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Summary and Statistical Analysis of Precipitation and Groundwater Data for Brunswick County, North Carolina, Water Year 2008

Open-File Report 2010–1154

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

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By Kristen Bukowski McSwain and A.G. Strickland

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U.S. Department of the Interior
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KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)

Vertical coordinate information is referenced to the N^qflk^i Dblabqf` Vertical Datum of 1929 (NGVD 29).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Altitude, as used in this report, refers to distance above the vertical datum.

Summary and Statistical Analysis of Precipitation and Groundwater Data for Brunswick County, North Carolina, Water Year 2008

By Kristen Bukowski McSwain and A.G. Strickland

Abstract

Groundwater conditions in Brunswick County, North Carolina, have been monitored continuously since 2000 through the operation and maintenance of groundwater-level observation wells in the surficial, Castle Hayne, and Peedee aquifers of the North Atlantic Coastal Plain aquifer system. Groundwater-resource conditions for the Brunswick County area were evaluated by relating the normal range (25th to 75th percentile) monthly mean groundwater-level and precipitation data for water years 2001 to 2008 to median monthly mean groundwater levels and monthly sum of daily precipitation for water year 2008[1]. Summaries of precipitation and groundwater conditions for the Brunswick County area and hydrographs and statistics of continuous groundwater levels collected during the 2008 water year are presented in this report. Groundwater levels varied by aquifer and geographic location within Brunswick County, but were influenced by drought conditions and groundwater withdrawals. Water levels were normal in two of the eight observation wells and below normal in the remaining six wells. Seasonal Kendall trend analysis performed on more than 9 years of monthly mean groundwater-level data collected in an observation well located within the Brunswick County well field indicated there is a strong downward trend, with water levels declining at a rate of about 2.2 feet per year.

Introduction

Since 2000, the population of Brunswick County has grown by more than 22 percent, nearly three times the average 7.9 percent growth experienced by the State of North Carolina as a whole (North Carolina State Demographics, 2006). Growth of this magnitude has the potential to place significant stress on water resources in the area. Brunswick County planners have recognized the potential consequences of land-use changes associated with growth and the resulting increased demand on groundwater resources by consolidating the many public utility providers into one organization and embarking on an aggressive utility expansion plan. In order to make more informed water-resource planning decisions, County officials need up-to-date groundwater-resource information. To address concerns about the availability of groundwater in the Brunswick County area, the U.S. Geological Survey (USGS) and Brunswick County initiated a cooperative water-resources program in 1998.

An overview of hydrologic conditions during water year 2008 is presented in this document, including summaries of precipitation and groundwater conditions for the Brunswick County area. Hydrographs and statistical summaries of continuous groundwater levels collected as part of the cooperative program are presented in the appendix.

Cooperative Water-Resources Program

The Federal-State cooperative water-resources program is a partnership between the USGS and State or local agencies to provide information needed for many of the Nation's water-resources management and planning activities. In addition, the information collected may provide an early warning of emerging water problems. The USGS uses nationally consistent techniques in the collection, quality assurance, and archiving of scientific data. Information is stored in a common database readily available for scientific interpretation and public dissemination. The knowledge gained through cooperative studies is published and added to a national body of hydrologic information. The objectives of the Brunswick County cooperative water-resources program are to (1) monitor water-level fluctuations in the surficial, Castle Hayne, and Peedee aquifers of the North Atlantic Coastal Plain aquifer system and (2) relate observed water-level trends to changes in climatic conditions and (or) groundwater withdrawals.

[1]Water year is the period October 1 to September 30 and is defined by the year in which the period ends. The 2008 water year is October 1, 2007, to September 30, 2008.

Groundwater-Resources Activities

During water year 2008, groundwater-resources activities conducted as part of the Brunswick County cooperative program included

- Monitoring of groundwater levels
  - The USGS has operated continuous water-level recorders at eight observation wells since October 2000 (fig. 1). Water-level data are collected at 15- or 60-minute intervals and are transmitted in near real time from seven of the eight wells. Water-level data are updated every 4 hours and are available at the USGS National Water Information System (NWIS) Web page *http://waterdata.usgs.gov/nc/nwis/current/?type=gw*.
- Maintaining Brunswick County area hydrologic databases
  - The USGS continually updates the NWIS database with groundwater-level and well information.
- Publishing annual summaries of local water-resources conditions
  - Summaries of local water-resources conditions are published annually. Water-level data collected from 2006 to 2008 are published by the USGS as part of the annual Water Data Report and are available online at *http://wdr.water.usgs.gov*. North Carolina water-resources data reports for years prior to 2006 are also available online at *http://nc.water.usgs.gov/reports/WDR/index.html*. Published water-level data for water year 2008 for each groundwater site are presented in the appendix.

Precipitation

The State Climate Office of North Carolina maintains rain gages at two long-term climatic data stations in Brunswick County (fig. 1). Station 315116, located in western Brunswick County near Longwood, has been in operation since June 1972. Station 318113, located in southeastern Brunswick County near Southport, has been in operation since January 1948. A comparison of rainfall data can be displayed graphically by constructing box plots (Ott and Longnecker, 2001). A box plot summarizes the distribution of the data by showing the median, 10th, 25th, 75th, and 90th percentiles. The top, bottom, and middle lines of the box correspond to the 75th percentile, 25th percentile, and median, respectively. The line caps (whiskers) extend from the 10th percentile to the 90th percentile. Box plots of monthly sums of daily precipitation were created for both the Longwood and Southport stations for the period of record covering June 1972 through September 2008 (fig. 2). Although the collection of precipitation data at the Southport station began in January 1948, the period of record from June 1972 through September 2008 was used to create the box plots because this is the period of record that is common for both stations. The monthly sum of daily precipitation for water year 2008 (represented by circles) overlies the box plot for comparison.

Rainfall amounts recorded at the Longwood station (315116) were normal (within the 25-75th percentile range) for 7 months of water year 2008 and below normal for 5 months (less than the 25th percentile range; fig. 2*A*). The months of October and November 2007, and August 2008 were much drier than normal, with less than 10 percent of the period of record receiving the same amount or less of rainfall.

For water year 2008, rainfall amounts recorded at the Southport station (318113) were normal for 6 months of the year and below normal for 6 months (fig. 2*B*). The months of October and November 2007, and March 2008 were much drier than normal, with less than 10 percent of the period of record receiving the same amount or less of rainfall.

Precipitation recharges the surficial aquifer; therefore, below normal precipitation can be an indicator of drought conditions. To determine if precipitation for water year 2008 was above normal, normal, or below normal at the Longwood and Southport precipitation stations, the total annual rainfall for water year 2008 was compared to the total annual rainfall recorded during water years 2001 to 2008 by using box plots (fig. 3*B*). The total annual rainfall received at both stations 315116 and 318113 was much lower than normal, indicating that Brunswick County experienced a severe drought in water year 2008.

Groundwater-Resources Conditions

Groundwater levels in the Brunswick County area have been continuously monitored since water year 2001 in eight observation wells as part of the cooperative study (fig. 1). Of the eight wells, three are completed the surficial aquifer, one in the Castle Hayne aquifer, one in both the Castle Hayne and the Peedee aquifers, and three in the Peedee aquifer. Water-level hydrographs for water year 2008 and the entire period of record for each observation well are presented in the appendix.

Median monthly mean water levels for water year 2008 were compared to monthly mean water levels for water years 2001 to 2008 by using box plots to determine if water levels were above normal, normal, or below normal. The record period covering water years 2001 to 2008 was selected for comparison purposes because this is the data-collection period that all eight wells have in common. To aid interpretation of the water-level box plots, a shaded area corresponding to the period-of-record normal range has been included. Additionally, the results of the water-level comparisons are represented graphically on maps.

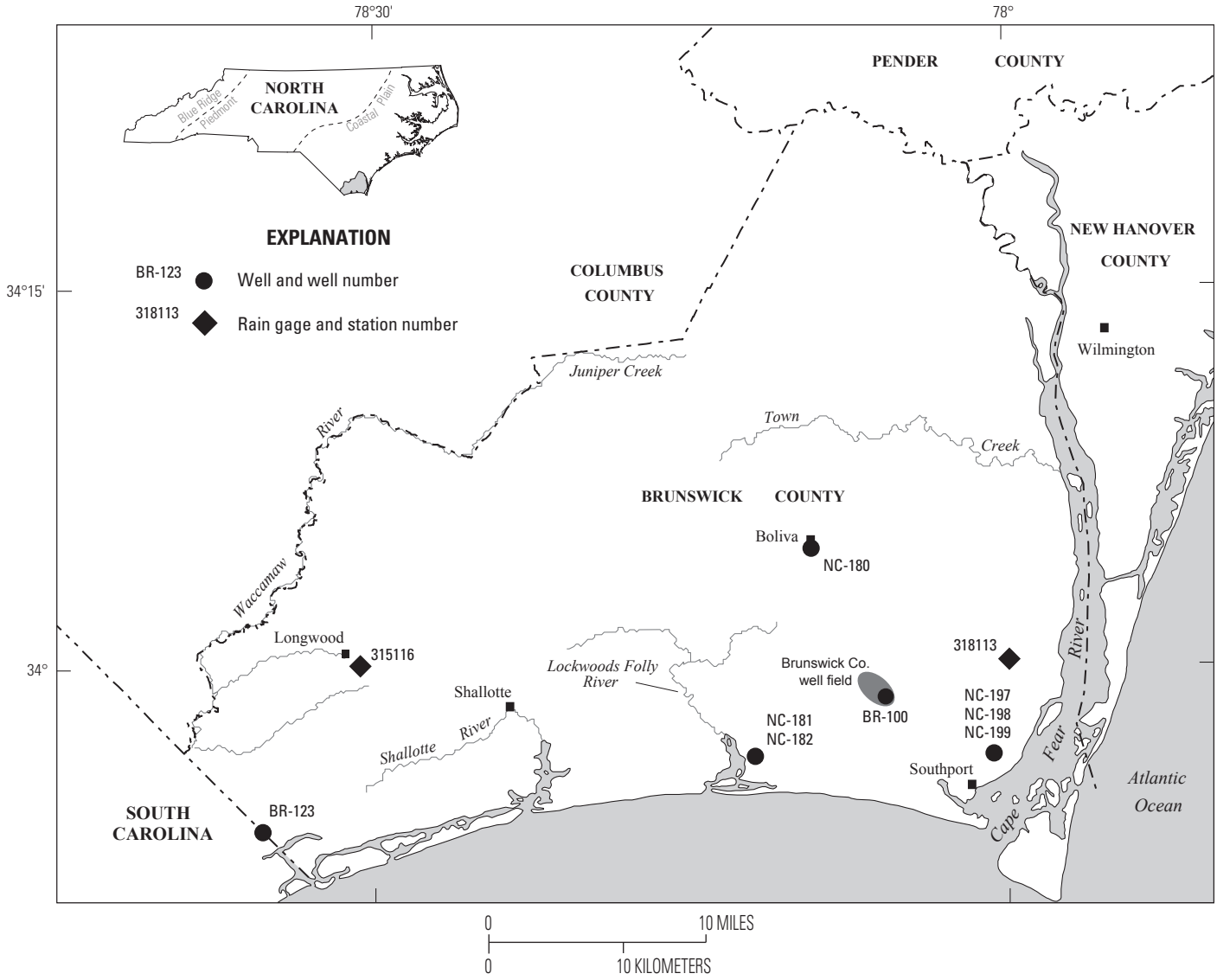


Figure 1. Map showing locations of observation wells and rain gages in Brunswick County, North Carolina.

Groundwater Levels

During water year 2008, water levels in the surficial aquifer were normal in one (BR-123) of the three wells monitored (fig. 3). Water levels monitored in wells NC-182 and NC-199 were below normal. Below-normal precipitation during much of water years 2007 (McSwain, 2008) and 2008 resulted in reduced recharge to the surficial aquifer, which is reflected by below normal water levels in wells NC-182 and NC-199.

Water levels in the Castle Hayne aquifer were below normal in both wells NC-198 and BR-100 (fig. 4) during water year 2008. The Castle Hayne aquifer is pumped in localized areas throughout Brunswick County as a source of potable water. It should be noted that BR-100, a monitoring well located in the Brunswick County well field, is completed in both the Castle Hayne and Peedee aquifers as there is not a confining layer between the two aquifers at this location. Water levels collected in this well are composite values and may not reflect the true water level found in either aquifer.

In the Peedee aquifer, the water level in one of the three wells monitored was normal, and below normal in two wells (fig. 5) during water year 2008. The water level in well NC-197 was normal. Water levels were below normal in wells NC-180 and NC-181. The Peedee aquifer is pumped in localized areas throughout Brunswick County as a source of potable water.

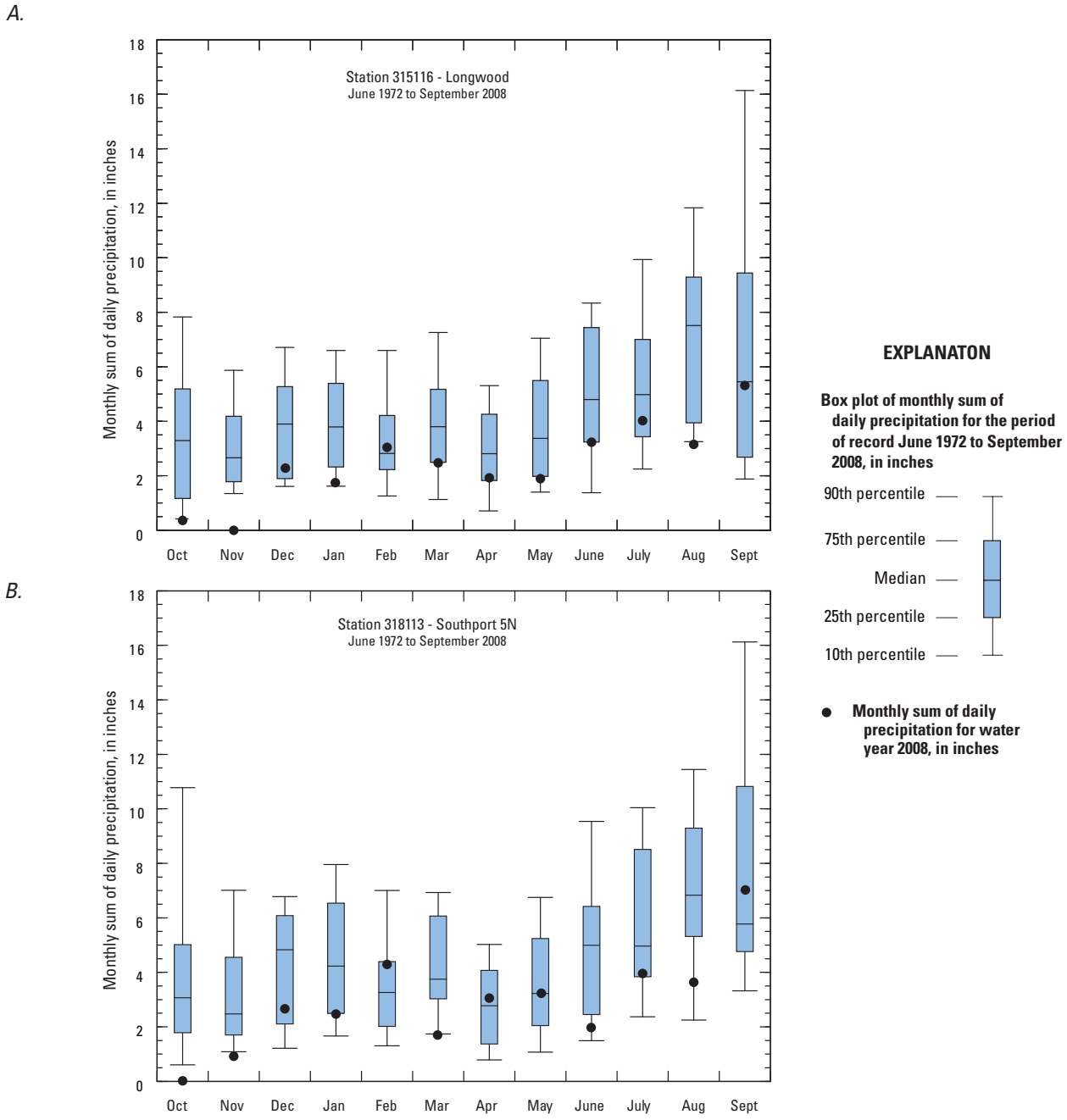
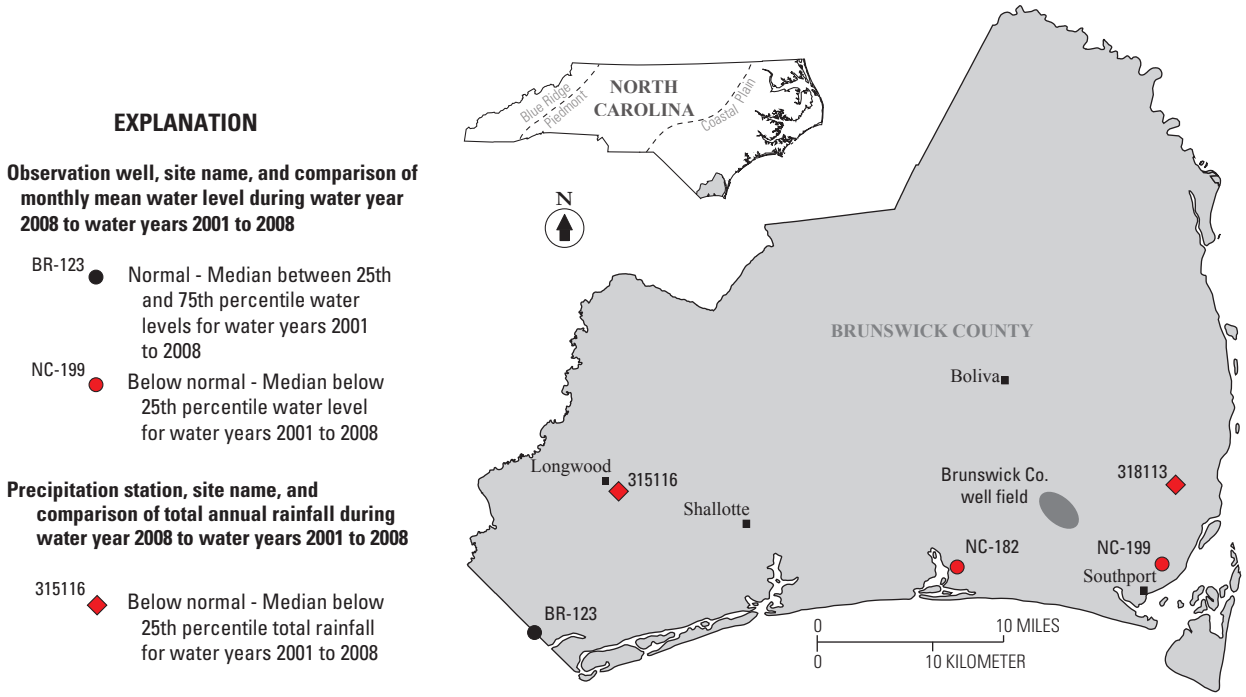


Figure 2. Box plots showing monthly sum of daily precipitation during water year 2008 and monthly sum of daily precipitation for the period June 1972 to September 2008 at North Carolina State Climate Office stations (*A*) 315116 Longwood and (*B*) 318113 Southport 5N in Brunswick County, North Carolina.

