SSCL-SR-1077

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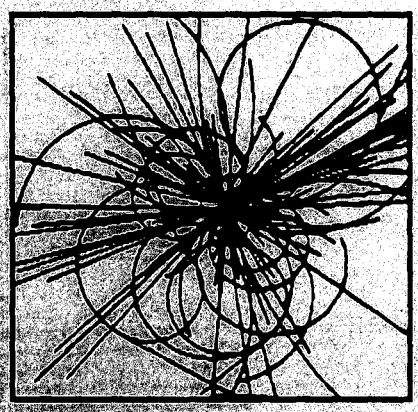
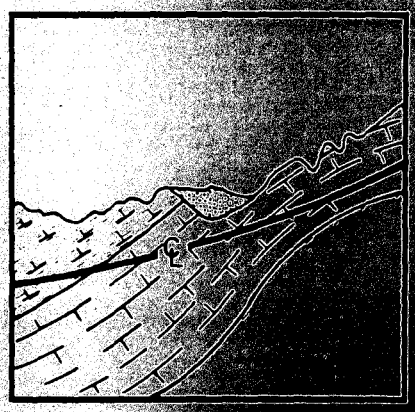
Project No. 87-588-0017

December 1989

-GR-18

Data Report for Corehole BF 1.6





Prepared by: The Earth Technology Corporation
Long Beach, California

Prepared for: RTK a John Wright Company
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 Designator: BF1.6

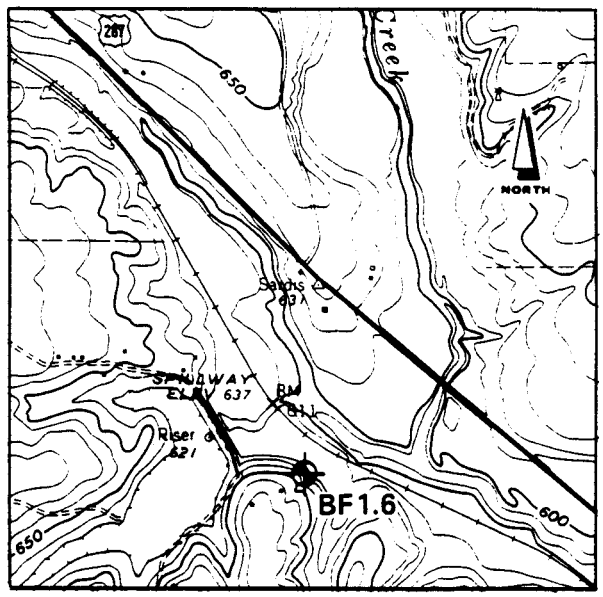
Objective: To delimit the top of the Eagle Ford Shale and to obtain core samples of Austin Chalk and Eagle Ford Shale for geomechanical laboratory testing.

Location: North 282,039

East 2,176,960

Surface Elevation 627.6

BF1.6 is located on the northwestern side of the ring, about 2 miles northwest of Sardis.



SCALE 1:24,000

1000 0 1000 2000 3000 FEET

CONTOUR INTERVAL 10 FEET

Scope and Schedule:	**Coring**	May 24, 1989
	Wireline Logging	May 24, 1989
	Laboratory Geomechanical Testing	May 25 to June 7, 1989
	Plugging and Abandonment	May 25, 1989

Conditions Encountered:

Total Hole Depth 152.7 feet
Soil 0.0 to 1.0 feet
Austin Chalk 1.0 to 98.3 feet
Eagle Ford Shale 98.3 to 152.7 feet
(see lithologic log, Appendix A)

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

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

TABLE 2. BULK AND CLAY MINERALOGY TEST RESULTS

Depth 26.5 feet **Austin Chalk**

Whole Rock Composition:

Mineral	Percent
quartz	1.4
K-feldspar	0.0
plagioclase	0.0
calcite	95.9
siderite	0.0
hornblende	0.0
pyrite	1.5
clay minerals	1.2
	100

Relative Clay Abundance:

Mineral	Percent
illite	9.2
kaolinite	0.0
Fe-chlorite	0.0
illite/smectite	90.8
	100

Depth 132.7 feet **Eagle Ford Shale**

Whole Rock Composition:

Mineral	Percent
quartz	19.5
K-feldspar	2.2
plagioclase	2.3
calcite	0.6
siderite	0.3
hornblende	0.5
pyrite	2.2
clay minerals	72.4
	100

