

SSCL-SR-11

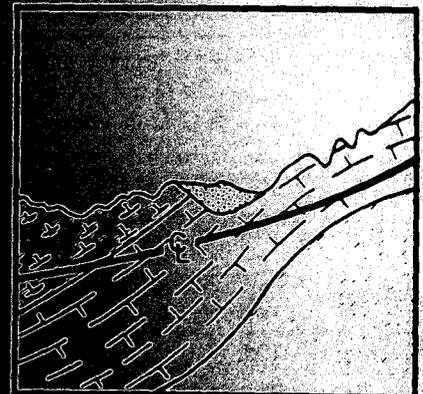
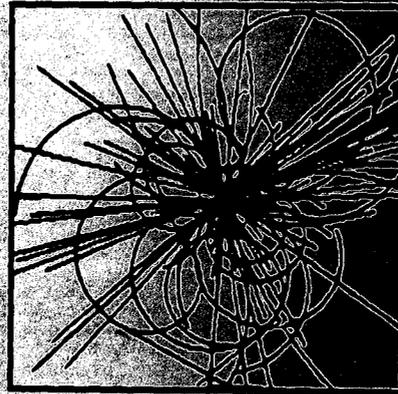
SSCL-SR-1081

Project No. 87-888-0012

January 1990

GR-22

Data Report for Structure Study Zones SF 10 and SF 10.1 and Coreholes BF 10.1 and SF 10.1



Prepared by:  **The Earth Technology Corporation**
Long Beach, California

Prepared for:  **RTK** a joint venture
Oakland, California

FOREWORD

The goal of the geotechnical studies at the Texas Superconducting Super Collider (SSC) site is to allow the geologist and engineer to build their level of knowledge and confidence about the geologic structures and geotechnical properties of the site materials to the point at which there remains only a realistically small risk of encountering geotechnical conditions during construction that would significantly increase construction costs or delay construction schedules. To do this, a characterization program has been designed to meet the following objectives:

- To confirm the site's suitability and optimize the ring location (the "footprint") and hall positions on the ring
- To provide data for a preliminary structural design
- To provide a rational framework within which construction contracts and schedules can be formulated
- To maximize the use of the site-specific data already gathered by the proposer.

The geotechnical program to meet these objectives has been divided into the following three phases of study:

- Footprint location data (the present phase)
- Global data (planned)
- Structure-specific data (planned).

The primary purpose of the present footprint location phase is to quickly assess whether individual components of the collider footprint, or the entire footprint, need to be relocated because of geotechnical constraints. Accordingly, the following areas have been assessed:

- Areas on the western side of the footprint where the geologic structure brings the Eagle Ford Shale close to the depth of the tunnel and experimental halls, thus presenting potential constraints due to weak, deformable rock.
- Areas where the tunnel placement is shallow and/or there are nearby sources of vibration such as major highways and railroads that may represent a problem due to unacceptable vibrations at tunnel depth.
- Zones of potentially poor rock quality and high water inflow in the rock that should be avoided for the experimental hall excavations.

This is one in a series of data reports prepared for the footprint phase of geotechnical characterization at the SSC site. Each data report includes the results of both field and laboratory tests for a specific drilling and sampling site. Interpretations of these data will be covered in topical reports, including three planned reports, as follows:

- Train-, traffic-, and quarry-caused vibrations
- Geomechanical properties of the Eagle Ford Shale
- Structure and stratigraphy of the near-cluster.

Future planned program phases--global and structure-specific data collection--will concentrate on (1) evaluating ring areas where few geotechnical data are currently available and (2) conducting more detailed studies at the sites of the injector and experimental halls.

DATA REPORT

Site Designators: BF10.1 and SF10.1

Objective: To determine the existence and constrain the location of faults based on geologic mapping and stratigraphic correlations between coreholes (determined by evaluation of the rock core and wire-line logs). To provide stratigraphic data for correlations with other borings.

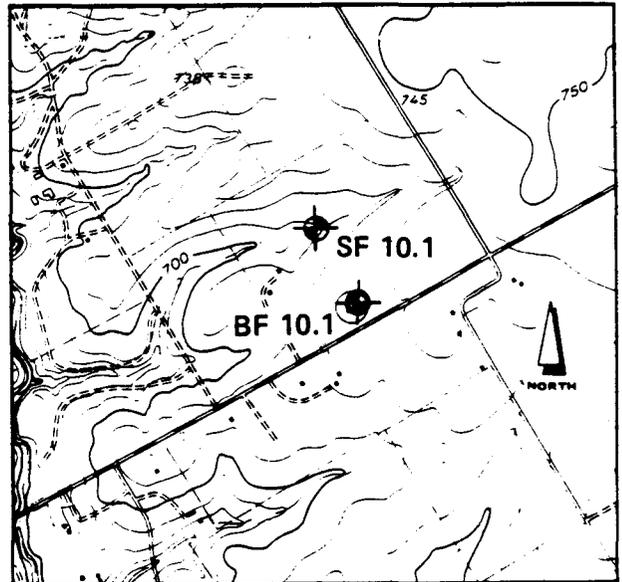
Hole No. BF10.1

Location: North 246,193.7 feet
East 2,174,167.8 feet
Surface Elevation 730.5 feet

Hole No. SF10.1

Location: North 247,060 feet
East 2,173,580 feet
Surface Elevation 714.6 feet

BF10.1 and SF10.1 are located north of where the proposed tunnel would cross under State Route 66, about 5 miles southwest of Waxahachie, Texas.



SCALE 1:24,000

1000 0 1000 2000 3000 FEET

CONTOUR INTERVAL 10 FEET

Scope and Schedule: Geologic Mapping

Structure Study Zone SF10	July 24 and 27, 1989
Structure Study Zone SF10.1	July 24, 1989
BF10.1: Core Drilling	July 24 to 25, 1989
Wire-line Logging	July 25, 1989
Laboratory Testing	July 26 to 27, 1989
Plugging and Abandonment	July 25, 1989
SF10.1: Core Drilling	July 26 and 27, 1989
Wire-line Logging	July 27, 1989
Plugging and Abandonment	July 28, 1989

Geologic Mapping: SF10 and SF10.1: Three north 65° east-trending lineaments on the aerial photographs were ground-checked. A small amount of calcite float along the trace of the central lineament was the only surficial indication of faulting. (See structure zone map, Appendix A.)

Hole No. BF10.1

Conditions Encountered:

Total Hole Depth: 257.6 feet

Soil: 0.0 to 2.2 feet

Austin Chalk: 2.2 to 203.0 feet

Eagle Ford Shale: 203.0 to 257.6 feet
(see lithologic log, Appendix B)

Hole No. SF10.1

Conditions Encountered:

Total Hole Depth: 245.0 feet

Soil: 0.0 to 3.0 feet

Austin Chalk: 3.0 to 209.8 feet

Eagle Ford Shale: 209.8 to 245.0 feet
(see lithologic log, Appendix B)

Comparing wire-line logs between BF10.1 and SF10.1 indicates (1) a 25-foot normal fault in boring SF10.1, (2) 57 feet of offset in the middle Austin Chalk between the two borings, and (3) 32 feet of offset in the lower Austin Chalk and the Eagle Ford Shale between the two borings (Figure A-1).

Geophysical Logging: (See wire-line logs, Appendix C)

Spontaneous Potential
Normal Resistivity (short)
Guarded Resistivity (long)
Natural Gamma
Compensated Density (caliper)
Sonic Velocity (full wave)

Hole Status: Boring BF10.1 was plugged and abandoned on July 25, 1989, and boring SF10.1 was plugged and abandoned on July 28, 1989. (See plugging report, Appendix D)

TABLE 1. GEOMECHANICAL TEST RESULTS - BORING BF10.1

Geologic Formation and General Lithology	Depth feet	Moisture Content percent	Dry Density pcf	Sample Dimension Ratio L/D	Uniaxial Compressive Strength psi	Triaxial Compression		Tangent Young's Modulus		Poisson's Ratio	Direct Shear		Brazil Tensile Strength psi
						σ_c psi	σ_1, σ_3 psi	E_{50} psi x 10 ⁻⁵	σ_3 psi		σ_n psi	τ psi	
Austin Chalk Limestone	201.6	13.7	121.9	2.2	1224								
Austin Chalk Limestone	202.0												271
Eagle Ford Shale	207.5	17.2	116.7	2.2	174								
Eagle Ford Shale	207.9	17.2	114.0								18	20	
Eagle Ford Shale	208.0	17.2	114.0								35	62	
Eagle Ford Shale	208.1	17.2	116.9								69	73	
Eagle Ford Shale	218.4	16.3	119.0										
Eagle Ford Shale	229.7	16.0	120.3	2.6	248								
Eagle Ford Shale	230.2	16.0	113.7								18	87	
Eagle Ford Shale	230.3	16.0	118.5								35	101	
Eagle Ford Shale	230.4	16.0	120.6								69	94	
Eagle Ford Shale	232.5	16.8	119.1	2.4		100	347						
Eagle Ford Shale	233.0			2.3		200	356						
Eagle Ford Shale	233.4			2.4		300	129	0.13	300	0.07			
Procedure		ASTM-D2216			ASTM-D2938	ASTM-D2664		ASTM-D2938		ASTM-D2938	ISRM		ISRM

APPENDIX A

STRUCTURE ZONE MAP

STRUCTURE STUDY ZONES SF10 AND SF10.1

Field mapping of the structure study zones consisted primarily of locating and noting areas of loose calcite fragments (float). Crystalline and fibrous calcite formed in fractures are primary indicators of faulting in the SSC study area. The bearing of significant bedrock fractures was also noted.

