

United States Geological Survey

Programs in Vermont



Fact Sheet

The USGS provides maps, reports, and information to help others meet their needs to manage, develop, and protect America's water, energy, mineral, and land resources. We help find natural resources needed to build tomorrow, and supply scientific understanding needed to help minimize or mitigate the effects of natural hazards and environmental damage caused by human activities. The results of our efforts touch the daily lives of almost every American.

For more than 100 years the U.S. Geological Survey (USGS) has been assessing, mapping, and reporting on Vermont's earth resources. Ongoing USGS programs in Vermont include topographic and geologic mapping, surface- and ground-water data collection, water-quality assessment, research on the effects of global change, assessment of hydrologic and geologic hazards, and mineral exploration. Through each of these programs and its cooperative efforts with State, local, and Federal agencies, the USGS contributes to the health, safety, and economic well being of Vermont's citizens.

National Mapping Program

Among the most popular and versatile products of the USGS are its topographic maps at the scale of 1:24,000 (one inch on the map represents 2,000 feet on the ground). These maps depict basic natural and cultural features of the landscape, such as lakes and streams, highways and railroads, boundaries, and geographic names. Contour lines are used to depict the elevation and shape of terrain. Vermont is covered by 217 maps at this scale, which are useful for civil engineering, land-use planning, natural resource monitoring, and other technical applications. These maps have long been favorites with the general public for outdoor uses, including hiking, camping, exploring, and back-country fishing expeditions.

Potential New Deposits of Metals

The USGS has evaluated large areas in northern New England for the presence of deposits of copper, molybdenum, tin, tungsten, uranium, gold, and other

rare-earth elements. Identifying local sources of minerals that contain these metals will assist in the economic development of the region. Recent geochemical investigations identified belts of rocks that may contain deposits of tin, tungsten, and uranium in Vermont and southern Maine. As a means of addressing environmental concerns regarding the elemental mobility of these elements, preliminary studies by the USGS have begun to establish geochemical data bases that document rocks and soils, as well as measurements of the types of fluids involved during element migration.

National Water-Quality Assessment Program

In 1991, the USGS began a full-scale National Water-Quality Assessment (NAWQA) program. The objectives of the NAWQA Program are to describe the water quality of large, representative parts of the United States's surface- and ground-water resources and to identify the principal natural factors and human activities that affect the quality of these resources. Products of the program include information that can be useful to water-resource policymakers and managers at national, State, and local levels. Available water-quality data and basin characteristics are evaluated; data for evaluation of surface-water and ground-water quality, riverbed sediments, and aquatic organisms are collected; and technical and nontechnical reports and papers describing study results are prepared.

One NAWQA Program study is underway in Vermont. The Connecticut River and Long Island Sound Coastal Rivers study unit contains a 15,750-square-mile drainage area that encom-

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passes eastern Vermont, western New Hampshire, west-central Massachusetts, most of Connecticut, and small parts of New York and Rhode Island. In Vermont, this area includes the western part of the Connecticut River drainage basin. The Program addresses the following issues: the presence and distribution of toxic substances in surface water and ground water; the effects of land use and releases of treated wastewater on surface-water quality; the contribution of upland sources to contamination of downstream coastal waters; the presence of high concentrations of naturally occurring trace elements and radon gas in some aquifers; the occurrence of synthetic, organic-chemical contamination in surface water and ground water; and the relation of fish and aquatic-insect communities to water quality.

A local committee of representatives from Federal, State, and local agencies; universities; and the private sector works closely with the USGS during each NAWQA Program study to exchange information on regional and local water-quality issues and assist in designing and planning project products to meet the

needs of the States and towns in the study units.

Landslide Hazards

The mountainous areas of Vermont, which are comprised of fractured bed-rock with a thin soil cover, have a variety of different types of slope failures, including rock falls, debris-flow avalanches, and landslides that result from precipitation and freeze-thaw cycles. These fast-moving, destructive landslides cause highway blockage and property damage. At the Smugglers Notch area in northern Vermont, the USGS, in cooperation with the Vermont Geological Survey, employed a multidisciplinary approach to study the types and distribution of slope-failure hazards. Slopes were monitored to evaluate the influence of external factors on slope stability. An instrumentation system was developed that has the potential for use as an early warning system of impending slope failures.

Stream Stability and Scour at Bridge Sites

Nationally, the scour of streambeds and riverbanks by floodwaters is the leading cause of failures of bridges over water. Flooding in Vermont can be widespread, as evidenced by the historical floods of 1927, 1936, and 1938, or localized, as in the floods of 1973, 1984, 1989, and 1990. Millions of dollars have been spent in Vermont as a direct result of flood damage, and about \$60 million has been spent on flood-control projects statewide since the 1927 flood. An assessment of potential scour of the stream channel and banks at bridge sites is used to design, construct, and maintain bridges properly, and to avoid future failures. Vermont is evaluating the safety of all bridges over water in the State.

