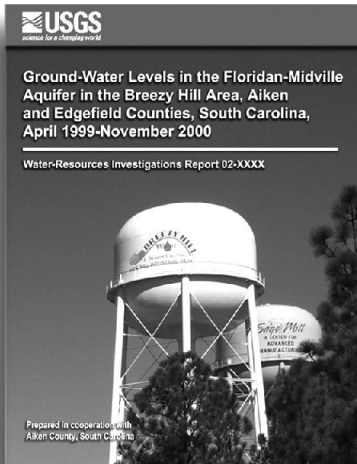


Ground-Water Levels in the Floridan-Midville Aquifer in the Breezy Hill Area, Aiken and Edgefield Counties, South Carolina, April 1999-November 2000

Water-Resources Investigations Report 02-4075



Prepared in cooperation with
Aiken County, South Carolina



COVER PHOTOGRAPH: Water towers located at Sage Mill Industrial Park in the Breezy Hill area, Aiken County, South Carolina

Photograph by: Larry G. Harrelson

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U.S. Geological Survey

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AIKEN COUNTY, SOUTH CAROLINA



Columbia, South Carolina
2002

U.S. DEPARTMENT OF THE INTERIOR
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U.S. GEOLOGICAL SURVEY
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CONVERSION FACTORS, DATUMS, AND ACRONYMS

Multiply	By	To obtain
Length		
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
Area		
square mile (mi ²)	2.590	square kilometer
Volume		
gallon (gal)	3.785	cubic decimeter
million gallon (Mgal)	3.785,000	liter
Flow		
gallon per day (gal/d)	0.00379	cubic meter per day
gallon per minute (gal/min)	0.06309	liter per second
million gallons per day (Mgal/d)	3.785	cubic meters per day
cubic foot per second (ft ³ /s)	0.02832	cubic meter per second
inch per year (in/yr)	25.4	millimeter per year

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.

Latitude and longitude coordinates for the water-level measurements used in the construction of plate 4 are referenced to the North American Datum of 1927 (NAD 27).

Latitude and longitude coordinates for wells in the appendix are referenced to the North American Datum of 1983 (NAD 83).

BHW&S	Breezy Hill Water and Sewer Company
ET	Evapotranspiration
GIS	Geographical Information System
GPS	Global Positioning System
NOAA	National Oceanic and Atmospheric Administration
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
USGS	United States Geological Survey

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ABSTRACT

The Breezy Hill area in Aiken and Edgefield Counties of west-central South Carolina is a rapidly growing region in need of increasing amounts of ground water. From 1995 to 1998, the local water utility increased ground-water withdrawals in the Breezy Hill area from 1.4 to 2.1 million gallons per day to meet water-supply demands. As development continues, future demands for ground water will likely put stress on the surface- and ground-water resources of the area. To address this issue, the U.S. Geological Survey, in cooperation with Aiken County, compiled and interpreted geologic and hydrologic data needed to map the ground-water system in the Breezy Hill study area.

The Breezy Hill study area consists of four interfluvial areas comprising the regions between Horse and Little Horse Creeks, Little Horse and Hightower Creeks, Hightower Creek and Franklin Branch, and Franklin Branch and Mims Branch. Across the interfluvial areas, the average elevation of the water-level surface ranged from 200 to 480 feet above sea level, and the average saturated thickness of the Floridan-Midville aquifer ranged from less than 20 to 70 feet thick. A water-level contour map of the surface of the Floridan-Midville

aquifer indicates that recharge to the aquifer occurs mainly within the interfluves. Recharge is derived principally from precipitation, although there is some potential for ground-water recharge from underlying crystalline rocks. Ground water discharges along the flanks of the interfluves into the bounding streams where the elevations of the ground water and streams coincide.

From April 1999 to November 2000, calculated long-term normal precipitation totaled about 84.0 inches; however, actual recorded precipitation totaled 69.2 inches, representing about a 17.6 percent decrease in precipitation during this period. Published estimates of annual evapotranspiration range from 30 to 35 inches.

A U.S. Geological Survey surface-water gaging station located near the center of the study area on Little Horse Creek monitors runoff from a drainage area of 26.6 square miles. Average annual flow for the station for water years 1990-2000 was 33.8 cubic feet per second. From April 1999 to November 2000, the monthly average flow was less than the average monthly flow for the long-term record, excluding December 1999 to March 2000 when no data were collected. Monthly average flow for Little Horse Creek exceeded the normal monthly flow during June and July 1999.

Ground water in the Breezy Hill area is principally withdrawn from the unconfined Floridan-Midville aquifer. Ground-water withdrawals by the local water utility increased 37 percent from 1989 to 2000 (315.2 to 500 million gallons, respectively). From January 1999 to December 2000, the utility exceeded the long-term monthly average ground-water withdrawals for every month except September and December 2000. Calculated long-term monthly ground-water withdrawals by the utility for a 20-month period from April 1999 to November 2000 totaled 674 million gallons; however, actual ground-water withdrawals totaled 883 million gallons, which is 31 percent more than the long-term average ground-water withdrawals for the production wells.

Published estimates of average annual ground-water recharge rates for the study area range from 13 to 15 inches per year. A base-flow recession analysis of streamflow data for Little Horse Creek provided an estimated recharge rate of 14.9 inches per year for the drainage area. Using an estimated average porosity ranging from 30 to 35 percent observed in sand-aquifer cores, the average annual recharge of 13 to 15 inches would cause a 3.6- to 4.1-foot water-level change to the saturated thickness of the aquifer, if applied instantaneously. The water-level declines observed in wells from April 1999 to November 2000 approximated an average decline of 4 feet.

From November 1999 to November 2000, ground-water levels in six wells near utility pumping centers declined 2 to 5 feet. Long-term water-level declines of 10.27 and 11.50 feet were measured in two wells between May 1992 and April 2000, respectively.

INTRODUCTION

The Breezy Hill area is a rapidly growing region of Aiken and Edgefield Counties, S.C. Ground water is the primary source of water supply in the area. From 1995 to 1998, the local water utility, Breezy Hill Water and Sewer Company, increased ground-water withdrawals in the Breezy Hill area from 1.4 Mgal/d (Newcome, 1995) to 2.1 Mgal/d (Newcome, 2000). In addition, domestic, irrigation, and industrial production wells collectively withdrew an unknown volume of ground water. As residential, industrial, and other forms of develop-

ment continue, future increased demands for ground water will put additional pressure on the water resources of the area.

This study was designed to investigate the ground-water resources in the Breezy Hill area. To address these issues, the U.S. Geological Survey (USGS), in cooperation with Aiken County, compiled and interpreted the hydrologic data needed to map the ground-water system in the study area. Water-resources planners can use this information in their decision-making processes to make informed decisions on further development of the ground-water resources.

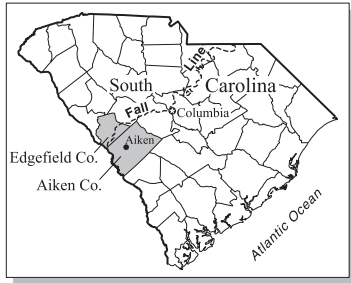
Purpose and Scope

The purpose of this report is to describe the configuration of the average water-level surface and to determine the average saturated thickness of the Floridan-Midville aquifer beneath the Breezy Hill area. This report is limited to the study of the Tertiary- and Upper Cretaceous-age sediments that make up the sedimentary aquifer beneath the study area. The crystalline bedrock, which forms the basal limit of this study, yields far less water than the Tertiary- and Upper Cretaceous-age sediments and may not be suitable for municipal or industrial water supplies in the area.

General Description of the Study Area

The Breezy Hill study area is located near Graniteville, S.C., and occupies approximately 57 mi² in the northwestern part of Aiken County and in the southeastern part of Edgefield County, S.C. (fig. 1). The Breezy Hill area lies east-northeast and adjacent to the city of North Augusta and is approximately 10 mi west-northwest of the city of Aiken. The study area includes the unincorporated communities of Graniteville, Clearwater, and parts of the city of North Augusta. The inner margin of the Coastal Plain, identified by the Fall Line, forms the bounding limits of the study area to the north. Horse Creek forms the bounding limits to the northeast and south, and U.S. Highway 25 to the west (plate 1).

The study area consists of four interfluvial areas comprising the regions between Horse and Little Horse Creeks, Little Horse and Hightower Creeks, Hightower Creek and Franklin Branch, and Franklin Branch and Mims Branch Creeks (plate 1). The topography of the region is in an intermediate stage of erosion, which is characterized by flat interfluvial divides and narrow stream valleys with up to 500 ft of relief (plate 1).



EXPLANATION

- Breezy Hill study area
- State boundary
- County boundary
- Fall Line
- Interstate highway
- U.S. highway
- Stream
- Location of geologic section for core holes AK-2448 and AK-2449
- Location of U.S. Geological Survey gaging station and station number
- Location of National Oceanic and Atmospheric Administration climatological station and station number

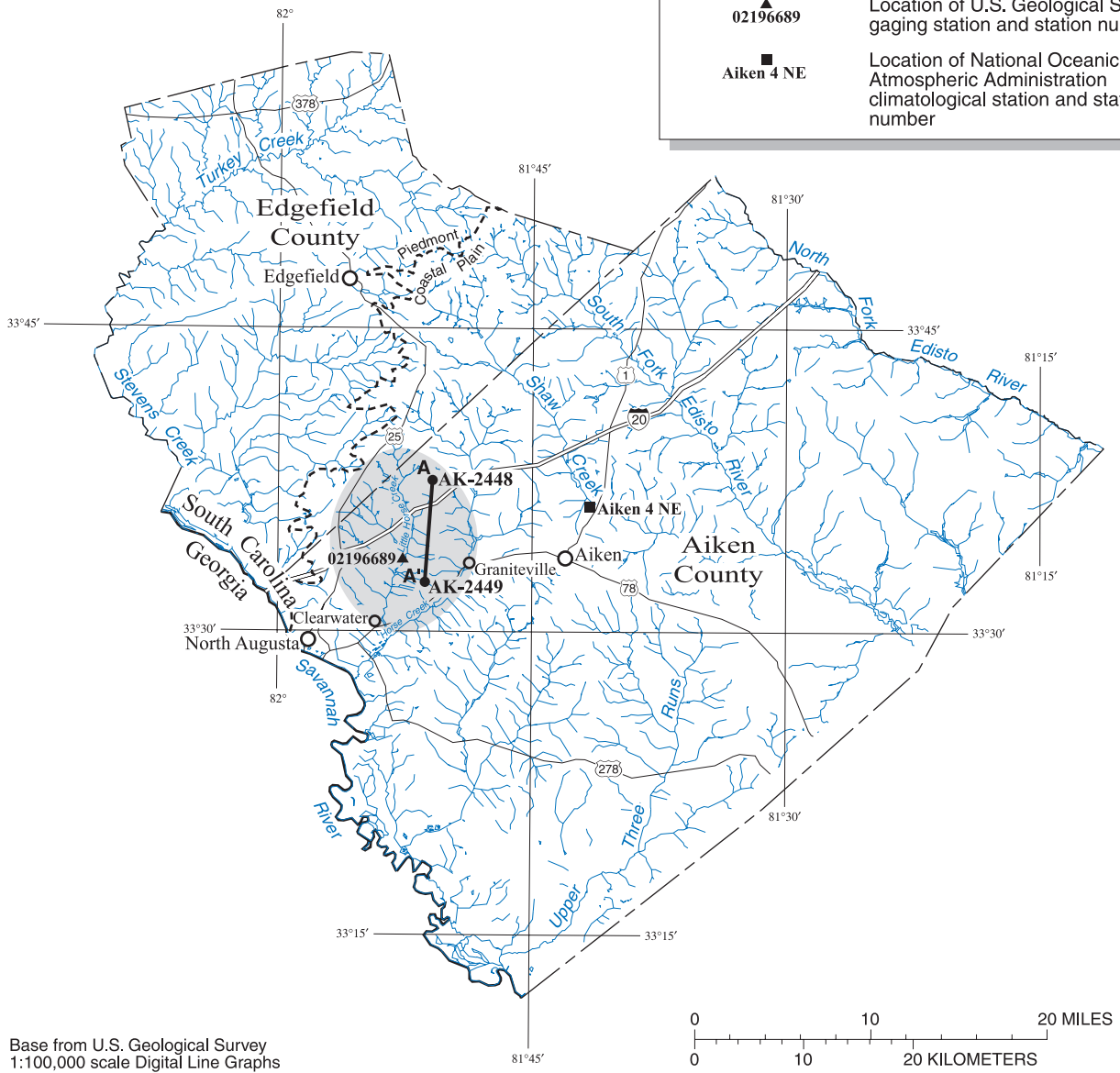


Figure 1. Location of the Breezy Hill area, Aiken and Edgefield Counties, South Carolina.

SYSTEM SERIES		GEOLOGY <small>(Christopher and others, 2000; Prowell and Chistopher, 2000)</small>		HYDROGEOLOGY <small>(Aadland and others, 1995)</small>	
COASTAL PLAIN SEDIMENTS	TERTIARY	MIOCENE(?)	UNDIFFERENTIATED	Floridan-Midville Aquifer	
		EOCENE	UPPER		Barnwell Group
			MIDDLE		Huber/Congaree Formation(s)
	UPPER CRETACEOUS	Black Creek Group	Donoho Creek Formation	"Middendorf" Formation	
PALEOZOIC		Crystalline Rocks			

Figure 2. Generalized correlation of the geology and hydrogeology in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina.

Sediments in the study area include Tertiary- and Upper Cretaceous-age strata, and consist of predominantly interlayered sequences of sand and clay (Nystrom and others, 1986). The sedimentary sequence unconformably overlies igneous and metamorphic rocks of Paleozoic age (Chowns and Williams, 1983) (fig. 2). In many places, streams have eroded through the sediments to expose bedrock in the valley floors (plate 2).

Horse, Little Horse, and Hightower Creeks, and Franklin and Mims Branch, as well as many smaller streams, intercept ground-water flow in the study area. Although, there is some potential for ground-water recharge from underlying crystalline rocks, recharge for the unconfined Floridan-Midville aquifer is derived

principally from precipitation that occurs within the interfluvium. Only a small percentage of total precipitation recharges the aquifer beneath the study area. Recharge to the aquifer is constrained by the amount of precipitation not lost to evapotranspiration or runoff and is thus available to recharge the aquifer. The vertical hydraulic conductivity and transmissivity of the surficial deposits or other strata in the recharge area control the amount of water that can percolate downward and move away from the recharge area in response to the prevailing hydraulic gradient (Fetter, 1980).

Previous Investigations

The hydrogeology of the Coastal Plain sediments in the Breezy Hill area has been described in general terms in regional hydrogeologic studies by Aucott and others (1987) and Aadland and others (1995). The area was described in a study of ground-water flow and stream-aquifer relations near the inner margin of the Coastal Plain in Georgia and South Carolina by Faye and Mayer (1990).

Aadland and others (1995) discussed, in general terms, the lithostratigraphy and hydrostratigraphy in this region of South Carolina. The lithostratigraphy of the study area has been mapped or described in various studies including Hammond (1883), Cooke (1936), Lang (1940), Smith (1949), Siple (1967), de Araujo and Filho (1975), Metzgar (1977), and Bramlett (1980). Other stratigraphic works published for this area are by Sloan (1904, 1907, and 1908), Cooke and MacNeil (1952), Colquhoun and Johnson (1968), Colquhoun and others (1969, 1982, and 1983), Bishop (1982), Campbell (1982), Willoughby (1983, 1985a, 1985b), Colquhoun and Steele (1986) and Nystrom and others (1986).

Krambis (2000) described the stratigraphy and hydrogeology, and developed a predevelopment numerical flow model of the Breezy Hill area. The steady-state three-dimensional flow model was designed to predict the natural system dynamics and was based on 1960-90 water-level data. Clarke and West (1997, 1998) developed numerical flow models to evaluate flow conditions for predevelopment and predevelopment through 1992 near the Savannah River and the potential for transriver flow beneath the Savannah River. These reports describe various features and characteristics of the geology, hydrogeology, and stream-aquifer relations near the Savannah River site in Georgia and South Carolina.

Acknowledgments

The authors would like to thank Charles Hilton, and the Board of Directors of Breezy Hill Water and Sewer Company, for providing invaluable assistance, information, data, and access to wells under their jurisdiction. In particular, appreciation is extended to South Carolina State Senator Thomas L. Moore for his efforts in securing financial support for this investigation. The authors also extend their appreciation to the local landowners, drillers, and managers of municipal waterworks for providing access to and helpful information on the wells utilized in this investigation. The authors recognize the South Carolina Department of Health and Environmental Control (SCDHEC) and the South Carolina Department of Natural Resources (SCDNR) for supplying data for this study. Appreciation also is extended to Dr. Ralph H. Willoughby, (SCDNR) for sharing his understanding of the geology within the study area.

GEOLOGY

The geology of the study area is described in general terms with geologic units discussed in ascending order (figs. 2 and 3). Although the Paleozoic igneous and metamorphic rocks are included in this discussion, the Upper Cretaceous and Tertiary sedimentary beds that overlie the Paleozoic rocks are the primary focus of this investigation.