Relative Clay Abundance:

Mineral	Percent
illite	17.4
kaolinite	3.9
Fe-chlorite	10.7
illite/smectite	68.0
	100

TABLE 2. BULK AND CLAY MINERALOGY TEST RESULTS

Depth 145.0 feet **Eagle Ford Shale**

Whole Rock Composition:

Mineral	Percent
quartz	10
clay minerals	90
	100

Relative Clay Abundance:

Mineral	Percent
illite	50
kaolinite	50
	100

TABLE 1. GEOMECHANICAL TEST RESULTS - COREHOLE BF1.6

Geologic Formation and General Lithology	Depth	Moisture Content	Dry Density	Sample Dimension Ratio L/D	Unconfined Compressive Strength	Triaxial Compression		Direct Shear		Brazil Tensile Strength	2nd Cycle Slake-Durability Index	Swell Pressure Index
						σ_c	$\sigma_1 - \sigma_3$	σ_n	τ			
	feet	percent	pcf		psi	psi	psi	psi	psi	psi	percent	psi
Austin Chalk Limestone	5.0	13.0	121.4	2.5	1349							
Austin Chalk Limestone	6.0									263		
Austin Chalk Limestone	25.4	11.9	126.6	2.5	1640					309		
Austin Chalk Limestone	25.8											
Austin Chalk Limestone	45.0			2.0		40	2441					
Austin Chalk Limestone	45.4	13.5	125.3	2.5	2670							
Austin Chalk Limestone	45.9											
Austin Chalk Limestone	89.0	10.0	131.9									
Austin Chalk Limestone	89.2							39	233			
Austin Chalk Limestone	90.0							129	300			
Eagle Ford Shale	102.7	20.8	110.2	2.1	3							
Eagle Ford Shale	103.5									31		
Eagle Ford Shale	107.7	17.6	115.0	2.5	298							
Eagle Ford Shale	108.2											
Eagle Ford Shale	108.7									74		
Eagle Ford Shale	108.9			1.9		100	374					
Eagle Ford Shale	116.9	17.1	114.9	2.5	233							
Eagle Ford Shale	117.5											
Eagle Ford Shale	118.0									37		
Eagle Ford Shale	123.9	15.2	118.3	2.4	271							
Eagle Ford Shale	124.9									95		
Eagle Ford Shale	132.7	16.7	116.4								38	36
Eagle Ford Shale	132.8	16.5	115.8									33
Eagle Ford Shale	133.4	15.3	118.0									43
Eagle Ford Shale	134.0	15.9	118.5	2.2	350							
Eagle Ford Shale	137.7	16.2	116.8	2.4	370							
Eagle Ford Shale	138.5									140		
Eagle Ford Shale	143.8	17.0	117.4	2.4	343							
Eagle Ford Shale	144.1									104		
Eagle Ford Shale	148.0	17.9	117.3	2.3	348							
Procedure		ASTM-D2216			ASTM-D2938	ASTM-D2664		ISRM		ISRM	ISRM	ISRM

Note: Mineralogical data available in Table 2.

APPENDIX A

LITHOLOGIC LOG

LOG OF BORING

PROJECT: SSC
CLIENT: TETC
TASK NO.: 17

BORING NO: BF1.6PG 1 OF 4
LOCATION: N 282,039 feet
E 2,176,960 feet
GROUND EL: 627.6 feet