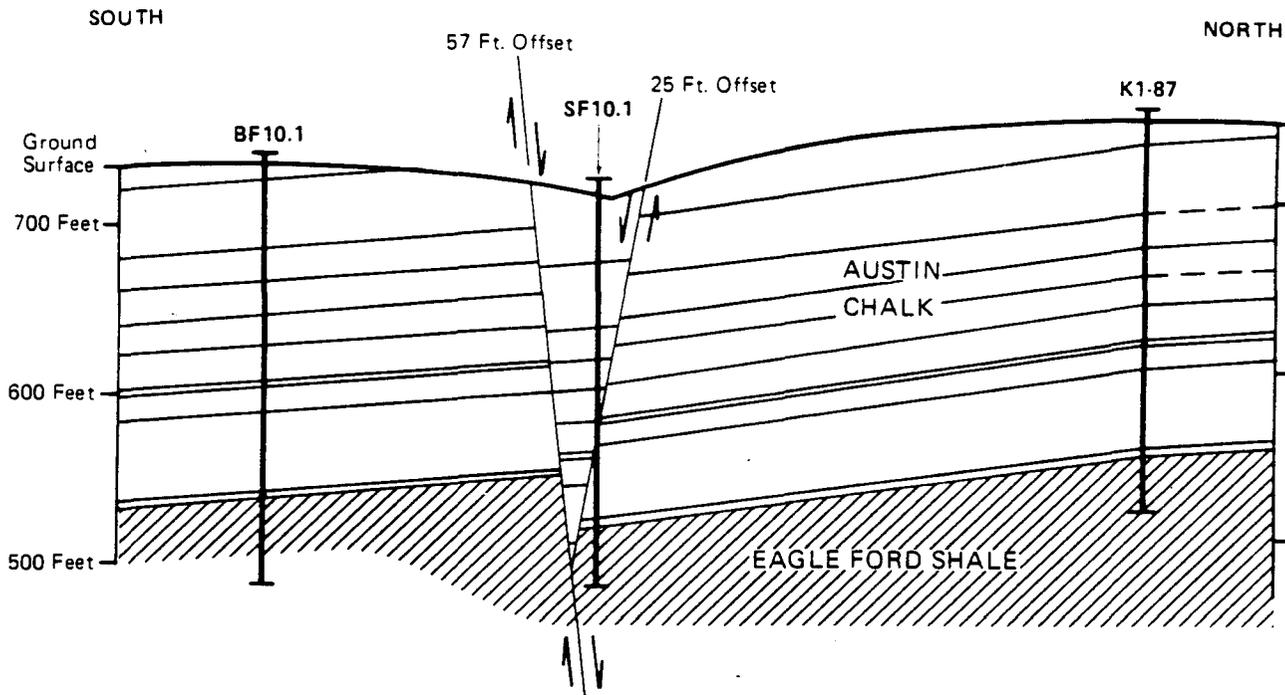
Structure Zone SF10

- Surface Expression: 7,500 ft-long lineament, discontinuous on aerial photographs, comprising subtle topographic breaks and tonal patterns.
- Trend: N 65° E

Traverses across the lineament at three locations (including one relatively continuous outcrop in Greathouse Branch) gave no indication of fault offset along this lineament. The Austin/Eagle Ford contact drilled in BF10.1 (to the north) and BE10.9 (south of the lineament) shows only a gentle southeastward dip consistent with the regional dip.

Structure Zone SF10.1

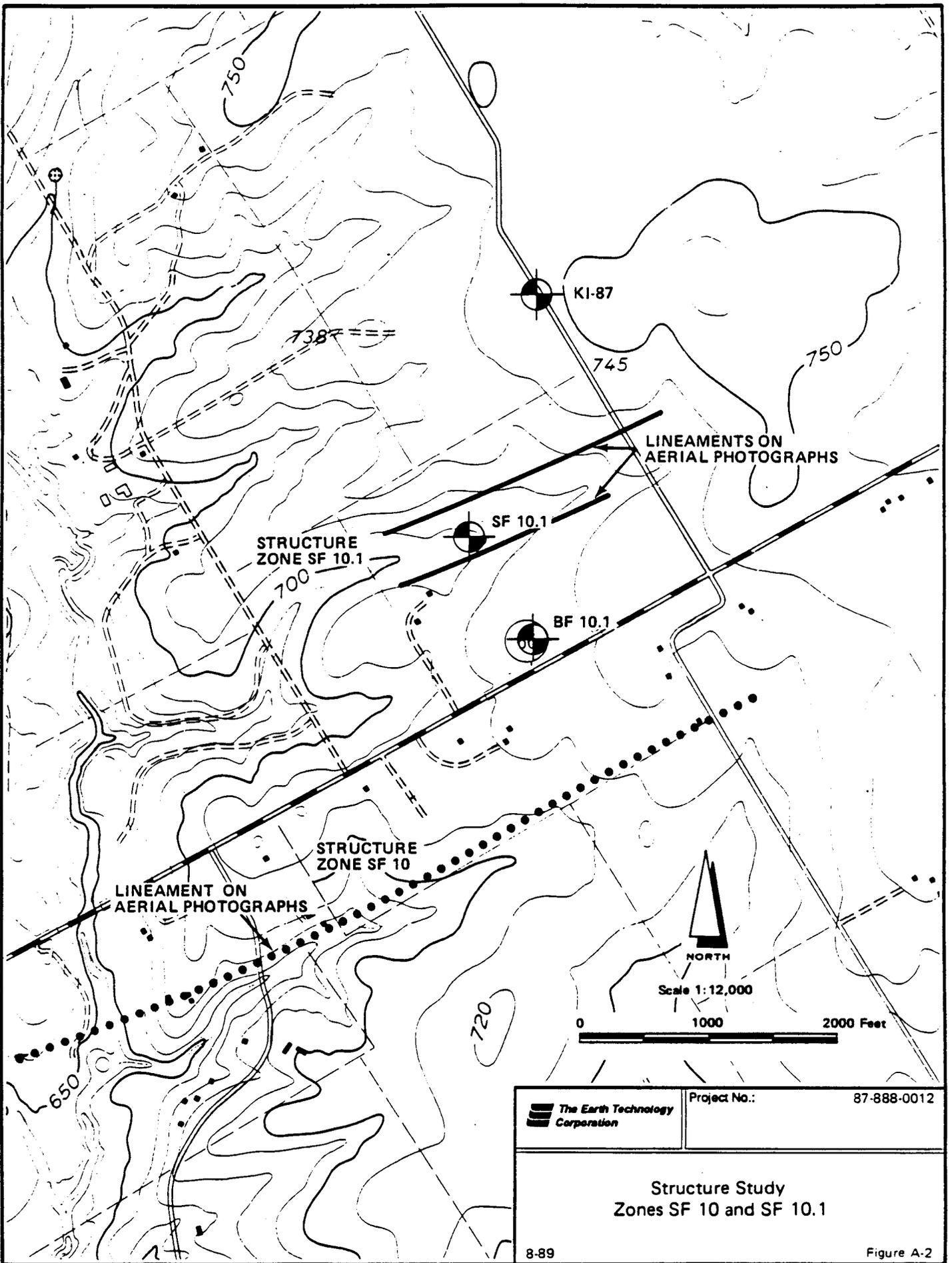
- Surface Expression: two parallel aerial photograph lineaments, about 2,000 feet long and 350 feet apart. The lineaments comprise subtle drainage alignments. Calcite float was observed along the southern lineament.
- Trend: N 65° E
- Width: based on drilling data (borings BF10.1 and SF10.1) the faults appear to bound a graben that is 350 ft wide at ground surface. The northern fault, where penetrated by boring SF10.1, is a relatively narrow zone (less than 5 feet).
- Faults in outcrop: none were observed
- Slickensides and Mineralization: a small amount of calcite float along the trace of the southern lineament was the only indication of faulting.
- Fractures: no outcrops were found in the vicinity of the faults; no fractures could be observed.
- Offset in borings: In boring SF10.1, the lower Austin Chalk section appears to be shortened by 25 feet (based on wire-line logs); a fault (presumably the northern fault) is interpreted with 25 feet of downdrop. Projection of the regional dip from BF10.1 indicates that the strata in the top of boring SF10.1 are downdropped 57 feet, assuming a normal fault between the two borings. The overall interpretation is a north-dipping normal fault with about 32 feet of offset, surmounted by an antithetic fault and graben with an additional 25 feet of downdrop (Figure A-1).



Note: Divisions presented in the Austin Chalk Formation represent distinct, correlative beds and zones within the chalk as determined from the rock core and geophysical logs.

	Project No.: 87-888-0015
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Geologic Cross Section Between Borings
BF10.1 and K1-87



APPENDIX B
LITHOLOGIC LOGS

LOG OF BORING

BORING NO: BF-10.1 PG 1 OF 7

PROJECT: SSC

LOCATION: N 246,193.7 feet
E 2,174,167.8 feet

CLIENT: TETC

GROUND EL: 730.5 feet

TASK NO.: 15

DATE: 7/24/89 TYPE: Nx Core CASED TO: 2.5' CONTRACTOR: MJA

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					DESCRIPTION OF STRATUM	
	/ / / /	2.5								Rock @ 2.2', Set Casing to 2.5', Started coring @ 2.5' Residual Soil: Clay, sli. silty, dk. brown
5	● ● ● ●	Box 1	2.5	4.5	90	0				LIMESTONE, med. hard, highly to mod. wea., tan Iron-staining along fracture surfaces Horizontal Fractures: smooth, clean surface, @ 2.5, 2.6, 2.7, 2.8, 3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.8, 3.9, 4.0, 4.1, 4.3
			4.5		84	9				Horizontal Fractures: smooth, clean surface @ 4.6, 4.7, 4.8, 5.0, 5.1, 5.3, 5.6, 5.8, 5.9, 6.4, 6.5, 6.8, 7.0, 7.1, 7.3, 7.6, 7.9, 8.1, 8.3, 8.5, 8.6
10	□ □ □ □		9.5							10.4-10.6 argillaceous
		12.7			99	75				14.5-14.9 vertical fracture, iron staining, smooth surface
15	□ □ □ □	Box 2	17.5							15.2 LIMESTONE, fresh, mod. hard, sli. fossiliferous, argillaceous layers, lt. gray
			17.5		100	100				15.8-15.9 bentonitic clay, soft, waxy, non-laminated, bluish-gray
20	□ □ □ □		21.5							
		Box 3	21.5		100	100				25.9-26.8 mod. arg. zone, dark gray
25	□ □ □ □									
		30.6								30.0-31.0 mod. arg. zone, dark gray
30	□ □ □ □		31.5							33.0-33.8 mod. arg. zone, dark gray
		Box 4	31.5							35.7-36.7 mod. arg. zone, dark gray
35	□ □ □ □				100	100				39.0-39.2 mod. arg. zone, dark gray
		39.0								
40	□ □ □ □		41.5							

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Gary Kincaid CHECKED BY W. D. Flanigan

LOG OF BORING

BORING NO: BF-10.1 PG 2 OF 7

PROJECT: SSC

LOCATION: N 246,193.7 feet

CLIENT: TETC

E 2,174,167.8 feet

TASK NO.: 15

GROUND EL: 730.5 feet

DATE: 7/24/89

TYPE: Nx Core

CASED TO: 2.5'

CONTRACTOR: MJA

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					S = SPLIT SPOON T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	
									DESCRIPTION OF STRATUM	
				41.5						LIMESTONE (Austin Chalk) fresh, mod. hard, slightly fossiliferous, argillaceous layers, lt. gray.
			41.5							
-45		Box 5			100	100				47.0-47.6 mod. arg. zone, dark gray
			48.1							49.5-50.6 mod. arg. zone, dark gray
-50				51.5						
		Box 6	51.5		100	100				55.1-55.4 mod. to v. arg. zone, dark gray
-55			56.3							57.7-58.5 mod. to v. arg. zone, dark gray
				61.5						61.5-62.5 mod. to v. arg. zone, dark gray
-60		Box 7		61.5						
			65.1		100	92				66.8-68.3 mod. to v. arg. zone, dark gray
-65				71.5						
		Box 8	71.5							
			73.9							
-75		Box 9			75	67				
				81.5						
-80										

