CALENDAR FOR WATER YEAR 2003

2002

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2003

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SEPTEMBER

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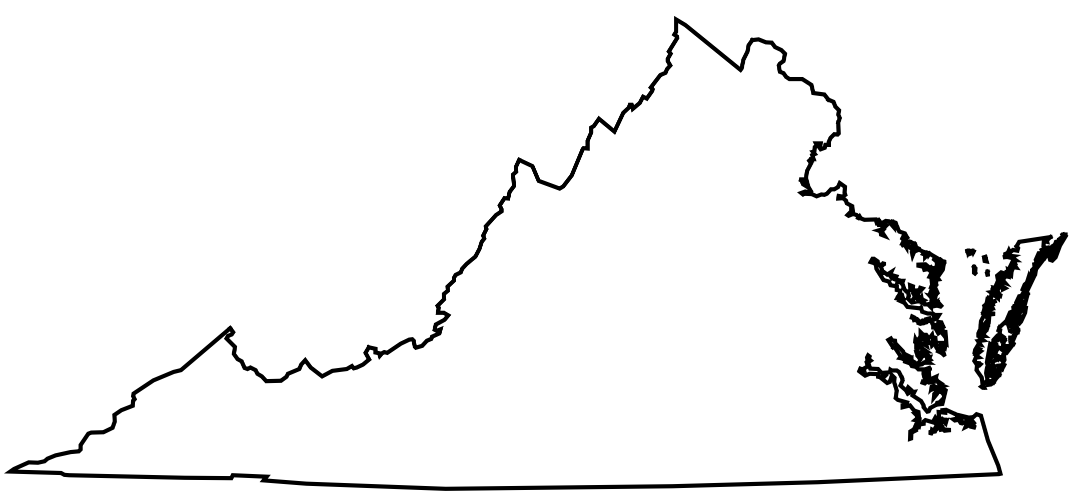
U.S. Department of the Interior
U.S. Geological Survey

Water Resources Data Virginia Water Year 2003

Volume 2. Ground-Water Level and Ground-Water Quality Records

By Roger K. White, Eugene D. Powell, Joel R. Guyer, and Joseph A. Owens

Water-Data Report VA-03-2



Prepared in cooperation with the
Virginia Department of Environmental Quality and with other agencies

U.S. DEPARTMENT OF THE INTERIOR

GALE A. NORTON, Secretary

U.S. GEOLOGICAL SURVEY

Charles G. Groat, Director

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Charlottesville, Virginia 22903

2004

PREFACE

This volume of the annual hydrologic data report of Virginia is one of a series of annual reports that document hydrologic data gathered from the U.S. Geological Survey's and cooperating agencies' surface- and ground-water data-collection networks in each State, Puerto Rico, and the Trust Territories. These records of streamflow, ground-water levels, and water quality provide the hydrologic information needed by State, local, and Federal agencies, and the private sector for developing and managing our Nation's land and water resources. Hydrologic data for Virginia are contained in two volumes:

Volume 1. Surface-Water-Discharge and Surface-Water-Quality Records

Volume 2. Ground-Water-Level and Ground-Water-Quality Records

This report (Volume 2) is the culmination of a concerted effort by dedicated personnel of the U.S. Geological Survey and the Virginia Department of Environmental Quality who collected, compiled, analyzed, verified, and organized the data, and who typed, edited, and assembled the report. In addition to the authors, who had primary responsibility for assuring that the information contained herein is accurate, complete, and adheres to Geological Survey policy and established guidelines, the following personnel contributed significantly to the collection, computation, processing, and completion of this information:

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This report was prepared in cooperation with the State of Virginia and with other agencies under the general supervision of Ward W. Staubitz, District Chief.

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No restriction on distribution. This report may be purchased from the National Technical Information Service, Springfield, VA 22161.

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13. ABSTRACT *(Maximum 200 words)*

Water-resources data for the 2003 water year for Virginia consist of records of water levels and water quality of ground-water wells. This report (Volume 2. Ground-Water-Level and Ground-Water-Quality Records) contains water levels at 354 observation wells and water quality at 64 wells. Locations of these wells are shown on figures 4 through 9. The data in this report represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Virginia.

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[SOW refers to the STATE OBSERVATION WELL numbering system as designated by the Virginia Department of Environmental Quality]

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WATER RESOURCES DATA - VIRGINIA, 2003

VOLUME 2. GROUND-WATER-LEVEL AND GROUND-WATER-QUALITY RECORDS

INTRODUCTION

The Water Resources Division of the U.S. Geological Survey (USGS), in cooperation with State agencies, obtains a large amount of data pertaining to the water resources of Virginia each water year. These data, accumulated during many water years, constitute a valuable data base for developing an improved understanding of the water resources of the State. To make these data readily available to interested parties outside the Geological Survey, the data are published annually in this report series entitled "Water Resources Data - Virginia.

