N00639.AR.000963
NSA MID SOUTH
5090.3a

RESOURCE CONSERVATION RECOVERY ACT FACILITY INVESTIGATION REPORT FOR ASSEMBLY E FOR SOLID WASTE MANAGEMENT UNITS 2, 9, 14, 38, 59 AND 65 VOLUME 2 ATTACHMENTS 1 THROUGH 7 MILLINGTON SUPPACT TN
4/1/1999
ENSAFE ALLEN AND HOSHALL

RCRA FACILITY INVESTIGATION REPORT
ASSEMBLY E
NAVAL SUPPORT ACTIVITY MEMPHIS

SWMUs 2, 9, 14, 38, 59, and 65

VOLUME II
ATTACHMENTS 1-7

CTO-106

SOUTHNAVFACENGCOM
CONTRACT NUMBER: N62467-89-D-0318

Revision: 0

Prepared for:

Department of the Navy
Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina

Prepared by:

EnSafe/Allen & Hoshall
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Memphis, Tennessee 38134
(901) 383-9115

June 13, 1997

ATTACHMENT 1

TOPOGRAPHIC MAP – NSA MEMPHIS SOUTHSIDE

ATTACHMENT 3

DPT PIEZOCONE SOUNDINGS AND HYDROCONE PLOTS

Table 3-1
Summary of Horizontal Hydraulic Conductivity Estimates From Hydrocone Data
Assembly E DPT Investigation
NSA Memphis — Millington, Tennessee

Sample ID	Horizontal Hydraulic Conductivity (cm/sec)	Horizontal Hydraulic Conductivity (feet/day)
SWMU 2 Upper Alluvium DPT Points		
002G001327	6.19e-06	0.01
002G001427	1.59e-05	0.04
002G001527	5.05e-06	0.01
002G001627	2.35e-06	< 0.01
002G001725	5.60e-06	0.01
002G001825	3.35e-06	< 0.01
002G001926	1.36e-05	0.03
002G002130	1.07e-06	< 0.01
002G002323	3.36e-06	< 0.01
002G002527	1.92e-06	< 0.01
002G002627	1.10e-07	< 0.01
002G002727	8.58e-07	< 0.01
AVERAGE	***4.95e-06***	***0.01***
SWMU 2 Deeper Alluvium		
002G001337	7.53e-04	2.13
002G001440	7.22e-06	0.02
002G001540	3.25e-05	0.09
002G001639	6.97e-06	0.01
002G001736	9.25e-05	0.26
002G001836	1.49e-04	0.42
002G001939	1.13e-04	0.32
002G002039	7.90e-06	0.02
002G002149	4.99e-04	1.41
002G002249	1.18e-03	3.34
002G002336	2.90e-04	0.82
002G002436	9.87e-07	< 0.01
002G002540	2.36e-04	0.66
002G002643	2.26e-05	0.06
002G002741	8.81e-05	0.24
AVERAGE	***2.32e-04***	***0.65***

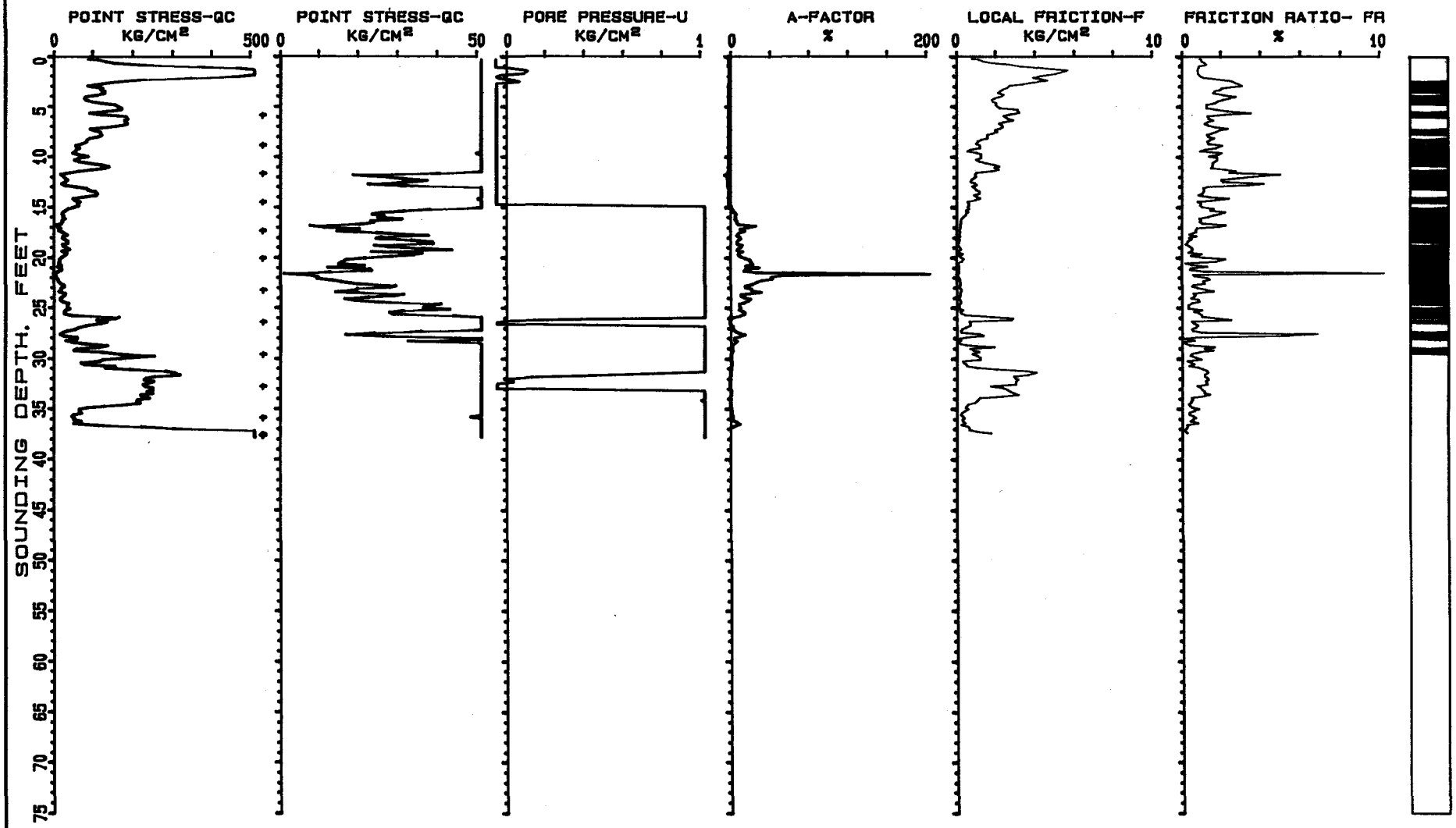
Table 3-1
Summary of Horizontal Hydraulic Conductivity Estimates From Hydrocone Data
Assembly E DPT Investigation
NSA Memphis — Millington, Tennessee

Sample ID	Horizontal Hydraulic Conductivity (cm/sec)	Horizontal Hydraulic Conductivity (feet/day)
SWMU 9 Deeper Alluvium DPT Points		
009G000946	2.15e-05	0.06
009G001046	2.39e-04	0.67
009G001150	6.36e-05	0.18
009G001246	9.97e-05	0.28
009G001348	2.19e-05	0.06
009G001445	1.30e-05	0.03
009G001547	1.00e-03	2.85
009G001644	5.43e-05	0.15
009G001747	5.07e-06	0.01
009G001852	1.57e-04	0.44
009G002142	3.47e-06	< 0.01
009G002244	1.63e-05	0.04
009G002347	5.28e-06	0.01
AVERAGE	***1.31e-04***	***0.37***
SWMU 14 Loess DPT Points		
014G000512	1.53e-05	0.04
014G000711	4.88e-05	0.13
014G000811	1.37e-05	0.03
014G000911	2.68e-05	0.07
014G001110	7.83e-06	0.02
014G001211	2.07e-06	0.01
014G001313	2.36e-05	0.06
014G001411	1.37e-04	0.39
AVERAGE	***3.44e-05***	***0.09***
SWMU 14 Upper Fluvial Deposits DPT Points		
014G000545	1.81e-04	0.51
014G000743	2.50e-05	0.07
014G000840	7.36e-06	0.02
014G000943	6.28e-05	0.17
014G001043	2.70e-05	0.07
014G001143	1.22e-05	0.03
014G001239	6.39e-07	< 0.01
014G001543	2.10e-06	< 0.01
AVERAGE	***3.98e-05***	***0.11***

SWMU 2

DPT SCREENING INVESTIGATION RESULTS

PIEZOCONE SOUNDING



+ PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
SOUNDING # 02-P13
TEST DATE 11-07-1995 13: 13: 49

IN-SITU TECHNOLOGY SOIL BEHAVIOR TABLE
FOR SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
FILE NAME..... 02-P13

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES #	N' VALUES #	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%) *	FRICTION ANGLE (DEGREES) **	YOUNGS MODULUS (KG/CM2) ***	UNDRAINED SHEAR STRENGTH (KG/CM2) ****	SENSITIVITY	COMP.	OCR
1	SILTY FINE SAND	196.6	2.62	49	49	.03	>90%	>48	432	--	--	--	--
2	DENSE OR CEMENTED S.	541.7	4.69	90	90	.067	>90%	>48	1191	--	--	--	--
3	SILTY FINE SAND	222.6	3.58	55	55	.098	>90%	>48	489	--	--	--	--
4	SILTY TO CLAYEY F.S.	117	2.3	39	39	.128	>90%	>48	257	--	--	--	--
5	SILTY TO CLAYEY F.S.	112.8	2	37	37	.159	80%-90%	>48	248	--	--	--	--
6	SILTY TO CLAYEY F.S.	148.4	2.76	49	49	.19	>90%	>48	326	--	--	--	--
7	SILTY FINE SAND	183.1	2.46	45	45	.221	>90%	>48	402	--	--	--	--
8	SILTY FINE SAND	123.8	1.92	30	30	.251	80%-90%	46-48	272	--	--	--	--
9	SILTY FINE SAND	89.4	1.24	22	22	.282	70%-80%	44-46	196	--	--	--	--
10	SILTY TO CLAYEY F.S.	64.5	1.03	21	21	.313	60%-70%	44-46	141	--	--	--	--
11	SILTY TO CLAYEY F.S.	91.5	1.55	30	30	.344	70%-80%	44-46	201	--	--	--	--
12	SILTY TO CLAYEY F.S.	73.9	1.38	24	24	.375	70%-80%	42-44	162	--	--	--	--
13	CLAYEY FINE SAND	34.7	.85	13	13	.405	40%-50%	40-42	76	--	--	--	--
14	SILTY FINE SAND	92.4	1.05	23	23	.436	70%-80%	44-46	203	--	--	--	--
15	SILTY TO CLAYEY F.S.	63.1	.73	21	21	.467	60%-70%	42-44	138	--	--	--	--
16	SILTY TO CLAYEY F.S.	32.2	.45	10	10	.498	<40%	38-40	70	--	--	--	--
17	CLAYEY FINE SAND	20.5	.21	8	8	.528	<40%	36-38	45	--	--	--	--
18	SILTY TO CLAYEY F.S.	22.6	.14	7	7	.559	<40%	36-38	49	--	--	--	--
19	SILTY TO CLAYEY F.S.	31.3	.13	10	10	.59	<40%	36-38	68	--	--	--	--
20	SILTY TO CLAYEY F.S.	32	.22	10	10	.621	<40%	36-38	70	--	--	--	--
21	CLAYEY FINE SAND	17.2	.17	6	6	.651	<40%	32-34	37	--	--	--	--
22	CLAYEY FINE SAND	13	.08	5	5	.682	<40%	30-32	28	--	--	--	--
23	CLAYEY FINE SAND	18.4	.17	7	7	.713	<40%	32-34	40	--	--	--	--
24	SILTY TO CLAYEY F.S.	22.8	.17	7	7	.744	<40%	34-36	50	--	--	--	--
25	SILTY TO CLAYEY F.S.	28.2	.14	9	9	.775	<40%	36-38	62	--	--	--	--
26	SILTY TO CLAYEY F.S.	53.9	.84	17	17	.805	40%-50%	38-40	118	--	--	--	--
27	FINE SAND	119.3	1.19	23	23	.838	60%-70%	42-44	262	--	--	--	--
28	SILTY TO CLAYEY F.S.	40.9	.52	13	13	.869	<40%	36-38	89	--	--	--	--
29	SILTY FINE SAND	78	.43	19	19	.9	50%-60%	40-42	171	--	--	--	--
30	FINE SAND	135.6	.98	27	27	.933	70%-80%	42-44	298	--	--	--	--

02-P13 CONTINUED ENSAFE

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	SENSITIVITY	COMP.	OCR
31	FINE SAND	121.4	.85	24	24	.966	60%-70%	40-42	267	--	--	--	--
32	FINE SAND	245.6	3.17	49	49	1	>90%	44-46	540	--	--	--	--
33	FINE SAND	237	2.66	47	47	1.033	>90%	44-46	521	--	--	--	--
34	FINE SAND	238.7	2.26	47	47	1.066	>90%	44-46	525	--	--	--	--
35	FINE SAND	182.6	.71	36	36	1.099	70%-80%	42-44	401	--	--	--	--
36	SILTY FINE SAND	64.1	.33	16	16	1.13	40%-50%	38-40	141	--	--	--	--
37	FINE SAND	123.7	.45	24	24	1.163	60%-70%	40-42	272	--	--	--	--

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)
* NORMALLY CONSOLIDATED SANDS
** FOR OVERCONSOLIDATED SANDS,SLIGHTLY REDUCE ABOVE FRICTION ANGLES
*** FOR OVERCONSOLIDATED SANDS, YOUNG'S MODULUS MAY BE AS MUCH AS 3 TO 6 TIMES HIGHER
**** NK OF 16 USED. FOR OVERCONSOLIDATED CLAYS, AN NK OF 17 IS SUGGESTED

THE ABOVE DATA WAS COMPUTED FOLLOWING 'BASIC' GUIDELINES BY P. K. ROBERTSON AND R. G. CAMPANELLA IN THE HANDBOOK 'GUIDELINES FOR USE AND INTERPERTATION OF THE ELECTRONIC CONE PENETRATION TEST'

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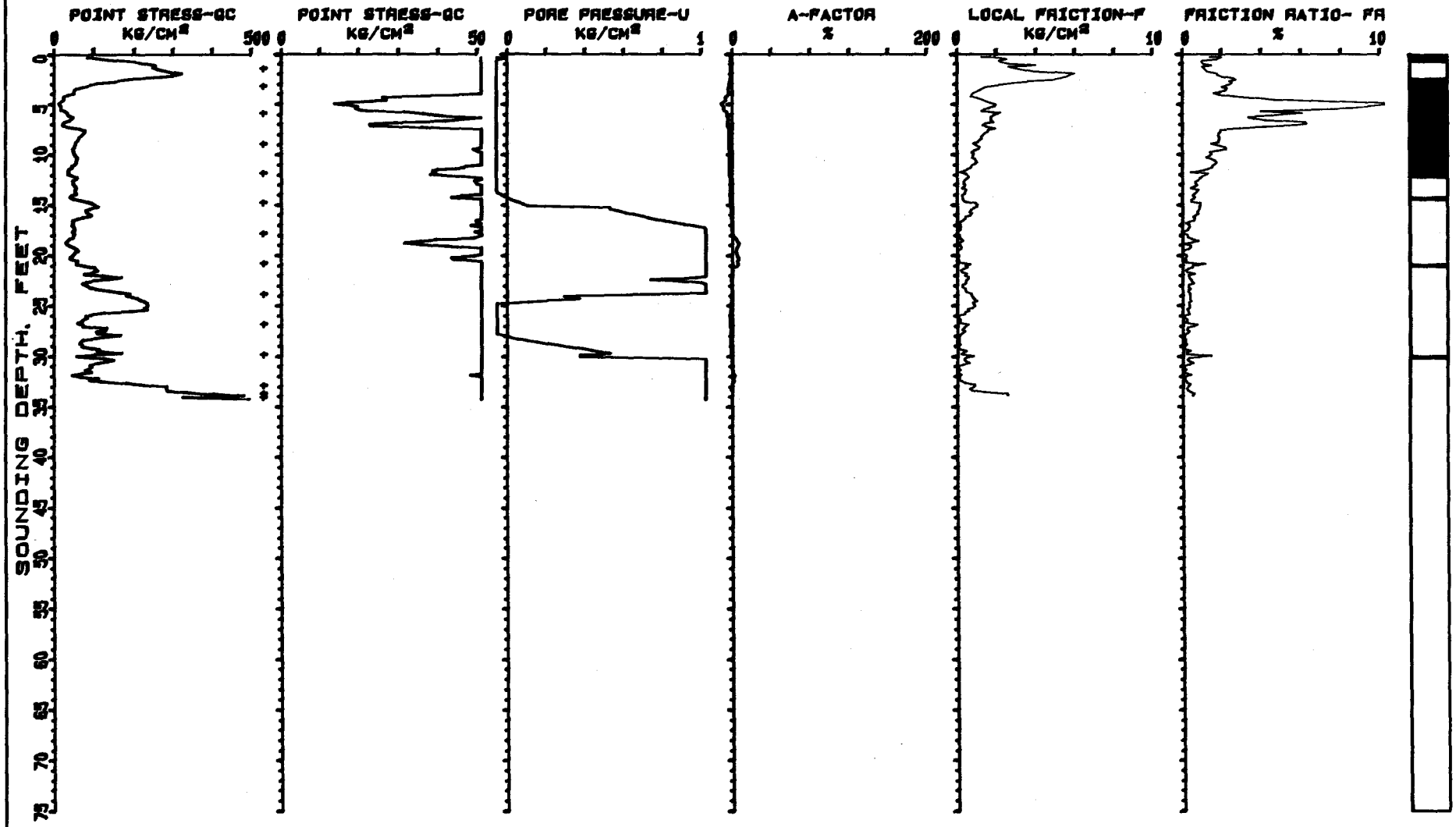
PIEZOCONE SOUNDING



* PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
SOUNDING # 02-P20
TEST DATE 11-08-1995 14:40:57

IN-SITU TECHNOLOGY SOIL BEHAVIOR TABLE
FOR SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
FILE NAME..... 02-P20

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES #	N' VALUES #	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%) *	FRICTION ANGLE (DEGREES) **	YOUNGS MODULUS (KG/CM2) ***	UNDRAINED SHEAR STRENGTH (KG/CM2) ****	SENSITIVITY	COMP.	OCR
1	SILTY FINE SAND	179.6	2.76	44	44	.03	>90%	>48	395	--	--	--	--
2	SILTY FINE SAND	272	4.23	68	68	.061	>90%	>48	598	--	--	--	--
3	SILTY FINE SAND	219.9	4.35	54	54	.092	>90%	>48	483	--	--	--	--
4	SILTY TO CLAYEY F.S.	70	1.28	23	23	.123	70%-80%	>48	154	--	--	--	--
5	SILTY CLAY TO CLAY	28.9	1.28	19	19	.15	--	--	--	1.78	2.2	UD	>6
6	CLAY	22.7	1.76	22	22	.175	--	--	--	1.39	1.2	UD	>6
7	SILTY CLAY TO CLAY	38.3	1.67	25	25	.202	--	--	--	2.36	2.2	UD	>6
8	CLAYEY FINE SAND	55.1	1.52	22	22	.233	60%-70%	44-46	121	--	--	--	--
9	SILTY TO CLAYEY F.S.	64.3	1.12	21	21	.264	70%-80%	44-46	141	--	--	--	--
10	SILTY TO CLAYEY F.S.	52.9	.94	17	17	.294	60%-70%	42-44	116	--	--	--	--
11	SILTY TO CLAYEY F.S.	57.5	.88	19	19	.325	60%-70%	42-44	126	--	--	--	--
12	SILTY TO CLAYEY F.S.	43.4	.53	14	14	.356	50%-60%	40-42	95	--	--	--	--
13	SILTY FINE SAND	51	.44	12	12	.387	60%-70%	42-44	112	--	--	--	--
14	SILTY FINE SAND	56.1	.37	14	14	.418	60%-70%	42-44	123	--	--	--	--
15	SILTY FINE SAND	70.8	.58	17	17	.448	60%-70%	42-44	155	--	--	--	--
16	SILTY FINE SAND	95.3	.72	23	23	.479	70%-80%	42-44	209	--	--	--	--
17	SILTY FINE SAND	62	.26	15	15	.51	50%-60%	40-42	136	--	--	--	--
18	SILTY FINE SAND	52.5	.04	13	13	.541	50%-60%	40-42	115	--	--	--	--
19	SILTY FINE SAND	40.6	.05	10	10	.571	40%-50%	38-40	89	--	--	--	--
20	SILTY FINE SAND	54	.04	13	13	.602	50%-60%	40-42	118	--	--	--	--
21	SILTY FINE SAND	56.8	.18	14	14	.633	50%-60%	40-42	124	--	--	--	--
22	FINE SAND	101	.41	20	20	.666	60%-70%	42-44	222	--	--	--	--
23	FINE SAND	111.2	.45	22	22	.699	70%-80%	42-44	244	--	--	--	--
24	FINE SAND	138.1	.57	27	27	.733	70%-80%	42-44	303	--	--	--	--
25	DENSE OR CEMENTED S.	220.6	.89	36	36	.769	>90%	44-46	485	--	--	--	--
26	FINE SAND	170.9	.42	34	34	.802	80%-90%	44-46	375	--	--	--	--
27	SILTY FINE SAND	74.3	.26	18	18	.833	50%-60%	40-42	163	--	--	--	--
28	FINE SAND	123.4	.24	24	24	.866	70%-80%	42-44	271	--	--	--	--
29	FINE SAND	85.2	.08	17	17	.9	50%-60%	40-42	187	--	--	--	--
30	FINE SAND	104	.33	20	20	.933	60%-70%	40-42	228	--	--	--	--

2-P20 CONTINUED ENSAFE

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	SENSITIVITY	COMP.	OCR
31	FINE SAND	109.9	.29	21	21	.966	60%-70%	40-42	241	--	--	--	--
32	FINE SAND	78.5	.07	15	15	.999	50%-60%	38-40	172	--	--	--	--
33	FINE SAND	154.6	.43	30	30	1.032	70%-80%	42-44	340	--	--	--	--

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)
* NORMALLY CONSOLIDATED SANDS
** FOR OVERCONSOLIDATED SANDS,SLIGHTLY REDUCE ABOVE FRICTION ANGLES
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**** NK OF 16 USED. FOR OVERCONSOLIDATED CLAYS, AN NK OF 17 IS SUGGESTED