Paleozoic Crystalline Rocks

In the southeastern Coastal Plain, Paleozoic igneous and metamorphic rock units are commonly called “crystalline bedrock,” and form a major hydrologic barrier at the base of the Coastal Plain sedimentary wedge (plate 3). Crystalline bedrock in the study area generally consists of granite, gneiss, and schist (fig. 3). These rocks are part of the Charlotte Belt as described by Overstreet and Bell (1965) and the Kiokee Belt of Crickmay (1952). Chemical weathering of igneous and metamorphic rocks yields a reduced-density residuum called saprolite. Saprolite overlies the fresh rock beneath the Upper Cretaceous and Tertiary strata and creates a zone of low permeability (confining unit) at the base of the highly permeable sediments.

Upper Cretaceous Strata

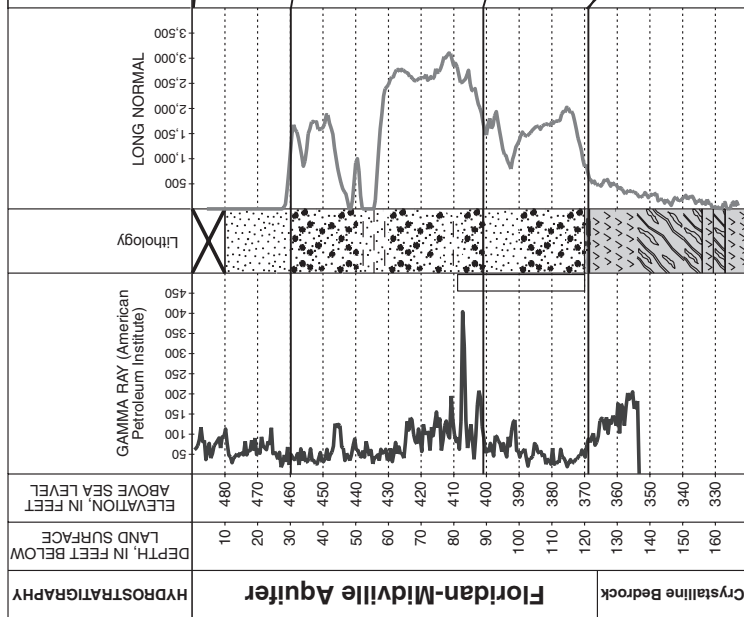
The Upper Cretaceous sediments of the Breezy Hill area consist of two formations formerly called the Middendorf Formation and the Donoho Creek Formation of the Black Creek Group (Prowell, 1994). Recent evidence suggests that: (1) the name “Middendorf” was incorrectly applied to the lower strata, and (2) all of the Upper Cretaceous strata in the study area are part of the Black Creek Group (Christopher and others, 2000; Prowell and Christopher, 2000). The name “Middendorf” was retained for the lower formation because a new name has yet to be established. The name is shown in quotes to denote the improper usage and correlation.

The base of the Upper Cretaceous strata is marked by angular to rounded cobbles, pebbles, and coarse-grained sand resting upon saprolite of the underlying Paleozoic rocks (Nystrom and others, 1986). Upper Cretaceous sediments pinch out in up-dip areas of Edgefield and northern Aiken Counties where they are overlapped by middle Eocene sediments (Nystrom and others, 1986).

Both of the Upper Cretaceous formations consist of fine- to very coarse-grained, poorly sorted, angular to subangular, quartz sand containing various amounts of micaceous, sandy kaolin. The “Middendorf” Formation is characterized by quartz gravel and large festoon crossbeds. Discontinuous lenses of kaolin are present at or near the top of the “Middendorf” strata. The Donoho Creek Formation of the Black Creek Group is characterized by local beds of fine-grained, well-sorted sand, locally discontinuous clay laminae, and low-angle

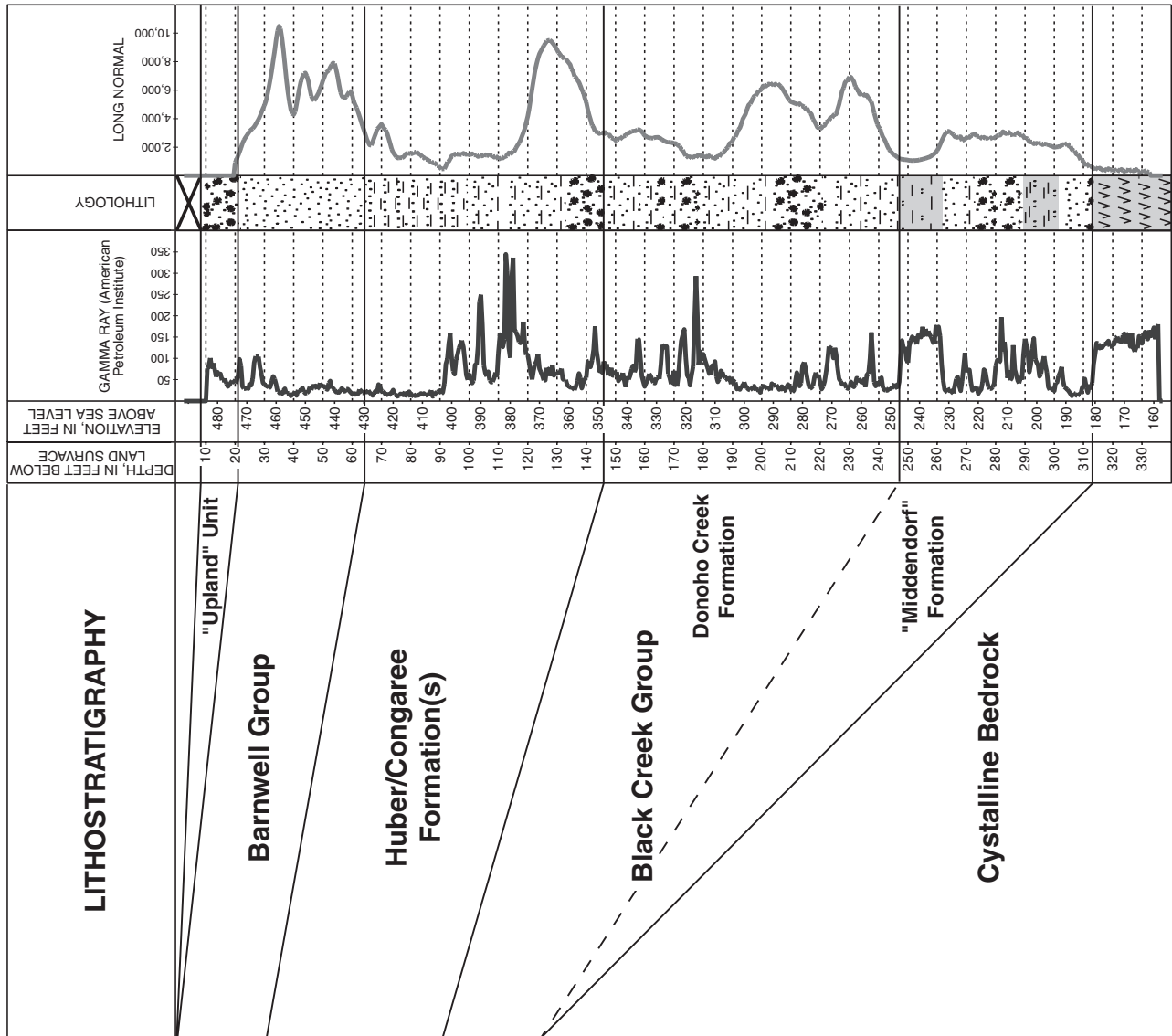
AK-2448

A



AK-2449

A'



EXPLANATION

	No recovery		Granite
	Sand		Gneiss/schist
	Sand and gravel		Clayey sand
	Gravel		Clay
	Interbedded sand and clay		Silty clay
			Clayey silt
			Unconformity lag

Figure 3. Dip-oriented correlation of lithostratigraphic and hydrostratigraphic units from core holes AK-2448 to AK-2449, Aiken County, South Carolina.

crossbeds. Scattered throughout these sediments are fine- to coarse-grained, dark, heavy minerals that tend to concentrate along bedding plains. Beds abundant in kaolin balls of various sizes also are common. A massive, thick bed of silty, white kaolin is present at the top of the Donoho Creek sediments near North Augusta (Willoughby, 1986) and north of Aiken where the bed was dated as late Campanian, based on fossil pollen (written commun., R.A. Christopher, Clemson University, 1980, 1999).

Tertiary Strata

The stratigraphic contact between the Upper Cretaceous strata and the overlying Tertiary strata is an erosional unconformity (Willoughby, 1986; Prowell, 1994). Pisolitic kaolin boulders are present at this contact near Graniteville (Nystrom and Willoughby, 1982) and at the northern edge of the town of Aiken. These boulders are thought to reflect periods of extensive erosion that occurred during a sedimentary hiatus.

Tertiary sediments include the Huber/Congaree Formation(s), Barnwell Group, and the "Upland" Unit (fig. 2). All three geologic units consist of sand and clay deposited under differing depositional environments. Although present in down-dip areas, limestone and other carbonate lithologies are not present in the Breezy Hill area.

The Huber/Congaree Formation(s) derives its name from work by Prowell (1994), who recognized intertongued marine and nonmarine middle Eocene beds in the North Augusta-Aiken area. Previously, the name Huber had been applied to the nonmarine strata (Buie, 1978) whereas the name Congaree had been applied to the marine strata (Siple, 1967). The Congaree strata is characterized by well- to moderately sorted, angular to subrounded, fine- to coarse-grained sand with thin clay laminae. Most sand beds have little to no interstitial clay and may contain vertical sand-filled burrows of marine animals. The Huber strata typically consists of subangular to angular, poorly sorted, medium- to very coarse-grained sand with some quartz granules and white kaolin balls. Crossbedding and cut-and-fill channeling is common. The Huber strata typically forms the top of the formation, which is characterized by discontinuous beds of hard kaolin (Prowell, 1994).

The Barnwell Group in the study area consists of two formations, Dry Branch and Tobacco Road, and is of late Eocene age (Huddlestun and Hetrick, 1979, Huddlestun, 1982). A thin layer of flat pebbles marks

the contact between the two formations, which are not differentiated in this report. The basal Barnwell stratum consists of well-sorted, very fine- to medium-grained sand with local, thinly interbedded clay layers. The upper Barnwell strata consists of poorly sorted, medium- to very coarse-grained sand with moderate to no interstitial clay (Nystrom and others, 1986). Thin clay wisps and clay-lined burrows of marine animals characterize these upper strata.

The "Upland" Unit is an informal geologic unit established by Nystrom and Willoughby (1982) to describe poorly sorted, medium- to coarse-grained, angular to subangular, clayey grit with abundant granules, pebbles, and cobbles. This unit is characterized by large gravel and sand-sized white clay speckles derived from weathered feldspar.

HYDROGEOLOGY

Aadland and others (1995) applied the name Floridan-Midville aquifer to the Coastal Plain sediments near the inner margins of the Coastal Plain, including the study area. The name, Floridan-Midville aquifer, is applied in this report to the entire sequence of Coastal Plain sediments between land surface and the top of crystalline bedrock. Although clayey sand and silty clay are interbedded with the porous, permeable sands in the Upper Cretaceous- and Tertiary-age geologic units, these sediments are generally lenticular and laterally discontinuous. Therefore, the entire Coastal Plain sequence is considered one aquifer in the study area (Aucott and others, 1987; Faye and Mayer, 1990, Aadland and others, 1995).

DATABASE DEVELOPMENT AND DATA COLLECTION

Current and historical well-construction data were compiled from SCDNR, SCDHEC, and USGS databases. These data were reviewed for potential water-level measurement sites. Published well data from previous inventories in the study area also were examined.

Well-construction data from the SCDNR and SCDHEC originated from water well records provided by local well drillers. These data were considered reliable; however, no inspections of the wells were performed. Some well-construction data were obtained by conversations with the individual landowners and area well drillers.

Latitude and longitude for each well were established utilizing a Global Positioning System (GPS). The horizontal accuracy provided by the GPS was about 30 ft from the actual location. Land-surface elevation for each well site was calculated by plotting latitude and longitude for the site on a USGS 1:24,000 Digital Line Graph topographic map and utilizing a Geographic Information System (GIS) to assign the elevation. This method maintained an unbiased approach to the assignment of the land-surface elevation for the well sites. It should be noted that the accuracy of the assigned land-surface elevations is one-half of the contour interval published for the maps. Thus, the land-surface elevation accuracy assigned for each well is 5 ft.

Well-Numbering System

The USGS and SCDNR share a common well-numbering system that is referred to as the USGS identifier in this report (see appendix). Wells inventoried in South Carolina are sequentially numbered in each county using an alphanumeric well designation. The alphabetic prefix refers to the county and the number refers to the chronological order in which wells were inventoried in that county. Thus, the first well inventoried in Aiken County is designated AK-1.

Aquifer Assignments

Elevations of the tops of the lithostratigraphic units used in this report are based on the geologic mapping of the study area by the SCDNR (Willoughby, 1983, 1984, 1985a, and 1986) (plate 2). The elevation of the crystalline bedrock was mapped from data collected from core and auger holes, and from field investigations (plate 3).

Elevations of the tops of the Upper Cretaceous and Tertiary units and crystalline bedrock were entered in a GIS to create digital three-dimensional surfaces. GIS digital surfaces were compared to the elevation of the open or screened interval(s) in each well to determine the aquifer assignment for the well. Wells assigned to the Floridan-Midville aquifer are open to the Upper Cretaceous and Tertiary sediments. If a well was open primarily to the Upper Cretaceous and Tertiary sediments with only a small part open to the crystalline bedrock, then it was assumed that the water-level elevation measured in that well represented the Floridan-Midville aquifer. If a well was open or screened exclusively in the crystalline bedrock or if the construction data for a well could not be verified, then water levels from the well

were not used to map the water-level surface of the Floridan-Midville aquifer. Data collected and verified for the 67 wells used in this investigation are listed in the appendix.

GROUND-WATER LEVELS

In the Breezy Hill area, ground-water levels and topographic elevations were used to map the average elevation of the water-level surface for the unconfined Floridan-Midville aquifer (plate 4). In this way, water-level elevations were depicted at or below land surface everywhere on the map, resulting in a water-level map that mirrors the topography of the land surface. For example, water-level contours along the steep stream valley of Little Horse Creek show numerous deflections owing to the substantial change in topographic elevation along the stream. Construction of the map showing average saturated thickness was accomplished by utilizing a GIS computer program that calculated and then plotted the difference in elevation between the average water level and the top of the crystalline bedrock (plate 5).

The water-level surface for the Floridan-Midville aquifer represents the top of the saturated part of the aquifer, which is assumed to be unconfined. Ground water that saturates the Floridan-Midville aquifer moves in response to differences in hydraulic head. The direction of ground-water flow can be inferred from water-level contour lines. Flow direction is perpendicular to the contour lines with ground water moving in the direction of declining hydraulic head. Flow lines depict the idealized path followed by water particles as they move through the aquifer (Heath, 1982).

During the investigation, water levels were measured in 67 wells in the study area (appendix). Ground-water-level measurements were collected intermittently during this investigation. Synoptic ground-water-level measurements were not made at each well. A total of 38 wells were utilized to construct the average water-level map. Of these wells, eight water-level measurements were collected from 29 wells; seven water-level measurements were collected from 8 wells; and six water-level measurements were collected from 1 well. An analysis of average water-level data for wells with eight intermittent measurements indicates less than a 1 percent difference between using eight measurements to compute an average water level and using six or seven measurements to compute an average water level. Therefore, calculated average water-level data for wells with only six or seven water-level measurements were acceptable for inclusion in the water-level map (appendix).

Precipitation

Within the Breezy Hill area, precipitation is the major source of water to recharge the aquifer. Precipitation data used in this study were acquired from the National Oceanic and Atmospheric Administration (NOAA) climatological station Aiken 4 NE, located about 10 mi east of the study area, and are regarded as representative of the precipitation within the Breezy Hill area (fig. 1). For station Aiken 4 NE, the normal yearly precipitation is about 51 in. (NOAA, 1999) (fig. 4).

From April 1999 to November 2000, the recorded monthly precipitation was less than the long-term normal monthly precipitation for all months except June, July, and September 1999, and January, August, September, and November 2000 (NOAA, 2000a-k). From April 1999 to November 2000, the calculated long-term normal precipitation for the period is about 84 in.; however, the recorded precipitation at the station was about 69.2 in. The difference of 14.8 in. between the calculated long-term normal precipitation and the recorded precipitation represents about a 17.6 percent decrease in normal precipitation for the period.

Evapotranspiration

Evapotranspiration (ET) varies seasonally and is an important component of the hydrologic cycle, second only to precipitation. During times of reduced precipitation, ET continues to deplete water supplies in surface-water bodies, streams, and sediment, and varies according to weather and wind conditions (Hanson, 1991). ET was not measured during this study. The mean ET for South Carolina ranges from 30 to 35 in/yr (Hanson, 1991). For a shallow unconfined aquifer, such as the Floridan-Midville aquifer, the estimated water loss of 30 to 35 in/yr to ET becomes increasingly significant during periods of reduced precipitation.

Surface-Water Flow

The USGS maintained a surface-water gaging station on Little Horse Creek near Graniteville (02196689) from October 1989 to March 2001 (fig. 5). The gage monitored a drainage area of 26.6 mi². During the study period, streamflow data were not collected from the gage from December 1999 to March 2000 (fig. 5). The gage was reactivated in March 2000

and continued operation until March 2001. For water-years 1990-2000, average annual flow for the station was 33.8 ft³/s, and annual runoff was 1.27 ft³/s. The lowest annual 7-day minimum flow of 8.5 ft³/s was recorded on July 16, 2000. The lowest daily mean discharge during the 2000 water year occurred on July 18, 2000, and was 7.0 ft³/s (Cooney and others, 2000).