The USGS, in cooperation with the Vermont Agency of Transportation, is completing a quantitative evaluation of scour potential and stream-channel stability at 403 scour-susceptible bridge sites. For each site, the evaluation includes a detailed survey and an assessment of the hydrologic and geomorphologic setting, floodflow frequencies, streamflow veloc-

ities, stability of streambed materials, and potential depth of scour. The evaluations will contribute to the improved safety of Vermont's transportation system and enhance the knowledge of stream-scour processes at bridge settings typical of those found in the glaciated Northeast.

Hydrologic Data Collection

The amount of water in Vermont's rivers, streams, lakes, reservoirs and aquifers is measured and monitored by the USGS data-collection program. These data are used for forecasting; water-resources planning; design and operation of projects for water supply, hydroelectric power, flood control and pollution control; designing bridges and culverts; flood warning; flood-plain management; and hydrologic research. Long-term records are needed to evaluate the responses of hydrologic systems to natural climatic variations and human-induced stresses so that potential problems can be defined early and appropriate planning and management actions can be taken by local and State agencies.

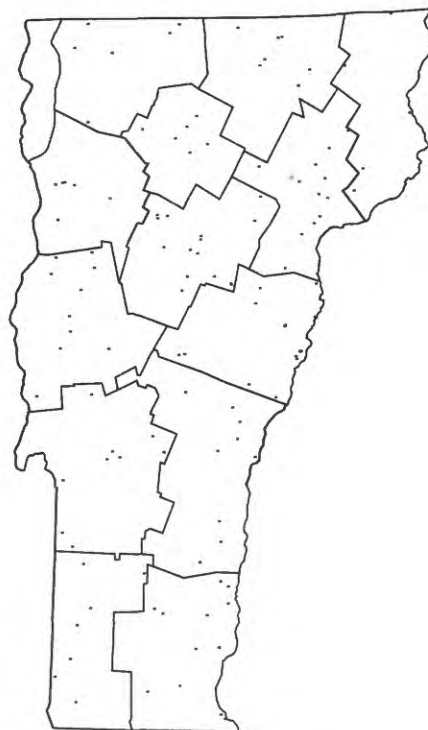


Figure 1. Surface- and ground-water data-collection sites in Vermont.

In Vermont, the USGS collects surface-water, ground-water, and water-quality data from a network of 34 continuous-record streamflow stations, 3 continuous-record lake-level stations, and 4 partial-record streamflow stations. The ground-water monitoring network provides monthly water-level data for 14 wells. Surface- and ground-water data-collection sites are shown in figure 1. Water-quality data-collection sites are shown in figure 2. These networks are operated cooperatively by the USGS and the Vermont Department of Environmental Conservation. Streamflow records are published annually, and ground-water levels are published monthly. These data are used routinely by private consultants, residents, newspapers, colleges and universities, and local government agencies throughout the State.

Water Quality in Lake Champlain

Studies conducted since 1979 on Lake Champlain have indicated that the quality of water is declining. Levels of phosphorous and pathogens are increasing, and in recent years, beaches on the



Figure 2. Water-quality data-collection sites in Vermont.

Lake have been closed to swimmers. Residents of Vermont who live and work on or near the Lake and use the Lake for swimming, fishing, or boating are concerned about the effect water quality will have on their health and the economy. As a result, U.S. Senators Leahy, Jeffords, Moynihan, and D'Amato sponsored the Lake Champlain Special Designation Act of 1990. The Act authorized a Management Conference Committee to address lake-management activities, including an assessment of the sources and cycling of toxic constituents in the Lake. The Lake Champlain Basin includes areas in Vermont, New York, and Canada. The USGS supports the goals of the Act through several major activities. The USGS operates and maintains more than 20 streamflow gaging stations to measure tributary inflows to the Lake and has cooperated with the Management Conference to develop a geographic information system that can be used to analyze the data for the Basin. USGS scientists also participate on various subcommittees of the Conference to provide technical assistance on various projects.

In 1992, USGS scientists collected and analyzed sediment samples from tributary streams to Lake Champlain to determine the concentrations of polychlorinated biphenyls and trace metals, including mercury. Bed sediments of 34 principal streams were sampled for trace metals and volatile organic compounds to determine which streams are significant sources of these contaminants. The results of this study can help water-resources management agencies in Vermont and New York in their efforts to improve water quality in the Lake. The report is being distributed to Federal, State, and local agencies, researchers, concerned citizen groups, universities, and colleges in the area.

