WATER-RESOURCES PROGRAMS IN THE NEW YORK DISTRICT — FISCAL YEARS 1990-92

Compiled by Mary P. Marshall

U.S. GEOLOGICAL SURVEY

Open-File Report 92-473

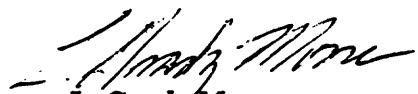
Albany, New York

1992

This booklet will acquaint you with the work of the Water Resources Division of the U.S. Geological Survey in New York State during fiscal years 1990, 1991, and 1992. Many of the programs will continue into 1993 or later.

Water-resources studies are directed by the New York District office in Albany. The Survey also engages in other programs in New York that encompass geology, offshore minerals assessment, and topographic mapping. These activities are administered by other divisions and directed from regional offices in Reston, Va.

Most of the Survey's water-related studies are supported through joint-funding agreements with State and local agencies. Formal, jointly funded programs are considered when a study is needed that is mutually advantageous to the Survey and the agency. Costs are shared equally when sufficient Federal matching funds are available. If you wish more information about USGS programs in New York, I would be happy to talk with you.



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U.S. Geological Survey Representative
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DEPARTMENT OF THE INTERIOR

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INTRODUCTION

The U.S. Geological Survey (USGS) was established by an act of Congress on March 3, 1879, to provide a permanent Federal Agency to conduct the systematic and scientific "classification of the public lands, and examination of the geological structure, mineral resources, and products of national domain." An integral part of that original mission includes publishing and disseminating the earth-science information needed to understand, to plan the use of, and to manage the Nation's energy, land, mineral, and water resources.

U.S. Geological Survey Programs

Since 1879, the research and fact-finding role of the USGS has grown and been modified to meet the changing needs of the Nation it. As part of that evolution, the USGS has become the Federal Government's largest earth-science research agency, the Nation's largest civilian mapmaking agency, the primary source of data on the Nation's surface- and groundwater resources, and the employer of the largest number of professional earth scientists. Today's programs serve a diversity of needs and users. Programs include:

- Conducting detailed assessments of the energy and mineral potential of the Nation's land and offshore areas.

- Investigating and issuing warnings of earthquakes, volcanic eruptions, landslides, and other geologic and hydrologic hazards.

- Conducting research on the geologic structure of the Nation.

- Studying the geologic features, structure, processes, and history of the other planets of our solar system.

- Conducting topographic surveys of the Nation and preparing topographic and thematic maps and related cartographic products.

- Developing and producing digital cartographic data bases and products.

- Collecting data on a routine basis to determine the quantity, quality, and use of surface water and ground water.

- Conducting water-resource appraisals to describe the consequences of alternative plans for developing land and water resources.

- Conducting research in hydraulics and hydrology, and coordinating all Federal water-data acquisition.

- Using remotely sensed data to develop new cartographic, geologic, and hydrologic research techniques for natural resources planning and management.

- Providing earth-science information through an extensive publications program and a network of public access points.

Along with its continuing commitment to meet the growing and changing earth-science needs of the Nation, the USGS remains dedicated to its original mission to collect, analyze, interpret, publish, and disseminate information about the natural resources of the Nation—providing "Earth Science in the Public Service."

Water Resources Division's Mission and Program

The mission of the Water Resources Division is to provide the hydrologic information and understanding needed for the optimum use and management of the Nation's water resources for the overall benefit of the people of the United States. This is accomplished, in large part, through cooperation with other Federal and non-Federal agencies by:

- Collecting, on a systematic basis, data needed for the continuing determination and evaluation of the quantity, quality, and use of the Nation's water resources.

- Conducting analytical and interpretive water-resource appraisals describing the occurrence, availability, and the physical, chemical, and biological characteristics of surface water and ground water.

- Conducting supportive basic and problem-oriented research in hydraulics, hydrology, and related fields of science to improve the scientific basis for investigations and measurement techniques and to understand hydrologic systems sufficiently well to quantitatively predict their response to stress, either natural or manmade.

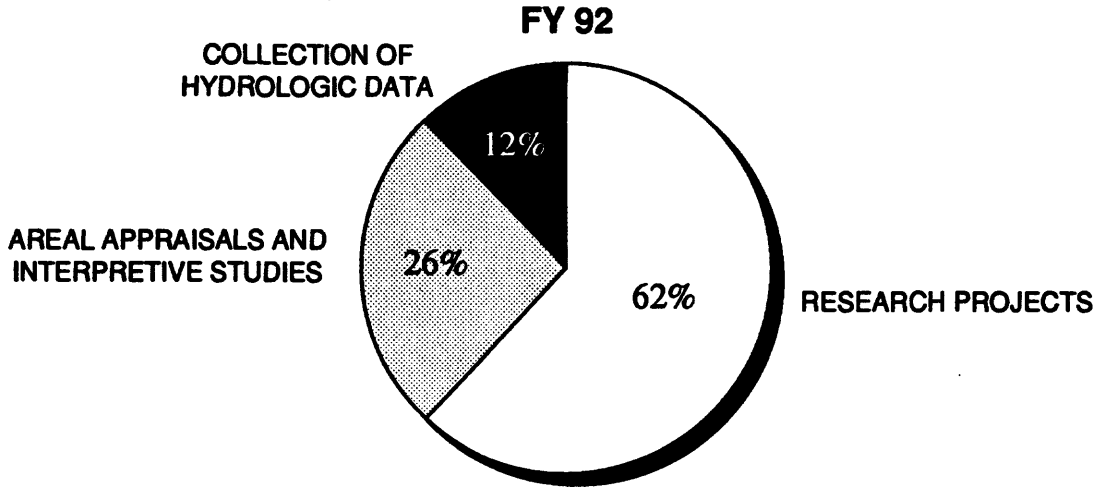
- Disseminating the water data and the results of these investigations and research through reports, maps, computerized information services, and other forms of public releases.

- Coordinating the activities of Federal agencies in the acquisition of water data for streams, lakes, reservoirs, estuaries, and ground water.

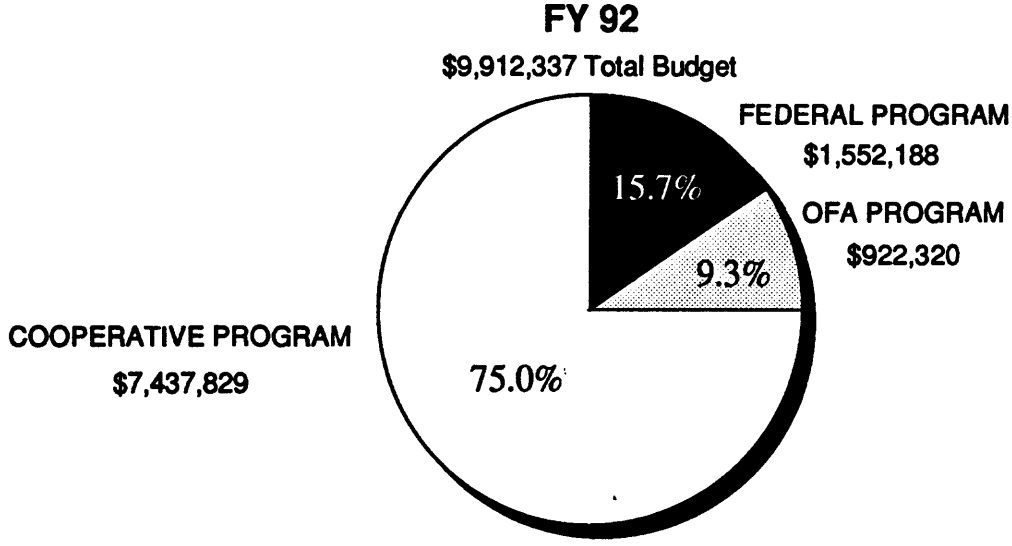
- Providing scientific and technical assistance in hydrologic fields to other Federal, State, and local agencies, to licensees of the Federal Power Commission, and to international agencies on behalf of the Department of State.

Types of Funding

The diagram below shows the percentage of the investigations for fiscal year 1992 in each of the broad categories of collection of hydrologic data, areal appraisals and interpretive studies, and research projects:



These investigations are directed toward obtaining the information needed by managers and planners for the solution or alleviation of water problems in New York. The investigations are supported by funds provided by State and local units of government and federal funds from the U.S. Geological Survey and other federal agencies. About 75 percent of the federal funds contributed by the U.S. Geological Survey are used to match, on a 50-50 basis, the funds contributed by the State and other local units of government. In fiscal year 1992, the financial support for all programs in New York was about $9.9 million, which was distributed as follows:



COOPERATING AGENCIES IN FISCAL YEAR 1992

Chautauqua County, Department of Planning & Development

City of Auburn

City of Batavia

City of Saratoga Springs

Cornell University, Department of Natural Resources

Cortland County Planning Department

Essex County Department of Planning

Federal Power Commission

Hudson River-Black River Regulating District

Monroe County Department of Environmental Health

Monroe County Department of Solid Waste

Nassau County Department of Health

Nassau County Department of Public Works

National Oceanic and Atmospheric Administration

New England Interstate Water Pollution Control

New York City Department of Environmental Protection

New York State Department of Environmental Conservation - Division of Water

New York State Department of Transportation

New York State Power Authority

Onondaga County Department of Public Works

Onondaga County Water Authority

Orange County Water Authority

COOPERATING AGENCIES IN FISCAL YEAR 1992 (continued)

Putnam County Department of Planning

Schuyler County

Suffolk County Department of Health Services

Suffolk County Water Authority

Tompkins County Department of Planning

Town of Amherst

Town of Brookhaven

Town of Cheektowaga

Ulster County

U.S. Army Corps of Engineers - Baltimore

U.S. Army Corps of Engineers - Buffalo

U.S. Army Corps of Engineers - New York City

U.S. Army Corps of Engineers - Pittsburgh

U.S. Department of Agriculture - Forest Service

U.S. Department of Energy

U.S. Environmental Protection Agency - New York City

U.S. Environmental Protection Agency - Corvallis, Oregon

U.S. Fish & W ildlife Service - Montezuma Wildlife Refuge

Village of Kiryas Joel

Village of Nyack

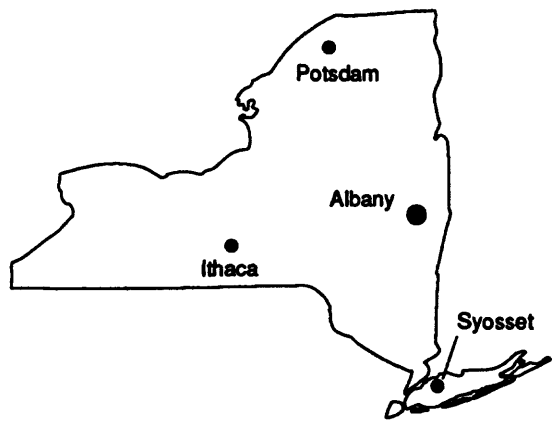
Village of Victor

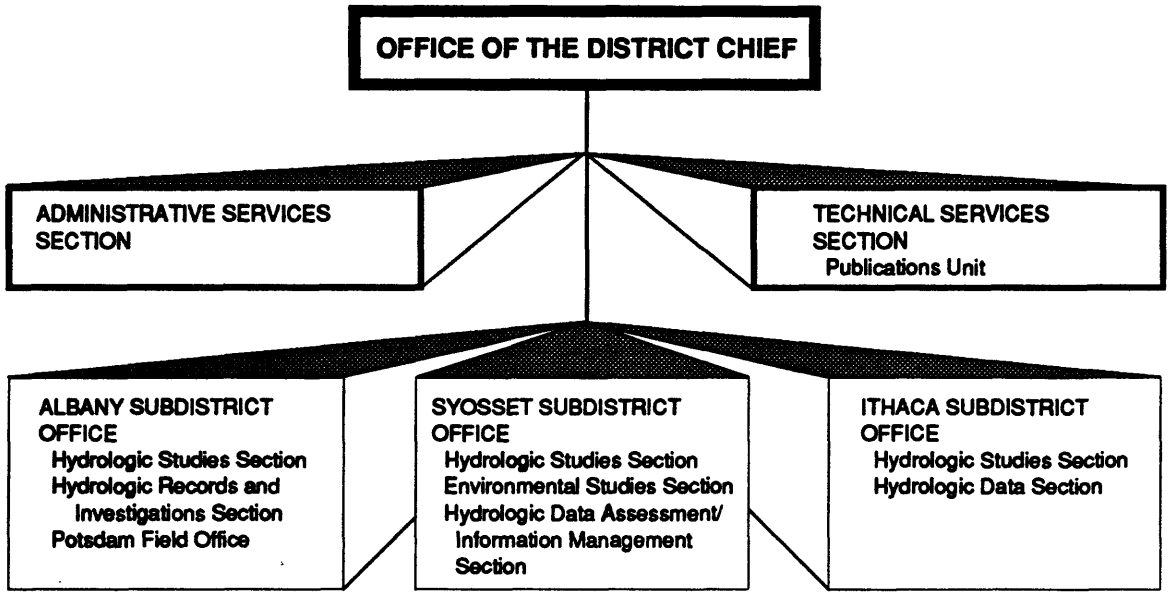
NEW YORK DISTRICT

The following sections describe the water-resources investigations conducted by the U.S. Geological Survey in New York in fiscal years 1990-92; many of these studies will continue into 1993 or longer. The Geological Survey began its water-resources studies in New York State in 1895 with a stream-gaging program in the Catskill Mountain region and entered its first cooperative program, with the Office of the State Engineer, in 1900. The Survey has maintained a District office in Albany since 1910 to direct its water investigations within the State and has maintained a subdistrict office on Long Island since 1932 to study and monitor the ground-water situation in this area of increasing urbanization. The Survey also maintains subdistrict offices in Ithaca and Albany to collect and interpret data from western and eastern New York, and maintains a field office in Potsdam to collect records in the northernmost part of the State.

The staff of the New York District numbers about 125. The professional hydrologists represent a variety of scientific and technical backgrounds that include engineering, chemistry, geology, mathematics, physics, biology, and soil science. The hydrologists are assisted by experienced engineering and hydrologic technicians who provide support service in the collection and analysis of field data, and by specialists in computer, publication, and administrative services.

The office addresses and organization chart are on page 7; the office locations are shown in the map below. A partial list of staff members is on page 54.





NEW YORK DISTRICT OFFICE ADDRESSES

District Office	(518) 472-3107	U.S. Geological Survey Water Resources Division 445 Broadway, Room 343 James T. Foley Courthouse P.O. Box 1669 Albany, N. Y. 12202-1669
Albany Subdistrict Office	(518) 472-3107	445 Broadway, Room 343 James T. Foley Courthouse P.O. Box 1669 Albany, N. Y. 12202-1669
Ithaca Subdistrict Office	(607) 266-0217	903 Hanshaw Road Ithaca, N.Y. 14850-1572
Syosset Subdistrict Office	(516) 938-8830	5 Aerial Way Syosset, N.Y. 11791
Potsdam Field Headquarters	(315) 265-4410	Market Square Mall 22 Depot Street Box U Potsdam, N.Y. 13676

Inquiries regarding projects described in this section may be directed to the District Office or Subdistrict Office in which the work originated.

Figure 1.—New York District organization chart with office addresses.
(List of staff members is on page 54.)

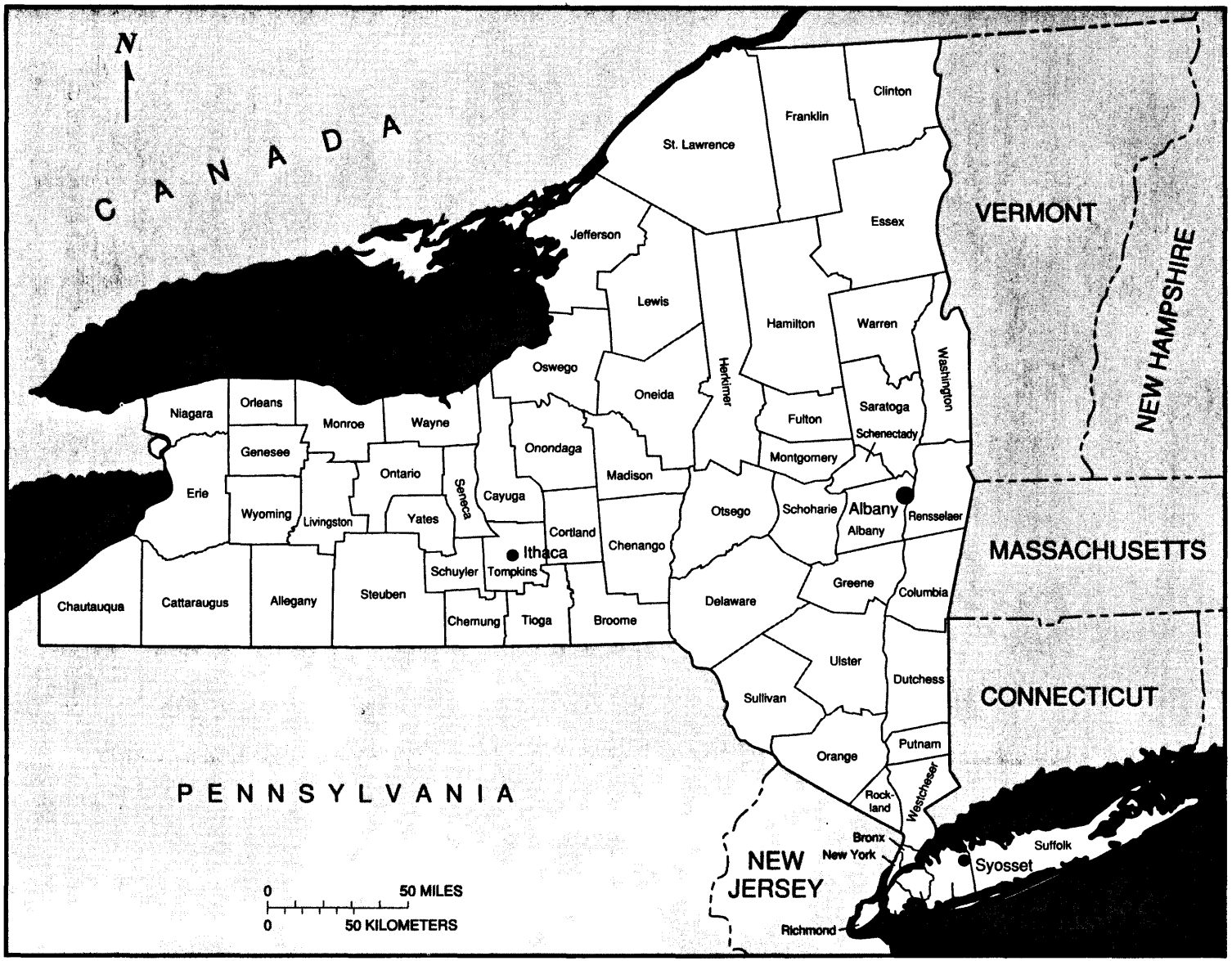
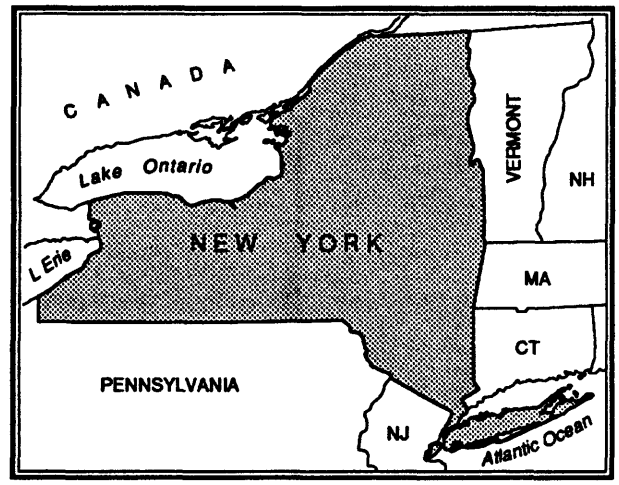


Figure 2.--Map showing counties in New York State.

