YIELDS AND WATER QUALITY OF STRATIFIED-DRIFT AQUIFERS IN THE SOUTHEAST COASTAL BASIN, COHASSET TO KINGSTON, MASSACHUSETTS

By James H. Persky

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Multiply	By	To Obtain
	Length	
inch (in.)	2.54	centimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
	Area	
square foot (ft^2)	0.09290	square meter
square mile (mi^2)	2.590	square kilometer
	Volume	
cubic foot (ft^3)	0.02832	cubic meter
gallon (gal)	0.003785	cubic meter
	Flow	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
gallon per minute (gal/min)	0.06308	liter per second
million gallons per day (Mgal/d)	0.04381	cubic meter per second
	Transmissivity	
cubic foot per day per square foot times foot of aquifer thickness $[(ft^3/d)ft^2]/ft$ (reduces to ft^2/d)	0.09290	cubic meter per day per square meter times meter of aquifer thickness

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929--a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Yields and Water Quality of Stratified-Drift Aquifers in the Southeast Coastal basin, Cohasset to Kingston, Massachusetts

By James H. Persky

ABSTRACT

The southeastern coastal area of Massachusetts (105 square miles) between Cohasset and Kingston is drained into Massachusetts Bay by several small rivers and coastal streams, including the North, South, and Jones Rivers. The major aquifers are stratified sand and gravel deposits of glacial origin. The yields from intercepted ground-water discharge and induced streamflow infiltration were determined for 21 major aquifers in the basin. Of these aquifers, 14 had a sustainable yield of at least 1.0 Mgal/d (million gallons per day) 80 percent of the time, and 10 had a sustainable yield of at least 1.0 Mgal/d 99 percent of the time. The two aquifers with the highest yields are the two aquifers with the greatest areal extent. The yields of the Duxbury Coastal and Kingston Coastal aquifers are 6.5 and 5.2 Mgal/d 80 percent of the time, and are 4.9 and 3.9 Mgal/d 99 percent of the time. Ground water was withdrawn from 14 of the aquifers for public supply in 1986; surface water was withdrawn in the recharge area of one of the other seven aquifers.

Twenty-seven water samples from 19 wells and the Jones River were analyzed for physical properties, common constituents, nutrients, selected trace elements, and phenols. The samples had pH values ranging from 5.2 to 7.5, meaning the water was slightly acidic and mildly corrosive to plumbing. The water is characterized as soft; all but one sample had a hardness of less than 60 milligrams per liter (as calcium carbonate). Alkalinity generally reflected a poor capacity to neutralize acid. Sodium was the dominant cation in most samples; chloride was generally the most abundant anion, but bicarbonate or sulfate was most abundant in several samples. Sodium concentrations in water samples from four wells exceeded the Massachusetts Department of Environmental Protection drinking-water standard of 20 milligrams per liter. Iron concentrations exceeded the U.S. Environmental Protection Agency secondary drinking-water standard of 300 micrograms per liter in seven wells and the Jones River; the secondary drinking-water standard of 50 micrograms per liter for manganese was exceeded in 10 wells and the Jones River. The highest phenol concentration detected was 12 micrograms per liter.

Water samples from 12 wells were tested for 36 volatile organic compounds. Methyl chloride was detected in two wells, at concentrations of 4.7 and 5.4 micrograms per liter; trichlorofluoromethane was detected in one well at a concentration of 4.3 micrograms per liter. Pesticides were not detected in water samples from two wells beside cranberry bogs.

INTRODUCTION

The southeastern coastal area of Massachusetts between Cohasset and Kingston is drained into Massachusetts Bay by several small rivers and coastal streams, including the North, South, and Jones Rivers (fig. 1). The combined 105 mi^2 drainage area of these rivers and streams is referred to in this report as the Southeast Coastal basin. All or part of 17 towns lie within the Southeast Coastal basin; nine of these lie mainly within the basin. Of the latter group, seven towns receive at least part of their municipal water supply from ground water. Cohasset and Rockland rely on surface water from ponds and reservoirs, using wells only as emergency sources. Scituate uses both surface and ground water. In addition, two of the three ponds that compose the main water supply for Brockton and Whitman--communities in the adjacent Taunton River basin--are in the Southeast Coastal basin.

Rapid population growth in southeastern Massachusetts has increased the demand on public water supplies. Brockton, which diverts about 40 percent of the water pumped from the Southeast Coastal basin to the Taunton River basin for public supply, has experienced chronic water shortages; in 1986, the State denied Brockton permission to increase the interbasin transfer of water. Scituate, Marshfield, Abington, Rockland, Duxbury, and Kingston reported to state officials in 1982 that current supplies would be insufficient to meet peak demands in 1990 at the current rate of growth (Massachusetts Division of Water Resources, written commun., 1984). Marshfield, Kingston, Brockton, Whitman, and Hanson declared water supply emergencies in 1987 and several other towns have imposed restrictions on use of municipal water.

As communities continue to grow and stresses on public supplies increase, State and local officials are coming under increased pressure to locate new supplies of potable water and provide optimal management of the existing supplies. To assess the capability of the ground-water resources in the Southeast Coastal basin to meet future demand, the U.S. Geological Survey conducted a hydrologic study of the resources. The main objectives of this study were to delineate the major stratified-drift aquifers in the basin and to estimate the potential sustained yield of each aquifer--the amount of water that can be withdrawn on a long-term basis without depleting the aquifer. This study was conducted in cooperation with the Massachusetts Department of Environmental Management, Office of Water Resources, under Chapter 800 Massachusetts legislation calling for quantitative assessment of the State's ground-water resources.

Purpose and Scope

This report is an assessment of the amounts of ground-water available from the major stratified-drift aquifers in the Southeast Coastal water resources planning basin which might be developed and sustained over the long term. It describes the general hydrogeology of the area, the source of water and the hydrologic properties of the geologic materials. Maps showing the distribution of saturated stratified drift more than 40 ft thick and showing aquifer transmissivity are included. Well construction and drilling information collected since the previous investigation (Williams and Tasker, 1974, sheet 2) were used to verify or correct the aquifer distribution and transmissivity map. A table of approximately 400 wells and test borings is included in the report (table 7). The sustainable yields of the major bodies of the mapped stratified drift are estimated on a basis of flow of streams draining them. Withdrawals are compared with the aquifer yields available for different amounts of time (duration). The causes of common ground water-quality problems are described and a general description of ground-water quality is summarized.

Previous Investigations

The geology and ground-water resources of towns in the basin have been extensively explored, and are described in numerous engineering reports by consulting firms. The data from many of these reports and from local well drillers are collected in Petersen (1962), Maevsky and Drake (1963), and Williams, Willey, and Tasker (1975). The geology in parts of the basin was mapped by Chute (1965a, 1965b) and Shaw and Petersen (1967). Williams and Tasker (1974) prepared U.S. Geological Survey Hydrologic Investigations Atlas HA-504 assessing the basin's surface- and ground-water resources as part of a Statewide cooperative program between the Massachusetts Office of Water Resources and the U.S. Geological Survey. The U.S. Department of Agriculture (1982) and the Massachusetts Water Resources Commission, Division of Water Pollution Control (1975) have prepared planning reports for water-resource management in the North and South River basins. Surface-water-quality classifications for the North and South Rivers were presented by the Metropolitan Area Planning Council (1977, p. 403-420). The Harvard Graduate School of Design (1977) outlined land-management methods for the tide-influenced portion

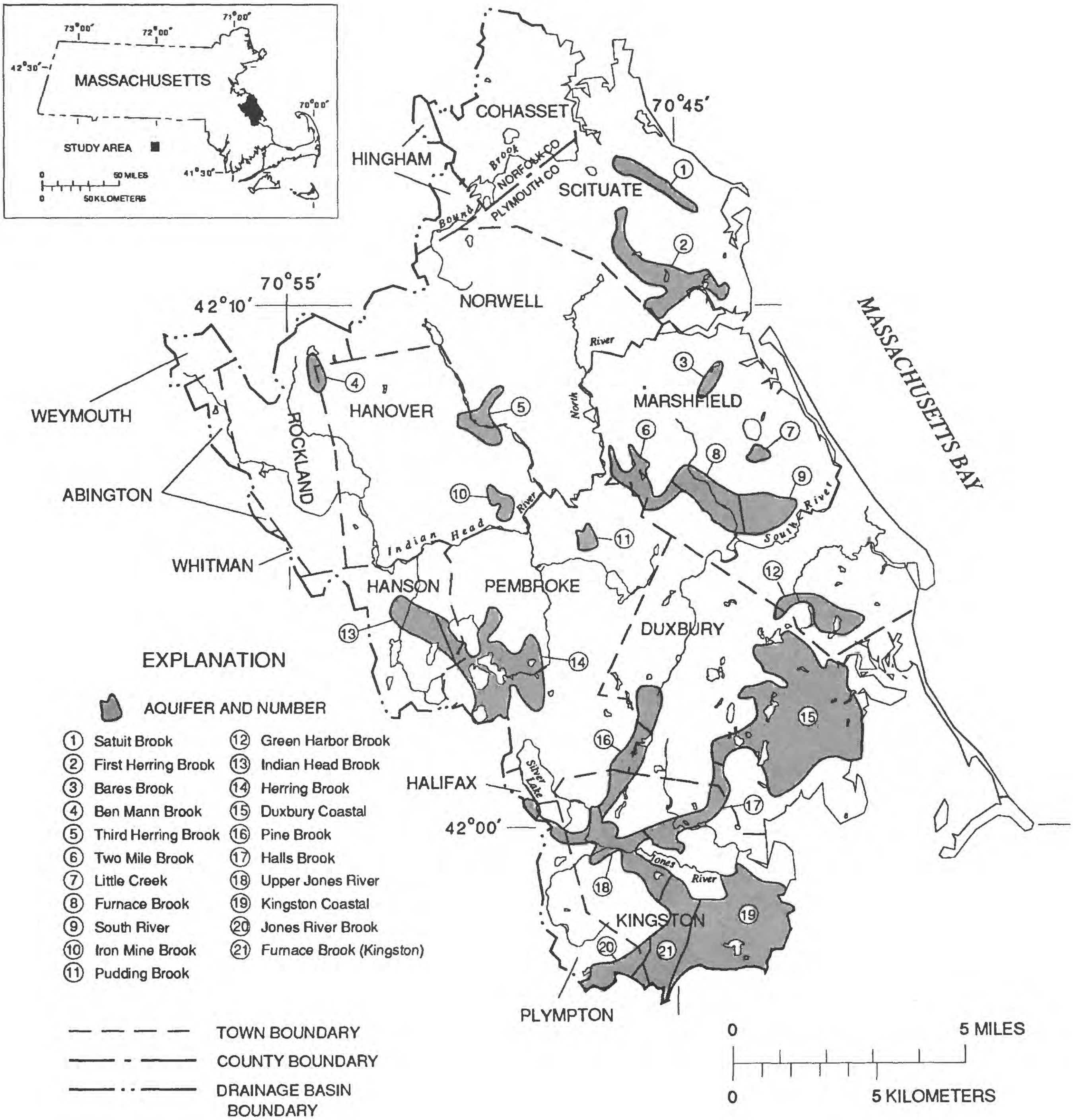

Figure 1. --Index map of study area and major stratified-drift aquifers in the Southeast Coastal basin.

of the North River. The U.S. Department of Agriculture (1975) presented descriptions of existing and potential reservoir sites. Wandle and Morgan (1984) presented streamflow characteristics at several sites in the basin. Johnson (1986) analyzed the distribution of streamflow in the Jones River and its tributaries under baseflow conditions. Noake (1988) assessed the potential effects of land use upon the water quality of Silver Lake, and inventoried the available data on the watershed for the Pilgrim Resource Conservation and Development Area Council.

Acknowledgments

The author is grateful for the information and assistance provided by many persons and agencies during this study. Numerous landowners granted access to their property for field investigations and provided information on present and historic land and water use. Town officials provided results of previous site studies, water-use information and access to town property and wells. The Massachusetts Water Resources Commission, Department of Environmental Management Division of Resource Conservation, Department of Environmental Protection, and U.S. Environmental Protection Agency provided water-use, lithologic, and water-quality information. Many consulting firms provided lithologic data and the results of site studies, either directly or through the towns; these firms include Whitman & Howard, Inc.; SEA Consultants, Inc.; IEP, Inc.; Goldberg-Zoino & Associates, Inc.; Amory Engineers, P.C.; Linenthal Eisenberg Anderson, Inc.; Shooshanian Engineering Associates, Inc.; M. Anthony Lally Associates; Camp, Dresser, and McKee, Inc.; and Weston Geophysical Engineers, Inc. The University of Massachusetts Cranberry Experiment Station provided information on pesticide use by cranberry growers. The author is particularly grateful to Francis Phillips, Roger Correira, and the personnel of the Kingston Water and Highway Departments for their continuous assistance and patience.

HYDROGEOLOGY OF THE STUDY AREA

Western Pembroke, northern Marshfield, Rockland, Whitman, Hanson, and part of Hanover are underlain by sedimentary rocks of Upper and Middle Pennsylvanian Age. The rest of the study area is underlain by igneous and metamorphic rock of Precambrian age, primarily granite and diorite (Zen, 1983, sheet 1).

Bedrock is exposed in most of Cohasset; the rest of the basin is generally covered by a mantle of unconsolidated material deposited during the Wisconsinan glaciation. These glacial deposits are classified into two groups--till and stratified drift.

Till is a compact, poorly sorted unconsolidated sediment consisting of clay, silt, sand, gravel, and cobbles deposited directly from glacial ice (sorting is the extent to which sediment is segregated by grain size). Hills in the study area are characteristically covered with a layer of till; some hills, called drumlins, consist almost entirely of till.

Stratified drift consists of glacial sediments transported and deposited by meltwater from the glacial ice. The deposits are layered, and moderately- to well-sorted with respect to grain size. Because stratified drift is deposited by water, these deposits are typically found in valleys. Where the ice margin remained stationary for a relatively long period during glacial retreat, thick deposits were formed. These deposits consist of sand and gravel deposited by streams and silt and clay deposited in deltas and lake bottoms. Where stratified drift is exposed at the land surface, a thin layer of till commonly mantles the bedrock beneath the stratified drift.

The northern half of the study area is characterized by valley deposits of outwash separated by till uplands. In the southern half, extensive stratified-drift deposits are prevalent. Thick deposits of sand and gravel are abundant in western Pembroke and eastern Duxbury. Southeastern Pembroke is underlain by delta or lake-bottom deposits which were formed in glacial Taunton Valley Lake (Shaw and Petersen, 1967; Stone and Peper, 1982, p. 150). In southern Kingston, ice-contact deposits grade into the thick outwash sheets that cover Plymouth and Cape Cod. The Monks Hill Moraine in southern Kingston, composed of sandy till, marks a temporary location of the ice margin during the glacial retreat. In some areas, including large sections of Scituate, Marshfield, and Duxbury, till from a re-advance of the glacier overlies sand and gravel deposits (fig. 2); these deposits have been discussed by Kaye (1983, p. 24-31).

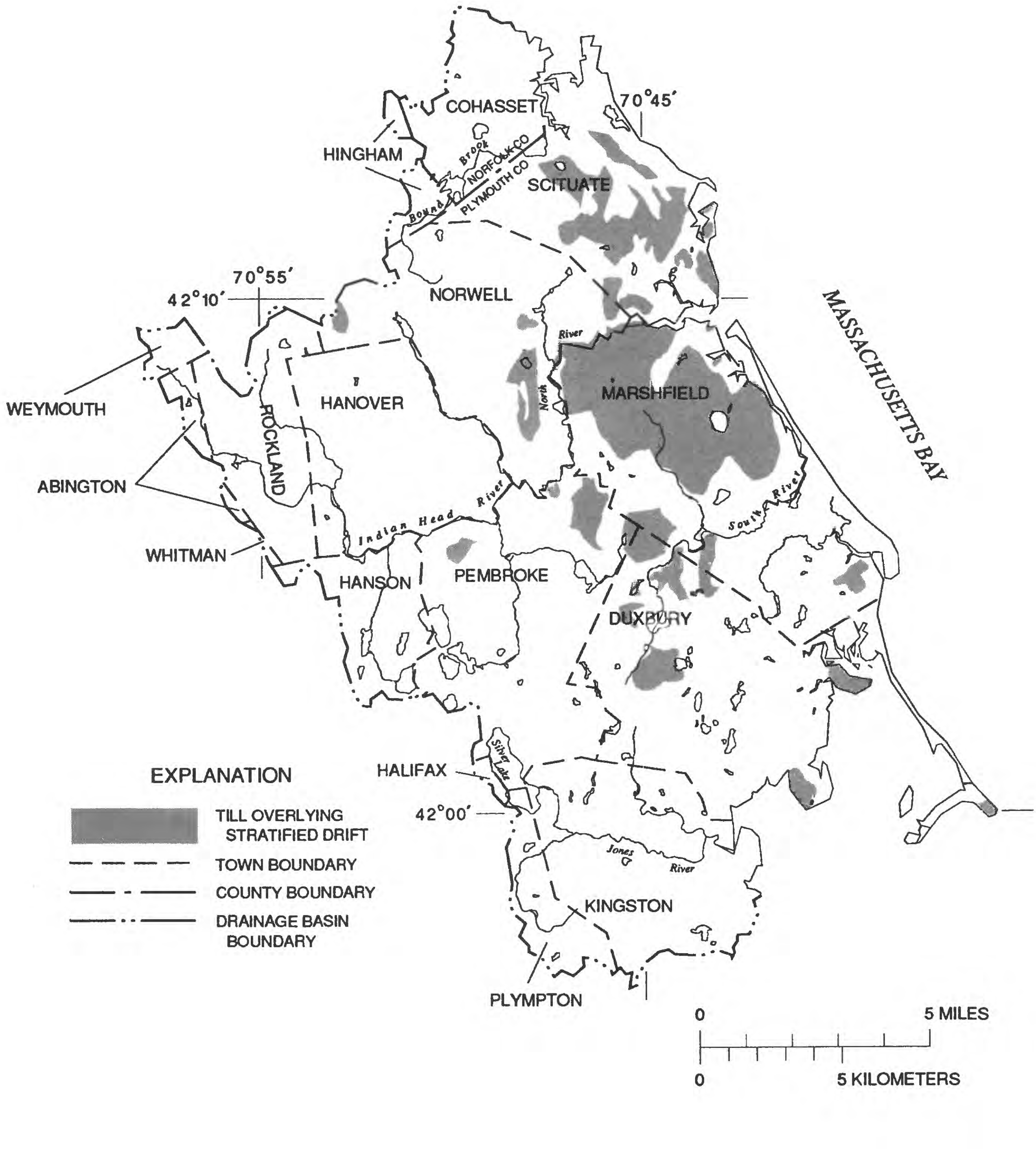

Figure 2.--Deposits of till overlying stratified drift in the Southeast Coastal basin.

Ground-Water-Level Fluctuations

Ground-water levels are not constant; they rise with increased recharge and fall as discharge exceeds recharge. In New England, ground-water levels tend to rise from October through the winter months as rain and snowmelt recharge the aquifer, reaching an annual high usually in March or April. During the summer months, ground-water discharge continues, but most percolating water is intercepted by plant roots or evaporates before it can recharge the aquifer. The lowest water levels of the year usually occur in September or October, at the end of the growing season.

Monthly water-level measurements from 1965 to 1988 for two wells in the Southeast Coastal basin are shown in figure 3. The annual fluctuation of the water level in these wells averages 2 to 3 ft. The water level varies from year to year based on the amount of precipitation. For example, water levels in the two wells were unusually low during the winter of 1984-85 because of a lack of recharge. Over a period of many years, however, the water levels in these two wells do not show either a rising or declining trend; the long-term average is constant.