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Gary Kincaid CHECKED BY W. D. Flanigan

LOG OF BORING

BORING NO: BF-10.1 PG 3 OF 7

PROJECT: SSC

LOCATION: N 246,193.7 feet

CLIENT: TETC

E 2,174,167.8 feet

TASK NO.: 15

GROUND EL: 730.5 feet

DATE: 7/24/89 TYPE: Nx Core

CASED TO: 2.5'

CONTRACTOR: MJA

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					S = SPLIT SPOON T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	
DESCRIPTION OF STRATUM										
				81.5						LIMESTONE (Austin Chalk) fresh, mod. hard, slightly fossiliferous, argillaceous layers, lt. gray.
		82.8	81.5				2.5'	recovered from previous core run		
85		Box 10			131	131				87.3 30° fracture, smooth to sli. rough surface, slks. 87.2-87.5 mod. to v. arg. zone, dark gray
				89.5						89.6-90.3 v. arg. zone, dark gray
90			89.5							
		92.0								94.5-97.2 mod. to v. arg. zone, dark gray
95		Box 11			100	100				
				99.8						98.8-110.3 mod. to v. arg. zone, dark gray
100		100.7	99.8							
		Box 12			100	100				
105										
		109.8	109.8							112.5-113.5 mod. to v. arg. zone, dark gray
110		Box 13	109.8		100	100				115.0-116.0 mod. to v. arg. zone, dark gray
										117.0-117.6 mod. to v. arg. zone, dark gray
		118.7								
120			119.8							
			119.8							

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Gary Kincaid CHECKED BY W. D. Flanigan

LOG OF BORING

BORING NO: BF-10.1 PG 4 OF 7

PROJECT: SSC

LOCATION: N 246,193.7 feet

CLIENT: TETC

E 2,174,167.8 feet

TASK NO.: 15

GROUND EL: 730.5 feet

DATE: 7/24/89 TYPE: Nx Core CASED TO: 2.5' CONTRACTOR: MJA

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					DESCRIPTION OF STRATUM	
		Box 14								
-125					100	100				LIMESTONE (Austin Chalk) fresh, mod. hard, slightly fossiliferous, argillaceous layers, lt. gray. 121.0-122.6 mod. to v. arg. zone, dark gray 124.8-126.2 mod. to v. arg. zone, dark gray 127.7-128.7 mod. to v. arg. zone, dark gray
		128.3								
-130			130.0							130.0-130.9 mod. to v. arg. zone, dark gray
		Box 15	130.0							132.6-133.0 mod. to v. arg. zone, dark gray 133.8-134.8 bentonitic clay, bluish-gray, waxy, soft, non-laminated
-135					100	100				
		137.6								138.7-139.7 mod. to v. arg. zone, dark gray
-140			140.0							
		Box 16	140.0							142.3-142.5 45° fracture, sli. rough, clean surface, slickensides
-145					100	94				145.8-146.2 60° fracture, rough, 1/4" calcite-filled, slickensides, w/several assoc. splays & 1 60°, closed, opposing slks. 147.1-147.4 60° fracture, closed, slks. 148.0 pyrite nodule 148.3 pyrite nodule
		146.5								149.3-150.0 mod. arg. zone, dark gray 151.0-152.3 mod. to v. arg. zone, dark gray
-150		Box 17	150.0							
		155.4			100	100				158.0-158.2 shaly zone, dark gray
-155										
		Box 18	160.0							
-160			160.0							

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Gary Kincaid CHECKED BY W. D. Flanigan

LOG OF BORING

BORING NO: BF-10.1 PG 5 OF 7

PROJECT: SSC

CLIENT: TETC

TASK NO.: 15

LOCATION: N 246,193.7 feet

E 2,174,167.8 feet

GROUND EL: 730.5 feet

DATE: 7/24/89

TYPE: Nx Core

CASED TO: 2.5'

CONTRACTOR: MJA

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					S = SPLIT SPOON T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	
			DESCRIPTION OF STRATUM							
			160.0							LIMESTONE (Austin Chalk) fresh, mod. hard, slightly fossiliferous, argillaceous layers, lt. gray. 161.9-162.3 mod. to v. arg. zone, dark gray 167.3-167.7 mod. to v. arg. zone, dark gray
			163.7		100	100				
-165		Box 19								
			170.0							
			170.0							171.3-171.6 mod. arg. zone, dark gray 173.0-173.2 mod. arg. zone, dark gray 176.9-177.0 mod. arg. zone, dark gray 179.6-180.3 mod. to v. arg. zone, dark gray
			172.7		100	100				
-175		Box 20								
			180.0							
			180.0							183.1-183.9 mod. to v. arg. zone, dark gray 188.9-189.3 mod. to v. arg. zone, dark gray
			181.8		99	99				
-185		Box 21								
			190.0							
			190.0							194.8-198.5 mod. to v. arg. zone, dark gray
			190.9							
-190		Box 22			100	100				
			200.0	200.0						
-195										
200										

 DRILLING GEOLOGIST Scott Lesikar

 ASSISTANT Gary Kincaid

 CHECKED BY W. D. Flanigan

LOG OF BORING

BORING NO: BF-10.1 PG 6 OF 7

PROJECT: SSC

LOCATION: N 246,193.7 feet

CLIENT: TETC

E 2,174,167.8 feet

TASK NO.: 15

GROUND EL: 730.5 feet

DATE: 7/25/89

TYPE: Nx Core

CASED TO: 2.5'

CONTRACTOR: MJA

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					S = SPLIT SPOON T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	
			DESCRIPTION OF STRATUM							
			200.0							LIMESTONE (Austin Chalk) fresh, mod. hard, slightly fossiliferous, argillaceous layers, lt. gray.
		Box 23			100	100				201.5 Transition Zone, argill, arenaceous, fossil., (bioclastics) mod. hd., med. to dk gray
-205										203.0 SHALE (Eagle Ford Shale), soft to med. hard, v. close bedding planes, fine grained, fresh, dk. gray
			208.5							208.5 60° fracture, smooth-sli. rough surface, slks.
				210.0						209.5 45° fracture, smooth-sli. rough surface, slks.
-210										
		Box 24	210.0		100	100				216.1 55° fracture, sli. rough surface, slks.
-215										
			216.8							
		Box 25	220.0							
-220				220.0						
										225.6 55° fracture, sli. rough surface, slks.
-225			225.6		100	100				226.0-226.2 calcareous concretion, lt. gray to dk. gray, hard to v. hard
		Box 26	230.0							230.7 30° fracture, smooth, clean surface
-230				230.0						
-235					100	100				
		Box 27								
			240.0							
-240				240.0						
			242.3							

DRILLING GEOLOGIST Scott Lesikar

ASSISTANT Gary Kincaid

CHECKED BY W. D. Flanigan

LOG OF BORING

BORING NO: BF-10.1 PG 7 OF 7

PROJECT: SSC

LOCATION: N 246,193.7 feet

CLIENT: TETC

E 2,174,167.8 feet

TASK NO.: 15

GROUND EL: 730.5 feet

DATE: 7/25/89 TYPE: Nx Core

CASED TO: 2.5'

CONTRACTOR: MJA

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					S = SPLIT SPOON T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	
			DESCRIPTION OF STRATUM							
			240.0							
		242.3								
-245	Box 28				100	94				
		250.0	250.0							
-250	Box 29		250.0		100	100				
		257.6	257.6							
-260									Bottom of Boring 7/25/89 Wireline Logged 7/25/89 Nx Boring Plugged 7/25/89	

DRILLING GEOLOGIST Scott Lesikar

ASSISTANT Gary Kincaid

CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: TEXAS SSC SITE
 CLIENT: The Earth Technology Corporation
 TASK NO.: 17

BORING NO: SF 10.1 PG 1 OF 7
 LOCATION: N 247,060 feet
 E 2,173,580 feet
 GROUND EL: 714.6 feet

DATE: 7/26-27/89 TYPE: Air/Water Rotary CASED TO: N/A CONTRACTOR: SWL (89-192)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					S = SPLIT SPOON T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	Drilled with Air Rotary methods to a depth of 155.0' and no seepage encountered, switched to Water Rotary and began coring below 155.0'
									DESCRIPTION OF STRATUM	
	[Diagonal Hatching]									CLAY, stiff, silty, mottled, brown to dark brown
- 5	[Cross-hatching]								3.0	LIMESTONE (Austin Chalk), soft, severely weathered, occasional clay layers, tan
- 10	[Cross-hatching]									
- 15	[Cross-hatching]									
- 20	[Cross-hatching]								19.0	LIMESTONE (Austin Chalk), medium, fresh, occasional shaly limestone layers, light gray to dark gray.
- 25	[Cross-hatching]									
- 30	[Cross-hatching]									
- 35	[Cross-hatching]									
- 40	[Cross-hatching]									

DRILLING GEOLOGIST Shawn Wood ASSISTANT Mike Granger CHECKED BY C. Bommarito

LOG OF BORING

PROJECT: TEXAS SSC SITE
 CLIENT: The Earth Technology Corporation
 TASK NO.: 17

BORING NO: SF 10.1PG 2 OF 7
 LOCATION: N 247,060 feet
 E 2,173,580 feet
 GROUND EL: 714.6 feet

DATE: 7/26-27/89 TYPE: Air/Water Rotary CASED TO: N/A CONTRACTOR: SWL (89-192)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					S = SPLIT SPOON T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	See p. 1 of 7
									DESCRIPTION OF STRATUM	
-45	[Brick pattern]								LIMESTONE (Austin Chalk), medium, fresh, occasional shaly limestone layers, light gray to dark gray	
-50	[Brick pattern]									
-55	[Brick pattern]									
-60	[Brick pattern]									
-65	[Brick pattern]									
-70	[Brick pattern]									
-75	[Brick pattern]									
-80	[Brick pattern]									
-85	[Brick pattern]									
-90	[Brick pattern]									

