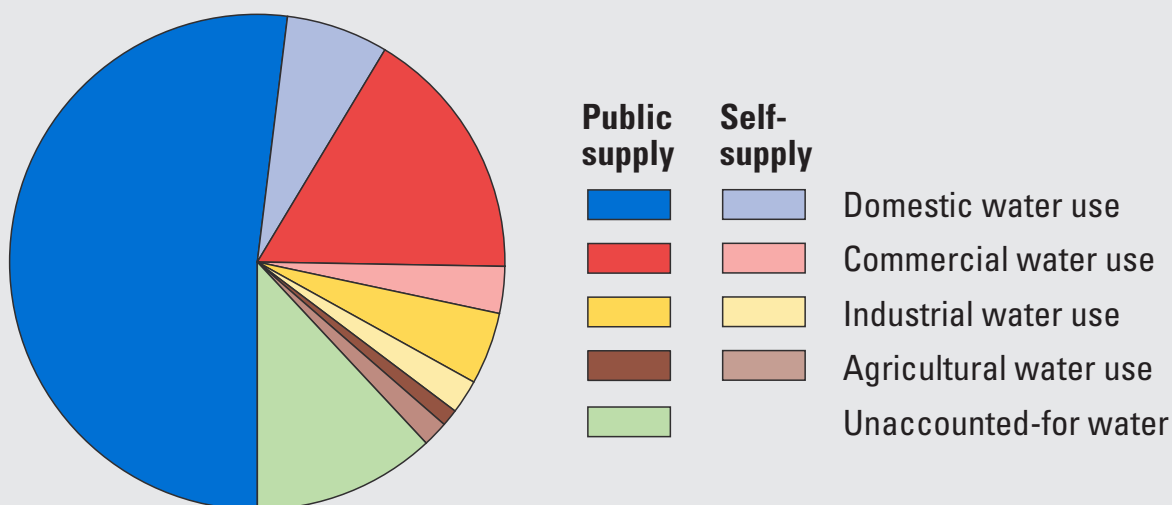


Prepared in cooperation with the
Massachusetts Department of Environmental Protection

Water Withdrawals, Use, and Wastewater Return Flows in the Concord River Basin, Eastern Massachusetts, 1996–2000



Scientific Investigations Report 2008–5158

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By Lora K. Barlow¹, Linda M. Hutchins², and Leslie A. DeSimone¹

¹ U.S. Geological Survey

² Massachusetts Department of Conservation and Recreation

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Conversion Factors, Datums, and Abbreviations

Multiply	By	To obtain
Length		
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
Area		
acre	0.004047	square kilometer (km ²)
square mile (mi ²)	2.590	square kilometer (km ²)
Volume		
gallon (gal)	0.003785	cubic meter (m ³)
million gallons (Mgal)	3,785	cubic meter (m ³)
Flow rate		
cubic foot per second (ft ³ /s)	0.02832	cubic meter per second (m ³ /s)
gallon per day (gal/d)	0.003785	cubic meter per day (m ³ /d)
million gallons per day (Mgal/d)	3,785	cubic meter per day (m ³ /d)
million gallons per year (Mgal/yr)	3,785	cubic meter per year (m ³ /yr)
million gallons per day per square mile [(Mgal/d)/mi ²]	1,461	cubic meter per day per square kilometer [(m ³ /d)/km ²]
million gallons per year per square mile [(Mgal/yr)/mi ²]	1,461	cubic meter per year per square kilometer [(m ³ /yr)/km ²]
inch per year per foot [(in/yr)/ft]	83.33	millimeter per year per meter [(mm/yr)/m]

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$^{\circ}\text{C}=(^{\circ}\text{F}-32)/1.8$$

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Altitude, as used in this report, refers to distance above the vertical datum.

GIS	Geographic information system
MADEP	Massachusetts Department of Environmental Protection
MWRA	Massachusetts Water Resources Authority
PCS	Permit Compliance System
NPDES	National Pollutant Discharge Elimination System
SIC	Standard industrial classification
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WMA	Massachusetts Water Management Act
WWTF	Wastewater treatment facility

Water Withdrawals, Use, and Wastewater Return Flows in the Concord River Basin, Eastern Massachusetts, 1996–2000

By Lora K. Barlow¹, Linda M. Hutchins², and Leslie A. DeSimone¹

Abstract

Water withdrawals, use, and wastewater return flows for the Concord River Basin were estimated for the period 1996–2000. The study area in eastern Massachusetts is 400 square miles in area and includes the basins of two major tributaries, the Assabet and Sudbury Rivers, along with the Concord River, which starts at the confluence of the two tributaries. About 400,000 people lived in the basin during the study period, on the basis of an analysis of census data, land use, and population density. Public water systems served an estimated 87 percent of the people in the basin, and public wastewater systems served an estimated 65 percent of the basin population. The estimates of water withdrawals, use, wastewater return flows, and imports and exports for the Concord River Basin and 25 subbasins provide information that can be used in hydrologic analyses such as water budgets and can guide water-resources allocations for human and environmental needs.

Withdrawals in the basin were estimated at 12,700 million gallons per year (Mgal/yr) during the study period, of which 10,100 Mgal/yr (about 80 percent) were withdrawn by public water-supply systems and 2,650 Mgal/yr were self-supplied by individual users. Water use in the basin and subbasins was estimated by using water withdrawals, average per capita use rates (about 72 gallons per day per person), land-use data, estimated population densities, and other information. Total water use in the basin, which included imports, was 19,200 Mgal/yr and was provided mostly (86.2 percent) by public supply. Domestic use (11,300 Mgal/yr) was the largest component, accounting for about 60 percent of total water use in the basin. Commercial use (3,770 Mgal/yr), industrial use (1,330 Mgal/yr), and agricultural use (including golf-course irrigation; 562 Mgal/yr) accounted for 19.6, 6.9, and 2.9 percent, respectively, of total use. Water that was unaccounted for in public-supply systems was estimated at 2,260 Mgal/yr, or 11.8 percent of total water use in the basin. Wastewater return flows discharged in the basin were

estimated at 11,800 Mgal/yr, of which 6,620 Mgal/yr were discharged from municipal wastewater-treatment facilities to surface waters and 5,190 Mgal/yr were self-disposed through septic systems to ground water; wastewater disposed through septic systems was generated by both public- and self-supply use.

Water use and management in the Concord River Basin resulted in an estimated import of 6,460 Mgal/yr of potable water for public supply and an estimated export of 6,590 Mgal/yr of wastewater. Water was imported into the Assabet, Sudbury, and Lower Concord (the area draining directly to the Concord River) River Basins for public supply. Wastewater was imported into the Assabet River Basin, but exported from the Sudbury and Lower Concord River Basins. Of the 25 subbasins in the Concord River Basin for which water use was analyzed, 20 subbasins imported potable water, 4 subbasins exported potable water (Fort Meadow Brook, Indian Brook, Lower Sudbury River, and Whitehall Brook), and potable water was neither imported nor exported in one subbasin (Elizabeth Brook). Wastewater was imported into the Assabet Headwaters, Assabet Main Stem, and Hop Brook subbasins; wastewater was neither imported to nor exported from the Elizabeth Brook, Nashoba Brook, and Pine Brook subbasins; and wastewater was exported from all other subbasins. Water use and management in the basin also resulted in a net transfer of water from ground water to surface water, discharged as wastewater, of about 4,000 Mgal/yr.

Introduction

Water resources in Massachusetts face increased and competing demands. Accurate information on water-use patterns in the Commonwealth aids in the optimal allocation of water resources for both human and environmental needs. For these reasons, the U.S. Geological Survey (USGS), in cooperation with the Massachusetts Department of Environmental Protection (MADEP), collected and analyzed water-use data for one of the Commonwealth's major river basins, the Concord River Basin. This effort, a case study, was intended to

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investigate the available information and its use in describing spatial and temporal patterns of water use. Available water-use data, including data on water withdrawals and wastewater return flows, was collected from MADEP, the U.S. Environmental Protection Agency (USEPA), water suppliers, and other sources, and was evaluated at the basin and subbasin scales.

Water use by people results in inflows to and outflows from ground- and surface-water-flow systems and can be important components of the overall water cycle in a basin. Water withdrawals for public supply, agriculture, and other uses are outflows from aquifers and streams. Ground water that seeps into sewer pipes also is an outflow from the ground-water flow system. Wastewater discharges, from treatment facilities or on-site septic systems, are inflows to surface waters or ground water. Although outflows from withdrawals and inflows from wastewater return flows may approximately balance within a large basin, the locations of these outflows and inflows often are distant from each other; thus, within subbasins, withdrawals and wastewater return flows often represent net inflows or outflows from the ground-water and surface-water flow systems. These water inflows and outflows can be quantified with water-use data and are integral components of basin water budgets, whether such budgets are based on a simple conceptual understanding or a complex numerical basin model.

Purpose and Scope

This report presents water-use data for the Concord River Basin in eastern Massachusetts from 1996 through 2000, including water withdrawals and purchases, public- and self-supply water use by category (domestic, commercial, industrial, agricultural, unaccounted-for, and consumptive), and wastewater return flows at National Pollutant Discharge Elimination System (NPDES) surface-water-discharge sites and at on-site septic systems. Imports and exports, calculated for the study area as a whole from withdrawals, use, and return flows, of potable water and wastewater are discussed. Finally, limitations of the data sources and analysis methods are discussed. Components of the complete water budget for the basin that are not associated with water use, such as evapotranspiration, recharge, and ground-water discharge to streams, were not quantified as part of this study.

Previous Investigations

Previous investigations in the Sudbury, Assabet, and Concord River Basins were done by the USGS and many others. USGS investigations include hydrologic atlases, water-availability estimates, and hydrologic models (Pollock and others, 1969; Brackley and Hansen, 1985; Bratton and Parker, 1995; and DeSimone, 2004). Continuous-record streamflow data for several long-term USGS streamflow-gaging stations in the Concord River Basin are available (Socolow and others,

2003). Streamflow and other hydrologic data for the Assabet River and its tributaries also were collected for a study of total maximum daily loads, in support of a surface-water model of the basin (ENSR International, 2001, 2004). Streamflow requirements for the protection of aquatic habitat were assessed by Parker and others (2004) at six sites in the basin. Information on current conditions of water use and disposal for the communities that discharge wastewater to the river (Hudson, Marlborough, Maynard, Northborough, Shrewsbury, and Westborough) is available in the Comprehensive Wastewater Management Plans for these towns (DeSimone, 2004). Information is also available from numerous studies completed to locate water-supply sources, determine wellhead-protection areas for public-supply wells, investigate ground-water contamination, or support specific development projects (DeSimone, 2004).

Description of the Study Area

The study area is composed of areas draining to the Sudbury, Assabet, and Concord Rivers in eastern Massachusetts, a combined area of about 400 mi², referred to in this report as the Concord River Basin. Mean annual streamflow from the basin is about 650 ft³/s (421 Mgal/d, the mean annual flow at gaging station 01099500, 1937–2005). The portion of the basin that drains directly to the Concord River, which is formed at the confluence of the Sudbury and Assabet Rivers in the town of Concord, is referred to as the Lower Concord River Basin (fig. 1). The Sudbury River Basin composes 162 mi², the Assabet River Basin 177 mi², and the Lower Concord River Basin 60 mi²—44, 41, and 15 percent, respectively—of the total Concord River Basin area. The Assabet River originates at a large flood-control dam and impoundment (the A1 Impoundment) at its headwaters in Westborough. It flows northeastward about 31 mi to its confluence with the Sudbury River. The headwaters of the Sudbury River are also in Westborough in an area known as Cedar Swamp. The Sudbury River flows east and north about 32 mi to the confluence with the Assabet River. Impoundments are common on both rivers and also on some tributaries; the impoundments, some of which extend for several miles, are used for water supply (for example, the Westborough Reservoir, fig. 1), recreation, and flood control or are unused remnants of former industry. The Concord River Basin is divided into 25 subbasins in this study (fig. 1). The subbasins were delineated by the Massachusetts Department of Conservation and Recreation and include 10 in the Assabet River Basin, 13 in the Sudbury River Basin, and 2 in the lower Concord River Basin.

Topography in the Concord River Basin ranges from gently rolling to hilly, with elevations ranging from about 100 to 750 ft. Higher elevations and steeper slopes are generally along the northwestern boundaries of the basin. Hills in the western part of the basin are elongate in the northeast-southwest direction, parallel to regional geologic features (Zen

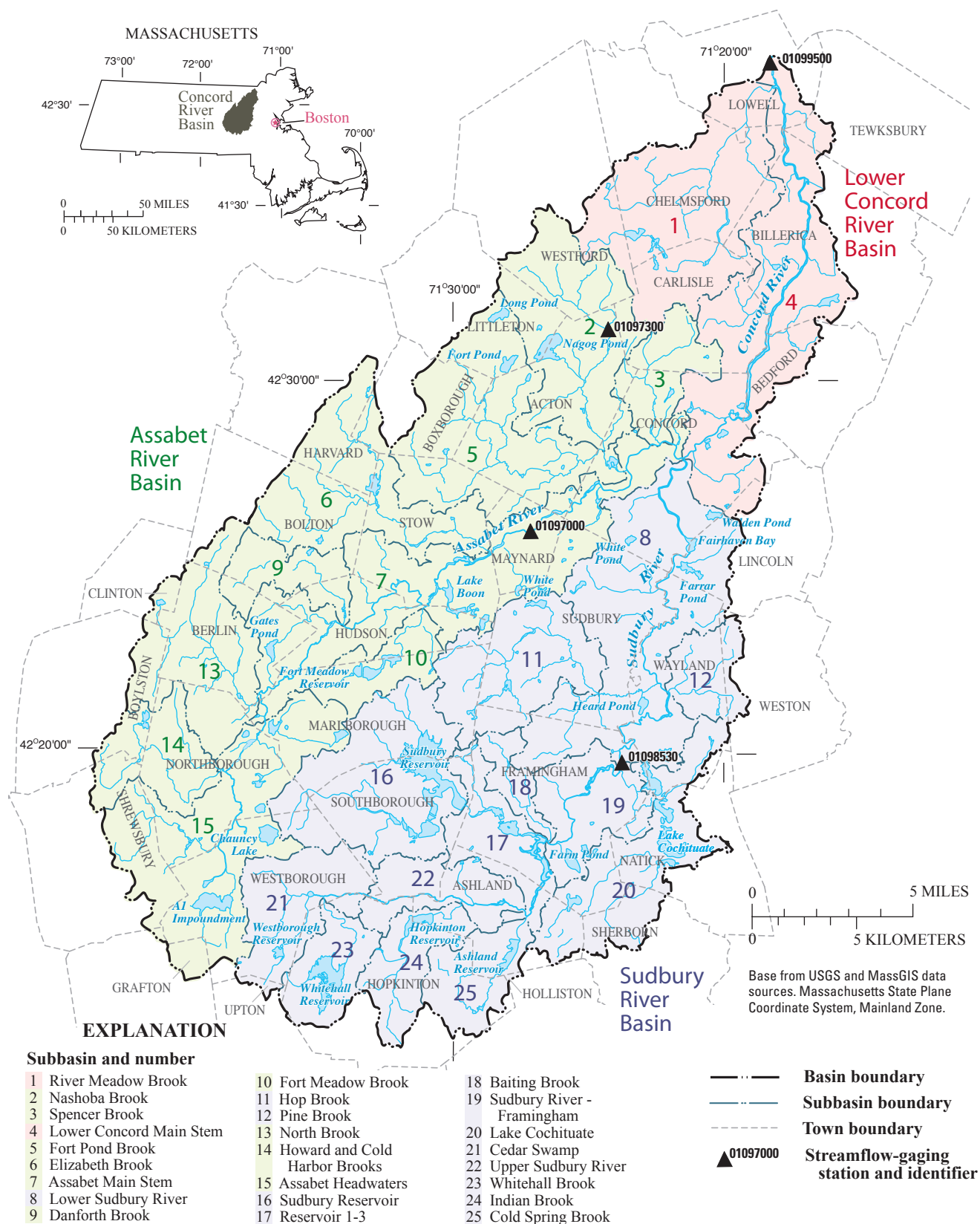


Figure 1. Location, subbasins, and towns of the Concord River Basin in eastern Massachusetts.

and others, 1983). There are three major geologic units in the Concord River Basin—glacial stratified deposits, glacial till, and the underlying bedrock. The glacial stratified deposits are discontinuous but form the most productive aquifers in the basin; bedrock aquifers also are used for water supply.

The Concord River Basin climate is, in general, humid and temperate. The average annual rainfall for the basin was about 44 in/yr, according to records for periods of least 25 years from five nearby weather stations in Berlin, Concord, Marlborough, Maynard, and Natick (BER510, CON704, MAR512, MAY516, and NATNWS; Massachusetts Department of Conservation and Recreation, 2007). Temperature averages about 48 °F, ranging from 25 °F in January to 71 °F in July, on the basis of long-term (1892–2002) data from a weather station at Worcester, MA (National Weather Service, 2003). Precipitation is nearly normally distributed throughout the year, and ranges from an average monthly low of 3.2 in. in February to a high of 4.1 in. in November.

The study period of 1996–2000 was overall slightly wetter than average, on the basis of a comparison of precipitation and streamflow with long-term conditions. Cumulative precipitation graphs for each of the study years 1996–2000 and the calculated normal precipitation are presented in figure 2. The long-term precipitation values are averages of period-of-record monthly averages for the five nearby weather stations described previously (BER510, CON704, MAR512, MAY516, and NATNWS; Massachusetts Department of Conservation and Recreation, 2007). For the 5-year period of study, the average annual rainfall for the five stations was 48.7 in., which is about 5 in. (11 percent) greater than the historical average. Annual rainfall was above average in 1996, 1998, and 2000 and was below average in 1997 and 1999. The lowest annual rainfall, 38.3 in., occurred in 1997, and the highest annual rainfall, 61.1 in., occurred in 1996. For the 5-year study period, the average monthly rainfall for the five weather stations ranged from 2.73 in. in August to 4.88 in. in October. The lowest rainfall amounts occurred in April and June 1999 (1.04 and 0.75 in., respectively). Rainfall amounts were relatively high during several months of the study period: October 1996 with 8.93 in., June 1998 with 10.9 in., and September 1999 with 9.84 in. The high rainfall volumes in September 1999 were associated with two tropical storms, Dennis and Floyd. Mean annual streamflows for 1996 through 2000 at

streamflow-gaging stations in the basin on the Assabet, Sudbury, and Concord Rivers (stations 01099500, 01097000, and 01098530; fig. 1) were 5 to 18 percent greater than long-term (period-of-record) average flows (Socolow and others, 1997, 1998, 1999, 2000, 2001). These differences were consistent with the above average precipitation that occurred during 1996 through 2000. Within the 5-year period, mean annual streamflows at all stations were near or above long-term average flows in each year except for 1999. In 1999, which was a relatively dry year (especially in the first half of the year), average annual streamflows at the stations were 24 to 44 percent below long-term average flows.

The Concord River Basin includes all or parts of 35 towns and cities (hereafter, “towns”; fig. 1; Holliston, with 0.5 percent of its land area in the basin, is not included in this study). Population density ranged from about 200 to more than 2,000 people per square mile in 2000 (U.S. Census Bureau, 2003). There were seven towns within the Concord River Basin with populations greater than 30,000, including Billerica, Chelmsford, Framingham, Lowell, Marlborough, Natick, and Shrewsbury. Densely developed areas were clustered along the main-stem Assabet and Sudbury Rivers and near the northeastern boundary of the basin. The most rapidly growing towns, however, were in the headwaters and along the northwestern upland parts of the basin; these towns included Bolton, Boxborough, Shrewsbury, Westborough, and Westford (fig. 1). Population increased in these towns by 27 to 46 percent between 1990 and 2000 (U.S. Census Bureau, 2003).

Land use in the Concord River Basin in 1999 (fig. 3) was predominately forest (44 percent) and residential (31 percent, table 1; MassGIS, 2001). Other land uses in the basin were agriculture (7.0 percent, includes 0.8 percent golf), wetland (3.6 percent), water (3.3 percent), industrial (2.5 percent), commercial (2.3 percent), transportation (1.7 percent), and other uses (5.1 percent). Land use varied widely among towns in the basin—from 34 to 66 percent for forest; from 13 to 39 percent for residential land use and from less than 1 to 14 percent for commercial, industrial, or agricultural land uses. Land use in the three major basins of the Concord River Basin varied only slightly, with the Assabet River Basin having a higher percentage of forested land use and lower percentage of residential land than the lower Concord and Sudbury River Basins (table 1).

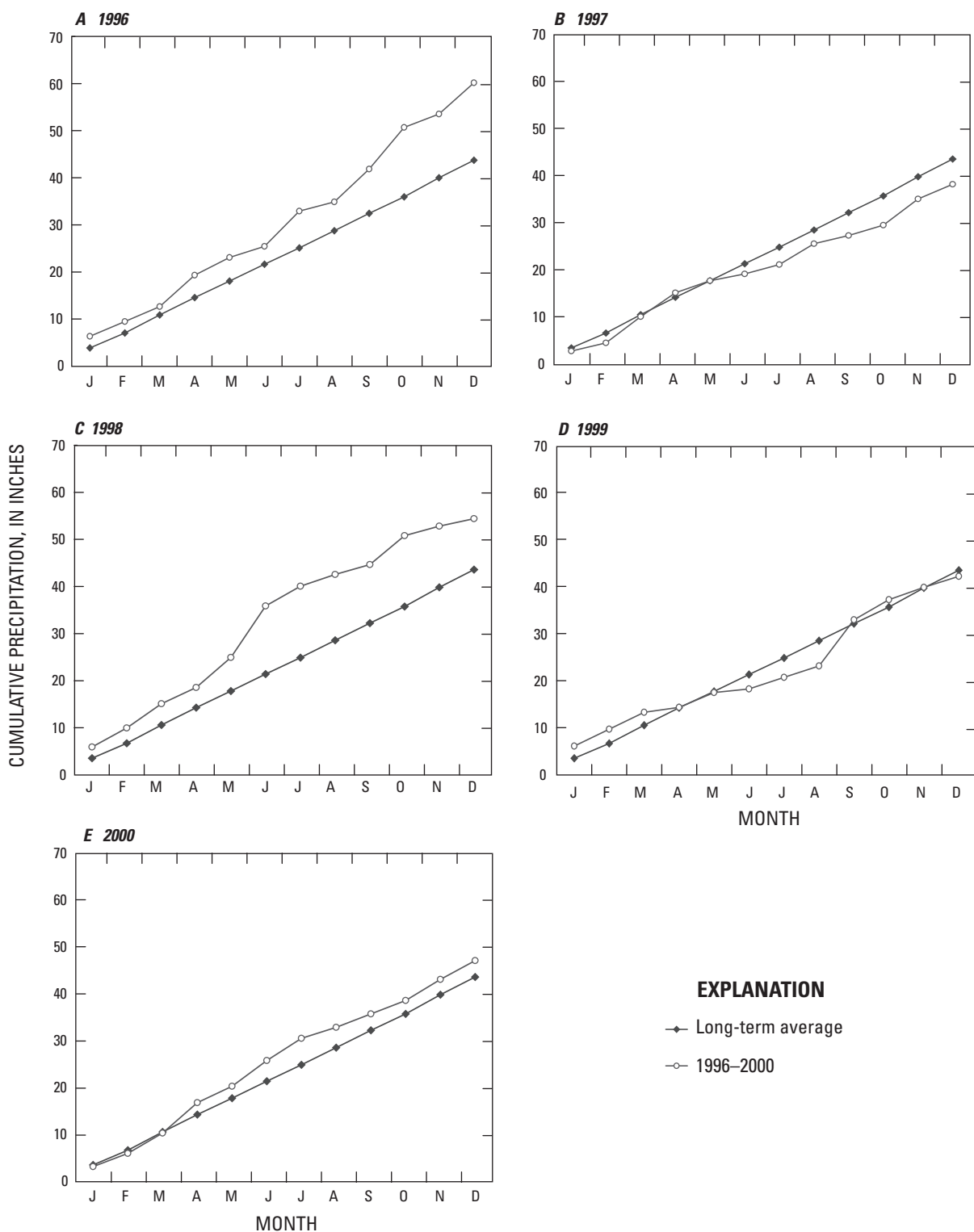


Figure 2. Long-term average and 1996–2000 cumulative monthly precipitation at weather stations in and near the Concord River Basin in eastern Massachusetts. Long-term averages are averages of period-of-record monthly averages for five nearby weather stations in Berlin, Concord, Marlborough, Maynard, and Natick, with records of at least 25 years (stations BER510, CON704, MAR512, MAY516, NATNWS; Massachusetts Department of Conservation and Recreation, 2007).

Table 1. Land use in the Concord River Basin in eastern Massachusetts.

[Land use data from MassGIS (2001). Detailed category names and codes (in parentheses) are attributes from the MassGIS 37-category land-use data layer]

Land use		Area (square miles)				Percentage of area			
Category	Detailed category name and code	Concord River Basin	Tributary Basins			Concord River Basin	Tributary Basins		
			Assabet River Basin	Sudbury River Basin	Lower Concord River Basin		Assabet River Basin	Sudbury River Basin	Lower Concord River Basin
Agriculture and golf	Cropland (1), pasture (2), golf (26)	28.1	14.5	10.18	3.94	7.0	8.1	6.3	6.5
Commercial	Commercial (15)	9.39	3.21	4.95	1.23	2.3	1.8	3.1	2.0
Forest	Forest (3)	175	87.0	65.6	22.6	44	49	40	37
Industrial	Industrial (16)	9.83	3.70	3.77	2.35	2.5	2.1	2.3	3.9
Residential	Residential (10,11,12,13)	123	48.1	53.08	21.6	31	27	33	36
Transportation	Transportation (18), transportation facilities (32)	6.76	2.47	2.72	1.57	1.7	1.4	1.7	2.6
Water	Water (20)	13.3	4.52	7.24	1.56	3.3	2.5	4.5	2.6
Wetland	Wetland (4)	14.4	5.65	6.26	2.49	3.6	3.2	3.9	4.1
Other	Mining (5), open land (6), participation, spectator, and water-based recreation (7,8,9), marina (29), urban public (31), cemeteries (34)	20.6	8.6	8.6	2.95	5.1	4.8	5.3	4.9
Total		400	178	162	60.3	100	100	100	100

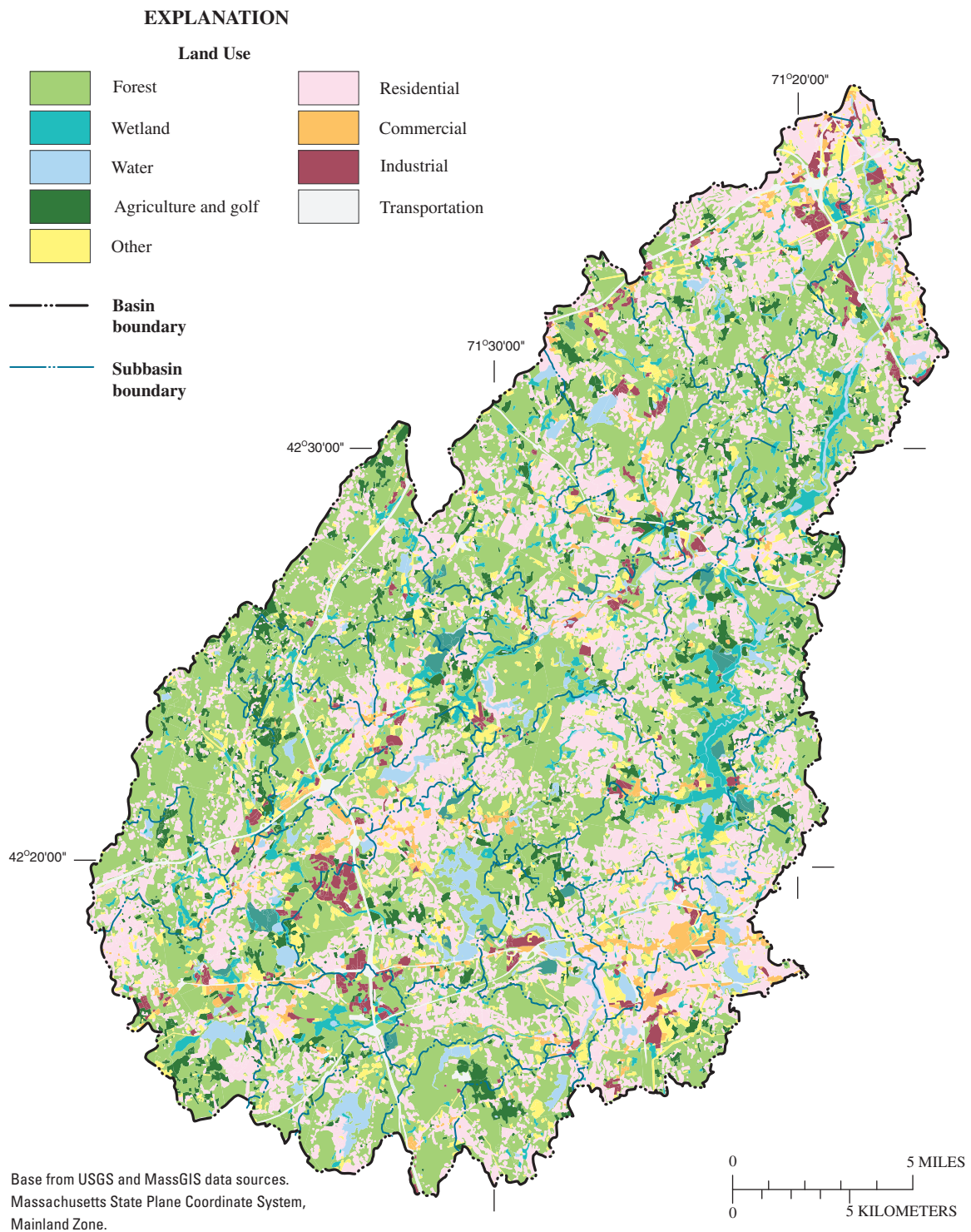


Figure 3. Land use in the Concord River Basin in eastern Massachusetts.

Water-Use Terms

Many terms are used in this report to describe components and aspects of water use. Definitions for use of the terms in this report are given in this section; the definitions are based on Solley and others (1998) and Maupin and Barber (2005) and on other sources where indicated. The term **water withdrawal** refers to the amount of water that is pumped or otherwise removed from an aquifer, stream, pond, or reservoir. Water-supply **sources** are the wells, well fields, streams, ponds, or reservoirs from which the water is withdrawn. Water withdrawals are made by public water-supply systems or by individual users. **Public water-supply systems** (or public-supply systems) withdraw water from sources and deliver it to users. Public water-supply systems may be publicly owned (**municipal community systems**) or privately owned (nonmunicipal). Nonmunicipal public water-supply systems may serve residential communities (**nonmunicipal community systems**), such as housing developments or condominiums, or they may serve nonresidents in settings such as schools and restaurants (**nonmunicipal noncommunity systems**). The common characteristic of public water-supply systems is that they serve at least 25 people or have at least 15 service connections (U.S. Environmental Protection Agency, 2007). Water withdrawals made by individual users (or systems that serve less than 25 people or have less than 15 connections) are called **self-supply** water withdrawals.

Water use, where it is quantified in this report, refers to the amount of water that is actually used for specific purposes, such as agricultural irrigation. **Water use** can also be used more generally to refer to all aspects of people's interaction with the hydrologic system, as in the heading of this section of this report. **Domestic or residential water use** is water used in households for purposes such as drinking, cooking, bathing, toilets, washing clothes and dishes, and outdoor watering. **Commercial water use** is water used in office buildings, hotels, restaurants, stores, institutions, and other commercial facilities. **Industrial water use** is water used for industrial purposes such as manufacturing, processing, washing, and cooling. **Agricultural water use** is water used for irrigating crops, for other activities involved with plant and animal production, and for maintaining vegetation for recreation in areas such as parks and golf courses. Some water that is withdrawn by public water systems is lost or used during the distribution process without a record of the volumes used, such as for fire-fighting or water-main flushing; this is called **unaccounted-for use**. Water use for all purposes may be supplied by public water-supply systems or may be self-supplied by individual users. In a specific area such as a basin or town, total or public-supply water use may differ from total or public-supply water withdrawals because of water distribution that crosses basin or town boundaries or because of unaccounted-for water. Self-supply water withdrawals and water use are typically equivalent, because there is usually no distribution and use is at the site of the withdrawal.

Water may be used consumptively or nonconsumptively. **Consumptive water use** is irrevocable water loss due to consumption by people or animals, transpiration by plants, evaporation, or incorporation into plants or products (Solley and others, 1998). Consumptive water use may be only a small fraction of the total for some water uses. Water that is used but not consumed is returned to the hydrologic system as **wastewater return flows**. **Public-disposed wastewater** is wastewater that is collected through wastewater-collection systems or sewers, treated at a facility, and discharged to a receiving water such as a river, estuary, or aquifer. Sewers also collect ground water or surface-water runoff that enters the sewer pipes; this water, called **infiltration and inflow**, mixes with the wastewater and is treated and disposed of with the wastewater. Public disposal of wastewater often results in the transfer of water from one basin or subbasin to another. **Privately or self-disposed wastewater** is wastewater that is disposed of by the user, typically on or near the site where it was generated. Self-disposed wastewater is usually discharged through septic systems (though it sometimes is discharged to surface waters) and is rarely transferred between basins.

The terms used in this report for entities making water withdrawals are slightly different from those used by suppliers and others to report withdrawals to the MADEP in Public Water Supply Annual Statistical Reports (henceforth referred to as “annual reports”), which are based on USEPA classifications of public water-supply systems. The public water-supply class, “community” (COM) corresponds to the two terms used in this report, “municipal community (MC)” and “nonmunicipal community (NMC)” public water systems. (The MADEP annual reports do not distinguish between publicly and privately owned public water systems). The two public water-supply classes “non-transient, noncommunity” (NTNC) and “transient noncommunity” (TNC) together correspond to the term used in this report, “nonmunicipal noncommunity (NMNC)” public water systems. The term, “self-supply”, as used in this report, refers to withdrawals by users themselves. Self-supply withdrawals fall into two groups: withdrawals greater than 100,000 gal/d that are regulated under the Massachusetts Water Management Act (WMA) and other, smaller withdrawals by private well owners, typically to serve only single households. Large public-supply withdrawals (municipal and nonmunicipal) also are regulated under the WMA; these are included in this report as public -supply withdrawals.

Population Estimates for Water Withdrawals, Use, and Wastewater Return Flows

The populations in the Concord River Basin and its subbasins were estimated from U.S. Census Bureau data and land-use data. Population densities were estimated for the residential land-use categories, described below, so that popu-

lations could be estimated for any subbasin or portion thereof by using the spatially distributed land-use data. This analysis, along with information on the areal extent of public water-supply and wastewater-collection systems, also was used to estimate populations on public supply (municipal community systems) and public disposal of wastewater, by town and by subbasin. These populations were needed to determine several components of water use and management in the study area.

Land-use data consisted of four categories of residential land use, as defined in the 1999 MassGIS land-use data layer (MassGIS, 2001): multifamily, high density (lot sizes less than 0.25 acre), medium density (lot sizes from 0.25 to 0.5 acre), and low density (lot sizes greater than 0.5 acre). Each of these categories was initially assigned an average household density based on lot size, as follows: 8 households per acre for multifamily, 5 households per acre for high density, 3 households per acre for medium density, and 0.75 households per acre for low density. These initial household densities were then adjusted for each town so that the total town population, calculated as the product of the household density assigned to each land-use category, the average number of people per household in each town in 2000 (U.S. Census Bureau, 2008), and the area of the each land-use category in each town, matched the reported town population in 2000. Median household densities obtained with this procedure were 16.1 people per acre for multifamily, 10.9 people per acre for high-density, 6.56 people per acre for medium-density residential, and 1.64 people per acre for low-density residential. The adjusted (estimated) population densities for each town are given in table 2. The adjusted population densities and areas of each residential land-use category in each town in the study area were used to calculate the populations in the entire Concord River Basin and in subbasins; the areas of many towns were only partially in the basin (table 3).

Data obtained from towns on public-supply water-distribution systems and publicly disposed wastewater-collection (sewer) systems were compiled into digital data layers for the basin (fig. 4). Available data for the distribution and sewer systems differed among towns and included spatially referenced, digital geographic information system (GIS) data, paper maps that were digitized for this study or for another recent study (DeSimone, 2004), or large-scale sectional engineering maps. Areas of residential land use with water-distribution and sewer systems were identified by overlaying (in GIS) the compiled digital data layer of distribution- and sewer-system lines in the basin (fig. 4) with digital data layers of land-use areas. Areas of low-density, medium-density, high-density, and multifamily residential land use that were identified as being served by public water and sewer in each town were then multiplied by the appropriate population density for the town to calculate estimated populations on municipal community public supply and public disposal in each subbasin and town. Populations estimated by this GIS-based method as being served by municipal community systems were compared to public-supply populations reported by municipal community suppli-

ers. In most cases, the differences were less than 10 percent of the reported populations. The GIS-based method was used to ensure consistent data quality for all towns and the consistency of the methods used to estimate public- and self-supply populations.

Populations served by nonmunicipal community public water systems were obtained directly from the year 2000 annual reports submitted by suppliers to MADEP. These populations were assumed to reside entirely within the same subbasin as the withdrawals for the systems.

The total population in the Concord River Basin in 2000 was about 400,000 people; this number was based on the estimated population densities for the four residential land-use categories and land use within the basin (table 3). The most highly populated subbasin was the Sudbury River - Framingham subbasin with an estimated population density of 4.67 people/acre or 2,987 people/mi², or 7.5 percent of the basin population in 2.5 percent of the basin area (table 4 and fig. 5). Parts of Natick and Framingham, relatively large towns, were in this subbasin. The least populated subbasin was the Elizabeth Brook subbasin (0.42 people/acre or 270 people/mi²), with 1.4 percent of the basin population in 5.1 percent of the basin area. Overall, population density in the basin averaged about 1.56 people/acre (998 people/mi²).

Municipal community public-supply systems were estimated to serve 87 percent of the total population in the Concord River Basin; nonmunicipal public-supply systems served 1 percent of the total basin population. Public wastewater systems were estimated to serve 65 percent of the total population in the basin (table 4 and fig. 5). Greater proportions of town and subbasins populations were served by public water and public wastewater systems in the eastern and central parts of the basin (figs. 4 and 5). Estimated populations served by municipal community public water and public wastewater systems differed considerably among subbasins, ranging from 0 to 99 percent for public supply and from 0 to 96 percent for public wastewater disposal overall (table 4 and fig. 5). More than 90 percent of the population was served by public water systems in 11 subbasins; these included both of the 2 subbasins in the Lower Concord River Basin, 8 of the 13 subbasins in the Sudbury River Basin, and 1 of the 10 subbasins in the Assabet River Basin (table 4, fig. 5B). About 50 percent or less of the population was served by public water systems in 3 subbasins in the Assabet River Basin. Subbasins with high percentages of the population served by public water systems typically also had high percentages of the population served by public wastewater systems. Public wastewater systems served about 80 percent or more of the population in both of the subbasins in the Lower Concord River Basin, 5 subbasins in the Sudbury River Basin, and 2 subbasins in the Assabet River Basin. Less than 50 percent of the population was served by public wastewater systems in 5 subbasins in the Assabet River Basin and 5 subbasins in the Sudbury River Basin (fig. 5B).

Table 2. Estimated population densities by town for four residential land-use categories in the Concord River Basin in eastern Massachusetts.

[U.S. Census data from U.S. Census Bureau (2003); --, land use not present in town or not applicable]

Town	U.S. Census data for year 2000		Estimated population densities by land use and town, in people per acre			
	Total town population	Average people per household	Multifamily residential	High-density residential	Medium-density residential	Low-density residential
Acton	20,331	2.69	17.4	10.8	6.51	1.63
Ashland	14,674	2.56	17.2	10.7	6.45	1.61
Bedford	12,595	2.60	14.3	8.97	5.38	1.34
Berlin	2,380	2.72	--	--	5.79	1.45
Billerica	38,981	2.92	15.0	9.38	5.63	1.41
Bolton	4,148	2.91	--	--	8.04	2.01
Boxborough	4,868	2.63	20.7	--	7.75	1.94
Boylston	4,008	2.55	14.1	8.79	5.27	1.32
Carlisle	4,717	2.92	18.0	--	--	1.68
Chelmsford	33,858	2.61	13.2	8.22	4.93	1.23
Clinton	13,435	2.38	21.3	13.3	7.99	2.00
Concord	16,993	2.62	15.2	9.52	5.71	1.43
Framingham	66,910	2.43	24.7	15.4	9.25	2.31
Grafton	14,894	2.54	19.4	12.1	7.27	1.82
Harvard	5,981	2.86	16.0	--	5.98	1.50
Hopkinton	13,346	2.97	15.7	9.82	5.89	1.47
Hudson	18,113	2.57	20.6	12.9	7.74	1.93
Lincoln	8,056	2.83	16.1	--	6.05	1.51
Littleton	8,184	2.72	--	10.7	6.41	1.60
Lowell	105,167	2.67	37.6	23.5	14.11	3.53
Marlborough	36,255	2.47	22.3	13.9	8.35	2.09
Maynard	10,433	2.43	19.5	12.2	7.32	1.83
Natick	32,170	2.42	18.7	11.7	7.01	1.75
Northborough	14,013	2.83	17.0	10.6	6.39	1.60
Sherborn	4,200	2.95	18.6	--	6.98	1.74
Shrewsbury	31,640	2.54	15.1	9.45	5.67	1.42
Southborough	8,781	2.97	13.0	8.12	4.87	1.22
Stow	5,902	2.82	14.3	8.97	5.38	1.35
Sudbury	16,841	3.02	11.9	7.42	4.45	1.11
Tewksbury	28,851	2.81	14.4	9.03	5.42	1.35
Upton	5,642	2.74	13.9	8.71	5.22	1.31
Wayland	13,100	2.80	16.1	--	6.04	1.51
Westborough	17,997	2.62	15.8	9.87	5.92	1.48
Westford	20,754	3.03	16.4	10.3	6.16	1.54
Weston	11,469	2.85	15.6	--	5.86	1.47
Average	--	2.71	17.5	10.9	6.56	1.64
Median	--	2.72	16.1	10.1	6.04	1.51

Table 3. Estimated population in towns in the Concord River Basin in eastern Massachusetts.

[Total population in 2000 from U.S. Census Bureau (2003); estimated population in basin was calculated from land-use data and estimated population densities; --, not applicable]

Town	Total population in 2000	Area		Estimated population in basin	
		Total, in square miles	Percentage in basin	Number of individuals	Percentage in basin
Acton	20,331	20.3	100	20,331	100
Ashland	14,674	12.9	95	13,368	91
Bedford	12,595	13.9	26	3,509	28
Berlin	2,380	13.2	100	2,380	100
Billerica	38,981	26.3	51	14,996	38
Bolton	4,148	20.1	72	2,613	63
Boxborough	4,868	10.4	66	3,604	74
Boylston	4,008	19.8	24	657	16
Carlisle	4,717	15.5	100	4,717	100
Chelmsford	33,858	23.1	65	20,078	59
Clinton	13,435	7.3	15	1,262	9
Concord	16,993	25.8	95	16,592	98
Framingham	66,910	26.5	100	66,910	100
Grafton	14,894	23.3	7	178	1
Harvard	5,981	27.1	22	1,621	27
Hopkinton	13,346	27.9	75	9,537	71
Hudson	18,113	11.9	100	18,113	100
Lincoln	8,056	15.0	27	1,776	22
Littleton	8,184	17.5	42	4,903	60
Lowell	105,167	14.5	33	34,474	33
Marlborough	36,255	22.0	100	36,255	100
Maynard	10,433	5.4	100	10,433	100
Natick	32,170	16.0	39	15,763	49
Northborough	14,013	18.7	100	14,013	100
Sherborn	4,200	16.1	20	651	16
Shrewsbury	31,640	21.7	37	12,642	40
Southborough	8,781	15.6	100	8,781	100
Stow	5,902	18.0	100	5,902	100
Sudbury	16,841	24.8	100	16,841	100
Tewksbury	28,851	21.1	5	1,541	5
Upton	5,642	21.8	3	23	0
Wayland	13,100	15.8	96	12,221	93
Westborough	17,997	21.4	98	17,676	98
Westford	20,754	31.4	34	4,465	22
Weston	11,469	17.3	9	414	4
Total	--	--	--	399,237	--

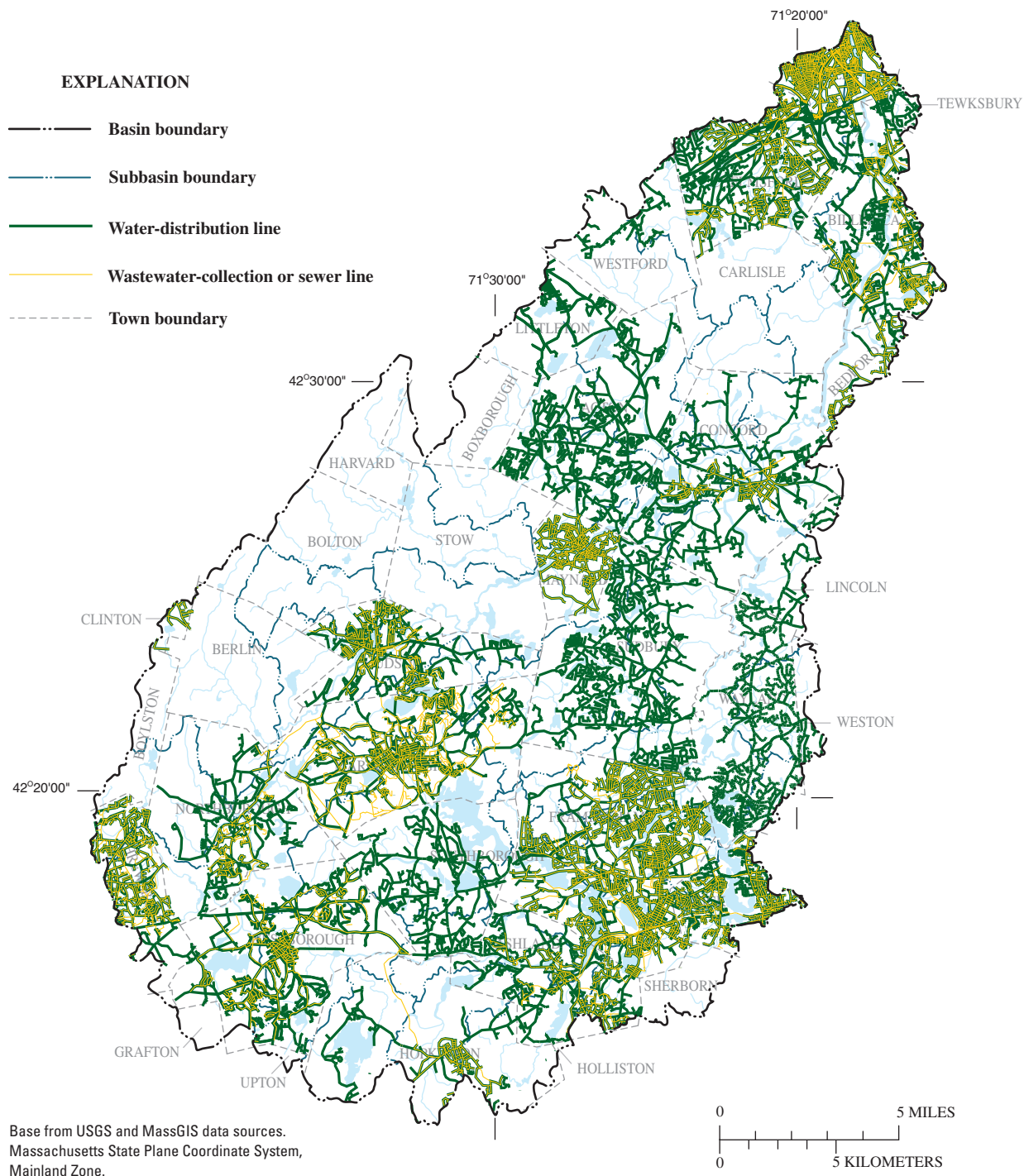


Figure 4. Public water-distribution and wastewater-collection systems in the Concord River Basin in eastern Massachusetts.

Table 4. Estimated total population and populations served by public water and wastewater systems by subbasin and town in the Concord River Basin in eastern Massachusetts.