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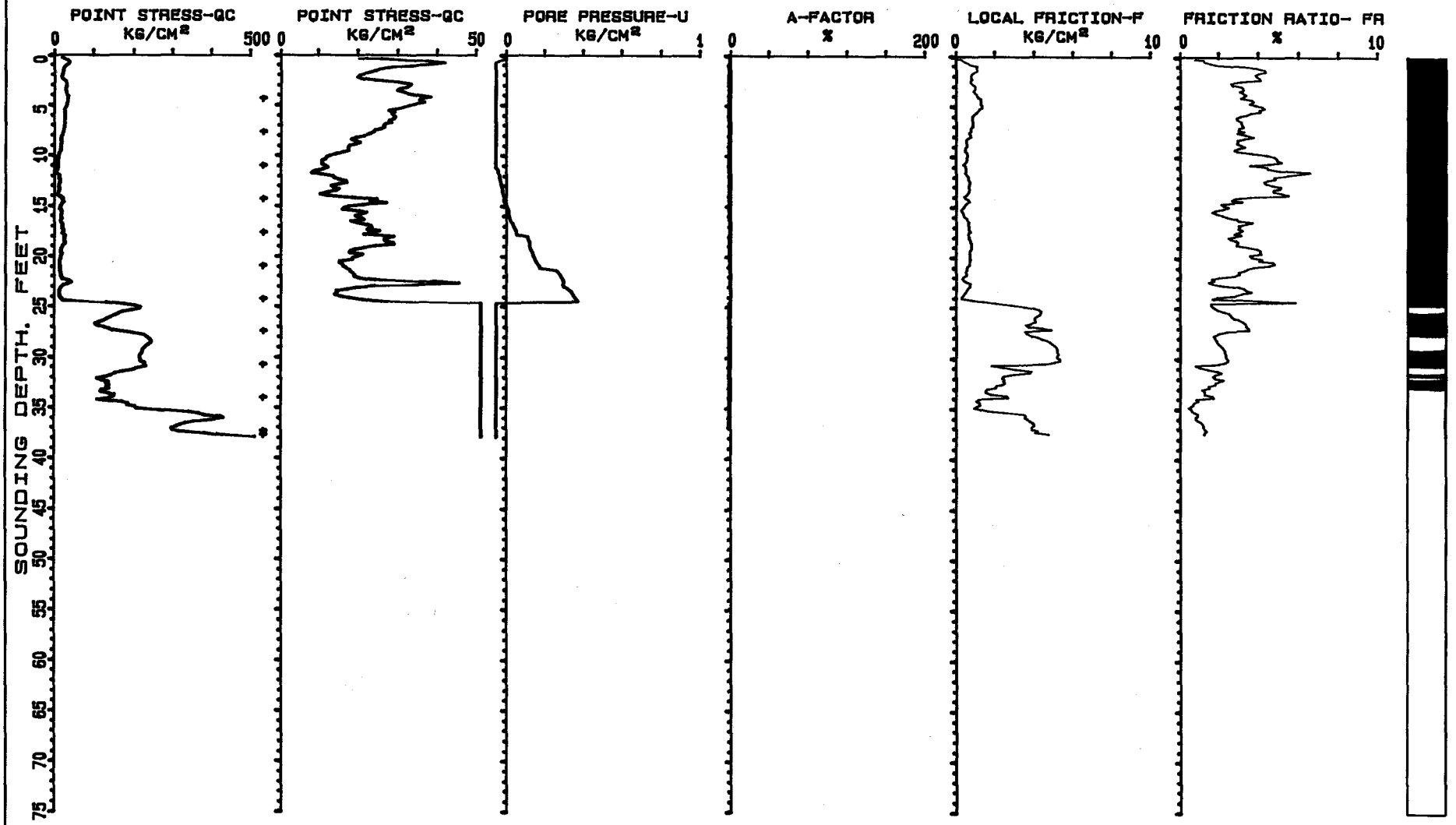
PIEZOCONE SOUNDING



* PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
SOUNDING # 02-P23
TEST DATE 12-01-1995 10:28:43

IN-SITU TECHNOLOGY SOIL BEHAVIOR TABLE
FOR SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
FILE NAME..... 02-P23

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N' VALUES	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%) *	FRICTION ANGLE (DEGREES) **	YOUNGS MODULUS (KG/CM2) ***	UNDRAINED SHEAR STRENGTH (KG/CM2) ****	SENSITIVITY	COMP.	OCR
				#									
1	CLAYEY FINE SAND	35.6	.85	14	14	.03	60%-70%	>48	78	.97	3.7	.01	6
2	SANDY CLAY	26.2	.97	13	13	.058	--	--	--	1.63	2.6	.02	>6
3	SANDY CLAY	25.3	.87	12	12	.085	--	--	--	1.57	2.9	.02	>6
4	SANDY CLAY	32	1.05	16	16	.112	--	--	--	1.98	3	.01	>6
5	SANDY CLAY	35.5	1.31	17	17	.14	--	--	--	2.2	2.7	.01	>6
6	SANDY CLAY	29.7	1.06	14	14	.167	--	--	--	1.83	2.7	.01	>6
7	SANDY CLAY	28	.85	14	14	.194	--	--	--	1.72	3.2	.02	>6
8	SANDY CLAY	24.4	.74	12	12	.222	--	--	--	1.49	3.2	.02	>6
9	SANDY CLAY	19.4	.57	9	9	.249	--	--	--	1.17	3.3	.01	>6
10	SILTY CLAY TO CLAY	16.3	.57	10	10	.276	--	--	--	.98	2.8	.01	6
11	CLAY	11.5	.52	11	11	.301	--	--	--	.67	2.1	.02	6
[illegible]	CLAY	10.9	.58	10	10	.326	--	--	--	.63	1.8	.02	6
[illegible]	CLAY	15.1	.7	15	15	.351	--	--	--	.89	2.1	.01	6
14	CLAY	13.1	.61	13	13	.376	--	--	--	.76	2.1	.01	6
15	SANDY CLAY	20.7	.53	10	10	.403	--	--	--	1.23	3.8	.02	6
16	SANDY CLAY	18.9	.41	9	9	.431	--	--	--	1.12	4.5	.01	6
17	SANDY CLAY	20.7	.66	10	10	.458	--	--	--	1.23	3.1	.02	6
18	SANDY CLAY	24.1	.7	12	12	.485	--	--	--	1.44	3.4	.02	6
19	SANDY CLAY	27.5	.8	13	13	.513	--	--	--	1.65	3.4	.02	6
20	SILTY CLAY TO CLAY	20.2	.76	13	13	.54	--	--	--	1.19	2.6	UD	6
21	SILTY CLAY TO CLAY	17.2	.7	11	11	.567	--	--	--	.99	2.4	.01	6
22	SANDY CLAY	18.1	.5	9	9	.595	--	--	--	1.05	3.5	.01	6
23	CLAYEY FINE SAND	29.7	.6	11	11	.626	<40%	36-38	65	--	--	--	--
24	SANDY CLAY	17	.45	8	8	.653	--	--	--	.97	3.7	.01	6
25	SILTY TO CLAYEY F.S.	101.3	2.4	33	33	.684	60%-70%	42-44	222	--	--	--	--
26	SILTY TO CLAYEY F.S.	179.6	4.2	59	59	.714	80%-90%	44-46	395	--	--	--	--
27	CLAYEY FINE SAND	121.8	4.06	48	48	.745	70%-80%	42-44	267	--	--	--	--
28	SILTY TO CLAYEY F.S.	175.7	4.06	58	58	.776	80%-90%	44-46	386	--	--	--	--
29	SILTY FINE SAND	239.7	4.87	59	59	.807	>90%	44-46	527	--	--	--	--
30	SILTY TO CLAYEY F.S.	222.5	5.22	74	74	.838	>90%	44-46	489	--	--	--	--

02-P23 CONTINUED ENSAFE

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	SENSITIVITY	COMP.	OCR
31	SILTY FINE SAND	222.2	3.92	55	55	.868	>90%	44-46	488	--	--	--	--
32	SILTY FINE SAND	176.1	2.93	44	44	.899	80%-90%	42-44	387	--	--	--	--
33	SILTY FINE SAND	127.5	2.17	31	31	.93	70%-80%	42-44	280	--	--	--	--
34	SILTY FINE SAND	135.1	1.81	33	33	.961	70%-80%	42-44	297	--	--	--	--
35	FINE SAND	169.2	1.19	33	33	.994	70%-80%	42-44	372	--	--	--	--
36	FINE SAND	347.2	3.18	69	69	1.027	>90%	46-48	763	--	--	--	--
37	FINE SAND	350.3	3.93	70	70	1.06	>90%	46-48	770	--	--	--	--

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)
* NORMALLY CONSOLIDATED SANDS
** FOR OVERCONSOLIDATED SANDS,SLIGHTLY REDUCE ABOVE FRICTION ANGLES
*** FOR OVERCONSOLIDATED SANDS, YOUNG'S MODULUS MAY BE AS MUCH AS 3 TO 6 TIMES HIGHER
**** NK OF 16 USED. FOR OVERCONSOLIDATED CLAYS, AN NK OF 17 IS SUGGESTED

THE ABOVE DATA WAS COMPUTED FOLLOWING 'BASIC' GUIDELINES BY P. K. ROBERTSON AND R. G. CAMPANELLA IN THE HANDBOOK 'GUIDELINES FOR USE AND INTERPERTATION OF THE ELECTRONIC CONE PENETRATION TEST'

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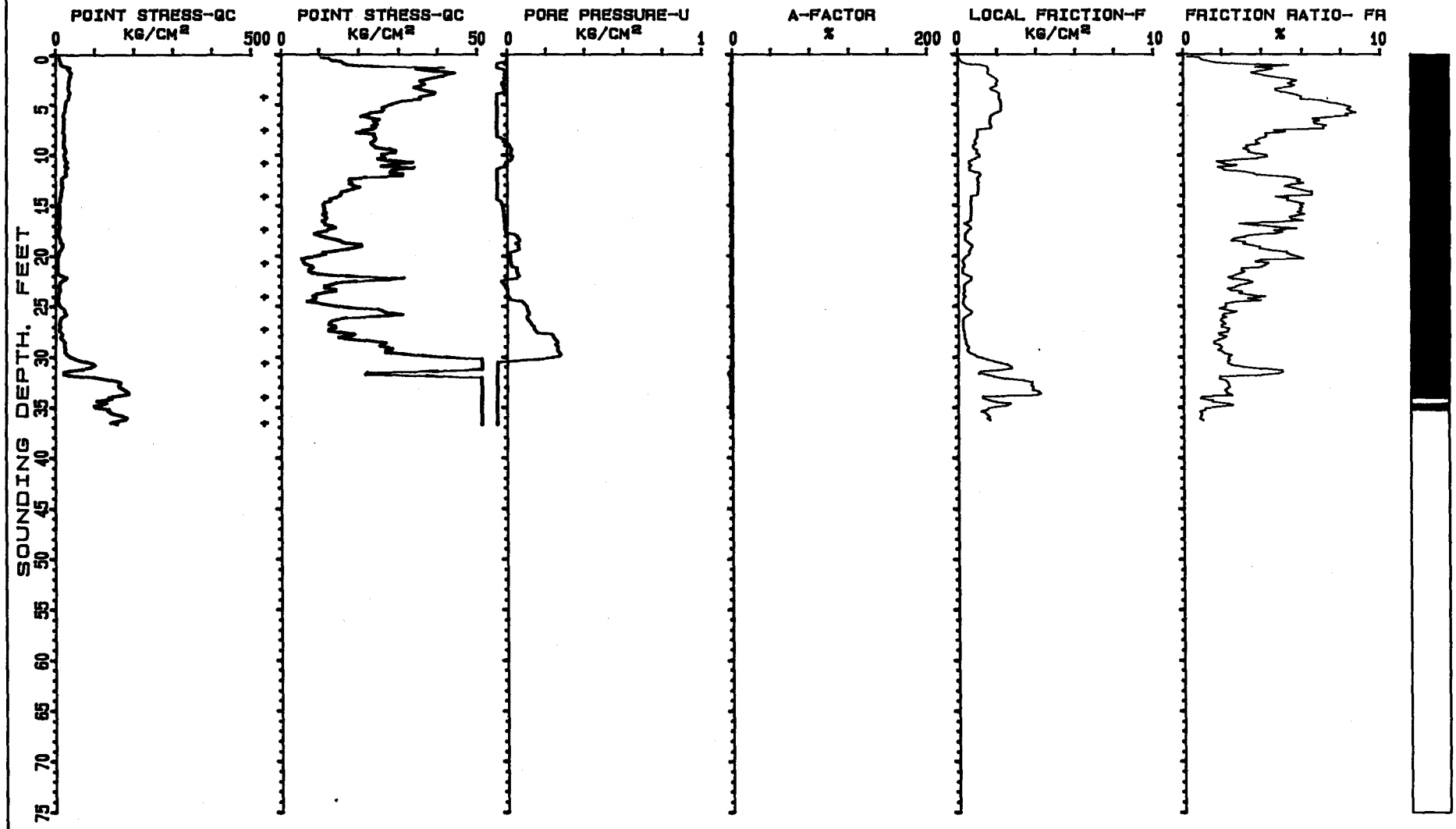
PIEZOCONE SOUNDING



* PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
SOUNDING # 02-P24
TEST DATE 12-01-1995 17:50:46

IN-SITU TECHNOLOGY SOIL BEHAVIOR TABLE
FOR SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
FILE NAME..... 02-P24

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES #	N'	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%) *	FRICTION ANGLE (DEGREES) **	YOUNGS MODULUS (KG/CM2) ***	UNDRAINED SHEAR STRENGTH (KG/CM2) ****	SENSITIVITY	COMP.	OCR
1	SANDY CLAY	15	.45	7	7	.027	--	--	--	.93	3.3	.01	>6
2	SILTY CLAY TO CLAY	34.5	1.52	23	23	.054	--	--	--	2.14	2.2	UD	>6
3	CLAY	38	1.91	38	38	.079	--	--	--	2.36	1.9	UD	>6
4	CLAY	36.6	1.9	36	36	.104	--	--	--	2.27	1.9	UD	>6
5	CLAY	33.5	2.15	33	33	.129	--	--	--	2.07	1.5	UD	>6
6	CLAY	25.3	2.02	25	25	.154	--	--	--	1.56	1.2	UD	>6
7	CLAY	23.3	1.64	23	23	.179	--	--	--	1.43	1.4	UD	>6
8	CLAY	22.8	1.28	22	22	.204	--	--	--	1.39	1.7	UD	>6
9	SILTY CLAY TO CLAY	23.7	.9	15	15	.231	--	--	--	1.44	2.6	UD	>6
10	SANDY CLAY	26.2	.91	13	13	.258	--	--	--	1.6	2.8	.02	>6
11	SANDY CLAY	27.4	.81	13	13	.286	--	--	--	1.67	3.3	.02	>6
12	CLAYEY FINE SAND	29.1	.8	11	11	.316	40%-50%	40-42	64	--	--	--	--
13	CLAY	21.5	1.04	21	21	.341	--	--	--	1.29	2	UD	6
14	CLAY	17.1	.95	17	17	.366	--	--	--	1.01	1.7	.01	6
15	CLAY	12.5	.65	12	12	.391	--	--	--	.72	1.9	.02	6
16	CLAY	11.1	.65	11	11	.416	--	--	--	.63	1.7	.02	6
17	CLAY	11.6	.55	11	11	.441	--	--	--	.66	2	.02	6
18	CLAY	11.3	.49	11	11	.466	--	--	--	.64	2.3	.02	6
19	SILTY CLAY TO CLAY	15.5	.52	10	10	.493	--	--	--	.9	2.9	.01	6
20	SILTY CLAY TO CLAY	14.7	.59	9	9	.521	--	--	--	.84	2.4	.01	6
21	CLAY	6.8	.29	6	6	.545	--	--	--	.35	2.2	.03	3
22	CLAY	9.3	.34	9	9	.57	--	--	--	.5	2.6	.02	3
23	SANDY CLAY	19.1	.51	9	9	.598	--	--	--	1.11	3.7	.01	6
24	SANDY CLAY	11.3	.31	5	5	.625	--	--	--	.62	3.6	.02	3
25	SILTY CLAY TO CLAY	9.7	.29	6	6	.652	--	--	--	.51	3.2	.02	3
26	CLAYEY FINE SAND	23.6	.51	9	9	.683	<40%	34-36	51	--	--	--	--
27	CLAYEY FINE SAND	15.3	.27	6	6	.714	<40%	32-34	33	--	--	--	--
28	SANDY CLAY	15	.3	7	7	.741	--	--	--	.83	4.8	.01	6
29	CLAYEY FINE SAND	22	.42	8	8	.772	<40%	34-36	48	--	--	--	--
30	CLAYEY FINE SAND	31.2	.75	12	12	.803	<40%	36-38	68	--	--	--	--

02-P24 CONTINUED ENSAFE

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	SENSITIVITY	COMP.	OCR
31	CLAYEY FINE SAND	75.3	2.08	30	30	.834	50%-60%	40-42	165	--	--	--	--
32	CLAYEY FINE SAND	53.8	1.78	21	21	.864	40%-50%	38-40	118	--	--	--	--
33	SILTY TO CLAYEY F.S.	148.7	3.52	49	49	.895	70%-80%	42-44	327	--	--	--	--
34	SILTY FINE SAND	169.3	3.19	42	42	.926	80%-90%	42-44	372	--	--	--	--
35	SILTY FINE SAND	118.9	1.9	29	29	.957	60%-70%	40-42	261	--	--	--	--
36	FINE SAND	144.9	1.43	28	28	.99	70%-80%	42-44	318	--	--	--	--

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)
* NORMALLY CONSOLIDATED SANDS
** FOR OVERCONSOLIDATED SANDS,SLIGHTLY REDUCE ABOVE FRICTION ANGLES
*** FOR OVERCONSOLIDATED SANDS, YOUNG'S MODULUS MAY BE AS MUCH AS 3 TO 6 TIMES HIGHER
**** NK OF 16 USED. FOR OVERCONSOLIDATED CLAYS, AN NK OF 17 IS SUGGESTED

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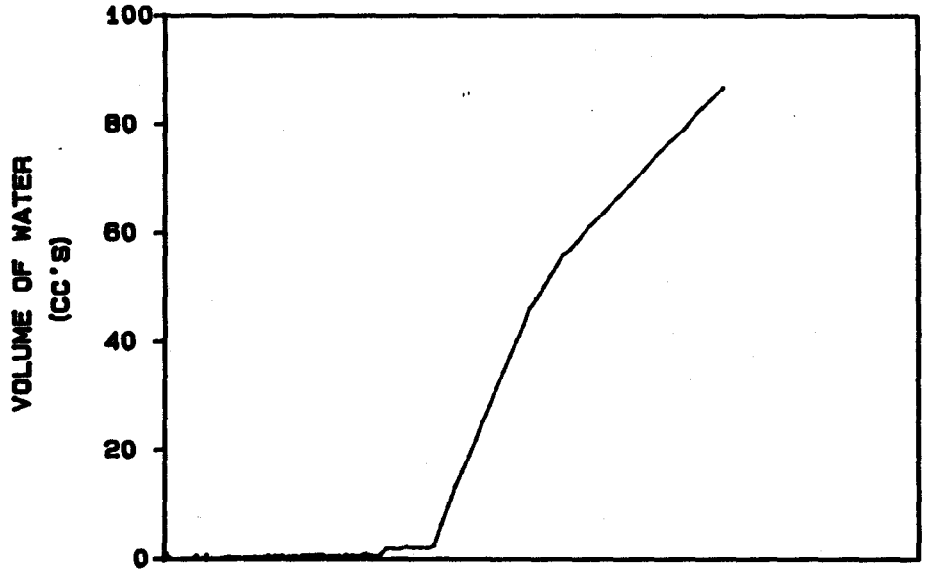
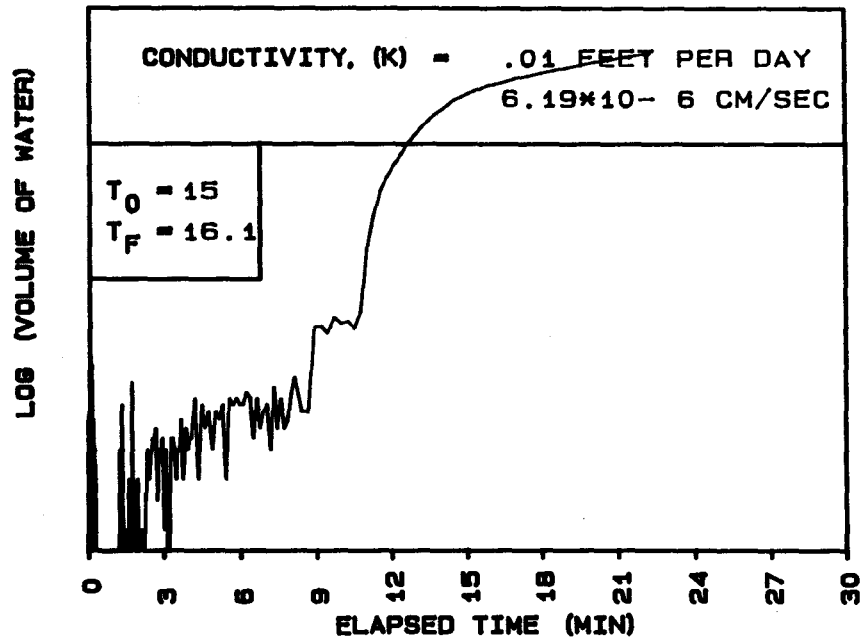
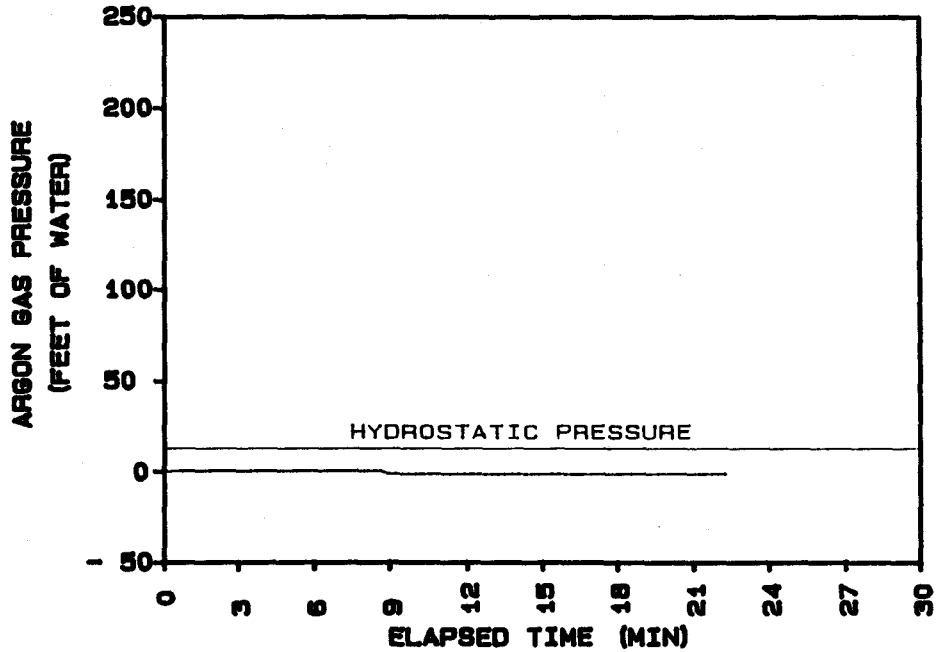
HYDROCONE TEST