This series of annual reports for Virginia began with the 1961 water year with a report that contained only data relating to the quantities of surface water. For the 1964 water year, a similar report was introduced that contained only data relating to water quality. Beginning with the 1975 water year, the report format was changed to present, in one volume, data on quantities of surface water, quality of surface and ground water, and ground-water levels. Beginning with the 1990 water year, the quantity of data to be published made it necessary to present the data in two volumes; Volume 1 encompassed surface-water-discharge and surface-water-quality records and Volume 2 encompassed ground-water-level and ground-water-quality records.

This report is Volume 2 in our 2003 series and includes records of water levels and water quality of ground-water wells. It contains records for water levels at 354 observation wells and water quality at 64 wells. Locations of these wells are shown on figures 4 through 9. The data in this report represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Virginia.

Prior to introduction of this series and for several water years concurrent with it, water-resources data for Virginia were published in U.S. Geological Survey Water-Supply Papers. Data on water levels for the 1935 through 1974 water years were published under the title "Ground-Water Levels in the United States." These Water-Supply Papers may be consulted in the libraries of the principal cities of the United States and may be purchased from U.S. Geological Survey, Branch of Information Services, Federal Center, Bldg. 41, Box 25286, Denver, CO 80225.

Publications similar to this report are published annually by the Geological Survey for all States.These official Survey reports have an identification number consisting of the two-letter State abbreviation, the last two digits of the water year, and the volume number. For example, this volume is identified as "U.S. Geological Survey Water-Data Report VA-03-2." For archiving and general distribution, the reports for l971-74 water years also are identified as water-data reports. These water-data reports are for sale in paper copy or in microfiche by the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22161.

Additional information, including current prices, for ordering specific reports may be obtained from the District Office at the address given on the back of the title page or by telephone (804) 261-2600.

Water resources data, including those provided in water data reports, are available through the World Wide Web on the Internet. The Universal Resource Location (URL) to the Virginia District's home page is:

http://va.water.usgs.gov

COOPERATION

The U.S. Geological Survey and agencies of the State of Virginia have had joint-funding agreements for the collection of water-resource records since 1930. Organizations that assisted in collecting the data in this report through joint-funding agreements with the Survey are:

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY, Robert G. Burnley, Executive Director.

CITY OF NEWPORT NEWS, Brian Ramaley, Director, Department of Public Utilities.

HAMPTON ROADS PLANNING DISTRICT COMMISSION, Arthur L. Collins, Executive Director.

Organizations that provided data are acknowledged in station descriptions.

RECORDS COLLECTED BY THE STATE OF VIRGINIA

In addition to data collected by the U.S. Geological Survey, there are included herein records for 183 observation wells operated by the Virginia Department of Environmental Quality. These records are published as provided and are acknowledged in the "REMARKS" paragraph of each individual well. The Virginia Department of Environmental Quality is under the direction of Robert G. Burnley, Executive Director. Published material for the ground-water wells is supplied through the Division of Water Resources, Terry D. Wagner, Director.

SUMMARY OF HYDROLOGIC CONDITIONS

Four years of drought ended in water year 2003, which was one of the wettest years ever recorded in Virginia. The drought had reached severe, extreme, or exceptional conditions in August 2002 in virtually all of Virginia and in many other states east and west of the Mississippi River. The severity of the drought in Virginia was reduced slightly by above-average rainfall in September 2002, the end of that water year, and above-average precipitation continued in water year 2003. From October through December 2002, precipitation was above average for most of the State, ending the drought in Virginia. Average or above-average precipitation was recorded in almost every month for the remainder of the 2003 water year, culminating with Hurricane Isabel in mid-September 2003 and, one week later, with tornado-producing thunderstorms in central Virginia.

Changes in ground-water levels during the 2003 water year are illustrated by hydrographs of end-of-month measurements from a network of 12 observation wells in Virginia. Ten of the wells are in water-table aquifers (fig. 1) and two are in confined aquifers of the Coastal Plain. The wells were selected to represent general water-level conditions across the State from different physiographic regions. The physiographic regions of Virginia range from the Cumberland Plateau of the Appalachian Province (coal fields) in the west, to the Valley and Ridge, Blue Ridge, Mesozoic Basins, and Piedmont, in the center of the State, to the Coastal Plain in the east (fig. 4). Water levels in other observation wells documented in this report can differ from those in the selected wells because of differences in well construction (in particular, the diameter and the depth of the open interval of the well), differences in the time interval chosen to measure or to represent the data, or because of local differences in hydrologic conditions.

The water-table aquifers respond to changes in rates of ground-water recharge, flow, and discharge, processes which are generally controlled by natural factors but may also be affected by human activities. The ten network wells in water-table aquifers generally are in areas that are not influenced by pumping. Water levels in the two network wells in the confined aquifers of the Coastal Plain, however, change primarily because of ground-water pumping. The locations of the selected network wells and other observation wells documented in this report are shown in figures 4 through 9.