[Populations on municipal community public supply and public wastewater were calculated from land-use data and estimated population densities; NAV, not metered, not reported, or otherwise unavailable; subbasin areas, in square miles (mi²), given in parentheses; the sum of the population numbers may not equal the total because of rounding; --, not applicable]

Town	Estimated population in basin	Public supply		Public wastewater disposal
		Municipal community	Nonmunicipal community	Number of individuals
		Number of individuals	Number of individuals	
Assabet River Basin				
Assabet Headwaters (29.6 mi²)				
Grafton	178	0	0	0
Marlborough	5,855	5,476	0	4,821
Northborough	8,765	7,562	0	5,876
Shrewsbury	9,220	8,855	0	8,498
Westborough	5,930	5,482	0	5,115
Subbasin total	29,947	27,375	0	24,311
Percent of subbasin total	--	91.4	0.0	81.2
Assabet Main Stem (33.7 mi²)				
Acton	215	200	0	0
Berlin	294	0	0	0
Bolton	274	0	0	0
Concord	6,196	6,158	0	3,610
Hudson	12,924	11,923	0	9,909
Marlborough	88	64	0	42
Maynard	8,880	8,709	0	8,709
Stow	2,677	0	220	0
Sudbury	2,361	2,301	0	1,626
Subbasin total	33,908	29,355	220	23,896
Percent of subbasin total	--	86.6	0.6	70.5
Danforth Brook (6.9 mi²)				
Berlin	157	0	0	0
Bolton	835	0	0	0
Hudson	3,061	2,732	0	2,562
Subbasin total	4,053	2,732	0	2,562
Percent of subbasin total	--	67.4	0.0	63.2
Elizabeth Brook (20.2 mi²)				
Bolton	1,290	0	0	0
Boxborough	262	0	856	0
Harvard	1,621	0	0	0
Stow	2,282	0	252	0
Subbasin total	5,456	0	1,108	0
Percent of subbasin total	--	0.0	20.3	0.0
Fort Meadow Brook (6.4 mi²)				
Hudson	1,957	1,547	0	1,315
Marlborough	8,153	6,954	0	6,979
Subbasin total	10,109	8,501	0	8,294
Percent of subbasin total	--	84.1	0.0	82.1

Table 4. Estimated total population and populations served by public water and wastewater systems by subbasin and town in the Concord River Basin in eastern Massachusetts.—Continued

[Populations on municipal community public supply and public wastewater were calculated from land-use data and estimated population densities; NAV, not metered, not reported, or otherwise unavailable; subbasin areas, in square miles (mi²), given in parentheses; the sum of the population numbers may not equal the total because of rounding; --, not applicable]

Town	Estimated population in basin	Public supply		Public wastewater disposal
		Municipal community	Nonmunicipal community	Number of individuals
		Number of individuals	Number of individuals	
Assabet River Basin				
Fort Pond Brook (25.7 mi²)				
Acton	11,793	10,956	0	0
Boxborough	3,342	0	609	0
Concord	1,203	1,135	0	699
Littleton	3,002	1,812	0	0
Maynard	1,553	1,542	0	1,542
Stow	943	0	750	0
Subbasin total	21,837	15,445	1,359	2,242
Percent of subbasin total	--	70.7	6.2	10.3
Howard and Cold Harbor Brooks (9.6 mi²)				
Berlin	3	0	0	0
Boylston	385	0	0	0
Northborough	2,923	1,956	0	821
Shrewsbury	3,422	3,317	0	3,353
Subbasin total	6,732	5,273	0	4,174
Percent of subbasin total	--	78.3	0.0	62.0
Nashoba Brook (21.0 mi²)				
Acton	8,193	7,526	982	0
Carlisle	232	0	0	0
Concord	147	134	0	0
Littleton	1,901	1,202	0	0
Westford	3,230	1,112	275	0
Subbasin total	13,702	9,973	1,257	0
Percent of subbasin total	--	72.8	9.2	0.0
North Brook (17.1 mi²)				
Berlin	1,925	0	48	0
Bolton	212	0	0	0
Boylston	272	0	0	0
Clinton	1,262	1,254	0	1,254
Northborough	2,325	1,800	0	0
Subbasin total	5,997	3,054	48	1,254
Percent of subbasin total	--	50.9	0.8	20.9
Spencer Brook (7.6 mi²)				
Acton	131	0	0	0
Carlisle	1,336	0	0	0
Concord	768	597	0	0
Subbasin total	2,235	597	0	0
Percent of subbasin total	--	26.7	0.0	0.0
Basin total	133,977	102,305	3,992	66,733
Percent of basin total	--	76.4	3.0	49.8

Table 4. Estimated total population and populations served by public water and wastewater systems by subbasin and town in the Concord River Basin in eastern Massachusetts.—Continued

[Populations on municipal community public supply and public wastewater were calculated from land-use data and estimated population densities; NAV, not metered, not reported, or otherwise unavailable; subbasin areas, in square miles (mi²), given in parentheses; the sum of the population numbers may not equal the total because of rounding; --, not applicable]

Town	Estimated population in basin	Public supply		Public wastewater disposal
		Municipal community	Nonmunicipal community	Number of individuals
		Number of individuals	Number of individuals	
Sudbury River Basin				
Baiting Brook (3.4 mi²)				
Framingham	4,904	4,733	0	4,429
Subbasin total	4,904	4,733	0	4,429
Percent of subbasin total	--	96.5	0.0	90.3
Cedar Swamp (11.9 mi²)				
Hopkinton	154	3	0	23
Southborough	3	3	0	0
Upton	21	0	0	0
Westborough	9,721	9,482	0	7,559
Subbasin total	9,900	9,488	0	7,582
Percent of subbasin total	--	95.8	0.0	76.6
Cold Spring Brook (8.0 mi²)				
Ashland	2,426	2,340	0	1,877
Hopkinton	3,623	2,307	0	1,867
Subbasin total	6,049	4,647	0	3,744
Percent of subbasin total	--	76.8	0.0	61.9
Hop Brook (15.7 mi²)				
Framingham	523	0	0	20
Hudson	172	24	0	0
Marlborough	3,123	2,029	0	1,207
Sudbury	8,559	8,196	0	0
Subbasin total	12,377	10,250	0	1,227
Percent of subbasin total	--	82.8	0.0	9.9
Indian Brook (7.9 mi²)				
Ashland	273	196	0	0
Hopkinton	3,277	2,605	0	2,655
Subbasin total	3,551	2,801	0	2,655
Percent of subbasin total	--	78.9	0.0	74.8
Lake Cochituate (17.6 mi²)				
Ashland	5,995	5,910	0	5,806
Framingham	12,008	11,878	0	11,811
Natick	15,355	14,624	0	14,111
Sherborn	651	0	0	0
Wayland	4,155	3,972	0	0
Subbasin total	38,164	36,383	0	31,728
Percent of subbasin total	--	95.3	0.0	83.1

Table 4. Estimated total population and populations served by public water and wastewater systems by subbasin and town in the Concord River Basin in eastern Massachusetts.—Continued

[Populations on municipal community public supply and public wastewater were calculated from land-use data and estimated population densities; NAV, not metered, not reported, or otherwise unavailable; subbasin areas, in square miles (mi²), given in parentheses; the sum of the population numbers may not equal the total because of rounding; --, not applicable]

Town	Estimated population in basin	Public supply		Public wastewater disposal
		Municipal community	Nonmunicipal community	Number of individuals
		Number of individuals	Number of individuals	
Sudbury River Basin				
Lower Sudbury River (35.0 mi²)				
Concord	4,374	4,161	0	2,540
Framingham	9,261	8,905	0	8,850
Lincoln	1,447	1,283	0	0
Sudbury	5,921	5,517	0	0
Wayland	5,073	4,897	0	0
Subbasin total	26,077	24,763	0	11,390
Percent of subbasin total	--	95.0	0.0	43.7
Pine Brook (5.8 mi²)				
Wayland	2,993	2,897	0	0
Weston	414	310	0	0
Subbasin total	3,407	3,207	0	0
Percent of subbasin total	--	94.1	0.0	0.0
Reservoir 1-3 (9.1 mi²)				
Ashland	1,610	1,549	0	1,424
Framingham	10,751	10,533	0	10,216
Marlborough	31	0	0	0
Southborough	643	329	0	0
Subbasin total	13,036	12,412	0	11,640
Percent of subbasin total	--	95.2	0.0	89.3
Sudbury River - Framingham (10.0 mi²)				
Framingham	29,462	29,070	0	28,276
Natick	408	403	0	403
Subbasin total	29,870	29,474	0	28,679
Percent of subbasin total	--	98.7	0.0	96.0
Sudbury Reservoir (22.5 mi²)				
Marlborough	19,005	14,949	0	15,989
Southborough	4,497	4,204	0	0
Westborough	1,937	1,627	0	1,180
Subbasin total	25,438	20,780	0	17,169
Percent of subbasin total	--	81.7	0.0	67.5
Upper Sudbury River (8.1 mi²)				
Ashland	3,064	3,019	0	2,717
Hopkinton	431	0	NAV	0
Southborough	3,638	3,423	0	0
Westborough	58	43	0	43
Subbasin total	7,190	6,485	NAV	2,760
Percent of subbasin total	--	90.2	NAV	38.4

Table 4. Estimated total population and populations served by public water and wastewater systems by subbasin and town in the Concord River Basin in eastern Massachusetts.—Continued

[Populations on municipal community public supply and public wastewater were calculated from land-use data and estimated population densities; NAV, not metered, not reported, or otherwise unavailable; subbasin areas, in square miles (mi²), given in parentheses; the sum of the population numbers may not equal the total because of rounding; --, not applicable]

Town	Estimated population in basin	Public supply		Public wastewater disposal
		Municipal community	Nonmunicipal community	Number of individuals
		Number of individuals	Number of individuals	
Sudbury River Basin				
Whitehall Brook (7.3 mi²)				
Hopkinton	2,052	1,318	0	90
Upton	2	0	0	0
Westborough	30	14	0	0
Subbasin total	2,084	1,332	0	90
Percent of subbasin total	--	63.9	0.0	4.3
Basin total	182,047	166,754	NAV	123,093
Percent of basin total	--	91.6	NAV	67.6
Lower Concord River Basin				
Lower Concord River Main Stem (32.7 mi²)				
Bedford	3,509	2,932	0	2,420
Billerica	14,435	14,171	0	12,573
Carlisle	1,689	0	0	0
Chelmsford	804	790	0	674
Concord	3,903	3,761	0	1,953
Lincoln	329	319	0	0
Lowell	16,909	16,682	0	16,682
Tewksbury	1,541	1,517	0	290
Subbasin total	43,118	40,172	0	34,592
Percent of subbasin total	--	93.2	0.0	80.2
River Meadow Brook (27.5 mi²)				
Billerica	561	515	0	406
Carlisle	1,460	0	0	0
Chelmsford	19,273	19,032	0	15,707
Lowell	17,565	17,571	0	17,571
Westford	1,235	705	0	16
Subbasin total	40,094	37,824	0	33,700
Percent of subbasin total	--	94.3	0.0	84.1
Basin total	83,212	77,996	0	68,292
Percent of basin total	--	93.7	0.0	82.1
Total Concord River Basin (400 mi²)				
Basin total	399,236	347,054	3,992	258,117
Percent of basin total	--	86.9	1.0	64.7

A Population densities

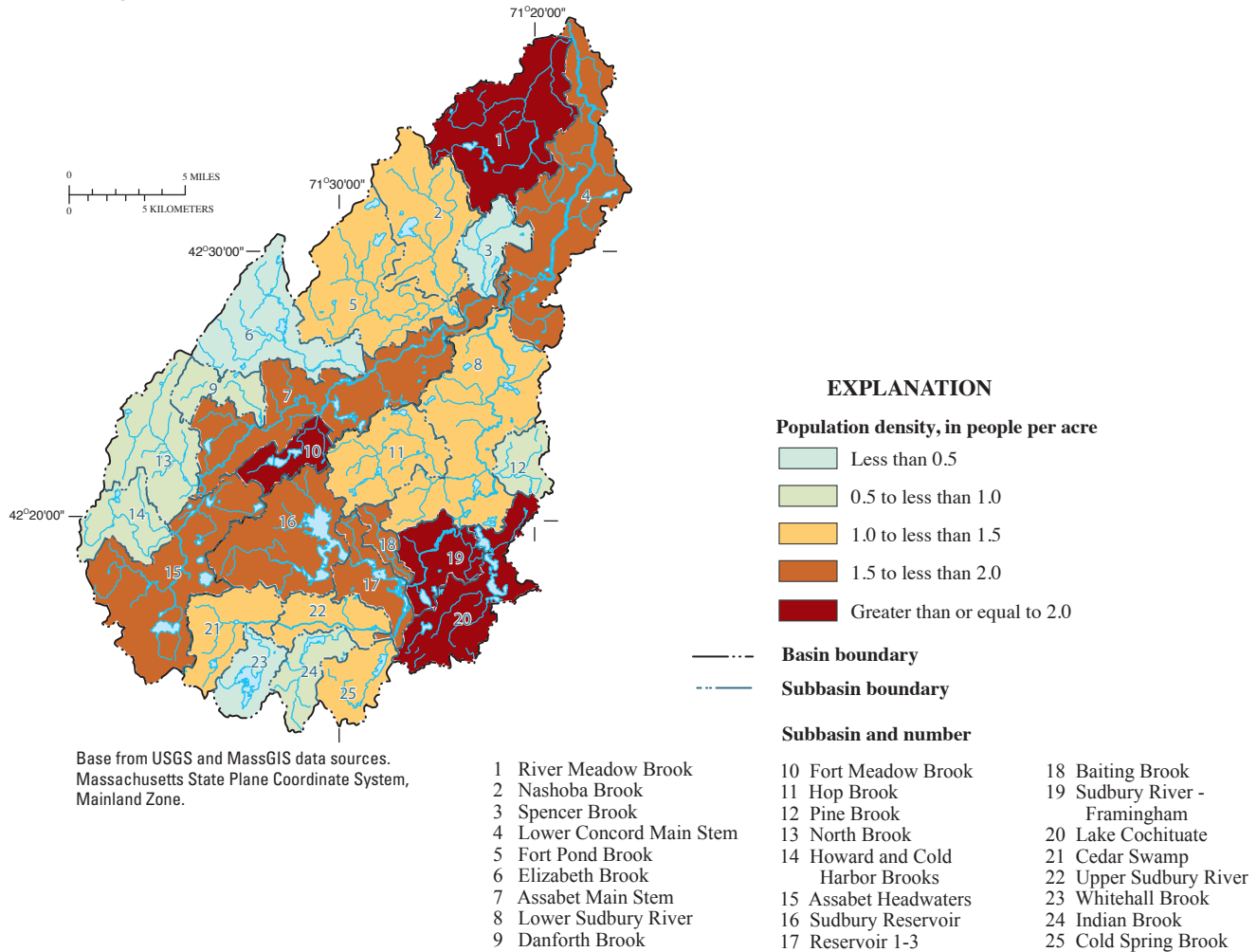
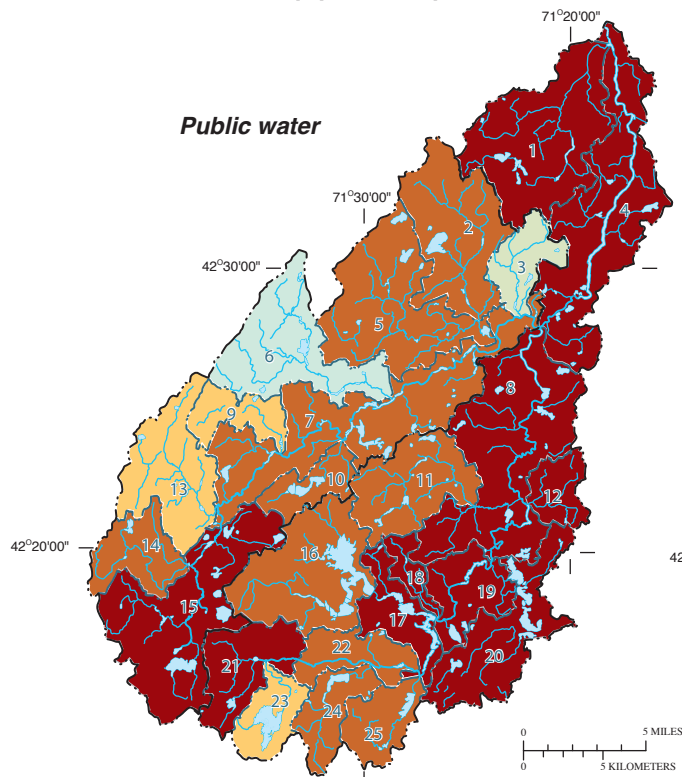
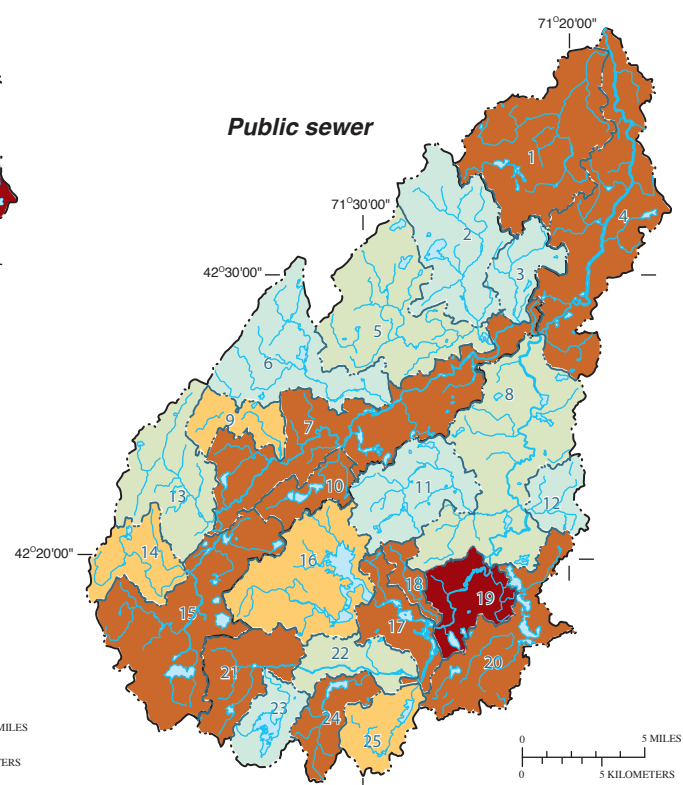


Figure 5. (A) Population densities and (B) percentages of total population on public water and wastewater systems in subbasins of the Concord River Basin in eastern Massachusetts.

Public water

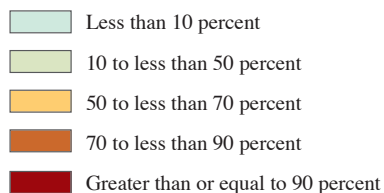


Base from USGS and MassGIS data sources.
Massachusetts State Plane Coordinate System,
Mainland Zone.

Public sewer

EXPLANATION

Percentage of population on public water or sewer



Basin boundary

Subbasin boundary

Subbasin and number

1 River Meadow Brook	10 Fort Meadow Brook	18 Baiting Brook
2 Nashoba Brook	11 Hop Brook	19 Sudbury River - Framingham
3 Spencer Brook	12 Pine Brook	20 Lake Cochituate
4 Lower Concord Main Stem	13 North Brook	21 Cedar Swamp
5 Fort Pond Brook	14 Howard and Cold Harbor Brooks	22 Upper Sudbury River
6 Elizabeth Brook	15 Assabet Headwaters	23 Whitehall Brook
7 Assabet Main Stem	16 Sudbury Reservoir	24 Indian Brook
8 Lower Sudbury River	17 Reservoir 1-3	25 Cold Spring Brook
9 Danforth Brook		

Figure 5. (A) Population densities and (B) percentages of total population on public water and wastewater systems in subbasins of the Concord River Basin in eastern Massachusetts.—Continued

Water Withdrawals and Use

Water withdrawals and use for public and self-supply were estimated for the Concord River Basin using various methods, that included volumes reported by suppliers, population estimates, and per capita use rates. Water use was estimated for domestic, commercial, industrial, and agricultural use categories. These estimates of water withdrawals and use, which were made for the entire Concord River Basin and its subbasins, allowed for estimates of imports and exports of water for public supply across basin and subbasin boundaries.

Water Withdrawals

Water withdrawals were estimated for the Concord River Basin and its subbasins by using information provided by water suppliers and reported to MADEP. The annual reports to MADEP by public water suppliers were the primary source of information on withdrawals; these reports list total monthly withdrawals for each source and for the entire system. Water withdrawals were determined for public water-supply systems, which are regulated as drinking-water sources, and for large commercial, industrial, and agricultural withdrawals other than public systems that are regulated by the Massachusetts WMA. Most information on water withdrawals for public-supply systems was obtained from the annual reports to MADEP by suppliers. These reports document monthly and annual withdrawals by system and by source, monthly and annual sales and purchases, the distribution of water withdrawals among use categories, and other information. Information on water withdrawals by users regulated by the WMA was obtained primarily from Registered and Permitted Withdrawals Annual Reports, which provide information similar to that provided by the public-supply annual reports, or directly from MADEP in digital form for annual withdrawals. Self-supply water withdrawals were considered equivalent to self-supply water use.

Seventeen municipal community public-supply systems withdrew water from the Concord River Basin during 1996–2000 for use in the towns and cities of Acton, Ashland, Billerica, Chelmsford, Concord, Hopkinton, Hudson, Lincoln, Marlborough, Maynard, Natick, Northborough, Shrewsbury, Sudbury, Wayland, and Westborough (table 5). Withdrawals by these municipal community water systems accounted for more than 98 percent of all withdrawals for public supply in the basin, on the basis of the 5-year average annual withdrawals for each type of system (table 5). The remaining withdrawals for public supply were made by nonmunicipal community systems, such as housing developments and condominiums (0.8 percent) and by nonmunicipal noncommunity systems, such as schools and restaurants (0.3 percent), although many of the latter were not metered.

Public-supply withdrawals for the basin between 1996 and 2000 averaged 10,100 Mgal/yr (27.7 Mgal/d) and ranged from 9,760 Mgal/yr in 2000 to 10,300 Mgal/yr in 1997 (table 5). These data were obtained from annual reports made

to the MADEP by suppliers. Withdrawals were calculated as the sums of reported monthly values for each source by system. For towns with sources outside of the Concord River Basin, only the sources within the basin were included. The years with the largest withdrawals, 1997 and 1999, were also the years with the lowest annual average precipitation during the 5-year period, although total withdrawals in 1997 and 1999 were only about 2 percent greater than the 5-year average. The Sudbury River Basin had the largest amount of public-supply withdrawals for the study period, 4,310 Mgal/yr (42.8 percent), followed by the Assabet River Basin at 3,480 Mgal/yr (34.6 percent), and the Lower Concord River Basin at 2,280 Mgal/yr (22.6 percent). Public-supply withdrawals in individual subbasins ranged from less than 0.01 percent in the Danforth Brook subbasin to 17.4 percent in the Lower Sudbury River subbasin of the total withdrawals for public supply in the Concord River Basin. Eight subbasins in the Concord River Basin had public-supply withdrawals of 5 percent or more of the total: the Assabet Headwaters, Assabet Main Stem, Fort Meadow Brook, Indian Brook, Lake Cochituate, Lower Sudbury River, Lower Concord Main Stem, and River Meadow Brook subbasins; withdrawals in these subbasins accounted for about 80 percent of the total withdrawals for public supply in the Concord River Basin.

Withdrawals by public-supply systems in the Concord River Basin were from ground and surface water. The greatest fraction of withdrawals was from ground-water sources, however, which supplied 72 percent of public-supply withdrawals overall and 71 percent of withdrawals by municipal community systems. The small fraction of public-supply withdrawals by nonmunicipal community systems and by nonmunicipal noncommunity systems was entirely from ground water. There were about 100 wells or well fields and 6 surface-water sources used for municipal and nonmunicipal community systems and at least 100 nonmunicipal noncommunity supply wells in the Concord River Basin (fig. 6). The surface-water sources were reservoirs or ponds in the Assabet Headwaters (554 Mgal/yr, Millham Reservoir), Assabet Main Stem (103 Mgal/yr, Gates and White Ponds), Nashoba Brook (154 Mgal/yr, Nagog Pond), Cedar Swamp (318 Mgal/yr, Sandra Pond, also known as Westborough Reservoir), and Lower Concord Main Stem (1,670 Mgal/yr, Concord River) subbasins. Surface-water withdrawals ranged from 13 to nearly 100 percent of public-supply withdrawals in these subbasins. The surface-water sources were used by municipal community systems for Billerica, Concord, Hudson, Maynard, Marlborough, and Westborough; however, only Billerica relied entirely upon surface water (the Concord River).

Withdrawals by public-supply systems varied seasonally. Monthly withdrawals, in millions of gallons per day, for all municipal and nonmunicipal community sources for which metered monthly withdrawal volumes were reported are given in appendix 1. Monthly withdrawal volumes typically were not reported by suppliers for nonmunicipal noncommunity sources. Withdrawals were generally larger for most systems in the summer months than in the winter months. In

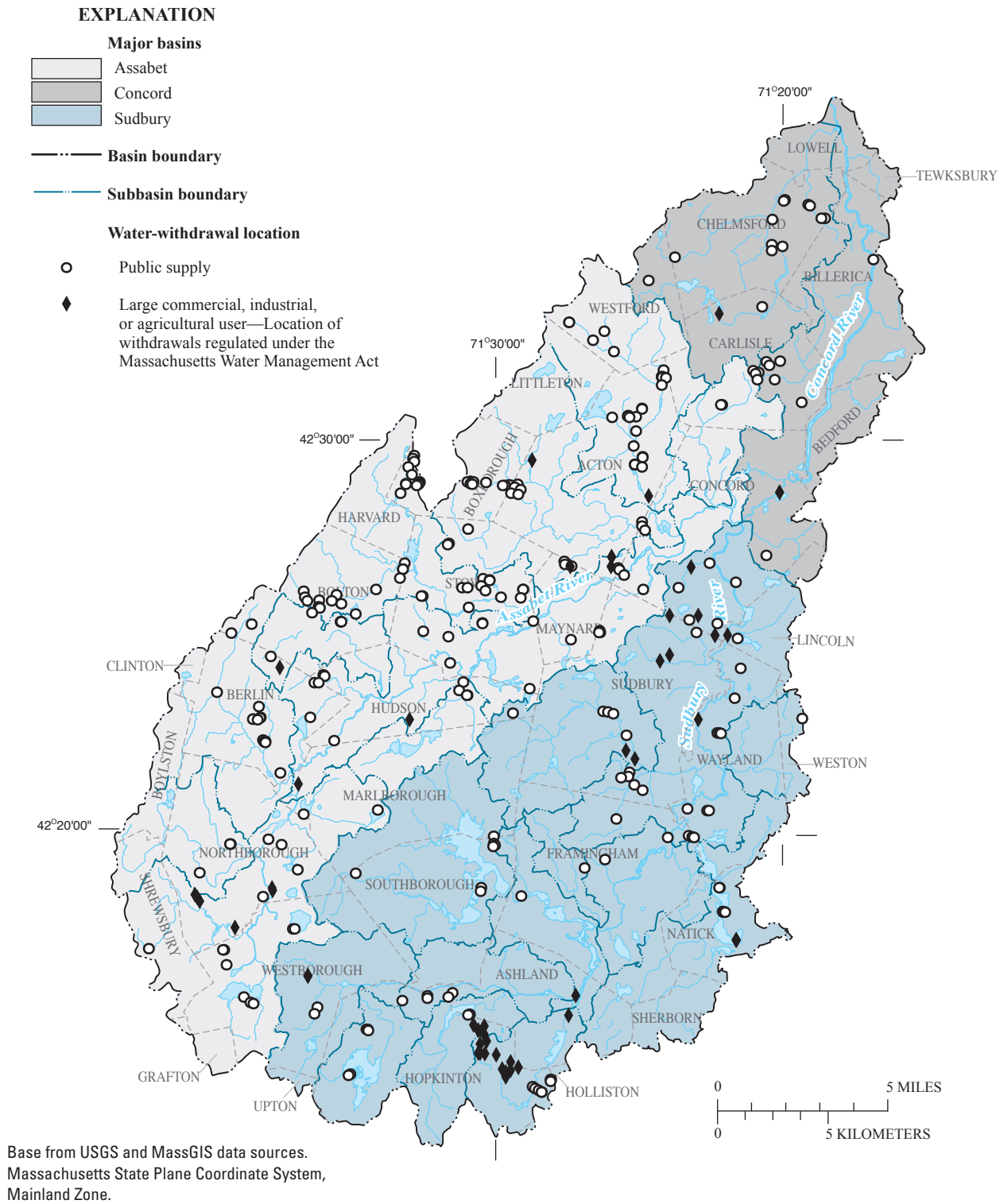


Figure 6. Water-withdrawal locations for public supply and large commercial, industrial, and agricultural users in the Concord River Basin in eastern Massachusetts.

Table 5. Annual average withdrawals for public-supply systems by subbasin in the Concord River Basin in eastern Massachusetts, 1996–2000.

[The sum of the withdrawal numbers may not equal the total because of rounding. Type: MC, municipal; NMC, nonmunicipal community; NMNC, noncommunity; NAV, not metered, not reported, or otherwise unavailable; --, not applicable; E, estimated]

Water supplier	Type	Town	Withdrawals for public supply, in million gallons per year						Percent of total withdrawals for public supply in the basin
			1996	1997	1998	1999	2000	5-year average	
Assabet River Basin									
Assabet Headwaters									
Marlborough Department of Public Works, Water Division	MC	Marlborough	552	627	647	463	480	554	5.5
Northborough Water Department	MC	Northborough	110	113	117	131	143	123	1.2
Shrewsbury Water Department	MC	Shrewsbury	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Westborough Water Department	MC	Westborough	323	351	451	540	471	427	4.2
Noncommunity public water systems	NMNC	Northborough, Westborough	NAV	NAV	NAV	NAV	NAV	--	--
Subbasin total	--	--	985	1,090	1,220	1,130	1,090	1,100	11.0
Assabet Main Stem									
Acton Water Supply District	MC	Acton	194	199	207	263	249	223	2.2
Concord Water Department	MC	Concord	158	237	218	228	188	206	2.0
Hudson Water Department	MC	Hudson	0.00	54.3	52.3	61.3	49.4	43.5	0.43
Juniper Hill Water Company	NMC	Stow	NAV	NAV	NAV	NAV	NAV	--	--
Maynard Department of Public Works	MC	Maynard	344	339	358	354	244	328	3.2
Shrewsbury Water Department	MC	Shrewsbury	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Noncommunity public water systems	NMNC	Berlin, Concord, Hudson, Stow	1.22	0.92	1.06	2.03	2.29	1.50	0.01
Subbasin total	--	--	698	830	836	909	732	801	7.9
Danforth Brook									
Noncommunity public water systems	NMNC	Berlin, Bolton	NAV	0.30	0.15	0.19	0.18	0.21	0.0
Subbasin total	--	--	NAV	0.30	0.15	0.19	0.18	0.21	0.0
Elizabeth Brook									
Codman Hill Condominiums	NMC	Boxborough	4.86	4.74	4.27	5.12	5.17	4.83	0.05
Harvard Ridge Condominiums	NMC	Boxborough	10.9 ^E	10.9 ^E	10.9 ^E	10.9 ^E	NAV	10.9	0.11
Pilot Grove Apartments	NMC	Stow	3.05	3.31	2.92	3.36	3.08	3.14	0.03
Plantation Apartments	NMC	Stow	1.60 ^E	1.67 ^E	1.64	1.71	1.38	1.60	0.02
Whitney Homestead Rest Home	NMC	Stow	0.23	0.23	0.10	0.07	0.07	0.14	0.00
Noncommunity public water systems	NMNC	Bolton, Boxborough, Stow	23.0	19.7	30.2	26.7	21.0	24.1	0.24
Subbasin total	--	--	43.7	40.6	50.1	47.9	30.7	44.8	0.44
Fort Meadow Brook									
Hudson Water Department	MC	Hudson	651	627	717	696	668	672	6.6
Subbasin total	--	--	651	627	717	696	668	672	6.6

Table 5. Annual average withdrawals for public-supply systems by subbasin in the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the withdrawal numbers may not equal the total because of rounding. Type: MC, municipal; NMC, nonmunicipal community; NMNC, noncommunity; NAV, not metered, not reported, or otherwise unavailable; --, not applicable; E, estimated]

Water supplier	Type	Town	Withdrawals for public supply, in million gallons per year						Percent of total withdrawals for public supply in the basin
			1996	1997	1998	1999	2000	5-year average	
Assabet River Basin									
Fort Pond Brook									
Acton Water Supply District	MC	Acton	248	262	255	211	220	239	2.4
Applewood Condominiums	NMC	Boxborough	6.51	6.74	6.61	5.33	6.54	6.35	0.06
Assabet Water Company/ Harvard Acres	NMC	Stow	25.5	29.1	28.7	23.8	23.4	26.1	0.26
Carriage House Condominiums	NMC	Boxborough	2.19 ^E	2.19 ^E	2.19 ^E	2.19 ^E	2.19 ^E	2.19	0.02
Centre Village Apartments	NMC	Boxborough	0.59	0.57	0.55	0.48	0.42	0.52	0.01
Liberty House Condominiums	NMC	Boxborough	0.77 ^E	0.77 ^E	0.77 ^E	0.77 ^E	0.77 ^E	0.77	0.01
Maynard Department of Public Works	MC	Maynard	0.00	0.00	0.00	0.00	97.4	19.5	0.19
Noncommunity public water systems	NMNC	Boxborough, Stow	0.25	0.77	1.28	1.18	0.99	0.89	0.01
Subbasin total	--	--	284	303	295	245	351	296	2.9
Howard and Cold Harbor Brooks									
Northborough Water Department	MC	Northborough	201	182	159	157	156	171	1.7
Subbasin total	--	--	201	182	159	157	156	171	1.7
Nashoba Brook									
Acton Water Supply District	MC	Acton	204	210	227	227	229	219	2.2
Concord Water Department	MC	Concord	267	111	214	168	12.7	154	1.5
Great Road Condominiums	NMC	Acton	NAV	NAV	NAV	NAV	NAV	--	--
Meadowbrook Condominiums	NMC	Acton	1.72 ^E	1.72 ^E	1.72 ^E	1.72 ^E	2.76	1.93	0.02
Pine Hill Condomniums	NMC	Acton	2.11	2.07	2.06	2.01	2.04	2.06	0.02
Richmond House Condominiums	NMC	Acton	1.20	1.08	1.17	1.07	NAV	1.13	0.01
Strawberry Hill Apartments	NMC	Acton	NAV	NAV	NAV	NAV	NAV	--	--
Vine Brook Estates	NMC	Westford	13.1	12.1	8.40	12.2	14.7	12.1	0.12
Wampus Apartments	NMC	Acton	NAV	NAV	NAV	NAV	NAV	--	--
Woodvale Condominiums	NMC	Acton	0.01 ^E	0.01 ^E	0.01 ^E	0.01 ^E	0.01 ^E	0.01	0.00
Noncommunity public water systems	NMNC	Westford	NAV	NAV	NAV	0.12	0.15	0.14	0.00
Subbasin total	--	--	489	338	454	411	261	391	3.9
North Brook									
Berlin Retirement Home/ Northbrook Village	NMC	Berlin	1.05 ^E	0.96 ^E	0.96 ^E	0.96 ^E	0.96 ^E	0.98	0.01
Noncommunity public water systems	NMNC	Berlin, Bolton	0.38	0.39	0.15	0.44	0.76	0.42	0.00
Subbasin total	--	--	1.43	1.35	1.11	1.40	1.72	1.40	0.01

Table 5. Annual average withdrawals for public-supply systems by subbasin in the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the withdrawal numbers may not equal the total because of rounding. Type: MC, municipal; NMC, nonmunicipal community; NMNC, noncommunity; NAV, not metered, not reported, or otherwise unavailable; --, not applicable; E, estimated]

Water supplier	Type	Town	Withdrawals for public supply, in million gallons per year						Percent of total withdrawals for public supply in the basin
			1996	1997	1998	1999	2000	5-year average	
Assabet River Basin									
Spencer Brook									
Noncommunity public water systems	NMNC	Carlisle	0.92	0.74	0.65	0.75	0.71	0.75	0.01
Subbasin total	--	--	0.92	0.74	0.65	0.75	0.71	0.75	0.01
Basin total	--	--	3,350	3,410	3,730	3,600	3,300	3,480	34.6
Sudbury River Basin									
Cedar Swamp									
Westborough Water Department	MC	Westborough	618	548	487	418	373	489	4.9
Subbasin total	--	--	618	548	487	418	373	489	4.9
Cold Spring Brook									
Noncommunity public water systems	NMNC	Hopkinton	NAV	NAV	NAV	NAV	NAV	--	--
Subbasin total	--	--	NAV	NAV	NAV	NAV	NAV	--	--
Hop Brook									
Hudson Water Department	MC	Hudson	229	241	123	194	209	199	2.0
Sudbury Water District	MC	Sudbury	103	175	119	197	295	178	1.8
Subbasin total	--	--	331	416	242	391	504	377	3.7
Indian Brook									
Ashland Water and Sewer Department	MC	Ashland	415	475	541	565	553	510	5.1
Subbasin total	--	--	415	475	541	565	553	510	5.1
Lake Cochituate									
Natick Water Division	MC	Natick	1,120	825	815	857	831	890	8.8
Subbasin total	--	--	1,120	825	815	857	831	890	8.8
Lower Sudbury River									
Concord Water Department	MC	Concord	410	540	369	527	593	488	4.8
Lincoln Water Department	MC	Lincoln	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Sudbury Water District	MC	Sudbury	581	557	528	569	481	543	5.4
Wayland Water Department	MC	Wayland	702	740	644	788	730	721	7.1
Noncommunity public water systems	NMNC		NAV	NAV	NAV	NAV	NAV	--	--
Subbasin total	--	--	1,690	1,840	1,540	1,880	1,800	1,750	17.4

Table 5. Annual average withdrawals for public-supply systems by subbasin in the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the withdrawal numbers may not equal the total because of rounding. Type: MC, municipal; NMC, nonmunicipal community; NMNC, noncommunity; NAV, not metered, not reported, or otherwise unavailable; --, not applicable; E, estimated]

Water supplier	Type	Town	Withdrawals for public supply, in million gallons per year						Percent of total withdrawals for public supply in the basin
			1996	1997	1998	1999	2000	5-year average	
Sudbury River Basin									
Reservoir 1-3									
Noncommunity public water systems	NMNC	Southborough	3.41	3.34	3.33	3.21	NAV	3.32	0.03
Subbasin total	--	--	3.41	3.34	3.33	3.21	NAV	3.32	0.03
Sudbury Reservoir									
Noncommunity public water systems	NMNC	Southborough	1.72	1.68	1.57	1.66	NAV	1.66	0.02
Subbasin total	--	--	1.72	1.68	1.57	1.66	NAV	1.66	0.02
Upper Sudbury River									
The Preserve at Hopkinton	NMC	Hopkinton	1.99	2.39	2.52	2.40	2.35	2.33	0.02
The Village at Highland Park	NMC	Hopkinton	1.80	1.78	1.81	1.68	1.43	1.70	0.02
Noncommunity public water systems	NMNC	Hopkinton	0.59	0.71	0.66	0.62	0.55	0.63	0.01
Subbasin total	--	--	4.38	4.88	4.99	4.70	4.33	4.66	0.05
Whitehall Brook									
Hopkinton Water Department	MC	Hopkinton	255	278	290	286	292	280	2.8
Subbasin total	--	--	255	278	290	286	292	280	2.8
Basin Total			4,440	4,390	3,930	4,410	4,360	4,310	42.8
Lower Concord River Basin									
Lower Concord Main Stem									
Billerica Water Works	MC	Billerica	1,720	1,770	1,620	1,720	1,530	1,670	16.6
Concord Water Department	MC	Concord	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Noncommunity public water systems	NMNC	Carlisle	0.58	0.63	0.62	0.78	0.78	0.68	0.01
Subbasin total	--	--	1,720	1,770	1,620	1,720	1,530	1,670	16.6
River Meadow Brook									
Chelmsford Water District	MC	Chelmsford	525	619	527	539	454	533	5.3
East Chelmsford Water District	MC	Chelmsford	65.2	80.0	62.8	30.6	115	70.7	0.7
Noncommunity public water systems	NMNC	Carlisle/ Westford	0.69	0.69	0.06	0.14	0.07	0.33	0.003
Subbasin total	--	--	591	699	590	570	569	604	6.0
Basin total	--	--	2,310	2,470	2,210	2,290	2,100	2,280	22.6
Total Concord River Basin									
Basin total	--	--	10,100	10,300	9,870	10,300	9,760	10,100	100

this study, the summer period was defined as May through September and the winter period was defined as November through March, with October and April not being considered as either summer or winter months (Paul Blain, Massachusetts Department of Environmental Protection, written commun., September 2003). For each calendar year, summer withdrawal rates were calculated as the average of monthly withdrawal rates in May, June, July, August, and September of the calendar year, and winter withdrawal rates were calculated as the average of monthly withdrawal rates in January, February, March, November, and December of the calendar year. Winter withdrawal rates thus calculated represent withdrawal rates for the winter months of each calendar year, rather than the withdrawal rates for any single winter season, which spans two calendar years.

Seasonal patterns in withdrawal rates, when aggregated by water-supply system, generally reflect seasonal water demand—for example, increased use in summer months resulting from outside lawn and landscape watering, car washing, and use for swimming pools. Seasonal patterns in withdrawal rates from individual sources may incorporate variation caused by operational procedures by water-system managers for systems with multiple sources, as well as variation in seasonal demand. Comparison of summer to winter withdrawal rates by supply system can provide information for the assessment of consumptive use, which occurs mainly in summer. Comparison of summer to winter withdrawal rates for individual sources can provide information for the determination of seasonal stresses on specific nearby water resources.

The median ratio of average summer to average winter withdrawals for municipal and nonmunicipal community public-supply sources for all 5 years of the study period was 1.18, with an interquartile range of 0.99 to 1.69 for all sources and years. Summer-to-winter ratios for water-supply systems based on the sums of withdrawals from all sources had a median value of 1.23, with an interquartile range of 1.02 to 1.53 for all systems and years. The median ratios for all sources and systems varied slightly among years, ranging from 1.16 (all sources) and 1.14 (all systems) in 1996 to 1.30 (all sources) and 1.33 (all systems) in 1997. The highest ratios for all systems—1.28 and 1.33—were in the years 1997 and 1999, with the lowest precipitation; the lowest ratios were in the year 1996, with the greatest precipitation during the 5-year study period. Ratios of summer-to-winter withdrawals were higher for municipal community systems (1.31 overall median) than for nonmunicipal community systems (1.07 overall). The lowest median ratio of summer-to-winter withdrawals for all sources in all 5 years (1.01, not shown in appendix 1), was determined for sources in the Elizabeth Brook subbasin, where there were no municipal community public-supply sources; the highest ratio (2.05) was determined for sources in the Hop Brook subbasin, where withdrawals were from municipal community public-supply sources for the towns of Hudson and Sudbury. During the summer period, monthly withdrawals were largest in June or July during the 5-year period (fig. 7). When average monthly winter and average monthly summer

withdrawals for all sources were added for the entire basin, the ratio of summer-to-winter withdrawals averaged 1.38 for the 5-year period.

Public-supply systems in the Concord River Basin relied on imported water as well as withdrawals from sources within the basin. Several municipal community suppliers purchased water from the Massachusetts Water Resources Authority (MWRA), which obtains water from reservoirs outside the Concord River Basin in central Massachusetts and supplies cities and towns in the Boston metropolitan area. Although they were not withdrawals from sources within basin boundaries, purchases from MWRA are described in this section because they were metered flows that contributed to public-supply water use in the basin. Municipal community suppliers also purchased and sold relatively small amounts of water to one another. Municipal and, to a lesser extent, nonmunicipal community suppliers also transferred water through water-distribution systems from local ground-water and surface-water sources within towns but outside basin boundaries. Imports and exports that resulted from purchases, sales, and transfers were estimated as equal to the differences between water use and withdrawals.

Water purchases from MWRA by municipal community water-supply systems in Bedford, Clinton, Framingham, Marlborough, Northborough, Southborough, and Weston on average totaled 6,270 Mgal/yr (table 6); however, not all of this water was used in the basin. The areas of four towns that purchased water from MWRA, including Framingham, Marlborough, Northborough, and Southborough, are entirely within the basin. Thus, all of the water purchased in these four towns, 4,482 Mgal/yr, was used in the basin. Only small areas (9 to 26 percent) of Bedford, Clinton, and Weston are within the basin (Bedford purchased water indirectly from MWRA through a purchase from Lexington, which obtained all of its water from MWRA). Thus, only a fraction of the 1,787 Mgal/yr purchased by these towns from MWRA was used in the basin; the amount of water purchased from MWRA and used in the basin areas of these towns was estimated by using the percentages of total town area and population (the average of the two percentages) in the basin. Monthly purchase rates from MWRA varied seasonally and are given in appendix 2. The ratio of summer-to-winter purchases for all years and systems had a median value of 1.84, higher than that for system withdrawals from sources in the basin. When average monthly winter and average monthly summer purchases for all systems were added for the entire basin, the ratio of summer-to-winter purchases averaged 1.50 for the 5-year period.

Large water withdrawals (greater than 100,000 gal/d) that were regulated under the Massachusetts WMA for commercial, industrial, or agricultural uses other than public supply averaged 445 Mgal/yr in the Concord River Basin from 1996–2000 on the basis of available data (table 7); data were not available for all regulated users, however. Withdrawals by these users were greatest in 1997 and 1999, as for withdrawals by public-supply systems (table 7). Monthly average

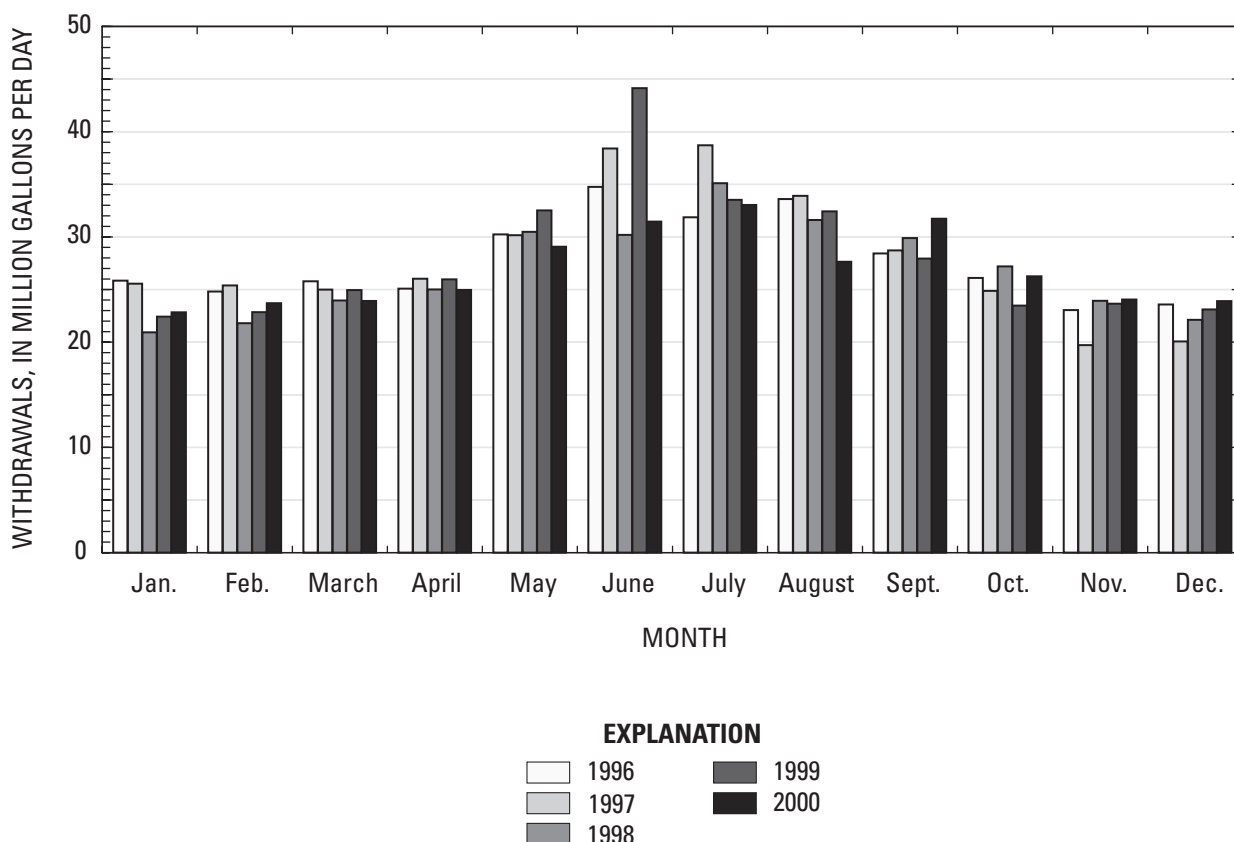


Figure 7. Total monthly withdrawals for public supply in the Concord River Basin in eastern Massachusetts, 1996–2000.

Table 6. Annual average purchases from the Massachusetts Water Resources Authority by municipal community public-supply systems in the Concord River Basin in eastern Massachusetts, 1996–2000.

[The sum of the purchase numbers may not equal the total because of rounding. MWRA: Massachusetts Water Resources Authority. Town and system name: DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District; Mgal/yr, million gallons per year; --, not applicable]

Town and system name	Water purchased from MWRA (Mgal/yr)						Percentage of town area in basin	Percentage of town population in basin	Estimated water purchases from MWRA for use in the basin, 1996–2000 (Mgal/yr)
	1996	1997	1998	1999	2000	5-year average			
Bedford WD	465	502	590	424	403	477	25.9	27.9	128
Clinton WD	804	803	745	714	651	743	14.6	9.40	89.2
Framingham WD	2,740	2,870	2,870	3,050	2,890	2,880	100	100	2,880
Marlborough DPW, WD	1,060	1,080	1,130	1,310	1,190	1,150	100	100	1,150
Northborough WD	68.6	83.7	104	110	82.1	89.7	100	100	89.7
Southborough	256	327	354	440	399	355	100	100	355
Weston WD	507	606	546	652	526	567	8.87	3.61	35.4
Basin total	5,900	6,270	6,340	6,700	6,140	6,270	--	--	4,740

Table 7. Annual average withdrawals regulated by the Massachusetts Water Management Act for commercial, industrial, and agricultural users in the Concord River Basin in eastern Massachusetts, 1996–2000.

[The sum of the withdrawal numbers may not equal the total because of rounding. Type: COM, commercial; IND, Industrial; AG, agricultural; GOLF, golf-course irrigation. NAV, not reported, not metered, or otherwise unavailable; WMA, Water Management Act; --, not applicable]

Subbasin	User name	Use type	Town	Withdrawals, in million gallons per year						Percentage of total WMA-regulated commercial, industrial, and agricultural withdrawals in the basin
				1996	1997	1998	1999	2000	5-year average	
Assabet River Basin										
Assabet Headwaters	Berberian Farm	AG	Northborough	5.42	9.58	7.60	11.1	5.55	7.84	1.8
Assabet Headwaters	Bigelow Farm	AG	Northborough	24.5	24.1	23.1	24.5	45.6	28.4	6.4
Assabet Headwaters	Juniper Hill Golf Course	GOLF	Northborough	14.0	24.3	23.3	26.8	15.8	20.8	4.7
Assabet Main Stem	Assabet Sand & Gravel	IND	Acton	59.5	57.3	59.0	53.4	44.0	54.6	12.3
Assabet Main Stem	Concrete Services	COM	Berlin	NAV	NAV	NAV	NAV	NAV	--	--
Assabet Main Stem	Digital Equipment/Intel	IND	Hudson	0.00	0.00	0.00	0.00	5.10	1.02	0.2
Assabet Main Stem	Stow Acres Country Club	GOLF	Stow	12.5	13.0	12.3	26.9	14.7	15.9	3.6
Danforth Brook	Great Oak Farm	AG	Berlin	NAV	NAV	NAV	NAV	0.00	0.00	0.0
Elizabeth Brook	Digital Equipment/Intel	IND	Stow	3.86	4.68	0.00	0.00	0.00	1.71	0.4
Elizabeth Brook	Stow Acres Country Club	GOLF	Stow	14.0	15.0	13.2	15.4	11.8	13.9	3.1
Fort Pond Brook	Idylwilde Farm	AG	Acton	2.52	2.52	2.52	2.52	2.52	2.52	0.6
Nashoba Brook	W.R. Grace	IND	Acton	NAV	NAV	NAV	NAV	NAV	--	--
Basin total	--	--	--	136	150	141	160	145	147	33.0
Sudbury River Basin										
Cedar Swamp	Tyrolit North America/Bay State Sterling	IND	Westborough	81.0	136	105	69.8	79.2	94.2	21.2
Cold Spring Brook	Kidde-Fenwal, Inc. (Well #1)	IND	Ashland	0.00	0.00	0.00	< 1	< 1	< 1	--
Cold Spring Brook	Weston Nurseries	AG	Hopkinton	99.4	140	116	143	110	122	27.3
Hop Brook	Cavicchio Greenhouse	AG	Sudbury	32.6	36.5	31.6	33.8	35.1	33.9	7.6
Indian Brook	Weston Nurseries	AG	Hopkinton	0.00	0.00	0.00	2.43	0.00	0.49	0.1
Lake Cochituate	U.S. Army Soldier Systems Center	IND	Natick	NAV	NAV	NAV	NAV	NAV	NAV	--
Lower Sudbury River	Concord Country Club	GOLF	Concord	8.87	17.1	12.0	34.5	16.3	17.8	4.0
Lower Sudbury River	Verrill Farm	AG	Concord	4.00	NAV	3.99	NAV	8.63	5.54	1.2
Lower Sudbury River	Nashawtuck Country Club	GOLF	Concord	18.7	21.1	18.7	19.4	10.8	17.7	4.0
Reservoir 1-3	Kidde-Fenwal (Well #2)	IND	Ashland	7.00	5.60	3.59	8.70	9.83	6.95	1.6
Basin total	--	--	--	252	357	291	311	270	298	67.0
Lower Concord River Basin										
River Meadow Brook	Carlisle Cranberries	AG	Carlisle	NAV	NAV	NAV	NAV	NAV	--	--
Basin total	--	--	--	--	--	--	--	--	--	--
Total Concord River Basin										
Basin total	--	--	--	388	507	432	472	415	445	100

withdrawals by these users are given in appendix 3. Water for agricultural uses and golf-course irrigation was withdrawn almost entirely in the summer months. Consequently, the median ratio of summer-to-winter withdrawals could not be calculated for many large regulated water withdrawals (ratio with denominator of zero for winter withdrawals, appendix 3). When average monthly winter and average monthly summer withdrawals for all sources were added for the entire basin, the ratio of summer-to-winter withdrawals averaged 5.71 for the 5-year period, considerably higher than the comparable values for withdrawals or purchases by community-supply systems. Within the summer period, monthly withdrawals were largest in June, July, or August during the 5-year period.

Water Use

Water use for the Concord River Basin and its subbasins was estimated for categories of domestic, commercial, industrial, and agricultural use. Agricultural use includes golf-course irrigation as well as water use for the production of plants and animals. For each category, use supplied by public systems and by individual users (self-supply) also was estimated. Public-supply water use by category was estimated by using information reported by public suppliers to MADEP. These include municipal community, nonmunicipal community, and nonmunicipal noncommunity public-supply systems (public-water systems defined by MADEP as: community; non-transient, noncommunity; and transient noncommunity). Self-supply uses were estimated with information reported for large-withdrawal users regulated by the Massachusetts WMA and, for small users not regulated by the WMA (primarily private-well owners), with information about public-supply use, population densities, and land use, and from other sources. Water that was unaccounted for in public-supply distribution systems and consumptive water use also were estimated.

Public-supply water for domestic, commercial, industrial, and agricultural uses was estimated on the basis of volumes (or percentages) of water reported by water suppliers for each use category on annual reports to MADEP for community public-supply systems. In some cases, these volumes include water that was purchased from another supplier; inclusion of this water is necessary to calculate the total volumes of water used in the service areas of these suppliers. Use categories were not required for reporting to MADEP by nonmunicipal noncommunity public-supply systems; the use represented by withdrawals for these systems was assumed to be commercial, as described below. Public-supply water used for each category was calculated for each subbasin by using the distribution of town populations (for domestic use) or land-use areas (for commercial, industrial, and agricultural uses) among subbasins.

Domestic

Public Supply

Public-supply domestic water use in the Concord River Basin, or use for residential purposes, was supplied by municipal and nonmunicipal community water systems for the years 1996 through 2000. Municipal community suppliers reported the number of gallons (or, in some cases, the percentage of total withdrawals) supplied for domestic use each year. For a few municipal systems, domestic use was not separately reported for one or more years. In these cases, domestic use was estimated as the product of the value reported by the supplier in a preceding or following year and the ratio of use during the missing year to use during the preceding or following year for the remaining towns for which there were data. For one town (Acton), domestic use was not reported for any year during the study period; the reported population served in each year and the average per capita use reported by suppliers in 2000 were used to estimate public-supply domestic water use by year in this town. The use of water withdrawn by all nonmunicipal community public-supply systems was assumed to be entirely domestic. These systems, by definition, serve residents and, in the Concord River Basin, included housing developments, condominiums, apartments, and retirement homes (table 5).

Domestic water use supplied by municipal community systems, which typically serve entire towns, was apportioned within the Concord River Basin and among its subbasins. For each subbasin, the total domestic use reported by the municipal community supplier for each town in the subbasin was multiplied by the fraction of the total population served by that municipal supplier in that subbasin (table 4). Fractional volumes of domestic use for each town in each subbasin were added to obtain the total domestic use supplied by municipal community supply systems in the subbasin. In Chelmsford, domestic water use reported by the three water districts in that town were combined and distributed together across the service areas of the three districts. For nonmunicipal community suppliers (privately owned water systems serving, for example, housing developments), water use was considered equal to withdrawals. The distribution and use of water supplied by these systems is typically of limited spatial extent. Thus, domestic water use supplied by each nonmunicipal community system was attributed entirely to the subbasin in which its withdrawal source was located. Domestic use supplied by municipal community systems and by nonmunicipal systems were added to obtain the total estimated public-supply domestic use in each subbasin.

From these data, it was estimated that 9,960 Mgal/yr were used for public-supply domestic water use in the Concord River Basin from 1996 through 2000 (table 8). The

Table 8. Public- and self-supply water use by subbasin and town in the Concord River Basin in eastern Massachusetts, 1996–2000.