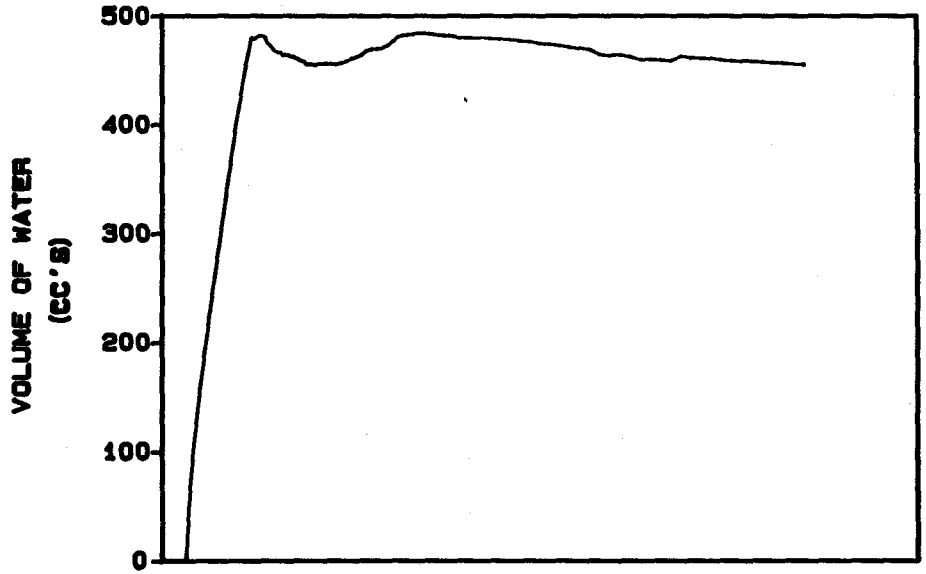


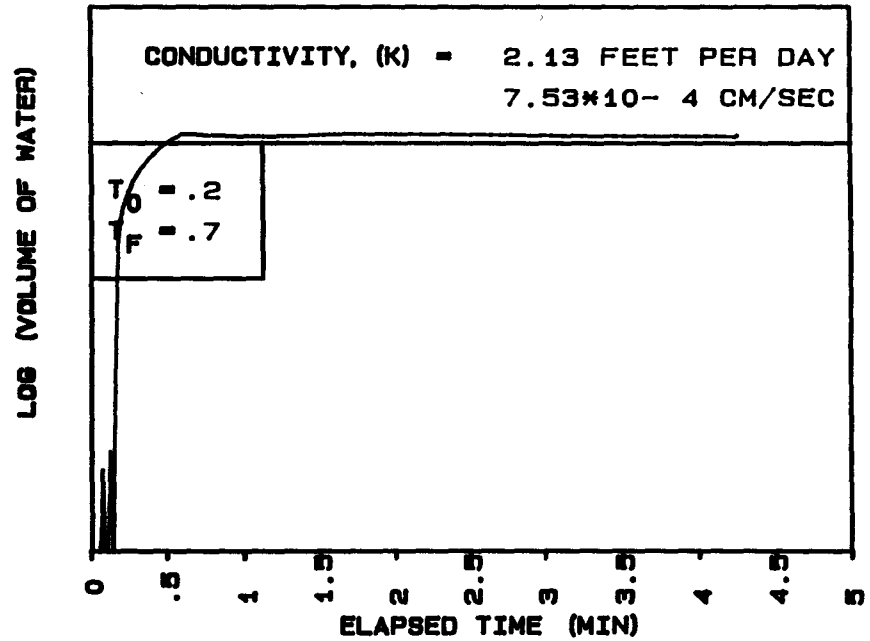


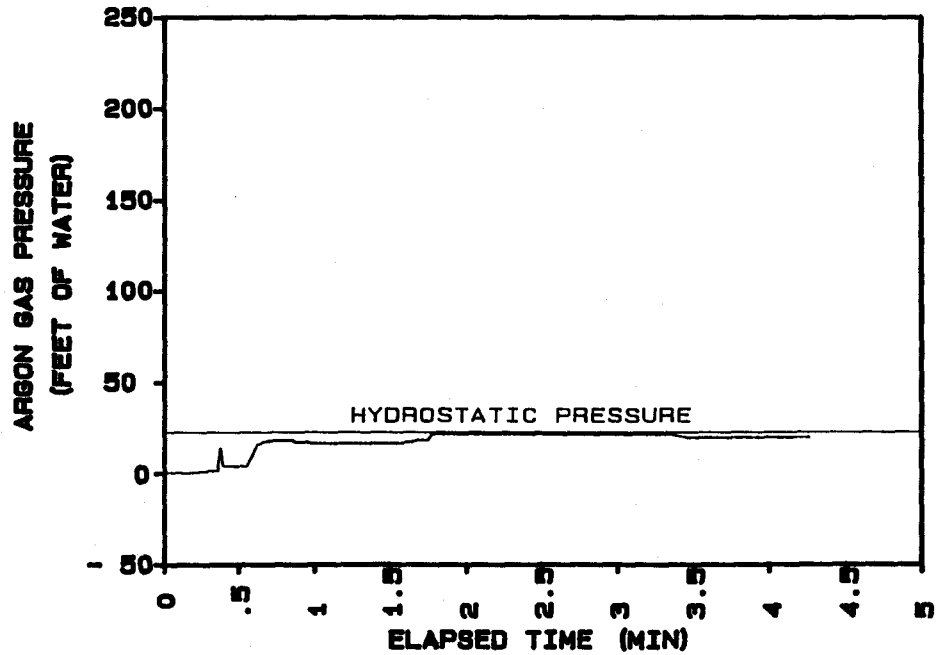
ENSAFE MEMPHIS NSA
LOCATION... 02H1327
TEST DATE
18: 12: 10 12-11-1995

SAMPLE DEPTH (FT) 27
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



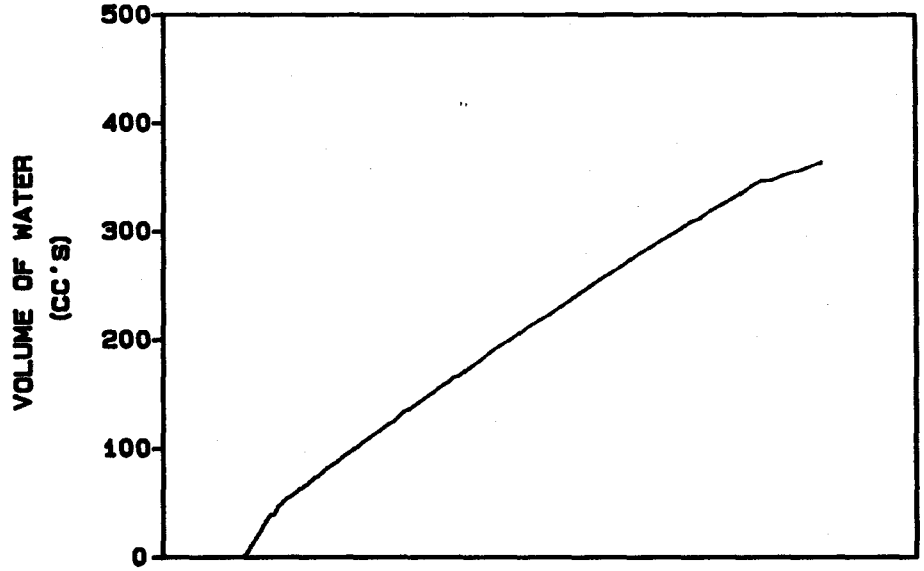


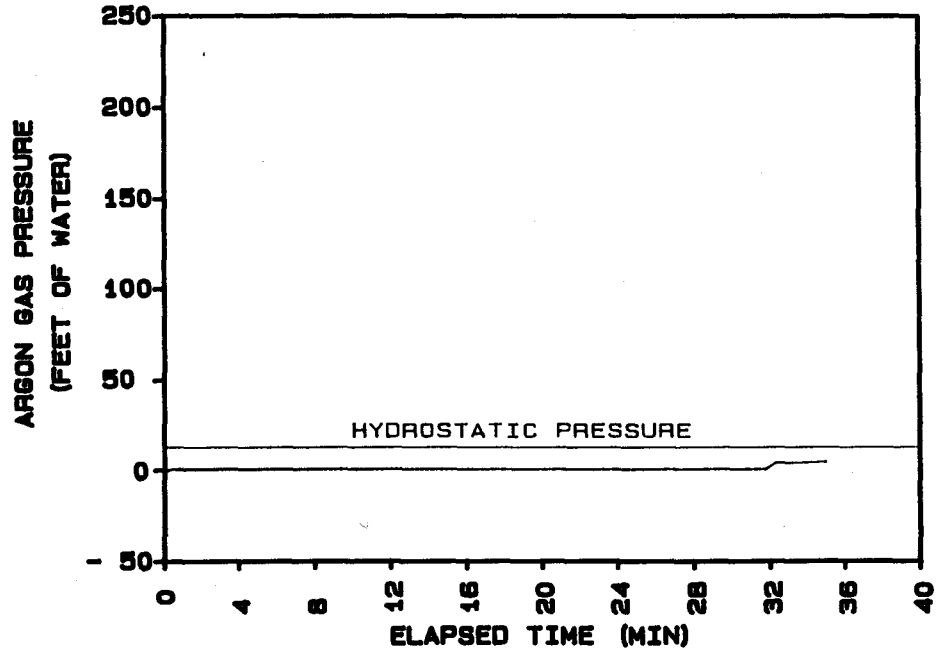


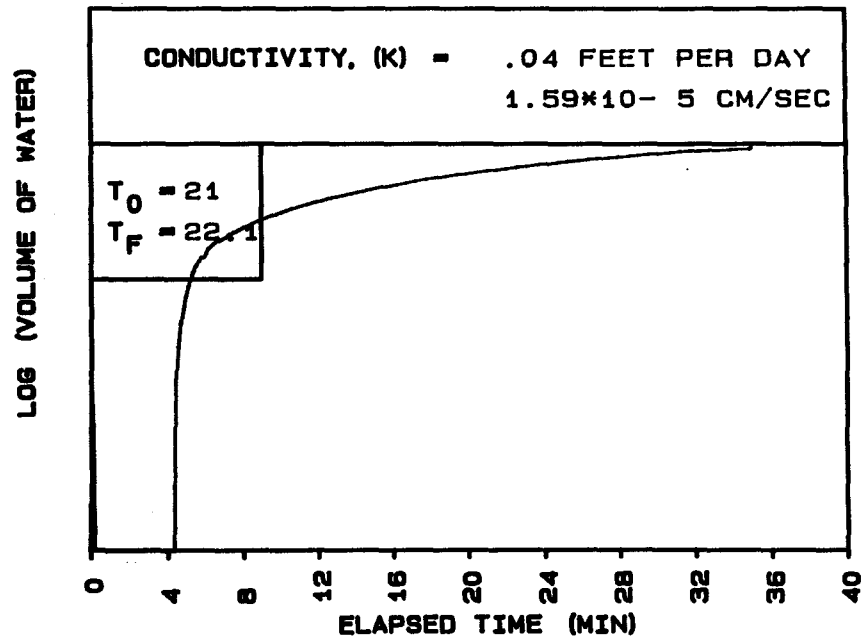
ENSAFE MEMPHIS NSA
LOCATION... 02H1337
TEST DATE
10: 05: 34 12-12-1995

SAMPLE DEPTH (FT) 37
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



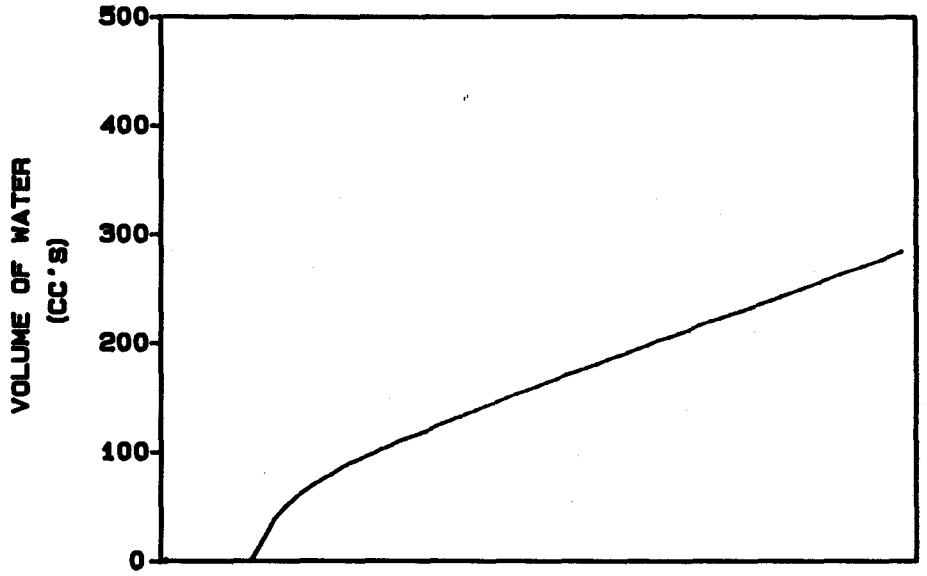


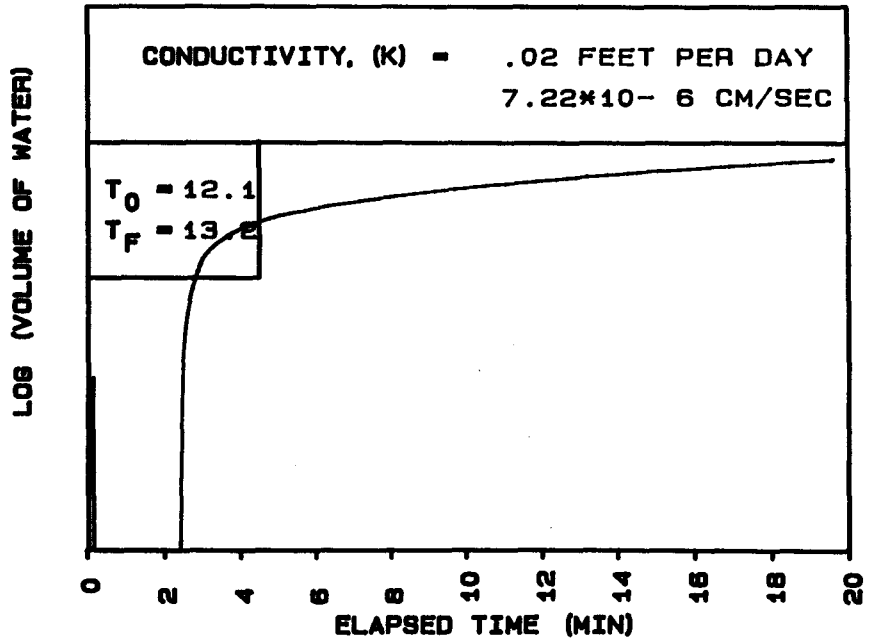


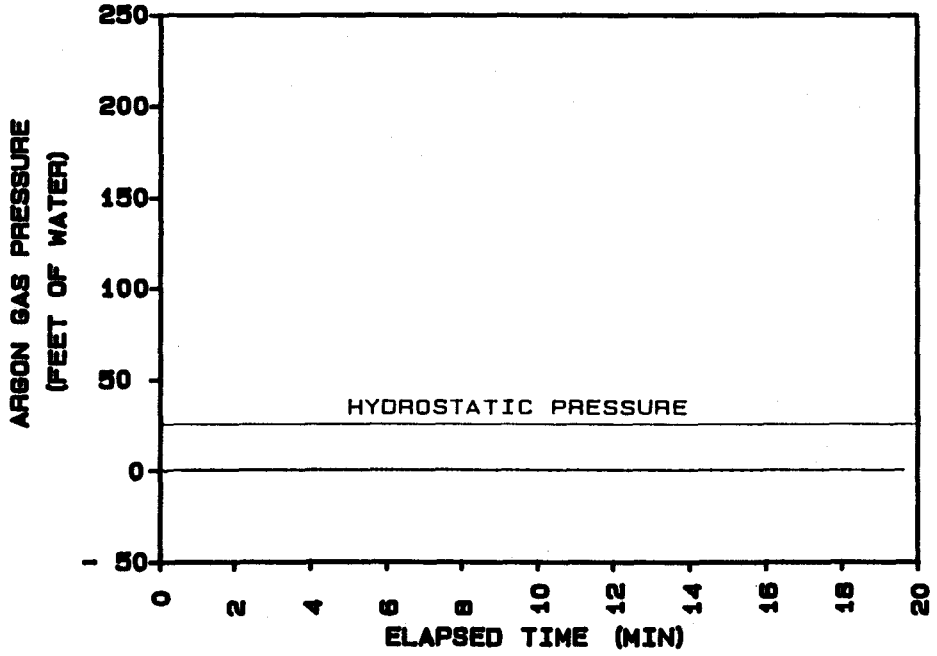
ENSAFE MEMPHIS NSA
LOCATION... 02H1427
TEST DATE
15: 59: 18 12-12-1995

SAMPLE DEPTH (FT) 27
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



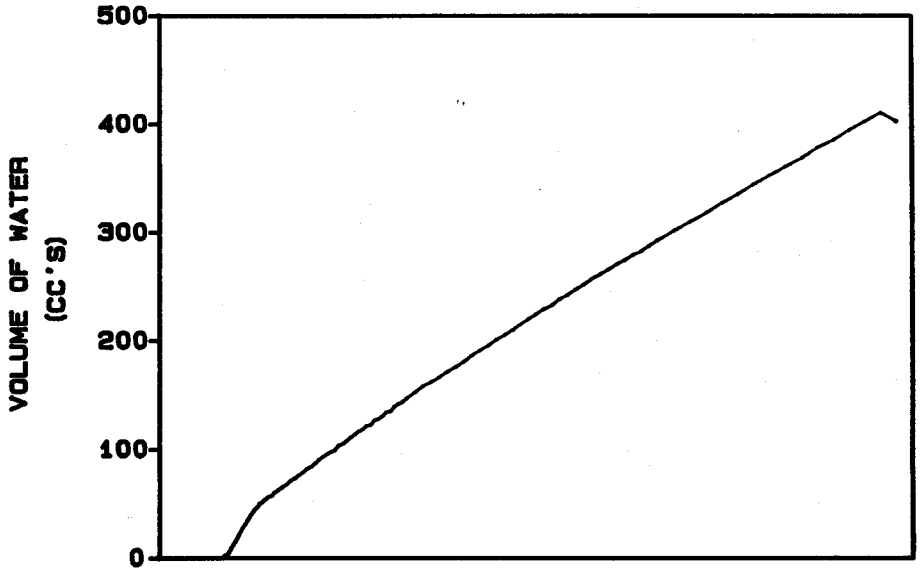


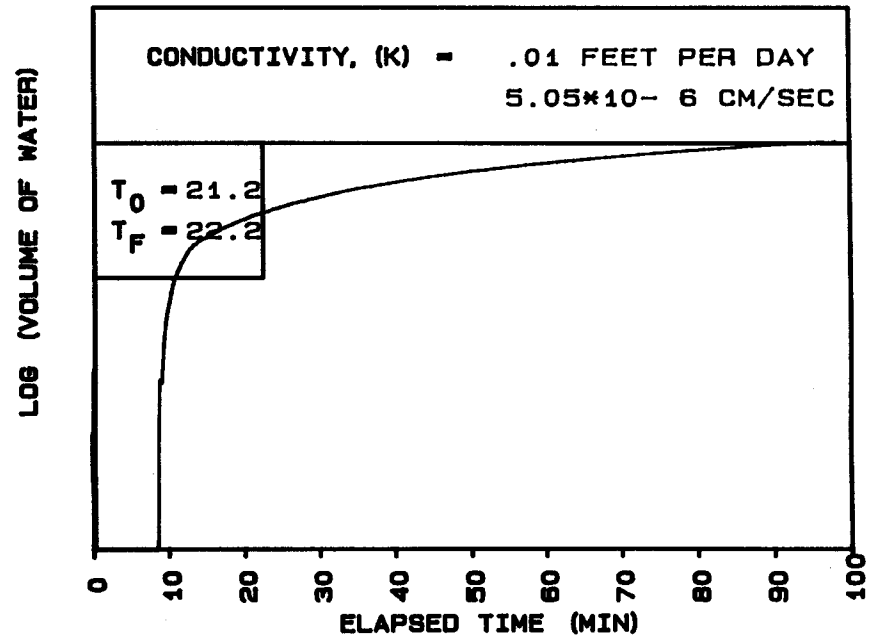


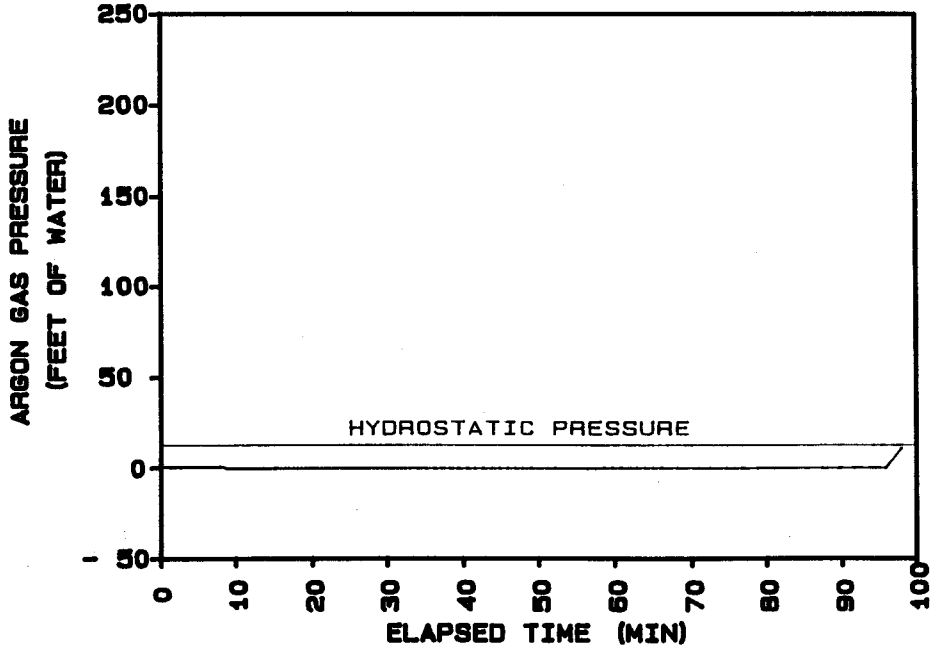
ENSAFE MEMPHIS NSA
LOCATION... 02H1440
TEST DATE
17: 28: 15 12-12-1995

