

Potentiometric Surface of the Upper Floridan Aquifer in the Southwestern Albany Area, Georgia, 1998–2005, Based on Revised Land-Surface Altitudes

By Debbie Warner Gordon

INTRODUCTION

As part of a cooperative agreement with the Albany Water, Gas, and Light Commission (WGL), the U.S. Geological Survey (USGS) has been collecting annual water-level data from the Upper Floridan aquifer in the southwestern Albany area, Georgia, since 1998. The water-level data are used to construct potentiometric-surface maps of the Upper Floridan aquifer. These maps have been used to monitor the effects of ground-water withdrawals and climate on the Upper Floridan aquifer as well as ground-water-flow directions in the area. In addition to monitoring, the maps may be used to calibrate ground-water-flow-models in the area.

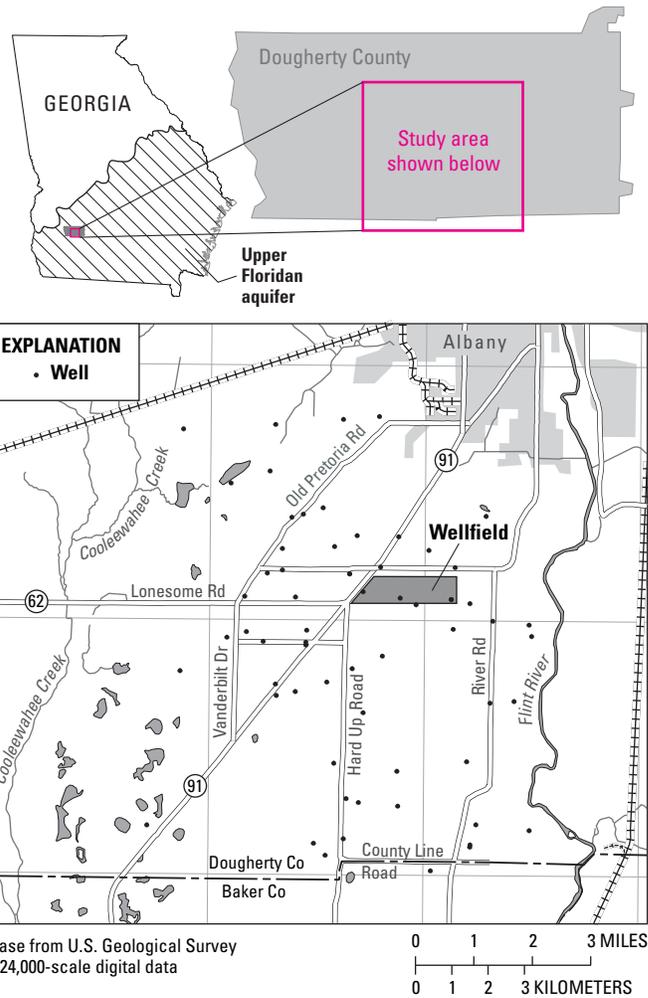
The study area encompasses about 64 square miles in Dougherty County, southwest of Albany, Georgia (map, right). Topography is karstic and relatively flat; altitudes at land surface range from about 160 to 200 feet (ft) above the National Geodetic Vertical Datum of 1929 (NGVD 29). Surface runoff is minimal because most of the drainage is internal. Sinkholes are prevalent in the area. The karstic nature of the Upper Floridan aquifer makes its top surface and its potentiometric surface irregular.

Scope of Work

Water-level measurements are collected from a network of 85 wells located in and around a municipal wellfield southwest of Albany. Precise land-surface altitudes at each well are critical for accurate potentiometric-surface maps. The land-surface altitudes for most of the wells originally were obtained from 7.5-minute topographic maps. These data have an accuracy of ± 2.5 ft. To improve the accuracy of the potentiometric-surface maps, WGL commissioned the Dougherty County Engineering Department to survey the land-surface altitude at each well. The new land-surface altitudes were used to construct more accurate potentiometric-surface maps for 1998 through 2005.

Methods of Study

The Dougherty County Engineering Department used standard land-surveying techniques to tie the land-surface altitude at each well to altitude benchmarks. The location of each well was checked with a global positioning system. The well locations were plotted on a map using geographic information system (GIS) software. A value for water level below land surface for each well was subtracted from the land-surface altitude to derive the water-level altitude at each well. These water-level altitudes were plotted on the map, and the GIS software was used to contour the new potentiometric-surface data. Then



Study area location and network of wells in Dougherty County, southwestern Albany area, Georgia.