PROJECTS IN FISCAL YEARS 1990-1992

Projects conducted by the New York District during fiscal years 1990-92 are described on the following pages. They are grouped by office location and listed in numerical order by project number. (See list on pp. iii-iv.)

SURFACE-WATER STATIONS (NY 00-001)



Period of project: Continuous since June 1898

Project leader: George C. Gravlee, Jr.

Field location: Statewide

Cooperating agencies: New York State Department of Environmental Conservation; U.S. Army Corps of Engineers; City of New York, Department of Environmental Protection; Nassau County Department of Public Works; Suffolk County Department of Environmental Control; Suffolk County Water Authority; National Weather Service; New York Power Authority; County of Chautauqua, Planning Department; County of Monroe, Department of Health; County of Onondaga, Department of Drainage and Sanitation; County of Onondaga, Water Authority Commission; City of Auburn; Town of Amherst, Erie County; Town of Cheektowaga, Erie County; County of Ulster, County Legislature; Board of Hudson River-Black River Regulating District; Essex County Planning Department; Orange County Water Authority; State University of New York; County of Nassau, Department of Public Works.

Problem: Surface-water information is needed for surveillance, planning, design, hazard warning, operation, and management in water-related fields such as water supply, hydroelectric power, flood control, irrigation, bridge and culvert design, wildlife management, pollution abatement, flood-plain management, and water-resources development. An appropriate data base is needed to provide this information.

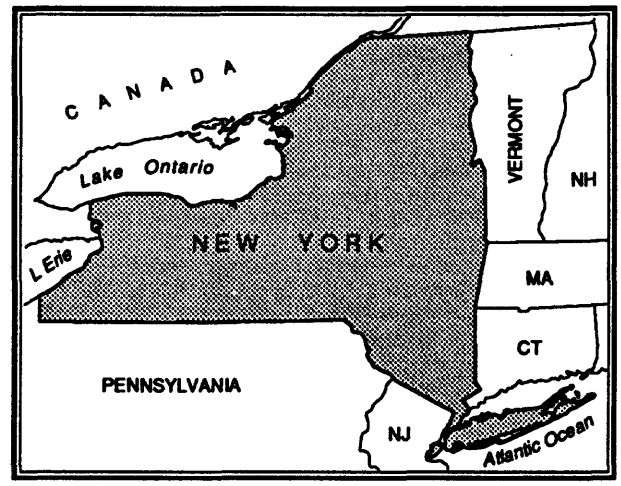
Objective: (1) To collect surface-water data for such purposes as (a) assessment of water resources, (b) operation of reservoirs or industries, (c) forecasting of stage or discharge, (d) pollution control and disposal of wastes, (e) providing discharge data to accompany water-quality measurements, (f) compact and legal requirements, and (g) research or special studies. (2) To collect data to define the properties and trends of water in streams, lakes, and estuaries for use in planning and design.

Approach: To use standard methods of data collection as described in the series "Techniques of Water Resources Investigations of the United States Geological Survey" and to use partial-record gaging instead of continuous-record gaging where possible.

Progress and significant results: Operation of the network continued. Equipment upgrading at gaging stations continues. New stations, planned through cooperative efforts, will be installed in water year 1992.

Plans for next year: To upgrade gaging equipment and to reactivate and construct specific sites as needed.

GROUND WATER STATIONS (NY 00-002)



Period of project: Continuous since July 1934

Project leader: John H. Williams

Field location: Statewide

Cooperating agencies: New York State Department of Environmental Conservation; Suffolk County Department of Environmental Control; Suffolk County Water Authority; Nassau County Department of Public Works.

Problem: Long-term information on ground-water levels is needed to evaluate the effects of climatic and man-made stresses on the aquifer systems of New York.

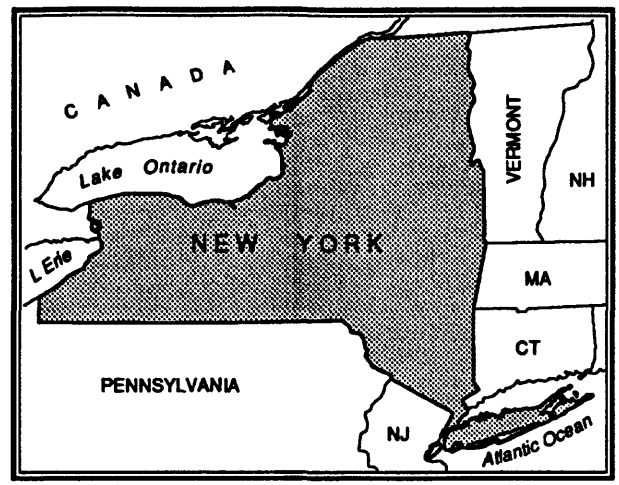
Objectives: (1) To provide long-term water-level records so that the response of aquifer systems to climatic and manmade stresses can be evaluated and potential problems can be defined early to allow for proper planning and management. (2) To provide long-term water-level records with which short-term information from ground-water investigations can be compared.

Approach: To collect long-term water-level records at selected observation wells that are representative of the hydrologic conditions in the State.

Progress and significant results: Collection and compilation of ground-water levels at 50 upstate and 800 Long Island wells continued. Ground-water level records were published in the annual data report.

Plans for next year: To continue to collect, compile, and publish water-level records and evaluate the observation-well network.

WATER-QUALITY STATIONS (NY 00-003)



Period of project: Continuous since June 1906

Project Leader: Robert J. Rogers

Field location: Statewide

Cooperating agencies: New York State Department of Environmental Conservation; Suffolk County Water Authority; Nassau County Department of Public Works; City of New York, Department of Environmental Protection

Problem: Water-resources planning and water-quality assessment require statewide and nationwide levels of information on the chemical and physical qualities of surface water and ground water.

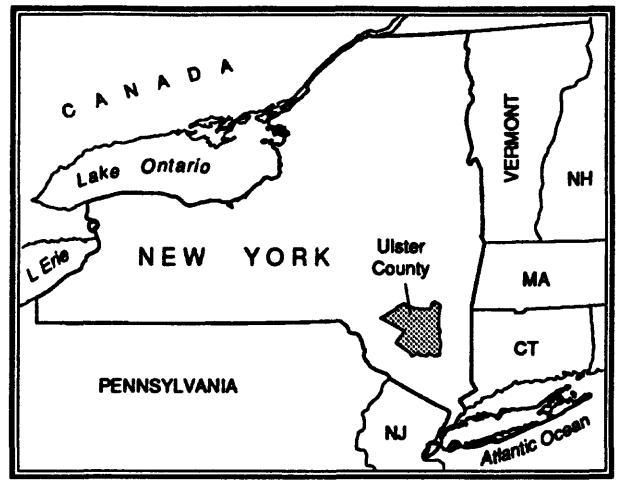
Objective: To develop a statewide and nationwide bank of water-quality data for Federal, State, and local planning and to provide these data where needed to support other projects within New York.

Approach: To maintain and operate a statewide network of water-quality stations (some of which are parts of nationwide networks) to provide data on concentrations, loads, and time trends of chemical constituents of surface water and ground water, and to provide water-temperature data for management purposes.

Progress and significant results: Water-quality samples were collected at 13 NASQAN (National Stream Quality Accounting Network) stations, one Hydrologic Benchmark Network station, 79 additional surface-water stations, and 48 ground-water stations for chemical analysis. Continuous water-temperature records were collected at 13 stations.

Plans for next year: The collection of water-quality samples will continue at 24 surface-water stations. Forty ground-water stations are planned for the network in 1993. Water-temperature records will be collected at the same stations as in 1991. Data from 1991-92 will be published in the annual water-data reports.

National Trends Network (NTN) for Monitoring Atmospheric Deposition (NY 83-005)



Period of project: Continuous since June 1983

Project leader: Peter S. Murdoch

Field location: Biscuit Brook, Ulster County

Cooperating agency: Federally funded

Problem: A nationwide long-term monitoring network needs to be developed and maintained to detect and measure chemical trends in atmospheric deposition. Before the National Atmospheric Deposition/NTN program, no national monitoring of deposition chemistry was being done. In addition, long-term trends in stream chemistry need to be established in headwater areas.

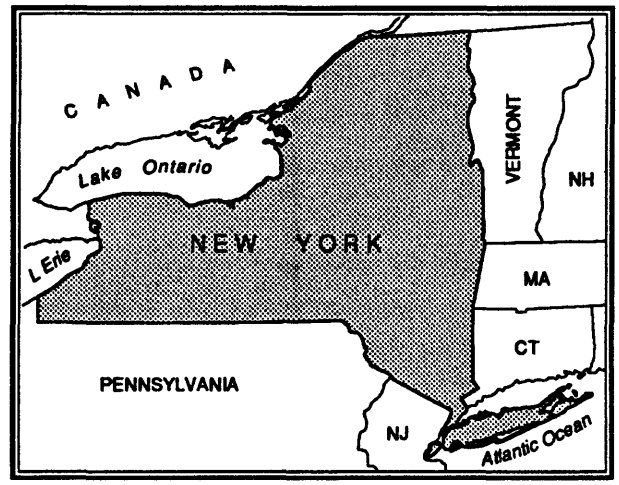
Objective: (1) To document weekly variations in atmospheric deposition and collect wet deposition for analysis of elements and compounds that contribute to the chemical composition of surface waters. (2) To determine the relation between stream chemistry and discharge, and to monitor long-term trends in stream chemistry.

Approach: (1) To (a) set up monitoring stations as part of the National Trends Network; (b) maintain stations, make on-site measurements, process samples, and submitsamples to laboratories; (c) verify data retrievals, and (d) prepare a periodic report. (2) To (a) collect long- and short-term samples of water from Biscuit Brook, (b) continuously monitor stream stage, and (c) conduct longitudinal chemistry and flow profiles.

Progress and significant results: Monitoring of volume and chemistry for precipitation and stream water has been continuous since 1983. Data indicate that the central Catskills receive the largest deposition of sulfate and nitrate in the northeastern United States, that stream sulfate concentrations have been decreasing during the 1980's, and that stream nitrate concentrations have increased significantly over the same period. The Biscuit Brook data have received increasing attention from scientists investigating the effects of acid deposition and the potential for nitrogen saturation in forest soils. Soil and ground-water sampling was added in 1990 to identify processes that control stream chemistry.

Plans for next year: Monitoring of precipitation will continue as part of the NTN program.

NEW YORK WATER-USE DATA (NY 79-007)



Period of project: Continuous since January 1979

Project leader: Deborah S. Snavely Lumia

Field location: Statewide

Cooperating agency: New York State Department of Environmental Conservation

Problem: The demand for water in New York is unevenly distributed, and little information is available on water use. Because increasing competition for local supplies could lead to shortages, information is needed on present uses, how use varies, and how the availability and nature of the resources vary with demand. These are addressed by two studies that are intended to (a) collect data on withdrawal, delivery, and return of water in New York State, and (b) examine the effect of waste disposal sites on water use and availability in Dutchess County.

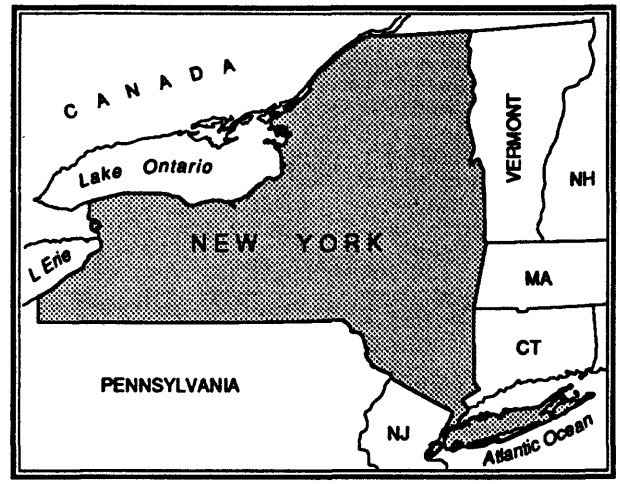
Objectives: (1) To determine which agencies collect data on water use in specified categories. (2) To collect and compile water-use data for input to SSWUDS (Site-Specific Water-Use Data System) and AWUDS (Aggregated Water-Use Data System). (3) To develop a system whereby the agencies that collect the data can transmit periodic updates to the main data bank. (4) To make the data available through computer processing and reports. (5) To evaluate the relation between water use and availability in Dutchess County, and identify possible sources of ground-water contamination.

Approach: (1) New York State agencies will furnish water-use data in specific categories of use and local agencies and organizations in specific counties or drainage basins will also supply water-use data. (2) A system of data transmittal will be established among State and local agencies and the USGS. (3) The data will be used to update SSWUDS and AWUDS. (4) Periodic water-use reports will be written.

Progress and significant results: The Dutchess County report was written and review process begun. A map report of 1985 statewide water-use data was completed. Data were collected for a report on estimated water use in the United States, in 1990. Sources and methods were documented. The AWUDS was updated. Water-use sites were entered into the data-base site file.

Plans for next year: (1) To complete the review of the Dutchess County report. (2) To assist the New York State Department of Environmental Conservation in the development of a site-specific New York water-use data base beginning in selected pilot areas. (3) To outline a report of water-use management in New York State and data reports that include sources and methods used in the water-use project.

FLOOD INVESTIGATIONS (NY 67-045)



Period of project: Continuous since July 1966

Project leader: Richard Lumia

Field location: Statewide

Cooperating agency: New York State Department of Transportation

Problem: Flooding is a serious problem in many parts of the State. Information on floods and analyses of flood data are needed to aid in the design of bridges, highways, and buildings, and in flood-plain zoning and flood-protection works.

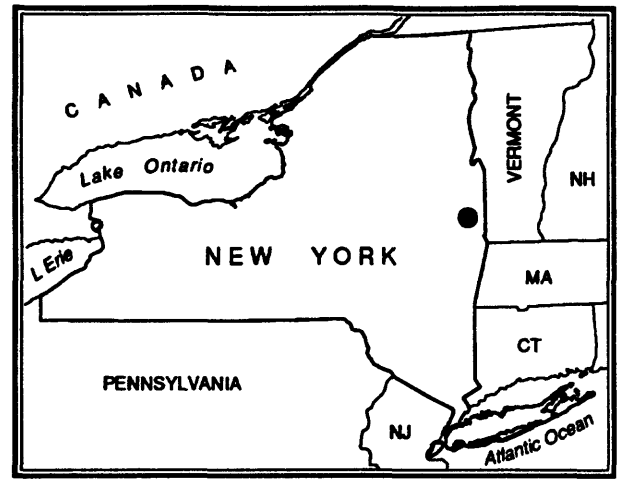
Objective: (1) To provide information on the magnitude and frequency of floods to agencies and individuals involved in flood-protection planning and design. (2) To develop regional flood-frequency relations for the entire State. (3) To make site studies.

Approach: To (a) collect flood data at crest-stage stations and publish annual peak discharges; (b) calculate discharges of floods, develop flood profiles, and collect information for flood-plain mapping; (c) prepare reports covering individual floods, and (d) make analyses to improve flood-frequency relations for streams throughout the State.

Progress and significant results: Regional flood-frequency relations for New York were developed, and a report has been published. Data collection continued at crest-stage stations, and annual peaks were published in the annual water-data report. A report updating the maximum known stages and discharges of New York streams is in press. A report documenting operational procedures for the Erie (Barge) Canal within the Oswego River basin is in preparation.

Plans for next year: (1) To print the report on the maximum known stages and discharges of New York streams. (2) To continue data collection at crest-stage stations. (3) To document any notable floods. (4) To complete the report documenting operation procedures for the Erie (Barge) canal within the Oswego River basin.

TRANSPORT OF POLYCHLORINATED BIPHENYL (PCB) RESIDUE IN THE UPPER HUDSON RIVER BASIN (NY 77-046)



Period of project: Continuous since February 1977

Project leader: Robert F. Snow

Field location: Hudson River from Fort Edward to Waterford

Cooperating agency: New York State Department of Environmental Conservation

Problem: The industrial discharge of PCB's (polychlorinated biphenyls) into the upper Hudson River has degraded the water quality. The effectiveness of proposed sediment-dredging operations in the upper Hudson remains unknown until it is determined whether they will cause significant quantities of PCB-contaminated sediment to be transported downstream.

