VOGTLE ELECTRIC
GENERATING
PLANT

STUDIES OF POSTULATED MILLETT FAULT

Report Prepared for
Georgia Power Company

BECHTEL

OCTOBER 1982

VOLUME I

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REPORT SUMMARY

United States Geological Survey Open-File Report 82-156 raised the possibility of faulting of Coastal Plain sediments near the Vogtle Electric Generating Plant, under construction approximately 26 miles southeast of Augusta, Georgia. The Open-File Report suggested that a fault, named the Millett fault, exists approximately seven miles southeast of the plant site at its closest approach. The report cited then-existing stratigraphic, ground water, and surface water hydrology data as supportive of the existence of the postulated fault. The Open-File Report also briefly mentioned the possible existence of a fault named the Statesboro fault about 32 miles southeast of the Vogtle site. Although the report did not state that these faults were capable, that is, had moved once in the past 35,000 years, or more than once in the last 500,000 years, it did not preclude this possibility. Nuclear Regulatory Commission regulations require the determination of fault capability; therefore, it was necessary to determine if the postulated faults were capable. If the faults were not capable, they could have no effect on the existing accepted seismic design bases of the Vogtle plant.

In response to the Open-File Report, a task force comprised of representatives of Georgia Power Company, Southern Company Services, and Bechtel was assembled to evaluate whether the postulated faults were or were not capable. Based on information in the Open-File Report, the postulated Millett fault was of primary interest and the

postulated Statesboro fault was of secondary interest to this study. A review of the data and evaluations used in the Open-File Report indicated that additional data and evaluations would be needed to adequately determine the capability of the postulated faults.

Bechtel was assigned the responsibility of conducting an investigation to determine if faults existed at the locations suggested by the Open-File Report. If a fault or faults were found to be present, the capability of such faults was to be determined.

The investigations encompassed several scientific fields which address the question of faulting. These include surface geology, subsurface geologic and geophysical characteristics, ground water aquifer characteristics, surface water hydrology, and the nature and distribution of historic seismicity in the area.

To provide guidance and review of the studies, a number of eminent consultants were retained. The following group of consultants was chosen because their fields of expertise were related to the planned studies: Dr. Bruce Bolt, Director of the Seismographic Station at the University of California, Berkeley; Dr. R.D. Hatcher of the University of South Carolina; Dr. V.J. Henry of the University of Georgia; Dr. P.E. LaMoreaux, President of P.E. LaMoreaux and Associates; Mr. H. LeGrand, an independent consultant in geohydrology; Dr. R. Lyon of

Stanford University; Dr. S. Papadopulos, President of S. Papadopulos and Associates; Mr. Carl Savit, Senior Vice President of Western Geophysical; Dr. Carl Stepp, affiliated with Woodward-Clyde Consultants, and Mr. L. Wood, ground water geology specialist with S. Papadopulos and Associates.

The results of the studies conclusively demonstrate the absence of a capable fault in the vicinity of the postulated Millett fault, and strongly suggest that no capable fault exists near the location of the postulated Statesboro fault.

These conclusions are based on the following:

1. Core drilling and geophysical logging clearly demonstrate subsurface continuity of beds 40 to 80 million years Before Present (m.y.B.P.) across the trace of the postulated Millett fault (See Figure A).

2. Acoustic reflection surveys performed in the Savannah River demonstrate continuity of subsurface strata deposited across the strike of both the postulated Millett and Statesboro faults during the last 80 million years.

3. Geologic mapping and remote sensing studies reveal no surface expression of faulting.

4. Examination of recorded and reported seismic events indicate that there is no historic seismicity which can be associated with either of the postulated faults.

5. Surface and ground water hydrology studies do not support the presence of faults.

Table A summarizes the results of individual studies in terms of whether or not they support the presence of a capable fault. These studies are described in detail in the body of the report.

It is concluded that no capable faults exist in the vicinity of the postulated Millett and Statesboro faults; therefore, they can have no impact on the existing accepted seismic design bases of the Vogtle Electric Generating Plant.

TABLE A

SUMMARY TABULATION OF RESULTS OF STUDIES TO DETERMINE PRESENCE OF CAPABLE FAULT

METHOD	EVIDENCE FOR FAULT +	EVIDENCE FOR FAULT o	EVIDENCE FOR FAULT –
GROUND WATER HYDROLOGY			
Review of Existing Data		X	
Evaluation of New Data		X	
Ground Water Modeling		X	
SURFACE WATER HYDROLOGY		X	
SEISMICITY			
Earthquake History			X
Microseismic Data			X
REMOTE SENSING			
Satellite Imagery			X
Low and High Altitude Photography			X
GEOLOGIC MAPPING			
Lithologic Units Distribution			X
Tectonic Structure Features			X
CORE DRILLING AND LOGGING			
Offset of Formations from Core			X
Offset of Formations from Geophysical Logs			X
LITHOLOGIC EVALUATION			
Petrography			X
Clay Mineralogy			X
Heavy Mineral		X	
GEOPHYSICAL EXPLORATION			
River Seismic Reflection Survey			X
SRP Survey			X
SeisData Services			X

Legend:
+ Results support the presence of a capable fault
o Results indeterminate as to fault capability
– Results support the absence of a capable fault

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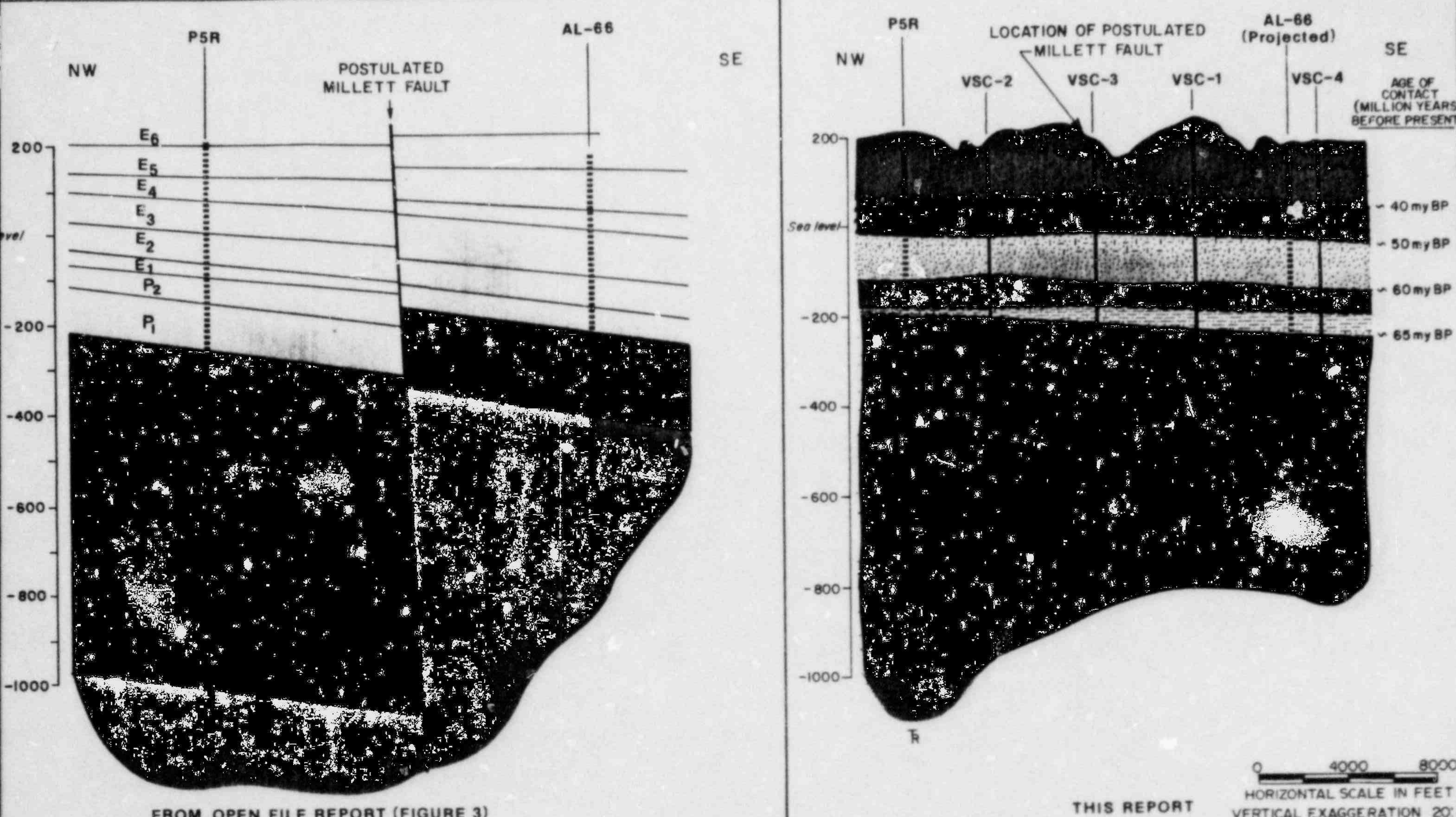


COMPARISON OF GEOLOGIC SECTIONS

FIGURE A

1.0 INTRODUCTION

This report carefully examines a postulated fault discussed in United States Geological Survey Open-File Report 82-156 (Faye and Prowell, 1982). The Open-File Report states: "Geologic and hydrologic investigations by the U.S. Geological Survey have defined stratigraphic and hydraulic anomalies suggestive of faulting within Coastal Plain sediments between the Ogeechee River in east-central Georgia and the Edisto River in west-central South Carolina." The postulated fault, referred to as the Millett fault, was proposed to exist approximately seven miles southeast of the Vogtle Electric Generating Plant (presently under construction southeast of Augusta, Georgia). Figure 1-1 shows the location of the postulated fault in relation to the plant site and other geographic reference points. A second fault, referred to in the Open-File Report as the Statesboro fault, was proposed to exist approximately 32 miles southeast of the Vogtle site. This feature was given secondary importance in the Open-File Report and was described as having less basis for existing than does the Millett fault.

The U.S. Nuclear Regulatory Commission has established criteria for determining whether a fault is "capable" and therefore must be considered in establishing the seismic design bases of a nuclear power plant. A fault is considered capable if it has moved either once in the last 35,000 years, or more than once in the last 500,000 years. The Open-File Report did not attempt to assess the age of last movement on the postulated Millett fault. No evidence was presented which would preclude the postulated fault being capable.

To evaluate the effect, if any, of the postulated fault on the accepted seismic design bases of the Vogtle Plant, a task force was assembled. This task force consists of personnel from Georgia Power Company, Southern Company Services, and Bechtel. Bechtel was given the responsibility of conceiving and conducting a program of investigation designed to determine the presence or absence of a fault at the location suggested by the Open-File Report and, if present, the capability of such a fault.

The investigations were directed at several scientific fields which address the question of faulting. These include surface and subsurface geology, geophysics, ground water characteristics, surface water hydrology, and historic seismicity of the area. The scope of the studies performed is discussed in Chapter 2 and subsequent sections of this report.

The studies were performed from March through August, 1982. The principal participants included personnel from Georgia Power Company, Southern Company Services, and Bechtel. Drilling services were provided by Alabama Power Company and Law Engineering and Testing Company (LETCO). Geophysical logging of core holes was performed by the Birdwell Division of Seismograph Service Corporation, and by LETCO. Seismic reflection work was performed by Harding-Lawson Associates in conjunction with Dr. V.J. Henry of the University of Georgia Marine Geology Program. Contract numerical modeling services were provided by Geomath, Incorporated, of Denver, Colorado. Clay mineralogy studies were performed by Dr. R.E. Grim of the University of

Illinois, and heavy mineral analyses were performed by Reservoirs, Incorporated, of Denver, Colorado.

To provide guidance and review of the studies, a number of eminent consultants were retained. The following group of consultants was chosen because their fields of expertise were related to the planned studies: Dr. V.J. Henry of the University of Georgia; Dr. Bruce Bolt, Director of the Seismographic Station at the University of California, Berkeley; Dr. P. E. LaMoreaux, President of P.E. LaMoreaux and Associates; Dr. Carl Stepp, affiliated with Woodward-Clyde Consultants; Dr. R.D. Hatcher of the University of South Carolina; Mr. H. LeGrand, an independent consultant in geohydrology; Mr. Carl Savit, Vice President of Western Geophysical; Dr. S. Papadopulos and Mr. L. Wood, ground water geology specialists with S. Papadopulos and Associates; and Dr. R. Lyon, remote sensing specialist at Stanford University.

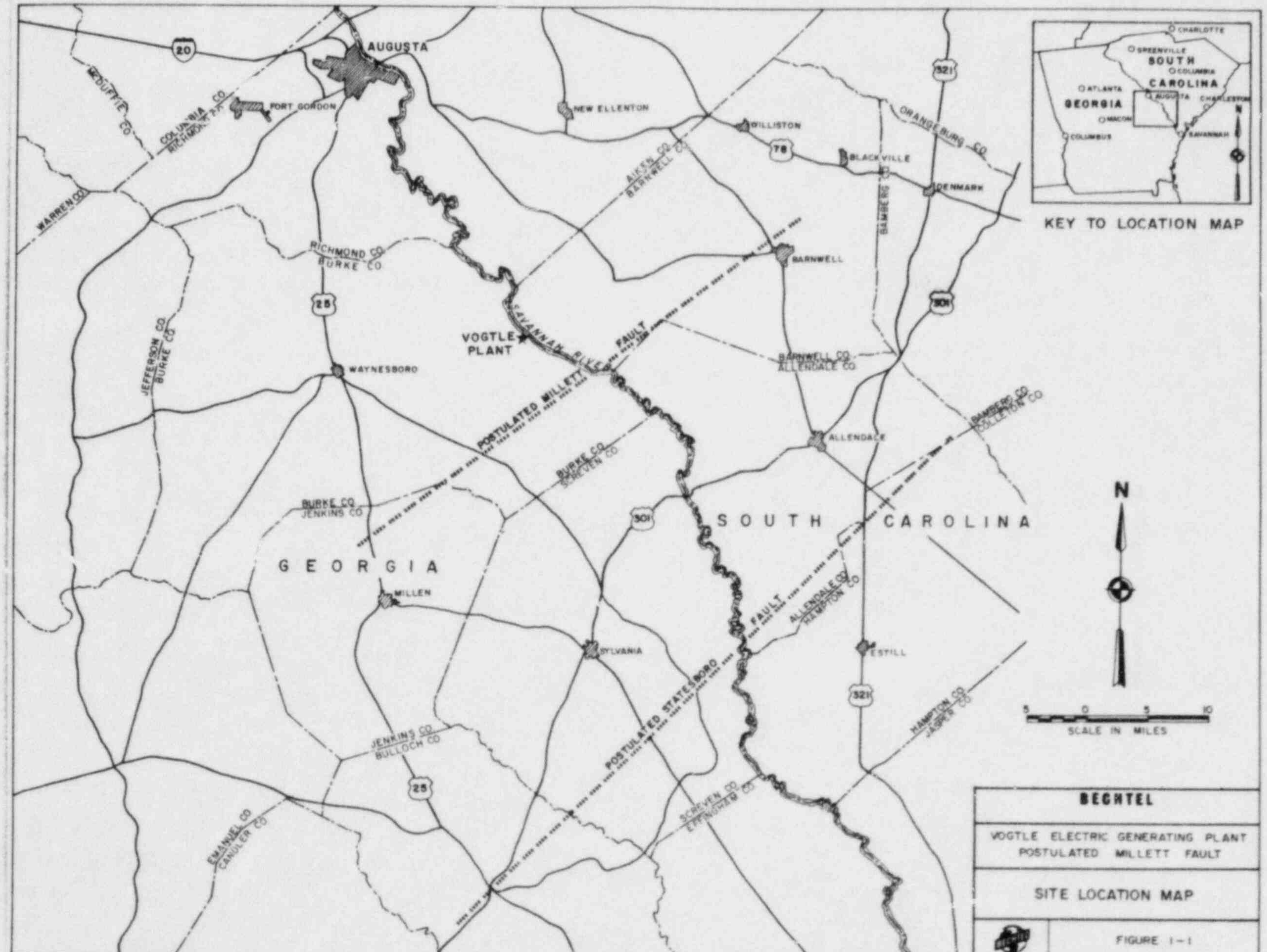
This report is organized into two volumes; the first contains a discussion of the studies performed along with the results of the studies and derived conclusions and the second contains supporting data and more detailed development of certain of the subjects covered in Volume I.

In Volume I, Chapter 2 describes the scope of studies and Chapter 3 presents a summary of the principal conclusions. Chapter 4 discusses the geologic features of the region and study area, while Chapter 5 describes regional and local ground water characteristics. Chapter 6 discusses the field investigations, and Chapter 7 describes the office

studies conducted in parallel with those in the field. Chapter 8 concludes the first volume and presents a detailed assessment of the postulated Millett fault.

Volume II contains appendices which present the supporting data as well as further details on certain of the studies. The report includes tables and is illustrated by figures and plates.

The writers gratefully acknowledge the helpful contribution of information and assistance provided by Dr. P. Huddlestun of the Georgia Geologic Survey. In addition, personnel of the USGS, the Georgia and South Carolina Geologic Surveys, and the South Carolina Water Resources Commission, provided data from their files. Mr. M.J. Sires III of DOE, and Dr. I.W. Marine of the Du Pont Company, provided open-file data, geophysical data, and microseismic records from the Savannah River plant, as well as many helpful suggestions during the course of the study. Mr. M. Hawkins and Dr. P. Mayer, representing Allied General Nuclear Services, also generously provided data, guidance, and review of the studies. Appreciation is extended to the management of the Savannah River Plant, to the Burke and Allendale County Boards of Commissioners, and to Mr. William Morris III, who gave permission for core holes to be drilled on federal property, county right-of-ways, and private land, respectively. We also wish to thank the many owners of existing wells who graciously cooperated with the well survey crews by providing access to their wells.



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VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

SITE LOCATION MAP

FIGURE 1-1

2.0 SCOPE OF STUDIES

The task force decided on a program of thoroughly investigating all lines of evidence which could help to resolve the issue of the existence and potential effects of faulting. Accordingly, an investigation was developed which encompassed a number of different fields. Care was taken to ensure that different studies would retain a measure of independence from one another and would not be overly influenced by the results of companion studies. Table 2-1 illustrates the tasks conducted.

The investigations performed can be classified into three general groups: 1) those designed to assemble and evaluate the vast body of existing data; 2) those designed to generate new original data to positively demonstrate the presence or absence of a capable fault; and 3) those designed to specifically address issues raised in the Open-File Report and cited as suggestive of faulting. This third category includes studies dealing with both existing and newly-generated data.

The first group of studies involved searches for published and unpublished data and the review and evaluation of these data. University theses were researched. Previous geologic data generated for the Vogtle project were assembled and reviewed. Visits to federal, state, and county agencies were conducted to procure and review

open-file data. Oil and gas exploration companies as well as geophysical prospecting firms were contacted to determine the availability of exploratory well and geophysical information. Discussions with knowledgeable local geologists also provided unpublished background material. All historic earthquake information within a radius of 62.5 miles around the Vogtle site was studied. Geologic and seismologic data collected by staff members of the Savannah River Plant, across the river from the Vogtle site, were reviewed and evaluated.

This information provided a framework for understanding the regional and local geology, ground and surface water hydrology, and seismicity. Remote sensing studies using air photos and satellite imagery provided the background for geologic mapping and lineament locations.

The second group of studies involved the collection of new data pertaining to the question of faulting. Tasks included surface geologic mapping of an area including the postulated Millett fault. This mapping was tied to previous mapping of a five-mile-radius area around the Vogtle site, and to previous published mapping of the Savannah River Plant (Siple, 1967). Subsurface information was obtained by drilling and logging of two lines of core holes across the trace of the postulated fault for correlation purposes. These lines of holes generally parallel the Savannah River with one line on the Georgia side and the other on the South Carolina side. The holes were

drilled to depths of about 600 feet, but one hole reached to a depth of 1024 feet. All holes were continuously cored and suites of geophysical logs were recorded. Soil sampling techniques were used in selected zones with poor core recovery. Petrographic studies and clay and heavy mineral analyses were performed on selected core samples to assist in correlating between holes. Upon completion of drilling, the holes were converted into ground water observation wells.

In addition to core drilling, several continuous seismic reflection profiles were run along the Savannah River across the traces of the postulated Millett and Statesboro faults. These surveys generally parallel the two lines of core holes and provide information on the subsurface geology as delineated by seismic reflectors. A uniboom and two airgun systems were employed to achieve varying degrees of penetration of the strata underlying the river.

The third category of studies mentioned above included analyses of existing data and gathering of new information designed to address specific criteria cited in the Open-File Report as suggestive of faulting. The Open-File Report addresses ground water evidence, therefore, a study of aquifer characteristics in a broad area around the postulated Millett fault was conducted. Water wells were inventoried and water levels and other pertinent information were collected and recorded to provide a concurrent data base for ground water studies and numerical modelling of aquifer characteristics.

Surface water hydrologic characteristics were evaluated based on historical stream flow records as this had been discussed in the Open-File Report as being suggestive of faulting. Petrographic descriptions of well-cuttings from key wells cited in the Open-File Report were made to determine whether there was a basis for the existence of upthrown Triassic rocks on the southeast side of the postulated Millett fault. Wells P5R and AL-66, the two wells cited in the Report as straddling the Millett fault, were re-logged geophysically to aid in correlations in the subsurface zone between them.

All of the above studies are described in greater detail in following sections of this report.

TABLE 2-1
SCOPE OF INVESTIGATIONS

Field Studies		Office Studies	
TASK	PURPOSE	TASK	PURPOSE
Core drilling	Investigate stratigraphic correlations across trace of postulated fault	Literature search	Assemble background information
		Thesis search	Assemble background information
Lithologic sampling	"	Acquisition of open-file data from federal, state, county agencies	Use for ground water studies; geologic structure studies
Geophysical logging of core holes	"	Evaluate available geophysical data	Use for geologic structure studies
Savannah River acoustic reflection survey	"	Seismicity study	Check for association of seismicity with postulated fault
		Remote sensing	Search for surface expression of faulting
Geologic Mapping	Stratigraphic correlation and search for surface expression of faulting	Lithologic evaluations Petrography Clay Mineralogy Heavy Minerals	Lithologic correlation across trace of postulated fault
Remote sensing field check	Search for surface expression of faulting		
Observation well installation	Investigate water levels in upper and lower aquifers across trace of postulated fault	Ground water evaluations	Reduction of field data; numerical modelling using concurrent base to check for fault effect
Water well survey	Provide concurrent data base for ground water studies	Surface Water Hydrology study	Analyses of base flows using concurrent data base to check fault effects

3.0 SUMMARY OF CONCLUSIONS

The results of the studies described in this report conclusively demonstrate that even if the postulated Millett fault referred to in the Open-File Report actually exists, it is not a capable fault. Therefore, it has no effect on the existing accepted seismic design bases of the Vogtle Electric Generating Plant. The evidence suggests that no fault is present within the depth range of this investigation. A second conclusion is that no capable fault exists near the location of the postulated Statesboro fault. These conclusions are supported as follows:

1. Results of core drilling, lithologic studies, and geophysical logs demonstrate continuity of subsurface horizons across the trace of the postulated Millett fault on both the Georgia and South Carolina sides of the Savannah River. These unfaulted subsurface horizons have ages ranging from approximately 40 million to approximately 80 million years Before Present.

2. Results of acoustic reflection studies demonstrate continuity of subsurface reflecting horizons down to an elevation of approximately -1,100 feet across the trace of the postulated Millett fault. A reflector at elevation -1,100 feet, believed to be the surface of the Triassic rocks in the Dunbarton Basin, may have an apparent offset of approximately 50 feet. This 50-foot

offset is questionable but would agree with small faults or erosion effects interpreted from SRP geophysical records. It disagrees with the 700-foot offset proposed in the Open-File Report. Reflectors above this feature are not offset.

3. Results of acoustic reflection studies demonstrate continuity of subsurface reflecting horizons across the trace of the postulated Statesboro fault.

4. Detailed surface geologic mapping and remote sensing studies reveal no evidence for surface expression of faulting in the area indicated in the Open-File Report.

5. Ground water studies performed using a concurrent data base do not support the existence of a fault.

6. Surface water hydrologic studies using a concurrent data base do not support the existence of a fault.

7. Historic seismicity, including microearthquake records, reveals no evidence of active faulting in the area.

8. Petrographic studies of well-cuttings from well AL-66 strongly indicate that this well bottoms in Cretaceous rather than Triassic rocks as suggested by the Open-File Report, thus removing upthrown Triassic rocks as a basis for a fault.

9. Core hole VSC-4, drilled near well AL-66 and approximately 300 feet deeper than the Triassic contact proposed in the Open-File Report, bottoms in Cretaceous rather than Triassic rocks, confirming the conclusion in eight, above.

The bases for the above findings are discussed in detail in the following sections of this report.

4.0 GEOLOGY

This chapter discusses the geology of the plant site and surrounding area. Reference can be made to the Preliminary Safety Analysis Report (PSAR) for Vogtle for additional discussion of both the local and regional geology.

Since the PSAR was written, the stratigraphic nomenclature in the study area has undergone a certain amount of reinterpretation and some of the formation names and intraformational boundaries are changing. The names of the intraformational units may change, but the formations of which they are a part are distinct, lithologically and geophysically, and can be correlated. The stratigraphic nomenclature adopted for this report accepts, in general, the current thought of geologists working in the area, most notably, P. Huddlestun, of the Georgia Geologic Survey. The terminology used was selected because, although not yet completely formalized, it is thought to accurately represent the best knowledge of the stratigraphic framework of the study area. A correlation chart (Figure 4-3), and a lithologic chart (Figure 4-4) are provided for reference.

4.1 Physiography and Geomorphology

The Vogtle site is approximately 26 miles south-southeast of Augusta, Georgia, in the Atlantic Coastal Plain Province. This province

adjoins the Piedmont Province to the northwest. Within a 200-mile radius of the site in Georgia are the Blue Ridge and Valley and Ridge Provinces. These provinces and the location of the site are shown on Figure 4-1.

The Atlantic Coastal Plain Province extends approximately 4,000 miles along the eastern edge of North America and covers approximately 60 percent of the total surface area of the State of Georgia. Along its inner margin, at the boundary with the Piedmont Province, is the Fall Line, which marks the contact between the crystalline basement rocks and the overlying Cretaceous and Cenozoic sediments.

The Vogtle plant site is on the eastern margin of the Tifton Upland, a sub-maturely dissected area of the Atlantic Coastal Plain Province just seaward of the Fall Line. The Savannah River valley is old, with a broad flood plain trending northwest-southeast across the coastal plain. Adjacent to this flood plain the land surface has been dissected by the tributaries of the Savannah River. Leaching of the soluble Utley Limestone (described in Section 4.2.3.1.2) has caused local subsidence producing small, shallow depressions.

4.2 Stratigraphy and Lithology

4.2.1 Late Precambrian and Paleozoic Eras

The crystalline basement complex beneath and north of the plant site is composed of igneous and metamorphic rocks of late Precambrian through Paleozoic age (800 to 250 m.y.B.P.).

The southern Appalachians evolved in a series of collisions of fragments of continental or island arc material at the eastern edge of North America. Several models have been developed to explain the development of the southern Appalachians (Hatcher, 1972; 1978; Rankin, 1975; 1976; Cook and others, 1980; 1981; Hatcher and Odom, 1980; Cook and Oliver, 1981).

About 750 m.y.B.P. a megacontinental expanse split into at least two large continents and at least two continental fragments, the Piedmont-Blue Ridge fragment and the Carolina Slate Belt fragment. In the period of early rifting volcanic and the metasedimentary rocks of the Blue Ridge, were deposited in a basin between proto-North America and the Piedmont-Blue Ridge fragment.

Volcanism started in the island arc of the Carolina Slate Belt about 650 m.y.B.P., meaning that subduction, which gave rise to the volcanic activity, also began at about the same time. As a result of the subduction the basin between proto-North America and the Piedmont-Blue Ridge fragment began to close about 500 m.y.B.P.

The first period of deformation and metamorphism (500 to 450 m.y.B.P.) can be attributed to closing of this basin and the subsequent collision of the Piedmont-Blue Ridge fragment and proto-North America. This deformation caused a shift in the source of the sediments that gave

rise to the Ordovician sandstones and shales of the Valley and Ridge Province, changing their character from poorly sorted graywackes, siltstones, shales, and conglomerates to better sorted material.

The second period of mountain building, from 400 to 350 m.y.B.P., was characterized by extensive metamorphism and deformation. It was triggered by the closing of the ocean basin between the Piedmont-Blue Ridge and the Carolina Slate Belt fragment.

The last major compressional event was from 300 to 250 m.y.B.P. This mountain building episode can be attributed to the collision of proto-North America and proto-Africa to form the supercontinent of Pangaea. Radioisotopic age dating indicates that many of the igneous bodies in the Piedmont were emplaced during this time. Between 250 and 200 m.y.B.P. extensional tectonism began to break Pangaea into smaller continents.

The crystalline basement rock ranges in age from Precambrian(?) through Paleozoic. The basement rocks exposed northwest of the Vogtle site include the gneisses and granites of the Kiokee Belt and the phyllites and greenstones of the Belair Belt (O'Connor and Prowell, 1978; Snoke and others, 1980). The upper surface of the basement rock has been eroded, tilted to the southeast, and buried. The general plane of this surface strikes approximately N62°E and dips southeast at 30-40 feet per mile.

4.2.2 Mesozoic Era

4.2.2.1 Triassic Period

The tectonic model which best explains the stratigraphic distribution of lower Mesozoic rock now on the eastern coast of North America includes the following sequence: 1) Permian to Late Triassic (280 to 205 m.y.B.P.) uplift and crustal thinning along the axis of the future Atlantic Ocean; 2) Middle to Late Triassic (215 to 205 m.y.B.P.) strike-slip faulting and volcanism along east-trending fracture zones followed by the advance of the Tethys Sea; 3) Late Triassic (205 to 193 m.y.B.P.) rifting along the axis of the proto-Atlantic Ocean and shearing along east-west fracture zones. This action had the combined effect of decoupling segments of the African and North American plates causing deposition of clastic sediments in the "Triassic" basins that formed. Late Triassic to Early Jurassic (205 to 188 m.y.B.P.) crustal extension and extrusion of basaltic lavas was followed by collapse of the continental margins and concomitant deposition of marine carbonates (Manspeizer and others, 1978).

"Triassic" basins occur along the eastern seaboard from Connecticut south to Georgia (Figure 4-5). Basins north of South Carolina are exposed in Piedmont crystalline rocks while those in South Carolina and Georgia are overlain by Cretaceous and Cenozoic sediments. The clastic sediments within these basins have been tentatively correlated to rocks

of the Newark Supergroup of Late Triassic and Early Jurassic age (Siple, 1967; Olsen and Galton, 1977; Van Houten, 1977; Gohn and others, 1978; Manspeizer and others, 1978). It is difficult to obtain an accurate age for the sedimentary rocks within these basins due to their nonfossiliferous, time-transgressive nature (Manspeizer and others, 1978). Because of these problems, considerable controversy still exists about the age of these basins, and the chrono-stratigraphic relationships of the various Newark depositional basins (Cornet and others, 1973; Manspeizer and others, 1978). Correlation of these sediments to the Newark Supergroup is based on a similarity in flora and fauna and that in some cases, they are overlain by basalts of Early Jurassic age (Cornet and others, 1973; Manspeizer and others, 1978).

As shown in Figure 4-6, the general area of the Vogtle site, the Savannah River Plant, and the postulated Millett fault are underlain by the buried Dunbarton "Triassic" Basin. The sediments within this basin have been identified as Triassic based on stratigraphic position and lithology. No microfossils (Marine and Siple, 1974; Marine, 1976; 1979) or igneous rocks (Popenoe and Zeitz, 1977; Dames and Moore, 1980) of Jurassic age have been found in the Dunbarton Basin, and for this reason the Dunbarton Basin is considered to be Triassic.

Marine and Siple (1974) have presented the most complete lithologic description of the Triassic rocks of the Dunbarton Basin based on drill cores.

They described the central northwest portion of the basin (DRB 9 on Figure 4-6) as a fanglomerate composed of red-brown breccias containing pink, weathered gneiss fragments and quartzite in a matrix of claystone and siltstone.

The central part of the Dunbarton Basin (DRB 10 on Figure 4-6) is composed of alternating layers of: 1) a friable and weakly cemented arkosic sandstone, medium- to coarse-grained, pink to buff, with of a matrix of hematitic clay containing sand-size particles of schist, quartz, and weathered pink feldspar, 2) a well consolidated and poorly sorted, fine- to medium-grained, gray-brown, sandstone, including much silt and clay; and 3) a mudstone containing silt, clay, and some fine-grained red to maroon sand (Marine and Siple, 1974). The rocks from this central area of the basin were apparently deposited under fluvial conditions, and commonly contain calcareous cement, probably from the evaporation of ground water shortly after deposition.

Rocks from what may be the southeastern part of the basin (P5R on Figure 4-6) are described as: 1) maroon siltstones and claystones, containing gray calcareous nodules; and 2) fine- to very fine-grained gray-brown sandstones, also containing calcareous nodules (Marine and Siple, 1974). The clastic sediment fraction appears to have been flood deposited but the calcareous nodules apparently have formed in place.

The lithology of the rocks in the Dunbarton Basin is of great importance to the present study because well cuttings reported to be Triassic in age in the Open-File Report are used as evidence for

postulating the Millett fault. This subject is discussed further in Chapters Seven and Eight.

The sedimentary fill in the basin may have reached a maximum thickness of 6,000 to 8,000 feet greater than at present based on estimates made from the conversion of montmorillonite to illite with depth of burial (Marine, 1976b). Subsequent erosion (Jurassic-Early Cretaceous, aproximately 188 to 100 m.y.B.P.) has not only removed the Triassic highlands, but also up to 8,000 feet of the former basin fill.

4.2.2.2 Cretaceous Period

Following a period of uplift and erosion in the Early Cretaceous (140 to 100 m.y.B.P.), there was a transgression of Late Cretaceous (100 to 65 m.y.B.P. years ago) seas (Vail and Mitchum, 1978). The basal clastic formation in the area of the postulated Millett fault is the subaerial Tuscaloosa Formation (Middendorf Formation in the Open-File Report - See Figure 4-3). Deposition of this formation began sometime between 100 and 94 million years ago (Cramer and Arden, 1980). An unconformity exists in the Upper Cretaceous series of South Carolina between 94 and 82 m.y.B.P. (Gohn and others, 1978; Christopher, 1982) which may be correlated in part with an erosional surface within the Tuscaloosa downdip of the plant site (Cramer and Arden, 1980; Gohn and others, 1982).

Following this period of erosion the sea again transgressed onto the continent. Clastic sediments ranging in age from 86 to 79 m.y.B.P. were deposited in localized regions in western and central Georgia.

These deposits are overlain by a sequence of marine sediments which, in the study area, are predominantly sands (Cramer and Arden, 1980).

The Tuscaloosa Formation consists of fluvial and estuarine deposits of cross-bedded sands and gravels intercalated with lenses of variegated silt and clay (Siple, 1967; Cramer and Arden, 1980; Gohn and others, 1982). The Tuscaloosa is unconformably overlain by the Ellenton Formation, or where the Ellenton is missing, by sediments of later Tertiary and Quaternary ages.

In the drill core, the Tuscaloosa Formation consists of light-gray to white, tan, and buff quartzitic to arkosic sand and minor gravel intercalated with lenses of white, pink, red, brown and purple silt and clay. Individual beds of coarse and fine sediment are interbedded in no regular sequence, and grade laterally into one another or pinch out in short distances. Abundant kaolin is present along with other clay minerals.

No rocks of latest Cretaceous age are present in Georgia or South Carolina (Rankin, 1977; Cramer and Arden, 1980; Gohn and others, 1982). The Cretaceous-Tertiary boundary is marked by an erosional surface which may be due, in part, to a post-depositional fall in sea level (Vail and Mitchum, 1978).

4.2.3 Cenozoic Era

4.2.3.1 Tertiary Period

4.2.3.1.1 Paleocene Epoch

Sediments deposited during the lower Paleocene (65 to 60 m.y.B.P.) are thickest in the southwest indicating that seas transgressed from that direction. Following this period of deposition, uplift of the region resulted in the erosion and removal of most of these rocks in Georgia (Rainwater, 1964; Cramer and Arden, 1980). This uplift was accompanied by faulting in response to the tectonic forces resulting from the northwestward drift of a passive continental margin (Bott, 1978). The lower Paleocene series consists of the Ellenton and the Huber Formations.

Ellenton Formation

The Ellenton Formation is of a dark-gray to black sandy lignitic micaceous clay interbedded with medium- to coarse-grained quartz sand. Authigenic gypsum crystals are commonly distributed throughout the unit.

The upper part of the formation contains a gray silty to sandy micaceous lignitic clay with which the gypsum is commonly associated. In some drill holes the clay zone was overlain by coarse quartz sand.

The lower part of the Ellenton is sandy, lignitic clay which, in some areas, becomes very coarse and gravelly. The sand grains are bluish-gray quartz.

The Ellenton is unconformable with the underlying Tuscaloosa Formation. The contact is characterized by a change in color of the clay and a change in composition of the sand. The dark-gray to black clay of the Ellenton is readily distinguished from the variegated clay of the Tusacloosa. The Ellenton grades into the overlying Huber Formation in two of the holes drilled for this study. The color of the sediments changes from the dark-gray to black sands and clays of the Ellenton to the red, tan, or mustard-yellow sands and clays of the overlying Huber Formation.

Siple (1967) tentatively assigned the Ellenton to the Late Cretaceous based on the similarity of the lithology and stratigraphic position with other formations of Late Cretaceous age in other parts of the Coastal Plain. Based on analysis of palynomorphs (N.O. Fredricksen, unpublished data, 1980) and planktonic foraminifera (P. Huddlestun, personal communication, 1982), the Ellenton Formation has been placed in the Paleocene in this study.

Huber Formation

The Huber Formation lies between the top of the Ellenton Formation and base of the overlying sands and limestone of middle Eocene age. The lithology of the Huber Formation is diverse, ranging from beds of multi-colored clays, high-purity and sandy kaolin, to thick, cross-bedded members of coarse, pebbly sand, and conglomerate composed of boulders of pisolitic kaolin (Buie, 1978). In the drill core the uppermost part of the Huber Formation shows signs of weathering and reduction.

A second transgression occurred in the late Paleocene (Rainwater, 1964; Cramer and Arden, 1980). The full landward extent of this transgression is unknown due to later Eocene erosion, but the thickness of the carbonate section in Georgia suggests that it was extensive (Cramer and Arden, 1980).

4.2.3.1.2 Eocene Epoch

Following a period of erosion during the early Eocene, the sea again transgressed over the Georgia Coastal Plain during the middle Eocene.

The bulk of the middle Eocene (49 to 45 m.y.B.P.) sediments are carbonates, with up to 10 percent chert and evaporite. Updip, all of the carbonate rocks become coarser and grade into calcareous sands, indicating a higher energy environment. Outcrops of the lower unit of middle Eocene sediments are sparse at the Fall Line because of overlap by the calcareous sand and limestone beds of the Lisbon Formation which effectively mask it. Marine overlap onto the Coastal Plain is evident and paleontological data indicate that the transgression was very slow (Cramer and Arden, 1980). Following the transgression of the Lisbon seas, regression again occurred and erosion of the middle Eocene rocks began.

Late Eocene (´5 to 38 m.y.B.P) deposition is represented by a relatively thin, uniform blanket of shelf limestone and calcareous sands. These rocks unconformably overlie rocks of middle Eocene age, but with only a small hiatus in time. The basal beds are part of the Utley Limestone Member which is sandy limestones. Northeastward along the Fall Line the fluctuating strandline of the Jackson-age sea is apparent in the intertonguing of carbonate and clastic formations. A period of regression is apparent, and rocks of late Eocene age overlain by upper Oligocene deposits. The Eocene series consists of the middle Eocene Lisbon Formation and upper Eocene Barnwell Group.

Lisbon Formation

The Lisbon Formation occurs between the top of the Huber Formation and an unconformity at the base of the Barnwell Group. In the study area, the Lisbon Formation is subdivided into three members: an unnamed basal sand and limestone Member, the Blue Bluff Member, and the McBean Limestone Member.

The basal member was present in the core holes drilled for this study. The lowermost portion consists of quartz sand which grades both up section and downdip into a calcareous sand. Overlying these sands is a limestone. These deposits were dated as middle Eocene and correlated with part of the Lisbon Formation based on examination of foraminifera from hole VG-8 (Huddlestun, personal communication, 1982). The Blue Bluff Member is a greenish- to bluish-gray, moderately hard calcareous siltstone or marl. In the core holes the marl is thinly interbedded to laminated, with isolated limestone nodules and shell fragments. Examination of foraminifera by Paul Huddlestun (personal communication,

1982) from holes VG-6 and VG-8 have verified the marl to be middle Eocene age, Lisbon Formation. Updip, the McBean Limestone Member is composed of soft, gray limestone and calcareous sand. Downdip the Blue Bluff Member interfingers with an unnamed gray calcareous sand and fossiliferous limestone.

Barnwell Group

In the study area deposits of late Eocene age include the Barnwell Group. This group consists of the Clinchfield Formation which contains the Utley Limestone Member; the Dry Branch Formation which contains the Irwinton Sand, Griffins Landing, and Twiggs Clay Members; and the Tobacco Road Sand. Downdip the Barnwell Group grades into the carbonate facies of the Ocmulgee, Crystal River, and Williston Formations of the Ocala Group.

Clinchfield Formation

The Utley Limestone Member of the Clinchfield Formation is typically a sandy, glauconitic, slightly argillaceous, and locally cavernous limestone of varying degrees of induration (Huddlestun and Hetrick, 1979). The Utley Limestone is locally discontinuous in Burke County.

Dry Branch Formation

Huddlestun and Hetrick (1979) raised the Dry Branch to formational rank and defined three distinct but interfingering lithofacies: a montmorillonite clay (Twiggs Clay); a distinctly bedded sand (Irwinton Sand); and an indistinctly to massively bedded, calcareous, fossiliferous sand (Griffins Landing).

The Twiggs Clay is a pale greenish, olive green, bluish-gray, dark gray, or locally, almost black, silty clay with hackly, blocky, subconchoidal to conchoidal fracture. As shown in Figure 4-3, Twiggs Clay interbeds occur in both the Irwinton Sand and Griffins Landing Members of the Dry Branch Formation (Huddlestun and Hetrick, 1979; Huddlestun, personal communication, 1982). The Irwinton Sand consists of fine- to medium-grained, well sorted, deeply weathered, almost pure quartz sand that shows well developed horizontal and local cross-bedding in outcrop. In core holes, the Irwinton Sand was difficult to recover owing to the lack of silt and clay in the matrix. Downdip, the Irwinton Sand interfingers with the Griffins Landing Member, a fairly well sorted, massive to indistinctly bedded calcareous sand. The unit often contains lenses of Twiggs Clay associated with oyster shell (Crassostrea gigantissima) beds. In the drill core, the Griffins Landing generally consists of oyster shell sands and clay overlain by massive calcareous sand. Downdip, the Griffins Landing grades into the Williston Formation, a non-fossiliferous, sandy equigranular limestone (Huddlestun, personal communication, 1982).

Tobacco Road Sand

The uppermost formation within the Barnwell Group is the Tobacco Road Sand, which is predominately a quartz sand. The sand in the Tobacco Road varies from fine-grained and well-sorted to very coarse-grained, granular, pebbly and poorly sorted. The Tobacco Road is characteristically massively bedded and bioturbated although locally

the formation may be thinly and distinctly bedded, even laminated (Huddlestun and Hetrick, 1978; 1979). The core and split spoon samples did not show these bedding features, but did show significant evidence of plant and animal life. The Tobacco Road Sand in Screven County grades into the Ocmulgee Formation, which includes: 1) foraminiferal marl; 2) fossiliferous, granular limestone; 3) clay. Further downdip, the Ocmulgee grades into the Crystal River Formation, a coarse bryozoa-rich limestone (Huddlestun, personal communication, 1982).

4.2.3.1.3 Oligocene Epoch

At least two transgression/regression cycles occurred during the Oligocene. Only the upper Oligocene (32 to 25 m.y.B.P.) transgression deposited material in the study area. The full extent of this overlap (Suwannee) is not known, since an undetermined quantity of updip rocks have been removed by erosion. Facies patterns indicate that the overlap was probably extensive. The remaining Suwannee rocks are shelf deposits, with none of the updip clastic facies preserved.

Suwannee Limestone

In the downdip portion of the study area the Suwannee Limestone rests unconformably upon the Ocala Group. The basal part of the Suwannee consists of sandy limestone that is sparingly fossiliferous. Above this is a layer of predominantly cream-colored, relatively soft, somewhat chalky, fossiliferous limestone. The upper part is a light

gray to cream color, dense, nodular, cherty, and somewhat sandy limestone (Cramer and Arden, 1980). These limestones occur downdip from the core holes drilled for this study.

4.2.3.1.4 Miocene Epoch

The rocks of Miocene age appear to be a sequence of predominantly clastic rocks deposited during and following the regression of the coast line. Considerable post-Miocene erosion took place before the return of the sea during Pleistocene time. In some places (Vogtle site included) erosion continued from the Miocene to the present. The erosion has altered the original sedimentary patterns, making changes in lithofacies difficult to interpret particularly since some of these sediments include terrigenous deposits of deltaic or possibly fluviatile origin.

Hawthorn Formation

The Hawthorn (Altamaha) Formation is the youngest Tertiary formation in the study area. It has been assigned an earliest Miocene (25 to 23 m.y.B.P.) age (Huddlestun, personal communication, 1982). Hawthorn sediments include poorly sorted clayey sands and gravels, containing cross-bedded stringers of limonite-goethite pebbles. These sediments were mapped during this study and are discussed in Section 6.1. The base of the Hawthorn sediments is generally above 200 feet elevation in the area of the core holes. Therefore, few borings penetrated these sediments.

4.2.3.2 Quaternary Period

Geomorphic evidence indicates that uplift and subsidence of the Coastal Plain of Georgia and surrounding states continued through at least the Pleistocene (Winker and Howard, 1977). Sediments have accumulated and related geomorphic features such as erosional scarps and terraces have developed.

Alluvial deposits consisting of coarse gravel and poorly sorted sand occur irregularly and discontinously in the tributaries and main channels of the Savannah River.

4.3 Structure

4.3.1 Tectonic Framework of the Georgia Coastal Plain

4.3.1.1 General

The crystalline basement underlying the Georgia Coastal Plain dips toward the southeast at approximately 30-40 feet per mile. This regional dip is interrupted by several local structures. Most of the knowledge of the basement rocks comes from geophysical work, as few wells of sufficient depth to encounter the basement have been drilled in this area.

4.3.1.2 Triassic Features

The Dunbarton Basin is one of several elongated basins filled with Triassic (and in some other cases, Jurassic) sediments, found buried beneath the Cretaceous and Cenozoic age sediments of the Georgia Coastal Plain.

The most probable origin of the Dunbarton Basin is the formation of a graben by normal faulting. Evidence has been presented for a northwest border fault of unknown displacement, and faulting has been hypothesized for the southeastern margin (Marine, 1976a, 1976b). Substantial evidence for a southeastern border fault is lacking, however, and the nature and extent of this margin of the Dunbarton Basin is derived from gravity and aeromagnetic surveys (Marine and Siple, 1974; Marine, 1976b). The basin is oriented northeast-southwest, and is about 31 miles long and six miles wide (Figure 4-6) based on an aeromagnetic survey.

The floor of the basin has been penetrated near the northwest basin margin by one well (DRB 9, Figure 4-6) which encountered an augen gneiss basement. This well penetrated 1,593 feet of Triassic rocks (Marine and Siple, 1974) beneath the Cretaceous before encountering basement rocks.

Recent geophysical studies (including aeromagnetic, gravity and seismic reflection) have indicated possible faulting within the Dunbarton Basin and in the underlying crystalline basement (Marine, 1976b; Dames and Moore, 1980). The data obtained in these studies suggests that the

basin is composed of a series of blocks separated by steeply dipping (80°-90°) faults, none of which can be traced into the Cretaceous sediments. An attempt to verify displacement along one of the more prominent of these intrabasinal faults was made and yielded inconclusive results (Marine, 1976b). Two holes, 690 feet apart and on different sides of the geophysically located trace, were drilled. No fault offset of the Triassic-Cretaceous erosional contact was observed. An attempt to core through one of these steeply dipping intrabasinal faults in the Triassic by directional drilling was also inconclusive. Therefore, although minor faulting may have occurred within the Dunbarton Basin, the prominent intrabasinal fault indicated by aeromagnetic and gravity data was not verified by drilling.

Available data indicate that from the northwestern border, the bottom of the Dunbarton Basin deepens to approximately 6,500 feet below the ground surface (about two miles southeast of DRB 10). The basin then decreases in depth to the southeast to approximately 4,200 feet near the southeastern boundary of the Savannah River Plant. Thus the bottom of the basin then appears to vary from 3,000 to 6,000 feet below the land surface southeast of the Savannah River Plant. Because of stratigraphic thickness and the nature of the truncation as shown on the gravity and magnetic data, faulting is a likely explanation for the southeastern boundary of the Dunbarton Basin.

4.3.1.3 Cretaceous and Cenozoic Features

The dominant structural features of the Georgia Coastal Plain are two large sedimentary basins separated by a structural high (Figure 4-2).

These features may be part of a larger system of southeast-northwest oriented structures in the eastern United States (Murray, 1961; Cramer, 1969).

The Southeast Georgia Embayment (Toulmin, 1955) includes an area of downwarping and sediment thickening which formed during Cretaceous and Cenozoic time (Cramer, 1969; Cramer and Arden, 1980). This feature has also been called the Okefenokee Embayment (Pressler, 1947), the Atlantic Embayment of Georgia (Herrick and Vorhis, 1963).

A second sedimentary basin, the Appalachicola Embayment, is an area of thickened Tertiary sediments extending into the southwest corner of Georgia. This feature has also been called the Southwest Georgia Basin (LeGrand, 1961; Murray, 1961).

Between these two embayments is a positive feature called the Central Georgia Uplift (Pressler, 1947), which is defined as a southeast-northwest striking upwarped feature between the two flanking downwarped areas. The southern extension of the Central Georgia Uplift is the Peninsular Arch (Applin, 1951) which also forms the spine of Florida.

4.3.1.4 Minor Framework Features

The Yamacraw Ridge is a basement feature trending parallel to the Georgia and South Carolina coastlines. It was first identified seismically and was later substantiated by a drill hole (Cramer and

Arden, 1980). Maps by Herrick and Vorhis (1963) show that this feature may have had some influence on Jpper Cretaceous sedimentation (Cramer, 1969).

4.3.2 Folding

Several small undulations appear within the confines of the Appalachicola Embayment. Most have been recognized from subsurface data, although a few are expressed as surface features. The folding in southwestern Georgia appears to be of Tertiary age, and some folding may have occurred as late as Miocene (Sever, 1966; Cramer, 1969).

4.3.3 Faulting

Faults with minor displacement of Cretaceous and Cenozoic deposits are present in the southeastern United States (York and Oliver, 1976). The geology of the southeastern Atlantic Coastal Plain, however, is such that faulting is not easily recognized. Poor exposure and subtle stratigraphic variations require that a detailed search for surface expression of these structures be made (Wentworth and Mergner-Keefer, 1981; 1982a; 1982b). Recent detailed work, for example, has indicated that northeast-trending faults with Late Cretaceous and Cenozoic reverse displacements do exist in the Atlantic Coastal Plain and Piedmont (Mixon and Newell, 1977; Prowell and O'Connor, 1978; Behrendt and others, 1981). Wentworth and Mergner-Keefer (1982b) propose that many of these faults may be reactivated Mesozoic and older high-angle normal faults.

4.3.3.1 Belair Fault Zone

The Belair fault zone is a structural feature extending along the inner margin of the Atlantic Coastal Plain (Figure 4-7). This fault is located a few miles west of Augusta and about 29 miles northwest of the Vogtle site. It is thought to extend at least 15 miles from Fort Gordon Military Reservation on the southwest, to a quarry just west of the Savannah River on the northeast (O'Connor and Prowell, 1976b; Prowell and others, 1976; Prowell and O'Connor, 1978).

The Belair fault zone has been shown to consist of at least eight en echelon reverse faults trending from N23°E to N50°E and dipping 50° to the southeast (Prowell and O'Connor, 1978). The fault zone juxtaposes crystalline phyllite of the Little River Series of late Precambrian or Cambrian age against Coastal Plain kaolinitic sands and gravels, which are formally correlated with the Upper Cretaceous Tuscaloosa Formation (Prowell and others, 1976). Individual fault segments are from one to three miles in length, with gouge zones only a few feet wide at most. According to Prowell and others (1976) the basal Tuscaloosa unconformity is vertically displaced from 15 to 100 feet. The most recent documentable movement along the Belair fault zone occurred about 40 million years ago (Wentworth and Mergner-Keefer, 1981; 1982b).

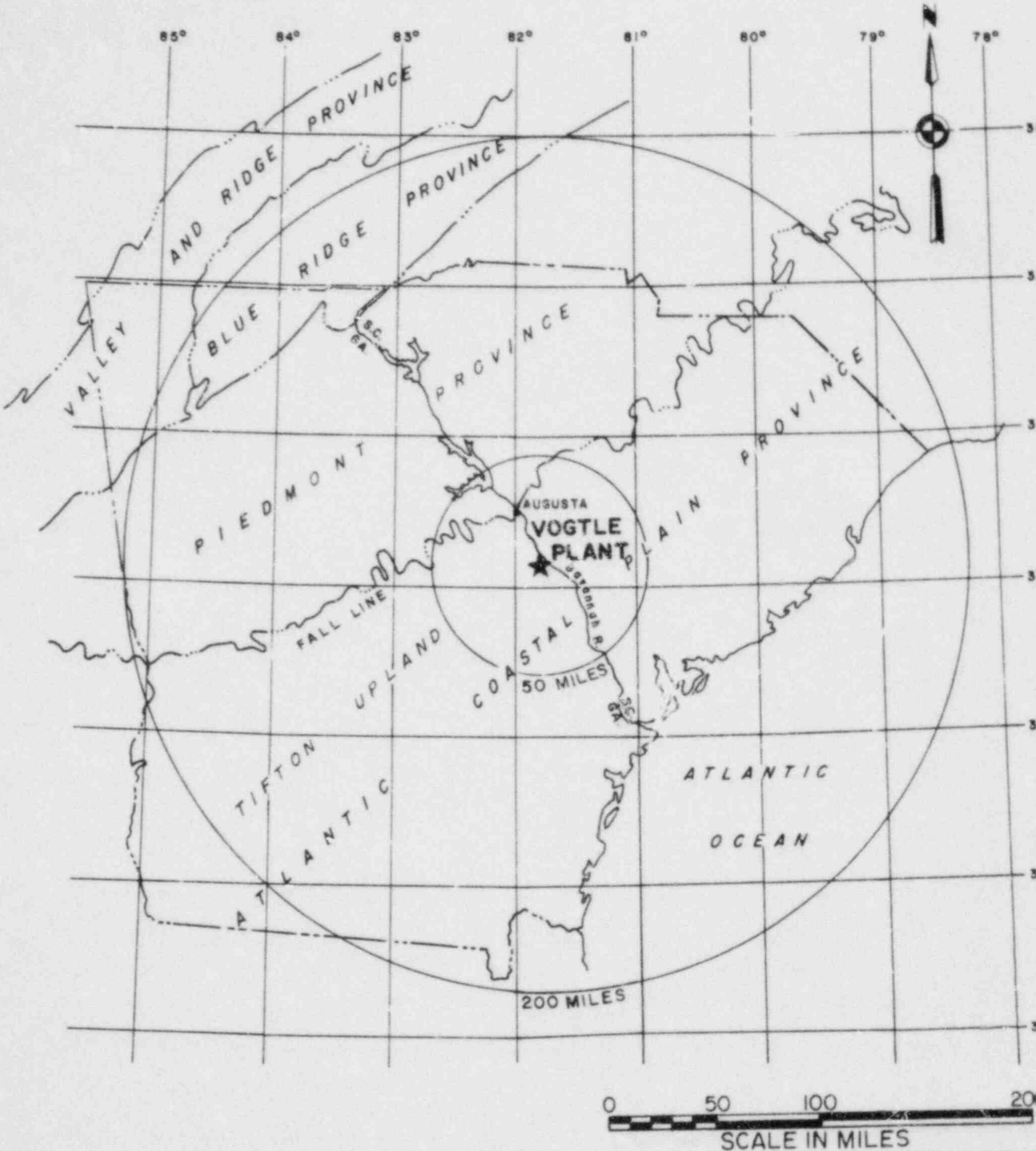
4.3.3.2 Gulf Trough

Much controversy surrounds the structure and origin of the Gulf Trough of Georgia (Figure 4-7). Herrick and Vorhis (1963) identified the Gulf Trough within the Appalachicola Embayment from isopach and structure

contour maps prepared from subsurface data. The structure is linear and more sharply defined than the surrounding folds, and for these reasons Cramer (1969) concludes that the trough was formed by faulting. In an earlier work, Callahan (1964) interpreted this feature as two parallel, down-to-the-southeast faults. Cramer and Arden (1980) also suggested evidence for faulting within the trough.

Bechtel Corporation (1978) studied the Gulf Trough using both field reconnaissance and well log data. The studies concluded that well log data are compatible with the proposed graben structure of Cramer (1969) southwest of Coffee County, but the structure could not be projected north-eastward to the Savannah River. If the Gulf Trough is due to faulting, the available data indicate that this movement would have to have occured prior to the beginning of the Miocene (Bechtel Corporation, 1978; Gelbaum and Howell, 1982). The evidence suggests that other geologic phenomena, such as erosion, local variations in regional tilt, local subsidence or warping can also explain the trough (Becht l Corporation, 1978).

The origin of the Gulf Trough is not clear. Various authors have suggested possible mechanisms for its formation (Herrick and Vorhis, 1963; Cramer, 1969; 1978; Patterson and Herrick, 1971). Patterson and Herrick (1971) have reviewed the proposals which include: 1) normal faulting producing a graben; 2) down-warping forming a syncline; and 3) a Tertiary marine strait or valley. Data from well log analyses by Bechtel Corporation (1978) do not favor any one of these proposed origins over the other but are compatible with all three.



Source: After Bechtel Corporation, 1973.

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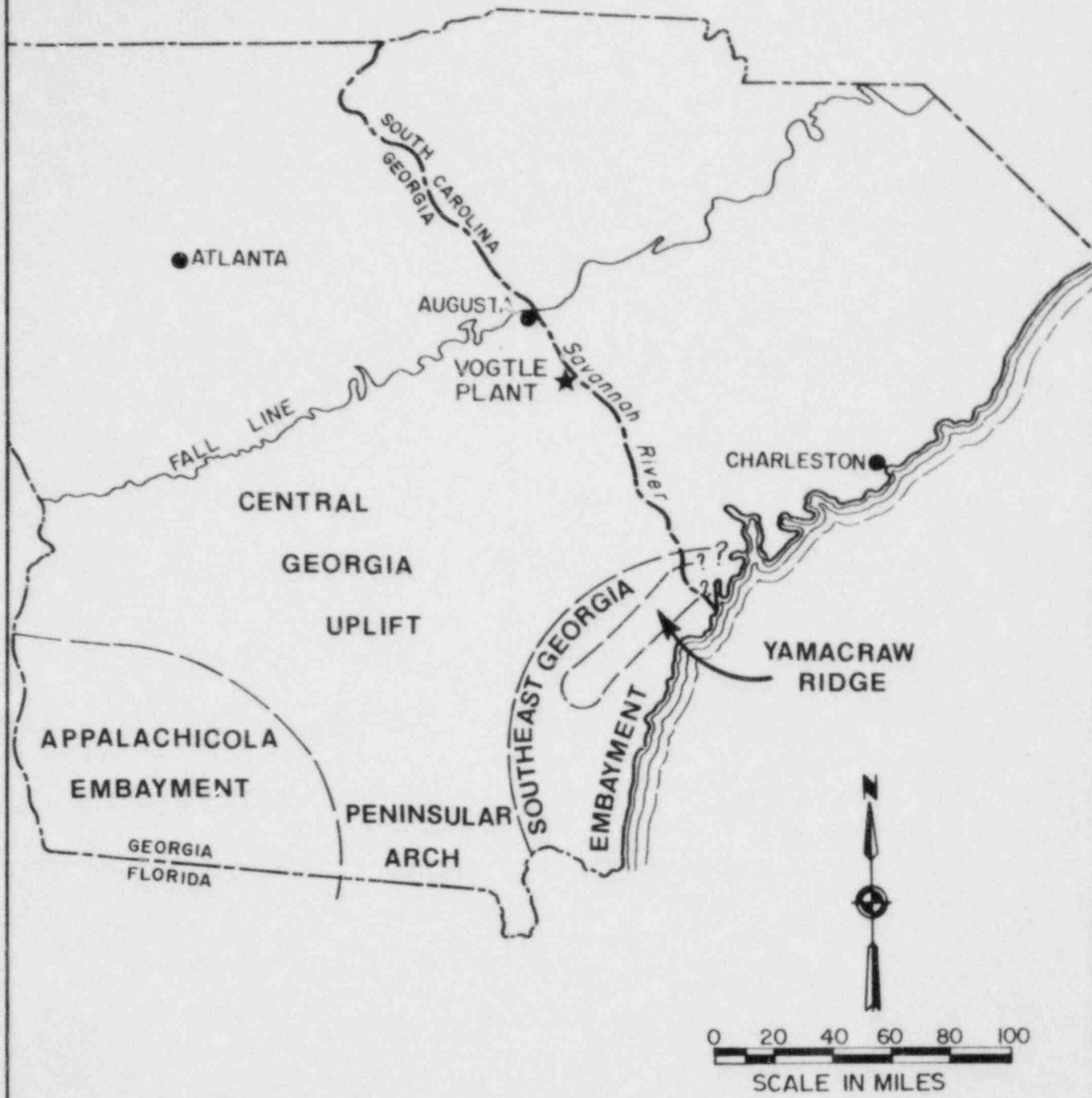
POSTULATED MILLETT FAULT

GENERALIZED REGIONAL
PHYSIOGRAPHIC MAP

FIGURE 4-1



SOURCE: After Cramer and Arden, 1980

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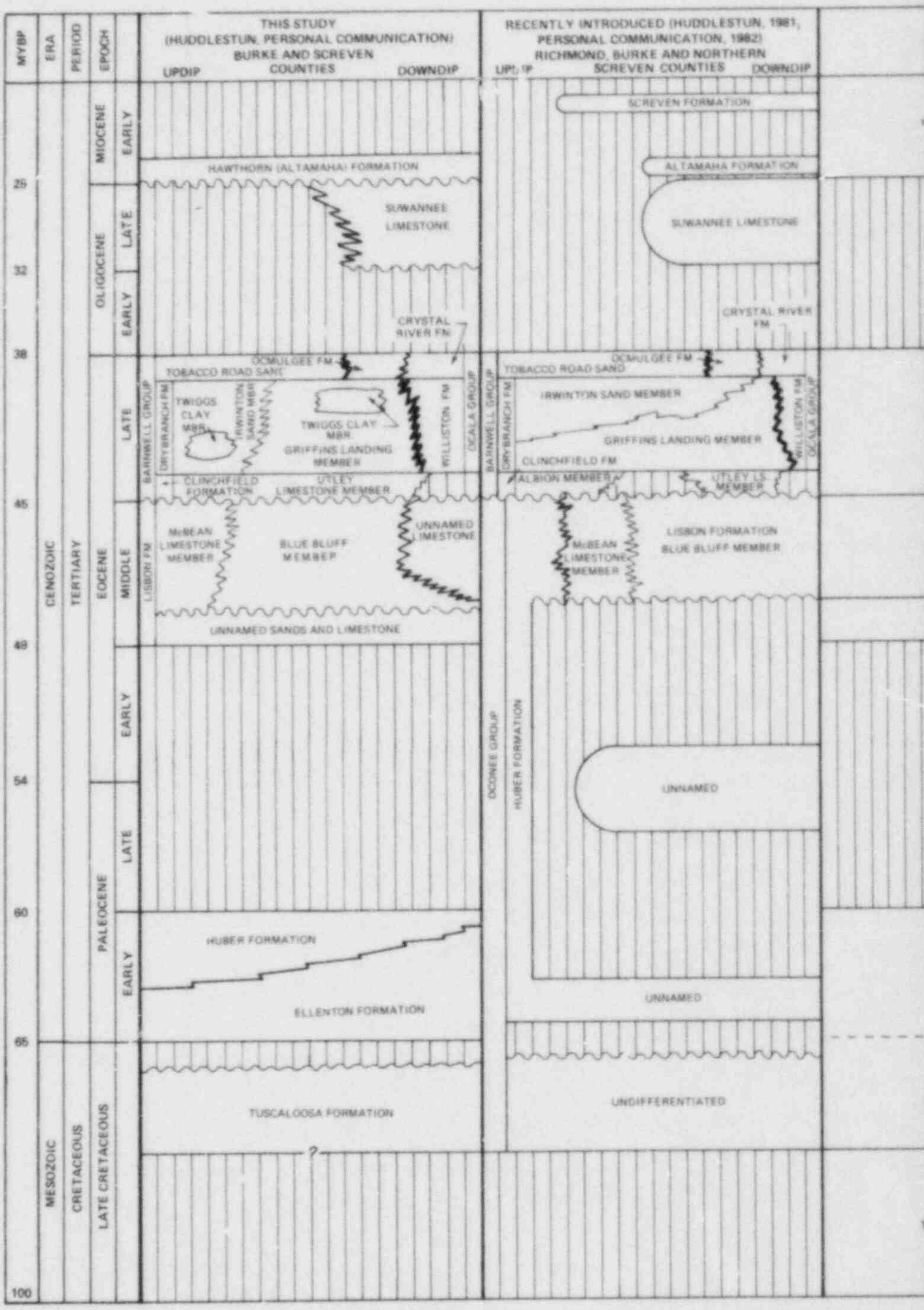
POSTULATED MILLETT FAULT

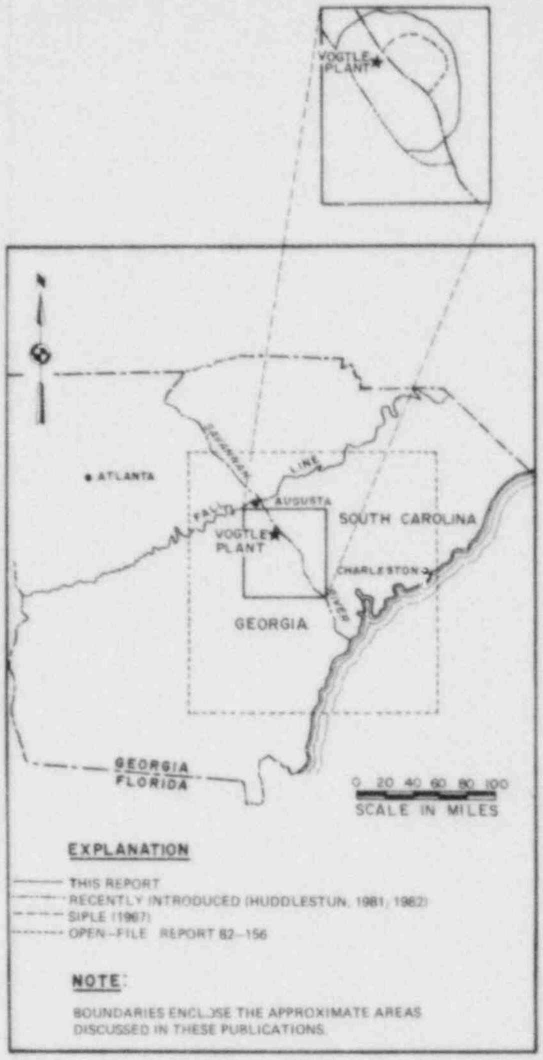
BASEMENT FEATURES
GEORGIA COASTAL PLAIN

FIGURE 4-2



TIME SCALE AFTER HAZEL AND OTHERS, 1977; HUDDLESTUN, 1981

...TER SIPLE (1967)	OPEN-FILE REPORT 82-156: SAVANNAH RIVER AREA, GEORGIA AND SOUTH CAROLINA	OPEN-FILE REPORT 82-156: LITHOLOGIC UNIT	OPEN-FILE REPORT 82-156: AQUIFER CONFINING UNIT
...THORN FORMATION			
...ARNWELL FORMATION	BARNWELL FORMATION	E_6 E_5	
McBEAN FORMATION	McBEAN FORMATION	E_2, E_3, E_4	
...NGAREE FORMATION	HUBER FORMATION ?	E_1	
	?		
	BLACK MINGO FORMATION	P_2	A_2
?	ELLENTON FORMATION	P_1	C_1
?	?		
...LENTON FORMATION	BLACK CREEK (?) FORMATION	UK_3	A_1
	?		
	MIDDENDORF FORMATION	UK_2 , UK_1	
...CALOOSA FORMATION	?		



EXPLANATION

- UNCONFORMITY
- AGE OF FORMATION IN QUESTION AT TIME OF REPORT
- ACTUAL AGE OF BOUNDARY IN QUESTION
- EROSION OR NON-DEPOSITION
- CONTACT BETWEEN MEMBERS
- CONTACT BETWEEN FORMATIONS
- CONTACT BETWEEN GROUPS

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STRATIGRAPHIC CORRELATION CHART

FIGURE 4-3

ERA	SYSTEM	SERIES	AGE	UNIT	DESCRIPTI
CENOZOIC	QUATER-NARY	PLEIS. & RECENT		ALLUVIUM	ALLUVIAL FILL AND TERRACE DEPOS CONSISTING OF TAN TO GRAY SAND
	TERTIARY	MIOCENE	EARLY	HAWTHORN (ALTAMAHA) FORMATION	POORLY SORTED CLAYEY SAND AND PURPLE IN COLOR. CONTAINS SOME C LIMONITE-GOETHITE PEBBLES.
		OLIGOCENE	LATE	SUWANNEE LIMESTONE	LIGHT-GRAY TO CREAM COLOR, FOSS LAYER IS SANDY.
		EOCENE	LATE	TOBACCO ROAD SAND; OCMULGEE FM; CRYSTAL RIVER FM BARNWELL GROUP: DRY BRANCH FM. (IRWINTON SAND MBR.; TWIGGS CLAY MBR.; GRIFFINS LANDING MEMBER; TWIGGS CLAY MBR.) OCALA GROUP: WILLISTON FM. CLINCHFIELD FM. (UTLEY LIMESTONE MBR.	TOBACCO ROAD SAND: FINE-GRAINED COARSE AND POORLY-SORTED SAND, OCMULGEE FM: FORAMINIFERAL MA CRYSTAL RIVER FM: COARSE, FOSSIL IRWINTON SAND MBR: FINE-TO MEDIU GRIFFINS LANDING MBR: WELL-SORTE TWIGGS CLAY MBR: GREENISH, BLUIS WILLISTON FM: NON-FOSSILIFEROUS UTLEY LIMESTONE MBR: SANDY, GLA LIMESTONE.
			MIDDLE	LISBON FM.: McBEAN LIMESTONE MEMBER; BLUE BLUFF MEMBER; UNNAMED LIMESTONE UNNAMED SANDS AND LIMESTONE	BLUE BLUFF MBR: GREENISH TO BLU McBEAN LIMESTONE MBR: SOFT, GRA SOME SHELL FRAGMENTS UNNAMED LIMESTONE: GRAY, FOSSI UNNAMED SAND AND LIMESTONE: Q SAND AND FOSSILIFEROUS LIMESTON
		PALEOCENE	EARLY	HUBER FORMATION ELLENTON FORMATION	HUBER FM: MULTI-COLORED CLAY, C KAOLIN TO COARSE BEDDED SAND. ELLENTON FM: DARK-GRAY TO BLAC CLAY, MEDIUM-TO DARK-GRAY COAR
MESOZOIC	CRETACEOUS	LATE		TUSCALOOSA FORMATION	TAN, BUFF, LIGHT-GRAY AND WHI QUARTZITE AND ARKOSIC SAND AN RED, BROWN AND PURPLE CLAY AND
	TRIASSIC	LATE		NEWARK (?) SUPERGROUP	GRAY, DARK-BROWN AND BRICK-RED CLAYSTONE WITH SECTIONS OF CON GLOMERATE.
PRECAMBRIAN & PALEOZOIC				BASEMENT ROCK OF THE KIOKEE BELT AND BELAIR BELT	GRANITE, GNEISS, PHYLLITE AND GR

AFTER SIPLE, 1967; BUIE, 1978; HATCHER, 1978; HUDDLESTUN AND HETRICK, 1978, 1979; HUDDLESTUN, PERS

...N
...TS IN STREAM VALLEYS; ...LAY, SILT AND GRAVEL.
...RAVEL; TAN, RED AND ...ROSS-BEDDED STRINGERS OF
...LIFEROUS LIMESTONE. BASAL
...AND WELL-SORTED TO ...RL AND LIMESTONE. ...FEROUS LIMESTONE. ...M-GRAINED QUARTZ SAND. ...D CALCAREOUS SAND. ...H GRAY, SILTY SAND. ...ANDY LIMESTONE. ...UCONITIC, FOSSILIFEROUS
...SH-GRAY MARL. ...Y, SANDY LIMESTONE WITH ...LIFEROUS LIMESTONE. ...ARTZ SAND, CALCAREOUS ...E.
...ONTAINS BEDS OF SANDY
...K SANDY LIGNITIC MICACEOUS ...SE SAND.
...E CROSS-BEDDED MICACEOUS ... GRAVEL, INTERBEDDED WITH ...HITE KAOLIN.
...SANDSTONE, SILTSTONE AND ...LOMERATE AND FAN-
...ENSTONE.

...NAL COMMUNICATION, 1982.

NOTE: FORMATION AGES ARE GIVEN ON FIGURE 4-3 AND IN TEXT.

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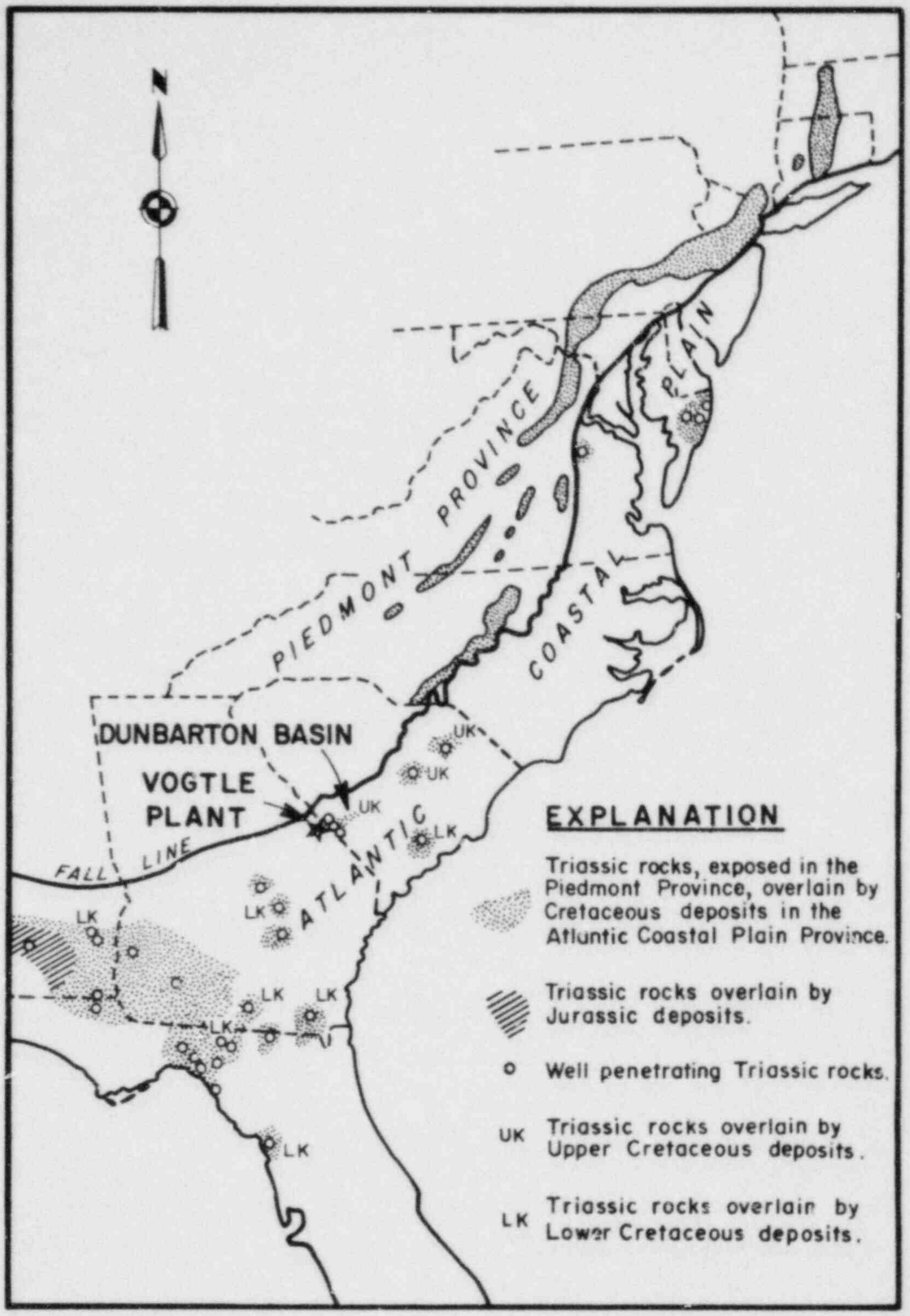
LITHOLOGIC CHART

FIGURE 4-4



Source: After Marine and Siple, 1974

0 50 100 150
SCALE IN MILES

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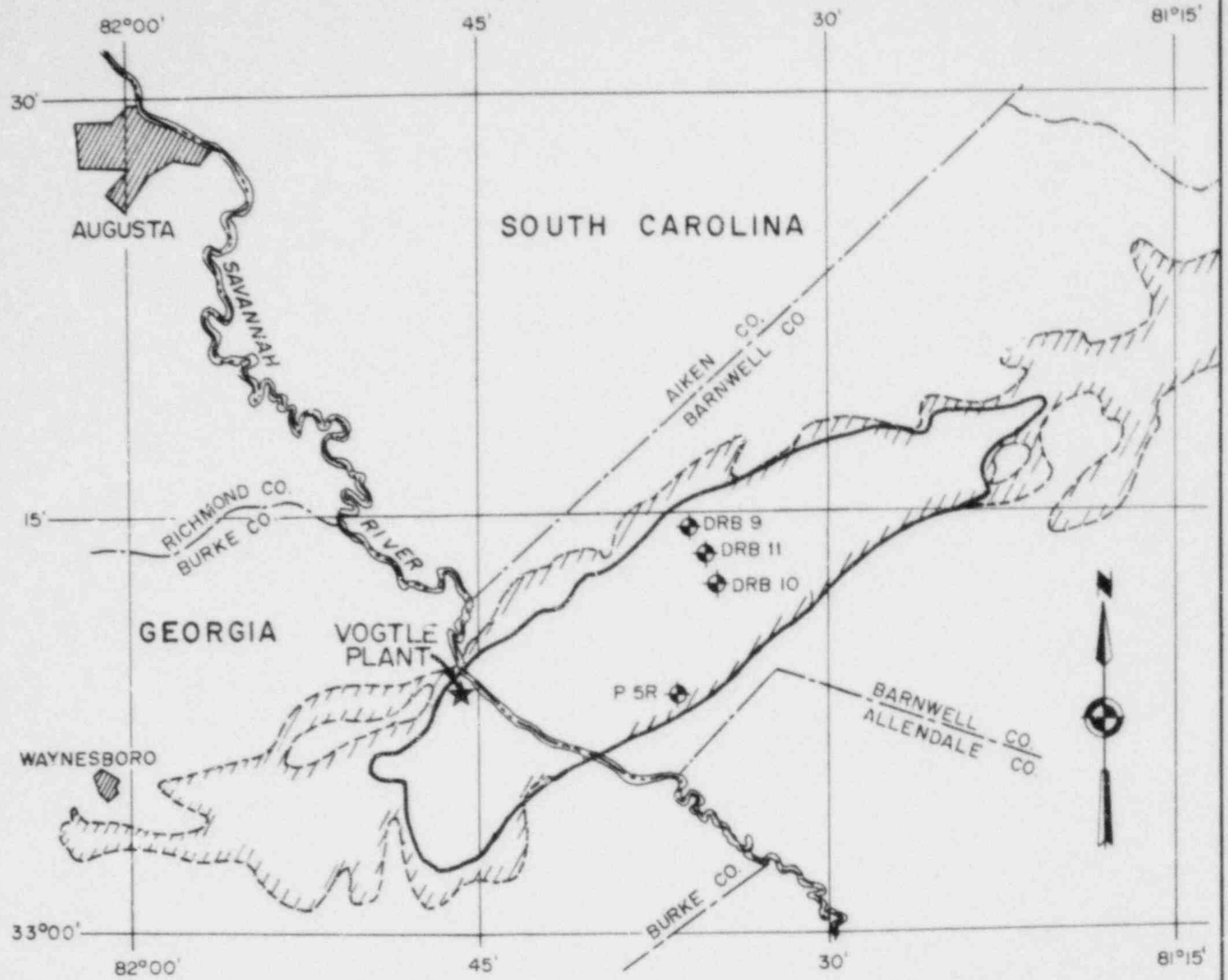
TRIASSIC ROCKS ALONG THE EASTERN SEABOARD

FIGURE 4-5



0 2 4 6 8

SCALE IN MILES

EXPLANATION

Boundary of Triassic basin inferred from aeromagnetic anomalies (Petty and others, 1965).

Boundary of Triassic basin as interpreted from seismic and aeromagnetic data (Marine and Siple, 1974; Petty and others, 1965; Siple, 1967).

DRB 9 — Deep rock boring penetrating Triassic rock.

REFERENCES:

1. Marine, I. W., and Siple, G.E., 1974, Buried Triassic basin in the central Savannah River area, South Carolina and Georgia: GSA Bull. v. 85, p. 311-320.
2. Petty, A.J. and others, 1965, Aeromagnetic map of Savannah River Plant, South Carolina and Georgia: USGS Geophys. Inv. Map GP-489.
3. Siple, G.E., 1967, Geology and ground water of the Savannah River Plant and vicinity, South Carolina USGS Water-Supply Paper 1841, 113 p.
4. Bechtel Corp; 1973, PSAR, v.I, Alvin W. Vogtle Nuclear Plant: Unpublished report.

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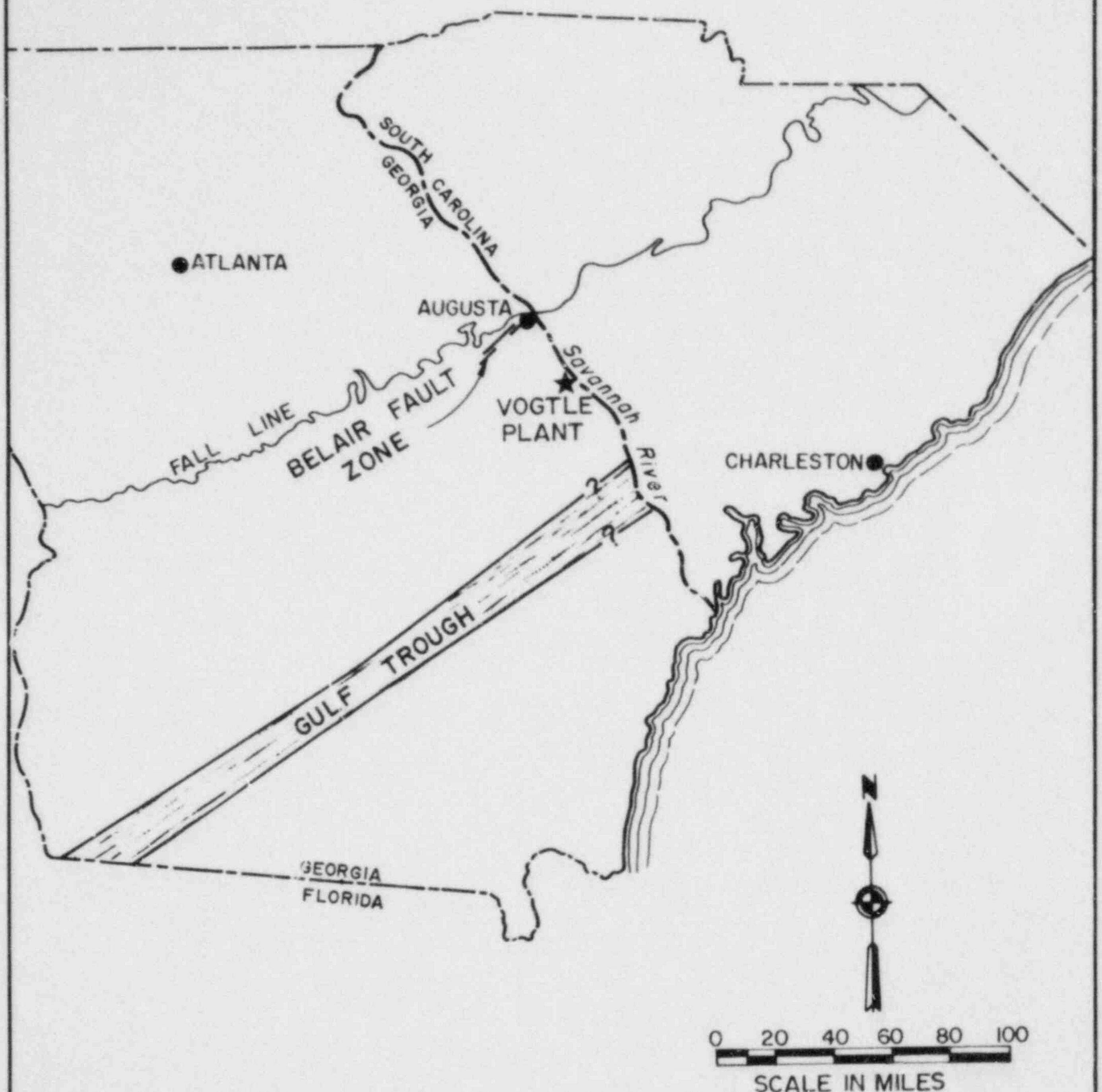
BOUNDARIES OF THE TRIASSIC DUNBARTON BASIN

FIGURE 4-6



SOURCE: Cramer, 1969; Bechtel Corp., 1978; Prowell and O'Connor, 1978; Cramer and Arden, 1980;

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VOGTLE ELECTRIC GENERATING PLANT
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APPROXIMATE LOCATIONS OF BELAIR FAULT ZONE AND GULF TROUGH

FIGURE 4-7

5.0 HYDROGEOLOGY

5.1 Occurrence and Movement of Ground Water in the Coastal Plain

The alternating beds of sand, clay, marl and limestone that underlie the Coastal Plain of South Carolina and Georgia comprise a complex sequence of aquifers and confining layers that dip to the southeast only slightly more than the regional ground surface. Water enters the permeable sands and limestones principally by direct infiltration of precipitation in their outcrop areas, and migrates downdip. The interbedded clays and marls, being nearly impermeable, confine the water within the aquifers, leading to artesian conditions. Recharge to the aquifers can also occur from small streams crossing their outcrop areas, but most streams, including the Savannah River, receive ground water discharge in the aquifer outcrop areas. Much of the recharge from water infiltrating the outcrops on the ridges between streams is discharged to the adjacent streams.

Because of the facies changes and discontinuity of interbeds that characterize the geologic units underlying the region, aquifer characteristics and interconnection between aquifers vary considerably from place to place. The sedimentary complex can be grouped into two aquifer systems that, at least in the area of confinement, are separated by the relatively impermeable Ellenton and Huber Formations. The systems are most conveniently identified by the geologic age of the

rocks comprising each system: the Tertiary and the Cretaceous, equivalent to the A_2 and upper part of the A_1 systems designated in the Open-File Report. They both extend over a much larger area than is discussed in the present report, and are commonly identified by local aquifer names.

5.1.1 Tertiary System

Underlying the southeastern United States is a limestone aquifer system of Tertiary age that is referred to as the Floridan aquifer in Florida and as the principal artesian aquifer in Georgia, Alabama and South Carolina. It is the primary source of municipal, industrial and agricultural water supply on the coastal plain of Georgia (Krause and Hayes, 1981). Within Georgia and South Carolina, the aquifer system includes the sequence of carbonate rocks (and associated interbedded sands) of Eocene and Oligocene age shown on Figures 4-3 and 4-4. From these charts it can be seen that within a single stratigraphic time horizon, facies changes downdip can result in a confining layer becoming an aquifer. For example, in the study area, the Tertiary aquifer is comprised of unnamed sands and limestone of the Lisbon Formation that underlie the Blue Bluff marl. However, downdip, the Blue Bluff interfingers with a permeable limestone that becomes part of the Tertiary aquifer system, and younger beds form the confining layer.

5.1.2 Cretaceous System

Beneath the Tertiary aquifer system is the equally extensive Cretaceous system. It is a thicker and more transmissive aquifer than the

Tertiary system, but is only minimally developed for water production. Only in and near outcrop areas, where the aquifer is relatively shallow, do many wells penetrate this aquifer. Downdip, the Cretaceous aquifer is too deep and few wells extend below the Tertiary system.

The Cretaceous system is made up primarily of Tuscaloosa Formation (or equivalent) sands and gravels, and is separated from the Tertiary system by extensive Paleocene carbonaceous clays of the Huber and Ellenton Formations. These clays appear to be an effective confining layer, providing hydraulic separation of the two aquifer systems where the clays are present. These clays tend to pinch out updip, toward the outcrop or recharge areas of the aquifers. In those areas water is relatively free to move from one aquifer system to another.

As in the Tertiary aquifer, interbedded silts and clays tend to separate the Cretaceous into aquifer zones. However, the Cretaceous stratigraphy is not as well defined and lithologic members have not been mapped.

5.2 Local Aquifer Conditions

The aquifer systems of the coastal plain are present within the study area under water table conditions in outcrop areas, and under confined conditions where younger, less permeable beds overlie them. The outcrop areas are principal sources of recharge. The high permeability, thickness and extent of the outcrops indicate a high

potential for acceptance of recharge, and the average precipitation in the area, in excess of 40 inches per year, is a large source of recharge. However, because the water levels in the aquifers are high, part of the recharge is rejected as discharge to streams that have incised the outcrops. The principal stream of the area, the Savannah River, has incised most deeply into the aquifers, from the Fall Line, north of Augusta, to more than 50 miles downstream. The average amount of ground water discharging to the Savannah River in the outcrop area of the Cretaceous aquifer (rejected recharge) has been estimated to be about 170 mgd (Siple, 1960). From the Tertiary aquifer, similar drainage of rejected recharge is also occurring, but in smaller amounts. Both aquifers also discharge to the tributary streams crossing the outcrops.

Downdip of the outcrop areas, the Tertiary aquifer system is overlain by younger beds of the Lisbon Formation and the Barnwell Group, and it becomes hydraulically separated from the Cretaceous aquifer by the carbonaceous clay facies of the Ellenton and Huber Formations. These finer grained geologic units act as confining layers of the two aquifer systems throughout the southern portion of the study area.

It is difficult to assess the hydrologic interrelationships of the several aquifer zones of the Tertiary system found in the study area. Potentiometric levels differ from one zone to another, although the zones are hydraulically interconnected. Domestic wells extract water

from the thin, but permeable Utley limestone, as well as from overlying sands of the Dry Branch Formation. However, when larger yields are desired, wells are drilled into the more permeable and thick, but unnamed, sands and limestones underlying the Blue Bluff marl. All of these units are part of the Tertiary system, and are interconnected, at least indirectly, updip in the recharge area and downdip through the limestone that is the age-equivalent of the Blue Bluff marl. Because of these hydraulic complexities, investigation of the Tertiary aquifer system has been limited, in the confined area of the aquifer, to studying the hydrologic regime of the unnamed sands and limestones underlying the Blue Bluff marl. They are referred to herein as the upper aquifer which is approximately equivalent to the A_2 aquifer of the Open-File Report (Figures 4-3 and 4-4). In the unconfined, or recharge area, it is unnecessary to distinguish between zones.

Vertical differences in potentiometric levels are also present within the Cretaceous aquifer system. This is well illustrated in the data collected by this study and is discussed in Section 7.8.1. Again, in order to minimize the variables in the hydrologic analyses, ground water data of the Cretaceous system, referred to as the lower aquifer, were restricted to wells open only to the uppermost part of the Tuscaloosa Formation in areas where it is confined. This is only partially equivalent to the A_1 aquifer of the Open-File Report, which includes all of the Tuscaloosa Formation as used in this report.

6.0 FIELD EXPLORATION METHODS

This chapter presents discussions of the field exploration methods used in the study. Results of each field task are described in Chapter Eight.

6.1 Geologic Mapping and River Meander Analysis

6.1.1 Geologic Mapping

Geologic field mapping was carried out to examine the exposed geologic units in the area of the postulated Millett fault to determine a correlatable stratigraphy, to map geologic structures that might be found, and specifically to search for any surface evidence of the postulated Millett fault. The mapping supplemented previous work for the Vogtle plant, work by Siple (1967) on the Savannah River Project and a field trip guidebook of Huddlestun and Hetrick (1979). Reconnaissance mapping for this study covered approximately 500 square miles (see Figure 6-1) in a northeast-southwest trending zone that extends from five to ten miles on either side of the postulated fault. Due to the flat-lying nature of the formations and the lack of topographic relief, relatively few formations are exposed. It was found that roadcuts, ravines and the bluffs along the Savannah River contained the best exposures. The bluffs adjacent to the postulated fault were examined in detail.

The uppermost bedrock unit, the Hawthorn (Altamaha) Formation, is primarily fine-grained sand with lesser medium- to coarse-grained sand and gravel. The underlying Barnwell Group is dominantly loose to very poorly consolidated sands which is divided into two subunits, the Tobacco Road Sand and the Dry Branch Formation. The contact between the Hawthorn Formation and the Barnwell Group is exposed at many localities in the field area. Local exposures of the Lisbon Formation (Blue Bluff Member) occur along the bluffs adjacent to the Savannah River.

The field investigation began with an examination of 7-1/2 minute U.S. Geological Survey topographic quadrangles and low altitude photographs to determine the likely locations of exposures. Approximately 170 possible outcrops were located by this method, and this number was supplemented by additional roadcuts discovered enroute to these locations. This examination was aided by the field trip guidebook of Huddlestun and Hetrick (1979); the geologic contacts and terminology used in this report conform closely to their report. The map of the Savannah River Project completed by Siple (1967) and previous geologic mapping of the Vogtle plant and vicinity are also included on the geologic map that accompanies this report (Figure 6-1). The Vogtle and SRP maps have been modified to conform to the terminology and unit definitions of Huddlestun. In particular, extensive outcrops of the McBean Formation shown on the SRP and Vogtle maps have been reclassified as part of the Barnwell Group. At the time of Siple's mapping, ambiguity existed as to the exact nature of the McBean and Barnwell Formations and his division of the units reduces the thickness

of the Barnwell to 60 to 70 feet. This unit, as defined by Huddlestun, is now believed to have a thickness ranging from about 150 to 200 feet.

The results of the geologic mapping are shown on Figure 6-1. The mapping found no surface geomorphic or geologic features which could be associated with faulting. The depositional contact between the Hawthorn and Barnwell units was found across the trace of the postulated fault with no detectable offset. This contact represents a horizon with an age of about 25 million years.

6.1.2 Savannah River Meander Pattern Analysis

According to the Open-File Report the position of the postulated Millett fault was partially determined by using a change in channel geometry of the Savannah River. The Report (p. 23) positions the fault trace across the Savannah River at the point where the channel changes from a "straight" to a "meandering" pattern (Figure 6-2). Although not cited as evidence for displacement, such a geomorphic expression of the fault trace may be construed as evidence for Quaternary fault activity. As part of the Millett fault study, a geomorphic analysis of the Savannah River was conducted to determine possible causes for the change in channel geometry. It is concluded that although the trace of the postulated Millett fault coincides with the abrupt change in channel geometry, there is no geomorphic basis indicating that the change is a result of fault displacement.

From Augusta, Georgia to the Atlantic Ocean, the Savannah River flows down a broad, alluviated valley. In the vicinity of the postulated

Millett fault, the river floodplain is well developed and averages 1.5 to 2 miles wide. This width is consistent across the postulated fault.

Rivers flowing in such broad alluviated valleys adjust to many variables. The principal independent variables (variables over which the river has no control) include base level, discharge, bedrock geology and sediment load. The principal dependent variables (variables which a river will change in response to other changes) are channel width and depth, bed roughness, grain size of sediment load, velocity, channel slope and channel geometry.

In the vicinity of the postulated Millett fault, most of these variables may be considered constant. Over such a local stretch in a large river, a change in the amount or grain size of sediment load, and hence bed roughness (Leopold, Wolman and Miller, 1964), sufficient to cause an abrupt change in channel geometry is not probable. Gaging station data from Augusta and Burtons Ferry Bridge (Section 7-7, Tables 7-13 and 7-15) indicate that there is no significant change in discharge. Sea level may be considered a constant base level (although alluvial fans constructed by tributary streams on the floodplain of the Savannah River may produce temporary base level changes). Navigation charts (U.S. Army Corps of Engineers, 1980) indicate that the river maintains a consistent average width of 250 to 300 ft and a thalweg (depth of deepest part of channel) depth of 12 to 15 feet. Because water velocity is a direct function of discharge, width and depth (Leopold, Wolman and Miller, 1964), it too is relatively constant.

A river may also adjust its channel to changes in slope and bedrock geology. The slope of the Savannah River floodplain increases from about 0.5 ft/mile along the straight stretch of river upstream from the postulated fault trace, to about 0.7 ft/mile along the meandering stretch downstream from the fault trace and could be interpreted as causing the change in channel pattern. This increase in slope coincident with a change from a straight to a meandering channel, however, is consistent with empirical observations by Leopold and Langbein (1966) and Schumm and Khan (1972) and is not an anomalous or unusual condition. These authors and Ritter (1979) conclude that the change in slope probably did not induce the change in pattern, but more likely is the result of the pattern change. Therefore, the difference in river slope is not the cause of the change in river meander pattern.

The change in channel geometry of the Savannah River is therefore probably related to a change in local geology. Empirical observations by numerous investigators (Leopold and Langbein, 1966; Leopold, Wolman and Miller, 1964; Schumm and Khan, 1972; Humphries and Hughes 1974; Keller, 1972), indicate that meanders develop when rivers carrying a relatively fine-grained bed load flow at low gradients and have cohesive but easily eroded banks. The Savannah River generally meets these requirements and should develop a stable meandering channel. Observations of the river below Augusta indicate that meandering is common while straight reaches are rare and thus the straight reaches are probably an unstable condition. The thalweg of the river in fact,

does meander (Figure 6-2) and the straight reach may be in transition from a straight to a meandering channel (Stage 2 or 3 of Keller, 1972). The important question to be considered, therefore, is not why does the river begin to meander below the trace of the postulated Millett fault but why is the river straight upstream of the fault?

Meanders develop and propagate by eroding material from the concave or outer bank of the meander and depositing it downstream on the convex or inner bank of the meander (Leopold and Langbein, 1966). A prerequisite for meander development, therefore, is lateral erosion. In the straight reach of the Savannah River the river is eroding the southeastern bank of the floodplain consisting of the resistant Blue Bluff marl member of the Lisbon Formation and overlying limestone and semi-consolidated sand and clay of the Barnwell group (Figure 6-1). Subsurface projection of stratigraphic units also suggests that the base of the river is eroding the resistant marl. Difficulty in eroding this resistant bank probably consumed any preexisting meanders as the river laterally traversed the floodplain towards the southeastern bank. Channel scars on the floodplain adjacent to the straight river section are evident on 1:20,000 and 1:40,000 areal photography (section 7-4; illustrated on Figure 6-2). Their arcuate shapes demonstrate that meandering has been a dominant fluvial process in this region during Holocene time.

As the river crosses the postulated Millett fault, it gradually swings away from the resistant southeastern bank. In this area the

resistant marl and limestone and overlying semi-consolidated sand and clay units have dipped beneath the river banks and channel so that the river is once again free to meander. Within the floodplain, where both banks consist of cohesive but easily eroded fine grained alluvium, the river again develops a meandering pattern. Channel scars in the floodplain cross the postulated fault trace with no evident displacement.

In summary, the local change in channel pattern from a straight to a meandering form appears to be related to local bedrock and not to regional or local changes in discharge, sediment load, base level, channel width or depth, velocity or channel slope. The stable channel pattern below Augusta appears to be meandering, the straight channels are anomalous, unstable features. Channel scars on the floodplain upstream from the postulated Millett fault suggest that although the river presently maintains a straight channel in this reach, it meandered across the floodplain in the Holocene. The straight channel probably results from the resistance to erosion of the river channel bank and is not a product of Quaternary displacement on the postulated Millett fault.

It can not be definitely determined with the evidence available what caused the river to swing against the southeastern bank. The presence of channel scars on the floodplain, however, suggests that the lateral migration is a natural evolutionary process of the river and that the present straight reach is a geologically temporary condition.

6.2 Core Drilling

Core drilling was used to define and to correlate the subsurface stratigraphy along two lines across the postulated Millett fault. The first line of holes was drilled along River Road in Georgia southeast of the Vogtle plant site. Eight holes were drilled over a distance of about eight miles. These holes supplement existing holes which had been drilled earlier to the northwest and southeast, as shown on Figure 6-3. The alignment of the holes is roughly perpendicular to the strike of the postulated fault and centered along its projected trace.

The second series of holes was drilled to define the subsurface structure and stratigraphy between wells AL-66 and P5R in South Carolina. Wells AL-66 and P5R were used in the Open-File Report as a basis for postulating the Millett fault. Four holes were drilled, as shown on Figure 6-3. These holes are approximately five miles northeast and subparallel to those drilled in Georgia.

The core drilling program was designed to determine whether faulting does occur in the area postulated, and if so, to define its location, extent, and capability, as defined by Nuclear Regulatory Commission criteria. The majority of the holes were drilled to a depth which would penetrate the Cretaceous materials defined as the A_1 aquifer in the Open-File Report. Holes VG-7 and VG-8 of the Georgia series were drilled to the top of the kaolinitic clays at the base of the A_2 aquifer as defined in the Open-File Report. In South Carolina VSC-4 was drilled adjacent to well AL-66. This hole was drilled to a depth which would retrieve sediment samples from a horizon which the Open-File

Report states is of Triassic age, based on cuttings from AL-66. VSC-4 was drilled to a total depth of 1,024 feet which exceeded the depth of AL-66 by over 200 feet. The adjacent holes P5R and AL-66 were geophysically logged to assist in correlation with the holes cored during this program. Section 6.3 discusses this program in more detail.

The core drilling was performed by Law Engineering and Testing Company (LETCO), and Alabama Power Company drill rigs and crews. A total of five drill rigs were used during the majority of the field period. Every effort was made to acquire continuous core samples with minimal core loss.

Early in the program it was found that the loose sands of the Barnwell Group in the upper part of the holes were difficult to recover even though several coring methods were used. Therefore, the remaining core holes used split spoon sampling to a depth where the samplers could no longer be driven; at this point core drilling was begun.

The core drilling used triple-tube NQ wireline equipment which provided core samples 1-7/8 inches in diameter. The drilling fluid consisted of clear water mixed with bentonite or a synthetic polymer mud (EZ mud) with barite and other additives used as required. During drilling it was found that the proper mud type, viscosity and density were critical for good core recovery, to prevent caving and to control artesian flow in the holes.

An experienced geologist was assigned to each drill rig to monitor drilling and log the core as it was retrieved. These personnel were

provided by Georgia Power Company and Bechtel. The geologist on each rig noted changes in drilling rate, character; mud color; loss or gain of fluid; and monitored cuttings in the mud.

The core was placed in strong wooden core boxes, with the run and recoveries noted on the box. Each box was then appropriately labelled and photographed once it was full. The core, which will be retained for permanent storage by Georgia Power Company was made available to the USGS, Georgia Geologic Survey, and Savannah River Project personnel for independent logging and sampling. All samples taken were catalogued and marked with a block in the core boxes.

The core hole locations were surveyed by a licensed land surveyor following the drilling. The holes were positioned horizontally and vertically to an accuracy of greater than 0.1 foot. Table 6-1 gives the Georgia State Grid coordinates and the ground surface elevation at the hole collar for all holes cored in this study.

Logs of core holes drilled for this study are reproduced in Appendix D, Volume II. While this study was in progress, the USGS cored a hole near the Savannah River. The USGS kindly allowed G. Grainger of Southern Company Services to log the core. This log is also included in Appendix D.

The results of the core drilling program are shown on the geologic section on Figures 8-1 through 8-3. Several distinct marker horizons and geologic formations were correlated in the core holes between AL-66 and P5R and between core holes and existing borings along a section

from the Vogtle plant southeast for 20 miles, across the postulated fault. These sections clearly show no detectable fault offset of the marker horizons or geologic formations. These undisrupted horizons have approximate ages of from 40 through 65 million years. As postulated in the Open-File Report they should show vertical offset of up to 140 feet.

6.3 Downhole Geophysical Logging

Each core hole was logged using small diameter downhole geophysical logging equipment. The logs recorded were natural gamma ray, neutron, caliper, resistivity and spontaneous potential information. The downhole geophysical logging was conducted to assist in the correlation of stratigraphic units between drill holes. The logging was found to be very useful in correlation and in accurately defining geologic contacts. Nuclear logs were also run in cased wells P5R and AL-66. These holes are adjacent to those drilled in South Carolina and were presented as evidence for postulating the Millett fault. Geophysical correlation of these existing holes with the newly drilled core holes was significant in determining the existence and capability of the postulated fault.

The downhole geophysical logging was initially performed under contract with the Birdwell Division of Seismograph Service Corporation of Henderson, Kentucky. Drill holes VG-1, VG-2, VG-3 and the upper portion of VG-4 were logged by Birdwell. Due to the lengthy travel time from Kentucky and commitments in the petroleum industry, Birdwell could not continue their services and Law Engineering and Testing

Company, Geophysical Services of Marietta, Georgia, was contracted to continue the downhole geophysical logging. LETCO logged VG-4 after the hole was complete. The logs for VG-4 from Birdwell and LETCO were then compared to determine if any appreciable differences existed using different types of equipment. The logs were found to be almost identical. As a result, LETCO logged the remaining holes in the program. An acoustic-velocity log was run in VSC-1 to determine if the velocities assumed in the seismic reflection survey along the river were correct. Additionally, the velocity log was used to aid in identifying the depth of materials having strong velocity contrasts.

The downhole logs were first compared from hole to hole independent of the geologic correlations. This allowed an independent verification of the correlations to be made based on the core logs and a re-examination of any apparent conflicting data.

The geophysical logs for surveys run as part of this study and those acquired from others and used in the sections are shown in Appendix E of Volume II. The correlation of geophysical logs are shown on Figures 8-4 through 8-7. These figures show that logs define unique and diagnostic geophysical signatures which are readily correlatable with adjacent drill holes. Due to the unique signature of the geophysical logs and ease of correlation, the geophysical sections could be used alone to demonstrate the absence of significant vertical offset as proposed in the Open File Report. The geophysical correlations strongly support the stratigraphic correlations shown on Figures 8-1 and 8-2.

6.4 Observation Well Installation

Following core drilling and geophysical logging, a ground water observation well was installed at each of the 12 core hole sites. In the case of VG-2 and VSC-4, caving in the core hole prevented installation of the well casing, and the well was installed in another hole drilled immediately adjacent. Six observation wells were constructed in the upper (Tertiary) aquifer and six were placed in the lower (Cretaceous) aquifer. The distribution of the wells is shown on Figure 6-3.

The wells are constructed as shown on Figure 6-4 to isolate the aquifer being monitored. The majority of the wells are constructed with a 2-inch diameter stainless steel screen at the base of 2-inch diameter black steel riser pipe. The screens are five feet in length and are continuous-slot, wire wound type (0.020-inch) manufactured by U.O.P. Johnson Company. Two wells in the South Carolina series of holes (VSC-1 and VSC-4A) were constructed using four-inch diameter PVC screen (0.018-inch machine-cut slots) and riser pipe. The well screen on VSC-1 is five feet in length and the screen on VSC-4A is 15 feet in length.

Cement grout was tremied through the drill rods to cement off the lower aquifer in those holes screened in the upper aquifer (Figure 6-4). Ground water in zones above the aquifer monitored was sealed off by placing cement grout in the 6- or 8-inch reamed portion of the hole. The grout was tremied to the base of the reamed portion of the hole

using 1-inch black plastic pipe. A steel ring plate welded to the outside of the riser pipe was used as a seal to prevent migration of the grout into the lower screened portion of the hole. In the holes completed with PVC casing, sand was placed as a seal at the base of the grouted section.

Each observation well was purged of at least two well volumes either by hand bailing or by injection of compressed air following installation. The rate of recovery of each well was measured following purging. Rapid and complete recovery indicated that the wells were functional with good interconnection between the aquifer and the well. Four of the twelve wells did not recover rapidly - VG-1, VG-6, VG-7, and VSC-2 - and additional development work was attempted to improve the hydraulic response.

Well VG-1 was purged by air lift for a considerable time, but only slight improvement in the response rate resulted. The well is apparently open to the aquifer zone, but is either restricted in some way or is screened in a lower permeability zone. Water level measurements in VG-1 indicate that it is functioning properly, but has a slower response time than other wells. It was found that well VSC-2 was plugged with silt. As a result of cleaning, it now responds effectively. Investigation of well VG-7 revealed that grout had entered the casing and filled the screened interval. Although the grout within the well was drilled out, it was necessary to use a small amount of explosive (Nipak) to fracture through the grout outside the well screen. The fracturing was successful, as evidenced by recovery

after bailing. Considerable effort was made to clean out grout that had entered VG-6, but without success.

6.5 River Reflection Survey

An acoustical seismic reflection survey was performed in the Savannah River in May, 1982. This survey obtained information on subsurface reflecting horizons in the vicinity of the postulated Millett and Statesboro faults. When correlated with particular geologic interfaces, these reflections allow determination of geologic horizon continuity and charaterization of geologic structure.

The survey was conducted under Bechtel's direction by Harding Lawson Associates, a company with extensive marine geophysical experience. Dr. V. J. Henry, of the University of Georgia served as technical consultant for the survey. Dr. Henry has conducted previous geophysical work on the Savannah River and other rivers in the southeast, and has also been involved with the offshore fault study of the Charleston, South Carolina area.

The survey used three different energy sources. To obtain the highest resolution and deep penetration along approximately 19 miles of the Savannah River in the area of the postulated Millett fault and along about 10 miles near the postulated Statesboro fault. A precise record of the depth to river bottom along the surveyed area was obtained using a Raytheon DE719 Fathometer.

For shallow structure (from river bottom to approximately 150 feet below river bottom) an EG&G Uniboom and hydrophone eel (receiving array of eight elements) were used. The Uniboom system gave the highest resolution records (horizons mapped to an accuracy of 5 to 10 feet) but could penetrate to only about 150 feet. A single strong, continuous reflecting horizon was identified on the Uniboom records.

Intermediate depth structure (down to 350 feet below river bottom) was mapped using a 10-cubic-inch Exploration Equipment Research Inc. (EERI) air gun. Several reflecting horizons were identified on the 10-cubic-inch air gun survey. These horizons are mapped with a resolution of 10 to 20 feet.

Finally, deep structure was investigated using a 20-cubic-inch EERI air gun. This large air gun survey identified a deep horizon at a depth of approximately 1,170 feet with a resolution of 30 to 50 feet.

Figure 6-5 shows the coverage of these seismic reflection surveys in relation to the postulated Millett and Statesboro faults. The postulated Millett fault coverage included 19-1/2 river miles of Uniboom survey, 16-1/2 river miles of 10-cubic-inch air gun survey, and 5-1/4 river miles of 20-cubic-inch air gun survey. All of these surveys were conducted so that the postulated fault location was bracketed on both the upstream and downstream sides. The equipment and methodology used in the reflection survey are discussed in more detail in Appendix F.

The location of the survey on a shallow, fast-moving river and the rigid time constraints required some special planning, particularly for the large air gun. In order to get both the air gun compressor and survey vessel up the shallow river without running aground, a raft containing the several-thousand-pound compressor was tied alongside the survey vessel. This configuration allowed three separate systems to be used (Uniboom, 10-cubic-inch air gun, and 20-cubic-inch air gun) which enabled the best possible data to be obtained.

There are two types of noise in the seismic reflection survey data: 1) that common to all reflection surveys (such as electric fluctuations in the recording equipment and multiple reflections), and 2) that arising from the complicated shallow river environment (such as spurious reflections from the irregular river channel margins, side reflections at or beyond the river banks, and onboard noise from the boat motors and compressor). All noise sources have characteristic signatures. They do not prevent identification of several high quality reflection horizons along the survey lines.

The seismic reflection studies did not identify either of the postulated faults. The results of the seismic reflection studies are discussed further in Section 8.1.5 and in Appendix F, where the Harding Lawson report is reproduced.

6.6 Water Well Survey

During the period from May 3, 1982 to June 26, 1982 a water well survey was conducted as part of the field investigations. The purpose of this

survey was to accumulate a comprehensive hydrogeologic data base applicable to the evaluation of the postulated Millett fault, during a short time period. The resulting data base is referred to as a concurrent data base since all wells were measured nearly concurrently.

The area selected for the survey consisted of 62 contiguous 7-1/2-minute and three 15-minute USGS topographic quadrangle maps. These maps encompass a total area of approximately 4,400 square miles (Figure 6-5).

Engineering and environmental personnel from Georgia Power Company performed the water well survey under the guidance and supervision of a Bechtel ground water geologist. Bechtel geologists processed and organized all incoming canvass data and performed a preliminary analysis before transmittal to the San Francisco office for further evaluation. The primary tasks assigned to the ground water investigating team are summarized as follows:

a) Canvass as many wells as possible within the study area, with particular emphasis on municipal, industrial, and irrigation wells.

b) Perform a preliminary evaluation of each well for applicability, coherence of data, etc.

c) Summarize canvass data on tabulation sheets and assign a discrete modeling code number for each well.

d) Plot each well, its modeling code and ground water elevation on control copies of quadrangle maps.

e) Transmit data to the office for final evaluation and classification of wells by aquifer systems.

6.6.1 Schedule of Field Work

To minimize the impact of differences in ground water levels related to time, it was considered essential to complete the survey in the shortest period practicable. For this reason, the large area of the survey was covered in three stages, beginning in the immediate vicinity of the postulated fault zone and then progressively expanding to the maximum area possible. The first stage, in the immediate vicinity of the postulated fault, was designated as "priority one". It consisted of 35, 7-1/2-minute quadrangle sheets covering an area of approximately 2,100 square miles. A total of 620 wells were investigated in this area.

Data obtained during stage two of the survey encompassed an area designated as "priority two" which surrounds the priority one area. This section contained 27, 7-1/2-minute and three 15-minute quadrangle sheets covering an area of approximately 2,300 square miles. A total of 93 wells were covered in this area. The priority one and two boundaries are shown in Figure 6-6.

Stage three of the survey consisted of a screening and investigation of well information obtained from Georgia and South Carolina state records and USGS well tabulations. During this stage 173 additional wells were located and recorded. In summation, a total of 886 wells were measured within an area covering 4,400 square miles. Figure 6-7 shows the locations of all wells included in the field measurement program.

The majority of the wells were located in the field by the canvass crews. Coordinate locations and surface elevations not surveyed or supplied by a reliable outside source were estimated. Low altitude aerial photographs obtained from the U.S. Department of Agriculture were used as a supplemental aid in well location.

Field data were obtained from a combination of actual measurements and owner-supplied information, and were recorded on a water well data form. All wells were measured under static conditions whenever possible. If a pump was running, an attempt was made to shut the pump off and allow the well to recover for one hour before any measurements were taken.

Water level measurements were made with one of two instruments: 1) a battery operated water level indicator, or 2) a steel surveyor's tape dusted with blue chalk to aid in making the water surface mark readily visible. Measurements deemed questionable due to condensation on the sides of the well or due to possible obstructions within the well were so noted in the remarks section of the form.

The total depth of the well was measured whenever possible with the surveyors tape with an attached weight. Owner-reported depths were recorded when the wells were too deep to measure or were blocked by a pump.

After the field well canvass crew had finished surveying a complete quadrangle sheet, the water well data forms and the quadrangle sheet showing the well locations were returned to the field office for review and preliminary evaluation.

6.6.2 Well Data Reduction

The field evaluation of the survey data began by screening the well data sheets and deleting those wells which were obviously unusable, e.g., shallow hand-dug wells, wells for which little information was available, and artesian wells that were flowing at the time of the survey. No pressure readings of artesian wells were made during this survey. The data were recorded on a summary sheet prepared for each quadrangle.

A preliminary attempt was made to determine which aquifer was penetrated by each well. The geologic section included in the Open-File Report was the primary source of information for this purpose. It was assumed that the section was representative of aquifer elevations over a fairly broad area. Each well was spotted at its corresponding location on the section and the depth of penetration into

the aquifers was estimated. Geophysical and lithologic logs were utilized whenever available.

The wells were plotted on quadrangle sheets, with water level elevations shown for each of the two aquifers penetrated. The quadrangle sheets, summary sheets and water well data sheets were then sent to the San Francisco office for final evaluation.

6.6.3 Supplemental Data

To provide a control data base for fluctuations in water levels during the period of the survey, water levels of selected wells were monitored weekly from May 21 to June 21, 1982, and hydrographs were drawn. These wells were MLT-1-1, MLT-1-5, IDL-4-3, and Vogtle observation well no. 32 (VEGP No. 32). Well locations are shown on Figure 7-1 and hydrographs are on Figure 6-8. The purpose of this monitoring program was to observe weekly fluctuations in order to determine the effect on water levels of external conditions such as weather and irrigation during the survey period. These control wells were chosen according to their depth of penetration into the aquifers and their accessibility. Well IDL-4-3 penetrates the lower aquifer, and the remaining wells (MLT-1-1, MLT-1-5 and VEGP No. 32) penetrate the upper aquifer.

Water level fluctuations were extracted from the hydrograph data base and plotted on Figure 6-8. The 4.7 foot maximum fluctuation shown at MLT-1-1 is attributed to pumping of this well for irrigation purposes. The 5.0 foot fluctuation at MLT-1-5 is also attributed to pumping. The

relatively low elevation of ground water at VEGP No. 32 is attributed to the proximity of the well to the Savannah River; in this area, the marl confining layer does not exist and the upper aquifer is discharging to the river. Additional error is possible due to the interpolation of ground surface elevation from topographic maps. Taking these variables into account, the hydrographs indicate that the maximum probable error introduced in the water level readings taken for the duration of the program is about five feet. If pumping of the wells is excluded from consideration, the probable error factor appears to be less than two feet.

In addition to the wells measured by the Georgia Power well canvass crews, wells on the Savannah River Plant property were measured by SRP staff members.

Water level measurements were also taken from the newly drilled observation holes in Georgia and South Carolina and used in the final analysis of the hydrogeologic data (refer to Section 6.6). These data were sent to the San Francisco office to supplement the data collected by Georgia Power and Bechtel personnel. The concurrent data base compiled during this intensive effort was used to prepare potentiometric surface maps for both the lower and upper aquifers, and to evaluate the possibility of a ground water barrier through modeling.

Evaluation of the well data is discussed in Section 7.8. A discussion of water level contours is presented in Section 7.8.1. Section 7.8.2 describes the use of the collected data for computer modeling studies.

Postulated Millett Fault Study
Vogtle Electric Generating Station

TABLE 6-1
DRILL HOLE SUMMARY

DRILL HOLE	LOCATION NORTH	LOCATION EAST	ANGLE FROM HORIZONTAL	BEARING	GROUND ELEVATION	DEPTH - - - - LENGTH	VERTICAL DEPTH TOP OF MARL	ELEVATION TOP OF MARL	ELEVATION BOTTOM OF HOLE
	Georgia State Grid				(FT.)	(FT.)	(FT.)	(FT.)	(FT.)
VG-1	1120358.26	660009.14	90°	-	156.6	565.0	156.3	0.3	-408.4
VG-2	1122608.99	650596.85	90°	-	253.1	618.0	250.0	3.0	-364.9
VG-3	1121183.52	655725.83	90°	-	165.7	574.9	163.0	2.0	-409.2
VG-4	1124629.41	644971.51	90°	-	150.3	554.4	129.0	21.3	-404.1
VG-5	1116669.12	665818.68	90°	-	94.5	502.0	112.0	-25.0	-407.5
VG-6	1110896.34	669643.15	90°	-	217.1	620.0	237.5	-20.0	-402.9
VG-7	1127245.60	640322.37	90°	-	250.6	392.0	225.0	-8.3	-141.4
VG-8	1104446.34	678744.09	90°	-	103.7	355.4	143.6	-39.9	-240.8
VSC-1	1134867.04	679423.71	90°	-	219.0	620.0	186.5	34.5	-401.0
VSC-2	1141512.71	673492.62	90°	-	201.7	600.0	152.0	49.7	-398.3
VSC-3	1138356.84	676254.55	90°	-	170.3	570.0	134.0	36.3	-399.7
VSC-4	1130590.27	683271.46	90°	-	156.7	1024.0	137.9	18.8	-867.3
	Estimated	Coordinates							
P5R	1145300	671700	90°	-	208.0	1250.0	~157	51	-1042.1
AL-66	1133400	684250	90°	-	202.2	800.0	~186	16	-597.8
AL-317	1128800	672300	90°	-	97.1	230.0	89.0	8.1	-132.9

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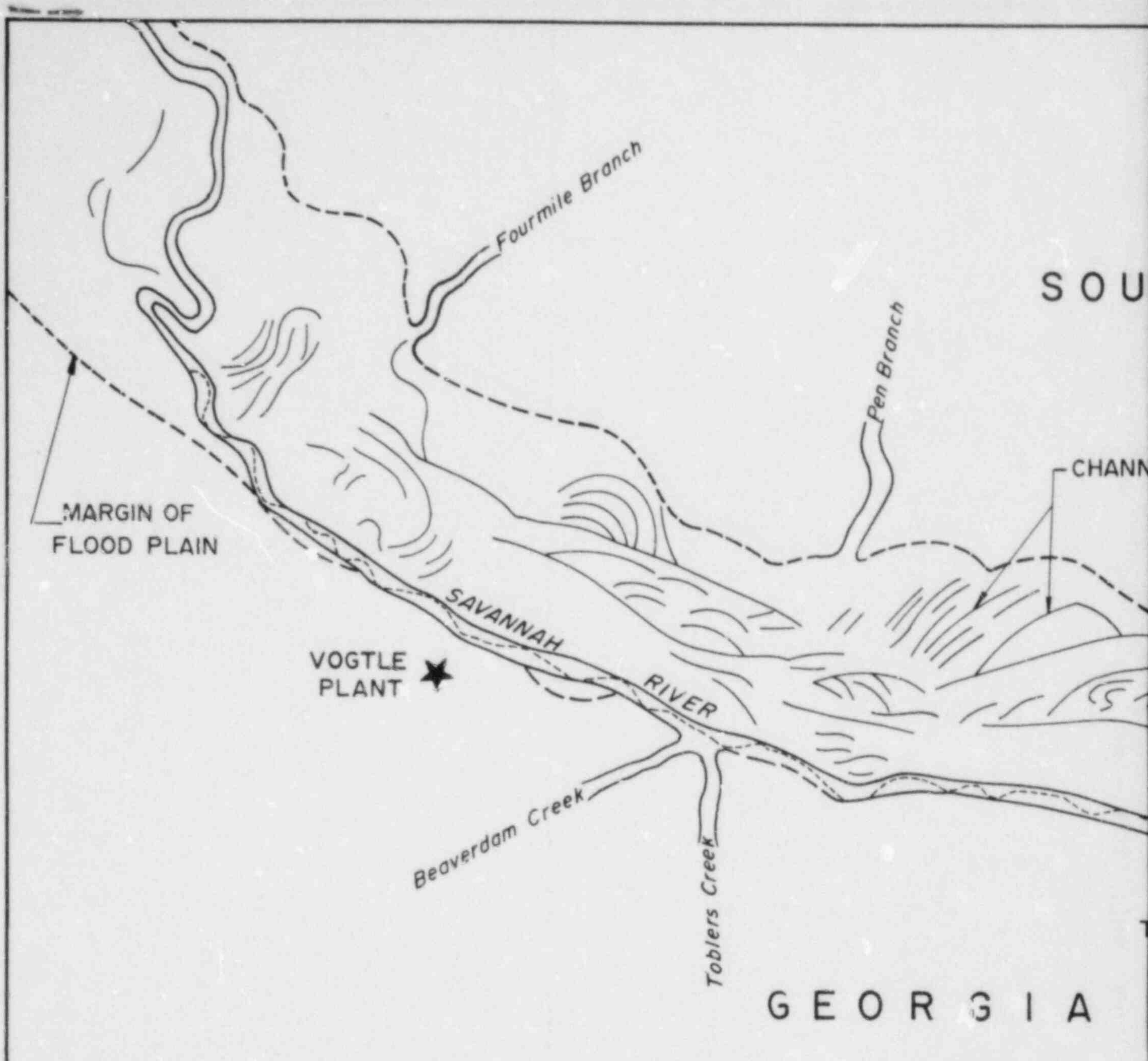
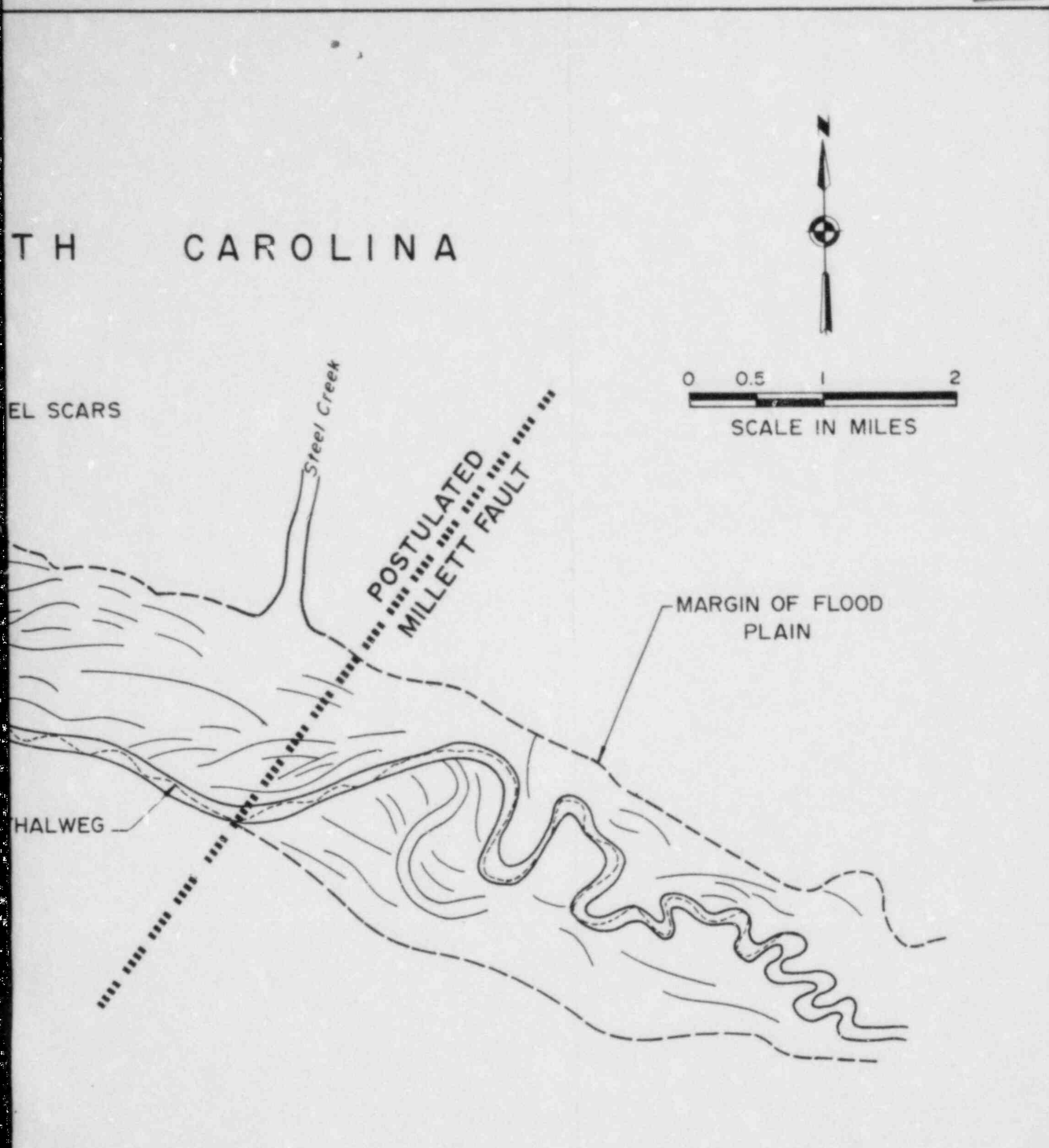


NOTES:

1. Channel scars detected primarily by vegetation contrast on mosaic of 1:62,500 aerial photography.
2. Channel thalweg determined from U.S. Army Corps of Engineers Navigation charts (1980).

EXPLANATION

- - - - - Margin of flood plain
——— Margin of Savannah R
≈≈≈ Channel scars on floo
‿‿‿ Thalweg of Savannah



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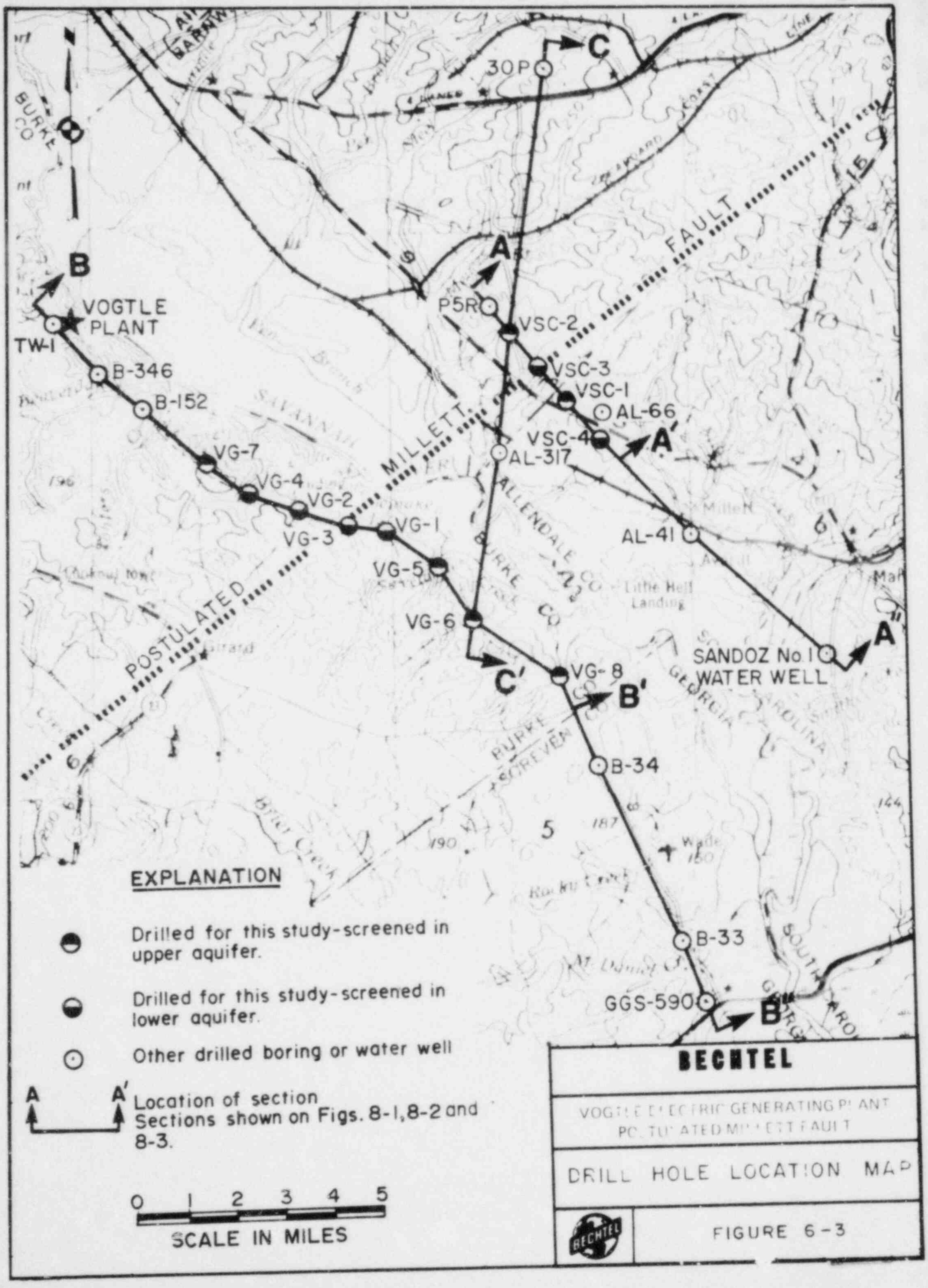
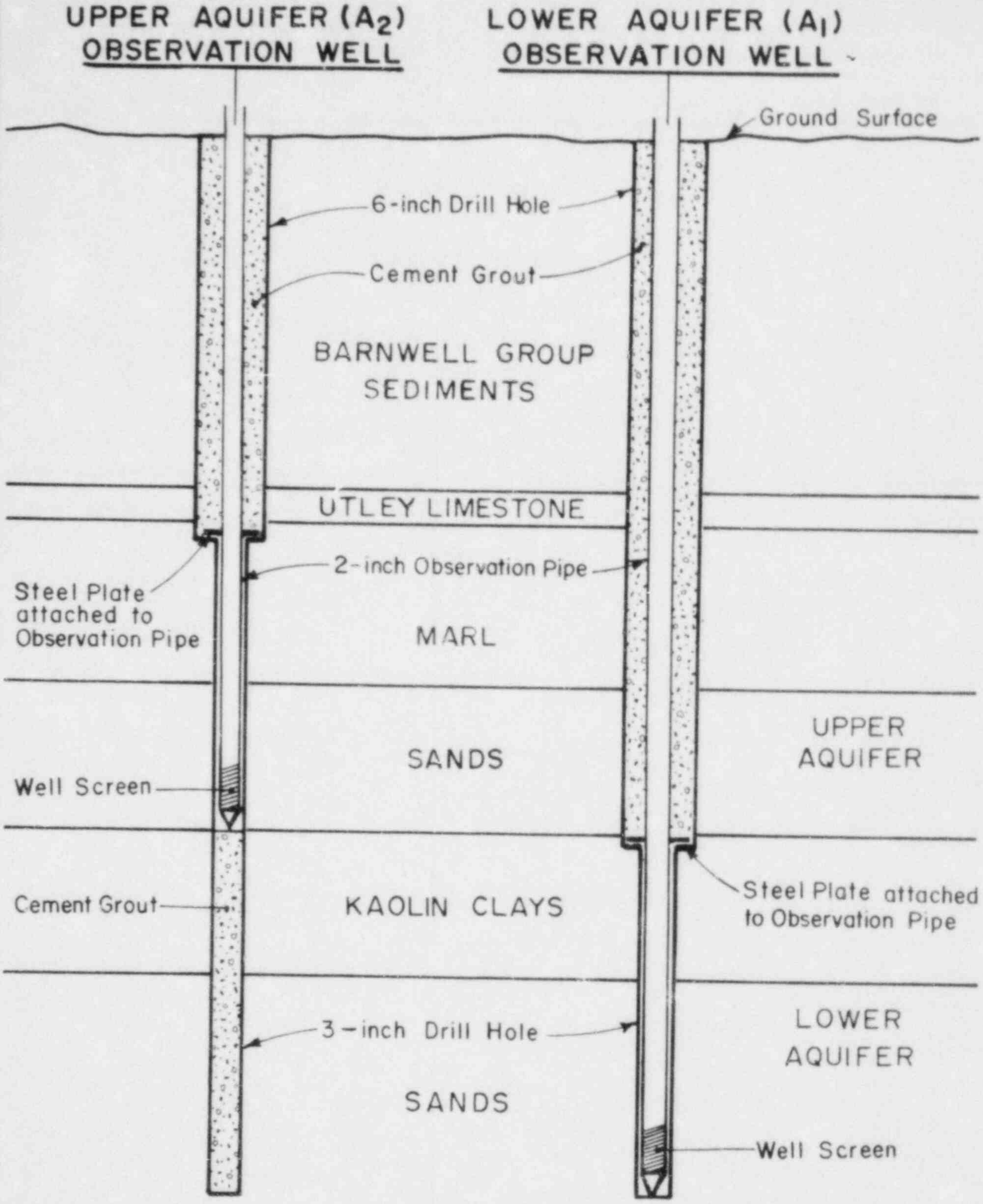
VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

MORPHOLOGY OF THE SAVANNAH RIVER AND FLOOD PLAIN

FIGURE 6-2



B
VOGTLE PLANT
TW-1
B-346
B-152
VG-7
VG-4
VG-2
VG-3
VG-1
VG-5
VG-6
VG-8
C
30P
A
P5R
VSC-2
VSC-3
VSC-1
AL-66
VSC-4
A'
AL-317
AL-41
SANDOZ No. 1 WATER WELL
A"
C'
B'
B-34
B-33
GGS-590
B"
POSTULATED MILLETT FAULT
SAVANNAH
ALLENDALE CO
BURKE CO
GEORGIA
SOUTH CAROLINA
BURKE CO
SCREVEN CO
EXPLANATION
Drilled for this study-screened in upper aquifer.
Drilled for this study-screened in lower aquifer.
Other drilled boring or water well
A A'
Location of section
Sections shown on Figs. 8-1, 8-2 and 8-3.
0 1 2 3 4 5
SCALE IN MILES
BECHTEL
VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT
DRILL HOLE LOCATION MAP
FIGURE 6-3



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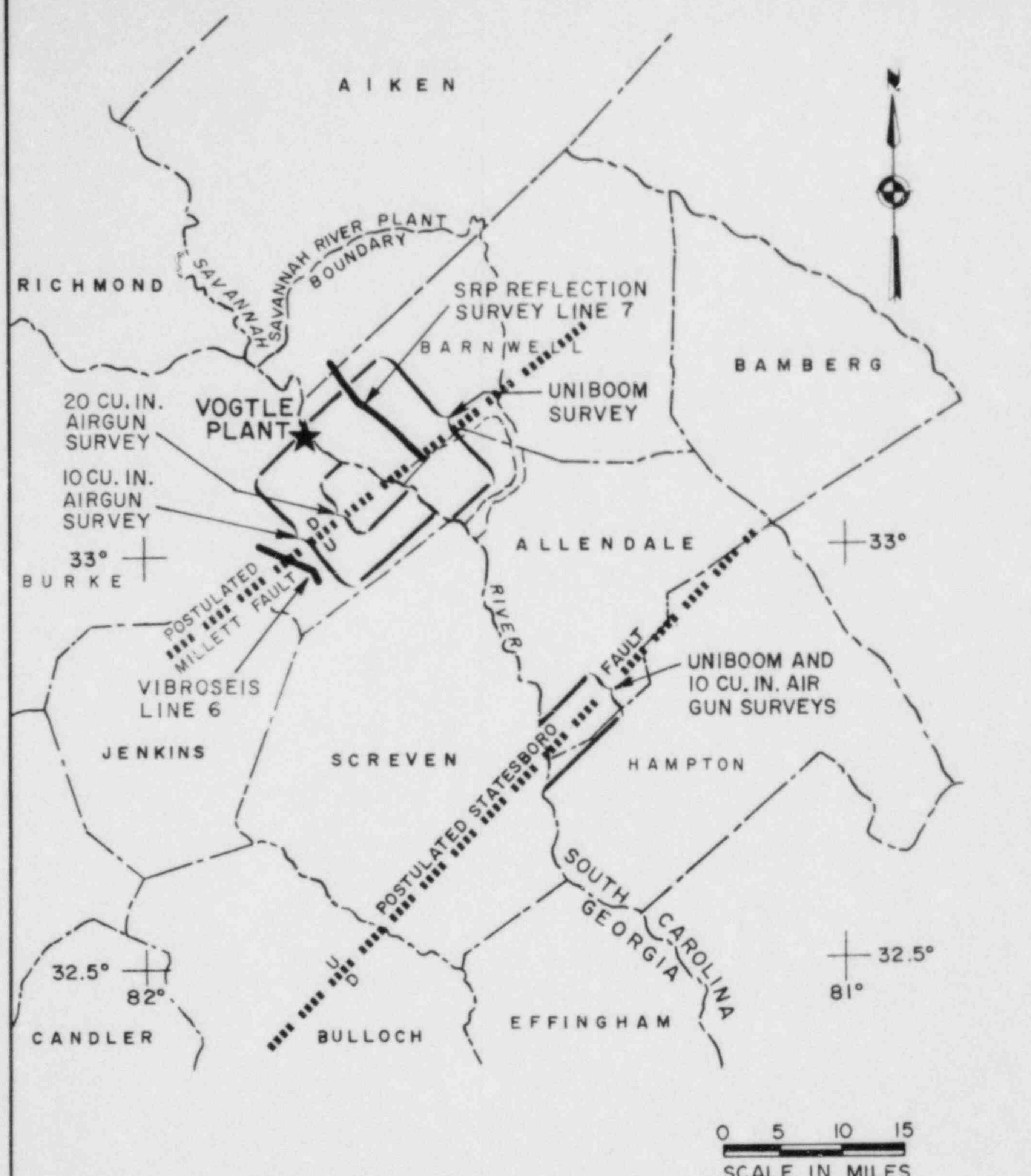
OBSERVATION WELL DESIGN

FIGURE 6-4



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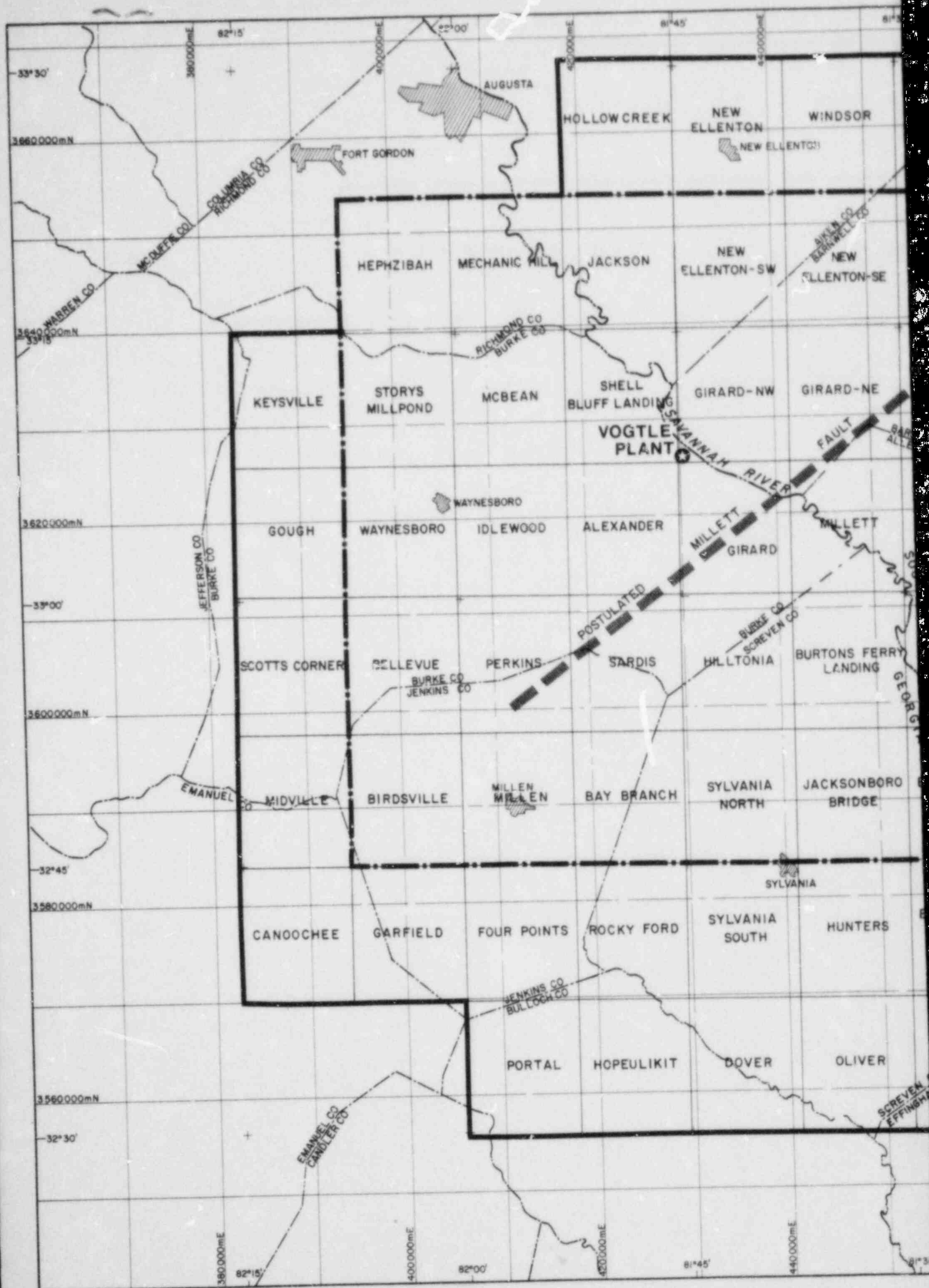
SEISMIC REFLECTION SURVEYS

FIGURE 6-5



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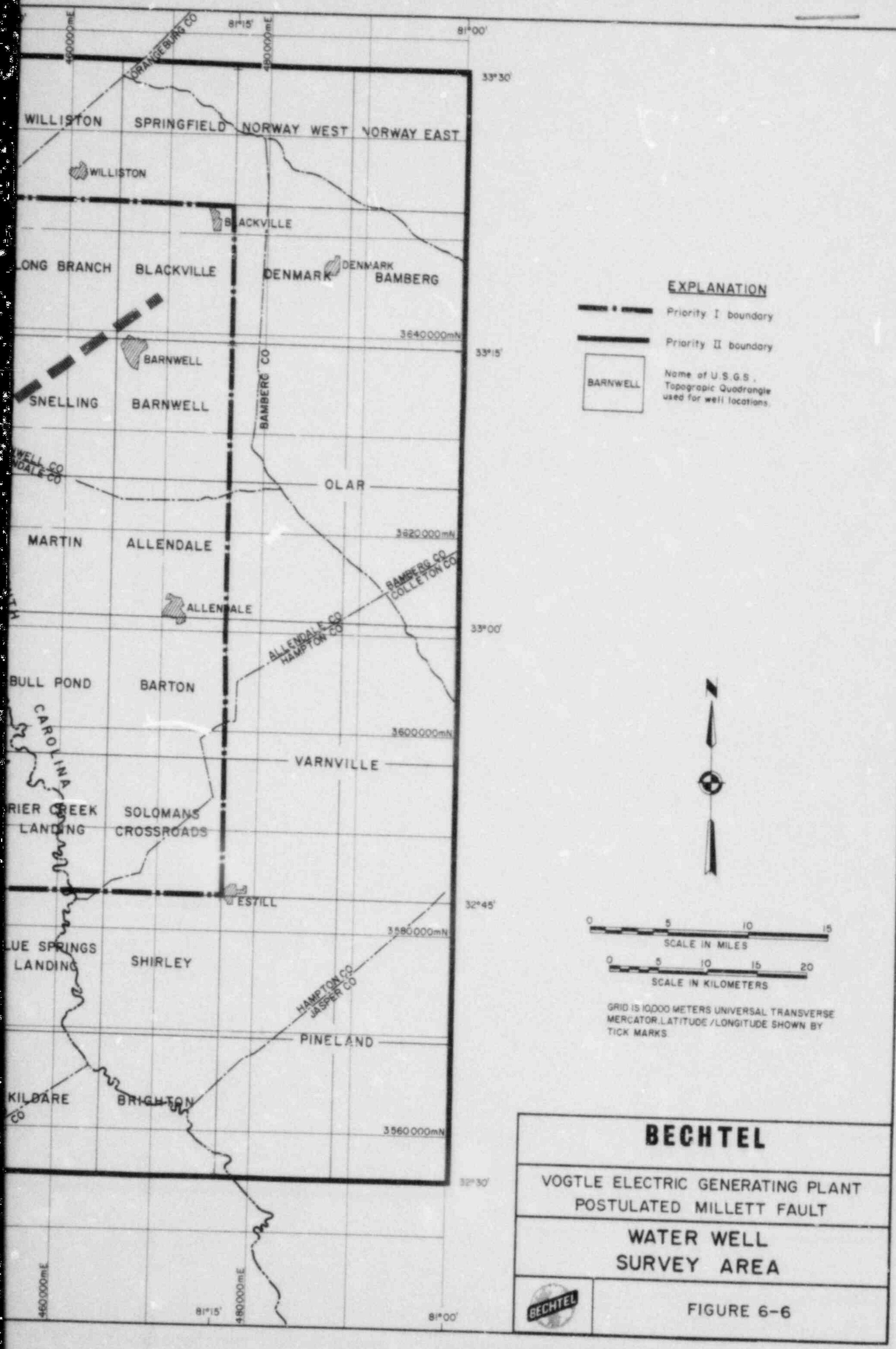
COLUMBIA CO
RICHMOND CO
McDUFFIE CO
WARREN CO
RICHMOND CO
BURKE CO
AIKEN CO
BARNWELL CO
JEFFERSON CO
BURKE CO
BURKE CO
SCREVEN CO
BURKE CO
JENKINS CO
EMANUEL CO
JENKINS CO
BULLOCH CO
EMANUEL CO
CANDLER CO
SCREVEN CO
HOLLOW CREEK
NEW ELLENTON
WINDSOR
HEPHZIBAH
MECHANIC HILL
JACKSON
NEW ELLENTON-SW
NEW ELLENTON-SE
KEYSVILLE
STORYS MILLPOND
McBEAN
SHELL BLUFF LANDING
GIRARD-NW
GIRARD-NE
VOGTLE PLANT
SAVANNAH RIVER
POSTULATED MILLETT FAULT
GOUGH
WAYNESBORO
IDLEWOOD
ALEXANDER
GIRARD
MILLETT
SCOTTS CORNER
BELLEVUE
PERKINS
SARDIS
HILLTONIA
BURTONS FERRY LANDING
MIDVILLE
BIRDSVILLE
MILLEN
BAY BRANCH
SYLVANIA NORTH
JACKSONBORO BRIDGE
CANOOCHEE
GARFIELD
FOUR POINTS
ROCKY FORD
SYLVANIA SOUTH
HUNTERS
PORTAL
HOPEULIKIT
DOVER
OLIVER



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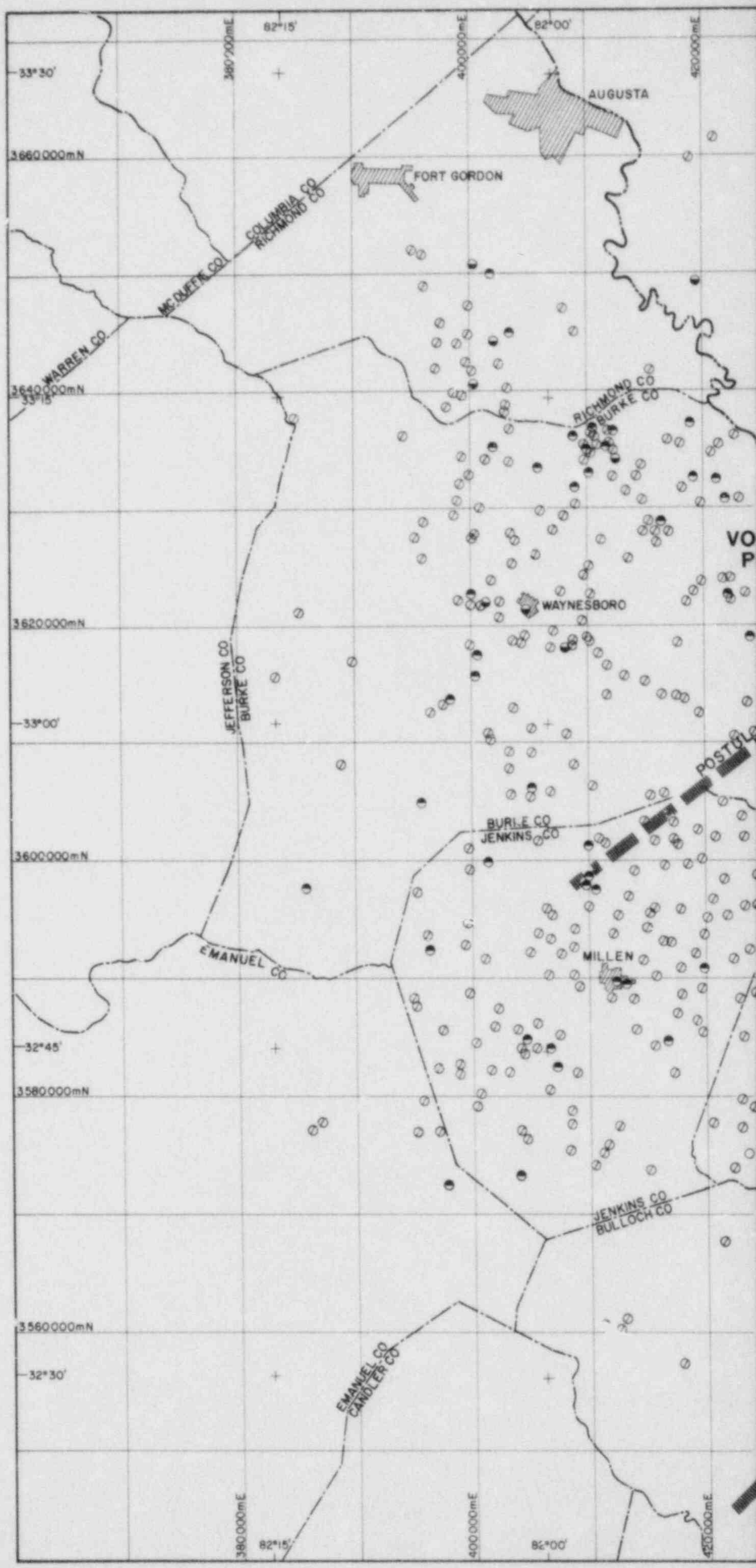
WATER WELL
SURVEY AREA

FIGURE 6-6



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MC DUFFIE CO
WARREN CO
3640000mN
33°15'
RICHMOND CO
BURKE CO
WAYNESBORO
3620000mN
JEFFERSON CO
BURKE CO
33°00'
BURKE CO
JENKINS CO
3600000mN
MILLEN
EMANUEL CO
32°45'
3580000mN
JENKINS CO
BULLOCH CO
3560000mN
32°30'
EMANUEL CO
CANDLER CO
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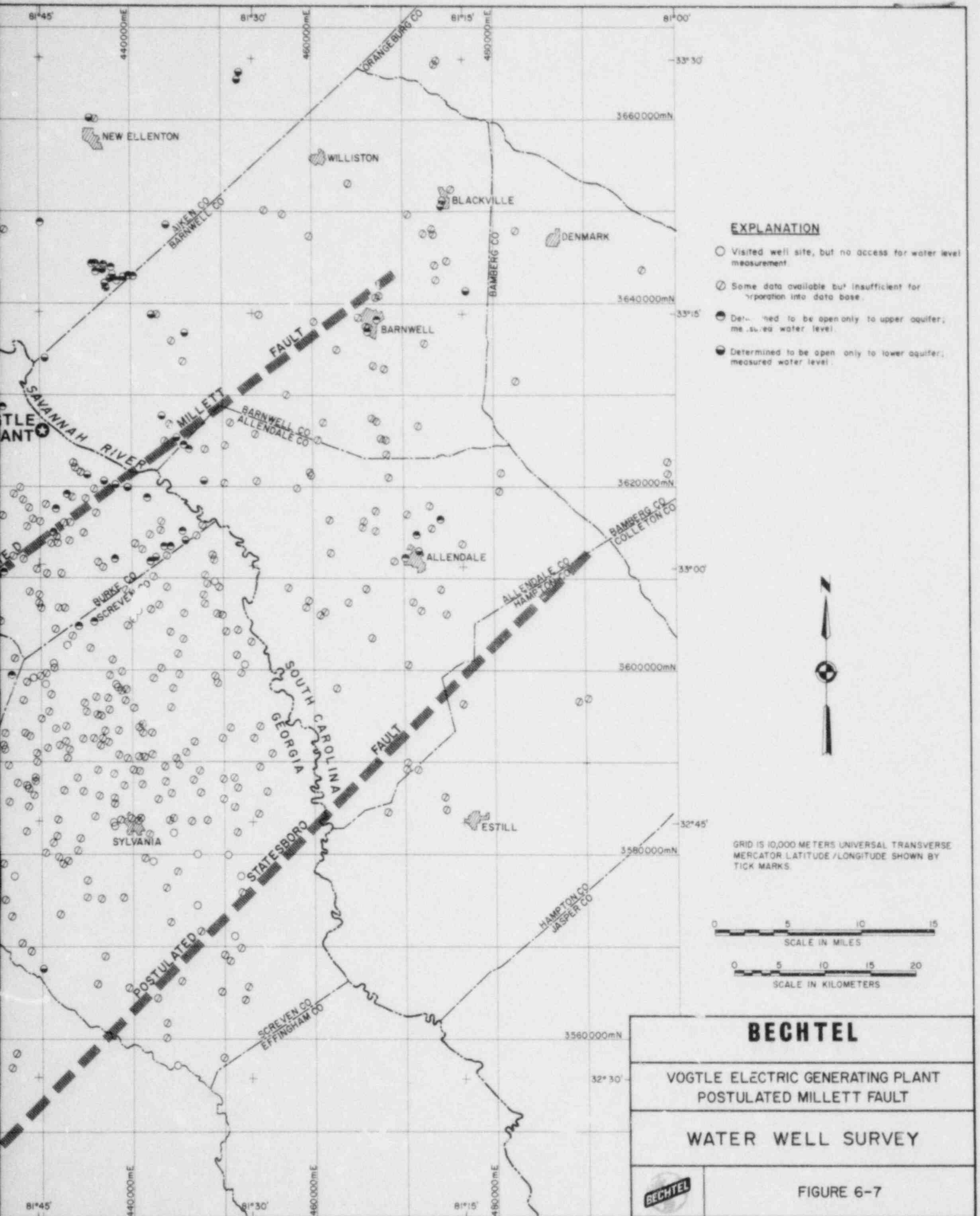

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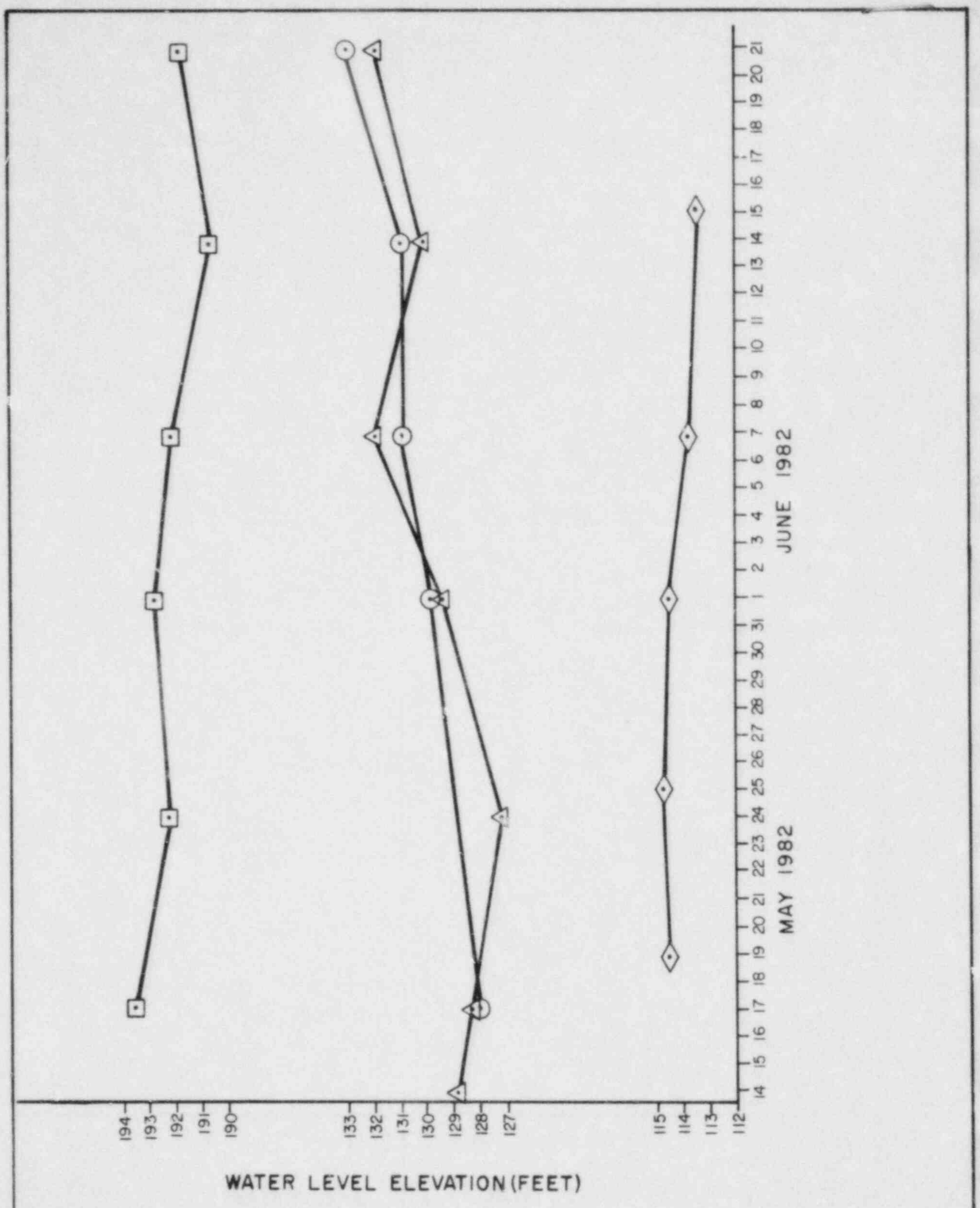
VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

WATER WELL SURVEY

FIGURE 6-7



EXPLANATION

- ⊡ Well No. IDL 4-3 (Lower aquifer)
- △ Well No. MLT 1-1 (Upper aquifer)
- ⊙ Well No. MLT 1-5 (Upper aquifer)
- ◇ VEGP Ob. Well No. 32 (Upper aquifer)

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VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

WELL HYDROGRAPHS

FIGURE 6-8

7.0 OFFICE STUDIES

In conjunction with the field investigations described in Chapter 6, a number of studies and analyses were also performed in the office. The data for these studies were derived from published and unpublished sources, and from the field investigations. This chapter discusses the office studies and the sources of data for each. Chapter 8 discusses the results of the studies.