A.



Site name	Other identifier
BR-123	DENR Calabash Research Station well HH39J7
NC-182	BR-080; DENR Sunset Harbor Research Station well GG34S7
NC-199	BR-083; DENR Southport Research Station well GG32T6
315116	Longwood
318113	Southport 5N

[DENR, North Carolina Department of Environment and Natural Resources]

B.

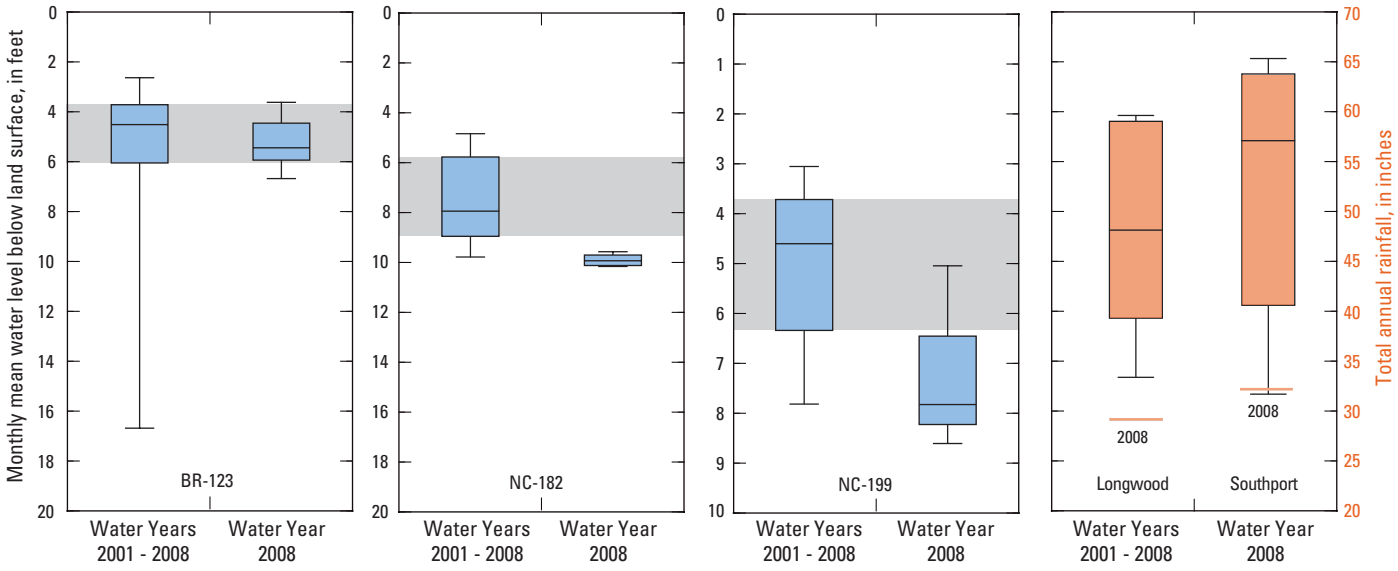
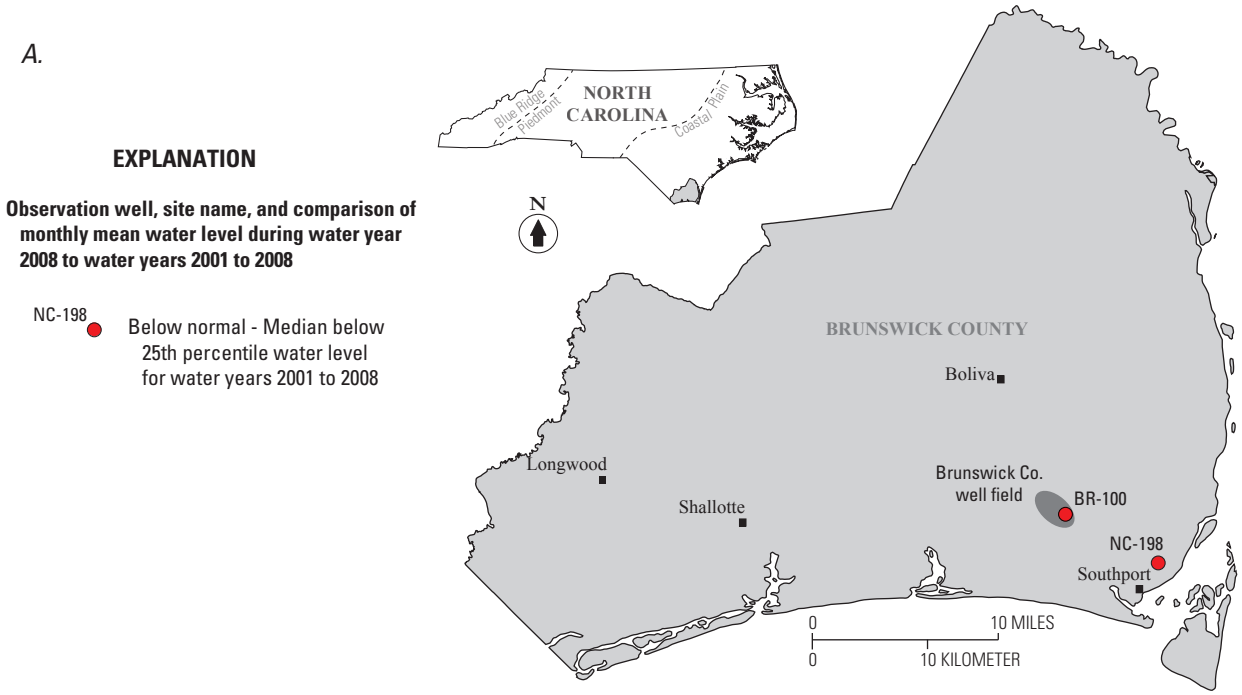


Figure 3. (*A*) Map showing observation wells completed in the surficial aquifer, and precipitation stations, Brunswick County, North Carolina (colored dots indicate locations where water levels in the surficial aquifer or total annual rainfall were normal or below normal for the surficial aquifer during water year 2008), and (*B*) box plots showing the monthly mean water levels and total annual rainfall for water years 2001 to 2008 in comparison to water year 2008 monthly mean water levels and total annual rainfall.

A.



Site name	Other identifier
BR-100	Well 15A
NC-198	BR-082; DENR Southport Research Station well GG32T5

* Note - BR-100 is completed in both the Castle Hayne and Peedee aquifers
[DENR, North Carolina Department of Environment and Natural Resources]

B.

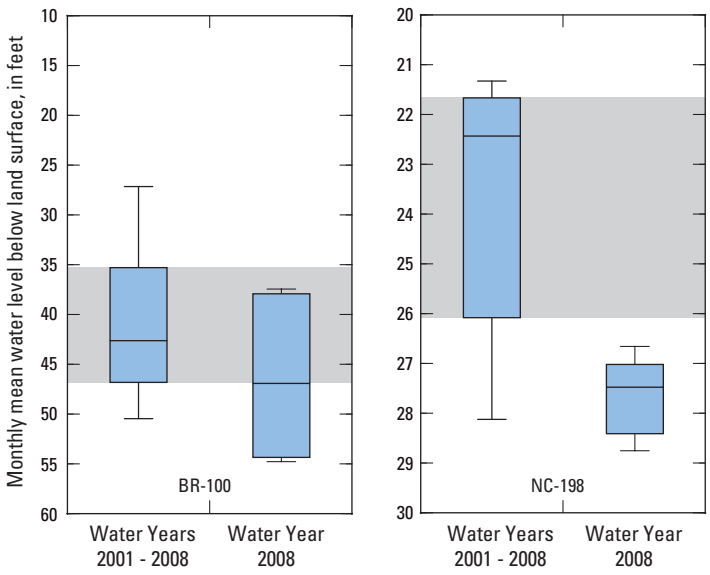
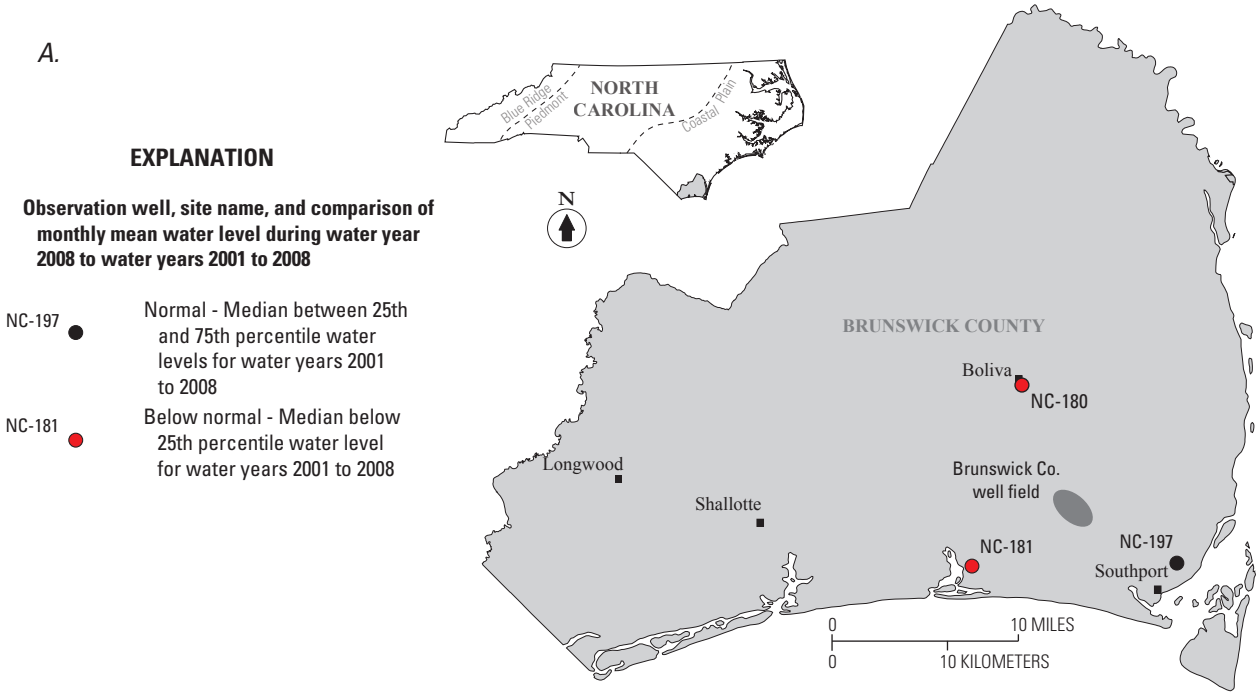


Figure 4. (*A*) Map showing observation wells completed in the Castle Hayne aquifer, Brunswick County, North Carolina (colored dot indicates locations where water levels were below normal for the Castle Hayne aquifer during water year 2008), and (*B*) box plots showing monthly mean water levels for water years 2001 to 2008 and water year 2008 monthly mean water levels.

A.



Site name	Other identifier
NC-181	BR-079; DENR Sunset Harbor Research Station well GG34S6
NC-180	BR-078; DENR Bolivia Research Station well FF33D2
NC-197	BR-081; DENR Southport Research Station well GG32T4

[DENR, North Carolina Department of Environment and Natural Resources]

B.

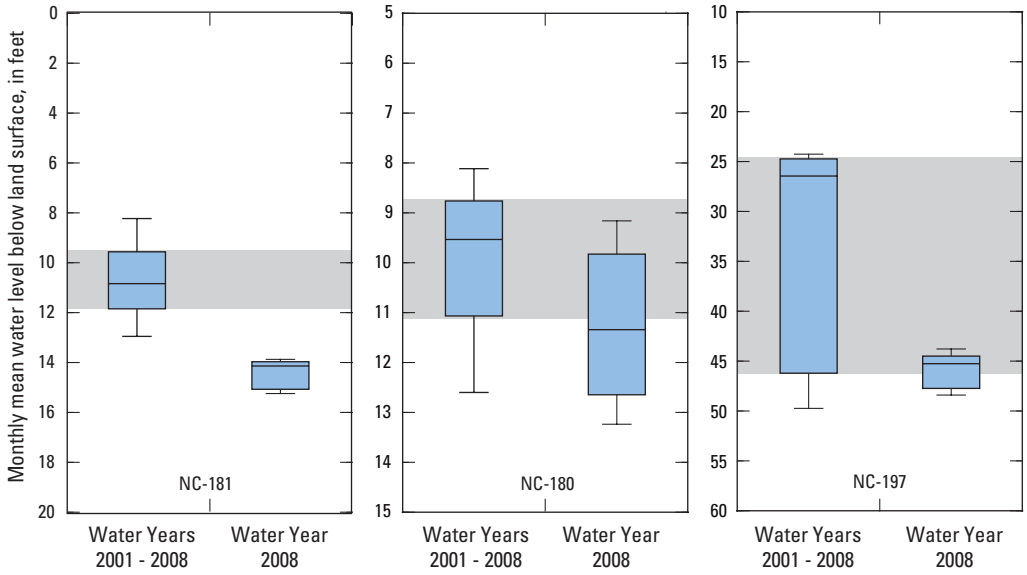


Figure 5. (*A*) Map showing observation wells completed in the Peedee aquifer, Brunswick County, North Carolina (colored dots indicate locations where water levels were normal or below normal for the Peedee aquifer during water year 2008), and (*B*) box plots showing monthly mean water levels for water years 2001 to 2008 and water year 2008 monthly mean water levels.

Long-Term Water-Level Trends

Temporal trends in monthly mean water levels in well BR-100 were evaluated for the period of record (February 1999 through September 2008). Well BR-100 was selected for trend test analysis because of its proximity to the Brunswick County well field (fig. 4). Because different seasons of the year may cause variations in the monthly mean water level, the distribution-free, nonparametric Seasonal Kendall trend test was used to test for the existence of trends in water-level data from well BR-100. This test, modified from the Mann-Kendall test (Helsel and Hirsch, 1992), measures the monotonic association between variables to determine whether the variables increase or decrease with time. The Seasonal Kendall test accounts for seasonality by computing a Mann-Kendall test for each month separately (January data are compared only with January, February only with February, etc.) over 12 statistical seasons, then combines the results.

Nearly 10 years of monthly mean water-level record for well BR-100 indicate a statistically significant downward trend of the monthly mean water levels (tau = -0.5198 and p-value = 0.0096). Since the p-value is less than 0.05, there is a 95-percent probability of a trend in the monthly mean water levels for the period of record, and because tau is negative, the trend is downward. The magnitude of the downward trend (slope) is the median of all within-season slopes calculated using the Mann-Kendall test for each month separately. At well BR-100, the slope of the trend is -2.2 feet per year (ft/yr). In the 10 years that the USGS has monitored well BR-100, water levels in the combined Castle Hayne and Peedee aquifers in the area of the Brunswick County well field have declined by about 22 feet.