Hydrogeologic Characteristics

Bedrock in the Southeast Coastal basin is not porous; water is transmitted primarily within joints and fractures in the rock caused by geologic stresses after the rock was formed. The yield of 133 bedrock wells in the basin recorded by Williams and Tasker (1974, sheet 2) ranged from 0.5 to 128 gal/min, with a median yield of 6 gal/min. The yield from bedrock wells depends on the number, size, and interconnections of the joints and fractures in the rock. These wells commonly supply adequate quantities of water for household use, but generally have insufficient yield for public supply. The Town of Hanover was investigating the water-supply potential of bedrock along a major geologic fault in 1989; in 1991, the Town proposed the use of two bedrock wells for public supply.

Wells finished in till are also suitable only for domestic supply. Till is compact and usually contains a large fraction of clay, which inhibits flow of water through the deposit. In some tills, much of the clay has been removed by meltwater, thereby increasing the yield of the material. This process is common in moraines in southeastern Massachusetts. However, these "sandy tills" still do not supply enough water for public supplies.

The only materials in the Southeast Coastal basin capable of yielding the large volumes of water needed for public supply are the stratified-drift deposits. Even some of these deposits are unsuitable as public-supply aquifers, however. Fine-grained stratified drift, such as that in southeastern Pembroke, has a low hydraulic conductivity; although the pore spaces between sediment grains are abundant and interconnected, the small pores are largely filled with water bound to the grains by surface tension, and the high ratio of surface area to pore volume causes frictional resistance to flow. The coarse sand and gravel deposits have large pore spaces that readily permit ground-water flow and are the best aquifers in the area, commonly yielding 300 gal/min or more to individual wells.

A rock (consolidated or unconsolidated) must be able to transmit water to be useful as an aquifer. This means the rock must have open spaces (pores or fractures) to hold the water, and the spaces must be interconnected enough for water to flow through the material to a pumped well. Hydraulic conductivity is a measure of the rate at which water flows through a unit area of a cross-section of the aquifer material under unit gradient.

In order to assess the suitability of a location for a water-supply well, the concept of hydraulic conductivity is extended from a unit-area cross-section of material to the entire thickness of the aquifer. This is done by multiplying the horizontal hydraulic conductivity of the material by the saturated thickness (the distance from the water table to the underlying till or bedrock). The product is called transmissivity. Williams and Tasker (1974, sheet 2) estimated that, in southeastern Massachusetts, a properly constructed well at a site with a transmissivity of 1,350 $[(ft^3/d)/ft^2]/ft$[1] would yield 100 gal/min, and a well at a site with a transmissivity of 4,000 ft^2/d would yield 300 gal/min.

Plate 1 is a map of the transmissivity of unconsolidated stratified deposits in the study area. This map is revised from Williams and Tasker (1974, sheet 2) on the basis of data for approximately 400

[1] $[(ft^3/d)ft^2]/ft$ = cubic foot per day per square foot times foot of aquifer thickness (reduces to ft^2/d).

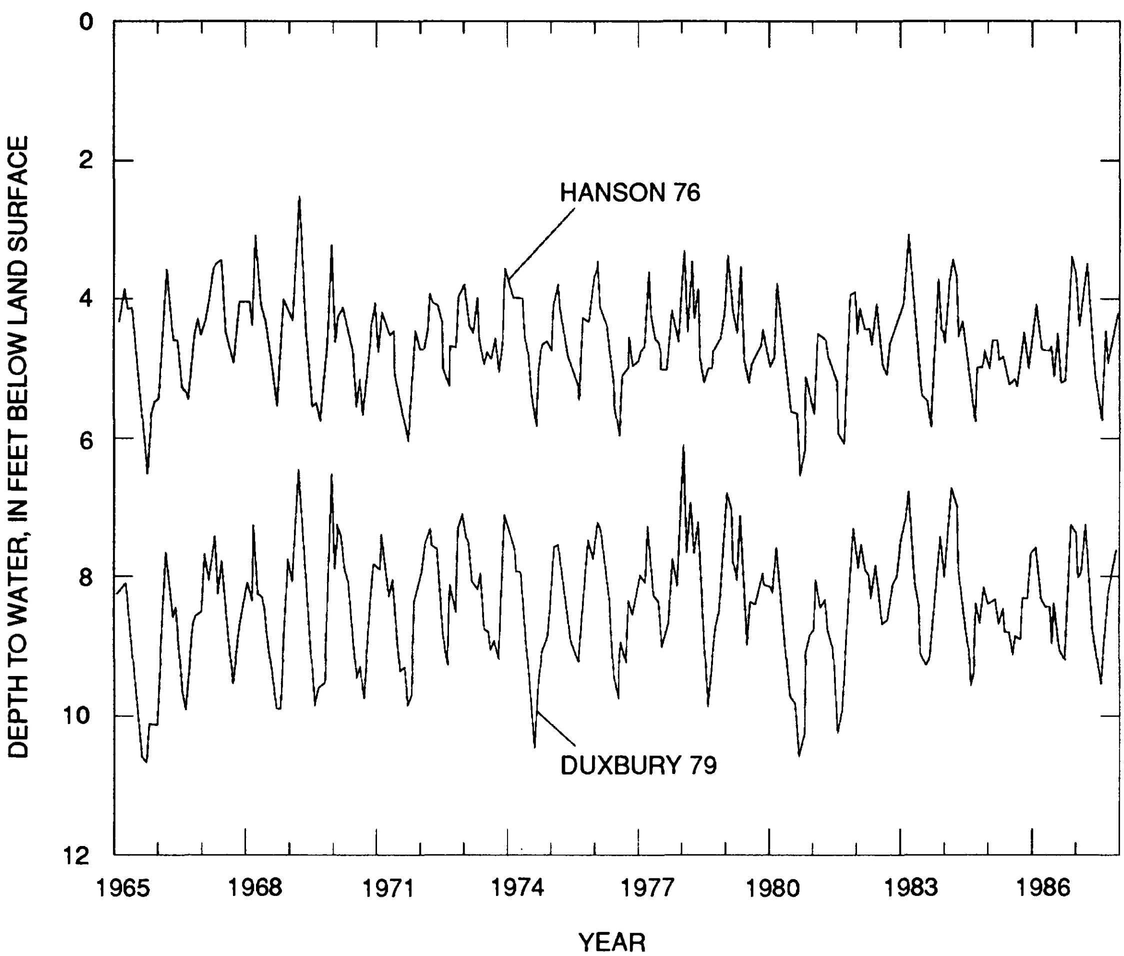

Figure 3.--Water-level fluctuation in Hanson well 76 and Duxbury well 79.

additional wells and test borings drilled during 1972-86. Most of these holes were drilled during exploration for public water supplies. Descriptions of the wells and borings are included in table 7 at the back of this report; their locations are shown in plate 1. The average horizontal hydraulic conductivity of the unconsolidated material at each site was estimated from sediment grain size recorded in the borehole log, using a table that relates aquifer grain size to hydraulic conductivities measured with aquifer tests and estimated from specific capacities of test wells (Brackley and Hansen, 1977, sheet 2). The transmissivity at the site was then calculated by multiplying the hydraulic conductivity by the saturated thickness of the unconsolidated material. Seismic-refraction surveys conducted for this study along Fountainhead Brook in Kingston and surveys conducted in Hanover by Weston Geophysical Engineers, Inc., were also used to estimate saturated thickness.

The transmissivity contours mapped by Williams and Tasker (1974, sheet 2) were generally retained where no new data were available. Therefore, plate 1 differs from the previous map mainly in Marshfield, Duxbury, and Kingston, the towns most active in test drilling in the intervening years. In these towns, new data indicate that areas of high-transmissivity deposits are less extensive than those mapped by Williams and Tasker (1974, sheet 2). Transmissivities were found to be higher than indicated by the previous map in the vicinities of the Church Street, Ferry Street, and Union Street #1 wells (Marshfield 266, 292, and 291) in Marshfield, and in small areas in central and western Duxbury. New data for the other towns in the basin do not indicate any significant re-definition of the transmissivity mapped by Williams and Tasker (1974, sheet 2).

In order to provide an overview of ground-water availability in the basin, plate 2 shows the location of unconsolidated stratified deposits that had both a transmissivity of at least 1,350 ft^2/d and a saturated thickness of at least 40 ft. Forty ft was chosen as a reasonable cut-off value for saturated thickness, to allow for a 10-ft-long well screen, 20 ft of drawdown, State regulations that require public-well screens to be submerged by at least 5 ft, and a 5-ft margin for water-level fluctuations caused by meteorological factors.

The areas mapped on plate 2 with transmissivities of at least 4,000 ft^2/d are the areas most likely to support public-supply wells. The locations of current public-water supplies in the Southeast Coastal basin are shown in plate 2. Plate 2 shows that some town wells had been sited in aquifers less than 40 ft thick. For example, Norwell's Washington Street wells (Norwell 327 and 328) pump from 35 ft of sand and gravel. Moderate yields can also be obtained from shallow, transmissive deposits with well fields of several small diameter wells pumped on a common suction line. The Mt. Skirgo (Marshfield 25) and Webster #2 (Marshfield 198 to 204) pumping stations in Marshfield are wellfields used to limit drawdown where an aquifer is less than 40 ft thick.

In some areas, recharge to the high-transmissivity deposits may not be adequate to sustain steady flow of water to a well. Land use, such as industrial and residential development or siting of landfills and sewage-disposal sites, may render some areas unsuitable for public-supply wells.

As the towns in the basin have conducted extensive test drilling, it is unlikely that any large areas of high-transmissivity material remain to be found in the basin. However, the thickness and transmissivity of the stratified material underlying till in northern Marshfield (fig. 2) are still largely unknown.

DELINEATION OF THE MAJOR STRATIFIED-DRIFT AQUIFERS

The major aquifers in the Southeast Coastal basin were delineated on the basis of a minimum transmissivity of 1,350 ft^2/d and a minimum saturated thickness of 40 ft (pl. 2). Most of the aquifers were named for the streams that drain them. In Duxbury and Kingston, the extensive sand-and-gravel deposits that drain to the ocean or to small coastal streams were named the Duxbury Coastal and Kingston Coastal aquifers. In all, 21 major aquifers were delineated.

The large areas of aquifer material in Marshfield, Kingston, Pembroke, and Hanson (pl. 2) underlie more than one surface-drainage basin. These areas were divided into several aquifers based on surface drainage because insufficient water-table data were available to define ground-water divides. The Herring Brook aquifer is defined as only that part of the large sand sheet in Pembroke and Hanson that is drained by Herring Brook. The Pudding Brook aquifer lies between Pudding Brook and Robinson Creek in Pembroke; ground water from the aquifer discharges to both streams. The Green Harbor Brook aquifer in Marshfield includes deposits in which ground-water flow is toward the ocean rather than Green Harbor Brook. The Upper Jones River aquifer includes not only part of the Jones River Valley, but also the basins of Fountainhead Brook and two unnamed tributaries. The Halls Brook aquifer includes the materials along the tributaries Mile Brook and Bassett Brook.

In areas where deposits of aquifer material underlie more than one surface-drainage basin, the locations of the surface-water and ground-water divides may not be coincident, especially if there is pumping near the surface-water divide. For example, from interpretation of geologic and seismic-refraction data along Fountainhead Brook in Kingston, ground-water flows beneath the surface-water divide and recharges the part of the aquifer tapped by the South Street well (Kingston well 42) in the Furnace Brook basin. For this study, however, surface-water and ground-water divides were assumed to coincide.

The location and areal extent of the aquifers reflect the geology of the basin. The northern half of the basin is characterized by small aquifers that lie along river valleys between till uplands. The southern half of the basin includes the extensive outwash and ice-contact deposits that comprise the Herring Brook, Duxbury Coastal, and Kingston Coastal aquifers.

GROUND-WATER DISCHARGE AND FLOW DURATION

In the Southeast Coastal basin, ground water continuously discharges to streams, except when the ground-water level drops below the level of the

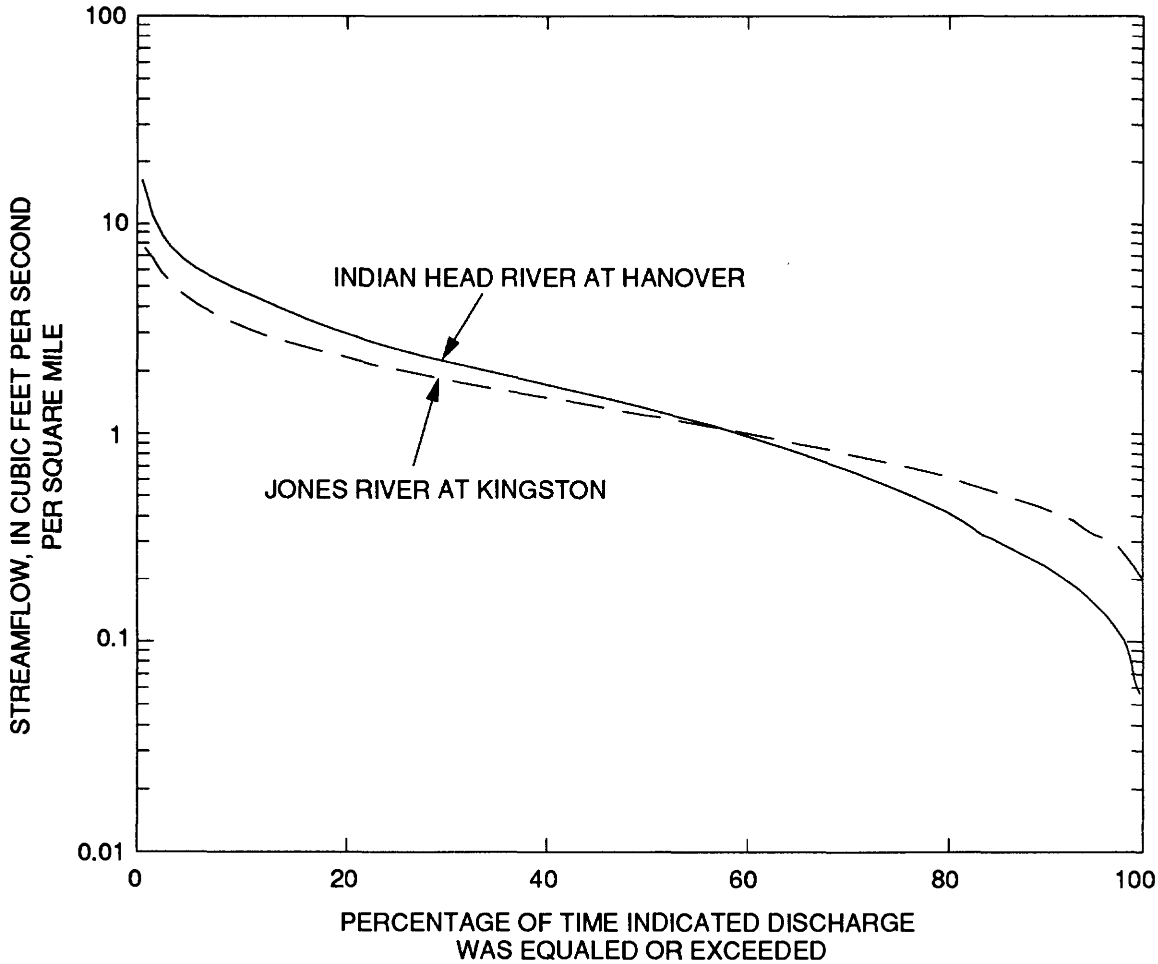

Figure 4.--Flow-duration curves for continuous-record streamflow sites in the Southeast Coastal basin.

streambed as a consequence of pumping or reduction in recharge. The component of streamflow contributed by ground-water discharge is called base flow. When no precipitation has occurred in a stream basin for several days, the water in the stream consists almost entirely of base flow (some base flow may also be released from storage in ponds or wetlands). The stream is then said to be under base-flow conditions.

Figure 4 shows flow-duration curves for the period of record (water years[2] 1969-87) for the two U.S. Geological Survey continuous-record streamflow sites in the Southeast Coastal basin, the Indian Head River[3] at Hanover and the Jones River at Kingston. The locations of these sites are shown in figure 5. These curves show the percentage of time that streamflow can be expected to equal or exceed a given value.

In glaciated terranes like the study area, the shape of a stream's flow-duration curve depends, in part, on the basin geology. For example, a greater percentage of the Jones River basin is covered with stratified drift than the Indian Head River basin. Although both basins receive about the same amount of precipitation, more of this water can infiltrate the sandy soil to recharge the ground water in the Jones River basin. This leaves less water available as surface runoff; thus, during high-flow conditions, the Jones River has less discharge per square mi of drainage area than the Indian Head River. During base-flow conditions, however, the Jones River has a greater discharge per square mi of drainage area than the Indian Head River, because the stratified drift has retained ground water that is later available for discharge to the stream. Rivers in basins covered primarily by strati-

[2] Water year begins October 1 of the previous calendar year and ends September 30.
[3] Indian Head River is the name given to the portion of the North River that is not tide-influenced.

fied drift tend to have duration curves with flatter slopes than rivers in basins covered primarily by till or bedrock. On the basis of the relation of base flow to surficial geology, several studies in New England have used the areal extent of stratified drift in basins to estimate the low-flow characteristics of streams (Thomas, 1966; Tasker, 1972; Cervione and others, 1982; Weiss, 1983).

Streamflow measurements were made at 29 sites to obtain data on ground-water discharge from stratified-drift aquifers (fig. 5); the measurements are listed in table 1. Measurements made under base-flow conditions are marked with an asterisk and reflect the ground-water discharge in the stream basins. Plate 2 shows the location of the measurement sites in relation to the major aquifers. Many streams in the study area are regulated for flood control or irrigation of cranberry bogs, especially in the Jones River basin. Flow measurements of regulated streams may not accurately reflect natural flow conditions. During extreme low flows, the velocities of some streams were below the calibrated range of the current meter; therefore, some of the measurements may slightly underestimate the actual streamflow.

The duration of the measured flows at the 29 streamflow sites could not be directly determined because continuous streamflow records were not available. All flow measurements were indexed to the duration of the concurrent flow at a continuous-record streamflow site in order to estimate the flow duration.

Most of the streamflow measurements were made during a period of very low flow. The concurrent flows at the Indian Head River at Hanover were exceeded 97 percent of the time. Many of the measurements in the Jones River basin were made when the flow of the Jones River at Kingston was at a level exceeded 94 percent of the time. These low flows indicate the capacity of the surficial deposits to sustain ground-water discharge to the streams, which is one measure of aquifer yield.

The difference between low-flow and extreme low-flow conditions can be dramatic. For example, base-flow measurements were made on the South River and several streams in the North River basin on August 14, 1987. The same sites were measured again on August 25, after 11 additional days with no rain. During this period, the flow in Third Herring Brook below Mill Pond near Hanover dropped from 1.4 to 0.09 ft^3/s, Herring Brook at Pembroke dropped from 6.3 to 1.4 ft^3/s, and the South River at Marshfield dropped from 3.6 to 0.46 ft^3/s.

Most of the major aquifers in the Southeast Coastal basin lie along tributaries to the North, South, and Jones Rivers; the tributaries are small, often only a few ft in width, and drain small areas. As a result, the discharge from most of these streams during low-flow conditions is small. As a reference point for the discharge values in table 1, 0.67 ft^3 is equivalent to 300 gal/min, the amount of water that Williams and Tasker (1974, sheet 2) estimated a well would yield if sited in material with a transmissivity of 4,000 ft^2/d. Some streams in basins underlain primarily by stratified drift have a fairly high discharge per square mi of drainage area, though the drainage area is small. Furnace Brook in Kingston is an example with slightly more than 1 ft^3/s at 96 percent flow-duration.

YIELDS OF THE MAJOR STRATIFIED-DRIFT AQUIFERS

Approach

Base-flow measurements reflect ground-water discharge within a drainage basin. Streamflows measured at the downstream end of an aquifer include surface runoff from the upstream portion of the drainage basin (water that could be induced to recharge a well beside the stream) and ground-water discharge from the aquifer (water that could be intercepted by a well before it discharges to the stream). These are the principal components of the long-term yield of the aquifer.