During the office studies a substantial amount of literature and drill hole data were assembled and evaluated. Much of this information did not ultimately contribute directly to the resolution of the Millett fault issue, but did provide an extensive data base for understanding the geology of the Coastal Plain. For this reason it was decided to include as appendices listings of information which could also prove useful to others conducting similar studies in the region. An annotated bibliography of references procured and reviewed in the literature search is included as Appendix A, and a complete tabulation of collected data pertaining to drill holes and water wells throughout the area is in Appendix C.

7.1 Literature Search and Review

A literature search was conducted as part of an effort to compile a broad base of background information relative to the geology of the southeastern Atlantic Coastal Plain. This search consisted of four

parts, each discussed separately below: computer searches; thesis searches; bibliographic searches; and identification of appropriate published reports from agencies and facilities in the area of study. The material obtained through the various searches included not only geologic, seismologic, and hydrologic articles, reports, and theses, but also geologic maps and geophysical surveys.

7.1.1 Searches

7.1.1.1 Computer Search

The computer search involved the use of COMPENDEX and GEOREF. The data base for COMPENDEX is The Engineering Index which covers materials published in the engineering field from 1970 to the present. GEOREF, the data base of the American Geological Institute, covers technical literature on geology and geophysics. GEOREF corresponds to the following printed publications: Bibliography and Index of North American Geology; Bibliography of Theses in Geology; Geophysical Abstracts; and the Bibliography and Index of Geology. This data base currently covers the time period from 1961 to the present.

7.1.1.2 Thesis Search

In addition to those theses listed in GEOREF, further listings were found through University Microfilm (Ann Arbor), and bibliographies and reference lists in the published literature. University libraries and

geology departments revealed a number of additional theses not yet listed elsewhere. Theses were obtained from 13 universities, most of which are in the southeastern United States.

7.1.1.3 Bibliographic Search

Beginning with the Open-File Report, the bibliographies and reference lists of published reports and articles under review were used to supplement the listings obtained through computer searches. The Bibliography of North American Geology, covering a period from 1900 to 1960, was also reviewed for pertinent literature.

7.1.1.4 Published Reports

Numerous reports dealing with the local geology and hydrology were obtained from state and federal geological surveys and from local facilities such as Vogtle Electric Generating Plant, the Savannah River Plant, and Barnwell Nuclear Fuel Plant.

7.1.1.5 Unpublished Geologic Data

Several unpublished geologic reports and maps were made available for this study to augment the existing published information. In addition to the unpublished data, discussions regarding the general geology of the study area were held with university professors and other experts in the field of southeastern coastal geology. Assistance in compiling the stratigraphic correlation chart shown in Figure 4-3 was provided by

Dr. Paul Huddlestun of the Georgia Geologic Survey. Dr. Huddlestun also provided guidance in identifying formational boundaries during coring operations carried out specifically for this study.

7.1.2 Review

All material obtained through the various searches was first entered into a master reference list which was made available to all those involved in the Millett fault studies. Each article, report, or map was then reviewed and its contents discussed in a brief paragraph. The resulting annotated bibliography is included in this report as Appendix A. With the exception of the Open-File Report, none of the reviewed literature suggested any tectonic offset of Tertiary units in the vicinity of the postulated Millett fault.

7.2 Acquisition and Review of Existing Field Data

Numerous water wells and exploratory borings have been drilled in the area of study. Information concerning the geology and hydrogeology of the area exists in the form of records produced during and after drilling of these wells. Both the quality and quantity of data varies from well to well and may include such items as drill logs, geophysical logs, well construction reports, water level, water quality and pumping test reports. The specific types of information available for each drill hole are indicated on Table C-1 of Appendix C. Drill holes for which adequate location information is available are plotted on Figure 7-1, although some fall outside the area covered by the map. The

primary sources of drill hole data were state and federal geological surveys, state and county water resources agencies, and local plant sites such as the VEGP, SRP and BNFP.

Although very little petroleum exploration has taken place in the study area, a search was made for existing geologic and geophysical data resulting from petroleum exploration activities. Contact with the Georgia Geologic Survey revealed six petroleum exploration wells within 40 miles of the postulated Millett fault (Table 7-1), but no data on these wells were found during this study.

The drill hole data were used principally to help define the geologic structure and stratigraphy of the area, and to identify aquifer elevations. For details regarding the individual sources of data and the nature of the information provided by each, refer to Table C-1, Appendix C.

Several types of geophysical data are available which provide subsurface geologic information for the study area. Types of data available include both reflection and refraction seismic data, aeromagnetic data, and gravity data. The information consists primarily of USGS and university studies, seismic surveys by geophysical exploration companies, and seismic lines and gravity surveys run at SRP, available through the Oak Ridge, Tennessee repository. Contact with numerous geophysical and petroleum companies produced very little information (Table 7-2). Contact with seismic brokerage firms, which have geophysical data available for sale, did not reveal any previously unknown data (Table 7-3).

Review of available geophysical studies performed by others is discussed further in Section 7.3.

In an effort to identify any surface expression of the postulated Millett fault, three types of remote sensing data were acquired during the course of this study. These include: Landsat satellite imagery, NASA U-2 high-altitude photography, and U.S. Department of Agriculture low-altitude black-and-white aerial photographs. These particular images and photographs were produced over a broad span of years and were chosen to represent different seasons and sun illumination angles so that any trace of the postulated fault would be more readily apparent. A detailed discussion of the remote sensing study is presented in Section 7.4.

7.3 Review of Existing Geophysical Studies

A comprehensive attempt was made to collect and evaluate available geophysical data relevant to the study of the postulated Millett and Statesboro faults. The specific geophysical data found include seismic, gravity and magnetic surveys.

7.3.1 Seismic Surveys

Two reflection seismic surveys pertinent to the postulated Millett fault study were found. These were a conventional explosive source survey conducted on the Savannah River Plant property (see Figure 7-2)

and a proprietary Vibroseis survey crossing the postulated fault near Sardis, Georgia (see Figure 6-5).

The Vibroseis survey was conducted in September 1981 and released through Seisdata Services Inc. The survey data acquisition parameters included: 96 channel, 24 fold CDP, 220 foot geophone group spacing, 440 foot vibrator point spacing, split spread of 11,000-600-600-11,000 feet, and source sweep of 48-12 Hz. Because the survey was designed to investigate deep basement structure, the shallowest identifiable horizon is the top of the Triassic crystalline basement where a strong continuous reflector crosses the postulated fault trace (shot point 4875) with no indication of fault offset. The depth of this reflector is approximately 475 milliseconds or -1175 feet elevation (assuming a velocity of 6000 feet per second and an elevation of shot point 4875 as +250 feet). The top of Triassic reflector starts to loose coherence at shot point 4885 most probably due to processing problems. If this loss of coherence interpreted as offset, the maximum displacement is on the order of several tens of feet.

The reflection survey of the Savannah River Plant site run by Seismograph Service Corporation (SSC) was conducted in 1971 to determine the structural characteristics of the bedrock surface, map the Triassic basins, and to identify any possible faulting. The study used standard geophone split spreads of 900-75-75-900 feet, buried explosive shot holes spaced 900 feet apart, digital recording of the data, standard numerical postprocessing of the data, and expert interpretation of the final digital replay sections. The final

interpretation was correlated with a number of logged test holes and these results were displayed as structural cross sections. General record quality was labeled fair to poor by SSC. The results interpreted by SSC which are relevant to the postulated Millett fault include: no identification of faulting of the Cretaceous horizons found by SSC; elevation of the top of Triassic varying from -770 feet to -1,160 feet; gentle southeastward dip of approximately 50 feet per mile; and minor normal faulting in the Triassic with displacements generally less than 100 feet. The survey coverage region, shot lines, and interpreted Triassic faults are shown in Figure 7-2. Also shown in this figure are the interpreted amounts of displacement of each fault and the location of the postulated Millett fault. The replay section record for line 7 has been reanalyzed for this study since it crosses the postulated Millett fault and is the closest shot line to the Savannah River acoustic reflection survey described in Section 6.5. Because of the shot method and analysis technique used, no useful information on the structure above the Triassic in line 7 is available, although some Cretaceous horizons have been identified on other lines. Line 7 does suggest fault offset of the top Triassic (depth 1,245 feet or -1,045 elevation) in the vicinity of the postulated Millett fault at the SRP site but with only one-half the SSC interpreted offset (approximately 50 feet instead of the slightly greater than 100 feet). The discrepancy for the interpreted offset is believed to be the over-emphasis by SSC of the near-fault drag phenomenon. When the offset is measured after eliminating the drag component, about 50 feet of offset remains. The independently conducted acoustic reflection Savannah River survey, the Savannah River Plant explosion reflection

survey, and the Seisdata Vibroseis Line 7 all show the Triassic basin reflector to be at a consistent depth. Various interpretations of this reflector are possible. If the undulations on the river reflection survey and the break-up of the reflector on the Vibroseis line are interpreted in a conservative sense as fault offset, all three surveys indicate approximately the same amount of offset.

7.3.2 Gravity Surveys

Two gravity surveys were found that had coverage of the postulated Millett fault zone. The first is a composite of the simple Bouguer anomaly maps for Georgia and South Carolina (Long and Champion, 1977) and the second is a special study done on the Savannah River Plant site (Birdwell, 1972).

The simple Bouguer anomaly map of Georgia and South Carolina has contour intervals of five and ten milligals based on station spacing of 2.5 to 3.75 miles (Popenoe and Zietz, 1977). The patterns on gravity maps of this type indicate density variations associated with lithologic changes in the crust. The rocks involved in the Appalachian orogeny including rocks beneath the Atlantic Coastal Plain exhibit anomalies that are elongated in the northeast-southwest direction. This type of anomaly elongation is strongly evident in the simple Bouguer anomaly map of Georgia and South Carolina. Most of these anomalies are believed to be produced by deep (greater than 1,000 feet depth), intra-basement crustal sources since these rocks have the greatest density contrast. The wide station spacing used does not

allow the upper structure to be resolved so that no information on the shallow structure (less than 1,000 feet depth) of the postulated Millett fault zone is available.

The simple Bouguer anomaly survey of the Savannah River Plant (Bildwell, 1972), with about a quarter-mile station spacing and 1 mgal contour interval, shows more detailed information on the crustal structure in the vicinity of the postulated Millett fault. The result of this survey is a gravity contour map that is elevation corrected (including average density) and latitude corrected. The occurrence of high density-type rock about three miles northwest of the postulated Millett fault trace is indicative of offset in the Triassic basin beneath the pre-late Cretaceous unconformity. Some faults located by the gravity survey correlate with those located by the seismic reflection surveys, while some modeled faults only correlate with the magnetic survey which was run over the same vicinity. As a result of the method used (e.g. quarter-mile station spacing) all the interpreted structures are at depths below the Cretaceous-Triassic boundary. Cored holes on the Savannah River Plant site indicate high angle foliation in the metamorphosed sediments forming the basement rocks. This would suggest that some of the gravity inflections could be representative of minor changes in rock density instead of faulting. Thus, the eroded top of the Triassic basin sediments may have a more uniform surface than that inferred by the fault interpretation, and the offset of the Triassic basin "faults" in the vicinity of the postulated Millett fault would be less or non-existent.

7.3.3 Magnetic Surveys

Magnetic surveys conducted in the vicinity of the postulated Millett fault include a vertical component magnetic survey of the Savannah River Plant (Birdwell, 1972) and various aeromagnetic surveys (Petty, and others, 1965; Geodata International, 1975a and 1975b; and Zietz and Gilbert, 1980).

The vertical component field survey of the Savannah River Plant was conducted to provide data for use in model studies of the metamorphic rocks underlying the Triassic basin. The principal uses of this magnetic survey are to estimate the depth of sedimentary basins and to locate faults.

The Savannah River Plant survey was conducted using two vertical magnetometers which could be read to an accuracy of about 2.5 gammas and a station spacing of one-quarter mile. The magnetic data indicate a change of rock type in the crystalline basement about three miles northwest of the postulated Millett fault trace. To the south, several other faults in the basement are suggested by the magnetic data. It should be noted that recovered cores from the vicinity show a high angle schistose foliation of the basement rocks. This high angle foliation suggests that metamorphosed sediments have been tilted (Birdwell, 1972) so that magnetic inflections could be representative of minor changes in magnetic content of the rocks in the metamorphic section instead of faulting. As a result, the basin may have a much more uniform basement surface than suggested by the fault

interpretations. Because of the lack of magnetic signature of the Cretaceous and younger sediments and the wide station spacing of one-quarter mile, no information on Cretaceous or younger faulting can be obtained from the Savannah River Plant magnetic survey.

The patterns shown on the aeromagnetic maps reflect structure and lithology in the crystalline and metamorphic rocks of the postulated fault region. The magnetic contribution of the Coastal Plain sedimentary rocks is negligible. These sedimentary rocks do increase the distance to the magnetic basement rocks. The effect of the increased distance is to decrease resolution of shallow anomalies, smooth and merge anomalies from deeper sources, and lower the amplitude and gradient of the shallow anomalies. The nonmagnetic rocks of the Triassic Dunbarton Basin are believed to be related to a deep, smooth, northeast-trending aeromagnetic low indicated on the various aeromagnetic surveys.

7.4 Remote Sensing

7.4.1 Imagery and Photography Employed in the Study

Imagery and photography of varying scales were used to search for evidence of faulting in the area of the postulated Millett fault. Three main types of imagery, collected by different sensor systems, were employed.

(1) Low-altitude aerial photography at scales of 1:20,000 and 1:40,000,

(2) High-altitude (approx. 65,000 feet) NASA U-2 oblique false color infrared photography, and

(3) Landsat satellite imagery including multispectral scanner (MSS) and return beam vidicon (RBV) sensor data. The MSS data are at a scale of 1:3,369,000 and the RBV at a scale of 1:500,000.

The areas covered by the various types of imagery are shown on Figure 7-3.

The area examined includes all of the 47 mile length suggested in the Open-File Report as the location of the postulated Millett fault. Low-altitude panchromatic black-and-white photographs taken in May, 1951 and December, 1969 at a scale of 1:20,000 were assembled into mosaics, as shown on Plates 1 and 2. The location of the postulated fault has been indicated on these plates as a zone between the dotted lines. An examination of this imagery revealed no surface evidence of faulting. Similarly, the oblique U-2 false color photography taken on May 1, 1969 was found to show no surface indications of faulting. This oblique photograph, shown on Plate 3, measures energy reflected from the surface of the earth in the visible and photographic infrared portions of the light spectrum.

Seven Landsat satellite images covering two seasonal conditions and different sun illumination angles were examined. Imagery from different seasons often reveal any features temporarily obscured by surface cover at other times of the year. Imagery taken with varying

sun angles, especially low sun angles, was used as shadows are useful in enhancing lineaments and hence aiding in their detection.

The six Landsat digital images and an RBV subscene examined for the study area are as follows:

Landsat MSS Imagery

December 1, 1973	Scene #1496-15301
	Sun Elevation 29°
February 11, 1974	Scene #1568-1528100
	Sun Elevation 33°
June 17, 1974	Scene #1694-1525200
	Sun Elevation 61°
January 23, 1976	Scene #2366-1518300
	Sun Elevation 27°
June 6, 1976	Scene #5414-1448000
	Sun Elevation 53°
January 17, 1977	Scene #2726-1507200
	Sun Elevation 25°

Landsat RBV Imagery

November 30, 1980	Scene #83100115085XC

7.4.2 Digital Processing and Image Analysis Techniques

These satellite images, stored as digital data on computer compatible tapes, were examined on Bechtel's image processor, Model-70, built by International Imaging Systems, Sunnyvale, California.

Digital enhancement procedures designed to enhance linear features were employed. Plates 4 and 5 show the satellite images over the area of the postulated Millett fault in Georgia and South Carolina. The two digital images, a summer scene (June 6, 1976) and a winter scene (February 11, 1974) were contrast stretched by the image processor to enhance surface features. This operation expands the digital range of the data by converting it from 7-bits to 8-bits utilizing the full dynamic range of 256 values. When the resultant digital data are displayed on the image processor the visual effect is to increase the contrast between adjacent pixels and hence the features of interest. The enhanced subscenes were then photographed directly from the television monitor using standard 35 mm equipment and assembled into a mosaic for study. The enhanced subscenes have not been geometrically corrected; hence the overall geometry of the mosaic is not considered a standard projection.

The imagery and photography were examined closely to identify linear features and isolate the lineaments that might represent the surface expression of a geologic structure. The procedure employed was to first identify lineaments on the imagery, then eliminate all of those lineaments having an obviously non-geologic basis, such as roads,

transmission lines, property lines and other cultural features. The remaining lineaments, those which could not be immediately attributed to cultural origins, were subjected to further study.

Professor R.J.P. Lyon of Stanford University, Remote Sensing Laboratory provided assistance in designing the study and interpreting the imagery.

7.4.3 Results of Remote Sensing Studies

Clear mylar overlays were placed over each mosaic which were then studied individually by geologists and remote-sensing specialists and the lineaments marked on the mylars. For the summer image taken on June 6, 1976, 168 lineaments were identified; for the winter image taken on February 2, 1974, 136 lineaments were identified. The lineaments are shown on Figures 7-4 and 7-5. Each lineament was then individually assessed and classified according to six criteria, as shown in Table 7-4. These criteria were further grouped into two major categories representing (1) those lineaments with a cultural origin and (2) those with a geomorphic origin. These two categories appear in Figures 7-4 and 7-5 where the lineaments colored in black indicate the cultural features, and those in red and blue indicate the geomorphic features.

7.4.3.1 Lineaments of Cultural Origin

The majority of the lineaments were found to be caused by the optical alignment of field boundaries and some stream sections and hence were classified as having a cultural origin. The low-altitude 1:20,000

aerial photography and selected field observations confirm the origins of these optical lineations on the satellite imagery. A smaller number of the cultural lineaments was attributable to roads which often parallel agricultural fields.

7.4.3.2 Lineaments of Geomorphic Origin

A high percentage of the lineaments not associated with cultural features are predominantly attributable to the alignment of stream and river sections. These lineaments appear in blue on Figures 7-4 and 7-5. Lineaments identified in red on Figures 7-4 and 7-5, and individually identified by letters, are predominantly associated with floodplain features and karst topography.

Lineaments Associated with Flood-Plain Margins

Comparison of Figures 7-4 and 7-5 indicates that many of the lineaments occur along the flood plain margins of streams and rivers the Landsat image of June 6, 1976 (Figure 7-5), while fewer are seen on the image taken February 11, 1974 (Figure 7-4). These lineaments are labelled A through I and M on Figure 7.5 and B1, C1 and X on Figure 7-4. Using Figure 7-4, it is possible to gain a better understanding of the margins of the river and stream floodplains, and the neighboring agricultural fields than in the image shown in Figure 7-5. Concurrent use of the two mosaics allows the interpreter to accurately identify the river floodplains and the associated depositional features such as meander scars and paleochannels.

Lineaments Associated with Drainage Basin Divide

Two geomorphic lineaments near the Vogtle plant site (labelled J and K on Figure 7-5) are present on the June 6, 1976 image. Field observation of these lineaments, together with an examination of the other mosaic in Figure 7-4 reveal that these linear features represent the drainage divide of the drainage basin in which the Vogtle plant is located.

Lineaments of Geomorphic Origin near Ellison's Landing

One lineament close to the postulated Millett fault and intersecting it near Ellison's Landing northeast of Girard was examined in the field. This lineament is labelled V on Figure 7-4 and L and L1 on Figure 7-5. This lineament is also identified by the green dashed line on Plates 4 and 5. It is approximately 13 miles in length. From the satellite imagery a number of stream branches and agricultural fields appear to be aligned. Additionally, Brier Creek deviates from its general northwest-southeast direction to flow north along the linear feature for a distance of 0.3 miles before resuming its southeasterly flow direction.

The results of the field investigation are:

(1) No scarps or other evidence of fault activity were found along the aligned creek branches or at Brier Creek.

(2) The bluffs behind Ellison's Landing are uniform in slope on either side of the linear feature, but there are no outcrops.

(3) The deviation in the flow direction of Brier Creek is most likely caused by chert deposits varying in size from 1-inch to 1-1/2-foot diameter boulders found in the stream bank deposits. The areal extent of these deposits is not known. The stream is less able to erode these hard deposits than the surrounding material and so is diverted in a northerly direction around this obstruction before proceeding to the southeast.

(4) The dark tones seen on the summer image east of the linear feature contrast with the distinctive white and red color signatures on the west side. These differences in color due to variations in ground cover contribute to the visual impression of a linear feature.

No evidence for faulting is present along the trace of this linear feature.

Lineaments Associated with Previous Quaternary Sea-Level Locations

A number of small geomorphic linear features identified in the southeasterly section of the imagery are possibly old 'strand lines' related to previous Quaternary stands of the Atlantic Ocean and are considered non-structural in origin. These lineaments are labelled R and S on Figure 7-4 and O, P and Q on Figure 7-5.

Lineaments Associated with Karst Topography.

The geomorphic lineaments identified as karst features are caused by the apparent alignment of circular ponds and agricultural fields in

this area. These lineaments are located mainly in the eastern half of both images on the topographic highs and are labelled T, U, Z, Y, W and Al on Figure 7-4 and N and Nl on Figure 7-5. The karst features were easily identified by enhancing the thermal bands on the image processor to preferentially display water bodies. There is no common orientation direction for these karst associated lineaments.

The satellite imagery shows that sections of the Savannah River and other major consequent drainage lines parallel one another and change flow direction from southeasterly to a more southerly direction. This general change may be caused by a change in regional dip as discussed in Herrick and Vorhis (1963).

The conclusion drawn from the remote sensing studies is that the lineations on the satellite imagery are unrelated to faulting. They are confidently explained as alignments of field boundaries, stream sections, karst features and fluvial geomorphic features not structurally controlled by faulting. None of the satellite imagery and photography examined showed any evidence of surface expression of the postulated Millett fault.

7.5 Lithologic Analyses

Lithologic analyses were performed on water well cuttings from AL-66 and AL-40 and on core samples from VSC and VG holes to supplement stratigraphic studies on the postulated Millett fault. The main purpose of these studies was to determine if Triassic rocks were

penetrated by holes in South Carolina and to verify stratigraphic correlations based on field evaluation of core from VSC and VG holes. Lithologic analyses included petrographic examination, x-ray diffraction of both bulk and clay size fractions of submitted samples, and heavy mineral analyses. The sample locations used in the analysis are shown on Figures 7-6 and 7-7.

Petrographic examinations were performed at Bechtel and splits of the collected samples were sent to Dr. R. C. Reynolds and Dr. R. Parnell of Dartmouth University, and Dr. Ralph E. Grim of the University of Illinois for x-ray diffraction analyses. Heavy mineral analyses were performed by Dr. J. Thomas of Reservoirs, Inc., Denver, Colorado.

7.5.1 Lithologic Analyses of Samples from Water Wells AL-66, AL-40 and Core Hole VSC-4

The Open File Report states that upthrown Triassic rocks have been encountered in water well AL-66 at about -500 feet elevation. In order to investigate this possibility, samples were analyzed from above and below the postulated contact in AL-66, AL-40 and in nearby VSC-4. These samples were submitted for lithologic analyses in order to; 1) compare lateral lithologic variability of samples collected from similar elevations in each hole, and 2) compare samples collected from below the postulated Triassic contact with the known Triassic-Jurassic rocks from DRB 10 (Marine, 1976b).

Samples collected from AL-66 and AL-40 were taken from the same stratigraphic horizons, but their lithologic characteristics differ. This is probably due to the treatment of the samples after they were

originally collected by the well driller. Samples from AL-40 were washed, while AL-66 samples were not. The washing process probably removed any clayey material that was originally in the samples from AL-40. Because the fine fraction of AL-40 was removed, only the coarse fraction was used for comparison with other samples.

7.5.1.1 Lithology of Water Well Cuttings From AL-66 and AL-40

Samples collected from AL-66 were submitted for petrographic examination, heavy mineral and x-ray diffraction analyses (Table 7-5 and Figure 7-8). Samples collected from AL-40 were submitted for petrographic examination only (Table 7-5).

Petrographic examination of AL-66-1 (-468 to -478 feet elevation) and AL-66-2 (-558 to -568 feet elevation), revealed them to be clayey quartz sands, based on the predominance of quartz within a matrix of fine-grained quartz, clay, and muscovite/sericite. The matrices of both samples are heavily stained by hematite and probably limonite. A few shale fragments and patches of kaolinite are present in AL-66-2.

Bulk x-ray diffraction studies support the results obtained from petrographic analyses by indicating a predominance of quartz, moderate amounts of clay, and minor to trace amounts of hematite. Because these water well samples are unwashed, a certain amount of drilling mud may be present as a contaminant. Therefore, discrete clay clasts were carefully extracted from the samples and analyzed. In most cases, these clay clasts consisted almost entirely of kaolinite with minor

amounts of smectite, indicating that they were derived from local units and are not contaminants (Appendix I). The clay matrix was also analyzed for its clay content and was found to consist predominantly of kaolinite.

The heavy mineral assemblages in AL-66-2 consist mainly of opaque minerals with trace amounts of rutile, and possible epidote and zircon.

Petrographic examination of washed water well cuttings from AL-40 (-440 to -450 foot and -550 to -560 foot elevations) indicated that they are almost entirely coarse-grained, moderately sorted quartz with some silt.

7.5.1.2 Lithology of Samples From VSC-4 Core Hole

Samples from VSC-4 were collected from elevations -448.3, -528.3, -538.3, -553.3, -641.3, -709.3 and -843.3 feet (Figure 7-6). Results of petrographic, x-ray diffraction, and heavy mineral analyses performed on these samples are presented in Tables 7-6, 7-7 and 7-8. In general, petrographic examination of these samples showed them to be sandy clay, quartz sand, interbedded shale and sand, sandy micaceous clay, sandy carbonaceous shale, sandy micaceous clay and quartz sand, respectively.

X-ray diffraction analysis of the interbedded shale and sand sample from elevation -538.3 feet, shows equal amounts of quartz and clay, with kaolinite predominant over illite. As determined from heavy mineral analysis, opaque minerals, garnet, unidentified minerals,

zircon and other accessory minerals are present in decreasing abundance. The sandy, micaceous clay from elevation -553.3 feet contains predominant quartz with moderate amounts of illite and smectite clay. Muscovite was not noted, but may have been identified as illite since x-ray diffraction peaks for the two minerals overlap.

Heavy mineral analysis of the quartz sand from elevation -528.3 feet indicates that opaque minerals are predominant with lesser amounts of zircon, tourmaline, garnet, epidote and other accessory minerals. The quartz sand from -843.3 feet elevation contain opaque minerals, zircon, tourmaline, and other accessory minerals.

7.5.1.3 Comparison of Samples Collected from Similar Elevations in AL-66 and VSC-4

The sandy clay sample collected from VSC-4 at elevation -448.3 feet is very similar in lithology to that of the clayey, quartz sand from elevation -468.0 feet in AL-66. Both samples consist of quartz grains within an iron-rich clay matrix.

The clayey quartz sand of the sample collected from an elevation of about -558 feet in AL-66 (Al-66-2) is very similar to the sandy, micaceous clay from -553.3 feet elevation in VSC-4. Both samples contain quartz, clay, muscovite and a trace of feldspar. These, in addition to the sample from about -550 feet in AL-40, contain trace amounts of dolomite (Appendix G).

Minor shaly material found in AL-66-2 was not found in the sample closest in elevation to VSC-4 (-553.3 feet). Similar shaly material was found in VSC-4 at elevation -538.3 feet. Since AL-66-2 consists of water well cuttings, it is probable that the shaly material in AL-66 is the result of contamination from above.

7.5.1.4 Comparison of Samples Collected from Below the Postulated Pre-Late Cretaceous Unconformity in AL-66, AL-40 and VSC-4 to Triassic Rocks from DRB 10

Samples were collected from approximately 50 feet below the postulated pre-Late Cretaceous unconformity in AL-66, AL-40 and VSC-4. Their lithologies were compared with those of Triassic rocks approximately 50 feet below the known Cretaceous-Triassic contact in core hole DRB 10 on the Savannah River Plant. Figure 7-8 shows the lithologies of samples AL-66-1 AL-66-2 and core from DRB 10 (Marine, 1976).

There are several significant differences between the lowermost samples from VSC-4, AL-66 and AL-40, and the Triassic rocks. First, a significant amount of plagioclase and minor amounts of potassium feldspar are present in Triassic rocks, but only minor amounts of potassium feldspar, and no plagioclase were detected in VSC-4, Al-66 or AL-40. Second, illite, followed by chlorite and mixed-layer clays, are the predominant clay minerals in Triassic rocks. Kaolinite is occasionally present but always in lesser amounts than illite. By contrast, kaolinite is the predominant clay in AL-66. Kaolinite is also the predominant clay type in VSC-4 at -538.3 feet elevation although equal amounts of illite and smectite were reported in VSC-4 at -553.3 feet elevation. Illite may have been mistaken for muscovite

since x-ray diffraction patterns of the two minerals overlap. Because samples from AL-40 had been washed, clay minerals are lacking in these samples they were not used for comparison.

The lithology of samples collected from AL-66, AL-40 and VSC-4 at elevations below the postulated pre-Late Cretaceous unconformity proposed in the Open-File Report are inconsistent with known Triassic-Jurassic lithology based on mineralogical analyses of core samples from DRB 10. Further, samples taken from AL-66 and AL-40, both above and below the proposed contact (-500 feet elevation), are not significantly different from each other suggesting that there is no lithologic contact at this elevation.

It is therefore, concluded that lithologic evidence does not support the existence of Triassic rocks in VSC-4, Al-66 or Al-40.

7.5.2 Lithologic Analyses of Core Samples from VSC and VG Core Holes

The lithology of selected core samples from VSC and VG holes was studied to supplement the stratigraphic correlations interpreted from the core drilling program described in Section 6.2. The intent of these studies was to delineate mineralogical and textural criteria which could aid in correlating and differentiating stratigraphic units.

The samples collected are considered representative of selected stratigraphic units encountered in the core holes. Sample selection was based on visual similarities of portions of core from each of the holes that appeared to represent stratigraphically equivalent units.

Figures 7-6 and 7-7 show sample locations in the VSC and VG core holes. The samples submitted for various studies were taken from the Barnwell Group; and Lisbon, Huber, Ellenton and Tuscaloosa Formations as determined from field study. Tables 7-6 through 7-11 summarizes the results from analytical testing.

7.5.2.1 Barnwell Group

7.5.2.1.1 Griffins Landing Member

The samples collected from the Griffins Landing Member of the Barnwell Group were determined petrographically to be quartzose, calcareous sand consisting of moderately to well sorted, angular to sub-angular quartz grains poorly cemented by microcrystalline calcite (micrite) and clay. Minor to trace amounts of feldspar, microfossils, muscovite, opaque minerals and epidote are often present. Bulk x-ray diffraction analyses of selected samples indicate that they usually contain predominant quartz with lesser amounts of calcite and clay. Clay generally makes up about 10 percent of these samples and usually consists primarily of smectite with some kaolinite and illite. Heavy mineral analyses show that these samples contain mainly opaque minerals with lesser amounts of garnet, zircon, tourmaline, kyanite, sillimanite, epidote and hornblende.

7.5.2.1.2 Twiggs Clay Member

Samples VSC-2-1 and VSC-3-2 were collected from the Twiggs Clay Member of the Barnwell Group. These samples were determined petrographically

to be clayey glauconitic sand, and sandy glauconitic claystone, respectively. X-ray diffraction studies verify the high amount of clay, mainly smectite. The high clay content, a relatively higher amount of unidentified minerals and the presence of collophane differentiates these from samples of the Griffins Landing Member.

7.5.2.1.3 Utley Limestone Member

Samples collected from the Utley Limestone Member of the Barnwell Group are determined petrographically to be fossiliferous, sandy limestone which contains abundant shell fragments and some moderately sorted quartz grains cemented by micrite. Minor to trace amounts of glauconite, feldspar, opaque minerals and epidote are also present. X-ray diffraction analyses indicate that these rocks are predominantly calcite with minor to moderate amount of quartz and usually only a few percent clay. Smectite is usually the predominant clay mineral with traces of kaolinite and illite also present. Although glauconite was reported in the petrographic examinations of these samples, it was not noted by x-ray diffraction techniques. This may be caused by either overlapping glauconite and illite peaks on the x-ray diffractogram or low concentrations of glauconite in the sample.

7.5.2.2 Lisbon Formation

7.5.2.2.1 Blue Bluff Member

Petrographic examination of samples collected from the Blue Bluff Member of the Lisbon Formation show them to be sandy to silty marl, and

shale, often glauconitic and usually laminated. Minor to trace amounts of microfossils, feldspar, opaque minerals, epidote and zircon may also be present. X-ray diffraction analyses of these samples indicate that they generally consist of 30 to 70 percent clay with quartz and sometimes calcite. ectite is usually the predominant clay mineral with secondary amounts of kaolinite and illite.

7.5.2.2.2 Unnamed Sand Member

Samples collected from the unnamed sand member of the Lisbon Formation consist almost entirely of unconsolidated quartz sand. Petrographic analyses show the sand to be medium-grained and moderately to well sorted. Trace amounts of clay, opaque minerals, epidote and staurolite are often present. The heavy mineral assemblage consists mainly of opaque minerals with lesser amounts of garnet, zircon, tourmaline, hornblende and epidote.

7.5.2.3 Huber Formation

X-ray diffraction analyses of samples collected from the Huber Formation indicate they consist mainly of c ay, predominantly kaolinite, with minor amounts of smectite and illite. Moderate amounts of quartz and amorphous material are present in some VSC and VG core holes.

7.5.2.4 Ellenton Formation

The carbonaceous silt and clay of the Ellenton Formation were analyzed by x-ray diffraction techniques. These samples are generally found to contain about 30 to 65 percent quartz, with the remainder consisting of clay and/or carbonaceous material. The predominant clay mineral is either kaolinite or smectite with lesser amounts of illite.

7.5.2.5 Tuscaloosa Formation

Samples collected from the Tuscaloosa Formation were determined petrographically to be clayey sand and sandy clay. In thin section, the matrix appears to consist of iron stained kaolinite. These samples contain, in addition to kaolinite clay, poorly sorted quartz with moderate to minor amounts of muscovite, gypsum and potassium feldspar. X-ray diffraction analyses indicate these samples contain 50 to 80 percent quartz with lesser amounts of clay and occasional feldspar. The clay content ranges from 15 to 45 percent, with kaolinite usually the predominant clay mineral. Illite, not muscovite was reported by x-ray diffraction; however, these minerals are virtually indistinguishable on an x-ray diffractogram. Heavy mineral analyses indicate that opaque minerals are predominant with lesser amounts of zircon, tourmaline, garnet, hornblende, epidote, and rutile.

7.5.2.6 Discussion of Lithologic Results

The samples collected from the formations described above are classified based on mineralogical and textural characteristics determined from petrographic examinations.

X-ray diffraction results support the petrographic study. Although clay mineral percentages (relative to each other) are very similar in the Griffins Landing Member, the Utley Limestone Member of the Barnwell Group, and the Blue Bluff Member of the Lisbon Formation, total clay amounts varied greatly. The total clay content for each formation is about 10, 3 and 50 percent, respectively.

The dominance of kaolinite in the Huber Formation samples is quite distinctive. The Ellenton and Tuscaloosa Formations are differentiated by the relatively higher quartz content and predominance of kaolinite in the Tuscaloosa Formation.

In general, heavy mineral analyses indicate that samples from various stratigraphic units contain similar heavy mineral assemblages. Two depth related trends in the VSC and VG core were noted though: 1) opaque mineral content increases with depth 2) sillimanite and kyanite content decreases with depth.

As determined from petrographic, x-ray diffraction, and to a lesser extent, heavy mineral analyses, the lithologic charateristics of the stratigraphic units sampled are quite distinctive. As is shown in Figures 7-6 and 7-7 , samples from the same stratigraphic unit occur at

the proper elevations. Also, samples were taken from near the lower contact of the Barnwell Group and the upper contact of the Lisbon Formation in order to verify formation contacts identified during core logging. The lithology of the samples confirms the stratigraphic correlations.

The lithology of the stratigraphic units described above are consistent with published descriptions of each formation. The lithologies of the Griffins Landing Member and Utley Limestone Member of the Barnwell Group as described by Huddlestun are consistent with the lithologies of samples thought to be from those units. The samples collected from what is considered to be the Blue Bluff Member and unnamed quartz sand member of the Lisbon Formation are lithologically consistent with Siple's description of the McBean Formation (1967) and Sever's description of the Lisbon Formation (1965). Buie's description of the kaolinite-rich Huber Formation (1980) is consistent with the "pure clay" (kaolinite) unit described in the present study. The lithology of samples taken from the unit below the Huber Formation is consistent with Siple's description of the Ellenton and Tuscaloosa Formations (1967).

Two conclusions can be made based on the lithologic studies. First, samples collected from AL-66, AL-40 and VSC-4 at depths below the Triassic contact shown in the Open-File Report are not consistent with the mineralogy of the Triassic rocks in DRB 10. They are consistent with the mineralogy of the Tuscaloosa Formation. The second conclusion is that mineralogy of the Paleocene and Eocene marker beds is similar

within each formation, thus verifying the stratigraphic correlations made between the core holes.

Samples considered to be represtative of stratigraphic units encountered by the VSC and VG core holes were found to be lithologically distinctive. The lithology of the samples confirms the stratigraphic correlations interpreted.

7.6 Seismicity

All available seismicity information within 62.5 miles (100 km) of the Vogtle site was reexamined to test for any association of earthquakes with the postulated Millett and Statesboro faults. This was done because, even should the Millett or Statesboro faults exist, they would be of interest for seismic design at Vogtle only if they should prove to be capable within the context of Appendix A to 10 CFR 100 (U.S. Nuclear Regulatory Commission, 1973). One test of fault capability provided in Appendix A above is exhibition by the fault of "macro-seismicity instrumentally determined with records of sufficient precision to demonstrate a direct relationship with the fault".

Earthquake detection and location have been greatly improved in the Vogtle area in recent years by the installation of many regional high gain seismograph stations. A permanent seismographic network was installed in 1974 in South Carolina between Charleston on the Atlantic Coast and Columbia in the central part of the state. Other stations have been installed permanently or temporarily at sites of particular

interest, especially at nearby reservoirs and at the Savannah River Plant (SRP) just across the Savannah River from Vogtle. Earthquakes located by a sufficient number of these high gain stations provide the main data set of accurately located events in the Vogtle site area.

Two other catalogs of site area seismicity are also considered in this section. Felt events through 1974 within 62.5 miles of the site are listed for completeness, although most of these earthquakes are not well-located. In addition, all earthquakes found in a search of the SRP array records are discussed.

7.6.1 Felt Earthquakes in the Study Area

A brief review of several recent studies (Stover and others, 1979; Reagor and others, 1980) was performed to compile a list of all known felt earthquakes through 1974 that have occurred within the 62.5 mile radius study area of this section. All earthquakes found as a result of this review are shown on Figure 7-9.

Although evaluation of instrumental data for some of the earthquakes shown on Figure 7-9, was performed in the references used by Stover and others (1979) and Reagor and others (1980), the epicenters of these events are not as precisely located as epicenters of earthquakes occurring after 1974. A rough estimate of epicenter location accuracy for these felt events indicates a range of error of one-tenth to several tenths of a degree (about six miles or more). Even within

these broad location limits, only the earthquake of August 14, 1972 (magnitude 2.5 to 3.0) can be considered near one of the faults postulated in the Open-File Report.

An attempt was made to more precisely locate the August 14, 1972 earthquake by performing an independent evaluation or all available data. Both felt reports and instrumental data were considered.

Shortly after the earthquake in 1972, G.A. Bollinger of Virginia Polytechnic Institute and State University (VPISU) mailed postcards to individuals in about 60 towns around the Bowman, South Carolina area requesting felt or damage information (Bollinger, personal communication, 1982). Responses from seven towns indicated that the earthquake had been felt by at least a few people. These towns (Barnwell, Bowman, Cordova, Horatio, North, Springfield, and Summerton, South Carolina) are shown as solid circles on Figure 7-10. The event was reported as "felt by many" and as a "small rumble" at Bowman. Otherwise it was felt only by a few as a slight shaking. Forty-seven other towns reported that the earthquake was not felt. These towns are shown as open circles on Figure 7-10. Although the felt information is diffuse, it is clear that an epicenter in the Barnwell area is not well supported by the data.

The nearest seismograph stations operating at the time of the August 14, 1972 earthquake (Poppe, 1979) were also contacted. These were ATL

(Atlanta, Georgia), CSC (Columbia, South Carolina), BLA (Blacksburg, Virginia), HBV (Harrisonburg, Virginia), LEX (Lexington, Virginia), ORT (Oak Ridge, Tennessee), and CPO (McMinnville, Tennessee). Emergent P- and S-wave arrival times were found for several stations. However, initial analysis indicated that the readings were not mutually consistent for any epicenter location, and that differences between observed and calculated P-wave arrival times of 15 seconds or more occurred. Thus, available instrumental data do not significantly constrain the location of this earthquake.

It is concluded from the above discussion that no felt earthquakes occurring before 1974 are located near enough or with sufficient precision to suggest association with either the postulated Millett or Statesboro faults.

7.6.2 Earthquakes Located with the Regional Seismograph Network

The installation of additional seismograph stations near the Vogtle site since 1974 has allowed much improved detection and location of more recent study area earthquakes. A summary of station distribution for the period 1978 through the beginning of 1982 is presented in Bollinger and Mathena (1982). Over 30 stations are currently operating within South Carolina and the northeast corner of Georgia (see Figure 7-11). Most are maintained by the U.S. Geological Survey, the Georgia Institute of Technology, and the Savannah River Plant. The detection

and location capabilities of this network are summarized by Tarr (1982). Tarr estimates that earthquakes within the study area with magnitudes between about 1.3 and 2.0 should be detected by five or more stations, and that earthquakes with magnitudes between about 2.1 and 2.5 should be detected by 15 or more stations, both at the 90 percent confidence level. Semi-major axes lengths for 90 percent confidence ellipses are on the order of three miles for most study area earthquakes of magnitude 2.0 or above (Tarr, 1982, Figures 3 and 4).

All published well-located earthquake epicenters within the study area (1974-May 1982) are shown on Figure 7-12. Sources of earthquake information for this figure are the various bulletins of the Southeastern U.S. Seismic Network (SEUSSN) compiled and edited at Blacksburg, Virginia (Bollinger and Murphy, 1978; Bollinger and Mathena, 1978-1982), and compilations of U.S. Geological Survey data (Rhea, 1981; Tarr, and others, 1981).

In addition to published information, an independent study was conducted to locate the recent earthquake of January 28, 1982. This is discussed further below.

All earthquakes shown on Figure 7-12 are small. The average magnitude is about 2.1 and none is greater than 2.8. Focal depths are shallow, the average being about four miles. The great majority of the earthquakes shown are located in the extreme northwest part of the

study area. These events are generally in the Piedmont Province, near and around Clark Hill Reservoir. A number of earthquakes in this part of the study area have been identified as explosions associated either with quarry operation or road construction (Long, 1981). It is not known which, if any, epicenters shown on Figure 7-12 are actually explosions. However, past experience in the area and the clustering of origin times during the afternoon indicates that many of the Piedmont epicenters shown in this figure are not tectonic earthquakes (Long, personal communication, 1982). None of these events are near the postulated Millett or Statesboro faults.

The three earthquakes nearest the postulated faults occurred on September 15, 1976, June 5, 1977, and January 28, 1982. Parametric studies were performed on these earthquakes to investigate the effect on location of crustal model variation, stations used in the solution, trial location, and azimuthal weighting. In no case was the final location changed by more than about three miles by these variations.

The 11-station hypocenter solution for the September 15, 1976 earthquake is very near 33.13°N, 81.40°W with a focal depth of just less than 2.5 miles. The smallest distances between this epicenter and the postulated Millett and Statesboro faults are about six miles and 18 miles, respectively.

Sixteen seismograph stations recorded the June 5, 1977 earthquake. This event is located near 33.02°N, 81.43°W at a depth of less than one mile. The closest approach of this epicenter to the postulated Millett

and Statesboro faults is about 11 miles and 14 miles, respectively. A focal mechanism solution has also been published for this earthquake (Guinn, 1980). This solution implies high-angle reverse motion on a fault striking northwest-southeast. This strike is inconsistent with the strike of either the postulated Millett or Statesboro faults. However, detailed studies of the first motion data for this event reveal that the Guinn focal mechanism solution is not well-constrained.

A 14-station solution of the January 28, 1982 earthquake using unpublished arrival time data (Marine, personal communication, 1982; Rhea, personal communication, 1982) places this event near 33.00°N, 81.41°W at a depth of about 2.5 miles. The closest approach of this epicenter to the postulated Millett and Statesboro faults is about 13 miles and 12.5 miles, respectively.

It is concluded that no earthquakes shown on Figure 7-10 are located near enough to suggest association with either the postulated Millett or Statesboro faults.

7.6.3 Data from the Savannah River Plant Array

Since the beginning of September 1976, three high gain, vertical component seismograph stations have been in operation at the Savannah River Plant (SRP) in South Carolina, just across the Savannah River from the Vogtle site. A summary description of the array configuration, properties, and early operating history may be found in Krapp and Stephenson (1977). The relative geometry of the array, the Vogtle site, and the postulated Millett fault are shown on Figure 7-13.

To take advantage of the close proximity of the SRP array to the site and to the postulated Millett fault, all available SRP records were reviewed independently as part of the study area seismicity investigation. A brief summary of this review is presented here.

The postulated Millett fault, as shown on Figure 7-13, and as taken from Figure 2 of the Open-File Report, ranges from about four to 38 miles from stations in the SRP array. The distance from station SRPN ranges from 11.5 to 38 miles. SRPN is the highest gain station of the array and generally records all events noted on the array. It has, therefore, been used in the following discussion to summarize array results.

During the period September 1976 through May 1982, a total of about 130 possible earthquakes were noted with readable P- and S-wave arrivals on at least station SRPN. Using the crustal model of Kean and Long (1980), S-P intervals (ranging from 1.6 to 59 seconds) may be converted into epicentral distances of from about 4.4 to 356 miles. A histogram of the number of events versus six mile distance intervals is shown on Figure 7-14. As shown on Figure 7-13 and indicated in Figure 7-14, events in the distance range from 12 to 38 miles are of principal interest. Most earthquakes occur at greater distances (42 to 102 miles), principally in the northwest (Piedmont) part of the study area or to the southeast in the Bowman and Summerville areas.

As shown on Figure 7-14, eight events were noted within the distance range of interest. These occurred on September 15, 1976, December 30, 1976, June 5, 1977, March 6, 1980, February 21, 1981, April 24, 1981, August 25, 1981, and January 28, 1982.

Of these eight events, all but those of December 30, 1976, April 24, 1981, and August 25, 1981 were previously known and located. The five remaining earthquakes appear on Figure 7-12. The earthquakes of September 15, 1976, June 5, 1977, and January 28, 1982 have been discussed in detail above. Published locations for the March 6, 1980 (Rhea, 1981) and February 21, 1981 (Bollinger and Mathena, 1981) earthquakes place their epicenters approximately 46 miles to the northwest and 24 miles to the northeast of the nearest point on the postulated Millett fault. A preliminary location for the April 24, 1981 earthquake places it in the Clark Hill Reservoir area (Rhea, personal communication, 1982) about 45 miles from the nearest point on the postulated Millett fault. No other station readings have been found for the December 30, 1976 and August 25, 1981 events. Therefore, both events are unlocatable (being recorded only at SRPN and SRPW). Both occurred during local work hours when SRP records are noisy, and both may well be cultural rather than seismic.

It is concluded that no earthquakes recorded on the SRP array are located on the postulated Millett fault. Nearby earthquakes, noted on regional arrays, are well recorded and distinct on the SRP stations. No similar time histories, but of smaller amplitude on SRP array records,

were found. Therefore, no evidence exists for the occurrence of earthquakes recorded only on the SRP array near the site or on the postulated Millett fault.

7.7 Surface Water Hydrology

7.7.1 Analysis by U.S. Geological Survey

The Open-File Report concludes that anomalously large aquifer discharges to the Savannah River occur between Augusta and Burtons Ferry Bridge and are an indirect manifestation of a fault near Millett. To support this finding, the two-year, 30-day low-flows were computed for various gauging stations on the Savannah River and adjacent watersheds, including the Ogeechee River, Brier Creek, and the south fork of Edisto River. Unit baseflows (baseflow rate per unit of surface-drainage area) were calculated for reaches near Millett. The locations of the gauging stations used and the alignment of the hypothetical fault are shown schematically on Figure 7-15. The Open-File Report unit baseflow estimates for the reaches of interest are presented in Table 7-12.

The Open-File Report study calculated a unit baseflow of 0.74 cfs/mi^2 contributed to the Savannah River between Augusta and Burtons Ferry Bridge, about four times that for the Ogeechee River between Louisville and Scarboro (0.17 cfs/mi^2) and 1.6 times that for the south fork of Edisto River between Montmorenci and Denmark (0.46 cfs/mi^2). In addition, the Open-File Report contended that the unit baseflow to the

Savannah River between Burtons Ferry Bridge and Clyo (0.23 cfs/mi^2) is only about 32 percent of that between Augusta and Burtons Ferry Bridge. The unit baseflow to the Ogeechee River between Scarboro and Eden (0.11 cfs/mi^2) is about 65 percent of that between Louisville and Scarboro (0.17 cfs/mi^2). In computing the unit baseflow of the Savannah River between Burtons Ferry Bridge and Clyo, flow contribution from Brier Creek (at the Millhaven gauge) was subtracted from that observed at Clyo. Based upon these observations, the Open-File Report concluded that anomalously large aquifer discharges to the Savannah River occur generally between Augusta and Burtons Ferry Bridge and are possibly an indication of the existence of a fault near Millett.

7.7.2 Factors Affecting Baseflow

Low-flow characteristics of a stream as predicted from streamflow-gauging records depend upon many factors other than the underlying geologic configuration of the drainage basin. These include the surface soil conditions, drainage area, land use, incised depth of the stream, ground water conditions, both surface water and ground water usage, stream length and density, upstream reservoir regulation, and most of all, climate. Extent and type of connection between aquifers and stream are also of major importance. Without the full consideration of all these factors, accurate projections of unit baseflows are not possible. The concept of baseflow per unit of surface drainage area is in itself a nebulous quantity, since the ground water drainage area is not necessarily equal to the surface water drainage area. Although data are not sufficient to accurately

define the ground water drainage area, Fig. 7-19 indicates that for the Savannah River, the drainage area for ground water may be larger than for surface water.

Accurate calculation of 30-day low-flows for the unit baseflow estimation is not without problems. Basically, the two-year, 30-day low-flows are derived from frequency analysis of recorded low-flows and are dependent on the length of the period of record as well as the flow characteristics within this period. Direct physical relationship between the two-year, 30-day low-flow values at two successive gauging locations on a river reach, or between two stations on different rivers, is probably impossible to project. Because of the lag-time between precipitation and ground water contribution to a stream, it is vital that concurrent records be used if comparisons are to be made between stations, and especially between streams.

Two major dams have been built on the Savannah River since 1950. They are Clark Hill, constructed in 1953, and Hartwell Reservoir, constructed in 1958. The first column in Table 7-13 shows unit base flows at Augusta from 1941 through 1970. The years 1953 and 1958 show distinct changes in low-flow regime due to regulation by these two dams. Low flows prior to 1953 are more variable than after 1953. In addition, the low flows are substantially higher after 1958.

7.7.3 Calculation of Baseflows

Because of variations in climate over time it is quite important to use concurrent streamflow records when comparing baseflows at different

locations on different streams. The available streamflow records for the stations utilized are presented on Figure 7-16. This chart shows that the only concurrent period of record for all stations is that from 1941 to 1949, a very short period for frequency analysis. The minimum 30-day low-flow period for each year at these gauging stations was identified and the results are shown in Table 7-14 for each year. The low flows were found to occur within a common time span of approximately 15 days during each year indicating that the streams do have some hydrologic homogeneity.

In computing the 30-day low-flow for the reach of the Savannah River between Burtons Ferry Bridge and Clyo, the contribution from Brier Creek (at the Millhaven gauge), a tributary of the Savannah entering just downstream of the Burtons Ferry Bridge gauge, was subtracted from the flow at Clyo. The unit baseflow was then determined as $\Delta Q/\Delta A$ where ΔQ is the incremental streamflow rate and ΔA is the incremental surface drainage area between successive gauging stations. The results of these calculations are shown in Table 7-13 where all records were used, and in Table 7-15 where only concurrent records were used. Plots of the unit baseflow values for the upper and lower reaches of the Savannah River for the period 1941 to 1970 are presented in Figures 7-17 and 7-18, respectively; average unit baseflows were 0.69 and 0.47 cfs/mi^2 for upstream and downstream reaches respectively.

Baseflows per unit of drainage area should be computed using ground water drainage areas. However, since ground water drainage areas cannot be determined, surface-drainage areas used in the Open-File Report were used here also.

7.7.4 Effects of Possible Streamflow Gauging Errors

The USGS classifies the streamflow records at all the gauging stations in question as "good". A "good" streamflow record will have 95 percent of the daily discharges reported within 10 percent of the true discharge values.

The mathematical process of computing unit baseflows involves subtracting two numbers of approximately equal magnitude. The resulting number of such a computation may have the same absolute error as the original numbers but its relative error is greatly increased. In order to assess the utility of the computation of unit baseflow it was important to examine the possible error inherent in the calculation. Two separate approaches were used.

A statistical analysis was performed of the unit baseflows estimated for the Savannah River reaches and shown in Table 7-13. Using the 30 years of flow records, assuming that the unit baseflows are normally distributed, and applying the t-distribution test indicates that at 98 percent confidence level, the unit-baseflow contribution to the upstream reach would lie between 0.56 and 0.83 cfs/mi^2. For the same confidence level, that for the downstream reach would lie between 0.28 and 0.66 cfs/mi^2.

The previous paragraph estimated probable ranges of unit-baseflow values considering random characteristics of errors. It is also important to estimate the possible maximum error based on magnitude of gauging errors alone. If the possible error in a 30-day low flow value is five percent, the range in unit baseflow would be given by the equation

$$\frac{\Delta Q}{\Delta A} = \frac{[(Q_2 \pm 0.05Q_2)-(Q_1 \pm 0.05Q_1)]}{\Delta A}$$

Choosing the algebraic signs on the right hand side of this equation to give maximum and minimum values respectively, yields what can be considered an estimate of maximum possible error. It should be noted that for rivers with moving beds, the gauging error during low flows is likely to be in the same direction throughout a sequential period since at least part of the error arises due to changes in bed configuration produced by higher flows. Considering year 1946 on the Savannah river as an example, the previous equation indicates that the calculated unit baseflow of 0.60 cfs/mi^2 on the upper reach could have been as large as 0.96 and as small as 0.24 cfs/mi^2. Similarly for the lower reach the calculated unit baseflow of 0.28 cfs/mi^2 could have been as large as 1.12 and as low as -0.57 cfs/mi^2. The negative value would indicate a losing-stream condition, a condition which actually appeared present during 1944, 1965, 1967, and 1969.

It is clear from all the surface water studies that variability of computed unit baseflows is great. Figures 7-17 and 7-18 show this variation graphically for the Savannah River 1941-1970 record. Table 7-14 shows that for the 30-year record of flows, unit baseflow in the

downstream reach was actually greater than that in the upstream reach for 10 separate years while for four years the downstream reach appeared to be a losing stream. The error analysis performed in Section 7.7.4 further emphasizes that computed unit baseflows are subject to enough variation that they cannot be used with confidence to prove or disprove the presence of a barrier (hypothesized fault) in an aquifer.

7.8 Ground Water Hydrology

Well data collected in the field survey were examined in the office to determine which aquifers were penetrated by the wells. Wells determined to be open only to either the Tertiary (upper) or the Cretaceous (lower) aquifers were plotted on separate base maps. Water level elevations were read into a computer program designed to construct potentiometric maps of both aquifers. These maps were subsequently examined and corrected manually to add the physical insight which a purely mechanical contouring is lacking. Wells with inadequate data to determine which aquifer was penetrated, or those penetrating multiple aquifers, were not used.

7.8.1 Reduction of Ground Water Data

The elevation of the top of each aquifer was determined by construction of a structure contour map of the upper aquifer. Data used to construct this map were obtained from publications, lithologic and

geophysical logs from public agencies, and the lithologic and geophysical logs of the core holes drilled in this study.

The water levels of the selected wells in the well survey were evaluated for accuracy. Wells with "reported" levels that are anomalous and those with measured levels known to have been affected by pumping were deleted. Wells located in areas where the confining layers are not present or have undergone facies changes and are no longer confining, were also deleted. When all the valid data from the well survey were assembled, contour maps were produced. The maps were computer drawn by a Calcomp 1055 plotter to produce unbiased graphic representations of the potentiometric surface of each aquifer. In areas of insufficient data, however, the computer extrapolated and often closed contours where there was no justification. Therefore, hand-modified contours were drawn in such questionable areas. These representations of the potentiometric surfaces of the aquifers are shown on Figures 7-19 for the Tertiary (upper) and 7-20 for the Cretaceous (lower) aquifers. These maps provide a basis for qualitative evaluations of the ground water hydrology at the Vogtle site, as discussed in Section 8.1.11. They were also used to calibrate the numerical model, which is described below.

In response to comments from the ground water consultants, interpretive contouring of the upper aquifer potentiometric data was done as a comparison to the computer-generated contour map. Additional control

points used for this interpretation include the water level of an observation well at the Vogtle Plant, and the river level upstream of the Vogtle plant in the outcrop area of the aquifer. It is evident that the aquifer discharges to the river in this area. Although ground water flow may have a significant vertical component at the river, the aquifer is unconfined in the outcrop area and the river elevation is believed to be close to the true potentiometric surface. Figure 7-21 compares the computer-generated with the hand-drawn (interpretive) piezometric contours for the upper aquifer, in the vicinity of the Vogtle plant. The principal differences are the more extended zone of ground water discharge along the river, and the relocated 160 and 180 foot contours in the zone of no data near Williston. The overall configuration of the potentiometric surface is not changed relative to the postulated Millett fault.

In order to investigate the possibility of anomalous water level changes across the postulated Millett fault, water levels were measured in two lines of wells and piezometers crossing this inferred structure as shown on Figure 7-22. Only wells completed in either the upper (Tertiary) or the lower (Cretaceous) aquifer were used for this analysis, and all water levels were collected during the summer of 1982. Data from AL-66 were considered unreliable because this well is completed in more than one aquifer unit. Figures 7-23 and 7-24 show the water level profiles constructed. Anomalous water levels are not present, as discussed in Chapter 8.

7.8.2 Numerical Model

7.8.2.1 Purpose and Approach

As explained in Section 8.1.11.2, the results of the water well survey indicate that ground water discharges into the Savannah River south of Augusta in the outcrop area of each aquifer. Both maps show reversal of ground water gradient in the vicinity of the Vogtle site. These reversals of gradients are the only features that could be considered anomalous. There are several possible explanations for the observed reversals of ground water gradients: 1) a barrier caused by faulting, 2) a marked change is lithology, and 3) the hypothesis advanced by Siple (1960), and LeGrand and Pettyjohn (1981). This theory describes one common type of hydrogeologic system which is dominated by consequent streams flowing down a structural basin. This is illustrated schematically on Figure 7-26. These streams capture large quantities of ground water discharge, which creates a natural cone of depression at the lowest exposed point in the aquifer. According to LeGrand and Pettyjohn (1981), the cone of depression observed in the Cretaceous aquifer south of Augusta, and the uneven distribution of ground water discharge in this area can be explained by the above theory. It is the purpose of the numerical model developed herein to study the validity of these hypotheses. The model also attempts to demonstrate as it was clearly stated at the beginning of this chapter that the interpretation of these ground water data alone does not

confirm or deny the existence of the postulated Millett fault. The digital model used for this study is part of Bechtel's library of computer programs. This two-dimensional finite element model, referred to as FLUMPB, has been shown to be well suited for a wide class of problems arising in subsurface hydrology. These problems include confined saturated flow, unconfined or partially confined flow, axisymmetric flow to a well with storage, and flow in saturated-unsaturated soils (Narasimhan et al., 1978). The program uses a special numerical procedure that eliminates many of the difficulties encountered in modeling extensive aquifer systems, while providing a high level of accuracy and efficienty. The model solves the time-dependent ground water flow equation and reaches the steady state asymptomatically as a limit to the transient problem.

7.8.2.2 Input Data

The input data necessary to operate the model are essentially of three types: model geometry, physical properties, and initial and boundary conditions.

The model geometry, as shown on Figure 7-25, has been designed so that the element shapes and the nodal spacings can accommodate variations in transmissivity, recharge rates, and boundary conditions. The grid is refined in the region of high gradients, especially along the Savannah River in the outcrop areas.

The transmissivity was varied throughout the model to account for changes in the aquifer thickness, which ranges from 0 to 1,500 ft in the area of the Vogtle site. In the model, the thickness was assumed to decrease from 1,250 ft at the lower end of the study area to 100 ft in the unconfined zone. The different thickness zones specified in the model are shown on Figure 7-25. The transmissivity values for each element were specified accordingly. The transmissivity changes in a stepwise manner in the confined part of the aquifer, and varies linearly with the head in unconfined areas.

Constant-head boundary conditions were assigned along the Savannah River where it cuts into the outcrop area. The values specified at the corresponding nodes were the average ground elevation in the immediate vicinity. The northwest limit of the model, where the Cretaceous rocks which comprise the lower aquifer thin and crop out, was also assigned a constant head boundary condition equal to the ground elevation. The lower southeast model boundary was similarly kept at a constant head equal to 140 ft. The sides of the model are no-flow boundaries.

Recharge to the ground water due to infiltration was taken into account by assigning appropriate source terms throughout the unconfined part of the aquifer. Of the average 48 inches per year of precipitation in the study area, 10 inches per year were taken to contribute to deep percolation. This rate of 10 inches per year is 50 percent of the rainfall during the non-growing season.

The storage coefficient was estimated to be 0.0001 in the confined part of the aquifer and 0.25 in the unconfined areas. These values are considered to be representative of the geologic materials prevailing at the site.

7.8.2.3 Numerical Model Results

This section presents the results obtained by numerical modeling. As explained in the previous section, the numerical model was developed to test alternative hypotheses that may account for the observed ground water conditions in the Cretaceous aquifer.

7.8.2.3.1 LeGrand's Hypothesis

This test case uses the model and the input data described in Section 7.8.2.2. The corresponding results are given on Figure 7-27, which shows the piezometric contours calculated under the conditions believed to be generally representative of those prevailing in the Cretaceous aquifer. It is apparent that an area of low ground water contours, (sinks), develops in the unconfined part of the Cretaceous aquifer around the Savannah River. This feature exists without taking any account of it in the model of the postulated Millett fault. The calculated potentiometric map is in general agreement with the observed field data (Figure 7-20), which also exhibit the characteristic sink north of the postulated Millett fault. The numerical simulation

therefore indicates that the ground water conditions observed at the site correspond to those prevailing around streams flowing along dipping strata, as stipulated in LeGrand's hypothesis.

7.8.2.3.2 Hypothesis of a Barrier Fault

The next step was to simulate the effect of a barrier at the location of the postulated Millett fault. This was achieved by assigning a lower permeability to the elements located in the appropriate mesh area. The results are shown on Figures 7-28 and 7-29, which correspond to a fault permeability equal to 100 ft/year and 1 ft/year, respectively. The ground water contours are significantly affected in the vicinity of the barrier, as it can be seen by comparing the base case (i.e. LeGrand's hypothesis, Figure 7-27) with Figures 7-28 and 7-29. However, the sink that characterized the ground water contours around the Savannah River in the base case is still apparent. It is therefore concluded that the ground water data alone cannot be used to prove or disprove the existence of a barrier fault.

7.8.2.3.3 Hypothesis of Reduced Transmissivity

Another hypothesis stipulated in the Open-File Report, was that of an abrupt reduction in aquifer thickness south of the postulated Millett fault. This hypothesis was tested with the model by reducing the transmissivity of the elements located in the corresponding area of the

finite element mesh. The new distribution of aquifer thickness assumed on the model is shown on Figure 7-30, and the corresponding simulation results are presented on Figure 7-31. Comparison of Figure 7-31 with the base case similation (Figure 7-27), indicates that the main effect of using lower transmissivity values south of the postulated fault is to shift southward the 200-foot potentiometric contour. Further comparison of both Figures 7-27 and 7-31 with the field data (Figure 7-20) indicates that assuming a reduced transmissivity south of the postulated fault yields a less satisfactory agreement with the observed data than when the transmissivity increases gradually from north to south, as it does in the base case. Consequently, it seems that the assumption of reduced transmissivity south of the postulated fault is not a valid hypothesis.

TABLE 7-1

AVAILABLE INFORMATION ON PETROLEUM COMPANIES AND WELL OPERATORS

WELL OWNER	WELL LOCATION	YEAR COMPLETED	REMARKS
Beddingfield & Falin	1 well: Emmanuel County	1932	These two men collaborated on this well only. No data.
F. W. McCain	1 well: Screven County	1963	Drilled by Barnwell Drilling Co., Shreveport, LA. No Data.
Georgia Oil Co.	1 well: Emmanuel County	1932	Company formed for this test well only. No Data.
Georgia Petroleum Co.	1 well: Jefferson County	1907	Only known information is that company was associated with A. F. Lucas of Spindletop fame.
Three Creeks Oil Co.	2 wells: Burke County	1923	No well location or information concerning this company was discovered.

TABLE 7-2

GEOPHYSICAL AND PETROLEUM COMPANIES CONTACTED

COMPANY NAME	DATA AVAILABLE
Allen Geophysical Consulting	None
Alliance Research Co.	None
Alpha Geophysical Consultants	None
American Resource Consultants	None
Anneler, Joy J.	None
Applied Research Concepts	None
B&H Geophysical, Inc.	None
Baird Petrophysical Group	None
Ballard, Jack W.	None
Bell & Murphy & Assoc.	None
Geosource, Inc.	None
Western Geophysical	None
Southeastern Exploration & Production Co.	Gravity survey, Burke-Screven Co. line
Texaco	Seismic reflection survey of Effingham Co., seismic reflection study down Savannah River from Savannah, GA. and continuing into Gulf of Mexico.

TABLE 7-3

SEISMIC BROKERAGE FIRMS CONTACTED

COMPANY NAME	REQUEST	RESULTS
Austin Exploration, Inc.	Data Search	No data discovered.
Dibler Seismic Service	Data Search	Uncovered Vibroseis line belonging to SeisData Services.
GDI, Inc.	Data Search	No data discovered.
GTS Corporation	Data Search	No data discovered.
Petroscience Corporation	Data Search	No data discovered.
SeisData Services	Data Search	Discovered Vibroseis line crossing strike of postulated Millett fault.

TABLE 7-4

ANALYSIS OF IMAGERY LINEAMENTS*

		CULTURAL FEATURES			GEOMORPHIC FEATURES		
LANDSAT IMAGE DATE	NUMBER OF LINEAMENTS	PREDOMINANTLY FIELD BOUNDARIES	PREDOMINANTLY FIELD BOUNDARIES & STREAM ALIGNMENT	ROADS AND POWER LINES	PREDOMINANTLY STREAM ALIGNMENT	PREDOMINANTLY FLOODPLAIN FEATURES	PREDOMINANTLY KARST FEATURES
6/6/76	168	55	52	3	39	17	2
2/11/74	136	47	54	3	21	5	6

*Dominant feature resulting in observed lineament.

TABLE 7-5

GENERAL PETROGRAPHIC DESCRIPTION OF
SAMPLES FROM WATER WELLS AL-66* AND AL-40*

AL-66-1 (-468 to -478 ft)**

Clayey, quartz sand
Coarse-grained, well sorted quartz within a matrix of fine-grained quartz, muscovite and clay

AL-40 (-440 to -450 ft)

Quartz sand
Coarse-grained, moderately sorted quartz

AL-66-2 (-558 to -568 ft)

Clayey, quartz sand
Poorly sorted quartz within a muscovite/sericite and clay matrix, with minor shale material and a trace of dolomite.

Heavy mineral fraction consists mainly of opaque minerals with minor amounts of rutile, epidote (?) and zircon (?) (See Appendix H).***

AL-40 (-550 to -560 ft)

Silty quartz sand
Coarse-grained, moderately sorted quartz with minor silty material and a trace of dolomite

*Examination made from grain mounts of water well cuttings.
**Sample locations are designated by elevations from sea level.
***Results provided by heavy mineral analysis.

TABLE 7-6

GENERAL PETROGRAPHIC DESCRIPTION OF SAMPLES FROM VSC CORE HOLES

	Core hole VSC-2	Core hole VSC-3	Core hole VSC-1	Core hole VSC-4
Barnwell Group Twiggs Clay and Griffins Landing Members	VSC-2-1(54.7 ft)** Clayey, glauconitic sand Moderately sorted quartz poorly consolidated by a clayey, glauconitic matrix	VSC-3-2(40.3 ft) Sandy, glauconitic claystone Fine-grained quartz and glauconite within a clay matrix	VSC-1-1(33.5 ft) Quartzose, calcareous sand Well sorted quartz cemented by micrite	VSC-4-1(58.7 ft) Quartzose, calcareous sand Moderately sorted quartz poorly cemented by micrite
Utley Member				VSC-4-2(20.7 ft) Fossiliferous sandy limestone Large shell fragments, moderately sorted quartz with some glauconite within a micrite cement
Lisbon Formation Blue Bluff Member	VSC-2-2(30.7 ft) Silty marl Mixed clay, micrite and very fine-grained quartz; massive	VSC-3-3(33.3 ft) Sandy marl Interbedded sandy and shaly material, both with microfossils, micrite and glauconite	VSC-1-2(31.0 ft) Sandy marl Interbedded sandy and shaly material, both with micrite and microfossils	VSC-4-3(11.7 ft) Sandy shale Very fine-grained quartz within a clay matrix containing relatively abundant garnet/zircon
Unnamed Sand Member	VSC-2-3(-70.3 ft) Quartz sand Well sorted, medium-grained, unconsolidated	VSC-3-4(-101.7 ft) Quartz sand Moderately sorted, medium-grained, unconsolidated	VSC-1-3(-111.0 ft) Quartz sand Moderately sorted, medium-grained, unconsolidated	VSC-4-4(-155.3 ft) Quartz sand Well sorted, medium-grained, unconsolidated
Tuscaloosa Formation		VSC-3-6(-298.7 ft) Sandy clay Poorly sorted quartz moderately consolidated by a clay matrix	VSC-1-6(-301.0 ft) Sandy clay Poorly sorted quartz within a clay matrix	VSC-4-7(-321.3 ft) Quartz sand Well sorted, fine-grained, unconsolidated
				VSC-4-8(-448.3 ft) Sandy clay Poorly sorted quartz within a clay matrix
				VSC-4-9(-528.3 ft) Quartz sand Well sorted, medium-grained unconsolidated
				VSC-4-10(-538.3 ft) Interbedded shale and sand Fine-grained quartz, carbonaceous with some muscovite; bedded
				VSC-4-11(-553.3 ft) Sandy, micaceous clay Poorly sorted quartz and muscovite within a clayey matrix
				VSC-4-12(-641.3 ft) Sandy, carbonaceous shale Fine-grained quartz and some muscovite within a carbonaceous, shaly matrix
				VSC-4-13(-709.3 ft) Sandy, micaceous clay Fine-grained quartz and muscovite poorly consolidated by a clay matrix
				VSC-4-14(-843.3 ft) Quartz sand Well sorted, medium-grained, unconsolidated

*Core holes are arranged from left to right as they are located in the field from NW to SE.

**Sample locations are designated by elevations from sea level.

TABLE 7-7

X-RAY DIFFRACTION ANALYSES OF BULK
AND CLAY SIZE FRACTIONS OF SAMPLES
FROM VSC CORE HOLES

	Core Hole VSC-2	Core hole VSC-3	Core hole VSC-1	Core Hole VSC-4
Barnwell Group Twiggs Clay and Griffins Landing Members	VSC-2-1 (54.7 ft) Bulk - 60% quartz, 40% clay Clay - 100% smectite	VSC-3-1 (61.3 ft) Bulk - 90% clay 10% quartz Clay - 85% smectite, 10% kaolinite, 5% illite	VSC-1-1 (33.5 ft) Bulk - 65% calcite 15% quartz, 10% clay, 5% cristobalite(?), 5% dolomite Clay - 100% smectite	VSC-4-1 (58.7 ft) Bulk - 60% quartz, 30% calcite, 10% clay Clay - 100% smectite
Utley Limestone Member				VSC-4-2 (20.7 ft) Bulk - 90% calcite, 10% quartz, trace clay Clay - trace smectite, illite
Lisbon Formation Blue Bluff Member	VSC-2-2 (30.7 ft) Bulk - 70% clay, 15% calcite, 15% quartz Clay - 90% smectite, 5% illite, 5% kaolinite	VSC-3-3 (33.3 ft) Bulk - 50% amorphous material, 30% clay, 20% quartz Clay - 70% smectite, 30% illite	VSC-1-2 (31.0 ft) Bulk - 50% quartz, 40% clay, 10% feldspar Clay - 60% smectite, 40% illite	VSC-4-3 (11.7 ft) Bulk - 70% clay, 30% quartz Clay - 70% smectite 15% kaolinite, 15% illite
Huber Formation	VSC-2-4 (-119.3 ft) Bulk - 90% clay, 10% quartz Clay - 90% kaolinite, 10% smectite	VSC-3-4 (-152.7 ft) Bulk - 60% clay, 40% quartz Clay - 50% kaolinite, 30% smectite, 20% illite	VSC-1-4 (-148.0 ft) Bulk - 60% clay 40% amorphous material Clay - 70% kaolinite 15% chlorite, 15% smectite	VSC-4-5 (-180.3 ft) Bulk - 100% clay Clay - 90% kaolinite, 10% smectite
Ellenton Formation	VSC-2-5 (-201.3 ft) Bulk - 60% quartz, 40% clay Clay - 75% smectite, 25% illite	VSC-3-5 (-198.7 ft) Bulk - 50% clay 30% quartz, 20% amorphous material Clay - 60% smectite, 20% kaolinite, 20% illite	VSC-1-5 (-205.0 ft) Bulk - 70% amorphous material, 30% clay Clay - 50% kaolinite, 35% chlorite, 15% smectite	VSC-4-6 (-231.3 ft) Bulk - 40% quartz, 30% cristobalite(?), 30% clay Clay - 70% smectite, 15% kaolinite, 15% illite
Tuscaloosa Formation		VSC-3-6 (-298.7 ft) Bulk - 55% quartz 45% clay Clay - 70% kaolinite, 20% smectite, 10% illite	VSC-1-6 (-301.0 ft) Bulk - 50% quartz, 25% clay, 25% amorphous material Clay - 80% kaolinite 20% illite	VSC-4-7 (-321.3 ft) Bulk - 75% quartz, 25% clay Clay - 40% kaolinite, 40% illite, 20% smectite VSC-4-10 (-538.3 ft) Bulk - 50% quartz 50% clay Clay - 60% kaolinite, 40% illite VSC-4-11 (-553.3 ft) Bulk - 60% quartz 40% clay Clay - 50% illite, 50% smectite

*Core holes are arranged from left to right as they are located in the field from NW to SE.

**Sample locations are designated by elevations from sea level.

Table 7-8

HEAVY MINERAL ANALYSES OF SAMPLES
FROM VSC CORE HOLES[1]

	Core hole VSC-2	Core hole VSC-4
Barnwell Group Twiggs Clay and Griffins Landing Members	VSC-2-1 (54.7 ft)[2] opaque minerals (predominant H/M[3])-46%, unidentified minerals, garnet, collophane, zircon, tourmaline, kyanite, others	VSC-4-1 (58.7 ft) opaque minerals (predominant H/M)-41%, garnet, zircon, tourmaline, monazite, others
Lisbon Formation Unnamed Sand Member	VSC-2-3 (-70.3 ft) opaque minerals (predominant H/M)-63% garnet, zircon, hornblende, tourmaline, epidote, unidentified minerals, others	VSC-4-4 (-155.3 ft) opaque minerals (predominant H/M)-55%, garnet, zircon, tourmaline, others
Tuscaloosa Formation		VSC-4-7 (-321.3 ft) opaque minerals (predominant (I/L[4])-65% zircon, hornblende, epidote, unidentified minerals, others VSC-4-9 (-528.3 ft) opaque minerals (predominant H/M)-61%, zircon, tourmaline, garnet, epidote, unidentified minerals, kyanite VSC-4-10 (-538.3 ft) opaque minerals (predominant H/M)-72%, garnet, unidentified minerals, zircon, others VSC-4-14 (-843.3 ft) opaque minerals (predominant H/M and I/L)-67%, zircon, tourmaline, unidentified minerals, garnet, others

Note: Heavy minerals are listed in order of abundance; minerals present in less than 3 percent are classified as others.

1. Core holes are arranged from left to right as they are located in the field from NW to SE.
2. Sample locations are designated by elevations from sea level.
3. H/M : Hematite and magnetite; hematite sometimes coats magnetite grains.
4. I/L : Ilmenite coated with leucoxene.

TABLE

GENERAL PETROGRAPH
OF SAMPLES FROM V

	Core hole VG-7	Core hole VG-4	Core hole VG-2	Core hole VG-3
Barnwell Group Griffins Landing Member			VG-2-1 (23.6 ft) Quartzose, calcareous sand Well sorted quartz poorly cemented by micrite and some clay.	VG-3-1 (21.2 ft) Quartzose, calcareous Moderately sorted quar poorly cemented by micrite and some clay.
Utley Limestone Member	VG-7-1 (44.6 ft)** Fossiliferous sandy limestone Large shell fragments and moderately sorted quartz within a micrite cement		VG-2-2 (8.7 ft) Fossiliferous sandy limestone Large shell fragments and moderately sorted quartz within a micrite cement.	VG-3-2 (6.3 ft) Fossiliferous sandy li Large shell fragments moderately sorted quar within a micrite cemen
Lisbon Formation Blue Bluff Member	VG-7-2 (24.6 ft) Sandy marl Very fine-grained quartz and micro-fossils within a clayey matrix	VG-4-1 (-3.7 ft) Clay and fossiliferous sandy shale Interbedded clay and sandy shale with microfossils and shell fragments.	VG-2-3 (-1.9 ft) Sandy glauconitic marl Well sorted quartz, microfossils and glauconite in a clayey matrix; bedded.	VG-3-3 (-4.3 ft) Silty marl Fine-grained quartz in micrite, clay, muscovi sericite matrix; stron bedded.
Unnamed Sand Member	VG-7-3 (-114.4 ft) Quartz sand Moderately sorted, medium-grained unconsolidated.		VG-2-4a (-131.9 ft) Quartz sand Well sorted, medium-grained unconsolidated.	VG-3-4 (-134.3 ft) Quartz sand Well sorted, medium grained unconsolidated.
Tuscaloosa Formation		VG-4-4 (-294.1 ft) Clayey sand Poorly sorted quartz and some muscovite in a clay matrix.	VG-2-7 (-296.9 ft) Clayey sand Poorly sorted quartz, microcline, and muscovite in a clay matrix.	VG-3-7 (-307.1 ft) Sandy clay Poorly sorted quartz and some microcline an muscovite in a clay ma

* Coreholes are arranged from left to right as they are located in the field from NW to SE.
** Sample locations are designated by elevations from sea level.

7-9

IC DESCRIPTION
C CORE HOLES

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<u>Core hole VG-1</u>

VG-1-1 (23.1 ft)
Quartzose, calcareous sand
Well sorted quartz poorly cemented by micrite and some clay.

VG-1-2 (8.2 ft)
Fossiliferous sandy limestone
Large shell fragments and moderately sorted quartz within a micrite cement.

VG-1-3 (-2.4 ft)
Glauconitic, sandy shale
Very fine-grained quartz with some sericite and glauconite in a clayey matrix; bedded.

VG-1-4a (-128.4 ft)
Quartz sand
Well sorted, medium-grained, unconsolidated.

VG-1-7 (-306.2 ft)
Clayey sand
Poorly sorted quartz and some muscovite within a clay matrix.

<u>Core hole VG-5</u>

VG-5-2 (34.5 ft)
Quartzose, calcareous sand
Well sorted quartz moderately cemented by micrite and some clay.

VG-5-3 (-14.5 ft)
Fossiliferous sandy limestone
Large shell fragments and well sorted quartz grains within a micrite cement.

VG-5-4 (-18.0 ft)
Marl and sandy marl
Sandy material in contact with shaly material both with clay and micrite.

VG-5-5 (-138.5 ft)
Quartz sand
Well sorted quartz, medium-grained, unconsolidated.

VG-5-8 (-310.5 ft)
Clayey sand
Poorly sorted quartz and some muscovite within a clay matrix.

<u>Core hole VG-6</u>

VG-6-1 (58.1 ft)
Quartzose, calcareous sand and shale
Well sorted quartz poorly cemented by micrite and possibly some clay, in contact with micritic, shaly material.

VG-6-2 (1.1 ft)
Fossiliferous sandy limestone
Large shell fragments and moderately sorted quartz within a micrite cement.

VG-6-3 (-42.9 ft)
Sandy marl
Interbedded sandy and shaly material both with microfossils, clay and micrite.

VG-6-4 (-172.9 ft)
Quartz sand
Well sorted, medium-grained, unconsolidated.

VG-6-7 (-343.9 ft)
Clayey, feldspathic sand
Poorly sorted quartz and feldspar with some muscovite in a clay matrix.

<u>Core hole VG-8</u>

VG-8-1 (1.7 ft)
Quartzose, calcareous sand
Moderately sorted quartz moderately cemented by calcareous to marly material.

VG-8-2 (-10.3 ft)
Fossiliferous sandy limestone
Large shell fragments and moderately sorted quartz within a micrite cement.

VG-8-3 (-52.3 ft)
Sandy shale
Very fine-grained quartz within a matrix of clay with some micrite.

	Core Hole VG-7	Core Hole VG-4	Core Hole VG-2	Core Hole
Barnwell Group Griffins Landing Member			VG-2-1 (23.6 ft) Approximately 10% clay, other constituents not determined Clay - mostly smectite trace illite, kaolinite	VG-3-1 (2 Approx other determ Clay - trace
Utley Limestone Member	VG-7-1 (44.6 ft)* Bulk - 85% calcite, 15% quartz		VG-2-2 (8.7 ft) Approximately 3% clay, Other constituents not determined Clay - mostly smectite trace kaolinite, illite	VG-3-2 (6 Approx other determ Clay - trace kaolin
Lisbon Formation Blue Bluff Member	VG-7-2 (24.6 ft) Bulk - 50% clay, 30% quartz, 20% calcite Clay - 80% smectite, 20% illite	VG-4-1 (-3.7 ft) Bulk - 70% clay, 30% quartz Clay - 71% smectite, 29% kaolinite	VG-2-3 (-1.9 ft) Approximately 50% clay with amorphous material and cristobalite (?), other constituents not determined Clay - 100% smectite, trace zeolite	VG-3-3 (- Approx other determ Clay - 40% sm illite
Huber Formation	VG-7-4 (-126.4 ft) Bulk - 80% clay, 20% quartz Clay - 75% kaolinite, 25% smectite	VG-4-2 (-161.7 ft) Bulk - 100% clay Clay - 95% kaolinite, 5% illite	VG-2-5 (-185.9 ft) Bulk - 100% clay Clay - 95% kaolinite, 5% smectite	VG-3-5 (- Bulk - 20% qu Clay - 10% sm
Ellenton Formation		VG-4-3 (-241.5 ft) Bulk - 50% quartz, 35% clay, 15% amorphous material Clay - 80% smectite, 10% kaolinite, 10% illite	VG-2-6 (-265.4 ft) Bulk - 60% clay, 40% quartz Clay - 50% kaolinite, 25% illite, 25% smectite	VG-3-6 (- Bulk - 30% amo 20% cla Clay - 30% ill
Tuscaloosa Formation		VG-4-4 (-294.1 ft) Bulk - 80% quartz 20% clay Clay - 50% kaolinite, 25% illite, 25% smectite	VG-2-7 (-296.9 ft) Bulk - 75% quartz, 25% clay Clay - 60% illite, 40% kaolinite	VG-3-7 (-3 Bulk - 15% cla Clay - 30% ill

* Core holes are arranged from left to right as they are located in the field from NW to SE.
**Sample locations are designated by elevations from sea level.

TABLE 7-10

X-RAY DIFFRACTION ANALYSES OF BULK AND CLAY SIZE FRACTIONS OF SAMPLES FROM VG CORE HOLES

VG-3	Core Hole VG-1	Core Hole VG-5	Core Hole VG-6	Core Hole VG-8
.2 ft) imately 10% clay, constituents not ined mostly smectite kaolinite, illite	VG-1-1 (23.1 ft) Bulk - 67% quartz, 15% calcite, 11% clay 5% zeolite, 3% plagioclase Clay - mostly smectite trace illite, zeolite	VG-5-1 (60.5 ft) Bulk - 60% quartz, 30% calcite, 10% clay Clay - 100% smectite		VG-8-1 (1.7 ft) Bulk - 50% quartz, 45% calcite, 5% clay Clay - 100% illite
.3 ft) imately 3% clay, constituents not ined mostly smectite illite, zeolite, ite	VG-1-2 (8.2 ft) Approximately 3% clay, other constituents not determined Clay - mostly smectite trace kaolonite, illite	VG-5-3 (-14.5 ft) Bulk - 60% calcite, 30% quartz, 10% clay Clay - 100% smectite, trace kaolinite		VG-8-2 (-10.3 ft) Bulk - 50% calcite, 30% quartz, 15% amorphous material, 5% clay Clay - 60% illite, 40% smectite
.3 ft) imately 50% clay, constituents not ined 60% kaolinite ectite, trace	VG-1-3 (-2.4 ft) Bulk - 54% clay, 32% quartz, 6% zeolite, 3% plagioclase, 2% calcite, 2% hematite, 1% potassium feldspar Clay - 60% smectite, 30% kaolinite, 5% illite, 5% zeolite	VG-5-4 (-18.0 ft) Bulk - 50% quartz, 50% clay Clay - 60% smectite, 40% illite	VG-6-3 (-42.9 ft) Bulk - 60% quartz, 40% clay Clay - 50% illite, 50% smectite	VG-8-3 (-52.3 ft) Bulk - 55% clay, 30% quartz, 15% calcite Clay - 80% smectite, 20% illite
83.5 ft) 80% clay, rtz 90% kaolinite, ctite	VG-1-5 (-190.4 ft) Bulk - 100% clay Clay - 90% kaolinite, 5% illite, 5% smectite	VG-5-6 (-188.5 ft) Bulk - 100% clay Clay - 70% kaolinite, 30% smectite	VG-6-4 (-211.9 ft) Bulk - 50% quartz, 50% clay Clay - 60% kaolinite, 40% smectite	VG-8-4 (-251.3 ft) Bulk - 80% clay 15% amorphous material 5% quartz Clay - 60% kaolinite, 40% smectite
59.3 ft) 50% quartz, rphous material y 40% kaolinite, ite, 30% smectite	VG-1-6 (-264.4 ft) Bulk - 65% quartz, 35% clay Clay - 40% kaolinite, 30% illite, 30% smectite	VG-5-7 (-262.5 ft) Bulk - 70% clay, 30% quartz Clay - 80% kaolinite, 15% illite, 5% smectite	VG-6-6 (-304.9 ft) Bulk - 55% clay, 45% quartz Clay - 75% smectite, 15% illite, 10% kaolinite	
07.1 ft) 75% quartz, y, 10% feldspar 70% kaolinite, ite	VG-1-7 (-306.2 ft) Bulk - 70% quartz, 30% clay Clay - 70% kaolinite, 30% illite	VG-5-8 (-310.5 ft) Bulk - 60% quartz, 40% clay Clay - 75% kaolinite, 25% smectite, trace illite	VG-6-7 (-343.9 ft) Bulk - 60% quartz, 40% clay Clay - 70% smectite, 15% kaolinite, 15% illite	

	Core hole VG-7	Core hole VG-4	Core ho
Barnwell Group Griffins Landing Member			VG-2-1 opaqu (pred sill kyan mine
Lisbon Formation Unnamed Sand Member	VG-7-4 (-114.4 ft) opaque minerals (predominant H/M)-58%, garnet, hornblende, kyagarnet, allanite (?), others		VG-2-4b opaqu (pred garn hornb glauc miner
Tuscaloosa Formation		VG-4-4 (-294.1 ft) opaque minerals (predominant H/M)-65%, garnet, zircon other	VG-2-7 opaqu H/M)- unide epido

Note: Heavy minerals are listed in order of abundance; minerals present in less than 3 pe as others.

1. Core holes are arranged from left to right as they are located in the field from NW to
2. Sample locations are designated by elevations from sea level.
3. H/M = Hematite and magnetite; hematite sometimes coats magnetite grains.
4. I/L = Ilmenite coated with leucoxene.

TABLE 7-11

HEAVY MINERAL ANALYSES OF SAMPLES
FROM VG CORE HOLES

le VG-2	Core hole VG-3	Core hole VG-1	Core hole VG-6	Core hole VG-8
(23.6 ft) e minerals ominant H/M)-44%, manite, garnet, tourmaline, te, epidote, unidentified als, zircon, others	VG-3-1 (21.2 ft) opaque minerals (predominant H/M)-27%, kyanite, garnet, sillimanite, zircon, unidentified minerals, epidote, others	VG-1-1 (23.1 ft) opaque minerals (predominant H/M)-51%, sillimanite, kyanite, garnet, zircon, rutile, unidentified, minerals, tourmaline, hornblende, epidote, others		VG-8-1 (1.7 ft) opaque minerals (predominant H/M)-63%, zircon, garnet, tourmaline, hornblende, epidote, sillimanite, others
(-132.9 ft) e minerals ominant I/L[4])-58%, t, zircon, tourmaline, lende, epidote, onite, unidentified als, others	VG-3-4 (-134.3 ft) opaque minerals (predominant (H/M)-63%, epidote, garnet, tourmaline, others	VG-1-4b (-130.4 ft) opaque minerals (predominant I/L)-57%, garnet, hornblende, epidote, unidentified minerals, zircon, glauconite, others		
(-296.9 ft) es (predominant 74%, tourmaline, ntified minerals, te, others	VG-3-7 (-307.1 ft) opaque minerals (predominant H/M)-63%, unidentified minerals, rutile, tourmaline, zircon, hornblende, epidote, others	VG-1-7 (-306.2 ft) opaque minerals (predominant H/M)-62% staurolite, zircon, epidote, rutile, unidentified minerals, tourmaline, andalusite, others	VG-6-7 (-343.9 ft) opaque minerals (predominant H/M)-61% epidote, hornblende, unidentified minerals, zircon, tourmaline, pyrite, others	

cent are classified

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TABLE 7-12

RESULT OF BASEFLOW ANLAYSIS BY USGS

River	Station	Drainage Area (Mi^2)	30-Day Q_2 (cfs)	Unit Baseflow $\Delta Q/\Delta A$
Savannah River	Augusta	7508	6300	0.74
	Burtons Ferry Br.	8650	7150	0.23*
	Clyo	9850	7540	
Ogeechee River	Louisville	800	170	0.17
	Scarboro	1940	360	0.11
	Eden	2650	440	
S.F. Edisto River	Montmorenci	198	117	0.46
	Denmark	720	358	

* The flow contribution from Brier Creek (at the Millhaven Gauge a drainage area of 646 sq. mi.) was subtracted from the flow at Clyo before the computation.

TABLE 7-13

RESULT OF UNIT BASEFLOW ANALYSIS

Savannah River				Ogeechee River			S.F. Edisto R.
Year	Augusta-Burtons Ferry Br.	Burtons Ferry Br. -Clyo	R	Louisville -Scarboro	Scarboro -Eden	R	Montmorenci -Denmark
1941	0.72	0.83	1.16	0.13	0.03	0.23	0.39
1942	0.54	0.54	0.99	0.12	0.09	0.75	0.35
1943	0.73	0.46	0.63	0.21	-0.05	-0.24	0.63
1944	0.85	-0.16	-0.19	0.16	0.02	0.13	0.44
1945	0.56	0.52	0.93	0.17	0.13	0.76	0.48
1946	0.60	0.28	0.47	0.15	0.08	0.53	0.36
1947	0.58	0.34	0.59	0.20	0.11	0.55	0.47
1948	1.04	0.84	0.81	0.20	0.29	1.45	0.49
1949	1.48	1.64	1.11	0.32	0.25	0.78	0.78
1950	1.27	0.62	0.49	NA	0.18	-	0.64
1951	0.80	0.98	1.23	NA	0.23	-	0.47
1952	0.41	0.75	1.81	NA	0.17	-	0.41
1953	0.60	0.39	0.65	NA	0.15	-	0.42
1954	0.56	0.04	0.08	NA	0.26	-	0.46
1955	0.80	0.77	0.97	NA	0.05	-	0.30
1956	0.57	1.00	1.75	NA	0.11	-	0.43
1957	0.18	0.68	3.71	NA	0.06	-	0.28
1958	0.25	0.07	0.28	NA	0.18	-	0.28
1959	0.06	0.20	3.21	NA	0.04	-	0.36
1960	0.38	0.56	1.50	NA	0.29	-	0.46
1961	0.50	0.43	0.86	NA	0.04	-	0.71
1962	0.68	0.23	0.34	NA	-0.01	-	0.53
1963	0.71	0.79	1.12	NA	0.02	-	0.61
1964	0.74	0.89	1.21	NA	0.13	-	0.41
1965	1.14	-0.03	-0.02	NA	0.18	-	0.88
1966	0.81	0.62	0.76	NA	0.13	-	0.92
1967	0.90	-0.38	-0.42	NA	0.16	-	NA
1968	0.82	0.34	0.41	NA	0.01	-	NA
1969	0.81	-0.30	-0.36	NA	-0.01	-	NA
1970	0.69	0.13	0.19	NA	0.31	-	NA

Remarks:

(1) Flow contribution from Brier Creek was subtracted

(2) Tabulated values are unit baseflows in cfs/mi^2

(3) R is the ratio of downstream unit baseflow to upstream unit baseflow

(4) NA indicates not available due to lack of corresponding streamflow data

TABLE 7-14

LOWEST 30-DAY LOW FLOWS (CFS)

River	Station	Year								
		1941	1942	1943	1944	1945	1946	1947	1948	1949
Savannah River	Augusta	2670	2300	3730	3560	3560	3770	3630	3190	4650
	Burtons Ferry Br.	3490	2920	4560	4530	4200	4450	4290	4380	6340
	Clyo	4180	3370	5060	4650	4750	4750	4730	5110	7670
Brier Creek	Millhaven	228	153	247	209	261	146	252	264	421
Ogeechee River	Louisville	288	143	200	155	218	118	157	224	424
	Scarboro	436	274	439	338	141	294	389	456	794
	Eden	460	341	403	349	507	354	469	662	970
S.F. Edisto River	Mont-morenci	96	77	145	116	106	106	118	124	185
	Denmark	297	258	472	347	359	295	361	380	591

TABLE 7-15

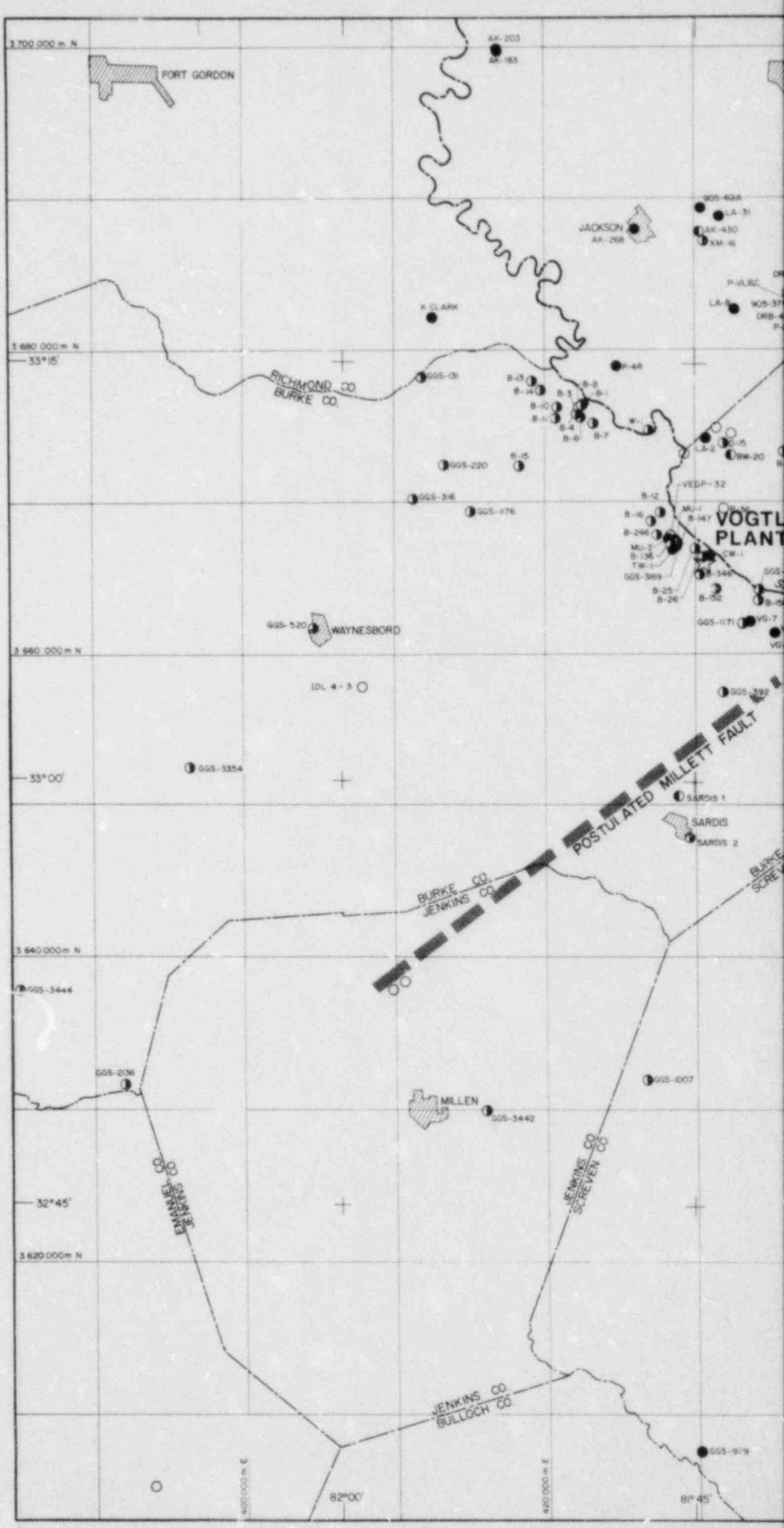
RESULT OF BASEFLOW ANALYSIS USING CONCURRENT STREAMFLOW RECORDS

Year	Savannah River					Ogeechee River					S.F. Edisto River	
	Augusta - Burtons Ferry Br. $\Delta A = 1142$ mi		Burtons Ferry Br. - Clyo $\Delta A = 554$ mi		R	Louisville - Scarboro $\Delta A = 1140$ mi		Scarboro - Eden $\Delta A = 710$ mi		R	Montmorenci-Denmark $\Delta A = 552$ mi	
	ΔQ	$(\frac{\Delta Q}{\Delta A})_1$	ΔQ	$(\frac{\Delta Q}{\Delta A})_2$		ΔQ	$(\frac{\Delta Q}{\Delta A})_1$	ΔQ	$(\frac{\Delta Q}{\Delta A})_2$		ΔQ	$(\frac{\Delta Q}{\Delta A})$
1941	820	0.72	462	0.83	1.16	148	0.13	24	0.23	0.23	201	0.39
1942	620	0.54	297	0.54	0.99	131	0.12	67	0.09	0.75	181	0.35
1943	830	0.73	253	0.46	0.63	239	0.21	-36	-0.05	-0.24	327	0.63
1944	970	0.85	-89	-0.16	-0.19	183	0.16	11	0.02	0.13	231	0.44
1945	640	0.56	289	0.52	0.93	196	0.17	93	0.13	0.76	253	0.48
1946	680	0.60	154	0.28	0.47	176	0.15	60	0.08	0.53	189	0.36
1947	660	0.58	188	0.34	0.59	232	0.20	80	0.11	0.55	243	0.47
1948	1190	1.04	466	0.84	0.81	232	0.20	206	0.29	1.45	256	0.49
1949	1690	1.48	909	1.64	1.11	370	0.32	176	0.25	0.78	406	0.78

ΔQ: Incremental lowest 30-day low flow for the indicated reach

ΔA: Incremental drainage area for the indicated reach

R: $(\frac{\Delta Q}{\Delta A})_2 \Big/ (\frac{\Delta Q}{\Delta A})_1$



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AK-203
AK-193
JACKSON
AK-268
K. CLARK
3 680 000 m N
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RICHMOND CO.
BURKE CO.
GGS-131
B-13
B-14
B-3
B-10
B-11
B-4
B-6
B-7
P-4R
LA-2
BW-20
GGS-220
B-15
GGS-316
GGS-1176
VEGP-32
B-12
MU-1
B-147
B-16
B-246
MU-2
B-136
TW-1
GGS-3389
CW-1
B-25
B-26
B-152
VOGTL
PLANT
GGS-1171
VG-7
GGS-520
WAYNESBORO
3 660 000 m N
IDL 4-3
GGS-3354
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SARDIS 1
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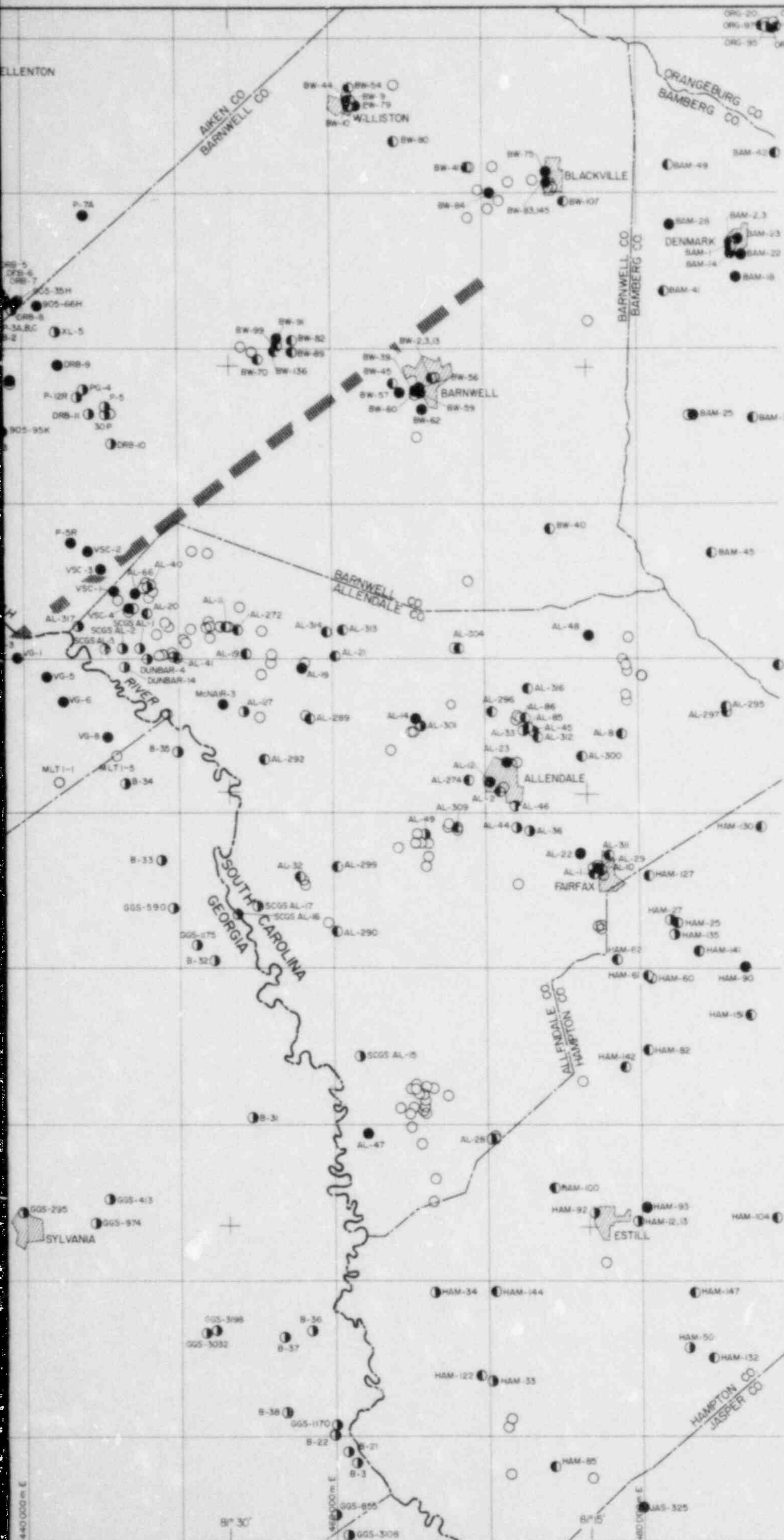
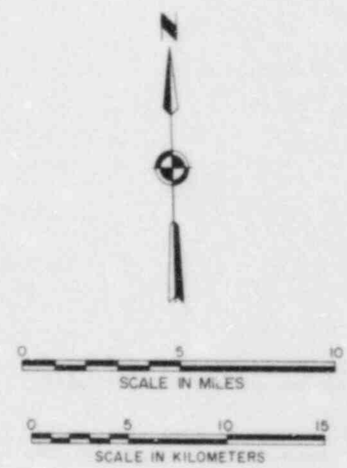
SARDIS 2
BURKE CO.
JENKINS CO.
3 640 000 m N
GGS-3444
GGS-2036
GGS-1007
MILLEN
GGS-3442
EMANUEL CO.
JENKINS CO.
JENKINS CO.
SCREVEN CO.
32° 45'
3 620 000 m N
JENKINS CO.
BULLOCH CO.
GGS-979
400 000 m E
82°00'
420 000 m E
81° 45'



EXPLANATION

- ○ Records available without geologic or ground water information
- ◑ Geologic and/or geophysical information available
- ◐ Ground water information available
- ● Some geologic / geophysical and ground water information available



GRID IS 10,000 METERS UNIVERSAL TRANSVERSE MERCATOR LATITUDE / LONGITUDE SHOWN BY TICK MARKS.

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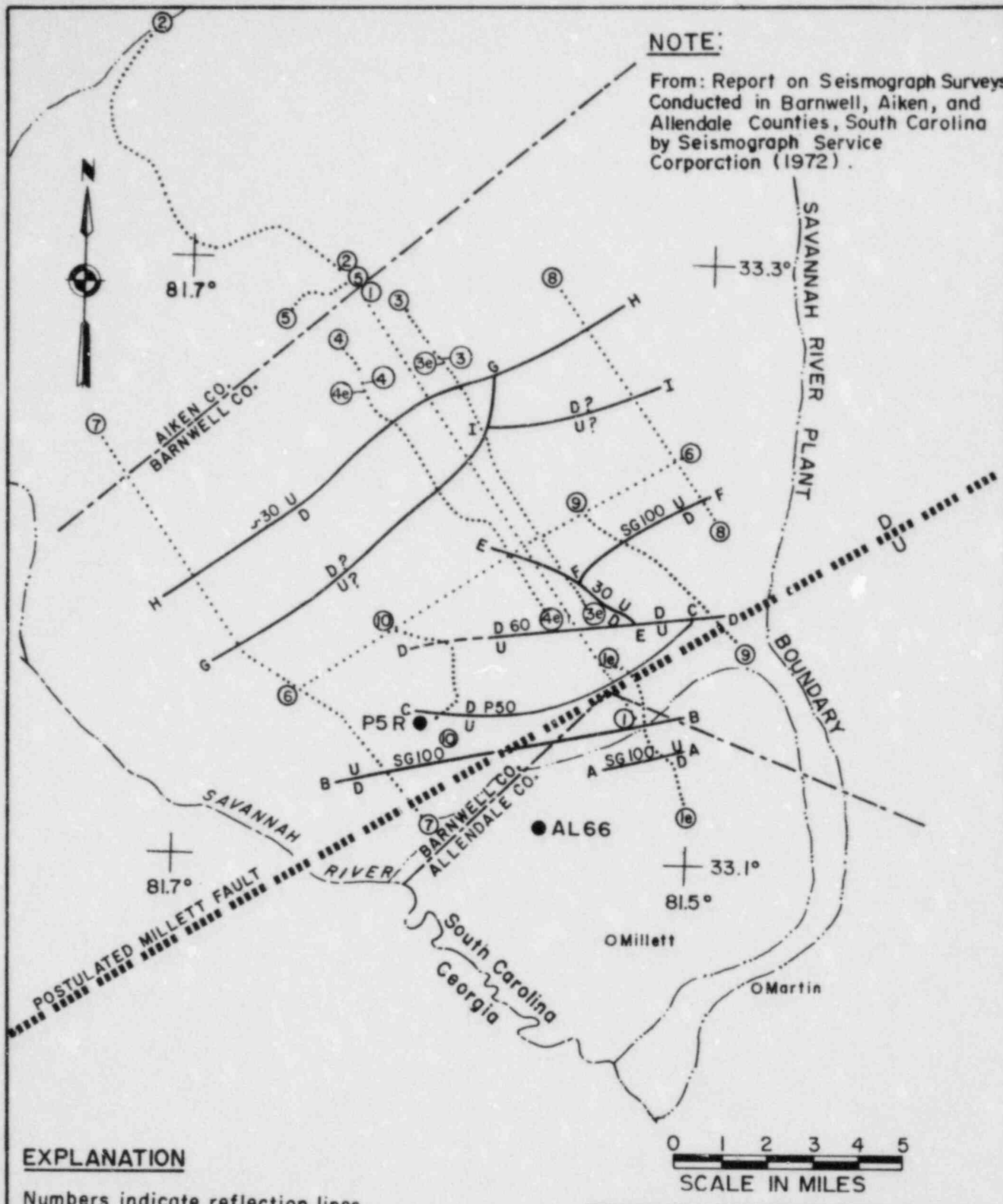
VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

REGIONAL MAP OF DRILL HOLES AND WATER WELLS

FIGURE 7-1



EXPLANATION

Numbers indicate reflection lines

Letters indicate interpreted faults at the top Triassic

Fault direction indicated by U (up) and D (down)

Offset indicated is for the top Triassic, in feet; SG=Slightly greater than; P=Possibly

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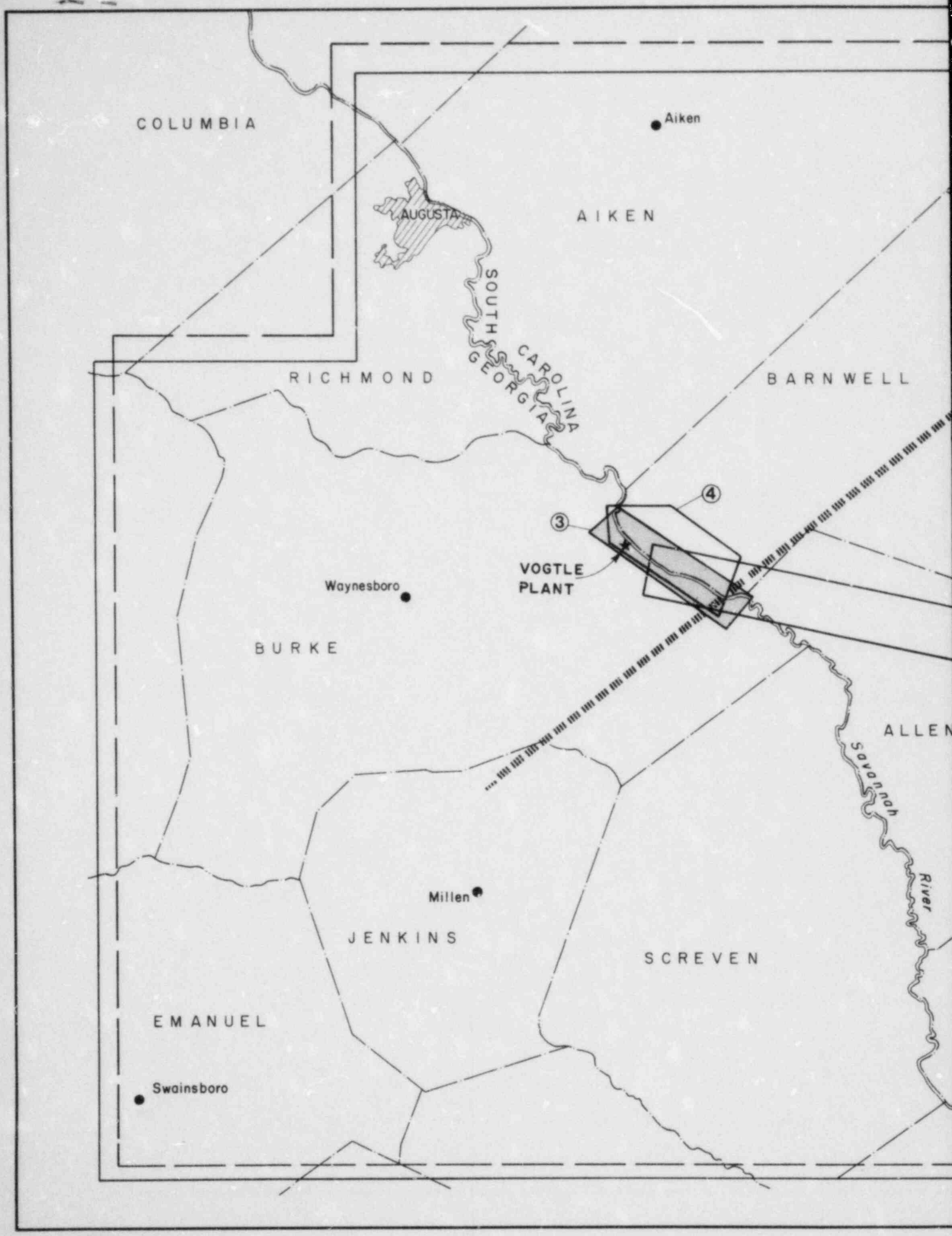
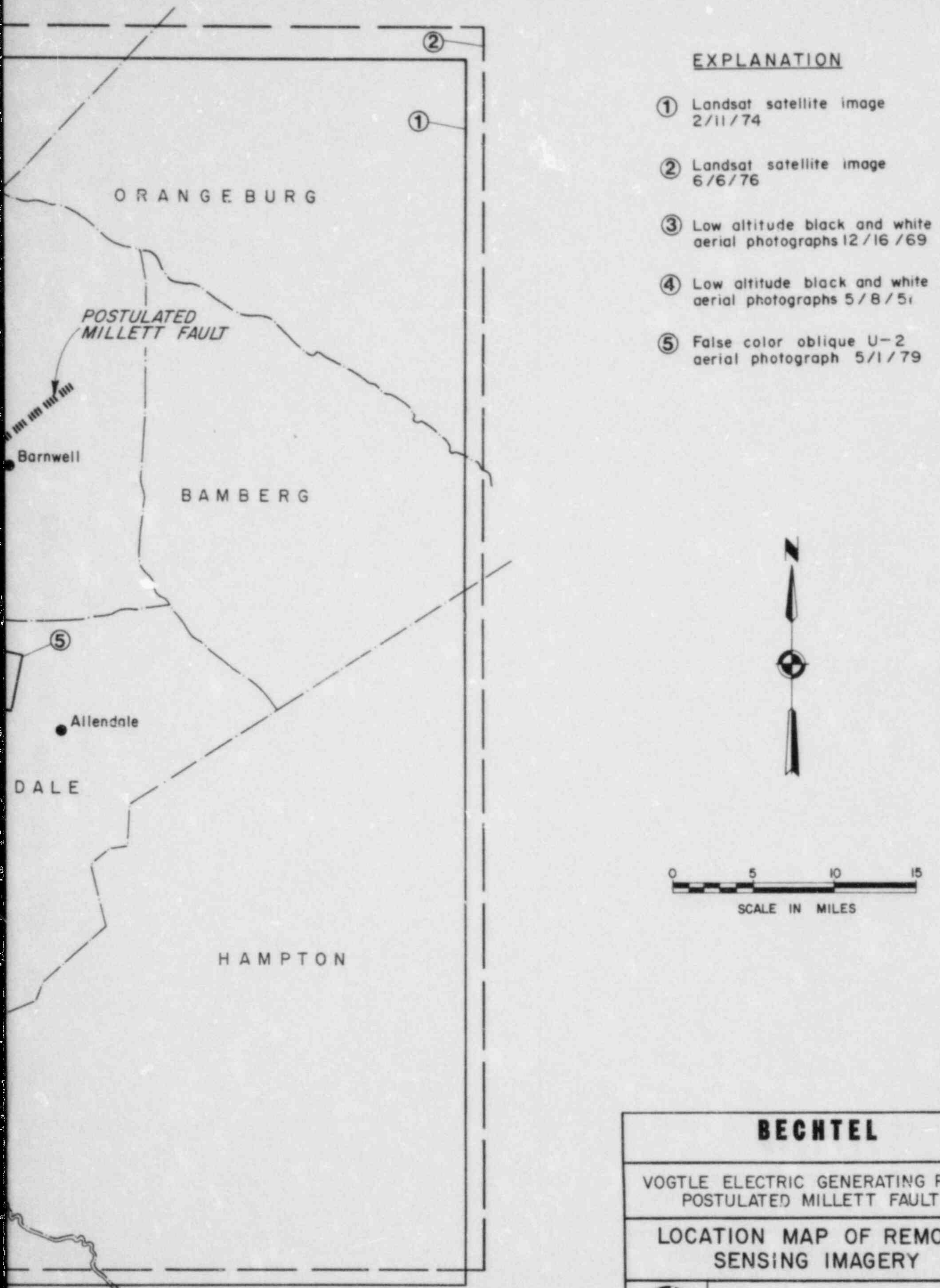
VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

SEISMOGRAPH SERVICE CORPORATION REFLECTION SURVEY OF THE SAVANNAH RIVER PLANT

FIGURE 7-2


COLUMBIA
Aiken
AUGUSTA
AIKEN
SOUTH CAROLINA
GEORGIA
RICHMOND
BARNWELL
4
3
VOGTLE PLANT
Waynesboro
BURKE
ALLEN
Savannah River
Millen
JENKINS
SCREVEN
EMANUEL
Swainsboro



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VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

LOCATION MAP OF REMOTE SENSING IMAGERY

FIGURE 7-3

VOGTLE PROJECT SITE

GEORGIA

LINEAMENT INTERPRETATION FROM

LANDSAT IMAGE TAKEN FEBRUARY 11, 1974

LANDSAT

#1568-15281

SCALE 1" ≑ 2.5 MILES

GEOMORPHIC LINEAMENTS

CULTURAL LINEAMENT

POSTULATED MILLETT FAULT

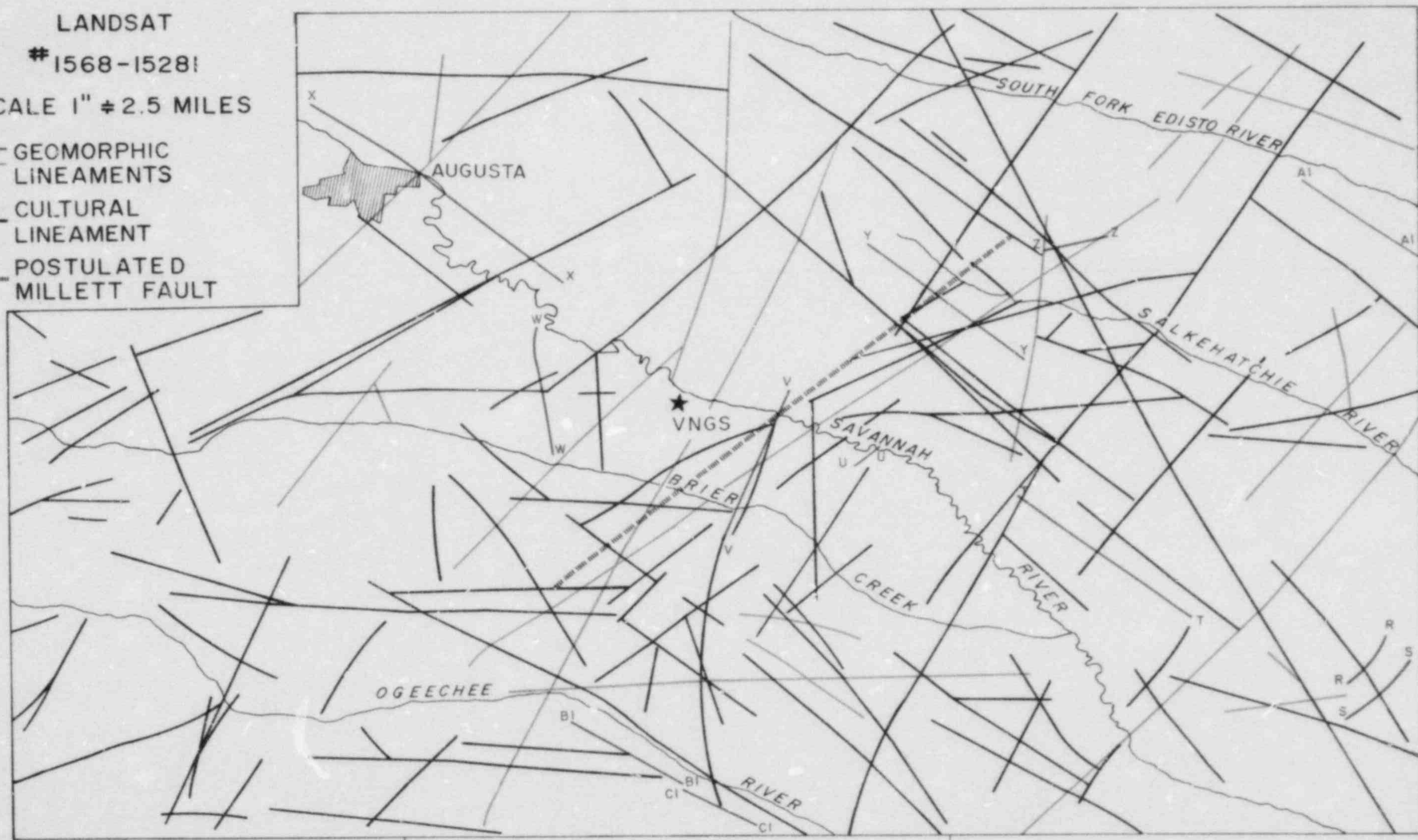


FIGURE 7-4

VOGTLE PROJECT SITE
GEORGIA
LINEAMENT INTERPRETATION FROM LANDSAT IMAGE TAKEN JUNE 6, 1976

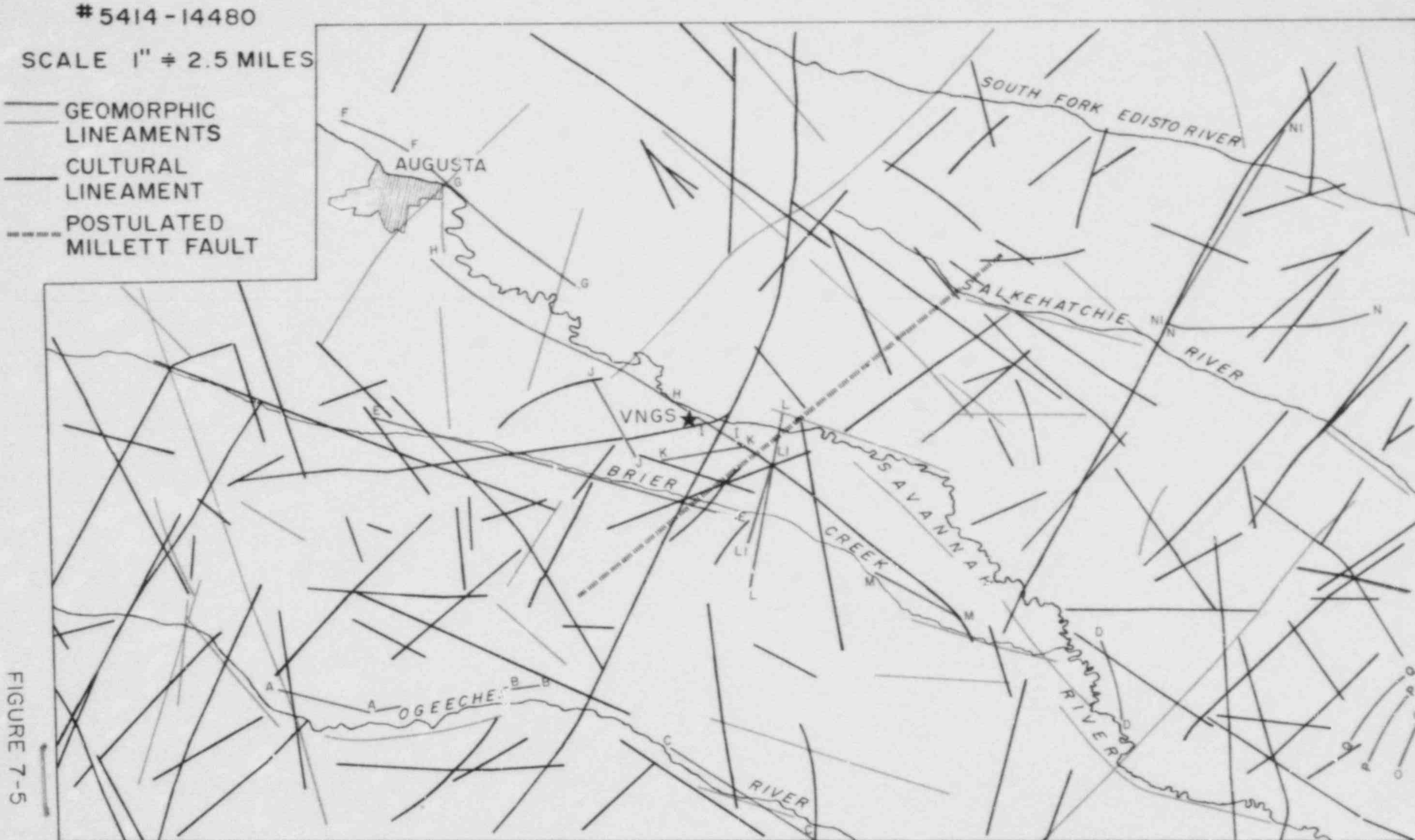
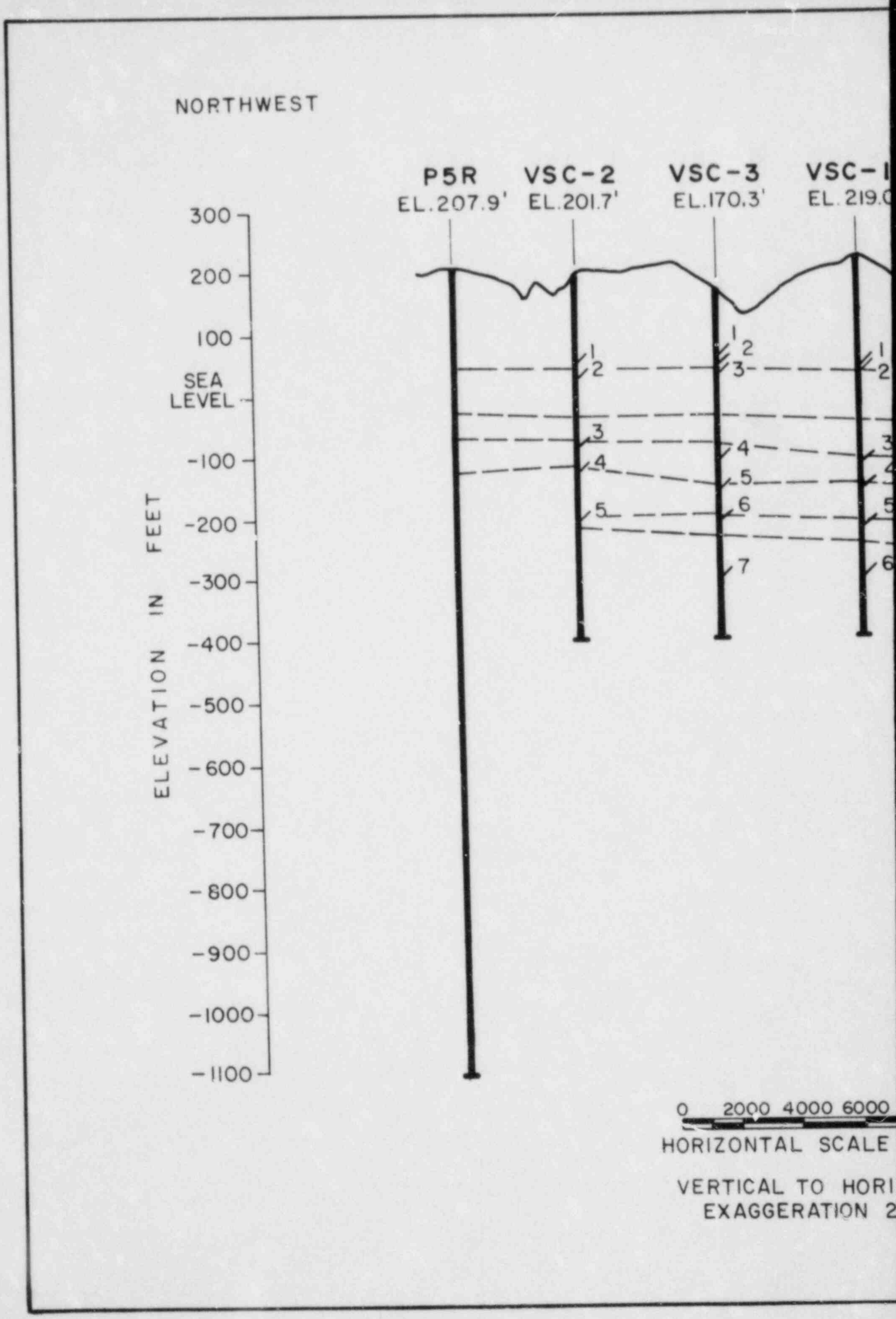
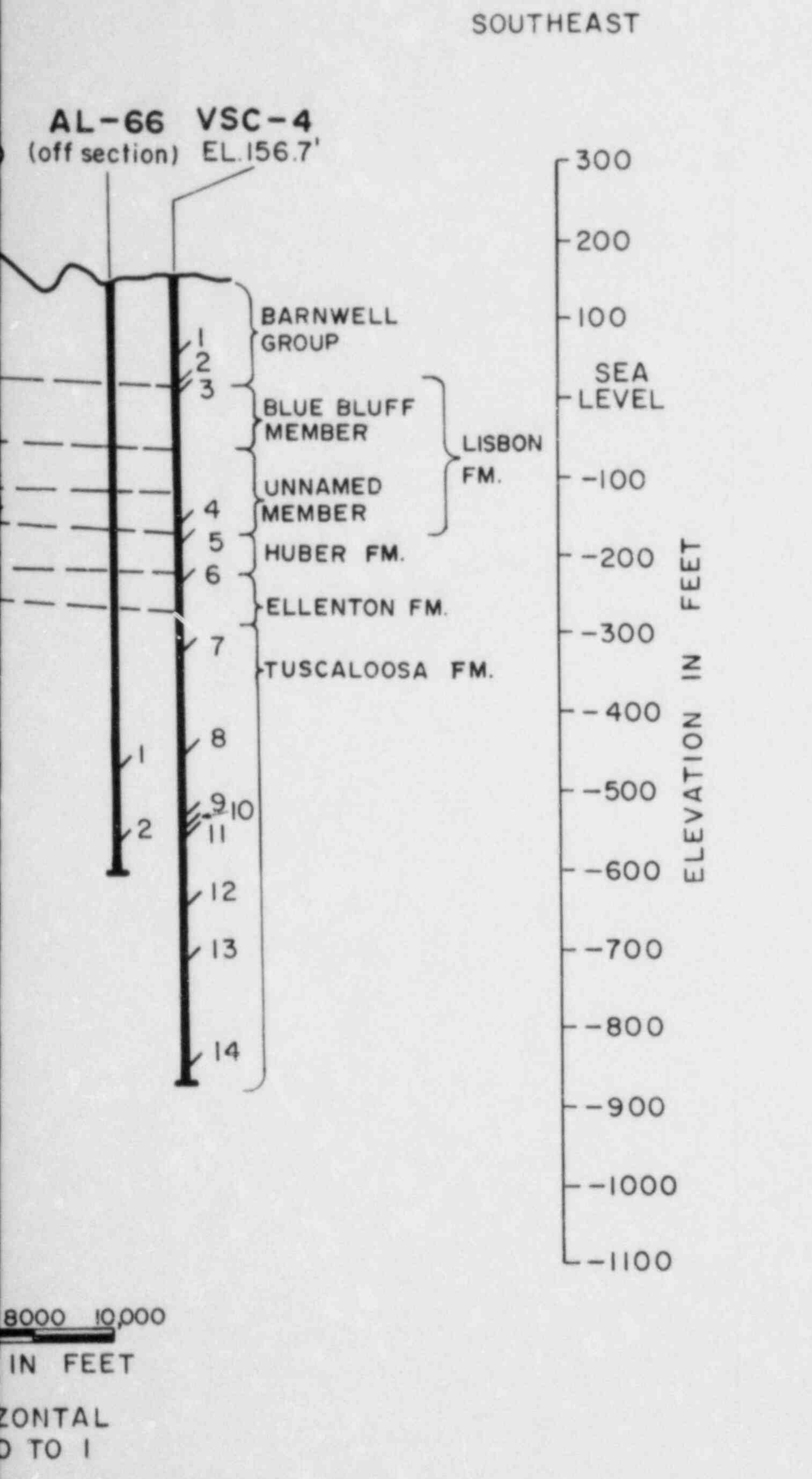


FIGURE 7-5



NORTHWEST
P5R
EL.207.9'
VSC-2
EL.201.7'
VSC-3
EL.170.3'
VSC-1
EL.219.0
300
200
100
SEA LEVEL
-100
-200
-300
-400
-500
-600
-700
-800
-900
-1000
-1100
ELEVATION IN FEET
0 2000 4000 6000
HORIZONTAL SCALE
VERTICAL TO HORI
EXAGGERATION 2

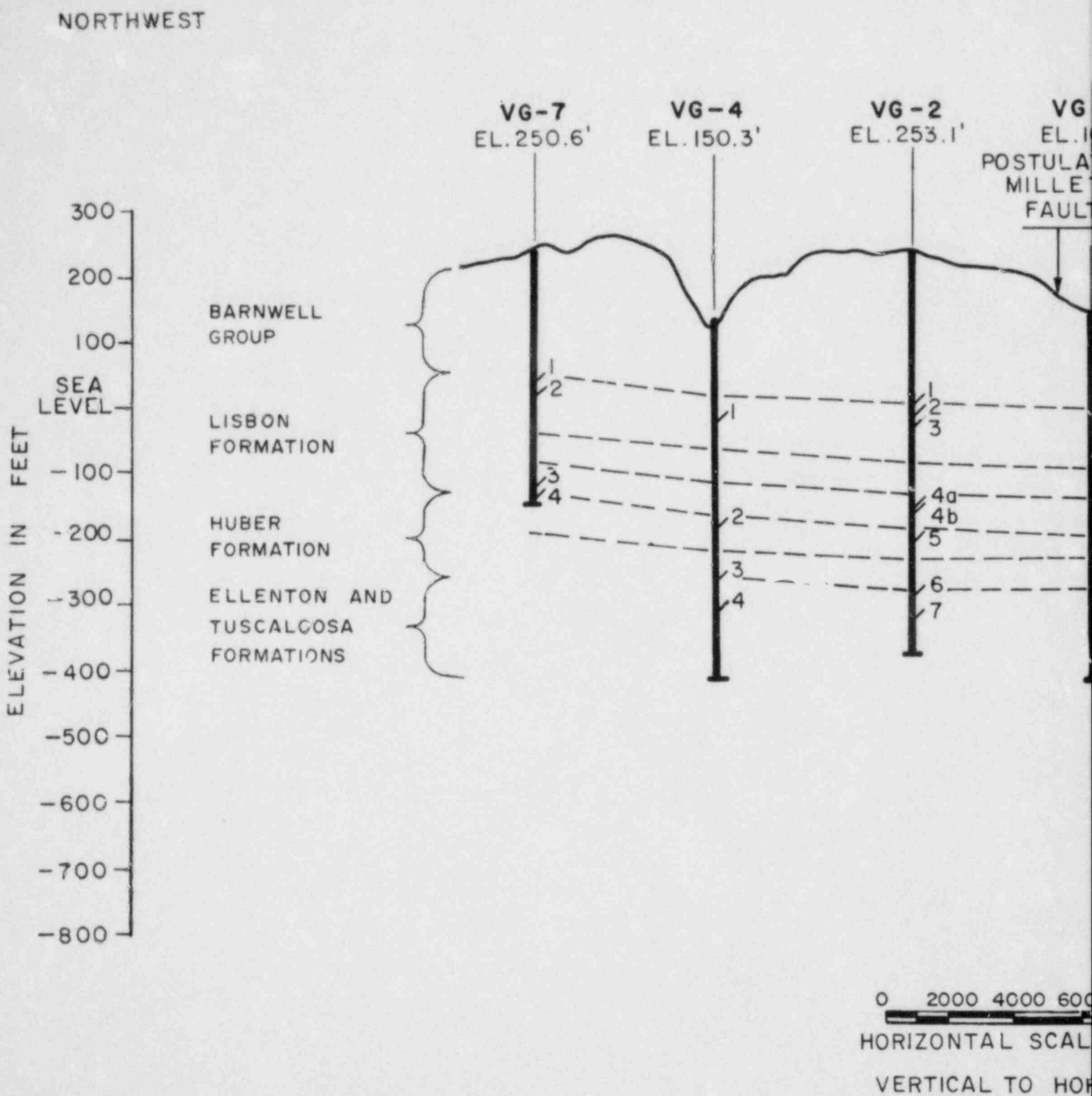


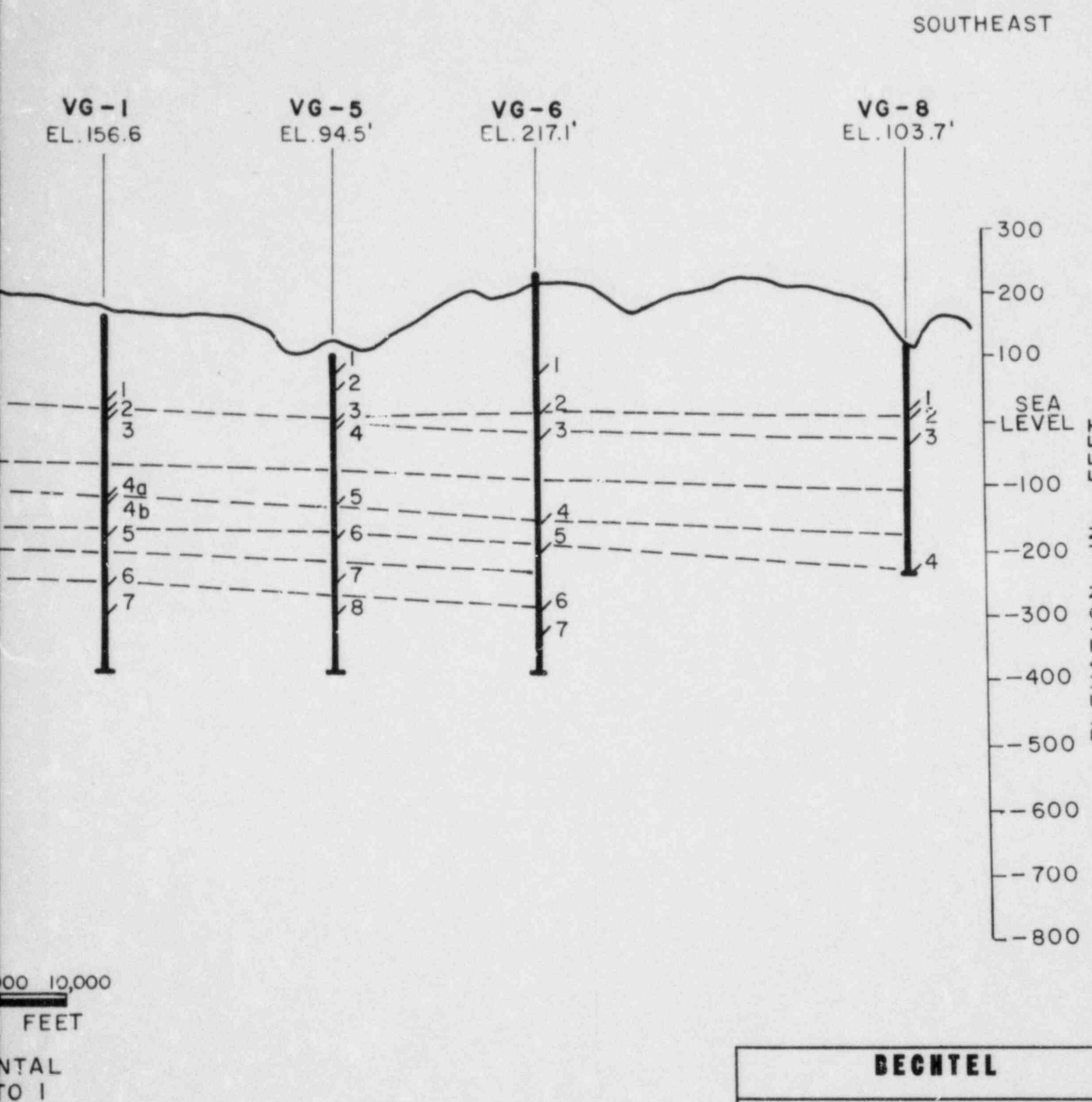
BECHTEL

VOCTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

LITHOLOGIC SAMPLE LOCATIONS
AL-66 AND VSC HOLES

FIGURE 7-6


NORTHWEST
VG-7
EL. 250.6'
VG-4
EL. 150.3'
VG-2
EL. 253.1'
POSTULA
MILLE
FAUL
ELEVATION IN FEET
300
200
100
SEA LEVEL
-100
-200
-300
-400
-500
-600
-700
-800
BARNWELL GROUP
LISBON FORMATION
HUBER FORMATION
ELLENTON AND TUSCALOOSA FORMATIONS
0 2000 4000 600
HORIZONTAL SCAL
VERTICAL TO HOR
EXAGGERATION



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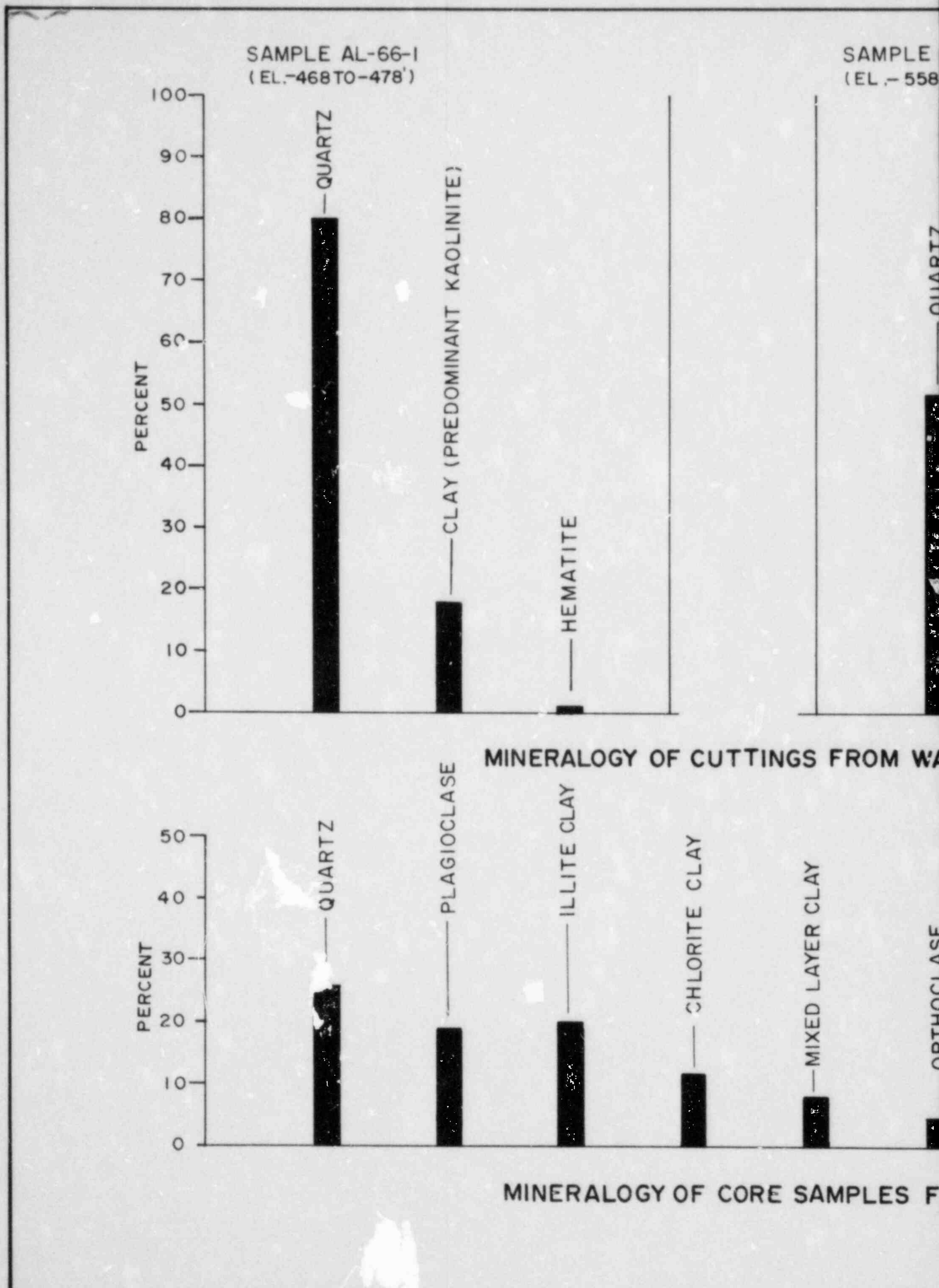
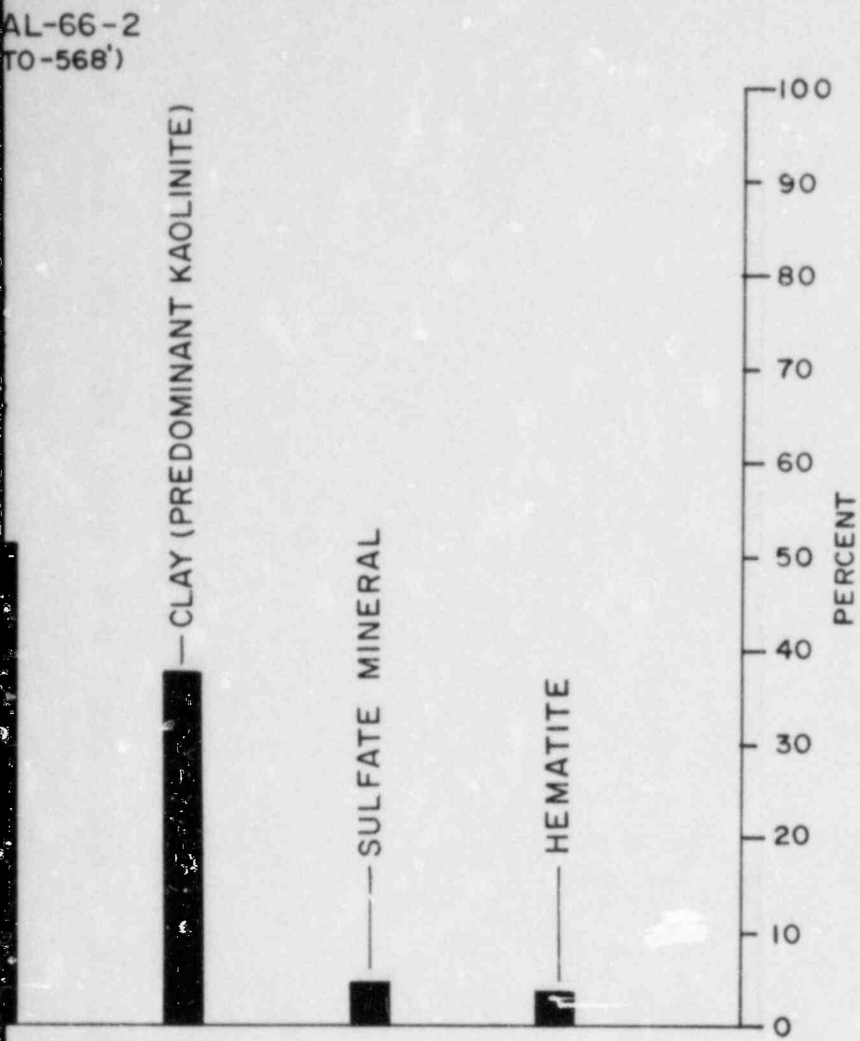
VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

LITHOLOGIC SAMPLE LOCATIONS-VG CORE HOLES

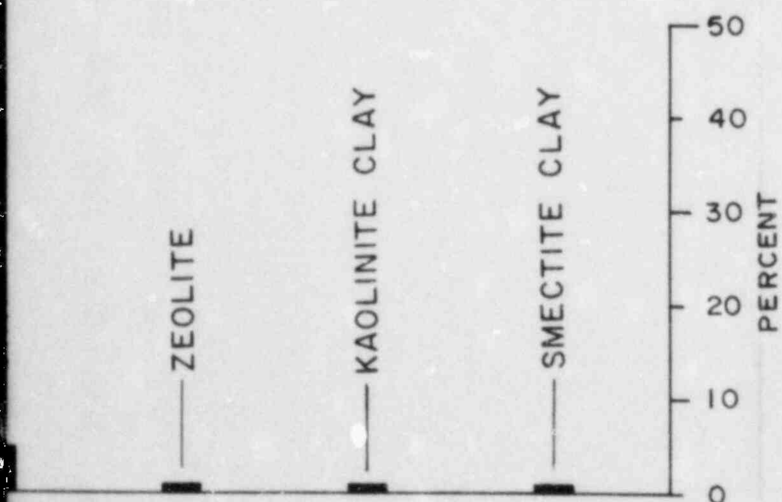
FIGURE 7-7



SAMPLE AL-66-1
(EL.-468 TO-478')
SAMPLE
(EL.- 558
PERCENT
100
90
80
70
60
50
40
30
20
10
0
QUARTZ
CLAY (PREDOMINANT KAOLINITE)
HEMATITE
MINERALOGY OF CUTTINGS FROM WA
PERCENT
50
40
30
20
10
0
QUARTZ
PLAGIOCLASE
ILLITE CLAY
CHLORITE CLAY
MIXED LAYER CLAY
ORTHOCLASE
MINERALOGY OF CORE SAMPLES F



ATER WELL AL-66



ROM DRB 10

NOTES:

1. The mineralogy of water well samples AL-66-1 and AL-66-2 were determined by Dr. Parnell, see App. I
2. The mineralogy of core samples from DRB 10 were determined by Marine, I.W., 1976; percentages based on samples collected between 25 to 150 feet below the upper Triassic contact.