Summary

The USGS has been working with Brunswick County to monitor water-resources conditions since 2000. This report presents data collected during water year 2008 (October 2007 through September 2008) to summarize the precipitation and groundwater conditions. The normal (25^{th} to 75^{th} percentile range) precipitation data for two climatic stations maintained by the State Climate Office of North Carolina and monthly mean groundwater levels for water years 2001 to 2008 at eight observation wells and were related to median monthly mean groundwater levels and monthly sums of daily precipitation for water year 2008 to determine groundwater-resources conditions. Water levels were normal in two wells and below normal in the remaining six wells. A Seasonal Kendall trend analysis was performed on water-level data from well BR-100 because of its proximity to the Brunswick County well field. A 95-percent probability of a downward trend was determined, with water levels declining at a rate of about 2.2 ft/yr.

Cited References

Helsel, D.R., and Hirsch, R.M., 1992, Statistical methods in water resources: U.S. Geological Survey Techniques of Water-Resources Investigations, book 4, chap. A3, 523 p.

McSwain, K.B., 2008, Summary of ground-water data for Brunswick County, North Carolina, water year 2007: U.S. Geological Survey Open-File Report 2008–1307, 37 p.

North Carolina State Demographics, 2006, State demographic data: accessed on December 5, 2006, at *http://demog.state.nc.us/*.

Ott, L., and Longnecker, M., 2001, An introduction to statistical methods and data analysis (5th ed.): Pacific Grove, California, Wadsworth Group, 1152 p.

Appendix—Groundwater-level hydrographs and statistics for selected wells in Brunswick County, North Carolina, water year 2008

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Water-Data Report 2008

335334078352106 Local number BR-123, NCDENR Calabash Research Station well HH39j7 near Calabash, NC (Surficial)

Surficial aquifer system
Post Miocene (Quaternary + Pliocene) Rocks

Brunswick County, NC

LOCATION.--Lat 33°53′34″, long 78°35′21″ referenced to North American Datum of 1983, Brunswick County, NC, Hydrologic Unit 03040207, 0.75 miles west of Country Club Drive on Carolina Shores Drive near Calabash. Owner: NCDENR (North Carolina Department of Environment and Natural Resources).

GROUND-WATER RECORDS

WELL CHARACTERISTICS.--Drilled observation well, depth 56 ft, diameter 4 in., cased to 46 ft, screened interval from 46 to 56 ft.

DATUM.--Land-surface datum is 47.28 ft above National Geodetic Vertical Datum of 1929. Measuring point: top of instrument shelf, 1.97 ft above land-surface datum, April 14, 1999, to present.

PERIOD OF RECORD.--April 1999 to current year. Continuous record began October 2000.

GAGE.--Water-level recorder collecting data at 60-minute intervals. Satellite telemetry at station.

REMARKS.--Well is part of Brunswick County ground-water study. Water levels may be affected by local pumping.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 0.49 ft below land-surface datum, October 8, 2005; lowest water level recorded, 23.12 ft below land-surface datum, May 11, 2001.

Water-Data Report 2008

335334078352106 Local number BR-123, NCDENR Calabash Research Station well HH39j7 near Calabash, NC (Surficial)—Continued

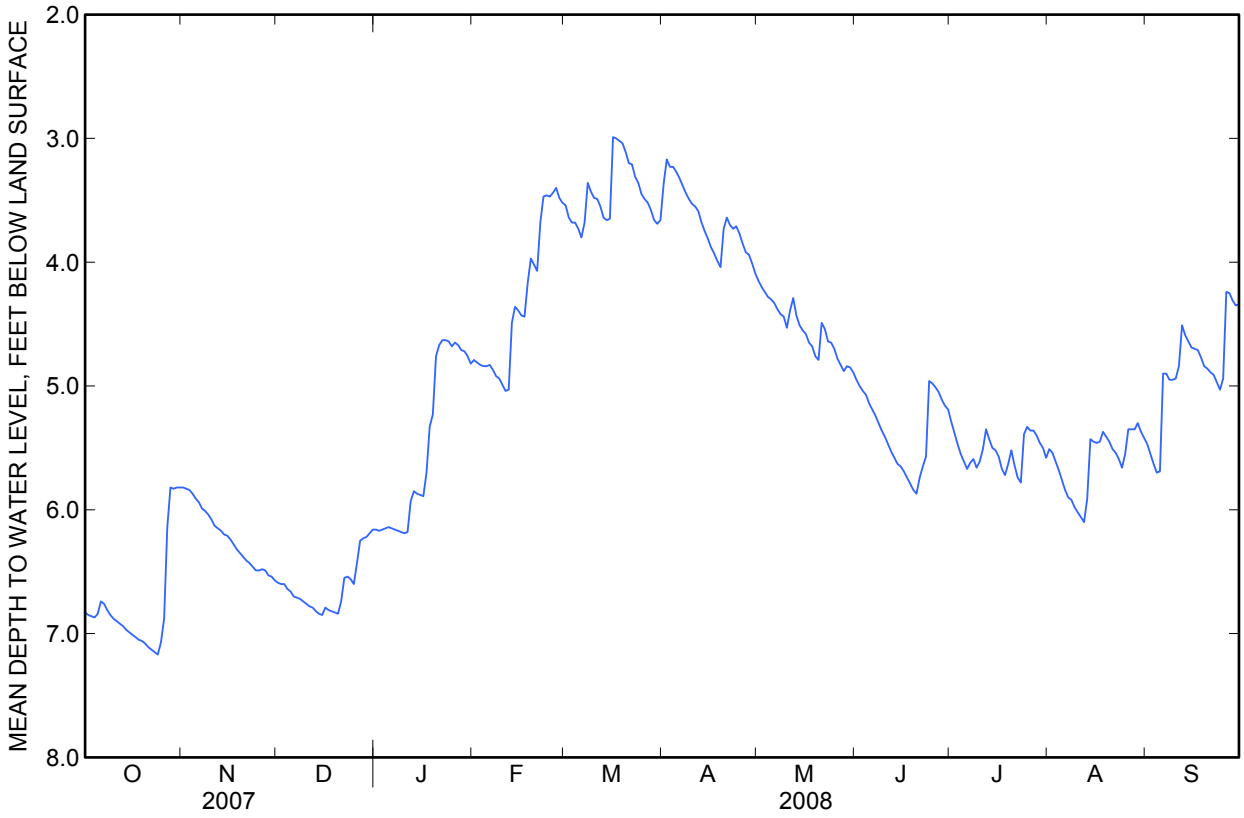
DEPTH TO WATER LEVEL, FEET BELOW LAND SURFACE
WATER YEAR OCTOBER 2007 TO SEPTEMBER 2008
DAILY MEAN VALUES

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	6.83	5.82	6.59	6.16	4.79	3.54	3.37	4.15	4.95	5.29	5.51	5.47
2	6.85	5.83	6.60	6.17	4.81	3.64	3.17	4.20	5.00	5.38	5.54	5.55
3	6.86	5.84	6.60	6.16	4.83	3.68	3.23	4.24	5.04	5.47	5.61	5.63
4	6.87	5.87	6.64	6.15	4.84	3.68	3.23	4.28	5.07	5.55	5.68	5.70
5	6.84	5.91	6.66	6.14	4.84	3.73	3.27	4.30	5.14	5.61	5.76	5.69
6	6.74	5.94	6.70	6.15	4.83	3.80	3.32	4.33	5.19	5.67	5.84	4.90
7	6.76	5.99	6.71	6.16	4.87	3.68	3.38	4.38	5.24	5.62	5.90	4.90
8	6.81	6.01	6.72	6.17	4.92	3.36	3.44	4.42	5.30	5.59	5.92	4.95
9	6.85	6.04	6.74	6.18	4.94	3.43	3.49	4.44	5.36	5.66	5.98	4.95
10	6.88	6.08	6.76	6.19	4.99	3.48	3.53	4.53	5.41	5.61	6.02	4.94
11	6.90	6.13	6.78	6.18	5.04	3.49	3.55	4.39	5.47	5.51	6.06	4.84
12	6.92	6.15	6.79	5.93	5.03	3.55	3.59	4.29	5.53	5.35	6.10	4.51
13	6.94	6.17	6.82	5.85	4.49	3.64	3.68	4.43	5.58	5.43	5.91	4.59
14	6.97	6.20	6.84	5.87	4.36	3.66	3.75	4.51	5.63	5.50	5.43	4.64
15	6.99	6.21	6.85	5.88	4.39	3.65	3.81	4.55	5.65	5.52	5.45	4.69
16	7.01	6.24	6.79	5.89	4.43	2.99	3.88	4.58	5.69	5.57	5.46	4.70
17	7.03	6.28	6.81	5.70	4.44	3.00	3.93	4.65	5.74	5.67	5.45	4.71
18	7.05	6.32	6.82	5.33	4.17	3.02	3.99	4.68	5.79	5.72	5.37	4.77
19	7.06	6.35	6.83	5.23	3.97	3.04	4.04	4.76	5.84	5.63	5.41	4.84
20	7.08	6.38	6.84	4.76	4.02	3.11	3.73	4.79	5.87	5.52	5.45	4.86
21	7.11	6.41	6.74	4.67	4.07	3.20	3.64	4.49	5.74	5.64	5.51	4.89
22	7.13	6.43	6.55	4.63	3.68	3.21	3.70	4.54	5.65	5.74	5.54	4.91
23	7.15	6.46	6.54	4.63	3.47	3.31	3.73	4.64	5.57	5.78	5.59	4.97
24	7.17	6.49	6.56	4.64	3.46	3.36	3.71	4.65	4.96	5.39	5.66	5.03
25	7.07	6.49	6.60	4.68	3.47	3.45	3.77	4.70	4.98	5.33	5.55	4.94
26	6.88	6.48	6.43	4.65	3.44	3.49	3.85	4.78	5.01	5.36	5.35	4.24
27	6.14	6.49	6.25	4.67	3.40	3.52	3.92	4.83	5.05	5.36	5.35	4.25
28	5.82	6.53	6.23	4.71	3.48	3.58	3.94	4.88	5.11	5.40	5.35	4.31
29	5.83	6.54	6.22	4.72	3.52	3.66	4.01	4.84	5.16	5.46	5.30	4.35
30	5.82	6.57	6.19	4.76	---	3.69	4.09	4.85	5.19	5.50	5.37	4.34
31	5.82	---	6.16	4.82	---	3.66	---	4.89	---	5.58	5.42	---
Mean	6.78	6.22	6.62	5.48	4.31	3.46	3.66	4.55	5.36	5.53	5.61	4.87
Max	7.17	6.57	6.85	6.19	5.04	3.80	4.09	4.89	5.87	5.78	6.10	5.70
Min	5.82	5.82	6.16	4.63	3.40	2.99	3.17	4.15	4.95	5.29	5.30	4.24

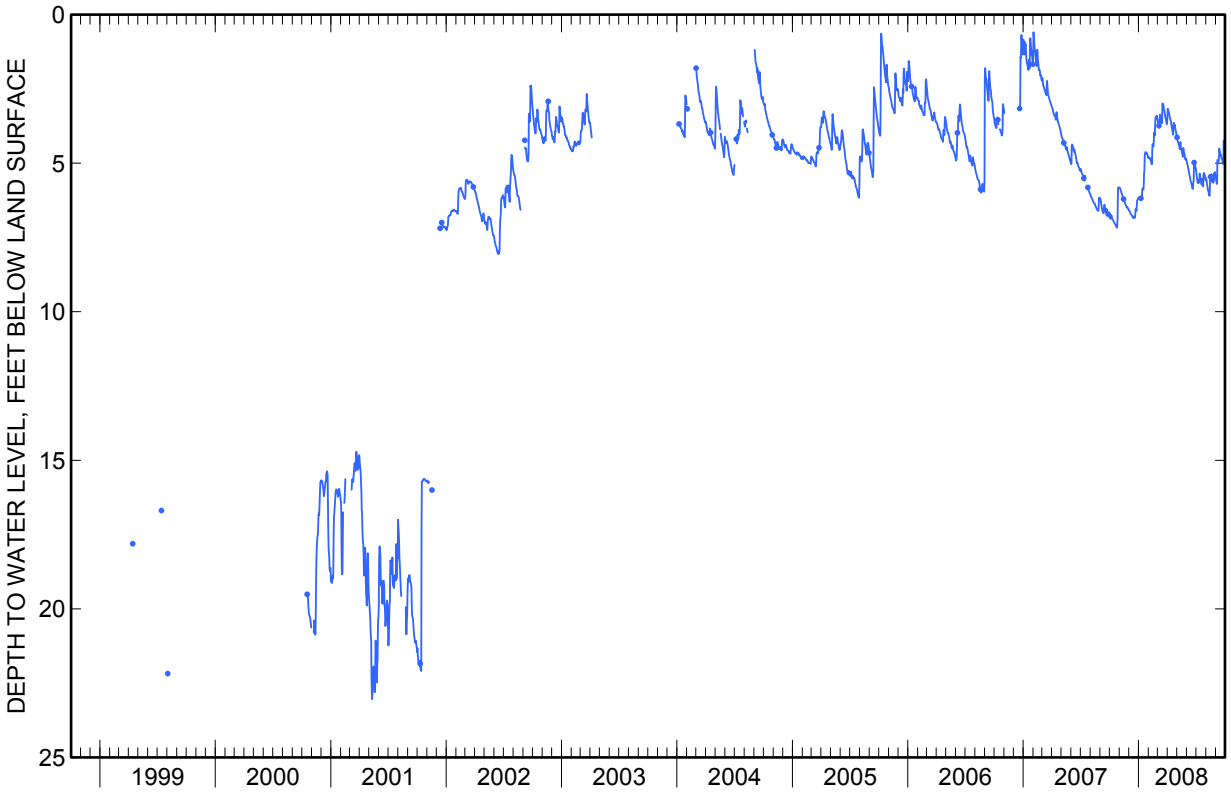
	Water Year 2008
Mean	5.21
High	2.99
Low	7.17

Water-Data Report 2008

335334078352106 Local number BR-123, NCDENR Calabash Research Station well HH39j7 near Calabash, NC (Surficial)—Continued



335334078352106 Local number BR-123, NCDENR Calabash Research Station well HH39j7 near Calabash, NC (Surficial)—Continued



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Water-Data Report 2008

340416078084202 Local number BR-078 (NC-180), NCDENR Bolivia Research Station well FF33d2, at Bolivia, NC

Northern Atlantic Coastal Plain aquifer system
Peedee Formation

Brunswick County, NC

LOCATION.--Lat 34°04′17″, long 78°08′41″ referenced to North American Datum of 1983, Brunswick County, NC, Hydrologic Unit 03040207, in Bolivia at town hall on U.S. Highway 17. Owner: NCDENR (North Carolina Department of Environment and Natural Resources).

GROUND-WATER RECORDS

WELL CHARACTERISTICS.--Drilled observation well, depth 140 ft, diameter 4 in., cased to 92 ft, open hole to 140 ft.

DATUM.--Land-surface datum is 40.97 ft above National Geodetic Vertical Datum of 1929. Measuring point: top of casing, 0.89 ft above land-surface datum, March 11, 1999 to present.

PERIOD OF RECORD.--April 1971 to current year. Continuous record May 1987 to September 1997, January 2000 to current year.

GAGE.--Water-level recorder collecting data at 60-minute intervals.

REMARKS.--Well is part of Brunswick County ground-water study.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 6.05 ft below land-surface datum, May 22, 1972; lowest water level recorded, 15.07 ft below land-surface datum, September 4, 1995.