DRILLING GEOLOGIST Shawn Wood ASSISTANT Mike Granger CHECKED BY C. Bonmarito

LOG OF BORING

PROJECT: TEXAS SSC SITE

BORING NO: SF 10.1PG 4 OF 7

CLIENT: The Earth Technology Corporation

LOCATION: N 247,060 feet
E 2,173,580 feet

TASK NO.: 17

GROUND EL: 714.6 feet

DATE: 7/26-27/89 TYPE: Nx Core

CASED TO: N/A

CONTRACTOR: SWL (89-192)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					S = SPLIT SPOON T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	See p. 1 of 7
DESCRIPTION OF STRATUM										
-125	[Brick pattern]									
-130	[Brick pattern]									
-135	[Brick pattern]									
-140	[Brick pattern]									
-145	[Brick pattern]									
-150	[Brick pattern]									
-155	[Brick pattern]		155.0							
-160	[Brick pattern]	C1			100	94				<p>-15° tight, smooth shear at 155.2'</p> <p>-shaly limestone, dark gray at 155.0'-155.2'</p> <p>-shaly limestone, dark gray at 157.0'-158.0'</p> <p>-60° tight, smooth shear at 157.8'</p> <p>-45° tight, smooth shear at 157.9'</p>

DRILLING GEOLOGIST Shawn Wood

ASSISTANT Mike Granger

CHECKED BY C. Bommarito

LOG OF BORING

PROJECT: TEXAS SSC SITE

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: SF 10.1 PG 5 OF 7

LOCATION: N 247,060 feet
E 2,173,580 feet

GROUND EL: 714.6 feet

DATE: 7/26-27/89 TYPE: Nx Core

CASED TO: N/A

CONTRACTOR: SWL (89-192)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					S = SPLIT SPOON T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	See p. 1 of 7
DESCRIPTION OF STRATUM										
									LIMESTONE (Austin Chalk), medium to moderately hard, fresh, sound, moderately argillaceous, slightly fossiliferous, pyrite nodules, light gray to dark gray	
-165			165.0						-shale parting, dark gray at 164.8' -80° smooth, tight shear at 165.0', large pyrite nodule filling along fracture plane -65° smooth, tight shear at 165.7' -shaly limestone, dark gray at 166.7'-167.4' -60° smooth, tight shear at 166.6' -60° smooth, tight transverse shear at 166.8' -75° smooth, tight pyrite filled shear at 169.6' -shale parting, dark gray at 169.7' -shaly limestone, dark gray at 173.0'-173.4' -shaly limestone, dark gray at 173.8'-173.9' -10° tight, smooth shear at 173.1' -shaly limestone, dark gray at 176.9'-177.3' -30° smooth, tight shears at 177.1' and 177.2' -shaly limestone, dark gray at 178.7'-179.0' -70° calcite filled (1/4") healed shear at 180.8'	
-170		C2	165.0		95	87				
-175			175.0							
-180		C3	175.0		100	100				
-185			185.0						-shaly limestone, dark gray at 185.7'-186.5'	
-190		C4			100	100			-shaly limestone, dark gray at 189.2'-190.3'	
-195			195.0						-shaly limestone, dark gray at 196.3'-197.4' -fossil parting at 197.1'	
-200		C5	195.0		99	99			-shaly limestone at 201.6'-205.0' -very fossiliferous at 204.5'-205.0' -fossil parting at 204.5'	

DRILLING GEOLOGIST Shawn Wood

ASSISTANT Mike Granger

CHECKED BY C. Bonmarito

LOG OF BORING

BORING NO: SF 10.1PG 6. OF 7

PROJECT: TEXAS SSC SITE

LOCATION: N 247,060 feet
E 2,173,580 feet

CLIENT: The Earth Technology Corporation

GROUND EL: 714.6 feet

TASK NO.: 17

DATE: 7/26-27/89 TYPE: Nx Core

CASED TO: N/A

CONTRACTOR: SWL (89-192)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					S = SPLIT SPOON T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	See p. 1 of 7
DESCRIPTION OF STRATUM										
										LIMESTONE (Austin Chalk), medium to moderately hard, fresh, sound, moderately argillaceous slightly fossiliferous, occasional pyrite nodules, light gray to dark gray
-205			205.0							207.6
-210		C6			82	82				209.8
										SHALY LIMESTONE (transition), medium to moderately hard, fresh, sound, extremely argillaceous, abundant fragments of fish bones, teeth and other fossil debris, pyrite, dark gray
-215			215.0							SHALE (Eagle Ford), medium, fresh, moderately fractured, slightly fossiliferous, fissile, occasional pyrite nodules and septarian concretions, dark gray
		C7	215.0		94	94				-limestone layer, light gray at 213.0'-213.2' -limestone layer, light gray at 215.0'-215.2'
-220										
-225			225.0							-limestone layer, light gray at 225.8'-225.9'
		C8	225.0		74	74				-40° smooth, tight shear at 230.0'
-230										
-235			235.0							-carbonate seam, light gray at 236.5'
		C9	235.0		93	93				
-240										

DRILLING GEOLOGIST Shawn Wood

ASSISTANT Mike Granger

CHECKED BY C. Bommarito

LOG OF BORING

PROJECT: TEXAS SSC SITE

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: SF 10.1PG 7 OF 7

LOCATION: N 247,060 feet
E 2,173,500 feet

GROUND EL: 714.6 feet

DATE: 7/26-27/89 TYPE: Nx Core

CASED TO: N/A

CONTRACTOR: SWL (89-192)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					S = SPLIT SPOON T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	See p. 1 of 7
DESCRIPTION OF STRATUM										
245				245.0						SHALE (Eagle Ford), medium, fresh, moderately fractured, slightly fossiliferous, fissile, occasional pyrite nodules and septarian concretions, dark gray.
250										Bottom of Exploration at 245.0' NOTE: Borehole grouted upon completion.
255										
260										
265										
270										
275										
280										

DRILLING GEOLOGIST Shawn Wood

ASSISTANT Mike Granger

CHECKED BY C. Bommarito

APPENDIX C

WIRE-LINE LOGS

WIRE-LINE LOGGING PARAMETERS

Hole No. BF10.1

Log Measured From: Ground level

Drilling Parameters

Depth 255.0 feet
Bit Diameter 3.25 inches

Logging Parameters

Electrical Log

Gamma Log

Sonic Log

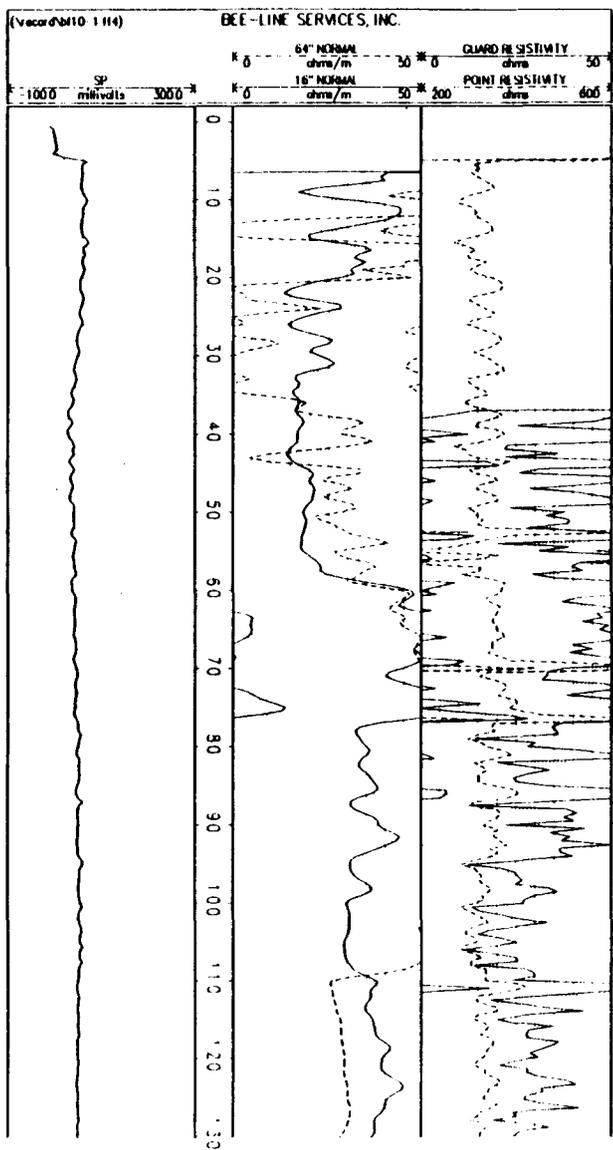
Date	July 25, 1989	July 25, 1989	July 25, 1989
Bottom Log Interval	254.5 feet	254 feet	249.4 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	mud	mud	mud
Time Since Circulation Stop	30 min.	30 min.	30 min.
Probe Type/S.N.	ALP-4979	XAP-4383	CLP-4877A
Module Type/S.N.	ALM-4979	XAM-4383	CLM-4877A
Logging Speed	19 feet/min.	19 feet/min.	8 feet/min.
Sample Interval	0.5 feet	0.5 feet	0.5 feet

Logged by:

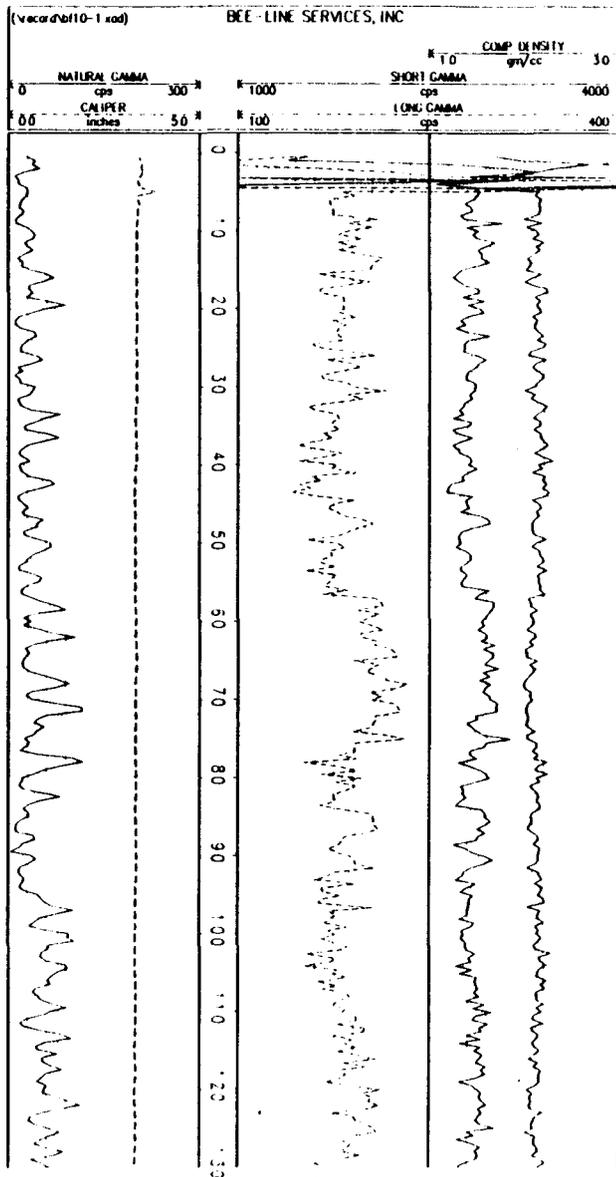
BEE-LINE SERVICES, INC.
P.O. Box 2096
Corsicana, TX 75151

BF10.1 Wire-line logs run July 25, 1989. Surface elevation 730.5 feet.