[The sum of the use numbers may not equal the total because of rounding. NCPWS, non-community public-supply systems; Mgal/yr, million gallons per year; NAV, not metered, not reported, or otherwise unavailable; --, not applicable]

Town	Public-supply water use (Mgal/yr)					Self-supply water use (Mgal/yr)				Total water use (Mgal/yr)
	Domestic	Commercial	Industrial	Agricultural	Unaccounted for	Domestic	Commercial	Industrial	Agricultural	
Assabet River Basin										
Assabet Headwaters										
Grafton	0.00	0.00	0.00	0.00	0.00	4.66	0.00	0.00	0.00	4.66
Marlborough	149	130	33.2	0.00	53.7	9.94	27.9	51.7	0.00	455
Northborough	165	18.0	7.61	0.00	56.9	31.5	4.10	0.45	57.7	341
Shrewsbury	276	197	4.51	0.00	174	9.59	7.63	3.95	0.25	673
Westborough	137	113	20.1	7.96	68.7	11.8	41.0	2.39	7.51	409
NCPWS	0.00	NAV	0.00	0.00	NAV	--	--	--	--	
Subbasin total	727	458	65.4	7.96	353	67.5	80.7	58.5	65.4	1,880
Assabet Main Stem										
Acton	4.94	8.53	0.00	0.00	5.12	0.39	1.21	56.6	0.04	76.8
Berlin	0.00	0.00	0.00	0.00	0.00	7.72	5.17	0.00	0.68	13.6
Bolton	0.00	0.00	0.00	0.00	0.00	7.20	0.00	0.00	0.01	7.21
Concord	225	62.8	0.16	0.00	13.0	1.01	0.00	2.22	1.16	306
Hudson	307	49.1	110	11.8	103	26.3	9.04	45.5	0.32	662
Marlborough	1.73	0.00	0.00	0.00	2.77	0.63	50.6	8.29	0.39	64.4
Maynard	176	58.9	58.1	3.60	27.5	4.47	0.00	0.71	0.05	329
Northborough	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03
Stow	NAV	0.00	0.00	0.00	6.37	64.4	7.52	0.15	21.9	100
Sudbury	78.9	0.00	0.00	0.00	0.00	1.57	0.00	0.00	0.03	80.5
NCPWS	0.00	1.50	0.00	0.00	NAV	--	--	--	--	1.50
Subbasin total	794	181	168	15.4	158	114	73.5	113	24.6	1,640
Danforth Brook										
Berlin	0.00	0.00	0.00	0.00	0.00	4.12	0.00	0.00	3.38	7.50
Bolton	0.00	0.00	0.00	0.00	0.00	21.9	1.93	0.00	1.29	25.1
Hudson	70.4	12.1	0.00	7.24	21.2	8.61	0.00	0.92	0.00	120
NCPWS	0.00	0.21	0.00	0.00	0.00	--	--	--	--	0.21
Subbasin total	70.4	12.3	0.00	7.24	21.2	34.7	1.93	0.92	4.67	153

Table 8. Public- and self-supply water use by subbasin and town in the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the use numbers may not equal the total because of rounding. NCPWS, non-community public-supply systems; Mgal/yr, million gallons per year; NAV, not metered, not reported, or otherwise unavailable; --, not applicable]

Town	Public-supply water use (Mgal/yr)					Self-supply water use (Mgal/yr)				Total water use (Mgal/yr)
	Domestic	Commercial	Industrial	Agricultural	Unaccounted for	Domestic	Commercial	Industrial	Agricultural	
Assabet River Basin										
Elizabeth Brook										
Bolton	0.00	0.00	0.00	0.00	0.00	33.9	7.37	0.00	0.97	42.2
Boxborough	15.8	0.00	0.00	0.00	0.00	0.00	2.35	2.54	0.09	20.8
Harvard	0.00	0.00	0.00	0.00	0.00	42.5	0.00	0.00	1.32	43.8
Stow	4.88	0.00	0.00	0.00	0.00	53.3	8.45	1.94	29.5	98.0
NCPWS	0.00	24.10	0.00	0.00	NAV	--	--	--	--	24.1
Subbasin total	20.7	24.1	0.00	0.00	0.00	130	18.2	4.48	31.8	229
Fort Meadow Brook										
Hudson	39.9	1.69	58.6	12.4	20.0	10.7	0.52	1.52	0.25	146
Marlborough	189	35.2	6.44	0.00	52.8	31.5	9.93	0.00	0.01	325
Subbasin total	229	36.9	65.0	12.4	72.8	42.2	10.5	1.52	0.25	470
Fort Pond Brook										
Acton	271	84.7	0.00	0.00	79.4	22.0	18.1	3.03	3.72	482
Boxborough	9.83	0.00	0.00	0.00	0.00	71.7	8.91	0.73	1.97	93.1
Concord	41.5	20.6	0.06	0.00	2.29	1.81	0.00	0.39	0.00	66.7
Littleton	40.3	6.97	0.00	0.00	19.4	31.2	0.17	0.00	0.89	99.0
Maynard	31.1	1.99	0.00	0.00	4.08	0.29	0.00	2.14	0.00	39.6
Stow	26.1	0.00	0.00	0.00	0.00	5.07	0.52	0.02	1.30	33.0
NCPWS	0.00	0.89	0.00	0.00	NAV	--	--	--	--	0.89
Subbasin total	420	115	0.06	0.00	105	132	27.7	6.31	7.88	814
Howard and Cold Harbor Brooks										
Berlin	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.07
Boylston	0.00	0.00	0.00	0.00	0.00	10.1	0.24	0.00	0.15	10.5
Northborough	42.6	7.19	0.00	0.00	19.1	25.4	3.42	0.02	0.83	98.5
Shrewsbury	104	0.00	0.00	0.00	62.8	2.73	0.75	0.00	0.01	170
Subbasin total	146	7.19	0.00	0.00	81.9	38.3	4.41	0.02	0.99	279

Table 8. Public- and self-supply water use by subbasin and town in the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the use numbers may not equal the total because of rounding. NCPWS, non-community public-supply systems; Mgal/yr, million gallons per year; NAV, not metered, not reported, or otherwise unavailable; --, not applicable]

Town	Public-supply water use (Mgal/yr)					Self-supply water use (Mgal/yr)				Total water use (Mgal/yr)
	Domestic	Commercial	Industrial	Agricultural	Unaccounted for	Domestic	Commercial	Industrial	Agricultural	
Assabet River Basin										
Nashoba Brook										
Acton	191	76.8	0.00	0.00	50.8	0.00	23.5	10.9	1.60	355
Carlisle	0.00	0.00	0.00	0.00	0.00	6.08	0.00	0.00	0.39	6.47
Concord	4.91	0.00	0.00	0.00	1.04	0.33	0.00	0.00	0.12	6.39
Littleton	26.8	18.6	0.00	0.00	14.5	18.3	2.27	0.93	0.39	81.8
Westford	42.4	51.5	0.00	0.00	8.54	48.4	10.6	5.35	1.50	168
NCPWS	0.00	0.14	0.00	0.00	NAV	--	--	--	--	0.14
Subbasin total	265	147	0.00	0.00	74.9	73.1	36.4	17.2	4.00	618
North Brook										
Berlin	0.98	0.00	0.00	0.00	0.00	49.3	1.78	0.00	3.02	55.0
Bolton	0.00	0.00	0.00	0.00	0.00	5.57	0.00	0.00	0.46	6.03
Boylston	0.00	0.00	0.00	0.00	0.00	7.13	0.00	0.00	0.21	7.35
Clinton	45.1	0.00	0.00	0.00	1.80	0.21	0.00	0.00	0.11	47.2
Marlborough	0.00	2.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.76
Northborough	39.2	4.99	7.99	0.00	8.87	13.80	0.00	0.09	0.11	75.0
NCPWS	0.00	0.42	0.00	0.00	NAV	--	--	--	--	0.42
Subbasin total	85.3	8.16	7.99	0.00	10.7	75.9	1.78	0.09	3.91	194
Spencer Brook										
Acton	0.00	0.00	0.00	0.00	0.00	3.43	0.00	0.00	0.13	3.55
Carlisle	0.00	0.00	0.00	0.00	0.00	35.1	0.65	0.00	1.31	37.0
Concord	22.4	5.23	0.00	0.00	2.86	4.50	6.19	0.00	0.97	42.1
NCPWS	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75
Subbasin total	22.4	5.98	0.00	0.00	2.86	43.0	6.83	0.00	2.40	83.5
Basin total	2,780	996	306	43.0	880	750	262	203	146	6,360

Table 8. Public- and self-supply water use by subbasin and town in the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the use numbers may not equal the total because of rounding. NCPWS, non-community public-supply systems; Mgal/yr, million gallons per year; NAV, not metered, not reported, or otherwise unavailable; --, not applicable]

Town	Public-supply water use (Mgal/yr)					Self-supply water use (Mgal/yr)				Total water use (Mgal/yr)
	Domestic	Commercial	Industrial	Agricultural	Unaccounted for	Domestic	Commercial	Industrial	Agricultural	
Sudbury River Basin										
Baiting Brook										
Framingham	135	34.6	0.00	61.8	21.8	4.49	1.53	0.00	0.80	260
Subbasin total	135	34.6	0.00	61.8	21.8	4.49	1.53	0.00	0.80	260
Cedar Swamp										
Hopkinton	0.06	0.00	0.00	4.60	0.01	3.95	0.00	0.00	0.27	8.90
Southborough	0.09	0.00	0.00	0.00	1.26	0.00	0.17	0.01	0.00	1.52
Upton	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.56
Westborough	237	84.7	65.4	0.76	104	6.28	34.90	101	0.53	634
Subbasin total	237	84.7	65.4	5.36	105	10.8	35.1	101	0.81	645
Cold Spring Brook										
Ashland	61.9	6.33	1.95	0.00	5.03	2.25	1.64	0.10	0.07	79.2
Hopkinton	43.8	3.27	0.00	1.43	5.70	34.5	0.00	0.00	122	210
NCPWS	0.00	NAV	0.00	0.00	NAV	--	--	--	--	0.00
Subbasin total	106	9.60	1.95	1.43	10.7	36.8	1.64	0.10	122	290
Hop Brook										
Framingham	0.00	0.00	0.00	0.00	0.00	13.7	0.00	0.00	0.33	14.0
Hudson	0.61	3.07	0.00	0.00	1.41	3.89	0.65	2.68	0.19	12.5
Marlborough	55.1	20.9	0.00	0.00	27.0	28.7	54.0	0.00	0.32	186
Sudbury	281	61.5	0.00	1.39	26.6	9.50	1.58	0.29	34.1	416
Subbasin total	337	85.5	0.00	1.39	55.0	55.8	56.2	2.97	34.9	628
Indian Brook										
Ashland	5.17	0.00	0.00	0.00	2.12	2.04	0.13	0.00	0.02	9.48
Hopkinton	49.4	15.2	14.2	0.17	7.25	17.6	5.07	1.84	0.78	112
Subbasin total	54.6	15.2	14.2	0.17	9.36	19.7	5.21	1.84	0.81	121

Table 8. Public- and self-supply water use by subbasin and town in the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the use numbers may not equal the total because of rounding. NCPWS, non-community public-supply systems; Mgal/yr, million gallons per year; NAV, not metered, not reported, or otherwise unavailable; --, not applicable]

Town	Public-supply water use (Mgal/yr)					Self-supply water use (Mgal/yr)				Total water use (Mgal/yr)
	Domestic	Commercial	Industrial	Agricultural	Unaccounted for	Domestic	Commercial	Industrial	Agricultural	
Sudbury River Basin										
Lake Cochituate										
Ashland	156	14.0	7.53	0.00	7.02	2.25	4.04	0.00	0.00	191
Framingham	339	108	29.4	15.0	41.6	3.43	13.4	3.20	0.01	554
Natick	431	134	19.7	0.96	46.8	19.2	5.32	0.48	0.08	658
Sherborn	0.00	0.00	0.00	0.00	0.00	17.1	0.96	0.01	2.06	20.1
Wayland	132	33.7	0.00	0.00	46.4	4.79	2.07	0.00	0.14	219
Subbasin total	1,060	290	56.6	16.0	142	46.7	25.8	3.70	2.29	1,640
Lower Sudbury River										
Concord	152	32.0	0.02	0.00	12.6	5.59	11.2	0.00	42.1	256
Framingham	254	17.2	0.72	18.5	31.8	9.35	0.00	0.08	0.12	332
Lincoln	43.3	0.93	0.00	0.00	4.21	4.30	0.00	0.00	0.80	53.5
Sudbury	189	37.0	0.00	4.80	20.7	10.6	9.33	0.26	2.58	274
Wayland	163	10.8	0.62	0.00	87.4	4.63	9.80	0.78	1.87	279
NCPWS	0.00	NAV	0.00	0.00	NAV	--	--	--	--	0.00
Subbasin total	802	97.9	1.35	23.3	157	34.5	30.3	1.13	47.4	1,190
Pine Brook										
Wayland	96.4	53.5	0.08	0.00	62.4	2.52	0.00	0.02	0.56	216
Weston	12.9	0.00	0.00	0.07	1.94	2.74	0.00	0.00	0.16	17.8
Subbasin total	109	53.5	0.08	0.07	64.4	5.26	0.00	0.02	0.72	233
Reservoir 1-3										
Ashland	41.0	9.73	3.92	0.00	4.01	1.60	1.65	7.06	0.07	69.0
Framingham	301	35.7	19.2	29.5	44.3	5.73	4.45	8.98	0.23	449
Marlborough	0.00	0.00	0.00	0.00	0.00	0.82	0.00	0.00	0.19	1.01
Southborough	9.46	0.00	0.00	0.00	2.32	8.23	13.4	0.01	0.19	33.6
NCPWS	0.00	3.32	0.00	0.00	NAV	--	--	--	--	3.32
Subbasin total	351	48.7	23.1	29.5	50.6	16.4	19.5	16.0	0.67	556

Table 8. Public- and self-supply water use by subbasin and town in the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the use numbers may not equal the total because of rounding. NCPWS, non-community public-supply systems; Mgal/yr, million gallons per year; NAV, not metered, not reported, or otherwise unavailable; --, not applicable]

Town	Public-supply water use (Mgal/yr)					Self-supply water use (Mgal/yr)				Total water use (Mgal/yr)
	Domestic	Commercial	Industrial	Agricultural	Unaccounted for	Domestic	Commercial	Industrial	Agricultural	
Sudbury River Basin										
Sudbury River - Framingham										
Framingham	831	365	21.2	6.77	116	10.3	32.6	0.42	0.08	1,380
Natick	11.9	76.8	21.9	0.00	5.42	0.12	3.09	0.00	0.00	119
Subbasin total	843	442	43.0	6.77	121	10.4	35.7	0.42	0.08	1,500
Sudbury Reservoir										
Marlborough	406	170	104	0.00	112	106	24.9	52.2	0.38	976
Northborough	0.00	0.00	2.39	0.00	0.00	0.00	0.00	0.00	0.00	2.39
Southborough	121	66.7	0.00	0.00	25.0	7.69	12.3	0.03	3.66	236
Westborough	40.6	0.00	28.10	0.22	18.1	8.12	6.44	0.36	0.09	102
NCPWS	0.00	1.66	0.00	0.00	NAV	--	--	--	--	1.66
Subbasin total	567	238	135	0.22	155	122	43.7	52.6	4.13	1,320
Upper Sudbury River										
Ashland	79.8	19.6	0.60	0.00	7.64	1.17	1.51	0.00	0.10	110
Hopkinton	4.03	0.00	0.00	0.00	0.00	11.3	0.55	0.00	0.00	15.9
Southborough	98.3	13.0	0.00	0.00	10.4	5.65	0.00	0.00	0.01	127
Westborough	1.08	0.00	1.16	0.00	0.88	0.38	0.00	0.08	0.00	3.57
NCPWS	0.00	0.63	0.00	0.00	NAV	--	--	--	--	0.63
Subbasin total	183	33.2	1.76	0.00	18.9	18.5	2.06	0.08	0.11	258
Whitehall Brook										
Hopkinton	25.0	0.41	0.00	0.87	5.55	19.3	0.00	0.00	0.81	51.9
Upton	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.04
Westborough	0.34	0.00	0.00	0.00	0.30	0.44	0.00	0.00	0.00	1.08
Subbasin total	25.4	0.41	0.00	0.87	5.86	19.7	0.00	0.00	0.81	53.0
Basin Total	4,810	1,430	342	147	916	401	257	180	215	8,700

Table 8. Public- and self-supply water use by subbasin and town in the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the use numbers may not equal the total because of rounding. NCPWS, non-community public-supply systems; Mgal/yr, million gallons per year; NAV, not metered, not reported, or otherwise unavailable; --, not applicable]

Town	Public-supply water use (Mgal/yr)					Self-supply water use (Mgal/yr)				Total water use (Mgal/yr)
	Domestic	Commercial	Industrial	Agricultural	Unaccounted for	Domestic	Commercial	Industrial	Agricultural	
Lower Concord River Basin										
Lower Concord Main Stem										
Bedford	97.9	0.00	0.00	0.00	7.43	15.1	0.00	0.00	0.33	121
Billerica	345	244	49.2	0.00	68.7	6.93	13.6	14.9	0.61	743
Carlisle	0.00	0.00	0.00	0.00	0.00	44.3	6.97	0.04	1.95	53.3
Chelmsford	22.8	3.99	1.39	0.00	3.71	0.37	0.00	0.00	0.00	32.3
Concord	138	49.7	0.000	0.00	12.1	3.74	9.00	0.00	1.44	214
Lincoln	10.8	0.00	0.00	0.00	1.31	0.25	1.13	0.00	0.00	13.5
Lowell	559	94.5	30.00	0.00	108	5.95	5.08	1.11	0.00	804
Tewksbury	31.6	1.73	18.80	0.59	6.45	0.63	0.65	0.00	0.01	60.5
NCPWS	0.00	0.68	0.00	0.00	NAV	--	--	--	--	0.68
Subbasin total	1,200	394	99.4	0.59	208	77.3	36.4	16.1	4.34	2,040
River Meadow Brook										
Billerica	12.5	15.3	2.68	0.00	3.78	1.20	1.83	1.12	0.04	38.4
Carlisle	0.00	0.00	0.00	0.00	0.00	38.3	2.59	0.28	2.75	43.9
Chelmsford	549	223	29.7	1.26	103	6.33	18.0	10.0	0.60	942
Lowell	589	95.3	139	0.00	145	0.00	0.82	0.85	0.01	970
Westford	19.2	26.3	0.00	0.00	8.52	13.9	4.67	0.48	1.14	74.2
NCPWS	0.00	0.33	0.00	0.00	NAV	--	--	--	--	0.33
Subbasin total	1,170	360	171	1.26	260.00	59.7	27.9	12.8	4.54	2,070
Basin total	2,380	755	271	1.85	468	137	64.3	28.90	8.88	4,110
Total Concord River Basin										
Basin total	9,960	3,180	919	192	2,260	1,290	583	411	370	19,200

Sudbury River Basin, with the largest population (45.6 percent of the entire Concord River Basin population and 48.0 percent of the basin population on public water) had the largest amount of public-supply domestic water use at 4,810 Mgal/yr or 48.3 percent of the total for the entire Concord River Basin. Public-supply domestic use in the Assabet River Basin (with 33.6 percent of the entire basin population and 29.5 percent of the basin population on public water) was estimated at 2,780 Mgal/yr (27.9 percent of the entire basin total). Public-supply domestic use in the Lower Concord River Basin (with 20.8 percent of the entire basin population and 22.5 percent of the basin population on public water) was estimated at 2,380 Mgal/yr (23.8 percent of the entire basin total). On a subbasin basis, the public-supply domestic use ranged from 20.7 Mgal/yr in the Elizabeth Brook subbasin to 1,200 Mgal/yr in the Lower Concord Main Stem subbasin (table 8).

The per capita water use for each municipal community supply system in the basin was calculated on the basis of the reported domestic water use and the populations served by the supply system as reported by the suppliers (1996 through 2000). Note that in several cases, the served populations listed in annual reports for supply systems did not change from year to year. The average per capita water use during 1996–2000, based on reported served populations, ranged from 50.2 to 118.7 gal/d/person among supply systems, with a median value for all systems of 74.2 gal/d/person and an average of 76.0 gal/d/person (table 9). For 2000, average per capita water use was 71.8 gal/d/person (median 68.0 gal/d/person) based on reported served populations. This per capita use rate was close to the estimate made for the Commonwealth of Massachusetts by Bratton, Horn, and Medalie (1996) of 72 gal/d/person for self-supply per capita water use. For comparison, per capita water use in 2000 also was calculated by using the reported domestic water use and the served populations as estimated on the basis of the analysis of land use and population density. The result obtained by this method was 74.7 gal/d/person (median 73.4 gal/d/person); it was higher than the average year 2000 value based on populations reported by suppliers primarily because the populations estimated from the land-use and population-density analysis were lower for some towns—specifically, Lowell, Marlborough, and Westford—than the population served reported by suppliers.

Self-Supply

Self-supply domestic water use in the Concord River Basin was estimated as follows. First, the self-supply population in each town and subbasin was calculated, as the difference between the total population and the public-supply (municipal and nonmunicipal community) populations in each town and subbasin (table 4). Then the volumes of water used by these populations were calculated by multiplying the self-supply population in each town and subbasin by 71.8 g/d/person, the average per capita water use calculated from the domestic water use and populations served by municipal community supply systems in 2000. This value was

used rather than the average per capita use rate calculated from the analysis of land use and population density, because it was considered most representative of the water use reported by suppliers throughout the basin. In this way, 1,290 Mgal/yr was estimated for self-supply domestic water use in the Concord River Basin from 1996 through 2000 (table 8). The Assabet River Basin had the largest amount of self-supply domestic water use at 750 Mgal/yr or 58.2 percent of the total, followed by the Sudbury River Basin at 401 Mgal/yr (31.1 percent) and the Lower Concord River Basin at 137 Mgal/yr (10.6 percent). On the subbasin level, the self-supply domestic use ranged from 4.49 Mgal/yr in the Baiting Brook subbasin to 132 Mgal/yr in the Fort Pond Brook subbasin (table 8).

Commercial

Public Supply

Public-supply commercial water use was determined from the commercial water use reported by municipal community supply systems and from water withdrawals reported by nonmunicipal, noncommunity suppliers. Commercial water use for municipal community systems was calculated from the total volumes reported each year by suppliers and the distribution of commercial land-use areas in each town and subbasin. Water use supplied by all nonmunicipal noncommunity public water systems was considered commercial. (Some of these systems may also have supplied industrial uses, but their withdrawals were included with commercial use because they were regulated as drinking-water sources and there was little information to determine otherwise.) The noncommunity systems supply institutions or businesses, such as schools, day-care centers, libraries, office buildings, campgrounds, stores, hotels, and restaurants, as described previously. As for domestic use from nonmunicipal community suppliers, commercial water use from each noncommunity supplier was assumed equal to the reported withdrawals and was assigned to the subbasin in which its withdrawal source was located. Commercial use supplied by municipal community systems was apportioned among subbasins by multiplying the total commercial use reported each municipal community supplier for a town by the fraction of the total commercial land area located within the supplier's water-distribution system in each subbasin.

In some cases, commercial or other categories of water use were not reported by municipal community suppliers for some or all years on annual reports. If commercial water use was not reported for one, two, or three years, it was estimated for the missing years from reported use in a preceding or following year and the ratios of commercial use for the appropriate years for towns for which there were data, as described for domestic use. For two towns (Acton and Marlborough), in which use for most or all categories was not reported for any year during the study period, public-supply commercial use was estimated by using the Standard Industrial Classification (SIC) information, as described for self-supply commercial

Table 9. Per capita domestic water use based on populations served as reported by suppliers in the Concord River Basin in eastern

[DPW, Department of Public Works; WA, Water Authority; WD, Water Department, District, Division, or Supply District; WSD, Water and Sewer Department;

Water supplier	Per capita water use, based on reported populations served by supply systems								
	1996			1997			1998		
	Domestic water use (Mgal/yr)	Population served	Per capita use (gal/d/person)	Domestic water use (Mgal/yr)	Population served	Per capita use (gal/d/person)	Domestic water use (Mgal/yr)	Population served	Per capita use (gal/d/person)
Acton WD	NAV	16,000	NAV	NAV	16,500	NAV	NAV	17,100	NAV
Ashland WSD	312	12,250	69.6	368	14,146	71.1	419	NAV	NAV
Bedford WD	399	12,500	87.1	470	12,500	103	351	12,500	76.7
Billerica WW	866	37,029	63.9	930	37,029	68.6	884	NAV	NAV
North Chelmsford WD	177	6,483	74.4	190	6,593	78.7	189	NAV	NAV
East Chelmsford WD	35.0	2,000	47.8	41.0	2,000	56.0	31.5	2,000	43.0
Chelmsford WD	780	26,050	81.8	792	NAV	NAV	769	NAV	NAV
Clinton WD	531	12,500	116	522	12,500	114	506	12,500	111
Concord WD	628	16,000	107	673	16,000	115	729	16,000	124
Framingham WD	1,710	65,000	71.8	1,800	65,000	75.7	1,820	65,000	76.5
Hopkinton WD	161	9,300	47.3	182	9,340	53.2	183	9,394	53.2
Hudson WD	402	16,800	65.4	424	16,800	69.0	421	16,800	68.5
Lincoln WD	146	5,059	79.0	153	NAV	NAV	170	5,100	91.3
Littleton WD	137	8,300	45.0	151	NAV	NAV	158	8,500	50.7
Lowell Regional WA	3,940	135,000	79.8	4,050	132,500	83.5	3,580	132,500	73.8
Marlborough DPW, WD	691	36,000	52.5	854	34,000	68.6	840	34,000	67.5
Maynard DPW, WD	194	10,000	52.9	199	10,000	54.4	198	10,000	54.1
Natick WD	943	32,000	80.5	1,070	32,000	91.4	868	32,000	74.1
Northborough WD	230	9,800	64.1	239	10,000	65.3	253	10,250	67.3
Shrewsbury WD	726	25,585	77.5	778	25,785	82.4	1,040	27,173	105
Southborough DPW	180	7,432	66.3	218	7,432	80.1	222	8,200	73.9
Sudbury WD	503	16,079	85.5	621	16,784	101	543	16,923	87.7
Tewksbury WD	550	28,500	52.8	572	28,500	54.8	586	NAV	NAV
Wayland WD	307	13,095	64.1	438	13,250	90.3	423	13,315	86.8
Westborough WD	407	16,000	69.5	411	16,000	70.2	442	16,862	71.7
Westford WD	289	14,538	54.3	332	14,903	60.9	357	15,497	62.9
Weston WD	415	10,400	109	481	11,059	119	457	10,500	119

Massachusetts, 1996–2000.

WW, Water Works; Mgal/yr, million gallons per year; gal/d/person, gallons per day per person; NAV, not available]

Water supplier	Per capita water use, based on reported populations served by supply systems								
	1999			2000			5-year average		
	Domestic water use (Mgal/yr)	Population served	Per capita use (gal/d/person)	Domestic water use (Mgal/yr)	Population served	Per capita use (gal/d/person)	Domestic water use (Mgal/yr)	Population served	Per capita use (gal/d/person)
Acton WD	NAV	19,305	NAV	NAV	19,305	NAV	NAV	17,642	NAV
Ashland WSD	431	14,000	84.1	373	15,016	67.9	380	13,853	74.9
Bedford WD	350	12,500	76.5	376	12,500	82.1	389	12,500	85.0
Billerica WW	1,060	37,029	78.3	899	37,029	66.4	928	37,029	68.5
North Chelmsford WD	179	6,835	71.4	165	6,835	66.0	180	6,687	73.5
East Chelmsford WD	86.0	2,000	117.5	73.0	2,000	99.7	53.3	2,000	72.8
Chelmsford WD	719	26,050	75.4	592	23,957	67.5	730	25,352	78.7
Clinton WD	506	13,000	106	343	13,000	72.0	482	12,700	104
Concord WD	522	16,000	89.1	439	16,000	75.0	598	16,000	102
Framingham WD	2,050	65,000	86.1	1,950	65,000	82.0	1,870	65,000	78.4
Hopkinton WD	180	9,500	51.7	176	9,500	50.6	176	9,407	51.2
Hudson WD	439	16,800	71.3	406	16,800	66.0	418	16,800	68.1
Lincoln WD	176	5,100	94.4	164	5,100	87.9	162	5,090	86.9
Littleton WD	174	8,500	56.1	157	8,500	50.5	155	8,450	50.2
Lowell Regional WA	3,110	132,500	64.1	2,540	135,000	51.4	3,440	133,500	70.5
Marlborough DPW, WD	828	34,000	66.5	803	35,000	62.7	803	34,600	63.4
Maynard DPW, WD	216	10,000	59.1	228	10,000	62.3	207	10,000	56.6
Natick WD	839	32,000	71.6	856	32,000	73.1	915	32,000	78.1
Northborough WD	270	10,600	69.6	244	10,820	61.6	247	10,294	65.6
Shrewsbury WD	853	27,416	85.0	917	27,647	90.7	863	26,721	88.2
Southborough DPW	284	8,300	93.6	245	8,500	78.9	230	7,973	78.8
Sudbury WD	559	16,532	92.4	523	16,929	84.4	550	16,649	90.3
Tewksbury WD	624	29,074	58.6	611	30,315	55.0	589	29,097	55.3
Wayland WD	491	13,500	99.4	415	13,840	81.9	415	13,400	84.6
Westborough WD	449	17,437	70.4	431	17,300	68.0	428	16,720	70.0
Westford WD	425	16,250	71.5	344	17,220	54.6	349	15,682	60.9
Weston WD	532	10,500	138	417	10,500	108.6	460	10,592	119

water use. In 1996, 1997, and 1998, commercial-use values were calculated as the sum of use volumes listed as “commercial” and “municipal” in the annual reports; in 1999 and 2000, when the annual reports included more detailed categories for reported use, commercial-use values were calculated as the sum of several listed uses, including commercial, school, institution, medical facility, day-care center, recreational area, service station, restaurant, and hotel/motel use. In some cases, this change may have introduced error; the differences between reported commercial water-use volumes in 1998 and 1999 averaged about 50 percent for all towns.

From these data, it was estimated that 3,180 Mgal/yr were used for public-supply commercial water use in the Concord River Basin during 1996 to 2000 (table 8). The Sudbury River Basin had the largest amount of public-supply commercial water use at 1,430 Mgal/yr (45.0 percent of the basin total), followed by the Assabet River Basin at 996 Mgal/yr (31.3 percent) and the Lower Concord River Basin at (755 Mgal/yr or 23.7 percent). On the subbasin level, public-supply commercial water use ranged from 0.41 Mgal/yr in Whitehall Brook to 458 Mgal/yr in the Assabet Headwaters subbasin (table 8).

Self-Supply

Self-supply commercial water use was estimated by using employment estimates by town and business, water-use coefficients by business type, and areas of commercial land use in towns. Numbers of employees in each town by business type yearly for 1996 through 2000 were obtained from the current employment statistics of the Massachusetts Division of Employment and Training (2003). In these statistics, business types are described in terms of SIC codes. Water-use coefficients (use per employee) for business as described by SIC code from a nationally applicable forecasting model (IWR-MAIN model, as described in Horn, 2000, table 10) were used to calculate the total (public- and self-supply) commercial use for each town. The total commercial use for the town, a volume, was converted to an areal use rate so that the total volume could be apportioned between public and self-supply and distributed spatially among subbasins. The areal commercial-use rate, in Mgal/yr/mi², was calculated by dividing the total commercial use volume for the town by the total commercial land area in the town. Use of this areal rate is based on the assumption that commercial water use in the town is uniformly distributed across all commercial land-use areas. Self-supply commercial water use in each town and subbasin was then calculated by multiplying the areal commercial water-use rate for the town by the area of commercial land use outside the extent of public water distribution lines in each town and subbasin.

For the 23 towns with municipal public water systems that separately reported commercial water use, a comparison between the commercial water-use volumes calculated from

SIC codes and the reported commercial water use provided a way to evaluate the accuracy of the SIC-based approach. The comparison was not straightforward, however, in that the SIC-based commercial water-use estimates were for entire towns, that is, for both public- and self-supply commercial water use in a town, whereas the reported commercial water use was for public-supply commercial use only. The public- and self-supply commercial water-use components of the SIC-based value were estimated by apportioning the SIC-based value for the entire town by the fraction of the total commercial land area in the town on public- and self-supply. The median difference between the SIC-based estimates of public-supply commercial use and the reported public-supplied commercial water use was small—0.53 percent of reported use—but the range of differences was large, with an interquartile range from -20 to +56 percent; for nine towns, the SIC-based values overestimated reported public-supply commercial water use by 20 percent or more. These towns were Bedford, Concord, Framingham, Hopkinton, Lincoln, Natick, Northborough, Tewksbury, and Westborough. For these towns, areal-use rates calculated from reported public-supply commercial-use rates, which were lower and therefore considered more conservative, were used to estimate self-supply commercial water use. The estimates of self-supply commercial water use were based entirely on the areal-use rates, either from SIC-based approach or from reported public water use, because no large users regulated under the WMA in the basin were identified as commercial users with withdrawal data (table 7).

Based on this information, 583 Mgal/yr were used for self-supply commercial water use in the Concord River Basin (table 8). Self-supply commercial water use was about equal in the Assabet River (262 Mgal/yr) and Sudbury River (257 Mgal/yr) Basins, and was smaller (64.3 Mgal/yr) in the Lower Concord River Basin. On the subbasin level, self-supply commercial water use ranged from 0.00 Mgal/yr in the Whitehall and Pine Brook subbasins to 80.7 Mgal/yr in the Assabet Headwaters subbasin (table 8).

It should be noted that there were many potential sources of error in the SIC-based estimates. First, the water-use coefficients by SIC code are very generalized estimates, based on median values of water use for broad categories of industry (Horn, 2000). Thus, the coefficients may not accurately reflect use by commercial (and industrial; see below) users in a specific study area. Second, the method is based on an assumed linear relation between water use by commercial (or industrial) users and the mapped area of commercial (or industrial) land use at the 24:000 scale (the land-use data used in this study). These and other sources of error in the SIC-based estimates of commercial (and industrial) water use in the basin were difficult to quantify; however, no other data were available with which to estimate self-supply use for commercial (and industrial) uses.

Table 10. Coefficients for estimating commercial, industrial, and agricultural water use in the Concord River Basin in eastern Massachusetts, 1996–2000.

[Standard Industrial Classification (SIC) codes from Horn (2000); agricultural coefficients for livestock from Barlow (2003). Coefficients are per employee for SIC use coefficients and are per animal for livestock-use coefficients]

Category	Water use, in gallons per day per unit
Standard Industrial Classification (SIC)	
Commercial	
Finance, insurance, and real estate	71
Public administration	106
Retail trade	58
Services	106
Transportation	51
Wholesale trade	58
Industrial	
Apparel	13
Chemicals	289
Electrical equipment	71
Fabricated metal	95
Food	469
Furniture	30
Instruments	66
Jewelry, precious metals	36
Lumber and wood	78
Machinery	58
Paper	863
Primary metal	178
Printing	42
Rubber	119
Stone, clay, glass, and concrete	202
Textile mill products	315
Livestock	
Beef cattle	16
Dairy cows	35
Goats	2
Heifers	3.5
Horses	12.5
Pigs	4
Pullets older than 3 months	0.05
Sheep	2
Turkeys	0.07

Industrial

Public Supply

Public-supply industrial water use was determined by the same method used for public-supply commercial water use—from the industrial water use reported each year by municipal suppliers and the fraction of the total industrial land area in each town in each subbasin. There were no nonmunicipal suppliers for public-supply industrial use. If a municipal supplier did not report use by category for one or more years, industrial water use was estimated by the same method used for commercial use not reported by category for municipal community supply systems. In 1996, 1997, and 1998, industrial-use values were taken as the values reported as industrial use on annual statistical reports. In annual statistical reports in 1999 and 2000, industrial and agricultural uses were combined into one category (“industrial/agricultural”) for reporting. For these years, industrial use was estimated as the difference between the total combined use reported for 1999 and 2000 and the agricultural use reported by the supplier in 1998; if no agricultural use was reported by the supplier in 1998, the entire combined use reported in 1999 or 2000 was assumed to be industrial.

Public-supply industrial water use was thus estimated at 919 Mgal/yr for the entire Concord River Basin during 1996 to 2000 (table 8). As with public-supply commercial use, the Sudbury River Basin had the largest amount of public-supply industrial water use at 342 Mgal/yr (37.2 percent of the basin total), followed by the Assabet River Basin at 307 Mgal/yr (33.3 percent) and the Concord River Basin at 271 Mgal/yr (29.4 percent). On a subbasin basis, the public-supply industrial use ranged from 0.00 Mgal/yr in several subbasins to 171 Mgal/yr in the River Meadow Brook subbasin (table 8).

Self-Supply

Self-supply industrial water use was estimated by the same method used for self-supply commercial water use—SIC-code data, water-use coefficients, and areas of industrial land use. The SIC-based industrial-use estimate for each town was divided by the total industrial land area in the town to estimate an areal industrial water-use rate in Mgal/yr/mi². Public-supply industrial water-use volumes calculated from with SIC-based approach were compared to volumes reported by public suppliers, as for commercial water use; data from 16 towns were included in the comparison. The average difference between the SIC-based estimates of public-supply industrial use and the reported public-supply industrial water use was small, -3.7 percent of reported use, but the median (-48 percent) and range of differences (interquartile range from -64 to +1.0 percent) were large; these statistics indicate that the SIC-based estimates were typically less than the reported values for public-supply industrial use. For consis-

tency with the self-supply commercial use estimates, however, SIC-based values were used to estimate self-supply industrial use, in all but three towns (Billerica, Chelmsford, and Framingham), in which the reported public-supply industrial water use was overestimated by the SIC-based values by 20 percent or more.

The self-supply industrial water use was calculated for each town and subbasin by multiplying the areal industrial water-use rate (SIC-based or based on reported volumes) for the town by the area of industrial land use outside the extent of public-water distribution lines in each town and subbasin. Site-specific WMA withdrawals for industrial use by large, regulated users were added to the industrial-use estimates calculated from land-use areas and SIC codes. The WMA withdrawals theoretically should have been included in the SIC-based estimates for towns. However, comparison of the reported WMA withdrawals and total SIC-based estimates for the towns in which the WMA withdrawals were made (Acton, Ashland, Westborough, and Westford, table 7) indicated that the SIC-based estimates were too low to include the WMA withdrawals. This disparity is consistent with the SIC-based rates being underestimates of industrial water use for public-supply industrial use. It may have resulted in part from the fact that the water-use coefficients for business types identified by SIC codes were median values for broad categories of industry and very generalized estimates (Horn, 2000).

Based on this information, 411 gal/yr were used for self-supply industrial water use in the Concord River Basin from 1996 through 2000 (table 8). Self-supply industrial water use was distributed similarly to self-supply commercial water use, with about equal amounts in the Assabet River (203 Mgal/yr) and Sudbury River (180 Mgal/yr) Basins, and was smaller (28.9 Mgal/yr) in the Lower Concord River Basin. On the subbasin level, self-supply industrial water use ranged from 0.00 Mgal/yr in the Spencer Brook, Baiting Brook, and Whitehall Brook subbasins to 113 Mgal/yr in the Assabet Main Stem subbasin (table 8). It should be noted, however, that like the estimates of self-supply commercial water use, the accuracy of these estimates of self-supply industrial water use was unknown.

Agricultural

Public Supply

Public-supply agricultural water use for the basin was determined from yearly reported use by water suppliers in their annual reports. In a few instances, agricultural use was estimated for one year for towns in which municipal suppliers did not report use by category, but did report agricultural use in the previous or following years; no agricultural use was estimated for two towns in which municipal suppliers did not report use by category for any years during the study period. In annual statistical reports in 1999 and 2000, in which agricultural and industrial uses were combined into one category for reporting, agricultural use was assumed equal to that

reported by the supplier in 1998. The public-supply agricultural water use for the town was disaggregated to the subbasin level in proportion to the agricultural land area on public supply. From this information, it was estimated that 192 Mgal/yr was used for public-supply agricultural water use in the basin from 1996 through 2000 (table 8). The Sudbury River Basin had the largest amount of public-supply agricultural water use at 147 Mgal/yr (76.6 percent), followed by the Assabet River Basin at 43 Mgal/yr (22.4 percent), and the Lower Concord River Basin at 1.85 Mgal/yr (1.0 percent) (table 8).

Self-Supply

Self-supply agricultural water use for crop irrigation and livestock was estimated by using county-level data from the 1997 U.S. Census of Agriculture (U.S. Department of Agriculture, 1999) and areas of agricultural land use (cropland and pasture, table 1) by county within the basin. Counties within the basin are Middlesex and Worcester counties. Data from the U.S. Census of Agriculture included the area of irrigated land and the number and type of livestock in counties. Separate, county-wide water-use volumes for crop irrigation and for livestock were first estimated for each county. These values were then converted to separate areal rates (Mgal/yr/mi²) on the basis of the total land-use areas occupied by cropland and pasture in each county. Areas of cropland and pasture on self-supply in each town and subbasin were identified as the cropland and pasture land-use areas outside the extent of public water distribution lines. The self-supply agricultural water-use volumes were calculated by multiplying the appropriate areal-use rate from the county data by the land areas on cropland and pasture on self-supply in each town and subbasin; a single agricultural water-use volume was then calculated as the sum of the cropland and pasture (livestock) use volumes for each town and subbasin. In this approach, water use associated with irrigated agriculture was distributed evenly over all of the self-supply areas of cropland and pasture, because there was no information on the spatial distribution in the basin of those portions of mapped cropland areas that were actually irrigated or of mapped pasture area that actually contained livestock. In addition, self-supply agricultural withdrawals reported by large users regulated under the WMA (use type “AG”, table 7) were included in the estimates.

The total water use for crop irrigation was estimated by using an assumed water requirement of 1 in/acre/week during the growing season (June, July, August, and September; Wild and Nimiroski, 2004) and the difference between this requirement and actual rainfall during the study period (rainfall deficit) during these months. The volume of water provided by self-supply agriculture was assumed equal to the rainfall deficit. The rainfall deficit thus calculated, averaged by month for the 5 years 1996–2000, was 0.35 in/week for June, 0.16 in/week for July, 0.30 in/week for August, and 0.25 in/week for September (overall average for all months, 0.26 in/week). The 5-year average rainfall deficits by month then were multiplied by the number of irrigated acres given

by the U.S. Census of Agriculture in each county to yield estimated water-use volumes for the growing-season months for each county. The total water use for livestock was estimated by multiplying the number of each type of animal in each county by its respective water use coefficient (table 10; coefficients from Barlow, 2003).

Self-supply water use for irrigation at golf courses was obtained directly from reported withdrawals for large users regulated under the WMA (table 7) or was estimated by using a water-use coefficient determined from regulated golf-course withdrawals in Massachusetts (0.0117 Mgal/d/1000 linear yards during June, July, and August; Wild and Nimiroski, 2004). Estimated use was for golf courses that were not regulated under the WMA as users with withdrawals greater than 100,000 gal/d. Golf courses in the Concord River Basin were identified on the basis of information from the MADEP and other, commercial sources (E.C. Wild, U.S. Geological Survey, written commun., 2004). Estimates were made only for golf courses which were known to be self-supplied. At some golf courses, water also was withdrawn for use at restaurants or in other public facilities. These withdrawals were regulated as nonmunicipal, noncommunity public water supplies (transient noncommunity systems) and were not included in the agricultural water use for golf-course irrigation described in this section; they were included in the withdrawals described in table 5 as noncommunity public water systems and in the estimates of public-supply commercial use in table 8.

Based on these data, self-supply agricultural water use was an estimated 370 Mgal/yr for the Lower Concord River Basin from 1996 through 2000 (table 8). The Sudbury River Basin had the largest volume of self-supply agricultural water use at 215 Mgal/yr (58.2 percent of the total self-supply agricultural water use), followed by the Assabet River Basin at 146 Mgal/yr (39.4 percent), and the Lower Concord River Basin at 8.88 Mgal/yr (2.40 percent). On the subbasin level, self-supply agricultural water use ranged from 0.08 Mgal/yr in the Sudbury River – Framingham subbasin to 122 Mgal/yr in the Cold Spring Brook subbasin (table 8).

Unaccounted-For

Unaccounted-for water includes water used in the operation of water-supply systems—for example, for flushing and filter backwashing; water used for purposes such as firefighting, street washing, and recreation; and water that is otherwise unaccounted for in the supply system, such as water that is lost through line breaks, leakage (exfiltration), and inaccurate metering. Unaccounted-for water was estimated only for municipal community systems because information on unaccounted-for water is not available for most noncommunity systems; unaccounted-for water in noncommunity systems is likely to be very small, however, because these systems have limited distribution and do not include water uses such as firefighting. Information on unaccounted-for water for municipal community systems was obtained from the annual reports

completed by suppliers. Several categories listed in the annual reports for 1996, 1997, and 1998—such as filter backwash, unaccounted-for water, and flushing—were combined to obtain the unaccounted-for volume in this study; in 1999 and 2000, the unaccounted-for volume was obtained from the single category that was provided for reporting. Unaccounted-for water use was estimated for the subbasins by disaggregating the reported total volumes for the entire basin in proportion to the length of water-supply distribution lines in each subbasin relative to the total length of these lines for each town. Note that this approach spatially distributes unaccounted-for water among subbasins at locations where the water supplied by the system is distributed and used, rather than at the location of the water loss for some components of unaccounted-for water (for example, filter backwash that may occur at the water-processing plant). Unaccounted-for water for nonmunicipal public supply or self-supply was not estimated, because there were no data available and because many of the processes that produce unaccounted-for water (for example, fire hydrant flushing) are not used with these supplies. Based on this information, unaccounted-for water use in the Concord River Basin averaged 2,260 Mgal/yr during 1996 to 2000, or 13.7 percent of total public-supply use (table 8).

Consumptive

Consumptive use in the Concord River Basin during the study period was estimated for domestic, commercial, industrial, and agricultural uses. The consumptive component of domestic use was estimated by using reported monthly withdrawals by municipal community systems, specifically, the difference between average winter (primarily nonconsumptive) and average annual domestic per capita use rates. Data from the year 2000 were used. The consumptive component of domestic use thus calculated averaged 16.6 percent of total withdrawals for all towns; this value is close to the 15-percent consumptive-use rate used by Horn (2000). The consumptive component for industrial and commercial uses was assumed equal to 10 percent of total use (Horn, 2000).

Agricultural use was assumed to be 100-percent consumptive. Although some agricultural use may be nonconsumptive (for example, estimated values of 1 percent for crop irrigation in Massachusetts and 16 percent for livestock in New England; Solley and others, 1998), these volumes are likely to be small, and there is little information on which to base estimates. Total consumptive use may have been underestimated by the assumption of 100-percent consumptive agricultural use, but only slightly—an estimate of 10-percent non-consumptive use for agriculture would have increased the total estimated consumptive use by 2.2 percent. Similarly, return flows may have been underestimated by this assumption about agricultural use, but the difference again would be slight—an estimate of 10-percent nonconsumptive use for agriculture would have reduced the total estimated return flows in the basin by only 1.1 percent.

Summary of Water Use and Withdrawals

Total water use in the Concord River Basin was estimated at 19,200 Mgal/yr for the period 1996–2000 (table 8). Most (86.2 percent) of this water use, or 16,500 Mgal/yr, was provided by public-supply systems; the remaining 2,650 Mgal/yr (13.8 percent) was self-supplied (fig. 8). Domestic use (11,300 Mgal/yr) was the largest component, accounting for 58.7 percent of the total water use in the basin, and 88.5 percent of domestic use was provided by public-supply systems. Commercial (3,770 Mgal/yr) and industrial (1,330 Mgal/yr) uses accounted for 19.6 and 6.9 percent, respectively, of total use; a greater fraction of commercial use (84.5 percent) was provided by public-supply systems than of industrial use (69.1 percent). Agriculture and golf-course irrigation (562 Mgal/yr) accounted for only 2.9 percent of total water use in the basin; most (65.9 percent) of this use was self-supplied.

Because self-supply water use was estimated, total withdrawals in the Concord River Basin also could be estimated (fig. 9). Total withdrawals for the basin for 1996–2000 were estimated at 12,700 Mgal/yr (table 11). This included 10,100 Mgal/yr for public supply and 2,650 Mgal/yr for self-supply, which is equal to the total self-supply use (table 8). Withdrawals from ground-water sources were 75.3 percent

of total withdrawals, or 9,580 Mgal/yr, and withdrawals from surface-water sources were 24.7 percent of total withdrawals, or 3,140 Mgal/yr (fig. 9). The distribution of withdrawals between ground- and surface-water sources was calculated by adding average annual withdrawals by source type for public supply (table 5) and large users (table 7) and by assuming that all withdrawals for self-supply use were from ground-water sources, except those reported by large users to be from surface-water sources.

Water Imports and Exports for Public Supply

Water-use estimates for the Concord River Basin and its subbasins and towns were combined with withdrawal data to estimate imports and exports of potable water into and out of the basin. The estimates were made for municipal community public-supply systems only; these include extensive distribution systems that typically cross basin and subbasin boundaries. The interbasin or intersubbasin transfers that result from the operation of these systems must be inferred, because they are not reported or metered by suppliers (reported purchases and sales of water by municipal systems are town-based, not basin-based). Water imports and exports through withdrawals and use by nonmunicipal community public-supply systems were not estimated and were assumed to be negligible;

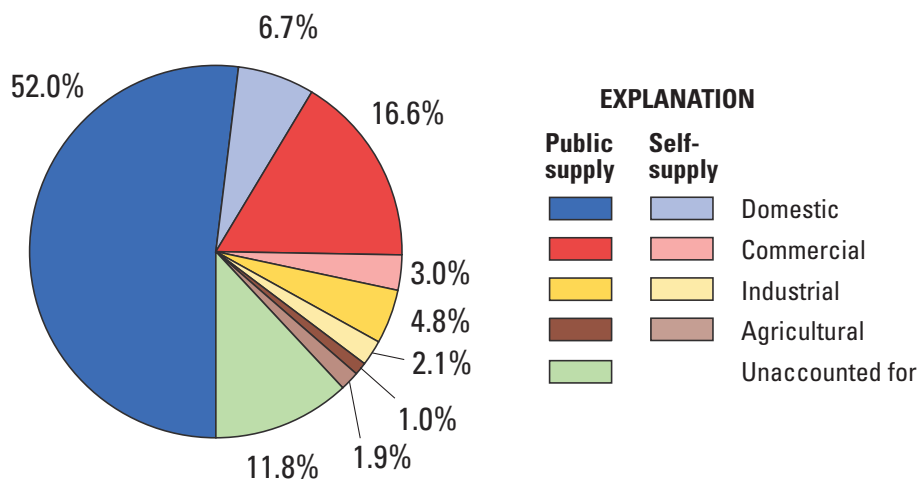


Figure 8. Estimated average annual public- and self-supply water use in the Concord River Basin in eastern Massachusetts, 1996–2000. Number is percentage (%) of total use. Total volume of use was 19,200 Mgal/yr. The sum of percentages does not equal 100 because of rounding. Consumptive use is not shown here because it is a component of other use types.

distribution systems for these supply systems are typically of limited areal extent and were assumed to result in no interbasin or intersubbasin transfers. Self-supply water withdrawals and use were similarly assumed to be co-located and also to result in no imports or exports across basin, subbasin, or town boundaries. Imports and exports of potable water were estimated as follows: in cases where use was greater than withdrawals, an import was inferred; in cases where use was less than withdrawals, an export was inferred (table 11). It should be noted that the imports and exports estimated for the Concord River Basin and its subbasins and towns are based on different sources of data, including census data, land-use data, reported withdrawals, and reported and estimated use volumes. These data sources incorporate many potential sources of error that are discussed throughout this report but were not quantified in this study.

For the entire basin, a net import of 6,460 Mgal/yr of potable water for public supply was inferred for the study period (table 11). This value was 39.1 percent of total public-supply use and 33.7 percent of total public- and self-supply use in the basin (fig. 10). There was a net import of water for public supply in the Assabet (1,520 Mgal/yr or 30.4 percent of public-supply use in the basin), Sudbury (3,340 Mgal/yr or 43.7 percent of public-supply use), and Lower Concord River (1,590 Mgal/yr or 41.2 percent of public-supply use) Basins.

Most subbasins also were net importers of water for public supply. Net exports of water for public supply occurred only in the Fort Meadow Brook, Indian Brook, Lower Sudbury River, and Whitehall Brook subbasins (table 11).

