RESULTS OF A TEST WELL IN THE NANAFALIA FORMATION NEAR MELVIN, CHOCTAW COUNTY, ALABAMA

By M. E. Davis, A. K. Sparkes, and B. S. Peacock

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 82-4108

1983

UNITED STATES DEPARTMENT OF THE INTERIOR

JAMES G. WATT, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

District Chief
U.S. Geological Survey
520 19th Avenue
Tuscaloosa, Alabama 35401

Copies of this report can be purchased from:

Open-File Services Section
Western Distribution Branch
U.S. Geological Survey
Box 25425, Federal Center
Denver, Colorado 80225
(Telephone: (303) 234-5888)

CONTENTS

ILLUSTRATIONS

TABLES

METRIC CONVERSION TABLE

The following factors may be used to convert the English units published herein to SI units.

Multiply English units	by	To obtain SI units
	Length	
inches (in)	2.54	centimeters (cm)
inches (in)	25.4	millimeters (mm)
feet (ft)	0.3048	meters (m)
miles (mi)	1.609	kilometer (km)
	Flow	
gallons per minute (gal/min)	0.6309	liters per second (l/s)
	Transmissivity	
feet squared per day (ft^2/d)	0.0929	meters squared per day (m^2/d)

RESULTS OF A TEST WELL IN THE NANAFALIA FORMATION NEAR MELVIN, CHOCTAW COUNTY, ALABAMA

By M. E. Davis, A. K. Sparkes, and B. S. Peacock

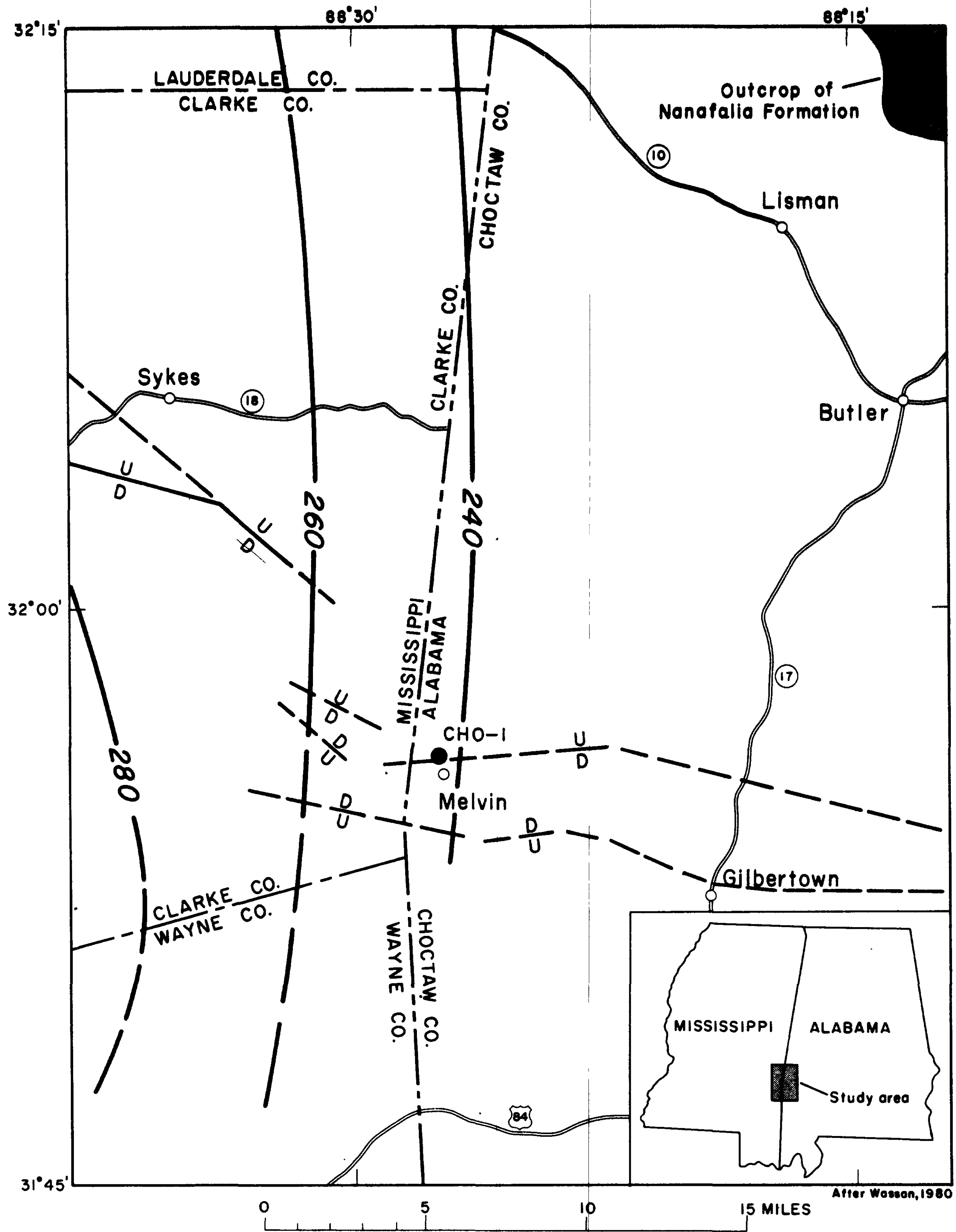
ABSTRACT

A test well was drilled by the U.S. Geological Survey near Melvin, Alabama, to investigate the water-bearing characteristics of the Nanafalia Formation of Tertiary (Paleocene) age and to determine the chemical quality of the water. The well was drilled to a depth of 2,070 feet, cased to a depth of 1,760 feet, and completed with a screen from 1,760 to 1,780 feet. A calculated transmissivity value of about 4,000 feet squared per day for a selected sand bed in the Nanafalia was determined from a 24-hour aquifer recovery test. A chemical analysis indicates that the water is of the sodium bicarbonate type, is soft, basic, and low both in iron and chloride content. The static water level on January 17, 1981, was 109.15 feet below land surface.

INTRODUCTION

Sands of the Nanafalia Formation of Tertiary (Paleocene) age form a major aquifer in Choctaw County in southwestern Alabama. The Nanafalia is the principal source of ground water for public water supplies at Butler, Lisman, and Pennington in northern Choctaw County where the sands are tapped at depths of 700 feet or less and may yield as much as 500 gal/min. Because the formation dips southwestward from the outcrop area in the northeast part of the county, it becomes progressively deeper to the south and west. The cost of obtaining water from the greater depths in these areas has limited development and utilization of water from the Nanafalia. However, recent drought conditions and associated declining water levels in wells tapping shallower, overlying aquifers have resulted in an interest in the quantity and quality of water available from the deeper aquifer.

As part of the Southeastern Coastal Plain Regional Aquifer Systems Analysis investigation, a test well was drilled in the NW1/4 SW1/4 SE1/4 sec. 11, T. 11 N., R. 5 W., near Melvin, Choctaw County, during January 1981 (fig. 1). The well is located sufficiently downdip that the test results could be used to interpolate and estimate water-bearing characteristics of the aquifer in other parts of the county. Interpretation of electric logs of oil-test wells in the area indicated that the sand beds of the Nanafalia were at least 100 feet in thickness, fairly homogeneous, and contained good-quality water.



EXPLANATION

—260— POTENTIOMETRIC CONTOUR — Shows altitude at which water level would have stood in tightly cased wells. Dashed where approximately located. Contour interval 20 feet. National Geodetic Vertical Datum of 1929