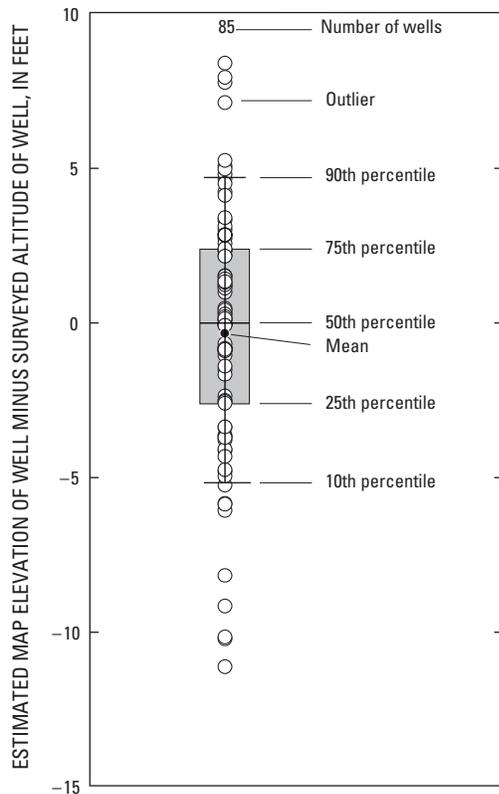
contours were adjusted by hand where necessary. The new water-level altitude data are accurate to 0.01 ft.

Previous Studies

Potentiometric-surface maps have been previously published for the Upper Floridan aquifer in the southwestern Albany area using the old land-surface altitudes. A potentiometric-surface map for November 2001 was published in Leeth and others (2003), and maps for October 2002 and September 2003 were published in Leeth and others (2005). The May 1998, October 1999, and March 1999 maps were published in Warner and Lawrence (2005).

REVISED LAND-SURFACE ALTITUDES

The revised land-surface altitudes for the 85 wells range from 0 to about 11 ft from the original altitudes. A box plot below shows the difference between the original altitude data and the surveyed data. Fifty percent of the surveyed altitudes ranged from 2.5 ft less than to 2.5 ft greater than the original altitude data. Eighty percent of the surveyed altitudes ranged from about 5 ft less than to about 5 ft greater than the original data.



Difference between original well altitude taken from U.S. Geological Survey 1:24,000-scale map and surveyed well altitude.

REVISED POTENTIOMETRIC SURFACES, 1998–2005

The revised land-surface altitudes were used to reconstruct the potentiometric-surface maps. The nine revised maps are shown on the following pages: May 1998, October 1998, March 1999, August 2000, November 2001, October 2002, September 2003, October 2004, and October 2005, respectively. The November 2001 map is an example of how the revised land-surface altitudes affected the potentiometric surfaces; the old potentiometric-surface is shown in pink along with the revised potentiometric surface (shown in blue). As was the case with most of the revised maps, the contour lines of the revised November 2001 map are “smoother” than the old lines. The direction of ground-water flow is generally

to the southeast, instead of southeast, west, and north. A mound of high water levels to the west of the wellfield shown on the old November 2001 map is an area of low water levels. Ground-water-flow directions were toward the east or southeast, toward the Flint River, from May 1998 through November 2001, except in the southeast corner of the study area. From October 2002 through October 2005, flow directions generally were toward the southeast. The ground-water levels dropped from October 1998 to October 2002 during drought conditions. Water levels in the wellfield area were about 165 ft during October 1998, and dropped to about 145 ft by August 2000. A cone of depression was evident on the east side of the wellfield during March 1999 and October 2000 before pumping at the wellfield began. Water levels rose at the wellfield to about 145–150 ft by November 2001 and October 2002 and to 160–165 by September 2003. Water levels were back down to 155–160 ft at the wellfield during October 2004 and rose to about 160 ft during October 2005. Pumping at the wellfield began during fall 2003 after the September 2003 water-level measurements were collected. Pumping rates were about 3.4 million gallons per day (Mgal/d) during October 2004 and about 4 Mgal/d during October 2005. No cone of depression is evident as a result of the wellfield pumping.