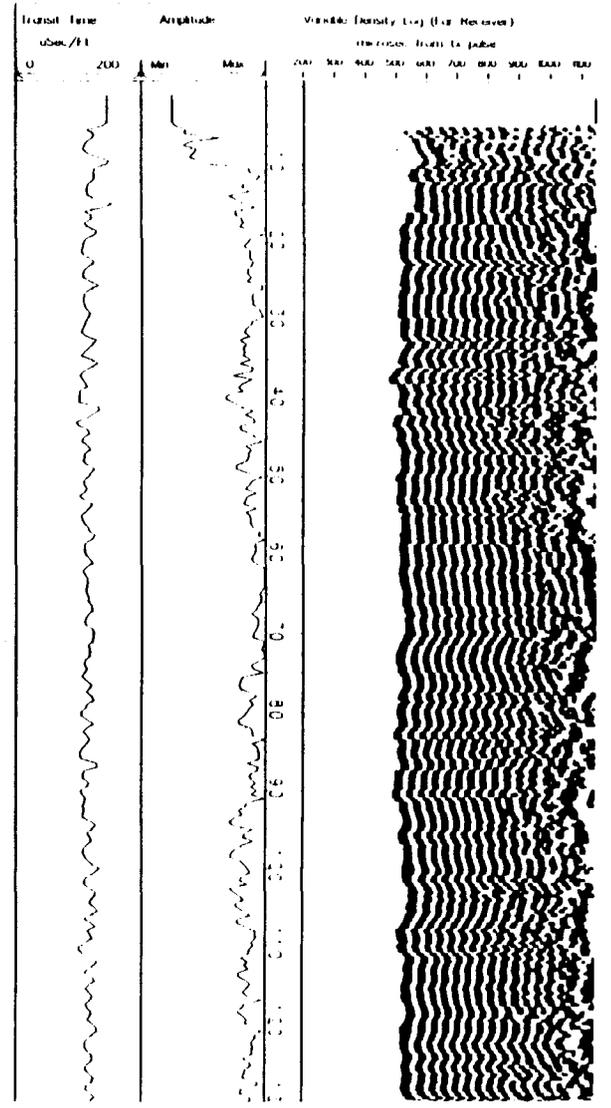
ELECTRICAL LOG



GAMMA LOG

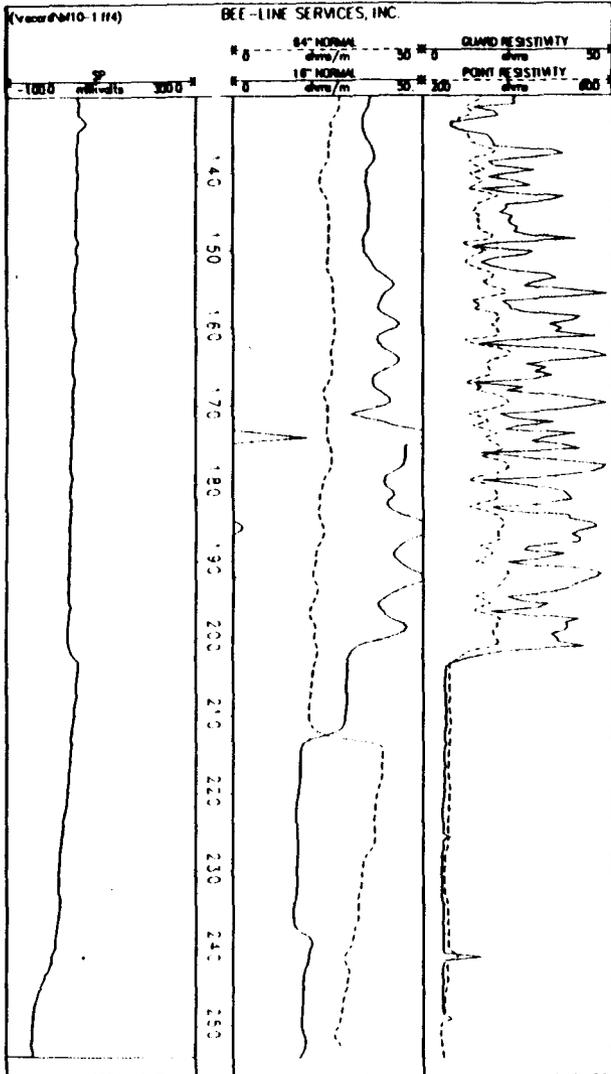


SONIC LOG

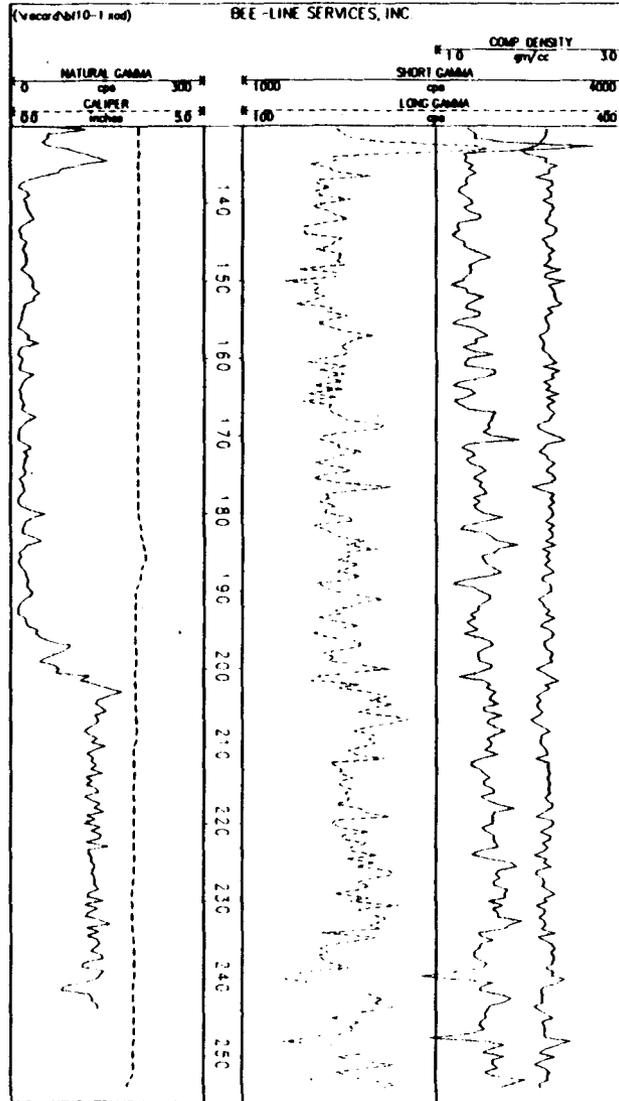


BF 10.1 Wire-line logs run July 25, 1989. Surface elevation 730.5 feet.