DATE: 5/23/89 TYPE: Nx Core CASED TO: 1.0 CONTRACTOR: MJA

SAMPLE LEGEND
S= SPLIT SPOON
T= 2" THIN WALL TUBE
U= 3" THIN WALL TUBE
C= NX ROCK CORE

WATER INFORMATION

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	DESCRIPTION OF STRATUM
			1.0	3.0	100	93			LIMESTONE (Austin Chalk), medium hard, mod. weathered, tan 2.7-2.9 fracture, 15°, ferruginous, rough
			3.0	5.0	95	91			2.9 LIMESTONE (Austin Chalk), moderately hard, fresh, slightly fossiliferous, with argillaceous bands, lt. gray
5		C1 5.0 to 6.5	5.0	10.0	98	91			2.9-3.9 argillaceous, gray 4.2-4.9 fracture, 70°, ferruginous, rough 10.0-10.3 argillaceous, dk. gray 11.5-13.0 argillaceous, dk. gray
10		Box 1 Box 2	10.0	15.0	98	93			
15			15.0	22.5	97	97			18.9-19.0 argillaceous, dk. gray 20.6-21.0 argillaceous, dk. gray 23.5-23.9 argillaceous, dk. gray 23.9 fracture, 45°, slickensided, rough 24.3-25.3 bentonitic seam
20		Box 3							
25		C2 25.3 to 27.2	22.5	32.5	100	95			
30		Box 4							28.4-28.9 argillaceous, dk. gray
35		Box 5	32.5	42.5	100	100			
40									40.5-41.0 shale
			42.5						

DRILLING GEOLOGIST J. Murchison ASSISTANT G. James CHECKED BY W. Flanigan

LOG OF BORING

PROJECT: SSC
CLIENT: TETC
TASK NO.: 17

BORING NO: BF1.6 PG 2 OF 4
LOCATION: N 282,039 feet
E 2,176,960 feet
GROUND EL: 627.6 feet

DATE: 5/23/89 TYPE: Nx Core CASED TO: 1.0 CONTRACTOR: MJA

SAMPLE LEGEND
S= SPLIT SPOON
T= 2" THIN WALL TUBE
U= 3" THIN WALL TUBE
C= NX ROCK CORE

WATER INFORMATION

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	DESCRIPTION OF STRATUM
			42.5						LIMESTONE, (Austin Chalk), moderately hard, fresh, slightly fossiliferous, with argillaceous bands, lt. gray
		Box 6		42.5					
45		C3 44.9 to 46.6			100	97			42.5-44.0 argillaceous, dk. gray
50			52.5						49.7-49.8 shale - broken zone
		Box 7		52.5					53.6-54.0 shale
55					100	99			
60									59.1-59.8 shale 60.2-60.4 shale 62.9 fracture, 20°, slickensided, rough 64.6-65.0 fracture, 70°, rough, clean surface 65.0-65.4 shale
		Box 8	62.5	62.5					65.5 fracture, 23° calcite healed, hairline 67.8-68.1 shale
65					100	100			
70		Box 9	72.5						72.0-72.5 shale
				72.5					
75					100	100			76.5-77.9 argillaceous, dk. gray
80		Box 10	82.5						
				82.5					

DRILLING GEOLOGIST J. Murchison ASSISTANT G. James CHECKED BY W. Flanigan

LOG OF BORING

BORING NO: BF1.6 PG 3 OF 4

PROJECT: SSC

CLIENT: TETC

TASK NO.: 17

LOCATION: N 282,039 feet
E 2,176,960 feet

GROUND EL: 627.6 feet

DATE: 5/23/89 TYPE: Nx Core CASED TO: 1.0 CONTRACTOR: MJA

SAMPLE LEGEND
S= SPLIT SPOON
T= 2" THIN WALL TUBE
U= 3" THIN WALL TUBE
C= NX ROCK CORE

WATER INFORMATION

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	DESCRIPTION OF STRATUM
				82.5					LIMESTONE, (Austin Chalk), moderately hard, fresh, slightly fossiliferous, with argillaceous bands, lt. gray
			82.5						83.0-83.5 fracture, 85°, rough, clean surface
									84.2-84.4 argillaceous, dk. gray
85					100	100			
		Box 11							89.0 pyrite nodule
									90.1-92.5 shaly zone
90		C4 89.0 to 90.5		92.5					92.5
			92.5						LIMESTONE, arenaceous, argillaceous, fossiliferous, moderately hard, fresh, gray-dk. gray
									95.7-96.3 fracture, 70°, rough
95					100	98			
									98.3
		Box 12							SHALE, (Eagle Ford) soft to medium hard, fresh, dk. gray-black
100		C5 102.7 to 103.7		102.7					98.3-98.6 broken zone
									101.3-101.8 fracture, 60°, rough, clean surface
			102.7						104.6-104.7 limestone
105					100	100			
		Box 13							
110		C6 107.7 to 109.3		112.7					112.6-112.7 limestone
			112.7						114.3-114.6 fracture, 45°, slickensided, rough
									114.7 limestone
									116.7 limestone
115									116.7-116.8 fracture, 10°, slickensided
		Box 14			86	86			118.0-118.1 fracture, 10°, slickensided
									119.4-119.9 fracture, 45°, slickensided
									120.3-120.4 fracture, 15°, slickensided
		C7 116.9 to 119.1							(1.4' core left in hole)
120				122.7		Stop drilling 5/23			
			122.7			Resume drilling 5/24			Picked up 1.0' core in hole