Ground-water storage in the aquifer is a minor component of the long-term aquifer yield, but it can supply a substantial short-term yield. During drought conditions, most water pumped from an aquifer is derived from storage. Pumping from storage for long periods can cause the water level in the aquifer to decline substantially. Depletions of ground-water storage are usually restored annually by recharge during the non-growing season--thus water that replenishes storage is not available for ground-water discharge.

In this study, long-term aquifer yields, considered to be equivalent to the total volume of intercepted ground-water discharge and induced infiltration available from streamflow, were determined using base-flow analysis. Like streamflow, aquifer yields can be considered to have durations; a greater yield is available 80 percent of the time than is available 99 percent of the time. The yields available 80, 90, 95,

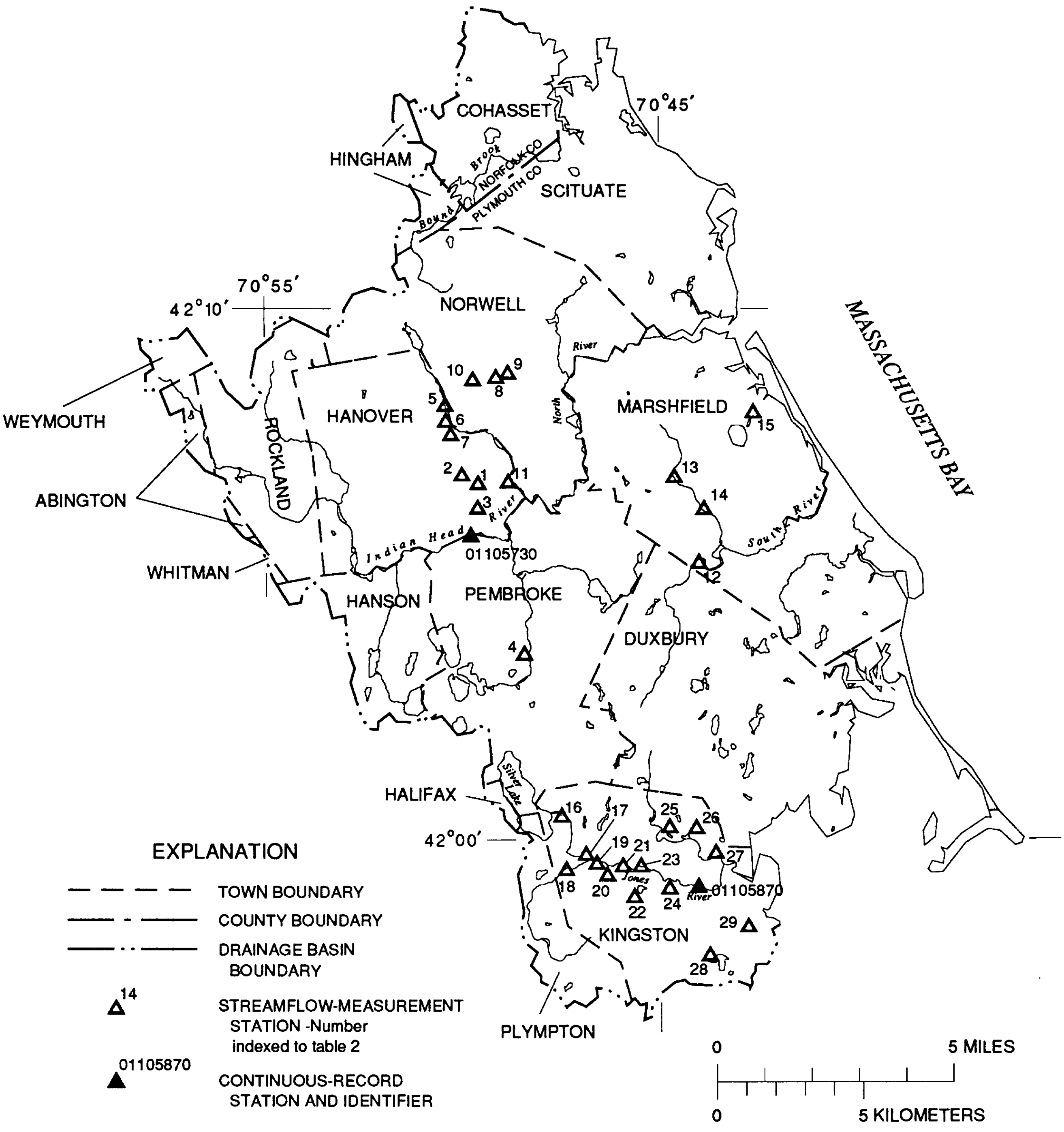

Figure 5.--Streamflow-measurement stations in the Southeast Coastal basin.

Table 1.--*Discharge measurements in the Southeast Coastal basin*

[mi^2, square miles; ft^3/s, cubic feet per second; >, greater than; *, base-flow measurement]

Flow duration in percent exceedance for concurrent discharge at the given index gage: Indian Head River at Hanover, Mass. (station number 01105730) or Jones River at Kingston, Mass. (station number 01105870).

Number in figure 5	Station number and stream	Tributary to	Location	Drainage area (mi^2)	Measurement Date	Measurement Discharge (ft^3/s)	Flow duration at index gage	Index gage
1	01105740 Iron Mine Brook	Indian Head River	Lat 42°06′52" Long 70°49′22", Plymouth County, at culvert on State Highway 139, 0.4 mi northwest of Hanover, Mass.	0.07	8-14-87 8-25-87	*0.08 *.12	97.7 >99.9	Indian Head River
2	01105750 Iron Mine Brook tributary	Iron Mine Brook	Lat 42°07′06" Long 70°49′41", Plymouth County, at culvert on Hanover Street, 0.8 mi northwest of Hanover, Mass.	.35	8-14-87 8-25-87	*0 (dry) *0 (dry)	97.7 >99.9	Indian Head River
3	01105760 Iron Mine Brook	Indian Head River	Lat 42°06′30" Long 70°49′18", Plymouth County, at culvert on Broadway, 0.4 mi southwest of Hanover, Mass.	.81	8-14-87 8-25-87	*.11 *.04	97.7 >99.9	Indian Head River
4	01105770 Herring Brook	North River	Lat 42°03′43" Long 70°48′09", Plymouth County, at culvert on Mountain Avenue, 0.8 mi southeast of Pembroke, Mass.	5.61	8-14-87 8-25-87	*6.3 *1.4	82 96	Jones River
5	01105806 Third Herring Brook	North River	Lat 42°08′22" Long 70°50′07", Plymouth County, 80 ft downstream from dam at mouth of Mill Pond, 2.2 mi northwest of Hanover, Mass.	2.77	8-14-87 8-25-87	*1.4 *.09	97.7 >99.9	Indian Head River
6	011058065 Third Herring Brook	North River	Lat 42°08′02" Long 70°50′01", Plymouth County, at sluiceway on Pond Street, 1.8 mi northwest of Hanover, Mass.	2.82	8-14-87 8-25-87	*.86 *0 (dry)	97.7 >99.9	Indian Head River
7	01105807 Silver Brook	Third Herring Brook	Lat 42°07′57" Long 70°50′01", Plymouth County, at culvert on Pond Street, 1.7 mi northwest of Hanover, Mass.	1.25	8-14-87 8-25-87	*.12 *.03	97.7 >99.9	Indian Head River
8	01105808 Wildcat Brook	Third Herring Brook	Lat 42°08′57" Long 70°48′59", Plymouth County, at culvert on Pleasant Street, 1.4 mi southwest of Norwell, Mass.	.24	8-14-87 8-25-87	*.04 *0 (dry)	97.7 >99.9	Indian Head River

Table 1.--*Discharge measurements in the Southeast Coastal basin*--Continued

Number in figure 5	Station number and stream	Tributary to	Location	Drainage area (mi^2)	Measurement Date	Measurement Discharge (ft^3/s)	Flow duration at index gage	Index gage
9	011058085 Wildcat Brook tributary	Wildcat Brook	Lat 42°09'03" Long 70°48'42", Plymouth County, at culvert on Circuit Street, 1.1 mi southwest of Norwell, Mass.	0.87	8-14-87 8-25-87	*0.04 *.01	97.7 >99.9	Indian Head River
10	01105809 Wildcat Creek	Wildcat Brook	Lat 42°08'49" Long 70°49'31", Plymouth County, at culvert on Pleasant Street, 1.9 mi southwest of Norwell, Mass.	1.46	8-14-87 8-25-87	*.02 *0	97.7 >99.9	Indian Head River
11	01105810 Third Herring Brook	North River	Lat 42°07'01" Long 70°48'35", Plymouth County, at culvert on River Street, 0.5 mi northeast of Hanover, Mass.	9.80	8-14-87 8-25-87	*.72 *.10	97.7 >99.9	Indian Head River
12	01105845 South River	Massachusetts Bay	Lat 42°05'32" Long 70°43'50", Plymouth County, at culvert on Old Ocean Street, 0.8 mi west of Marshfield, Mass.	7.52	8-14-87 8-25-87	*3.6 *.46	97.7 >99.9	Indian Head River
13	01105848 Furnace Brook	South River	Lat 42°07'06" Long 70°44'34", Plymouth County, at culvert on School Street, 2.5 mi northwest of Marshfield, Mass.	.88	8-26-87	*.01	99.8	Indian Head River
14	01105850 Furnace Brook	South River	Lat 42°06'30" Long 70°43'53", Plymouth County, at culvert on Furnace Street, 1.8 mi northwest of Marshfield, Mass.	1.57	8-14-87 8-26-87	*.32 *.26	97.7 99.8	Indian Head River
15	01105852 Littles Creek	South River	Lat 42°08'09" Long 70°42'35", Plymouth County, 100 ft downstream from culvert on Summer Street, 1.7 mi southeast of Marshfield Hills, Mass.	2.00	8-14-87 8-26-87	*1.1 *.87	97.7 99.8	Indian Head River
16	01105856 Jones River	Massachusetts Bay	Lat 42°00'43" Long 70°47'16", Plymouth County, 100 ft downstream from culvert on Lake Street, 2.0 mi northeast of North Plympton, Mass.	4.18	8-21-87	*.01	95	Jones River
17	01105859 Pine Brook	Jones River	Lat 42°00'03" Long 70°46'34", Plymouth County, at culvert on Grove Street, 1.8 mi northeast of North Plympton, Mass.	4.81	8-19-87 8-21-87 9-17-87	*.28 *.44 .94	96 95 58	Jones River

Table 1.--*Discharge measurements in the Southeast Coastal basin*--Continued

Number in figure 5	Station number and stream	Tributary to	Location	Drainage area (mi^2)	Measurement Date	Discharge (ft^3/s)	Flow duration at index gage	Index gage
18	01105861 Jones River Brook	Jones River	Lat 41°59'47" Long 70°47'18", Plymouth County, at culvert on West Street, 1.2 mi northeast of North Plympton, Mass.	4.72	8-21-87	*0.44	95	Jones River
19	01105862 Jones River	Massachusetts Bay	Lat 41°59'53" Long 70°46'23", Plymouth County, at culvert on private road, 2700 ft north of State Highway 106, 2.1 mi west of Kingston, Mass.	14.7	8-18-87	*2.3	94	Jones River
20	01105864 Jones River tributary No. 2	Jones River	Lat 41°59'41" Long 70°46'15", Plymouth County, at dirt road, 1800 ft north of State Highway 106, 2.0 mi west of Kingston, Mass.	.52	8-18-87	*.26	94	Jones River
21	01105865 Jones River	Massachusetts Bay	Lat 41°59'46" Long 70°45'41", Plymouth County, 30 ft upstream from confluence with cranberry bog, 1.6 mi west of Kingston, Mass.	16.2	5-23-86 8-18-87	28 *2.2	31 94	Jones River
22	01105866 Fountainhead Brook	Jones River	Lat 41°59'14" Long 70°45'42", Plymouth County, 1800 ft south of State Highway 106, 1.7 mi southwest of Kingston, Mass.	.53	8-18-87	*.04	94	Jones River
23	01105867 Jones River	Massachusetts Bay	Lat 41°59'48" Long 70°45'24", Plymouth County, 50 ft downstream from confluence with Fountainhead Brook, 1.3 mi west of Kingston, Mass.	17.3	8-18-87	*1.8	94	Jones River
24	01105869 Furnace Brook	Jones River	Lat 41°59'26" Long 70°44'43", Plymouth County, at footbridge on logging road in conservation land, 1.0 mi west of Kingston, Mass.	1.99	8-19-87 9-17-87	*2.4 3.5	96 58	Jones River
25	011058714 Bassett Brook	Halls Brook	Lat 42°00'31" Long 70°44'42", Plymouth County, at culvert on Winthrop Street, 1.0 mi northwest of Kingston, Mass.	.81	8-19-87 8-26-87 9-17-87	*.82 *.65 1.1	96 95 58	Jones River

Table 1.--*Discharge measurements in the Southeast Coastal basin*--Continued

Number in figure 5	Station number and stream	Tributary to	Location	Drainage area (mi^2)	Measurement Date	Measurement Discharge (ft^3/s)	Flow duration at index gage	Index gage
26	011058716 Mile Brook	Halls Brook	Lat 42°00'29" Long 70°44'08", Plymouth County, 200 ft north of Winthrop Street, 0.7 mi north of Kingston, Mass.	0.73	8-19-87	*0.26	96	Jones River
					8-26-87	*.28	95	
					9-17-87	.51	58	
27	011058722 Halls Brook	Jones River	Lat 41°59'58" Long 70°43'38", Plymouth County, at culvert on Maple Street, 0.2 mi northeast of Kingston, Mass.	4.14	8-21-87	*2.0	95	Jones River
					9-17-87	6.6	58	
28	011058726 Smelt Brook	Jones River	Lat 41°58'15" Long 70°43'29", Plymouth County, at culvert on Raboth Road, 1.9 mi south of Kingston, Mass.	.59	7- 1-86	*.17	85	Jones River
					8-26-87	*.13	95	
29	011058728 Smelt Brook	Jones River	Lat 41°58'38" Long 70°42'48", Plymouth County, at culvert on Cranberry Road, 1.7 mi southeast of Kingston, Mass.	.91	7- 1-86	*.42	85	Jones River
					8-26-87	*.34	95	

and 99 percent of the time were determined for the 21 major aquifers in the Southeast Coastal basin.

Streamflow at 80, 90, 95, and 99-percent flow duration was determined for 14 sites in the basin. One site was the continuous-record gage on the Indian Head River at Hanover. At each low-flow site, flows were related to concurrent flows at a continuous-record site using the technique described by Searcy (1959, p. 12-21). Low-flow measurements made for this study (table 1) and previous measurements reported by Petersen (1962), Williams and Tasker (1974), or Johnson (1986) were included in the data sets for the concurrent-flow analysis. Sites in the North and South River basins were generally related to the Indian Head River at Hanover, and sites in the Jones River basin were generally related to the Jones River at Kingston; Herring Brook in Pembroke was related to the Jones River at Kingston, because the basin geology is more typical of the Jones River basin. Two sites were related to the Wading River at Norton (a tributary of the Taunton River), because most of the measurements at these sites were made before the Indian Head River and Jones River gages were established.

The flows determined using the Searcy method were adjusted to add or subtract diversions upstream from the measurement sites. Half of the water diverted from the Herring Brook Basin and the Cushing Brook Basin was estimated to come from storage during low-flow conditions; the adjusted flows do not include this water.

Five of the low-flow sites were at or near the downstream ends of the Indian Head Brook, Herring Brook, Pine Brook, Furnace Brook–Kingston, and Halls Brook aquifers. The adjusted flows were used as the values of the yields of these aquifers.

Several studies have shown a relation between low flows and the percentage of a drainage basin that is covered with coarse stratified drift (Thomas, 1966; Tasker, 1972; Cervione and others, 1982; Weiss, 1983). On the basis of this relation, linear regression was used to develop a method to estimate aquifer yields at sites where few or no low-flow measurements were available. The adjusted flows divided by drainage area were used as the values of the dependent variable in the regression analysis.

Linear regression analysis, in which the percentage of coarse stratified-drift was the only independent variable, did not accurately estimate low flows in the Southeast Coastal basin; neither did the methods established by Thomas (1966), Cervione and others (1982), and Weiss (1983). A second independent variable--the percentage of the drainage area covered by surface water, wetlands, and cranberry bogs--was added to the regression analysis to account for water losses owing to evaporation. These losses affect the flows measured at low-flow sites and, therefore, affect estimates of aquifer yields.

The values of the percentage of the drainage area covered by coarse stratified drift were obtained by digitizing the areas mapped on plate 1 as having a transmissivity of at least 1,350 ft^2/d. Areas where till overlays stratified drift were assumed to be underlain by the same ratio of coarse to total stratified drift as the remainder of the basin. The till areas were multiplied by this ratio; the resulting values were added to the areas of mapped coarse stratified drift in each basin.

Regression of these two independent variables against the adjusted flows for the 14 measured sites produced the following equations:

$$Q_{80} = A\,[\,0.0152\ C - 0.0338\ W + 0.632\,] \quad (R^2 = 0.83)\ (SEE = 0.17)\,, \tag{1}$$

$$Q_{90} = A\,[\,0.0156\ C - 0.0293\ W + 0.364\,] \quad (R^2 = 0.89)\ (SEE = 0.13)\,, \tag{2}$$

$$Q_{95} = A\,[\,0.0153\ C - 0.0260\ W + 0.241\,] \quad (R^2 = 0.89)\ (SEE = 0.12)\,, \text{ and} \tag{3}$$

$$Q_{99} = A\,[\,0.0154\ C - 0.0220\ W + 0.0814\,] \quad (R^2 = 0.89)\ (SEE = 0.12)\,, \tag{4}$$

where

Q_n	=	flow at given percent flow duration (n), in cubic ft per second;
A	=	drainage area, in square mi;
C	=	areal extent of coarse-grained stratified drift given as a proportion of the total drainage area (A), in percent;
W	=	areal extent of surface water, wetlands, and cranberry bogs given as a proportion of the total drainage area (A), in percent; and
R^2	=	adjusted coefficient of determination
SEE	=	standard error of estimate.

In these equations, the coefficient for the coarse-stratified-drift factor is effectively independent of flow duration. The values of C for the 14 sites used in the regression analysis ranged from 6.3 to 88.0, and the values of W ranged from 6.3 to 32.0. Thus, the regression analysis includes most of the possible range of values of C, and the equations should be valid for any value of C; the equations may not be valid for basins covered mainly by wetlands (a high value of W). The highest value of W for any of the major aquifers in the Southeast Coastal basin was 32.6.

R^2, the square of the correlation coefficient, is also called the coefficient of determination. It expresses the fraction of the variability of the dependent variable that can be explained by the variability of the independent variables. For example, at 99-percent flow duration, 89 percent of the variation in flow can be attributed to the effects of the areal extent of coarse stratified drift and the areal extent of surface water, wetlands, and cranberry bogs. The values given for R^2 are adjusted based on the number of samples (14) and independent variables (2). The R^2 value at 80 percent flow duration is lower than at the other durations, probably because not all flow at 80 percent duration is base flow.

The yields of 15 aquifers where few or no low-flow measurements were available were estimated using these equations. The Pudding Brook aquifer overlaps the drainage basins of Pudding Brook and Robinson Creek; for this aquifer, yields were determined by adding adjusted flows for Pudding Brook to multiple-regression results for Robinson Creek. All yield values were divided by 1.547 to convert them from cubic ft per second to million gallons per day--units commonly used in reference to water supply.