Water-Use Information Program

Water resources in Vermont are increasingly stressed by new demands. Competition for water necessitates that available supplies be matched with existing and future demands. Data on water

use and availability are limited in Vermont, and without adequate information, decisionmakers cannot resolve critical issues related to water supply, hydropower, snowmaking, water quality, and the potential effects of streamflow withdrawals on ecosystems. The USGS, in cooperation with the Vermont Department of Environmental Conservation, Water Supply Division, is providing water-use information for the management of Vermont's water resources. Assistance is provided to the State in the collection, analysis, and dissemination of water-use data. Work on developing a data base and a water-use atlas for Vermont is underway for distribution to State and Federal agencies, educators, consultants, and other organizations concerned with water resources. Reports on public supply and wastewater in New England are published and distributed as results of the study become available.

Global Change Hydrology Research

The potential for global warming and other global environmental changes necessitates research to assess the effects of these changes on global ecosystems. The current state of knowledge on the interrelations of hydrologic, energy, and biogeochemical processes is insufficient to define such effects adequately. A better understanding of these processes is

needed in a representative cross-section of global ecosystems. At the Sleepers River Research Watershed in Danville (fig. 3), the USGS is investigating these processes on forested and agricultural basins. Energy fluxes within the basins are determined, and the processes responsible for streamflow generation and streamwater quality are identified. Carbon and oxygen isotopes are being used to trace the flow of water and solutes in the basins and the sensitivity of trace-gas budgets to changing land use and climate. This investigation is part of the USGS Global Change Hydrology Program.

Geologic Mapping

Work by the USGS, in cooperation with State agencies, is underway to develop a new bedrock geologic map of Vermont and establish the ground rules and procedures for development of a digital database of useful geologic information. The digital base data is compatible with geographic information systems and is useful to engineers, planners, Federal Forest managers, and Regional Planning Commissions. The maps will be used for regional ground-water-quality studies, land-use and erosion studies near large ski developments, studies of potential contamination of trout streams by particulates, and areal assessment studies of

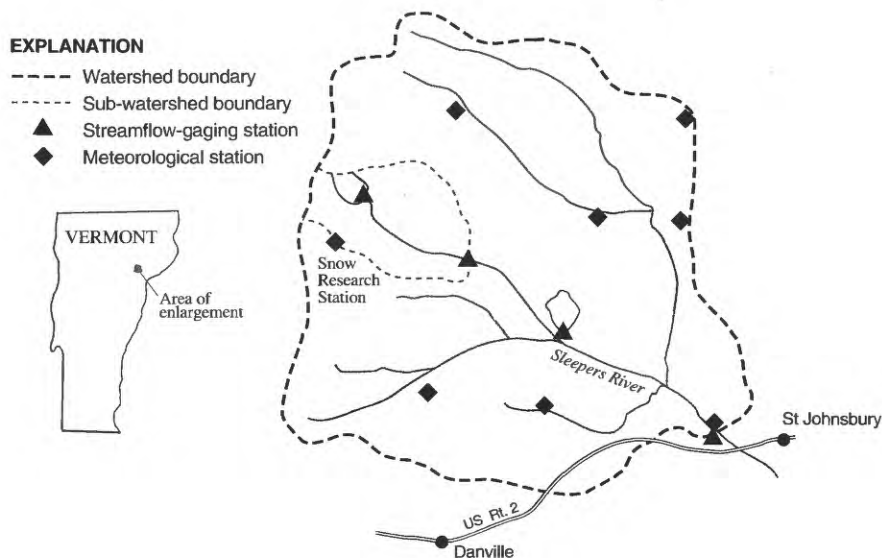


Figure 3. Location of sampling sites for the global change hydrology research.

the potential for radon in water wells completed in bedrock.

Earth Observation Data

Through its Earth Resources Observation Systems Data Center near Sioux Falls, South Dakota, the USGS distributes a variety of aerial photographs and satellite image data products that cover Vermont. Mapping photographs of some sites go back about 40 years. Satellite images dating from 1972 can be used to study changes in regional landscapes.

National Landslide Information Center

The National Landslide Information Center (NLIC) in Golden, Colorado, is the focal point for collection and dissemination of information on significant land-

slide events, critical research results, and public-policy issues relating to landslides. The NLIC collects and distributes a vast amount of information related to landslides to users throughout the world.

Cooperative Programs

The work of the USGS is pursued in partnership with myriad Federal, State and local agencies. A few examples not referenced above are the Citizens Utility Corporation; the Vermont Department of Health, Water Supply Program; and the Green Mountain Power Corporation.

The USGS provides support to the Vermont Water Resources and Lake Studies Center, which conducts a program of research, education, and information and technology transfer.

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1-800-654-4966

Additional earth science information can be found by accessing the USGS "Home Page" on the World Wide Web at "<http://www.usgs.gov>".

For more information on all USGS reports and products (including maps, images, and computerized data), call 1-800-USA-MAPS.