Water-Table Aquifer

The water-table aquifers are the shallowest aquifers in Virginia and are present throughout the State. They are formed in different geologic materials at different locations. Water levels in the aquifers respond to changes in rates of recharge and evapotranspiration, but the response time depends on antecedent conditions of the unsaturated zone, on the depth of the water table below land surface, the depth of the open interval of the well, and on the materials above the open interval.

In a normal year, ground-water levels would rise when rates of recharge are highest, typically during the winter and early spring months. Ground-water recharge generally requires adequate precipitation, wet conditions near land surface to allow infiltration of water into the soil, dormant vegetation, and subsequent percolation of water to the water table. Water levels in the water-table aquifers in Virginia typically are highest in late winter or early spring when trees and other plants are dormant and evapotranspiration is low. In Virginia, ground-water levels typically begin to decline after the opening of leaves in March and April, when rates of evapotranspiration increase. Water levels normally continue to decline through the summer to seasonal lows in the late summer and early fall when evapotranspiration is high and soil moisture can become depleted. The resulting dry soil typically retains much of the precipitation that falls during these periods, thereby limiting recharge to the water-table aquifer. Consequently, water levels are lowest from late summer to early winter. However, water year 2003 was not a typical year.

End-of-month water levels for each network well were plotted against average, minimum, and maximum water levels from each wells period of record (fig. 1). The hydrographs indicate variations in water year 2003 from the typical seasonal cycles and record extremes. At the beginning of the water year, water levels in all of the water-table wells were below the normal monthly averages. The water level in one well, however, 52V2 in Fairfax County was only slightly below the average and that in another 51G 1 in Colonial Heights was marginally below the average. The water level in a third well 50W 4C in Loudoun County began the year not much more than 1 foot below average. The remaining seven observations wells in the water-table aquifers were far below the average, and because of the drought, all of these wells were at or below record lows. Observation well 45N 1 in Louisa County was dry.

Water levels in three network wells-- 41Q 1, 55P 9, and 58B 13-- continued to decline for one month after the beginning of the water year. The water levels in 41H 3 remained steady for one month. Water levels in four wells increased from the beginning of the water year in October through November, 2002, presumably in response to the above-normal precipitation. Water levels in eight of the wells rose through November and December 2002, some dramatically in response to the above-normal precipitation. Water levels in five of those wells were above average by January 2003. Water levels in well 46W175 in Clarke County declined slightly in November before rising in December. By the end of February 2003, water levels in eight of the ten wells were above average, and all of those wells rose above the previous record highs at some time during the remainder of the water year. Water levels well 41H 3 in Buckingham County rose steadily through the water year from a depth of about 12 feet below average, but did not rise above average until the end of July. The Louisa County well remained dry until the end of February, then water levels rose steadily from a depth of about 15 feet below average, however, the level never reached average by the end of the water year.

In summary, most water levels in the wells in the water-table aquifers responded quickly to the end of the drought early in the 2003 water year, rose above average by the middle of the year, and hit new record highs at some period during the remainder of the water year. The exceptions were the water levels in two wells that began the water year with the lowest water levels.