Water was imported into the basin for public supply through purchases from the MWRA, through purchases from municipal community supply systems outside the basin, and from transfer of water from sources outside of basin through water-distribution systems operated in towns that straddle basin boundaries. Water purchased from the MWRA by municipal community water supply systems was the primary source of imported water for public supply. This import, estimated at 4,740 Mgal/yr for the entire Concord River Basin, was based on the water purchased by municipal community supply systems for towns entirely within the basin and a fraction of the purchased water for towns partly in the basin. (The fraction was based on the average of percentages of town area and population in the basin; table 4). Water was purchased from the MWRA by Bedford, Clinton, Framingham, Marlborough, Northborough, Southborough, and Weston, as described previously; purchases reported for the study period by municipal suppliers in most of these towns were comparable to the imports estimated by difference for these towns (table 12). Imports of MWRA-purchased water for use in Framingham (2,880 Mgal/yr) and Marlborough

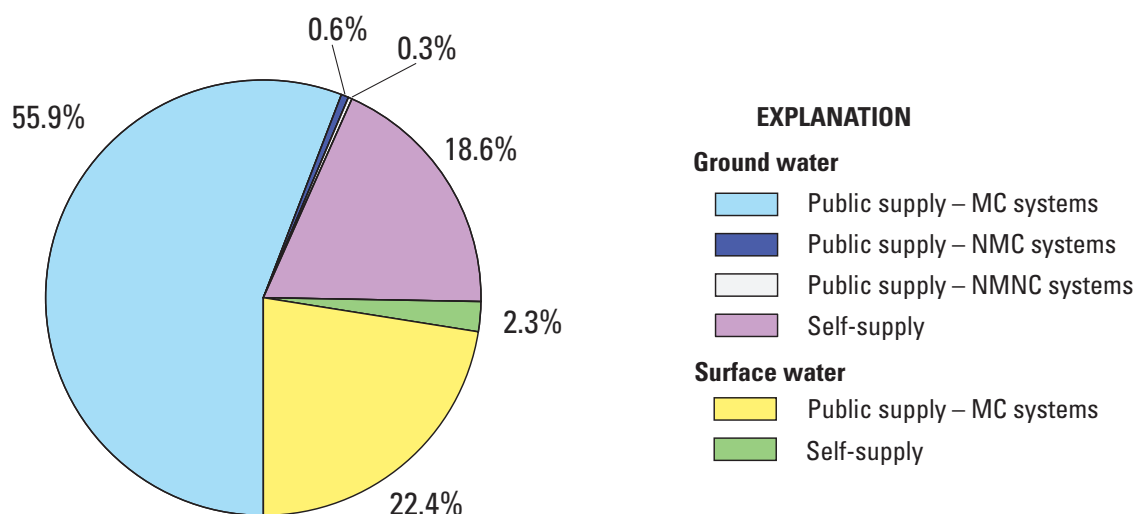


Figure 9. Estimated average annual public- and self-supply withdrawals from ground water and surface water in the Concord River Basin in eastern Massachusetts, 1996–2000. Number is percentage (%) of total withdrawals. Total volume of withdrawals was 12,700 Mgal/yr. The sum of percentages does not equal 100 because of rounding. MC, municipal community public-supply systems (described as “community water systems” in annual reports to MADEP); NMC, nonmunicipal community public-supply systems (also described as “community water systems” in annual reports to MADEP); NMNC, nonmunicipal, noncommunity public-supply systems (described as “non-transient, noncommunity” and “transient noncommunity” public-supply systems in annual reports to MADEP). MADEP, Massachusetts Department of Environmental Protection.

(1,150 Mgal/yr) represented two of the three largest imports by town of potable water into the basin (table 12). Other large imports by town were for use in Lowell (1,760 Mgal/yr) and Shrewsbury (818 Mgal/yr); these imports were from sources outside the basin, including the Merrimack River for Lowell and water-supply wells in the Blackstone River Basin for Shrewsbury. The single large export (931 Mgal/yr) was from water withdrawn from the Concord River and distributed for

use in areas of Billerica outside the basin (table 12). Other inferred imports and exports were derived from small transfers of water in towns partly within the basin, purchases or sales of water, or error in the estimates of use or withdrawals. Specifically, error was likely responsible for the inferred imports or exports for towns that were entirely within the basin and reported no sales or purchases of water—that is, for Acton, Hudson, Maynard, and Sudbury.

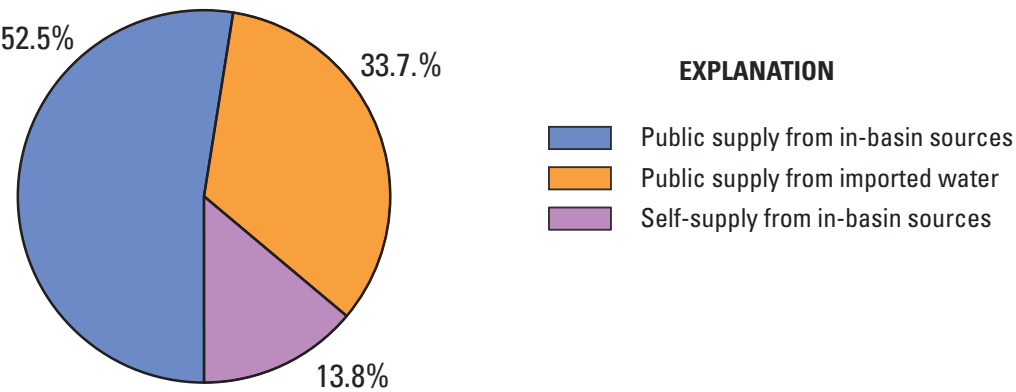


Figure 10. Estimated average annual public- and self-supply water use from sources in and outside the Concord River Basin in eastern Massachusetts, 1996–2000. Number is percentage (%) of total use. Total use was 19,200 Mgal/yr.

Table 11. Public- and self-supply water withdrawals, use, and imports and exports for public supply in subbasins of the Concord River Basin in eastern Massachusetts, 1996–2000.

[The sum of the values may not equal the total because of rounding. Mgal/yr, million gallons per year. NAV, not reported, not metered or otherwise unavailable; --, not applicable. Total imports and exports for subbasins and basins are net values]

Town	Public supply (Mgal/yr)				Self-supply (Mgal/yr)		Public and self-supply
	Withdrawals	Use	Imports	Exports	Withdrawals	Use	Withdrawals
Assabet River Basin							
Assabet Headwaters							
Grafton	0.00	0.00	0.00	0.00	4.66	4.66	4.66
Marlborough	554	366	0.00	188	89.6	89.6	643
Northborough	123	247	125	0.00	93.7	93.7	216
Shrewsbury	0.00	652	652	0.00	21.4	21.4	21.40
Westborough	427	346	0.00	80.9	62.7	62.7	490
NCPWS	NAV	NAV	0.00	0.00	0.00	0.00	NAV
Subbasin total	1,100	1,610	507	0.00	272	272	1,380
Assabet Main Stem							
Acton	223	18.60	0.00	204	58.2	58.2	281
Berlin	0.00	0.00	0.00	0.00	13.6	13.6	13.6
Bolton	0.00	0.00	0.00	0.00	7.21	7.21	7.21
Concord	206	301	95.7	0.00	4.39	4.39	210
Hudson	43.5	581	538	0.00	81.1	81.1	125
Marlborough	0.00	4.50	4.50	0.00	59.9	59.9	59.9
Maynard	328	324	0.00	4.08	5.24	5.24	333
Northborough	0.00	0.00	0.00	0.00	0.03	0.03	0.03
Stow	NAV	6.37	NAV	NAV	94.0	94.0	94.0
Shrewsbury	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sudbury	0.00	78.9	78.9	0.00	1.60	1.60	1.60
NCPWS	1.50	1.50	0.00	0.00	0.00	0.00	1.50
Subbasin total	801	1,320	515	0.00	325	325	1,130
Danforth Brook							
Berlin	0.00	0.00	0.00	0.00	7.50	7.50	7.50
Bolton	0.00	0.00	0.00	0.00	25.1	25.1	25.1
Hudson	0.00	111	111	0.00	9.54	9.54	9.54
NCPWS	0.21	0.21	0.01	0.00	0.00	0.00	0.21
Subbasin total	0.21	111	111	0.00	42.2	42.2	42.4
Elizabeth Brook							
Bolton	0.00	0.00	0.00	0.00	42.2	42.2	42.2
Boxborough	15.8	15.8	0.00	0.00	4.99	4.99	20.8
Harvard	0.00	0.00	0.00	0.00	43.8	43.8	43.8
Stow	4.88	4.88	0.00	0.00	93.1	93.1	98.0
NCPWS	24.1	24.1	0.00	0.00	0.00	0.00	24.1
Subbasin total	44.8	44.8	0.00	0.00	184	184	229

Table 11. Public- and self-supply water withdrawals, use, and imports and exports for public supply in subbasins of the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the values may not equal the total because of rounding. Mgal/yr, million gallons per year. NAV, not reported, not metered or otherwise unavailable; --, not applicable. Total imports and exports for subbasins and basins are net values]

Town	Public supply (Mgal/yr)				Self-supply (Mgal/yr)		Public and self-supply
	Withdrawals	Use	Imports	Exports	Withdrawals	Use	Withdrawals
Assabet River Basin							
Fort Meadow Brook							
Hudson	672	132	0.00	539	13.0	13.0	685
Marlborough	0.00	283	283	0.00	41.4	41.4	41.4
Subbasin total	672	416	0.00	256	54.4	54.4	726
Fort Pond Brook							
Acton	239	435	195	0.00	46.8	46.8	286
Boxborough	9.83	9.83	0.00	0.00	83.3	83.3	93.1
Concord	0.00	64.50	64.5	0.00	2.20	2.20	2.20
Littleton	0.00	66.70	66.7	0.00	32.3	32.3	32.3
Maynard	19.5	37.2	17.7	0.00	2.43	2.4	21.9
Stow	26.1	26.1	0.00	0.00	6.91	6.91	33.0
NCPWS	0.89	0.89	0.00	0.00	0.00	0.00	0.89
Subbasin total	296	640	344	0.00	174	174	470
Howard and Cold Harbor Brooks							
Berlin	0.00	0.00	0.00	0.00	0.07	0.07	0.07
Boylston	0.00	0.00	0.00	0.00	10.5	10.5	10.5
Northborough	171	68.9	0.00	102	29.6	29.6	201
Shrewsbury	0.00	166	166	0.00	3.49	3.49	3.49
Subbasin total	171	235	64.10	0.00	43.70	43.70	215
Nashoba Brook							
Acton	224	319	94.3	0.00	36.0	36.0	260
Carlisle	0.00	0.00	0.00	0.00	6.47	6.47	6.47
Concord	154	5.95	0.00	148	0.45	0.45	155
Littleton	0.00	59.8	59.8	0.00	21.9	21.9	21.9
Westford	12.1	102	90.4	0.00	65.9	65.9	77.9
NCPWS	0.14	0.14	0.00	0.00	0.00	0.00	0.14
Subbasin total	391	487	96.10	0.00	131	131	522
North Brook							
Berlin	0.98	0.98	0.00	0.00	54.0	54.0	55.0
Bolton	0.00	0.00	0.00	0.00	6.03	6.03	6.03
Boylston	0.00	0.00	0.00	0.00	7.35	7.35	7.35
Clinton	0.00	46.9	46.9	0.00	0.33	0.33	0.33
Marlborough	0.00	2.76	2.76	0.00	0.00	0.00	0.00
Northborough	0.00	61.1	61.1	0.00	14.0	14.0	14.0
NCPWS	0.42	0.42	0.00	0.00	0.00	0.00	0.42
Subbasin total	1.40	112	111	0.00	81.7	81.7	83.1

Table 11. Public- and self-supply water withdrawals, use, and imports and exports for public supply in subbasins of the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the values may not equal the total because of rounding. Mgal/yr, million gallons per year. NAV, not reported, not metered or otherwise unavailable; --, not applicable. Total imports and exports for subbasins and basins are net values]

Town	Public supply (Mgal/yr)				Self-supply (Mgal/yr)		Public and self-supply
	Withdrawals	Use	Imports	Exports	Withdrawals	Use	Withdrawals
Assabet River Basin							
Spencer Brook							
Acton	0.00	0.00	0.00	0.00	3.55	3.55	3.55
Carlisle	0.00	0.00	0.00	0.00	37.0	37.0	37.0
Concord	0.00	30.5	30.5	0.00	11.7	11.7	11.7
NCPWS	0.75	0.75	0.00	0.00	0.00	0.00	0.75
Subbasin total	0.75	31.2	30.5	0.00	52.2	52.2	53.0
Basin total	3,480	5,000	1,520	0.00	1,360	1,360	4,840
Sudbury River Basin							
Baiting Brook							
Framingham	0.00	253	253	0.00	6.82	6.82	6.82
Subbasin total	0.00	253	253	0.00	6.82	6.82	6.82
Cedar Swamp							
Hopkinton	0.00	4.67	4.67	0.00	4.23	4.23	4.23
Southborough	0.00	1.35	1.35	0.00	0.17	0.17	0.17
Upton	0.00	0.00	0.00	0.00	0.56	0.56	0.56
Westborough	489	492	2.74	0.00	143	143	631
Subbasin total	489	498	8.76	0.00	148	148	636
Cold Spring Brook							
Ashland	0.00	75.2	75.2	0.00	4.08	4.08	4.08
Hopkinton	0.00	54.2	54.2	0.00	156	156	156
NCPWS	NAV	NAV	--	--	0.00	0.00	NAV
Subbasin total	0.00	129	129	0.00	160	160	160
Hop Brook							
Framingham	0.00	0.00	0.00	0.00	14.0	14.0	14.0
Hudson	199	5.09	0.00	194	7.41	7.41	207
Marlborough	0.00	103	103	0.00	83.0	83.0	83.0
Sudbury	178	371	193	0.00	45.4	45.4	223
Subbasin total	377	479	102	0.00	150	150	527
Indian Brook							
Ashland	510	7.28	0.00	503	2.20	2.20	512
Hopkinton	0.00	86.2	86.2	0.00	25.3	25.3	25.3
Subbasin total	510	93.5	0.00	416	27.5	27.5	537

Table 11. Public- and self-supply water withdrawals, use, and imports and exports for public supply in subbasins of the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the values may not equal the total because of rounding. Mgal/yr, million gallons per year. NAV, not reported, not metered or otherwise unavailable; --, not applicable. Total imports and exports for subbasins and basins are net values]

Town	Public supply (Mgal/yr)				Self-supply (Mgal/yr)		Public and self-supply
	Withdrawals	Use	Imports	Exports	Withdrawals	Use	Withdrawals
Sudbury River Basin							
Lake Cochituate							
Ashland	0.00	185	185	0.00	6.29	6.29	6.29
Framingham	0.00	533	533	0.00	20.1	20.1	20.1
Natick	890	633	0.00	257	25.1	25.1	915
Sherborn	0.00	0.00	0.00	0.00	20.1	20.1	20.1
Wayland	0.00	212	212	0.00	7.00	7.00	7.00
Subbasin total	890	1,560	673	0.00	78.5	78.5	969
Lower Sudbury River							
Concord	488	197	0.00	291	58.8	58.8	547
Framingham	0.00	323	323	0.00	9.55	9.55	9.55
Lincoln	0.00	48.4	48.4	0.00	5.10	5.10	5.10
Sudbury	543	252	0.00	292	22.8	22.8	566
Wayland	721	262	0.00	459	17.1	17.1	738
NCPWS	NAV	NAV	--	--	0.00	0.00	NAV
Subbasin total	1,750	1,080	0.00	670	113	113	1,870
Pine Brook							
Wayland	0.00	212	212	0.00	3.10	3.10	3.10
Weston	0.00	14.9	14.9	0.00	2.89	2.89	2.89
Subbasin total	0.00	227	227	0.00	6.00	6.00	6.00
Reservoir 1-3							
Ashland	0.00	58.6	58.6	0.00	10.4	10.4	10.4
Framingham	0.00	430	430	0.00	19.4	19.4	19.4
Marlborough	0.00	0.00	0.00	0.00	1.01	1.01	1.01
Southborough	0.00	11.8	11.8	0.00	21.8	21.8	21.8
NCPWS	3.32	3.32	0.00	0.00	0.00	0.00	3.32
Subbasin total	3.32	503	500	0.00	52.6	52.6	55.9
Sudbury River - Framingham							
Framingham	0.00	1,340	1,340	0.00	43.4	43.4	43.4
Natick	0.00	116	116	0.00	3.22	3.22	3.22
Subbasin total	0.00	1,460	1,460	0.00	46.6	46.6	46.6
Sudbury Reservoir							
Marlborough	0.00	792	792	0.00	184	184	184
Northborough	0.00	2.39	2.39	0.00	0.00	0.00	0.00
Southborough	0.00	212	212	0.00	23.7	23.7	23.7
Westborough	0.00	87.1	87.1	0.00	15.0	15.0	15.0
NCPWS	1.66	1.66	0.00	0.00	0.00	0.00	1.66
Subbasin total	1.66	1,100	1,090	0.00	223	223	224

Table 11. Public- and self-supply water withdrawals, use, and imports and exports for public supply in subbasins of the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the values may not equal the total because of rounding. Mgal/yr, million gallons per year. NAV, not reported, not metered or otherwise unavailable; --, not applicable. Total imports and exports for subbasins and basins are net values]

Town	Public supply (Mgal/yr)				Self-supply (Mgal/yr)		Public and self-supply
	Withdrawals	Use	Imports	Exports	Withdrawals	Use	Withdrawals
Sudbury River Basin							
Upper Sudbury River							
Ashland	0.00	108	108	0.00	2.78	2.78	2.78
Hopkinton	4.03	4.03	0.00	0.00	11.9	11.9	15.9
Southborough	0.00	122	122	0.00	5.65	5.65	5.65
Westborough	0.00	3.11	3.11	0.00	0.46	0.46	0.46
NCPWS	0.63	0.63	0.00	0.00	0.00	0.00	0.63
Subbasin total	4.66	237	233	0.00	20.7	20.7	25.4
Whitehall Brook							
Hopkinton	280	31.9	0.00	248	20.1	20.1	300
Upton	0.00	0.00	0.00	0.00	0.04	0.04	0.04
Westborough	0.00	0.65	0.65	0.00	0.44	0.44	0.44
Subbasin total	280	32.50	0.00	248	20.5	20.5	301
Basin total	4,310	7,650	3,340	0.00	1,050	1,050	5,360
Lower Concord River Basin							
Lower Concord Main Stem							
Bedford	0.00	105	105	0.00	15.4	15.4	15.4
Billerica	1,670	707	0.00	965	36.1	36.1	1,710
Carlisle	0.00	0.00	0.00	0.00	53.3	53.3	53.3
Chelmsford	0.00	31.9	31.9	0.00	0.37	0.37	0.37
Concord	0.00	199	199	0.00	14.2	14.2	14.2
Lincoln	0.00	12.1	12.1	0.00	1.38	1.38	1.38
Lowell	0.00	792	792	0.00	12.1	12.1	12.1
Tewksbury	0.00	59.2	59.2	0.00	1.29	1.29	1.29
NCPWS	0.68	0.68	0.00	0.00	0.00	0.00	0.68
Subbasin total	1,670	1,910	235	0.00	134	134	1,810
River Meadow Brook							
Billerica	0.00	34.3	34.3	0.00	4.18	4.18	4.18
Carlisle	0.00	0.00	0.00	0.00	43.9	43.9	43.9
Chelmsford	603	907	303	0.00	34.9	34.9	638
Lowell	0.00	968	968	0.00	1.69	1.69	1.69
Westford	0.00	54.0	54.0	0.00	20.2	20.2	20.2
NCPWS	0.33	0.33	0.00	0.00	0.00	0.00	0.33
Subbasin total	604	1,960	1,360	0.00	105	105	709
Basin total	2,280	3,870	1,590	0.00	239	239	2,520
Total Concord River Basin							
Basin total	10,100	16,500	6,460	0.00	2,650	2,650	12,700

Table 12. Public-supply water withdrawals, use, imports and exports, and purchases from the Massachusetts Water Resources Authority by town in the Concord River Basin in eastern Massachusetts, 1996–2000.

[Purchase from MWRA: Averaged purchased water from the Massachusetts Water Resources Authority for 1996–2000 for use in the basin; the sum of the values may not equal the total because of rounding; --, not applicable]

Town	Public supply, in million gallons per year				
	Withdrawals	Use	Imports	Exports	Purchases from MWRA
Acton	686	772	85.8	0.00	0.00
Ashland	510	433	0.00	76.30	0.00
Bedford	0.00	105	105	0.00	¹ 128
Berlin	0.98	0.98	0.00	0.00	0.00
Billerica	1,670	741	0.00	931	0.00
Bolton	0.00	0.00	0.00	0.00	0.00
Boxborough	25.6	25.6	0.00	0.00	0.00
Boylston	0.00	0.00	0.00	0.00	0.00
Carlisle	0.00	0.00	0.00	0.00	0.00
Chelmsford	603	939	335	0.00	0.00
Clinton	0.00	46.9	46.9	0.00	¹ 89.2
Concord	848	798	0.00	49.3	0.00
Framingham	0.00	2,880	2,880	0.00	2,880
Grafton	0.00	0.00	0.00	0.00	0.00
Harvard	0.00	0.00	0.00	0.00	0.00
Hopkinton	284	181	0.00	103	0.00
Hudson	914	830	0.00	84.8	0.00
Lincoln	0.00	60.5	60.5	0.00	0.00
Littleton	0.00	127	127	0.00	0.00
Lowell	0.00	1,760	1,760	0.00	0.00
Marlborough	554	1,550	997	0.00	1,150
Maynard	347	361	13.60	0.00	0.00
Natick	890	749	0.00	141	0.00
Northborough	294	380	85.8	0.00	89.7
Sherborn	0.00	0.00	0.00	0.00	0.00
Shrewsbury	0.00	818	818	0.00	0.00
Southborough	0.00	347	347	0.00	355
Stow	31.0	37.3	6.37	0.00	0.00
Sudbury	721	701	0.00	19.8	0.00
Tewksbury	0.00	59.2	59.2	0.00	0.00
Upton	0.00	0.00	0.00	0.00	0.00
Wayland	721	687	0.00	34.3	0.00
Westborough	916	929	12.6	0.00	0.00
Westford	12.1	156	144	0.00	0.00
Weston	0.00	14.9	14.9	0.00	¹ 35.4
Total	--	--	--	--	4,740

¹Fraction of total purchase used in the basin estimated from the percentages of town area and town population in the basin.

Wastewater Return Flows

Wastewater return flows in the Concord River Basin and its subbasins were determined for public- and self-disposed wastewater. Public-disposed wastewater was considered to be wastewater collected through sewers and discharged from a municipal wastewater-treatment facility (WWTF); these facilities served one or more towns and were permitted under the USEPA NPDES program. Return flows for WWTFs were determined primarily from information on discharges obtained from the facilities. Self-disposed wastewater was considered to be wastewater disposed by individual users, typically on site. Self-disposed wastewater in this study also included wastewater from all nonmunicipal public water systems outside the areal extent of municipal sewer systems. Return flows for self-disposed wastewater through on-site septic systems were estimated from water-use rates, population density, and land-use data. Imports and exports of wastewater were estimated as the differences between wastewater generated in the basin and wastewater discharges disposed of in the basin.

Wastewater Discharges from Treatment Facilities

Eleven municipal WWTFs and one MWRA WWTF served the towns in the Concord River Basin during 1996–2000. Seven of these facilities were in the Concord River Basin: the Billerica WWTF, Concord WWTF, Hudson WWTF, Marlborough Easterly WWTF, Marlborough Westerly WWTF, Maynard WWTF, and Westborough WWTF (fig. 11). Two WWTFs served more than one town in the basin: The Marlborough Westerly WWTF received wastewater from Marlborough and Northborough, and the Westborough WWTF received wastewater from Westborough, Shrewsbury, and Hopkinton. The remaining municipal facilities, which served Grafton, Lowell, and Upton, and the MWRA facility, which served Clinton, were outside the Concord River Basin. In addition, wastewater from Ashland, Bedford, Framingham, and Natick was collected for treatment at the MWRA regional facility on an island in Boston Harbor. Users served by municipal WWTFs also were served by municipal community public-supply systems, as indicated by the superposition of sewer and water-distribution lines (fig. 4). Discharges from the facilities in the basin were to the Assabet and Concord Rivers and to Hop Brook. Discharge and location data for the municipal WWTFs were obtained from the facility managers, USEPA NPDES Permit Compliance System (PCS) database, and MADEP. Wastewater return flows for the seven municipal WWTFs in the Concord River Basin averaged 6,620 Mgal/yr for the study period (table 13). The annual discharge rates from these seven facilities ranged from 6,030 Mgal/yr in 1999 to 7,290 Mgal/yr in 1996. These discharges from WWTFs included infiltration and inflow.

Wastewater Return Flows from Self-Disposal

Self-disposal of wastewater in the Concord River Basin was primarily through on-site septic systems to ground water. Wastewater also can be self-disposed to surface waters, and commercial, industrial, and other facilities that discharge to surface waters are, like municipal WWTFs, permitted under the USEPA NPDES program. Several NPDES-permitted facilities other than municipal WWTFs were present in the Concord River Basin during the study period (fig. 11). Discharge data were not available for many of these facilities, however; as a result, these discharges were not included in the estimates of return flows from self-disposal of wastewater in this study. Based on the available data, return flows from NPDES-permitted facilities other than municipal WWTFs were likely to have been less than 100 Mgal/yr. Return flows from MADEP-permitted ground-water-discharge sites (facilities that discharge more than 10,000 gal/d to ground water; fig. 11) also were not included in estimates of self-disposed wastewater return flows in this study because available data for these facilities were limited to maximum daily flows.

Self-disposal of wastewater through septic systems was estimated from non-consumptive use rates for domestic, commercial, and industrial use. Self-disposal of wastewater from domestic use was estimated from domestic per capita use rates and the populations on (1) self-supply and self-disposal and (2) public supply and self disposal. All residents on self-supply were assumed to also be on self-disposal, as indicated by the superposition of water-distribution and sewer lines (fig. 4). Residents served by nonmunicipal community public-supply systems outside the areal extent of municipal sewer systems, such as systems serving housing developments and apartments, also were considered to be on self disposal. Return flows in areas of self-supply were estimated as the product of the number of people per town and subbasin on self-supply and nonmunicipal community public supply (table 4) and the average per capita nonconsumptive (winter) domestic water-use rate calculated from public-supply withdrawals and supplier-reported populations served for the year 2000, or 59.9 gal/d/person. Return flows in areas of public supply and self-disposal were calculated from the difference between the number of people on public supply and the number of people on public disposal in each town and subbasin; this value was multiplied by the average per capita nonconsumptive domestic water-use rate calculated from public-supply data for the basin for the year 2000. Self-disposal of wastewater from commercial and industrial use was estimated from the difference between the commercial and industrial areal use rates and an assumed 10-percent consumptive-use rate, and the commercial and industrial areas by town and subbasin on self disposal. Agricultural water use was assumed to be entirely consumptive, and to result in no wastewater return flow.

An estimated 5,190 Mgal/yr was returned to the Concord River Basin through septic systems (table 14). About

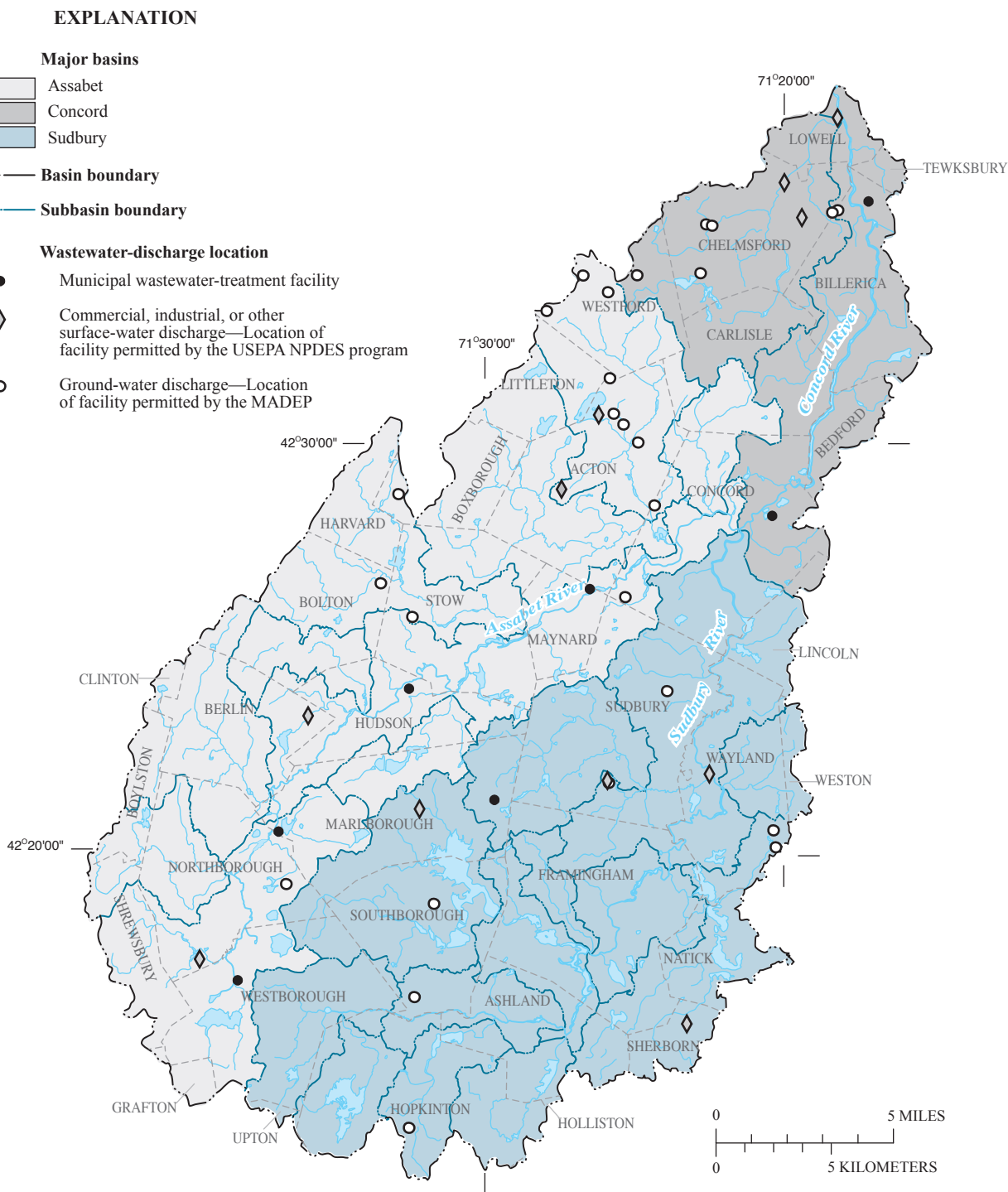


Figure 11. Wastewater-discharge sites in the Concord River Basin in eastern Massachusetts. USEPA, U.S. Environmental Protection Agency; NPDES, National Pollutant Discharge Elimination System; MADEP, Massachusetts Department of Environmental Protection.

Table 13. Annual average wastewater discharges from municipal wastewater-treatment facilities in the Concord River Basin in eastern Massachusetts, 1996–2000.

[The sum of the discharges may not equal the total because of rounding; NPDES, National Pollutant Discharge Elimination System; WWTF, wastewater-treatment facility; --, not applicable]

Subbasin	Wastewater-treatment facility	Towns served	NPDES permit number	Receiving water	Wastewater return flow, in million gallons per year					
					1996	1997	1998	1999	2000	5-year average
Assabet River Basin										
Assabet Headwaters	Marlborough Westerly WWTF	Marlborough, Northborough	MA0100480	Assabet River	718	726	808	714	803	754
Assabet Headwaters	Westborough WWTF	Westborough, Hopkinton, Shrewsbury	MA0100412	Assabet River	2,070	1,750	2,020	1,820	1,890	1,910
Assabet Main Stem	Hudson WWTF	Hudson	MA0101788	Assabet River	1,040	845	951	765	802	881
Assabet Main Stem	Maynard WWTF	Maynard	MA0101001	Assabet River	508	396	457	365	399	425
Basin total	--	--	--	--	4,340	3,720	4,240	3,670	3,900	3,970
Sudbury River Basin										
Hop Brook	Marlborough Easterly WWTF	Marlborough	MA0100498	Hop Brook	1,350	1,060	1,190	1,160	1,410	1,230
Basin total	--	--	--	--	1,350	1,060	1,190	1,160	1,410	1,230
Lower Concord River Basin										
Lower Concord Main Stem	Billerica WWTF	Billerica	MA0101711	Concord River	1,220	1,070	1,160	906	1,050	1,080
Lower Concord Main Stem	Concord WWTF	Concord	MA0100668	Concord River	364	308	383	299	309	333
Basin total	--	--	--	--	1,590	1,380	1,540	1,210	1,360	1,410
Total Concord River Basin										
Basin total	--	--	--	--	7,290	6,150	6,970	6,030	6,660	6,620

60 percent (3,130 Mgal/yr) of this return flow was from domestic use; two-thirds of the return flow from domestic use was estimated to originate from public supply and self-disposal (65.7 percent or 2,060 Mgal/yr) and about one-third from self-supply and self-disposal (34.3 percent or 1,070 Mgal/yr). Self-disposed wastewater was greatest in the Assabet River Basin, at 2,370 Mgal/yr (45.7 percent of the basin total), followed by the Sudbury River Basin, at 2,050 Mgal/yr (39.5 percent) and the Lower Concord River Basin at 764 Mgal/yr (14.7 percent). On the subbasin level, self-disposed return flow from septic systems ranged from 12.5 Mgal/yr in Baiting Brook subbasin to 547 Mgal/yr in the Fort Pond Brook subbasin.

Wastewater Imports and Exports

In the Concord River Basin, wastewater generated from water use in the basin or its subbasins may be disposed locally to ground water through on-site septic systems, collected by sewers and delivered to a WWTF for disposal to surface water in the basin or the same subbasin, or collected by sewers and delivered to a WWTF outside the basin or subbasin as a wastewater export. A wastewater import also may result when wastewater is generated outside the basin or a subbasin and is delivered through sewers to a WWTF that discharges to surface water in the basin or subbasin. Imports and exports of wastewater were estimated as the differences between (1) wastewater disposed to and collected by sewers plus infiltration and inflow to sewers in each subbasin and town and (2) wastewater discharged from municipal WWTFs in each subbasin and town. Wastewater collection and return flows for self-disposed wastewater to on-site septic systems were assumed to be co-located and thus not to result in any imports or exports across basin, subbasin, or town boundaries.

Wastewater disposed to sewers after use in each subbasin and town was estimated by the same method as used for the estimates of self-disposed wastewater return flows. Wastewater from domestic use was calculated from the average nonconsumptive per capita use rate estimated for the basin (59.9 gal/d/person) and the number of people on public supply and public disposal in each subbasin and town. Wastewater from commercial and industrial use was calculated as 90 percent (total use minus 10-percent consumptive use) of the commercial and industrial water use in each subbasin and town. Wastewater collected through sewers thus estimated averaged 8,550 Mgal/yr from for the entire Concord River Basin (table 14).

Wastewater that originated as infiltration and inflow into sewer pipes by subbasin and town was estimated from average annual infiltration and inflow rates for each town and the distribution of sewer-line length among subbasins and towns. Infiltration and inflow data were collected for towns in the Concord River Basin from Comprehensive Wastewater Management Plans and other consultants' reports (table 15).

In most cases, infiltration and inflow estimates were combined into one value, with only a few towns reporting infiltration and inflow separately. Comprehensive Management Plans for two towns (Clinton and Concord) did not report average annual infiltration and inflow rates but did report springtime infiltration rates. Annual average infiltration and inflow rates were calculated for these towns from their reported springtime rates and the average ratio of annual to springtime infiltration and inflow (0.60) for six other towns in the basin (Ashland, Bedford, Framingham, Hudson, Maynard, and Natick). The volume of infiltration and inflow for each town and subbasin was calculated by multiplying the average annual infiltration and inflow rate for the entire town (for example, 1.70 Mgal/yr for Marlborough, table 15) by the fraction of the town's total sewer line length in each subbasin. Infiltration and inflow thus estimated averaged 4,650 Mgal/yr for the entire Concord River Basin (table 14). Infiltration and inflow are components of the discharges from wastewater-treatment facilities. The estimates of infiltration and inflow for subbasins, although based on available data, likely incorporate substantial error—for example, from applying average rates uniformly across entire sewer systems.

Wastewater generated from use in the basin was estimated at 18,400 Mgal/yr (table 14, fig. 12). A little less than half of the wastewater generated in the basin (8,550) was disposed to sewers, where it was mixed with ground- and surface-water infiltration and inflow (roughly estimated at 25 percent of the total wastewater generated in the basin, or 4,650 Mgal/yr). About 30 percent of the wastewater generated in the basin (5,190 Mgal/d) was disposed to ground water through septic systems; this wastewater originated from both public- and self-supply use (table 14, fig. 12).

Comparison of wastewater generated and disposed in the basin indicated a net export of wastewater from the entire Concord River Basin of 6,590 Mgal/yr (table 14, fig. 13). This export resulted from wastewater collected through sewers and delivered to WWTFs outside of the basin; it represented about half of the total estimated wastewater collected through sewers in the basin (including infiltration and inflow) and about one-third (36 percent) of the total wastewater generated in the basin (table 14, fig. 12). Among individual basins, there were net exports of wastewater from the Sudbury River (4,890 Mgal/yr) and Lower Concord River (2,500 Mgal/yr) Basins and a net import of wastewater into the Assabet River Basin (808 Mgal/yr). Among subbasins, wastewater was imported in the Assabet Headwaters, Assabet Main Stem, and Hop Brook subbasins. In all other subbasins, there were either net exports (19 subbasins) or neither imports nor exports (3 subbasins) of wastewater. Total wastewater discharged in the basin was estimated at 11,800 Mgal/yr. A little more than half (6,620 Mgal/yr or 56.0 percent) was discharged to surface water and a little less than half (5,190 or 44.0 percent) was discharged to ground water through septic systems (table 14, fig. 13).

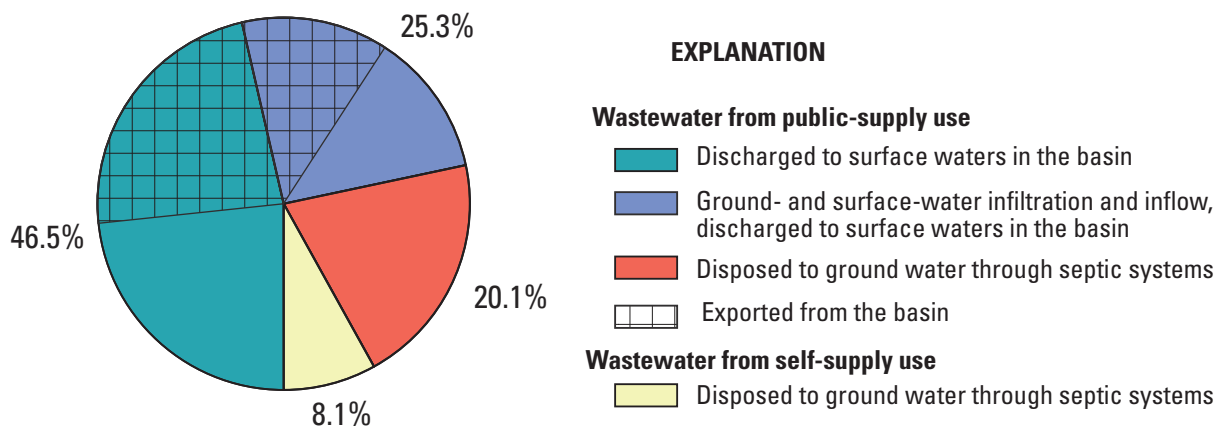


Figure 12. Estimated average annual public- and self-disposed wastewater generated from public- and self-supply use in the Concord River Basin in eastern Massachusetts, 1996–2000. Number is percentage (%) of total wastewater. Total volume of wastewater generated, which includes infiltration and inflow, was 18,400 Mgal/yr; estimated export of wastewater was 6,590 Mgal/yr.

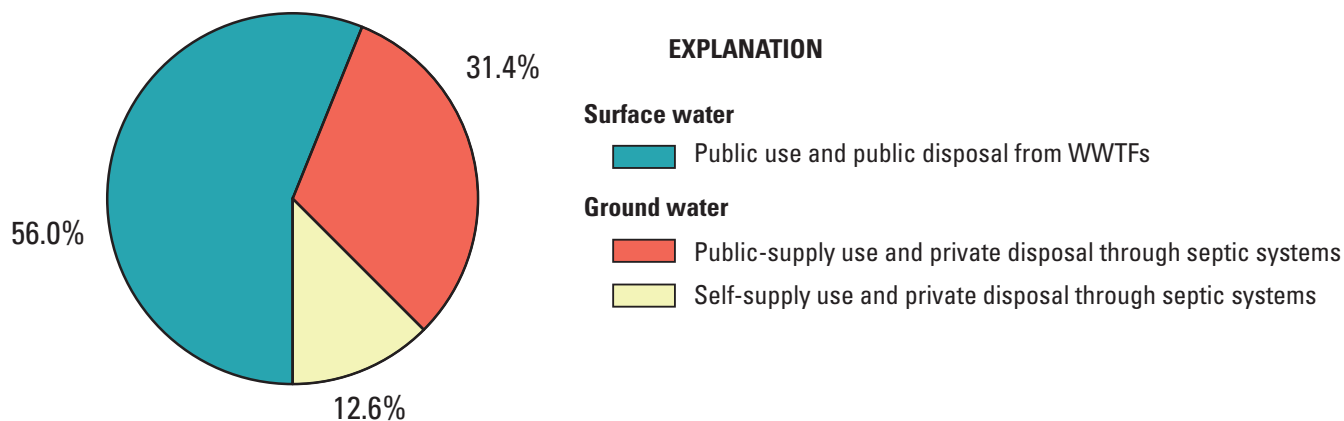


Figure 13. Estimated average annual public- and self-disposed wastewater discharged to surface water and ground water in the Concord River Basin in eastern Massachusetts, 1996–2000. Number is percentage (%) of the total discharge. Total volume of wastewater discharged, which includes infiltration and inflow, was 11,800 Mgal/yr. WWTFs, wastewater-treatment facilities.

Table 14. Public- and self-disposed wastewater return flows and imports and exports of wastewater in subbasins of the Concord River Basin in eastern Massachusetts, 1996–2000.

[The sum of the values may not equal the total because of rounding; Mgal/yr, million gallons per year; NAV, not reported, not metered or otherwise unavailable; WWTF, wastewater-treatment facility. **Wastewater generation** includes wastewater associated with public disposal through sewers only. Total wastewater generation in the basin or a subbasin also includes wastewater self-disposed through septic systems, equal to wastewater return flows from self-disposal through septic systems]

Town	Wastewater return flows (Mgal/yr)			Wastewater generation (Mgal/yr)		Wastewater imports and exports (Mgal/yr)	
	Public disposal through municipal WWTFs	Self-disposal through septic systems	Total	Wastewater disposed to sewers in subbasin	Infiltration and inflow to sewers	Imports	Exports
Assabet River Basin							
Assabet Headwaters							
Grafton	0.00	3.89	3.89	0.00	0.00	0.00	0.00
Marlborough	754	62.9	817	258	127	369	0.00
Northborough	0.00	83.7	83.7	138	28.9	0.00	167
Shrewsbury	0.00	86.9	86.9	314	147	0.00	461
Westborough	1,910	152	2,060	180	40.3	1,690	0.00
Subbasin total	2,670	389	3,060	891	343	1,430	0.00
Assabet Main Stem							
Acton	0.00	17.3	17.3	0.00	0.00	0.00	0.00
Berlin	0.00	11.6	11.6	0.00	0.00	0.00	0.00
Bolton	0.00	6.00	6.00	0.00	0.00	0.00	0.00
Concord	0.00	87.2	87.2	111	52.9	0.00	164
Hudson	881	182	1,060	336	164	381	0.00
Marlborough	0.00	15.6	15.6	40.0	10.8	0.00	50.8
Maynard	425	4.03	429	266	86.1	73.1	0.00
Stow	0.00	66.1	66.1	0.00	0.00	0.00	0.00
Shrewsbury	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sudbury	0.00	16.1	16.1	35.6	0.00	0.00	35.6
Subbasin total	1,310	406	1,710	788	314	204	0.00
Danforth Brook							
Berlin	0.00	3.44	3.44	0.00	0.00	0.00	0.00
Bolton	0.00	21.5	21.5	0.00	0.00	0.00	0.00
Hudson	0.00	10.9	10.9	68.5	43.3	0.00	112
Subbasin total	0.00	35.9	35.9	68.5	43.3	0.00	112
Elizabeth Brook							
Bolton	0.00	43.3	43.3	0.00	0.00	0.00	0.00
Boxborough	0.00	22.1	22.1	0.00	0.00	0.00	0.00
Harvard	0.00	35.5	35.5	0.00	0.00	0.00	0.00
Stow	0.00	58.4	58.4	0.00	0.00	0.00	0.00
Subbasin total	0.00	159	159	0.00	0.00	0.00	0.00
Fort Meadow Brook							
Hudson	0.00	68.6	68.6	62.0	23.0	0.00	85.0
Marlborough	0.00	37.2	37.2	189	129	0.00	318
Subbasin total	0.00	106	106	251	152	0.00	403

Table 14. Public- and self-disposed wastewater return flows and imports and exports of wastewater in subbasins of the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the values may not equal the total because of rounding; Mgal/yr, million gallons per year; NAV, not reported, not metered or otherwise unavailable; WWTF, wastewater-treatment facility. **Wastewater generation** includes wastewater associated with public disposal through sewers only. Total wastewater generation in the basin or a subbasin also includes wastewater self-disposed through septic systems, equal to wastewater return flows from self-disposal through septic systems]

Town	Wastewater return flows (Mgal/yr)			Wastewater generation (Mgal/yr)		Wastewater imports and exports (Mgal/yr)	
	Public disposal through municipal WWTFs	Self-disposal through septic systems	Total	Wastewater disposed to sewers in subbasin	Infiltration and inflow to sewers	Imports	Exports
Assabet River Basin							
Fort Pond Brook							
Acton	0.00	363	363	0.00	0.00	0.00	0.00
Boxborough	0.00	82.3	82.3	0.00	0.00	0.00	0.00
Concord	0.00	11.1	11.1	35.8	20.6	0.00	56.4
Littleton	0.00	68.3	68.3	0.00	0.00	0.00	0.00
Maynard	0.00	1.15	1.15	35.7	12.60	0.00	48.3
Stow	0.00	21.2	21.2	0.00	0.00	0.00	0.00
Subbasin total	0.00	547	547	71.6	33.2	0.00	105
Howard and Cold Harbor Brooks							
Berlin	0.00	0.06	0.06	0.00	0.00	0.00	0.00
Boylston	0.00	8.65	8.65	0.00	0.00	0.00	0.00
Northborough	0.00	53.1	53.1	21.4	2.61	0.00	24.0
Shrewsbury	0.00	2.28	2.28	74.1	48.6	0.00	123
Subbasin total	0.00	64.1	64.1	95.5	51.2	0.00	147
Nashoba Brook							
Acton	0.00	296	296	0.00	0.00	0.00	0.00
Carlisle	0.00	5.07	5.07	0.00	0.00	0.00	0.00
Concord	0.00	3.21	3.21	0.00	0.00	0.00	0.00
Littleton	0.00	51.0	51.0	0.00	0.00	0.00	0.00
Westford	0.00	139	139	0.00	0.00	0.00	0.00
Subbasin total	0.00	495	495	0.00	0.00	0.00	0.00
North Brook							
Berlin	0.00	45.2	45.2	0.00	0.00	0.00	0.00
Bolton	0.00	4.64	4.64	0.00	0.00	0.00	0.00
Boylston	0.00	5.95	5.95	0.00	0.00	0.00	0.00
Clinton	0.00	0.18	0.18	27.4	23.4	0.00	50.80
Marlborough	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Northborough	0.00	54.5	54.5	9.93	1.03	0.00	11.00
Subbasin total	0.00	110	110	37.4	24.4	0.00	61.8
Spencer Brook							
Acton	0.00	2.86	2.86	0.00	0.00	0.00	0.00
Carlisle	0.00	29.9	29.9	0.00	0.00	0.00	0.00
Concord	0.00	28.1	28.1	0.00	0.32	0.00	0.32
Subbasin total	0.00	60.9	60.9	0.00	0.32	0.00	0.32
Basin total	3,970	2,370	6,350	2,200	961	808	0.00

Table 14. Public- and self-disposed wastewater return flows and imports and exports of wastewater in subbasins of the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the values may not equal the total because of rounding; Mgal/yr, million gallons per year; NAV, not reported, not metered or otherwise unavailable; WWTF, wastewater-treatment facility. **Wastewater generation** includes wastewater associated with public disposal through sewers only. Total wastewater generation in the basin or a subbasin also includes wastewater self-disposed through septic systems, equal to wastewater return flows from self-disposal through septic systems]

Town	Wastewater return flows (Mgal/yr)			Wastewater generation (Mgal/yr)		Wastewater imports and exports (Mgal/yr)	
	Public disposal through municipal WWTFs	Self-disposal through septic systems	Total	Wastewater disposed to sewers in subbasin	Infiltration and inflow to sewers	Imports	Exports
Sudbury River Basin							
Baiting Brook							
Framingham	0.00	12.5	12.5	125	105	0.00	230
Subbasin total	0.00	12.5	12.5	125	105	0.00	230
Cedar Swamp							
Hopkinton	0.00	3.30	3.30	0.50	NAV	NAV	NAV
Southborough	0.00	0.27	0.27	0.00	0.00	0.00	0.00
Upton	0.00	0.47	0.47	0.00	0.00	0.00	0.00
Westborough	0.00	166	166	327	52.3	0.00	379
Subbasin total	0.00	170	170	328	52.3	0.00	380
Cold Spring Brook							
Ashland	0.00	16.7	16.7	44.4	16.30	0.00	60.70
Hopkinton	0.00	40.6	40.6	60.0	NAV	NAV	NAV
Subbasin total	0.00	57.3	57.3	104	16.3	0.00	121
Hop Brook							
Framingham	0.00	11.4	11.4	0.44	1.61	0.00	2.05
Hudson	0.00	8.58	8.58	0.00	0.00	0.00	0.00
Marlborough	1,230	92.5	1,330	50.1	37.2	1,150	0.00
Sudbury	0.00	250	250	0.00	0.00	0.00	0.00
Subbasin total	1,230	363	1,600	50.6	38.8	1,140	0.00
Indian Brook							
Ashland	0.00	6.11	6.11	0.00	0.00	0.00	0.00
Hopkinton	0.00	27.5	27.5	68.1	NAV	NAV	NAV
Subbasin total	0.00	33.6	33.6	68.1	0.00	0.00	68.10
Lake Cochituate							
Ashland	0.00	16.3	16.3	134	44.9	0.00	179
Framingham	0.00	8.82	8.82	432	241	0.00	673
Natick	0.00	41.6	41.6	435	299	0.00	733
Sherborn	0.00	15.2	15.2	0.00	0.00	0.00	0.00
Wayland	0.00	126	126	0.00	0.00	0.00	0.00
Subbasin total	0.00	208	208	1,000	585	0.00	1,590

Table 14. Public- and self-disposed wastewater return flows and imports and exports of wastewater in subbasins of the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the values may not equal the total because of rounding; Mgal/yr, million gallons per year; NAV, not reported, not metered or otherwise unavailable; WWTF, wastewater-treatment facility. **Wastewater generation** includes wastewater associated with public disposal through sewers only. Total wastewater generation in the basin or a subbasin also includes wastewater self-disposed through septic systems, equal to wastewater return flows from self-disposal through septic systems]

Town	Wastewater return flows (Mgal/yr)			Wastewater generation (Mgal/yr)		Wastewater imports and exports (Mgal/yr)	
	Public disposal through municipal WWTFs	Self-disposal through septic systems	Total	Wastewater disposed to sewers in subbasin	Infiltration and inflow to sewers	Imports	Exports
Sudbury River Basin							
Lower Sudbury River							
Concord	0.00	53.0	53.0	85.6	56.9	0.00	143
Framingham	0.00	10.7	10.7	208	186	0.00	394
Lincoln	0.00	32.6	32.6	0.00	0.00	0.00	0.00
Sudbury	0.00	177	177	0.00	0.00	0.00	0.00
Wayland	0.00	133	133	0.00	0.00	0.00	0.00
Subbasin total	0.00	406	406	294	243	0.00	537
Pine Brook							
Wayland	0.00	119	119	0.00	0.00	0.00	0.00
Weston	0.00	9.06	9.06	0.00	0.00	0.00	0.00
Subbasin total	0.00	128	128	0.00	0.00	0.00	0.00
Reservoir 1-3							
Ashland	0.00	7.77	7.77	39.2	21.1	0.00	60.3
Framingham	0.00	31.1	31.1	299	229	0.00	529
Marlborough	0.00	0.68	0.68	0.00	0.00	0.00	0.00
Southborough	0.00	27.4	27.4	0.00	0.00	0.00	0.00
Subbasin total	0.00	67.0	67.0	339	250	0.00	589
Sudbury River - Framingham							
Framingham	0.00	58.4	58.4	972	666	0.00	1,640
Natick	0.00	9.82	9.82	80.4	25.5	0.00	106
Subbasin total	0.00	68.3	68.3	1,050	691	0.00	1,740
Sudbury Reservoir							
Marlborough	0.00	141	141	558	40.4	0.00	599
Northborough	0.00	0.00	0.00	32.1	0.00	0.00	32.1
Southborough	0.00	179	179	0.00	0.00	0.00	0.00
Westborough	0.00	59.4	59.4	25.8	16.3	0.00	42.1
Subbasin total	0.00	380	380	616	56.6	0.00	673
Upper Sudbury River							
Ashland	0.00	11.2	11.2	75.8	28.8	0.00	105
Hopkinton	0.00	9.93	9.93	0.00	NAV	NAV	NAV
Southborough	0.00	93.1	93.1	0.00	0.00	0.00	0.00
Westborough	0.00	0.35	0.35	3.76	1.47	0.00	5.23
Subbasin total	0.00	115	115	79.5	30.3	0.00	110

Table 14. Public- and self-disposed wastewater return flows and imports and exports of wastewater in subbasins of the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the values may not equal the total because of rounding; Mgal/yr, million gallons per year; NAV, not reported, not metered or otherwise unavailable; WWTF, wastewater-treatment facility. **Wastewater generation** includes wastewater associated with public disposal through sewers only. Total wastewater generation in the basin or a subbasin also includes wastewater self-disposed through septic systems, equal to wastewater return flows from self-disposal through septic systems]

Town	Wastewater return flows (Mgal/yr)			Wastewater generation (Mgal/yr)		Wastewater imports and exports (Mgal/yr)	
	Public disposal through municipal WWTFs	Self-disposal through septic systems	Total	Wastewater disposed to sewers in subbasin	Infiltration and inflow to sewers	Imports	Exports
Sudbury River Basin							
Whitehall Brook							
Hopkinton	0.00	43.3	43.3	1.98	NAV	NAV	NAV
Upton	0.00	0.03	0.03	0.00	0.00	0.00	0.00
Westborough	0.00	0.66	0.66	0.00	0.00	0.00	0.00
Subbasin total	0.00	44.0	44.0	1.98	0.00	0.00	1.98
Basin Total	1,230	2,050	3,290	4,060	2,070	0.00	4,890
Lower Concord River Basin							
Lower Concord Main Stem							
Bedford	0.00	23.8	23.8	53.0	124	0.00	177
Billerica	1,080	194	1,280	504	257	321	0.00
Carlisle	0.00	43.9	43.9	0.00	0.00	0.00	0.00
Chelmsford	0.00	11.0	11.0	18.5	19.4	0.00	38.0
Concord	333	51.6	384	92.0	55.6	185	0.00
Lincoln	0.00	8.32	8.32	0.00	0.00	0.00	0.00
Lowell	0.00	10.2	10.2	468	440	0.00	907
Tewksbury	0.00	73.4	73.4	6.34	0.05	0.00	6.39
Subbasin total	1,410	416	1,830	1,140	896	0.00	622
River Meadow Brook							
Billerica	0.00	27.5	27.5	8.88	3.47	0.00	12.4
Carlisle	0.00	34.6	34.6	0.00	0.00	0.00	0.00
Chelmsford	0.00	225	225	604	630	0.00	1,230
Lowell	0.00	1.1	1.1	536	95.3	0.00	632
Westford	0.00	59.1	59.1	0.36	0.00	0.00	0.36
Subbasin total	0.00	347	347	1,150	729	0.00	1,880
Basin total	1,410	764	2,180	2,290	1,620	0.00	2,500
Total Concord River Basin							
Basin total	6,620	5,190	11,800	8,550	4,650	0.00	6,590

Table 15. Infiltration and inflow rates for municipal wastewater-collection systems in the Concord River Basin in eastern Massachusetts.

