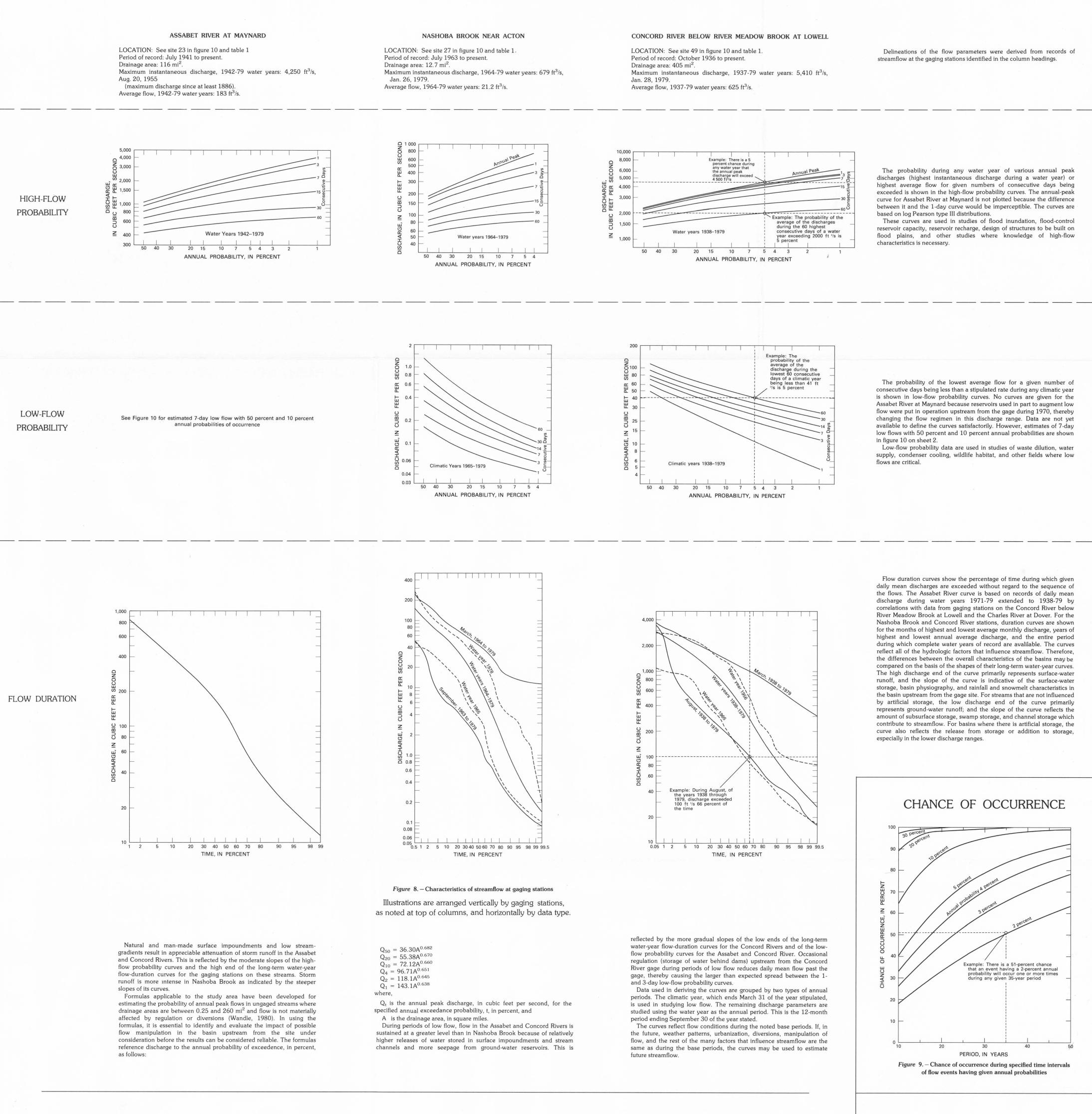
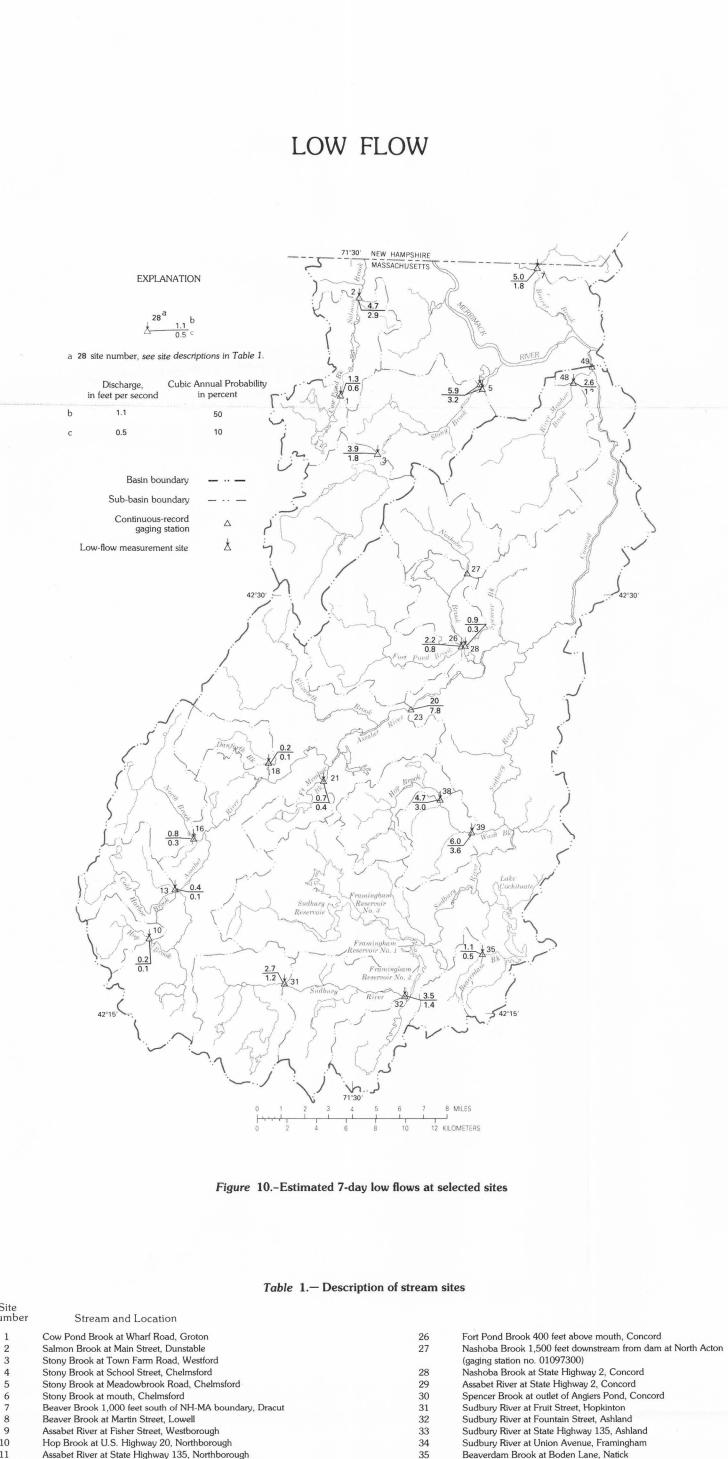
DEPARTMENT OF THE INTERIOR U.S. GEOLOGICAL SURVEY BOSTON, MASSACHUSETTS WATER USE SOURCES AND TRENDS INTRODUCTION **Ground Water** Hachured areas denote by public supply systems Metropolitan Commission HIGH-FLOW **PROBABILITY** Figure 3.—Water use during 1976 EXPLANATION 5 5 0 5 KILOMETERS Report Area 0 10 20 30 40 50 MILES 0 10 20 30 40 50 KILOMETERS Average water use in the study area in 1976 was 56 Mgal/d (million gallons per day). Of this, 82 percent was supplied from the study area by Basin boundary withdrawals of surface water (35 percent) and ground water (47 percent). Interbasin transfer of water by the MDC (Metroplitan District Hachured areas denote Commission) accounted for the remaining 18 percent. Withdrawals for water withdrawn and distributed by public supply systems Figure 1.—Location of study area areas not served by public supply systems were estimated on the basis of a per capita use rate of 60 gal/d (gallons per day). This self-supplied water amounts to 8 percent of the total water use. Figure 4.-Water use in major drainage basins In response to needs for additional water supplies and for accurate water data to plan developments and management of the water resources of Massachusetts, the U.S. Geological Survey, in cooperation with the Commonwealth of Massachusetts Water Resources Commission, is The quantity of water withdrawn in (or transferred to) individual preparing a series of reports describing the water resources of the drainage basins is related to the degree of industrial development and the onwealth. The study area includes the Sudbury, Assabet, and population. Framingham, in the Sudbury River basin, and Lowell, in the Concord River basins (SuAsCo River basin) and the Massachusetts part Merrimack River basin, are