Summary of the Groundwater-Level Hydrologic Conditions in New Jersey, Water Year 2010

Groundwater is one of the Nation's most important natural resources. It provides about 40 percent of our Nation's public water supply. Nearly 50 percent of New Jersey's drinking water is supplied by more than 300,000 groundwater wells that serve more than 4.3 million people (J.P. Nawyn, U.S. Geological Survey, written commun., 2011). The 2010 Census recently reported a 4.5 percent increase in population in New Jersey during 2000–2010 (2010 Census Data, accessed August 10, 2011, at *http://2010.census.gov/2010census/data/*). As population increases, so does demand for water. Management of the development and use of the groundwater resource so that the supply can be maintained for an indefinite time without causing unacceptable environmental, economic, or social consequences is critical.

The U.S. Geological Survey (USGS) has operated a groundwater-level monitoring network in New Jersey since 1923. Long-term systematic measurement and computerized data storage of water levels provide key information needed to evaluate changes in the groundwater resource over time. These data become more valuable as the period of record increases. New Jersey's groundwater network has 161 wells with 20 or more years of record; 127 of those wells have 30 or more years of record, and 94 of those wells have 50 or more years of record. These data are used to evaluate groundwater recharge and discharge, seasonal fluctuations, long-term climate change, and water-supply development. Water-level data also are used to develop groundwater models and to forecast trends.

This report describes the USGS New Jersey Water Science Center Observation Well Network during water year 2010 (October 1, 2009, through September 30, 2010). Trends in water levels in confined aquifers in southern New Jersey, fractured rock aquifers in northern New Jersey, and unconfined aquifers throughout the State are summarized. Hydrographs of water levels in 12 wells—3 wells open to bedrock, 3 unconfined (water-table) wells, 1 glacial aquifer well, and 5 confined wells—are shown. Worldwide Web site addresses for access to the data also are included.

Water-Level Monitoring in 2010

During water year 2010, groundwater levels were measured in 192 network wells; 136 wells were equipped with water-level recorders, and 56 wells were measured manually two to six times per year. Twenty-two wells are equipped with satellite data-collection platforms that provide near real-time data. The locations of the observation wells in New Jersey during the 2010 water year are shown in figure 1. A map with the locations of wells with hydrographs presented in this report is shown in the inset in figure 1. The published data for water year 2010, including site information, tables of water levels, and water-level hydrographs, are available in *Water Resources Data for the United States—Water Year 2010 Annual Water Data Report* at *http://wdr.water.usgs.gov*.

Water Levels in Unconfined and Fractured-Rock Aquifers

Water levels in wells completed in unconfined and fractured rock aquifers are directly related to the amount of annual precipitation. Average annual precipitation in New Jersey ranges from about 40 inches along the southeastern coast to 51 inches in the north-central part of the State. The statewide annual mean precipitation is 45 inches per year, based on precipitation during 1895–2010 (Office of the N.J. State Climatologist, Rutgers University, New Jersey, accessed February 8, 2010, at *http://climate.rutgers.edu/*). During the 2010 water year, precipitation was more than 3 inches greater than average (fig. 2). Climatically, water year 2010 was a record-setting year. Record-setting precipitation in December and March (8.44 inches and 9.39 inches, respectively) caused groundwater levels in many unconfined network wells to exceed their previous recorded highest level.

This wet period was followed by the warmest growing season (April–August) since record keeping began in 1895. Six consecutive months of below-average precipitation and above-average temperatures caused moderate drought conditions to develop by September. As a result, U.S Secretary of Agriculture Thomas Vilsack designated 16 New Jersey counties as natural disaster areas to help farmers who suffered crop losses (Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Salem, Somerset, Sussex, and Warren). Water levels in shallow unconfined wells in aquifers with limited storage were adversely affected. Fractured-rock aquifers have less storage capacity than Coastal Plain or valley-fill aquifers and, therefore, are more prone to depletion during drought. Groundwater levels in several unconfined network wells exceeded their previous recorded lowest level.