[Springtime infiltration and inflow equal to the average of monthly estimates for March, April, and May; MWRA, Massachusetts Water Resources Authority; NAV, not available]

Town	Infiltration and inflow, in million gallons per day						Source of data
	Average annual		Average springtime		Maximum monthly		
	Infiltration	Inflow	Infiltration	Inflow	Infiltration	Inflow	
Ashland ¹	0.24	0.09	0.39	0.11	0.64, April 1997	0.33, June 1998	Kristen Hall, MWRA, written commun., December 2002.
Bedford ¹	1.51	0.24	2.08	0.30	2.88, April 1997	1.52, June 1998	Kristen Hall, MWRA, written commun., December 2002.
Billerica		³ 1.52	NAV	NAV	NAV	NAV	Fay, Spofford, and Thorndike (1999).
Clinton	0.90d	NAV	1.50	NAV	NAV	NAV	Massachusetts Water Resources Authority (2003).
Concord		^{3,4} 0.51		³ 0.85	NAV	NAV	Stone Environmental and Lombardo Associates (2000).
Framingham ¹	3.14	0.77	5.35	1.90	7.00, April 1997	2.70, June 1998	Kristen Hall, MWRA, written commun., December 2002.
Hopkinton	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Hudson		³ 0.63		³ 1.22	NAV	NAV	Earth Tech (2001a).
Lowell, Chelmsford, and Tewksbury ²		³ 11.6	NAV	NAV	NAV	NAV	Camp, Dresser, and McKee (1990).
Marlborough Easterly		³ 1.13	NAV	NAV	NAV	NAV	Camp, Dresser, and McKee (2001).
Marlborough Westerly		³ 0.57	NAV	NAV	NAV	NAV	Camp, Dresser, and McKee (2001).
Maynard		³ 0.27		³ 0.46	NAV	NAV	Dufresne-Henry (2001).
Natick ¹	1.61	0.44	2.77	0.67	3.77, April 1997	1.96, June 1998	Kristen Hall, MWRA, written commun., December 2002.
Northborough		³ 0.09	NAV	NAV	NAV	NAV	Fay, Spofford, and Thorndike (2001a).
Shrewsbury		³ 0.69	NAV	NAV	NAV	NAV	Fay, Spofford, and Thorndike (2001b).
Shrewsbury, Westborough	0.85	0.47	NAV	NAV	NAV	NAV	Eileen Davis, Westborough Treatment Plant Board, written commun., July 2003.
Westborough		³ 0.28	NAV	NAV	NAV	NAV	Earth Tech (2001b).

¹ Served by the Massachusetts Water Resources Authority.

² Served by the Lowell Regional Wastewater Facility.

³ Value is for infiltration and inflow combined.

⁴ Estimated from the average ratio of annual to springtime infiltration and inflow from six other towns.

Summary of Water Withdrawals, Use, and Wastewater Return Flows

Total withdrawals for the Concord River Basin for 1996–2000 were estimated at 12,700 Mgal/yr (table 16). This included 10,100 Mgal/yr for public supply and 2,650 Mgal/yr for self-supply (equal to self-supply use, table 11). The estimated 5-year average withdrawal rates ranged from 6.00 Mgal/yr in the Pine Brook subbasin to 1,870 Mgal/yr in the Lower Sudbury River subbasin. A net import of 6,460 Mgal/yr of potable water for the Concord River Basin was estimated. Nearly all subbasins imported potable water; estimated import volumes ranged from 8.76 Mgal/yr in the Cedar Swamp subbasin to 1,460 Mgal/yr in the Sudbury River- Framingham subbasin. Only four subbasins (Fort Meadow Brook, Indian Brook, Lower Sudbury River, and Whitehall Brook) exported potable water. One subbasin (Elizabeth Brook) neither exported nor imported potable water (table 16).

Water use, including public and self-supply, for the Concord River Basin was estimated at 19,200 Mgal/yr, which included 16,900 Mgal/yr for domestic, commercial, industrial, and agricultural use and 2,260 Mgal/yr for unaccounted-for water in public-supply systems. Estimated water use (excluding unaccounted-for water) ranged from 47.2 Mgal/yr in the Whitehall Brook subbasin to 1,830 Mgal/yr in the Lower Concord Main Stem subbasin. Consumptive use for the Concord River Basin was estimated at about 2,600 Mgal/yr.

Total wastewater return flows in the basin were estimated at 11,800 Mgal/yr. Wastewater return flows included 6,620 Mgal/yr discharged to surface water at municipal WWTFs and 5,190 Mgal/yr discharged to ground water through septic systems. Additional wastewater was discharged in the basin to surface water from NPDES-permitted facilities other than municipal WWTFs and to ground-water from MADEP-permitted facilities. Data were not adequate to determine 5-year average return flows for these sites; however, the available data indicated that return flows from NPDES-permitted facilities other than municipal WWTFs probably totaled less than 100 Mgal/yr during the study period. Overall, wastewater was exported from the entire Concord River Basin at an estimated rate of 6,590 Mgal/yr. There was a net import of wastewater to the Assabet River Basin and net exports of wastewater from the Sudbury and Lower Concord River Basins. Nearly all subbasins exported wastewater; two subbasins (Assabet Headwaters and Assabet Main Stem) in the Assabet River Basin imported wastewater; and one subbasin (Elizabeth Brook) neither exported nor imported wastewater.

Overall, water use and management in the Concord River Basin resulted in imports of potable water and exports of wastewater, and these imports and exports roughly balanced. Water use and management in the basin also resulted in a net transfer of water, as wastewater, from ground water to surface water. Total withdrawals for water supply from ground water were estimated at 9,580 Mgal/yr and total wastewater dis-

charges to ground water were estimated at 5,190 Mgal/yr, for an estimated net outflow from ground water of 4,390 Mgal/yr. Total withdrawals for water supply from surface water were estimated as 3,140 Mgal/yr and total wastewater discharges to surface water were reported as 6,620 Mgal/yr, for a net estimated inflow to surface water of 3,480 Mgal/yr. Thus, the net transfer of water from ground water to surface water, as wastewater, was about 4,000 Mgal/yr.

Data and Analysis Limitations

The data needed to estimate the water withdrawals, use, and return flows for the Concord River Basin were compiled from multiple sources, each with limitations that affected the quality of the estimates. In addition, the analysis and estimation methods used in the study may have resulted in errors or inaccuracy that was largely unquantified; these errors are discussed with reference to an example for wastewater return flows.

Withdrawal Data

Withdrawal data were obtained from the annual reports filed by suppliers or users with the MADEP. The accuracy of the data in these reports was not known. In some cases, the presence of inaccuracies could be inferred. For example, the sums of reported withdrawals from individual sources in a municipal community system on occasion did not add up to the total withdrawals reported for the system, or the sum of the total withdrawals from system sources plus wholesale purchases minus wholesale sales did not match net consumption reported for the system. These discrepancies were probably due to arithmetic errors in the reports, and were handled by using withdrawals reported for individual sources as the primary data source. Another issue was the reporting of water use by category for some municipal community systems that seemed inconsistent from year to year. Changes in the annual report forms for public supply during the study period may have led to some of these inconsistencies. Water-use categories on the form changed from 1998 to 1999. Several new categories and subcategories were added (for example, residential use was subdivided from one to three categories for reporting). Other categories, such as system flushing, backwash water, and process water, were dropped from the form. Also, agricultural use and industrial uses were combined into a single category for reporting starting in 1999. Thus, it was no longer possible to track the two use categories separately after that date except by assuming that agricultural use did not change from 1998 onwards. A third issue with the public-supply reports was reported populations that did not change from year to year; counts may have been carried over from previous years in some cases and may not have accurately represented the population associated with the reported year's domestic use. Thus, per capita use rates calculated from these data may have

Table 16. Summary of estimated water withdrawals, wastewater return flows, and net imports and exports of water in the Concord River Basin in eastern Massachusetts, 1996–2000.

[The sum of the values may not equal the total because of rounding; Mgal/yr, million gallons per year]

Subbasin	Total public- and self-supply withdrawals (Mgal/yr)	Total public- and self-supply use (Mgal/yr)		Consumptive use (Mgal/yr)	Total wastewater return flow (Mgal/yr)		Net imports (+) or exports (-) (Mgal/yr)	
		Domestic, commercial, industrial, and agricultural use	Public-supply unaccounted- for water use		Surface water	Ground water	Potable water for water supply	Waste- water
Assabet River Basin								
Assabet Headwaters	1,380	1,530	353	248	2,670	389	507	1,430
Assabet Main Stem	1,130	1,480	158	218	1,310	406	515	204
Danforth Brook	42.4	132	21.2	27.8	0.00	35.9	111	-112
Elizabeth Brook	229	229	0.00	57.1	0.00	159	0.00	0.00
Fort Meadow Brook	726	397	72.80	61.1	0.00	106	-256	-403
Fort Pond Brook	470	709	105	98.4	0.00	547	344	-105
Howard and Cold Harbor Brooks	215	197	81.9	27.4	0.00	64.1	64.1	-147
Nashoba Brook	522	543	74.9	70.4	0.00	495	96.1	0.00
North Brook	83.1	183	10.7	27.8	0.00	110	111	-62.8
Spencer Brook	53.0	80.6	2.86	12.6	0.00	60.9	30.5	-0.32
Basin total	4,840	5,480	880	849	3,970	2,370	1,520	808
Sudbury River Basin								
Baiting Brook	6.82	238	21.8	85.4	0.00	12.5	253	-230
Cedar Swamp	636	540	105	68.7	0.00	170	8.76	-380
Cold Spring Brook	160	279	10.7	144	0.00	57.3	129	-121
Hop Brook	527	573	55.0	105	1,230	363	102	1,140
Indian Brook	537	112	9.36	14.8	0.00	33.6	-416	-68.1
Lake Cochituate	969	1,500	142	207	0.00	208	673	-1,590
Lower Sudbury River	1,870	1,040	157	198	0.00	406	-670	-537
Pine Brook	6.00	169	64.4	21.8	0.00	128	227	0.00
Reservoir 1-3	55.9	505	50.6	91.3	0.00	67.0	500	-589
Sudbury River - Framingham	46.6	1,380	121	176	0.00	68.3	1,460	-1,740
Sudbury Reservoir	224	1,160	155	146	0.00	380	1,090	-673
Upper Sudbury River	25.4	239	18.9	31.5	0.00	115	233	-110
Whitehall Brook	301	47.2	5.86	7.90	0.00	44.0	-248	-1.98
Basin total	5,360	7,790	916	1,300	1,230	2,050	3,340	-4,890
Lower Concord River Basin								
Lower Concord Main Stem	1,810	1,830	208	235	1,410	416	235	-622
River Meadow Brook	709	1,810	260	232	0.00	347	1,360	-1,880
Basin total	2,520	3,640	468	467	1,410	764	1,590	-2,500
Total Concord River Basin								
Basin total	12,700	16,900	2,260	2,610	6,620	5,190	6,460	-6,590

been inaccurate. This potential source of error was addressed by using average per capita use rates from all suppliers in the basin. Another potential source of inaccuracy, which applied both to reported public-supply withdrawals and withdrawals reported for large users regulated under the WMA, was the limited accuracy of the water meters on which the reported supplies and distributed volumes were based; these limitations were not addressed in this study. Finally, although not a data-quality issue, withdrawal volumes for some small public suppliers were not reported on their annual statistical reports. Many such withdrawals apparently were not metered and thus could not be included in the estimates in this report.

Wastewater Return-Flow Data

Wastewater discharge data for sites permitted under the USEPA NPDES program were available from the PCS database, which included mostly sites classified as major dischargers at the time the data for this report were compiled; the database included some, but not all, sites classified as minor dischargers. The classification of a facility as a major discharger was based on effluent flow for municipal WWTFs (greater than 1 Mgal/d), but on flow as well as effluent contaminant concentrations and the condition of the receiving water for industrial and commercial dischargers. Thus, industrial and commercial sites discharging similar wastewater volumes may have been inconsistently included in the PCS database. Also, flow data were not available for all sites that were included in the PCS database. Finally, location information (latitude and longitude) also were missing from the PCS database for several sites. To address these limitations, information on NPDES site locations was also obtained from the MADEP; however, MADEP and USEPA PCS data sets were not entirely consistent in terms of sites in the study area. Because of these limitations, flow data for NPDES-permitted sites other than municipal WWTFs were not included quantitatively in return-flow estimates.

Wastewater-discharge data at ground-water-discharge sites permitted by the MADEP were limited to maximum daily flows. These data would be useful for calculating maximum daily loads, but were insufficient for calculation of the total flow discharged at a site. Average monthly flows or total flow per month would be needed for this purpose. For these reasons, return flows at MADEP ground-water discharge sites were not included in return-flow estimates in this study.

The estimation of total return flow for areas with public disposal of wastewater required information on rates of infiltration and inflow into sewer lines. Infiltration and inflow vary over time and spatially with ground-water levels and differences in sewer integrity. Information on infiltration and inflow was rarely available on an annual basis, however, and never at the spatial scale adequate to represent differences in rates among subbasins.

Commercial and Industrial Water-Use Data

Water-use and return-flow estimates for self-supply commercial and industrial uses relied on SIC-code categories, data on employees by town in each SIC-code category, and water-use coefficients for each SIC category. These water-use coefficients were the median values calculated for data from a group of employers in small and medium-sized businesses (Horn, 2000); an individual employer may use more or less water than the median. Consequently, the use of these coefficients, particularly in subbasins with little commercial or industrial uses, was potentially a large source of inaccuracy in the commercial and industrial use and return-flow estimates. Some of this variability was apparent in the disagreement between SIC-based estimates and the reported withdrawals at Water Management Act sites, although the estimates based on SIC codes may not have been directly comparable to the withdrawals by the larger users at Water Management Act sites. The comparison of public-supply commercial and industrial water use, calculated with the SIC-based approach and with the values reported by suppliers, provided perspective on the potential inaccuracies in estimates based on SIC codes, despite uncertainties in the accuracy of the reported use volumes.

Analysis Methods

The methods used to estimate water use and wastewater return-flow volumes by category, town, and subbasin in this study relied on many data sets, approximation methods, coefficients, and generalizations that potentially produced inaccuracies in the volume estimates. These inaccuracies were largely unquantified in this study. Another potential source of error was inaccuracy or spatial-scale limitations in the land-use GIS data layer, which was used to distribute many of the volume estimates among subbasins. Another important and potentially large source of inaccuracy was the land-use-based population-density estimates; these estimates were used to calculate populations on public- and self-supply and return-flow volumes and to distribute those volumes among towns and subbasins. Per capita water-use coefficients averaged over the entire study area also were likely sources of error in use and return-flow estimates for individual subbasins. Estimates of imports and exports by difference also incorporate the errors associated with multiple estimated volumes.

As an example of such errors, a comparison was made of estimated and reported wastewater volumes for selected towns. The comparison was made for two types of wastewater volumes: (1) wastewater disposal in the basin (a) estimated in this study from populations served and use coefficients by subbasin and (b) reported by WWTFs for towns with sewered areas entirely within the basin, and (2) wastewater exports from the Concord River Basin (a) estimated in this study and (b) reported by MWRA for towns served by MWRA for

wastewater. The estimated wastewater exports and disposal volumes incorporate many of the data sources and analysis methods used throughout the study, including disaggregated (by subbasin) population estimates, water-use and return-flow coefficients, consumptive-use estimates, and disaggregated estimates of infiltration and inflow. The reported wastewater exports are metered volumes entering the MWRA collection system (Massachusetts Water Resources Authority, written commun., 2003) for Ashland, Bedford, Framingham, and Natick, and the disposal volumes are the reported discharges at municipal WWTFs (table 13) for Concord, Hudson, and Maynard. The estimated exports and disposal volumes were based on population estimates and use coefficients; they were independently calculated and do not rely on the reported export and disposal volumes. Differences are tabulated in table 17 and ranged from -42 percent to +45 percent, with a median difference of +10 percent, an average difference of 4.3 percent, and an average absolute difference of 25 percent (table 17). These differences provide perspective on the magnitude and range of inaccuracies that may be included in some of the individual volume estimates made in this study. When aggregated across subbasins or for the entire basin, these inaccuracies are likely to be smaller, however, than for individual volume estimates, because local variability is averaged and volumes are more accurately represented by basin-wide average values. Also, inaccuracies in the wastewater exports and disposal volumes are likely to represent worst-case examples,

because they include poorly constrained estimates of infiltration and inflow.

Summary

Water withdrawals, use, and return flows were estimated by USGS, in cooperation with the MADEP, for the Concord River Basin and its subbasins, based on available data, for the period 1996 to 2000. Water withdrawals were mostly (75 percent) from ground water. Public supply provided most (86 percent) of the total water use in the basin, and domestic use was the largest component (59 percent) of total water use. Public disposal to surface waters through municipal wastewater-treatment facilities accounted for more than half (56 percent) of wastewater return flows discharged in the basin. Overall, the basin was estimated to import potable water for public supply and export wastewater for treatment and disposal outside of the basin. The potable-water import and wastewater export were each estimated at about 6,500 Mgal/yr for the study period. Within the basin, water use and management resulted in a net transfer of water from ground-water to surface-water systems. These estimates of water withdrawals, use, return flows, imports and exports provide water-use information that can be used in a hydrologic, basin-based context. Data and analysis limitations, however, should be considered when using this water-use information.

Table 17. Comparison of estimated and reported disposal or exports of wastewater for selected towns in the Concord River Basin in eastern Massachusetts, 1996–2000.

[Estimated exports and disposal volumes based on per-capita non-consumptive water use, infiltration and inflow, and populations on public sewers in the basin. Reported exports of wastewater from Massachusetts Water Resources Authority, written commun., 2003. Reported disposal volumes of wastewater from wastewater-treatment facilities. Mgal/yr, million gallons per year]

Town	Disposal in basin or export from basin	Estimated disposal or exports of wastewater (Mgal/yr)	Reported disposal or exports of wastewater (Mgal/yr)	Percent difference between estimated and reported values
Ashland	Export ¹	404	279	45.1
Bedford	Export	177	304	-42.0
Concord	Disposal in basin	178	0.00	--
Hudson	Disposal in basin	697	881	-20.9
Framingham	Export ¹	3,470	3,020	14.7
Maynard	Disposal in basin	425	400	6.18
Natick	Export ¹	839	684	22.7

¹Receiving water for export was Boston Harbor during the period of the study.

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Appendixes

72 Water Withdrawals, Use, and Wastewater Return Flows in the Concord River Basin, Eastern Massachusetts, 1996–2000

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
1996									
Assabet River Basin									
Assabet Headwaters									
2170000-01S	Marlborough	MC	Marlborough DPW, WD	SW	Millham Reservoir	1.14	1.82	2.41	2.63
2215000-01G	Northborough	MC	Northborough WD	GW	Brigham Street Well	0.358	0.336	0.307	0.322
2215000-02G	Northborough	MC	Northborough WD	GW	Lyman Street Well	0.000	0.000	0.000	0.000
2328000-03G	Westborough	MC	Westborough WD	GW	Andrews I Well	0.429	0.438	0.454	0.327
2328000-04G	Westborough	MC	Westborough WD	GW	Andrews II Well	0.380	0.367	0.248	0.153
2328000-05G	Westborough	MC	Westborough WD	GW	Otis Street Well	0.296	0.265	0.286	0.336
2328000-06G	Westborough	MC	Westborough WD	GW	Wilkinson Well	0.165	0.157	0.159	0.118
2328000-07G	Westborough	MC	Westborough WD	GW	Chauncy Lake Well #1	0.000	0.000	0.000	0.000
2328000-08G	Westborough	MC	Westborough WD	GW	Chauncy Lake Well #2	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	2.77	3.39	3.87	3.88
Assabet Main Stem									
2002000-05G	Acton	MC	Acton WD	GW	Assabet Well #1	0.285	0.295	0.109	0.288
2002000-06G	Acton	MC	Acton WD	GW	Assabet Well #2	0.285	0.295	0.109	0.288
2141000-01G	Hudson	MC	Hudson WD	GW	Rimkus Well	0.000	0.000	0.000	0.000
2141000-01S	Berlin	MC	Hudson WD	SW	Gates Pond Reservoir	0.000	0.000	0.000	0.000
2174000-01G, -02G	Maynard	MC	Maynard DPW, WD	GW	Old Marlboro Road Wells #1 and 2	0.408	0.425	0.496	0.406
2174000-01S	Maynard	MC	Maynard DPW, WD	SW	White Pond	0.181	0.187	0.328	0.401
2174000-03G	Maynard	MC	Maynard DPW, WD	GW	Old Marlboro Road Well #3	0.212	0.241	0.213	0.000
2174000-04G	Maynard	MC	Maynard DPW, WD	GW	Great Road Well #4	0.000	0.000	0.000	0.000
2271000-01G	Shrewsbury	MC	Shrewsbury WD	GW	South Street Well	0.000	0.000	0.000	0.000
2286000-01G, -02G, -03G	Stow	NMC	Juniper Hill Water Co.	GW	Wells #1-3	NAV	NAV	NAV	NAV
3067000-05G	Concord	MC	Concord WD	GW	Second Division Well	0.661	0.629	0.376	0.288
Subbasin total	--	--	--	--	--	2.03	2.07	1.63	1.67
Elizabeth Brook									
2037001-01G	Boxborough	NMC	Codman Hill Condo.	GW	Well #1	0.013	0.013	0.012	0.014
2037002-01G	Boxborough	NMC	Harvard Ridge Condo.	GW	Dunster House Well	0.012	0.013	0.012	0.013
2037002-02G	Boxborough	NMC	Harvard Ridge Condo.	GW	Eliot House Well	0.012	0.013	0.012	0.013
2037002-03G	Boxborough	NMC	Harvard Ridge Condo.	GW	Leverett House Well	0.005	0.005	0.005	0.005
2286017-01G	Stow	NMC	Plantation Apt.	GW	Well #1	NAV	NAV	NAV	NAV
2286018-01G	Stow	NMC	Pilot Grove Apt.	GW	Well #1	0.004	0.004	0.004	0.004
2286018-02G	Stow	NMC	Pilot Grove Apt.	GW	Well #2	0.004	0.004	0.004	0.004
Subbasin total	--	--	--	--	--	0.050	0.053	0.050	0.053
Fort Meadow Brook									
2141000-03G	Hudson	MC	Hudson WD	GW	Kane Well	0.130	0.147	0.134	0.143
2141000-04G	Hudson	MC	Hudson WD	GW	Chestnut Street Well #1	0.000	0.000	0.000	0.000
2141000-05G	Hudson	MC	Hudson WD	GW	Chestnut Street Well #2	0.747	0.803	0.748	0.891
2141000-06G	Hudson	MC	Hudson WD	GW	Chestnut Street Well #3	0.475	0.470	0.467	0.483
Subbasin total	--	--	--	--	--	1.35	1.42	1.35	1.52

Massachusetts, 1996–2000.

Apartments; Co., Company; Condo., Condominiums; DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District; WSD, unavailable; --, not applicable]

Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
1996												
Assabet River Basin												
Assabet Headwaters												
2170000-01S	2.85	1.59	0.951	0.946	0.942	1.09	0.617	1.12	1.51	1.46	1.42	1.02
2215000-01G	0.315	0.279	0.286	0.330	0.274	0.248	0.246	0.300	0.30	0.30	0.31	0.96
2215000-02G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2328000-03G	0.000	0.173	0.410	0.401	0.452	0.443	0.068	0.000	0.30	0.29	0.28	1.03
2328000-04G	0.043	0.180	0.427	0.400	0.431	0.326	0.125	0.000	0.26	0.30	0.22	1.32
2328000-05G	0.393	0.332	0.300	0.165	0.255	0.241	0.224	0.234	0.28	0.29	0.26	1.11
2328000-06G	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.05	0.00	0.10	0.02
2328000-07G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2328000-08G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Subbasin total	3.60	2.55	2.38	2.24	2.35	2.35	1.28	1.66	2.69	2.63	2.59	1.01
Assabet Main Stem												
2002000-05G	0.349	0.340	0.246	0.228	0.239	0.253	0.283	0.276	0.27	0.28	0.25	1.12
2002000-06G	0.349	0.340	0.246	0.228	0.239	0.253	0.283	0.276	0.27	0.28	0.25	1.12
2141000-01G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2141000-01S	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2174000-01G, -02G	0.396	0.405	0.381	0.376	0.382	0.455	0.326	0.331	0.40	0.39	0.40	0.98
2174000-01S	0.427	0.570	0.431	0.391	0.315	0.212	0.225	0.355	0.34	0.43	0.25	1.67
2174000-03G	0.044	0.311	0.241	0.236	0.241	0.286	0.229	0.222	0.21	0.21	0.22	0.96
2174000-04G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2271000-01G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2286000-01G, -02G, -03G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
3067000-05G	0.650	0.499	0.376	0.410	0.089	0.091	0.434	0.675	0.43	0.40	0.55	0.73
Subbasin total	2.21	2.47	1.92	1.87	1.51	1.55	1.78	2.13	1.90	2.00	1.93	1.03
Elizabeth Brook												
2037001-01G	0.015	0.015	0.014	0.013	0.013	0.012	0.013	0.012	0.01	0.01	0.01	1.10
2037002-01G	0.012	0.013	0.012	0.012	0.013	0.012	0.013	0.012	0.01	0.01	0.01	0.99
2037002-02G	0.012	0.013	0.012	0.012	0.013	0.012	0.013	0.012	0.01	0.01	0.01	0.99
2037002-03G	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.01	0.01	0.01	0.99
2286017-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2286018-01G	0.004	0.004	0.004	0.006	0.003	0.004	0.004	0.004	0.00	0.00	0.00	1.07
2286018-02G	0.004	0.004	0.004	0.006	0.003	0.004	0.004	0.004	0.00	0.00	0.00	1.07
Subbasin total	0.053	0.054	0.051	0.056	0.049	0.049	0.051	0.050	0.05	0.05	0.05	1.04
Fort Meadow Brook												
2141000-03G	0.130	0.120	0.119	0.086	0.016	0.000	0.000	0.003	0.09	0.09	0.08	1.14
2141000-04G	0.138	0.717	0.632	0.659	0.809	0.815	0.793	0.758	0.44	0.59	0.31	1.90
2141000-05G	0.831	0.589	0.433	0.801	0.832	0.735	0.797	0.788	0.75	0.70	0.78	0.90
2141000-06G	0.461	0.435	0.627	0.484	0.553	0.561	0.513	0.470	0.50	0.51	0.48	1.07
Subbasin total	1.56	1.86	1.81	2.03	2.21	2.11	2.10	2.02	1.78	1.89	1.65	1.15

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise]

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Assabet River Basin									
Fort Pond Brook									
2002000-01G	Acton	MC	Acton WD	GW	Whitcomb Well	0.000	0.000	0.306	0.386
2002000-03G	Acton	MC	Acton WD	GW	Lawsbrook	0.115	0.129	0.221	0.165
2002000-04G	Acton	MC	Acton WD	GW	Christofferson Well	0.115	0.129	0.221	0.165
2002000-07G	Acton	MC	Acton WD	GW	Clapp Well	0.000	0.000	0.000	0.000
2002000-08G	Acton	MC	Acton WD	GW	Scribner Well	0.115	0.129	0.221	0.165
2037006-01G	Boxborough	NMC	Centre Village Apt.	GW	Rock Well	0.001	0.001	0.002	0.002
2037009-01G	Boxborough	NMC	Carriage House Condo.	GW	Well #1	0.006	0.006	0.006	0.006
2037013-02G	Boxborough	NMC	Applewood Condo.	GW	Well #2	0.018	0.017	0.017	0.019
2037014-02G	Boxborough	NMC	Liberty House Condo.	GW	Well #2	NAV	NAV	NAV	NAV
2174000-05G	Maynard	MC	Maynard DPW, WD	GW	Rock Well #2	0.000	0.000	0.000	0.000
2174000-07G	Maynard	MC	Maynard DPW, WD	GW	Rock Well #5	0.000	0.000	0.000	0.000
2286001-01G, -02G	Stow	NMC	Assabet Water Co./ Harvard Acres	GW	Wells #1-2	0.065	0.066	0.069	0.071
Subbasin total	--	--	--	--	--	0.433	0.478	1.06	0.978
Howard and Cold Harbor Brooks									
2215000-03G	Northborough	MC	Northborough WD	GW	Crawford Street Well	0.403	0.358	0.405	0.381
2215000-04G, -05G, -06G	Northborough	MC	Northborough WD	GW	Howard Street Wells #1-3	0.128	0.210	0.226	0.195
Subbasin total	--	--	--	--	--	0.532	0.568	0.632	0.576
Nashoba Brook									
2002000-02G	Acton	MC	Acton WD	GW	Conant Well	0.000	0.000	0.000	0.000
2002000-09G	Acton	MC	Acton WD	GW	Marshall Well	0.000	0.017	0.107	0.087
2002000-10G, -11G, 12G, 13G	Acton	MC	Acton WD	GW	Kennedy Wells #1-4	0.336	0.387	0.468	0.448
2002000-14G, -15G, -16G, -17G, -18G	Acton	MC	Acton WD	GW	Conant II Wells #1-5	0.000	0.000	0.000	0.000
3067000-01S	Acton	MC	Concord WD	SW	Nagog Pond	0.000	0.307	0.725	1.07
2002003-01G	Acton	NMC	Meadowbrook Condo.	GW	Well #1	NAV	NAV	NAV	NAV
2002005-01G	Acton	NMC	Wampus Apt.	GW	Well #1	NAV	NAV	NAV	NAV
2002006-02G	Acton	NMC	Great Road Condo.	GW	Wells #1-2	NAV	NAV	NAV	NAV
2002007-02G	Acton	NMC	Woodvale Condo.	GW	Well #1	NAV	NAV	NAV	NAV
2002009-01G	Acton	NMC	Richmond House Condo.	GW	Well #1	NAV	NAV	NAV	NAV
2002010-01G	Acton	NMC	Pine Hill Condo.	GW	Well #1	0.006	0.006	0.006	0.006
2002014-01G	Acton	NMC	Strawberry Hill Apt.	GW	Wells #1-2	NAV	NAV	NAV	NAV
2330014-01G	Westford	NMC	Vinebrook Estates	GW	Well #1	0.021	0.026	0.022	0.023
Subbasin total	--	--	--	--	--	0.363	0.743	1.33	1.63
North Brook									
2028007-01G, -02G, -03G, -04G	Berlin	NMC	Berlin Retirement Homes/ Northbrook Village	GW	Rock Wells #1-4	NAV	NAV	NAV	NAV
Subbasin total	--	--	--	--	--	NAV	NAV	NAV	NAV

Massachusetts, 1996–2000.—Continued

Apartments; Co., Company; Condo., Condominiums; DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District; WSD, unavailable; --, not applicable]

Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Assabet River Basin												
Fort Pond Brook												
2002000-01G	0.348	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.10	0.10	0.06	1.56
2002000-03G	0.215	0.216	0.172	0.185	0.085	0.041	0.118	0.163	0.15	0.17	0.15	1.17
2002000-04G	0.215	0.216	0.172	0.185	0.085	0.041	0.118	0.163	0.15	0.17	0.15	1.17
2002000-07G	0.000	0.176	0.275	0.304	0.335	0.327	0.067	0.000	0.12	0.22	0.01	16.16
2002000-08G	0.215	0.216	0.172	0.185	0.085	0.041	0.118	0.163	0.15	0.17	0.15	1.17
2037006-01G	0.002	0.002	0.001	0.002	0.002	0.002	0.001	0.002	0.00	0.00	0.00	1.14
2037009-01G	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.01	0.01	0.01	0.99
2037013-02G	0.018	0.019	0.018	0.018	0.018	0.017	0.018	0.017	0.02	0.02	0.02	1.06
2037014-02G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2174000-05G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2174000-07G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2286001-01G, -02G	0.073	0.071	0.070	0.068	0.074	0.068	0.068	0.074	0.07	0.07	0.07	1.04
Subbasin total	1.09	1.05	0.887	0.951	0.690	0.544	0.513	0.588	0.77	0.93	0.62	1.52
Howard and Cold Harbor Brooks												
2215000-03G	0.392	0.338	0.336	0.436	0.377	0.312	0.230	0.297	0.36	0.38	0.34	1.11
2215000-04G, -05G, -06G	0.223	0.192	0.244	0.213	0.171	0.090	0.205	0.216	0.19	0.21	0.20	1.06
Subbasin total	0.615	0.530	0.580	0.649	0.549	0.402	0.434	0.513	0.55	0.58	0.54	1.09
Nashoba Brook												
2002000-02G	0.000	0.171	0.309	0.311	0.280	0.280	0.158	0.220	0.14	0.21	0.08	2.84
2002000-09G	0.112	0.072	0.000	0.000	0.015	0.000	0.000	0.000	0.03	0.04	0.02	1.60
2002000-10G, -11G, 12G, 13G	0.440	0.390	0.329	0.331	0.343	0.369	0.378	0.309	0.38	0.37	0.38	0.98
2002000-14G, -15G, -16G, -17G, -18G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
3067000-01S	1.07	1.07	1.06	1.04	1.04	0.363	1.020	0.000	0.73	1.06	0.41	2.57
2002003-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002005-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002006-02G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002007-02G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002009-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002010-01G	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.005	0.01	0.01	0.01	1.04
2002014-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2330014-01G	0.038	0.050	0.073	0.062	0.037	0.028	0.024	0.023	0.04	0.00	0.02	0.07
Subbasin total	1.67	1.76	1.77	1.75	1.72	1.05	1.59	0.558	1.33	1.68	0.92	1.84
North Brook												
2028007-01G, -02G, -03G, -04G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Subbasin total	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise]

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Sudbury River Basin									
Cedar Swamp									
2328000-01G	Westborough	MC	Westborough WD	GW	Hopkinton Road Well	0.360	0.286	0.327	0.357
2328000-01S	Westborough	MC	Westborough WD	SW	Sandra Pond	0.460	0.605	0.584	0.693
2328000-02G	Westborough	MC	Westborough WD	GW	Morse Street Well	0.327	0.322	0.324	0.314
Subbasin total	--	--	--	--	--	1.15	1.21	1.23	1.36
Hop Brook									
2141000-02G	Hudson	MC	Hudson WD	GW	Cranberry Bog Well	0.827	0.869	0.824	0.934
3288000-03G	Sudbury	MC	Sudbury WD	GW	GP Well #3	0.239	0.228	0.238	0.200
3288000-08G, -10G	Sudbury	MC	Sudbury WD	GW	GP Wells #8 and 10	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	1.07	1.10	1.06	1.13
Indian Brook									
3014000-04G	Ashland	MC	Ashland WSD	GW	Howe Street GP Well #4	0.860	0.992	0.452	0.121
3014000-05G	Ashland	MC	Ashland WSD	GW	Howe Street GP Well #5	0.853	0.016	0.469	0.729
3014000-06G	Ashland	MC	Ashland WSD	GW	Howe Street GP Well #6	0.015	0.003	0.044	0.047
Subbasin total	--	--	--	--	--	1.73	1.01	0.965	0.897
Lake Cochituate									
3198000-01G	Natick	MC	Natick WD	GW	Springvale Well #1	0.777	0.823	0.802	0.830
3198000-02G	Natick	MC	Natick WD	GW	Springvale Well #3	1.02	0.120	0.662	0.439
3198000-07G	Natick	MC	Natick WD	GW	Springvale Well #4	1.28	0.761	0.522	0.158
3198000-09G	Natick	MC	Natick WD	GW	Evergreen Well #1	0.518	0.496	0.565	0.354
3198000-10G	Natick	MC	Natick WD	GW	Evergreen Well #2	0.740	0.723	0.839	0.557
Subbasin total	--	--	--	--	--	4.34	2.92	3.39	2.34
Lower Sudbury River									
3067000-01G	Concord	MC	Concord WD	GW	Jennie Dugan Well	0.297	0.271	0.496	0.464
3067000-03G	Concord	MC	Concord WD	GW	Deaconess Well	1.05	0.747	0.149	0.000
3067000-04G	Concord	MC	Concord WD	GW	White Pond Well	0.000	0.000	0.000	0.000
3067000-06G	Concord	MC	Concord WD	GW	Robinson Well	0.000	0.000	0.000	0.000
3157000-02G	Lincoln	MC	Lincoln WD	GW	Farrar Pond Well	0.000	0.000	0.000	0.000
3288000-02G, -09G	Sudbury	MC	Sudbury WD	GW	GP Wells #2 and 9	0.720	0.647	0.410	0.543
3288000-04G	Sudbury	MC	Sudbury WD	GW	GP Well #4	0.179	0.033	0.000	0.000
3288000-05G	Sudbury	MC	Sudbury WD	GW	GP Well #5	0.000	0.000	0.000	0.000
3288000-06G	Sudbury	MC	Sudbury WD	GW	GP Well #6	0.281	0.466	0.450	0.479
3288000-07G	Sudbury	MC	Sudbury WD	GW	GP Well #7	0.000	0.077	0.364	0.107
3315000-01G	Wayland	MC	Wayland WD	GW	Baldwin Pond Well #1	0.009	0.007	0.006	0.046
3315000-02G	Wayland	MC	Wayland WD	GW	Campbell Road Well #1	0.002	0.001	0.001	0.000
3315000-03G	Wayland	MC	Wayland WD	GW	Happy Hollow Well #1	0.001	0.002	0.000	0.000
3315000-04G	Wayland	MC	Wayland WD	GW	Happy Hollow Well #2	0.496	0.492	0.495	0.477
3315000-05G	Wayland	MC	Wayland WD	GW	Meadowview Well #1	0.000	0.001	0.001	0.000
3315000-06G	Wayland	MC	Wayland WD	GW	Baldwin Pond Well #3	0.437	0.443	0.501	0.486
3315000-07G	Wayland	MC	Wayland WD	GW	Baldwin Pond Well #2	0.538	0.569	0.567	0.562
3315000-08G	Wayland	MC	Wayland WD	GW	Chamberlain Well #1	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	4.01	3.76	3.44	3.16

Massachusetts, 1996–2000.—Continued

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Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Sudbury River Basin												
Cedar Swamp												
2328000-01G	0.356	0.376	0.379	0.359	0.086	0.000	0.131	0.000	0.25	0.31	0.22	1.41
2328000-01S	1.61	1.72	1.36	1.29	1.13	1.11	1.31	1.65	1.13	1.42	0.92	1.54
2328000-02G	0.309	0.309	0.305	0.294	0.286	0.285	0.291	0.306	0.31	0.30	0.31	0.96
Subbasin total	2.28	2.41	2.05	1.95	1.50	1.40	1.74	1.96	1.69	2.04	1.46	1.40
Hop Brook												
2141000-02G	0.897	0.962	0.685	0.587	0.237	0.235	0.210	0.240	0.63	0.67	0.59	1.13
3288000-03G	0.315	0.434	0.443	0.483	0.293	0.057	0.214	0.170	0.28	0.39	0.22	1.81
3288000-08G, -10G	0.023	0.025	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.01	0.00	--
Subbasin total	1.24	1.42	1.13	1.07	0.530	0.292	0.424	0.410	0.91	1.08	0.81	1.33
Indian Brook												
3014000-04G	0.213	0.443	1.05	1.07	0.282	0.672	0.945	0.862	0.66	0.61	0.82	0.75
3014000-05G	0.223	0.325	0.125	0.152	0.721	0.281	0.001	0.135	0.34	0.31	0.29	1.05
3014000-06G	0.572	0.483	0.022	0.094	0.081	0.076	0.103	0.055	0.13	0.25	0.04	5.65
Subbasin total	1.01	1.25	1.20	1.32	1.08	1.03	1.05	1.05	1.13	1.17	1.16	1.01
Lake Cochituate												
3198000-01G	0.821	0.853	0.830	0.860	0.855	0.793	0.735	0.699	0.81	0.84	0.77	1.10
3198000-02G	0.614	0.464	0.705	0.849	0.613	0.774	1.073	0.770	0.68	0.65	0.73	0.89
3198000-07G	0.497	0.350	0.533	0.105	0.008	0.440	0.366	0.696	0.48	0.30	0.73	0.41
3198000-09G	0.239	0.343	0.217	0.847	0.921	0.896	0.335	0.000	0.48	0.51	0.38	1.34
3198000-10G	0.467	0.660	0.440	0.936	0.884	0.880	0.368	0.000	0.62	0.68	0.53	1.27
Subbasin total	2.64	2.67	2.73	3.60	3.28	3.78	2.88	2.16	3.06	2.98	3.14	0.95
Lower Sudbury River												
3067000-01G	0.302	0.416	0.328	0.389	0.371	0.445	0.089	0.200	0.34	0.36	0.27	1.34
3067000-03G	0.286	0.998	0.629	0.613	0.373	0.680	0.118	1.02	0.55	0.58	0.62	0.94
3067000-04G	0.000	0.278	0.598	0.598	0.587	0.608	0.001	0.000	0.22	0.41	0.00	--
3067000-06G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
3157000-02G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
3288000-02G, -09G	0.705	1.095	0.685	0.756	0.700	0.699	0.567	0.412	0.66	0.79	0.55	1.43
3288000-04G	0.232	0.205	0.231	0.253	0.077	0.138	0.009	0.023	0.11	0.20	0.05	4.10
3288000-05G	0.170	0.401	0.177	0.222	0.089	0.000	0.000	0.000	0.09	0.21	0.00	--
3288000-06G	0.368	0.568	0.612	0.550	0.493	0.575	0.479	0.589	0.49	0.52	0.45	1.14
3288000-07G	0.358	0.199	0.445	0.480	0.443	0.238	0.000	0.019	0.23	0.39	0.09	4.18
3315000-01G	0.122	0.257	0.125	0.093	0.068	0.153	0.408	0.080	0.11	0.13	0.10	1.30
3315000-02G	0.286	0.349	0.344	0.410	0.403	0.168	0.000	0.000	0.16	0.36	0.00	--
3315000-03G	0.159	0.200	0.235	0.426	0.434	0.415	0.588	0.245	0.23	0.29	0.17	1.74
3315000-04G	0.473	0.510	0.450	0.530	0.300	0.332	0.031	0.591	0.43	0.45	0.42	1.07
3315000-05G	0.086	0.299	0.339	0.332	0.151	0.000	0.289	0.505	0.17	0.24	0.16	1.52
3315000-06G	0.464	0.566	0.376	0.313	0.026	0.000	0.000	0.000	0.30	0.35	0.28	1.26
3315000-07G	0.561	0.503	0.554	0.523	0.488	0.525	0.259	0.509	0.51	0.53	0.49	1.08
3315000-08G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Subbasin total	4.57	6.84	6.13	6.49	5.00	4.98	2.84	4.19	4.62	5.81	3.65	1.59

78 Water Withdrawals, Use, and Wastewater Return Flows in the Concord River Basin, Eastern Massachusetts, 1996–2000

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Sudbury River Basin									
Upper Sudbury River									
2139007-01G, -02G	Hopkinton	NMC	Village at Highland Park	GW	Wells #1 and 2	0.003	0.004	0.003	0.003
2139007-03G	Hopkinton	NMC	Village at Highland Park	GW	Well #3	0.000	0.000	0.003	0.003
2139008-02G	Hopkinton	NMC	The Preserve at Hopkinton Condo.	GW	Well #2	0.005	0.004	0.006	0.005
Subbasin total	--	--	--	--	--	0.008	0.008	0.012	0.011
Whitehall Brook									
2139000-01G	Hopkinton	MC	Hopkinton WD	GW	Well #1	0.249	0.262	0.282	0.290
2139000-02G	Hopkinton	MC	Hopkinton WD	GW	Well #2	0.117	0.133	0.127	0.163
2139000-03G	Hopkinton	MC	Hopkinton WD	GW	Well #3	0.052	0.031	0.000	0.025
2139000-04G	Hopkinton	MC	Hopkinton WD	GW	Well #4	0.081	0.078	0.087	0.088
2139000-05G	Hopkinton	MC	Hopkinton WD	GW	Well #5	0.085	0.080	0.098	0.038
Subbasin total	--	--	--	--	--	0.584	0.584	0.594	0.604
Lower Concord River Basin									
Lower Concord Main Stem									
3031000-01S	Billerica	MC	Billerica WW	SW	Concord River	4.30	4.12	3.95	4.03
3067000-02G	Concord	MC	Concord WD	GW	Hugh Cargill Well	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	4.30	4.12	3.95	4.03
River Meadow Brook									
3056000-02G	Chelmsford	MC	Chelmsford WD	GW	Turnpike Road GP Well #1	0.000	0.000	0.000	0.003
3056000-05G, -15G, -16G	Chelmsford	MC	Chelmsford WD	GW	Mill Road GP Wells #1-3	0.465	0.472	0.519	0.527
3056000-09G, 11G	Chelmsford	MC	Chelmsford WD	GW	Riverneck Road GP Wells #1-2	0.523	0.666	0.484	0.433
3056001-01G	Chelmsford	MC	East Chelmsford WD	GW	Canal Street GP Well #1	0.142	0.205	0.219	0.225
Subbasin total	--	--	--	--	--	1.13	1.34	1.22	1.19
Total Concord River Basin									
Basin total	--	--	--	--	--	25.8	24.8	25.8	25.0
1997									
Assabet River Basin									
Assabet Headwaters									
2170000-01S	Marlborough	MC	Marlborough DPW, WD	SW	Millham Reservoir	2.94	3.17	3.12	3.25
2215000-01G	Northborough	MC	Northborough WD	GW	Brigham Street Well	0.291	0.168	0.298	0.276
2215000-02G	Northborough	MC	Northborough WD	GW	Lyman Street Well	0.000	0.000	0.000	0.000
2328000-03G	Westborough	MC	Westborough WD	GW	Andrews I Well	0.000	0.033	0.297	0.408
2328000-04G	Westborough	MC	Westborough WD	GW	Andrews II Well	0.000	0.000	0.184	0.087
2328000-05G	Westborough	MC	Westborough WD	GW	Otis Street Well	0.216	0.148	0.076	0.099
2328000-06G	Westborough	MC	Westborough WD	GW	Wilkinson Well	0.000	0.000	0.000	0.000
2328000-07G	Westborough	MC	Westborough WD	GW	Chauncy Lake Well #1	0.000	0.000	0.000	0.000
2328000-08G	Westborough	MC	Westborough WD	GW	Chauncy Lake Well #2	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	3.45	3.52	3.97	4.12

Massachusetts, 1996–2000.—Continued

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Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Sudbury River Basin												
Upper Sudbury River												
2139007-01G, -02G	0.003	0.007	0.008	0.009	0.007	0.004	0.004	0.003	0.01	0.01	0.00	2.00
2139007-03G	0.005	0.000	0.010	0.000	0.007	0.000	0.000	0.003	0.00	0.00	0.00	--
2139008-02G	0.005	0.006	0.007	0.007	0.006	0.005	0.005	0.005	0.01	0.01	0.01	1.20
Subbasin total	0.013	0.012	0.025	0.016	0.020	0.009	0.009	0.012	0.71	0.84	0.61	1.38
Whitehall Brook												
2139000-01G	0.301	0.348	0.309	0.321	0.304	0.235	0.238	0.234	0.28	0.32	0.25	1.25
2139000-02G	0.146	0.175	0.188	0.183	0.179	0.155	0.164	0.156	0.16	0.17	0.14	1.25
2139000-03G	0.056	0.046	0.054	0.049	0.042	0.040	0.037	0.037	0.04	0.05	0.03	1.57
2139000-04G	0.083	0.156	0.169	0.158	0.096	0.094	0.086	0.070	0.10	0.13	0.08	1.65
2139000-05G	0.140	0.184	0.181	0.150	0.111	0.112	0.099	0.112	0.12	0.15	0.09	1.61
Subbasin total	0.726	0.909	0.902	0.860	0.732	0.635	0.624	0.609				
Lower Concord River Basin												
Lower Concord Main Stem												
3031000-01S	4.80	6.36	6.04	5.87	4.82	4.19	3.88	3.86	4.68	5.58	4.02	1.39
3067000-02G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Subbasin total	4.80	6.36	6.04	5.87	4.82	4.19	3.88	3.86	4.68	5.58	4.02	1.39
River Meadow Brook												
3056000-02G	0.000	0.187	0.123	0.319	0.110	0.000	0.000	0.000	0.06	0.15	0.00	--
3056000-05G, -15G, -16G	0.974	0.773	0.874	1.15	1.05	0.819	0.913	0.835	0.78	0.97	0.64	1.51
3056000-09G, 11G	0.910	0.693	0.632	0.765	0.633	0.468	0.453	0.423	0.59	0.38	0.51	0.74
3056001-01G	0.289	0.377	0.153	0.123	0.118	0.085	0.087	0.119	0.18	0.21	0.15	1.37
Subbasin total	2.17	2.03	1.78	2.36	1.91	1.37	1.45	1.38	1.61	1.70	1.30	1.30
Total Concord River Basin												
Basin total	30.2	34.2	31.4	33.1	28.0	25.7	22.6	23.2	0.29	0.33	0.26	1.28
1997												
Assabet River Basin												
Assabet Headwaters												
2170000-01S	2.71	1.01	0.941	0.996	0.970	0.620	0.131	0.855	1.73	1.33	2.04	0.65
2215000-01G	0.357	0.323	0.260	0.296	0.349	0.345	0.376	0.369	0.31	0.32	0.30	1.06
2215000-02G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2328000-03G	0.508	0.474	0.416	0.409	0.406	0.404	0.397	0.412	0.35	0.44	0.23	1.94
2328000-04G	0.149	0.425	0.413	0.422	0.374	0.351	0.335	0.283	0.25	0.36	0.16	2.22
2328000-05G	0.175	0.251	0.392	0.274	0.408	0.429	0.461	0.434	0.28	0.30	0.27	1.12
2328000-06G	0.009	0.154	0.147	0.111	0.099	0.125	0.140	0.147	0.08	0.10	0.06	1.81
2328000-07G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2328000-08G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Subbasin total	3.91	2.64	2.57	2.51	2.61	2.27	1.84	2.50	2.99	2.85	3.06	0.93

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise]