Water that was part of the available yield for one aquifer was not considered available for other aquifers downstream. Although part of the Duxbury Coastal aquifer is drained by Green Harbor Brook, this part and the area upstream from it were not considered part of the recharge area of the Green Harbor Brook aquifer for the calculation of its yield. The drainage areas of the Pine Brook and Jones River Brook aquifers, as well as the drainage area of Silver Lake which supplies 5.9 Mgal/d to Brockton and Whitman, were not considered part of the recharge area of the Upper Jones River aquifer for the calculation of its yield.

Calculations for the Ben Mann Brook aquifer in Rockland were based on the yield available under natural hydrologic conditions--as if the Hingham Street Reservoir were not present. The available aquifer yield is likely to be smaller, because some water stored in the reservoir would otherwise recharge the aquifer.

In basins where till overlies stratified drift in most of the drainage basin (fig. 2), the multiple-regression method may not accurately estimate yields. To obtain a yield estimate for the Littles Creek and Bares Brook aquifers in Marshfield, the area mapped on plate 1 as having a transmissivity of at least 1,350 ft^2/d was used in the regression method as the areal extent of coarse stratified drift, when the material in that area was either stratified drift or till overlying stratified drift.

Aquifer Yields

The sustainable yields potentially available from the major stratified-drift aquifers in the Southeast Coastal basin are shown in table 2. The two aquifers with the highest yields are those with the greatest areal extent of sand and gravel deposits. The Duxbury Coastal and Kingston Coastal aquifers had yields of 6.5 and 5.2 Mgal/d 80 percent of the time, and yields of 4.9 and 3.9 Mgal/d 99 percent of the time.

Table 2.--*Yields of stratified-drift aquifers in the Southeast Coastal basin from intercepted ground-water discharge and induced infiltration from streamflow*

[mi^2, square miles; Mgal/d, million gallons per day]

Aquifer	Recharge area (mi^2)	Yield available for indicated percentage of time (Mgal/d)				Average 1986 withdrawal[1] (Mgal/d)
		80	90	95	99	
Satuit Brook	1.61	0.7	0.5	0.4	0.3	0
Ben Mann Brook	1.04	.3	.2	.2	.2	[2]0
Indian Head Brook	4.31	.6	.4	.4	.2	0
Iron Mine Brook	.81	.6	.5	.4	.4	.31
Herring Brook	5.61	2.8	2.6	2.5	2.3	[3].97
Pudding Brook	5.61	2.0	1.1	.8	.4	0
Third Herring Brook	8.65	2.7	1.7	1.3	.8	1.22
Two Mile Brook	2.13	2.3	2.0	1.8	1.6	.45
First Herring Brook	5.70	3.2	2.5	2.1	1.7	[4]1.15
Bares Brook	1.49	1.0	.7	.6	.5	0
Furnace Brook--Marshfield	1.98	2.3	2.0	1.8	1.6	1.61
South River	.68	.6	.6	.5	.4	.04
Littles Creek	1.28	1.1	.9	.8	.7	.68
Green Harbor Brook	1.75	1.7	1.5	1.4	1.2	.11
Duxbury Coastal	6.90	6.5	5.8	5.3	4.9	1.06
Jones River Brook	.95	.9	.8	.8	.7	0
Pine Brook	4.81	.7	.5	.5	.4	.22
Upper Jones River	7.35	3.3	2.5	2.2	1.9	0
Furnace Brook--Kingston	1.98	2.4	2.1	2.0	1.9	.62
Halls Brook	3.93	2.7	2.1	1.8	1.5	.12
Kingston Coastal	4.23	5.2	4.6	4.3	3.9	.32

[1] From Massachusetts Division of Water Supply (written commun., 1988).

[2] 0.85 million gallons per day of surface water also withdrawn, from Hingham Street Reservoir.

[3] 3.10 million gallons per day of surface water also withdrawn, from Great Sandy Bottom Pond and Furnace Pond.

[4] 0.23 million gallons per day of surface water also withdrawn, from Old Oaken Bucket Pond.

Fourteen of the 21 aquifers had yields of at least 1.0 Mgal/d 80 percent of the time. Of these, 10 exceed 1.0 Mgal/d 99 percent of the time.

As an example of what these yields mean, table 2 shows that the Halls Brook aquifer has a yield of 2.7 Mgal/d 80 percent of the time. This is water that potentially could be induced from streamflow to recharge a well beside the stream or ground water that could be intercepted before it discharges to the stream. During the remaining 20 percent of the time, less than 2.7 Mgal/d is available. In theory, if 2.7 Mgal/d were continually pumped from the aquifer and not returned, during the 20 percent of the time when the lowest flows occur, the stream would be dry and pumping would deplete the ground-water storage of the aquifer to make up the deficit. At 99-percent flow duration, 1.2 Mgal/d would be pumped from ground-water storage. During a prolonged drought, continued pumping from storage could cause a significant decline in ground-water levels and dewater much of the aquifer. This might cause wetlands and shallow private-supply wells to go dry.

In order to prevent streams from drying up because of pumping during low-flow periods, the withdrawal rate would have to be limited to maintain a given streamflow, such as the 95-percent flow duration. For example, the flow at 95-percent flow duration for Halls Brook is 1.8 Mgal/d (table 2). To maintain a streamflow of 1.8 Mgal/d at 80-percent flow duration, the water available for withdrawal would decline from 2.7 to 0.9 Mgal/d. The available yield at 90-percent flow duration would decline to 0.3 Mgal/d, and, by definition, no water would be available for pumping at 95-percent streamflow duration. This water-management criterion has been described for other Massachusetts river basins (Lapham, 1988; de Lima, 1989).

Maintenance of streamflow may not be a realistic water-management goal for small streams in basins with a high percentage of stratified-drift cover. These streams have relatively flat flow-duration curves, so the flow at 80-percent duration may not differ greatly from the flow at 95-percent duration. For example, the yield of the Furnace Brook–Kingston aquifer is 2.4 Mgal/d at 80-percent flow duration and 2.0 Mgal/d at 95-percent flow duration. Maintenance of streamflow at 95 percent duration in such basins would preclude use of most of the available yield.

Available Yield and Water Use

The average daily ground-water withdrawals from the major aquifers in 1986 are given in table 2 (Massachusetts Division of Water Supply, written commun., 1988); these values include only pumpage for public supply, not pumpage for private, industrial, or agricultural use. In two cases, the 1986 withdrawals exceed the estimated potential sustained yield available during extreme low-flow conditions--the excess withdrawal would be pumped from ground-water storage. For example, on August 25, 1987, Third Herring Brook was dry along a sluiceway directly between two public-supply wells (Hanover well 3 and Norwell well 43; table 1). At that time, the wells were pumping water primarily from storage. Ground water was withdrawn for public supply in 1986 from 14 of the 21 major aquifers in the Southeast Coastal basin; surface-water withdrawal occurred in the drainage area of one of the other seven aquifers.

Use of the entire available yield may be difficult to achieve for the several aquifers in the Southeast Coastal basin that are not typical valley aquifers. In a valley aquifer, virtually all of the water discharging from the basin passes through the stream at the downstream end of the aquifer and can be measured. The Duxbury Coastal and Kingston Coastal aquifers, on the other hand, discharge to the ocean and to small coastal streams. Several wells would be needed to capture all of the potential yield from these aquifers. The Pudding Brook aquifer is drained by both Pudding Brook and Robinson Creek. The Halls Brook aquifer includes aquifer material along Halls Brook and along two tributary streams, Mile Brook and Bassett Brook. The downstream end of the aquifer is in a wetland where construction of a pumping station would be difficult. Separate pumping stations dispersed along all three streams would probably be needed to make full use of the potential yield. The Upper Jones River aquifer includes a reach of the Jones River and the drainage basins of two tributaries that flow into the Jones River below this reach--Fountainhead Brook and an unnamed tributary. The valley of the reach that all three portions of the aquifer drain into is underlain by material with a low transmissivity. Separate pumping stations would also be needed in this aquifer to obtain the full potential yield.

Other factors also may preclude use of some of the potential yield; water-quality problems may occur in part of an aquifer. Current or planned land development for residential or commercial use may make the cost of land acquisition at a well site prohibitive. There may be a previous claim on the water for use in cranberry agriculture.

The Southeast Coastal basin contains 996 acres of cranberry bogs, which have a total annual water need of about 27.8 x 10^9 gallons (U.S. Department of Agriculture, 1986, p. 8). This figure represents an average daily use of 76.2 Mgal/d, though use is highly seasonal. The water is used for irrigation, frost protection, winter flooding, and, in some bogs, for harvesting. The U.S. Department of Agriculture (1986, p. 13) estimates that the water needs in the study area could be reduced 9.7 percent through conservation measures. Cranberry growers in the study area typically use reservoirs or surface-water diversion for supply, though at least one grower (in the Fountainhead Brook Basin) supplements this supply with ground water. Most of the water use is non-consumptive--the water is returned to the basin's hydrologic system after use. The consumptive use by evapotranspiration at a cranberry bog is estimated to be 17 inches per year more than if the bog was not cultivated (Hansen, B.P., and Lapham, W.W., U.S Geological Survey, oral commun., 1987). For the entire basin, this amounts to 461 Mgal of annual consumption, with an average consumption of 1.26 Mgal/d.

GROUND-WATER QUALITY IN THE STRATIFIED-DRIFT AQUIFERS

In order to describe water quality and geochemical conditions in the stratified-drift aquifers, 27 water samples from 19 wells and the Jones River (fig. 6) were analyzed for physical properties, common constituents, nutrients, selected trace metals, and phenols (table 3). Twelve wells were also sampled for volatile organic compounds (VOCs), and two were sampled for insecticides. The locations of the sampling sites in relation to the major aquifers are shown in plate 2. Twelve of the sampled wells were public-supply wells; the other seven were observation wells. The public-supply-well samples were collected from taps at the wellhouses. The observation-well samples were collected using either submersible or peristaltic pumps.

Physical Properties and Inorganic Constituents

The samples had pH values ranging from 5.2 to 7.5. All but three samples had pH less than 7.0, meaning the water was slightly acidic and mildly corrosive. Some towns, such as Hanover, adjust the pH of the public supply to prevent corrosion of the town distribution system and domestic plumbing fixtures.

Hardness is a measure of the abundance of cations, mainly calcium and magnesium, that react with soap to form insoluble compounds or precipitate from heated water to form encrustations (Hem, 1985, p. 158). All but one sample had hardness values of 0 to 60 mg/L the range called soft in the classification system by Durfor and Becker (1964, p. 27).

Sodium was the dominant cation in most samples; in a few samples calcium or iron was dominant. Chloride was the most abundant anion, but bicarbonate (measured as alkalinity) was dominant in some samples. In a few samples, sulfate was the most abundant anion. Sodium concentrations in water samples from four wells exceeded the Massachusetts Department of Environmental Protection drinking-water standard of 20 mg/L, set to protect persons on very restricted sodium diets. No samples contained chloride or sulfate concentrations that exceeded the U.S. Environmental Protection Agency (1976, p. 205-206) secondary drinking-water standard of 250 mg/L. The median alkalinity for all samples was 16.5 mg/L, with values ranging from 4 to 64 mg/L. On the whole, ground water from the basin has a low capacity for neutralizing acids. The four lowest pH values were from the four wells with the lowest alkalinities.

Iron is a common water-quality problem in southeastern Massachusetts, where bog iron ore was once mined. The reducing conditions around the many wetlands create an environment in which iron is highly soluble. In order to prevent an objectionable taste and staining of laundry and plumbing fixtures, the U.S. Environmental Protection Agency (1976, p. 78-79) secondary drinking-water standard for iron is 300 µg/L. Ground water in southeastern Massachusetts often must be treated for iron before it can be used. Iron concentrations exceeding the 300 µg/L regulation were found in seven wells and in the Jones River. Two samples from Kingston well 201 had iron concentrations of 23,000 and 25,000 µg/L; this well was between a cranberry bog and a pond, and was screened in a reducing zone below a layer of clay. The

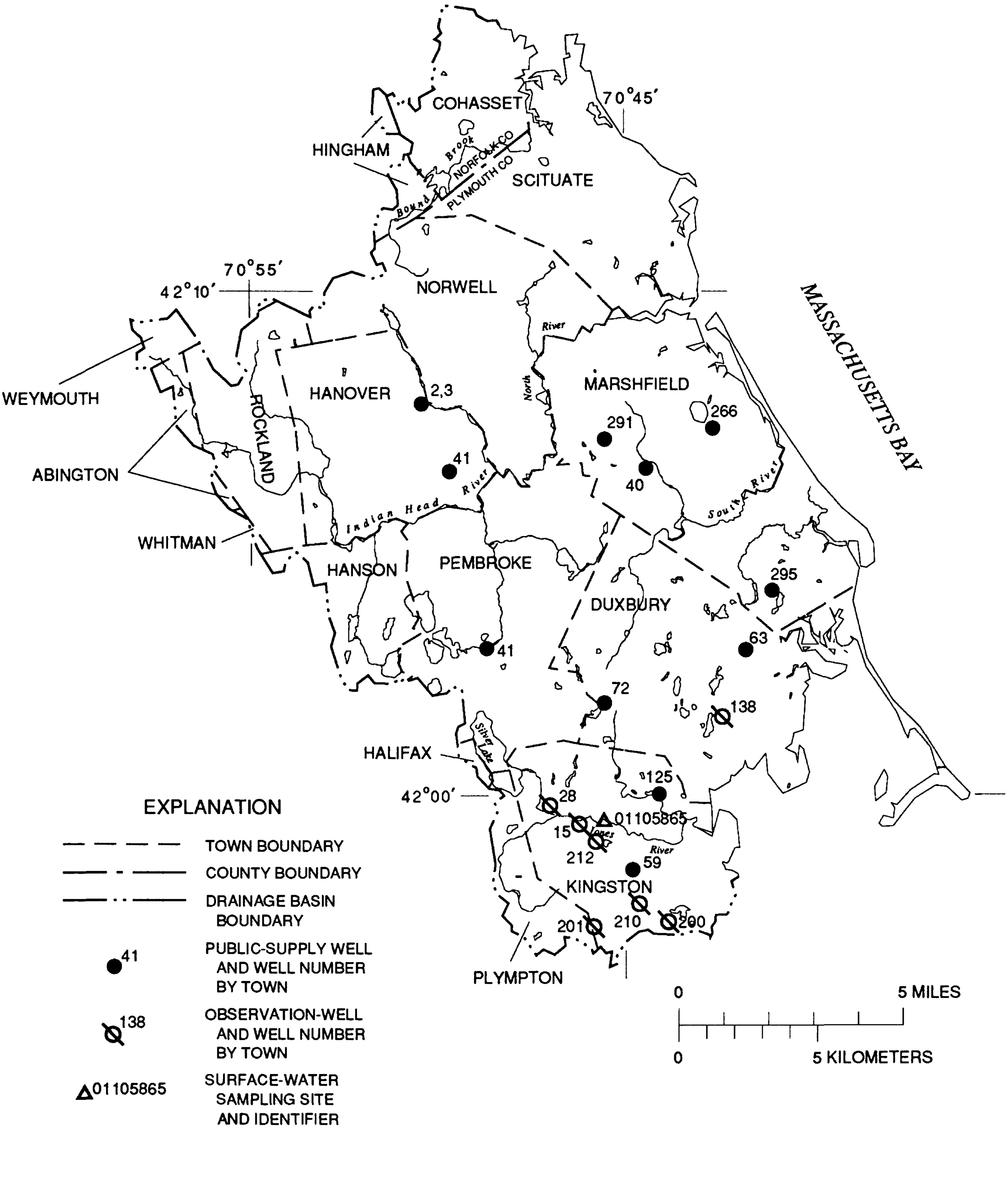

Figure 6.--Water-quality sites in the Southeast Coastal basin.

Table 3.--*Chemical analyses of water samples from the Southeast Coastal basin*

[Date: month, day, and year of sample collection; °C, degrees Celsius; diss., dissolved; µS/cm, microsiemens per centimeter at 25 °C; mg/L, milligrams per liter; <, less than; --, sample not analyzed for constituent or property; µg/L, micrograms per liter; the Jones River sample was taken from surface-water site 01105865; all other samples were from ground water; station name is the U.S. Geological Survey well number]

Station name	Date	Specific conductance (µS/cm)	pH (standard units)	Water temperature (°C)	Hardness (mg/L as $CaCO_3$)	Calcium diss. (mg/L)	Magnesium diss. (mg/L)	Sodium diss. (mg/L)	Potassium diss. (mg/L)	Alkalinity (mg/L as $CaCO_3$)
				SURFACE-WATER SAMPLE						
Jones River	5-23-86	97	6.6	17.5	14	3.0	1.5	9.8	1.1	11
				PUBLIC-SUPPLY-WELL WATER SAMPLES						
Duxbury 63	8-15-86	134	6.0	11.0	22	4.4	2.7	14	1.1	15
Duxbury 72	8-15-86	152	5.6	15.0	24	5.3	2.5	16	1.4	10
Hanover 2	8-05-86	270	6.3	18.0	28	6.6	2.9	40	1.8	21
Hanover 3	6-29-87	300	5.8	15.0	27	6.0	2.8	40	1.6	11
Hanover 41	8-05-86	199	6.5	16.0	40	9.8	3.7	22	1.1	31
	6-29-87	296	6.7	15.0	85	26	4.8	24	1.0	63
Kingston 59	8-07-86	112	6.2	12.0	21	4.9	2.1	11	1.1	16
Kingston 125	8-14-86	--	--	--	44	8.9	5.4	53	1.8	--
Marshfield 40	6-30-87	145	6.0	13.0	30	6.8	3.1	14	.70	15
Marshfield 266	7-06-87	122	6.4	13.0	28	6.4	3.0	11	.90	14
Marshfield 291	7-06-87	91	6.6	12.0	23	5.0	2.6	7.0	.80	22
Marshfield 294	6-30-87	169	6.0	12.0	34	7.0	4.1	16	.90	19
Pembroke 41	5-26-87	158	6.4	12.0	26	6.2	2.5	18	1.4	17
				OBSERVATION-WELL WATER SAMPLES						
Duxbury 138	8-15-86	99	5.9	11.0	18	4.0	2.0	8.3	.80	19
Kingston 15	8-25-86	225	6.4	11.0	38	8.3	4.1	18	3.8	53
	6-02-87	211	7.2	11.0	37	8.4	4.0	17	3.7	28
Kingston 28	8-27-86	125	7.2	12.0	33	9.9	2.0	7.6	1.1	53
	6-01-87	136	7.5	12.0	34	10	2.1	7.4	.90	49
Kingston 200	9-05-86	51	5.2	12.0	10	2.0	1.1	4.9	1.4	7
	6-02-87	42	6.4	11.0	7	1.6	.85	3.0	1.2	4
Kingston 201	8-05-86	118	6.4	12.0	9	1.6	1.1	6.3	1.3	64
	6-01-87	118	6.8	13.0	8	1.6	.99	5.6	1.2	52
Kingston 210	9-05-86	50	5.6	11.0	8	1.9	.87	5.0	.70	10
	6-02-87	53	6.0	11.0	9	2.0	.98	5.2	.60	8
Kingston 212	5-22-86	78	6.4	10.0	11	2.4	1.2	3.8	1.0	16
	9-08-86	61	5.5	12.0	11	2.3	1.3	5.7	.90	7

Table 3.--*Chemical analyses of water samples from the Southeast Coastal basin*--Continued