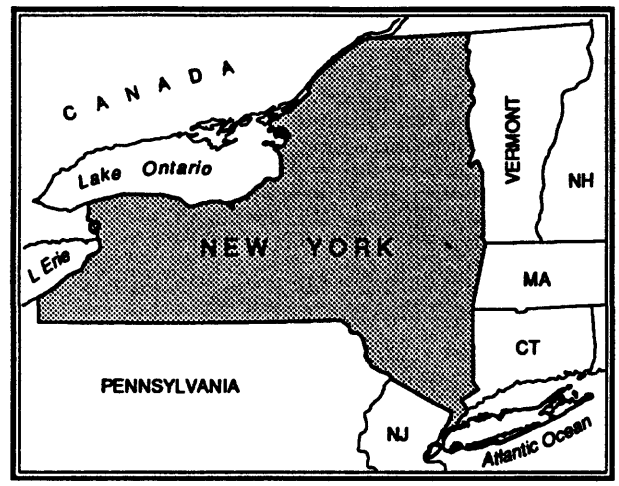
Objective: To estimate the amount of PCB's contributed from the upper Hudson River to the estuary and determine whether PCB-contaminated sediments have been transported into the estuary. This study will provide a data base from which the effects of dredging in the upper Hudson (if carried out) can be evaluated.

Approach: Annual PCB and sediment loads for the Hudson River will be calculated from daily-flow and sediment data.

Progress and significant results: Annual suspended-sediment loads and PCB loads for water year 1989 were calculated and compared to those of preceding years. Analysis of 1990 samples continued, and results of 1991 samples were published in the annual data report. Plans for high-volume samples were made for the 1992 water year, in cooperation with New York State Department of Environmental Conservation.

Plans for next year: To continue sampling the Hudson River to determine PCB levels, and to update reporting on PCB concentration and transport.

HYDROGEOLOGIC ASSESSMENT OF SELECTED AQUIFERS (NY 82-114)



Period of project: Continuous since October 1981

Project leader: Richard J. Reynolds

Field location: Glacial valleys in upstate New York

Cooperating agency: New York State Department of Environmental Conservation

Problem: Most principal aquifers in upstate New York are isolated unconfined glacial or alluvial deposits in valleys cut into crystalline or shale bedrock. Development has rendered these aquifers susceptible to contamination. Contamination, whether from agricultural, industrial, or nonpoint sources, jeopardizes the only economical source of water for homes, communities, and small industries in many places. Management's decision to resolve or prevent this problem would be facilitated by an appraisal of selected areas of known or potential contamination.

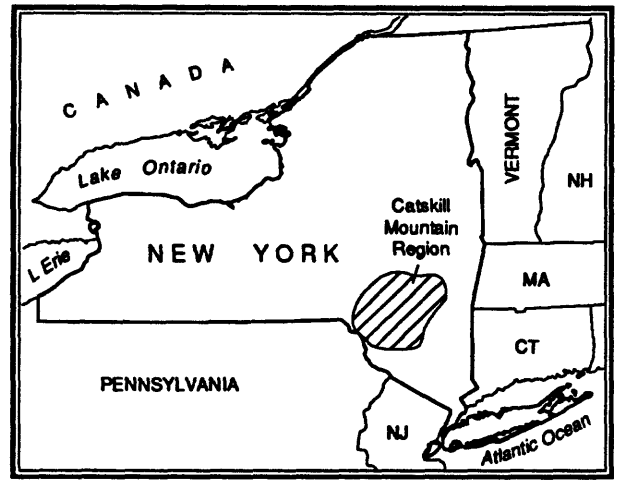
Objectives: (1) To select aquifers that have known or potential ground-water contamination problems. (2) To compile geohydrologic maps of the aquifer systems. (3) To select a ground-water-quality monitoring system for major water-supply users. (4) To sample and analyze ground water for baseline quality.

Approach: Aquifer selection will be flexible, depending on the needs of the cooperating agency. Aquifers will be mapped generally at the 1:24,000 scale from published geologic, soils, and land-use maps or minor field mapping. Aquifer characteristics will be interpreted and depicted on aquifer-thickness, water-level, and water-quality maps and geologic sections.

Progress and significant results: Water Resources Investigations Reports covering the valley fill aquifer at Owego, in Tioga County, was published. A Water Resources Investigations Report covering the Sand Ridge aquifer in Oswego County was approved and will be released in 1992. Work on the Schodack Terrace aquifer in Rensselaer and Columbia Counties, as well as a reinvestigation into the Clifton Park area continues.

Plans for next year: (1) To publish reports on the Oxford-Brisben area, the Port Jervis area, and the Schodack Terrace aquifer. (2) To complete a report on the Waverly-Sayre area. (3) To collect additional hydrogeologic and water-level data from the Clifton Park area. (4) To establish a network of observation wells in the Colonie Channel aquifer in Saratoga County and to monitor water levels at selected wells with continuous recorders. (5) To prepare a potentiometric-surface map of the Colonie Channel aquifer if data are sufficient.

RESPONSE OF FISH AND INVERTEBRATES TO EPISODIC CHANGES IN STREAM CHEMISTRY AND DISCHARGE AT FOUR STREAMS, AND LONG-TERM MONITORING OF SEVEN STREAMS IN THE CATSKILL MOUNTAINS (NY 85-152)



Period of project: October 1984 through October 1990

Project leader: Peter S. Murdoch

Field location: Catskill Mountains

Cooperating agency: United States Environmental Protection Agency

Problem: Reconnaissance data suggest that acid precipitation can affect stream chemistry in the Catskill Mountains. Assessment of the processes that cause stream acidification and the effect of acid deposition on fish and invertebrates requires data on both short-term and long-term trends in stream chemistry.

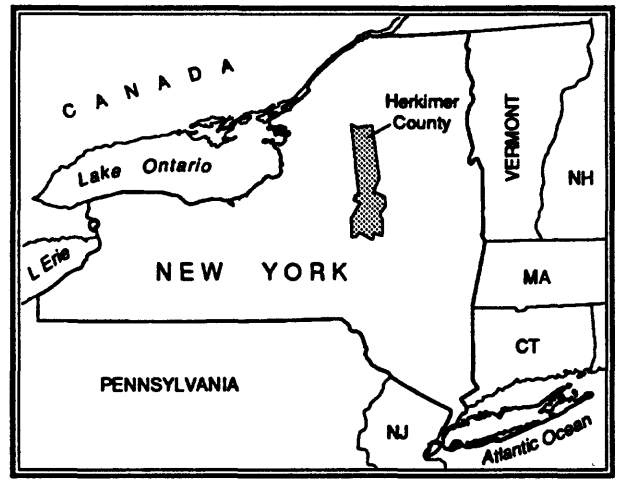
Objective: (1) To asses the relations among soil chemistry, stream chemistry, and discharge at four streams of differing base-flow pH. (2) To calculate a mass balance for input and output of key constituents throughout the respective watershed. (3) To compare the effect of precipitation acidity of selected storms on the chemistry of these streams. (4) To assess the effect of episodic acidification on fish and invertebrate populations. (5) To assess the long-term changes in stream chemistry at seven Catskill streams.

Approach: To conduct (a) hourly sampling of stream and rain during 10 storms at the four streams, (b) weekly sampling during nonstorm periods, (c) weekly sampling of wetfall within the Biscuit Brook watershed as part of the NTN (National Trends Network) program, (d) monthly sampling at seven streams peripheral to the Biscuit Brook watershed with simultaneous discharge measurements, and (e) monitoring of biologic response by population estimates, bioassay experiments, and radiotelemetry studies.

Progress and significant results: Long-term monitoring continued. Nitrate concentrations in streams increased, and sulfate concentrations decreased during the 1980's. Relations between constituents and flow were developed for all streams in the network. Storm data show increased nitrate and decreased sulfate concentrations with increasing flow, except during midsummer. Populations of fish and invertebrates were smaller in the acidic streams than in the buffered streams. Fish held in streams showed a significantly increased mortality rate during acid episodes .

Plans for next year: Continue long-term monitoring, and complete papers for the Episodic Response Project.

Hydrologic Budget and Changes in Aquatic Chemistry of Woods Lake Outlet after Watershed Liming (NY 88-173)



Period of project: October 1988 through March 1991

Project leader: Douglas A. Burns

Field location: Woods Lake, Herkimer County

Cooperating agency: Cornell University, Department of Natural Resources

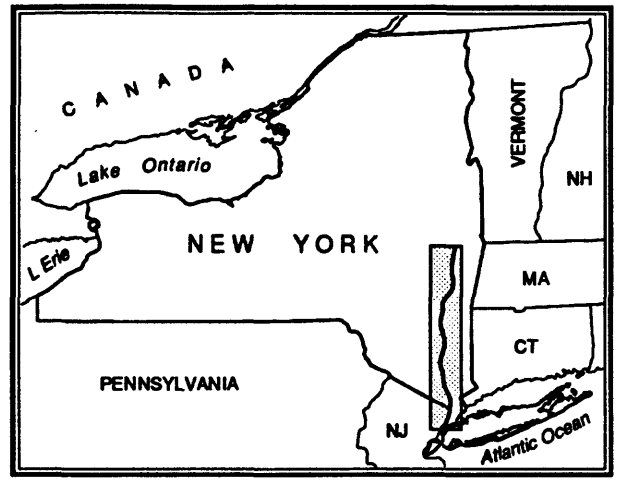
Problem: To determine the magnitude of chemical changes, including acidification mitigation, in a lake-outlet stream after watershed liming.

Objective: (1) To determine the effects of watershed liming on the lake-outlet stream. (2) To identify the processes that alter or control stream-water chemistry. (3) To determine how the effects of watershed liming change through time.

Approach: Determine longitudinal chemical changes and mass balances for the outlet stream through water sampling and operation of continuous streamflow gages.

Progress and significant results: Base-flow samples have been collected and analyzed. Longitudinal sampling profiles were completed in May, August, and September 1989. Several high-flow samples were collected during snowmelt runoff. The cooperator terminated this project before it's completion.

RESOURCE MANAGEMENT EVALUATION AND STUDY OF SALTWATER MOVEMENT WITHIN THE TRANSITION ZONE OF THE HUDSON RIVER ESTUARY (NY 88-175)



Period of project: May 1988 through September 1993

Project leader: M. Peter de Vries

Field location: Lower Hudson River basin

Cooperating agencies: City of New York; New York State Department of Environmental Conservation

Problem: The effect of major freshwater withdrawals on salinity in the transition zone of the Hudson River is unknown. Increased salinity and upstream movement of the salt front could adversely affect wildlife habitats and water supplies. As a result, new water supplies cannot be developed until their probable effect on saltwater movement can be determined.

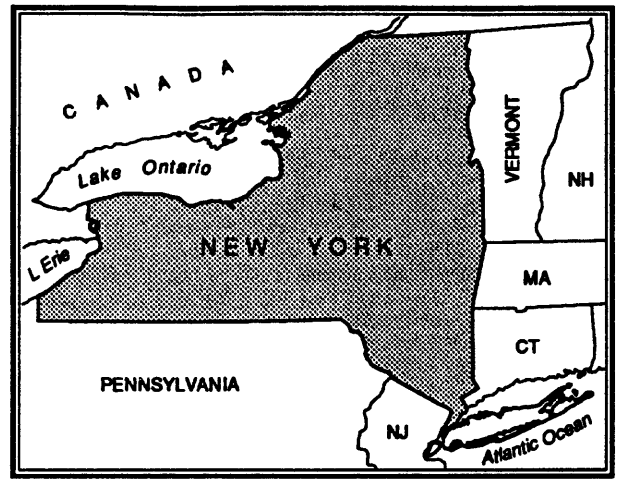
Objective: (a) To identify and describe the forces that determine the location and shape of the salt front, (b) identify the effect of seasonal variations and channel geometry on the location of the salt front, and (c) predict the effect of water withdrawals at different points on the location of the salt front.

Approach: This study will be divided into several phases that include: (a) identifying and evaluating present models, data, and data-collection programs; (b) installing tide-stage and water-quality stations at several locations; (c) developing and using a one-dimensional model to evaluate what additional data and data-collection sites are needed: (d) performing tidal-cycle discharge and salinity measurements under differing hydrologic conditions; (e) using these data to calibrate and verify one- and two-dimensional models to simulate the forces that control flow and saltwater movement in the estuary; and (f) evaluating several water-withdrawal plans with these models.

Progress and significant results: Six continuous-record water-quality and tide-stage gages, and two weather stations were operated. This record describes the seasonal movement of the salt front and provides boundary conditions for digital models. Twenty-nine boat runs were made to delineate the longitudinal variation of chloride concentration during high-slack tide conditions. The salt front (100 milligrams per liter of chloride) ranges from below Hastings-on-Hudson to New Hamburg during most years, but can move as far north as Poughkeepsie during periods of drought. Ten 24-hour tidal-cycle discharge and chloride-concentration-profile measurements were performed, each of which entailed more than 100 discharge measurements in the cross section and provided detailed horizontal and vertical velocity, and specific conductance profiles. Results show measured discharge rates as high as 370,000 ft^3/s (cubic feet per second) near Ossining. Chloride concentrations indicate that the transition zone of the estuary is partly mixed in some areas and behaves as a salt wedge in others. Data are to be included in the National Water-Information System. A GIS data base, including digital elevation and bathymetric data has been developed and interfaced with the models. The one-dimensional Branch flow model has been calibrated for the 133 mile reach from Hastings-on-Hudson to Green Island.

Plans for next year: Finalize one- and two-dimensional flow and solute-transport models and observe model response to withdrawal scenarios.

Evaluation of Scour at Bridges in New York (NY 88-178)



Period of project: July 1988 through September 1993

Project leader: Gerard K. Butch

Field location: Statewide, excluding Long Island and New York City

Cooperating agency: New York State Department of Transportation

Problem: No reliable technique is available to estimate scour at bridges in New York . Uncertainty as to which scour-prediction equations to use for a particular set of circumstances has prompted an effort to develop data bases that reflect full-scale, prototype field conditions. The types of channels and bridges that are vulnerable to scour, and reliable data-collection methods, need to be identified.

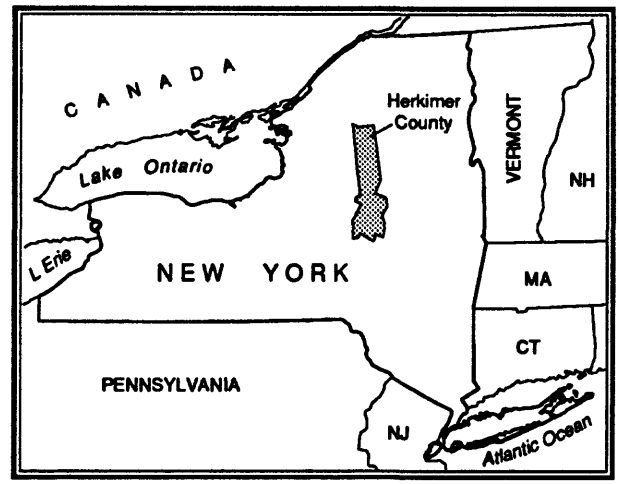
Objective: (1) To collect scour data to evaluate and perhaps improve current scour-prediction equations. (2) To categorize the types of channels and bridge designs vulnerable to scour. (3) To assess alternative methods of data collection.

Approach: Scour data are being collected at 77 bridges in New York. Bridges near USGS stations on streams with erodible bed material were selected in six physiographic provinces. High-flow data are being collected at 31 bridges, and annual data at the remaining 46 bridges. The conventional method of data collection with a sounding weight is being compared with sonar and other geophysical techniques for accuracy, safety, and ease of operation. Streambed cross sections measured at the beginning of the study are to be compared with bridge plans, previous measurements, and data collected during the remaining years of the project to determine the extent of scour at the selected sites. Results of scour-prediction equations will be compared with measured scour. Regression analyses and (or) other curve-fitting techniques will be used to improve scour-prediction equations. The types of channels and bridges vulnerable to scour will be categorized.

Progress and significant results: Local scour holes 1 to 2 ft deep were found at many piers, but not the abutments, at the start of the study. At a few sites, the scour has exposed spread footings that bridge plans show to have been buried during construction. Fifteen high-flow measurements, including two flows with a recurrence interval exceeding 5 years, did not show any new scour. Present scour holes and the coarse bed material could indicate that clear-water scour is more common than live-bed scour in these streams. Geophysical techniques were applied to gravel and cobble streambeds but did not reveal any backfilled scour holes. A fathometer provided quick and accurate depth measurements. The mobile method that uses a four-wheel base and crane was cumbersome. A fixed installation designed to record the distance between the transducer and the streambed automatically at selected time intervals required extensive protection but is expected to provide useful information during floods.

Plans for next year: Complete data collection and determine the type(s) and extent of scour at each site. Write final report.

WATER FLOW PATHS IN TWO LIMED INLET WATERSHEDS AT WOODS LAKE (NY 89-181)



Period of project: May 1989 through March 1991

Project leader: Douglas A. Burns

Field location: Woods Lake, Herkimer County

Cooperating agency: Cornell University, Department of Natural Resources

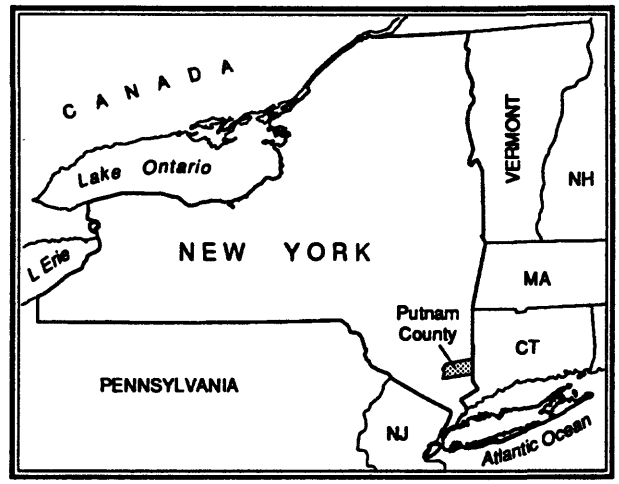
Problem: Watershed liming is being investigated as a possible method of mitigating the effects of acidic precipitation on lake-water chemistry and biota. The flow paths of incoming precipitation and melting snow affect the amount of buffering and therefore the acidity of lake tributaries and the lake itself, and are expected to prove important the neutralization process after lime addition.