Water-Data Report 2008

340416078084202 Local number BR-078 (NC-180), NCDENR Bolivia Research Station well FF33d2, at Bolivia, NC—Continued

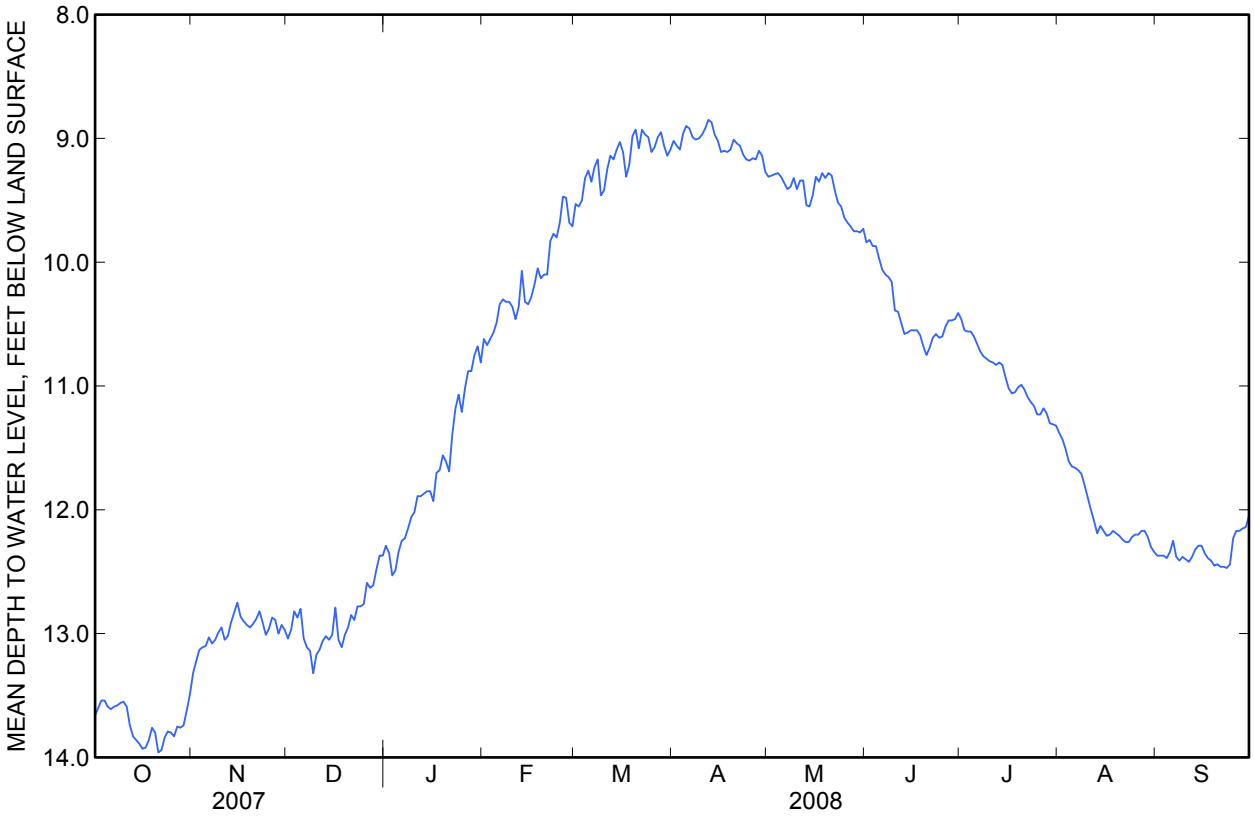
DEPTH TO WATER LEVEL, FEET BELOW LAND SURFACE
WATER YEAR OCTOBER 2007 TO SEPTEMBER 2008
DAILY MEAN VALUES

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	13.66	13.32	13.04	12.29	10.62	9.53	9.02	9.31	9.84	10.46	11.38	12.37
2	13.60	13.22	12.97	12.35	10.67	9.55	9.06	9.30	9.82	10.55	11.43	12.37
3	13.54	13.13	12.82	12.53	10.62	9.50	9.09	9.29	9.87	10.56	11.51	12.37
4	13.54	13.11	12.87	12.49	10.57	9.32	8.96	9.28	9.87	10.56	11.61	12.39
5	13.59	13.10	12.80	12.34	10.49	9.26	8.90	9.31	9.97	10.60	11.65	12.34
6	13.61	13.03	13.04	12.25	10.34	9.35	8.92	9.36	10.06	10.66	11.66	12.25
7	13.59	13.08	13.11	12.23	10.30	9.23	8.99	9.41	10.10	10.72	11.68	12.38
8	13.58	13.05	13.14	12.15	10.32	9.17	9.01	9.39	10.12	10.76	11.71	12.41
9	13.56	12.99	13.32	12.06	10.32	9.46	9.00	9.32	10.16	10.78	11.80	12.38
10	13.55	12.95	13.17	12.02	10.36	9.42	8.97	9.41	10.39	10.80	11.90	12.40
11	13.59	13.05	13.13	11.89	10.46	9.25	8.92	9.34	10.40	10.81	12.00	12.42
12	13.74	13.02	13.06	11.89	10.36	9.14	8.85	9.34	10.49	10.83	12.09	12.38
13	13.83	12.91	13.02	11.87	10.07	9.17	8.87	9.54	10.58	10.81	12.19	12.32
14	13.86	12.83	13.05	11.85	10.32	9.09	8.97	9.55	10.57	10.83	12.13	12.29
15	13.89	12.75	13.01	11.85	10.34	9.03	9.02	9.46	10.55	10.93	12.17	12.29
16	13.93	12.86	12.79	11.93	10.28	9.11	9.11	9.31	10.55	11.02	12.21	12.35
17	13.92	12.90	13.05	11.70	10.18	9.31	9.10	9.35	10.55	11.06	12.20	12.39
18	13.86	12.93	13.11	11.68	10.05	9.21	9.11	9.28	10.59	11.05	12.17	12.41
19	13.76	12.95	13.01	11.56	10.13	8.98	9.09	9.32	10.68	11.01	12.19	12.45
20	13.80	12.92	12.95	11.61	10.10	8.93	9.01	9.28	10.75	10.99	12.21	12.44
21	13.96	12.88	12.85	11.69	10.10	9.08	9.04	9.30	10.69	11.03	12.24	12.46
22	13.94	12.82	12.89	11.39	9.83	8.93	9.06	9.42	10.61	11.09	12.26	12.46
23	13.84	12.91	12.78	11.18	9.77	8.97	9.13	9.52	10.58	11.13	12.26	12.47
24	13.79	13.01	12.78	11.07	9.80	8.99	9.17	9.55	10.61	11.16	12.22	12.44
25	13.80	12.96	12.76	11.21	9.68	9.11	9.18	9.64	10.60	11.23	12.20	12.23
26	13.83	12.87	12.59	11.02	9.47	9.07	9.16	9.68	10.52	11.23	12.20	12.17
27	13.75	12.89	12.63	10.88	9.48	8.99	9.17	9.71	10.47	11.18	12.17	12.17
28	13.76	13.00	12.61	10.88	9.68	8.95	9.10	9.75	10.47	11.22	12.17	12.15
29	13.74	12.93	12.48	10.75	9.71	9.06	9.14	9.75	10.46	11.30	12.22	12.14
30	13.62	12.97	12.37	10.68	---	9.14	9.27	9.76	10.41	11.31	12.30	12.05
31	13.49	---	12.37	10.81	---	9.09	---	9.73	---	11.32	12.34	---
Mean	13.73	12.98	12.89	11.68	10.15	9.17	9.05	9.45	10.38	10.94	12.02	12.34
Max	13.96	13.32	13.32	12.53	10.67	9.55	9.27	9.76	10.75	11.32	12.34	12.47
Min	13.49	12.75	12.37	10.68	9.47	8.93	8.85	9.28	9.82	10.46	11.38	12.05

	Water Year 2008
Mean	11.24
High	8.85
Low	13.96

Water-Data Report 2008

340416078084202 Local number BR-078 (NC-180), NCDENR Bolivia Research Station well FF33d2, at Bolivia, NC—Continued



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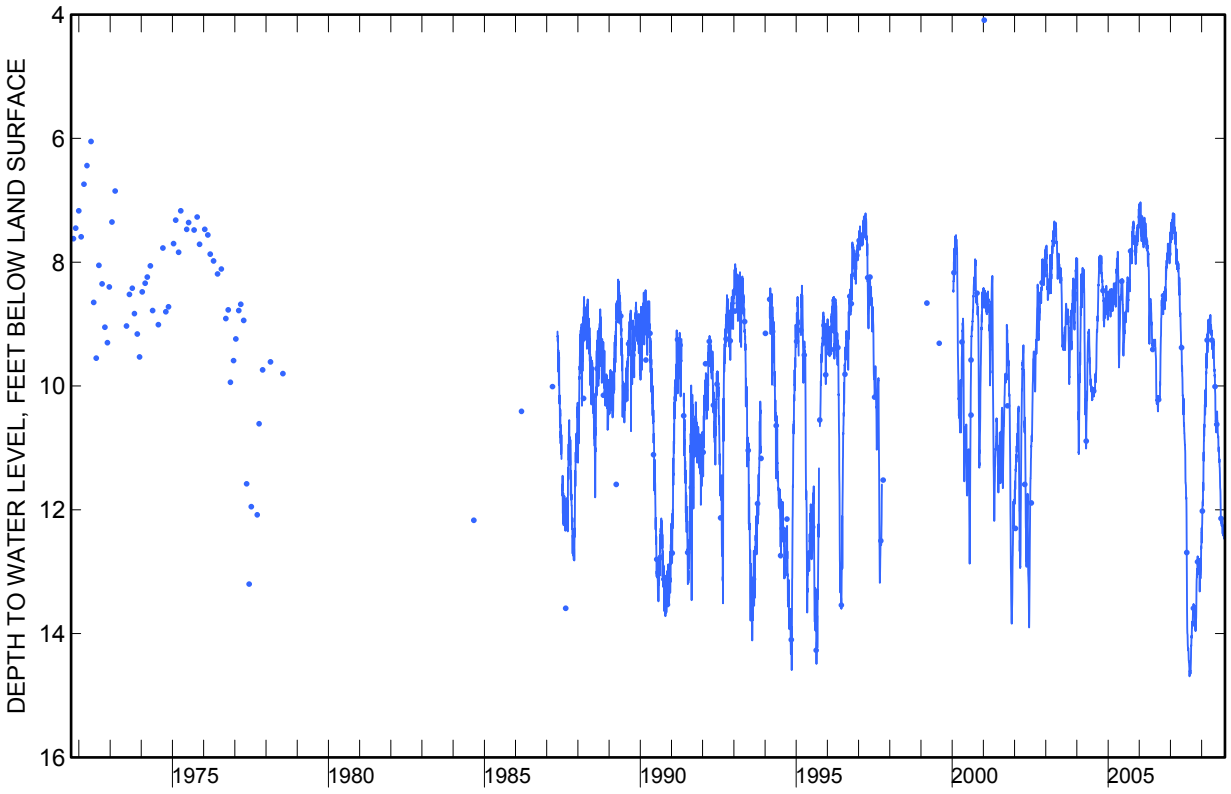

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Water-Data Report 2008

335629078115406 Local number BR-079 (NC-181), NCDENR Sunset Harbor Research Station well GG34s6, near Sunset Harbor, NC (Peedee)

Northern Atlantic Coastal Plain aquifer system
Peedee Formation

Brunswick County, NC

LOCATION.--Lat 33°56′29″, long 78°11′56″ referenced to North American Datum of 1983, Brunswick County, NC, Hydrologic Unit 03040207, 1 mi north of Sunset Harbor, and 4.3 mi south of North Carolina Highway 211 on Secondary Road 1112. Owner: NCDENR (North Carolina Department of Environment and Natural Resources).

GROUND-WATER RECORDS

WELL CHARACTERISTICS.--Drilled observation well, depth 102 ft, diameter 6 in., cased to 84 ft, open hole from 84 to 102 ft.

DATUM.--Land-surface datum is 28.06 ft above National Geodetic Vertical Datum of 1929. Measuring point: top of instrument shelf, 2.02 ft above land-surface datum, January 14, 1987 to present.

PERIOD OF RECORD.--March 1987 to current year.

GAGE.--Water-level recorder collecting data at 60-minute intervals. Satellite telemetry at station.

REMARKS.--Well is part of Brunswick County ground-water study. Water levels are affected by local pumping.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 4.24 ft below land-surface datum, October 22, 1999; lowest water level recorded, 17.28 ft below land-surface datum, September 5, 2008.

Water-Data Report 2008

335629078115406 Local number BR-079 (NC-181), NCDENR Sunset Harbor Research Station well GG34s6, near Sunset Harbor, NC (Peedee)—Continued

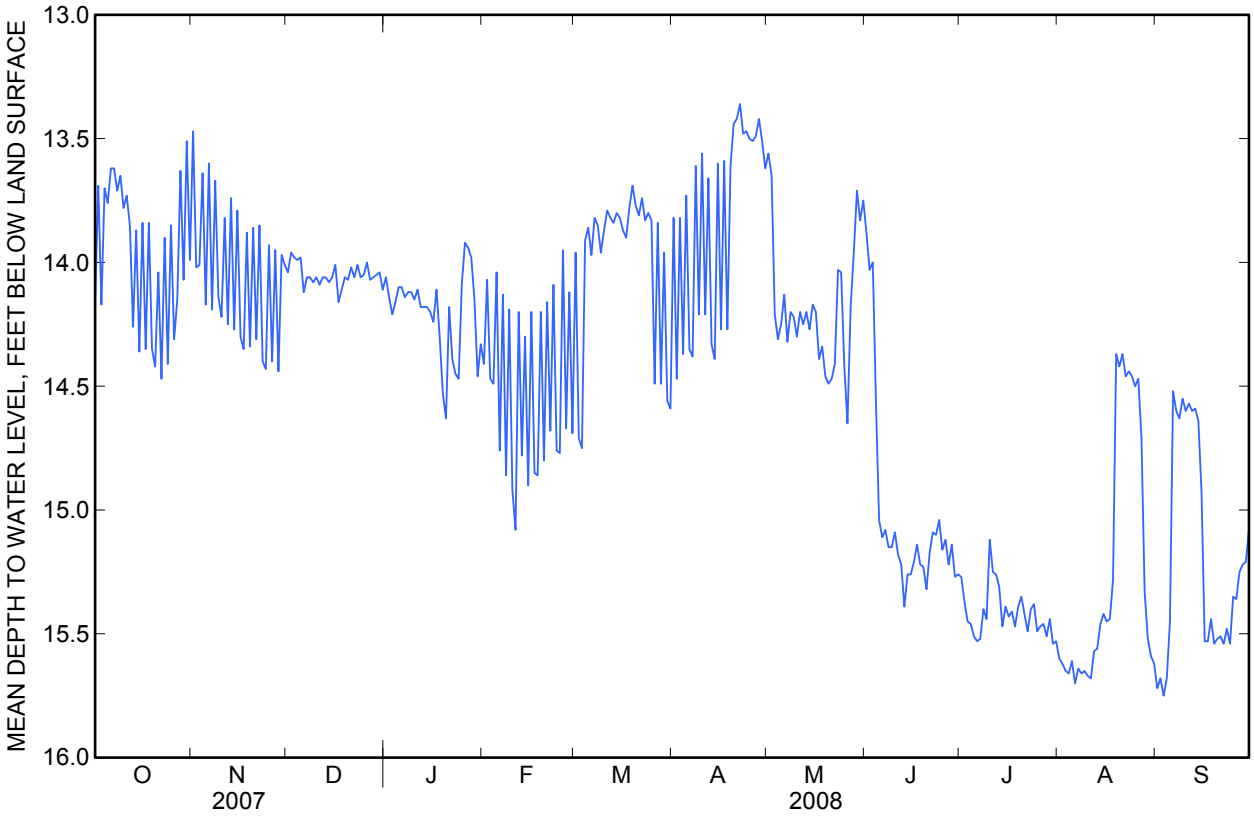
DEPTH TO WATER LEVEL, FEET BELOW LAND SURFACE
WATER YEAR OCTOBER 2007 TO SEPTEMBER 2008
DAILY MEAN VALUES

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	14.15	13.47	14.04	14.06	14.41	13.96	13.82	13.56	13.88	15.27	15.60	15.72
2	13.69	14.02	13.96	14.14	14.07	14.71	14.47	13.65	14.03	15.37	15.62	15.68
3	14.17	14.01	13.98	14.21	14.47	14.75	13.82	14.21	14.00	15.45	15.65	15.75
4	13.70	13.64	13.99	14.16	14.49	13.91	14.37	14.31	14.56	15.46	15.66	15.68
5	13.76	14.17	13.98	14.10	14.04	13.86	13.73	14.25	15.04	15.51	15.61	15.45
6	13.62	13.60	14.12	14.10	14.76	13.97	14.35	14.13	15.11	15.53	15.70	14.52
7	13.62	14.19	14.06	14.14	14.13	13.82	14.38	14.32	15.08	15.52	15.64	14.60
8	13.71	13.67	14.06	14.12	14.86	13.85	13.61	14.20	15.15	15.40	15.66	14.63
9	13.65	14.14	14.08	14.12	14.19	13.96	14.21	14.22	15.15	15.44	15.65	14.55
10	13.78	14.22	14.06	14.15	14.92	13.87	13.56	14.30	15.09	15.12	15.67	14.60
11	13.73	13.82	14.09	14.11	15.08	13.79	14.21	14.20	15.18	15.25	15.68	14.57
12	13.85	14.25	14.06	14.18	14.20	13.82	13.66	14.25	15.22	15.26	15.57	14.60
13	14.26	13.74	14.06	14.18	14.78	13.84	14.33	14.20	15.39	15.31	15.56	14.59
14	13.87	14.27	14.08	14.18	14.30	13.80	14.39	14.27	15.26	15.47	15.46	14.64
15	14.36	13.79	14.06	14.20	14.90	13.82	13.60	14.17	15.26	15.39	15.42	14.93
16	13.84	14.30	14.01	14.24	14.20	13.87	14.27	14.20	15.21	15.43	15.45	15.53
17	14.35	14.35	14.16	14.11	14.85	13.90	13.59	14.39	15.14	15.41	15.44	15.53
18	13.84	13.88	14.11	14.30	14.86	13.78	14.27	14.34	15.22	15.47	15.28	15.44
19	14.35	14.34	14.06	14.53	14.20	13.69	13.61	14.46	15.23	15.39	14.37	15.54
20	14.42	13.86	14.07	14.63	14.80	13.77	13.44	14.49	15.32	15.35	14.42	15.52
21	14.04	14.31	14.02	14.18	14.16	13.81	13.42	14.47	15.17	15.42	14.37	15.51
22	14.47	13.85	14.06	14.39	14.68	13.74	13.36	14.41	15.09	15.49	14.46	15.54
23	13.90	14.40	14.01	14.45	14.09	13.83	13.48	14.03	15.10	15.40	14.44	15.48
24	14.41	14.43	14.06	14.47	14.76	13.80	13.47	14.04	15.04	15.38	14.46	15.54
25	13.85	13.93	14.05	14.09	14.77	13.83	13.50	14.42	15.16	15.49	14.50	15.35
26	14.31	14.40	14.00	13.92	13.95	14.49	13.51	14.65	15.12	15.47	14.47	15.36
27	14.15	13.95	14.07	13.94	14.67	13.84	13.49	14.18	15.22	15.46	14.71	15.25
28	13.63	14.44	14.06	13.98	14.12	14.49	13.42	13.96	15.14	15.51	15.33	15.22
29	14.07	13.97	14.05	14.15	14.69	13.96	13.51	13.71	15.27	15.44	15.52	15.21
30	13.51	14.01	14.04	14.46	---	14.56	13.62	13.83	15.26	15.54	15.59	15.08
31	13.99	---	14.11	14.33	---	14.59	---	13.75	---	15.53	15.62	---
Mean	13.97	14.05	14.05	14.20	14.50	13.99	13.82	14.18	15.04	15.42	15.24	15.19
Max	14.47	14.44	14.16	14.63	15.08	14.75	14.47	14.65	15.39	15.54	15.70	15.75
Min	13.51	13.47	13.96	13.92	13.95	13.69	13.36	13.56	13.88	15.12	14.37	14.52