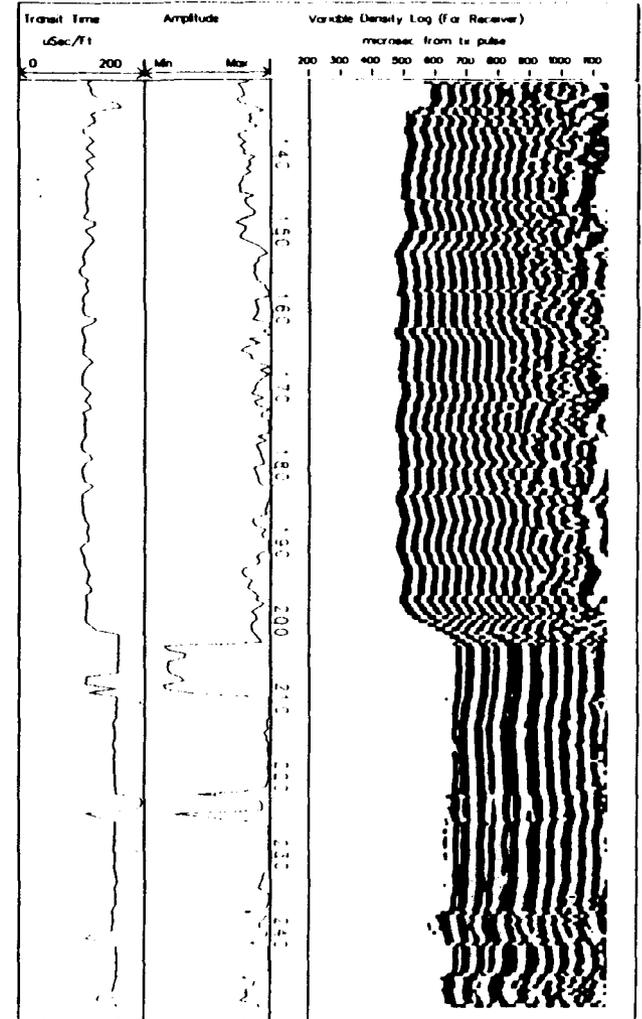
ELECTRICAL LOG CONTINUED



GAMMA LOG CONTINUED



SONIC LOG CONTINUED



WIRE-LINE LOGGING PARAMETERS

Hole No. SF10.1

Log Measured From: Ground level

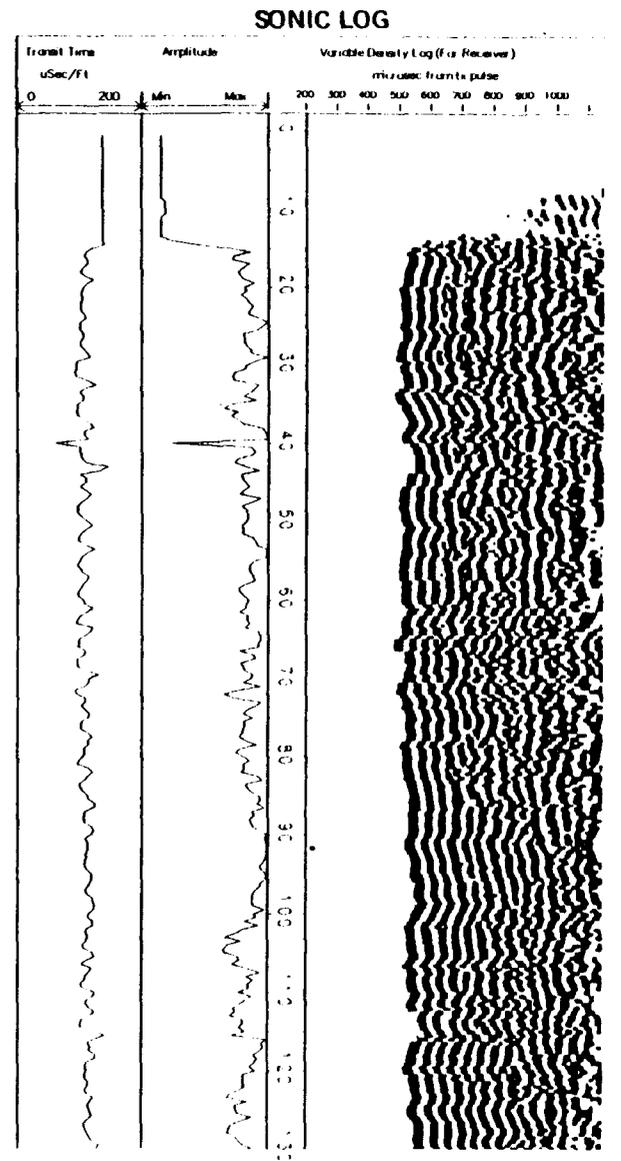
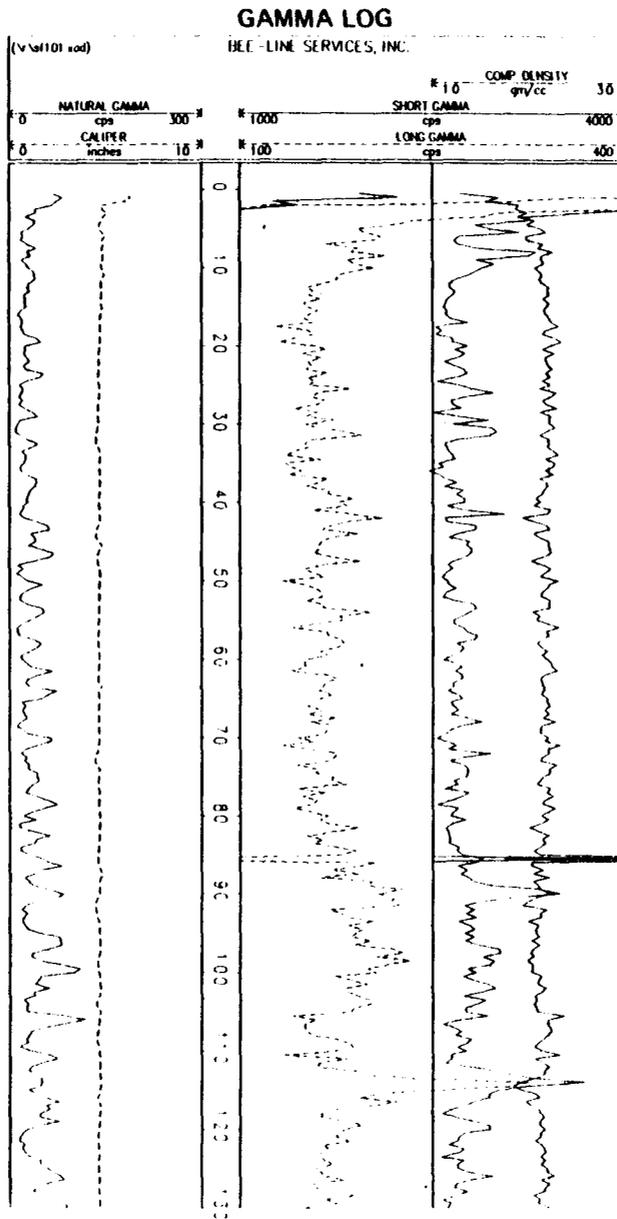
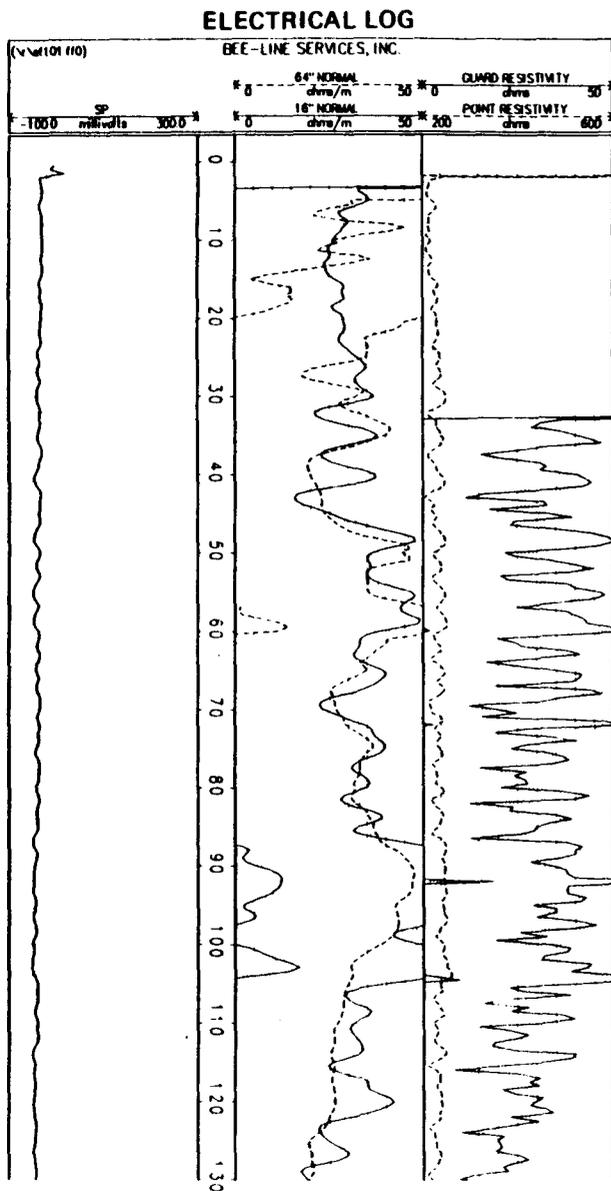
Drilling Parameters

Depth 245.0 feet
Bit Diameter 4.5 inches

<u>Logging Parameters</u>	<u>Electrical Log</u>	<u>Gamma Log</u>	<u>Sonic Log</u>
Date	July 27, 1989	July 27, 1989	July 27, 1989
Bottom Log Interval	242.0 feet	242.0 feet	237.9 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	mud	mud	mud
Time Since Circulation Stop	1 hour	1 hour	1 hour
Probe Type/S.N.	ALP-4979	XAP-4383	CLP-4877A
Module Type/S.N.	ALM-4979	XAM-4383	CLM-4877A
Logging Speed	40 feet/min.	20 feet/min.	20 feet/min.
Sample Interval	0.5 feet	0.5 feet	0.5 feet

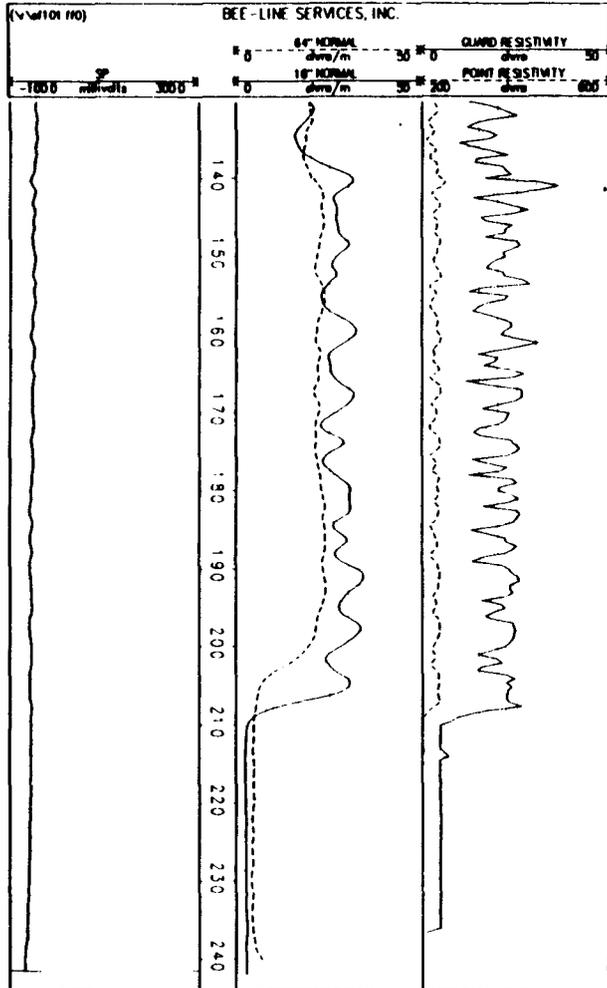
Logged by: BEE-LINE SERVICES, INC.
P.O. Box 2096
Corsicana, TX 75151

SF 10.1 Wire-line logs run July 27, 1989. Surface elevation 714.6 feet.

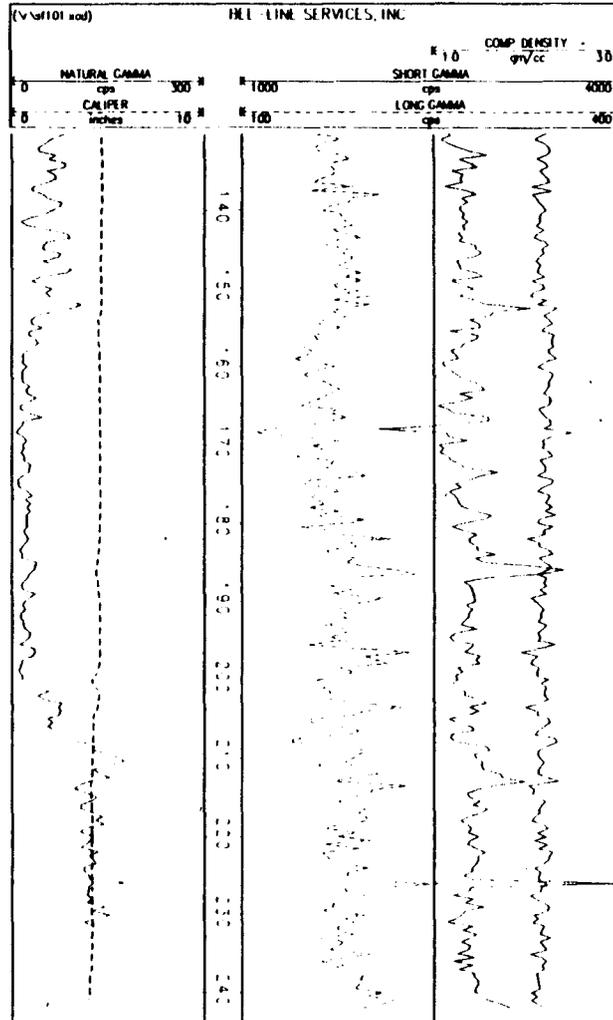


SF 10.1 Wire-line logs run July 27, 1989. Surface elevation 714.6 feet.