Objective: (1) To quantify the relative amounts of precipitation, soil water, and ground water entering two Woods Lake inlet streams during periods of high flow. (2) To determine the implications of the hydrologic flow paths on the magnitude and expected duration of buffering effects in the inlet streams and lake.

Approach: (1) To collect monthly background samples of precipitation , soil water, ground water, and stream water to examine the variability of isotopic ratios. (2) To determine the isotopic ratios of streamwater and precipitation during at least three high-flow periods each year. (3) To use additional flow-path-separation techniques to verify the results obtained from isotope analysis.

Progress and significant results: Background samples of precipitation, stream water and ground water were collected during the summer of 1989. One high flow in one of the inlet streams was sampled in late September. The cooperator terminated this project before it was completed.

HYDROGEOLOGIC CHARACTERISTICS OF THE CRYSTALLINE-BEDROCK AQUIFERS IN PUTNAM COUNTY (NY 89-188)



Period of project: February 1989 to September 1992

Project leader: Stephen W. Wolcott

Field location: Putnam County

Cooperating agency: Putnam County Department of Planning

Problem: Southeastern New York is undergoing rapid suburban development. In many of the developing areas, including Putnam County, crystalline-bedrock aquifers are the sole source of water and are highly susceptible to the effects of drought and overpumping. The hydrogeology of these fractured-rock systems is poorly documented.

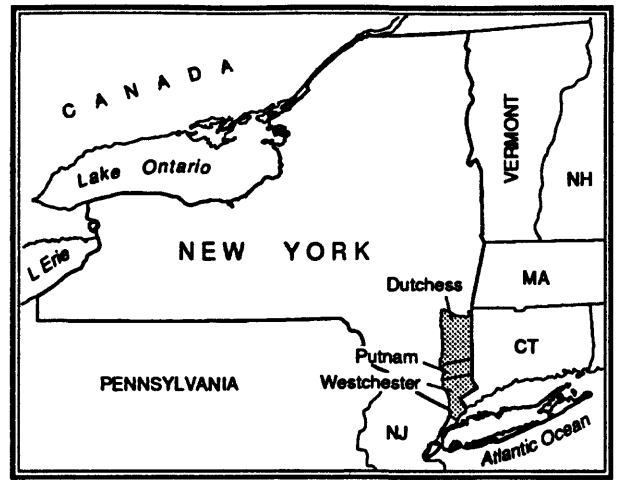
Objective: To define the hydrogeology of the crystalline bedrock in Putnam County, including the areal and vertical distribution of water-bearing fractures and their hydraulic characteristics.

Approach: (1) To compile and evaluate available aquifer-test data from production wells completed in crystalline bedrock. (2) To select five sites for hydrogeologic analyses that will include an analysis of the distribution of the water-bearing fractures. (3) To complete downhole surveys at one site and delineate water-bearing fractures. (4) To complete multiple-well aquifer tests to determine the hydraulic properties and connectivity of the water-bearing fractures delineated by downhole geophysics techniques.

Progress and significant results: Borehole geophysical data were collected at one site where water-bearing fractures are being delineated. Aquifer-test data were compiled for all five sites and evaluated at one site.

Plans for next year: To complete geophysical data collection and conduct an aquifer test at the site where fractures are being delineated, and write final report.

WATER-RESOURCES DATA-COLLECTION AND MONITORING NETWORK IN THE CROTON RIVER WATERSHED, NEW YORK (NY 90-191)



Period of project: July 1990 to September 1993

Project leader: Stephen W. Wolcott

Field location: Croton River Watershed (Dutchess, Putnam, and Westchester Counties)

Cooperating agency: City of New York, Department of Environmental Protection

Problem: Expanding urbanization in the Croton River watershed has led to the deterioration of water quality in the Croton Reservoir system. The water does not require filtration at present, but if current trends in urbanization and subsequent deterioration in water quality continue, filtration and other expensive types of treatment will be inevitable. Data on water use, streamflow, ground-water levels, and water quality are needed by water-resource managers to evaluate the quality and quantity of water resources in the watershed.

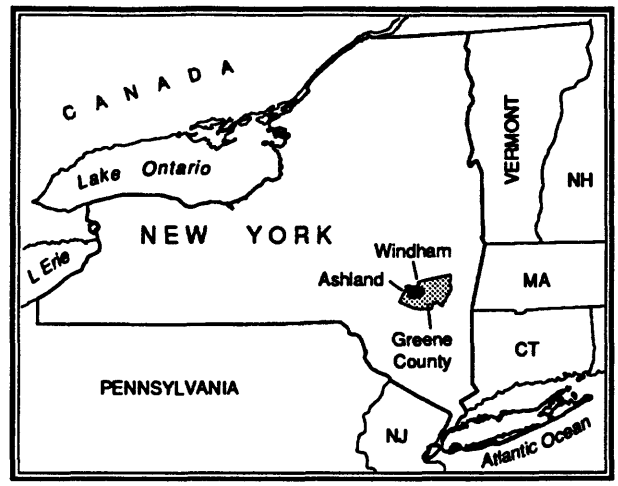
Objective: To summarize current and historical water-resources data and to establish a monitoring network that can be used to evaluate changes in water quality and quantity that result from urbanization within the Croton River watershed.

Approach: Historical water-resources data will be compiled on low flow and miscellaneous streamflow, well yields, ground-water levels, water quality, water use, and precipitation. Where possible, these data will be converted into Geographic Information System (GIS) coverages. These data will be used to determine optimum locations for new stream gages, observation wells, and water-quality-measurement sites.

Progress and significant results: Many GIS data coverages have been assembled.

Plans for next year: To complete collection of historical surface-water, water-quality, and ground-water data and determine optimum sites for water-resources data collection.

GROUND-WATER RESOURCES OF THE BATAVIA KILL AT WINDHAM, GREENE COUNTY (NY 90-192)



Period of project: May 1990 through September 1993

Project leader: Paul M. Heisig

Field location: Batavia Kill valley, Towns of Windham and Ashland

Cooperating agency: New York City Department of Environmental Protection

Problem: Development in the Town of Windham, in the drainage basin of the Batavia Kill, has raised concern about the adequacy of ground-water resources for local supply as well as the potential effect of development on the quantity and quality of surface water reaching the New York City reservoir system. In 1981, a ski center at Windham was opened to the public, and the subsequent demand for vacation homes and multi-unit dwellings has spurred development in the area. The general lack of information on water resources in the area has caused concern over the potential effect of essentially unregulated development. Both ground-water and surface-water quality may be degraded by sewage disposal, and components of the water budget such as stream discharge could be altered by withdrawals for domestic needs and snowmaking.

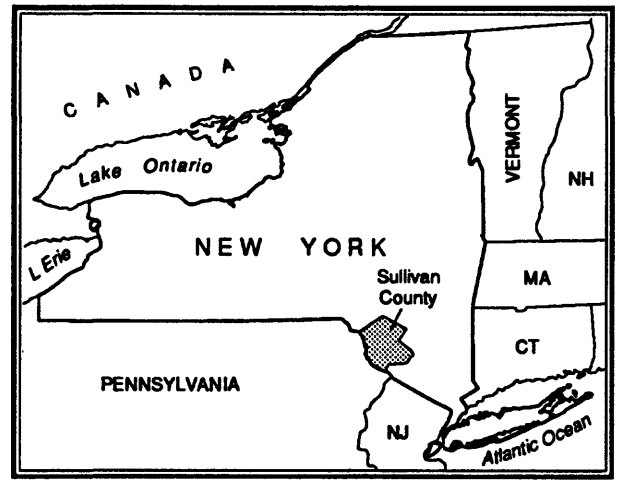
Objective: (1) To assess the water resources of the Batavia Kill basin near Windham, by determining stratified-drift aquifer geometry, ground-water flow directions, and hydraulic properties, and ground-water and surface-water quality. (2) To document the effects of seasonal pumping and sewage disposal on ground-water levels and water quality.

Approach: Geometry of the stratified-drift aquifer and directions of ground-water flow will be determined from existing hydrogeologic well-log data, a field inventory of domestic and production wells that includes water-level measurements, surface geophysical surveys, drilling of test holes and installation of observation wells, and borehole geophysical surveys. Water quality will be assessed through chemical analysis of ground-water and surface-water samples. A water balance for the study area will be developed from field data, water-use data, precipitation data, and estimates of runoff. Effects of pumping and sewage disposal on the hydrologic system will be monitored near the areas of stress.

Progress and significant results: Continued bedrock water-level monitoring during stress and non-stress periods in the Batavia Kill valley suggests strong interconnection between wells in several parts of the valley. A 48-hour aquifer test and a shorter test were performed to assess well interconnection and response. Interconnection of wells 3/4 mile apart has been observed during withdrawals of less than 100 gallons per minute. Ground-water and surface-water sampling and borehole logging continue; large differences in the specific conductance of water within a well have been observed at several locations. Two precipitation gages have been installed at altitudes of 2,300 and 2,700 ft, respectively, to supplement precipitation data in the valley (altitude 1,500 to 1,700 ft). About 150 wells have been field checked and their records cataloged and entered into the national data base.

Plans for next year: To complete fieldwork, interpret data, and write final report.

RELATIONS AMONG GEOCHEMICAL PROCESSES THAT CONTROL POND-WATER CHEMISTRY IN HODGE POND WATERSHED IN THE CATSKILL MOUNTAINS (NY 90-193)



Period of project: June 1990 through September 1991

Project leader: Douglas A. Burns

Field location: Village of Lew Beach, Sullivan County

Cooperating agency: Town of Rockland, New York

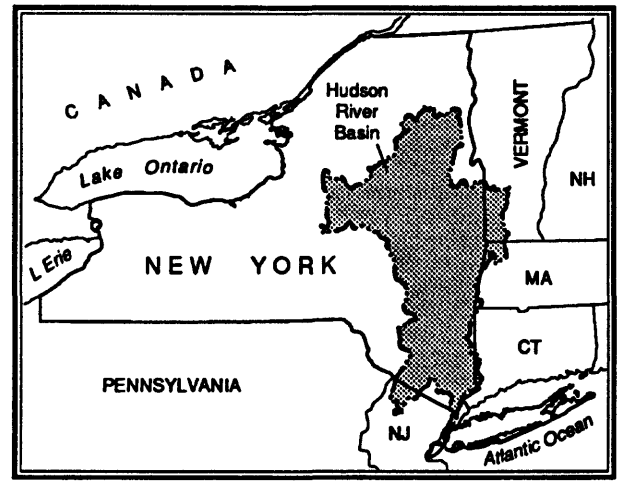
Problem: State and local officials in charge of managing the water resources of the Catskill Mountain region are concerned about the effects of acid precipitation and of hydrologic changes due to global warming on the water quality of headwater lakes and streams. The information needed to address these concerns is inadequate because few studies of natural headwater lakes in the Catskill region have been done.

Objective: To determine how the biologic, hydrologic, and geochemical processes operating in the watershed and pond control the chemical composition of the pond water.

Approach: The chemical quality and quantity of water along its major pathways into and out of the watershed will be monitored to compute seasonal and annual water and chemical balancesfor the watershed. The relative proportions of precipitation, ground water, and soil water in Hodge Pond will also be determined from chemical concentrations and through the use of mass balance.

Progress and significant results: Installation of 18 wells, a lake-level gage, a lake-outlet stream gage, and a weighing-bucket rain gage was completed in the fall of 1991. A water-quality-sampling program was established in May 1991. The shallow part of Hodge Pond and the outlet have shown stable alkalinity values of 50 to 65 μeq/L. Alkalinity does not seem to decrease as sharply during rain storms and snowmelt as in many drainage lakes in the northeastern U.S. Alkalinity increases steadily from spring until fall turnover in the deepest part of the lake. In late spring and early summer, this alkalinity increase coincides with an increase in base-cation concentration (primarily Ca2+), a decrease in NO_3^- concentration to below detection limits, and a steady increase in NH_4^+ concentration. Late in the summer until fall mixing, the increase in alkalinity is more coincident with decreased SO_4^{2-} concentrations. Ground-water alkalinity is between 15 and 50 times greater than pond alkalinity . Base-cation concentrations, pH, and silica concentrations show similar differences. The data suggest that little ground water seeps into the pond. A preliminary water balance, based on limited data and estimates of evaporation, suggests that the precipitation that fell on the pond in 1991 is not sufficient to complete a hydrologic balance, which suggests other sources of input. The cooperator terminated this project before the work was completed.

National Water-Quality Assessment (NAWQA) of the Hudson River Basin (NY 91-199)



Period of project: Continuous since January 1991

Project leader: Ward O. Freemen

Field location: Hudson River Basin in New York, Vermont, Massachusetts, and New Jersey

Cooperating agency: Federally funded

Problem: Information on natural and human factors that affect water quality at local and national scales is needed. A comprehensive program that combines the benefits of basinwide studies into a national assessment of water quality can to help provide the types of information needed by water-resource managers.

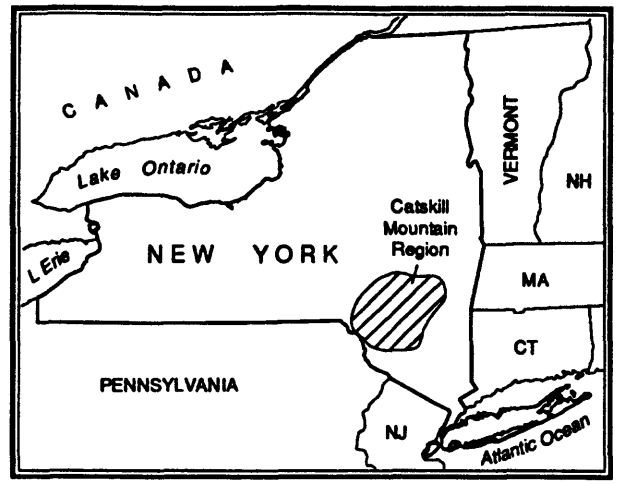
Objective: (1) To provide a nationally consistent description of current chemical, physical, and biological conditions of a large part of the Nation's water resources. (2) To define the long-term trends (or lack of trends) in water quality. (3) To identify, to the extent possible, the major natural and human factors that affect these conditions and trends.

Approach: The Hudson River basin represents one of 60 study units that will provide information for local, regional, and national assessments of water quality. An initial task is to form a committee of representatives from Federal, State, and local government agencies; industries; private organizations; and universities interested in water-resource management or research in the Hudson River basin. Available data will be compiled and used to formulate water-quality issues and design sampling programs. Intensive sampling will be conducted during 1993-95 to describe the occurrence and distribution of chemical constituents, biologic indicators of water quality, ground-water and surface-water interactions, sources of water-quality problems, and long-term water-quality trends. This phase will be followed by 6 years of less frequent sampling, after which another intensive sampling phase will begin.

Progress and significant results: The research team includes specialists in biology, ground-water and surface-water hydrology, water quality, geography, and computer science. The liaison committee has had two meetings to discuss water-quality issues, data availability, and water-quality-sampling programs and is helping to evaluate NAWQA plans and coordinate their own programs with NAWQA to make the best use of available funds and information. More than 46 sources of data have been identified, and data from 21 of these have been obtained. Data bases with the most information are being compiled first, and other sources will be evaluated to help fill gaps. This retrospective analysis has provided an overview of the chemical, physical, and biological processes that affect water quality.

Plans for next year: Data collection will continue, and two reports describing the distribution and occurrence of: (1) pesticides and synthetic organic compounds and (2) nutrients and suspended sediments will be produced. Specialists in surface-water and ground-water field techniques will be hired. Site selection and reconnaissance will be completed throughout the basin, and the sampling programs will be designed. Sampling for the occurrence and distribution of chemical constituents in clam tissue and riverbed sediments throughout the basin are planned.

STREAM-WATER QUALITY AS A FUNCTION OF WATERSHED SCALE IN THE NEVERSINK RIVER IN THE CATSKILL MOUNTAINS (NY 91-200)



Period of project: October 1990 through September 1995

Project leader: Gregory B. Lawrence

Field location: Catskill Mountains

Cooperating agency: New York City Department of Environmental Protection

Problem: Maintaining the water quality of Catskill reservoirs that supply drinking water to New York City requires a detailed knowledge of watershed processes that control the chemical quality of streams and rivers that flow into the reservoirs.

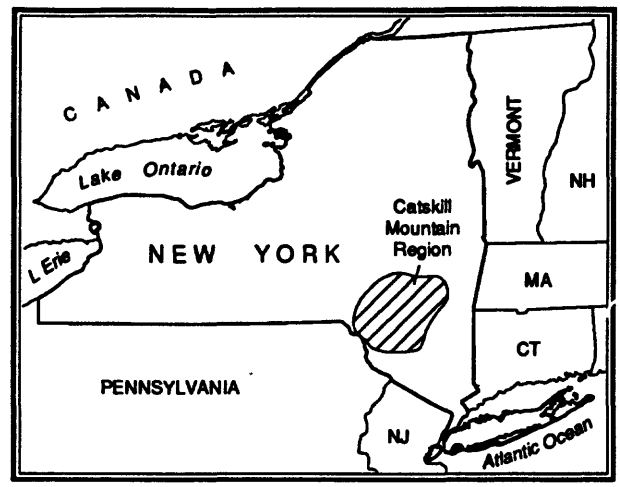
Objective: (1) To define water-quality relations between the Neversink River and upstream drainages by assessing the chemical changes along streams throughout the basin. (2) To develop quantitative relations among stream chemistry, discharge, and watershed characteristics. (3) To develop methods to integrate water-quality data from watersheds at differing scales.

Approach: Conduct a detailed spatial analysis of surface-water quality throughout the basin. Relate topographic characteristics and other watershed factors to spatial variations in stream chemistry. Evaluate temporal variability of streamflow and chemistry at different watershed scales.