The effects of climate on daily mean water levels in six observation wells during water year 2010 can be seen in the hydrographs shown in figure 3. Daily mean water levels for three wells open to bedrock aquifers [Taylor (37-202), Readington 11 (19-270), and Cranston Farms 15 (21-364) observation wells] and three wells open to the unconfined aquifer [Morrell 1 (23-104), Lebanon State Forest 23-D (5-689), and Vocational School 2 (11-42) observation wells] are shown in relation to long-term monthly extremes, the median, and percentile classes. In the wells that tap bedrock aquifers (37-202, 19-270, and 21-364), the highest groundwater levels of the year occurred

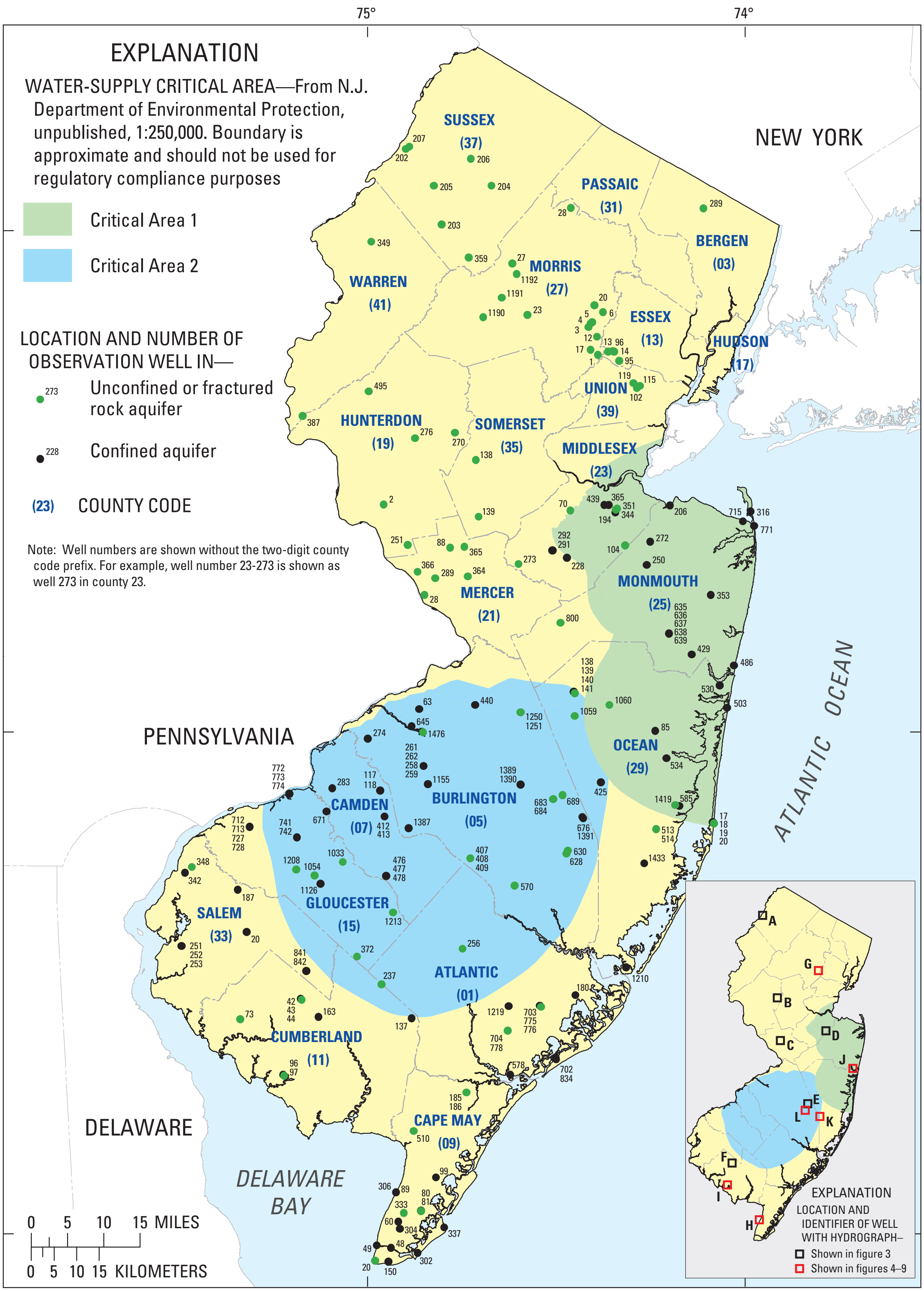

Figure 1. Location of groundwater-level observation wells in New Jersey.