DRILLING GEOLOGIST J. Murchison ASSISTANT G. James CHECKED BY W. Flanigan

LOG OF BORING

PROJECT: SSC

CLIENT: TETC

TASK NO.: 17

BORING NO: BF1.6 PG 4 OF 4

LOCATION: N 282,039 feet
E 2,176,960 feet

GROUND EL: 627.6 feet

DATE: 5/24/89 TYPE: Nx Core CASED TO: 1.0 CONTRACTOR: MJA

SAMPLE LEGEND: S= SPLIT SPOON; T= 2" THIN WALL TUBE; U= 3" THIN WALL TUBE; C= NX ROCK CORE

WATER INFORMATION

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	DESCRIPTION OF STRATUM
		C8 123.9 to 124.9		122.7					SHALE, (Eagle Ford), soft to medium hard, fresh, dk. gray-black
			122.7						124.9 fracture, 30°, rough, clean surface
									125.4 fracture, 30°, rough, clean surface
125					95	85			125.8 fracture, 10°, rough, clean surface 126.8-127.6 soft broken zone
		Box 15							129.4-129.9 broken zone
130		C9 132.7 to 134.5		132.7					131.5-131.8 soft broken zone
			132.7						
135					100	98			135.1 limestone 136.4 fracture, 20°, rough, clean surface
		Box 16							
140		C10 138.8 to 140.0		142.7					142.4-142.8 soft zone 143.6 fracture, 45°, rough, clean surface
			142.7						
145					100	98			146.5 fracture, 20°, rough, clean surface
		C11 143.8 to 146.5							
150		C12 148.0-149.5		152.7					152.2-152.7 broken zone
									Total Depth 152.7' Wireline Logged 5/24/89 Boring Plugged 5/25/89

DRILLING GEOLOGIST J. Murchison ASSISTANT G. James CHECKED BY W. Flanigan

APPENDIX B

WIRE-LINE LOGS

WIRE-LINE LOGGING PARAMETERS

Hole No. BF1.6 **Log Measured From:** Ground Level

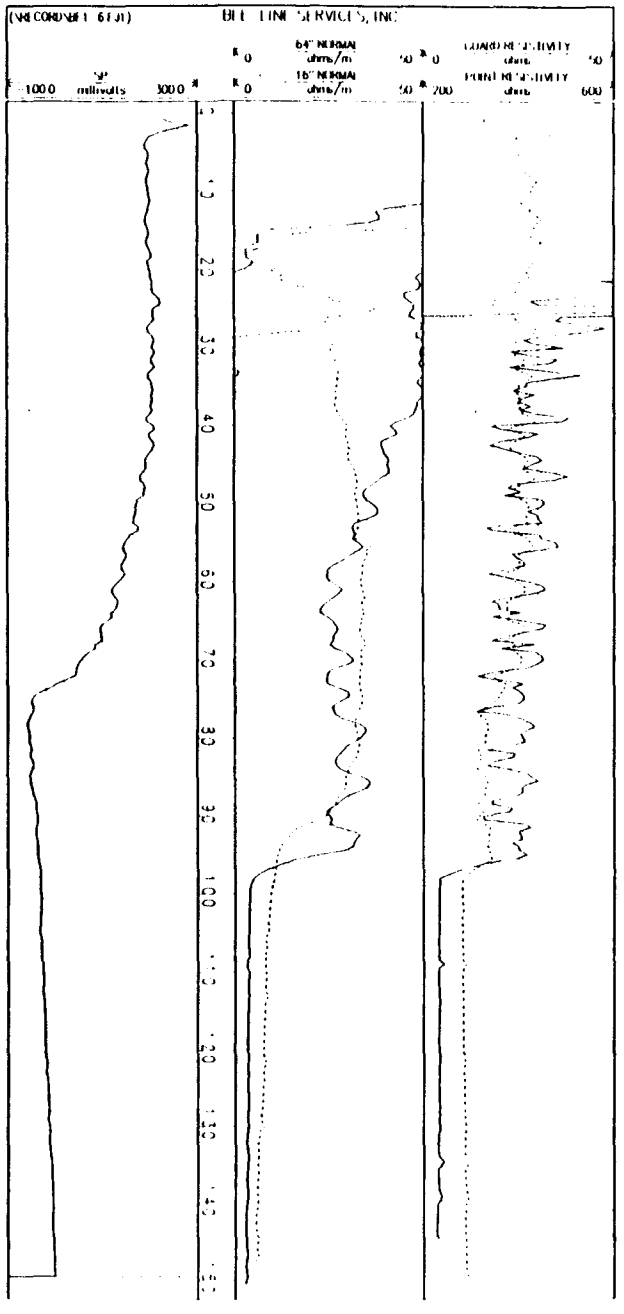
Drilling Parameters
Depth 150 feet
Bit Diameter 3.25 inches