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Assabet River Basin									
Assabet Main Stem									
2002000-05G	Acton	MC	Acton WD	GW	Assabet Well #1	0.246	0.304	0.308	0.309
2002000-06G	Acton	MC	Acton WD	GW	Assabet Well #2	0.246	0.304	0.308	0.309
2141000-01G	Hudson	MC	Hudson WD	GW	Rimkus Well	0.000	0.000	0.000	0.000
2141000-01S	Berlin	MC	Hudson WD	SW	Gates Pond Reservoir	0.000	0.000	0.000	0.000
2174000-01G, -02G	Maynard	MC	Maynard DPW, WD	GW	Old Marlboro Road Wells #1 and 2	0.300	0.287	0.297	0.315
2174000-01S	Maynard	MC	Maynard DPW, WD	SW	White Pond	0.334	0.314	0.308	0.330
2174000-03G	Maynard	MC	Maynard DPW, WD	GW	Old Marlboro Road Well #3	0.208	0.222	0.218	0.229
2174000-04G	Maynard	MC	Maynard DPW, WD	GW	Great Road Well #4	0.000	0.000	0.000	0.000
2271000-01G	Shrewsbury	MC	Shrewsbury WD	GW	South Street Well	0.000	0.000	0.000	0.000
2286000-01G, -02G, -03G	Stow	NMC	Juniper Hill Water Co.	GW	Wells #1-3	NAV	NAV	NAV	NAV
3067000-05G	Concord	MC	Concord WD	GW	Second Division Well	0.710	0.557	0.700	0.606
Subbasin total	--	--	--	--	--	2.04	1.99	2.14	2.10
Elizabeth Brook									
2037001-01G	Boxborough	NMC	Codman Hill Condo.	GW	Well #1	0.013	0.015	0.014	0.014
2037002-01G	Boxborough	NMC	Harvard Ridge Condo.	GW	Dunster House Well	0.012	0.014	0.012	0.013
2037002-02G	Boxborough	NMC	Harvard Ridge Condo.	GW	Eliot House Well	0.012	0.014	0.012	0.013
2037002-03G	Boxborough	NMC	Harvard Ridge Condo.	GW	Leverett House Well	0.005	0.005	0.005	0.005
2286017-01G	Stow	NMC	Plantation Apt.	GW	Well #1	NAV	NAV	NAV	NAV
2286018-01G	Stow	NMC	Pilot Grove Apt.	GW	Well #1	0.003	0.004	0.004	0.004
2286018-02G	Stow	NMC	Pilot Grove Apt.	GW	Well #2	0.003	0.004	0.004	0.004
Subbasin total	--	--	--	--	--	0.049	0.055	0.051	0.052
Fort Meadow Brook									
2141000-03G	Hudson	MC	Hudson WD	GW	Kane Well	0.004	0.000	0.000	0.026
2141000-04G	Hudson	MC	Hudson WD	GW	Chestnut Street Well #1	0.772	0.748	0.673	0.626
2141000-05G	Hudson	MC	Hudson WD	GW	Chestnut Street Well #2	0.812	0.784	0.706	0.647
2141000-06G	Hudson	MC	Hudson WD	GW	Chestnut Street Well #3	0.399	0.376	0.321	0.299
Subbasin total	--	--	--	--	--	1.99	1.91	1.70	1.60
Fort Pond Brook									
2002000-01G	Acton	MC	Acton WD	GW	Whitcomb Well	0.043	0.103	0.075	0.076
2002000-03G	Acton	MC	Acton WD	GW	Lawsbrook	0.197	0.168	0.183	0.193
2002000-04G	Acton	MC	Acton WD	GW	Christofferson Well	0.197	0.168	0.183	0.193
2002000-07G	Acton	MC	Acton WD	GW	Clapp Well	0.000	0.000	0.000	0.000
2002000-08G	Acton	MC	Acton WD	GW	Scribner Well	0.197	0.168	0.183	0.193
2037006-01G	Boxborough	NMC	Centre Village Apt.	GW	Rock Well	0.002	0.002	0.002	0.002
2037009-01G	Boxborough	NMC	Carriage House Condo.	GW	Well #1	0.006	0.007	0.006	0.006
2037013-02G	Boxborough	NMC	Applewood Condo.	GW	Well #2	0.021	0.017	0.016	0.020
2037014-02G	Boxborough	NMC	Liberty House Condo.	GW	Well #2	NAV	NAV	NAV	NAV
2174000-05G	Maynard	MC	Maynard DPW, WD	GW	Rock Well #2	0.000	0.000	0.000	0.000
2174000-07G	Maynard	MC	Maynard DPW, WD	GW	Rock Well #5	0.000	0.000	0.000	0.000
2286001-01G, -02G	Stow	NMC	Assabet Water Co./ Harvard Acres	GW	Wells #1-2	0.080	0.082	0.080	0.083
Subbasin total	--	--	--	--	--	0.741	0.714	0.727	0.764

Massachusetts, 1996–2000.—Continued

Apartments; Co., Company; Condo., Condominiums; DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District; WSD, unavailable; --, not applicable]

Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Assabet River Basin												
Assabet Main Stem												
2002000-05G	0.337	0.375	0.325	0.240	0.151	0.213	0.229	0.239	0.27	0.29	0.27	1.08
2002000-06G	0.337	0.375	0.325	0.240	0.151	0.213	0.229	0.239	0.27	0.29	0.27	1.08
2141000-01G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2141000-01S	0.000	0.374	0.519	0.390	0.182	0.121	0.121	0.067	0.15	0.29	0.04	7.77
2174000-01G, -02G	0.275	0.415	0.376	0.317	0.292	0.271	0.300	0.298	0.31	0.33	0.30	1.13
2174000-01S	0.174	0.000	0.422	0.332	0.608	0.476	0.520	0.521	0.36	0.31	0.40	0.77
2174000-03G	0.250	0.283	0.259	0.196	0.189	0.166	0.000	0.000	0.19	0.24	0.13	1.81
2174000-04G	0.163	0.172	0.384	0.109	0.000	0.000	0.000	0.000	0.07	0.17	0.00	--
2271000-01G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2286000-01G, -02G, -03G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
3067000-05G	0.564	0.687	0.615	0.533	0.653	0.756	0.749	0.646	0.65	0.61	0.67	0.91
Subbasin total	2.10	2.68	3.23	2.36	2.23	2.22	2.15	2.01	2.27	2.52	2.07	1.22
Elizabeth Brook												
2037001-01G	0.013	0.014	0.013	0.013	0.012	0.012	0.012	0.011	0.01	0.01	0.01	0.98
2037002-01G	0.012	0.013	0.012	0.012	0.013	0.012	0.013	0.012	0.01	0.01	0.01	0.99
2037002-02G	0.012	0.013	0.012	0.012	0.013	0.012	0.013	0.012	0.01	0.01	0.01	0.99
2037002-03G	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.01	0.01	0.01	0.99
2286017-01G	NAV	NAV	0.011	0.005	0.004	0.002	0.002	0.005	--	--	--	--
2286018-01G	0.004	0.005	0.006	0.007	0.006	0.004	0.004	0.003	0.01	0.01	0.00	1.55
2286018-02G	0.004	0.005	0.006	0.007	0.006	0.004	0.004	0.004	0.01	0.01	0.00	1.47
Subbasin total	0.050	0.054	0.066	0.061	0.058	0.051	0.053	0.053	0.05	0.05	0.05	1.06
Fort Meadow Brook												
2141000-03G	0.127	0.205	0.221	0.207	0.195	0.042	0.031	0.025	0.09	0.19	0.01	16.03
2141000-04G	0.755	0.803	0.796	0.723	0.708	0.585	0.447	0.282	0.66	0.76	0.58	1.29
2141000-05G	0.760	0.788	0.797	0.718	0.624	0.581	0.562	0.602	0.70	0.74	0.69	1.06
2141000-06G	0.223	0.085	0.000	0.000	0.000	0.434	0.517	0.576	0.27	0.06	0.44	0.14
Subbasin total	1.86	1.88	1.81	1.65	1.53	1.64	1.56	1.49	1.72	1.75	1.73	1.01
Fort Pond Brook												
2002000-01G	0.107	0.200	0.059	0.068	0.086	0.000	0.000	0.126	0.08	0.10	0.07	1.50
2002000-03G	0.191	0.228	0.171	0.166	0.169	0.164	0.095	0.098	0.17	0.18	0.15	1.25
2002000-04G	0.191	0.228	0.171	0.166	0.169	0.164	0.095	0.098	0.17	0.18	0.15	1.25
2002000-07G	0.000	0.190	0.289	0.211	0.232	0.249	0.294	0.151	0.13	0.18	0.09	2.08
2002000-08G	0.191	0.228	0.171	0.166	0.169	0.164	0.095	0.098	0.17	0.18	0.15	1.25
2037006-01G	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.002	0.00	0.00	0.00	0.79
2037009-01G	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.01	0.01	0.01	0.99
2037013-02G	0.017	0.019	0.020	0.019	0.020	0.018	0.017	0.017	0.02	0.02	0.02	1.08
2037014-02G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2174000-05G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2174000-07G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2286001-01G, -02G	0.085	0.090	0.072	0.063	0.081	0.073	0.083	0.085	0.08	0.08	0.08	0.95
Subbasin total	0.790	1.19	0.959	0.867	0.932	0.839	0.687	0.682	0.82	0.95	0.71	1.33

82 Water Withdrawals, Use, and Wastewater Return Flows in the Concord River Basin, Eastern Massachusetts, 1996–2000

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Assabet River Basin									
Howard and Cold Harbor Brooks									
2215000-03G	Northborough	MC	Northborough WD	GW	Crawford Street Well	0.258	0.355	0.359	0.406
2215000-04G, -05G, -06G	Northborough	MC	Northborough WD	GW	Howard Street Wells #1-3	0.213	0.215	0.162	0.201
Subbasin total	--	--	--	--	--	0.471	0.570	0.521	0.607
Nashoba Brook									
2002000-02G	Acton	MC	Acton WD	GW	Conant Well	0.254	0.030	0.099	0.059
2002000-09G	Acton	MC	Acton WD	GW	Marshall Well	0.000	0.000	0.000	0.000
2002000-10G, -11G, 12G, 13G	Acton	MC	Acton WD	GW	Kennedy Wells #1-4	0.330	0.388	0.285	0.358
2002000-14G, -15G, -16G, -17G, -18G	Acton	MC	Acton WD	GW	Conant II Wells #1-5	0.000	0.000	0.000	0.000
3067000-01S	Acton	MC	Concord WD	SW	Nagog Pond	0.000	0.000	0.000	0.000
2002003-01G	Acton	NMC	Meadowbrook Condo.	GW	Well #1	NAV	NAV	NAV	NAV
2002005-01G	Acton	NMC	Wampus Apt.	GW	Well #1	NAV	NAV	NAV	NAV
2002006-02G	Acton	NMC	Great Road Condo.	GW	Wells #1-2	NAV	NAV	NAV	NAV
2002007-02G	Acton	NMC	Woodvale Condo.	GW	Well #1	NAV	NAV	NAV	NAV
2002009-01G	Acton	NMC	Richmond House Condo.	GW	Well #1	NAV	NAV	NAV	NAV
2002010-01G	Acton	NMC	Pine Hill Condo.	GW	Well #1	0.005	0.006	0.005	0.006
2002014-01G	Acton	NMC	Strawberry Hill Apt.	GW	Wells #1-2	NAV	NAV	NAV	NAV
2330014-01G	Westford	NMC	Vinebrook Estates	GW	Well #1	0.016	0.021	0.018	0.028
Subbasin total	--	--	--	--	--	0.605	0.444	0.407	0.451
North Brook									
2028007-01G, -02G, -03G, -04G	Berlin	NMC	Berlin Retirement Homes/ Northbrook Village	GW	Rock Wells #1-4	NAV	NAV	NAV	NAV
Subbasin total	--	--	--	--	--	NAV	NAV	NAV	NAV
Sudbury River Basin									
Cedar Swamp									
2328000-01G	Westborough	MC	Westborough WD	GW	Hopkinton Road Well	0.000	0.000	0.000	0.000
2328000-01S	Westborough	MC	Westborough WD	SW	Sandra Pond	1.77	1.82	1.44	1.44
2328000-02G	Westborough	MC	Westborough WD	GW	Morse Street Well	0.295	0.264	0.226	0.233
Subbasin total	--	--	--	--	--	2.06	2.09	1.67	1.67
Hop Brook									
2141000-02G	Hudson	MC	Hudson WD	GW	Cranberry Bog Well	0.311	0.329	0.504	0.683
3288000-03G	Sudbury	MC	Sudbury WD	GW	GP Well #3	0.094	0.000	0.155	0.282
3288000-08G, -10G	Sudbury	MC	Sudbury WD	GW	GP Wells #8 and 10	0.000	0.000	0.000	0.049
Subbasin total	--	--	--	--	--	0.405	0.329	0.658	1.01
Indian Brook									
3014000-04G	Ashland	MC	Ashland WSD	GW	Howe Street GP Well #4	0.700	0.115	0.014	0.447
3014000-05G	Ashland	MC	Ashland WSD	GW	Howe Street GP Well #5	0.330	0.839	0.930	0.334
3014000-06G	Ashland	MC	Ashland WSD	GW	Howe Street GP Well #6	0.014	0.025	0.040	0.403
Subbasin total	--	--	--	--	--	1.04	0.978	0.984	1.18

Massachusetts, 1996–2000.—Continued

Apartments; Co., Company; Condo., Condominiums; DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District; WSD, unavailable; --, not applicable]

Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Assabet River Basin												
Howard and Cold Harbor Brooks												
2215000-03G	0.412	0.334	0.357	0.210	0.476	0.339	0.376	0.355	0.35	0.36	0.34	1.05
2215000-04G, -05G, -06G	0.226	0.207	0.208	0.141	0.003	0.055	0.024	0.110	0.15	0.16	0.14	1.09
Subbasin total	0.638	0.542	0.565	0.351	0.479	0.394	0.400	0.465	0.50	0.52	0.49	1.06
Nashoba Brook												
2002000-02G	0.109	0.241	0.254	0.214	0.020	0.197	0.139	0.075	0.14	0.17	0.12	1.40
2002000-09G	0.049	0.000	0.000	0.000	0.000	0.000	0.017	0.089	0.01	0.01	0.02	0.46
2002000-10G, -11G, 12G, 13G	0.330	0.523	0.578	0.484	0.482	0.378	0.454	0.448	0.42	0.48	0.38	1.26
2002000-14G, -15G, -16G, -17G, -18G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
3067000-01S	0.108	0.768	1.149	1.090	0.507	0.000	0.000	0.000	0.30	0.72	0.00	--
2002003-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002005-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002006-02G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002007-02G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002009-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002010-01G	0.005	0.006	0.006	0.006	0.006	0.006	0.006	0.005	0.01	0.01	0.01	1.04
2002014-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2330014-01G	0.031	0.066	0.053	0.062	0.034	0.024	0.026	0.019	0.03	0.10	0.02	2.46
Subbasin total	0.631	1.60	2.04	1.86	1.05	0.605	0.642	0.637	0.91	1.49	0.55	2.72
North Brook												
2028007-01G, -02G, -03G, -04G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Subbasin total	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Sudbury River Basin												
Cedar Swamp												
2328000-01G	0.003	0.236	0.250	0.349	0.421	0.400	0.425	0.425	0.21	0.25	0.17	1.48
2328000-01S	1.45	1.43	1.39	0.881	0.632	0.052	0.106	0.091	1.04	1.16	1.05	1.10
2328000-02G	0.244	0.268	0.249	0.236	0.246	0.339	0.228	0.235	0.26	0.25	0.25	1.00
Subbasin total	1.69	1.93	1.89	1.47	1.30	0.791	0.760	0.751	1.51	1.66	1.47	1.13
Hop Brook												
2141000-02G	0.834	0.901	0.894	0.822	0.798	0.607	0.564	0.650	0.66	0.85	0.47	1.80
3288000-03G	0.237	0.375	0.332	0.187	0.228	0.174	0.185	0.160	0.20	0.27	0.12	2.29
3288000-08G, -10G	0.000	0.589	0.487	0.523	0.468	0.371	0.417	0.426	0.28	0.41	0.17	2.45
Subbasin total	1.07	1.86	1.71	1.53	1.49	1.15	1.17	1.24	1.14	1.53	0.76	2.02
Indian Brook												
3014000-04G	0.795	1.09	0.966	0.640	0.348	0.374	0.756	0.723	0.58	0.77	0.46	1.66
3014000-05G	0.032	0.074	0.083	0.833	0.685	0.380	0.000	0.000	0.38	0.34	0.42	0.81
3014000-06G	0.604	0.810	0.845	0.019	0.019	0.489	0.438	0.419	0.34	0.46	0.19	2.45
Subbasin total	1.43	1.97	1.89	1.49	1.05	1.24	1.19	1.14	1.30	1.57	1.07	1.47

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise]

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Sudbury River Basin									
Lake Cochituate									
3198000-01G	Natick	MC	Natick WD	GW	Springvale Well #1	0.202	0.000	0.000	0.000
3198000-02G	Natick	MC	Natick WD	GW	Springvale Well #3	0.896	1.02	0.873	0.588
3198000-07G	Natick	MC	Natick WD	GW	Springvale Well #4	0.906	1.02	1.18	0.519
3198000-09G	Natick	MC	Natick WD	GW	Evergreen Well #1	0.000	0.048	0.000	0.000
3198000-10G	Natick	MC	Natick WD	GW	Evergreen Well #2	0.000	0.000	0.000	0.076
Subbasin total	--	--	--	--	--	2.01	2.08	2.06	1.18
Lower Sudbury River									
3067000-01G	Concord	MC	Concord WD	GW	Jennie Dugan Well	0.106	0.358	0.207	0.332
3067000-03G	Concord	MC	Concord WD	GW	Deaconess Well	1.07	1.06	1.04	1.04
3067000-04G	Concord	MC	Concord WD	GW	White Pond Well	0.000	0.000	0.000	0.000
3067000-06G	Concord	MC	Concord WD	GW	Robinson Well	0.000	0.000	0.000	0.000
3157000-02G	Lincoln	MC	Lincoln WD	GW	Farrar Pond Well	0.000	0.000	0.000	0.000
3288000-02G, -09G	Sudbury	MC	Sudbury WD	GW	GP Wells #2 and 9	0.370	0.307	0.338	0.850
3288000-04G	Sudbury	MC	Sudbury WD	GW	GP Well #4	0.159	0.193	0.174	0.053
3288000-05G	Sudbury	MC	Sudbury WD	GW	GP Well #5	0.000	0.000	0.000	0.000
3288000-06G	Sudbury	MC	Sudbury WD	GW	GP Well #6	0.632	0.615	0.511	0.378
3288000-07G	Sudbury	MC	Sudbury WD	GW	GP Well #7	0.314	0.315	0.069	0.403
3315000-01G	Wayland	MC	Wayland WD	GW	Baldwin Pond Well #1	0.006	0.001	0.001	0.156
3315000-02G	Wayland	MC	Wayland WD	GW	Campbell Road Well #1	0.000	0.000	0.101	0.029
3315000-03G	Wayland	MC	Wayland WD	GW	Happy Hollow Well #1	0.211	0.610	0.412	0.421
3315000-04G	Wayland	MC	Wayland WD	GW	Happy Hollow Well #2	0.692	0.252	0.324	0.325
3315000-05G	Wayland	MC	Wayland WD	GW	Meadowview Well #1	0.002	0.077	0.057	0.362
3315000-06G	Wayland	MC	Wayland WD	GW	Baldwin Pond Well #3	0.000	0.000	0.000	0.000
3315000-07G	Wayland	MC	Wayland WD	GW	Baldwin Pond Well #2	0.571	0.586	0.562	0.594
3315000-08G	Wayland	MC	Wayland WD	GW	Chamberlain Well #1	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	4.13	4.37	3.80	4.94
Upper Sudbury River									
2139007-01G, -02G	Hopkinton	NMC	Village at Highland Park	GW	Wells #1 and 2	0.003	0.004	0.004	0.003
2139007-03G	Hopkinton	NMC	Village at Highland Park	GW	Well #3	0.000	0.000	0.000	0.000
2139008-02G	Hopkinton	NMC	The Preserve at Hopkinton Condo.	GW	Well #2	0.005	0.005	0.005	0.005
Subbasin total	--	--	--	--	--	0.008	0.009	0.008	0.008
Whitehall Brook									
2139000-01G	Hopkinton	MC	Hopkinton WD	GW	Well #1	0.236	0.233	0.231	0.232
2139000-02G	Hopkinton	MC	Hopkinton WD	GW	Well #2	0.155	0.158	0.160	0.165
2139000-03G	Hopkinton	MC	Hopkinton WD	GW	Well #3	0.034	0.032	0.039	0.037
2139000-04G	Hopkinton	MC	Hopkinton WD	GW	Well #4	0.102	0.091	0.093	0.102
2139000-05G	Hopkinton	MC	Hopkinton WD	GW	Well #5	0.085	0.087	0.088	0.104
Subbasin total	--	--	--	--	--	0.613	0.601	0.611	0.639

Massachusetts, 1996–2000.—Continued

Apartments; Co., Company; Condo., Condominiums; DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District; WSD, unavailable; --, not applicable]

Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Sudbury River Basin												
Lake Cochituate												
3198000-01G	0.197	0.221	0.149	0.225	0.495	0.085	0.000	0.000	0.13	0.26	0.04	6.36
3198000-02G	1.18	0.834	1.206	0.793	0.546	0.847	0.120	0.000	0.74	0.91	0.58	1.57
3198000-07G	0.941	0.573	0.756	0.614	0.368	0.732	0.138	0.000	0.65	0.65	0.65	1.00
3198000-09G	0.000	0.586	0.943	1.223	0.980	0.527	0.000	0.000	0.36	0.75	0.01	78.04
3198000-10G	0.000	0.423	0.124	1.959	1.614	0.364	0.000	0.000	0.38	0.82	0.00	--
Subbasin total	2.32	2.64	3.18	4.81	4.00	2.56	0.259	0.000	2.26	3.39	1.28	2.65
Lower Sudbury River												
3067000-01G	0.251	0.437	0.477	0.402	0.287	0.248	0.206	0.302	0.30	0.37	0.24	1.57
3067000-03G	1.03	1.01	0.806	0.255	0.505	0.849	1.00	1.04	0.89	0.72	1.04	0.69
3067000-04G	0.463	0.637	0.674	0.653	0.626	0.402	0.000	0.000	0.29	0.61	0.00	--
3067000-06G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
3157000-02G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
3288000-02G, -09G	0.851	1.17	1.05	0.355	0.000	0.000	0.000	0.000	0.44	0.68	0.20	3.37
3288000-04G	0.008	0.123	0.208	0.102	0.000	0.000	0.000	0.000	0.08	0.09	0.11	0.84
3288000-05G	0.000	0.403	0.486	0.449	0.240	0.178	0.000	0.000	0.15	0.32	0.00	--
3288000-06G	0.425	0.652	0.537	0.482	0.521	0.505	0.460	0.537	0.52	0.52	0.55	0.95
3288000-07G	0.448	0.519	0.436	0.335	0.445	0.480	0.176	0.059	0.33	0.44	0.19	2.34
3315000-01G	0.745	0.823	0.689	0.566	0.410	0.428	0.623	0.776	0.44	0.65	0.28	2.30
3315000-02G	0.036	0.480	0.644	0.627	0.303	0.200	0.026	0.000	0.20	0.42	0.03	16.43
3315000-03G	0.245	0.425	0.563	0.571	0.343	0.517	0.066	0.342	0.39	0.43	0.33	1.31
3315000-04G	0.093	0.565	0.543	0.215	0.388	0.088	0.058	0.143	0.31	0.36	0.29	1.23
3315000-05G	0.415	0.493	0.518	0.445	0.340	0.068	0.421	0.157	0.28	0.44	0.14	3.10
3315000-06G	0.000	0.000	0.017	0.024	0.000	0.015	0.000	0.000	0.01	0.01	0.00	--
3315000-07G	0.546	0.337	0.444	0.254	0.352	0.385	0.160	0.001	0.40	0.39	0.38	1.03
3315000-08G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Subbasin total	5.55	8.07	8.09	5.74	4.76	4.36	3.20	3.35	5.03	6.44	3.77	1.71
Upper Sudbury River												
2139007-01G, -02G	0.005	0.008	0.000	0.000	0.000	0.000	0.000	0.004	0.00	0.00	0.00	0.91
2139007-03G	0.000	0.000	0.006	0.005	0.007	0.006	0.004	0.000	0.00	0.00	0.00	--
2139008-02G	0.007	0.010	0.013	0.009	0.006	0.005	0.005	0.004	0.01	0.01	0.01	1.89
Subbasin total	0.012	0.018	0.019	0.014	0.014	0.011	0.008	0.008	0.01	0.02	0.01	1.83
Whitehall Brook												
2139000-01G	0.256	0.397	0.411	0.229	0.228	0.227	0.217	0.220	0.26	0.30	0.23	1.34
2139000-02G	0.173	0.259	0.285	0.138	0.144	0.140	0.128	0.157	0.17	0.20	0.15	1.32
2139000-03G	0.041	0.074	0.073	0.057	0.061	0.061	0.048	0.038	0.05	0.06	0.04	1.60
2139000-04G	0.121	0.190	0.215	0.157	0.144	0.080	0.101	0.091	0.12	0.17	0.10	1.73
2139000-05G	0.129	0.233	0.299	0.170	0.206	0.197	0.143	0.121	0.16	0.21	0.10	1.98
Subbasin total	0.721	1.15	1.28	0.752	0.783	0.705	0.637	0.627	0.76	0.94	0.62	1.52

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise]

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Lower Concord River Basin									
Lower Concord Main Stem									
3031000-01S	Billerica	MC	Billerica WW	SW	Concord River	3.85	3.84	4.06	3.92
3067000-02G	Concord	MC	Concord WD	GW	Hugh Cargill Well	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	3.85	3.84	4.06	3.92
River Meadow Brook									
3056000-02G	Chelmsford	MC	Chelmsford WD	GW	Turnpike Road GP Well #1	0.000	0.246	0.055	0.000
3056000-05G, -15G, -16G	Chelmsford	MC	Chelmsford WD	GW	Mill Road GP Wells #1-3	1.41	1.05	0.968	1.07
3056000-09G, 11G	Chelmsford	MC	Chelmsford WD	GW	Riverneck Road GP Wells #1-2	0.532	0.450	0.445	0.553
3056001-01G	Chelmsford	MC	East Chelmsford WD	GW	Canal Street GP Well #1	0.157	0.148	0.158	0.150
Subbasin total	--	--	--	--	--	2.10	1.89	1.63	1.78
Total Concord River Basin									
Basin total	--	--	--	--	--	25.6	25.4	25.0	26.0
1998									
Assabet River Basin									
Assabet Headwaters									
2170000-01S	Marlborough	MC	Marlborough DPW, WD	SW	Millham Reservoir	0.967	1.38	3.15	3.23
2215000-01G	Northborough	MC	Northborough WD	GW	Brigham Street Well	0.330	0.441	0.282	0.093
2215000-02G	Northborough	MC	Northborough WD	GW	Lyman Street Well	0.000	0.000	0.000	0.000
2328000-03G	Westborough	MC	Westborough WD	GW	Andrews I Well	0.366	0.399	0.386	0.408
2328000-04G	Westborough	MC	Westborough WD	GW	Andrews II Well	0.343	0.329	0.219	0.281
2328000-05G	Westborough	MC	Westborough WD	GW	Otis Street Well	0.463	0.263	0.266	0.246
2328000-06G	Westborough	MC	Westborough WD	GW	Wilkinson Well	0.176	0.194	0.050	0.116
2328000-07G	Westborough	MC	Westborough WD	GW	Chauncy Lake Well #1	0.000	0.000	0.051	0.053
2328000-08G	Westborough	MC	Westborough WD	GW	Chauncy Lake Well #2	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	2.65	3.00	4.40	4.43
Assabet Main Stem									
2002000-05G	Acton	MC	Acton WD	GW	Assabet Well #1	0.259	0.241	0.256	0.036
2002000-06G	Acton	MC	Acton WD	GW	Assabet Well #2	0.259	0.241	0.256	0.036
2141000-01G	Hudson	MC	Hudson WD	GW	Rimkus Well	0.000	0.000	0.000	0.000
2141000-01S	Berlin	MC	Hudson WD	SW	Gates Pond Reservoir	0.087	0.069	0.075	0.099
2174000-01G, -02G	Maynard	MC	Maynard DPW, WD	GW	Old Marlboro Road Wells #1 and 2	0.270	0.067	0.000	0.066
2174000-01S	Maynard	MC	Maynard DPW, WD	SW	White Pond	0.631	0.512	0.466	0.444
2174000-03G	Maynard	MC	Maynard DPW, WD	GW	Old Marlboro Road Well #3	0.000	0.245	0.406	0.298
2174000-04G	Maynard	MC	Maynard DPW, WD	GW	Great Road Well #4	0.000	0.000	0.000	0.000
2271000-01G	Shrewsbury	MC	Shrewsbury WD	GW	South Street Well	0.000	0.000	0.000	0.000
2286000-01G, -02G, -03G	Stow	NMC	Juniper Hill Water Co.	GW	Wells #1-3	NAV	NAV	NAV	NAV
3067000-05G	Concord	MC	Concord WD	GW	Second Division Well	0.506	0.746	0.581	0.740
Subbasin total	--	--	--	--	--	2.01	2.12	2.04	1.72

Massachusetts, 1996–2000.—Continued

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Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Lower Concord River Basin												
Lower Concord Main Stem												
3031000-01S	5.12	7.80	7.07	5.94	4.73	4.31	3.82	3.80	4.85	6.13	3.87	1.58
3067000-02G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Subbasin total	5.12	7.80	7.07	5.94	4.73	4.31	3.82	3.80	4.85	6.13	3.87	1.58
River Meadow Brook												
3056000-02G	0.406	0.417	0.374	0.358	0.000	0.000	0.000	0.000	0.15	0.31	0.06	5.16
3056000-05G, -15G, -16G	0.890	1.00	1.06	1.15	0.683	0.739	0.577	0.561	0.93	0.96	0.91	1.05
3056000-09G, 11G	0.781	0.650	0.555	0.755	0.730	0.719	0.567	0.571	0.61	0.26	0.51	0.51
3056001-01G	0.174	0.297	0.337	0.253	0.296	0.261	0.197	0.190	0.22	0.27	0.17	1.60
Subbasin total	2.25	2.37	2.32	2.52	1.71	1.72	1.34	1.32	1.91	1.80	1.66	1.09
Total Concord River Basin												
Basin total	30.2	38.4	38.7	33.9	28.7	24.9	19.7	20.1	0.30	0.35	0.24	1.45
1998												
Assabet River Basin												
Assabet Headwaters												
2170000-01S	3.34	2.36	1.90	1.20	0.992	0.979	0.763	0.990	1.77	1.96	1.45	1.35
2215000-01G	0.301	0.366	0.344	0.326	0.329	0.344	0.365	0.336	0.32	0.33	0.35	0.95
2215000-02G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2328000-03G	0.399	0.356	0.365	0.321	0.306	0.336	0.310	0.310	0.36	0.35	0.35	0.99
2328000-04G	0.355	0.330	0.286	0.285	0.292	0.326	0.347	0.311	0.31	0.31	0.31	1.00
2328000-05G	0.348	0.100	0.308	0.405	0.570	0.491	0.492	0.440	0.37	0.35	0.38	0.90
2328000-06G	0.092	0.121	0.138	0.131	0.140	0.158	0.167	0.159	0.14	0.12	0.15	0.83
2328000-07G	0.096	0.019	0.004	0.061	0.079	0.053	0.250	0.157	0.07	0.05	0.09	0.57
2328000-08G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Subbasin total	4.93	3.65	3.35	2.73	2.71	2.69	2.69	2.70	3.33	3.47	3.09	1.12
Assabet Main Stem												
2002000-05G	0.291	0.291	0.295	0.377	0.358	0.372	0.240	0.374	0.28	0.32	0.27	1.18
2002000-06G	0.291	0.291	0.295	0.377	0.358	0.372	0.240	0.374	0.28	0.32	0.27	1.18
2141000-01G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2141000-01S	0.166	0.118	0.357	0.214	0.123	0.125	0.156	0.123	0.14	0.20	0.10	1.92
2174000-01G, -02G	0.323	0.413	0.061	0.448	0.425	0.409	0.362	0.262	0.26	0.33	0.19	1.74
2174000-01S	0.451	0.234	0.791	0.318	0.399	0.402	0.446	0.351	0.45	0.44	0.48	0.91
2174000-03G	0.319	0.225	0.035	0.109	0.020	0.023	0.158	0.144	0.17	0.14	0.19	0.74
2174000-04G	0.169	0.152	0.204	0.477	0.206	0.000	0.000	0.000	0.10	0.24	0.00	--
2271000-01G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2286000-01G, -02G, -03G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
3067000-05G	0.739	0.363	0.697	0.513	0.653	0.687	0.260	0.687	0.60	0.59	0.56	1.07
Subbasin total	2.75	2.09	2.73	2.83	2.54	2.39	1.86	2.32	2.28	2.59	2.07	1.25

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise]

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Assabet River Basin									
Elizabeth Brook									
2037001-01G	Boxborough	NMC	Codman Hill Condo.	GW	Well #1	0.011	0.012	0.013	0.012
2037002-01G	Boxborough	NMC	Harvard Ridge Condo.	GW	Dunster House Well	0.012	0.014	0.012	0.013
2037002-02G	Boxborough	NMC	Harvard Ridge Condo.	GW	Eliot House Well	0.012	0.014	0.012	0.013
2037002-03G	Boxborough	NMC	Harvard Ridge Condo.	GW	Leverett House Well	0.005	0.005	0.005	0.005
2286017-01G	Stow	NMC	Plantation Apt.	GW	Well #1	0.003	0.003	0.005	0.002
2286018-01G	Stow	NMC	Pilot Grove Apt.	GW	Well #1	0.003	0.004	0.004	0.004
2286018-02G	Stow	NMC	Pilot Grove Apt.	GW	Well #2	0.004	0.004	0.004	0.005
Subbasin total	--	--	--	--	--	0.050	0.056	0.056	0.053
Fort Meadow Brook									
2141000-03G	Hudson	MC	Hudson WD	GW	Kane Well	0.000	0.000	0.004	0.008
2141000-04G	Hudson	MC	Hudson WD	GW	Chestnut Street Well #1	0.728	0.750	0.745	0.736
2141000-05G	Hudson	MC	Hudson WD	GW	Chestnut Street Well #2	0.681	0.657	0.653	0.661
2141000-06G	Hudson	MC	Hudson WD	GW	Chestnut Street Well #3	0.674	0.675	0.671	0.663
Subbasin total	--	--	--	--	--	2.08	2.08	2.07	2.07
Fort Pond Brook									
2002000-01G	Acton	MC	Acton WD	GW	Whitcomb Well	0.200	0.155	0.150	0.131
2002000-03G	Acton	MC	Acton WD	GW	Lawsbrook	0.098	0.102	0.124	0.214
2002000-04G	Acton	MC	Acton WD	GW	Christofferson Well	0.098	0.102	0.124	0.214
2002000-07G	Acton	MC	Acton WD	GW	Clapp Well	0.048	0.093	0.059	0.139
2002000-08G	Acton	MC	Acton WD	GW	Scribner Well	0.098	0.102	0.124	0.214
2037006-01G	Boxborough	NMC	Centre Village Apt.	GW	Rock Well	0.002	0.002	0.001	0.002
2037009-01G	Boxborough	NMC	Carriage House Condo.	GW	Well #1	0.006	0.007	0.006	0.006
2037013-02G	Boxborough	NMC	Applewood Condo.	GW	Well #2	0.018	0.013	0.014	0.024
2037014-02G	Boxborough	NMC	Liberty House Condo.	GW	Well #2	NAV	NAV	NAV	NAV
2174000-05G	Maynard	MC	Maynard DPW, WD	GW	Rock Well #2	0.000	0.000	0.000	0.000
2174000-07G	Maynard	MC	Maynard DPW, WD	GW	Rock Well #5	0.000	0.000	0.000	0.000
2286001-01G, -02G	Stow	NMC	Assabet Water Co./ Harvard Acres	GW	Wells #1-2	0.079	0.081	0.072	0.090
Subbasin total	--	--	--	--	--	0.646	0.657	0.673	1.03
Howard and Cold Harbor Brooks									
2215000-03G	Northborough	MC	Northborough WD	GW	Crawford Street Well	0.338	0.354	0.366	0.254
2215000-04G, -05G, -06G	Northborough	MC	Northborough WD	GW	Howard Street Wells #1-3	0.115	0.113	0.112	0.096
Subbasin total	--	--	--	--	--	0.453	0.467	0.479	0.350

Massachusetts, 1996–2000.—Continued

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Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Assabet River Basin												
Elizabeth Brook												
2037001-01G	0.011	0.012	0.011	0.011	0.011	0.013	0.013	0.012	0.01	0.01	0.01	0.92
2037002-01G	0.012	0.013	0.012	0.012	0.013	0.012	0.013	0.012	0.01	0.01	0.01	0.99
2037002-02G	0.012	0.013	0.012	0.012	0.013	0.012	0.013	0.012	0.01	0.01	0.01	0.99
2037002-03G	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.01	0.01	0.01	0.99
2286017-01G	0.004	0.004	0.012	0.005	0.004	0.004	0.004	0.003	0.00	0.01	0.00	1.49
2286018-01G	0.004	0.004	0.004	0.004	0.004	0.003	0.004	0.004	0.00	0.00	0.00	1.04
2286018-02G	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.00	0.00	0.00	1.03
Subbasin total	0.053	0.054	0.061	0.053	0.053	0.053	0.056	0.053	0.05	0.05	0.05	1.01
Fort Meadow Brook												
2141000-03G	0.047	0.007	0.000	0.055	0.128	0.086	0.028	0.000	0.03	0.05	0.01	7.47
2141000-04G	0.769	0.721	0.685	0.636	0.631	0.607	0.617	0.600	0.69	0.69	0.69	1.00
2141000-05G	0.678	0.622	0.633	0.576	0.585	0.605	0.617	0.604	0.63	0.62	0.64	0.96
2141000-06G	0.680	0.634	0.582	0.573	0.573	0.559	0.582	0.552	0.62	0.61	0.63	0.96
Subbasin total	2.17	1.98	1.90	1.84	1.92	1.86	1.84	1.76	1.96	1.96	1.97	1.00
Fort Pond Brook												
2002000-01G	0.243	0.221	0.197	0.046	0.171	0.000	0.000	0.000	0.13	0.18	0.10	1.74
2002000-03G	0.213	0.172	0.221	0.224	0.212	0.196	0.209	0.142	0.18	0.21	0.13	1.54
2002000-04G	0.213	0.172	0.221	0.224	0.212	0.196	0.209	0.142	0.18	0.21	0.13	1.54
2002000-07G	0.043	0.000	0.100	0.015	0.000	0.000	0.000	0.000	0.04	0.03	0.04	0.79
2002000-08G	0.213	0.172	0.221	0.224	0.212	0.196	0.209	0.142	0.18	0.21	0.13	1.54
2037006-01G	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.00	0.00	0.00	0.81
2037009-01G	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.01	0.01	0.01	0.99
2037013-02G	0.024	0.012	0.014	0.018	0.033	0.017	0.017	0.015	0.02	0.02	0.02	1.34
2037014-02G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2174000-05G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2174000-07G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2286001-01G, -02G	0.083	0.064	0.092	0.073	0.092	0.065	0.063	0.087	0.08	0.08	0.08	1.06
Subbasin total	1.67	1.94	2.30	1.95	2.03	1.74	1.45	0.536	0.80	0.94	0.65	1.46
Howard and Cold Harbor Brooks												
2215000-03G	0.050	0.357	0.326	0.259	0.309	0.388	0.316	0.373	0.31	0.26	0.35	0.74
2215000-04G, -05G, -06G	0.093	0.100	0.106	0.104	0.125	0.199	0.193	0.198	0.13	0.11	0.15	0.72
Subbasin total	0.144	0.457	0.433	0.364	0.434	0.588	0.510	0.571	0.44	0.37	0.50	0.74

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise]

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Assabet River Basin									
Nashoba Brook									
2002000-02G	Acton	MC	Acton WD	GW	Conant Well	0.045	0.039	0.000	0.196
2002000-09G	Acton	MC	Acton WD	GW	Marshall Well	0.131	0.126	0.125	0.085
2002000-10G, -11G, 12G, 13G	Acton	MC	Acton WD	GW	Kennedy Wells #1-4	0.451	0.410	0.470	0.441
2002000-14G, -15G, -16G, -17G, -18G	Acton	MC	Acton WD	GW	Conant II Wells #1-5	0.000	0.000	0.000	0.000
3067000-01S	Acton	MC	Concord WD	SW	Nagog Pond	0.000	0.000	0.000	0.000
2002003-01G	Acton	NMC	Meadowbrook Condo.	GW	Well #1	NAV	NAV	NAV	NAV
2002005-01G	Acton	NMC	Wampus Apt.	GW	Well #1	NAV	NAV	NAV	NAV
2002006-02G	Acton	NMC	Great Road Condo.	GW	Wells #1-2	NAV	NAV	NAV	NAV
2002007-02G	Acton	NMC	Woodvale Condo.	GW	Well #1	NAV	NAV	NAV	NAV
2002009-01G	Acton	NMC	Richmond House Condo.	GW	Well #1	0.003	0.003	0.003	0.003
2002010-01G	Acton	NMC	Pine Hill Condo.	GW	Well #1	0.005	0.006	0.006	0.006
2002014-01G	Acton	NMC	Strawberry Hill Apt.	GW	Wells #1-2	NAV	NAV	NAV	NAV
2330014-01G	Westford	NMC	Vinebrook Estates	GW	Well #1	NAV	NAV	NAV	NAV
Subbasin total	--	--	--	--	--	0.636	0.584	0.604	0.730
North Brook									
2028007-01G, -02G, -03G, -04G	Berlin	NMC	Berlin Retirement Homes/ Northbrook Village	GW	Rock Wells #1-4	NAV	NAV	NAV	NAV
Subbasin total	--	--	--	--	--	NAV	NAV	NAV	NAV
Sudbury River Basin									
Cedar Swamp									
2328000-01G	Westborough	MC	Westborough WD	GW	Hopkinton Road Well	0.434	0.299	0.098	0.150
2328000-01S	Westborough	MC	Westborough WD	SW	Sandra Pond	0.145	0.308	0.932	0.868
2328000-02G	Westborough	MC	Westborough WD	GW	Morse Street Well	0.249	0.253	0.257	0.261
Subbasin total	--	--	--	--	--	0.828	0.859	1.29	1.28
Hop Brook									
2141000-02G	Hudson	MC	Hudson WD	GW	Cranberry Bog Well	0.012	0.043	0.080	0.134
3288000-03G	Sudbury	MC	Sudbury WD	GW	GP Well #3	0.106	0.063	0.131	0.122
3288000-08G, -10G	Sudbury	MC	Sudbury WD	GW	GP Wells #8 and 10	0.166	0.174	0.158	0.000
Subbasin total	--	--	--	--	--	0.284	0.280	0.369	0.256
Indian Brook									
3014000-04G	Ashland	MC	Ashland WSD	GW	Howe Street GP Well #4	0.767	0.716	0.004	0.657
3014000-05G	Ashland	MC	Ashland WSD	GW	Howe Street GP Well #5	0.000	0.173	1.182	0.227
3014000-06G	Ashland	MC	Ashland WSD	GW	Howe Street GP Well #6	0.449	0.382	0.187	0.386
Subbasin total	--	--	--	--	--	1.22	1.27	1.37	1.27

Massachusetts, 1996–2000.—Continued

Apartments; Co., Company; Condo., Condominiums; DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District; WSD, unavailable; --, not applicable]

Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Assabet River Basin												
Nashoba Brook												
2002000-02G	0.253	0.238	0.266	0.248	0.312	0.251	0.254	0.254	0.20	0.26	0.12	2.23
2002000-09G	0.179	0.040	0.140	0.088	0.000	0.000	0.000	0.000	0.08	0.09	0.08	1.17
2002000-10G, -11G, 12G, 13G	0.189	0.310	0.279	0.254	0.320	0.335	0.380	0.348	0.35	0.27	0.41	0.66
2002000-14G, -15G, -16G, -17G, -18G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
3067000-01S	0.635	1.117	1.223	1.116	1.093	1.061	0.740	0.000	0.58	1.04	0.15	7.01
2002003-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002005-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002006-02G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002007-02G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002009-01G	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.00	0.00	0.00	0.99
2002010-01G	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.006	0.01	0.01	0.01	0.98
2002014-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2330014-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Subbasin total	1.26	1.71	1.92	1.72	1.73	1.66	1.38	0.610	1.21	1.67	0.76	2.19
North Brook												
2028007-01G, -02G, -03G, -04G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Subbasin total	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Sudbury River Basin												
Cedar Swamp												
2328000-01G	0.054	0.427	0.423	0.443	0.425	0.447	0.463	0.447	0.34	0.35	0.35	1.02
2328000-01S	1.17	1.16	1.39	1.36	0.903	0.508	0.138	0.211	0.76	1.20	0.35	3.45
2328000-02G	0.264	0.223	0.221	0.223	0.215	0.202	0.196	0.200	0.23	0.23	0.23	0.99
Subbasin total	1.48	1.81	2.04	2.03	1.54	1.16	0.796	0.858	1.33	1.78	0.93	1.92
Hop Brook												
2141000-02G	0.480	0.326	0.695	0.619	0.581	0.387	0.320	0.340	0.33	0.54	0.16	3.40
3288000-03G	0.226	0.166	0.174	0.187	0.346	0.270	0.000	0.000	0.15	0.22	0.06	3.67
3288000-08G, -10G	0.160	0.503	0.544	0.083	0.175	0.141	0.000	0.000	0.18	0.29	0.10	2.94
Subbasin total	0.867	0.996	1.41	0.889	1.10	0.799	0.320	0.340	0.66	1.05	0.32	3.31
Indian Brook												
3014000-04G	0.373	0.818	0.017	1.42	1.05	0.756	1.094	0.327	0.67	0.73	0.58	1.26
3014000-05G	0.874	0.144	1.506	0.104	0.691	1.29	0.174	0.890	0.60	0.66	0.48	1.37
3014000-06G	0.200	0.486	0.224	0.177	0.008	0.000	0.000	0.003	0.21	0.22	0.20	1.07
Subbasin total	1.45	1.45	1.75	1.70	1.75	2.05	1.27	1.22	1.48	1.62	1.27	1.27

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Sudbury River Basin									
Lake Cochituate									
3198000-01G	Natick	MC	Natick WD	GW	Springvale Well #1	0.000	0.052	0.037	0.002
3198000-02G	Natick	MC	Natick WD	GW	Springvale Well #3	0.000	0.121	0.444	0.479
3198000-07G	Natick	MC	Natick WD	GW	Springvale Well #4	0.850	0.856	0.693	0.816
3198000-09G	Natick	MC	Natick WD	GW	Evergreen Well #1	0.000	0.137	0.124	0.236
3198000-10G	Natick	MC	Natick WD	GW	Evergreen Well #2	0.000	0.097	0.172	0.313
Subbasin total	--	--	--	--	--	0.850	1.26	1.47	1.84
Lower Sudbury River									
3067000-01G	Concord	MC	Concord WD	GW	Jennie Dugan Well	0.406	0.164	0.345	0.267
3067000-03G	Concord	MC	Concord WD	GW	Deaconess Well	0.968	1.03	0.935	1.010
3067000-04G	Concord	MC	Concord WD	GW	White Pond Well	0.000	0.000	0.000	0.000
3067000-06G	Concord	MC	Concord WD	GW	Robinson Well	0.000	0.000	0.000	0.000
3157000-02G	Lincoln	MC	Lincoln WD	GW	Farrar Pond Well	0.000	0.000	0.000	0.000
3288000-02G, -09G	Sudbury	MC	Sudbury WD	GW	GP Wells #2 and 9	0.000	0.000	0.000	0.000
3288000-04G	Sudbury	MC	Sudbury WD	GW	GP Well #4	0.000	0.049	0.276	0.230
3288000-05G	Sudbury	MC	Sudbury WD	GW	GP Well #5	0.000	0.000	0.000	0.000
3288000-06G	Sudbury	MC	Sudbury WD	GW	GP Well #6	0.521	0.436	0.394	0.554
3288000-07G	Sudbury	MC	Sudbury WD	GW	GP Well #7	0.332	0.505	0.110	0.316
3315000-01G	Wayland	MC	Wayland WD	GW	Baldwin Pond Well #1	0.422	0.300	0.481	0.336
3315000-02G	Wayland	MC	Wayland WD	GW	Campbell Road Well #1	0.194	0.001	0.049	0.667
3315000-03G	Wayland	MC	Wayland WD	GW	Happy Hollow Well #1	0.413	0.294	0.000	0.023
3315000-04G	Wayland	MC	Wayland WD	GW	Happy Hollow Well #2	0.176	0.063	0.000	0.010
3315000-05G	Wayland	MC	Wayland WD	GW	Meadowview Well #1	0.131	0.265	0.475	0.453
3315000-06G	Wayland	MC	Wayland WD	GW	Baldwin Pond Well #3	0.000	0.005	0.000	0.000
3315000-07G	Wayland	MC	Wayland WD	GW	Baldwin Pond Well #2	0.151	0.555	0.538	0.080
3315000-08G	Wayland	MC	Wayland WD	GW	Chamberlain Well #1	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	3.71	3.67	3.60	3.95
Upper Sudbury River									
2139007-01G, -02G	Hopkinton	NMC	Village at Highland Park	GW	Wells #1 and 2	0.004	0.003	0.000	0.000
2139007-03G	Hopkinton	NMC	Village at Highland Park	GW	Well #3	0.000	0.000	0.003	0.003
2139008-02G	Hopkinton	NMC	The Preserve at Hopkinton Condo.	GW	Well #2	0.005	0.005	0.004	0.005
Subbasin total	--	--	--	--	--	0.008	0.008	0.008	0.008
Whitehall Brook									
2139000-01G	Hopkinton	MC	Hopkinton WD	GW	Well #1	0.244	0.255	0.246	0.255
2139000-02G	Hopkinton	MC	Hopkinton WD	GW	Well #2	0.158	0.151	0.151	0.157
2139000-03G	Hopkinton	MC	Hopkinton WD	GW	Well #3	0.037	0.035	0.041	0.045
2139000-04G	Hopkinton	MC	Hopkinton WD	GW	Well #4	0.082	0.081	0.076	0.092
2139000-05G	Hopkinton	MC	Hopkinton WD	GW	Well #5	0.121	0.103	0.119	0.133
Subbasin total	--	--	--	--	--	0.643	0.624	0.633	0.681

Massachusetts, 1996–2000.—Continued

Apartments; Co., Company; Condo., Condominiums; DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District; WSD, unavailable; --, not applicable]

Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Sudbury River Basin												
Lake Cochituate												
3198000-01G	0.233	0.482	0.595	0.104	0.021	0.018	0.054	0.000	0.13	0.29	0.03	10.02
3198000-02G	0.445	0.711	1.146	0.969	0.772	0.920	0.871	0.798	0.64	0.81	0.45	1.81
3198000-07G	0.734	0.390	0.508	0.252	0.850	0.983	0.850	0.558	0.69	0.55	0.76	0.72
3198000-09G	0.021	0.223	0.018	0.032	0.005	0.002	0.000	0.000	0.07	0.06	0.05	1.15
3198000-10G	0.608	1.229	0.778	1.41	1.10	0.806	1.47	0.349	0.70	1.03	0.42	2.45
Subbasin total	2.04	3.04	3.04	2.77	2.75	2.73	3.25	1.70	2.23	2.73	1.71	1.60
Lower Sudbury River												
3067000-01G	0.374	0.347	0.332	0.197	0.250	0.155	0.253	0.216	0.28	0.30	0.28	1.08
3067000-03G	0.842	0.223	0.306	0.161	0.410	0.081	0.050	1.048	0.59	0.39	0.81	0.48
3067000-04G	0.052	0.393	0.477	0.623	0.220	0.000	0.000	0.000	0.15	0.35	0.00	--
3067000-06G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
3157000-02G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
3288000-02G, -09G	0.215	0.241	0.507	1.36	0.636	1.320	0.000	0.000	0.36	0.19	0.00	--
3288000-04G	0.264	0.158	0.210	0.074	0.073	0.159	0.296	0.287	0.17	0.16	0.18	0.86
3288000-05G	0.200	0.237	0.255	0.270	0.177	0.090	0.057	0.000	0.11	0.23	0.01	20.00
3288000-06G	0.580	0.394	0.476	0.258	0.054	0.224	0.556	0.575	0.42	0.35	0.50	0.71
3288000-07G	0.447	0.415	0.533	0.255	0.341	0.146	0.639	0.609	0.39	0.40	0.44	0.91
3315000-01G	0.415	0.400	0.470	0.145	0.054	0.116	0.151	0.089	0.28	0.30	0.29	1.03
3315000-02G	0.296	0.515	0.548	0.205	0.453	0.053	0.002	0.002	0.25	0.40	0.05	8.15
3315000-03G	0.270	0.555	0.657	0.613	0.288	0.091	0.185	0.412	0.32	0.48	0.26	1.83
3315000-04G	0.059	0.232	0.373	0.580	0.716	0.728	0.622	0.256	0.32	0.39	0.22	1.76
3315000-05G	0.200	0.248	0.376	0.016	0.063	0.206	0.083	0.024	0.21	0.18	0.20	0.92
3315000-06G	0.000	0.000	0.000	0.000	0.217	0.472	0.431	0.489	0.13	0.04	0.18	0.24
3315000-07G	0.467	0.111	0.356	0.247	0.242	0.066	0.052	0.135	0.25	0.28	0.29	0.99
3315000-08G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Subbasin total	4.68	4.47	5.88	5.00	4.20	3.91	3.38	4.14	4.22	4.45	3.70	1.20
Upper Sudbury River												
2139007-01G, -02G	0.000	0.011	0.000	0.006	0.000	0.003	0.003	0.000	0.00	0.00	0.00	1.77
2139007-03G	0.005	0.000	0.010	0.000	0.007	0.000	0.000	0.003	0.00	0.00	0.00	3.31
2139008-02G	0.007	0.008	0.011	0.011	0.010	0.006	0.004	0.005	0.01	0.01	0.01	2.02
Subbasin total	0.011	0.019	0.021	0.017	0.016	0.010	0.007	0.009	0.01	0.02	0.01	2.17
Whitehall Brook												
2139000-01G	0.331	0.341	0.392	0.370	0.324	0.266	0.263	0.278	0.30	0.35	0.26	1.37
2139000-02G	0.205	0.204	0.249	0.216	0.173	0.169	0.136	0.135	0.18	0.21	0.15	1.43
2139000-03G	0.060	0.056	0.067	0.060	0.061	0.050	0.012	0.034	0.05	0.06	0.03	1.91
2139000-04G	0.119	0.142	0.187	0.197	0.213	0.145	0.129	0.121	0.13	0.17	0.10	1.76
2139000-05G	0.199	0.149	0.224	0.181	0.176	0.112	0.102	0.093	0.14	0.19	0.11	1.73
Subbasin total	0.916	0.892	1.12	1.02	0.947	0.742	0.642	0.661	0.79	0.98	0.64	1.53

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise]