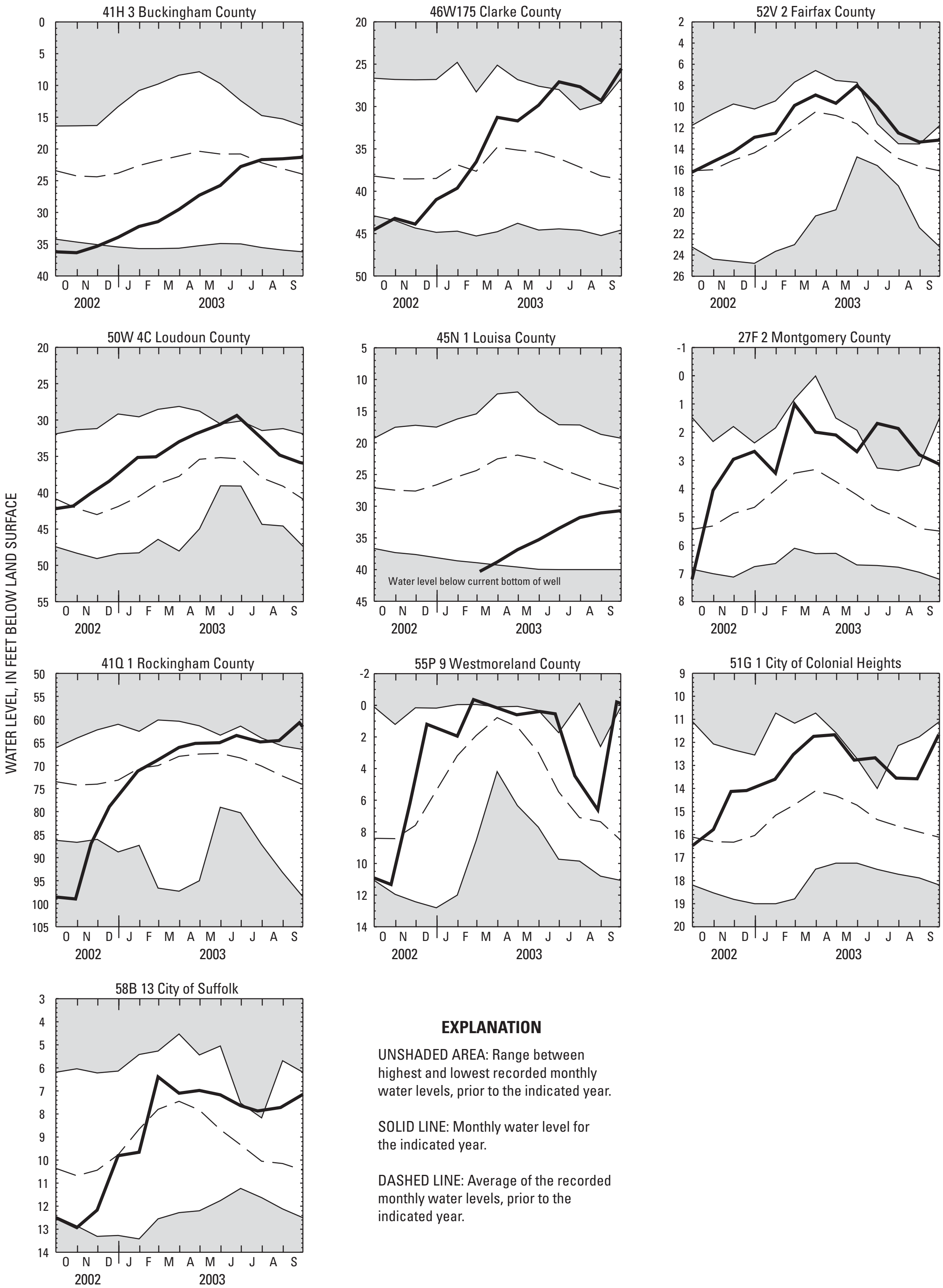

Figure 1. Monthly ground-water levels at index observation wells in water-table aquifers.

Confined Coastal Plain Aquifers

The Coastal Plain of Virginia is in the eastern part of the State (fig. 4) and is underlain by a system of sandy aquifers separated by silty and clayey confining units. These aquifers are laterally continuous throughout the Coastal Plain of Virginia and extend into adjacent states. The confined aquifers are among the highest water-yielding aquifers in Virginia. Consequently, large amounts of water are withdrawn by industrial, municipal, agricultural, and domestic users. The Coastal Plain aquifer system increases in thickness toward the east, and the greatest depths from which water can be withdrawn typically increases to the east.

Because of the lateral continuity of these aquifers, declines in water levels that result from pumping can extend over large areas. The magnitude of the decline in a particular well depends on the hydraulic properties of the aquifers and confining units, the amount of water pumped, and the proximity of the well to the pumps. Consequently, water levels in wells indicate the combined effects of regional declines from pumping throughout the aquifer system and local declines from nearby pumps.

In the early 1900's, prior to significant pumping from the confined aquifers, water levels throughout the Coastal Plain were above sea level and likely were near land surface. In the eastern part of the Coastal Plain, water flowed from many wells at land surface, indicating that water levels were above land surface. Water levels have declined in the Coastal Plain from the time that pumping began. This regional decline has been well documented in numerous data and interpretive reports.

Water levels in the two network wells (wells 55B16 in Isle of Wight County and 56H27 in James City County) indicate the history of the more recent changes in water levels. Well 55B16 is open to the middle Potomac aquifer. The small, short-term changes in water levels in this well likely result from changes in local pumping (fig. 2). Water levels were likely near land surface prior to pumping and therefore the overall decline in water levels was probably about 100 ft at this location before 1960 when water levels were first measured in this well. Water levels in this well have declined an additional 100 ft since then, mostly during the 1960s. For one month in 1970, and again in 1974, water levels rose significantly in the well because of industrial shutdowns at Franklin, Virginia. When the pumping resumed, the water levels fell back to pumping levels. More recently, water levels generally changed less than earlier water levels, with the exception of September 1999 when torrential rain from Hurricane Floyd caused flooding and the shutdown of industrial wells at Franklin, Virginia. Water levels in water year 2003 generally were similar to those in 2001 but somewhat higher than those of the early to mid 1990s.

Well 56H27 is open to the Brightseat-upper Potomac aquifer. Because of the low frequency at which water levels are measured, the influence of local pumping on water levels in this well is not readily evident. The land surface altitude at this well is about 100 ft above sea level and water levels at this location likely declined 50 to 100 ft before 1985 when water levels were first measured (fig. 2). Water levels in this well have declined more than 26 ft since 1985. After a small rise in water levels at the beginning of the water year, water levels in well 56H27 again declined, establishing a record new low during the last tape down in July of 2003.