Progress and significant results: Field sampling program was implemented; workplan is in review for publication. Data analysis and interpretation underway.

Plans for next year: To continue data collection, analysis, and interpretation.

BIOGEOCHEMICAL PROCESSES THAT CONTROL NITROGEN CYCLING AND ASSOCIATED HYDROGEN AND ALUMINUM LEACHING IN AN UNDEVELOPED HEADWATER BASIN (NY 91-204)



Period of project: July 1991 through September 1997

Project leader: Peter S. Murdoch

Field location: Neversink River basin

Cooperating agency: New York City Department of Environmental Protection

Problem: Nitric acid is the primary mineral acid that causes a decrease in pH and increases in inorganic aluminum concentrations in streams during storms and snowmelt in the Catskill Mountains. Processes that control nitrogen movement in forested catchments are poorly understood. Information on nitrogen processes and movement in forest soils is needed to define the flowpaths of water and the transport of aluminum in watersheds.

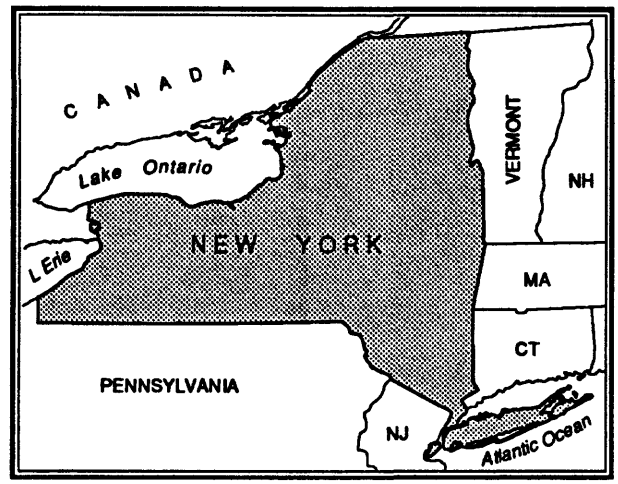
Objective: To (a) identify the processes that control nitrogen storage and movement in forested watersheds, (b) describe relations among processes which control concentration and movement of nitrogen, and dissolved organic carbon compounds, and (c) identify the effect of these processes on aluminum mobility in forest soils.

Approach: To monitor soil water, ground water, soil gas, and atmospheric deposition in three similar watersheds for $2^1/_2$ years, after which one watershed will be clearcut, one will be cut 40 percent (common logging practice), and one will remain pristine. Monitoring will then continue for 4 years. Automated samplers will be used to collect soil and stream water during selected storms. Soil bags with homogenized B-horizon soil will be buried below the O-horizon throughout each watershed and collected every 6 months and analyzed to determmine rates of nitrification and weathering.

Progress and significant results: Station sites were selected, and installation and base-line monitoring were begun.

Plans for next year: Installation of stream gages, soil lysimeters, soil bags, soil-gas collectors, and wells will be completed. Base-line monitoring will proceed, and special storm related studies will begin.

Channel-Roughness Characteristics ("n" Value) Verification Study (NY 84-140)



Period of project: October 1983 through September 1990

Project leader: William F. Coon

Field location: Statewide

Cooperating agency: New York State Department of Transportation

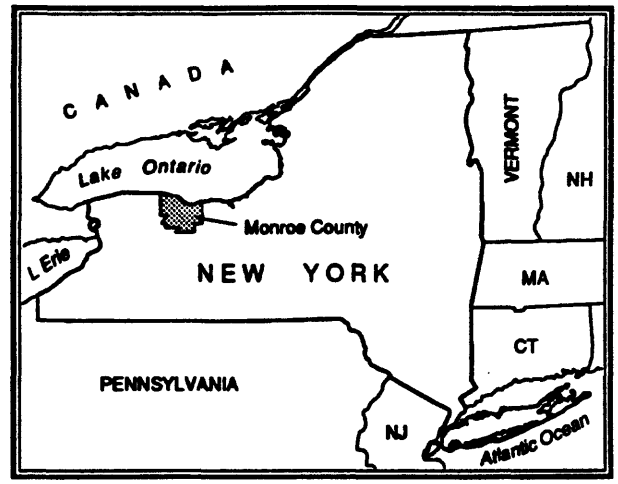
Problem: The indirect computation of flood discharges and flood profiles requires estimates of channel-roughness coefficients ("n" values). The reliability of slope-area measurements and step-backwater analyses, in particular, is heavily dependent on the evaluation of channel roughness. Although several guides for estimating "n" values for natural channels are available (for example, Barnes, 1967), subjective judgment will probably always play a part in the final determination when the field hydrologists consider all factors (streambed constituency, bank and floodplain vegetation, channel shape and curvature, depth of water, etc.).

Objective: (1) To develop site-specific relations between "n" values and such variables as flood depth and seasonal variation of vegetation cover. (2) To assess the transferability of these relations to other sites. (3) To compile and maintain a file for each site that includes site maps, cross-section plots, site plans, photographs, and stereo slides that can be duplicated and used for office and field-training exercises.

Approach: Select 30 to 40 sites at well-rated gaging stations. After a flood, make a slope-area measurement to obtain the initial "n" verification and cross-section location for subsequent installation of crest-stage gages. Operate crest gages until enough record is collected to define the roughness characteristics of the reach and the relation between roughness and variables such as depth and vegetation. From the data of the 30 to 40 sites, evaluate the transferability of site-specific relations.

Progress and significant results: Three hydraulically different types of channels were identified. The roughness coefficient varied with flow depth in a different, but predictable, manner for each type of channel. Streambank vegetation appears to have a measurable effect on the "n" value for channels with wetted perimeters that are more than 25 percent vegetated. The project report was completed and is in press.

Effects of an Instream Impoundment on Runoff and Water Quality in a Small Residential Headwater Basin (NY 86-161)



Period of project: January 1986 through September 1990

Project leader: Phillip J. Zarriello

Field location: Irondequoit Creek basin, Monroe County

Cooperating agency: Monroe County Environmental Health Laboratory

Problem: Stormwater-detention basins are widely used as a means of controlling runoff quantity and quality, but their effectiveness as a water-quality control remains largely undocumented. A detailed analysis of the effect of detention basins on runoff quality is needed to develop design criteria and to help local water managers determine the cost effectiveness of such structures in improving the quality of downstream receiving waters.

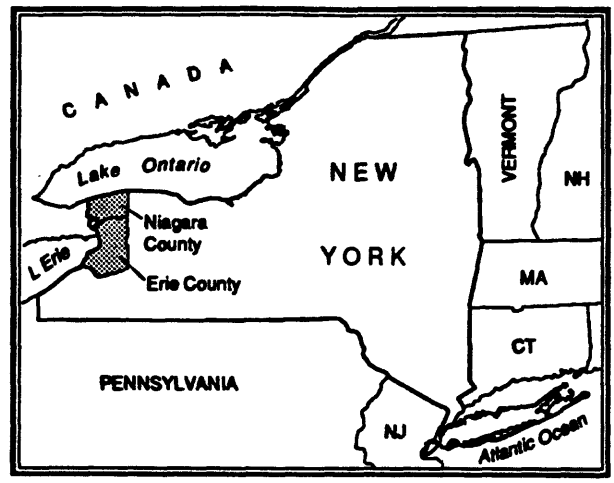
Objective: To evaluate the effects of increased detention on constituent loads in storm runoff.

Approach: Precipitation and the inflow to and outflow from a detention basin were monitored over a 3-year period. Data were analyzed to determine changes in constituent concentration and mass flux through the detention basin. The outflow to the detention basin was modified twice during the study to increase retention time and evaluate the effect on trap efficiencies for selected constituents.

Progress and significant results: Mass flux and trap efficiencies in a normally dry detention basin were calculated for 22 constituents over a 3-year period while the basin was in its original configuration and after two outlet modifications to increase retention time. The first configuration showed the most variable trap efficiency among constituents. Little or negative efficiencies were noted during this configuration for sediments and nutrients that are of concern in the eutrophication of Irondequoit Bay. Trap efficiencies for most constituents showed substantial improvement after the first outlet modification, which nearly doubled retention time, but increased only slightly after the second modification, which increased retention time about tenfold. The small improvement in trap efficiency after the second modification is probably attributable to differences in characteristics of the storms sampled. Results of this study indicate that the detention basin, as originally designed to control peak flows of large storms, is not effective in removing contaminants from runoff from small storms, but simple modifications to the outlet to increase retention time improved retention of many constituents. This improvement indicates that simple modifications of the flow control in similar types of basins could provide an inexpensive means of improving stormwater quality elsewhere.

Plans for next year: Project was completed. Summary report is in press.

Hydrogeology of the Niagara Falls Area (NY 86-164)



Period of project: June 1986 through September 1991

Project leader: William M. Kappel

Field location: southern Niagara County; northern Erie County

Cooperating agency: U.S. Environmental Protection Agency

Problem: Ground-water and surface-water quality along the Niagara River have been degraded by direct discharge and migration of contaminants from industrial plants and waste-burial sites for more than 50 years. The Niagara Falls area alone contains nine Superfund sites and more than 30 waste-burial sites. A regional ground-water-flow study is needed to evaluate the effect of these sites on the surface-water and ground-water resources of the Niagara Falls area in both the United States and Canada.

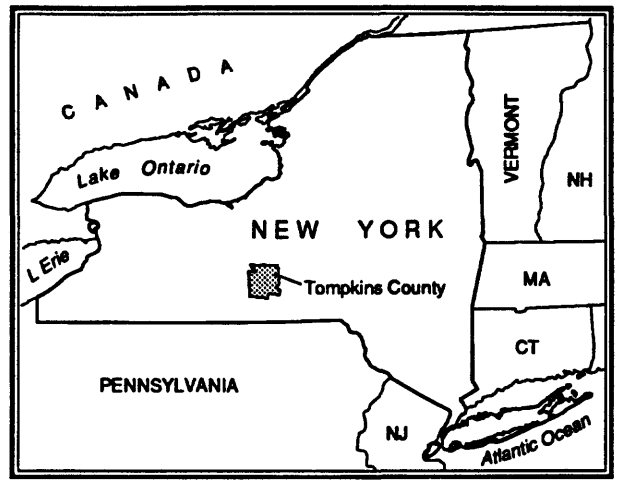
Objectives: (1) To define the hydrogeologic characteristics of bedrock units in the area. (2) To describe the natural geochemistry of ground water in the bedrock aquifers. (3) To develop a three-dimensional flow model to describe hydrologic conditions and ground-water flow patterns and provide a basis for initial boundary conditions for future site-specific modeling.

Approach: This study has four phases. Phase 1 is the compilation of available hydrogeologic and water-quality information and development of a conceptual ground-water model; phase 2 entails field investigations and initial development and calibration of a three-dimensional ground-water model and geochemical model; phase 3 involves calibration and sensitivity analyses of the three-dimensional model; and phase 4 entails the final data analysis.

Progress and significant results: Ground water in areas undisturbed by natural and manmade structures flows southward from the Niagara Escarpment toward the Niagara River. Ground water near the City of Niagara Falls flows to natural and manmade drains. A three-dimensional flow model was developed to simulate regional directions and rates of ground-water flow within the study area; results indicate that areal recharge accounts for more than 50 percent of the ground water entering the model area, and that infiltration from the New York Power Authority pumped-storage reservoir and Niagara River account for the remainder. More than 50 percent of the water exiting the modeled area discharges to the Falls Street Tunnel at a point where it crosses the New York Power Authority conduits. This amount exceeds the amount that can be reasonably discharged from the aquifer and, thus, indicates a possible hydraulic connection between the tunnel and the Niagara River. The remaining discharges are to the upper Niagara River, the lower Niagara Gorge, and the Niagara Escarpment.

Plans for next year: Project complete.

Fate and Transport of Landfill Leachate in a Phragmites Wetland (NY 88-170)



Period of project: October 1987 through September 1992

Project leader: Jan M. Surface

Field location: Tompkins County

Cooperating agencies: Tompkins County Department of Solid Waste, New York State Energy Research and Development Authority, Cornell University

Problem: Infiltration of precipitation and migration of ground water through landfills produces leachate that contains varying quantities of toxic organic and inorganic chemicals. This leachate has long been a source of groundwater and surface-water contamination. Contamination resulting from the migration of leachate has led to stringent regulations in New York State and elsewhere that require new landfills to be lined and equipped with a leachate-collection system. No economically or environmentally sound system for renovating leachate is yet available, however.

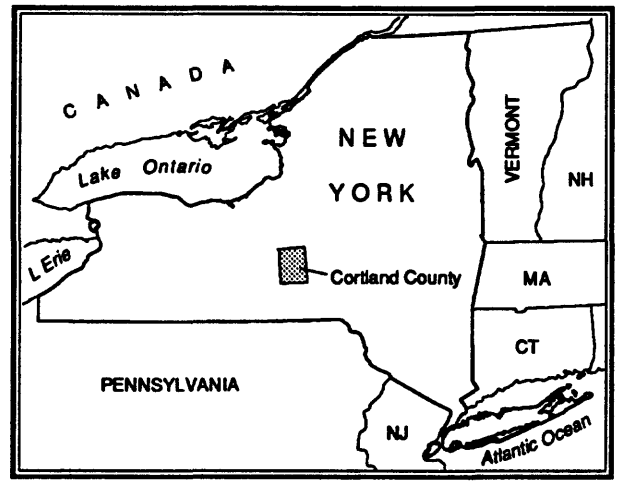
Objectives: (1) To examine the physical, chemical, and biological processes that occur within the wetland system and to determine the ability of wetlands to fix or transform nutrients, metals, and organic constituents of landfill leachate. (2) To measure the efficiency of leachate treatment as a function of substrate material, plant growth, leachate quality, and seasonal change in climate.

Approach: The study is designed to last 4 years and will include 1 year of field-data collection. Four wetland systems, consisting of three *Phragmites* beds of differing substrate material and one unplanted control bed, were constructed. The plots were built and planted during the summer of 1988. Leachate application began in early summer 1990 and continued for 1 year. The quantity and quality of leachate influent and effluent were measured, the speciation of metals in the substrate material determined, water and chemical mass loadings calculated, and treatment efficiencies of each plot evaluated.

Progress and significant results: The leachate beds were constructed, and the *Phragmites* were planted. The leachate-holding tank, delivery line and metering equipment, and piping for delivering the leachate to the beds were installed. Sampling of leachate began in 1990. Leachate application continued through October 1991. Biweekly samples for nutrients and metals were collected and analyzed. Substrate metals speciation continued through September 1991.

Plans for next year: Give two presentations at the International Wetlands Conference in Columbus, Ohio (September 1992). An invited presentation will be made at the second Joint Conference on Environmental Hydrology and Hydrogeology (May 1993). The final report will be published along with companion journal articles.

Estimation of Contributing Areas to Public Water-Supply Wells and Flow Paths from Contaminant Sources in the Glacial-Drift Aquifer at Cortland (NY 89-184)



Period of project: June 1989 through September 1993

Project leader: Todd S. Miller

Field location: Cortland County

Cooperating agency: Cortland County Health Department

Problem: Increasing development over the Cortland aquifer and several chemical spills, including trichloroethylene (TCE) from an industry, gasoline from leaking storage tanks from at least two service stations, and leachate from inactive hazardous-waste sites, have degraded the water quality in parts of the aquifer. The movement and fate of the contaminants need to be tracked to avoid adverse effects on human health.

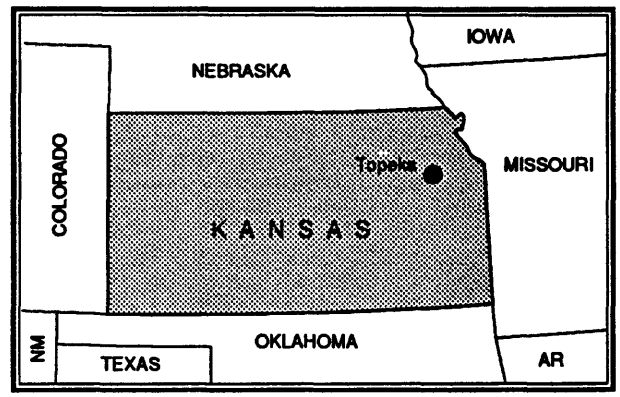
Objective: To (a) expand and refine knowledge of the hydrogeologic setting and ground-water flow system of the Otter Creek-Dry Creek aquifer, (b) estimate the zones of contribution and traveltimes to public water-supply wells. Determine the extent of the TCE plume, (c) determine the general water quality of the aquifer, with emphasis on organic chemicals, and (d) estimate ground-water flow paths and traveltimes from potential and known sources of contamination to the discharge areas.

Approach: (1) A modular quasi-three-dimensional model will be constructed and coupled with a particle-tracking routine to simulate flow paths and traveltimes. Surface geophysical surveys, such as seismic refraction and marine reflection, and 25 test holes will be drilled to determine stratigraphy, aquifer geometry, and water levels. Water samples will be collected from 50 wells and analyzed for purgeable organic compounds and several inorganic constituents.

Progress and significant results: Most fieldwork, including drilling of 25 test wells, two seismic surveys, and sampling of 50 wells twice, was completed. Geologic sections depicting stratigraphy and the quasi-3-dimensional model were constructed. Water levels in about 100 wells and streamflow at about 25 sites were measured three times; once each during average-high, average, and average-low conditions. The trichloroethylene plume was mapped.

Plans for next year: To write final report.

Probabilistic Assessment of Atrazine Contamination in Ground Water (NY 90-186)



Period of project: October 1989 to September 1993

Project leader: David A. Eckhardt

Field location: Kansas River Valley Experiment Field, Topeka, Kansas

Cooperating agency: Federal (USGS Toxic Substance Hydrology Program)

Problem: Results of multidisciplinary research into processes and factors that affect the transport and chemical fate of the herbicide atrazine in the unsaturated zone need to be compiled, and results of the susceptibility of ground water to contamination by atrazine, need to be evaluated through probabilistic solute-transport models.

