U.S. Geological Survey Programs in Connecticut

U.S. Department of the Interior ■ U.S. Geological Survey

For more than 100 years, the U.S. Geological Survey (USGS) has provided the information needed to manage the Nation's earth resources, to mitigate geologic hazards, and to understand the environment. In Connecticut, the USGS works cooperatively with local, State, and other Federal agencies, as well as with universities, to study earth science.

Geologic Mapping

Geologic maps, which describe and delineate bedrock units, surficial deposits, and geologic structures, are fundamental tools necessary for analyzing earth-related resources. Substantial cost savings can be realized by using geologic map information to site highways, structures, or landfills. Geologists from USGS have worked cooperatively with the Connecticut Geological and Natural History Survey (CGNHS) for many years to map Connecticut's geologic units and natural resources. The STATEMAP component of the National Cooperative Geologic Mapping Program funded detailed mapping in the Rockville quadrangle during fiscal year 1996.

A key result of the USGS/State cooperation is a series of bedrock and surficial geologic maps for the State. Bedrock geologic maps describe the character and distribution of the bedrock that underlies all areas of the State. Surficial geologic maps describe the character, distribution, and thickness of the unconsolidated glacial and alluvial deposits that overlie the bedrock surface in most places. Maps at the 1:24,000 scale are available for most quadrangles in the State; statewide maps at the 1:125,000 scale include the "Bedrock Geological Map" and the "Surficial Materials Map of Connecticut."

Digital coverage of surficial materials units shown on the State map is available by quadrangle. An area near Hartford is shown in figure 1. The materials map has many uses, including water-resources evaluation and protection, engineering and construction projects, and slope-stability studies.

USGS geologists, in cooperation with the CGNHS, are working on the "Quaternary Geologic Map of Connecticut and Long Island Sound Basin," which is a geologic map that describes glacial deposits in terms of their depositional environment and geologic history.

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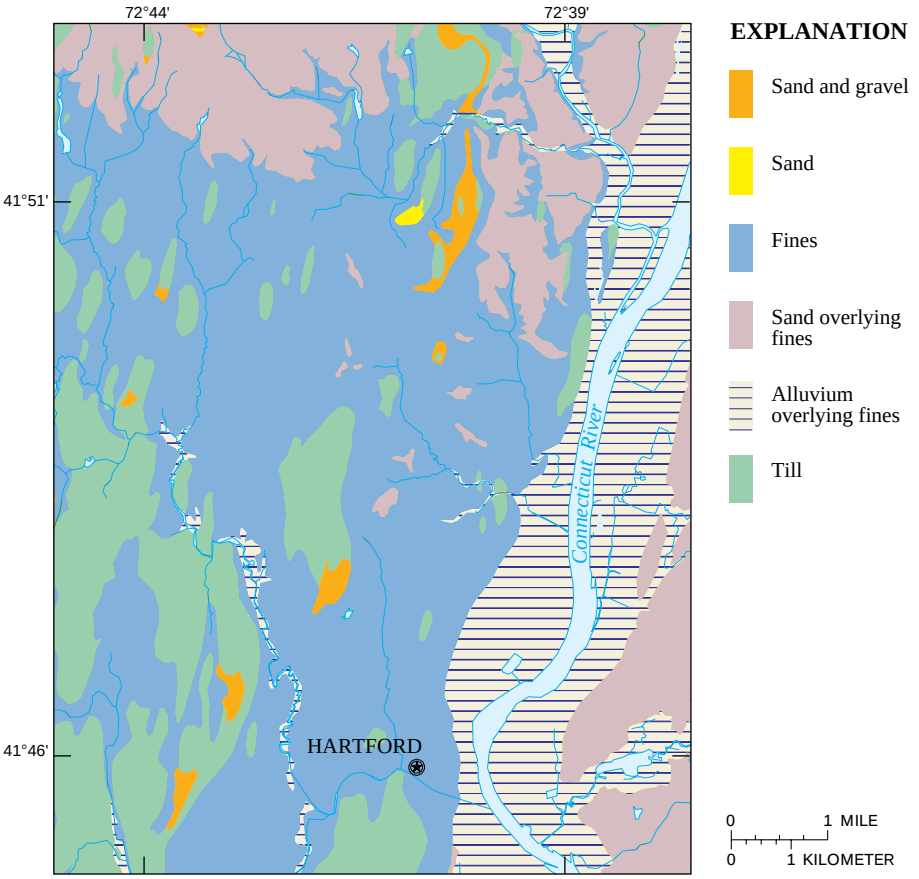

Figure 1. Surficial materials of the Hartford North quadrangle, Connecticut. Materials maps, such as this, are very useful for engineering and construction projects.