Station name	Date	Sulfate diss. (mg/L)	Chloride diss. (mg/L)	Fluoride diss. (mg/L)	Silica diss. (mg/L)	Total diss. solids (mg/L)	Nitrite total (mg/L as N)	Nitrite + nitrate total (mg/L as N)	Ammonia total (mg/L as N)	Ammonia organic nitrogen total (mg/L) as N)
				SURFACE-WATER SAMPLE						
Jones River	5-23-86	21	12	<0.10	3.6	60	<0.01	<0.10	0.03	0.60
				PUBLIC-SUPPLY-WELL WATER SAMPLES						
Duxbury 63	8-15-86	11	20	<.10	12	75	<.01	.80	.04	<.20
Duxbury 72	8-15-86	10	27	<.10	11	80	<.01	1.4	.02	<.20
Hanover 2	8-05-86	13	60	.10	9.9	150	<.01	<.10	.04	.60
Hanover 3	6-29-87	13	68	.10	8.9	150	<.01	.20	.04	.30
Hanover 41	8-05-86	20	26	<.10	17	120	<.01	1.7	<.01	.40
	6-29-87	14	38	<.10	17	160	<.01	2.8	.01	.30
Kingston 59	8-07-86	10	14	<.10	14	67	<.01	.30	<.01	<.20
Kingston 125	8-14-86	15	97	<.10	9.5	200	<.01	1.9	.07	.30
Marshfield 40	6-30-87	8.2	21	<.10	14	77	<.01	1.8	<.01	.30
Marshfield 266	7-06-87	12	19	<.10	16	77	<.01	.40	.02	<.20
Marshfield 291	7-06-87	7.3	9.4	<.10	22	67	<.01	.20	.03	.80
Marshfield 294	6-30-87	15	22	<.10	13	89	<.01	3.1	<.01	.20
Pembroke 41	5-26-87	10	26	.20	15	89	<.01	1.1	<.01	.50
				OBSERVATION-WELL WATER SAMPLES						
Duxbury 138	8-15-86	5.6	17	<.10	12	63	<.01	<.10	.02	.20
Kingston 15	8-25-86	16	26	<.10	12	130	.07	1.4	.08	.30
	6-02-87	17	26	<.10	14	110	<.01	2.3	.03	<.20
Kingston 28	8-27-86	11	9.0	.20	17	92	.01	<.10	.32	.30
	6-01-87	12	9.6	.10	18	96	<.01	<.10	.37	.70
Kingston 200	9-05-86	7.0	5.0	<.10	7.0	32	<.01	.90	<.01	.30
	6-02-87	6.7	3.7	<.10	7.2	27	<.01	.50	<.01	.20
Kingston 201	8-05-86	2.6	5.8	<.10	18	98	.02	<.10	.27	.40
	6-01-87	37	11	<.10	19	130	<.01	<.10	.29	.80
Kingston 210	9-05-86	4.8	6.4	<.10	11	36	<.01	.20	<.01	<.20
	6-02-87	4.4	11	<.10	11	40	<.01	<.10	.01	<.20
Kingston 212	5-22-86	18	7.5	<.10	6.8	51	<.01	<.10	.01	.20
	9-08-86	9.3	7.7	<.10	9.6	42	<.01	<.10	.02	<.20

Table 3.--*Chemical analyses of water samples from the Southeast Coastal basin*--Continued

Station name	Date	Nitrogen total (mg/L)	Total phosphorus (mg/L)	Orthophosphorus total (mg/L as P)	Arsenic diss. (µg/L)	Boron diss. (µg/L)	Iron diss. (µg/L)	Lead diss. (µg/L)	Manganese diss. (µg/L)	Selenium diss. (µg/L)	Phenols total (µg/L)
SURFACE-WATER SAMPLE											
Jones River	5-23-86	--	0.06	0.01	<1	20	1,100	<1	67	<1	7
PUBLIC-SUPPLY-WELL WATER SAMPLES											
Duxbury 63	8-15-86	--	.56	.06	<1	10	310	<5	80	<1	<1
Duxbury 72	8-15-86	--	.58	.09	<1	10	54	<5	66	<1	<1
Hanover 2	8-05-86	--	.12	.09	1	40	700	<5	240	<1	<1
Hanover 3	6-29-87	.50	.03	.02	<1	30	230	<5	210	<1	1
Hanover 41	8-05-86	2.1	.02	.01	<1	30	13	<5	4	<1	2
	6-29-87	3.1	.04	.01	<1	40	9	7	6	<1	3
Kingston 59	8-07-86	--	.03	.03	<1	<10	12	<5	3	<1	3
Kingston 125	8-14-86	2.2	.02	.02	<1	20	54	40	31	<1	<1
Marshfield 40	6-30-87	2.1	.04	.03	<1	20	64	<5	27	<1	<1
Marshfield 266	7-06-87	--	.01	.03	<1	<10	6	5	3	<1	2
Marshfield 291	7-06-87	1.0	.04	.04	<1	<10	4	<5	<1	<1	2
Marshfield 294	6-30-87	3.3	.15	.03	<1	20	<3	8	3	<1	5
Pembroke 41	5-26-87	1.6	.04	.02	<1	20	200	<5	50	<1	<1
OBSERVATION-WELL WATER SAMPLES											
Duxbury 138	8-15-86	--	<.01	<.01	<1	<10	2,300	39	28	<1	2
Kingston 15	8-25-86	1.7	.43	<.01	--	20	8,200	<5	82	<1	<1
	6-02-87	--	.01	<.01	<1	20	2,400	<5	17	<1	<1
Kingston 28	8-27-86	--	.03	.01	8	10	1,400	<5	1,200	1	2
	6-01-87	--	.27	.03	8	10	5,100	<5	1,300	<1	2
Kingston 200	9-05-86	1.2	<.01	<.01	<1	<10	17	<5	18	<1	<1
	6-02-87	.70	.01	<.01	<1	10	11	<5	17	<1	5
Kingston 201	8-05-86	--	.72	.46	4	20	23,000	<5	140	<1	--
	6-01-87	--	.79	.02	1	<10	25,000	<5	140	<1	12
Kingston 210	9-05-86	--	.03	.01	<1	<10	5	<5	84	<1	<1
	6-02-87	--	.04	.02	<1	<10	5	<5	27	<1	--
Kingston 212	5-22-86	--	.04	<.01	1	10	660	1	76	<1	1
	9-08-86	--	.01	<.01	<1	<10	600	<5	33	<1	1

high ammonia concentrations found in this well and Kingston well 28 reflected the reducing conditions that mobilized the iron. Manganese has a chemistry similar to that of iron and causes similar water-quality problems. Water from ten wells and the Jones River had manganese concentrations that equalled or exceeded the U.S. Environmental Protection Agency (1976, p. 95) secondary drinking-water standard of 50 µg/L. None of the samples exceeded the U.S. Evironmental Protection Agency primary drinking-water standard of 50 µg/L for arsenic and lead (U.S. Environmental Protection Agency, 1976, p. 14, 82).

Organic Compounds

Water samples from six observation wells in Kingston and six public-supply wells in Marshfield, Hanover, and Pembroke (table 4) were tested for 36 VOCs. None of the VOCs were present at the analytical detection limit of 3 µg/L in any of the public-supply samples (table 5). Three observation-well samples contained trace levels of organic contaminants. Methyl chloride, a degreasing compound, was detected at concentrations of 4.7 and 5.4 µg/L in Kingston wells 200 and 210. A concentration of 4.3 µg/L trichlorofluoromethane, a refrigerant, was found in Kingston well 212. The sources of these compounds were not known.

Kingston wells 201 and 212, which were located beside cranberry bogs, were also sampled for a variety of organophosphorus insecticides and organochlorine chemicals (table 6). The analyses included those for parathion and chlorpyrifos, the two insecticides most commonly used by cranberry growers (Karl Deubert, University of Massachusetts Cranberry Experiment Station, oral commun., 1986). None of these chemicals were detected in the two water samples.

Phenols, which include a variety of organic compounds, can occur naturally. They can also arise from a number of human activities, such as distillation of coal and wood, human and livestock wastes, and chemical breakdown of pesticides (U.S. Environmental Protection Agency, 1976, p. 183). Phenols that become chlorinated can give water a bad taste and smell at concentrations as low as 2 µg/L (U.S. Environmental Protection Agency, 1976, p. 184). The highest phenol concentration detected (table 3) was 12 µg/L. The highest concentration detected in a public-supply well was 5 µg/L.

Water Quality Problems

Although ground-water quality in the Southeast Coastal basin is generally suitable for most uses, water-quality problems are common. Saltwater intrusion, coastal flooding, and road salting can increase concentrations of sodium and chloride. Acidic and reducing chemical conditions in, and adjacent to, the abundant wetlands can mobilize iron and manganese. Induced infiltration of water from wetlands often causes problems with color, an indicator of dissolved organic material. Most towns in the study area treat their water supplies to improve water quality.

Several public-supply wells have been closed because of contamination or chronic water-quality problems.

Table 4.--*Volatile organic compounds analyzed for ground-water samples from the Southeast Coastal basin*

Benzene	1,4-Dichlorobenzene	Methyl bromide
Bromoform	Dichlorobromomethane	Methyl chloride
Carbon tetrachloride	Dichlorodifluoromethane	Methylene chloride
Chlorobenzene	1,1-Dichloroethane	Styrene
Chlorodibromomethane	1,2-Dichloroethane	1,1,2,2-Tetrachloroethane
Chloroethane	1,1-Dichloroethylene	Tetrachloroethylene
1,1,2-Trichloroethane	1,2-trans-Dichloroethylene	Toluene
2-Chloroethyl vinyl ether	1,2-Dichloropropane	1,1,1-Trichloroethane
Chloroform	1,3-Dichloropropane	Trichloroethylene
1,2-Dibromoethylene	cis-1,3-Dichloropropene	Trichlorofluoromethane
1,2-Dichlorobenzene	trans-1,3-Dichloropropene	Vinyl chloride
1,3-Dichlorobenzene	Ethylbenzene	Xylene

Table 5.--*Volatile organic compound analyses of ground-water samples from the Southeast Coastal basin*

[Date: month, day, and year of sample collection; µg/L, micrograms per liter; samples were analyzed for chemicals listed in table 4; chemicals detected are those which exceeded the detection limit of 3 micrograms per liter]

Well number	Date	Chemical detected and concentrations (µg/L)	
Hanover 3	6-29-87	none	
Kingston 15	6-02-87	none	
Kingston 28	8-27-86	none	
Kingston 200	9-05-86	Methyl chloride	4.7
Kingston 201	6-01-87	none	
Kingston 210	9-05-86	Methyl chloride	5.4
Kingston 212	9-08-86	Trichlorofluoromethane	4.3
Marshfield 40	6-30-87	none	
Marshfield 266	7-06-87	none	
Marshfield 291	7-06-87	none	
Marshfield 294	6-30-87	none	
Pembroke 41	5-26-87	none	

Table 6.--*Insecticides and organochlorine chemicals analyzed for samples from Kingston wells 201 and 212*

Aldrin	Lindane
Chlordane	Malathion
Chlorpyrifos	Methoxychlor
DDD	Methyl parathion
DDE	Methyl trithion
DDT	Mirex
Diazinon	Parathion
Dieldrin	Perthane
Disulfoton	Phorate
Endosulfan	Polychlorinated biphenyls (PCBs)
Endrin	Polychlorinated naphthalenes (PCNs)
Ethion	Toxaphene
Heptachlor	Trithion
Heptachlor epoxide	

Four wells in the Furnace Brook and South River aquifers in Marshfield (wells 28, 29, 39, and 295) were closed in 1986 when trace concentrations of trichloroethylene (TCE) were detected. The Webster Meadow wells in Scituate (wells 10 and 11) were temporarily closed in 1987 because saltwater contamination from coastal flooding occurred when a dike broke during a spring storm. The Evergreen wells in Duxbury (wells 167 and 168) are used only for emergency supply because of iron concentrations, and some public-supply wells in Scituate have been retired over the years because of chronic problems with color, iron, manganese, alkalinity, and chloride.

Water-quality problems may prevent use of some water that is potentially available. For example, recent TCE contamination has limited use of water from the Furnace Brook–Marshfield and South River aquifers. Also, land use may pose immediate or potential water-quality threats that preclude use of parts of an aquifer. Much of the Kingston Coastal aquifer is not suitable as a source of public supply because a municipal landfill and a sewage-disposal site are located on the aquifer. Development of land for residential or commercial use is decreasing the availability of sites suitable for public-supply wells.

SUMMARY

The major aquifers in the Southeast Coastal basin are stratified sand and gravel deposits of glacial origin. A new aquifer transmissivity map of the Southeast Coastal basin in Massachusetts was prepared using information from approximately 400 wells and borings drilled between 1972 and 1986. Twenty-one major aquifers were delineated. The potential sustained yields of these aquifers--assumed to be the potential total intercepted ground-water discharge and induced infiltration from streamflow--were estimated. The yields of five aquifers were determined from base-flow measurements made at or near the downstream limits of the aquifers. The yields of fifteen aquifers were determined from equations that estimate the flow at the downstream limits of the aquifers at 80, 90, 95, and 99 percent flow duration using basin characteristics. The yield of one aquifer was determined using a combination of these two methods.

The equations used to estimate aquifer yields were determined using multiple linear regression. The flows at 80, 90, 95, and 99 percent flow duration were determined for 14 streams where sufficient base-flow data were available. The flows were used as values for the dependent variable in the regression. Two independent variables were used; they were (1) the percentage of the drainage area covered with coarse stratified drift, and (2) the percentage of the drainage area covered with surface water, wetlands, and cranberry bogs.

Fourteen of the 21 major aquifers in the basin had a potential sustained yield of at least 1.0 Mgal/d 80 percent of the time, and 10 had a potential sustained yield of at least 1.0 Mgal/d 99 percent of the time. The two aquifers with the highest yields were the two aquifers with the greatest areal extent. The Duxbury Coastal and Kingston Coastal aquifers yielded 6.5 and 5.2 Mgal/d 80 percent of the time, and yielded 4.9 and 3.9 Mgal/d 99 percent of the time. Ground water was withdrawn from 14 of the aquifers for public supply in 1986; surface-water withdrawal occurred in the recharge area of one of the remaining aquifers.

For valley aquifers drained by a single stream, the yield consists of water that can be induced from streamflow to recharge a well beside the stream and ground water that can be intercepted before it discharges to the stream. In areally extensive aquifers that do not discharge through a small, discrete area, such as the Duxbury Coastal and Kingston Coastal aquifers, several pumping stations would be needed to obtain the entire potential yield. Land use, water-quality problems, and land-acquisition costs may prevent the development and use of some of the available yield.

Twenty-seven water samples from 19 wells and from the Jones River were analyzed for physical properties, common constituents, nutrients, selected trace elements, and phenols. The pH values of the samples ranged from 5.2 to 7.5, with 23 samples having a pH less than 7.0. This water was slightly acidic and mildly corrosive. All but one sample had hardness values below 60 mg/L as calcium carbonate, in the range characterized as soft. Alkalinity values ranged from 4 to 63 mg/L as calcium carbonate, and generally reflected a poor capacity to neutralize acid.

In most samples, sodium was the dominant cation. Chloride was generally the most abundant anion; in several samples, bicarbonate or sulfate was more abundant. Sodium concentrations in water samples from four wells exceeded the Massachusetts recommended drinking-water guideline of 20 mg/L. No samples exceeded U.S. Environmental Protection

Agency secondary drinking-water standards for chloride or sulfate.

Near the many wetlands in the study area, acidic and reducing conditions create a chemical environment in which iron and manganese dissolve and become mobile. Iron concentrations exceeded the U.S. Environmental Protection Agency secondary drinking-water standard of 300 μg/L in seven wells and the Jones River; manganese concentrations exceeded the secondary drinking-water standard of 50 μg/L in 10 wells and the Jones River. The U.S. Environmental Protection Agency primary drinking-water standards for lead and arsenic were not exceeded in any of the 27 samples.

Water samples from 12 wells were tested for 36 VOCs. Methyl chloride was detected in two wells, at concentrations of 4.7 and 5.4 μg/L; trichlorofluoromethane was detected in a different well at a concentration of 4.3 μg/L. No organophosphorus or organochlorine pesticides were detected in water from two wells beside cranberry bogs. The highest phenol concentration detected was 12 μg/L.

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Table 7.--*Description of wells and borings in the Southeast Coastal basin*

Local well number: Letter prefix indicates--A, U.S. Geological Survey auger boring; W, well or test well (the "W" is omitted from plate 1 to conserve space); X, miscellaneous test boring.

Latitude/longitude: In degrees, minutes, and seconds.

Altitude of land surface: In feet above sea level.

Well finish: F, gravel wall with perforated or slotted casing; G, gravel wall with commercial screen; O, open end; P, perforated or slotted casing; S, screen; T, sand point.

Water level: In feet below land surface; negative numbers indicate water level above land surface.

Well depth: Depth of finished well, in depth below land surface.

Well use: O, observation; T, test; W, water withdrawal; Z, destroyed (includes casing pulled or not installed).

Depth to refusal: In feet below land surface; numbers followed by "R" refer to depth to bedrock.

Water use: H, domestic; I, irrigation; N, industrial; P, public supply; U, unused.

Pumping yield: In gallons per minute (gal/min).

Water-bearing material: Principal water-bearing zone.

Adjective (first character)	Lithology (second character)
1 Very fine grained	G Gravel
2 Fine grained	P Clay
3 Medium grained	Q Silt
4 Coarse grained	R Sand and gravel
5 Very coarse grained	S Sand
6 Clayey	T Till
7 Silty	X Silty sand
8 Sandy	Y Clayey gravel
9 Gravelly	

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*

Local well number	Latitude/ longitude		Altitude of land surface (ft)	Owner or user	Year drilled	Well: Diameter (in.)	Well: Finish	Well: Depth (ft)	Well: Use	Depth to refusal (ft)	Water-bearing material	Water: Level (ft)	Water: Date measured	Water: Use	Pumping: Yield (gal/min)	Pumping: Time (hr)
						COHASSET										
X 9	421233	0704923	50	COHASSET TOWN OF	1975	--	-	--	T	17R	7S	2	10-75	U	--	--
X 10	421235	0704923	46	COHASSET TOWN OF	1975	--	-	--	T	20R	8Q	-2	10-75	U	--	--
X 11	421234	0704927	49	COHASSET TOWN OF	1975	--	-	--	T	23R	8Q	3	10-75	U	--	--
X 12	421235	0704930	64	COHASSET TOWN OF	1975	--	-	--	T	5R	--	3	10-75	U	--	--
X 13	421236	0704928	48	COHASSET TOWN OF	1975	--	-	--	T	15R	X	2	10-75	U	--	--
X 14	421232	0704926	44	COHASSET TOWN OF	1975	--	-	--	T	6R	--	-5	10-75	U	--	--
						DUXBURY										
W 150	420326	0704312	45	DUXBURY TOWN OF	1974	2.5	P	35	T	--	R	4	12-74	U	20	1
W 151	420210	0704401	100	DUXBURY TOWN OF	1974	2.5	P	24	T	25	R	5	12-74	U	60	2
W 152	420216	0704408	100	DUXBURY TOWN OF	1974	2.5	P	29	Z	34	R	--	--	U	36	--
W 153	420209	0704354	100	DUXBURY TOWN OF	1974	--	-	--	Z	4	--	--	--	U	--	--
W 154	420152	0704358	100	DUXBURY TOWN OF	1974	2.5	P	35	T	48	R	13	12-74	U	40	2
W 155	420437	0704548	40	DUXBURY TOWN OF	1974	2.5	P	30	T	30	R	4	12-74	U	60	2
W 156	420437	0704437	35	DUXBURY TOWN OF	1974	2.5	P	29	T	29	3R	10	12-77	U	60	1
W 157	420442	0704442	35	DUXBURY TOWN OF	1974	--	P	--	Z	10	8P	--	--	U	--	--
W 158	420445	0704443	35	DUXBURY TOWN OF	1974	--	-	--	Z	15	8P	--	--	U	--	--
W 159	420439	0704432	35	DUXBURY TOWN OF	1974	--	-	--	Z	15	8P	--	--	U	--	--
W 160	420434	0704433	35	DUXBURY TOWN OF	1975	--	-	--	Z	15	P	--	--	U	--	--
W 161	420433	0704443	38	DUXBURY TOWN OF	1975	--	-	--	Z	21	P	1	2-75	U	--	--
W 162	420432	0704435	35	DUXBURY TOWN OF	1975	2.5	P	35	Z	35	4S	4	2-75	U	5	--
W 163	420432	0704446	35	DUXBURY TOWN OF	1975	2.5	P	32	T	--	4S	5	2-75	U	30	1
W 164	420338	0704305	45	DUXBURY TOWN OF	1975	2.5	P	25	Z	25	4R	11	2-75	U	30	--
W 165	420016	0704255	15	DUXBURY TOWN OF	1975	--	-	--	Z	53	P	--	--	U	--	--
W 166	420339	0704255	45	DUXBURY TOWN OF	1975	--	-	--	Z	22	R	8	2-75	U	--	--
W 167	420147	0704217	55	DUXBURY TOWN OF	1975	24	G	52	W	--	S	13	10-75	P	708	72
W 168	420147	0704211	80	DUXBURY TOWN OF	1976	24	G	71	W	--	--	14	1-76	P	609	48
W 169	420448	0704524	55	PRIVATE OWNER	1983	6	-	350	W	55R	--	--	--	H	2	--

