing baseline water quality, and evaluating the cause/effect relations of the implementation of agricultural management practices on surface- and ground-water quality in the Pequea/Mill Creek watersheds	6/92 to 9/99	GW - SW	Effect of agricultural practices on water quality	C
PA92-222	Factors affecting transport of soil phosphorus to surface water	8/92 to 9/95	SW	Movement of phosphorus from soil to surface water	C
Tennessee					
TN86-074	Effects of the diversion system in the vicinity of Lake No. 9 on water supply to Reelfoot Lake	7/86 to 2/90	GW - SW	Effects of lowering the ground-water table to support agriculture	C

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
TN--con't.					
TN89-086	Water quality of farmstead wells in Tennessee	3/89 to 12/90	GW	Evaluation of water quality in agricultural areas	C
TN89-094	Effects of agriculture on water quality in the Beaver Creek basin of west Tennessee	8/89 to 9/94	GW - SW	Effects of agricultural practices on water quality	C
Texas					
TX89-118	Evaluation of methods to calculate irrigated crop acreages using remote-sensing data in Uvalde and Medina Counties	5/89 to 9/92	GW - SW	Estimates of irrigated crop acreage through remote sensing	C
TX91-135	Evaluation of the effects of rangeland management practices on water quality and quantity in the Seco Creek basin near San Antonio	4/91 to 9/94	GW - SW	Effects of rangeland management practices on water quality and quantity	C
TX91-138	Agricultural chemical contamination of a shallow aquifer system in north-central Texas	7/91 to 9/94	GW	Effects of agricultural chemicals on water quality	C
Utah					
UT88-191	Detailed study of irrigation drainage in the Middle Green River basin	10/87 to 9/92	GW - SW	Effects of irrigation drainage on water quality	C, OFA
UT92-211	Recharge to basin-fill aquifers from irrigation, southwestern Utah	10/91 to 10/94	GW - SW	Effects of changes in irrigation methods on recharge	C

Appendix B.--List of selected U.S. Geological Survey investigations and research activities related to agriculture (continued)

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
UT--con't.					
UT92-218	Ground water in Juab Valley	1/92 to 9/95	GW - SW	Effects of agriculture on water quality	C
UT93-220	Irrigation drainage studies in the western United States	10/92 to 9/94	GW - SW	Effects of irrigation drainage on water quality	F
Virginia					
VA91-093	Biogeochemical processes controlling nitrate concentrations in ground-water discharge	10/90 to 9/94	GW - SW	Effect of agricultural chemicals on water quality	C
Washington					
WA86-321	National Water-Quality Assessment Program, Surface Water Phase, pilot study in the Yakima River basin	10/85 to 9/92	SW	Effects of agriculture on water quality	F
WA89-335	Quality of ground water in the Toppenish basin, Yakima Indian Reservation	2/89 to 6/93	GW	Effect of agricultural chemicals on water quality	C
PN90-346	Ground-water resources of portions of the lower Nooksack and upper Sumas River basins, Whatcom County	10/89 to 9/92	GW	Effect of agricultural chemicals on water quality	C
PN91-365	National Water Quality Assessment Program, Central Columbia Plateau	6/91 to 9/97	GW - SW	Effects of agricultural practices on water quality	F
PN91-371	Water-table altitudes and water quality in the shallow aquifer of Long Beach Peninsula	10/90 to 6/93	GW	Effect of agricultural chemicals on water quality	C
PN91-373	Department of the Interior irrigation drainage reconnaissance study of the Columbia Basin Irrigation Project	3/91 to 9/93	SW	Effects of irrigation drainage on water quality	F

Project Number	Title	Period of Study	Principal Emphasis	Relation to Agriculture	Source of Funding
Wisconsin					
WI89-166	Evaluating best management practices in Wisconsin	7/89 to 9/94	SW	Effect of agricultural practices on water quality	C
Wyoming					
WY90-121	Quantification of seepage and sedimentation in selected irrigation canals on the Wind River Indian Reservation	3/90 to 9/92	SW	Effects of seepage from irrigation canals on water quality and availability	C
WY92-135	Synthesis and interpretation of data from National Irrigation Water Quality Program investigations of areas receiving irrigation drainage	9/92 to 9/94	GW - SW	Effects of irrigation drainage on water quality	F

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