Water-Data Collection

Complete and accurate hydrologic data are needed by water-resource managers, engineers, planners, public safety officials, consultants, and researchers. To meet their needs, the USGS maintains a national network of data-collection stations. In Connecticut, there are currently about 75 surface-water stations, 70 ground-water stations, and 33 surface-water-quality stations. Records of historical data, in some cases dating to 1905, also are maintained for additional locations.

About one-third of the surface-water stations in Connecticut use satellites or modems to transmit real-time data measurements of instantaneous discharge (the volume of water flowing in the river). These data are important for several reasons. Real-time measurements of high water are used by the National Weather Service and the Connecticut Department of Environmental Protection (DEP) to issue warnings during periods of flooding. Real-time measurements of low water are used to alert power and water companies when water supplies may become depleted. For example, during July 1995, when water levels throughout the State fell to very low levels, officials from water companies used the Survey's real-time data to determine when certain pumps in well fields near rivers should be turned off.

The USGS water-quality network in Connecticut, which is operated in cooperation with the DEP, provides data that are used to determine the quality of streams and lakes and trends in water quality, to demonstrate effects of management practices on water quality, and to highlight unforeseen changes in water quality. Water-quality data also are used by the State to monitor compliance with established water-quality standards. Stations are selected to provide data from different parts of the State or to represent different land uses. The station on the Connecticut River at Thompsonville monitors the largest drainage area (almost 10,000 square miles) and provides data on the quality of the river as it enters the State. Stations on the Salmon and the Shepaug Rivers provide data on more natural areas of the State, whereas stations on the Quinnipiac, the Naugatuck, and the Hockanum Rivers monitor urban areas.

Topographic Mapping

The National Mapping Program (NMP) of the USGS fosters partnerships with State and other Federal agencies to improve the effectiveness of data-collection activities, to maximize resource sharing, and to enhance availability of timely and accurate data to the public. The Program strives to ensure the availability of map data in graphic and digital form to the public. Among the most popular and versatile products of the USGS are 1:24,000-scale topographic maps (1 inch on the map represents 2,000 feet on the ground). Connecticut is covered by 125 of these maps, which depict natural and cultural features of the landscape, such as lakes and streams, highways and railroads, boundaries, and geographic names. Contour lines are used to show the elevation and shape of the terrain. Digital cartographic data, which include boundaries, transportation, hydrography, and digital elevation models, are available statewide at the 1:24,000 scale.

Earth Science Information Centers

Earth Science Information Centers (ESIC's) provide information about USGS programs, products, and technological developments to the public. The ESIC in Hartford was established under a cooperative agreement with the DEP. The University of Connecticut Map Library in Storrs also is a State ESIC. These offices provide information on earth science topics, such as cartography, geography, digital data, remote sensing, geology, geophysics, geochemistry, hydrology, geohydrology, aerial photography, and land use.

Contamination of Sediments in Long Island Sound

The USGS, in cooperation with the CGNHS and the DEP, is studying the contamination of sediments in Long Island Sound, which is a major urbanized estuary that lies near the most densely populated region of the United States. Sewage, wastes, and chemicals enter the Sound from direct discharges, river runoff, and the atmosphere; this has caused widespread contamination of bottom sediments and loss of habitat for bottom-dwelling (benthic) organisms and affects millions of people who use the Sound for recreational and commercial activities.

This study is part of a multidisciplinary, basinwide program to document the sea-floor processes that control distribution of benthic habitats and sediment-related contaminants (fig. 2). This program uses unique USGS capabilities in sea-floor imaging, contaminant-transport modeling, and geochemical sampling. This study and other geological, geophysical, and mapping investigations of the continental margins of the United States and around the world are being conducted by the USGS at Woods Hole, Massachusetts. These studies address critical issues in environmental quality and preservation, geologic hazards and public safety, natural resources, global environmental change, and information. The long-range goals of the research and mapping efforts are to provide a comprehensive understanding of the geology, his-