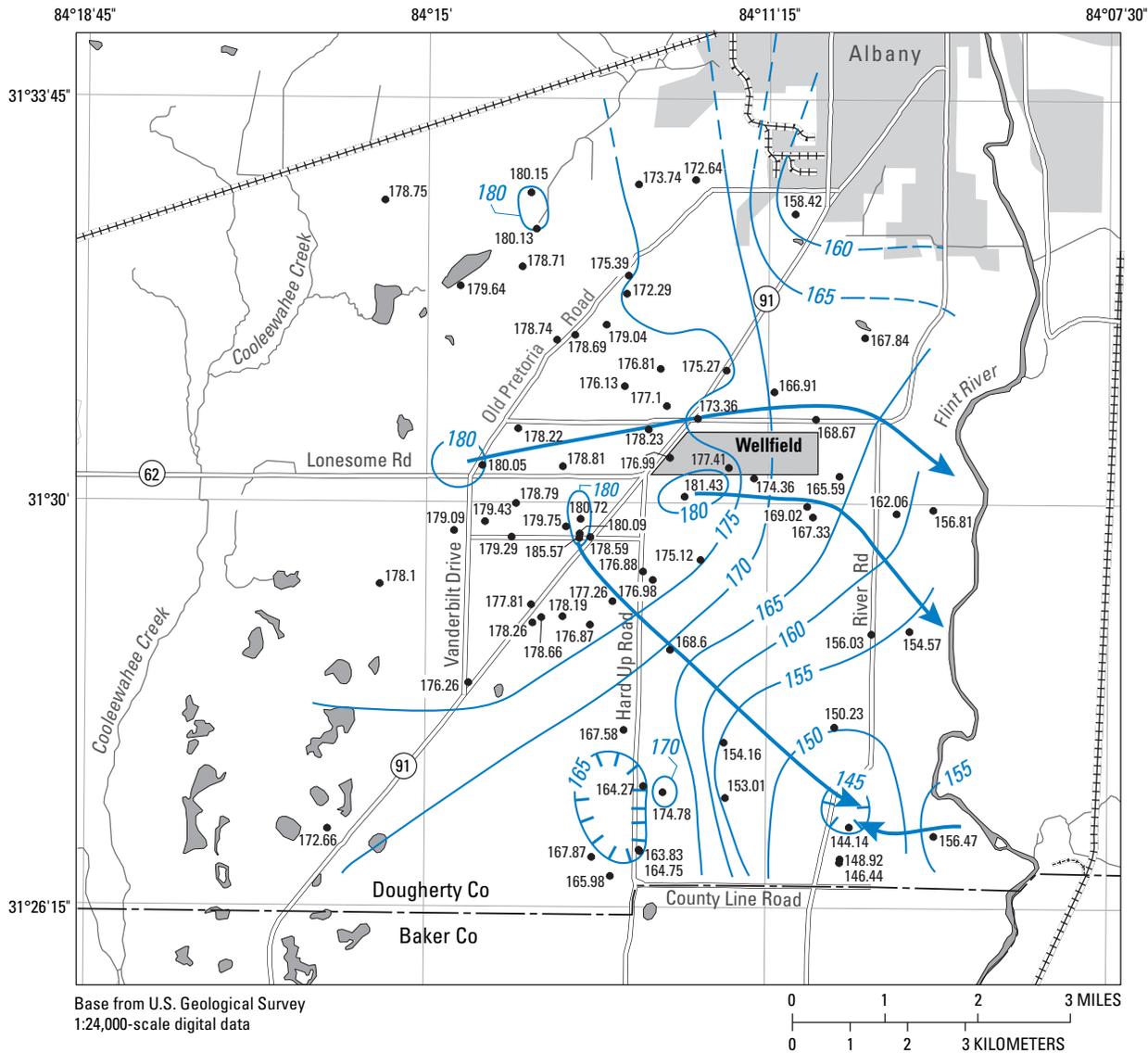
During August 2000, depressions in the potentiometric surface were present in, to the west of, and to the northwest of the wellfield. A depression was present to the west of the wellfield during November 2001 and September 2003. These depressions disrupt the southeasterly flow of water across the study area.

In the southeastern corner of the study area ground water flows west or southwest away from the Flint River. More data in the southeastern part of the study area are needed to determine the cause of the westward movement.

REFERENCES CITED

- Leeth, D.C., Clarke, J.S., Wipperfurth, C.J., and Craigg, S.D., 2003, Ground-water conditions and studies in Georgia, 2001: U.S. Geological Survey Water-Resources Investigations Report 03-4032, 96 p., available on the Web at <http://ga.water.usgs.gov/pubs/wrir/wrir034032/>.
- Leeth, D.C., Clarke, J.S., Craigg, S.D., and Wipperfurth, C.J., 2005, Ground-water conditions and studies in Georgia, 2002–03: U.S. Geological Survey Investigations Report 2005-5065, 128 p., Web-only publication available at <http://pubs.usgs.gov/sir/2005/5065/>.
- Warner, Debbie, and Lawrence, S.J., 2005, Ground-water flow and water quality in the Upper Floridan aquifer, southwestern Albany area, Georgia, 1998–2001: U.S. Geological Survey Scientific Investigations Report 2005-5047, 77 p., Web-only publication available at <http://pubs.usgs.gov/sir/2005/5047/>.