EXPLANATION OF THE RECORDS

The ground-water records published in this report are for the 2003 water year that began October 1, 2002, and ended September 30, 2003. A calendar of the water year is provided on the inside of the front cover. The records contain ground-water-level and ground-water-quality data. The locations of the wells where the water-level data were collected are shown in figures 4 through 9. The following sections of the introductory text are presented to provide users with a more detailed explanation of how the hydrologic data published in this report were collected, analyzed, computed, and arranged for presentation.

Station Identification Numbers

Each well in this report is assigned a unique identification number. This number is unique in that it applies specifically to a given well and to no other. The number usually is assigned when a well is first established in U.S. Geological Survey records and is retained for that well indefinitely. The system used by the U.S. Geological Survey to assign identification numbers for ground-water well sites is based on geographic location. The "latitude-longitude" system is used for wells.

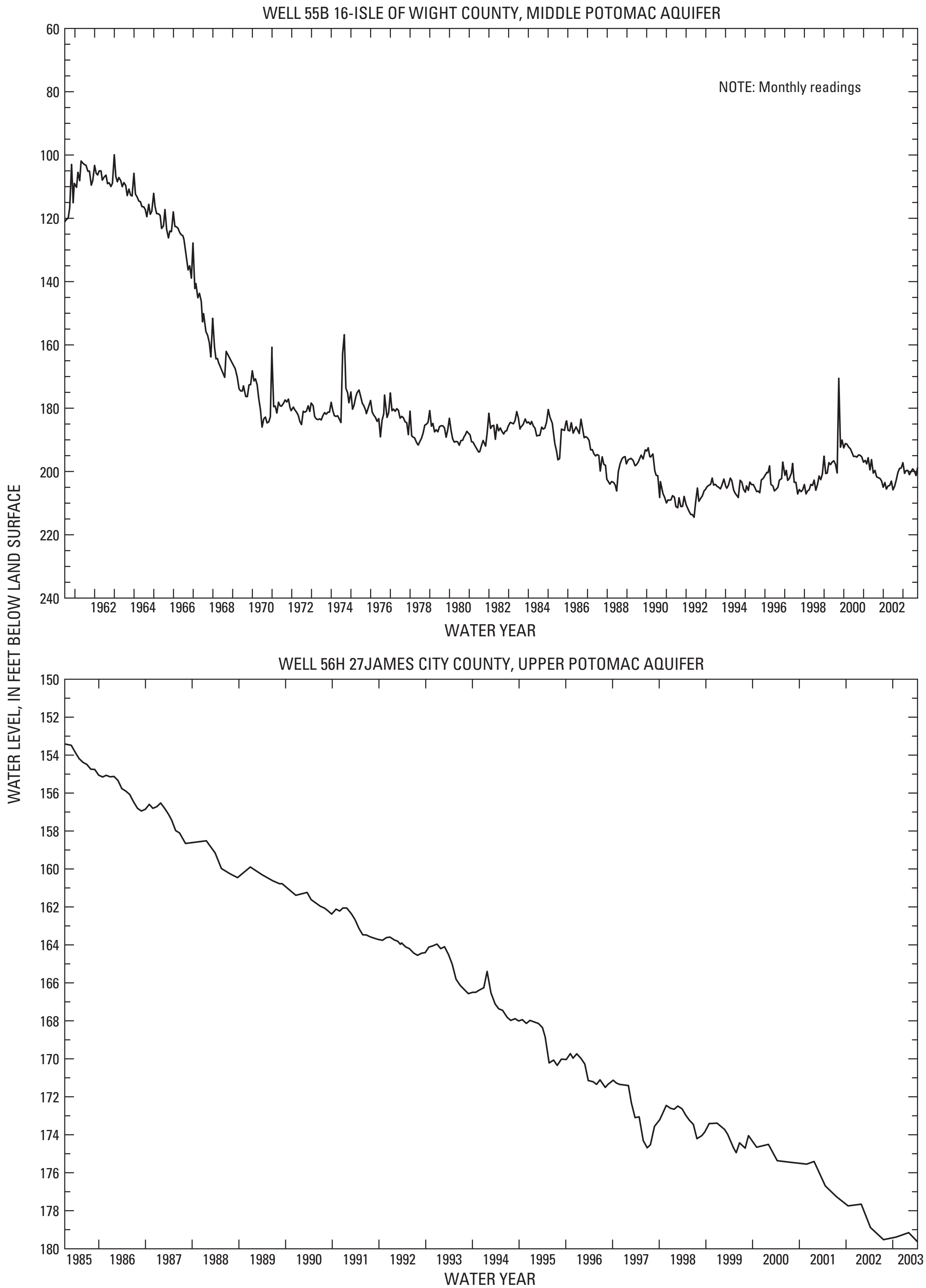

Figure 2. Ground-water levels in selected observation wells in confined Coastal Plain aquifers.