—— FAULT — Dashed where approximately located. U, upthrown side; D, downthrown side

CHO-1 ● WELL

Figure 1.—Location of well CHO-1 and potentiometric surface of water in the Nanafalia Formation.

The well site is believed to be directly north and on the upthrown side of an eastward trending fault. The measured displacement of the fault, about 0.8 mile east of Melvin, is about 25 feet (Turner and Newton, 1971, p. 2). The base of the Oligocene Series at this location is at an altitude similar to that of the base of the underlying Jackson Group. Major faulting is known to be present in the underlying Cretaceous formations in this area (Moore, 1970, pl. 1). Sand beds in the Cretaceous formations contain saline water having greater than 3,000 mg/L (milligrams per liter) dissolved solids.

Drilling of the test well began January 6, 1981, and was completed on January 14, 1981. The test well was drilled to a depth of 2,070 feet through the Nanafalia Formation and into the Naheola Formation. The well was completed by setting a screen opposite a selected sand bed from 1,760 to 1,780 feet in the Nanafalia. Following completion of the well, a 24-hour aquifer test was conducted and a water sample collected for analysis. The well has been equipped with a water-level recorder and added to the Alabama observation well network as local well number CHO-1 and Federal site identification number 315553088273001.

Purpose and Scope

The purpose of this report is to assemble and present hydrologic and geologic data collected by the U.S. Geological Survey during the drilling and testing of the test well. Hydrogeologic data collected are presented in tables, graphs, and diagrams. These data include lithologic, geophysical, and sample logs, and the results of aquifer tests and chemical analyses of ground water.

Acknowledgments

Appreciation is extended to Mr. Ernest Land for permission to locate the test well on his property in Melvin and for granting access to the well periodically to maintain the water-level recorder.

WELL CONSTRUCTION

Drilling and Casing Procedures

The test well was drilled with a hydraulic-rotary drilling rig. Bentonite-base mud mixed with freshwater was used as the circulating fluid only prior to logging operations to build up a mud cake on the walls of the test hole. Natural clay beds encountered during drilling of the test hole generally kept the drilling fluid sufficiently thick to coat the walls and circulate the formation cuttings to the surface.

The test well was drilled to a depth of 1,720 feet using an 8 3/4-inch soft-formation bit. All depths in this report are referenced to land surface as the zero datum. Surface altitude at the test well is 350 feet as determined from the 7 1/2-minute topographic map for Melvin, Ala. A 6-inch ID (inside diameter) casing was set to a depth of 1,720 feet to facilitate further drilling and testing of the underlying sand beds in the Nanafalia

Formation. The casing was pressure-grouted with cement from 1,720 feet back to the land surface. All casing joints were butt-welded. A 5 1/2-inch diameter hole was drilled from the bottom of the 6-inch casing to a depth of 2,070 feet, completely penetrating the Nanafalia Formation and 30 feet of the top of the Naheola Formation. The well was completed by setting a 20-foot section of 4-inch Johnson[1/] wire-wrapped stainless steel screen opposite a selected sand bed from 1,760 to 1,780 feet in the Nanafalia Formation. A sieve analysis of the average size of sand in this section indicated a screen opening size of 0.015 inch (No. 15).

