

Shallow Ground-Water Quality in the Boston, Massachusetts Metropolitan Area

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Analyses of water samples collected from 29 wells across the Boston metropolitan area indicate that shallow ground water in recently urbanized settings often contains trace amounts of nutrients, fuel, and industrial-based organic compounds. Most of the samples that contained detectable amounts of organic compounds also had elevated levels of iron and total dissolved solids. Nitrate was detected in 83 percent of the samples, but the U.S. Environmental Protection Agency's (USEPA) drinking-water standard of 10 milligrams per liter nitrate was exceeded in just one sample. Low levels of volatile organic compounds (VOCs) were detected in 76 percent of the samples, with as many as 13 different VOCs detected in a single sample. The concentration of methyl-tert-butyl ether (MTBE) in one sample was 267 micrograms per liter, which exceeds the Massachusetts Department of Environmental Protection drinking-water guideline of 70 micrograms per liter. Chloroform and MTBE were the two most frequently detected VOCs. MTBE was detected at the same frequency in ground water in the Boston metropolitan area as in other urban areas of New England. Chloroform is detected at higher frequency in old, densely populated areas in New England than in more recently developed, less densely populated areas. Pesticide detections were few, but only at trace concentrations, and none of the concentrations exceeded any drinking-water standard.

INTRODUCTION

The effect of urbanization on water quality is an important issue to many water-resource managers and is a major focus of the U.S. Geological Survey's (USGS) National Water-Quality Assessment Program (NAWQA) (Ayotte and Robinson, 1997). As part of the NAWQA program, New England Coastal Basins (NECB) study, the USGS installed and sampled 29 monitoring wells in unconsolidated surficial aquifers in suburban parts of the Boston, Mass. metropolitan area (figs. 1 and 2) to determine the quality of shallow ground water in recently urbanized areas.

Description of Study Area

The Boston metropolitan area (BMA), which includes the city of Boston and the surrounding smaller cities and suburban communities, covers 4,800 square miles (mi²) in eastern Massachusetts and southern New Hampshire (fig. 2). The study area had an estimated population of more than 5.4 million in 1998. The older, more densely populated areas in and near Boston grew at a rate of 5 percent between 1970 and 1998, while the outlying suburban areas grew at a rate of almost 20 percent over the same period (Dr. Stephen Coelen, Massachusetts Institute of Social and Economic Research, written commun., 1999).

Unconsolidated surficial aquifers cover 47 percent of the BMA and are an important source of public-supplied water to local municipalities (fig. 2). These aquifers consist of layered sediments ranging from clay to coarse gravel and cobbles, are generally less than 100 ft thick, highly permeable, and capable of yielding large amounts of water to wells for public supply. The water table ranges from 0 to 30 ft below land surface (Flanagan and others, 1999). These characteristics make the water in these aquifers highly vulnerable to contamination by human activities.



(Photograph by Joseph R. Melanson, Aero Photo, Inc.)

Aerial view of Boston metropolitan area from Newton, Massachusetts, eastward to Boston.

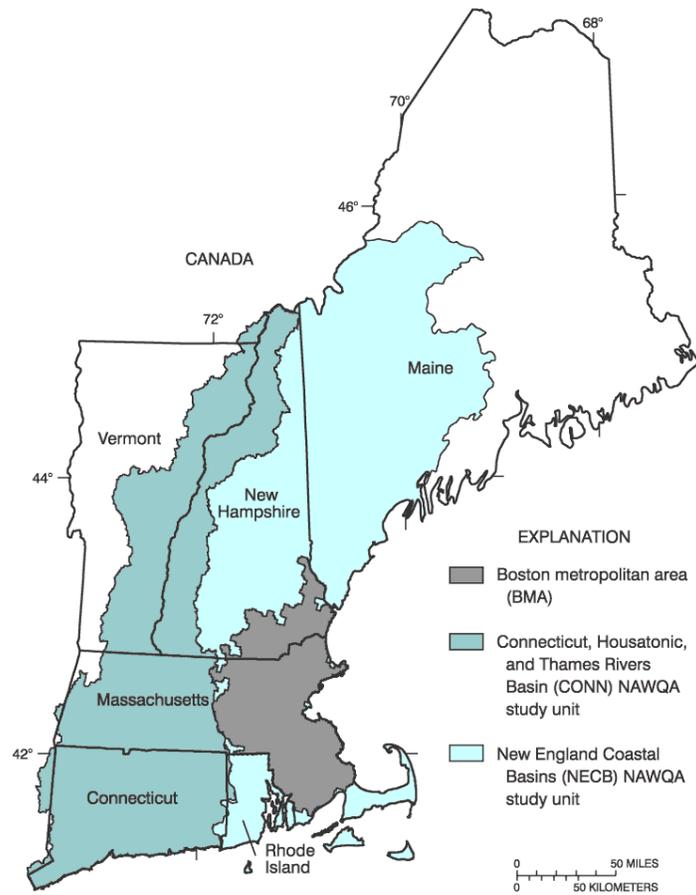


Figure 1. Location of the Boston metropolitan study area (BMA) and its relation to the NAWQA Connecticut, Housatonic, and Thames River Basins (CONN), and the New England Coastal Basins (NECB) study areas.