Latitude-Longitude System

The identification numbers for wells are assigned according to the grid system of latitude and longitude. The number consists of 15 digits. The first six digits denote the degrees, minutes, and seconds of latitude, the next seven digits denote degrees, minutes, and seconds of longitude, and the last two digits (assigned sequentially) identify the wells or other sites within a 1-second grid. This site-identification number, once assigned, is a pure number and has no locational significance. In the rare instance where the initial determination of latitude and longitude are found to be in error, the station will retain its initial identification number; however, its true latitude and longitude will be listed in the LOCATION paragraph of the station description.

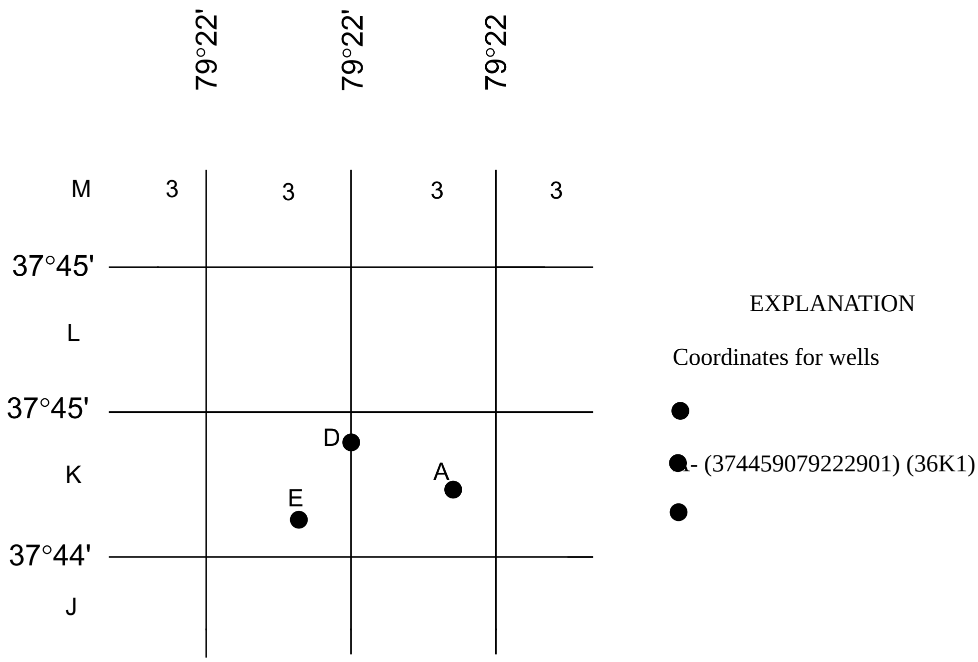

Figure 3. System for numbering wells.

A second well-numbering system used in Virginia utilizes 7 1/2-minute quadrangles within the State. The quadrangles are numbered from west to east, and lettered from south to north, omitting the letters "I" and "O." The designation for each quadrangle is determined by the method "Read Right, Up." Wells are numbered serially within each quadrangle. This local well number is shown immediately after the primary well number.

Well records furnished by the State of Virginia also include the well number that is based on an indexing system used by the Virginia Department of Environmental Quality.

Records of Ground-Water Levels

Only water-level data from a national network of observation wells are given in this report. These data are intended to provide a sampling and historical record of water-level changes in the Nation's most important aquifers. Locations of the observation wells in this network in Virginia are shown in figures 4 through 9.

Data Collection and Computation

Measurements of water levels are made in many types of wells under varying conditions, but the methods of measurement are standardized to the extent possible. The equipment and measuring techniques used at each observation well ensure that measurements at each well are of consistent accuracy and reliability.

Tables of water-level data are presented by counties arranged in alphabetical order. The prime identification number for a given well is the 15-digit number that appears in the upper left corner of the table. The secondary identification number is the local well number, an alphanumeric number, derived from the township-range location of the well.

Water-level data are obtained from direct measurements with a steel tape or manometer, or from graphic, punched tape, or electronic water-stage recorder. The water-level measurements in this report are given in feet with reference to land-surface datum (lsd). Land-surface datum is a datum plane that is approximately at land surface at each well. If known, the elevation of the land-surface datum is given in the well description. The height of the measuring point (MP) above or below land-surface datum is given in each well description. Water levels in wells equipped with recording gages are reported for every fifth day and the end of each month (eom).

Water levels are reported to as many significant figures as can be justified by the local conditions. For example, in a measurement of a depth to water of several hundred feet, the error of determining the absolute value of the total depth to water may be a few tenths of a foot, whereas the error in determining the net change of water level between successive measurements may be only a hundredth or a few hundredths of a foot. For lesser depths to water, the accuracy is greater. Accordingly, most measurements are reported to a hundredth of a foot, but some are given to a tenth of a foot or a larger unit.

Data Presentation

Each well record consists of three parts, the station description, the data table of water levels observed during the current water year, and a graph of the water levels for the current water year or other selected period. The description of the well is presented first through use of descriptive headings preceding the tabular data. The comments to follow clarify information presented under the various headings.