To stabilize the screen at this interval, 290 feet of 4-inch blank casing was installed in the lower part of the hole, followed by 20 feet of 4-inch screen, which was followed by 50 feet of 4-inch blank casing. The 4-inch casing extended 10 feet into the bottom of the 6-inch casing and was sealed by packing a lead seal in the annulus between the 4- and 6-inch casings. A construction diagram of the well is shown in figure 2.

Well Development

The test well was developed, after completion, by pumping with compressed air. Compressed air was injected through the drill-rod string and out a horizontal-jetting tool positioned opposite the screen. Simultaneous jetting and pumping continued for 20 hours until the water from the well contained only a slight amount of suspended sediment. Development removed the drilling mud as well as fine sand, silt, and clay from the water-bearing formation in the screened interval and forced the fine materials to pass through the screen openings into the well where they were pumped to the surface.

HYDROGEOLOGIC DATA

Hydrogeologic data collected during the construction of the well include lithologic logs, aquifer test results, and water analyses that are presented in tables 1 and 2 and figures 2 and 3. Geophysical logs, a graphic lithologic log, and a construction diagram are presented in figure 2.

Drill Cuttings

Drill cuttings were collected from every 10-foot interval during drilling. The cuttings were collected from a sample discharge trough leading from the drill hole to the mud-settling pit. The trough was cleaned of cuttings following each 10-foot sample collection so that the next sample collected would represent cuttings from the following 10-foot section of the well.

A sample description log with formation determinations made by the Geological Survey of Alabama is presented in table 1.

[1/]Use of the brand name in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

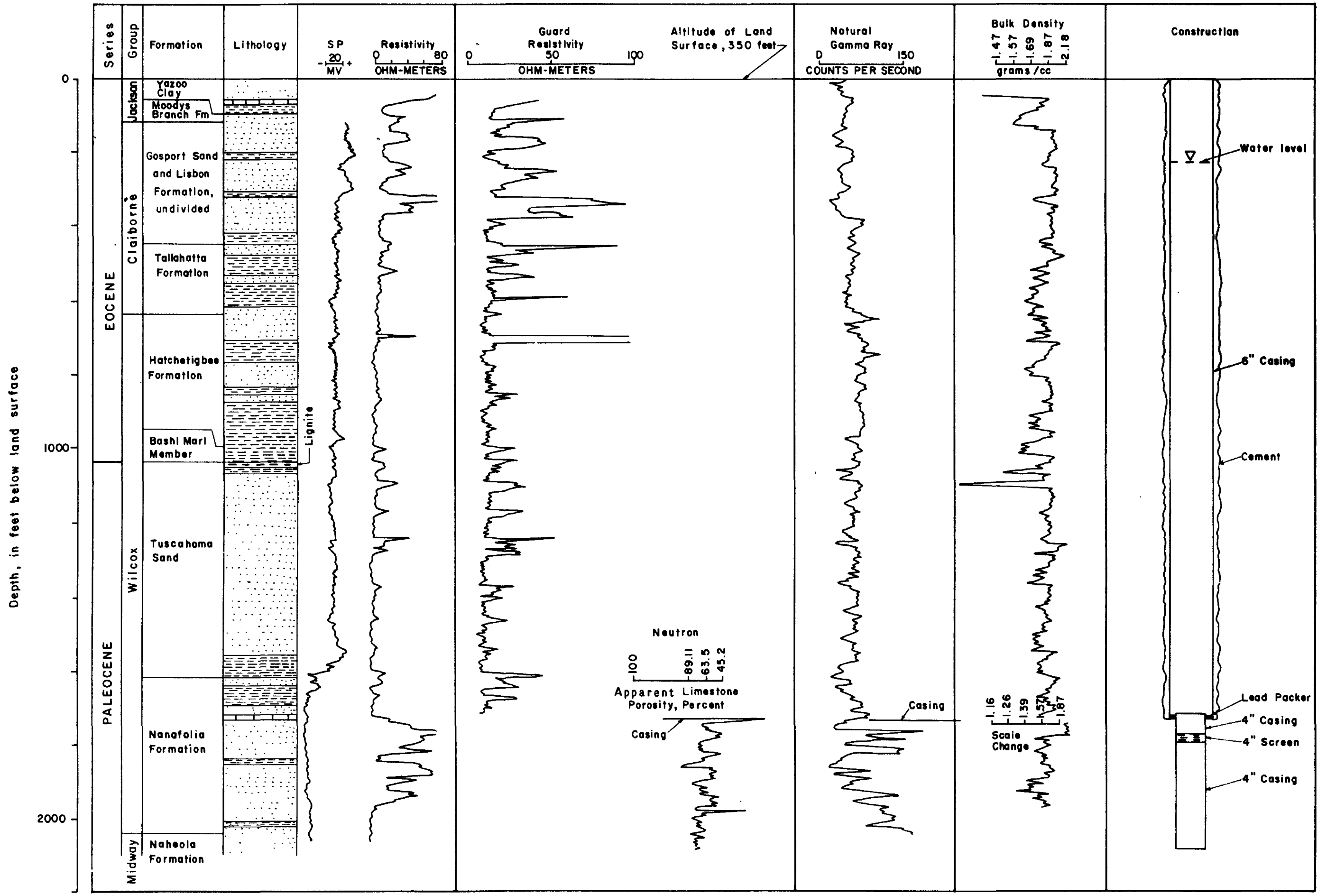


Figure 2.-- Geophysical logs, graphic lithologic log, and construction diagram of well CHO-1.