SAMPLE DEPTH (FT) 40
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



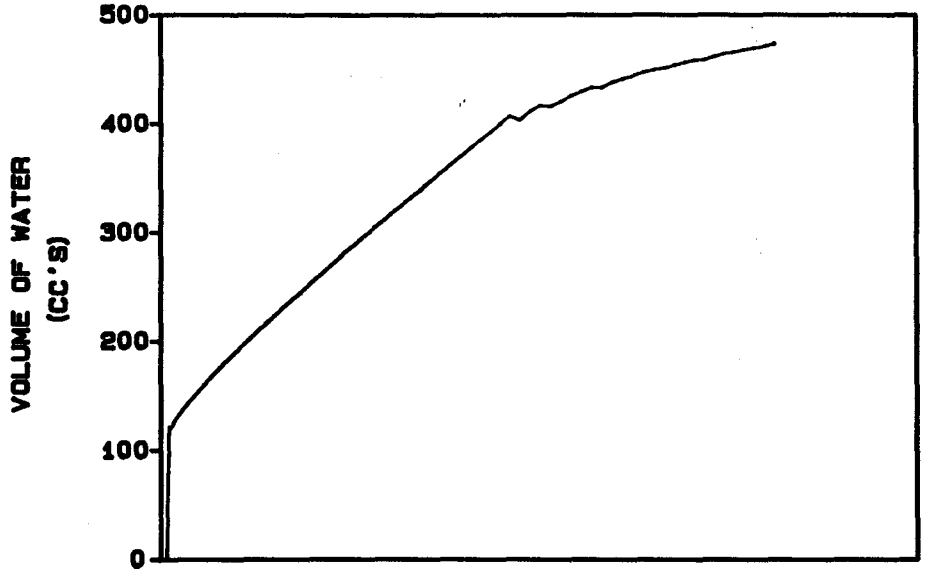


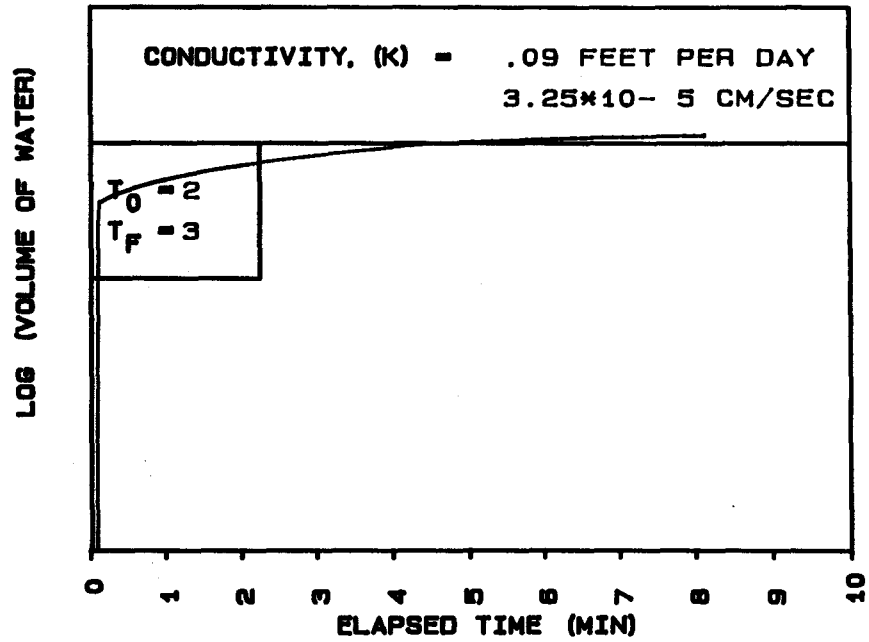


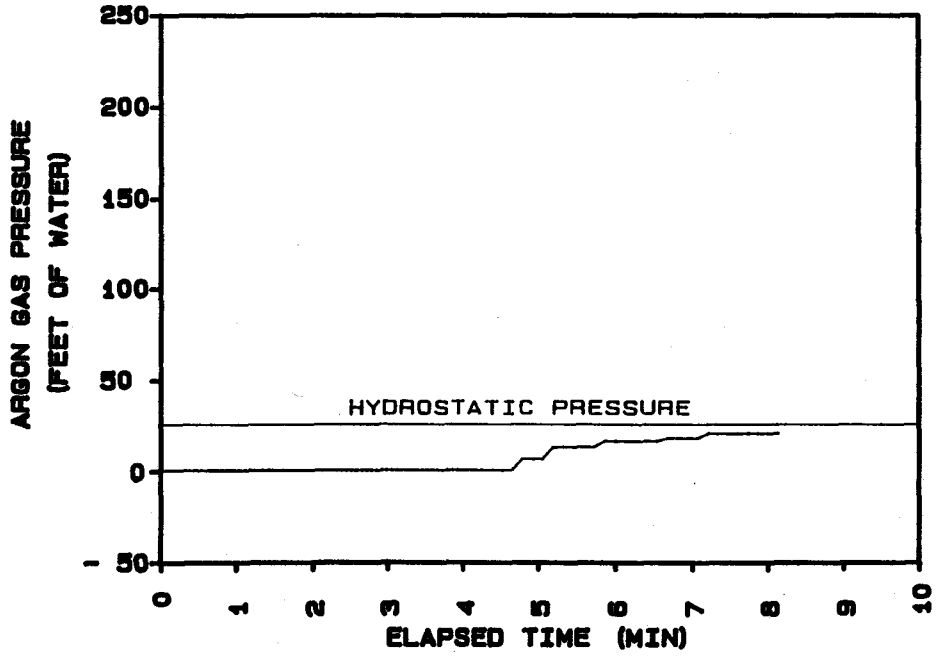
ENSAFE MEMPHIS NSA
LOCATION... 02H1527
TEST DATE
11: 01: 55 12-13-1995

SAMPLE DEPTH (FT) 27
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



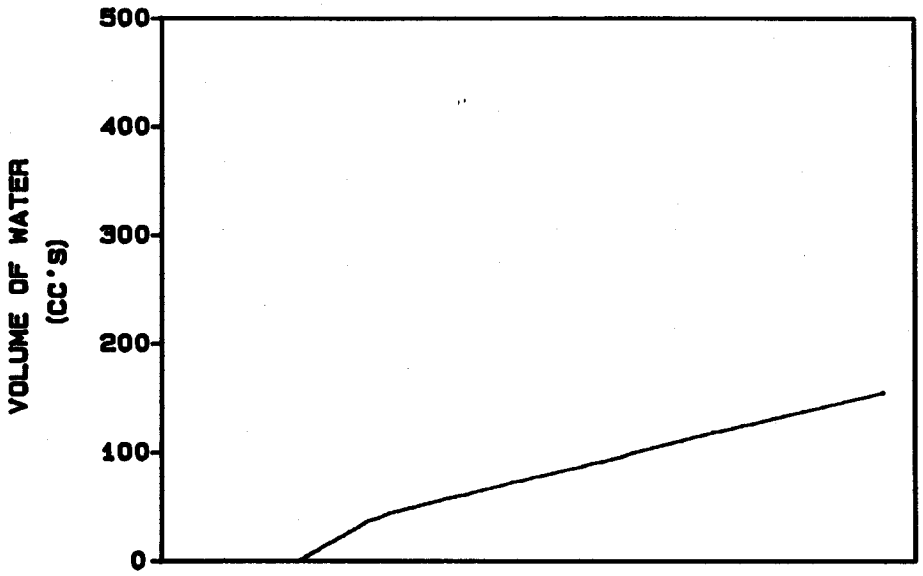


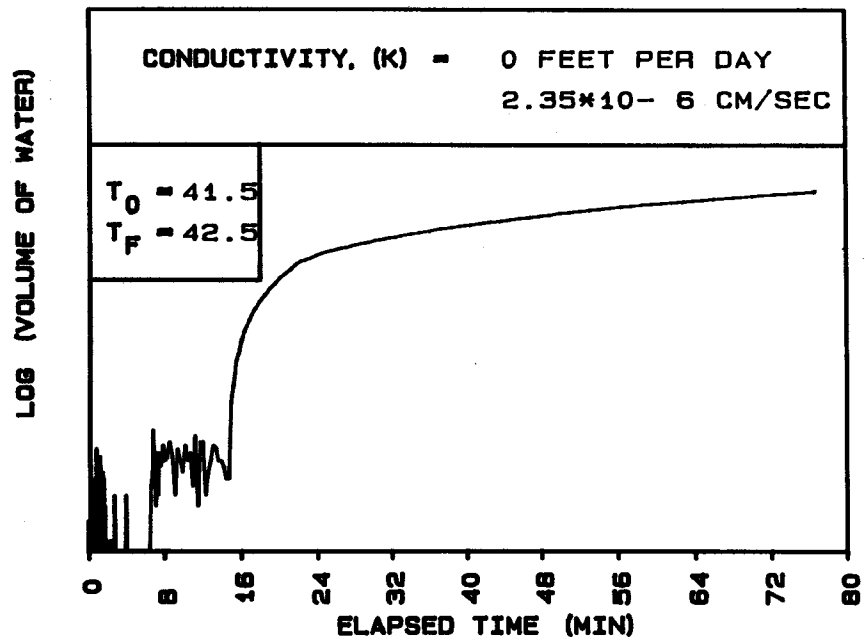


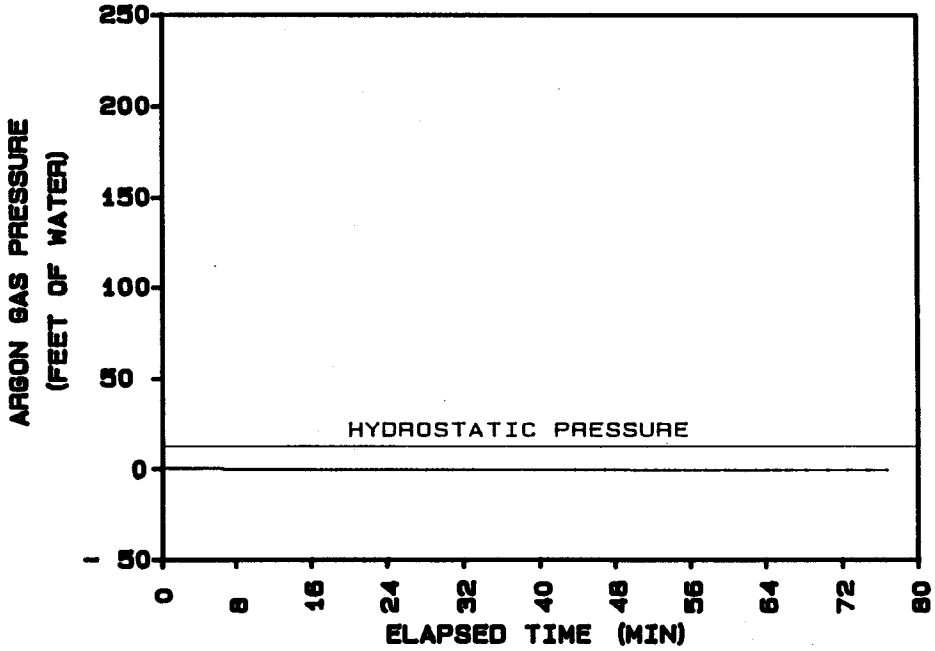
ENSAFE MEMPHIS NSA
LOCATION... 02H1540
TEST DATE
15: 26: 45 12-13-1995

SAMPLE DEPTH (FT) 40
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



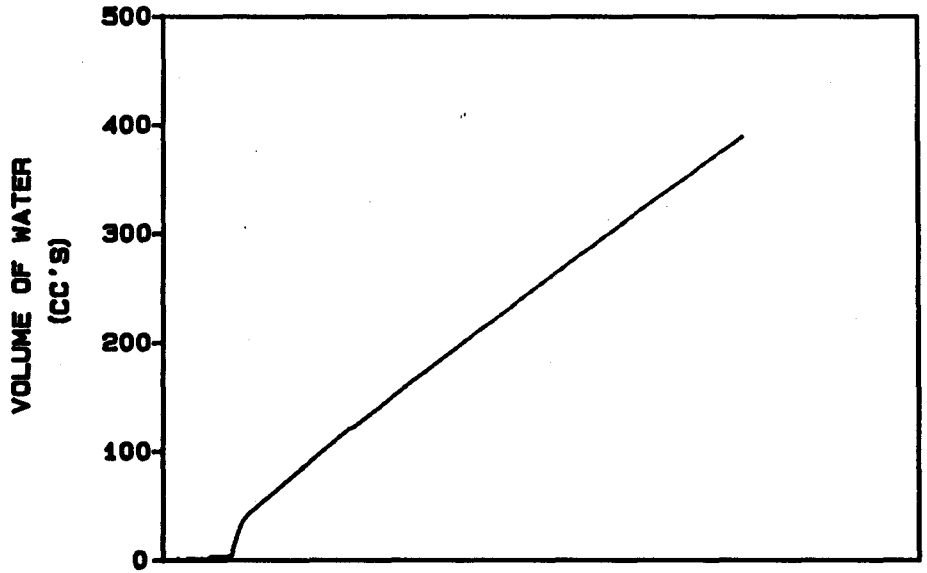


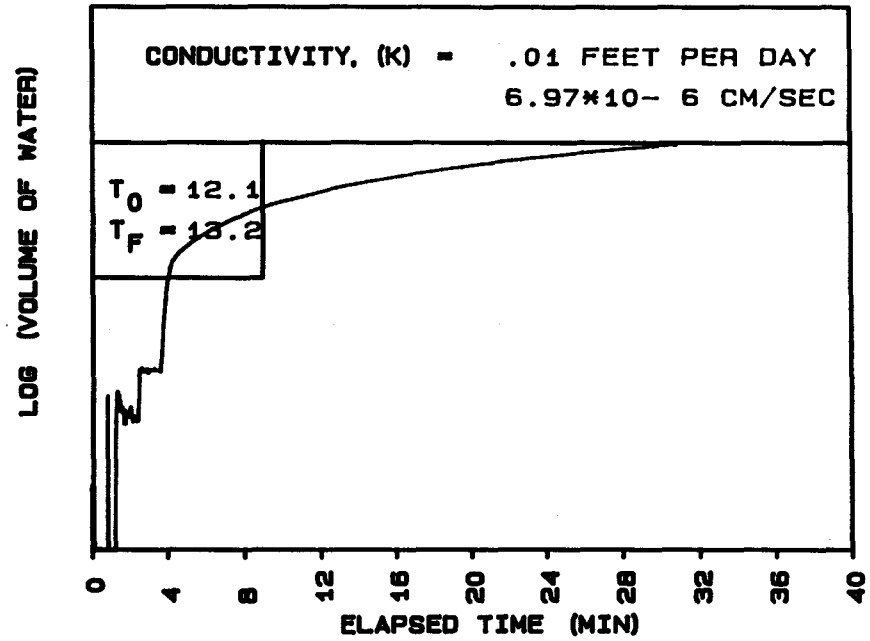


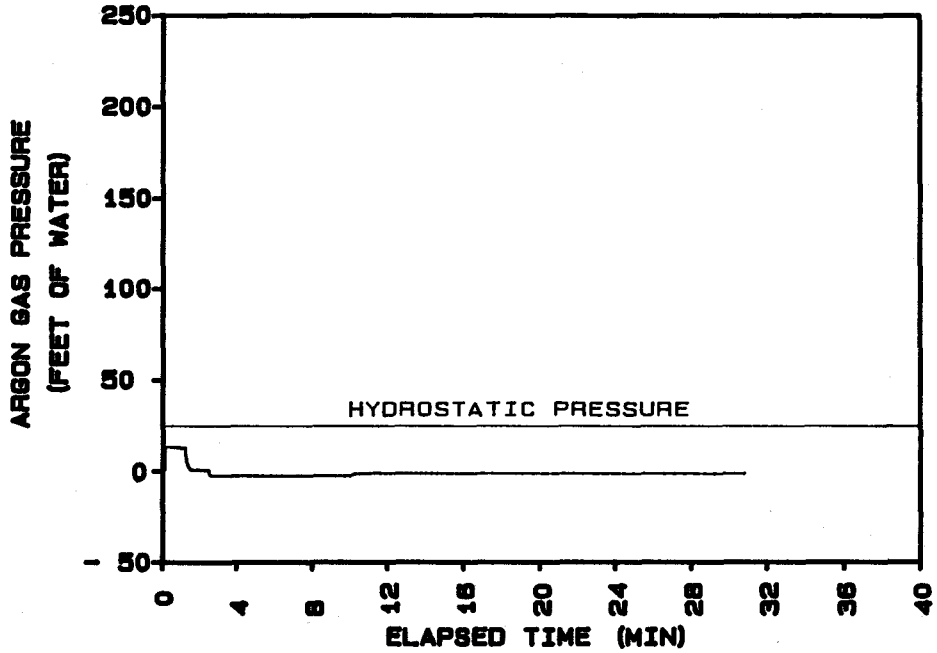
ENSAFE MEMPHIS NSA
LOCATION... 02H1627
TEST DATE
08: 31: 33 12-14-1995

SAMPLE DEPTH (FT) 27
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



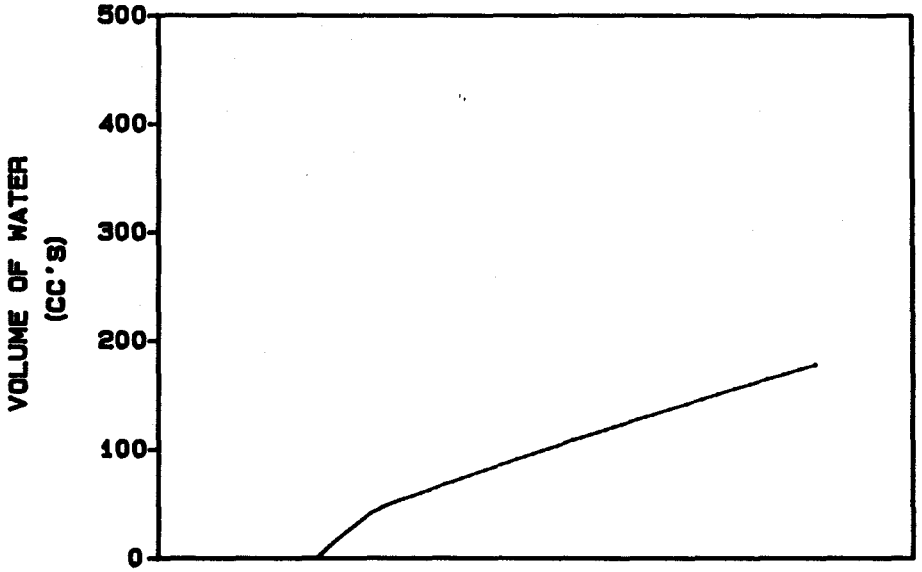


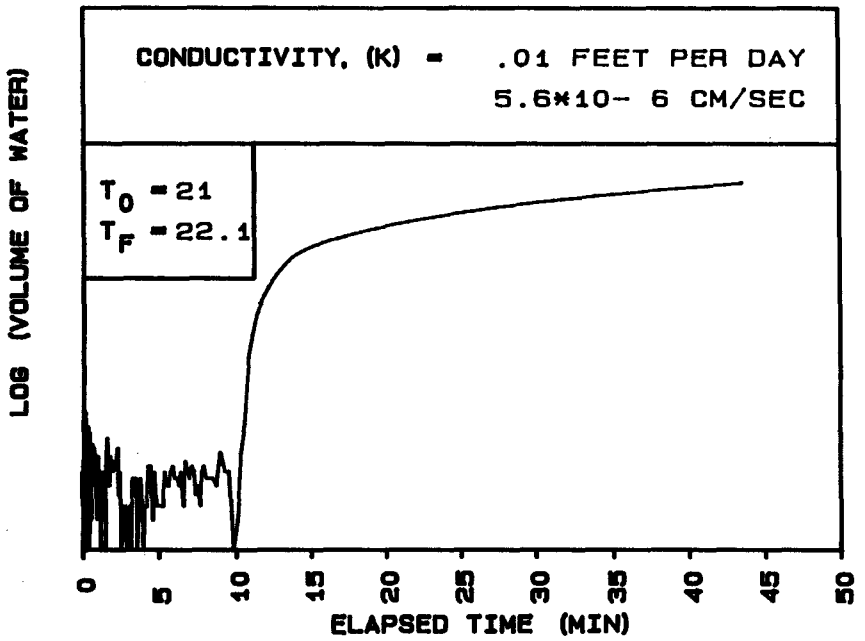


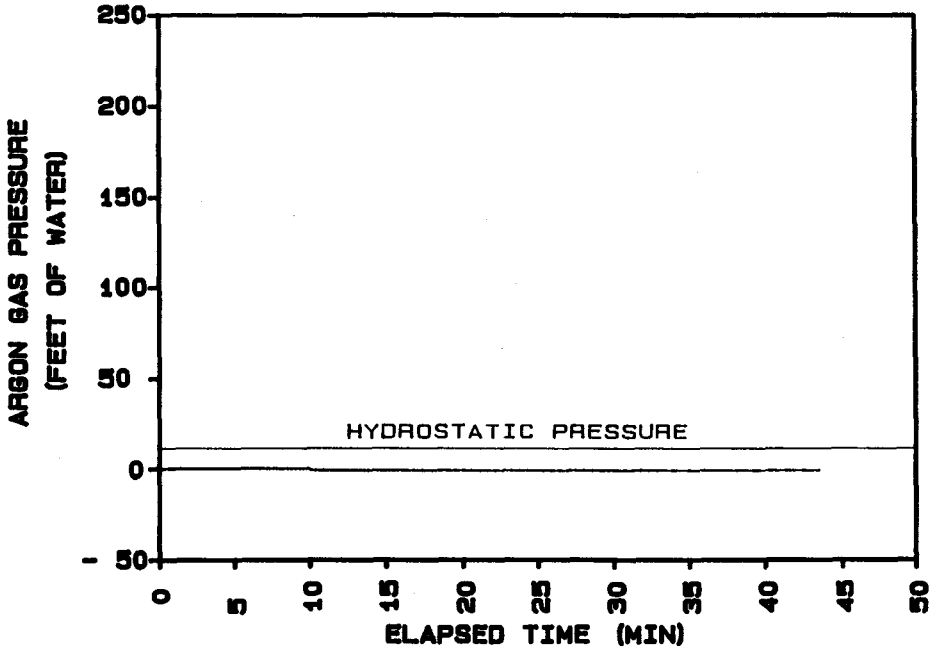
ENSAFE MEMPHIS NSA
LOCATION... 02H1639
TEST DATE
17: 14: 51 12-13-1995

SAMPLE DEPTH (FT) 39
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



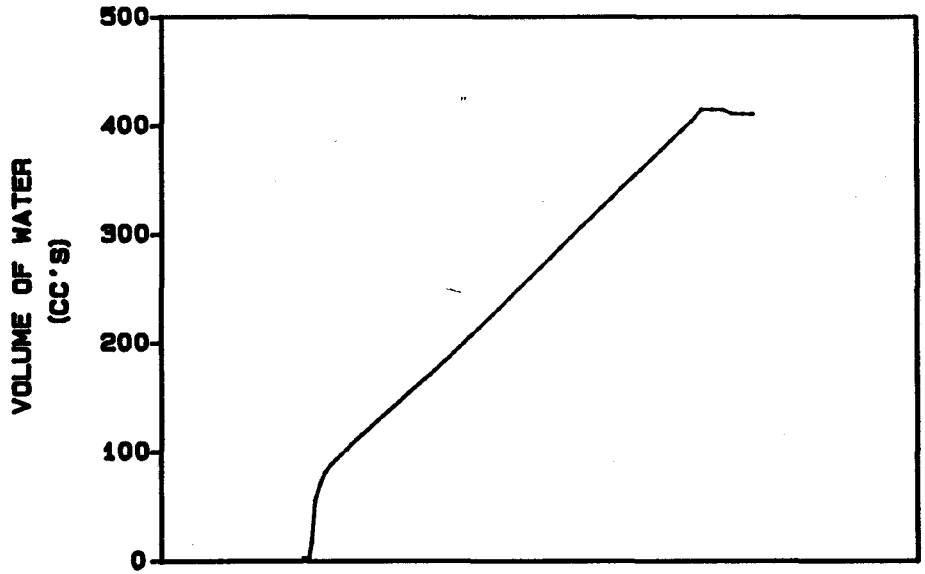


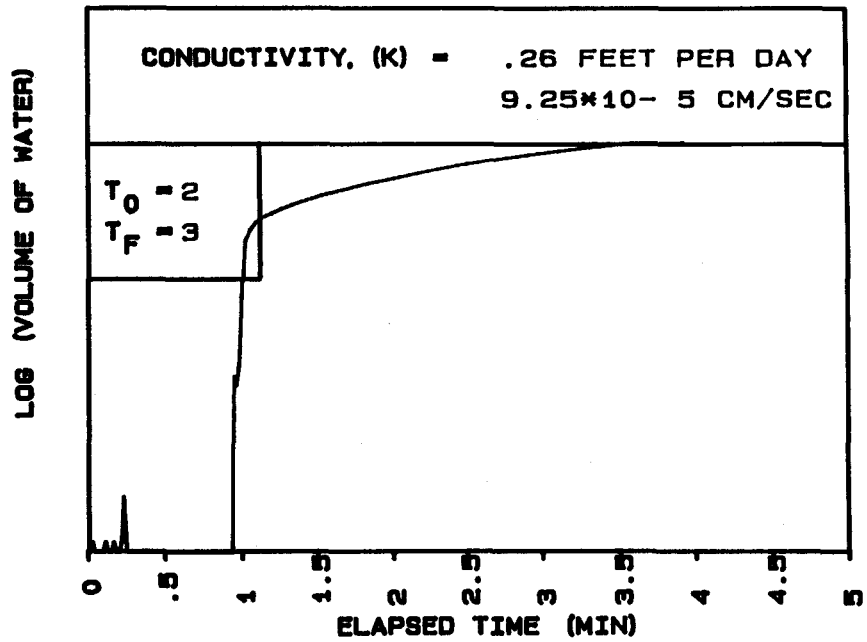


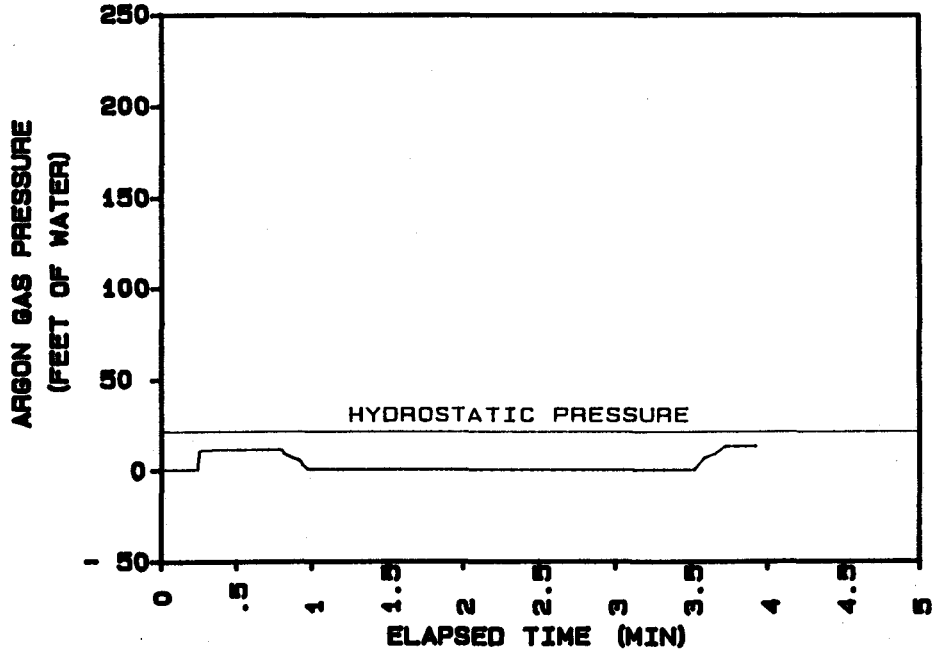
ENSAFE MEMPHIS NSA
LOCATION... 02H1726
TEST DATE
16: 59: 26 12-15-1995