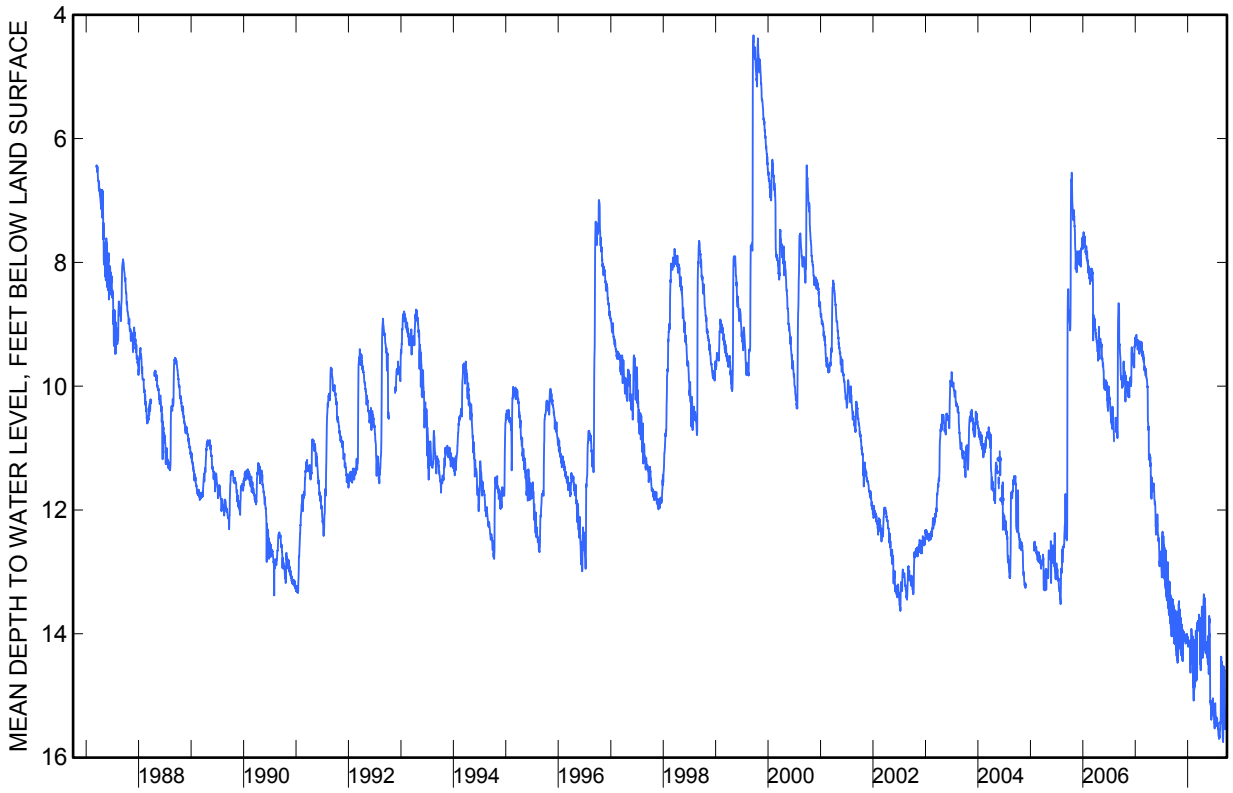
	Water Year 2008
Mean	14.47
High	13.36
Low	15.75

Water-Data Report 2008

335629078115406 Local number BR-079 (NC-181), NCDENR Sunset Harbor Research Station well GG34s6, near Sunset Harbor, NC (Peedee)—Continued



335629078115406 Local number BR-079 (NC-181), NCDENR Sunset Harbor Research Station well GG34s6, near Sunset Harbor, NC (Peedee)—Continued



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Water-Data Report 2008

335629078115407 Local number BR-080 (NC-182), NCDENR Sunset Harbor Research Station well GG34s7, near Sunset Harbor, NC (Surficial)

Surficial aquifer system
Post Miocene (Quaternary + Pliocene) Rocks

Brunswick County, NC

LOCATION.--Lat 33°56′29″, long 78°11′56″ referenced to North American Datum of 1983, Brunswick County, NC, Hydrologic Unit 03040207, 1 mi north of Sunset Harbor, and 4.3 mi south of North Carolina Highway 211 on Secondary Road 1112. Owner: NCDENR (North Carolina Department of Environment and Natural Resources).

GROUND-WATER RECORDS

WELL CHARACTERISTICS.--Drilled observation well, drilled to 15 ft, diameter 4 in., cased to 10 ft, screened interval from 10 to 15 ft.

DATUM.--Land-surface datum is 28.06 ft above National Geodetic Vertical Datum of 1929. Measuring point: top of collar on casing, 2.65 ft above land-surface datum, August 19, 1986 to present.

PERIOD OF RECORD.--January 1987 to September 1997, October 2000 to current year.

GAGE.--Water-level recorder collecting data at 60-minute intervals. Satellite telemetry at station.

REMARKS.--Well is part of Brunswick County ground-water study. Water levels may be affected by local pumping.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 0.63 ft above land-surface datum, October 8, 2005; lowest water level recorded, 14.27 ft below land-surface datum, October 31, 2003.

Water-Data Report 2008

335629078115407 Local number BR-080 (NC-182), NCDENR Sunset Harbor Research Station well GG34s7, near Sunset Harbor, NC (Surficial)—Continued

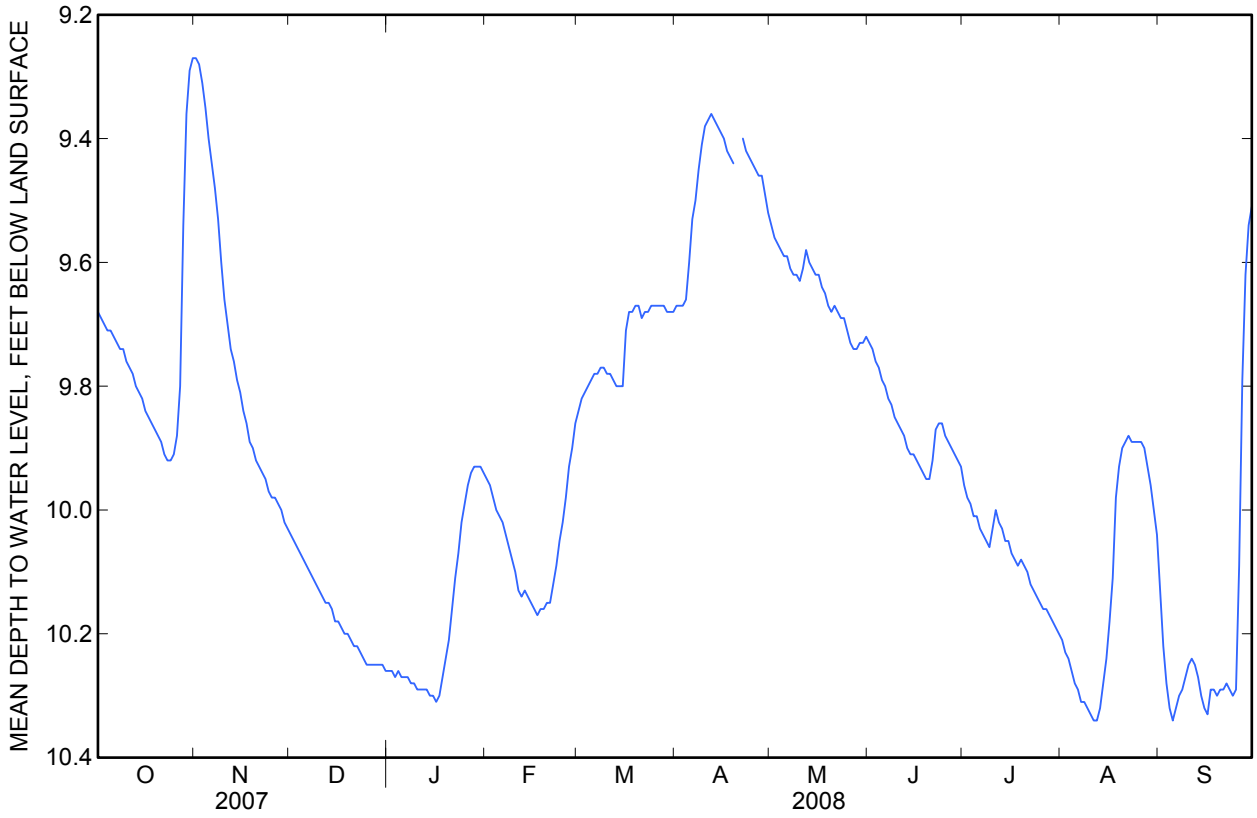
DEPTH TO WATER LEVEL, FEET BELOW LAND SURFACE
WATER YEAR OCTOBER 2007 TO SEPTEMBER 2008
DAILY MEAN VALUES

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	9.68	9.27	10.04	10.26	9.95	9.84	9.67	9.54	9.73	9.96	10.21	10.13
2	9.69	9.28	10.05	10.26	9.96	9.82	9.67	9.56	9.74	9.98	10.23	10.22
3	9.70	9.31	10.06	10.27	9.98	9.81	9.67	9.57	9.76	9.99	10.24	10.28
4	9.71	9.35	10.07	10.26	10.0	9.80	9.66	9.58	9.77	10.01	10.26	10.32
5	9.71	9.40	10.08	10.27	10.01	9.79	9.60	9.59	9.79	10.01	10.28	10.34
6	9.72	9.44	10.09	10.27	10.02	9.78	9.53	9.59	9.80	10.03	10.29	10.32
7	9.73	9.48	10.10	10.27	10.04	9.78	9.50	9.61	9.82	10.04	10.31	10.30
8	9.74	9.53	10.11	10.28	10.06	9.77	9.45	9.62	9.83	10.05	10.31	10.29
9	9.74	9.60	10.12	10.28	10.08	9.77	9.41	9.62	9.85	10.06	10.32	10.27
10	9.76	9.66	10.13	10.29	10.10	9.78	9.38	9.63	9.86	10.03	10.33	10.25
11	9.77	9.70	10.14	10.29	10.13	9.78	9.37	9.61	9.87	10.00	10.34	10.24
12	9.78	9.74	10.15	10.29	10.14	9.79	9.36	9.58	9.88	10.02	10.34	10.25
13	9.80	9.76	10.15	10.29	10.13	9.80	9.37	9.60	9.90	10.03	10.32	10.27
14	9.81	9.79	10.16	10.30	10.14	9.80	9.38	9.61	9.91	10.05	10.28	10.30
15	9.82	9.81	10.18	10.30	10.15	9.80	9.39	9.62	9.91	10.05	10.24	10.32
16	9.84	9.84	10.18	10.31	10.16	9.71	9.40	9.62	9.92	10.07	10.18	10.33
17	9.85	9.86	10.19	10.30	10.17	9.68	9.42	9.64	9.93	10.08	10.11	10.29
18	9.86	9.89	10.20	10.27	10.16	9.68	9.43	9.65	9.94	10.09	9.98	10.29
19	9.87	9.90	10.20	10.24	10.16	9.67	9.44	9.67	9.95	10.08	9.93	10.30
20	9.88	9.92	10.21	10.21	10.15	9.67	---	9.68	9.95	10.09	9.90	10.29
21	9.89	9.93	10.22	10.16	10.15	9.69	---	9.67	9.92	10.10	9.89	10.29
22	9.91	9.94	10.22	10.11	10.12	9.68	9.40	9.68	9.87	10.12	9.88	10.28
23	9.92	9.95	10.23	10.07	10.09	9.68	9.42	9.69	9.86	10.13	9.89	10.29
24	9.92	9.97	10.24	10.02	10.05	9.67	9.43	9.69	9.86	10.14	9.89	10.30
25	9.91	9.98	10.25	9.99	10.02	9.67	9.44	9.71	9.88	10.15	9.89	10.29
26	9.88	9.98	10.25	9.96	9.98	9.67	9.45	9.73	9.89	10.16	9.89	10.09
27	9.80	9.99	10.25	9.94	9.93	9.67	9.46	9.74	9.90	10.16	9.90	9.79
28	9.54	10.00	10.25	9.93	9.90	9.67	9.46	9.74	9.91	10.17	9.93	9.62
29	9.36	10.02	10.25	9.93	9.86	9.68	9.49	9.73	9.92	10.18	9.96	9.54
30	9.29	10.03	10.25	9.93	---	9.68	9.52	9.73	9.93	10.19	10.0	9.51
31	9.27	---	10.26	9.94	---	9.68	---	9.72	---	10.20	10.04	---
Mean	9.75	9.74	10.17	10.18	10.06	9.73	9.47	9.65	9.87	10.08	10.11	10.19
Max	9.92	10.03	10.26	10.31	10.17	9.84	9.67	9.74	9.95	10.20	10.34	10.34
Min	9.27	9.27	10.04	9.93	9.86	9.67	9.36	9.54	9.73	9.96	9.88	9.51

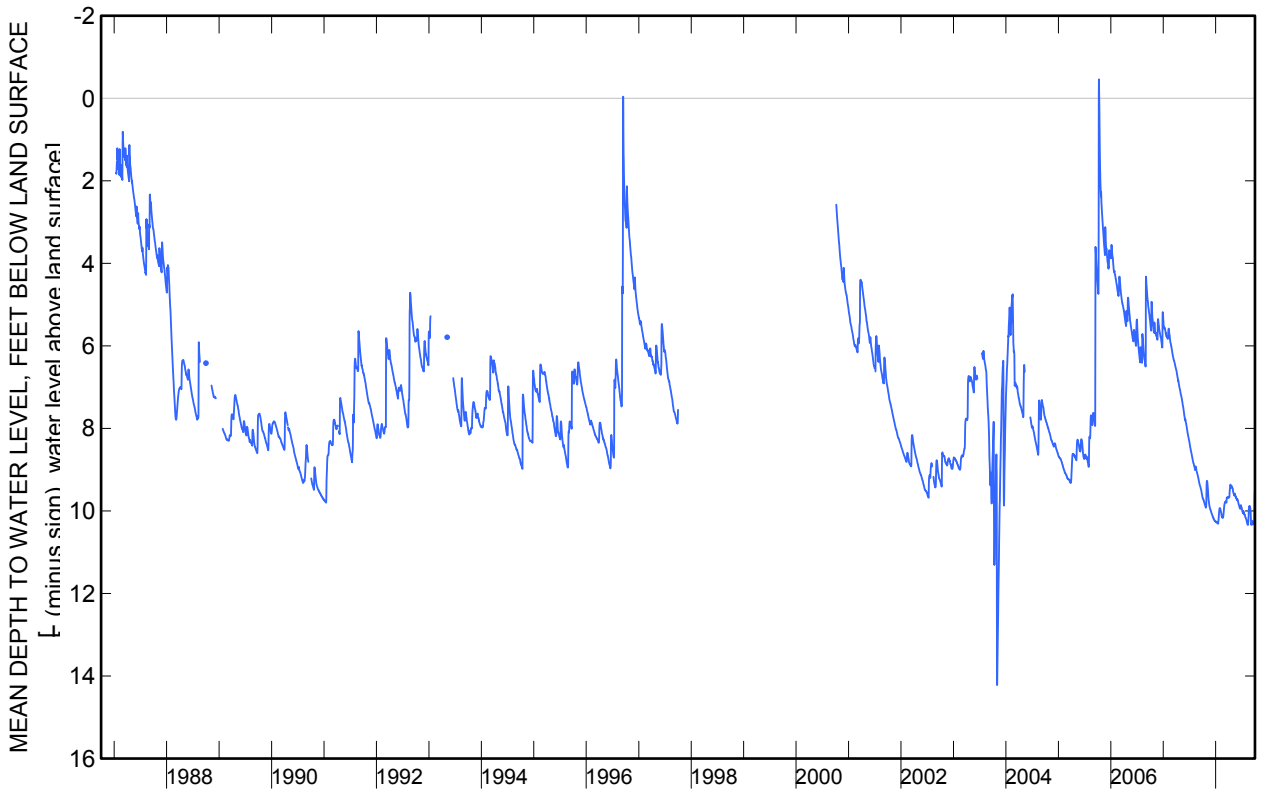
	Water Year 2008
Mean	9.92
High	9.27
Low	10.34

Water-Data Report 2008

335629078115407 Local number BR-080 (NC-182), NCDENR Sunset Harbor Research Station well GG34s7, near Sunset Harbor, NC (Surficial)—Continued



335629078115407 Local number BR-080 (NC-182), NCDENR Sunset Harbor Research Station well GG34s7, near Sunset Harbor, NC (Surficial)—Continued



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Water-Data Report 2008

335631078003604 Local number BR-081 (NC-197), NCDENR Southport Research Station well GG32t4, near Southport, NC (Peedee)

Northern Atlantic Coastal Plain aquifer system
Peedee Formation

Brunswick County, NC

LOCATION.--Lat 33°56′31″, long 78°00′35″ referenced to North American Datum of 1983, Brunswick County, NC, Hydrologic Unit 03030005, north of Southport, 0.45 mi northeast of Secondary Road 1526 on Secondary Road 1527. Owner: NCDENR (North Carolina Department of Environment and Natural Resources).