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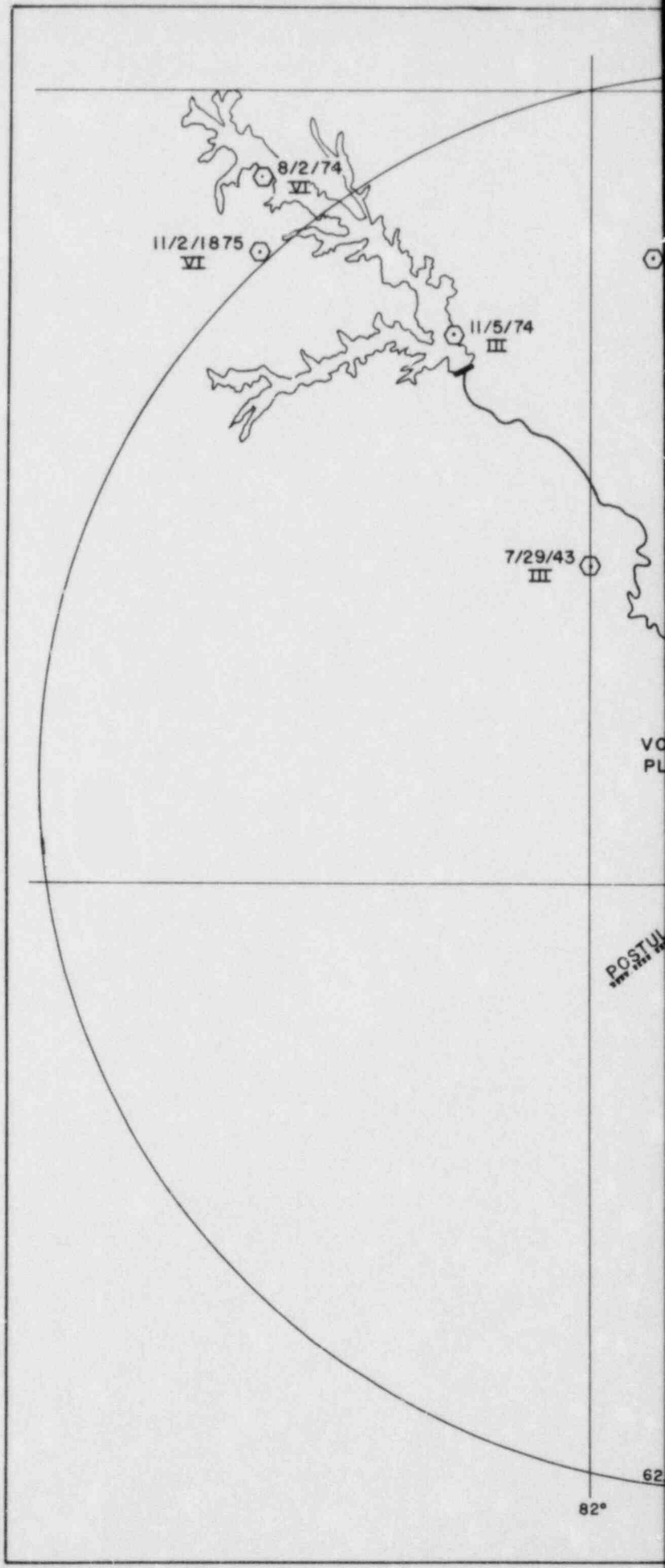
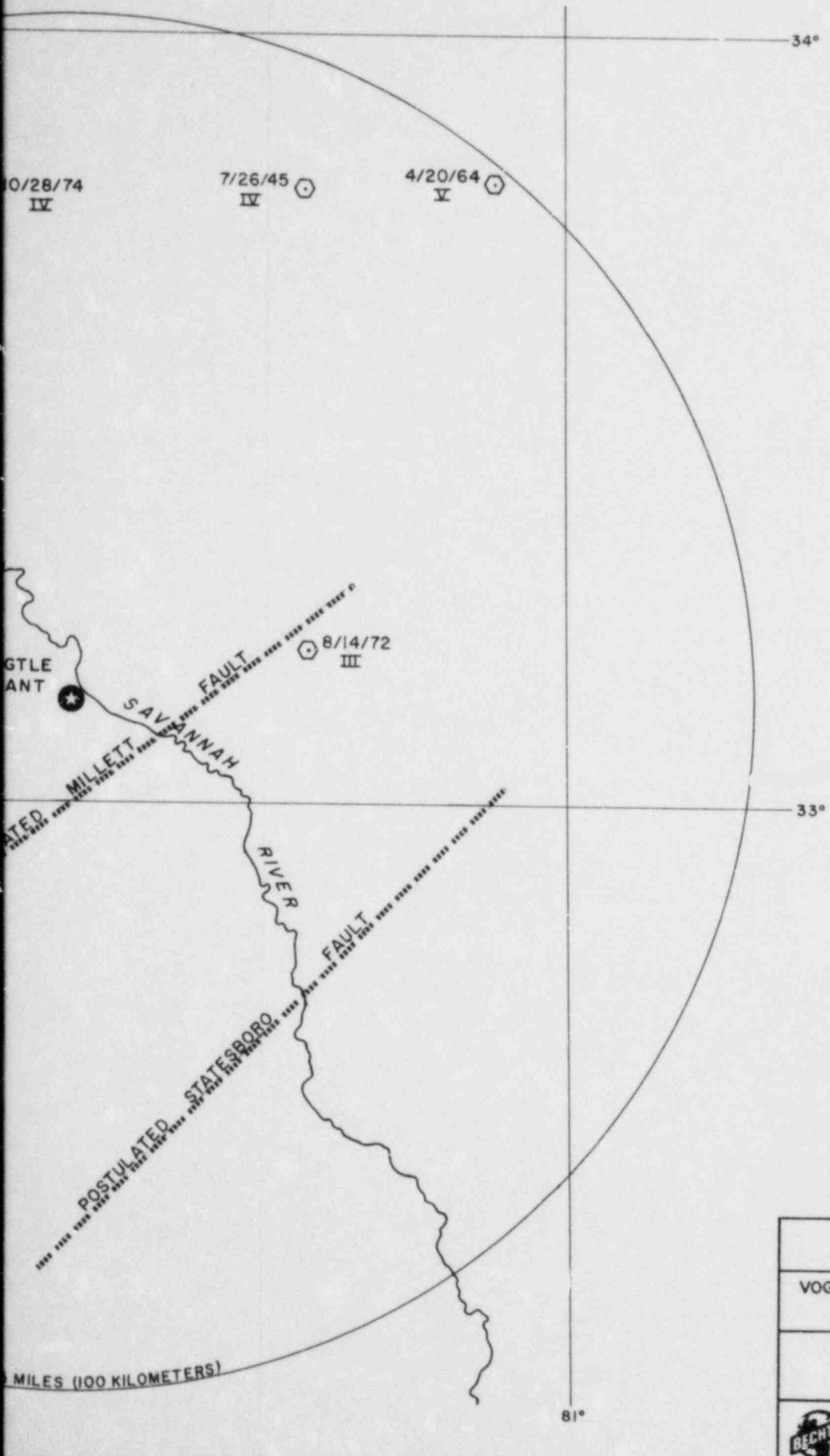
VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

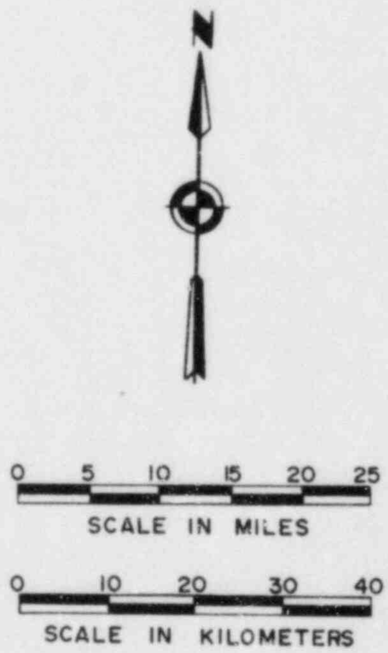
MINERALOGY OF SAMPLES FROM AL-66 AND DRB 10

FIGURE 7-8



8/2/74
VI
11/2/1875
VI
11/5/74
III
7/29/43
III
VC
PL
POSTU
62
82°





EXPLANATION

Dates of occurrence and modified Mercalli intensites are shown by each epicenter

SOURCES

Reagor, B.G. Stover, C.W., Algermissen, S.T. (1980)

Stover, C.W., Reagor, B.G., Algermissen, S.T. Long, L.T. (1979).

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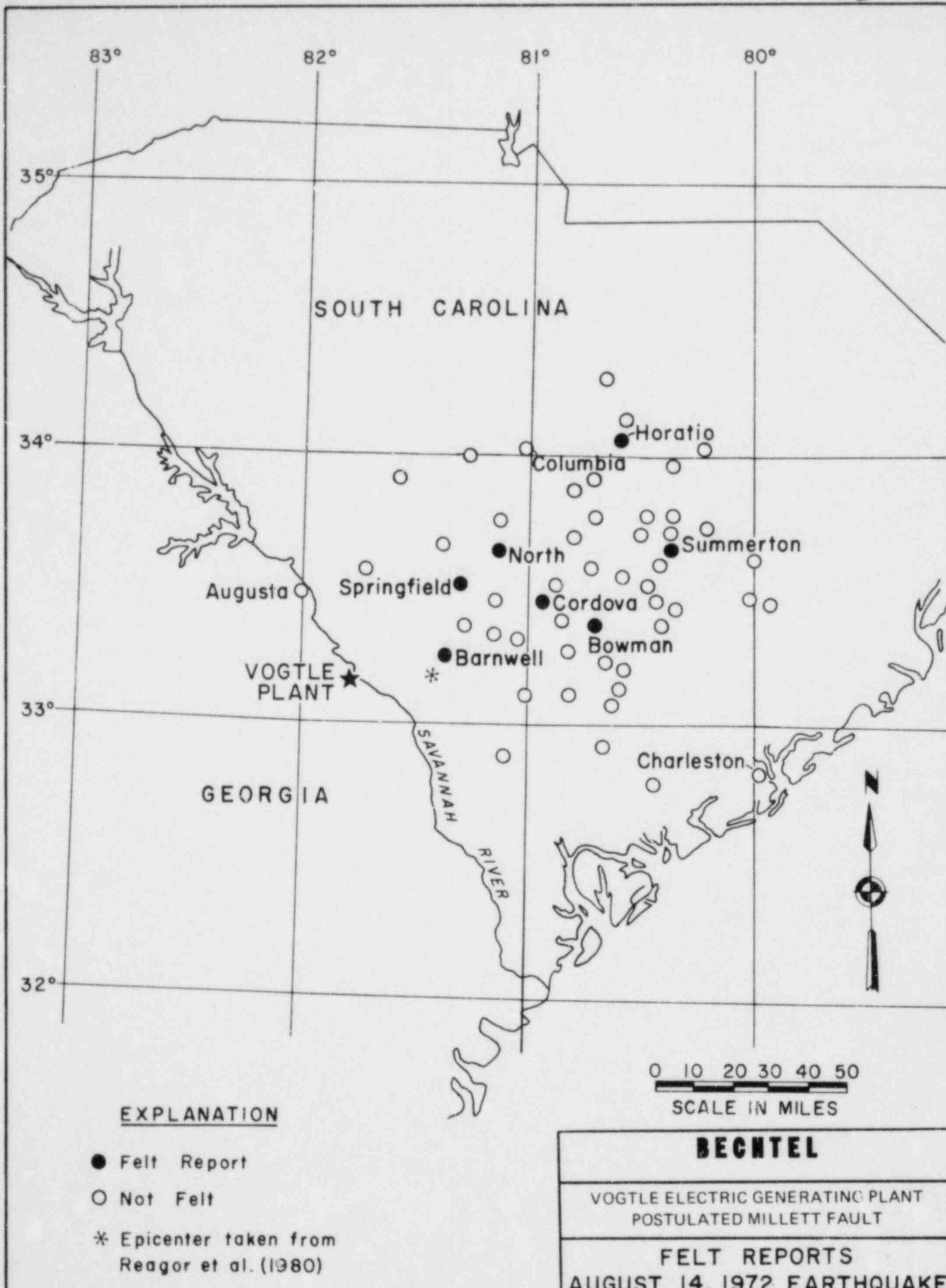
VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

FELT EARTHQUAKES
1900 – 1974

FIGURE 7–9

17 x 22 "C" SIZE



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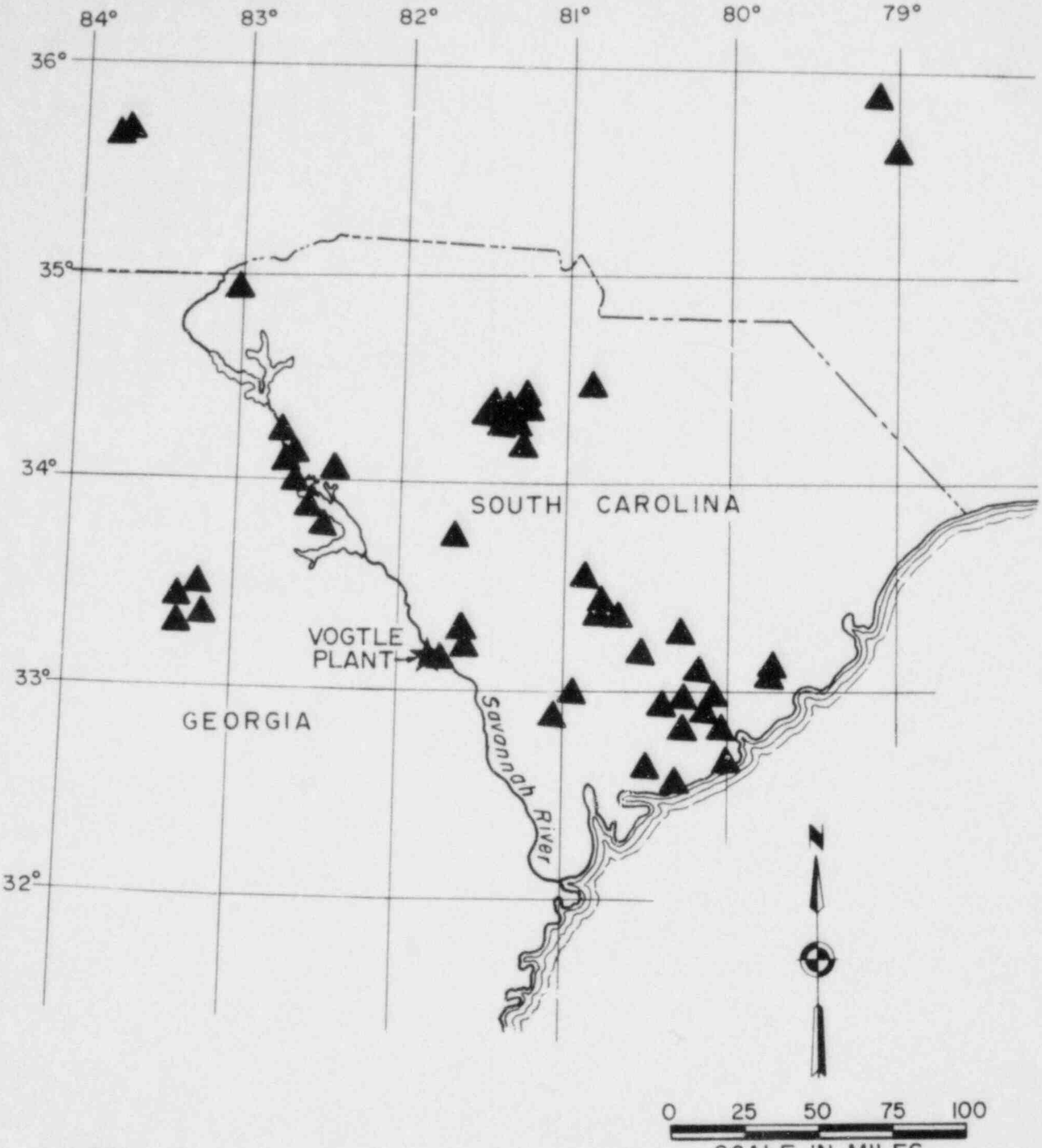
VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

FELT REPORTS
AUGUST 14, 1972 EARTHQUAKE

FIGURE 7-10



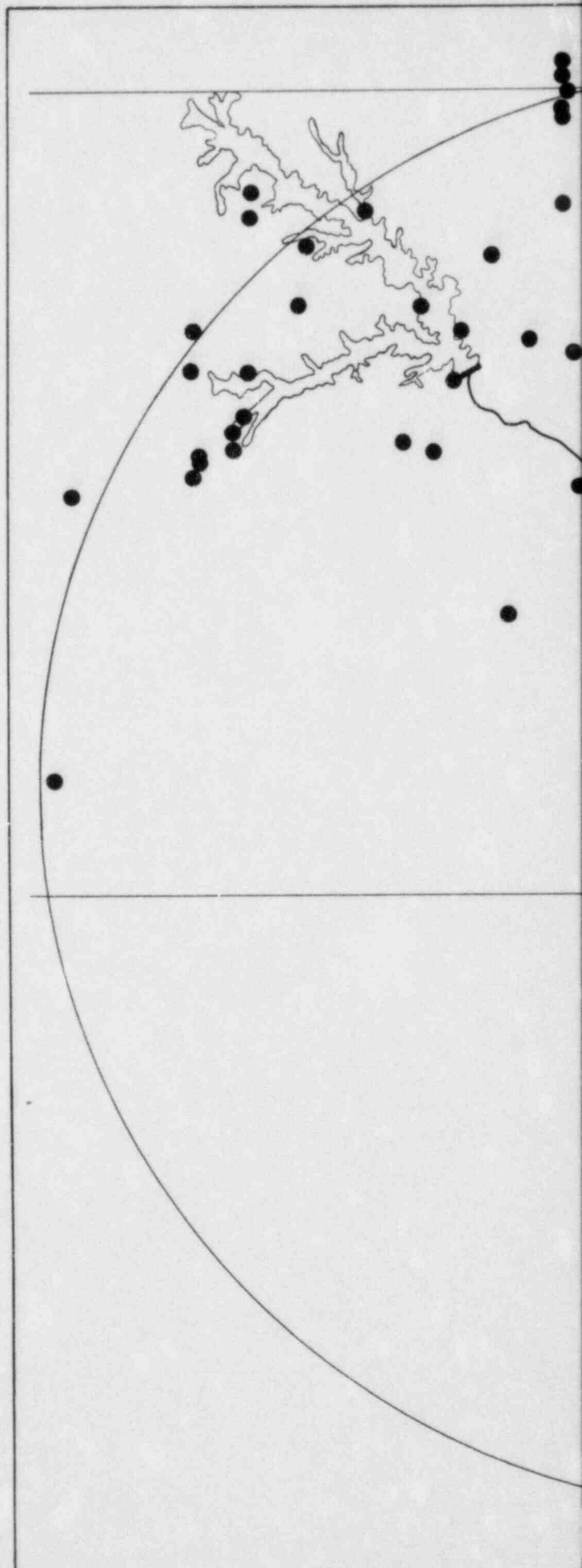
NOTE:

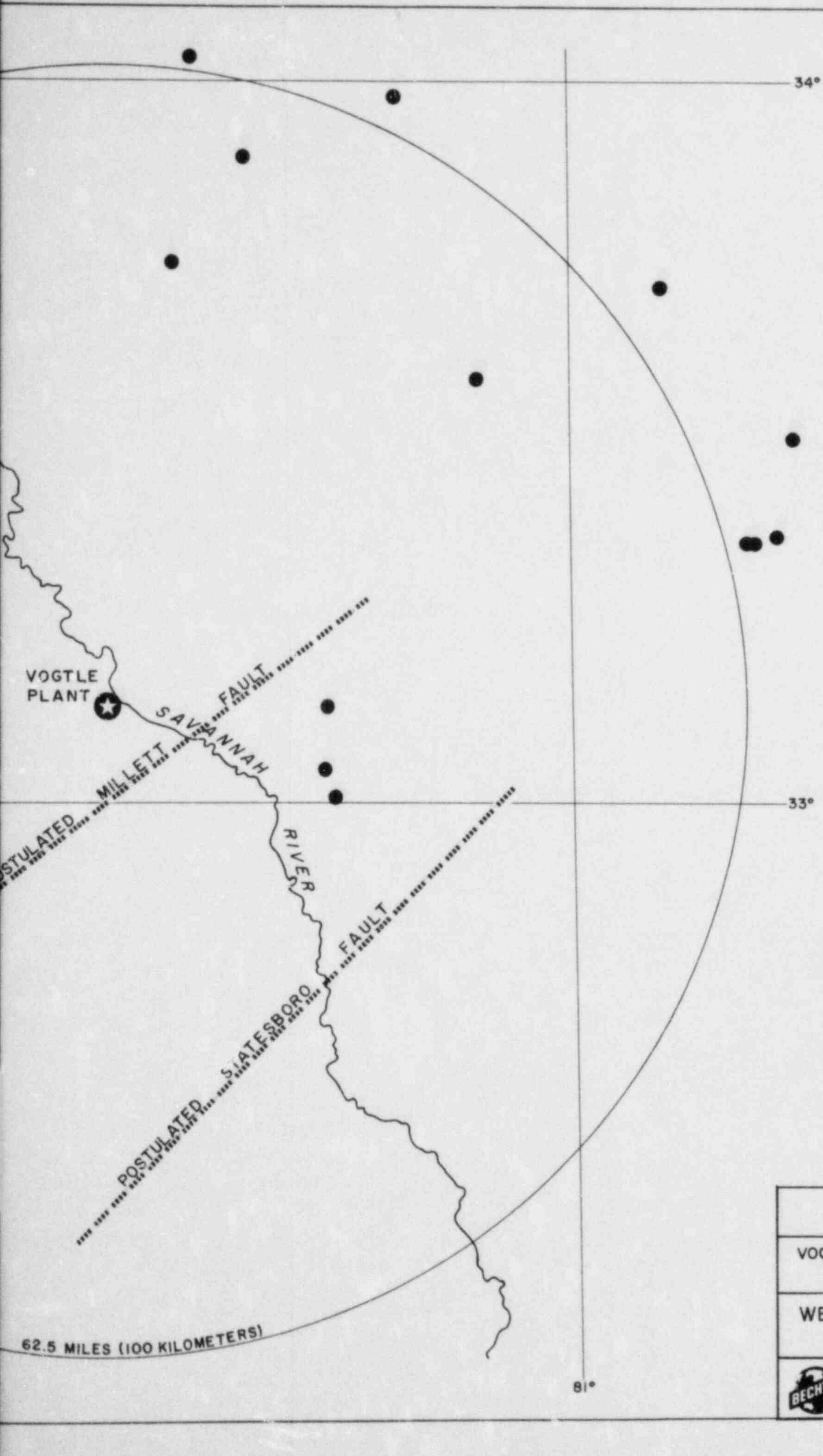
Principal regional seismograph stations in operation during the interval 1974 to the present. Most stations were not in operation during that entire interval but the pattern shown is representative of coverage after the early part of 1977.

SOURCES:

Bollinger and Mathena (1981, 1982)
Rhea (1981)

BECHTEL
VOGTLE ELECTRIC GENERATING PLANT POSTULATED MILLETT FAULT
LOCATIONS OF SEISMOGRAPH STATIONS
FIGURE 7-11





EXPLANATION

Recent earthquakes near the site. All events are small (average magnitude about 2.1 and none larger than 2.8) and shallow (average depth about 4 miles or 7 kilometers).

SOURCES

Bollinger, G.A. and Murphy, C.A. (1978)

Bollinger, G.A. and Mathena E. (1978-1982)

Rhea, S. (1981)

Tarr, A., Talwani, P. Rhea, S. Carver, D. and Amick, D. (1981)

N

0 5 10 15 20 25
SCALE IN MILES

0 10 20 30 40
SCALE IN KILOMETERS

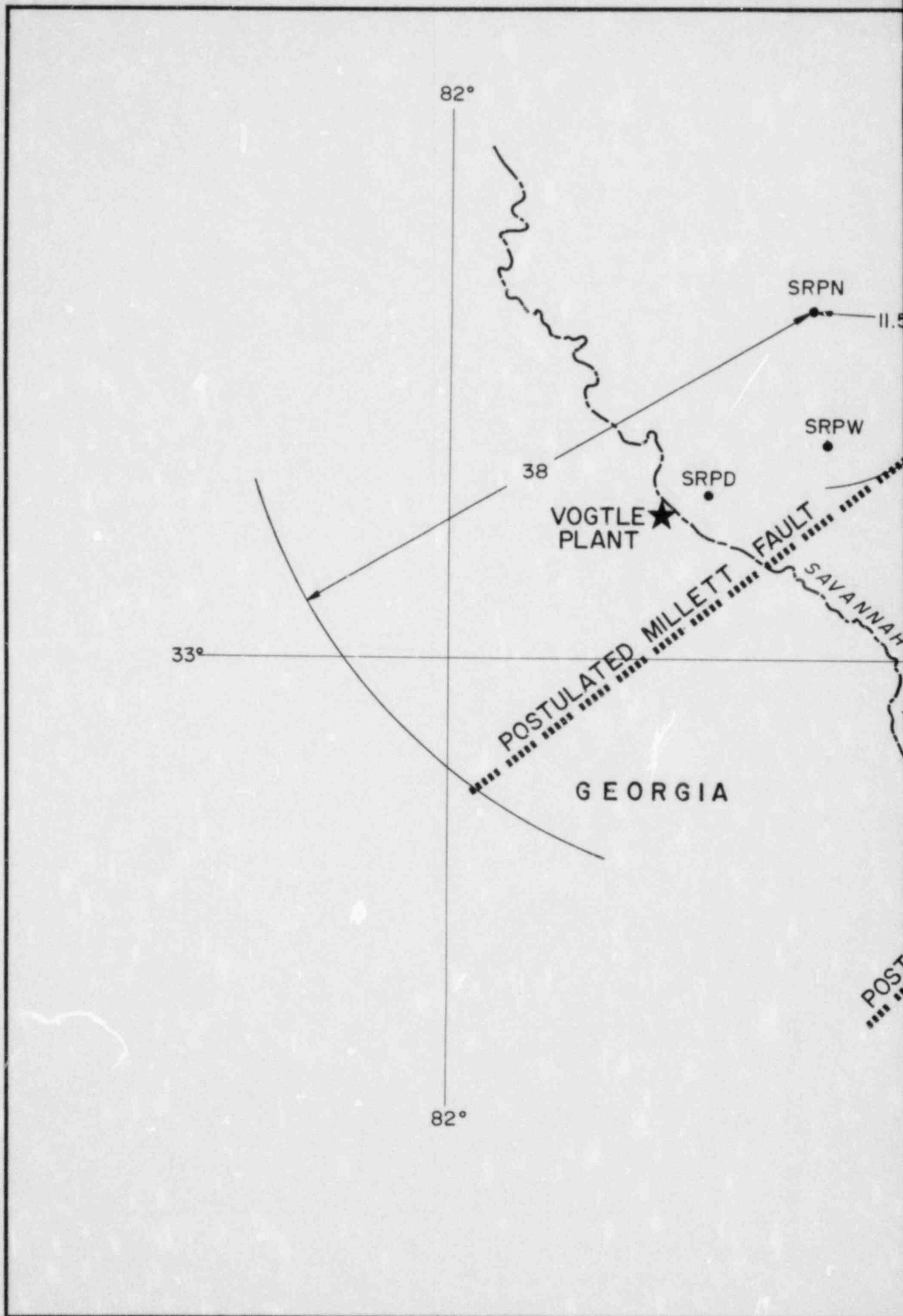
BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

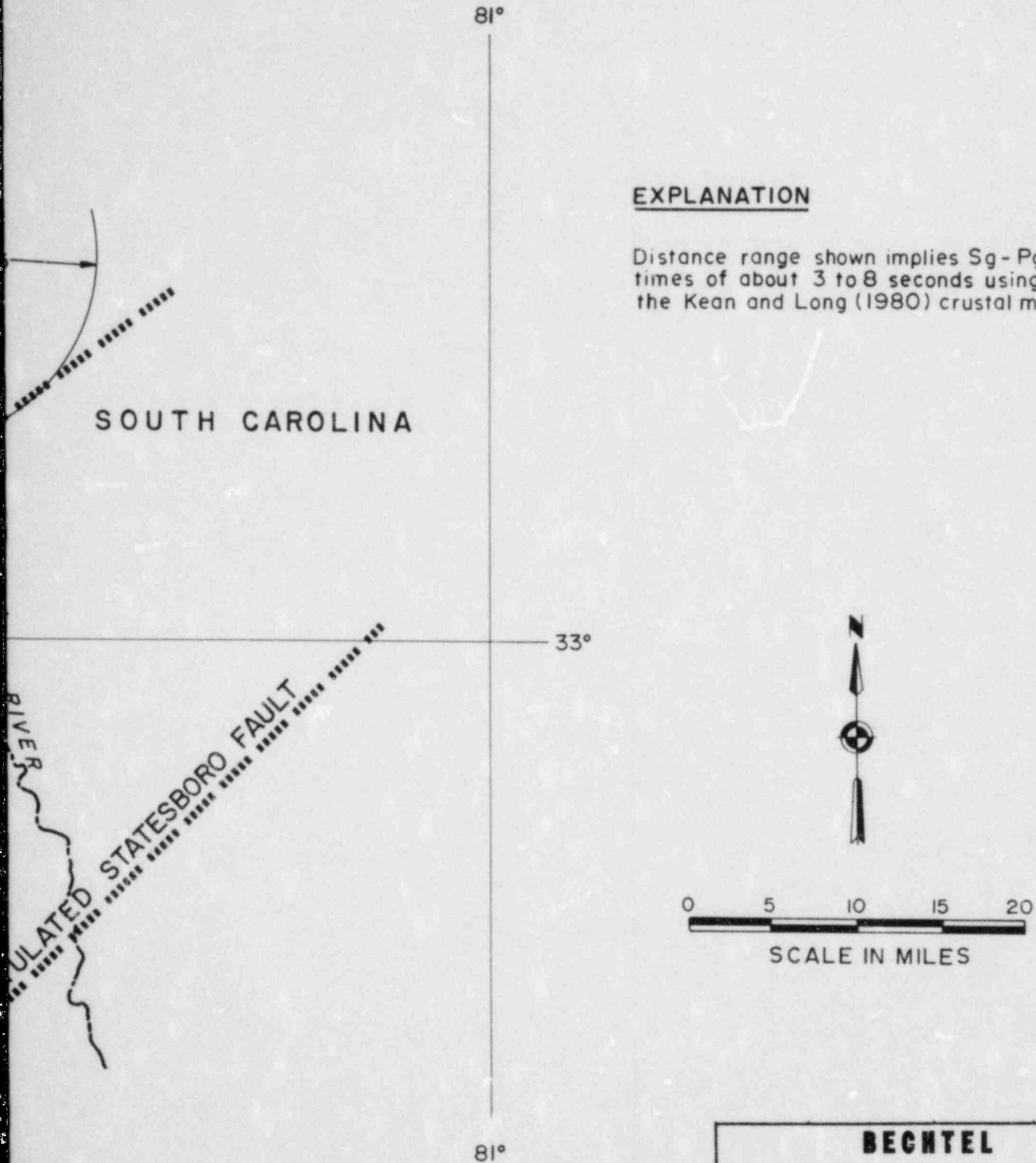
WELL-LOCATED EARTHQUAKES
1974-1982

FIGURE 7-12

"C" SIZE



82°
SRPN
11.5
SRPW
38
SRPD
VOGTLE
PLANT
FAULT
SAVANNAH
POSTULATED MILLETT
33°
GEORGIA
POST
82°
94052



EXPLANATION

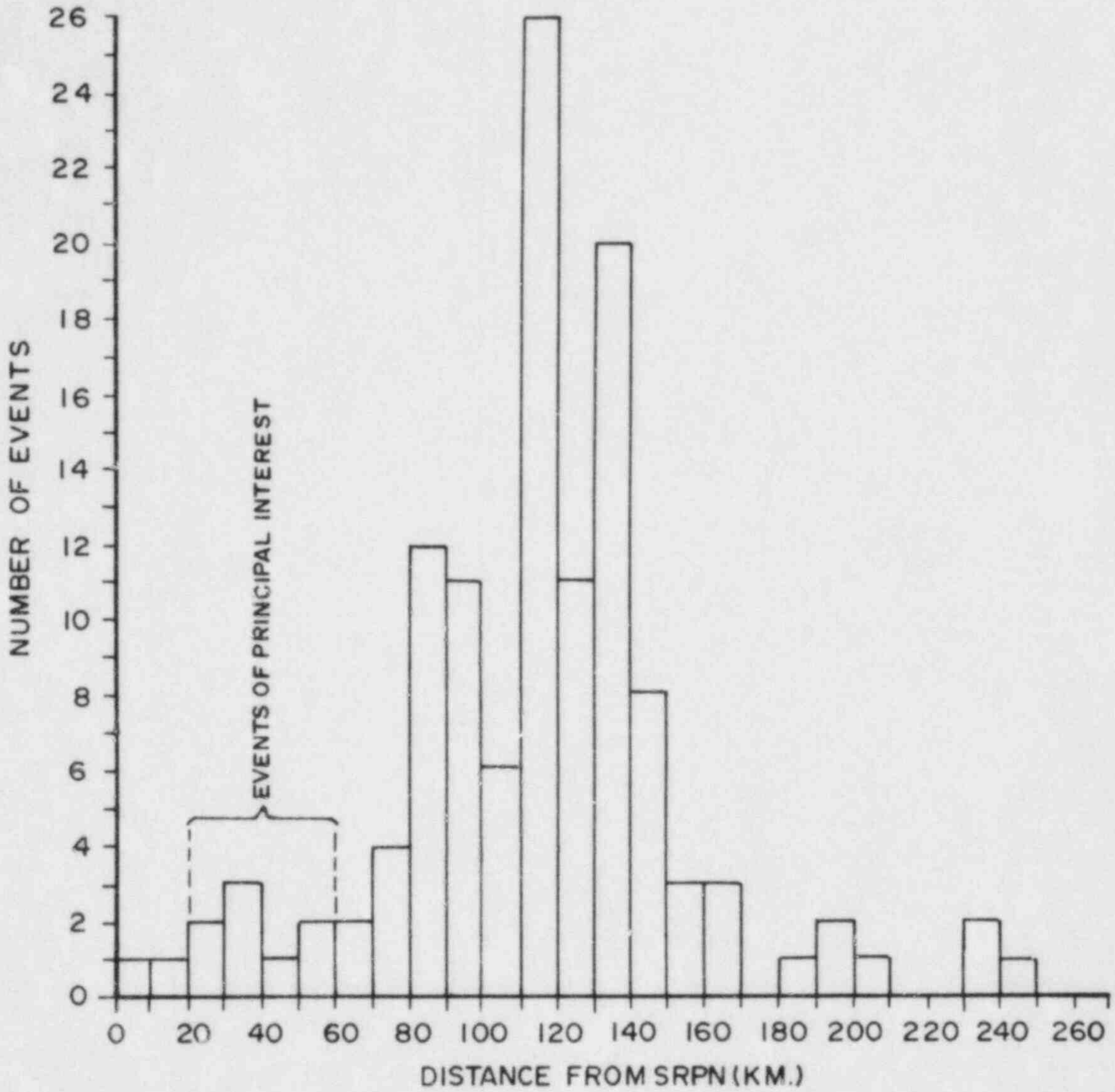
Distance range shown implies Sg - Pg times of about 3 to 8 seconds using the Kean and Long (1980) crustal model.

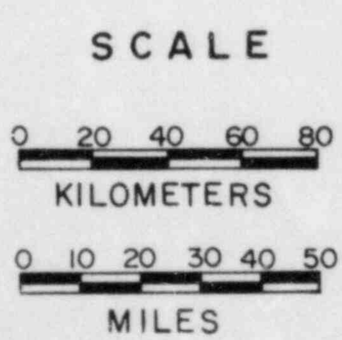
BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

SRP SEISMOGRAPH ARRAY

FIGURE 7-13





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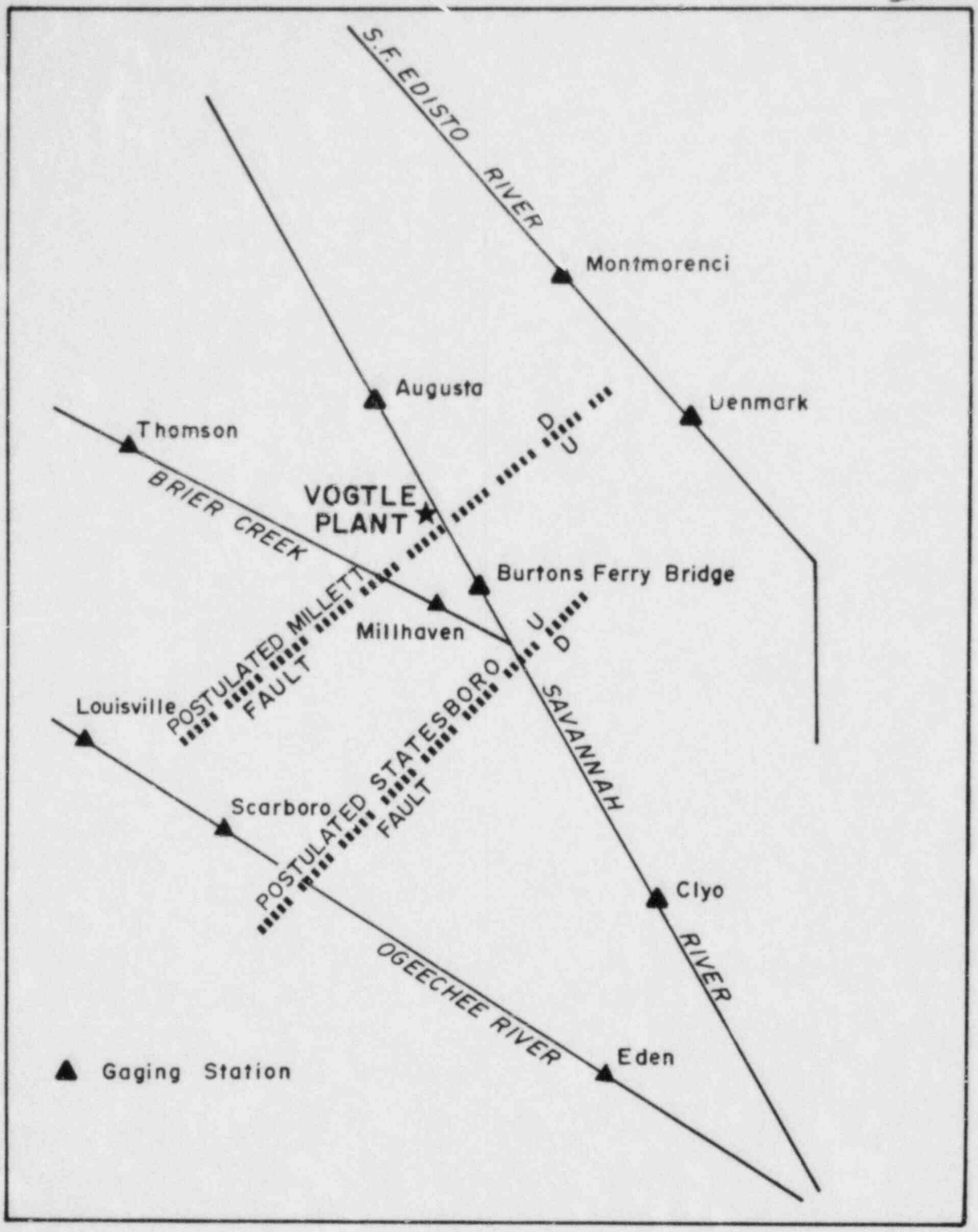
VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

SEISMIC FREQUENCY vs. DISTANCE FROM SRPN

FIGURE 7-14



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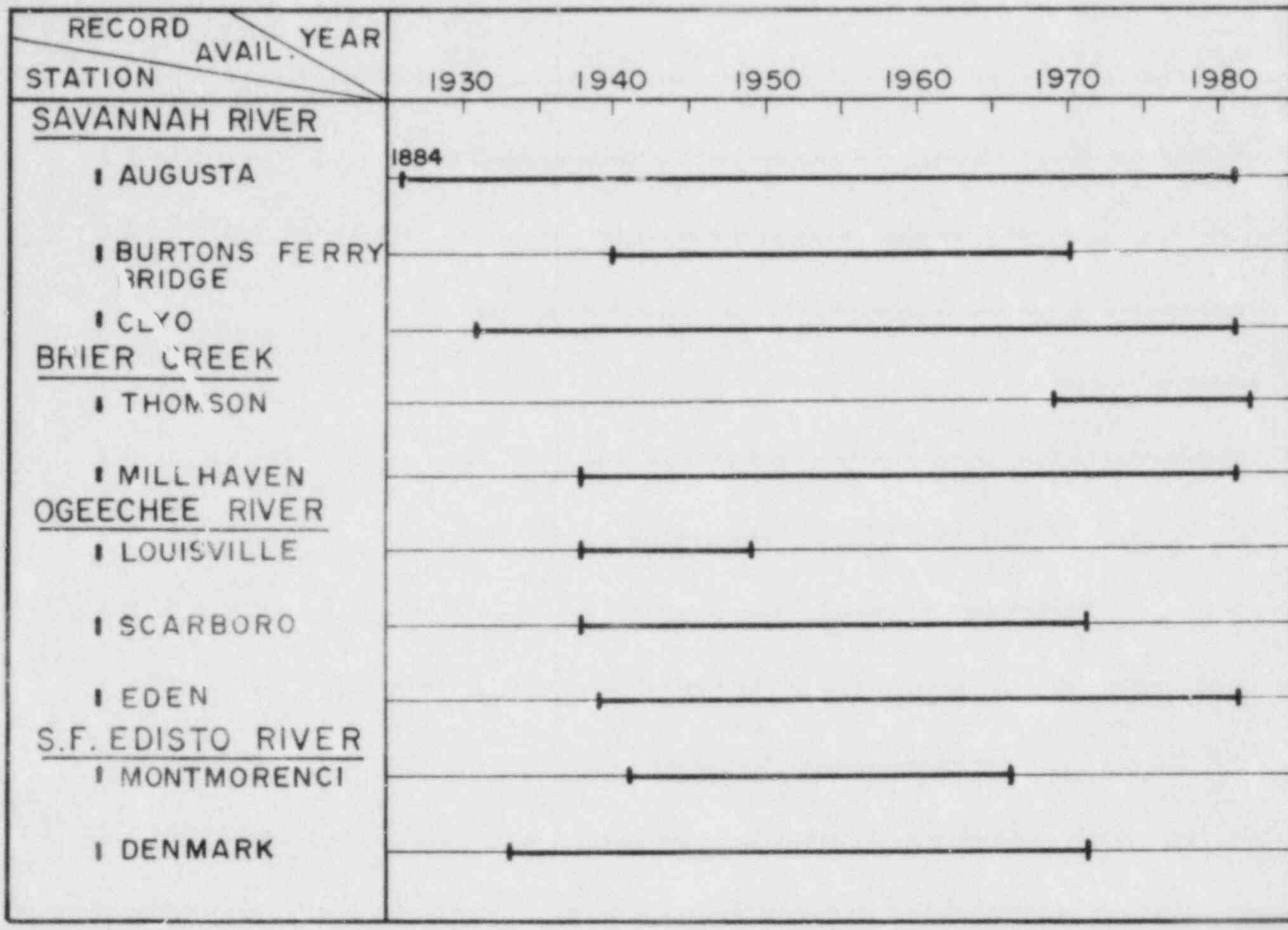
VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

LOCATIONS OF STREAM GAUGING STATIONS

FIGURE 7-15

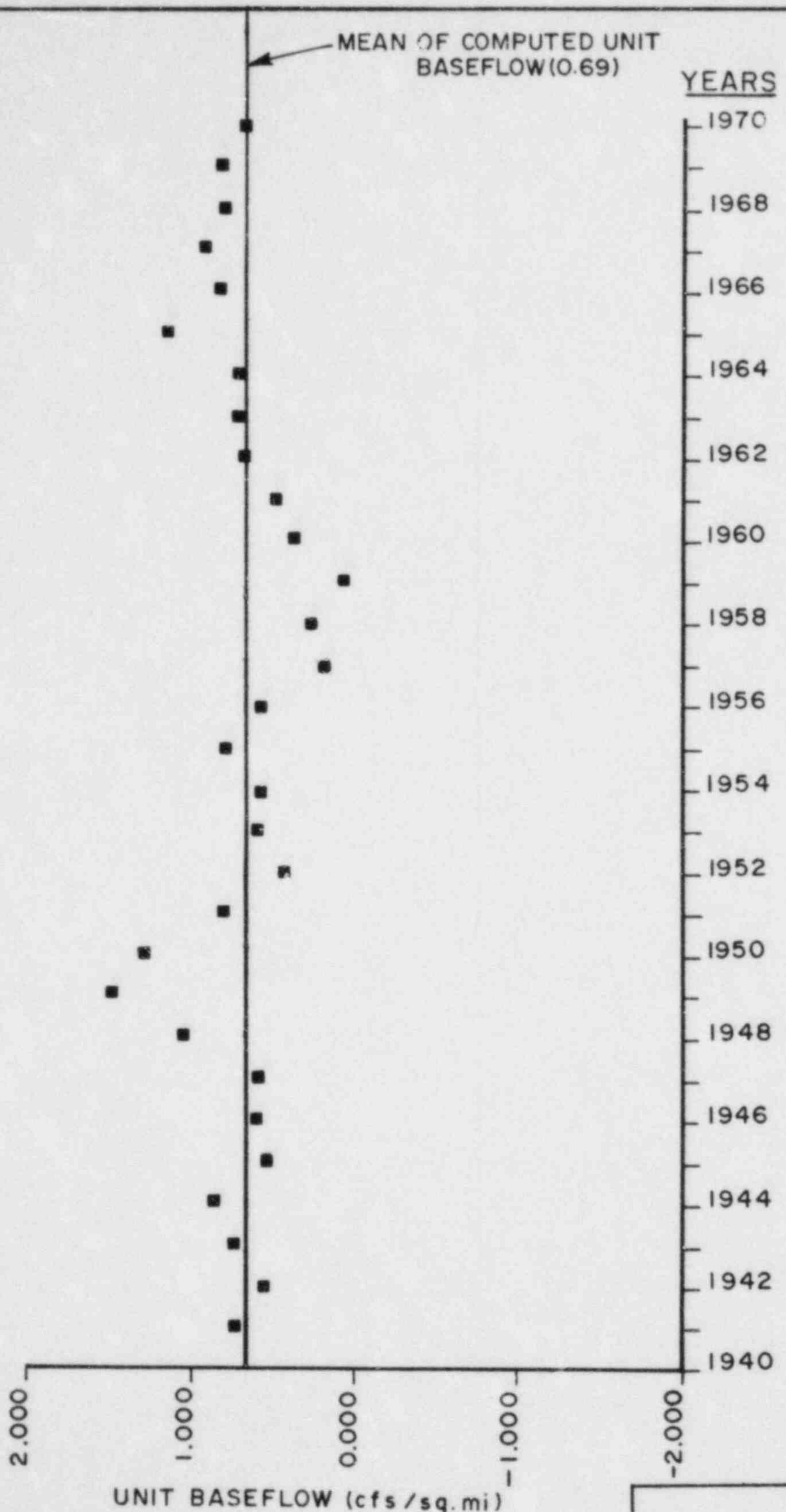


BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

AVAILABLE STREAMFLOW RECORDS

FIGURE 7-16



EXPLANATION

— Mean computed unit baseflow

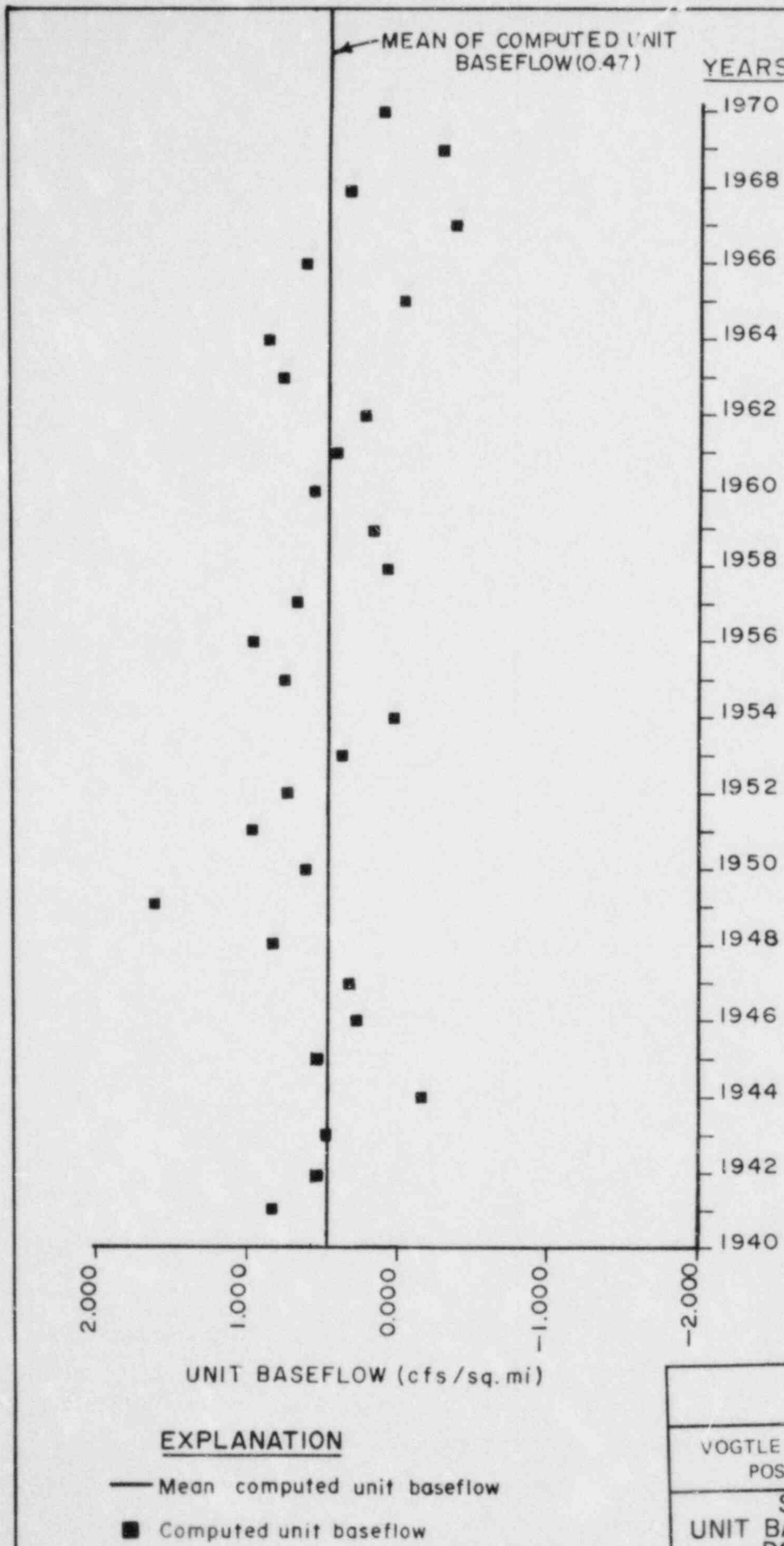
■ Computed unit baseflow

BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

SAVANNAH RIVER
UNIT BASEFLOW CONTRIBUTION
UPSTREAM REACH

FIGURE 7-17



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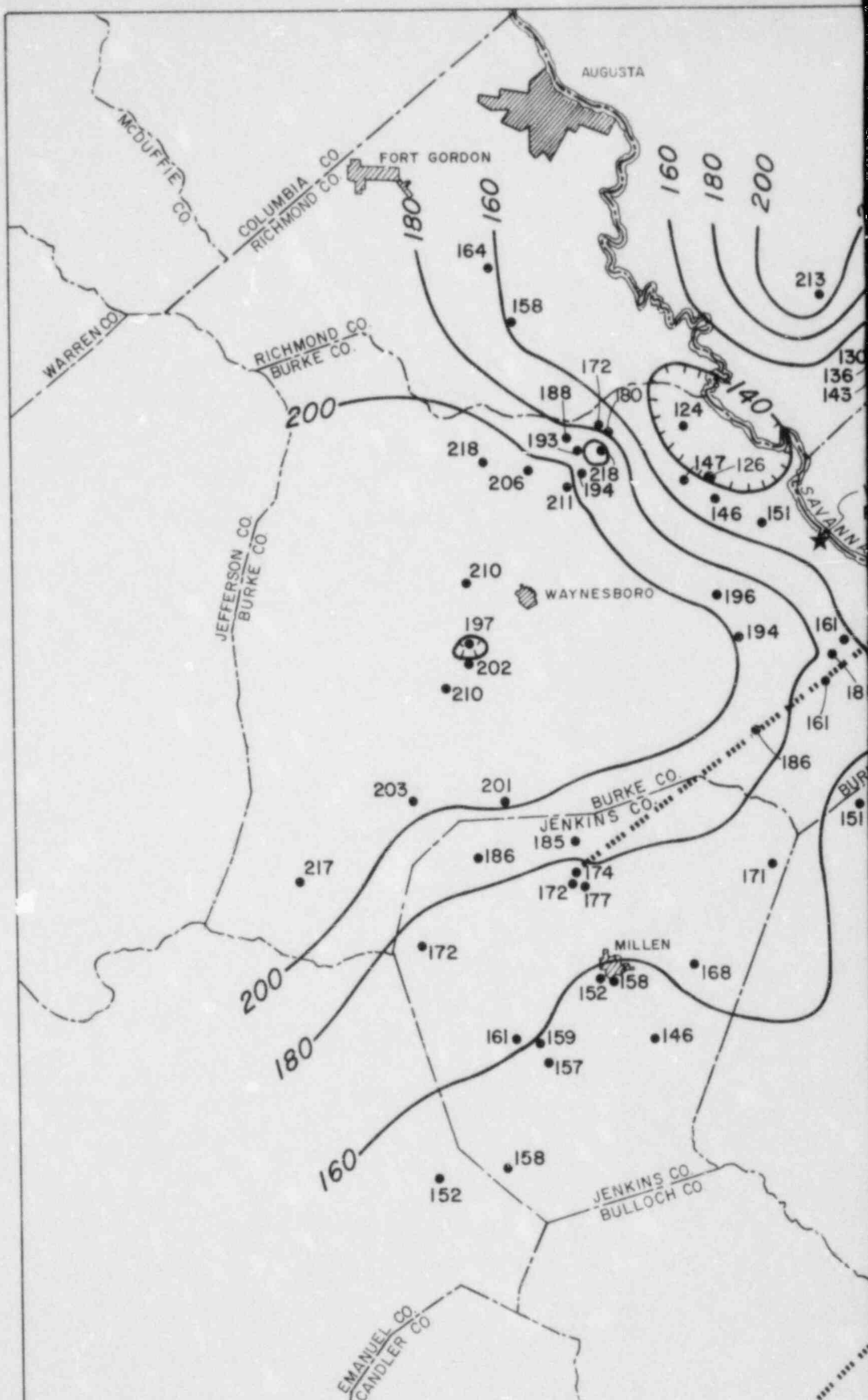
VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

SAVANNAH RIVER
UNIT BASEFLOW CONTRIBUTION
DOWNSTREAM REACH

FIGURE 7-18



AUGUSTA
FORT GORDON
McDUFFIE CO
COLUMBIA CO
RICHMOND CO
WARREN CO
RICHMOND CO
BURKE CO
JEFFERSON CO
BURKE CO
WAYNESBORO
BURKE CO
JENKINS CO
MILLEN
JENKINS CO
BULLOCH CO
EMANUEL CO
CANDLER CO
SAVANN
160
180
200
140
213
130
136
143
164
158
172
188
180
193
218
206
218
194
211
124
147
126
146
151
210
196
194
161
161
197
202
210
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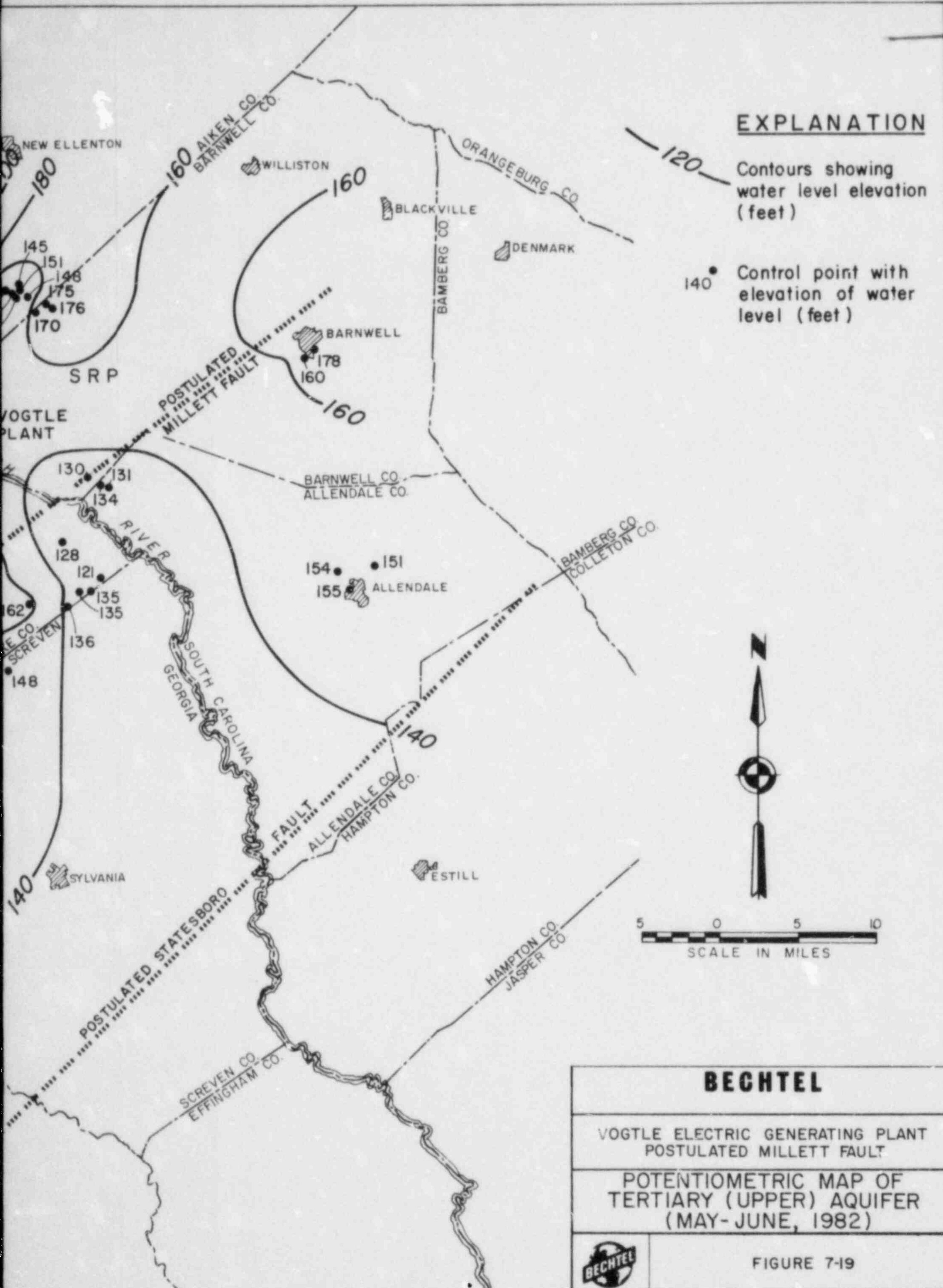
159
146
157
158
152

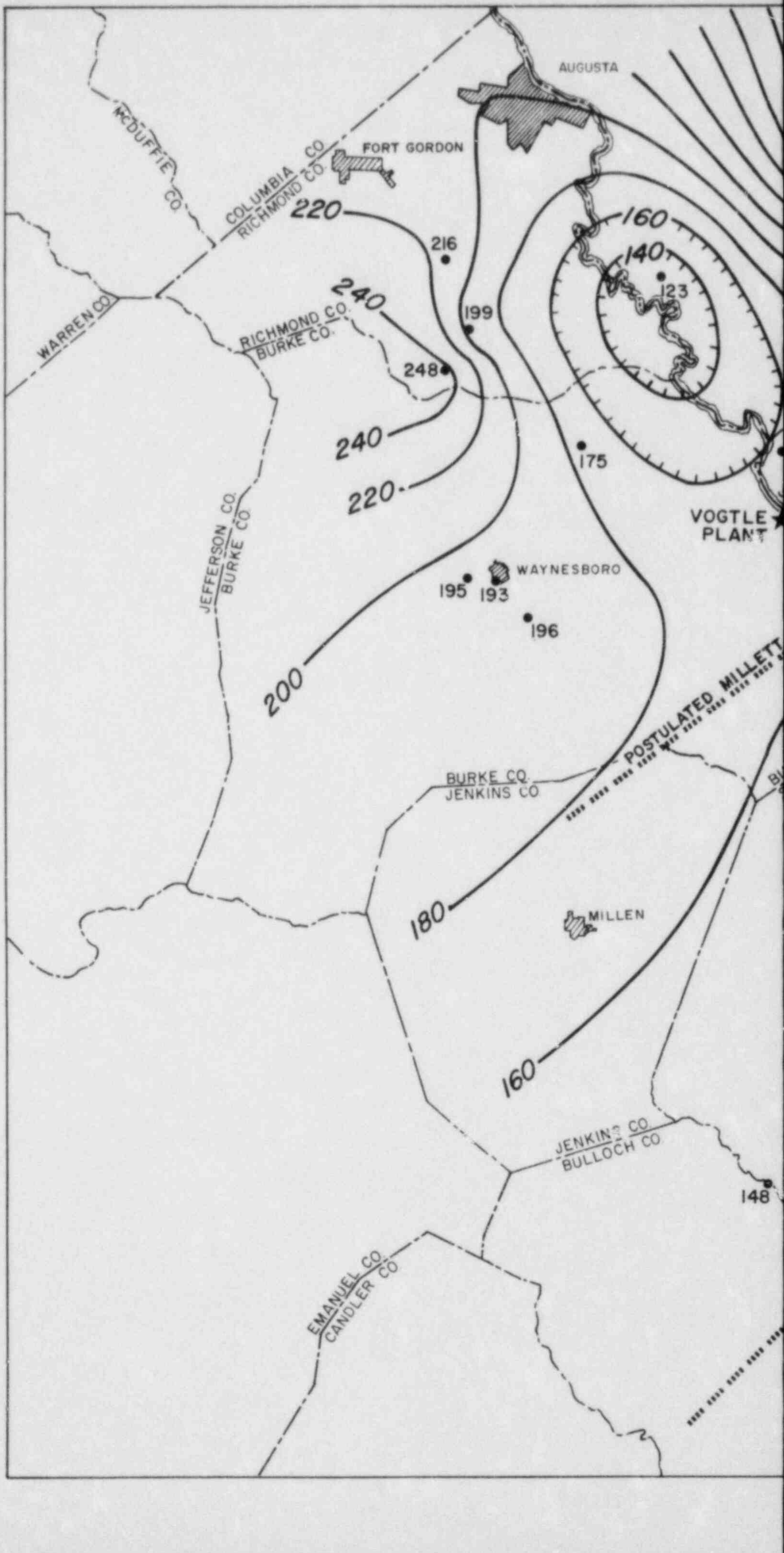


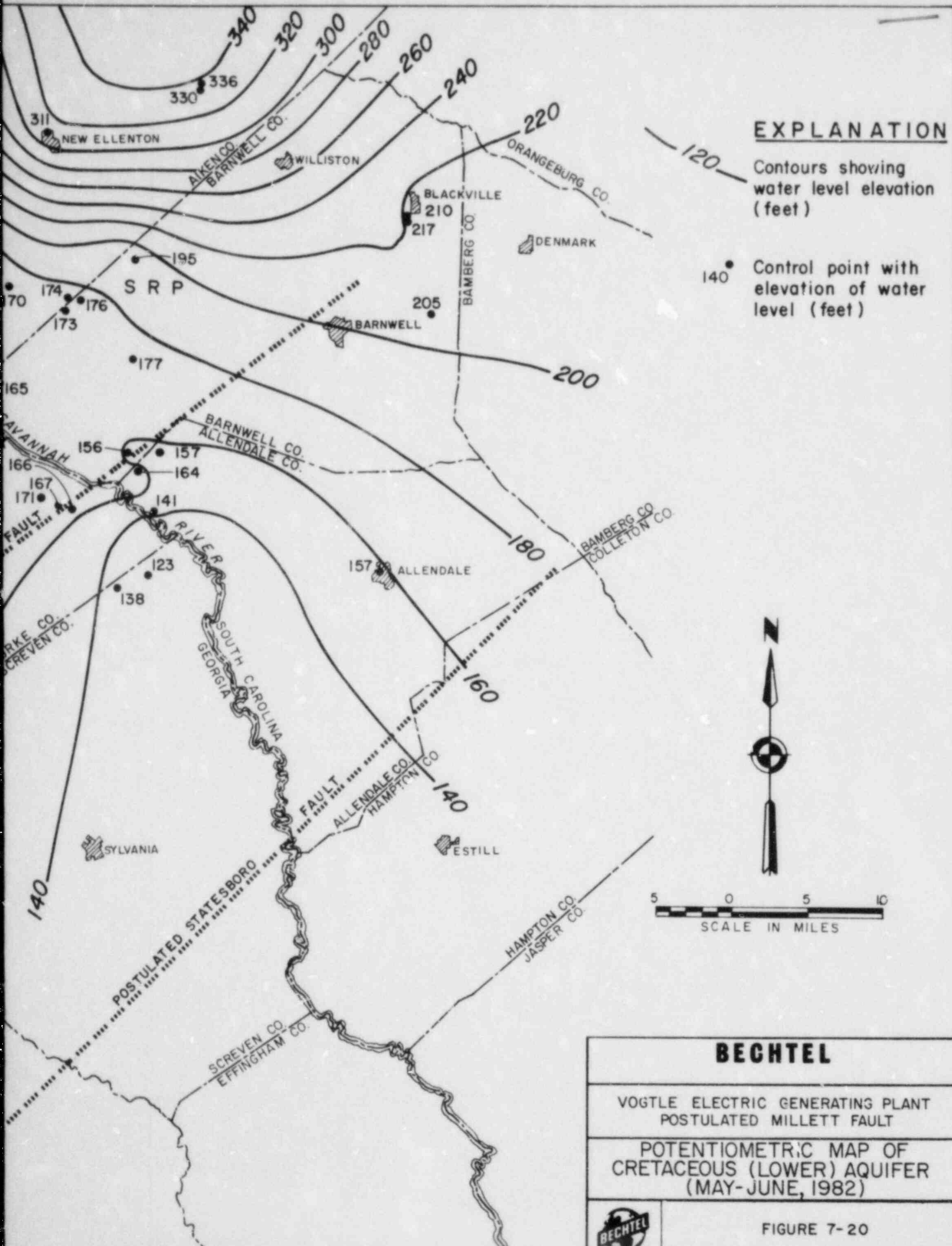
BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

POTENTIOMETRIC MAP OF TERTIARY (UPPER) AQUIFER (MAY-JUNE, 1982)

FIGURE 7-19


AUGUSTA
FORT GORDON
McDUFFIE CO
COLUMBIA CO
RICHMOND CO
WARREN CO
RICHMOND CO.
BURKE CO.
JEFFERSON CO.
BURKE CO
220
216
240
199
248
160
140
123
175
240
220
VOGTLE PLANT
WAYNESBORO
195
193
196
200
POSTULATED MILLETT
BURKE CO.
JENKINS CO
180
MILLEN
160
JENKINS CO.
BULLOCH CO
148
EMANUEL CO.
CANDLER CO

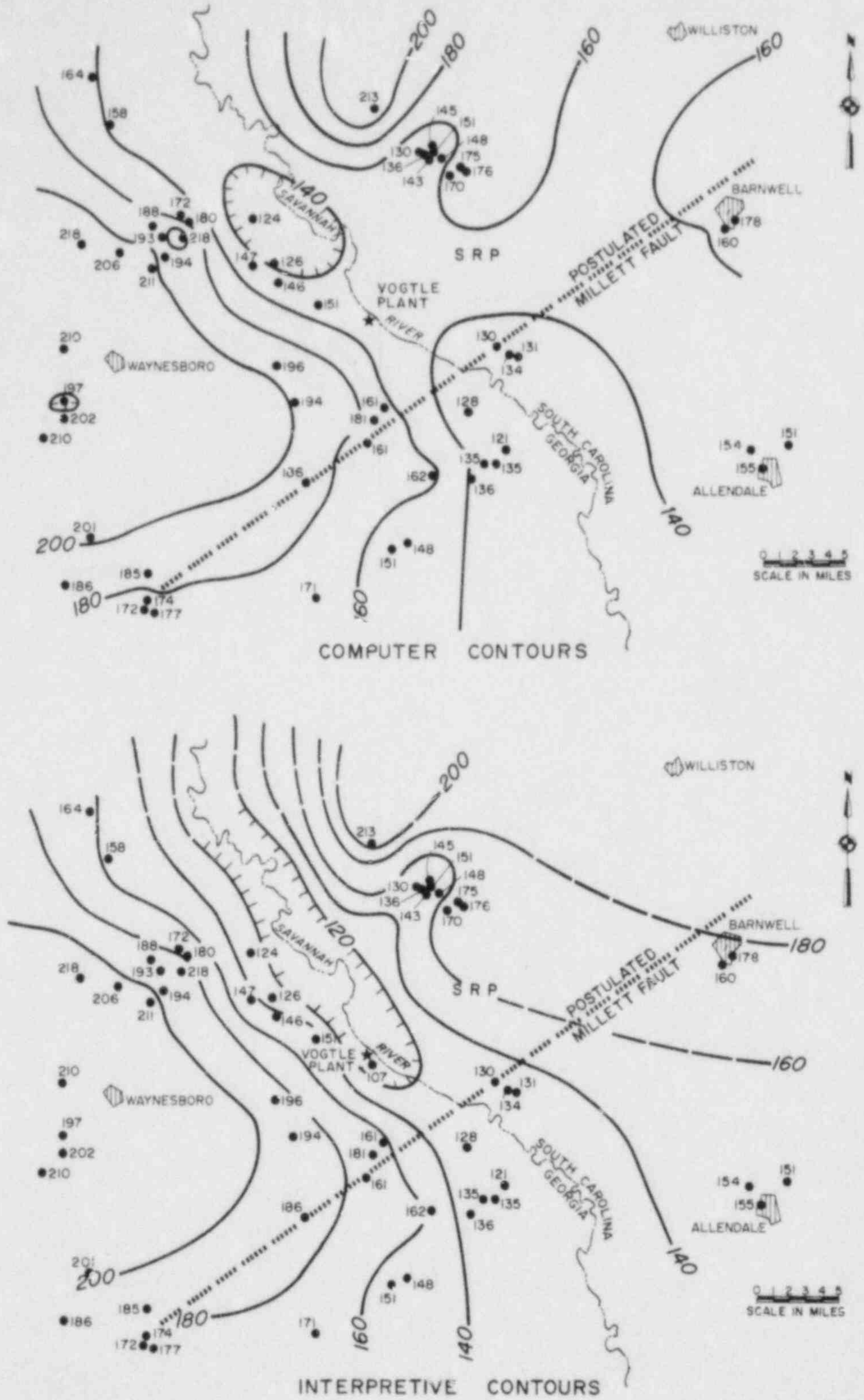


BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

POTENTIOMETRIC MAP OF
CRETACEOUS (LOWER) AQUIFER
(MAY-JUNE, 1982)

FIGURE 7-20

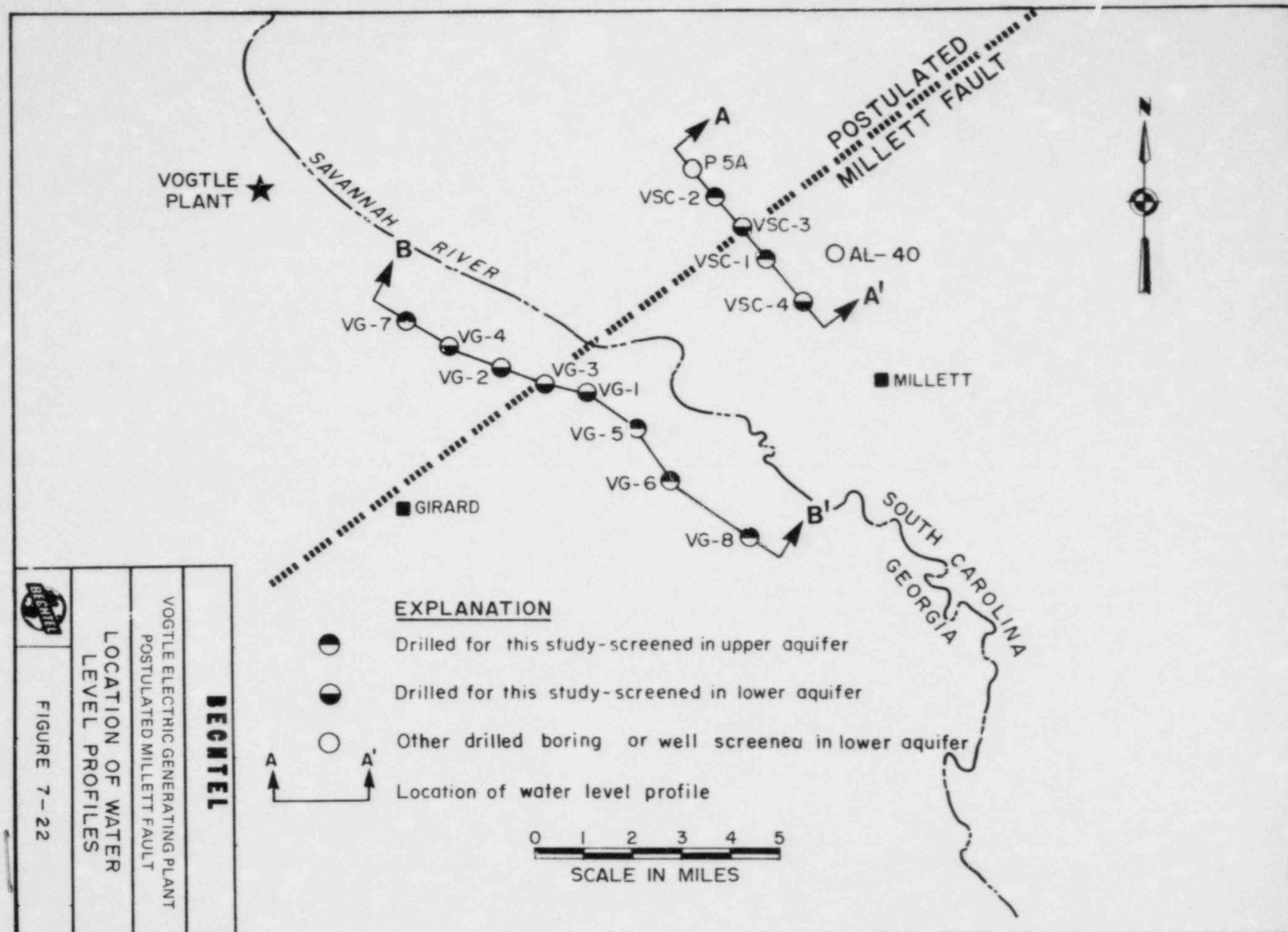


BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

COMPARISON OF COMPUTER AND INTERPRETIVE PIEZOMETRIC CONTOURS-TERTIARY AQUIFER

FIGURE 7-21



BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

LOCATION OF WATER LEVEL PROFILES

FIGURE 7-22

DOCUMENT/
PAGE
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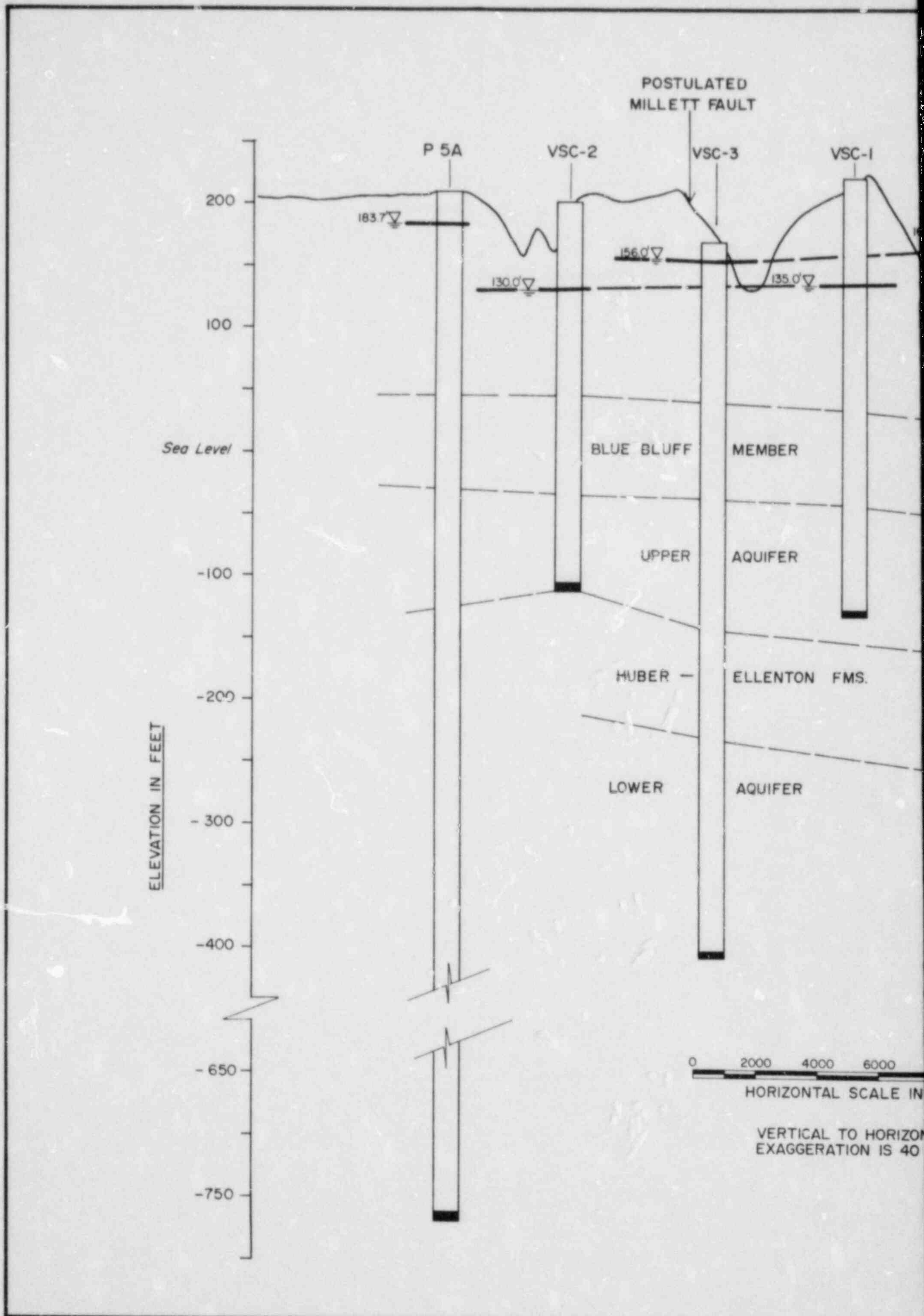
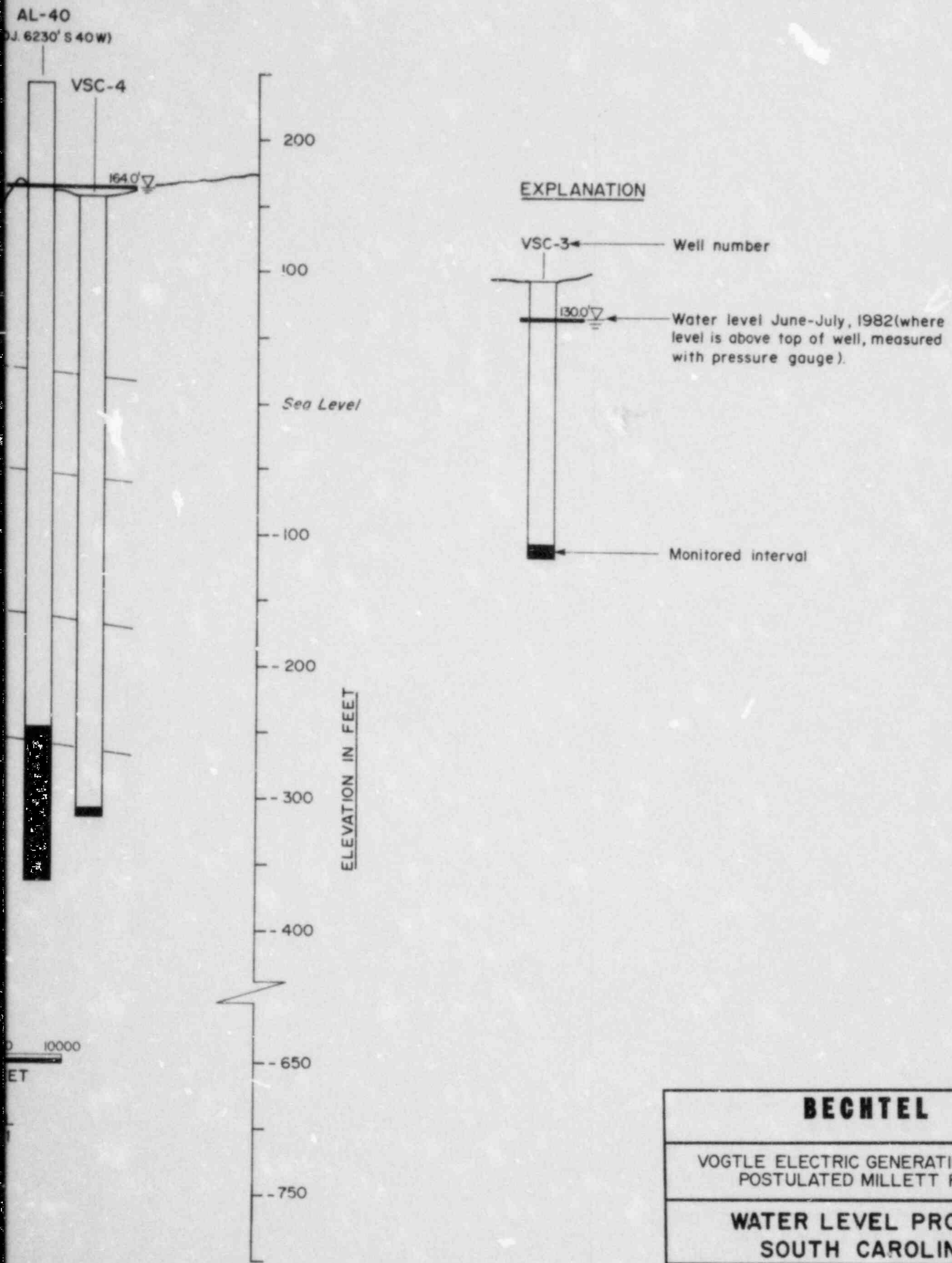


POSTULATED
MILLETT FAULT
P 5A
VSC-2
VSC-3
VSC-1
183.7'
156.0'
130.0'
135.0'
200
100
Sea Level
-100
-200
-300
-400
-650
-750
ELEVATION IN FEET
BLUE BLUFF MEMBER
UPPER AQUIFER
HUBER — ELLENTON FMS.
LOWER AQUIFER
0 2000 4000 6000
HORIZONTAL SCALE IN
VERTICAL TO HORIZON
EXAGGERATION IS 40

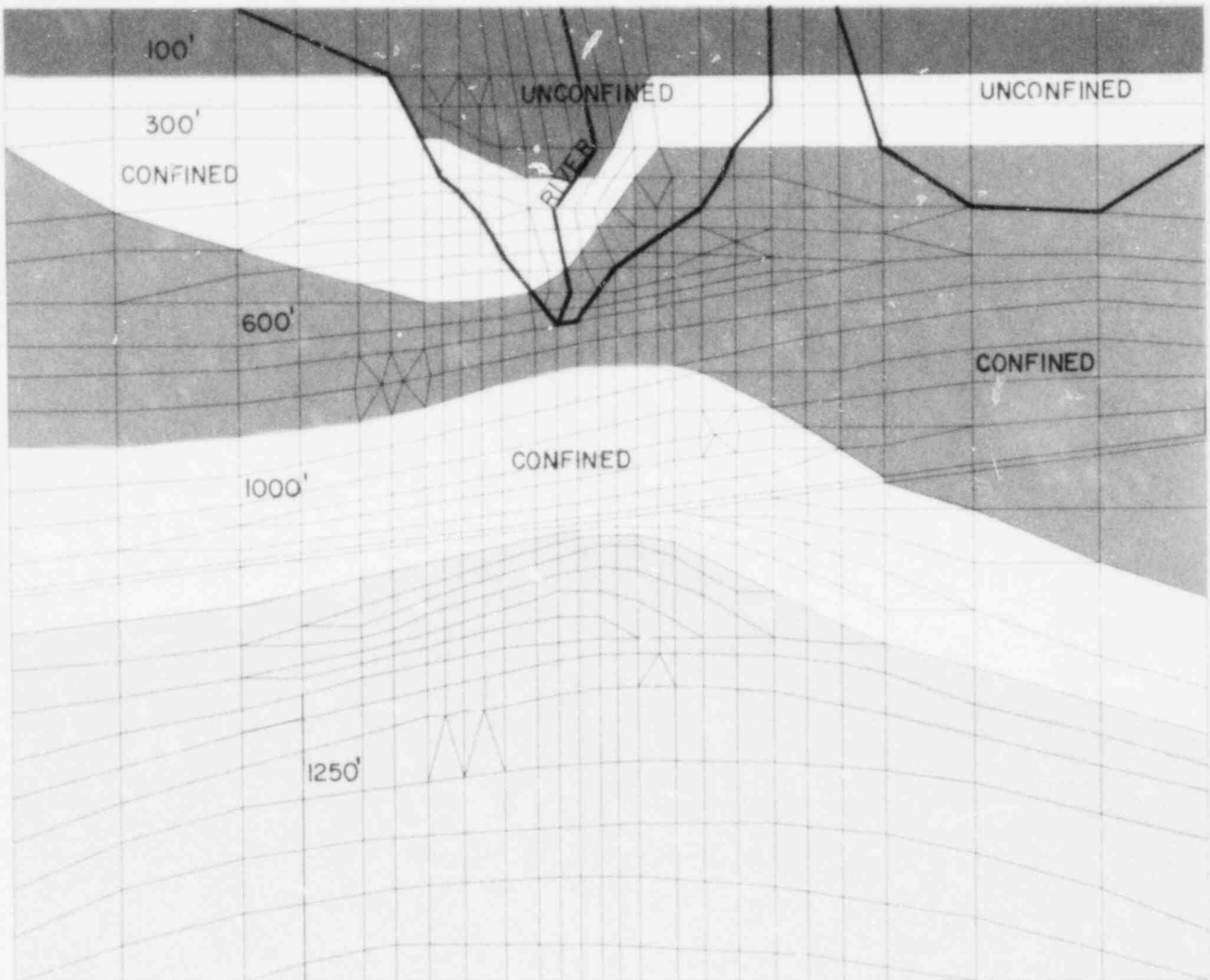


BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

WATER LEVEL PROFILE
SOUTH CAROLINA

FIGURE 7-24



EXPLANATION

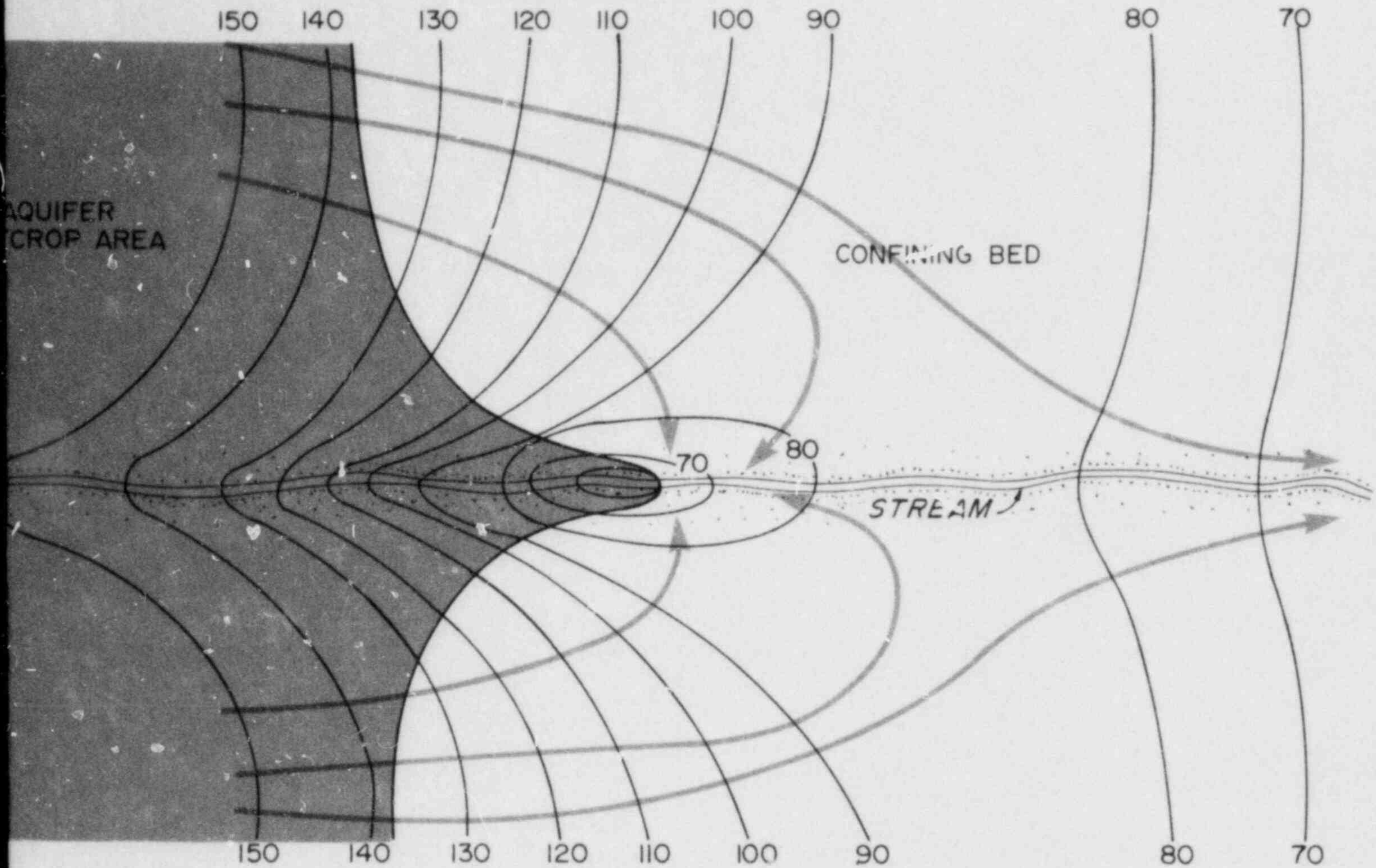
The aquifer thickness increases from North to South as indicated by the different colors.

BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

FINITE ELEMENT MESH

FIGURE 7-25



OTE:

ltitude of water level in feet.

EFERENCE:

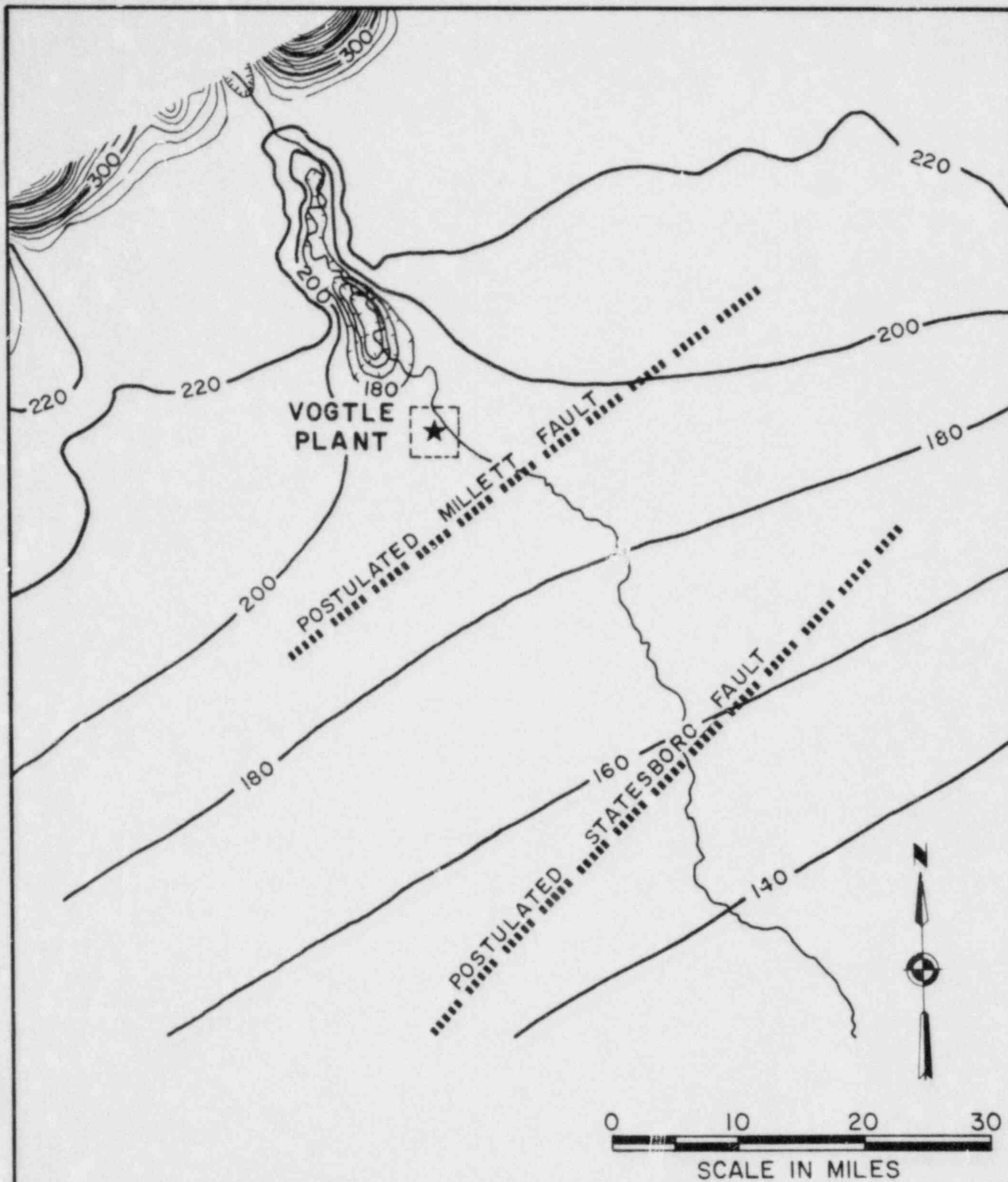
eGrand and Pettyjohn (1981)

BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

SCHEMATIC REPRESENTATION OF LEGRAND'S HYPOTHESIS

FIGURE 7-26



EXPLANATION

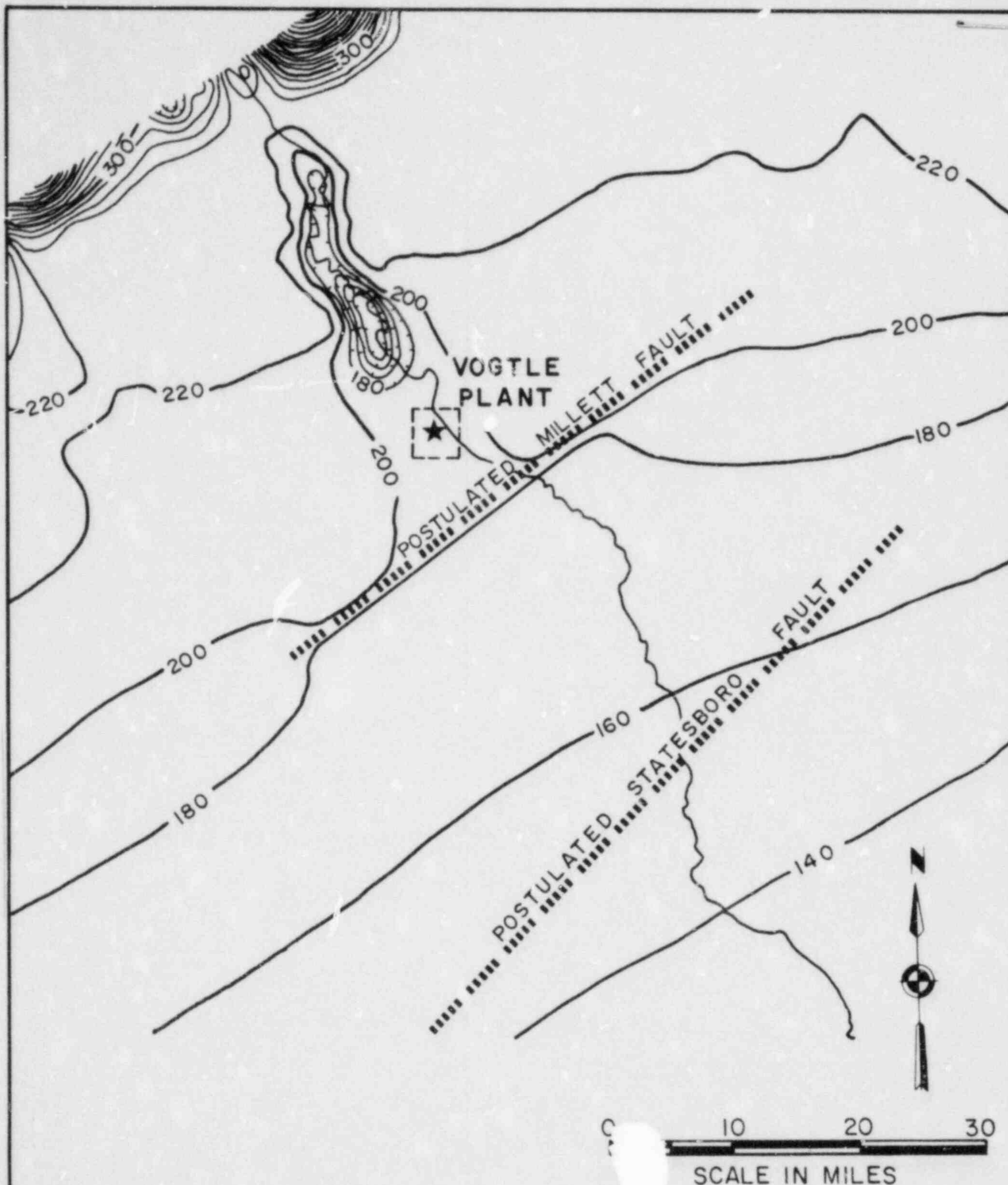
—200— Potentiometric Contour
(Contour Interval = 20 ft.)

BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

CALCULATED POTENTIOMETRIC SURFACE, LEGRAND'S HYPOTHESIS (BASE CASE)

FIGURE 7-27



EXPLANATION

K_B = Hydraulic Conductivity of the Postulated Millett Fault as a Barrier.

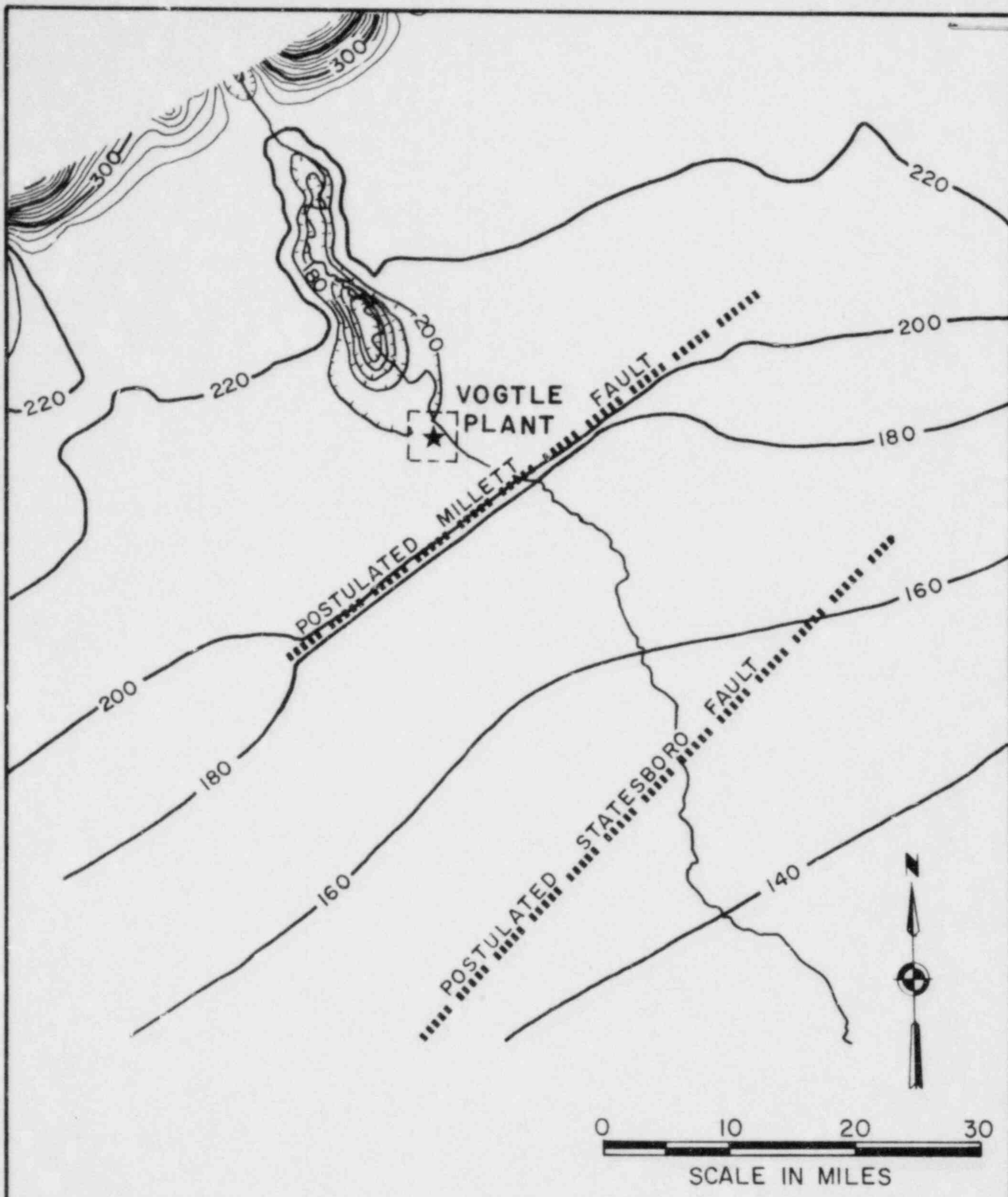
—200— Potentiometric Contour (Contour Interval = 20 ft.)

BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

CALCULATED POTENTIOMETRIC SURFACE. BARRIER FAULT HYPOTHESIS (K_B = 100 ft./yr.)

FIGURE 7 – 28



EXPLANATION

K_B = Hydraulic Conductivity of the Postulated Millett Fault as a Barrier.

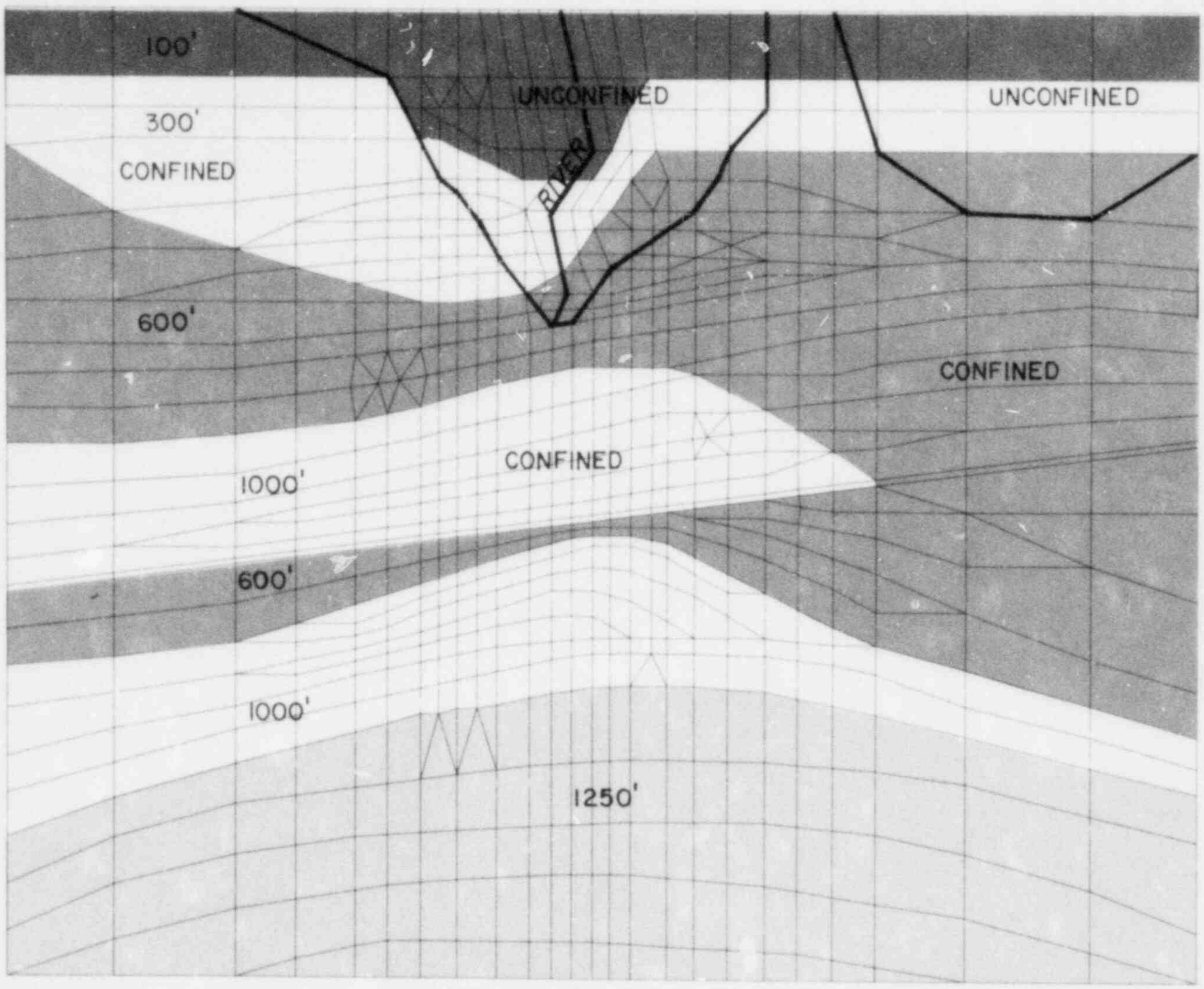
—200— Potentiometric Contour (Contour Interval = 20 ft.)

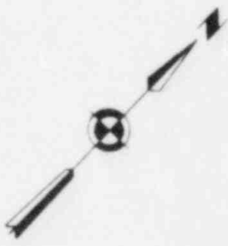
BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

CALCULATED POTENTIOMETRIC SURFACE, BARRIER FAULT HYPOTHESIS (K_B = 1 ft./yr.)

FIGURE 7-29





EXPLANATION

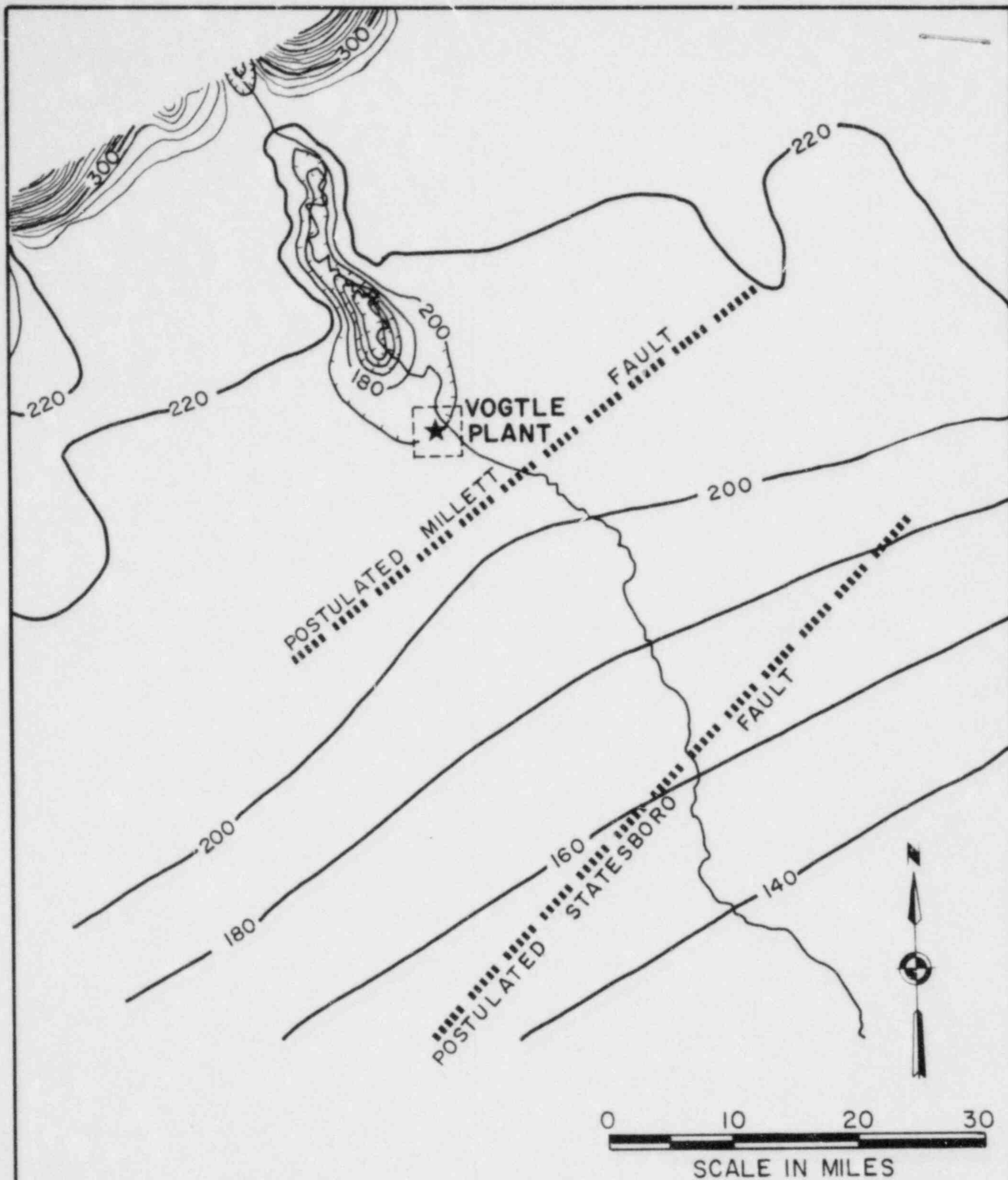
The aquifer thickness changes as indicated by the different colors.

BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

FINITE ELEMENT MESH FOR THE REDUCED TRANSMISSIVITY HYPOTHESIS

FIGURE 7-30



EXPLANATION

—200— Potentiometric Contour
(Contour Interval = 20 ft.)

BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

CALCULATED POTENTIOMETRIC SURFACE. REDUCED TRANSMISSIVITY HYPOTHESIS

FIGURE 7-31

VOGTLE PROJECT SITE
GEORGIA
AERIAL PHOTOGRAPHY
MAY 8, 1951

SCALE 1" = 1 MILE

------------ THEORETICAL MILLETT FAULT ZONE

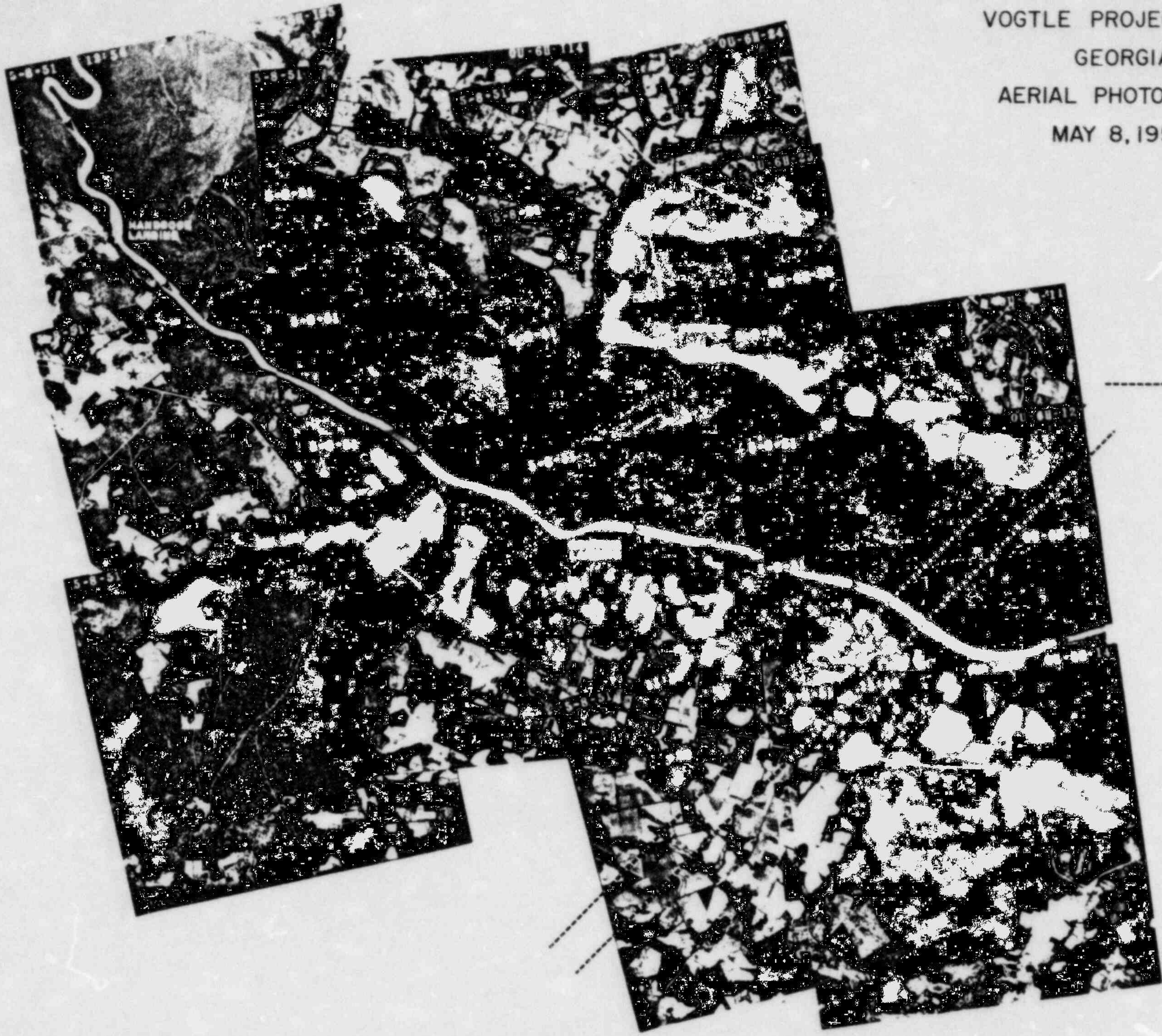


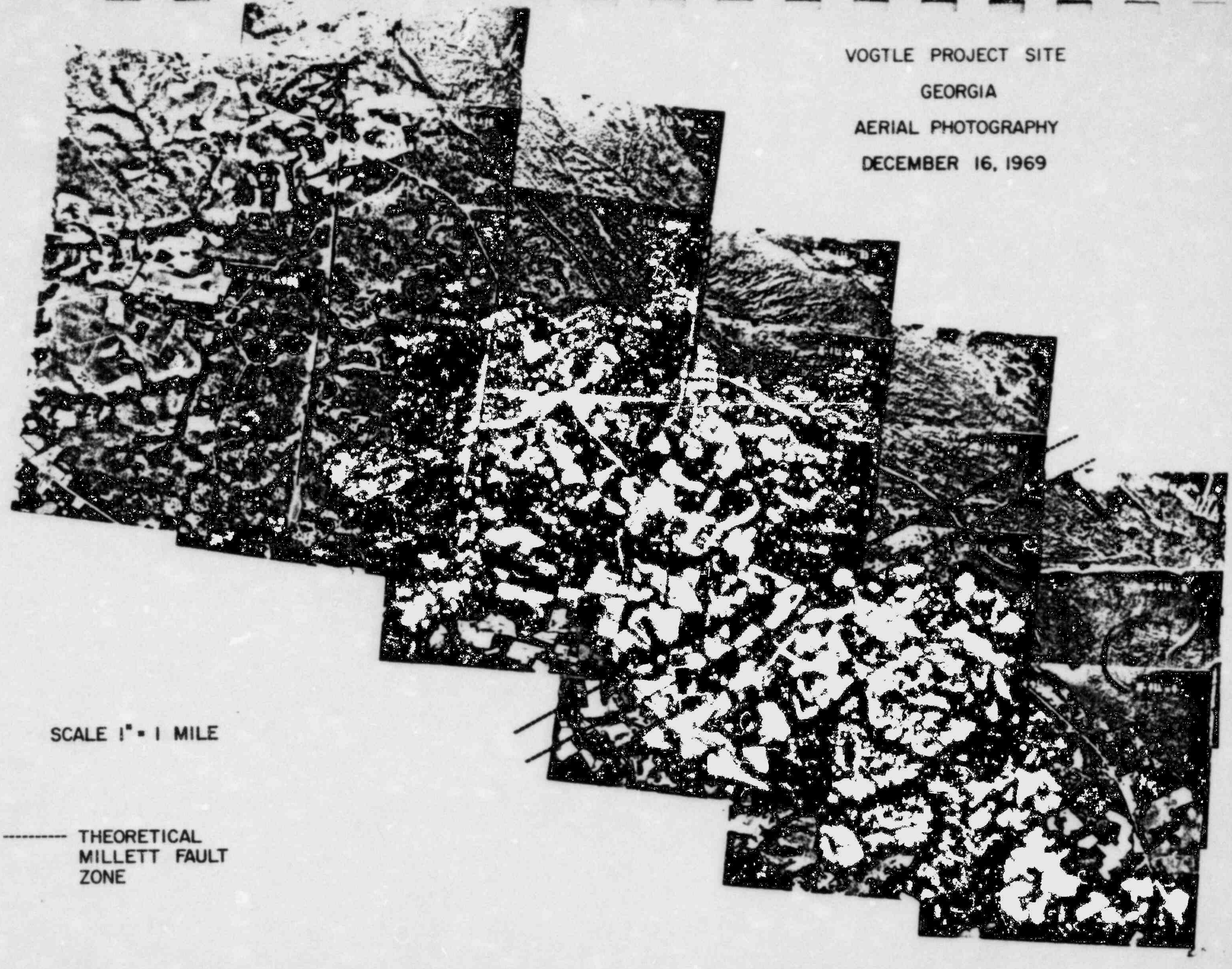
PLATE 1

VOGTLE PROJECT SITE

GEORGIA

AERIAL PHOTOGRAPHY

DECEMBER 16, 1969



SCALE 1" = 1 MILE

---------- THEORETICAL MILLETT FAULT ZONE

PLATE 2

VOGTLE PROJECT SITE

GEORGIA

FALSE COLOR OBLIQUE U-2 PHOTOGRAPHY

MAY 1, 1979

NASA PHOTOGRAPH
579002748024100

PHOTOGRAPH CENTER N 33° 5'
W 81° 31'

------------ THEORETICAL MILLETT FAULT ZONE

PLATE 3

VOGTLE PROJECT SITE

GEORGIA

ENHANCED LANDSAT SATELLITE IMAGERY

FEBRUARY 11, 1974

LANDSAT SCENE

1568-15281

SCALE 1" = 2.5 MILES

--------- LINEAMENT

--------- THEORETICAL MILLETT FAULT

PLATE 4

VOGTLE PROJECT SITE

GEORGIA

ENHANCED LANDSAT SATELLITE IMAGERY

JUNE 6, 1976

LANDSAT SCENE

*5414-14480

SCALE 1" = [illegible]5 MILES

• DATE / M_L EARTHQUAKE EPICENTER

-------- LINEAMENT

--------- THEORETICAL MILLETT FAULT

PLATE 5

8.0 ASSESSMENT OF POSTULATED MILLETT FAULT

All of the field and office studies described in Chapters Six and Seven were directed at resolving the issue of whether the postulated Millett fault could be a capable fault by NRC criteria, and therefore of concern to the Vogtle Plant. In this chapter the results of those studies and the conclusions derived from them are discussed. Section 8.1 describes the results of each of the investigations discussed in Chapters Six and Seven which were designed to specifically address the issue of faulting. Section 8.2 discusses conclusions.

8.1 Results of Investigations

8.1.1 Results of Geologic Mapping

The geologic map produced during the field mapping, combined with the SRP and Vogtle geologic maps is shown on Figure 6-1. This map is a detailed study and is the best possible for the terrain and cover in the area. The conclusions that are pertinent to the postulated Millett fault can be quickly stated. First, there is no detectable offset of the Barnwell-Hawthorn (Altamaha) contact across the trace of the postulated fault. Second, there is no variation in mappable units across the suggested fault that cannot be more logically attributed to facies changes. Third, no surface geologic features were observed that are typically associated with shearing in or near fault zones. Finally, no geomorphic features were observed that would indicate the presence of a fault in the area mapped.

8.1.2 Results of Core Drilling

Key Contacts and Marker Horizons

The core drilling program resulted in a clear definition of the subsurface stratigraphy along both the Georgia and South Carolina section lines crossing the postulated fault. Contacts between geologic units were found to be distinctive, making them useful for hole to hole correlation. These contacts were one of the criteria used in determining whether or not fault offset had occurred between holes. The lithologic correlations of units and their contacts are shown on Figures 8-1 through 8-3. Analysis of these geologic sections has not shown any offset which could be attributed to faulting as suggested in the Open-File Report.

The lowermost units cored consist of multicolored clays with interbedded sands belonging to the Late Cretaceous Tuscaloosa Formation. Correlation of the individual beds within this formation is very difficult. These materials were deposited in an environment characterized by rapid lithologic changes which resulted in few laterally extensive beds. Significant intraformational periods of erosion and redeposition also occurred, further complicating the section.

Overlying the Tuscaloosa is the lower Paleocene carbonaceous silt and clay unit known as the Ellenton Formation. The upper contact of the

unit is the deepest marker useful for correlation in the section penetrated by drilling. The age of this unconformable contact is about 60 million years.

Above the Ellenton are sediments of the Huber Formation. These include a micaceous quartz sand which was found to be a laterally extensive unit in the Georgia core holes (Figure 8-2). However, in South Carolina kaolinitic clay of the Huber Formation extends down to the top of the carbonaceous clay of the underlying Ellenton in most holes (Figure 8-1). The multicolored clays of the Huber Formation represent another distinct unit useful for correlation. The upper contact of the Huber Formation is an unconformity which exhibits several feet of weathering discoloration. This contact with the overlying non-calcareous sands is a distinctive marker for correlation.

The sands overlying the Huber Formation belong to a unit which is unnamed in this report. They consist of upper calcareous and lower non-calcareous sands with gradational contact between. The contact can be determined using acid to detect a change in carbonate content, and in some core samples is represented by a color change. The geophysical logs clearly define this contact, and the contact has therefore been employed as a marker for correlation.

The calcareous sand unit generally increases in fossil content upward into a fossiliferous limestone. The thickness of the limestone and the

gradational nature of the change from calcareous sand to limestone does not allow use of the sand-limestone contact as a marker horizon. The top of the limestone where it is in contact with the base of the overlying marl does, however, define a good marker. This contact is characteristically abrupt and sharp with an age of approximately 50 million years and is not offset.

The marl overlying the unnamed sands is middle Eocene in age and is known as the Blue Bluff Member of the Lisbon Formation. As can be seen on Figures 8-1 through 8-3, the marl is the most distinctive and useful marker horizon for correlating purposes. This unit generally becomes finer upward with local thin bedding. Intermittent thin beds of limestone occur throughout the marl.

The material overlying the marl varies among the core holes. In the northwestern portion of the Georgia section (refer to Figure 8-2), the marl is capped by fossiliferous limestone. This limestone, known as the Utley Limestone is variable in thickness. The basal contact of the limestone represents an unconformable contact with the marl. Downdip to the southeast, the marl is overlain by calcareous sand which thickens downdip. The calcareous sand is overlain by limestone of similar lithologically to the Utley Limestone overlying the marl to the northwest. The drill holes in the South Carolina section (Figure 8-1) did not encounter the equivalent upper limestone. These holes generally penetrated a deeply weathered, thin bed of sandy clay above

the marl. For correlation purposes the top of the limestone was used for the marker horizon in the Georgia section (Figure 8-2). The age of this contact is estimated at 45 million years. In the South Carolina section (Figure 8-1), the top of the marl was used as the marker because of the absence of the limestone.

The uppermost geologic units penetrated by core drilling are the sands of the Barnwell and Hawthorn (Altamaha) Formations. These formations have late Eocene and early Miocene ages, respectively. Distinct marker horizons were not found in these materials.

As can be seen in Figures 8-1 through 8-3, the stratigraphic markers described above can be correlated across the postulated Millett fault without evidence of offset. This correlation is found in sections using drill hole data from both sides of the Savannah River. It is therefore concluded from the core drilling that there is no evidence of fault displacement between the core holes within the depth of investigations.

8.1.3 Results of Geophysical Logging

The downhole geophysical logs were interpreted for similiar overall trace character and specific contacts. Correlations were drawn between characteristic points from hole to hole. These correlations were made independent of the lithologic marker horizons described in Section

8.1.2 which were correlated from the core logs. The electrical and nuclear log correlations are shown on Figures 8-4 through 8-7.

Several discrepancies between the lithologic and geophysical correlation points are readily apparent. These are due to the nature of the physical properties measured by each type of log. The lithologic log has contacts designated at bedding discontinuities observed in the core samples. The geophysical logs, however, measure specific physical characteristics such as porosity, natural gamma radiation, pore water chemistry, etc. As a result the correlative contacts picked in these different logging methods do not always coincide. However, the significant aspect of the geophysical correlation is that physical properties of the formations, as measured by the geophysical logs, can be correlated from hole to hole without apparent offset. These correlations agree with the lithologic correlations in that neither shows any evidence of faulting.

8.1.4 Results of River Reflection Survey

The acoustical marine reflection profile records of the Savannah River (obtained from the three profiling systems described in Section 6.5) were examined for: key reflecting horizons, lateral continuity and variation of the horizons, seismic reflecting characteristics that indicate structural features, and displacements that could be an indication of faulting.

The original records and reflecting horizons for the Millett fault portion of the survey are shown in Plates 3, 4, and 5 of Appendix F. Reflecting horizons for the Statesboro portion of the survey are shown in Plate 7 of Appendix F. In interpreting the time and depth scales of these plates it is important to note that the time scale on the figures is as recorded, while the depth scale incorporates a correction for a 20 foot travel path through the water. The depth scale is arbitrarily set to zero at river bottom. Because of the water correction, the assumed velocity of 6,000 feet per second cannot be multiplied by one-half the two way travel time to obtain the corresponding depth.

The general results of the reflection surveys are: 1) identification of several key, continuous, southeast dipping reflectors at different depths ranging from elevation +70 to -1150 feet (see Plate 2 of Appendix F); 2) an indication of localized features, including a depressional feature between river mile marker 143 and 144; and, most important, 3) the absence of the faulting as postulated in the Open-File Report.

The reflectors observed on the river survey were correlated with the adjacent VG core holes about one mile to the southwest. Figure 8-8 illustrates these correlations in the area adjacent to the postulated Millett fault. The reflectors A through C are interpreted to be from beds of clay and shell bioherm layers in the Barnwell Group. Reflector E correlates with the top of the Utley Limestone, the lowermost unit in

the Barnwell Group. Due to the large velocity contrast between the overlying unconsolidated sands, clay, and shells; this reflector can be identified over most of the area. Reflector F represents the base of the Blue Bluff marl at the contact with the lower unnamed limestone. Reflector G correlates with the unconformable contact between the upper unnamed sands of the Lisbon Formation and the top of the kaolinitic clays of the Huber Formation. The reflector H is interpreted to be the top of the thick sand aquifer within the Tuscaloosa Formation. Finally the deep reflector designated I is correlated with the top pre-Late Cretaceous erosion surface (the top of the Triassic sedimentary rocks). This correlation is verified by the drill hole P5R, less than 5 miles to the northeast, penetrating the Triassic rock at about the same elevation. Reflection lines on the SRP and the Seisdata line near Sardis, Georgia also show this same strong reflector at that elevation.

The lack of bedding offset, along with the overall continuity of the identified reflecting horizons, indicates that no faulting of the kind and magnitude postulated in the Open-File Report has occurred. A similar conclusion holds for the postulated Statesboro fault (see Plate 7 of Appendix F).

Several shallow reflectors with small, less than 10 feet, displacements are found adjacent to Fix 13 on the Uniboom and 10 cubic-inch air gun records. The features could be the result of interference due to multiple reflections. If the features are interpreted to be displaced

beds several origins are possible, these include fault offset, slumping and collapse. Fault offset would result in displacement of lower reflectors, with increasing offset with depth and age of the formations. A review of the records show several reflectors below the displaced reflector which do not show offset. These include reflector C at a depth of about 60 feet, reflector E at a depth of 100 feet, reflector G at 280 feet, reflector H at about 500 feet, and reflector I at about 1170 feet. Additionally, the undisturbed reflectors are shown to not be offset in the adjacent core hole section.

The records show several features which are analogous to collapse and buried karstic surfaces. The limestone and upper portion of the marl display solutioning and resultant collapse in both outcrop along the river bluffs and in the reflection profiles. The overlying sediments collapse into the depression causing offset with the adjacent sedimentary beds.

Two examples of the Fix 13 type of features are shown in Plates 3 and 4 of Appendix F. The first is shown on Plate 3, Appendix F, approximately 550 feet northwest of Fix 13 at a time between 11 and 14 milliseconds while the second is shown on Plate 4, Appendix F, approximately 500 feet southwest of Fix 13 in the upper 0.05 seconds of the record. These features are found in reflector A materials which show a blocky, irregular nature in adjacent areas on Uniboom records (Plate 3). The blocks show slight rotation of the bedding, which is consistent with slumping into a depression. The areas between the blocks do not show diffraction patterns, which are associated with vertical faulting.

During the river survey, several passes were made of this portion of the river. The records from the additional passes were reviewed to aid in the interpretation of the features. The record shown on Plate 4 is from Line 6. Another 10 cu. in. airgun pass is shown on Figure 8-9 from Line 4. The differences between the lines include a change in the filter setting from 170-800 Hz band to 700-1000 Hz band, as well as a different position of the boat in the river channel. Figure 8-9 clearly shows far less offset of the reflector than is shown on Plate 4. This is most likely the result of position shift in the river channel. If the feature were a fault offset, the amount of offset would be consistent regardless of position in the channel. If the feature were the result of block sliding into a depression, different amounts of offset would be expected within a short lateral distance, as was found.

Figure 8-9 does not have the same strong 'bubble pulse' interference at 0.06 milliseconds due to the different filter setting. As a result, several good reflectors are evident between 0.04 and 0.08 milliseconds on Figure 8-9, which were masked by the bubble pulse on Plate 4. These reflectors do not show offset as do those above. Reflector G at 0.12 milliseconds does not show offset. Thus, the small offsets shown on Plate 4 can most logically be attributed to collapse and block sliding and clearly not to capable faulting.

A possible offset is shown in the I horizon (Triassic rocks) on the 20 cubic inch Air Gun record (Plate 5, Appendix F) at the approximate location of the postulated Millett fault. The apparent offset is 40 feet (±10 ft) down to the south. The horizon I feature correlates quite well with the small step-like faults interpreted at the Triassic contact on the Savannah River Plant geophysical records discussed in Section 7.3. This feature, if it is faulting, has the opposite sense of movement and at least an order of magnitude less offset than the postulated Millett fault.

8.1.5 Results of Existing Geophysical Studies

The gravity and magnetic surveys reviewed for this report all contain anomalies which indicate the possibility of faulting. The survey methods (e.g. station spacing) and the physical characteristics of the local rocks (e.g. nonmagnetic sedimentary rocks to great depth) limit the interpretation to depths greater than 1000 feet (ages greater than 80 m.y.B.P.). Since no information on the shallow Cretaceous structure is obtainable from the gravity and magnetic surveys no conclusions as to the capability of the postulated faults can be made.

The reviewed reflection survey of the Savannah River Plant was designed to map the Triassic basins. This required survey techniques that gave little information on the Cretaceous structure. Some Cretaceous reflecting horizons to the northwest of the postulated Millett fault

were identified as not faulted. Several top-of-Triassic reflecting horizons were identified with displacements generally less than 100 feet. In the vicinity of the postulated Millett fault, offset of about 50 feet up to the northwest was found on Line 7 (Figure 7-2). This 50 foot displacement is much less than the several hundred feet postulated for the Millett fault.

The purchase of part of Seisdata Vibroseis Line 6 resulted in the identification of a strong continuous top-of-Triassic reflector (elevation -1175 feet) across the postulated Millett fault trace. The top-of-Triassic reflector loses coherence about 1/2 mile southeast of the postulated fault. If the break up is interpreted as displacement, the maximum offset of the top of Triassic is on the order of tens of feet.

An important consistency to note between all the seismic reflection surveys and the cored hole P5R (Marine and Siple, 1974) is the elevation of the top of Triassic.

Source	Elevation (feet) Top of Triassic
Cored hole P5R (Figure 7-2)	-1100
Savannah River Plant Line 7 - southernmost part (Figure 7-2)	-1100
Savannah River Survey - at postulated fault (Figure 6-5)	-1130
Savannah River Plant Line 1E - southernmost part (Figure 7-2)	-1150
Vibroseis Line 6 - at postulated fault (Figure 6-5)	-1175

These data indicate that the top of Triassic (age approximately 80 m.y.B.P.) in the vicinity of the postulated Millett Fault, if offs.: at all, has been displaced less than 100 feet.

Finally, no geophysical data lead to the conclusion that there is a capable fault in the vicinity of the postulated Millett fault.

8.1.6 Results of Remote Sensing Studies

As explained in Section 7.4.1, imagery and photography of varying scales were used to search for evidence of faulting in the area of the postulated Millett fault. Three main types of imagery, collected by different sensor systems were employed; including low-altitude aerial photography, high-altitude NASA U-2 oblique false color photography, and Landsat satellite imagery.

Seven Landsat satellite images covering two seasonal conditions and different sun illumination angles were examined. These satellite images, stored as digital data on computer compatible tapes, were examined on Bechtel's image processor using digital enhancement procedures designed to enhance linear features.

The imagery and photography were examined closely to identify linear features and isolate the lineaments that might represent the surface expression of a geologic structure. The procedure employed was to

first identify lineaments on the imagery, then eliminate all of those lineaments having an obviously non-geologic basis, such as roads, transmission lines, property lines and other cultural features. The remaining lineaments, those which could not be immediately attributed to cultural origins, were subjected to further study. Only one significant lineament was identified as possibly fault-related and was field examined. This lineament is shown as the green dashed lined on Plates 4 and 5.

Professor R.J.P. Lyon of Stanford University, Remote Sensing Laboratory provided assistance in designing the study and interpreting the imagery.

The main conclusion from the majority of the lineaments was that they were caused by optical alignment of field boundaries and some stream sections and hence were classified as having a 'cultural' origin. The low-altitude 1:20,000 aerial photography and selected field observations confirm the origins of these optical lineations on the satellite imagery. A smaller number of the 'cultural' lineaments were attributable to roads which often parallel agricultural fields.

Lineaments identified in red on Figures 7-4 and 7-5, and individually identified by letters, are predominantly associated with floodplain features and karst topography. These lineaments colored blue are predominantly associated with the alignment of stream and river sections.

- Comparison of Figures 7-4 and 7-5 indicates that many of the lineaments occur along the flood plain margins of streams and rivers. These lineaments are labelled A through I and M on Figure 7-5, and B1, C1, and X on Figure 7-4.

- Two geomorphic lineaments near the Vogtle plant site (labelled J and K on Figure 7-5) are present on the June 6, 1976 image. Field observation of these lineaments, together with an examination of the other mosaic in Figure 7-4, reveals that these linear features represent the drainage divide of the drainage basin in which the plant site is located.

- One lineament close to the postulated Millett fault and intersecting it near Ellison's Landing northeast of Girard was examined in the field. This lineament is labelled V on Figure 7.4 and L and L1 on Figure 7-5 and is also shown as a green dashed line on Plates 4 and 5. The results of the field investigation indicate no evidence of faulting along the trace of this linear feature.

- A number of small geomorphic linear features identified in the southeasterly section of the imagery are possibly old 'strand lines' related to previous Quaternary stands of the Atlantic Ocean and are considered non-structural in origin. These lineaments are labelled R and S on Figure 7.4 and O, P and Q on Figure 7.5.

° The 'geomorphic' lineaments identified as karst features are caused by the apparent alignment of circular ponds and agricultural fields in this area. These lineaments are labelled T, U, Z, Y, W and Al on Figure 7-4 and N and Nl on Figure 7-5.

In summary, the remote sensing studies indicate that the lineations on the satellite imagey are unrelated to faulting. They are confidently explained as alignments of field boundaries, stream sections and karst features and fluvial geomorphic features not structurally controlled by faulting. None of the satellite imagery and photography examined showed any evidence of surface expression of the postulated Millett fault.

8.1.7 Results of River Meander Analysis

An analysis of the Savannah River meander pattern was conducted, since the Open-File Report states that the location of the postulated fault is based, in part, on a change in the meander pattern. The analysis has shown that the change from a straight to sinuous p[illegible] is a temporary condition in time and is most probably caused by a change in the erosional resistance of the bank and channel bottom materials. The flood plain shows meander scars adjacent to the straight channel area, demonstrating that the change is temporary. The strata along the straight section consist of hard, well cemented limestone and marl and some semi-consolidated sand and clay beds.

8.1.8 Results of Lithologic Studies

Lithologic studies conducted on samples from AL-66, AL-40 and VSC and VG core holes supplement field studies performed to investigate the stratigraphy in the vicinity of the postulated Millett fault. These studies include petrographic examination, x-ray diffraction and heavy mineral analyses. The main purpose of the studies on samples from AL-66, AL-40 and VSC-4 was to determine whether Triassic rocks were penetrated near the base of these holes. For the VG and VSC holes, the lithologic studies were used to verify the stratigraphic sections.

The Open-File Report postulated the Millett fault on the determination that the lower 100 feet of AL-66 were in Triassic rocks. Results of the lithologic studies indicate that: 1) the lithology of samples collected from AL-66, AL-40 and VSC-4 at elevations below the postulated pre-Late Cretaceous unconformity in the Open-File Report are inconsistent with Triassic-Jurassic lithology based on a comparison with the mineralogical analyses of core samples from DRB 10, 2) samples collected from similar elevations in each hole are lithologically similar to each other. These data indicate that the lithologic unit they were collected from has not been offset.

Samples considered to be representative of some stratigraphic units encountered by the VSC and VG core holes were found to be lithologically distinctive. The lithology of the samples confirms the stratigraphic correlations.

8.1.9 Results of Seismicity Studies

All available seismicity information within 62.5 miles (100 kilometers) of the Vogtle site was reexamined to test for any possible association with the postulated Millett or Statesboro faults. All historic felt earthquakes, all earthquakes located by the regional array of stations in operation since about 1974, and all earthquakes noted on the three station Savannah River Plant array were considered.

These data show that earthquakes of Intensity VI (modified Mercalli) have occurred in the Piedmont part of the 62.5-mile-radius study area defined above, and that smaller, scattered activity appears throughout the Coastal Plain part of the study area. Small recent earthquakes are also concentrated in the Piedmont (although some of these may be quarry or road construction explosions) with a few scattered Coastal Plain events. No clustering of small earthquakes is occurring near either the postulated Millett or Statesboro faults. It is concluded that there is no evidence of association of any known earthquake with either of the postulated faults.

8.1.10 Results of Surface Water Hydrology Studies

Unit baseflows, computed from concurrent records and shown in Table 7-15, show some agreement with those published in the Open-File Report.

The following listing compares USGS obtained values with average values of unit baseflow obtained in this analysis of concurrent records and longer term records:

	U.S.G.S.	Values from this report (Concurrent record)	(1941-1970)
Savannah River			
Augusta-Burtons Ferry	0.74	0.79	0.69
Burtons Ferry-Clyo	0.23	0.59	0.47
Ogeechee River			
Louisville-Scarboro	0.17	0.18	
Scarboro-Eden	0.11	0.10	
S.F. Edisto River			
Montmorenci-Denmark	0.46	0.49	

All average values agree reasonably well except for the Burtons Ferry-Clyo reach. Here the Open-File Report analysis indicates a much greater difference between reaches. Analysis of the 1941-1970 record for the Savannah River yields different values of baseflow also closer in magnitude than those quoted in the Open-File Report. In all cases, unit baseflows in the upstream reaches are greater than those for downstream reaches. As pointed out in the section on ground water, the unit baseflow contribution above Burtons Ferry is expected to be greater than that below Burtons Ferry since the ground water aquifer slopes more steeply than the stream bed.

Variability of computed unit baseflows is great. Figures 7-17 and 7-18 show this variation graphically for the Savannah River 1941-1970

record. Table 7-14 shows that for the 30-year record of flows, unit baseflow in the downstream reach was actually greater than that in the upstream reach for 10 separate years while for four years the downstream reach appeared to be a losing stream. The error analysis performed in Section 7.7.4 further emphasizes that computed unit baseflows are subject to enough variation that they cannot be used with confidence to prove or disprove the presence of a barrier (hypothesized fault) in an aquifer.

8.1.11 Results of Ground Water Studies

8.1.11.1 Water Well Survey

The potentiometric maps of the Tertiary (upper) and Cretaceous (lower) aquifers, Figures 7-19 and 7-20, respectively, indicate that the water in both aquifers moves from the outcrop areas downdip beneath the Coastal Plain. The data indicate that ground water near the Savannah River moves toward the river. Away from the river, the direction of flow shifts to the southeast, downdip. There is a closed "low" (ground water sink) shown on each map at the Savannah River just south of Augusta in the outcrop areas of each aquifer, indicating discharge to the river. Both maps show reversals of ground water gradient on the river downstream of the ground water sinks, in the vicinity of the Vogtle site. There is no evidence of anomalously different water level elevations between wells in either aquifer. The reversals in gradient downdip of the ground water sinks in each aquifer are the only features that could be considered anomalous.

Possible explanations for the observed reversals in ground water gradient are: 1) a barrier caused by faulting, 2) a marked change in transmissivity, or 3) the hypothesis first suggested by Siple (1960), and expanded upon by LeGrand and Pettyjohn (1981), that the reversal, or "saddle" configuration in the potentiometric surface, is a natural consequence of ground water flow to a stream breaching a confined aquifer.

Examination of the geologic cross sections (Figures 8-1 and 8-2) along the line of core holes drilled during this investigation show that there has not been any displacement of sediments within either aquifer. In addition, one hole, VSC-4, was drilled to a depth of 1024 feet and was completed in sands of the Cretaceous aquifer, rather than in the Triassic rocks postulated to be present at that depth by the authors of Open-File Report 82-156. Since there is no geologic evidence for faulting, it is not likely that the reversals in ground water gradient are a result of fault movement.

These same Figures (8-1 and 8-2) show that the sediments are uniform in thickness and rock type along the sections, indicating that there are probably no marked changes in transmissivity. Also, both aquifers exhibit ground water flow reversals in the same region. It is unlikely that both aquifers would have such marked transmissivity changes (from high to low) at exactly the same place. The most probable explanation of the localized reversal of the ground water flow paths is the

hypothesis of saddle configuration (Siple, 1960; LeGrand and Pettyjohn, 1981). The reversal in gradient of both aquifers occurs in areas of reversal in flow due to discharge to the Savannah River as shown on the Cretaceous aquifer potentiometric map (Figure 8-10) of Siple (1954) and on Figures 7-19 through 7-21.

In addition to evaluating regional ground water flow patterns, water levels across the postulated fault were examined for anomalous differences which could be suggestive of a ground water barrier. A barrier is usually detected as a result of relatively large water level differences in wells a short distance apart and may or may not be a result of faulting. Anomalies can be produced by local changes in lithology, changes in transmissivity, or more importantly by comparing water levels from wells screened in different aquifers (or in multiple aquifers). If one well is pumped more heavily than an adjacent well, a semipermanent pumping depression at the more heavily used well can also produce a difference in water levels.

If a ground water barrier is determined to be present, the interpretation of whether or not it is fault-related must be consistent with the geologic structure and stratigraphy.

The reverse situation is also true. The absence of water level anomalies does not preclude the presence of a fault. Fault offsets would be more likely to produce anomalous water levels when an impermeable gouge zone is present along the fault plane, or when permeable aquifer materials are offset against less permeable clays or silts.

Water level profiles across the postulated fault were prepared from reliable data. Only wells screened in the same unit were used, and all water levels were measured in the field during the same time period. Water wells suspected of having failed seals, or having poor communication with the aquifer, were not included. As noted in Chapter 6, observation wells used for analysis of water levels across the postulated fault were thoroughly developed to ensure reliable measurements. The water level profiles are shown on Figures 7-23 and 7-24 (see Figure 7-22 for location of sections), and show no evidence of a ground water barrier. Anomalous water levels presented in the Open-File Report are believed to be a result of using non-concurrent data (water levels not measured at the same time) and data from wells not completed in equivalent aquifers.

8.1.11.2 Numerical Modeling

As described in Section 7.8.2, a numerical model was developed to test alternative hypotheses that can explain the ground water conditions observed at the study site.

The first case analyzed considers the hypothesis of Siple (1960) and LeGrand and Pettyjohn (1981). This theory describes one common type of hydrogeologic system dominated by consequent streams flowing down a structural basin. The input data to the model for this simulation

consist of material properties representative of the Cretaceous aquifer and do not assume any discontinuity at the location of the postulated Millett fault. The corresponding piezometric contours are shown on Figure 7-27.

The second hypothesis analyzed was that of a barrier at the location of the postulated Millett fault. This was achieved by assigning a lower permeability to the elements located in the appropriate area of the finite element mesh. The results are shown on Figures 7-28 and 7-29, which correspond to fault permeabilities equal to 100 ft/yr and 1 ft/yr, respectively.

The last hypothesis was that of an abrupt reduction in aquifer thickness south of the postulated Millett fault. This hypothesis was tested in the model by reducing the transmissivity of the elements located in the corresponding area of the finite element mesh. The piezometric surface calculated in this case is shown on Figure 7-31.

The main conclusions derived from the numerical simulation are as follows:

1. An area of low ground water contours (sinks) can exist in the unconfined part of the Cretaceous aquifer, without any consideration of discontinuities around the postulated Millett fault. These ground water conditions, similar to those observed at

the site, correspond to those prevailing around streams flowing along dipping strata, as stipulated in the hypothesis of Siple (1960) and LeGrand and Pettyjohn (1981).

2. Introducing a barrier fault at the location of the postulated fault does not preclude the development of ground water sinks. Hence, the observed potentiometric contours cannot be used to imply the existence of a fault.

3. A reduction in transmissivity south of the postulated Millett fault alters the calculated potentiometric contours in a manner that is contrary to field observations. Hence, the hypothesis of reduced aquifer transmissivity seems invalid.

8.2 Conclusions

As described in this report, extensive investigations have been undertaken to address the postulated Millett fault described in the Open-File Report 82-156. The results of these studies demonstrate the absence of a capable fault anywhere in the vicinity of the postulated Millett fault. Further, the studies strongly suggest that no capable fault exists near the location of the postulated Statesboro fault.

It is therefore concluded that the postulated Millett and Statesboro faults have no impact on the seismic safety of the Vogtle Electric Generating Plant.

The contributing reasons for these conclusions are as follows:

1. Results of core drilling, lithologic studies, and geophysical logs demonstrate continuity of subsurface horizons across the trace of the postulated Millett fault on both the Georgia and South Carolina sides of the Savannah River. These subsurface horizons have ages ranging from approximately 40 million to approximately 80 million years before present.

2. Results of acoustic reflection studies in the Savannah River demonstrate continuity of subsurface reflecting horizons down to an elevation of approximately -1,100 feet across the strike of the

postulated Millett fault. A reflector at elevation -1,100 feet, believed to be the Triassic surface, may have an apparent offset up of 50 feet. Even this 50-foot offset is questionable but does agree with small faults interpreted from SRP geophysical records and disagrees with the 700-foot offset proposed in the Open-File Report.

3. Results of acoustic reflection studies across the trace of the postulated Statesboro fault also demonstrate continuity of subsurface reflecting horizons.

4. Detailed surface geologic mapping and remote sensing studies reveal no evidence for surface expression of faulting in the area of the postulated Millett fault.

5. Analysis of ground water information, including collection and use of a concurrent data base, indicates there is no basis to support or preclude the existence of a fault. Water levels measured in two lines of piezometers crossing the postulated Millett fault do not show marked changes from one side to the other.

6. Surface water hydrologic studies using a concurrent data base neither prove nor disprove the existence of a fault.

7. Historic seismicity, including microearthquake records, reveals no evidence of active faulting in the area.

8. Petrographic studies of well-cuttings from well AL-66 indicates that this well bottoms in Cretaceous rather than Triassic rocks as suggested in the Open-File Report, thus removing upthrown Triassic rocks as a basis for a fault.

9. Core hole VSC-4, drilled near well AL-66 and approximately 300 feet deeper than the proposed Triassic contact of the Open-File Report, bottoms in Cretaceous rocks rather than Triassic, confirming conclusion eight, above.

