New York

New York City's Water Supply

New York City's water-supply system provides water to about 40 percent of the State's 18.1 million people. The U.S. Geological Survey (USGS) has worked with the New York City Department of Environmental Protection (NYCDEP) for many years to monitor and assess the City's water resources and provide information for effective resource management.

The USGS is investigating the effects of forest-harvesting techniques on nitrogen cycling in the Neversink watershed in the Catskill Mountains. The Neversink River feeds the Neversink Reservoir, a major water source for New York City. The Catskill region receives large amounts of acid rain, which can acidify surface waters and release aluminum, which can be toxic to fish. Nitrogen in forest soils in excess of biological demands results in soil water and surface-water acidification by nitric acid. The project aims to demonstrate whether or not forest-harvesting practices can moderate stream-water acidification.

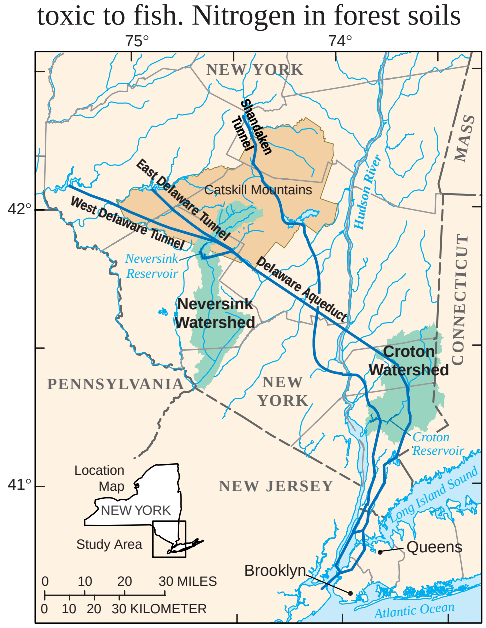

Figure 1. New York City water-supply system.

A recent USGS-NYCDEP project in the Croton River watershed examined the effects of suburban development on the chemical quality of ground water that discharges to local streams. These streams feed the Croton Reservoir system, which provides 10 to 15 percent of New York City's water supply. The concentrations of some constituents were found to increase with an increase in suburban development. Increased chloride and nitrate concentrations were identified as indicators of unsewered suburban development.

The USGS and NYCDEP are monitoring ground-water levels and water quality in Brooklyn and Queens because ground water in these locations might be used to supplement the City's reservoir system during drought. During 1992–96, water levels were measured monthly at 88 wells, and 240 water samples were collected and analyzed for an extensive list of chemicals. This monitoring is continuing. A computer-based model of ground-water flow in the aquifer system was developed to simulate proposed ground-water withdrawals so that the effects on ground-water levels and saltwater intrusion can be predicted.

The NYCDEP is constructing new water-supply tunnels in the bedrock beneath the City, where water-bearing fractures can cause costly and hazardous problems. Information obtained from drilling and coring does not adequately describe either the ground-water conditions in the bedrock along the proposed route of the tunnel or other geologic features such as faults, which can cause construction problems. The USGS is integrating several new, advanced borehole geophysical methods to investigate ground-water flow in fractured bedrock. Recently, the USGS and NYCDEP began a cooperative effort to apply these methods to characterize waterbearing fractures and other geologic features that will be encountered during tunnel construction. This should enable safer and more efficient construction and expand our knowledge of the geology in the area.

Pesticides

Improved analytical capability developed in USGS laboratories detects pesticides at concentrations much lower than regulatory limits and allows the USGS to observe the transport and fate of pesticides after they are applied. The USGS, in cooperation with the New York State Department of Environmental Conservation (NYSDEC), has surveyed the occurrence of pesticides (both herbicides and insecticides) in streams and rivers across the State and in ground water on Long Island. Herbicides were detected most frequently in streams draining watersheds with significant agricultural use, and insecticides were detected most frequently in streams draining watersheds that are urbanized or that contain extensive areas of

U.S. Department of the Interior
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USGS Fact Sheet 033-99
September 1999

vineyards or orchards. Concentrations of most pesticides detected were low, generally not exceeding 0.1 part per billion. Continuing work is examining pesticide occurrence in some of the Finger Lakes, in the sole source aquifer system on Long Island, in public water-supply sources, and in ground water.