BLANK PAGE

Table 1.--Sample description log of well CHO-1

(USGS ID No. 315559088272301)

(Sample description by Geological Survey of Alabama)

Owner: U.S. Geological Survey

Location: NW1/4SW1/4SE1/4 sec. 11, T. 11 N., R. 5 W., at dirt road 0.05 mi north of junction with County Road 14 in Melvin, 9.0 mi northeast of Gilbertown, and 17.7 mi southwest of Butler
Driller: Graves Drilling Company, Sylacauga, Ala.
Date drilled: January 1981
Total depth of hole: 2,070 ft
Total depth of well: 1,780 ft
Casing diameter: 6-in ID and 4-in ID
Well finish: 4-in wire-wrapped (No. 15) stainless steel screen from 1,760 to 1,780 ft
Method of drilling: Hydraulic rotary
Aquifer: Nanafalia Formation
Altitude (land surface): 350 ft
Water level: 109.15 ft below land surface January 17, 1981
Yield: 200 gal/min
Transmissivity: 4,000 ft^2/d
Chloride concentration: 73 mg/L
Temperature: 33.0°C

	Thickness (feet)	Depth (feet)
Yazoo Clay		
Sand, pale-yellowish-orange (10YR8/6), to white (N9), fine- to medium-grained, subangular to subrounded, quartzose, with clay, pale-reddish-brown, (10R5/4), trace; fossiliferous.	30	30
Sand, mostly white, some pale-yellowish-orange, fine- to medium-grained, subangular to subrounded, quartzose; limestone, light-olive (5Y6/1), to light-greenish-gray (5GY8/1), very finely crystalline, pelecypod, echinoderm, and fish skeletal fragments, ostracods, and foraminifera.	30	60
Limestone, light-olive (5Y6/1) to light-greenish-gray (5GY8/1) fossiliferous, sand, as above (10 percent); clay, light-gray, calcareous, silty; pelecypod, gastropod, and echinoderm fragments, foraminifera and ostracods.	10	70
Clay, light-gray, silty, calcareous, few fossils and fossil fragments, miliolid foraminifers, ostracods.	30	100

Table 1.--Sample description log of well CHO-1--Continued

	Thickness (feet)	Depth (feet)
Moodys Branch Formation		
Sand, white to light-greenish-gray, fine- to medium-grained, subangular to subrounded, quartzose, with glauconite pellets, pale-yellowish (10GY7/2), to grayish-green (10GY5/2); limestone, very light (N8), to pinkish-gray (5YR8/1), very finely crystalline, arenaceous, fossiliferous; gastropod, pelecypod, and echinoderm fragments, foraminifera, include _Sphaerogypsina globulus_.	20	120
Gosport Sand and Lisbon Formation, undivided		
Sand as above, fossiliferous; 10 percent limestone as above, 10 percent clay olive-black (5Y2/1), lignitic, shell fragments.	20	140
Sand, very light gray to white, fine- to coarse-grained, very angular to subrounded, quartzose, with glauconite, trace; lignite, trace.	40	180
Sand, very light gray, very fine to medium, some pale-yellowish-orange sand, 5 percent clay, olive-gray (5Y4/1), slightly fossiliferous, with gastropod and pelecypod fragments.	30	210
Clay, olive-gray, silty; sand as above, some pale-yellowish-orange sand, fossiliferous; gastropod, pelecypod and echinoderm fragments.		
Sand, fossiliferous, as above, with abundant glauconite; clay, trace; shell fragments, microfossils.	20	240
Sand, as above, fossiliferous, with abundant glauconite; 20 percent limestone, yellowish-gray (5Y8/1), very finely crystalline, arenaceous; large pelecypod fragments (oyster shells), forminifera and ostracods.	20	260
Sand, same, except glauconite reduced, fossiliferous; pelecypod fragments (oyster shells), foraminifera.	20	280
Sand, same, fossiliferous; glauconite, trace; 10 percent clay, light-olive-gray; pelecypod, gastropod, echinoderm, and bryozoan fragments, foraminifera.	30	310
Clay, light-brownish- to yellowish-gray; sand, glauconite, gypsum, fossiliferous; pelecypod, coral, and gastropod fragments, foraminifera, ostracodes.	10	320