8.3 Consultant Conclusions

A group of consultants, with expertise in the geology of the region and in specialized fields, were retained to provide guidance and review of this study. Following completion of the study they reviewed the report and prepared the attached letter. This outline lists their affiliation and area of expertise:

Dr. Bruce Bolt	Univ. of California	Seismologist
Dr. Robert Hatcher	Univ. of South Carolina	Structural Geologist
Dr. Vernon Henry	Skidaway Institute	Geologist
Dr. Philip LaMoreaux	LaMoreaux Assoc.	Hydrogeologist
Mr. Harry LeGrand	Consultant	Hydrogeologist
Dr. Stavros Papadopulos	Papadopulos Assoc.	Hydrogeologist
Mr. Carl Savit	Senior Vice President Western Geophysical	Geophysicist
Dr. Carl Stepp	Woodward-Clyde Consultants	Geophysicist
Mr. Leonard Wood	Papadopulos Assoc.	Hydrologist

September 29, 1982

Mr. C. R. McClure
Manager-Engineering/Geology
Bechtel Civil & Minerals, Inc.
San Francisco, California 94119

We, the undersigned, have reviewed the conclusions of U.S.G.S. Open-File Report 82-156, which postulates the existence of the Millett fault near the Vogtle Plant Site southeast of Augusta, Georgia. The Open-File Report also suggests the possible existence of another fault, the Statesboro fault, farther southeast from the plant site.

We reviewed the draft report entitled "Studies of Postulated Millett Fault", prepared by Bechtel for the Georgia Power Company and Southern Company Services to evaluate these postulated faults, and we provided comments and suggestions on the format and content of the report. Where appropriate, we visited the field during the exploration phase to examine the drill cores and review the hydrologic studies. We also participated in meetings and discussions with members of Bechtel, Southern Company Services, and Georgia Power Company regarding specific data and analyses related to our individual areas of expertise.

Based on the data and interpretations in the draft report by Bechtel and the Open-File Report, we independently evaluated this information as specifically related to areas of our expertise and experience in the region.

The studies performed by Bechtel have focused on the issue of fault capability, as this is of primary importance in establishing the seismic design basis of a nuclear power plant. According to criteria of 10 CFR 100 Appendix A, a fault is considered capable if it has moved at or near the earth surface once in the last 35,000 years, or more than once in the last 500,000 years. A fault shown to be not capable need not be considered in the seismic design bases of the plant. The studies have therefore concentrated on the capability question rather than the existence of faulting per se.

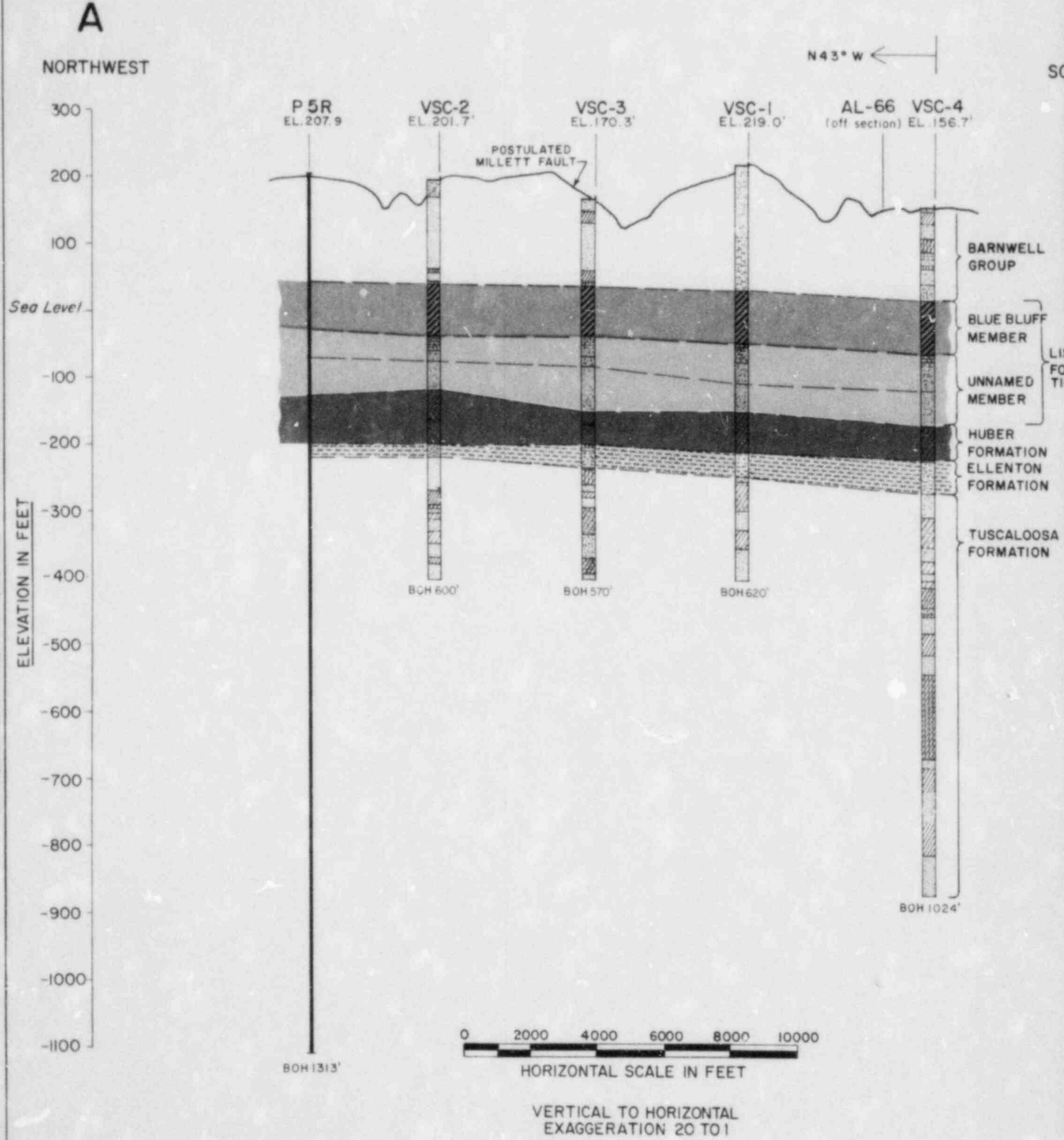
We have primarily reviewed those portions of the studies which fall under our individual areas of expertise, and reviewed the remaining portions in less detail. The results of our individual reviews may be collectively stated as follows:

- Extensive stratigraphic and geophysical studies did not provide credible evidence of faulting within subsurface strata having ages of up to approximately 80 million years.

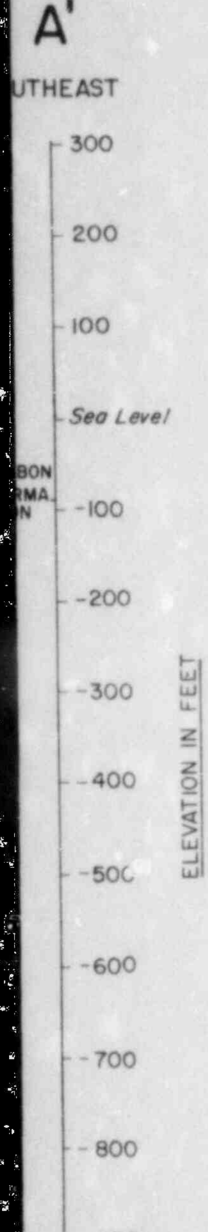
- Hydrologic data do not support the presence of a ground water barrier, which could be a fault, within these same strata.
- Neither the data nor its evaluation support the presence of a capable fault at or near the postulated Millett fault.
- The evidence does not support a capable fault at or near the postulated Statesboro fault.

In summary, the existing data and reports together with data and evaluations developed during this study and reviewed by us do not support the existence of a capable fault at or near the Vogtle Plant site.

Robert D. Hatcher, Jr.	Carl Savit
Leonard Wood	Harry LeGrand
Carl Stepp	V. J. Henry
P. E. LaMoreaux	Bruce Bolt
S. S. Papadopulos	

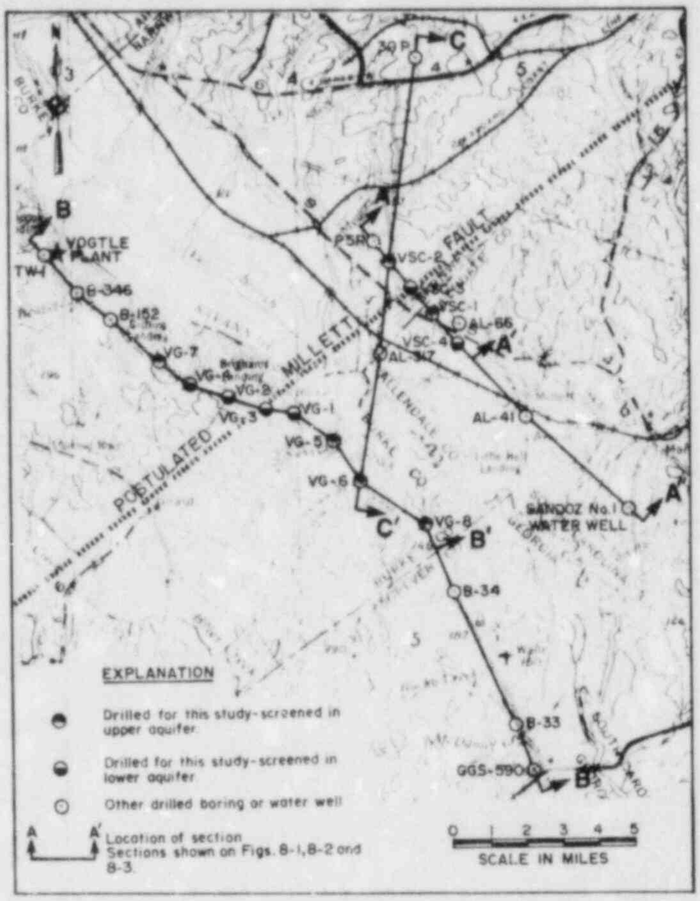


A
NORTHWEST
N43° W
P 5R
EL. 207.9
VSC-2
EL. 201.7'
VSC-3
EL. 170.3'
VSC-1
EL. 219.0'
AL-66
(off section)
VSC-4
EL. 156.7'
POSTULATED MILLETT FAULT
300
200
100
Sea Level
-100
-200
-300
-400
-500
-600
-700
-800
-900
-1000
-1100
ELEVATION IN FEET
BARNWELL GROUP
BLUE BLUFF MEMBER
UNNAMED MEMBER
HUBER FORMATION
ELLENTON FORMATION
TUSCALOOSA FORMATION
BOH 600'
BOH 570'
BOH 620'
BOH 1024'
BOH 1313'
0
2000
4000
6000
8000
10000
HORIZONTAL SCALE IN FEET
VERTICAL TO HORIZONTAL EXAGGERATION 20 TO 1



EXPLANATION

- Clay
- Silty Clay
- Sandy Clay
- Carbonaceous Clay
- Calcareous Siltstone (Marl)
- Calcareous Sand
- Fossiliferous Sand
- Sand
- Limestone



NOTES:

1. Chapter 4.0 describes the lithology and age of the units.
2. Correlations to P5R are based on interpretation of the geophysical log;
3. Appendix D contains the core logs for the holes.

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VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

GEOLOGIC SECTION A-A'

FIGURE 8-1

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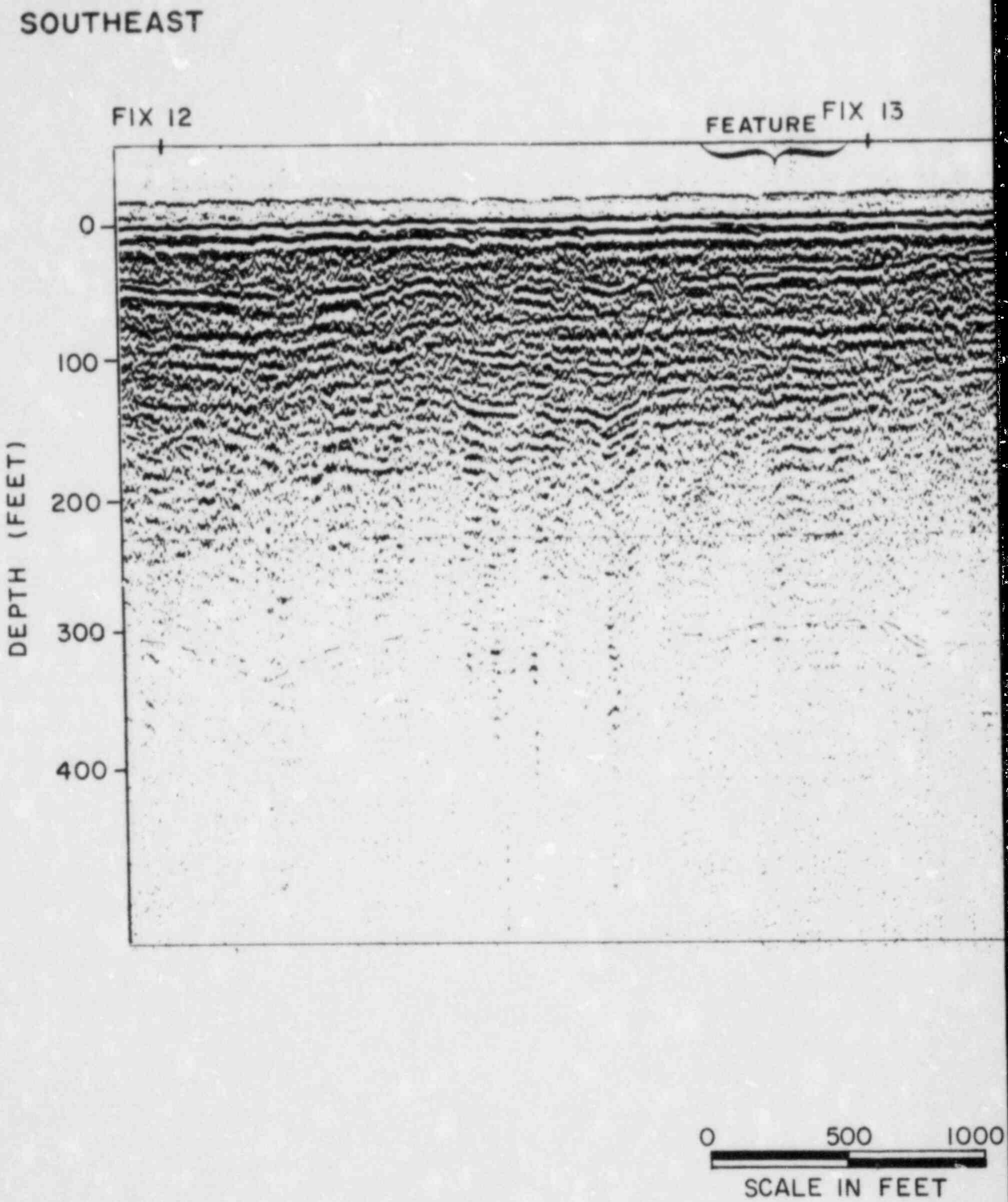
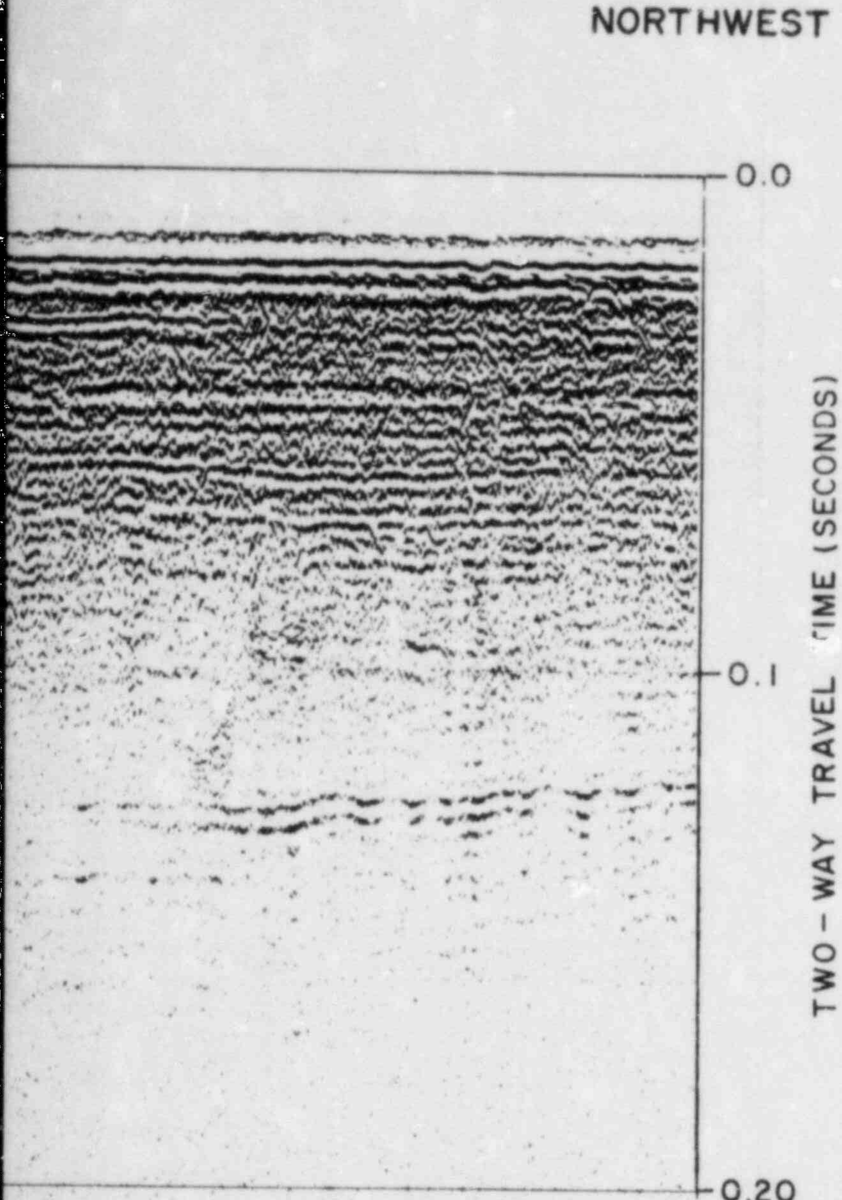


SOUTHEAST
FIX 12
FEATURE
FIX 13
DEPTH (FEET)
0
100
200
300
400
0
500
1000
SCALE IN FEET



NOTE:

IO cubic-inch air gun survey, Line 4. For additional information see Appendix F.

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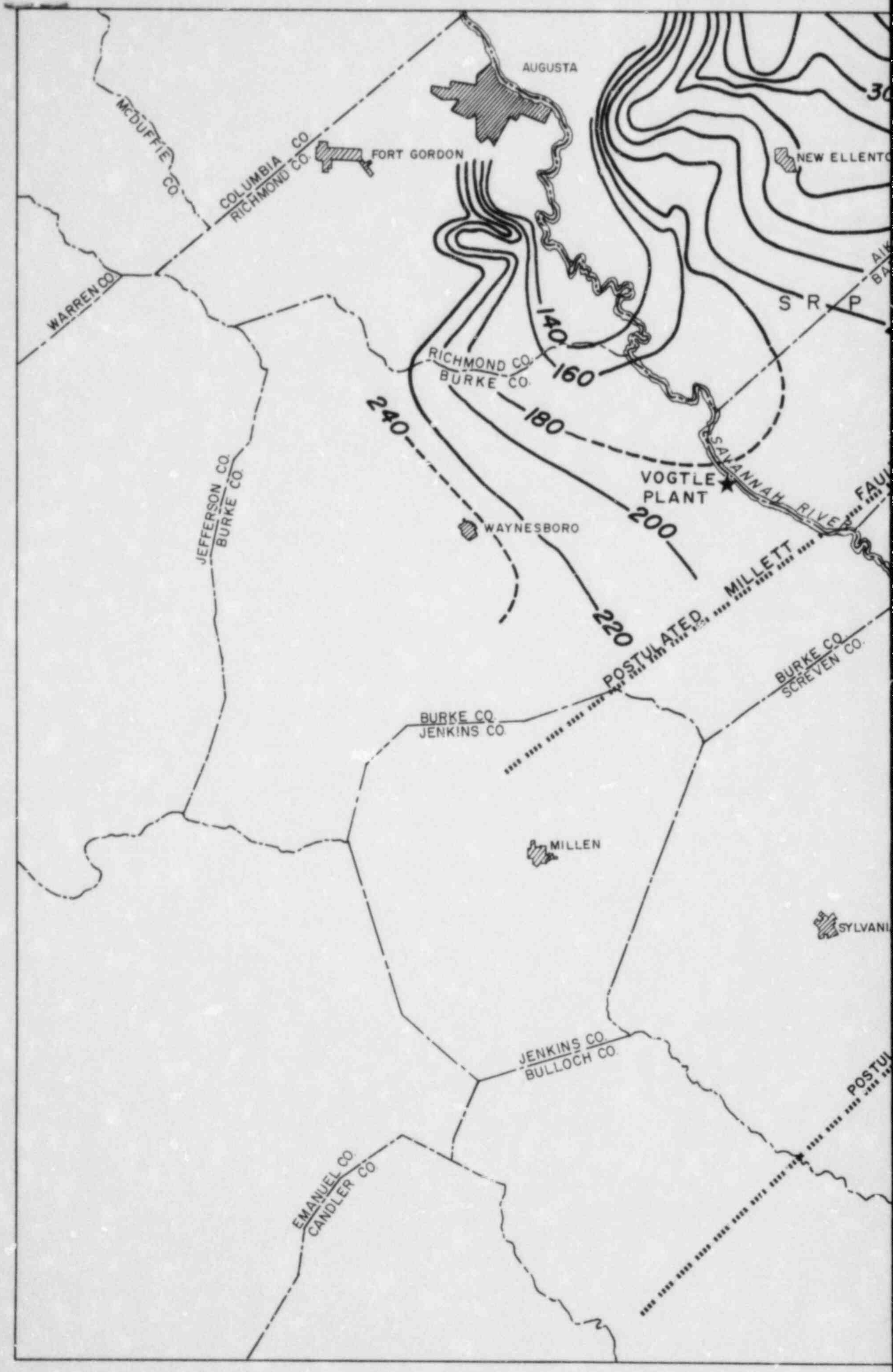
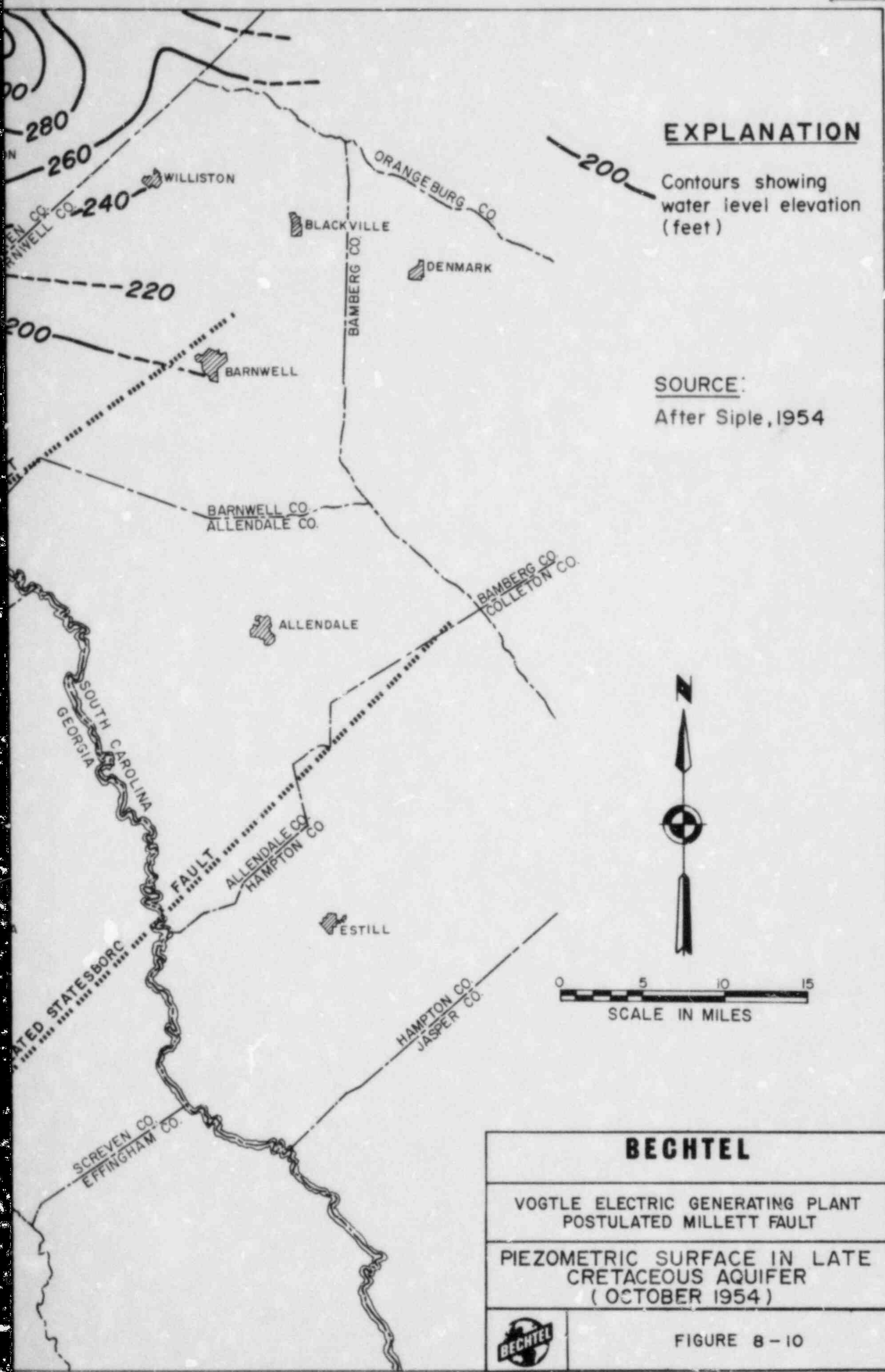
VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

RIVER REFLECTION PROFILE
LINE 4

FIGURE 8-9


AUGUSTA
FORT GORDON
NEW ELLENTO
McDUFFIE CO.
COLUMBIA CO.
RICHMOND CO.
WARREN CO.
S R P
140
160
180
200
220
240
RICHMOND CO.
BURKE CO.
SAVANNAH RIVER
VOGTLE PLANT
WAYNESBORO
JEFFERSON CO.
BURKE CO.
POSTULATED MILLETT FAUL
BURKE CO.
SCREVEN CO.
BURKE CO.
JENKINS CO.
MILLEN
SYLVANI
JENKINS CO.
BULLOCH CO.
EMANUEL CO.
CANDLER CO.



BECHTEL

VOGTLE ELECTRIC GENERATING PLANT
POSTULATED MILLETT FAULT

PIEZOMETRIC SURFACE IN LATE CRETACEOUS AQUIFER (OCTOBER 1954)

FIGURE 8-10

REFERENCES CITED

Applin, P.L., 1951, Preliminary report on buried pre-Mesozoic rocks in Florida and adjacent states: U.S. Geological Survey Circular 91, 28 p.

Bechtel Corporation, 1973, Preliminary Safety Analysis Report, volumes II and III - Alvin W. Vogtle Nuclear Plant: Unpublished report for Georgia Power Company, Atlanta, Georgia: Report on file at U.S. Geological Survey, Doraville, Georgia 30360.

Bechtel Corporation, 1978, Gulf Trough structure study: Unpublished report, 8 p.

Behrendt, J.C., Hamilton, R.M., Ackermann, H.D., and Henry, V.J., 1981, Cenozoic faulting in the vicinity of the Charleston, South Carolina, 1886 earthquake: Geology, v. 9, no. 3, p. 117-122.

Birdwell Division, Seismograph Service Corporation, 1972, Gravity - magnetic survey Savannah River Plant, South Carolina, 34 p.

Bollinger, G.A., and Murphy, C.A., 1978, Seismicity of the southeastern United States: Southeastern U.S. Seismic Network Bulletin No. 1.

Bollinger, G.A., and Mathena, E., 1978-1982, Seismicity of the southeastern United States: Southeastern U.S. Seismic Network Bulletins No. 2-9.

Bott, M.H., 1978, Subsidence mechanisms at passive continental margins: American Association of Petroleum Geologists Memoir 29, p. 3-9.

Buie, B.F., 1978, The Huber Formation of eastern central Georgia: Georgia Geologic Survey Bulletin 93, p. 1-7.

Buie, B.F., 1980, Kaolin deposits and the Cretaceous-Tertiary boundary in east-central Georgia: Geological Society of America, Field Trip No. 15, p. 311-322.

Callahan, J.T., 1964, The yield of sedimentary aquifers of the Coastal Plain southeast river basins: U.S. Geological Survey Water-Supply Paper 1669-W, 56 p.

Christopher, R.A., 1982, Palynostratigraphy of the basal Cretaceous units of the eastern Gulf and southern Atlantic Coastal Plain: in Arden, D.D., Beck, B.F., and Morrow E., ed., Second Symposium on the Geology of the Southeastern Coastal Plain, p. 10-23.

Cook, F.A., and Oliver, J.E., 1981, The late Precambrian-early Paleozoic continental edge in the Appalachian orogen: American Journal of Science, v. 281, no. 8, p. 993-1008.

Cook, F.A., Brown, L.D., and Oliver, J.E., 1980, The southern Appalachians and the growth of continents: Scientific American, v. 243, no. 4, p. 156-168.

Cook, F.A., Brown, L.D., Kaufman, S., Oliver, J.E., and Petersen, T.A., 1981, COCORP seismic profiling of the Appalachian orogen beneath the Coastal Plain of Georgia: Geological Society of America Bulletin, part I, v. 92, no. 10, p. 738-748.

Cornet, B., Traverse, A., and McDonald, N.G., 1973, Fossil spores, pollen and fishes from Connecticut indicate Early Jurassic age for part of the Newark Group: Science, v. 182, no. 4118, p. 1243-1247.

Cramer, H.R., 1969, Structural features of the Coastal Plain of Georgia: Southeastern Geology, v. 10, no. 2, p. 111-123.

Cramer, H.R., and Arden, D.D., 1980, Subsurface Cretaceous and Paleogene geology of the Coastal Plain of Georgia: Georgia Geologic Survey Open-File Report 80-8, 184 p.

Dames and Moore, Inc., 1980, Review of potential host rocks for radioactive waste disposal in the southeast United States-Triassic basin subregion: E.I. du Pont de Nemours and Company, Savannah River Laboratory, DP-1569.

Faye, R.E. and Prowell, D.C., 1982, Effects of Late Cretaceous and Cenozoic faulting on the geology and hydrology of the Coastal Plain near the Savannah River, Georgia and South Carolina: U.S. Geological Survey Open-File Report 82-156, 73 p.

Gelbaum, C., and Howell, J., 1982, The geohydrology of the Gulf Trough: in Arden, D.D., Beck, B.F., and Morrow, E., 1982, Second Symposium on the Geology of the Southeastern Coastal Plain, p. 140-153.

Geodata International, Inc., 1975a, Aerial radiometric and magnetic survey, Augusta National Topographic Map, Georgia and South Carolina areas, volumes 1 and 2: U.S. Energy and Development Administration, GJO-1663-1, 55 p.

Geodata International, Inc., 1975b, Aerial radiometric and magnetic survey, Savannah National Topographic Map, Georgia and South Carolina areas, volumes 1 and 2: U.S. Energy Research and Development Administration, GJO-1663-1, 50 p.

Gohn, G.S., Houser, B.B., and Schnider, R.R., 1982a, Geology of the lower Mesozoic(?) sedimentary rocks in Clubhouse Crossroads test hole #3 near Charleston, South Carolina: in Gohn, G.S., ed., Studies related to the Charleston, South Carolina, earthquake of 1886--tectonics and seismicity (collected abstracts): U.S. Geological Survey Open-File Report 82-134, p. 7-8.

Gohn, G.S., Gottfried, D., Lanphere, M.A., and Higgins, B.B., 1978c, Regional implications of Triassic or Jurassic age for basalt and sedimentary red beds in the South Carolina Coastal Plain: Science, v. 202, no. 4370, p. 887-890.

Guinn, S.A., 1980, Earthquake focal mechanisms in the southeastern United States: U.S. Nuclear Regulatory Commission, NUREG/CR-1503, 150 p.

Hatcher, R.D., Jr., 1972, Development model for the southern Appalachians: Geological Society of America Bulletin v. 83, no. 9, p. 2735-2760.

Hatcher, R.D., Jr., 1978, Tectonics of the western Piedmont and Blue Ridge, southern Appalachians: Review and speculation: American Journal of Science, v. 278, no. 3, p. 276-304.

Hatcher, R.D., Jr., and Odom, A.L., 1980, Timing of thrusting in the southern Appalachians, U.S.A.: Model for orogeny: Journal of Geological Society of London, v. 137, part 3, 321-327.

Hazel, J.E., Bybell, L.M., Christopher, R.A., Fredricksen, N.O., May, F.E., McLean, D.M., Poore, R.Z., Smith, C.C., Sohl, N.F., Valentine, P.C., and Witmer, R.J., 1977, Biostratigraphy of the deep corehole (Clubhouse Crossroads corehole 1) near Charleston, South Carolina, in Rankin, D. W., ed., Studies related to the Charleston, South Carolina, earthquake of 1886 - A preliminary report: U.S. Geological Survey Professional Paper 1028, p. 71-89.

Herrick, S.M., 1961, Well logs of the Coastal Plain of Georgia: Georgia Geologic Survey Bulletin 70, 462 p.

Herrick, S.M., and Vorhis, R.C., 1963, Subsurface geology of the Georgia Coastal Plain: Georgia Geologic Survey Information Circular 25, 80 p.

Huddlestun, P.F., 1981, Correlation chart, Georgia Coastal Plain: Georgia Geologic Survey Open-File Report 82-1.

Huddlestun, P.F., and Hetrick, J.H., 1978, Stratigraphy of the Tobacco Road Sand - A new formation: Georgia Geologic Survey Bulletin 93, p. 56-77.

Huddlestun, P.F., and Hetrick, J.H., 1979, The stratigraphy of the Barnwell Group of Georgia: Georgia Geologic Survey Open-File Report 80-1, 89 p.

Humphreys, B., and Hughes, D.J., 1974, Development of alluvial stream channels: A five-stage model: Discussion: Geological Society of America Bulletin, v. 85, no. 1, p. 149.

Kean, A.E., and Long, L.T., 1980, A seismic refraction line along the axis of the southern Piedmont and crustal thicknesses in the southeastern United States: Earthquake Notes, v. 51, no. 4, p. 3-13.

Keller, E.A., 1972, Development of alluvial stream channels: A five-stage model: Geological Society of American Bulletin, v. 83, no. 5, p. 1531-1536.

Krapp, C.W., and Stephenson, D.E., 1978, SRP seismograph network operations August 6, 1976 to August 31, 1977: in Crawford, T.V., ed., Savannah River Laboratory Environmental Transport and Effects Research Annual Report-1977, U.S. Energy Resources Development Agency, DE-1489, p. 73-79.

Krause, R.E., and Hayes, L.R., 1981, Potentiometric surface of the principal artesian aquifer in Georgia, May 1980: Georgia Geologic Survey Hydrologic Atlas 6.

LeGrand, H.E., 1961, Summary of geology of Atlantic Coastal Plain: Bulletin of the American Association of Petroleum Geologists, v. 45, No. 9, p. 1557-1571.

LeGrand, H.E., and Pettyjohn, W.A., 1981, Regional hydrogeological concepts of homoclinal flanks: Groundwater, v. 19, no. 3, p. 303-310.

Leopold, L.B., and Langbein, W.B., 1966, River meanders: Scientific American, v. 214, no. 6, p. 60-70.

Leopold, L.B., Wolman, M.G., and Miller, J.P., 1964, Fluvial Processes in Geomorphology: San Francisco, W.H. Freeman and Company, 522 p.

Long, L., 1981, Microearthquake instrumentation and analysis between Hartwell and Clark Hill Reservoir areas, Annual Report No. 1: Project No. G-35-661, School of Geophysical Sciences, Georgia Institute of Technology.

Long, L.T., and Champion, J.W., 1977, Bouguer gravity map of the Summerville-Charleston, South Carolina, epicentral zone and tectonic implications: in Rankin, D.W., ed., Studies related to the Charleston, South Carolina earthquake of 1886 - A preliminary report: U.S. Geological Survey Professional Paper 1028, p. 151-166.

Madeley, H.M., 1972, Petrology of the Tuscaloosa Formation in west-central Georgia: Ohio State University, M.S. thesis, 93 p.

Manspeizer, W., Puffer, J.H., and Cousminer, H.L., 1978, Separation of Morocco and eastern North American: A Triassic-Liassic stratigraphic record: Geological Society of America Bulletin, v. 89, no. 6, p. 901-920.

Marine, I.W., 1976a, Structural model of the buried Dunbarton Triassic Basin in South Carolina and Georgia, Geological Society of America, (abs.), v. 8, no. 2, p. 225.

Marine, I.W., 1976b, Structural and sedimentational model of the buried Dunbarton Basin, South Carolina and Georgia: Presented at the Annual Meeting of the Geological Society of America Southeastern Section, Arlington, VA, 1976.

Marine, I.W., 1979a, Hydrology of buried crystalline rocks at the Savannah River Plant near Aiken, South Carolina: U.S. Department of Energy, DOE/SR-SM 79-2, 220 p.

Marine, I.W., and Siple, G.E., 1974, Buried Triassic basin in the central Savannah River area, South Carolina and Georgia: Geological Society of America Bulletin, v. 85, no. 2, p. 311-320.

Mixon, R.B., and Newell, W.L., 1977, Stafford fault system: Structures documenting Cretaceous and Tertiary deformation along the Fall Line in northeastern Virginia: Geology, v. 5, no. 7, p. 437-440.

Murray, G.E., 1961, Geology of the Atlantic and Gulf Coastal Provinces of North America: Harper and Brothers, New York, 692 p.

Narasimhan, T.N., Neuman, S.P., and Witherspoon, P.A., 1978, Finite element method for subsurface hydrology using a mixed explicit-implicit scheme: Water Resources Research, v. 14, no. 5, p. 863-877.

O'Connor, B.J., and Prowell, D.C., 1976b, The geology of the Belair fault zone and basement rocks of the Augusta, Georgia area: Georgia Geologic Society Guidebook 16, p. 21-32.

Olsen, P.E., and Galton, P.M., 1977, Triassic-Jurassic tetrapod extinctions: Are they real?: Science, v. 197, no. 4307, p. 983-986.

Patterson, S.H., and Herrick, S.M., 1971, Chattahoochee Anticline, Appalachicola Embayment, Gulf Trough and related structural features, southwestern Georgia, fact or fiction: Geological Survey of Georgia, Department of Mines, Mining and Geology, Information Circular 41, 16 p.

Petty, A.J., Petrafeso, F.A., and Moore, F.C., Jr., 1965, Aeromagnetic map of the Savannah River Plant area. South Carolina and Georgia: U.S. Geological Survey Geophysical Investigations Map GP-489. 1 sheet, scale: 1:250,000.

Popenoe, P., and Zietz, I., 1977, The nature of the geophysical basement beneath the Coastal Plain of South Carolina and northeastern Georgia, in Rankin, D.W., ed., Studies related to the Charleston, South Carolina, earthquake of 1886 - A preliminary report: U.S. Geological Survey Professional Paper 1028, p. 119-137.

Poppe, B., 1979, Historical survey of U.S. seismograph stations: U.S. Geological Survey Professional Paper 1096, 389 p.

Pressler, E.D., 1947, Geology and occurrence of oil in Florida: Bulletin of the American Association of Petroleum Geologists, v. 31, no. 10, p. 1851-1862.

Prowell, D.C. and O'Connor, B.J., 1978, Belair fault zones: Evidence of Tertiary fault displacement in eastern Georgia. Geology, v. 6, no. 11, p. 681-684.

Prowell, D.C., O'Connor, B.J., and Rubin, M., 1975, Preliminary evidence for Holocene movement along the Belair fault zone near Augusta, Georgia: U.S. Geological Survey Open-File Report 75-680, 8 p.

Rainwater, E.H., 1964, Transgressions and regressions in the Gulf Coast Tertiary: Transactions of the Gulf Coast Association and Geologic Society, v. 14, p. 217-230.

Rankin, D.W., 1975, The continental margin of eastern North American in the southern Appalachians: The opening and closing of the proto-Atlantic Ocean: American Journal of Science, v. 275-A, no. 3, p. 298-336.

Rankin, D.W., 1976, Appalachian salients and recesses: Late Precambrian continental breakup and the opening of the Iapetus Ocean: Journal of Geophysical Research, v. 81, no. 2, p. 5605-5619.

Rankin, D.F., ed., 1977, Studies related to the Charleston, South Carolina Earthquake of 1886 - A preliminary report: U.S. Geological Survey Professional Paper 1028, 204 p.

Reagor, B.G., Stover, C.W., and Algermissen, S.T., 1980, Seismicity map of the State of South Carolina: U.S. Geological Survey Miscellaneous Investigations Map MF-1225, 1 sheet, scale 1:1,000,000.

Rhea, S., 1981, South Carolina seismic program, seismological data report: U.S. Geological Survey Open-File Report 81-362, 79 p.

Ritter, D.F., 1979, Process Geomorphology: Dubuque, Wm. C. Brown Company Publishers, 603 p.

Schumm, S.A. and Khan, H.R., 1972, Experimental study of channel patterns: Geological Society of America Bulletin, v. 83, no. 6, p. 1755-1770.

Sever, C.W., 1965, Ground water resources and geology of Seminole, Decatur, and Grady Counties, Georgia: U.S. Geological Survey Water-Supply Paper 1809-Q, 30 p.

Sever, C.W., 1966, Miocene structural movement in Thomas County, Georgia: U.S. Geological Survey Professional Paper 550-C, p. C12-C16.

Siple, G.E., 1960, Piezometric levels in the Cretaceous sand aquifer of the Savannah River basin: Georgia Mineral Newsletter, v. 13, no. 4, p. 163-166.

Siple, G.E., 1967, Geology and ground water of the Savannah River Plant and vicinity, South Carolina: U.S. Geological Survey Water-Supply Paper 1841, 113 p.

Snoke, A.W., Kish, S.A., and Secor, D.T., Jr., 1980, Deformed Hercynian granitic rocks from the Piedmont of South Carolina: American Journal of Science, v. 280, no. 10, p. 1018-1034.

Stover, C.W., Reagor, B.G., Algermissen, S.T., and Long, L.T., 1979, Seismicity map of the State of Georgia: U.S. Geological Survey Miscellaneous Field Studies Map MF-1060. 1 sheet, scale 1:1,000,000.

Tarr, A., 1982, Detection and location capability of the southeastern United States seismic network: Southeastern U.S. Seismic Network Bulletin No. 9, p. 36-42.

Tarr, A., Talwani, P., Rhea, S., Carver, D., and Amick, D., 1981, Results of recent South Carolina seismological studies: Bulletin of the Seismological Society of America, v. 71, p. 1883-1902.

Toulmin, L.D., 1955, Cenozoic geology of southeastern Alabama, Florida, and Georgia: Bulletin of the American Association of Petroleum Geologists, v. 39, no. 2, p. 207-235.

U.S. Army Corps of Engineers, Savannah District, 1980, Navigation charts, Savannah River, Georgia and South Carolina, Savannah to Augusta: Corps of engineers, U.S. Army, Savannah, Georgia, 57 p.

U.S. Nuclear Regulatory Commission, 1973, Seismic and geologic siting criteria for nuclear power plants, Appendix A to 10 CFR 100: Federal Registar, 28 FR 31279.

Vail, P.R., and Mitchum, R.M. Jr., 1978, Global cycles of relative changes of sea level from seismic stratigraphy: American Association of Petroleum Geologists Memoir 29, p. 469-472.

Van Houten, F.B., 1977, Triassic-Liassic deposits of Morocco and eastern North America: Comparison: Bulletin of the American Association of Petroleum Geologists, v. 61, no. 1, p. 79-99.

Wentworth, C.M., and Mergner-Keefer, M., 1981, Reverse faulting along the eastern seaboard and the potential for large earthquakes: in Beavers, J.E., ed., Earthquakes and Earthquake-Engineering, Eastern U.S., v. 1, p. 109-128.

Wentworth, C.M., and Mergner-Keefer, M., 1982a Regenerate faults of small Cenozoic offset - probable earthquake sources in the southeastern United States: in Gohn, G.S., ed., Studies related to the Charleston, South Carolina, earthquake of 1886 - tectonics and seismicity (collected abstracts): U.S. Geological Survey Open-File Report 82-134, p. 34-35.

Wentworth, C.M., and Mergner-Keefer, M., 1982b Regenerate faults of small Cenozoic offset as probable earthquake sources in the southeastern United States: U.S. Geological Survey professional Paper 1313, in press.

Winker, C.D., and Howard, J.D., 1977, Correlation of tectonically deformed shorelines on the southern Atlantic Coastal Plain: Geology, v. 5, no. 2, p. 123-127.

York, J.E., and Oliver, J.E., 1976, Cretaceous and Cenozoic faulting in eastern North America: Geological Society of America Bulletin, v. 87, no. 8, p. 1105-1114.

Zietz, I., and Gilbert, F.P., 1980, Aeromagnetic map of part of the southeastern United States: In color: U.S. Geological Survey Geophysical Investigations Map GP-936, 1 sheet, scale 1:2,000,000.

VOGTLE ELECTRIC
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STUDIES OF POSTULATED MILLETT FAULT

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APPENDIX A

ANNOTATED BIBLIOGRAPHY

APPENDIX A

Appendix A presents an annotated bibliography of references which were either cited in the report or used to provide background information. This appendix summarizes 1) journal articles, 2) theses, 3) State and Federal reports, maps and atlases, and 4) unpublished reports. The summaries in this appendix focus on the geology, ground water, seismology and geophysics of the southeastern Atlantic Coastal Plain. Each citation discusses the major points presented in its respective publication.

Ackermann, H.D., 1982, Seismic-refraction study in the area of the Charleston, South Carolina, 1886 earthquake: in Gohn, G.S., ed., Studies Related to the Charleston, South Carolina, earthquake of 1886-tectonics and seismicity (collected abstracts): U.S. Geological Survey Open-File Report 82-134, p. 11-12.

Seismic refraction spreads in the area near Summerville, South Carolina, show that the surface of the pre-Mesozoic crystalline basement complex consists of a northeast-trending ridge-like feature. The ridge is bounded on the northwest by an abrupt 3,000 foot drop in altitude of the basement surface, inferred to represent a Triassic border fault. Fault-plane determinations indicate high-angle faults both parallel and perpendicular to the ridge-boundary fault.

Ackermann, H.D., Bain, G.L., and Zohdy, A.A.R., 1976, Deep exploration of an east-coast Triassic basin using electrical resistivity: Geology, v. 4, no. 3, p. 137-140.

Thirty-two Schlumberger soundings were made in the Durham-Wadesboro Triassic Basin of North Carolina. The sounding measurements indicate a large resistivity contrast between the Triassic and the surrounding Piedmont rocks. Depth interpretations indicate that the thickness of the Triassic sedimentary rocks is as much as 7,500 feet, while further interpretations show to shape of the basin to be consistent with the known geology.

Advisory Committee on Reactor Safeguards, Subcommittee on Extreme External Phenomena, 1982, Nuclear Regulatory Commission, 704 p.

Transcript of the January 28 and 29, 1982 meeting of the Subcommittee on Extreme External Phenomena. Included are references to the 1886 Charleston, South Carolina earthquake and the Grand Gulf Nuclear Generating Station.

Allied-General Nuclear Services, 1980, Geological investigation at the Chem-Nuclear Waste Storage Site - Barnwell, South Carolina, 17 p.

This report represents a chronological journal of recent studies related to reported faults in the burial trenches at the Chem-Nuclear storage site which is adjacent to the eastern site boundary of Allied-General Nuclear Services' Barnwell Nuclear Fuel Plant (BNFP).

The observations made during this study do not conclusively indicate the origin of the faults and clastic dikes. They could be related to regional tectonic deformations or to local movements caused by solution, subsidence, and weathering. The fact that the orientations of clastic dikes reported here are

different from the orientations reported by others suggests the control of local factors. In any event, the geologic work indicates that the processes responsible for the faults and clastic dikes in this area have not been active during the considerable period of time required for the development of the present soil profile.

Allison, J.D., 1980, Seismicity of the Central Georgia Seismic Zone: Georgia Institute of Technology, M.S. thesis, 204 p.

The Central Georgia Seismic Zone is an area of east-central Georgia where thirteen historical earthquakes have occurred. Roughly defined as the area within a 47 mile radius of Milledgeville, Georgia, the Central Georgia Seismic Zone includes the Lake Sinclair and Lake Oconee areas where almost two hundred microearthquakes have been recorded from 1977 through June 1980.

Documentation of the historical events has resulted in a re-assignment of intensity based on the effects mentioned in the original newspaper accounts. The largest historical earthquake occurred on March 5, 1914 and had a maximum intensity of VII. An isoseismal map constructed from newspaper intensity data gives a magnitude (MbLg) of 4.9 $\pm$ 0.1 based on the area of the intensity IV isoseism.

Antoine, J.W., and Henry, V.J., Jr., 1965, Seismic refraction study of shallow part of continental shelf off Georgia: Bulletin of the American Association of Petroleum Geologists, v. 49, no. 5, p. 601-609.

Seismic refraction profiles over the shallow part of the continental shelf off the Georgia coast showed: 1) a layer a few feet beneath the sea bottom, probably Miocene in age; 2) the Oligocene; 3) the Early Eocene; and 4) the pre-Cretaceous basement surface. Structural contours on the Oligocene and Eocene refractors indicate the eastern boundary of the Atlantic Embayment of Georgia.

Applin, P.L., 1951, Preliminary report on buried pre-Mesozoic rocks in Florida and adjacent states: U.S. Geological Survey Circular 91, 28 p.

The report proposes a threefold classification for the buried pre-Mesozoic rocks in Florida, the Coastal Plain of Georgia, and southeastern Alabama. These rocks are classified as: dominantly marine sedimentary Paleozoic rocks, which on the basis of faunal evidence, range in age from Late Cambrian or Early Ordovician to Silurian; rhyolitic lavas and pyroclastic rocks that are tentatively classified as early Paleozoic or

Precambrian; and granite, diorite, and metamorphic rocks, which are probably in part Precambrian and in part of Paleozoic age. Penetration has not been sufficient to show definitely the vertical sequence of the different rock types that are encountered in different wells. The report discusses tentative conclusions on the sequence of the types of rocks in the foregoing classification.

Applin, E.R., and Applin, P.L., 1964, Logs of selected wells in the Coastal Plain of Georgia: Georgia Geologic Survey Bulletin 74, 229 p.

This report contains lithologic and paleontologic descriptions of cuttings and cores from 31 selected wells in the Coastal Plain of Georgia. These descriptive logs are based on microscopic studies made periodically from 1937 to 1962.

Bartholomew, M.J., Gathright, T.M. II, and Henica, W.S., 1981, A tectonic model for the Blue Ridge in central Virginia: American Journal of Science, v. 281, no. 9, p. 1164-1183.

The two principal goals of this paper are to: 1) define and describe the major tectonic features formed in Paleozoic time in the central Blue Ridge and 2) provide a preliminary tectonic model for evolution of crystalline rocks of this region from middle Precambrian (Grenville-age) to middle Paleozoic time.

Baum, G.R., Collins, J.S., Jones, R.M., Madlinger, B.A. and Powell, R.J., 1980, Correlation of the Eocene strata of the Carolinas: South Carolina Geology, v. 24, no. 1, p. 19-27.

The Santee Limestone is divided into two faunal zones. The Cross Member of the Santee Limestone is raised to the Cross Formation and is equivalent to the New Bern Formation in North Carolina.

Bechtel Corporation, 1969, Preliminary Safety Analysis Report, Appendix C - Barnwell Nuclear Fuel Plant: Unpublished report.

General discussion of the geology and ground water of the Barnwell Nuclear Fuel Plant and Savannah River Plant.

Bechtel Corporation, 1970, Safety Analysis Report, volume I, Barnwell Nuclear Fuel Plant: Unpublished report.

The soils under the site area are capable of supporting the plant and related facilities without undue settlement under the conditions of static load, dynamic load and seismic load postulated in this report. A zone of silty and clayey sand

(Barnwell Formation) about 40 to 70 feet below the ground surface was investigated for susceptibility to liquefaction under Design Base Earthquake conditions. To provide and adequate safety factor against soils liquefaction, a 15-foot berm of earth will be placed around the perimeter of the main process building. No other potential geologic problems are know to exist. A conservative value of 0.12g should be adequate for the Operating Basis Earthquake and 0.20g surface acceleration is recommended for the Design Basis Earthquake, based of historical seismic activity.

Bechtel Corporation, 1972, Applicants Environmental Report, volumes I and II - Alvin W. Vogtle Nuclear Plant: Unpublished report for Georgia Power Company, Atlanta, Georgia: Report on file at U.S. Geological Survey, Doraville, Georgia 30360.

Brief sections on the geology, seismology, and geohydrology of the Vogtle Plant site. Drilling at the site and across the river on the Atomic Energy Commission's Savannah River Project property established correlation of the Georgia-South Carolina geologic formations. The correlation was established by means of Oligocene, Eocene, and Cretaceous formations with excellent agreement found in several lithologic units. This interstate correlation of formations refutes the possibility of a post-Cretaceous "Savannah River" fault. The site area has not been subject to high seismic activity since deposition of Upper Cretaceous sediments. Shocks may be felt at the site from distance sources, but the intensity is expected to be no more that VI (MM).

Bechtel Corporation, 1973, Preliminary Safety Analysis Report, volumes II and III - Alvin W. Vogtle Nuclear Plant: Unpublished report for Georgia Power Company, Atlanta, Georgia: Report on file at U.S. Geological Survey, Doraville, Georgia 30360.

Includes discussions of regional and site geology. The results are based both on a literature search and field exploration program. The stratigraphy presented in this report is in the process of being updated.

Bechtel Corporation, 1978, Gulf Trough structure study: Unpublished report, 8 p.

Evaluation of the Gulf Trough in Georgia as a possible graben structure using data furnished by Southern Company Services, Inc. An appendix by George O. Gates is included. Based on subsurface information, remote sensing analysis, and field studies the report concludes that the "horst and graben" faulting theory attached to the Gulf Trough continues to be only hypothetical. The evidence suggests that other geologic phenomena, such as erosion, regional tilt, local subsidence or warping are the likely causes of the geologic feature.

Mr. Gates concludes that the origin of the Gulf Trough is not clear. Data from well logs do not support any of the proposed origins and are compatible with all three.

Behrendt, J.C., Hamilton, R.M., Ackermann, H.D., and Henry, V.J., 1981, Cenozoic faulting in the vicinity of the Charleston, South Carolina, 1886 earthquake: Geology, v. 9, no. 3, p. 117-122.

It is likely that the ancient thrust faults that exist in the Charleston area and the current stress field are oriented in about the same direction as when the faults developed. Movement on these thrust faults is the primary cause of modern seismicity. Zones of Mesozoic rifting would now be experiencing reverse fault movement on faults such as the Cooke and Helena Banks. Association of Charleston seismicity with Triassic structures raises the possibility that a Charleston-type earthquake may not be limited to that immediate region.

Behrendt, J.C., Hamilton, R.M., Ackermann, H.D., Henry, V.J., and Bayer, K.C., 1982, Marine multichannel seismic reflection evidence for Cenozoic faulting and deep crustal structure near Charleston, South Carolina: in Gohn, G.S., ed., Studies related to the Charleston, South Carolina, earthquake of 1886-tectonics and seismicity (collected abstracts): U.S. Geological Survey Open-File Report 82-134, p. 19-20.

Suggests that the seismicity in the Charleston area is caused primarily by movement along the Appalachian decollement and that movement on the high-angle reverse faults in the area, although it is a second-order effect, also may cause earthquakes.

Benson, P.H., 1969, Evidence against a large scale disconformity between the Upper Cretaceous Black Creek and Peedee Formations in South Carolina: South Carolina Geologic Notes, v. 13, no. 2, p. 47-50.

The stratigraphic and paleontologic evidence indicates an interfingering contact between Peedee and Black Creek lithologies. The presence of a large unconformity between the two formations in South Carolina is doubtful.

Birdwell Division, Seismograph Service Corporation, 1972, Gravity-magnetic survey Savannah River Plant, South Carolina, 34 p.

A combined gravity-magnetic survey was run on the Savannah River Plant. Six models were developed in an attempt to define the configuration of the basement rocks surrounding the Dunbarton Triassic Basin, underlying the Savannah River

Plant. The density contrasts used in the development of the models were based primarily upon information obtained from DRB 9 and theoretical conditions which could satisfy the observed gravity profiles. The results are such that several conclusions may be drawn.

Black, W.W., 1979, Chemical characteristics of metavolcanics in the Carolina slate belt: in Wones, D.R. ed., Proceedings on "the Caledonides in the USA" (I.G.C.P. project 27: Caledonide orogen): Virginia Polytechnic Institute and State University, Department of Geological Sciences, Memoir no. 2., Blacksburg, Virginia, 24061, p. 271-278.

Rocks of the Carolina Slate Belt were formed in a volcanic arc (island arc) environment and have since been metamorphosed to the greenschist facies. The structure of the Carolina Slate Belt, on a gross scale, is a series of alternating anticlines and synclines. On a fine scale, it is sometimes "layer-cake" while in other places it is intensely deformed into tight folds which are nearly vertical. Seismic data in several places suggest that the slate belt extends to a depth of six to seven miles.

Bland, A.E., and Blackburn, W.H., 1979, Geochemical studies on the greenstones of the Atlantic Seaboard Volcanic Province, south-central Appalachians: in Wones, D.R. ed., Proceedings on the "Caledonides in the USA" (I.G.C.P. project 27: Caledonide orogen): Virginia Polytechnic Institute and State University, Department of Geological Sciences Memoir no. 2, Blacksburg, Virginia, 24061, p. 263-270.

The trace element data and its tectonic implications have placed constraints on the interpretation of the tectonic evolution of the south-central Appalachians. The chemical data has defined the majority of the Atlantic Seaboard Volcanic Province as related to island arc development.

Bollinger, G.A., 1972, Historical and recent seismic activity in South Carolina: Bulletin of the Seismological Society of America, v. 62, no. 3, p. 851-864.

The great Charleston earthquake of August 31, 1886 dominates the seismic history of South Carolina and is often cited as an example that no region is completely safe from earthquake hazard. This paper presents a review and summary of what has been published on the 1886 shock and the subsequent seismic activity in South Carolina; a report on a three-month microearthquake recording program conducted during the summer of 1971 in the Charleston area; and the results of seismic studies of the four earthquakes that occurred in the state during 1971.

Bollinger, G.A., and Murphy, C.A., 1978, Seismicity of the southeastern United States: Southeastern U.S. Seismic Network Bulletin No. 1.

A compilation of seismic events recorded in the southeastern United States. This report also contains information on seismic stations in operation in the area under study.

Bollinger, G.A., and Mathena, E., 1978-1982, Seismicity of the southeastern United States: Southeastern U.S. Seismic Network Bulletins No. 2-9.

A compilation of seismic events recorded in the southeastern United States.

Bonini, W.E., and Woollard, G.P., 1960, Subsurface geology of North Carolina - South Carolina Coastal Plain from seismic data: Bulletin of the American Association of Petroleum Geologists, v. 44, no. 3, p. 298-315.

This article provides an analysis of 60 seismic-refraction measurements on the Coastal Plain of North Carolina and South Carolina and 39 measurements in the Piedmont Province. The following conclusions were made: 1) the Piedmont complex extends under the Coastal Plain sediments as far east as the present coast, 2) the Carolina Slate Belt extends under the Coastal Plain, and reaches a maximum of 80 miles in North Carolina, 3) the buried Florence Triassic Basin is 40 by 13 miles and strikes east-northeast, 4) the Cape Fear Arch has moved twice since Cretaceous time, 5) the Pre-Cretaceous basement is an erosional surface with topographic relief on the order of 200 feet, 6) the break in basement slope in eastern North Carolina must be projected seaward of Cape Fear and the South Carolina coast, 7) there is the suggestion of an east-west syncline superimposed on the steeper basement slope in eastern North Carolina.

Bott, M.H., 1978, Subsidence mechanisms at passive continental margins: American Association of Petroleum Geologists Memoir 29, p. 3-9.

There are four main stages in the tectonic development of a rifted passive margin: 1) the rift valley stage involving early graben formation, 2) the youthful stage, lasting about 50 million years after the onset of spreading, 3) the mature stage during which more subdued regional subsidence may continue (present stage in the development of most of the Atlantic margins), and 4) the fracture, when subduction starts. This paper discusses recently proposed mechanisms for subsidence at passive margins: 1) gravity loading mechanisms based on local or flextural isostacy, 2) thermal hypotheses, 3) crustal creep hypotheses, and 4) necking of the crust at incipient margins (not favored); a mechanism for early graben formation prior to splitting provided by applying the Vening Meinesz wedge subsidence hypothesis to the upper brittle part of the crust.

Bramlett, K.W., Secor, D.T., and Prowell, D.C., 1980, Displacement on the Belair fault zone in South Carolina: Geological Society of America (abs.), v. 12, no. 4, p. 171-172.

This article discusses two important fault systems in the crystalline piedmont rocks along the Atlantic Coastal Plain in Georgia and South Carolina. The eastern Piedmont fault system of unknown displacement, trends N70°E along the Fall Line and is late Paleozoic and perhaps early Mesozoic in age. The Belair fault trends N25°E to N30°E and has undergone Tertiary displacement. Cretaceous displacement has been 98 feet vertical and 14 miles left-lateral strike-slip displacement.

Brooks, H.K., Gremillion, L.R., Olson, N.K., Puri, H.S., 1966, Geology of the Miocene and Pliocene series in the north Florida - south Georgia area: Atlantic Coastal Plain Geological Association and Southeastern Geological Society, 94 p.

The Miocene and Pliocene series of the extreme north Florida - South Georgia area have one overall characteristic in common. Terrestrial and near shore marine conditions prevailed throughout this sub-region as evidenced by land vertebrate and marine invertebrate fossils, character of sediments, composition of the clay minerals, and associated factors.

Brown, P.M., 1974, Subsurface correlation of Mesozoic rocks in Georgia, in Stafford, L.P., Symposium on the Petroleum Geology of the Georgia Coastal Plain: Georgia Geologic Survey Bulletin 87, p. 45-59.

Mesozoic rocks present in the Georgia Coastal Plain are considered to be Comanchean and Gulfian in age. Comanchean rocks attain a maximum thickness in excess of 2,500 feet in the extreme southwest part of Georgia, have a variable thickness of 100 to 300 feet in the tier of counties that border the Atlantic Ocean and are proportionately thinner or absent in most other segments of the state. Gulfian rocks are proportionately thickest in the central part of the state.

Brown, P.M., Brown, D.L., Reid, M.S., and Lloyd, O.B., Jr., 1979, Evaluation of the geologic and hydrologic factors related to the waste-storage potential of Mesozoic aquifers in the southern part of the Atlantic Coastal Plain, South Carolina and Georgia: U.S. Geological Survey Professional Paper 1088, 37 p.

This report describes the subsurface distribution of rocks of Cretaceous to Late Jurassic(?) age in the Atlantic Coastal Plain, South Carolina, and Georgia, and examines their potential for deep-well waste storage. Subsurface data,

derived from study of well cuttings, cores, and geophysical logs from about 400 wells, 88 of which make up a key-well network, were used to develop the concept and definition of a waste-storage "operational unit." This data was used to construct 32 regional maps and eight stratigraphic cross sections.

Buffler, R.T., Watkins, J.S. and Dillion, W.P., 1979, Geology of the offshore Southeast Georgia Embayment, United States. Atlantic continental margin based on multichannel seismic reflection profiles: American Association of Petroleum Geologists Memoir 29, p. 11-25.

Discusses a geologic interpretation of the offshore Southeast Georgia Embayment based on a 680 mile multichannel seismic reflection survey. The Southeast Georgia Embayment consists of a wedge of Cretaceous and Cenozoic sedimentary rocks that thins from three to five miles beneath the Blake Plateau to about 0.6 miles over the Cape Fear Arch. This sedimentary section is divided into three major seismic intervals.

Buie, B.F., 1978, The Huber Formation of eastern central Georgia: Georgia Geologic Survey Bulletin 93, p. 1-7.

The term "Huber Formation" is proposed for all of the post-Cretaceous pre-late Eocene strata in the kaolin mining districts of Georgia, northeast of the Ocmulgee River. The lithology of the Huber Formation as a whole is very diverse, ranging from beds of high-purity and sandy kaolin to thick, cross-bedded members of coarse, pebbly sand, and even conglomerate composed of boulders of pisolitic kaolin.

Buie, B.F., 1980, Kaolin deposits and the Cretaceous-Tertiary boundary in east-central Georgia: Geological Society of America, Field Trip No. 15, p. 311-322.

The Cretaceous-Tertiary boundary in east-central Georgia, formerly placed at the top of the highest kaolin bed in local stratigraphic sections, is now known to be lower; invertebrate fossils of Tertiary age demonstrably underlie some kaolins. The fossils and their stratigraphic relationships also help distinguish between Claibornian (middle Eocene) and Jacksonian (upper Eocene) strata, which are separated by an unconformity. These Coastal Plain deposits are characterized structurally by gentle dips and lack of significant folds or faults, although joints are common locally.

Butts, C., and Gildersleeve, B., 1948, Geology and mineral resources of the Paleozoic area in northwest Georgia: Georgia Geologic Survey Bulletin 54, p. 3-8.

The Paleozoic rocks of Georgia are in that part of the eastern United States known as the Appalachian valley. This area is

bounded on the east and south by the outcrop or trace of a great overthrust fault plane on which more ancient rocks are thrust over the Paleozoic rocks. The fault is located easily by the abrupt change from the stratified Paleozoic rocks to the flaky, greenish schist of the overthrust mass.

Callahan, J.T., 1964, The yield of sedimentary aquifers of the Coastal Plain southeast river basins: U.S. Geological Survey Water-Supply Paper 1669-W, 56 p.

The aquifer systems of the study area, from lowermost to uppermost, include: the sand aquifers of Cretaceous age; the limestone and sand aquifers of early Tertiary age; the principal artesian aquifer of Eocene, Oligocene, and Miocene age; the sand and gravel aquifers of Miocene and post-Miocene age of the southwestern area; and the sand aquifers of Miocene and Pliocene to Recent age of the Atlantic coast.

The safe yield of the aquifer systems was estimated from known geologic and hydrologic data and by making broad assumptions regarding the extent, thickness, and permeability of the aquifers and the continuity of physical conditions that control the occurrence and movement of ground water.

Carter, R.F., and Putnam, S.A., 1978, Low-flow frequency of Georgia streams: U.S. Geological Survey Water-Resources Investigations 77-127, 104 p.

This report contains analyses of low-flow data and tabulations of computed low-flow frequency for all stream sites in Georgia where suitable flow records have been collected. These include 134 continuous-record gaging stations and 102 partial-record gaging stations. Frequency records for gaging stations with short records have been adjusted where possible to more closely represent results that would have been obtained from longer records.

Carver, R.E., 1966, Stratigraphy of the Jackson Group (Eocene) in central Georgia: Southeastern Geology, v. 7, no. 2, p. 83-91.

In central Georgia two distinct facies of the Jackson Group are present. The dominantly calcareous Ocala facies lies to the south and southeast and the dominantly clastic Barnwell facies to the north and east. The Barnwell facies, composed of the Twiggs Clay, Irwinton Sand, and Upper Sand Members of the Barnwell Formation, is a regressive sequence entirely equivalent to the Ocala Limestone of the coastal area. The Ocala facies consists of the Ocala Limestone and Cooper Marl. The Cooper Marl is equivalent to upper parts of the Ocala Limestone.

Carver, R.E., 1972, Stratigraphy of the Jackson Group in eastern Georgia: Southeastern Geology, v. 14, no. 3, p. 153-181.

The Jackson Group in eastern Georgia is predominantly upper Eocene in age. It is a transgressive-regressive sequence with a thin, extensively developed transgressive sand and a much thicker, more complex fine- to coarse-clastic regressive phase. In downdip areas the group is represented by the Ocala Limestone; in updip areas, by fluviatile sediments indistinguishable from the Late Cretaceous to possibly middle Eocene Middendorf Formation. Between the downdip marine limestone facies and the updip fluviatile facies occurs a lithologically complex nearshore facies, the Barnwell Formation. While general patterns of lithologic distribution can be recognized and the formation roughly divided into members, individual lithologic units are lenticular or deeply channeled and can not be traced over distances of more than a very few miles.

Carver, R.E., and Scott, R.M., 1978, Stratigraphic significance of heavy minerals in Atlantic Coastal Plain sediments of Georgia: Georgia Geologic Survey Bulletin 93, p. 11-14.

Composition of the heavy mineral suite of Atlantic Coastal Plain sediments is largely determined by the degree of intrastratal solution of the unstable heavy mineral suite: hornblende, epidote, and garnet. Piedmont rivers carry sediment rich in hornblende and epidote to the coast, but hornblende and epidote in this sediment are diluted by mixing of river sediment with more mature coastal plain sediment, and in addition, are depleted by post-depositional intrastratal solution.

Cederstrom, D.J., Boswell, E.H., and Tarver, G.R., 1979, Summary appraisals of the nation's ground water resources, South Atlantic-Gulf region: U.S. Geological Survey Professional Paper 813-0, 35 p.

Enormous quantities of ground water are available in the South Atlantic-Gulf states in the extensive aquifers that underlie the Coastal Plain Province. The principal coastal plain aquifers consist largely of deltaic sand and gravel deposits of Cretaceous to Quaternary age; however, a notable exception is the highly permeable Tertiary limestone aquifer, which underlies parts of four states. Most of the major coastal plain aquifers are recharged where they are exposed and water moves downdip to the south. The general direction of ground water movement in the coastal plain aquifers is seaward. There is, however, movement of water vertically and laterally that affects pressure and quality in every aquifer.

Champion, J.W., Jr., 1975, A detailed gravity study of the Charleston, South Carolina, epicentral zone, Georgia Institute of Technology, M.S. thesis, 97 p.

Approximately 2,000 new gravity measurements were made near Charleston, South Carolina, in the suspected epicentral zone of the 1886 earthquake. These data were used to construct a simple Bouguer gravity map. In the central western quadrangle, a large positive anomaly exhibits a steep gravity gradient of two to three milligals per kilometer on both its northern and southern sides. This anomaly is considered to result from basic flows intermixed with coastal plain sediments. Surrounding this anomaly there are large negative anomalies which are interpreted to be representative of deep sedimentary basins.

Three-dimensional modeling of the simple Bouguer gravity data shows that the linear alignment of anomalies can be interpreted to result from basic flows which are down-faulted to the southeast. The throw on the interpreted fault would be on the order of one mile.

In general, it is not unreasonable to expect that such a fault exists under the Atlantic Coastal Plain because many such buried grabens have been found. If a graben is present, isostatic readjustments within such a down-faulted block may explain the earthquake activity in this area.

Cheetham, A., 1959, Late Eocene zoogeography of the eastern Gulf Coast region: Columbia University, Ph.D. disertation, 212 p.

Calcareous upper Eocene (Jacksonian) sediments in southeastern Alabama, southwestern Georgia, and Florida contrast markedly with stratigraphically equivalent terrigenous deposits from central Alabama westward. The enclosed fossils, chiefly marine invertebrates, permit subdivision of the Jacksonian Stage into stratigraphic (zones) and geographic (biofacies) units. This study is concerned primarily with the abundance and distribution of invertebrate fossils, particularly cheilostome bryozoans, in the four major biofacies of the eastern Gulf Coast Jacksonian.

Chowns, T.M., 1976, Paleogeology of the pre-Cretaceous surface beneath the Georgia Coastal Plain: A reassessment: Bulletin of the Georgia Academy of Science, v. 34, no. 2, p. 82.

Pre-Cretaceous rocks of the Georgia Coastal Plain include: 1) a medium-high grade metamorphic suite, restricted to an area 30-90 miles south of the fall line, 2) a Cambrian or Precambrian(?) volcanic terrane, 3) fossiliferous, marine and

nonmarine Paleozoic sandstones which extend into Florida; and 4) a continental red bed association, probably of Triassic age, frequently intruded by diabase, which forms a large graben in the south-central and southwestern part of the state. This graben forms the structural framework of the northern part of the Appalachicola Embayment.

Chowns, T.M., 1978, Pre-Cretaceous geology beneath Georgia Coastal Plain: Bulletin of the American Association of Petroleum Geologists, v. 62, no. 3, p. 504.

The pre-Cretaceous surface beneath the Georgia Coastal Plain is composed of four distinct terranes. These are 1) a medium- to high-grade metamorphic terrance continuous with the Piedmont, 2) a Cambrian(?) felsic volcanic terrane with associated granite plutons underlying the Southeast Georgia Embayment and Swannee Saddle, and 3) a sequence of fossiliferous marine Paleozoic sandstones and shales (Lower Ordovician-Middle Devonian), which subcrop in the extreme southeast and southwest of the state, and extend southward to form the nucleus of the Peninsular Arch in Florida, and 4) a continental red-bed association, probably of Triassic age, occupying a large graben which forms the structural framework for the Appalachicola Embayment.

Chowns, T.M., and Williams, C.T., 1982, Pre-Cretaceous rocks beneath the Georgia Coastal Plain--Regional implications: in Gohn, G.S., ed., Studies related to the Charleston, South Carolina, earthquake of 1886-tectonics and seismicity (collected abstracts): U.S. Geological Survey Open-File Report 82-134, p. 23-24.

Four major "basement" terrances are recognized in the southern Atlantic and Gulf Coastal Plains. The first consists of medium- to high-grade metamorphic rocks and granitic plutons immediately south of the Fall Line and represents the subsurface continuation of the Piedmont province. In south Georgia, the "basement" is quite different and comprises a terrane of mildly deformed Paleozoic sedimentary rocks underlain by a terrane of felsic volcanic rocks. These two anomalous terranes are separated from the buried Piedmont by a fourth terrane of lower Mesozoic continental red beds correlated with the Newark Group. The red beds are known to be at least 11,500 feet thick and occupy a complex graben, the South Georgia Basin. The red beds contain dikes and sills of tholeitic diabase belonging to the lower Mesozoic eastern North American suite.

Christl, R.J., 1964, Storage of radioactive wastes in basement rock beneath the Savannah River Plant: U.S. Atomic Energy Commission, DP-844, 105 p.

The ground beneath the Savannah River Plant was explored to determine the feasibility of storing radioactive wastes in the underlying crystalline basement rocks. The hydrology of the basement rock and overburden was reviewed.

Christopher R.A., 1982, Palynostratigraphy of the basal Cretaceous units of the eastern Gulf and southern Atlantic Coastal Plain: in Arden, D.D., Beck, B.F., and Morrow, E., ed., Second Symposium on the Geology of the Southeastern Coastal Plain, p. 10-23.

Palynologic examination of samples from the Tuscaloosa Formation of Alabama and western Georgia placed them in pollen zone IV of late Cenomanian age. Pollen in eastern Georgia is placed into pollen zone V of latest Coniacian or Santonian. The two are separated by a hiatus representing Turonian and almost all of the Coniacian age.

Colquhoun, D.J., 1965, Terrace sediment complexes in central South Carolina: Atlantic Coastal Plain Geological Association, Field Conference, 62 p.

Coastal Plain terraces-formations are sediment complexes bounded above by terrestrial and marine landforms and below by terrestrial and marine unconformities. Between these surficial and basal surfaces are lithologic facies, biologic facies and paleoecologic zones representative of Recent coastal plain and shelf environments. Eleven terraces are to be noted. Seven terrace-formations have been proven to exist.

Colquhoun, D.J., Heron, D.S., Jr., Johnson, H.S., Jr., Pooser, W.K., and Siple, G.E., 1969, Updip Paleocene-Eocene stratigraphy of South Carolina reviewed: South Carolina Geologic Notes, v. 13, no. 3 p. 1-26.

Detailed information on the establishment of the type section, variations in lithology, mineralogy, common sedimentary structures, paleontology, depositional environments, contacts, age, and correlation of formations of Cretaceous, Paleocene and Eocene age. Two major marine transgressions with respect to the continent are apparent within the strata studied. The first occurred in Late Cretaceous time and continued into early Eocene time. The second began in the middle Eocene and continued until at least late Eocene or Oligocene.

Conn, W.V., 1954, Soil and geologic features of Buford Project. Project of the American Society of Civil Engineers, v. 80, no. 425, 10 p.

This report discusses the geology and soils of the Buford Dam site on the Chattahoochee river in Gwinnett and Forsyth Counties.

Connell, J.F.L., 1955, Stratigraphy and paleontology of the Jackson Group of Georgia, University of Oklahoma, M.S. thesis, 348 p.

This report entails a study of the stratigraphic position, facies relationship, and fauna of beds of Jackson age in the

Coastal Plain of Georgia. The Jackson Group of Georgia is composed of two formations, the Ocala Limestone and the Barnwell sands and clays. The Ocala Limestone has at its base in central Georgia a tongue of soft, cream to white bryozoan limestone, and a bed of uncemented, tan, calcareous sand, thus constituting a unit known as the Tivola tongue of the Ocala. The Barnwell Formation consists of several members differentiated by many authors because of distinctive lithologies. In the writer's opinion, the argillaceous red sands composing the typical Barnwell, i.e., outside the area of outcrop of the Irwinton and Upper Sand members, should be termed the Uppermost Red Sand Member of the Barnwell Formation. The Barnwell and Ocala Formations are stratigraphic equivalents, intergrading in central Georgia, and thus indicating a change from littoral facies of predominantly red argillaceous sand and gray to green fuller's earth type clay to the north and northeast, to deeper water off-shore deposits of relatively pure, extremely fossiliferous limestone to the south and southwest.

Cook, F.A., and Oliver, J.E., 1981, The late Precambrian-early Paleozoic continental edge in the Appalachian orogen: American Journal of Science, v. 281, no. 8, p. 993-1008.

This report presents an interpretation which integrates data from gravity, seismic reflection, seismic refraction, magnetics, and surface geology studies and suggests that the major crustal change from thick continental crust to thin oceanic or attenuated continental crust is present beneath the crystalline rocks of the southern Appalachians. This interpretation favors the notion that the Blue Ridge and Inner Piedmont constitute an allochthonous sheet overlying sedimentary strata of the late Precambrian-early Paleozoic shelf, at least as far east as the east edge of the Inner Piedmont.

Cook, F.A., Brown, L.D., and Oliver, J.E., 1980, The southern Appalachians and the growth of continents: Scientific American, v. 243, no. 4, p. 156-168.

Due to the petroleum industry's exploration technique of seismic-reflection profiles much is being learned about the formation and structure of the continents. By using the technique, new details of the geological structure of the continental basement have been mapped. Application of the technique in the southern Appalachians reveals how the margins of continents change as ocean basins close and continents collide at subduction zones. Profiles made in the southern Appalachians revealed that the mountains are underlain to a depth of at least 11 miles by horizontal layers of material

that is sedimentary or once was. Furthermore, these horizontal sedimentary strata are younger than or contemporaneous with the highly deformed, metamorphic rocks which overlie them.

Cook, F.A., Brown, L.D., Kaufman, S., Oliver, J.E., and Petersen, T.A., 1981, COCORP seismic profiling of the Appalachian orogen beneath the Coastal Plain of Georgia: Geological Society of America Bulletin, part I, v. 92, no. 10, p. 738-748.

A southeastward extension onto the coastal plain of an earlier COCORP has provided some spectacular reflections most of which can be interpreted as either fault surfaces or as metamorphosed strata of late Precambrian-early Paleozoic age. The reflections are consistent with the hypothesis that a major detachment extends eastward beneath this part of the orogen. Deep reflections indicate that the structural configuration of the rocks is complex and that the remains of a collision zone are being observed. In conjunction with surface geologic information, these new data demonstrate that late Paleozoic compressive deformation was pervasive and resulted in lateral movements in the upper crust, extending from the valley and ridge to the crystalline rocks beneath the coastal plain.

Cook, F.A., Albaugh, D.S., Brown, L.D., Kaufman, S., Oliver, J.E., and Hatcher, R., 1979a, the Brevard fault: A subsidiary thrust fault to the southern Appalachian sole thrust: in Wones, D.R. ed., Proceedings on the "Caledonides in the USA" (I.G.C.P. project 27: Caledonide orogen): Virginia Polytechnic Institute and State University, Department of Geological Sciences, Memoir no. 2, Blacksburg, Virginia, 24061, p. 205-213.

Seismic reflection profiling by COCORP has resulted in the discovery of a thin, layered sequence of Paleozoic sedimentary rocks underlying a four to nine mile thick layer of the crystalline rocks of the Blue Ridge, Inner Piedmont, and possibly the Charlotte Belt and Carolina Slate Belt in the southern Appalachians. These sediments appear remarkably undisturbed, and their configuration implied that the overlying thin crystalline sheet has overthrust the Paleozoic continental margin of the southeastern United States for a distance of perhaps 160 miles or more.

Cook, F.A., Albaugh, D.S., Brown, L.D., Kaufman, S., Oliver, J.E., and Hatcher, R.D., Jr., 1979b, Thin-skinned tectonics in the crystalline southern Appalachians; COCORP seismic-reflection profiling of the Blue Ridge and Piedmont: Geology, v. 7, no. 12, p. 563-567.

COCORP seismic-reflection profiling in Georgia, North Carolina, and Tennessee and related geological data indicate that the crystalline Precambrian and Paleozoic rocks of the

Blue Ridge, Inner Piedmont, Charlotte Belt, and Carolina Slate Belt constitute an allochthonous sheet, generally four to nine miles thick, which overlies relatively flat-lying authochthonous lower Paleozoic sedimentary rocks, 0.6 to three miles thick, of the proto-Atlantic continental margin. Thus, the crystalline rocks of the southern Appalachians appear to have been thrust at least 161 miles to the west, and they overlie sedimentary rocks that cover an extensive area of the central and southern Appalachians.

Cooke, C.W., 1931, Seven coastal terranes in the southeastern states: Journal of the Washington Academy of Science, v. 21, no. 21, p. 503-513.

This paper discusses the development, elevation, and locations of seven Pleistocene coastal terraces. These terraces are attributed to sea level fluctuations due to variations in the volume of water in continental ice sheets.

Cooke, C.W., 1936, Geology of the Coastal Plain of South Carolina: U.S. Geological Geological Survey Bulletin 867, 196 p.

This bulletin discusses physical geography, stratigraphy, structure, geologic history, mineral resources, and ground water. The geologic history of South Carolina records many advances and retreats of the sea during which sediments were deposited and planed off time and again. Many of the formations that were once continuous now persist only as small remanants. The shiftings of the shore line during Pleistocene time are regarded by the writer as due partly to glacial control of sea level.

Cooke, C.W., 1943, Geology of the Coastal Plain of Georgia: U.S. Geological Survey Bulletin 941, 121 p.

The major portion of this bulletin is a detailed discussion of the sediments found in the Coastal Plain of Georgia. A significant feature is the much more complete outcrop of the formations in the west than elsewhere. Near the Chattahoochee River, 11 formations are exposed between the Tuscaloosa and the Hawthorn Formations. Near the Ocmulgee River there are only four, and along the Savannah River there are only three. This difference is the result of progressive overlap. It appears to indicate either an intermittent downwarp in the central and eastern parts of the state, which permitted the ocean to advance farther and farther inland, or an uplift in the west, which hastened the erosion of the littoral facies of the younger formations and exposed more and more of the underlying beds.

Cooke, C.W., and MacNeil, F.S., 1952, Tertiary stratigraphy of South Carolina: U.S. Geological Survey Professional Paper 243-B, p. 19-29.

The following changes in the current classification of the Tertiary formations of South Carolina are proposed: 1) the Black Mingo Formation, mainly of Wilcox age, may include some Paleocene deposits, 2) the McBean Formation, heretofore including all the deposits of known Claiborne age in South Carolina, is restricted to the Ostrea sellaeformis Zone, of late middle Claiborne age, and the names Congaree Formation (equivalent to the Tallahatta Formation) and Warley Hill Marl (equivalent to the Winona Formation) are revived for deposits of early Claiborne and early middle Claiborne age, 3) a large part of the deposits mapped as Barnwell Formation (of Jackson age) proves to be Congaree, 4) the Santee Limestone, heretofore supposed to be of early Jackson age, represents the Ostrea sellaeformis Zone and seems to be an offshore facies of the restricted McBean Formation, 5) the Cooper Marl currently referred to the late Eocene (Jackson), is reassigned to the early Oligocene(?), 6) gravelly facies of the Miocene Hawthorn Formation similar to that in Georgia is recognized for the first time in South Carolina, where the formation had previously been recognized only by its offshore facies.

Cooke, C.W., and Shearer, H.K., 1918, Deposits of Claiborne and Jackson age in Georgia: U.S. Geological Survey Professional Paper 120, p. 41-81.

An early summary of Eocene deposits in Georgia which places the Barnwell "sand" in the Jackson and changes the name to Barnwell Formation. The "Congaree" clay member of the McBean Formation is placed in the Barnwell formation and renamed the Twiggs Clay.

Cornet, B., Traverse, A., and McDonald, N.G., 1973, Fossil spores, pollen and fishes from Connecticut indicate Early Jurassic age for part of the Newark Group: Science, v. 182, no. 4118, p. 1243-1247.

Palynologically productive localities have been found throughout the Newark Group basins. Palynological data indicate that the Newark Group has considerable time-stratigraphic range: Upper Triassic for the Cumnock Formation (North Carolina), the Vinita Beds (Virginia), and the upper New Oxford Formation (Pennsylvania), Raeto-Liassic for the Brunswick Formation (New Jersey), Portland Formation (Connecticut and Massachusetts), and the Shuttle Meadow Formation (Connecticut).

Cramer, H.R., 1969, Structural features of the Coastal Plain of Georgia: Southeastern Geology, v. 10, no. 2, p. 111-123.

The structural features of the Coastal Plain of Georgia appears to be both Cretaceous and Cenozoic in age. There is a

southwest-northeast alignment of the features and specific geophysical trends such as gravity and magnetic anomaly alignments. Tension appears to have been a predominant source of energy for the faulting.

Cramer, H.R., 1974, Isopach and lithofacies analyses of the Cretaceous and Cenozoic rocks of the Coastal Plain of Georgia, in Stafford, L.P., Symposium on the Petroleum Geology of the Georgia Coastal Plain: Georgia Geological Survey Bulletin 87, p. 21-44.

Volumes of sedimentary rocks are computed from isopach-contour maps. Periods of greatest sedimentation are the Upper Cretaceous and Eocene. Detailed lithofacies maps are included.

Cramer, H.R., and Arden, D.D., 1978, Faults in Oligocene rocks of Georgia Coastal Plain: Geological Society of America (abs.), v. [illegible] no. 4, p. 156.

Faulting dominates the interpretation of isopach and structure-contour maps of Oligocene rocks from the Georgia Coastal Plain. Faults include: one which is a pronounced graben, up to ten miles wide, trending northeastward from Decatur and Grady Counties through northern Coffee County to at least the Savannah River. The throw is several hundred feet. Oligocene and Miocene rocks in the graben are thicker, with Oligocene rocks thin to absent on the upthrown sides.

Cramer, H.R., and Arden, D.D., 1980 Subsurface Cretaceous and Paleogene geology of the Coastal Plain of Georgia: Georgia Geologic Survey Open-File Report 80-8, 184 p.

The report provides a detailed stratigraphic framework of the Coastal Plain of Georgia and serves to update work published over the previous 15 years. Basement includes paleontologically dated Paleozoic rocks and radiometrically detected Triassic rocks. Granitic, volcanic and metamorphic crystalline rocks are also present. Cretaceous rocks are Comanchean and Gulfian in age. Rocks of all Tertiary ages exist in the Coastal Plain. The Gulf Trough fault theory is supported.

Cramer, H.R., and Grant, W.H., 1965, Some highlights of the Cretaceous and crystalline terranes of Georgia, in Southeastern Geological Society, 11th Field Trip: Emory University, p. 2-11.

Cretaceous rocks in Georgia are exposed in a thin band along the Fall Line in Georgia. Downdip, in the subsurface, the Cretaceous system is generally identified only as Tuscaloosa Formation and "post-Tuscaloosa undifferentiated". Marine and

nonmarine (or at least deltaic) sediments exhibit striking alternation. It seems evident that Cretaceous exposures in Georgia represent the deposits of a fluctuating strand line during the Upper Cretaceous and this area is critical for correlation purposes. These rocks are the easternmost exposures of the Gulf Coast Cretaceous.

Crawford, M.L., and Crawford, W.A., 1980, Metamorphic and tectonic history of the Pennsylvania Piedmont: Journal of the Geological Society of London, v. 137, part 3, p. 311-320.

The Piedmont Province of southeastern Pennsylvania consists of moderately to highly metamorphosed rocks ranging in age from Precambrian to Ordovician. Three episodes of metamorphism have occurred and include: a one billion years B.P. regional granulite facies episode, a second younger and lower pressure granulite facies episode, and a greenschist to upper amphibolite facies episode. The proposed tectonic model includes a rifting of continental basement forming a basin with a lower Paleozoic carbonate bank on the northwestern margin and an island arc to the southeast.

Crickmay, G.W., 1952, Geology of the crystalline rocks of Georgia: Georgia Geologic Survey Bulletin 58, 54 p.

The crystalline rocks of Georgia occupy the piedmont, upland, and highland provinces, and underlie about one third of the state. This paper offers general descriptions of mineral resources, stratigraphy and a historical summary, but is necessarily brief.

Dallmeyer, R.D., 1975, The Palisades Sill: A Jurassic intrusion? Evidence from $^{40}Ar/^{39}Ar$ incremental release ages: Geology, v. 3, no. 5, p. 243-245.

Available K-Ar dates from the Palisades Sill (142 to 202 m.y.B.P.) are generally younger than the ages of post-Triassic intrusive rocks in other areas. $^{40}Ar/^{39}Ar$ release spectra of chill-zone samples record of ages of 192 and 186 m.y.B.P. and furnish no evidence of postcrystallization argon loss. These ages are similar to published K-Ar biotite ages and probably refer to the time of crystallization of the sill. Recent palynologic studies in the Hartford Basin have shown that rocks stratigraphically equivalent to those intruded by the Palisades are, in part, of Early Jurassic age.

Dames and Moore, Inc., 1980, Review of potential host rocks for radioactive waste disposal in the southeast United State-Triassic basin subregion: E.I. duPont de Nemours and Company, Savannah River Laboratory, DP-1569.

An evaluation of the exposed and buried Triassic basins from Maryland to Georgia. The purpose of the evaluation was to determine the feasibility of these basins as repositories for radioactive wastes.

Daniels, D.L., 1974, Geologic interpretation of geophysical maps, central Savannah River area, South Carolina and Georgia: U.S. Geological Survey Geophysical Investigations Map GP-893, 3 sheets, scale-sheets 1 and 2 - 1:250,000, sheet 3 - 1:500,000.

Interpretive geologic map showing Carolina Slate Belt, Charlotte Belt, Kiokee Belt, and Belair Belt rocks. Aeromagnetic map and aeroradioactivity level map. Region covered is northwest of Millett fault study area (Sheet 1 of 3). Aeromagnetic map of Piedmont part of Savannah River Plant (after Petty and others, 1965) (Sheet 2 of 3). Aeromagnetic map with interpretive bedrock geology of coastal plain (after Petty and others, 1965) (Sheet 3 of 3).

Daniels, D.L., and Zietz, I., 1978, Geologic interpretation of aeromagnetic maps of the Coastal Plain region of South Carolina and parts of North Carolina and Georgia: U.S. Geological Survey, Open-File Series 78-261, 61 p.

The U.S. Coastal Plains Regional Commission has joined with the U.S. Geological Survey in a cooperative program to complete the airborne radiometric and magnetic surveying in the Coastal Plain regions of North Carolina, South Carolina, Georgia, and recently, Virgina and Florida. This report covers the aeromagnetic data, and consists of a compilation of the data collected in the first two years of the program and the previous aeromagnetic surveys, with an interpretation of the geology of the basement rocks. The interpretation utilizes the aeromagnetic maps, samples from wells penetrating the basement, previous interpretations of the basement geology, and other geophysical data.

Daniels, D.L. Zietz, I., and Popenoe, P., 1982, Distribution of subsurface lower Mesozoic rocks in the southeastern United States, as interpreted from regional aeromagnetic and gravity maps: in Gohn, G.S., ed., Studies related to the Charleston, South Carolina, earthquake of 1886-tectonics and seismicity (collected abstracts): U.S. Geological Survey Open-File Report 82-134, p. 21-22.

Aeromagnetic data reveal some of the complexity of the broad early Mesozoic rift basin, which appears to extend at least from the Gulf of Mexico to the Atlantic Ocean. Along the northern edge of this rift, in the Savannah River region, depth-to-magnetic-source calculations delineate two interconnected basins, which are separated from the main rift by a broad horst of crystalline basement. The Riddleville (Georgia) Basin appears to contain at least 7,220 feet of basin fill; it is deeper than the Dunbarton (South Carolina) Basin, which has at least 3,300 feet of fill. A maximum thickness of 11,500 feet near Statesboro, Georgia is indicated for the main basin, called here the South Georgia Rift.

Davis, L.B., Jr., 1974, Petrology of the Claiborne Group and part of the Wilcox Group, southwest Georgia and southeast Alabama: University of Texas at Austin, M.A. thesis, 215 p.

Sediments of the Claiborne Group cropping out in southwest Georgia and southeast Alabama were probably deposited in a complex of fluvial and marine environments. The sediments of the upper part of the Tuscahoma Formation and the Hatchetigbee Formation, both of the Wilcox Group, are probably marine to marginal marine deposits. The boundary between these two groups is difficult to define, for there is locally a layer of sediment with intermediate characteristics.

De Boer, J., 1967, Palecmagnetic-tectonic study of Mesozoic dike swarms in the Appalachians: Journal of Geophysical Research, v. 72, no. 8, p. 2237-2250.

Paleomagnetic evidence indicates that most of the extensive dike swarms cutting Triassic and older formations probably intruded in a time of regional tectonic and magmatic activity distinct from the Late Triassic tectogenesis. The fossil magnetic directions of the dikes suggest a Jurassic age for the intrusions. These dikes were emplaced along tensional fractures that were the surficial expressions of deep-seated movements.

Denman, H.E., Jr., 1974, Implications of seismic activity at the Clark Hill Reservoir: Georgia Institute of Technology, M.S. thesis, 103 p.

Examination of seismograph records revealed a localized zone of seismic activity at Clark Hill. Bouguer anomalies computed for the area reveal a breached, linear northeast-southwest trending ridge of anomalies which corresponds to the area of microearthquake locations. A right lateral strike-slip displacement of approximately 2,000 feet is indicated by offset of these anomalies along a possible northwest-southeast striking fault.

Dillon, W.P., and Paull, C.K., 1982, Summary of development of the continental margin of Georgia based on multichannel and single-channel seismic-reflection profiling and stratigraphic well data: in Arden, D.D., Beck, B.F., and Morrow, E., ed., Second Symposium on the Geology of the Southeastern Coastal Plain, p. 197-200.

The continental margin off Georgia probably began to form with rifting, mafic intrusive and extrusive activity, and rapid sediment deposition which led to development of a transitional basement. Early subsidence was rapid for the basement beneath

the present Blake Plateau Basin, and the Upper Jurassic deposits form the thickest unit. Reefs acted as sediment dams at the seaward side of the basin. The Gulf Stream became significant on the Blake Plateau near the Paleocene-Eocene boundary, and since then has prevented the shelf sediments from prograding across the plateau.

Dillion, W.P., Paull, C.K., Buffler, R.T., and Fail, J., 1978, Structure and development of the Southeast Georgia Embayment and northern Blake Plateau: Preliminary analysis: American Association of Petroleum Geologists Memoir 29, p. 27-41.

Multichannel seismic reflection profiles from the Southeast Georgia Embayment and northern Blake Plateau show reflectors that have been correlated tentatively with horizons of known age.

Doering, J.A., 1960, Quaternary surface formations of the southern part of the Atlantic Coastal Plain: Journal of Geology, v. 68, no. 1, p. 182-202.

The Citronelle Formation of the eastern Gulf Coast extends northward across the Coastal Plains of Georgia, South Carolina, North Carolina, and Virginia as a gravelly sand formation 100 feet thick. Deposition of the formation in the Atlantic Coast region occurred on a peneplain developed during a tectonically quiet time in the late Miocene and Pliocene and was caused by the first of a series of uplifting and warping movements.

Drennen, C.W., 1950, Geology of the Piedmont-Coastal Plain contact in eastern Alabama and western Georgia, University of Alabama, M.S. thesis, 42 p.

The chief purpose of this work was to map the contact of the Piedmont and Coastal Plain rocks in east Alabama and west Georgia, a contact difficult to identify at some places because the rocks have been intensely weathered. Locally, faulting has involved both the Piedmont and Coastal Plain rocks, and in places the Coastal Plain strata have been disturbed by slumping and soil creep.

Eardley, A.J., 1951, Structural geology of North America: New York, Harper and Row, 743 p.

A detailed, dated (pre-plate tectonics) discussion of the United States, Canada, and Mexico. Separate sections on the Atlantic Coastal Plain and exposed Triassic basins.

Ellwood, B.B., Whitney, J.A., Wenner, D.B., Mose, D., and Amerigian, C., 1980, Age, paleomagnetism, and tectonic significance of the Elberton granite, northeast Georgia Piedmont: Journal of Geophysical Research, v. 85, no. B11, p. 6521-6533.

The Elberton granite is a large, fine-grained pluton intruded into orthogneisses and paragneisses of the Inner Piedmont of eastern Georgia. Within this paper, two partially conflicting estimates of tectonic rotation are developed and evaluated. The first requires a post emplacement rotation of 30°-35° down to the southeast about a north-northeast axis. The second, indicates a postemplacement rotation for the body of approximately 15° down to the northwest along an east-northeast axis. The Rb/Sr whole rock age of 350± 11 m.y.B.P., the remnant magnetism, and petrology of samples from 21 sites within the granitic Elberton pluton have been determined.

Faye, R.E. and Prowell, D.C., 1982, Effects of Late Cretaceous and Cenozoic faulting on the geology and hydrology of the Coastal Plain near the Savannah River, Georgia and South Carolina: U.S. Geological Survey Open-File Report 82-156, 73 p.

Geologic and hydrologic investigations by the U.S. Geological Survey have defined stratigraphic and hydraulic anomalies suggestive of faulting within coastal plain sediments between the Ogeechee River in east-central Georgia and the Edisto River in west-central South Carolina. Examination of borehole cuttings, cores, and geophysical logs from test wells indicate that Triassic rocks, and Upper Cretaceous and lower Tertiary coastal plain sediments near the Barnwell-Allendale County line near Millett, South Carolina, are offset by a northeast-trending fault downthrown to the northwest. The location of this suspected coastal plain fault generally coincides with the location of an inferred fault in basement rocks as interpreted from aeromagnetic surveys. Apparent vertical offsets range from about 700 feet at the base of Upper Cretaceous sediments to about 20 feet in strata of late Eocene age. As a result, the Upper Cretaceous Middendorf Formation which directly overlies crystalline and Triassic rocks updip (northwest) of this fault, is absent immediately downdip of the fault. The thickness of Upper Cretaceous sediments is also sharply reduced from about 700 feet to about 180 feet across the fault.

Sediments of the basal coastal plain aquifer are largely truncated by uplifted Triassic rocks at the fault near Millett, South Carolina. Lateral ground water flow near the Savannah River is consequently disrupted updip of the fault and ground water is transferred vertically into overlying sediments and possibly into the Savannah River. At several locations, abrupt changes in potentiometric head occur across this fault. Computed transmissivity of the basal coastal plain aquifer is also radically reduced downdip of the fault, sharply reversing a downdip trend of rapidly increasing aquifer transmissivity.

Other anomalous potentiometric data along a northeast-trending line between Statesboro, Georgia, and Fairfax, South Carolina, suggest the possibility of similar faulting in correlative geologic units. The location of the suspected fault near Statesboro, Georgia, generally coincides with the eastward extension of the Gulf Trough, a regional potentiometric anomaly in central Georgia.

Flint, R.F., 1940, Pleistocene features of the Atlantic Coastal Plain: American Journal of Science, v. 238, no. 11, p. 757-787.

This paper reviews the literature of the Pleistocene sediments and surface features of the Atlantic Coastal Plain, and gives the results of reconnaissance study of a part of this region. It discusses three hypotheses concerning the environment in which these sediments were accumulated, and in which the related, scarps, terraces, and other morphologic features were fashioned: 1) marine origin, 2) fluvial origin, 3) a combination of both environments.

Forgotson, J.M., 1963, Depositional history and paleotectonic framework of Comanchean Cretaceous Trinity stage, Gulf Coast area: Bulletin of the American Association of Petroleum Geologists, v. 47, no. 1, p. 69-103.

The Early Cretaceous Trinity Stage is a broad regional wedge of rocks thickening basinward from the zero edge to more than 4,000 feet. The tectonic framework and regional paleogeography were uniform during deposition.

Frazier, W.J., 1982, Sedimentology and paleoenvironmental analysis of the Upper Cretaceous Tuscaloosa and Eutaw Formations in western Georgia: in Arden, D.D., Beck, B.F., and Morrow, E., ed., Second Symposium on the Geology of the Southeastern Coastal Plain, p. 39-52.

The Tuscaloosa Formation lies nonconformably on Piedmont crystalline rocks on top of which is developed a thin, lateritic paleosoil, present now primarily on the higher portions of the erosional surface. The Tuscaloosa consists of two major lithologies, a crossbedded, conglomeratic, arkosic arenite and a mottled, silty mudstone, which occur stratigraphically in a series of fining-upward sequences separated by disconformities.

Gelbaum, C., 1978, The geology and ground water of the Gulf Trough: Georgia Geologic Survey Bulletin 93, p. 38-48.

There is a steep increase in the potentiometric surface in the direction of flow across the axis of the Gulf Trough in the central Coastal Plain of Georgia. This steep gradient

indicates that the transmissivity of the principal artesian aquifer has been inhibited. Low yields may be due to: 1) the principal aquifer being located much deeper than elsewhere, 2) multi-aquifer wells that tap the entire Miocene and only a small portion of the main aquifer, 3) principal aquifer being thinner due to erosion, non-deposition or slow deposition, 4) faulting parallel to the Trough resulting in a low permeability barrier, 5) carbonate facies changes.

Gelbaum, C., and Howell, Jr., 1982, The geohydrology of the Gulf Trough: in Arden, D.D., Beck, B.F., and Morrow, E., ed., Second Symposium on the Geology of the Southeastern Coastal Plain, p. 140-153.

The Gulf Trough is a long, narrow geologic feature that was produced by a combination of depositional and structural conditions. The Trough is approximately 235 miles long about 10 miles wide, and trends N53°E from Decatur through Bulloch Counties. Development of the Gulf Trough began, at least as early as Oligocene time, with subsidence of several elongate basins and infilling of these basins with a thick sequence of Swannee Limestone. Faulting occurred in limited areas, forming parts of two basins. The Gulf Trough is coincident with a steep potentiometric gradient anomaly on the potentiometric map of the principal artesian aquifer. Both the trough and the anomaly extend from Decatur County in southwest Georgia northeastward to Bulloch and Effingham Counties, where they disappear. The Gulf Trough creates the potentiometric anomaly and, by acting essentially as a vertical boundary to ground water flow, is responsible for reduced ground water availability.

Geodata International, Inc., 1975a, Aerial radiometric and magnetic survey, Augusta National Topographic Map, Georgia and South Carolina areas, Volumes 1 and 2: U.S. Energy and Development Administration, GJO-1663-1, 55 p.

This report includes a general geologic description of the area, including descriptions of the various geologic units and correlates the airborne data to the geologic units as provided by the geologic maps. Also included is a frequency distribution study of the data as a function of the geologic units encountered over the area including tie line data.

Geodata International, Inc., 1975b, Aerial radiometric and magnetic survey Savannah National Topographic Map, Georgia and South Carolina areas, volumes 1 and 2: U.S. Energy Research and Development Administration, GJO-1663-1, 50 p.

This report includes a general geologic description of the area, including descriptions of the various geologic units and correlates the airborne data to the geologic units as provided

by the geologic maps. Also included is a frequency distribution study of the data as a function of the geologic units encountered over the area including tie line data.

Georgia Department of Natural Resources, 1976, Geologic map of Georgia, scale - 1:500,000.

Detailed geologic map of the entire State of Georgia. Formations shown in the study area include: Lower Tertiary-Cretaceous undifferentiated, Twiggs Clay, McBean Formation, Irwinton Sand, Neogene undifferentiated, and alluvium.

Gohn, G.S., 1982a, Studies related to the Charleston, South Carolina, earthquake of 1886 - tectonics and seismicity (collected abstracts): U.S. Geological Survey Open-File Report 82-134, 38 p.

Recent investigations in the Charleston, South Carolina area have been multidisciplinary studies of the materials recovered from the Clubhouse Crossroads test holes; seismic reflection and refraction surveys in the Charleston area and offshore; regional studies of aeromagnetic, gravity, and deep-well data; and continued monitoring and analysis of the seismicity near Charleston. This report presents, as abstracts, principal conclusions and working hypotheses of some of the ongoing investigations.

Gohn, G.S., 1982b, Geology of the basement rocks near Charleston, South Carolina - Data from detrital rock fragments in lower Mesozoic (?) rocks, Clubhouse Crossroads test hole #3: in Gohn, G.S., ed. Studies related to the Charleston, South Carolina, earthquake of 1886-tectonics and seismicity (collected abstracts). U.S. Geological Survey Open-File Report 82-134, p. 9-10.

Four types of basement rocks occur as detrital clasts; granodiorite, microbreccia, basalt, and mylonite. The mylonite and microbreccia may represent relatively ductile and relatively brittle deformation, within a single fault zone, or they may represent contrasting styles of deformation in different fault zones of different age. Based on the probable age of the sedimentary section, the minimum age of faulting is established as early Mesozoic.

Gohn, G.S., Houser, B.B., and Schnider, R.R., 1982a, Geology of the lower Mesozoic(?) sedimentary rocks in Clubhouse Crossroads test hole #3 near Charleston, South Carolina: in Gohn, G.S., ed., Studies related to the Charleston, South Carolina, earthquake of 1886-- tectonics and seismicity (collected abstracts): U.S. Geological Survey Open-File Report 82-134, p. 7-8.

In the Clubhouse Crossroads well #3, red beds of probable Late Triassic or Early Jurassic age were found to underlie

subaerial basalt flows. The red beds are similar to those found elsewhere in the eastern United States.

Gohn, G.S., Bybell, L.M., Smith, C.C., and Owens, J.P., 1978a, Preliminary cross sections of Cretaceous sediments along South Carolina coastal margin: U.S. Geological Survey Miscellaneous Field Studies Map MF-1015A, 2 sheets.

This report describes the distribution of Cretaceous sediments along the South Carolina coastal margin. Cross sections employing in-hole geophysical logs have been used to illustrate the distribution of the major stratigraphic units. The units delineated on the cross sections are informal rock-stratigraphic units of approximately formational rank. Formational names were not used, however, to avoid discussions of stratigraphic nomenclature and to avoid the necessarily tenuous correlation of subsurface and outcrop units. Ages of the units shown on the cross sections are given where they are known in specific boreholes.

Gohn, G.S., Bybell, L.M., Smith, C.C., and Owens, J.P., 1978b, Cenozoic sediments, South Carolina coastal margin: U.S. Geological Survey Miscellaneous Field Studies Map MF-1015B, 2 sheets.

This report describes the distribution of Cretaceous sediments along the South Carolina coastal margin. Cross sections employing in-hole geophysical logs have been used to illustrate the distribution of the major stratigraphic units. The units delineated on the cross sections are informal rock-stratigraphic units of approximately formational rank. Formational names were not been used, however, to avoid discussions of stratigraphic nomenclature and to avoid the necessarily tenuous correlation of subsurface and outcrop units. Ages of the units shown on the cross sections are given where they are known in specific boreholes.

Gohn, G.S., Gottfried, D., Lanphere, M.A., and Higgins, B.B., 1978c, Regional implications of Triassic or Jurassic age for basalt and sedimentary red beds in the South Carolina Coastal Plain: Science, v. 202, no. 4370, p. 887-890.

Clubhouse Crossroads basalt and underlying red beds have been assigned an age of Late Triassic to Early Jurassic based on whole rock potassium-argon studies. The red beds below the Clubhouse Crossroads basalt are lithologically similar to exposed rocks of the Newark Group. The presence of a large early Mesozoic basin (graben?) extended across the southeastern United States is suggested.

Gohn, G.S., Bybell, L.M., Christopher, R.A., Owens, J.P., Smith, C.C., 1982b, A stratigraphic framework for Cretaceous and Paleogene margins along the South Carolina and Georgia coastal sediments: in Arden, D.D., Beck, B.F., and Morrow, E., ed., Second Symposium on the Geology of the Southeastern Coastal Plain, p. 64-74.

Viewing the coastal Georgia-South Carolina cross section as a whole, virtually all the units are thicker in Georgia than in South Carolina and are thicker on the peninsular arch than on the Cape Fear Arch, thereby giving a considerable asymmetry to the embayment. In the area of thickest sedimentation in Glynn and Camden Counties, Georgia. The section consists of roughly 50 to 60 percent Tertiary sediments, well over half of which are Eocene carbonate rocks. The post-Eocene section consists primarily of upper Oligocene beds in the Charleston, South Carolina area and primarily of Miocene sediments in southern South Carolina and Georgia.

Gray, M.G., 1978, Pre-Gulfian rocks of the southwestern Georgia Coastal Plain, Emory University, M.S. thesis, 72 p.

Differential rates of crustal subsidence had a marked influence on the thickness and distribution of pre-Gulfian coastal plain sedimentary rocks in southwestern Georgia and southeastern Alabama.

Pre-Gulfian coastal plain rocks are subdivided into formats in southwestern Georgia and southeastern Alabama. Both formats consist of predominantly arenaceous clastic rocks, but the lowermost Early Format contains a higher concentration of argillaceous material than does the uppermost Worth Format.

This change in the stratigraphic sequence is the result of a relatively abrupt change in the regional depositional environment, and is interpreted to be the result of: 1) an increase in basin-deepening tectonics, 2) a raising of the topography in the source area, 3) an increase in stream activity, or 4) some combination of these.

Pre-Gulfian rocks of the Georgia Coastal Plain could be Upper Jurassic and/or Lower Cretaceous (Comanchean and/or Coahuilan) in age.

Griffin, J.S. Jr., 1974, Analysis of the Piedmont in northwest South Carolina: Geological Society of America Bulletin, v. 85, no. 7, p. 1123-1138.

Two major autochthonous nappes and a deep synformal structural occur in the Piedmont of northwest South Carolina. The cataclastic Brevard zone, a non-migmatitic belt, is associated

with the synformal belt of partially cataclastic and retrograded a rocks. The autochthonous nappe complex probably formed in a continental rise assemblage subjected to intense thermal effects in the early Paleozoic.

Guinn, S.A., 1980, Earthquake focal mechanisms in the southeastern United States: U.S. Nuclear Regulatory Commission, NUREG/CR-1503, 150 p.

Focal mechanism solutions indicate that southeastern intraplate seismic activity does not appear to be the result of a single dominant stress direction. Many of the solutions support nearly vertical fault planes suggesting a low level compressional to tensional environment for the southeast.

Hadley, J.B., and Devine, J.F., 1979, Seismotectonic map of the eastern United States: U.S. Geological Survey Miscellaneous Field Investigations Map MF-620. 3 sheets, scale - 1:5,000,000.

The map describes the distribution of historic seismic activity in relation to geologic structures and tectonic provinces and to identify structures or regions that are characterized by consistent relations between seismic activity and structural features. It is clear from existing structural data, as well as from the distribution of earthquakes, that historic earthquake activity bears no consistent relation to the tectonic provinces of the southeastern United States.

Hamilton, R.M., Behrendt, J.C., and Ackermann, H.D., 1982, Land multichannel seismic-reflection evidence for tectonic features near Charleston, South Carolina: in Gohn, G.S., ed., Studies related to the Charleston, South Carolina, earthquake of 1886-tectonics and seismicity (collected abstracts): U.S. Geological Survey Open-File Report 82-134, p. 17-18.

Reflection studies in the vicinity of the 1886 Charleston earthquake shows a smooth pre-Late Cretaceous unconformity dipping to the southeast. The smoothness shows that vertical faulting within a mile of the surface has not been substantial since at least the Late Cretaceous. There are a few places where the deformation appears to have tectonic significance. One such deformation, the Cooke fault, shows about 164 feet of vertical displacement on a Jurassic age basalt layer at 2,500 feet depth. Two other zones of unknown strike that indicate Cenozoic faulting are seen. In the northern part of the study area, layered reflections are interpreted as Triassic red beds bounded on the southeast by a Triassic(?) normal fault. The shallow minor deformation seen on the profiles is interpreted as a second-order manifestation of deep faulting, possibly caused by reactivation of ancient thrust faults.

Harms, J.C., and Tackenberg, P., 1972, Seismic signatures of sedimentation models: Geophysics, v. 37, no. 1, p. 45-58.

Sedimentation models summarize much geologic information which can be applied to exploration problems, especially in sparsely drilled areas. If lithologic variations, summarized by sedimentation models, control velocities, different stratigraphic sequences should yield recognizable and systematically different reflection seismic cross-sections.

Harrington, J.W., 1951, Structural analysis of the west border of the Durham Triassic Basin: Geological Society of America Bulletin, v. 62, no. 2, p. 149-158.

Normal faulting in Triassic time is responsible for basinal formation. Deposition accompanied and followed the faulting and erosion of the original fault surfaces. Post-sedimentation normal faulting allowed the deposition of finer clastic rocks against the crystalline rocks, and often depressed the conglomerate facies below erosional level.

Harris, L.D., and Bayer, K.C., 1979, Sequential development of the Appalachian orogen above a master decollement-a hypothesis: Geology, v. 7, no. 12, p. 568-572.

Surface geology and seismic-reflection data suggest that rather than having a massive rooted central core the southern part of the Appalachian orogen from the Appalachian Plateau to the Atlantic continental shelf is underlain by an eastward-dipping decollement zone. This decollement zone was a long lived structural element, intermittently growing from east to west during late Proterozoic to late Paleozoic time. Onshore displacement along the detachment surface was episodic through this long period of time, so that reliable estimates of total shortening for the entire orogen are not possible.

Harris, L.D., and Milici, R.C., 1977, Characteristics of thin-skinned style of deformation in the southern Appalachians and potential hydrocarbon traps: U.S. Geological Survey Professional Paper 1018, 40 p.

Rootless folds and gently to steeply dipping thrust faults, which, at depth join a master decollement (low angle thrust) near the sedimentary rock - basement contact, are the key tectonic features of the southern Valley and Ridge and Appalachian Plateaus Provinces. This paper is an attempt to focus attention on the more important characteristics of the thin-skinned style of deformation in the southern Appalachians by presenting a model to illustrate the regional anatomy of a decollement and to identify likely structures that need additional investigation as possible prospects for hydrocarbon accumulation.

Hatcher, R.D., 1977, Regional structural relationships of the Chauga belt-western mobilized Inner Piedmont of the crystalline southern Appalachians of northeast Georgia and South Carolina: Geological Society of American (abs.), v. 9, no. 2, p. 781.

Although the synclinal Chauga belt and articlinal mobilized Inner Piedmont are generally thought to be lithologically and structurally distinct, certain rock units are traceable continuously across a previously mapped "tectonic" boundary separating the two. The boundary in this area is one of minimal tectonic offset, more likely involving a metamorphic gradient. A further complication is a large allochthon of sillimanite grade gneisses, schists and amphibolites which extends from the Georgia-South Carolina border to just east of Gainesville, Georgia.

Hatcher, R.D., Jr., 1972, Development model for the southern Appalachians: Geological Society of America Bulletin, v. 83, no. 9, p. 2735-2760.

A four-phase developmental model for the southern Appalachians is proposed. This scheme includes: 1) an early (late Precambrian to Middle Ordovician) phase of continental margin sedimentation, igneous activity, and initial compression, 2) an intermediate (late Precambrian to Late Devonian) phase of compression producing isoclinal folding, regional metamorphism, and intrusive activity with deposits from a rising tectonic source land, 3) next a later (mid-late Paleozoic) phase of compression and igneous activity accompanied by continued deposition from the rising mountain system occurred, 4) finally, there was a tensional phase (Triassic-Jurassic) accompanied by normal faulting, and deposition related to the decoupling of Africa and North America.

Hatcher, R.D. Jr., 1977, Macroscopic polyphase folding illustrated by the Toxaway Dome, eastern Blue Ridge, South Carolina - North Carolina: Geological Society of America Bulletin, v. 88, no. 11, p. 1678-1688.

The Toxaway Dome is located in the Blue Ridge of North and South Carolina immediately north-west of the Brevard zone. This study is principally a delineation of the structure the southwestern part of the Toxaway Dome. A structural synthesis is presented here based on detailed geologic mapping and analysis of mesoscopic structures, with a consideration of its implications to the regional structural history of the Blue Ridge.

Hatcher, R. D. Jr., 1978, Tectonics of the western Piedmont and Blue Ridge, southern Appalachians: Review and speculation: American Journal of Science, v. 278, no. 3, p. 276-304.

This paper is concerned with the tectonics of the crystalline southern Appalachians from the Inner Piedmont westward and with the relationship of this portion of the Appalachians to the remainder. Its purpose is to review the recent work done in the Blue Ridge, Chauga belt, and Inner Piedmont and add recent ideas relating these belts to a common but complex history of the opening and closing of small ocean basins along the ancient continental margin of southeastern North America.

Hatcher, R. D. Jr., and Odom, A. L., 1980, Timing of thrusting in the southern Appalachians, U.S.A.: Model for orogeny: Journal of Geological Society of London, v. 137, part 3, p. 321-327.

Field and geochronological studies in the southern Appalachians reveal a space-time relationship of thrust and other large faults to their relative positions in the orogen, and their ties of formation in relation to thermal-metamorphic peaks. This transgression of thrusting begins with early pre-, syn-, and late-metamorphic (taconic) thrusting in the metamorphic core. The core was also affected by Devonian (Acadian) thrusting and high angle faulting. Late (Hercynian-Alleghanian) faults are restricted to the flanks of the orogen.

Hatcher, R.D., Jr., Howell, D.E. and Talwani, P., 1977, Eastern Piedmont fault system: Speculation on its extent: Geology, v. 5, no. 10, p. 636-640.

Geologic mapping, interpretation, and field checking of recent aeromagnetic data suggest the existence of a closely associated series of faults and splays extending from Alabama to Virginia, termed the Eastern Piedmont fault system. Characteristic magnetic anomalies were found to be associated with known faults and were used to trace them through covered intervals. The fault system extends northeastward from the Goat Rock fault of Alabama and west-central Georgia, crossing the lower Piedmont of South Carolina, passes beneath a segment of the Coastal Plains in the Carolinas, and then flanks the Raleigh Belt in North Carolina and continues into Virginia. From east-central Georgia to Virginia, cataclastic rocks along the faults of the system are bounded to the northwest and southeast by rocks of the Carolina Slate Belt, forming perhaps the most extensive fault system in eastern North America.

Hatcher, R.D. Jr., Butler, J.R., Fullagar, P.D., Secor, D.T., and Snoke, A.W., 1979, Geologic synthesis of the Tennessee-Carolinas-northeast Georgia southern Appalachians: in Wones, D.R., ed., Proceedings on the "Caledonides in the USA" (I.G.C.P. project 27: Caledonide orogen): Virginia Polytechnic Institute and State University, Department of Geologic Sciences, Memoir no. 2, Blacksburg, Virginia, 24061, p. 83-90.

The Tennessee-Carolinas-northeast Georgia (TCG) southern Appalachians have been divided into several geologic provinces based on the aspects of structure, stratigraphy, metamorphic or plutonic history. These provinces include the Cumberland Plateau and Valley and Ridge, the Blue Ridge which is divisible into three distinctive belts, and the Piedmont which is divisible into six belts. This paper discusses the stratigraphy, igneous activity, faulting, metamorphism and plate tectonic models for the provinces.

Hazel, J.E., Bybell, L.M., Christopher, R.A., Fredricksen, N.O., May, F.E., McLean, D.M., Poore, R.Z., Smith, C.C., Sohl, N.F., Valentine, P.C., and Witmer, R.J., 1977, Biostratigraphy of the deep corehole (Clubhouse Crossroads corehole 1) near Charleston, South Carolina, in Rankin, D.W., ed., Studies related to the Charleston, South Carolina, earthquake of 1886 - A preliminary report: U.S. Geological Survey Professional Paper 1028, p. 71-89.

Microfossils (calcareous nannoplankton, dinoflagellates, forminifers, ostracodes, and sporomorphs) and mollusks have been used to date the sedimentary part of a 2,599 foot core from a test hole (Clubhouse Crossroads corehole 1) drilled 25 miles west-northwest of Charleston, south Carolina. The sedimentary section is 2,462 feet thick and is of Late Cretaceous and (except for a few meters of probable Pleistocene) early Tertiary age. The drillhole bottomed in amygdaloidal basalt of Cretaceous (?) age.

Heller, P.L., Wentworth, C.M., and Poag, C.W., 1982, Episodic post-rift subsidence of the United States Atlantic continental margin: Geological Society of America Bulletin, v. 93, no. 5, p. 379-390.

The Atlantic margin of North America is generally thought to have subsided regularly as a result of cooling and sediment loading. However, sediment thickness, paleobathymetry, and chronostratigraphy from COST wells offshore from Georgia and New Jersey indicate periods of rapid subsidence in the Cretaceous and Tertiary. Because no global sea level change can account for all residual movements, it is proposed that tectonism, variously amplified by loading, is responsible for the observed episodes of rapid subsidence.

Heron, S.D., 1959, A small basement cored anticlinal warp in the basal Cretaceous sediments near Cheraw, South Carolina: South Carolina Division of Geology, Geology Notes, v. 3, no. 4, p. 1-4.

The origin of the warping is not clear, and several hypotheses have been considered: 1) a tectonic origin for the structure is unlikely as there is no evidence of Cretaceous or post-Cretaceous tectonic activity in the region, 2) a sedimentary origin is not possible, 3) differential compaction is possible, 4) the most logical hypothesis is that the structure is due to solution of the calceum carbonate$_3$ component of the argillite.

Heron, S.D., Jr., 1962, Limestone resources of the Coastal Plain of South Carolina: Division of Geology Bulletin 28, 128 p.

There are five Coastal Plain geologic formations in South Carolina that contain appreciable quantities of calcium carbonate. Of these, the Santee Limestone of Eocene age has the highest potential as a source of high grade calcium carbonate suitable for industrial and chemical uses.

Herrick, S.M., 1961, Well logs of the Coastal Plain of Georgia: Georgia Geologic Survey Bulletin 70, 462 p.

Detailed listing of the geologic well logs from the Georgia Coastal Plain.

Herrick, S.M., 1964, Upper Eocene smaller foraminifera from Shell Bluff and Griffin Landings, Burke County, Georgia: U.S. Geological Survey Professional Paper 501-C, p. C64-C65.

Identification of microfossils from equivalent zones at Shell Bluff Landing and Griffin Landings Georgia reveals lithologic and microfaunal differences that are explained through normal facies change. The foraminifera are of late Eocene age and indicate that the fossil-bearing stratum correlates with the Moodys Branch Formation of Mississippi and Alabama and the lower Barrwell Formation of Georgia.

Herrick, S.M. and Counts, H.I., 1968, Late Tertiary stratigraphy of eastern Georgia: Guidebook for Third Annual Field Trip: Georgia Geological Society, 88 p.

Formational overlap and interformational facies change are considered to be chiefly responsible for rather profound stratigraphic and lithologic changes in Tertiary deposits in updip areas of eastern Georgia. The principal stratigraphic changes resulting from overlap include: 1) overlap of Paleocene and early Eocene deposits by the McBean Formation of

middle Eocene age, 2) overlap of the McBean Formation by the Barnwell Formation of late Eocene age, 3) overlap of the Barnwell Formation and Ocala Limestone by geologically younger deposits of Oligocene age.

One striking result of such overlap is that geologically younger deposits are found resting upon progressively older strata. The McBean Formation rests upon the Tuscaloosa Formation of Late Cretaceous age. The Barnwell Formation, as well as beds of Oligocene age, rests upon the Tuscaloosa Formation and, in places, upon the much older basement complex.

Herrick, S.M., and Vorhis, R.C., 1963, Subsurface geology of the Georgia Coastal Plain: Georgia Geological Survey Information Circular 25, 78 p.

Data from 354 lithologic-paleontologic logs was used to restudy the subsurface geology of the Georgia Coastal Plain. Two contrasting areas of deposition are described: An updip area of clastics and a downdip area of limestones. Several reinterpretations of stratigraphy were made. The Cooper Marl and the Barnwell Formation are the updip equivalents of the Ocala Limestone. The Lisbon and Tallahata Formations are updip equivalents of the Avon Park Limestone and Lake City Limestone, respectively, of Florida.

Howell, D.E., and Zupan, A.W., 1974, Evidence for post-Cretaceous tectonic activity in the Westfield Creek area north of Cheraw, South Carolina: South Carolina Geologic Notes, v. 18, no. 4, p. 98-105.

Post-Cretaceous faulting and folding of Carolina Slate Belt argillites and Late Cretaceous sediments of the Middendorf Formation are well exposed in two roadcuts along Westfield Creek, northwest of Cheraw, South Carolina. The only known tectonic activity during post-Cretaceous time in the region is that of the uplifting Cape Fear arch. These faults and folds located on the southern limb of the Cape Fear Arch, could, therefore, be related to the crustal shortening creating the arch during the Tertiary period.

Huddlestun, P.F., 1981, Correlation chart, Georgia Coastal Plain: Georgia Geologic Survey Open-File Report 82-1.

Stratigraphic column for Burke, Richmond, and northern Screven Counties does not show the Tuscaloosa Formation. The only Cretaceous rock found in the stratigraphic column is an undifferentiated member of the Oconee Group. The Barnwell Group is divided into a number of formations and members. The stratigraphic columns in the correlation chart are based on approximately 110 cores logged and examined by the author, in addition to cuttings from selected oil and water wells and numerous geophysical logs.

Huddlestun, P.F., and Hetrick, J.H., 1978, Stratigraphy of the Tobacco Road Sand - A new formation: Georgia Geologic Survey Bulletin 93, p. 56-77.

The Tobacco Road Sand is a belt of coastal marine sands of late Eocene age. This belt of coastal sands of probable sound or lagoon origin lies parallel to the Fall Line in eastern Georgia. It grades downdip to the south into carbonate facies.

Huddlestun, P.F., and Hetrick, J.H., 1979, The stratigraphy of the Barnwell Group of Georgia: Georgia Geologic Survey Open-File Report 80-1, 89 p.

This redefinition of the upper Eocene deposits of central and eastern Georgia raises the Barnwell to group ranking and recognizes three formations within the Barnwell Group. In ascending order these are, the Clinchfield Formation, the Dry Branch Formation (new), and the Tobacco Road Sand. The Clinchfield Formation has four members, the Dry Branch Formation has three members, and the Tobacco Road Sand has one.

Humphreys, B., and Hughes, D.J., 1974, Development of alluvial stream channels: A five-stage model: Discussion: Geological Society of America Bulletin, v. 85, no. 1, p. 149.

A short discussion of Keller's five-stage model for the development of alluvial stream channels. Uses an open-system point of view rather than a closed-system point of view as Keller used in his model. This removes the need to trace the system back to a starting point and also the need to adjust the conceptualized processes through the sequential stages.

Hurst, V.J., and Sandy, J., 1964, Marl in Burke County, Georgia: Interim Report No. 1, Geology Department, University of Georgia, 42 p.

The Burke County marl varies in thickness, but is a persistent layer underlying most of the county except the extreme northwestern portion. A thickness of more than 50 feet is common. The marl consists of alternating layers of calcareous sand, marl, and coarse-fossil oyster shells embedded in calcareous sand.

Inden, R.F., and Zupan, A.W., 1975, Normal faulting of upper coastal plain sediments, Ideal Kaolin Mine, Langley, South Carolina: South Carolina Division of Geology Geologic Notes v. 19, no. 4, p. 159-165.

Normal faulting created a small graben at the Ideal kaolin mine in Langley, South Carolina. Orientation of the west-bounding fault is N30°W, 68°E and of the east-bounding fault is N40°W, 75°W.

Jacobeen, F.H., 1972, Seismic evidence for high angle reverse faulting in the Coastal Plain of Prince George and Charles Counties, Maryland: Maryland Geological Survey Information Circular No. 13, 21 p.

The Brandywine fault system is divided into two en echelon faults. Both extend beyond and are increasing in throw toward the limits of the study area. Maximum throw seen on the southern fault, the Danville fault, is over 250 feet at the top of the granite and top of the Lower Cretaceous Arundel Formation. Throw on the northern fault, the Cheltenham fault, is about 100 feet.

Although stream anomalies and lineaments are clues to the location of buried faults, recent drilling has shown that no rupture reaches the surface; rather, the fault displacement is absorbed upward and only folding occurs in the Tertiary sediments.

Johnston, R.H., Healy, H.G., and Hayes, L.R., 1981, Potentiometric surface of the Tertiary limestone aquifer system, southeastern United States, May 1980: U.S. Geological Survey Open-File Report 81-486.

Map covers Florida, the southern two-thirds of Georgia and South Carolina, and the southern half of Alabama. The aquifer system includes units of Paleocene to early Miocene age that combine to form a continuous carbonate sequence that is hydraulically connected in varying degrees. The contours do not cross the Millett fault study area.

Johnston, R.H., Krause, R.E., Meyer, F.W., Ryder, P.D., Tibbals, C.H., and Hunn, J.D., 1980, Estimated potentiometric surface for the Tertiary limestone aquifer system, southeastern United States, prior to development: U.S. Geological Survey Open-File Report 80-406.

Map covers Georgia, Florida, South Carolina, and the southern half of Alabama. The upper water-bearing units occur in limestones and dolomites within several formations principally the Tampa, Suwannee, Ocala, and Avon Park Limestones. In coastal Georgia and adjacent South Carolina the configuration of the potentiometric surface is essentially unchanged from Warren's generalized map.

Kay, M. 1958, North American geosynclines: Geological Society of America Memoir 48, 143 p.

Early Paleozoic North America had a rather stable center (craton) margined by deeper sinking belts (miogeosynclines) that initally received carbonate rocks, and quartz sands from the interior; neither area had appreciable volcanism. The

continental borders have distinctive volcanic flows and fragmentals, which with associated sediments show deep subsidence (eugeosynclines) and development of associated tectonic welts. Lands raised in the eugeosynclinal belts yielded sediments to the adjoining miogeosynclines; with deformation of the latter, terrigenous detritus spread into subsiding areas in the margin of the craton. The craton periodically gained basin or trough-shaped depressions isolated from highland source areas or receiving debris from associated intracratonal elevations.

Kean, A.E., and Long, L.T., 1980, A seismic refraction line along the axis of the southern Piedmont and crustal thicknesses in the southeastern United States: Earthquake Notes, v. 51, no. 4, p. 3-13.

In order to evaluate Moho depths, a detailed refraction line and crustal model were developed along the axis of the southern Piedmont Province from central Georgia across South Carolina. No evidence for an intermediate layer in the crust was observed. In the coastal plain, Moho depths of 25 miles shallow toward the southeast to 18 miles near the coast. Moho depths of 32 to 34 miles were measured for the mountains of north Georgia, eastern Tennessee and western North Carolina.

Keller, E.A., 1972, Development of alluvial stream channels: A five-stage model: Geological Society of American Bulletin, v. 83, no. 5, p. 1531-1536.

A five-stage model is proposed to explain the development of alluvial channels. The model is based upon channel morphology, channel morphometry, and qualitative conclusions based on numerous field observations.

Kesler, T.L., 1957, Environment and origin of the Cretaceous kaolin deposits of Georgia and South Carolina: Georgia Mineralogical Newsletter, v. 10, no. 1, p. 541-545.

Unsorted sands containing little gravel and much diseminated kaolin constitute the Upper Cretaceous section from central Georgia at least to central South Carolina. Lenses of relatively pure kaolin occur largely in two areas. A gentle unconformity separates the Cretaceous beds from overlying Tertiary beds. Kaolinite was formed by decomposition of the detrital feldspar in exposed parts of the deltas.

King, P.B., 1977, The Evolution of North America: Princeton, Princeton University Press, 197 p.

A detailed discussion of the geologic history of North America, including plate tectonics. Very short section on the Atlantic Coastal Plain.

Klein, G. De V., 1969, Deposition of Triassic sedimentary rocks in separate basins, eastern North America: Geological Society of America, Bulletin v. 80, no. 9, p. 1825-1832.

The Triassic basins of the Atlantic Coastal Plain were originally assumed to be fault-bounded troughs similar to those found in the recent troughs in the Basin-and-Range Province. This model assumes the coincidence of physiographic boundaries with structural boundaries. In the Dead Sea graben the basin boundary faults coincide with both the deepest portion of the Dead Sea on the west and a fault scarp on the right. A similar facies model may explain the regional facies distribution of each isolated Triassic basin.

Krapp, C.W., and Stephenson, D.E., 1978, SRP seismograph network operations August 6, 1976 to August 31, 1977: in Crawford, T.V., ed., Savannah River Laboratory Environmental Transport and Effects Research Annual Report-1977, E.I. duPont de Nemours and Company, Report DP-1489, p. 73-79.

Three stations (SRFD, SRPN, SRPW) make up the seismographic network at the Savannah River Plant. In one year of nearly continuous operation 25 local earthquakes and more than 100 teleseisms have been recorded.

Krause, R.E., and Hayes, L.R., 1981, Potentiometric surface of the principal artesian aquifer in Georgia, May 1980: Georgia Geologic Survey Hydrologic Atlas 6.

Map covers the coastal plain of Georgia and shows roughly the same trends in potentiometric surface as U.S. Geological Survey Open-File Report 81-486. The axis of the Gulf Trough is indicated. Potentiometric contours do not cross the Millett fault study area.

La Moreaux, P.E., 1946a, Geology of the Coastal Plain of east-central Georgia: Georgia Geologic Survey Bulletin 50, p. 1-25.

The oldest rocks exposed in east-central Georgia are the metamorphic and igneous rocks of probable Precambrian age, which are present in the Piedmont. The Tuscaloosa Formation of Upper Cretaceous age lies unconformably on the peneplaned crystalline rocks and crops out in a discontinuous belt from two to eight miles wide along the northern margin of the coastal plain. Throughout most of east-central Georgia the Tuscaloosa Formation is overlapped by deposits of upper Eocene age because rocks of Paleocene and early and middle Eocene age are not present in much of the area. During late Eocene time, approximately 150 to 200 feet of sand, clay, marl, and limestone were deposited in a shallow marine sea. These upper

Eocene deposits which lie uncomformably on the Tuscaloosa Formation are represented by the Barnwell Formation, which contains the Twiggs Clay Member, Irwinton Sand Member, and a possible thin coarse sand bed with flat polished beach pebbles, tentatively included as the Upper Sand Member, although the latter may prove to be of Oligocene age. Undifferentiated deposits of Miocene and Oligocene age lie unconformably on the Eocene deposits.

La Moreaux, P.E., 1946b, Geology and ground water resources of the Coastal Plain of east central Georgia: Geologic Geologic Survey Bulletin 52, 173 p.

The area covered includes a major part of the kaolin mining district in Georgia. The oldest rocks in the area are metamorphic and igneous rocks of Precambrian age. Rocks of Paleocene, and lower and middle Eocene are not present in the area. The Tuscaloosa Formation is the best source of ground water.

LeGrand, H.E., 1961, Summary of geology of Atlantic Coastal Plain: Bulletin of the American Association of Petroleum Geologists, v. 45, no. 9, p. 1557-1571.

Some noteworthy features of the Atlantic Coastal Plain include:

1. In comparison with the Gulf Coast, the volume of sediments beneath the emerged part of the Atlantic Coastal Plain is not large. The volume of Cretaceous sediments is several times that of Cenozoic sediments.

2. Almost all sediments north of North Carolina are sand and clay and are unconsolidated; southward, Tertiary limestone beds represent the only significant quantity of consolidated beds shallower than 2,000 feet. Permeability of artesian aquifers decreases at great depth.

3. Fresh water extends to a depth of several hundred feet in the mid-section of the coastal plain, but extends to shallower depths in coastal areas. The bulk of sediments contain salt water.

4. Some sedimentary features include: a) basal Cretaceous clastics that make correlations difficult, b) the scarcity of calcareous material north of North Carolina, c) the large amount of glauconite deposited from the Late Cretaceous through the middle of the Eocene, north of Cape Fear Arch, d) the tendency toward downdip thickening, resulting in subsurface occurrence of beds having no surface equivalents.

LeGrand, H.E., and Furcron, A.S., 1956, Geology and ground water resources of central-east Georgia: Georgia Geologic Survey Bulletin 64, 174 p.

This report covers an area along the Savannah River which includes both the Piedmont and Coastal Plain Provinces. Includes Burke, Jefferson and Richmond Counties. The Tuscaloosa Formation yields as much as 1,000 gallons per minute.

LeGrand, H.E., and Pettyjohn, W.A., 1981, Regional hydrogeologic concepts of homoclinal flanks: Ground water, v. 19, no. 3, p. 303-310.

The Savannah River increases in discharge as it crosses a number of aquifers that are sandwiched between confining beds. Detailed hydrogeologic work would surely indicate that several aquifers are crossed by the river, but two major water-bearing zones are known. The upper one, consisting of limestone of Tertiary age that represents the principal artesian aquifer in Georgia, is crossed by the Savannah River along most of the river's course through Screven County. The other major aquifer system is the Cretaceous sand aquifer.

The potentiometric map of the Cretaceous sand aquifer shows three contours that point downstream, indicating a water-losing stretch. Using a transmissivity of 200,000 gallons per day per foot it has been estimated that about 2.8 million gallons per day discharges through each 1-mile-long strip of the aquifer at the 160-foot contour line.

LeGrand, H.E., and Stringfield, V.T., 1971, Differential erosion of carbonate-rock terranes: Southeastern Geology, v. 13, no. 1, p. 1-17.

Relief in carbonate-rock terranes may be local and small as expressed by many shallow sinkholes, or large as expressed by escarpments. In addition to relief within the karst terrane, there is commonly significant relief between a belt of carbonate rocks and an adjacent belt of noncarbonate rocks. Differential erosion results from a combination of physical and chemical processes. Erosion in carbonate terranes is favorable under moderate rather than under extreme conditions of cover, purity of the carbonate rock, topographic relief, and precipitation.

Leopold, L.B., and Langbein, W.B., 1966, River meanders: Scientific American, v. 214, no. 6, p. 60-70.

This paper discusses the formation of river meanders, which appear to be the form in which the river does the least work in turning.

Leopold, L.B., Wolman, M.G., and Miller, J.P., 1964, Fluvial processes in geomorphology: San Franciso, W.H. Freeman and Company, 522 p.

General geomorphology text containing a detailed discussion of fluvial landforms.

Lewin, J., 1976, Initiation of bed forms and meanders in coarse-grained sediment: Geological Society of America Bulletin, v. 87, no. 2, p. 281-285.

In a straight plane-bed channel in coarse sediment under natural flow conditions, primary transverse bars were rapidly formed during infrequent high flows,and the accompanying flow modifications led to bank erosion. Primary bars were subsequently incorporated as the cores of point-bar complexes, with additional lateral and trail accretion, chute formation, and lesser erosional and sedimentary modifications. A three-stage model of meander development is found to be adequate for describing this process.

Lewis, S.R., 1974, Significance of the vertical and lateral changes in the clay mineralogy of the Dunbarton Triassic Basin: University of North Carolina, M.S. thesis, 34 p.

Because of the differences in depth at which comparable reactions occurred in the two wells studied, a major fault is postulated as having occurred between the two wells with a theoretical displacement of 4,000 feet. Uplift and subsequent erosion of from 6,000 to 10,000 feet of sediment has occurred after Triassic but before Upper Cretaceous time in order for the sections in DRB 10 and DRB 11 to be present at the top of the basin.

Liddicoat, J.C., and Opdyke, N.D., 1979, Paleomagnetic dating of late Neogene deposits in the Atlantic Coastal Plain with application to dating tectonic deformation in the southeastern United States: Final Technical Report to the U.S. Geological Survey, Contract No. USGS-14-08-0001-17721, 18 p.

Upper Tertiary and Quaternary marine deposits in the Atlantic Coastal Plain of Virginia, North Carolina, and South Carolina were studied and correlated by using magnetostratigraphy and biostratigraphy. The geochronology resulting from these integrated paleomagnetic and biostratigraphic investigations has application to a wide variety of geological studies in the Atlantic Coastal Plain, including interpretation of tectonic activity, dating of sea level fluctuations, and correlation of the onshore record with the deep sea record and a global time scale.

Lindholm, R.C., 1979, Geologic history and stratigraphy of the Triassic-Jurassic Culpeper Basin, Virgina: Summary: Geological Society of America Bulletin, Part I, v. 90, no. 11, p. 995-997.

The Culpeper Basin, in northern Virginia, is but one of many such basins in North America where sedimentation extended from Late Triassic to Early Jurassic time. Red beds deposited on broad alluvial plains dominate in most of these basins. The sequence in the Culpeper Basin begins with coarse clastic rocks at the base, passing upward into fine-grained clastic rocks.

Long, L.T., 1979, The Carolina Slate Belt - evidence of a continental rift zone: Geology, v. 7, no. 4, p. 180-184.

The Carolina Slate Belt in Georgia and South Carolina may delineate the axis of a continental rift or rift system and may represent remnants of rift-derived volcanic and sedimentary rocks. The proposed rift zone is interpreted mainly from crystal thicknesses and velocities obtained from gravity and seismic data. The rift developed from late Precambrian through Cambrian time (650 to 520 m.y. B.P.), as determined from radiometric age dates.

Long, L., 1981, Microearthquake instrumentation and analysis between Hartwell and Clark Hill Reservoir Areas, Annual Report No. 1: Project No. G-35-661, School of Geophysical Sciences, Georgia Institute of Technology.

The objective of the microearthquake instrumentation and the analysis of data on events occurring between the Hartwell and Clark Hill Reservoir Areas is to document the seismicity prior to, during, and after impoundment of the Richard B. Russell Lake. This first report covers the installation of the seismic monitoring system and the analysis of the data obtained by the seismic monitoring system through January 31, 1981.

Long, L.T., 1982, Seismicity in Georgia: in Arden, D.D., Beck, B.F., and Morrow, E., ed., Second Symposium on the Geology of the Southeastern Coastal Plain, p. 202-210.

Earthquakes in Georgia occur in the Coastal Plain, central Piedmont and folded Appalachian provinces. Six earthquakes are known to have occurred in the Georgia Coastal Plain. The seismic activity in the central piedmont occurs in a zone which extends northeast from central Georgia into South Carolina. Eight events have been felt in central Georgia and two near the South Carolina border in the central piedmont. The folded Appalachians of northwest Georgia have experienced

three events from within Georgia and others from adjacent areas of Alabama and Tennessee. No geologic fault in Georgia has been found to be associated with seismic activity. Large geologic faults can be found throughout Georgia, but they are considered inactive.

Long, L.T., and Champion, J.W., 1977, Bouguer gravity map of the Summerville-Charleston, South Carolina, epicentral zone and tectonic implications: in Rankin, D.W., ed., Studies related to the Charleston, South Carolina earthquake of 1886-A preliminary report: U.S. Geological Survey Professional Paper 1028, p. 151-166.

A new Bouguer anomaly map of the Summerville-Charleston, South Carolina, epicentral zone is interpreted to reveal a mafic intrusive body and associated flows, and a northeast-trending Triassic(?) basin. Two shallow structures interpreted from the gravity data and associated with the Triassic(?) basin may be significant in determining the mechanism for the 1886 Charleston earthquake. The first is a border fault on the northwest side of the basin striking N45°E, and the second is a linear positive anomaly striking east. The first structure suggests the more conventional earthquake mechanism of reactivation of a basement fault. The second structure suggests a newly proposed mechanism of stress amplification in the anomalously rigid structure responsible for the linear positive anomaly. Intensity data from the August 31, 1886, Charleston earthquake and epicenters of recent events favor stress amplification as the more likely explanation for earthquake activity in the Summerville-Charleston epicentral zone.

Madeley, H.M., 1972, Petrology of the Tuscaloosa Formation in west-central Georgia: Ohio State University, M.S. thesis, 93 p.

This study had two objectives. The primary objective was to determine the environment of deposition of the Tuscaloosa Formation where it is exposed in west-central Georgia.

In this area, the Tuscaloosa Formation unconformably overlies granite, diorite, gneiss, and schist of the Georgia Piedmont. These same rock types are exposed north of the study area and are presumed to be similar to the rock types present there when the Tuscaloosa Formation was being deposited. A secondary objective of the study was to determine whether Folk's Empirical Quartz Classification System could profitably be employed in a study of the environment of deposition.

Maher, D.H., 1979, The Belair Belt of South Carolina and Georgia: Stratigraphy and depositional regime as compared to the Carolina slate belt: Geological Society of America (abs.), v. 11, no. 4, p. 184.

It is probable that the Carolina Slate Belt and the Belair Belt are depositionally correlative as part of an island-arc sequence.

Manspeizer, W., Puffer, J.H., and Cousminer, H.L., 1978, Separation of Morocco and eastern North American: A Triassic-Liassic stratigraphic record: Geological Society of America Bulletin, v. 89, no. 6, p. 901-920.

Events leading to the separation of Africa and North America, and the subsequent spreading of the North Atlantic sea floor, are documented in rocks of Late Triassic to Early Jurassic age in eastern North America and Morocco. This paper presents new stratigraphic and geochemical data on the lower Mesozoic rocks of Morocco and establishes stratigraphic datums for trans-Atlantic correlations. These data are used to infer the sequence of events that led to the rifting of Pangaea and the subsequent spreading of the North Atlantic sea floor.

Marine, I.W., 1967, The permeability of fractured crystalline rock at the Savannah River Plant near Aiken, South Carolina: U.S. Geological Survey Professional Paper 575-B, p. B203-B211.

The apparent permeability of finely fractured crystalline rock beneath the coastal plain sediments at the Savannah River Plant is estimated from swabbing tests to average about 0.0003 gallon per day per square foot. The apparent permeability of zones of more open fractures is estimated from pumping tests to average about one gallon per day per square foot.

Marine, I.W., 1973, Geohydrology of the buried Triassic basin at the Savannah River Plant: Unpublished report presented at the International Symposium on Underground Waste Management and Artificial Recharge at New Orleans, Louisana, September 26-30, 1973, 20 p.

The Dunbarton Basin is 31 miles by 6 miles, and is 5,300 feet thick. The permeability of the mudstone is low, with water-transmitting fractures virtually nonexistent. Reflection seismic surveys show a sharp northwest boundary but do not indicate termination of the Triassic rocks where the southeast border was inferred from the aeromagnetic map. With scattered discontinuities (inferred faults) the contact of coastal plain beds and Triassic rocks could be followed by reflection. The contact of Triassic and basement rock could not be detected. Evidence from drill holes P12R and DRB 11 show that the inferred fault between them has not moved in 100 million years. The general trend in coastal plain sediments due to tectonic tension has been indicated by downwarping.

Marine, I.W., 1976a, Structural model of the buried Dunbarton Triassic Basin in South Carolina and Georgia, Geological Society of America, (abs.), v. 8, no. 2, p. 225.

Seismic reflection surveys and model interpretation of gravity-magnetic surveys in the Dunbarton Triassic Basin apparently indicated that the basin consists of fault blocks of different thicknesses and displacements. Drilling, however showed that apparent displacement on the top of the Triassic was caused by a masking of the reflection from the top of the Triassic. No fault displacement has occurred on the top of the Triassic since about 100 million years ago. Drilling information did not confirm or deny the displacement of the bottom of the Triassic.

Marine, I.W., 1976b, Structural and sedimentational model of the buried Dunbarton Basin, South Carolina and Georgia: Unpublished report presented at the 1976 Annual meeting of the Geological Society of America, Southeastern Section.

No fault displacement has occurred since the development of the erosional surface on the top of the Triassic rock about 100 million years ago. Prior to intrabasinal faulting, while the basin was filling, a highland existed to the northwest and was separated by a border fault, similar to those found in the Basin and Range Province. Two exploration wells, one on either side of an inferred intrabasinal fault show no displacement of the surface, casting some doubt on the validity of the other inferred faults. The Dunbarton Basin may be wider than the 10 kilometers as previously reported (Marine and Siple, 1974). The other intrabasinal faults inferred from the seismic data were also initially based on the displacement of the Triassic rock surface. They may also be caused by lensing of the masking reflector.

Marine, I.W., 1979a, Hydrology of buried crystalline rocks at the Savannah River Plant near Aiken, South Carolina: U.S. Department of Energy DOE/SR-WM-79-2, 220 p.

This Triassic basin may have faults at both borders, but the fault on the southeast may have a greater displacement causing the bottom of the basin to slope southeastward.

All of the Triassic basins are bounded on one or both sides by large normal fault zones. Within the basins, normal faults are also common. There is no evidence of any compressional episodes in the form of metamorphism or intense folding since the deposition of the sediments.

The reddish brown pre-Tuscaloosa rocks encountered in wells P5R and DRB 9 are identified as Triassic on the basis of their lithologic composition, as no fossils were recovered from either well. The stratigraphic and structural position of

this body of rock as inferred from magnetic and seismic information also correlates well with a Triassic age assignment. Whereas definition of the boundaries are inexact, the steep magnetic gradient on the southeast, probably indicating a large normal fault, permits a more accurate placement of this boundary than the gentle and somewhat irregular magnetic gradient allows for the boundary on the northwest.

Marine, I.W., 1979b, The use of naturally occurring helium to estimate ground water velocities for studies of geologic storage of radioactive waste: Water Resources Research v. 15, no. 5, p. 1130-1136.

In a study assessing the potential for storing radioactive waste in metamorphic rock at the Savannah River Plant, the rate of water movement was determined to be about 0.19 ft/yr by analyzing gas dissolved in the water. This water velocity is more applicable to the assessment of a geologic site for storage of radioactive waste than are velocities estimated from packer tests, pumping tests, or artificial tracer tests.

Marine, I.W., and Fritz, S.J., 1981, Osmotic model to explain anomalous hydraulic heads: Water Resources Research, v. 17, no. 1, p. 73-82.

In the Dunbarton Basin it is suspected that osmosis causes the saline water in the basin center to be slightly geopressurized in relation to freshwater in the overlying coastal plain aquifer. Wells penetrating the top and edge of the Triassic basin probably penetrate a zone where ion leakage gives rise to less saline water.

Marine, I.W. and Krapp, C.W., 1976, Simulated seepage basin flow studies with soil-filled columns, in Crawford, T.V., Ed., Savannah River Laboratory Environmental Transport and Effects Research, Annual Report - FY 1975: U.S. Energy Resources Development Agency, DP-1412, p. 22-1 to 22-4.

During 1974, the fluid level in H Area Seepage Basin Number 4 began to rise while inflow remained approximately constant indicating a decrease in seepage rate. To elucidate the causes and possible remedies for this undesirable situation, a series of soil column experiments were conducted using seepage basin soil and a variety of fluids.

Marine, I. W., and Root, R.W., 1978, Geohydrology of deposits of Claiborne age at the Savannah River Plant: in Crawford, T.V., ed., Savannah River Laboratory Environmental Transport and Effects Research Annual Report - 1977: U.S. Energy Resources Development Agency, DP-1489, p. 57-59.

In U.S. Geological Survey Bulletin 867 (1936) Cooke considered all deposits of Claiborne age in the South Carolina Coastal Plain to belong to the McBean Formation. In 1952, Cooke and

MacNeil raised the lower part of the deposits of Claiborne to formational status and called them the Congaree Formation and the Warley Hill Marl. The Congaree Formation is a relatively high yielding aquifer; second only to the Tuscaloosa Formation in this area. It is probable that much of the water produced by high yielding wells (3,592 m^3/day; 660 gpm) reported to be pumping from the McBean Formation actually comes from the Congaree Formation.

Marine, I.W., and Root, R.W., Jr., 1976, Summary of hydraulic conductivity tests in the SRP separations areas, in Crawford, T.V., ed., Savannah River Laboratory Environmental Transport and Effects Research, Annual Report - FY 1975: U.S. Energy Resources Development Agency, DP-1412, p. 21-1 to 21-4.

In preparation for mathematically modeling the movement of water in the separations areas at the Savannah River Plant (SRP), hydraulic conductivities were calculated from existing data. This data was collected from laboratory tests of cores, pumping tests, water injection tests, injection-detection tracer tests, and point dilution tracer tests.

Marine, I.W. and Routt, K.R., 1975, A ground water model of the Tuscaloosa aquifer at the Savannah River Plant, in Crawford, T.V., ed., Savannah River Laboratory Environmental Transport and Effects Research, Annual Report - 1974: U.S. Energy Resources Development Agency, DP-1374, p. 14-1 to 14-10.

In areas of the South Carolina Coastal Plain within about 25 miles of the Fall Line, sand beds in the Tuscaloosa Formation form one of the major ground water supplies. Due to several additional planned ground water withdrawals from the Tuscaloosa Formation in the vicinity of SRP, a computer model of the Tuscaloosa aquifer was developed from existing information to obtain an estimate of the water flux through the system.

Marine, I.W., and Siple, G.E., 1974, Buried Triassic basin in the central Savannah River area, South Carolina and Georgia: Geological Society of America, Bulletin v. 85, no. 2, p. 311-320.

A basin filled with Triassic red beds, located on the South Carolina-Georgia line 20 miles southeast of Augusta, Georgia, is buried beneath 1,100 feet of Coastal Plain sediments. An extensive aeromagnetic survey, seismic refraction and reflection surveys, and geophysical logs and samples from three wells define the extent and character of the basin. This basin, herein named the Dunbarton Triassic Basin, is 31 miles long, six miles wide, and trends northeast.

The northwest margin of the basin is well defined by the aeromagnetic survey, a seismic reflection traverse, and a well that passed through 1,600 feet of Triassic fanglomerate before entering the crystalline metamorphic rocks below. Near the center of the Triassic basin, a well passed through 3,900 feet of maroon Triassic mudstone and sandstone of fluvial origin without penetrating the bottom of the basin.

Marsalis, W.E., 1970, Petroleum exploration in Georgia: Georgia Geologic Survey Information Circular 38, 52 p.

This information circular describes the oil and gas tests drilled in Georgia from 1903 through 1970. Most of the data has been compiled from the files of the Department of Mines, Mining and Geology, and from Geological Survey of Georgia Bulletin 70.

Marsalis, W.E., and Fridell, M.S., 1975, A guide to selected Upper Cretaceous and lower Tertiary outcrops in the lower Chattahoochee River valley of Georgia: Georgia Geological Society Guidebook 15, 79 p.

The Chattahoochee River valley has excellent exposures of formations ranging in age from Late Cretaceous to middle Eocene. The geology is complicated by solution, overlap, and facies changes along strike and downdip, and also by cyclic deposits of Cretaceous age.

Mayer, P.G., and Platt, R.B., 1971, The impact of BNFP's operation of ground water resources: Unpublished report No. EMP-102, 66 p.

