GROUND-WATER RESOURCES
of
CHOWAN COUNTY
NORTH CAROLINA

By

Orville B. Lloyd, Jr.

Geologist, U. S. Geological Survey

GROUND WATER BULLETIN NO. 14

NORTH CAROLINA
DEPARTMENT OF WATER AND AIR RESOURCES

George E. Pickett, *Director*

DIVISION OF GROUND WATER

Harry M. Peek, *Chief*

Prepared by the
United States Geological Survey
In cooperation with the
Chowan County Board of Commissioners
and the
North Carolina Department of Water and Air Resources

JULY 1968

North Carolina
Board of Water and Air Resources

CONTENTS

CONTENTS

CONTENTS

ILLUSTRATIONS

ILLUSTRATIONS

ILLUSTRATIONS

STATE OF NORTH CAROLINA

DEPARTMENT OF WATER AND AIR RESOURCES

GEORGE E. PICKETT, DIRECTOR
E. C. HUBBARD, ASST. DIRECTOR
P. O. BOX 9392
RALEIGH, N. C. 27603
TELEPHONE 829-3003

The Honorable Dan K. Moore
Governor of North Carolina
Raleigh, North Carolina

Dear Governor Moore:

I am pleased to submit Ground-Water Bulletin Number 14, "Ground Water Resources of Chowan County, North Carolina" by Orville B. Lloyd, Jr., Geologist, U. S. Geological Survey.

This report contains the results of a detailed study of ground water availability, quality and potential in Chowan County. The study was made by the U. S. Geological Survey in cooperation with the Chowan County Board of Commissioners and the North Carolina Department of Water and Air Resources. This report will be a valuable aid in the development and management of water resources in Chowan County, and should contribute much to the future economy and welfare of the area.

Respectfully submitted,

George E. Pickett

GROUND-WATER RESOURCES OF CHOWAN COUNTY NORTH CAROLINA

By

Orville B. Lloyd, Jr.

ABSTRACT

Chowan County is located in the northeastern part of the Coastal Plain province of North Carolina, and includes an area of about 180 square miles. The county is in the humid subtropical climatic belt of the eastern United States. Average annual temperature is about 61° F. and average annual precipitation is approximately 50 inches.

The topography of Chowan County is controlled by two marine terraces and the streams that dissect them. Remnants of one terrace form a topographic ridge, between 30 and 50 feet above mean sea level, that trends in a north-northeast direction across the county. The second terrace, about 15 feet above mean sea level, occurs in the southeastern section of the area. The topographic ridge forms a drainage divide in the area, west of which all streams flow to the Chowan River and east of which all streams flow to Albemarle Sound.

About 2,000 feet of sediments, composed of unconsolidated to partially consolidated sand, silt, clay, limestone and shell layers, occur between basement rock and land surface in the area. These sediments range from Early Cretaceous to post-Miocene in age. The deposits older than Late Miocene generally strike north-northeast and dip and thicken toward the east and southeast. Upper Miocene and younger deposits are essentially flat lying. Five water-bearing zones (Aquifers A, B, C, D, and E) occur in the sedimentary section

INTRODUCTION

General Setting

Chowan is located in northeastern North Carolina and includes an area of about 180 square miles. It is bounded on the north and east by Gates and Perquimans Counties, and on the south and west by Albemarle Sound and the Chowan River (fig. 1). Approximately 2,000 feet of unconsolidated to partially consolidated sedimentary rocks occur between land surface and basement rock in the county. The rocks are composed of interbedded sand, silt, clay, and limestone, and shell beds, and are part of the Coastal Plain sediments which dip generally eastward, and thickens from the west edge of the Coastal Plain to about 10,000 feet at Cape Hatteras (fig. 1). These sediments constitute a vast reservoir for ground water, and the physical and chemical character of the sedimentary material controls the availability, occurrence and, to a great extent, the chemical quality of the ground water.

Purpose and Scope of Investigation

The purpose of this investigation was to determine the lithic character, areal extent, depth, and thickness of the water-bearing formations in Chowan County; to estimate the capacity and ability of the formations to store and transmit water, and to determine the quality of the ground water.

An ever increasing use of ground water, and an emphasis on industrial growth in Chowan County, led to the need for a more complete knowledge of the ground-water resources of the county. The

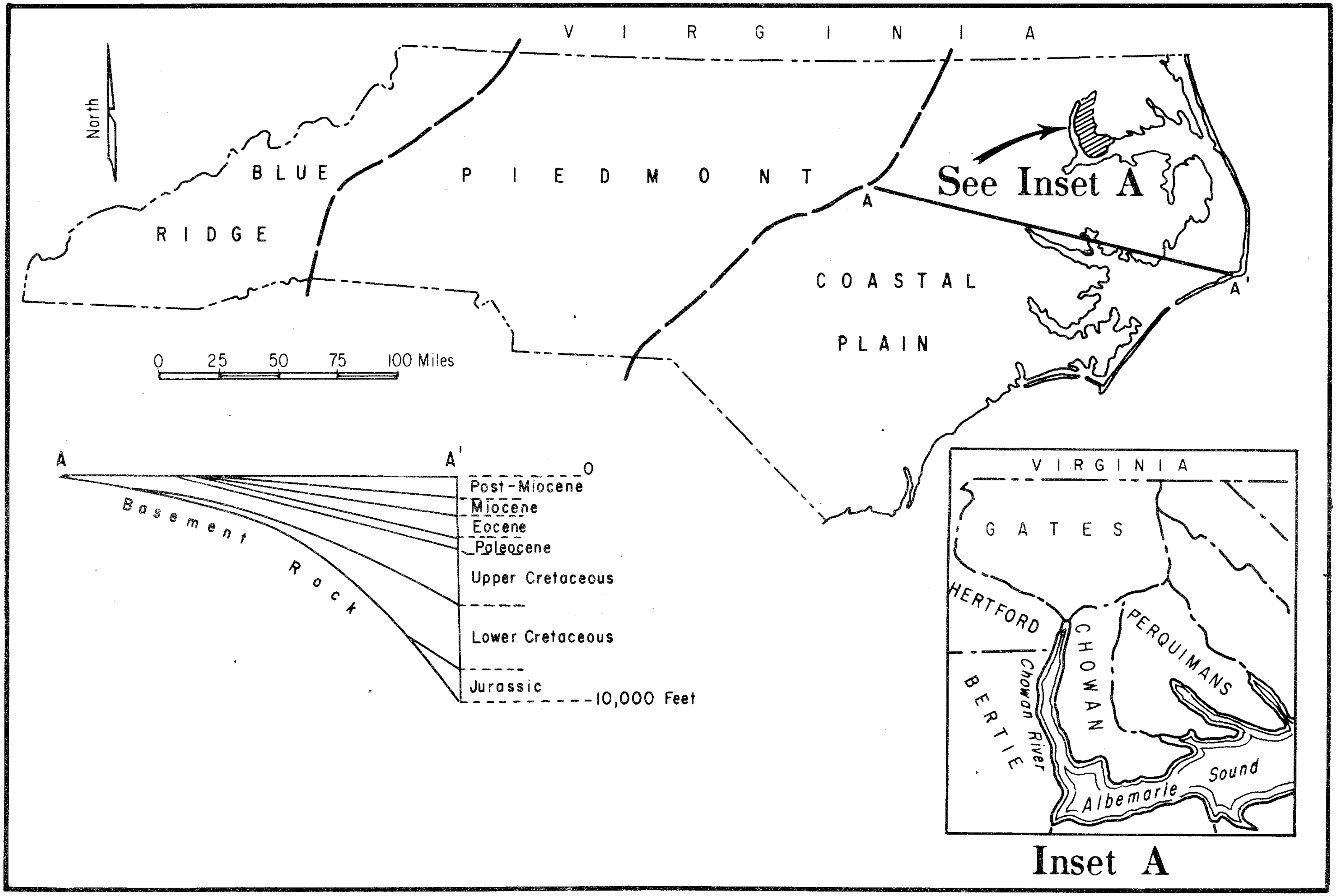


FIGURE 1.- MAP SHOWING LOCATION OF CHOWAN COUNTY, PHYSIOGRAPHIC PROVINCES, AND DIAGRAMMATIC SECTION OF THE COASTAL PLAIN SEDIMENTS IN NORTH CAROLINA.

Chowan County Board of Commissioners under the direction of their chairman, W. E. Bond, and the Edenton Chamber of Commerce recognized this need. In 1961, the Board requested the U. S. Geological Survey to make a detailed investigation of the county's ground-water resources.

The work was done during the 4-year period from June 1961 to June 1965. The funds were established by cooperative agreement between the Chowan County Board of Commissioners, the State of North Carolina, and the U. S. Geological Survey.

Previous Investigations

The geology and ground-water resources of Chowan County have not been studied in detail prior to this report. However, several reports published by the U. S. Geological Survey and the North Carolina Department of Conservation and Development discuss the geologic formations and the occurrence of ground-water in Chowan County.

Mundorff (1945) reports the Yorktown Formation to be the major aquifer in Chowan County. His report includes one complete water analysis and six inventoried wells from the former Edenton Naval Air Base property and the town of Edenton. P. M. Brown (1958) describes in detail the lithology and microfossils (Ostracoda) in the material penetrated in a 460-foot test well drilled on the former Edenton Naval Air Base property. In addition Brown (1959) describes the geology and ground-water resources of Chowan County in a reconnaissance report which includes data on 69 inventoried wells and 8 complete chemical analyses of water samples from Chowan County.

Well-Numbering System

The well-numbering system used in North Carolina conforms to the system adopted by the U. S. Geological Survey for the data card processing of well information. This numbering system is intended to locate the position of a given well on the earth's surface.

Positions on the earth's surface may be located by a system of coordinates known as parallels of latitude and meridians of longitude. The parallels of latitude circle the earth parallel to the equator and are numbered from the equator to the poles in degrees, minutes, and seconds, depending upon the angular distance between them and the equator. The meridians of longitude traverse the earth north and south and are numbered east or west from the Greenwich, England, prime meridian in degrees, minutes, and seconds.

The well-numbering system, derived from longitude and latitude coordinates, is based on a grid of 1-second meridians of longitude and parallels of latitude. The wells in a 1-second quadrangle are numbered consecutively in the order inventoried.

The well number is composed of fifteen numbers and letters: the first six numbers and one letter compose the digits of the degrees, minutes, seconds, and indicate northern (N) or southern (S) hemisphere that define the latitude of the 1-second quadrangle; the next seven numbers compose the digits of the degrees, minutes, and seconds that define the longitude on the east side of the 1-second quadrangle; the last number, following a decimal, indicates the order in which wells were inventoried within the 1-second quadrangle (fig. 2).

A latitude-longitude well number can be assigned to each well inventoried in Chowan County from the information given in table 3. The altitude and longitude part of the number is determined by the location of the well, and the last digit, following a decimal, is the sequential number shown in table 3. For example, the latitude-longitude number for the first well listed in table 3 is 362028N0763346.1. The column listed "Well No." in table 3 gives simple reference numbers for the inventoried wells that are shown on plate 3 and referred to in this report.

Acknowledgments

Special thanks are due the residents of Chowan County for supplying pertinent information about their wells and for allowing special tests to be made on their wells. In addition, many town officials and well drillers were very cooperative in making well data available during the investigation. The Edenton Water and Electric Department, the R. L. Magette Well Company, the R. W. Magette Well Company, and the Layne-Atlantic Company were especially cooperative.

The work was done under the direct supervision of Philip M. Brown, former District Geologist, and Granville G. Wyrick, District Geologist, U. S. Geological Survey.

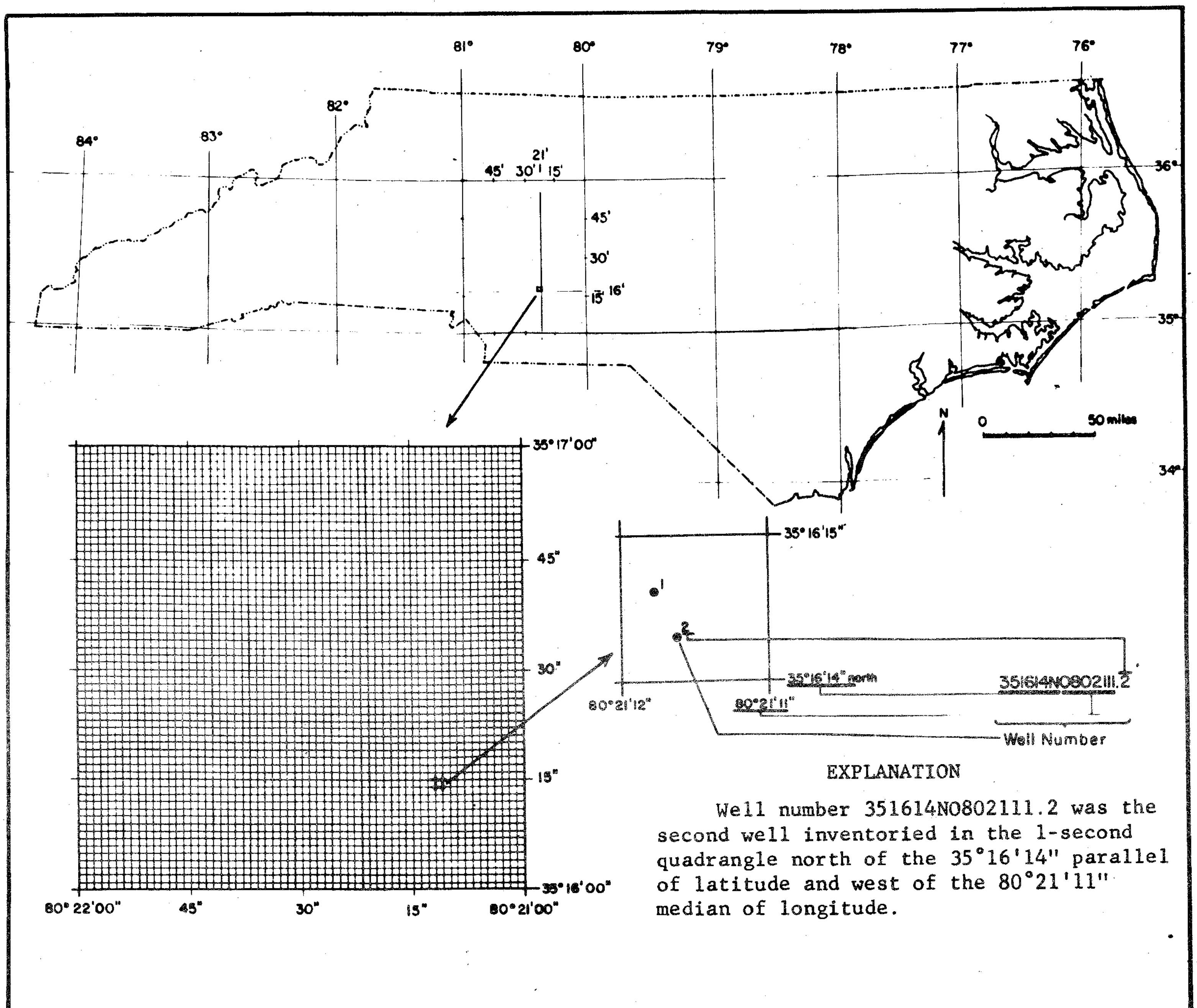


FIGURE 2.- MAP AND DIAGRAMS SHOWING THE METHOD OF DETERMINING LATITUDE-LONGITUDE WELL NUMBERS.

GEOGRAPHY

Area and Population

Approximately 80 square miles of Chowan County is cleared land, of which about 64 square miles are in cropland and pasture, and 16 square miles are in urban development and miscellaneous uses. The remaining 100 square miles are forested with pine, cypress, cedar, gum, yellow poplar, and oak.

The total population of the area was 11,913 in 1960, according to the U. S. Bureau of Census. About 38 percent of the population is urban, residing in the town of Edenton, and 62 percent is rural. A total of 3,378 homes are found in the county and of these, 1,450 are classified as urban. The homes in the urban area get their water supply from the Edenton municipal supply wells. In the rural areas, individual wells are the main source of water supply, and an average of 2.3 homes are supplied by each well.

Economy

The economy of Chowan County is predominantly agricultural. Main crops are peanuts, cotton, soybeans, and tobacco. These and other agricultural products, together with livestock (particularly swine and beef cattle), account for nearly 50 percent of the annual cash income in the county. The remainder of the annual income is provided by local businesses and approximately 25 industries. The industries manufacture or process textile, wood, peanut, metal, chemical, and fish products.

Climate

Chowan County is located in the humid subtropical climatic belt of the eastern United States. This region is characterized by warm summers, mild winters, and precipitation that is well distributed throughout the year.

The average annual temperature at Edenton is about 61°F. (Fahrenheit). The average temperature between May and October is 73°F., and for the remaining months is 49°F. Average annual precipitation at Edenton, is approximately 50 inches. The greatest amount of precipitation occurs between June and September, when the average is about 5.5 inches per month. During the remainder of the year the precipitation is rather evenly distributed, and averages about 3.4 iches per month.

A climatic summary of Edenton is given in figure 3. The graphs were prepared from the climatological records of the U. S. Weather Bureau.

Physiography

Chowan County is included in the Atlantic Coastal Plain province of North Carolina. Generally the Coastal Plain is characterized by a relatively flat surface that slopes gently to the southeast. This nearly flat surface is composed of a number of terraces that were formed by wave and current action during periods when portions of the Coastal Plain were submerged beneath the sea. The terrace surfaces have been eroded and drained by streams and rivers since the sea retreated.

Two such terraces, and the streams that dissect them, control the topographic features in Chowan County. Remnants of one of these

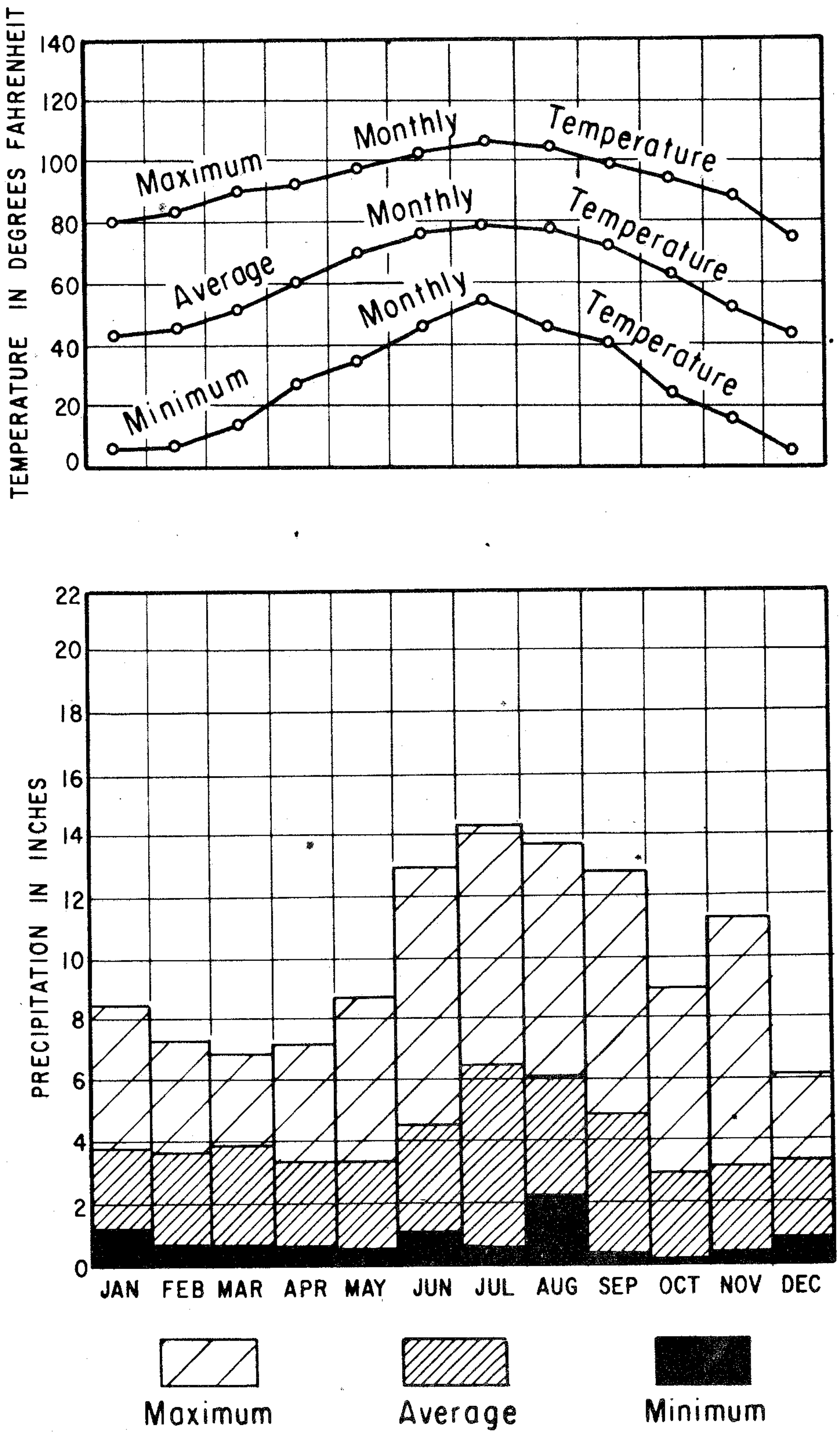


FIGURE 3.- GRAPHS OF CLIMATIC SUMMARY FOR EDENTON, FOR THE PERIOD FROM 1931-64.

terraces forms a topographic ridge between 30 and 50 feet above mean sea level that trends in a north-northeast direction across the county, along a line drawn between Emperor Landing, Tyner, and the northeastern tip of the county. This topographic feature widens from about half a mile at Valhalla to about 4 miles in the northern part of the area. Stream density west of the ridge is relatively high. At the eastern limits of this ridge an escarpment of 20 to 30 feet is found. This escarpment marks the western extent of the second terrace in the county. The elevations on this second surface are generally less than 20 feet above mean sea level, and the stream density on this surface is low. Much of this area is occupied by Bear Swamp.

All the drainage in the area is divided by the topographic ridge that transects the county. Streams to the west of the ridge, Warwick Creek, Dillard Creek, and Rockyhock Creek, flow west or south to the Chowan River and Albemarle Sound. Streams to the east of the ridge, Pollock Swamp-Pembroke Creek, Queen Anne Creek and Burnt Mill Creek-Yeopim River, flow south and east to Albemarle Sound (pl. 3).

GEOLOGY

The Relation of Geology to Ground Water

A thorough understanding of the geology of the area is the first step toward evaluating the availability, occurrence, and chemical quality of the ground water in the county. This is true because the void spaces between the rock materials that underlie Chowan County constitute the reservoir in which the water is stored and the conduits through which the water moves.

Because the rocks in the area are sedimentary and for the most part unconsolidated, the void spaces occur between clay, silt, sand, and shell particles. With a change in the physical character and arrangement of these rock constituents, there is a change in the availability and occurrence of the ground water. Thus, the amount of ground water that can be stored and transmitted by the rocks is determined by the size, shape, and assortment of the rock particles and the type of rock materials.

The chemical constituents of the rocks have a direct bearing on the quality of the ground water. Many rock constituents are dissolved, transported in solution, and redeposited by ground water. Therefore, a change in the character of the sedimentary particles will result in a similar change in the dissolved solids found in the ground water.

Methods of Investigation

Geologic mapping was restricted to subsurface methods because Chowan County is blanketed with post-Miocene sediments which were mapped as one surficial unit for the purposes of this report. Three stratigraphic test wells ranging in depth from 604 to 946 feet and 48 auger holes ranging in depth from 77 to 167 feet were drilled in the area (fig. 4). Samples of the penetrated material were collected at 5-foot depth intervals for the determination of mineral character and microfossil content. The microfossil identifications were made by Philip M. Brown.

Five electric well logs and 31 gamma-ray well logs were made and correlated with lithic and paleontological information to define and map the geologic formations and the water-bearing zones. An electric log shows the electrical properties, resistivity and spontaneous potential, of rock material penetrated in a well. Such a log is made by passing energized electrodes down the uncased and saturated portion of a well or bore hole and recording the electrical properties on a graph. Resistivity, measured in ohms, is generally recorded on the right side of the graph and spontaneous potential, measured in millibolts, on the left. The electrical properties largely depend upon the kind of fluids that saturate the rock materials and the kinds of fluid used in drilling the well (Levorsen, 1958). When formation and drilling fluids are fresh water, resistivity is usually low in clay and high in sand and limestone,and spontaneous potential is high (positive) in clay and low (negative) in sand and limestone. High concentrations of dissolved salts in formation fluids will greatly reduce the resistivity of sands and permeable limestone and, if the formation water is more saline than the drilling fluid, the spontaneous potential will generally be more negative. The correlation between electric logs and the rock material in Chowan County is shown in plate 1.

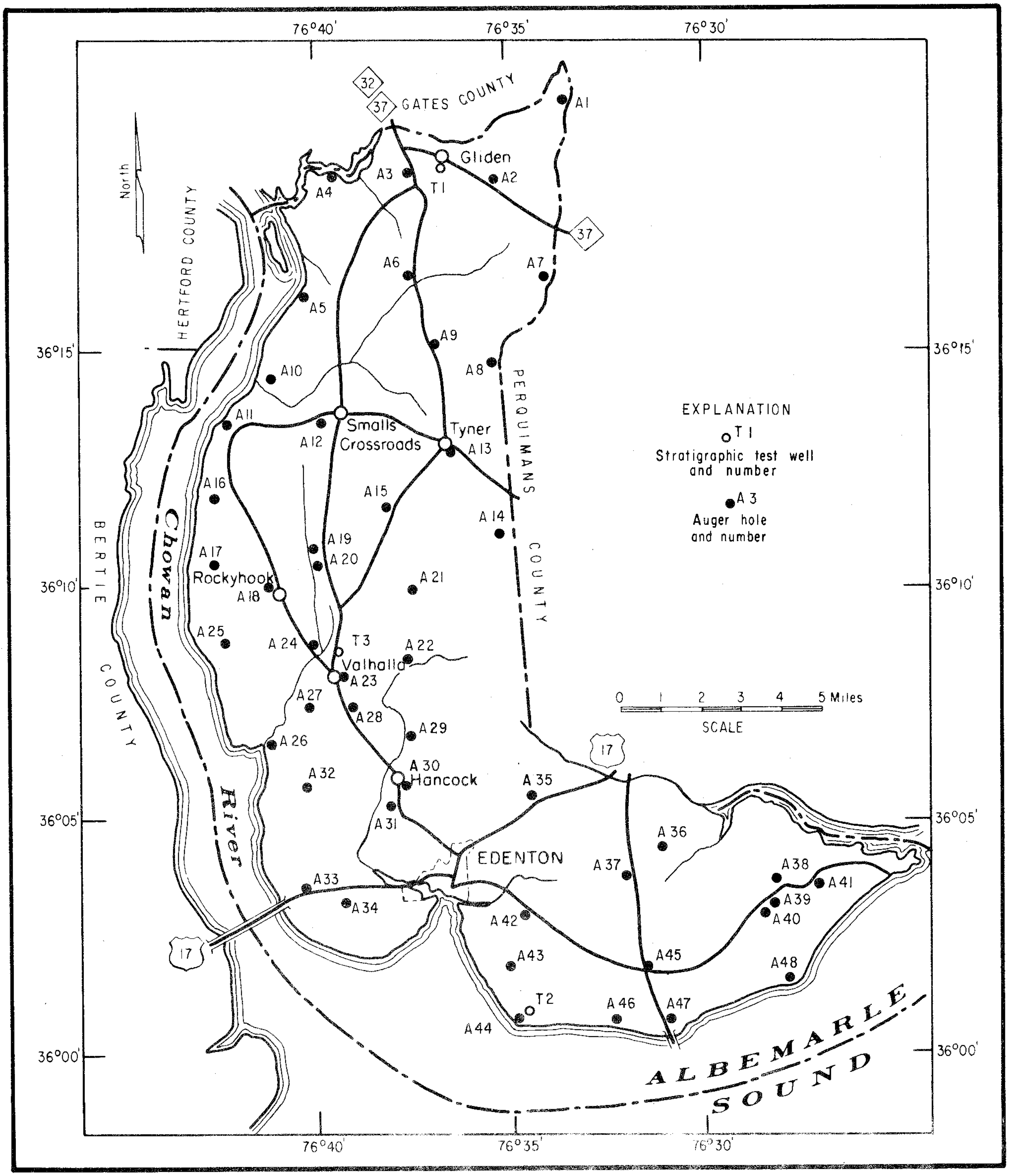


FIGURE 4.-MAP SHOWING LOCATION OF STRATIGRAPHIC TEST WELLS AND AUGER HOLES.

Gamma-ray logs show the relative concentration of natural gamma-radiation emitting elements in rock material. Generally the concentration of these radioactive elements in Chowan County is low in sand, limestone, and shell, high in silt, higher in clay, and higher in sediments that contain phosphate. A gamma-ray log, unlike an electric log, may be made in cased and/or unsaturated wells and bore holes. The intensity of the gamma-ray emission is measured in milliroentgens per hour (MR/H) and recorded on the same type graph used for electric logging. Plate 1 illustrates the correlation between gamma-ray logs and the rock material in Chowan County.

General Geology

The materials that comprise the sedimentary rocks that underlie Chowan County were derived from the crystalline rocks of the Blue Ridge and Piedmont provinces. The crystalline rocks were weathered and eroded, and the resulting rock fragments were transported by streams and rivers to the sea. Here the sedimentary particles were sorted by wave and current action, mixed with chemical precipitates and shells, and depositied at the bottom of the sea. With time, the earlier deposits were buried by later accumulations.

Deposition of the sediments at any particular place was not always continuous. Intermittently, an elevation of the land mass caused the sea to retreat or regress, and exposed the latest deposits to weathering. These exposed sedimentary deposits were subsequently stripped away by erosion processes until the land mass subsided and again allowed the sea to encroach or transgress upon the land. The eroded sediments were then buried beneath newer deposits that accumulated on the sea floor.

The rock material that accumulated in this way has been divided into a number of separate, mappable, units called formations. A formation can be identified by its position in the sedimentary sequence, its lithic composition, and its fossil content. Formations overlying one another are separated by surfaces known as contacts. Where there is no significant time lapse between the deposition of two their contact is referred to as conformable. If there is a time lapse between the deposition of two formations the contact is known as an unconformity. When bedding in a formation above an unconformity is parallel to that of the formation below, the contact is referred to as a disconformity. If the bedding in the two formations is not parallel the contact between them is called an angular unconformity. Unconformities are formed during periods of nondeposition or erosion and are generally represented by undulating surfaces. The geologic formations that underlie Chowan County and their contact relationships are discussed in the following section.

Geologic Formations

The sediments of the Coastal Plain province were deposited on crystalline basement rocks that are similar to those found in the Piedmont province. The sediments form a wedge that thickens from a feather edge at the western edge of the Coastal Plain to about 10,000 feet at Cape Hatteras. At Chowan County this wedge is approximately 2,000 feet thick. Only the upper half of this sedimentary wedge was penetrated by test drilling in Chowan County.

The penetrated sediments have been assigned to six separate series; oldest to youngest, they are the Lower Cretaceous, Upper Cretaceous, Paleocene, Eocene, Miocene, and post-Miocene. The Lower Cretaceous is, at present, undifferentiated; the Upper Cretaceous includes the Tuscaloosa, Black Creek, and Peedee Formations; the Paleocene includes the Beaufort Formation; the Eocene includes the Castle Hayne Limestone; the Miocene includes the Pungo River and Yorktown Formations; the post-Miocene includes relatively thin deposits of undifferentiated clay, silt, and sand.

The Lower Cretaceous sediments, and the Tuscaloosa Formation of the Upper Cretaceous Series are recognized only in the northernmost stratigraphic test well T1 (inventoried well number 9) in the area. Geologic control is at present too incomplete to establish the exact depths to, and thicknesses of, these sediments. In addition, chemical analyses of water samples taken from depths of 558 and 840 feet in the test well indicate that water from these sediments contains excessively high concentrations of chloride (table 4). Consequently, detailed discussion of the Lower Cretaceous sediments and the Tuscaloosa Formation is omitted below.

Cretaceous System

Upper Cretaceous Series

Black Creek Formation.--The major part of the Black Creek Formation was deposited unconformably on the Tuscaloosa Formation, underlies the entirety of Chowan County, and is confined to the subsurface throughout the area. The top of this formation has an average strike of N. 15° E. and dips about 28 feet per mile toward the east-southeast (fig. 5).

The Black Creek sediments were fully penetrated in the northernmost test well where they are approximately 210 feet thick (pl. 1). These sediments consist chiefly of gray, fine- to medium-grained glauconitic quartz sands interbedded with thin layers of light-gray to reddish-brown clay. The sands commonly contain lignitized wood fragments, amber and mica flakes.

Eighteen of the 344 inventoried wells in Chowan County draw small, domestic water supplies from the Black Creek Formation.

Peedee Formation.--The Peedee Formation conformably overlies the Black Creek Formation in the southern part of Chowan County and is absent in the northern central part of the area. The upper surface of the Peedee Formation strikes in an approximate north-south direction and dips about 20 feet per mile toward the east (fig. 6). This formation is 90 feet thick at test well T2, and pinches out between this well and test well T3, near Valhalla (pl. 1).

The Peedee Formation is composed of mottled red and gray clay interbedded with fine- to very fine-grained quartz sand.

The inventoried wells in Chowan County do not tap the Peedee Formation for water supply. Because of the fine-grained nature of the Peedee sediments, and the brackish water contained in the formations above and below the Peedee sediments, it is presumed that this formation will not yield potable or usable amounts of water in Chowan County.

A rising land mass caused the sea to retreat after the deposition

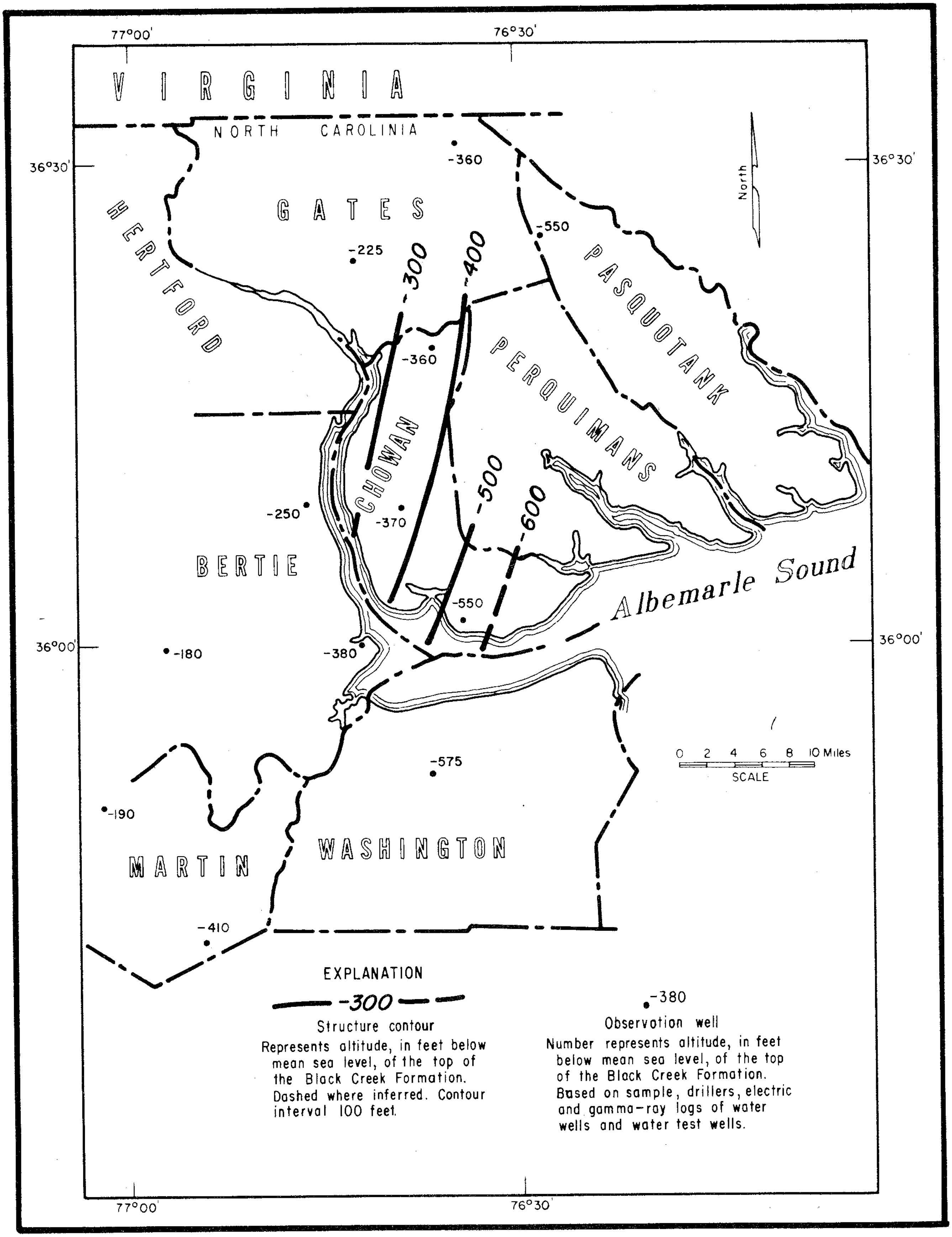


FIGURE 5.- MAP SHOWING THE APPROXIMATE ALTITUDE OF THE TOP OF THE BLACK CREEK FORMATION.

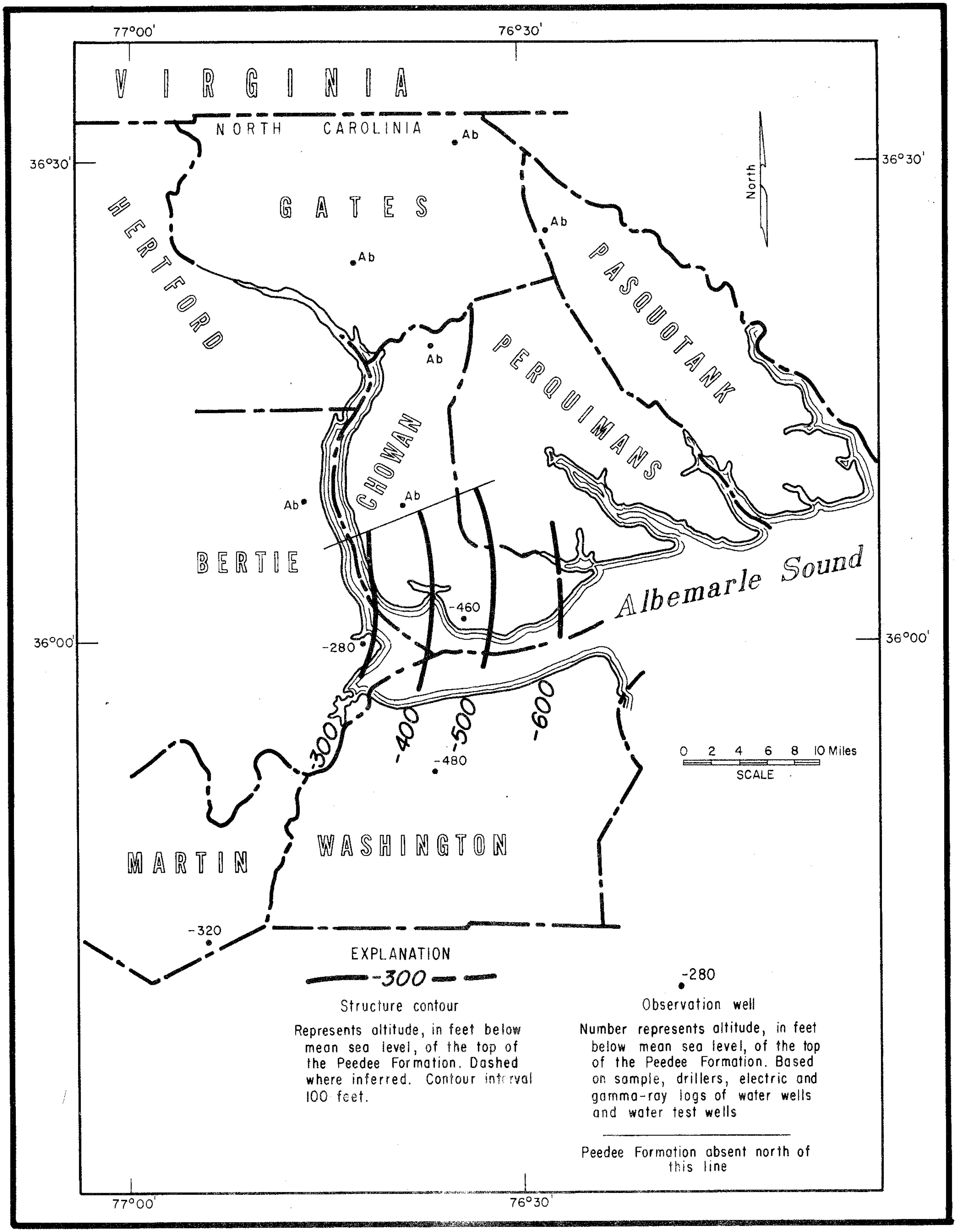


FIGURE 6.- MAP SHOWING THE APPROXIMATE ALTITUDE OF THE TOP OF THE PEEDEE FORMATION.

of the Peedee Formation, and the Late Cretaceous sediments were exposed to a long period of weathering and erosion which marked the end of the Cretaceous Period.

Tertiary System

Paleocene Series

Beaufort Formation.--The land was again inundated by the sea in Paleocene time. The Beaufort Formation was unconformably deposited on the Peedee Formation in the southern part of the county and on the Black Creek Formation in the northern part of the county where the Peedee sediments had been stripped away by erosion. The strike of the top of the Beaufort Formation varies from N. 10° W., in the southern part of the county, to N. 15° E. in the northern part. The dip averages 10 feet per mile toward the east (fig. 7). The Paleocene sediments thicken toward the south and east. They are 120 feet thick at test well T1, 150 feet thick at test well T3, and 230 feet thick at test well T2 (pl. 1).