LOCATION.--This paragraph follows the well-identification number and reports the latitude and longitude (given in degrees, minutes, and seconds); a landline location designation; the hydrologic-unit number; the distance and direction from a geographic point of reference; and the owner's name.

AQUIFER.--This entry designates by name (if a name exists) and geologic age the aquifer(s) open to the well.

WELL CHARACTERISTICS.--This entry describes the well in terms of depth, diameter, casing depth and/or screened interval, method of construction, use, and additional information such as casing breaks, collapsed screen, and other changes since construction.

INSTRUMENTATION.--This paragraph provides information on both the frequency of measurement and the collection method used, allowing the user to better evaluate the reported water-level extremes by knowing whether they are based on weekly, monthly, or some other frequency of measurement.

DATUM.--This entry describes both the measuring point and the land-surface elevation at the well. The measuring point is described physically (such as top of collar, notch in top of casing, plug in pump base and so on), and in relation to land surface (such as 1.3 ft above land-surface datum). The elevation of the land-surface datum is described in feet above (or below) sea level; it is reported with a precision depending on the method of determination.

REMARKS.--This entry describes factors that may influence the water level in a well or the measurement of the water level. It should identify wells that also are water-quality observation wells, and may be used to acknowledge the assistance of local (non-Survey) observers.

PERIOD OF RECORD.--This entry indicates the period for which there are published records for the well. It reports the month and year of the start of publication of water-level records by the U.S. Geological Survey and the words "to current year" if the records are to be continued into the following year. Periods for which water-level records are available, but are not published by the Geological Survey, may be noted.

EXTREMES FOR PERIOD OF RECORD.--This entry contains the highest and lowest water levels of the period of published record, with respect to land-surface datum, and the dates of their occurrence.

EXTREMES FOR CURRENT YEAR.--This entry contains the highest and lowest instantaneous water levels, along with the dates of occurrence, at sites with water-stage recorders. The values are for the current water year, and are with respect to land-surface datum.

A table of water levels follows the station description for each well. Water levels are reported in feet below land-surface datum and all taped measurements of water level are listed. For wells equipped with recorders, only abbreviated tables are published; generally, only water-level lows are listed for every fifth day and at the end of the month (eom). The highest and lowest water levels of the water year and their dates of occurrence are shown on a line below the abbreviated table. Because all values are not published for wells with recorders, the extremes may be values that are not listed in the table. Missing records are indicated by dashes in place of the water level. A hydrograph for a selected period of record follows each water-level table.

Records of Ground-Water Quality

Records of ground-water quality in this report differ from other types of records in that, for most sampling sites, they consist of only one set of measurements for the water year. The quality of ground water ordinarily changes only slowly; therefore, for most general purposes, one annual sampling, or only a few samples taken at infrequent intervals during the year, is sufficient. Frequent measurement of the same constituents is not necessary unless one is concerned with a particular problem, such as monitoring for trends in nitrate concentration. In the special cases where the quality of ground water may change more rapidly, more frequent measurements are made to identify the nature of the changes.

Data Collection and Computation

The records of ground-water quality in this report were obtained mostly as a part of special studies in specific areas. Consequently, a number of chemical analyses are presented for some counties but none are presented for others. As a result, the records for this year, by themselves, do not provide a balanced view of ground-water quality Statewide. Such a view can be attained only by considering records for this year in context with similar records obtained for these and other counties in earlier years.

Most methods for collecting and analyzing water samples are described in the "U.S. Geological Survey Techniques of Water-Resources Investigations" publications referred to in the "On-site Measurements and Sample Collection" and the "Laboratory Measurements" sections in this data report. In addition, the TWRI book 1, Chapter D2, describes guidelines for the collection and field analysis of ground-water samples for selected unstable constituents. The values reported in this report represent water-quality conditions at the time of sampling as much as possible, consistent with available sampling techniques and methods of analysis. These methods are consistent with ASTM standards and generally follow ISO standards. All samples were obtained by trained personnel. The wells sampled were pumped long enough to assure that the water collected came directly from the aquifer and had not stood for a long time in the well casing where it would have been exposed to the atmosphere and to the material, possibly metal, comprising the casings.

Data Presentation

The records of ground-water quality are published in a section titled QUALITY OF GROUND WATER immediately following the ground-water-level records. Data for quality of ground water are listed alphabetically by County and are identified by well number. The prime identification number for wells sampled is the 15-digit number derived from the latitude-longitude locations. No descriptive statements are given for ground-water-quality records; however, the well number, depth of well, date of sampling, and other pertinent data are given in the table containing the chemical analyses of the ground water.

Remark Codes

The following remark codes may appear with the ground-water-quality data in this report:

PRINTED OUTPUT	REMARK
E	Estimated value
>	Actual value is known to be greater than the value shown
<	Actual value is known to be less than the value shown
K	Results based on colony count outside the acceptance range (non-ideal colony count)
L	Biological organism count less than 0.5 percent (organism may be observed rather than counted)
D	Biological organism count equal to or greater than 15 percent (dominant)
V	Analyte was detected in both the environmental sample and the associated blanks.
&	Biological organism estimated as dominant
M	Constituent was detected but not quantified.