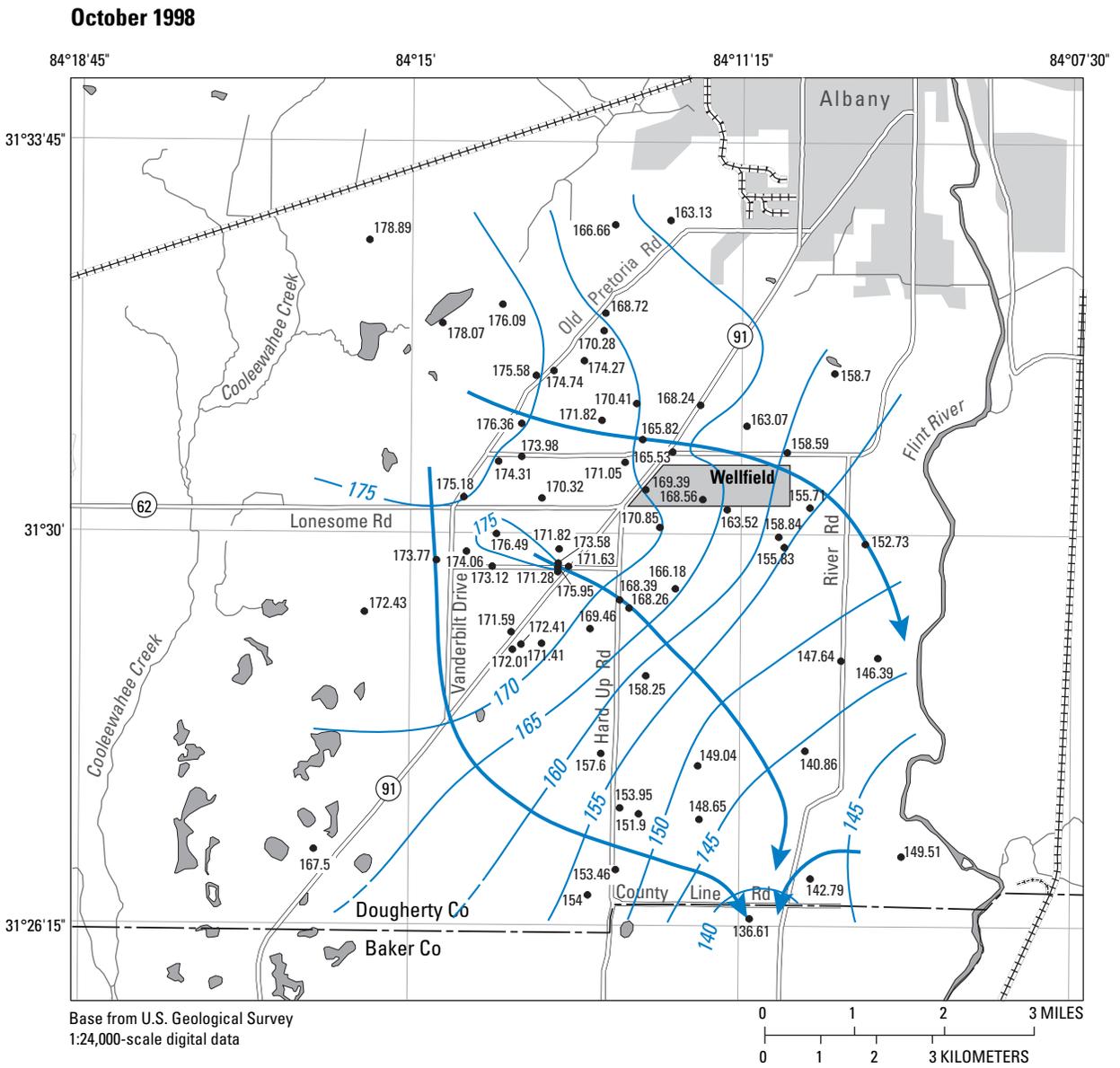
May 1998



EXPLANATION

- 155 — **Potentiometric contour**— Shows altitude at which water level would have stood in tightly cased wells during May 1998. Dashed where approximately located. Hachures indicate depression. Contour interval 5 feet. Datum is National Geodetic Vertical Datum of 1929
- ➔ **Direction of ground-water flow**
- 178.1 **Well and water level**

Potentiometric surface of the Upper Floridan aquifer, southwestern Albany area, Georgia, May 1998.