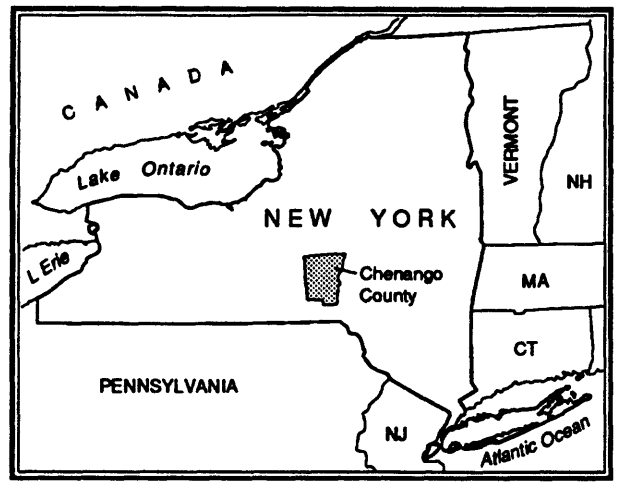
Objective: To (a) assess current knowledge of processes and factors that affect atrazine mobility in the hydrologic environment and integrate findings into appropriate models; (b) identify and statistically characterize key variables; and (c) develop probabilistic representations of atrazine transport to ground water through stochastic simulations with transport models.

Approach: Selected unsaturated-zone transport models will be evaluated and modified to develop a working set of analytical and numerical models for parallel applications. A sensitivity analysis of selected model variables will be conducted, data needs determined, models evaluated through field and laboratory data, and predictions of the potential for atrazine contamination of ground water will be verified through model simulations and appropriate field data.

Progress and significant results: Physical and hydraulic properties of soils at an agricultural field site near Topeka, Kansas, were spatially delineated, and models that describe soil-water movement were developed. Field collection of soil cores for solute-transport study of tracer and herbicides was begun. Unsaturated-zone flow models that describe soil-water movement were developed for the field site. A bromide tracer and two herbicides (atrazine and alachlor) were applied to the 0.75-hectare plot, and core samples of soil were collected for chemical analysis of spatial and temporal solute distributions.

Plans for next year: (1) To continue soil-water modeling to include spatial variability of physical properties and boundary conditions and begin solute-transport model analysis with 1991 field data (soil-core analysis). (2) To conduct laboratory studies of herbicide sorption on soils from the field site to provide information needed for transport models.

HYDROGEOLOGY OF UNCONSOLIDATED DEPOSITS IN CHENANGO COUNTY, NEW YORK (NY 89-187)



Period of project: June 1989 through March 1991

Project leader: Wendy S. McPherson

Field location: Chenango County

Cooperating agency: Chenango County

Problem: A hydrogeologic data base is needed for the successful management of ground-water resources and for ground-water quality protection.

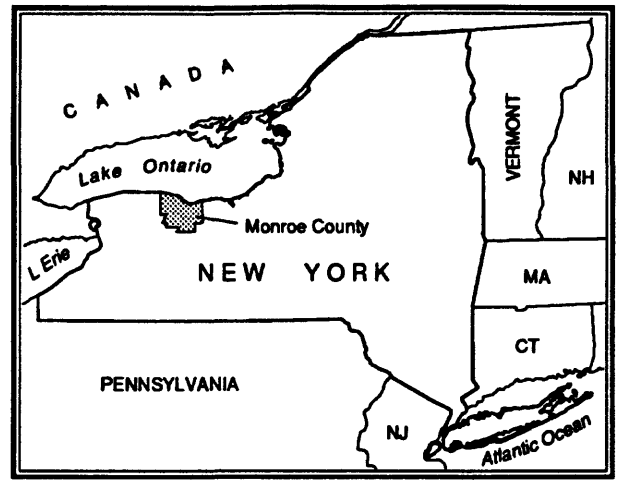
Objective: To develop a hydrogeologic data base that will include a well inventory table and maps showing well locations, thickness of unconsolidated deposits, and potential well yields in valley-fill aquifers.

Approach: Well data were collected throughout the county and entered into the USGS Ground-Water Site Inventory (GWSI) data base. Well locations, thickness of unconsolidated deposits, and potential well yield in valley-fill aquifers, were delineated on maps from the well data, soil data, and previous studies.

Progress and significant results: The well inventory was compiled and checked. The well-location map indicating whether the well was completed in unconsolidated deposits or bedrock, was completed. Five zones of unconsolidated material, ranging from less than 5 feet to greater than 200 feet in thickness, were delineated. The boundaries of the valley-fill aquifers were delineated, and potential well yields and the location of confined aquifers were indicated. The report was completed.

Plans for next year: To publish the report.

Effects of Stormwater Detention in Wetlands of the Lower Irondequoit Creek Basin Near Rochester, New York (NY 90-190)



Period of project: October 1990 through September 1996

Project leader: William F. Coon

Field location: Irondequoit Creek Wetlands, Rochester, N.Y., Monroe County

Cooperating agency: Monroe County Health Department

Problem: Irondequoit Creek, which flows through an expansive flood-plain wetland into Irondequoit Bay, has been identified as a significant source of nonpoint-source pollutants. The USGS studied the Irondequoit basin as part of the National Urban Runoff Program (NURP) in 1980-81. A recommendation arising from that study was to evaluate the possibility of using the wetland as a natural detention area for stormwater for removal of nutrients and thereby improve the quality of water entering Irondequoit Bay.

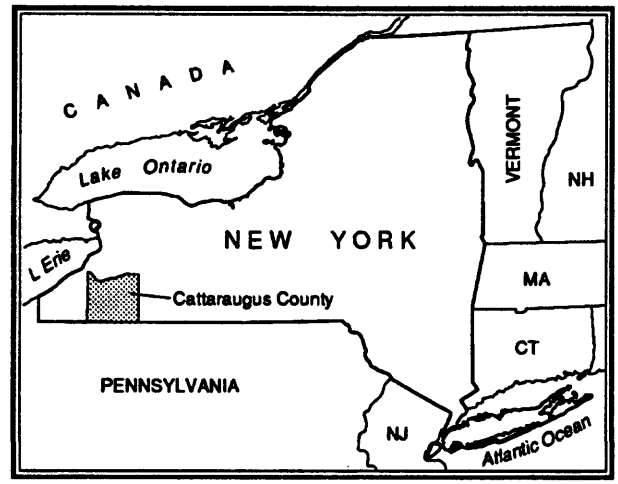
Objective: To (a) evaluate the use of the flood-plain wetlands at the mouth of Irondequoit Creek as a nutrient and sediment filter, (b) determine the effects of increasing detention time and dispersal of stormwater runoff and its associated constituents on a monocultural cattail (*Typha glauca*) wetland after flow modification, and (c) document the present and future floral and faunal structure of the wetland and evaluate ecosystem changes that could affect the multiple-use value of the wetland.

Approach: Baseline discharge and water-quality data will be collected upstream and downstream of the wetland area along Irondequoit Creek. The chemical quality of atmospheric deposition will be measured to identify its nonpoint pollutant contribution. After implementation of flow regulation to improve flow dispersion and detention within the wetlands, discharge- and water-quality-data collection will continue so that resultant changes can be documented. Flora and fauna surveys will be conducted periodically to document ecological changes. Shallow sediment and plant-tissue samples taken along transects in each wetland unit will be analyzed to document changes in the accumulation of nutrients, trace metals, and organic compounds.

Progress and significant results: The flora and fauna surveys were completed. Streamflow and water-quality data were collected, and an atmospheric-deposition collector and sedimentation traps were installed in the wetlands. Extensive efforts were made to model flows through the wetlands and to show the expected changes in water-surface elevations caused by various proposed flow-modification structures. The cooperator was assisted in permit-processing activities for the proposed flow-modification structure.

Plans for next year: To (a) continue measurement of streamflow and water quality at gaging stations upstream and downstream of the wetlands, (b) continue calibration of the ultrasonic velocity meter, and (c) continue assistance to cooperator in permit-processing activities.

Simulated Low-Level Radioactive Waste Disposal in Fine-Grained Sediments of West Valley (NY 90-194)



Period of project: June 1990 to September 1993

Project leader: Richard M. Yager

Field location: Cattaraugus County

Cooperating agency: Federally funded

Problem: Low-level radioactive waste disposal typically entails shallow burial trenches excavated in the unsaturated zones of unconsolidated materials. In the humid Northeast, shallow trenches are excavated in fine-grained sediments to retard contaminant movement, but where the unsaturated zone is thin the waste generally is placed near the water table. Disposal in this manner has resulted in the migration of contaminants at some locations. An alternative method is to bury the waste within the saturated zone of fine-grained sediments, where ground-water flow is minimal and molecular diffusion is the dominant mechanism for transport of radionuclides. Even sites that meet these general requirements can be located, the effect of waste disposal in the saturated zone, specifically by the emplacement technique, on the movement of ground water through the sediments, the waste, and the backfill is unknown.

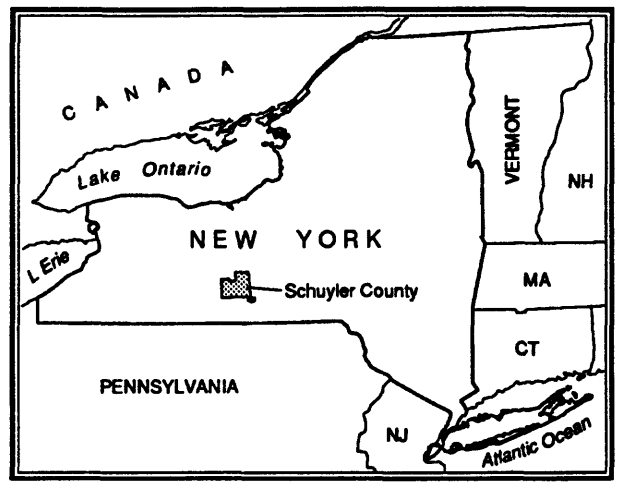
Objective: To determine the effects of the excavation and backfill used in the disposal of low-level radioactive waste on the movement of water through saturated fine-grained sediments that serve as the host material for the burial facility.

Approach: The proposed study will be a several-year effort consisting of three phases: (1) site characterization to document the hydrology and delineate the diffusion-dominated part of the flow system; (2) installation of a monitoring caisson to simulate waste disposal and investigate its effects on the flow system; and (3) remediation of the site upon completion of the study. Vertical boreholes will be drilled to provide estimates of physical, hydraulic, and transport properties of the till; and determine the hydraulic gradient and age of ground water within the study area. A research trench will be excavated to investigate the depth of vertical fractures and thereby determine the boundary between advective and diffusive transport in the flow system. The monitoring caisson emplaced in the till will contain ports to allow placement of instruments to measure water content, pressure, and stress in the backfill and in the till. Movement of water along the interface, between the till and grout, the most probable pathway of radionuclide migration, will be investigated by coring from the caisson into the till and analyzing samples to determine the extent and rate of migration of a conservative tracer. Constant-head injection tests will be conducted in the annulus through fine-sand layers within a layer of grout. The hydraulic conductivity of the till/grout interface will be determine from the measured flow rate.

Progress and significant results: A plan of study report describing the methods was completed. A laboratory test of pressure transducers selected for the study were completed to measure the drift and accuracy of long-term measurements.

Plans for next year: The hydrochemical effects of excavating and sealing the disposal facility will be simulated by a model developed by the U.S. Army Corps of Engineers. The results will predict displacement in the till toward a large-diameter, augured hole and the stress distribution surrounding the excavation.

Thickness of Unconsolidated Deposits in Schuyler County (NY 91-201)



Period of project: October 1990 through September 1992

Project leader: Wendy S. McPherson

Field location: Schuyler County

Cooperating agency: Schuyler County

Problem: Data on the thickness of unconsolidated deposits in Schuyler County are needed for successful management of ground-water resources. This information is needed to estimate the amount of ground water available from aquifers and the aquifer's susceptibility to contamination. Well records collected during a previous study did not provide sufficient information to allow mapping of the thickness of unconsolidated deposits, particularly in the southward-draining stream valleys.

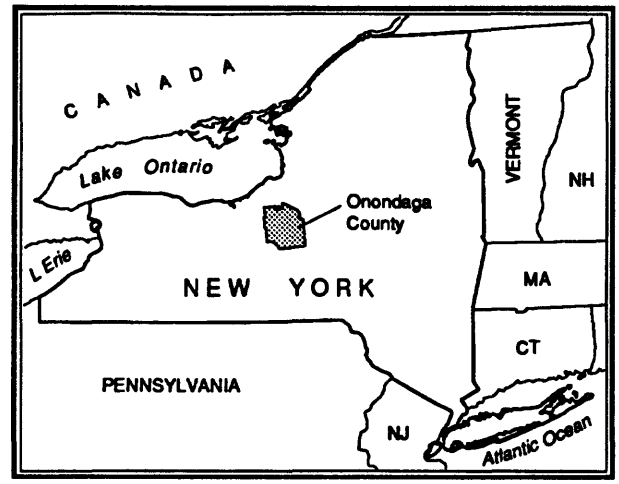
Objective: The thickness of the unconsolidated deposits, with emphasis on valley-fill deposits in south-draining stream valleys.

Approach: To determine the thickness of unconsolidated deposits will be estimated from well records, surficial geology maps, and geophysical techniques. Data previously collected will be supplemented with additional well-inventory data. Surficial geology maps of the Finger Lakes Region will be used to estimate the extent and thickness of unconsolidated deposits between data points and in areas with no data. Seismic-refraction surveys will be completed across the major southward-draining stream valleys to determine the thickness of valley-fill deposits.

Progress and significant results: Seismic-refraction data were interpreted and used to delineate thickness of unconsolidated deposits in the valleys. Geologic cross sections at the seismic lines locations were drafted. The map and text were completed.

Plans for next year: To complete the report.

HYDROGEOLOGY OF THE TULLY VALLEY MUDBOILS (NY 92-205)



Period of project: October 1991 through September 1993

Project leader: William M. Kappel

Field location: Onondaga County

Cooperating agency: Onondaga Lake Management Conference

Problem: Mudboils or mud volcanoes have been documented for nearly 100 years in the Tully Valley of central New York. Mudboils are volcano-like cones formed by the discharge of turbid (silty) ground water and fine sand. The cone of fine sand can range from several inches to several feet high and from several feet to 30 feet in diameter. Where mudboil activity is persistent, land subsidence due to removal of sediment at depth can occur.

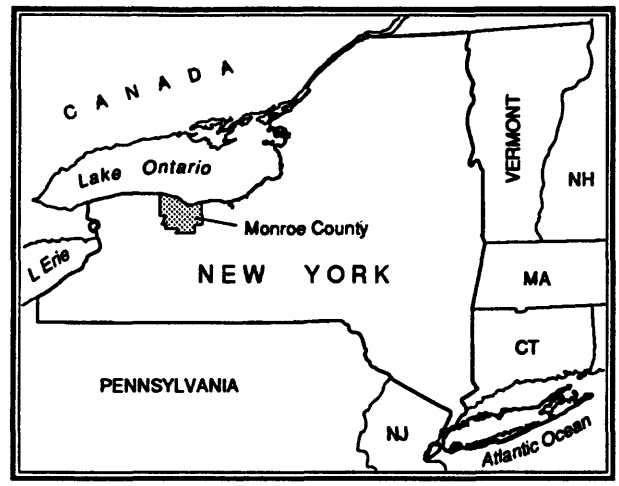
Objective: Data on the origin of the mudboils, their persistence, and the possible extent of their migration is needed to mitigate or remediate land subsidence, and degradation of Onondaga Creek, through turbidity, fine-sediment deposition, and chloride loading. Data on the stratigraphy of glacial deposits and hydraulic-head distribution within them is needed to determine the source(s) of pressure gradients that cause ground water to discharge through the mudboils.

Approach: The flow discharging from the main mudboil depression area (MDA) will be calculated as the difference between inflow to the MDA and outflow leaving it. Sediment concentrations at the outflow measurement flume will be measured through daily and storm sampling. The stratigraphy of the unconsolidated glacial deposits will be defined through a phased drilling program. A series of exploratory holes (about 125 feet deep) will define the regional stratigraphy of unconsolidated deposits. Monitoring wells will be installed in the more permeable zones for determination of hydraulic head profiles. Results of the first phase of drilling will guide the subsequent phases as to the location and depth of drilling, to determine grain size, plasticity, and moisture content of the materials encountered. General field determinations of water quality will be made during the drilling program.

Progress and significant results: The inflow and outflow measurement flumes were installed and initial results indicate that the mudboil-depression area discharges about 300 gallons of water and sediment per minute; seasonal changes in this discharge is between 30 to 40 tons per day, on average.

Plans for next year: To (1) continue the collection of flow and sediment data, and complete the drilling and hydraulic-head measurement program, (2) prepare an interim report and, if. funds are available, expand the flow and unconsolidated sediment/hydraulic-head-measurement programs to determine the source of the overpressuring of the mudboil discharges.

USE OF WETLAND SYSTEMS TO TREAT LEACHATE (NY 92-207)



Period of project: July 1992 through September 1994

Project leader: Jan M. Surface

Field location: Monroe County

Cooperating agency: Monroe County Department of Solid Waste

Problem: Infiltration of precipitation and migration of ground water through landfills produce leachate that contains varying quantities of toxic organic and inorganic chemicals. Nearly all landfills in humid areas produce leachate, and this leachate has long been a source of groundwater and surface-water contamination. Wetlands have been shown to successfully renovate municipal wastewater and a preliminary study at the Tompkins County landfill indicates that wetlands also have the capacity to renovate landfill leachate.

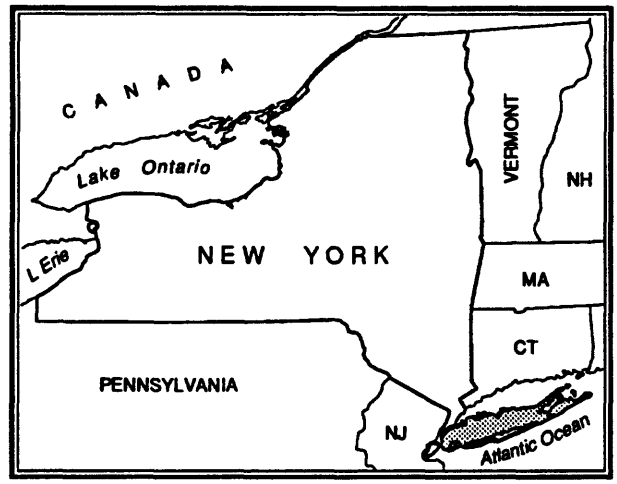
Objective: To determine whether treated landfill leachate discharged from a constructed wetland system meets State and national pollution-discharge-elimination standards, and identify the nature of water-renovating processes within the system and their capacity to treat the leachate.