The Beaufort Formation is composed of interbedded greenish-gray, fine- to medium-grained glauconitic quartz sand, glauconitic sandy limestone, glauconitic limey sandstone, and greenish-gray sandy silt and clay. Concentrations of as much as 50 percent fine- to medium-grained glauconite are common in this formation in the northern part of the county. Glauconitic and calcareous sand, and glauconitic sandy shell limestone are found at the top of the Paleocene section. This unit is 45 feet thick at test well T2 and gradually thins to the north where it is about 10 feet thick at test well T1. Another thick unit

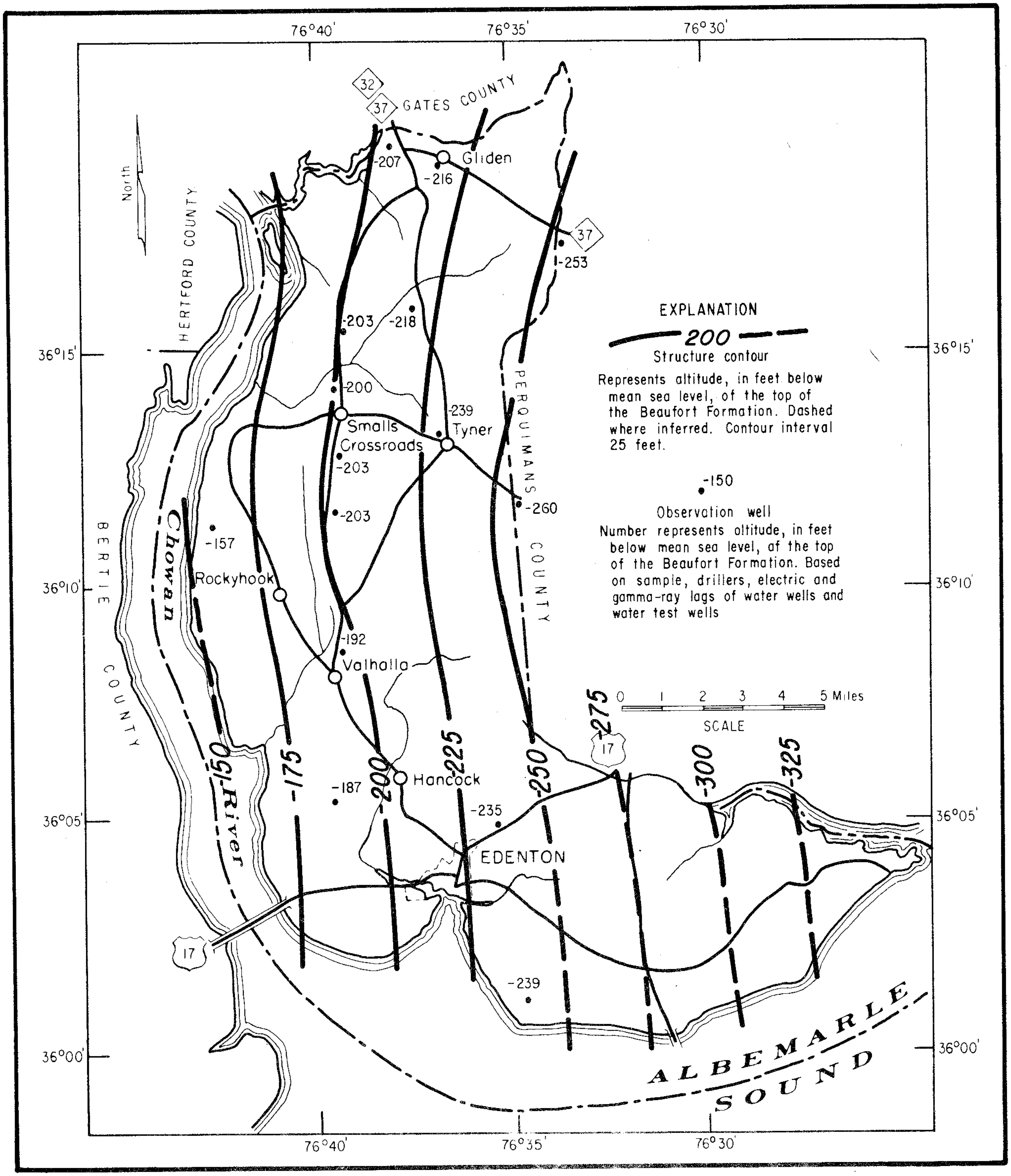


FIGURE 7.- MAP SHOWING THE APPROXIMATE ALTITUDE OF THE TOP OF THE BEAUFORT FORMATION.

of glauconitic sand, calcareous sand, and glauconitic sandy shell limestone is found near the middle of the Beaufort Formation. Sandy silt and clay are found above and below this thick sand section (pl. 1).

Thirty-two of the inventoried wells in Chowan County tap the Beaufort Formation for water supply.

After the retreat of the Paleocene sea the Beaufort Formation was exposed to a period of erosion and weathering until the encroachment of the Eocene sea and the subsequent deposition of the Castle Hayne Limestone.

Eocene Series

Castle Hayne Limestone.--The presence of the Castle Hayne Limestone in the county is inferred by the correlation of electric well logs from a stratigraphic test well in easternmost Martin County and test well T2 in Chowan County. There has been no positive identification of Eocene fauna in Chowan County (written communication, P. M. Brown). Sparse geologic control for this unit makes it difficult to determine whether or not limestone found in the county is isolated from or continuous with the main body of the Castle Hayne Limestone found farther to the south.

The Castle Hayne Limestone is found only in the southern part of the county where it lies unconformably on the Beaufort Formation. Extrapolation of data from Martin and Washington Counties indicate that the top of the limestone strikes approximately N. 15° E. and dips about 10 feet per mile toward the east-southeast. It is about 20 feet thick at test well T2 and pinches out between Edenton and Valhalla (pl. 1).

Thin patches of the Castle Hayne Limestone isolated by erosion may occur farther to the north.

In Chowan County the Castle Hayne Limestone is composed of light-brown, calcareous, fine- to coarse-grained quartz sand, white shell limestone and reddish-brown to gray clay. Traces of fine-grained brown to black phosphate and fine-grained, dark- to light-green glauconite are common.

The two municipal-supply wells at Edenton probably tap a thin section of the Castle Hayne Limestone and also the Beaufort and Pungo River Formations for water supply. In addition, a few small-diameter domestic wells in the vicinity of Edenton may be screened in thin sections of the Castle Hayne Limestone. The water from this formation is generally hard, and contains high concentrations of chloride in the extreme southern and southeastern parts of the county.

Extensive erosion and weathering followed the deposition of the Castle Hayne Limestone, and these processes continued until middle Miocene time and the deposition of the Pungo River Formation.

Miocene Series

Pungo River Formation.--The Pungo River Formation (Kimrey, 1964) underlies the entire area of study. It unconformably overlies the Beaufort Formation throughout most of the county, and the Castle Hayne Limestone, where present, in the southern part of the area. Generally the top of the formation strikes N. 10° W. and dips approximately 10 feet per mile toward the east (fig. 8). The average thickness of the formation is about 25 feet.

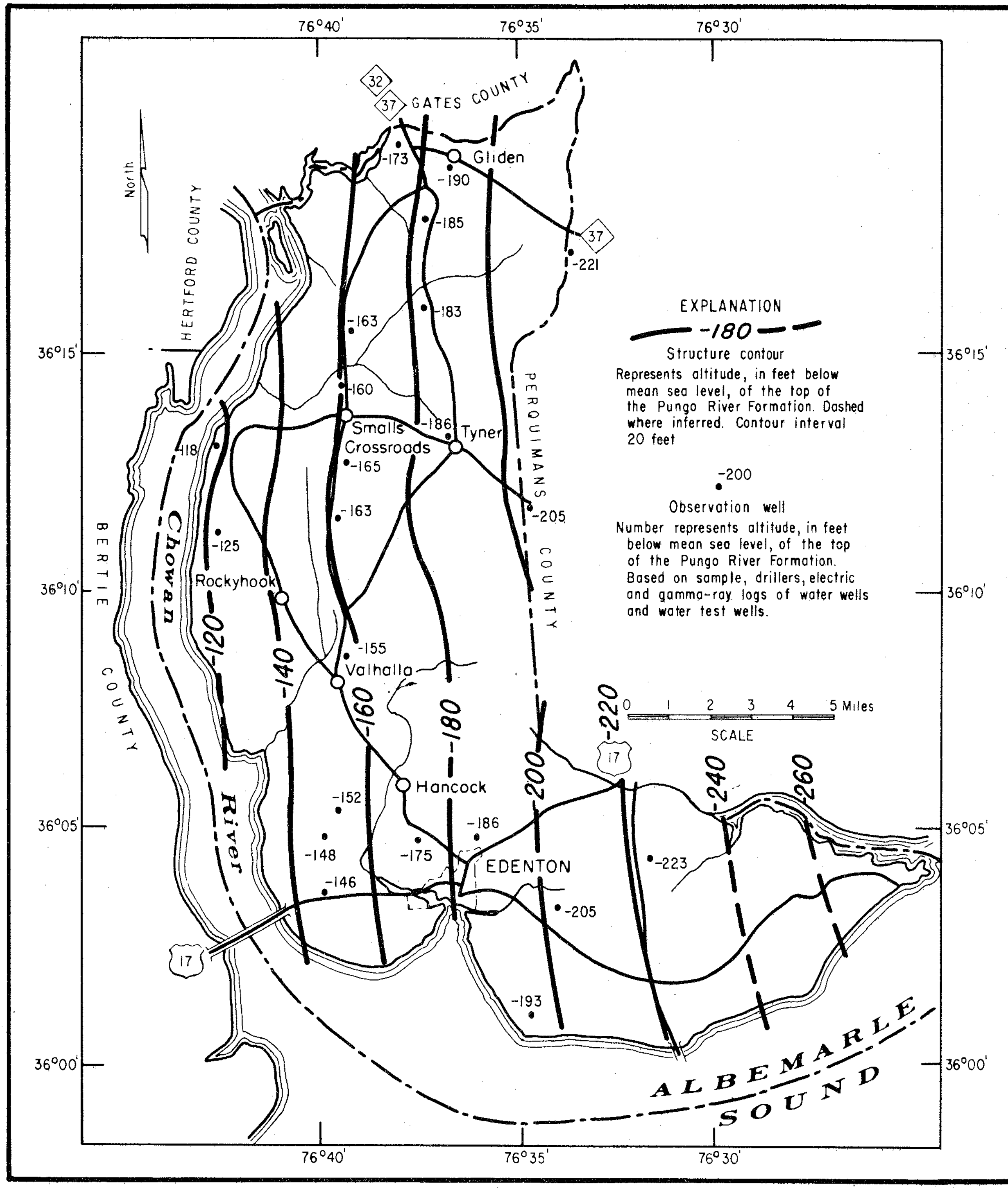


FIGURE 8.-MAP SHOWING THE APPROXIMATE ALTITUDE OF THE TOP OF THE PUNGO RIVER FORMATION.

The Pungo River Formation consists of brown to greenish-gray, fine- to medium-grained phosphatic quartz sand, interbedded with indurated shell and calcareous sand beds and greenish-gray clay. The phosphate occurs as fine- to medium-grained spherules of brown- to black-colored collophane.

Domestic and municipal water supplies are pumped from the Pungo River sediments in the southern part of the area, where the deposits are coarsest. In the northern part of the county, only one of the inventoried wells taps the Pungo River Formation for water supply (table 3).

The Pungo River Formation was exposed to weathering and erosion and then buried beneath the Yorktown Formation that was deposited in a transgressive sea during late Miocene time.

Yorktown Formation.--The Yorktown Formation over lies the Pungo River Formation throughout Chowan County (pl. 1). The top of the Yorktown sediments, primarily defined by the first occurrence of upper Miocene microfossils, generally conforms to the land surface topography in the county (fig. 9). The formation thickens from about 120 feet at the western part of the county to about 220 feet near the eastern part.

The Yorktown Formation is composed chiefly of gray, fine- to medium-grained quartz sand interbedded with blue-gray silt and clay, and unconsolidated to partially consolidated shell layers. Traces of fine-grained brown or black phosphate and light- to dark-green glauconite are common in the lower half of the formation. The highest concentrations of sand are found in the upper 80 to 100

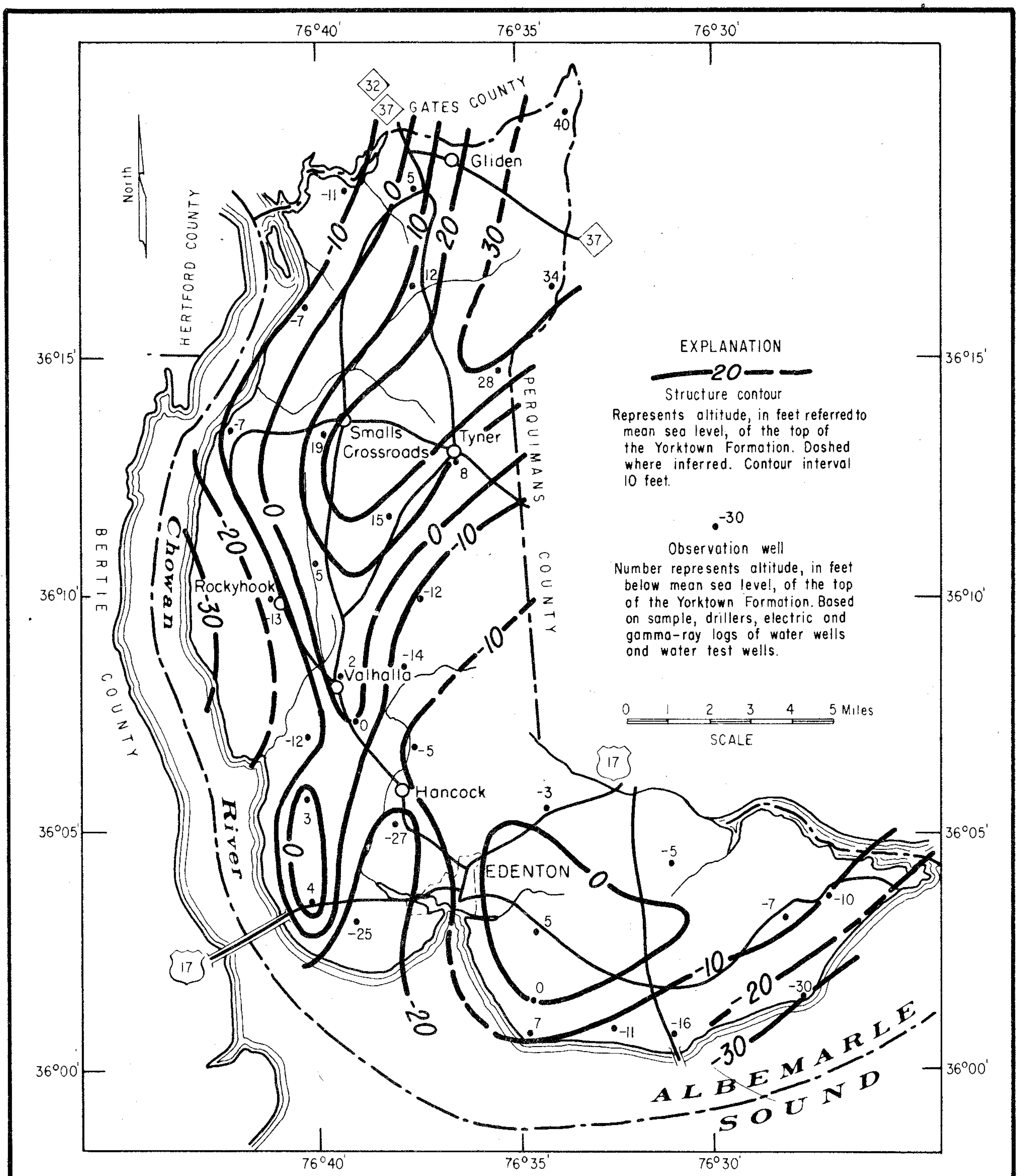


FIGURE 9.- MAP SHOWING THE APPROXIMATE ALTITUDE OF THE TOP OF THE YORKTOWN FORMATION.

feet of the sediments. Coarse sand and fine gravel are prominent in the upper half of the formation near the central part of the county, where the sands are thickest (fig. 10). One hundred and five of the inventoried wells in Chowan County tap the Yorktown Formation for water supply.

Quaternary System

Post-Miocene Series

Surficial deposits.--From 10 to 35 feet of surficial deposits overlie the Yorktown Formation in Chowan County (pl. 1). The lithic character of these sediments varies from tany clay and silt to tan or brown, to fine- to medium-grained quartz sand. Approximately half of the inventoried wells in Chowan County tap these surficial deposits for water supply.

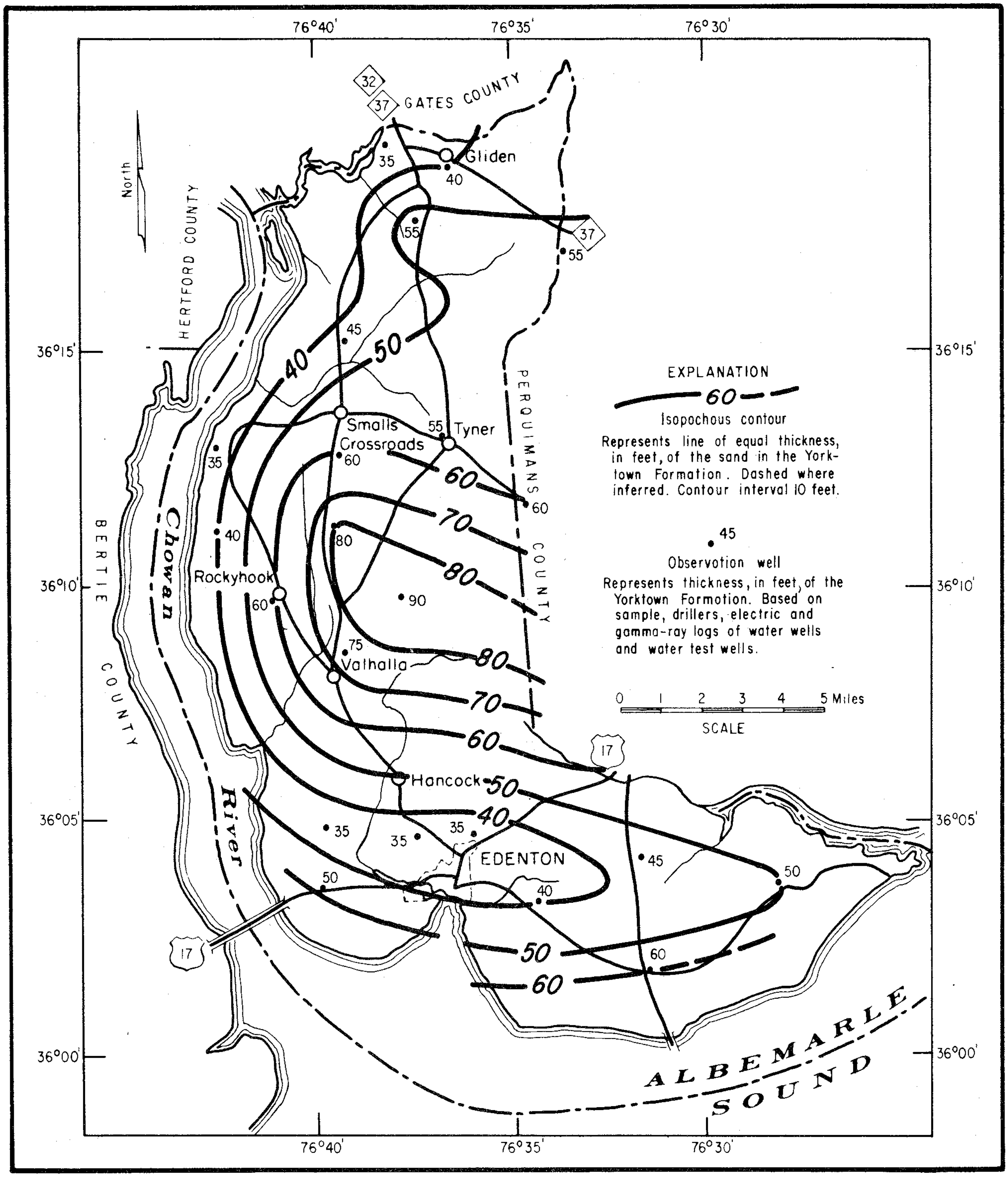


FIGURE 10.-MAP SHOWING THE APPROXIMATE THICKNESS OF SAND IN THE YORKTOWN FORMATION.

GROUND WATER

Source and Occurrence

Water on the earth is kept in never-ending circulation between the seas, atmosphere, and land by energy supplied from the sun. Water is evaporated from the seas and remains in the atmosphere until it is released as precipitation. Of the precipitation that falls on the land, some runs off into streams and rivers, some is returned to the atmosphere by evaporation or through transpiration by plants, and some percolates downward to the zone of saturation and becomes ground water (fig. 11).

The zone of saturation is the zone in which all available void spaces in the rock or soil are filled with water. Water in this zone is under pressure equal to or greater than atmospheric pressure. In Chowan County this zone includes all the sedimentary formations from basement rock, about 2,000 feet below land surface, to the water table, generally about 5 feet below land surface. Ground water in the zone of saturation occurs under non-artesian and artesian condition. Ground water occurs under non-artesian or water-table conditions in the upper part of the zone of saturation, where the water is not confined by impermeable beds. Under these conditions the water level in a well defines the top of the zone of saturation. Ground water occurs under artesian conditions in the permeable parts of the zone of saturation that are confined above and below by impermeable beds. Under artesian conditions the water level in a well will rise above the top of the water-bearing zone.

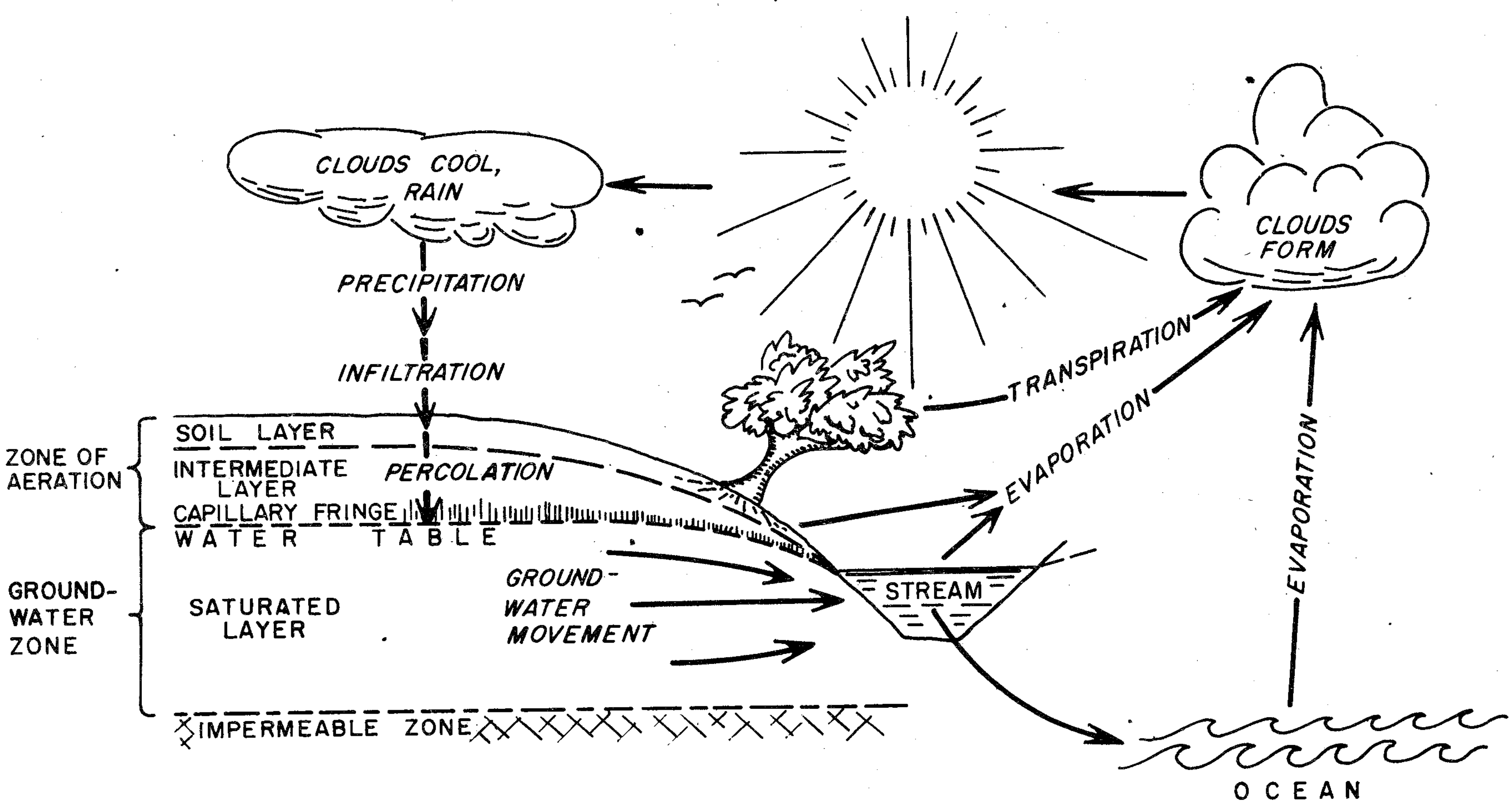


FIGURE 11.-DIAGRAM OF THE WATER CYCLE AND THE SUBSURFACE WATER ZONES.

Aquifers

Formations or parts of formations in the zone of saturation that will transmit usable quantities of water to wells or springs are called aquifers. Aquifer is a relative term that connotes no fixed amount of usuable water. Therefore, a rock unit that yields only small amounts of water may be considered an aquifer if the associated rock units yield even less water. Conversely, a rock unit that yields small amounts of water would not be considered an aquifer if it were found in a sequence of rock units that yield large quantities of water.

The principal supplies of available ground water in Chowan County occur in five aquifers within the various geologic formations that underlie the county. These zones are referred to by letter (A,B,C,D, and E) rather than by formation because the different aquifers occur in more than one formation or in only part of a formation (pl. 1). The aquifers are lettered from the surface downward because the complete sedimentary sequence was only partially penetrated by test drilling and other water-bearing zones exist between aquifer E and basement rock.

Aquifers A and B

Aquifer A includes all the post-Miocene sands from land surface to depths ranging from 10 to 35 feet below land surface in Chowan County (pl. 1). The water contained in this aquifer is under non-artesian or water-table conditions. Aquifer A is composed of very fine-grained to medium-grained tan quartz sand, interbedded with thin layers of brown to tan clay. Pumping tests were not made on wells that tap Aquifer A, but reported sustained yields are generally less than 10 gpm (gallons per minute) from $1\frac{1}{4}$- to 36-inch diameter wells. The water from this aquifer is corrosive and generally contains high concentrations of dissolved iron. Locally, however, water of relatively good quality is available.

Aquifer B includes the sand and shell beds in the upper part of the Yorktown Formation, and it is separated from Aquifer A by lenticular layers of silt and clay (pl. 1). Where these silt and clay layers are thick and continuous with high proportions of clay, the water in Aquifer B is under artesian conditions. Where the separating layers are thin and discontinuous, Aquifers A and B act as one unit, and the water in Aquifer B is under non-artesian or water-table conditions.

The top of Aquifer B is about 15 feet above msl in the northeastern part of Chowan County, 30 feet below msl in the central part, and 5 to 29 feet below msl in the southern part of the county (fig. 12). This water-bearing zone thickens from 35 feet, along the Chowan River and in the vicinity of Edenton, to 90 feet about 3 miles northeast of Valhalla. Average thickness of this aquifer is about 50 feet. Aquifer B is composed of gray-colored, fine- to coarse-grained quartz sand interbedded with layers of shell and blue-gray silt and clay. Yields range from 2 to 20 gpm in $1\frac{1}{4}$- and 2-inch diameter wells, and from 20 to more than 100 gpm in the larger diameter, gravel-packed wells. A properly constructed, naturally developed, 2-inch diameter well, screening 50 feet of this aquifer, should yield about 3 gpm for each foot of drawdown in water level after pumping for one day (table 1). Drawdown is the vertical distance water levels are lowered in a well by pumping.

Chloride concentrations in water from Aquifer B are generally below 30 ppm (parts per million). Total hardness and iron concentrations

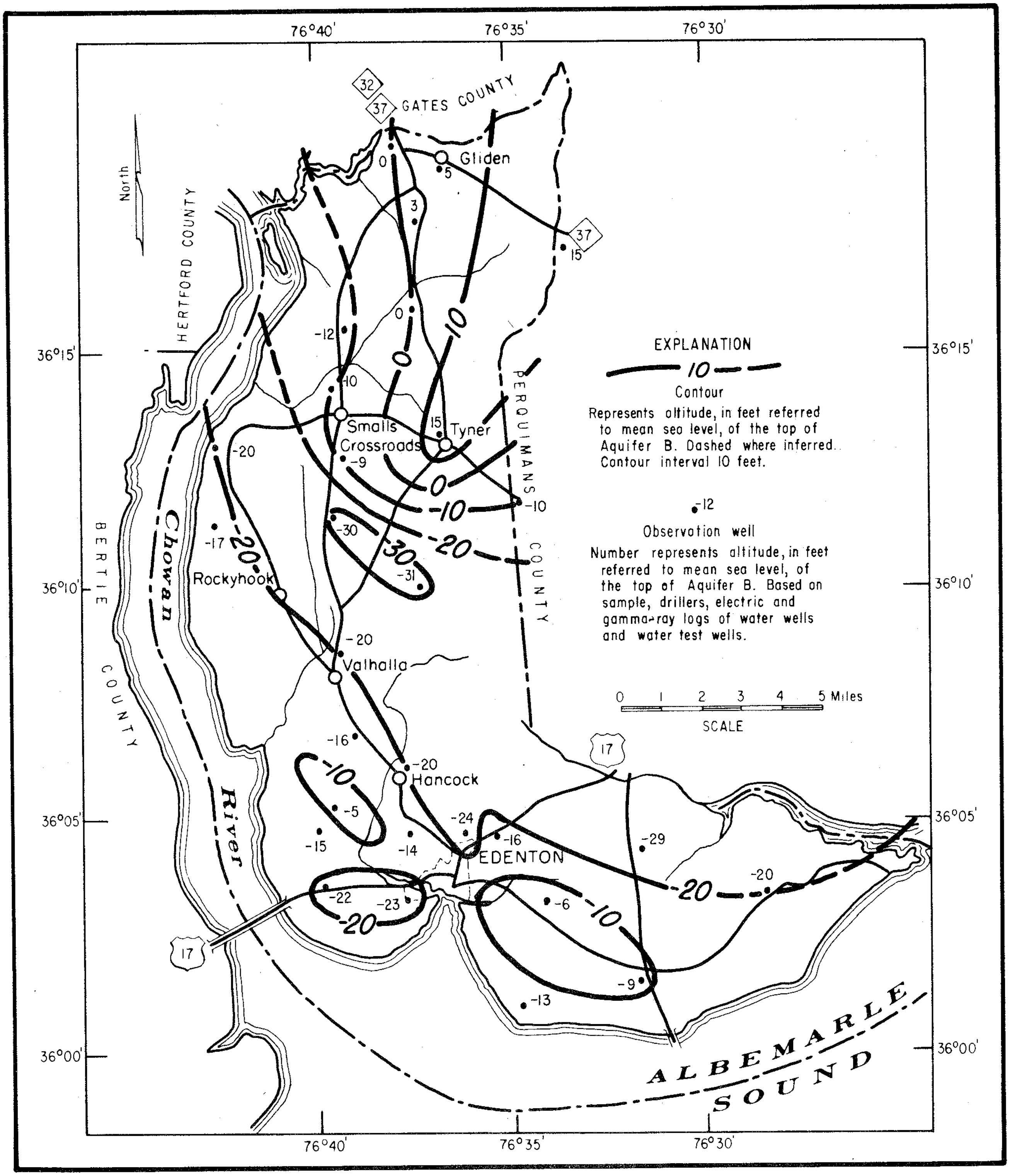


FIGURE 12.-MAP SHOWING THE APPROXIMATE ALTITUDE OF THE TOP OF AQUIFER B.

are locally high enough to require treatment of the water for most uses. Plate 2 shows the depth, thickness, and average water-yielding capacity of the Aquifer B, and the general areas where concentrations of hardness and iron in the water are above or below 120 ppm and 0.3 ppm, respectively.

Aquifer C

Aquifer C includes the upper part of the Beaufort Formation, the Castle Hayne Limestone where it is present in the southern part of the area, and the Pungo River Formation (pl. 1). Aquifers C and B are separated from one another by thick, continuous layers of silt and blue-gray clay of the Yorktown Formation. The thickness of these separating beds ranges from 50 feet in the western part to about 170 feet in the southeastern part of the county. The water in Aquifer C is under artesian conditions.

The top of this water-bearing zone strikes about N. 10° W. in the southern part of the area, and N. 15° E. in the northern part, and dips approximately 10 feet per mile toward the east (fig. 13). The aquifer thins from the south, where it is 65 feet thick at test well T2, to the north, where it is 35 feet thick at test well T1 (pl. 1). The thinning occurs as a result of the erosional pinch out of the Castle Hayne Limestone in the vicinity of Edenton and the erosional beveling of the top of the Beaufort Formation. The thickness of the Pungo River Formation remains relatively constant throughout the county.

The upper part of the Beaufort Formation consists of brown to gray, indurated and partially consolidated calcareous quartz sand and sandy-shell limestone, and unconsolidated fine- to medium-grained quartz sand.

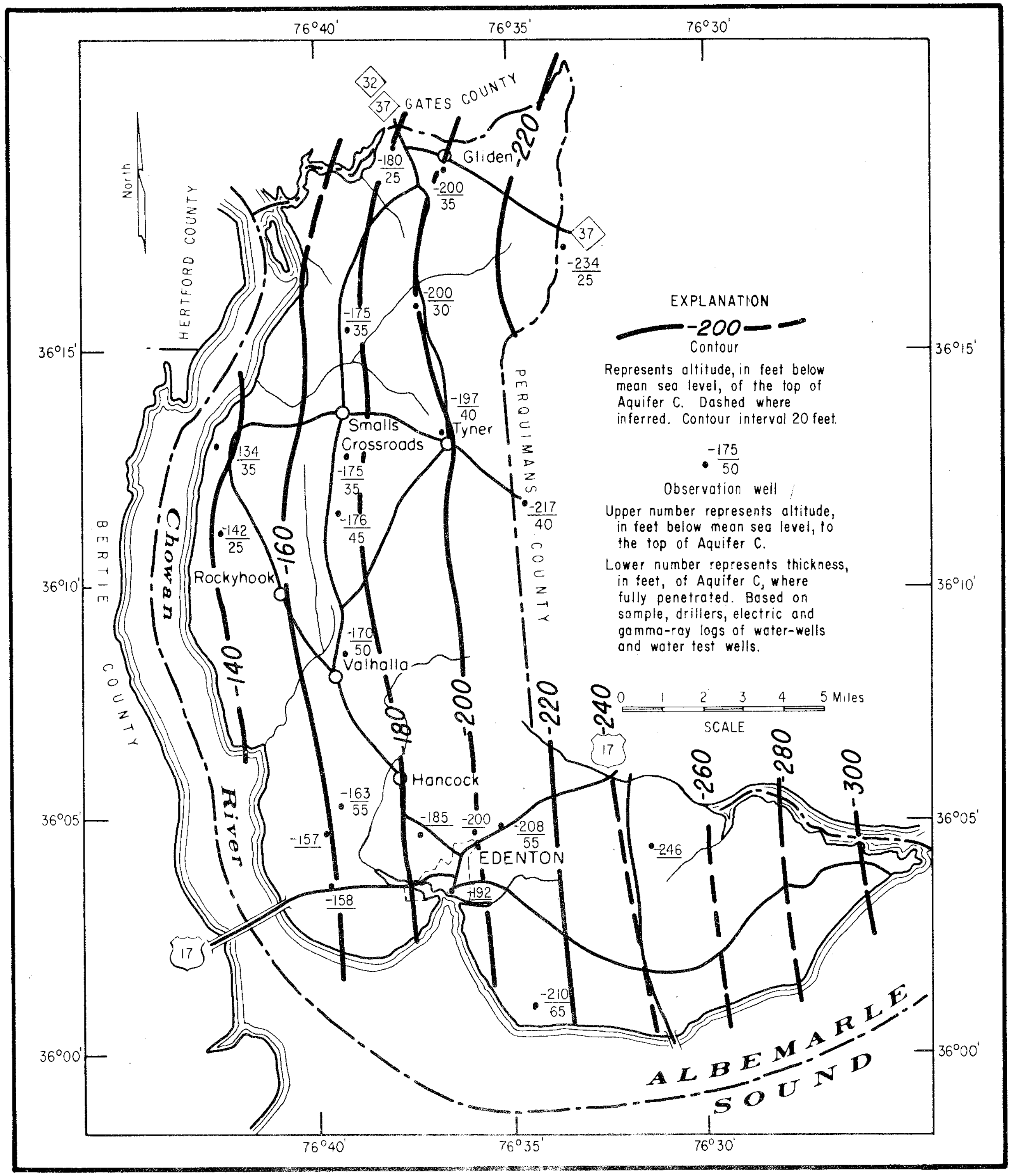


FIGURE 13.- MAP SHOWING THE APPROXIMATE ALTITUDE OF THE TOP OF AQUIFER C.

The Castle Hayne Limestone is composed of white and gray sandy-shell limestone and light-brown medium-grained quartz sand. The Pungo River Formation consists of interbedded brown to green-gray, fine- to medium-grained quartz sand, fine- to medium-grained phosphate, indurated shell beds and green-gray clay. In addition to thinning toward the north, the lithic texture of the aquifer becomes finer toward the north.

The shell and limestone in Aquifer C imparts hardness to the water. However, in many places where the domestic wells tap the cleaner quartz sand of this aquifer the water may be soft. High iron concentrations in the water are encountered locally, and excessive concentrations of chloride are found in water from this zone in the southern, eastern, and northern part of the county.

Aquifer C is the most productive aquifer in the southern part of Chowan County. It has not been developed in the northern part of the area because of excessive concentrations of chloride in the water and low permeability of the sands. Aquifer test data indicate that about 80 percent of the 500 gpm pumped from each of the municipal supply wells at Edenton comes from this aquifer. Yields of 10 to 25 gpm are common in domestic wells that range from $1\frac{1}{4}$ to 4 inches in diameter. In the southern part of the county, a naturally developed, properly constructed 2-inch diameter well, that screens the full thickness of this aquifer, should yield about 10 gpm for each foot of drawdown in water level after pumping for one day. Plate 2 shows the depth, thickness, and average water-yielding capacity of Aquifer C in Chowan County. This plate also shows the general areas where concentrations of chloride, iron, and hardness-causing constituents in the water are above or below 250 ppm, 0.3 ppm, and 120 ppm, respectively.

Aquifer D

Aquifer D consists of a permeable zone found near the middle of the Beaufort Formation (pl. 1). Aquifer D is separated from Aquifer C by about 40 feet of glauconitic silt and clay, and the water in Aquifer D is under artesian conditions. The top of this aquifer strikes about N. 10° to 15° E. and dips approximately 12 feet per mile toward the east (fig. 14). Aquifer D thins slightly toward the north, from 70 feet at test well T2 to 60 feet at test well T1 (pl. 1). East of a line drawn between test wells T1 and T2, Aquifer D is about 50 feet thick; the average thickness of this water-bearing zone is about 55 feet.

Aquifer D is composed of light-gray, fine- to medium-grained quartz sand, and fine- to medium-grained, dark- to light-green glauconite, interbedded with indurated to partially consolidated cream to light gray, glauconitic and sandy limestone. The top of Aquifer D is commonly marked by the occurrence of one of these indurated limestone layers. The water quality is generally good in the central and western part of the county, but chloride concentrations in the water increase rapidly toward the north, south, and east.

Yields range between 3 and 25 gpm in 2-inch and 4-inch diameter wells. Between 50 and 100 gpm are pumped from Aquifer D in the northernmost municipal supply well at Edenton. The calculated yield from a properly constructed, naturally developed well, 2 inches in diameter, screening the full thickness of the aquifer, is about 4.6 gpm for each foot of drawdown after pumping for one day. Plate 2 shows the depth, thickness and average water-yielding capacity of Aquifer D in Chowan

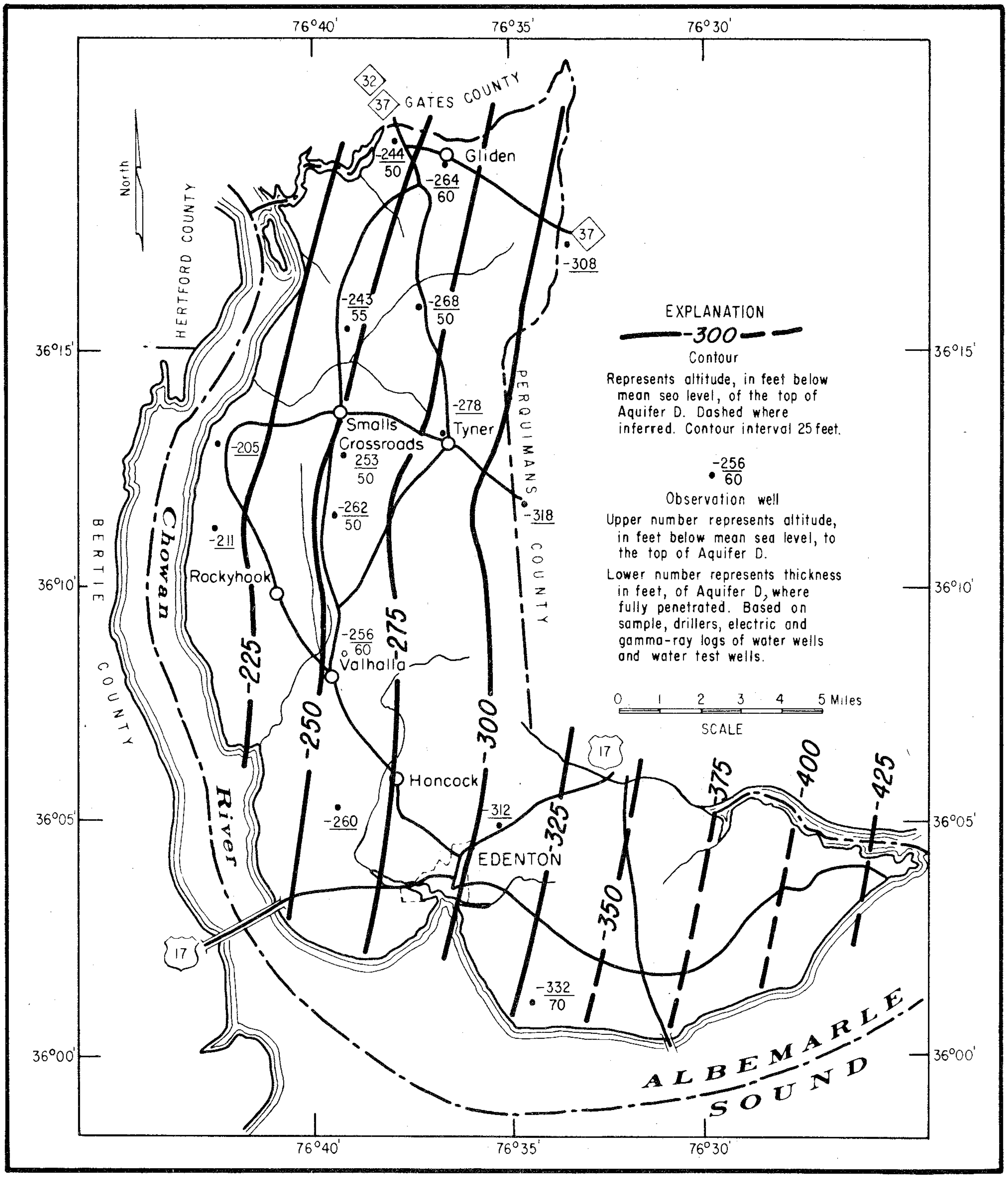


FIGURE 14.-MAP SHOWING THE APPROXIMATE ALTITUDE OF THE TOP OF AQUIFER D.

County. This plate also shows the general areas where concentrations of chloride, iron, and hardness-causing constituents in the water are above or below 250 ppm, 0.3 ppm, and 120 ppm, respectively.

Aquifer E

Aquifer E includes the sands found in the upper part of the Black Creek Formation (pl. 1). Aquifers E and D are separated by 170 feet of silt and clay in the southern part, and 30 feet of silt and clay in the northern part of the area. The water in Aquifer E is under artesian conditions.