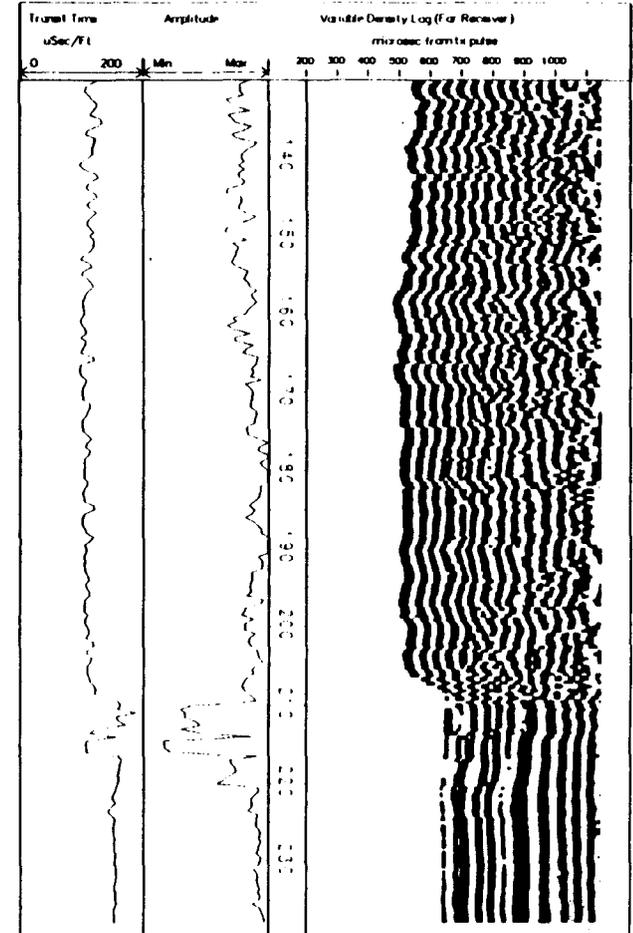
ELECTRICAL LOG CONTINUED



GAMMA LOG CONTINUED



SONIC LOG CONTINUED



APPENDIX D
PLUGGING REPORTS

SSC BOREHOLE PLUGGING REPORT

FETC Project No. 87-888-0015

Task No. 15

Boring No. BF-10.1

Texas Coordinate Location:

N 246,193.7 feet

E 2,174,167.8 feet

Surface Elevation: 730.5 feet

Total Boring Depth: 257.6'

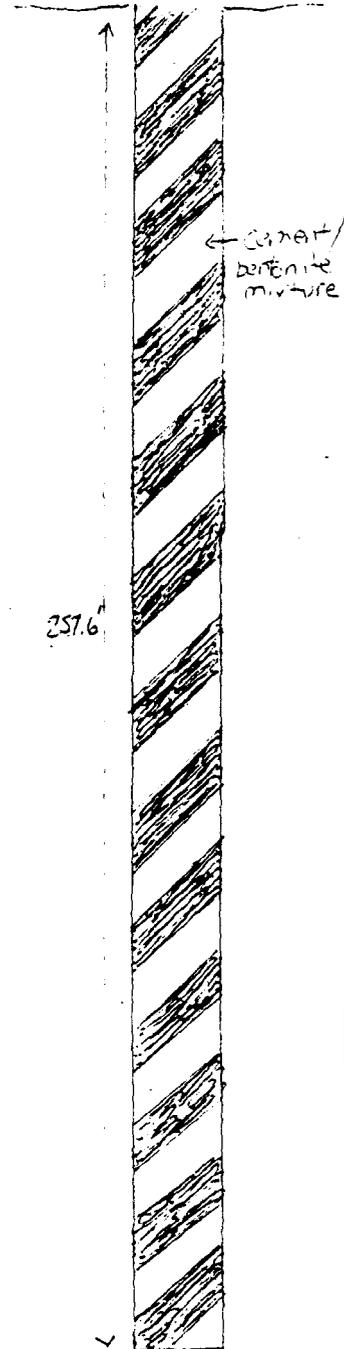
Plugging Remarks: _____

Boring grouted w/ cement/bentonite mixture with ~ 7 gallons water per sack. Grout placed with Tri-Loc PVC tremie pipe. Total cement used: 7sacks Total bentonite used: 1/2 sack
Surface casing (2.5') removed during grouting. Boring was checked on 7-28-89 and found to be ~ 3' low.
Remaining hole was filled w/ bentonite/grout/clay mixture.

Date Plugged: 7-25-89

Time Completed: 4:00 pm

Drilling Geologist: Scott Leskar
MJA Coordinator: W.D. Flanigan WDF.
MJA No.: 5530.15



SSC BOREHOLE PLUGGING REPORT

TETC Project No. 87-88-0017

Task No. 17

Boring No. SF 10.1

Texas Coordination Location: N 247,060 feet
 E 2,173,580 feet

Surface Elevation: 714.6 feet

Total Boring Depth: 245.0 ft.

Date Drilled: 7-26/7-27-89

Date Plugged: 7-28-89

Time Completed: 11:30 AM

Remarks:

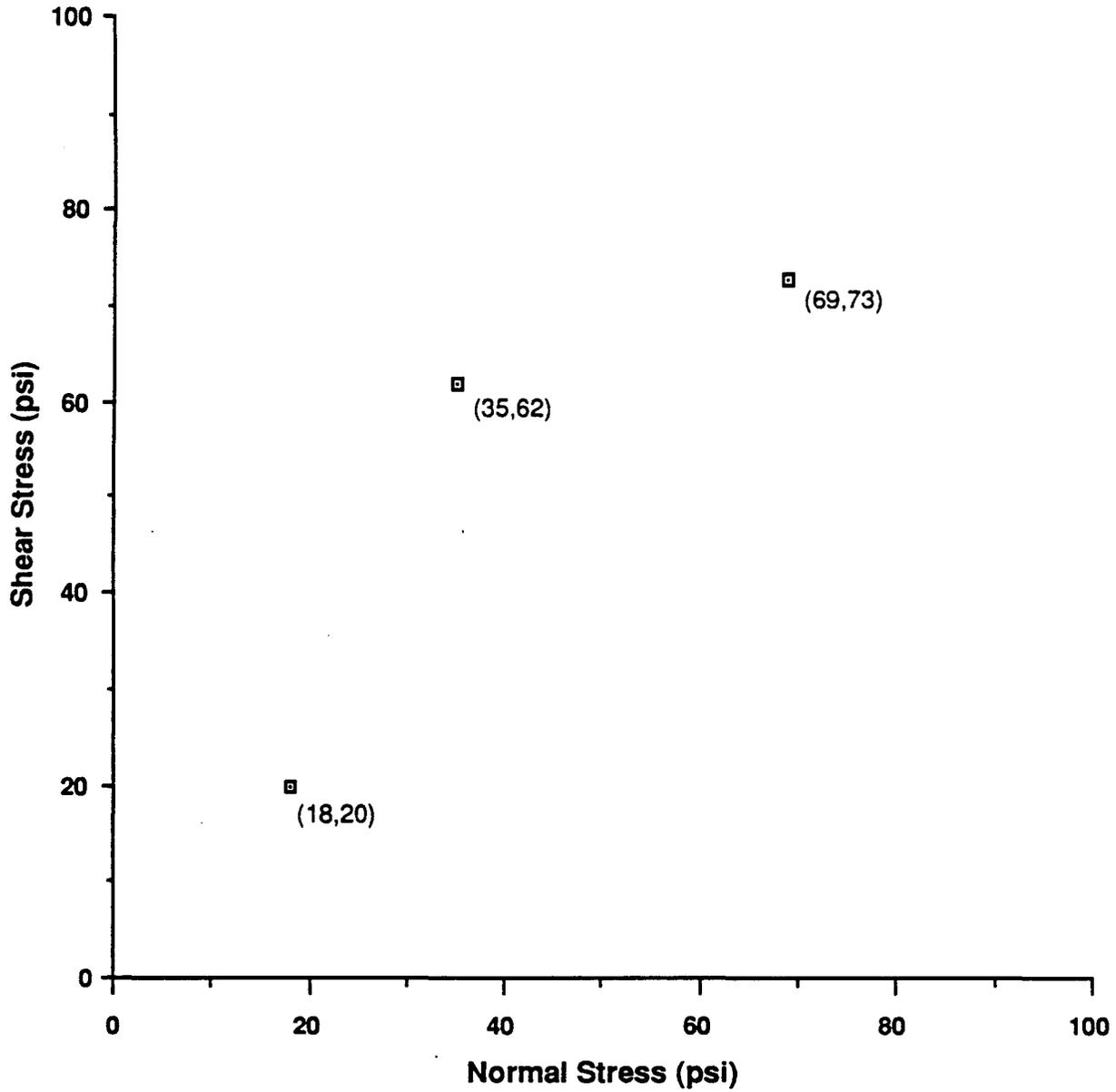
250 gallons of grout was used to completely cement boring from bottom to top. Water/cement ratio was approximately 7 gallons per sack.