SAMPLE DEPTH (FT) 26
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



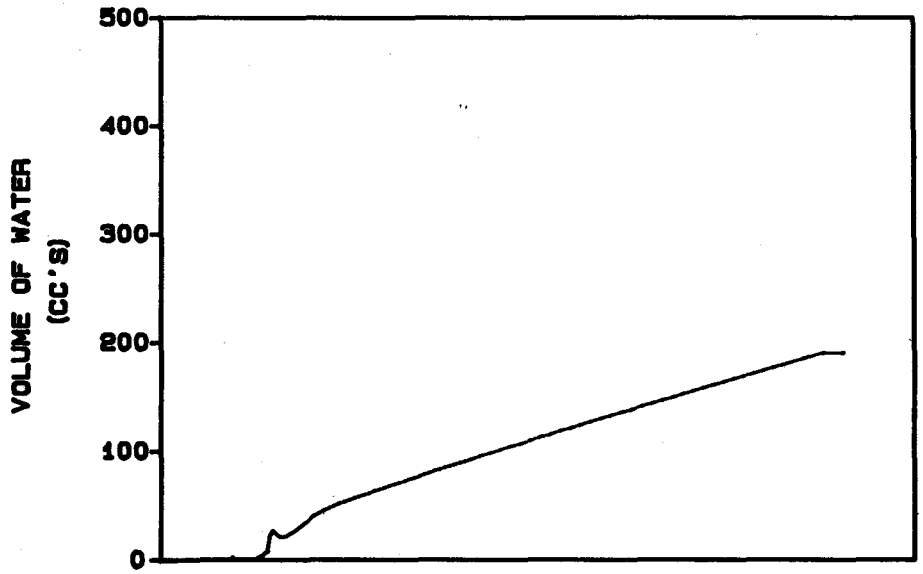


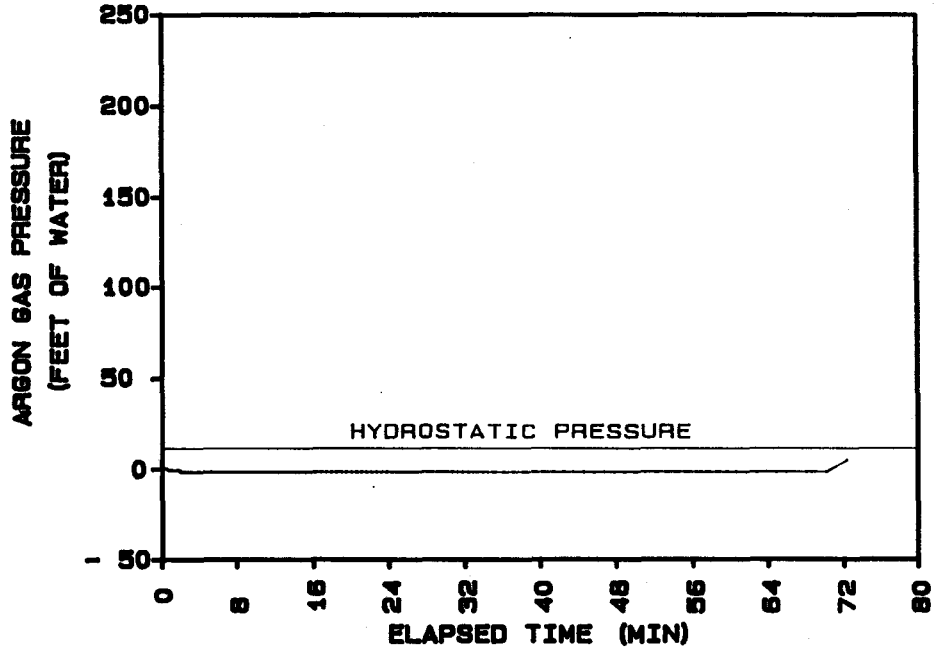


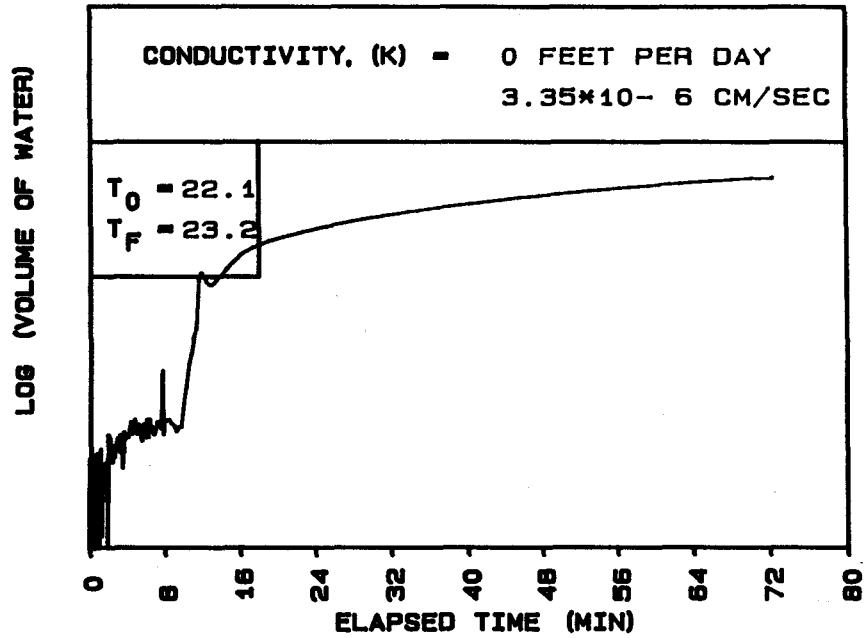
ENSAFE MEMPHIS NSA
LOCATION... 02H1736
TEST DATE
18: 44: 27 12-15-1995

SAMPLE DEPTH (FT) 36
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



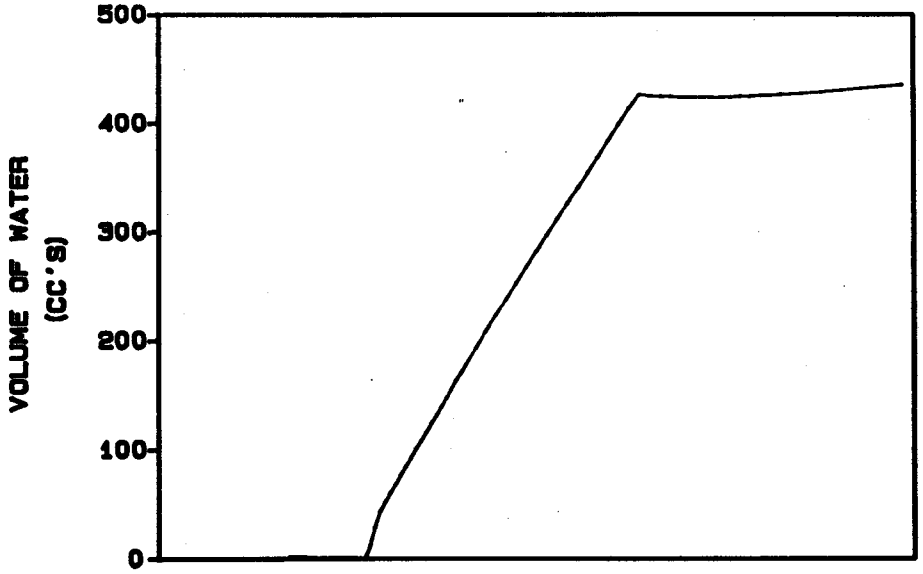


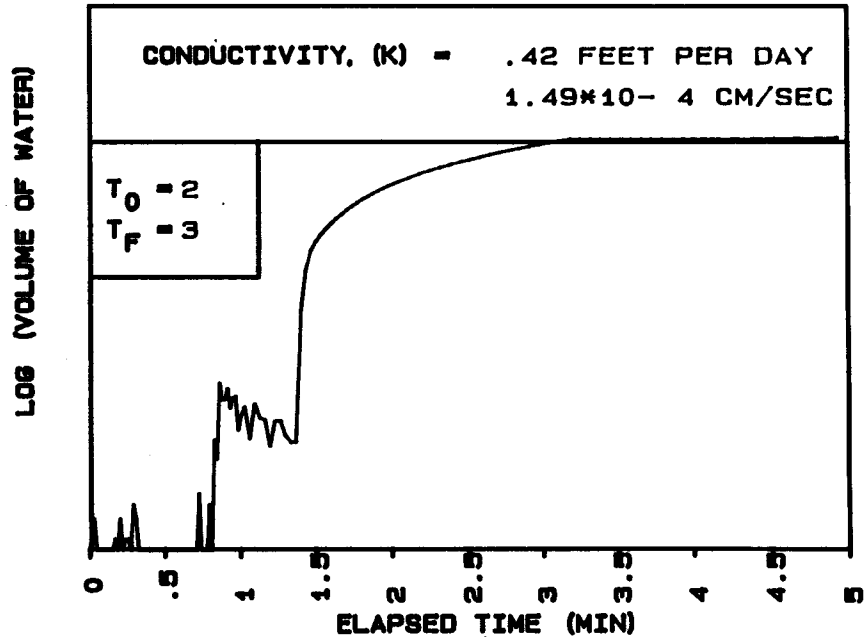


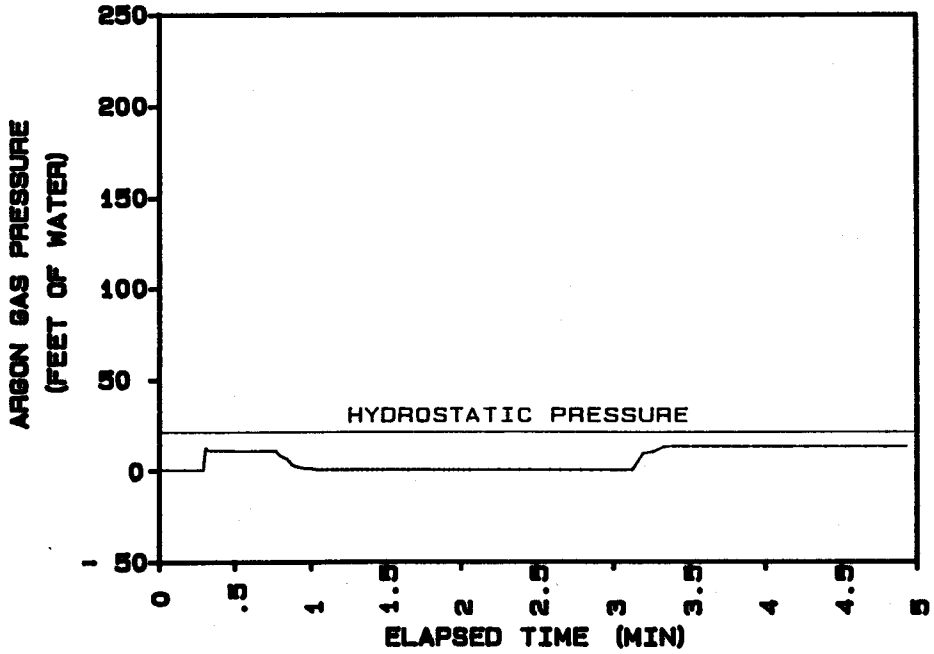
ENSAFE MEMPHIS NSA
LOCATION... 02H1826
TEST DATE
09: 10: 31 12-16-1995

SAMPLE DEPTH (FT) 26
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



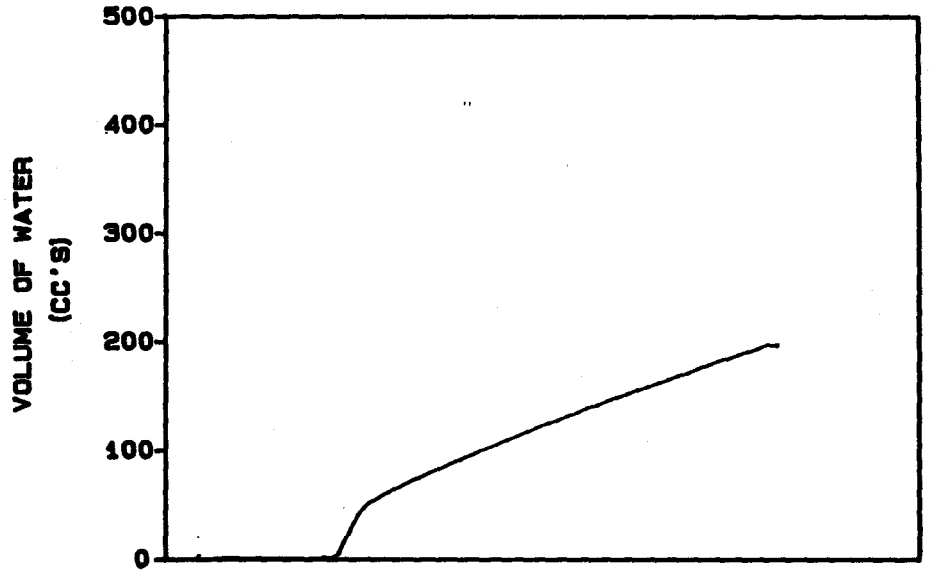


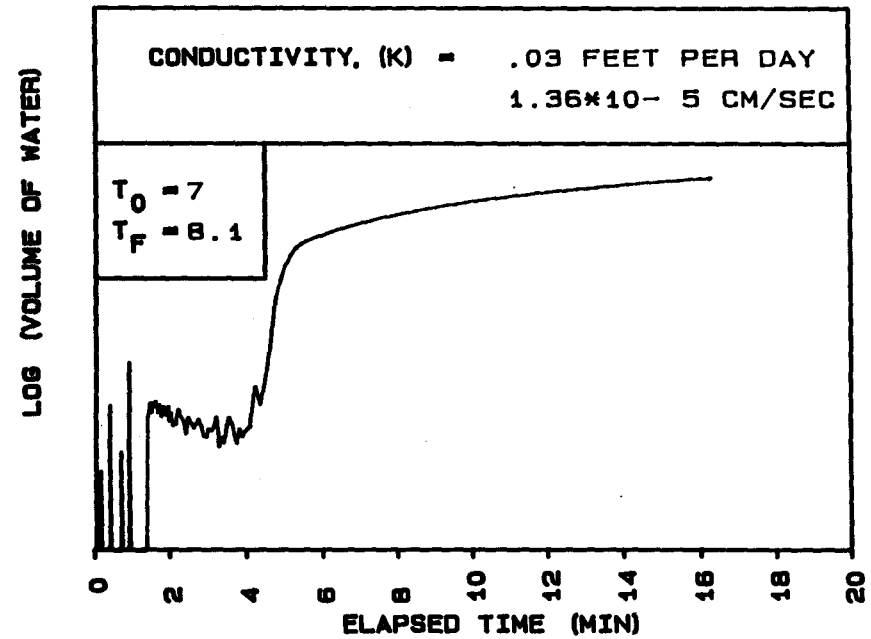


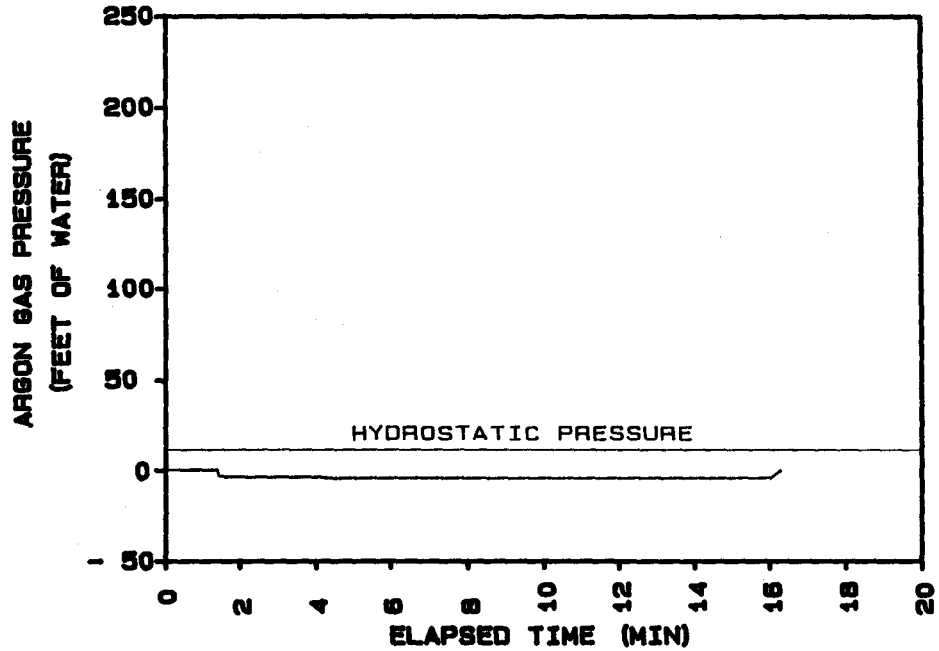
ENSAFE MEMPHIS NSA
LOCATION... 02H1836
TEST DATE
11: 37: 04 12-16-1995

SAMPLE DEPTH (FT) 36
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



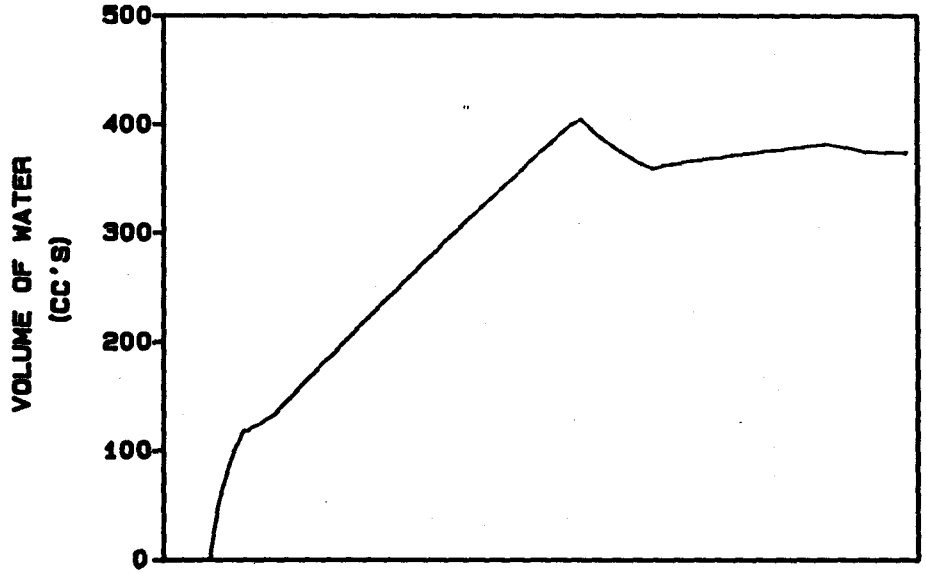


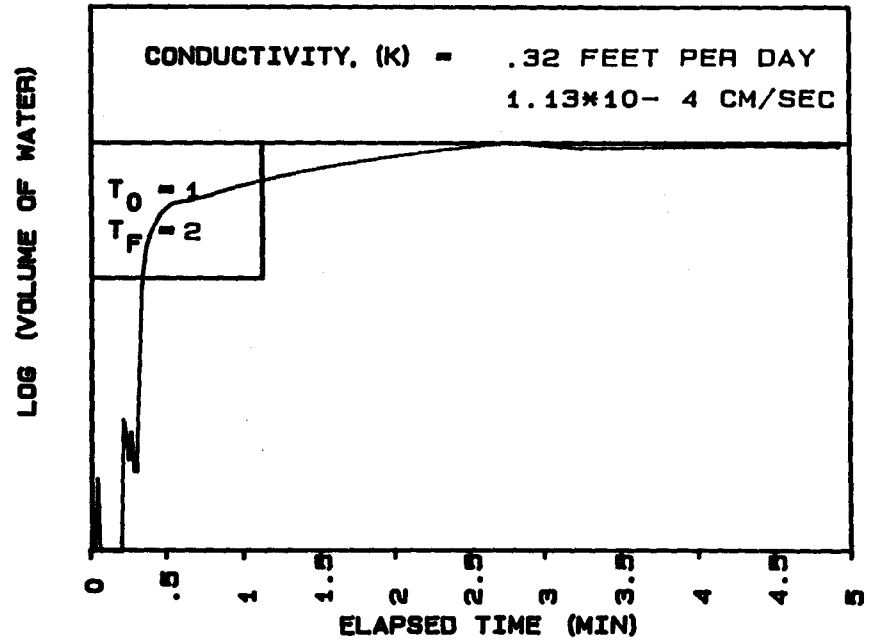


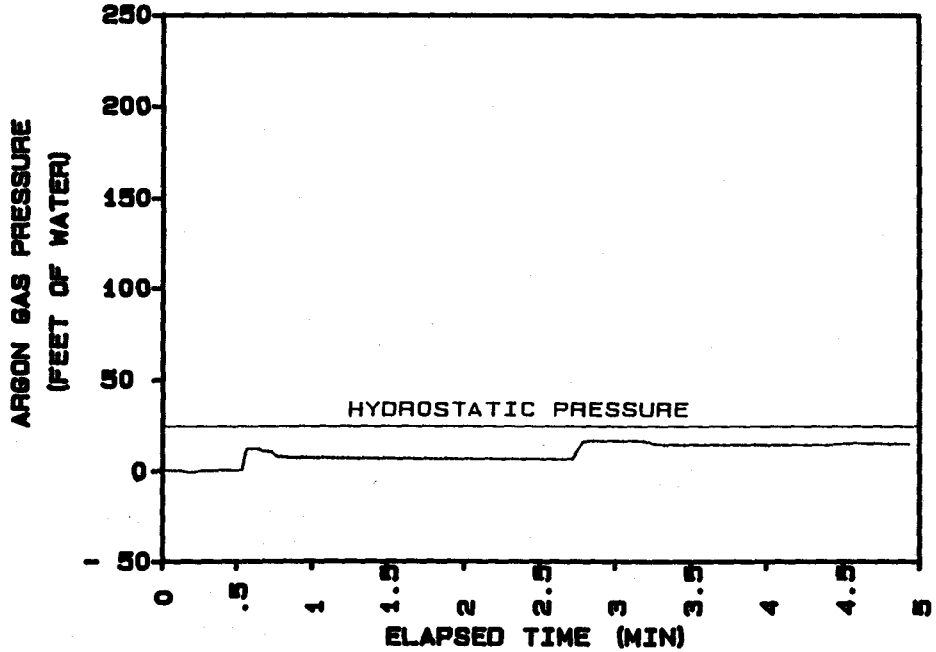
ENSAFE MEMPHIS NSA
LOCATION... 02H1926
TEST DATE
13: 14: 16 12-16-1995