The top of Aquifer E nearly coincides with the top of the Black Creek Formation, striking about N. 15° to 20° E. and dipping approximately 25 feet per mile to the east-southeast (fig. 15). This aquifer is 120 feet thick at test well T2, about 110 feet thick at test well T3, and about 100 feet thick at test well T1, thinning slightly toward the north (pl. 1). Average thickness throughout the county is about 100 feet.

Aquifer E consists of gray-colored, poorly sorted, fine- to medium-grained quartz sand, interbedded with thin shell beds and thin, gray to black clay layers. The quality of water from this zone is generally good in the western and central part of the county, but chloride concentrations in the water are high in the southern, eastern, and northern parts of the county.

Yields from inventoried wells screened in Aquifer E ranged from 1 to 5 gpm, and seemed exceptionally low for the texture of the sands in this aquifer. Probably the screens in these wells were set in some of the less permeable units in this water-bearing zone. Depth differences

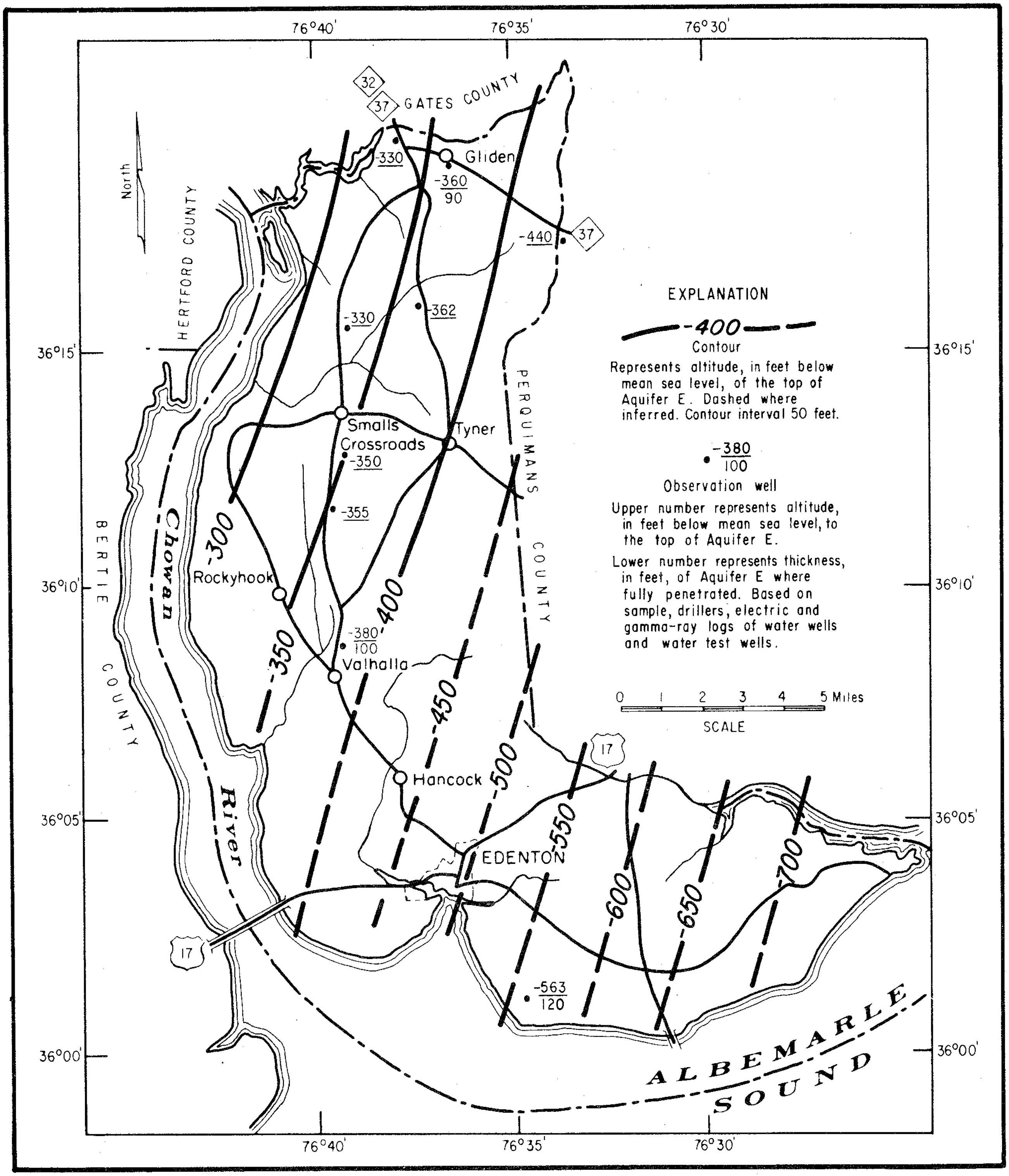


FIGURE 15.-MAP SHOWING THE APPROXIMATE ALTITUDE OF THE TOP OF AQUIFER E.

of as little as 5 feet in screen setting can be critical because of the clay layers found in the sands of this aquifer. Screen settings were determined by referring to lithic samples collected during drilling and without the use of electric and/or gamma-ray logs. The amount of error in determining screen settings by this method increases with the depth of the hole because of the time lag between the bit cutting the material and the return of the cuttings to land surface.

Plate 2 shows the depth to and approximate thickness of Aquifer E in Chowan County and the general areas where concentrations of chloride, iron, and hardness-causing constituents in the water are above or below 250 ppm, 0.3 ppm, and 120 ppm, respectively.

Aquifer Tests

Twenty-two aquifer tests were made from wells in Chowan County to determine the hydraulic characteristics - the coefficients of storage and the transmissibility - of the aquifers (table 1). These characteristics were determined by applying the nonequilibrium and recovery formulas (Theis, 1935) and the modified nonequilibrium formula (Jacob, 1950) to the test data.

The coefficient of transmissibility is defined as the number of gallons of water per day that will move through a saturated vertical strip of an aquifer one foot wide under a hydraulic gradient of one foot per foot at the prevailing temperature of the water. This value expresses the ability of an aquifer to transmit water. The coefficient of storage is defined as the volume of water released from or taken into storage in each column of the aquifer having a base of one square foot and a height equal to the thickness of the aquifer, when the head or water level is lowered or raised one foot. This value expresses the capacity of an aquifer to store water.

The hydraulic characteristics can be used to determine the water-yielding capacity of wells tapping an aquifer, the effects of pumping on water levels in an aquifer, and the volume and velocity of water moving through an aquifer.

The water-yielding capacity of a well, the specific capacity, is the amount of water in gallons per minute that a properly constructed well will yield for each foot of drawdown in water level after a specific period of pumping, generally one day. Table 1 lists the average hydraulic characteristics and calculated specific capacities, etc., of Aquifers B, C, and D.

The measured specific capacity of a well, in many cases, will be less than the calculated specific capacity and, to a great extent, the difference may be caused by improper construction and/or poor well development. A comparison of the measured and calculated specific capacities of a well can be used to determine well efficiency. For example, if a well were pumped at 1000 gpm for one day and the drawdown at the end of this period was 20 feet, the measured specific capacity would be 50 gpm per foot of drawdown. If the calculated specific capacity was 100 gpm per foot of drawdown, the well would have 50 percent efficiency.

Pumping water from an aquifer causes water levels to decline in the vicinity of the pumped well. As a result, the piezometric surface or the water table of the aquifer is depressed so that it resembles the shape of an inverted cone which has its apex at the center of the pumped well. Such a piezometric or water-table configuration is referred to

Table I.- Average Quantitative Values For Aquifer B, C, And D In Chowan County, N. C.

Formation	Aquifer	Trans-missibility	Coefficient of storage	Aquifer thickness (in feet)	Permea-ability (field)	Calculated Specific Capacity	
						2-inch° dia.	36-inch°° dia.
Yorktown	B	7,000	.001	50	140	2.9	3.5
Pungo River Castle Hayne* Upper part of Beaufort	C	30,000	.0001	40**	750	10	13
Beaufort	D	12,000	.0001	55	217	4.6	5.2

Transmissibility - Coefficient of transmissibility in gallons per day through a vertical strip of the aquifer 1 foot wide with a height equal to the thickness of the aquifer, under a unit hydraulic gradient.

Permeability ----- Coefficient of field permeability in gallons per day through a cross section of 1 square foot, under a unit hydraulic gradient. This coefficient is determined by dividing the coefficient of transmissibility by the thickness of the aquifer.

* ---------------- Where present

** ---------------- Thickness picked at site of Well No. 234

° ---------------- Average diameter for domestic wells

°° ---------------- Average diameter for most gravel packs as a cone of depression (fig. 16). The characteristics (shape, size, and growth rate) of the cone of depression depend to a large degree upon the rate and duration of the pumping, the coefficients of storage and transmissibility of the aquifer, and the amount of ground water that leaks from other aquifers to the zone from which water is being withdrawn during pumping. Other factors remaining the same, the characteristics of the cone of depressions are determined by the transmissibility of the aquifer. Flat cones that spread very rapidly develop in aquifers with high transmissibility and steep cones that spread slowly develop in aquifers with low transmissibility.

Figures 17, 18, and 19 represent half-sections through calculated cones of depression in Aquifers B, C, and D, respectively. These graphs show the calculated drawdown in water level at selected times and various distances from a well being pumped at a constant rate. In the formula used for constructing these distance-drawdown plots it is assumed that the coefficients of storage and transmissibility are constant and the same in all directions, the aquifer is infinite in areal extent, homogeneous, and confined between impermeable beds so that all the water is drawn from storage in the aquifer, the well penetrates and draws water from the full thickness of the aquifer, and that ground water is released from storage instantaneously with a decline in artesian head. Variations from these calculated plots can be expected because the above conditions are seldom if ever met, and because the distance-drawdown graphs are, for the most part, constructed from average values of the hydraulic characteristics of the aquifers. Therefore, when a well is constructed it is important to pump it and determine the hydraulic characteristics of the screened aquifer in the vicinity of the well. Measured drawdown will generally be less than

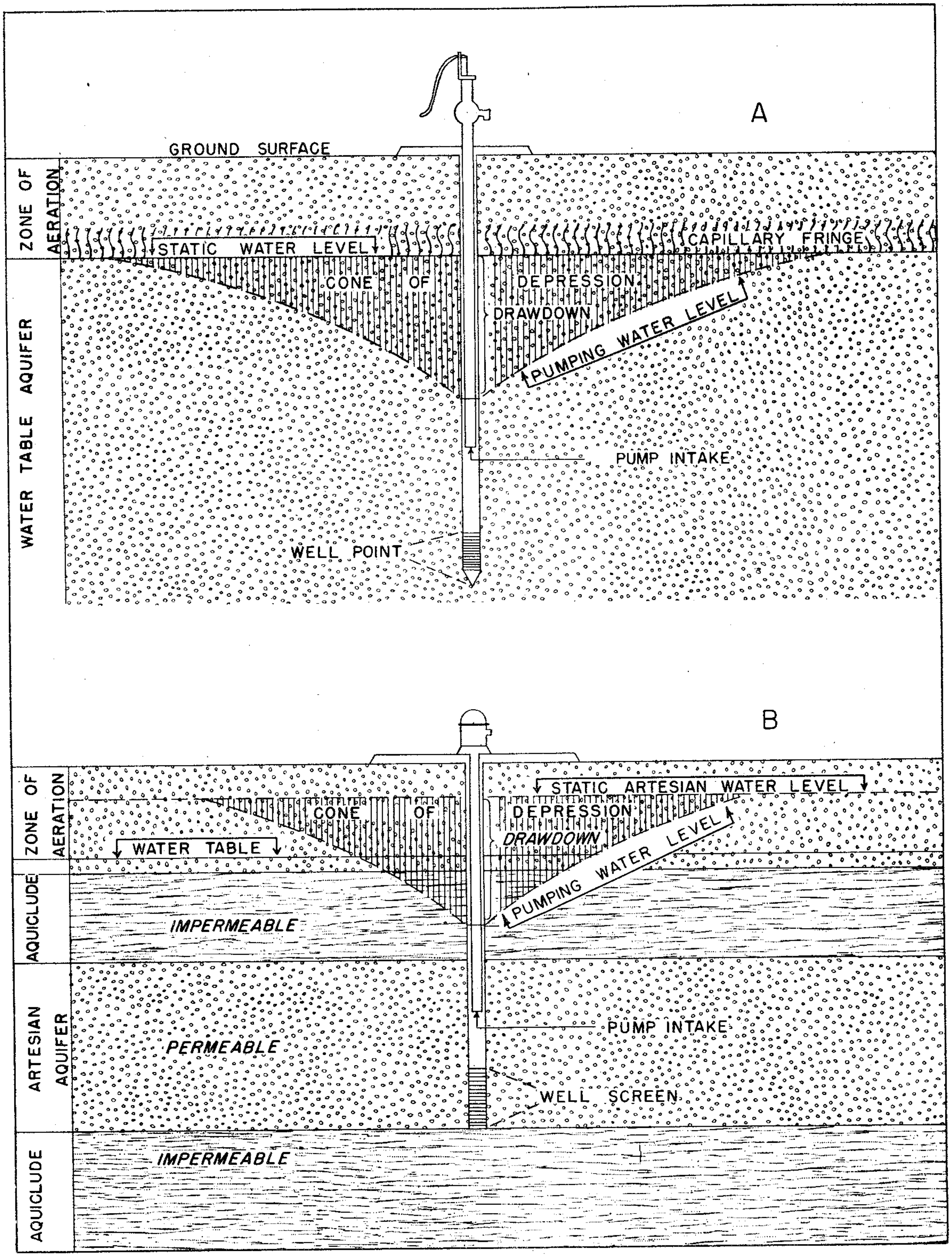


FIGURE 16.-DIAGRAMMATIC SECTION SHOWING THE EFFECTS OF PUMPING ON (A) THE WATER TABLE AND (B) THE PIEZOMETRIC SURFACE.

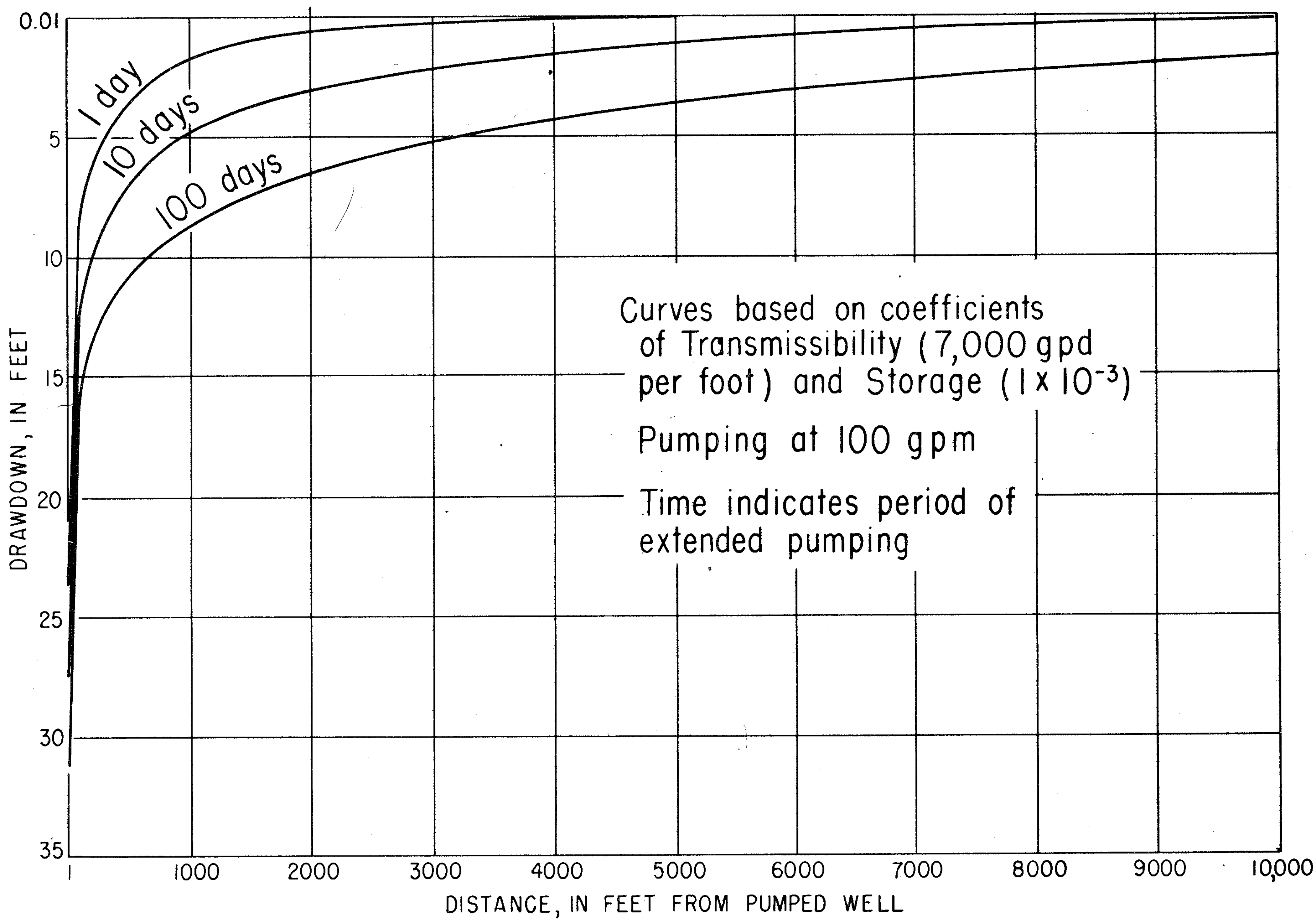


FIGURE 17.-CALCULATED DISTANCE-DRAWDOWN CURVES DETERMINED FOR PUMPING FROM WELLS SCREENED IN AQUIFER B.

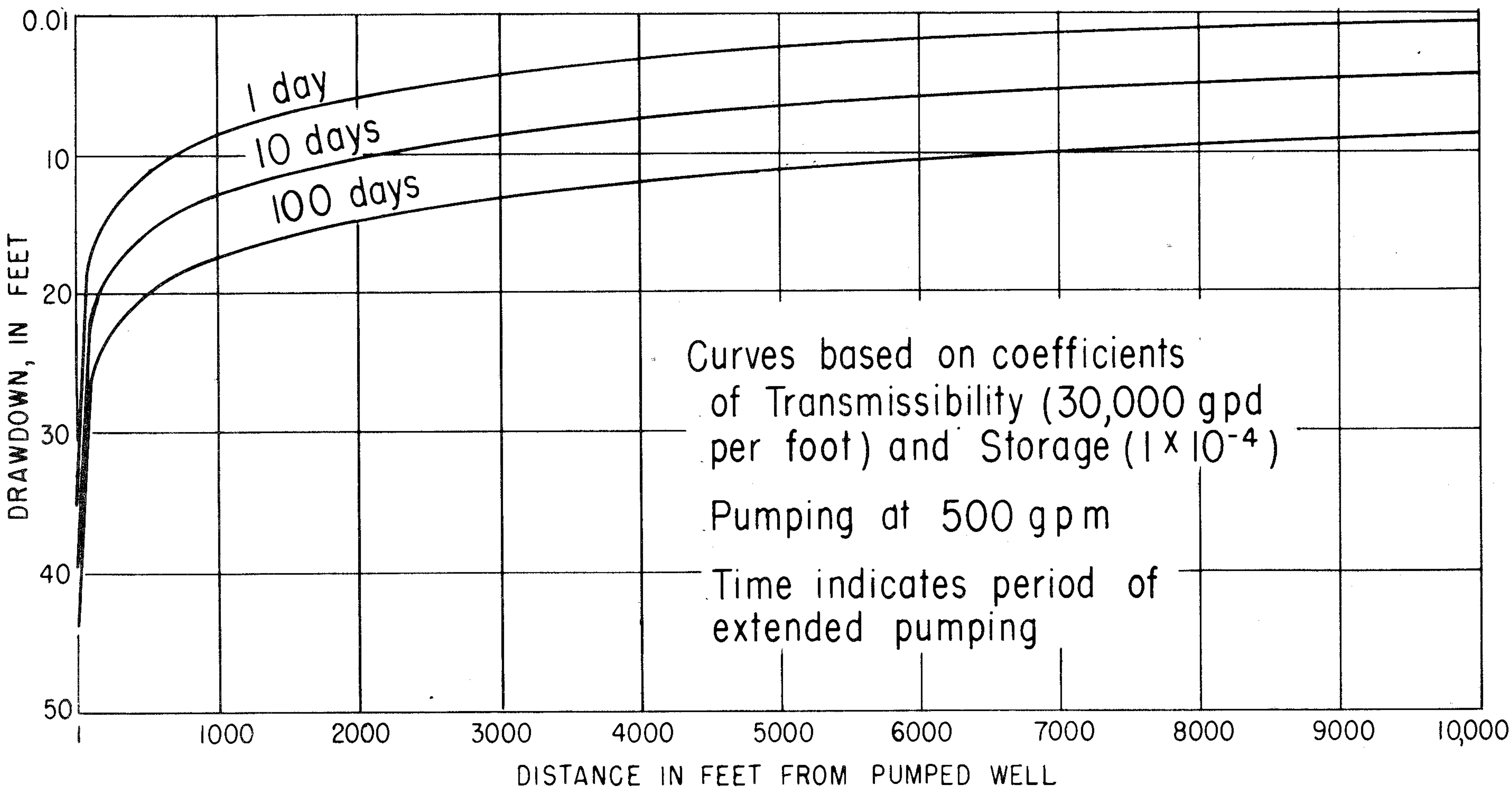


FIGURE 18.-CALCULATED DISTANCE-DRAWDOWN CURVES DETERMINED FOR PUMPING FROM WELLS SCREENED IN AQUIFER C.

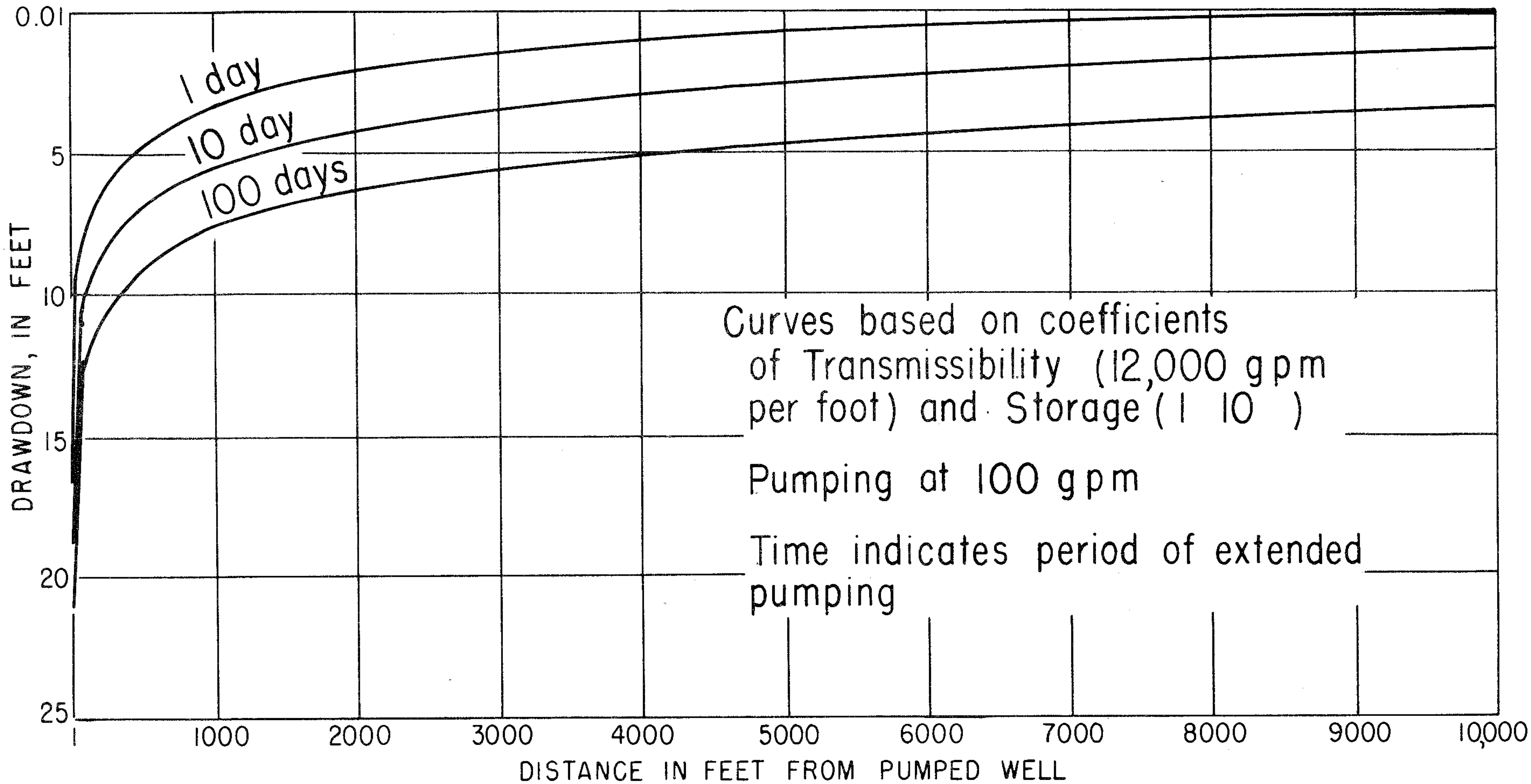


FIGURE 19.-CALCULATED DISTANCE-DRAWDOWN CURVES DETERMINED FOR PUMPING FROM WELLS SCREENED IN AQUIFER D.

the calculated drawdown after extended periods of pumpage except where barriers to recharge are intercepted by the cone of depression. This is due to the fact that drawdown, caused by pumping, will induce the flow of water from other aquifers to the pumped zone, thus increasing the rate of recharge. As the cone of depression spreads, more and more recharge will be intercepted until, if the pumping rate is constant, recharge to the aquifer equals the withdrawal. When recharge equals withdrawal the cone of depression and drawdown will stabilize.

The graphs as shown in figures 17, 18, and 19 are useful for estimating drawdowns at short distances from a pumped well over short periods of time. Similar plots can be constructed for any desired yield, because drawdown is approximately proportional to the pumping rate for wells screened in artesian aquifers. To determine the calculated drawdown for some desired yield other than that shownon the figures, divide the drawdown shown on the graph by the indicated yield, then multiply by the desired pumping rate, selecting values from the graph along the same time plot. For example, the calculated drawdown 2,500 feet from a properly constructed, naturally developed well screening the full thickness of Aquifer D, pumping 200 gpm for 100 days can be determined as follows. Select the drawdown 2,500 feet from the pumped well on the 100 days curve on figure 19 (7 feet). Divide 7 feet by 100 gpm (the indicated yield on figure 19) which gives 0.07 foot/gpm. Multiply 0.07 foot/gpm by 200 gpm the (desired yield). The gpm units cancel out, and the answer is 14 feet of drawdown.

Such information is essential for estimating the spacing of two or more wells to be constructed in the same area. When wells are spaced close together their cones of depression may overlap when they are pumped. Where overlap occurs drawdown is additive. Thus, the calculated drawdown half-way between two wells screening the full thickness of Aquifer D, spaced 5,000 feet apart and pumped at 500 gpm each for 10 days would be about 8 feet, or double the drawdown that would occur 2,500 feet from one well pumped at 100 gpm for 10 days (fig. 19). Additive drawdown effects lower the specific capacity of wells, and may cause excessive water-level declines. It is desirable to reduce the overlap of cones of depression as much as possible to insure maximum well and aquifer efficiency. However, well spacing involves economics as well as hydrology and hydraulics. Costs of installation and maintenance of interconnecting pipeline and electrical systems may be prohibitive if wells are spaced to completely eliminate additive drawdown. Therefore, the distance between wells must be determined by considering both the economic and hydrologic-hydraulic factors (Bentall, 1963).

Movement

Ground water moves through the geologic formations and aquifers in Chowan County in response to gravity. It moves from areas where ground-water levels are high (areas of recharge) toward areas where the ground-water levels are low (areas of discharge). Figures 20, 21, 22, and 23 show the water-level distributions in Aquifers A, B, C, D, and E, respectively, during December 1964.

The direction of the ground-water flow in the aquifers is at right angles to the contours of equal water level or head. In Aquifers A and B the areas of high and low head coincide with topographic highs and lows,

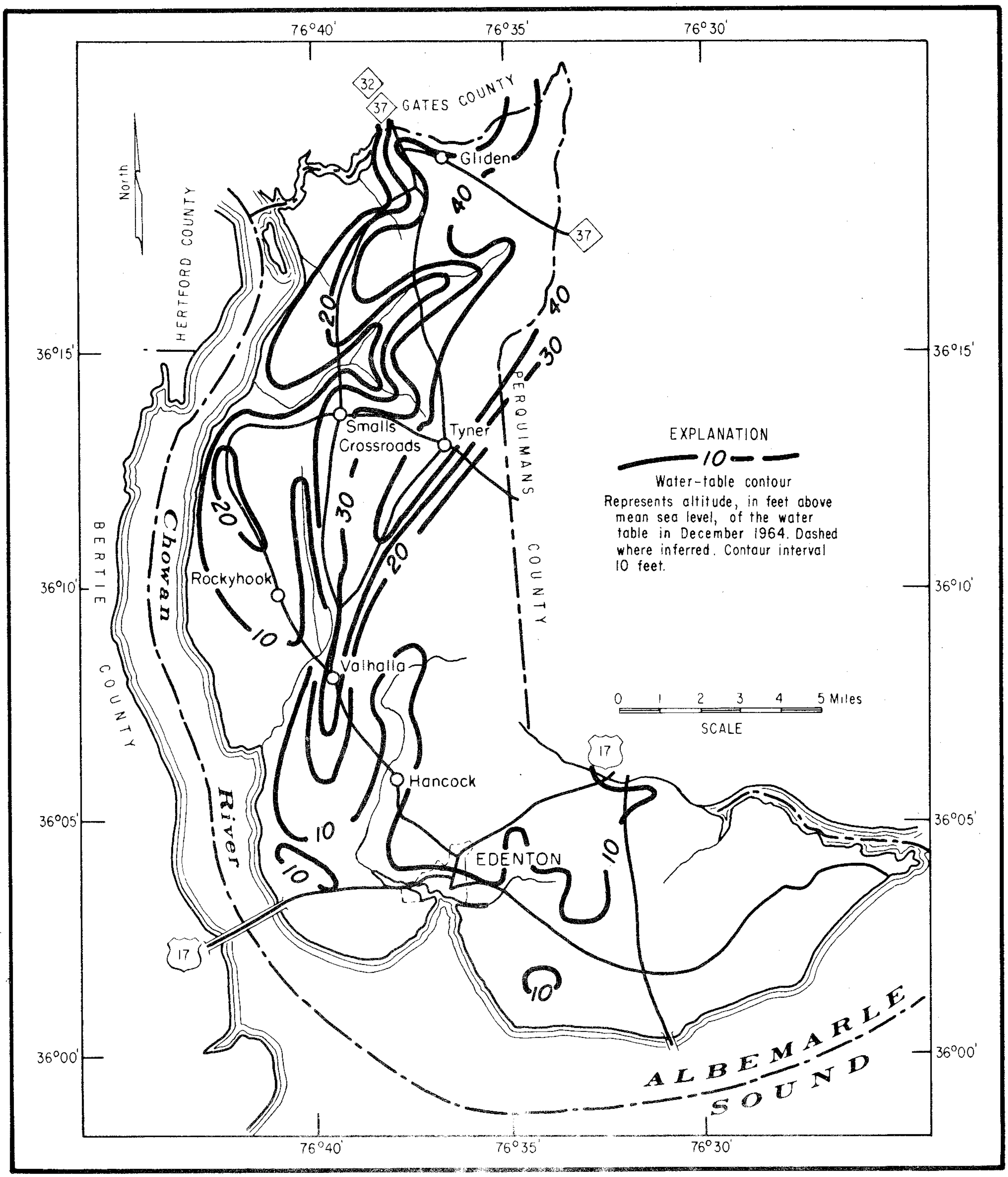


FIGURE 20.-MAP SHOWING THE APPROXIMATE ALTITUDE OF THE WATER TABLE FOR AQUIFERS A AND B, DECEMBER 1964.

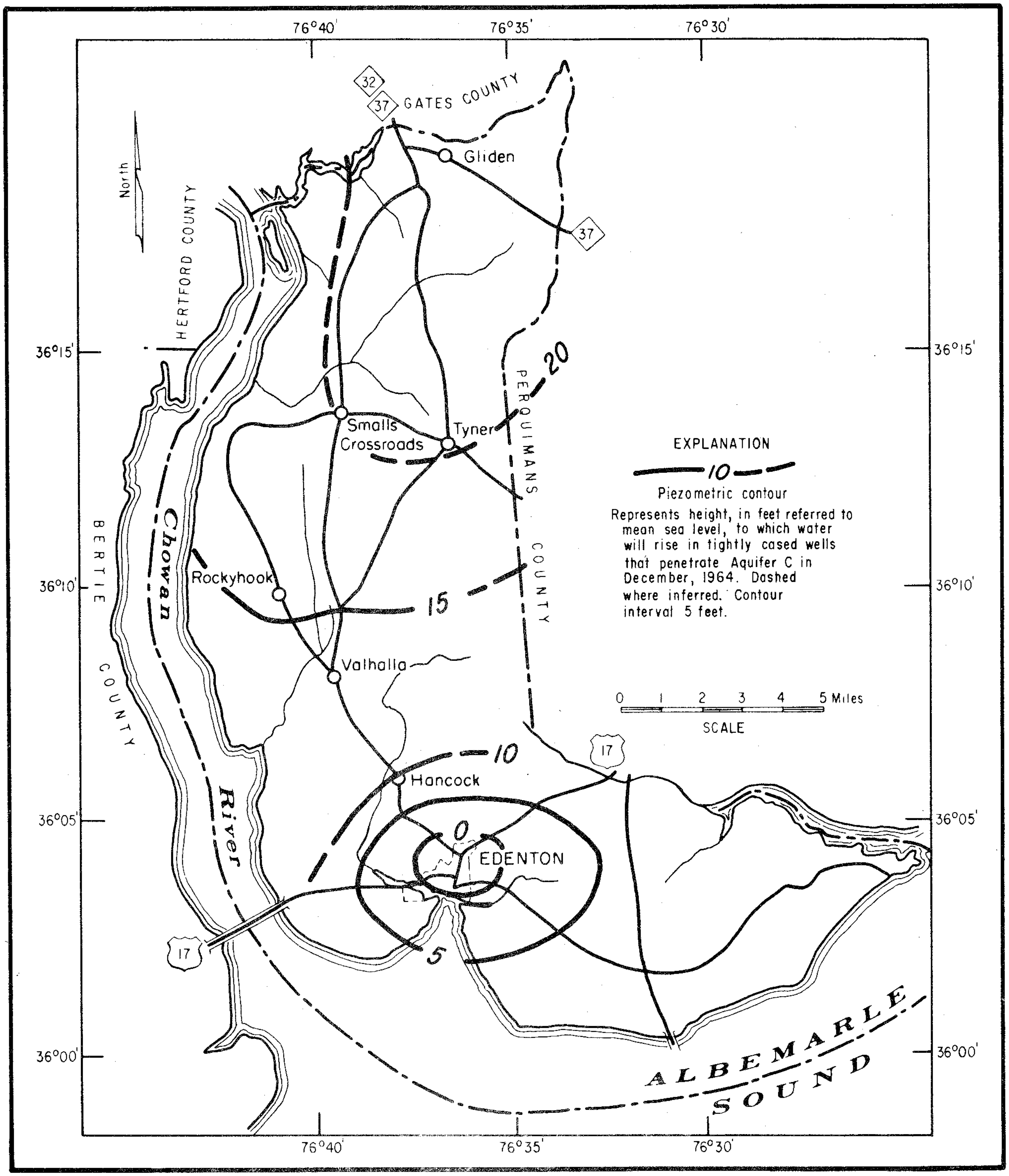


FIGURE 21.- MAP SHOWING THE APPROXIMATE ALTITUDE OF THE PIEZOMETRIC SURFACE FOR AQUIFER C, DECEMBER 1964.

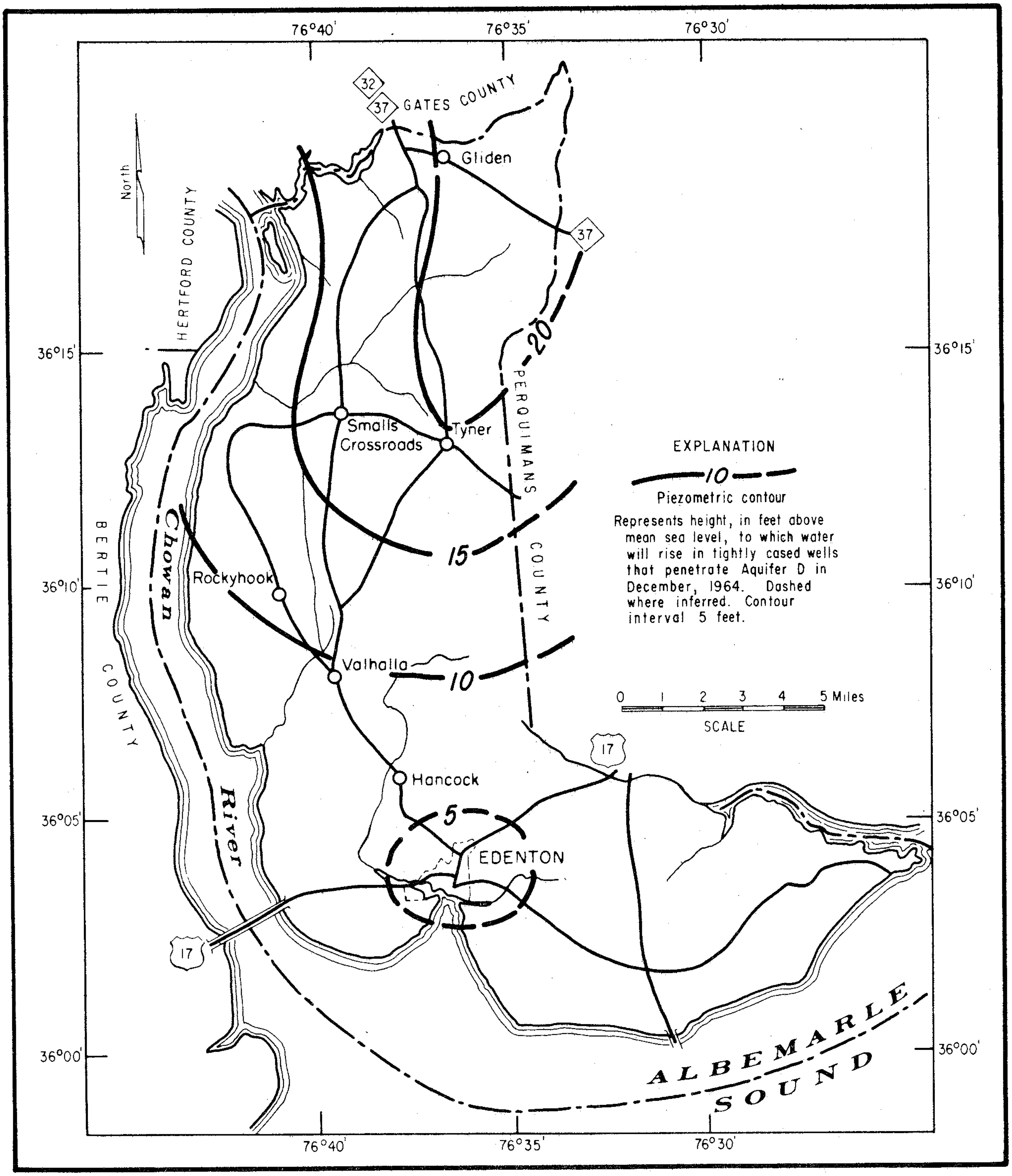


FIGURE 22.-MAP SHOWING THE APPROXIMATE ALTITUDE OF THE PIEZOMETRIC SURFACE FOR AQUIFER D, DECEMBER 1964.

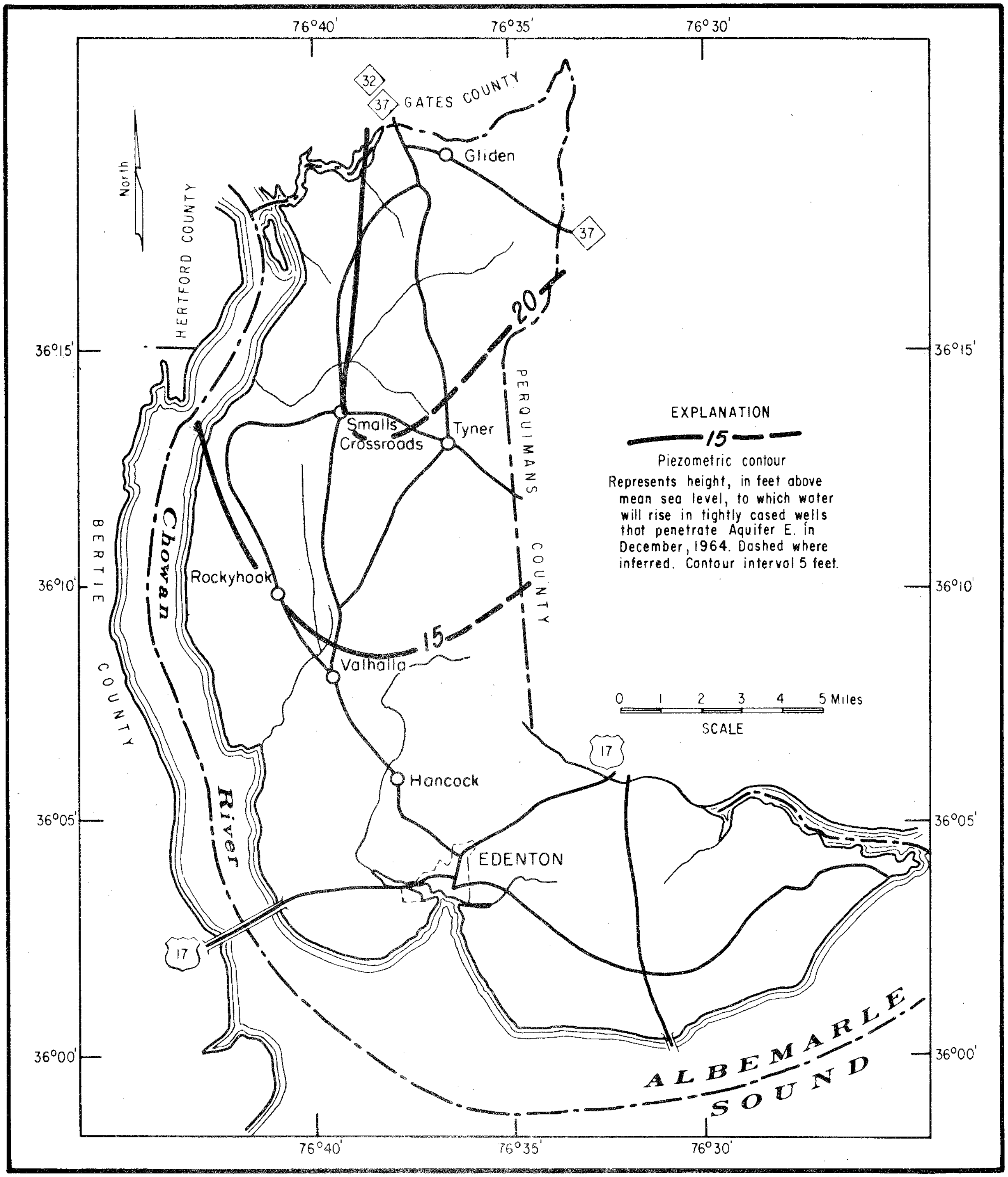


FIGURE 23.-MAP SHOWING THE APPROXIMATE ALTITUDE OF THE PIEZOMETRIC SURFACE FOR AQUIFER E, DECEMBER 1964.

respectively, and movement is away from the hills and ridges toward the lakes, streams, rivers, swamps, and the sound. Generally the same flow pattern exists in the deeper aquifers (C, D, and E), but small topographic features have little or no apparent control on the head distributions. In Aquifer C, D, and E the ground water moves away from the northeastern part of the county toward Chowan River, Albemarle Sound, and Perquimans County.