Drilling geologist: Shawn D. Wood
Coordinator: Bruce Bailey
SwL Report No. 89-192

APPENDIX E

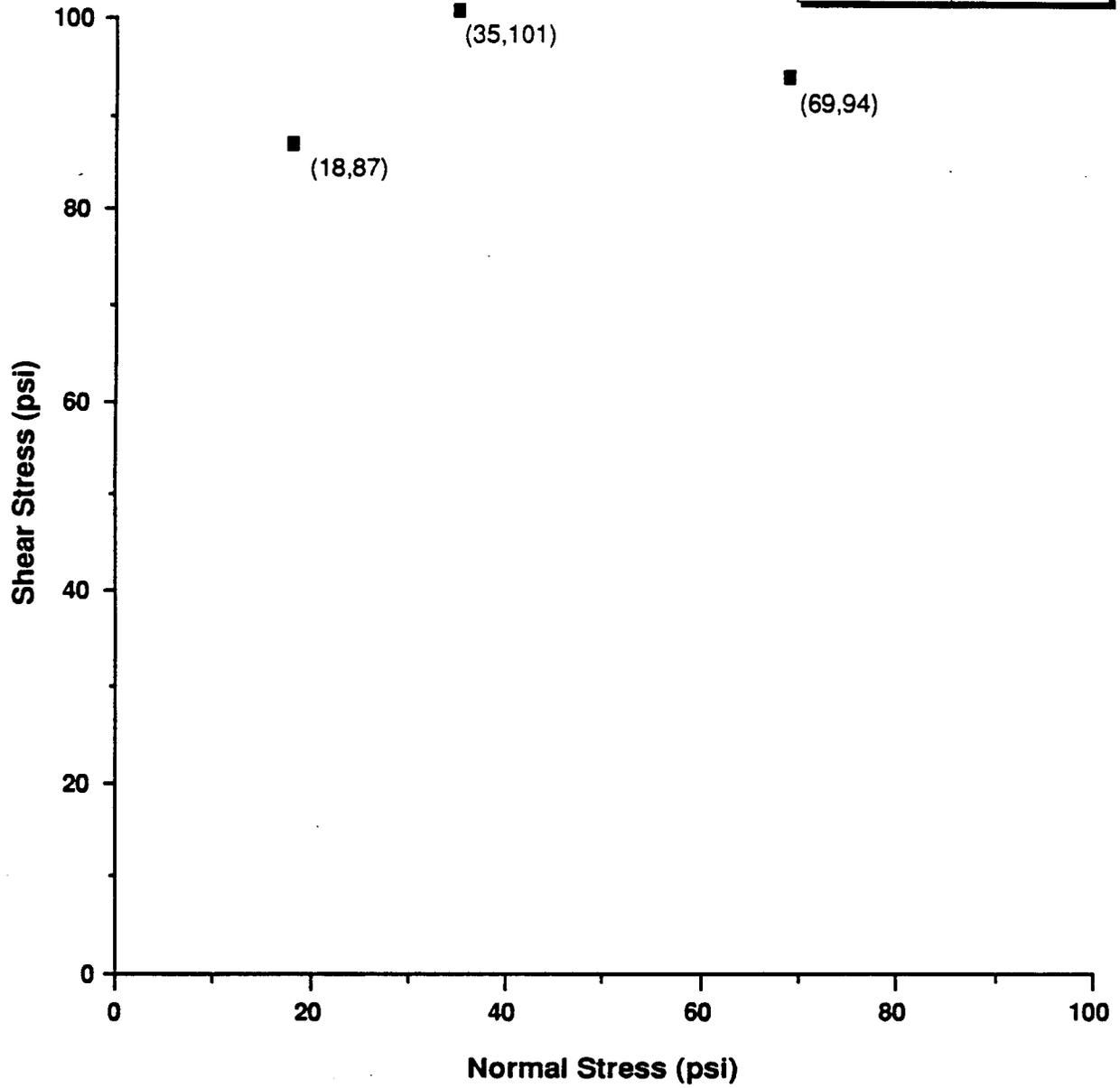
DIAGRAMS OF LABORATORY RESULTS

BORING BF10.1	
Eagle Ford Shale	
Test	Depth (ft)
□ DS	207.9-208.1



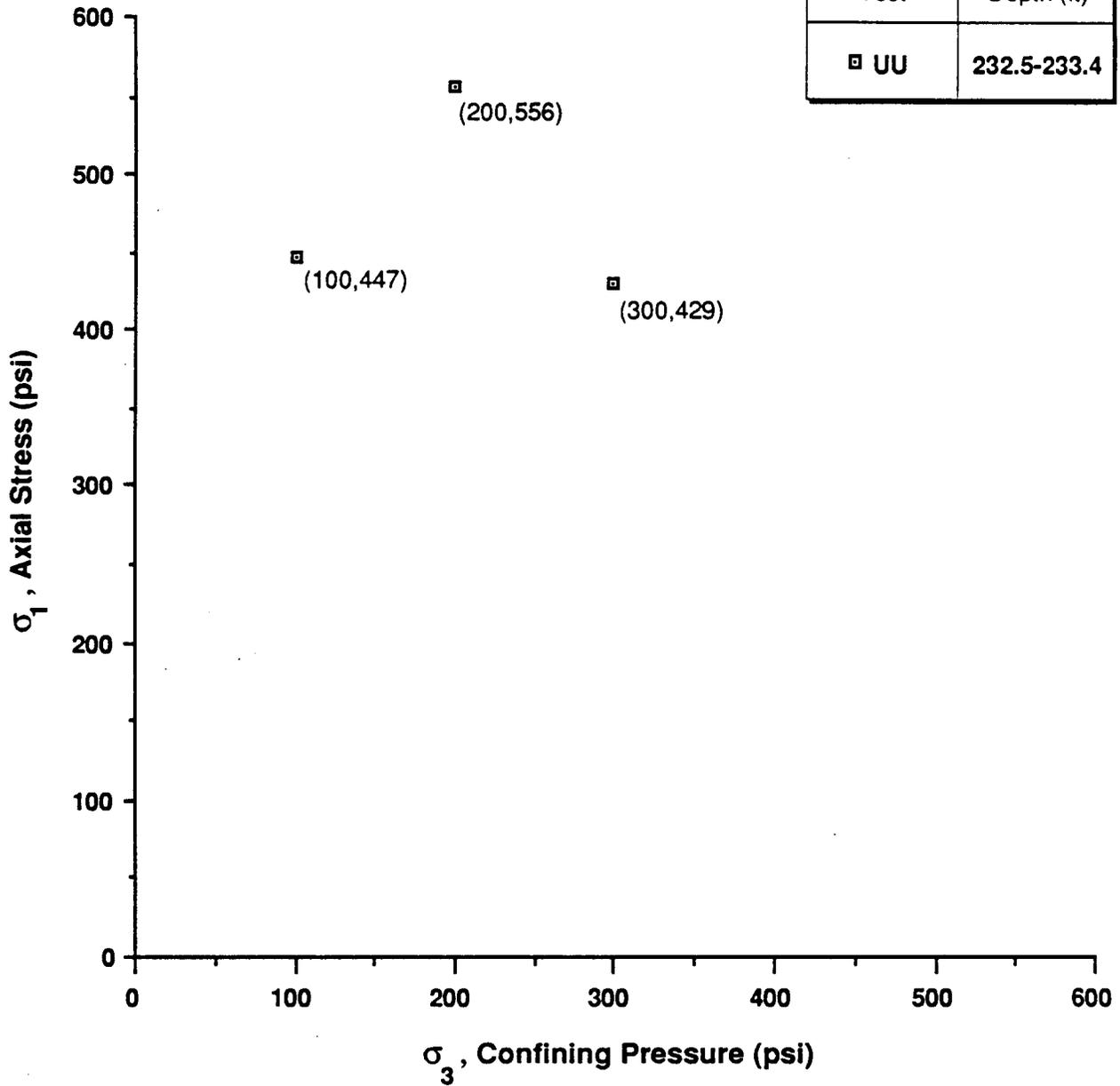
DS-ISRM

BORING BF10.1 Eagle Ford Shale	
Test	Depth (ft)
■ DS	230.2-230.4



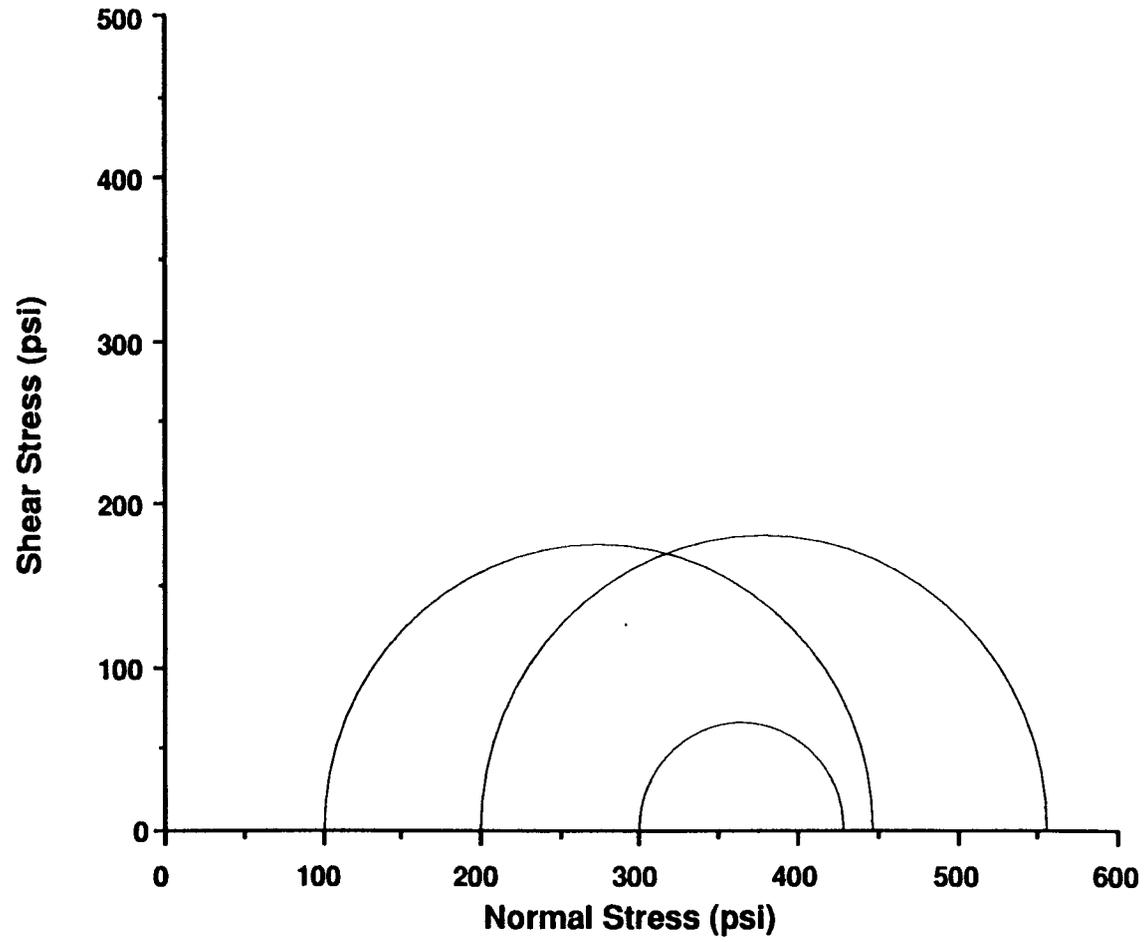
DS-ISRM

BORING BF10.1 Eagle Ford Shale	
Test	Depth (ft)
□ UU	232.5-233.4



UU -ASTM D2664

BORING BF10.1 Eagle Ford Shale	
Test	Depth (ft)
UU	232.5-233.4



UU-ASTM D2664



**Mohr Circle Plot
Texas SSC Site**

**FIGURE
E-4**