GROUND-WATER RECORDS

WELL CHARACTERISTICS.--Drilled observation well, depth 200 ft, diameter 6 in., cased to 93.5 ft, open hole from 93.5 to 200 ft; measured depth 199 ft, September 1997.

DATUM.--Land-surface datum is 28.08 ft above National Geodetic Vertical Datum of 1929. Measuring point: top of instrument shelf, 1.17 ft above land-surface datum, October 29, 1999, to present.

PERIOD OF RECORD.--January 1970 to current year. Continuous record began October 1999.

REVISED RECORDS.--WDR NC-04-2: 2002 (daily water levels).

GAGE.--Water-level recorder collecting data at 15-minute intervals. Satellite telemetry at station.

REMARKS.--Well is part of the Brunswick County ground-water study. Water levels affected by local pumping since December 2002.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 21.28 ft below land-surface datum, March 8, 1988; lowest water level recorded, 58.39 ft below land-surface datum, January 28, 2005.

Water-Data Report 2008

335631078003604 Local number BR-081 (NC-197), NCDENR Southport Research Station well GG32t4, near Southport, NC (Peedee)—Continued

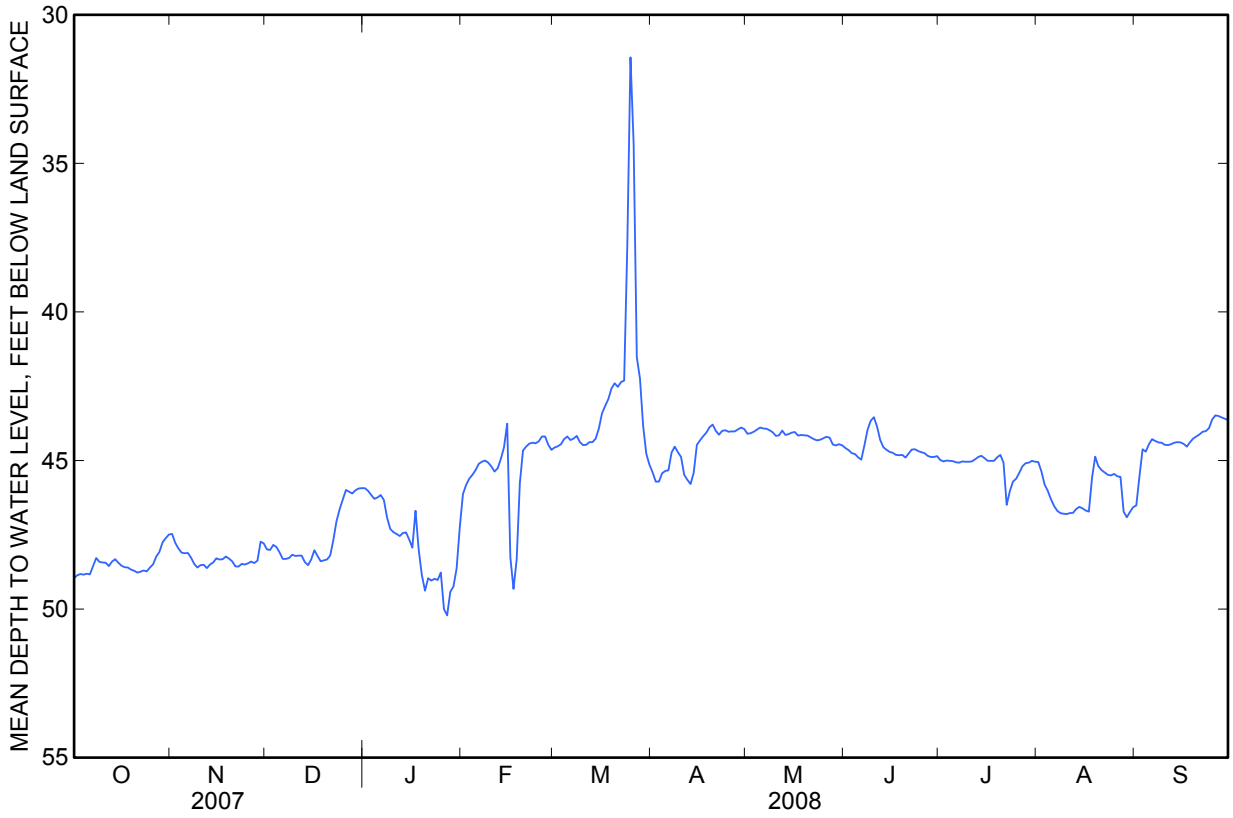
DEPTH TO WATER LEVEL, FEET BELOW LAND SURFACE
WATER YEAR OCTOBER 2007 TO SEPTEMBER 2008
DAILY MEAN VALUES

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	48.96	47.47	47.99	45.93	46.13	44.56	45.40	44.10	44.58	44.98	45.05	46.51
2	48.86	47.77	48.01	46.02	45.82	44.52	45.71	44.08	44.65	45.03	45.37	45.53
3	48.82	47.96	47.84	46.16	45.61	44.45	45.71	44.03	44.75	45.00	45.81	44.62
4	48.84	48.10	47.91	46.29	45.48	44.28	45.43	43.96	44.78	45.01	46.02	44.70
5	48.81	48.12	48.09	46.24	45.32	44.19	45.35	43.89	44.89	45.02	46.30	44.45
6	48.83	48.11	48.31	46.16	45.11	44.31	45.33	43.92	44.97	45.06	46.53	44.28
7	48.55	48.27	48.31	46.33	45.04	44.26	44.73	43.93	44.49	45.07	46.69	44.34
8	48.28	48.48	48.28	46.92	45.00	44.17	44.53	43.98	43.96	45.03	46.77	44.39
9	48.41	48.60	48.17	47.30	45.07	44.38	44.72	44.05	43.66	45.04	46.79	44.40
10	48.43	48.52	48.21	47.41	45.20	44.48	44.88	44.17	43.54	45.04	46.80	44.47
11	48.44	48.51	48.20	47.47	45.37	44.47	45.48	44.15	43.86	45.03	46.77	44.48
12	48.55	48.62	48.20	47.54	45.26	44.38	45.65	43.99	44.31	44.96	46.76	44.45
13	48.40	48.50	48.42	47.44	44.94	44.38	45.79	44.14	44.55	44.88	46.63	44.40
14	48.32	48.43	48.52	47.42	44.55	44.26	45.41	44.11	44.64	44.84	46.56	44.38
15	48.44	48.29	48.33	47.66	43.76	43.92	44.47	44.06	44.71	44.92	46.61	44.39
16	48.54	48.33	48.02	47.93	48.26	43.41	44.32	44.04	44.74	45.01	46.68	44.44
17	48.59	48.32	48.21	46.69	49.32	43.16	44.18	44.16	44.81	45.01	46.72	44.53
18	48.60	48.23	48.39	48.00	48.33	42.93	44.06	44.14	44.82	45.01	45.58	44.38
19	48.67	48.30	48.36	48.85	45.76	42.57	43.88	44.15	44.81	44.89	44.87	44.26
20	48.71	48.39	48.33	49.38	44.66	42.40	43.79	44.16	44.90	44.81	45.19	44.19
21	48.77	48.56	48.20	48.96	44.53	42.52	44.00	44.22	44.76	45.07	45.32	44.12
22	48.74	48.57	47.68	49.04	44.43	42.36	44.13	44.28	44.63	46.49	45.40	44.03
23	48.70	48.48	47.04	48.98	44.40	42.31	44.00	44.32	44.62	46.03	45.48	44.01
24	48.73	48.50	46.64	49.02	44.42	37.73	43.98	44.30	44.68	45.71	45.50	43.91
25	48.60	48.46	46.31	48.77	44.35	31.43	44.03	44.25	44.72	45.61	45.45	43.62
26	48.49	48.40	45.99	50.00	44.19	34.34	44.02	44.20	44.75	45.41	45.53	43.48
27	48.23	48.45	46.05	50.21	44.19	41.52	44.02	44.23	44.84	45.19	45.55	43.50
28	48.07	48.37	46.11	49.42	44.47	42.24	43.95	44.46	44.88	45.09	46.72	43.55
29	47.75	47.73	46.00	49.24	44.64	43.83	43.89	44.49	44.88	45.07	46.91	43.59
30	47.61	47.79	45.94	48.63	---	44.77	43.94	44.45	44.85	45.01	46.73	43.64
31	47.49	---	45.93	47.25	---	45.14	---	44.49	---	45.04	46.57	---
Mean	48.49	48.29	47.61	47.83	45.30	42.83	44.63	44.16	44.60	45.14	46.12	44.30
Max	48.96	48.62	48.52	50.21	49.32	45.14	45.79	44.49	44.97	46.49	46.91	46.51
Min	47.49	47.47	45.93	45.93	43.76	31.43	43.79	43.89	43.54	44.81	44.87	43.48

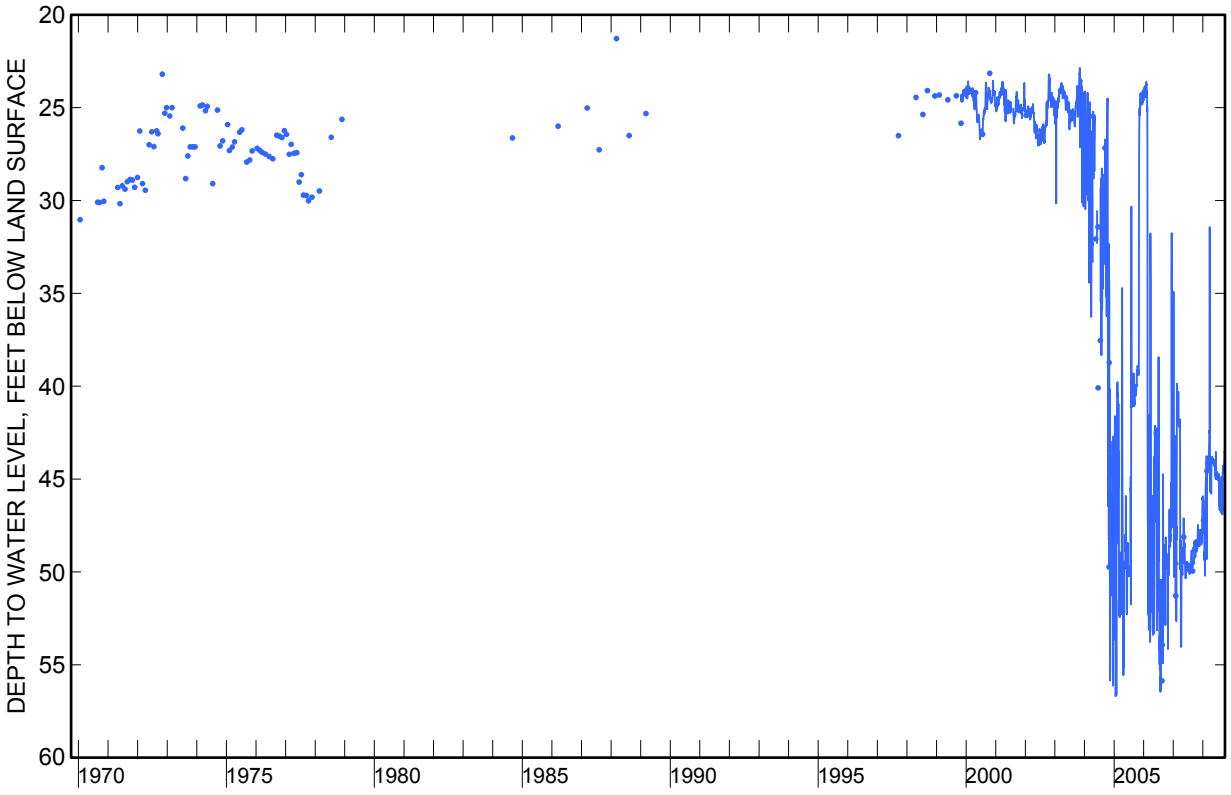
	Water Year 2008
Mean	45.78
High	31.43
Low	50.21

Water-Data Report 2008

335631078003604 Local number BR-081 (NC-197), NCDENR Southport Research Station well GG32t4, near Southport, NC (Peedee)—Continued



335631078003604 Local number BR-081 (NC-197), NCDENR Southport Research Station well GG32t4, near Southport, NC (Peedee)—Continued



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Water-Data Report 2008

335631078003605 Local number BR-082 (NC-198), NCDENR Southport Research Station well GG32t5, near Southport, NC (Castle Hayne)

Northern Atlantic Coastal Plain aquifer system
Castle Hayne Formation

Brunswick County, NC

LOCATION.--Lat 33°56′31″, long 78°00′35″ referenced to North American Datum of 1983, Brunswick County, NC, Hydrologic Unit 03030005, north of Southport, 0.45 miles northeast of Secondary Road 1526 on Secondary Road 1527. Owner: NCDENR (North Carolina Department of Environment and Natural Resources).

GROUND-WATER RECORDS

WELL CHARACTERISTICS.--Drilled observation well, depth 74 ft, diameter 4 in., cased to 64 ft, screened from 64 to 74 ft.

DATUM.--Land-surface datum is 28.26 ft above National Geodetic Vertical Datum of 1929. Measuring point: top of instrument shelf, 2.20 ft above land-surface datum, October 29, 1999 to present.

PERIOD OF RECORD.--January 1970 to current year. Continuous record began November 1999.

GAGE.--Water-level recorder collecting data at 15-minute intervals. Satellite telemetry at site.

REMARKS.--Well is part of the Brunswick County ground-water study. Water levels are affected by local pumping.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 20.68 ft below land-surface datum, November 11, 1999; lowest water level recorded, 33.35 ft below land-surface datum, February 6, 2007.