the major industrial and population centers. of the Merrimack River tributary basins from Salmon Brook to the Together they account for 37 percent of the 1976 water use. Water-use confluence of the Concord and Merrimack Rivers. The Assabet River data were obtained from municipal water departments. heads in Westborough and flows generally northeastward to Concord, where it joins the Sudbury River to form the Concord River. The Sudbury River heads in Westborough, flows eastward to Framingham, then northward to its confluence with the Assabet River. The Concord River LOW-FLOW flows northward to Lowell, where it empties into the Merrimack River. **PROBABILITY** Population and water use have increased during the past several ----- Population decades, and data for two dissimilar communities are presented in the above graph as examples. Wayland is predominantly a residential town, whereas Framingham has a high degree of industrial and commercial development. In Wayland, population and water use have remained relatively constant during the last decade. During this period, the population of Framingham has also remained fairly constant, but water use has continued to increase, because of continued industrial and commercial development. Figure 5.—Water use and population trends MDC SYSTEM IN UPPER SUDBURY RIVER BASIN FLOW DURATION Into basin 🛊 🛊 Into basin <1 ft 3/s Lines of equal mean annual precipitation Interval 2 inches Sudbury 0 ft 3/s Reservoir Figure 2. – Distribution of precipitation 80 ft ³/s 13 ft ³/s Framingham | Framingham | Average precipitation on the study area is 42 inches per year, of which about half evaporates or transpires. Part of the remainder travels overland directly to streams and, during or immediately after storm periods, makes up a large part of the increased streamflow. However, most of the water not