From April 1999 to November 2000, excluding December 1999 to March 2000, monthly average flow recorded for Little Horse Creek exceeded the long-term monthly average flow during the months of June and July 1999. During the remainder of the study period, recorded monthly flows were less than the long-term monthly average for the period (fig. 6).

Ground-Water Withdrawals

Residents and industry within the Breezy Hill study area operate domestic, irrigation, and industrial production wells that collectively withdraw an unknown volume of ground water. Breezy Hill Water and Sewer Company (BHW&S) is the largest producer of potable ground water within the study area and ranks 54 out of the 100 largest public-water suppliers in South Carolina. The utility serves water to local industries and a population of approximately 10,000 with an estimated per capita use of 104 gal/d. The utility distributes an average 2.1 Mgal/d of water (Newcome, 2000). When required, BHW&S purchases approximately 300,000 gal/d from the City of North Augusta. During periods of peak usage, BHW&S purchases an additional 200,000 gal/d of water from Edgefield County Water Sewer and 450,000 gal/d from the City of North Augusta (C. Hilton, Breezy Hill Water and Sewer Company, written commun., 2001).

Water-use data were obtained from the SCDHEC water-use files and from conversations with the local water-utility manager (C. Hilton, Breezy Hill Water and Sewer Company., oral commun., 2001). Over time, the local water utility has installed production wells to meet the demands for water within the area (table 1). During the study, the utility operated 13 production wells. Water-use data show that from 1989 to 2000 annual ground-water withdrawals increased from 315.2 to 500.0 Mgal, which represents a 37 percent increase in ground-water withdrawals for the utility (fig. 7). From January 1999 to December 2000, the utility exceeded the long-term monthly average ground-water withdrawals for all months except September and December 2000. Calculated long-term monthly

1999	Monthly precipitation			2000	Monthly precipitation		
	Long-term normal	Recorded	Departure from long-term normal		Long-term normal	Recorded	Departure from long-term normal
April	3.82	2.64	-1.18	January	4.64	8.72	4.08
May	4.17	2.16	-2.01	February	4.47	1.31	-3.16
June	5.13	7.60	2.47	March	5.28	3.51	-1.77
July	5.16	5.38	0.22	April	3.82	2.01	-1.81
August	5.31	3.47	-1.84	May	4.17	0.35	-3.82
September	3.52	5.08	1.56	June	5.13	2.14	-2.99
October	2.84	1.43	-1.41	July	5.16	2.36	-2.80
November	2.88	1.18	-1.70	August	5.31	5.95	0.64
December	3.79	1.46	-2.33	September	3.52	7.98	4.46
				October	2.84	0.01	-2.83
				November	2.88	4.43	1.55

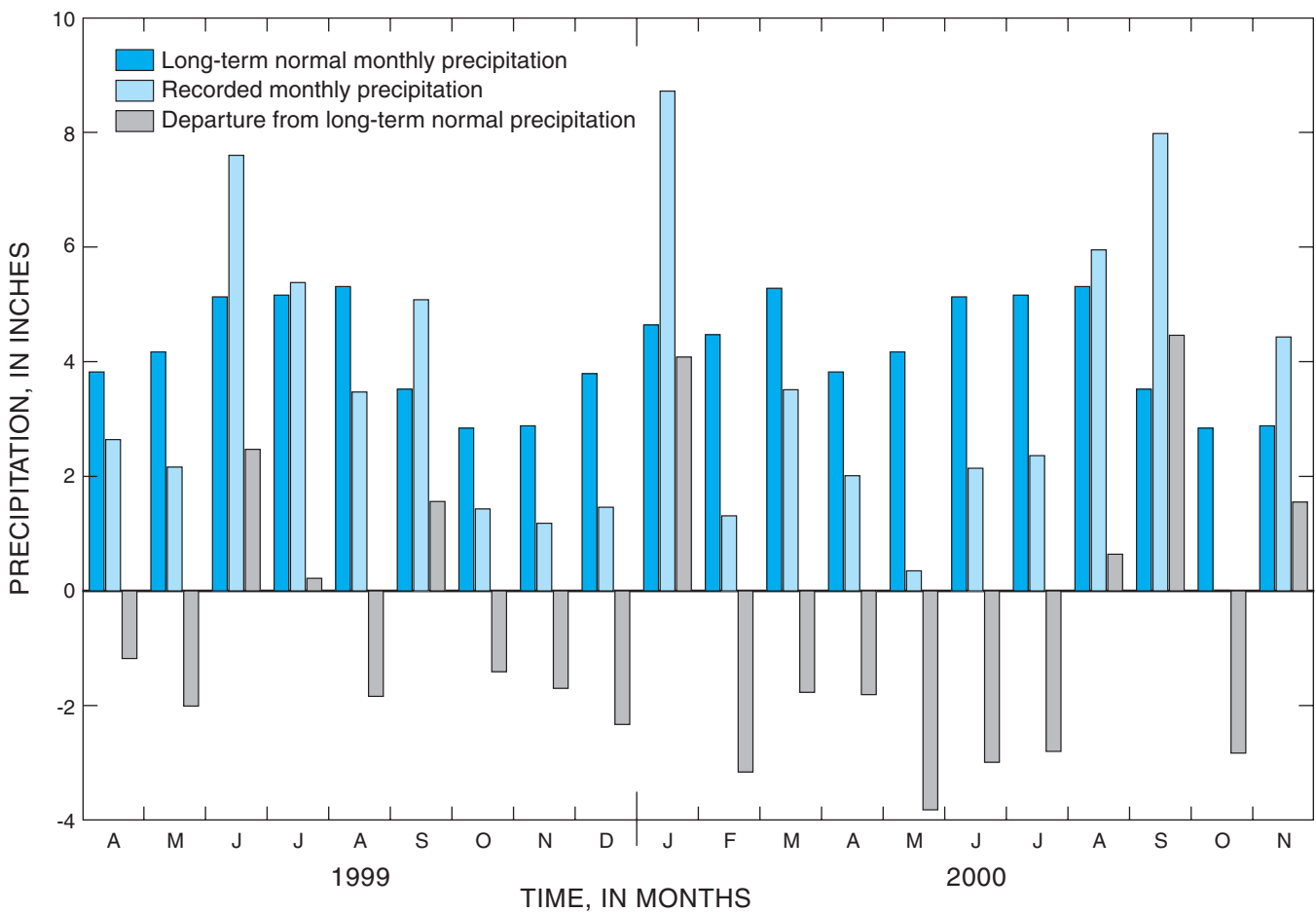


Figure 4. Long-term normal monthly precipitation, recorded monthly precipitation, and departure from long-term normal monthly precipitation, Aiken County, South Carolina, April 1999–November 2000. (Data from the National Oceanic and Atmospheric Administration climatological station, Aiken 4 NE.)

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1989										26.0	31.4	37.0
1990	37.4	31.4	30.9	24.1	28.5	18.7	19.6	20.1	11.8	41.9	29.3	31.0
1991	40.3	33.2	43.7	37.1	40.3	47.8	41.2	41.4	25.6	23.2	28.4	30.4
1992	37.4	32.3	40.4	33.4	20.0	29.4	25.0	30.8	27.5	36.4	51.7	49.0
1993	71.7	55.2	59.6	53.3	39.0	28.5	17.9	16.2	22.6	23.8	29.1	36.4
1994	47.7	54.5	59.1	32.5	20.5	36.6	27.4	27.2	21.8	38.5	38.3	43.4
1995	53.1	67.8	48.8	33.5	24.6	35.9	26.9	33.7	35.6	34.0	38.9	37.8
1996	39.9	36.5	48.9	34.8	29.4	24.9	21.4	24.0	23.9	26.0	26.7	26.1
1997	33.4	32.5	32.2	28.6	23.3	26.5	30.0	16.0	20.0	25.8	29.4	34.6
1998	47.5	54.5	62.6	66.6	48.6	35.0	23.9	20.7	34.8	24.8	27.8	29.0
1999	40.4	39.6	31.7	32.8	22.0	33.7	35.0	13.7	15.7	22.3	25.8	no data
2000	no data	no data	27.7	27.4	17.7	14.7	13.5	18.9	22.0	13.5	20.4	

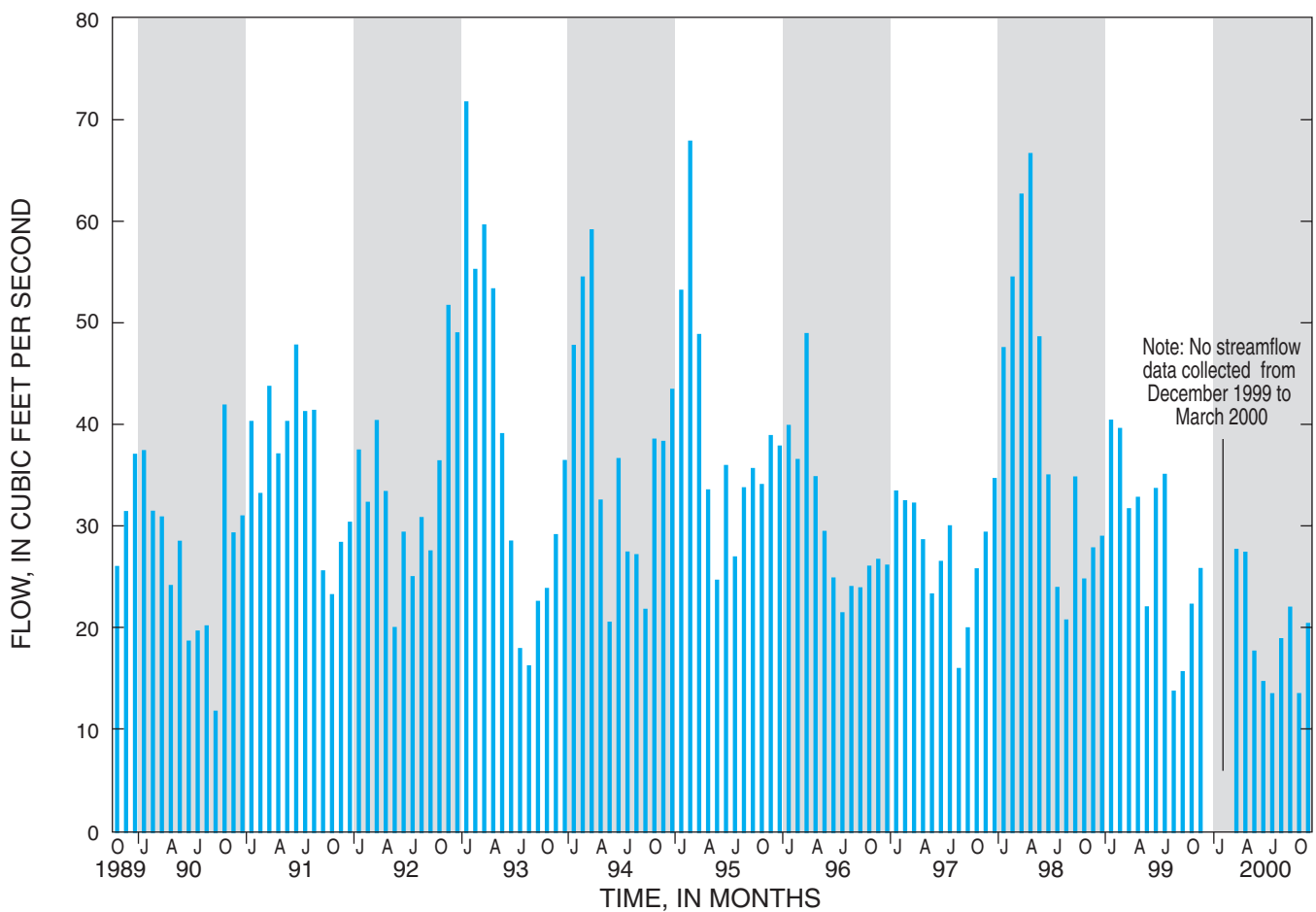


Figure 5. Monthly average flow at Little Horse Creek near Graniteville, South Carolina, October 1989–November 2000. (Data from U.S. Geological Survey gaging station 02196689.)

1999	Monthly flow			2000	Monthly flow		
	Long-term average	Recorded	Departure from long-term average		Long-term average	Recorded	Departure from long-term average
April	37.7	32.8	-4.9	January	44.9	no data	no data
May	29.6	22.0	-7.6	February	43.7	no data	no data
June	31.7	33.7	2.0	March	45.8	27.7	-18.1
July	26.9	35.0	8.2	April	37.7	27.4	-10.3
August	24.4	13.7	-10.7	May	29.6	17.7	-11.9
September	23.9	15.7	-8.2	June	31.7	14.7	-17.0
October	30.0	22.3	-7.7	July	26.9	13.5	-13.4
November	33.0	25.8	-7.3	August	24.4	18.9	-5.5
December	35.5	no data	no data	September	23.9	22.0	-1.9
				October	30.0	13.5	-16.5
				November	33.1	20.4	-12.7

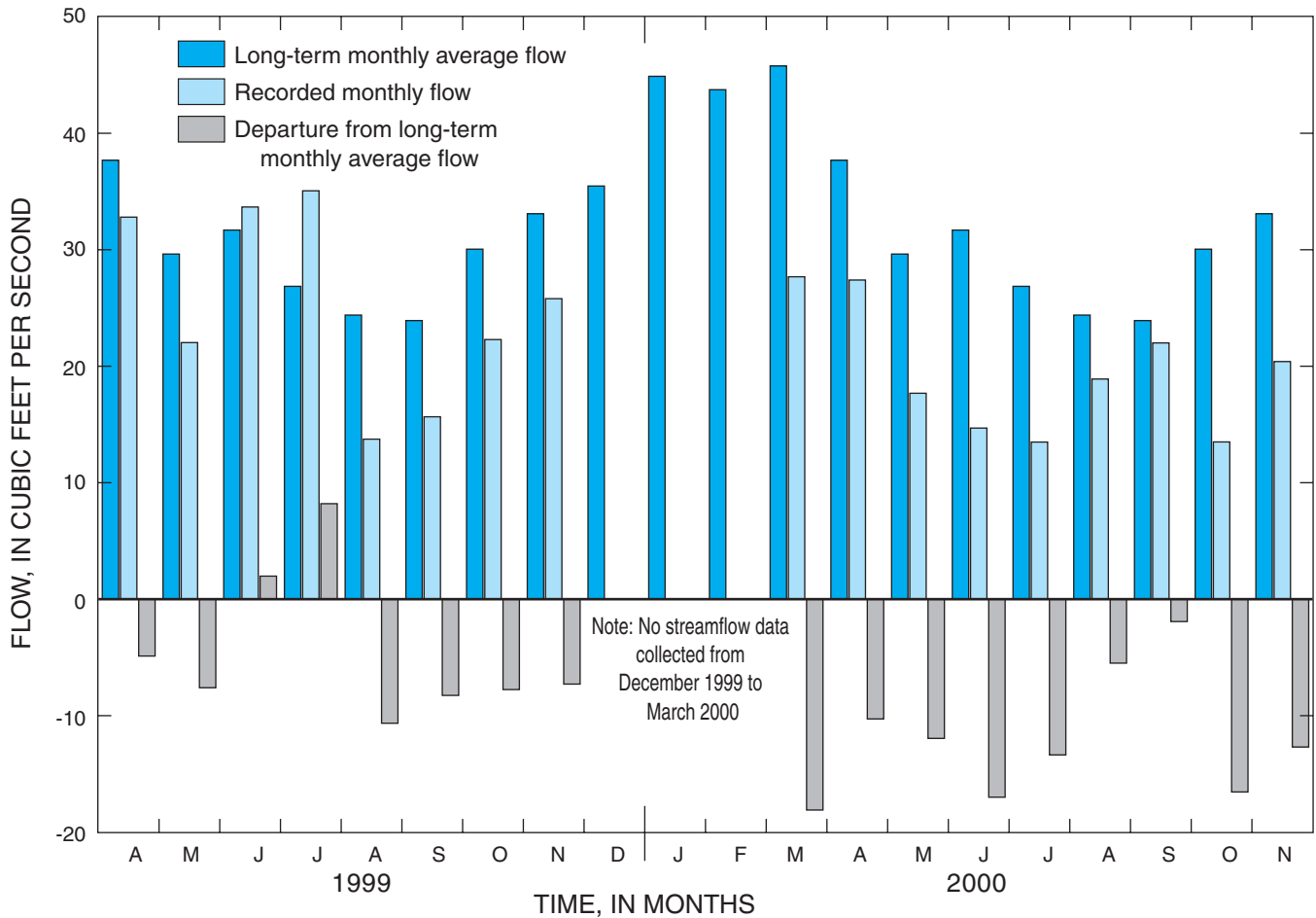


Figure 6. Long-term monthly average flow, recorded monthly flow, and departure from long-term monthly average flow at Little Horse Creek near Graniteville, South Carolina, April 1999–November 2000. (Data from U.S. Geological Survey gaging station 02196689.)