Water-Data Report 2008

335631078003605 Local number BR-082 (NC-198), NCDENR Southport Research Station well GG32t5, near Southport, NC (Castle Hayne)—Continued

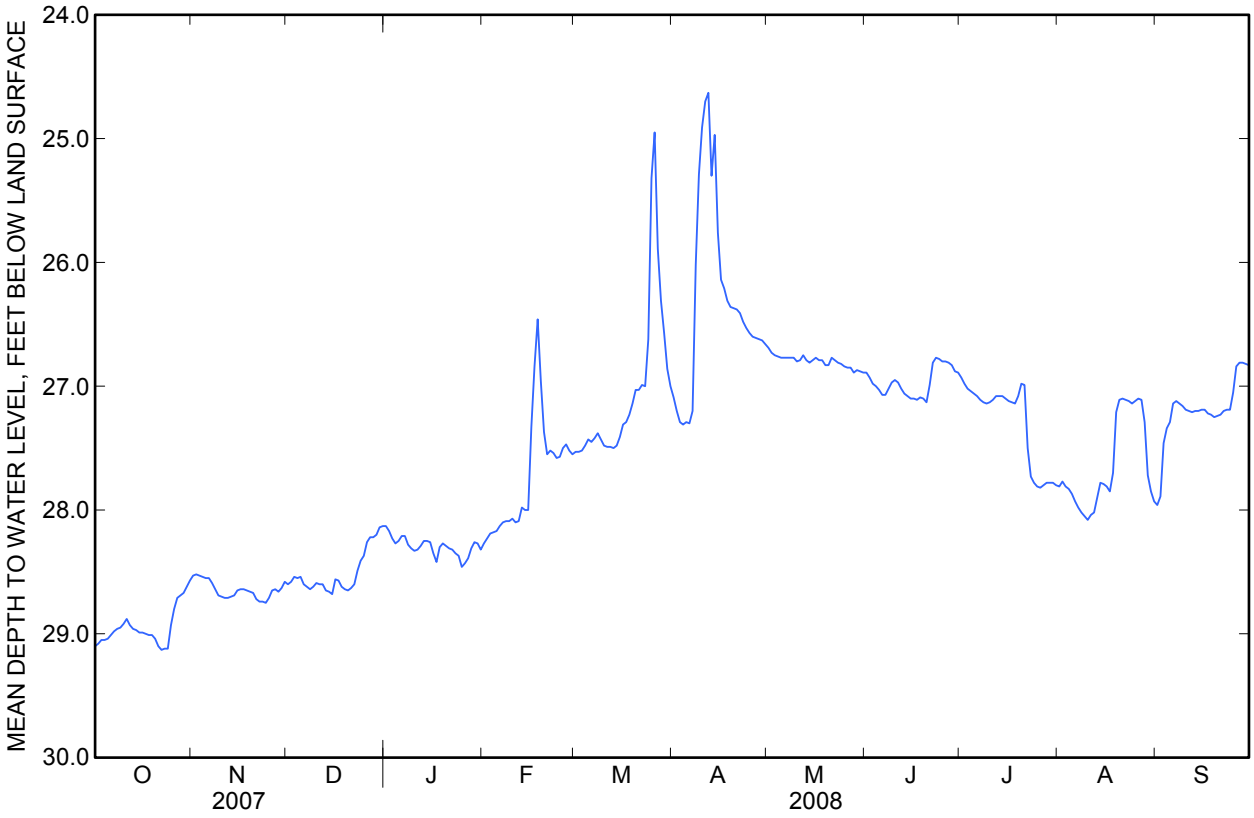
DEPTH TO WATER LEVEL, FEET BELOW LAND SURFACE
WATER YEAR OCTOBER 2007 TO SEPTEMBER 2008
DAILY MEAN VALUES

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	29.10	28.53	28.60	28.13	28.27	27.53	27.09	26.69	26.89	26.93	27.81	27.96
2	29.08	28.52	28.58	28.17	28.23	27.53	27.20	26.73	26.93	26.98	27.77	27.89
3	29.05	28.53	28.54	28.23	28.19	27.52	27.29	26.75	26.98	27.02	27.81	27.46
4	29.05	28.54	28.55	28.27	28.18	27.48	27.31	26.76	27.00	27.04	27.83	27.34
5	29.04	28.55	28.54	28.25	28.17	27.43	27.29	26.77	27.03	27.06	27.87	27.29
6	29.01	28.55	28.60	28.21	28.13	27.45	27.30	26.77	27.07	27.08	27.93	27.14
7	28.98	28.59	28.62	28.21	28.10	27.42	27.20	26.77	27.07	27.11	27.98	27.12
8	28.96	28.64	28.64	28.28	28.09	27.38	26.02	26.77	27.02	27.13	28.02	27.14
9	28.95	28.69	28.62	28.31	28.09	27.43	25.29	26.77	26.97	27.14	28.05	27.16
10	28.92	28.70	28.59	28.33	28.07	27.48	24.91	26.80	26.95	27.13	28.08	27.19
11	28.88	28.71	28.60	28.32	28.10	27.49	24.70	26.79	26.97	27.11	28.04	27.20
12	28.93	28.71	28.60	28.29	28.09	27.49	24.63	26.75	27.02	27.08	28.02	27.21
13	28.96	28.70	28.65	28.25	27.98	27.50	25.30	26.79	27.06	27.08	27.90	27.20
14	28.97	28.69	28.66	28.25	28.00	27.48	24.97	26.81	27.08	27.08	27.78	27.20
15	28.99	28.65	28.68	28.26	28.00	27.41	25.76	26.79	27.10	27.10	27.79	27.19
16	28.99	28.64	28.56	28.35	27.33	27.31	26.14	26.77	27.10	27.12	27.81	27.19
17	29.00	28.64	28.57	28.42	26.84	27.29	26.21	26.79	27.11	27.13	27.85	27.22
18	29.01	28.65	28.62	28.30	26.46	27.23	26.31	26.79	27.09	27.14	27.70	27.23
19	29.01	28.66	28.64	28.27	26.96	27.14	26.36	26.83	27.10	27.08	27.21	27.25
20	29.04	28.67	28.65	28.29	27.37	27.03	26.37	26.83	27.13	26.98	27.11	27.24
21	29.10	28.72	28.63	28.31	27.55	27.03	26.38	26.77	26.99	26.99	27.10	27.23
22	29.13	28.74	28.60	28.32	27.52	26.99	26.41	26.79	26.81	27.50	27.11	27.20
23	29.12	28.74	28.49	28.35	27.54	27.00	26.48	26.81	26.77	27.73	27.12	27.19
24	29.12	28.75	28.41	28.37	27.58	26.62	26.53	26.82	26.78	27.78	27.14	27.19
25	28.93	28.71	28.37	28.46	27.57	25.32	26.57	26.84	26.80	27.81	27.12	27.05
26	28.80	28.65	28.26	28.43	27.50	24.95	26.60	26.85	26.80	27.82	27.10	26.84
27	28.71	28.64	28.22	28.39	27.47	25.89	26.61	26.85	26.81	27.80	27.11	26.81
28	28.69	28.66	28.22	28.31	27.52	26.31	26.62	26.89	26.83	27.78	27.29	26.81
29	28.67	28.63	28.20	28.26	27.55	26.57	26.63	26.87	26.88	27.78	27.72	26.82
30	28.62	28.58	28.14	28.27	---	26.86	26.66	26.88	26.89	27.78	27.85	26.83
31	28.57	---	28.13	28.32	---	27.00	---	26.89	---	27.80	27.93	---
Mean	28.95	28.65	28.51	28.30	27.74	27.05	26.30	26.80	26.97	27.29	27.64	27.19
Max	29.13	28.75	28.68	28.46	28.27	27.53	27.31	26.89	27.13	27.82	28.08	27.96
Min	28.57	28.52	28.13	28.13	26.46	24.95	24.63	26.69	26.77	26.93	27.10	26.81

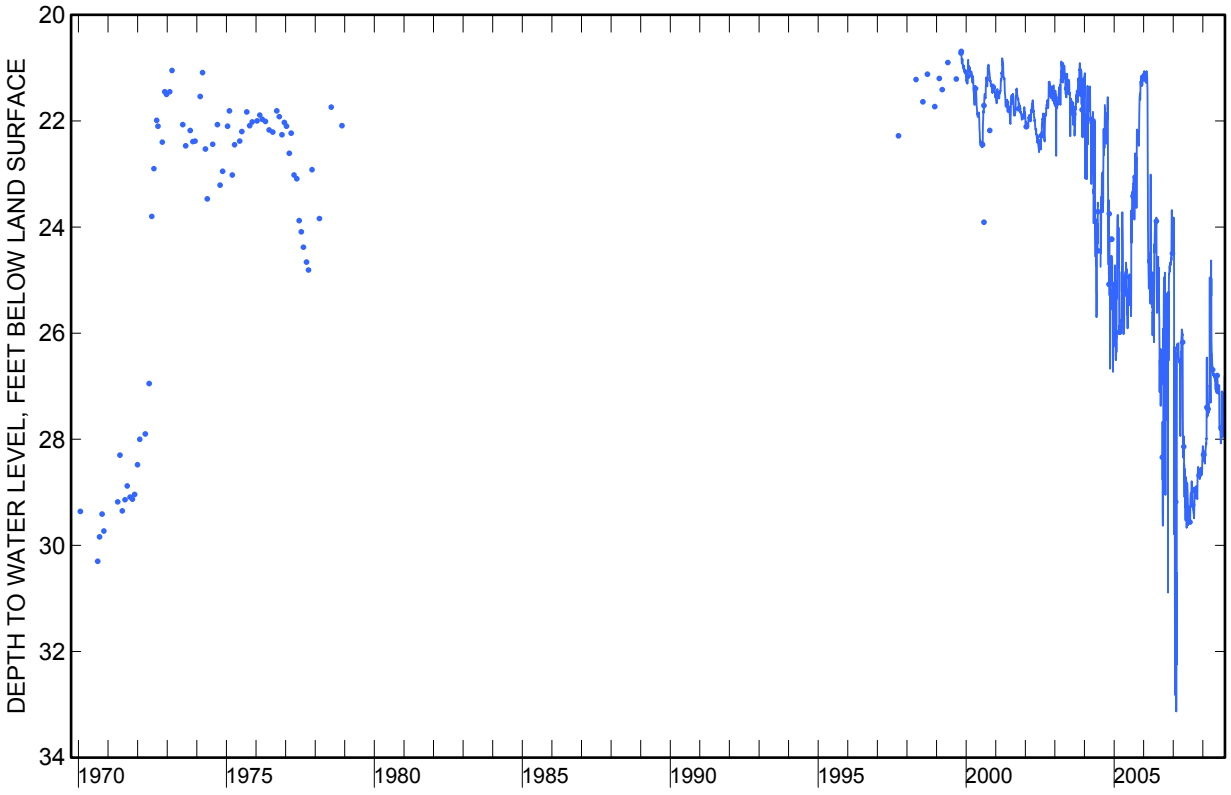
	Water Year 2008
Mean	27.62
High	24.63
Low	29.13

Water-Data Report 2008

335631078003605 Local number BR-082 (NC-198), NCDENR Southport Research Station well GG32t5, near Southport, NC (Castle Hayne)—Continued



335631078003605 Local number BR-082 (NC-198), NCDENR Southport Research Station well GG32t5, near Southport, NC (Castle Hayne)—Continued



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Water-Data Report 2008

335631078003606 Local number BR-083 (NC-199), NCDENR Southport Research Station well GG32t6, near Southport, NC (Surficial)

Surficial aquifer system
Post Miocene (Quaternary + Pliocene) Rocks

Brunswick County, NC

LOCATION.--Lat 33°56′31″, long 78°00′35″ referenced to North American Datum of 1983, Brunswick County, NC, Hydrologic Unit 03030005, north of Southport, 0.45 mi northeast of Secondary Road 1526 on Secondary Road 1527. Owner: NCDENR (North Carolina Department of Environment and Natural Resources).

GROUND-WATER RECORDS

WELL CHARACTERISTICS.--Drilled observation well, depth 21 ft, diameter 4 in., cased to 11 ft, screened from 11 to 21 ft.

DATUM.--Land-surface datum is 28 ft above National Geodetic Vertical Datum of 1929. Measuring point: top of instrument shelf, 1.27 ft above land-surface datum, October 16, 1997 to present.

PERIOD OF RECORD.--January 1970 to current year. Continuous record began October 1997.

GAGE.--Water-level recorder collecting data at 15-minute intervals. Satellite telemetry at station.

REMARKS.--Well is part of the Brunswick County ground-water study.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 0.13 ft below land-surface datum, September 16, 1999; lowest water level measured, 11.36 ft below land-surface datum, October 10, 1977.

Water-Data Report 2008

335631078003606 Local number BR-083 (NC-199), NCDENR Southport Research Station well GG32t6, near Southport, NC (Surficial)—Continued

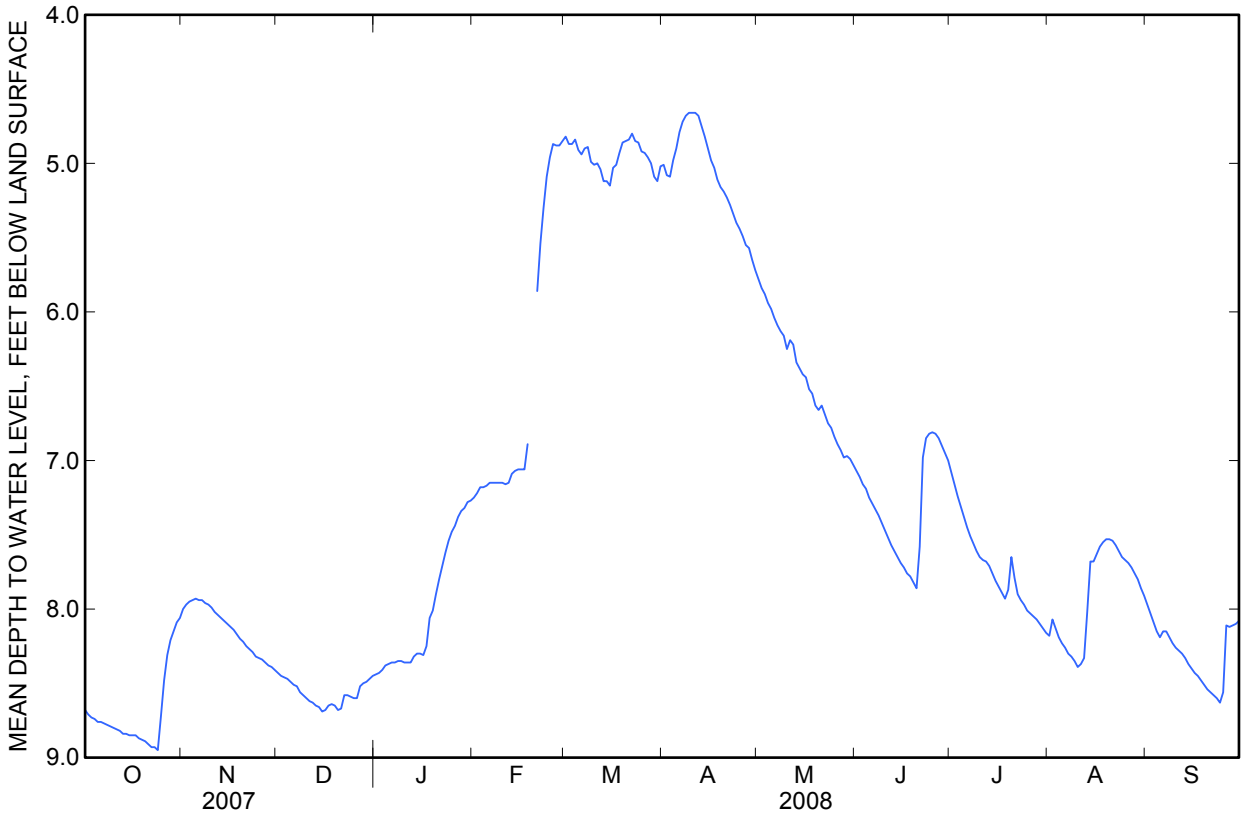
DEPTH TO WATER LEVEL, FEET BELOW LAND SURFACE
WATER YEAR OCTOBER 2007 TO SEPTEMBER 2008
DAILY MEAN VALUES

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	8.68	8.00	8.43	8.44	7.25	4.82	5.01	5.78	7.07	7.08	8.18	7.97
2	8.71	7.97	8.45	8.43	7.22	4.87	5.08	5.84	7.11	7.16	8.07	8.03
3	8.73	7.95	8.46	8.41	7.18	4.87	5.09	5.88	7.16	7.24	8.13	8.09
4	8.74	7.94	8.47	8.38	7.18	4.84	4.98	5.94	7.19	7.31	8.19	8.15
5	8.76	7.93	8.49	8.37	7.17	4.91	4.90	5.98	7.25	7.38	8.23	8.19
6	8.76	7.94	8.51	8.36	7.15	4.94	4.79	6.04	7.29	7.45	8.26	8.15
7	8.77	7.94	8.52	8.36	7.15	4.90	4.72	6.09	7.33	7.51	8.30	8.15
8	8.78	7.96	8.56	8.35	7.15	4.89	4.68	6.13	7.37	7.56	8.32	8.19
9	8.79	7.97	8.58	8.35	7.15	4.99	4.66	6.16	7.42	7.61	8.35	8.23
10	8.80	7.99	8.60	8.36	7.15	5.01	4.66	6.25	7.47	7.65	8.39	8.26
11	8.81	8.02	8.62	8.36	7.16	5.00	4.66	6.19	7.52	7.67	8.37	8.28
12	8.82	8.04	8.63	8.36	7.15	5.04	4.68	6.22	7.57	7.68	8.33	8.30
13	8.84	8.06	8.65	8.32	7.09	5.12	4.75	6.34	7.61	7.71	8.02	8.33
14	8.84	8.08	8.66	8.30	7.07	5.12	4.82	6.38	7.65	7.76	7.68	8.37
15	8.85	8.10	8.69	8.30	7.06	5.15	4.90	6.42	7.69	7.81	7.68	8.40
16	8.85	8.12	8.68	8.31	7.06	5.03	4.98	6.44	7.72	7.85	7.63	8.43
17	8.85	8.14	8.65	8.25	7.06	5.01	5.03	6.52	7.76	7.89	7.58	8.45
18	8.87	8.17	8.64	8.06	6.89	4.93	5.11	6.55	7.78	7.93	7.55	8.48
19	8.88	8.20	8.65	8.01	---	4.86	5.16	6.63	7.82	7.87	7.53	8.51
20	8.89	8.22	8.68	7.90	---	4.85	5.19	6.66	7.86	7.65	7.53	8.54
21	8.91	8.25	8.67	7.80	5.86	4.84	5.23	6.63	7.58	7.79	7.54	8.56
22	8.93	8.27	8.58	7.71	5.54	4.80	5.28	6.69	6.98	7.90	7.57	8.58
23	8.93	8.29	8.58	7.62	5.30	4.85	5.34	6.75	6.85	7.94	7.61	8.60
24	8.95	8.32	8.59	7.54	5.09	4.86	5.40	6.78	6.82	7.97	7.65	8.63
25	8.72	8.33	8.60	7.48	4.96	4.92	5.44	6.84	6.81	8.01	7.67	8.56
26	8.48	8.34	8.60	7.44	4.87	4.93	5.49	6.89	6.82	8.03	7.69	8.11
27	8.31	8.36	8.52	7.38	4.88	4.96	5.55	6.93	6.85	8.05	7.72	8.12
28	8.21	8.38	8.50	7.34	4.88	5.00	5.57	6.98	6.90	8.07	7.76	8.11
29	8.15	8.39	8.49	7.32	4.85	5.09	5.65	6.97	6.95	8.10	7.80	8.10
30	8.09	8.41	8.47	7.28	---	5.12	5.72	6.99	7.00	8.13	7.86	8.08
31	8.06	---	8.45	7.27	---	5.02	---	7.03	---	8.16	7.91	---
Mean	8.70	8.14	8.57	8.01	6.46	4.95	5.08	6.45	7.31	7.74	7.91	8.30
Max	8.95	8.41	8.69	8.44	7.25	5.15	5.72	7.03	7.86	8.16	8.39	8.63
Min	8.06	7.93	8.43	7.27	4.85	4.80	4.66	5.78	6.81	7.08	7.53	7.97

