

## INTRODUCTION

Aquifers—water-bearing deposits of sand and gravel, glacial till, and fractured bedrock—provide an extensive and readily accessible ground-water supply in Massachusetts. Ground water affects our everyday lives, not just in terms of how much water is available, but also in terms of the position of ground-water levels in relation to land surface. Knowledge of ground-water levels is needed by Federal, State, and local agencies to help plan, manage, and protect ground-water supplies, and by private construction companies for site planning and evaluation.

A primary part of the mission of the U.S. Geological Survey (USGS), Water Resources Division, is the systematic collection of ground-water, surface-water, and water-quality data. These data are needed to manage and protect the nation's water resources. The Massachusetts—Rhode Island District of the USGS, in cooperation with the Massachusetts Department of Environmental Management (DEM), Office of Water Resources, and county and town environmental agencies, has maintained a network of observation wells throughout the Commonwealth since the mid 1930's. The purpose of this network is to monitor seasonal and long-term changes in ground-water storage in different lithologic, topographic, and geographic settings. These data are analyzed to provide a monthly index of ground-water conditions to aid in water-resources management and planning, and to define long-term changes in water levels resulting from manmade stresses (such as pumping and construction-site drainage) and natural stresses (such as floods and droughts).

## OBSERVATION-WELL DATA-COLLECTION NETWORK

The network of observation wells in Massachusetts started with monthly measurements at a single well in 1936. By 1970, the network had grown to 70 wells

as a result of a prolonged drought during the early 1960's, and currently (1994) it includes 169 wells. At present, six wells are equipped with recorders that collect water-level data hourly. Subnetworks of wells are used to monitor water levels in sole-source aquifers on Cape Cod, Martha's Vineyard, and Nantucket Island. The USGS measures water levels at the 6 wells using automated recorders and makes monthly water-level measurements at 70 other wells. Water levels in wells on Cape Cod are measured by personnel from the Water Resources Office of the Cape Cod Commission, an environmental and regulatory land-use agency funded by Barnstable County. Water levels in wells on Martha's Vineyard and Nantucket Island are measured by observers from the University of Massachusetts, Dukes County Cooperative Extension, and the Nantucket Land Council, respectively. Monthly water-level measurements at the remaining 9 wells are made by county engineering offices. Water-level data collected by non-USGS agencies are sent to the USGS Marlborough office, and the quality of these data are assured by occasional testing of measuring techniques used by the other agencies and individuals. Water-level data collected at 11 strategic wells are included in a Federal network of approximately 2,200 wells used to assess ground-water conditions nationwide. Data collected as part of the national network are published in the USGS National Water Summary report series.

## DATA USERS AND APPLICATIONS

- The Massachusetts DEM uses data from the network of observation wells to assess ground-water conditions Statewide. Knowledge of current ground-water conditions and trends is essential in managing water supplies, evaluating potential effects from construction activities, and determining the interaction between ground-water and surface-water bodies. USGS ground-water-level data are used by the Massachusetts Department of

Environmental Protection (DEP), Office of Watershed Management, and local town health boards. The current version of the Massachusetts "Title 5, State Environmental Code 310 CMR 15.00" recommends use of the USGS observation-well-network data to determine whether ground-water levels are at their annual maximum. The USGS, in cooperation with the DEP, also has used data collected from the network to develop a method for estimating maximum ground-water levels at sites where only short-term or single water-level measurements are available. In addition, town health boards rely heavily on monthly ground-water data both for determining appropriate times to evaluate sites for septic-system suitability, and for estimating maximum ground-water levels at proposed sites.

- The USGS routinely uses most of the water-level data for Statewide investigations. USGS investigators on Cape Cod, for example, use measured water-level data to calibrate ground-water models. The U.S. Environmental Protection Agency (USEPA) and the USGS use data from the continuous-record wells to estimate recharge values and to evaluate well data collected intermittently at nearby ground-water remediation sites. Confidence in ground-water-quality remediation strategies can be improved if recharge values are used.

## DATA REPORTING AND STORAGE

Water-level data for Massachusetts are published by the USGS in a monthly report entitled "Current Water Resources Conditions in Central New England," and in an annual report entitled "Water Resources Data—Massachusetts and Rhode Island." As of 1994, approximately 800 subscribers (mostly consulting firms and town health boards) receive the monthly report, and about 300 copies of the annual report are distributed each year to Federal, State, and local agencies, consulting firms, and universities. Water-

level data are stored in the USGS Northeast Area Ground Water Site Inventory (GWSI) File. Data can be retrieved and distributed as paper copy or on computer diskettes.

## USGS REPORTS BASED ON NETWORK DATA

The following USGS reports are available for inspection at the Massachusetts USGS office:

Frimpter, M.H., 1980, *Probable high ground-water levels on Cape Cod, Massachusetts*: U.S. Geological Survey Water-Resources Investigations, Open-File Report 80-1008, 20 p., 4 plates. This report describes a method for estimating high ground-water levels on Cape Cod in order to determine site suitability for septic systems.

\_\_\_\_\_ 1981, *Probable high ground-water levels in Massachusetts*: USGS Water-Resources Investigations, Open-File Report 80-1205, 19 p. This publication adapts the Cape Cod ground-water level estimating approach for application to the rest of the State.

Maevsky, Anthony, 1976, *Ground-water levels in Massachusetts, 1936-74*: U.S. Geological Survey Massachusetts Hydrologic-Data Report No. 17, 107 p.,

1 map. This report presents observation-well characteristics, ground-water temperature, tables of ground-water levels, and long-term hydrographs of wells in the network as of 1974.

Ryan, Barbara J., 1980, *Cape Cod Aquifer, Cape Cod, Massachusetts*: U.S. Geological Survey Water-Resources Investigations Report 80-571, 23 p., 3 plates. This publication describes the shape, size, and materials of the Cape Cod Aquifer, identifies ground-water boundaries of the fresh-water lenses, provides chemical analyses of water from selected wells, and includes several land- and water-use projections for the future.

## OUTREACH

In addition to the publication of formal reports and maps, the USGS also presents ground-water information through informal lectures and field trips. Staff of the Massachusetts-Rhode Island District, for example, have described the observation-well network and presented reports resulting from analysis of network data to members of the Massachusetts Health Officers Association.

The USGS also makes students aware of the importance of water resources. The USGS, in cooperation with the USEPA, the American Water Resources Associa-

tion, and the National Science Teachers Association, prepared a series of four posters titled "GROUND WATER: The Hidden Resource!", "WATER: The Resource That Gets Used & Used & Used for Everything!", "How Do We Treat Our Waste Water?", and "WETLANDS: Water, Wildlife, Plants, and People". The fronts of these posters show various types of water resources and water uses. The backs contain classroom problems and exercises (at both grade-school and middle-school levels) geared to educating students in the field of hydrology.

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