evaporated or transpired percolates through the ground to the water table and then moves to streams, where it becomes the major component of annual streamflow (runoff). Ground-water runoff may be as much as two-thirds of the average annual runoff and, in ANNUAL PROBABILITY, IN PERCENT 0 ft ³/s Out of unregulated streams, is commonly the sole supply for streamflow during Figure 7. - Probability of high flows in the Sudbury River low-flow periods. at Framingham Reservoir Number 1 outlet Figure 2 is based on a map of normal precipitation (base period, 1941-2 Wachusett-Marlborough Tunnel 70) in New England (except Maine) compiled by Robert E. Lautzenheiser, Massachusetts State Climatologist, dated June 13, 1975. Figure 6.—Average flow through Metropolitan District Commission water system during 1979 The high-flow frequency curves (fig. 7) were derived from MDC data of daily a releases to the Sudbury River during water years 1965-79. Daily release data for climatic years 1965-79 were used to obtain 1and 7-day low-flow figures at the 50 and 10 percent annual probability levels. Each of these four parameters is 2 .3 ft³/s. The MDC (Metropolitan District Commission) regulates flow from the For explanations of high-flow frequency curves and low-flow upper 75 square miles of the Sudbury River basin at the outlet of probability, see the extreme right column in figure 8. Framingham Reservoir Number 1 in Framingham (fig. 6). The northern section of this subbasin is part of the MDC water system. Water from Wachusett Reservoir, in the Nashua River basin, is conveyed into or through the subbasin by aquaducts for use in communities in the study area or in Greater Boston. At times, the transfer water from Wachusett Reservoir is supplemented by runoff in the subbasin. Flow rates in figure 6 were calculated from data supplied by the MDC