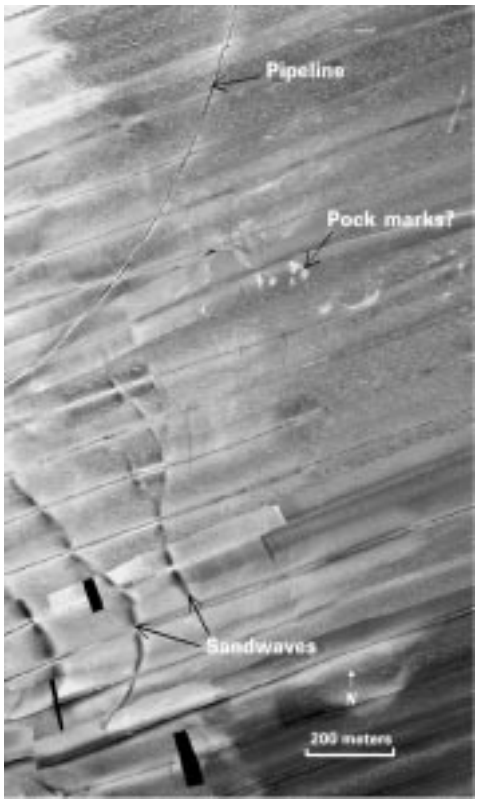

Figure 2. Portion of a high-resolution sidescan sonar mosaic obtained off the Connecticut coast in Long Island Sound. Dark tones on the image represent areas of weak acoustic backscatter produced by finer grained sediments; light tones represent areas of strong acoustic backscatter produced by courser grained sediments. Selected features that reflect natural processes and human influences are labeled on the image. [200 meters equal about 655 feet.]

tory, and processes of the continental margins and to develop a predictive capability to determine the consequences of using the continental margins.

Channel Scour Potential at Bridges

Changes in stream channels and scouring of riverbeds near bridges is a widespread problem throughout the United States. To protect public safety, the USGS, in cooperation with the Connecticut Department of Transportation, assessed and evaluated channel stability and potential for scour at about 1,600 bridges in Connecticut that span waterways. The bridges range in size from simple span structures to multilane highways that carry thousands of vehicles every day, such as the Interstate 91 bridge over the Connecticut River in Windsor Locks. On the basis of this assessment, bridges with observed scour or high scour potential have been identified for detailed study.

Mineral-Resource Information

The USGS maintains two minerals data bases, the Mineral Resources Data System (MRDS) and the Mineral Availability System (MAS), that contain information on hundreds of thousands of deposits and mineral processing locations worldwide. The MRDS and MAS contain information on about 550 sites in Connecticut, including metallic and nonmetallic deposits. Information from MRDS and MAS assists Federal and State land-management agencies, regional planners, industry, and local governments in planning environmentally sound and economically viable minerals-related development. The data bases are the principal tools that the USGS uses for mineral-resource and mineral-related environmental research. CD-ROM's of the data bases and other information from USGS minerals research are available to government agencies and the general public.

The USGS is compiling digital geological, geophysical, geochemical, and mineral-deposit data on Connecticut to delineate tracts that may contain different kinds of copper, lead, and zinc deposits. New geologic data indicate that there is the potential for kinds of mineral deposits that had not previously been found in the State.

Urban Ground-Water Quality

Protecting the quality of the Nation's streams, lakes, and ground water continues to be a high priority for many government agencies and the public. The National Water-Quality Assessment (NAWQA) Program was designed to describe the status and trends in the quality of the Nation's ground- and surface-water resources and to provide an understanding of the natural and human factors that affect the quality of these resources. A NAWQA study is underway in the Connecticut, the Housatonic, and the Thames River Basins, which is a 16,000-square-mile area in the Northeastern United States that includes most of Connecticut.

As part of the NAWQA Program, a detailed study of ground-water quality in urban areas is being done along a flowpath in the Hockanum River aquifer in Manchester (fig. 3). Water-quality samples are collected along the direction of ground-water flow—from upgradient recharge areas to downgradient discharge areas. Flowpath studies are designed to understand the spatial and seasonal variations in ground-water quality, to increase understanding of the natural processes and man-made factors that control ground-water quality along flowpaths, and to compare shallow ground- and stream-water quality under base-flow conditions.

In Manchester, 14 observation wells were installed to determine concentrations of nutrients, pesticides, and volatile-organic compounds (VOC's) in ground water. Preliminary findings show that concentrations of nitrate nitrogen (a nutrient), were elevated in water samples from 13 of the wells. Although no concentrations exceeded the U.S. Environmental Protection Agency (USEPA) maximum contaminant level (MCL) of 10 milligrams per liter (mg/L), concentrations ranged from 1.9 to 5 mg/L. Potential sources of this nutrient include lawn fertilizers, animal wastes, leaking sanitary sewer lines, and rainfall. Also, at least one VOC was detected in water samples from 12 of the 14 wells. Trichloroethylene (a VOC) was detected at a level higher than the MCL (5 micrograms per liter) in four samples from one well.