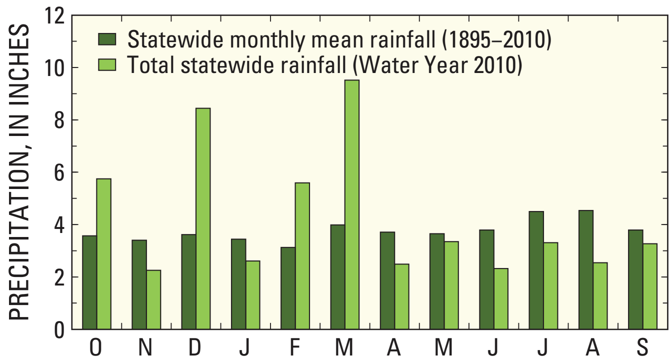

Figure 2. Monthly total for water year 2010 and monthly mean rainfall in New Jersey during 1895–2010. (Data from Office of the N.J. State Climatologist, Rutgers University, New Jersey)

during March, when they exceeded their previous recorded highest levels. Groundwater levels declined steeply during the summer due to the hot and dry conditions. Water levels in wells 37-202 and 19-270 declined to near the 10th percentile, whereas water levels in well 21-364 exceeded the previous recorded monthly low during parts of June through September. In wells open to the unconfined Kirkwood-Cohansey aquifer (5-689 and 11-42) in the Coastal Plain of New Jersey, water levels also rose as a result of the above-average precipitation during December, February, and March but declined from April through September to near the mean levels for September. Water levels in well 23-104, a shallow well in the outcrop area of the Englishtown aquifer system, briefly exceeded the previous recorded monthly high in October and December through April, and then declined steeply in June, August, and September to within the 10th percentile class.

Water levels in many observation wells that tap stratified drift deposits in northern New Jersey remained near their highest levels in the last 30 years (27-1, 27-4, 27-5, 27-6, 27-12, 27-17, and 27-20). The water level in the Briarwood School well (27-12) rose more than 27 feet from December 2002 to April 2010 (fig. 4). This rise was due, in part, to a reduction in the use of groundwater and increased use of surface water in this area in recent years.

Water Levels in Confined Aquifers

Water levels in the confined aquifers in the Coastal Plain of New Jersey fluctuate seasonally in response to increased groundwater withdrawals during the summer when water levels decline and decreased withdrawals during the winter when water levels rise. However, groundwater levels also show the effects of changes in withdrawal patterns. In general, water-level changes in these aquifers are the result of changes in withdrawals rather than climatic variations.

Seasonal fluctuations in water levels in the confined Cohansey aquifer in Cape May County caused by withdrawal patterns ranged from 3 to 15 feet in USGS observation wells. Groundwater levels in this aquifer have remained stable in recent years (2000–2010), rising slightly in the past 3 years from 1 to 6 feet.

Increased withdrawals have affected water levels in the Atlantic City 800-foot sand in Atlantic and Cape May Counties. Water levels in well 9-302 (fig. 5) and six other wells open to this aquifer (1-578, 1-702, 1-703, 1-704, 9-306, and 9-337) exceeded their previous recorded low during the 2010 water year.

Increased withdrawals from the Piney Point aquifer have affected groundwater levels in USGS observation wells. Water levels in three wells that tap the Piney Point aquifer in Cumberland County—wells 11-44, 11-96 (fig. 6), and 11-163—declined 68, 29, and 42 feet, respectively, from February 2003 to September 2010. In Atlantic County and southern Ocean County, water levels continued a long-term decline in wells 1-834, 1-1219, and 29-1210. Water levels in wells 5-407, 5-676, and 29-425 in the Piney Point aquifer in northern Ocean and Burlington Counties have been relatively stable over the past 10 years.

Water levels in observation wells that tap the Wenonah-Mount Laurel aquifer and Englishtown aquifer system in Burlington, Camden, and Salem Counties (5-1155, 5-1390, 7-478 15-1126, and 33-20) rose slightly in the 2010 water year. In eastern Monmouth and Ocean Counties, groundwater levels in several observation wells that tap the Wenonah-Mount Laurel aquifer and the Englishtown aquifer system have risen over the past 20 years (fig. 7). Groundwater levels in many wells in both aquifers in Monmouth County exceeded their previous recorded highs, including 25-353, 25-486, 25-637, and 25-800 in the Wenonah-Mount Laurel aquifer and 25-250, 25-429, 25-638, 25-715, and 25-771 in the Englishtown aquifer system.