In the cone of depressions that has developed in Aquifers C and D from pumpage in the Edenton area (fig. 21, and 22), the natural flow direction, which is generally toward the south, has been interrupted. Within the area of influence of this cone of depression, ground water moves from all directions toward the center of pumpimg.

In addition to lateral movement within the aquifers, ground water also moves vertically from one aquifer to another. This flow is much slower than that within the water-bearing zones because it is retarded by the silt and clay layers (aquicludes) that separate the aquifers. However, when head differences are large over an extensive area, even thick clay layers can transmit considerable quantities of water over long periods of time. For example, in the northern part of Chowan County, the water table in Aquifers A and B is generally 15 feet higher than the piezometric surface in Aquifer C over about a 36 square-mile area (fig. 20 and 21). The average thickness of the aquiclude between Aquifers B and C is about 120 feet. Assume this aquiclude transmits 0.0002 gpd (gallons per day) through a cross-sectional area of 1 square foot under a difference of 1 foot. With this vertical permeability it would transmit about 21,600 gpd from Aquifer A and B to to Aquifer C for the 15 foot head difference over the 36 square mile area described above.

The example above illustrates a downward movement of water with relation to land surface. In many cases, however, where the pressure head is greater in the deeper than in the shallower aquifers, the ground-water movement is upward with relation to land surface. Such conditions exist in the southern half of Chowan County where there is a general upward movement of water from Aquifer E to Aquifer D (fig. 23 and 22), and from Aquifer D to Aquifer C (fig. 22 and 21). Whether the flow is upward or downward with relation to land surface, the direction of movement is always down the hydraulic gradient.

The rate of ground-water movement is governed by head differences and the transmissibility of the aquifer. The highest rates are associated with high transmissibilities and large head differences that occur over short distances. Lowest rates are associated with the converse of these conditions. The highest ground-water velocities in Chowan County occur in Aquifers A, B, and C. In Aquifers A and B where hydraulic gradients are steep (20 feet per mile or more) and in Aquifer C in the cone of depression around Edenton, where transmissibilities are the highest in the county, ground-water velocities are in the order of magnitude of 0.05 to 0.07 foot per day. The lowest ground-water velocities in Chowan County occur in Aquifer E where head differences are only about 1 foot per mile. The flow rates here are probably 10 to 100 times slower than those cited above.

Recharge

The principal source of ground-water recharge to the aquifers in Chowan County is rainfall. The greatest percentage of rainfall percolates to the zone of saturation in areas where water levels are high. These areas are generally outlined in figure 24. Major recharge to the artesian aquifers occurs in the northern part of the county where the water table is 15 to 20 feet higher than the piezometric surfaces. This area is generally outlined by the 20 foot piezometric contours in Aquifers C, D, and E (fig. 21, 22, and 23).

Most of the ground-water recharge occurs between the months of November and March. Even though rainfall is relatively light during this period of the year (fig. 3), greater percentages of rainfall reach the ground-water reservoir during this time because very little water is lost through evaporation and transpiration. This is shown in the hydrographs for observation wells screened in the various aquifers in the area (fig. 25, and 26), and in table 2. The table indicates that the ground water added to storage from 16.5 inches of rain in the winter and early spring of 1963-64, was more than 4 times that added to storage from 25.9 inches of rain during the late summer and fall of 1964. Table 2 further indicates that about 75 percent of the recharge occurred from 7 inches of rain in December and January when the water levels in the aquifer are relatively low. The ratio of recharge to rainfall decreased with the filling of the ground-water reservoir, and was least in March when the water level in the aquifer was highest. Although the table was prepared for a well screening Aquifer A and B, the same recharge pattern exists, with less water-level fluctuation, in the deeper water-bearing zones.

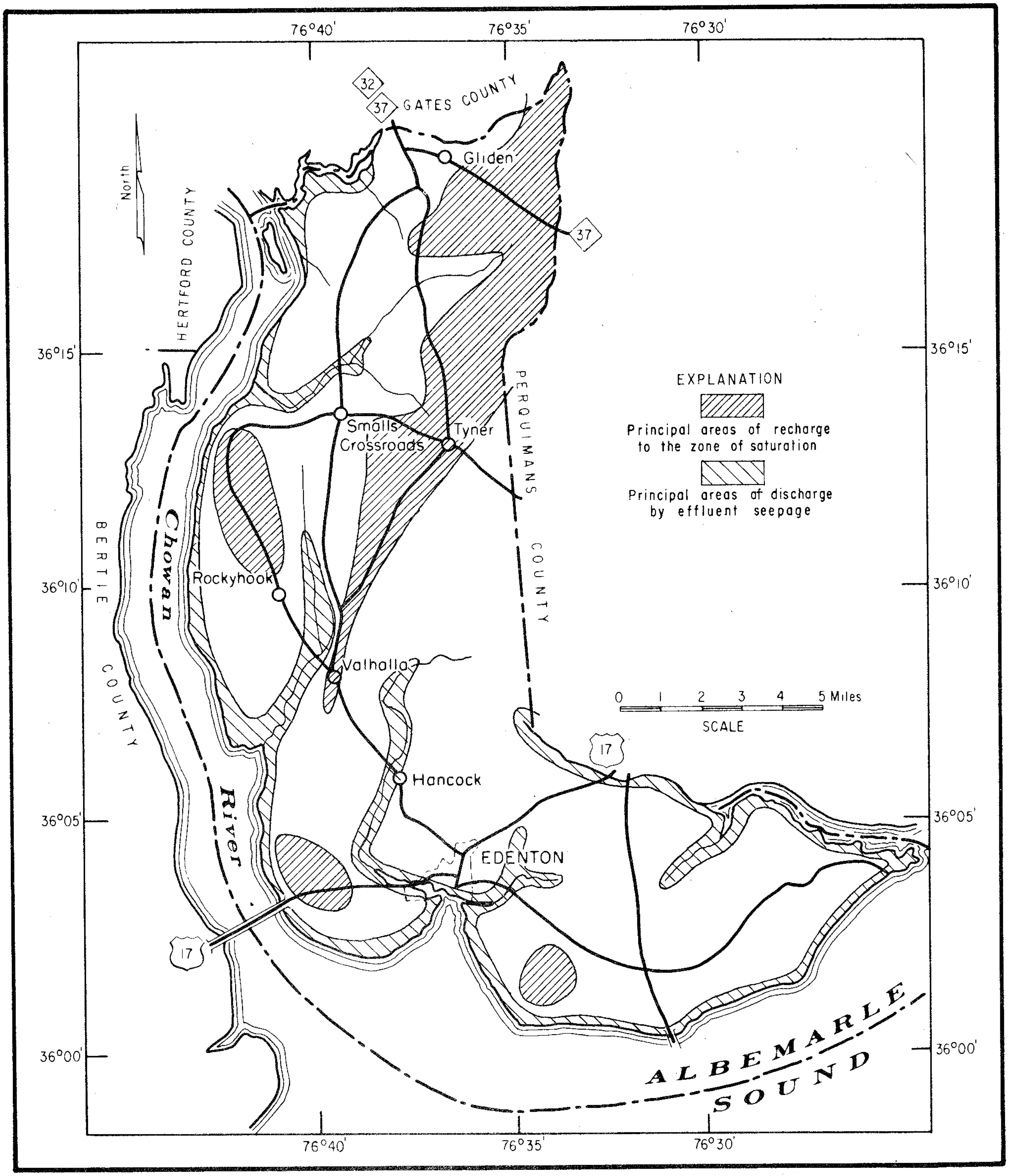


FIGURE 24.-MAP SHOWING PRINCIPAL AREAS OF RECHARGE TO THE ZONE OF SATURATION AND DISCHARGE BY EFFLUENT SEEPAGE.

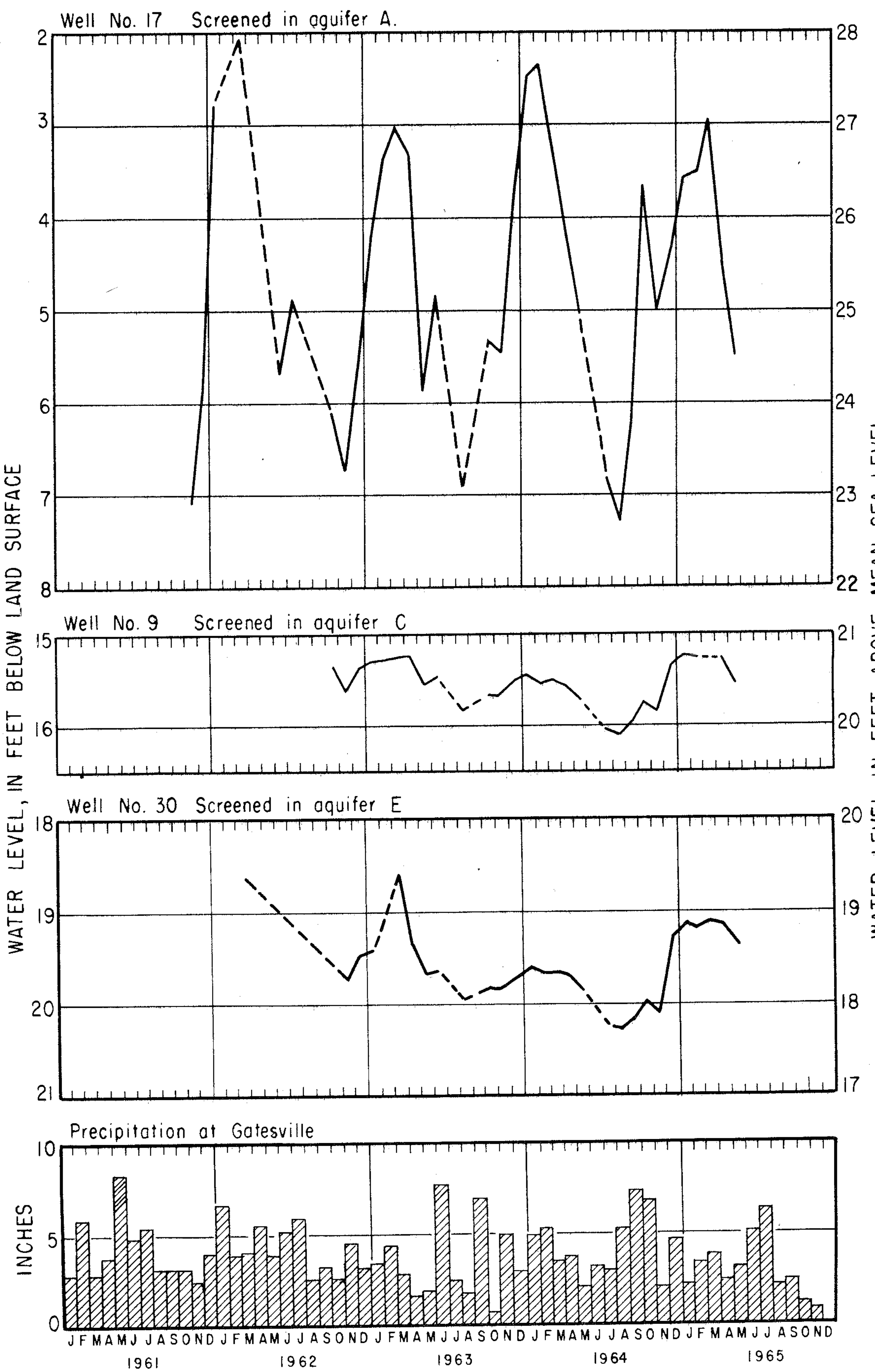


FIGURE 25.-GRAPHS SHOWING WATER LEVELS IN WELLS NO. 17, 9, AND 30, AND PRECIPITATION AT GATESVILLE, 1961-65.

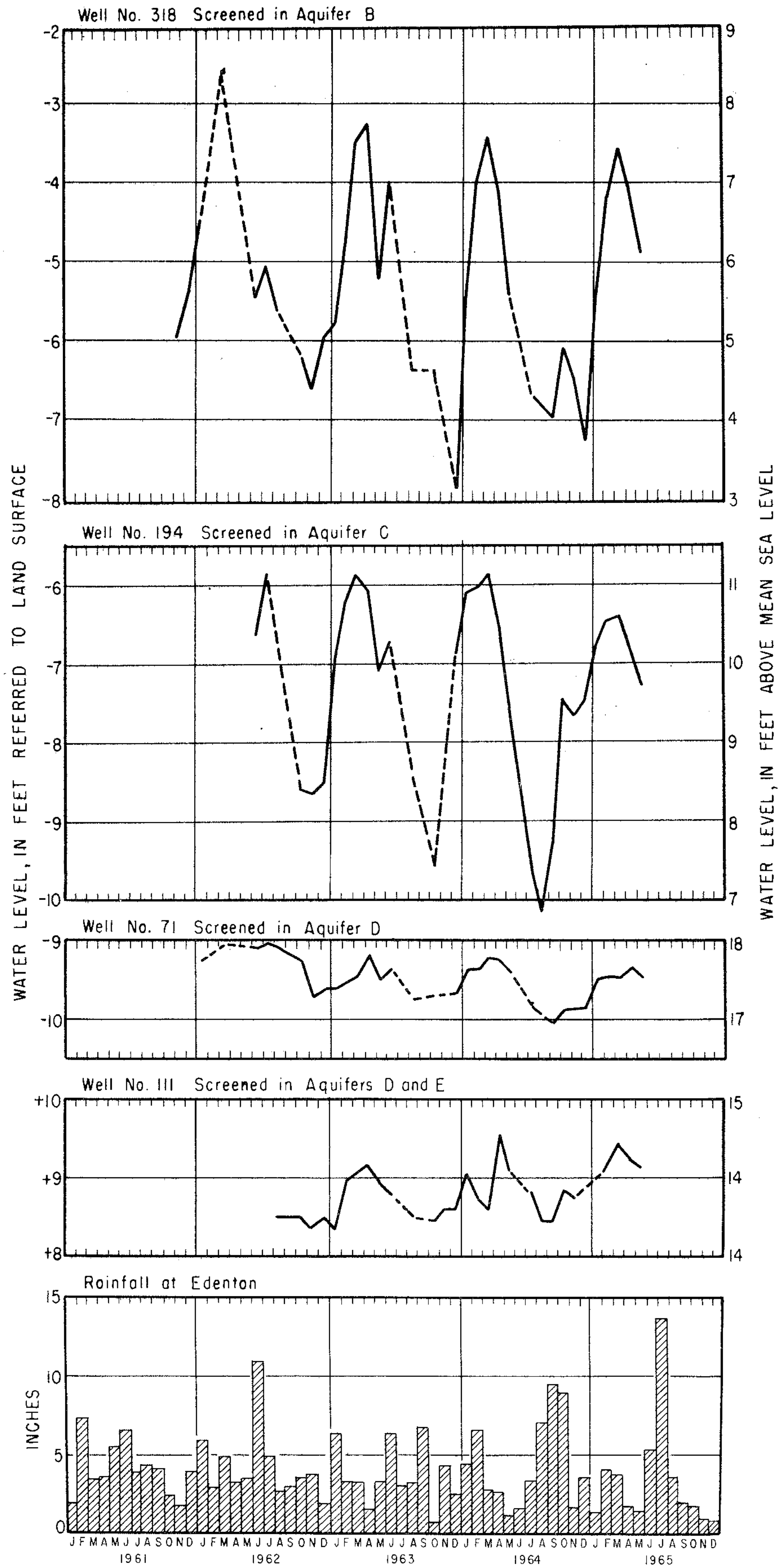


FIGURE 26.-GRAPHS SHOWING WATER LEVELS IN WELLS NO. 318, 194, 71, AND 111, AND PRECIPITATION AT EDENTON, 1961-65.

TABLE 2. RAINFALL AT EDENTON AND CORRESPONDING WATER-LEVEL RISE IN WELL NO. 318, FOR SELECTED MONTHS IN 1963-64.

Date	Rainfall in inches at Edenton, N. C.	Water level rise, in feet, in Well No. 318
December, 1963	2.5	1.1
January, 1964	4.5	2.1
February, 1964	6.7	1.0
March, 1964	2.8	0.3
Total	16.5	4.5
August, 1964	7.2	0.00
September, 1964	9.6	0.45
October, 1964	9.1	0.50
Total	25.9	0.95

Discharge

Ground water is discharged continuously by evapotranspiration, by effluent seepage into streams, ponds, the Chowan River, and Albermarle Sound, and by pumpage from wells.

Evaporation of water from the soils and surface-water bodies, and transpiration of water by plants, occurs everywhere in Chowan County. The greatest evapotranspiration rates occur between May and October, when temperatures are high and vegetation is dense. During this time of the year these two processes account for at least two-thirds of the total discharge from the zone of saturation (Meinzer, 1942). When evapotranspiration rates are high in Chowan County, discharge exceeds recharge, and water levels in the aquifers decline (fig. 25 and 26).

Ground water seeps from the zone of saturation into streams,rivers, and the sound throughout the year. The principal areas of effluent seepage are shown in figure 24.

An estimated average of 1.2 mgd (million gallons per day,) are pumped from the aquifers in the area. Of this, 0.7 mgd are pumped from wells in the rural part of the county, where withdrawal is distributed over a large area. The effects of this pumping on water levels have been insignificant. The remaining 0.5 mgd are pumped from the municipal supply wells and domestic wells in and around Edenton, where the ground-water withdrawals are confined to a small area. The greatest effects of this concentrated and increasing pumpage are seen in the declining water levels in Aquifer C (fig. 27). Well No. 268 is located about 0.5 mile south of the center of the cone of depression that has developed in the water levels in Aquifer C and D (fig. 21 and 22). When first drilled, in the early 1900's Well No. 268 flowed, and the water level was reported at approximately 8 feet above mean sea level.

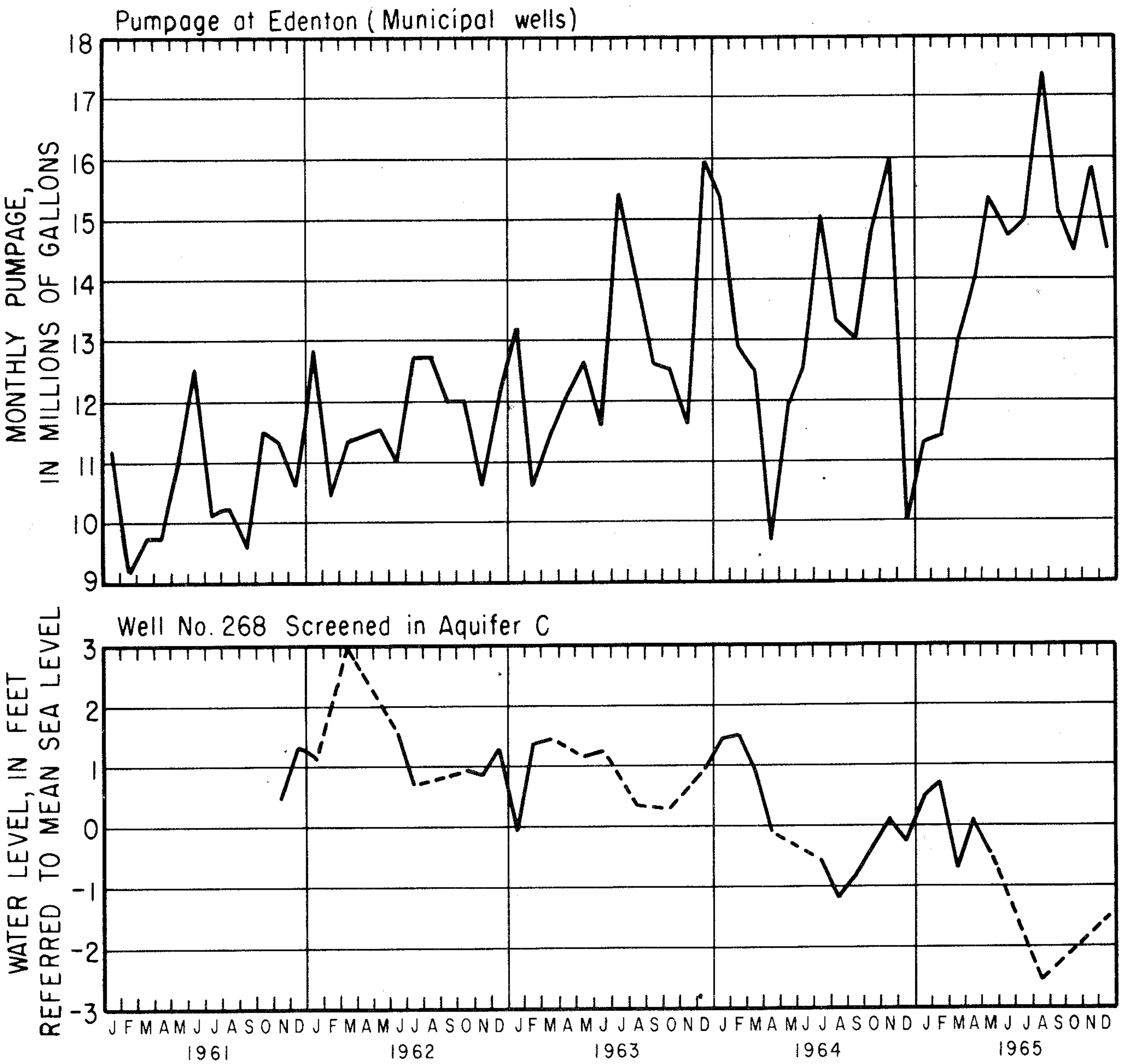


FIGURE 27.-GRAPHS SHOWING PUMPAGE FROM THE MUNICIPAL SUPPLY WELLS IN EDENTON, AND THE WATER LEVEL IN WELL NO. 268, FROM 1961-65.

Since that time withdrawals from Aquifer C have caused the water level in Well No. 268 to fall below mean sea level. Water level declines have occurred in all wells screened in Aquifer C that are within the cone of depression around Edenton. The declines reflect a spreading in the cone of depression that will continue until pumpage ceases and/or becomes so constant that equilibrium is reached between withdrawal from and recharge to the water-bearing zones effected by the cone.

Discharge has generally exceeded recharge in Chowan County from 1961-65. This is shown by a slight decline in the highest and the lowest water levels recorded during each of these years (fig. 25 and 26). The decrease in ground-water storage is probably due to the fact that total rainfall during this period was 10 inches below normal.

Recovery of Ground Water

Wells are the primary source of domestic, municipal, and industrial water supplies in Chowan County. Three types of wells are used to recover ground water from the aquifers; dug or bored wells, driven wells, and drilled wells.

Dug or bored wells are constructed by digging or boring a large diameter hole that is deep enough to intersect the water table. The hole is generally cased with wood, brick, stone, concrete, or tile to prevent caving, and grout is placed around the outside of the casing to prevent surface water and foreign matter from entering the well. Such wells are used to recover ground water from Aquifers A and B in the county. They range in depth from 5 feet to 25 feet, and are generally 24 to 36 inches in diameter.

Driven wells are constructed by attaching a drive screen to a length of steel well casing and driving the screen into a sandy water-bearing zone. If the exact depth of the water-bearing zone is not known, water can be poured into the casing during 2- or 3-foot depth intervals until, when the screen is in a water-bearing zone, the water flows down the casing and out the drive screen as fast as it is introduced. When the desired depth is reached, the well is surged, generally with a pitcher pump, to clear the fine sandy material from the screen. Driven wells in Chowan County range from 8 to 65 feet in depth and from $1\frac{1}{4}$ to 2 inches in diameter. They are used to recover ground water from Aquifers A and B.

Drilled wells in the county are constructed by the open-end, natural-development, and gravel-pack methods. The open-end method of construction consists of drilling a hole from land surface into a consolidated rock unit, and setting steel casing from land surface to the top of the rock unit. The hole below the bottom of the casing remains open, allowing water to flow from the rock into the well. The success of this method depends on the degree of consolidation of the rock. When the rock is only partially consolidated the sedimentary material will probably cave into the uncased portion of the hole and retard the flow of water into the well. Drilled open-end wells are used to recover water from the consolidated shell and sandy-limestone units in Aquifers B, C, and D in the county. These wells range in depth from 45 to 360 feet and from 2 to 6 inches in diameter.

A naturally developed well is constructed by drilling a hole from land surface down through a sand aquifer, casing the hole with steel casing and an attached screen in the sand aquifer, surging the well so that fine sand and clay particles are washed from the aquifer, leaving the coarser material packed around the screen. For multiple-screen wells tapping more than one aquifer, one screen at a time should be developed by the method described above. The screens should have openings large enough to pass the finer 50 to 80 percent of the constituents in the aquifers. This method of construction is most effective in aquifers that are composed of unconsolidated sedimentary particles of widely varying size. Naturally developed wells are commonly used to recover ground water from all the aquifers in the county; and they range from $1\frac{1}{4}$ to 6 inches in diameter and from 30 to 470 feet in depth.

Gravel-packed wells are constructed by drilling a hole from land surface down through a sand aquifer, reaming a large diameter hole in the aquifer, setting a screen attached to a string of steel casing in the reamed portion of the aquifer, pumping gravel into the large diameter hole between the aquifer material and the screen, and surging the well so that fine sand and clay particles are washed from the gravel pack. If more than one aquifer is to be used in the same well, each aquifer should be reamed, screened, graveled, and developed as described above. Only six gravel-packed wells are used for the recovery of ground water in Chowan County; two municipal supply wells and one abandoned well at Edenton, and three supply wells at the Edenton Municipal Airport. The municipal supply wells tap Aquifers C and D, and the other wells tap Aquifers A and B. These wells range from 77 to 360 feet in depth and from 6 to 12 inches in diameter, and yield larger amounts of water than any other type of well in Chowan County.

QUALITY OF GROUND WATER

The domestic, municipal, industrial, and agricultural use of ground water in the county is determined by the chemical and physical quality of the water. Chemical quality depends upon the type and amount of dissolved mineral constituents in water, and physical quality on the color, taste, odor, and temperature of the water.

Chemical Quality

The chemical constituents in ground water generally exist as positively and negatively charged particles referred to as cations and anions, respectively. Exceptions to this mode of occurrence are found with iron, which may occur as colloidal-sized particles, and silica, which is nonionic in most natural waters. The amount of cations, anions, and nonionic material in water is measured by chemical analyses. Results of the analyses are reported in ppm (parts per million), which is the concentration by weight of each constituent in a million unit weights of water. Thus, a water containing 34 ppm calcium would contain 34 pounds of calcium in each million pounds of water. In many cases the results of an analysis may be required in grains per U.S. gallon. These units may be obtained by dividing the ppm by 17.1. Thus, water containing 34 ppm calcium would contain nearly 2 grains of calcium in each U. S. gallon of water.

About 300 water samples were collected from wells that screen the major aquifers in the area. All analyses were made in the laboratory by the Quality of Water Branch, U. S. Geological Survey, and the chemical and geochemical interpretations were made by H. B. Wilder, Chemist, U. S. Geological Survey. Results of the analyses are shown in table 3 and table 4. Each of the principal constituents reported in table 4, and their significance and relation to the aquifer, is discussed below.

Silica

Silica is derived from the chemical decomposition of silicate minerals, which are very abundant in rock and soil. The chemistry of the breakdown of silicates is very complex and the form silica takes in ground water is not completely understood. At present it is thought that silica does not occur in true ionic form in ground water.

Concentrations of silica found in ground water in Chowan County will have little or no effect on the domestic and/or the general industrial use of water. However, some industrial processes require water with less than 5 ppm silica to prevent scale from forming in high pressure boilers or on turbine blades. Silica concentrations in ground water sampled in Chowan County ranged from 2.9 to 66 ppm, and were least in Aquifers A and E, where the average was about 15 ppm (table 4).

Aluminum (Al)

Many minerals, particularly the alumino-silicates, contain significant amounts of aluminum, but this cation is very resistant to removal by solution during weathering. Aluminum is therefore found only in small amounts in natural ground waters. Concentrations of aluminum in ground water sampled in Chowan County ranged from trace amounts to 0.3 ppm, and have no effect on the utilization of the water.

Iron (Fe)

Iron compounds are abundant in soil and rock materials, and they are readily dissolved by the slightly acidic rainwater that percolates to the zone of saturation. The acidic nature of the water is derived from the reaction of the water with carbon dioxide to form carbonic acid. The carbon dioxide is furnished by the atmosphere, and by decaying organic matter and metabolic processes of plant roots in the unsaturated portion of the soil (Hem. 1959). Iron dissolved in water generally occurs as ferrous iron, however, when exposed to oxygen in the air, the ferrous iron is oxidized to the ferric state and precipitates as rust-colored ferric hydroxide. This reddish-brown precipitate is often seen in water samples containing large amounts of iron.

The U. S. Public Health Service recommends that the concentration of iron in ground water should not exceed 0.3 ppm (U. S. DHEW, 1962). Concentrations of iron greater than 0.3 ppm will generally stain laundry, porcelain, utensils, and food, and may impart a disagreeable bitter taste to beverages. Water with less than 0.3 ppm iron is usually acceptable for most uses, however, some industries may require water with concentrations less than 0.1 ppm. When encountered in excessive amounts, iron may be economically removed from water by treatment (Nordeel, 1961).

In Chowan County, observed concentrations of iron in ground water ranged from trace amounts to 30 ppm. Generally the highest concentrations were found in the shallower aquifers, and the lowest in the deep aquifers (table 3). This is due to the fact that the ground water becomes more alkaline or basic as it dissolves calcareous material from the deeper formations and, being more basic, it is less able to keep iron in solution. As a result the iron is precipitated in the aquifers.

Manganese (Mn)

Manganese is similar to iron in its chemical behavior in ground water. However, manganese is much less abundant in rock-forming minerals, and concentrations of this cation in water are usually lower than those of iron. The U. S. Public Health Service recommends that drinking waters contain no more than 0.05 ppm manganese. Concentrations of manganese above this recommended maximum may cause a brown stain in laundry, and may impart a disagreeable taste to coffee and tea. Concentrations of manganese in fresh ground-water samples from the area of study ranged from trace amounts to 0.1 ppm, and exceeded 0.05 ppm in one analysis only (table 4).

Calcium (Ca) and Magnesium (Mg)

Compounds of calcium and magnesium, like those of iron are easily dissolved by slightly acidic water or water containing carbon dioxide in solution. Both calcium and magnesium are derived from the solution of limestone,dolomite, shell, and other calcareous materials, and comprise the major hardness-causing constituents in water. Although calcium is more abundant than magnesium in most fresh ground water, it is less soluble than magnesium. Therefore, when present in large amounts, calcium may precipitate and cause scaling on well screens, pipes, plumbing fixtures, and boilers, etc. High concentrations of magnesium generally occur in brackish and saline waters, and in waters contained by dolomite ore magnesium limestone. Calcium and magnesium can be removed from water by treatment (Nordell, 1961).

Observed concentrations of calcium and magnesium in ground water from

Chowan County ranged from 3.2 to 133 ppm and 1.2 to 85 ppm, respectively.

Sodium (Na) and Potassium (K)

Sodium and potassium-bearing minerals are dissolved by water containing carbon dioxide. Once dissolved, sodium tends to remain in solution where as potassium will readily recombine with clay minerals (Hem, 1959). Thus, sodium is more common than potassium in both natural ground water and ocean water.

In ground-water samples from Chowan County concentrations of sodium ranged from 1.4 to 2,880 ppm, and concentrations of potassium ranged from 0.7 to 79 ppm. The smallest amounts of these elements occur in water contained by the shallower aquifers in the county. Higher concentrations are found in water in the deeper aquifers, particularly where these deeper water-bearing zones contain brackish or saline water (table 4). Generally, concentrations of these metals are not high enough to effect the utilization of the fresh ground water in the area.

Bicarbonate (HCO_3)

Bicarbonate is formed by the reaction or carbon dioxide (CO_2) and dissolved shell material ($CaCO_3$) with ground water. Shell is abundant in the formations that underlie Chowan County and, therefore, bicarbonate is a prominent anion in the ground water of the area. Where bicarbonate is the prominent anion in the water, the most common cation is usually calcium or sodium. Calcium-bicarbonate water is hard and generally occurs in aquifers that are composed of calcareous material. As water from calcareous formations moves through clay and glauconitic material, the calcium ions are taken from solution and replaced by sodium ions. Clay minerals and glauconite have a great capacity for such cation exchange. As a result, hard, calcium-bicarbonate water is changed to soft, sodium-bicarbonate water.

When heated and pressurized, water with high concentrations of sodium bicarbonate will attain high pH values, and my be objectionable for food-processing and commercial-canning processes. Calcium bicarbonate in water breaks down, when heated, to form calcium carbonate which may scale on condensers, boilers, piping, and plumbing fixtures.

Sulfate (SO_4)

Sulfate in ground water in the area comes from the solution of calcium- and magnesium-sulfate minerals in shell and limestone beds. In addition, any sulfide mineral that occur in the upper soil horizons are chemically decomposed, and the sulfur is oxidized to a soluble sulfate form which is leached from the soil by water percolating to the zone of saturation. Water containing sulfate, with calcium and/or magnesium, causes scaling and corrosion in heated and pressurized plumbing systems. Thus, calcium- and magnesium-sulfate water should be treated before it is used in steam boilers, etc. (Nordell, 1961). Sulfate in water may be reduced to hydrogen sulfide gas and sulfur by bacterial action. Hydrogen sulfide gas has a disagreeable odor characteristic of rotten eggs, and when this gas is dissolved in water it forms a weak acid that makes the water corrosive. Hydrogen sulfide gas may be economically removed from water by aeration and/or chlorination (Nordell, 1961).

The U. S. Public Health Service recommends that drinking water contain no more than 250 ppm sulfate. Concentrations of sulfate in ground water sampled in Chowan County ranged from 0 to 533 ppm, and exceeded 75 ppm in only 16 percent of the analyses (table 4). The highest sulfate contents were found in water from Aquifer E, in test well T2, where the aquifer contains residual sea water.

Chloride (Cl)

In Chowan County, the principal source of chloride in ground water is residual sea water in the aquifers. Comparatively small amounts of chloride are dissolved from the sedimentary formations and from human and animal wastes. The U. S. Public Health Service recommends that chloride in drinking water should not exceed 250 ppm. At present there is no economical method for removing excessive concentrations of chloride from water.

Observed concentrations of chloride in ground water from the area ranged from 3.8 to 4,140 ppm (table 3). The lowest amounts of chloride occur in water from the shallower aquifers and the highest concentrations occur in water from the deeper water-bearing zones.

Fluoride (F)

The solution of fluoride-bearing minerals such as apatite, phosphates, micas, hornblendes, and fluorite, accounts for concentrations of fluorides in ground water. The solubility of most fluorides is relatively low and, therefore, the amount of fluoride found in water is usually small. Small amounts of fluoride in water, about 1.0 to 1.5 ppm, will help prevent decay in children's teeth, but concentrations greater than about 1.5 ppm may cause a permanent mottling of their teeth (Mair, 1950).

Fluoride concentrations in ground water in the area ranged from trace amounts to 3.0 ppm. Eighty-three percent of the samples analyzed for fluoride contained less than 1.5 ppm. Concentrations exceeding 1.5 ppm were found only in water from Aquifers D and E, and most frequently in Aquifer E (table 4). Excessive concentration of fluoride may be removed from water, but the defluoridating process is generally very expensive (Nordell, 1961).

Nitrate (NO_3)

Although nitrate compounds are readily soluble in water, they are insignificant in inorganic rock and soil material in the area and, consequently, only small amounts of nitrate are found in most of the ground water in Chowan County. High concentrations of nitrate in water may indicate pollution by human or animal wastes, or the leaching of nitrate from fertilizers or organic humus in the soil.

Excessive nitrate in drinking water may cause cyanosis in infants. This condition may be fatal, and it is recognized by a bluish-gray color of the skin, which is caused by a lack of oxygen in the blood. To avoid such occurrences, the U. S. Public Health Service recommends that water containing more than 45 ppm nitrate should not be fed to infants, and should not be ingested by mothers who are breast feeding infants.

Observed concentrations of nitrate in water from the area ranged from trace amounts to 66 ppm. About 80 percent of the water samples analyzed for this anion contained less than 45 ppm nitrate, and concentrations higher than 45 ppm were found only in water from Aquifer A (table 4).

Phosphate (PO_4)

Minerals containing phosphate are only partially soluble in water containing carbon dioxide and, once in solution, the phosphate readily recombines with clay minerals. Thus, high concentrations of phosphate in natural ground water are rare, and when they are encountered they may indicate contamination from phosphate detergents and/or fertilizers.

Concentrations of phosphate in the sampled ground water of the area ranged from trace amounts to 1.1 ppm (table 4), and have little or no effect on the utilization of the water.

Hardness

The relative hardness of water is represented by its soap-consuming power and can be recognized by the amount of curd formed with soap. The soap consumption and curd results from the reaction of cations in the water with the soap to form insoluble compounds. Hardness of water may also cause scaling in boilers and cooking utensils. All hardness-causing constituents in water are reported together as an equivalent amount of calcium carbonate ($CaCO_3$). The following scale is used by the U. S. Geological Survey to classify the hardness of waters:

Hardness as $CaCO_3$	Classification
0–60 ppm	Soft water
61–120 ppm	Moderately hard water
121–180 ppm	Hard water
181+ ppm	Very hard water

When the hardness-causing cations total more than the equivalent amount of carbonate and bicarbonate anions taken together, the remainder of the cations are reported as noncarbonate or permanent hardness. Calcium and magnesium, the major hardness-causing constituents, can be economically removed from water by treatment (Nordell, 1961). Observed hardness in ground water from Chowan County ranged from 12 to 533 ppm, and was greatest where calcareous material is prominent, in Aquifers B, C, and D (table 3).

Dissolved Solids

The amount of chemical constituents dissolved in water may be determined in two ways: (1) by evaporating a given volume of water and determining the amount of residue remaining after it is dried at some specified temperature (180° C. by the U. S. Geological Survey) and, (2) by adding about half the amount of bicarbonate to the sum of the other chemical constituents, all being determined by chemical analysis. The results of these methods should be approximately the same, and are reported as total dissolved solids and computed dissolved solids, respectively. Computed dissolved solids are used in table 4.

The U. S. Public Health Service recommends that public supplies contain no more than 500 ppm dissolved solids. Computed dissolved solids in ground water from Chowan County ranged from 60 to 8,010 ppm. The highest concentrations were found in brackish and saline waters in Aquifers C, D, and E (table 4).

Specific Conductance

Specific conductance is a measure of the amount of electric current water will conduct. The amount of current conducted depends upon the amount of mineral constituents dissolved in the water and their degree of ionization. Generally, highly mineralized water is a good conductor and pure water is a poor conductor of electricity. Thus, specific conductance values are used to estimate the total amount of solids dissolved in water. Specific conductance is expressed as micromhos, the reciprocal of ohms multiplied by 10^6, at 25° C. In ground water from Chowan County, it was found that multiplying specific conductance by 0.6 would give a close approximation of the amount of dissolved solids in the water.

Hydrogen-Ion Concentration (pH)

The hydrogen-ion concentration is a measure of the degree of acidity or alkalinity of water. The pH of a solution is defined as the negative logarithm of the concentration of free hydrogen ions in moles per liter. The pH scale extends from 0 to 14, and water with a pH value of 7.0 is neutral, above 7.0 is alkaline or basic, and below 7.0 is acid. Because the pH values are set on a logarithm scale, water with a pH of 4.0 is ten times as acidic as water with a pH of 5.0 and, likewise, water with a pH of 9.0 is ten times as basic as water with a pH of 8.0. Waters with low pH values are usually more corrosive than those with pH values of 7.0 or above. Acidic or basic waters may be economically neutralized (Nordell, 1961).

The observed pH values of ground water from the area ranged from 4.3 to 8.5, and the water was generally acid in Aquifers A and B, and alkaline in Aquifers C, D, and E (table 3).

Physical Quality

Color

Color in water is thought to result from the decomposition of vegetable matter, and is generally recognized as a brown or yellow hue. The relative amount of color in water is determined by comparing the water with standard platinum-cobalt solutions, and the results are reported in color units. More than 15 units of color may make the water esthetically undesirable, and may stain laundry and porcelain fixtures.

Observed color in ground water from Chowan County ranged from 1 to 70 units, and did not exceed 15 units in 90 percent of the analyses where color was determined (table 4).

Taste and Odor

Disagreeable tastes in the ground water of the area are usually associated with excessive concentrations of chloride and/or iron. Generally, when these chemical constituents are below the maximum amounts recommended by the U. S. Public Health Service, the water has no objectionable taste. Odor is primarily derived from hydrogen sulfide gas which can be removed by aeration and/or chlorination.

Temperature

The observed temperature of ground water from the artesian aquifers in Chowan County has little if any seasonal fluctuation, and ranged from 60 to 73° F.

Quality of Ground-Water in the Aquifers

Aquifer A

Computed concentrations of dissolved solids in water from Aquifer A were in nearly all cases below 500 ppm and averaged about 171 ppm. However, this water commonly contains objectionable concentrations of iron and is somewhat acid. Observed iron content in water from Aquifer A ranged from 0.04 to 24 ppm and was above 0.3 ppm throughout most of the county. In some places, particularly in areas of discharge, concentrations of iron are below 0.3 ppm (fig. 28). The pH of the water averaged 5.5, and the water is potentially corrosive. Locally, where wells are screened in shell beds the water is hard, but most of the hardness values were below 100 ppm, and hardness scale and excessive soap consumption are uncommon. Water in Aquifer A is subject to contamination from human and animal wastes, fertilizers, detergents, etc. Unusually high concentrations of nitrate, chloride, or phosphate should be regarded as indicators of possible dangerous pollution.