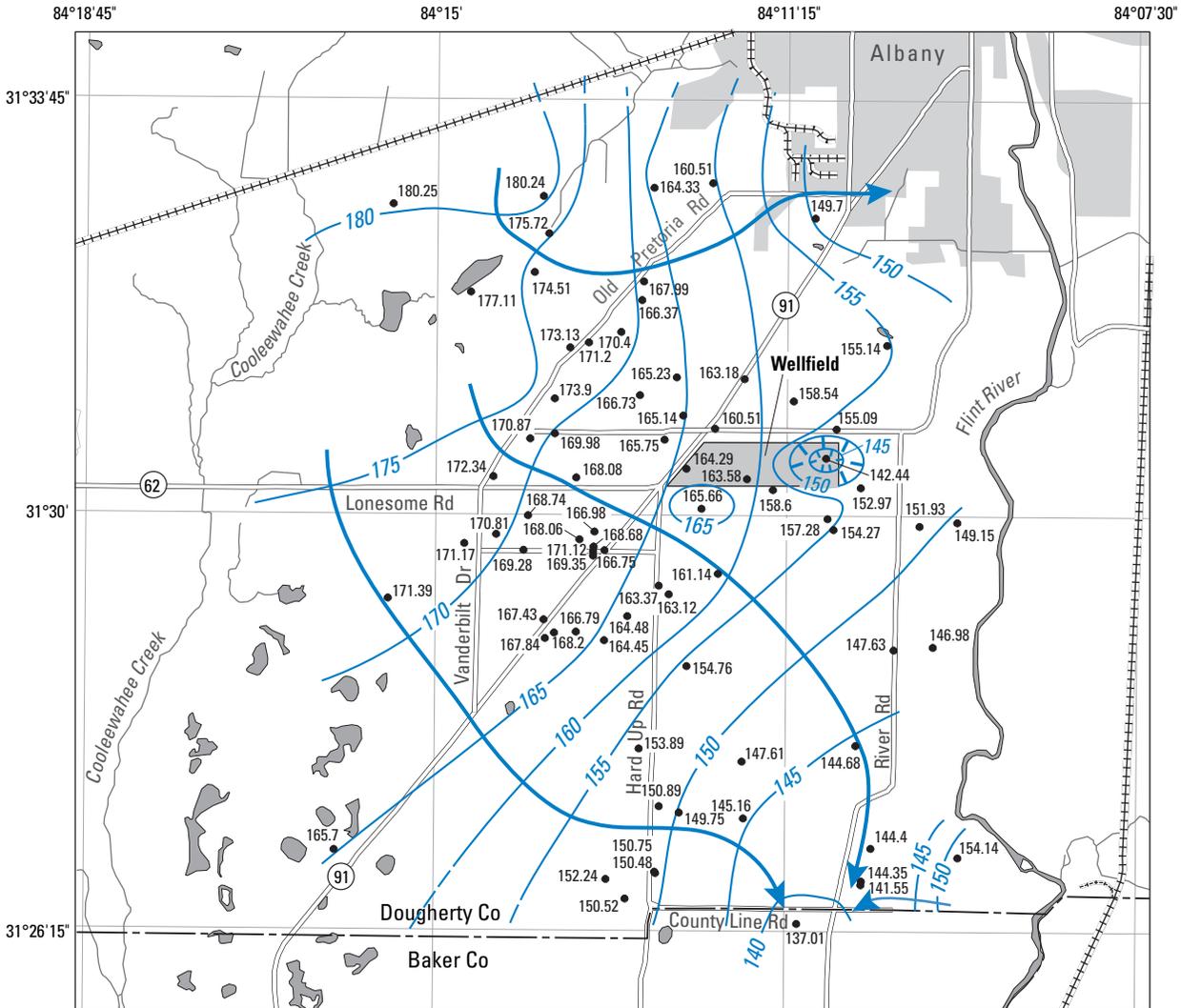


EXPLANATION

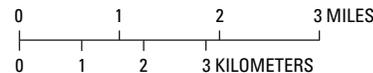
- 155 — **Potentiometric contour**— Shows altitude at which water level would have stood in tightly cased wells during October 1998. Dashed where approximately located. Contour interval 5 feet. Datum is National Geodetic Vertical Datum of 1929
- ➔ **Direction of ground-water flow**
- 172.43 **Well and water level**

Potentiometric surface of the Upper Floridan aquifer, southwestern Albany area, Georgia, October 1998.