The reaction of groundwater levels to withdrawal trends in the Potomac-Raritan-Magothy aquifer system has been mixed. Withdrawals have caused declines in water levels in several wells in central Burlington and southern Monmouth Counties over the past few years (5-1389, 5-1391 (fig. 8), and 25-639). Water levels in a number of wells that tap the Potomac-Raritan-Magothy aquifer system in Burlington, Camden, and Gloucester Counties, however, have risen gradually over the past few years (5-258, 5-261, 5-262, 5-274, 5-683 (fig. 9), 7-117, 7-283, 7-412, 7-413, 7-476, 7-477, 11-137, 15-671, and 15-772). In general, recovery continues throughout much of this area. Groundwater levels in several wells exceeded their previous recorded highs, including 7-283, 7-712, 7-713, 15-741, 15-742, and 15-772.

Availability of Data

The water-level data in the 2010 New Jersey Annual Data Report can be accessed online at *2010 Annual Water Data Report (http://wdr.water.usgs.gov/wy2010/search.jsp)*. A map interface is available at this site with links to hydrographs and tables of the water levels recorded or measured during water year 2010.

The Active Water-Level Network web site shows data and statistics (if sufficient data are available to produce statistics) for all wells measured in the current year by New Jersey Water Science Center personnel; it can be accessed at *Active New Jersey Groundwater Sites (http://groundwaterwatch.usgs.gov/StateMaps/NJ.html)*. Data from the 22 wells in New Jersey equipped with real-time capability can be accessed at *Real-time Groundwater Network (http://groundwaterwatch.usgs.gov/).*

Hydrologic data are recognized as the cornerstone of hydrologic science. Accurate measurements of groundwater levels provide important indicators of the status of our groundwater resources. By collecting and storing data pertaining to the quantity, quality, and use of our nation's groundwater and