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Lower Concord River Basin									
Lower Concord Main Stem									
3031000-01S	Billerica	MC	Billerica WW	SW	Concord River	3.44	3.48	3.56	3.90
3067000-02G	Concord	MC	Concord WD	GW	Hugh Cargill Well	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	3.44	3.48	3.56	3.90
River Meadow Brook									
3056000-02G	Chelmsford	MC	Chelmsford WD	GW	Turnpike Road GP Well #1	0.000	0.000	0.000	0.000
3056000-05G, -15G, -16G	Chelmsford	MC	Chelmsford WD	GW	Mill Road GP Wells #1-3	0.598	0.568	0.711	0.724
3056000-09G, 11G	Chelmsford	MC	Chelmsford WD	GW	Riverneck Road GP Wells #1-2	0.609	0.590	0.454	0.545
3056001-01G	Chelmsford	MC	East Chelmsford WD	GW	Canal Street GP Well #1	0.221	0.221	0.174	0.177
Subbasin total	--	--	--	--	--	1.43	1.38	1.34	1.45
Total Concord River Basin									
Basin total	--	--	--	--	--	25.8	24.8	25.8	25.0
1999									
Assabet River Basin									
Assabet Headwaters									
2170000-01S	Marlborough	MC	Marlborough DPW, WD	SW	Millham Reservoir	0.997	1.630	3.13	3.01
2215000-01G	Northborough	MC	Northborough WD	GW	Brigham Street Well	0.321	0.365	0.383	0.357
2215000-02G	Northborough	MC	Northborough WD	GW	Lyman Street Well	0.000	0.000	0.000	0.000
2328000-03G	Westborough	MC	Westborough WD	GW	Andrews I Well	0.200	0.289	0.145	0.039
2328000-04G	Westborough	MC	Westborough WD	GW	Andrews II Well	0.155	0.282	0.158	0.030
2328000-05G	Westborough	MC	Westborough WD	GW	Otis Street Well	0.295	0.233	0.150	0.205
2328000-06G	Westborough	MC	Westborough WD	GW	Wilkinson Well	0.087	0.118	0.002	0.000
2328000-07G	Westborough	MC	Westborough WD	GW	Chauncy Lake Well #1	0.000	0.000	0.000	0.000
2328000-08G	Westborough	MC	Westborough WD	GW	Chauncy Lake Well #2	0.498	0.262	0.000	0.000
Subbasin total	--	--	--	--	--	2.55	3.18	3.97	3.65
Assabet Main Stem									
2002000-05G	Acton	MC	Acton WD	GW	Assabet Well #1	0.389	0.380	0.365	0.362
2002000-06G	Acton	MC	Acton WD	GW	Assabet Well #2	0.457	0.437	0.392	0.398
2141000-01G	Hudson	MC	Hudson WD	GW	Rimkus Well	0.000	0.000	0.000	0.000
2141000-01S	Berlin	MC	Hudson WD	SW	Gates Pond Reservoir	0.115	0.086	0.122	0.115
2174000-01G, -02G	Maynard	MC	Maynard DPW, WD	GW	Old Marlboro Road Wells #1 and 2	0.398	0.477	0.444	0.251
2174000-01S	Maynard	MC	Maynard DPW, WD	SW	White Pond	0.178	0.173	0.310	0.486
2174000-03G	Maynard	MC	Maynard DPW, WD	GW	Old Marlboro Road Well #3	0.177	0.201	0.191	0.119
2174000-04G	Maynard	MC	Maynard DPW, WD	GW	Great Road Well #4	0.000	0.000	0.000	0.000
2271000-01G	Shrewsbury	MC	Shrewsbury WD	GW	South Street Well	0.000	0.000	0.000	0.000
2286000-01G, -02G, -03G	Stow	NMC	Juniper Hill Water Co.	GW	Wells #1-3	NAV	NAV	NAV	NAV
3067000-05G	Concord	MC	Concord WD	GW	Second Division Well	0.752	0.686	0.684	0.703
Subbasin total	--	--	--	--	--	2.47	2.44	2.51	2.43

Massachusetts, 1996–2000.—Continued

Apartments; Co., Company; Condo., Condominiums; DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District; WSD, unavailable; --, not applicable]

Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Lower Concord River Basin												
Lower Concord Main Stem												
3031000-01S	5.08	4.89	6.31	5.55	5.31	4.48	3.73	3.47	4.43	5.43	3.54	1.53
3067000-02G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Subbasin total	5.08	4.89	6.31	5.55	5.31	4.48	3.73	3.47	4.43	5.43	3.54	1.53
River Meadow Brook												
3056000-02G	0.245	0.441	0.390	0.407	0.249	0.171	0.217	0.000	0.18	0.35	0.04	7.97
3056000-05G, -15G, -16G	0.741	0.926	1.10	1.03	0.916	0.844	0.765	0.761	0.81	0.94	0.68	1.39
3056000-09G, 11G	0.546	0.359	0.423	0.641	0.586	0.244	0.309	0.213	0.46	0.51	0.43	1.18
3056001-01G	0.060	0.142	0.153	0.179	0.189	0.169	0.185	0.198	0.17	0.14	0.20	0.72
Subbasin total	1.59	1.87	2.07	2.26	1.94	1.43	1.48	1.17	1.62	1.94	1.36	1.43
Total Concord River Basin												
Basin total	30.2	34.2	31.4	33.1	28.0	25.7	22.6	23.2	0.28	0.33	0.23	1.39
1999												
Assabet River Basin												
Assabet Headwaters												
2170000-01S	1.25	1.07	0.519	0.441	0.441	0.777	1.08	0.914	1.27	0.74	1.55	0.48
2215000-01G	0.345	0.373	0.372	0.331	0.332	0.375	0.374	0.370	0.36	0.35	0.36	0.97
2215000-02G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2328000-03G	0.283	0.334	0.347	0.337	0.307	0.269	0.252	0.218	0.25	0.32	0.22	1.46
2328000-04G	0.268	0.146	0.335	0.367	0.347	0.345	0.372	0.329	0.26	0.29	0.26	1.13
2328000-05G	0.443	0.512	0.329	0.434	0.286	0.244	0.109	0.255	0.29	0.40	0.21	1.93
2328000-06G	0.165	0.005	0.116	0.129	0.190	0.261	0.238	0.252	0.13	0.12	0.14	0.87
2328000-07G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2328000-08G	0.475	0.786	0.779	0.700	0.731	0.748	0.764	0.760	0.54	0.69	0.46	1.52
Subbasin total	3.22	3.23	2.80	2.74	2.63	3.02	3.19	3.10	3.11	2.92	3.20	0.91
Assabet Main Stem												
2002000-05G	0.371	0.364	0.343	0.330	0.334	0.356	0.346	0.340	0.36	0.35	0.36	0.96
2002000-06G	0.414	0.376	0.359	0.332	0.318	0.329	0.300	0.267	0.37	0.36	0.37	0.97
2141000-01G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2141000-01S	0.126	0.503	0.321	0.252	0.202	0.033	0.014	0.122	0.17	0.28	0.09	3.06
2174000-01G, -02G	0.193	0.384	0.174	0.353	0.276	0.270	0.415	0.256	0.32	0.28	0.40	0.69
2174000-01S	0.690	1.033	0.601	0.288	0.301	0.092	0.000	0.000	0.35	0.58	0.13	4.41
2174000-03G	0.110	0.230	0.053	0.069	0.049	0.119	0.155	0.122	0.13	0.10	0.17	0.60
2174000-04G	0.000	0.042	0.108	0.396	0.277	0.317	0.494	0.392	0.17	0.16	0.18	0.93
2271000-01G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2286000-01G, -02G, -03G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
3067000-05G	0.542	0.693	0.484	0.545	0.577	0.606	0.540	0.681	0.62	0.57	0.67	0.85
Subbasin total	2.45	3.62	2.44	2.57	2.33	2.12	2.26	2.18	2.49	2.68	2.37	1.13

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise]

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Assabet River Basin									
Elizabeth Brook									
2037001-01G	Boxborough	NMC	Codman Hill Condo.	GW	Well #1	0.011	0.013	0.013	0.013
2037002-01G	Boxborough	NMC	Harvard Ridge Condo.	GW	Dunster House Well	0.012	0.014	0.012	0.013
2037002-02G	Boxborough	NMC	Harvard Ridge Condo.	GW	Eliot House Well	0.012	0.014	0.012	0.013
2037002-03G	Boxborough	NMC	Harvard Ridge Condo.	GW	Leverett House Well	0.005	0.005	0.005	0.005
2286017-01G	Stow	NMC	Plantation Apt.	GW	Well #1	0.003	0.002	0.005	0.004
2286018-01G	Stow	NMC	Pilot Grove Apt.	GW	Well #1	0.003	0.004	0.003	0.005
2286018-02G	Stow	NMC	Pilot Grove Apt.	GW	Well #2	0.003	0.004	0.003	0.005
Subbasin total	--	--	--	--	--	0.050	0.056	0.054	0.058
Fort Meadow Brook									
2141000-03G	Hudson	MC	Hudson WD	GW	Kane Well	0.000	0.000	0.000	0.000
2141000-04G	Hudson	MC	Hudson WD	GW	Chestnut Street Well #1	0.477	0.519	0.541	0.574
2141000-05G	Hudson	MC	Hudson WD	GW	Chestnut Street Well #2	0.655	0.567	0.582	0.626
2141000-06G	Hudson	MC	Hudson WD	GW	Chestnut Street Well #3	0.520	0.393	0.395	0.422
Subbasin total	--	--	--	--	--	1.65	1.48	1.52	1.62
Fort Pond Brook									
2002000-01G	Acton	MC	Acton WD	GW	Whitcomb Well	0.000	0.000	0.000	0.000
2002000-03G	Acton	MC	Acton WD	GW	Lawsbrook	0.158	0.136	0.136	0.202
2002000-04G	Acton	MC	Acton WD	GW	Christofferson Well	0.158	0.127	0.129	0.172
2002000-07G	Acton	MC	Acton WD	GW	Clapp Well	0.000	0.000	0.000	0.000
2002000-08G	Acton	MC	Acton WD	GW	Scribner Well	0.072	0.088	0.090	0.122
2037006-01G	Boxborough	NMC	Centre Village Apt.	GW	Rock Well	0.002	0.001	0.001	0.002
2037009-01G	Boxborough	NMC	Carriage House Condo.	GW	Well #1	0.006	0.007	0.006	0.006
2037013-02G	Boxborough	NMC	Applewood Condo.	GW	Well #2	0.011	0.011	0.010	0.012
2037014-02G	Boxborough	NMC	Liberty House Condo.	GW	Well #2	NAV	NAV	NAV	NAV
2174000-05G	Maynard	MC	Maynard DPW, WD	GW	Rock Well #2	0.000	0.000	0.000	0.000
2174000-07G	Maynard	MC	Maynard DPW, WD	GW	Rock Well #5	0.000	0.000	0.000	0.000
2286001-01G, -02G	Stow	NMC	Assabet Water Co./ Harvard Acres	GW	Wells #1-2	0.035	0.069	0.071	0.069
Subbasin total	--	--	--	--	--	0.443	0.439	0.443	0.585
Howard and Cold Harbor Brooks									
2215000-03G	Northborough	MC	Northborough WD	GW	Crawford Street Well	0.333	0.375	0.395	0.323
2215000-04G, -05G, -06G	Northborough	MC	Northborough WD	GW	Howard Street Wells #1-3	0.166	0.109	0.109	0.101
Subbasin total	--	--	--	--	--	0.499	0.484	0.503	0.424

Massachusetts, 1996–2000.—Continued

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Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Assabet River Basin												
Elizabeth Brook												
2037001-01G	0.013	0.015	0.013	0.015	0.016	0.015	0.017	0.015	0.01	0.01	0.01	1.03
2037002-01G	0.012	0.013	0.012	0.012	0.013	0.012	0.013	0.012	0.01	0.01	0.01	0.99
2037002-02G	0.012	0.013	0.012	0.012	0.013	0.012	0.013	0.012	0.01	0.01	0.01	0.99
2037002-03G	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.01	0.01	0.01	0.99
2286017-01G	0.003	0.007	0.007	0.008	0.008	0.004	0.003	0.002	0.01	0.01	0.00	2.29
2286018-01G	0.004	0.004	0.006	0.005	0.005	0.004	0.007	0.003	0.01	0.01	0.00	1.23
2286018-02G	0.005	0.005	0.006	0.006	0.005	0.004	0.007	0.003	0.01	0.01	0.00	1.23
Subbasin total	0.054	0.062	0.061	0.063	0.065	0.057	0.065	0.052	0.06	0.06	0.06	1.10
Fort Meadow Brook												
2141000-03G	0.254	0.381	0.267	0.212	0.206	0.172	0.162	0.029	0.14	0.26	0.04	6.90
2141000-04G	0.693	0.745	0.694	0.660	0.553	0.504	0.509	0.477	0.58	0.67	0.50	1.33
2141000-05G	0.742	0.768	0.736	0.711	0.726	0.734	0.782	0.821	0.70	0.74	0.68	1.08
2141000-06G	0.490	0.510	0.487	0.500	0.527	0.535	0.519	0.486	0.48	0.50	0.46	1.09
Subbasin total	2.18	2.40	2.18	2.08	2.01	1.95	1.97	1.81	1.91	2.17	1.69	1.29
Fort Pond Brook												
2002000-01G	0.056	0.273	0.251	0.272	0.243	0.174	0.278	0.278	0.15	0.22	0.11	1.97
2002000-03G	0.234	0.198	0.158	0.143	0.142	0.183	0.132	0.139	0.16	0.17	0.14	1.25
2002000-04G	0.197	0.215	0.135	0.132	0.126	0.072	0.126	0.126	0.14	0.16	0.13	1.21
2002000-07G	0.043	0.315	0.028	0.000	0.000	0.000	0.000	0.000	0.03	0.08	0.00	--
2002000-08G	0.117	0.141	0.055	0.065	0.075	0.096	0.070	0.067	0.09	0.09	0.08	1.17
2037006-01G	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.00	0.00	0.00	0.93
2037009-01G	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.01	0.01	0.01	0.99
2037013-02G	0.013	0.014	0.019	0.013	0.024	0.015	0.019	0.015	0.01	0.02	0.01	1.25
2037014-02G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2174000-05G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2174000-07G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2286001-01G, -02G	0.075	0.085	0.067	0.067	0.071	0.064	0.051	0.060	0.07	0.07	0.06	1.28
Subbasin total	0.741	1.25	0.720	0.699	0.688	0.611	0.682	0.691	0.67	0.82	0.54	1.52
Howard and Cold Harbor Brooks												
2215000-03G	0.345	0.313	0.274	0.110	0.183	0.287	0.298	0.312	0.30	0.25	0.34	0.72
2215000-04G, -05G, -06G	0.163	0.199	0.173	0.116	0.118	0.098	0.128	0.129	0.13	0.15	0.13	1.20
Subbasin total	0.508	0.512	0.447	0.226	0.301	0.386	0.426	0.441	0.43	0.40	0.47	0.85

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise]

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Assabet River Basin									
Nashoba Brook									
2002000-02G	Acton	MC	Acton WD	GW	Conant Well	0.282	0.220	0.092	0.026
2002000-09G	Acton	MC	Acton WD	GW	Marshall Well	0.000	0.000	0.000	0.000
2002000-10G, -11G, 12G, 13G	Acton	MC	Acton WD	GW	Kennedy Wells #1-4	0.365	0.406	0.428	0.472
2002000-14G, -15G, -16G, -17G, -18G	Acton	MC	Acton WD	GW	Conant II Wells #1-5	0.000	0.000	0.026	0.144
3067000-01S	Acton	MC	Concord WD	SW	Nagog Pond	0.000	0.000	0.000	0.000
2002003-01G	Acton	NMC	Meadowbrook Condo.	GW	Well #1	NAV	NAV	NAV	NAV
2002005-01G	Acton	NMC	Wampus Apt.	GW	Well #1	NAV	NAV	NAV	NAV
2002006-02G	Acton	NMC	Great Road Condo.	GW	Wells #1-2	NAV	NAV	NAV	NAV
2002007-02G	Acton	NMC	Woodvale Condo.	GW	Well #1	NAV	NAV	NAV	NAV
2002009-01G	Acton	NMC	Richmond House Condo.	GW	Well #1	0.003	0.003	0.003	0.003
2002010-01G	Acton	NMC	Pine Hill Condo.	GW	Well #1	0.005	0.006	0.005	0.005
2002014-01G	Acton	NMC	Strawberry Hill Apt.	GW	Wells #1-2	NAV	NAV	NAV	NAV
2330014-01G	Westford	NMC	Vinebrook Estates	GW	Well #1	0.012	0.021	0.024	0.028
Subbasin total	--	--	--	--	--	0.667	0.656	0.577	0.678
North Brook									
2028007-01G, -02G, -03G, -04G	Berlin	NMC	Berlin Retirement Homes/ Northbrook Village	GW	Rock Wells #1-4	NAV	NAV	NAV	NAV
Subbasin total	--	--	--	--	--	NAV	NAV	NAV	NAV
Sudbury River Basin									
Cedar Swamp									
2328000-01G	Westborough	MC	Westborough WD	GW	Hopkinton Road Well	0.321	0.197	0.127	0.160
2328000-01S	Westborough	MC	Westborough WD	SW	Sandra Pond	0.636	0.761	1.59	1.67
2328000-02G	Westborough	MC	Westborough WD	GW	Morse Street Well	0.208	0.218	0.224	0.209
Subbasin total	--	--	--	--	--	1.17	1.18	1.94	2.04
Hop Brook									
2141000-02G	Hudson	MC	Hudson WD	GW	Cranberry Bog Well	0.476	0.602	0.600	0.585
3288000-03G	Sudbury	MC	Sudbury WD	GW	GP Well #3	0.385	0.277	0.115	0.273
3288000-08G, -10G	Sudbury	MC	Sudbury WD	GW	GP Wells #8 and 10	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	0.861	0.878	0.715	0.858
Indian Brook									
3014000-04G	Ashland	MC	Ashland WSD	GW	Howe Street GP Well #4	1.018	0.335	0.890	0.065
3014000-05G	Ashland	MC	Ashland WSD	GW	Howe Street GP Well #5	0.149	0.992	0.236	1.26
3014000-06G	Ashland	MC	Ashland WSD	GW	Howe Street GP Well #6	0.054	0.023	0.011	0.017
Subbasin total	--	--	--	--	--	1.22	1.35	1.14	1.34

Massachusetts, 1996–2000.—Continued

Apartments; Co., Company; Condo., Condominiums; DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District; WSD, unavailable; --, not applicable]

Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Assabet River Basin												
Nashoba Brook												
2002000-02G	0.112	0.084	0.199	0.089	0.022	0.000	0.000	0.000	0.09	0.10	0.12	0.85
2002000-09G	0.069	0.148	0.000	0.000	0.000	0.000	0.000	0.000	0.02	0.04	0.00	--
2002000-10G, -11G, 12G, 13G	0.477	0.459	0.264	0.276	0.301	0.393	0.346	0.349	0.38	0.36	0.38	0.94
2002000-14G, -15G, -16G, -17G, -18G	0.175	0.217	0.160	0.172	0.185	0.151	0.157	0.183	0.13	0.18	0.07	2.48
3067000-01S	0.971	1.17	1.06	0.961	1.09	0.229	0.000	0.000	0.46	1.05	0.00	--
2002003-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002005-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002006-02G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002007-02G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002009-01G	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.00	0.00	0.00	1.04
2002010-01G	0.006	0.006	0.006	0.006	0.005	0.005	0.005	0.005	0.01	0.01	0.01	1.05
2002014-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2330014-01G	0.042	0.082	0.043	0.038	0.035	0.033	0.023	0.019	0.03	0.05	0.02	2.44
Subbasin total	1.86	2.17	1.74	1.54	1.64	0.814	0.534	0.560	1.12	1.79	0.60	2.99
North Brook												
2028007-01G, -02G, -03G, -04G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Subbasin total	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Sudbury River Basin												
Cedar Swamp												
2328000-01G	0.324	0.408	0.239	0.373	0.307	0.304	0.277	0.223	0.27	0.33	0.23	1.44
2328000-01S	0.909	1.27	0.377	0.295	0.341	0.105	0.150	0.156	0.69	0.64	0.66	0.97
2328000-02G	0.214	0.218	0.208	0.201	0.201	0.231	0.133	0.000	0.19	0.21	0.16	1.33
Subbasin total	1.45	1.89	0.824	0.869	0.849	0.641	0.560	0.378	1.15	1.18	1.04	1.13
Hop Brook												
2141000-02G	0.550	0.785	0.558	0.514	0.476	0.396	0.397	0.447	0.53	0.58	0.50	1.14
3288000-03G	0.218	0.470	0.394	0.431	0.371	0.223	0.120	0.406	0.31	0.38	0.26	1.45
3288000-08G, -10G	0.000	0.628	0.397	1.389	0.222	0.000	0.123	0.000	0.23	0.53	0.02	21.43
Subbasin total	0.768	1.88	1.35	2.33	1.07	0.619	0.641	0.854	1.07	1.48	0.79	1.88
Indian Brook												
3014000-04G	0.586	0.615	0.877	1.00	0.328	0.556	0.292	0.791	0.61	0.68	0.67	1.03
3014000-05G	0.854	1.075	0.923	0.143	0.637	0.258	0.787	0.000	0.61	0.73	0.43	1.68
3014000-06G	0.269	0.755	0.158	0.656	0.678	0.449	0.400	0.436	0.33	0.50	0.18	2.72
Subbasin total	1.71	2.44	1.96	1.80	1.64	1.26	1.48	1.23	1.55	1.91	1.28	1.49

100 Water Withdrawals, Use, and Wastewater Return Flows in the Concord River Basin, Eastern Massachusetts, 1996–2000

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Sudbury River Basin									
Lake Cochituate									
3198000-01G	Natick	MC	Natick WD	GW	Springvale Well #1	0.000	0.013	0.001	0.000
3198000-02G	Natick	MC	Natick WD	GW	Springvale Well #3	1.19	1.23	1.24	1.18
3198000-07G	Natick	MC	Natick WD	GW	Springvale Well #4	0.579	0.418	0.135	0.342
3198000-09G	Natick	MC	Natick WD	GW	Evergreen Well #1	0.000	0.008	0.546	0.444
3198000-10G	Natick	MC	Natick WD	GW	Evergreen Well #2	0.000	0.043	0.123	0.000
Subbasin total	--	--	--	--	--	1.77	1.72	2.04	1.97
Lower Sudbury River									
3067000-01G	Concord	MC	Concord WD	GW	Jennie Dugan Well	0.358	0.361	0.358	0.360
3067000-03G	Concord	MC	Concord WD	GW	Deaconess Well	0.945	0.896	0.961	1.03
3067000-04G	Concord	MC	Concord WD	GW	White Pond Well	0.000	0.000	0.000	0.000
3067000-06G	Concord	MC	Concord WD	GW	Robinson Well	0.000	0.000	0.000	0.000
3157000-02G	Lincoln	MC	Lincoln WD	GW	Farrar Pond Well	0.000	0.000	0.000	0.000
3288000-02G, -09G	Sudbury	MC	Sudbury WD	GW	GP Wells #2 and 9	0.000	0.000	0.000	0.084
3288000-04G	Sudbury	MC	Sudbury WD	GW	GP Well #4	0.257	0.225	0.271	0.243
3288000-05G	Sudbury	MC	Sudbury WD	GW	GP Well #5	0.000	0.000	0.000	0.113
3288000-06G	Sudbury	MC	Sudbury WD	GW	GP Well #6	0.493	0.474	0.532	0.450
3288000-07G	Sudbury	MC	Sudbury WD	GW	GP Well #7	0.347	0.473	0.619	0.527
3315000-01G	Wayland	MC	Wayland WD	GW	Baldwin Pond Well #1	0.091	0.164	0.470	0.062
3315000-02G	Wayland	MC	Wayland WD	GW	Campbell Road Well #1	0.000	0.000	0.001	0.258
3315000-03G	Wayland	MC	Wayland WD	GW	Happy Hollow Well #1	0.425	0.590	0.653	0.574
3315000-04G	Wayland	MC	Wayland WD	GW	Happy Hollow Well #2	0.227	0.160	0.007	0.139
3315000-05G	Wayland	MC	Wayland WD	GW	Meadowview Well #1	0.004	0.009	0.000	0.035
3315000-06G	Wayland	MC	Wayland WD	GW	Baldwin Pond Well #3	0.471	0.203	0.051	0.422
3315000-07G	Wayland	MC	Wayland WD	GW	Baldwin Pond Well #2	0.138	0.272	0.257	0.069
3315000-08G	Wayland	MC	Wayland WD	GW	Chamberlain Well #1	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	3.76	3.83	4.18	4.37
Upper Sudbury River									
2139007-01G, -02G	Hopkinton	NMC	Village at Highland Park	GW	Wells #1 and 2	0.004	0.004	0.003	0.004
2139007-03G	Hopkinton	NMC	Village at Highland Park	GW	Well #3	0.000	0.000	0.000	0.000
2139008-02G	Hopkinton	NMC	The Preserve at Hopkinton Condo.	GW	Well #2	0.006	0.004	0.004	0.006
Subbasin total	--	--	--	--	--	0.009	0.008	0.007	0.010
Whitehall Brook									
2139000-01G	Hopkinton	MC	Hopkinton WD	GW	Well #1	0.298	0.242	0.260	0.261
2139000-02G	Hopkinton	MC	Hopkinton WD	GW	Well #2	0.176	0.158	0.175	0.180
2139000-03G	Hopkinton	MC	Hopkinton WD	GW	Well #3	0.043	0.040	0.040	0.043
2139000-04G	Hopkinton	MC	Hopkinton WD	GW	Well #4	0.130	0.112	0.115	0.116
2139000-05G	Hopkinton	MC	Hopkinton WD	GW	Well #5	0.033	0.088	0.074	0.132
Subbasin total	--	--	--	--	--	0.680	0.640	0.664	0.731

Massachusetts, 1996–2000.—Continued

Apartments; Co., Company; Condo., Condominiums; DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District; WSD, unavailable; --, not applicable]

Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Sudbury River Basin												
Lake Cochituate												
3198000-01G	0.027	0.189	0.058	0.009	0.000	0.000	0.000	0.018	0.03	0.06	0.01	8.63
3198000-02G	1.13	1.08	1.05	0.358	0.771	1.20	1.02	0.958	1.04	0.88	1.13	0.78
3198000-07G	1.198	1.079	0.995	0.040	0.000	0.083	1.219	0.981	0.59	0.66	0.67	0.99
3198000-09G	0.209	0.759	0.299	0.697	0.311	0.123	0.011	0.032	0.29	0.45	0.12	3.81
3198000-10G	0.947	1.329	0.419	1.082	0.492	0.188	0.017	0.260	0.41	0.85	0.09	9.65
Subbasin total	3.52	4.44	2.82	2.19	1.57	1.59	2.27	2.25	2.35	2.91	2.01	1.45
Lower Sudbury River												
3067000-01G	0.252	0.347	0.306	0.042	0.040	0.042	0.083	0.216	0.23	0.20	0.28	0.72
3067000-03G	0.732	1.01	0.406	0.342	0.330	1.01	0.707	0.952	0.78	0.56	0.89	0.63
3067000-04G	0.439	0.633	0.597	0.474	0.000	0.000	0.000	0.000	0.18	0.43	0.00	--
3067000-06G	0.000	0.390	0.581	0.584	0.490	0.481	0.480	0.065	0.26	0.41	0.11	3.75
3157000-02G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
3288000-02G, -09G	0.331	0.868	1.001	0.869	1.000	0.868	0.547	0.000	0.46	0.81	0.11	7.45
3288000-04G	0.131	0.238	0.134	0.168	0.185	0.100	0.212	0.214	0.20	0.17	0.24	0.72
3288000-05G	0.298	0.410	0.344	0.322	0.259	0.108	0.032	0.000	0.16	0.33	0.01	51.20
3288000-06G	0.382	0.396	0.288	0.349	0.152	0.019	0.277	0.342	0.35	0.31	0.42	0.74
3288000-07G	0.510	0.552	0.332	0.476	0.314	0.008	0.086	0.463	0.39	0.44	0.40	1.10
3315000-01G	0.197	0.463	0.515	0.506	0.263	0.234	0.000	0.030	0.25	0.39	0.15	2.57
3315000-02G	0.385	0.522	0.370	0.429	0.308	0.010	0.003	0.001	0.19	0.40	0.00	428.97
3315000-03G	0.556	0.621	0.470	0.209	0.153	0.018	0.043	0.000	0.36	0.40	0.34	1.17
3315000-04G	0.613	0.859	0.758	0.862	0.886	0.873	0.722	0.839	0.58	0.80	0.39	2.03
3315000-05G	0.068	0.361	0.304	0.301	0.097	0.111	0.252	0.146	0.14	0.23	0.08	2.75
3315000-06G	0.455	0.458	0.346	0.455	0.561	0.448	0.173	0.114	0.35	0.45	0.20	2.25
3315000-07G	0.168	0.505	0.328	0.368	0.300	0.056	0.468	0.564	0.29	0.33	0.34	0.98
3315000-08G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Subbasin total	5.52	8.63	7.08	6.75	5.34	4.38	4.09	3.95	5.16	6.66	3.96	1.68
Upper Sudbury River												
2139007-01G, -02G	0.004	0.009	0.005	0.005	0.006	0.005	0.003	0.003	0.01	0.01	0.00	1.73
2139007-03G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2139008-02G	0.004	0.015	0.006	0.010	0.006	0.004	0.006	0.008	0.01	0.01	0.01	1.50
Subbasin total	0.007	0.024	0.011	0.016	0.012	0.010	0.009	0.011	0.01	0.01	0.01	1.59
Whitehall Brook												
2139000-01G	0.358	0.375	0.323	0.280	0.232	0.220	0.249	0.244	0.28	0.31	0.26	1.21
2139000-02G	0.224	0.214	0.180	0.173	0.121	0.122	0.156	0.160	0.17	0.18	0.16	1.11
2139000-03G	0.058	0.066	0.051	0.058	0.058	0.057	0.045	0.044	0.05	0.06	0.04	1.37
2139000-04G	0.180	0.211	0.159	0.173	0.159	0.151	0.105	0.099	0.14	0.18	0.11	1.57
2139000-05G	0.173	0.261	0.166	0.181	0.179	0.164	0.127	0.130	0.14	0.19	0.09	2.13
Subbasin total	0.993	1.13	0.879	0.866	0.748	0.714	0.681	0.677	0.78	0.92	0.67	1.38

102 Water Withdrawals, Use, and Wastewater Return Flows in the Concord River Basin, Eastern Massachusetts, 1996–2000

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Lower Concord River Basin									
Lower Concord Main Stem									
3031000-01S	Billerica	MC	Billerica WW	SW	Concord River	3.40	3.35	3.39	3.77
3067000-02G	Concord	MC	Concord WD	GW	Hugh Cargill Well	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	3.40	3.35	3.39	3.77
River Meadow Brook									
3056000-02G	Chelmsford	MC	Chelmsford WD	GW	Turnpike Road GP Well #1	0.000	0.000	0.000	0.000
3056000-05G, -15G, -16G	Chelmsford	MC	Chelmsford WD	GW	Mill Road GP Wells #1-3	0.952	0.979	0.839	0.840
3056000-09G, 11G	Chelmsford	MC	Chelmsford WD	GW	Riverneck Road GP Wells #1-2	0.000	0.000	0.471	0.600
3056001-01G	Chelmsford	MC	East Chelmsford WD	GW	Canal Street GP Well #1	0.280	0.228	0.000	0.000
Subbasin total	--	--	--	--	--	1.23	1.21	1.31	1.44
Total Concord River Basin									
Basin total	--	--	--	--	--	22.4	22.9	25.0	26.0
2000									
Assabet River Basin									
Assabet Headwaters									
2170000-01S	Marlborough	MC	Marlborough DPW, WD	SW	Millham Reservoir	0.898	1.48	1.49	1.26
2215000-01G	Northborough	MC	Northborough WD	GW	Brigham Street Well	0.366	0.436	0.412	0.361
2215000-02G	Northborough	MC	Northborough WD	GW	Lyman Street Well	0.000	0.000	0.000	0.000
2328000-03G	Westborough	MC	Westborough WD	GW	Andrews I Well	0.311	0.171	0.135	0.091
2328000-04G	Westborough	MC	Westborough WD	GW	Andrews II Well	0.285	0.280	0.258	0.108
2328000-05G	Westborough	MC	Westborough WD	GW	Otis Street Well	0.277	0.255	0.190	0.217
2328000-06G	Westborough	MC	Westborough WD	GW	Wilkinson Well	0.230	0.234	0.210	0.069
2328000-07G	Westborough	MC	Westborough WD	GW	Chauncy Lake Well #1	0.000	0.000	0.000	0.000
2328000-08G	Westborough	MC	Westborough WD	GW	Chauncy Lake Well #2	0.745	0.748	0.761	0.283
Subbasin total	--	--	--	--	--	3.11	3.60	3.45	2.39
Assabet Main Stem									
2002000-05G	Acton	MC	Acton WD	GW	Assabet Well #1	0.348	0.341	0.352	0.373
2002000-06G	Acton	MC	Acton WD	GW	Assabet Well #2	0.260	0.247	0.254	0.082
2141000-01G	Hudson	MC	Hudson WD	GW	Rimkus Well	0.000	0.000	0.000	0.000
2141000-01S	Berlin	MC	Hudson WD	SW	Gates Pond Reservoir	0.036	0.143	0.130	0.117
2174000-01G, -02G	Maynard	MC	Maynard DPW, WD	GW	Old Marlboro Road Wells #1 and 2	0.382	0.326	0.296	0.393
2174000-01S	Maynard	MC	Maynard DPW, WD	SW	White Pond	0.000	0.000	0.000	0.000
2174000-03G	Maynard	MC	Maynard DPW, WD	GW	Old Marlboro Road Well #3	0.156	0.116	0.129	0.151
2174000-04G	Maynard	MC	Maynard DPW, WD	GW	Great Road Well #4	0.489	0.423	0.407	0.528
2271000-01G	Shrewsbury	MC	Shrewsbury WD	GW	South Street Well	0.000	0.000	0.000	0.000
2286000-01G, -02G, -03G	Stow	NMC	Juniper Hill Water Co.	GW	Wells #1-3	NAV	NAV	NAV	NAV
3067000-05G	Concord	MC	Concord WD	GW	Second Division Well	0.461	0.645	0.600	0.690
Subbasin total	--	--	--	--	--	2.13	2.24	2.17	2.33

Massachusetts, 1996–2000.—Continued

Apartments; Co., Company; Condo., Condominiums; DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District; WSD, unavailable; --, not applicable]

Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Lower Concord River Basin												
Lower Concord Main Stem												
3031000-01S	5.33	8.18	6.73	6.11	5.34	3.84	3.47	3.41	4.69	6.34	3.40	1.86
3067000-02G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Subbasin total	5.33	8.18	6.73	6.11	5.34	3.84	3.47	3.41	4.69	6.34	3.40	1.86
River Meadow Brook												
3056000-02G	0.445	0.467	0.048	0.190	0.207	0.000	0.000	0.000	0.11	0.27	0.00	--
3056000-05G, -15G, -16G	0.935	0.997	0.771	0.726	0.823	0.790	0.743	0.648	0.84	0.85	0.83	1.02
3056000-09G, 11G	0.845	0.803	0.619	0.571	0.597	0.613	0.590	0.581	0.52	0.69	0.33	2.09
3056001-01G	0.000	0.000	0.027	0.074	0.063	0.049	0.000	0.290	0.08	0.03	0.16	0.21
Subbasin total	2.23	2.27	1.47	1.56	1.69	1.45	1.33	1.52	1.56	1.84	1.32	1.40
Total Concord River Basin												
Basin total	32.5	44.1	33.5	32.4	27.9	23.5	23.7	23.1	0.29	0.35	0.24	1.46
2000												
Assabet River Basin												
Assabet Headwaters												
2170000-01S	3.03	2.16	0.938	0.906	0.903	0.883	0.902	0.897	1.31	1.59	1.13	1.40
2215000-01G	0.377	0.398	0.403	0.392	0.411	0.416	0.429	0.285	0.39	0.40	0.39	1.03
2215000-02G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2328000-03G	0.223	0.246	0.247	0.243	0.258	0.240	0.176	0.177	0.21	0.24	0.19	1.25
2328000-04G	0.205	0.032	0.145	0.283	0.321	0.400	0.398	0.359	0.26	0.20	0.32	0.62
2328000-05G	0.187	0.163	0.390	0.348	0.370	0.348	0.267	0.261	0.27	0.29	0.25	1.17
2328000-06G	0.136	0.054	0.112	0.136	0.153	0.143	0.144	0.137	0.15	0.12	0.19	0.62
2328000-07G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2328000-08G	0.184	0.287	0.177	0.284	0.230	0.387	0.393	0.348	0.40	0.23	0.60	0.39
Subbasin total	4.34	3.34	2.41	2.59	2.64	2.82	2.71	2.46	2.99	3.07	3.07	1.00
Assabet Main Stem												
2002000-05G	0.296	0.312	0.316	0.305	0.327	0.271	0.131	0.255	0.30	0.31	0.29	1.09
2002000-06G	0.418	0.398	0.527	0.497	0.497	0.431	0.514	0.408	0.38	0.47	0.34	1.39
2141000-01G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2141000-01S	0.123	0.139	0.214	0.138	0.128	0.194	0.162	0.097	0.14	0.15	0.11	1.31
2174000-01G, -02G	0.335	0.375	0.469	0.255	0.233	0.129	0.057	0.203	0.29	0.33	0.25	1.32
2174000-01S	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2174000-03G	0.158	0.175	0.035	0.089	0.125	0.098	0.182	0.152	0.13	0.12	0.15	0.79
2174000-04G	0.429	0.471	0.229	0.000	0.000	0.015	0.000	0.000	0.25	0.23	0.26	0.86
2271000-01G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2286000-01G, -02G, -03G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
3067000-05G	0.574	0.537	0.497	0.432	0.323	0.319	0.620	0.471	0.51	0.47	0.56	0.84
Subbasin total	2.33	2.41	2.29	1.72	1.63	1.46	1.66	1.59	2.00	2.07	1.96	1.06

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Assabet River Basin									
Elizabeth Brook									
2037001-01G	Boxborough	NMC	Codman Hill Condo.	GW	Well #1	0.015	0.014	0.014	0.013
2037002-01G	Boxborough	NMC	Harvard Ridge Condo.	GW	Dunster House Well	NAV	NAV	NAV	NAV
2037002-02G	Boxborough	NMC	Harvard Ridge Condo.	GW	Eliot House Well	NAV	NAV	NAV	NAV
2037002-03G	Boxborough	NMC	Harvard Ridge Condo.	GW	Leverett House Well	NAV	NAV	NAV	NAV
2286017-01G	Stow	NMC	Plantation Apt.	GW	Well #1	0.003	0.003	0.004	0.004
2286018-01G	Stow	NMC	Pilot Grove Apt.	GW	Well #1	0.004	0.004	0.004	0.004
2286018-02G	Stow	NMC	Pilot Grove Apt.	GW	Well #2	0.004	0.004	0.004	0.005
Subbasin total	--	--	--	--	--	0.025	0.025	0.025	0.026
Fort Meadow Brook									
2141000-03G	Hudson	MC	Hudson WD	GW	Kane Well	0.000	0.000	0.000	0.000
2141000-04G	Hudson	MC	Hudson WD	GW	Chestnut Street Well #1	0.463	0.580	0.601	0.594
2141000-05G	Hudson	MC	Hudson WD	GW	Chestnut Street Well #2	0.701	0.817	0.774	0.783
2141000-06G	Hudson	MC	Hudson WD	GW	Chestnut Street Well #3	0.415	0.381	0.369	0.377
Subbasin total	--	--	--	--	--	1.58	1.78	1.74	1.75
Fort Pond Brook									
2002000-01G	Acton	MC	Acton WD	GW	Whitcomb Well	0.295	0.307	0.307	0.342
2002000-03G	Acton	MC	Acton WD	GW	Lawsbrook	0.145	0.141	0.149	0.165
2002000-04G	Acton	MC	Acton WD	GW	Christofferson Well	0.126	0.125	0.132	0.139
2002000-07G	Acton	MC	Acton WD	GW	Clapp Well	0.000	0.000	0.000	0.000
2002000-08G	Acton	MC	Acton WD	GW	Scribner Well	0.069	0.069	0.070	0.060
2037006-01G	Boxborough	NMC	Centre Village Apt.	GW	Rock Well	0.001	0.002	0.001	0.001
2037009-01G	Boxborough	NMC	Carriage House Condo.	GW	Well #1	0.006	0.006	0.006	0.006
2037013-02G	Boxborough	NMC	Applewood Condo.	GW	Well #2	0.021	0.019	0.011	0.015
2037014-02G	Boxborough	NMC	Liberty House Condo.	GW	Well #2	NAV	NAV	NAV	NAV
2174000-05G	Maynard	MC	Maynard DPW, WD	GW	Rock Well #2	0.000	0.000	0.000	0.000
2174000-07G	Maynard	MC	Maynard DPW, WD	GW	Rock Well #5	0.000	0.000	0.000	0.000
2286001-01G, -02G	Stow	NMC	Assabet Water Co./ Harvard Acres	GW	Wells #1-2	0.053	0.040	0.082	0.066
Subbasin total	--	--	--	--	--	0.717	0.709	0.758	0.794

Massachusetts, 1996–2000.—Continued

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Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Assabet River Basin												
Elizabeth Brook												
2037001-01G	0.016	0.014	0.013	0.013	0.013	0.015	0.014	0.015	0.01	0.01	0.01	0.95
2037002-01G	NAV	NAV	NAV	NAV	NAV	0.001	0.002	0.001	--	--	--	--
2037002-02G	NAV	NAV	NAV	NAV	NAV	0.002	0.002	0.002	--	--	--	--
2037002-03G	NAV	NAV	NAV	NAV	NAV	0.001	0.001	0.001	--	--	--	--
2286017-01G	0.003	0.005	0.004	0.002	0.007	0.003	0.004	0.003	0.00	0.00	0.00	1.26
2286018-01G	0.004	0.005	0.004	0.005	0.005	0.004	0.005	0.004	0.00	0.01	0.00	1.13
2286018-02G	0.003	0.005	0.004	0.005	0.004	0.004	0.005	0.004	0.00	0.00	0.00	1.04
Subbasin total	0.026	0.029	0.025	0.025	0.029	0.032	0.033	0.031	0.03	0.03	0.03	1.04
Fort Meadow Brook												
2141000-03G	0.000	0.011	0.355	0.272	0.334	0.413	0.322	0.355	0.17	0.19	0.14	1.43
2141000-04G	0.630	0.602	0.618	0.602	0.596	0.591	0.575	0.555	0.58	0.61	0.55	1.10
2141000-05G	0.887	0.849	0.807	0.816	0.794	0.761	0.717	0.655	0.78	0.83	0.73	1.13
2141000-06G	0.407	0.402	0.428	0.394	0.284	0.000	0.000	0.000	0.29	0.38	0.23	1.64
Subbasin total	1.92	1.86	2.21	2.08	2.01	1.76	1.61	1.57	1.82	2.02	1.66	1.22
Fort Pond Brook												
2002000-01G	0.363	0.000	0.046	0.005	0.046	0.088	0.000	0.000	0.15	0.09	0.18	0.51
2002000-03G	0.188	0.205	0.198	0.159	0.145	0.127	0.119	0.096	0.15	0.18	0.13	1.38
2002000-04G	0.061	0.180	0.274	0.263	0.192	0.196	0.188	0.202	0.17	0.19	0.15	1.25
2002000-07G	0.011	0.253	0.168	0.072	0.087	0.000	0.111	0.149	0.07	0.12	0.05	2.27
2002000-08G	0.092	0.104	0.076	0.046	0.041	0.012	0.000	0.000	0.05	0.07	0.04	1.73
2037006-01G	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.00	0.00	0.00	1.01
2037009-01G	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.01	0.01	0.01	0.99
2037013-02G	0.016	0.018	0.019	0.018	0.019	0.017	0.018	0.017	0.02	0.02	0.02	1.04
2037014-02G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2174000-05G	0.000	0.000	0.201	0.201	0.140	0.169	0.158	0.046	0.08	0.11	0.04	2.65
2174000-07G	0.000	0.000	0.127	0.249	0.498	0.414	0.443	0.536	0.19	0.17	0.20	--
2286001-01G, -02G	0.073	0.063	0.067	0.067	0.066	0.066	0.065	0.058	0.06	0.07	0.06	1.13
Subbasin total	0.810	0.831	1.18	1.09	1.24	1.10	1.11	1.11	0.95	1.03	0.88	1.17

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise]

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Assabet River Basin									
Nashoba Brook									
2002000-02G	Acton	MC	Acton WD	GW	Conant Well	0.000	0.000	0.000	0.000
2002000-09G	Acton	MC	Acton WD	GW	Marshall Well	0.000	0.000	0.000	0.000
2002000-10G, -11G, 12G, 13G	Acton	MC	Acton WD	GW	Kennedy Wells #1-4	0.310	0.443	0.484	0.475
2002000-14G, -15G, -16G, -17G, -18G	Acton	MC	Acton WD	GW	Conant II Wells #1-5	0.176	0.108	0.113	0.250
3067000-01S	Acton	MC	Concord WD	SW	Nagog Pond	0.000	0.000	0.000	0.000
2002003-01G	Acton	NMC	Meadowbrook Condo.	GW	Well #1	NAV	NAV	NAV	NAV
2002005-01G	Acton	NMC	Wampus Apt.	GW	Well #1	NAV	NAV	NAV	NAV
2002006-02G	Acton	NMC	Great Road Condo.	GW	Wells #1-2	NAV	NAV	NAV	NAV
2002007-02G	Acton	NMC	Woodvale Condo.	GW	Well #1	NAV	NAV	NAV	NAV
2002009-01G	Acton	NMC	Richmond House Condo.	GW	Well #1	NAV	NAV	NAV	NAV
2002010-01G	Acton	NMC	Pine Hill Condo.	GW	Well #1	0.005	0.006	0.005	0.005
2002014-01G	Acton	NMC	Strawberry Hill Apt.	GW	Wells #1-2	NAV	NAV	NAV	NAV
2330014-01G	Westford	NMC	Vinebrook Estates	GW	Well #1	0.021	0.036	0.029	0.034
Subbasin total	--	--	--	--	--	0.512	0.592	0.631	0.764
North Brook									
2028007-01G, -02G, -03G, -04G	Berlin	NMC	Berlin Retirement Homes/ Northbrook Village	GW	Rock Wells #1-4	NAV	NAV	NAV	NAV
Subbasin total	--	--	--	--	--	NAV	NAV	NAV	NAV
Sudbury River Basin									
Cedar Swamp									
2328000-01G	Westborough	MC	Westborough WD	GW	Hopkinton Road Well	0.190	0.000	0.000	0.133
2328000-01S	Westborough	MC	Westborough WD	SW	Sandra Pond	0.226	0.461	0.553	1.29
2328000-02G	Westborough	MC	Westborough WD	GW	Morse Street Well	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	0.417	0.461	0.553	1.43
Hop Brook									
2141000-02G	Hudson	MC	Hudson WD	GW	Cranberry Bog Well	0.692	0.478	0.517	0.546
3288000-03G	Sudbury	MC	Sudbury WD	GW	GP Well #3	0.427	0.308	0.412	0.362
3288000-08G, -10G	Sudbury	MC	Sudbury WD	GW	GP Wells #8 and 10	0.000	0.193	0.418	0.375
Subbasin total	--	--	--	--	--	1.12	0.978	1.35	1.28
Howard and Cold Harbor Brooks									
2215000-03G	Northborough	MC	Northborough WD	GW	Crawford Street Well	0.240	0.335	0.402	0.290
2215000-04G, -05G, -06G	Northborough	MC	Northborough WD	GW	Howard Street Wells #1-3	0.123	0.134	0.120	0.120
Subbasin total	--	--	--	--	--	0.363	0.469	0.523	0.410
Indian Brook									
3014000-04G	Ashland	MC	Ashland WSD	GW	Howe Street GP Well #4	0.172	0.400	0.060	0.419
3014000-05G	Ashland	MC	Ashland WSD	GW	Howe Street GP Well #5	0.660	0.452	0.775	0.467
3014000-06G	Ashland	MC	Ashland WSD	GW	Howe Street GP Well #6	0.429	0.432	0.425	0.476
Subbasin total	--	--	--	--	--	1.26	1.28	1.26	1.36

Massachusetts, 1996–2000.—Continued

Apartments; Co., Company; Condo., Condominiums; DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District; WSD, unavailable; --, not applicable]

Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Assabet River Basin												
Nashoba Brook												
2002000-02G	0.075	0.091	0.206	0.224	0.237	0.141	0.137	0.132	0.10	0.17	0.05	3.10
2002000-09G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2002000-10G, -11G, 12G, 13G	0.430	0.399	0.345	0.242	0.256	0.340	0.352	0.326	0.37	0.33	0.38	0.87
2002000-14G, -15G, -16G, -17G, -18G	0.195	0.154	0.097	0.102	0.145	0.178	0.176	0.169	0.16	0.14	0.15	0.93
3067000-01S	0.000	0.000	0.410	0.000	0.000	0.000	0.000	0.000	0.03	0.08	0.00	--
2002003-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002005-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002006-02G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002007-02G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002009-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2002010-01G	0.005	0.006	0.006	0.006	0.006	0.006	0.006	0.005	0.01	0.01	0.01	1.08
2002014-01G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
2330014-01G	0.041	0.044	0.062	0.048	0.046	0.027	0.046	0.049	0.04	0.05	0.04	1.33
Subbasin total	0.746	0.694	1.13	0.622	0.690	0.692	0.717	0.682	0.71	0.78	0.63	1.24
North Brook												
2028007-01G, -02G, -03G, -04G	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Subbasin total	NAV	NAV	NAV	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Sudbury River Basin												
Cedar Swamp												
2328000-01G	0.074	0.097	0.268	0.139	0.373	0.342	0.367	0.355	0.19	0.19	0.18	1.04
2328000-01S	1.55	1.61	1.17	0.551	0.378	0.386	0.323	0.272	0.73	1.05	0.37	2.86
2328000-02G	0.000	0.000	0.071	0.319	0.277	0.090	0.210	0.135	0.09	0.13	0.07	1.93
Subbasin total	1.62	1.70	1.51	1.01	1.03	0.818	0.899	0.762	1.02	1.37	0.62	2.22
Hop Brook												
2141000-02G	0.680	0.768	0.535	0.405	0.544	0.608	0.501	0.578	0.57	0.59	0.55	1.06
3288000-03G	0.204	0.286	0.275	0.304	0.330	0.098	0.299	0.437	0.31	0.28	0.38	0.74
3288000-08G, -10G	0.767	0.778	0.741	0.527	0.676	0.660	0.184	0.602	0.49	0.70	0.28	2.50
Subbasin total	1.65	1.83	1.55	1.24	1.55	1.37	0.984	1.62	1.38	1.56	1.21	1.29
Howard and Cold Harbor Brooks												
2215000-03G	0.329	0.341	0.339	0.336	0.362	0.295	0.295	0.215	0.32	0.34	0.30	1.15
2215000-04G, -05G, -06G	0.127	0.127	0.143	0.093	0.094	0.086	0.086	0.090	0.11	0.12	0.11	1.05
Subbasin total	0.457	0.468	0.482	0.429	0.456	0.381	0.381	0.306	0.43	0.46	0.41	1.12
Indian Brook												
3014000-04G	0.141	1.11	0.191	1.06	0.094	0.895	0.791	0.001	0.44	0.52	0.28	1.82
3014000-05G	0.858	0.001	1.10	0.095	1.17	0.149	0.068	0.905	0.56	0.64	0.57	1.13
3014000-06G	0.543	0.629	0.692	0.593	0.522	0.426	0.483	0.446	0.51	0.60	0.44	1.35
Subbasin total	1.54	1.74	1.98	1.75	1.78	1.47	1.34	1.35	1.51	1.76	1.30	1.35