Table 1.--Sample description log of well CHO-1--Continued

	Thickness (feet)	Depth (feet)
Gosport Sand and Lisborn Formation, undivided (continued)		
Sand, very light gray to white, stained light-brownish-gray, fine- to medium-grained, subangular to subrounded, quartzose, lignitic, with glauconite, trace, micaceous, slightly fossiliferous, with shell fragments, cavings?	40	360
Sand, as above, brownish-gray (5YR4/1), lignitic, slightly fossiliferous, with shell fragments.	20	380
Sand, very light gray to white, fine- to coarse-grained, subangular to subrounded, quartzose, fossiliferous, micaceous, clay, olive- light-olive-gray, with trace of glauconite and lignite.	20	400
Fossiliferous sand, as above, very fine to medium; clay, less abundant.	10	410
Sand, as above, fossiliferous clay, more abundant, abundant shell fragments.	10	420
Clay, olive-gray, abundant; fossiliferous sand, as above, abundant glauconite, pelecypod and gastropod fragments, foraminifera.	20	440
Clay, yellowish-gray; fossiliferous sand, very fine to medium, abundantly glauconitic (Winona?), shell fragments, foraminifera.	10	450
Tallahatta Formation		
Sand, light-greenish-gray (5GY8/1) to white, medium- to coarse-grained, subangular to subrounded, quartzose, with glauconite, calcareous, micaceous, fossiliferous; claystone, light-greenish-gray (5GY8/1), sandy, glauconitic, siliceous; pelecypod, gastropod, and echinoderm fragments, foraminifera.	20	470
Sand, as above; claystone, very light to yellowish gray, sandy in part, slightly fossiliferous; shell fragments, foraminifera.	10	480
Claystone, as above; finely sandy and glauconitic in part; sand, as above, mostly very fine to medium, slightly fossiliferous; shell fragments, foraminifera.	50	530

Table 1.--Sample description log of well CHO-1--Continued

	Thickness (feet)	Depth (feet)
Tallahatta Formation (continued)		
Sand, very light-gray to white, fine- to medium-grained, subangular to subrounded, quartzose, with glauconite, micaceous; claystone, very light to yellowish-gray, sandy in part, micaceous, lightly fossiliferous; shell fragments, foraminifera.	20	550
Claystone, as above, trace sand, very slightly fossiliferous; shell fragments, foraminifera.	70	620
Sand, very light-gray to white, some stained pale-yellowish-orange, medium- to coarse-grained, subangular to subrounded, quartzose, with glauconite; claystone, very light to yellowish-gray, micaceous, fossiliferous; few foraminifera.	20	640
Hatchetigbee Formation		
Sand, very light gray to white, some stained pale-yellowish-orange, very fine to medium-grained, subangular to subrounded, quartzose, glauconitic, micaceous, claystone, same, trace, cavings, slightly fossiliferous; foraminifera, pelecypod fragments, gastropod fragments.	50	690
Sand, as above; claystone, same, from above, slightly calcarous in part, slightly fossiliferous; trace medium-light-gray carbonaceous silty, clay.		
Clay, medium-light-gray, silty, micaceous, carbonaceous; quartzose sand, light-gray, very fine to medium, with trace glauconite.	10	720
Clay, medium-light-gray, silty, micaceous, carbonaceous, and sand, light-gray, fine to medium, quartzose, glauconitic.	50	770
Sand, and clay as above; sandstone, light-gray, fine-grained, trace glauconite.	70	840
Clay, light-olive-gray (5Y6/1), carbonaceous, sandy, slightly fossiliferous; foraminifera.	10	850
Sand, very light gray to white, some stained pale-yellowish-orange, moderate-yellow-green (5GY7/1), fine- to coarse-grained, subangular to subrounded, quartzose, with glauconite, micaceous; fossiliferous as above, clay, microfossils.	20	870

Table 1.--Sample description log of well CHO-1--Continued

	Thickness (feet)	Depth (feet)
Hatchetigbee Formation (continued)		
Sand, as above, and clay, light-gray, silty, micaceous, carbonaceous.	10	880
Clay, olive (5Y4/1)- to light-olive-gray (5Y6/1), carbonaceous; sand, as above.	10	900
Clay medium-gray, micaceous, carbonaceous; sand light-gray, fine- to medium-grained, quartzose, slightly glauconitic, possibly fossiliferous; shell fragments.	100	1000
Bashi Marl Member of Hatchetigbee Formation		
Clay, medium-gray to light-olive-gray; fossiliferous; sand, very light gray to white, some stained pale-yellowish-orange and moderate-yellow-green (5GY7/4), fine- to medium-grained, subangular to subrounded, quartzose, with glauconite, micaceous; abundant gastropod and pelecypod fragments, foraminifera.	40	1040
Tuscahoma Sand		
Lignite, grayish-black (N2) to black (N1); clay, light-olive-gray to medium-gray, silty, carbonaceous; sand, very light gray to white, some stained pale-yellowish-orange, and light-greenish-gray (5GY8/1), very fine- to medium-grained, some coarse grains, subangular to subrounded, quartzose, with glauconite, micaceous, slightly fossiliferous; microfossils, shell fragments, cavings?	10	1050
Clay, as above, sandy; sand, as above; lignite, as above, trace, shell fragments from above.	120	1170
Sand, as above, clayey and clay, as above; trace lignite.	60	1230
Sand, as above, dominant, mostly stained pale-yellowish-orange; clay, as above, carbonaceous; trace lignite.	10	1240
Sand, as above, clayey; carbonaceous clay, as above, trace lignite, marl or impure limestone, finely sandy, glauconitic, hard.	40	1280
Sand, as above, dominant, mostly stained pale-yellowish-orange, fine to medium quartzose, glauconitic; slightly fossiliferous clay, as above; trace lignite, as above, microfossils, gastropod, and pelecypod fragments.	20	1300