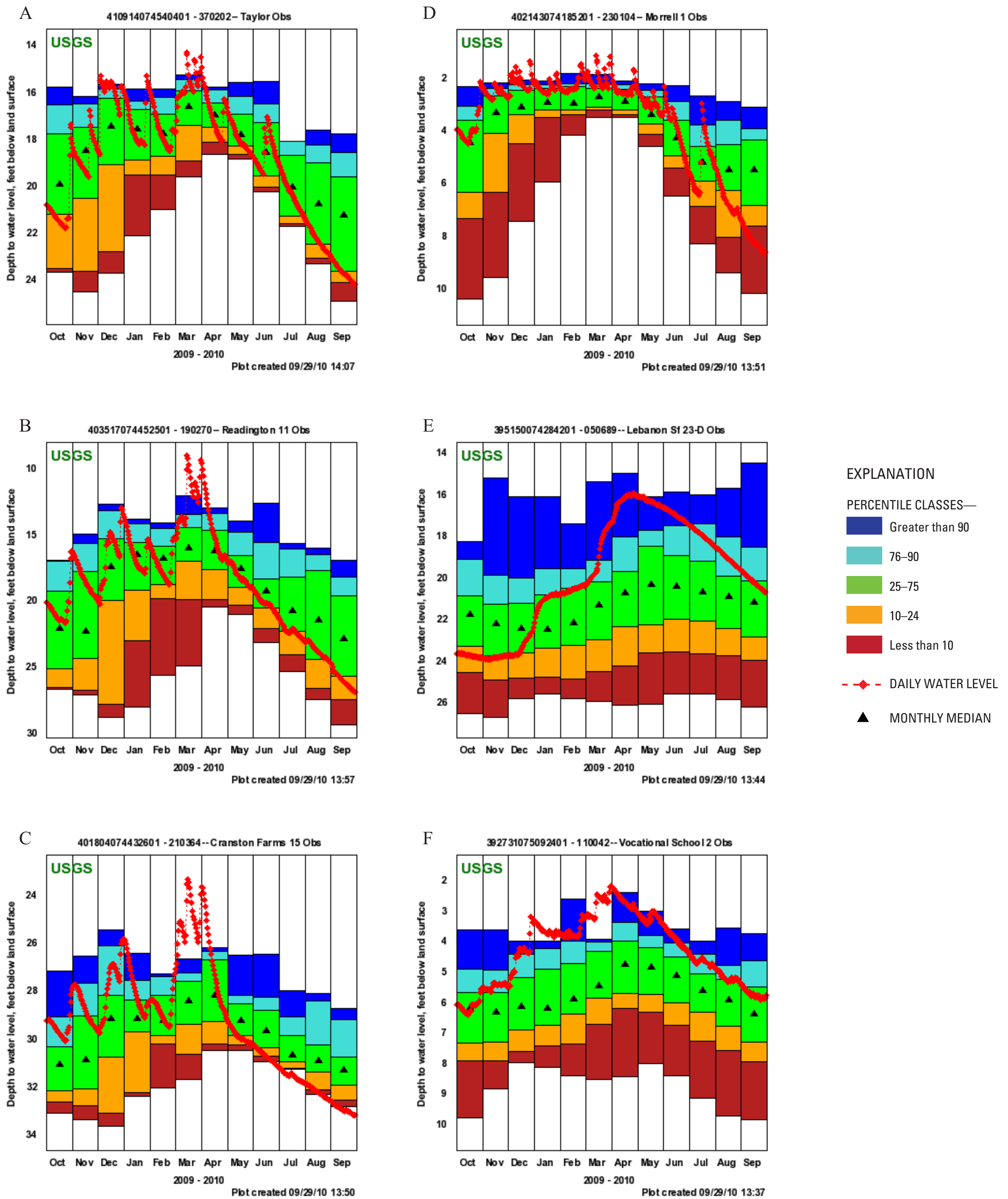

Figure 3. Groundwater levels in three bedrock wells in northern New Jersey (A-C) and three unconfined aquifer wells (D-F) in the New Jersey Coastal Plain, 2010.

providing timely access via the internet, the USGS helps water resource-managers develop, regulate, and monitor the resource to ensure its continued availability for future generations.

By Walter Jones and Don Storck

For more information, contact:

Director, New Jersey Water Science Center
U.S. Geological Survey
810 Bear Tavern Road, Suite 206
West Trenton, NJ 08628

Email: ***dc_nj@usgs.gov*** **On the web:** ***http://nj.usgs.gov/***

G

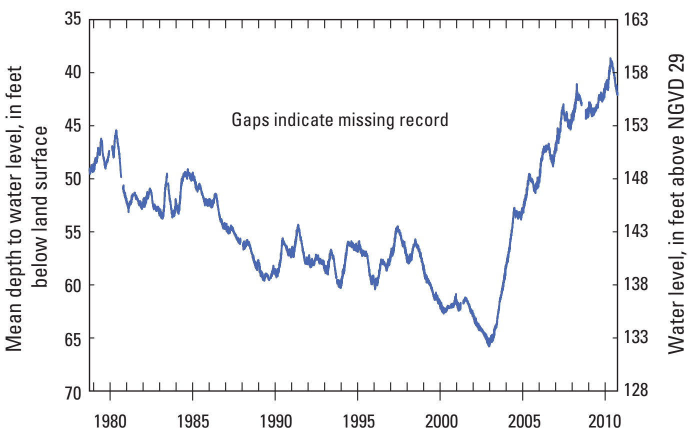

Figure 4. Long-term water levels in glacial aquifer (stratified drift) well 27-12, 1978–2010.

H

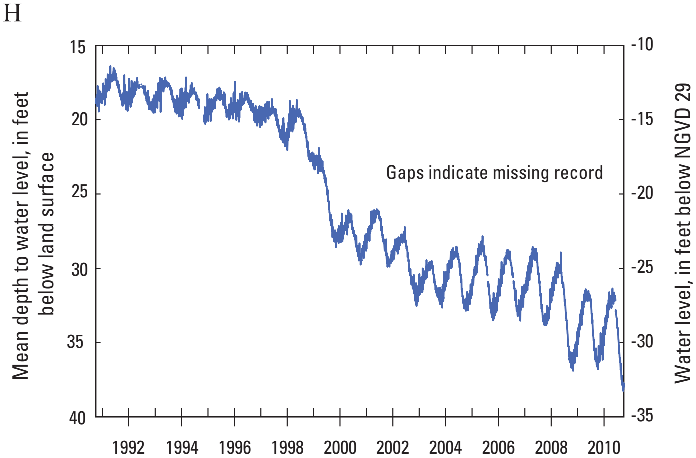

Figure 5. Long term water levels in well 9-302 screened in the Atlantic City 800-foot sand, New Jersey, 1990–2010.