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude		Altitude of land surface (ft)	Owner or user	Year drilled	Well				Depth to refusal (ft)	Water-bearing material	Water			Pumping	
						Diameter (in.)	Finish	Depth (ft)	Use			Level (ft)	Date measured	Use	Yield (gal/min)	Time (hr)
				DUXBURY--Continued												
W 170	420450	0704523	55	PRIVATE OWNER	1983	6	-	255	W	70R	--	--	--	H	4	--
W 171	420452	0704521	55	PRIVATE OWNER	1983	6	-	455	W	70R	--	--	--	H	2	--
W 172	420252	0704407	96	PRIVATE OWNER	1983	2	T	25	W	--	9S	12	7-83	H	15	3
W 173	420139	0704515	95	DUXBURY TOWN OF	1975	2.5	-	30	Z	30	6S	5	2-75	U	--	--
W 174	420130	0704528	85	DUXBURY TOWN OF	1975	--	-	--	Z	15	4S	--	--	U	--	--
W 175	420302	0704515	75	DUXBURY TOWN OF	1975	2.5	P	28	T	28	4S	6	2-75	U	40	1
W 176	420301	0704518	75	DUXBURY TOWN OF	1975	2.5	-	25	T	25	4S	3	2-75	U	60	1
W 177	420300	0704515	75	DUXBURY TOWN OF	1975	2.5	-	26	T	26	R	2	2-75	U	60	1
W 180	420154	0704518	90	DUXBURY TOWN OF	1975	--	-	--	Z	16	S	3	2-75	U	--	--
W 181	420150	0704517	90	DUXBURY TOWN OF	1975	--	-	15	Z	15	T	4	2-75	U	--	--
W 182	420147	0704515	90	DUXBURY TOWN OF	1975	--	-	--	Z	22	S	--	--	U	--	--
W 183	420142	0704521	90	DUXBURY TOWN OF	1975	--	-	--	Z	28	8P	--	--	U	--	--
W 184	420314	0704541	95	DUXBURY TOWN OF	1975	--	-	--	Z	10	T	--	--	U	--	--
W 185	420314	0704537	95	DUXBURY TOWN OF	1975	--	-	--	Z	12	T	--	--	U	--	--
W 186	420321	0704207	28	DUXBURY TOWN OF	1977	8	P	47	T	--	3S	5	7-77	U	305	119
W 187	420251	0704254	58	DUXBURY TOWN OF	1977	8	P	48	T	--	4S	6	9-77	U	257	220
W 188	420313	0704245	65	DUXBURY TOWN OF	1976	--	S	35	Z	35	2S	8	11-76	U	--	--
W 189	420311	0704240	62	DUXBURY TOWN OF	1976	--	-	24	Z	24	2S	12	11-76	U	--	--
W 190	420248	0704256	70	DUXBURY TOWN OF	1976	--	-	41	Z	41	2S	12	12-76	U	--	--
W 191	420229	0704218	40	DUXBURY TOWN OF	1976	--	-	55	Z	55	2S	14	12-76	U	--	--
W 192	420228	0704218	50	DUXBURY TOWN OF	1976	--	-	51	Z	51	2S	6	12-76	U	--	--
W 193	420214	0704204	82	DUXBURY TOWN OF	1972	--	P	82	Z	82	2S	36	10-72	U	--	--
W 194	420222	0704204	52	DUXBURY TOWN OF	1972	--	P	45	T	78	2S	18	10-72	U	30	--
W 195	420234	0704249	60	DUXBURY TOWN OF	1972	--	P	--	Z	52	2S	10	10-72	U	16	--
W 196	420224	0704254	64	DUXBURY TOWN OF	1972	--	P	50	T	54	4S	4	10-72	U	55	1

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude		Altitude of land surface (ft)	Owner or user	Year drilled	Well: Diameter (in.)	Well: Finish	Well: Depth (ft)	Well: Use	Depth to refusal (ft)	Water-bearing material	Water: Level (ft)	Water: Date measured	Water: Use	Pumping: Yield (gal/min)	Pumping: Time (hr)
				DUXBURY--Continued												
W 197	420224	0704252	48	DUXBURY TOWN OF	1972	--	P	53	T	62	2S	5	10-72	U	85	1
W 198	420221	0704247	62	DUXBURY TOWN OF	1972	--	P	55	T	59	2S	7	10-72	U	60	2
W 199	420209	0704254	65	DUXBURY TOWN OF	1972	--	-	70	Z	70	1X	2	11-72	U	--	--
W 200	420352	0704308	58	DUXBURY TOWN OF	1972	--	-	48	Z	48	6S	2	11-72	U	--	--
W 201	420340	0704150	27	DUXBURY TOWN OF	1972	--	P	45	T	72	2S	2	11-72	U	60	2
W 202	420339	0704256	45	DUXBURY TOWN OF	1972	--	P	--	Z	38	S	2	11-72	U	5	--
W 203	420341	0704304	48	DUXBURY TOWN OF	1972	--	-	30	Z	30	1X	4	11-72	U	--	--
W 204	420340	0704156	28	DUXBURY TOWN OF	1972	--	P	50	T	67	2S	3	11-72	U	75	2
W 205	420401	0704320	55	DUXBURY TOWN OF	1972	--	-	28	Z	28	2S	8	11-72	U	--	--
W 206	420357	0704323	55	DUXBURY TOWN OF	1972	--	-	24	Z	24	2S	8	11-72	U	--	--
W 207	420307	0704224	58	DUXBURY TOWN OF	1972	--	-	62	Z	62	1S	2	11-72	U	--	--
W 208	420244	0704247	58	DUXBURY TOWN OF	1972	--	-	58	Z	58	2S	3	11-72	U	--	--
W 209	420259	0704238	80	DUXBURY TOWN OF	1972	--	-	--	Z	29	2S	--	--	U	--	--
W 210	420208	0704300	81	DUXBURY TOWN OF	1972	--	-	45	Z	45	1S	12	11-72	U	--	--
W 211	420201	0704252	88	DUXBURY TOWN OF	1972	--	-	--	Z	17	--	--	11-72	U	--	--
W 212	420159	0704258	83	DUXBURY TOWN OF	1972	--	P	35	Z	60	2S	16	11-72	U	5	--
W 213	420052	0704325	65	PRIVATE OWNER	1974	--	-	--	T	--	2S	11	9-74	U	--	--
W 214	420103	0704327	68	PRIVATE OWNER	1974	--	-	19	T	--	2S	13	7-74	U	--	--
W 215	420101	0704320	70	PRIVATE OWNER	1974	--	-	20	T	--	2S	10	7-74	U	--	--
W 216	420057	0704324	65	PRIVATE OWNER	1974	--	-	14	T	36	2S	10	7-74	U	--	--
W 217	420323	0704152	27	DUXBURY TOWN OF	1981	8	-	64	T	--	4S	7	3-81	U	180	144
W 218	420242	0704301	68	DUXBURY TOWN OF	1977	--	-	--	Z	51	6S	22	11-77	U	--	--
W 219	420243	0704306	70	DUXBURY TOWN OF	1977	--	-	--	Z	41	8P	--	--	U	--	--
W 220	420308	0704201	45	DUXBURY TOWN OF	1977	--	-	--	Z	41	8P	--	--	U	--	--
W 221	420323	0704149	27	DUXBURY TOWN OF	1977	2.5	P	63	T	63	S	8	11-77	U	40	2
W 222	420325	0704155	32	DUXBURY TOWN OF	1977	2.5	P	49	T	53	S	16	11-77	U	40	2
W 223	420206	0704323	77	DUXBURY TOWN OF	1977	--	-	--	Z	29	6S	2	11-77	U	--	--

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude	Altitude of land surface (ft)	Owner or user	Year drilled	Well: Diameter (in.)	Well: Finish	Well: Depth (ft)	Well: Use	Depth to refusal (ft)	Water-bearing material	Water: Level (ft)	Water: Date measured	Water: Use	Pumping: Yield (gal/min)	Pumping: Time (hr)
					DUXBURY--Continued										
W 224	420201 0704324	76	DUXBURY TOWN OF	1977	--	-	--	Z	24	Y	--	--	U	--	--
W 225	420150 0704312	80	DUXBURY TOWN OF	1977	--	-	--	Z	31	6S	--	--	U	--	--
W 226	420143 0704306	70	DUXBURY TOWN OF	1977	--	-	--	Z	25	6S	--	--	U	--	--
W 227	420132 0704550	68	DUXBURY TOWN OF	1977	2.5	P	30	Z	30	4S	3	12-77	U	--	--
W 228	420135 0704548	68	DUXBURY TOWN OF	1977	--	-	--	Z	33	6S	8	12-77	U	--	--
W 229	420135 0704551	68	DUXBURY TOWN OF	1977	--	P	31	T	31	R	4	12-77	U	65	2
W 230	420230 0704148	45	DUXBURY TOWN OF	1977	2.5	P	46	T	62	S	16	12-77	U	25	2
W 231	420327 0704155	60	DUXBURY TOWN OF	1977	2.5	P	55	T	62	3S	6	12-77	U	50	2
W 232	420325 0704149	35	DUXBURY TOWN OF	1977	--	-	--	Z	78	6S	11	12-77	U	--	--
W 233	420123 0704557	65	DUXBURY TOWN OF	1977	--	-	--	Z	31	6S	9	12-77	U	--	--
W 234	420355 0704229	28	DUXBURY TOWN OF	1978	2.5	P	35	Z	38	R	5	1-78	U	35	2
W 235	420341 0704300	37	DUXBURY TOWN OF	1978	2.5	P	32	Z	32	R	5	2-78	U	45	2
W 236	420347 0704259	50	DUXBURY TOWN OF	1978	2.5	P	35	Z	38	R	3	2-78	U	35	2
W 237	420252 0704258	55	DUXBURY TOWN OF	1978	2.5	P	55	T	61	R	8	3-78	U	60	2
W 238	420346 0704259	50	DUXBURY TOWN OF	1978	2.5	P	28	T	34	R	1	3-78	U	25	2
W 239	420345 0704302	50	DUXBURY TOWN OF	1978	2.5	P	28	T	32	R	1	3-78	U	60	2
W 240	420405 0704237	55	DUXBURY TOWN OF	1978	2.5	P	28	Z	31	R	3	3-78	U	5	--
W 241	420402 0704233	38	DUXBURY TOWN OF	1978	2.5	P	36	Z	39	R	5	3-78	U	--	--
W 242	420224 0704252	48	DUXBURY TOWN OF	1974	8	S	50	W	--	3S	5	1-74	P	247	214
					HANOVER										
W 119	420630 0704940	100	HANOVER TOWN OF	1981	2.5	P	56	O	64	4R	12	5-81	U	25	--
W 120	420635 0704943	105	HANOVER TOWN OF	1981	2.5	P	42	O	50	4R	18	5-81	U	35	--
W 121	420637 0704938	75	HANOVER TOWN OF	1981	2.5	-	35	O	44	R	10	5-81	U	25	--
W 122	420633 0704936	75	HANOVER TOWN OF	1981	2.5	-	42	O	48	R	7	5-81	U	30	--
W 123	420631 0704932	95	HANOVER TOWN OF	1981	2.5	P	56	O	61	4R	2	5-81	U	20	--

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude		Altitude of land surface (ft)	Owner or user	Year drilled	Well: Diameter (in.)	Well: Finish	Well: Depth (ft)	Well: Use	Depth to refusal (ft)	Water-bearing material	Water: Level (ft)	Water: Date measured	Water: Use	Pumping: Yield (gal/min)	Pumping: Time (hr)
						HANOVER--Continued										
W 124	420639	0704925	75	HANOVER TOWN OF	1981	2.5	S	56	O	60	R	8	5-81	U	20	--
W 125	420640	0704928	75	HANOVER TOWN OF	1981	2.5	P	42	O	48	4R	8	5-81	U	35	--
W 126	420642	0704927	75	HANOVER TOWN OF	1981	2.5	P	42	O	55	2R	6	5-81	U	30	--
W 127	420633	0704920	75	HANOVER TOWN OF	1981	--	-	35	O	59	6R	--	--	U	--	--
W 128	420630	0704920	80	HANOVER TOWN OF	1981	2.5	P	56	O	59	R	13	4-81	U	20	--
W 129	420630	0704916	75	HANOVER TOWN OF	1981	2.5	P	21	O	23	6R	6	5-81	U	5	--
W 130	420758	0705242	85	HANOVER TOWN OF	1971	2.5	S	35	Z	35	R	3	8-71	U	3	--
W 131	420751	0705240	90	HANOVER TOWN OF	1971	--	-	--	Z	--	8Y	--	--	U	--	--
W 132	420752	0705234	85	HANOVER TOWN OF	1971	2.5	S	26	Z	29	8Y	4	9-71	U	10	--
W 133	420800	0705003	60	HANOVER TOWN OF	1973	8	S	57	Z	--	Y	--	--	U	60	--
W 134	420635	0705231	85	PRIVATE OWNER	1972	2	-	30	W	--	--	22	5-72	H	--	--
W 135	420731	0705147	75	PRIVATE OWNER	1982	6	-	145	W	55R	--	12	8-82	H	12	--
W 136	420735	0705128	95	PRIVATE OWNER	1971	6	-	100	W	55R	--	10	8-71	H	50	--
W 137	420758	0705043	130	PRIVATE OWNER	1972	6.62	-	155	W	70R	--	40	5-72	H	50	--
W 138	420923	0705054	85	PRIVATE OWNER	1972	6.62	-	245	W	35R	--	10	8-72	H	6	--
W 139	420822	0705033	65	PRIVATE OWNER	1972	6.5	-	220	W	20R	--	23	1-72	N	25	--
W 140	420703	0704940	75	PRIVATE OWNER	1982	2	-	14	W	--	--	2	5-82	H	10	2
X 2	420818	0705028	140	PRIVATE OWNER	1981	2.5	-	--	Z	--	--	--	--	U	--	--
						KINGSTON										
A 3	420052	0704436	40	USGS	1986	--	-	--	Z	44R	3S	4	4-86	U	--	--
A 4	420030	0704439	27	USGS	1986	--	-	--	Z	41R	3S	4	4-86	U	--	--
A 5	415933	0704535	40	USGS	1986	--	-	--	Z	--	7P	--	--	U	--	--
A 6	415925	0704547	33	USGS	1986	--	-	--	Z	42R	3S	10	4-86	U	--	--
A 7	415924	0704545	33	USGS	1986	--	-	--	Z	41	3S	7	4-86	U	--	--

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude		Altitude of land surface (ft)	Owner or user	Year drilled	Well				Depth to refusal (ft)	Water-bearing material	Water			Pumping	
						Diameter (in.)	Finish	Depth (ft)	Use			Level (ft)	Date measured	Use	Yield (gal/min)	Time (hr)
						KINGSTON--Continued										
A 8	415940	0704536	55	USGS	1986	--	-	--	Z	53R	6Q	18	4-86	U	--	--
W 147	415806	0704356	145	KINGSTON TOWN OF	1972	2.5	P	104	Z	104	2R	15	10-72	U	30	3
W 148	415811	0704423	145	KINGSTON TOWN OF	1972	2.5	P	66	Z	66	2R	15	10-72	-	3	--
W 149	415907	0704339	45	KINGSTON TOWN OF	1972	4	G	36	T	36	2R	-3	9-72	-	60	1
W 150	415909	0704344	30	KINGSTON TOWN OF	1972	--	O	16	Z	16	--	--	--	-	--	--
W 151	415910	0704346	45	KINGSTON TOWN OF	1972	--	O	16	Z	16	--	--	--	-	--	--
W 152	415912	0704347	45	KINGSTON TOWN OF	1972	4	G	37	T	37	R	-2	9-72	-	45	--
W 153	415949	0704559	45	KINGSTON TOWN OF	1972	2.5	S	24	T	24	R	5	9-72	-	45	--
W 154	420006	0704702	50	KINGSTON TOWN OF	1972	2.5	S	31	T	32	R	5	9-72	-	20	--
W 155	420008	0704710	50	KINGSTON TOWN OF	1972	2.5	S	52	T	54	R	3	9-72	-	60	--
W 156	420009	0704649	50	KINGSTON TOWN OF	1972	--	-	85	Z	85	1X	6	9-72	-	3	--
W 158	420113	0704555	55	KINGSTON TOWN OF	1972	--	-	20	Z	20	6R	--	--	-	--	--
W 159	420115	0704558	60	KINGSTON TOWN OF	1972	--	-	20	Z	20	6R	--	--	-	--	--
W 160	415718	0704505	140	KINGSTON TOWN OF	1974	8	P	96	T	--	3R	7	12-74	-	507	120
W 161	415811	0704344	95	KINGSTON TOWN OF	1974	8	P	80	W	--	6R	9	12-74	P	505	144
W 162	415811	0704344	95	KINGSTON TOWN OF	1974	2.5	S	96	T	--	3S	8	11-74	-	60	2
W 163	415813	0704344	95	KINGSTON TOWN OF	1975	2.5	P	85	T	--	3S	13	1-75	-	50	2
W 164	415718	0704507	140	KINGSTON TOWN OF	1974	2.5	P	103	T	--	4S	15	11-74	-	50	2
W 165	415858	0704223	40	KINGSTON TOWN OF	1981	1.25	P	13	O	--	9X	5	12-81	-	--	--
W 166	415952	0704231	8	KINGSTON TOWN OF	1981	1.25	P	30	O	--	2S	18	11-81	-	--	--
W 167	415924	0704344	25	KINGSTON TOWN OF	1981	1.25	P	32	O	--	2S	22	11-81	-	--	--
W 168	415950	0704411	40	KINGSTON TOWN OF	1981	1.25	P	20	O	20	9X	13	10-81	-	--	--
W 171	415847	0704328	125	KINGSTON TOWN OF	1982	2	P	58	T	106	2S	30	11-82	U	--	--
W 172	415844	0704339	115	KINGSTON TOWN OF	1982	2	P	45	T	72	2S	21	11-82	U	--	--
W 173	415839	0704324	135	KINGSTON TOWN OF	1982	2	P	45	T	--	2S	--	--	U	--	--
W 174	415817	0704345	125	KINGSTON TOWN OF	1982	2	P	72	T	--	2S	--	--	U	--	--