Logging Parameters	Electrical Log	Gamma Log	Sonic Log
Date	May 24, 1989	May 24, 1989	May 24, 1989
Bottom Log Interval	150.5 feet	150 feet	146.1 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	boring fluid	boring fluid	boring fluid
Time Since Circulation Stop	1 hour	6 hours	1 hour
Probe Type/S.N.	ALP-4979	XAP-4383	CLP-4877A
Module Type/S.N.	ALM-4979	XAM-4383	CLM-4877A
Logging Speed	15 feet/min.	15 feet/min.	6 feet/min.
Sample Interval	0.5 feet	0.5 feet	0.1 feet

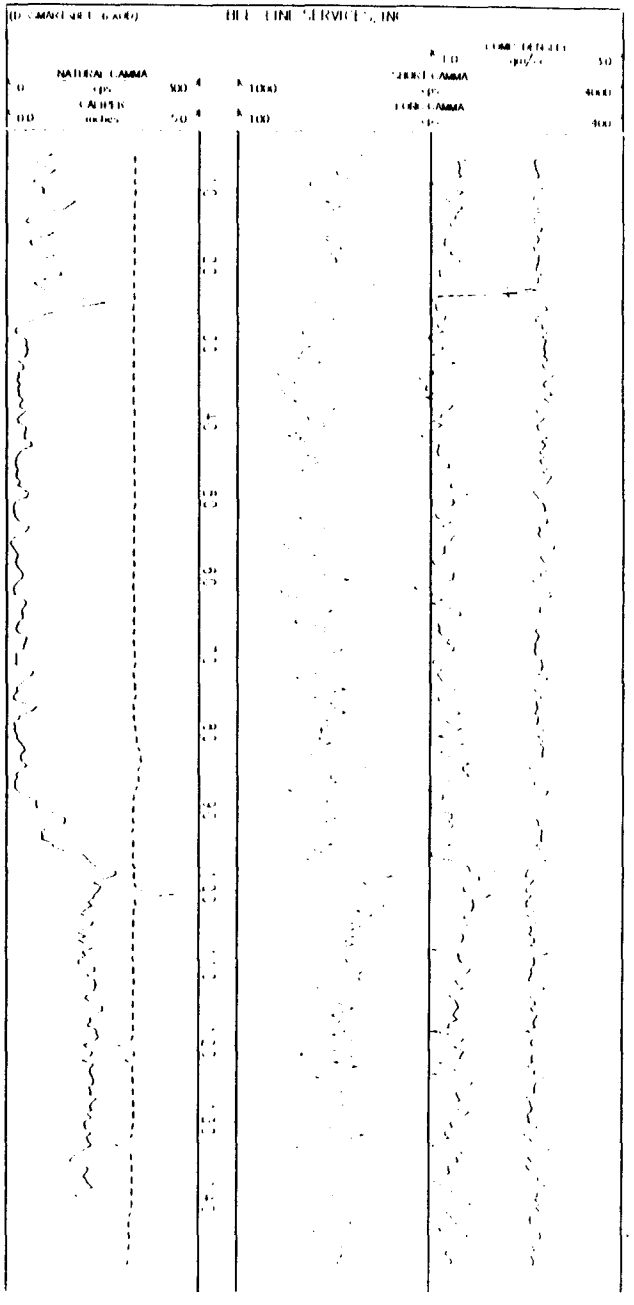
Logged by: BEE-LINE SERVICES, INC.
P.O. Box 2096
Corsicana, TX 75151

BF1.6 Wire-line logs run May 24, 1989. Surface elevation 627.6 feet.