I

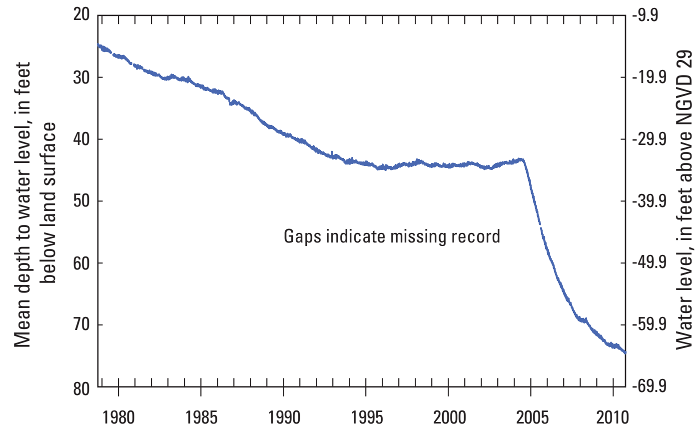

Figure 6. Long-term water levels in well 11-96 screened in the Piney Point aquifer, New Jersey, 1977–2010.

J

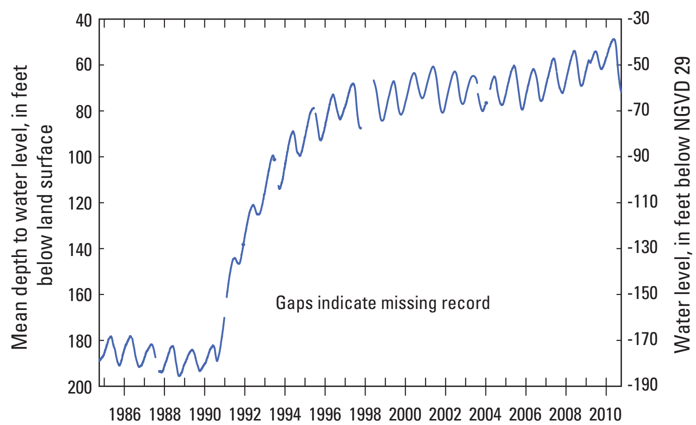

Figure 7. Long-term water levels in well 25-486 screened in the Wenonah-Mount Laurel aquifer, New Jersey, 1984–2010.

K

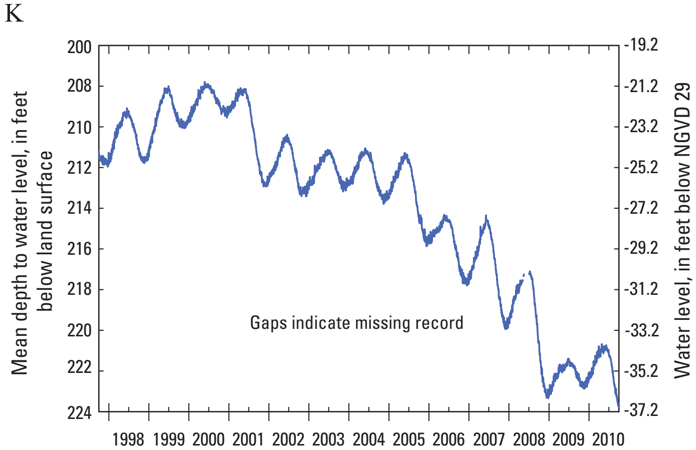

Figure 8. Long-term water levels in well 5-1391 screened in the Upper Potomac-Raritan-Magothy aquifer, New Jersey, 1997–2010.

L

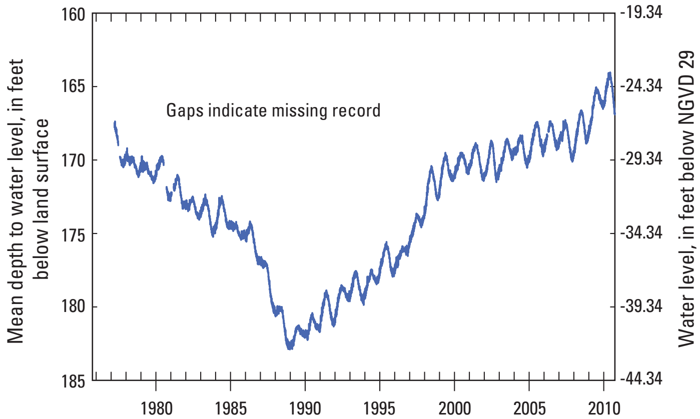

Figure 9. Long-term water levels in well 5-683 screened in the Undifferentiated Potomac-Raritan-Magothy aquifer, New Jersey, 1981–2010.