New York Harbor

Sediment accumulation obstructs New York Harbor and causes economic losses. Some of the sediment is contaminated with heavy metals, PCB's, and other organic compounds, and the contamination makes the disposal of dredged material a concern. Planning for the safe disposal of the contaminated, dredged material requires identification of which sediments deposited within the harbor are contaminated and evaluations of disposal sites.

The USGS is studying this region to identify sediments on the sea floor, map the distribution of contaminants in the sediment, and develop a predictive capability for the long-term transport and fate of sediments and contaminants. A regional understanding of the sea floor geology, topography, and dynamics of these coastal sediments is needed for management and use of the nearshore environment and to plan further studies.

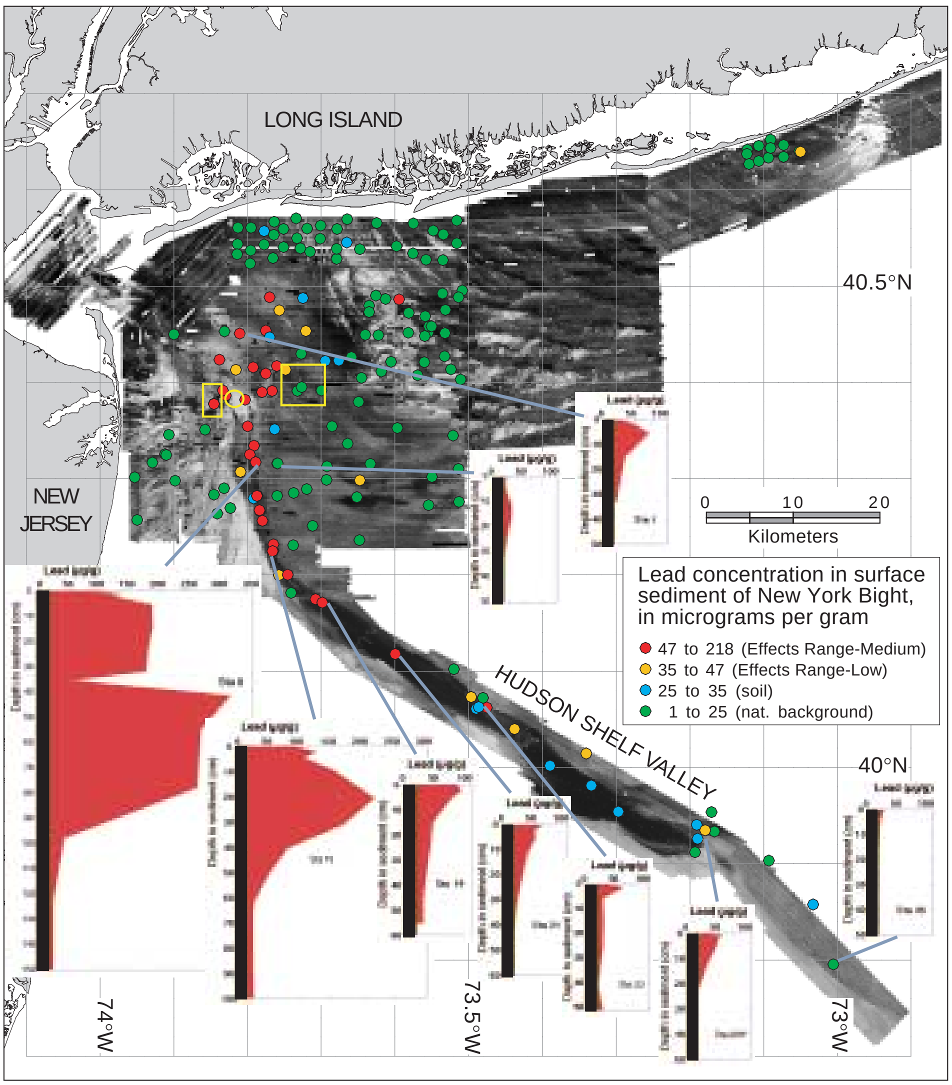


Figure 2. Map of the area offshore of the New York-New Jersey metropolitan region showing topographic features on the sea floor (gray scale), dumpsites (areas enclosed by yellow lines), lead concentrations in surface sediments (colored dots), and subsurface accumulation of lead (profiles with concentrations elevated above background values in red). The highest concentrations of lead (and other contaminants) are in the upper Hudson Shelf Valley and extend as far as 80 km downvalley from the original dumpsite.