Water Quality-Control Data

Data generated from quality-control (QC) samples are a requisite for evaluating the quality of the sampling and processing techniques as well as data from the actual samples themselves. Without QC data, environmental sample data cannot be adequately interpreted because the errors associated with the sample data are unknown. The various types of QC samples collected by this district are described in the following section. Procedures have been established for the storage of water-quality-control data within the USGS. These procedures allow for storage of all derived QC data and are identified so that they can be related to corresponding environmental samples.

Blank Samples

Blank samples are collected and analyzed to ensure that environmental samples have not been contaminated by the overall data-collection process. The blank solution used to develop specific types of blank samples is a solution that is free of the analytes of interest. Any measured value signal in a blank sample for an analyte (a specific component measured in a chemical analysis) that was absent in the blank solution is believed to be due to contamination. There are many types of blank samples possible, each designed to segregate a different part of the overall data-collection process. The types of blank samples collect in this district are:

Source solution blank - a blank solution that is transferred to a sample bottle in an area of the office laboratory with an atmosphere that is relatively clean and protected with respect to target analytes.

Ambient blank - a blank solution that is put in the same type of bottle used for an environmental sample, kept with the set of sample bottles before sample collection, and opened at the site and exposed to the ambient conditions.

Field blank - a blank solution that is subjected to all aspects of sample collection, field processing preservation, transportation, and laboratory handling as an environmental sample.

Trip blank - a blank solution that is put in the same type of bottle used for an environmental sample and kept with the set of sample bottles before and after sample collection.

Equipment blank - a blank solution that is processed through all equipment used for collecting and processing an environmental sample (similar to a field blank but normally done in the more controlled conditions of the office).

Sampler blank - a blank solution that is poured or pumped through the same field sampler used for collecting an environmental sample.

Pump blank -a blank solution that is processed through the same pump-and-tubing system used for an environmental sample.

Standpipe blank - a blank solution that is poured from the containment vessel (stand-pipe) before the pump is inserted to obtain the pump blank.

Filter blank - a blank solution that is filtered in the same manner and through the same filter apparatus used for an environmental sample.

Splitter blank - a blank solution that is mixed and separated using a field splitter in the same manner and through the same apparatus used for an environmental sample.

Preservation blank - a blank solution that is treated with the sampler preservatives used for an environmental sample.

Canister blank - a blank solution that is taken directly from a stainless steel canister just before the VOC sampler is submerged to obtain a field blank sample.

Reference Samples

Reference material is a solution or material prepared by a laboratory whose composition is certified for one or more properties so that it can be used to assess a measurement method. Samples of reference material are submitted for analysis to ensure that an analytical method is accurate for the known properties of the reference material. Generally, the selected reference material properties are similar to the environmental sample properties.

Replicate Samples

Replicate samples are a set of environmental samples collected in a manner such that the samples are thought to be essentially identical in composition. Replicate is the general case for which a duplicate is the special case consisting of two samples. Replicate samples are collected and analyzed to establish the amount of variability in the data contributed by some part of the collection and analytical process. There are many types of replicate samples possible, each of which may yield slightly different results in a dynamic hydrologic setting, such as a flowing stream. The types of replicate samples collected in this district are:

Concurrent sample - a type of replicate sample in which the samples are collected simultaneously with two or more samplers or by using one sampler and alternating collection of samples into two or more compositing containers.

Sequential samples - a type of replicate sample in which the samples are collected one after the other, typically over a short time.

Split sample - a type of replicate sample in which a sample is split into subsamples contemporaneous in time and space.

Spike Samples

Spike samples are samples to which known quantities of a solution with one or more well-established analyte concentrations have been added. These samples are analyzed to determine the extent of matrix interference or degradation on the analyte concentration during sample processing and analysis.

Concurrent sample - a type of spike sample that is collected at the same time with the same sampling and compositing devices then spiked with the same spike solution containing laboratory-certified concentrations of selected analytes.

Split sample - a type of spike sample in which a sample is split into subsamples contemporaneous in time and space then spiked with the same spike solution containing laboratory-certified concentrations of selected analytes.

ACCESS TO USGS WATER DATA

The USGS provides near real-time stage and discharge data for many ofthe gaging stations equipped with the necessary telemetry and historic daily-mean and peak-flow discharge data for most current or discontinued gaging stations through the world wide web (WWW). These data may be accessed at:

http://va.water.usgs.gov

Some water-quality and ground-water data also are available through the WWW. In addition, data can be provided in various machine-readable formats on magnetic tape or 3-1/2 inch floppy disk. Information about the availability of specific types of data or products, and user charges, can be obtained locally from each of the Water Resources Division District Offices (See address on the back of the title page.)