Table 1.--Sample description log of well CHO-1--Continued

	Thickness (feet)	Depth (feet)
Tuscahoma Sand (continued)		
Clayey sand, as above, slightly fossiliferous; clay, as above; trace lignite, as above; shell fragments.	160	1460
Sand, as above, clayey, slightly fossiliferous; clay, light-olive (5Y6/1)- to medium-gray, carbonaceous, slightly calcareous, micaceous; mainly shell fragments.	80	1540
Sand, very light gray to white, same stained pale-yellowish-green (110GY7/2), and pale-yellowish-orange, fine to coarse-grained, subangular to subrounded, quartzose, with glauconite; trace clay, few fossils.	20	1560
Clay, medium-gray to light-olive (5Y6/1)- to yellowish-gray (5Y8/1), carbonaceous, slightly calcareous, micaceous; sand, as above, some microfossils, shell fragments.	60	1620
Nanafalia Formation		
Sand, very light gray to gray-yellowish-orange, mainly fine to medium quartzose, glauconitic, clean; clay, as above, few fossils.	20	1640
Clay, medium-gray, silty, micaceous, carbonaceous sandy; sand, as above; trace lignite, black; few fossils.	50	1690
Sand, very fine to fine with some medium and coarse, clayey; clay, same; lignite, same, trace; fossils, trace.	20	1710
Sand, very light gray to white, some stained pale-yellowish-green (10GY7/2), and pale-yellowish-orange, fine to coarse-grained, subangular to subrounded, quartzose, with glauconite, micaceous, clayey; clay, light-brownish- to medium-gray, slightly calcareous, some shell fragments.	10	1720
Limestone, light-gray to grayish-orange-pink (5YR7/2), impure, indurated in part, quartzose, glauconitic, fossiliferous; sand, fine to coarse with some very coarse, quartz, glauconite; fragments of *O. thirsae* (Gabb).	10	1730

Table 1.--Sample description log of well CHO-1--Continued

	Thickness (feet)	Depth (feet)
Nanafalia Formation (continued)		
Clean sand, very light gray to white, some stained pale-yellowish-orange sand, fine- to medium-grained, with some coarse grains, subangular to subrounded, quartzose, with trace glauconite and lignite, mica. Sand at 1,760 to 1,770 is mostly coarse-grained; sand at 1,800 to 1,810 is mostly fine-grained.	90	1820
Sand, as above, oyster shell fragments.	10	1830
Clayey sand, as above; clay, light-olive (5Y6/1)- to light-brownish-gray, micaceous, pyritic, slightly calcareous; abundant pyritic, sandy, carbonaceous material; some microfossils, shell fragments.	10	1840
Clay, medium-light-gray (N6), slightly calcareous; trace sand.	10	1860
Sand, very light gray to white, fine- to medium-grained, subangular to subrounded, quartzose, with trace glauconite, micaceous; trace clay, as above.	10	1860
Sand, as above, clayey; clay, as above.	10	1870
Sand, as above, fine to coarse, trace lignite, and glauconite.	50	1920
Sand, very light gray to white, fine- to coarse-grained, subangular to subrounded, quartzose, with glauconite, lignite, pyrite and mica.	20	1940
Sand, as above, clayey; clay, light- to light-olive-gray, pyritic.	20	1960
Sand, as above, slightly clayey; sandstone, medium-light (N6)- to light-olive-gray (5Y6/1), fine- to medium-grained, angular to subrounded, quartzose, micaceous, with glauconite, and calcareous cement.	10	1970
Sand, as above.	10	1980
Sand, as above, clayey; clay, brownish (5YR4/1)- to light-brownish- to light-gray.	20	2000
Sand, and brownish-gray clay, as above with hard very finely sandy, glauconitic limestone.	10	2010

Table 1.--Sample description log of well CHO-1--Continued

	Thickness (feet)	Depth (feet)
Nanafalia Formation (continued)		
Clay, medium-light-gray, silty, micaceous, carbonaceous; trace sand; limestone same in minor amounts.	10	2020
Sand, as above, clayey; clay, as above.	20	2040
Naheola Formation		
Sand, as above, glauconite abundant; trace clay; sand has salt and pepper appearance.	20	2060
Sand, as above, some stained pale-yellowish-orange, trace clay.	10	2070

Geophysical Logs

Caliper, spontaneous-potential, electrical-resistivity, gamma ray, neutron, density, gamma gamma, and guard logs were made of the mud filled open-hole section of the well to 1,720 feet prior to setting the 6-inch casing. Following installation of the 6-inch casing, the well was drilled to a total depth of 2,070 feet and the open-hole section (1,720 to 2,070 feet) was logged with the same suite of logs as the upper section of the hole. Figure 2 shows the geophysical logs (upper and lower logged sections joined at 1,720 feet), graphic lithologic log, and construction diagram of the completed well.