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude		Altitude of land surface (ft)	Owner or user	Year drilled	Well				Depth to refusal (ft)	Water-bearing material	Water			Pumping	
						Diameter (in.)	Finish	Depth (ft)	Use			Level (ft)	Date measured	Use	Yield (gal/min)	Time (hr)
						KINGSTON--Continued										
W 175	420011	0704624	50	BROCKTON CITY OF	1981	1.25	S	--	T	--	2X	7	9-81	-	--	--
W 176	420017	0704623	50	BROCKTON CITY OF	1981	1.25	T	24	T	--	Q	11	9-81	-	--	--
W 177	420023	0704623	50	BROCKTON CITY OF	1981	1.25	T	28	T	39	2X	3	9-81	-	--	--
W 178	420027	0704638	50	BROCKTON CITY OF	1981	2.5	P	48	T	48	2S	22	9-81	-	--	--
W 179	420037	0704705	50	BROCKTON CITY OF	1981	2.5	P	29	T	--	2S	--	--	-	--	--
W 180	420047	0704735	45	BROCKTON CITY OF	1981	1.25	S	33	T	35	3S	11	9-81	-	--	--
W 181	420030	0704734	45	BROCKTON CITY OF	1981	1.25	S	29	T	--	3S	14	9-81	-	--	--
W 182	420012	0704708	50	BROCKTON CITY OF	1981	2.5	P	47	T	49	2S	9	9-81	-	--	--
W 183	420031	0704729	60	BROCKTON CITY OF	1981	1.25	S	44	T	--	1S	23	10-81	-	--	--
W 184	420019	0704628	40	BROCKTON CITY OF	1980	2.5	-	49	T	49	4S	7	12-80	-	60	--
W 185	420017	0704629	40	BROCKTON CITY OF	1980	2.5	-	37	T	37	3R	5	12-80	-	60	--
W 186	420017	0704640	40	BROCKTON CITY OF	1980	2.5	-	47	T	47	3S	6	12-80	-	50	--
W 187	420024	0704642	41	BROCKTON CITY OF	1980	2.5	-	35	T	35	4G	3	12-80	-	60	--
W 188	420019	0704648	50	BROCKTON CITY OF	1981	2.5	-	33	T	39	2X	7	9-81	-	19	--
W 189	420030	0704650	55	BROCKTON CITY OF	1981	2.5	P	42	T	44	R	5	7-81	-	28	--
W 190	415826	0704247	145	KINGSTON TOWN OF	1981	1.5	T	80	T	--	--	68	3-81	-	--	--
W 191	415833	0704247	95	KINGSTON TOWN OF	1981	1.5	T	35	T	--	--	30	3-81	-	--	--
W 192	415834	0704243	85	KINGSTON TOWN OF	1981	1.5	T	35	T	--	--	18	3-81	-	--	--
W 193	415835	0704251	85	KINGSTON TOWN OF	1981	1.5	T	25	T	--	--	18	3-81	-	--	--
W 195	415828	0704250	100	KINGSTON TOWN OF	1981	--	-	32	T	--	2X	26	3-81	-	--	--
W 196	415829	0704250	100	KINGSTON TOWN OF	1981	1.5	-	36	T	93	2X	23	3-81	-	--	--
W 197	415733	0704313	197	KINGSTON TOWN OF	1973	2.5	P	150	T	164	S	75	11-73	U	2	4
W 198	415724	0704320	190	KINGSTON TOWN OF	1973	2.5	P	135	T	--	4S	59	11-73	U	3	4
W 199	415725	0704356	145	KINGSTON TOWN OF	1973	2.5	P	70	T	--	4R	6	11-73	U	60	2
W 200	415748	0704334	152	USGS	1985	2	P	58	O	--	4S	39	11-85	U	--	--

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude		Altitude of land surface (ft)	Owner or user	Year drilled	Well: Diameter (in.)	Well: Finish	Well: Depth (ft)	Well: Use	Depth to refusal (ft)	Water-bearing material	Water: Level (ft)	Water: Date measured	Water: Use	Pumping: Yield (gal/min)	Pumping: Time (hr)
						KINGSTON--Continued										
W 201	415744	0704526	135	USGS	1985	2	P	48	O	87R	3S	11	11-85	U	--	--
W 202	415813	0704556	148	USGS	1985	2	P	38	O	49	2S	25	11-85	U	--	--
W 203	415842	0704439	97	USGS	1985	2	P	42	O	--	6X	23	11-85	U	--	--
W 204	415754	0704408	131	USGS	1985	2	P	26	O	73R	3S	14	11-85	U	--	--
W 205	415716	0704509	135	KINGSTON TOWN OF	1974	2.5	P	99	O	--	3S	10	10-74	U	50	2
W 206	415815	0704248	173	KINGSTON TOWN OF	1973	2.5	P	48	T	60	4S	26	11-73	-	30	2
W 207	415814	0704239	102	KINGSTON TOWN OF	1973	2.5	P	80	T	--	2X	5	12-73	U	50	2
W 208	415904	0704158	27	KINGSTON TOWN OF	1981	1.25	P	14	T	14	--	--	--	U	--	--
W 209	415946	0704212	25	KINGSTON TOWN OF	1981	1.25	P	10	T	--	P	2	10-81	U	--	--
W 210	415809	0704434	149	USGS	1986	2	P	52	O	--	3S	41	4-86	U	--	--
W 211	415902	0704552	82	USGS	1986	2	P	16	O	16R	3S	7	4-86	U	--	--
W 212	415925	0704541	39	USGS	1986	2	P	32	O	84R	3R	4	5-86	U	--	--
W 213	415845	0704332	133	KINGSTON TOWN OF	1986	2	P	67	O	--	2S	54	1-86	U	--	--
W 214	415843	0704333	129	KINGSTON TOWN OF	1986	2	P	95	O	--	3S	48	1-86	U	--	--
W 215	415847	0704333	130	KINGSTON TOWN OF	1986	2	P	62	O	--	2S	52	2-86	U	--	--
W 216	415828	0704346	168	KINGSTON TOWN OF	1985	2	P	90	O	105	2S	73	12-85	U	--	--
W 217	415845	0704402	117	KINGSTON TOWN OF	1986	2	P	34	O	100	3S	26	1-86	U	--	--
W 218	415856	0704335	88	KINGSTON TOWN OF	1985	2	P	50	O	58R	2S	22	12-85	U	--	--
W 219	415858	0704359	84	KINGSTON TOWN OF	1986	2	P	40	O	59R	2S	24	1-86	U	--	--
W 220	415900	0704319	65	KINGSTON TOWN OF	1985	2	P	39	O	59	S	7	12-85	U	--	--
W 221	415919	0704342	26	KINGSTON TOWN OF	1986	2	P	46	O	55	3S	14	1-86	U	--	--
W 222	415804	0704257	170	PRIVATE OWNER	1979	2.5	O	--	Z	95	R	37	12-79	-	--	--
W 223	415802	0704249	130	PRIVATE OWNER	1979	2.5	S	91	T	--	3R	9	12-79	-	60	2
W 224	415930	0704547	37	PRIVATE OWNER	1964	8	S	76	W	--	R	--	--	I	400	--
X 1	420001	0704416	40	KINGSTON TOWN OF	1983	--	-	--	T	7	7S	2	3-83	-	--	--

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude	Altitude of land surface (ft)	Owner or user	Year drilled	Well: Diameter (in.)	Well: Finish	Well: Depth (ft)	Well: Use	Depth to refusal (ft)	Water-bearing material	Water: Level (ft)	Water: Date measured	Water: Use	Pumping: Yield (gal/min)	Pumping: Time (hr)
				KINGSTON--Continued											
X 2	420000 0704419	40	KINGSTON TOWN OF	1983	--	-	--	T	--	7S	2	3-83	-	--	--
X 3	420004 0704343	40	KINGSTON TOWN OF	1983	--	-	--	T	--	2S	9	3-83	-	--	--
X 4	420001 0704343	38	KINGSTON TOWN OF	1983	--	-	--	T	--	2S	10	3-83	-	--	--
X 5	420010 0704558	45	BROCKTON CITY OF	1980	--	-	--	T	20	7S	--	--	-	--	--
X 6	420010 0704558	45	BROCKTON CITY OF	1980	--	-	--	T	17	--	--	--	-	--	--
X 7	420014 0704558	45	BROCKTON CITY OF	1980	--	-	--	T	10	--	--	--	-	--	--
X 8	420014 0704558	45	BROCKTON CITY OF	1980	--	-	--	T	11	--	--	--	-	--	--
X 9	420026 0704610	50	BROCKTON CITY OF	1980	--	-	--	T	38	6X	--	--	-	--	--
X 10	420031 0704613	60	BROCKTON CITY OF	1980	--	-	--	T	35	7S	--	--	-	--	--
X 11	420023 0704614	60	BROCKTON CITY OF	1980	--	-	--	T	29	7S	--	--	-	--	--
X 13	420021 0704626	50	BROCKTON CITY OF	1980	--	-	--	T	51	6X	--	--	-	--	--
X 14	420010 0704625	40	BROCKTON CITY OF	1980	--	-	--	T	49	6X	--	--	-	--	--
X 15	420014 0704622	35	BROCKTON CITY OF	1980	--	-	--	T	42	P	--	--	-	--	--
X 16	420019 0704625	40	BROCKTON CITY OF	1980	--	-	--	T	48	6X	--	--	-	--	--
X 17	420026 0704628	61	BROCKTON CITY OF	1980	--	-	--	T	52	P	--	--	-	--	--
X 18	420029 0704635	60	BROCKTON CITY OF	1980	--	-	--	T	66	7P	--	--	-	--	--
X 19	415918 0704218	40	KINGSTON TOWN OF	1981	--	-	--	T	--	--	12	-81	-	--	--
X 20	415918 0704214	35	KINGSTON TOWN OF	1981	--	-	--	T	--	--	10	-81	-	--	--
				MARSHFIELD											
W 164	420442 0704003	10	MARSHFIELD TOWN OF	1974	--	-	--	Z	47	9P	--	--	U	--	--
W 165	420454 0704028	15	MARSHFIELD TOWN OF	1974	2.5	P	30	T	36	6R	5	12-74	U	15	2
W 166	420609 0704258	20	MARSHFIELD TOWN OF	1975	2.5	P	40	T	--	4R	7	1-75	U	60	2
W 167	420607 0704253	25	MARSHFIELD TOWN OF	1975	2.5	P	50	Z	65	6S	12	1-75	U	5	2
W 168	420607 0704256	20	MARSHFIELD TOWN OF	1975	--	P	40	T	--	4G	4	1-75	U	200	144

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude		Altitude of land surface (ft)	Owner or user	Year drilled	Well				Depth to refusal (ft)	Water-bearing material	Water			Pumping	
						Diameter (in.)	Finish	Depth (ft)	Use			Level (ft)	Date measured	Use	Yield (gal/min)	Time (hr)
						MARSHFIELD--Continued										
W 169	420806	0704554	70	MARSHFIELD TOWN OF	1975	--	-	--	Z	21	6S	--	--	U	--	--
W 170	420514	0704148	10	MARSHFIELD TOWN OF	1974	--	-	--	Z	13	--	--	--	-	--	--
W 171	420514	0704144	10	MARSHFIELD TOWN OF	1974	--	-	--	Z	14	--	--	--	-	--	--
W 172	420444	0703946	5	MARSHFIELD TOWN OF	1974	2.5	-	35	Z	35	6R	5	11-74	U	--	1
W 173	420442	0704015	10	MARSHFIELD TOWN OF	1974	--	-	--	Z	14	8P	--	--	-	--	--
W 174	420442	0704019	10	MARSHFIELD TOWN OF	1974	--	-	--	Z	7	--	--	--	-	--	--
W 175	420444	0704208	10	MARSHFIELD TOWN OF	1974	2.5	P	21	T	21	Y	6	12-74	-	18	2
W 176	420510	0704338	50	MARSHFIELD TOWN OF	1974	--	-	--	Z	10	--	--	--	-	--	--
W 177	420513	0704330	50	MARSHFIELD TOWN OF	1974	--	-	--	Z	10	--	--	--	-	--	--
W 178	420546	0704348	35	MARSHFIELD TOWN OF	1975	2.5	P	45	T	50	6S	--	2-75	-	40	2
W 179	420607	0704428	100	MARSHFIELD TOWN OF	1975	--	-	--	Z	60	6S	--	--	-	--	--
W 180	420604	0704418	90	MARSHFIELD TOWN OF	1975	--	-	--	Z	24	6S	--	--	-	--	--
W 181	420610	0704420	90	MARSHFIELD TOWN OF	1975	2.5	P	35	T	43	3S	11	2-75	-	40	2
W 182	420615	0704447	90	MARSHFIELD TOWN OF	1975	--	-	--	Z	32	8P	--	--	-	--	--
W 183	420615	0704451	90	MARSHFIELD TOWN OF	1975	--	-	--	Z	40	6X	--	--	-	--	--
W 184	420718	0704242	48	MARSHFIELD TOWN OF	1975	2.5	-	50	T	--	6R	3	3-75	-	10	2
W 185	420723	0704244	60	MARSHFIELD TOWN OF	1975	2.5	-	60	T	70	7R	8	3-75	-	50	2
W 186	420724	0704252	62	MARSHFIELD TOWN OF	1975	2.5	-	40	T	42	4R	14	3-75	-	25	2
W 187	420703	0704412	100	MARSHFIELD TOWN OF	1975	2.5	P	158	T	160	3S	40	4-75	-	3	2
W 188	420549	0704231	25	MARSHFIELD TOWN OF	1975	2.5	-	28	T	31	6R	4	3-75	-	20	--
W 189	420609	0704256	35	MARSHFIELD TOWN OF	1975	2.5	P	100	T	103	6S	7	1-75	-	--	--
W 190	420822	0704558	48	MARSHFIELD TOWN OF	1975	--	-	--	Z	27	6R	--	--	U	--	--
W 191	420827	0704606	70	MARSHFIELD TOWN OF	1975	--	-	--	Z	38	6S	--	--	U	--	--
W 192	420730	0704247	35	MARSHFIELD TOWN OF	1975	2.5	P	50	T	53	6R	4	3-75	U	50	2
W 193	420701	0704622	20	MARSHFIELD TOWN OF	1975	2.5	P	45	Z	66	6S	11	4-75	U	10	2

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude		Altitude of land surface (ft)	Owner or user	Year drilled	Well: Diameter (in.)	Well: Finish	Well: Depth (ft)	Well: Use	Depth to refusal (ft)	Water-bearing material	Water: Level (ft)	Water: Date measured	Water: Use	Pumping: Yield (gal/min)	Pumping: Time (hr)
				MARSHFIELD--Continued												
W 194	420656	0704628	35	MARSHFIELD TOWN OF	1975	2.5	P	45	T	57	4S	6	4-75	U	37	4
W 195	420604	0704513	65	MARSHFIELD TOWN OF	1975	2.5	P	100	T	104	6X	0	4-75	U	50	2
W 196	420713	0704539	55	MARSHFIELD TOWN OF	1975	2.5	P	122	T	124	6R	-1	5-75	U	60	2
W 197	420709	0704541	45	MARSHFIELD TOWN OF	1975	2.5	P	60	T	--	6R	-2	5-75	U	20	2
W 198	420430	0704036	17	MARSHFIELD TOWN OF	1973	6	S	30	W	--	3G	3	5-73	P	110	10
W 199	420430	0704036	19	MARSHFIELD TOWN OF	1973	6	S	30	W	--	3G	5	5-73	P	100	3
W 200	420429	0704036	19	MARSHFIELD TOWN OF	1973	6	S	30	W	--	2G	5	4-73	P	100	3
W 201	420429	0704036	18	MARSHFIELD TOWN OF	1973	6	S	30	W	--	3G	4	5-73	P	100	10
W 202	420428	0704036	19	MARSHFIELD TOWN OF	1973	6	S	32	W	--	3G	5	5-73	P	100	12
W 203	420427	0704036	19	MARSHFIELD TOWN OF	1974	6	S	30	W	--	4G	7	8-74	P	130	8
W 204	420427	0704036	19	MARSHFIELD TOWN OF	1974	6	S	30	W	--	4G	6	8-74	P	125	8
W 205	420718	0704242	48	MARSHFIELD TOWN OF	1975	8	S	65	T	--	3R	4	8-75	U	302	168
W 206	420336	0704100	15	MARSHFIELD TOWN OF	1976	--	-	--	Z	8	--	--	--	U	--	--
W 207	420634	0704148	18	MARSHFIELD TOWN OF	1976	2.5	S	35	Z	--	6S	-4	2-76	U	5	--
W 208	420635	0704150	25	MARSHFIELD TOWN OF	1976	2.5	S	29	Z	32	6R	-4	2-76	U	25	--
W 209	420633	0704150	18	MARSHFIELD TOWN OF	1976	2.5	S	26	Z	29	6R	-4	1-76	U	1	--
W 210	420407	0704101	22	MARSHFIELD TOWN OF	1976	2.5	S	37	T	39	6R	7	1-76	U	35	2
W 211	420406	0704105	20	MARSHFIELD TOWN OF	1976	2.5	S	26	T	42	6R	2	1-76	U	15	2
W 212	420400	0704108	10	MARSHFIELD TOWN OF	1975	2.5	S	21	Z	21	6R	--	--	U	--	--
W 213	420405	0704108	30	MARSHFIELD TOWN OF	1975	2.5	S	36	Z	36	2R	--	--	U	--	--
W 214	420403	0704108	20	MARSHFIELD TOWN OF	1975	2.5	S	30	T	36	2R	7	12-75	U	15	2
W 215	420401	0704111	8	MARSHFIELD TOWN OF	1975	2.5	S	32	T	32	2S	0	12-75	U	35	2
W 216	420404	0704126	8	MARSHFIELD TOWN OF	1976	2.5	S	28	T	--	R	7	5-76	U	60	1
W 217	420404	0704126	8	MARSHFIELD TOWN OF	1976	2.5	S	31	T	--	R	7	5-76	U	60	1
W 218	420404	0704126	8	MARSHFIELD TOWN OF	1976	2.5	S	36	T	--	4R	7	4-76	U	60	1

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude		Altitude of land surface (ft)	Owner or user	Year drilled	Well: Diameter (in.)	Well: Finish	Well: Depth (ft)	Well: Use	Depth to refusal (ft)	Water-bearing material	Water: Level (ft)	Water: Date measured	Water: Use	Pumping: Yield (gal/min)	Pumping: Time (hr)
				MARSHFIELD--Continued												
W 219	420404	0704126	8	MARSHFIELD TOWN OF	1976	2.5	S	41	T	--	6R	8	4-76	U	60	1
W 220	420404	0704126	8	MARSHFIELD TOWN OF	1976	2.5	S	37	T	47	6R	6	4-76	U	60	1
W 221	420404	0704126	8	MARSHFIELD TOWN OF	1976	2.5	S	38	T	--	6R	8	4-76	U	60	1
W 222	420404	0704126	8	MARSHFIELD TOWN OF	1976	2.5	S	37	T	--	R	7	4-76	U	60	1
W 223	420404	0704126	8	MARSHFIELD TOWN OF	1976	2.5	S	25	T	45	6R	7	3-76	U	60	2
W 224	420428	0704218	42	MARSHFIELD TOWN OF	1976	--	-	--	Z	21	4R	--	--	U	--	--
W 225	420402	0704131	8	MARSHFIELD TOWN OF	1975	2.5	S	30	T	36	3R	8	3-75	U	60	1
W 226	420404	0704122	18	MARSHFIELD TOWN OF	1976	2.5	S	38	T	41	6R	6	3-76	U	60	2
W 227	420647	0704126	15	MARSHFIELD TOWN OF	1976	--	S	--	Z	27	4R	--	--	U	--	--
W 228	420406	0704123	10	MARSHFIELD TOWN OF	1976	--	-	--	Z	42	6X	--	--	U	--	--
W 229	420403	0704129	10	MARSHFIELD TOWN OF	1976	2.5	S	25	T	41	6R	4	3-76	U	60	2
W 230	420444	0704002	10	MARSHFIELD TOWN OF	1976	--	-	--	Z	20	P	--	--	-	--	--
W 231	420443	0704006	7	MARSHFIELD TOWN OF	1976	2.5	S	25	T	42	6R	1	2-76	U	15	2
W 232	420449	0703948	5	MARSHFIELD TOWN OF	1976	--	-	--	Z	32	8P	--	--	U	--	--
W 233	420448	0703952	5	MARSHFIELD TOWN OF	1976	--	-	--	T	28	6S	--	--	U	--	--
W 234	420600	0704018	2	MARSHFIELD TOWN OF	1976	2.5	S	26	T	40	6S	0	2-76	U	60	2
W 235	420551	0704031	5	MARSHFIELD TOWN OF	1976	--	S	38	T	38	4R	4	2-76	U	75	1
W 236	420556	0704023	2	MARSHFIELD TOWN OF	1976	2.5	S	52	T	54	6X	7	3-76	U	60	--
W 237	420334	0704100	40	MARSHFIELD TOWN OF	1976	2.5	S	27	Z	33	6S	10	2-76	U	30	2
W 238	420720	0704232	70	MARSHFIELD TOWN OF	1977	2.5	S	45	T	70	3R	6	4-77	U	60	2
W 239	420721	0704302	95	MARSHFIELD TOWN OF	1977	--	S	--	Z	122	6S	46	3-77	U	--	--
W 240	420512	0704226	18	MARSHFIELD TOWN OF	1977	2.5	S	26	T	27	6R	1	3-77	U	43	2
W 241	420514	0704228	20	MARSHFIELD TOWN OF	1977	2.5	S	33	T	33	4R	8	3-77	U	30	2
W 242	420516	0704230	12	MARSHFIELD TOWN OF	1977	--	-	--	Z	16	Y	--	--	-	--	--
W 243	420617	0704249	75	MARSHFIELD TOWN OF	1977	--	-	--	Z	114	6S	--	--	-	--	--