Aquifer B

Concentrations of dissolved solids in water from Aquifer B ranged from 192 to 435 ppm and averaged 296 ppm. Objectionable amounts of dissolved mineral matter, other than iron and hardness-causing constituents, are uncommon in this water. Iron content ranged from 0.02 to 30 ppm and was above 0.3 ppm in most of the area. However, iron content in water from Aquifer B is generally below 0.3 ppm in areas of ground-water discharge (fig. 29). Hardness ranged from 16 to 397 ppm, and was above 180 ppm a-

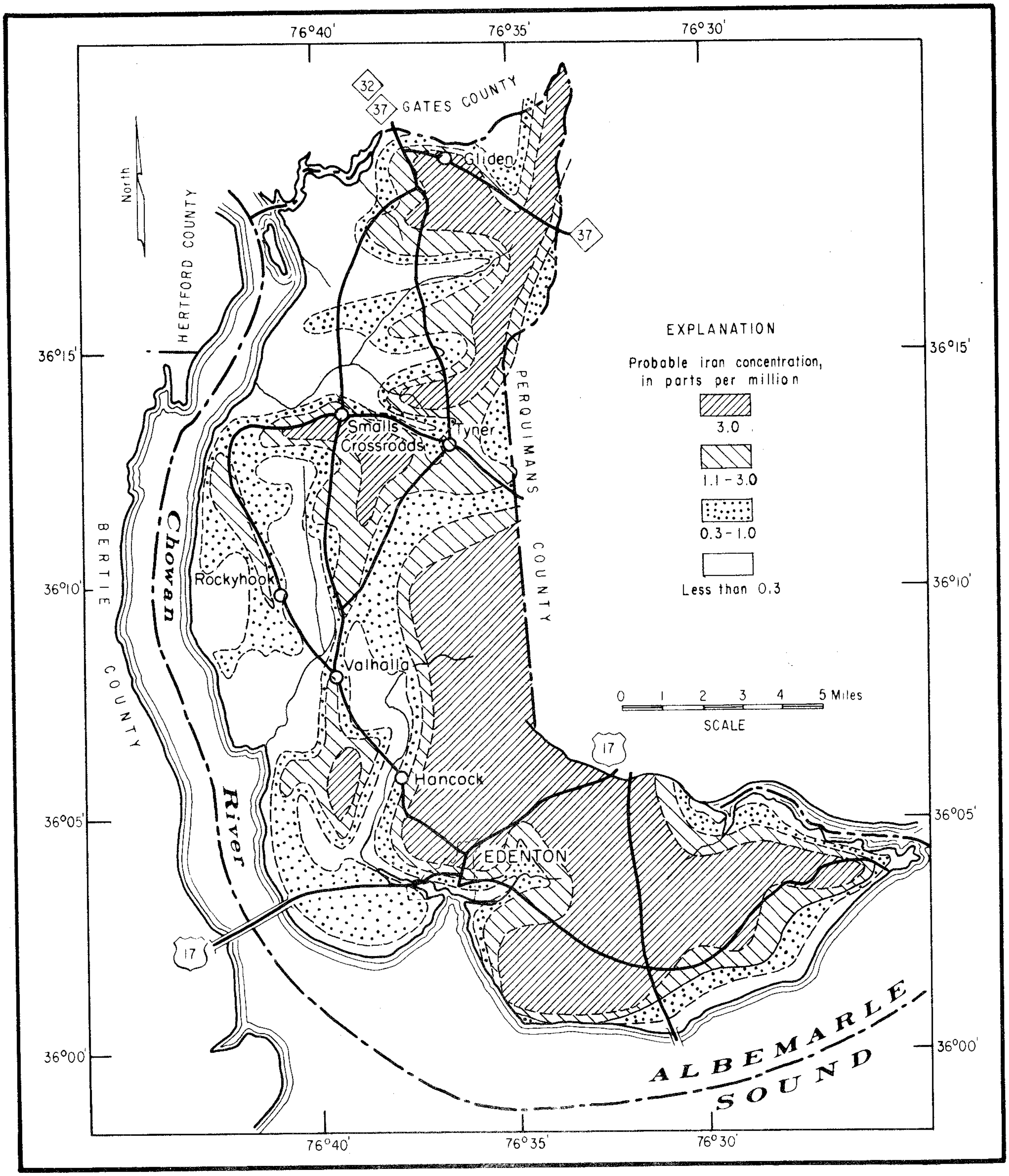


FIGURE 28.-MAP SHOWING THE APPROXIMATE DISTRIBUTION OF DISSOLVED IRON IN WATER FROM AQUIFER A.

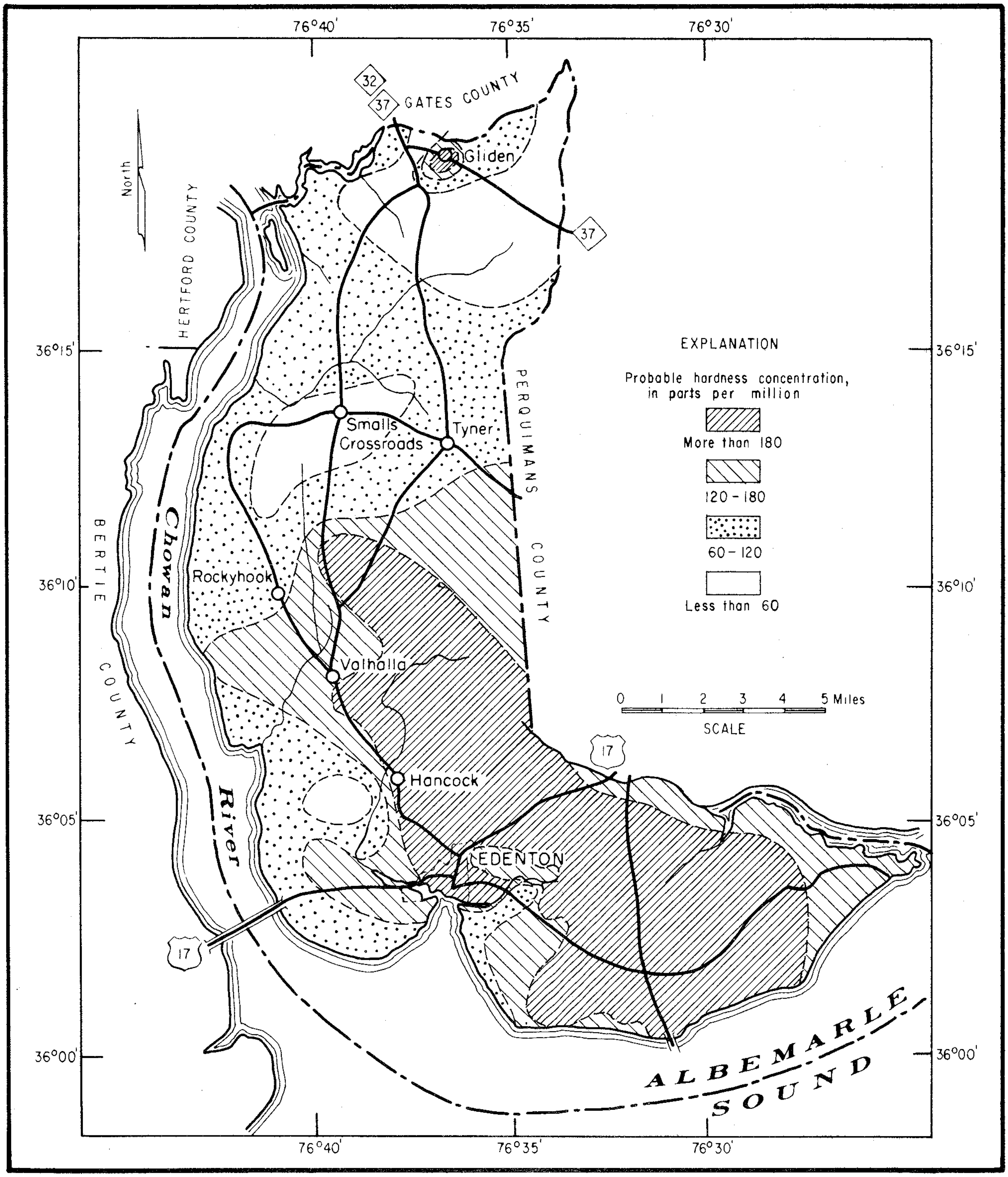


FIGURE 30.-MAP SHOWING THE APPROXIMATE DISTRIBUTION OF THE HARDNESS OF WATER FROM AQUIFER B.

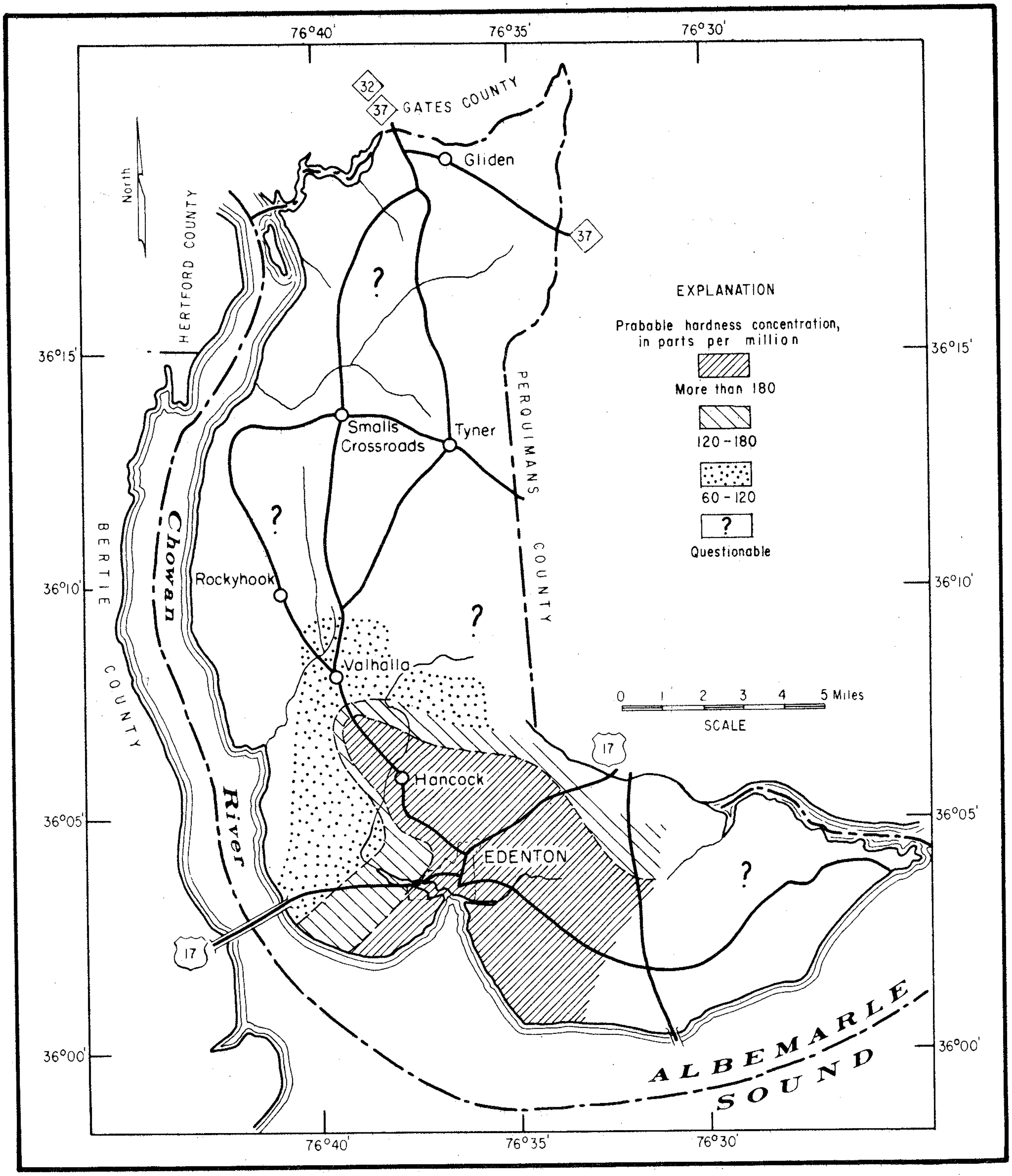


FIGURE 31.-MAP SHOWING THE APPROXIMATE DISTRIBUTION OF THE HARDNESS OF WATER FROM AQUIFER C.

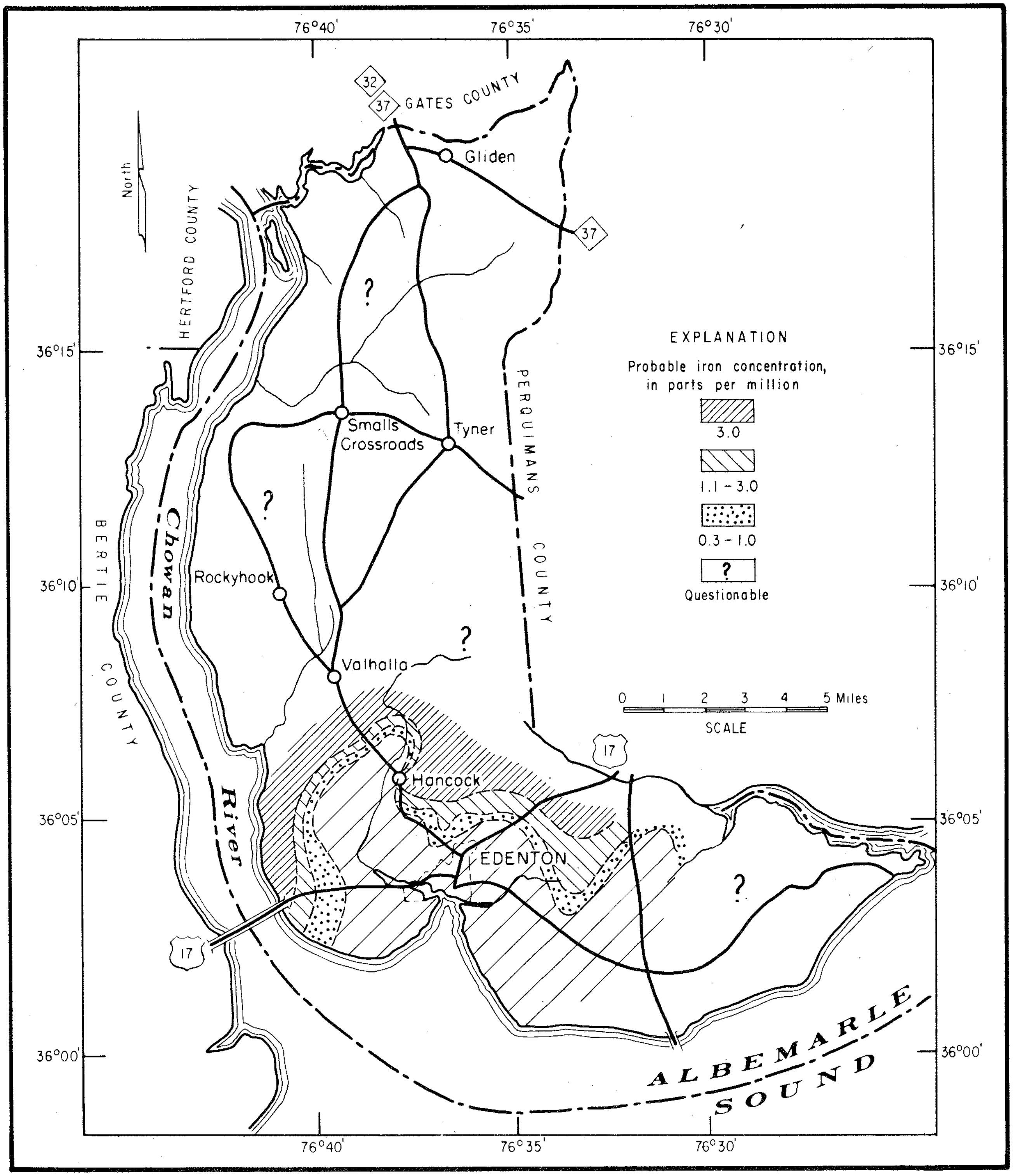


FIGURE 32.-MAP SHOWING THE APPROXIMATE DISTRIBUTION OF DISSOLVED IRON IN WATER FROM AQUIFER C.

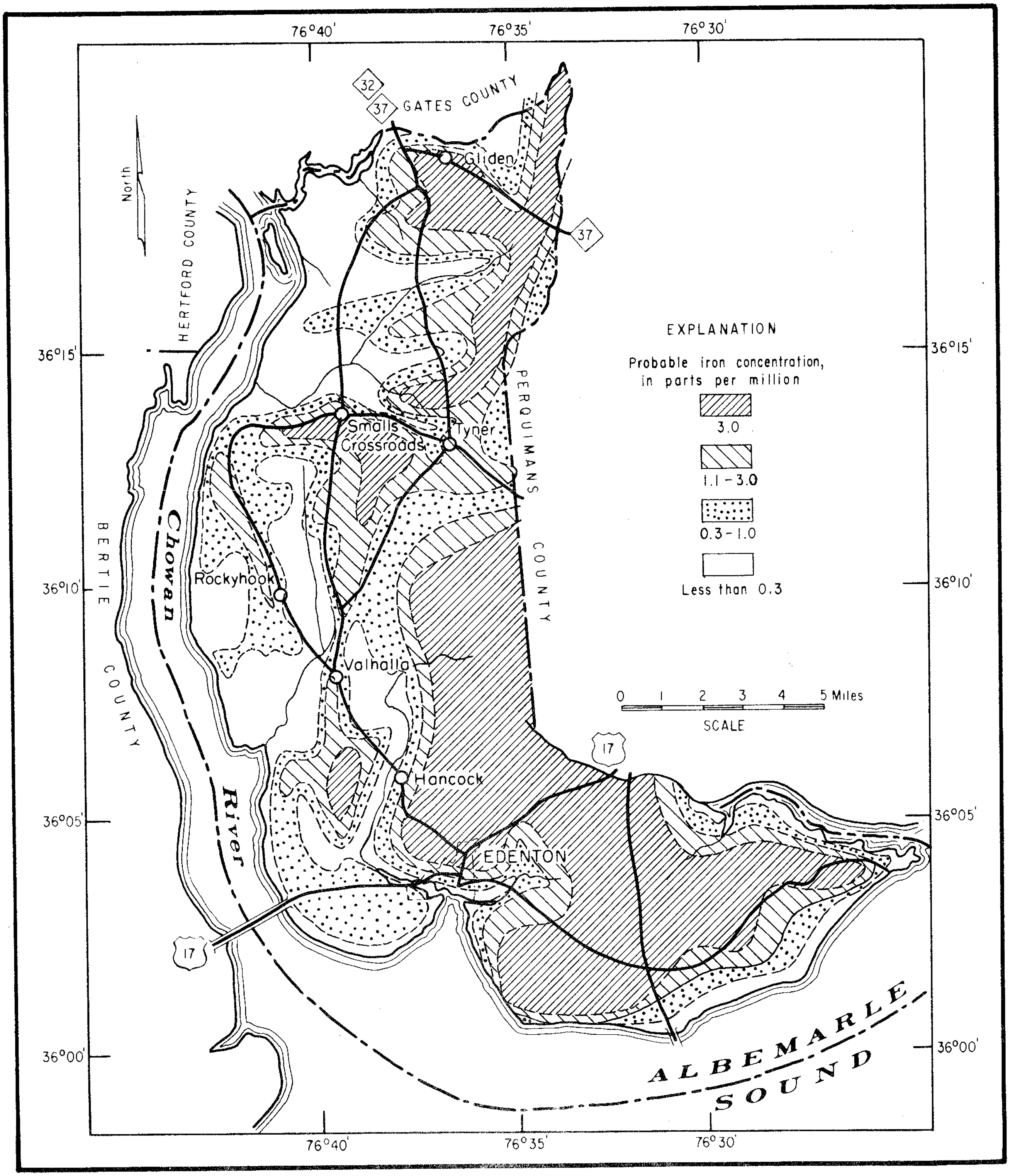


FIGURE 28.-MAP SHOWING THE APPROXIMATE DISTRIBUTION OF DISSOLVED IRON IN WATER FROM AQUIFER A.

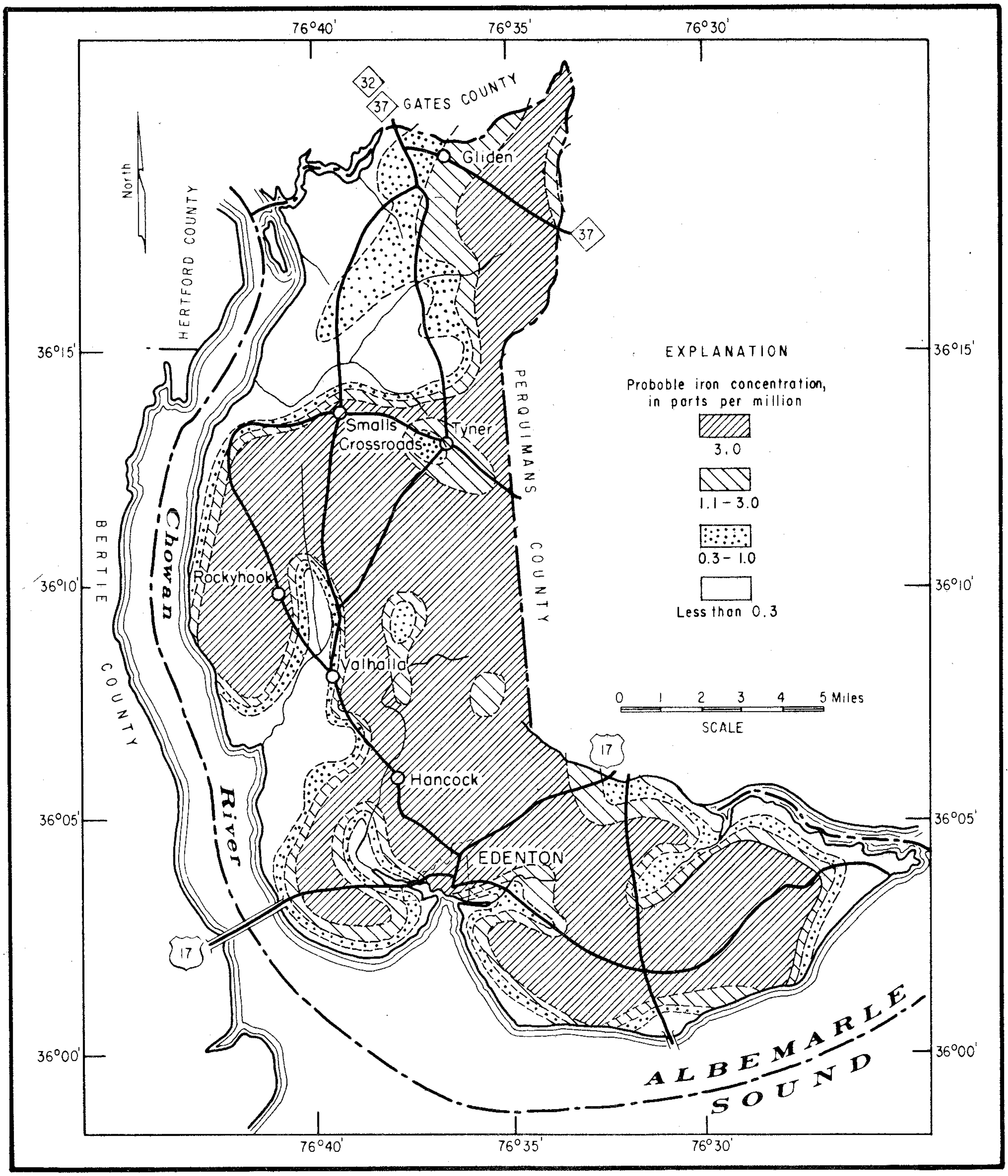


FIGURE 29.-MAP SHOWING THE APPROXIMATE DISTRIBUTION OF DISSOLVED IRON IN WATER FROM AQUIFER B.

round Gliden and throughout the southern part and the southeastern part of the county. Figure 30 shows the distribution of observed hardness in water from this aquifer. The pH values of the water average 6.8, and its corrosive potential is relatively low.

Aquifer C

Water from Aquifer C contains objectionable amounts of hardness-causing constituents, iron, and chloride in certain areas of Chowan County. Hardness of the water ranged from 64 to 423 ppm; the distribution of hardness in the southern part of the county is shown in figure 31. The iron content in water from Aquifer C ranged from 0.03 to 5.5 ppm, and its distribution, in the southern part of the county is shown in figure 32. The distribution of iron and hardness are not shown for the northern and central parts of the county because available information was too sparse. The lack of information is due to the fact that very few wells screen Aquifer C for water supply in the central and northern part of the area.

Observed concentrations of chloride in the water ranged from 6 to 2,310 ppm and exceeded 250 ppm in the northern half, and the extreme southern part of the county (fig. 33). Other dissolved constituents are not present in excessive or objectionable amounts where the water from this aquifer is fresh.

Aquifer D

The most common objectionable constituent in water from Aquifer D is chloride. Observed concentrations ranged from 30 to 2,340 ppm and were a-

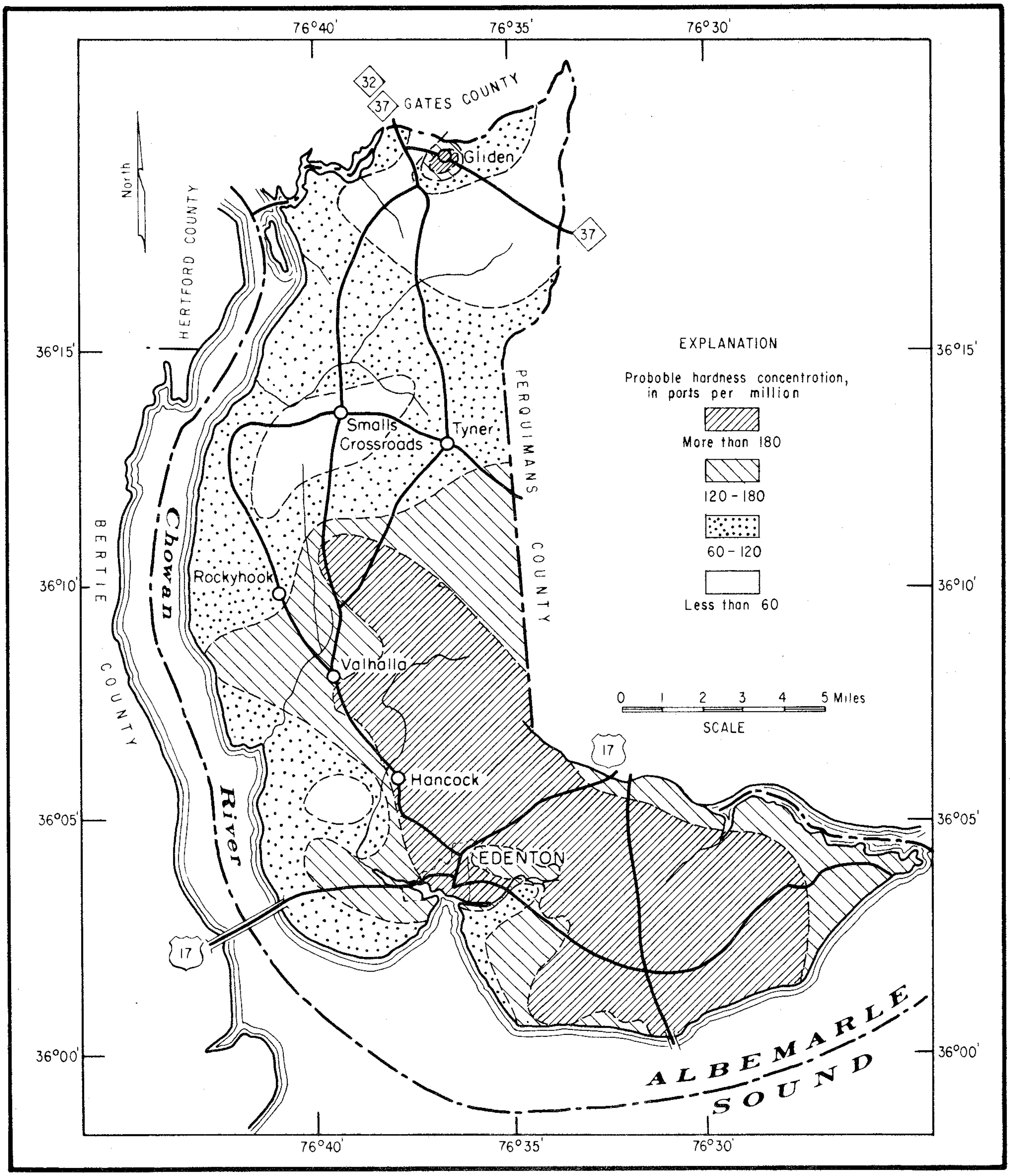


FIGURE 30.-MAP SHOWING THE APPROXIMATE DISTRIBUTION OF THE HARDNESS OF WATER FROM AQUIFER B.

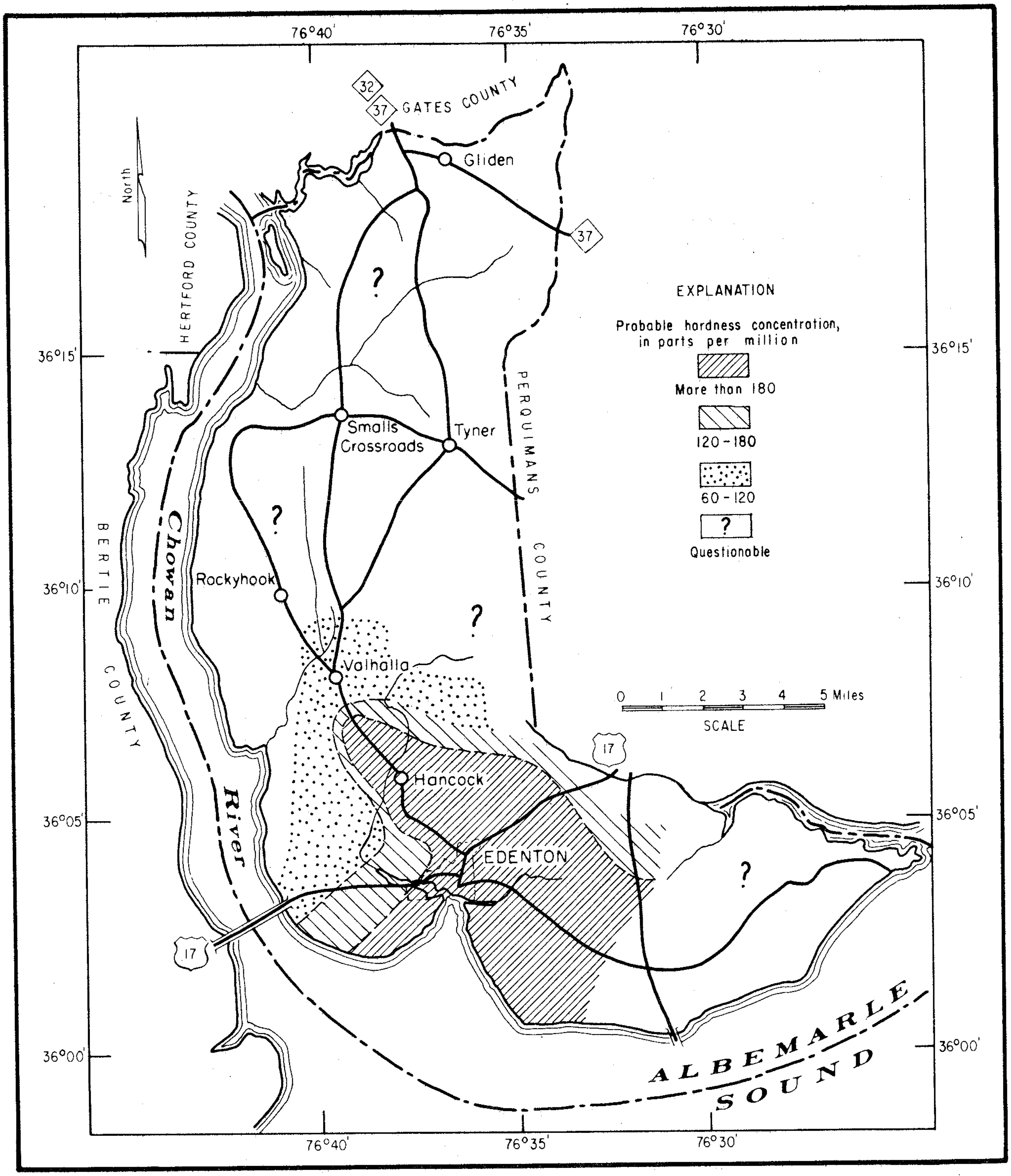


FIGURE 31.-MAP SHOWING THE APPROXIMATE DISTRIBUTION OF THE HARDNESS OF WATER FROM AQUIFER C.

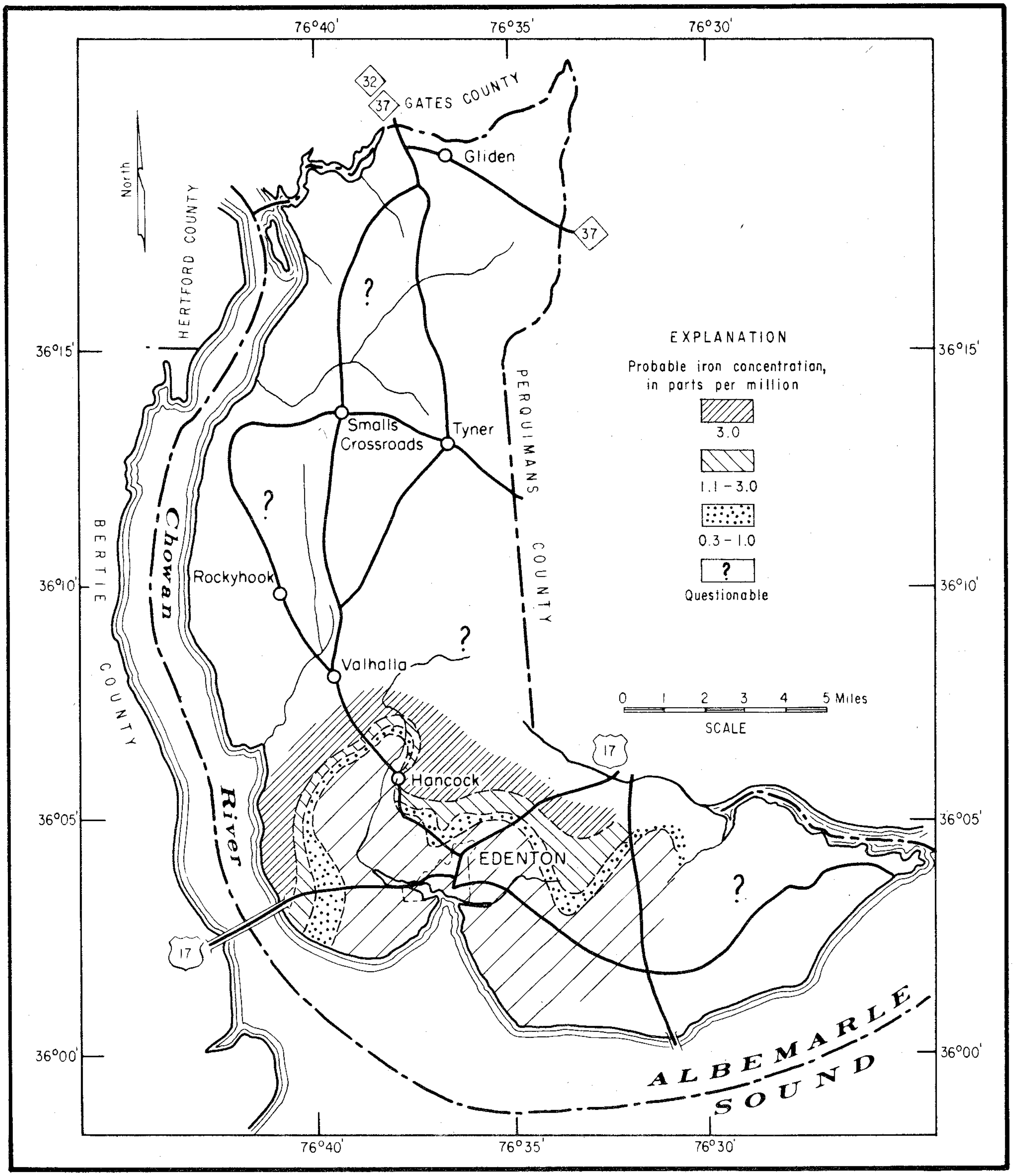


FIGURE 32.-MAP SHOWING THE APPROXIMATE DISTRIBUTION OF DISSOLVED IRON IN WATER FROM AQUIFER C.

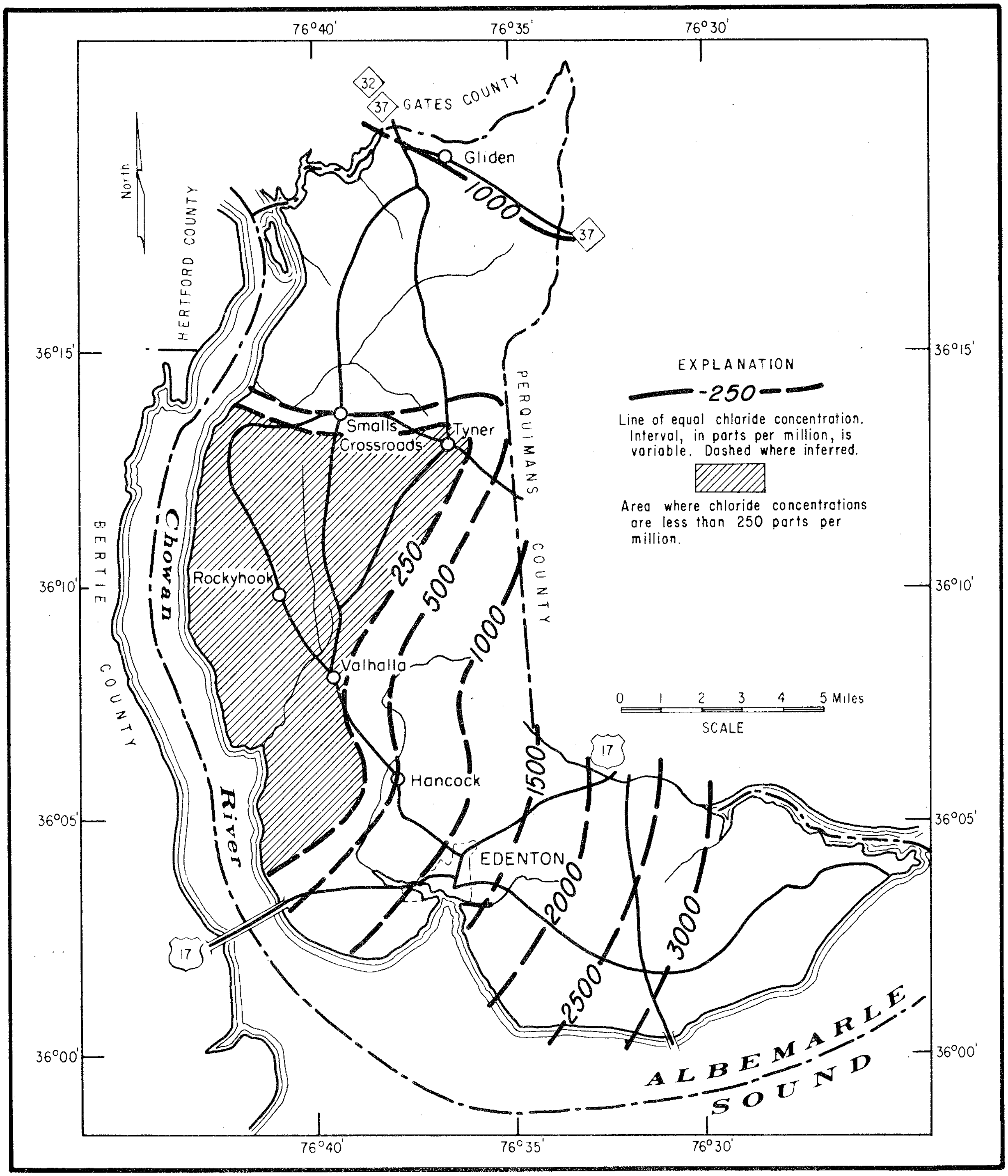


FIGURE 34.-MAP SHOWING THE APPROXIMATE DISTRIBUTION OF CHLORIDE CONCENTRATIONS IN WATER FROM AQUIFER D.

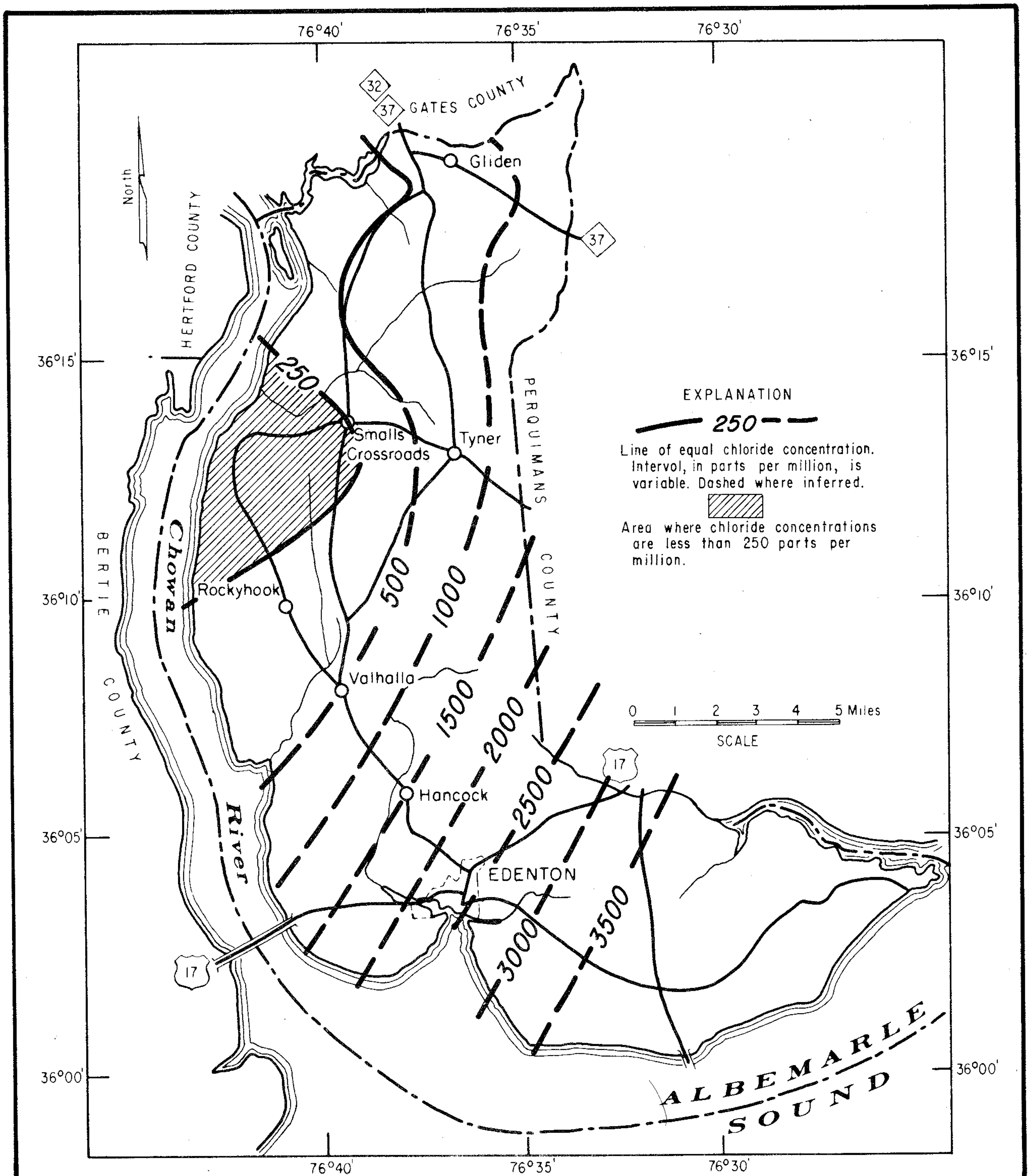


FIGURE 35.-MAP SHOWING THE APPROXIMATE DISTRIBUTION OF CHLORIDE CONCENTRATIONS IN WATER FROM AQUIFER E.

SALT WATER CONTAMINATION

The excessive concentrations of chloride in the water in the artesian aquifers of the area are derived from residual sea water. The sediments, laid down in a marine environment, were saturated with sea water during and after deposition. After the most recent withdrawal of the sea, fresh water percolating into the ground has diluted and partially flushed the saline water from the deeper aquifers.