A comprehensive investigation of the quantitative and qualitative aspects of ground water in the BNFP area.

Mayer, P.G., 1972a, Report of Emergency Cooling in Beacon Pond: Unpublished report No. EMP-103, 18 p.

An analysis of the effect of power failures on water temperatures in Beacon Pond.

Mayer, P.G., 1972b, Impact of BNFP's pumpage from the Tuscaloosa aquifer on the ground water table: Unpublished report number EMP-104, prepared for Allied-Gulf Nuclear Services, v. III, page 6: Report on file at U.S. Geological Survey Doraville, Georgia 30360.

Adverse effects of pumpage from the Tuscaloosa on the water supply systems in the area were not observed. Pumpage from the Tuscaloosa aquifer did not result in any drawdown of the upper water table. The report concludes that the Tuscaloosa aquifer is safe from inflow of radionuclide-contaminated water that might be introduced accidentally into the upper table at BNFP.

Mayer, P.G., 1973a, The Hydrology of the Barnwell Nuclear Fuel Plant area: Unpublished report No. EMP-106, 65 p.

This is a detailed hydrologic study of the Barnwell Nuclear Fuel Plant including a hydrologic study of the Barnwell Nuclear Fuel Plant including a hydrologic description of the site and facilities, as well as environmental hazards (flooding, dam failure, tsunami).

Mayer, P.G., 1973b, The hydrologic studies at Allied-Gulf's Barnwell Plant: Unpublished report no. EMP-110, 14 p.

A report of hydrologic studies presented to the Advisory Committee on Reactor Safeguards. The studies showed that accidentally introduced radionuclides would produce no hazards. A safe, reliable water supply is available from wells in the Tuscaloosa aquifer, and withdrawal from the Tuscaloosa aquifer will have little effect on piezometric levels in existing deep wells and no effect on wells in the McBean Formation.

Mayer, P.G., 1974, Letter regarding review comments of AEC on S/F FSAR: Unpublished report no. EMP-118.

Hydrologic engineering review comments on site drainage probable maximum flood potential, the effects of local maximum precipitation on the site drainage systems, and discussion of a runoff model for the Barnwell Nuclear Fuel Plant.

Mayer, P.G., 1975, Letter regarding ground water at Barnwell Nuclear Fuel Plant: Unpublished report no. EMP-127.

Analysis of ground water elevations at the Barnwell Nuclear Fuel Plant and rainfall data from Columbia, South Carolina and Augusta, Georgia.

Mayer, P.G., 1979, Review report on studies related to the Charleston, South Carolina earthquake of 1886, Unpublished report no. EMP-140, 11 p.

A review of studies relating to tectonic activity in the southeastern United States was made. The basis of the review was the U.S. Geological Survey Professional Paper 1028. The review was made to assess the validity of the earthquake design criteria employed in the design of the Barnwell Nuclear Fuel Plant of the Allied-General Nuclear Services, Inc. of Barnwell, South Carolina. In the light of the present review, the earthquake design criteria employed at BNFP appear satisfactory.

McKee, E.D. and others, 1959, Paleotectonic maps Triassic system: U.S. Geological Survey Miscellaneous Geological Investigations Map I-300, 33 p., 9 pls., 32 figs., scale - 1:5,000,000 for pls. 1-6, 8.

Detailed discussions and maps of several fault bounded Triassic basins in the Atlantic Coastal Plain.

Milton, C., and Hurst, V.J., 1965, Subsurface "basement" rocks of Georgia: Georgia Geologic Survey Bulletin 76, 56 p.

This report describes all available specimens of rocks found as bottom cores or cuttings, by drilling below the Cretaceous or younger coastal plain sediments. This report also reviews what is known about buried Triassic rocks in states north of Georgia, and discusses the alteration of sandstones by igneous intrusions within the basins.

Mitchell, G.D., 1980, Potentiometric surface of the principal artesian aquifer in Georgia-November, 1979: Georgia Geologic Survey Hydrologic Atlas 4, 2 sheets.

Map covers the Coastal Plain of Georgia and small parts of Alabama, Florida, and South Carolina. Potentiometric contours differ little from those shown in U.S. Geological Survey Open-File Report 81-486 and Georgia Geologic Survey Hydrologic Atlas 6.

Mixon, R.B., and Newell, W.L., 1977, Stafford fault system: Structures documenting Cretaceous and Tertiary deformation along the Fall Line in northeastern Virginia: Geology, v. 5, no. 7, p. 437-440.

Four en echelon northeast-trending structures, including southeast-dipping monoclines and northwest-dipping, high-angle reverse faults have been mapped along the inner edge of the Coastal Plain. Although displacements are small, the structures have an effect on the present thickness and distribution of coastal plain sediments in the area. Most of the deformation took place in the Cretaceous and middle(?) Tertiary, but more recent movement is possible. Similarities between the Stafford fault system and Brandywine fault system suggest the two may be tectonically related.

Moye, F., 1976, Abstracts of theses on Georgia geology through 1974: Georgia Geologic Survey Bulletin 89, 94 p.

Lists titles and abstracts of theses on the geology of Georgia.

Murray, G.E., 1961, Geology of the Atlantic and Gulf Coastal Provinces of North America: Harper and Brothers, New York, 692 p.

A detailed, somewhat dated (pre-plate tectonics) discussion of the history, structure, stratigraphy and geography of the Atlantic and Gulf Coastal Provinces.

Narasimhan, T.N., Neuman, S.P., and Witherspoon, P.A., 1978, Finite element method for subsurface hydrology using a mixed explicit-implicit scheme: Water Resources Research, v. 14, no. 5, p. 863-877.

The mixed explicit-implicit Galerkin finite element method developed previously by the authors is shown to be ideally suited for a wide class of problems arising in subsurface hydrology. These problems include confined saturated flow, unconfined flow under free surface conditions subject to the Dupuit assumption, flow in aquifers which are partly confined and partly unconfined, axisymmetric flow to a well with storage, and flow in saturated-unsaturated soils. A single computer program, entitled FLUMP, can now handle all of these problems. The mixed explicit-implicit solution strategy employed in the program insures a high level of accuracy and computation efficiency in most cases.

Noble, D.F., 1962, Origin of the expandable clay minerals in the Twiggs Clay of Eocene age: Florida State University, M.S. thesis, 85 p.

The Twiggs Clay Member of the upper Eocene Barnwell Formation crops out along a zone extending from the central part of Houston County, Georgia northeastward to Wrens, Georgia, and probably into South Carolina. This member contains expandable clays of two derivations. One of these, degraded illite, has been derived from muscovite, the other, "true" montmorillonite, from non-micaceous materials. The results indicate that the degree of degradation of muscovite, illite, and contractible expanded clay may be used as a key to the rate of erosion and severity of weathering in the source area.

O'Connor, B.J. and Prowell, D.C., 1976a, Post-Cretaceous faulting along the Belair fault zone near Augusta, Georgia: Geological Society of America (abs.), v. 8, no. 2, p. 236-237.

Detailed outcrop and subsurface investigations have revealed that the Belair fault is a zone of significant early Tertiary faulting. The fault, which thrusts upper Precambrian(?) phyllites over suspected early Tertiary sands and gravels, is well exposed in several locations. Extensive auger and core drilling data show that the fault zone is a series of northeast-trending en echelon breaks, where the eastern fault block has moved up and to the west relative to the western block.

O'Connor, B.J., and Prowell, D.C., 1976b, The geology of the Belair fault zone and basement rocks of the Augusta, Georgia area: Georgia Geologic Society Guidebook 16, p. 21-32.

"Basement" rock of the east-northeast trending Kiokee Belt in the Augusta area consists of high grade gneisses which are intruded by a variety of granites. On the south the Kiokee

Belt is in contact with low grade phyllites and related metavolcanic and metasedimentary rocks of the Belair Belt of the "Little River Series."

The age of the Tuscaloosa Formation is critical because it is the youngest of the coastal plain sediments cut by the Belair fault. Definite correlation is difficult because of a paucity of fossils; palanological studies indicate an age as young as middle Eocene in clays found in eastern Georgia. The unconformity at the base of the Tuscaloosa is important because changes in its elevation are used to locate the Belair fault zone. Bedding of the Tuscaloosa is slightly warped by the fault within about 20 feet of the fault plane. Vertical separation of the unconformity across the zone increases from south to north, and the zone comprises more individual faults in the north. Because of poor exposure, deep weathering, and the lack of a persistent marker horizon, the unconformity at the base of the Eocene sediments is not mapped in detail. Also due to this poor exposure there are no documented faults in the Eocene sediments. The fault zone has been delineated by surface and drilling using the base of the Tuscaloosa as a marker horizon. The eastern block was moving up and tilting southward relative to the western block during faulting. In spite of the uncertainty of radiocarbon dates it is suggested that an age of 1,500 to 2,000 years Before Present is proper for the reworked sediments and thus a minimum age for late movement on the fault. The carbon flakes in the gray lenses were deposited at the same time as the sands of the reworked sediments and that the radiocarbon ages determined are the depositional ages.

The Belair Fault zone has been traced 13 miles by means of detailed surface mapping and extensive drilling It trends north-northeast and has as much as 100 feet of vertical separation of the unconformity at the base of the Tuscaloosa Formation. Surface exposures of the fault at two localities show that the basement phyllites have been thrust westward over coastal plain sediments with at least two episodes of movement; one in the last few thousand years.

Oldham, R.W., 1981, Surface to subsurface geology of eastern Aiken, western Orangeburg, northern Bamberg, and northern Barnwell Counties and structural attitude and occurrence of the Black Mingo Formation in the subsurface between the Santee and Savannah Rivers, South Carolina, University of South Carolina, M.S. thesis, 111 p.

The regional subsurface occurrence, structural attitude, and lithostratigraphy of the Black Mingo Formation have been mapped in the area of the Coastal Plain of South Carolina located between the Santee and Savannah Rivers. Two

subsurface formations are proposed. The Neeses Formation and Bamberg Formation represent shoreward and transitional lithofacies with respect to the seaward Santee Limestone Formation and were deposited during the lower middle Eocene transgression, high stand and regression. A graben is mapped in Jasper and Beaufort Counties as an interpretation for displaced Black Mingo sediments. Faulting may have occurred as early as the Paleocene and as late as the Miocene. A fault is also mapped in north Bamberg County. Displacement is less than 100 feet and the upthrown side is to the east.

Oliver, J., 1977, Recent vertical crustal movements: The eastern United States: Quarterly progress report for period 9/1/76-1/1/77 to U.S. Nuclear Regulatory Commission.

Preliminary results in the Blue Ridge and Piedmont Provinces indicate a regional northeastward tilting of the Blue Ridge belt; and a peak of relative velocity in North Carolina near Asheville, which corresponds to the Blue Ridge escarpment, marking the locus of the Atlantic Gulf drainage divide. These data suggest dynamic uplift of the Blue Ridge-Piedmont geologic boundary in the southern Appalachian orogen. Preliminary results of the first detailed transcontinental profile of vertical crustal movements indicate that movements in the western and eastern United States are similar.

Olsen, P.E., and Galton, P.M., 1977, Triassic-Jurassic tetrapod extinctions: Are they real?: Science, v. 197, no. 4307, p. 983-986.

Terrestrial vertebrate fossils show that part of the Newark Supergroup of the eastern United States, all of the Glen Canyon Group of the southwestern United States, and the Upper Stormberg Group of southern Africa are Early Jurassic. This new correlation demonstrates that the supposed widespread tetrapod extinction at the Triassic-Jurassic boundary is an artifact of spurious correlation.

Ormsby, M.R., 1980, Probability that another intensity X event could occur in the S.E. during a 200 year period: Georgia Institute of Technology, M.S. thesis, 100 p.

Seismic risk computations for the relatively a seismic southeastern United States generally show that Charleston, South Carolina (and the southeast) have considerable potential for earthquake damage. The probability of the southeast sustaining another intensity X earthquake in the 200 year period following the 1886 Charleston, South Carolina has been calculated to be as high as 0.50. One reason for this high risk calculation value is the inclusion of major aftershock sequences. Using an aftershock time window to remove major aftershock sequences reduces the probability of recurrence to 0.12.

Padgett, G.G., 1980, Lithostratigraphy of the Black Mingo Formation in Sumter, Calhoun, and Richland Counties, South Carolina: University of South Carolina, M.S. thesis, 68 p.

The purpose of this study is to extend the investigation of the Black Mingo Formation from type areas in Williamsburg County to Sumter, Calhoun, and Richland Counties. Correlation of geophysical logs and measured outcrops between the Congaree Bluffs and the Lane, South Carolina drill holes and outcrops were made in order to tie previous field work in Lexington County to biostratigraphic studies from Lane and to the type sections of the Black Mingo Formation. An opaline claystone has been correlated within the Black Mingo Formation and interpreted as a marsh/lagoonal sequence of the Williamsburg member. Depositional environments have been interpreted and a transgressive sequence with minor prograding and retrograding sequences within the Williamsburg Member of the Black Mingo Formation are proposed. An upper deltaic sequence underlying the Williamsburg Member is proposed to be within the Black Mingo Formation.

Patterson, S.H., and Buie, B.F., 1974, Field conference on kaolin and fuller's earth, November 14-16, 1974: Georgia Geological Survey, 53 p.

The kaolin deposits in the Macon-Gordon area, Georgia are part of a belt of kaolin deposits extending along the inner edge of the coastal plain from the Aiken district South Carolina, southwestward to the vicinity of Macon.

Patterson, S.H., and Herrick, S.M., 1971, Chattahoochee Anticline, Appalachicola Embayment, Gulf Trough and related structural features, southwestern Georgia, fact or fiction: Georgia Geological Survey Information Circular 41, 16 p.

The original definition of the Chattahoochee Anticline is now known to be incorrect. The Gordon Anticline may exist in the southern part of the area originally thought to have been occupied by the Chattahoochee Anticline.

Some geologists have thought that the Ochlockonee fault of Sever forms the southeast side of the Gulf Trough. There is insufficient evidence to support this conclusion. The Gulf Trough may be a sediment-filled Tertiary strait or marine valley instead of a syncline or graben, and its structure may have been modified by carbonate solution.

Petty, A.J., Petrafeso, F.A., and Moore, F.C., Jr., 1965, Aeromagnetic map of the Savannah River Plant area. South Carolina and Georgia: U.S. Geological Survey Geophysical Investigations Map GP-489. 1 sheet, scale: 1:250,000.

Aeromagnetic survey of the Savannah River Plant and surrounding area. The general outline of the Dunbarton Basin can be inferred.

Pickering, S.M., Jr., 1971, Lithostratigraphy and biostratigraphy of the north-central Georgia Coastal Plain: Georgia Geological Society, Sixth Annual Field Trip.

Field trip guide discussing the lithostratigraphy and biostratigraphy of the Tuscaloosa Formation, Clinchfield Sand, Ocala Limestone, Twiggs Clay, Irwinton Sand, Flint River Formation, McBean Formation, and the upper sands of the Barnwell Formation. Included is a description of the stratigraphy at Georgia Kaolin Co. mine no. 59 B.

Pirkel, W.A., 1981, Geology of the Limestone quadrangle, west-central South Carolina: South Carolina Geology, v. 25, no. 1, p. 21-27.

The Limestone 7.5-minute quadrangle is in the slate belt of west-central South Carolina. Rock units include argillites, felsic metavolcanics, and greenstones. These units occur in bands that trend northeast-southwest. A large granite intrusion is present in the western part of the quadrangle. The slate belt rocks of the area are a part of a regional syncline that trends northeast-southwest.

Poag, C.W., 1982, Biostratigraphy, sea level fluctuations, subsidence rates, and petroleum potential of the Southeast Georgia Embayment: in Arden, D.D., Beck, B.F., and Morrow, E., ed., Second Symposium on the Geology of the Southeastern Coastal Plain, p. 3-9.

The age of sedimentary rocks in the GE-1 well ranges from Early Cretaceous to Pleistocene, and a variety of paleoenvironments are represented (e.g., terrestrial, continental shelf, upper continental slope). Eight major hiatuses represent intervals of erosion and nondeposition and are correlative with low stands of global sea level. Conversely, the deepest water paleoenvironments correspond to high stands of global sea level.

Pollard, L.D. and Vorhis, R.C., 1980, The geohydrology of the Cretaceous aquifer system in Georgia; Georgia Geologic Survey Hydrologic Atlas 3, 5 sheets.

This report delineates aquifers and aquicludes in the Creteceous aquifer system and describes the quality and availability of the water in each of the aquifers. Structure contours cross the Millett fault study area. Potentiometric contours cover only a small southern portion of the Millett fault study area.

Pooser, W.K., 1965, Biostratigraphy of Cenozoic ostracoda from South Carolina: University of Kansas Paleontological Contributions 8, 60 p.

The ostracodes proved to be a reliable means of determining the geologic age of the Cenozoic units, differentiating the strata into readily recognizable biostratigraphic units, and interpreting with a high degree of confidence the environments of deposition for strata as old as Miocene.

Pooley, R.N., 1960, Basement configuration and subsurface geology of eastern Georgia and southern South Carolina as determined by seismic-refraction measurements, University of Wisconsin, M.S. thesis, 47 p.

This thesis supports the presence of the subsurface feature first postulated and named the Yamacraw Uplift as first reported. This structure appears to be of tectonic origin but probably originated before the advent of Cretaceous time since, none of the overlying sediments show evidence of structural derangement.

Popenoe, P., and Zietz, I., 1977, The nature of the geophysical basement beneath the Coastal Plain of South Carolina and northeastern Georgia, in Rankin, D.W., ed., Studies related to the Charleston, South Carolina, earthquake of 1886 - A preliminary report: U.S. Geological Survey Professional Paper 1028, p. 119-137.

Geophysical data delineate two distinctive crustal provinces beneath the Coastal Plain of Georgia and South Carolina. The province adjacent to and east of the Fall Line is a continuation of the Piedmont, composed chiefly of schist and gneiss units, which geologically and geophysically reflect the fabric of the Appalachian orogen. In structure and composition, the basement rocks are similar to those of the Carolina Slate Belt and the Charlotte Belt immediately west of the Fall Line. At least two small Triassic basins are present within the province and are clearly delineated by the magnetic data.

Poppe, B., 1979, Historical survey of U.S. seismograph stations: U.S. Geological Survey Professional Paper 1096, 389 p.

A listing of seismograph stations, including information on operating organizations, instrumentation, and availability of seismograms.

Pressler, E.D., 1947, Geology and occurrence of oil in Florida: American Association of Petroleum Geologists Bulletin, v. 31, no. 10, p. 1851-1862.

This report provides names for several framework features of the Georgia Coastal Plain, among them are the Okeefenokee Embayment, Appalachicola Embayment, and Central Georgia Uplift.

Prowell, D.C., and O'Connor, B.J., 1978, Belair fault zones: Evidence of Tertiary fault displacement in eastern Georgia: Geology, v. 6, no. 11, p. 681-684.

The Belair fault is the first well-documented Cenozoic fault in this region. The southeast fault block has moved up and to the north, having a vertical offset of 100 feet since Late Cretaceous time and 33 feet since the late Eocene. It consists of eight en echelon oblique-slip reverse faults and is at least 15 miles long; lateral displacement of 14 miles is recognized.

Prowell, D.C., O'Connor, B.J., and Rubin, M., 1975, Preliminary evidence for Holocene movement along the Belair fault zone near Augusta, Georgia: U.S. Geological Survey Open File Report 75-680, 8 p.

The unconformity at the base of the Tuscaloosa is the only easily recognized marker horizon offset by the fault. Bedding of the Tuscaloosa is slightly warped by the fault within about 20 feet of the fault plain. Vertical separation of the unconformity across the zone increases from south to north and the zone comprises more individual faults in the north. Holocene faulting is indicated by the structural-stratigraphic relation exposed in a U.S. Geological Survey backhoe trench.

Rainwater, E.H., 1964, Transgressions and regressions in the Gulf Coast Tertiary: Transactions of the Gulf Coast Association and Geologic Society v. 14, p. 217-230.

The thick Tertiary section of the central and western Gulf Coast is composed of alternating sand and shale sequences and is characterized by an alternation of marine and nonmarine strata. It appears that eustatic sea level changes did not cause the advance and retreat of the shoreline, but that tectonics and variation in sediment supply caused the transgressions and regressions in the area of terrigenous clastics.

Randazzo, A.F., and Copeland, R.E., 1976, The geology of the northern portion of the Wadesboro Triassic Basin, North Carolina: Southeastern Geology, v. 17, no. 3, p. 115-138.

Clastic sediments representing alluvial fan and other fluvial deposits have been mapped in the northern portion of the Wadesboro Triassic basin. Complex faulting and fanglomerate deposits occur along the northwestern border of this basin, and a major normal fault forms the southeastern border. Post-depositional movement along this fault has given the Triassic beds a southeasterly dip.

Randazzo, A.F., Swe, W., and Wheeler, W.H., 1970, A study of tectonic influence on Triassic sedimentation, the Wadesboro basin, central Piedmont: Journal of Sedimentary Petrology, v. 40, no. 3, p. 998-1006.

The Wadesboro basin is defined by normal border faults with the basin representing the down dropped block. Many normal cross faults cut both Newark and pre-Newark rocks of the region. Newark rocks are cut by longitudinal faults which are also normal and trend northeast. Prominent fault scarps produced coarse-grained clastic rocks. Fine-grained sediments are found where faults are not rejuvenated. The eastern margin has finer grained sediments which may have been deposited prior to activity of the eastern border fault or during a period of quiescence. Steep faults must have existed on the western border as indicated by the presence of fanglomerates. During sedimentation the source was periodically uplifted as evidenced by alterations in the size of the sediments. The Wadesboro basin may represent a complete graben fitting the "Physiographic Coincidence Model".

Rankin, D.W., 1975, The continental margin of eastern North American in the southern Appalachians: The opening and closing of the proto-Atlantic Ocean: American Journal of Science, v. 275-A, no. 3, p. 298-336.

Two themes are developed within this paper; the first is the evidence in the southern Appalachians for an early episode of rifting. It appears that by about 800 m.y.B.P. ago a broad region more or less paralleling the Appalachian orogen was undergoing lateral extension accompanied by the emplacement of a nonorogenic bimodal plutonic volcanic group.

The second theme developed is that the Blue Ridge and Piedmont Provinces represent different continental plates (the North American plate and African plate, respectively). Differences in lithology and deformational history of the two provinces led to this interpretation which also proposes that large masses of the African plate have been thrust onto the margin of the North American plate.

Rankin, D.W., 1976, Appalachian salients and recesses: Late Precambrian continental breakup and the opening of the Iapetus Ocean: Journal of Geophysical Research, v. 81, no. 2, p. 5605-5619.

The major thesis of this paper is that Appalachian salients and recesses are inherited from the initial breakup of a continental mass by the intersection of rift valleys radiating from triple junctions at the start of the opening of the Iapetus Ocean. Discussion focuses mainly on the Appalachian

orogen between Chattanooga, Tennessee, and Quebec City, Canada. Within this length, five major bends in Appalachian structural trends are candidates for plume-generated triple junctions.

Rankin, D.F., ed., 1977, Studies related to the Charleston, South Carolina earthquake of 1886 - A preliminary report: U.S. Geological Survey Professional Paper 1028, 204 p.

The crystalline basement beneath the Charleston-Summerville area is not simply a seaward extension of crystalline rocks of the Appalachian orogen that are exposed in the Piedmont to the northwest, but has a distinctive magnetic signature that does not reflect Appalachian orogenic trends. The area underlain by this distinctive geophysical basement, the Charleston block, may represent a broad zone of Triassic and (or) Jurassic crustal extension formed during the early stages of the opening of the Atlantic Ocean. The Charleston block is characterized in part by prominent, roughly circular magnetic and gravity highs that are thought to reflect mafic or ultramafic plutons.

The present stress regime of the Charleston-Summerville area appears to be one of northeast-southwest compression rather than of extension as it presumably was in the Mesozoic. The present stress regime seems similar to that of much of the eastern United States.

Reagor, B.G., Stover, C.W., and Algermissen, S.T., 1980, Seismicity map of the state of South Carolina: U.S. Geological Survey Miscellaneous Investigations Map MF-1225, 1 sheet, scale 1:1,000,000.

This map contains earthquake data originally used in preparing a report on seismic risks in the United States. Intensity values were updated from new and additional data sources that were not available at the time of original compilation.

Reichert, S.O., 1967, Summary report on the geology and hydrology of the 100 and 200 areas at Savannah River Plant for the period 1961-1966: E.I. duPont de Nemours and Co., 52 p.

This paper reports the results of monthly measuring the water level elevations of 52 wells in the 200 Areas, 15 in 100K Area, 14 in 100C Area, 18 in 100L Area, and 17 in 100P Area. It also summarizes the lithology by 10-foot increments of depth below the ground surface of 89 drill holes in the 200 Areas, and of the logs of drill holes in the 100 Areas that were used for water level measurements.

Reinhardt, J., Gibson, T.G., Bybell, L.M., Edwards, L.E., Fredericksen, N.O., Smith, C.C., and Sohl, N.F., 1980, Upper Cretaceous and lower Tertiary geology of the Chattahoochee River valley, western Georgia and eastern Alabama: Geological Society of America Field Trip No. 20, p. 385-463.

This report discusses the stratigraphy, depositional environment, and the biostratigraphy of both macrofossils and microfossils of the Chattahoochee River valley.

Rhea, S., 1981, South Carolina seismic program, Seismological data report: U.S. Geological Survey Open-File Report 81-362, 79 p.

This paper reports data collected on the South Carolina Seismic Network from March 1973 thru July 1980. Hypocentral parameters were computed by the program HYPOELLIPSE.

Rice, T.E., Jr., 1980, The Sabine Stage in the Georgia Coastal Plain: Emory University, M.S. thesis, 122 p.

In the subsurface of the Georgia Coastal Plain, along the southern and southeastern margins, a relatively thick Sabine section overlies Gulfian (Upper Cretaceous) rocks. In the interior of the Coastal Plain a relatively thin Sabine section overlies a significant thickness of Midwayan (lowest Tertiary) rocks. Tectonism along a major south-southeast fault system in the Georgia Coastal Plain is proposed to be responsible for these Midway-Sabine stratigraphic - structural relations.

The Sabine deposits of the Georgia Coastal Plain are increasingly clastic in a northwestward, updip direction. The Sabine section at its extreme updip limit is comprised of nonmarine, clastic sediments of the Gravel Creek Member of the Nanafalia Formation.

Ritter, D.F., 1979, Process Geomorphology: Dubuque, Wm. C. Brown Company Publishers, 603 p.

General text in geomorphology containing detailed discussions of fluvial landforms.

Root, R.W., 1979a, Computer modeling of ground water flow at the Savannah River Plant: Geological Society of America (abs.), v. 11, no. 4, 210 p.

Using a three dimensional finite difference scheme, a ground water head model of the subsurface beneath a part of the Savannah River Plant is being developed. The study area is underlain by unconsolidated and semiconsolidated sands, clays, sandy clays, and clayey sands. The ground water system of

interest is bounded on two sides by surface streams, on the third side by a piezometric high, on the top by the water table, and on the bottom by a permeable flow boundary. The presence of low conductivity clay layers causes definite vertical gradients of hydraulic head.

Root, R.W., 1979b, A summary of exploration drilling in F Area for hydrogeologic information, in Crawford, T.V., ed., Savannah River Laboratory Environmental Transport and Effects Research, Annual Report 1978: U.S. Department of Energy, DP-1489, p. 69-71.

Analysis of undisturbed cores, continuous split-barrel samples, and tests on permanent wells were used in developing a mathematical model of three-dimensional ground water flow beneath the Separations Areas and a conceptual geologic framework at the Savannah River Plant.

Root, R.W., Jr., 1979b, Results of drilling a well cluster near F Area at SRP, in Crawford, T.V., ed., Savannah River Laboratory Environmental Transport and Effects Research, Annual Report - 1978: U.S. Department of Energy, DP-1526, p. 213-217.

A cluster of five wells was drilled on the bluff above Upper Three Runs Creek in the northwestern part of the Savannah River Plant Separations Areas to confirm the conceptual geohydrologic model in this area. The upward head gradient in the Congaree and Ellenton Formations suggests that water is discharging into Upper Three Runs Creek from these formations. This information is useful in developing a three-dimensional model of ground water movement and potential contaminant transport.

Root, R.W., Jr., 1979c, Subsurface hydrology of coastal plain sediments in the SRP Separations Areas, in, Crawford, T.V., ed., Savannah River Laboratory Environmental Transport and Effects Research, Annual Report - 1978: U.S. Department of Energy, DP-1526, p. 207-212.

The water table beneath the Savannah River Plant occurs primarily within the Barnwell Formation. The gradient in the Congaree is low compared to the gradient of the water table and the McBean Formation.

Root, R.W., and Marine, I.W., 1978, Water-level fluctuations in coastal plain sediments at SRP: in Crawford, T.V., ed., Savannah River Laboratory Environmental Transport and Effects Research Annual Report - 1977: U.S. Department of Energy, DP-1489, p. 65-68.

Water levels in all wells generally increase in elevation during the winter and early spring and decline for the remainder of the year. Water levels in the Barnwell Formation are higher than those in the McBean Formation; and these, in turn, are higher than the water levels in the Congaree

Formation. Due to low clay content relative to the Barnwell and McBean Formations, the Congaree Formation conducts water more rapidly towards Upper Three Runs Creek, where it is discharged from the formation. The source of most of the water that moves down through the Barnwell and McBean Formations into the Congaree Formation is local precipitation. However, the Tuscaloosa Formation is recharged by precipitation northeast of the Savannah River Plant. Thus, the water levels in the Tuscaloosa Formation are not influenced by natural recharge or discharge at the Savannah River Plant. The amplitude of the water-level fluctuations are dampened with depth, but the response of the water levels in the deeper formations to rainfall is as immediate as that in the shallower formations.

Sanover, A., and Sowers, G.F., 1967, Appendix A: Aerial photographic studies for Altamaha River Project, Georgia Power Company: Law Engineering Testing Company, Atlanta, Georgia, 18 p.

These studies provide an analysis of aerial photographs from the U.S. Department of Agriculture. The photographs were used to define geographic features such as drainage anomalies, Carolina Bays, sink holes and spring heads.

Schilt, F.S., Brown, L.D., Oliver, J.E., and Kaufman, S., 1982, Subsurface structure near Charleston, South Carolina--results of COCORP reflection profiling in the Atlantic Coastal Plain: in Gohn, G.S., ed., Studies related to the Charleston, South Carolina, earthquake of 1886-tectonics and seismicity (collected abstracts): U.S. Geological Survey Open-File Report 82-134, p. 15-16.

Seismic reflection survey lines in the Charleston-Summerville area showed that the top of the basement has as much as one kilometer of relief. The coastal plain sediments, basalt layer, and basement can all be traced with good continuity over much of the lines; they are cut by a reverse fault and possibly by a small fault-bounded graben, each having an offset of a few tens of meters.

Schmidt, R.G., 1962, Aeroradioactivity survey and areal geology of the Savannah River Plant area, South Carolina and Georgia (ARMS-1): Civil Effects Study CEX-58.4.2, Civil Effects Test Operations, U.S. Atomic Energy Commission, 51 p.

This outdated aeroradioactivity survey shows no anomalies with regard to the Triassic basin.

Schumm, S.A. and Khan, H.R., 1972, Experimental study of channel patterns: Geological Society of America Bulletin, v. 83, no. 6, p. 1755-1770.

A seris of experiments was performed in a large flume to determine the effect of slope and sediment load on channel patterns. These experiments suggest that landforms may not

always respond progressively to altered conditions. Rather, dramatic morphologic changes can occur abruptly when critical erosional and (or) depositional threshold values are exceeded.

Scrudato, R.J., 1969, Kaolin and associated sediments of east-central Georgia: University of North Carolina Ph.D. dissertation, 97 p.

Lower Upper Cretaceous clastic sediments of east-central Georgia are characterized by coarse, cross-bedded, kaolinitic sands and gravels and high-quality, commercial, massive kaolin deposits. These deposits extend from Columbia, South Carolina, to the Ocmulgee River of central Georgia.

Pollens indicate that major kaolin deposition was not restricted to early Late Cretaceous but also occurred during middle(?) Eocene. Associated pollen and spores indicate that climatic conditions were tropical to subtropical and therefore, probably conducive to extensive laterization of source Piedmont igneous and metamorphic rocks.

Clay mineralogy of weathered igneous and metamorphic Piedmont rocks and of lower Upper Cretaceous, middle and upper Eocene, and Quaternary rocks differs significantly.

Seismograph Service Corporation, 1972, Report on seismorgraph surveys conducted in Barnwell, Aiken, and Allendale Counties, South Carolina, 41 p.

The purposes of this work were to obtain additional seismic information regarding the attitude of the surface and bedrock; to determine the position and outline of the Triassic basin; and to determine the strike of faults suggested as cutting previously established seismic survey lines.

Sever, C.W., 1965, Ground water resources and geology of Seminole, Decatur, and Grady Counties, Georgia: U.S. Geological Survey Water-Supply Paper-1809 Q, 30 p.

Seminole, Decatur, and Grady Counties comprise about 1,350 square miles along the Georgia-Florida state line in the extreme southwest corner of Georgia. Structural contours drawn on the top of the Suwannee Li estone, of Oligocene age, show the surface to be downwarped about 540 feet beneath the Tifton Upland. This downwarping affected the stratigraphy of Eocene to Miocene rocks, the quality of their contained water, and the quantity of water available to wells tapping them.

Sever, C.W., 1966, Miocene structural movements in Thomas County, Georgia: U.S. Geological Survey Professional Paper 550-C, p. C12-C16.

Rocks of Oligocene and Miocene age in Thomas County, in the Coastal Plain Province of southwestern Georgia, are gently folded and transected by at least one northeast-trending

fault. Maximum displacement along the fault is at least 190 feet and may be somewhat greater. Structural deformation began during Oligocene time, or at least before the Tampa Limestone (early Miocene) was deposited, and continued spasmodically through middle Miocene and possibly through late Miocene time. The trends of the Miocene structures parallel those of late Paleozoic structures in the Appalachian tectonic province of Georgia. The parallel trends suggest that the older Paleozoic structures have in some way controlled the Miocene structures.

Sever, C.W., 1967, Brief summary of the regional area and local geology as related to interpretation of seismology of the proposed site of a nuclear fueled power plant in south-central Georgia (report 2, second draft): Unpublished report, 28 p.

Continuous cores, electrical resistivity logs, self potential logs and gamma radiation logs from more than 50 drill holes were used to determine the stratigraphy and structure in the vicinity of the plant site.

Sheridan, R.E., 1974, Conceptual model for the block-fault origin of the North American Atlantic continental margin geosyncline: Geology, v. 2, no. 9, p. 465-468.

A new interpretation of the basement structure of the Atlantic continental margin is proposed. The basins of the geosyncline are believed to be isolated fault bounded troughs with alignments more or less paralleling that of the continental slope. The apparent stress pattern can be explained by the clockwise rotation of a unit structural block encompassing the entire North American continental margin from Labrador to the Bahamas.

Sheriff, R.E., 1976, Inferring stratigraphy from seismic data: Bulletin of the American Association of Petroleum Geologists, v. 60, no. 4, p. 528-542.

The conventional application of seismic data to mapping depth and attitude of reflecting interfaces has been supplemented in recent years by measurements of velocity and amplitude for stratigraphic and lithologic information. Special attention is given to: 1) resolution of events, 2) the measurement and interpretation of seismic velocity, 3) amplitude measurements, and 4) display, so as to help an interpreter grasp the interrelations of data elements.

Siple, G.E., 1946, Ground water investigations in South Carolina: South Carolina Research, Planning and Development Board Bulletin 15, 73 p.

Data from municipal water wells or springs was used to study the quality of the ground water of South Carolina. Wells in

the coastal plain generally yield larger amounts of water than wells in the piedmont. A brief description of the geology of the piedmont and coastal plain is included.

Siple, G.E., 1960, Piezometric levels in the Cretaceous sand aquifer of the Savannah River basin: Georgia Mineral Newsletter, v. 13, no. 4, p. 163-166.

Ground water in Cretaceous deposits within 40 miles of Augusta, Georgia occurs under both water table and artesian conditions.

Siple, G.E., 1967, Geology and ground water of the Savannah River Plant and vicinity, South Carolina: U.S. Geological Survey Water-Supply Paper 1841, 113 p.

The Savannah River Plant area is underlain by a sequence of unconsolidated Upper Cretaceous, Tertiary, and Quaternary sediments that were deposited on an eroded basement of Precambrian(?) and Paleozoic igneous and metamorphic rocks. The basement rocks contain a down faulted Triassic basin containing arkosic sandstone and siltstone. The Cretaceous and younger sediments form a wedge ranging in thickness from a few feet on the northwest side of the area to more than 1,200 feet on the southeast side.

The principal aquifer beneath the Savannah River Plant consists of the coarse sand and gravel of the Tuscaloosa and Ellenton Formations. Although the permeable zones in the two formations appear to be separated locally by interbeds of non-water-bearing silt and clay, the permeable zones are hydraulically connected owing to the discontinuity of the silt and clay beds. Consequently, the permeable zones in the two formations are considered to be a single ground water reservoir.

The principal aquifer is recharged by leakage through the Tertiary sediments, and discharge occurs in the outcrop area of the Tuscaloosa Formation. Doubtless, water is also discharged from the principal aquifer by moving downdip toward the coast and thence leaking upward through the upper confining beds.

Siple, G.E., 1969, Salt water encroachment of Tertiary limestones along coastal South Carolina: South Carolina Geologic Notes, v. 13, no. 2, p. 51-65.

Limestone of middle Eocene to early Miocene age, and clastic sediments of Paleocene to early Eocene age constitute the major water-bearing Tertiary formations along coastal South

Carolina which have been invaded during recent and past geologic epochs by seawater. Upper zones of Eocene limestones, incised by estuaries during Pleistocene and Recent time, are now subject to salt water encroachment. Encroachment is also thought to occur along the sub-sea level contact of the Eocene and Oligocene deposits.

Smith, D.L., Gregory, R.G., and Emhof, J.W., 1977, Heat flow in the southern Appalachians and southeastern Coastal Plain: Geological Society of America (abs.), v. 9, no. 2, p. 185.

Preliminary analyses of geothermal gradient determinations and thermal conductivity measurements from 28 borehole sites in Alabama, Georgia, South Carolina, North Carolina and eastern Tennessee yield new heat flow values which suggest regionally characteristic geothermal properties. Characteristic of the southeastern United States, the heat flow data are indicative of a mildly low thermal anomaly with areal variations probably related to major structural features and distributions of radioactivity in the crust.

Smith, C.W., III, 1979, Stratigraphy of the Aiken County Coastal Plain, South Carolina: South Carolina Geological Survey Open-File Report 19, 34 p.

Six stratigraphic units are mapped in Aiken County: 1) Piedmont undifferentiated, 2) Cretaceous Middendorf Formation(?), 3) Paleocene to mid-Eocene Huber Formation, 4) late Eocene Barnwell Group, 5) Miocene to pre-early Pleistocene Citronelle Formation, and 6) Plio-Pleistocene(?) to Recent alluvium. Also included is a geologic map.

Smith, G.W., III, 1980 Preliminary report on the geology of Lexington County, South Carolina: South Carolina Geological Survey Open-File Report 20, 45 p.

Six lithostratigraphic units were mapped in the upper Coastal Plain of Lexington County, the: 1) Huber Formation, 2) Black Mingo Formation, 3) Tobacco Road Sand, 4) Dry Branch Formation, 5) Citronelle(?) Formation, and 6) Pinehurst Formation.

Smith, J.W., Wampler, J.M. and Green, M.A., 1968, Isotopic dating and metamorphic isograds of the crystalline rocks of Georgia: Georgia Geologic Survey Bulletin 80, p. 121-139.

Micas in Georgia crystalline rocks date from about 250 million years on the southeast to 350 million years on the northwest side. The metamorphic isograds indicate one period of metamorphism spanning both the Acadian and Alleghanian orogenies. Granitic intrusion and/or granitization may have occurred during the Taconic orogeny.

Snipes, D.S., 1965, Stratigraphy and sedimentation of the Middendorf Formation between Lynches River, South Carolina and the Ocmulgee River, Georgia: University of North Carolina Ph.D. dissertation, 140 p.

The outcropping basal Upper Cretaceous beds between the Lynches River, South Carolina, and the Ocmulgee River, Georgia, are assigned to the Middendorf Formation. These beds, which are very similar to strata exposed at the type section of the Middendorf Formation, near Middendorf, South Carolina, previously have been referred to as the Tuscaloosa Formation, but their lithology differs appreciably from typical Tuscaloosa strata exposed near Tuscaloosa, Alabama. Evidence obtained from studies of sedimentary structures, clay minerals and heavy minerals indicates that the Middendorf clastics were derived from the Piedmont Province. These studies, together with studies of size analyses and thin sections, indicate that the Middendorf Formation is dominantly fluvial. It was deposited by streams of high viscosity and density on the upper part of river flood plains, which were located immediately south of the Cretaceous Fall Line.

Snoke, A.W., Secor, D.T., Jr., and Metzgar, C.R., 1977, Batesburg - Edgefield cataclastic zone: A fundamental tectonic boundary in the South Carolina piedmont: Geological Society of America (abs.), v. 9, no. 2, p. 185.

Between Lake Murray, South Carolina, and the Savannah River, the boundary between the Carolina Slate and Kiokee Belts is a steep northwest dipping fault. Structures here such as flattening foliation, associated elongation lineation and intersecting cleavages suggest a polyphase history for the Batesburg - Edgefield cataclastic zone which began during infrastructural upwelling but subsequently evolved into strike-slip faulting.

Snoke, A.W., Kish, S.A. , and Secor, D.T. Jr., 1980, Deformed Hercynian granitic rocks from the Piedmont of South Carolina: American Journal of Science, v. 280, no. 10, p. 1018-1034.

Granitic magmatism, amphibolite facies regional metamorphism, and penetrative deformation provide documentation of a complex late Paleozoic (Hercynian) orogeny, which is widespread in the Kiokee Belt of South Carolina and Georgia. Late stage effects of this orogenic episode include east-west crenulation cleavage and brittle faulting. Movements along these brittle faults probably began no sooner than Late Cretaceous, perhaps even Permian, time. Such data substantiate the role of compressional tectonics in the evolution of this portion of the southern Appalachian orogen during the late Paleozoic.

Staheli, A.C., 1977, Geologic significance of riverine swamp distribution on the Georgia Piedmont: Geological Society of America (abs.), v. 9, no. 2 p. 186.

Numerous swamps occur on the floodplains of major piedmont streams and their tributaries in the southeastern United States. Classification of over 1000 riverine swamps showed that ninety percent of all piedmont swamps occur southeast of the Brevard Zone in drainage basins of streams that flow normal to regional structures. The greatest concentration of swamps southeast of the Brevard Zone and most of the largest swamps on the Georgia Piedmont are found in an area bounded by: the upper Chattahoochee River basin or Brevard lineament on the north; the lower Chattahoochee River basin on the west; the Savannah River Basin on the east; and the Pine Mountain structure on the south.

Stephenson, D.E., and Pratt, H.R., 1981, In situ stress field in the southeastern United States and its implication: Southeastern Geology, v. 22, no. 3, p. 115-121.

In the Coastal Plain of the southeast, in situ stress measurements show the major principal stress component to be in the vertical direction, which indicates normal faulting. Fault plane solutions for the Coastal Plain indicate both normal and reverse faulting. The solutions are not well constrained, and the exact mechanism is difficult to determine. Recent studies indicate normal faulting in coastal plain sediments near Charleston, South Carolina; however, thrust faulting may be present in the crystalline basement.

Stephenson, L.W., 1928a, Major marine transgressions and regressions and structural features of the Gulf Coastal Plain: American Journal of Science, Fifth Series, v. 16, no. 94, p. 281-298.

A general discussion of the history of the transgressions and regressions that occurred from Comanchean time through the Quaternary.

Stephenson, L.W., 1928b, Structural features of the Atlantic and Gulf Coastal Plain: Geological Society of America Bulletin, v. 39, no. 4, p. 887-900.

Discusses the general features and extent of the Atlantic and Gulf Coastal Plains. The structure of the region is summed up as a gentle monocline including all formations from Cretaceous to Holocene.

Stewart, D.M., Ballard, J.A., and Black, W.W., 1973, A seismic estimate of depth of Triassic Durham Basin, North Carolina: Southeastern Geology, v. 18, no. 2, p. 93-103.

A seismic measurement of depth to basement was been made near the center of the Triassic Durham Basin and indicates that the probable depth of sediments at that point is 6,000 ± 500 feet.

Stover, C.W., Reagor, B.G., Algermissen, S.T., and Long, L.T., 1979, Seismicity map of the State of Georgia: U.S. Geological Survey Miscellaneous Field Studies Map MF-1060, 1 sheet, scale 1:1,000,000.

Contains earthquake data originally used in preparing a report on seismic risks in the United States. Intensity values were up dated from new and additional data sources that were not available at the time of the original compilation.

Straley, H.W., III, 1966, Magnetic anomalies and epicentral lines on the South Carolina Coastal Plain: Tectonophysics, v. 3, no. 5, p. 381.

The history of magnetic geophysical investigations upon the southern Atlantic Coastal Plain is traced, an incomplete map of part of South Carolina is presented, and a few hypothetical geological structures or litholigical alignments that may be reflected in the plotted magnetic data are pointed out.

Stringfield, V.T., 1966, Artesian water in Tertiary limestone in the southeastern states: U.S. Geological Survey Professional Paper 517, 226 p.

In Florida, southern Georgia, and adjacent parts of Alabama and South Carolina an artesian aquifer system of Tertiary age is the source of some of the largest ground water supplies in the United States. The aquifer system consists of as many as eight formations, chiefly limestone. The area of the system discussed in this report includes all of Florida and most of the Coastal Plain of Georgia as well as adjacent parts of South Carolina and Alabama. It extends from the Atlantic coast to as far inland as the Fall Line in a few places.

Swift, D.J.P., 1966, The Black Creek-Peedee contact in South Carolina: South Carolina Geologic Notes, v. 10, no. 2, p. 17-36.

The upper Black Creek Formation of Late Cretaceous age in the Peedee River valley, South Carolina, consists mainly of laminated sands and clays deposited in a fluviomarine environment. Lenses of clean sand at the top of the formation are littoral and nearshore sand bodies. The overlying Peedee Formation is a muddy shelf sand. The Peedee - Black Creek contact is a ravinement or disconformity cut by the transgressing Peedee Sea.

Talwani, P., 1975a, Crustal structure of South Carolina: Second Technical Report to U.S. Geological Survey, Contract No. 14-08-0001-14553, 79 p.

This report documents advances made in the study of crustal structure of South Carolina. By monitoring quarry blasts the velocity structure, both underneath the Piedmont and under the

Coastal Plains has begun to emerge, and the possible existence of a buried sedimentary basin under the Coastal Plains is indicated. Macroscopic and instrumental data were obtained for five earthquakes felt in the state. Both seismic and other geophysical data have helped in the delineation of the Goat Rock fault.

Talwani, P., 1975b, Crustal structure of South Carolina: Semi-Annual Technical Report to U.S. Geological Survey, Contract No. 14-08-001-14553, 34 p.

During the reporting period, quarry blasts were monitored and an aftershock investigation following the August 2, 1974 earthquake on the South Carolina-Georgia border was carried out. This earthquake was predominantly strike-slip. The fault plane strikes northeast, parallel to the regional geological trend.

Talwani, P., 1977, Recent earthquakes in the South Carolina coastal plains and their tectonic significance: Geological Society of America (abs.), v. 9, no. 2, p. 189.

The Trenton Earthquake of 4/29/76 was probably associated with the contact between the Kiokee Belt and the Belair Belt. Fault plane solution suggests thrust faulting with the southeastern block overthrust. Four events on 9/22-23/76 located near Bowman, may be associated with a postulated buried Triassic basin near Orangeburg.

Talwani, P., 1979, Induced seismicity and earthquake prediction studies in South Carolina: Eighth Technical Report to U.S. Geological Survey, Contract No. 14-08-0001-14553, 36 p.

This report includes induced seismicity studies at Lakes Jocassee and Keowee, and Monticello and Clark Hill reservoirs. It also includes results from earthquake prediction studies at Lake Jocassee and seismic refraction studies in South Carolina.

Talwani, P., Amick, D., and Stevenson, D., 1979, Crustal structure studies in South Carolina Coastal Plain: Ninth Technical Report to U.S. Geological Survey, Contract No. 14-08-0001-17670, 81 p.

Refraction, gravity and borehole data suggest that the shallow crustal structure in the Charleston area is complicated. The northeast-southwest direction of major axis of compressive stress suggests that the tectonic stresses responsible for the formation of the Cape Fear Arch to the northeast and the Peninsular Arch to the south are still active. The presence of tensional Mesozoic features in the Charleston area such as basalts and red beds suggests that the present day stresses are being released along preexisting zones of weakness.

Talwani, P., Rastogi, B.K., and Stevenson, D., 1980, Induced seismicity and earthquake prediction studies in South Carolina: Tenth Technical Report to U.S. Geological Survey, Contract No. 14-08-0001-17670, 212 p.

This report presents data on induced seismicity studies in South Carolina up to September 1979. The seismicity 1) is shallow (1.25 miles), 2) spreads in discrete jumps due to the heterogeneous nature of the rocks, 3) spreads along existing joint and fracture planes, 4) is caused by changes in pore pressures at hypocentral depths, and 5) suggests the existence of large horizontal stresses at shallow depths.

Talwani, P., Stevenson, D., Chiang, J., Sauber, J., and Amick, D., 1977, The Josassee Earthquake (March-May '77) A Progress Report: Fifth Technical Report to U.S. Geological Survey, Contract No. 14-08-0001-14553, 49 p.

Between March and May 1977 low level, low magnitude, and shallow seismic activity was recorded in the vicinity of Lake Jocassee. A comparison of water level fluctuations in the lake over a two year period suggests that the observed seismicity may be associated with sustained periods of increase in water level.

Tarr, A., 1982, Detection and location capability of the southeastern United States Seismic Network: Southeastern U.S. Seismic Network Bulletin No. 9, p. 36-42.

Discusses the methods for obtaining the theoretical detection and location capabilities of the southeastern United States Seismic Network.

Tarr, A., Talwani, P., Rhea, S., Carver, D., and Amick, D., 1981, Results of recent South Carolina seismological studies: Bulletin of the Seismological Society of America, v. 71, no. 6, p. 1883-1902.

Results of recent geophysical and geological studies, when combined with the seismological results, indicate two seismic regimes in South Carolina. The first regime covers the buried basement structure of the middle and lower Coastal Plain Province, which has been shown by geophysical studies to be quite unlike Piedmont Province structures to the northwest. The second regime covers the exposed Piedmont Province and the upper coastal plain. Earthquake activity may be associated with strain release on or near mapped faults or contacts between metamorphic belts.

Taylor, P.T., Zietz, I., and Dennis, L.S., 1968, Geologic implications of aeromagnetic data for the eastern continental margin of the United States: Geophysics, v. 33, no. 5, p. 755-780.

Aeromagnetic data suggests that Florida and part of Georgia were added to the paleocontinent of North America in pre-Paleozoic time.

Thayer, P.A., 1970, Geology of Davis County Triassic Basin, North Carolina: Southeastern Geology, v. 11, no. 3, p. 187-198.

The Davis County Basin is believed to be an outlier of the Dan River Basin. Upper Triassic nonmarine strata within the basin can be divided into two intertonguing facies: 1) basin margin conglomerate, and 2) basin center sandstone-siltstone. Lithofacies distribution indicates that the basin was filled from the eastern and western sides, and that the sediment was dominantly derived from nearby medium and high rank metamorphic sources.

Thayer, P.A., 1970, Stratigraphy and geology of Dan River Triassic Basin, North Carolina: Southeastern Geology, v. 12, no. 1, p. 1-31.

Dan River basin, a northeast-trending asymmetrical fault trough located in Stokes and Rockingham Counties, North Carolina, contains up to 15,000 feet of nonmarine clastic strata (Dan River Group). On the basis of distinctive sedimentary features and stratigraphic position this thick sequence can be divided into three formations. Environments of deposition include alluvial fan, floodplain, lacustrine and swamp environments. Movements along basin-margin fault zones initiated and accompanied sedimentation, and erosion of uplifted fault blocks provided most of the detritus to the subsiding trough. After sedimentation the strata were tilted to the northwest and folded, faulted, and intruded by dolerite dikes.

Thomas, W.A., Tull, J.F., Bearce, D.N., Russell, G., and Odom, A.L., 1979, Geologic synthesis of the southernmost Appalachians, Alabama, and Georgia: in Wones, D.R., ed., Proceedings on the "Caledonides in the USA" (I.G.C.P. project 27: Caledonide orogen): Virginia Polytechnic Institute and state university, Department of Geological Sciences, Memoir no. 2, Blacksburg, Virginia, 24061, p. 91-97.

The Appalachian orogen is within the regional Alabama structural recess between the Tennessee Appalachian structure salient and the Ouachita structural salient. The orogen includes a belt of folded and thrust faulted Paleozoic sedimentary rocks on the northwest, and a belt of Precambrian and Paleozoic metamorphic rocks. Included are discussions involving the Appalachian fold and thrust belt, the piedmont northwest of the Brevard Zone, and the rocks southeast of the Brevard zone.

Thornbury, W.D., 1965, Regional geomorphology of the United States: New York, John Wiley & Sons, Inc., 609 p.

Included in the chapter on the Coastal Plain Province are sections on the geology, characteristics and descriptions of geomorphic sections, and geologic history.

Toulmin, L.D., 1955, Cenozoic geology of southern Alabama, Florida, and Georgia: Bulletin of the American Association of Petroleum Geologist, v. 39, no. 2, p. 207-235.

The outstanding feature of the geology of the Coastal Plain of the southeastern states is the presence of two distinct sedimentary provinces, one in the northern Gulf Coast area extending basins or embayments of the two provinces are more or less separated structurally by the Peninsular Arch. The provinces are distinct lithologically in that the northern Gulf Coast Province contains in the Cenozoic section, marine clastic deposits chiefly, with a minor proportion of carbonates, mostly upper Eocene and Oligocene in age. The Florida Peninsula sediments, on the other hand, consist almost entirely of organic limestones, from the basal clastics of the Lower Cretaceous throughout the section to the Miocene. Miocene and later deposits, however, make up a very small part of the total Cenozoic section. Finally, the two provinces are distinct faunally, as the fauna of the Florida Peninsula is more closely related to that of the Caribbean than it is to that of the northern Gulf Coast Province.

Tuohy, M.A., Gardinier, C.L., Brown, S.E., and Karp, H.C., 1981, Well log location maps for the Pliocene to Recent, Miocene, principal artesian, and Cretaceous aquifers: Georgia Geologic Survey Hydrologic Atlas 7, 4 sheets.

Map covers the Coastal Plain of Georgia. Four sheets are included (Pliocene-to-Recent, Miocene, principal artesian, and Cretaceous aquifers). Well location and log type (geologic, driller's or lithologic, electric G.S.P. and resistivity, and gamma ray) are shown.

Turner, P.A., 1959, Sedimentation in the Upper Cretaceous of east-central Georgia: Cornell University, M.S. thesis, 80 p.

Upper Cretaceous sediments were derived from the crystalline Piedmont of Georgia. The lower part was transported and deposited rapidly on a flood plain close to the shore line. The upper part of the Upper Cretaceous section was deposited in a lagoonal environment separated from the ocean by barrier beaches that extended approximately east-west through Georgia.

Tschudy, R.H., and Patterson, S.H., 1975, Palynological Evidence for Late Cretaceous, Paleocene, and early and middle Eocene ages for strata in the Kaolin Belt, central Georgia: Journal of Research of the U.S. Geological Survey, v. 3, no. 4, p. 433-445.

Beds assigned to the Tuscaloosa Formation are now known to be at least as old as Late Cretaceous and as young as middle Eocene (Claiborne). The Tuscaloosa Formation in central Georgia contains strata considerably younger than does the

formation at the type locality. The beds assigned to this formation in central Georgia contain considerable evidence for what could be called intraformational unconformities, such as channel-fill deposits, lenticular units, and irregular and undulating contacts between units of different lithologies. Some of these features may be found to represent stratigraphic breaks that can be recognized throughout the region.

Tull, J.F., 1979, Overview of the sequence and timing of deformational events in the southern Appalachians: Evidence from the crystalline rocks North Carolina to Alabama: in Wones, D.R., ed., Proceedings on the "Caledonides in the USA" (I.G.C.P. Project 27: Caledonide orogen): Virginia Polytechnic Institute and State University, Department of Geological Sciences, Memoir no. 2, Blacksburg, Virginia, 240601, p. 167-177.

The purpose of this paper is to examine some of the pertinent data relating to the timing of southern Appalachian deformational events affecting crystalline rocks, and to exclude from this discussion stratigraphic and structural relationships which have been documented in the Appalachian Valley and Ridge and Plateau Provinces to the northwest.

U.S. Army Corps of Engineers, Charleston District, 1952, Geologic engineering investigations Savannah River Plant: Waterways Experiment Station, Corps of Engineers, U.S. Army, Vicksburg, MS, 45 p.

This report presents the results of the geological investigation of the foundation areas of the Savannah River Plant, and an interpretation of the engineering significance of the geological features. The geological work also included the investigation of ground and surface water supplies, drainage conditions, and sources of aggregate for construction.

U.S. Army Corps of Engineers, Savannah District, 1980, Navigation charts, Savannah River, Georgia and South Carolina, Savannah to Augusta: Corps of Engineers, U.S. Army Savannah, GA, 57 p.

Aerial photography atlas of the Savannah River between Augusta and Savannah. Depths listed used to determine the thalweg of the Savannah River.

U.S. Atomic Energy Commission, Division of Materials and Licensing, 1970, Allied-Gulf Nuclear Services Barnwell Nuclear Fuel Plant, Docket No. 50-332, 146 p.

An evaluation of the geology, hydrology, and seismology of the Barnwell Nuclear Fuel Plant site.

U.S. Geological Survey, 1976a, Probable recent fault movement in Georgia: Department of Interior News Release, January 12.

This news release proposed that movement on the Belair fault zone has probably occurred within the last 2,500 years. The sediments dated as less than 2,500 years old, were found to be offset at least three feet. Older strata, between 65 and 100 million years old (Latè Cretaceous age), were found to be offset 55 feet, which shows that the fault has moved more than once.

U.S. Geological Survey, 1976b, Fault movement in Georgia not as recent as believed: Department of Interior News Release, November 18.

Movement along the Belair fault may not have taken place within the last 2,500 years, but has occurred within the past 50 million years. Radiocarbon dates reported earlier did not give accurate data on the last fault movement.

U.S. Geological Survey, 1977, Preliminary report on Belair exploratory trench no. 10-76 near Augusta, Georgia: U.S. Geological Survey Open-File Report 77-441, 20 p.

Exploratory trench no. 10-76 showed several fault planes and shear zones in the vicinity of Augusta, Georgia. There is absence of evidence of fault movement for at least the past 2,000 years, but no direct evidence of fault history over the past 100 million years. No offset, shear or other deformation was observed in the post-Tuscaloosa sediments.

U.S. Geological Survey, 1980, Water resources investigations, Georgia District, 1980, 45 p.

This report contains a brief description of the water-resource investigations in Georgia in which the Geological Survey participates, and a list of selected references.

U.S. Nuclear Regulatory Commission, 1973, Seismic and geologic siting criteria for nuclear power plants, Appendix A to 10 CFR 100: Federal Registrar, 38 FR 31279.

Geologic and seismic citing criteria for nuclear electric generating stations.

Vail, P.R., and Mitchum, R.M. Jr., 1978, Global cycles of relative changes of sea level from seismic stratigraphy: American Association of Petroleum Geologists Memoir 29, p. 469-472.

The evidence for cycles of relative change of sea level on a global scale, is based on the fact that many regional cycles determined on different continents are simultaneous, and that the relative magnitudes of the changes generally are similar.

Because global cycles are records of geotectonic, glacial, and other large-scale processes, they reflect major events of Phanerozoic history.

Van Houten, F.B., 1969, Late Triassic Newark Group, north central New Jersey and adjacent Pennsylvania and New York: in Subitzky, ed., Geology of selected areas in New Jersey and eastern Pennsylvania, Geological Society of America Guidebook of Excursions, Field Trip No. 4, p. 314-331.

The Newark Group consists of 16,000-20,000 feet of nonmarine sedimentary rocks and associated intrusive and extrusive basic rocks. Their strike generally parallels the trend of the basin and they dip 10-20°NW. Along the northwestern margin these rocks are bounded by Precambrian and Paleozoic rocks. Most of this boundary is a system of high-angle faults, but intermittently the Triassic deposits overlap on rocks of the upland terrane. Within the basin, Newark strata lie on Paleozoic and subordinate Precambrian rocks of the Blue Ridge and Piedmont Provinces. Along the southeastern margin Newark deposits overlap on Precambrian and Paleozoic rocks of the Piedmont Province. Newark strata, in turn, are overlapped by Cretaceous and younger deposits of the Coastal Plain Province to the southeast.

Van Houten, F.B., 1977, Triassic-Liassic deposits of Morocco and eastern North America: Comparison: Bulletin of the American Association of Petroleum Geologists, v. 61, no. 1, p. 79-99.

This study examines fault basins that developed on the broad flanks of a central Atlantic arch and focuses on four tectonic provinces that frame the present North Atlantic Basin, namely, the African platform and Variscan domain in Morocco, and the southern Alleghenian, and northern, Acadian, domains in eastern North America. The review involves the record of events from early fragmentation about 215 m.y.B.P., to initial separation and opening of the Mid-Atlantic Rift about 175 m.y.B.P.

Veatch, J.D., and Stephenson, L.W., 1911, Preliminary report on the Geology of the Coastal Plain of Georgia: Georgia Geologic Survey Bulletin 26, 466 p.

This report contains much of the initial stratigraphic and structural work done on the Coastal Plain of Georgia. The Okeefenokee Embayment was originally mapped in this report based on changes in key horizons in the subsurface, but lack of deep well data prevented the establishment of the extent of the basin.

Warren, M.A., 1944, Artesian water in southeastern Georgia: Georgia Geological Survey Bulletin 49, 140 p.

The rocks of the principal artesian aquifers in southeastern Georgia are limestones of Eocene and Oligocene age. Most of the recharge of these aquifers lies five to 120 miles south and southeast of the Fall Line. The transmitting capability of the aquifers increase in the southern part of the state.

Warren, M.A., 1945, Artesian water in southeastern Georgia: Georgia Geologic Survey Bulletin 49A, 83 p.

Lists data on location, owner, driller, diameter, depth, completion date, and yield of artesian wells in Georgia.

Weaver, C.E., and Beck, K.C., 1977, Miocene of the S.E. United States: A model for chemical sedimentation in a peri-marine environment: Sedimentary Geology, v. 17, nos. 1 and 2, p. 1-234.

Discusses a geochemical model for the deposition of the commercial deposits of clay and phosphate.

Weaver, C.E., and Beck, K.C., 1982, Environmental implications of palygorskite (attapulgite) in Miocene of the southeastern United States: in Arden, D.D., Beck, B.F., and Morrow, E., ed., Second Symposium on the Geology of the Southeastern Coastal Plain, p. 118-125.

During early Miocene time palygorskite formed in the southeastern United States in shallow, brackish-water coastal lagoons. It altered from montmorillonite by the addition of silicon and magnesium. It formed in a humid, subtropical to tropical climate that was modified by ocean currents controlled by the movement of continental plates. It is unlikely that the palygorskite formed in a normal marine environment.

Wentworth, C.M., and Mergner-Keefer, M., 1981, Reverse faulting along the eastern seaboard and the potential for large earthquakes: in Beavers, J.E., ed., Earthquakes and Earthquake-Engineering, Eastern U.S., v. 1, p. 109-128.

The origin of earthquakes along the eastern seaboard has long been a problem, as neither active faults or earthquake-related surface faulting has been recognized. The absence of surface deformation in the Quaternary, despite the occurrence of earthquakes as shallow as those expressed at the surface in the west, suggests that the rates of deformation in the east are low. Reverse faults with small Cretaceous and Cenozoic offsets exist, and earthquake focal-mechanism solutions also show reverse fault geometries.

Wentworth, C.M., and Mergner-Keefer, M., 1982a, Regenerate faults of small Cenozoic offset - probable earthquake sources in the southeastern United States: in Gohn, G.S., ed., Studies related to the Charleston, South Carolina, earthquake of 1886 - tectonics and seismicity (collected abstracts): U.S. Geological Survey Open-File Report 82-134, p. 34-35.

The principal style of Cenozoic faults and earthquake focal-mechanism solutions known along the eastern seaboard suggests that a domain undergoing northwest-southeast compression extends along the eastern seaboard between the continental margin and the front of the Appalachian Mountains. In the southeast, several mapped northeast-trending zones of high-angle reverse faults and many faults in isolated exposures offset coastal plain deposits as much as 325 feet; the youngest recognized offset is one foot in probable Pliocene or Pleistocene surficial gravels in the Stafford fault zone in Virginia.

The extent of the domain is inferred from 1) reverse faults known in South Carolina and along the Fall Line from Georgia to New Jersey, 2) earthquake source mechanisms, particularly in coastal New England, and 3) the broad distribution of early Mesozoic normal faults in the exposed piedmont terrain and beneath the coastal plain and offshore. The authors suggest that, to a large extent, the reverse faults reuse parts of these early Mesozoic faults.

Wentworth, C.M., and Mergner-Keefer, M., 1982b, Regenerate faults of small Cenozoic offset as probable earthquake sources in the southeastern United States: U.S. Geological Survey Professional Paper 1313, in press.

An analogy is made between the western foothills of the Sierra Nevada and the Piedmont, to reinforce parts of the reverse fault hypothesis. The analogy is made given the lithologic similarity between the two regions. Offsets in the younger rocks of the Sierra foothills indicate that normal faulting along pre-existing faults has been underway since the Miocene, but has accumulated relatively small offsets. The foothills example suggests that much more evidence of Cenozoic faulting may be found in the scattered surficial deposits in the piedmont.

Of the alternative sources of earthquakes that have been proposed, the Appalachian decollement has the most direct relation to the reverse-fault hypothesis. Although there is no geologic evidence that such a decollement has moved at all since the Paleozoic, some of the early Mesozoic extension could have reused such a decollement as a sole, and the reverse faulting might be a shallow expression of more recent decollement movement in a compressional regime.

White, W.A., 1952, Post-Cretaceous faults in Virginia and North Carolina: Geological Society of America Bulletin, v. 63, no. 7, p. 745-748.

At several localities in Virginia and North Carolina faults of small displacement cut young fluvial gravels. Some of these faults are normal; others are reverse.

Whitney, J.A., Paris, T.A., Carpenter, R.H., and Hartley, M.E. III, 1978, Volcanic evolution of the southern slate belt of Georgia and South Carolina: A primitive oceanic island arc: Journal of Geology, v. 86, no. 2, p. 173-192.

The Carolina Slate Belt is recognized as a major metavolcanic tectonic province of the southern Appalachians. The lower stratigraphic sequence is composed of "metadacite." These are overlain by a sequence of tuffs which grade vertically into argillites. The petrographic suite is similar to that found in primitive island arcs. Modern day analogs suggest a model for the slate belt during this volcanic phase in which the primitive island arc formed separated from a continent by a marginal basin.

Wigley, P.B., ed., 1981, Latest thinking on the stratigraphy of selected areas in Georgia: Georgia Geologic Survey Information Circular 54-A, 67 p.

This report consists of three papers which provide interpretations regarding the stratigraphy of selected areas in the Blue Ridge and Piedmont of Georgia and adjacent parts of Alabama. Two features which are especially significant about all three of these reports are: 1) they present stratigraphic interpretations in structurally complex areas where multiple deformation plays an important role in the orientation of stratigraphic sequences, and 2) there is movement away from the old "belt" concept first introduced in Georgia by G.W. Crickmay in 1952.

Winker, C.D., and Howard, J.D., 1977, Correlation of tectonically deformed shorelines on the southern Atlantic Coastal Plain: Geology, v. 5, no. 2, p. 123-137.

Warping of the Atlantic Coastal Plain has continued through the Pleistocene following previously established Cenozoic structural features. These results are based on the maximum transgression of sea level.

Woolard, G.P., 1955, Preliminary report on seismic investigation in Tift and Atkinson Counties, Georgia: Georgia Mineral Newsletter, v. 8, no. 2, p. 67-77.

Reflection and refraction studies were carried out in Tift and Atkinson Counties, Georgia. At the time of publication the results of the studies were still being tabulated.

York, J.E., and Oliver, J.E., 1976, Cretaceous and Cenozoic faulting in eastern North America: Geological Society of America Bulletin, v. 87, no. 8, p. 1105-1114.

Cretaceous and Cenozoic faults in eastern North America provide evidence of modest intraplate tectonic activity in this region. Gravity and thrust faults with inconsistent trends are present, thus indicating that stresses that vary spatially and (or) temporally rather than a single stress field acting steadily throughout the entire North American plate, are responsible for causing this intraplate tectonic activity. Strike-slip, movement is not demonstrable, but could have occurred in some places.

Zen, E.A., 1981, An alternative model for the development of the allochthonous southern Appalachian piedmont: American Journal of Science, v. 281, no. 9, p. 1153-1163.

The recent COCORP deep seismic profile revealed that a clearly recognizable though possibly composite seismic horizon, interpreted as a structural discontinuity in the rocks, exists in the crust underlying this transect at least as far east as the Kings Mountain Belt. It is proposed that both the rocks are allochthonous by overthrusting, and the rocks east of it, for which the seismic evidence for discontinuity is weaker, may be parts of an aggregated terrain consisting of microplates.

Zietz, I., and Gilbert, F.P., 1980, Aeromagnetic map of part of the southeastern United States: In color: U.S. Geological Survey Geophysical Investigations Map GP-936, 1 sheet, scale 1:2,000,000.

Aeromagnetic map covering the Atlantic Coastal Plain and Piedmont from northern Florida to southern Pennsylvannia. Map is based on Aeromagnetic surveys conducted between 1965 and 1979. Dunbarton Triassic Basin appears on this map.

Zimmerman, E.A., 1977, Ground water resources of Colquitt County, Georgia: U.S. Geological Survey Open-File Report 77-56, 41 p.

The principal artesian aquifer is made up of limestone beds of Eocene, Oligocene and lower Miocene age. The Swannee Strait traverses Colquitt County from near the southwest corner to the northeast corner. In this strait, limestone in the principal artesian aquifer is partly replaced by fine-grained clastic sediment, impairing transmissivity and making wells hard to construct. The transmissivity is much lower northwest of the strait than it is southeast, probably because of facies changes in the aquifer. The clastic beds of Miocene age are of little importance in the ground water picture because larger yields can be obtained from the underlying principal artesian aquifer.

Zoback, M.D.; Healy, J.H.; Roller, J.C.; Gohn, G.S.; and Higgins, B.B., 1978, Normal faulting and in situ stress in the South Carolina Coastal Plain near Charleston: Geology, v. 6, no. 3, p. 147-152.

Evidence presented suggests that normal faults in coastal plain sediments near Charleston, South Carolina are currently active. Hydraulic fracture studies were carried out in Clubhouse Crossroads wells #2 and #3 which are located on the edge of the Charleston meizoseismal zone. The magnitude of the least-principal stress in coastal plain sediments in the Clubhouse Crossroads wells is significantly less than the overburden stress. Incipient normal faulting might occur if the difference between these stresses were large enough. Such a fault would strike northwest-southeast and dip about 60°.

Zoback, M.L., and Zoback, M., 1980, State of stress in the conterminous United States: Journal of Geophysical Research, v. 85, no. B11, p. 6113-6156.

Northwest-southeast to west-northwest-east-southeast compression characterizes the Atlantic Coast stress province, which includes the Atlantic Coastal Plain, the Piedmont Province of the southern Appalachians, and the entire Appalachian fold belt in the northeast.

Earthquakes in the Atlantic Coast Province often have components of both thrust and strike-slip motion. Such oblique motion is expected because the earthquakes seem to occur on favorably oriented preexisting structures. For modern earthquakes associated with northeast striking normal faults which bound Triassic basins, the current sense of motion on the fault (reverse) is exactly opposite to the motion that created the faults.

APPENDIX B

OBSERVATION WELL LOGS

APPENDIX B

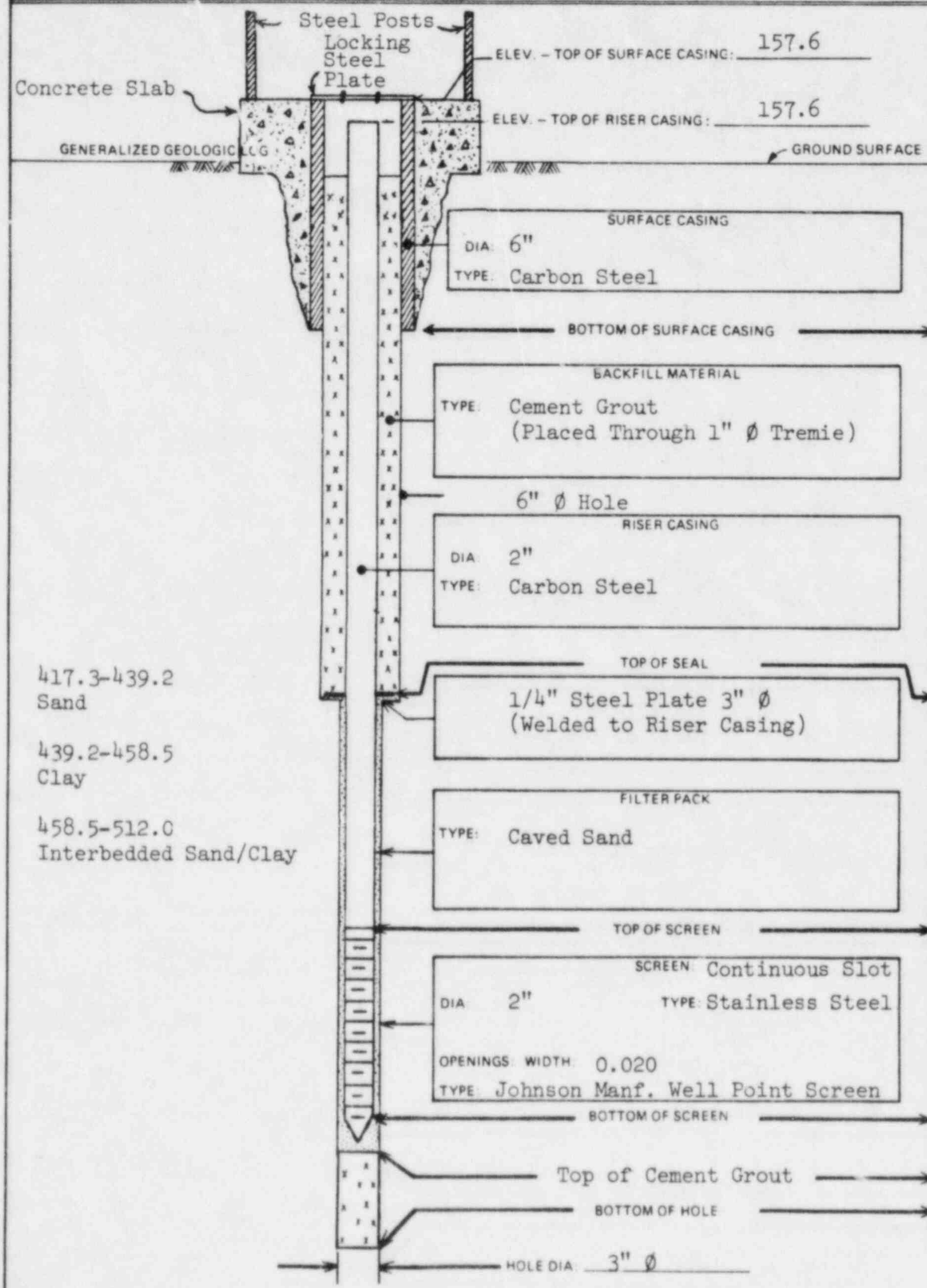
The following logs show the well construction for holes drilled as part of this study. A description of the observation well installation is in Section 6.4.

OBSERVATION WELL

PROJECT	WELL NO
VOGTLE ELECTRIC GENERATING PLANT	VG-1

JOB NO	SITE	COORDINATES
9510	Postulated Millett Fault	N 1120358.26 E 660009.14

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
5/16/82	5/26/82	Ron Wood (GPC)	Top of Surface Casing



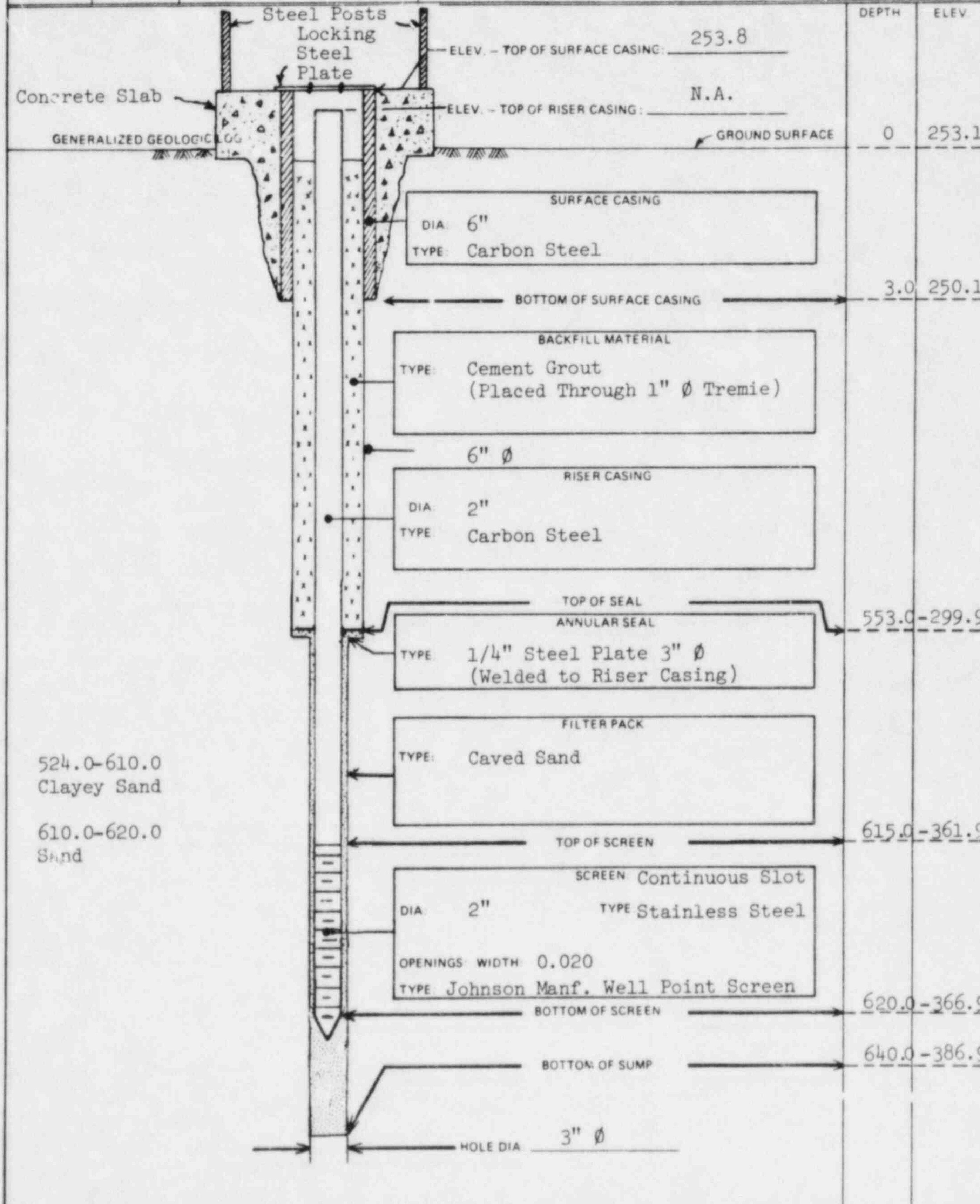
	DEPTH	ELEV.
Ground Surface	0	156.6
Bottom of Surface Casing	2.0	154.6
Top of Seal	425.0	-268.4
Top of Screen	507.0	-350.4
Bottom of Screen	512.0	-355.4
Top of Cement Grout	512.0	-355.4
Bottom of Hole	565.0	-408.4

OBSERVATION WELL

PROJECT	WELL NO
VOGTLE ELECTRIC GENERATING PLANT	VG-2

JOB NO	SITE	COORDINATES
9510	Postulated Millett Fault	N 1122608.99 E 650596.85

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
5/14/82	5/20/82	E. Vanek	Top of Surface Casing

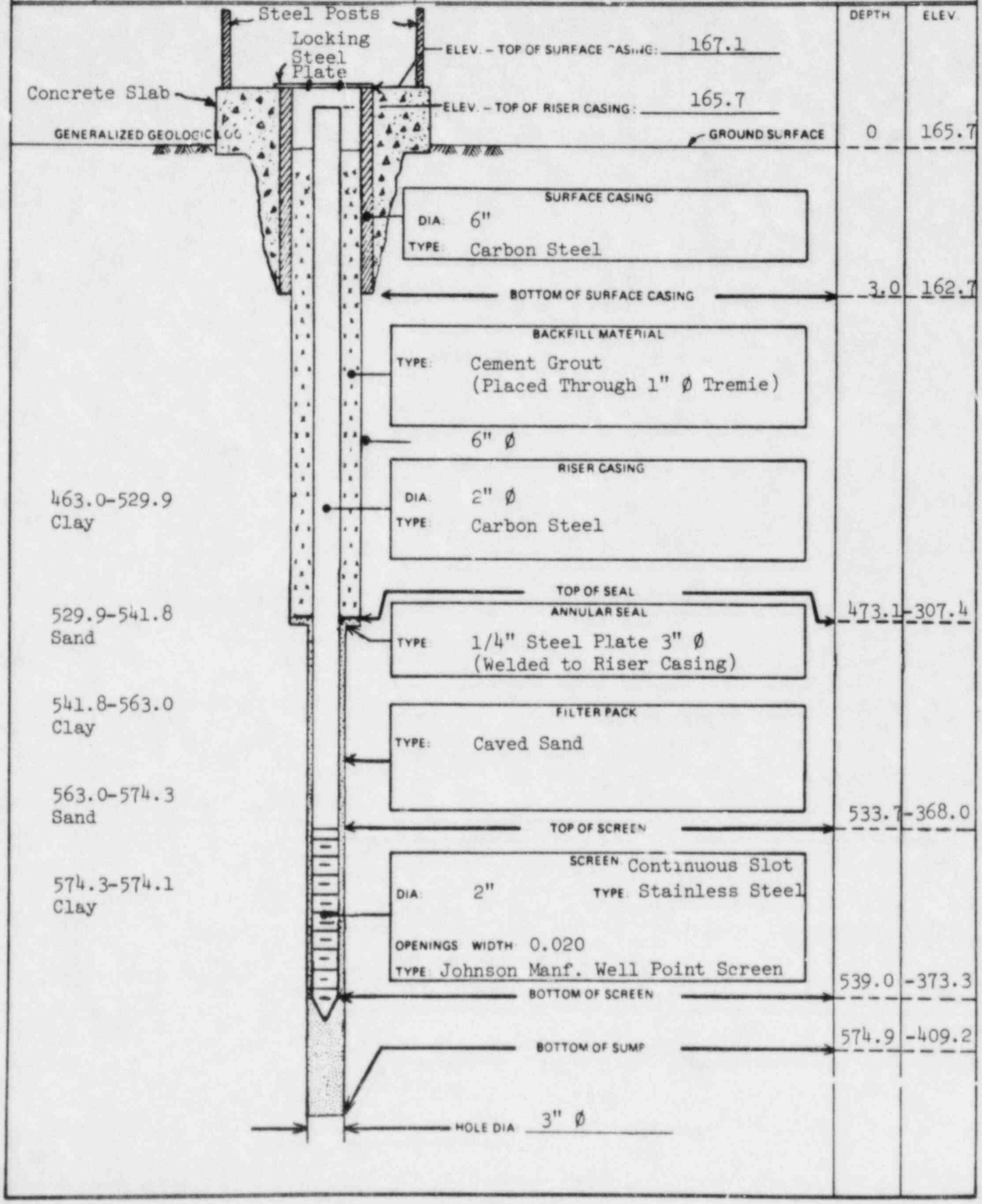


OBSERVATION WELL

PROJECT	WELL NO
VOGTLE ELECTRIC GENERATING PLANT	VG-3

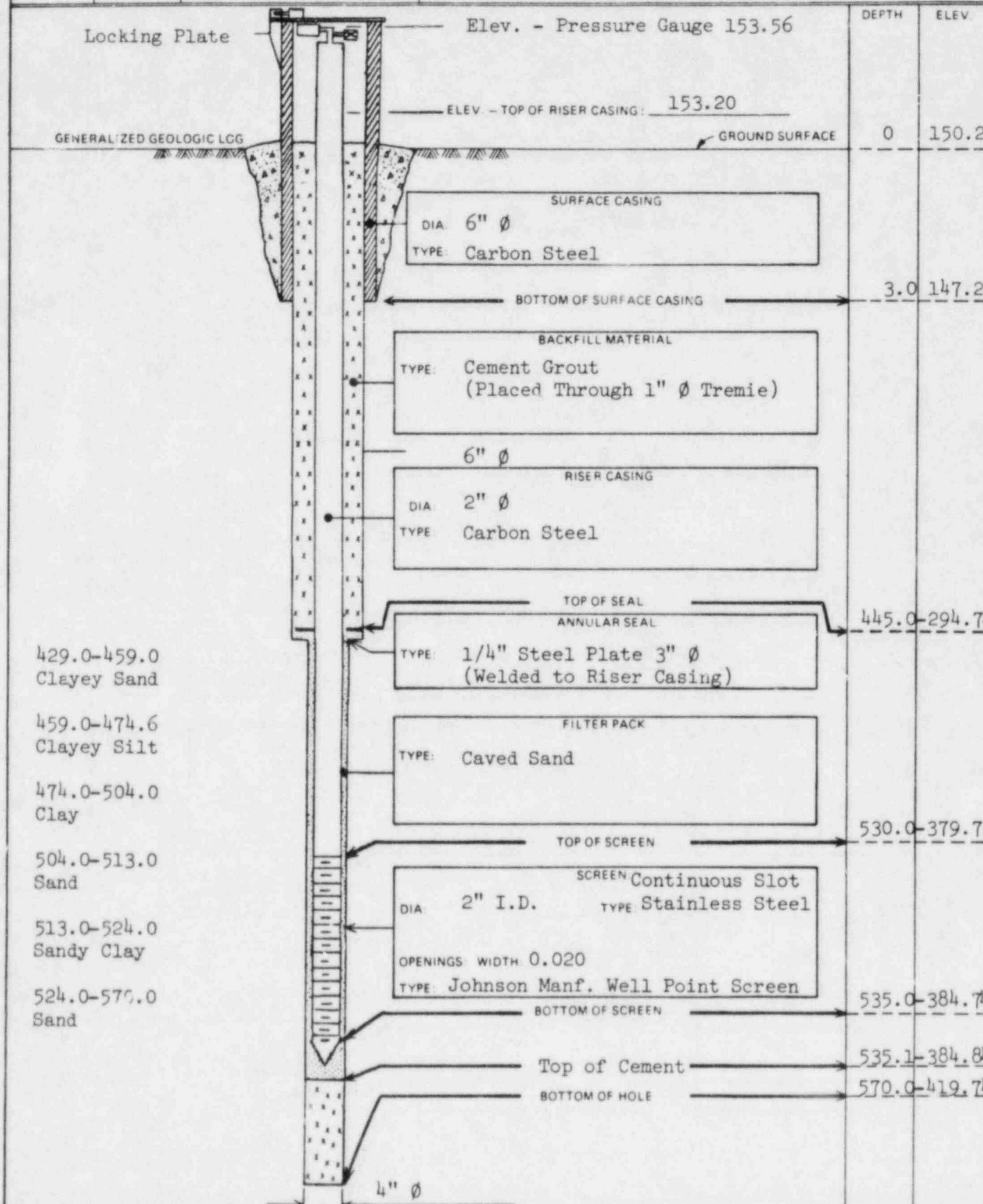
JOB NO	SITE	COORDINATES
9510	Postulated Millett Fault	N 1121183.52 E 655725.83

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
5/15/82	5/17/82	E. M. Fanelli	Top of Surface Casing



OBSERVATION WELL

PROJECT	VOGTLE ELECTRIC GENERATING PLANT	WELL NO.	VG-4
JOB NO.	9510	SITE	Postulated Millett Fault
COORDINATES	N 1124629.41 E 644971.51		
BEGUN	5/27/82	COMPLETED	5/31/82
PREPARED BY	Thackaberry/Crosby	REFERENCE POINT FOR MEASUREMENTS	Center of Pressure Gauge

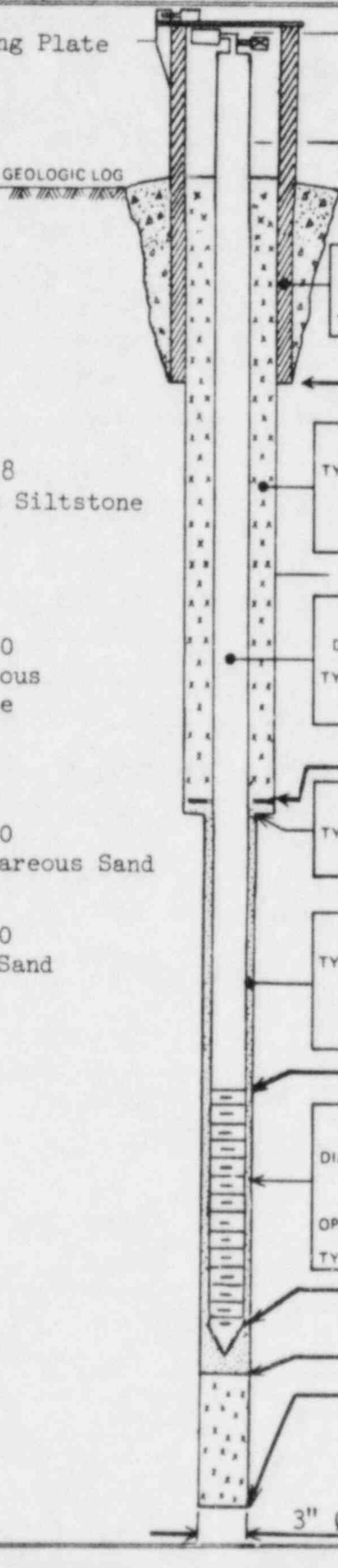


OBSERVATION WELL

PROJECT	WELL NO.
VOGTLE ELECTRIC GENERATING PLANT	VG-5

JOB NO	SITE	COORDINATES
9510	Postulated Millett Fault	N 1116669.12 E 665818.68

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
6/13/82	6/15/82	R. J. Kelleher	Center of Pressure Gauge



Locking Plate

Elev. - Pressure Gauge 98.4

ELEV. – TOP OF RISER CASING: 96.9

GENERALIZED GEOLOGIC LOG

112.0-186.8
Calcareous Siltstone
(Marl)

186.8-202.0
Fossiliferous
Limestone

202.0-232.0
Foss. Calcareous Sand

232.0-282.0
Non-Calc. Sand

SURFACE CASING
DIA: 6"
TYPE: Carbon Steel

BACKFILL MATERIAL
TYPE: Cement Grout
(Placed Through 1" Ø tremie)

RISER CASING
DIA: 2"
TYPE: Carbon Steel

ANNULAR SEAL
TYPE: 1/4" Steel Plate 4" Ø
(Welded to Riser Casing)

FILTER PACK
TYPE: Caved Sand

SCREEN: Continuous Slot
DIA: 2" TYPE: Stainless Steel
OPENINGS: WIDTH: 0.020
TYPE: Johnson Manf. Well Point Screen

3" Ø

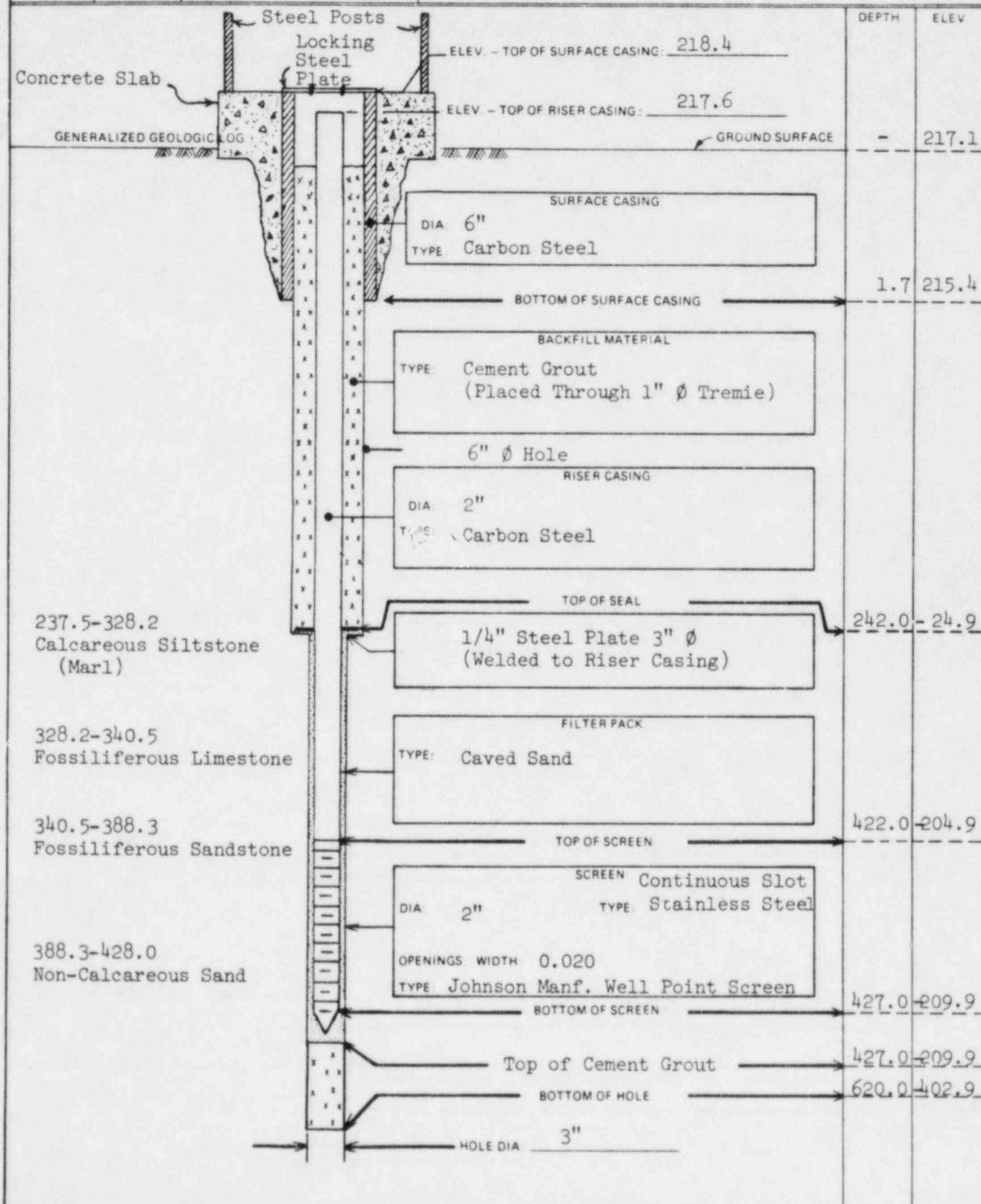
	DEPTH	ELEV.
GROUND SURFACE	0	94.5
BOTTOM OF SURFACE CASING	2.1	92.4
TOP OF SEAL	120.0	- 25.5
TOP OF SCREEN	237.0	-142.5
BOTTOM OF SCREEN	242.0	-147.5
Top of Cement	242.0	-147.5
BOTTOM OF HOLE	502.0	-407.5

OBSERVATION WELL

PROJECT	WELL NO
VOGTLE ELECTRIC GENERATING PLANT	VG-6

JOB NO.	SITE	COORDINATES
9510	Postulated Millett Fault	N 1110896.34 E669643.15

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
6/11/82	6/12/82	Robert J. Kelleher	Top of Surface Casing

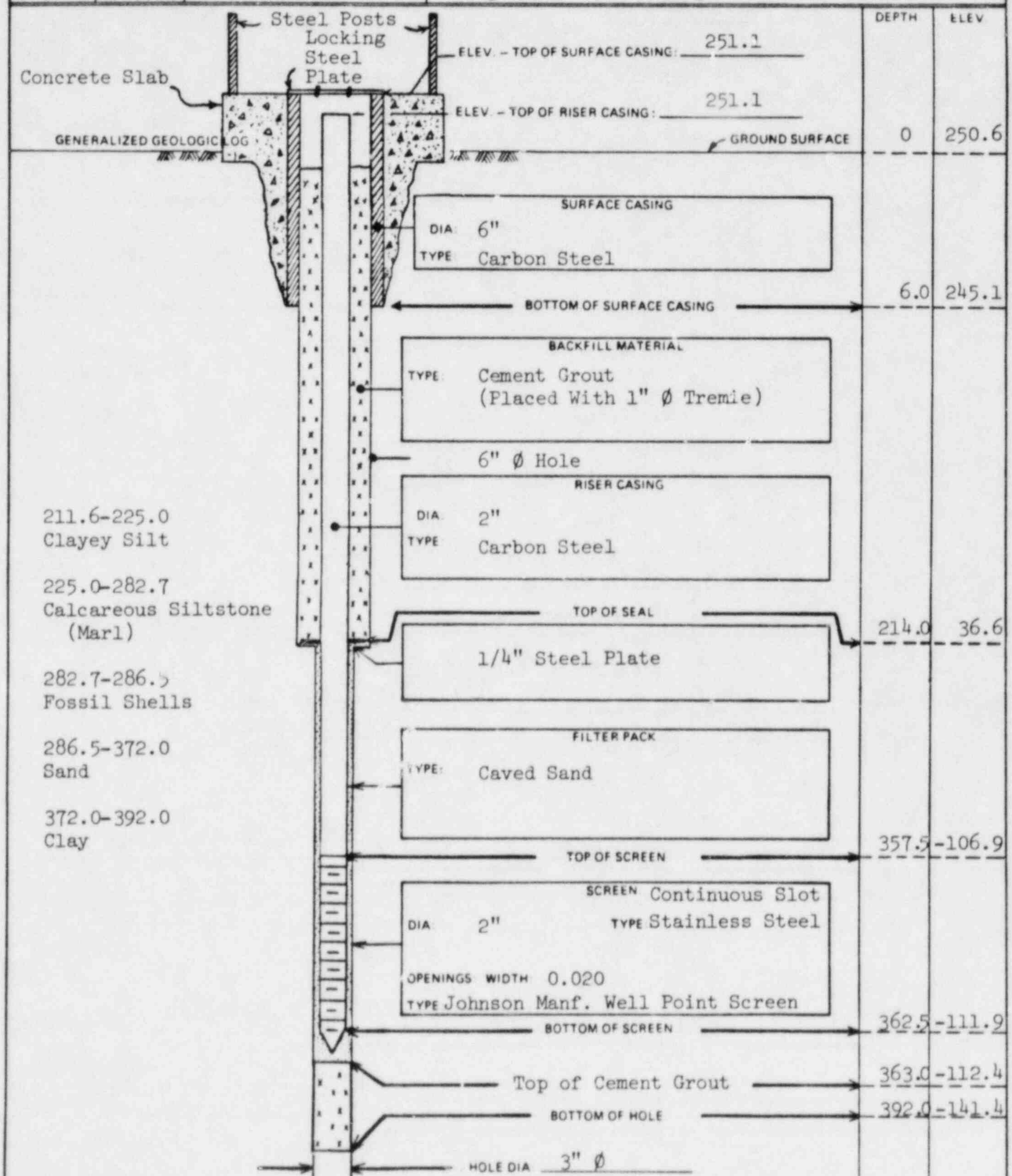


OBSERVATION WELL

PROJECT	WELL NO
VOGTLE ELECTRIC GENERATING PLANT	VG-7

JOB NO	SITE	COORDINATES
9510	Postulated Millett Fault	N 1127245.60 E 640322.37

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
6/25/82	6/25/82	S. Balone	Top of Surface Casing

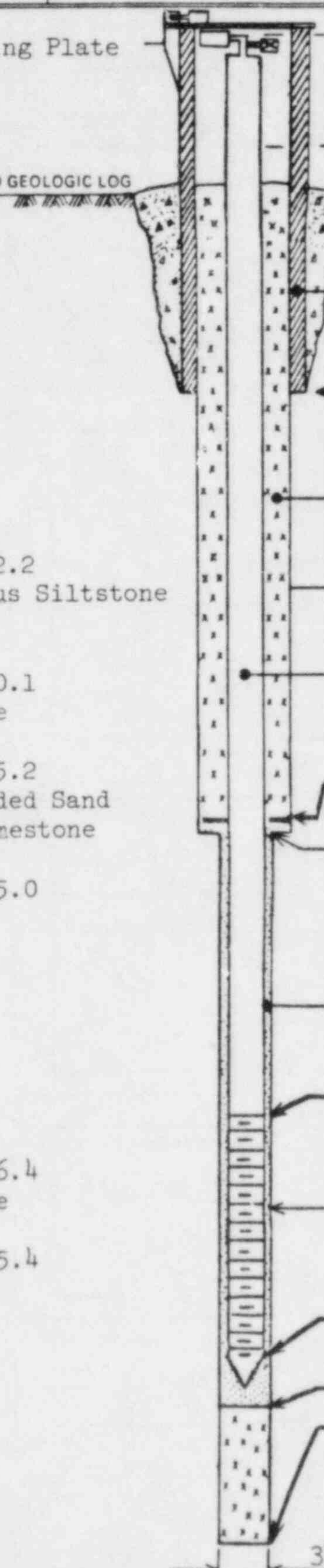


OBSERVATION WELL

PROJECT	WELL NO.
VOGTLE ELECTRIC GENERATING PLANT	VG-8

JOB NO.	SITE	COORDINATES
9510	Postulated Millett Fault	N 1104446.34 E 678744.09

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
6/24/82	6/25/82	S. Balone	Center of Pressure Gauge



Locking Plate

Elev. - Pressure Gauge 107.6

ELEV. - TOP OF RISER CASING: N.A.

GENERALIZED GEOLOGIC LOG

GROUND SURFACE

SURFACE CASING
DIA: 6"
TYPE: Carbon Steel

BOTTOM OF SURFACE CASING

BACKFILL MATERIAL
TYPE: Cement Grout (Placed Through 1" Ø Tremie)

6" Ø Hole

RISER CASING
DIA: 2"
TYPE: Carbon Steel

TOP OF SEAL

ANNULAR SEAL
TYPE: 1/4" Steel Plate 3" Ø (Welded to Riser Casing)

FILTER PACK
TYPE: Caved Sand

TOP OF SCREEN

SCREEN Continuous Slot
DIA: 2" TYPE: Stainless Steel
OPENINGS WIDTH: 0.020
TYPE: Johnson Manf. Well Point Screen

BOTTOM OF SCREEN

Top of Cement

BOTTOM OF HOLE

3" Ø

Generalized geologic log:

143.6-222.2
Calcareous Siltstone (Marl)

222.2-240.1
Limestone

240.1-285.2
Interbedded Sand and Limestone

285.2-335.0
Sand

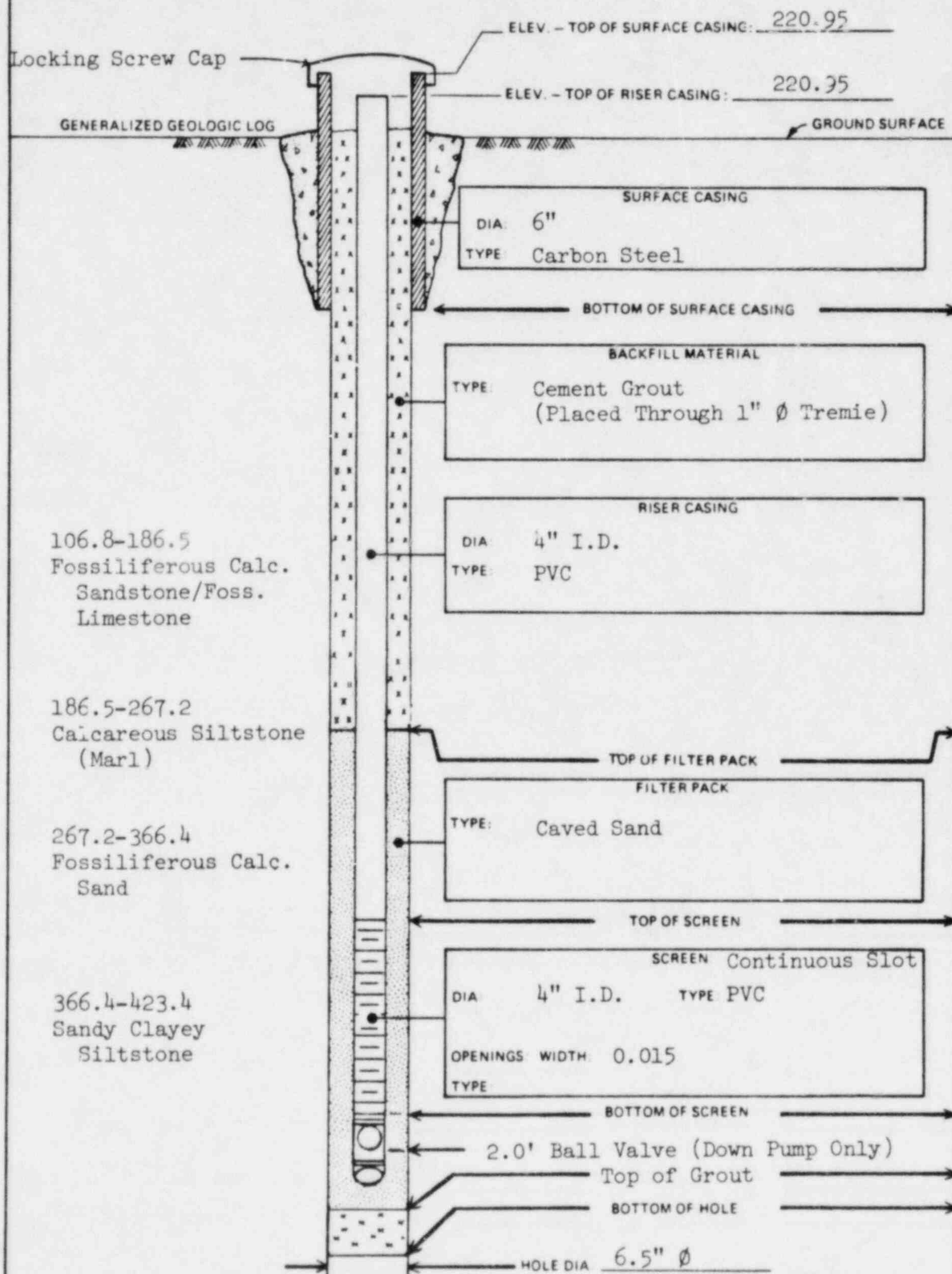
335.0-336.4
Limestone

336.4-355.4
Clay

Level	DEPTH	ELEV.
Pressure Gauge	+ 3.9	107.6
Ground Surface	0	103.7
Bottom of Surface Casing	2.1	101.6
Top of Seal	147.0	- 43.3
Top of Screen	307.0	-203.3
Bottom of Screen	312.0	-208.3
Top of Cement	312.0	-208.3
Bottom of Hole	355.4	-251.7

OBSERVATION WELL

PROJECT	VOGTLE ELECTRIC GENERATING PLANT			WELL NO. VSC-1
JOB NO. 9510	SITE Postulated Millett Fault	COORDINATES N 1134867.04 E 679423.1		
BEGUN 6/14/82	COMPLETED 6/17/82	PREPARED BY K. Wornick	REFERENCE POINT FOR MEASUREMENTS Top of Surface Casing	



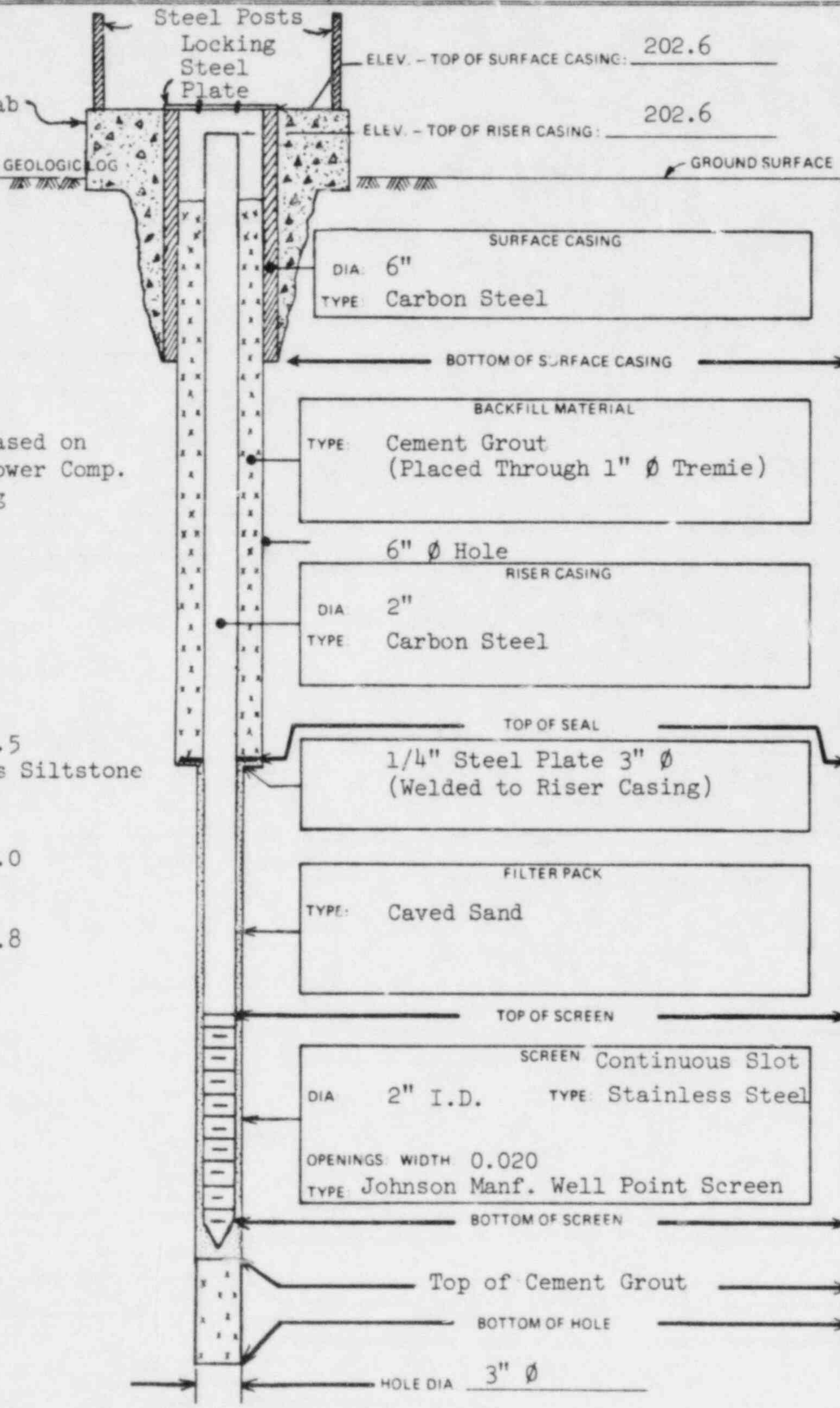
	DEPTH	ELEV.
Ground surface	0	219.0
Bottom of surface casing	3.0	216.0
Top of filter pack	186.0	33.0
Top of screen	345.0	-126.0
Bottom of screen	350.0	-131.0
Ball valve	366.0	-147.0
Top of grout / bottom of hole	620.0	-401.0

OBSERVATION WELL

PROJECT	WELL NO.
VOGTLE ELECTRIC GENERATING PLANT	VSC-2

JOB NO.	SITE	COORDINATES
9510	Postulated Millett Fault	N 1141512.71 E 67349.62

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
6/14/82	6/14/82	K. Wornick/(R. Wood)	Top of Surface Casing



Geology based on Georgia Power Comp. Boring Log

152.0-256.5
Calcareous Siltstone (Marl)

256.5-316.0
Sand

316.0-362.8
Clay

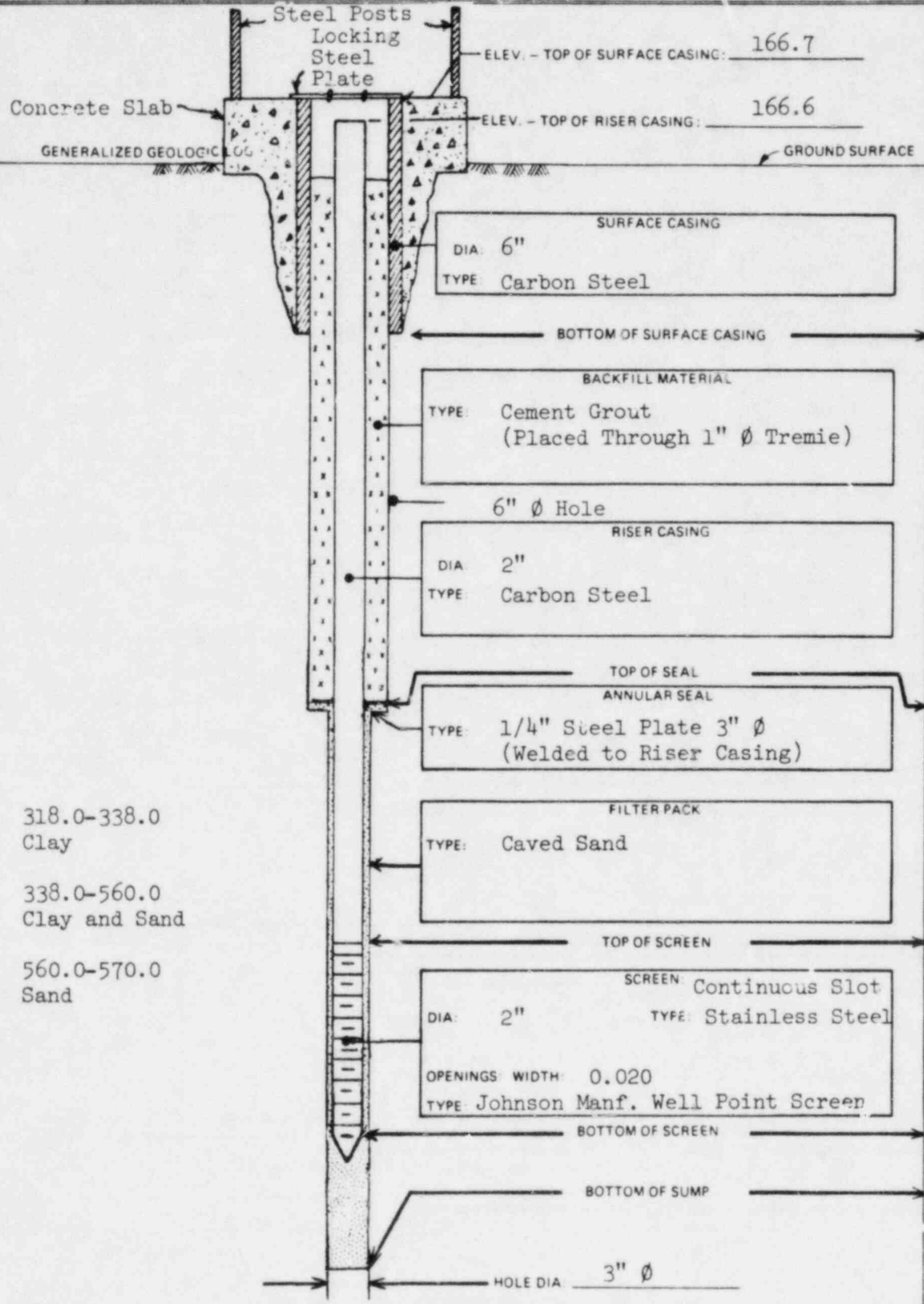
	DEPTH	ELEV.
Ground surface	0	201.7
Bottom of surface casing	2.1	199.6
Top of seal	160.0	41.7
Top of screen	310.0	-108.3
Bottom of screen	315.0	-113.3
Top of cement grout	317.0	-115.3
Bottom of hole	600.0	-398.3

OBSERVATION WELL

PROJECT	WELL NO
VOGTLE ELECTRIC GENERATING PLANT	VSC-3

JOB NO	SITE	COORDINATES
9510	Postulated Millett Fault	N 1138356.84 E 676254.55

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
6/29/82	6/30/82	Ron Wood (GPC)	Top of Surface Casing



	DEPTH	ELEV
Ground surface	0	165.7
Bottom of surface casing	2.0	163.7
Top of seal	325.0	-159.3
Top of screen	565.0	-399.3
Bottom of screen	570.0	-404.3
Bottom of sump	578.0	-412.3

318.0-338.0
Clay

338.0-560.0
Clay and Sand

560.0-570.0
Sand

OBSERVATION WELL

PROJECT	WELL NO
VOGTLE ELECTRIC GENERATING PLANT	VSC-4A

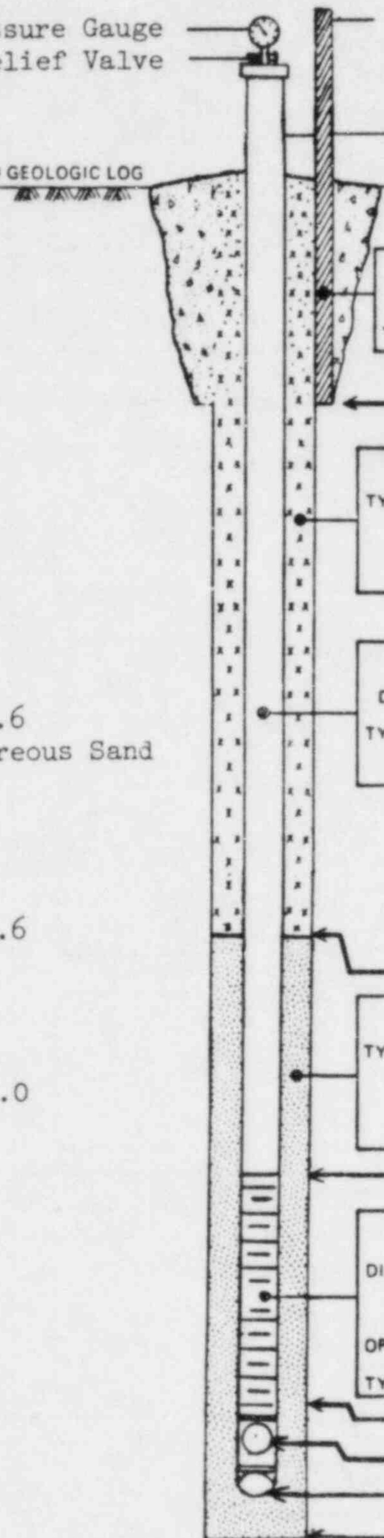
JOB NO	SITE	COORDINATES
9510	Postulated Millett Fault	N 1130601.87 E 683297.22

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7/21/82	7/28/82	R. J. Kelleher	Center of Pressure Gauge

Pressure Gauge
Relief Valve
Steel Post

ELEV. – TOP OF RISER CASING: 158.0

GENERALIZED GEOLOGIC LOG



271.9-323.6
Non-Calcareous Sand

323.6-378.6
Clay

378.6-490.0
Sand

SURFACE CASING
DIA: Surface shelter will be built
TYPE: by land owner.

BACKFILL MATERIAL
TYPE: Cement Grout
(Placed through 1" Ø Tremie)

RISER CASING
DIA: 4"
TYPE: PVC Sch. 80

FILTER PACK
TYPE: Fine Aggregate Sand for Concrete Placed Through 1" Ø Tremie

SCREEN Continuous Slot
DIA: 4" I.D. TYPE: PVC
OPENINGS WIDTH: 0.015
TYPE:

2.0' Ball Valve (Down Pump Only)

HOLE DIA: 8" Ø

	DEPTH	ELEV
GROUND SURFACE	0	156.7
BOTTOM OF SURFACE CASING		
TOP OF FILTER PACK	360.0	-203.3
TOP OF SCREEN	465.0	-308.3
BOTTOM OF SCREEN	480.0	-323.3
BOTTOM OF SUMP	482.0	-325.3
BOTTOM OF HOLE	490.0	-333.3

APPENDIX C

TABULATION OF EXISTING WATER WELL AND DRILL HOLE DATA

APPENDIX C

WATER WELL AND DRILL HOLE INVENTORY

This appendix provides a tabular listing of available information from numerous water wells and exploratory borings drilled throughout the study area. This typically includes such general information as the well location, depth and surface elevation. The availability of additional information is indicated by a check in the appropriate column. Such information may include a geologist's log, a driller's log, geophysical logs spontaneous potential, resistivity, gamma ray and/or neutron, water level data, water quality data, well test and/or construction reports, and governmental agency reports. The primary sources for this drill hole data are state and federal geological surveys, state and county water resources agencies, and local plant sites such as Vogtle Electric Generating Plant, Savannah River Plant and Barnwell Nuclear Fuel Plant.

TABLE NO. C-1 (SHEET 1A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BURKE COUNTY, GEORGIA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
B-1	33° 13' 38" N 81° 49' 35" W			X			
B-3	33° 13' 28" N 81° 49' 50" W			X			
B-4	33° 13' 13" N 81° 49' 51" W			X			
B-6	33° 13' 03" N 81° 49' 41" W			X			
B-7	33° 12' 55" N 81° 49' 12" W			X			
B-8	33° 13' 33" N 81° 49' 40" W			X			
B-10	33° 13' 29" N 81° 50' 20" W			X			
B-11	33° 13' 04" N 81° 50' 24" W			X			
B-12	33° 09' 45" N 81° 46' 21" W			X			
B-13	33° 14' 22" N 81° 51' 50" W			X			
B-14	33° 14' 03" N 81° 51' 28" W			X			
B-15	33° 11' 22" N 81° 52' 19" W			X			
B-16	33° 09' 26" N 81° 46' 46" W			X			
B-25	33° 08' 27" N 81° 44 50" W			X			
B-26	33° 08' 09" N 81° 44' 37" W			X			

TABLE NO. C-1 (SHEET 1B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BURKE COUNTY, GEORGIA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY* REPORT	REMARKS
B-1	33° 13' 38" N 81° 49' 35" W						Split spoon samples only
B-3	33° 13' 28" N 81° 49' 50" W						Split spoon samples only
B-4	33° 13' 13" N 81° 49' 51" W						Split spoon samples only
B-6	33° 13' 03" N 81° 49' 41" W						Split spoon samples only
B-7	33° 12' 55" N 81° 49' 12" W						Split spoon samples only
B-8	33° 13' 33" N 81° 49' 40" W						Split spoon samples only
B-10	33° 13' 29" N 81° 50' 20" W						Split spoon samples only
B-11	33° 13' 04" N 81° 50' 24" W						Split spoon samples only
B-12	33° 09' 45" N 81° 46' 21" W						Split spoon samples only
B-13	33° 14' 22" N 81° 51' 50" W						Split spoon samples only
B-14	33° 14' 03" N 81° 51' 28" W						Split spoon samples only
B-15	33° 11' 22" N 81° 52' 19" W						Split spoon samples only
B-16	33° 09' 26" N 81° 46' 46" W						Split spoon samples only
B-25	33° 08' 27" N 81° 44' 50" W						Split spoon samples only
B-26	33° 08' 09" N 81° 44' 37" W						Split spoon samples only

* Well record obtained from USGS, state or county agency.

TABLE NO. C-1 (SHEET 2A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BURKE COUNTY, GEORGIA

WELL NUMBER	LOCATION	DEPTH (FT)	SURFACE ELEVATION (FT)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
B-35A	Alvin W. Vogtle Site	70	94.4	X			
B-36A	Alvin W. Vogtle Site	70	98.3	X			
B-36B	Alvin W. Vogtle Site	150	98.4	X			
B-45	18,300 N.E. of 36*	370	273.5	X			
B-136	N 1,142,996.2 (a) E 623,848.8	300	209.5	X			
B-147	33° 08' 37" N 81° 45' 37" W			X			
B-152	N 1,133,830.7 (a) E 633,343.7	200	152.[illegible]	X			
B-156	N 1,131,584.1 (a) E 642,340.1	260	237.7	X			
B-246	N 1,145,531.6 (a) E 620,553.1	400	210.4	X			
B-346	N 1,137,351 (a) E 628,477	26.5	108	X			
CW-1	N 69+13 (b) E 89+19	251			X		
GGS***131	33° 14' 11" N 81° 56' 46" W	620	129	X			
GGS 220	33° 11' 20" N 81° 55' 30" W	1002		X			
GGS 316	33° 10' 10" N 81° 56' 55" W	1003	276	X			
GGS 391	32° 49' 41" N 82° 14' 26" W	250	229	X			

* See remarks
*** Georgia Geologic Survey
(a) Georgia state grid
(b) Vogtle plant grid

TABLE NO. C-1 (SHEET 2B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BURKE COUNTY, GEORGIA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENC. REPORT	
B-35A	Alvin W. Vogtle site						**
B-36A	Alvin W. Vogtle site						**
B-36B	Alvin W. Vogtle site	X					**
B-45	18,300 N.E. of 36*	X					Best location available **
B-136	N 1,142,996.2 (a) E 623,848.8	X					
B-147	33° 08' 37" N 81° 45' 37" w						
B-152	N 1,133,830.7 (a) E 633,343.7	X					
B-156	N 1,131,584.1 (a) E 642,340.1	X					
B-246	N 1,145,531.6 (a) E 620,553.1	X					Report on referred fossils
B-346	N 1,137,351 (a) E 628,477	X					
CW-1	N 69+13 (b) E 89+19	X	X	X		X	
GGS***131	33° 14' 11" N 81° 56' 46" W						
GGS 220	33° 11' 20" N 81° 55' 30" W					X	
GGS 316	33° 10' 10" N 81° 56' 55" W					X	
GGS 391	32° 49' 41" N 82° 14' 26" W			X		X	

* See remarks
** Not shown on Figure 7-1
*** Georgia Geologic Survey
(a) Georgia state grid
(b) Vogtle plant grid

TABLE NO. C-1 (SHEET 3A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BURKE COUNTY, GEORGIA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
GGS 392	33° 03' 19" N 81° 43' 40" W	175	230	X			
GGS 520	33° 05' 33" N 82° 01' 00" W	700	300	X			
GGS 1171 (Burke #1)	33° 05' 53" N 81° 42' 40" W	187		X		X	X
GGS 1172 (Burke #2)	33° 07' 00" N 81° 42' 15" W	150	100	X			
GGS 1176 (Burke #4)	33° 09' 46" N 81° 54' 25" W	150	300	X		X	X
GGS 2136 (Burke #2)	32° 49' 37" N 82° 09' 14" W	405		X			
GGS 3169	33° 08' 29" N 81° 45' 38" W	378			X	X	XX
GGS 3354	33° 00' 34" N 82° 06' 23" W	410	268	X		X	
GGS 3444	32° 52' 32" N 82° 13' 15" W	1530	268	X		X	X
MU* #1(#5)	N 1,144,424.7 (a) E 624,530.7	851	197		X	X	X
MU* #2(#6)	N 1,144,500 (a) E 623,135	850	214.5		X	X	
TW-1	33° 08' 24" N 81° 45' 41" W	928	219	X		XX	X
Sardis #1	32° 58' 25" N 81° 45' 32" W	300					
Sardis #2	32° 58' 10" N 81° 45' 07" W	300					

* Makeup
(a) Georgia state grid

TABLE NO. C-1 (SHEET 3B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BURKE COUNTY, GEORGIA

WELL NUMBER	LOCATION	DATA AVAILABLE CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
GGS 392	33° 03' 19" N 81° 43' 40" W					X	
GGS 520	33° 05' 33" N 82° 01' 00" W						
GGS 1171 (Burke #1)	33° 05' 53" N 81° 42' 40" W						
GGS 1172 (Burke #2)	33° 07' 00" N 81° 42' 15" W						
GGS 1176 (Burke #4)	33° 09' 46" N 81° 54' 25" W						
GGS 2136 (Burke #2)	32° 49' 37" N 82° 09' 14" W						
GGS 3169	33° 08' 29" N 81° 45' 38" W						
GGS 3354	33° 00' 34" N 82° 06' 23" W						
GGS 3444	32° 52' 32" N 82° 13' 15" W						Temperature, acoustic velocity, caliper, and fluid logs
MU* #1(#5)	N 1,144,424.7(a) E 624,530.7	X	X	X		X	
MU* #2(#6)	N 1,144,500(a) E 623,135	X	X	X			
TW-1	33° 08' 24" N 81° 45' 41" W	X					Logs of interval velocity, elastic moduli, bulk density and Poisson's ratio
Sardis #1	32° 58' 25" N 81° 45' 32" W		X	X			
Sardis #2	32° 58' 10" N 81° 45' 07" W		X	X			

* Makeup
(a) Georgia state grid

TABLE NO. C-1 (SHEET 4A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BURKE COUNTY, GEORGIA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	GEOLOGIST'S LOG	DATA AVAILABLE		
						GEOPHYSICAL LOGS	
					DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
Waynesboro #2	South side of Waynesboro	300	256				
EFFINGHAM COUNTY, GEORGIA							
GGS 3108 (Effingham #10)	32° 34' 22" N 81° 25' 03" W	198		X			
GGS 3109 (Effingham #11)	32° 33' 07" N 81° 22' 34" W	188		X			
GGS 3110 (Effingham #12)	32° 31' 47" N 81° 19' 57" W	210		X			
EMANUEL COUNTY, GEORGIA							
Georgia Oil Co.	32° 35' 00" N 82° 08' 00" W*	2232					
GGS 172	32° 48' 00" N 82° 14' 00" W*	1833	200				

* See remarks
** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 4B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
JEFFERSON COUNTY, GEORGIA

WELL NUMBER	LOCATION	DATA AVAILABLE: CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
Waynesboro #2	South side of Waynesboro		X	X			**
EFFINGHAM COUNTY, GEORGIA							
GGS 3108 (Effingham #10)	32° 34' 22" N 81° 25' 03" W						
GGS 3109 (Effingham #11)	32° 33' 07" N 81° 22' 34" W						**
GGS 3110 (Effingham #12)	32° 31' 47" N 81° 19' 57" W						**
EMANUEL COUNTY, GEORGIA							
Georgia Oil Co.	32° 35' 00" N 82° 08' 00" W*					X	Approximate location
GGS 172	32° 48' 00" N 82° 14' 00" W*					X	Approximate location **

* See remarks
** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 5A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
JEFFERSON COUNTY, GEORGIA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
Ash #1	Near Monticello*	103			X		
City of Wadley	Wadley, Georgia	491		X			
Georgia Petroleum Co.	32° 59' 00" N 82° 27' 00" W*	1143	445				
GGS 133	32° 12' 20" N 82° 23' 40" W	549	445	X			
GGS 480	33° 03' 40" N 82° 23' 35" W	750	355	X			
GGS 532	32° 53' 54" N 82° 23' 22" W	410	265	X			
GGS 554	32° 59' 44" N 82° 24' 40" W	370	57	X			
GGS 1192	32° 54' 15" N 82° 23' 45" W	253		X		X	
Joiner #1	SE/4 NW/4, sec.6 T2N R6E	168		X			
Sasser #1	SW/4 NW/4 sec.36 T2N R3E	270		X			
Wooten #2	Center sec. 5, T2N, R5E	162		X			

* See remarks
** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 5B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
JEFFERSON COUNTY, GEORGIA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	
Ash #1	Near Monticello*						0.2 mi. west of SE corner of Section 1, T2N, R6E**
City of Wadley	Wadley, Georgia	X	X	X	X		**
Georgia Petroleum Co.	32° 59' 00" N 82° 27' 00" W*					X	Approximate location **
GGS 133	32° 12' 20" N 82° 23' 40" W						**
GGS 480	33° 03' 40" N 82° 23' 35" W						**
GGS 532	32° 53' 54" N 82° 23' 22" W						**
GGS 554	32° 59' 44" N 82° 24' 40" W						**
GGS 1192	32° 54' 15" N 82° 23' 45" W						**
Joiner #1	SE/4 NW/4, sec.6 T2N R6E						**
Sasser #1	SW/4 NW/4 sec.36 T2N R3E						**
Wooten #2	Center sec. 5, T2N, R5E						**

* See remarks
** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 6A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
JENKINS COUNTY, GEORGIA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
GGS 227	32° 52' 42" N 81° 57' 42" W						
GGS 1032	32° 52' 59" N 81° 57' 12" W						
GGS 3442	32° 48' 24" N 81° 53' 55" W	400		X			
Magnolia Springs #1	Magnolia Springs State Park, Millen	480			X		
Magnolia Springs #2	C.C.C. camp at Magnolia Springs State Park*	357	210		X		
RICHMOND COUNTY, GEORGIA							
Kimberly Clark test well	33° 16' 37" N 81° 56' 00" W	700	290			X	X
SCREVEN COUNTY, GEORGIA							
B*** 1	Newington, Georgia	199					
B-3	32° 36' 49" N 81° 24' 37" W	202		X			
B-4	Newington, Georgia	162					
B-5	Newington, Georgia	104.5					

* See remarks
*** Boring

TABLE NO. C-1 (SHEET 6B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
JENKINS COUNTY, GEORGIA

WELL NUMBER	LOCATION	DATA AVAILABLE CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
GGS 227	32° 52' 42" N 81° 57' 42" W						
GGS 1032	32° 52' 59" N 81° 57' 12" W						
GGS 3442	32° 48' 24" N 81° 53' 55" W						
Magnolia Springs #1	Magnolia Springs State Park, Millett	X	X	X			**
Magnolia Springs #2	C.C.C. camp at Magnolia Springs State Park*			X			4-1/2 miles north of Millen**

RICHMOND COUNTY, GEORGIA

WELL NUMBER	LOCATION	CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
Kimberly Clark test well	33° 16' 37" N 81° 56' 00" W		X				Acoustic velocity log

SCREVEN COUNTY, GEORGIA

WELL NUMBER	LOCATION	CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
B*** 1	Newington, Georgia						Boring log**
B-3	32° 36' 49" N 81° 24' 37" W						Boring log
B-4	Newington, Georgia						Boring log**
B-5	Newington, Georgia						Boring log**

* See remarks
** Not shown on Figure 7-1
*** Boring

TABLE NO. C-1 (SHEET 7A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
SCREVEN COUNTY, GEORGIA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
B-21	32° 37' 13" N 81° 25' 00" W	203		X			
B-22	32° 37' 50" N 81° 25' 33" W	202		X			
B-23	Screven/Effingham border						
B-31	32° 48' 46" N 81° 28' 50" W	248.2		X			
B-32	32° 54' 14" N 81° 30' 32" W	253.2		X	X		
B-33	32° 57' 31" N 81° 32' 29" W	273.2	95	X	X		
B-34	33° 00' 59" N 81° 34' 35" W	273.3		X	X		
B-35	33° 01' 28" N 81° 31' 56" W	203.5			X		
B-36	32° 41' 34" N 81° 26' 32" W	173.3			X		
B-37	32° 41' 10" N 81° 27' 36" W	233.1		X	X		
B-38	32° 38' 32" N 81° 27' 30" W	212.4		X	X		
B-40	2 miles north of Clyo, Ga.*	190.5		X	X		
B-41	4 miles south of Clyo, Ga.*	232		X	X		

* See remarks

TABLE NO. C-1 (SHEET 7B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
SCREVEN COUNTY, GEORGIA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
B-21	32° 37' 13" N 81° 25' 00" W						Boring log
B-22	32° 37' 50" N 81° 25' 33" W						Boring log
B-23	Screven/Effingham border		X	X			**
B-31	32° 48' 46" N 81° 28' 50" W						
B-32	32° 54' 14" N 81° 30' 32" W						
B-33	32° 57' 31" N 81° 32' 29" W						
B-34	33° 00' 59" N 81° 34' 35" W						
B-35	33° 01' 28" N 81° 31' 56" W						
B-36	32° 41' 34" N 81° 26' 32" W						
B-37	32° 41' 10" N 81° 27' 36" W						
B-38	32° 38' 32" N 81° 27' [illegible]" W						
B-40	2 miles north of Clyo, GA.*						400 ft east of GA. highway 91, **
B-41	4 miles south of Clyo, GA.*						Along Stillwell Rd. **

* See remarks
** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 8A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
SCREVEN COUNTY, GEORGIA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
BFL 4-2	Millhaven Plantation	790	180		X	XX	
GGS 295	32° 45' 26" N 81° 38' 29" W	490	202	X			
GGS 413	32° 45' 54" N 81° 34' 54" W	216	210	X			
GGS 590	32° 55' 59" N 81° 32' 14" W	374	95	X			
GGS 855	32° 35' 00" N 81° 25' 40" W	2677	130	X		XX	
GGS 940	32° 53' 06" N 81° 39' 31" W						
GGS 974	32° 45° 04" N 81° 35' 29" W					XX	X
GGS 979*	32° 36' 25" N 81° 44' 40" W	#1 - 1336 #2 - 670 #3 - 1331	160		X X		
GGS 1007	32° 49' 31" N 81° 46' 53" W	260*		X		XX	X
GGS 1047	32° 55' 32" N 81° 40' 18" W						
GGS 1170	32° 38' 07" N 81° 25' 29" W	340*		X		XX	X
GGS 1174	33° 01' 17" N 81° 34' 35" W						
GGS 1175	32° 55' 59" N 81° 31' 15" W	295		X		XX	X
GGS 3032	32° 41' 18" N 81° 30' 54" W			X			X

* See remarks

TABLE NO. C-1 (SHEET 8B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
SCREVEN COUNTY, GEORGIA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
BFL 4-2	Millhaven Plantation	X	X				Caliper log, **
GGS 295	32° 45' 26" N 81° 38' 29" W						
GGS 413	32° 45' 54" N 81° 34' 54" W						
GGS 590	32° 55' 59" N 81° 32' 14" W						
GGS 855	32° 35' 00" N 81° 25' 40" W						
GGS 940	32° 53' 06" N 81° 39' 31" W						**
GGS 974	32° 45° 04" N 81° 35' 29" W						
GGS 979	32° 36' 25" N 81° 44' 40" W	#1 - X #2 - X #3 - X	X X	X X		X X	King Manufacturing Company #1, #2, and #3
GGS 1007	32° 49' 31" N 81° 46' 53" W						Depth from gamma log
GGS 1047	32° 55' 32" N 81° 40' 18" W						**
GGS 1170	32° 38' 07" N 81° 25' 29" W						Depth from E-log
GGS 1175	32° 55' 59" N 81° 31' 15" W						
GGS 3032	32° 41' 18" N 81° 30' 54" W						

* See remarks
** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 9A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
SCREVEN COUNTY, GEORGIA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE: GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS: SP/ RESISTIVITY	GAMMA/ NEUTRON
GGS 3095	North Screven County*	75		X			
GGS 3198	32° 41' 25" N 81° 30' 29" W	212		X			

WASHINGTON COUNTY, GEORGIA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
GGS 223	32° 59' 25" N 83° 00' 15" W	605	480	X			

* See remarks

TABLE NO. C-1 (SHEET 9B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
SCREVEN COUNTY, GEORGIA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
GGS 3095	North Screven County*						East of Hitonia**
GGS 3198	32° 41' 25" N 81° 30' 29" W						

WASHINGTON COUNTY, GEORGIA

WELL NUMBER	LOCATION	CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
GGS 223	32° 59' 25" N 83° 00' 15" W						

* See remarks
** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 10A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
AIKEN COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
AK-23	SE/4 of Oakwood Quadrangle*	73	418		X		
AK-29	N 723.4 (c) E 466.5	172	460		X		
AK-183	N 699.2 (c) E 417.5	320	254		X		
AK-203	33° 26' 01" N 81° 54' 43" W	364	149		X		
AK-266	N 710.2 (c) E 434.5	519	490		X		
AK-268	N 688.0 (c) E 426.2	153	220		X		
AK-269	N 707.1 (c) E 410.3	280	432		X		
AK-380	City of Ellenton*	484	420		X		
AK-428	33° 29' 40" N 81° 52' 05" W	93					X
AK-430	33° 19' 40" N 81° 44' 35" W	605	357				
AK-437	Town of Bath	140			X		
AK-438	Town of Bath*	235				X	
AK-453	Town of Belvedere	190				X	
AK-454	Town of Belvedere	242			X		

* See remarks
(c) Modified Universal Transverse Mercator (UTM) grid.

TABLE NO. C-1 (SHEET 10B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
AIKEN COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
AK-23	SE/4 of Oakwood Quadrangle*			X			2 miles past Aiken St. Park boundary to the west on SC-53**
AK-29	N 723.4 (c) E 466.5	X	X	X			**
AK-183	N 699.2 (c) E 417.5	X	X	X			
AK-203	33° 26' 01" N 81° 54' 43" W	X	X	X		X	
AK-266	N 710.2 (c) E 434.5	X	X	X			**
AK-268	N 688.0 (c) E 426.2	X	X	X		X	
AK-269	N 707.1 (c) E 410.3	X		X		X	**
AK-380	City of Ellenton*		X	X		X	Corner of Oak and Boatner St.**
AK-428	33° 29' 40" N 81° 52' 05" W			X		X	**
AK-430	33° 19' 40" N 81° 44' 35" W			X			
AK-437	Town of Bath	X		X		X	**
AK-438	Town of Bath*					X	Under ..w water tank along Co. road 20**
AK-453	Town of Belvedere					X	**
AK-454	Town of Belvedere	X	X	X		X	**

* See remarks
(c) Modified Universal Transverse Mercator (UTM) grid.