March 1999



Base from U.S. Geological Survey 1:24,000-scale digital data

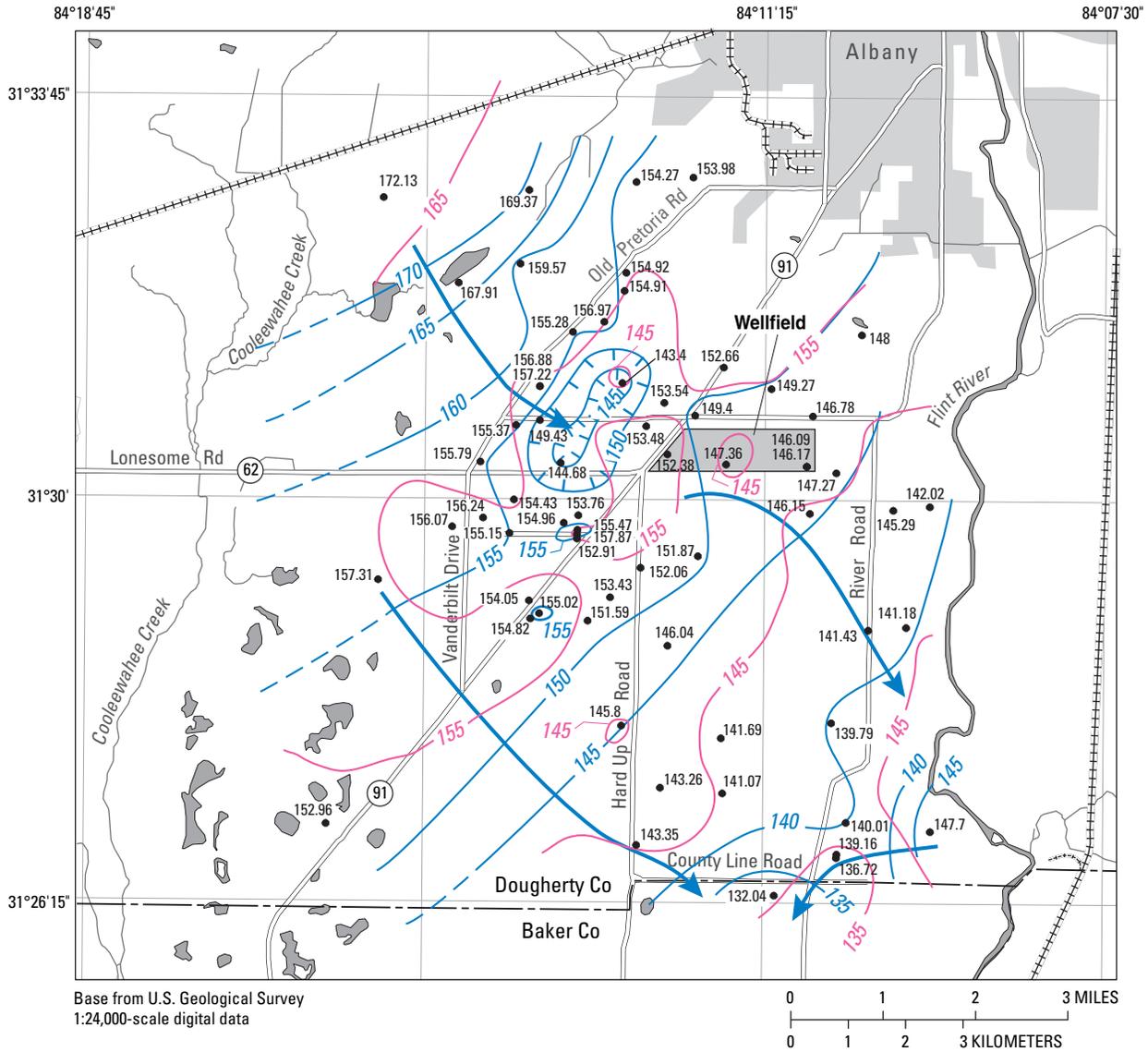


EXPLANATION

- 155 — **Potentiometric contour**— Shows altitude at which water level would have stood in tightly cased wells during March 1999. Dashed where approximately located. Hachures indicate depression. Contour interval 5 feet. Datum is National Geodetic Vertical Datum of 1929
- ➔ **Direction of ground-water flow**
- 171.39 **Well and water level**

Potentiometric surface of the Upper Floridan aquifer, southwestern Albany area, Georgia, March 1999.