108 Water Withdrawals, Use, and Wastewater Return Flows in the Concord River Basin, Eastern Massachusetts, 1996–2000

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Sudbury River Basin									
Lake Cochituate									
3198000-01G	Natick	MC	Natick WD	GW	Springvale Well #1	0.064	0.000	0.027	0.176
3198000-02G	Natick	MC	Natick WD	GW	Springvale Well #3	0.126	0.000	0.069	0.478
3198000-07G	Natick	MC	Natick WD	GW	Springvale Well #4	1.10	1.330	0.308	0.359
3198000-09G	Natick	MC	Natick WD	GW	Evergreen Well #1	0.115	0.000	0.000	0.000
3198000-10G	Natick	MC	Natick WD	GW	Evergreen Well #2	0.000	0.000	1.53	1.54
Subbasin total	--	--	--	--	--	1.41	1.33	1.93	2.55
Lower Sudbury River									
3067000-01G	Concord	MC	Concord WD	GW	Jennie Dugan Well	0.001	0.000	0.000	0.000
3067000-03G	Concord	MC	Concord WD	GW	Deaconess Well	0.890	0.676	0.771	0.790
3067000-04G	Concord	MC	Concord WD	GW	White Pond Well	0.000	0.000	0.000	0.000
3067000-06G	Concord	MC	Concord WD	GW	Robinson Well	0.497	0.483	0.410	0.487
3157000-02G	Lincoln	MC	Lincoln WD	GW	Farrar Pond Well	0.000	0.000	0.000	0.000
3288000-02G, -09G	Sudbury	MC	Sudbury WD	GW	GP Wells #2 and 9	0.000	0.000	0.000	0.000
3288000-04G	Sudbury	MC	Sudbury WD	GW	GP Well #4	0.154	0.233	0.193	0.206
3288000-05G	Sudbury	MC	Sudbury WD	GW	GP Well #5	0.165	0.030	0.000	0.000
3288000-06G	Sudbury	MC	Sudbury WD	GW	GP Well #6	0.639	0.649	0.352	0.233
3288000-07G	Sudbury	MC	Sudbury WD	GW	GP Well #7	0.527	0.519	0.193	0.237
3315000-01G	Wayland	MC	Wayland WD	GW	Baldwin Pond Well #1	0.144	0.239	0.123	0.060
3315000-02G	Wayland	MC	Wayland WD	GW	Campbell Road Well #1	0.301	0.001	0.238	0.374
3315000-03G	Wayland	MC	Wayland WD	GW	Happy Hollow Well #1	0.039	0.007	0.000	0.000
3315000-04G	Wayland	MC	Wayland WD	GW	Happy Hollow Well #2	0.752	0.782	0.762	0.739
3315000-05G	Wayland	MC	Wayland WD	GW	Meadowview Well #1	0.174	0.209	0.199	0.185
3315000-06G	Wayland	MC	Wayland WD	GW	Baldwin Pond Well #3	0.186	0.192	0.258	0.415
3315000-07G	Wayland	MC	Wayland WD	GW	Baldwin Pond Well #2	0.204	0.589	0.242	0.052
3315000-08G	Wayland	MC	Wayland WD	GW	Chamberlain Well #1	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	4.67	4.61	3.74	3.78
Upper Sudbury River									
2139007-01G, -02G	Hopkinton	NMC	Village at Highland Park	GW	Wells #1 and 2	0.004	0.002	0.002	0.002
2139007-03G	Hopkinton	NMC	Village at Highland Park	GW	Well #3	0.000	0.000	0.000	0.000
2139008-02G	Hopkinton	NMC	The Preserve at Hopkinton Condo.	GW	Well #2	0.005	0.007	0.007	0.005
Subbasin total	--	--	--	--	--	0.009	0.008	0.009	0.008
Whitehall Brook									
2139000-01G	Hopkinton	MC	Hopkinton WD	GW	Well #1	0.259	0.239	0.241	0.274
2139000-02G	Hopkinton	MC	Hopkinton WD	GW	Well #2	0.161	0.167	0.184	0.207
2139000-03G	Hopkinton	MC	Hopkinton WD	GW	Well #3	0.045	0.042	0.041	0.033
2139000-04G	Hopkinton	MC	Hopkinton WD	GW	Well #4	0.098	0.094	0.096	0.096
2139000-05G	Hopkinton	MC	Hopkinton WD	GW	Well #5	0.125	0.123	0.133	0.133
Subbasin total	--	--	--	--	--	0.689	0.665	0.694	0.743

Massachusetts, 1996–2000.—Continued

Apartments; Co., Company; Condo., Condominiums; DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District; WSD, unavailable; --, not applicable]

Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Sudbury River Basin												
Lake Cochituate												
3198000-01G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.02	0.00	0.02	0.00
3198000-02G	0.019	0.019	0.206	0.067	0.837	0.770	0.763	0.879	0.35	0.23	0.37	0.62
3198000-07G	0.000	0.040	0.000	0.031	1.01	0.381	0.521	0.000	0.42	0.22	0.65	0.33
3198000-09G	0.000	0.000	0.250	0.862	1.24	1.43	1.14	1.322	0.53	0.47	0.52	0.91
3198000-10G	2.08	2.17	1.60	0.554	0.490	0.162	0.572	0.629	0.94	1.38	0.55	2.53
Subbasin total	2.10	2.23	2.06	1.51	3.57	2.74	3.00	2.83	2.27	2.30	2.10	1.09
Lower Sudbury River												
3067000-01G	0.358	0.440	0.355	0.374	0.380	0.377	0.000	0.106	0.20	0.38	0.02	17.81
3067000-03G	0.900	0.783	0.674	0.561	0.887	0.887	0.677	0.929	0.79	0.76	0.79	0.97
3067000-04G	0.000	0.303	0.510	0.494	0.467	0.132	0.000	0.000	0.16	0.35	0.00	--
3067000-06G	0.461	0.483	0.519	0.490	0.490	0.484	0.467	0.426	0.47	0.49	0.46	1.07
3157000-02G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
3288000-02G, -09G	0.000	0.234	1.142	0.819	0.667	0.210	0.000	0.000	0.26	0.57	0.00	--
3288000-04G	0.164	0.224	0.025	0.104	0.161	0.000	0.200	0.027	0.14	0.14	0.16	0.84
3288000-05G	0.000	0.000	0.049	0.000	0.067	0.294	0.063	0.000	0.06	0.02	0.05	0.45
3288000-06G	0.304	0.367	0.696	0.684	0.656	0.207	0.647	0.746	0.52	0.54	0.61	0.89
3288000-07G	0.339	0.544	0.372	0.084	0.135	0.362	0.313	0.546	0.35	0.29	0.42	0.70
3315000-01G	0.430	0.236	0.297	0.227	0.197	0.253	0.083	0.235	0.21	0.28	0.16	1.68
3315000-02G	0.454	0.317	0.184	0.267	0.313	0.313	0.183	0.181	0.26	0.31	0.18	1.69
3315000-03G	0.112	0.241	0.432	0.084	0.167	0.143	0.312	0.021	0.13	0.21	0.08	2.74
3315000-04G	0.797	0.838	0.829	0.036	0.875	0.565	0.311	0.673	0.66	0.67	0.66	1.03
3315000-05G	0.357	0.197	0.192	0.087	0.106	0.190	0.000	0.000	0.16	0.19	0.12	1.61
3315000-06G	0.181	0.573	0.599	0.574	0.578	0.309	0.472	0.177	0.38	0.50	0.26	1.95
3315000-07G	0.012	0.234	0.463	0.312	0.263	0.003	0.008	0.000	0.20	0.26	0.21	1.23
3315000-08G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Subbasin total	4.87	6.02	7.34	5.20	6.41	4.73	3.74	4.07	4.93	5.97	4.17	1.43
Upper Sudbury River												
2139007-01G, -02G	0.002	0.002	0.010	0.007	0.005	0.004	0.003	0.004	0.00	0.01	0.00	1.86
2139007-03G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
2139008-02G	0.005	0.004	0.012	0.007	0.006	0.007	0.005	0.006	0.01	0.01	0.01	1.17
Subbasin total	0.006	0.006	0.023	0.014	0.011	0.012	0.008	0.010	0.01	0.01	0.01	1.39
Whitehall Brook												
2139000-01G	0.310	0.340	0.378	0.328	0.333	0.296	0.250	0.245	0.29	0.34	0.25	1.37
2139000-02G	0.234	0.221	0.258	0.208	0.208	0.129	0.168	0.178	0.19	0.23	0.17	1.32
2139000-03G	0.045	0.052	0.057	0.048	0.051	0.055	0.046	0.039	0.05	0.05	0.04	1.19
2139000-04G	0.115	0.146	0.156	0.124	0.126	0.136	0.109	0.095	0.12	0.13	0.10	1.35
2139000-05G	0.155	0.180	0.239	0.162	0.156	0.162	0.117	0.117	0.15	0.18	0.12	1.45
Subbasin total	0.858	0.938	1.09	0.871	0.875	0.779	0.691	0.675	0.80	0.93	0.68	1.36

Appendix 1. Monthly average withdrawals for community public-supply sources by subbasin and year in the Concord River Basin in eastern

[The sum of the withdrawal numbers may not equal the total because of rounding. System type: MC, municipal; NMC, nonmunicipal community; System name: Apt., Water and Sewer Department; WW, Water Works. Source name: GP, gravel-packed; Monthly withdrawals: E, estimated; NAV, not metered, not reported, or otherwise

Source identifier	Community	System type	System name	Source type	Source name	Monthly withdrawals, in million gallons per day			
						Jan.	Feb.	March	April
Lower Concord River Basin									
Lower Concord Main Stem									
3031000-01S	Billerica	MC	Billerica WW	SW	Concord River	3.26	3.25	3.45	3.74
3067000-02G	Concord	MC	Concord WD	GW	Hugh Cargill Well	0.000	0.000	0.000	0.000
Subbasin total	--	--	--	--	--	3.26	3.25	3.45	3.74
River Meadow Brook									
3056000-02G	Chelmsford	MC	Chelmsford WD	GW	Turnpike Road GP Well #1	0.000	0.000	0.000	0.000
3056000-05G, -15G, -16G	Chelmsford	MC	Chelmsford WD	GW	Mill Road GP Wells #1-3	0.568	0.631	0.706	0.680
3056000-09G, 11G	Chelmsford	MC	Chelmsford WD	GW	Riverneck Road GP Wells #1-2	0.648	0.641	0.587	0.607
3056001-01G	Chelmsford	MC	East Chelmsford WD	GW	Canal Street GP Well #1	0.335	0.297	0.329	0.313
Subbasin total	--	--	--	--	--	1.55	1.57	1.62	1.60
Total Concord River Basin									
Basin total	--	--	--	--	--	22.8	23.6	23.9	25.0

Massachusetts, 1996–2000.—Continued

Apartments; Co., Company; Condo., Condominiums; DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District; WSD, unavailable; --, not applicable]

Source identifier	Monthly withdrawals, in million gallons per day											Ratio of summer-to-winter withdrawals
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average Summer	Average Winter	
Lower Concord River Basin												
Lower Concord Main Stem												
3031000-01S	4.19	5.07	5.80	5.20	5.35	3.91	3.57	3.42	4.18	5.12	3.39	1.51
3067000-02G	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Subbasin total	4.19	5.07	5.80	5.20	5.35	3.91	3.57	3.42	4.18	5.12	3.39	1.51
River Meadow Brook												
3056000-02G	0.094	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.01	0.02	0.00	--
3056000-05G, -15G, -16G	0.813	0.620	0.629	0.755	0.610	0.458	0.460	0.458	0.62	0.69	0.56	1.21
3056000-09G, 11G	0.352	0.513	0.658	0.710	0.727	0.661	0.630	0.652	0.62	0.59	0.63	0.94
3056001-01G	0.319	0.307	0.310	0.319	0.307	0.297	0.323	0.319	0.31	0.31	0.32	0.97
Subbasin total	1.58	1.44	1.60	1.78	1.64	1.42	1.41	1.43	1.55	1.61	1.52	1.06
Total Concord River Basin												
Basin total	29.1	30.6	32.7	27.1	30.9	25.5	23.9	23.9	0.29	0.32	0.25	1.27

Appendix 2. Monthly average purchases from the Massachusetts Water Resources Authority by municipal community public-supply systems in the Concord River Basin in eastern Massachusetts, 1996–2000.

[The sum of the purchase numbers may not equal the total because of rounding. MWRA, Massachusetts Water Resources Authority. Town and system name: DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District]

Source identifier	Town and system name	Monthly purchases from MWRA, in million gallons per day															Ratio of summer-to-winter purchases
		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average summer	Average winter	
1996																	
3023000-01P	Bedford WD	1.05	1.12	1.01	0.986	1.23	1.71	1.74	1.69	1.35	1.18	1.10	1.09	1.27	1.54	1.07	1.44
2064000-01P	Clinton WD	2.07	2.17	1.97	2.03	2.05	2.32	2.49	2.55	2.30	2.30	2.07	2.10	2.20	2.34	2.08	1.13
3100000-01P to -04P	Framingham WD	6.67	6.91	6.71	6.90	7.84	8.89	8.88	8.89	7.79	7.06	6.80	6.74	7.51	8.46	6.76	1.25
2170000-01P	Marlborough DPW, WD	2.75	2.48	1.88	1.47	1.56	3.41	4.10	4.20	3.67	2.99	3.26	2.82	2.88	3.39	2.64	1.29
2215000-01P	Northborough WD	0.064	0.034	0.033	0.117	0.163	0.429	0.375	0.251	0.179	0.274	0.211	0.117	0.19	0.28	0.09	3.04
2277000-01P, -02P	Southborough	0.524	0.526	0.519	0.610	0.773	0.964	1.03	0.988	0.742	0.599	0.573	0.550	0.70	0.90	0.54	1.67
3333000-01P	Weston WD	0.973	0.982	0.949	1.05	1.45	2.23	2.13	2.25	1.50	1.09	1.03	0.984	1.39	1.91	0.98	1.95
Basin total	--	14.1	14.2	13.1	13.2	15.1	19.9	20.8	20.8	17.5	15.5	15.0	14.4	16.1	18.8	14.2	1.33
1997																	
3023000-01P	Bedford WD	1.19	1.16	1.14	1.12	1.38	2.02	2.42	1.97	1.51	0.983	0.793	0.778	1.37	1.86	1.01	1.84
2064000-01P	Clinton WD	2.11	2.08	2.03	2.04	2.24	2.54	2.49	2.32	2.32	2.15	2.02	2.05	2.20	2.38	2.06	1.16
3100000-01P to -04P	Framingham WD	5.62	6.10	6.73	6.98	7.59	10.2	11.2	9.72	8.49	7.69	6.94	6.92	7.85	9.44	6.46	1.46
2170000-01P	Marlborough DPW, WD	1.25	0.935	1.01	0.952	1.71	4.87	5.27	4.60	4.06	3.78	3.88	3.08	2.95	4.10	2.03	2.02
2215000-01P	Northborough WD	0.149	0.112	0.072	0.059	0.065	0.587	0.638	0.506	0.141	0.117	0.245	0.055	0.23	0.39	0.13	3.06
2277000-01P, -02P	Southborough	0.561	0.531	0.507	0.569	0.789	1.38	1.71	1.31	1.02	0.599	0.916	0.839	0.89	1.24	0.67	1.85
3333000-01P	Weston WD	0.957	0.965	0.978	1.07	1.39	2.74	3.57	2.81	1.97	1.42	0.986	0.995	1.65	2.50	0.98	2.56
Basin total	--	11.8	11.9	12.5	12.8	15.2	24.4	27.3	23.2	19.5	16.7	15.8	14.7	17.1	21.9	13.3	1.64
1998																	
3023000-01P	Bedford WD	0.656	0.729	0.792	0.797	1.34	1.96	2.60	2.92	3.00	2.43	1.22	0.853	1.61	2.36	0.85	2.78
2064000-01P	Clinton WD	2.27	1.98	1.95	2.06	2.01	1.99	2.35	2.20	2.14	1.81	1.85	1.78	2.03	2.14	1.97	1.09
3100000-01P to -04P	Framingham WD	7.03	6.89	6.88	7.10	8.29	8.35	9.86	9.59	8.77	7.49	6.85	6.95	7.84	8.97	6.92	1.30
2170000-01P	Marlborough DPW, WD	3.01	2.64	1.27	1.23	1.99	2.98	4.21	4.78	4.51	3.65	3.53	3.16	3.08	3.69	2.72	1.36
2215000-01P	Northborough WD	0.102	0.072	0.181	0.459	0.690	0.201	0.568	0.615	0.403	0.051	0.048	0.004	0.28	0.50	0.08	6.10
2277000-01P, -02P	Southborough	0.726	0.683	0.577	0.733	1.06	1.07	1.56	1.56	1.29	0.849	0.763	0.758	0.97	1.31	0.70	1.86
3333000-01P	Weston WD	0.998	0.953	1.03	1.07	1.72	1.80	2.63	2.37	2.04	1.29	0.972	0.979	1.49	2.11	0.99	2.14
Basin total	--	14.8	14.0	12.7	13.5	17.1	18.3	23.8	24.0	22.2	17.6	15.2	14.5	17.3	21.1	14.2	1.48

Appendix 2. Monthly average purchases from the Massachusetts Water Resources Authority by municipal community public-supply systems in the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

[The sum of the purchase numbers may not equal the total because of rounding. MWRA, Massachusetts Water Resources Authority. Town and system name: DPW, Department of Public Works; WD, Water Department, District, Division, or Supply District]

Source identifier	Town and system name	Monthly purchases from MWRA, in million gallons per day															Ratio of summer-to-winter purchases
		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average summer	Average winter	
1999																	
3023000-01P	Bedford WD	1.00	1.17	1.09	0.779	0.754	1.49	1.98	1.80	1.26	0.959	0.830	0.817	1.16	1.46	0.98	1.48
2064000-01P	Clinton WD	1.74	1.78	1.79	1.84	2.03	2.60	2.31	2.21	1.96	1.78	1.71	1.70	1.96	2.22	1.75	1.27
3100000-01P to -04P	Framingham WD	6.94	6.79	6.83	7.25	8.52	11.7	10.8	10.5	8.97	7.75	7.12	7.11	8.36	10.10	6.96	1.45
2170000-01P	Marlborough DPW, WD	3.25	2.59	1.23	1.52	4.01	5.90	5.76	4.87	4.27	3.48	3.10	3.07	3.59	4.96	2.65	1.88
2215000-01P	Northborough WD	0.081	0.031	0.000	0.231	0.381	0.932	0.536	0.687	0.414	0.209	0.062	0.042	0.30	0.59	0.04	13.65
2277000-01P, -02P	Southborough	0.773	0.761	0.739	0.909	1.32	2.30	1.97	1.90	1.32	0.915	0.769	0.763	1.20	1.76	0.76	2.32
3333000-01P	Weston WD	0.926	0.922	0.895	1.13	1.95	3.65	3.39	3.15	2.28	1.22	0.946	0.914	1.78	2.88	0.92	3.13
Basin total	--	14.7	14.1	12.6	13.7	19.0	28.6	26.7	25.1	20.5	16.3	14.5	14.4	18.3	24.0	14.1	1.70
2000																	
3023000-01P	Bedford WD	0.738	0.725	0.807	0.741	0.897	1.47	1.69	1.51	1.57	1.08	0.876	1.092	1.10	1.43	0.85	1.69
2064000-01P	Clinton WD	1.66	1.78	1.67	1.70	1.85	2.02	2.14	1.90	2.02	1.66	1.53	1.47	1.78	1.99	1.62	1.22
3100000-01P to -04P	Framingham WD	7.16	7.38	7.20	7.18	7.87	8.82	9.96	8.83	8.67	7.58	7.07	6.96	7.89	8.83	7.15	1.23
2170000-01P	Marlborough DPW, WD	3.02	2.53	2.59	2.93	1.88	2.97	4.67	4.08	4.15	3.63	3.28	3.27	3.25	3.55	2.94	1.21
2215000-01P	Northborough WD	0.140	0.055	0.080	0.137	0.161	0.326	0.533	0.277	0.328	0.200	0.170	0.276	0.22	0.33	0.14	2.26
2277000-01P, -02P	Southborough	0.798	0.763	0.769	0.862	1.14	1.44	1.90	1.43	1.39	0.986	0.793	0.790	1.09	1.46	0.78	1.86
3333000-01P	Weston WD	0.898	0.975	0.895	0.974	1.46	2.00	2.57	2.11	2.16	1.30	0.973	0.912	1.44	2.06	0.93	2.21
Basin total	--	14.4	14.2	14.0	14.5	15.3	19.1	23.5	20.1	20.3	16.4	14.7	14.8	16.8	19.6	14.4	1.36

Appendix 3. Monthly average withdrawals regulated by the Massachusetts Water Management Act for commercial, industrial, and

[The sum of the withdrawal numbers may not equal the total because of rounding. Use type: COM, commercial; IND, Industrial; AG, agricultural; GOLF,

Subbasin	User name	Use type	Source name	Source type	Monthly withdrawals, in million gallons per day						
					Jan.	Feb.	March	April	May	June	July
1996											
Assabet River Basin											
Assabet Headwaters	Berberian Farm	AG	Smith Pond	SW	0.000	0.000	0.000	0.000	0.008	0.024	0.072
Assabet Headwaters	Bigelow Nurseries	AG	All sources	GW ¹	0.000	0.000	0.000	0.056	0.115	0.140	0.157
Assabet Headwaters	Juniper Hill Golf Course	GOLF	Assabet River	SW	0.000	0.000	0.000	0.000	0.042	0.106	0.092
Assabet Main Stem	Assabet Sand & Gravel	IND	Assabet River	SW	0.000	0.000	0.000	0.175	0.258	0.224	0.234
Assabet Main Stem	Concrete Services	COM	Assabet River	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Assabet Main Stem	Digital Equipment/Intel	IND	All sources	GW	0.007	0.009	0.010	0.008	0.010	0.016	0.012
Assabet Main Stem	Stow Acres Country Club	GOLF	Assabet River	SW	0.000	0.000	0.000	0.000	0.039	0.073	0.113
Danforth Brook	Great Oak Farm	AG	Pond	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Elizabeth Brook	Digital Equipment/Intel	IND	All sources	GW	0.006	0.008	0.009	0.008	0.010	0.019	0.032
Elizabeth Brook	Stow Acres Country Club	GOLF	Pond	SW	0.000	0.000	0.000	0.000	0.005	0.113	0.148
Fort Pond Brook	Idylwilde Farm	AG	Fort Pond Brook	SW	0.000	0.000	0.000	0.000	0.000	0.028	0.027
Nashoba Brook	W.R. Grace	IND	All sources	GW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Basin total	--	--	--		0.014	0.017	0.019	0.247	0.486	0.743	0.887
Sudbury River Basin											
Cedar Swamp	Tyrolit North America/Bay State Sterling	IND	Wells #2-4	GW	0.197	0.218	0.197	0.203	0.197	0.203	0.197
Cold Spring Brook	Kidde-Fenwal, Inc.	IND	Well #1	GW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cold Spring Brook	Weston Nurseries	AG	All sources	SW	0.000	0.000	0.000	0.016	0.286	0.635	0.643
Cold Spring Brook	Weston Nurseries	AG	Well #1	GW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Indian Brook	Weston Nurseries	AG	Island Pond	SW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lake Cochituate	U.S. Army Soldier Systems Center	IND	All sources	GW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Lower Sudbury River	Concord Country Club	GOLF	Well #1	GW	0.000	0.000	0.000	0.005	0.008	0.081	0.060
Lower Sudbury River	Verrill Farm	AG	All sources	SW	0.000	0.000	0.000	0.000	0.000	0.000	0.065
Lower Sudbury River	Nashawtuc Country Club	GOLF	8th Pond	SW	0.000	0.000	0.000	0.002	0.003	0.138	0.152
Reservoir 1-3	Kidde-Fenwal, Inc.	IND	Well #2	GW	0.013	0.012	0.006	0.032	0.036	0.021	0.032
Basin total	--	--	--	--	0.210	0.230	0.203	0.258	0.529	1.08	1.15
Lower Concord River Basin											
River Meadow Brook	Carlisle Cranberries	AG	Bog Reservoir	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Basin total	--	--	--	--	--	--	--	--	--	--	--
Total Concord River Basin											
Basin total	--	--	--	--	0.224	0.248	0.222	0.505	1.015	1.821	2.036

agricultural users in the Concord River Basin in eastern Massachusetts, 1996–2000.

golf-course irrigation. Source type: GW, ground water, SW, surface water. NAV, not reported, not metered, or otherwise unavailable; --, not applicable]

Subbasin	User name	Monthly withdrawals, in million gallons per day—Continued								Ratio of summer-to-winter withdrawals
		Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average summer	Average winter	
1996										
Assabet River Basin										
Assabet Headwaters	Berberian Farm	0.057	0.015	0.000	0.000	0.000	0.01	0.04	0.00	All in summer.
Assabet Headwaters	Bigelow Nurseries	0.163	0.129	0.042	0.000	0.000	0.07	0.14	0.00	All in summer.
Assabet Headwaters	Juniper Hill Golf Course	0.156	0.052	0.007	0.000	0.000	0.04	0.09	0.00	All in summer.
Assabet Main Stem	Assabet Sand & Gravel	0.247	0.211	0.247	0.190	0.158	0.16	0.23	0.07	3.38
Assabet Main Stem	Concrete Services	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Assabet Main Stem	Digital Equipment/Intel	0.012	0.017	0.010	0.008	0.008	0.01	0.01	0.01	1.58
Assabet Main Stem	Stow Acres Country Club	0.152	0.010	0.019	0.000	0.000	0.03	0.08	0.00	All in summer.
Danforth Brook	Great Oak Farm	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Elizabeth Brook	Digital Equipment/Intel	0.017	0.015	0.012	0.010	0.007	0.01	0.02	0.01	2.28
Elizabeth Brook	Stow Acres Country Club	0.177	0.003	0.006	0.000	0.000	0.04	0.09	0.00	All in summer.
Fort Pond Brook	Idylwilde Farm	0.027	0.000	0.000	0.000	0.000	0.01	0.02	0.00	All in summer.
Nashoba Brook	W.R. Grace	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Basin total	--	1.01	0.452	0.345	0.207	0.173	0.38	0.72	0.09	8.31
Sudbury River Basin										
Cedar Swamp	Tyrolit North America/Bay State Sterling	0.197	0.203	0.197	0.333	0.323	0.22	0.20	0.25	0.79
Cold Spring Brook	Kidde-Fenwal, Inc.	0.000	NAV	0.000	0.000	0.000	0.00	0.00	0.00	--
Cold Spring Brook	Weston Nurseries	1.02	0.377	0.221	0.039	0.000	0.27	0.59	0.01	76.00
Cold Spring Brook	Weston Nurseries	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Indian Brook	Weston Nurseries	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Lake Cochituate	U.S. Army Soldier Systems Center	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Lower Sudbury River	Concord Country Club	0.105	0.025	0.004	0.000	0.000	0.02	0.06	0.00	All in summer.
Lower Sudbury River	Verrill Farm	0.065	0.000	0.000	0.000	0.000	0.01	0.03	0.00	All in summer.
Lower Sudbury River	Nashawtuc Country Club	0.267	0.042	0.004	0.000	0.000	0.05	0.12	0.00	All in summer.
Reservoir 1-3	Kidde-Fenwal, Inc.	0.031	0.016	0.009	0.015	0.008	0.02	0.03	0.01	2.47
Basin total	--	1.69	0.664	0.435	0.387	0.331	0.60	1.02	0.27	3.75
Lower Concord River Basin										
River Meadow Brook	Carlisle Cranberries	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Basin total	--	--	--	--	--	--	--	--	--	--
Total Concord River Basin										
Basin total	--	2.695	1.116	0.779	0.594	0.504	0.98	1.74	0.36	4.85

Appendix 3. Monthly average withdrawals regulated by the Massachusetts Water Management Act for commercial, industrial, and

[The sum of the withdrawal numbers may not equal the total because of rounding. Use type: COM, commercial; IND, Industrial; AG, agricultural; GOLF,

Subbasin	User name	Use type	Source name	Source type	Monthly withdrawals, in million gallons per day						
					Jan.	Feb.	March	April	May	June	July
1997											
Assabet River Basin											
Assabet Headwaters	Berberian Farm	AG	Smith Pond	SW	0.000	0.000	0.000	0.000	0.005	0.121	0.114
Assabet Headwaters	Bigelow Nurseries	AG	All sources	GW ¹	0.000	0.000	0.000	0.058	0.104	0.136	0.135
Assabet Headwaters	Juniper Hill Golf Course	GOLF	Assabet River	SW	0.000	0.000	0.000	0.000	0.016	0.211	0.201
Assabet Main Stem	Assabet Sand & Gravel	IND	Assabet River	SW	0.000	0.000	0.078	0.183	0.245	0.233	0.248
Assabet Main Stem	Concrete Services	COM	Assabet River	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Assabet Main Stem	Digital Equipment/Intel	IND	All sources	GW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Assabet Main Stem	Stow Acres Country Club	GOLF	Assabet River	SW	0.000	0.000	0.000	0.000	0.023	0.080	0.129
Danforth Brook	Great Oak Farm	AG	Pond	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Elizabeth Brook	Digital Equipment/Intel	IND	All sources	GW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Elizabeth Brook	Stow Acres Country Club	GOLF	Pond	SW	0.000	0.000	0.000	0.000	0.010	0.093	0.142
Fort Pond Brook	Idylwilde Farm	AG	Fort Pond Brook	SW	0.000	0.000	0.000	0.000	0.000	0.028	0.027
Nashoba Brook	W.R. Grace	IND	All sources	GW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Basin total	--	--	--	--	0.000	0.000	0.078	0.241	0.401	0.903	0.996
Sudbury River Basin											
Cedar Swamp	Tyrolit North America/Bay State Sterling	IND	Wells #2-4	GW	0.312	0.396	0.295	0.291	0.281	0.330	0.395
Cold Spring Brook	Kidde-Fenwal, Inc.	IND	Well #1	GW	0.008	0.006	0.010	0.008	0.004	0.025	0.045
Cold Spring Brook	Weston Nurseries	AG	All sources	SW	0.000	0.000	0.000	0.021	0.310	0.977	1.17
Cold Spring Brook	Weston Nurseries	AG	Well #1	GW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Indian Brook	Weston Nurseries	AG	Island Pond	SW	0.000	0.000	0.000	0.000	0.000	0.001	0.010
Lake Cochituate	U.S. Army Soldier Systems Center	IND	All sources	GW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Lower Sudbury River	Concord Country Club	GOLF	Well #1	GW	0.000	0.000	0.000	0.000	0.064	0.121	0.178
Lower Sudbury River	Verrill Farm	AG	All sources	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Lower Sudbury River	Nashawtuc Country Club	GOLF	8th Pond	SW	0.000	0.000	0.000	0.000	0.069	0.254	0.205
Reservoir 1-3	Kidde-Fenwal, Inc.	IND	Well #2	GW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Basin total	--	--	--	--	0.321	0.402	0.306	0.319	0.729	1.71	2.01
Lower Concord River Basin											
River Meadow Brook	Carlisle Cranberries	AG	Bog Reservoir	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Basin total	--	--	--	--	--	--	--	--	--	--	--
Total Concord River Basin											
Basin total	--	--	--	--	0.321	0.402	0.384	0.560	1.13	2.61	3.00

agricultural users in the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

golf-course irrigation. Source type: GW, ground water, SW, surface water. NAV, not reported, not metered, or otherwise unavailable; --, not applicable]

Subbasin	User name	Monthly withdrawals, in million gallons per day—Continued								Ratio of summer-to-winter withdrawals
		Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average summer	Average winter	
1997										
Assabet River Basin										
Assabet Headwaters	Berberian Farm	0.059	0.015	0.000	0.000	0.000	0.03	0.06	0.00	All in summer.
Assabet Headwaters	Bigelow Nurseries	0.159	0.139	0.057	0.000	0.000	0.07	0.13	0.00	All in summer.
Assabet Headwaters	Juniper Hill Golf Course	0.163	0.148	0.055	0.000	0.000	0.07	0.15	0.00	All in summer.
Assabet Main Stem	Assabet Sand & Gravel	0.182	0.223	0.222	0.182	0.078	0.16	0.23	0.07	3.35
Assabet Main Stem	Concrete Services	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Assabet Main Stem	Digital Equipment/Intel	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Assabet Main Stem	Stow Acres Country Club	0.145	0.030	0.016	0.000	0.000	0.04	0.08	0.00	All in summer.
Danforth Brook	Great Oak Farm	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Elizabeth Brook	Digital Equipment/Intel	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Elizabeth Brook	Stow Acres Country Club	0.165	0.053	0.026	0.000	0.000	0.04	0.09	0.00	All in summer.
Fort Pond Brook	Idylwilde Farm	0.027	0.000	0.000	0.000		0.01	0.02	0.00	All in summer.
Nashoba Brook	W.R. Grace	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Basin total	--	0.900	0.608	0.377	0.182	0.078	0.40	0.76	0.07	11.26
Sudbury River Basin										
Cedar Swamp	Tyrolit North America/Bay State Sterling	0.457	0.452	0.468	0.332	0.457	0.37	0.38	0.36	1.07
Cold Spring Brook	Kidde-Fenwal, Inc.	0.016	0.008	0.021	0.020	0.014	0.02	0.02	0.01	1.67
Cold Spring Brook	Weston Nurseries	0.825	0.573	0.325	0.128	0.266	0.38	0.77	0.08	9.79
Cold Spring Brook	Weston Nurseries	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Indian Brook	Weston Nurseries	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Lake Cochituate	U.S. Army Soldier Systems Center	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Lower Sudbury River	Concord Country Club	0.161	0.034	0.000	0.000	0.000	0.05	0.11	0.00	All in summer.
Lower Sudbury River	Verrill Farm	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Lower Sudbury River	Nashawtuc Country Club	0.101	0.039	0.022	0.000	0.000	0.06	0.13	0.00	All in summer.
Reservoir 1-3	Kidde-Fenwal, Inc.	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Basin total	--	1.56	1.11	0.836	0.480	0.737	0.88	1.42	0.45	3.17
Lower Concord River Basin										
River Meadow Brook	Carlisle Cranberries	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Basin total	--	--	--	--	--	--	--	--	--	--
Total Concord River Basin										
Basin total	--	2.46	1.71	1.21	0.662	0.815	1.27	2.18	0.52	4.23

Appendix 3. Monthly average withdrawals regulated by the Massachusetts Water Management Act for commercial, industrial, and

[The sum of the withdrawal numbers may not equal the total because of rounding. Use type: COM, commercial; IND, Industrial; AG, agricultural; GOLF,

Subbasin	User name	Use type	Source name	Source type	Monthly withdrawals, in million gallons per day						
					Jan.	Feb.	March	April	May	June	July
1998											
Assabet River Basin											
Assabet Headwaters	Berberian Farm	AG	Smith Pond	SW	0.000	0.000	0.000	0.000	0.027	0.005	0.091
Assabet Headwaters	Bigelow Nurseries	AG	All sources	GW ¹	0.000	0.000	0.000	0.040	0.092	0.144	0.150
Assabet Headwaters	Juniper Hill Golf Course	GOLF	Assabet River	SW	0.000	0.000	0.000	0.013	0.108	0.066	0.160
Assabet Main Stem	Assabet Sand & Gravel	IND	Assabet River	SW	0.000	0.000	0.081	0.217	0.220	0.253	0.231
Assabet Main Stem	Concrete Services	COM	Assabet River	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Assabet Main Stem	Digital Equipment/Intel	IND	All sources	GW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Assabet Main Stem	Stow Acres Country Club	GOLF	Assabet River	SW	0.000	0.000	0.000	0.000	0.065	0.033	0.123
Danforth Brook	Great Oak Farm	AG	Pond	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Elizabeth Brook	Digital Equipment/Intel	IND	All sources	GW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Elizabeth Brook	Stow Acres Country Club	GOLF	Pond	SW	0.000	0.000	0.000	0.000	0.071	0.007	0.106
Fort Pond Brook	Idylwilde Farm	AG	Fort Pond Brook	SW	0.000	0.000	0.000	0.000	0.000	0.028	0.027
Nashoba Brook	W.R. Grace	IND	All sources	GW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Basin total	--	--	--	--	0.000	0.000	0.081	0.271	0.583	0.536	0.889
Sudbury River Basin											
Cedar Swamp	Tyrolit North America/Bay State Sterling	IND	Wells #2-4	GW	0.368	0.407	0.387	0.360	0.358	0.360	0.310
Cold Spring Brook	Kidde-Fenwal, Inc.	IND	Well #1	GW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cold Spring Brook	Weston Nurseries	AG	All sources	SW	0.000	0.000	0.023	0.107	0.461	0.443	0.698
Cold Spring Brook	Weston Nurseries	AG	Well #1	GW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Indian Brook	Weston Nurseries	AG	Island Pond	SW	0.000	0.000	0.000	0.000	0.000	0.000	0.004
Lake Cochituate	U.S. Army Soldier Systems Center	IND	All sources	GW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Lower Sudbury River	Concord Country Club	GOLF	Well #1	GW	0.000	0.000	0.000	0.000	0.028	0.000	0.141
Lower Sudbury River	Verrill Farm	AG	All sources	SW	0.000	0.000	0.000	0.000	0.000	0.000	0.065
Lower Sudbury River	Nashawtuc Country Club	GOLF	8th Pond	SW	0.000	0.000	0.000	0.021	0.039	0.060	0.115
Reservoir 1-3	Kidde-Fenwal, Inc.	IND	Well #2	GW	0.007	0.005	0.003	0.008	0.007	0.009	0.037
Basin total	--	--	--	--	0.375	0.412	0.414	0.496	0.893	0.872	1.37
Lower Concord River Basin											
River Meadow Brook	Carlisle Cranberries	AG	Bog Reservoir	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Basin total	--	--	--	--	--	--	--	--	--	--	--
Total Concord River Basin											
Basin total	--	--	--	--	0.375	0.412	0.494	0.766	1.48	1.41	2.26

agricultural users in the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

golf-course irrigation. Source type: GW, ground water, SW, surface water. NAV, not reported, not metered, or otherwise unavailable; --, not applicable]

Subbasin	User name	Monthly withdrawals, in million gallons per day—Continued								Ratio of summer-to-winter withdrawals
		Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average summer	Average winter	
1998										
Assabet River Basin										
Assabet Headwaters	Berberian Farm	0.086	0.038	0.000	0.000	0.000	0.02	0.05	0.00	All in summer.
Assabet Headwaters	Bigelow Nurseries	0.167	0.122	0.039	0.000	0.000	0.06	0.14	0.00	All in summer.
Assabet Headwaters	Juniper Hill Golf Course	0.196	0.144	0.072	0.000	0.000	0.06	0.13	0.00	All in summer.
Assabet Main Stem	Assabet Sand & Gravel	0.225	0.167	0.209	0.217	0.109	0.16	0.22	0.08	2.70
Assabet Main Stem	Concrete Services	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Assabet Main Stem	Digital Equipment/Intel	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Assabet Main Stem	Stow Acres Country Club	0.103	0.053	0.023	0.000	0.000	0.03	0.08	0.00	All in summer.
Danforth Brook	Great Oak Farm	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Elizabeth Brook	Digital Equipment/Intel	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Elizabeth Brook	Stow Acres Country Club	0.132	0.080	0.032	0.000	0.000	0.04	0.08	0.00	All in summer.
Fort Pond Brook	Idylwilde Farm	0.027	0.000	0.000	0.000		0.01	0.02	0.00	All in summer.
Nashoba Brook	W.R. Grace	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Basin total	--	0.936	0.605	0.375	0.217	0.109	0.38	0.71	0.08	8.73
Sudbury River Basin										
Cedar Swamp	Tyrolit North America/Bay State Sterling	0.213	0.160	0.194	0.110	0.242	0.29	0.28	0.30	0.93
Cold Spring Brook	Kidde-Fenwal, Inc.	0.000	NAV	0.000	0.000	0.000	0.00	0.00	0.00	--
Cold Spring Brook	Weston Nurseries	0.916	0.656	0.351	0.131	0.000	0.32	0.63	0.03	20.63
Cold Spring Brook	Weston Nurseries	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Indian Brook	Weston Nurseries	0.002	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Lake Cochituate	U.S. Army Soldier Systems Center	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Lower Sudbury River	Concord Country Club	0.154	0.064	0.004	0.000	0.000	0.03	0.08	0.00	All in summer.
Lower Sudbury River	Verrill Farm	0.065	0.000	0.000	0.000	0.000	0.01	0.03	0.00	All in summer.
Lower Sudbury River	Nashawtuc Country Club	0.199	0.132	0.043	0.000	0.000	0.05	0.11	0.00	All in summer.
Reservoir 1-3	Kidde-Fenwal, Inc.	0.009	0.008	0.009	0.008	0.009	0.01	0.01	0.01	2.16
Basin total	--	1.56	1.02	0.600	0.249	0.251	0.71	1.14	0.34	3.36
Lower Concord River Basin										
River Meadow Brook	Carlisle Cranberries	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Basin total	--	--	--	--	--	--	--	--	--	--
Total Concord River Basin										
Basin total	--	2.49	1.62	0.975	0.466	0.360	1.09	1.85	0.42	4.40

Appendix 3. Monthly average withdrawals regulated by the Massachusetts Water Management Act for commercial, industrial, and

[The sum of the withdrawal numbers may not equal the total because of rounding. Use type: COM, commercial; IND, Industrial; AG, agricultural; GOLF,

Subbasin	User name	Use type	Source name	Source type	Monthly withdrawals, in million gallons per day						
					Jan.	Feb.	March	April	May	June	July
1999											
Assabet River Basin											
Assabet Headwaters	Berberian Farm	AG	Smith Pond	SW	0.000	0.000	0.000	0.004	0.037	0.137	0.079
Assabet Headwaters	Bigelow Nurseries	AG	All sources	GW ¹	0.000	0.000	0.000	0.044	0.079	0.142	0.148
Assabet Headwaters	Juniper Hill Golf Course	GOLF	Assabet River	SW	0.000	0.000	0.000	0.005	0.151	0.218	0.194
Assabet Main Stem	Assabet Sand & Gravel	IND	Assabet River	SW	0.000	0.000	0.056	0.194	0.211	0.250	0.182
Assabet Main Stem	Concrete Services	COM	Assabet River	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Assabet Main Stem	Digital Equipment/Intel	IND	All sources	GW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Assabet Main Stem	Stow Acres Country Club	GOLF	Assabet River	SW	0.000	0.000	0.000	0.033	0.084	0.290	0.238
Danforth Brook	Great Oak Farm	AG	Pond	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Elizabeth Brook	Digital Equipment/Intel	IND	All sources	GW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Elizabeth Brook	Stow Acres Country Club	GOLF	Pond	SW	0.000	0.000	0.000	0.027	0.101	0.144	0.122
Fort Pond Brook	Idylwilde Farm	AG	Fort Pond Brook	SW	0.000	0.000	0.000	0.000	0.000	0.028	0.027
Nashoba Brook	W.R. Grace	IND	All sources	GW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Basin total	--	--	--	--	0.000	0.000	0.056	0.307	0.664	1.21	0.991
Sudbury River Basin											
Cedar Swamp	Tyrolit North America/Bay State Sterling	IND	Wells #2-4	GW	0.160	0.180	0.186	0.220	0.002	0.181	0.242
Cold Spring Brook	Kidde-Fenwal, Inc.	IND	Well #1	GW	<0.001	<0.001	<0.001	<0.001	<0.001	0.000	0.000
Cold Spring Brook	Weston Nurseries	AG	All sources	SW	0.000	0.000	0.009	0.215	0.741	1.13	0.939
Cold Spring Brook	Weston Nurseries	AG	Well #1	GW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Indian Brook	Weston Nurseries	AG	Island Pond	SW	0.000	0.000	0.000	0.000	0.003	0.002	0.000
Lake Cochituate	U.S. Army Soldier Systems Center	IND	All sources	GW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Lower Sudbury River	Concord Country Club	GOLF	Well #1	GW	0.000	0.000	0.000	0.098	0.127	0.300	0.239
Lower Sudbury River	Verrill Farm	AG	All sources	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Lower Sudbury River	Nashawtuc Country Club	GOLF	8th Pond	SW	0.000	0.000	0.000	0.018	0.090	0.189	0.169
Reservoir 1-3	Kidde-Fenwal, Inc.	IND	Well #2	GW	0.023	0.016	0.016	0.020	0.018	0.043	0.021
Basin total	--	--	--	--	0.183	0.196	0.211	0.570	0.980	1.85	1.61
Lower Concord River Basin											
River Meadow Brook	Carlisle Cranberries	AG	Bog Reservoir	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Basin total	--	--	--	--	--	--	--	--	--	--	--
Total Concord River Basin											
Basin total	--	--	--	--	0.183	0.196	0.267	0.877	1.64	3.05	2.60

agricultural users in the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

golf-course irrigation. Source type: GW, ground water, SW, surface water. NAV, not reported, not metered, or otherwise unavailable; --, not applicable]

Subbasin	User name	Monthly withdrawals, in million gallons per day—Continued								Ratio of summer-to-winter withdrawals
		Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average summer	Average winter	
1999										
Assabet River Basin										
Assabet Headwaters	Berberian Farm	0.082	0.022	0.000	0.000	0.000	0.03	0.07	0.00	All in summer.
Assabet Headwaters	Bigelow Nurseries	0.173	0.161	0.055	0.000	0.000	0.07	0.14	0.00	All in summer.
Assabet Headwaters	Juniper Hill Golf Course	0.214	0.083	0.010	0.000	0.000	0.07	0.17	0.00	All in summer.
Assabet Main Stem	Assabet Sand & Gravel	0.176	0.207	0.204	0.143	0.124	0.15	0.21	0.06	3.19
Assabet Main Stem	Concrete Services	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Assabet Main Stem	Digital Equipment/Intel	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Assabet Main Stem	Stow Acres Country Club	0.197	0.030	0.006	0.000	0.000	0.07	0.17	0.00	All in summer.
Danforth Brook	Great Oak Farm	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Elizabeth Brook	Digital Equipment/Intel	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Elizabeth Brook	Stow Acres Country Club	0.065	0.027	0.016	0.000	0.000	0.04	0.09	0.00	All in summer.
Fort Pond Brook	Idylwilde Farm	0.027	0.000	0.000	0.000	0.000	0.01	0.02	0.00	All in summer.
Nashoba Brook	W.R. Grace	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Basin total	--	0.934	0.529	0.291	0.143	0.124	0.44	0.87	0.06	13.42
Sudbury River Basin										
Cedar Swamp	Tyrolit North America/Bay State Sterling	0.290	0.269	0.218	0.182	0.165	0.19	0.20	0.17	1.13
Cold Spring Brook	Kidde-Fenwal, Inc.	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Cold Spring Brook	Weston Nurseries	0.947	0.412	0.168	0.029	0.000	0.38	0.83	0.01	107.77
Cold Spring Brook	Weston Nurseries	0.052	0.027	0.000	0.000	0.000	0.01	0.02	0.00	All in summer.
Indian Brook	Weston Nurseries	0.001	0.000	0.000	0.000	0.000	0.00	0.00	0.00	All in summer.
Lake Cochituate	U.S. Army Soldier Systems Center	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Lower Sudbury River	Concord Country Club	0.257	0.092	0.014	0.004	0.000	0.09	0.20	0.00	All in summer.
Lower Sudbury River	Verrill Farm	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Lower Sudbury River	Nashawtuc Country Club	0.134	0.027	0.006	0.001	0.000	0.05	0.12	0.00	All in summer.
Reservoir 1-3	Kidde-Fenwal, Inc.	0.034	0.026	0.023	0.031	0.016	0.02	0.03	0.02	1.39
Basin total	--	1.72	0.853	0.429	0.248	0.182	0.75	1.40	0.20	6.87
Lower Concord River Basin										
River Meadow Brook	Carlisle Cranberries	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Basin total	--	--	--	--	--	--	--	--	--	--
Total Concord River Basin										
Basin total	--	2.65	1.38	0.720	0.391	0.305	1.19	2.27	0.27	8.45

Appendix 3. Monthly average withdrawals regulated by the Massachusetts Water Management Act for commercial, industrial, and

[The sum of the withdrawal numbers may not equal the total because of rounding. Use type: COM, commercial; IND, Industrial; AG, agricultural; GOLF,

Subbasin	User name	Use type	Source name	Source type	Monthly withdrawals, in million gallons per day						
					Jan.	Feb.	March	April	May	June	July
2000											
Assabet River Basin											
Assabet Headwaters	Berberian Farm	AG	Smith Pond	SW	0.000	0.000	0.000	0.000	0.000	0.012	0.086
Assabet Headwaters	Bigelow Nurseries	AG	All sources	GW ¹	0.000	0.000	0.000	0.000	0.105	0.192	0.533
Assabet Headwaters	Juniper Hill Golf Course	GOLF	Assabet River	SW	0.000	0.000	0.000	0.009	0.042	0.042	0.179
Assabet Main Stem	Assabet Sand & Gravel	IND	Assabet River	SW	0.000	0.000	0.131	0.177	0.208	0.171	0.140
Assabet Main Stem	Concrete Services	COM	Assabet River	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Assabet Main Stem	Digital Equipment/Intel	IND	All sources	GW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Assabet Main Stem	Stow Acres Country Club	GOLF	Assabet River	SW	0.000	0.000	0.000	0.000	0.006	0.025	0.172
Danforth Brook	Great Oak Farm	AG	Pond	SW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Elizabeth Brook	Digital Equipment/Intel	IND	All sources	GW	0.000	0.000	0.000	0.000	0.082	0.085	0.000
Elizabeth Brook	Stow Acres Country Club	GOLF	Pond	SW	0.000	0.000	0.000	0.030	0.012	0.056	0.115
Fort Pond Brook	Idylwilde Farm	AG	Fort Pond Brook	SW	0.000	0.000	0.000	0.000	0.000	0.028	0.027
Nashoba Brook	W.R. Grace	IND	All sources	GW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Basin total	--	--	--	--	0.000	0.000	0.131	0.217	0.455	0.611	1.25
Sudbury River Basin											
Cedar Swamp	Tyrolit North America/Bay State Sterling	IND	Wells #2-4	GW	0.147	0.191	0.209	0.202	0.228	0.269	0.195
Cold Spring Brook	Kidde-Fenwal, Inc.	IND	Well #1	GW	0.000	0.000	0.000	<0.001	<0.001	<0.001	0.000
Cold Spring Brook	Weston Nurseries	AG	All sources	SW	0.000	0.000	0.000	0.118	0.294	0.599	0.958
Cold Spring Brook	Weston Nurseries	AG	Well #1	GW	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Indian Brook	Weston Nurseries	AG	Island Pond	SW	0.000	0.000	0.000	0.000	0.002	0.005	0.005
Lake Cochituate	U.S. Army Soldier Systems Center	IND	All sources	GW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Lower Sudbury River	Concord Country Club	GOLF	Well #1	GW	0.000	0.000	0.000	0.005	0.069	0.070	0.138
Lower Sudbury River	Verrill Farm	AG	All sources	SW	0.000	0.000	0.000	0.003	0.007	0.100	0.097
Lower Sudbury River	Nashawtuc Country Club	GOLF	8th Pond	SW	0.000	0.000	0.000	0.000	0.029	0.054	0.084
Reservoir 1-3	Kidde-Fenwal, Inc.	IND	Well #2	GW	0.021	0.022	0.020	0.016	0.024	0.029	0.024
Basin total	--	--	--	--	0.168	0.213	0.229	0.344	0.654	1.13	1.50
Lower Concord River Basin											
River Meadow Brook	Carlisle Cranberries	AG	Bog Reservoir	SW	NAV	NAV	NAV	NAV	NAV	NAV	NAV
Basin total	--	--	--	--	--	--	--	--	--	--	--
Total Concord River Basin											
Basin total	--	--	--	--	0.168	0.213	0.360	0.561	1.11	1.74	2.75

¹Includes ground-water and surface-water sources

agricultural users in the Concord River Basin in eastern Massachusetts, 1996–2000.—Continued

golf-course irrigation. Source type: GW, ground water, SW, surface water. NAV, not reported, not metered, or otherwise unavailable; --, not applicable]

Subbasin	User name	Monthly withdrawals, in million gallons per day—Continued								Ratio of summer-to-winter withdrawals
		Aug.	Sept.	Oct.	Nov.	Dec.	Average monthly	Average summer	Average winter	
2000										
Assabet River Basin										
Assabet Headwaters	Berberian Farm	0.026	0.058	0.000	0.000	0.000	0.02	0.04	0.00	All in summer.
Assabet Headwaters	Bigelow Nurseries	0.434	0.110	0.104	0.000	0.000	0.12	0.27	0.00	All in summer.
Assabet Headwaters	Juniper Hill Golf Course	0.110	0.100	0.032	0.002	0.000	0.04	0.09	0.00	All in summer.
Assabet Main Stem	Assabet Sand & Gravel	0.210	0.128	0.127	0.129	0.018	0.12	0.17	0.06	3.09
Assabet Main Stem	Concrete Services	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Assabet Main Stem	Digital Equipment/Intel	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Assabet Main Stem	Stow Acres Country Club	0.133	0.100	0.040	0.000	0.000	0.04	0.09	0.00	All in summer.
Danforth Brook	Great Oak Farm	0.000	0.000	0.000	0.000	0.000	--	--	--	--
Elizabeth Brook	Digital Equipment/Intel	0.000	0.000	0.000	0.000	0.000	0.01	0.03	0.00	All in summer.
Elizabeth Brook	Stow Acres Country Club	0.095	0.050	0.028	0.000	0.000	0.03	0.07	0.00	All in summer.
Fort Pond Brook	Idylwilde Farm	0.027	0.000	0.000	0.000	0.000	0.01	0.02	0.00	All in summer.
Nashoba Brook	W.R. Grace	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Basin total	--	1.04	0.546	0.331	0.131	0.018	0.39	0.78	0.06	13.93
Sudbury River Basin										
Cedar Swamp	Tyrolit North America/Bay State Sterling	0.255	0.241	0.227	0.225	0.213	0.22	0.24	0.20	1.21
Cold Spring Brook	Kidde-Fenwal, Inc.	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Cold Spring Brook	Weston Nurseries	0.600	0.586	0.395	0.030	0.000	0.30	0.61	0.01	100.68
Cold Spring Brook	Weston Nurseries	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Indian Brook	Weston Nurseries	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	--
Lake Cochituate	U.S. Army Soldier Systems Center	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Lower Sudbury River	Concord Country Club	0.149	0.066	0.030	0.004	0.000	0.04	0.10	0.00	All in summer.
Lower Sudbury River	Verrill Farm	0.056	0.017	0.002	0.000	0.000	0.02	0.06	0.00	All in summer.
Lower Sudbury River	Nashawtuc Country Club	0.091	0.077	0.018	0.000	0.000	0.03	0.07	0.00	All in summer.
Reservoir 1-3	Kidde-Fenwal, Inc.	0.043	0.031	0.035	0.004	0.054	0.03	0.03	0.02	1.25
Basin total	--	1.19	1.02	0.707	0.263	0.266	0.64	1.10	0.23	4.83
Lower Concord River Basin										
River Meadow Brook	Carlisle Cranberries	NAV	NAV	NAV	NAV	NAV	--	--	--	--
Basin total	--	--	--	--	--	--	--	--	--	--
Total Concord River Basin										
Basin total	--	2.23	1.56	1.04	0.394	0.284	1.36	1.88	0.28	6.62

For additional information call or write to:

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