Aquifer Test

An aquifer test was made in the well to determine the transmissivity of the sand bed in the Nanafalia Formation where the well was screened. The well was pumped continuously at 200 gal/min for 24 hours and water-level measurements were made of both the drawdown and recovery. Discharge was measured using a 3-inch orifice on a 4-inch discharge line. The beginning water level was 109.15 feet below top of casing; maximum drawdown after 24 hours was 40.15 feet and the water level recorded to 109.18 feet, only 0.03 foot from the static level at the start of the test. The water levels after about 18 hours of the discharge test appeared to have stablized. A transmissivity of about 4,000 ft^2/d was obtained from the early part of the recovery limb of the water-level data (fig. 3). That part of the data are believed to reflect conditions primarily in the screened zone. The response of the aquifer during this test and in preliminary step drawdown tests indicate that the well probably was not fully developed and that some of the initial drawdown and recovery measured was in response to well loss.

Figure 1 shows the potentiometric surface of the Nanafalia Formation in the Melvin area which was prepared by adding this water-level control point to the potentiometric surface map of the Nanafalia Formation in adjoining Mississippi (Wasson, 1980). Although faulting is known to be present in the Cretaceous sediments (Moore, 1970, pl. 1) below the Nanafalia Formation and also in the overlying Tertiary sediments (Newton and McCain, 1972), there is no discernible affect of the faulting reflected by the potentiometric surface of the Nanafalia.

Chemical Analyses of Water

A water sample was collected from well CHO-1, during the aquifer test, after pumping at a rate of 200 gal/min for 20 hours. The sample was analyzed for major and minor chemical constituents by the U.S. Geological Survey Central Laboratory in Doraville, Ga. The analysis of the water is listed in table 2.

The chemical analysis indicates that water from the tested sand in the Nanafalia Formation at Melvin is of the sodium bicarbonate type. According to the U.S. Environmental Protection Agency drinking water standards, it is soft, basic, and low both in iron and chloride content. Based on the results of this analysis, the water is suitable for most purposes except irrigation

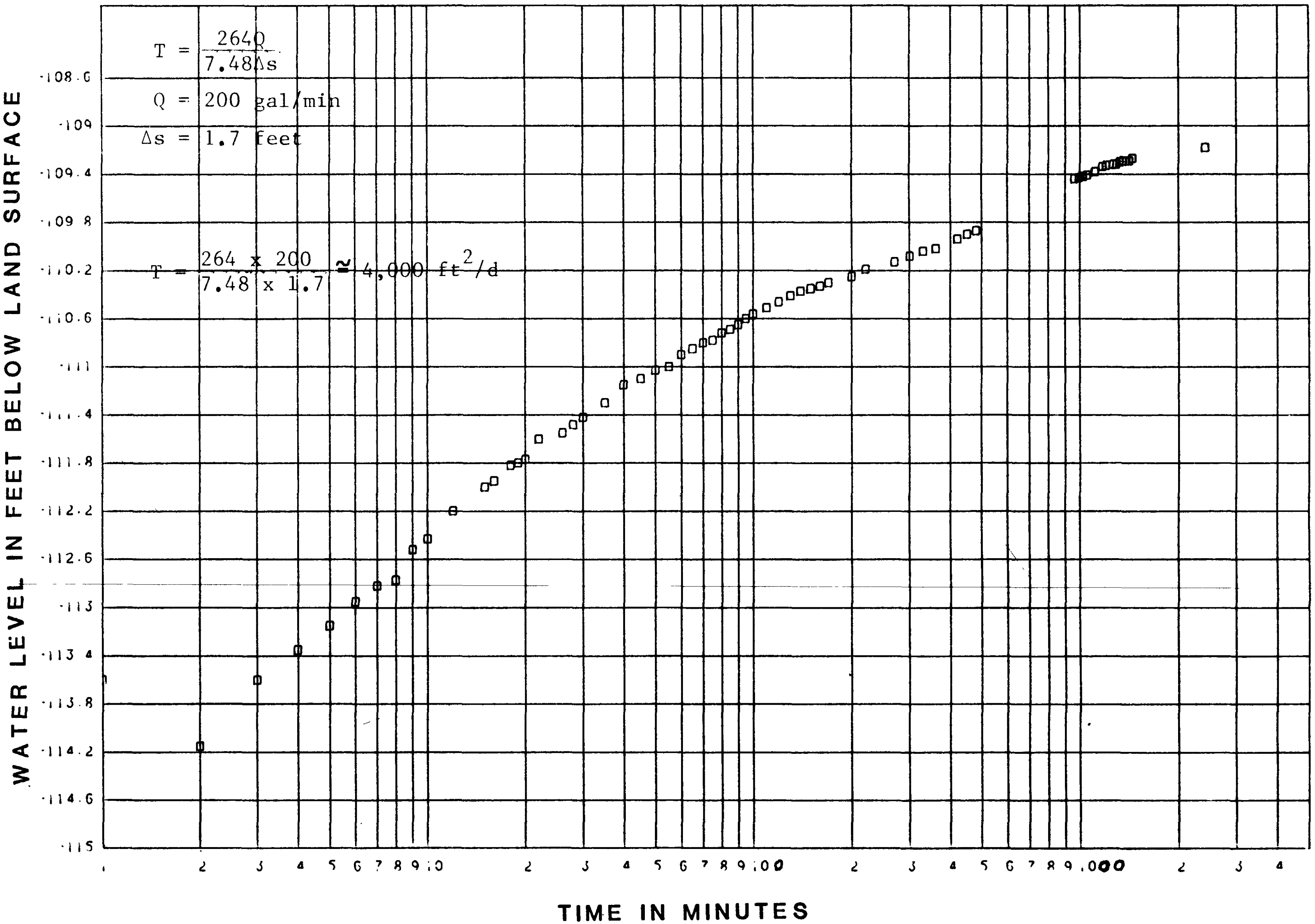


Figure 3.--Computation of transmissivity of selected sand bed in Nanafalia Formation.