November 2001

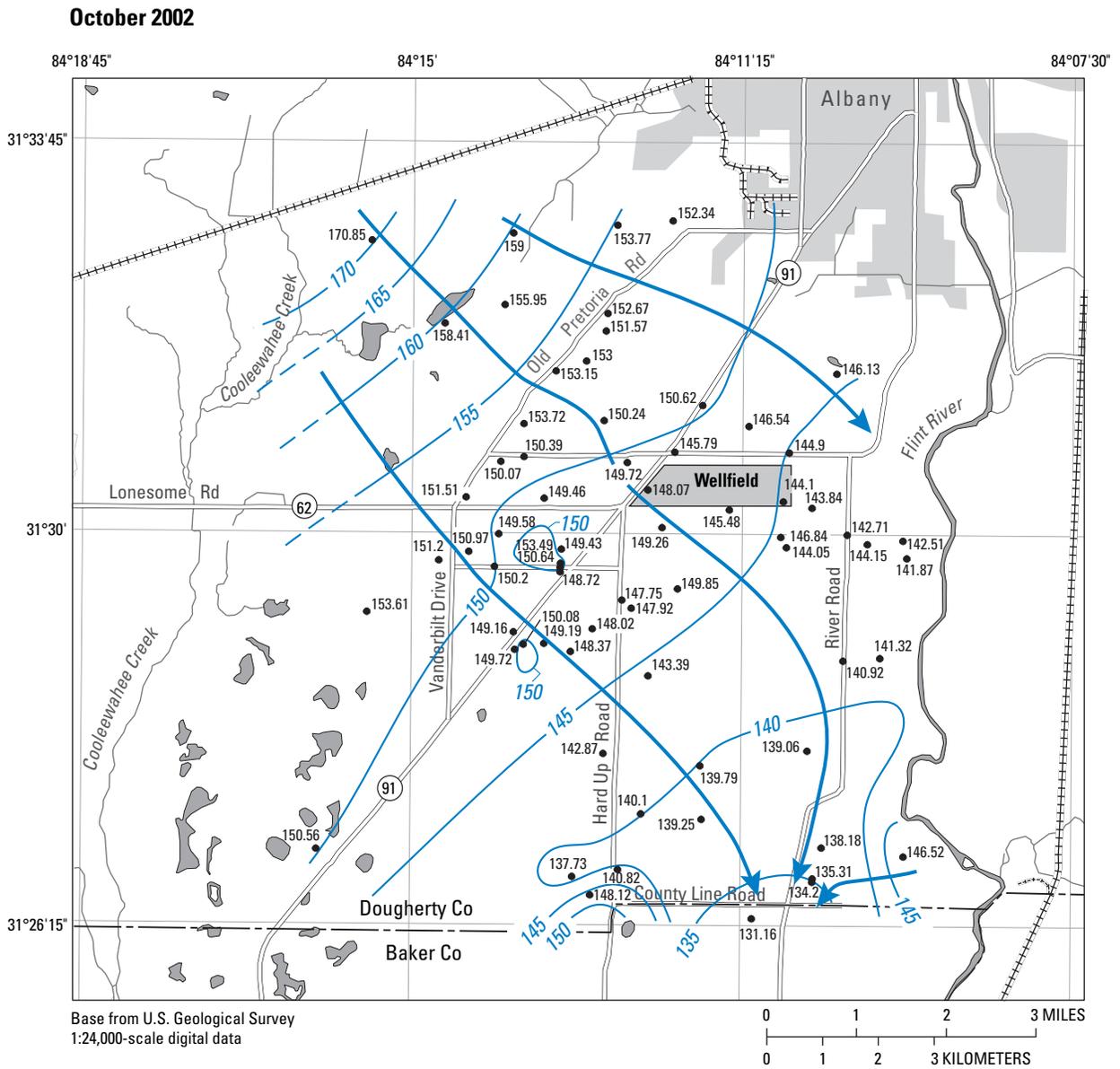


Base from U.S. Geological Survey
1:24,000-scale digital data

EXPLANATION

- 145 — **Potentiometric contour**—Shows altitude at which water level would have stood in tightly cased wells during November 2001. Dashed where approximately located. Contour interval 5 feet. Datum is National Geodetic Vertical Datum of 1929. Altitude data estimated from 1:24,000-scale map, plus or minus 5 feet
- 155 — **Potentiometric contour**—Shows altitude at which water level would have stood in tightly cased wells during November 2001. Dashed where approximately located. Hachures indicate depression. Contour interval 5 feet. Datum is National Geodetic Vertical Datum of 1929. Altitude data from leveled land surface data (2005), to the nearest one hundredth of a foot
- ➔ **Direction of ground-water flow**
- 143.26 **Well and water level**

Potentiometric surface of the Upper Floridan aquifer, southwestern Albany area, Georgia, November 2001.

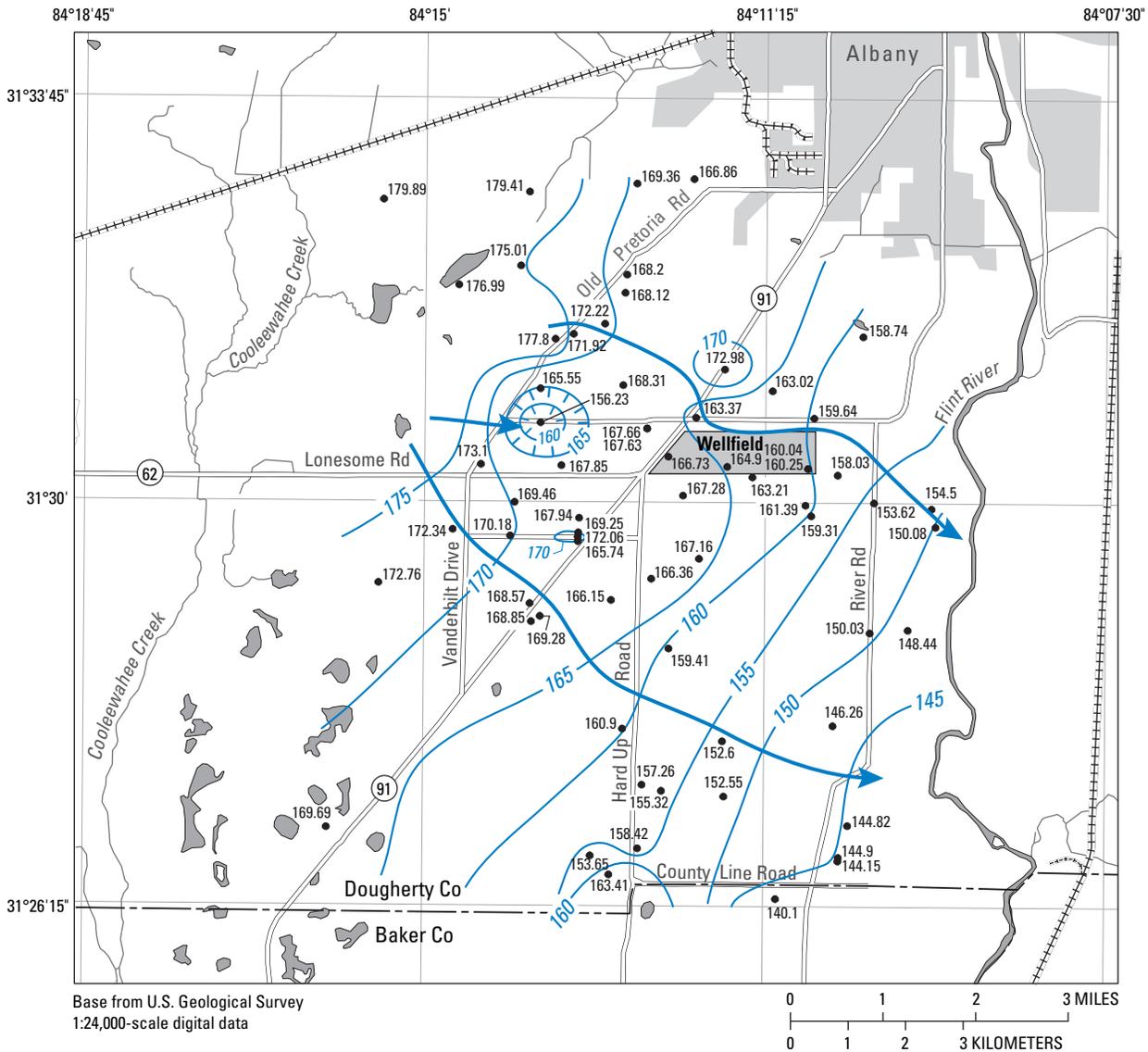


EXPLANATION

- 155 — **Potentiometric contour**— Shows altitude at which water level would have stood in tightly cased wells during October 2002. Dashed where approximately located. Contour interval 5 feet. Datum is National Geodetic Vertical Datum of 1929
- ➔ **Direction of ground-water flow**
- **Well and water level**
● 153.61

Potentiometric surface of the Upper Floridan aquifer, southwestern Albany area, Georgia, October 2002.