Approach: A wetland system will be constructed at the Northeast Quadrant Solid Waste Facility in Monroe County. The site is representative of hydrogeologic settings of many landfills in humid regions. The system will consist of an overland-flow pretreatment area that discharges into a constructed rock-and-reed wetland. Samples of influent and effluent will be collected biweekly and analyzed for selected organic and inorganic constituents.

Progress and significant results: Equipment for construction is being purchased.

Plans for next year: Wetland system will be constructed and planted. Instrumentation will be installed. Leachate application and monitoring of soil, plants, and water will begin.

HYDROLOGIC MODELS, LONG ISLAND (NY 84-125)



Period of project: October 1983 through September 1991

Project Chief: Steven M. Feldman

Field location: Long Island

Cooperating agencies: Nassau County Department of Public Works; Suffolk County Department of Health Services; Suffolk County Water Authority

Problem: The potable water supply of Long Island is threatened by declining ground-water levels, streamflow depletion, saltwater encroachment into aquifers, and pollution from industrial and domestic wastes. Integral to water-resource-management planning is thorough knowledge of the hydrologic system and the testing of various management alternatives through predictive hydrologic models.

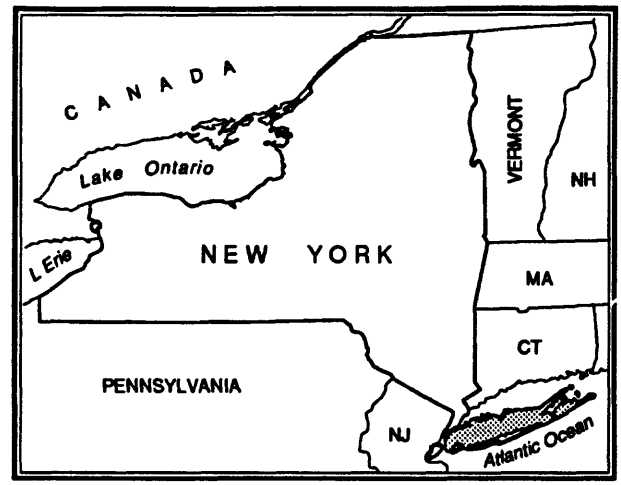
Objective: To provide quantitative estimates of (a) the hydraulic characteristics of the ground-water system under predevelopment conditions, (b) the changes that have been induced by man, and (c) the changes that would result from implementation of various water-resources management schemes. Pertinent characteristics of the ground-water system include the patterns and rates of ground-water movement and the rates of ground-water discharge at boundaries (streams, shore, subsea discharges).

Approach: A new three-dimensional, finite-difference ground-water flow model that represents all unconsolidated hydrogeologic units on Long Island will permit regional hydrologic simulations. Data compilation and analysis for model input include estimates of gaged- and ungaged-stream base flow, current interpretation of unit geometry, approximation of the saltwater-interface position, and refined calculation of ground-water recharge under natural and urban conditions. Steady-state simulations of predevelopment and recent hydrologic conditions and a transient-state simulation of the 1960's drought will be made and results compared with historical data to demonstrate the accuracy of the model. Predictive runs will be made to assess various development strategies.

Progress and significant results: A three-dimensional flow model was used to assess various effects of proposed stream augmentation on the ground-water system. In simulations, pumping wells were placed at interstream locations, and water was piped to various locations from which it was discharged to stream segments.

Plans for next year: To keep the model available to answer cooperator requests, and to finish all reports.

HYDROLOGIC ATLAS, LONG ISLAND (NY 83-132)



Period of project: April 1983 through September 1990

Project chief: Kenneth A. Pearsall

Field location: Long Island

Cooperating agency: New York State Department of Environmental Conservation (NYSDEC)

Problem: Make effective management of Long Island's freshwater resources a vital concern. Until now, the "safe yield" concept has been fundamental to water-resources management on Long Island. The complexity of Long Island's hydrologic system makes the allowable withdrawal rates impossible to determine before formulation of a specific development plan; however, an alternative management approach has been presented that is based on (a) defining pertinent aspects of present hydrologic condition on a regional scale, and (b) identifying areas most susceptible to undesirable hydrologic effects.

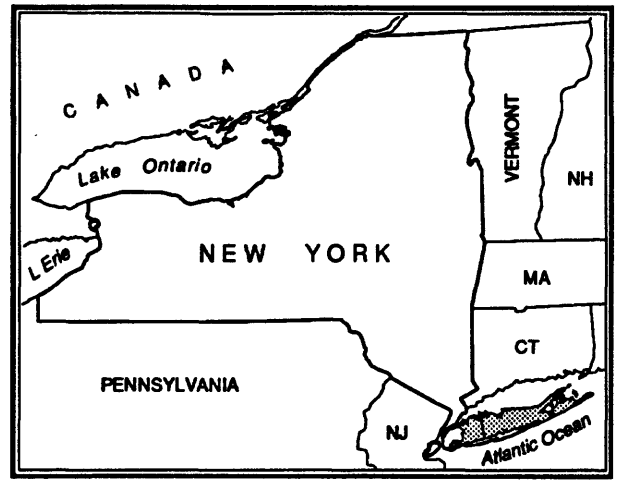
Objective: (1) To compile all hydrologic data pertinent to water-resources management in a readily usable format. (2) To publish a regional hydrologic interpretation of these data periodically. (3) To reevaluate the regional monitoring networks and recommend augmentation as needed. (4) To demonstrate the feasibility, practicality, and advantage of a technically based water-resource-management policy by making available and demonstrating the usefulness of pertinent interpretive hydrologic data.

Approach: A sequence of maps will be developed that demonstrate a hydrologic interpretation of data collected in regional monitoring networks. These will include: (1) a standard base map and topographic base map at scale of 1:250,000, (2) hydrogeologic maps showing structure contours, lines of equal formation thickness, and cross sections through Long Island aquifers, and (3) hydrologic maps showing potentiometric-surface altitudes, streamflow data, and water-transmitting property.

Progress and significant results: Technical assistance to NYSDEC continues for the implementation of the Long Island ground-water management plan and well-permit program.

Plans for next year: This project has been incorporated into the data program.

WATER QUALITY APPRAISAL OF LONG ISLAND (NY 84-148)



Period of project: April 1984 through September 1990

Project leader: Stephen J. Cauller

Field location: Nassau and Suffolk Counties

Cooperating agency: Federally funded

Problem: The hydrogeologic setting and land-use characteristics of Long Island provide a unique location for a water-quality appraisal. The reliance on ground water as a source of public supply for 2.6 million people has grown sharply in the past few years, but contamination of this resource has restricted its use in many areas. Successful management of ground-water resources requires a thorough accounting of the present quality of ground water, and of the nature and extent of ground-water contamination.

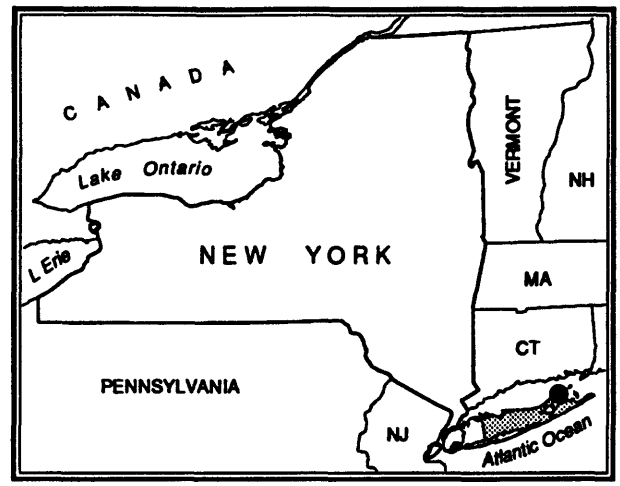
Objective: (1) To assess the quality of Long Island's ground-water resources by investigating the nature and extent of contamination in selected areas. (2) To present pertinent hydrologic and water-quality data to help in the evaluation and management of Long Island's ground-water resources and contamination problems.

Approach: (1) Assemble current and historical water-quality data. (2) Inventory and classify contaminants. (3) Define areal and cross-sectional distributions of identified contaminants. (4) Correlate land-use patterns and hydrogeologic characteristics with patterns of contamination. (5) Provide graphic semiquantitative representation of contaminant extent for identified classes of contaminants. (6) Develop well networks and water-quality-sampling protocols to provide the data needed to address the objectives. (7) Investigate shallow ground-water quality in areas of distinct land-use effects.

Progress and significant results: (1) A statistical relation between the presence of volatile organic compounds in shallow ground water and pertinent variables (population density and land use) that represent the degree of urbanization was defined. (2) A statistical analysis of major inorganic ions, inorganic trace elements, volatile organic compounds, organic compounds, and five groups of pesticides in five land-use areas was completed.

Plans for next year: A statistical analysis will be performed to determine the relation between land use and power consumption and ground-water quality. Any temporal variation in chemical constituents over a 1-year period will be evaluated. Interpretive data reports will be completed.

Advective Transport and Saltwater Influences on the North Fork of Long Island (NY 88-172)



Period of project: October 1987 through September 1991

Project leader: Elizabeth R. Cartwright

Field location: Greenport, Suffolk County

Cooperating agencies: Suffolk County Department of Health Services; Suffolk County Water Authority

Problem: Fresh ground water on the eastern part of Long Island's north fork is the sole source of water for the surrounding communities. Contamination from agricultural pesticides and fertilizers as well as saltwater intrusion threaten this resource. A detailed quantitative analysis of the flow system within the fresh ground-water system will provide the knowledge necessary to evaluate the fate of contaminants (other than saltwater) within the system.

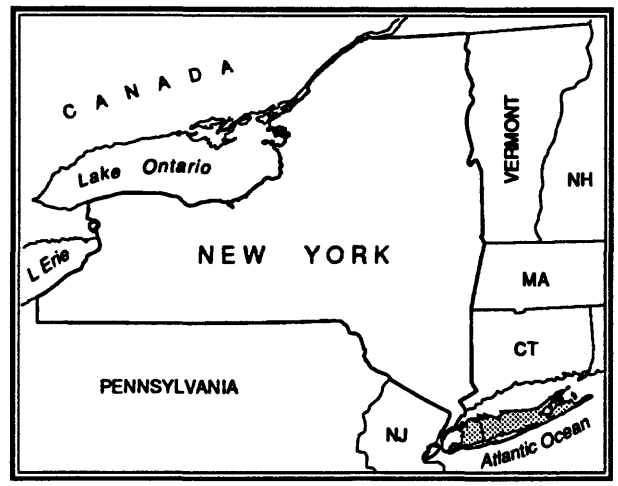
Objective: To define the features of this shallow freshwater flow system by investigating (a) the position of the saltwater/freshwater interface, (b) the aquifer-material properties, and (c) steady-state and transient stresses on the system. This information will enable the development of a numerical model of the flow system. Several progressively detailed approaches probably will be required. These efforts will be finalized in a comprehensive numerical simulation of the study area's flow system.

Approach: The freshwater/saltwater system will be defined by (1) water-level readings and development of a water-table map, (2) water-quality measurements, (3) aquifer-parameter determination, (4) water-budget considerations such as rain and snowfall as input and pumping and discharge as outflow, and (5) incidental influences such as tidal variations that must be considered to prevent misinterpretation of data. Numerical simulation of the study area will require preliminary two-dimensional finite-difference modeling of the freshwater zone only. Verification and sensitivity of the developed model will be tested before results are accepted.

Progress and significant results: Surface geophysics surveys were conducted to investigate the position of the spring and fall saltwater interfaces. New fresh- and saltwater wells were installed in the summer of 1989. A regular sampling for 1989-90 was completed. A numerical model has been calibrated and nonlinear regression performed. The final report is in progress.

Plans for next year: To finish all reports.

WELL-SITING METHODS (NY 88-174)



Period of project: April 1988 through September 1990

Project leader: Ralph J. Haefner

Field location: Nassau and Suffolk Counties

Cooperating agency: New York State Department of Environmental Conservation (NYSDEC)

Problem: NYSDEC is responsible for the management of the quality and quantity of ground water on Long Island and must review various data sources in the form of maps and computer and paper files to assess spatial distribution of geographic, hydrologic, and manmade influences that could affect the quality of water drawn through a proposed well. Because other agencies may store data in incompatible formats, environmental decisions could be made with inadequate data or could require time-consuming efforts.

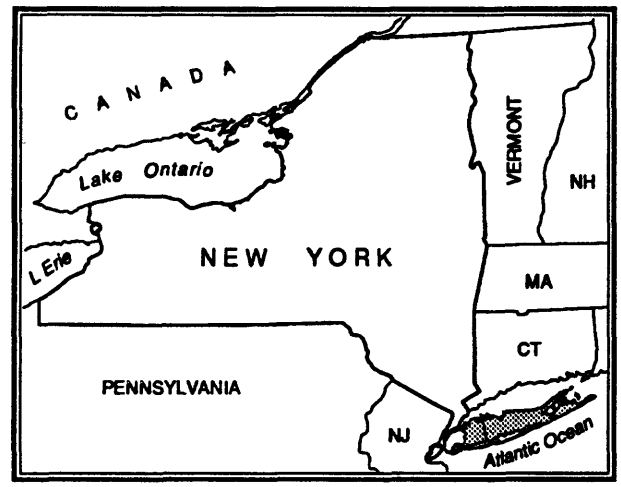
Objectives: (1) To design and develop a GIS (Geographic Information System) data base from NYSDEC and USGS data. (2) To design a set of automated GIS computer programs to assess geographic, hydrologic, and manmade features that influence the siting of a well. (3) To evaluate and test the programs in a wide variety of applications.

Approach: (1) To develop a conceptual, then physical, design of the GIS data base. (2) To select a pilot study area containing a wide range of data complexity. (3) To prepare data-source maps for digitization. (4) To digitize data layers and check them for quality control. (5) To document data layers. (6) To develop computer programs to access the GIS data base, and conduct overlay and proximity analysis for features of hydrologic significance to aid in well siting. (7) To evaluate and test the programs. (8) To continue digitization beyond the pilot study area as time allows.

Progress and significant results: A pilot study area was selected that encompasses 162.55 mi^2 within six 7.5-minute quadrangles on eastern Long Island. This study area includes varying degrees of data density. Twenty-six data layers indicating the geographic, hydrologic, and manmade features within the study area were automated. The AML (ARC Macro Language) program, which accesses and retrieves the data, has been completed but it is still undergoing testing. The study area has been expanded to an area closer to the Nassau/Suffolk County border that has a greater data density. Data automation will continue in this expanded area to allow further testing of the AML program.

Plans for next year: To complete the final report.

Northeast Atlantic Coastal Plain Ground-Water Quality Regionalization Study, New York (NY 89-180)



Period of project: October 1988 to September 1993

Project leader: Paul E. Stackelberg

Field location: Nassau and Suffolk Counties

Cooperating agency: Federally funded

Problem: Recent studies of nonpoint-source contamination of ground water have established significant statistical relations between shallow contamination and certain human activities and hydrogeologic factors. Additional research is needed to determine whether the effects of human activities are evident along projected flow lines in deep parts of aquifer systems.

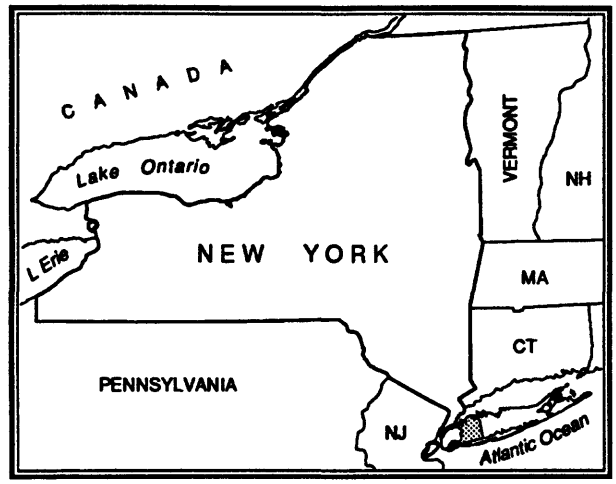
Objective: This project is designed to statistically evaluate water-quality data from several depth intervals of the Long Island aquifer system beneath five areas of differing land uses to determine whether constituent concentrations differ significantly as a function of depth, land use, or a combination of depth and land use.

Approach: Nonparametric statistical techniques will be used to determine the probability of differences in water-quality among land-use areas, and among aquifer-depth intervals within and between land-use areas.

Progress and significant results: Preliminary analyses for inorganic constituents of water samples from shallow- and intermediate-depth zones in five land-use areas along the regional ground-water divide indicate that water-quality patterns differ significantly among land-use areas and with depth. The volatile organic compounds 1,1,1-trichloroethane, trichloroethylene, and tetrochloroethylene were found to increase in detection frequency from the shallow to intermediate depth intervals of the long-term-sewered suburban area.

Plans for next year: To continue statistical evaluation of inorganic and organic constituents and prepare the results as a Water-Resources Investigation Report.

MODIFICATIONS OF RECHARGE STRUCTURES (NY 89-182)



Period of project: October 1988 through December 1994

Project leader: Henry F. H. Ku

Field location: East Meadow Brook, Nassau County

Cooperating agency: Nassau County Department of Public Works

Problem: Urbanization has caused a decline in the water table through loss of recharge through (1) sanitary sewers, (2) increased discharge of storm runoff from paved areas to streams, and (3) increased pumpage. In turn, base flow has decreased, streams have been shortened, wetland area has been diminished, and the amount of fresh ground water has decreased. The increased discharges of storm runoff to streams also has increased bacteria loading to the surrounding bays.