Previous work by the USGS has shown that Hudson River tributaries supply differing amounts of sediment depending on flow conditions and on land use in their basins. The USGS is helping NYSDEC to identify sources of contaminants flowing into New York Harbor by operating four monitoring sites in the Hudson River basin. At these sites, sediment transport is measured and sediment samples are collected for contaminant analysis.

Lake Ontario

In April 1998, USGS scientists caught a deepwater sculpin in southwestern Lake Ontario by towing a trawl net along the lake floor 492 feet below the surface from the USGS Research Vessel KAHO. Deepwater sculpin had not been captured in the U.S. waters of Lake Ontario since 1942, and only six deepwater sculpin have been reported in Canadian waters since 1972. Deepwater sculpin were plentiful in Lake Ontario in the early 1900's, but their numbers plummeted in the 1950's, probably through predation on the sculpin young by alewife, a nonnative fish that invaded Lake Ontario from the Atlantic Ocean. Deepwater sculpins are an important link in the offshore food chain, eating bottom-dwelling invertebrates and, in turn, being eaten by lake trout, historically the lake's top predator. The reappearance of deepwater sculpin in U.S. waters of Lake Ontario is one of many recent signs of recovery of the lake's native fish community. Other signs are that the numbers of two other formerly abundant native fishes—burbot and emerald shiner—are increasing in survey catches and hatchery lake trout are successfully reproducing after more than a decade of failure.

Growing populations of the double-crested cormorant in the eastern basin of Lake Ontario have caused concern among natural-resource managers and the public because cormorants eat fish, including game fish. Many worry that an overabundance of the birds will adversely affect fish populations and change the ecology of the lake. USGS scientists have been studying cormorants in Lake Ontario since 1993. Early investigations showed that most predation of stocked salmon and trout occurred within the first 24 hours after stocking and that about 11 percent of the stocked fish were eaten by cormorants within 4 days. Subsequent research revealed that predation can be significantly reduced when fish are either stocked at night or released offshore. These results have led the NYSDEC to modify its salmonid stocking strategy, thereby increasing the survival of stocked fish.

Figure 3. Deepwater sculpin.

Mapping

Color-infrared digital orthophoto quadrangles are available for about 80 percent of New York. When completed, this statewide project, funded by six Federal and State agencies [the NYSDEC, the National Park Service, the Natural Resources Conservation Service, the U.S. Environmental Protection Agency (EPA), the Farm Services Agency, and the USGS], will provide data users with the first standardized, large-scale image base for the entire State. In addition, the NYSDEC, in cooperation with the USGS, produced a statewide coverage of digital elevation model data with 10-meter resolution. Both datasets are important for visualizing the terrain and the human impact on that terrain. Uses for these data include delineating flood plains, planning for emergencies such as floods, developing soil conservation techniques, identifying and remedying nonpoint-source pollution, and revising maps.

The USGS is collecting data on urban areas and transportation during the 20th century in the New York City metropolitan area to provide a visualization of settlement patterns through time. These data can be used to predict future growth in the metropolitan area. This can lead to improved planning and policymaking regarding resource availability, resource exploitation, and conservation strategies in response to a growing investment in urban roads, water supply, sewer systems, and other utilities. The USGS is coordinating this project with Cornell University, the Regional Planning Authorities, and the EPA.

The USGS and the New York State Department of Transportation (NYSDOT) are studying the feasibility of a cooperative effort to produce single edition, 1:24,000-scale, 7.5-minute quadrangle maps, which both organizations now produce independently. Production processes and standards are being examined for similarities and differences between the two map series. If test results are satisfactory, both agencies would distribute the same map product, thus minimizing production and distribution costs while freeing resources and capabilities to revise the 1:24,000-scale maps within the State.

Tidal Scour at a State Highway Bridge

In the summer of 1998, USGS expertise in stream processes and bridge scour was put to use in an unusual setting at a narrow marine channel where the potential for tidal scour is high. Scour is the erosive action of flowing water that removes material from the stream or channel bed. Previous depth surveys of the Sloop Channel Bridge along the southern shore of Nassau County suggested that some scouring had taken place, but due to insufficient resolution and density of data, and the possibility of infilling of scourholes, a more precise geophysical survey was needed. The public safety issue prompted the USGS, in cooperation with the NYSDOT, to quickly mobilize research-grade instrumentation resources from New York, Connecticut, and Kentucky to conduct a marine geophysical survey at the Sloop Channel Bridge to delineate the extent of tidal scour.