SAMPLE DEPTH (FT) 26
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



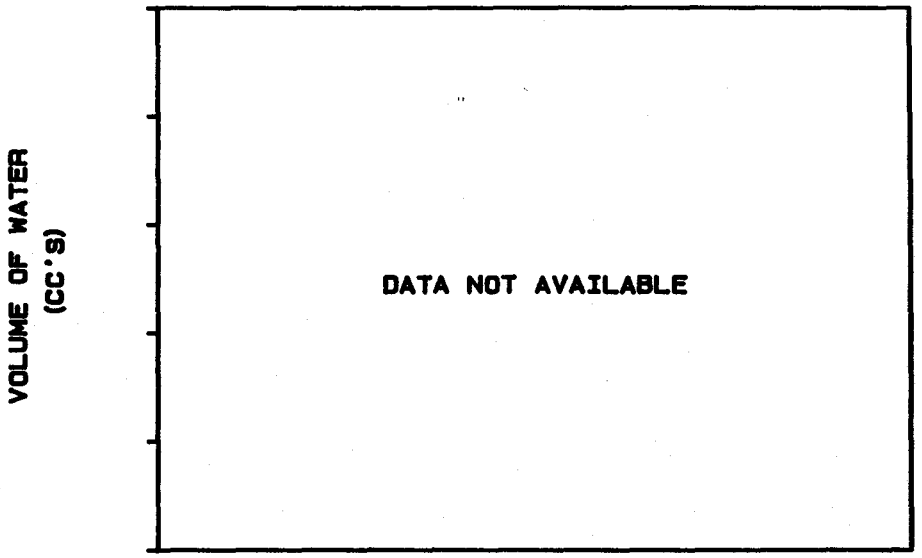


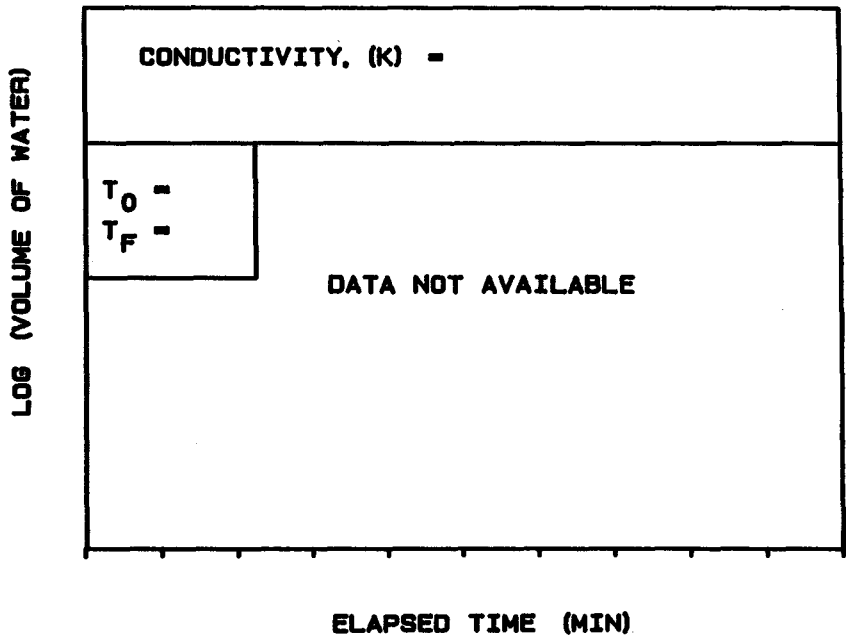


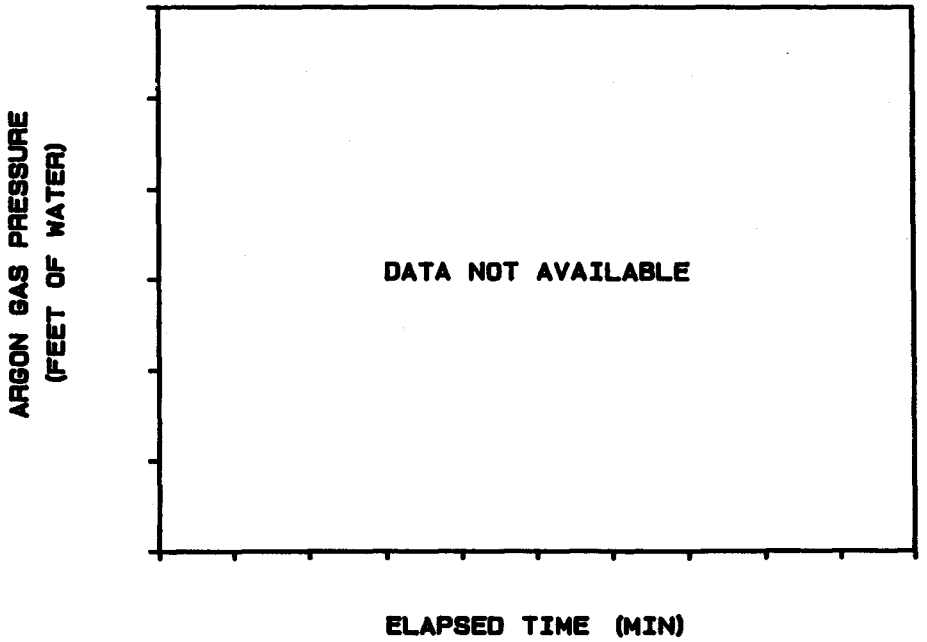
ENSAFE MEMPHIS NSA
LOCATION... 02H1939
TEST DATE
14: 52: 42 12-16-1995

SAMPLE DEPTH (FT) 39
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



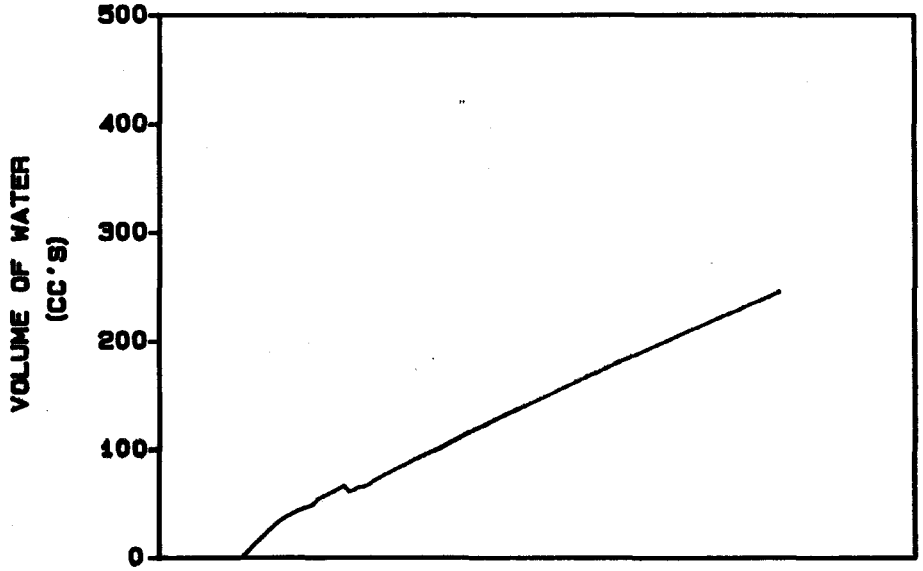


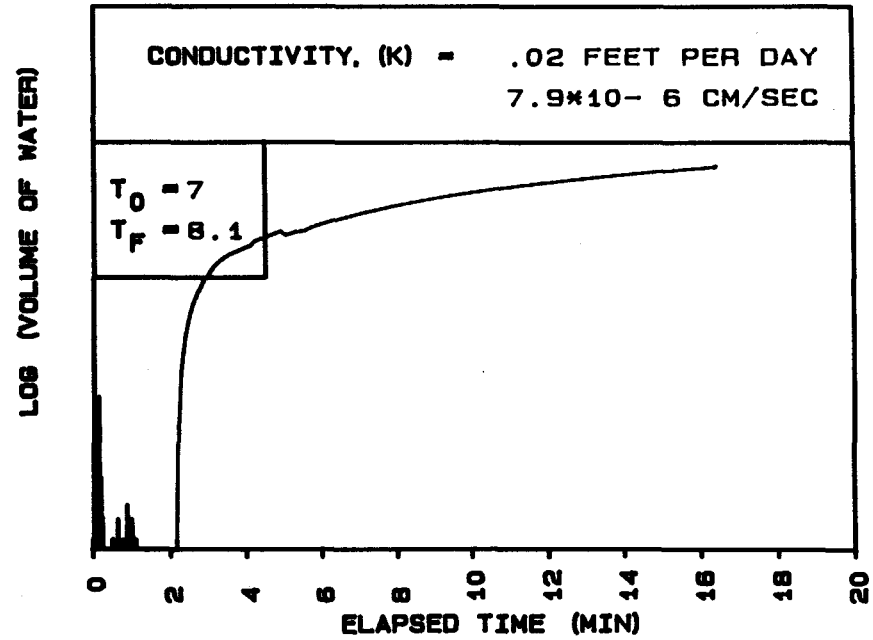


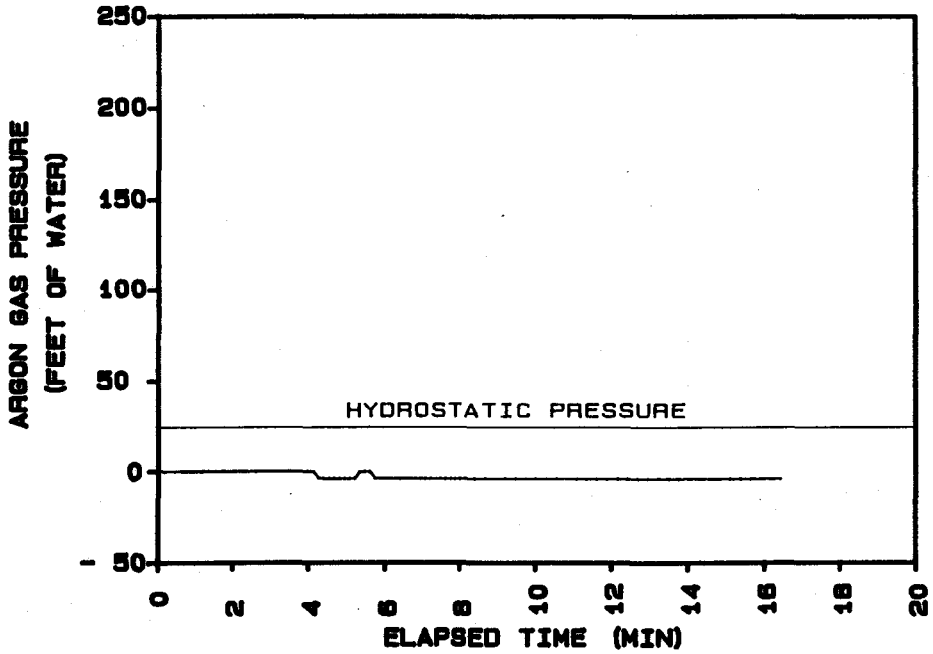
ENSAFE MEMPHIS NSA
LOCATION... 02H2022

DATA NOT AVAILABLE

HYDROCONE TEST



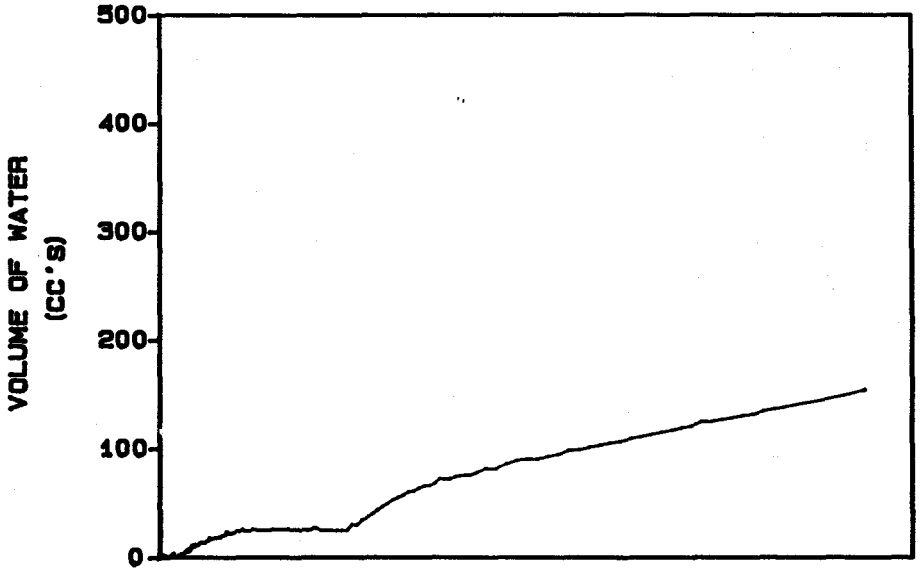


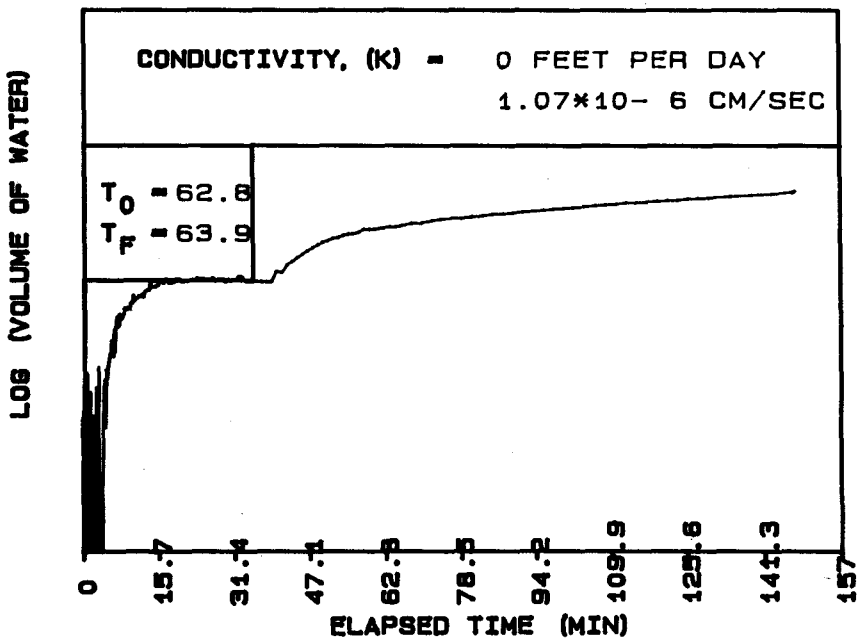


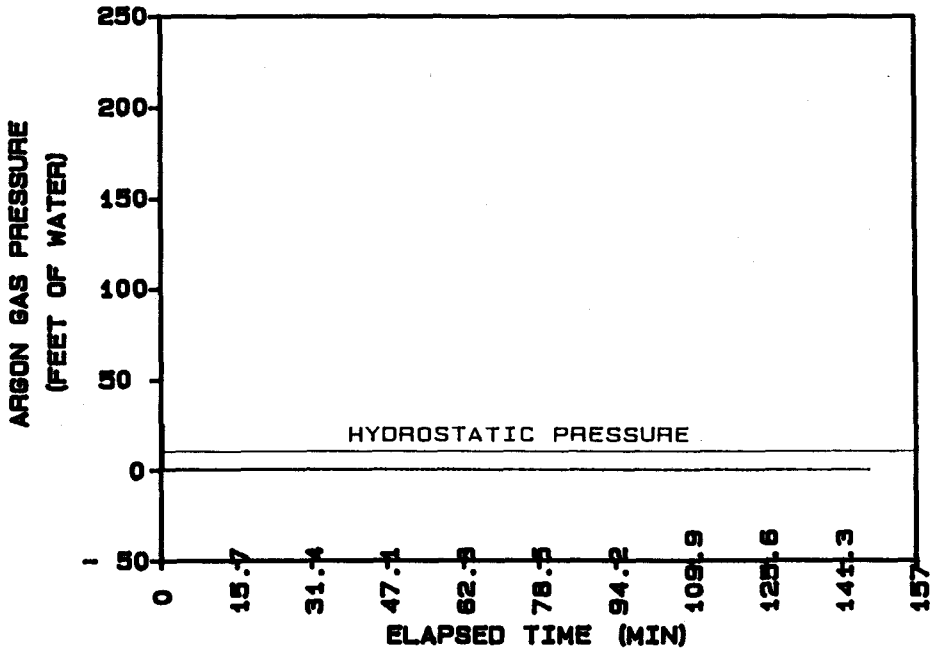
ENSAFE MEMPHIS NSA
LOCATION... 02H2039
TEST DATE
16: 58: 12 12-16-1995

SAMPLE DEPTH (FT) 39
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



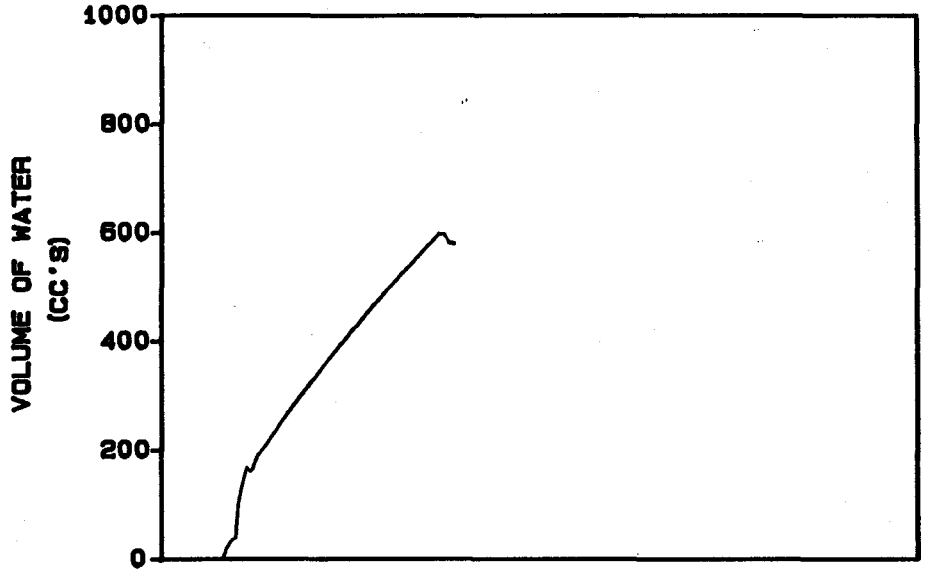


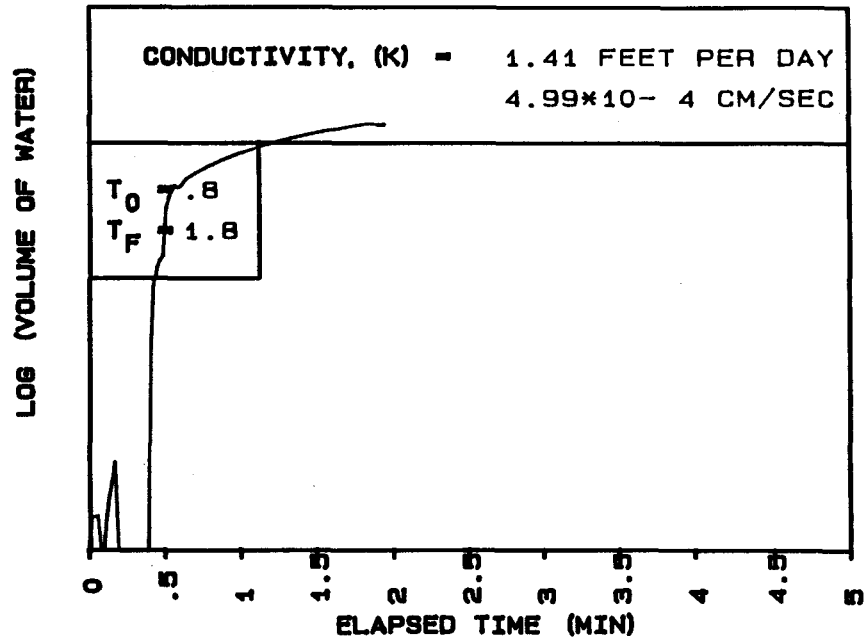


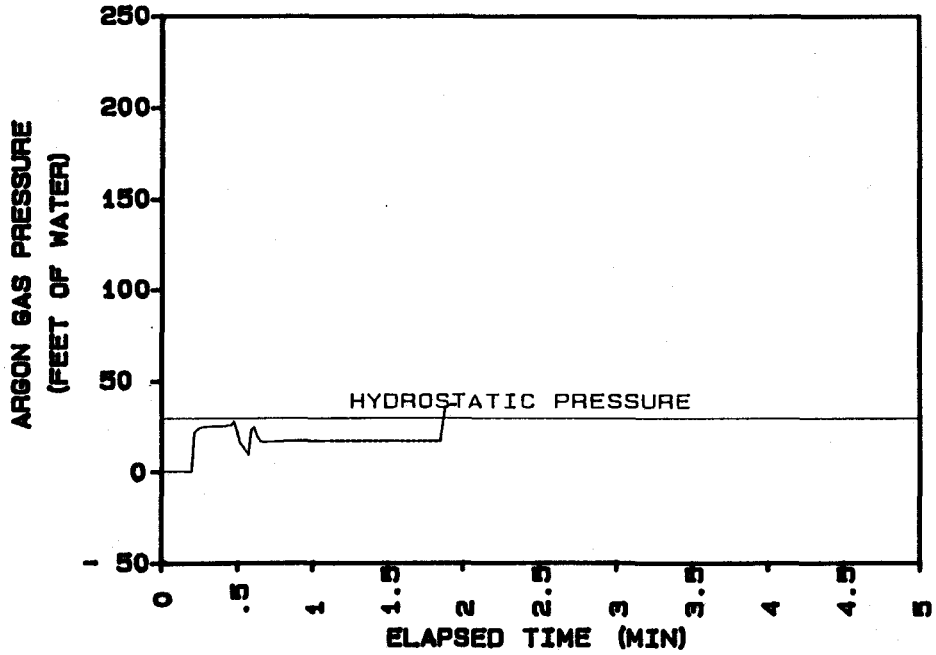
ENSAFE MEMPHIS NSA
LOCATION... 02H2130
TEST DATE
14: 55: 42 12-05-1995

SAMPLE DEPTH (FT) 30
GROUNDWATER DEPTH (FT) 20

HYDROCONE TEST







ENSAFE MEMPHIS NSA
LOCATION... 02H2149
TEST DATE
18: 24: 50 12-05-1995

SAMPLE DEPTH (FT) 49
GROUNDWATER DEPTH (FT) 20

HYDROCONE TEST

VOLUME OF WATER (CC'S)