September 2003

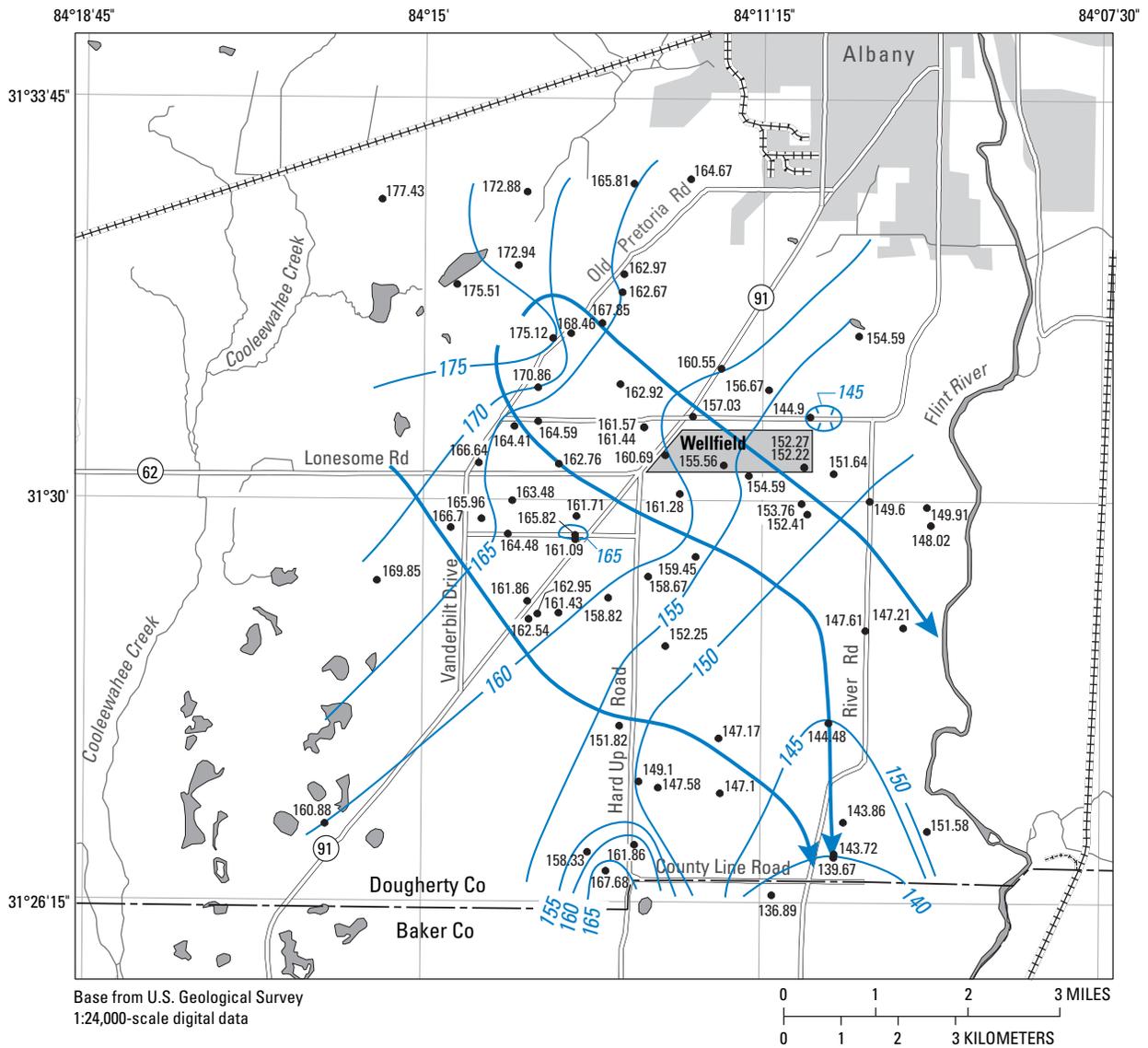


EXPLANATION

- 155 — **Potentiometric contour**— Shows altitude at which water level would have stood in tightly cased wells during September 2003. Hachures indicate depression. Contour interval 5 feet. Datum is National Geodetic Vertical Datum of 1929
- ➔ **Direction of ground-water flow**
- Well and water level**
 •172.76

Potentiometric surface of the Upper Floridan aquifer, southwestern Albany area, Georgia, September 2003.

October 2004



EXPLANATION

- 155 — Potentiometric contour— Shows altitude at which water level would have stood in tightly cased wells during October 2004. Hachures indicate depression. Contour interval 5 feet. Datum is National Geodetic Vertical Datum of 1929
- ➔ Direction of ground-water flow
- 169.85 Well and water level

Potentiometric surface of the Upper Floridan aquifer, southwestern Albany area, Georgia, October 2004.