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude		Altitude of land surface (ft)	Owner or user	Year drilled	Well: Diameter (in.)	Well: Finish	Well: Depth (ft)	Well: Use	Depth to refusal (ft)	Water-bearing material	Water: Level (ft)	Water: Date measured	Water: Use	Pumping: Yield (gal/min)	Pumping: Time (hr)
				MARSHFIELD--Continued												
W 244	420508	0704103	10	MARSHFIELD TOWN OF	1977	2.5	S	38	T	52	3R	7	3-77	U	43	2
W 245	420502	0704100	20	MARSHFIELD TOWN OF	1977	2.5	S	31	T	31	6R	10	3-77	U	43	2
W 246	420520	0704158	10	MARSHFIELD TOWN OF	1977	2.5	S	39	T	39	4R	3	3-77	U	30	2
W 247	420851	0704401	30	MARSHFIELD TOWN OF	1973	2.5	S	50	Z	68	6S	6	1-73	U	20	1
W 248	420849	0704403	28	MARSHFIELD TOWN OF	1973	2.5	S	40	Z	64	6S	2	1-75	U	10	--
W 249	420422	0704039	20	MARSHFIELD TOWN OF	1973	2.5	S	30	T	40	R	4	2-73	U	50	2
W 250	420423	0704111	17	MARSHFIELD TOWN OF	1973	--	S	50	T	60	2S	2	3-73	U	200	288
W 251	420418	0704119	17	MARSHFIELD TOWN OF	1973	2.5	S	35	T	53	Y	--	--	U	50	--
W 252	420438	0704157	15	MARSHFIELD TOWN OF	1973	--	-	--	Z	18	P	--	--	U	--	--
W 253	420413	0704144	15	MARSHFIELD TOWN OF	1973	2.5	S	25	Z	25	P	--	--	U	40	4
W 254	420412	0704140	15	MARSHFIELD TOWN OF	1973	--	-	--	Z	32	Y	--	--	U	--	--
W 255	420723	0704231	50	MARSHFIELD TOWN OF	1977	2.5	S	57	T	67	6S	5	6-77	U	50	1
W 256	420722	0704234	50	MARSHFIELD TOWN OF	1977	2.5	S	49	T	55	6S	6	6-77	U	20	2
W 257	420719	0704228	90	MARSHFIELD TOWN OF	1977	2.5	S	65	T	69	6S	10	6-77	U	38	2
W 258	420724	0704240	50	MARSHFIELD TOWN OF	1977	--	S	51	T	61	3S	0	6-77	U	70	2
W 259	420515	0704003	5	MARSHFIELD TOWN OF	1977	2.5	S	30	Z	31	6R	2	6-77	U	4	2
W 260	420508	0704103	8	MARSHFIELD TOWN OF	1977	2.5	S	36	T	47	4S	6	8-77	U	35	2
W 261	420506	0704102	10	MARSHFIELD TOWN OF	1977	2.5	S	40	T	40	6S	6	8-77	U	15	1
W 262	420510	0704101	8	MARSHFIELD TOWN OF	1977	2.5	S	36	T	41	4R	6	8-77	U	45	2
W 263	420729	0704243	30	MARSHFIELD TOWN OF	1977	2.5	S	32	T	32	6R	8	9-77	U	38	2
W 264	420723	0704242	65	MARSHFIELD TOWN OF	1977	2.5	S	34	T	34	R	8	9-77	U	30	2
W 265	420651	0704423	85	MARSHFIELD TOWN OF	1977	2.5	S	91	T	104	6R	26	9-77	U	5	2
W 266	420723	0704231	50	MARSHFIELD TOWN OF	1977	8	S	57	W	--	2R	6	7-77	P	305	268
W 267	420459	0704024	13	MARSHFIELD TOWN OF	1979	2.5	S	30	Z	32	3R	13	3-79	U	25	2
W 268	420459	0704028	9	MARSHFIELD TOWN OF	1979	2.5	S	35	Z	35	3R	7	3-79	U	50	2

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude	Altitude of land surface (ft)	Owner or user	Year drilled	Well: Diameter (in.)	Well: Finish	Well: Depth (ft)	Well: Use	Depth to refusal (ft)	Water-bearing material	Water: Level (ft)	Water: Date measured	Water: Use	Pumping: Yield (gal/min)	Pumping: Time (hr)
MARSHFIELD--Continued															
W 269	420459 0704022	10	MARSHFIELD TOWN OF	1979	2.5	S	38	Z	42	3R	10	3-79	U	37	2
W 270	420501 0704025	9	MARSHFIELD TOWN OF	1979	2.5	S	33	Z	33	3R	7	3-79	U	30	2
W 271	420457 0704026	13	MARSHFIELD TOWN OF	1979	2.5	S	25	Z	33	3R	12	3-79	U	10	1
W 272	420455 0704024	18	MARSHFIELD TOWN OF	1979	2.5	S	33	Z	33	3R	12	4-79	U	60	2
W 273	420649 0704413	80	MARSHFIELD TOWN OF	1979	2.5	O	70	T	87	6R	14	4-79	U	30	2
W 274	420420 0704030	30	MARSHFIELD TOWN OF	1979	2.5	S	71	T	72	3R	7	5-79	U	37	2
W 275	420422 0704030	35	MARSHFIELD TOWN OF	1979	2.5	S	57	T	59	6R	7	5-79	U	32	2
W 276	420423 0704029	32	MARSHFIELD TOWN OF	1979	2.5	S	35	T	39	8P	8	5-79	U	60	2
W 277	420421 0704033	25	MARSHFIELD TOWN OF	1979	2.5	S	52	Z	54	6R	2	5-79	U	10	--
W 278	420421 0704028	28	MARSHFIELD TOWN OF	1979	8	S	68	T	--	Y	17	11-79	U	204	144
W 279	420421 0704028	28	MARSHFIELD TOWN OF	1979	2.5	S	66	T	78	6R	18	8-79	U	50	2
W 280	420708 0704532	75	MARSHFIELD TOWN OF	1982	2.5	S	70	T	--	6R	15	1-82	U	10	--
W 281	420706 0704530	90	MARSHFIELD TOWN OF	1982	2.5	S	25	Z	36	6R	--	--	U	--	--
W 282	420703 0704529	85	MARSHFIELD TOWN OF	1982	2.5	S	35	Z	--	6R	--	--	U	--	--
W 283	420652 0704518	90	MARSHFIELD TOWN OF	1982	2.5	S	55	T	60	6R	10	2-82	U	25	--
W 284	420705 0704532	75	MARSHFIELD TOWN OF	1982	--	S	--	Z	53	Y	--	--	U	--	--
W 285	420654 0704521	85	MARSHFIELD TOWN OF	1982	--	S	--	Z	31	Y	--	--	U	--	--
W 286	420651 0704521	100	MARSHFIELD TOWN OF	1982	--	S	--	Z	61	6R	--	--	U	--	--
W 287	420710 0704534	65	MARSHFIELD TOWN OF	1982	2.5	S	85	T	96	6R	8	3-82	U	50	--
W 288	420556 0704238	40	MARSHFIELD TOWN OF	1979	2.5	S	31	T	45	3R	16	5-79	U	30	2
W 289	420557 0704237	30	MARSHFIELD TOWN OF	1979	2.5	S	41	Z	41	3R	13	5-79	U	15	2
W 290	420557 0704239	30	MARSHFIELD TOWN OF	1979	2.5	S	27	Z	42	3R	--	--	U	--	--
W 291	420713 0704539	55	MARSHFIELD TOWN OF	1985	--	G	--	W	--	R	--	--	P	--	--
W 292	420718 0704242	48	MARSHFIELD TOWN OF	1979	24	G	71	W	--	R	--	--	P	--	--
W 293	420708 0704435	81	MARSHFIELD TOWN OF	1972	18	G	73	W	--	-	--	--	P	--	--
W 294	420423 0704111	17	MARSHFIELD TOWN OF	1975	24	G	61	W	--	S	--	--	P	--	--
W 295	420606 0704247	40	MARSHFIELD TOWN OF	1971	24	G	48	U	--	R	--	--	P	275	--

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude		Altitude of land surface (ft)	Owner or user	Year drilled	Well: Diameter (in.)	Well: Finish	Well: Depth (ft)	Well: Use	Depth to refusal (ft)	Water-bearing material	Water: Level (ft)	Water: Date measured	Water: Use	Pumping: Yield (gal/min)	Pumping: Time (hr)
						NORWELL										
W 324	420939	0704906	105	NORWELL TOWN OF	1983	3	P	11	T	--	--	7	4-83	-	--	--
W 325	420941	0704910	103	NORWELL TOWN OF	1983	3	P	15	T	--	3R	3	4-83	-	--	--
W 326	420942	0704908	107	NORWELL TOWN OF	1983	2.5	P	12	T	--	--	10	4-83	-	--	--
W 327	420949	0705212	135	NORWELL TOWN OF	1972	8	S	40	W	--	4G	6	1-72	P	150	--
W 328	420949	0705212	137	NORWELL TOWN OF	1971	12	S	45	W	--	3R	9	1-71	P	200	--
W 329	421016	0704943	120	NORWELL TOWN OF	1980	2.5	O	35	T	42	6R	12	4-80	U	18	--
W 330	421010	0704952	112	NORWELL TOWN OF	1980	--	-	30	Z	30	6S	--	--	U	--	--
W 331	421033	0705033	125	NORWELL TOWN OF	1980	2.5	S	26	T	33	2R	1	4-80	U	60	1
W 332	421034	0705030	125	NORWELL TOWN OF	1980	2.5	S	26	T	33	R	3	4-80	U	50	1
W 333	421032	0705016	125	NORWELL TOWN OF	1980	--	-	--	Z	18	--	--	--	U	--	--
W 334	421035	0705032	125	NORWELL TOWN OF	1980	2.5	S	21	T	30	4R	3	4-80	U	15	--
W 335	421034	0705027	128	NORWELL TOWN OF	1980	2.5	S	28	T	34	4R	5	5-80	U	50	1
W 336	421016	0704732	60	NORWELL TOWN OF	1980	2.5	O	25	T	29	8P	2	5-80	U	25	1
W 337	421017	0704728	65	NORWELL TOWN OF	1980	2.5	O	31	Z	37	8P	--	--	U	37	--
W 338	421018	0704725	75	NORWELL TOWN OF	1980	--	-	--	Z	44	6X	--	--	U	--	--
W 339	421018	0704731	75	NORWELL TOWN OF	1980	2.5	O	40	Z	46	6X	9	5-80	U	10	--
W 340	421003	0705133	120	NORWELL TOWN OF	1980	--	-	--	Z	21	2R	--	--	U	--	--
W 341	421005	0705136	125	NORWELL TOWN OF	1980	2.5	S	26	Z	26	2R	--	--	U	10	--
W 342	421006	0705137	125	NORWELL TOWN OF	1980	2.5	S	28	Z	38	3R	11	5-80	U	10	--
W 343	421006	0705202	132	NORWELL TOWN OF	1980	2.5	S	31	T	36	4R	6	5-80	U	25	1
W 345	421020	0705121	120	NORWELL TOWN OF	1980	2.5	S	35	T	44	2R	2	7-80	U	50	--
W 347	421020	0705126	130	NORWELL TOWN OF	1980	2.5	S	35	T	55	3R	3	7-80	U	60	1
W 348	421021	0705129	130	NORWELL TOWN OF	1980	2.5	O	41	T	45	3R	13	7-80	U	60	1
W 349	421021	0705128	130	NORWELL TOWN OF	1980	2.5	S	48	T	50	4R	10	7-80	U	60	1
W 350	421021	0705124	140	NORWELL TOWN OF	1980	2.5	S	52	T	58	4R	7	8-80	U	60	1

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude		Altitude of land surface (ft)	Owner or user	Year drilled	Well: Diameter (in.)	Well: Finish	Well: Depth (ft)	Well: Use	Depth to refusal (ft)	Water-bearing material	Water: Level (ft)	Water: Date measured	Water: Use	Pumping: Yield (gal/min)	Pumping: Time (hr)
						NORWELL--Continued										
W 351	421106	0705146	125	NORWELL TOWN OF	1980	2.5	S	27	Z	32	2S	2	8-80	U	20	1
W 352	421020	0705137	135	NORWELL TOWN OF	1980	2.5	S	37	T	43	S	12	8-80	U	50	2
W 353	421019	0705136	128	NORWELL TOWN OF	1981	8	S	46	T	46	3G	11	1-81	U	140	120
W 354	421017	0705137	122	NORWELL TOWN OF	1980	2.5	S	37	T	40	3X	5	8-80	U	10	1
W 355	421019	0705139	143	NORWELL TOWN OF	1980	--	-	--	Z	36	6S	--	--	U	--	--
W 356	421020	0705141	145	NORWELL TOWN OF	1980	2.5	S	52	T	54	6R	21	8-80	U	30	1
W 357	421018	0705143	140	NORWELL TOWN OF	1980	--	-	--	Z	55	6S	--	--	U	--	--
W 358	421021	0705139	143	NORWELL TOWN OF	1980	2.5	O	46	T	--	3R	14	9-80	U	30	1
W 359	421003	0705048	165	NORWELL TOWN OF	1981	--	-	--	Z	16	--	--	--	U	--	--
W 360	421004	0705051	162	NORWELL TOWN OF	1981	--	-	--	Z	16	--	--	--	U	--	--
W 361	421011	0705059	147	NORWELL TOWN OF	1981	--	-	--	Z	32	8P	--	--	U	--	--
W 362	421012	0705111	120	NORWELL TOWN OF	1981	--	-	--	Z	10	--	--	--	U	--	--
W 363	421013	0705117	120	NORWELL TOWN OF	1981	--	-	--	Z	11	--	--	--	U	--	--
W 364	421010	0705115	123	NORWELL TOWN OF	1981	--	-	--	Z	35	9P	--	--	U	--	--
W 365	421007	0705113	120	NORWELL TOWN OF	1981	--	-	--	Z	25	9P	--	--	U	--	--
W 366	421003	0705113	120	NORWELL TOWN OF	1981	--	-	--	Z	25	9P	--	--	U	--	--
W 367	421001	0705113	120	NORWELL TOWN OF	1981	--	-	--	Z	21	9P	--	--	U	--	--
W 368	421003	0705107	130	NORWELL TOWN OF	1981	--	-	--	Z	16	9P	--	--	U	--	--
W 369	420803	0704938	60	NORWELL TOWN OF	1981	2.5	S	55	T	69	2S	7	8-81	U	50	1
W 370	420804	0704931	62	NORWELL TOWN OF	1981	2.5	O	69	T	74	4R	9	8-81	U	50	1
X 1	420937	0704909	104	NORWELL TOWN OF	1983	--	P	--	T	6	--	3	3-83	-	--	--
						PEMBROKE										
W 346	420242	0704936	80	PEMBROKE TOWN OF	1981	8	P	64	Z	--	4G	11	10-81	U	--	--
W 347	420239	0704949	72	PEMBROKE TOWN OF	1981	2.5	P	42	O	--	2R	11	10-81	U	50	1
W 348	420257	0704941	70	PEMBROKE TOWN OF	1981	2.5	P	72	O	--	7R	10	10-81	U	40	1
W 349	420242	0704936	80	PEMBROKE TOWN OF	1984	24	F	65	W	--	R	4	5-84	U	710	144
W 350	420217	0704903	75	PEMBROKE TOWN OF	1971	18	G	--	W	--	2S	--	--	P	--	--

Table 7.--*Description of wells and borings in the Southeast Coastal Basin*--Continued

Local well number	Latitude/ longitude		Altitude of land surface (ft)	Owner or user	Year drilled	Well: Diameter (in.)	Well: Finish	Well: Depth (ft)	Well: Use	Depth to refusal (ft)	Water-bearing material	Water: Level (ft)	Water: Date measured	Water: Use	Pumping: Yield (gal/min)	Pumping: Time (hr)
						PLYMPTON										
W 109	415958	0704758	60	PRIVATE OWNER	1981	6	-	200	W	75R	--	--	--	H	8	--
W 110	415737	0704648	110	PRIVATE OWNER	1978	6	-	51	W	--	--	29	4-78	H	15	10
						ROCKLAND										
W 110	420655	0705518	105	PRIVATE OWNER	1983	6	-	120	W	50R	--	8	7-83	H	45	5
W 112	420517	0705358	95	PRIVATE OWNER	1975	6	-	200	W	74R	--	10	4-75	H	--	--
						SCITUATE										
W 185	421246	0704611	10	SCITUATE TOWN OF	1982	--	P	35	T	--	6R	0	3-82	U	200	216
W 186	421247	0704612	10	SCITUATE TOWN OF	1982	2	P	40	T	--	6R	0	4-82	U	60	4
W 187	421245	0704611	10	SCITUATE TOWN OF	1982	2	P	35	T	--	6R	0	4-82	U	60	6
W 188	421209	0704603	65	SCITUATE TOWN OF	1982	2	P	26	T	28	2R	3	4-82	U	25	--
W 189	421211	0704601	65	SCITUATE TOWN OF	1982	--	-	--	Z	30	Y	6	4-82	U	--	--
W 190	421115	0704614	47	SCITUATE TOWN OF	1982	2	P	56	T	--	7R	5	4-82	U	15	--
W 191	421117	0704618	47	SCITUATE TOWN OF	1982	2	P	73	T	--	2R	3	3-82	U	60	2
W 192	421154	0704429	26	SCITUATE TOWN OF	1982	2	P	42	Z	45	6R	--	4-82	U	--	--
W 193	421216	0704439	25	SCITUATE TOWN OF	1982	--	-	--	Z	35	6R	4	4-82	U	--	--
W 194	421121	0704621	48	SCITUATE TOWN OF	1982	2	P	28	T	45	6R	3	4-82	U	30	--
W 195	421250	0704559	12	SCITUATE TOWN OF	1982	--	-	--	Z	28	6S	5	5-82	U	--	--
W 196	421250	0704601	12	SCITUATE TOWN OF	1982	--	-	--	Z	31	6R	5	5-82	U	--	--
W 197	421252	0704605	12	SCITUATE TOWN OF	1982	--	-	--	Z	44	6R	5	5-82	U	--	--
W 198	421251	0704603	12	SCITUATE TOWN OF	1982	2	-	35	T	58	6R	4	4-82	U	40	--