TABLE NO. C-1 (SHEET 11A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
AIKEN COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
AK-456	Town of Belvedere	118			X		
AK-459	Town of Clearwater	195				X	
AK-461	Town of Clearwater	172				X	X
DRB 1	33° 17' 56" N 81° 40' 18" W	1900	261.62		X		
DRB 2	33° 16' 39" N 81° 39' 48" W	1982	281.6		X		X
DRB 3	33° 17' 14" N 81° 39' 49" W	1941	285.3		X		X
DRB 4	33° 16' 39" N 81° 38' 03" W	1938	250.75		X		XX
DRB 5	33° 17' 40" N 81° 39' 37" W	1838	286.7		X		XX
DRB 6	33° 17' 29" N 81° 39' 21" W	1913	269.08		X		XX
DRB 7	33° 17' 17" N 81° 40' 28" W	1969	277.9		X		XX
DRB 8	33° 16' 54" N 81° 38' 54" W	1965*					
LA-8	33° 17' 01" N 81° 43' 09" W	629	274		X		

* See remarks

TABLE NO. C-1 (SHEET 11B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
AIKEN COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	
AK-456	Town of Belvedere	X		X		X	**
AK-459	Town of Clearwater					X	**
AK-461	Town of Clearwater	X				X	**
DRB 1	33° 17' 56" N 81° 40' 18" W						
DRB 2	33° 16' 39" N 81° 39' 48" W						Directional, sonic, temperature, microlateral logs
DRB 3	33° 17' 14" N 81° 39' 49" W						Microlateral log
DRB 4	33° 16' 39" N 81° 38' 03" W						Caliper & sonic logs
DRB 5	33° 17' 40" N 81° 39' 37" W						Caliper, sonic and microcaliper logs
DRB 6	33° 17' 29" N 81° 39' 21" W						Directional, sonic, temperature, microlateral logs
DRB 7	33° 17' 17" N 81° 40' 28" W						Caliper & sonic logs
DRB 8	33° 16' 54" N 81° 38' 54" W			X	X		Depth taken from cross-section of NW border of Triassic basin ***, 1
LA-8	33° 17' 01" N 81° 43' 09" W	X	X	X	X		

** Not shown on Figure 7-1
*** Cross section with lithologies
1 From Marine, 1979a

TABLE NO. C-1 (SHEET 12A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
AIKEN COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
LA-31	33° 20' 16" N 81° 43' 51" W	685			X		
P-1A	N 75,444 (d) E 56,848	920	2[illegible]7.9		X	X	
P-1B	N 75,443 (d) E 56,818	555	289.1				
P-1C	N 75,465 (d) E 56,797	368	289				
P-2A	N 73,896 (d) E 53,316	843	249.9		X	X	
P-2B	N 73,895 (d) E 53,335	532	250.3		X		
P-2C	N 73,893 (d) E 53,281	350	249		X		
P-3A	N 72,800 (d) E 60,100	936	277.7		X	X	
P-3B	N 72,800 (d) E 60,130	548	277.6				
P-3C	N 72,826 (d) E 60,115	410	278				
P-7A	33° 20' 00" N 81° 35' 54" W	725*	273.5			X	
P-4R	N 90,559 (d) E 14,902	765	105.3		X		
SCGS*** Butler #1	Central portion of North Augusta 7.5' Quad*	100	503			X	

*See remarks
***South Carolina Geological Survey
(d) Savannah River Plant (SRP) grid

TABLE NO. C-1 (SHEET 12B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
AIKEN COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	
LA-31	33° 20' 16" N 81° 43' 51" W	X	X	X	X		
P-1A	N 75,444 (d) E 56,848			X	X		Driller's log of piezometers; caliper log
P-1B	N 75,443 (d) E 56,818	X		X	X		
P-1C	N 75,465 (d) E 56,797	X		X	X		
P-2A	N 73,896 (d) E 53,316			X	X		Driller's log of piezometers
P-2B	N 73,895 (d) E 53,335	X		X	X		
P-2C	N 73,893 (d) E 53,281	X		X	X		
P-3A	N 72,800 (d) E 60,100	X		X			Driller's log of piezometers
P-3B	N 72,800 (d) E 60,130	X		X	X		
P-3C	N 72,826 (d) E 60,115	X		X	X		
P-7A	33° 20' 00" N 81° 35' 54" W	X		X			Caliper log available; depth from caliper log**
P-4R	N 90,559 (d) E 14,902			X			Driller's log of piezometers
SCGS*** Butler #1	Central portion of North Augusta 7.5' Quad*						0.38 miles NW of intersection of I-20 and US-25**

* See remarks
** Not shown on Figure 7-1
*** South Carolina Geological Survey
(d) Savannah River Plant (SRP) grid

INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
AIKEN COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
SCGS Huber #1	Hollow Creek 7.5' Quad*	408		X			
SCGS McGriff Site #2	NE/4 of Windsor 7.5' Quad*	60	350		X		
SCGS McNeil #2	SE/4 of Augusta East 7.5' Quad*	100	180		X		
SCGS Oakwood #1	Same as AK-23 (Sheets 10A & 10B)	73	418		X		
SCGS Oakwood #2	NW/4 of Oakwood 7.5 Quad*	63	500		X		
SCGS Washington Corp. #1	SE/4 of Augusta East 7.5' Quad*	30	175		X		
SCWRC *** 39V-b1	33° 29' 11" N 81° 41' 30" W		505				
SCWRC 39V-b2	33° 29' 10" N 81° 41' 31" W	240	505				
SCWRC 39V-b3	33° 29' 09" N 81° 41' 32" W	239	505		X		
SCWRC 40X-m1	(No location)	200*					X
T-1	Savannah River Plant	801	270			X	
W-1	33° 12' 42" N 81° 46' 46" W*	152	96				

* See remarks
*** South Carolina Water Resources Commission

TABLE NO. C-1 (SHEET 13B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
AIKEN COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
SCGS Huber #1	Hollow Creek 7.5' Quad*						At junction of S-2-145 and S-2-146**
SCGS McGriff Site #2	NE/4 of Windsor 7.5' Quad*						1.5 miles SE of Tarrants Mill Pond **
SCGS McNeil #2	SE/4 of Augusta East 7.5 Quad*			X			0.1 miles NE of MM 148**
SCGS Oakwood #1	Same as AK-23 (Sheets 10A & 10B)			X			**
SCGS Oakwood #2	NW/4 of Oakwood 7.5 Quad*			X			0.5 mi. down dirt road off SC-29**
SCGS Washington Corp. #1	SE/4 of Augusta East 7.5' Quad*			X			0.47 mi. NW of Silver Bluff Church**
SCWRC *** 39V-b1	33° 29' 11" N 81° 41' 30" W					X	**
SCWRC 39V-b2	33° 29' 10" N 81° 41' 31" W					X	**
SCWRC 39V-b3	33° 29' 09" N 81° 41' 32" W					X	**
SCWRC 40X-m1	(No location)					X	Caliper log; depth from gamma log**
T-1	Savannah River Plant						**
W-1	33° 12' 42" N 81° 46' 46" W*						Well lithologies and local geology available from graphic logs, CDCE****, 2, approx. location

* See remarks
** Not shown on Figure 7-1
*** South Carolina Water Resources Commission
**** Charleston District Corps of Engineers
2 Corps of Engineers, Geologic-Engineering Investigations (1952)

TABLE NO. C-1 (SHEET 14A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
AIKEN COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
X-M-16	33° 19' 06" N 81° 44' 08" W	354	354				
21-F	Savannah River Plant	790*				X	
54-R	Savannah River Plant	460*				X	
55-P	Savannah River Plant	570*				X	
905-68A	33° 20' 34" N 81° 20' 34" W	384			X		
905-37F	33° 17' 00" N 81° 40' 28" W	773	299.5		X		
905-35H	33° 17' 13" N 81° 38' 36" W	824	298.7		X		
905-93P	Savannah River Plant	610*				X	
ALLENDALE COUNTY, SOUTH CAROLINA							
AL-1	32° 57' 24" N 81° 14' 15" W	750	140				
AL-2	33° 00' 13" N 81° 18' 21" W	800	200				

* See remarks

TABLE NO. C-1 (SHEET 14B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
AIKEN COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	
X-M-16	33° 19' 06" N 81° 44' 08" W						Well lithologies and local geology available from graphic logs, CDCE, 2
21-F	Savannah River Plant						Depth from E-log **
54-R	Savannah River Plant						Depth from E-log **
55-P	Savannah River Plant						Depth from E-log **
905-68A	33° 20' 34" N 81° 20' 34" W	X		X	X		
905-37F	33° 17' 00" N 81° 40' 28" W	X	X	X	X		
905-35H	33° 17' 13" N 81° 38' 36" W	X		X	X		
905-93P	Savannah River Plant						Depth from E-log**
ALLENDALE COUNTY, SOUTH CAROLINA							
AL-1	32° 57' 24" N 81° 14' 15" W				X	X	
AL-2	33° 00' 13" N 81° 18' 21" W				X	X	

** Not shown on Figure 7-1
2 Corps of Engineers, Geologic-Engineering Investigations (1952)

TABLE NO. C-1 (SHEET 15A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
AL-3	Peeples 7.5' Quad*	40			X		
AL-5	32° 57' 38" N 81° 14' 29" W	700	140				
AL-6	32° 57' 33" N 81° 14' 29" W	750	140				
AL-8	33° 02' 08" N 81° 13' 21" W	600	151				
AL-9	32° 57' 27" N 81° 14' 12" W	660	140				
AL-10	32° 57' 28" N 81° 14' 15" W	635	140				
AL-11	33° 05' 52" N 81° 30' 04" W	84					
AL-12	33° 00' 38" N 81° 19' 07" W	648	215		X		
AL-13	33° 01' 35" N 81° 23' 02" W	371	300				
AL-14	33° 02' 40" N 81° 22' 00" W	150			X		
AL-15	33° 04' 35" N 81° 28' 56" W	210	120				
AL-16	33° 04' 55" N 81° 29' 08" W	210	120				
AL-17	33° 04' 56" N 81° 28' 04" W	210	120				

* See remarks

TABLE NO. C-1 (SHEET 15B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	
AL-3	Peeples 7.5' Quad*						2.8 miles NW of Milletville**
AL-5	32° 57' 38" N 81° 14' 29" W					X	
AL-6	32° 57' 33" N 81° 14' 29" W					X	
AL-8	33° 02' 08" N 81° 13' 21" W				X	X	
AL-9	32° 57' 27" N 81° 14' 12" W					X	
AL-10	32° 57' 28" N 81° 14' 15" W				X	X	
AL-11	33° 05' 52" N 81° 30' 04" W			X		X	
AL-12	33° 00' 38" N 81° 19' 07" W	X	X	X	X	X	
AL-13	33° 01' 35" N 81° 23' 02" W					X	
AL-14	33° 02' 40" N 81° 22' 00" W	X	X	X			
AL-15	33° 04' 35" N 81° 28' 56" W					X	
AL-16	33° 04' 55" N 81° 29' 08" W				X	X	
AL-17	33° 04' 56" N 81° 28' 04" W					X	

* See remarks
** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 16A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
AL-18	33° 05' 49" N 81° 31' 32" W	218	120				
AL-19	33° 04' 30" N 81° 26' 48" W	760	161.5		X	X	
AL-20	33° 06' 18" N 81° 33' 05" W	200+	140				
AL-21	33° 04' 48" N 81° 25' 25" W	100	120				
AL-22	32° 57' 58" N 81° 15' 05" W	830	148		X	X	
AL-23	33° 01' 08" N 81° 18' 07" W	889	210		X		
AL-24	33° 00' 13" N 81° 18' 21" W	740	200				
AL-27	See Sandoz #1, Sheet C-52						
AL-28	32° 48' 05" N 81° 18' 56" W	480*	140			X	X
AL-29	32° 57' 31" N 81° 14' 18" W	668	140		X		X
AL-30	32° 57' 00" N 81° 11' 41" W						
AL-32	32° 57' 08" N 81° 26" 54" W	260	100				
AL-33	33° 02' 18" N 81° 17' 22" W	800	180		X	X	X

* See remarks

TABLE NO. C-1 (SHEET 16B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	
AL-18	33° 05' 49" N 81° 21' 32" W					X	
AL-19	33° 04' 30" N 81° 26' 48" W	X		X		X	
AL-20	33° 06' 18" N 81° 33' 05" W				X	X	
AL-21	33° 04' 48" N 81° 25' 25" W				X	X	
AL-22	32° 57' 58" N 81° 15' 05" W	X		X		X	
AL-23	33° 01' 08" N 81° 18' 07" W		X	X	X	X	
AL-24	33° 00' 13" N 81° 18' 21" W					X	
AL-27	See Sandoz #1, Sheet C-52						
AL-28	32° 48' 05" N 81° 18' 56" W					X	Caliper lcg, depth taken from E-log
AL-29	32° 57' 31" N 81° 14' 18" W	X	X			X	Caliper log
AL-30	32° 57' 00" N 81° 11' 41" W						
AL-32	32° 57' 08" N 81° 26" 54" W		X			X	
AL-33	33° 02' 18" N 81° 17' 22" W					X	Samples stored at SCWRSR***

* See remarks
*** South Carolina Water Resources Sample Repositcry

TABLE NO. C-1 (SHEET 17A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
AL-36	32° 58' 45" N 81° 17' 14" W	667*	160			X	X
AL-37	32° 45' 52" N 81° 21' 29" W	154					
AL-38	32° 56' 53" N 81° 26' 39" W	298	100				
AL-39	33° 04' 08" N 81° 28' 37" W	200	80				
AL-40	33° 07' 18" N 81° 33' 19" W	755	240		X	X	
AL-41	33° 04' 49" N 81° 32' 12" W	500	140				X
AL-44	32° 58' 50" N 81° 17' 45" W	856	162			X	X
AL-45	33° 02' 14" N 81° 17' 15" W	758					X
AL-46	32° 59' 35" N 81° 17' 50" W	908				X	
AL-47	32° 46' 39" N 81° 22' 27" W	170	60		X	X	X
AL-48	33° 05' 18" N 81° 14' 27" W	310	186*		X		
AL-49	32° 58' 40" N 81° 21' 45" W	849	240		X	X	
AL-51	32° 02' 10" N 81° 22' 13" W	240	270				

* See remarks

TABLE NO. C-1 (SHEET 17B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	
AL-36	32° 58' 45" N 81° 17' 14" W					X	Depth from gamma log, samples stored at SCWRSR
AL-37	32° 45' 52" N 81° 21' 29" W					X	
AL-38	32° 56' 53" N 81° 26' 39" W					X	Samples stored at SCWRSR
AL-39	33° 04' 08" N 81° 28' 37" W					X	
AL-40	33° 07' 18" N 81° 33' 19" W	X					Samples stored at SCWRSR
AL-41	33° 04' 49" N 81° 32' 12" W					X	
AL-44	32° 58' 50" N 81° 17' 45" W					X	
AL-45	33° 02' 14" N 81° 17' 15" W						
AL-46	32° 59' 35" N 81° 17' 50" W					X	
AL-47	32° 46' 39" N 81° 22' 27" W	X			X	X	Samples stored at SCWRSR
AL-48	33° 05' 18" N 81° 14' 27" W	X	X	X	X	X	Sand analysis, logging depth is 800 ft.
AL-49	32° 58' 40" N 81° 21' 45" W	X				X	Samples stored at SCWRSR
AL-51	32° 02' 10" N 81° 22' 13" W					X	Samples stored at SCWRSR

TABLE NO. C-1 (SHEET 18A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
AL-52	33° 02' 10" N 81° 22' 13" W	330	270				
AL-53	33° 04' 34" N 80° 26' 45" W	783	200				
AL-54	33° 04' 34" N 80° 26' 45" W		200				
AL-55	32° 58' 56" N 81° 20' 39" W		220				
Al-56	32° 58' 55" N 81° 20' 42" W		220				
AL-57	32° 58' 40" N 81° 21' 58" W		240				
AL-58	32° 58' 22" N 81° 22' 03" W		240				
AL-59	32° 58' 12" N 81° 22' 50" W		200				
AL-60	32° 58' 19" N 81° 21' 48" W		220				
AL-61	32° 58' 20" N 81° 21' 32" W		220				
AL-62	32° 57' 52" N 81° 21' 38" W		280				
AL-63	33° 06' 54" N 81° 33' 13" W		220				
AL-64	33° 06' 29" N 81° 33' 51" W		170				

TABLE NO. C-1 (SHEET 18B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	
AL-52	33° 02' 10" N 81° 22' 13" W					X	
AL-53	33° 04' 34" N 80° 26' 45" W					X	
AL-54	33° 04' 34" N 80° 26' 45" W					X	
AL-55	32° 58' 56" N 81° 20' 39" W					X	
Al-56	32° 58' 55" N 81° 20' 42" W					X	
AL-57	32° 58' 40" N 81° 21' 58" W					X	
AL-58	32° 58' 22" N 81° 22' 03" W					X	
AL-59	32° 58' 12" N 81° 22' 50" W					X	
AL-60	32° 58' 19" N 81° 21' 48" W					X	
AL-61	32° 58' 20" N 81° 21' 32" W					X	
AL-62	32° 57' 52" N 81° 21' 38" W					X	
AL-63	33° 06' 54" N 81° 33' 13" W					X	
AL-64	33° 06' 29" N 81° 33' 51" W					X	

TABLE NO. C-1 (SHEET 19A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
AL-65	33° 06' 23" N 81° 34' 07" W		156.79				
AL-66	33° 06' 55" N 81° 33' 56" W	800	202.23	X	X	X	XX
AL-67	33° 06' 48" N 81° 34' 26" W		175				
AL-68	33° 05' 59" N 81° 32' 34" W		210				
AL-69	33° 05' 47" N 81° 32' 43" W		190				
AL-70	33° 05' 37" N 81° 32' 55" W		180				
AL-71	33° 04' 56" N 81° 32' 38" W		140				
AL-72	33° 04' 53" N 81° 32' 49" W		140				
AL-73	33° 04' 53" N 81° 32' 13" W		140				
AL-74	33° 04' 50" N 81° 32' 10" W		140				
AL-75	33° 05' 20" N 81° 31' 45" W		200				
AL-76	33° 05' 25" N 81° 31' 51" W		210				
AL-77	33° 05' 52" N 81° 30' 05" W		160				

TABLE NO. C-1 (SHEET 19B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	
AL-65	33° 06' 23" N 81° 34' 07" W					X	
AL-66	33° 06' 55" N 81° 33' 56" W		X			X	Samples stored at SCWRSR
AL-67	33° 06' 48" N 81° 34' 26" W					X	
AL-68	33° 05' 59" N 81° 32' 34" W					X	
AL-69	33° 05' 47" N 81° 32' 43" W					X	
AL-70	33° 05' 37" N 81° 32' 55" W					X	
AL-71	33° 04' 56" N 81° 32' 38" W					X	
AL-72	33° 04' 53" N 81° 32' 49" W					X	
AL-73	33° 04' 53" N 81° 32' 13" W					X	
AL-74	33° 04' 50" N 81° 32' 10" W					X	
AL-75	33° 05' 20" N 81° 31' 45" W					X	
AL-76	33° 05' 25" N 81° 31' 51" W					X	
AL-77	33° 05' 52" N 81° 30' 05" W					X	

TABLE NO. C-1 (SHEET 20A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
AL-78	33° 05' 54" N 81° 30' 05" W		160				
AL-79	33° 05' 53" N 81° 32' 26" W		230				
AL-80	32° 48' 05" N 81° 18' 56" W	R***180-200	140				
AL-83	32° 48' 13" N 81° 18' 44" W		140				
AL-85	33° 02' 18" N 81° 17' 22" W		120				
AL-86	33° 02' 43" N 81° 17' 27" W	34*	190				
AL-87	32° 02' 44" N 81° 17' 46" W		230				
AL-88	33° 02' 39" N 81° 17' 52" W		220				
AL-89	33° 02' 39" N 81° 17' 56" W		210				
AL-90	32° 49' 24" N 81° 21' 40" W	R936	140				
AL-91	32° 49' 13" N 81° 21' 33" W		130				
AL-92	32° 48' 44" N 81° 21' 46" W		100				
AL-93	32° 46' 39" N 81° 21' 23" W		90				

* See remarks
*** Reported depth

TABLE NO. C-1 (SHEET 20B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
AL-78	33° 05' 54" N 81° 30' 05" W					X	
AL-79	33° 05' 53" N 81° 32' 26" W					X	
AL-80	32° 48' 05" N 81° 18' 56" W					X	
AL-83	32° 48' 13" N 81° 18' 44" W					X	
AL-85	33° 02' 18" N 81° 17' 22" W			X		X	
AL-86	33° 02' 43" N 81° 17' 27" W			X		X	Depth cited is a measured depth
AL-87	32° 02' 44" N 81° 17' 46" W					X	
AL-88	33° 02' 39" N 81° 17' 52" W					X	
AL-89	33° 02' 39" N 81° 17' 56" W					X	
AL-90	32° 49' 24" N 81° 21' 40" W					X	
AL-91	32° 49' 13" N 81° 21' 33" W					X	
AL-92	32° 48' 44" N 81° 21' 46" W					X	
AL-93	32° 46' 39" N 81° 21' 23" W					X	

TABLE NO. C-1 (SHEET 21A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
AL-94	32° 47' 54" N 81° 22' 01" W		90				
AL-95	32° 48' 30" N 81° 22' 23" W		100				
AL-96	32° 48' 55" N 81° 22' 31" W		110				
AL-97	32° 49' 09" N 81° 22' 18" W		110				
AL-98	32° 49' 07" N 18° 22' 52" W		120				
AL-99	32° 49' 47" N 81° 22' 12" W		110				
AL-100	32° 49' 45" N 81° 22' 24" W		110				
AL-101	32° 49' 59" N 81° 22' 11" W		115				
AL-102	32° 49' 53" N 81° 21' 45" W		140				
AL-103	32° 49' 49" N 81° 21' 28" W		150				
AL-104	32° 49' 47" N 81° 21' 57" W		130				
AL-105	32° 49' 37" N 81° 21' 58" W		120				

TABLE NO. C-1 (SHEET 21B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
AL-94	32° 47' 54" N 81° 22' 01" W					X	
AL-95	32° 48' 30" N 81° 22' 23" W					X	
AL-96	32° 48' 55" N 81° 22' 31" W					X	
AL-97	32° 49' 09" N 81° 22' 18" W					X	
AL-98	32° 49' 07" N 81° 22' 52" W					X	
AL-99	32° 49' 47" N 81° 22' 12" W					X	
AL-100	32° 49' 45" N 81° 22' 24" W					X	
AL-101	32° 49' 59" N 81° 22' 11" W					X	
AL-102	32° 49' 53" N 81° 21' 45" W					X	
AL-103	32° 49' 49" N 81° 21' 28" W					X	
AL-104	32° 49' 47" N 81° 21' 57" W					X	
AL-105	32° 49' 37" N 81° 21' 58" W					X	

TABLE NO. C-1 (SHEET 22A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
AL-106	32° 49' 23" N 81° 22' 12" W		100				
AL-109	33° 07' 21" N 81° 33' 05" W		210				
AL-111	33° 07' 14" N 81° 33' 10" W		230				
AL-113	32° 07' 15" N 81° 33' 30" W		240				
AL-114	32° 07' 08" N 81° 33' 05" W		220				
AL-120	32° 57' 32" N 81° 21' 40" W		220				
AL-132	33° 04' 02" N 81° 28' 35" W	150+	110				
AL-141	33° 02' 45" N 81° 26' 43" W	125	260				
AL-156	33° 05' 42" N 81° 28' 30" W	290	190				
AL-165	33° 05' 51" N 81° 30' 47" W	275	170				
AL-209	33° 06' 05" N 81° 30' 31" W	73	190				
AL-211	33° 06' 33" N 81° 29' 28" W	108	250				
AL-251	33° 08' 30" N 81° 31' 30" W		320				
AL-268	33° 05' 50" N 81° 30' 18" W		175				

TABLE NO. C-1 (SHEET 22B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
AL-106	32° 49' 23" N 81° 22' 12" W					X	
AL-109	33° 07' 21" N 81° 33' 05" W					X	
AL-111	33° 07' 14" N 81° 33' 10" W					X	
AL-113	32° 07' 15" N 81° 33' 30" W					X	
AL-114	32° 07' 08" N 81° 33' 05" W					X	
AL-120	32° 57' 32" N 81° 21' 40" W					X	
AL-132	33° 04' 02" N 81° 28' 35" W					X	
AL-141	33° 02' 45" N 81° 26' 43" W					X	
AL-156	33° 05' 42" N 81° 28' 30" W					X	
AL-165	33° 05' 51" N 81° 30' 47" W					X	
AL-209	33° 06' 05" N 81° 30' 31" W					X	
AL-211	33° 06' 33" N 81° 29' 28" W					X	
AL-251	33° 08' 30" N 81° 30' 31" W					X	
AL-268	33° 05' 50" N 81° 30' 18" W					X	

TABLE NO. C-1 (SHEET 23A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
AL-269	33° 05' 30" N 81° 30' 42" W		120				
AL-270	33° 05' 52" N 81° 30' 51" W		170				
AL-271	33° 05' 51" N 81° 30' 47" W	500+	170				
AL-272	33° 05' 41" N 81° 29' 32" W	240	15				
AL-273	33° 08' 30" N 81° 31' 30" W		320				
AL-274	33° 00' 18" N 81° 19' 50" W		190				
AL-275	33° 04' 35" N 81° 13' 12" W		160				
AL-276	33° 04' 50" N 81° 13' 20" W		160				
AL-277	33° 04' 20" N 81° 13' 10" W		160				
AL-279	33° 03' 22" N 81° 12' 48" W		140				
AL-280	33° 03' 30" N 81° 12' 49" W		140				
AL-281	33° 03' 22" N 81° 12' 48" W		140				
AL-282	33° 03' 22" N 81° 12' 48" W		140				
AL-283	33° 04' 37" N 81° 12' 32" W	620	160				

TABLE NO. C-1 (SHEET 23B OF 98)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	
AL-269	33° 05' 30" N 81° 30' 42" W					X	
AL-270	33° 05' 52" N 81° 30' 51" W					X	
AL-271	33° 05' 51" N 81° 30' 47" W					X	
AL-272	33° 05' 41" N 81° 29' 32" W			X		X	
AL-273	33° 08' 30" N 81° 31' 30" W					X	
AL-274	33° 00' 18" N 81° 19' 50" W			X		X	
AL-275	33° 04' 35" N 81° 13' 12" W					X	
AL-276	33° 04' 50" N 81° 13' 20" W					X	
AL-277	33° 04' 20" N 81° 13' 10" W					X	
AL-279	33° 03' 22" N 81° 12' 48" W					X	
AL-280	33° 03' 30" N 81° 12' 49" W					X	
AL-281	33° 03' 22" N 81° 12' 48" W					X	
AL-282	33° 03' 22" N 81° 12' 48" W					X	
AL-283	33° 04' 37" N 81° 12' 32" W					X	

TABLE NO. C-1 (SHEET 24A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
AL-284	33° 04' 37" N 81° 12' 32" W	165-185	160				
AL-285	33° 04' 37" N 81° 12' 32" W		160				
AL-286	33° 05' 32" N 81° 13' 03" W		160				
AL-289	33° 02' 43" N 81° 26' 48" W	290	250				
AL-290	32° 55' 13" N 81° 25' 23" W		120				
AL-291	32° 55' 30" N 81° 25' 50" W	60-70	130				
AL-292	33° 01' 12" N 81° 13' 21" W	200	140				
AL-295	33° 03' 04" N 81° 08' 56" W		140				
AL-296	33° 02' 55" N 81° 18' 59" W	150	200				
AL-297	33° 02' 55" N 81° 18' 59" W		200				
AL-298	illegible N 81° 20' 34" W	1030	140				
AL-299	32° 57' 28" N 81° 26' 42" W	315	60				
AL-300	33° 01' 23" N 81° 15' 02" W		140				
AL-301	33° 02' 27" N 81° 21' 52" W	340	280				

TABLE NO. C-1 (SHEET 24B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
AL-284	33° 04' 37" N 81° 12' 32" W					X	
AL-285	33° 04' 37" N 81° 12' 32" W					X	
AL-286	33° 05' 32" N 81° 13' 03" W					X	
AL-289	33° 02' 43" N 81° 26' 48" W			X		X	
AL-290	32° 55' 13" N 81° 25' 23" W			X		X	
AL-291	32° 55' 30" N 81° 25' 50" W					X	
AL-292	33° 01' 12" N 81° 13' 21" W			X		X	
AL-295	33° 03' 04" N 81° 08' 56" W			X			
AL-296	33° 02' 55" N 81° 18' 59" W			X		X	
AL-297	33° 02' 55" N 81° 18' 59" W			X			
AL-298	illegible N 81° 20' 34" W					X	Samples stored at SCWRSR
AL-299	32° 57' 28" N 81° 26' 42" W			X		X	
AL-300	33° 01' 23" N 81° 15' 02" W			X			
AL-301	33° 02' 27" N 81° 21' 52" W			X		X	

TABLE NO. C-1 (SHEET 25A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
AL-302	32° 56' 49" N 81° 17' 48" W	295	120				
AL-303	33° 05' 12" N 81° 20' 18" W		26.0				
AL-304	33° 05' 12" N 81° 20' 18" W	350	260				
AL-305	32° 55' 21" N 81° 14' 20" W	450	110				
AL-306	32° 55' 23" N 81° 14' 21" W	750	110				
AL-307	32° 55' 27" N 81° 14' 19" W		100				
AL-308	32° 58' 55" N 81° 18' 32" W	275	158				
AL-309	32° 58' 55" N 81° 18' 31" W		158				
AL-310	33° 01' 08" N 81° 18' 07" W	329*	210				
AL-311	33° 57' 56" N 81° 14' 02" W	390	135				
AL-312	33° 02' 02" N 81° 16' 52" W	450	170				
AL-313	33° 05' 48" N 81° 25' 08" W		140				
AL-314	33° 05' 42" N 81° 25' 47" W	300	230				
AL-316	33° 03' 43" N 81° 17' 21" W	300	190				

* See remarks

TABLE NO. C-1 (SHEET 25B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	
AL-302	32° 56' 49" N 81° 17' 48" W					X	
AL-303	33° 05' 12" N 81° 20' 18" W					X	
AL-304	33° 05' 12" N 81° 20' 18" W			X		X	
AL-305	32° 55' 21" N 81° 14' 20" W					X	
AL-306	32° 55' 23" N 81° 14' 21" W					X	
AL-307	32° 55' 27" N 81° 14' 19" W					X	
AL-308	32° 58' 55" N 81° 18' 32" W			X		X	
AL-309	32° 58' 55" N 81° 18' 31" W					X	
AL-310	33° 01' 08" N 81° 18' 07" W					X	Test hole depth - 239 ft, samples stored at SCWRSR
AL-311	33° 57' 56" N 81° 14' 02" W					X	
L-312	33° 02' 02" N 81° 16' 52" W			X		X	
AL-313	33° 05' 48" N 81° 25' 08" W			X		X	
AL-314	33° 05' 42" N 81° 25' 47" W			X		X	
AL-316	33° 03' 43" N 81° 17' 21" W			X		X	

TABLE NO. C-1 (SHEET 26A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
AL-317	33° 05' 56" N 81° 36' 06" W	230	97.12				
New Googe Street	Googe Street, City of Allendale						
Sandoz #1	33° 02' 23" N 81° 29' 18" W	790	186.5	X		X	
SCGS AL-1	33° 04' 52" N 81° 33' 44" W	65	145	X			
SCGS AL-2	33° 04' 59" N 81° 34' 29" W	45	150	X			
SCGS AL-3	33° 05' 05" N 81° 34' 30" W	40	150	X			
SCGS AL-10	NE/4 of Peepples 15' Quad*	75	90	X			
SCGS Al-15	32° 50' 56" N 81° 24' 21" W	50	80	X			
SCGS AL-16	32° 55' 42" N 81° 29' 16" W	65	70	X			
SCGS AL-17	32° 55' 48" N 81° 28' 30" W	70	90	X			
SCGS Dunbar #4	33° 04' 43" N 81° 33' 18" W	90	140	X			
SCGS Dunbar #14	33° 04' 26" N 81° 34' 13" W	40	92	X			
SCGS Dunbar #15	NE/4 of Millet 7.5' Quad.*	60	140	X			
SCGS McNair #3	33° 03' 08" N 81° 30' 12" W	64	82.8	X			

* See remarks

TABLE NO. C-1 (SHEET 25B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	
AL-317	33° 05' 56" N 81° 36' 06" W						Boring log
New Googe Street	Googe Street, City of Allendale		X	X			**
Sandoz #1	33° 02' 23" N 81° 29' 18" W						Same location as AL-27; depth from E-log
SCGS AL-1	33° 04' 52" N 81° 33' 44" W						
SCGS AL-2	33° 04' 59" N 81° 34' 29" W						
SCGS AL-3	33° 05' 05" N 81° 34' 30" W						
SCGS AL-10	NE/4 of Peepples 15' Quad*						On dirt road 2.3 mi. SE of Barton**
SCGS Al-15	32° 50' 56" N 81° 24' 21" W						
SCGS AL-16	32° 55' 42" N 81° 29' 16" W						
SCGS AL-17	32° 55' 48" N 81° 28' 30" W						
SCGS Dunbar #4	33° 04' 43" N 81° 33' 18" W						
SCGS Dunbar #14	33° 04' 26" N 81° 34' 13" W						
SCGS Dunbar #15	NE/4 of Millet 7.5' Quad.*						Same location as SCGS Dunbar #3**
SCGS McNair #3	33° 03' 08" N 81° 30' 12" W			X			

* See remarks
** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 27A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BAMBERG COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
Bam-1	33° 19' 14" N 81° 08' 39" W	R240	244				
Bam-2	33° 19' 26" N 81° 08' 38" W	R240	248				
Bam-3	33° 19' 22" N 81° 08' 39" W	R240	248				
Bam-6	32° 17' 45" N 81° 02' 15" W	584	170				X
Bam-7	33° 17' 45" N 81° 02' 15" W	435	170			X	X
Bam-8	33° 17' 15" N 81° 02' 23" W	160	150				
Bam-9	33° 05' 42" N 81° 00' 43" W	596	120				
Bam-10	33° 05' 50" N 81° 00' 50" W	596	146				
Bam-14	33° 18' 59" N 81° 08' 45" W	R473	244		X		
Bam-15	33° 17' 42" N 81° 02' 14" W	R200	120				
Bam-16	33° 17' 45" N 81° 02' 14" W	195	120				
Bam-18	33° 18' 11" N 81° 08' 35" W	R284	220		X	X	
Bam-19	33° 17' 45" N 81° 02' 15" W	500-550	170			X	X

TABLE NO. C-1 (SHEET 27B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ALLENDALE COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
Bam-1	33° 19' 14" N 81° 08' 39" W				X	X	
Bam-2	33° 19' 26" N 81° 08' 38" W				X		
Bam-3	33° 19' 22" N 81° 08' 39" W				X	X	
Bam-6	32° 17' 45" N 81° 02' 15" W				X	X	Caliper log**
Bam-7	33° 17' 45" N 81° 02' 15" W				X	X	Fluid, temperature, and caliper logs**
Bam-8	33° 17' 15" N 81° 02' 23" W					X	**
Bam-9	33° 05' 42" N 81° 00' 43" W				X	X	**
Bam-10	33° 05' 50" N 81° 00' 50" W					X	**
Bam-14	33° 18' 59" N 81° 08' 45" W			X	X	X	Sanitary survey
Bam-15	33° 17' 42" N 81° 02' 14" W					X	**
Bam-16	33° 17' 45" N 81° 02' 14" W				X	X	**
Bam-18	33° 18' 11" N 81° 08' 35" W		X	X		X	**
Bam-19	33° 17' 45" N 81° 02' 15" W					X	Fluid, temperature, and caliper logs**

** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 28A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BAMBERG COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
Bam-20	33° 17' 43" N 81° 02' 15" W	399	170				
Bam-21	33° 17' 45" N 81° 02' 15" W	169	170				X
Bam-22	33° 18' 56" N 81° 08' 20" W	302	220		X	X	X
Bam-23	33° 19' 27" N 81° 08' 25" W	R296*	244		X	X	X
Bam-24	33° 17' 15" N 81° 02' 15" W	551*	147			X	X
Bam-25	33° 13' 19" N 81° 10' 21" W	R250	240		X		X
Bam-26	33° 06' 05" N 81° 00' 41" W	400	140		X	X	
Bam-27	33° 17' 15" N 81° 02' 25" W	550	147			X	X
Bam-28	33° 19' 56" N 81° 11' 17" W	R340*	260			X	X
Bam-29	33° 13' 20" N 81° 10' 30" W	R150	240				
Bam-30	33° 05' 40" N 81° 00' 45" W		120				
Bam-31	33° 17' 46" N 80° 02' 13" W	176	120		X		
Bam-34	33° 13' 15" N 80° 07' 49" W	R175	200				

* See remarks

TABLE NO. C-1 (SHEET 28B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BAMBERG COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
Bam-20	33° 17' 43" N 81° 02' 15" W					X	**
Bam-21	33° 17' 45" N 81° 02' 15" W					X	Caliper log**
Bam-22	33° 18' 56" N 81° 08' 20" W	X	X	X		X	**
Bam-23	33° 19' 27" N 81° 08' 25" W	X	X	X		X	Total depth is 310 ft, sanitary survey
Bam-24	33° 17' 15" N 81° 02' 15" W						Depth from gamma log, **
Bam-25	33° 13' 19" N 81° 10' 21" W	X		X	X	X	
Bam-26	33° 06' 05" N 81° 00' 41" W	X		X	X	X	Sand analysis performed **
Bam-27	33° 17' 15" N 81° 02' 25" W					X	Sample stored at SCWRSR**
Bam-28	33° 19' 56" N 81° 11' 17" W			X		X	Completed depth 500 ft, sample stored at SCWRSR
Bam-29	33° 13' 20" N 81° 10' 30" W					X	
Bam-30	33° 05' 40" N 81° 00' 45" W					X	**
Bam-31	33° 17' 46" N 80° 02' 13" W	X		X		X	**
Bam-34	33° 13' 15" N 80° 07' 49" W			X		X	

** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 29A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BAMBERG COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
Bam-36	33° 04' 35" N 81° 06' 53" W	R220	131				
Bam-37	33° 11' 15" N 81° 01' 15" W		144				
Bam-38	33° 11' 07" N 80° 55' 58" W	R300	143				
Bam-40	33° 11' 19" N 80° 53' 32" W		147				
Bam-41	33° 17' 39" N 81° 11' 35" W		220				
Bam-42	33° 22' 26" N 81° 07' 04" W	R140	194				
Bam-43	33° 07' 52" N 80° 55' 35" W	R165+	126				
Bam-45	33° 08' 30" N 81° 09' 30" W		175				
Bam-49	33° 22' 04" N 81° 11' 22" W	500	260				
City of Denmark A	City of Denmark	470			X		
City of Denmark B	City of Denmark						
City of Denmark C	City of Denmark	300					
City of Denmark D	City of Denmark	340			X		
City of Denmark E	City of Denmark						

* See remarks

TABLE NO. C-1 (SHEET 29B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BAMBERG COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
Bam-36	33° 04' 35" N 81° 06' 53" W			X		X	
Bam-37	33° 11' 15" N 81° 01' 15" W			X		X	**
Bam-38	33° 11' 07" N 80° 55' 58" W			X		X	**
Bam-40	33° 11' 19" N 80° 53' 32" W			X		X	**
Bam-41	33° 17' 39" N 81° 11' 35" W			X		X	
Bam-42	33° 22' 26" N 81° 07' 04" W			X		X	
Bam-43	33° 07' 52" N 80° 55' 35" W			X		X	**
Bam-45	33° 08' 30" N 81° 09' 30" W			X			Sample stored at SCWRSR
Bam-49	33° 22' 04" N 81° 11' 22" W			X		X	
City of Denmark A	City of Denmark	X		X			**
City of Denmark B	City of Denmark						Installation report**
City of Denmark C	City of Denmark	X		X			**
City of Denmark D	City of Denmark						**
City of Denmark E	City of Denmark*			X			Behind Denmark warehouse, installation report**

* See remarks
** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 30A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
B-36	33° 09' 54" N 81° 43' 32" W			X			
B-45	33° 11' 54" N 81° 41' 54" W						
Blackville #1	Town of Blackville *	470					
BW-2	33° 14' 38" N 81° 21' 17" W	R200	220				
BW-3	33° 14' 38" N 81° 21' 17" W	R180	220				
BW-4	33° 14' 38" N 81° 21' 17" W	180-185	220				
BW-5	33° 21' 18" N 81° 16' 20" W	200					
BW-6	33° 21' 14" N 81° 16' 12" W	350	290				
BW-7	33° 21' 30" N(?) 81° 16' 45" W	300+					
BW-8	Town of Williston*	150					
BW-9	33° 24' 15" N 81° 24' 50" W	150					
BW-10	33° 24' 05" N 81° ?4' 45" W	150					
BW-11	Barnwell Air Base	200	231				
BW-12	North side of ice plant*						
BW-13	33° 14' 38" N 81° 21' 17" W	165	220				

* See remarks

TABLE NO. C-1 (SHEET 30B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	
B-36	33° 09' 54" N 81° 43' 32" W						
B-45	33° 11' 54" N 81° 41' 54" W						
Blackville #1	Town of Blackville *	X	X	X			Under water tank near railroad**
BW-2	33° 14' 38" N 81° 21' 17" W				X	X	
BW-3	33° 14' 38" N 81° 21' 17" W				X	X	
BW-4	33° 14' 38" N 81° 21' 17" W					X	
BW-5	33° 21' 18" N 81° 16' 20" W					X	
BW-6	33° 21' 14" N 81° 16' 12" W					X	
BW-7	33° 21' 30" N(?) 81° 16' 45" W					X	
BW-8	Town of Williston*					X	West of tank**
BW-9	33° 24' 15" N 81° 24' 50" W				X	X	
BW-10	33° 24' 05" N 81° 24' 45" W				X	X	
BW-11	Barnwell Air Base					X	**
BW-12	North side of ice plant*					X	West of railroad tracks**
BW-13	33° 14' 38" N 81° 21' 17" W				X	X	

* See remarks
** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 31A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
BW-14	Town of Barnwell*	160					
BW-15	North side of plant*	200					
BW-16	Town of Barnwell	145-150					
BW-17	Elko public school	24					
BW-19	Town of Dunbarton*	137					
BW-20	33° 11' 50" N 81° 43' 20" W	217	120				
BW-21	Town of Dunbarton						
BW-24	0.3 mi. S of SC-40 0.3 mi. SW of SC-54	196	250				
BW-25	Williston dorms*	142	355				
BW-26	Town of Blackville	306	350				
BW-28	0.95 mi. south of SC-64 on SC-3	68	210				
BW-30	Old section houses at Ashleigh*	95	270				
BW-31	Ritz drive-in theater	140	240				

* See remarks

TABLE NO. C-1 (SHEET 31B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
BW-14	Town of Barnwell*					X	20 ft SE of reservoir**
BW-15	North side of plant*					X	Near railroad tracks**
BW-16	Town of Barnwell					X	10 ft north of reservoir**
BW-17	Elko Public School					X	**
BW-19	Town of Dunbarton*					X	2 blocks south of railroad tracks**
BW-20	33° 11' 50" N 81° 43' 20" W				X	X	
BW-21	Town of Dunbarton					X	**
BW-24	0.3 mi. S of SC-40 0.3 mi. SW of SC-54					X	**
BW-25	Williston dorms*					X	1.75 mi. west of Rt-39 at Williston on US-78**
BW-26	Town of Blackville					X	**
BW-28	0.95 mi. south of SC-64 on SC-3					X	**
BW-30	Old section houses at Ashleigh*					X	Southern railroad Barnwell and Blackville**
BW-31	Ritz drive-in theater					X	**

* See remarks
** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 32A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
BW-32	Schumport store*	80	340				
BW-33	0.85 mi. east of SC-3 on SC-78	85	244				
BW-34	1.9 mi. south of Salrathie Rur on SC-73	98	220				
BW-35	0.45 mi. SE of Rt. 39 on SC-163	98	320				
BW-36	On SC Rt. 39 approx. 3.75 mi. south of US-78		340				
BW-37	East of Dunbarton	136					
BW-38	Tri Ct. across BW Co. Airport, on Elko Rd.*	130	220				
BW-39	33° 14' 17" N 81° 21' 54" W	230	215.7		X		
BW-40	33° 09' 20" N 81° 16' 20" W	960	240				
BW-41	33° 21' 55" N 81° 19' 44" W	290	280				
BW-42	33° 21 ' 55" N 81° 19' 44" W	270	280				
BW-43	33° 21' 26" N 81° 18' 04" W	250	300				

* See remarks

TABLE NO. C-1 (SHEET 32B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
BW-32	Schumport store*					X	East of Elko on US-78**
BW-33	0.85 mi. east of SC-3 on SC-78					X	**
BW-34	1.9 mi. south of Salrathie Rur on SC-73					X	**
BW-35	0.45 mi. SE pf Rt. 39 on SC-163					X	**
BW-36	On SC Rt. 39 approx. 3.75 mi. south of US-78					X	**
BW-37	East of Dunbarton					X	By railroad tracks**
BW-38	Tri Ct. across BW Co. Airport, on Elko Rd.* on Elko Rd.*					X	1.1 mi. N intersection W SC-64,**
BW-39	33° 14' 17" N 81° 21' 54" W	X			X	X	
BW-40	33° 09' 20" N 81° 16' 20" W				X	X	
BW-41	33° 21' 55" N 81° 19' 44" W				X	X	
BW-42	33° 21' 55" N 81° 19' 44" W					X	
BW-43	33° 21' 26" N 81° 18' 04" W					X	

* See remarks
** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 33A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
BW-44	33° 24' 08" N 81° 24' 53" W	820	352		X	X	
BW-45	33° 14' 25" N 81° 22' 58" W	246	220				
BW-46	33° 21' 22" N 81° 16' 19" W	R246	290				
BW-47	Barnwell dorms*	230					
BW-49	2.5 mi. NW of Rt. 39*	112	280				
BW-50	0.65 mi. west of SC-33 on SC-112	112					
BW-51	33° 12' 36" N 81° 21' 59" W	R400?	160				
BW-52	Owens Rd., City of Barnwell	R176					
BW-53	0.2 mi. south on Woids Rd.*	84					
BW-54	33° 24' 45" N 81° 25' 00" W	136	350				
BW-55	33° 14' 10" N 81° 21' 54" W	280	150		X		
BW-56	33° 14' 06" N 81° 22' 06" W	285	150		X		

* See remarks

TABLE NO. C-1 (SHEET 33B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
BW-44	33° 24' 08" N 81° 24' 53" W	X	X	X	X	X	
BW-45	33° 14' 25" N 61° 22' 58" W				X	X	
BW-46	33° 21' 22" N 81° 16' 19" W					X	
BW-47	Barnwell dorms*					X	1.3 mi. south of SC-64 on side road 0.4 mi. west of SC-3**
BW-49	2.5 mi. NW of Rt. 39*					X	At Williston Rd., north side of railroad tracks**
BW-50	0.65 mi. west of SC-33 on SC-112					X	**
BW-51	33° 12' 36" N 81° 21' 59" W					X	
BW-52	Owens Rd., City of Barnwell					X	**
BW-53	0.2 mi. south on Woids Rd.*					X	0.2 mi. east of Stringefellow Gallon SC-62**
BW-54	33° 24' 45" N 81° 25' 00" W				X	X	
BW-55	33° 14' 10" N 81° 21' 54" W	X				X	
BW-56	33° 14' 06" N 81° 22' 06" W	X	X	X		X	

* See remarks
** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 34A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
BW-57	33° 14' 10" N 81° 22' 45" W	336	190		X		
BW-58	33° 14' 43" N 81° 21' 05" W	345	230				
BW-59	33° 13' 58" N 81° 21' 48" W	252	150		X		
BW-60	33° 14' 07" N 81° 21' 59" W	330	150		X		
BW-61	Barnwell Mills, 0.2 mi. behind water tank	343			X		
BW-62	33° 13' 38" N 81° 21' 40" W	271			X		
BW-63	City of Barnwell						
BW-64	33° 21' 10" N 81° 19' 20" W	184	285				
BW-65	City of Barnwell	85					
BW-66	33° 13' 59" N 81° 21' 57" W	262	150				
BW-68	33° 15' 40" N 81° 29' 10" W						
BW-69	Town of Hilda	338					
BW-70	33° 15' 15" N 81° 28' 25" W	886				X	

TABLE NO. C-1 (SHEET 34B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	
BW-57	33° 14' 10" N 81° 22' 45" W	X	X	X		X	
BW-58	33° 14' 43" N 81° 21' 05" W					X	
BW-59	33° 13' 58" N 81° 21' 48" W	X	X	X		X	
BW-60	33° 14' 07" N 81° 21' 59" W	X	X	X		X	
BW-61	Barnwell Mills, 0.2 mi. behind water tank	X	X	X			**
BW-62	33° 13' 38" N 81° 21' 40" W	X	X	X			
BW-63	City of Barnwell		X	X			**
BW-64	33° 21' 10" N 81° 19' 20" W	X				X	
BW-65	City of Barnwell					X	**
BW-66	33° 13' 59" N 81° 21' 57" W					X	
BW-68	33° 15' 40" N 81° 29' 10" W					X	
BW-69	Town of Hilda					X	**
BW-70	33° 15' 15" N 81° 28' 25" W						

** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 35A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE: GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS: SP/ RESISTIVITY	GAMMA/ NEUTRON
BW-71	33° 15' 30" N 81° 28' 45" W						
BW-75	32° 21' 40" N 81° 15'' 40" W	465	293		X	X	X
BW-76	0.04 mi. east of P coordinates*		255		X	X	X
BW-77	City of Barnwell	312			X		
BW-78	26 ft S of West St., 41 ft E of Elko St.	808*				X	X
BW-79	33° 24' 05" N 81° 24' 24" W	785*				X	X
BW-80	33° 22' 46" N 81° 22' 49" W	140	345				
BW-81	33° 24' 46" N 81° 22' 49" W		350				
BW-82	33° 15' 53" N 81° 27' 06" W	34	248				
BW-83 (145)	33° 21' 25" N 81° 16' 33" W	367			X	X	X
BW-84	33° 21' 02" N 81° 18' 52" W	315	290				X
BW-89	33° 15' 18" N 81° 27' 13" W	41.5	238				
BW-91	33° 15' 55" N 81° 27' 46" W	61.5	262.8		X		

* See remarks

TABLE NO. C-1 (SHEET 35B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
BW-71	33° 15' 30" N 81° 28' 45" W					X	
BW-75	32° 21' 40" N 81° 15' 40" W	X	X	X	X	X	
BW-76	0.04 mi. east of P coordinates*						South 1012 - West 403 (BNF*** coordinates)
BW-77	City of Barnwell*					X	Under water tank**
BW-78	26 ft S of West St., 41 ft E of Elko St.						Depth from gamma log**
BW-79	33° 24' 05" N 81° 24' 24" W						Depth from gamma log
BW-80	33° 22' 46" N 81° 22' 49" W	X		X		X	
BW-81	33° 24' 46" N 81° 22' 49" W					X	
BW-82	33° 15' 53" N 81° 27' 06" W		X	X		X	
BW-83 (145)	33° 21' 25" N 81° 16' 33" W		X		X	X	
BW-84	33° 21' 02" N 81° 18' 52" W		X	X		X	Sample stored at SCWRSR
BW-89	33° 15' 18" N 81° 27' 13" W		X	X		X	
BW-91	33° 15' 55" N 81° 27' 46" W			X		X	Sample stored at SCWRSR

* See remarks
** Not shown on Figure 7-1
*** Barnwell Nuclear Fuel Plant

TABLE NO. C-1 (SHEET 36A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
BW-99	33° 15' 38" N 81° 27' 48" W	308	251.4				
BW-106	33° 20' 12" N 81° 19' 46" W	R80-100	310				
BW-107	33° 20' 46" N 81° 15' 46" W	79	290				
BW-108	33° 20' 28" N 81° 18' 55" W		300				
BW-109	33° 20' 45" N 81° 18' 25" W		290				
BW-111	33° 21' 30" N 81° 18' 45" W		295				
BW-136	33° 15' 34" N 81° 27' 48" W	32.5	247.5				
BW-145	33° 21' 25" N 81° 16' 15" W	410			X	X	X
City of Hilda	33° 16' 35" N 81° 14' 45" W	330					
C-5	33° 14' 59" N 81° 40' 16" W	approx. 250	approx. 283				
D-15	33° 12' 12" N 81° 43' 33" W	approx. 150	approx. 135				
DRB-9	33° 15' 00" N 81° 36' 58" W	approx. 2700	approx. 300	X			
DRB-10	33° 12' 15" N 81° 34' 48" W	1280		X			

* See remarks

TABLE NO. C-1 (SHEET 36B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
BW-99	33° 15' 38" N 81° 27' 48" W			X		X	
BW-106	33° 20' 12" N 81° 19' 46" W					X	
BW-107	33° 20' 46" N 81° 15' 46" W		X	X		X	
BW-108	33° 20' 28" N 81° 18' 55" W					X	
BW-109	33° 20' 45" N 81° 18' 25" W					X	
BW-111	33° 21' 30" N 81° 18' 45" W					X	
BW-136	33° 15' 34" N 81° 27' 48" W		X	X		X	
BW-145	33° 21' 25" N 81° 16' 15" W	X	X	X	X	X	Sand analysis
City of Hilda	33° 16' 35" N 81° 14' 45" W					X	
C-5	33° 14' 59" N 81° 40' 16" W						Approximate location given, graphic log
D-15	33° 12' 12" N 81° 43' 33" W						Approximate location given, graphic log
DRB-9	33° 15' 00" N 81° 36' 58" W			X	X		Sample analysis by thin section and X-ray diffraction
DRB-10	33° 12' 15" N 81° 34' 48" W						Sample analysis by x-ray diffraction

* See remarks

TABLE NO. C-1 (SHEET 37A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
DRB-11	33° 13' 18" N 81° 35' 42" W	1012		X			
DU-42	33° 12' 44" N 81° 43' 51" W*	R80-100					
DU-47	33° 12' 31" N 81° 43' 14" W*	79					
H-12	33° 13' 26" N 81° 35' 48" W						
K-5	33° 13' 02" N 81° 39' 57" W*	approx. 350	approx. 273				
LA-2	33° 12' 15" N 81° 44' 26" W	573	128		X		
LA-3	33° 14' 49" N 81° 38' 56" W	575	290		X		
LA-33	33° 12' 27" N 81° 39' 29" W	644	297		X		
PG-4	33° 13' 08" N 81° 34' 05" W	413	321				
PH2-2	33° 11' 50" N 81° 45' 18" W*						
P-5	33° 13' 34" N 81° 34' 58" W*	approx. 270	approx. 316				
P-15	33° 13' 23" N 81° 34' 50" W*						
P-5R	33° 08' 57" N 81° 36' 57" W	1312.9	207.95		X		X

* See remarks

TABLE NO. C-1 (SHEET 37B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE: CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
DRB-11	33° 13' 18" N 81° 35' 42" W						Sample analysis by X-ray diffraction
DU-42	33° 12' 44" N 81° 43' 51" W*						Approximate location given
DU-47	33° 12' 31" N 81° 43' 14" W*						Approximate location given
H-12	33° 13' 26" N 81° 35' 48" W						
K-5	33° 13' 02" N 81° 39' 57" W*						Approximate location given
LA-2	33° 12' 15" N 81° 44' 26" W	X	X	X	X		
LA-3	33° 14' 49" N 81° 38' 56" W	X	X	X	X		
LA-33	33° 12' 27" N 81° 39' 29" W	X	X	X	X		
PG-4	33° 13' 08" N 81° 34' 05" W						Boring, graphic logs showing local and well lithologies
PH2-2	33° 11' 50" N 81° 45' 18" W*						Approximate location given
P-5	33° 13' 34" N 81° 34' 58" W*						Approximate location given, graphic log
P-15	33° 13' 23" N 81° 34' 50" W*						Approximate location given
P-5R	33° 08' 57" N 81° 36' 57" W						Depth from composite log, driller's log of piezometers, upper and lower aquiter depths available

* See remarks

TABLE NO. C-1 (SHEET 38A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

				DATA AVAILABLE			
						GEOPHYSICAL LOGS	
WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
P-12R	33° 13' 50" N 81° 36' 07" W	381		X			
SC-BW-P4	33° 17' 13" N 81° 38' 35" W	301					
SCWRC #33 W-ql	33° 21' 37" N 81° 13' 06" W	160	300	X			
SWRC #342-01	33° 07' 28" N 81° 19' 56" W		270				
XL-5	33° 16' 05" N 81° 37' 02" W	441	321				
3-CS	33° 14' 14" N 81° 38' 55" W*						
30-P	33° 13' 28" N 81° 34' 47" W	605	312	X			
905-91C	N 66, 730 E 46, 520 (d)	608*				X	
905-66H	N 72, 100 E 62, 190 (d)	863	303		X	X	
905-95K	N 53, 170 E 41, 300 (d)	607*				X	

*See remarks
(d) Savannah River Plant (SRP) grid

TABLE NO. C-1 (SHEET 38B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
BARNWELL COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE: CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
P-12R	33° 13' 50" N 81° 36' 07" W						Sample analysis by X-ray diffraction**
SC-BW-P4	33° 17' 13" N 81° 38' 35" W						Supplementary well data available
SCWRC #33 W-ql	33° 21' 37" N 81° 13' 06" W					X	
SCWRC #342-01	33° 07' 28" N 81° 19' 56" W					X	
XL-5	33° 16' 05" N 81° 37' 02" W						Graphic log
3-CS	33° 14' 14" N 81° 38' 55" W*						Approximate location given
30-P	33° 13' 28" N 81° 34' 47" W						
905-91C	N 66, 730 E 46, 520 (d)						Depth from E-log
905-66H	N 72, 100 E 62, 190 (d)		X	X			
905-95K	N 53, 170 E 41, 300 (d)						Depth from E-log

* See remarks
** Not shown on Figure 7-1
(d) Savannah River Plant (SRP) grid

TABLE NO. C-1 (SHEET 39A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
HAMPTON COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
HAM-1	32° 36' 18" N 81° 14' 52" W	1000-1100					
HAM-12	32° 45' 14" N 81° 14' 32" W	R850-950	112				X
HAM-13	32° 45' 14" N 81° 14' 32" W	R883	112				X
HAM-18	32° 51' 03" N 81° 04' 56" W	R870	107			X	X
HAM-20	32° 51' 09" N 81° 04' 57" W	900	107			X	X
HAM-21	32° 52' 38" N 81° 06' 42" W	R820				X	
HAM-25	32° 55' 32" N 81° 11' 11" W	745					
HAM-27	32° 55' 40" N 81° 11' 21" W	720	135	X			
HAM-33	32° 39' 42" N 81° 18' 59" W	1008			X		X
HAM-34	32° 42' 43" N 81° 21' 21" W	822			X	X	
HAM-38	32° 52' 38" N 81° 06' 42" W	1469	105			X	
HAM-40	32° 51' 09" N 81° 04' 57" W	R810	117				
HAM-41	32° 51' 49" N 81° 06' 54" W	R864	100		X		

TABLE NO. C-1 (SHEET 39B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
HAMPTON COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
HAM-1	32° 36' 18" N 81° 14' 52" W					X	
HAM-12	32° 45' 14" N 81° 14' 32" W					X	
HAM-13	32° 45' 14" N 81° 14' 32" W					X	
HAM-18	32° 51' 03" N 81° 04' 56" W					X	Measured depth 673 ft.**
HAM-20	32° 51' 09" N 81° 04' 57" W					X	**
HAM-21	32° 52' 38" N 81° 06' 42" W		X			X	**
HAM-25	32° 55' 32" N 81° 11' 11" W			X		X	
HAM-27	32° 55' 40" N 81° 11' 21" W					X	
HAM-33	32° 39' 42" N 81° 18' 59" W					X	
HAM-34	32° 42' 43" N 81° 21' 21" W					X	
HAM-38	32° 52' 38" N 81° 06' 42" W					X	**
HAM-40	32° 51' 09" N 81° 04' 57" W					X	**
HAM-41	32° 51' 49" N 81° 06' 54" W					X	Measured depth 853 ft.**

** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 40A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
HAMPTON COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
HAM - 43	35° 52' 38" N 81° 06' 42" W	R600*	105		X		XX
HAM - 46	32° 53' 07" N 81° 04' 57" W	911			X		X
HAM - 49	32° 53' 05" N 81° 00' 11" W	723					X
HAM - 50	32° 40' 48" N 81° 11' 20" W	986					X
HAM - 60	32° 53' 36" N 81° 12' 09" W		70				
HAM - 61	32° 53' 41" N 81° 12' 18" W		70				
HAM - 62	32° 54' 15" N 81° 13' 35" W		70				
HAM - 71	32° 43' 46" N 81° 14' 12" W		140				
HAM - 72	32° 58' 43" N 81° 06' 51" W	880	115	X		X	X
HAM - 82	32° 51' 09" N 81° 12' 23" W		125				
HAM - 85	32° 36' 38" N 81° 16' 22" W		71				
HAM - 90	32° 54' 04" N 81° 09' 19" W	537*	105			X	X
HAM - 92	32° 45' 31" N 81° 14' 46" W	1015	112			X	X

* See remarks

TABLE NO. C-1 (SHEET 40B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
HAMPTON COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
HAM - 43	35° 52' 38" N 81° 06' 42" W			X		X	Measured depth - 243 ft.**
HAM - 46	32° 53' 07" N 81° 04' 57" W	X	X	X		X	**
HAM - 49	32° 53' 05" N 81° 00' 11" W					X	Caliper log**
HAM - 50	32° 40' 48" N 81° 11' 20" W					X	
HAM - 60	32° 53' 36" N 81° 12' 09" W			X			
HAM - 61	32° 53' 41" N 81° 12' 18" W			X			
HAM - 62	32° 54' 15" N 81° 13' 35" W			X			
HAM - 71	32° 43' 46" N 81° 14' 12" W					X	
HAM - 72	32° 58' 43" N 81° 06' 51" W			X		X	**
HAM - 82	32° 51' 09" N 81° 12' 23" W			X			
HAM - 85	32° 36' 38" N 81° 16' 22" W			X			
HAM - 90	32° 54' 04" N 81° 09' 19" W			X		X	Depth from E-log
HAM - 92	32° 45' 31" N 81° 14' 46" W					X	

** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 41A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
HAMPTON COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
HAM - 93	32° 45' 41" N 81° 12' 30" W	R900	100			X	X
HAM - 94	32° 52' 38" N 81° 06' 42" W	815	105		X		
HAM - 100	32° 46' 23" N 81° 16' 23" W		140				
HAM - 103	32° 56' 54" N 81° 02' 04" W	550	95				
HAM - 104	32° 45' 25" N 81° 06' 58" W		120				
HAM - 110	32° 36' 25" N 81° 18' 15" W	R1800	60				
HAM - 111	32° 38' 20" N 81° 18' 11" W	R956	74				
HAM - 117	32° 38' 02" N 81° 18' 19" W	R850	75				
HAM - 122	32° 39' 49" N 81° 19' 30" W		75				
HAM - 127	32° 57' 13" N 81° 12' 13" W		140				
HAM - 130	32° 58' 57" N 81° 07' 31" W		120				
HAM - 132	32° 40' 29" N 81° 09' 40" W		100				
HAM - 135	32° 55' 08" N 81° 11' 14" W	843	130			X	X
HAM - 141	32° 54' 35" N 81° 10' 09" W		110				

TABLE NO. C-1 (SHEET 41B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
HAMPTON COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
HAM - 93	32° 45' 41" N 81° 12' 30" W			X		X	Measured depth 797 ft.
HAM - 94	32° 52' 38" N 81° 06' 42" W		X	X		X	**
HAM - 100	32° 46' 23" N 81° 16' 23" W			X			
HAM - 103	32° 56' 54" N 81° 02' 04" W					X	**
HAM - 104	32° 45' 25" N 81° 06' 58" W			X			
HAM - 110	32° 36' 25" N 81° 18' 15" W					X	
HAM - 111	32° 38' 20" N 81° 18' 11" W					X	
HAM - 117	32° 38' 02" N 81° 18' 19" W					X	
HAM - 122	32° 39' 49" N 81° 19' 30" W			X			
HAM - 127	32° 57' 13" N 81° 12' 13" W			X			
HAM - 130	32° 58' 57" N 81° 07' 31" W			X			
HAM - 132	32° 40' 29" N 81° 09' 40" W			X			
HAM - 135	32° 55' 08" N 81° 11' 14" W					X	
HAM - 141	32° 54' 35" N 81° 10' 09" W			X			

** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 42A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
HAMPTON COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
HAM - 142	32° 50' 34" N 81° 13' 21" W		139				
HAM - 144	32° 42' 48" N 81° 18' 52" W		102				
HAM - 147	32° 42' 46" N 81° 10' 29" W		114				
HAM - 151	32° 52' 20" N 81° 08' 01" W		110				
HAM - 153	32° 51' 42" N 81° 04' 28" W	945					X
HAM - 155	32° 58' 39" N 81° 06' 49" W	465	110		X		X
HAM - 156	32° 39' 57" N 81° 15' 08" W	505	85				

JASPER COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
JAS - 102	32° 30' 50" N 81° 00' 10" W	R210	80		X		
JAS - 108	32° 28' 50" N 80° 58' 50" W	R340	55		X		
JAS - 324	32° 32' 39" N 81° 10' 09" W	R1550	40				
JAS - 325	32° 35' 18" N 81° 12' 41" W	540*	60			X	X

*See remarks

TABLE NO. C-1 (SHEET 42B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
HAMPTON COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
HAM - 142	32° 50' 34" N 81° 13' 21" W			X			
HAM - 144	32° 42' 48" N 81° 18' 52" W			X			
HAM - 147	32° 42' 46" N 81° 10' 29" W			X			
HAM - 151	32° 52' 20" N 81° 08' 01" W			X			
HAM - 153	32° 51' 42" N 81° 04' 28" W					X	**
HAM - 155	32° 58' 39" N 81° 06' 49" W			X		X	**
HAM - 156	32° 39' 57" N 81° 15' 08" W					X	**

JASPER COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
JAS - 102	32° 30' 50" N 81° 00' 10" W	X	X	X		X	**
JAS - 108	32° 28' 50" N 80° 58' 50" W		X	X		X	**
JAS - 324	32° 32' 39" N 81° 10' 09" W					X	**
JAS - 325	32° 35' 18" N 81° 12' 41" W			X		X	Test hole depth

** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 43A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ORANGEBURG COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
						GEOPHYSICAL LOGS	
				GEOLOGIST'S LOG	DRILLER'S LOG	SP/ RESISTIVITY	GAMMA/ NEUTRON
ORG - 3	33° 29' 44" N 81° 16' 50" W	138	300				
ORG - 4	33° 29' 53" N 81° 16' 49" W	R100 - 120	300				
ORG - 5	33° 26' 50" N 81° 07' 30" W	R250					
ORG - 11	33° 26' 50" N 81° 07' 30" W	R100					
ORG - 12	33° 26' 50" N 81° 07' 30" W	180					
ORG - 19	33° 27' 00" N 81° 07' 00" W	175					
ORG - 20	33° 27' 00" N 81° 07' 30" W	195					
ORG - 45	33° 26' 50" N 81° 07' 30" W	162			X	X	
ORG - 93	33° 28' 24" N 80° 01' 07" W	412	300				
ORG - 95	33° 26' 49" N 81° 07' 25" W	214	240			X	XX
ORG - 97	33° 26' 52" N 81° 07' 31" W	231			X	X	X
ORG - 201	33° 29' 53" N 81° 16' 49" W		300				
ORG - 204	Norway area, South Carolina	486			X	X	

TABLE NO. C-1 (SHEET 43B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ORANGEBURG COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	REMARKS
ORG - 3	33° 29' 44" N 81° 16' 50" W			X		X	**
ORG - 4	33° 29' 53" N 81° 16' 49" W			X		X	**
ORG - 5	33° 26' 50" N 81° 07' 30" W		X	X		X	
ORG - 11	33° 26' 50" N 81° 07' 30" W			X		X	
ORG - 12	33° 26' 50" N 81° 07' 30" W			X		X	
ORG - 19	33° 27' 00" N 81° 07' 00" W					X	
ORG - 20	33° 27' 00" N 81° 07' 30" W					X	
ORG - 45	33° 26' 50" N 81° 07' 30" W	X	X	X		X	
ORG - 93	33° 28' 24" N 80° 01' 07" W					X	**
ORG - 95	33° 26' 49" N 81° 07' 25" W	X				X	Caliper log
ORG - 97	33° 26' 52" N 81° 07' 31" W	X	X	X		X	
ORG - 201	33° 29' 53" N 81° 16' 49" W					X	**
ORG - 204	Norway area, South Carolina	X	X	X			Electric logging data sheet**

** Not shown on Figure 7-1

TABLE NO. C-1 (SHEET 44A OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ORANGEBURG COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DEPTH (FT.)	SURFACE ELEVATION (FT.)	DATA AVAILABLE			
				GEOLOGIST'S LOG	DRILLER'S LOG	GEOPHYSICAL LOGS	
						SP/ RESISTIVITY	GAMMA/ NEUTRON
ORG - 227	33° 27' 06" N 81° 03' 20" W	500			X		
ORG - 228	1.5 mi. NW of intersection of SC-332 & 70	187	200		X		
ORG - 230	33° 27' 08" N 81° 06' 02" W	480			X		
ORG - 245	33° 29' 14" N 81° 05' 22" W	300	290				
ORG - 249	Off SC-690*	197					
SCWRC # 31V-q2	Off SC-690*	490			X		

*See remarks

TABLE NO. C-1 (SHEET 44B OF 88)
INVENTORY OF EXISTING DRILL HOLE AND WATER WELL DATA
ORANGEBURG COUNTY, SOUTH CAROLINA

WELL NUMBER	LOCATION	DATA AVAILABLE					REMARKS
		CONSTRUCTION REPORT	WELL TEST	WATER LEVEL	WATER QUALITY	AGENCY REPORT	
ORG - 227	33° 27' 06" N 81° 03' 20" W	X					Electrical logging data sheet**
ORG - 228	1.5 mi. NW of intersection of SC-332 & 70		X	X		X	**
ORG - 230	33° 27' 08" N 81° 06' 02" W	X				X	**
ORG - 245	33° 29' 14" N 81° 05' 22" W					X	**
ORG - 249	Off SC-690*		X	X		X	0.5 mi. south of the intersection of SC-690 and SC-74**
SCWRC # 31V-q2	Off SC-690*	X	X	X		X	0.5 mi. south of the intersection of SC-690 and SC-74, electrical logging data sheet**

APPENDIX D

CORE LOGS

APPENDIX D

This appendix contains the logs from all core holes drilled in this study. The logs from B-33, B-34 and AL-317 are also included. See Chapter 6 for discussion on core drilling methods, Chapter 8 contains the hole to hole correlations.

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	1 of 16	VSC-1

SITE	COORDINATES	ANGLE FROM HORIZ.	BEARING
POSTULATED MILLETT FAULT	N 1134867.04 E 679423.71 (GA.)	90°	N.A.

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH
5-28-82	6-12-82	LAW ENGINEERING	Mobil 55	NQ	-	-	620.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
356.17/57.9%	24	3	-	219.0	88.1/131.9 (6-21-82)	-

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
N.A.	Observation Well	K. Wornick

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES
NQ - CORE	2.0	1.4	70%		CORE BOX 1	
	2.0	1.4	70%			
	1.0	0.5	50%			
	10.0	1.6	16%			
	5.0	0.7	14%			
	5.0	0.5	10%			
	2.0	0.5	25%			
	2.0	0.9	45%			
	2.0	1.2	60%			
	4.0	0.6	15%			

ELEVATION (Ft.): 219 (top), 184 (bottom)

DEPTH (Ft.): 0, 5, 10, 15, 20, 25, 30, 31, 35

DESCRIPTION AND CLASSIFICATION

0-106.8': SAND: Moderate reddish brown (10 R 4/6) to dark yellowish orange (10 YR 6/6), sand (quartz) with clay grading out to silt with depth (-60.0') very fine to medium-grained subangular to sub-rounded, moderately well graded, locally loose, firm in place.

0-5.0': Sand and Clay

5.0-15.0': Clay and Silt

15.0-106.8': Loose sand, silt; some thin bedding.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

E-Z mud, barite, and bentonite used as required.

0-106.8': Poor recovery in this zone partially limits more detailed lithologic description.

0-106.8': Moderate to no loss of circulation.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	2 OF 16	VSC-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ-CORE							184	35			0-106.8': SAND (cont)	
	5.0	0.4	8%		CORE BOX 1							0-106.8': Generally low recovery in loose material assumed to be washing out at face of core bit.
	5.0	0.6	12%					40				
	1.0	0.0	0%					45			47.0-48.0': 1' gradational color change from moderate reddish brown (10 R 4/6) to yellowish orange (10 YR 6/6).	
	1.0	0.2	20%									
	1.0	0.5	50%									
	1.0	0.3	30%								48.0-106.8': Degree of weathering decreasing with depth.	
	1.0	0.4	40%					50				
	5.0	0.7	14%									
	2.0	0.0	0%					55				
	2.0	0.0	0%									
	1.0	0.4	40%									
	1.0	1.1	110%	Includes stub from previous run.				60				
	1.0	0.6	60%		CORE BOX 2							
	3.0	0.0	0%									
	5.0	0.9	18%					65				
	5.0	0.0	0%					70				
							144	75				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	3 OF 16	VSC-1

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NQ-CORE							144	75	0-106.8': SAND: (cont)	
	5.0	3.3	66%		CORE BOX 2					
	5.0	3.1	62%					80		
	5.0	0.5	10%					85		
	5.0	0.9	18%					90	90.0-106.8': Color change from sand to fossiliferous calcareous sand; contact delineated by presence of calcareous material in sand and clay; clean sharp horizontal contact	
	5.0	0.8	16%					95		
	5.0	0.6	12%					100		
	5.0	3.2	64%				112.2	105 / 106.8	106.8-185.0': FOSSILIFEROUS CALCAREOUS SAND/ FOSSILIFEROUS LIMESTONE: Yellowish gray (5 Y 8/1) fine-to-medium-grained, typically subangular to subrounded.	106.8-186.5': Moderate to total loss of circulation.
	5.0	1.0	20%		CORE BOX 3		104	110 / 115		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	4 OF 16	VSC-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)
NQ-CORE	5.0	1.3	26%		CORE BOX 3		104	115
	5.0	3.3	66%					120
	10.0	Cuttings	0%					125–130
	5.0	2.2	44%					135
	5.0	0.0	0%					140
	1.0	3.7	37%	Includes stub from previous run.				145
	9.0	0.0	0%				64	150–155

DESCRIPTION AND CLASSIFICATION

106.8-185.0': FOSSILIFEROUS CALCAREOUS SAND — FOSSILIFEROUS LIMESTONE (cont) Poorly to moderatley sorted, weak to hard, weathered, (well cemented) numerous large oyster shells and smaller calcareous shell fragments 110.0-135.1 fossiliferous limestone, 185.0-186.5 moderately hard, fresh.

115.0-115.3': Oyster shell.

120.1-120.2': Oyster shell.

135.1-135.6': Clay bed.

135.6-175.2': Poorly cemented calcareous sand.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

106.8-186.5': Slow and steady drilling, very little loss of circulation.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	5 OF 16	VSC-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)
NQ-CORE						CORE BOX 3		64	155
	5.0	1.4		28%					
	5.0	0.0		0%					160
	5.0	1.7		34%					165
	5.0	0.9		18%		CORE BOX 4			170
	10.0	1.8		18%					175, 180
								34.0	185
	5.0	4.3		86%				32.5	186.5
	5.0	4.7		94%					190
								24	195

GRAPHIC LOG:

DESCRIPTION AND CLASSIFICATION

106.8-185.0': FOSSILIFEROUS CALCAREOUS SAND - FOSSILIFEROUS LIMESTONE (cont)

175.2-175.5': Clay bed.

185.0-186.5': LIMESTONE: Yellowish gray (5 Y 8/1) some fossils and shell fragments, hard, planar lower contact apparently horizontal.

186.5-267.2': CALCAREOUS SILTSTONE (MARL): Grayish green (5 G 5/2) to dark greenish gray (5 GY 4/1), fresh.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

186.5': Little to no loss of circulation.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	6 OF 16	VSC-1

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Graphic log	Sample	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ-CORE							24	195			186.5-267.2': CALCAREOUS SILTSTONE (MARL) (cont) Hasnearly horizontal and frequently convoluted lamina delineated by small fossil shells/fragments, calcareous streaks/ thin beds; weak to hard (well cemented); some fractures, assumed to be mechanical (no polished surfaces: breaks approximately horizontal across bedding).	
	10.0	10.0	100%					200				
					CORE BOX 5			205				186.5-267.2': Excellent recovery throughout.
	10.0	10.0	100%					210				
											214.2-214.9': Very calcareous, hard.	
								215				
	10.0	10.0	100%		CORE BOX 6			220				
								225			225.9-226.7': Very calcareous, hard.	
	10.0	10.0	100%					230				
					CORE BOX 7		-14	235				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO.: VSC-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	7 OF 16	VSC-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ-CORE							-16	235	186.5-267.2': CALCAREOUS SILTSTONE (MARL) (cont)	
	10.0	10.0	100%		CORE BOX 7			240		186.5-267.2': Excellent recovery throughout.
	10.0	10.0	100%		CORE BOX 8			245 / 250	252.3-252.7': Very calcareous, hard.	
	10.0	10.0	100%					255 / 260		
	10.0	10.0	100%		CORE BOX 9			265 / 267.2	CLEAN, APPROXIMATELY HORIZONTAL CONTACT 267.2-278.7': LIMESTONE: Very light gray (N/8), light olive gray (5 Y 6/1), very fine-grained well cemented, hard, vuggy.	267.2-278.7': Slow drilling, no loss of circulation.
							-54	270 / 275		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	8 of 16	VSC-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)
NQ-CORE	10.0	10.0	100%		CORE BOX 10		-56	276
	10.0	4.6	46%		CORE BOX 10		-59.7	278.7
	10.0	5.6	56%		CORE BOX 11		76.8	295.8
	10.0	3.7	37%		CORE BOX 11		-95.8	314.8

Depth scale: 276, 278.7, 280, 285, 290, 295, 295.8, 300, 305, 310, 314.8, 315

DESCRIPTION AND CLASSIFICATION

267.2-278.7': LIMESTONE (cont) Vuggy

GRADATIONAL CONTACT

278.7-295.8': FOSSILIFEROUS CALCAREOUS SANDSTONE: Very light grey (N/8) to light olive grey (5 Y 6/1) very fine-grained, well to moderately well cemented, many shells and shell fragments; vuggy 286.5-287.3'.

GRADATIONAL CONTACT

295.8-314.8': SAND: Dark greenish gray (5 GY 4/1) to greenish black (5 GY 2/1), coarse-grained, loose, poorly cemented, moderatley calcareous.

305.1-305.2': Locally well cemented bed (sandstone)

GRADATIONAL CONTACT

314.8-324.8': FOSSILIFEROUS CALCAREOUS SANDSTONE

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

267.2-278.7': Slow drilling, no loss of circulation.

278.7-295.8 Slow drilling, 20% loss of circulation.

295.8-314.8': Fast drill rate, high loss of circulation. 250 gallons of drill mud lost to formation.

314.8-324.8': Slow drill rate.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	9 of 16	VSC-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ-CORE	10.0	5.1	51%				-96	315	314.8-324.8': FOSSILIFEROUS CALCAREOUS SANDSTONE (cont) very light gray (N/8) to light olive (5 Y 6/1), very fine-grained, well-to-moderately well cemented, many shells and shell fragments.	
							-105.8	324.8	CLEAN CONTACT	
	10.0	0.8	8%		CORE BOX 11			325	324.8-366.4': SAND: Grayish yellow (5 Y 8/4) to dusky yellow (5 Y 6/4), coarse grained, loose, poorly cemented, moderatley clean, non-calcareous.	324.8-366.4': Fast drill rate. High loss of circulation. 100 gallons of drill mud per 10 ft core run.
	10.0	2.1	21%							
	10.0	0.5	5%		CORE BOX 12		-134	366		

Depth scale: 315, 320, 325, 330, 335, 340, 345, 350, 366

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	10 OF 16	VSC-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES
NQ-CORE	10.0	0.0	0%			
NQ-CORE	7.0	3.4	49%		CORE BOX 12	
NQ-CORE	3.0	0.0	0%		CORE BOX 12	
NQ-CORE	10.0	10.0	10%		CORE BOX 12	
NQ-CORE	10.0	4.8	48%		CORE BOX 13	

ELEVATION (Ft)	DEPTH (Ft.)
-136	355
	360
	365
-147.4	366.4
	370
	375
	380
	385
	390
-174	395

DESCRIPTION AND CLASSIFICATION

324.8-366.4': SAND: (cont) Grayish yellow (5 Y 8/4) to dusky yellow (5 Y 6/4), coarse-grained, loose, poorly cemented, moderatley clean, non-calcareous.

365.4-367.4 Sand and clay.

2.0' GRADATIONAL CONTACT

366.4-423.4': SANDY CLAY Multi-colored; very pale orange (10 YR 8/2) to pale red, purple (5 RP 6/2) to grayish red purple (5 RP 4/2); locally highly mottled, numerous oxidized zones and stringers, massive, firm, generally long core lengths. Unit varies slightly in percentage of constituents; and to a greater degree in weathering. Some red purple beds hard,

366.4-378.7': Lighter (kaolin) clay moderatley friable, no oxidized zone apparent.

378.7-412.5': Red purple oxidized zone.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

324.8-366.4': Fast drill rate. High loss of circulation.
100 gallons drill mud per 10 ft core run.

366.4-423.4': Moderate drill rate. No loss of circulation.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	11 OF 16	VSC-1

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)
NQ-CORE							176	395
	5.0	10.2	204%	Rec. stub from previous run.	CORE BOX 13			
								400
	5.0	4.8	96%					
								405
	10.0	10.0	100%		CORE BOX 14			410
								415
	10.0	10.0	100%					420
					CORE BOX 15		-204.4	423.4
								425
	10.0	10.0	100%					430
							-216	435

DESCRIPTION AND CLASSIFICATION

366.4-423.4': SANDY CLAY (cont)

412.8: Polished surface.

413.9: Polished surface.

414.3: Polished surface.

415.0-415.3': Highly oxidized zone.

416.3: Polished surface.

417.0-423.4': Polished surface zone 4 7.1, 417.6, 419.9-240.2, 421.0, 421.9, 423.5

LOWER CONTACT DIP 20^{0}-30^{0}

423.4-477.1': CARBONACEOUS CLAY: Dark gray (N/3), weak to moderately hard, fine to very fine sand and silt, thinly bedded, occasionally micaceous, trace thin beds of pyrite, occasional subrounded quartz grains, move in low density, porous rocks, non-calcareous.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

366.6-423.4': Improved core recovery throughout as driller adjusts to thinner viscosity.

Color change not in lamina, possible change in depositional env. (i.e. reducing env.)

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	12 of 16	VSC-1

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)
NQ-CORE	10.0	7.7	77%		CORE BOX 16		-216	435–440
	10.0	10.0	100%		CORE BOX 17			445–450
	10.0	10.0	100%					455–460
	10.0	8.7	87%		CORE BOX 18		-256	465–475

DESCRIPTION AND CLASSIFICATION

423.4-477.1': CARBONACEOUS CLAY: (cont)

High Angle Polished Surfaces:

425.2-425.4'

427.4-427.6'

444.7-444.8'

453.7-453.8'

457.7-457.8'

466.7

469.0

469.4

469.8-470.1'

461.3-464.4': Silty sandstone, coarse-grained, subangular, stiff, moderately weathered.

467.4-468.0': Joint - nearly horizontal, no movement indentified, possibly mechanical.

470.1-477.1': Zone of broken silt/clay.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

423.4-477.1': Generally fast drill rates and high core recovery throughout.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO.: VSC-1

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	13 of 16	VSC-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES
NQ-CORE	10.0	5.2	52%		CORE BOX 18	
NQ-CORE	10.0	3.1	31%		CORE BOX 19	
NQ-CORE	5.5	0.6	11%		CORE BOX 19	
NQ-CORE	4.5	0.0	0%		CORE BOX 19	
NQ-CORE	10.0	9.5	95%		CORE BOX 19	

ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION
-256	475	423.4-477.1': CARBONACEOUS CLAY: (cont)
-258.1	477.1	477.1-570.2': SANDY CLAY: Multi-colored; light gray (N7) to medium light gray (N6) grading into grayish red purple (5 RP 4/2) and pale reddish brown (10 R 5/4) to moderate reddish brown (10 R 5/4) continuing back into light gray (N7); and light bluish gray (5 B 7/1); generally sandy clay with occasional alternating beds (thin to thick) of sand or clay; sands are medium to coarse-grained, sub angular to subrounded, hard, moderately fresh; clays are very fine, fresh to moderately weathered, soft to hard.
		477.1-485.0': Clay with some carbonaceous siltstone inclusions near contact
		485.0-486.0': Sandy clay, fresh.
		486.0-515.4': Sandy clay, weathered.
-296	515	

Depth scale: 475, 480, 485, 490, 495, 500, 505, 510, 515

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

477.1-570.2': Slow drill rate used and very thin mud to recover sandy clay.

500.0-505.0': Loss assumed to be wash out in a zone of increased sand.

505.0: Wire line jumped off pulley and was realigned.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	14 OF 16	VSC-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ-CORE							-296	515	477.1-570.2': SANDY CLAY (cont)	
									515.4-535.4': Sandy clay (coarse sand), fresh.	515.4-544.7': Color change not in lithology; possible change in depositional environment.
	10.0	7.1	71%					520		
								525		
	10.0	0.0	0%					530		
					CORE BOX 20			535	535.4-544.7': Sandy clay, mottled, weathered.	535.0: Wire line jumped off boom pulley and was realigned.
	10.0	8.6	86%					540		
									544.7-566.2': Clay, kaolinite, very light gray to darker reds, no sand.	
								545		
	10.0	10.0	100%		CORE BOX 21			550		
							-336	555		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	15 OF 16	VSC-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ-CORE								-336	555			477.1-570.2': SANDY CLAY (cont)	
	10.0	7.8		78%		CORE BOX 21			560				
									565			566.2-570.2': Sandy clay mottled, weathered.	
	10.0	9.9		99%		CORE BOX 22		-351.2	570 / 570.2			570.2-620.0': SAND: Light gray (N7) to dark gray (N3), silt and/or clay matrix, some dark minerals and mica, medium-to coarse-grained, subangular to subrounded, generally well graded, clean: non-calcareous, weak to very weak.	570.2-620.0': Very slow drill rate and thin mud used to recover sand.
									575				
	10.0	4.0		40%					580				
									585				
	10.0	7.8		78%		CORE BOX 23			590				
								-376	595				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	16 OF 16	VSC-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ-CORE							-376	595			570.2-620.0': SAND (cont)	
	10.0	10.0	100%		CORE BOX 23			600				
	10.0	4.9	49%		CORE BOX 24			605				
								610				
								615				
	5.0	4.8	96%									
							-401	620			TOTAL DEPTH - 620.0' CONDITIONED BORING IN PREPARATION FOR GEOPHYSICAL LOGGING. INSTALLED OBSERVATION WELL.	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	1 of 16	VSC-2

SITE	COORDINATES	ANGLE FROM HORIZ.	BEARING
Postulated Millett Fault	N 1141512.71 E 673492.62	90°	NA

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH
5/26/82	6/11/82	Law Engineering/Ivy	Mobil Drill	NQ	-	-	600.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
		-	-	201.7	See Observation Well	-

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
	See Observation well	Ron Wood (Geologist G.P.C.) (K. Wornick)

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES
SS	2.0	0.2	20%			
SS	2.0	2.0	100%			
SS	2.0	1.5	75%			
SS	0.5	0.5	100%			
SS	1.0	1.0	100%			
SS	1.0	0.4	40%			
NQ	4.0	2.5	63%		BOX 1	
NQ	2.5	0.0	0%			
SS	0.2	0.2	100%			
NQ	4.0	0.0	0%			
NQ	5.8	0.4	7%			
NQ	5.0	0.0	0%			
SS	2.0	1.8	90%			
SS	2.0	0.8	40%			
SS	2.0	1.6	80%			

ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
	0	0-2.2': BLOW SAND	0.0-8.5': Split spoon samples.
199.5	2.2	2.2-6.0': SAND: Dark yellowish orange (10 YR 6/6) fine grained, slightly clayey, silty, loose to firm.	
195.7	6.0	6.0-24.0': CLAY: Dusky red (5 R 3/6) slightly silty, sandy, mottled, stiff to very stiff.	6.0-6.5': High resistance to pushing split spoon.
			8.5': 5/26/82 Stopped sampling.
			8.5-15.0': NQ wire line.
			0.0-15.0': Reamed 6" ø.
	15		15.0-15.2': Split spoon resistance TRX coring ▲ 0.2/0.2.
			15.2-30.0': Cored NQ WL.
			19.2-25.0': Poor recovery because inner barrel did not lock in.
	20	21.0-24.0': Clay; blue white (5 B 9/1) and pale red purple (5 RP 6/2), slightly silty.	
177.7	24	APPROXIMATE CONTACT	24.0': Drill mud showed sand.
	25	24.0-152.0': SAND: Very pale orange (10 YR 8/2) to moderately orange pink (5 YR 8/4) to dark yellowish orange (10 YR 6/6), slightly silty, fine grained, very dense, thin bedding delineated by color..	
	30		30.0-48.0': Driving 2 7/8" split spoon.
			32.0-34.0': 18 5/2' used sand trap, did not work.
		34.0-35.0 Gravel, silt, sand	
	35		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-2

H&CF 19-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATINGPLANT	9510	2 OF 16	VSC-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS	2.0	1.6	80%				166.7	35			24.0-152.0': SAND (cont): very pale orange (10 YR 8/2) to moderately orange (5 YR 5/4) to dark yellowish orange (10 YR 6/6), silty, fine grained, thin to medium bedded, delineated by color, dense to very dense.	32.0-34.0': Gravel; well rounded, 2 mm to 2 cm. S.R.R.R.
	2.0	1.4	70%									
	2.0	1.4	70%									
	2.0	1.0	50%					40				
	2.0	1.1	55%									42.0': 5/27/82 Stopped sampling.
	2.0	1.3	65%					45				
	2.0	1.3	65%									48.0-600.0': Total depth NQ WL.
NQ CORE	3.0	0.0	0%					50				
	0.7	2.0	35%								≈ 53.0': Dark yellowish orange (10 YR 6/6) silty, fine-to medium-grained, dense to very dense, some slightly clayey lenses.	
	2.0	1.0	50%		CORE BOX 2							
	3.0	0.0	0%					55				55.0-80.0': Sand in return drill mud.
	2.0	0.0	0%									
	3.0	0.0	0%					60				
	2.0	0.0	0%									
	3.0	0.0	0%					65			Pale orange (10 YR 8/4) to dark-yellowish-orange (10 YR 6/6), slightly silty, fine-to medium-grained, dense to very dense.	
	2.0	0.0	0%									
	2.0	0.0	0%					70				
	3.0	0.0	0%					75				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	3 OF 16	VSC-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	3.0	0.0	0%		CORE BOX 2		126.7	75	24.0-152.0': SAND: (cont)	
	2.0	0.0	0%							
	2.0	0.4	20%					80		
	3.0	0.6	20%							
	2.0	0.0	0%					85		48.0-105.0': Made list of drilling variables (i.e., RPM's water pressure, down pressure, water opening at end of inner barrel, drill mud, etc.) and tried combinations of these on short 2.0-3.0' runs to recover sand.
	3.0	0.0	0%							
	2.0	0.0	0%					90		
	3.0	0.0	0%							
	2.0	0.0	0%					95		
	3.0	0.0	0%							
	2.0	0.0	0%					100		
	3.0	0.0	0%							
	5.0	0.6	12%					105	106.0': Medium-grained, clean (sugar) loose to firm.	
	5.0	0.0	0%					110		
								115		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	4 of 16	VSC-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	5.0	0.0	0%		CORE BOX 3			116		24.0-152.0': SAND (cont)	
	5.0	0.0	0%					120			
	5.0	0.8	16%					125			
	5.0	0.0	0%					130		Very pale orange (10 YR 6/2), clayey (kaolonite) fine-to medium-grained, dense to very dense.	
	5.0	1.3	26%					135		≈ 135.0-140.0': Yellow green (5 G 6/4), sandy clayey silt; medium bedded with alternate silt and sand zones, very stiff to hard.	135.0-140.0': Approximately 0.5' core fell in hole as barrel was pulled from over hole.
	5.0	0.0	0%					140			
	5.0	1.3	26%					145		Olive brown (5 Y 4/6) to light olive (0 Y 5/4), silty, sandy, clay; some shell fragments, slightly calcareous, very stiff to hard.	
	5.0	1.3	26%				49.7	150 152		CONTACT UNCERTAIN (± 1.0') 152.0-233.8: CALCAREOUS SILTSTONE (MARL):	
								155			

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	5 of 16	VSC-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N" PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE							46.7	155	152.0-233.8': CALCAREOUS SILTSTONE (MARL):(cont) Dark greenish gray (5 GY 4/1), calcareous, slightly sandy, clayey, numerous shell fragments, hard to very hard, thin to medium bedded to finely bedded.	155.0': 5/29/82 Stopped coring.
	10.0	1.8	18%		CORE BOX 3			160		
	5.0	6.5	130%					165		
	5.0	3.8	76%					170		
								175	±175.0': Slight gradational change.	
	10.0	10.7	107%		CORE BOX 4			180		
								185	Limestone: Moderately hard, light gray (N7) fine-grained lenses at 191.8 to 192.2, 193.4-194.4, 196.3 to 196.7, 197.7 to 198.1, 199.1 to 199.3, 200.0 to 200.1, 204.6 to 205.0, 205.3 to 205.5.	
	10.0	9.2	92%		CORE BOX 5			190		
								195		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	6 of 16	VSC-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE							6.7	196			152.0-233.8': CALCAREOUS SILTSTONE (MARL)(cont)	
	10.0	10.0	101%		CORE BOX 5			200				
								205				Polished surface 209.8 @ 50°.
	10.0	10.6	106%					210				
					CORE BOX 6			215			215.8': Gradational change from grayish yellow green (5 GY 7/8) to pale olive (10 Y 6/2), slightly sandy, clayey, calcareous, hard to very hard, some shell fragments.	
	10.0	2.7	27%					220				
								225				
	10.0	10.1	101%		CORE BOX 7			230				
							-32.1	233.8			Distinct sharp contact.	
								235				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED LIMMETT FAULT	VSC-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	7 of 16	VSC-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE					CORE BOX 7		-34.3	236	233.8-236.0': LIMESTONE: White (N9) to medium bluish gray (5 B 5/1), bioclastic, calcareous, soft to moderately hard. CONTACT UNCERTAIN	
	10.0	1.1	11%					240	236.0-256.5': LIMESTONE: Grayish yellow green (5 GY 7/2), fossiliferous, sandy, soft to moderately hard, becoming sandier and less cemented with depth.	
	10.0	0.0	0%					245–255		
	5.0	3.6	72%				-54.8	256.5	256.5-316.0': SAND: Pale olive (10 Y 6/2) clean non-calcareous, fine-to medium-grained, loose to firm.	260.0: 5/30/82 Stopped coring
	5.0	0.0	0%					260		
	5.0	0.0	0%					265	Olive gray (5 Y 4/1), fine-grained, slightly silty, carbonaceous.	265.9-270.0': Small amount of material caught by core catcher.
	5.0	1.0	20%					270–275	Grayish olive (10 Y 4/2), fine-grained, slightly silty, dense to very dense.	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	8 OF 16	VSC-2

Column headings: SAMPLER TYPE AND DIAMETER; SAMPLER ADVANCE / LENGTH CORE RUN; SAMPLE RECOVERY / CORE RECOVERY; SAMPLE BLOWS "N" / PERCENT CORE RECOVERY; WATER PRESSURE TESTS (LOSS IN G.P.M.; PRESSURE P.S.I.; TIME IN MINUTES); ELEVATION; DEPTH; GRAPHIC LOG; SAMPLE; DESCRIPTION AND CLASSIFICATION; NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Elevation at 276: -73.3

Depth scale: 276, 280, 285, 290, 295, 300, 305, 310, 315

Sampler type: NO CORE

Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Percent Core Recovery	Pressure column
5.0	0.0	0%	CORE BOX 7
5.0	0.0	0%	CORE BOX 7
5.0	0.0	0%	CORE BOX 8
5.0	1.5	30%	CORE BOX 8
5.0	0.0	0%	CORE BOX 8
5.0	0.0	0%	CORE BOX 8
5.0	0.0	0%	CORE BOX 8
5.0	0.0	0%	CORE BOX 8

Description and Classification:

256.5-316.0': SAND: (cont) Dark greenish gray (5 GY 4/1), non-calcareous, clayey, fine to medium grained, firm, dense.

(305) Medium grained, clean.

(311) Medium-grained, clean.

Notes:

285.0-290.0': Sand caught behind core catcher (fine-to medium-grained sand).

295.0: Sand returning in drill mud, added barite to E-Z mud.

275.0-310.0': Sand in drill mud.

305.0-310.0': Sample taken from rods sanded in 80' from bottom of hole at 310.0'

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	9 OF 16	VSC- 2

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Graphic log	Sample	Description and classification	Notes on: water levels, water return, character of drilling, etc.
BQ CORE								315			256.5-316.0': SAND (cont)	305.0-310.0':(cont) Rid broke attempting to pull rods. 5/31/82 310.0: 6/2/82 Rig repaired, washed back to bottom of hole 310.0'
	5.0	2.8	56%		CORE BOX 8		-114.3	316			316.0-319.4': SILT: Very light gray (N8), medium light gray (N6), medium grained, pyrite/marcasite along streaked areas.	
	5.0	3.1	62%				-117.7	319.4			319.4-354.0': CLAY Bluish white (5 B 9.1) to very light gray (N8), mottled, dark reddish brown (10 R 3/4) to dark yellowish orange (10 YR 6/6) and pale purple (5 RP 7/2) to grayish red purple (5 RP 4/2), slightly silty, non-calcareous, occasional sandy zones, very stiff to hard.	316.0: Driller indicated clay at this depth. 316.0-319.4 Several polished faces.
								320				
								325				325.0-335.0': Left some core in hole.
	10.0	3.8	38%					330				
								335				
	5.0	5.9	118%									
								340				
	5.0	6.6	132%		CORE BOX 9							
								345				
	10.0	4.9	49%					350				
							-152.3	354			354.0-362.8': SILT	354.0: Driller indicated out of clay here.
								356				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO.: VSC-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	10 OF 16	VSC-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	5.0	0.7	14%		CORE BOX 10			355	354.0-362.8': SILT: (cont) Very light gray (N8), slightly sandy, clayey, stiff to very stiff, micaceous, non-calcareous.	
	5.0	2.8	56%				-161.1	360 / 362.8	APPROXIMATE CONTACT 362.8-392.0': SAND: Light gray (N7), fine-grained, loose to firm, clayey, micaceous, non-calcareous.	
	5.0	0.0	0%					365		365.0: Fine sand in return drill mud.
	5.0	0.0	0%					370		
	5.0	0.0	0%					375		
	5.0	0.0	0%					380		380.0: 6/2/82 Stopped coring, pulled 60' of rods. 6/3/82 Rods went all the way to 380.0, no caving.
	5.0	0.2	4%					385		
	5.0	0.6	12%				-190.3	390 / 392.0 / 395	392.0-414.0': SILT: Dark gray (N7), carbonaceous, slightly clayey, stiff to very stiff, micaceous, non-calcareous.	392.0: Driller indicated clay at this depth.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	11 of 16	VSC-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	5.0	0.0	0%		CORE BOX 10			395	392.0-414.0': SILT: (cont) Dark gray (N3) (carbonaceous?), clayey, fine-grained sand lenses, stiff to very stiff, non-calcareous.	395.0: Driller indicated sand at this depth.
	5.0	5.0	100%					400		
	10.0	0.5	10%					405		405.0: 6/3/82 Stopped coring, pulled rods, and mudded hole in preparation for break. 6/9/82 Rods returned to bottom of hole 405.0
								410		
							-212.3	414	414.0-466.0': SAND: Fine-to medium-grained, dark quartz with some dark minerals and (shell?) fragments.*	*414.0: Description from sand in drill mud.
	5.0	0.0	0%					415		
	5.0	0.0	0%					420		
	5.0	0.0	0%					425		
	5.0	0.0	0%					430		430.0: Hole collapsed, artesian flow added barite, still slight loss of circulation. More heavy mud stopped artesian flow.
								435		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	12 OF 16	VSC-2

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NQ CORE	5.0	0.0	0%		CORE BOX 10			435–440	414.0-466.0': SAND: (cont)	
NQ CORE	5.0	1.1	22%		CORE BOX 10			440–445	444.0-446.0': Clay; dark gray (N3), micaceous, silty clay to clayey silt, with some fine-grained sand layers/lenses.	444.0-446.0': Driller indicated clay.
NQ CORE	5.0	0.0	0%		CORE BOX 10			445–450		446.0: Driller indicated sand. 444.0-446.0': Description from material in drill mud return.
NQ CORE	5.0	0.0	0%		CORE BOX 10			450–455		
NQ CORE	5.0	0.0	0%		CORE BOX 10			455–460		
NQ CORE	5.0	0.0	0%		CORE BOX 10			460–465		
NQ CORE	5.0	2.2	44%		CORE BOX 10 / CORE BOX 11		-264.3	465–470 (466)	466.0-470.0': CLAY: Light gray (N7), slightly silty, very stiff to hard with some sand at upper contact.	466.0: Driller indicated clay.
NQ CORE	5.0	0.0	0%		CORE BOX 11		-268.3	470–475	470.0-486.7': CLAY	470.0 6/9/82 Stopped drilling. 470.0-475.0': Core not retrieved by catcher, pick up next run.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO.: VSC-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	13 OF 16	VSC-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)
NQ CORE	5.0	8.8	176%		CORE BOX 11			475–480
	5.0	0.0	0%					480–485
	5.0	8.3	166%				-285.0	486.7
	5.0	0.0	0%		CORE BOX 12		-290.3	492
	5.0	0.0	0%				-296.3	498
	5.0	7.5	150%					
	10.0	2.0	20%				-307.3	509

DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
475–486.7	470.0-486.7': CLAY: (cont) Very light gray (N8) dark reddish brown (10 R 3/4) to dark yellowish orange (10 YR 6/6), mottled, slightly sandy, silty, very stiff to hard, non-calcareous.	480.0-485.0': Core was not picked up by catcher, retrieved on next run.
486.7	GRADATIONAL CONTACT	
486.7–492	486.7-492.0': SILT: Light gray (N7), slightly sandy, clayey, micaceous, stiff to very stiff.	
492–498	492.0-498.0': SAND: Medium-grained quartz, subrounded, some dark minerals.	492.0: Driller indicated sand, description from material in drill mud.
498–509	498.0-509.0': CLAY: Very light gray (N8), dark reddish brown (10 R 3/4), dark yellowish orange (10 YR 6/6), occasionally pale-purple slightly silty, non-calcareous, very stiff to hard.	498.0: Driller indicated clay.
509–515	509.0-532.0': SILTY SAND: Very light gray (N8), yellowish gray (5 Y 8/1), medium-to coarse-grained, loose to firm, clayey.	509.0: Driller indicated sand. 509.0-532.0': Medium-to coarse-grained sand based on return drill mud.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	14 of 16	VSC-2

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: water levels, water return, character of drilling, etc.
NQ CORE	5.0	0.0	0%		CORE BOX 12			515	509.0-532.0': SILTY SAND: (cont)	
	5.0	0.8	16%					520		
	5.0	0.0	0%					525		
	2.0	0.0	0%					530		
	8.0	9.0	113%				-330.3	532	532.0-543.0': CLAY: Very light gray (N8), mottled dark reddish brown (10 R 3/4) to dark yellowish orange (10 YR 6/6), occasionally pale purple (5 RP 7/2) to grayish red purple (5 RP 4/2), slightly silty, very stiff to hard, non-calcareous.	532.0: Driller indicated clay, blocked out, pulled inner barrel, no recovery.
	5.0	0.0	0%		CORE BOX 13		-341.3	543	543.0-563.0': SAND: Medium-to coarse grained, (some gravel) subrounded quartz, some dark minerals and mica; silt/clay*.	*Description from return in drill mud.
	5.0	0.0	0%					545, 550		
	5.0	0.0	0%					555		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO.: VSC-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PROJECT	9510	15 of 16	VSC-2

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Percent Core Recovery	Water Pressure Tests (Loss in G.P.M. / Pressure P.S.I. / Time in Minutes)	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NQ CORE	5.0	0.0	0%	CORE BOX 13		555	543.0-563.0': SAND (cont)	
	5.0	0.9	18%			560		560.0: Wash sample from return drill mud.
					-361.3	563	563.0-573.0': CLAY: Light gray to dark reddish brown to dark yellowish orange. Coarse to gravel size sand increasing with depth.	
	10.0	0.0	0%			565, 570		
					-371.3	573	573.0-600.0': SAND: Light gray (N7), dark gray (N3), interbedded medium-to coarse-grained, some silt/clay, stiff to very stiff, non-calcareous, micaceous.	573.0: Driller indicated sand.
	5.0	0.7	14%			575		575.0: Wash sample from drill mud return. 575.0-580.0': Clay recovered in this run lost from interval 565.0-575.0.
	5.0	0.0	0%			580		
	5.0	0.7	14%			585		
	5.0	0.4	8%			590, 595		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	16 of 16	VSC-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	5.0	0.0	0%		CORE BOX 13			595			573.0-600.0': SAND (cont)	573.0-600.0': Not enough change in drill rates to distinguish between silts and sands.
							-398.3	600			BORING TERMINATED - Hole was geophysically logged and an observation well was installed.	600.0: 6-11-82 Mudded hole and pulled rods to prepare for geophysical logging.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	1 of 15	VSC-3

SITE	COORDINATES	ANGLE FROM HORIZ.	BEARING
POSTULATED MILLETT FAULT	N 1138356.84 E 676254.55 (GA.)	90°	N.A.

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH
6/16/82	6/28/82	Law Engineering	Mobil Drill	2-63/64	---	---	570.0'

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
197.9'/35%	14	0	--	170.3	See Observation Well Data	---

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
N.A.	Observation Well to be Installed	Ken Wornick/Ron Wood (GPC)

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ Core	4.0	0		0%		CORE BOX 1		170.3	0			0-19.0': SANDY CLAY: Dark yellowish orange (10 YR 6/6), medium-to very fine-grained, subangular to subrounded, firm, moderately weathered.	E-Z Mud, Quik-Gel (Bentonite) and Baroid Barite used as needed during the drilling.
	5.0	.6		12%					5				
	5.0	0		0%					10				5' core runs. Used to 134'.
	5.0	0		0%					15				
								151.3	19.0			APPROXIMATE CONTACT	19' drill. Mud color change used as basis for contact.
	5.0	0		0%					20			19.0-36.0': SANDY CLAY: Moderate reddish brown (10 R 4/6) to pale red (10 R 6/2), medium-grained, subangular, hard, firm, (brick-like?), well to moderately cemented.	
	5.0	0		0%					25				
	4.0	.3		7%					30				
									35				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-3

H&CF 19-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	2 OF 15	VSC-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ Core						CORE BOX 1		134.3	36.0			19.0-36.0': SANDY CLAY (cont)	36' drill. Mud color change used as basis for contact.
												APPROXIMATE CONTACT	
	5.0	0		0%								36.0-108.7': SAND: Grayish orange (10 YR 7/4) to yellowish gray (5 Y 7/2), medium-to coarse-grained, subangular to subrounded, loose, silty, some bedding (93.5'). Material recovered was non-calcareous.	36.0-108.7': Extremely low recovery prevents lithologic detail of individual core runs.
	5.0	0		0%					40				
	5.0	0		0%					45				
	5.0	0		0%					50				
	5.0	0		0%					55				
	5.0	0		0%					60				
	5.0	.3		7%					65				
	5.0	1.2		24%					70				
									75				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-3

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	3 OF 15	VSC-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE #
NQ Core	5.0	1.3		26%		CORE BOX 1			75		
	5.0	0.6		12%					80		
	5.0	1.0		20%					85		
	5.0	1.2		24%					90		
	5.0	0		0%					95		
	5.0	0		0%					100		
	5.0	0.5		10%					105		
								61.6	108.7		
	5.0	0.5		10%					110		
									115		

DESCRIPTION AND CLASSIFICATION

36.0-108.7': SAND (cont) Grayish orange (10 YR 7/4) to yellowish gray (5 Y 7/2), medium-to coarse-grained, subangular to subrounded, loose, silty, some bedding (93.5'). Material recovered was non-calcareous.

Clean contact at 5^{0}-10^{0} dip.

108.7-124.1': CLAY: Greenish gray (5 GY 6/1) very fine, fresh, some black sand/organics. Dense, firm, laminae horizontal at 109.3'.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

36.0-108.7': Extremely low recovery prevents lithologic detail of individual core runs.

108.7-124.1': Slow drilling in clay.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-3

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	4 OF 15	VSC-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES
NQ Core	5.0	0	0%		CORE BOX 1	
	5.0	0	0%			
	5.0	.9	18%			
	5.0	4.8	96%			
	10.0	10.0	100%		CORE BOX 2	
	10.0	5.5	55%			

ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
	116	108.7-124.1': CLAY (cont) Greenish gray (5 GY 6/1), very fine, fresh, some black sand/organics, dense, firm.	108.7-124.1': Slow drilling in clay.
46.2	124.1	124.1-128.8': CLAYEY SAND: Light olive gray (5 Y 6/1), to greenish gray (5 GY 6/1) medium-to fine-grained, subangular to subrounded, some silt, moderately bedded throughout.	124.1-128.8': Slow drilling in clayey sand.
41.5	128.8	128.8-129.4': ORGANIC MATERIAL: Grayish black (N 2) with moderate yellow (5 Y 7/6) blebs, smooth consistency, pollen (?), clean horizontal contact.	128.8-129.4': Fast drilling, some loss of circulation.
40.9	129.4	129.4-134.0': CLAY: Pale olive (10 Y 6/2), very fine-grained, firm, fresh, clean contact.	129.4-134.0': Slow drilling rate in clay.
36.3	134.0	134.0-205.5': CALCAREOUS SILTSTONE (MARL): See next page for complete description.	

Depth scale: 116, 120, 125, 130, 135, 140, 145, 150, 155

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-3

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	5 OF 15	VSC-3

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Graphic log	Sample	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ Core	5.0	9.0	180%					155			134.0-205.5': CALCAREOUS SILTSTONE (MARL) (cont) Dark green gray (5 G 4/1), fresh, has nearly horizontal and frequently convoluted laminae delineated by small shell fragments, calcareous streaks and fine grains, weak to stiff, core lengths often length of run, locally clayey or sandy (fine sand), numerous 0.2-0.6' limestone beds, generally increased sand with depth, lignitic bleb 136.5', slightly broken 138.0-138.7'.	134.0-205.5': Smooth, slow drill rate, little to no loss of circulation, to 208.0'.
	5.0	5.3	106%		CORE BOX 3			160			Limestone beds 144.0-144.2' 144.7-145.2' 156.8-157.4' 163.4-164.2' 173.9-174.0' 174.9-175.6'	
	10.0	10.0	100%					165, 170			Isolated thin beds 177.0-184.0'	
	10.0	10.0	100%		CORE BOX 4			175, 180				
	10.0	10.0	100%		CORE BOX 5			185, 190, 195				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-3

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	6 OF 15	VSC-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N" PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)
NQ Core	10.0	10.0	100%					196–205.4
NQ Core	10.0	2.8	28%				-35.2	205.4
NQ Core	10.0	2.6	26%					
NQ Core	10.0	2.0	20%					234.0

Depth scale: 196, 200, 205, 205.4, 210, 215, 220, 225, 230, 234.0, 235

DESCRIPTION AND CLASSIFICATION

134.0-205.5': CALCAREOUS SILTSTONE (MARL) (cont)

185.7': Loose clay bed 0.2' thick.

186.5-205.5': Thicker limestone bed.

205.4-234.0': FOSSILIFEROUS LIMESTONE/SANDSTONE: Light to medium gray (N 5, N 7) vuggy. Moderately weathered, friable, numerous shells and shell fragments.

205.5-213.8': Highly vuggy.

213.8-224.0': Fresh, moderately vuggy.

224.0-234.0': Fresh, few vugs, firm, hard.

234.0-318.0': SAND.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

205.4': Contact low recovery zone, increase loss of circulation at contact.

208.0- Fast drill rates, high loss of circulation.

Sand washing up core barrel after removal of inner barrel, needed to wash back down to bottom of each core run before dropping inner barrel in place and proceeding to next core run.

Continued on (GPL) (Ron Wood) Log VSC-3.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO.: VSC-3

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	7 OF 15	VSC-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ Core					CORE BOX 6		-64.7	235			234.0-318.0': SAND (cont) Medium light gray (N 6); fine to medium grained; slightly silty, slightly to non-calcareous; partially cemented; firm to dense.	0.0-235.0': Portion of hole logged by Ken Wornick (Bechtel).
	1.0	10.0	10%					240				
							-77.7	245			Calcareous Sand	
	0	6.0	0%					250			Sand, moderate olive brown (5 Y 4/3); fine-grained; slightly silty; loose to firm, non-calcareous.	
	0.3	5.0	6%					255				255.0-265.0': Fine sand in return drill mud.
								260				
	0	10.0	0%					265			Sand, medium light gray (N 6) to light gray (N 7); medium-to coarse-grained; firm to dense; with very few dark minerals and mica; occasional, thin, clay layers; non-calcareous.	
	1.1	5.0	22%		CORE BOX 7			270				
	1.7	5.0	34%					275				

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-3

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	8 OF 15	VSC-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE					CORE BOX 7			275			234.0-318.0': SAND (cont)	275.0': 6/24/82 stopped drilling.
	3.0	5.0	60%					280				
	0	5.0	0%					285				
								290				
	.8	10.0	8%					295				295.0-305.0': Sand in return drill mud.
	0	5.0	0%					300				
	0	5.0	0%					305				
	1.5	5.0	30%					310			Sand, medium light gray (N 6) to light gray (N 7); medium-to coarse-grained; firm to dense, with very few dark minerals and mica,	
											(next page)	
	0	5.0	0%					315				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-3

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	9 OF 15	VSC-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
									315			234.0-318.0': SAND (cont) non-calcareous; occasional, thin clay layers.	
								-147.7	318.0			318.0-338.0': CLAY: White (N 9) to very pale orange (10 YR 8/2), mottled, dark reddish brown (10 R 3/4) to dark yellowish orange (10 YR 6/6) and pale red purple (5 RP 6/2), slightly silty, clay; very stiff to hard, becoming micaceous and silty in last 1.0-2.0'; non-calcareous.	318.0': Driller indicated clay. 318.0-321.6': Numerous streaks and bands of pyrite/ marcasite.
	0	5.0		0%		CORE BOX 7			320				
	7.5	5.0		150%					325				
									330				
	1.4	10.0		14%					335				
								167.7	338.0			CONTACT ESTIMATED	
	2.2	5.0		44%		CORE BOX 8			340			338.0-366.6': SAND*: Medium-to coarse-grained, clean, subrounded quartz.	340.0': 6/25/82 stopped drilling. * Description taken from material in return drill mud.
	0	5.0		0%					345				
	0	5.0		0%					350				
	0	5.0		0%					355			SILT: Olive-gray (5Y 4/1), slightly sandy,	

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SITE: POSTULATED MILLETT FAULT

HOLE NO.: VSC-3

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	10 OF 15	VSC-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE								355	micaceous, clayey, silt; firm to stiff, with several small pieces of wood, lignite; non-calcareous.	
	2.0	5.0	40%					360		
	0	5.0	0%					365		
					CORE BOX 8		-196.3	366.6	366.6-369.0': CLAY: Brownish black (5 YR 2/1), slightly silty, carbonaceous (?); very stiff to hard with occasional thin, fine-grained sand lenses or layers.	366.6-367.1': Piece of wood, lignite (?)
	3.5	5.0	70%				-198.7	369.0		
								370	369.0-376.3': SAND: Olive black (5 Y 2/1); slightly silty, micaceous; partially cemented (non-calcareous); fine-grained, very dense.	
	5.0	5.0	100%					375		
							-206.0	376.3	376.3-398.0': SILT Soft, olive black (5 Y 2/1), slightly sandy, non-calcareous, with occasional thin, fine-grained sand lenses or layers, and occasional clayey zones.	
					CORE BOX 9			380		579.2' - 70° Joint (?) 580.0' - 80° Joint (?)
	9.0	10.0	90%					385		385.0-395.0': Core crushed, ground in several places by drilling.
								390		
	8.8	10.0	88%					395		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-3

BECHTEL

GEOLOGIC DRILL LOG

PROJECT: VOGTLE ELECTRIC GENERATING PLANT | JOB NO. 9510 | SHEET NO. 11 OF 15 | HOLE NO. VSC-3

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N"	Percent Core Recovery	Water Pressure Tests	Elevation (Ft.)	Depth (Ft.)
NO CORE	3.5	5.0		70%		-227.7	398.0
	3.9	5.0		78%	CORE BOX 10		
	4.5	10.0		45%			
	2.4	10.0		24%		-257.2	427.5
	8.1	10.0		81%	CORE BOX 11		

Depth marks: 395, 400, 405, 410, 415, 420, 425, 430, 435

DESCRIPTION AND CLASSIFICATION

376.3-398.0': SILT (cont)

398.0-400.0': SAND: Medium dark gray (N 4), soft to moderately hard, non-calcareous, some shell (?) fragments, partially cemented, fine-to-medium-grained with some glauconite.

400.0-427.5': SILT: Soft, olive black (5 Y 2/1), slightly sandy, non-calcareous, with occasional thin, fine-grained sand lenses or layers and occasional clayey zones.

408.6-408.8': SAND: Very light gray (N 8), non-calcareous, fine-grained.

427.5-437.0': SAND: Medium light gray (N 6), slightly silty, micaceous, non-calcareous fine-to-medium-grained, dense to very dense, with some dark minerals and occasional pieces of organic matter.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

415.0-425.0': Driller indicated this run had interbedded sand and clay.

425.0' - 6/26/82 Stopped drilling.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT | HOLE NO. VSC-3

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT: VOGTLE ELECTRIC GENERATING PLANT | JOB NO.: 9510 | SHEET NO.: 12 OF 15 | HOLE NO.: VSC-3

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NQ CORE								435	427.5-437.0': SAND (cont)	
							-266.7	437.0	437.0-440.0': SAND: Interbedded, medium light gray (N 6), non-calcareous, partially cemented and CLAY: Olive black (5 Y 2/1), slightly silty with fine-grained sand lenses.	
							-269.7	440	440.0-445.0': CLAY: Bluish white (5 B 9/1) to white (N 9) with some light brownish gray (5 YR 6/1), slightly sandy, some mica, very stiff to hard.	
	5.2	10.0	52%					445	445.0-460.0': SAND: Medium-to coarse-grained, clean (?), quartz sand.	445.0-455.0': Medium to coarse sand in return mud.
								450		
	0	10.0	0%		CORE BOX 11			455		
	0	5.0	0%				-289.7	460	460.0-466.0': SAND: Bluish white (5 B 9/1) to very light gray (N 8), mottled dark yellowish orange (10 YR 6/6) and pale red purple (5 RP 6/2), slightly silty, clayey, medium-to coarse-grained (some gravel), firm to dense.	460.0': Driller indicated clay.
	0	5.0	0%					465		
							-295.7	466.0	466.0-471.0': CLAY: Very light gray (N 8), mottled dark yellowish orange (10 YR 6/6), slightly silty, sandy, very stiff to hard.	471.0-475.0': Sand in return drill mud.
	10.1	5.0	202%		CORE BOX 12			470		
							-300.7	471.0	471.0-537.0': SAND: Medium-to coarse-grained (some gravel), clean, quartz, with some heavy minerals .	
	0	5.0	0%					475		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT | HOLE NO.: VSC-3

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BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	13 of 15	VSC-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE					CORE BOX 12			475			471.0-537.0': SAND (cont)	475.0-480.0': Sand in return drill mud.
	5.0	0	0%					480				
											APPROXIMATE CONTACT	
							-312.2				SAND to SANDY CLAY, bluish white (5 B 9/1) to very light gray (N 8), mottled with dark yellowish orange (10 YR 6/6) to dark reddish brown (10 R 3/4), clayey, coarse to gravelly sand, fine-grained sandy tones, hard to very hard with some mica.	482.5': Driller indicated clay.
	5.0	0	0%					485				485.0-490.0': Core left in hole, went back in hole, tried to recover but not successful.
	5.0	0	0%					490				
	5.0	0	0%					495				
											APPROXIMATE CONTACT	
	5.0	7.3	146%		CORE BOX 13		-328.7	500			SAND, medium-to coarse-grained (some gravel), quartz, some heavy minerals and occasional organic fragments.*	499.0': Driller indicated sand.
												*Description from material in return drill mud.
	5.0	0	0%					505				
	5.0	0	0%					510				
	5.0	0	0%					515				515.0': 6/27/82 Stopped drilling.

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-3

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BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	14 OF 15	VSC-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE					CORE BOX 13			515	471.0-537.0': SAND (cont)	
	0	5.0	0%					520		
	0	5.0	0%					525		
	0	5.0	0%					530		
	0	5.0	0%					535		
							-366.7	537	* SEE NOTE	
	2.8	5.0	56%					540	537.0-560.0: CLAY: Bluish white (5 B 9/1) to very light gray (N8), mottled and streaked with dark reddish brown (10 R 3/4) to dark yellowish orange (10 YR 6/6), and grayish red purple (5 RP 4/2); slightly sandy to sandy (medium to coarse-grained) clay; hard to very hard, occasionally, micaceous, fine-grained sand zones at depth.	*538.0: Driller indicated clay contact changed to 537 because of amount of clay recovered.
	0	5.0	0%					545		
	5.0	5.0	100%					550		
	5.0	5.0	100%					555		

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-3

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	15 of 15	VSC-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE					CORE BOX 14			555	537.0-560.0: CLAY (cont)	
							-389.7	560	560.0-570.0: SAND: Fine-to medium-grained, clean (?), quartz sand*	559.0: Driller indicated sand contact changed to 560.0 because of amount of clay recovered. *Description from material in return drill mud.
	4.8	10.0	48					565		
	0	5.0	0				-399.7	570	BORING TERMINATED - HOLE WAS GEOPHYSICALLY LOGGED; AND AN OBSERVATION WELL WAS INSTALLED.	570.0 - 6/28/82 Stopped drilling.

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	POSTULATED MILLETT FAULT	VSC-3

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	1 of 26	VSC-4

SITE	COORDINATES	ANGLE FROM HORIZ.	BEARING
Postulated Millett Fault	N 1130590.27 E 683274.46(GA.)	90°	-

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH
6-22-82	7/10/82	Law Engineering	Mobile-53	3"	-	-	1024

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
492.2'/48.3%	34	3	-	156.7	See observation well data	-

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
N.A.	See Observation Well Log	Robert J. Kelleher / Ken Wornick

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS	2.0	1.3	65%				156.7	0	Drilling with Quick Gel, Easy Mud, water.
SS	2.0	1.1	55%						
SS	1.0	1.0	100%						
NO CORE	5.0 - 15.0'			CORE BOX 1			151.0	5.7	100% water recovery.
	10.0	3.2	32%						
	15.0 - 25.0'								4.5' core length 6/22/82.
							139.6	17.1	3.4' core length.
	10.0	9.7	97%	22.8			134.0	22.7	
	25.0 - 35.0'			CORE BOX 2					
	10.0	3.3	33%						90% water recovery.
							121.7	35	100% water recovery.

DESCRIPTION AND CLASSIFICATION

0.0-5.7': SAND: Grayish orange (10 YR 7/4), pale yellowish brown (10 YR 6/2), dark yellowish orange (10 YR 6/6) light brown (5 YR 5/6); very fine-to fine-grained, sub rounded to sub angular, moderately stiff to soft, loose, clayey, mottled, weathered, some organics.

GRADATIONAL CONTACT

5.7-17.1': SANDY CLAY: Dark yellowish orange (10 YR 6/6), grayish orange (10YR 7/4) moderate reddish orange (10 R 6/6) grayish red (10 R 4/2), fine-to medium-grained, moderately soft to stiff, mottled, weathered. Clay is hand breakable, cohesive

14.5-15.3': Clay; white (N9).

GRADATIONAL CONTACT

17.1-22.7': CLAY: Pale red (5 R 6/2) very light gray (N8); moderately stiff to stiff, hand breakable, very cohesive, mottled, weathered, silty, slightly sandy, kaolinite clay.

GRADATIONAL CONTACT

22.7-45.2': SAND: Dark yellowish orange (10 YR 6/6), moderate reddish brown, dark yellowish orange (10 YR 6/6) to light-brown (5 YR 5/6), grayish orange (10 YR 7/4) very fine-to fine-grained, angular to sub rounded, soft to moderately stiff, very poorly cemented, loose, well-sorted, micaceous, slightly clayey; silty sand is predominantly quartz with some black ferro magnesian minerals, clayey with some large muscovite flakes toward bottom of unit.

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	2 OF 26	VSC-4

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NO CORE	35.0 - 45.0				CORE BOX 2			35	22.7-45.2': SAND (cont)	Sand in drilling fluid. 100% drilling fluid recovery.
	10.0	0.0	0%					40	45.0-45.2': Sandstone; very light gray, (N8), very fine-to fine-grained, moderately hard to hard, very well cemented, tight, dense.	Easy drilling. Drillier could not tell when he hit hard sandstone.
							111.5	45 / 45.2	SHARP CONTACT	
	45.0 - 55.0'								45.2-65.5': CLAYEY SILT: Light greenish gray (5 GY 8/1) moderately soft to moderately stiff, cohesive, sandy; moderatley soft where sandy and silty, sand is predominantly quartz and muscovite mica, trace of feldspar, trace of organics.	
	10.0	1.2	12%					50		50% drilling fluid recovery. Added Bariod to drilling fluid.
	55.0 - 65.0'							55		
	10.0	1.5	15%					60	64.0-64.5': Sand; yellowish gray (5 Y 7/2) loose, poorly cemented.	90% drilling fluid recovery.
							91.2	65 / 65.5	SHARP CONTACT	
	65.0 - 75.0'								65.5-74.8': CALCAREOUS SAND: Light greenish gray (5 GY 8/1) very fine-to medium-grained, angular to sub rounded, poorly sorted, moderately soft to slighty hard, well cemented, dense, tight, silty, clayey where moderately soft; sand is predominantly quartz with trace of feldspar, trace of organics.	
	10.0	5.3	53%					70		Harder drilling.
							81.9	74.8 / 75		

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	3 OF 26	VSC-4

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NO CORE	75.0 - 85.0'			76.2				75	SHARP CONTACT 74.8-84.4': INTERBEDDED CLAY AND SAND: Light bluish gray (5 B 7/1), medium bluish gray (5 B 5/1), thin horizontal bedding, stiff to slightly hard, calcareous, laminated; sand is very fine-to fine-grained, moderately well cemented; claystone is very cohesive, stiff.	100% drilling fluid recovery.
	10.0	8.7	87%	CORE BOX 3				80		
	85.0 - 95.0'						72.3	84.4 / 85	GRADATIONAL CONTACT 84.4-90.2': SAND: Light bluish gray; very fine-to medium-grained, angular to sub rounded, slightly hard, poorly cemented, weak; numerous very large white shell (oyster) fragments, dense, calcareous.	Easy drilling.
	10.0	9.2	92%	90.0			66.5	90 / 90.2	SHARP CONTACT 90.2-112.9': SAND: Grayish yellow (5 Y 8/4) very fine-to medium-grained, angular to sub rounded, moderately soft to moderatley stiff, moderately loose, weak, poorly cemented; calcareous, poorly sorted, friable, silty, slightly clayey; sand is predominantly quartz, trace of muscovite, trace of a dark ferromagnesian mineral, some shell fragments.	100% water recovery.
	95.0 - 105.0'							95		
	10.0	4.6	46%	CORE BOX 4				100		
	105.0 - 115.0'							105		Sand in cuttings.
	10.0	1.8	18%					110		
							43.8	112.9	GRADATIONAL CONTACT 112.9-137.9': INTERBEDED FOSSILIFEROUS LIMESTONE AND CALCAREOUS SAND	6/23/82 @ 115
								115		

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	4 OF 26	VSC-4

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	115.0 - 125.0'			CORE BOX 4				115			112.9-137.9': INTERBEDDED FOSSILIFEROUS LIMESTONE AND CALCAREOUS SAND: (cont) White (N9) bluish white (5 B 9/1), yellowish-gray (5 Y 8/1), dusty yellow (5 Y 6/4); fine-to coarse-grained, moderately soft to slightly hard, silty, clayey, numerous shell fragments; limestone is slightly hard, sandy, numerous voids, poorly cemented, loose, sand is predominantly quartz and a black ferromagnesian mineral, locally mottled and weathered.	Sand in drilling fluid.
	10.0	0.6	6%					120				100% drilling fluid recovery.
	125.0 - 135.0'							125				
	10.0	1.7	17%					130			134.1-134.5': Silty clay; white (N9); kaolinite.	
	135.0 - 145.0'			137.0				135			UPPER 2' OF MARL SHOWS LIGHT BROWN WEATHERING	Easy drilling.
							18.8	137.9			SHARP CONTACT	
	10.0	8.4	84%	CORE BOX 5				140			137.9-219.0': CALCAREOUS SILTSTONE (MARL): Dark greenish gray (5GY 4/1) (5 G 4/1), light bluish gray (5 B 7/1), fresh, has near horizontal and frequently convoluted laminae delineated by small fossil shell fragments, calcareous streaks, twin beds and rare wood fragments, weak to stiff, core length often unbroken, locally clayey or sandy, some mica.	
	145.0 - 155.0'							145				
	10.0	10.0	100%					150				No loss of circulation.
								155				

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-4

GEOLOGIC DRILL LOG

BECHTEL

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	5 of 26	VSC-4

Sampler Type and Diameter	Sampler Advance Length Core Run	Sample Recovery Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, Etc.
NQ CORE	155.0 - 165.0'			CORE BOX 6				155	137.9-219.0': CALCAREOUS SILTSTONE (MARL): (cont)	100% drilling fluid recovery
	10.0	10.0	100%					160		1 4.2' core length.
								165		Easy drilling.
	165.0 - 175.0'			167.9						
	10.0	9.3	93%	CORE BOX 7				170		8.7' core length.
	175.0 - 185.0'							175		
	10.0	10.0	100%					180		
				183.3					184.7-185.0': Limestone nodule; light bluish gray (5 B 7/1).	Easy drilling 100% drilling fluid return.
	185.0 - 195.0'			CORE BOX 8				185		
	10.0	8.7	87%					190	191.2: Limestone nodule; light bluish gray (5 B 7.1).	3.6' core length.
									194.1: Limestone nodule; light bluish gray (5 B 7/1).	195' Geologist's shift change.
								196		

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-4

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BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	6 OF 26	VSC-4

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ-3 CORE	195.0 - 205.0'			CORE BOX 8				195	137.9-219.0': CALCAREOUS SILTSTONE (MARL) (cont)	195.0-205.0': Recovered core in broken state due to 10' run on a 10.3' recovery. Stub from previous run packed core in barrel beyond capacity.
									193.8-194.0': Limestone bed, hard, fresh.	
									196.4-196.9': Limestone bed, hard, fresh.	
	Recovered stub from previous run									
	10.0	10.3	103%					200		
	205.0 - 215.0'			CORE BOX 9				205		
	10.0	9.8	98%					210	211.^ ...mestone laminations.	
	215.0 - 225.0'							215		
									0.8' GRADATIONAL CONTACT	
	10.0	9.4	94%	CORE BOX 10			-62.3	219 / 220	219.0-225.0': LIMESTONE: Light gray (N7) to light bluish gray (5 B 7/1), very fine, fresh to moderately weathered, vuggy 219.0-220.8, some fossil shell fragments.	220.0-230.0': 50% drill fluid loss.
	225.0 - 235.0'						-69.2	225 / 225.9	225.0-225.9': CALCAREOUS SILTSTONE (MARL): Dark greenish gray (5 GY 4/1) (5 G 4/1) light bluish gray (5 B 7/1), fresh, generally massive, laminated, calcareous streaks.	225.0-230.0': Barrel blocked off; low recovery.
	10.0	1.8	18%					230	225.9-271.9': LIMESTONE, CALCAREOUS SAND: Dark greenish gray (5 GY 4/1) (5 G 4/1) very fine-to medium-grained, sub-angular to sub rounded, hard and fresh to loose and moderately weathered, small shell fragments throughout.	230.0-235.0': Driller having difficult time of establishing proper drill rate and pump pressure for the formation.
									225.9-235.0': Limestone bed, vuggy, moderately weathered.	
								235	235.0-237.6': Calcareous sand, loose.	

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-4

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BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	7 of 26	VSC-4

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NQ CORE	235.0 - 245.0'			CORE BOX 10				235	225.9-271.9': LIMESTONE, CALCAREOUS SAND (cont)	235.0-245.0': Fast to slow drill rate, moderate loss of circulation.
									237.6-238.4': Limestone bed, fresh.	General
									238.4-254.0': Calcareous sand, loose.	High revs. and low pump pressure seems to be working in recovery sand.
	10.0	4.1	41%					240		
	245.0 - 255.0'			CORE BOX 11				245		245.0: Pipe sanded in. Will pull all stem and wash back down to bottom.
	10.0	1.8	18%					250		
	255.0 - 265.0'							255	254.0-255.0': Limestone bed, fresh to vuggy.	
									255.0-255.8': Calcareous sand, loose.	
									255.8-256.2': Limestone, fresh, hard.	
	10.0	10.0	100%					260		
	265.0 - 275.0'							265	265.2-271.9': Calcareous sand, loose	265.0' Drillers shift change.
	10.0	7.7	77%	CORE BOX 12				270		
							-115.2	271.9	SHARP CONTACT	271.9: Lithology basically unchanged at contact. Contact delineated by calc. to non-calc. change.
									271.9-323.6': NON-CALCAREOUS SAND: Light gray (N7), greenish gray (5 GY 6/1), translucent; very fine-to course-grained, angular to sub angular, very loose, very poorly cemented, poorly sorted.	
								275		

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	8 OF 26	VSC-4

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	275.0 - 285.0'			CORE BOX 12				275	271.9-323.6': NON-CALCAREOUS SAND: (cont) Micaceous, clean; sand is predominantly medium quartz grains with some muscovite and a trace of a black ferromagnesian mineral.	
	10.0	0.0	0%					280	271.0-275.0': Olive gray (5 Y 3/2), light olive gr y (5 Y 5/2), very fine-to-fine grained, sub angular to sub rounded, clayey, silty, loose, poorly cemented, micaceous.	Easy drilling.
									275.0-323.6': Clean, loose sand.	
	285.0 - 295.0'							285		
	10.0	0.0	0%					290		Sand in drilling fluid (medium grained quartz-clean).
	295.0 - 305.0'							295		90% (est) drilling fluid recovery
	10.0	0.0	0%					300		
	305.0 - 315.0'							305		Medium grained quartz sands in cuttings.
	10.0	2.9	29%					310		
								315		90% drilling fluid recovery.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO.: VSC-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	9 OF 26	VSC-4

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N" PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	315.0 - 325.0'							315			271.9-323.6': NON-CALCAREOUS SAND:(cont)	
	10.0	2.5	25%					320				
							-116.9	323.6			SHARP CONTACT	
											323.6-375.0': CLAY: Very light gray (N8), light bluish gray (5B 7/1), grayish pink (5 R 8/2), pale reddish brown (10 R 5/4), moderate reddish brown (10 R 4/6), dark reddish brown (10 R 3/4), dark yellowish orange (10 YR 6/6), moderately soft to stiff, mottled, weathered, cohesive, silty, clay contains some muscovite and is slightly sandy (fine-grained). Clay becomes sandy toward the bottom of the unit.	Drilling fluid color change to reddish brown.
	325.0 - 335.0'							325				
	10.0	0.2	2%	CORE BOX 12				330				
								335				Harder drilling, increased RPM.
	335.0 - 345.0'											
	10.0	4.7	47%					340				100% water recovery.
								345				Sl... drilling.
	345.0 - 350.0'			345.9								
	5.0	5.0	50%									
	350.0 - 355.0'							350				
	5.0	5.0	100%	CORE BOX 13								100% drilling fluid recovery.
								355				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	10 of 26	VSC-4

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)
NO CORE	355.0 - 360.0'							355
	5.0	5.0	100%					
	360.0 - 365.0'			CORE BOX 14				360
	5.0	0.7						
	365.0 - 375.0'							365
	10.0	9.7	97%					370
	375.0 - 385.0'						-218.3	375
	10.0	10.0	100%	CORE BOX 15			-221.9	380
	385.0 - 395.0'							385
	10.0	10.0	100%					390
								395

DESCRIPTION AND CLASSIFICATION

- 323.6-375.0' CLAY (cont)
  - 364.5-365.0': Clayey sand; very fine-to fine-grained.
  - Clay becomes soft and less cohesive towards bottom of unit.
- 375.0-378.6': CLAYSTONE: Greenish gray (5 GY 6/1) moderately stiff to stiff, silty, sandy, micaceous, some dark horizontal laminations.
  - 376.1: Polished face @ 45°.
  - 377.1: Polished face @ 45°.
  - MODERATELY SHARP CONTACT
- 378.6-493.7': SAND (QUARTZ): Grayish black (N2) to greenish black (5G 2/1) very fine-to fine-grained, sub angular to sub rounded, thin to thickly bedded, moderately stiff to stiff, occasionally friable, poorly cemented, micaceous clay.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

- (365) Moderate drilling rate in clay.
- (375) Mud color change to medium brown. Increase drill rate 30% loss of circulation.
- (385) Smooth drilling.
- (395) No loss of circulation.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; C = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	11 of 26	VSC-4

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N" PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	395.0 - 405.0'			CORE BOX 16				395			378.6-493.7': SAND (QUARTZ) (cont)	
	10.0	9.8	98%					400				
								405				Smooth drilling.
	405.0 - 415.0'											
	10.0	9.6	96%	CORE BOX 17				410			Numerous voids in core	
												No loss of circulation.
	415.0 - 425.0'							415				
	10.0	9.9	99%					420				
											423.5: Polished face @ 40^{0}	
								425				Smooth drilling.
	425.0 - 435.0'			CORE BOX 18							426.1: Color change to an olive gray. Medium light gray (N6) to medium dark gray (N4), medium- to very fine-grained, very thin to thinly bedded, often with varying degrees of silt and clay, occasional thin clay beds, moderately to highly micaceous, non-calcareous, poorly to moderately well cemented, friable to loose.	Some sand remaining suspended in circulation.
	10.0	10.0	100%					430				
								435				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO.: VSC-4

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	12 of 26	VSC-4

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ-CORE	435.0 - 445.0'							435	378.6-493.7': SAND (QUARTZ) (cont)	
	10.0	2.5	25%	CORE BOX 18				440		
									443.5-444.0': Sandstone; thinnly bedded, fine-grained, moderately well cemented, hard.	
								445	444.7-444.9': Sandstone, same.	
	445.0 - 455.0'									
	10.0	1.4	14%					450		
									454.0-455.4': Silty clay; some sand, fine-grained, moderately homogeneous.	
								455	455.4-493.7': Continued loose, moderately well sorted sand.	455.0' Geologist's shift change 7:00 am 5-24-82
	455.0 - 465.0'			CORE BOX 19						
	10.0	3.6	36%					460		
	465.0 - 475.0'							465		465.0-475.0': Hole was discovered to be sanded in upon attempted placement of inner barrel. Pulled 4x20' stem and washed back to 465'. 9:00am most of recovery on 465'-475' assumed washed out. Driller was instructed to pay careful attention to the proven success of recovery sand; high revs. and low pump pressure.
	10.0	0.2	2%					470		
								475		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	13 OF 26	VSC-4

Columns: SAMPLER TYPE AND DIAMETER | SAMPLER ADVANCE / LENGTH CORE RUN | SAMPLE RECOVERY / CORE RECOVERY | SAMPLE BLOWS "N" | PERCENT CORE RECOVERY | WATER PRESSURE TESTS: LOSS IN G.P.M., PRESSURE P.S.I., TIME IN MINUTES | ELEVATION (Ft.) | DEPTH (Ft.) | GRAPHIC LOG | SAMPLE | DESCRIPTION AND CLASSIFICATION | NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Sampler type and diameter: NQ-CORE

Core run	Length core run	Core recovery	Percent core recovery	Core box
475.0 - 485.0'	10.0	1.4	14%	
485.0 - 495.0'	10.0	2.8	28%	CORE BOX 19
495.0 - 505.0'	10.0	8.1	81%	CORE BOX 19 / CORE BOX 20
505.0 - 515.0'	10.0	0.7	7%	CORE BOX 20

Elevation: -337.0 (at depth 493.7)

Depth (Ft.): 475, 480, 485, 490, 493.7, 495, 500, 504, 505, 510, 515

Description and Classification

378.6-493.7': SAND (QUARTZ)

454.4-493.7': Continued loose sand to contact.

CONTACT MODERATELY SHARP, CLEAN: (DIP NOT VISIBLE)

493.7-504.0': CLAYEY SAND: Medium light gray (N6) to medium dark gray (N4), medium-to coarse-grained sand, sub rounded to sub angular, very fine dense clay, some silt, mica, moderately well to poorly cemented, well sorted grading into poorly sorted with depth, thinly bedded, dense.

CONTACT HIGHLY GRADATIONAL (4' 502.0-506.0')

504.0- 525.0': SAND: Medium light gray (N6) to medium dark gray (N4), medium-to fine-grained, sub angular to sub rounded, often with varying degrees of silt and clay, thin to very thinly bedded non-calcareous, moderately to poorly cemented.

515.0-525.0':No recovery.

525.0-535.0': 100%

CONTACT APPROXIMATE

Between 515' and 525'
Significantly slower drill rate at 525-535'.

Notes

485.0-495.0': Distinctly slower drill rate and high pump pressure.

485.0-495.0': Loss assumed to be sand washed out at start of run. Contact well defined.

495.0-505.0': Loss assumed to be at the end of run as wash-out (sandy).

505.0-515.0': Pulled core barrel. Sand washed/caved up drill stem. Pulled 4x20' stem with difficulty, washed back down to bottom.

515.0-525.0': Formation washing out at face of core bit.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	14 of 26	VSC-4

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Graphic log	Sample	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ-CORE	515.0 - 525.0' / 10.0	0	0%	CORE BOX 20				515–525			504.0-525.0': SAND (cont) CONTACT APPROXIMATE	
NQ-CORE	525.0 - 535.0' / 10.0	10.0	100%	CORE BOX 20			-368.3	525			525.0-544.0': CLAY: Multi-colored including dark reddish brown (10 R 3/4), pale reddish brown (10 R 5/4), moderate red (5 R 5/4), pale red (5 R 6/2) dark yellowish orange (10 YR 6/6), medium dark gray (N4), light gray (N7) moderately soft to stiff, micaceous, mottled, weathered, very cohesive, some very fine-grained sand.	525' Drillers shift change. According to driller, the first run (525-535) of the shift was clay. Recovery on last run of previous shift was 0%. Assumed that sand washed out at face of bit to approx. 525'. Contract should be considered approximate however, between 515 and 525 on the chance that clay was lost in that interval.
NQ-CORE	535.0 - 545.0' / 10.0	9.2	92%	CORE BOX 21			-387.3	544			SHARP CONTACT	
NQ-CORE	545.0 - 555.0' / 10.0	0.0	0%	CORE BOX 21			-398.3	555			544.0-555.0': SAND: Pale reddish brown (10 R 5/4), fine-to coarse-grained, angular to sub angular, loose, weak, very poorly cemented; well sorted, micaceous (muscovite) sand is predominantly quartz with a trace of smokey quartz, trace of feldspar.	535-545' slow drill rate, high pump pressure. @ 550' sand in cuttings. 1/27/82 Geologist's shift change at @ 1:00 am

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	15 of 26	VSC-4

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Lost in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ CORE	555.0 - 565.0'							555	SHARP CONTACT?	
	10.0	9.5	95%	CORE BOX 21				555–564	555.0-564.0': CLAY: Multi-colored including pale red (10 R 6/2), dark yellowish orange (10 YR 6/6), light gray; fine-grained, soft to moderately stiff, micaceous, mottled, weathered sand toward bottom of unit.	
							-417.3	564	GRADATIONAL CONTACT	
	565.0 - 575.0'			CORE BOX 22				564–574	564.0-574.0': SAND: Very light gray (N8) fine- to coarse-grained, angular to sub angular, poorly sorted, micaceous (muscovite), clayey (kaolinite) loose, some small gravel up to 1/2" in size, sand is predominantly quartz, trace of a black ferromagnesian mineral.	
	10.0	1.1	11%					570		570.0': Sand in cuttings. Geologists shift change 5:00 pm 5/27/82. Continued pulling rods, recovered inner barrel, tripped to bottom of hole, plugged bit, pulled rods, cleaned bit, begin washing back down hole, caved at 250'. Continued washing to bottom. Back to bottom at 2:45 pm.
							-417.3	574	574.0-595.0': CLAY: Multi-colored including very light gray (N8), pale red purple (5 RP 6/2), dark reddish brown (10 R 3/4), moderate brown (5 YR 4/4), moderate yellow (5 Y 7/6) moderately stiff to stiff, mottled, weathered, very cohesive, slightly sandy 574.0-575.6': Sandy with some small gravel at the upper end of the unit. Becomes sandy at the lower 1' of the unit.	
	575.0 - 585.0'							575		
	10.0	10.0	100%					580		5/28/82 Geologist shift change 1:30 pm. 580.0': Sand in cuttings. 80% drilling fluid circulation, high RPM, low water pressure. 582.0': Drilling fluid color change to an orange brown.
	585.0 - 595.0'							585		
	10.0	0.7	7%					590		
							-438.3	595		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	16 OF 26	VSC-4

Columns: SAMPLER TYPE AND DIAMETER; SAMPLER ADVANCE / LENGTH CORE RUN; SAMPLE RECOVERY / CORE RECOVERY; SAMPLE BLOWS "N" / PERCENT CORE RECOVERY; WATER PRESSURE TESTS (LOSS IN G.P.M.; PRESSURE P.S.I.; TIME IN MINUTES); ELEVATION (Ft.); DEPTH (Ft.); GRAPHIC LOG; SAMPLE; DESCRIPTION AND CLASSIFICATION; NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Sampler type	Core run	Length core run	Core recovery	Percent core recovery
NO-CORE	595.0 - 605.0'	10.0	2.7	27%
NO-CORE	605.0 - 615.0'	10.0	0.0	0%
NO-CORE	615.0 - 625.0'	10.0	0.0	0%
NO-CORE	625.0 - 635.0'	10.0	1.9	19%

Loss in G.P.M. column: 596; CORE BOX 23

Depth 595

595.0-602.0': SAND: Very light gray (N8) fine- to coarse grained, angular to sub rounded, loose.

(*Note-unit location and width are based on cuttings and sand covering clay core.)

SHARP CONTACT

Elevation -445.3, Depth 602.0

602.0-605.0': CLAY: Multi-colored including light gray (N8), pale red purple (5 RP 6/2), very fine-grained, mottled, dense.

Depth 605

605.0-633.1': SAND: (Based on cuttings re-returned in drill mud); very light gray (N8),medium-to coarse-grained, angular to sub angular, poorly cemented, micaceous, (silty clay matrix?) some small gravels (quartz); drill mud color mostly dark reddish brown (10 R 3/4).

APPROXIMATE CONTACT

Elevation -476.4, Depth 633.1

633.1-665.0': INTERBEDDED CLAY AND SILT: Multi-colored grading from red, purple and brown, to gray and black, to gray and white

Notes:

595.0: Artesian water pressure.

597.0: Sand in cuttings.

606.0: Coarse-grained sand in cutting.

80% water recovery.

615.0: Coarse grained sand in cuttings.

Geologist shift change 9:00 am 6/29/82.

605.0-633.1': Assumed to be sand based on no core recovery, and sand returns in drill mud.

Contacts noted as approximate based on low recovery.

Drilling smoothly, no loss of circulation.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	17 OF 26	VSC-4

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
	635.0 - 645.0'			CORE BOX 23				635	633.1-665.0': INTERBEDDED CLAY AND SILT: (cont) with depth, pale red purple (5 RP 6/2), dark reddish brown (10 R 3/4), moderate yellow (5 Y 7/6), dark gray (N4), light gray (N8), very fine-grained, some fine-grained laminations, well to moderately sorted, micaceous, moderately weathered, (mottled) to fresh.	Inner barrel blocked off at 638.3.
	10.0	9.3	93%					640	637.3: Polished surface 640.3-645.0': Interbedded fine sand and silt lenses, very thinly bedded, horizontal. 655.0-665.0': Clay with 8' loss (in center of run?) appearing to be a sand lense.	638.3-655.0': Washed out before driller realized it.
	645.0 - 655.0'							645		
	10.0	3.3	33%	CORE BOX 24				650		
	655.0 - 665.0'							655		656.0-664.0': Loss assumed to be in sand and gravel.
	10.0	2.0	20%					660		660.0' Drillers shift change.
	665.0 - 675.0'						-508.3	665	APPROXIMATE CONTACT. 665.0-693.3': SAND: Light gray (N8), very fine-to fine-grained, angular to sub-rounded sand grains, well sorted, loose, very poorly cemented; micaceous, sand is predominantly quartz with some muscovite, trace of smokey quartz, and a trace of a black ferromagnesian mineral.	665.0-675.0': Inner barrel jammed in stem. Pulled all stem to recover.
	10.0	0	0%					670	(*665.0 Contact is assumed due to the loss of recovery in the run from 665'-675')	Driller changed bits (diamond) @ 7:00 am.
								675		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	18 of 26	VSC-4

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
	675.0 - 685.0'							675	665.0-693.3': SAND (cont)	
	10.0	0.9	9%					680		Sand in cuttings. 60% drilling fluid recovery.
	685.0 - 695.0'							685		
	10.0	1.7	17%					690		689.0: Sand in cuttings. 685.0-695.0': Little to no loss of circulation.
							-536.6	693.3	SHARP CONTACT 693.3-819.5': CLAYEY SILT AND SILT: Dark gray to black (N4-N1), medium-to very fine-grained, very thin to thinly bedded, often convoluted laminae delineated by varying grain size; moderately soft and friable to hard, moderately dense, core recovered often runs unbroken for length of interval, moderately to highly micaceous, some organic material (woody?), some fossil shell inprints, non-calcareous (replacement?), occasionaly highly broken with some polished surfaces assumed to be mechanical.	
	695.0 - 705.0'			BOX 24				695		
	10.0	2.1	21%					700		
	705.0 - 712.5'							705		
	7.5	6.3	84%					710		
	712.5 - 717.5'									712.5-717.5': Continued high revs. and low pump pressure. No visible loss of circulation.
	9.5	3.5	37%	BOX 25				715		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	19 OF 26	VSC-4

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ-CORE	712.5 - 717.5'							715			693.3-819.5': CLAYEY SILT AND SLIT: (cont) Dark gray to black (N4-N1), medium-to very fine-grained, very thin to thinly bedded, often convoluted laminae delineated by varying grain size, moderately soft and friable to hard, moderately dense, core recovered often runs unbroken for length of interval, moderately to highly micaceous, some organic material (woody?), some fossil shell imprints, (non-calcareous, replacement?), occasionaly highly broken with some polished surfaces assumed to be mechanical.	
	5.0	4.7	94%									
	717.5 - 727.5'							720				
	9.5	3.5	37%	CORE BOX 25				725				
	727.0 - 737.0'											727.0-747.0': Slightly slower revs. and high pump pressure; no visible loss of circulation.
	10.0	10.3	103%					730				
	Recovered core left in hole from previous run.						-578.3	735				
	737.0 - 744.0'											
	7.0	5.1	73%					740				
	744.0 - 747.0'							745				
	3.0	2.1	70%	CORE BOX 26								
	747.0 - 757.0'							750				747.0: Drillers shift change 6:00 pm 7/7/82.
	10.0	10.0	100%					755				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	20 OF 26	VSC-4

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ-CORE	747.0 - 757.0'							755	693.3-819.5': CLAYEY SILT AND SILT (cont)	
	10.0	10.0	100%							
	757.0 - 767.0'			CORE BOX 28						757.0: Geologist's shift change 7:00 pm 7/7/82.
	10.0	9.3	93%					760		
									764.0: Sandy	
								765		100% drilling fluid recovery.
	767.0 - 777.0'									
								770	Silt is very fine-grained, thinly bedded, moderately soft and friable to slightly hard, moderately dense, micaceous.	
	10.0	8.3	83%							
							-618.3	775		
	777.0 - 787.0'			CORE BOX 29						
								780		
	10.0	10.0	100%							
								785		100% drilling fluid recovery.
	787.0 - 797.0'									
								790		
	10.0	5.3	53%							
								795		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	21 of 26	VSC-4

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ-CORE	787.0 - 797.0'							795	693.3-819.5': CLAYEY SILT AND SILT (cont)	Drillers shift change @ 6:30 am. Geologist's shift change 7:00 am 7/8/82.
	10.0	5.3	53%							
	797.0 - 807.0'			CORE BOX 29				800		797.0-807.0': No recovery returned downhole and recovered lost core (3.0').
	10.0	3.0	30%					805		
	807.0 - 817.0'							810		807.0-817.0': High revs. and low pump pressure; no loss of circulation.
	10.0	10.0	100%					815		
	817.0 - 827.0'			CORE BOX 30			-662.8	819.5	APPROXIMATE CONTACT; BASED ON DRILLING AND CUTTINGS	
	10.0	2.5	25%					820	819.5-832.8': SAND: Light gray (N7), medium-grained, sub angular to sub rounded, poorly sorted, loose, poorly cemented.	819.5-827.0': Loss assumed to be sand based on cuttings at end of interval.
	827.0 - 837.0'							825		827.0-832.8': Driller confirmed sand in cuttings.
	10.0	4.3	43%				-676.1	830 / 832.8	APPROXIMATE CONTACT; BASED ON DRILLING AND CUTTINGS	
								835	832.8-964.8': SILTY CLAY: Light gray (N8) to dark gray (N3) (some red iron oxidation staining), moderately soft to moderately stiff, moderately dense, mottled, weathered, micaceous.	832.8-837.0': Drilling like clay, high revs. high pump pressure.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO.: VSC-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	22 of 26	VSC-4

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ-CORE	827.0 - 837.0'			CORE BOX 30				835	832.8-964.8': SILTY CLAY: (cont)	
	10.0	4.3	43%							
	837.0 - 847.0'			CORE BOX 31				840		
	10.0	7.6	76%						843.0-845.0': Increased sand zone.	
								845	844.7-845.9': Clayey sand; very fine to fine-grained, sub angular to sub rounded, well sorted, poorly cemented, friable, moderately loose.	844.0: Loss assumed to be in sandy zone of interval. 843.0-845.0': Some rig chatter. Geologist's shift change @ 7:00 pm 7/8/82.
	847.0 - 857.0'							850		
	10.0	9.0	90%							100% drilling fluid recovery.
							-698.3	855		
	857.0 - 867.0'			858.2 / CORE BOX 32						
								860	860.7: Polished face @ 40°.	Continued high RPM rate, low pump pressure.
	10.0	9.3	93%							
								865	Approximate contact as based on drilling characteristics and cuttings.	
	867.0 - 877.0'								867.0-897.0': Sand, translucent, fine to medium sand grains, sub angular to sub-rounded, poorly sorted, loose, clean.	
								870		Sand in cuttings: medium-grained quartz.
	10.0	0.0	0%							
								875		50% drilling fluid recovery.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	23 OF 26	VSC-4

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ-CORE	867.0 - 877.0'			CORE BOX 32				875	832.8-964.8': <u>SILTY CLAY</u> (cont)	
	10.0	0.0	0%						867.0-897.0': Sand continued as based on drilling and cuttings.	
	877.0 - 887.0'							880		Sand in cuttings medium grained, translucent.
	10.0	0.0	0%					885		50% drilling fluid recovery.
	887.0 - 897.0'							890		Medium grained, translucent quartz grains in cuttings.
	10.0	0.0	0%					895		Geologist's shift change 10:00 am 7/9/82.
	897.0 - 904.0'						-740.3		897.0-904.9': Clayey sand, light gray (N7), translucent, medium-to coarse-grained, sub angular sand; very fine, dense (koalin) clay.	897.0-904.0': First run with Failing, 1500 drill rig brought in to complete boring. No other equipment changes.
	7.0	0.8	12%					900		Sand returned in cuttings.
	904.0 - 914.0'							905	904.0-914.4': Sand; translucent. clean, loose, poorly sorted based on returns in drill mud.	904.0-914.0': Sand returned in cuttings. Driller thought some clay was present, possibly as a matrix which washed out with sand at face of core bit 50% loss of circulation.
	10.0	0.0	0%					910		914.0-924.0': Assumed 8.7' sand lost as washout.
	914.0 - 924.0'						-757.3	915	914.0-924.0': 1.3' Clayey sand; light gray (N7); translucent, medium-to coarse-grained, sub angular sand, very fine-grained dense (kaolin) clay.	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	24 OF 26	VSC-4

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ-CORE	914.0 - 924.0'							915	832.8-964.8': SILTY CLAY (cont)	
	10.0	1.3	13%	CORE BOX 32				920		
	924.0 - 934.0'							925	924.0-934.0': 6.8' Sandy clay, sand is a very fine, dense, (kaolin) clay, translucent poorly sorted, sub angular.	924.0-934.0': Assumed 3.2' loss as sand washout at face of core bit based on cuttings.
	10.0	6.8	68%	928.3				930		
	934.0 - 944.0'						-777.3	935	934.0-964.8': Silty clay, very light gray (N8) to medium gray (N5), moderately soft to moderately stiff, mottled, weathered, sandy,	
	10.0	7.7	77%	CORE BOX 33				940		80% drilling fluid recovery.
	944.0 - 954.0'							945		
	10.0	3.1	31%					950		Continued drilling at a high RPM rate with low pump pressure.
	954.0 - 964.0'							955		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	25 OF 26	VSC-4

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ-CORE	954.0 - 964.0'			BOX 33				955	832.8-964.8': SILTY CLAY (cont)	
	10.0	0.8	8%					960		Sand in cuttings: quartz, fine-to medium-grained, sub-angular to sub rounded.
									CONTACT IS APPROXIMATE AS BASED ON DRILLING AND CUTTINGS. RETURNS ARE SAND (QUARTZ) FINE TO MEDIUM GRAINED: SUB-ROUNDED TO SUB- ANGULAR	
	964.0 - 974.0'						-808.1	964.8 / 965	964.8-1024.0': SAND: Very light gray (N8) yellowish gray (5 Y 8/1), fine to coarse-grained, translucent, sub angular to sub-rounded, moderately well sorted, loose, very poorly cemented, clean; sand is predominantly quartz with a traçe of a dark ferromagnesian mineral.	Sand in cuttings: fine-to medium-grained, sub angular.
	10.0	0.0	0%					970		
				974.3					974.0-974.3': Woody lignite, grayish black (N2) soft, fibrous, intact.	
	974.0 - 984.0'			BOX 34				975		90% drilling fluid recovery.
	10.0	8.2	82%					980		
										984.0: Very coarse grained sand in cuttings, translucent, clean.
	984.0 - 994.0'							985		
	10.0	0.0	0%					990		
	994.0 - 1004.0'							995		90% drilling fluid circulation.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VSC-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	26 OF 26	VSC-4

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ-CORE	994.0 - 1004.0'			CORE BOX 34				995	964.8-1024.0': SAND: (cont) Very light gray (N8), yellowish gray (5 Y 8/1), fine to coarse-grained, translucent, sub angular to sub rounded, moderately well sorted, loose, poorly cemented, clean.	
	10.0	8.5	85%					1000		
	1004.0 - 1014.0'							1005		Medium-grained translucent quartz sand in cuttings.
	10.0	0.0	0%					1010		90% drilling fluid recovery.
	1014.0 - 1024.0'							1015		1014.0: Geologist's shift change 3:00 pm 7/10/82.
	10.0	0.0	0%					1020		
							-867.3	1024	TOTAL DEPTH: 1024' BOTTOM OF HOLE	

Sand caved and locked rods in hole. Boring was discontinued and an attempt was made to recover the rods at a later date. See daily reports and observation well as-built for post-coring data.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VSC-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	1 OF 15	VG-1

SITE	COORDINATES	ANGLE FROM HORIZ.	BEARING
POSTULATED MILLETT FAULT	N 1120358.26 E 660009.141 (GA.)	90^{0}	N.A.

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH
4/21/82	5/15/82	Law Engin/Melvin	Mobil 53	NQ	---	---	565.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
255.5/45.2%	18	---	---	156.6	See Observation Well	---

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
---	See Observation Well As-Built	Ron Wood (Georgia Power)

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
WASHED TO 5' NO SAMPLES TAKEN							156.6	0		
								5	Began Sampling	
NQ CORE	5.0 - 15.0				CORE BOX 1			5	0.0-120.0': SAND: Moderate reddish brown (10R4/6), slightly clayey, silty, fine grained, firm to dense.	Started coring at 5'.
	10.0	2.0	20%					10		
	15.0 - 20.0							15		
	5.0	0	0%							
	20.0 - 25.0						136.6	20		
	5.0	0.3	6%							
	25.0 - 30.0							25		
	5.0	0	0%							
	30.0 - 35.0							30		
	5.0	0	0%					35		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-1

H&CF 19-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	2 of 15	VG-1

SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	PERCENT CORE RECOVERY	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION
35.0 - 40.0 / 5.0	0	0%		35	0.0-120.0': <u>SAND</u>: (Cont)
40.0 - 45.0 / 5.0	0	0%		40	
45.0 - 50.0 / 5.0	0	0%		45	
50.0 - 55.0 / 5.0	0	0%		50	
55.0 - 60.0 / 5.0	0	0%		55	
60.0 - 65.0 / 5.0	0.5	10%	96.6	60	60.0-70.0': Pale orange (10 YR 8/2) to grayish-orange (10 YR 7/4), silty, fine-grained, loose to firm.
65.0 - 70.0 / 5.0	0.9	18%		65	
70.0 - 75.0 / 5.0	0	0%		70	
				75	

Water pressure tests column: CORE BOX 1

Column headings: Sampler type and diameter; Sampler advance / length core run; Sample recovery / core recovery; Sample blows "N" / percent core recovery; Water pressure tests (Loss in G.P.M.; Pressure P.S.I.; Time in minutes); Elevation (Ft.); Depth (Ft.); Graphic log; Sample; Description and classification; Notes on: water levels, water return, character of drilling, etc.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT — HOLE NO. VG-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	3 OF 15	VG-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	75.0 - 80.0							75	0.0-120.0': SAND (cont)	
	5.0	0	0%							
	80.0 - 85.0							80	80.0-85.0': Sand, moderate yellowish brown (10 YR 5/4) to pale olive (10 Y 6/2), clayey, silty, fine-grained.	
	5.0	0.9	18%						84.7-85.0': Clayey sand, loose to firm.	
	85.0 - 90.0				CORE BOX 1			85	85.0-90.0': Sand, very pale orange (10 YR 8/2), slightly silty, fine-grained, loose, some clay seams.	
	5.0	3.0	60%							
	90.0 - 95.0							90	90.0-95.0': Sand, yellowish gray (5 Y 7/2), fine-to medium-grained, loose.	
	5.0	2.6	52%							
	95.0 - 105.0							95	95.0-105.0': Sand, dark greenish gray (5 GY 4/1), fine-to medium-grained, partially cemented with large shell fragments, dense to very dense.	
	10.0	2.6	26%				56.6	100		
	105.0 - 110.0				CORE BOX 2			105	105.0-110.0': Sand, greenish gray (5 GY 4/1), slightly silty, fine-grained, loose, with firm to stiff sandy silt, shell fragments at bottom of sample.	
	5.0	1.7	34%							
	110.0 - 115.0							110	110.0-115.0': Sand, greenish gray (5 GY 5/1) slightly silty, fine-grained, loose, with interbeds of stiff to very stiff dark greenish gray clay (56 Y 4/1), slightly sandy silt with some shell fragments.	
	5.0	1.8	38%					115		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLET FAULT

HOLE NO. VG-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	4 of 15	VG-1

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: water levels, water return, character of drilling, etc.
NQ CORE	115.0 - 122.0							115	115.0-120.0': Medium gray (N5), slightly silty sand, fine-grained, loose.	
	7.6	1.6	23%							
							36.6	120	120.0-138.3': SAND: Very pale orange (10 YR 8/2), grayish orange (10 YR 7/3) slightly clayey, silty, fine grained, firm to very dense some parts of sample partially cemented.	120.0: Contact uncertain due to poor recovery. 122.0: Stopped using triple tube; using double tube.
	122.0 - 125.0				CORE BOX 2					
	3.0	3.0	100%							
	125.0 - 130.0							125		
	5.0	5.0	100%							
	130.0 - 135.0							130		
	5.0	5.0	100%							
	135.0 - 145.0				CORE BOX 3			135		
							18.3	138.3	138.3-149.0': CALCAREOUS CEMENTED SAND: Soft to moderately hard white (N9) to pale greenish yellow (10 Y 8/2), fine- to medium-grained with numerous shell fragments.	
	10.0	8.0	80%					140		
	145.0 - 154.0.5							145	145.0-145.7': Greenish gray (5 GY 4/1) slightly clayey, fine-grained.	
					CORE BOX 4		7.6		149.0-153.0': LIMESTONE: Hard, fossiliferous sandy limestone, solution caustic.	
	9.5	5.4	57%					150		152.0: Total loss of circulation.
									Total loss of circulation.	
								155	153.5-156.3': CLAY	155.0: Stopped coring 4/22/82.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	5 of 15	VG-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES
NQ-CORE	5.4	5.4	100%		CORE BOX 4	
	8.5	8.5	100%			
	6.5	6.5	100%		CORE BOX 5	
	5.5	5.6	102%			
	4.5	4.6	102%		CORE BOX 6	
	0.5	0.4	80%			
	1.3	3.2				
	8	6.6	83%		CORE BOX 7	

ELEVATION (Ft.): Sea Level 0 (at depth approx. 157); - 29.4 (at depth 186.0)

DEPTH (Ft.): 155, 156.3, 160, 165, 170, 175, 180, 185, 186.0, 190, 195

DESCRIPTION AND CLASSIFICATION

153.0-156.3': CLAY: Dusky yellow (5 Y 6/4), slightly silty, stiff to very stiff, some shell fragments.

156.3-186.0': CALCAREOUS CLAY (MARL): Dark greenish gray (5 GY 4/1) occasional silty or sandy zones very stiff to hard, fossiliferous becoming more calcareous with depth, hard to very hard, finely layered.

CONTACT GRADATIONAL

186.0-237.5': CALCAREOUS SILTSTONE (MARL): Dark greenish gray (5 GY 4/1), slightly sandy, fossiliferous, hard to very hard, finely layered.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

170.8: 50° polished face.

175.0: 4/26/82 Stopped coring.

186.3: Blocked out.