Table 1. Selected well data for production and observation wells owned by the Breezy Hill Water and Sewer Company, Aiken County, South Carolina

[USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request]

USGS ID	Latitude	Longitude	Elevation of land surface (feet, above sea level)	Well depth (feet, below land surface)	Elevation of top of open zone (feet, above sea level)	Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation	Production capacity (gallons per minute)
AK-432	33°35'	81°50'	482	235	287	257	Floridan-Midville	¹ 176
AK-436	33°34'	81°50'	470	250	260	240	Floridan-Midville	252
AK-455	33°31'	81°55'	458	285	223	193	Floridan-Midville	230
AK-457	33°34'	81°50'	480	237	276	246	Floridan-Midville	224
AK-472	33°30'	81°54'	274	136	164	144	Floridan-Midville	98
AK-473	33°34'	81°50'	441	192	277	257	Floridan-Midville	174
AK-747	33°31'	81°52'	353	240	193	113	Floridan-Midville	no data
AK-750	33°34'	81°50'	470	300	270	170	Floridan-Midville	no data
AK-777	33°33'	81°49'	247	70	207	202	Floridan-Midville	100
	no data	no data	no data	no data	192	182	no data	no data
AK-778/AK-900	33°31'	81°52'	355	240	195	115	Floridan-Midville	400
AK-781	33°34'	81°50'	470	300	270	170	Floridan-Midville	403
AK-843	33°31'	81°52'	353	220	193	133	Floridan-Midville	170
AK-844	33°30'	81°55'	430	1,010	210	110	Floridan-Midville and crystalline bedrock	168
	no data	no data	no data	no data	65	-580	no data	no data
AK-2439	33°37'	81°50'	470	120	390	350	Floridan-Midville	206
AK-2440	33°37'	81°51'	490	130	390	360	Floridan-Midville	175
AK-2542	33°37'	81°50'	470	112	380	360	Floridan-Midville	no data
AK-2543	33°31'	81°52'	357	240	197	117	Floridan-Midville	no data
AK-2544	33°37'	81°51'	490	142	390	360	Floridan-Midville	no data

¹ Data from C. Hilton, Breezy Hill Water and Sewer Company, oral commun., February 2001.

ground-water withdrawals by the utility for a 20-month period from April 1999 to November 2000 totaled 674 Mgal; however, actual ground-water withdrawals by the utility totaled 883 Mgal (fig. 8). During the study period, the difference of 209 Mgal between the calculated long-term and actual monthly ground-water withdrawals represented a 31 percent increase in ground-water withdrawals for the production wells.

Floridan-Midville Aquifer

Average water-level elevations for the unconfined Floridan-Midville aquifer from April 1999 to November 2000 were mapped. The configuration of the water-level surface is a subdued version of the local topography (plate 4). Water-level contours indicate

lower hydraulic gradients beneath the broad crest of the interfluves and higher hydraulic gradients beneath the flanks of the interfluves in the creek and stream valleys. The highest water-level elevations were observed near the Aiken-Edgefield County boundary in the northern part of the study area (plate 4). During the study, the average water-level elevation for the Floridan-Midville aquifer ranged from about 200 ft near Langley Pond in the southern regions of the study area to more than 480 ft in the northern region near the Aiken-Edgefield County boundary (plate 4).

The direction of ground-water flow is from north to south between Horse and Little Horse Creeks and northwest to southeast between Little Horse and Hightower Creeks, Hightower Creek and Franklin Branch, and Franklin Branch and Mims Branch (plate 4). Ground

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1989	19.58	20.94	24.89	32.72	30.00	27.35	25.71	25.45	25.92	23.49	27.61	31.49
1990	27.13	23.45	26.48	28.68	34.23	38.05	32.83	31.32	32.56	27.44	27.70	27.53
1991	27.01	24.11	28.61	25.79	28.45	31.03	29.99	26.51	29.00	33.66	28.81	28.12
1992	27.71	26.13	29.74	28.26	35.37	32.52	34.89	33.60	29.51	30.00	27.92	28.59
1993	27.58	25.37	29.51	27.80	38.93	45.31	49.54	45.21	36.06	37.72	32.87	32.77
1994	27.15	23.80	27.24	38.03	49.00	43.08	32.83	32.96	30.79	28.88	27.56	25.96
1995	28.61	28.37	33.21	39.90	50.47	37.97	40.86	37.17	37.17	35.48	33.12	33.07
1996	32.01	30.29	32.14	35.97	42.94	41.19	36.87	36.97	37.67	35.60	31.74	29.34
1997	29.71	26.24	32.87	33.96	42.87	39.21	46.51	46.97	45.14	41.48	28.51	22.85
1999	33.63	28.57	29.21	39.96	49.65	53.89	50.80	64.15	50.12	37.53	34.79	30.65
2000	34.44	29.97	35.80	40.93	73.50	65.40	54.68	38.63	33.06	35.26	29.95	28.47

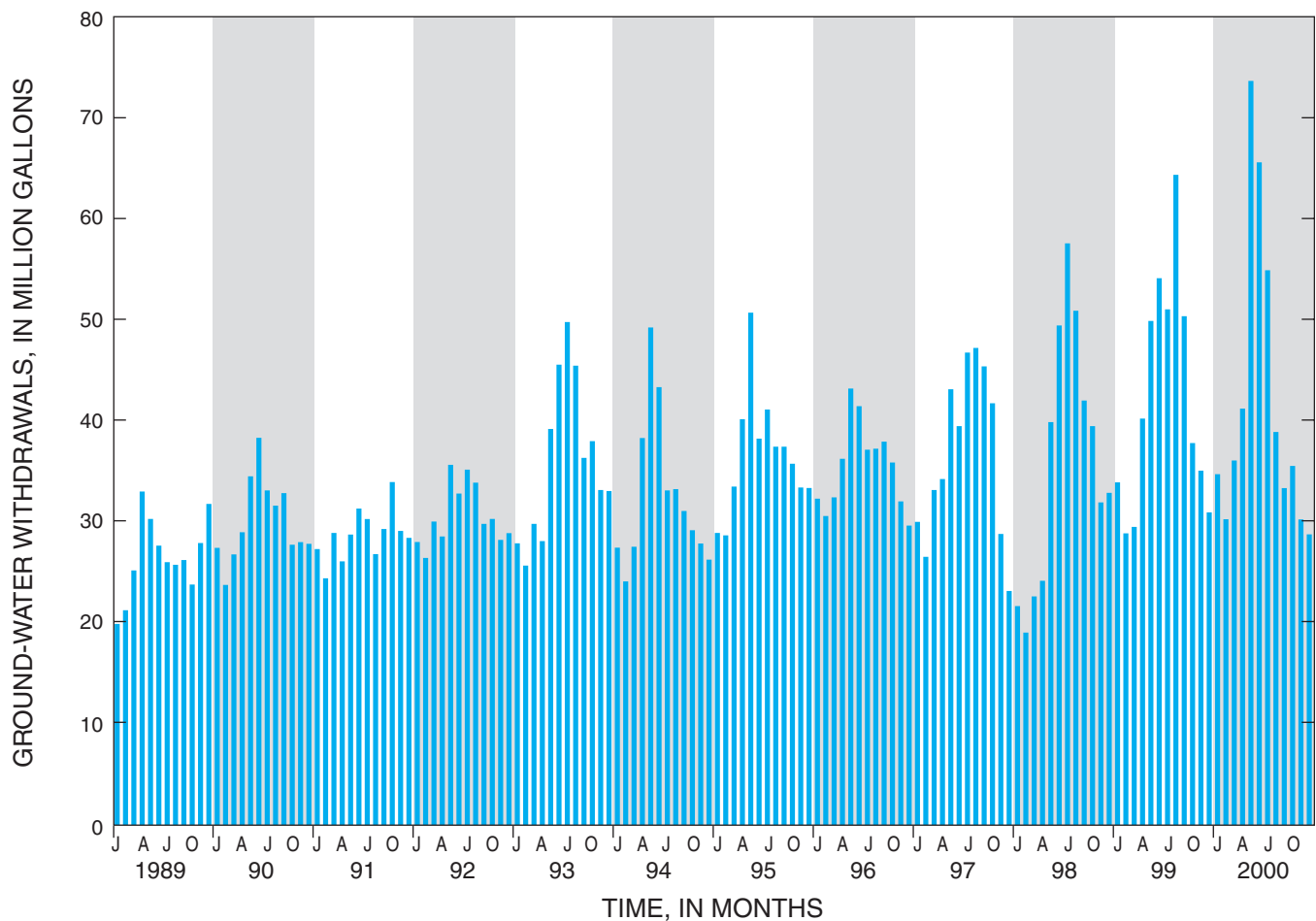


Figure 7. Monthly total ground-water withdrawals for the Breezy Hill Water and Sewer Company, Aiken County, South Carolina, 1989–2000.

1999	Monthly ground-water withdrawals			2000	Monthly ground-water withdrawals		
	Long-term average	Total	Departure from long-term average		Long-term average	Total	Departure from long-term average
January	26.78	33.63	6.85	January	26.78	34.44	7.66
February	24.74	28.57	3.82	February	24.74	29.97	5.23
March	28.70	29.21	0.51	March	28.70	35.80	7.10
April	31.50	39.96	8.47	April	31.50	40.93	9.43
May	39.19	49.65	10.47	May	39.19	73.50	34.31
June	38.49	53.89	15.40	June	38.49	65.40	26.91
July	38.74	50.80	12.06	July	38.74	54.68	15.94
August	36.68	64.15	27.46	August	36.68	38.63	1.95
September	34.56	50.12	15.57	September	34.56	33.06	-1.50
October	33.29	37.53	4.24	October	33.29	35.26	1.97
November	29.75	34.79	5.04	November	29.75	29.95	0.20
December	29.23	30.65	1.41	December	29.23	28.47	-0.76

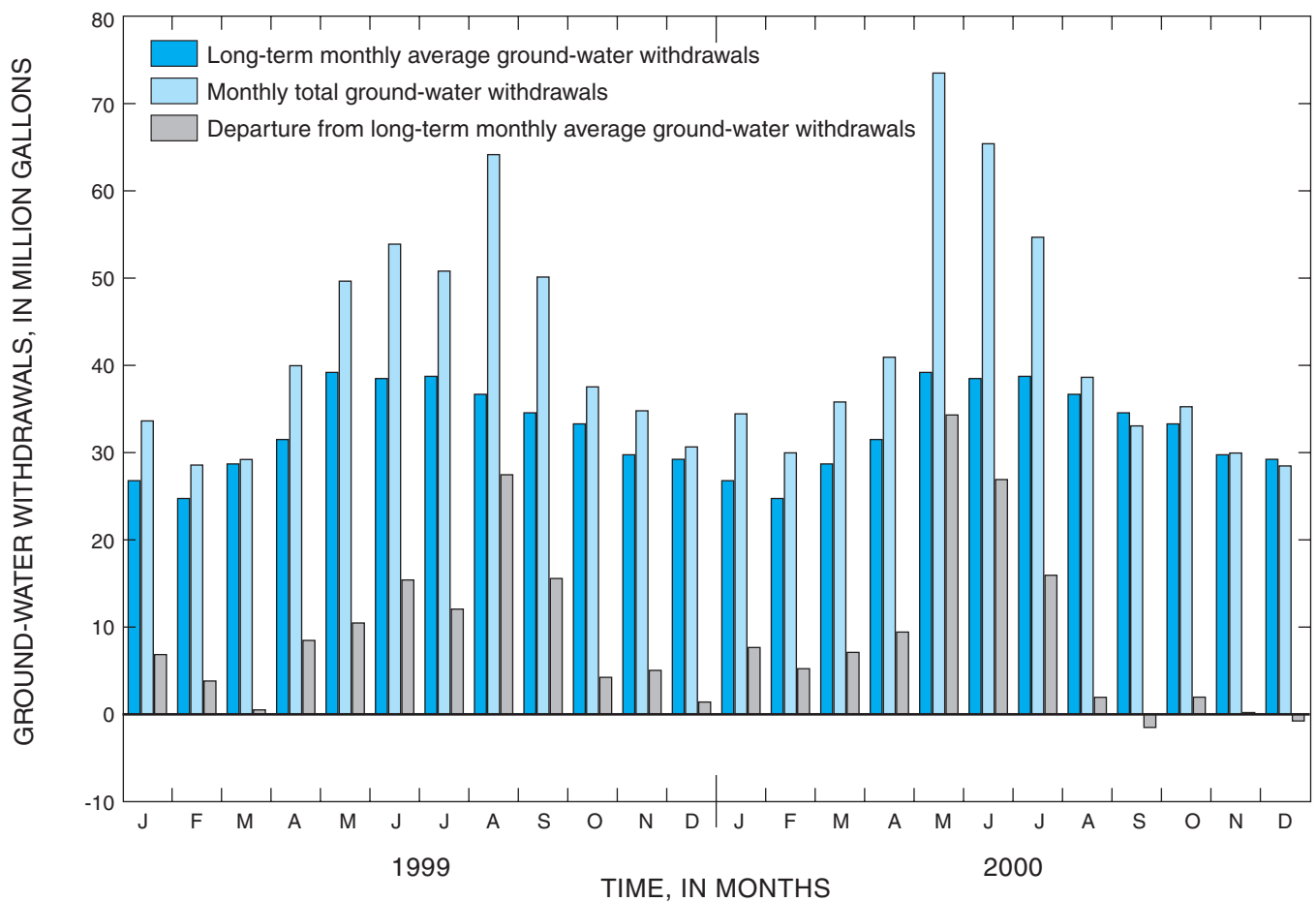


Figure 8. Long-term monthly average ground-water withdrawals, monthly total ground-water withdrawals, and departure from long-term monthly average ground-water withdrawals for the Breezy Hill Water and Sewer Company, Aiken County, South Carolina, 1999–2000.

water discharges along the flanks of the interfluves into the bounding streams where the elevations of the ground water and streams coincide (plate 4).

From November 1999 to November 2000 ground-water levels near pumping centers declined. Water levels in wells AK-747, AK-750, AK-777, AK-2542, AK-2543, and AK-2544 declined 4.55, 4.99, 1.59, 2.18, 3.9 and 1.99 ft, respectively (see appendix). Few historic ground-water levels are available for the Breezy Hill area. Water levels for wells AK-747 and AK-750 measured May 1992 (Harrelson and others, 1997) were compared to April 2000 water levels, which illustrate a water-level decline of 10.27 and 11.50 ft, respectively.

Average saturated thickness of the Floridan-Midville aquifer is highly variable in the Breezy Hill area, ranging from about 0 to 20 ft along the upper and middle flanks of the interfluve bounded by Horse Creek to about 70 ft near Langley Pond. Average saturated thickness ranged from about 0 to 20 ft along Little Horse Creek and many of the smaller, ephemeral creeks, to about 20 to 70 ft across the interfluvial areas (plate 5).

The USGS computer program PART (Rutledge, 1998) was used to generate a base-flow recession analysis and to estimate an average annual recharge rate utilizing streamflow data for Little Horse Creek. From 1990 to 1997, the PART program produced an estimated mean base flow of 14.9 in/yr for the creek. Krambis (2000) conducted a base-flow recession analysis on streamflow data for Little Horse Creek from October 1, 1989, to August 5, 1996, that estimated an average annual recharge rate of 14.4 in/yr. Based on historical streamflow data and losses to evapotranspiration, Cherry and Badr (1998) and Gebert and others (1987) estimated that annual average recharge rates ranged from 13-15 in/yr for the area.

Using an estimated average porosity ranging from 30 to 35 percent, based on observations of the sand-aquifer cores, an average annual recharge of 13 to 15 in. would cause a 3.6- to 4.1- ft water-level change to the saturated thickness of the Floridan-Midville aquifer if applied instantaneously. Water-level declines observed in wells from April 1999 to November 2000 approximated an average decline of 4 ft.

SUMMARY

The Breezy Hill area in Aiken and Edgefield Counties of west-central South Carolina is a rapidly growing region in need of increasing amounts of ground water. From 1995 to 1998, the local water utility increased ground-water withdrawals in the Breezy Hill area from 1.4 to 2.1 million gallons per day to meet water-supply demands. As development continues, future demands for ground water will likely put stress on the surface- and ground-water resources of the area. To address this issue, the U.S. Geological Survey, in cooperation with Aiken County, compiled and interpreted geologic and hydrologic data needed to map the ground-water system in the Breezy Hill study area.

The Breezy Hill study area consists of four interfluvial areas comprising the regions between Horse and Little Horse Creeks, Little Horse and Hightower Creeks, Hightower Creek and Franklin Branch, and Franklin Branch and Mims Branch. Across the interfluvial areas, the average elevation of the water-level surface ranged from 200 to 480 feet above sea level, and the average saturated thickness of the Floridan-Midville aquifer ranged from less than 20 to 70 feet thick. The configuration of the water-level surface for the Floridan-Midville aquifer indicates that recharge to the aquifer occurs mainly within the interfluves. Recharge is derived principally from precipitation, although some potential exists for ground-water recharge from underlying crystalline rocks. Ground water discharges along the flanks of the interfluves into the bounding streams where the elevations of the ground water and streams coincide.

Precipitation data obtained from the National Oceanic and Atmospheric Administration climatological station, Aiken 4 NE, show that normal annual precipitation is about 51 inches. For a 20-month period from April 1999 to November 2000, calculated long-term normal precipitation totaled about 84.0 inches; however, actual recorded precipitation totaled 69.2 inches, representing about a 17.6 percent decrease in precipitation during this period. Published estimates of annual evapotranspiration range from 30 to 35 inches.

A U.S. Geological Survey surface-water gaging station located near the center of the study area on Little Horse Creek monitors runoff from a drainage area of 26.6 square miles. Average annual flow for the station for water years 1990-2000 was 33.8 cubic feet per second. From April 1999 to November 2000, the monthly average flow was less than the average monthly

flow for the long-term record, excluding December 1999 to March 2000 when no data were collected. Monthly average flow for Little Horse Creek exceeded the normal monthly flow during June and July 1999. The lowest annual 7-day minimum flow of 8.5 cubic feet per second was recorded on July 16, 2000. The lowest daily mean discharge during the 2000 water year occurred on July 18, 2000, and was 7.0 cubic feet per second.