DATA NOT AVAILABLE

LOG (VOLUME OF WATER)

CONDUCTIVITY, (K) =

T_O =
T_F =

DATA NOT AVAILABLE

ELAPSED TIME (MIN)

ARGON GAS PRESSURE (FEET OF WATER)

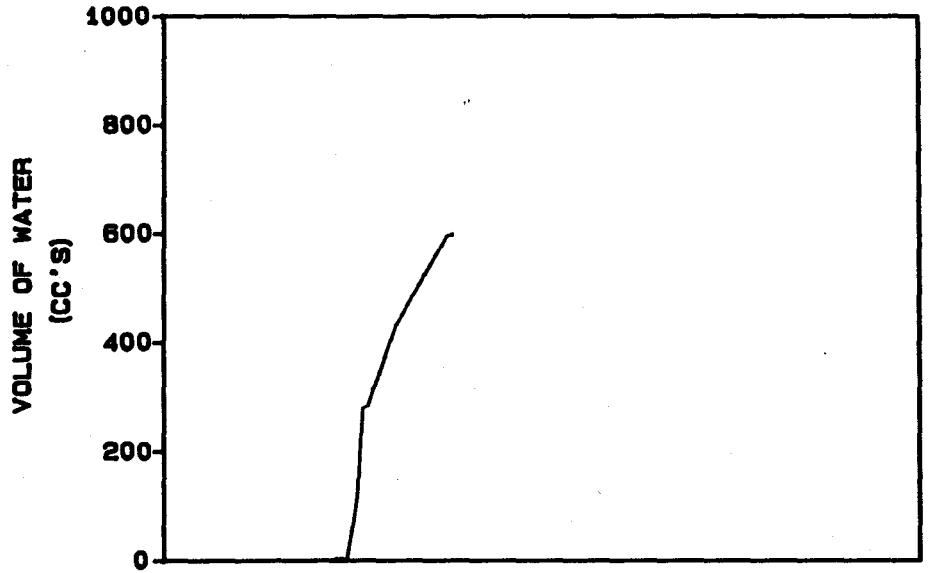
DATA NOT AVAILABLE

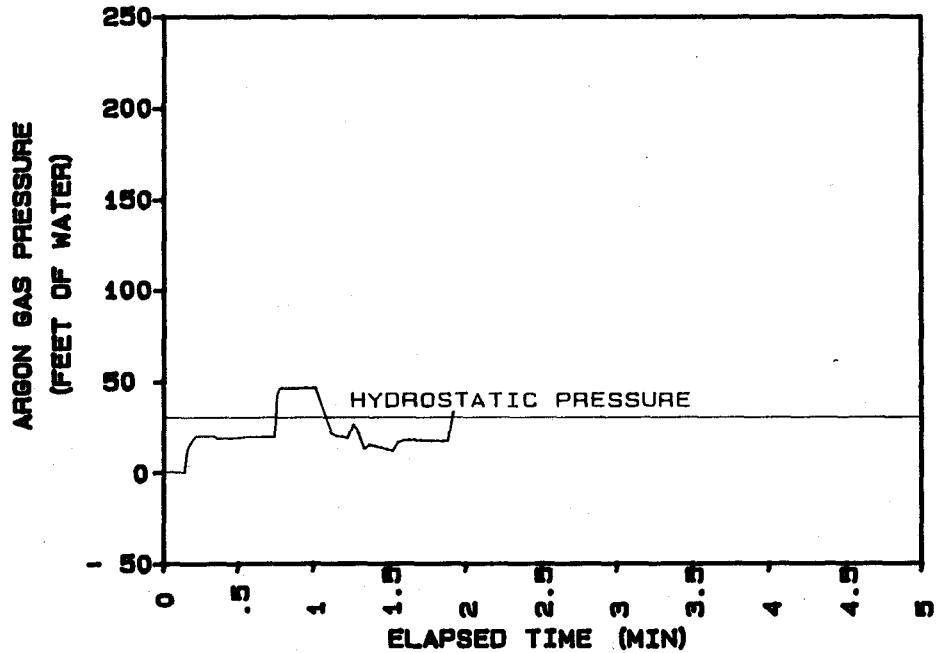
ELAPSED TIME (MIN)

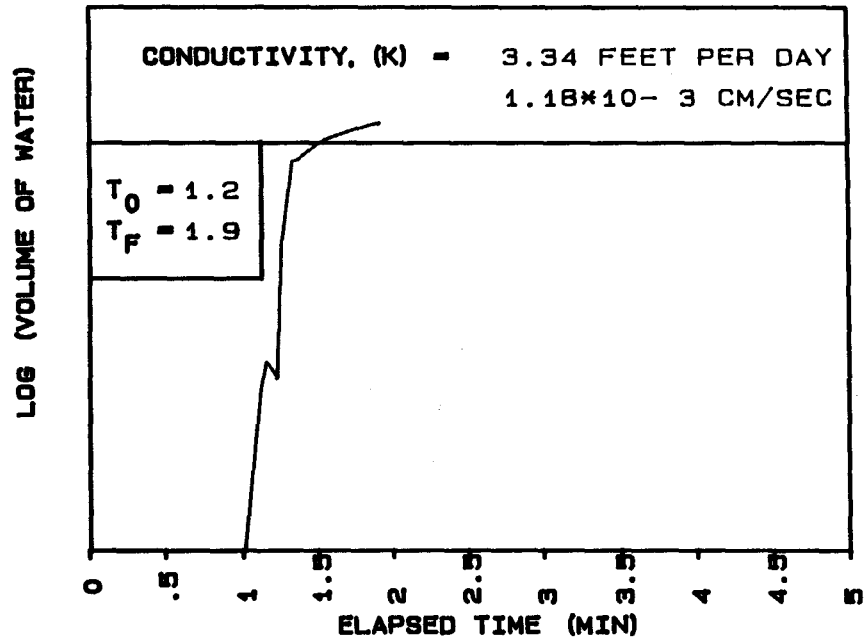
ENSAFE MEMPHIS NSA
LOCATION... 02H2229

DATA NOT AVAILABLE

HYDROCONE TEST



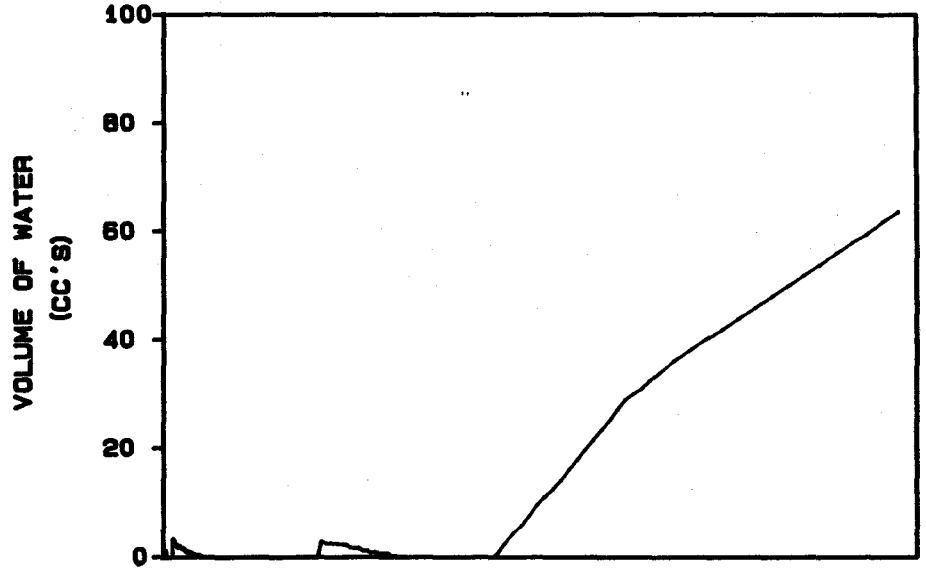


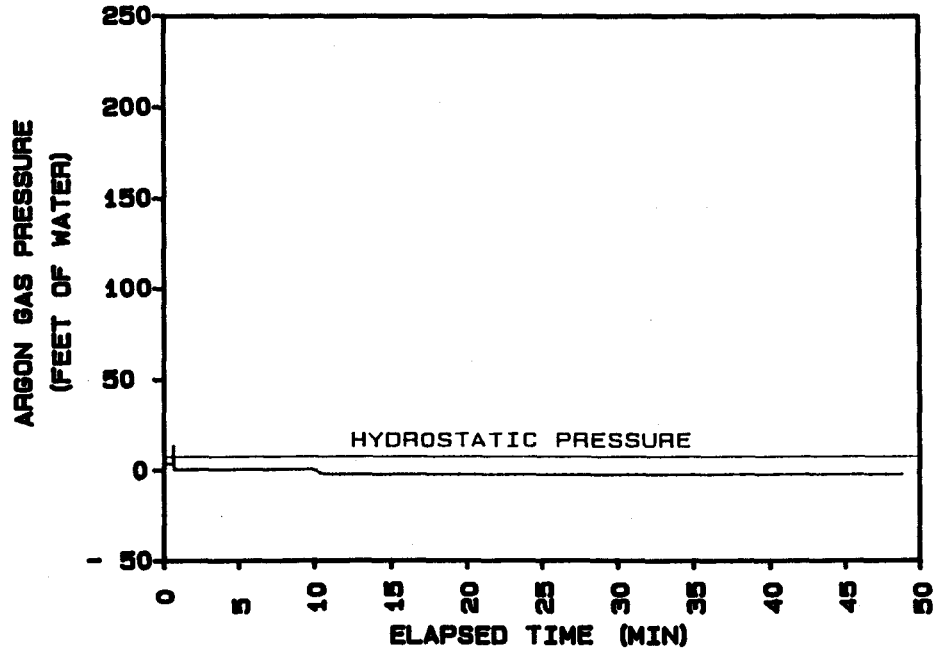


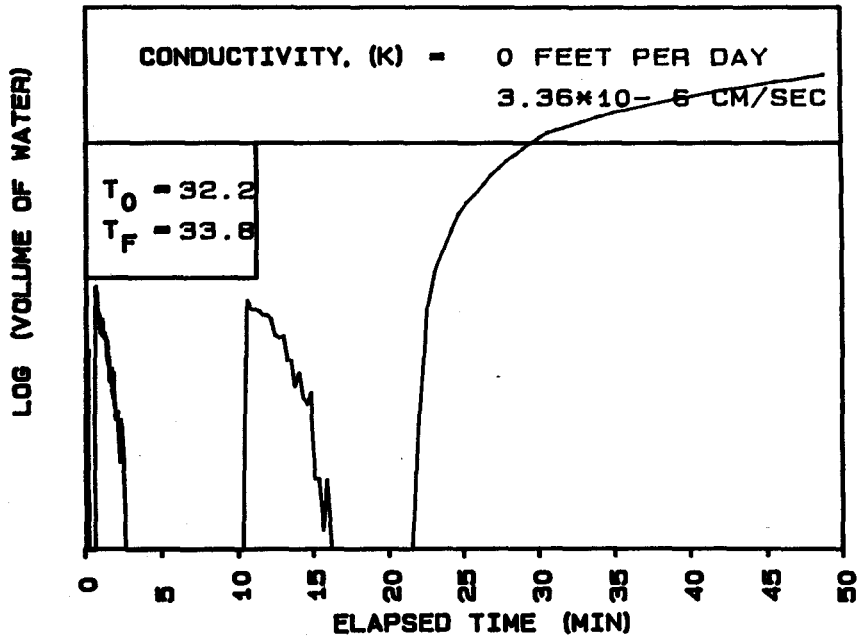
ENSAFE MEMPHIS NSA
LOCATION... 02H2249
TEST DATE
14: 14: 24 12-06-1995

SAMPLE DEPTH (FT) 49
GROUNDWATER DEPTH (FT) 19

HYDROCONE TEST



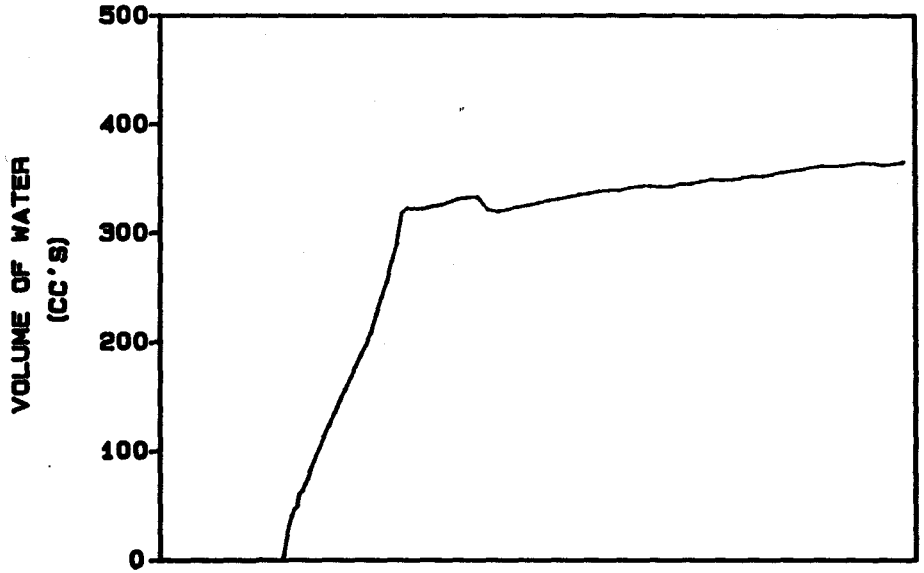


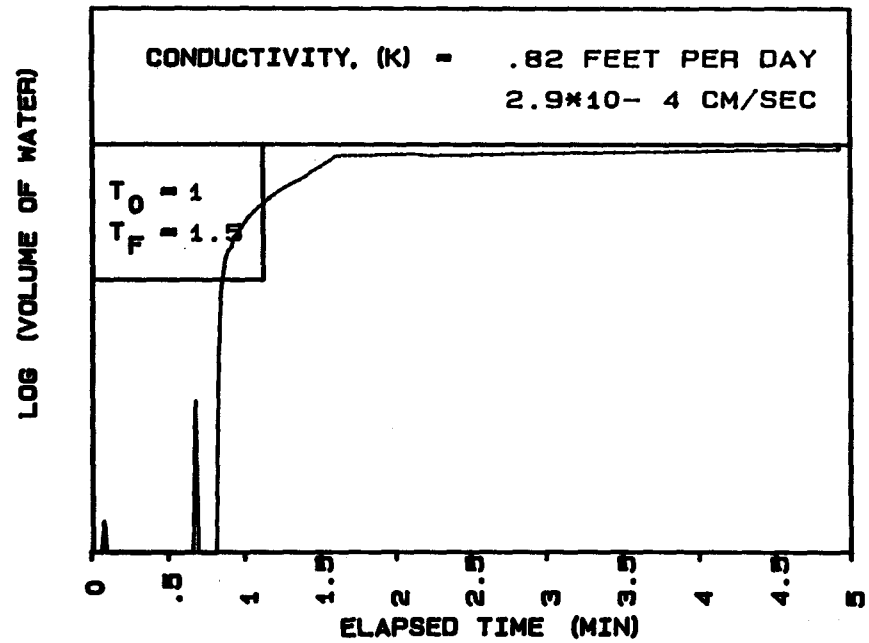


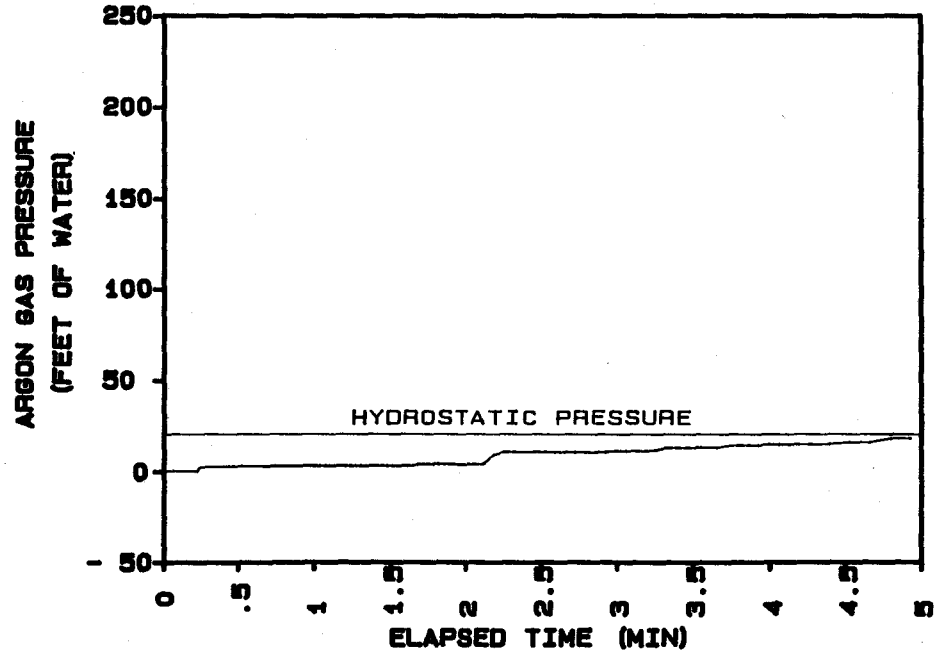
ENSAFE MEMPHIS NSA
LOCATION... 02H2323
TEST DATE
13: 25: 32 12-01-1995

SAMPLE DEPTH (FT) 23
GROUNDWATER DEPTH (FT) 16

HYDROCONE TEST



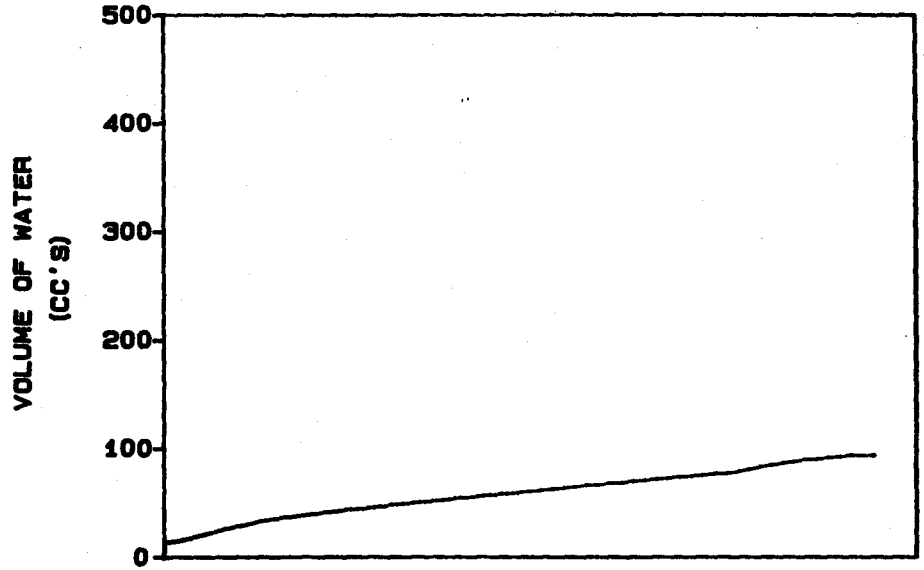


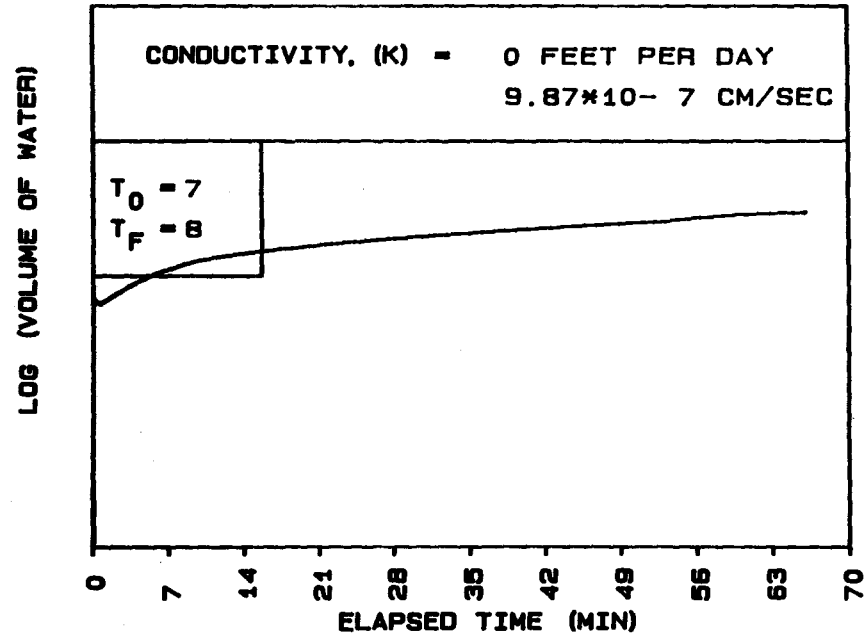


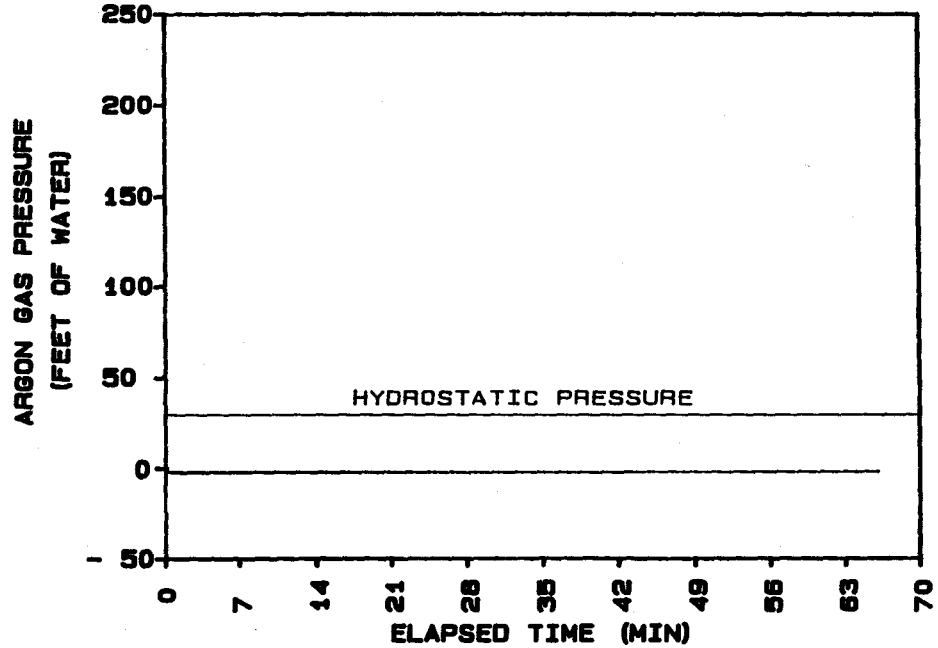
ENSAFE MEMPHIS NSA
LOCATION... 02H2336
TEST DATE
15: 35: 12 12-01-1995