The flushing and dilution of residual sea water in aquifers generally occurs more rapidly in areas of recharge. Therefore, the occurrence of the freshest water in the aquifers is usually defined by recharge areas. However, a comparison of the piezometric maps (fig. 21, 22, and 23) with the concentration of chloride maps (fig. 33, 34, and 35) shows that the areas of recharge and lowest chloride concentrations are not the same in Chowan County. The piezometric surfaces indicate that most of the recharge to the artesian aquifers is occurring north of the county and in the northeastern part of the county, and the chloride concentrations indicate that flushing of salt water from the aquifers is most complete in the western and central part of the county.

This chloride-piezometric distribution was probably caused by a relatively recent change in the hydrologic conditions in the area. Prior to extensive erosion and dissection by streams; the high level terrace that occurs between 50 and 75 feet above mean sea level in Bertie, Chowan, and other counties in the northeastern part of the state, was connected and continuous. The present distribution of chloride concentrations (fig. 33, 34, and 35) was established during this time, when the major recharge was occurring in the higher topographic areas west of Chowan County, and residual sea water in the aquifers was being flushed from the west toward the east. When sea level rose and the present drainage system was well developed, this recharge and flushing pattern was interrupted and divided by the Chowan River. As a result, the major recharge to the artesian aquifers in Chowan County now occurs in the northeastern part of the county, and residual sea water is now being flushed toward the east, south, and west. The piezometric surfaces adjusted rapidly to the change, but the redistribution of chloride concentrations, which will reflect the new flushing pattern, has lagged behind because the actual movement of ground water is extremely slow.

Under the present hydrologic conditions, the saline water contained by the artesian aquifers in the area of recharge will slowly encroach upon the areas where these aquifers contain fresh water. The highest level to which chlorides can increase due to this encroachment is limited to about 1,000 ppm (the highest chloride concentrations encountered in water from Aquifers C, D, and E, in the recharge area), and will most likely be less than 1,000 ppm because of dilution by fresh water from the shallower water-bearing zones, and by the fresh water already in the deeper aquifers. The amount and rate of increase will depend upon the hydraulic gradients, which will be steepened by pumpage, the transmissibilities of the aquifers, and the movement of water from one aquifer to another. Both the level and rate of increase of the chloride concentrations will be higher where hydraulic gradients are steep, transmissibilities are high, and the aquifers are separated by thick layers of clay so that the dilution by fresh water from the shallow aquifers is retarded.

Water in the artesian aquifers is being naturally and artificially discharged in the southern part of the county. The artificial discharge, ground-water withdrawals in the Edenton area, is exerting the major influence on ground-water movement. Within the area of influence of the cone of depression water is drawn from all directions, vertically and laterally, toward the center of pumping. The upward leakage of saline water from Aquifers D and E, and the downward leakage of fresh water from Aquifers A and B is retarded by the clay layers that separate the water-bearing zones. However, lateral movement of water in the aquifers is not retarded by clay layers, and the saline water in Aquifer C is moving slowly from the south and east toward the center of pumping. An estimate of the rate of encroachment is difficult to make as long as pumpage in the Edenton area changes in rate and the cone of depression continues to spread. However, frequent observations of water levels and of chloride content in water from Aquifer C east, southeast, and southwest of Edenton would provide the information needed to determine the rate of encroachment and, its potential to contaminate the municipal water supply.

SUMMARY AND CONCLUSIONS

The sedimentary formations that underlie Chowan County range from Early Cretaceous to post-Miocene in age, and are composed of interbedded sand, silt, clay, shell, and limestone beds that are saturated with water.

The sediments between land surface and about 450 feet below contain fresh water and can be divided into five aquifers (A, B, C, D, and E) that are generally separated by four aquicludes. Aquifer A is composed of very fine- to medium-grained quartz sand that occurs between land surface and about 25 feet below land surface. The top and bottom of this aquifer at any one place is marked by the water table and the deepest occurrence of the surficial sands, respectively. The ground water in Aquifer A is under non-artesian or water-table conditions. Yields from dug, bored, and driven wells screened in this aquifer are usually less than 10 gpm. Water from this zone generally contains more than 0.3 ppm iron, but other dissolved mineral constituents are usually below the maximums recommended by the U. S. Public Health Service.

Aquifer B is composed of fine- to coarse-grained quartz sand and shell beds. The top of this zone occurs at approximately 30 feet and the bottom occurs at about 80 feet below land surface. Water in Aquifer B is generally under semiartesian conditions. Bored, driven, and drilled naturally-developed and gravel-packed wells are used to recover water from Aquifer B. The specific capacity of properly constructed, naturally-developed wells screening the full thickness of this aquifer should be about 3 gpm per foot of drawdown. Concentrations of iron in water from this zone are generally above 0.3 ppm, and the water is usually very hard in the southern and southeastern part of the county.

Aquifer C is composed of sandy-shell limestone, glauconitic sand, and sandy limestone and phosphatic quartz sand. The top of this water-bearing zone occurs at about 150 feet and the bottom occurs at about 190 feet below land surface in the western part of the county, and these depths increase about 10 feet per mile toward the east. The water in Aquifer C is under artesian conditions. Drilled open-end, naturally developed, and gravel-packed wells are used to recover ground water from this aquifer. In the southern part of the county the specific capacity of gravel-packed or naturally developed, properly constructed wells screening the full thickness of Aquifer C should be about 10 gpm per foot drawdown. The specific capacities of wells screening Aquifer C in the central and northern part of the county will be much less because the Castle Hayne Limestone is absent and the general lithic texture of the aquifer is much finer in these areas. Water from Aquifer C is very hard in the vicinity of Edenton, and where hardness is below 180 ppm, concentrations of dissolved iron generally exceed 0.3 ppm. Concentrations of chloride in this water exceed 250 ppm in the northern half and the southeastern part of the county.

Aquifer D is composed of interbedded fine- to medium-grained quartz sand, glauconite, and gluconitic and sandy limestone. The top of Aquifer D occurs at about 220 feet and the bottom occurs at about 270 feet below land surface in the western part of the area, and these depths increase about 12 feet per mile toward the east. Drilled open-end and naturally developed wells are used to recover water from this aquifer. Water contained by Aquifer D is under artesian conditions. The specific capacity for properly constructed, naturally-developed wells screening the full thickness of Aquifer D should be about 5 gpm per foot of drawdown. Concentrations of chloride in water from this aquifer are below 250 ppm only in the central western part of the county and, locally the water is very hard, contains more than 0.3 ppm iron, and more than 1.5 ppm fluoride.

Aquifer E consists of interbedded fine- to medium-grained quartz sand, shell, and clay layers. The top of this water-bearing zone occurs at about 320 feet and the bottom occurs at about 420 feet below land surface in the western part of the county and these depths increase about 25 feet per mile toward the east-southeast. Ground water in Aquifer E is under artesian conditions. Drilled naturally-developed wells are used to recover water from Aquifer D. Yields from wells screened in this zone are exceptionally low (1 to 5 gpm) for the texture of the sands in this aquifer, and could probably be improved if electric or gamma-ray well logs were used to determine screen depths during well construction. Where the water from this aquifer contains less than 250 ppm chloride (in a small area north of Rockyhock and generally west of Smalls Cross Roads), other dissolved constituents are usually below the maximum concentrations recommended by the U. S. Public Health Service.

Rainfall recharges the aquifers with ground water. More recharge occurs during the winter and the early spring months than any other time of the year, because evapotranspiration rates are low. Water levels generally rise during this period. Most of the ground-water recharge occurs in the elevated topographic areas in the county where the piezometric surfaces and the water table are high. The water moves away from these recharge areas toward areas of natural and artificial discharge where the piezometric surfaces and the water table are low. Discharge usually exceeds recharge in the late spring, summer, and early fall months, because of high evapotranspiration rates. Therefore, water levels are generally lowest during this time of the year.

The distribution of chloride concentrations in water in Aquifers C, D, and E (the increase in chloride from west to east in the area) was established before the present drainage system was developed, when major recharge to these aquifers was occurring west of Chowan County. Since the development of the present drainage system, major recharge to the artesian aquifers in the county has occurred in the northern and northeastern part of the area, and water containing high concentrations of chloride is now being diluted and flushed from the north toward the east, south, and west.

Concentrated and increasing pumpage in the Edenton area has developed a rather extensive cone of depression in the piezometric surface of Aquifer C, the major artesian aquifer in the southern part of Chowan County. This cone of depression is expanding, and will continue to expand as long as pumping increases, and has already intercepted areas southeast of Edenton where the water in Aquifer C contains excessive concentrations of chloride.

BASIC DATA

Stratigraphic Test Well Number T1

Location: Gliden, Chowan County, North Carolina

Owner: U. S. Geological Survey

Date Drilled: September-October 1962

Elevation of Land Surface: 36 feet above mean sea level

Total Depth: 946 feet

Depth (feet) below land surface	Log of Well
	Quaternary - surficial sands
0-14	Sand, tan; very fine-grained subangular to subrounded quartz sand. Light-brown clay and limonite-stained quartz sand prominent. Trace of fine-grained dark- to light green glauconite, fine-grained phosphate and medium-grained quartz gravel. Foraminifera rare, no Ostracoda.
	Upper Miocene - Yorktown Formation
14-49	Sand, light-gray; 90 percent very fine-grained subangular to subrounded quartz sand, 10 percent medium-grained quartz sand. Coarse shell fragments prominent. Trace of fine-grained phosphate, limonite-stained quartz and rose quartz. Foraminifera rare from 14 to 39 feet and common from 39 to 49 feet; no Ostracoda.
49-80	Sand and clay, medium-gray; 55 percent very fine-grained angular to subangular quartz sand, 30 percent medium-gray clay, 15 percent shell fragments. Trace of smoky quartz, fine-grained dark- to light-green glauconite and fine-grained brown phosphate. Foraminifera abundant, no Ostracoda.
80-136	Clay and shell, medium-gray; 40 percent medium-gray clay, 30 percent very fine-grained angular to subangular quartz sand, 30 percent coarse to medium shell fragments. Trace of fine-grained phosphate, fine-grained dark- to light-green glauconite, medium grained rounded quartz gravel, pyrite aggregates. Foraminifera abundant, no Ostracoda.

Depth (feet) below land surface	
136-203	Sand and clay, medium-gray; 50 percent very fine-grained angular to subangular quartz sand, 40 percent medium-gray clay, 10 percent shell fragments. Trace of fine-grained brown phosphate, fine-grained dark- to light-green glauconite, reddish-brown clay and black clay. Foraminifera abundant, diatoms common, no Ostracoda.
203-230	Glauconitic sand and clay, dark-gray; 50 percent fine-grained subangular to subrounded quartz sand, 30 percent medium-gray clay, 10 percent coarse shell fragments, 10 percent dark- to light-green glauconite. Trace of pyrite aggregates, limonite-stained quartz and yellow-brown clay. Foraminifera abundant, diatoms common, no Ostracoda.
	<u>Middle Miocene - Pungo River Formation</u>
230-260	Sand, light-gray; fine-grained angular to subangular quartz sand. Fine-grained dark- to light-green glauconite, fine- to medium-grained phosphate prominent. Trace of rose quartz and limonite-stained quartz. Foraminifera common, no Ostracoda or diatoms.
	<u>Paleocene - Beaufort Formation</u>
260-290	Glauconitic sand and shell, medium-gray; 60 percent fine-grained subangular to subrounded quartz sand, 20 percent medium-grained dark- to light-green glauconite, 10 percent fine to medium shell fragments. Medium-grained phosphate prominent. Trace of light-gray clay, rose quartz and limestone-and-sand aggregates. Foraminifera abundant, no Ostracoda.
290-316	Glauconite and sand, green-gray mottled; 70 percent medium-grained dark- to light green glauconite, 30 percent fine- to medium-grained subangular

Depth (feet) below land surface	
	to subrounded quartz sand. Trace of medium-grained phosphate, medium shell fragments, pyrite aggregates, medium-gray limestone, and oxidized glauconite grains. Foraminifera rare, no Ostracoda.
316-341	Glauconite, sand and shell, dark-gray; 50 percent medium-grained dark- to light-green glauconite, 25 percent fine-grained quartz sand, 15 percent coarse to medium shell fragments and white limestone-and-sand aggregates and 10 percent gray clay occuring as alternating indurated and partially consolidated layers. Medium-grained quartz sand oxidized glauconite prominent. Trace of pyrite aggregates, and fine-grained phosphate. Foraminifera common, no Ostracoda.
341-367	Glauconitic sand and clay, medium-gray; 50 percent medium-grained angular to to subangular quartz sand, 25 percent medium-grained dark- to light-green glauconite, 15 percent gray clay, 10 percent shell fragments and white limestone-and-sand aggregates. Trace of coarse-grained quartz sand, limonite-stained quartz, oxidized glauconite, pyrite aggregates and fine-grained phosphate. Foraminifera common, no Ostracoda.
367-390	Glauconite sand and clay, medium-gray; 50 percent medium-grained angular to subangular quartz sand, 30 percent light-gray clay, 15 percent medium-grained dark- to light-green glauconite, 5 percent shell fragments. Trace of white limestone-and-sand aggregates, oxidized glauconite, fine-grained glauconite and pyrite aggregates. Foraminifera common, Ostracoda rare.
	Upper Cretaceous - Black Creek Formation
390-480	Glauconitic sand and clay, medium-gray; 55 percent fine- to medium-grained angular to subangular quartz sand, 30 percent gray clay, 10 percent

Depth (feet) below land surface	
	medium-grained dark- to light-green glauconite, 5 percent shell fragments. Trace oxidized glauconite, pyrite aggregates medium-grained phosphate, rose quartz, hematite, yellow-brown clay, black clay, lignitized wood, light-gray limestone and amber. Foraminifera common, Ostracoda rare.
480-541	Sand, light-gray; 80 percent medium-grained angular to subangular quartz sand, 10 percent light-gray clay, 5 percent medium-grained dark-green glauconite, 5 percent coarse-grained quartz sand. Trace of shell fragments, pyrite aggregates, black clay, medium-grained phosphate, rose quartz, lignitized wood fragments and amber. Foraminifera common, no Ostracoda.
541-595	Sand, light-gray; 90 percent medium-grained subangular quartz sand, 5 percent coarse-grained quartz sand, 5 percent medium-grained dark-green glauconite. Red and steel-gray hematite prominent. Trace of limonite-stained quartz-pyrite aggregates, black clay, white limestone-and-sand aggregates and shell fragments. Foraminifera common, no Ostracoda.
	Upper Cretaceous - Tuscaloosa (?) Formation
595-715	Sand, light-gray; 85 percent medium- to fine-grained angular to subangular quartz sand, 15 percent coarse-grained subangular quartz sand. Medium-grained dark- to light-green glauconite and gray clay prominent. Trace of red hematite, hematite-stained quartz, shell fragments, white limestone- and-glauconite aggregates, rose quartz, pyrite aggregates, black clay, muscovite and amber. Foraminifera common, Ostracoda rare.
715-835	Sand and clay, light-gray; 40 percent fine-grained subangular quartz sand, 20 percent medium-grained quartz sand, 40 percent light-gray clay. Fine-grained to medium-grained dark- to light-green glauconite prominent.

Depth (feet) below land surface	
	Trace of medium-grained phosphate, red hematite, shell fragments, rose quartz, pyrite aggregates, hematite- and limonite-stained quartz, white limestone-and-glauconite aggregates, fine-grained muscovite, amber and black clay. Foraminifera common and diatoms rare, no Ostracoda.
835-855	Sand, light-gray; 60 percent fine-grained subangular quartz sand, 25 percent light-gray clay, 15 percent medium- to coarse-grained quartz sand. Trace of fine-grained dark-green glauconite, fine-grained phosphate, shell fragments, red hematite, pyrite aggregates, limonite-stained quartz, muscovite and black clay. Foraminifera common, diatoms rare, no Ostracoda.
855-920	Sand and clay, gray; 50 percent fine-grained subangular quartz sand, 40 percent gray clay, 10 percent medium- to coarse-grained quartz sand. Trace of fine-grained dark-green glauconite, red hemitite, limonite-stained quartz, shell fragments, pyrite aggregates, white limestone-and-glauconite aggregates and black clay. Foraminifera common, diatoms and Ostracoda rare.
920-946 (bottom)	No representative sample.

Stratigraphic Test Well Number T2

Location: 3.5 miles southeast of Edenton, Chowan County, North Carolina

Owner: U. S. Geological Survey

Date Drilled: August-September 1962

Elevation of Land Surface: 8 feet above mean sea level

Total Depth: 852 feet

Log of Well

Depth (feet) below land surface	
	Quaternary - surficial sands
0-15	Sand, tan; fine- to medium-grained subangular to subrounded quartz sand with iron staining common. Trace of phosphate, glauconite, smoky quartz, lignitized wood and brown clay. No microfossils.
	Upper Miocene - Yorktown Formation
15-42	Sand and shell, light-gray; 85 percent fine- to medium-grained subangular to subrounded quartz sand, and 15 percent medium to coarse shell fragments. Trace of red garnet, phosphate, glauconite and brown clay. Foraminifera rare, no Ostracoda.
42-63	Shell and clay, light-gray; 65 percent shell fragments, 25 percent blue-gray clay, and 10 percent coarse quartz sand. Trace coarse-grained phosphate, fine-grained quartz sand and black clay. Foraminifera rare, no Ostracoda.
63-98	Clay and shell, light-gray; 50 percent blue-gray clay, 40 percent coarse shell fragments and 10 percent fine-grained quartz sand. Trace coarse quartz sand and phosphate. Foraminifera abundant, Ostracoda rare.
98-139	Shell and clay, light-gray; 60 percent coarse shell fragments, 20 percent blue-gray clay and 10 percent fine-grained quartz sand. Trace phosphate. Foraminifera common, no Ostracoda.

Depth (feet) below land surface	
139-174	Sand shell and clay, light-gray; 55 percent fine angular to subangular quartz sand, 25 percent white shell fragments, 20 percent light-gray clay. Trace of fine-grained phosphate and reddish-brown clay. Foraminifera common, Ostracoda rare.
174-215	Sand and clay, tan; 50 percent fine subrounded quartz sand, 35 percent brown clay, 15 percent dark- to light-gray shell fragments. Trace of phosphate. Foraminifera common, Ostracoda rare.
	Middle Miocene - Pungo River Formation
215-235	Sand and clay, reddish-brown; 60 percent fine subrounded quartz sand, 15 percent white shell fragments, 10 percent reddish-brown clay, 10 percent fine-grained phosphate. Trace of fine-grained light-green glauconite. Foraminifera abundant, Ostracoda rare.
	Middle Eocene - Castle Hayne Limestone
235-255	Sand and shell, light-brown; 60 percent medium subangular to subrounded quartz sand, 20 percent white to gray shell fragments. 15 percent fine-grained quartz sand, 5 percent brown clay occurring as alternating indurated and partially consolidated layers. Trace of fine-grained light-green glauconite.
	Paleocene - Beaufort Formation
255-288	Sand, reddish-brown; 70 percent medium- to fine-grained subangular to sub-rounded quartz sand, 20 percent reddish-brown clay, 10 percent white to gray shell fragments. Indurated and partially consolidated layers of shell are common. Trace of fine-grained phosphate and fine-grained dark- to light-green glauconite. Foraminifera common, no Ostracoda.
288-350	Sand, yellow-brown; 90 percent fine- to medium-grained subangular to sub-rounded quartz sand, 5 percent fine- to medium-grained dark-green glauconite, 5 percent reddish-brown clay. Trace of phosphate, shell fragments and rose quartz. Foraminifera common, Ostracoda rare.

Depth (feet) below land surface	
350-380	Glauconitic sand, gray-green; 60 percent medium-grained subangular to subrounded quartz sand, 20 percent fine-grained quartz sand, 15 percent medium-grained dark- to light-green glauconite, 5 percent white shell fragments. Trace of reddish-brown clay, phosphate and smoky quartz. Foraminifera common, Ostracoda rare.
380-432	Sand and shell, tan; 40 percent coarse quartz sand to fine gravel, 25 percent medium to coarse shell fragments, 20 percent fine subangular to subrounded quartz sand, 10 percent reddish-brown clay, 5 percent fine-grained dark-green glauconite. White limestone-and-sand aggregates prominent. Trace of phosphate, pyrite aggregates and limonite-stained quartz. Foraminifera rare, no Ostracoda.
432-490	Sand, shell and clay, tan; same as 380-432 foot interval with 20 percent decrease in coarse sand and fine gravel and a corresponding increase in fine sand and clay. Trace of hematite and hematite-stained quartz. Foraminifera rare, no Ostracoda.
	Upper Cretaceous - Peedee Formation
490-580	Sand and clay, red-gray mottled; 40 percent fine-grained subangular to subrounded quartz sand, 15 percent shell fragments, 10 percent coarse-grained quartz sand, 10 percent dark-gray clay, 20 percent red clay and hematite aggregates, 5 percent fine-grained dark- to light-green glauconite. Trace of pyrite aggregates, limonite-and-sand aggregates, muscovite, amber and lignitized wood. Foraminifera common, Ostracoda rare.
	Upper Cretaceous - Black Creek Formation
580-678	Sand and clay, medium-gray; 45 percent fine subangular to subrounded quartz sand, 25 percent dark-gray clay, 20 percent shell fragments, 5 percent coarse-grained quartz sand, 5 percent fine-grained dark- to light-green glauconite. Medium quartz gravel reddish-brown clay prominent. Trace of rose quartz, limonite-stained quartz, phosphate, pyrite aggregates, black clay, amber muscovite. Foraminifera common, no Ostracoda.

Depth (feet) below land surface	
678-749	Sand and clay, dark-gray; 70 percent fine-grained subangular to subrounded quartz sand, 20 percent dark-green clay, 10 percent fine-grained dark- to light-green glauconite. Reddish-brown clay, shell fragments, and coarse-grained quartz sand prominent. Trace of phosphate, pyrite aggregates, black clay, hematite-stained quartz, limestone-and-sand aggregates, amber and muscovite. Foraminifera common, Ostracoda rare.
749-801	Sand, light-gray; 65 percent fine-grained subangular to subrounded quartz sand, 30 percent fine-grained dark- to light-green glauconite. Fine-grained phosphate and coarse shell fragments prominent. Trace of light-gray clay, pyrite aggregates, reddish-brown clay, rose quartz, limonite-stained quartz, amber and black clay. Foraminifera and Ostracoda rare.
801-847	Sand, tan; 75 percent fine-grained subangular to subrounded quartz sand, 15 percent coarse grained quartz sand, 10 percent reddish-brown clay. Fine-grained glauconite and limonite-stained quartz prominent. Trace of smoky quartz, fine-grained phosphate, pyrite aggregates, amber and fine-grained rounded quartz gravel. Foraminifera common, no Ostracoda.
847-857	No sample.
857 (bottom smaple)	Glauconitic sand and clay, medium-gray; 50 percent fine-grained angular to subangular quartz sand, 30 percent medium-gray clay, 10 percent fine-grained dark- to light-green glauconite. Trace of medium-grained quartz gravel, fine-grained phosphate, limonite-stained quartz and amber. Foraminifera common, no Ostracoda.

Stratigraphic Test Well Number T3

Location: .5 miles north Valhalla, Chowan County, North Carolina

Owner: U. S. Geological Survey

Date Drilled: June-July 1964

Elevation of Land Surface: 39 feet above mean sea level

Total Depth: 604 feet

Log of Well

Depth (feet) below land surface	
	Quaternary - surficial sands
0-35	Sand, tan; 75 percent fine-grained angular to subangular clear quartz sand, 25 percent fine- to medium-grained subangular limonite-stained quartz sand. Trace ilmenite, rose quartz ~~and~~ lignitized wood. No microfossils.
	Upper Miocene - Yorktown Formation
35-40	Sand, tan; 60 percent medium-grained subangular to subrounded quartz sand, 30 percent fine-grained quartz sand, 10 percent coarse-grained sand. Ilmenite, hematite- and limonite-stained quartz prominent. Trace of rose quartz and shell fragments.
40-45	Sand, tan; 50 percent coarse-grained subrounded quartz sand, 25 percent medium-grained subangular to subrounded quartz sand, 25 percent fine- to very fine-grained subrounded quartz sand. Limonite- and hematite-stained quartz grains prominent. Trace of ilmenite, rose quartz and shell fragments.
45-50	Sand, light-gray; fine-grained subangular to subrounded quartz sand. Limonite-stained quartz grains prominent. Trace of coarse- to medium-grained quartz,rose quartz and ilmenite.
50-60	Sand, tan; 80 percent very fine-grained subangular to subrounded quartz sand, 20 percent fine to medium- grained subrounded quartz sand. Limonite-stained quartz grains prominent. Trace of ilmenite, hematite grains and rose quartz.
60-75	Sand, brownish-gray; 65 percent fine-grained subrounded quartz sand, 15 percent medium-grained quartz sand, 15 percent very fine-grained quartz sand, 5 percent shell frag-

Depth (feet) below land surface	
	ments. Hematite- and limonite-stained Trace of rose quartz, fine-grained light-green glauconite and smoky quartz.
75-130	Sand, brownish-gray; 60 percent fine-grained subrounded to subangular quartz sand, 20 percent gray clay, 20 percent very fine-grained quartz. Shell fragments, limonite, and hematite-stained quartz grains prominent. Trace of rose quartz, ilmenite and ~~dark-green~~ fine-~~grained~~ ~~glauconite~~. Foraminifera and Ostracoda present.
130-155	Sand, brownish-gray; 75 percent fine- to very fine-grained subrounded quartz sand, 20 percent gray clay, 5 percent medium-grained quartz sand. Shell fragments prominent. Trace of rose quartz, muscovite, limonite-stained quartz, light- to dark-green glauconite, and ilmenite. Foraminifera and Ostracoda present.
155-175	Sand and clay, light-gray; 65 percent very fine- to fine-grained subrounded quartz sand, 30 percent light-gray clay, 5 percent medium-grained subrounded quartz sand. Shell fragments prominent. Trace of fine-grained dark- to light-green glauconite, limonite-stained quartz, rose quartz, brown to black fine-grained phosphate, ilmenite, biotite and muscovite. Foraminifera common. Ostracoda rare.
175-210	Same as 155-175 foot interval with 10 percent increase in light-gray clay and corresponding decrease in very fine- to fine-grained quartz sand.
	<u>Middle Miocene - Pungo River Formation</u>
210-245	Sand, brownish-gray; 60 percent fine-grained subrounded to subangular quartz sand, 15 percent brown to black fine- to coarse grained phosphate, 15 percent brown clay, 5 percent medium- to coarse-grained quartz sand, 5 percent coarse shell fragments. Trace of light- to dark-green glauconite, rose quartz, muscovite, sand-and-glauconite aggregates, and limonite-stained quartz. Foraminifera rare, no Ostracoda.

Depth (feet) below land surface	Paleocene - Beaufort Formation
245-260	Sand and limestone, brownish, gray; indurated to partially consolidated fine-grained quartz sand interbedded with shell limestone. Trace of fine-grained dark-green glauconite, glauconite-sand-and-limestone aggregates, brown to black fine-grained phosphate, and limonite-stained quartz grains. No microfossils.
260-300	Glauconite and clay, dark-green and gray; 50 percent fine-grained dark- to light-green glauconite, 35 percent brownish-gray silt and clay, 15 percent very fine-grained subrounded quartz sand. Shell fragments prominent. Trace of pyrite- and-glauconite aggregates, fine-grained brown phosphate. Foraminifera rare, no Ostracoda.
300-360	Sand, glauconite and limestone, cream to light-gray; 50 percent fine- to medium-grained subrounded quartz sand, 30 percent fine- to medium-grained dark- to light-green glauconite, 20 percent cream crystalline limestone occurring as alternating consolidated and partially consolidated layers. Calcareous cemented sand-and-glauconite aggregates prominent. Trace of rose, oxidized glauconite, pyrite, fine-grained brown phosphate. Foraminifera rare, no Ostracoda.
360-370	Sand and clay, dark-green and gray; 60 percent very fine- to fine-grained subrounded quartz sand, 30 percent brown clay, 10 percent dark- to light-green fine-grained glauconite. Cream-colored coarse cystalline limestone fragments prominent. Trace of rose quartz, oxidized glauconite, pyrite, limonite-stained quartz, limestone-sand-and-glauconite aggregates, brown phosphate, muscovite, and hematite grains. Foraminifera present, no Ostracoda.
370-390	Clay, dark-gray.
390-415	Sand and clay, dark gray; 50 percent fine-grained subrounded to subangular quartz sand, 40 percent gray clay, 10 percent fine-grained dark-green glauconite. Trace of shell fragments, rose quartz, oxidized glauconite, brown phosphate, limonite- and hematite-stained quartz. Foraminifera rare, no Ostracoda.

Depth (feet) below land surface	
415-420	Clay, dark-gray. Foraminifera rare, no Ostracoda.
	Upper Cretaceous - Black Creek Formation
420-490	Sand and clay, dark gray; 60 percent very fine- to fine-grained subrounded quartz sand, 30 percent light-gray clay, 10 percent fine-grained dark-to light-green glauconite. Trace of cream-colored crystalline limestone, limonite-stained quartz, oxidized glauconite, marcasite aggregates, brown phosphate, lignitized wood and amber. Foraminifera present, no Ostracoda.
495-505	Sand and clay, dark-gray; 70 percent fine- to very fine-grained subrounded quartz sand, 30 percent brown clay. Fine-grained dark- to light-green glauconite, shell fragments prominent. Trace of fine quartz gravel, limestone-and-glauconite aggregates, marcasite aggregates, rose quartz, brown phosphate, lignitized wood, muscovite. Foraminifera present, no Ostracoda.
505-520	Clay, dark-gray. Foraminifera present, no Ostracoda.
520-530	Sand and clay, dark-gray. Same as 495-505 foot interval. Foraminifera present, no Ostracoda.
530-550	Clay, dark-gray. Foraminifera present, no Ostracoda.
550-565	Sand and clay, dark-gray; 40 percent fine-grained subrounded quartz sand, 25 percent medium-grained subrounded quartz sand, 25 percent gray to brown clay, 10 percent coarse-grained subangular quartz sand and fine quartz gravel. Dark-green glauconite and shell fragments prominent. Trace of muscovite, rose quartz, oxidized glauconite, limonite-stained quartz, limestone-sand-and-glauconite aggregates, marcasite-and-quartz aggregates, brown fine-grained phosphate, biotite, muscovite, hematite grains, lignitized wood and amber. Foraminifera present, no Ostracoda.

Depth (feet) below land surface	
565-570	Clay, dark-gray. Foraminifera present, no Ostracoda.
570-585	Sand and clay, dark-gray; 40 percent fine-grained quartz sand, 30 percent gray-brown clay, 30 percent medium- to coarse-grained quartz sand and fine quartz gravel. Fine- to medium- grained dark- to light-green glauconite prominent. Trace of rose quartz, muscovite, oxidized glauconite marcasite-and-quartz aggregates, hematite grains, lignitized wood, and amber. Foraminifera present, no Ostracoda.
585-590	Sand and clay, dark-gray; 70 percent fine- to very fine-grained subrounded quartz sand, 30 percent brown and gray clay. Fine-grained glauconite prominent. Trace of oxidized glauconite, marcasite aggregates, rose quartz, fine quartz gravel, lignitized wood and amber. Foraminifera rare, no Ostracoda.
590-604 (bottom)	Sand, light-gray; 50 percent fine-grained subrounded quartz sand, 40 percent coarse- to medium-grained subangular to subrounded quartz sand, 10 percent gray to brown clay. Shell fragments, dark- to light-green glauconite, and fine quartz gravel prominent. Trace of rose quartz, limonite-stained quartz, limestone-sand-and-glauconite aggregates, marcasite-sand-and-limestone aggregates, brown phosphate, lignitized wood and amber. Foraminifera present, no Ostracoda.

Table 3. Records of wells in Chowan County, N. C.

Well location: Latitude	Well location: Longitude	Sequence No.	Well No.	Owner	Ownership	Use of water	QW analysis	Log data	Depth (feet)	Depth cased (feet)	Diameter (in)	Finish	Altitude of LSD (feet)	Water level below LSD (feet)	Yield (gpm)	Drawdown (feet)	Quality of water: Iron	Quality of water: pH	Quality of water: Chloride	Quality of water: Hardness	Quality of water: Sp. Cond.	Aquifer	Water-bearing formation	Remarks
36°20'28"N	76°33'46"	1	1	Miss S. Roundtree-	P	H	P	G	41	37	1¼	T	51	3	5	---	18	8.4	8	24	110	B	Y	
36°19'55"N	76°35'03"	1	2	R. C. Bunch ------	P	H	P	-	25	25	24	O	36	1.6	---	---	22	6.5	12	72	178	B	Y	
36°19'48"N	76°35'09"	1	3	E. T. Bunch ------	P	H	P	-	8	8	24	O	30	2.5	---	---	.20	5.5	18	60	217	A	PM	
36°19'14"N	76°36'14"	1	4	W. Umphlett ------	P	H	P	-	20	17	1¼	T	32	-----	5	---	7.4	5.4	13	24	130	A	PM	
36°18'56"N	76°36'15"	1	5	R. F. Jordan -----	P	H	P	-	20	20	24	O	35	2.7	5	---	4.7	6.1	11	54	142	A	PM	
36°19'00"N	76°36'33"	1	6	N. D. Chappell ---	P	H	P	-	20	17	1¼	T	35	-----	---	---	12	6.7	13	138	320	A	PM	
36°19'12"N	76°36'53"	1	7	Lloyd Briggs -----	P	H	P	-	75	72	1¼	S	35	-----	5	---	.85	7.5	12	251	587	B	Y	
36°19'12"N	76°36'55"	1	8	Lloyd Briggs -----	P	C	P	-	75	72	1¼	S	35	-----	5	---	1.4	7.3	12	230	583	B	Y	
36°19'06"N	76°36'55"	1	9	U.S.G.S. ---------	F	U	C	Y	845	835	2	S	36	28	2	---	.00	8.5	1200	75	4900	-	LC	Test well T3; total
36°19'06"N	76°36'55"	1	9	U.S.G.S. ---------	F	U	C	Y	563	553	2	S	36	22	2	---	.01	8.2	500	32	2680	-	T	depth 940 ft. Casing
36°19'06"N	76°36'55"	1	9	U.S.G.S. ---------	F	U	C	Y	405	395	2	S	36	16.5	5	10	.01	8.5	835	57	3670	E	BC	pulled back and screen set at 232-242 ft.
36°19'06"N	76°36'55"	1	9	U.S.G.S. ---------	F	U	C	Y	242	232	2	S	36	15.3	1	---	.51	7.7	1000	185	4130	C	PR	Observation well.
36°19'20"N	76°37'04"	1	10	Jacob Spivey -----	P	U	-	-	11	11	36	O	30	7	---	---	------	---	----	---	------	A	PM	
36°19'20"N	76°37'04"	2	11	Jacob Spivey -----	P	H	P	-	18	18	24	O	30	1	5	15	.31	6.0	8	37	227	A	PM	
36°19'37"N	76°37'12"	1	12	A. D. Ward -------	P	U	P	-	8	5	1¼	T	10	+1	1	---	.37	4.8	11	36	119	A	PM	
36°19'19"N	76°37'24"	1	13	A. D. Ward -------	P	H	P	-	21	18	1¼	T	30	-----	5	---	------	4.5	18	32	149	A	PM	
36°19'13"N	76°37'20"	1	14	C. A. White ------	P	H	P	-	14	11	1¼	T	34	-----	---	---	22	6.7	15	29	162	A	PM	
36°19'11"N	76°37'41"	1	15	Elwood White -----	P	H	P	-	55	52	1½	S	32	-----	4	---	30	6.2	14	57	148	B	Y	
36°19'21"N	76°38'15"	1	16	F. A. Ward -------	P	H	P	J	362	---	4-2	S	26	7	6	20	.97	8.3	700	52	3500	E	BC	Observation well. Aquifer test 4/7/65.
36°19'19"N	76°38'15"	1	17	F. A. Ward -------	P	U	P	-	10	10	24	O	30	4	---	---	.44	6.8	36	154	443	A	PM	Observation well.
36°18'05"N	76°39'23"	1	18	J. F. Harrell ----	P	H	P	-	15	12	1¼	T	10	3	---	---	.14	5.7	8	62	163	A	PM	
36°18'08"N	76°38'29"	1	19	Mrs. B. W. Parker-	P	H	P	-	32	29	1¼	T	20	-----	5	---	.17	5.2	8	28	101	B	Y	
36°18'10"N	76°38'08"	1	20	E. E. Boyce ------	P	H	P	-	22	22	36	O	30	21	---	---	.12	4.6	13	26	119	A	PM	
36°18'15"N	76°37'51"	1	21	L. E. Twine ------	P	H	C	-	386	381	4-2	S	34	13	10	---	.34	8.0	642	42	3100	E	BC	
36°18'47"N	76°37'30"	1	22	C. A. Perry ------	P	H	C	-	447	437	4-2	S	34	12.5	10	---	.89	8.1	530	35	2810	E	BC	
36°18'45"N	76°37'23"	1	23	T. Berryman ------	P	H	P	-	11	11	24	O	35	8	---	---	4.1	4.3	46	122	536	A	PM	
36°18'00"N	76°37'20"	1	24	Isaac Byrum ------	P	HS	C	J	310	310	6	O	37	19	40	20	.58	8.5	962	84	3790	D	B	Bailer test, 1936.
36°18'22"N	76°35'27"	1	25	L. White ---------	P	U	-	-	6	6	36	O	36	4	---	---	------	---	----	---	------	A	PM	
36°18'52"N	76°35'04"	1	26	A. C. Hobbs ------	P	HS	P	-	10	8	1¼	T	32	2	5	---	.16	5.1	21	69	203	A	PM	
36°18'12"N	76°35'06"	1	27	W. J. Chappell ---	P	S	P	-	6	6	36	O	46	4	---	---	.38	5.1	4	16	49	A	PM	
36°17'50"N	76°34'07"	1	28	B. M. Lamb -------	P	H	P	-	30	27	1¼	T	49	-----	---	---	1.0	5.0	8	42	118	A	PM	
36°17'50"N	76°34'48"	1	29	Irvin Kelley -----	P	H	P	-	15	13	1¼	T	48	2	---	---	-----	6.3	6	18	63	A	PM	
36°17'04"N	76°34'18"	1	30	D. A. Cornelius --	P	U	P	-	5	5	36	O	47	2	---	---	.80	5.3	8	24	80	A	PM	Observation well.

Ownership: F-Federal Government; M-Municipal; P-Private; S-State agency; C-County; N-Corporation. Use: C-Commercial; H-Domestic; P-Public supply; S-Stock supply; I-Institutional; N-Industrial; U-Unused. Type of QW analysis available: P-Partial; C-Complete. Log data available: G-Geologist's log; E-Electric log; J-Gamma-ray log; Y-Geologist, electric, and gamma-ray logs. Well finish: O-Open-end; S-Screen; T-Sand point; G-Gravel wall with commercial screen; MS-Multiple screen. Aquifer: Letter shown is the same as described in this report. Water-bearing formation: PM-Post Miocene; Y-Yorktown; PR-Pungo River; CH-Castle Hayne limestone; B-Beaufort; BC-Black Creek; T-Tuscaloosa; LC-Unnamed lower Cretaceous. Quality of water reported in parts per million except Specific conductance in micromhos and pH.