Ground water in the Breezy Hill area is principally withdrawn from the unconfined Floridan-Midville aquifer. Residents and industry within the Breezy Hill area operate domestic, irrigation, and production wells that collectively withdraw an unknown volume of ground water. The local water utility has installed production wells over time to meet increasing demands for water. During the study period, the utility operated 13 production wells. Water-use data were obtained from the South Carolina Department of Health and Environmental Control and from conversations with the local water utility manager. Ground-water withdrawals by the local water utility increased 37 percent from 1989 to 2000 (315.2 to 500 million gallons, respectively). From January 1999 to December 2000, the utility exceeded the long-term monthly average ground-water withdrawals for every month except September and December 2000. Calculated long-term monthly ground-water withdrawals by the utility for a 20-month period from April 1999 to November 2000 totaled 674 million gallons; however, actual ground-water withdrawals totaled 883 million gallons, which is 31 percent more than the long-term average ground-water withdrawals for the production wells.

Published estimates of average annual ground-water recharge rates for the study area range from 13 to 15 inches per year. The U.S. Geological Survey computer program PART was used to conduct a base-flow recession analysis and to estimate an average annual recharge rate utilizing streamflow data for Little Horse Creek. The analysis provided an estimated recharge rate of 14.9 inches per year for the Little Horse Creek drainage area.

Using an estimated average porosity ranging from 30 to 35 percent observed in the sand-aquifer cores, an average annual recharge of 13 to 15 inches would cause a 3.6- to 4.1-foot water-level change to the saturated thickness of the aquifer, if applied instantaneously. The water-level declines observed in wells from April 1999 to November 2000 approximated an average decline of 4 feet.

From November 1999 to November 2000, ground-water levels in six wells near utility pumping centers declined 2 to 5 feet. Long-term water-level declines of 10.27 and 11.50 feet were measured in two wells between May 1992 and April 2000, respectively.

Normal evapotranspiration and reduced precipitation limited the amount of water available to recharge the aquifer, and as a result, the Floridan-Midville aquifer retained very little, if any, of the estimated annual recharge. Water-level declines observed in many wells and the decrease in streamflow in Little Horse Creek, indicate that ground-water levels and storage are responding to reduced precipitation, normal evapotranspiration, and increased ground-water withdrawals. During the study period, ground-water levels within the study area reflected the results of natural and human stresses superimposed on the hydrologic system.

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Appendix

Appendix. Water-level elevations for wells in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999–November 2000

[Shaded values indicate that data were used to construct the average water-level map. USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request. --, no data]

USGS ID	Latitude	Longitude	Elevation of land surface (feet, above sea level)	Well depth (feet, below land surface)	Elevation of top of open zone (feet, above sea level)	Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation for water-level measurement	Date of water-level measurement	Elevation of water level (feet, above sea level)	Average elevation of water level (feet, above sea level)
Aiken County										
AK-747	33°31'	81°52'	353	240	192	112	Floridan-Midville	09/22/99	195.72	--
	--	--	--	--	--	--	--	11/18/99	195.01	--
	--	--	--	--	--	--	--	02/24/00	194.47	--
	--	--	--	--	--	--	--	04/19/00	193.25	--
	--	--	--	--	--	--	--	07/21/00	189.35	--
	--	--	--	--	--	--	--	08/21/00	191.01	--
	--	--	--	--	--	--	--	10/17/00	190.58	--
	--	--	--	--	--	--	--	11/16/00	190.46	--
	--	--	--	--	--	--	--	--	--	192.48
AK-750	33°34'	81°50'	470	300	270	170	Floridan-Midville	06/07/99	289.28	--
	--	--	--	--	--	--	--	09/24/99	288.30	--
	--	--	--	--	--	--	--	11/18/99	287.83	--
	--	--	--	--	--	--	--	02/28/00	286.85	--
	--	--	--	--	--	--	--	04/02/00	285.73	--
	--	--	--	--	--	--	--	07/20/00	283.33	--
	--	--	--	--	--	--	--	08/21/00	283.02	--
	--	--	--	--	--	--	--	10/13/00	283.03	--
	--	--	--	--	--	--	--	11/16/00	282.84	--
	--	--	--	--	--	--	--	--	--	285.58
AK-777	33°33'	81°49'	247	70	208	203	Floridan-Midville	04/01/99	227.46	--
	--	--	--	--	--	--	--	11/18/99	225.63	--
	--	--	--	--	--	--	--	02/23/00	226.00	--
	--	--	--	--	--	--	--	04/19/00	225.50	--
	--	--	--	--	--	--	--	07/19/00	224.17	--
	--	--	--	--	--	--	--	08/21/00	223.68	--
	--	--	--	--	--	--	--	10/16/00	224.10	--
	--	--	--	--	--	--	--	11/16/00	224.04	--
	--	--	--	--	--	--	--	--	--	225.07
AK-2449	33°32'	81°51'	491	340	202	182	Floridan-Midville	08/18/99	236.53	--
	--	--	--	--	--	--	--	11/10/99	237.24	--
	--	--	--	--	--	--	--	02/23/00	235.62	--
	--	--	--	--	--	--	--	04/19/00	235.03	--
	--	--	--	--	--	--	--	07/20/00	233.70	--
	--	--	--	--	--	--	--	08/21/00	233.30	--

Appendix. Water--level elevations for wells in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999--November 2000 (Continued)

[Shaded values indicate that data were used to construct the average water-level map. USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request. --, no data]

USGS ID	Latitude	Longitude	Elevation of land surface (feet, above sea level)		Well depth (feet, below land surface)	Elevation of open zone (feet, above sea level)		Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation for water-level measurement	Date of water-level measurement	Elevation of water level (feet, above sea level)	Average elevation of water level (feet, above sea level)
			land surface (feet, above sea level)	sea level		top of open zone (feet, above sea level)	sea level					
AK-2470	--	--	--	--	--	--	--	--	--	10/17/00	232.79	--
	--	--	--	--	--	--	--	--	--	11/16/00	232.48	--
	33°33'	81°49'	366	216	170	196	196	Floridan-Midville	--	06/16/99	258.49	234.59
	--	--	--	--	--	--	--	--	--	11/16/99	256.90	--
	--	--	--	--	--	--	--	--	--	02/29/00	255.90	--
	--	--	--	--	--	--	--	--	--	04/20/00	255.25	--
	--	--	--	--	--	--	--	--	--	07/20/00	254.33	--
	--	--	--	--	--	--	--	--	--	08/31/00	253.80	--
	--	--	--	--	--	--	--	--	--	10/13/00	253.87	--
	--	--	--	--	--	--	--	--	--	11/13/00	254.74	--
AK-2471	33°33'	81°49'	387	--	--	--	--	Undetermined	--	06/10/99	264.19	--
	--	--	--	--	--	--	--	--	--	11/16/99	262.36	--
	--	--	--	--	--	--	--	--	--	02/29/00	261.53	--
	--	--	--	--	--	--	--	--	--	04/20/00	260.79	--
	--	--	--	--	--	--	--	--	--	07/20/00	259.87	--
	--	--	--	--	--	--	--	--	--	08/31/00	259.30	--
	--	--	--	--	--	--	--	--	--	10/13/00	259.31	--
	--	--	--	--	--	--	--	--	--	11/13/00	259.10	--
	--	--	--	--	--	--	--	--	--	--	--	260.81
	33°33'	81°49'	280	194	106	174	174	Floridan-Midville	--	07/29/99	235.87	--
AK-2473	--	--	--	--	--	--	--	--	--	11/15/99	235.21	--
	--	--	--	--	--	--	--	--	--	02/23/00	235.02	--
	--	--	--	--	--	--	--	--	--	04/19/00	234.71	--
	--	--	--	--	--	--	--	--	--	07/18/00	233.75	--
	--	--	--	--	--	--	--	--	--	08/31/00	233.13	--
	--	--	--	--	--	--	--	--	--	10/16/00	232.85	--
	--	--	--	--	--	--	--	--	--	11/13/00	232.40	--
	--	--	--	--	--	--	--	--	--	--	--	234.12
	33°31'	81°50'	210	140	425	100	100	Floridan-Midville and crystalline bedrock	--	08/30/99	188.00	--
	--	--	--	--	--	--	--	--	--	11/15/99	186.40	--
AK-2474	--	--	--	--	--	--	--	--	--	02/23/00	186.27	--
	--	--	--	--	--	--	--	--	--	04/20/00	185.90	--
	--	--	--	--	--	--	--	--	--	07/19/00	185.15	--
	--	--	--	--	--	--	--	--	--	09/28/00	184.08	--
	--	--	--	--	--	--	--	--	--	10/16/00	184.74	--
	--	--	--	--	--	--	--	--	--	--	--	--

Appendix. Water--level elevations for wells in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999–November 2000 (Continued)

[Shaded values indicate that data were used to construct the average water-level map. USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request. --, no data]

USGS ID	Latitude	Longitude	Elevation of land surface (feet, above sea level)	Well depth (feet, below land surface)	Elevation of top of open zone (feet, above sea level)	Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation for water-level measurement	Date of water-level measurement	Elevation of water level (feet, above sea level)	Average elevation of water level (feet, above sea level)
AK-2475	33°31'	81°50'	260	460	200	140	Floridan-Midville and crystalline bedrock	11/13/00	183.55	--
	--	--	--	--	--	--	--	--	--	185.51
	--	--	--	--	--	--	--	08/03/99	204.03	--
	--	--	--	--	--	--	--	11/15/99	202.90	--
	--	--	--	--	--	--	--	02/23/00	202.64	--
	--	--	--	--	--	--	--	04/20/00	202.14	--
	--	--	--	--	--	--	--	07/19/00	201.62	--
	--	--	--	--	--	--	--	09/28/00	201.48	--
	--	--	--	--	--	--	--	10/16/00	201.14	--
	--	--	--	--	--	--	--	11/13/00	200.99	--
	--	--	--	--	--	--	--	--	--	202.12
AK-2476	33°33'	81°50'	400	200	220	200	Floridan-Midville	07/30/99	256.71	--
	--	--	--	--	--	--	--	11/15/99	255.51	--
	--	--	--	--	--	--	--	02/23/00	254.19	--
	--	--	--	--	--	--	--	04/20/00	253.50	--
	--	--	--	--	--	--	--	07/18/00	252.26	--
	--	--	--	--	--	--	--	08/31/00	251.92	--
	--	--	--	--	--	--	--	10/16/00	251.59	--
	--	--	--	--	--	--	--	11/13/00	251.46	--
	--	--	--	--	--	--	--	--	--	253.39
AK-2477	33°32'	81°50'	277	180	157	97	Floridan-Midville	02/23/00	200.99	--
	--	--	--	--	--	--	--	04/20/00	200.42	--
	--	--	--	--	--	--	--	07/19/00	199.46	--
	--	--	--	--	--	--	--	09/28/00	198.89	--
	--	--	--	--	--	--	--	10/16/00	198.82	--
	--	--	--	--	--	--	--	11/13/00	198.58	--
	--	--	--	--	--	--	--	--	--	199.53
AK-2478	33°34'	81°50'	441	180	281	261	Floridan-Midville	08/10/99	304.10	--
	--	--	--	--	--	--	--	11/16/99	303.38	--
	--	--	--	--	--	--	--	02/28/00	301.92	--
	--	--	--	--	--	--	--	04/21/00	301.29	--
	--	--	--	--	--	--	--	07/19/00	299.30	--
	--	--	--	--	--	--	--	09/29/00	299.24	--
	--	--	--	--	--	--	--	10/17/00	299.04	--
	--	--	--	--	--	--	--	11/17/00	298.33	--
	--	--	--	--	--	--	--	--	--	300.83
AK-2479	33°36'	81°50'	446	140	346	306	Floridan-Midville	08/09/99	374.01	--

Appendix. Water--level elevations for wells in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999--November 2000 (Continued)

[Shaded values indicate that data were used to construct the average water-level map. USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request. --, no data]

USGS ID	Latitude	Longitude	Elevation of land surface (feet, above sea level)		Well depth (feet, below land surface)	Elevation of open zone (feet, above sea level)		Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation for water-level measurement	Date of water-level measurement	Elevation of water level (feet, above sea level)	Average elevation of water level (feet, above sea level)
			feet, above sea level	sea level		top of open zone (feet, above sea level)	bottom of open zone (feet, above/below sea level)					
	--	--	--	--	--	--	--	--	--	11/09/99	372.76	--
	--	--	--	--	--	--	--	--	--	02/15/00	371.61	--
	--	--	--	--	--	--	--	--	--	04/17/00	371.51	--
	--	--	--	--	--	--	--	--	--	07/26/00	370.59	--
	--	--	--	--	--	--	--	--	--	09/28/00	370.03	--
	--	--	--	--	--	--	--	--	--	10/11/00	370.16	--
	--	--	--	--	--	--	--	--	--	11/17/00	369.87	--
	--	--	--	--	--	--	--	--	--	--	--	371.32
AK-2480	33°35'	81°50'	458	308	170	308	288	288	Floridan-Midville	07/30/99	324.23	--
	--	--	--	--	--	--	--	--	--	11/16/99	322.32	--
	--	--	--	--	--	--	--	--	--	02/28/99	317.16	--
	--	--	--	--	--	--	--	--	--	04/20/00	318.20	--
	--	--	--	--	--	--	--	--	--	07/20/00	318.21	--
	--	--	--	--	--	--	--	--	--	09/28/00	318.21	--
	--	--	--	--	--	--	--	--	--	10/13/00	317.87	--
	--	--	--	--	--	--	--	--	--	11/17/00	317.56	--
	--	--	--	--	--	--	--	--	--	--	--	319.22
AK-2481	33°36'	81°51'	462	341	131	341	331	331	Floridan-Midville	08/09/99	380.19	--
	--	--	--	--	--	--	--	--	--	11/09/99	379.08	--
	--	--	--	--	--	--	--	--	--	02/15/00	377.42	--
	--	--	--	--	--	--	--	--	--	04/17/00	377.49	--
	--	--	--	--	--	--	--	--	--	07/26/00	376.63	--
	--	--	--	--	--	--	--	--	--	09/12/00	376.28	--
	--	--	--	--	--	--	--	--	--	10/11/00	376.06	--
	--	--	--	--	--	--	--	--	--	11/17/00	375.97	--
	--	--	--	--	--	--	--	--	--	--	--	377.39
AK-2482	33°32'	81°51'	408	181	247	181	161	161	Floridan-Midville	11/16/99	229.55	--
	--	--	--	--	--	--	--	--	--	02/23/00	230.61	--
	--	--	--	--	--	--	--	--	--	04/19/00	226.89	--
	--	--	--	--	--	--	--	--	--	07/21/00	225.91	--
	--	--	--	--	--	--	--	--	--	09/01/00	225.78	--
	--	--	--	--	--	--	--	--	--	10/17/00	224.72	--
	--	--	--	--	--	--	--	--	--	11/16/00	224.60	--
	--	--	--	--	--	--	--	--	--	--	--	226.87
AK-2483	33°34'	81°51'	308	--	--	--	--	--	Undetermined	06/14/99	276.62	--
	--	--	--	--	--	--	--	--	--	02/28/00	275.26	--
	--	--	--	--	--	--	--	--	--	04/21/00	275.01	--
	--	--	--	--	--	--	--	--	--	07/20/00	273.84	--

Appendix. Water--level elevations for wells in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999--November 2000 (Continued)

[Shaded values indicate that data were used to construct the average water-level map. USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request. --, no data]

USGS ID	Latitude	Longitude	Elevation of land surface (feet, above sea level)	Well depth (feet, below land surface)	Elevation of top of open zone (feet, above sea level)	Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation for water-level measurement	Date of water-level measurement	Elevation of water level (feet, above sea level)	Average elevation of water level (feet, above sea level)
	--	--	--	--	--	--	--	09/28/00	273.57	--
	--	--	--	--	--	--	--	10/13/00	273.53	--
	--	--	--	--	--	--	--	11/16/00	273.29	--
	--	--	--	--	--	--	--	--	--	274.45
AK-2484	33°37'	81°51'	473	80	413	393	Floridan-Midville	06/08/99	421.38	--
	--	--	--	--	--	--	--	11/09/99	418.96	--
	--	--	--	--	--	--	--	02/15/00	418.04	--
	--	--	--	--	--	--	--	04/17/00	418.23	--
	--	--	--	--	--	--	--	07/7/00	417.72	--
	--	--	--	--	--	--	--	09/8/00	417.36	--
	--	--	--	--	--	--	--	10/10/00	417.30	--
	--	--	--	--	--	--	--	11/17/00	417.20	--
	--	--	--	--	--	--	--	--	--	418.27
AK-2485	33°36'	81°51'	431	--	--	--	Undetermined	06/23/99	375.28	--
	--	--	--	--	--	--	--	11/09/99	373.95	--
	--	--	--	--	--	--	--	02/15/00	373.21	--
	--	--	--	--	--	--	--	04/17/00	372.91	--
	--	--	--	--	--	--	--	07/26/00	372.40	--
	--	--	--	--	--	--	--	09/12/00	372.16	--
	--	--	--	--	--	--	--	10/11/00	372.01	--
	--	--	--	--	--	--	--	11/17/00	371.93	--
	--	--	--	--	--	--	--	--	--	372.98
AK-2486	33°37'	81°51'	474	100	394	374	Floridan-Midville	06/10/99	412.19	--
	--	--	--	--	--	--	--	11/09/99	410.48	--
	--	--	--	--	--	--	--	--	--	411.34
AK-2487	33°31'	81°51'	418	260	198	158	Floridan-Midville	08/11/99	215.03	--
	--	--	--	--	--	--	--	11/18/99	213.45	--
	--	--	--	--	--	--	--	02/24/00	212.79	--
	--	--	--	--	--	--	--	04/19/00	211.99	--
	--	--	--	--	--	--	--	07/26/00	211.04	--
	--	--	--	--	--	--	--	09/01/00	210.84	--
	--	--	--	--	--	--	--	10/17/00	210.71	--
	--	--	--	--	--	--	--	11/16/00	210.54	--
	--	--	--	--	--	--	--	--	--	212.05
AK-2488	33°37'	81°52'	445	61	399	384	Floridan-Midville	06/10/99	406.78	--
	--	--	--	--	--	--	--	11/09/99	405.06	--
	--	--	--	--	--	--	--	02/25/00	404.41	--
	--	--	--	--	--	--	--	04/17/00	404.19	--