(Data represent recovery of water level in aquifer following a period of withdrawal at a constant rate of 200 gal/min.)

Table 2.--Chemical analyses of water from well CHO-1

(constituents are dissolved and reported in milligrams per liter unless indicated otherwise; analyses by U.S. Geological Survey)

	CHO-1	E.P.A. Drinking Water Standards
Date of collection	January 27, 1981	-----
Temperature (°C)	33.0	-----
Color (platinum-cobalt units)	5.0	15
Specific conductance (μmhos at 25°C)	900.0	-----
pH (standard units)	8.6	-----
Calcium (Ca^{+2})	2.5	-----
Magnesium (Mg^{+2})	0.4	-----
Sodium (Na^{+})	220.0	-----
Potassium (K^{+})	1.4	-----
Bicarbonate (HCO_3^{-1})	430.0	-----
Carbonate (CO_3^{-2})	10.0	-----
Sulfate (SO_4^{-2})	0	250
Chloride (Cl^{-})	76.3	280
Fluoride (F^{-})	0.3	2
Silica (SiO_2)	15.0	-----
Solids (sum of constituents)	535.0	-----
Sulfide (S^{-2})	0.2	-----
Nitrate (NO_3^{-1})	0	45
Phosphate (PO_4^{-3})	0.33	-----
Gross Alpha (pCi/L as U-Nat)[1]	5.8	15
Gross Beta (pCi/L as CS-137)[2]	<4.3	200
Barium (Ba) (μg/L)[3]	20.0	1,000
Beryllium (Be) (μg/L)	<1.0	-----
Cadmium (Cd) (μg/L)	2.0	10
Cobalt (Co) (μg/L)	<3.0	-----
Copper (Cu) (μg/L)	<10.0	1,000
Iron (Fe) (μg/L)	76.0	300
Lead (Pb) (μg/L)	<10.0	50
Lithium (Li) (μg/L)	16.0	-----
Manganese (Mn) (μg/L)	4.0	50
Molybdenum (Mo) (μg/L)	<10.0	-----
Strontium (Sr) (μg/L)	120.0	-----
Vanadium (V) (μg/L)	<6.0	-----
Zinc (Zn) (μg/L)	7.0	5,000

[1]Picocuries per liter as uranium natural.
[2]Picocuries per liter as cesium-137.
[3]Micrograms per liter.

or boiler supply. Except for the normal increase of dissolved-solids concentration with depth and distance from the recharge area, the water is similar in quality to that from wells tapping the Nanafalia Formation at Butler (Newton and McCain, 1972).

There is no chemical evidence of upward leakage of saline water along the fault zone from the underlying Cretaceous formations.

SELECTED REFERENCES

Boswell, E. H., 1976, The Lower Wilcox in Mississippi: U.S. Geological Survey Water-Resources Investigations 75-60, 3 sheets.

Davis, M. E., 1980, Ground-water levels in Alabama, for observation wells measured periodically August 1952 through July 1977: Alabama Geological Survey Circular 105, 74 p.

Ferris, J. G., Knowles, D. B., Brown, R. H., and Stallman, R. W., 1962, Theory of aquifer tests: U.S. Geological Survey Water-Supply Paper 1536-E, p. 69-174.

MacNeil, F. S., 1946, Geologic map of the Tertiary formations of Alabama: U.S. Geological Survey Oil and Gas Investigations OM-45, scale 1:500,000.

Moore, D. B., 1970, Subsurface geology of southwest Alabama: Alabama Geological Survey Bulletin 99, 80 p.

Newton, J. G., and McCain, J. F., 1972, Water availability of Choctaw County, Alabama: Alabama Geological Survey Map 125, 23 p.

Turner, J. D., and Newton, J. G., 1971, Geology of Choctaw County, Alabama: Alabama Geological Survey Map 102, 15 p.

U.S. Environmental Protection Agency, 1976a, National interim primary drinking water regulations: EPA-570/9-76-003, 159 p.

_____1976b, Quality criteria for water: EPA, 256 p.

_____1977, National secondary drinking water regulations: Federal Register, v. 42, no. 62, Thursday, March 31, 1977, Part I, p. 17143-17147.

U.S. Geological Survey, 1982, Water-resources data for Alabama - Water Year 1981: U.S. Geological Survey Water-Data Report AL-81-1, 540 p.

Wasson, B. E., 1980, Potentiometric map of the Lower Wilcox aquifer in Mississippi, Fall 1979: U.S. Geological Survey Water-Resources Investigations Open-File Report 80-597.