Objectives: (1) To evaluate the hydrologic and water-quality effects of stream-channel modification in urban streams. (2) To quantify changes in peak flow and in bacterial and chemical loads as stormflow passes through stream-modification structures. (3) To examine how changes in ground-water levels affect the relationship between stream and aquifer. (4) To determine how to efficiently lengthen streams and increase recharge.

Approach: To obtain detailed drainage-basin data and establish rainfall-runoff, rainfall-recharge, and peak discharge relations. Historical discharge records and water-quality data will be examined, and discharge will be measured during storms and dry weather. Water-table altitudes will be monitored after installation of flow-modification structures.

Progress and significant results: Analysis of storm runoff indicates a closed system with good correlation among variables. The relations between rainfall and recharge in the study area appears to have seasonal variations. A relation was found between storm intensity and peak discharges. Successful dye-dilution discharge measurements were obtained for stages greater than 3.5 feet. Quarterly sampling of water from wells in the headwater study area and regular sampling of stormflows continues. A water-quality minimonitor was installed at East Meadow Brook to measure temperature, and specific conductance. Geophysical logging of the well network was completed, and correlations and interpretations are underway. Periodic water-table maps were produced for the heakwaters and regional well networks.

Plans for next year: To continue water-level measurements, analysis of stormflow data, and stormflow and ground-water sampling. Additional equipment and monitoring will be needed to determine changes in water quality and the amount of recharge at East Meadow Brook after stream modification.

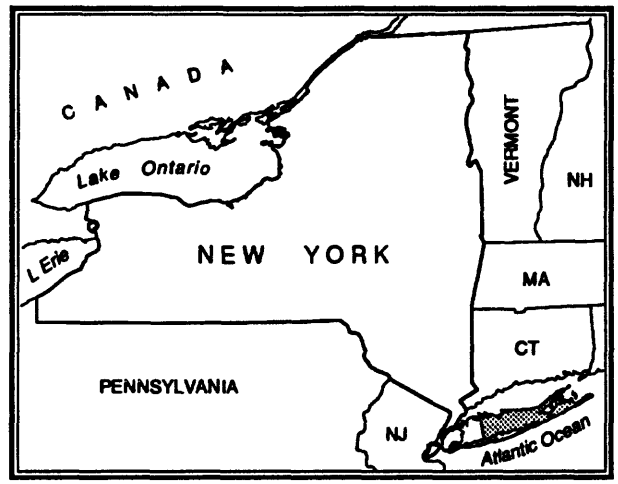
IRON IN THE LONG ISLAND GROUND-WATER SYSTEM (NY 90-196)

Period of project: October 1989 to September 1992

Project leader: Donald A. Walter

Field location: Suffolk County

Cooperating agency: Suffolk County Water Authority



Problem: Elevated iron concentrations in some of Long Island's ground water has led to the degradation of significant parts of the Island's aquifer system and to the biofouling of several public supply wells. This has required water suppliers to undertake costly redevelopment programs and to abandon some wells. Iron-related fouling is due to the growth of iron bacteria on well screens and in the surrounding foundation. Investigation into the geochemical and microbiological processes responsible for iron-related fouling as well as the spatial distribution of iron and other constituents that contribute to the biofouling process is needed to aid local water suppliers in minimizing the effects on their well networks.

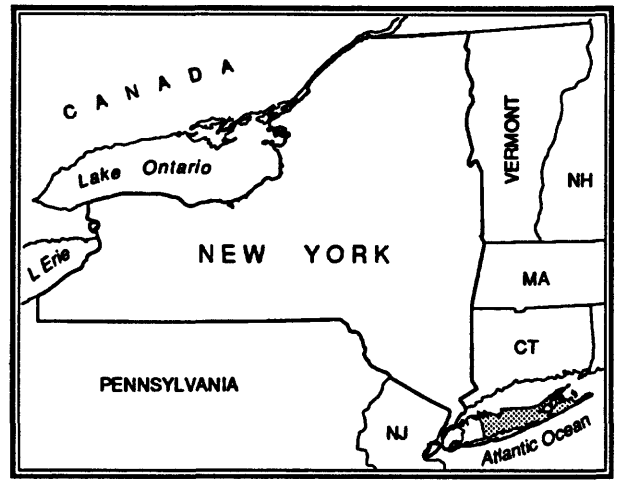
Objectives: To (a) assess the effect of iron-related biofouling on the Suffolk County Water Authority (SCWA) well network, (b) determine the spatial distribution of water-quality constituents that affect the biofouling process in Suffolk County, (c) identify the geochemical and hydrologic processes responsible for iron-related biofouling, and (d) to assess the role and source of iron bacteria involved in the process.

Approach: Water quality and specific capacity data bases will be assembled from the USGS and local data bases and used to generate GIS coverages. Water-quality data from "normal" and "problem" wells will be statistically compared to identify constituents that affect the biofouling process. The spatial distribution of these constituents in Suffolk County will be determined. Water quality data collected during the redevelopment of "problem" wells will be used to determine saturation indices for iron and manganese minerals and to document the effects of iron bacteria biofilms on water quality. Dissolved oxygen and ferrous and ferric iron data will be collected and used to estimate redox conditions in the fouled wells. Encrusting material will also be collected and used to assess the consortia of filamentous iron bacteria in the biofilms. Core samples from test borings and circulation water will be tested for the presence of iron bacteria.

Progress and significant results: A total of 22,338 water-quality analyses from 1,214 supply and observation wells from the upper glacial and magothy aquifers were assembled from the USGS data base. Specific-capacity data and water-quality data from the Suffolk County Water Authority test boring program were also assembled. The data were used to generate GIS coverages and to statistically compare water quality from "normal" wells with that from "problem" wells. Biofilm samples from 42 fouled wells were analyzed by light microscopy. Filamentous iron bacteria were present in 32 of the samples. Select biofilm samples were also analyzed by X-ray diffraction and energy dispersion. Core samples from 10 test borings were tested for iron-related bacteria. Water quality data collected during the redevelopment of several "problem" wells were used to determine saturation indices for various iron minerals and to estimate redox conditions in the wells. Results indicate that existing biofilms remove dissolved iron from solution and increase the pH of the ground water.

Plans for next year: To complete data collection and analysis and prepare two reports.

A THREE-DIMENSIONAL ANALYSIS OF THE SOURCE OF WATER TO WELLS (NY 90-197)



Period of project: October 1989 through September 1992

Project leader: Paul E. Misut

Field location: Suffolk County

Cooperating agency: Suffolk County Water Authority

Problem: Long Island's aquifers have been designated as "sole source" by the U.S. Environmental Protection Agency. Each year, public-supply pumpage in Nassau and Suffolk Counties far exceeds 300 Mgal/d. Contaminants have been observed in many ground-water samples from various depths within the aquifers in both counties. Hydrologic conditions at the contaminated wells vary from site to site. Each well represents a unique hydrologic situation that is determined by local hydrogeology, proximity to recharge and discharge zones, aquifer characteristics, and the pumping stress. Each factor affects the local flow pattern and source of water for each well. A water-management strategy would depend on a method of obtaining quantitative and qualitative information on the effects of pumping wells under a variety of hydrologic conditions.

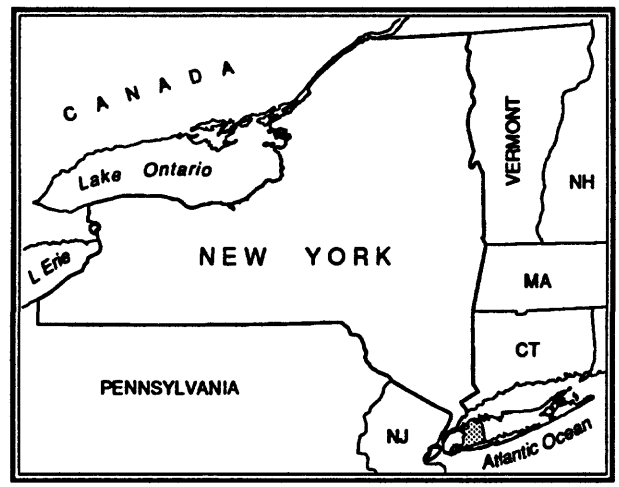
Objective: To provide decision makers with quantitative and qualitative estimates of the effects that various hydrologic conditions have on pumping wells and the sources of water to those wells. Specifically, for each location in which a pumping well is active or proposed, the study will define flow patterns and quantify flow around the well, delineate the source of water to the well, and calculate traveltime for water particles from the recharge area to the discharge point, to analyze the sensitivity of the variables that most affect the rate of ground-water flow and changes in the source of water.

Approach: This investigation will use digital modeling techniques to quantify changes in aquifer response to stress. The primary tools will be the USGS three-dimensional flow model, the USGS three-dimensional particle tracker (a post-processing routine that uses output data from the flow model to define discrete flow paths), and the USGS statistical processor for analyzing flow-model simulations. The model will simulate a large region of Suffolk County that encompasses several hydrologic categories. A variable-spaced grid will be used so that pumping wells can be placed in predetermined locations where fine-scaled grid representation has been incorporated. The model will be calibrated to present-day steady-state hydrologic conditions.

Progress and significant results: The study-area model was calibrated. Sensitivity analysis of parameters associated with hydraulic conductivity was performed. Particle-tracking techniques were used to delineate contributing areas to pumping wells throughout several hydrogeologic regimes. The particle tracking produced realistic flow paths in terms of well depth, pumping rate, well interference, and natural discharges. Hydrologic responses to pumping wells throughout the system were simulated.

Plans for next year: To prepare a final report.

MIGRATION OF CHLORINATED ORGANIC COMPOUNDS IN GROUND WATER IN THE NEW CASSEL AREA, NASSAU COUNTY (NY 90-198)



Period of project: October 1989 through September 1992

Project leader: Richard A. Cartwright

Field location: New Cassel, Nassau County

Cooperating agency: Nassau County Department of Health

Problem: Chlorinated organic contaminant concentrations that exceed New York State drinking-water guidelines have been detected in the water-table aquifer in the New Cassel area. The vertical gradients between the water-table and Magothy aquifers have caused concern over potential contamination of the Magothy. Because the Magothy is the sole source of potable water for local residents, the pumping of Magothy wells increases the vertical component of the velocity in the system.

Objectives: (1) To define the contamination plume in the New Cassel area, and describe how natural and human-induced stresses affect ground-water flow patterns and rates and affect the advective transport of contaminants. (2) To develop a series of hypothetical model simulations that will be used to determine safe pumping practices for public water suppliers.

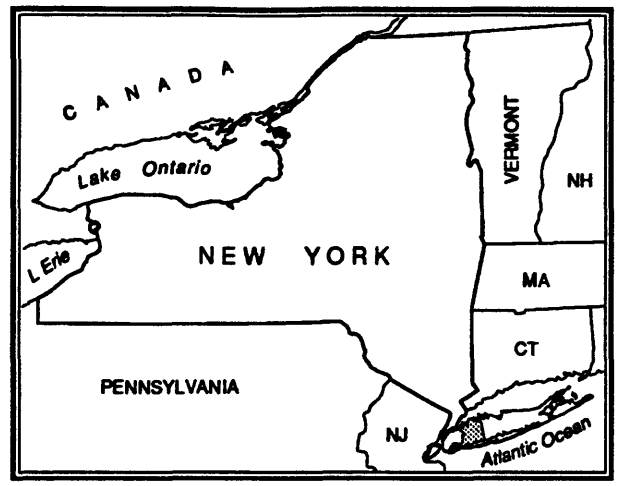
Approach: A complete review of available data will be conducted to establish a monitoring network from which water-quality and water-level information will be derived. Additional wells will be installed as needed to determine plume extent. Water-quality samples will be collected. A three-dimensional flow model will be designed that allows for simulation of all pumping wells.

Progress and significant results: Twenty-two additional observation wells were installed, leveled, and sampled. Corrections to the water-table map resulted in a refined water-table delineation. Laboratory analyses of volatile organic compound concentrations support previous sampling results, which indicate several sources of organic contaminants within the industrial area. A second sampling of 56 wells representing the entire study area was completed. Results improved plume delineations, including changes in concentration and extent of plumes. Generally, plume concentrations have been decreasing. Gamma and EM-39 logs were run on all 22 new wells to aid in description of local lithology. Initial input arrays were constructed, and a first model run was completed.

Plans for next year: Budget cuts resulted in the termination of this project.

Completed reports: A data report is being compiled.

GEOHYDROLOGY OF NORTHERN NASSAU COUNTY (NY 91-202)



Period of project: October 1990 through September 1995

Project leader: Frederick Stumm

Field location: Nassau County

Cooperating agency: Nassau County Department of Public Works

Problem: Increased ground-water use in northern Nassau county has predicated the need for detailed knowledge of the hydrologic and hydrogeologic framework of the area. Northern Nassau County contains many necks and peninsulas surrounded by saltwater bays and inlets. This proximity of saltwater coupled with an ever-increasing demand for the limited supply of underlying fresh ground water causes concern over possible saltwater intrusion.

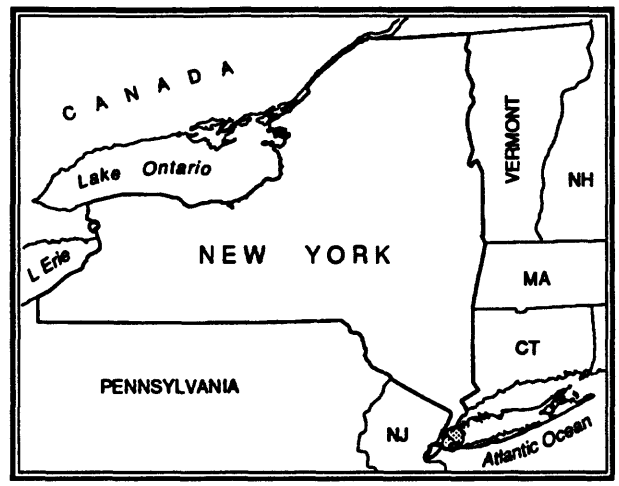
Objective: To (a) investigate and delineate the present position of a freshwater-saltwater interface, (b) determine hydraulic separations and connections between aquifers and local ground-water flow patterns, and (c) map hydrogeologic units at an increased resolution.

Approach: (1) Develop a water-level monitoring network within the study area, and measure and map water-table and potentiometric surface elevations to determine hydraulic gradients within and between aquifers. (2) Compile available ground-water data, water levels, chloride analyses and geophysical logs to provide a data base from which future drilling sites can be identified. (3) Sample selected wells for major inorganic constituents, in particular chloride concentrations, at regular intervals. (4) Compile hydrogeologic maps and cross sections from previous studies to determine future drilling sites for detailed hydrogeologic mapping. (5) Drill and install wells with PVC casing and collect geologic, electromagnetic (induction), and gamma logs.

Progress and significant results: A monitoring network of 150 wells was developed and maintained within the study area. Results indicated that the induction logger can be calibrated for specific wells to detect changes in ground-water conductivity (saltwater intrusion). Several areas invaded by saltwater have been delineated in the Great Neck area.

Plans for next year: To continue drilling wells within study area to delineate geologic contacts, correlate cross sections, and begin saltwater-intrusion monitoring; also to analyze core samples for mineralogy and to measure water levels quarterly.

KINGS AND QUEENS AQUIFER (NY 92-203)



Period of project: April 1992 through March 1996

Project leader: Henry F.H. Ku

Field location: Kings and Queens Counties

Cooperating agency: New York City Department of Environmental Protection

Problem: Public water supply in Kings and Queens Counties has historically been problematic. Early ground water withdrawals caused severe water-level declines and saltwater intrusion. Intensive urbanization resulted in contamination of ground water. Pumping was stopped in 1947 and 1974 in Kings and western Queens Counties, respectively, and caused flooding of underground structures as water levels recovered. Most water is now supplied through aqueducts that tap upland reservoirs. Recent droughts have provoked renewed interests in tapping ground water for public supply.

Objectives: (1) Establish a data collection network that includes ground-water levels and streamflow. (2) Define the ground-water quality with an emphasis on volatile organic compounds and saltwater intrusion. (3) Through numerical simulations, determine the feasibility of ground-water withdrawals while maintaining a workable balance between the following: (a) dewatering of underground structures, (b) effects on the position of the fresh-salt interface, and (c) minimizing the potential for drawing shallow contamination into the deeper aquifers.

Approach: Compile water-quality data from the past 10 years and new data from about 100 wells used in a 1981-1983 study. Establish stream-gaging stations at two locations. Drill 10 additional PVC wells and use EM39 to determine vertical water-quality profiles. Identify long-term water-level monitoring network. Develop a detailed three-dimensional ground-water flow model of western Long Island that will be calibrated under average, steady-state conditions, and test various pumping and dewatering scenarios.

Progress and significant results: Well inventory for water level measurements and water-quality sampling is half completed. Selection of surface-water measuring sites is underway. Supplies and equipment are being ordered. Compilation of water-quality and water-use data from 1982-92 began, as did collection of available GIS data. GIS needs plan was prepared.

Plans for next year: Continue data collection to include quarterly water-level measurements and collect from about 100 wells one round of samples to be analyzed for inorganic compounds, nutrients, extractable compounds, volatile organic compounds, and pesticides. Collect surface-water data and begin well-network evaluations. Collect historic water-level values and estimate measurement error on all of these. Complete all unfinished GIS coverages.

NEW YORK DISTRICT STAFF
1992

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Assistant District Chief	Vacant
Administrative Services Unit, Chief	Carol L.Woodward
Albany Subdistrict Office Chief	John R. Ritter
Hydrologic Records Unit	Gary Firda
Potsdam Field Office	Howard C. Lent
Hydrologic Studies Section	Leonard R. Frost, Jr.
Syosset Subdistrict Office Chief	Vacant
Assistant Subdistrict Chief	Bronius Nemickas
Hydrologic Studies Section	Bronius Nemickas
Environmental Studies Section	Vacant
Hydrologic Data Assessment/ Information Management Section	Kenneth A. Pearsall
Ithaca Subdistrict Office Chief	Vacant
Hydrologic Data Section	James Campbell
Hydrologic Studies Section	Robin G. Brown

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