Appendix. Water--level elevations for wells in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999--November 2000 (Continued)

[Shaded values indicate that data were used to construct the average water-level map. USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request. --, no data]

USGS ID	Latitude	Longitude	Elevation of land surface		Well depth (feet, below land surface)	Elevation of open zone		Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation for water-level measurement	Date of water-level measurement	Elevation of water level (feet, above sea level)	Average elevation of water level (feet, above sea level)
			(feet, above sea level)	(feet, above sea level)		(feet, above sea level)	(feet, above sea level)					
	--	--	--	--	--	--	--	--	--	07/07/00	403.70	--
	--	--	--	--	--	--	--	--	--	09/08/00	403.48	--
	--	--	--	--	--	--	--	--	--	10/13/00	403.59	--
	--	--	--	--	--	--	--	--	--	11/17/00	403.33	--
	--	--	--	--	--	--	--	--	--	--	--	404.32
AK-2489	33°31'	81°52'	387	172	235	152	152	Floridan-Midville		08/12/99	227.61	--
	--	--	--	--	--	--	--	--	--	02/24/00	223.85	--
	--	--	--	--	--	--	--	--	--	07/21/00	214.05	--
	--	--	--	--	--	--	--	--	--	--	--	221.84
AK-2491	33°37'	81°52'	450	--	--	--	--	Undetermined		06/10/99	382.24	--
	--	--	--	--	--	--	--	--	--	11/10/99	380.46	--
	--	--	--	--	--	--	--	--	--	02/15/00	380.18	--
	--	--	--	--	--	--	--	--	--	04/17/00	379.97	--
	--	--	--	--	--	--	--	--	--	07/07/00	379.44	--
	--	--	--	--	--	--	--	--	--	09/08/00	379.08	--
	--	--	--	--	--	--	--	--	--	10/10/00	379.08	--
	--	--	--	--	--	--	--	--	--	11/17/00	378.92	--
	--	--	--	--	--	--	--	--	--	--	--	379.92
AK-2492	33°37'	81°52'	378	308	864	-486	-486	Crystalline bedrock		06/14/99	371.33	--
	--	--	--	--	--	--	--	--	--	11/10/99	370.56	--
	--	--	--	--	--	--	--	--	--	02/25/00	370.92	--
	--	--	--	--	--	--	--	--	--	04/18/00	371.10	--
	--	--	--	--	--	--	--	--	--	07/07/00	369.72	--
	--	--	--	--	--	--	--	--	--	09/08/00	369.79	--
	--	--	--	--	--	--	--	--	--	10/10/00	370.00	--
	--	--	--	--	--	--	--	--	--	11/17/00	369.76	--
	--	--	--	--	--	--	--	--	--	--	--	370.40
AK-2493	33°37'	81°52'	359	256	550	-191	-191	Crystalline bedrock		06/14/99	350.27	--
	--	--	--	--	--	--	--	--	--	11/10/99	351.86	--
	--	--	--	--	--	--	--	--	--	02/25/00	352.59	--
	--	--	--	--	--	--	--	--	--	04/18/00	352.40	--
	--	--	--	--	--	--	--	--	--	07/07/00	350.32	--
	--	--	--	--	--	--	--	--	--	09/08/00	351.77	--
	--	--	--	--	--	--	--	--	--	10/10/00	352.10	--
	--	--	--	--	--	--	--	--	--	11/17/00	351.28	--
	--	--	--	--	--	--	--	--	--	--	--	351.57
AK-2494	33°37'	81°52'	414	324	500	-86	-86	Crystalline bedrock		06/14/99	369.11	--
	--	--	--	--	--	--	--	--	--	11/10/99	368.04	--

Appendix. Water--level elevations for wells in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999--November 2000 (Continued)

[Shaded values indicate that data were used to construct the average water-level map. USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request. --, no data]

USGS ID	Latitude	Longitude	Elevation of land surface (feet, above sea level)	Well depth (feet, below land surface)	Elevation of top of open zone (feet, above sea level)	Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation for water-level measurement	Date of water-level measurement	Elevation of water level (feet, above sea level)	Average elevation of water level (feet, above sea level)
	--	--	--	--	--	--	--	02/25/00	368.52	--
	--	--	--	--	--	--	--	04/18/00	368.60	--
	--	--	--	--	--	--	--	07/07/00	367.42	--
	--	--	--	--	--	--	--	09/08/00	367.21	--
	--	--	--	--	--	--	--	10/10/00	367.44	--
	--	--	--	--	--	--	--	11/17/00	367.32	--
AK-2495	33°37'	81°52'	349	450	246	-101	Crystalline bedrock	06/14/99	--	367.96
	--	--	--	--	--	--	--	11/10/99	337.24	--
	--	--	--	--	--	--	--	02/25/00	334.92	--
	--	--	--	--	--	--	--	04/18/00	338.02	--
	--	--	--	--	--	--	--	07/07/00	338.76	--
	--	--	--	--	--	--	--	09/08/00	334.74	--
	--	--	--	--	--	--	--	10/10/00	334.37	--
	--	--	--	--	--	--	--	11/17/00	335.55	--
AK-2496	33°37'	81°52'	433	500	330	-67	Crystalline bedrock	06/14/99	--	336.15
	--	--	--	--	--	--	--	11/10/99	378.80	--
	--	--	--	--	--	--	--	02/25/00	377.92	--
	--	--	--	--	--	--	--	04/18/00	379.15	--
	--	--	--	--	--	--	--	07/07/00	379.37	--
	--	--	--	--	--	--	--	09/08/00	377.50	--
	--	--	--	--	--	--	--	10/10/00	377.28	--
	--	--	--	--	--	--	--	11/17/00	377.77	--
	--	--	--	--	--	--	--		377.57	378.17
AK-2497	33°37'	81°52'	438	70	388	368	Floridan-Midville	06/14/99	383.71	--
	--	--	--	--	--	--	--	11/10/99	381.96	--
	--	--	--	--	--	--	--	02/25/00	382.00	--
	--	--	--	--	--	--	--	04/18/00	382.20	--
	--	--	--	--	--	--	--	07/07/00	381.66	--
	--	--	--	--	--	--	--	09/08/00	381.37	--
	--	--	--	--	--	--	--	10/10/00	381.42	--
	--	--	--	--	--	--	--	11/17/00	381.29	--
AK-2498	33°37'	81°52'	441	75	391	366	Floridan-Midville	06/14/99	--	381.95
	--	--	--	--	--	--	--	11/10/99	384.73	--
	--	--	--	--	--	--	--	02/25/00	385.62	--
	--	--	--	--	--	--	--	04/18/00	385.63	--
	--	--	--	--	--	--	--		385.84	--

Appendix. Water--level elevations for wells in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999--November 2000 (Continued)

[Shaded values indicate that data were used to construct the average water-level map. USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request. --, no data]

USGS ID	Latitude	Longitude	Elevation of land surface (feet, above sea level)	Well depth (feet, below land surface)	Elevation of top of open zone (feet, above sea level)	Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation for water-level measurement	Date of water-level measurement	Elevation of water level (feet, above sea level)	Average elevation of water level (feet, above sea level)
	--	--	--	--	--	--	--	07/07/00	385.30	--
	--	--	--	--	--	--	--	09/08/00	385.00	--
	--	--	--	--	--	--	--	10/10/00	385.08	--
	--	--	--	--	--	--	--	11/17/00	384.94	--
	--	--	--	--	--	--	--	--	--	385.27
AK-2499	33°37'	81°52'	376	--	--	--	Undetermined	11/12/99	344.62	--
	--	--	--	--	--	--	--	02/28/00	348.82	--
	--	--	--	--	--	--	--	07/07/00	341.60	--
	--	--	--	--	--	--	--	09/08/00	342.50	--
	--	--	--	--	--	--	--	--	--	344.39
AK-2500	33°37'	81°52'	348	240	208	108	Crystalline bedrock	04/26/99	328.06	--
	--	--	--	--	--	--	--	11/12/99	322.26	--
	--	--	--	--	--	--	--	--	--	325.16
AK-2501	33°36'	81°52'	352	140	322	212	Crystalline bedrock	04/26/99	320.61	--
	--	--	--	--	--	--	--	11/12/99	318.06	--
	--	--	--	--	--	--	--	02/25/00	316.83	--
	--	--	--	--	--	--	--	07/07/00	312.62	--
	--	--	--	--	--	--	--	09/08/00	316.02	--
	--	--	--	--	--	--	--	10/13/00	315.74	--
	--	--	--	--	--	--	--	--	--	316.65
AK-2502	33°36'	81°54'	433	58	385	375	Floridan--Midville	08/08/99	394.57	--
	--	--	--	--	--	--	--	11/15/99	393.46	--
	--	--	--	--	--	--	--	02/25/00	392.70	--
	--	--	--	--	--	--	--	04/19/00	392.53	--
	--	--	--	--	--	--	--	07/27/00	391.84	--
	--	--	--	--	--	--	--	09/12/00	391.74	--
	--	--	--	--	--	--	--	10/11/00	391.78	--
	--	--	--	--	--	--	--	11/21/00	391.80	--
	--	--	--	--	--	--	--	--	--	392.55
AK-2503	33°36'	81°54'	411	32	389	379	Floridan--Midville	08/17/99	397.48	--
	--	--	--	--	--	--	--	11/12/99	397.66	--
	--	--	--	--	--	--	--	02/28/00	399.11	--
	--	--	--	--	--	--	--	04/18/00	398.48	--
	--	--	--	--	--	--	--	07/27/00	397.30	--
	--	--	--	--	--	--	--	09/12/00	397.78	--
	--	--	--	--	--	--	--	10/11/00	398.39	--
	--	--	--	--	--	--	--	11/21/00	397.61	--
	--	--	--	--	--	--	--	--	--	397.98

Appendix. Water--level elevations for wells in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999--November 2000 (Continued)

[Shaded values indicate that data were used to construct the average water-level map. USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request. --, no data]

USGS ID	Latitude	Longitude	Elevation of land surface (feet, above sea level)	Well depth (feet, below land surface)	Elevation of top of open zone (feet, above sea level)	Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation for water-level measurement	Date of water-level measurement	Elevation of water level (feet, above sea level)	Average elevation of water level (feet, above sea level)
AK-2504	33°36'	81°54'	480	80	420	400	Floridan-Midville	08/17/99	417.76	--
	--	--	--	--	--	--	--	11/12/99	417.21	--
	--	--	--	--	--	--	--	02/28/00	417.92	--
	--	--	--	--	--	--	--	04/18/00	418.04	--
	--	--	--	--	--	--	--	07/27/00	417.29	--
	--	--	--	--	--	--	--	09/12/00	417.30	--
	--	--	--	--	--	--	--	10/11/00	417.50	--
	--	--	--	--	--	--	--	11/21/00	417.28	--
AK-2505	33°36'	81°54'	481	85	421	396	Floridan-Midville	--	--	417.54
	--	--	--	--	--	--	--	08/17/99	433.53	--
	--	--	--	--	--	--	--	11/12/99	433.05	--
	--	--	--	--	--	--	--	02/28/00	432.94	--
	--	--	--	--	--	--	--	04/18/00	432.91	--
	--	--	--	--	--	--	--	07/27/00	432.47	--
	--	--	--	--	--	--	--	09/12/00	432.33	--
	--	--	--	--	--	--	--	10/11/00	432.34	--
	--	--	--	--	--	--	--	11/21/00	432.18	--
AK-2506	33°36'	81°54'	420	30	--	--	Undetermined	08/16/99	400.85	--
	--	--	--	--	--	--	--	11/12/99	399.94	--
	--	--	--	--	--	--	--	02/28/00	403.02	--
	--	--	--	--	--	--	--	04/18/00	402.20	--
	--	--	--	--	--	--	--	07/27/00	399.72	--
	--	--	--	--	--	--	--	09/12/00	401.16	--
	--	--	--	--	--	--	--	10/11/00	402.21	--
	--	--	--	--	--	--	--	11/21/00	401.02	--
AK-2507	33°36'	81°54'	417	40	397	377	Floridan-Midville	--	--	401.26
	--	--	--	--	--	--	--	08/17/99	403.79	--
	--	--	--	--	--	--	--	11/12/99	403.22	--
	--	--	--	--	--	--	--	02/28/00	404.96	--
	--	--	--	--	--	--	--	04/18/00	404.19	--
	--	--	--	--	--	--	--	07/27/00	403.02	--
	--	--	--	--	--	--	--	09/12/00	403.60	--
	--	--	--	--	--	--	--	10/11/00	404.06	--
	--	--	--	--	--	--	--	11/21/00	403.38	--
AK-2508	33°36'	81°54'	482	80	--	--	Undetermined	--	--	403.78
	--	--	--	--	--	--	--	08/16/99	416.63	--
	--	--	--	--	--	--	--	11/12/99	416.34	--

Appendix. Water--level elevations for wells in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999--November 2000 (Continued)

[Shaded values indicate that data were used to construct the average water-level map. USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request. --, no data]

USGS ID	Latitude	Longitude	Elevation of land surface (feet, above sea level)	Well depth (feet, below land surface)	Elevation of top of open zone (feet, above sea level)	Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation for water-level measurement	Date of water-level measurement	Elevation of water level (feet, above sea level)	Average elevation of water level (feet, above sea level)
	--	--	--	--	--	--	--	02/28/00	416.80	--
	--	--	--	--	--	--	--	04/18/00	416.99	--
	--	--	--	--	--	--	--	07/27/00	416.07	--
	--	--	--	--	--	--	--	09/12/00	416.14	--
	--	--	--	--	--	--	--	10/11/00	416.65	--
AK-2509	33°36'	81°54'	467	80	--	--	Undetermined	08/16/99	416.38	416.52
	--	--	--	--	--	--	--	11/12/99	415.68	--
	--	--	--	--	--	--	--	02/28/00	416.52	--
	--	--	--	--	--	--	--	04/18/00	416.53	--
	--	--	--	--	--	--	--	07/27/00	415.89	--
	--	--	--	--	--	--	--	09/12/00	415.88	--
	--	--	--	--	--	--	--	10/11/00	416.03	--
	--	--	--	--	--	--	--	11/21/00	415.93	--
AK-2510	33°38'	81°51'	539	70	489	469	Floridan-Midville	07/23/99	480.89	416.11
	--	--	--	--	--	--	--	11/08/99	480.12	--
	--	--	--	--	--	--	--	02/14/00	479.51	--
	--	--	--	--	--	--	--	04/06/00	479.85	--
	--	--	--	--	--	--	--	07/05/00	479.52	--
	--	--	--	--	--	--	--	08/22/00	479.81	--
	--	--	--	--	--	--	--	09/29/00	479.35	--
	--	--	--	--	--	--	--	11/21/00	479.80	--
AK-2511	33°38'	81°51'	539	320	--	--	Undetermined	07/28/99	474.15	479.86
	--	--	--	--	--	--	--	11/08/99	474.03	--
	--	--	--	--	--	--	--	02/14/00	474.17	--
	--	--	--	--	--	--	--	04/06/00	473.95	--
	--	--	--	--	--	--	--	07/07/00	471.95	--
	--	--	--	--	--	--	--	08/22/00	472.48	--
	--	--	--	--	--	--	--	09/29/00	473.95	--
	--	--	--	--	--	--	--	11/21/00	474.71	--
AK-2512	33°38'	81°52'	513	49	479	464	Floridan-Midville	07/20/99	472.92	473.67
	--	--	--	--	--	--	--	11/08/99	472.45	--
	--	--	--	--	--	--	--	02/14/00	472.42	--
	--	--	--	--	--	--	--	04/06/00	472.81	--
	--	--	--	--	--	--	--	07/05/00	472.19	--

Appendix. Water-level elevations for wells in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999–November 2000 (Continued)

[Shaded values indicate that data were used to construct the average water-level map. USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request. --, no data]