SURFACE WATER

FLOW CHARACTERISTICS AT GAGING STATIONS



Assabet River at East Main Street, Northborough

Assabet River at Boundary Street, Marlborough

Assabet River at U.S. Highway 290, Marlborough

North Brook at Whitney Street Berlin

Assabet River at Chapin Road, Hudson

Danforth Brook at Cox Street, Hudson

Assabet River at Main Street, Hudson

Assabet River at Pine Street, Concord

(gaging station no. 01097000

Assabet River at Gleasondale Road, Stow

Fort Meadow Brook at Chestnut Street, Hudson

Elizabeth Brook at Gleasondale Road, Stow

Cold Harbor Brook 100 feet below Howard Brook, Northborough

Assabet River 150 feet upstream from State Highway 27, Maynard

Assabet River at State Highway 62, 1,600 feet northeast of High Street, Acton

Cochituate Brook at Old Connecticut Path, Framingham

Sudbury River at Fuller Street, Framingham

Sudbury River at U.S. Highway 20, Wayland

Sudbury River at State Highway 62, Concord

Concord River at State Highway 225, Bedford

Concord River at Monument Street, Concord

Concord River at River Street, Billerica

Concord River at Pollard Street, Billerica

Concord River at Lawrence Street, Lowell

(gaging station no. 01099500)

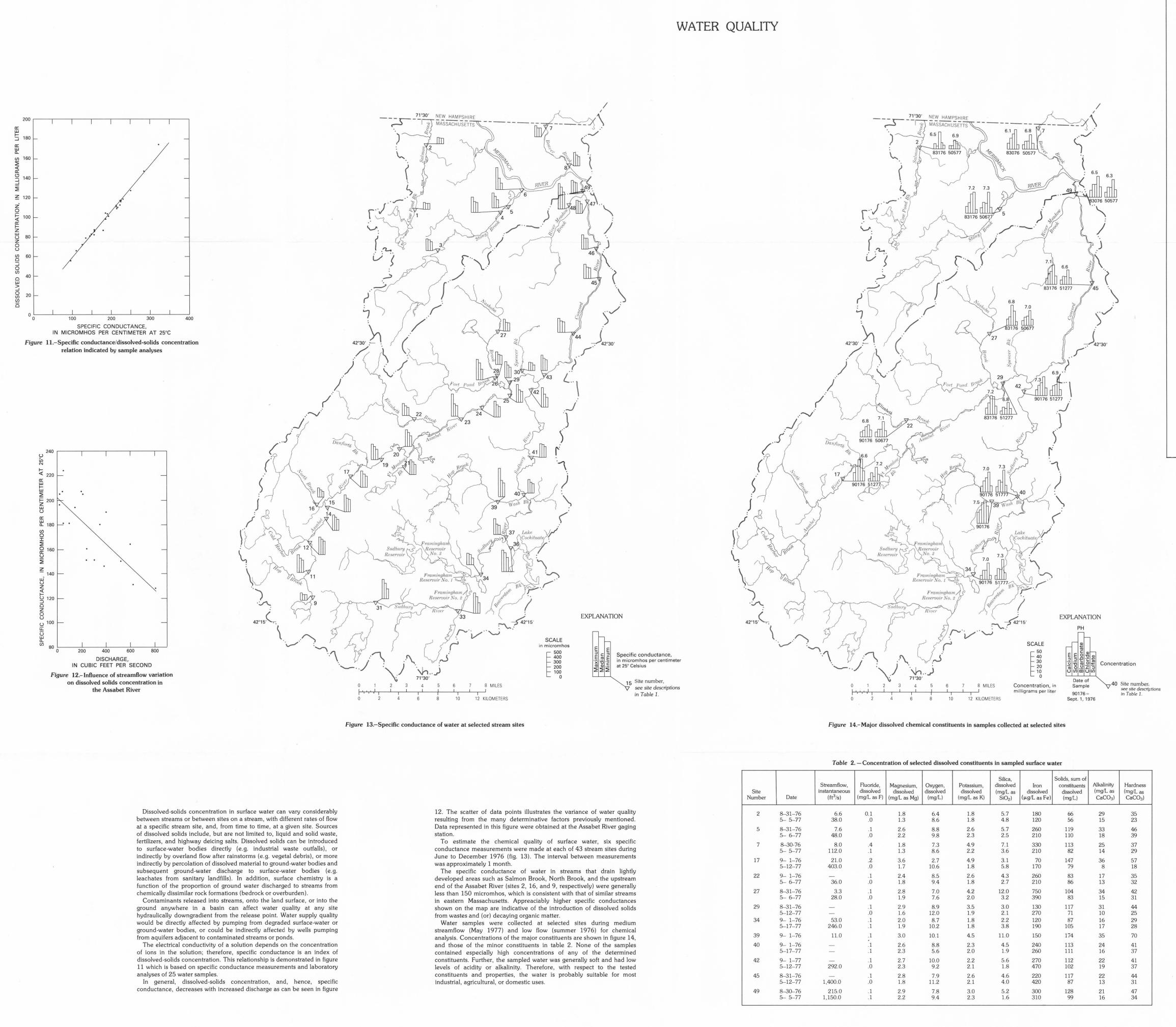
River Meadow Brook at Plain Street, Lowell