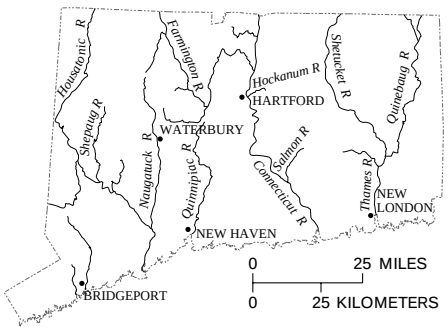

Figure 3. Major rivers and towns in Connecticut.

Ground-Water Contamination in Fractured Rocks

Central Connecticut is underlain by a thick sequence of sedimentary rocks. Aquifers within these rocks provide water to single-family domestic, public supply, and industrial supply wells. The rocks do not yield much water; however, fractures in them store and transmit ground water—from precipitation at the land surface through the subsurface to wells. At several sites in Connecticut, fractured-rock aquifers have been contaminated with hazardous substances.

To clean up contaminated aquifers, information on the factors that control the rate and direction of ground-water flow, such as the location of ground-water recharge and discharge areas, is needed. Hydrologists and geologists at the USGS, in cooperation with the USEPA and the Agency for Toxic Substances and Disease Registry (ATSDR), have used borehole- and surface-geophysical methods, surface- and ground-water surveillance, hydraulic testing, and computer modeling to identify fracture patterns and characteristics at several sites in Connecticut. The ATSDR is using the results of these hydrogeologic studies to assess potential exposure by citizens to hazardous materials.

Ecosystem Studies

The Biological Resources Division (formerly the National Biological Service) is participating in the Connecticut River Ecosystem Initiative, which highlights an ecosystem approach to resource management. Initiative activities include incorporating biological data into a geographic information system, inventorying the existing barriers to Atlantic salmon migrations, mapping the distribution of fish

populations, and cataloguing information sources and data bases. In addition, the New England Gap Analysis program identifies significant ecological areas by overlaying maps of land cover and species occurrence onto maps of protected areas. The program, in cooperation with the DEP and the Connecticut Geological and Natural History Survey, is developing a high-resolution map of the vegetation in central and western Connecticut in order to evaluate the efficiency of mapping methods for eastern deciduous forests in New England.

Outreach

The USGS has a long history of providing speakers and fieldtrip leaders for schools, colleges, scout troops, and other community groups. This outreach effort was expanded in 1995 when the USGS signed a Partners-in-Education agreement with Parish Hill High School Regional District #11 in the towns of Chaplin, Hampton, and Scotland. The goal of the Partnership is to improve the quality of education in earth and physical sciences and related subjects by assisting the school system in providing long-term, active learning projects related to the environment. USGS personnel participated in the school's Environmental Technology Day and the Freshman Environmental Studies fieldtrip (fig. 4), conducted a local geology field trip, installed monitoring wells at the high school and elementary schools so students can study local hydrology, and supplying USGS teaching packages to teachers at several grade levels.

Figure 4. A USGS employee describes sediment characteristics in a split-spoon sample to teachers and students from Parish Hill Regional High School. (USGS photograph)

Water-Quality Trends

Surface-water-quality data from 39 monitoring stations in Connecticut were analyzed for trends for water years 1969 to 1988. Specific conductance and concentrations of calcium, magnesium, chloride, dissolved solids, and total solids generally increased from 1975 through 1988 and indicate a general increase statewide in dissolved constituents in streamflow.

Increasing trends in chloride concentrations were more numerous than any other dissolved constituents measured at the monitoring sites (fig. 5). The effects of increased urbanization, which include municipal and industrial wastewater, septic system leachate, and runoff from streets and highways, are possible causes for increases in chloride concentration.

Increasing concentrations of dissolved and suspended constituents, which indicate deterioration in water quality, have been detected in small, sparsely developed drainage basins that previously were considered to represent water quality that is relatively unaffected by human activities. Although typically small in magnitude, these changes may indicate increasing contamination from various nonpoint sources in the less developed areas of the State.

Continued water-quality sampling since 1988 will permit further analysis of water-quality trends throughout the State.

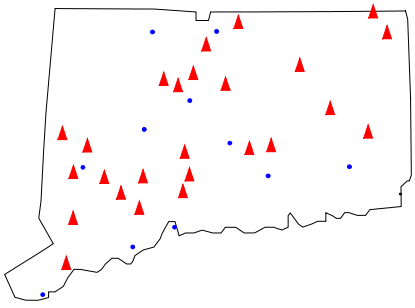

Figure 5. Surface-water stations with increasing trends in chloride concentration, 1981-88. Blue dots are stations with no significant trend.

For More Information

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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**

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

U.S. Geological Survey
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