USGS ID	Latitude	Longitude	Elevation of land surface (feet, above sea level)	Well depth (feet, below land surface)	Elevation of top of open zone (feet, above sea level)	Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation for water-level measurement	Date of water-level measurement	Elevation of water level (feet, above sea level)	Average elevation of water level (feet, above sea level)
	--	--	--	--	--	--	--	08/22/00	472.22	--
	--	--	--	--	--	--	--	09/29/00	472.38	--
	--	--	--	--	--	--	--	11/21/00	472.62	--
AK-2514	33°38'	81°51'	529	48	491	481	Floridan-Midville	07/21/99	--	472.50
	--	--	--	--	--	--	--	11/08/99	489.40	--
	--	--	--	--	--	--	--	02/14/00	488.97	--
	--	--	--	--	--	--	--	04/06/00	488.93	--
	--	--	--	--	--	--	--	07/05/00	489.21	--
	--	--	--	--	--	--	--	08/22/00	488.46	--
	--	--	--	--	--	--	--	10/10/00	488.68	--
	--	--	--	--	--	--	--	11/21/00	488.89	--
	--	--	--	--	--	--	--	--	488.94	488.94
AK-2515	33°38'	81°51'	527	196	487	331	Floridan-Midville and crystalline bedrock	07/21/99	--	--
	--	--	--	--	--	--	--	11/08/99	489.74	--
	--	--	--	--	--	--	--	02/14/00	489.21	--
	--	--	--	--	--	--	--	04/06/00	486.92	--
	--	--	--	--	--	--	--	07/05/00	488.35	--
	--	--	--	--	--	--	--	08/22/00	487.73	--
	--	--	--	--	--	--	--	--	--	488.53
AK-2516	33°38'	81°52'	518	300	298	218	Crystalline bedrock	07/21/99	472.10	--
	--	--	--	--	--	--	--	11/08/99	472.42	--
	--	--	--	--	--	--	--	02/14/00	470.18	--
	--	--	--	--	--	--	--	04/06/00	470.16	--
	--	--	--	--	--	--	--	07/05/00	471.08	--
	--	--	--	--	--	--	--	08/22/00	469.98	--
	--	--	--	--	--	--	--	09/29/00	470.20	--
	--	--	--	--	--	--	--	11/21/00	470.67	--
	--	--	--	--	--	--	--	--	--	470.85
AK-2517	33°36'	81°50'	469	--	--	--	Undetermined	07/16/99	371.37	--
	--	--	--	--	--	--	--	11/09/99	370.05	--
	--	--	--	--	--	--	--	02/15/00	369.00	--
	--	--	--	--	--	--	--	04/17/00	368.73	--
	--	--	--	--	--	--	--	07/26/00	368.11	--
	--	--	--	--	--	--	--	08/22/00	367.97	--
	--	--	--	--	--	--	--	10/11/00	367.50	--
	--	--	--	--	--	--	--	11/16/00	367.49	--

Appendix. Water--level elevations for wells in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999--November 2000 (Continued)

[Shaded values indicate that data were used to construct the average water-level map. USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request. --, no data]

USGS ID	Latitude	Longitude	Elevation of land surface (feet, above sea level)		Well depth (feet, below land surface)	Elevation of open zone (feet, above sea level)		Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation for water-level measurement	Date of water-level measurement	Elevation of water level (feet, above sea level)	Average elevation of water level (feet, above sea level)
			land surface (feet, above sea level)	sea level		top of open zone (feet, above sea level)	bottom of open zone (feet, above/below sea level)					
AK-2518	33°36'	81°50'	--	462	--	--	--	--	Undetermined	07/19/99	--	368.78
	--	--	--	--	--	--	--	--	--	02/15/00	363.42	--
	--	--	--	--	--	--	--	--	--	04/17/00	361.18	--
	--	--	--	--	--	--	--	--	--	07/26/00	360.45	--
	--	--	--	--	--	--	--	--	--	09/12/00	360.33	--
	--	--	--	--	--	--	--	--	--	10/11/00	360.03	--
	--	--	--	--	--	--	--	--	--	11/16/00	359.80	--
	--	--	--	--	--	--	--	--	--	--	359.78	--
AK-2521	33°32'	81°53'	--	203	70	153	133	133	Crystalline bedrock	12/14/99	--	360.71
	--	--	--	--	--	--	--	--	--	02/24/00	196.29	--
	--	--	--	--	--	--	--	--	--	04/19/00	196.42	--
	--	--	--	--	--	--	--	--	--	07/26/00	196.09	--
	--	--	--	--	--	--	--	--	--	09/01/00	195.41	--
	--	--	--	--	--	--	--	--	--	10/17/00	195.71	--
	--	--	--	--	--	--	--	--	--	11/16/00	195.79	--
	--	--	--	--	--	--	--	--	--	--	195.85	--
	--	--	--	--	--	--	--	--	--	--	--	195.94
AK-2522	33°37'	81°50'	479	397	112	367	367	367	Floridan-Midville	12/14/99	402.16	--
	--	--	--	--	--	--	--	--	--	02/15/00	401.77	--
	--	--	--	--	--	--	--	--	--	04/06/00	401.62	--
	--	--	--	--	--	--	--	--	--	07/26/00	399.79	--
	--	--	--	--	--	--	--	--	--	08/22/00	399.60	--
	--	--	--	--	--	--	--	--	--	10/10/00	400.38	--
	--	--	--	--	--	--	--	--	--	11/17/00	400.32	--
	--	--	--	--	--	--	--	--	--	--	--	400.81
AK-2523	33°36'	81°52'	368	--	--	--	--	--	Undetermined	12/06/99	342.20	--
	--	--	--	--	--	--	--	--	--	02/28/00	343.11	--
	--	--	--	--	--	--	--	--	--	--	--	342.66
AK-2524	33°33'	81°53'	359	287	112	247	247	247	Floridan-Midville	12/20/99	274.63	--
	--	--	--	--	--	--	--	--	--	02/29/00	274.34	--
	--	--	--	--	--	--	--	--	--	04/21/00	274.12	--
	--	--	--	--	--	--	--	--	--	07/21/00	275.09	--
	--	--	--	--	--	--	--	--	--	09/28/00	275.07	--
	--	--	--	--	--	--	--	--	--	10/13/00	273.13	--
	--	--	--	--	--	--	--	--	--	11/16/00	275.14	--
	--	--	--	--	--	--	--	--	--	--	--	274.50
AK-2526	33°31'	81°54'	290	185	125	165	165	165	Floridan-Midville	12/29/99	200.64	--
	--	--	--	--	--	--	--	--	--	02/29/00	200.54	--

Appendix. Water--level elevations for wells in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999--November 2000 (Continued)

[Shaded values indicate that data were used to construct the average water-level map. USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request. --, no data]

USGS ID	Latitude	Longitude	Elevation of land surface (feet, above sea level)	Well depth (feet, below land surface)	Elevation of top of open zone (feet, above sea level)	Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation for water-level measurement	Date of water-level measurement	Elevation of water level (feet, above sea level)	Average elevation of water level (feet, above sea level)
	--	--	--	--	--	--	--	04/19/00	200.73	--
	--	--	--	--	--	--	--	07/21/00	200.98	--
	--	--	--	--	--	--	--	09/01/00	200.22	--
	--	--	--	--	--	--	--	10/16/00	200.50	--
	--	--	--	--	--	--	--	11/13/00	200.67	--
AK-2527	33°33'	81°55'	445	150	315	295	Floridan-Midville	12/28/99	329.95	200.61
	--	--	--	--	--	--	--	02/29/00	330.96	--
	--	--	--	--	--	--	--	04/21/00	328.96	--
	--	--	--	--	--	--	--	07/27/00	329.15	--
	--	--	--	--	--	--	--	09/28/00	331.25	--
	--	--	--	--	--	--	--	10/13/00	331.37	--
	--	--	--	--	--	--	--	11/16/00	331.32	--
AK-2528	33°34'	81°52'	348	90	268	258	Floridan-Midville	12/28/99	278.21	330.42
	--	--	--	--	--	--	--	02/29/00	278.32	--
	--	--	--	--	--	--	--	04/21/00	278.51	--
	--	--	--	--	--	--	--	07/20/00	278.02	--
	--	--	--	--	--	--	--	09/28/00	278.09	--
	--	--	--	--	--	--	--	10/13/00	278.19	--
	--	--	--	--	--	--	--	11/16/00	278.25	--
AK-2529	33°32'	81°50'	220	80	--	--	Undetermined	05/01/00	198.29	278.23
	--	--	--	--	--	--	--	07/19/00	197.66	--
	--	--	--	--	--	--	--	09/01/00	197.36	--
	--	--	--	--	--	--	--	10/16/00	197.18	--
	--	--	--	--	--	--	--	11/13/00	196.90	--
AK-2530	33°33'	81°50'	331	--	--	--	Undetermined	05/01/00	244.67	197.48
	--	--	--	--	--	--	--	07/18/00	243.90	--
	--	--	--	--	--	--	--	08/31/00	244.05	--
	--	--	--	--	--	--	--	10/16/00	243.74	--
	--	--	--	--	--	--	--	11/13/00	243.56	--
AK-2531	33°30'	81°52'	169	--	--	--	Undetermined	05/03/00	157.51	243.98
	--	--	--	--	--	--	--	07/19/00	157.39	--
	--	--	--	--	--	--	--	09/01/00	157.36	--
	--	--	--	--	--	--	--	10/16/00	157.25	--

Appendix. Water-level elevations for wells in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999–November 2000 (Continued)

[Shaded values indicate that data were used to construct the average water-level map. USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request. --, no data]

USGS ID	Latitude	Longitude	Elevation of land surface (feet, above sea level)	Well depth (feet, below land surface)	Elevation of top of open zone (feet, above sea level)	Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation for water-level measurement	Date of water-level measurement	Elevation of water level (feet, above sea level)	Average elevation of water level (feet, above sea level)
AK-2532	33°33'	81°49'	255	40	223	215	Floridan–Midville	07/30/99	227.94	--
	--	--	--	--	--	--	--	11/16/99	227.21	157.10
	--	--	--	--	--	--	--	02/29/00	227.34	157.32
	--	--	--	--	--	--	--	04/20/00	227.37	--
	--	--	--	--	--	--	--	07/18/00	226.78	--
	--	--	--	--	--	--	--	08/31/00	226.51	--
	--	--	--	--	--	--	--	10/13/00	226.40	--
	--	--	--	--	--	--	--	11/13/00	226.28	--
AK-2540	33°36'	81°53'	500	150	370	350	Floridan–Midville	12/30/99	379.94	226.98
	--	--	--	--	--	--	--	02/25/00	379.52	--
	--	--	--	--	--	--	--	04/19/00	379.01	--
	--	--	--	--	--	--	--	07/27/00	378.71	--
	--	--	--	--	--	--	--	09/22/00	378.51	--
	--	--	--	--	--	--	--	10/11/00	378.35	--
	--	--	--	--	--	--	--	11/21/00	378.07	--
AK-2542	33°37'	81°50'	470	112	90	110	Floridan–Midville	11/18/99	400.84	378.87
	--	--	--	--	--	--	--	02/14/00	401.16	--
	--	--	--	--	--	--	--	04/06/00	400.41	--
	--	--	--	--	--	--	--	05/23/00	399.00	--
	--	--	--	--	--	--	--	07/26/00	397.90	--
	--	--	--	--	--	--	--	08/21/00	398.39	--
	--	--	--	--	--	--	--	10/10/00	399.16	--
	--	--	--	--	--	--	--	11/17/00	398.66	--
AK-2543	33°31'	81°52'	357	220	191	131	Floridan–Midville	09/22/99	203.08	399.44
	--	--	--	--	--	--	--	11/18/99	202.56	--
	--	--	--	--	--	--	--	02/24/00	202.19	--
	--	--	--	--	--	--	--	04/19/00	201.34	--
	--	--	--	--	--	--	--	07/20/00	198.86	--
	--	--	--	--	--	--	--	08/21/00	198.98	--
	--	--	--	--	--	--	--	10/17/00	198.73	--
	--	--	--	--	--	--	--	11/16/00	198.66	--
AK-2544	33°37'	81°51'	490	142	390	360	Floridan–Midville	11/18/99	405.43	200.55
	--	--	--	--	--	--	--	--	--	--

Appendix. Water--level elevations for wells in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999--November 2000 (Continued)

[Shaded values indicate that data were used to construct the average water-level map. USGS ID, U.S. Geological Survey well identifier. Latitude and longitude are expressed in degrees (°) and minutes ('); specific coordinates are available upon request. --, no data]

USGS ID	Latitude	Longitude	Elevation of land surface (feet, above sea level)	Well depth (feet, below land surface)	Elevation of top of open zone (feet, above sea level)	Elevation of bottom of open zone (feet, above/below sea level)	Aquifer system designation for water-level measurement	Date of water-level measurement	Elevation of water level (feet, above sea level)	Average elevation of water level (feet, above sea level)
	--	--	--	--	--	--	--	02/15/00	404.64	--
	--	--	--	--	--	--	--	04/06/00	404.75	--
	--	--	--	--	--	--	--	07/26/00	402.75	--
	--	--	--	--	--	--	--	08/21/00	403.12	--
	--	--	--	--	--	--	--	10/10/00	403.82	--
	--	--	--	--	--	--	--	11/17/00	403.44	--
	--	--	--	--	--	--	--	--	--	403.99
Edgefield County										
EDG-328	33°38'	81°52'	511	48	478	463	Floridan-Midville	07/29/99	474.24	--
	--	--	--	--	--	--	--	11/08/99	473.93	--
	--	--	--	--	--	--	--	02/14/00	473.62	--
	--	--	--	--	--	--	--	04/06/00	474.09	--
	--	--	--	--	--	--	--	07/05/00	473.58	--
	--	--	--	--	--	--	--	08/22/00	473.40	--
	--	--	--	--	--	--	--	10/10/00	473.61	--
	--	--	--	--	--	--	--	11/21/00	473.79	--
	--	--	--	--	--	--	--	--	--	473.78
EDG-329	33°38'	81°52'	512	51	482	461	Floridan-Midville	07/26/99	476.72	--
	--	--	--	--	--	--	--	11/08/99	476.35	--
	--	--	--	--	--	--	--	02/14/00	476.11	--
	--	--	--	--	--	--	--	04/06/00	476.53	--
	--	--	--	--	--	--	--	07/05/00	476.07	--
	--	--	--	--	--	--	--	08/22/00	475.92	--
	--	--	--	--	--	--	--	10/10/00	476.08	--
	--	--	--	--	--	--	--	11/21/00	476.25	--
	--	--	--	--	--	--	--	--	--	476.25



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Harrelson, L.G., Falk, W.F., and Powell, D.C., 2002. Ground-water levels in the Floridan-McMillan aquifer in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999-November 2000.

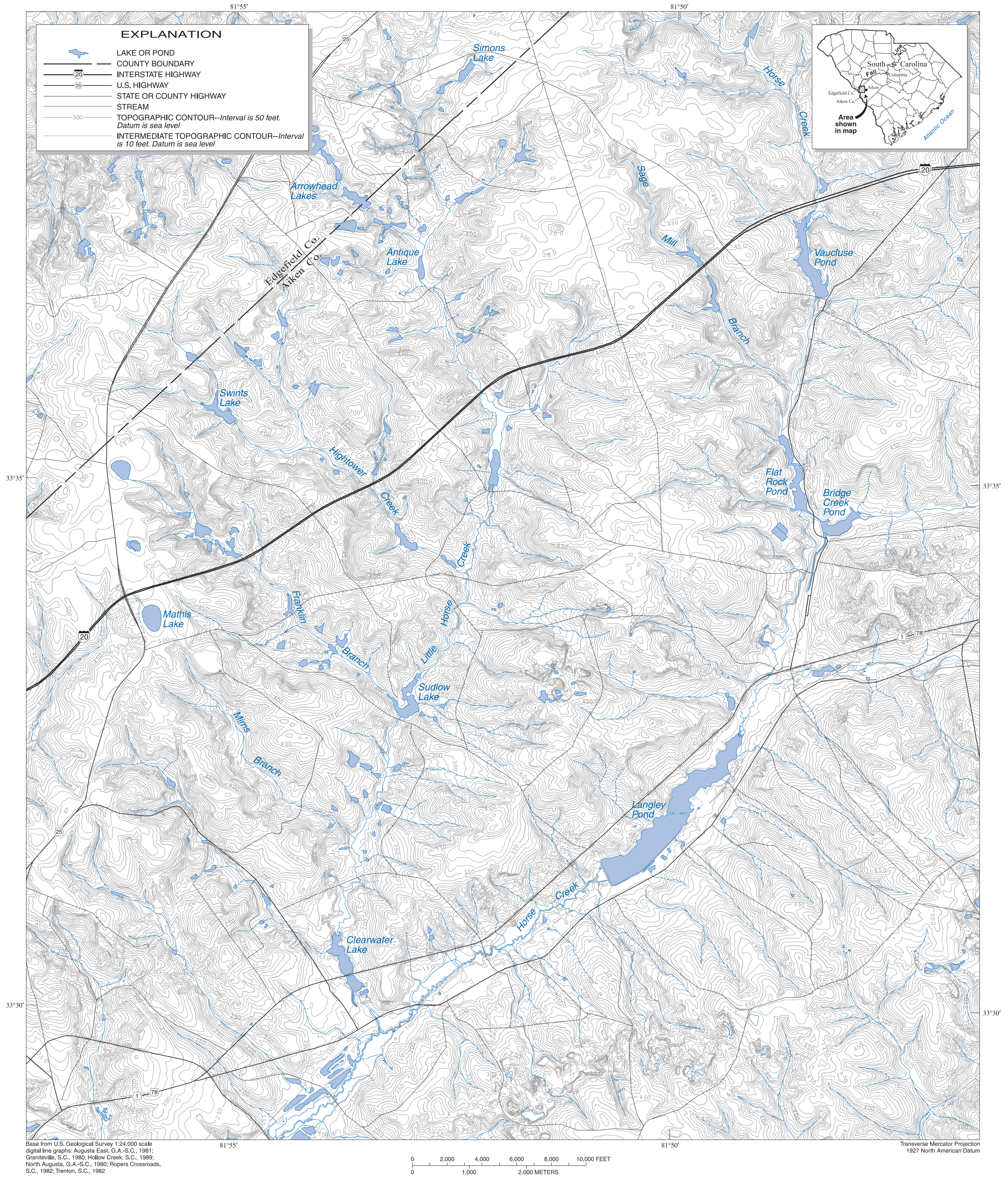


Plate 1. Topography of the Breezy Hill area, Aiken and Edgefield Counties, South Carolina.