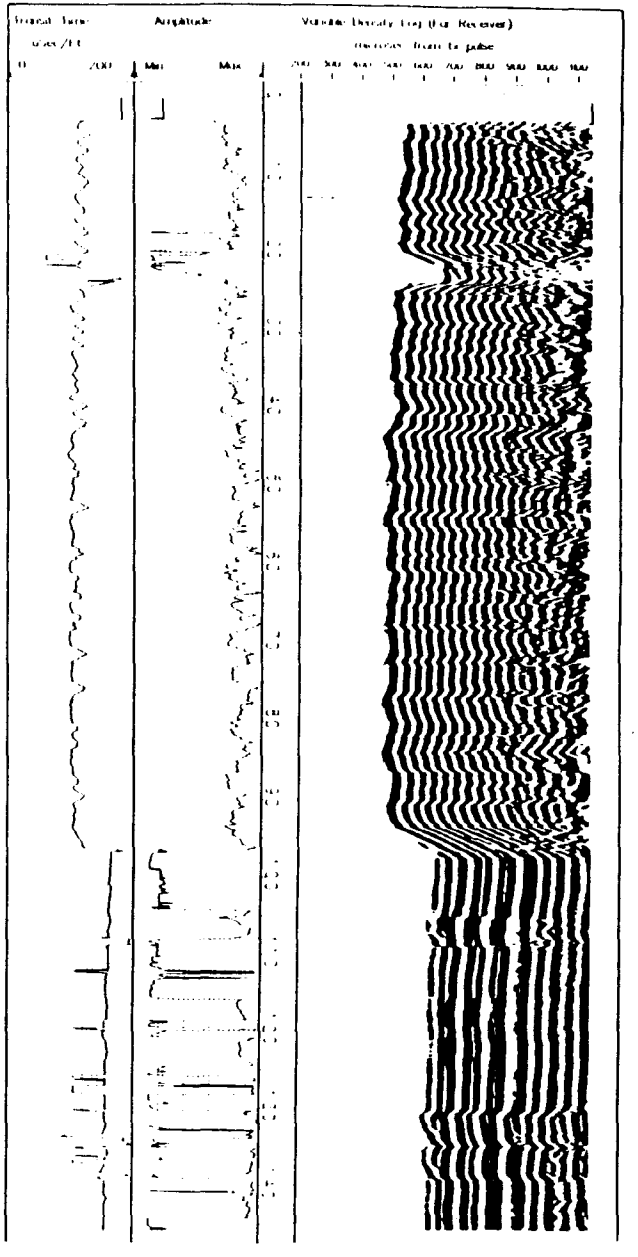
ELECTRICAL LOG



GAMMA LOG



SONIC LOG



APPENDIX C

PLUGGING REPORT

SSC BOREHOLE PLUGGING REPORT

TETC Project No. 87-888-00/7

Task No. 17

Boring No. BF-1.6

Texas Coordinate Location:

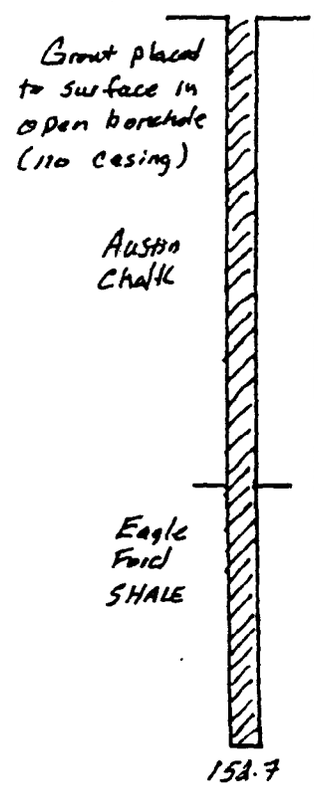
N 282,039 feet

E 2,176,960 feet

Surface Elevation: 627.6 feet

Total Boring Depth: 152.7

Plugging Remarks: Boring Grouted upon completion of drilling and field testing. 9 sacks of cement and 1/2 sack of bentonite mixed with approximately 6 gallons of water/sack were placed in borehole with drill rods