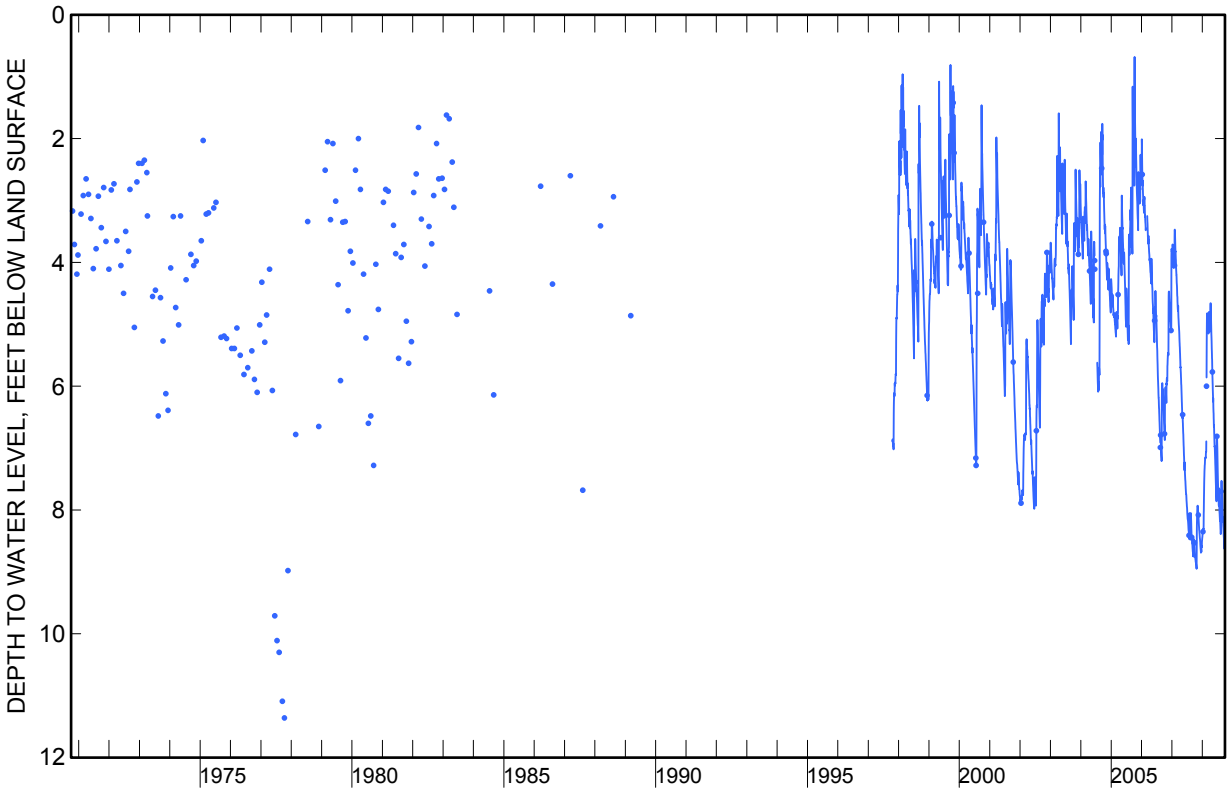
	Water Year 2008
Mean	7.31
High	4.66
Low	8.95

Water-Data Report 2008

335631078003606 Local number BR-083 (NC-199), NCDENR Southport Research Station well GG32t6, near Southport, NC (Surficial)—Continued



335631078003606 Local number BR-083 (NC-199), NCDENR Southport Research Station well GG32t6, near Southport, NC (Surficial)—Continued



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Water-Data Report 2008

335849078054301 Local number BR-100, Well 15A, near Southport, NC (Castle Hayne/PeeDee)

Northern Atlantic Coastal Plain aquifer system
Peedee Formation

Brunswick County, NC

LOCATION.--Lat 33°58′49″, long 78°05′43″ referenced to North American Datum of 1983, Brunswick County, NC, Hydrologic Unit 03030005, west of Southport on North Carolina Highway 211, 1.8 mi northwest of intersection with North Carolina Highway 133. Owner: Brunswick County.

GROUND-WATER RECORDS

WELL CHARACTERISTICS.--Drilled observation well, depth 158.3 ft, diameter 6 in.; cased to 60 ft, open hole from 60 ft to 158.3 ft.

DATUM.--Land-surface datum is 56 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of instrument shelf, 2.42 ft above land-surface datum, October 19, 1999, to present.

PERIOD OF RECORD.--February 1999 to current year.

GAGE.--Water-level recorder collecting data at 15-minute intervals. Satellite telemetry at station.

REMARKS.--Well is completed in the Castle Hayne and Peedee aquifers. Water levels are affected by pumping of nearby water-supply wells. Well is part of the Brunswick County ground-water study.

EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 8.30 ft below land-surface datum, April 1, 2001; lowest water level recorded, 54.96 ft below land-surface datum, September 8, 2008.

Water-Data Report 2008

335849078054301 Local number BR-100, Well 15A, near Southport, NC (Castle Hayne/PeeDee)—Continued

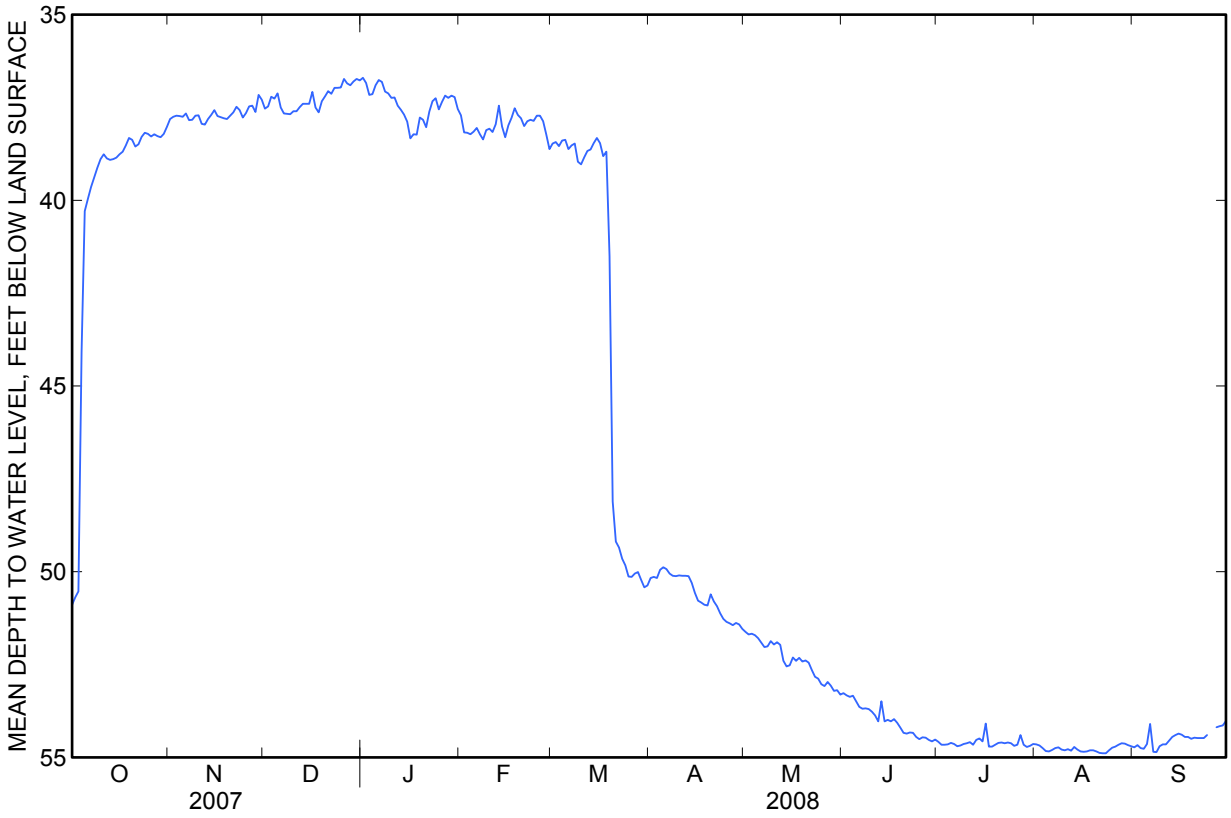
DEPTH TO WATER LEVEL, FEET BELOW LAND SURFACE
WATER YEAR OCTOBER 2007 TO SEPTEMBER 2008
DAILY MEAN VALUES

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	50.89	37.81	37.53	36.70	37.71	38.47	50.17	51.62	53.27	54.58	54.65	54.73
2	50.69	37.75	37.47	36.84	38.17	38.43	50.14	51.69	53.33	54.66	54.68	54.67
3	50.53	37.72	37.21	37.16	38.18	38.54	50.17	51.67	53.37	54.66	54.75	54.75
4	44.08	37.73	37.26	37.14	38.22	38.39	49.95	51.71	53.34	54.65	54.83	54.77
5	40.29	37.75	37.12	36.90	38.15	38.37	49.88	51.79	53.49	54.61	54.84	54.64
6	39.96	37.66	37.50	36.76	38.05	38.62	49.93	51.91	53.64	54.64	54.80	54.10
7	39.64	37.84	37.66	36.81	38.22	38.52	50.05	52.03	53.69	54.70	54.75	54.85
8	39.38	37.83	37.67	37.07	38.36	38.47	50.11	52.01	53.68	54.68	54.73	54.86
9	39.12	37.72	37.68	37.12	38.11	38.96	50.12	51.87	53.70	54.64	54.79	54.70
10	38.89	37.71	37.60	37.24	38.07	39.03	50.10	51.96	53.77	54.62	54.81	54.65
11	38.76	37.94	37.60	37.23	38.16	38.84	50.11	51.90	53.87	54.59	54.78	54.65
12	38.87	37.96	37.49	37.45	37.95	38.67	50.11	51.97	54.03	54.66	54.82	54.55
13	38.91	37.81	37.40	37.56	37.45	38.63	50.12	52.40	53.49	54.53	54.72	54.45
14	38.89	37.70	37.40	37.69	38.01	38.46	50.30	52.55	54.03	54.49	54.79	54.40
15	38.85	37.57	37.40	37.88	38.30	38.32	50.57	52.52	53.99	54.57	54.84	54.36
16	38.76	37.73	37.08	38.33	37.98	38.46	50.78	52.31	54.03	54.09	54.85	54.39
17	38.69	37.76	37.50	38.22	37.78	38.81	50.83	52.40	53.97	54.71	54.84	54.45
18	38.52	37.79	37.63	38.23	37.52	38.69	50.89	52.32	54.07	54.71	54.81	54.45
19	38.32	37.81	37.33	37.77	37.70	41.50	50.91	52.42	54.20	54.66	54.81	54.50
20	38.37	37.72	37.20	37.83	37.79	48.11	50.61	52.39	54.34	54.61	54.84	54.47
21	38.55	37.63	37.06	38.03	38.00	49.19	50.80	52.45	54.36	54.60	54.88	54.48
22	38.49	37.48	37.13	37.61	37.87	49.35	50.93	52.65	54.33	54.62	54.89	54.48
23	38.29	37.57	36.97	37.33	37.83	49.65	51.12	52.83	54.34	54.60	54.89	54.48
24	38.18	37.77	36.97	37.25	37.86	49.83	51.27	52.88	54.45	54.62	54.81	54.40
25	38.21	37.65	36.96	37.55	37.72	50.13	51.35	53.03	54.51	54.69	54.74	---
26	38.28	37.47	36.73	37.35	37.72	50.14	51.39	53.08	54.46	54.66	54.71	---
27	38.22	37.45	36.85	37.18	37.87	50.05	51.44	52.97	54.47	54.40	54.66	54.19
28	38.27	37.62	36.90	37.24	38.23	50.01	51.38	53.07	54.53	54.66	54.62	54.16
29	38.30	37.16	36.80	37.18	38.62	50.22	51.42	53.21	54.57	54.72	54.63	54.14
30	38.21	37.29	36.73	37.22	---	50.42	51.54	53.19	54.52	54.69	54.67	54.02
31	38.02	---	36.77	37.54	---	50.37	---	53.31	---	54.64	54.70	---
Mean	40.05	37.68	37.25	37.40	37.99	43.02	50.62	52.39	53.99	54.61	54.77	54.49
Max	50.89	37.96	37.68	38.33	38.62	50.42	51.54	53.31	54.57	54.72	54.89	54.86
Min	38.02	37.16	36.73	36.70	37.45	38.32	49.88	51.62	53.27	54.09	54.62	54.02

	Water Year 2008
Mean	46.15
High	36.70
Low	54.89

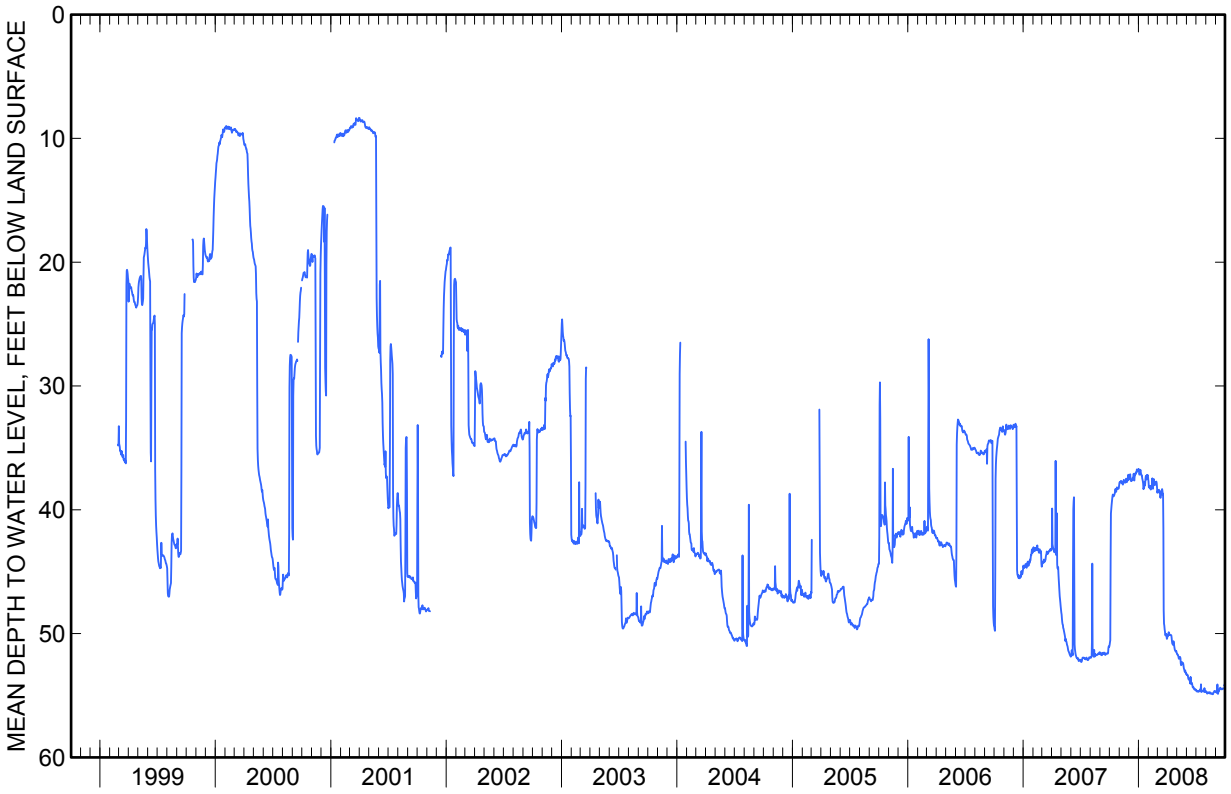
Water-Data Report 2008

335849078054301 Local number BR-100, Well 15A, near Southport, NC (Castle Hayne/PeeDee)—Continued



Water-Data Report 2008

335849078054301 Local number BR-100, Well 15A, near Southport, NC (Castle Hayne/PeeDee)—Continued



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