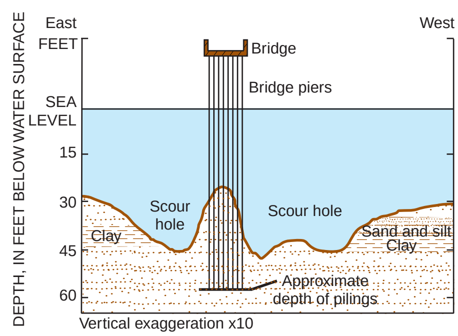


Figure 4. Section from seismic reflection profile at bridge at Sloop Channel.

Two large scour holes along the eastern and western sides of the bridge were identified. These scour holes extended to more than 47 feet below sea level and partly beneath the bridge—much deeper and farther beyond the bridge than had been mapped previously. Several bathymetric profiles depicted scour holes that have developed around several piers under the bridge. An evaluation of flow velocities under the bridge showed that the bridge piers create a flume effect that increases water velocities and enhances scour.

As a result of this study, the NYSDOT and Federal Highway Administration have begun to reevaluate the manner in which bridges are inspected and surveyed for tidal scouring in southeastern New York State. Shortly after the geophysical survey of Sloop Channel Bridge, the NYSDOT decided to demolish Sloop Channel Bridge and build a new structure in its place.

Wetlands

The use of wetlands to reduce peak stormwater flows and to treat stormwater and landfill leachate is increasing, but their effectiveness is yet to be demonstrated in many settings. The USGS is assessing the effectiveness of natural and artificial wetlands as passive, inexpensive methods of stormwater and leachate treatment in New York State.

Two USGS studies in cooperation with the New York State Energy Research and Development Authority evaluated treatment of landfill leachate. In Tompkins County, four types of treatments were evaluated, and use of a mixed bed of sand and gravel was found to be most effective. A subsequent test of design improvements in Monroe County (a ponded pretreatment wetland and a subsurface-flow gravel bed) showed that increased leachate detention times and the addition of passive baffles that increased mixing within the wetland further improved treatment efficiencies.

Ongoing USGS work includes studies with Monroe County to evaluate the use of the floodplain wetland at the mouth of Irondequoit Creek near Rochester as a nutrient and sediment filter to improve the water quality of Irondequoit Bay and the effects of stormwater detention in a mature and diversely vegetated constructed wetland on water quality and temperature. Also, a study with the Natural Resources Conservation Service is evaluating the effects of a constructed nutrient- and sediment-control system to treat runoff from a cattle pasture in Cayuga County. The studies with Monroe County have documented the effectiveness of constructed and natural wetlands in significantly reducing the loads of phosphorus and suspended solids in storm runoff. Small, but significant, reductions in nitrogen loads also have been measured in the natural wetland. One concern addressed in the created wetland study was that a wetland used to treat runoff from a residential development could cause water temperatures to increase and adversely affect fish habitat. Study results showed that these concerns were unfounded. Outflow temperatures were 2-5 degrees Fahrenheit lower than inflow temperatures during most of the year. During the late spring and early summer, when outflow temperatures were close to or slightly above the inflow temperatures, the detention of flows in the wetland caused a slower release of water to the receiving water body than would have occurred otherwise.

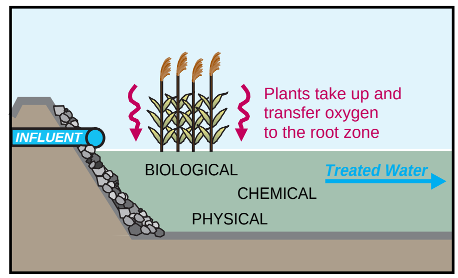
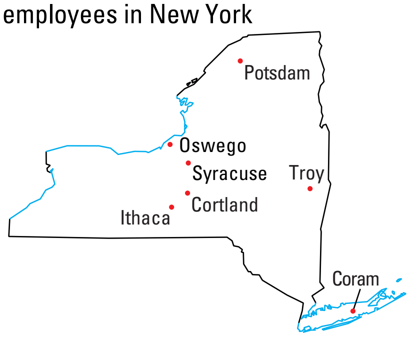


Figure 5. Contaminant removal processes in a constructed wetland.

USGS office locations

The USGS has 139 employees in New York



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