Well location: Latitude	Well location: Longitude	Sequence No.	Well No.	Owner	Ownership	Use of water	QW analysis	Log data	Depth (feet)	Depth cased (feet)	Diameter (in)	Finish	Altitude of LSD (feet)	Water level below LSD (feet)	Yield (gpm)	Drawdown (feet)	Quality of water: Iron	pH	Chloride	Hardness	Sp. Cond.	Aquifer	Water-bearing formation	Remarks
36°17'23"N	76°35'26"	1	31	J. J. Copeland ---	P	U	P	-	90	87	1¼	S	49	6	---	---	6.6	5.2	7	44	107	B	Y	
36°17'12"N	76°35'45"	1	32	J. Chappell ------	P	HS	P	-	15	13	1¼	T	47	3	---	---	.10	5.3	14	73	182	A	PM	
36°17'18"N	76°35'50"	1	33	N. D. Chappell ---	P	U	P	-	6	6	24	O	47	2	---	---	1.2	5.9	10	32	128	A	PM	
36°16'52"N	76°36'39"	1	34	Elton Harrell ----	P	H	-	-	22	19	1¼	T	42	2.5	5	---	----	---	----	---	-----	A	PM	
36°17'22"N	76°37'56"	1	35	D. T. Ward -------	P	H	P	-	340	340	2	O	34	13	6	15	.18	7.6	990	100	3700	D	B	Aquifer test 4/16/65.
36°17'35"N	76°38'38"	1	36	James Baker ------	P	HS	P	-	8	8	24	O	31	3	---	---	1.3	4.5	19	65	222	A	PM	
36°17'23"N	76°38'45"	1	37	N. D. Baker ------	P	HS	P	-	345	345	4	O	31	12	---	---	1.2	7.9	870	95	3200	D	B	
36°17'49"N	76°39'26"	1	38	D. G. Welch ------	P	H	P	-	15	12	1¼	T	10	1	4	---	.20	4.9	8	91	210	A	PM	
36°16'57"N	76°39'10"	1	39	E. M. Ward -------	P	HS	C	-	455	445	4-2	S	31	-----	8	---	5.6	8.5	434	88	2100	E	BC	
36°16'58"N	76°39'45"	1	40	M. P. Perry ------	P	H	P	-	18	15	1¼	T	11	-----	5	---	.16	4.9	12	83	214	A	PM	
36°16'04"N	76°40'00"	1	41	N. M. Hendrix ----	P	H	C	-	20	17	1¼	T	26	14	---	---	.18	5.1	15	30	158	A	PM	
36°16'01"N	76°39'58"	1	42	E. M. Modlin -----	P	U	-	-	8	8	36	O	26	7	---	---	-----	---	----	---	-----	A	PM	
36°19'59"N	76°39'27"	1	43	A. E. Byrum ------	P	H	C	-	380	370	2	S	30	16	11	---	.18	7.9	500	49	2100	E	BC	
36°16'11"N	76°39'15"	1	44	J. R. Hendrix ----	P	H	C	-	420	410	1½	S	34	13	---	---	.14	7.6	550	32	2600	E	BC	
36°16'01"N	76°39'15"	1	45	J. Hendrix -------	P	S	-	-	8	8	36	O	31	7	---	---	-----	---	----	---	-----	A	PM	
36°16'48"N	76°38'24"	1	46	E. Blanchard -----	P	HS	P	-	437	427	4-2	S	37	16	5	---	2.5	7.8	750	51	3400	E	BC	
36°16'45"N	76°38'24"	1	47	E. Blanchard -----	P	S	P	-	9	9	36	O	32	2	---	---	.16	4.2	14	34	172	A	PM	
36°16'25"N	76°38'10"	1	48	T. L. Ward -------	P	HS	C	-	15	13	1¼	T	40	-----	---	---	.10	5.3	11	92	229	A	PM	
36°16'06"N	76°36'06"	1	49	M. L. Bateman ----	P	HS	P	-	464	454	2	S	30	-----	---	---	.02	7.3	732	84	3000	E	BC	
36°16'32"N	76°37'43"	1	50	H. I. Ward -------	P	S	P	-	7	7	24	O	41	5	---	---	.10	4.9	4	19	77	A	PM	
36°15'56"N	76°37'27"	1	51	W. T. Byrum ------	P	HS	P	J	393	---	4-2	S	27	8	2	18	2.0	7.7	760	58	3200	E	BC	Aquifer test 4/12/65.
36°16'15"N	76°36'07"	1	52	Vernon Jordan ----	P	HS	P	-	11	9	1¼	T	30	-----	---	---	1.0	5.0	10	62	170	A	PM	
36°16'41"N	76°35'33"	1	53	C. W. Copeland ---	P	HS	P	-	20	17	1¼	T	41	3.5	5	---	.44	4.8	4	19	77	A	PM	
36°16'14"N	76°34'21"	1	54	Raymond Dail -----	P	HS	P	-	15	13	1¼	T	50	3.4	5	---	.28	4.9	11	51	179	A	PM	
36°15'24"N	76°34'34"	1	55	E. J. Lane -------	P	H	C	-	15	13	1¼	T	47	1.5	4	---	.25	6.1	15	36	169	A	PM	
36°15'20"N	76°36'57"	1	56	N. D. Dale -------	P	S	P	-	5	5	36	O	42	1	---	---	1.3	5.6	4	35	72	A	PM	
36°15'30"N	76°37'48"	1	57	W. D. Elliot -----	P	HS	P	-	10	10	36	O	25	4	---	---	1.3	4.3	26	16	148	A	PM	
36°15'35"N	76°38'12"	1	58	J. H. Hollowell --	P	S	-	-	13	13	36	O	20	4	---	---	-----	---	----	---	-----	A	PM	
36°15'42"N	76°39'12"	1	59	H. R. Peele ------	P	H	C	-	247	247	2	O	34	14	---	---	.08	7.8	628	104	2400	C	PR	
36°15'31"N	76°39'15"	1	60	Mrs. E. N. Elliot	P	HS	C	J	433	423	4-2	S	32	13	---	---	3.1	8.1	530	32	2050	E	BC	
36°15'50"N	76°40'10"	1	61	J. T. Byrum ------	P	H	P	-	25	22	1¼	T	27	-----	---	---	.25	5.6	13	89	254	A	PM	
36°15'31"N	76°40'12"	1	62	R. C. Nixon ------	P	S	P	-	10	10	36	O	27	8	---	---	.06	5.9	190	207	1210	A	PM	
36°15'31"N	76°40'19"	1	63	W. J. Bunch ------	P	H	P	-	30	27	1¼	T	23	-----	---	---	.04	5.1	16	72	211	A	PM	

Well location: Latitude	Well location: Longitude	Sequence No.	Well No.	Owner	Ownership	Use of water	QW analysis	Log data	Depth (feet)	Depth cased (feet)	Diameter (in)	Finish	Altitude of LSD (feet)	Water level below LSD (feet)	Yield (gpm)	Drawdown (feet)	Quality of water: Iron	pH	Chloride	Hardness	Sp. Cond.	Aquifer	Water-bearing formation	Remarks
36°15'23"N	76°40'11"	1	64	R. C. Nixon ------	P	HS	P	-	30	27	1¼	T	27	-----	5	---	.51	6.0	18	157	390	A	PM	
36°14'45"N	76°40'12"	1	65	Unknown ----------	-	U	P	-	18	15	1¼	T	20	6	---	---	3.0	5.2	7	23	138	A	PM	
36°14'07"N	76°41'05"	1	66	Robert Hare ------	P	H	P	-	10	8	1¼	T	47	4	---	---	.20	---	8	34	113	A	PM	
36°14'39"N	76°40'12"	1	67	G. T. King -------	P	H	P	-	20	18	1¼	T	16	-----	---	---	.24	5.4	10	76	169	A	PM	
36°14'07"N	76°40'14"	1	68	C. Blanchard -----	P	HS	P	-	25	22	1¼	T	12	7.5	---	---	.24	5.2	12	96	241	A	PM	
36°13'44"N	76°40'19"	1	69	Walter Lane ------	P	S	P	-	10	10	24	O	11	7	---	---	1.4	5.0	15	84	247	A	PM	
36°14'12"N	76°39'23"	1	70	Chowan County ----	C	T	C	-	420	410	4	S	28	-----	70	---	.39	8.0	295	44	1600	E	BC	Yield reported
36°14'08"N	76°39'24"	1	71	Chowan County ----	C	U	P	J	261	---	6	S	27	10	8	13	-----	7.5	890	297	-----	D	B	Observation well. Aquifer test 4/1/64.
36°13'50"N	76°39'27"	2	72	R. H. Hollowell --	P	H	P	-	450	---	4	S	32	-----	---	---	1.0	---	318	35	1700	E	BC	
36°13'32"N	76°39'49"	1	73	J. H. Dale -------	P	HS	P	-	25	22	1¼	T	30	-----	---	---	.66	---	10	20	83	A	PM	
36°13'50"N	76°39'27"	1	74	R. H. Hollowell --	P	U	P	-	16	16	36	O	32	4	---	---	.46	---	10	12	120	A	PM	Observation well.
36°13'40"N	76°39'25"	1	75	Melvin Evans -----	P	H	P	-	47	44	1¼	S	31	-----	5	---	-----	---	15	3	206	B	Y	
36°13'32"N	76°39'25"	1	76	J. B. Hollowell --	P	H	C	J	442	432	4-2	S	31	12.5	2.5	15	.99	7.8	247	18	1380	E	BC	Aquifer test 4/14/65.
36°13'36"N	76°39'13"	1	77	Center Hill Fire Department -----	N	H	C	-	40	37	1¼	S	31	-----	---	---	25	4.3	101	51	401	B	Y	
36°13'37"N	76°38'54"	1	78	J. A. Hobbs ------	P	H	P	-	23	23	24	O	32	1.5	---	---	-----	---	9	3	172	A	PM	
36°13'36"N	76°38'48"	1	79	J. A. Hobbs ------	P	S	P	-	9	9	36	O	32	1	---	---	-----	---	10	99	229	A	PM	
36°13'30"N	76°38'40"	1	80	H. W. Dale -------	P	HS	C	-	360	360	4	O	34	-----	---	---	.17	7.7	440	158	2130	D	B	
36°14'08"N	76°37'50"	1	81	H. Dale ----------	P	HS	P	-	8	8	36	O	32	6	---	---	8.8	5.0	8	42	119	A	PM	
36°14'16"N	76°37'12"	1	82	T. D. Boyce ------	P	S	P	-	6	6	24	O	34	5	---	---	3.4	5.6	6	27	96	A	PM	
36°14'33"N	76°36'44"	1	83	Thomas Byrum -----	P	HS	P	-	20	18	1¼	T	37	-----	4	---	.28	4.9	17	74	198	A	PM	
36°14'59"N	76°36'24"	1	84	Mrs. E. Griffin --	P	HS	P	-	13	10	1¼	T	40	3.5	---	---	.52	4.7	12	53	130	A	PM	
36°14'27"N	76°35'23"	1	85	Robert Hare ------	P	U	P	-	10	8	1¼	T	47	4	---	---	3.0	5.2	7	23	138	A	PM	
36°13'24"N	76°36'02"	1	86	J. E. Rogerson ---	P	H	P	-	18	15	1¼	T	48	-----	---	---	1.2	4.5	9	45	136	A	PM	
36°13'36"N	76°36'40"	1	87	Center Hill Community ------	N	U	-	-	11	9	1½	T	45	6	---	---	-----	---	----	---	-----	A	PM	
36°13'35"N	76°36'48"	1	88	W. J. Privott ----	P	H	P	-	14	11	1¼	T	45	-----	---	---	.17	5.4	6	73	181	A	PM	
36°13'03"N	76°36'33"	1	89	Mrs. J. I. Boyce -	P	H	C	J	333	333	2	O	46	26	15	---	.02	7.8	196	57	1390	D	B	
36°12'49"N	76°36'20"	1	90	Roy Lane ---------	P	HS	C	-	16	13	1¼	T	48	8	3	---	1.4	6.0	20	92	250	A	PM	
36°13'03"N	76°35'45"	1	91	Preston Mounds ---	P	H	P	-	23	20	1¼	T	16	-----	---	---	1.4	7.1	10	143	269	B	Y	
36°11'40"N	76°35'29"	1	92	Nehimiah Bunch ---	P	S	P	-	80	---	1¼	O	12	+2	1.5	---	1.1	7.2	296	238	1610	B	Y	Aquifer test 3/19/65.
36°12'51"N	76°36'49"	1	93	M. A. Byrum ------	P	H	P	-	30	28	1¼	T	47	-----	---	---	.87	6.3	23	82	243	A	PM	
36°12'25"N	76°37'09"	1	94	Unknown ----------	-	U	P	-	13	11	1¼	T	45	5	---	---	1.7	5.9	7	75	207	A	PM	
36°11'56"N	76°37'29"	1	95	C. B. White ------	P	H	P	-	16	13	1¼	T	44	7	5	---	.39	6.2	9	18	141	A	PM	

Well location		Sequence No.	Well No.	Owner	Ownership	Use of water	QW analysis	Log data	Depth (feet)	Depth cased (feet)	Diameter (in)	Finish	Altitude of LSD (feet)	Water level below LSD (feet)	Yield (gpm)	Drawdown (feet)	Quality of water					Aquifer	Water-bearing formation	Remarks
Latitude	Longitude																Iron	pH	Chloride	Hardness	Sp. Cond.			
36°11'45"N	76°38'30"	1	96	Mrs. G. L. Toppin	P	U	P	-	8	6	1¼	T	40	3	3	---	4.8	6.1	20	27	190	A	PM	
36°12'13"N	76°38'53"	1	97	Vandy Nixon ------	P	HS	P	-	12	10	1¼	T	31	-----	---	---	1.8	4.7	24	30	245	A	PM	
36°11'27"N	76°39'34"	1	98	Carroll Byrum ----	P	HS	C	J	439	429	4-2	S	28	10	3	18	.08	7.7	301	43	1590	E	BC	Aquifer test 8/10/64.
36°12'37"N	76°39'25"	1	99	G. C. Beanam -----	P	H	P	-	59	56	1¼	S	29	3.5	5	20	4.1	---	13	216	450	B	Y	
36°12'44"N	76°39'24"	1	100	F. A. White ------	P	HS	C	J	448	438	2	S	27	8.5	---	---	1.8	7.8	235	22	1340	E	BC	
36°12'33"N	76°39'32"	1	101	W. A. Perry ------	P	S	P	-	14	14	36	O	28	4	---	---	.59	---	128	24	498	A	PM	
36°12'43"N	76°39'47"	1	102	Chowan County ----	C	T	P	-	35	32	1½	S	23	-----	---	---	8.1	---	22	16	95	A	PM	
36°13'15"N	76°39'56"	1	103	White Oak Church -	N	T	P	-	36	34	1¼	T	31	4.5	---	---	13	5.4	8	18	64	A	PM	
36°13'17"N	76°40'12"	1	104	L. M. Hollowell --	P	HS	-	-	35	32	1¼	T	30	7	5	---	-----	---	----	----	-----	A	PM	
36°13'15"N	76°40'33"	1	105	L. M. Hollowell --	P	HS	P	-	33	30	1¼	T	30	4	---	---	1.9	---	18	26	119	A	PM	
36°13'13"N	76°41'04"	1	106	W. H. Winborne ---	P	H	P	-	25	23	1¼	T	19	1.5	---	---	12	---	80	56	440	A	PM	
36°13'24"N	76°41'37"	1	107	M. J. Evans ------	P	HS	C	-	20	18	1¼	T	25	-----	---	---	.27	5.5	20	56	209	A	PM	
36°13'40"N	76°42'19"	1	108	Arrow Head Beach Association ------	N	P	C	-	280	270	4	S	6	+7	2.7	---	.30	8.1	36	86	712	D	B	Aquifer test 3/17/65.
36°13'13"N	76°42'09"	1	109	Leroy Bunch ------	P	H	P	-	27	25	1¼	T	32	-----	---	---	.64	---	7	48	133	A	PM	
36°13'04"N	76°42'43"	1	110	Chowan Beach Association ------	N	P	-	-	19	17	1¼	T	20	15	---	---	-----	---	----	----	-----	A	PM	
36°13'05"N	76°42'45"	1	111	Zeno Best --------	P	U	C	J	470	465	2	MS	5	+9.5	8	---	.41	7.9	334	213	1500	ED	BCB	Observation well. Aquifer test 3/15/20.
36°12'43"N	76°42'28"	1	112	R. C. Bunch ------	P	H	P	-	20	18	1¼	T	33	-----	---	---	.33	---	5	16	48	A	PM	
36°12'31"N	76°42'50"	1	113	United Piece and Dye Works --------	N	N	C	-	374	364	4-2	S	15	+3	1	---	.16	7.8	161	88	1220	E	BC	
36°12'08"N	76°42'39"	1	114	C. Privott -------	P	H	P	-	17	15	1¼	T	23	5	5	---	2.7	5.7	5	17	52	A	PM	
36°11'37"N	76°42'09"	1	115	W. T. Bunch ------	P	S	P	-	12	12	36	O	30	6	---	---	2.2	---	13	102	247	A	PM	
36°12'10"N	76°41'31"	1	116	J. L. Parrish ----	P	HS	P	-	22	20	1¼	T	20	5.5	3	---	.09	---	26	143	351	A	PM	
36°11'38"N	76°40'48"	1	117	W. T. Nixon ------	P	H	P	-	15	13	1¼	T	13	3	---	---	.59	---	13	64	171	A	PM	
36°11'33"N	76°40'14"	1	118	R. C. Privott ----	P	H	P	-	13	11	1¼	T	13	3.5	---	---	.72	---	20	119	304	A	PM	
36°11'56"N	76°39'40"	1	119	C. C. Nixon ------	P	C	P	-	60	57	1¼	S	28	-----	5	---	-----	---	----	---	-----	B	Y	
36°11'50"N	76°39'40"	1	120	C. C. Nixon ------	P	H	-	-	17	15	1¼	T	30	4.5	5	---	-----	---	----	---	-----	A	PM	
36°11'36"N	76°40'02"	1	121	R. C. Privott ----	P	S	P	-	11	11	24	O	13	4	---	---	1.6	---	42	62	237	A	PM	
36°10'47"N	76°40'00"	1	122	G. E. Bunch ------	P	H	P	-	18	16	1¼	T	30	-----	---	---	.68	---	15	42	158	A	PM	
36°10'44"N	76°39'46"	1	123	U. S. G. S. ------	F	U	P	-	87	84	1¼	T	34	19	2	10	11	7.3	4	180	330	B	Y	
36°10'50"N	76°39'39"	1	124	W. W. Bunch, Jr. -	P	U	P	-	5	5	24	O	34	1	---	---	.45	---	24	88	390	A	PM	
36°11'11"N	76°38'02"	1	125	W. A. Twine ------	P	H	-	-	22	19	1¼	T	42	2.5	4	---	-----	---	----	---	-----	A	PM	
36°10'43"N	76°38'14"	1	126	E. Jernigan ------	P	H	P	-	18	16	1¼	T	37	-----	---	---	.38	5.1	12	59	179	A	PM	

Well location: Latitude	Well location: Longitude	Sequence No.	Well No.	Owner	Ownership	Use of water	QW analysis	Log data	Depth (feet)	Depth cased (feet)	Diameter (in)	Finish	Altitude of LSD (feet)	Water level below LSD (feet)	Yield (gpm)	Drawdown (feet)	Quality of water: Iron	pH	Chloride	Hardness	Sp. Cond.	Aquifer	Water-bearing formation	Remarks
36°09'59"N	76°39'35"	1	127	Chowan County ----	C	T	P	-	10	7	1¼	T	39	-----	4	---	.40	5.3	7	36	148	A	PM	
36°10'37"N	76°41'21"	1	128	R. E. Whiteman ---	P	S	P	-	11	11	24	O	24	5	---	---	.04	---	17	86	267	A	PM	
36°10'51"N	76°41'41"	1	129	Percy Smith ------	P	H	C	-	15	13	1¼	T	11	4	---	---	1.3	5.4	10	14	83	A	PM	
36°11'02"N	76°41'33"	1	130	W. E. Smith ------	P	C	P	-	60	57	1¼	S	28	-----	5	---	2.8	---	12	65	202	B	Y	
36°11'03"N	76°41'40"	1	131	E. Z Evans -------	P	S	P	-	8	8	24	O	28	4	---	---	.35	---	7	55	177	A	PM	
36°11'03"N	76°42'45"	1	132	J. R. Peele ------	P	HS	C	J	245	240	4	O	23	10	15	15	.56	7.5	30	220	568	D	B	
36°10'56"N	76°42'59"	1	133	J. D. Peele ------	P	H	C	JG	265	255	4-2	S	18	10	6	---	.39	7.4	61	164	644	D	B	
36°10'54"N	76°42'44"	1	134	Wallace Peele ----	P	H	C	-	272	250	4-3	O	23	13	16	13	1.2	7.8	53	173	613	D	B	
36°10'14"N	76°42'59"	1	135	G. Harrell -------	P	H	P	-	15	13	1¼	T	10	-----	---	---	.37	6.0	5	54	153	A	PM	
36°10'13"N	76°42'08"	1	136	C. M. Evans ------	P	HS	P	-	10	10	24	O	20	5.5	---	---	.14	---	27	81	339	A	PM	
36°09'27"N	76°42'37"	1	137	E. C. Harrell ----	P	HS	P	-	20	17	1¼	T	15	-----	---	---	.13	5.7	9	47	139	A	PM	
36°09'40"N	76°41'25"	1	138	W. H. Pearce -----	P	U	-	-	6	6	24	O	16	3	---	---	-----	---	---	---	-----	A	PM	Observation well.
36°09'40"N	76°41'20"	1	139	Earl Bunch -------	P	U	P	-	13	11	1¼	T	22	4	5	---	1.2	---	34	46	420	A	PM	
36°09'46"N	76°41'06"	1	140	Rockyhock Community --------	N	T	P	J	170	165	2	S	23	7	11	16	1.1	7.9	6	400	650	C	PR	Observation well. Aquifer test 4/3/64.
36°09'42"N	76°41'00"	1	141	Rockyhock Baptist Church -----------	N	T	P	J	172	167	2	S	24	8	---	---	6.1	---	8	430	800	C	PR	
36°09'21"N	76°40'47"	1	142	B. G. Leary ------	P	H	P	-	22	20	1¼	T	17	-----	---	---	.23	---	7	46	116	A	PM	
36°09'22"N	76°40'42"	1	143	B. Leary ---------	P	H	P	-	15	12	1¼	T	17	-----	---	---	.17	---	5	40	112	A	PM	
36°09'50"N	76°39'04"	1	144	N. C. Highway Department -------	S	T	P	-	15	12	1¼	T	41	4	6	---	4.4	5.6	5	12	50	A	PM	
36°09'00"N	76°39'06"	1	145	W. L. Miller -----	P	H	P	-	12	10	1¼	T	40	5	---	---	.09	5.1	4	16	56	A	PM	
36°09'49"N	76°37'32"	1	146	W. B. White ------	P	H	C	-	165	---	4	S	17	1	8	---	.28	7.8	34	98	710	B	Y	
36°09'42"N	76°37'31"	1	147	W. B. White ------	P	S	P	-	7	7	24	O	15	3	---	---	8.2	6.7	100	181	742	A	PM	Water may be contaminated.
36°08'58"N	76°37'50"	1	148	J. C. Hall -------	P	HS	P	-	80	77	1¼	S	15	-----	---	---	.63	7.2	4	252	446	B	Y	
36°08'24"N	76°37'46"	1	149	J. Roberts -------	P	HS	P	-	69	66	1¼	S	16	-----	---	---	10	6.8	7	295	547	B	Y	
36°08'20"N	76°37'47"	1	150	S. R. Welch ------	P	U	P	-	11	11	36	O	16	3	---	---	.62	6.5	23	70	314	A	PM	
36°08'02"N	76°37'48"	1	151	J. Valentine -----	P	HS	P	-	16	14	1¼	T	15	3.5	4	---	.32	5.3	16	37	172	A	PM	
36°08'30"N	76°38'33"	1	152	R. O. Evans ------	P	H	P	-	40	37	1¼	T	18	-----	5	---	12	6.8	7	174	351	B	Y	
36°08'36"N	76°38'40"	1	153	R. O. Evans ------	P	U	-	-	6	6	24	O	18	2.5	---	---	-----	---	---	---	-----	A	PM	
36°08'28"N	76°39'18"	1	154	U. S. G. S. ------	F	U	C	Y	455	445	4	S	39	24	2	---	.37	7.6	494	62	2280	E	BC	Test well T3; total depth 603 feet.
36°08'28"N	76°39'18"	1	154	U. S. G. S. ------	F	U	C	Y	355	345	4	S	39	-----	1	---	.11	7.7	300	51	1670	D	B	Casing and screen recovered.

Well location		Sequence No.	Well No.	Owner	Ownership	Use of water	QW analysis	Log data	Depth (feet)	Depth cased (feet)	Diameter (in)	Finish	Altitude of LSD (feet)	Water level below LSD (feet)	Yield (gpm)	Drawdown (feet)	Quality of water					Aquifer	Water-bearing formation	Remarks
Latitude	Longitude																Iron	pH	Chloride	Hardness	Sp. Cond.			
36°08'28"N	76°39'18"	1	154	U. S. G. S. ------	F	U	C	Y	306	296	4	S	39	29	5	---	.11	7.9	100	24	1260	D	B	
36°08'28"N	76°39'18"	1	154	U. S. G. S. ------	F	U	C	Y	235	225	4	S	39	30	2	---	.37	7.8	18	45	871	C	PR	
36°08'00"N	76°39'23"	1	155	Valhalla Produce Company ----------	P	C	P	-	20	18	1½	T	38	3.5	---	---	1.2	5.1	33	45	271	A	PM	
36°08'00"N	76°39'18"	1	156	Valhalla Produce Company ----------	P	C	P	-	14	11	1½	T	37	-----	---	---	.45	5.1	20	26	111	A	PM	
36°08'07"N	76°39'32"	1	157	W. W. Byrum, Jr. -	P	H	P	-	15	13	1½	T	35	-----	5	---	.08	5.1	9	56	180	A	PM	
36°08'08"N	76°39'30"	1	158	W. W. Byrum, Jr. -	P	U	-	J	118	---	2	-	35	28	---	---	-----	---	---	---	-----	B	Y	
36°08'46"N	76°40'39"	1	159	David Ober -------	P	S	P	-	11	11	36	O	16	4	---	---	.09	5.4	21	30	184	A	PM	
36°08'43"N	76°40'[illegible]	1	160	Ray Byrum --------	P	H	P	-	22	20	1½	T	13	-----	---	---	.32	5.5	18	103	270	A	PM	
36°08'36"N	76°40'37"	1	161	E. T. Byrum ------	P	H	P	-	22	20	1½	T	12	-----	---	---	.39	5.5	12	76	200	A	PM	
36°08'10"N	76°40'53"	1	162	R. Layton --------	P	H	P	-	18	15	1½	T	10	-----	---	---	.13	4.7	8	102	244	A	PM	
36°08'44"N	76°41'13"	1	163	I. L. Harrell ----	P	H	P	-	15	13	1½	T	15	-----	---	---	.81	5.5	8	54	130	A	PM	
36°08'33"N	76°41'51"	1	164	J. G. Perry ------	P	H	P	-	15	13	1½	T	12	1	4	---	.23	5.4	8	34	98	A	PM	
36°08'46"N	76°42'03"	1	165	J. G. Perry ------	P	H	P	-	22	20	1½	T	12	-----	---	---	.19	5.2	15	62	201	A	PM	
36°08'35"N	76°42'[illegible]	1	166	M. L. Tynch ------	P	H	P	-	45	42	1½	S	8	-----	8	---	4.0	7.1	7	130	241	B	Y	
36°08'32"N	76°4[illegible]	1	167	M. J. Tynch ------	P	H	P	-	45	42	1½	S	8	-----	---	---	5.1	7.3	8	126	248	B	Y	
36°07'14"N	76°4[illegible]	1	168	T. E. Bunch ------	P	HS	P	-	20	17	1½	T	12	-----	4	---	.27	5.2	12	90	215	A	PM	
36°07'14"N	76°41'0[illegible]	2	169	T. E. Bunch ------	P	HS	P	-	11	11	36	O	12	7	---	---	.13	4.7	6	44	146	A	PM	
36°06'45"N	76°[illegible]	1	170	A. A. Parrish, Jr.	P	HS	P	-	22	22	1½	T	21	-----	---	---	.08	5.0	9	75	210	A	PM	
36°07'15"N	76°39'51"	1	171	C. O. Forehand ---	P	H	P	-	20	18	1½	T	27	-----	2.5	---	.11	4.5	11	68	200	A	PM	
36°07'30"N	76°39'42"	1	172	C. O. Forehand ---	P	H	P	-	75	70	2	S	36	23	2	---	.17	7.5	4	120	247	B	Y	
36°07'25"N	76°39'0[illegible]	1	173	Russell Byrum ----	P	HS	P	-	110	107	1½	S	21	-----	---	---	5.1	7.1	8	223	423	B	Y	
36°07'20"N	76°39'0[illegible]	1	174	Russell Byrum ----	P	H	P	-	60	57	1½	S	22	9	---	---	7.3	6.9	28	249	521	B	Y	
36°07'18"N	76°39'[illegible]	1	175	J. L. Perry ------	P	HS	P	-	102	99	1½	S	20	6.5	3	---	.99	7.0	11	164	345	B	Y	
36°07'06"N	76°38'5[illegible]	1	176	W. A. Harrell ----	P	H	C	-	35	33	1½	S	20	-----	---	---	.12	4.8	28	124	391	A	PM	
36°06'49"N	76°38'38"	1	177	J. E. Hare -------	P	HS	P	J	196	186	2	S	21	6.5	3	---	5.5	---	6	196	429	C	PR	
36°07'03"N	76°37'51"	1	178	Lloyd Bunch ------	P	U	P	-	45	45	1½	O	8	+2.5	1	---	2.3	6.7	12	311	600	B	Y	Observation well. Aquifer test 3/16/65.
36°07'03"N	76°37'41"	1	179	Mrs. G. L. Goodwin	P	U	P	-	47	45	1½	S	6	+6	2	---	2.6	7.0	11	330	558	B	Y	
36°07'23"N	76°37'50"	1	180	A. R. Spruill ----	P	S	-	-	50	47	1½	S	15	+2	3	---	-----	---	---	---	-----	B	Y	
36°07'42"N	76°37'43"	1	181	A. R. Spruill ----	P	HS	P	-	75	73	1½	S	15	-----	---	---	3.0	6.9	13	275	532	B	Y	
36°07'15"N	76°37'25"	1	182	Edward Goodwin ---	P	H	P	-	50	---	1½	-	17	2	5	---	7.4	7.1	13	308	533	B	Y	

Well location		Sequence No.	Well No.	Owner	Ownership	Use of water	QW analysis	Log data	Depth (feet)	Depth cased (feet)	Diameter (in)	Finish	Altitude of LSD (feet)	Water level below LSD (feet)	Yield (gpm)	Drawdown (feet)	Quality Of water					Aquifer	Water-bearing formation	Remarks
Latitude	Longitude																Iron	pH	Chloride	Hardness	Sp. Cond.			
36°07'15"N	76°36'30"	1	183	H. V. Bass ------	P	U	-	-	65	62	1½	T	18	6	---	---	-----	---	---	---	-----	B	Y	
36°07'15"N	76°36'30"	2	184	H. V. Bass ------	P	HS	P	-	90	87	1½	O	18	-----	---	---	19	7.0	17	248	448	B	Y	
36°07'41"N	76°35'49"	1	185	L. T. Bass ------	P	HS	P	-	60	57	1½	S	17	-----	---	---	1.1	7.1	12	309	576	B	Y	
36°07'32"N	76°35'48"	1	186	Howard Ange -----	P	HS	P	-	60	57	1½	S	17	-----	7	---	1.2	7.1	10	288	530	B	Y	
36°07'27"N	76°35'33"	1	187	Mrs. J. F. White	P	H	P	-	75	---	1½	-	17	-----	4	---	1.5	7.2	7	287	521	B	Y	
36°06'46"N	76°35'47"	1	188	N. C. Diagnostic Laboratory ------	S	H	-	-	35	32	1½	S	19	6	4	---	-----	---	---	---	-----	A	PM	
36°06'46"N	76°35'47"	2	189	N. C. Diagnostic Laboratory ------	S	H	-	-	35	32	1½	S	19	6	4	---	-----	---	---	---	-----	A	PM	
36°06'28"N	76°35'52"	1	190	W. M. Harris ----	P	HS	P	-	50	48	1½	S	19	6	---	---	9.8	7	23	281	540	B	Y	
36°06'11"N	76°35'53"	1	191	John Horton -----	P	H	P	-	89	86	1½	S	18	-----	---	---	7.4	6.9	7	338	623	B	Y	
36°06'07"N	76°35'55"	1	192	Sidney White ----	P	HS	P	-	135	130	1½	S	18	-----	---	---	3.1	7.0	10	312	618	B	Y	
36°05'49"N	76°35'56"	1	193	Jack Lane -------	P	HS	P	-	193	188	2	S	18	7	3	---	4.0	7.0	11	283	549	C	PR	
36°06'03"N	76°37'37"	1	194	George Goodwin --	P	H	P	-	189	179	2	S	17	6	---	---	5.5	7.4	9	312	602	C	PR	Observation well.
36°06'36"N	76°37'23"	1	195	N. J. Goodwin, Jr.	P	HS	P	-	65	62	1½	S	16	-----	---	---	3.0	7.2	21	266	518	B	Y	
36°06'54"N	76°37'44"	1	196	J. W. Doodwin ---	P	HS	P	-	85	82	1½	S	16	-----	---	---	3.7	7.1	12	304	536	B	Y	
36°06'31"N	76°38'16"	1	197	J. F. Perry -----	P	H	-	-	15	13	1½	T	15	3	4	---	-----	---	---	---	-----	A	PM	
36°06'12"N	76°37'51"	1	198	L. C. Bunch -----	P	HS	P	-	21	21	24	O	19	9	10	10	.17	6.2	15	285	-----	B	Y	
36°06'06"N	76°37'42"	1	199	C. T. Dixon -----	P	H	P	J	200	195	2	S	19	9	5	---	.51	7.3	10	310	610	C	PR	
36°06'20"N	76°40'46"	1	200	W. T. Bass ------	P	HS	C	-	20	18	1½	T	22	-----	---	---	.82	5.2	35	75	310	A	PM	
36°06'12"N	76°40'50"	1	201	W. T. Bass ------	P	HS	P	-	25	22	1½	T	22	-----	---	---	.89	5.1	28	79	262	A	PM	
36°06'05"N	76°40'55"	1	202	Mr. Potter ------	P	H	P	-	15	13	1½	T	20	-----	---	---	2.2	4.7	23	63	220	A	PM	
36°06'07"N	76°40'08"	1	203	Advance Community	N	T	-	-	30	27	1½	S	26	-----	3	---	-----	---	---	---	-----	A	PM	
36°05'30"N	76°41'04"	1	204	Bristoe Perry ---	P	S	-	-	16	14	1½	T	14	6	5	---	-----	---	---	---	-----	A	PM	
36°05'28"N	76°40'33"	1	205	Frank Small -----	P	U	P	-	10	10	24	O	30	5	---	---	.21	5.9	29	58	418	A	PM	
36°05'28"N	76°40'33"	2	206	Frank Small -----	P	HS	P	-	82	80	1½	S	30	-----	5	---	.02	4.2	11	63	171	B	Y	
36°05'36"N	76°39'34"	1	207	N. C. Highway Department ------	S	T	P	J	300	290	2	S	28	20	25	50	-----	8.1	150	58	1400	D	B	
36°05'42"N	76°39'05"	1	208	C. E. Belch -----	P	H	P	-	15	12	1½	T	20	-----	---	---	3.4	5.1	14	17	113	A	PM	
36°05'25"N	76°38'35"	1	209	W. W. Small -----	P	HS	P	-	40	37	1½	S	20	-----	---	---	5.7	5.2	16	60	197	B	Y	
36°05'17"N	76°38'37"	1	210	C. E. Small -----	P	H	P	-	187	178	2	S	20	10	---	---	.14	7.5	93	89	914	C	PR	
36°05'35"N	76°37'41"	1	211	W. B. White -----	P	H	P	-	200	190	2	S	20	10	---	---	1.1	7.4	19	264	700	C	PR	
36°05'02"N	76°36'03"	1	212	T. E. Bateman ---	P	H	P	J	236	236	1½	O	17	15	12	13	.47	6.8	13	286	625	C	PR	

Well location: Latitude	Well location: Longitude	Sequence No.	Well No.	Owner	Ownership	Use of water	QW analysis	Log data	Depth (feet)	Depth cased (feet)	Diameter (in)	Finish	Altitude of LSD (feet)	Water level below LSD (feet)	Yield (gpm)	Drawdown (feet)	Quality of water: Iron	pH	Chloride	Hardness	Sp. Cond.	Aquifer	Water-bearing formation	Remarks
36°05'11"N	76°35'43"	1	213	Mrs. S. W. Moore	P	H	P	-	215	210	1¼	S	19	-----	5	---	2.7	7.1	10	264	671	C	PR	
36°05'22"N	76°34'35"	1	214	W. M. Boyce -----	P	H	C	-	21	19	1¼	T	17	2	3	---	5.3	7.3	17	256	512	A	PM	
36°05'33"N	76°33'50"	1	215	J. O. Perry -----	P	U	P	-	8	8	36	O	17	1	---	---	.40	5.6	4	24	90	A	PM	
36°05'40"N	76°33'19"	1	216	J. O. Preey -----	P	H	-	-	47	45	1¼	S	16	1.5	---	---	-----	---	---	---	-----	B	Y	
36°05'47"N	76°32'48"	1	217	E. J. Boyce -----	P	H	P	-	62	60	1¼	S	17	-----	---	---	2.0	7.1	11	175	354	B	Y	
36°05'19"N	76°32'22"	1	218	Carey Privott ---	P	H	P	-	110	105	1¼	O	13	-----	---	---	.55	7.3	13	293	601	B	Y	
36°05'15"N	76°32'25"	1	219	Carey Privott ---	P	H	-	-	37	35	1¼	S	13	3	---	---	-----	---	---	---	-----	B	Y	
36°05'41"N	76°31'27"	1	220	T. W. Fleetwood -	P	S	P	-	35	32	1¼	T	10	+2	1	---	3.4	7.2	14	288	556	B	Y	
36°05'17"N	76°30'26"	1	221	D. L. Webb ------	P	H	P	-	25	23	1¼	T	11	4	---	---	.17	5.7	10	55	188	A	PM	
36°04'09"N	76°26'28"	1	222	D. R. Inglis ----	P	S	P	-	12	12	24	O	12	7	---	---	.26	5.7	36	53	262	A	PM	
36°04'10"N	76°26'28"	1	223	D. R. Inglis ----	P	H	P	-	18	16	1¼	T	13	8	4	---	1.1	5.9	16	59	203	A	PM	
36°04'08"N	76°26'52"	1	224	D. L. Jethro ----	P	H	P	-	20	18	1¼	T	11	-----	3	---	.43	5.4	24	59	217	A	PM	
36°03'53"N	76°27'17"	1	225	D. L. Jethro ----	P	H	C	-	15	13	1¼	T	10	-----	---	---	4.7	6.1	24	76	267	A	PM	
36°03'59"N	76°29'12"	1	226	G. T. Bond ------	P	H	P	-	38	36	1¼	S	15	4.5	---	---	6.0	7.1	39	316	613	B	Y	
36°04'04"N	76°29'32"	1	227	W. J. Goodwin ---	P	H	P	-	48	45	1¼	S	12	-----	---	---	6.2	7.1	24	337	670	B	Y	
36°04'15"N	76°30'05"	1	228	W. J. Goodwin ---	P	HS	P	-	45	43	1¼	S	12	6	4	---	4.8	7.1	37	317	723	B	Y	
36°04'29"N	76°30'50"	1	229	W. H. Sawyer ----	P	H	P	-	45	43	1¼	S	12	4	---	---	21	7.1	71	372	773	B	Y	
36°04'18"N	76°30'58"	1	230	L. E. Overton ---	P	HS	P	-	40	37	1¼	S	13	-----	---	---	.61	7.2	18	234	497	B	Y	
36°04'42"N	76°31'15"	1	231	W. L. Brabble ---	P	HS	C	-	45	43	1¼	S	12	-----	---	---	3.3	7.3	23	183	601	B	Y	
36°04'15"N	76°31'30"	1	232	C. L. Parker ----	P	H	C	J	280	270	2	S	14	7	10	---	.07	8.3	230	154	1700	C	PR	
36°04'24"N	76°31'48"	1	233	Henry Jordan ----	P	H	-	-	47	47	1¼	O	14	2	3	---	-----	---	---	---	-----	B	Y	
36°04'47"N	76°35'30"	1	234	Austin Company --	N	U	P	EG	365	355	6	S	16	17	30	---	.25	7.9	1350	220	-----	D	B	Preliminary test well
36°04'47"N	76°35'30"	1	234	Austin Company --	N	U	P	EG	302	292	6	S	16	19.5	6	---	.20	7.7	155	120	-----	D	B	Casing and screens
36°04'47"N	76°35'30"	1	234	Austin Company --	N	U	P	EG	241	231	6	S	16	18.5	40	---	.30	7.3	20	256	-----	C	PR,CH	recovered.
36°04'19"N	76°36'00"	1	235	R. B. Baer and Company ---------	P	U	P	-	66	63	1¼	S	17	7	---	---	9.2	7.0	13	142	292	B	Y	
36°04'15'N	76°36'00"	1	236	R. B. Baer and Company ---------	P	N	-	-	32	30	1¼	S	16	-----	5	---	-----	---	---	---	-----	B	Y	
36°04'21"N	76°36'23"	1	237	Albemarle Peanut Company ---------	P	U	P	-	57	53	1¼	S	16	6	---	---	-----	---	25	---	-----	B	Y	
36°04'22"N	76°36'23"	1	238	Albemarle Peanut Company ---------	P	N	-	-	70	65	1¼	S	16	5	8	---	-----	---	---	---	-----	B	Y	
36°04'23"N	76°36'38"	1	239	Linwood Harrell -	P	H	P	-	45	43	1¼	S	16	-----	---	---	-----	7.2	24	255	559	B	Y	

Well location		Sequence No.	Well No.	Owner	Ownership	Use of water	QW analysis	Log data	Depth (feet)	Depth cased (feet)	Diameter (in)	Finish	Altitude of LSD (feet)	Water level below LSD (feet)	Yield (gpm)	Drawdown (feet)	Quality Of water					Aquifer	Water-bearing formation	Remarks
Latitude	Longitude																Iron	pH	Chloride	Hardness	Sp. Cond.			
36°04'09"N	76°36'28"	1	240	City of Edenton -	M	P	C	-	358	---	10-8	G	17	19	500	50	.11	8.4	106	198	960	C,D	PR, CH,B	Screen setting: 219-239, 260-265, 335-355. Aquifer test 4/30/64.
36°04'39"N	76°36'58"	1	241	W. S. Morris ----	P	H	P	-	236	226	2	S	16	17.5	---	---	.88	7.4	20	216	751	C	PR, CH?	
36°04'51"N	76°37'12"	1	242	J. E. Roberts ---	P	C	P	-	207	202	2	S	16	-----	5	---	.26	7.4	15	223	720	C	PR	
36°04'33"N	76°37'15"	1	243	B. C. Hare ------	P	HS	P	-	240	230	2	S	17	16	---	---	.24	---	45	148	901	C	PR, CH?	
36°04'48"N	76°37'20"	1	244	E. V. McClenney -	P	HS	P	J	227	217	2	S	18	16.5	5	13	.29	7.4	16	215	740	C	CH?B	Aquifer test 3/22/65.
36°04'57"N	76°37'57"	1	245	W. E. Bond ------	P	U	P	-	11	11	24	O	13	6	---	---	3.0	5.7	55	112	427	A	PM	
36°04'54"N	76°38'00"	1	246	W. E. Bond ------	P	H	P	-	22	20	1¼	T	13	-----	---	---	.60	4.8	15	97	294	A	PM	
36°04'13"N	76°38'36"	1	247	L. E. Francis ---	P	H	P	-	58	55	2	S	12	-----	5	---	2.6	---	10	116	266	B	Y	
36°04'11"N	76°38'33"	1	248	Charles White ---	P	H	P	-	220	210	2	O	12	-----	5	---	.10	---	90	126	1150	C	B	
36°04'02"N	76°39'28"	1	249	A. C. Griffin ---	P	HS	P	-	13	11	1¼	T	11	8	---	---	1.1	4.9	22	40	151	A	PM	
36°04'38"N	76°39'48"	1	250	Charles Small ---	P	H	P	-	28	26	1¼	T	14	4	---	---	6.3	---	12	176	352	B	Y	
36°04'46"N	76°39'52"	1	251	Charles Small ---	P	HS	C	J	201	191	2	S	22	8	---	---	.07	7.8	49	64	963	C	B	
36°04'22"N	76°40'23"	1	252	J. R. Briggs ----	P	H	P	-	20	18	1¼	T	20	-----	3	---	.15	5.5	16	97	258	A	PM	
36°04'05"N	76°40'20"	1	253	C. W. Perry -----	P	H	P	-	25	22	1¼	T	16	-----	---	---	.10	5.3	11	101	248	A	PM	
36°03'53"N	76°40'14"	1	254	Mrs. Ruth Morgan	P	H	P	-	18	16	1¼	T	16	7	---	---	.60	5.1	8	18	85	A	PM	
36°03'32"N	76°40'11"	1	255	E. Jones --------	P	HS	P	-	15	13	1¼	T	20	-----	---	---	.77	5.8	5	54	130	A	PM	
36°03'31"N	76°39'37"	1	256	Albemarle Motel -	P	C	P	J	196	186	2	S	16	-----	---	---	.54	7.6	79	107	984	C	CH?B	
36°03'24"N	76°39'29"	1	257	H. C. Jackson ---	P	H	P	-	210	200	2	S	15	-----	8	---	.63	7.5	282	154	1700	C	CH?B	
36°03'22"N	76°39'09"	1	258	American Legion -	N	H	-	-	16	14	1¼	T	16	9	---	---	-----	---	---	---	-----	A	PM	
36°03'34"N	76°38'31"	1	259	U. S. Department of Interior -----	F	H	P	-	200	190	6	S	14	8	15	---	.07	7.5	86	137	1100	C	PR CH?	
36°03'34"N	76°38'32"	1	260	U. S. Department of Interior -----	F	P	P	-	207	197	6	S	14	8	25	12	.07	7.4	102	143	1170	C	PR CH?B	Aquifer test 3/29/65.
36°03'34"N	76°38'33"	1	261	U. S. Department of Interior -----	F	H	P	-	200	190	6	S	14	8	15	---	.07	7.5	93	137	1100	C	PR,CH?	