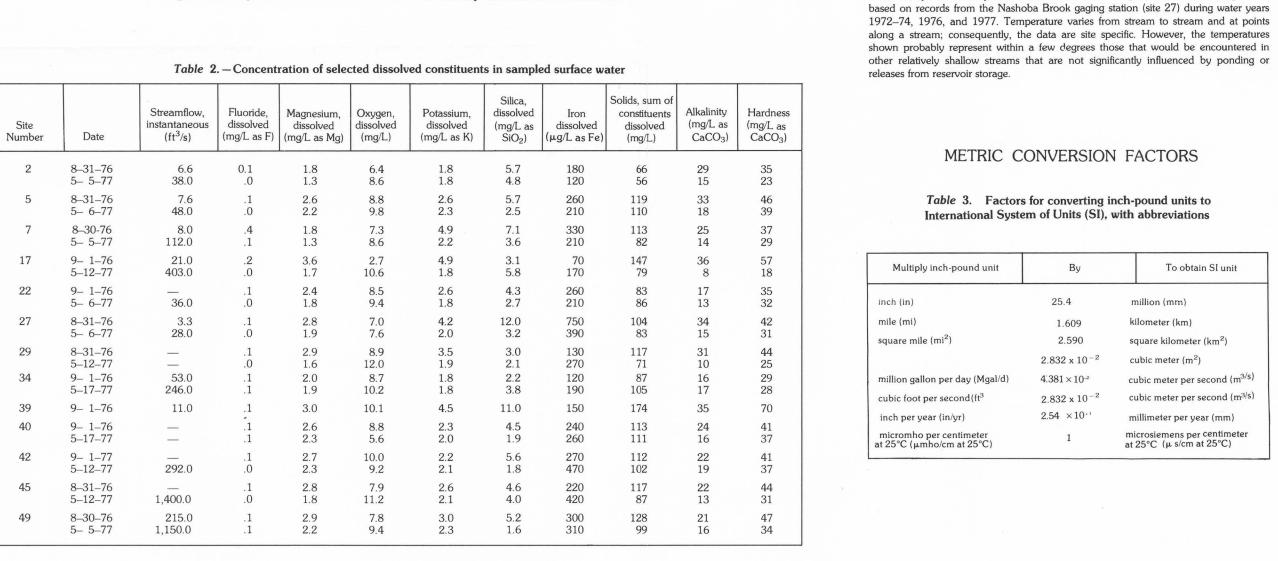
Concord River 300 feet downstream from Rogers Street, Lowell

Sudbury River at Sherman Bridge Road, Wayland

Hop Brook at Peakham Road. Sudbury

Wash Brook at Landham Road Sudbury





METRIC CONVERSION FACTORS Table 3. Factors for converting inch-pound units to International System of Units (SI), with abbreviations Multiply inch-pound unit To obtain SI unit kilometer (km) 1.609 square kilometer (km²) cubic meter (m2) 2.832×10^{-2} million gallon per day (Mgal/d) cubic meter per second (m^{3/s} cubic meter per second (m^{3/s}) cubic foot per second(ft³ 2.832×10^{-2} $2.54 \times 10^{+1}$ inch per year (in/yr) millimeter per year (mm) microsiemens per centimete at 25°C (μ s/cm at 25°C) micromho per centimeter at 25°C (μ mho/cm at 25°C

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Figure 15.-Monthly variation of water temperature

at the Nashoba Brook gaging station

An example of monthly variation in surface-water temperature is shown in figure 15,

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EXPLANATION

Median monthly maximum

Median monthly minimum

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HYDROLOGY AND WATER RESOURCES OF TRIBUTARY BASINS TO THE MERRIMACK RIVER FROM SALMON BROOK TO THE CONCORD RIVER, MASSACHUSETTS

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