Date Plugged: 5/25/89

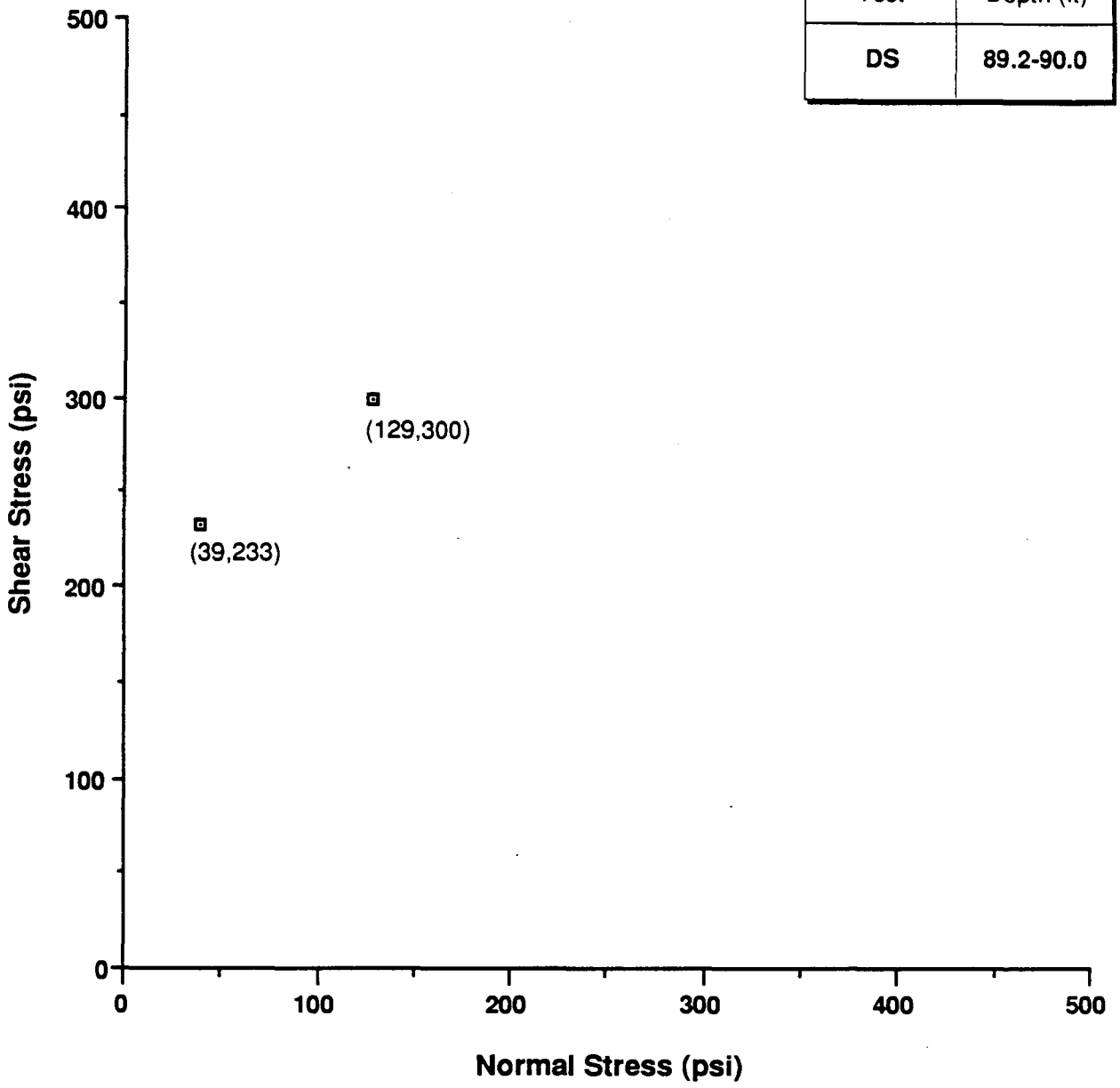
Time Completed: 9:00 AM

Drilling Geologist: John Murchison
MJA Coordinator: Bill Flonigan
MJA No.: 5530.17

APPENDIX D

DIAGRAMS OF LABORATORY RESULTS

BORING BF1.6 Austin Chalk	
Test	Depth (ft)
DS	89.2-90.0



DS-ISRM

The Earth Technology Corporation

Direct Shear Test
Texas SSC Site

FIGURE
D-1