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WATER-RESOURCES INVESTIGATIONS REPORT 02-4075
Generalized geology--PLATE 2 OF 5

Harrebin, L.G., Falk, W.F., and Powell, D.C., 2002, Ground-water levels in the Floridan-Middle aquifer in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999-November 2000.

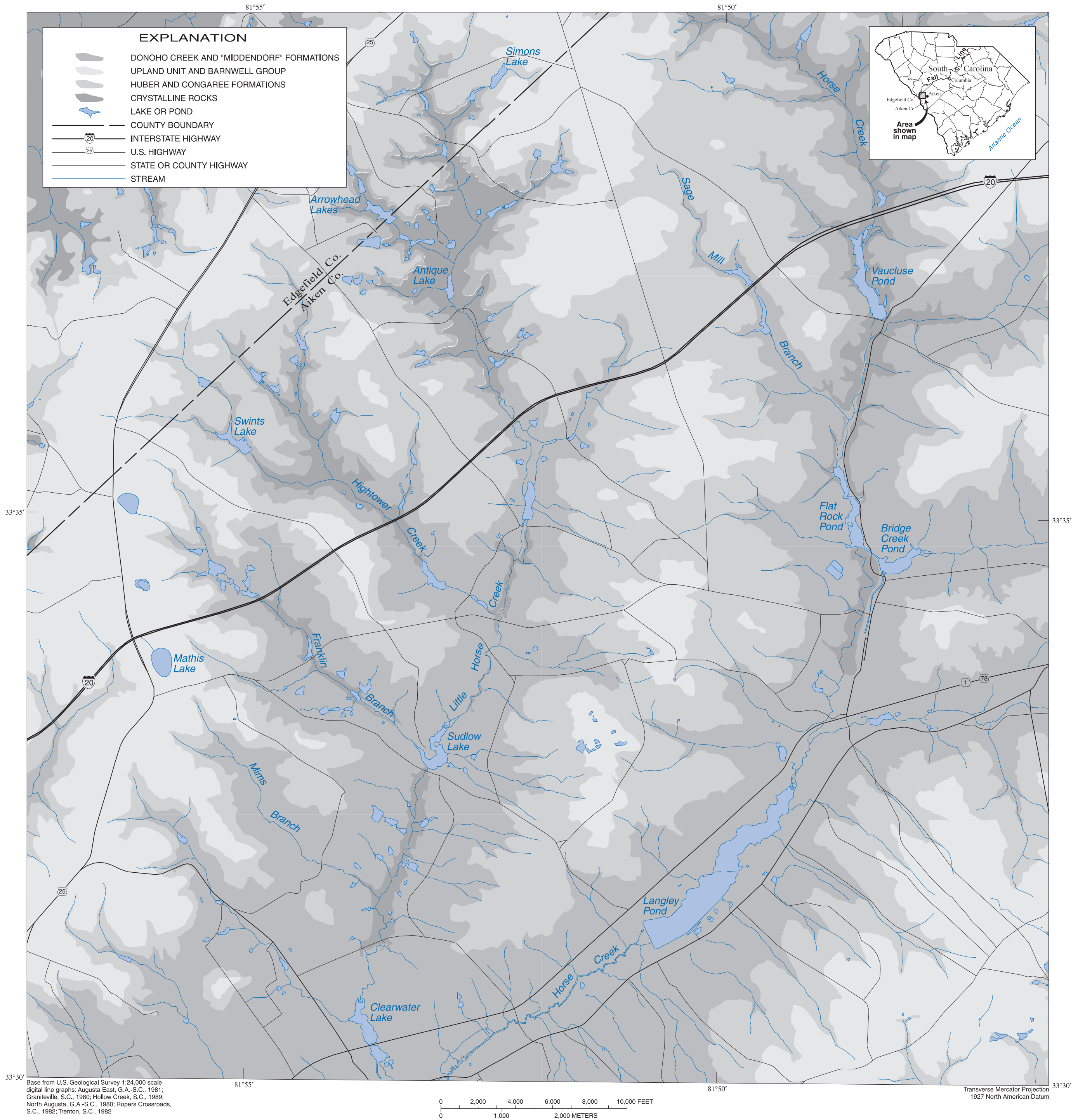


Plate 2. Generalized geology of the Breezy Hill area, Aiken and Edgefield Counties, South Carolina (compiled from Willoughby 1983, 1984, 1985, and 1986).



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WATER-RESOURCES INVESTIGATIONS REPORT 02-4075
Top of crystalline bedrock--PLATE 3 OF 5

Harrebin, L.G., Falls, W.F., and Powell, D.C., 2002, Ground-water levels in the Floridan-Middle aquifer in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999-November 2000.

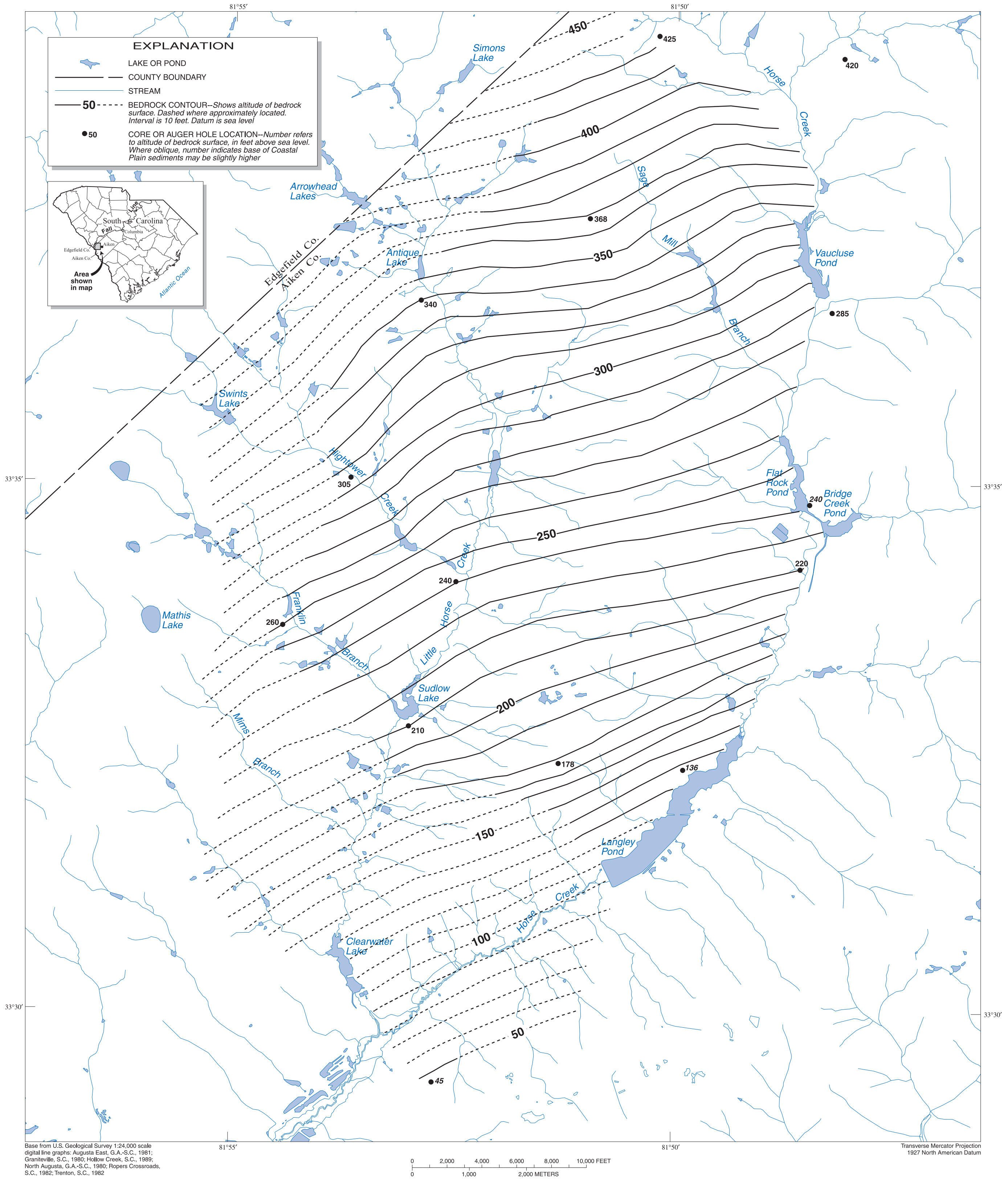


Plate 3. Configuration of the top of crystalline bedrock in the Breezy Hill area, Aiken County, South Carolina.



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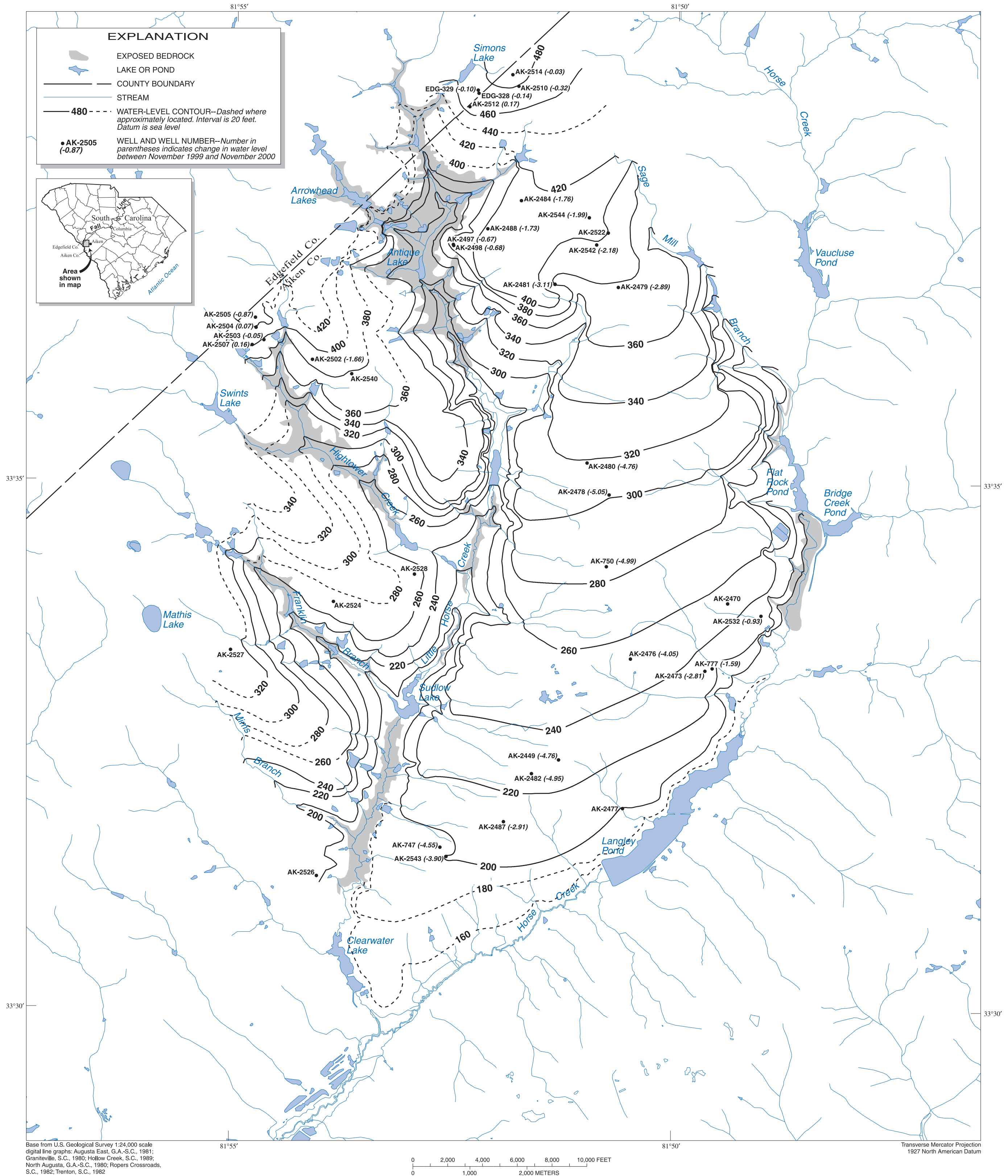


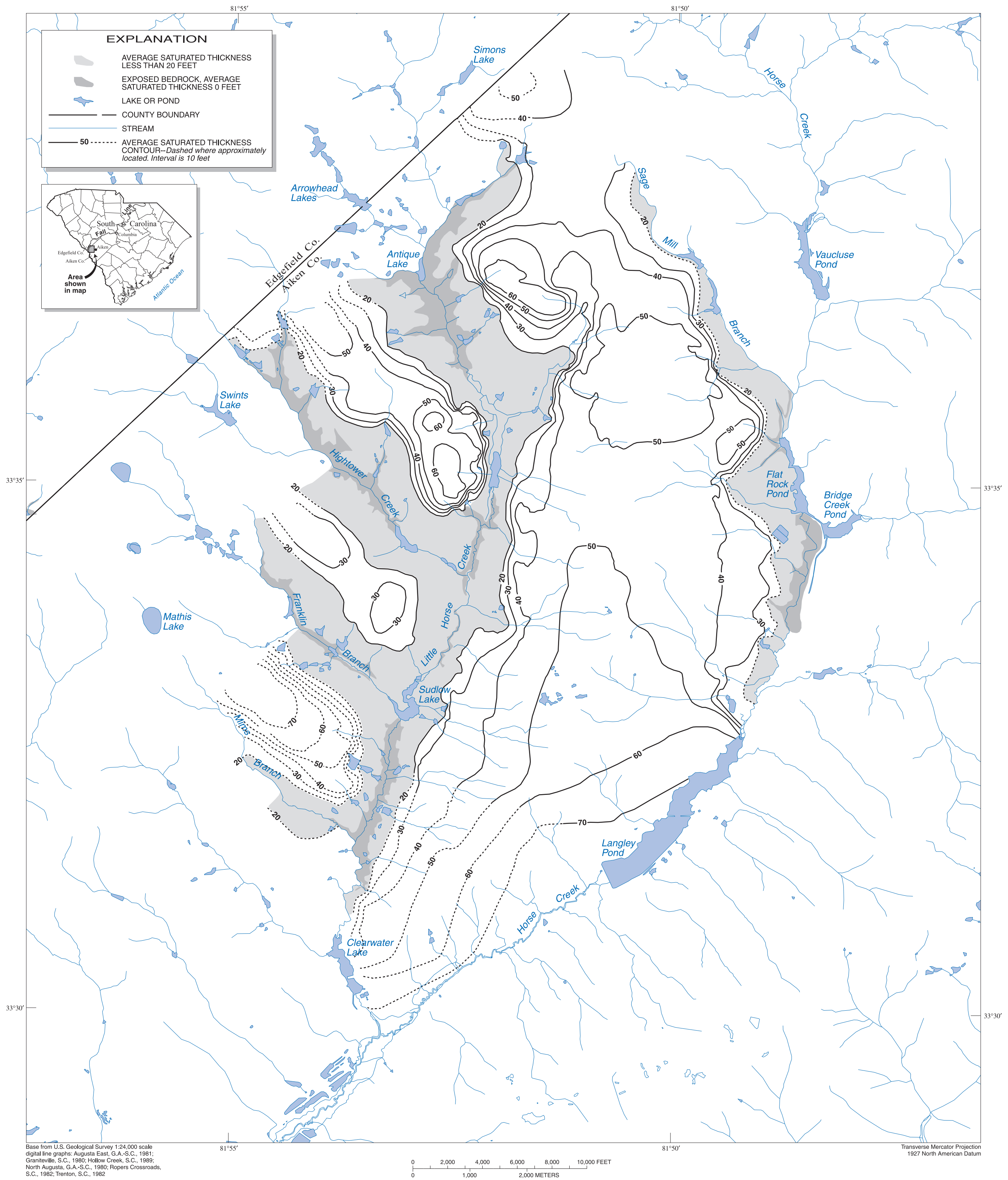
Plate 4. Configuration of the average water-level surface for the Floridan-Midville aquifer in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999-November 2000.



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Harrebin, L.G., Falls, W.F., and Powell, D.C., 2002, Ground-water levels in the Floridan-Midville aquifer in the Breezy Hill area, Aiken and Edgefield Counties, South Carolina, April 1999-November 2000.



Base from U.S. Geological Survey 1:24,000 scale digital line graphs: Augusta East, G.A.-S.C., 1981; Gramsville, S.C., 1980; Hollow Creek, S.C., 1989; North Augusta, G.A.-S.C., 1980; Popers Crossroads, S.C., 1982; Trenton, S.C., 1982.

Transverse Mercator Projection
1927 North American Datum

Plate 5. Average saturated thickness of the Floridan-Midville aquifer in the Breezy Hill area, Aiken County, South Carolina, April 1999-November 2000.

Ground-Water Levels in the Floridan-Midville Aquifer in the Breezy Hill Area, Aiken and Edgefield Counties,
South Carolina, April 1999-November 2000
HARRELSON

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