187.0: 4/27/82 Stopped coring.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	6 OF 15	VG-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ-CORE	195.0 - 205.0							195	186.0-237.5': CALCAREOUS SILTSTONE (MARL): (cont)	187.0: (Cont) 4-28-82 set 90' 4" casing, then reamed to 187.0' and set 189.0' of casing.
									194.2-195.0': Limestone nodules, light gray (N7). Moderately hard, fine-grained.	
	10.0	9.6	96%		CORE BOX 7			200		
									204.3-204.5': Limestone, light gray (N7), fine-grained.	
	205.0 - 215.0							205		
									209.4-209.8': Limestone, light gray (N7), fine-grained.	
	10.0	9.2	92%		CORE BOX 8			210		
									211.6-212.8': Limestone, light gray (N7), fine-grained.	
									213.0-213.2': Limestone, light gray (N7) fine-grained.	
									212.6 Vuggy, open fracture in limestone, some calcite filling.	
							-58.4	215		
	9.5	10.1	106%					220		
								225		
	10.0	8.8	88%		CORE BOX 9			230	233.6: Polished surface	
	10.5	4.7	45%					235		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	7 OF 15	VG-1

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
								235	186-237.5': CALCAREOUS SILTSTONE (MARL) (cont)	
	10.5	4.7	45%				-80.9	237.5	237.5-254.0': LIMESTONE: Bluish white (5 B 9/1) to greenish gray (5 G 6/1), slightly silty, clayey, numerous shell fragments, partially to well cemented. Calcareous.	
	10.0	6.0	60%					240, 245, 250		
					CORE BOX 10		-97.4	254.0	254.0-322.0': SAND: Grayish yellow green (5 GY 7/2), slightly silty, fine-to medium-grained, calcareous, loose to firm.	
	10.0	0.6	6%					255, 260		
								265		265.0: 4-29-82 Stopped coring.
	10.0	0.9	9%					270, 275		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	8 OF 15	VG-1

Depth (Ft.)	Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
275		5.0	0	0%					254.0-322.0': SAND: (cont)	
280		5.0	0	0%						280.0-285.0: Sand in drill mud return.
285		5.0	2.0	40%					286.0-287.0': Sand, coarse-grained, well sorted rounded quartz, slightly calcareous.	
290		5.0	0	0%		CORE BOX 10				290.0-295.0: Sand in drill mud return, drilling rate slow, low water pressure, mud very thick.
295		5.0	0	0%				-138.4		
300		5.0	0	0%						300.0: Stuck in hole 4-30-82 Stopped coring.
305		5.0	0	0%						305.0: Rods sanded in, pulled rods. Mixed new mud. 305.0-310.0: Sample taken from new mud circulating, no core recovered
310		5.0	0	0%		CORE BOX 11				Sand in rods, had to pull and clear between runs.
315										

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	9 OF 15	VG-1

Columns: SAMPLER TYPE AND DIAMETER; SAMPLER ADVANCE / LENGTH CORE RUN; SAMPLE RECOVERY / CORE RECOVERY; SAMPLE BLOWS "N"; PERCENT CORE RECOVERY; WATER PRESSURE TESTS (LOSS IN G.P.M.; PRESSURE P.S.I.; TIME IN MINUTES); ELEVATION (Ft.); DEPTH (Ft.); GRAPHIC LOG; SAMPLE; DESCRIPTION AND CLASSIFICATION; NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Sampler type: NQ-CORE. Core boxes: CORE BOX 11; CORE BOX 12.

Depth (Ft.)	Length Core Run	Core Recovery	Percent Core Recovery
315–320	5.0	0	0%
320–325	5.0	0	0%
325–330	5.0	0	0%
330–335	5.0	0	0%
335–340	5.0	3.0	60%
340–345	5.0	5.5	110%
345–355	10.0	8.7	87%

Elevation: -178.4 at depth 335

Depth scale: 315, 320, 325, 330, 335, 340, 345, 350, 355

Description and Classification

254.0-322.0': SAND: (cont) Coarse-grained, clean, round, quartz.

CHANGE IN DRILLING NOTED BY DRILLER

POSSIBLE CHANGE IN LITHOLOGY

322.0-335.0': CLAY: Light gray (N7) to medium gray (N5), non-calcareous, slightly silty.

335.0-368.0': CLAY: Pale purple (5 RP 7/2) to grayish red purple (5 RP 4/2), bluish white (5 B 9/1), slightly silty, mottled, (kaolonite?) non-calcareous, very stiff to hard.

335.0-338.0': Clay (kaolinite?) with medium grained pyrite/marcasite.

347.0-350.3': Nearly vertical fracture partially lined with dendritic manganese.

347.8 50° Polished surface.

352.0-353.5': Randomly distributed small kaolin balls.

Notes

330.0-335.0: Cuttings used as basis for lithologic description.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT — HOLE NO. VG-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	10 OF 15	VG-1

Column headings: SAMPLER TYPE AND DIAMETER | SAMPLER ADVANCE / LENGTH CORE RUN | SAMPLE RECOVERY / CORE RECOVERY | SAMPLE BLOWS "/N" / PERCENT CORE RECOVERY | WATER PRESSURE TESTS: LOSS IN G.P.M., PRESSURE P.S.I., TIME IN MINUTES | ELEVATION (Ft.) | DEPTH (Ft.) | GRAPHIC LOG | SAMPLE | DESCRIPTION AND CLASSIFICATION | NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Sampler type: NQ-CORE

Length core run	Core recovery	Percent core recovery
10.0	7.2	72%
10.0	4.6	46%
10.0	0.8	8%
5.0	0	0%
5.0	0	0%

CORE BOX 12

CORE BOX 13

Elevation: -211.4 (at depth 368.0)

Depth (Ft.): 355, 360, 365, 368.0, 370, 372.0, 375, 380, 385, 390, 395

DESCRIPTION AND CLASSIFICATION

335.0-368.0': CLAY: Pale purple (5 RP 7/2) to grayish red purple (5 RP 4/2), mottled, bluish white (5 B 9/1), slightly silty, kaolinitic, non-calcareous, stiff.

368.0-372.0': SILT: Light gray (N7), stiff to very stiff, non-calcareous.

372.0-414.1': SAND: Pale yellowish brown (10 R 7/2), micaceous, clayey, fine-to medium-grained, subangular, quartz. Some dark minerals, loose to firm, non-calcareous.

NOTES

368.0: Silt, core loss was probably below this depth.

375.0: 5-3-82 Stopped coring.

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	11 OF 15	VG-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
	5.0	0	0%					395	372.0-414.1': SAND: (cont) Pale yellowish brown (10 YR 7/2), micaceous, clayey, fine- to medium-grained, subangular, loose to firm, non-calcareous (description from cuttings and sample run 410-415).	
	5.0	0.5	10%					400		405.0: Stopped coring. Mixed E-Z mud, barite and bentonite. Pulled up 20 ft of rods, removed inner barrel, slowly circulated mud, forced inner barrel down with pump pressure.
	5.0	0	0%					405		
	5.0	1.7	34%		CORE BOX 13		-257.5	410, 414.1	414.1-417.3': LIGNITE: Brownish black, strong organic odor.	
	5.0	1.2	24%				-260.7	415, 417.3	417.3-429.0': SILTY CLAY AND SAND: Silty clay with small lenses of fine-grained sand, micaceous, pyrite/marcasite.	
	5.0	3.2	64%					420		
	5.0	2.5	50%					425	GRADATIONAL CONTACT	429.0: Driller note more difficult drilling
	2.9	1.3	45%					429.0, 430	429.0-439.2': SANDSTONE: Greenish gray (5 G 5/1) to medium gray (N5), fine-to medium-grained. Non-to slightly calcareous; (some fractures lined with a very hard, thin vitreous, siliceous lining).	432.9: 5-5-82 Stopped coring.
	2.1	0.8	38%					435		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	12 of 15	VG-1

Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Percent Core Recovery	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
				435	429.0-439.2': SANDSTONE (cont)	5-6-82: Cleaned hole to 432.9 mudded with barite, E-Z mud, bentonite. Pulled rods to prepare for geophysical logging.
10.0	4.2	42%	-282.6	439.2	439.2-458.5': CLAY: Olive black (5 Y 2/1), carbonaceous, silty, very stiff to hard, some fine thin sand lenses.	5-7-82 to 5-10-82: No drilling.
				445		445.0: 5-11-82 Stopped drilling.
10.0	0.4	4%		450		
5.0	1.5	30%	-301.9	458.5	458.5-467.0': SAND AND GRAVEL: Bluish gray (5 B 8/1), coarse, poorly sorted, dense to very dense.	
5.0	4.9	98%		460		
				465		467.0: Driller noted change.
10.0	4.3	43%		467.0	467.0-475.5': SAND AND CLAY: Light bluish gray (5 B 8/1) fine-grained, dense, micaceous, very stiff to hard.	470.0: Blocked off.
				470		475.0-485.0: Probably left some core in hole
				475		

Water pressure tests column: CORE BOX 14

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	13 OF 15	VG-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							-318.9	475.5	467.0-475.5': SAND AND CLAY (cont)	
	10.0	4.6	46%		CORE BOX 15			475.5-505.5	475.5-505.5': SAND AND GRAVEL: Light bluish gray (5 B 8/1) coarse, poorly sorted, subrounded, dense to very dense with occasional dusky red clayey zones.	485: 5-12-82 Stopped drilling.
	10.0	6.5	65%		CORE BOX 15					485.0 5-13-82 Artesian flow noted before drilling -1 gpm. 485.0-495.0: As inner was retrieved. 1.0' core was seen falling out.
	10.0	0	0%		CORE BOX 15					495.0-505.0: Sand in drill mud, light colored with clay portion.
	10.0	10.4	104%		CORE BOX 15 / CORE BOX 16		-348.4	505	505.0-533.6': CLAY: Grayish red purple (5 RP 4/2), slightly sandy, silty, very stiff to hard, mottled, light bluish gray (5 B 8/1), scattered sandy zones medium- to coarse-grained.	505.0-507.0: Color of drill mud turned red.

Depth scale: 475, 480, 485, 490, 495, 500, 505, 510, 515

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-1

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	14 OF 15	VG-1

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NQ-CORE	10.0	10.3	103%		515	505.0-533.6': CLAY: (cont) Grayish red purple (5 RP 4/2), slightly silty, very stiff to hard, mottled light bluish gray (5 B 8/1), scattered sandy zones, medium-to coarse-grained.	515.0: 5-13-82 Stopped coring, artesian flow, all rods pulled. 5-14-82: No artesian flow.
	10.0	6.0	60%	-377.0	533.6	533.6-540.0': CLAYEY SAND: Light bluish gray (5 B 8/1), fine, micaceous.	
	10.0	6.9	69%		540.0	540.0-547.0': SAND: Light bluish gray (5 B 8/1) to yellowish orange (10 YR 7/6), micaceous, clayey, fine-grained.	540.0-547.0: Sand 547.0-548.0: Clay 548.0-558.0: Sand 548.0-558.0: Small sample used for lithologic description found at top of core catcher.
					547.0	547.0-548.0': MICACEOUS SILTY CLAY	
	10.0	0.9	9%		548.0	548.0-558.0': SAND: Olive black (5 Y 2/1), slightly clayey, medium-grained.	

Water Pressure Tests: Loss in G.P.M. | Pressure P.S.I. | Time in Minutes — CORE BOX 16

Depth scale: 515, 520, 525, 530, 533.6, 535, 540, 545, 547.0, 548.0, 550, 555

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	15 of 15	VG-1

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								555			548.0-558.0': SAND (cont) Olive black (5 Y 2/1), slightly clayey, medium-grained.	
NQ-CORE	10.0	6.3	63%		CORE BOX 16			558			558.0-565.0': CLAY: Light bluish gray (5 B 8/1) to moderate reddish brown, mottled, silty, very stiff to hard, scattered micaceous fine-grained sand zones.	565.0: 5-15-82 Stopped coring. Pumped barite mud in hole and pulled rods to prepare for geophysical logging. 5-15-82: Logged by Birdwell.
							-408.4	565			TOTAL DEPTH- 565.0 Hole was geophysically logged and an observation well was installed.	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	1 OF 16	VG-2

SITE	COORDINATES	ANGLE FROM HORIZ.	BEARING
POSTULATED MILLETT FAULT	N 1122608.989 E 650596.847 (GA)	Vertical	-

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH
4/21/82	5/12/82	Law Engineering	CME-55	NQ	-	620	620

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
230.25/37%	16	-	2.2'	253.0		620/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
-	240' 3 7/8"	E. Vanek

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							253.0	0			Depths of rock units measured from top of casing, not ground surface	
	Rotary Drilled										0-95.0': SAND: Moderate reddish brown (10 R 4/6), pale yellowish orange (10 YR 8/6), fine-grained quartz with few mafic grains. Some clay.	Drilled with bentonite
NQ CORE	5.0 - 15.0'			CORE BOX 1				5				Drilling water is moderate reddish brown.
	10.0	2.7	27%					10				
							240					
	15.0 - 25.0'							15				Drill time is about 15 min/10 ft.
	10.0	0.0	0%					20				
	25.0 - 30.0'							25				
	5.0	0.0	0%									
	30.0 - 35.0'							30				
	5.0	0.0	0%				220					
								35				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT — HOLE NO. VG-2

H&CF 19-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	2 OF 16	VG-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	35.0 - 40.0'			CORE BOX 1				35			0-95.0': SAND (cont)	100% water recovery.
	5.0	0.0	0%									
	40.0 - 45.0'							40				Varying drill rates.
	5.0	0.0	0%									
	45.0 - 50.0'							45				
	5.0	0.0	0%									
	50.0 - 55.0'							50				
	5.0	0.7	14%				200				52.0-75.0': Pale red purple (5 RP 6/2) fine-grained sand.	Water becomes darker red at 53'.
	55.0 - 60.0'							55				
	5.0	0.0	0%									
	60.0 - 62.0'							60				
	2.0	0.0	0%									About 150 gallons water loss from 62 to 75'.
	62.0 - 65.0'											Pulled rods, bit was split, set casing at 62'.
	3.0	0.0	0%									
	65.0 - 70.0'							65				
	5.0	0.0	0%									
	70.0 - 75.0'							70				
	5.0	0.0	0%									About 75 gallons water loss from 75 to 85'.
								75				

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	3 OF 16	VG-2

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Graphic Log	Sample	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NO CORE	75.0 - 80.0' 5.0	0.4	8%		CORE BOX 1			75			0-95.0': SAND (cont) 75.0-95.0': Grayish orange (10 YR 7/4) fine-grained sand.	
	80.0 - 85.0' 5.0	0.0	0%					80				
	85.0 - 90.0' 5.0	0.0	0%					85				
	90.0 - 95.0' 5.0	0.0	0%				160	90				Water return contains some clots of dark brown silt.
	95.0 - 100.0' 5.0	0.0	0%					95			APPROXIMATE CONTACT 95.0 - 185.0': SAND: Grayish yellow (5 Y 8/4) fine-to medium grained, mainly subrounded to subangular quartz with scattered mica and mafic grains, some zones of clayey sand or silt commonly showing faint bedding and black laminae, moderately well sorted, uncemented.	
	100.0 - 105.0' 5.0	0.0	0%					100				White sand cuttings at about 100'.
	105.0 - 110.0' 5.0	0.0	0%					105				
	110.0 - 115.0' 5.0	0.0	0%				140	110				
								115				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	4 OF 16	VG-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	115.0 - 120.0' 5.0	1.5	30%		CORE BOX 1			115			95.0-185.0': SAND (cont)	Poor water recovery.
	120.0 - 125.0' 5.0	.55	11%					120				Metal shavings in cuttings
	125.0 - 130.0' 5.0	0.8	16%					125				Drill rate slowed at 127 ft.
	130.0 - 135.0' 5.0	0.4	8%				120	130			130.0-135.0': Clayey silt of moderate hardness, surfaces of broken core are coated with manganese oxide or organic material.	
	135.0 - 140.0' 5.0	0.0	0%					135				Cased to 135' to improve circulation, reamed hole first, also changed from diamond to carbide bit.
	140.0 - 145.0' 5.0	1.5	30%					140				
	145.0 - 150.0' 5.0	1.6	32%					145				
	150.0 - 155.0' 5.0	3.7	74%				100	150-155			152.0-160.0': Hard to medium hard, contains several cavities up to 0.15' in diameter, filled with pale greenish yellow clay.	Good water recovery.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	5 of 16	VG-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)
NO CORE	155.0 - 160.0'				CORE BOX 2			155
	5.0	3.3	66%					
	160.0 - 165.0'							160
	5.0	0.6	12%					
	165.0 - 170.0'							165
	5.0	0.0	0%					
	170.0 - 175.0'							170
	5.0	0.0	0%				90	
	175.0 - 180.0'							175
	5.0	0.0	0%					
	180.0 - 185.0'							180
	5.0	1.4	28%					
	185.0 - 190.0'							185
	5.0	0.75	15%					
	190.0 - 195.0'							190
	5.0	4.0	80%				60	195

DESCRIPTION AND CLASSIFICATION

95.0-185.0': SAND (cont)

180.7-181.5': Sand, grayish green and grayish purple mottling, abundant mafic and pink colored grains, some clay mixed in.

185.0-237.0': CALCAREOUS SAND: Yellowish gray (5 Y 7/2), mostly medium grained, subangular, well sorted, contains numerous small (a few millimeters) shell fragments, soft, occasionaly clayey.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Drill runs are about 1 ft/min.

About 30% water loss until about 190 ft where recovery improves.

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	6 OF 16	VG-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	195.0 - 200.0'							195	185.0-237.0': CALCAREOUS SAND: (cont)	
	5.0	0.0	0%							
	200.0 - 205.0'							200		
	5.0	3.55	71%							
	205.0 - 215.0'							205		
	10.0	3.7	37%				40	210		
	215.0 - 220.0'							215		
	5.0	0.0	0%		CORE BOX 3					
	220.0 - 225.0'							220		
	5.0	2.5	50%							
	225.0 - 230.0'							225		
	5.0	1.5	30%							
	230.0 - 235.0'							230		
	5.0	3.3	60%				20	235		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	7 OF 16	VG-2

Sampler type and diameter	Sampler advance / Length core run	Sampler recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ CORE	235.0 - 239.0'							235	235.0-236.7': Clayey silt to fine-grained sand bed.	
	4.0	2.7	68%					237	237.0-250.0': FOSSILIFEROUS LIMESTONE: Very light gray (N8), medium grained, very hard, some sand present.	Long, solid core pieces, about 1 ft. Fast drill rate.
	239.0 - 245.0'							240		
	6.0	2.8	47%		CORE BOX 4					
	245.0 - 255.0'							245		
	10.0	8.0	80%					250	250.0-326.3': CALCAREOUS SILTSTONE (MARL): Dark greenish gray (5 GY 4/1) silty and clayey layers, laminated, calcareous cement, moderately hard, poorly defined, convoluted bedding, zones of harder limestone.	
							0		250.4: Polished surface almost vertical.	
	255.0 - 265.0'							255		
	10.0	10.0	100%					260		
	265.0 - 275.0'				CORE BOX 5			265		
	10.0	10.0	100%					270		
									272.2: Possible polished surface.	
							-20	275		275.0: 40% mud loss.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	8 OF 16	VG-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	275.0 - 280.0' 5.0	5.0	100%		CORE BOX 6			275	250.0-326.3': CALCAREOUS SILTSTONE (MARL): 277.4 Large clam shell. 279.0-334.9': Irregularly alternating zones of lime tone; marl is predominantly dark greenish gray (5 GY 4/1).	
	280.0 - 285.0' 5.0	0.3	6%					280		
	285.0 - 290.0' 5.0	5.0	100%					285		
	290.0 - 295.0' 5.0	4.9	98%				-40	290	294.0: 35° orientated polished surface.	
	295.0 - 297.5' 2.5	0.7	28%		CORE BOX 7			295		4 inch coupled steel casing set to 240' before coring below 297.5'. Reset outer casing to 1.8' stick-up.
	297.5 - 305.0' 7.5	7.5	100%					300		
	305.0 - 315.0' 10.0	9.6	96%				-60	305, 310, 315	306.6: 10° orientated polished surface.	

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	9 OF 16	VG-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	315.0 - 325.0'				CORE BOX 8			315	250.0-326.3': CALCAREOUS SILTSTONE (MARL)(cont)	Plugged off at 315', tripped core before continuing.
	10.0	9.7	97%					320		
									324.6': Possible polished surface, almost vertical orientation.	
								325	326.0-326.3': Dark gray to black, quartz and mafic grains with brownish-green clayey silt mixed in sharp upper contact, bottom looks blocked off.	
	325.0 - 335.0'							326.3	APPROXIMATE CONTACT	
					CORE BOX 9				326.3-336.0': FOSSILIFEROUS LIMESTONE: Very light-gray (N8), very hard, some fine-to medium-grained light grey sand mixed in.	
	10.0	1.3	13%					330		
							-80			
								335		
	335.0 - 345.0'							336	APPROXIMATE CONTACT	
									336.0-371.5': CALCAREOUS SAND: Grayish yellow (5 Y 8/4), fine-grained, subangular to angular quartz grains with scattered mafic grains and shell fragments, sandstone is well sorted, poorly cemented. massive. There are a few zones approximately 0.1' long of hard limestone.	Shell fragments cuttings at 337'.
	10.0	1.1	11%					340		
	345.0 - 350.0'							345		
	5.0	2.2	44%							
	350.0 - 353.0'							350		Moderately rough drilling.
	3.0	2.8	93%							Blocked off at 353'.
							-100			
	353.0 - 355.0'									
	2.0	0.4	20%					355		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING FAULT	9510	10 of 16	VG-2

Sampler type and diameter	Sampler advance / length core run	Sample recovery / core recovery	Sample blows "N" / percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ CORE	355.0 - 365.0'				CORE BOX 9			355	336.0-371.5': CALCAREOUS SAND: (Cont)	
	10.0	4.8	48%					360		Good water recovery.
	365.0 - 370.0'							365		Slowed drill rate.
	5.0	1.3	26%							Harder drilling at 368'.
								370		
	5.0	3.4	68%		CORE BOX 10		-120	371.5	371.5-424.0': SAND: Medium gray (N5), medium-grained quartz with scattered mafics, grains are well sorted, rounded to subrounded and uncemented, non-calcareous.	
									372.0-375.0': Lignitic sand, dark greenish gray, fine-grained, well sorted, soft.	
	375.0 - 380.0'							375		
	5.0	0.0	0%							
	380.0 - 385.0'							380		Drill action suggests sand at 375.0; black sand cuttings, water return is darker brown.
	5.0	0.0	0%							
	385.0 - 390.0'							385		
	5.0	1.3	26						389.0-393.0': Hard, dark greenish gray, clayey siltstone.	Drilling suggests sand until 389.0', sand cuttings at 385.0'.
	390.0 - 395.0'							390		Drilling suggests hard clay at 390.0' to 393.0', then sand.
	5.0	0.2	4%				-140			
								395		Triple sleeve put in at 395.0'.

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	11 of 16	VG-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NO CORE	395.0 - 400.0' 5.0	0.0	0%		CORE BOX 10			395	371.5-424.0': SAND (cont)	Sand cuttings from 395' are quartz with few feldspar and rock fragments.
	400.0 - 405.0' 5.0	0.0	0%					400		Good water return.
	405.0 - 410.0' 5.0	0.0	0%					405		Fine grained sand cuttings at 405-410'.
	410.0 - 415.0' 5.0	0.7					-160	410	411.0-412.0':'Hard, dark greenish gray clayey siltstone; 0.1'chunks of very hard silica cemented sandstone; fine-to coarse-grained.	
	415.0 - 420.0' 5.0	0.0	0%					415		Driller pulled out 100 ft of rod at 415' end of day, some cave in next day due to pressure from aquifer water. Hard drilling at 415-420', clayey cuttings.
	420.0 - 425.0' 5.0	0.1	2%					420 424	APPROXIMATE CONTACT-BASED ON DRILLING	
	425.0 - 430.0' 5.0	0.0	0%					425	424.0-471.0': CLAY AND SANDY CLAY: Light bluish gray (5 B 7/1), grayish purple (5 RP 4/2), pale red purple (5 RP 6/2) claystone with very little silt; dusky red (5 R 3/4) sandy claystone, hard to moderately hard, long pieces of core remain intact.	
	430.0 - 435.0' 5.0	2.0	4%				-180	430 435	431.0-432.2': Pale yellowish brown mixed with moderate reddish brown claystone.	

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	12 OF 16	VG-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)
NQ CORE	435.0 - 440.0'				CORE BOX 10			435
	5.0	4.4	88%					
	440.0 - 445.0'				CORE BOX 11			440
	5.0	4.0	80%					
	445.0 - 455.0'							445
	10.0	10.0	100%				-200	450
	455.0 - 465.0'				CORE BOX 12			455
	10.0	10.0	100%					460
	465.0 - 475.0'							465
	10.0	5.5	55%				-220	470, 471, 475

DESCRIPTION AND CLASSIFICATION

424.0-471.0': CLAY and SANDY CLAY: (cont)

436.0, 438.7, 439.7, 440.4, 440.7: Polished surfaces.

441.5-449.7': Sharp contact into moderate red sandy clay with trace lignite, muscovite, dusky yellow silt, moderately soft.

449.7-459.1': Pale red purple and pale blue clay with abundant dark red microfractures. Dusky yellow silty streaks.

459.1-474.0': Light bluish gray clay becoming increasingly siltier with depth. High angle joint showing 20° polished surface at 463.1.

APPROXIMATE CONTACT

471.0-524.0': SAND AND SILTY CLAY: Dark grayish black (3N3), irregularly alternating micaceous sand, fine-to medium-grained, rounded to subrounded with some lignitic fragments and micaceous silty clay; clay rich zones show weak concoidal fracturing.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Pulled up about 40' of rod, some sand inside core barrels.

Clay cuttings from interval 420-425', drilling suggests claystone comes in at 426', white and blueish green clay cuttings, sandy clay at 425-430'.

Alternating rough and smooth drilling at 430-435'. Water return is not colored, wire line stuck for awhile, took out triple sleeve at 435'.

Took uut 40-60 ft of rods at 445', end of day, next day rods were stuck, used hammer and kerosene.

Still good water return, red brick color at 445', harder drilling, tannish orange water ay 450', redder at 455'.

Using heavier E-Z mud starting 445'.

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SITE: POSTULATED MILLETT FAULT

HOLE NO.: VG-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	13 of 16	VG-2

Sampler type and diameter: NQ CORE — CORE BOX 12

Interval	Sampler advance / Length core run	Sample recovery / Core recovery	Percent core recovery
475.0 - 480.0'	5.0	0.0	0%
480.0 - 495.0'	5.0	0.0	0%
485.0 - 490.0'	5.0	0.0	0%
490.0 - 495.0'	5.0	0.0	0%
495.0 - 500.0'	5.0	0.0	0%
500.0 - 505.0'	5.0	0.0	0%
505.0 - 510.0'	5.0	0.1	2%
510.0 - 515.0'	5.0	0.0	0%

Elevation (Ft.): -240 (at approx. 493'), -260 (at approx. 513')

Depth (Ft.): 475 – 515

Description and Classification

471.0-524.0': SAND AND SILTY CLAY: (cont)

485.0-490.0': Sand, fine-to coarse-grained, abundant muscovite cuttings.

490.0-495.0': Cuttings are fine-to medium-grained, rounded to subrounded quartz with muscovite, Fe oxides and a lot of black organic chips.

495.0-500.0': Abundant black chips, clayey at 498', dark gray sandy clay lines inside of wire lines.

Notes on: Water levels, water return, character of drilling, etc.

Drilling indicates sand at 474'. (at 475')

Driller says a little clay present. (at 485')

Pump broke down at 500', pulled 180 ft of rod at end of day, no trouble getting next day.

Alternating use of triple sleeve every other run.

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SITE: POSTULATED MILLETT FAULT — HOLE NO. VG-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	14 OF 16	VG-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)
NQ CORE	515.0 - 520.0'							515
	5.0	4.9	98%		CORE BOX 13			
	520.0 - 525.0'							520
	5.0	1.2	24%					524
	525.0 - 530.0'							525
	5.0	5.0	100%					
	530.0 - 535.0'							530
	5.0	0.0	0%				-280	
	535.0 - 540.0'							535
	5.0	2.5	50%					
	540.0 - 545.0'							540
	5.0	0.0	0%					
	545.0 - 550.0'							545
	5.0	4.4	88%		CORE BOX 14			
	550.0 - 555.0'							550
	5.0	2.7	54%				-300	555

DESCRIPTION AND CLASSIFICATION

471.0-524.0': SAND AND SILTY CLAY: (cont)

515.0-516.3': Mainly soft sand.

519.9-520.0': Silty clay, spotted appearance (kaolin?).

APPROXIMATE CONTACT

524.0-579.0': CLAYEY SAND: Grayish blue (5 PB 5/2), pale purple (5 P 6/2), grayish-red purple (5 RP 4/2), gradational and mottled, zones of dusky yellow (5 Y 6/4) silt mixed in. Fine-to coarse-grained, moderately soft to moderately hard, intervals of moderately well sorted to poorly sorted; consists mainly of rounded to subrounded quartz, micaceous, with a few mafic and Fe oxide grains. Long pieces of core remain intact.

525.0-530.0': Pyrite "dust"; high angle joint with almost vertical polished face at 527.2. Mainly grayish blue sandy clay.

550.0-555.0': Mainly grayish red purple clayey sand.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

100% water return, red-brick color.

Drill rate at 515-520': 15 minutes.

Gray clayey silt inside of wire line barrel from 520-525'.

Triple sleeve does not affect recovery, stopped using it at 530'.

Yellowish tan sand inside wireline barrel at 540-545'.

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	15 of 16	VG-2

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N" PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)
NQ CORE	555.0 - 560.0'				CORE BOX 14			555
	5.0	4.6	92%					
	560.0 - 565.0'							560
	5.0	5.0	100%					
	565.0 - 575.0'				CORE BOX 15			565
	10.0	2.3	23%					570
							-320	
	575.0 - 580.0'							575
	5.0	1.3	26%					579
	580.0 - 585.0'							580
	5.0	5.0	100%					
	585.0 - 595.0'							585
	10.0	4.0	40%					589
								590
							-340	
								595

DESCRIPTION AND CLASSIFICATION

524.0-579.0': CLAYEY SAND: (cont)

563.0-575.0': Mottled dusky yellow and dark reddish brown clayey sand.

579.0': Naturally occuring polished surface on blocked off top of run, vertically orientated.

APPROXIMATE CONTACT

579.0-589.0': CLAY: Mainly pale red purple to grayish purple, scattered, medium-to coarse-grained quartz with minor feldspar and muscovite, moderate hardness, some dark reddish brown and dusky yellow sand mottling, dark red microfracturing near bottom.

589.0-606.3': CLAYEY SAND: Pale red purple to grayish purple, fine-to coarse-grained, angular to subangular quartz, poorly sorted, micaceous with few mafic and Fe oxide, grains moderately soft and massive, dusky yellow, mottling near bottom.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Gray clayey sand cuttings at 555'; pulled 180' of rod at end of day.

Drilling suggests sand at 562'.

Driller varies drill speed and rpm.

Good water recovery all along, no significant aquifer pressure.

Pulled rods at 575' for geophysical logging.

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	16 OF 16	VG-2

Sampler type and diameter	Run	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Sample
NQ CORE	595.0 - 600.0'	5.0	5.0	100%		CORE BOX 16			595	
NQ CORE	600.0 - 605.0'	5.0	0.0	0%		CORE BOX 16			600	
NQ CORE	605.0 - 610.0'	5.0	2.5	50%		CORE BOX 16			605, 606.3	
NQ CORE	610.0 - 615.0'	5.0	0.0	0%		CORE BOX 16		-360	610	
NQ CORE	615.0 - 620.0'	5.0	0.0	0%		CORE BOX 16			615, 620	

DESCRIPTION AND CLASSIFICATION

589.0-606.3': CLAYEY SAND (cont)

606.3-620.0': CLAYEY SAND: Light bluish gray, fine to coarse, predominantly medium-grained quartz grains that are subrounded to subangular; coarser grains are frosted. Abundant muscovite, few mafics and Fe oxides, soft and massive, sharp upper contact.

610.0-620.0: No recovery suggests presence of relatively cleaner sand.

BOTTOM OF HOLE - 620'

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Left hole for 4 days, lost water return at first, but got it back at about 585'.

Faster drilling at 593'.

Pulled 100' of rod at 600 ft, end of day.

Used triple sleeve and drilled slow at 605-620'.

Driller says that mud is thinning out due to sand, not aquifer water. No aquifer pressure.

Used core lifter for 610-615' run.

Unable to pull casing out of hole.

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-2

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	1 OF 15	VG-3

SITE	COORDINATES	ANGLE FROM HORIZ.	BEARING
Proposed Millett Fault	N 1121183.52 E 655725.83	Vertical	-

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH
4-28-82	5-17-82	Alabama Power	Joy 22	NQ	63'	511.9'	574.9'

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
331.8/57.7 %	23	-	0	165.7	-	63'/102.7

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
-	See observation well report	C. T. Scott / E. M. Fanelli

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
	Rotary Drilled						165.7	0			0-63.0': SAND: Light brown to reddish orange, black where organic. Loose, locally silty, fine- to coarse-grained. Grains mostly subangular, poorly sorted.	Rockbit to 9.9'.
								5				
NQ Core	9.7 - 14.9'							10			Material logged on the basis of cuttings.	9.9': Used face discharge bit (diamond) low circulation rate, high rpm, high advance rate.
	5.0	0	0%									
	14.9 - 24.9'							15				
	10.0	0	0%									
							145.7	20				
	24.9 - 34.9'							25				
	10.0	0	0%					30				Very fast and smooth drilling to 63', where drill rate slowed up.
								35				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-3

H&CF 19-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	2 of 15	VG-3

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ CORE	34.9 - 44.9'							35	0-63.0': SAND (cont)	
	10.0	0	0%				125.7	40		Low water loss; using Baroid, E-Z mud.
	44.0 - 54.9'							45		
	10.0	0	0%					50		
	54.9 - 64.9'							55		
	10.0	1.9	19%				105.7	60		
					CORE BOX			63.0	63.0-150.5': SAND: Dark yellowish orange (10 YR 6/6) to predominantly yellowish gray (5 Y 7/2), very fine- to medium-grained, often having a silt or clay fraction. Grains are subangular to subrounded. Generally massive, faint near horizontal bedding traces common. Calcareous, moderatley well sorted. Occasional shell fragments and muscovite flakes.	
	64.9 - 75.4'							65		
	10.5	0.5	5%					70		
								75		

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HOLE NO. VG-3

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	3 OF 15	VG-3

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N"	Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NO CORE	75.4 - 84.9'				CORE BOX 1				76	63.0-150.5': SAND (cont)	
	9.5	0.1		1%				85.7	80	63.0-120.0': Very weak, loose, poorly cemented. 63.0-65.0': Yellowish gray (5 Y 7/2), streaked dark yellowish orange (10 YR 6/6). Distinctly more clay in matrix. 65.0-100.0': Dark yellowish orange (10 YR 6/6)	
	84.9 - 94.9'								85		
	10.0	0.2		2%					90		
	94.9 --104.9'								95		
	10.0	0		0%				65.7	100		
	104.9 - 114.9'								105	100.0-150.5': Yellowish gray (5 Y 7/2).	104.9': Obtained sand sample from core barrel spring. 105.0': 100% circulation loss. Added bentonite and mica to mud, regained about 30% circulation.
	10.0	0.4		4%					110		112.0: 100% circulation return.
									115		

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HOLE NO. VG-3

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	4 of 15	VG-3

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Graphic log	Sample	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ Core	114.9 - 124.9'							115			63.0-150.5': SAND (cont)	
												116.4': Drilled slower, rough.
	10.0	0	0%				45.7	120			100.0-150.5': Yellowish gray sand.	
	124.9 - 134.9'							125				
												129.9': Changed bit, used carbide tooth bit, bottom discharge.
	10.0	6.1	61%					130				
	134.9 - 144.9'				CORE BOX 1			135				
	10.0	9.0	90%				25.7	140				
	144.9 - 154.9'							145				
	10.0	3.8	38%					150				
					CORE BOX 2			150.5			150.5-163.0': FOSSILIFEROUS LIMESTONE: Light gray (N 8) to bluish white (5 B9-1). Locally sandy, soft, poorly to moderately well cemented. Numerous small voids that are often iron stained.	160.0-163.0': About 80% circulation loss, thickened mud; 100% return by 165.0'.
								155				

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-3

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	5 OF 15	VG-3

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)
NQ Core	154.9 - 164.9'							155
	10.0	5.2	52%					160
								163.0
	164.9 - 174.9'				CORE BOX 2		SEA -0- LEVEL	165
	10.0	8.7	87%					170
	174.9 - 184.9'				CORE BOX 3			175
	10.0	10.0	100%				- 14.3	180
	184.9 - 194.9'							185
	10.0	9.9	90%		CORE BOX 4			190
								195

DESCRIPTION AND CLASSIFICATION

150.5-163.0': FOSSILIFEROUS LIMESTONE (cont)

163.0-241.0': CALCAREOUS SILTSTONE (MARL): Greenish gray (5 GY 8/1), clayey and sandy, fine-grained, weak to moderately hard, contains horizontally oriented small shells and shell fragments, laminated with alternating layers of fine sand, clay and silt; sometimes laminations are convoluted, interbedded with irregular shaped blebs of hard, bluish gray (5 B 7/1) limestone from:

192.0-192.5'
194.4-194.9'
199.7-200.1
201.7-202.2'
208.1-208.7'
211.5-211.8'
212.2-212.5'
214.0-214.2'
224.0-224.2'
224.4-224.8'
228.9-229.1'
230.4-230.5'
230.7-230.8'

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

160.0-163.0': About 80% circulation loss, thickened mud; 100% return by 165.0'.

191.5': Driller thinks might have blocked off. Hard to drill.

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POSTULATED MILLETT FAULT	VG-3

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	6 OF 15	VG-3

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ Core	194.9 - 204.9'							195	163.0-241.0': CALCAREOUS SILTSTONE (MARL) (cont)	
	10.0	10.0	100%				34.3	200		
	204.9 - 214.9'							205		
	10.0	9.9	99%		CORE BOX 5			210		
	214.9 - 224.9'							215		
	10.0	9.9	99%		CORE BOX 6		-54.3	220	222.5': High angle fracture with polished face.	
	224.9 - 234.9'							225		
	10.0	10.0	100%		CORE BOX 7			230		
								235		

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-3

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	7 OF 15	VG-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ Core	234.9 - 244.9'				CORE BOX 7			235	163.0-241.0': CALCAREOUS SILTSTONE (MARL) (cont)	
							- 74.3	240	241.0': High angle polished face (50°).	
	10.0	9.4	94%					241.0	241.0-246.7': FOSSILIFEROUS LIMESTONE: Light blue gray (5 B 7/1), moderate to hard, clayey and sandy, massive, contains areas of dark silt and several voids. Gradational upper contact.	
	244.9 - 251.9'							245		
	7.0	6.4	91.4%					246.7	246.7-286.6': CALCAREOUS SAND: Yellow gray (5 Y 7/2), medium- to fine-grained generally fining with depth, angular, soft, dense, very poorly cemented, some grains have amethyst coloring, clayey, silty becoming siltier with depth. Silt occurs in thin horizontal beds that are convoluted between 283.7-284.9', contains calcareous, small shells that are randomly oriented.	
								250		251.0': Driller changed drill bits (using carbide bit). 252.0': Became harder to drill.
	251.9 - 254.9'									
	3.0	3.0	100%							
	254.9 - 264.9'				CORE BOX 8			255		
	10.0	10.0	100%				- 94.3	260		
	264.9 - 274.9'				CORE BOX 9			265		
	10.0	10.0	100%					270		
								275		274.9': Stopped drilling because of pump problems.

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POSTULATED MILLETT FAULT	VG-3

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	8 OF 15	VG-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ Core	274.9 - 284.9'								275			276.7-286.6': CALCAREOUS SAND (cont)	
	10.0	9.9		99%				-114.3	280				
												283.7-284.9': Silt beds are convoluted and more frequent.	
	284.9 - 290.3'					CORE BOX 10			285				
	5.4	3.8		70.3%					286.6			286.6-344.8': SAND: Dark greenish gray (5 GY 4/1), medium- to coarse-grained angular, coarsing with depth, clayey, clay is distributed irregularly - concentrates in clumps and layers, becomes more clayey with depth, very soft where sandy, finer where clayey, slight amounts of visible mica, contains few dark, hard, dull small mafics, contains small red and orange colored grains, (possibly heavy minerals); interbedded with thin to 4" thicknesses of solid massive clay containing sand, non-calcereous.	
	290.3 - 299.3'								290				290.3': Blocked off.
	9.0	3.3		36.6%					295				
	299.3 - 304.9'					CORE BOX 11		-134.3	300				299.3': Blocked off. Lost core barrel, had to pull rods to retrieve it.
	5.6	4.3		76.8%									
	304.9 - 314.9'								305				
	10.0	1.9		19%					310				
									315				

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POSTULATED MILLETT FAULT	VG-3

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BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	9 OF 15	VG-3

Sampler type and diameter: NQ Core

Sampler advance / length of core run	Sample recovery / core recovery	Percent core recovery
314.9 - 318.8'		
3.9	1.3	33.3%
318.8 - 323.5'		
4.7	2.7	57.4%
323.5 - 324.9'		
1.4	1.4	100%
324.9 - 331.2'		
6.0	2.0	66%
331.2 - 334.0'		
2.8	1.6	57%
334.0 - 340.6'		
6.6	0	0%
340.6 - 344.5'		
3.9	1.4	35.9%
0.6	0.3	50%
345.1 - 347.8'		
2.7	2.7	100%
347.8 - 354.7'		
6.9	6.9	100%

Water pressure tests: CORE BOX 11; CORE BOX 12

Elevation (Ft.)	Depth (Ft.)
	315
-154.3	320
	325
	330
	335
-174.3	340
	344.8
	345
	350
	355

Description and Classification

286.6-344.8': SAND (cont)

330.2-331.2': Solid greenish gray (5 GY 4/1) clay interval.

340.6': Very hard, well cemented sandstone.

344.8-378.5': SANDY CLAY: Light bluish gray (5 B 5/1) to medium bluish gray (5 B 7/1) becoming very light gray (N 8) at base of unit, pebble to fine-grained quartz, massive, very soft where sandy, firmer where clayey, contains poorly sorted quartz, coarsing with depth, micaceous, slightly arkosic (white grains of feldspar), few hard, dull fine-grained mafics, contains pyrite in clayey portions which is indicative of a reducing environment.

Notes on: water levels, water return, character of drilling, etc.

318.8': Blocked off.

323.5': Blocked off.
324.9': Blocked off.

Removing triple tube to try to stop problem of continually blocking off.

344.5': Blocked off.
345.1': Blocked off.

Drilling is very slow throughout section.

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HOLE NO. VG-3

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GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENE?ATING PLANT	9510	10 OF 15	VG-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ Core	354.7 - 364.9'					CORE BOX 13			355			344.8-378.5': SANDY CLAY (cont)	
												347.8-349.2': Interbedded, mottled light blue gray (5 B 7/1) and yellowish orange (10 YR 6/6) clay.	
	10.2	2.8		28%				-194.3	360			345.6 and 349.0': High angle fractures with polished faces.	
												352.5-354.0': Fractured zone - no orientation to fractures.	
												367.8-378.5': Common occurrence of pebble size grains in pebble matrix.	
	364.9 - 369.9'								365				
	5.0	2.2		44%									
	369.9 - 378.5'								370				369.9': Blocked off.
	8.6	0		0%					375				
	378.5 - 384.9'								378.5			378.5-405.6: CARBONACEOUS SAND: Medium light to dark gray (N/4, N/6), contains fine- to coarse-grained quartz, micaceous (large muscovite crystals clearly visible), clayey though clay is unevenly distributed throughout the core in thin to thick layers. Interbedded with thin, horizontal to 10°, dipping beds of black organic matter. Core has strong sour odor in places, locally arkosic, contains some pyrite, often shows alternating fine silt and clay layers, clay often shows slatey cleavage or thin splitting bedding. In general unit becomes siltier with depth and finer with depth although a few pockets of clean fine-grained sands occur.	378.5': Blocked off.
	6.4	1.9		29.7%				-214.3	380				Very slow drilling.
	384.9 - 388.9'								385				
	4.0	1.6		40%									
	388.9 - 398.6'								390				
									395				

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GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	11 OF 15	VG-3

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
	388.9 - 398.6'							395	378.5-405.6': CARBONACEOUS CLAY (cont)	
	9.7	1.3	13.4%							
	398.6 - 401.6'									
	3.0	1.8	60%				-234.3	400		
	1.0	1.0	100%							
	402.6 - 405.6'									405.6': Pulled rods to E log hole, added 100 lbs. barite. Discovered drill bit had completely worn off (5/5/82). Mud settled out over break period (5/11/82). Took awhile to clean out hole. Put on a new diamond drill bit.
	3.0	.6	20%					405		
	405.6 - 412.5'							405.6	405.6-422.5': CARBONACEOUS SAND: Gray(ing) coarse to gravel quartz sand, arkosic, micaceous silty and clayey, subrounded to rounded, some pyrite. Interbedded grayish black laminated clay and lignite clay layers at: 400.7 - 401.6; 402.1 - 402.2; 412.5 - 414.0	
	6.9	1.5	21.7%					410		
	412.5 - 422.6'							415		
	10.0	4.3	43%		CORE BOX 14		-254.3	420		
	422.6 - 432.6'							422.5	422.5-432.3': CLAY: Black (N8) massive, solid, very firm, with thin, fine, embedded silt layers.	
	10.1	5.1	50.5%					425		
								430		
								432.3	432.3-463.0': CARBONACEOUS SILT	
								435		

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GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	12 OF 15	VG-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION	DEPTH	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
	432.6 - 442.6'					CORE BOX 15			435	432.5-463.0': CARBONACEOUS SILT: Medium light to dark gray (N4-N6); some medium- to fine-grained quartz. Sand with pockets of clean sand, interbedded with silt layers and some black clay layers, micaceous, some feldspar fines with depth, soft to medium firm, hard sandstone nodules at 432.5 and 434.9-435.0.	
	10.0	8.4		84%				-274.3	440	460-463': Interbedded coarse, subrounded to angular grayish, silty, clayey sand.	
	442.6 - 450.3'								445		
	7.7	4.2		54.5%					450		450.3: Blew swivel washer. Had to stop to replace.
	450.3 - 460.3'								455		
	10.0	8.2		82%				-294.3	460		
	460.3 - 470.0'					CORE BOX 16			463.0	463.0-529.9': CLAY: Light bluish gray (5 B 7/1), sandy clay, quartz sand is irregularly distributed, poorly sorted, fine- to very coarse-grained. Clay mottled with massive, multicolored clays ranging from predominantly pale red-purple (5 RP 6/2) and grayish red-purple (5 RP 4/2) to dark yellowish orange (10 YR 6/6). (Several other variations in color are also present.) Micaceous where sandy, slight amounts of feldspar and dark silt, becomes less sandy with depth, large intervals of solid clay. Firm to very firm where solid clay, softer where sandy. Generally, to predominantly solid clay between: 470.0 - 476.7' 484.3 - 490.0' 500.3 - 529.9'	
	9.7	9.7		100%					465		
						CORE BOX 17			475		

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BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	13 of 15	VG-3

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Graphic log	Sample #	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ Core	470.0 - 480.0'							475			463.0-529.9': CLAY (cont): Light bluish gray (5 B 7/1), sandy clay, quartz sand is irregularly distributed, poorly sorted, fine- to very coarse-grained. Clay mottled with massive, multi-colored clays ranging from predominantly pale red-purple (5 RP 6/2) and grayish red-purple (5 RP 4/2) to dark yellowish orange (10 YR 6/6). (Several other variations in color are also present.) Micaceous where sandy, slight amounts of feldspar and dark silt, becomes less sandy with depth, large intervals of solid clay. Firm to very firm where solid clay, softer where sandy. Generally, to predominantly solid clay between: 470.0-476.7', 484.3-490.0', 500.3-529.9'	
	10.0	10.0	100%		CORE BOX 17		314.3	480				
	480.0 - 490.0'							485				
	10.0	9.4	94%									
	490.0 - 500.3'				CORE BOX 18			490				
	10.3	9.8	95.1%					495				
	500.3 - 509.9'						334.3	500				
	9.6	9.6	100%		CORE BOX 19			505				
								510				
								515				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-3

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	14 OF 15	VG-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ Core	509.9 - 519.9' 10.0	7.7	77%		CORE BOX 19			515	463.0-529.9': CLAY (cont)	519.9': Put new washer on swivel.
	519.9 - 528.5' 8.6	8.6	100%				-354.3	520, 525		528.2': Blocked off.
	528.5 - 533.5' 5.0	5.0	100%		CORE BOX 20			529.9, 530	529.9-541.8': SAND: Light bluish gray (5 B 7/1), medium- to coarse-grained, some gravel, micaceous, contains some feldspar, few ferromagnesians, possibly chlorite or biolite. Clayey and silty, soft.	533.5': (5/13) Stuck in hole, used hammer to pull out. Sign of artesian water.
	533.5 - 541.8' 8.3	7.1	85.5%				-374.3	535, 540		
	541.8 - 550.6' 8.8	8.8	100.0%		CORE BOX 21			541.8, 545, 550, 555	541.8-563.0': CLAY: Mottled, predominantly grayish red purple (5 RP 6/2), massive, clay with several other colors also present. Very firm to hard, slightly sandy.	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-3

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	15 OF 15	VG-3

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ Core	550.6 - 557.6'							555			541.8-563.0': CLAY (cont): Mottled, predominantly grayish red purple (5 RP 6/2), massive, clay with several other colors also present. Very firm to hard, slightly sandy.	
	7.0	2.0	100%		CORE BOX 22							
	552.6 - 564.9'						- 394.3	560				
	7.3	7.3	100%									
	564.9 - 574.9'				CORE BOX 23			565			563.0-574.3': SAND: Pale yellowish orange (10 YR 8/0), clayey, medium- to fine-grained, micaceous, soft.	
	10.0	9.9	99%					570				
							- 409.2	574.3			574.3-574.9': CLAY: Mottled, multicolored, firm, massive.	
								575			BOTTOM OF HOLE 574.9 Boring was geophysically logged and an observation well was installed.	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-3

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	1 OF 14	VG-4

SITE	COORDINATES	ANGLE FROM HORIZ.	BEARING
POSTULATED MILLETT FAULT	N 1124629.408 E 644971.508 (GA)	Vertical	---

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH
5/1/82	5/26/82	Law Engineering	Failing 1500	NQ			554.4

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
238.6/47.8%	20	34	---	150.26		

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
N/A	---	C. T. Scott/W. R. Thackaberry

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES
	NO SAMPLE					
ST	2.0	2.0			CORE BOX 1 2.0-18.5'	
ST	2.0	2.0				
ST	2.0	2.0				
ST	2.0	0.5				
ST	2.0	2.0				
ST	2.0	2.0				
SS	1.5	1.5				
SS	1.5	1.5				
SS	1.5	1.5				
SS	1.5	1.5			CORE BOX 2 18.5-35.0'	
SS	1.5	1.5				
SS	1.5	1.5				
SS	1.5	0.9				
SS	1.5	1.1				
SS	1.5	1.5				
SS	1.5	1.5				
SS	1.5	0.5				
SS	1.5	1.5				
SS	1.5	1.5				
SS	1.5	1.5				

ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
150.3	0	0-11.0': SAND: Moderate brown (5 YR 4/4) to grayish orange (10 YR 7/4). Fine-grained, grains subangular to subrounded, moderately well sorted - locally silty, loose, firm in place. Grayish orange (10 YR 7/4) to dark yellow orange (10 YR 6/6), silty and cohesive.	Bentonite drill fluid. Continuous samples, hole reamed with 3-7/8" rock bit. All samples shoved, generally used 3" split spoon to obtain best sample.
139.3	11.0	11.0-26.0': SANDY SILT AND CLAY: Mottled yellow gray (5 Y 5/2) clay and dark yellowish orange sandy silt (10 YR 6/6); local brownish black (5 YR 2/1) irregular blebs or laminae of soft coal. Bedding very irregular and contorted. Cohesive to slightly plastic.	Surveyed on 5/5/82.
124.3	26.0	26.0-72.3': SAND: Typically greenish gray (5 GY 6/1), silty, very fine-to fine-grained, horizontal bedding or laminae usually weathered to silty sand and locally sandy, silty clay. Very weak to weak, often cohesive. Locally trace black color where organic; clayey in these areas. Occasional 10 to 20 degree planar joints, calcareous and fossiliferous below 52.8'.	

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	2 OF 14	VG-4

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)
	1.5	1.5			CORE BOX 3 35.0-51.5'			35
	1.5	0.2						
	1.5	1.5						
	1.5	1.5						40
	1.5	1.5						
	1.5	1.5						
	1.5	1.5						45
	1.5	1.5						
	1.5	1.5						
	1.5	1.5						50
	1.5	1.5						
	1.5	1.5			CORE BOX 4 51.5-75.0'			
	1.5	1.0						
	1.0	1.0						55
	NO SAMPLE							
NQ Core	56.0 - 65.0'							
	9.0	1.5	17%					60
	65.0 - 70.0'							65
	5.0	4.8	96%					
	70.0 - 75.0'						80.26	70
	5.0	4.6	92%					72.3
								75

DESCRIPTION AND CLASSIFICATION

26.0-72.3': SAND: Typically greenish gray (5 GY 6/1), silty, very fine-to fine-grained, horizontal bedding or laminae usually weathered to silty sand and locally sandy, silty clay. Very weak to weak, often cohesive. Locally trace black color where organic; clayey in these areas. Occasional 10 to 20 degree planar joints, calcareous and fossiliferous below 52.8'.

54.5-57.0': Numerous oyster shells.

72.3-75.2': SILTY, CLAYEY SAND: Medium bluish gray (5 B 5/1), calcareous, very fine-to medium-grained, weak, locally soft and cohesive.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

54.5-55.5': Drove, then hammered 3" SS to refusal.

Set NW casing to 56.0'.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	3 OF 14	VG-4

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
	75.0 - 80.0'							75.0 / 75.2			72.3-75.2': SILTY CLAYEY SAND: (Cont)	
	5.0	2.6	52 %								75.2-117.8': FOSSILIFEROUS CALCAREOUS SAND/ SANDY LIMESTONE: Yellowish gray (5 Y 8/1), weathered. Fine-to medium-grained, grains typically subangular, poorly to moderately sorted. Weak (poorly cemented) to moderately hard. Fossiliferous; numerous small calcareous shell fragments and oyster shells. Upper contact horizontal.	
	80.0 - 85.0'							80				
	5.0	2.1	42 %								75.2-100.0': Generally weak calcareous sandstone grading to finer grained and harder limestone.	
	85.0 - 90.0'							85				Core run, 85.0-90.0', oyster shell plugged barrel.
	5.0	0.2	2 %									
	90.0 - 95.0'							90				
	5.0	1.4	28 %		CORE BOX 5 75.0-121.7'							
	95.0 - 100.0'							95				
	5.0	1.8	36 %									
	100.0 - 104.0'							100			100.0-117.8': Limestone with thin beds calcareous sand, generally poorly sorted, vuggy.	
	4.0	1.4	35 %									
	104.0 - 109.0'							105				
	5.0	1.1	22 %									
	109.0 - 114.0'							110				
	5.0	0	0 %									
	2.0	0.5	25 %					115				

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	4 OF 14	VG-4

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)
NQ Core	116.0 - 121.0'							115
	5.0	2.0	40 %				32.5	117.8
	121.0 - 125.0'				CORE BOX 6 121.7-141.5'			120
	4.0	2.6	65 %					
	125.0 - 130.0'							125
	5.0	4.8	96 %					129.0
	130.0 - 135.0'						21.3	130
	5.0	1.0	20 %					
	135.0 - 138.0'							135
	3.0	3.0	100 %					
	138.0 - 143.0'							140
	5.0	4.9	98 %					
	143.0 - 145.0'				CORE BOX 7 141.5-157.8'			
	2.0	2.0	100 %					145
	145.0 - 155.0'							
	10.0	9.7	97 %				0.26	150
								155

DESCRIPTION AND CLASSIFICATION

75.2-117.8': FOSSILIFEROUS CALCAREOUS SAND/ SANDY LIMESTONE: (Cont)

117.8-129.0': FOSSILIFEROUS LIMESTONE: Light gray (N-7), locally greenish gray (5 GT 6/1) below 132 feet. Moderately hard, fresh, locally vuggy. Distinct, planar, lower contact dips less than five degrees.

129.0-201.4': CALCAREOUS SILTSTONE (MARL): Pale green (10 G 8/2) at top contact, grades rapidly to dark greenish gray (56 Y 4/1). Fresh, has nearly horizontal laminae delineated by small fossil shells/ fragments, calcareous streaks and occasional lignite. Slightly calcareous, weak to stiff (core lengths often length of core run), locally clayey or sandy, numerous 0.2-0.6' limestone beds or lenses, occasional polished fractures.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

116.0': Blocked off.

117.8': Rough, slower drilling.

125.0-130.0': Drilled slow and steady, poor recovery due to bad core spring. Drilled to 135.0', still no recovery, tripped rods. Recovered core on run to 143.0'.

Reamed and set NX casing to 141.4'.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	5 OF 14	VG-4

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ Core	155.0 - 164.0'				CORE BOX 7			155			129.0-201.4': CALCAREOUS SILTSTONE (MARL): (Cont)	
	9.0	9.0	100%					160			163.8, 166.9, 186.0 and 196.8': Joints, polished, 55 degree dip, undulate. Polished faces are along an up-down direction, oriented about 10 degrees from vertical.	
	164.0 - 174.0'				CORE BOX 8 157.8-173.2'			165				
	10.0	10.0	100%					170				
	174.0 - 184.0'							175				
	10.0	9.8	98%		CORE BOX 9 173.2-188.6'			180			Limestone lenses, fine-grained and hard at 163.1-163.4; 164.0-164.5; 166.3-166.5; 166.9-167.2; 167.7-167.9; 168.6-169.2; 178.9-179.3; 180.8-181.0; 181.8-182.0; 182.4-182.7; 186.0-186.3; 187.6-187.8; 188.7-189.0; 193.2-193.4; 194.7-194.9; 196.9-197.1; 197.5-197.7; 198.0-198.3 feet.	
	184.0 - 194.0'							185				
	10.0	9.4	94%		CORE BOX 10			190				
	9.0	8.4	93%					195				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	6 OF 14	VG-4

Sampler Type and Diameter	Sampler Advance / Length Core R.	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes
194.0 - 203.0'	9.0	8.4	93 %		CORE BOX 10 188.6-214.0'	
203.0 - 213.0'	10.0	1.1	11 %			
213.0 - 218.0'	5.0	1.5	30 %		CORE BOX 11 214.0-240.0'	
218.0 - 223.0'	5.0	1.5	30 %			
223.0 - 228.0'	5.0	3.4	68 %			
228.0 - 233.0'	5.0	2.7	54%			
233.0 - 238.0'						

Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
	195	129.0-201.4': CALCAREOUS SILTSTONE (MARL): (Cont)	
-51.1	201.4	201.4-205.0': FOSSILIFEROUS LIMESTONE: Light gray (N 7), locally greenish gray (5 GT 6/1), moderately hard, vuggy, fresh.	201.4': Rough, clattery drilling. 205.0': Change in drilling from slow and rough to smooth and relatively faster.
-54.7	205	205.0-249.5': CALCAREOUS SAND: Light olive gray (5 Y 6/1 to 5 Y 5/2), silty, locally clayey. Fine-to medium-grained, grains generally subangular, moderately sorted. Massive, very poorly to poorly cemented, compact, dense, fossiliferous. 205.0-230.6': Very calcareous, weak to soft.	
-79.74	230		
	235		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	7 OF 14	VG-4

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)
NQ Core	5.0	4.6	92%		CORE BOX 11			235
	238.0 - 243.0'							
	5.0	3.5	70%					240
	243.0 - 248.0'							
	5.0	5.0	100%					245
	248.0 - 255.0'							249.5
	7.0	1.2	17%		CORE BOX 12 - 240.0-303.6'		-99.2	250
	255.0 - 259.0'							255
	4.0	0	0%					
	259.0 - 264.0'							260
	5.0	0	0%					
	264.0 - 269.0'							265
	5.0	0	0%					
	269.0 - 274.0'							270
	5.0	0	0%					275

DESCRIPTION AND CLASSIFICATION

230.6-234.8': Olive gray (5 Y 4/1), slightly calcareous, silty, very fine-grained, firm, dense, core lengths greater than 2 feet, near horizontal contacts.

234.8-249.5': Silty, numerous medium sized grains, soft, core lengths equal to length of core run.

249.5-299.8': INTERBEDDED SAND AND CLAY: Translucent quartz sand grains and dark greenish gray (5 GY 4/1) clay. Sand is loose to very poorly cemented, non-calcareous, grains often subangular and medium sized as based on cuttings. Clay is sandy and silty, horizontally laminated, stiff and contains stringers of fine-to coarse-grained quartz sand, grains are subangular to subrounded.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

249.5': Very fast drill advance rate.

264.0': Varied drill rotation, feed rate and pump pressure.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	8 OF 14	VG-4

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ Core	274.0 - 279.0' / 5.0	0.5	10%		CORE BOX 12 - 240.0-303.6'				249.5-29?.8': INTERBEDDED SAND AND CLAY: (Cont)	274.0-279.0': Core run, blocked off.
									277.0-280.0': CLAY	277.0': Drilled slowly.
	279.0 - 284.0' / 5.0	0	0%					280		
	284.0 - 289.0' / 5.0	0	0%					285		
	289.0 - 294.0' / 5.0	1.0	20%					290	292.0-294.8': CLAY	
	294.0 - 299.0' / 5.0	0	0%					295		299.0': Pulled string, bit definitely plugged.
	299.0 - 304.0' / 5.0	4.4	88%					299.8 / 300	299.8-355.5': SANDY CLAY: Very pale orange (10 YR 8/2) grading to pale red purple (5 RP 6/2) and grayish red purple (5 RP 4/2). Generally mottled, locally even colored, numerous irregular oxidized zones that occasionally resemble high angle fractures. Massive, firm and stiff to slightly hard, long core lengths. Unit varies in sand and clay content, occasional coarse, angular grains of quartz and pyrite.	
	304.0 - 312.6' / 8.6	6.9	80%				-159.74	305 / 310		
	312.6 - 322.6'							315		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	9 OF 14	VG-4

Sampler Type and Diameter	Sampler Advance Length Core Run	Sample Recovery Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Graphic Log	Sample	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
	312.6 - 322.6'							316			299.8-355.5': SANDY CLAY (Cont)	
	10.0	3.1	31%					320				322.6': Pulled drill string, repaired core barrel.
	322.6 - 327.6'											
	5.0	3.5	70%					325				
	327.6 - 334.0'				CORE BOX 13 - 303.3-337.4'			330				
	6.4	0	0%									
	1.0	0	0%									334.0': Core spring didn't catch; new core spring and drilled to 335.0', didn't retrieve any core. Made spring from 3" SS spring, pushed & recovered.
	2.0	0.6	30%					335				
	337.0 - 342.0'											
	5.0	4.9	98%					340				
	342.0 - 345.0'											
	3.0	2.5	83%					345				345.0': Bit plugged, barrel blocked.
	345.0 - 350.0'				CORE BOX 14 - 337.4-394.1'							
	5.0	3.3	66%					350				350.0': Barrel blocked.
	350.0 - 360.0'											
	10.0	0	0				- 205.24	355				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	10 OF 14	VG-4

Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Percent Core Recovery	Water Pressure Tests	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
					355	299.8-355.5': SANDY CLAY (Cont)	
					355.5	355.5-393.0': SAND: Very light gray (N 8) to translucent micaceous quartz sand, some pebble gravel, locally clayey. Dense, very poorly cemented, fine-to very coarse-grained, mostly coarse grains, grains angular to subangular, pebble gravel subrounded, moderately sorted as based on cuttings. Grades to lignitic sand and silt below.	355.5': Drills much faster.
360.0 - 365.0'					360	355.5-380.0': Very light gray sand (N 8), loose.	360.0': Inner barrel not latched. No recovery.
5.0	0	0 %					355.0-380.0: Estimate 20% circulation loss.
365.0 - 375.0'					365	380.0-384.0': Becoming lignitic as based on cuttings.	365.0-375.0': Core run, core fell out at barrel just as raised from wire line
						384.0-390.0': Drill mud turning black.	
10.0	0	0 %			370		
375.0 - 384.4'			CORE BOX 14 - 337.4-394.1'		375		
9.4	0.4	4 %			380		380.0': Black flakes lignite in cuttings, mud turned blackish gray.
							384.0 - : About 90% water loss.
384.4 - 394.4'					385		
9.4	4.1	47 %		-239.74	390	390.0-393.0': Grayish black (N 2) clayey silt with some sand, organic (lignitic).	
				-242.74	393.0	393.0-414.0': SAND (See Next Page for Description)	
					395		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	11 OF 14	VG-4

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NQ Core	394.4 - 404.4' 10.0	3.3	33 %		CORE BOX 15 - 394.1-449.1'			395–414	393.0-414.0': SAND: Greenish gray (5 GF 6/1) to light gray (N 7). Very weak to moderately hard, occasional yellowish orange oxide staining. Micaceous. medium-grained, grains, subangular to subrounded, some mafic grains. Generally moderately sorted, often silty.	
	404.4 - 414.4' 10.0	0.3	3 %				-263.74	414		
	414.4 - 424.4' 10.0	3.2	32 %					414–418	414.0-418.0': CARBONACEOUS SILT: Dark gray (N 3), weak to moderately hard. Very fine sand to silt to clay. Micaceous, occasional subrounded coarse quartz grains.	419.9': Faster drilling.
							-267.74	418	418.0-459.0': SAND: Medium light gray (N 6) to medium dark gray (N A), locally mottled pale red purple (5 P 6/2) to dusty yellow (5 Y 6/4). Loose, poorly cemented sand grading to a dense clayey sand. Fine-grained sand to granules, micaceous, often arkosic. 418.0-428.0': Medium light gray (N 6), weak, loose, medium-grained, grains subrounded.	428.0-429.5': Slower drilling, no cuttings. 429.5': Faster drilling.
	424.4 - 434.4' 10.0	0.7	7 %					425–435	428.0-429.5': Clay, grayish red (5 R 4/2). 429.5-459.0': Clayey, fine-grained to granules, subrounded, weak to slightly hard, often arkosic.	

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	12 of 14	VG-4

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.) 267.74	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NZ Core	434.4 - 444.4'				CORE BOX 15 - 394.1-449.1'				418.0-459.0': SAND (Cont)	
	10.0	4.5	45%					440		
	444.4 - 454.4'							445		
	10.0	7.8	78%		CORE BOX 16 - 449.1-467.9			450		One 7.8' core length; 444.4-454.4'.
	454.4 - 464.4'							455		
							-308.74	459	459.0-474.6': CLAYEY SILT: Mottled dusty yellow (5 Y 6/4) to light gray (N 7) to grayish red purple (5 RP 5/2). Polished face at 468.1' approximately 20° from horizontal. Clayey silt micaceous.	
	10.0	7.8	78%					460		
	464.4 - 474.4'							465		
	10.0	5.4	54%				-319.74	470		
								474.6 / 475	474.6-524.4': SANDY CLAY	

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-4

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	13 OF 14	VG-4

Column headings: SAMPLER TYPE AND DIAMETER; SAMPLER ADVANCE LENGTH CORE RUN; SAMPLE RECOVERY CORE RECOVERY; SAMPLE BLOWS "N"; PERCENT CORE RECOVERY; WATER PRESSURE TESTS (LOSS IN G.P.M.; PRESSURE P.S.I.; TIME IN MINUTES); ELEVATION (Ft.); DEPTH (Ft.); GRAPHIC LOG; SAMPLE; DESCRIPTION AND CLASSIFICATION; NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Sampler type and diameter: NQ Core

Core run	Advance	Recovery	Percent core recovery	Time	Core box
474.4 - 484.4'	10.0	9.9	99 %	45 minutes	CORE BOX 17 - 467.9-487.9'
484.4 - 494.4'	10.0	10.0	100 %	53 minutes	CORE BOX 18 - 487.9-502.9'
494.4 - 504.4'	10.0	10.1	101 %	48 minutes	CORE BOX 19 - 502.9-531.8'
504.4 - 514.4'	10.0	1.6	16 %	18-1/2 minutes	

Elevations (Ft.): -326.14, -328.84, -330.34, 350.64, -352.34, -354.14, -362.54, -363.24, -365.14

Depth (Ft.): 475, 480, 485, 490, 495, 500, 505, 510, 515

Description and Classification

459.0-524.4': SANDY CLAY (Cont)

476.4-479.1': SANDY CLAY: Light gray (10 YR 7/1), stiff, fine- to medium-grained, clear, subangular, quartz sand.

479.1-480.3': CLAY: Kaolin, white (10 YR 8/1), micaceous, stiff, moist, very sticky.

480.3-500. ': SILTY CLAY: Pale red (5 R 6/2), light gray to white (N 7 to N 9), dark reddish brown (10 R 3/4), very stiff, mottled, light yellowish brown (10 YR 5/6) clayey silt. Heavily weathered. Zones of pale red and dark reddish brown are typically separated from each other by a thin zone of white to light gray.

0.02' lamination of fat clay, red (2.5 YR 4/6) at 484.7'.

494.9-500.9': Same as above but slightly sandy.

500.9-502.6': CLAY: Light bluish gray (5 B 7/1), (kaolin ?) micaceous trace sand (fine).

502.6-504.4': SANDY CLAY: Pale red (5 R 6/2), light bluish gray (5 B 7/1), and yellowish brown (10 YR 5/6) mottled sandy micaceous clay.

504.4-512.8': SAND*: Clear with slight greenish gray (5 GY 6/1) tint, fine-to medium-grained, subangular.

512.8-513.5': CLAYEY SAND: Olive yellow (2.5 Y 6/6), and light gray (N 7), micaceous.

513.5-515.4': SANDY CLAY: Light gray (N 7), pale red (5 R 6/2), reddish brown (2.5 YR 4/4) mottled. Medium to coarse sand and fine gravel subangular to subrounded, quartz, clay is firm, medium plasticity.

Notes

5/25/82 W.R.T. hole had caved to 414'.

474.4-484.4': Slow drilling. 3 min./ft. down to 480'. 3 min./ft. - 480-484'.

Slow drilling.

Slow drilling.

Driller reports first 8' drilled fast, last 2' slower.

*Cuttings - no core.

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-4

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	14 OF 14	VG-4

Sampler type and diameter	Sampler advance / length core run	Sample recovery / core recovery	Sample blows "N" / percent core recovery	Water pressure tests (loss in G.P.M. / pressure P.S.I. / time in minutes)	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ Core	514.4 - 524.4' 10.0	10.2	102%	CORE BOX 19 - 502.9-531.8'	-365.14	515	474.6-524.4': SANDY CLAY (Cont) 515.4-521.0': CLAYSTONE/SILTSTONE: Pale red (5 R 6/2), olive (5 Y 4/4), and light gray (N 7), mottled. Hard to moderately hard.	5/26/82 W.R.T. 20' of hole had caved overnight. Driller recalls that last 6" drilled fast - very soft.
	49 minutes				-370.74	520	521.0-524.4': (?) SANDY CLAY / CLAYEY SAND: Light gray (N 7) and olive (5 Y 4/4) (little dusky red), mottled, sandy clay grading into light gray (N 7) clayey sand, fine-to coarse-grained, very stiff to moderately hard. Grains are subangular to subrounded, micaceous.	Driller reports first 6' drilled faster than last 4'.
	524.4 - 534.4' 10.0	4.0	40%			524.4 525	524.4-554.4': SAND: Fine-to medium-grained quartz. 530.4-531.6': Clayey sand, some cohesion, micaceous, light gray (N-7), (kaolin). 531.6-534.4': Silty sand, little cohesion, micaceous, weak banding. 534.4 (?) -542.9': Light brown (7.5 YR 6/4), soft, micaceous, wet.	
	12 minutes					530		
	534.4 - 544.4' 10.0	1.5	15%	CORE BOX 20 - 531.8-554.5'		535 540	542.9-543.9': Light gray (N 7), soft, micaceous, wet. Some bedding visible. 543.9-544.4': SANDY SILTY CLAY: Light gray (N 7) and medium dark gray (N 4), micaceous, very stiff.	
	17-1/2 minutes				-393.64			
	544.4 - 554.4' 10.0	0	0%		-394.14	545	544.4-554.4': SAND*: Light yellowish brown (10 YR 6/4), fine-to medium-grained quartz, micaceous.	*Cuttings only. 544.4-554.4': Very easy drilling.
	13 minutes				-399.74	550		Hole was geophysically logged and an observation well was installed.
					-404.14	554.4 555	554.4': BOTTOM OF HOLE	

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-4

H&CF 19-2

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	1 OF 13	VG-5

SITE	COORDINATES	ANGLE FROM HORIZ.	BEARING
MILLET FAULT	N 1116669.117 E 665818.683 (GA.)	Vertical	N.A.

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH
5/17/82	6/15/82	Law Engineering	Failing 1500	3"	103.9	399.1	502'

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
235.3/47%	17	6	Obs. Well	92.53	See Obs. Well	---

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
---	Observation Well	E. M. Fanelli/R. Kelleher

SAMPLER TYPE AND DIAMETER	RUN (FT.)	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY
Split Spoon	0.0-1.3'	1.5	.5	30
Split Spoon	1.3-3.0'	1.5	1.1	73
Split Spoon	3.0-4.5'	1.5	0	0
Split Spoon	4.5-6.5'	2.0	1.5	75
Split Spoon	6.5-8.5'	2.0	.6	30
Split Spoon	8.5-10.5'	2.0	2.0	100
NQ Wireline Core	10.5 - 14.0'	3.5	2.4	69%
NQ Wireline Core	14.0-19.0'	5.0	4.1	82%
NQ Wireline Core	19.0-23.8'	4.3	4.3	100%
NQ Wireline Core	23.8-29.7'	6.5	6.5	100%
NQ Wireline Core	29.7-40.3'	10.5	7.4	70%

WATER PRESSURE TESTS (Loss in G.P.M. / Pressure P.S.I. / Time in Minutes): Core Box 1 — 187.0; Core Box 2 — 337.0

ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
92.53	0	0.0-9.0': SANDS: Yellow gray (5 Y 8/1) to light gray (N7), clayey with depth, loose, soft sand, some iron oxidation - weathering.	Drilled with Quik-gel, bentonite and Baroid weight mud.
82.0	9	9.0-13.3': SANDY CLAY: Grayish orange (10 YR 7/4), very soft, generally massive becoming a laminated clay, fine-grained sand and silt towards base. Color due to weathering.	
	13.3	13.3-33.7': SANDY CLAY: Medium bluish gray (5 B 5/1), calcareous, fine-grained sand, silt, and clay layers, cleaves along bedding planes, bedding planes are generally horizontal, sand layers are hard and brittle, silty layers are firm and show slatey cleavage, laminated.	
72.0	20		
62.0	30		
	33.7	33.7-103.9': FOSSILIFEROUS CLAYEY SAND:	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-5

M&CF 19-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	2 OF 13	VG-5

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N"	Percent core recovery	Water pressure tests: L.G.S. in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ Wire Line Core					Core Box 3				35	33.7-103.9': <u>FOSSILIFEROUS CLAYEY SAND</u> (cont): Medium bluish gray (5 B 5/1) changing to greenish gray (5 GY 6/1) at 40.3', massive, soft, calcareous, clayey, silty, medium- to coarse-grained, angular, quartz sand contains several large shells (oysters) and some small blebs of hard massive limestone associated with the shell material. Limestone blebs generally contain voids. Some mica.	Very poor recovery in the fossiliferous clayey sand.
	10.5	7.4		70%							
	40.3-50.3'							52.0	40		
									45		
	10.0	2.6		26%							
	50.3-60.4'							42.0	50		
									55		
	10.1	3.3		33%							
	60.4-70.3'							32.0	60	- Hard limestone nodule recovered.	- 60.4': Overshot broke, had to pull rods to retrieve it.
									65		
	9.9	.2		2%							
	70.3-80.3'							22.0	70	- Large hard oyster shell recovered, cuttings show shell fragments and sand.	- 70.0': Artesian water .5 gpm. Cased upper 5' of hole leaving 1' of stick-up.
	10.0	.2		2%							

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-5

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	3 of 13	VG-5

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N"	Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ Wire Line Core	70.3-80.3'								75	33.7-103.9': FOSSILIFEROUS CLAYEY SAND (cont)	Used NW casing.
	10.	.2		2%							
	80.3-85.3'					Core Box 3		12.0	80	- Description based on cutting - sand; medium- to fine-grained, shell fragments, some silt.	
	5.0	1.9		38%							
	85.3-91.8'								85		- 85.3' Removed triple tube to try to achieve better recovery.
	6.5	3.7		57%		88.4					
								Sea 0 Level	90		
	91.8-101.8'								95		
	10.0	1.7		17%							
								12.0	100	- 101.8': Hard limestone nodule recovered.	- 101.0' Mud, 47 sec. Baroid + Quik-Gel.
	101.8-105.8								103.9		
	4.0	2.0		50					105	103.9-112.0': FOSSILIFEROUS LIMESTONE: Light bluish gray (5 B 7/1) silty, slightly clayey, moderately hard to hard, massive, moderately voided, containing several dark ferromagnesians in siltier portions.	Measured rods at 111.8. Discovered true depth was 112.
	105.8-112.0					Core Box 4					
	6.2	1.5		24				22.0	110		
	112.0-122.0								112.0	112.0-186.8': CALCAREOUS SILTSTONE (MARL): Dark greenish gray (5 G 4/1) sometimes laminated, alternating layers of clay, fine grained sand and silt, sometimes massive	
	10.0	9.1		91					115		

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-5

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	4 OF 13	VG-5

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation	Depth	Description and classification	Notes on water levels, water return, character of drilling, etc.
NQ Wire Line Core	112.0-122.0'				Core Box 4			115	112.0-186.8: CALCAREOUS SILTSTONE (cont) and more sandy, generally very firm, fossiliferous, calcareous, micaceous, (muscovite), contains some mafic sand and some dark, dull, small grains of organic material. Laminae are horizontal to 10°, dipping beds are sometimes convoluted, often faint.	
	10.0	9.1	91%				32.0	120		
					122.0					
	122.0-132.0'							125		
	10.0	6.6	66%				42.0	130	- 130.0' 45° polished surface.	
	132.0-142.0'				Core Box 5			135		Cased hole with NX casing to a depth of 120'. Installed a desander to mud tub and pump to help keep drilling mud free of sand.
	10.0	9.5	95%				52.0	140		
					141.3					
	142.0-152.0'							145		
	10.0	1.0	100%				62.0	150	LIMESTONE: Interbedded, light bluish gray (5 B 7/1) blebs very hard and massive from: 152.0-152.4' 152.6-152.7' 153.7-153.8'	
	152.0-162.0'				Core Box 6					
	10.0	8.2	82%					155		

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SITE: POSTULATED MILLETT FAULT

HOLE NO.: VG-5

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BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	5 OF 13	VG-5

SAMPLER TYPE AND DIAMETER	SAMPLE/ ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ Wire Line Core	152.0-162.0'				156.3			155	112.0-186.8': CALCAREOUS SILTSTONE (MARL): (cont)	
	10.0	8.2	82%						158.7-159.0' 159.8-160.1' 171.6-171.8' 169.2-169.5' 169.6-169.9'	
							72.0	160		
	162.0-172.0'									
								165		
	10.0	10.0	100		Core Box 7					
							82.0	170	- 171.5 /Polished surface on an approximately 30° fracture.	
	172.0-182.0'				172.9					
								175		
	10.0	9.8	98%							
							92.0	180		
	182.0-192.0'				Core Box 8					
								185		
	10.0	9.0	90%		187.7			186.8 187.7	186.8-202.0': FOSSILIFEROUS LIMESTONE: Light greenish gray (5 G 8/1), sandy and clayey, clay gives predominan color and is unevenly distributed throughou unit tending to be more concentrated near the top of the unit; small amount of black clay occurs in just 1' of core, indicating reducing conditions. Sand is medium- to coarse-grained, angular, quartz, becomes sandier with depth. Unit is massive f iable where sandy, hard where clayey, con ins many voids and high pressure artes in water.	
							100.0	190		
	192.0-202.0'									
	10.0	4.3	43%					195		

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-5

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	6 OF 13	VG-5

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ Wire Line Core	192.0-202.0' 10.0	4.3	43%				110.0	195 – 202.0	186.8-202.0: <u>FOSSILIFEROUS</u> <u>LIMESTONE</u> (cont)	
	202.0-212.0' 10.0	9.0	90%		Core Box 9 (to 210.0)		120.0	202.0 – 212	202.0-232.0': <u>CALCAREOUS SAND</u>: Light olive gray (5 Y 6/1) to very light gray (N 8), fossiliferous, calcareous, quartz sand. Poorly to moderately well sorted, medium- to coarse-grained and angular, silty, just slightly clayey, few mafics, some dark, dull, rounded organic grains. Very soft (loose) to moderately stiff where fossiliferous.	- 202.0' Very high pressure artesian water 50 gpm flowing from hole.
	212.0-222.0' 10.0	7.0	70%		Core Box 10		130.0	212 – 222		
	222.0-232.0' 10.0	1.5	15%				140.0	222 – 232.0		
	232.0-242.0' 10.0	1.8	18%					232.0 – 235	232.0-282.0': <u>SAND</u>: Greenish gray (5 G 6/1) to dark greenish gray (6 GY 4/1) where clayey,	- Using 90 sec Mud, Bariod and Quik-Gel.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-5

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	7 OF 13	VG-5

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ Wire Line Core	232.0-242.0'							235	232.0-282.0 SAND (con't.) non-calcarenous, poorly to moderately well sorted, medium-to coarse-grained clear quartz, few grains have amethyst coloring, slightly clayey and silty mainly occuring as thin (0.5") lenses. Very soft and loose. Few mafics and organics. Few hard nodules of sandstone.	Very poor recovery throughout unit.
	10.0	1.8	18%				150.0	240		
	242.0-252.0'				Core Box 10			245		
	10.0	4.2	42%		250.3		160.0	250		
	252.0-262.0'							255		
	10.0	0	0%				170.0	260	Cuttings: Medium-to coarse-grained angular sand. Few soft black organics.	
	262.0-272.0'							265		
	10.0	0	0%				180.0	270		
	272.0-282.0'				Core Box 11					
	10.0	0.1	1%					275		75% water return.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-5

H&CF 19-2

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	8 OF 13	VG-5

Sampler type and diameter	Sampler advance / length core run	Sample recovery / core recovery	Sample blows "N" / percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ Wire Line Core	292.0-282.0'							275	232.0-282.0' SAND (con't.)	
	10.0	.1	1%				190.0	280	- Cuttings: Coarse to medium grained quartz sand.	- 20° changed bits. Put on new diamond side discharge.
		282.0						282.0	282.0-342.0' (?): MULTI-COLORED CLAYS: Bluish white (5 B 9/1), pale to dark yellow brown (10 YR 6/2 to 10 YR 6/6) and pale red purple (10 R 6/4) including all hues SP & 5 PR. Massive, mottled and veined, micaceous, slightly sandy and silty, becoming sandier with depth such that the lower contact is gradational, moderately stiff to soft where sandy.	Dulling mud colored by clay.
	6.6	2.0	30%					285		
	288.6-292.0'									- 288.6' Broke overshot. Pulled rods to retrieve inner barrel.
	3.4	0	0%				200.0	290		
	292.0-300.2'				Core Box 11					
	8.2	8.2	100%					295		
	300.2-301.3'									
	1.1	.9	82%		301.3		210.0	300	- Color predominantly pale red purple (10/B/4/6).	Mud approximately 36 sec., however continually thickens during drilling.
	301.3-311.3'									
	10.0	8.1	81%					305		
					Core Box 12		220.0	310	- Color predominantly bluish white (5 B 9/1) veined with red clay.	
	311.3-321.3'									
	10.0	10.0	100%					315		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-5

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	9 OF 13	VG-5

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ Wire Line Core	10.0	10.0	10%		Core Box 12; 319.8			315	262.0-342.0' (?): MULTI-COLORED CLAYS (con't) - Very marbled, multi-colored to 331.3'.	Poor recovery from 321.3' on.
							230.0	320		
	321.3-331.3'									
	10.0	1.4	14%					325		
							240.0	330	Massive, solid colored, light bluish gray (5 B 7/1).	
	331.3-333.1'									
	1.8	.9	50%						- Becoming sandier.	
	333.1-342.0'									
	9.9	3.0	30%					335		
							250.0	340	- Gradational contact.	
	342.0-352.0'				Core Box 13			342.0	342.0 (?)-356.8': CLAYEY SAND: Pale yellowish brown (10 YR 6/2), medium-to coarse-grained quartz, becomming coarser with depth, angular to rounded, becoming more rounded with depth, very soft, clayey, micaceous, just slightly silty. Few mafics, massive.	
	10.0	.5	5%					345		
							260.0	350		
	352.0-356.8'									
	4.8	.1	2%					355	- Grains gravel size, well rounded, frosted, pitted.	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO.: VG-5

H&CF 19-2

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	10 OF 13	VG-5

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N"	Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NQ Wire Line Core	4.8	.1		2%					355	342.0 (?)-356.8': <u>CLAYEY SAND</u> (con't)	
	356.8-362.0' 5.2	3.2		62%		Core Box 13 362.0		270.0	360	356.8-404.2': <u>CLAY</u>: Dark gray (N 3) to black (N 2), sandy, silty, micaceous (muscovite), lignitic clay; massive where sandy to faintly bedded where silty. Laminae more apparent with depth. Lignite generally horizontal and shows slately cleavage soft to moderately stiff.	
	362.0-372.0' 10.0	.8		8%					365	362.0-375.0': Interbedded sand: Clayey, silty, micaceous, very soft, coarse grained, subrounded quartz. Few nodules of very hard, well cemented sandstone containing abundant pyrite at base of sand and gravel (upper contact approximate).	
	372.0-373.2' 1.2	0		0				280.0	370		372' - Bit clogged, pulled rods.
	373.2-282.2' 10.0	7.7		77%				290.0	375, 380	375.5-383.2': Black clay generally less sandy than top of unit, sandy from 379.0-379.5'. Silt increases with depth. Firm to moderately hard.	
	383.2-384.6' 1.4	1.0		71%						383.2-384.6': Interbedded sand: Dusky green (5 G 3/2), clayey, glauconitic, fine-to medium-grained quartz sand, faintly laminated, silty, silt concentrated in laminae, calcareous. Soft to moderately hard - one hard sandstone nodule retrieved at 384.6'.	Drilling is continuous from 384.6 to bottom of hole.
	384.6-388.0' 3.4	.9		26%					385		
	388.0-392.0' 4.0	1.7		43%		Core Box 14		300.0	390		
	392.0-402.0' 10.0	2.2		22%					395		

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-5

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	11 of 13	VG-5

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation	Depth	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ Wire Line Core	10.0	2.2	22%		Core Box 14 (to 402.0)		310.0	395–404.2	384.6-404.2': Black clay to silty, sandy clay, laminated with thin layers of fine-grained silt and sands, micaceous. Soft where sandy to firm where clayey. 395.0-404.2': Core becomes sandier.	Mud 50 sec.
	402.0-412.0' 10.0	8.4	84%				320.0	404.2–412	404.2-502.0': <u>INTERBEDDED SANDY CLAYS AND CLAYEY SANDS</u>: Multi-colored, massive sandy clay and clayey sand. Sand is poorly sorted, fine-to coarse-grained quartz, rounded to subangular, several grains are tinted rose to amber hues. Soft where sandy, firm where clayey, contacts are generally gradational, slightly silty, contains some feldspar and pyrite in localized areas, micaceous. 404.2-422.0': Predominantly a light blue gray (5 B 7/1), with grayish red purple (5 RP 4/2) and dark yellowish orange (10 YR 6/6), mottled very sandy clay becoming a clayey sand, very coarse-grained with large feldspar and quartz crystals, micaceous and containing traces of pyrite, moderately stiff to weak.	
	412.0-422.0' 10.0	1.4	14%				330.0	412–422		Mud 70 sec.
	422.0-432.0' 10.0	1.1	11%		Core Box 15		340.0	422–432		
	432.0-442.0' 10.0		%					432–435		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-5

CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	12 OF 13	VG-5

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ Wire Line Corer					436.1			435	404.2-502.0 INTERBEDDED SANDY CLAYS AND CLAYEY SANDS (con't)	
	10.0	.9	9						422.0-442.0': Predominantly medium light gray (N5) clayey, finer grained sand, subrounded to subangular grains, containing mica and feldspar, soft. Sharp change in color at 432.0' to a light brownish gray (5 YR 6/1) micaceous clayey sand that grades back into a light gray (N6) stiff, sandy clay, containing stringers of silt.	
							350.0	440		
	442.0-452.0'								442.0-458.0': Light olive gray (5 Y 6/1) to medium dark gray (N4) coarse-grained clayey sand, several grains are tinted rose and amber colors rounded to subrounded.	
								445		
	10.0	1.9	19%							
							360.0	450		
	452.0-462.0'									
					Core Box 16			455		
	10.0	10.0	100%						458.0-502.0': Mottled, moderately hard clay, micaceous, slightly silty and sandy.	
					460.0		370.0	460		
	462.0-472.0'									
								465		
	10.0	1.4	14%							
									- Color predominantly brownish-red.	
					Core Box 17		380.0	470		
	472.0-482.0'									
								475		

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-5

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	13 OF 13	VG-5

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N"	Percent core recovery	Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: water levels, water return, character of drilling, etc.
NQ Wire Line Core									475	404.2-502.0': INTERBEDDED SANDY CLAYS AND CLAYEY SANDS (con't)	
	10.0	0		0%							
								390.0	480		
	482.0-492.0'										
									485	- Predominantly, grayish red purple, dark yellowish orange and light blue gray (5 B 7/1, 5 RP 4/2, 10 YR 6/6) clay.	
	10.0	10.0		100%		Core Box 17					
								400.0	490		
	492.0-502.0'										
									495		
	10.0	0		0%							
								410.0	500		
						502.0			502.0		
										502.0': BOTTOM OF HOLE HOLE WAS GEOPHYSICALLY LOGGED, AND AN OBSERVATION WELL WAS INSTALLED.	

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-5

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	1 of 16	VG-6

SITE	COORDINATES	ANGLE FROM HORIZ.	BEARING
Burke Co.	N 1110896.34 E 669643.15 (GA)	90°	N.A.

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH
5-18-82	6-10-82	Alabama Power	Joy 22	NQ-3	85.0'	535.0	620

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
497.8/78%	33	2	-	217.10	See Observation Well	85.0'/132.1

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
-	-	K. Wornick / R. J. Kelleher

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS	1.5	1.5					217.1	0			0-85.0': CLAYEY SAND: Dark reddish brown (10 R 3/4) to pale reddish brown (10 R 5/4), grading into pale red purple (5 R 6/2), grayish red purple (5 RP 4/2), moderate reddish brown (10 R 4/6), dusky yellow (5 Y 6/4) and light olive brown (5 Y 5/6). Generally medium to very fined-grained throughtout; sand (quartz) subangular to subrounded; moderate to highly weathered, generally poorly cemented. Weak and friable.	E-Z mud drill fluid used throughtout coring. Mica-tex and bentonite used (infrequently) as needed.
	.5	.5										
	Rotary drilled 2.0' to 8.0' to accommodate first core run down hole.							5				
NQ CORE	8.0 - 18.7				CORE BOX 1 0' - 32.2'						0-2.0': Dark reddish brown. Thin banding, mechanically broken in split spoon.	0-69.6': No loss of circulation.
								10			18.7-49.6': Grayish red purple thin to thick banding, parting.	
	10.7	.35	.03%									
								15				
	18.7 - 29.0							20				
	10.3	10.3	100%					25				
	29.0 - 39.3							30				
	10.3	4.6	45%					35				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-6

H&CF 19-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATINGPLANT	9510	2 OF 16	VG-6

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)
NQ-CORE	29.0 - 39.3							182.1	35
	10.3	4.6		45%					
	39.3 - 49.6								
	10.3	5.0		49%		CORE BOX 2 32.2'-60.0'			
	49.6 - 59.6								
	10.0	7.7		77%					
	59.6 - 69.6								
	10.0	9.3		93%		CORE BOX 3 60.0'-75.6'			
	69.6 - 79.6								
	10.0	6.1		61%					

DESCRIPTION AND CLASSIFICATION

0-85.0': CLAYEY SAND: (cont)

40.0-50.0': Slightly less friable, some isolated zones of increased cementing.

35.0-85.0': Thin bio-turbational banding @ 5°-10°.

58.0': Thin clay bed, hard, very fine-grained.

68.0': 2" gradational color change from grayish red purple (5 RP 4/2) to dark reddish brown (10 R 3/4).

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

69.6-79.6': This coring run marks the beginning of the total loss of circulation segment approximately 1500 gallons lost between 69.6' and 90.0'. Casing set at 89.5' and stopped loss of circulation

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-6

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	3 of 16	VG-6

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ CORE	69.6 - 79.6						142.1	75	0-85.0': <u>CLAYEY SAND</u> (cont)	completely.
	10.0	6.1	61%		CORE BOX 4 75.6' - 102.5'					
	79.6 - 89.6							80	CONTACT 2" GRADATIONAL CHANGE	Casing set at 91'.
	10.0	2.4	24%				132.1	85	APPROXIMATE CONTACT	
									85.0-158.6': <u>CALCAREOUS SAND</u>: Very light gray (N/8) to light gray (N/7). Sand (quartz) fine-to very fine-grained, subangular, poorly to moderately well sorted, massive. Moderately hard when dry, poorly consolidated when wet; fossiliferous (shell fragments).	85.0-158.6': Slow and steady drilling No loss of circulation following placement of casing.
	89.6 - 93.5							90		
	3.9	3.2	82%							
	93.5 - 103.5							95		
	10.0	10.0	100%					100		
	103.5 - 113.5				CORE BOX 5 102.5' - 117.5'			105		
	10.0	10.0	100%					110	Slight color change with depth to yellow gray (5 Y 8/1).	
	113.5 - 123.5							115		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-6

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	4 of 16	VG-6

Sampler type and diameter	Sampler advance / length core run	Sample recovery / core recovery	Sample blows "N" / percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ CORE	113.5 - 123.5				CORE BOX 6 117.5' - 132.6'		102.1	115	85.0-158.6': CALCAREOUS SAND (cont)	Continued slow and steady drilling with no loss of circulation.
	10.0	10.0	100%					120		
	123.5 - 127.6									
	4.1	3.9	95%					125		
	127.6 - 134.7									
	7.1	6.0	85%					130		
	134.7 - 144.7				CORE BOX 7 132.6' - 149.3'			135	137.6-138.1': Small bed of fossiliferous limestone; light gray (N/7) moderately hard, fresh.	
									138.1': Contact; grading color change with depth to pale green (10 G 8/2).	
	10.0	9.2	92%					140		
	144.7 - 154.7							145		
	10.0	10.0	100%					150		
								155		

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-6

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	5 OF 16	VG-6

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	154.7 - 164.7				CORE BOX 8 149.3' - 164.7'		62.1	155		85.0-158.6': <u>CALCAREOUS SAND</u> (cont)	
	10.0	10.0	100%							SHARP COLOR CHANGE	
							58.5	158.6		158.6-214.5': <u>CALCAREOUS SAND</u>: Greenish gray (5 G 6/1) to dark greenish gray (5 G 4/1), some silt, fine to very fine, weak to hard, typically cohesive, 0-20° convoluted bedding planes well to poorly graded.	
								160			
	164.7 - 174.7				CORE BOX 9 164.7' - 179.8'			165			
	10.0	10.0	100%					170			
	174.7 - 184.7							175			
	10.0	9.6	96%					180			
	184.7 - 194.7				CORE BOX 10 179.8' - 195.3'			185			
	10.0	10.0	100%					190			
								195			

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-6

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	6 OF 16	VG-6

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	194.7 - 204.7						22.1	195	158.6-214.5': CALCAREOUS SAND: (Cont)	
	10.0	9.8	98%					200		
	204.7 - 214.7							205		
	10.0	10.0	100%					210		
	214.7 - 217.5						2.6	214.5 / 215	214.5-237.5': FOSSILIFEROUS LIMESTONE: Light bluish gray (5 B 7/1), calcareous, numerous shells, sandy, clayey, medium soft to medium hard, sand and clay is unevenly distributed, some voids, some 1.5' core lengths.	
	2.8	1.7	60%						@ 217.0-221.0'± Oyster shells	Varying drilling rates.
	217.5 - 221.4								@ 234.0': Limestone becomes bluish white (5 B 9/1), slightly harder, with some areas more massive, fewer voids.	100% water recovery.
	3.9	1.4	36%					220		
	221.4 - 223.5									
	2.1	2.1	100%							
	223.5 - 233.2							225		
	9.7	9.0	93%					230		
	233.3 - 243.2							235		

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-6

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	7 OF 16	VG-6

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ CORE	233.2 - 243.2						-17.9	235	214.5-237.5': FOSSILIFEROUS LIMESTONE: (cont)	
							-20.4	237.5	GRADATIONAL CONTACT	100% water recovery.
	10.0	9.4	94%		CORE BOX 13				237.5-328.2': CALCAREOUS SILTSTONE (MARL): Greenish-gray (5 G 6/1) to dark greenish gray (5 G 4/1) and medium bluish gray (5 B 5/1); moderately soft to moderately stiff, weak, friable, poorly cemented, tight, laminations in weathered zone dip 0^{0}-5^{0}, laminations in unweathered zone are nearly horizontal; micaceous, some hard shell fragments, core lengths are typically 2' or less; slightly clayey but mostly silty, thin dark laminations are prominent.	
	243.2 - 252.0							240	237.5-238.9': Weathered, mottled.	Harder drilling.
								245	247.2-248.1': Fossiliferous limestone.	
					247.7				251.2-252.0': Fossiliferous limestone.	
	8.8	6.8	77%					250	247.5-248.3': Limestone nodule, light bluish gray (5 B 7/1).	100% water recovery, faster drilling.
									249.4': Large hard shell.	
	252.0 - 262.0								249.6-249.8': Limestone nodule, light bluish gray (5 B 7/1).	
					CORE BOX 14			255	251.0-251.1': Limestone nodule, light bluish gray (5 B 7/1).	
	10.0	9.9	99%						251.6-251.9': Limestone nodule, light bluish gray (5 B 7/1).	
					262.4			260		
	262.0 - 272.0							265		100% water recovery.
	10.0	7.6	76%		CORE BOX 15					
								270		
	272.0 - 280.3									
	8.3	8.3	100%					275		

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-6

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	8 of 16	VG-6

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE							-57.9	275			237.5-328.2': CALCAREOUS SILTSTONE (MARL) (cont)	
					277.0						276.8-277.0': Limestone nodule, light bluish gray (5 B 7/1).	Easy drilling.
											279.0: Polished faces (horizontal).	
								280			280.3-328.2': Sandy (quartz and some ferromagnesian minerals).	100% water recovery.
	280.3 - 290.3'											Drillers had trouble getting core out of core barrel.
	10.0	9.3	93%		CORE BOX 16			285				
											289.3': Polished face @ 20°.	
								290				100% water recovery.
	290.3 - 300.3'				292.2						293.2-243.5': Limestone nodlue, light bluish gray (5 B 7/1).	
	10.0	10.0	100%					295				
											298.3-299.1': Limestone nodule, light bluish gray (5 B 7/1).	Easy drilling.
	300.3 - 309.9'				CORE BOX 17			300			300.8-301.4': Limestone nodule, light bluish gray (5 B 7/1).	
	9.6	9.2	96%		306.3			305				
	309.9 - 319.9'							310			310.8': Polished face @ 45°.	100% water recovery.
	10.0	7.8	78%		CORE BOX 18			315				

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-6

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	9 OF 16	VG-6

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)
NQ CORE					CORE BOX 18		97.9	315
	319.9 - 329.5				323.5			320
	9.6	9.6	100%					325
							-111.1	328.2
	329.5 - 339.5				CORE BOX 19			330
	10.0	9.2	92%					335
					339.3			
	339.5 - 349.5						-123.4	340 / 340.5
	10.0	9.6	96%		CORE BOX 20			345
	349.5 - 359.5							350
	10.0	9.6	96%		354.0			355

DESCRIPTION AND CLASSIFICATION

237.5-328.2': CALCAREOUS SILTSTONE (MARL) (cont)

311.0': Polished face @ 45°.

312.2': Polished face @ 50°.

313.4': Polished face @ 45°.

328.2-340.5': FOSSILIFEROUS LIMESTONE: Very light gray (N8) to bluish white (5 B 9/1), medium soft to medium hard, calcareous, weak, friable, poorly cemented, clayey, fresh, some sand, numerous shell fragments.

GRADATIONAL CONTACT

340.5-375.1': FOSSILIFEROUS SAND: Yellowish gray (5 Y 8/1) and light olive green (5 Y 6/1), very fine-to medium-grained, subangular to subrounded, very poorly cemented, calcareous, very loose, weak; well sorted; sand contains quartz and some mafic minerals; silty, shell fragments, slightly convoluted by fossiliferous fragments.

348.5-350.9': Fossiliferous limestone, light olive gray (5 Y 6/1), sandy.

352.5-352.7': Fossiliferous limestone, light olive gray (5 Y 6/1), sandy.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Easy drilling.

100% water recovery.

100% water recovery.

Easy drilling.

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-6

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	10 of 16	VG-6

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ CORE							-137.9	355	340.5-375.1': FOSSILIFEROUS SAND (cont) 354.7-354.9': Moderately well cemented with limestone. 355.3-355.4': Moderately well cemented with limestone. 361.8-361.9': Moderately well cemented with limestone.	100% water recovery. Easy drilling.
	359.5 - 369.5'				CORE BOX 21			360		
	10.0	9.2	92%					365		
	369.5 - 378.8'							370		
					371.6				GRADATIONAL CONTACT	
	9.3	9.3	100%				-158.0	375 / 375.1	375.1-381.7': FOSSILIFEROUS LIMESTONE: Light olive gray (5 Y 6/1); sandy, moderately hard, well cemented, shell fragments throughout, no voids, some intermixed bio-clastic sediments.	
	378.8 - 380.0'									
	1.2	1.1	92%					380	GRADATIONAL CONTACT	-380: 95% water loss much harder drilling.
	380.0 - 388.2'				CORE BOX 22		-164.6	381.7	381.7-388.3': FOSSILIFEROUS SAND: Yellowish gray (5 Y 8/1), and light olive green (5 Y 6/1), very fine-to medium-grained, subangular, well sorted, very loose, very poorly cemented, calcareous, sand is predominantly quartz with some ferromagnesian minerals.	-384: 100% water recovery. -384.6: Easy drilling.
	8.3	4.4	53%					385		
	388.3 - 398.3'							388.3	SHARP CONTACT 388.3-428.0': SAND: Greenish gray (5 GY 6/1), light olive green, fine-to coarse-grained, angular to subrounded, well sorted, loose, clean, predominantly quartz, trace of ferromagnesians. Non-calcareous, quartz.	Added mica to drilling fluid.
					390.7			390		
	10.0	9.8	98%					395		

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-6

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	11 of 16	VG-6

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on water levels, water return, character of drilling, etc.
NQ CORE							-177.9	395	388.3-428.0': SAND (cont)	
	398.3 - 408.3'				CORE BOX 23			400		Easy drilling.
	10.0	10.0	100%		406.1			405		
	408.3 - 418.5'				CORE BOX 24			410		
	10.2	8.2	80%					415		100% water recovery.
	418.5 - 428.2'				423.5			420	SHARP CONTACT 428.0-444.5': CLAY: Dark reddish brown (10 R 3/4), very light gray (N/8), light olive brown (5 Y 5/6), silty, some very fine-grained sand that is unevenly distributed (quartz), micaceous, mottled, moderately stiff, weathered. 428.5': Polished face @ 25°. 429.2': Polished face @ 30°. 429.7': Polished face @ 15°.	
	9.7	9.1	94%					425		Drilling fluid color change to an orangish brown.
	428.2 - 428.4'						-210.9	428		
	0.2	0.2	100%							
	428.4 - 438.4'				CORE BOX 25			430		
	10.0	10.0	100%					435	433.6-444.5': There is an abrupt color change to a bluish white (5 B 9/1). Clay (kaolinite becomes very sandy and grades into a clayey sand with depth.	

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-6

H&F F 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	12 of 16	VG-6

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ CORE							-217.9	435	428.0-444.5': CLAY (cont) 390.0-442.1': Thin, horizontal laminations.	Easy drilling.
	438.4 - 448.5'				438.4					
	10.1	7.9	71%					440	GRADATIONAL CONTACT 444.5-455.0': SAND: Very light gray (N8), very fine-to medium-grained, sand becomes coarser grained with depth, angular to subrounded, sand is predominantly quartz and muscovite mica, with a trace of feldspar and a black ferromagnesian mineral. Loose, very poorly cemented, clayey, silty, micaceous.	
							-227.4	445		
	448.5 - 451.8'									
	3.3	0.0	0%					450	454.0-455.0': Some small gravel, angular to subrounded, up to 1/2" in size.	100% wtaer recovery.
	451.8 - 454.8'									
	3.0	0.0	0%		CORE BOX 26					
	454.8 - 463.4'						-237.9	455	GRADATIONAL CONTACT 455.0-466.1': INTERBEDDED SILT AND CLAY: Light gray (N7), thinly interbedded, trace of a very fine-grained sand, moderately cohesive, dark laminations (0^{o}-5^{o}) and convoluted laminations (0^{o}-5^{o}), moderately soft, weak.	
	8.6	2.3	27%					460		
	463.4 - 473.7'							465		Color change in drilling fluid to a very dark brown.
							-249.0	466.1	GRADATIONAL CONTACT 466.1-520.7': SAND: Very light gray (N8) to light gray (N5); very fine-to coarse-grained, angular to subrounded; medium gray sands are coarse-grained and poorly sorted, loose, very poorly cemented, soft to moderately soft; light gray sands are finer grained and well sorted. Sand is predominantly quartz and muscovite mica with some feldspar and a trace of a dark ferromagnesian mineral; some horizontal clay laminations; some gravel, angular to subrounded and up to 1/2" in size.	
					468.1					
	10.3	7.0	68%					470		Hole caved.
					CORE BOX 27					Drilling fluid changed color to a darker brown from 473'-483'.
	473.7 - 483.7'							475		

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-6

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	13 of 16	VG-6

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Graphic Log	Sample	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NQ CORE	473.7 - 483.7'				CORE BOX 27		-257.9	475			466.1-520.7': <u>SAND</u> (cont)	
	10.0	0.0	0%					480				
	483.7 - 493.7'											484.0: 100% water loss added quick gel and Bariod to E-Z mud (30 second).
	10.0	2.9	29%					485				
								490			491.0': Sand is very weakly cemented.	100% water recovery.
	493.7 - 496.2'											
	2.5	1.7	68%					495				
	496.2 - 503.7'											
	7.5	1.0	13%					500			503.1-503.7': Wood and clayey lignite; dusty brown (5 YR 2/2)	
	503.7 - 511.8'										504.0': Sands are coarser grained, well sorted, porous, low density.	Easy drilling.
	8.1	6.4	79%					505			509.3-509.7': Some convoluted laminations @ 40°.	
								510			511.9-512.6 Gravelly, angular to subrounded and up to 1/2" in size.	
	511.8 - 521.8'				512.7							
	10.0	7.9	79%					515				

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BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	14 OF 16	VG-6

Column headings: SAMPLER TYPE AND DIAMETER; SAMPLER ADVANCE / LENGTH CORE RUN; SAMPLE RECOVERY / CORE RECOVERY; SAMPLE BLOWS "N" / PERCENT CORE RECOVERY; WATER PRESSURE TESTS (LOSS IN G.P.M.; PRESSURE P.S.I.; TIME IN MINUTES); ELEVATION (Ft.); DEPTH (Ft.); GRAPHIC LOG; SAMPLE; DESCRIPTION AND CLASSIFICATION; NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Sampler type and diameter: NQ CORE

Core run	Length core run	Core recovery	Percent core recovery
521.8 - 530.3'	8.5	8.5	100%
530.3 - 540.3'	10.0	7.9	79%
540.3 - 550.3'	10.0	8.9	89%
550.3 - 560.3'	10.0	9.7	97%

Core box	Interval
CORE BOX 28	to 529.9
CORE BOX 29	529.9 - 548.0
CORE BOX 30	from 548.0

Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes
-297.9	515	466.1-520.7': SAND: (cont)	Easy drilling.
		SHARP CONTACT	
-303.6	520.7	520.7-525.0': CLAY: Grayish black (N2), parting along bedding; silty, micaceous, moderately soft to moderately stiff; cohesive.	Drilling fluid color change to a very dark brown.
		GRADATIONAL CONTACT	
-307.9	525	525.0-532.7': CALCAREOUS SAND: Dark greenish gray (5 G 4/1) and greenish black (5 G 2/1), sand is very fine-to fine-grained, subangular to subrounded, moderately stiff, micaceous, clayey, silty. 526.2': Becomes calcareous.	100% water recovery.
		GRADATIONAL CONTACT	
-315.6	532.7	532.7-535.0': LIMESTONE: Very light gray (N8), fossiliferous, some voids, moderately hard.	Easy drilling.
		SHARP CONTACT	
-317.9	535	535.0-548.5': CLAY: Greenish black (5 G 2/1), moderately stiff to stiff, calcareous, thinly bedded, silty, micaceous. 540.3-544.3': Clayey silt, olive gray (5 Y 4/1) calcareous, weak, poorly cemented, micaceous. 548.4-548.5': Limestone nodule, very light gray (N8) moderately hard, sandy toward base of unit	2.6' core lengths.
		GRADATIONAL CONTACT	
-331.4	548.5	548.5-567.1': SAND: Dark greenish gray (5 G 4/1) to greenish-black (5 G 2/1), limestone nodules are light bluish gray (5 B 7/1); very fine-to medium-grained, subangular to subrounded sand grains, poorly sorted, limey sands, loose to well cemented limestone nodules, locally calcareous, silty, clayey, mottled, weathered.	100% water recovery.
	555		

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-6

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	15 OF 16	VG-6

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, Etc.
NQ CORE					CORE BOX 30		-337.9	556	548.5-567.1': SAND: (cont) 553.9': Unit becomes non-calcareous. 550.4-550.5': Limestone nodule. 550.6-550.7': Limestone nodule. 552.0-552.6': Limestone nodule.	1.5' core lengths.
	560.3 - 570.3'				563.0			560		100% water recovery.
	10.0	10.0	100%					565		
							-350.0	567.1	GRADATIONAL CONTACT 567.1-569.8': SANDY CLAY: Pale red purple (5 RP 6/2), stiff, mottled, weathered, moderately cohesive.	Easy drilling. Drilling fluid color change to a dark reddish brown.
							-352.7	569.8	GRADATIONAL CONTACT 569.8-584.8': CLAYEY SAND: Dark yellowish orange (10 YR 6/6), light-gray (N7), fine- to coarse-grained, subangular to subrounded grains, poorly sorted, moderately soft, loose, poorly cemented; mottled, weathered; sand is predominantly quartz and large muscovite particles with some feldspar, trace of a mafic mineral, trace of garnet. 579.1-580.3': Sandy clay, dark yellowish orange (10 YR 6/6) grayish red purple (5 RP 4/2), stiff, micaceous.	
	570.3 - 580.3'				CORE BOX 31			570		
	10.0	4.9	49%					575		
	580.3 - 584.7'							580		
	4.7	0.0	0%							
	584.7 - 594.7'						-367.7	584.8	GRADATIONAL CONTACT 584.8-586.9': SAND: Light gray (N7), very fine- to coarse-grained, subrounded to subangular, very poorly cemented, very loose, weak; poorly sorted, moderatley soft.	100% water recovery.
					587.4		-369.8	586.9	GRADATIONAL CONTACT 586.9-595.6': SANDY CLAY: Medium light gray (N6), very light gray (N8), grayish red purple (5 RP 4/2); moderately soft to stiff, very fine-to coarse-grained, mottled, weathered, hand breakable.	
	10.0	9.2	92%		CORE BOX 32			590		
								595		

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-6

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	16 OF 16	VG-6

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NQ CORE	594.7 - 604.7'						-377.9	595	586.9-595.6': SANDY CLAY (cont)	
							-378.5	595.6	SHARP CONTACT 595.6-597.7': SAND: Medium light gray (N6), very fine-to coarse-grained, subrounded to subangular, poorly sorted; loose, very poorly cemented, weak; silty, slightly clayey; sand is predominantly quartz with some feldspar, trace of a ferromagnesian mineral, trace of muscovite, trace of garnet.	Very fast drilling.
	10.0	9.3	93%		CORE BOX 32		-380.6	597.7		100% water recovery.
					603.9			600		
	604.7 - 614.7'							605	SHARP CONTACT 597.7-620.0': INTERBEDDED SANDY CLAY AND CLAY: Sandy clay is dusty yellow (5 Y 6/4), dark reddish brown (10 R 3/4), and medium light gray (N6); clay is pale red purple (5 RP 6/2), fine-to coarse-grained, thin to moderately bedded; moderately soft to moderately stiff, cohesive, mottled, weathered. Clay is very cohesive.	Sand in cuttings.
	10.0	0.0	0%		CORE BOX 33			610		
	614.7 - 616.7'							615		
	2.0	1.9	95%							
	3.3	3.3	100%		620.0		-402.9	620		100% water recovery.
									BOTTOM OF HOLE: 620.0' Hole was geophysically logged and an observation well was installed.	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-6

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	1 OF 10	VG-7

SITE	COORDINATES	ANGLE FROM HORIZ.	BEARING
POSTULATED MILLETT FAULT	N 1127245.595 E 640322.371 (GA)	90°	N/A

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH
6/2/82	6/16/82	Law Engineering	Failing 1500	NQ Core 5-7/8" Rm	---	---	392.0'

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
194.0/56%	13	---	---	216.7	---	---

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
---	---	W. P. Thackaberry/S. Balone

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N"	Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes
S.S.	1.5	1.4					
	1.5	1.2					
	1.5	1.2					
	1.5	1.4					
	0.8	0.8					
	1.5	1.3					
	1.5	1.3					
	1.5	1.5					
	1.5	1.4					
	1.5	1.2					
	1.5	1.4					
	1.5	1.1					
	1.5	1.4					
	1.5	1.3					
	1.5	1.0					
	1.5	1.0					
	1.5	1.1					
	1.5	0.9					
	1.5	0.9					
	1.5	1.2					
	1.5	0.8					
	1.5	1.0					
	1.5	1.0					
	1.5	1.1					

CORE BOX 1 0-17.3'

CORE BOX 2 17.3-38.3'

Elevation (Ft.)	Depth (Ft.)
216.7	0
210.7	6.0
197.9	18.8
195.2	
194.2	
188.3	
187.4	
184.2	

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35

DESCRIPTION AND CLASSIFICATION

0-6.0': SAND: Fine-to medium-grained quartz.

0-0.9': Dark yellow brown (10 YR 4/2), soft, moist.

0.9-3.0': Gray orange (10 YR 7/4), firm, moist (little coarser than above).

3.0-6.0': Moderate yellow brown (10 YR 5/4), firm, wet.

6.0-93.0': CLAYEY SAND: Weathered fine to medium-grained, weakly cemented.

6.0-6.8': Light brown (5 YR 5/6), moderate reddish brown (10 R 4/6), mottled, stiff to very stiff.

6.8-9.8': Same colors, more dense than material above.

9.8-11.3': Little light gray clayey sand (kaolin + quartz sand) (N 8).

11.3-12.8': Moderate reddish brown (10 R 4/6), very stiff to hard.

12.8-14.3': Moderate reddish brown (10 R 4/6), very stiff, slightly micaceous.

14.3-18.8': More micaceous.

18.8-21.5': Silty sand, moderate reddish brown (10 R 4/6), little clay, slightly coarser than above, few spots of grayish red purple (5 RP 4/2), clay spots, lamination of white clayey sand.

21.5-22.5': Clayey sand, grayish red (10 R 4/2), medium-to fine-grained, quartz.

22.5-28.4': Sand, various colors, fine-to medium-grained, soft, wet.

22.5-23.3': Moderate red-orange (10 R 6/6), dark yellow orange (10 YR 6/6), silty, few light gray clayey laminations.

23.3-24.8': Moderate orange pink (10 RP 7/4), and moderate red (5 R 4/6), pinkish gray (5 YR 8/1), clay lense at 24'.

24.8-28.0': Medium orange pink (10 R 7/4), little silt.

28.0-28.4': Light gray laminations (kaolin), then pink to light brown (5 YR 5/6) silty sand.

28.4-29.3': Clay, pale red purple (5 RP 6/2), very light gray (N8), moderate reddish brown (10 R 4/6), thinly bedded, micaceous, stiff.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

0'-41.3': Drilling with E-Z Mud.

41.3-63.3': Drilling with E-Z Mud, quick-trol, diesel.

24.8-27.8': Noticeable water loss.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-7

H&CF 19-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	2 OF 10	VG-7

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	CORE BOX
S.S.	1.5	1.3			CORE BOX 2
	1.5	1.0			
	1.5	1.5			
	1.5	1.3			
NQ Core	41.3 - 43.3' 2.0	0		0%	CORE BOX 3
	43.3 - 53.3' 10.0	1.8		18	
	53.3 - 63.3' 10.0	1.0		10%	
	63.3 - 73.3' 10.0	0.8		8%	
	73.3 - 83.3'				

ELEVATION (Ft.)	DEPTH (Ft.)
	35
177.7	39
176.4	40
	45
	50
	55
	60
153.7	63
	65
	70
	75

DESCRIPTION AND CLASSIFICATION

6.0-93.0 CLAYEY SAND (con't)

29.3-32.5': Silty sand.

29.3-29.9': Moderate reddish brown silt, very light gray clay (N 8), with fine, medium and coarse quartz sand (moderate brown) laminated or thinly bedded.

29.9-32.5': Light olive gray silty clay (5 Y 5/2), micaceous with pale red (10 R 6/2), fine silty sand, laminated.

32.5-39.0': Silty sand, medium to fine grain, quartz.

32.5-32.9': Dark yellow orange (10 YR 6/6)

32.9-33.2': Moderate reddish brown & pale red.

33.8-34.0': Sandy silt, pale red, soft.

34.0-39.0': Silty sand, little clay, pale red, moderate reddish brown & grayish red, stiff laminations.

39.0-40.3': Silty fine sand, pale red purple, (5 RP 6/2), thinly bedded.

40.3-63.0': Silty fine sand.

40.3-43.3': Dark yellow orange (10 YR 6/6), thinly bedded.

43.3-53.3': Dark yellow orange and pale red (cuttings) slightly micaceous, stiff, few quartz grains visible.

53.3-63.0': Dark yellow orange (10 YR 6/6), firm, moist.

63.0-93.0': Silty sand, dark yellow orange (10 YR 6/6), fine to medium grained sand with carbonaceous granular laminations.

72.9-83.3': (10 YR 5/4)

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

6/2/82

6/3/82

53.3-63.3': Water loss noted. Hole collapsed after pulling rods up to retrieve core.

6/3/82
6/4/82
6/8/82

63.3-73.3': 10% return water.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-7

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT: VOGTLE ELECTRIC GENERATING PLANT | JOB NO.: 9510 | SHEET NO.: 3 OF 10 | HOLE NO.: VG-7

Sampler type and diameter	Sampler advance / length core run	Sample recovery / core recovery	Sample blows "N"	Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ Core	73.3 - 83.3'							141.7	75	6.0-93.0 SILTY CLAYEY SAND (con't)	
	10.0	0.5		5%					80		Hole caved before run 83.3-93.3': rods sandlocked severely. Removed all rods.
	85.0 - 93.0'								85		6/9/82 Reamed hole with 3-7/8" roller bit with recirculating E-Z Mud & Quik-Gel bentonite. Installed 3" casing to 85.0 ft., resumed coring. No recovery 85.0-93.0' due to drillers trying to bang the overshot out of outer barrel.
	8.0	0		0%					90	SHARP CONTACT	
	93.0 - 103.0'							123.7	93.0	93.0-133.4': SILT: Yellow-gray (5 Y 7/2), locally very fine, sandy, dense, grades less sandy below top of run. Calcareous below 99.9', partially consolidated, trace of clay.	93.0-103.0': Full water return.
	10.0	5.5		55%					95		
						CORE BOX 3 & 38.3			100		103.0-113.0': Full water return.
	103.0-113.0'								105		
	10.0	6.6		66%					110		
	113.0 - 123.0'					CORE BOX 4		101.7	115		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT | HOLE NO.: VG-7

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	4 OF 10	VG-7

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ Core	113.0 - 123.0'				CORE BOX 4		101.7	115	93.0-133.4': SILT (con't) Silt becoming more consolidated with depth. Locally mottled pink coloration.	113.0-123.0': Full water return. Driller reports harder drilling 122.0-123.0'.
	10.0	9.7	97 %		122.2			120		
	123.0 - 133.0'							125	Sand fraction becomes coarser - (fine-grained). Silt interbedded with hard silty clay, pale olive (10 Y 6/2), and black carbonaceous laminations nearly horizontal. Calcareous throughout, partially consolidated.	123.0-133.0': Full water return.
	10.0	9.7	97%					130		
	133.0 - 143.0'				CORE BOX 5		83.3	133.4	133.4-136.7': SILT. Fine- to medium grained, sandy, calcareous, fossiliferous, hard to medium hard, locally Fe-stained, yellowish gray (5 Y 8/1).	133.0-143.0': Full water return.
					137.0			135		
	10.0	6.3	63%				80.0	136.7	136.7-137.0': Claystone, medium soft (5 Y 7/2) 137.0-137.1': Claystone, soft, (5 G 4/1) 137.1-137.7': Claystone, soft (10 Y 6/2), fossiliferous, locally sandy.	
								140	137.7-144.7': LIMESTONE: Yellowish gray (5 Y 7/2), hard to locally uncemented, medium sandy silt matrix, fossiliferous.	143.0-153.0': 80% water return.
	143.0 - 153.0'							144.7		
							72.0	145	144.7-167.7': SAND: Silty, fine grained, loose to locally cemented (medium hard), fossiliferous, yellowish gray (5 Y 7/2).	
	10.0	5.2	52%					150		
	153.0 - 163.0'				CORE BOX 6		61.7	155		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-7

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	5 OF 10	VG-7

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NQ Core	153.0 - 163.0'						61.7	156	144.7-167.7': SAND (con't)	153.0-163.0': Full water return.
	10.0	8.0	80%		161.3 CORE BOX 6			160	163.8-164.8': Interbed of sand, fine grained, loosely consolidated, dark greenish gray (5 G 4/1).	
	163.0 - 173.0'							165		163.0-173.0': ≈ 90% water return.
	10.0	6.5	65%				49.0	167.7	167.7-173.0': CLAYEY SILT: Greenish gray. (5 GY 6/1), some fine sand, large fossil shells, stiff to hard.	
								170		173.0-183.0': ≈ 90% water return.
	173.0 - 183.0'						43.7	173	173.0-181.3': SAND: Fine-to medium-grained, fossiliferous, loosely consolidated to locally well cemented and hard (limestone), occasional 5 mm. vugs.	
	10.0	8.3	83%		181.3 CORE BOX 7			175, 180		
							35.4	181.3	181.3-187.4': CLAY AND SILT: Greenish gray (5 GY 6/1), laminated to thinly interbedded, (horizontal), lenses and thin beds of very fine sand, stiff to hard, calcareous.	
	183.0 - 192.0'							185		183.0-192.0': ≈ 80% water return.
	9.0	9.0	100%				29.3	187.4	187.4-198.7': SAND: Greenish gray (5 GY 6/1), fine-to medium-grained, calcareous, locally clayey, well consolidated to moderately well cemented (N 7.5).	
								190	193.9-198.7': Greenish gray (5 GY 7/1), silty, medium-grained sand, salt and pepper appearance.	
	192.0 - 202.0				CORE BOX 8		21.7	195		

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-7

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	6 OF 10	VG-7

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ Core	192.0 - 202.0 10.0	8.0	80		196.4		21.7	195	187.4-198.7': <u>SAND</u> (con't):	192.0-202.0': Full water return.
NQ Core	202.0 - 208.5' 6.5	5.8	89%				18.0	198.7	198.7-211.6': <u>LIMESTONE</u>: Greenish gray (5 GY 7/1), <u>very fine</u> sandy silt matrix, very hard, fossiliferous, vuggy, vugs increase with depth, locally weathered to clay. Distinct, nearly horizontal lower contact.	202.0-208.5': ≈ 50% return water. Changed to diamond impregnated core bit at top of this run.
NQ Core	208.5 - 213.0' 4.5	4.1	91%						SHARP CONTACT	208.5-213.0': 25% water return.
NQ Core	213.0 - 223.0' 10.0	0	0%		CORE BOX 9		5.1	211.6	211.6-225.0': <u>CLAYEY SILT</u>: Greenish gray (5 GY 6/1), calcareous, consolidated, partially cemented. Core loss in bottom of run - softer material.	213.0-223.0': Attempted twice unsuccessfully to retrieve core. Pulled rods and casing, reamed to 225.0', reset casing to 225.0'. Roller bit 3" to 225.0'.
RB 3"	223.0 - 225.0' 2.0	0	0%		225.8					
NQ Core	225.0 - 234.0' 9.0	9.0	100%		CORE BOX 10		-8.3	225	225.0-282.7': <u>CALCAREOUS SILTSTONE (MARL)</u>: Irregular and convoluted very fine sand lenses throughout, fossiliferous, medium soft, moderately strong, breaks along nearly horizontal planes, dark green gray (5 GY 5/1), gradational lower contact.	
							-18.3	235		

Depth scale: 195, 200, 205, 210, 215, 220, 225, 230, 235

SS = SPLIT SPOON; SY = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-7

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	7 of 10	VG-7

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ Core	234.0 - 244.0'				240.2 CORE BOX 10		-18.3	235	225.0-282.7': CALCAREOUS SILTSTONE (MARL) (con't) : Silty, medium soft, calcareous, occasional fossil shells, irregular lenses of very fine sandstone as above, lighter colored and harder than remainder, bed of silty limestone.	234.0-244.0': Full water return.
	10.0	10.0	100 %					240	242.8-243.1': Hard, dense, dark green-gray (5 GY 5/1).	
	244.0 - 254.0'							245	Sandstone lenses increase with depth.	244.0-245.0': Full water return. Core retrieved in pieces up to 6' long without breaks.
	10.0	10.0	100 %		255.1 CORE BOX 11			250		
	254.0 - 264.0'							255	Grading to siltstone, clay or very fine sand locally, calcareous, dark green gray (5 GY 5/1), soft to medium hard.	254.0-264.0': Full water return.
	10.0	10.5	105 %					260	258.5': Polished, striated fracture at 60° dip. Rock is intact.	
	264.0 - 274.0'				268.8 CORE BOX 12			265	Grading back to silty claystone, color grades from (5 GY 5/1) to (10 Y 5/2) gray olive. Numerous irregularly shaped very fine-grained sandstone blebs, convoluted bedding.	264.0-274.0': Full water return.
	10.0	10.0	1[illegible]					270	265.7-265.9': Black carbonaceous material, earthy odor, ovoid clasts of surrounding claystone. Woody texture.	
					CORE BOX 13		-58.3	275		

SA[illegible] ... SHELBY TUBE; D ... [illegible]ER: O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-7

H?CF 19[illegible]

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	8 OF 10	VG-7

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Graphic log	Sample	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ CORE	274.0 - 284.0'						-58.3	275			225.0-282.7': CALCAREOUS SILTSTONE (MARL) (con't):	274.0-284.0': Full water return.
	10.0	10.0	100%		284.0 CORE BOX 13			280				
							-66.0	282.7			282.7-286.5': FOSSIL SHELLS: Greenish gray (5 GY 6/1), well compacted, moderately well cemented, locally very sandy matrix.	
	284.0 - 294.0'							285				284.0-294.0': 50% water return.
							-69.8	286.5			286.5-372.0': SAND: Greenish gray (5 GY 6/1), silty, very fine to fine grained, poorly graded, loose to very dense and well compacted, calcareous, scattered fossil shell fragments, trace clay.	
	10.0	2.5	25%					290				
	294.0 - 304.0'											294.0-304.0': 75% water return.
								295			295.2-296.3': Bed of moderately well cemented fossil shells.	
	10.0	4.2	42%					300				
	304.0 - 314.0'							305			306.9-307.7': Moderately well cemented bed of fossil shells.	304.0-314.0': 75% water return.
	10.0	7.8	78%					310				
							-98.3	315				

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SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-7

H&CF 19-2

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	9 OF 10	VG-7

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	314.0 - 324.0'						-98.3	315			286.5-372.0: SAND: (con't) Scattered shell fragments.	314.0-324.0': 75% water return.
	10.0	3.8	38%					320				
	324.0 - 334.0'						-107.3	325			324.0-372.0: SAND: Greenish gray (5 GY 5/1) some silt, very loose, medium grey, non-calcareous, occasional coarse grains, fairly clean quartz, sand, sub angular, poor to moderate sphericity.	324.0-334.0': Full retürn water. Pump back-pressure required by pass of some water circulation.
	10.0	0.0	0%					330				
	334.0 - 344.0'							335				334.0-344.0': Full water return - high pump back-pressure again, trace of very fine grained sand in return water.
	10.0	0.0	0%					340				
	344.0 - 354.0'							315				344.0-354.0': Full water return.
	10.0	0.0	0%				-138.3	350 355				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-7

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	10 OF 10	VG-7

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
NQ CORE	354.0 - 362.0'						-138.3	355	286.5-372.0' SAND: (con't)	354.0-362.0': Full water return.
	8.0	7.7	96%							
	362.0 - 372.0'									362.0-372.0': Full water return.
	10.0	1.0	10%						371.8-372.0': Silty clay, very stiff to hard, non-clacareous, trace fine gravel, little fine sand (quartz), dark greenish gray (5 GY 4/1).	
	372.0 - 382.0'						-155.3		372.0-375.0': CLAYEY MEDIUM SAND: Dark greenish gray (5 GY 4/1) some gravel (quartz) some silt, well compacted.	372.0-382.0': Full water return.
	10.0	7.5	75%				-158.3	375	375.0-392.0': CLAY: Hard, multi-colored, dry to moist, very well compacted, fractured from 0° to 90°, commonly at 60° and 6" spacing. All fractures have polished, striated faces. Occasionally fine to coarse quartz sand, nodules of FeO in yellow brown clay. Talcose? 375.0-379.1': Light blue gray (5 B 6/1) 391.1-382.0': Moderate yellow brown (10 YR 54)	
	382.0 - 392.0'								382.0-392.0': Dusky yellow (5 Y 6/4)	382.0-392.0': Full water return.
	10.0	3.2	32%				-175.3			
									TOTAL DEPTH - 392.0'	

Depth scale: 355, 360, 365, 370, 375, 380, 385, 390, 395

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-7

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	1 OF 9	VG-8

SITE	COORDINATES	ANGLE FROM HORIZ.	BEARING
POSTULATED MILLETT FAULT	N 1104446.338 E 678744.091(GA.)	90°	---

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH
6/14/82	6/23/82	Alabama Power	Joy 22	NQ-3	207.3	148.1	355.4'

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
191.0/55%	13	---	---	103.7	See Observation Well	

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
N/A	None	R. J. Kelleher/S. Balone

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.) 103.7	DEPTH (Ft.)	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
Rotary Drilled								0		0.0-20.2': SAND: Light brownish gray (5 YR 6/1), pinkish gray (5 YR 8/1), dark yellowish orange (10 YR 6/5), pale yellowish brown (10 YR 6/2), very fine-to fine-grained, subrounded to subangular, well sorted, clayey, silty, soft to moderately soft, weak, friable, trace of organics.	Drilled with Quik-Gel, Baroid and Easy Mud.
NQ CORE	10.0-20.0'							10			100% water recovery.
	10.0	0.7	7%			CORE BOX 1		15		19.4-19.9': Sandy clay.	
	20.0-30.0'						83.5	20.2		20.2-40.0': FOSSILIFEROUS SAND: Moderate yellowish brown (10 YR 5/4), pinkish gray (5 YR 8/1), clayey, silty, very fine-to coarse-grained, subrounded to subangular, poorly sorted, moderately soft to moderately hard, moderately well cemented, calcareous, tight, mottled, weathered, oyster shell fragments.	
	10.0	4.2	42%					25			Easy drilling.
	30.0-40.0'							30			
	10.0	1.9	19%				68.7	35			

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT — HOLE NO. VG-8

H&CF 19-1

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	2 OF 9	VG-8

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								68.7	36	20.2-40.0': FOSSILIFEROUS SAND: (Cont)	
										SHARP CONTACT	100% water recovery.
	40.0-45.1'							63.7	40	40.0-69.1': SAND: Light bluish gray (5 B 7/1), medium bluish gray (5 B 5/1), dark greenish gray (5 B 4/1), very fine-to fine-grained, subrounded to subangular, cohesive and poorly cemented, calcareous, tight, thin dark convoluted laminations (0°-5°), micaceous. Sand is predominantly quartz, trace of feldspar, trace of ferromagnesian minerals, trace of organics. Some light gray horizontal laminations.	
	5.1	4.6		90 %		CORE BOX 1					
	45.1-55.1'								45	42.2': Sharp color change to medium bluish gray (5 B 5/1).	
						48.5					
	10.0	10.0		100 %					50		Casing set at 50'.
											1-2.2' core length.
	55.1-65.1'								55		
NQ CORE	10.0	9.1		91 %		CORE BOX 2					Easy drilling.
									60		
						64.5					
	65.1-75.1'								65	Thin clay beds, dark greenish gray (5 B 4/1).	
										GRADATIONAL CONTACT	
						CORE BOX 3		34.6	69.1	69.1-73.8': FOSSILIFEROUS LIMESTONE: Light bluish gray (5 B 7/1), sandy, clayey, moderately soft to moderately hard, thin horizontal siltstone beds, numerous shell fragments, some convoluted (0°-5°). Light and dark laminations, softer and weaker where clayey and sandy, some voids, some mica in sand.	100% water recovery.
	10.0	10.0		100 %					70		
								29.9		72.5': Oyster shells; medium light gray (N-6).	
										73.8-79.9': INTERBEDDED FOSSILFEROUS SAND AND SILT:	
								28.7	75		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-8

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	3 OF 9	VG-8

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	75.1-85.1'					End Box 3; 79.3			75	73.8-79.9': INTERBEDDED FOSSILIFEROUS SAND AND SILT: Greenish gray (5 GY 6/1), light bluish gray (5 B 7/1), clayey, calcareous, soft to moderately soft, moderately well cemented, numerous shell fragments, very fine-to medium-grained, subrounded to subangular, thinly bedded.	Easy drilling.
	10.0	8.8		88%				23.8	79.9	GRADATIONAL CONTACT	
									80	79.9-95.8': CLAYEY SAND: Medium bluish gray (5 B 5/1), dark greenish gray (5 B 4/1), very light gray (N 8), very fine- to medium-grained, subrounded to subangular; calcareous, weak, friable, poorly cemented, moderately tight; sand is predominantly quartz with some feldspar, micaceous, trace of a ferromagnesian mineral, trace of organics; some shell fragments.	
	85.1-95.1'					CORE BOX 4			85		
	10.0	10.0		100%					90		
	95.1-105.1'					End Box 4; 95.5		7.9	95; 95.8	GRADATIONAL CONTACT	95' Hit artesian water pressure.
										95.8-110.3': INTERBEDDED FOSSILIFEROUS SAND AND SILT: Light gray (N-7), clayey, moderately soft to moderately hard, weak, friable, poorly cemented; thinly bedded; calcareous, micaceous. Sand is very fine- to medium-grained, subrounded to subangular, poorly sorted, sand is predominantly quartz, some dark ferromagnesian minerals, trace of garnet. Siltstone is clayey.	
	10.0	10.0		100%					100	102.1-103.7': Fossiliferous, limestone: light bluish gray (5 B 7/1).	100% water recovery
						CORE BOX 5				109.7-110.3': Mottled, weathered.	
	105.1-115.1'								105		
						End Box 5; 110.3			110; 110.3	GRADATIONAL CONTACT	
	10.0	10.0		100%				-6.6		110.3-117.8': FOSSILIFEROUS LIMESTONE: Light greenish gray (5 GY 8/1), very light gray (N 8), sandy, clayey, numerous voids, moderately soft to moderately hard, soft where clayey and sandy, some large shell fragments, sand is predominantly quartz with some ferromagnesian minerals.	100% water recovery.
								-11.3	115		

Graphic log:

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-8

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	4 of 9	VG-8

Sampler type and diameter	Sampler advance / Length core run	Sample recovery / Core recovery	Sample blows "N" / Percent core recovery	Water pressure tests: Loss in G.P.M.	Pressure P.S.I.	Time in minutes	Elevation (Ft.)	Depth (Ft.)	Description and classification	Notes on: water levels, water return, character of drilling, etc.
115.1-120.1'	5.0	3.8	76%				-11.3	116	110.3-117.8': FOSSILIFEROUS LIMESTONE (cont)	
							-14.1	117.8	GRADATIONAL CONTACT	Easy drilling.
120.1-125.1'	5.0	4.2	84%					120	117.8-143.6': SAND: Light olive gray (5 Y 6/1), greenish gray (5 GY 6/1), clayey, silty, calcareous, very fine- to medium-grained, angular to subrounded, weak, friable, poorly cemented, dense. Some small shell fragments, sand is predominantly quartz and a dark ferromagnesian mineral; micaceous.	
125.1-135.1'	10.0	0.0	0%					125, 130	135.2': Oyster shells	
135.1-143.6'	8.5	3.1	36%		End Box 6 142.9			135, 140	135.3': Color change to a greenish gray (5 G 6/1) and light olive gray (5 Y 5/2), some large shell fragments.	
							-39.9	143.6	GRADATIONAL CONTACT	100% water recovery
143.6-153.6'	10.0	9.6	96%					145, 150	143.6-222.2': CALCAREOUS SILTSTONE (MARL): Dark green gray (5 G 4/1), fresh, has nearly horizontal and frequently convoluted laminae delineated by small shell fragments, calcareous streaks, and fine grains. Weak to stiff, core lengths often length of run. Locally clayey or sandy (fine sand), numerous 0.2-0.6' limestone beds.	Harder drilling.
153.6-163.6'							-51.3	155		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-8

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	5 OF 9	VG-8

Sampler Type and Diameter	Sampler Advance / Length Core Run	Sample Recovery / Core Recovery	Sample Blows "N" / Percent Core Recovery	Water Pressure Tests: Loss in G.P.M.	Pressure P.S.I.	Time in Minutes	Elevation (Ft.)	Depth (Ft.)	Description and Classification	Notes on: Water Levels, Water Return, Character of Drilling, etc.
NQ CORE	153.6-163.6'				End Box 7 159.0		-51.3	155	143.6-222.2': CALCAREOUS SILTSTONE (MARL): (Cont)	100% water recovery.
	10.0	10.0	100%					160		Drilling with higher rpm's.
	163.6-173.6'				CORE BOX 8			165		2.3' Core length.
	10.0	8.1	81%					170		Easier drilling.
	173.6-182.4'				175.4			175		
	8.8	8.3	94%					180		100% water recovery.
	182.4-192.4'				CORE BOX 9			185		2.5' Core length.
	10.0	9.5	95%		190.0			190		
	192.4-194.4'				CORE BOX 10					
	2.0	1.7	85%				-91.3	195		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO.: VG-8

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	6 OF 9	VG-8

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N" / PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NO CORE	194.5-203.4' 9.0	6.2	69%				-96.3	200	143.6-222.2': CALCAREOUS SILTSTONE (MARL): (Cont) Dark green gray (5 G 4/1), fresh, has nearly horizontal, and frequently convoluted laminae delineated by small shell fragments, calcareous streaks, and fine grains. Weak to stiff, core lengths often length of run. Locally clayey or sandy (fine sand), numerous 0.2-0.6' limestone beds.	100% water recovery.
	203.4-212.9' 9.5	9.5	100%		End Box 10 207.8			205		3.2' core length.
								210		Easier drilling.
	212.9-222.4' 9.5	9.2	97%		CORE BOX 11 222.4		-118.5	215 220 222.2		
	222.4-230.1' 7.7	7.6	99%				-121.1	224.8 225	222.2-224.8': LIMESTONE: Greenish gray (5 GY 6/1), very hard, dense, very well cemented, fossiliferous, trace pyrite (?) x'tals, very fine grained matrix. 224.8-240.1': LIMESTONE: Yellow with gray, (5 Y 8/2), cemented shells (moderately well cemented), very little fine sand matrix, dense, vuggy.	
	230.1-240.1' 10.0	3.1	31%		CORE BOX 12		-136.3	230 235 240		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-8

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	7 OF 9	VG-8

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)
NQ CORE	240.1-250.1'							-136.3	240
	10.0	3.1		31%		End Box 12 251.0			240.1
	250.1-257.5'					CORE BOX 13			
	6.4	2.7		42%					
	257.5-265.0'								
	7.5	0.6		8%					
	265.0-275.0'								
	10.0	0.5		5%					
	14.5 minutes								
	275.0-285.0'							-171.3	275
	See Sheet 8							-175.6	279.3

DESCRIPTION AND CLASSIFICATION

240.1-275.0': <u>SAND WITH INTERBEDDED LIMESTONE</u>: Light olive gray (5 Y 7/1), sand is clean, fine-to medium-grained, very dense, slightly cemented, calcareous, 0.5 mm shell fragments (few to locally abundant).

250.1-251.0': Limestone is cemented shells with fine to medium sand matrix, moderately well cemented, medium soft.

264.4-2)': Limestone, light olive gray (5 Y 6/1), very hard, well cemented, dense, vuggy, fossiliferous, very fine-grained sand matrix.

275.0-279.3': <u>SILTY SAND</u>: Gray-olive (10 Y 4/2), fine-grained, calcareous, uncemented, dense, occasional shell fragments, well graded. 1/4" thick bed of carbonaceous material and oil film (natural) at 276.2'.

279.3-281.2': <u>SILTY SAND</u>:

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Full water return.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-8

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	8 OF 9	VG-8

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE / LENGTH CORE RUN	SAMPLE RECOVERY / CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	275.0-285.0' 10.0	8.2		82%		CORE BOX 13		-176.3 / -177.5	280 / 281.2			279.3-281.2': <u>SILTY SAND</u>: Light olive gray (5 Y 5/2), fine-grained, moderately well cemented, dense, numerous shell fragments, occasional carbonaceous material, gradational lower contact.	50% to 75% water return.
	285.0-290.0' 5.0	0.2		4%				-181.3	285 / 285.2			281.2-285.1': <u>LIMESTONE</u>: Light olive-gray (5 Y 5/2), well cemented, dense, hard to very hard, fossiliferous, fine sand and silt matrix, vuggy.	
	290.0-295.0' 5.0	0.0		0%					290			285.1-285.2': <u>CLAYEY SAND</u>: Light olive gray (5 Y 6/1), fine-grained, some silt, well graded, loose, calcareous.	
	295.0-305.0' 10.0	0.0		0%					295 / 300			285.2-335.0': No further recovery to depth of 335.0'; artesian pressure and caving of bore wall required use of a heavy mud to stabilize hole; this mud also carried away sand or sand and silt deposits in the core not recovered; probable stratigraphy in the zone from 285.2 to 343.0 is a silty fine sand with occasional thin beds or stringers of limestone.	
	305.0-315.0' 10.0	0.0		0%					305 / 310				80% to 100% water return.
	315.0-325.0' See Sheet 9							-216.3	315 / 320				

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
POSTULATED MILLETT FAULT	VG-8

H&CF 19-2

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
VOGTLE ELECTRIC GENERATING PLANT	9510	9 OF 9	VG-8

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N" PERCENT CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES	ELEVATION (Ft.)	DEPTH (Ft.)	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
NQ CORE	315.0-325.0' 10.0	0.0	0%				-216.3	320			285.2-335.0': (No further recovery) (cont)	Full water return.
	7 minutes											
	325.0-335.0' 10.0	0.0	0%					325			When sand-locked core barrel was pulled from hole, the "locking" material was coating the annulus between the inner and outer core barrels: Silty fine sand: Light olive-gray (5 Y 5/2), calcareous.	Full Water return.
	9 minutes							330				
	335.0-345.0' 10.4	1.4	13%					335			335.0-336.4': LIMESTONE: Olive gray (5 Y 5/2), fine sand and silt matrix, vuggy, well cemented, dense, hard to very hard, fossiliferous.	Full water return, changes from gray to red at 343'. Driller reports top of clay at 343 ft.
							-239.3	343.0			343.0-355.4: CLAY: Multi-colored, dark reddish brown (10 R 3/4), white (N9), pinkish red (5 R 6/4), medium yellow-brown (10 YR 5/4), hard, moderately strong, mottled, non-calcareous.	
	25 minutes							345				
	345.0-355.4' 10.0	0.9	9%		End Box 13			350				
	30 minutes				355.4		-251.7	355 355.4			TOTAL DEPTH: 355.4' Electric resistivity, natural gamma and neutron logs performed; hole completed as observation well.	
								360				

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SITE: POSTULATED MILLETT FAULT

HOLE NO. VG-8

Georgia Power Company

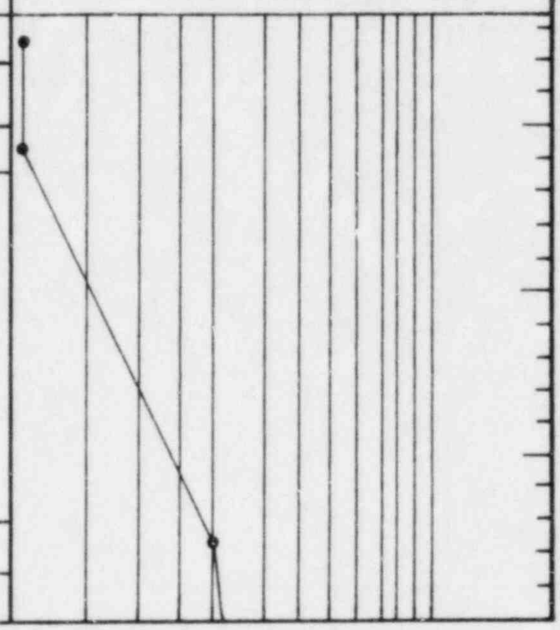
PROJECT Screven County

HOLE NO. B-33
SHEET 1 OF 7

DRILLING LOG

LOCATION Georgia State Grid 1,077,625N 691,510 E River Road (S1321) at Rocky Creek (2 miles north Hwy. 301)
CONTRACTOR Hastings DRILLER Green
GROUND ELEV. 95 OVERBURDEN DEPTH 5.1 TOTAL BORING DEPTH 273.2
ELEV. WATER TABLE ____ DRILLING START 06/09/72 COMPLETE 06/23/72
NO. CORE BOXES 9 LOGGED BY G. S. Grainger (GPC) P. Huddlestun (GGS)

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS (0 5 10 20 40 60 80 100)
95	0.0		Ground Surface			
			Tan loose silty fine sand with pea gravel lenses			
89.9	5.1		Gray to brownish gray very hard silicified limestone (boulder)	1.5/3.0	Box 1	Started coring NQWL
86.0	9.0		Brown very soft silty clay with rock fragments. Grades to clayey fine sand at bottom	0.3/5.0		
				0/4.5		Started split spoon sampling
					1	
					2	
70.0	25.0		Light tan firm to dense clean fine quartz sand			
					3	



UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

T1140-2070-3

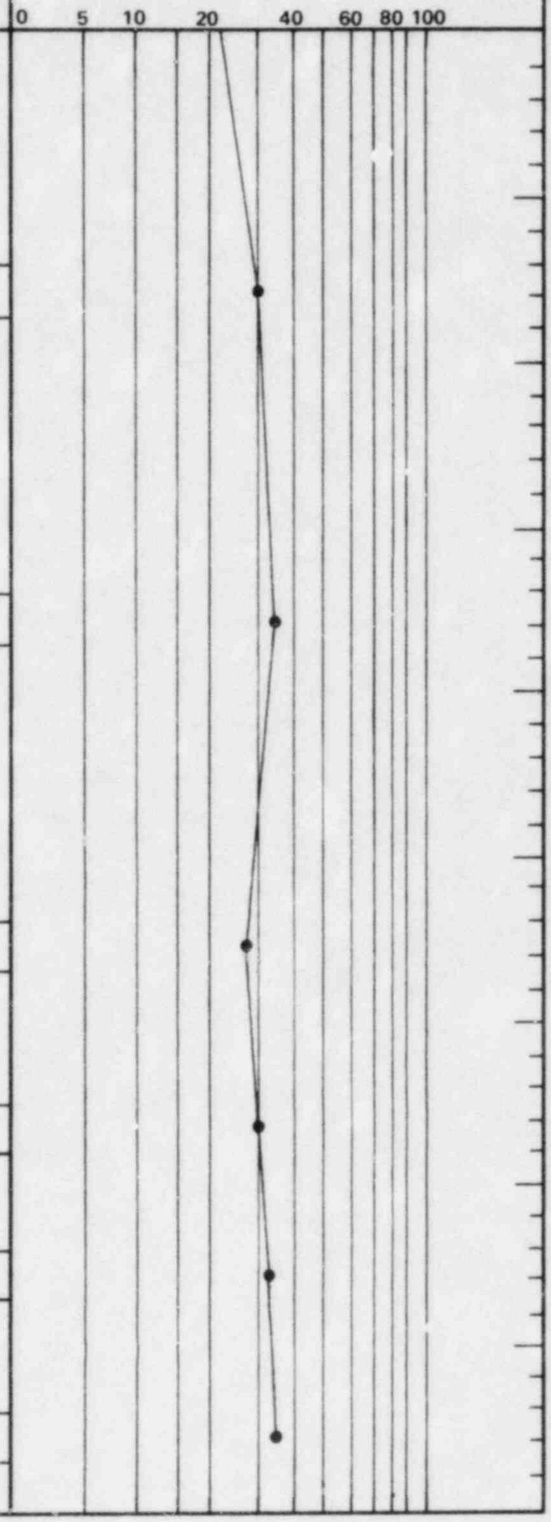
Georgia Power Company

PROJECT Screven County

HOLE NO. B-33
SHEET 2 OF 7

DRILLING LOG

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS
60.0	35.0					
					4	
50.0	45.0		Light tan firm to dense clean fine quartz sand.			
					5	
40.0	55.0					
					6	
30.0	65.0					
					7	
					8	
20.0	75.0					
					9	



UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

Form No. 9-797

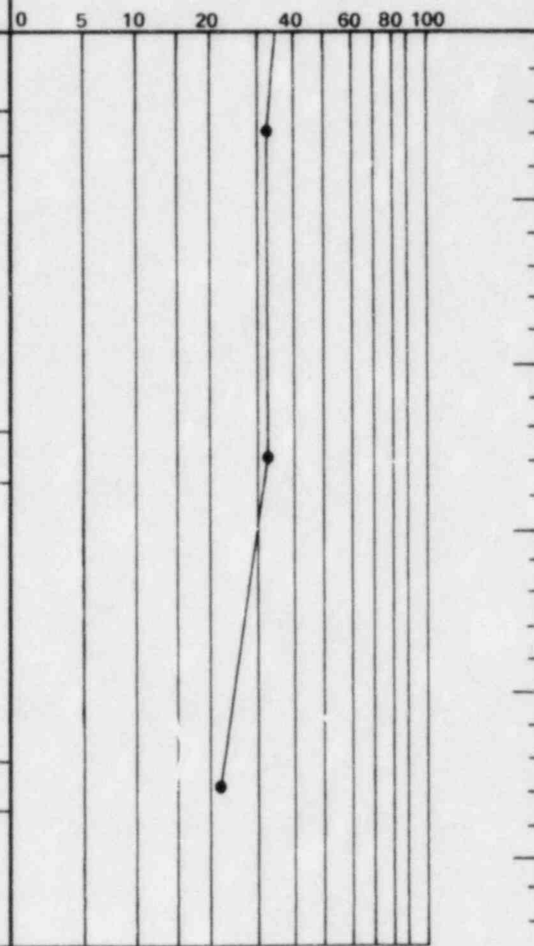
Georgia Power Company

PROJECT Screven County

HOLE NO. B-33
SHEET 3 OF 7

DRILLING LOG

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS
15.0	80.0		Light tan firm to dense clear fine quartz sand.		10	
5.0	90.0		Light grey firm to dense calcareous fine quartz sand trace of mica		11	
					12	
-12.6	107.6			5.6 / 5.6 100%	Box	
-15.0	110.0		Grey medium to coarse textured slightly argillaceous sandy calcarenite limestone slightly consolidated in upper part, soft unconsolidated in lower part		1	Contains small branching bryozoans
				4.4 / 10.0 44%		
-25.0	120.		Dry Branch FM griffins landing mbr.			



■ UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

HOLE NO. B-33 SHEET 3 OF 7

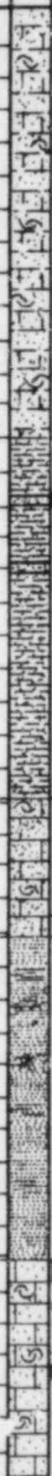
Form No. 9-797

Georgia Power Company

PROJECT Screven County

HOLE NO. B-33
SHEET 4 OF 7

DRILLING LOG



ELEV. -30.0	DEPTH 125.0	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS (0 5 10 20 40 60 80 100)
			57%	Box	
			0.0/5.0	1	
-40.0	135.0	Dry Branch FM Griffins Landing Mbr.	1.3/5.0 26%		
		Thinly bedded laminated silty micareous shaley clay with some thin beds of sandy lime-stone and calcareous sand-stone, some thin beds or laminae of silt or sand	3.9/5.0 78%	2	
		Dry Branch FM Twiggs Clay lithologies	8.2/10.0 82%		
-53.8	148.8	Rubbly ~extured, coarse, calcarenitic sandstone; fossiliferous sandy calcarenitic limestone bioclastic			
-58.2	153.2	Clinch Field rm _ Utley L.S. Some fine dense sandstone and bits of shaley clay	0.6/10.0 6%	3	
-68.2	163.2	Massive indurated sandy glauconitic fossiliferous limestone even textured moldic in upper part, rubbly poorly sorted bioclastic in lower part.	5.7/10.0 57%		163.2-164.0 - Coarse casts and molds

UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

Form No. 9-797

Georgia Power Company

PROJECT Screven County

HOLE NO. B-33
SHEET 5 OF 7

DRILLING LOG

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS (0 5 10 20 40 60 80 100)
-75.0	170.0		Clinch field FM Utley Limestone Mbr.	57%	Box	
	175.5		Indurated, mdedium grained, bioclastic rubbly calcarenitic limestone with intervals of unconsolidated calcarenite and alot of pelletal or equi-demensional bioclastic material poor sorting on a fine scale due to apparent lutitic materix	8.4/10.0	3	177.0-178.5 Coarse casts and molds
-85.0	180.0					183.2 Encountered artesian aquifier. Flow rate approx. 3 GPM
				10.0/10.0 100%	Box 4	
-95.0	190.0					Clay like and finer-grained at depth
				10.0/10.0 100%		191.0-193.2 - Medium to coarse sheel fragments
-105.0	200.0		Unnamed Lisbon FM equivalent limestone-possibly santee limestone equivalent		Box 5	
				9.7/10.0 97%		203.0 - 204.0 Medium to coarse shell fragments
-115.0	210.0				Box 6	205.0-209.0- Grey green compact shell limestone appears to O. Sellaeformis and C. Cocoana

UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

Form No. 9-797

Georgia Power Company

PROJECT Screven County

HOLE NO. B-33
SHEET 6 OF 7

DRILLING LOG

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS (0 5 10 20 40 60 80 100)
-120.0	215.0					
				10.0 / 10.0 100%	Box 6	
-125.0	220.0					
				10.0 / 10.0 100%	Box 7	
-135.0	230.0		Indurated, medium grained, bioclastic rubbly calcarenitic limestone			
				10.0 / 10.0 100%		
-145.0	240.0					
			Unnamed Lisbon FM equivalent limestone possibly santee limestone equivalent	10.0 / 10.0 100%	Box 8	
-155.0	250.0					
				10.0 / 10.0 100%	Box 9	
-165.0	260.0					

UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

HOLE NO. B-33 SHEET 6 OF 7

Form No. 9-797

Georgia Power Company

PROJECT Screven County

HOLE NO. B-33
SHEET 7 OF 7

DRILLING LOG

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS (0 5 10 20 40 60 80 100)
-165.0	260.0					
	262.5				Box	
			Massive bedded, micaceous silty very calcareous clay Marl with sparse glauconite Lisbon FM Blue Bluff Mbr.	4.0 / 10.0	9	
-178.2	273.2		Hole terminated.			

UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

Form No. 9-797

Georgia Power Company

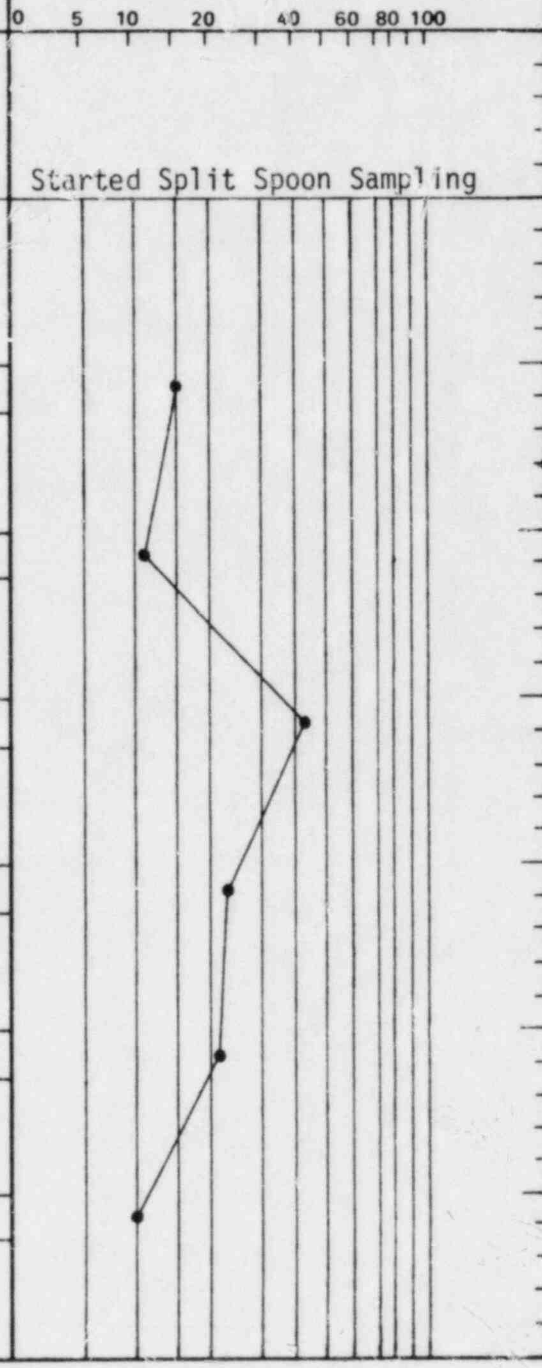
PROJECT: Screven County

HOLE NO. B-34
SHEET 1 OF 7

DRILLING LOG

LOCATION: GA state Grid N 1,094,300 E 683,750 1.35 miles outh of Stoney Bluff Road along River Road (SI321)
CONTRACTOR: Hastings
DRILLER: Green- Morton
GROUND ELEV.: 182.0
OVERBURDEN DEPTH: 141.5
TOTAL BORING DEPTH: 273.3
ELEV. WATER TABLE:
DRILLING START: 07/10/82
COMPLETE: 07/18/82
NO. CORE BOXES: 5
LOGGED BY: G. S. Grainger, SCS, P. Huddlestun (GGS)

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS
182.0	0.0		Ground Surface			Started Split Spoon Sampling
			Light tan firm slightly silty fine sand		1	
174.0	8.0		Light brown stiff slightly sandy clay with small pebbles of cemented sand		2	
169.5	12.5		Red-brown-gray mottled very stiff to hard slightly sandy clay.		3	
162.0	20.0		Hawthorn Group Altamaha Fm		4, 5	
154.0	28.0		Purple and gray layered firm to slightly stiff silty fine sandy clay and clayey sand		6	
			Barnwell Group Tobacco Road Sand			



▬ UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

TB40-20/0-3

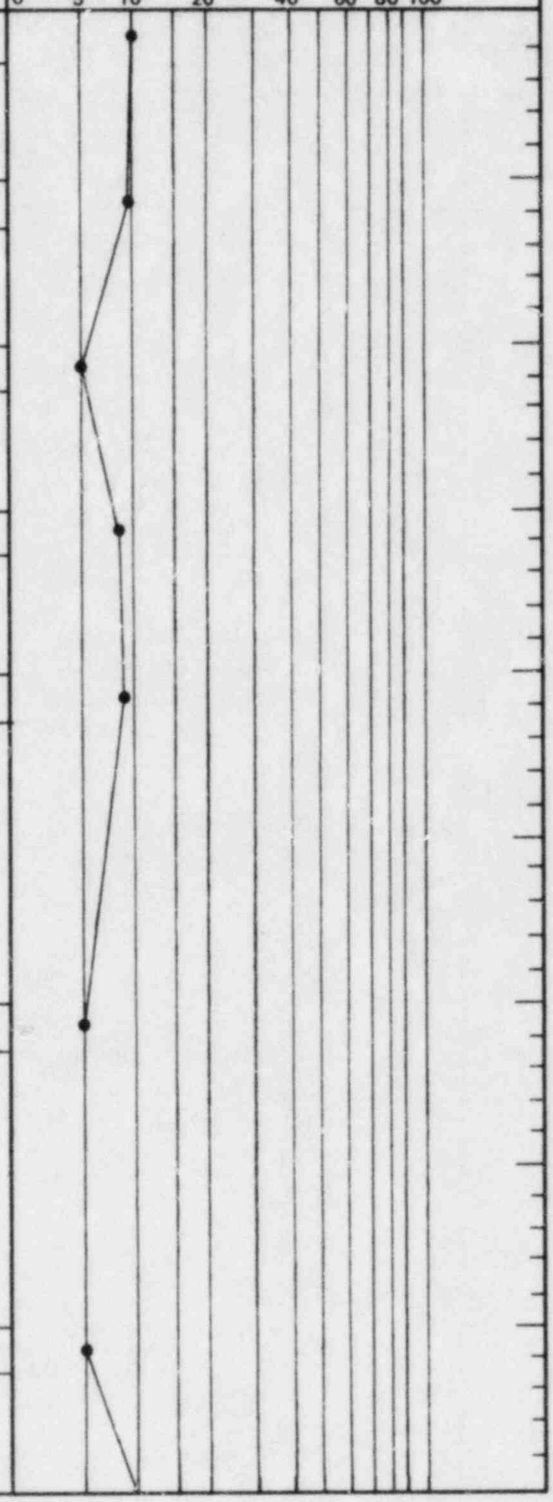
Georgia Power Company

PROJECT Screven County

HOLE NO. B-34
SHEET 2 OF 7

DRILLING LOG

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS
152.0	30.0				6	
					7	
142.0	40.0				8	
			Purple and gray layered firm to slightly stiff silty fine sandy clay and clayey sand Barnwell Group Tobacco Road Sand		9	
132.0	50.0				10	
122.0	60.0				11	
113.5	68.5		Tan firm silty very fine sandy clay Barnwell Group Dry Branch Fm.		12	



■ UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

Form No. 9-797

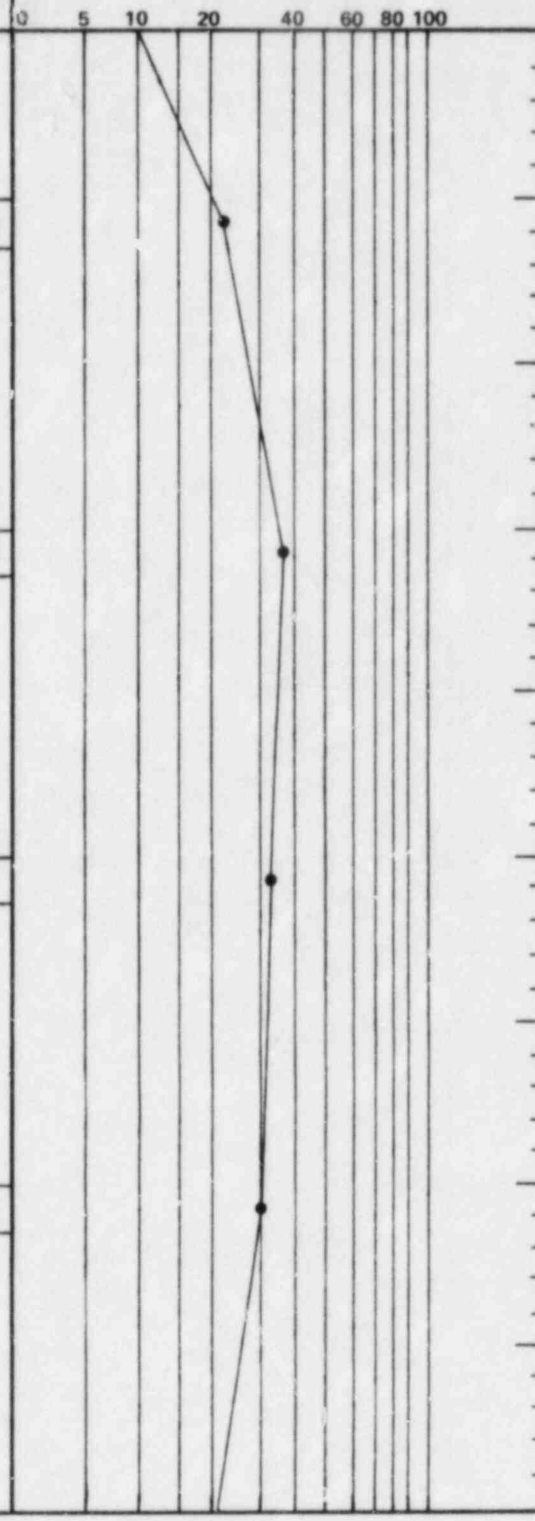
Georgia Power Company

PROJECT Screven County

HOLE NO. B-34
SHEET 3 OF 7

DRILLING LOG

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS
107.0	75.0					
104.0	78.0		Light brown fine to dense silty fine sand Barnwell Group Dry Branch Fm.		13	
92.0	90.0				14	
82.0	100.0				15	
72.0	110.0				16	



UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

Form No. 9-797

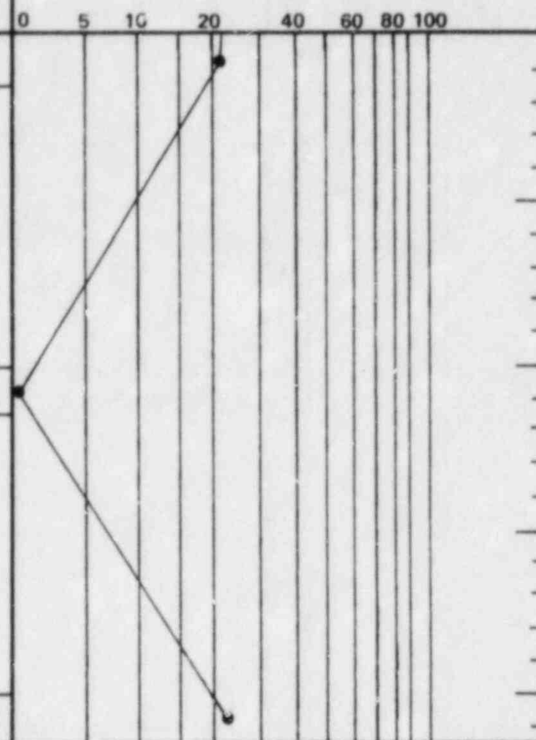
Georgia Power Company

PROJECT: Screven County

HOLE NO. B-34
SHEET 4 OF 7

DRILLING LOG

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS
62.0	120.0		Light brown firm to dense silty fine sand		17	
53.0	129.0		Tan very soft very fine sandy clay Barnwell Group Dry Branch Fm		18	
42.0	140.0				19	
			Cream to Beige bedded argillaceous, microfossiliferous medium grained calcarentic sand with intervals of very fossiliferous impure limestone and argillaceous intervals, quartz and CO_3 persistent throughout	4.8 8.4	Box 1	Started Coring 141.5 Loss all drilling water Core loss 141.5-145.0 163.3-171.0
32.0	150.0					
				9.3 10.0 93%		
22.0	160.0		Barnwell Group Dry Branch FM Griffins Landing Sand Mbr.			
				20%		



UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

Form No. 9-797

Georgia Power Company

PROJECT Screven County

HOLE NO. B-34
SHEET 5 OF 7

DRILLING LOG

ELEV. 17.0	DEPTH 165.0	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS (0 5 10 20 40 60 80 100)
			Thinly bedded, fissle, silty calcareous clay Twiggs Lithofacies	2.0 / 10.0 20%	Box 2	Slightly oxidized - some solution channels present
11.0	171.0		Beige very calcareous sandstone; very sandy fossiliferous limestone at top, moldic sandstone in middle. Barnwell Group Dry Branch Fm. Griffins Land Mbr.	2.5 / 10.0 25%		
-0.7	182.7					
-1.3	183.3		Grey very hard dense sandy Limestone			
			Twiggs Lithofacies Grey and beige soft to moderately hard sandy thinnly bedded calcareous clay	4.0 / 10.0 40%		
-7.5	189.5		Beige unconsolidated, micaceous, argillaceous very calcareous sand	7.0 / 10.0		
-15.2	197.2		Dark grey hard dense fine calcareous sandstone	70%		
-16.7	198.7		Beige very calcareous somewhat fossiliferous sand			
-18.0	200.0		Indurated, consolidated somewhat sandy fossiliferous limestone			Griffins Landing Mbr. Abundant coarse molluse molds, echinoids, corals, bryozoans present
	205.0		Barnwell Group Clinchfield Fm Utley L.S. Mbr.	7.6 / 10.0 76%	Box 3	Medium to coarse casts and molds sparsely glauconitic

UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

HOLE NO. B-34 SHEET 5 OF 7

Form No. 9-797

Georgia Power Company

PROJECT: Screven County

HOLE NO. B-34
SHEET 6 OF 7

DRILLING LOG

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS (0 5 10 20 40 60 80 100)
-30.0	212.0				Box	
			Cream to beige massive granular, consolidated medium to coarse grained <u>sandy</u> <u>fossiliferous</u> calcarenitic <u>limestone</u> with grains of glauconite	10.0 / 10.0 100%	3	Slightly oxidized and scattered thin clay seams or layers present 212-218 Mainly medium to coarse grained calcareous sand 212-234.3 - Small delicate oyster fragments present at 223 concentrated zone-oyster shells
			Barnwell Group Clinchfield Fm Utley L.S. Mbr.			
				4.4 / 10.0 44%	Box 4	
-52.3	234.3		Greenish gray very slightly micaceous <u>calcareous</u>, glauconitic, <u>argillaceous</u> medium <u>sand</u> massive bedding slightly oxidized	2.0 / 10.0 20%		233.3-234.3- Highly solutionized and oxidized
			Lisbon FM undifferentiated			
				1.1 / 10.0 11%		

- UNDISTURBED SAMPLE
- WATER TABLE, 24 HR.
- WATER TABLE, TIME OF BORING
- ▲ % LOSS OF DRILLING WATER

Form No. 9-797

Georgia Power Company

PROJECT Screven County

HOLE NO. B-34
SHEET 7 OF 7

DRILLING LOG

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS (0 5 10 20 40 60 80 100)
-73.3	255.3		Moderately hard greenish grey sandy micareous thinly bedded or laminated calcareous clay-MARL	6.8 / 10.0 68%	Box 4	Scattered glaconite grains
			Lisbon FM Blue Bluff Mbr.		Box 5	
-91.3	273.3		Hole Terminated			

UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

Form No. 9-797

Boring Log

Georgia Power

PROJECT: Postulated Millett Fault Investigation	BORING NO: AL 317	SHEET 1 OF 6
LOCATION: 81° 36' 06.5" W 33° 06' 06.5" N		
CONTRACTOR: USGS	DRILLER: H. Dudley	
GROUND ELEV: 97.1	OVERBURDEN DEPTH: 9.0	TOTAL BORING DEPTH: 230
ELEV. WATER TABLE: 130	DRILLING START: 04/27/82	DRILLING COMPLETE: 05/07/82
NO. CORE BOXES: 10	LOGGED BY: G. S. Grainger, Geologist, SCS	

ELEV. 100±	DEPTH 0	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS (0 5 10 20 40 60 80 100)
			Overburden			No samples
88.1	9.0		Grayish yellow (SY 8/4) thinly bedded to laminated silty very fine to fine grained calcareous cemented quartz sand	4.2 / 7.0 60%	Box 1	Started coring NQWL
82.1	15.1					
	16.0		Dusky yellow green (56Y5/2) to grayish yellow green (56Y7/2) med. to coarse grained clayey calcareous sand with shell fragments and thin beds of clay	9.6 / 10.0 96%	Box 2	
73.1	24.0		Grayish yellow green (56Y7/2) med. to very coarse clayey calcareous sand with shell frags. and oyster shells	1.9 / 2.0	Box	
69.1	28.0		Contact uncertain			Core blocked
			Dusky yellow green (56Y5/2) to grayish yellow green (56Y7/2) med. to coarse grained clayey calcareous sand with shell fragments	0.0 / 8.0 0%	2	
61.1	26.0				Box 3	

UNDISTURBED SAMPLE
WATER TABLE, 24 HR
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

702468

Boring Log Continuation Sheet

Georgia Power

PROJECT: Postulated Millett Fault Investigation | BORING NO. AL 317 | SHEET 2 OF 6

ELEV.	DEPTH	LOG	CLASSIFICATION	RECY	SMPL	SOIL PENETRATION OR REMARKS
	40.0			4.5 / 10.0 45%	Box	
51.6	45.5		Contact uncertain			
	46.0		Grayish yellow (5Y8/4) poorly cemented fine to medium grained clayey calcareous quartz sand with scattered small shell fragments.		3	
				1.9 / 3.0 63%		
	49.0					47.0-.2' cemented sandstone
				1.5 / 7.0 21%		
41.1	56.0					
				0.0 / 10.0	Box	
				0%	4	56.0-66.0 - No recovery-cuttings in bag
31.1	66.0					
				1.0 / 10.0 10%		
21.1	76.0					
				0.4 / 10.0 4%		

SOIL PENETRATION scale: 0, 5, 10, 20, 40, 60, 80, 100

- UNDISTURBED SAMPLE
- WATER TABLE, 24 HR.
- WATER TABLE, TIME OF BORING
- ▲ % LOSS OF DRILLING WATER

702470

Boring Log Continuation Sheet

Georgia Power

PROJECT	BORING NO.	SHEET
Postulated Millett Fault Investigation		SHEET 3 OF 6

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS (0 5 10 20 40 60 80 100)
				1.0 / 3.0 33%	Box	
8.1	89.0		Dark greenish gray (56Y4/1) massive, indurated silty <u>calcareous</u> <u>clay</u> (marl) with scattered indurated siltstone layers or modules	6.1 / 7.0 87%	4	
1.1	96.0			10.0 / 10.0 100%	Box 5	
-8.9	106.0			10.0 / 10.0 100%	Box 6	
	116.			10.2 / 11.0 93%	Box 7	120.3-120.7 Calcareous siltstone layer
-29.9	127.0					

UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
% LOSS OF DRILLING WATER

BORING NO. AL 317 SHEET 3 OF 6

702470

Boring Log Continuation Sheet

Georgia Power

PROJECT	BORING NO.	SHEET
Postulated Millett Fault Investigation	AL317	SHEET 4 OF 6

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS (0 5 10 20 40 60 80 100)
-32.9	130.0			8.9/10.0 89%	Box 8	129.6-129.8, 130.6-130.8, 131.8-132.2 Calcareous siltstone layers
	136.0		Dark greenish gray (56Y4/1) massive, indurated, silty <u>calcareous</u> <u>clay</u> (Marl) with scattered indurated siltstone layers or nodules	9.7/10.0	Box 9	136.6-137.4, 139.5-139.8, 142.4-142.9, 145.1-145.5-Calcareous siltstone layers
-48.9	146.0			9.8/10.0 98%	Box 10	150.6-5° joint, rough no slickensides
	156.0			9.9/10.0 99%	Box 11	
	166.0					
-70.6	167.7			7.1/10.0 71%	Box 12	167.7-170.8 well cemented, hard, calcareous quartz sandstone 170 - Encountered artesian pressures

UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

BORING NO. AL 317 SHEET 4 OF 6

Boring Log Continuation Sheet

Georgia Power

PROJECT	BORING NO.	SHEET
Postulated Millett Fault Investigation	AL 317	SHEET 5 OF 6

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL	SOIL PENETRATION OR REMARKS
-78.9	176.0					
				2.3/6.0	Box	
			Pale greenish yellow (10Y8/2) medium to very coarse grained well cemented to poorly cemented calcareous quartz sandstone & bioclastic sandy limestone	33%	12	180.0-184.0 Sandy bioclasitic shell limestone
	182.0			4.0/4.0 100%	Box	
-88.9	186.0		Light olive gray (5Y5/2) cemented, fine to coarse grained quartz sandy shell limestone	5.1/8.0	13	
-96.9	194.0			1.4/2.0	Box	
				8.0/8.0 100%	14	
-107.9	205.0			.7/1.0		
				8.5/9.0 94%	Box 15	208.2-213.5 - Medium to coarse grained calcareous sand
	215.0			.9/1.0		
-119.0	216.1		Light olive gray (5Y5/2) fine to medium slightly calcareous quartz sand		Box 16	≈220 only sample is wash cutting

■ UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

702470

Boring Log Continuation Sheet

Georgia Power

PROJECT	BORING NO.	
Postulated Millett Fault Investigation	AL317	SHEET 6 OF 6

ELEV.	DEPTH	LOG	CLASSIFICATION	REC'Y	SMPL.	SOIL PENETRATION OR REMARKS (0 5 10 20 40 60 80 100)
-122.9	220				Box	225-230 Wash cutting sample
-127.9	225				10	
			Medium to very coarse quartz sand and shell fragments with black bone fragments & small sharks teeth			
						Boring stopped on 05/07/82 because drilling problems with artesian pressures.

UNDISTURBED SAMPLE
WATER TABLE, 24 HR.
WATER TABLE, TIME OF BORING
▲ % LOSS OF DRILLING WATER

702470

APPENDIX E

GEOPHYSICAL LOGS

APPENDIX E

This appendix contains the borehole geophysical logs for those holes used in the geologic sections. A description of the logging methods used in this study is in Section 6.3. The geophysical log correlations are shown on Figures 8-4 thru 8-7.

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APPENDIX F

HARDI.. LAWSON ASSOCIATES

REPORT ON SEISMIC REFLECTION STUDIES

APPENDIX F

This appendix contains the Savannah River reflection survey report of Harding Lawson Associates. Nineteen river miles of reflection profiling was conducted across the projected strikes of the postulated Millett and Statesboro faults during May 1982. Discussion of the results of this survey and their implications to the Millett fault study can be found in Sections 6.5 and 8.1.5.

A Report Prepared for

Bechtel Civil & Minerals Inc.
50 Beale Street
San Francisco, California

MARINE GEOPHYSICAL SURVEY
SAVANNAH RIVER
BURKE AND SCREVEN COUNTIES, GEORGIA

HLA Job No. 3854,062.01

by

Kenneth G. Blom,
Associate Geophysicist

Jerome S. Nelson,
Geophysicist - II

Harding Lawson Associates
7655 Redwood Boulevard, P. O. Box 578
Novato, California 94948
415/892-0821

June 25, 1982

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I SUMMARY

A marine geophysical survey was conducted along the Savannah River in the vicinity of the Vogtle Generating Station in Burke County, Georgia, between May 2 and May 13, 1982. Three subbottom profiling systems were used to attain both high resolution and deep penetration of the sediments and bedrock along 19-mile and 10-mile stretches of the river from Mile 133 to Mile 152 and Mile 87 to 97, respectively.

The purpose of the survey was to obtain geophysical data to assist in defining the subsurface structure in the vicinity of the recently postulated faults southeast of the Vogtle Plant Site.

Several key reflecting horizons have been defined to depths in excess of 1000 feet below the river bottom. These horizons indicate a regional structural trend dipping to the southeast.

The shallow horizons (less than 100-foot depth) have local features such as ancient channels that are indicative of past erosional and depositional processes. These horizons probably represent interbeds and are generally continuous for more than five miles. Several of the reflecting horizons appear to be locally exposed at the river bottom in areas where bedrock forms steep resistant cliffs along the riverbank.

Two deeper horizons at depths of 200 to 300 feet and 1150 feet, respectively, are traceable for more than 10 miles. These horizons probably represent formational changes that could be lithologic and/or density contrasts.

The continuity, extent, and configuration of key horizons do not indicate the presence of faulting.

II INTRODUCTION

This report contains the findings of a marine geophysical survey conducted by Harding Lawson Associates (HLA) along a portion of the Savannah River near the Vogtle Electric Generating Station in Burke County, Georgia. Geophysical systems with various penetration capabilities were operated along 19-mile and 10-mile stretches of the river. The field work was performed between May 2 and May 13, 1982, by Kenneth Blom, HLA marine geophysicist and project manager, and Thomas Casebier, HLA electronics technician. Jerome S. Nelson, HLA, was the Project Director. Dr. V. J. Henry, Professor of Geology at the University of Georgia, and the Skidaway Institute of Oceanography, Savannah, Georgia, served as technical consultant. Logistical support was provided by the Skidaway Institute of Oceanography. Don S. Michniuk was the client field liaison from Bechtel Civil & Minerals, Inc.

A recent open file report by the U.S. Geological Survey (USGS) suggests that two possible faults referred to as the Millett fault and Statesboro fault are located southeast of the Vogtle site. The postulated Millett fault is shown in the report crossing the Savannah River about 7-1/2 miles downstream of the Vogtle Plant Site. The postulated Statesboro fault is shown about 33 miles downstream of the site. The geophysical

survey described in this report was performed to obtain subbottom data along a portion of the Savannah River that includes the areas of the postulated faults. The locations of these survey areas are shown on Plates 1 and 6. These data will be used to help determine whether or not the faults exist.

III SCOPE

The scope of work included providing a marine geophysical crew and all equipment and instrumentation necessary to conduct a seismic reflection survey along a portion of the Savannah River. The work also included analyzing the data collected and providing conclusions concerning the existence of subsurface faulting in the area of the survey. Three geophysical systems were operated in the same areas to define subbottom reflecting horizons to over 1000 feet deep. The data were analyzed to determine the lateral extent and configuration of subbottom reflecting horizons with regard to whether or not subsurface faulting exists.

IV EQUIPMENT AND PROCEDURES

A. Field Operations

The marine geophysical equipment was installed aboard the survey vessel Morgan J on May 2 and 3, 1982, at the Skidaway Institute of Oceanography, near Savannah, Georgia. A small barge was tied alongside the Morgan J to carry the air compressor for an air gun system. These vessels departed on May 4 and arrived at the survey area some 135 miles upstream on May 6. Field operations in the postulated Millett fault area began on May 6 and were completed on May 10. Field operations in the postulated Statesboro fault area were conducted on May 11. The survey vessels then returned to the Skidaway Institute, where all equipment was off-loaded on May 13.

B. Equipment

The following equipment was used for this investigation:

- A Raytheon DE719 fathometer to measure water depths with resolution of approximately 0.2 feet.

- An EG&G high-resolution subbottom profiler with a Uniboom electromechanical sound source for subbottom penetration up to about 150 feet and resolution of approximately 3 feet.

- An EG&G subbottom profiling system with 10- and 20-cubic-inch air gun sound sources for subbottom penetration up to about 500 feet and more than 1000 feet, and resolution of approximately 10 feet and 30 feet respectively.

These systems are described in more detail in the Appendix. During the survey operations, the subbottom profiling systems were operated independently of one another. The fathometer system was operated concurrently with all profiling systems.

C. Survey Coverage

The geophysical surveys in the postulated Millett fault area were run between Mile 133 and Mile 152-1/2 of the Savannah River. The surveys were run in both the upstream and downstream directions, generally in the deepest portion of the river channel. Plate 1 shows the portions of the Savannah River investigated and the seismic profile location reference marks, referred to as "fixes." The locations of the survey profile lines have been referenced to mile markers and other cultural and geographic features shown on the U.S. Army Corps of Engineers' Navigation Charts for the Savannah River, Savannah to Augusta, June 1980.

Survey coverage by the three subbottom systems along the postulated Millett fault area is as follows:

- Uniboom - Mile 133 to 152-1/2; 19-1/2 river miles
- 10-cubic-inch air gun - Mile 134-1/2 to 151; 16-1/2 river miles
- 20-cubic-inch air gun - Mile 140-3/4 to 146; 5-1/4 river miles

The geophysical surveys along the postulated Statesboro fault area shown on Plate 6 were run between Mile 87 and 97-1/2 of the Savannah River. The Uniboom and 10-cubic-inch air gun systems were both run along this same area for coverage of 10-1/2 miles for each system.

D. Data Analysis and Presentation

The seismic profiles obtained from the three systems were reviewed to define subbottom seismic reflecting horizons and the seismic characteristics of the subsurface. Key horizons were picked and then analyzed for (1) lateral continuity and variation; (2) seismic reflecting characteristics that indicate bedding planes, lithologic changes, erosional surfaces, or density contrasts; (3) depth; and (4) displacements that could be indicative of faulting. Depth calculations were based on an assumed material velocity of 6000 feet per second (fps).

The depth and lateral continuity of the reflecting horizons were plotted on a composite line drawing to show the overall structural trend. Interpretive tracings of the seismic profiles were prepared to illustrate specific features or areas.

Water depths were directly obtained from the precision fathometer analog records.

V RESULTS

A. Postulated Millett Fault Survey Area

The course of the Savannah River along this area varies from relatively straight to meandering with numerous oxbow lakes. The straighter portion is along the northwestern two-thirds of the survey area.

The shoreline of the Savannah River shows evidence of both active erosion and depositional areas. The average height of the erosional cut banks is about 8 feet; brown to red-brown, poorly to semiconsolidated, interbedded sandy silt is exposed in the banks. In two areas (Mile 147 and Mile 150) near the Vogtle Plant, vertical cliffs up to about 30 feet high show local exposures of hard, resistant, interbedded limestone and sandstone with occasional shell beds. The depositional areas consist of loose sand and silt along the shoreline and are associated with shallow water areas.

Water depth in the survey area averages about 10 feet but it can be as deep as 25 feet. Most of the river bottom has asymmetric undulations indicative of migrating channel lag deposits. In some of the deeper areas where scour appears to be occurring, local bottom irregularities are probably due to outcrops of the older and more resistant limestone and sandstone, especially near the vertical cliffs in the vicinity of the Vogtle Plant.

1. Subbottom Structure

The subbottom reflecting horizons show that the regional structure is gently dipping to the southeast. Plate 2 is a composite section incorporating all reflecting horizons obtained from the three profiling systems (Uniboom, 10-inch air gun, and 20-inch air gun). The horizons are labeled from A to I according to depth with A the shallowest. For simplicity, an average water depth of 10 feet has been assumed along the entire section.

Because the deeper penetrating svstems were operated along only a portion of the area represented by the section, the deeper horizons appear truncated; these horizons probably extend farther upstream and downstream than shown. Generally, the subbottom definition is better along the northwestern two-thirds of the survey area in the vicinity of the plant site and the postulated Millett fault area. This area of better subbottom definition generally corresponds to the portion of the river that has a straighter course. The lack of definition along the southeast portion of the section where the river meanders and has numerous oxbow lakes may be a result of gradual changes in the shallow materials that attenuated seismic penetration, or minor lithologic or density differences at depth.

The following discussion of specific horizons is keyed to depth intervals (shallow, intermediate, and deep) that relate to the differences in the penetration capabilities of the

systems used. The numbers of reflectors found in these depth intervals are probably a function of system resolution. It appears as though the numerous shallower horizons may represent formational interbeds whereas the deeper horizons are formational contacts or larger scale features.

a. Shallow Horizons

Horizons A through E are at depths of less than 125 feet. Horizon A and Horizon B are key horizons that are well defined and continuous. Their seismic characteristics and irregularity suggest a distinct change in lithology and/or density and that they are erosional surfaces. These horizons range from less than 20 to over 70 feet deep (Elevations +50 to 0 feet) and are probably overlain by more recent reworked stream channel deposits. The horizons are traceable along the survey tracklines for 9 miles from Mile 137 to Mile 146. Several depressions in these horizons are suggestive of ancient filled channels. The most notable of these features is at Mile 143-1/2; this depression is about 200 feet wide and 25 feet deep. Horizons C and D can also be considered key horizons since they are continuous and well defined, especially in the vicinity of the Vogtle Plant and Mile 147. These horizons appear to be locally exposed on the river bottom near the cliff exposures of limestone and sandstone mentioned above. Horizons

C and D are smooth and parallel but are undulating. They probably represent interbeds whose density and hardness contrast significantly with the surrounding material. Locally small features that appear indicative of past channelization similar to that observed along Horizons A and B are found between Miles 148 and 150. Horizon E is a strong reflector that is similar to Horizons C and D and appears to be nearly exposed along the river bottom near Mile 150.

b. Intermediate Horizons

Horizon F is discontinuous and poorly defined with limited lateral extent near Mile 139 and Mile 150. Horizon G is a key reflecting layer that is continuous but varies from strong to weak. This horizon, encountered between depths of 200 and 300 feet (Elevations -130 to -230 feet), is irregular at some localities and smooth at others. Horizon G could represent the top of a formation that has a change in lithology and/or density and varying degrees of consolidation or hardness. It is traceable along an area of at least 10 miles from Mile 141 to Mile 151.

c. Deep Horizons

Horizons H and I are shown at depths of 400 to 500 feet and at 1170 feet (Elevations -330 to -430 and -1100 feet), respectively. Horizon H is found in two locations and continuous along segments of 3 and 4 miles, but poorly defined and weak.

The southeasterly extent as shown on Plate 2 is governed by the limits of the survey coverage. Horizon I is the deepest horizon observed and could represent a key formational change. It is generally flat and continuous and extends to the limits of the survey coverage.

2. Faulting

Representative seismic profile records and interpreted sections across the postulated Millett fault between Mile 144 and 143 are presented on Plates 3, 4, and 5.

Faults can commonly be defined on seismic reflection profiles by the presence of one or more of several different features. The most common is a noticeable sharp vertical displacement of reflecting horizons when correlating from one side of the fault to the other. Another is a sharp change in the attitude of bedding. Both features may or may not show drag folding. A third type of feature indicative of a fault is a sharp truncation of bedding through the section that may include a sharp change in the acoustical characteristics or reflectivity.

The seismic records and interpreted sections shown on Plates 3, 4, and 5 as well as the continuation of these profiles shown on Plate 2 do not show any features that would indicate faulting.

B. Postulated Statesboro Fault Survey Area

The shoreline and river bottom conditions are similar to those observed in the postulated Millett fault area. Water depths are slightly greater and probably average about 12 feet. Generally, the course of the river is meandering with occasional oxbow lakes.

1. Subbottom Structure

The subbottom reflecting horizons defined by the Uniboom and 10-cubic-inch air gun systems are shown on the composite section, Plate 7. For simplicity, an average water depth of 10 feet has been assumed along the entire section. The elevation of the bottom is approximately +60 feet. Within the upper 85 feet of the section (Elevation +60 to -15 feet) several discontinuous horizons are shown. Due to their limited lateral continuity which is about 0.25 to 1.5 miles, they have not been labeled. Where these horizons are detectable, they are well defined. These horizons suggest that the shallow bedrock has lateral variations that could have been caused during the time of deposition or by subsequent erosional processes.

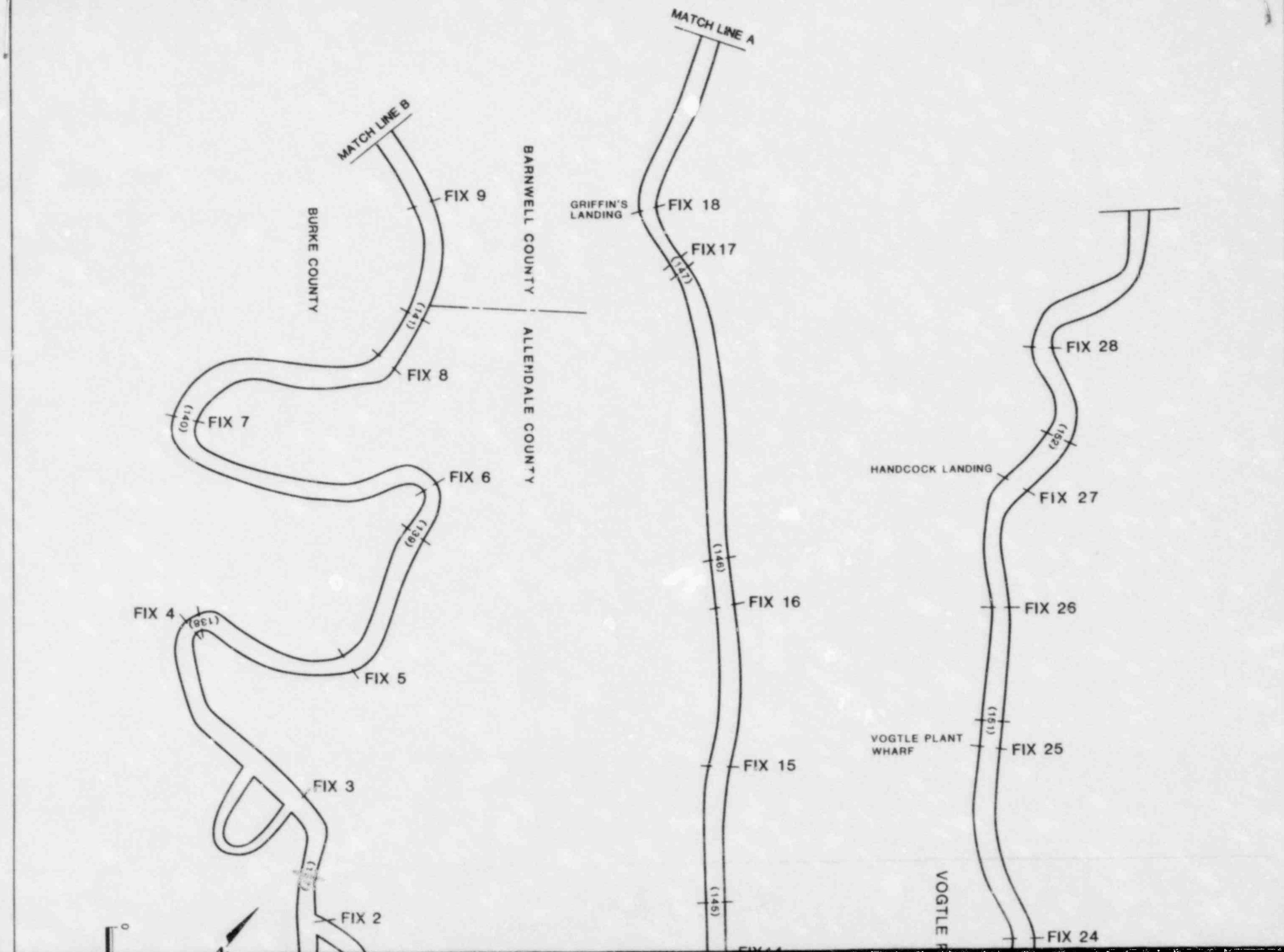
Two deeper horizons labeled A and B are shown at depths of approximately 240 and 370 feet (Elevations -180 and -300 feet), respectively. Horizon A is continuous for about 6.5 miles, varies from well to poorly defined, and generally parallels Horizon B. Horizon B is a strong, well defined reflector

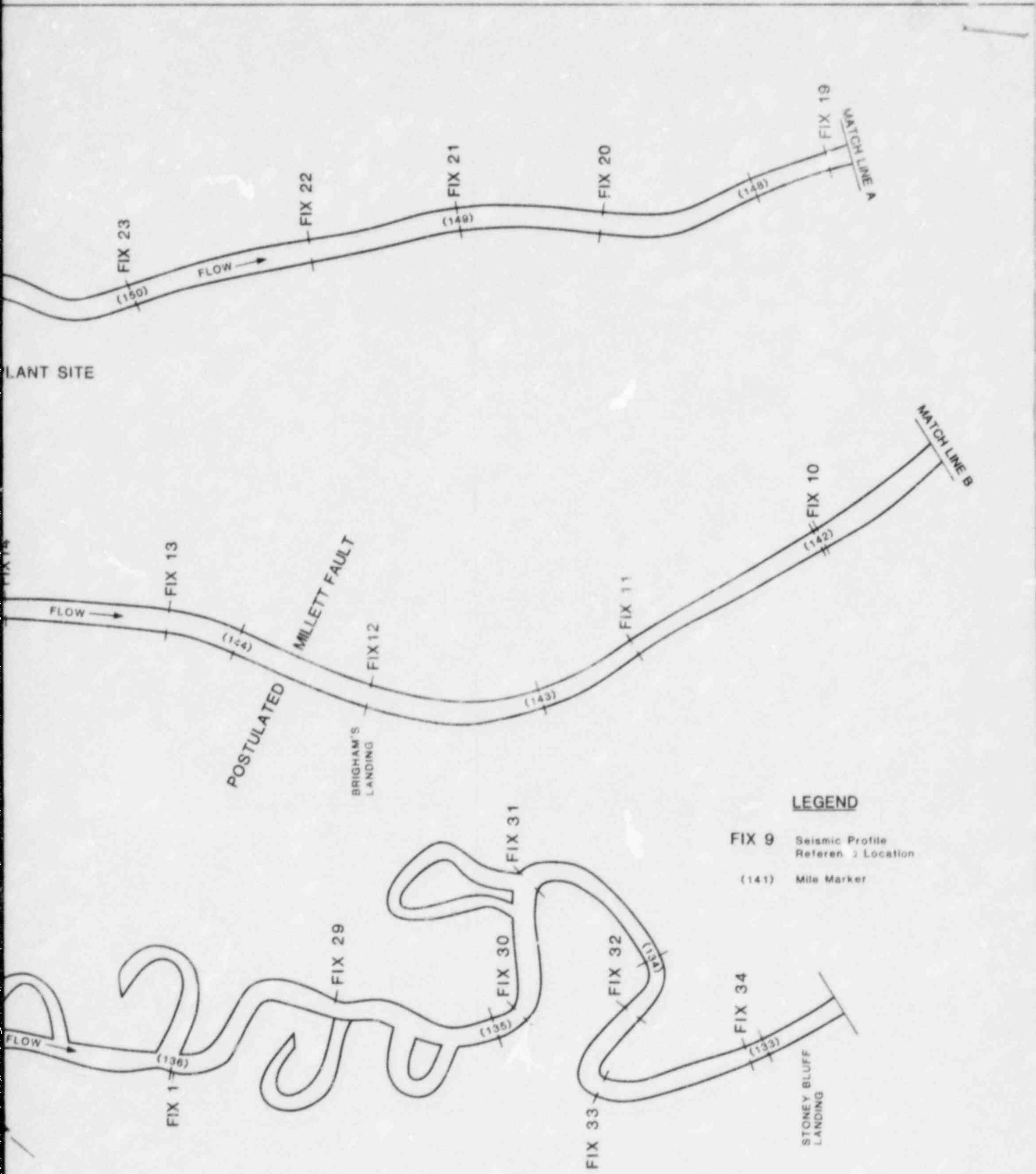
that is continuous for at least 9 miles and it probably continues beyond the survey coverage. Based on the depth, continuity and seismic characteristics, Horizon B may correlate with Horizon G shown on Plate 2.

2. Faulting

No features indicative of faulting along the seismic profiles have been observed. Horizons A and B are well defined and continuous along the postulated Statesboro fault area and show no indications that they have been disturbed by fault activity.

VI ILLUSTRATIONS


MATCH LINE B
FIX 9
BURKE COUNTY
BARNWELL COUNTY
ALLENDALE COUNTY
(141)
FIX 8
(140)
FIX 7
FIX 6
(139)
FIX 4
(138)
FIX 5
FIX 3
FIX 2
MATCH LINE A
GRIFFIN'S LANDING
FIX 18
FIX17
(147)
(146)
FIX 16
FIX 15
(145)
FIX 28
(152)
HANDCOCK LANDING
FIX 27
FIX 26
(151)
VOGTLE PLANT WHARF
FIX 25
FIX 24



REFERENCE: Modified from Navigation Charts, Savannah River, Savannah to Augusta, U.S. Army Corps of Engineers, June 1980

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LOCATION MAP
Savannah River Geophysical Survey
Vogtle Generating Station
Burke County, Georgia

PLATE **1**

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REVISED	DATE	REVISED	DATE

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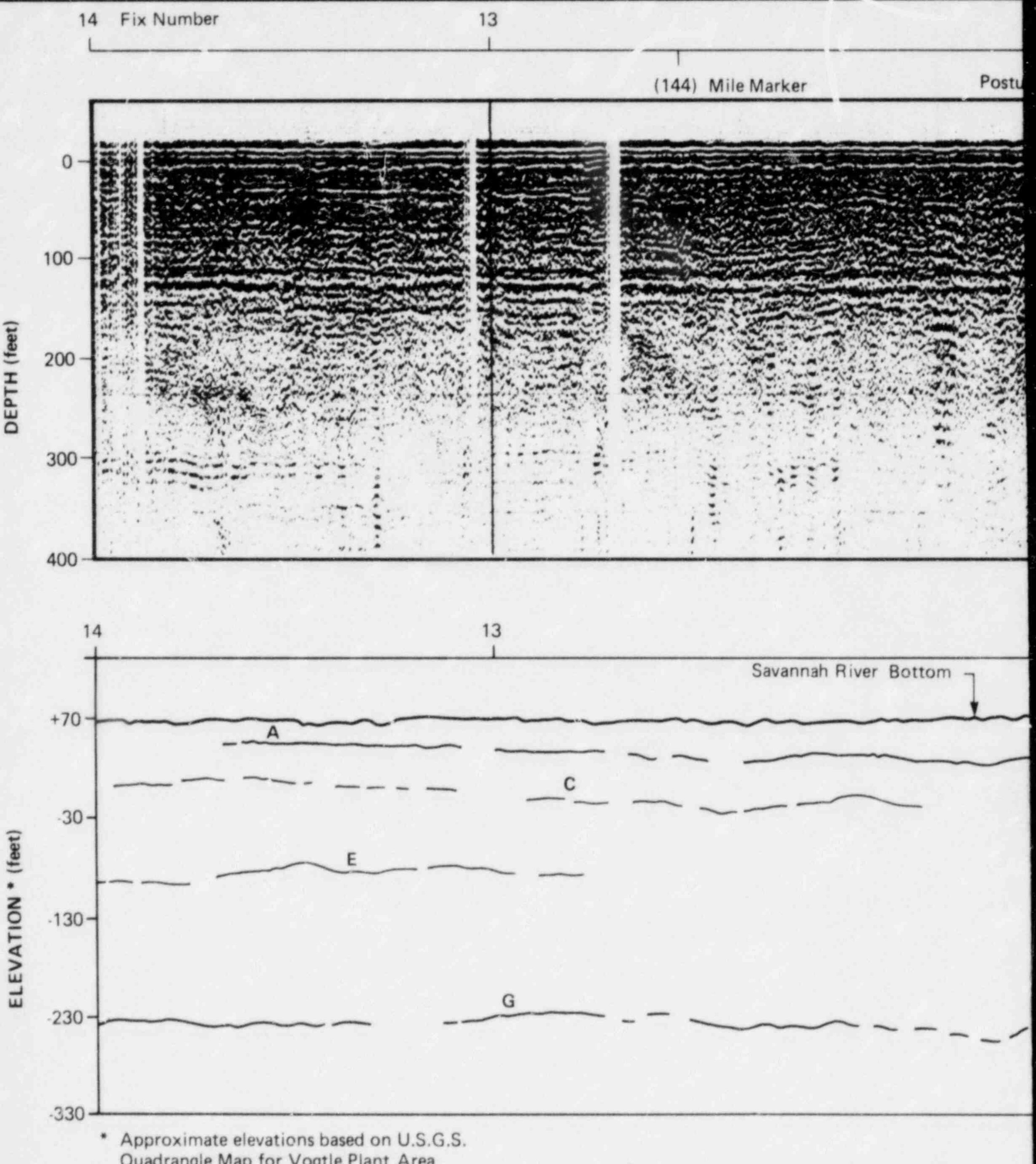
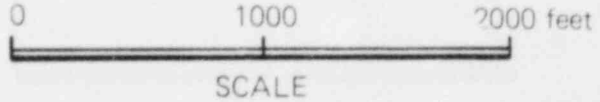
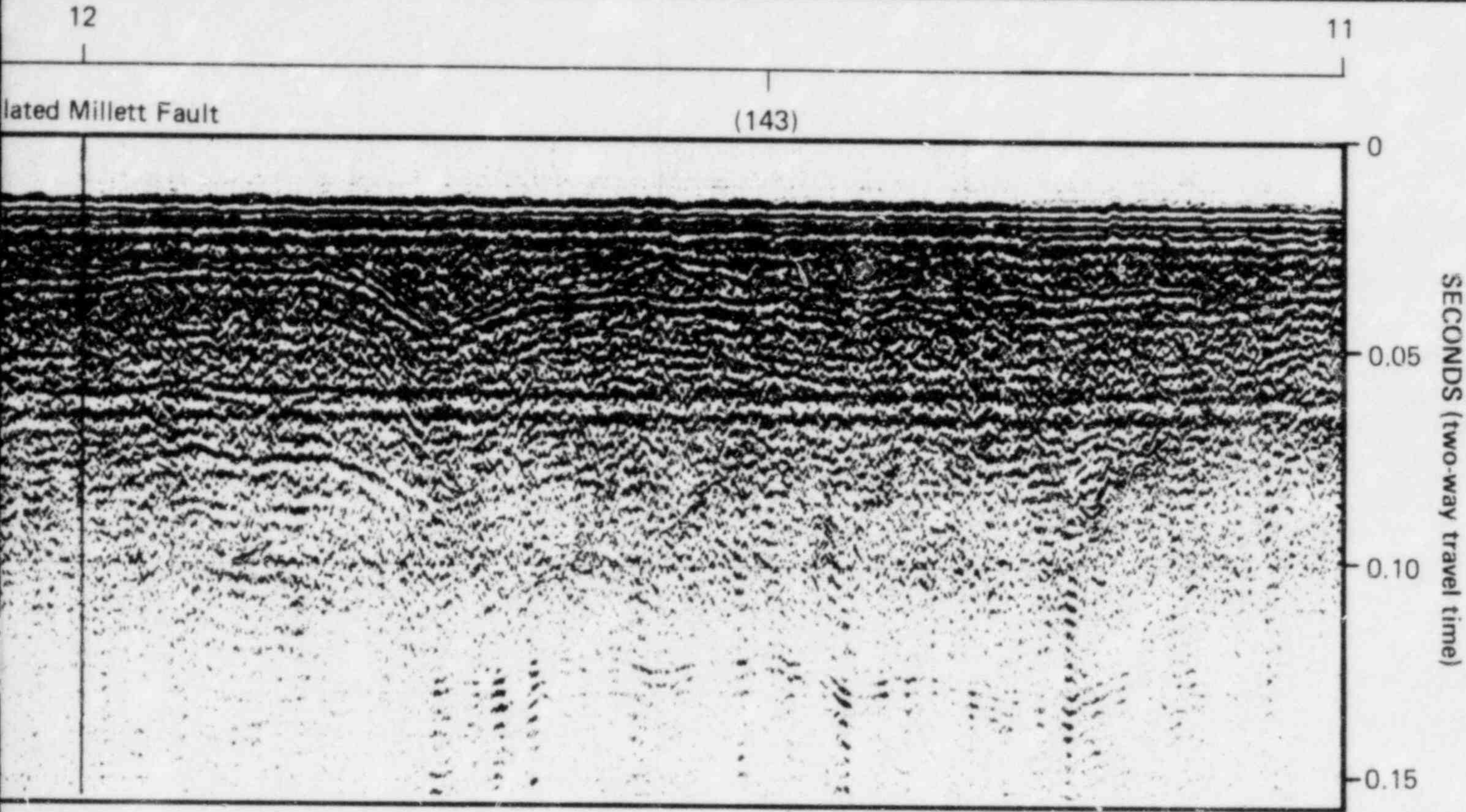
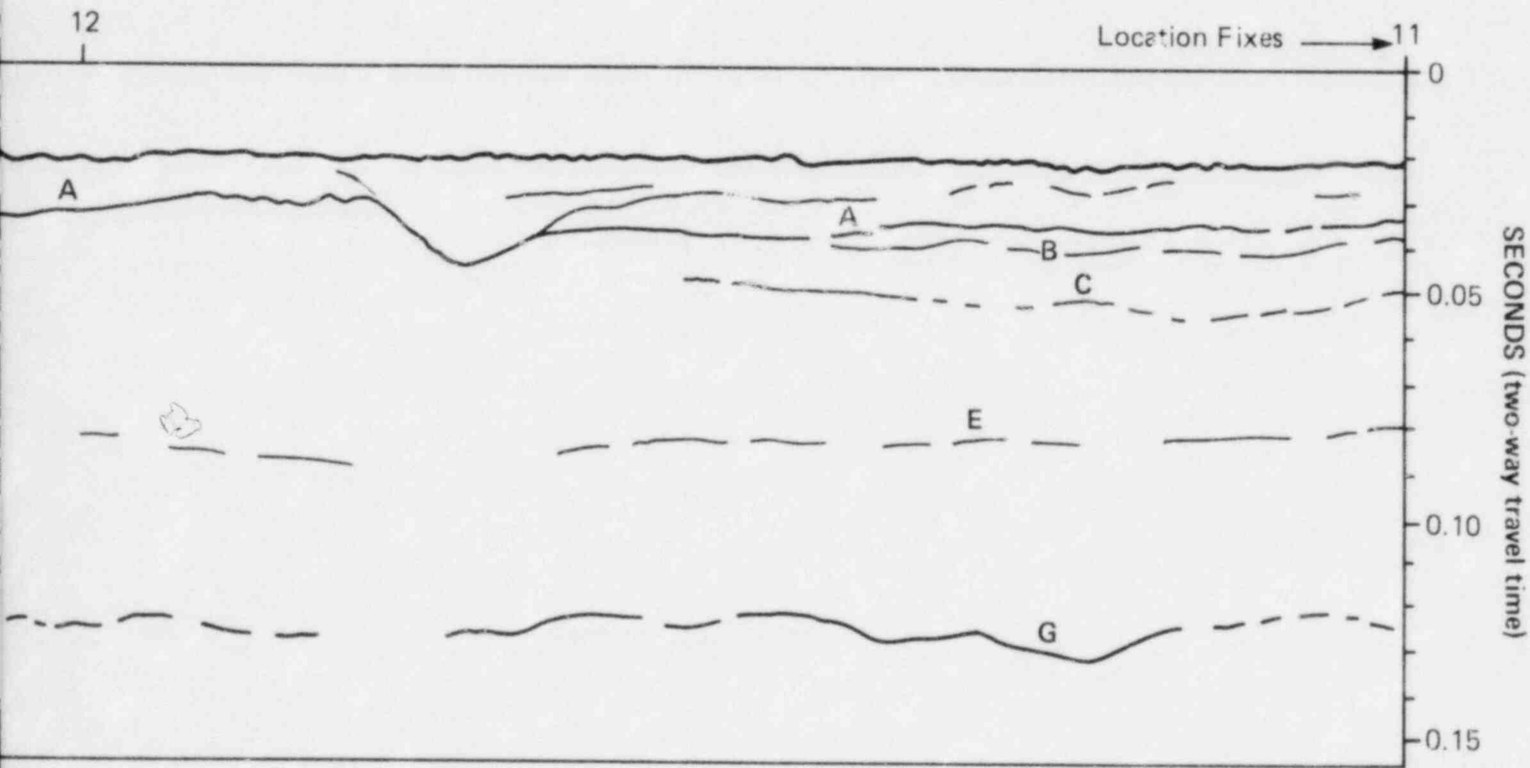


* Approximate elevations based on U.S.G.S. Quadrangle Map for Vogtle Plant Area



Note: Letters refer to Seismic Horizons shown on Plate 2





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AIRGUN PROFILE AND INTERPRETED SECTION
Savannah River Geophysical Survey
Vogtle Generating Station
Burke County, Georgia

PLATE
4

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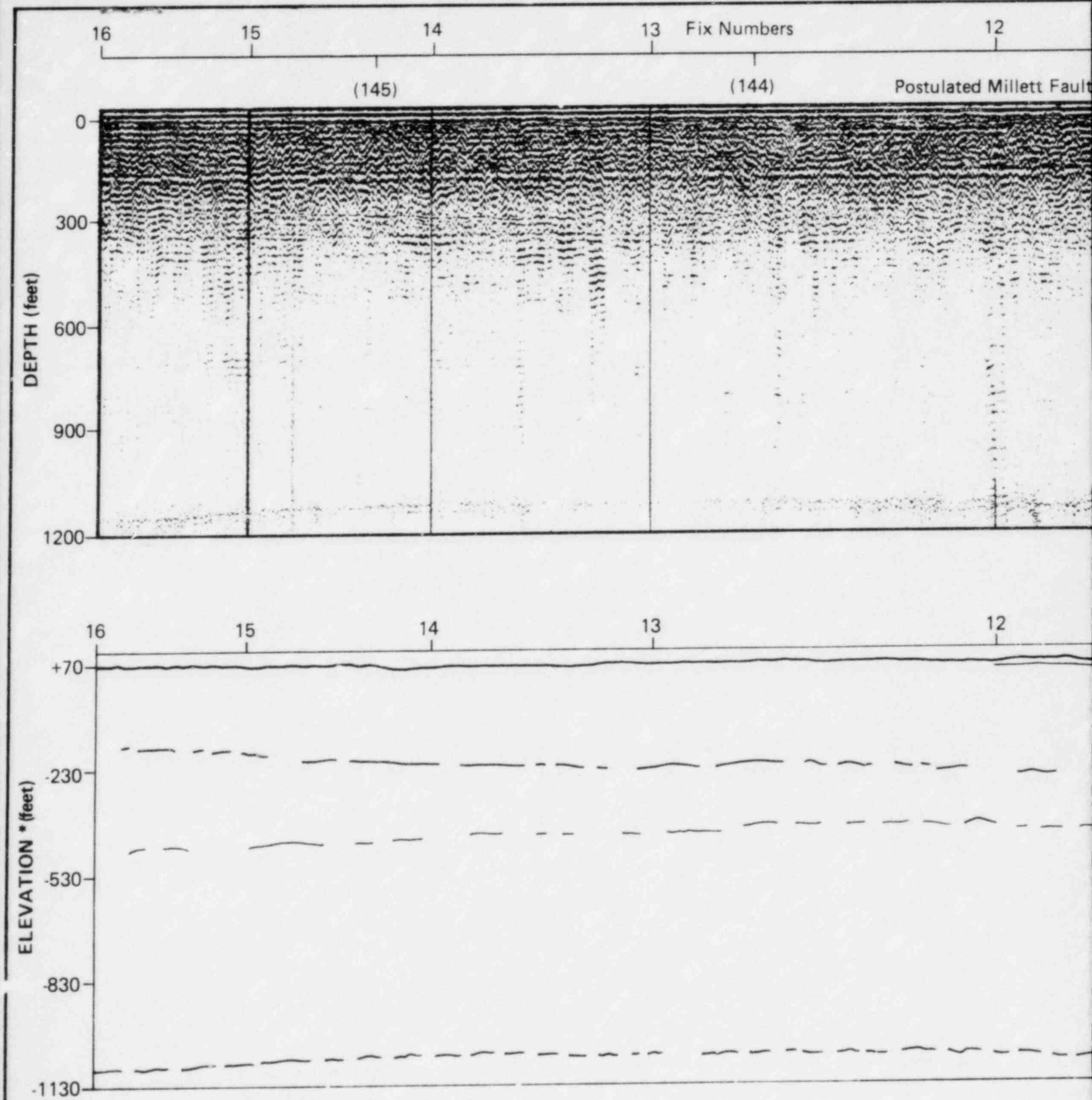

* Approximate elevations based on U.S.G.S. Quadrangle Map for Vogtle Plant Area

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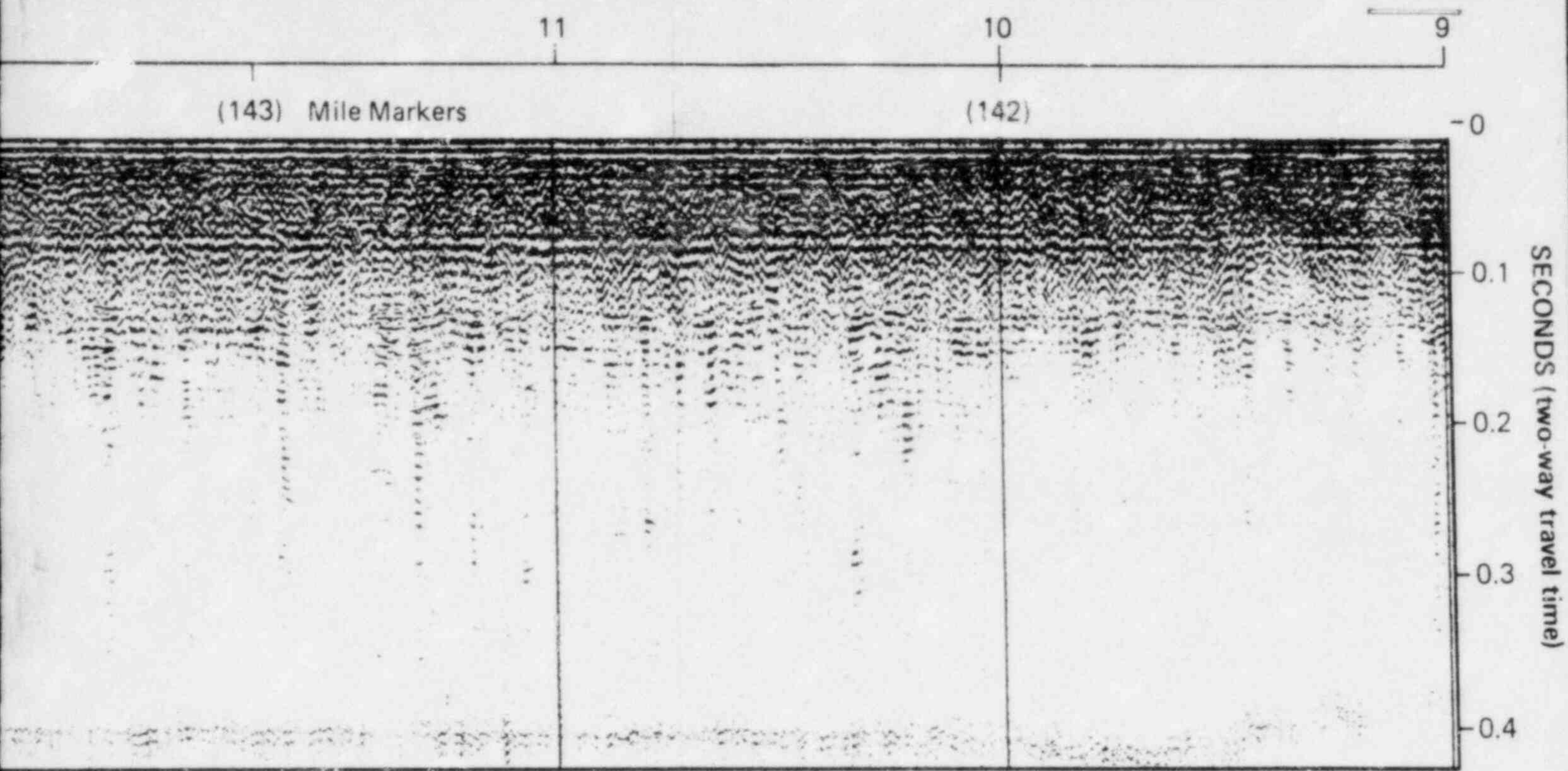
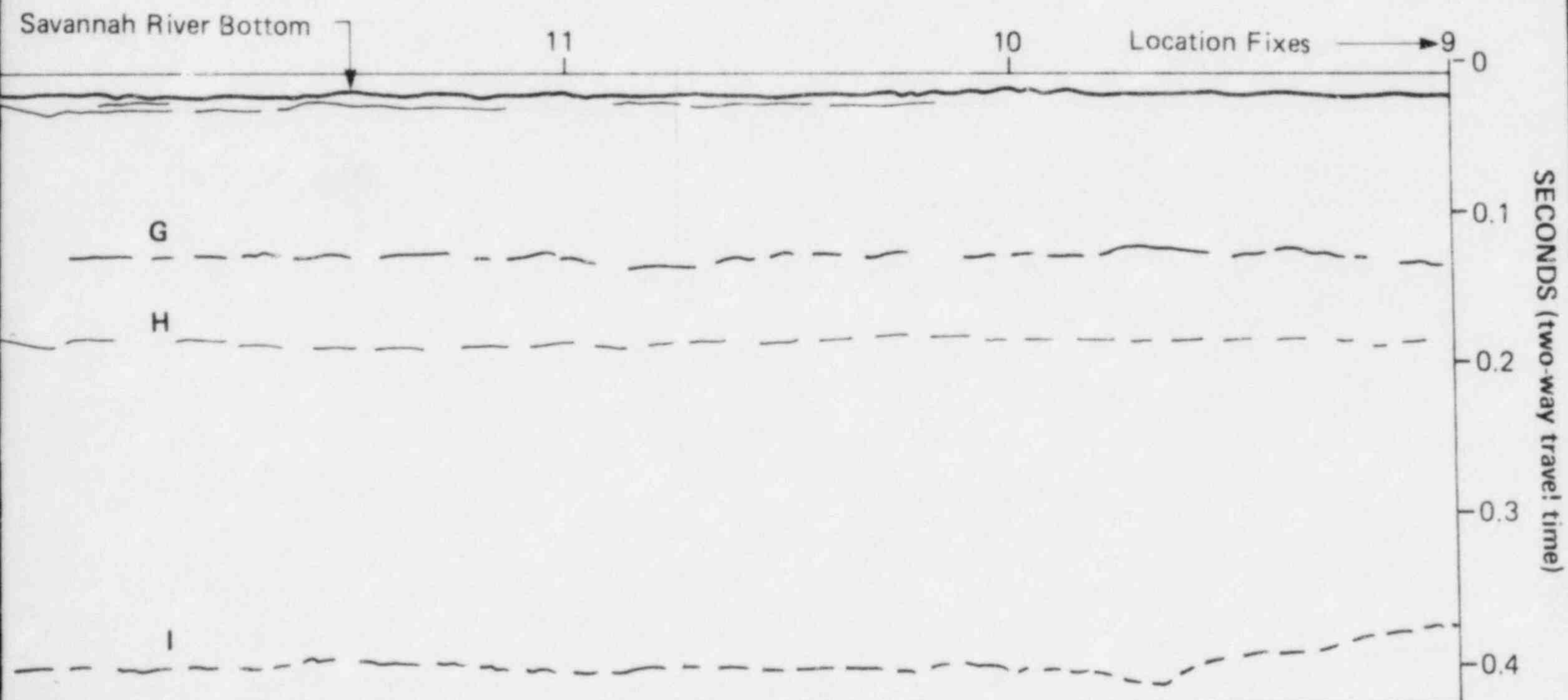
SCALE

Note: Letters refer to Seismic Horizons shown on Plate 2





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DEEP AIRGUN PROFILE AND INTERPRETED SECTION

Savannah River Geophysical Survey
Vogtle Generating Station
Burke County, Georgia

PLATE 5

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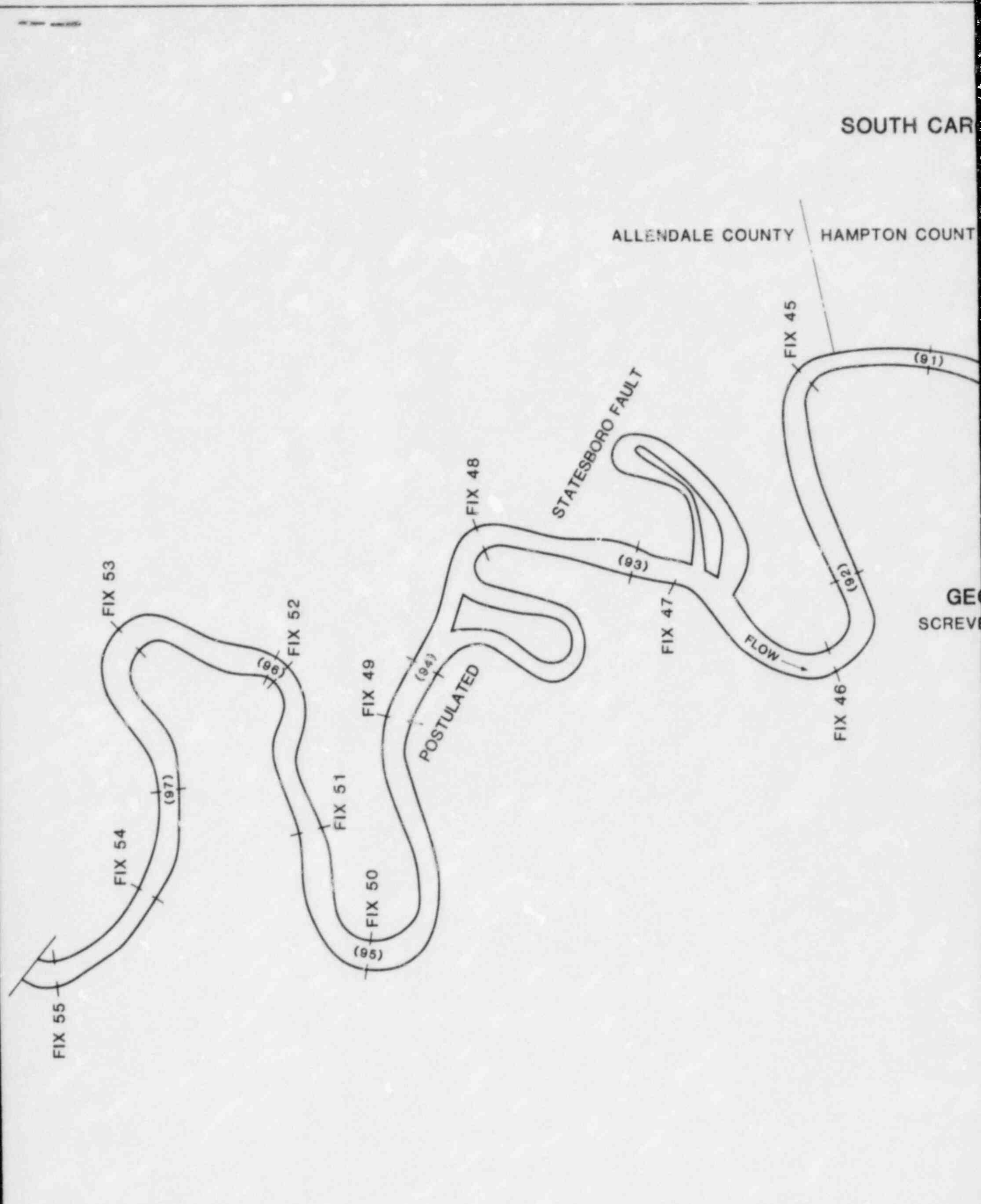

SOUTH CAR
ALLENDALE COUNTY
HAMPTON COUNT
GE
SCREVE
STATESBORO FAULT
POSTULATED
FLOW
FIX 45
FIX 46
FIX 47
FIX 48
FIX 49
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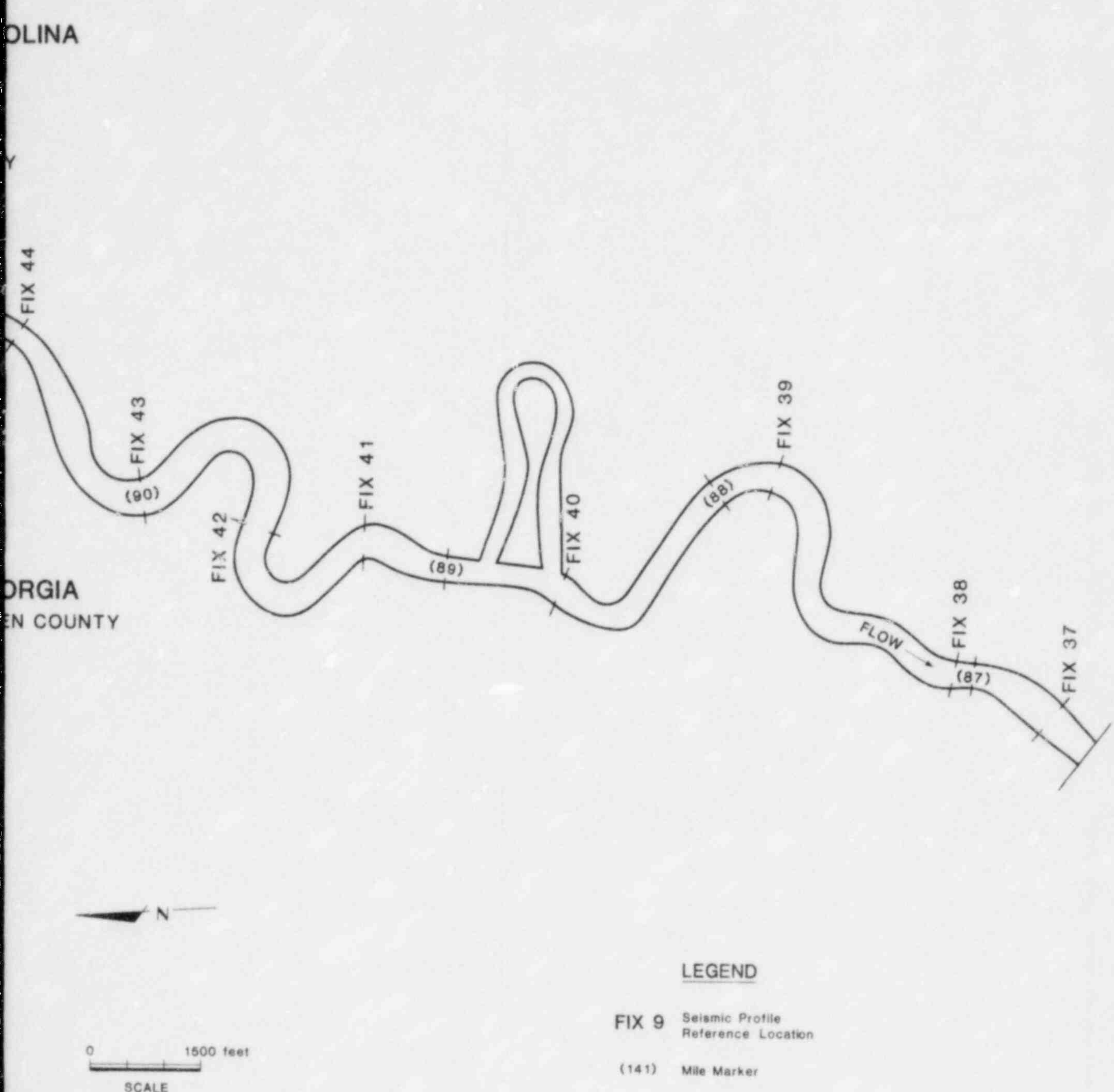

LEGEND

FIX 9 Seismic Profile Reference Location

(141) Mile Marker

REFERENCE: Modified from Navigation Charts, Savannah River, Savannah to Augusta, U. S. Army Corps of Engineers, June 1980

HLA Harding Lawson Associates Engineers, Geologists & Geophysicists	LOCATION MAP Savannah River Geophysical Survey Vogtle Generating Station Burke County, Georgia		PLATE 6
DRAWN F. Hamilton	JOB NUMBER 3854,062.01	APPROVED	DATE 6/25/82

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Appendix

MARINE GEOPHYSICAL METHODS

MARINE GEOPHYSICAL METHODS

The three geophysical systems used in this investigation were:

- A Raytheon DE719 fathometer to measure water depths
- An EG&G high-resolution subbottom profiler with a Uniboom electromechanical sound source for subbottom penetration up to about 150 feet.
- An EG&G subbottom profiling system with Exploration Equipment Research Inc. (EERI) 10- and 20-cubic-inch air gun sound sources for subbottom penetration up to 500 feet and more than 1000 feet, respectively.

The Uniboom and air gun subbottom profiling systems and the fathometer have similar methods of operation. They all send out an impulse or signal through the water; the impulse penetrates below the river bottom and is then reflected back to the receiver near the water surface, where it is amplified and processed to a visual output on an analog graphic recorder.

A seismic reflection is returned energy (in seismic wave form) which has been emitted from the energy source at the surface, has traveled through the water column, and has been reflected from an acoustic discontinuity back to the receiving hydrophone array. An acoustic discontinuity consists of a distinct contrast in density and sound velocity propagation properties between two elastic media. This contrast could represent a boundary between differences in consolidation of

sediments, lithified rock or between two sedimentary strata of different lithology.

The instrumentation used in the air gun and Uniboom subbottom systems is very similar; the basic difference is the source used to generate the seismic signal. Both systems consist of a sound source, a towed sound receiver (hydrophone array), and onboard controls for output power. and amplifying, filtering, and graphic recording of the data received.

The Uniboom source consists of a towed electromechanical sound source (transducer) mounted on a catamaran float. Power is provided by a capacitor-driven power unit that has a controlled variable output ranging from 100 to 300 joules. For this survey, a 300-joule output was used with a firing rate of 0.4 second and a 0.2 second recorder sweep.

The air gun has a variable output of 10, 20, and 45 cubic inches. The air supply is provided by a 50-cubic-feet-perminute air compressor with a 2500-cubic-inch air reservoir. For this survey, 10- and 20-cubic-inch air volumes were used at an average pressure of 1500 pounds per square inch. The 10-inch gun was fired at a 2.1-second fire rate with a recorder sweep of 0.7 second. For the 20-inch gun, a 4.2-second fire rate was used with a recorder sweep of 1.4 seconds.

A Khron-Hite variable filter and multistage amplifier was used for the received signal conditioning with both the Uniboom and air gun systems.

The seismic data were recorded on an EPC Model 4603 seismic recorder. Recording frequencies for the systems were as follows:

- Uniboom: 600 to 1800 hertz
- 10-cubic-inch air gun: 200 to 800 hertz
- 20-cubic-inch air gun: 100 to 600 hertz

The sound source and the receiver for the three systems were towed approximately 30 feet aft of the survey vessel and 7 feet apart. The air guns and the receiver hydrophone were towed below the water surface at a depth of approximately 3-1/2 feet and 1 to 2 feet, respectively.

Precision water depth data were obtained with a Raytheon Model DE-719 depth recorder. This system has a 200-kilohertz transducer with a beam width of 8 degrees that provides water depths to an accuracy of 0.5 percent plus 2.5 cm of the recorded depth. The water depth recordings were corrected for the depth of the transducer, towed 1-1/2 feet below the water surface.

All electrical power was provided by two portable 3300 kilo-watt generators and the shipboard 12 volt DC system.

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APPENDIX G

Petrographic Examination of Samples from

VSC and VG Core Holes and Water Wells AL-66 and AL-40

APPENDIX G

TABLE OF CONTENTS

APPENDIX G

This appendix contains petrographic descriptions of thin sections made from samples collected from VSC and VG coreholes and water wells AL-66 and AL-40. The purpose of the examination is to provide a general lithologic description of each sample to use as supplemental data for lithologic and stratigraphic correlations. This examination was made using a Zeiss polarizing microscope. Relative mineral percentages were made by visual approximations. A summary of these lithological descriptions is in Tables 7-5, 7-6, and 7-9. Elevations that the samples were collected from are indicated next to the sample number. A discussion of these petrographic examinations is in Section 7.5.

VSC-1-1 (33.5 ft): Quartzose, calcareous sand

(stained for calcite)

Mineral Constituents		Approximate Abundance (%)
Calcite		68
Micrite (with some clay?)	51	
Microfossils	17	
Quartz		30
Others		2

This sample consists of well sorted grains cemented by micrite. Quartz grains average about 0.5 mm in size, are angular to sub-angular and generally do not show signs of strain. Microfossils are common and trace amounts of clay, muscovite, feldspar, epidote, glauconite, and opaque minerals were noted.

VSC-1-2 (31.0 ft): Sandy marl

(stained for calcite)

Mineral Constituents		Approximate Abundance (%)
Clay		35
Calcite		32
Micrite	20	
Microfossils	12	
Quartz		23
Glauconite		3
Muscovite		3
Chalcedony		2
Opaque minerals (mostly pyrite)		2

This sample consists of irregularly interbedded sandy and shaly material. The sandy material consists mainly of very fine-grained (0.05 mm), subrounded quartz, muscovite, glauconite, microfossils, opaque minerals and some minor feldspar and chalcedony. The shaly material consists mainly of micrite as well as clay with minor mineral constituents characteristic of the sandy material. Some chlorite may be present.

VSC-1-3 (-111.0 ft): Quartz sand

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Quartz	98
Others	2

This sample consists of unconsolidated, moderately sorted quartz grains. These grains range from 0.2 to 1.5 mm in size, are rounded to sub-angular and generally do not show signs of strain. Trace amounts of clay, opaque minerals, muscovite and staurolite were noted.

VSC-1-6 (-301.0 ft): Sandy clay

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Clay	54
Quartz	40
Muscovite	3
Quartzite rock fragments	3
Others	Trace

This sample consists of poorly sorted quartz within a clay matrix. Quartz grains range from 0.2 to 1.5 mm in size, are sub-angular to sub-rounded and often show signs of strain. Some fresh muscovite flakes and quartzite rock fragments are present. Trace amounts of "corroded" potassium feldspar and hornblende were noted.

VSC-2-1 (54.7 ft): Clayey, glauconitic sand

(Stained for calcite)

Mineral Constituents	Approximate Abundance (%)
Quartz	40
Clay	25
Glauconite	19
Calcite	5
Chalcedony	3
Hematite	2
Others	1

This sample is poorly consolidated consisting mainly of quartz within a clayey, glauconitic matrix. Quartz grains are moderately sorted, (0.2-1.2 mm), sub-rounded to sub-angular, and commonly strained. The clayey, glauconitic matrix shows a mottled appearance. Glauconite, possibly admixed with some chlorite, occurs both as disseminated and as pelletal material. Some minor calcite may be present in the matrix. Minor amounts of chalcedony is present along with trace amounts of feldspar, epidote, and staurolite.

VSC-2-2 (30.7 ft): Silty marl

(stained for calcite)

Mineral Constituents	Approximate Abundance (%)
Clay	45
Micrite	28
Quartz	23
Hematite	2
Others	2

This sample consists mainly of clay, micrite and some very fine-grained quartz. Minor fine-grained quartz (0.05-0.1 mm) is scattered throughout. Minor amounts of hematite grains are present along with trace amounts of glauconite, epidote, zircon and chalcedony. A few microfossil remnants were noted. Bedding is not evident.

VSC-2-3 (-70.3 ft): Quartz sand

(Grain mount - stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Quartz	91
Clay	5
Potassium feldspar	3
Others	3

This sample consists of unconsolidated, well sorted, medium-grained quartz. These grains range from 0.2 to 0.5 mm in size and are generally sub-angular and show signs of strain. Minor amounts of iron-stained clay, potassium feldspar (orthoclase) are present along with trace amounts of glauconite, epidote, hornblende, muscovite, staurolite and chalcedony. Minute opaque grains, zircon grains and one large garnet were also noted.

VSC-3-2 (40.3 ft): Sandy, glauconitic claystone

(stained for calcite)

Mineral Constituents	Approximate Abundance (%)
Clay	59
Quartz	25
Glauconite	10
Muscovite	3
Other	3

This sample consists of fine-grained quartz and glauconite within a clay matrix. Quartz grains range from 0.1 to 0.2 mm in size, are generally sub-angular, and usually do not show signs of strain. Glauconite pellets range from 0.1 to 0.2 mm in size. Minor amounts of opaque minerals, chlorite and muscovite were noted. A trace amount of zircon and calcite was noted.

VSC-3-3 (33.3 ft): Sandy marl

(stained for calcite)

Mineral Constituents		Approximate Abundance (%)
Clay		31
Quartz		30
Calcite		24
Microfossils	14	
Micrite	10	
Muscovite		7
Glauconite		4
Opaques minerals (mostly pyrite)		3

This sample consists of interbedded sandy and shaly material. The sandy material consists of quartz, microfossils, and glauconite in a micrite and clay matrix. Quartz grains, averaging about 0.2 mm in size, are well sorted, sub-rounded to sub-angular and generally do not show signs of strain. Muscovite, pyrite and zircon grains were also noted. Oriented muscovite flakes define weak bedding. The shaly material is composed of very fine-grained quartz and muscovite in a micrite and clay matrix. Glauconite and pyrite are also present.

VSC-3-4 (-101.7 ft): Quartz sand

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Quartz	98
Other	2

This sample consists of unconsolidated, medium-grained quartz. These grains are moderately sorted ranging from 0.2 to 0.5 mm on size, sub-angular to sub-rounded and generally do not show signs of strain. Trace amounts of opaque minerals, clay, glauconite, potassium feldspar and staurolite were noted.

VSC-3-7 (-298.7 ft): Sandy clay

(..tained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Clay	58
Quartz	35
Muscovite	3
Quartzite	2
Others	2

This sample consists of poorly sorted quartz moderately consolidated in a clay matrix. Quartz grains range from 0.2 to 1.5 mm in size, are generally sub-angular and do not show signs of strain. Some fresh muscovite flakes and quartzite fragments are present. Opaque minerals and zircon are relatively abundant.

VSC-4-1 (58.7 ft): Quartzose, calcareous sand

(stained for calcite)

Mineral Constituents		Approximate Abundance (%)
Calcite		60
Micrite	55	
Relatively coarse-grained calcite	3	
Microfossils	2	
Quartz		30
Clay		5
Others		3
Zircon		2

This sample consists of quartz grains poorly cemented by micrite. Quartz grains are moderately sorted, ranging from 0.1 to 1.0 mm in size, generally angular and often show signs of strain. These grains often have a corroded appearance. Minor amounts of calcite and microfossils are present. Zircon is relatively abundant. Trace amounts of muscovite, opaque minerals, glauconite and feldspar were noted.

VSC-4-2 (20.7 ft): Fossiliferous sandy limestone

Mineral Constituents		Approximate Abundance (%)
Calcite		82
Micrite cement	47	
Shell fragments	35	
Quartz		8
Glauconite		4
Chalcedony		3
Zircon		2
Others		1

This sample consists mainly of large shell fragments and quartz grains within a micritic cement. Quartz grains are moderately sorted, ranging from 0.2 to 0.8 mm in size and are sub-rounded to angular. Most grains do not show signs of strain. Minor amounts of glauconite and zircon are present. Chalcedony usually occurs as partial shell fragment replacement. Trace amounts of hematite, feldspar and epidote were noted. Many solution cavities are present and appear to have been caused by the partial dissolution of shell fragments.

VSC-4-3 (11.7 ft): Sandy shale

(stained for calcite)

Mineral Constituents	Approximate Abundance (%)
Clay (with some micrite?)	44
Quartz	35
Garnet/Zircon	8
Muscovite	7
Others (mostly microfossils, opaques)	4
Glauconite	2

This sample consists mainly of very fine-grained quartz within a shaly matrix which may contain some micrite. Quartz grains are well sorted, ranging from 0.05 to 0.1 mm in size, and are sub-rounded to sub-angular. Garnet, zircon, muscovite and glauconite are also present in decreasing abundance. Minor amounts of opaque minerals, microfossils and feldspar were noted. Bedding is well defined by oriented muscovite flakes, grain size segregation and compositional banding.

VSC-4-4 (-155.3 ft): Quartz sand

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Quartz	98
Others	2

This sample consists of unconsolidated, medium-grained, well sorted quartz. These grains average 0.5 mm in size, are sub-rounded to sub-angular and do not show signs of strain. Trace amounts of potassium feldspar, hornblende, staurolite, clay and opaque minerals are present. A single grain of glauconite containing pyrite inclusions was noted.

VSC-4-7 (-321.3 ft): Quartz sand

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Quartz	92
Potassium feldspar	4
Muscovite	2
Opaques	1
Others	1

This sample consists of unconsolidated, fine-grained, well sorted quartz. These grains range from 0.1 to 0.3 mm in size, are sub-angular and do not show signs of strain. Minor amounts of potassium feldspar, muscovite and opaque minerals were noted along with trace amounts of gypsum, hornblende and clay.

VSC-4-8 (-448.3 ft): Sandy clay

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Clay	59
Quartz	20
Limonite	7
Muscovite	4

This is a poorly consolidated sample consisting of quartz within a clayey matrix. Quartz grains are poorly sorted (0.1 to 1.2 mm) sub-rounded, moderately fractured and generally show signs of strain. Some muscovite is present. The clay matrix is heavily stained by limonite.

VSC-4-9 (-528.3 ft): Quartz sand

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Quartz	94
Muscovite	2
Gypsum	2
Others	2

This sample consists of unconsolidated, medium grained, well sorted quartz. These grains range from 0.3 to 0.5 mm in size, are sub-rounded to sub-angular and often show signs of strain. Minor amounts of muscovite and gypsum are present along with trace amounts of potassium feldspar, garnet, epidote, calcite, zircon and opaque minerals. One ~~rock~~ fragment consisting of fine-grained quartz and muscovite within a clayey matrix was noted.

VSC-4-10 (-538.3 ft): Interbedded shale and sand

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance %
Quartz	56
Clay	25
Muscovite	10
Carbonaceous material	5
Opaque minerals (mostly pyrite)	3
Feldspar	1

This sample consists of interbedded sandy and shaly material. The sandy material consists of quartz and muscovite within a clay matrix. The quartz grains range from 0.1 to 0.4 mm in size, are sub-angular to sub-rounded and generally do not show signs of strain. Muscovite flakes are relatively fresh. Opaque minerals are relatively abundant and a trace amount of feldspar was noted. The shaly material consists of silt size quartz, muscovite, and carbonaceous material within a clay (often iron-rich) matrix. Oriented muscovite flakes and lenticular masses of carbonaceous material define bedding in the shaly material.

VSC-4-11 (-553.3 ft): Sandy, micaceous clay

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Clay	54
Quartz	30
Muscovite	12
Feldspar (microcline)	2
Chalcedony (?)	1
Others	1

This sample consists of poorly sorted quartz and muscovite poorly consolidated by a clayey matrix. Quartz grains range from 0.05 to 1.2 mm in size, are sub-rounded to sub-angular and often show signs of strain. Some quartz grains have a corroded appearance. Minor amounts of feldspar (probably microcline) and chalcedony (?) are present along with trace amounts of glauconite, dolomite, opaque minerals, hornblende, epidote and zircon. Bedding textures are not evident.

VSC-4-12 (-641.3 ft): Sandy, carbonaceous shale

Mineral Constituents	Approximate Abundance (%)
Clay	60
Quartz	15
Muscovite	14
Carbonaceous material	8
Opaque minerals	3

This sample consists of fine-grained quartz within a shaly matrix. Quartz grains average about 0.1 mm in size and are generally sub-rounded. Muscovite is relatively abundant and some feldspar is present. Carbonaceous material is also relatively abundant. Pyrite and magnetite grains are scattered throughout the rock. Oriented muscovite flakes and lenticular masses of carbonaceous material defines bedding.

VSC-4-13 (-709.3 ft): Sandy, micaceous clay

(stained for calcite)

Mineral Constituents	Approximate Abundance (%)
Clay	44
Quartz	35
Muscovite	15
Limonite	4
Opaque minerals	2
Others	Trace

This is a poorly consolidated sample consisting of well sorted, fine-grained quartz within a clayey matrix. Quartz grains average about 0.1 mm in size, and are generally sub-rounded. Muscovite flakes are relatively abundant and are generally fresh. The clay matrix is stained by limonite. Minor amounts of magnetite and hematite are present along with trace amounts of epidote and zircon.

VSC-4-14 (-843.3 ft): Quartz sand

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Quartz	96
Sandstone or quartzite grains	2
Muscovite	1
Others	1

This sample consists of unconsolidated, medium-grained, well sorted quartz. Quartz grains range from 0.2 to 0.8 mm in size and are sub-rounded to sub-angular. Minor sandstone or quartzite grains are present. Muscovite, opaque minerals, zircon and potassium feldspar are also present in decreasing abundance.

AL66 (-468 to -478 ft): Clayey quartz sand

(Grain mount of water well cuttings, unwashed)

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance %
Coarse-grained quartz	67
Matrix - fine-grained quartz muscovite, clay	30
Quartzite fragments	3

This sample consists of coarse-grained, ~~fairly~~ well sorted quartz within a matrix of fine-grained quartz, muscovite, and iron-rich clay. Coarse-grained quartz grains are generally 1.5 to 2.0 mm in size, rounded to sub- rounded and sometimes show signs of strain. Many quartz grains are coated with opaque, dendritic material, possibly pyrolusite. Both well sorted and poorly sorted quartzite fragments showing evidence of strain are present. The fine-grained quartz grains and muscovite flakes within the matrix material range from 0.05 to 0.15 mm in size. Much of the clay is stained by hematite and possibly limonite. Trace amounts of glauconite, opaque minerals, carbonate, and sometimes gypsum are present. None of the mineral constituents takes on the potassium feldspar stain. Weak bedding planes are defined by oriented muscovite flakes within the matrix material.

AL66 (-558 to -568 ft): Clayey quartz sand

(Grain mount of water well cuttings, unwashed)

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance %
Quartz (coarse and fine-grained)	70
Clay	15
Muscovite and sericite	5
Microcline	3
Gypsum	3
Hematite	3
Others	1

This sample consists of poorly sorted quartz within a clayey matrix. Quartz grains are generally 0.1 to 2.0 mm in size, sub-angular to sub-rounded and show signs of strain. Minor to trace amounts of shaly material, poorly sorted quartzite grains, garnet, gypsum, microcline, glauconite and hematite replaced microfossils are present. Minor amounts of euhedral to subhedral dolomite crystals are present. The matrix consists of fine-grained quartz, clay, muscovite and sericite. The texture of the matrix material is irregular: patches of poorly sorted mixtures of clay, quartz and muscovite are interspered with areas of homogeneous fine grained mixtures of clay and sericite. Patches of pure kaolinite are also present. Much of the clay is heavily iron-stained.

AL40 (-440 to -450 ft): Quartz sand

(Grain mount of water well cuttings, washed)

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Quartz	93
Silt	4
Opaque minerals	2
Others	1

This sample consists almost entirely of moderately sorted coarse-grained quartz ranging from 0.4 to 2.5 mm in size. These grains are sub-rounded to sub-angular and occasionally show signs of strain. A minor amount of silt consisting of clay and/or carbonate material is present and sometimes fills fractures in quartz grains. Minute opaque grains are relatively abundant. A few poorly sorted quartzite fragments are present along with trace amounts of rutile and zircon.

AL40 (-550 to -560 ft): Silty quartz sand

(Grain mount of water well samples, washed)

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Quartz	85
Silt	10
Potassium feldspar (microcline)	2
Opaque minerals	2
Others	1

This sample consists mainly of moderately sorted quartz grains that have a "corroded" appearance. These grains average about 0.6 mm in size, are sub-rounded to sub-angular and do not show signs of strain. Silty material is also present and appears to consist of very fine-grained quartz, clay and/or carbonate material. Minute opaque grains are relatively abundant. Minor amounts of microcline and microfossils replaced by carbonate/clay/hematite are present along with trace amounts of muscovite and a cluster of rounded dolomite grains.

VG-1-1 (23.1 ft): Quartzose, calcareous sand

(stained for calcite)

Mineral Constituents	Approximate Abundance %
Micrite (with some clay)	65
Quartz	35
Others	2

This sample consists mainly of well sorted quartz grains poorly cemented by micrite (very fine grained calcite) and some clay. Quartz grains are about 0.2 mm in size, angular to sub-angular and show no signs of strain. Trace amounts of feldspar, microfossils, muscovite, epidote and opaques are scattered throughout.

VG-1-2 (8.2 ft): Fossiliferous sandy limestone

(stained for calcite)

Mineral Constituents	Approximate Abundance %	
Calcite		80
Shell fragments	40	
Micrite cement	40	
Quartz		14
Glauconite		2
Feldspar		1
Others		1

This sample consists mainly of shell fragments and moderately sorted quartz grains within a micritic cement. Quartz grains are sub-angular to sub-rounded, and sometimes show signs of strain. Shell fragments are relatively large, ranging from 0.8 to 5.0 mm in length. Some glauconite pellets are present and sometimes partially replace microfossils. Minor feldspar, hematite, and epidote grains are present.

VG-1-3 (-2.4 ft): Glauconitic sandy shale

(stained for calcite)

Mineral Constituents	Approximate Abundance %
Quartz	50
Clayey matrix	36
Muscovite	7
Glauconite	6
Microfossils	2
Others	1

This sample consists mainly of very fine-grained, well sorted quartz in a clayey matrix. Quartz grains range from 0.05-0.2 mm in size, are generally sub-angular to sub-rounded, and often show signs of strain. The matrix material is slightly calcareous and consists of clay with some sericite. Some glauconite pellets, muscovite and microfossils are present. Trace amounts of feldspar, opaque minerals (hematite and pyrite), epidote, and zircon were noted. Bedding is generally present and is occasionally contorted. Some grain size segregation is also apparent.

VG-1-4a (-1[illegible]8.4 ft): Quartz sand

Mineral Constituents	Approximate Abundance %
Quartz	98
Feldspar	1
Other	1

This sample consists almost entirely of well sorted, medium-grained quartz that are both uncemented and unconsolidated. Quartz grains range from 0.2 to 0.8 mm in size, are generally rounded to sub-rounded, and show some signs of strain. Trace amounts of feldspar, clay, and epidote are present.

VG-1-7 (-306.2 ft): Clayey sand

(stained for calcite)

Mineral Constituents	Approximate Abundance %
Quartz	60
Clay matrix	30
Muscovite	8
Opaques	2
Others	Trace

This sample consists mainly of poorly sorted quartz and some muscovite within an iron-rich clay matrix. Quartz grains range from 0.2 to 2.5 mm in size, are angular to sub-rounded and have a "corroded" appearance. They generally show signs of strain. Muscovite flakes are relatively fresh. The clay matrix is probably kaolinite with a little sericite. Abundant minute hematite grains are present within the clay. Minute opaque grains, probably magnetite, were noted along with trace amounts of potassium feldspar, zircon, and epidote. Bedding is roughly defined by oriented muscovite flakes.

VG-2-1 (23.6 ft): Quartzose, calcareous sand

(stained for calcite)

Mineral Constituents	Approximate Abundance %
Calcareous clay matrix	64
Quartz	35
Others	1

This sample consists of well sorted quartz grains poorly cemented by micrite and some clay. Quartz grains range from 0.2 to 0.4 mm, are sub-angular to sub-rounded, and usually do not show signs of strain. Minor amounts of muscovite, opaque minerals and a trace of epidote were noted.

VG-2-2 (8.7 ft): Fossiliferous sandy limestone

(stained for calcite)

Mineral Constituents		Approximate Abundance %
Calcite		81
Micrite cement	51	
Shell fragments	30	
Quartz		15
Glauconite		3
Others		1

This sample consists mainly of large shell fragments and moderately sorted quartz within a micrite cement. Quartz grains do not show signs of strain, range from 0.2 to 0.6 mm in size and are sub-angular to sub-rounded. Some glauconite pellets are present; glauconite also partially replaces a few microfossils. Minor amounts of opaque minerals, epidote and zircon were noted.

VG-2-3 (-1.9 ft): Sandy glauconitic marl

(stained for calcite)

Mineral Constituents	Approximate Abundance %
Quartz	35
Clayey matrix	25
Microfossil fragments and forams	20
Glauconite	12
Muscovite	4
Opaques	4
Feldspar	Trace

This sample consists mainly of well sorted quartz grains, microfossils and glauconite pellets. Quartz grains and glauconite pellets average 0.1 mm in size. Quartz grains are angular to subangular and usually show signs of strain. Calcite is usually present as lenticular microfossil fragments although abundant foraminifera are also present. Forams are occasionally partially replaced by pyrite. Some feldspar and muscovite is present. Opaque minerals are relatively abundant; zircon was also noted. Bedding is defined by oriented lenticular microfossil fragments and muscovite flakes.

VG-2-4a (-131.9 ft): Quartz sand

Mineral Constituents	Approximate Abundance %
Quartz	98
Others	2

This sample consists almost entirely of well sorted, medium-grained uncemented and unconsolidated quartz grains. These grains range from 0.2 to 0.6 mm in size and are generally rounded to sub-angular. Trace amounts of clay, allanite, epidote, garnet, kyanite and/or staurolite were noted.

VG-2-7 (-296.9 ft): Clayey sand

(stained for calcite)

Mineral Constituents	Approximate Abundance %
Quartz	55
Clay matrix	31
Microcline	8
Muscovite	5
Quartzite	1

This sample consists mainly of poorly sorted quartz, microcline, and muscovite in a clay matrix. Quartz and microcline grains range from 0.2 to 1.5 mm in size, are sub-angular to sub-rounded and unstrained. A few quartzite fragments are present, one of which appears strongly foliated. Microcline grains show characteristic gridiron twinning. Muscovite flakes are relatively fresh. The clay matrix is mainly kaolinite stained by hematite. Bedding is not evident.

VG-3-1 (21.2 ft): Quartzose, calcareous sand

(stained for calcite)

Mineral Constituents	Approximate Abundance %
Calcareous clayey matrix	69
Quartz	30
Others	1

This sample consists of moderately sorted quartz grains poorly cemented by micrite and clay. Quartz grains range from 0.2 to 0.6 mm in size, are angular to sub-angular, and generally do not show signs of strain. Trace amounts of allanite(?) and sillimanite or kyanite were noted. Some remnant foraminifera are also present.

VG-3-2 (6.3 ft): Fossiliferous sandy limestone

(stained for calcite)

Mineral Constituents		Approximate Abundance %
Calcite		83
Micritic cement	48	
Shell fragments	35	
Quartz		12
Glauconite		3
Calcite		2

This sample consists mainly of shell fragments and moderately sorted quartz grains within a micritic cement. Quartz grains range from 0.05 to 0.5 mm in size and are angular to sub-rounded. Shell fragments generally consist of relatively coarse-grained calcite. Minor amounts of discrete calcite grains and glauconite pellets are present. Glauconite partially replaces a few microfossils. Traces of iron staining were noted in the cement.

VG-3-3 (-4.3 ft): Silty marl

(stained for calcite)

Mineral Constituents	Approximate Abundance %
Calcareous clayey matrix	85
Quartz	7
Glauconite	3
Pyrite	3
Others	2

This sample consists of fine-grained quartz within a matrix consisting of micrite, clay, muscovite/ sericite and probably silt size quartz. Some glauconite pellets are present and disseminted pyrite is relatively abundant. Zircon and possibly a trace of zoisite were noted. Bedding is defined by strongly oriented muscovite and sericite and by some grain-size segregated bands. A gypsum vein is oriented parallel to the bedding.

VG-3-4 (-134.3 ft): Quartz sand

Mineral Constituents	Approximate Abundance %
Quartz	96
Sandstone(?) fragments	4

This sample consists almost entirely of unconsolidated, well sorted, medium-grained quartz. These grains average about 0.8 mm in size, are generally rounded to sub-rounded and occasionally show signs of strain. Some poorly sorted quartz sandstone(?) fragments are present. A trace amount of clay material partially rims a few of the quartz grains.

VG-3-7 (-307.1 ft): Sandy clay

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance %
Clay matrix (with hematite)	51
Quartz	40
Microcline	5
Muscovite	2
Others	2

This sample consists mainly of poorly sorted quartz and some microcline in a clay matrix. Quartz and microcline grains range from 0.1 to 3.0 mm in size, are angular to sub-rounded and occasionally show signs of strain. A few quartzite fragments are present; one appears to be strongly foliated and shows signs of strain. A minor amount of muscovite, zircon, opaques (magnetite), and calcareous material are present. The clay consists mainly of kaolinite containing abundant minute grains of hematite. Bedding is not evident.

VG-4-1 (-3.7 ft): Clay and fossiliferous sandy shale

Mineral Constituents	Approximate Abundance %
Clay	63
Microfossils and shell fragments	25
Quartz	10
Glauconite	1
Opaque Minerals	1
Muscovite	Trace

This sample consists of irregularly interbedded clay and sandy shale. The sample as a whole consists of abundant clay, microfossils and shell fragments with minor amounts of quartz. Quartz grains range from 0.05 to 0.1 mm in size and are angular to sub-rounded. Minor amounts of glauconite and opaque minerals (primarily pyrite as microfossil replacements) are present, along with a trace amount of muscovite. Bedding is defined by compositional banding and mineral alignment.

VG-4-4 (-294.1 ft): Clayey sand

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance %
Quartz	65
Clay matrix	26
Muscovite	5
Gypsum	3
Potassium feldspar	2
Opaques	1

This sample consists mainly of poorly sorted quartz and some muscovite in a clay matrix. Quartz grains range from 0.1 to 1.5 mm in size, are sub-angular to sub-rounded and occasionally show signs of strain. A few strongly foliated and strained quartzite fragments were noted. Some fresh muscovite flakes and probably gypsum are present along with minor amounts of "corroded" potassium feldspar grains (as indicated by potassium feldspar staining) and trace amounts of magnetite and pyrite. The clay consists mainly of kaolinite with some sericite. Abundant minute hematite grains stain the clay matrix. Weak bedding is defined by oriented muscovite flakes.

VG-5-2 (34.5 ft): Quartzose, calcareous sand

(stained for calcite)

Mineral Constituents		Approximate Abundance (%)
Calcite		58
Micrite (with some clay?)	48	
Microfossils and shell fragments	10	
Quartz		40
Others		2

This sample consists of well sorted quartz grains moderately cemented by micrite and probably some clay. Quartz grains range from 0.1 to 0.2 mm in size, are angular to sub-rounded and generally do not show signs of strain. Some microfossils and shell fragments are present along with trace amounts of muscovite, feldspar, opaque minerals, glauconite, and hornblende.

VG-5-3 (-14.5 ft): Fossiliferous sandy limestone

(stained for calcite)

Mineral Constituents	Approximate Abundance (%)	
Calcite		74
Micrite	55	
Shell fragments	29	
Quartz		10
Glauconite		5
Others		1

This sample consists of large shell fragments and quartz grains within a micrite cement. Q artz grains are well sorted, averaging about 0.2 mm in size, are angular to sub-angular and generally do not show signs of strain. Glauconite is relatively abundant and trace amounts of opaque minerals, feldspar, epidote and muscovite were noted.

VG-5-4 (-18.0 ft): Marl and sandy marl

(stained for calcite)

Mineral Constituents	Approximate Abundance (%)	
Clay		45
Quartz	30	
Micrite	20	
Muscovite		3
Others		3

This sample consists of sandy material in contact with shaly material. The contact is slightly gradational, represented by the presence of silty material approximately 1.5 mm thick. The sand consists mainly of poorly sorted quartz with minor glauconite, muscovite, microfossils, feldspar and opaque minerals within a clay and micrite matrix. The shaly material consists almost entirely of clay and micrite. Some solution cavities are present and are aligned parallel to bedding. These cavities are often filled with opaque minerals.

VG-5-5 (-138.5 ft): Quartz sand

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Quartz	95
Clay	3
Others	2

This sample consists mainly of unconsolidated, well sorted, medium-grained quartz. The grains range from 0.2 to 0.5 mm in size, are generally sub-rounded to sub-angular and often show signs of strain. Minor clay and trace amounts of potassium feldspar, glauconite, opaque minerals, and staurolite are present.

VG-5-8 (-310.5 ft): Clayey sand

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Quartz	60
Clay	35
Muscovite	4
Others	1

This sample consists of poorly sorted quartz grains very loosely held by a clay matrix. Quartz grains range from 0.2 to 1.5 mm in size, are sub-rounded to sub-angular and sometimes show signs of strain. Some fresh muscovite flakes are present along with trace amounts of quartzite fragments, epidote, opaque minerals and potassium feldspar.

VG-6-1 (58.1 ft): Quartzose, calcareous sand and shale

(stained for calcite)

Mineral Constituents	Approximate Abundance (%)	
Calcite		60
Micrite	50	
Microfossils	10	
Quartz		30
Clay		7
Others		3

This sample consists of well sorted quartz poorly cemented by micrite and possibly some clay. Some shaly material is also present and is in relatively sharp contact with the calcareous sand. Quartz grains range from 0.05 to 0.1 mm in size, generally do not show signs of strain. Many quartz grains have a "corroded" appearance. Microfossils are relatively abundant, and minor amounts of chalcedony and opaque minerals along with trace amounts of feldspar, glauconite, epidote and garnet(?) were noted. The shale material consists of micrite as well as clay, with minor amounts of fine-grained quartz and chalcedony. Some solution cavities and fractures are present in the shale.

VG-6-2 (1.1 ft): Fossiliferous sandy limestone

(stained for calcite)

Mineral Constituents		Approximate Abundance (%)
Calcite		85
Micrite	70	
Shell fragments	15	
Quartz		13
Others		2

This sample consists of some large shell fragments and some moderately sorted quartz grains within a micrite cement. Quartz grains range from 0.2 to 0.8 mm in size, are angular to sub-rounded and sometimes show signs of strain. Many of them have a "corroded" appearance. Some solution cavities are present. Minor clay and chalcedony are present and partially replace shell fragments. Traces of opaque minerals are present.

VG-6-3 (-42.9 ft): Sandy marl

Mineral Constituents		Approximate Abundance (%)
Clay		40
Calcite		27
Micrite	17	
Microfossils	10	
Quartz		25
Glauconite		3
Muscovite		3
Opaque minerals		2

This sample consists of irregularly interbedded sandy and shaly material. The sandy material consists of fairly well sorted quartz averaging about 0.1 mm in size, muscovite, glauconite, microfossils and opaque minerals with a trace of feldspar. The shaly material includes micrite as well as clay, together with minor amounts of minerals present in the sandy material. Trace amounts of zircon and epidote were noted.

VG-6-4 (-172.9 ft): Quartz sand

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Quartz	99
Others	1

This sample consists of unconsolidated, well sorted, medium-grained quartz. These grains average about 0.5 mm in size, are sub-rounded to sub-angular and often show signs of strain. Trace amounts of potassium feldspar, clay, muscovite, glauconite, zircon and opaque minerals were noted.

VG-6-7 (-343.9 ft): Clayey, feldspathic sand

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Quartz	45
Clay	37
Potassium feldspar (microcline?)	13
Muscovite	4
Others	1

This sample consists mainly of quartz and potassium feldspar in a clayey matrix. Quartz and feldspar grains are poorly sorted, ranging from 0.2 to 1.0 mm in size and are generally sub-rounded. Quartz grains often have a corroded appearance. Some muscovite is present. The clay matrix consists mainly of kaolinite at least some of which probably formed from alteration of the potassium feldspar. Minute hematite and zircon grains are scattered throughout the matrix. A trace amount of staurolite(?) was noted.

VG-7-1 (44.6 ft): Fossiliferous sandy limestone

(stained for calcite)

Mineral Constituents		Approximate Abundance (%)
Calcite		89
Micrite cement	59	
Shell fragments	30	
Quartz		8
Glauconite		3

This sample consists of shell fragments and quartz grains within a micrite cement. Quartz grains are moderately sorted, ranging from 0.3 to 0.8 mm in size. These grains are rounded to sub-rounded, usually relatively fresh, though sometimes moderately fractured. Glauconite pellets are relatively abundant. Some pore space caused by the partial dissolution of shell fragments is evident.

VG-7-2 (24.6 ft): Sandy marl

(stained for calcite)

Mineral Constituents	Approximate Abundance (%)
Clay (with some micrite)	62
Calcite (as microfossils)	15
Quartz	10
Muscovite	5
Others	3

This sample consists of very fine-grained (0.05 mm) quartz and microfossils within a matrix of clay with some muscovite and micrite. Trace amounts of glauconite, pyrite, hematite and magnetite grains are present. Muscovite orientation, grain size segregation, and compositional banding define bedding.

VG-7-3 (-114.4 ft): Quartz sand

(stained for potassium feldspar)

Mineral Constituents	Approximate Abundance (%)
Quartz	98
Others	2

This sample consists of unconsolidated, medium-grained quartz. These grains are moderately sorted, ranging from 0.2 to 0.8 mm in size, generally sub-rounded, and show some signs of strain. Trace amounts of clay, pyrite, hornblende (?), staurolite (?) and potassium feldspar were noted.

VG-8-1 (1.7 ft): Quartzose, calcareous sand

(Stained for calcite)

Mineral Constituents	Approximate Abundance (%)
Calcite (with some clay)	55
Quartz	40
Microfossils	3
Others	2

This sample consists mainly of quartz grains moderately cemented by calcareous to marly material. Quartz grains are moderately sorted, ranging from 0.1 to 0.5 mm in size, angular to sub-rounded, and show signs of strain. Minor amounts of microfossils along with trace amounts of muscovite, feldspar, opaque minerals, epidote, tourmaline and hornblende were noted. Vague alignment of quartz grains defines bedding.

VG-8-2 (-10.3 ft): Fossiliferous sandy limestone

(stained for calcite)

Mineral Constituents		Approximate Abundance (%)
Calcite		86
Micrite cement	54	
Shell fragments	32	
Quartz		12
Others		2

This sample consists of relatively large shell fragments and quartz within a micrite cement. Quartz grains are moderately sorted, ranging from 0.2 to 1.2 mm in size and are rounded to sub-rounded and do not show signs of strain. Minor amounts of opaque minerals, glauconite and a trace amount of epidote were noted.

VG-8-3 (-52.3 ft): Sandy shale

(stained for calcite)

Mineral Constituents	Approximate Abundance (%)
Clay	58
Quartz	20
Micrite	10
Zircon	5
Muscovite	3
Opaques	3
Others	1

This sample consists of some quartz and muscovite within a matrix of clay with some micrite. Quartz is very fine-grained, averaging about 0.05 mm in size. Opaque minerals and zircon are relatively abundant. Some microfossils are present and trace amounts of glauconite, epidote and feldspar were noted. Some solution cavities are present. Oriented muscovite flakes and elongated solution cavities define bedding.

APPENDIX H

Heavy Mineral Analyses of Samples

from VSC and VG Core Holes and Water Well AL-66

APPENDIX H

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1.0 INTRODUCTION

Heavy mineral analyses were performed to identify characteristic assemblages of heavy minerals in selected stratigraphic units as an aid in stratigraphic correlation. These analyses were performed by Dr. T. Thomas at Reservoirs, Inc., Denver, Colorado. This appendix describes the methods used to analyze heavy minerals in submitted samples and provides descriptions and relative percentages of heavy minerals present. These descriptions are summarized in Tables 7-8 and 7-11. A discussion of the results is in Section 7.5.

3.0

X-ray Diffraction Analyses

by

Drs. Parnell and Reynolds

PROCEDURE FOR HEAVY MINERAL SEPARATION AND IDENTIFICATION

1. Disaggregation: Samples were gently disaggregated in a ceramic mortar and pestle, then dried and weighed.

2. From bulk sample, sufficient quantity was weighed after separation and immersed in bromoform (specific gravity 2.85 gm/cc.) After approximately one hour of periodic agitation, sample was separated by opening stopcock and heavy mineral fraction was recovered.

3. Washing, drying, and weighing: Samples were washed in appropriate solvent, gently dried overnight, and weights of light and heavy mineral fractions recorded. Difference between original sample weight and final sample weight is carried as percent loss during separation.

4. Heavy minerals were only separated as greater than or less than 14 mesh to remove excessive aggregate concentrations. Note: This permits study of silt-sized and very fine sand-sized heavy minerals.

5. Visual descriptions for each sample were made prior to separation.

6. Each sample was mounted in Canada balsam and studied for grain size, minerals present, particular grain size variations or surface textures that are unusual, and approximate abundances.

7. Two hundred point counts on each of the samples were rendered whenever possible, and data recorded in whole percentage numbers. Included in those numbers are grains that cannot be identified because of excessive alteration, small size, or inclusions.

3.0

HEAVY MINERAL ANALYSES
OF SAMPLES FROM VSC
CORE HOLES AND AL-66 WATER WELL

PERCENT SUMMARY OF POINT COUNT DATA - 200 POINTS
VSC Core Holes AND WATER WELL AL-66

SAMPLE	Hematite/ Magnetite	Ilmenite/ Leucoxene	Hematite/ Limonite	Garnet	Zircon	Tourmaline	Kyanite	Sillimanite	Staurolite	Andalusite	Hornblende	Epidote	Others*
VSC-2-(54.7 ft)	32	14	t	5	4	3	3	2		2	2	2?	U(26) C(5)
VSC-2-(-70.3 ft)	31	17	15	14	11	5	1?	2		t?	6	4	M(2) U(4) R(2) P(1)
VSC-4-(58.7 ft)	25	12	4?	16	12	8	2	--		--	t?	2	M(4) R(2) C(2)
VSC-4-(-155.3 ft)	29	25	1	12?	11	5	2	2		2	2	?	C(1) U(2) R(1)
VSC-4-(-321.3 ft)	24	34	3	6	9	8	--	--		--	6	5	R(1) U(3) Am(t)
VSC-4-(-528.3 ft)	28	21	12	5	8	6	3	2	--	--	2	4	R(2) Am(1) Biot (2) U(4)
VSC-4-(-538.3 ft)	65	3?	4	11	4	--	--	1	--	--	--	2	G(1); R(1); U(8) (qtz/incl)
VSC-4-(-843.3 ft)	30	30	7	4	10	9	tr	--	--	--	2	?	R(t) Pyr.(2) Am(?) U(7)
AL-66-(-558 to 568 ft)	50	40	--	--	1?	An estimated point count only - heavily iron-stained					--	2?	R(2)

*Others = Monazite (M); Pyrite (P); Allanite (A); Amphibole (Am); Collophane (C): Rutile (R); Glauconite (G)
M (3) - 3 percent Monazite; Unidentified (U);
t = present but not counted

General Description and Approximate Abundances
of Heavy Minerals in Samples from VSC Coreholes and Water Well AL-68

Sample Elevation (ft)	Wt. %	Comments
VSC-2 - (54.7)	0.9	Heavy mineral separate includes tan to white clasts, probably clay-coated shell fragments containing iron and phosphatic material. Estimated 30% by weight of total sample. Minerals present: garnet (two types), zircon, tourmaline, sillimanite, kyanite, andalusite, hornblende (?), magnetite (well rounded), and ilmenite (with leucoxene). (Note: one grain, possibly considered sphene, is actually garnet, with very high indices of refraction.) Opaque to non-opaque ratio is approximately 50-50. Approximate order of abundance: garnet, zircon, tourmaline, andalusite, sillimanite, kyanite, others.
VSC-2 - (-70.3)	0.4	Noted are at least two types of garnet, with pale red and dark red internal colors. Garnet mineralogy is coarser than other heavies in sample. Minerals present: garnet, zircon, hornblende (oxyhornblende?), epidote (green), andalusite, sillimanite, ilmenite, magnetite, tourmaline. Note approximately 50% of ilmenite grains are coated in part with leucoxene. Approximate order of abundance: garnet, zircon, hornblende (brown), andalusite, epidote, sillimanite, opaques. Note: Opaques are less than 50% of the heavy mineral fraction.
VSC-4 - (58.7)	0.3	This sample exhibits a distinct bimodal size distribution with opaques (ilmenite, hematite, limonite, and magnetite). The shape of the larger clasts (opaques) is highly irregular, appearing to be aggregates of smaller particles. Note that the limonite-hematite is much coarser than the magnetite and ilmenite (with leucoxene). Approximate order of abundance: hematite plus limonite, magnetite, ilmenite, garnet, zircon, tourmaline, kyanite; traces of collophane (?), monazite, epidote (?).

4.0

X-ray Diffraction Analyses

by

Dr. R. Grim

Sample Elevation (ft)	Wt. %	Comments
VSC-4 - (-155.3)	0.2	This represents a subequal mixture of opaque and non-opaque heavy minerals. All non-opaque minerals are subhedral to euhedral, rather than anhedral, as in the VSC-2 samples mentioned above. Minerals present: garnet, tourmaline, zircon, sillimanite, kyanite, rutile, hornblende, magnetite, ilmenite (with some leucoxene), pyrite (or pyritic sandstone), and phosphate (collophane??). Approximate order of abundance: garnet, zircon, sillimanite, kyanite, andalusite, rutile, hornblende. Note: possible epidote, but pleochroism and optic signs resemble hornblende.
VSC-4 - (-321.3)	0.6	This sample consists of very fine sand- to coarse silt-sized material with abundant opaque minerals and non-opaque minerals that are subhedral to euhedral. Opaques include ilmenite magnetite, with a trace of pyrite. Non-opaques include zircon, garnet, tourmaline, monazite (?), epidote, hornblende (oxy-), rutile, and riebeckite (?). Note that this sample contains a subequal amount of nearly all heavy minerals, and the tourmaline and zircon contain abundant inclusions. Approximate order of abundance: Ilmenite, zircon, garnet, tourmaline, oxyhornblende, epidote, monazite, rutile, magnetite. Also noted in this sample were apparent aggregates of tourmaline, probably clumped together by clay.
VSC-4 - (-528.3)	0.7	(0.5% loss during separation) Small sample quantity and loss in separation because of small quantity render analysis somewhat suspect. Noticeable is the grain size difference between garnet and opaques (upper very fine-upper fine) and remainder of the non-opaque fraction (coarse silt-lower very fine sand). Opaque mineral fraction approximately 45-55% compared to non-opaque. Minerals present: Magnetite, ilmenite, garnet, tourmaline, zircon, kyanite, sillimanite, epidote, glauconite, rutile, and allanite (?). Also present are numerous grains of quartz containing inclusions of magnetite and/or hematite. All grains are subhedral to euhedral, with magnetite exhibiting good octahedral shape. Also present is a trace of green biotite.

Sample Elevation (ft)	Wt. %	Comments
VSC-4 - (-528.3) (Continued)	0.7	Approximate order of abundance: Magnetite, ilmenite hematite/limonite, zircon, tourmaline, garnet, epidote, kyanite, sillimanite, rutile. Note unknown grains and quartz contamination are approximately 5% of total.
VSC-4 - (-538.3)	0.5	(0.7% loss during separation) This sample contains a wide range in grain size of heavy minerals. Predominant are large, subhedral grains of magnetite that are coated with virtually no hematite or limonite. Few grains of ilmenite were noted. The non-opaque mineral fraction is slightly finer than the opaque mineral fraction. Overall grain size ranges between upper coarse and lower fine. Grain shape in lower fine is subhedral to anhedral. The opaque to non-opaque ratio is approximately 7:3. Minerals present: Magnetite, garnet, tourmaline (two varieties, based on pleochroic formula), zircon, epidote, rutile, hornblende, glauconite (?), monazite (??). Approximate order of abundance: Magnetite, garnet, zircon, epidote, hornblende (?), rutile, sillimanite.
VSC-4 - (-843.3)	[illegible].2	(Loss 0.2% during separation) Compared to the previous sample, mineralogy is much simpler, with better sorting. There is less upper fine-grained material and much less limonite. Pyrite present seems to be in the form of aggregates. Most grains are subhedral, with many broken crystals. Approximately 70% of the heavy mineral fraction is made up of opaque minerals. Minerals present: Magnetite, ilmenite, limonite/hematite, pyrite, garnet, zircon, tourmaline, hornblende, rutile, amphibole (?), pyrite, and minerals unidentifiable, including some quartz grain aggregates containing magnetite inclusions. Approximate order of abundance: Magnetite, ilmenite, zircon, hematite, tourmaline, garnet, hornblende, pyrite. Unknowns at least 5% of total sample. (Note the lack of kyanite and other contact metamorphic minerals present in previous sample.)

Sample Elevation (ft)	Wt. %	Comments
AL-66 - (-558 to -568)	2.6	(0.9% loss during separation) This sample consists of a high percentage of coarse grains of opaque material, generally magnetite with heavy coatings of hematite and/or limonite. Ilmenite is also indicated by whitish coatings on certain opaque minerals. Grain shape is subhedral (well rounded to rounded). Grain size range is upper coarse to lower medium. In addition, several of the grains that appear to be hematite-coated magnetite may be hematite-coated quartz grains. Approximate ratio of opaques to non-opaques is 8:2. Minerals present: Magnetite, ilmenite, epidote, rutile, zircon (?). Note that this sample is difficult to point count and should be considered highly suspect.

Weight Percentages of Heavy Minerals from

VSC Core Holes and Water Well AL-66 - Bromoform Extraction

Sample Elevation (ft)	"Light" Fraction %	"Heavy" Fraction %
VSC-2 - (54.7)	99.10	0.90
VSC-2 - (-70.3)	99.60	0.40
VSC-4 - (58.7)	99.97	0.30
VSC-4 - (-155.3)	99.80	0.20
VSC-4 - (-321.3)	99.40	0.60
VSC-4 - (-528.3)	98.80	0.70
VSC-4 - (-538.3)	98.80	0.50
VSC-4 - (-843.3)	99.60	0.20
AL-66 - (-558 to -568)	96.50	2.60

4.0

HEAVY MINERAL ANALYSES OF SAMPLES FROM VG CORE HOLES

PERCENT SUMMARY OF POINT COUNT DATA - 200 POINTS
VG Core Holes

SAMPLE	Hematite/ Magnetite	Ilmenite/ Leucoxene	Hematite/ Limonite	Garnet	Zircon	Tourmaline	Kyanite	Sillimanite	Staurolite	Andalusite	Hornblende	Epidote	Others*
VG-1-(23.1 ft)	34	17	--	6	4	3	8	12	tr	2	3	3	R(4); U(4)
VG-1-(-130.4 ft)	24	33	--	7	4	4	1	2		--	7	7	P(1) M(1) G(3) U(5)
VG-1-(-306.2 ft)	46	13	3 (bot mass)	tr	7	4	--	--	8	3	--	5	U(5);R(5)M(1?)
VG-2-(23.6 ft)	38	4?	2	8	5	6	6	12	1	2	2	6	U(6)(qtz/incl) R(2); M(tr)
VG-2-(-132.9 ft)	16	40	2	12	6	6	--	2		--	5	4	G(3) M(2) R(1) U(3)
VG-2-(-296.9 ft)	51	21	2?	--	--	8	tr	1	--	tr?	2	6	U(7)(qtz/incl) R(2)
VG-3-(21.2 ft)	17	10	--	14	11	2	16	13	tr	--	--	4	U(6 incl) (2 snell deb.) R(4); A(1?)
VG-3-(-134.3 ft)	35	24	4	6?	2	5	2	1	--	--	--	9	G(2);R(2);U(2)
VG-3-(-307.1 ft)	44	19	?	2	5	6	tr?	--	--	--	3	3	U(11) (qtz/incl)R(7)
VG-4-(-294.1 ft)	42	16	7	11	8	4	--	--	--	tr	2	4	P(1); R(4); A(1)
VG-6-(-343.9 ft)	36	25	--	2	3	3	1	2		--	10	11	P(3) M(1) R(1) U(4)
VG-7-(54.6 ft)	26	19	6?	18	8	5	1	5		--	4	3	A(2) R(1) Am(3) U(3)
VG-7-(-114.4 ft)	31	26	1	6	2	3	4	1		1	6	4	P(3) A?(3) U(2) Am(2)
VG-8-(1.7 ft)	35	28	--	6	9	5	2	3		--	5	4	A(1) U(2) R(t)

*Others : Monazite (M); Pyrite (P); Allanite (A); Amphibole (Am);
Collophane (C): Rutile (R); Glauconite (G)
M (3) - 3 percent Monazite; Unidentified (U);
t : present but not counted

General Description and Approximate Abundances
of Heavy Minerals in Samples from VG Coreholes

Sample Elevation (ft)	Wt. %	Comments
VG-1 - (23.1)	0.3	(0.6% loss during separation) This sample contains noticeably abundant grains of sillimanite and kyanite that are subhedral. Grain size is upper very fine to lower fine. Grain shape is generally subhedral (subangular). Approximate opaque to non-opaque ratio is 6:4. Minerals present: Garnet, kyanite, sillimanite, rutile, tourmaline, hornblende (?), epidote, andalusite, magnetite, ilmenite. Approximately 50% of the ilmenite is coated with leucoxene, and hematite rimming is evident on all magnetite grains. Two yellowish-brown grains with extremely high birefringence may be sphene, but they were not included in the point count. Grains are too small for optical identification. Approximate order of abundance: Magnetite, ilmenite, sillimanite, kyanite, garnet, zircon, epidote, tourmaline, hornblende, andalusite.
VG-1 - (-130.4)	0.5	This sample contains many well rounded opaque and non-opaque heavy minerals fairly coarse in size (fine to medium). Noticeable is the presence of three very well rounded fragments of glauconite, identified by its composite, tiny "flake-like" appearance in crossed nicols, deep green body color, lack of pleochroism, and lack of cleavage. Opaque heavy minerals occur as before, but there is much less leucoxene developed on the ilmenite. Also present are several grains with clay coatings and make identification difficult. Approximate order of abundance: opaques (magnetite ilmenite), garnet, tourmaline (brown), hornblende-allanite, epidote, glauconite, zircon (unusually low), rutile. Possible minerals also present include monazite (with typical yellow-brown pleochroism), sillimanite, and kyanite.
VG-1 - (-306.2)	0.1	(1% loss during separation) This sample contains distinctly bimodal sizes of heavy minerals. The coarsest heavies are rutile, and the finer fraction is made up of the opaque

Sample Elevation (ft)	Wt. %	Comments
VG-1 - (-306.2) (Continued)	0.1	mineral suite, plus the remainder of the non-opaques. Shape of the larger clasts is subrounded, whereas the finer clasts are all subangular (subhedral). Included are several fragments of quartz containing inclusions of opaque minerals thought to be magnetite. Opaque minerals consist of magnetite and ilmenite. Note alteration products leucoxene on ilmenite, and limonite/hematite on magnetite are also present. The opaque/non-opaque ratio is approximately 60:40. Minerals present: Zircon, hornblende (oxyhornblende), magnetite, ilmenite, staurolite (one piece), sillimanite, kyanite, tourmaline. Grain size is coarse silt to lower very fine sand for most of heavies, and upper fine for rutile and associated grains. Approximate order of abundance: Magnetite, ilmenite, zircon, rutile, staurolite, kyanite, sillimanite, tourmaline. Hematite and leucoxene are alteration products on opaques.
VG-2 - (23.6)	0.3	(0.4% loss during separation) As with Sample VG-2-550, this sample contains definite percentages of kyanite, sillimanite, and possibly andalusite. Also present is heavy mineral inclusion-rich quartz. Opaque minerals are subequal in abundance with non-opaques in the ratio 5:5. Grain size is generally upper very fine to upper fine. Grain shape is euhedral to subhedral (angular to very angular). Minerals present: Sillimanite, kyanite, zircon, garnet, hornblende, epidote, rutile, magnetite, ilmenite, tourmaline, monazite (?). Note that the surface texture of the garnet is slightly pitted. The zircon is rich in inclusions, as is the tourmaline. Approximate order of abundance: Magnetite, sillimanite, epidote, garnet, tourmaline, zircon, hornblende. Noted is one sillimanite grain with a tourmaline inclusion.
VG-2 - (-132.9)	0.8	In this sample, there are abundant heavy minerals, predominantly opaques. All grains appear to be fairly well rounded, though some are subhedral. Ilmenite with leucoxene is much greater in abundance than is magnetite.

Sample Elevation (ft)	Wt. %	Comments
VG-2 - (-132.9) (Continued)	0.8	Approximate order of abundance: ilmenite (with leucoxene) magnetite, garnet, hornblende (green-brown variety), epidote, tourmaline (two types, dark brown and light brown), zircon, rutile, monazite, sillimanite. Also identified is one clast of weathered biotite.
VG-2 - (-296.9)	0.5	(0.9% loss during separation) The majority of heavy mineral grains in this sample are altered opaque minerals. Also present is a fair percentage of inclusion-rich quartz that contains magnetite. The non-opaque heavy mineral fraction is quite small. Grain size in this sample is fairly uniform between upper very fine and lower fine; some bimodality is suggested. Grain shape appears subrounded (subhedral to anhedral). Exceptions are grains of tourmaline that are subhedral to euhedral. Minerals present: Magnetite, ilmenite, rutile, sillimanite, tourmaline, hornblende, epidote, kyanite. The majority of sample appears to be coated with hematite and/or limonite. Some ilmenite grains are coated with leucoxene, apparently. Identification of specific grains is somewhat questionable. Approximate order of abundance: Magnetite coated with hematite and leucoxene, ilmenite, tourmaline, rutile, hornblende, epidote, sillimanite, kyanite.
VG-3 - (21.2)	0.3	(0.4% loss during separation) This sample contains a subequal mixture of lower fine and upper fine sand-sized heavy minerals. In general, the grains are subhedral to euhedral (subrounded to subangular), with the coarser grains being mostly well rounded. Noticeable, in contrast to the other samples, is the increase in amount of garnet, zircon, and epidote, with an associated decrease in opaques. The opaque/non-opaque mineral ratio is approximately 4:6. The opaque minerals are predominantly magnetite, with thin, irregular rims of hematite and/or limonite. Minerals present: Magnetite (with hematite and limonite), ilmenite, garnet, kyanite, sillimanite, zircon, tourmaline, epidote, rutile, allanite (?), phosphatic shell fragments (three pieces). Note the unusually high abundance of kyanite plus sillimanite, and the slightly pitted nature of the garnet crystal faces.

Sample Elevation (ft)	Wt. %	Comments
VG-3 - (21.2) (Continued)	0.3	Approximate order of abundance: Kyanite, sillimanite, magnetite, zircon, garnet, rutile, epidote, ilmenite, phosphatic shell material.
VG-3 - (-134.3)	0.2	(0.3% loss during separation) The heavy mineral fraction is predominated by opaque minerals. The coarsest grains (upper medium) are magnetite, with little hematite alteration. Heavily hematite-altered magnetite is also present in the finest grain fraction, which is lower fine. Approximate ratio of opaques to non-opaques is 7:3. Grain shape is generally subhedral, with the coarser grains being more anhedral (subrounded). Minerals present: Magnetite, ilmenite, epidote, rutile, garnet, tourmaline, zircon, kyanite. Note that epidote is inclusion-rich, and most grains have a thin rim of low birefringent material thought to be clay. A trace of glauconite was also noted.
VG-3 - (-307.1)	0.4	(0.5% loss during separation) Much fine silt-sized material is evident in this heavy mineral separate. Identifiable heavy minerals are either silt- to lower very fine sand-sized or upper fine- to lower medium-sized. Present are occasional pieces of quartz that are inclusion-rich. Also noted are inclusion-rich pieces of epidote and aggregates (few) of heavy minerals. Most grains appear rimmed with hematitic or limonitic stain. Opaque minerals are predominantly magnetite, with some ilmenite. Both minerals are coated with their respective alteration products--hematite/limonite and leucoxene. Approximate opaque/non-opaque ratio is 3:2. Noticeable is the coarseness of rutile (upper fine) and extreme fineness of zircon (lower very fine sand). Larger grains appear subhedral (rounded) and smaller clasts are angular or subhedral to euhedral. Minerals present: Magnetite, ilmenite, garnet, zircon, hornblende, epidote, tourmaline, rutile. Note that opaque grains have oxides on rims. Approximate order of abundance: Magnetite, ilmenite, tourmaline, rutile, zircon, hornblende, epidote, garnet. (Note the low percentage of garnet vs. other minerals.)

Sample	Elevation (ft)	Wt. %	Comments
VG-4 -	(-294.1)	0.2	(0.6% loss during separation.) Distinctly bimodal in size, this heavy mineral separate is dominated by opaques, particularly hematite coated magnetite. The opaques and rutile are upper fine and lower medium in size, but the non-opaque fraction is lower very fine in size. The opaque/non-opaque ratio is 7:3. Minerals present: Hornblende, magnetite, ilmenite, hematite (flakes), epidote, tourmaline, zircon, garnet, rutile, pyrite (one piece), and allanite (?). Approximate order of abundance: Magnetite, ilmenite, garnet, zircon, hematite (flakes), tourmaline, epidote, rutile, allanite, pyrite. Possible is one piece of andalusite.
VG-6 -	(-343.9)	0.4	Weight percent results on this sample are strongly skewed because of a large clump of clay containing iron-stained, opaque heavy minerals. Overall, the heavy mineral suite is in the very fine sand to coarse silt size range. Pyrite that is present is common as aggregates, and there is lots of leucoxene on ilmenite particles. Magnetite exhibits well rounded but subtle octahedral shapes. Opaque mineral fraction is much greater than the non-opaque mineral fraction. Approximate order of abundance: opaque minerals (ilmenite magnetite), garnet, hornblende, epidote, tourmaline, zircon, glauconite, monazite, kyanite. Note: There are many clay rims on opaque and non-opaque heavy minerals.
VG-7 -	(54.6)	0.3	In this sample, the heavy minerals exhibit a wide range of sizes, from very fine silt to fine sand. The size is noticeably coarser (0.30 mm) compared to Sample VSC-4 - 58.7 ft., and contains abundant opaques. There are few mineral aggregates. Several minerals were identified tentatively as allanite, having similarities to oxyhornblende, except that it exhibits poor cleavage and a pleochroism formula that is dark brown to brown to colorless. Minerals present in the opaque fraction include magnetite, ilmenite (with leucoxene), and limonite (questionably developed on hematite).

Sample Elevation (ft)	Wt. %	Comments
		Approximate order of abundance: garnet, opaques (magnetite ilmenite), tourmaline, zircon, hornblende, allanites, amphibole (aegerine-augite?), rutile, kyanite. Note: This sample also contains fragments of quartz that contaim flects of opaque material (tentatively magnetite).
VG-7 - (-114.4)	0.8	Note: This sample contains several large fragments that appear to be curving, angular chips of inclusion-rich opal or chalcedony. Identification was not possible. Opaque minerals include pyrite, magnetite, ilmenite with leucoxene, and all are much larger in size and in greater abundance than the non-opaque fraction. All non-opaque particles are either euhedral or angular (broken crystal outlines). Conspicuously low is the abundance of zircon. Approximate order of abundance: opaques (ilmenite with leucoxene, magnetite, pyrite, hematite and limonite), garnet, allanite or oxyhornblende, amphibole, epidote, kyanite, tourmaline and sillimanite. Note: In this sample, epidote appears to be the typical green variety, with Persian carpet birefringence. Allanite identified in this sample actually may be oxyhornblende that has been heavily weathered.
VG-8 - (1.7)	0.2	Most heavy minerals in this sample are in the coarse silt size range, with few in the very fine sand size range. There are a number of long, prismatic crystals of zircon, sillimanite, and kyanite. Opaques include magnetite ilmenite (with leucoxene). Observed also was one blue-green garnet. Approximate order of abundance: opaques (magnetite ilmenite), garnet, (three types, brown, clear, blue), kyanite, sillimanite, zircon (two types, brown and clear), hornblende, epidote. Note: This sample also contains a markedly higher percentage of opaques than of non-opaques.

Weight Percentages of Heavy Minerals from

VG Core Holes - Bromoform Extraction

Sample Elevation (ft)	"Light" Fraction %	"Heavy" Fraction %
VG-1 - (23.1) ft	99.10	0.30
VG-1 - (-130.4) ft.	99.50	0.50
VG-1 - (-306.2) ft.	98.90	0.10
VG-2 - (23.6) ft.	99.30	0.30
VG-2 - (-132.9) ft.	99.20	0.80
VG-2 - (-296.9) ft.	98.60	0.50
VG-3 - (21.2) ft.	99.30	0.30
VG-3 - (-134.3) ft.	99.50	0.20
VG-3 - (-307.1) ft.	99.10	0.40
VG-4 - (-294.1) ft.	99.20	0.20
VG-6 - (-343.9) ft.	99.60	0.40
VG-7 - (54.6) ft.	99.70	0.30
VG-7 - (-114.4) ft.	99.20	0.80
VG-8 - (1.7) ft.	99.77	0.23

APPENDIX I

X-Ray Diffraction Analyses of Bulk and Clay

Samples from VSC and VG Core Holes and Water Well AL-66

APPENDIX I

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1.0 INTRODUCTION

X-ray diffraction analyses of the clay fraction of submitted samples were performed in order to identify and quantify the clay minerals present. This was done so that similarities and differences between clay mineral assemblages could be used for stratigraphic correlation. The procedures used by Dr. Grim to analyze these samples are described further on in this appendix. Similar analytical procedures were used by Dr's. Reynolds and Parnell. For purposes of consistency in the VSC and VG core holes, x-ray diffractograms produced by Dr. Reynolds from VSC and VG samples were interpreted by Dr. Grim. The results from Dr. Grim's analyses are listed in Table 7-7 and 7-10. Copies of Dr. Grim's correspondence and x-ray diffraction analyses are in this appendix. Sample locations indicated by Dr. Grim represent depth from ground surface. Samples from AL-66-1 and AL-66-2 were analyzed by Dr's. Reynolds and Parnell and are described further on in this appendix. Dr. Parnell's results are listed in Figure 7-8. A discussion of these results is in Section 7.5.

ANALYTICAL PROCEDURE

The procedure used in analyzing the samples is as follows:

The samples are core samples. A section of the core is cut out, or in the case of hard samples, is sawed out with a hack saw.

The cut out portion is crushed to about 50 mesh and allowed to air dry. After air drying, a quartered portion of the 50 mesh sample is finely ground to minus 200 mesh and a powder X-ray diffraction pattern is obtained.

About 100 grams of the 50 mesh material is placed in a small beaker with distilled water and allowed to soak for about twenty-four hours. It is then vigorously stirred several times with a Waring blender. A portion of the resulting suspension carrying minus two micron material is extracted with a pipette and placed on a glass microscope slide to dry. As the suspension dries, the sedimented particles form an oriented aggregate. An X-ray diffraction pattern is obtained from the oriented aggregate.

If there is any question of the presence of smectite, the oriented aggregate is placed in a dessicator with ethylene glycol for twenty-four hours and then subjected to X-ray diffraction.

The X-ray diffraction unit is a North American Philips apparatus. The radiation is Copper k-alpha and the goniometer is rotated at two degrees per minute through an arc from two degrees to forty degrees.

X-ray Diffraction Analyses of
Bulk Samples - Dr. Parnell

	VG-1 (23.1 ft)*	VG-1 (-2.4 ft)	AL-66 (-468 to -478 ft)	AL-66 (-558 to -568 ft)
Bulk powder				
% quartz	67	31	81	51
% total clays	13	53	18	38
% plagioclase	3	3	-	-
% calcite	15	2	-	1 (?)
% sulfate	<1	-	-	5
% clinoptilolite	3	6	-	-
% potossium-feldspar	-	1	-	-
% hematite	-	2	1	4

clays (from bulk powder data)
VG-1 (23.1 ft) predominantly illite-smectite
VG-1 (-2.4 ft) mixed layered > kaolinite > mica
Al-66 (-468 to -478 ft) kaolinite > mica
Al-66 (-558 to -568 ft) kaolinite > mica > illite-smectite

*Sample locations are designated by elevations from sea level.

X-ray Diffraction Analysis of Clay Fraction
($<2\mu$) extracted from bulk samples - Dr. Reynolds

Sample	Elevation (ft)	Description
AL-66-1	(-468 to -478)	
	Grey Mudstone Clasts	Smectite, Kaolinite, Illite
	White Clay	Kaolinite, trace Illite
	Pink Clay	Kaolinite, Smectite, Illite
	Clay Matrix	Kaolinite, Smectite, Illite
AL-66-2	(-558 to -568)	
	Grey Mudstone Clasts	Kaolinite trace Smectite, Illite
	White Clay	Kaolinite trace Illite
	Pink Clay	Kaolinite trace Illite
	Clay Matrix	Kaolinite trace Illite, trace Smectite.

RALPH E. GRIM
Geologist - Mineralogist
704 WEST FLORIDA AVENUE
URBANA ILLINOIS 61801

TELEPHONE (217) 344-5713

June 16, 1982

Miss Eva Vanek
Bechtel Civil & Minerals, Inc.
P. O. Box 3965
San Francisco, CA 94119

Dear Miss Vanek:

Enclosed herewith is a table giving results of the mineral analyses by X-ray diffraction of the thirteen samples accompaning your letter of June 7th.

These analyses were made with reference toyour Job N_o. 9510.

Sincerely yours,
Ralph E. Grim

REG/feg

Relph E. Grim

Enc.

RALPH E. GRIM
Geologist - Mineralogist
704 WEST FLORIDA AVENUE
URBANA ILLINOIS 6180[illegible]

TELEPHONE (2'7) 344-5713

Sample No.	Depth (ft)	Mineral Composition
VG-1-5	347.0	kaolinite 90% (moderately well crystalline); illite 5%; smectite 5%.
VG-1-6	421.0	quartz 65%; kaolinite 15%; illite 10%; smectite 10%.
VG-1-7	462.8	quartz 70%; kaolinite 20%; illite 10%.
VG-2-5	439.0	kaolinite 95% (moderately well crystalline); smectite 5%.
VG-2-6	518.5	smectite 50%; quartz 40%; kaolinite 5%; illite 5%.
VG-2-7	550.0	quartz 75%; illite 15%; kaolinite 10%.
VG-3-5	349.2	kaolinite 70% (poorly crystalline); quartz 20%; smectite 10%.
VG-3-6	425.0	quartz 50%; kaolinite 10%; illite 5%; smectite 5%; amorphous 30%.
VG-3-7	472.8	quartz 75%; feldspar 10%; kaolinite 10%; illite 5%.
VG-4-1	154.0	smectite 50%; quartz 30%; kaolinite 20%.
VG-4-2	312.0	kaolinite 95% (moderately poor crystalline); illite 5%.
VG-4-3	391.8	quartz 50%; kaolinite 15%; illite 10%; smectite 10%; amorphous 15%.
VG-4-4	444.4	quartz 80%; kaolinite 10%; illite 5%; smectite 5%.

Samples VG-3-5 and VG-4-3 contain some very poorly crystalline material (amorphous) making very difficult the identification of the components other than quartz.

June 14, 1982
Ralph E. Grim

RALPH E. GRIM
Geologist - Mineralogist
704 WEST FLORIDA AVENUE
URBANA ILLINOIS 61801

TELEPHONE (217) 344-5713

July 16, 1982

Miss Eva Vanek
Bechtel Civil-Minerals, Inc.
P. O. Box 3965
San Francisco, CA 94119

Dear Miss Vanek:

Enclosed herewith are the results of the mineral analyses by X-ray diffraction of the twenty samples which you recently sent to me.

With kind regards.

Sincerely yours,

Ralph E. Grim

Ralph E. Grim

RLG/feg

Enc.

RALPH E. GRIM
Geologist - Mineralogist
704 WEST FLORIDA AVENUE
URBANA ILLINOIS 61801

TELEPHONE (217) 344-5713

July 16, 1982

MINERAL ANALYSES OF BECHTEL SAMPLES

VSC-2	147	Quartz 60%; smectite 40%.
VSC-2	171	Smectite 60%; calcite 15%; quartz 15%; illite 5%; kaolinite 5%.
VSC-2	321	Kaolinite 80% (moderately-well crystalline); quartz 10%; smectite 10%.
VSC-2	403	Quartz 60%; smectite 30%; illite 10%.
VSC-4	98	Quartz 60%; calcite 30%; smectite 10%.
VSC-4	136	Calcite 90%; quartz 10%; smectite, illite, trace.
VSC-4	145	Smectite 50%; quartz 30%; kaolinite 10%; illite 10%.
VSC-4	337	Kaolinite 90% (moderately-well crystalline); smectite 10%.
VSC-4	388	Quartz 40%; cristoballite 30%; smectite 20%; kaolinite 5%; illite 5%.
VSC-4	478	Quartz 75%; kaolinite 10%; illite 10%; smectite 5%.
VG-6	522	Smectite 40%; quartz 45%; illite 10%; smectite 5%.
VG-6	561	Quartz 60%; smectite 30%; kaolinite 5%; illite 5%.
VG-7	196	Quartz 50%; calcite 40%; illite and smectite 10%.
VG-7	206	Calcite 85%; quartz 15%.
VG-7	226	Smectite 40%; quartz 30%; calcite 20%; illite 10%,
VG-7	377	Kaolinite 60% (poorly crystalline); quaetz 20%; smectite 20%.
VG-8	102	Quartz 50%; calcite 45%; illite 5%.
VG-8	114	Calcite 50%; quartz 30%; illite, smectite, 5%; noncrystalline 15%.
VG-8	156	Smectite 45%; quartz 30%; calcite 15%; illite 10%.
VG-8	355	Kaolinite 50% (poorly crystalline); smectite 30%; quartz 5%; noncrystalline 15%.

RALPH E. GRIM
Geologist - Mineralogist
704 WEST FLORIDA AVENUE
URBANA ILLINOIS 61801

TELEPHONE (217) 344-5713

July 16, 1982

Dear Miss Vanek:

I have gone over the X-ray patterns prepared by Dr. Reynolds which arrived today, and would interpret them as follows:

VG - 133.5 Smectite 100%; illite and zeolite (?) trace.

VG - 148.4 Smectite 85%; kaolinite 10%; illite 5%.

VG - 159 < 2μ Smectite 60%; kaolinite 30%; illite 5%; zeolite (?) 5%.

VG-2 229 < 2μ Smectite 95%; kaolinite and illite 5%.

VG-2 244.4 < 2μ Smectite 90%; kaolinite 5%; illite 5%.

VG-2 255 < 2μ Smectite 60%; cristobellite 10%; zeolite (?) 5%; non-crystalline 25%.

VG-3 144.5 < 2μ Smectite 95%; illite and zeolite (?) 5%.

VG-3 170 < 2μ Kaolinite 60%; smectite 40%;

VG-3 159.4 Smectite 90%; illite 5%; zeolite (?) 5%; kaolinite, trace.

Am looking forward to discussing the above when I see you on Friday.

Ralph E. Grim

Ralph E. Grim

REG/feg

RALPH E. GRIM
Geologist - Mineralogist
704 WEST FLORIDA AVENUE
URBANA ILLINOIS 61801

TELEPHONE (217) 344-5713

July 31, 1982

Miss Eva Vanek
Bechtel Civil Minerals, Inc.
P. O. Box 3965
Mail Stop 45-31-817
San Francisco, CA 94119

Dear Eva:

Following are the results of the mineral analyses by X-ray diffraction of the five samples whi_h you gave me when I was in your office about a week ago. If you have any questions or comments I will be glad to try to answer them.

VSC-4; 608: Quartz, 55%; kaolinite (poorly crystalline), 35%; illite-smectite mixed-layer, 10%.

VSC-4; 798.7: Quartz, 45%; smectite, 30%; illite, 15%; kaolinite, 10%.

VSC-4; 866.0: Quartz, 45%; kaolinite, 40% (poorly crystalline); illite, 10%; smectite, 5%.

Sincerely yours,

Ralph E. Grim

Ralph E. Grim

REG/feg

CC: Mr. C. R. McClure

RALPH E. GRIM
Geologist - Mineralogist
704 WEST FLORIDA AVENUE
URBANA ILLINOIS 61801

TELEPHONE (217) 344-5713

August 28, 1982

Miss Eva Vanek
Bechtel Civil-Minerals, Inc.
P. O. Box 3965
Mail Stop 45-31-817
San Francisco, CA 94119

Dear Eva:

I am enclosing the results of the mineral analyses obtained for the twenty one samples submitted by you on August 20, 1982.

The procedure used in making the analyses is also enclosed.

Sincerely yours,

Ralph E. Grim

REG/feg

Encs - 2

CC: Mr. C. R. McClure

RALPH E. GRIM
Geologist - Mineralogist
704 WEST FLORIDA AVENUE
URBANA ILLINOIS 61801

TELEPHONE (217) 344-5713

August 28, 1982

MINERAL ANALYSES OF SAMPLES SUBMITTED AUGUST 20, 1982

VSC - 1	169.0	Quartz, 60%; calcite, 30%; smectite, 10%; kaolinite, trace.
VSC - 1	185.5	Calcite, 65%; quartz, 15%; cristoballite, 5%; dolomite, 5%; smectite, 10%.
VSC - 1	188.0	Quartz, 50%; feldspar, 10%; illite, 15%; smectite, 25%.
VSC - 1	367.0	Kaolinite (poorly crystalline), 40%;chlorite,10%; smectite, 10%; amorphous, 40%.
VSC - 1	424.0	Kaolinite, 15%; chlorite, 10%; smectite, 5%; amorphous, 70%.
VSC - 1	520.0	Quartz, 50%; kaolinite, 20%; illite, 5%; amorphous, 25%.
VSC - 3	109.0	Smectite, 75%; quartz, 10%; kaolinite, 10%; illite, 5%.
VSC - 3	137.0	Quartz, 20%; illite, 10%; smectite, 20%; amorphous, 50%.
VSC - 3	323.0	Quartz, 40%; kaolinite (well crystalline), 30%; smectite, 20%; illite, 10%.
VSC - 3	369.0	Quartz, 30%; smectite, 30%; kaolinite, 10%; illite, 10%; amorphous, 20%.
VSC - 3	469.5	Quartz, 55%; kaolinite, (well crystalline), 30%; smectite, 10%; illite, 5%.
VSC - 4	695.0	Quartz, 50%; kaolinite (well crystalline), 30%; illite, 20%.
VSC - 4	710.0	Quartz, 60%; illite, 20%; smectite, 20%.

RALPH E. GRIM
Geologist - Mineralogist
704 WEST FLORIDA AVENUE
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August 28, 1982

MINERAL ANALYSES OF SAMPLES SUBMITTED AUGUST 20, 1982

VG - 5	34.0	Quartz, 60%; calcite, 30%; smectite, 10%.
VG - 5	109.0	Calcite, 60%; quartz, 30%; smectite, 10%; kaolinite, trace.
VG - 5	112.5	Quartz, 50%; illite, 20%; smectite, 30%.
VG - 5	283.0	Kaolinite (well crystalline), 70%; smectite, 30%.
VG - 5	357.0	Quartz, 30%; kaolinite (well crystalline), 55%; illite, 10%; smectite, 5%.
VG - 5	405.0	Quartz, 60%; kaolinite (well crystalline), 30%; smectite, 10%; illite, trace.
VG - 6	260.0	Quartz, 60%; illite, 20%; smectite, 20%.
VG - 6	429.0	Quartz, 50%; kaolinite (well crystalline), 30%; smectite, 20%.

The amorphous component is mostly organic material.