Well location: Latitude	Well location: Longitude	Sequence No.	Well No.	Owner	Ownership	Use of water	QW analysis	Log data	Depth (feet)	Depth cased (feet)	Diameter (in)	Finish	Altitude of LSD (feet)	Water level below LSD (feet)	Yield (gpm)	Drawdown (feet)	Quality of water: Iron	Quality of water: pH	Quality of water: Chloride	Quality of water: Hardness	Quality of water: Sp. Cond.	Aquifer	Water-bearing formation	Remarks
36°03'23"N	76°37'44"	1	262	Town of Edenton -	M	U	C	J	77	67	6	G	17	15	8	7	1.1	7.9	19	129	315	A,B	Y	Aquifer test 4/2/64. Observation well.
36°03'22"N	76°37'38"	1	263	Dr. D. O. Wright	P	U	P	-	236	88	4	O	10	-----	---	---	-----	---	153	---	-----	C	PR	Wells drilled for old U.S. Fish Hatchery.
36°03'23"N	76°37'39"	1	264	Dr. D. O. Wright	P	U	P	-	236	195	3	O	10	-----	---	---	-----	---	203	---	-----	C	PR, CH?	
36°03'23"N	76°37'40"	1	265	Dr. D. O. Wright	P	U	P	-	60	60	2	O	10	-----	---	---	-----	---	22	---	-----	B	Y	
36°03'23"N	76°37'42"	1	266	Dr. D. O. Wright	P	U	-	-	208	208	4	O	10	-----	5	---	-----	---	---	---	-----	C	PR	Aquifer test 3/27/64.
36°03'26"N	76°36'45"	1	267	J. H. Conger ----	P	U	P	-	46	41	4	S	6	1	16	4	-----	---	114	---	-----	B	Y	Aquifer test 3/26/64.
36°03'25"N	76°36'39"	1	268	City of Edenton -	M	U	-	J	213	---	8	O	6	7	16	3	-----	---	---	---	-----	C	PR, CH	Observation well.
36°03'48"N	76°36'33"	1	269	City of Edenton -	M	P	C	JG	291	---	12	G	16	-----	900	100	.21	7.8	114	248	1900	C,D	PR, CH,B	Screen settings: 214-229, 233-243, 257-271, 281-291.
36°03'29"N	76°36'23"	1	270	Barrows Bottling Works ----------	P	C	P	-	40	37	1¼	S	15	-----	---	---	11	7.0	57	207	469	B	Y	Six such wells are at plant.
36°03'45"N	76°35'36"	1	271	W. E. Speight ---	P	H	P	-	95	92	1¼	S	13	-----	---	---	5.5	7.0	12	204	419	B	Y	
36°03'25"N	76°35'01"	1	272	R. L. Bunch, Jr.	P	H	P	-	30	27	1¼	S	15	-----	---	---	.32	5.5	17	79	229	A	PM	
36°03'15"N	76°34'58"	1	273	S. F. Small -----	P	H	P	-	240	235	2	S	15	-----	30	---	.13	---	271	260	-----	C	PR, CH?	
36°03'45"N	76°34'28"	1	274	Robert Bunch ----	P	H	C	-	25	23	1¼	T	10	6	---	---	1.2	6.2	26	38	173	A	PM	
36°03'17"N	76°34'35"	1	275	Mrs. M. C. Hobbs	P	H	P	J	256	251	2	S	16	12	5	14	.24	7.3	312	289	1700	C	CH?B	Aquifer test 4/15/65.
36°03'24"N	76°34'07"	1	276	J. L. Hassell ---	P	HS	P	-	315	---	4	-	15	-----	---	---	1.1	7.4	266	226	1690	C	B	
36°03'06"N	76°34'09"	1	277	Harry Lassiter --	P	H	P	-	60	58	1¼	S	15	-----	---	---	1.3	7.5	5	182	358	B	Y	
36°03'12"N	76°33'51"	1	278	J. H. Harrell ---	P	HS	P	-	35	33	1¼	S	15	-----	---	---	12	7.0	15	262	527	B	Y	
36°03'03"N	76°33'55"	1	279	D. T. Hudson ----	P	H	P	-	58	58	1¼	S	16	6.5	3	---	3.4	6.8	8	164	388	B	Y	
36°02'52"N	76°33'53"	1	280	Russell Wheeler -	P	H	P	-	70	67	1¼	S	16	-----	4	---	.65	7.4	6	164	352	B	Y	
36°03'28"N	76°32'23"	1	281	T. Czerniak -----	P	H	-	-	45	43	1¼	S	16	-----	7.5	---	-----	---	---	---	-----	B	Y	
36°03'27"N	76°31'36"	1	282	J. D. Swindell --	P	H	P	-	32	30	1¼	S	16	4	---	---	.61	7.8	46	321	802	A	PM	
36°03'03"N	76°31'38"	1	283	G. E. Privott ---	P	S	P	-	10	10	36	O	14	2	---	---	1.7	5.8	12	50	194	B	Y	
36°13'14"N	76°28'30"	1	284	F. L. Williams --	P	H	P	-	85	82	1¼	S	13	-----	---	---	1.9	7.3	12	269	529	B	Y	Observation well.
36°03'06"N	76°28'28"	1	285	U. S. G. S. -----	F	U	-	-	86	84	1¼	S	15	3	---	---	-----	---	---	---	-----			
36°03'11"N	76°28'22"	1	286	Mrs. J. C. B. Ehringhaus ------	P	H	P	-	60	57	1½	S	13	-----	5	---	1.7	7.3	14	287	600	B	Y	

Well location: Latitude	Well location: Longitude	Sequence No.	Well No.	Owner	Ownership	Use of water	QW analysis	Log data	Depth (feet)	Depth cased (feet)	Diameter (in)	Finish	Altitude of LSD (feet)	Water level below LSD (feet)	Yield (gpm)	Drawdown (feet)	Quality of water: Iron	Quality of water: pH	Quality of water: Chloride	Quality of water: Hardness	Quality of water: Sp. Cond.	Aquifer	Water-bearing formation	Remarks
36°03'32"N	76°27'59"	1	287	Hilton Wardsworth	P	S	P	-	15	13	1¼	T	14	2	---	---	14	6.3	120	99	610	A	PM	
36°03'32"N	76°27'24"	1	288	R. E. Baker -----	P	S	-	-	10	10	36	O	12	2	---	---	-----	---	---	---	-----	A	PM	
36°03'33"N	76°27'25"	1	289	R. E. Baker -----	P	H	P	-	13	11	1¼	T	12	-----	---	---	4.3	5.6	135	137	942	A	PM	
36°03'18"N	76°27'07"	1	290	Draft Corporation	N	H	P	-	45	42	1¼	S	11	-----	6	---	3.9	7.3	9	170	343	B	Y	
36°03'18"N	76°26'31"	1	291	G. C. Wood ------	P	H	P	-	65	63	1¼	S	10	-----	---	---	.05	7.4	13	147	363	B	Y	
36°03'14"N	76°26'23"	1	292	G. C. Wood ------	P	S	P	-	5	5	36	O	8	2	---	---	6.2	7.0	11	66	189	A	PM	
36°02'30"N	76°27'19"	1	293	G. H Harding ----	P	H	P	-	18	16	1¼	T	9	-----	---	---	14	5.9	51	46	303	A	PM	
36°02'27"N	76°27'16"	1	294	G. H. Harding ---	P	H	P	-	15	13	1¼	T	9	6	---	---	.89	5.9	30	34	179	A	PM	
36°02'13"N	76°29'46"	1	295	Mrs. Katie Granby	P	HS	P	-	17	15	1¼	T	14	6	---	---	12	6.3	37	74	316	A	PM	
36°01'52"N	76°30'48"	1	296	Mrs. Emma Harris	P	H	P	-	13	11	1¼	T	14	5	---	---	2.3	5.8	30	112	429	A	PM	
36°01'46"N	76°31'33"	1	297	Albert Barrow ---	P	H	C	-	38	36	1¼	S	13	6	3	---	4.6	7.3	16	272	532	B	Y	
36°02'12"N	76°32'33"	1	298	McKinley Welch --	P	HS	P	-	38	35	1¼	S	15	-----	5	---	4.5	6.8	46	397	797	B	Y	
36°02'12"N	76°35'26"	1	299	J. J. Wood ------	P	H	P	-	43	40	1¼	S	15	9	5	---	5.3	7.3	16	135	285	B	Y	
36°01'37"N	76°34'37"	1	300	U. S. Navy ------	F	U	-	-	99	93	8	S	15	8	46	42	-----	---	---	---	-----	B	Y	Navy test well. Casing and screen recovered. Total depth 128 feet.
36°01'37"N	76°34'37"	1	300	U. S. Navy ------	F	U	-	-	70	64	8	S	15	-----	12	25	-----	---	---	---	-----	B	Y	
36°01'37"N	76°34'37"	1	300	U. S. Navy ------	F	U	-	-	47	41	8	S	15	-----	8	---	-----	---	---	---	-----	B	Y	
36°01'34"N	76°34'32"	1	301	U. S. Navy ------	F	U	P	-	237	257	8	S	15	-----	---	---	-----	---	710	---	-----	C	PR, CH?B	Navy test well. Casing and screen recovered. Total depth 269 feet.
36°00'52"N	76°34'48"	1	302	U. S. G. S. -----	F	U	-	JG	116	112	1¼	O	14	9	2	---	-----	---	---	---	-----	B	Y	Drilled prior to 1945 Observation well.
36°01'13"N	76°34'07"	1	303	U. S. G. S. -----	F	U	C	Y	688	678	2	S	8	+11	2	---	.66	8.3	4140	523	13000	E	BC	Test well T2. Total depth 857 feet.
36°01'13"N	76°34'07"	1	303	U. S. G. S. -----	F	U	C	Y	602	592	2	S	8	+10	5	---	.26	7.9	3360	384	11000	E	BC	Casing pulled back and screen set at 139-149 feet.
36°01'13"N	76°34'07"	1	303	U. S. G. S. -----	F	U	C	Y	352	342	2	S	8	1	8	---	.10	7.7	2340	350	7780	D	B	
36°01'13"N	76°34'07"	1	303	U. S. G. S. -----	F	U	C	Y	246	236	2	S	8	1.3	35	---	.06	7.6	2310	432	7780	C	PR, CH?B	
36°01'13"N	76°34'07"	1	303	U. S. G. S. -----	F	U	C	Y	149	139	2	S	8	.5	6	---	.21	8.0	82	179	750	B	Y	Observation well.
36°01'14"N	76°34'06"	1	304	J. S. Crisanti --	P	H	-	-	47	37	2	S	10	3	15	21	-----	---	---	---	-----	B	Y	
36°01'00"N	76°34'07"	1	305	U. S. Navy ------	F	U	-	-	40	35	4	S	15	-----	7	---	-----	---	---	---	-----	B	Y	Navy test well. Casing and screen recovered. Total depth 55 feet.

Well location: Latitude	Well location: Longitude	Sequence No.	Well No.	Owner	Ownership	Use of water	QW analysis	Log data	Depth (feet)	Depth cased (feet)	Diameter (in)	Finish	Altitude of LSD (feet)	Water level below LSD (feet)	Yield (gpm)	Drawdown (feet)	Quality of water: Iron	pH	Chloride	Hardness	Sp. Cond.	Aquifer	Water-bearing formation	Remarks
36°02'03"N	76°33'59"	1	306	U. S. Navy -------	F	U	-	G	52	47	4	S	15	-----	1	---	-----	---	---	---	-----	B	Y	Navy test well. Casing and screen recovered.
36°01'46"N	76°33'28"	1	307	U. S. Navy -------	F	U	-	-	47	42	4	S	15	-----	1	---	-----	---	---	---	-----	B	Y	Navy test well.
36°01'46"N	76°33'28"	1	307	U. S. Navy -------	F	U	-	-	35	30	4	S	15	8	8	8	-----	---	---	---	-----	B	Y	Casing and screen recovered. Total depth 70 feet.
36°01'21"N	76°33'11"	1	308	Diamond P. Ranch -	P	S	P	-	42	36	6	S	15	6	40	20	8.0	6.8	37	175	451	B	Y	
36°01'21"N	76°33'19"	1	309	Diamond P. Ranch -	P	S	P	-	42	36	6	S	15	6	40	21	22	---	38	---	-----	B	Y	
36°01'07"N	76°33'33"	1	310	U. S. Lumber Company ----------	N	P	P	G	94	56	8	G	13	8	120	42	7.1	6.9	11	282	-----	B	Y	Total depth 112 feet. Screen settings: 56-61, 69-74, 82-92. Field permeabilities available. Aquifer test 4/22/64.
36°01'07"N	76°33'28"	1	311	U. S. Navy -------	F	U	P	G	400	395	6	S	14	-----	10	---	-----	---	3000	---	-----	D	B	Navy test well.
36°01'07"N	76°33'28"	1	311	U. S. Navy -------	F	U	P	G	291	286	6	S	14	-----	15	---	-----	---	2400	---	-----	C	B	Casing and screen
36°01'07"N	76°33'28"	1	311	U. S. Navy -------	F	U	P	G	250	245	6	S	14	-----	60	---	-----	---	900	---	-----	C	CH?B	recovered. Total
36°01'07"N	76°33'28"	1	311	U. S. Navy -------	F	U	-	G	72	100	6	S	14	-----	20	---	-----	---	----	---	-----	B	Y	depth 420 feet. Drilled prior to 1945.
36°01'19"N	76°32'47"	1	312	U. S. Navy -------	F	U	-	G	114	---	8	S	13	-----	---	---	-----	---	---	---	-----	B	Y	Navy test well. Casing and screen recovered. Field permeabilities available.
36°01'13"N	76°33'08"	1	313	U. S. Lumber Company ----------	N	U	-	J	41	31	6	S	12	-----	21	---	-----	---	----	---	-----	B	Y	Total depth 48 feet.
36°01'12"N	76°33'04"	1	314	U. S. Lumber Company ----------	N	U	-	-	32	22	6	S	12	-----	25	---	-----	---	----	---	-----	B	Y	Total depth 41 feet.
36°01'07"N	76°33'01"	1	315	U. S. Lumber Company ----------	N	U	-	-	48	38	6	S	12	-----	17	---	-----	---	----	---	-----	B	Y	Total depth 60 feet.
36°01'05"N	76°32'59"	1	316	U. S. Lumber Company ----------	N	U	-	-	49	39	6	S	12	-----	28	---	-----	---	----	---	-----	B	Y	Total depth 60 feet.

Well location: Latitude	Well location: Longitude	Sequence No.	Well No.	Owner	Ownership	Use of water	QW analysis	Log data	Depth (feet)	Depth cased (feet)	Diameter (in)	Finish	Altitude of LSD (feet)	Water level below LSD (feet)	Yield (gpm)	Drawdown (feet)	Quality of water: Iron	pH	Chloride	Hardness	Sp. Cond.	Aquifer	Water-bearing formation	Remarks
36°01'03"N	76°32'58"	1	317	U. S. Lumber Company ---------	N	U	-	-	45	35	6	S	12	-----	18	---	-----	---	---	---	-----	B	Y	Total depth 50 feet.
36°01'09"N	76°32'54"	1	318	U. S. Lumber Company ---------	N	U	-	J	34	24	6	S	11	6	28	---	-----	---	---	---	-----	B	Y	Observation well. Total depth 40 feet.
36°01'06"N	76°32'55"	1	319	U. S. Lumber Company ---------	N	U	-	-	33	23	6	S	12	-----	35	---	-----	---	---	---	-----	B	Y	Total depth 39 feet.
36°01'03"N	76°32'54"	1	320	U. S. Lumber Company ---------	N	U	-	-	36	26	6	S	11	-----	22	---	-----	---	---	---	-----	B	Y	Total depth 43 feet.
36°01'02"N	76°32'52"	1	321	U. S. Lumber Company ---------	N	P	C	E	90	70	8	G	13	8	42	17	8.2	8.2	34	114	365	B	Y	Total depth 112 feet. Aquifer test 4/20/64.
36°01'08"N	76°32'48"	1	322	U. S. Lumber Company ---------	N	U	-	-	36	26	6	S	12	-----	41	---	-----	---	---	---	-----	B	Y	Total depth 41 feet.
36°01'06"N	76°32'49"	1	323	U. S. Lumber Company ---------	N	U	-	-	36	26	6	S	12	-----	55	---	-----	---	---	---	-----	B	Y	Total depth 42 feet.
36°01'02"N	76°32'48"	1	324	U. S. Lumber Company ---------	N	U	-	-	36	26	6	S	11	-----	16	---	-----	---	---	---	-----	B	Y	Total depth 42 feet.
36°01'08"N	76°32'25"	1	325	U. S. Navy ------	F	U	-	G	112	---	8	-	13	-----	---	---	-----	---	---	---	-----	B	Y	Navy test well. Casing and screen recovered. Field permeabilities available.
36°01'10"N	76°32'27"	1	326	U. S. Navy ------	F	U	-	-	101	95	6	S	13	9	24	---	-----	---	---	---	-----	B	Y	Navy test well. Casing and screen recovered.
36°01'10"N	76°32'24"	1	327	U. S. Navy ------	F	U	-	-	92	87	4	S	13	10	15	---	-----	---	---	---	-----	B	Y	Navy test well.
36°01'10"N	76°32'24"	1	327	U. S. Navy ------	F	U	-	-	80	75	4	S	13	-----	5	40	-----	---	---	---	-----	B	Y	Casing and screen
36°01'10"N	76°32'24"	1	327	U. S. Navy ------	F	U	-	-	64	54	4	S	13	-----	2	---	-----	---	---	---	-----	B	Y	recovered. Total
36°01'10"N	76°32'24"	1	327	U. S. Navy ------	F	U	-	-	45	35	4	S	13	-----	11	---	-----	---	---	---	-----	B	Y	depth 102 feet.
36°01'07"N	76°32'23"	1	328	U. S. Lumber Company ---------	N	U	-	J	47	37	4	G	13	-----	27	---	-----	---	---	---	-----	B	Y	Navy test well. Capped for future use. Total depth 70 feet.

Well location: Latitude	Well location: Longitude	Sequence No.	Well No.	Owner	Ownership	Use of water	QW analysis	Log data	Depth (feet)	Depth cased (feet)	Diameter (in)	Finish	Altitude of LSD (feet)	Water level below LSD (feet)	Yield (gpm)	Drawdown (feet)	Quality of water: Iron	Quality of water: pH	Quality of water: Chloride	Quality of water: Hardness	Quality of water: Sp. Cond.	Aquifer	Water-bearing formation	Remarks
36°01'04"N	76°32'34"	1	329	T. B. Wood -------	P	H	P	-	47	44	1¼	S	15	-----	4	---	3.5	6.9	13	206	415	B	Y	
36°00'37"N	76°32'15"	1	330	T. B. Wood -------	P	H	P	-	80	77	1¼	S	12	-----	---	---	.33	7.1	9.8	---	308	B	Y	
36°00'38"N	76°31'43"	1	331	T. J. Jackson ----	P	H	P	-	40	37	1¼	S	12	-----	---	---	.32	7.2	19	162	352	B	Y	
36°00'35"N	76°31'29"	1	332	R. E. Jackson ----	P	H	P	-	42	39	1¼	S	12	-----	---	---	.07	7.4	17	204	417	B	Y	
36°00'37"N	76°30'53"	1	333	Sandy Point Beach	P	P	P	-	37	34	1¼	S	5	4	3	---	.09	7.5	37	258	542	B	Y	
36°01'20"N	76°28'20"	1	334	Tom Hoskins ------	P	H	P	-	55	51	1¼	S	12	10	---	---	4.2	7.1	22	291	605	B	Y	

Table 4. Analyses of water from wells screened in the principal aquifers in Chowan County, N. C.

Well Number	Date of Collection	Sampled Depth	Specific Conductance	PH	Temperature °F	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Flouride (F)	Nitrate (NO_3)	Phosphate (PO_4)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Dissolved Solids: Sum	Hardness as $CaCO_3$	Noncarbonate Hardness	Color	Aquifer
9	10/5 1962	237	4130	7.7	67	25	31	0.1	870	38	722	34	1000	1.2	-	.0	0.3	.51	0.1	2380	185	0	7	C
9	10/3 1962	400	3670	8.5	66	9.8	9.6	8.1	820	26	603	104	835	3.0	-	.0	.0	.01	.05	2130	57	0	7	E
9	10/2 1962	558	2680	8.2	64.5	7.8	6.1	3.9	618	18	703	126	500	1.7	-	.0	0.1	.01	.08	1630	32	0	5	-
9	10/1 1962	840	4900	8.5	-	7.7	14	9.6	1095	26	630	158	1200	0.6	-	.0	0.1	.0	0.1	2850	75	0	6	-
21	8/27 1963	380	3100	8.0	67	10	6.3	6.5	718	21	724	97	642	1.8	.0	0.1	-	.34	-	1860	42	0	-	E
22	8/27 1963	445	2810	8.1	66	10	3.2	6.5	615	19	730	88	530	1.9	.0	.0	-	.89	-	1630	35	0	-	E
24	8/27 1963	310	3790	8.5	64	16	12	14	810	30	552	32	962	1.6	.0	0.2	-	.58	-	2150	84	0	-	D
39	8/27 1963	455	2110	8.5	68	29	19	9.8	469	17	490	47	434	1.1	0.1	0.1	-	5.6	-	1273	88	0	-	E
41	6/13 1962	20	158	5.1	-	6.0	9.1	1.7	11	7.8	3	24	15	0.2	13	.0	-	.18	-	89	30	27	1	A
43	7/12 1963	380	1910	7.9	62	12	8.8	6.6	481	20	451	35	500	1.3	0.2	.0	-	.18	-	1290	49	0	-	E
44	12/31 1963	420	2600	7.6	-	10	6.0	4.1	562	21	496	39	550	1.8	-	0.1	-	.14	-	1440	32	0	-	E
48	6/13 1962	15	229	5.3	-	5.5	29	5.2	1.4	5.2	3	52	11	0.1	30	.0	-	.10	-	140	92	90	2	A
53	8/27 1963	20	211	4.8	-	5.3	16	5.2	5.3	11	2	31	13	.0	26	.0	-	.44	-	114	62	60	-	A
55	6/13 1962	15	169	6.1	-	2.9	11	2	16	5.3	17	19	15	0.1	19	.0	-	.25	-	99	36	22	6	A
59	7/12 1963	247	2360	7.8	66	19	17	15	508	30	422	29	628	1.1	0.2	.0	-	.08	-	1460	104	0	-	C
60	7/12 1963	433	2050	8.1	73	9.2	5	4.7	515	17	471	36	530	1.6	.0	.0	-	3.1	-	1350	32	0	-	E

Well Number	Date of Collection	Sampled Depth	Specific Conductance	PH	Temperature °F	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Flouride (F)	Nitrate (NO_3)	Phosphate (PO_4)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Dissolved Solids: Sum	Hardness as $CaCO_3$	Noncarbonate Hardness	Color	Aquifer
70	5/18 1965	420	1600	8.0	-	11	10	4.6	325	21	423	23	295	1.3	0.1	.0	-	.39	.02	879	44	0	7	E
76	1/2 1964	430	1380	7.8	-	40	3.4	2.4	288	20	364	26	247	1.5	-	0.1	-	.99	-	808	18	0	-	E
77	6/13 1962	40	401	4.3	-	33	6	8.7	50	3.5	0	23	101	0.1	.0	.0	-	25	-	252	51	51	3	B
80	7/23 1962	360	2130	7.7	68	27	26	22	412	34	372	145	440	0.3	0.6	.0	0.1	.17	-	1290	158	0	-	D
89	7/23 1962	333	1390	7.8	70	20	9.8	7.9	289	20	444	64	196	0.9	1.1	.0	.0	.02	-	828	57	0	-	D
90	6/13 1962	16	250	6.8	-	3.9	26	6.9	5.5	8.1	9	43	20	0.1	32	.0	-	1.4	-	151	92	85	1	A
98	7/20 1962	440	1590	7.7	70	9.6	5	7.4	337	21	384	41	301	0.9	1.8	0.2	.0	.08	-	914	43	0	-	E
100	7/17 1962	450	1340	7.8	68	10	4.5	2.6	288	17	372	28	235	0.8	0.8	.0	.0	1.8	-	772	22	0	-	E
107	6/13 1962	20	209	5.5	-	9.3	10	7.5	7.8	5	3	4.8	20	0.1	56	.0	-	.27	-	122	56	54	1	A
108	3/17 1965	280	712	8.1	-	31	17	11	116	18	370	3.2	36	0.9	0.3	.0	0.1	.30	-	416	86	0	7	D
111	8/12 1962	470	1500	7.9	-	30	45	24	210	25	341	21	334	0.4	.0	.0	-	.41	-	858	213	0	3	E,D
113	10/21 1964	374	1220	7.8	64	16	16	12	222	26	416	30	161	0.3	0.2	.0	0.1	.16	-	689	88	0	5	E
129	6/13 1962	15	83	5.4	-	16	3.8	1.2	8.9	0.7	4	16	9.5	0.1	0.1	.0	-	1.3	-	60	14	11	5	A
132	7/23 1962	250	568	7.5	67	42	60	17	37	14	312	4.4	30	0.4	0.1	.0	0.1	.56	-	360	220	0	-	D
134	8/4 1965	272	613	7.8	-	36	34	21	60	19	290	3.4	53	0.5	0.6	.0	0.2	1.2	-	371	173	0	4	D
140	4/3 1964	170	620	7.9	66	42	133	6.3	9.3	3.6	451	.0	6	0.2	0.7	.0	-	1.1	-	423	357	0	60	C

Well Number	Date of Collection	Sampled Depth	Specific Conductance	PH	Temperature °F	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Flouride (F)	Nitrate (NO_3)	Phosphate (PO_4)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Dissolved Solids: Sum	Hardness as $CaCO_3$	Noncarbonate Hardness	Color	Aquifer
146	7/20 1962	165	710	7.8	65	45	18	13	129	15	395	16	34	1.1	0.5	.0	.0	.28	-	467	98	0	-	B
154	7/15 1964	230	871	7.8	-	46	7.6	6.4	183	17	452	51	18	1.5	0.3	-	-	.37	-	553	45	0	-	C
154	7/11 1964	300	1260	7.9	-	23	3.6	3.6	272	22	505	44	100	1.1	0.6	0.6	-	.12	-	719	24	0	-	D
154	7/9 1964	350	1670	7.7	-	10	9.8	6.4	336	24	358	60	300	1.1	0.4	1.1	-	.11	-	925	51	0	-	D
154	7/2 1964	450	2280	7.6	-	8.8	11	8.5	434	70	349	55	494	1.1	0.1	.0	-	.37	-	1210	62	0	-	E
176	6/13 1962	35	391	4.8	-	9	31	12	19	6.4	2	67	28	0.2	66	.0	-	.12	-	240	124	123	5	A
200	6/13 1962	20	311	5.2	-	5.1	19	6.8	21	9.2	3	46	35	0.1	33	.0	-	.82	-	177	75	72	3	A
207	8/12 1964	307	1400	8.1	-	30	8.3	9.1	291	19	525	56	148	1.7	0.4	.0	-	-	.01	821	58	0	20	D
214	6/13 1962	15	512	7.3	-	35	84	11	17	1.5	301	1.4	17	0.2	0.2	.0	-	5.3	-	321	256	9	5	A
225	6/13 1962	15	267	6.1	-	23	13	11	23	1.8	28	63	24	0.1	3.4	.0	-	4.7	-	181	76	53	4	A
231	6/13 1962	45	601	7.3	-	66	65	4.8	24	3.5	262	2.4	23	0.3	.0	.0	-	3.3	-	321	183	0	5	B
232	11/18 1964	280	1650	8.0	63	54	23	20	321	21	638	25	222	0.8	1.0	.0	-	.07	.0	1000	142	0	25	C
240	6/11 1963	358	960	8.4	71	44	20	14	168	18	357	31	106	0.8	.0	0.1	0.1	.11	.01	591	109	0	7	C,B
251	7/23 1962	201	963	7.8	66	43	10	9.1	211	17	549	16	49	1.3	0.3	.0	0.1	.07	-	627	64	0	-	C
262	4/2 1964	75	315	7.9	-	16	48	2.2	15	1.8	146	16	19	0.1	0.2	0.1	-	1.1	.05	192	129	10	10	A,B
269	6/11 1963	291	1900	7.8	-	19	62	23	350	25	537	92	350	1.0	.0	.0	0.1	.21	.0	1190	248	0	7	C,B

Well Number	Date of Collection	Sampled Depth	Specific Conductance	PH	Temperature °F	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Phosphate (PO_4)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Dissolved Solids: Sum	Hardness as $CaCO_3$	Noncarbonate Hardness	Color	Aquifer
274	6/13 1962	15	173	6.2	-	22	8.2	4.1	17	1.7	28	17	26	0.1	1.9	.0	-	1.2	-	113	38	14	5	A
297	6/13 1962	15	532	7.3	-	51	62	29	15	1.8	346	2	16	0.2	0.2	.0	-	4.6	-	352	272	0	10	A
303	9/15 1962	145	750	8.0	66	44	40	19	84	8.6	296	11	82	0.1	-	.0	0.1	.21	0.1	435	179	0	8	B
303	9/14 1962	240	7780	7.6	65	32	68	64	1570	48	458	183	2310	1.2	-	.0	0.3	.06	.04	4500	432	57	7	C
303	9/14 1962	347	7780	7.7	-	13	55	51	1620	57	428	180	2340	1.4	-	.0	0.2	.10	.10	4530	350	0	5	D
303	9/13 1962	600	11000	7.9	68	8.2	52	62	2450	72	450	429	3360	1.1	-	.0	0.2	.26	.05	6660	384	14	4	E
303	9/11 1962	685	13000	8.3	69	7.3	68	85	2880	79	379	553	4140	0.8	-	.0	0.3	.66	.06	8010	523	212	3	E
321	4/20 1964	110	365	8.2	62	26	31	8.7	37	3	166	8.6	34	0.2	0.4	.0	-	8.2	.01	239	114	0	10	B

REFERENCES

Bentall, R., 1963, Spacing of wells by C. V. Theis: U. S. Geol. Survey Water-Supply Paper 1545-C.

Brown, P. M., 1958, Well logs from the Coastal Plain of North Carolina: North Carolina Dept. Conserv. Devel. Bull. 72,68 p.

__________, 1959, Geology and ground-water resources in the Greenville area, North Carolina: North Carolina Dept. Conserv. Devel. Bull. 73, 87 p.

Hem, J. D., 1959, Study and interpretation of the chemical characteristics of natural water: U. S. Geol. Survey Water-Supply Paper 1473, 269 p.

Jacob, C. E., 1950, Flow of ground water, chapt. 5 in Rouse, Hunter, Engineering hydraulics: New York, John Wiley & Sons.

Kimrey, J. O., 1964, The Pungo River formation, a new name for Middle Miocene phosphorites in Beaufort County, North Carolina: Southeastern Geology, v. 5, no. 4, p. 195-205.

Levorsen, A. I., 1958, Geology of Petroleum: W. H. Freeman and Co. 703 p.

Maier, F. J., 1950, Fluoridation of public water supplies: Am. Water Works Assoc. Jour., v. 42, pt. 1, p. 1120-1132.

Meinzer, O. E., and others, 1942, Hydrology: New York, McGraw Hill Book Co. Inc., 712 p.

Mundorff, M. J., 1945, Progress Report on Ground Water in North Carolina: North Carolina Dept. Conserv. Devel. Bull. 47, 78 p.

Nordell, E., 1961, Water treatment for industrial and other uses: New York, Reinhold Publishing Co., 598 p.

Swain, F. M. and Brown, P. M., 1964, Cretaceous Ostracoda from wells in the southeastern United States: North Carolina Dept. Conserv. Devel. Bull. 78, 55 p.

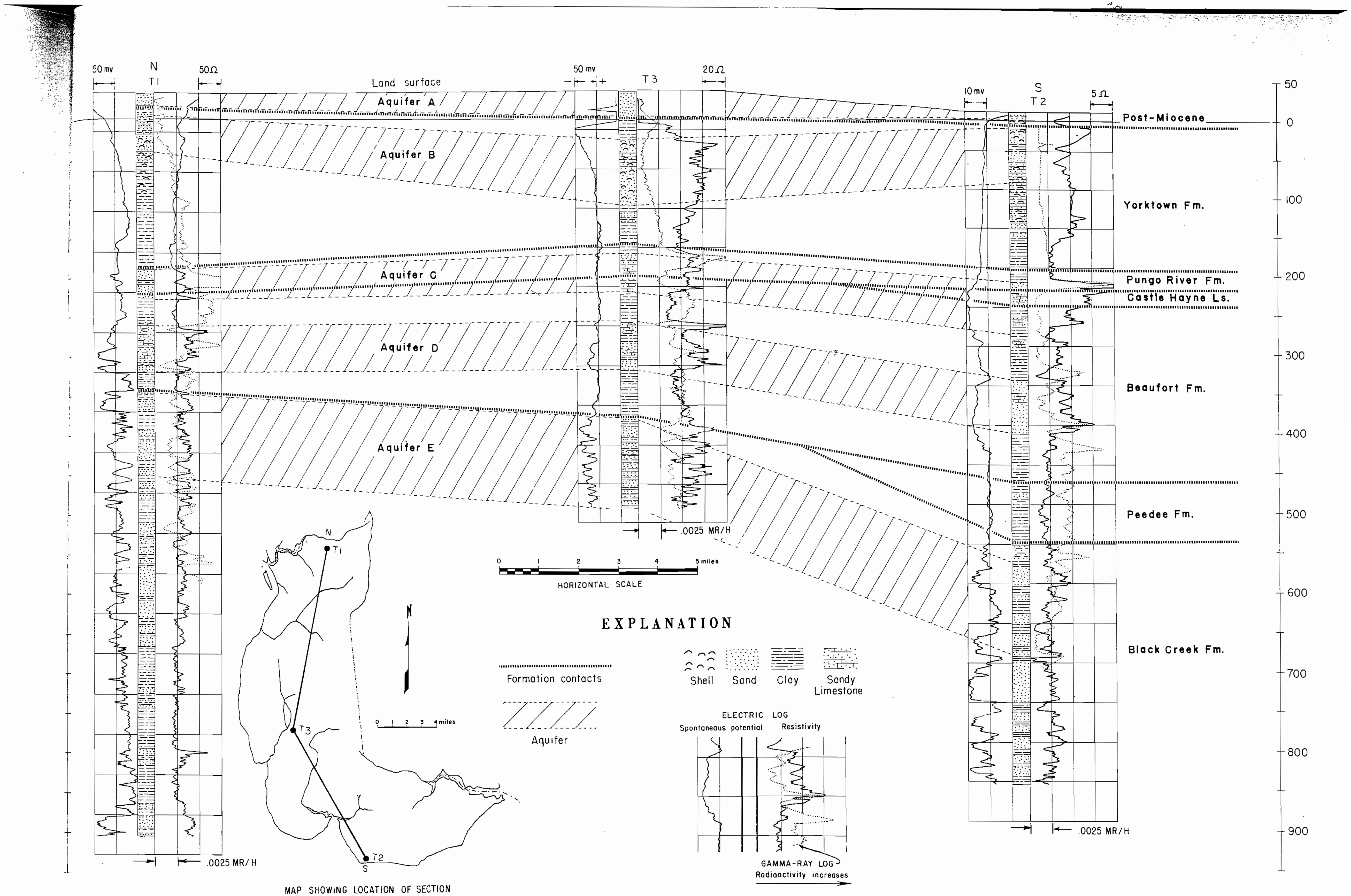
Theis, C. V. 1935, Relation between the lowering of the piezometric surface and the rate duration of discharge of a well using ground-water storage: Am. Geophys., Union Trans., pt. 2, p. 519-524; dupl. as U. S. Geol. Survey Ground Water Note 5, 1952.

U. S. Dept. of Commerce; U. S. Bureau of Census, 1960, Census of Housing, v. 1, pt. 6, tables 29, 31, 33, and 35.

U. S. Dept. of Commerce; U. S. Bureau of Census, 1960, Census of Populations, v. 1, pt. A, table 6.

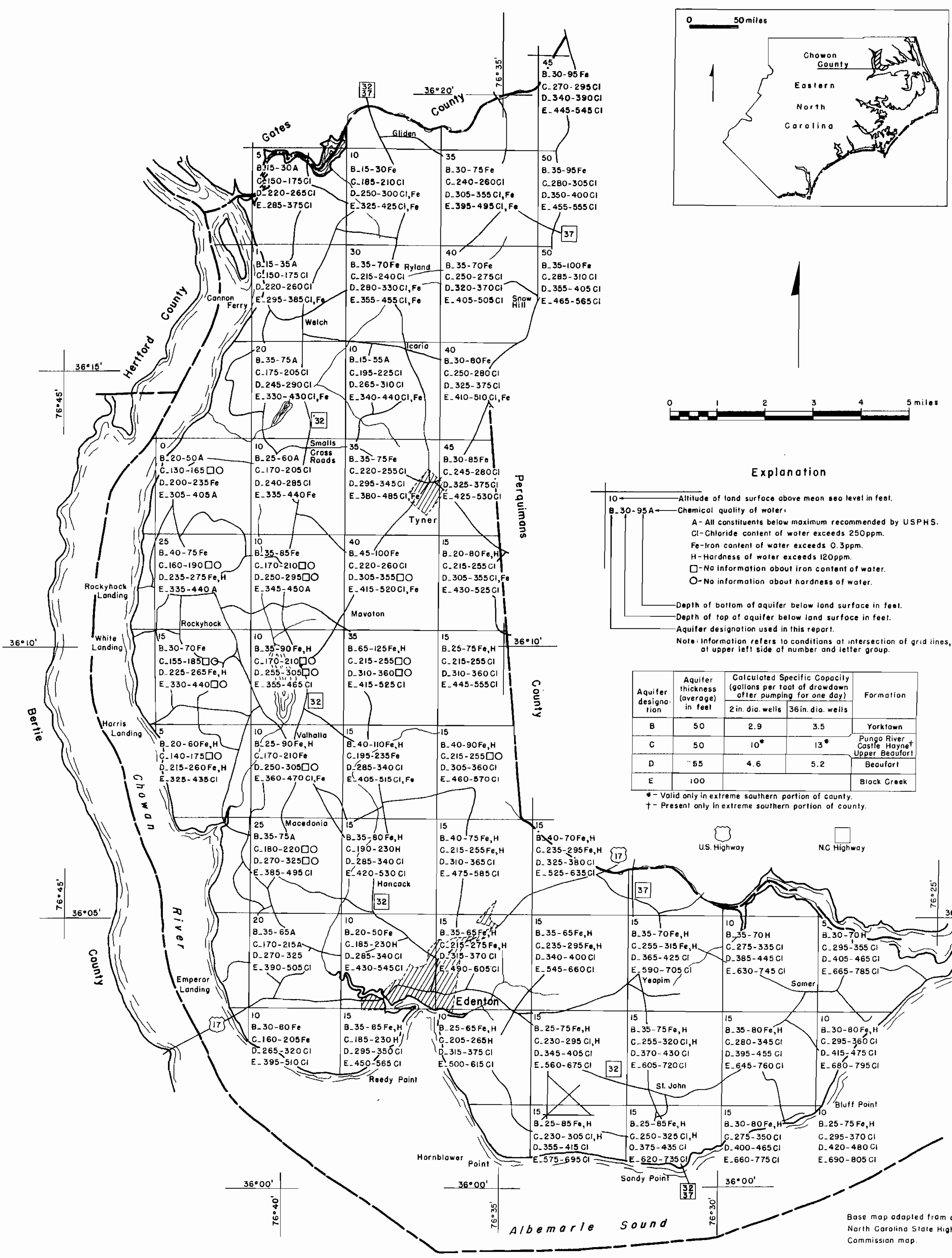
U. S. Dept. of Health, Education, and Welfare; Public Health Service, 1962, Public Health Service drinking water standards: Public Health service Pub. 956, 61 p.

Wyrick, G. G. 1966, Ground-water resources of Martin County, North Carolina: North Carolina Dept. Water Resources Ground-Water Bull. No. 9, 85 p.



SECTION SHOWING THE CORRELATION OF GEOLOGIC FORMATIONS AND AQUIFERS BY USING ELECTRIC, GAMMA-RAY, AND LITHIC LOGS.

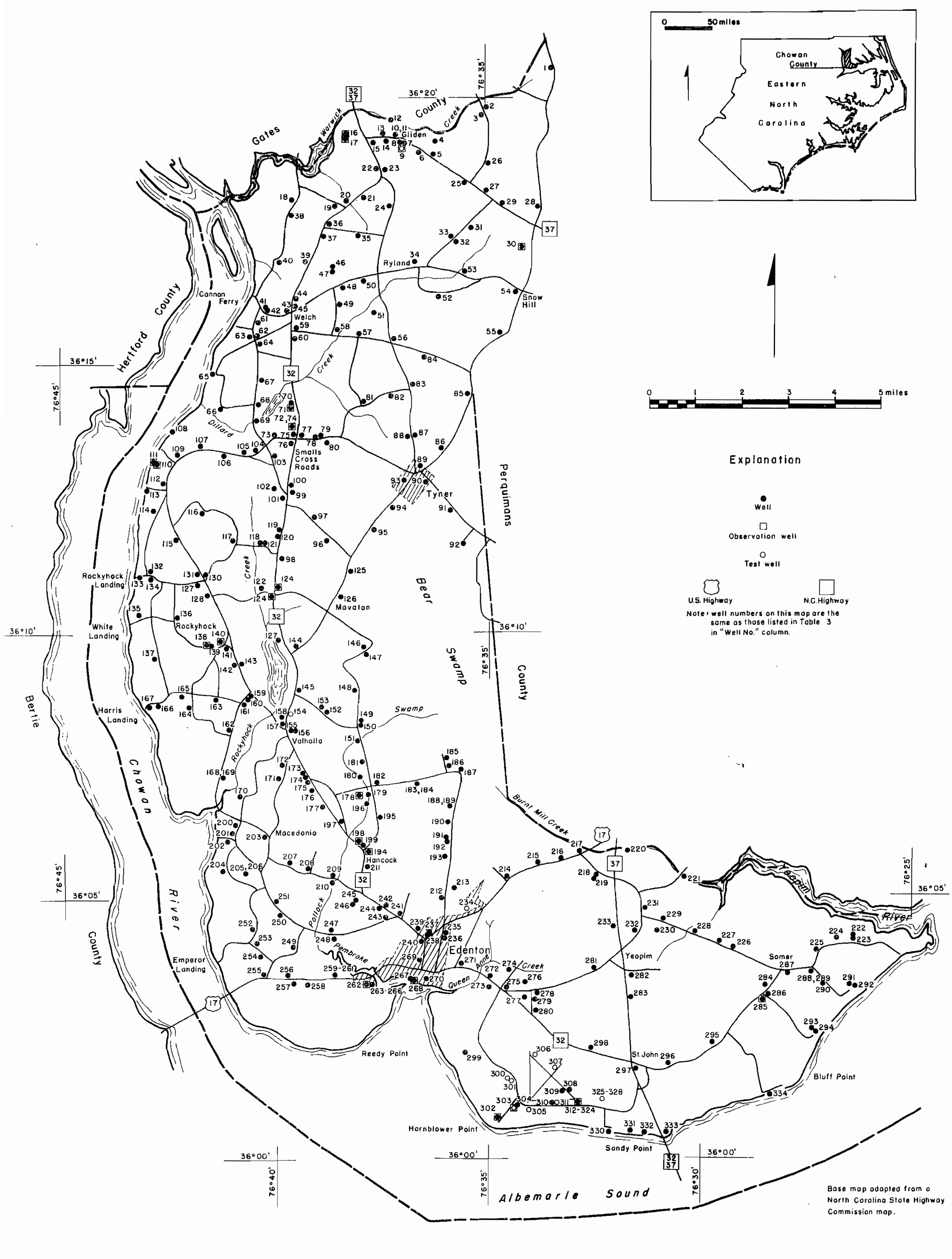
PLATE I



Aquifer designation	Aquifer thickness (average) in feet	Calculated Specific Capacity (gallons per foot of drawdown after pumping for one day) 2 in. dia. wells	36 in. dia. wells	Formation
B	50	2.9	3.5	Yorktown
C	50	10*	13*	Pungo River Castle Hayne† Upper Beaufort
D	55	4.6	5.2	Beaufort
E	100			Black Creek

MAP SHOWING CHARACTER OF PRINCIPAL AQUIFERS IN CHOWAN COUNTY.

PLATE 2



MAP SHOWING INVENTORIED WELLS IN CHOWAN COUNTY.

PLATE 3