SAMPLE DEPTH (FT) 36
GROUNDWATER DEPTH (FT) 16

HYDROCONE TEST



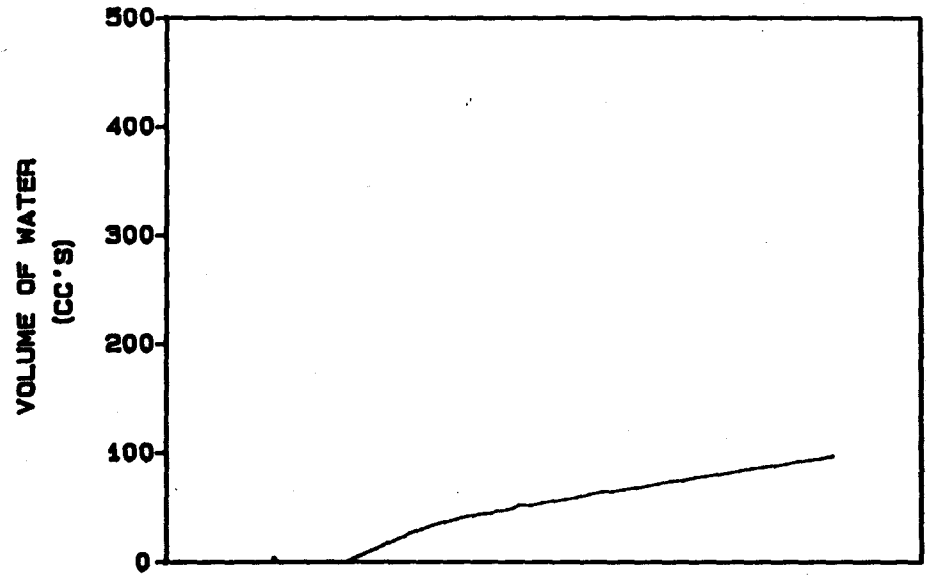


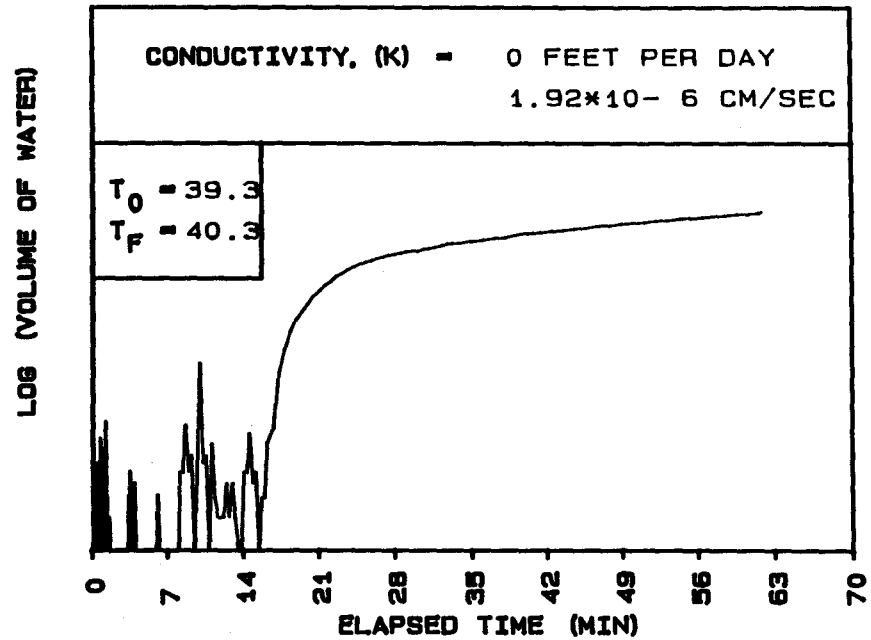


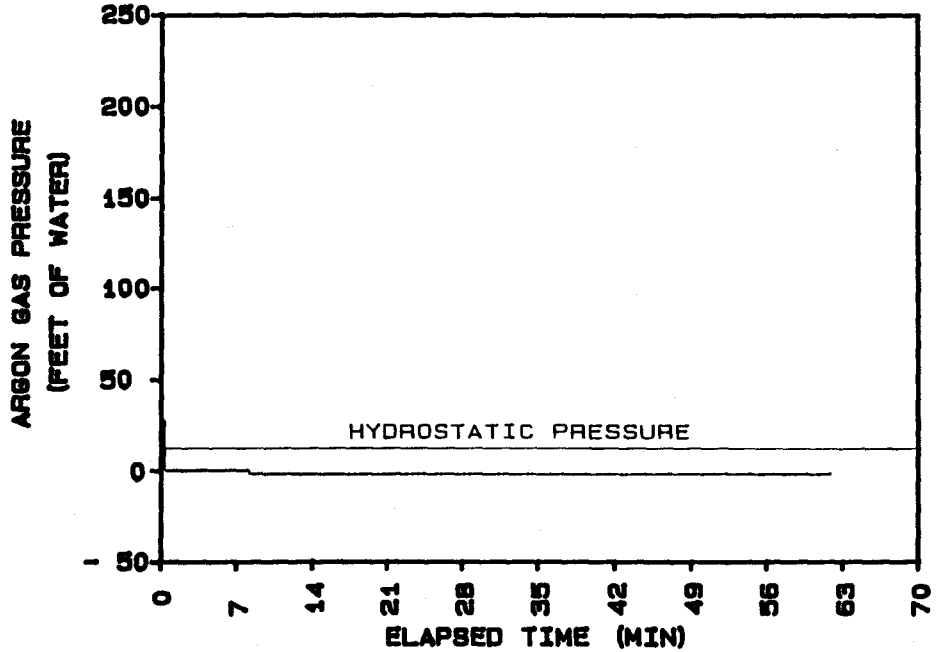
ENSAFE MEMPHIS NSA
LOCATION... 02H2436
TEST DATE
10: 23: 14 12-02-1995

SAMPLE DEPTH (FT) 37
GROUNDWATER DEPTH (FT) 8

HYDROCONE TEST



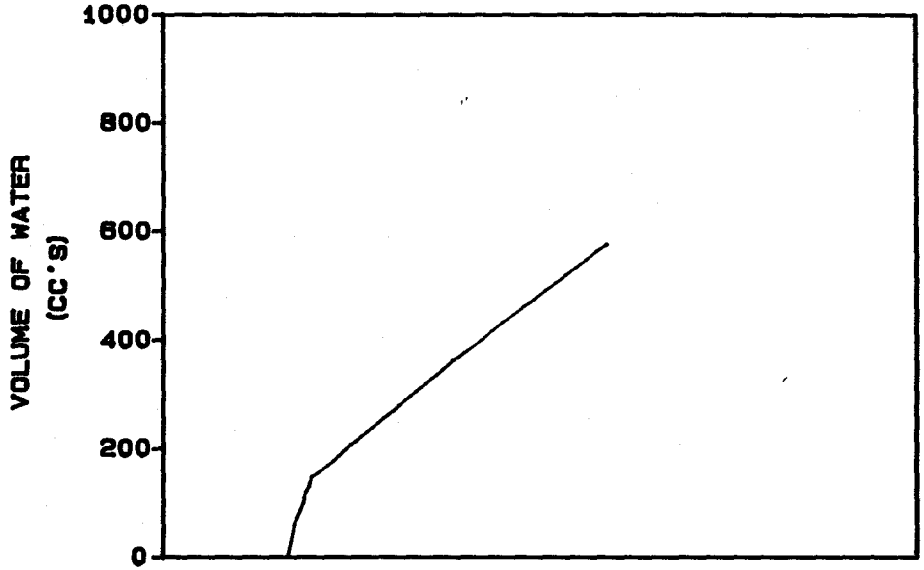


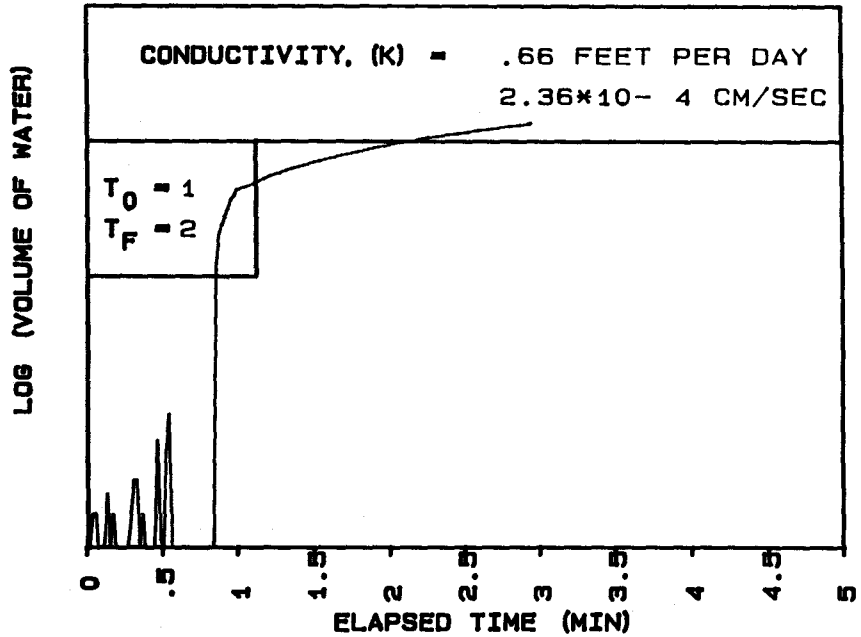


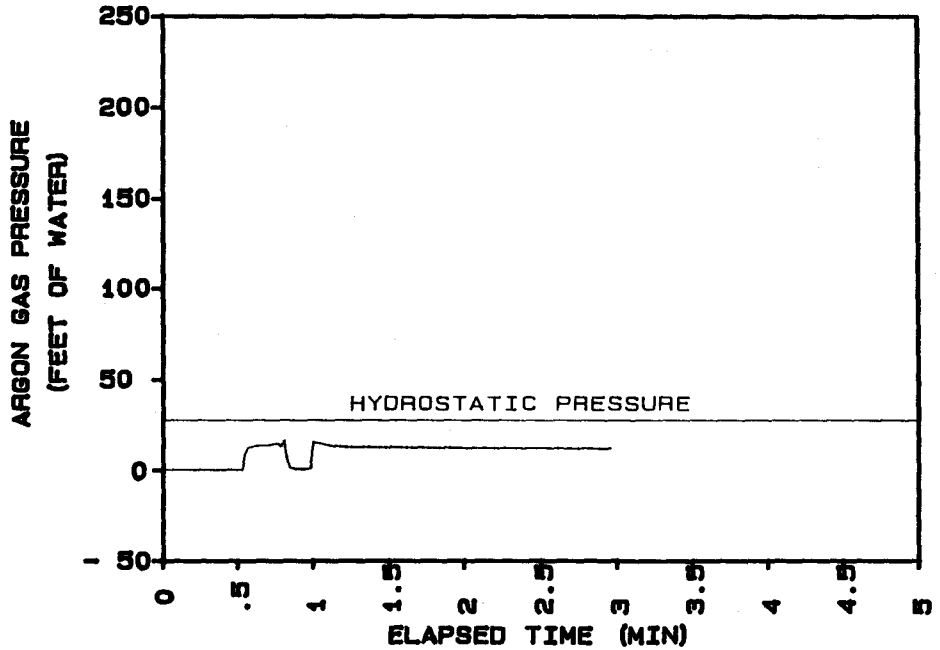
ENSAFE MEMPHIS NSA
LOCATION... 02H2527
TEST DATE
19: 19: 10 12-04-1995

SAMPLE DEPTH (FT) 27
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



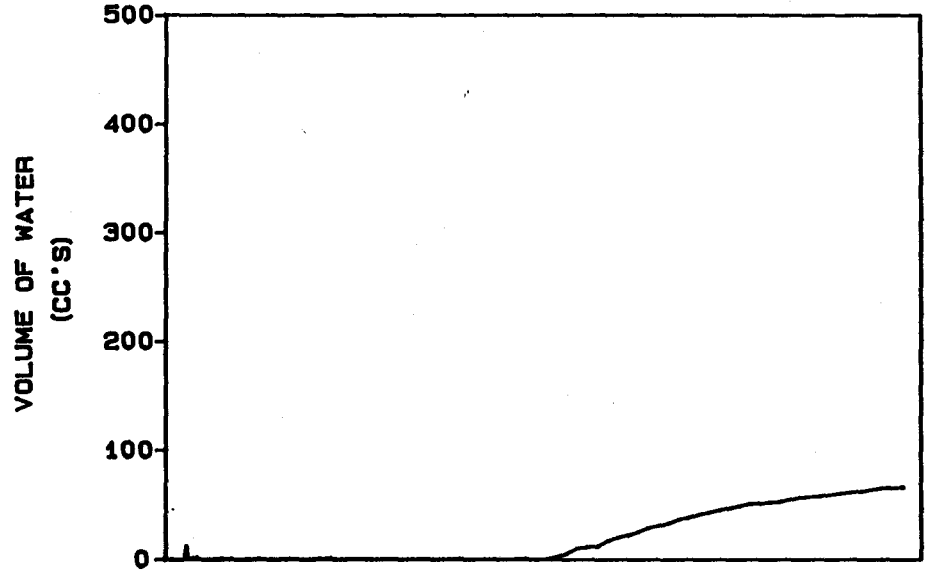


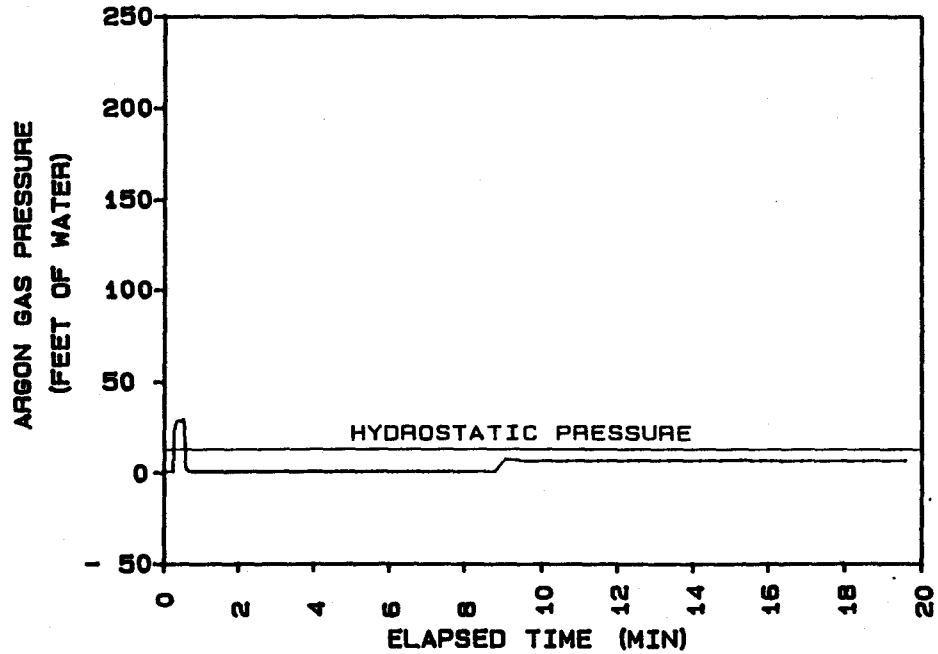


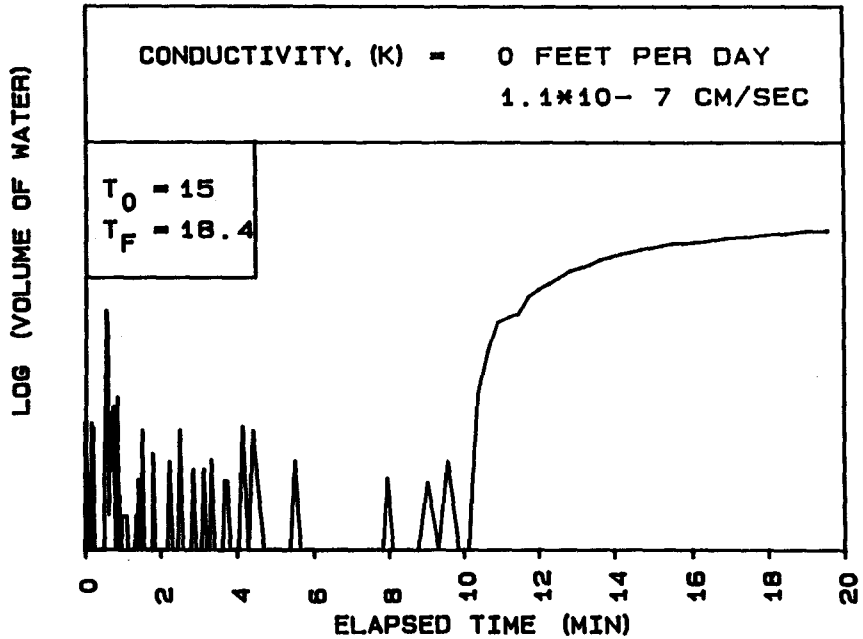
ENSAFE MEMPHIS NSA
LOCATION... 02H2540
TEST DATE
12: 47: 38 12-05-1995

SAMPLE DEPTH (FT) 40
GROUNDWATER DEPTH (FT) 13

HYDROCONE TEST



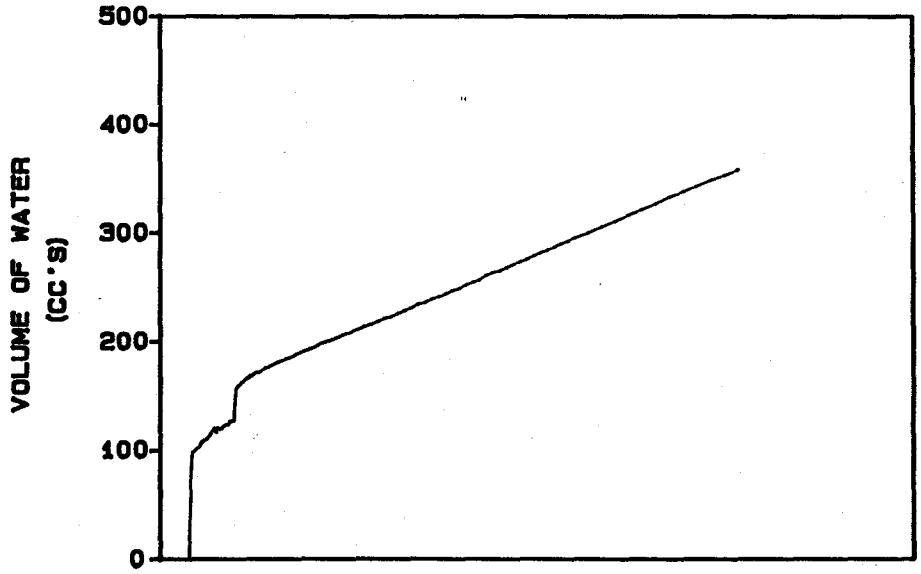


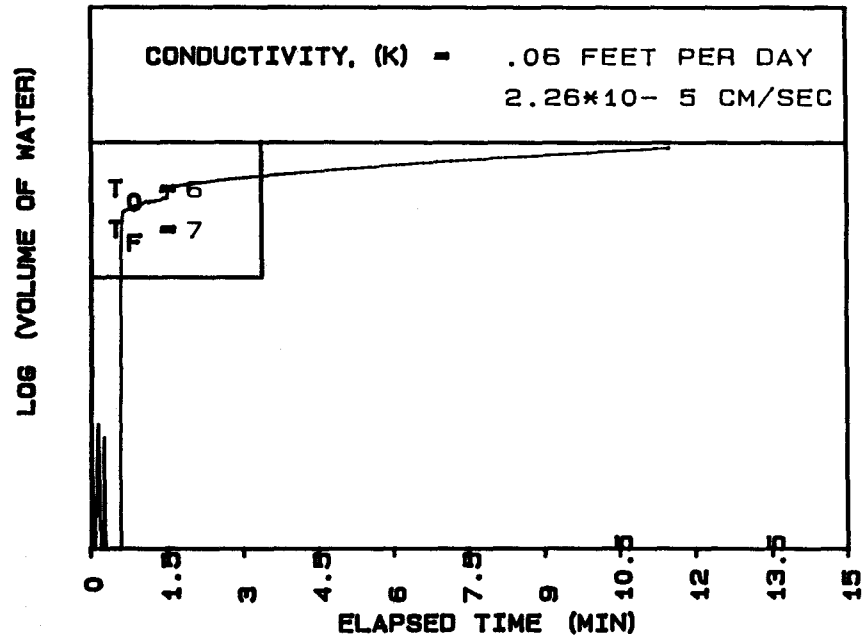


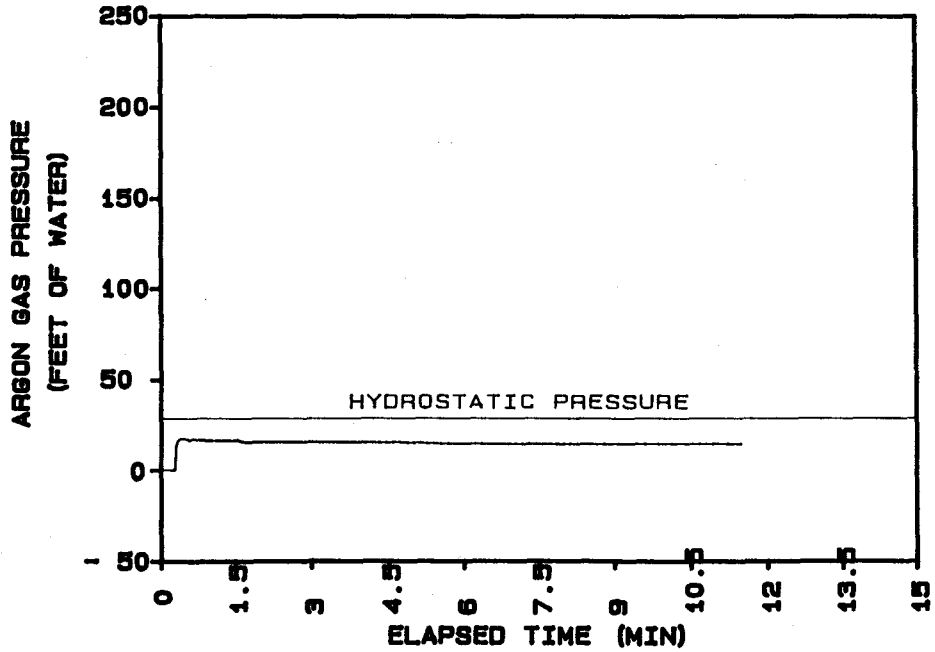
ENSAFE MEMPHIS NSA
LOCATION... 02H2627
TEST DATE
12: 35: 47 12-03-1995

SAMPLE DEPTH (FT) 27
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



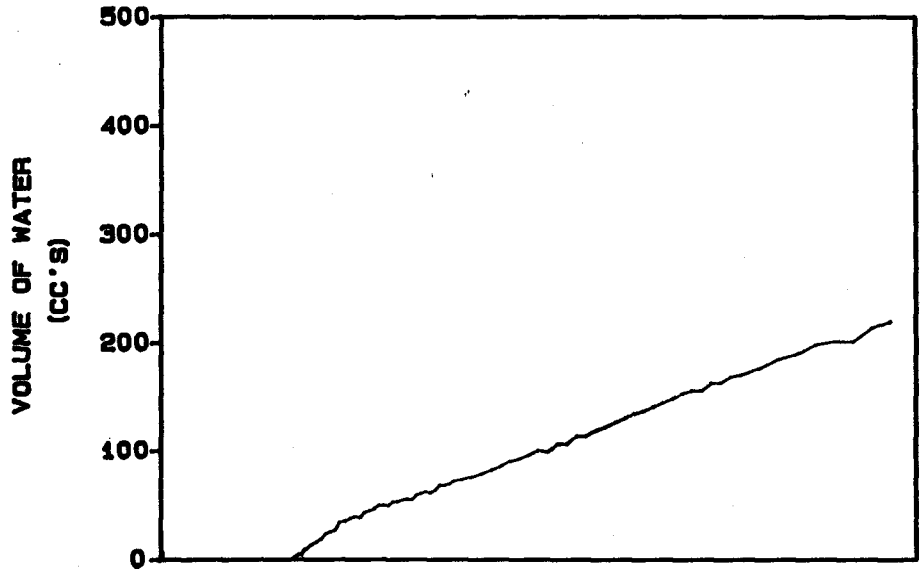


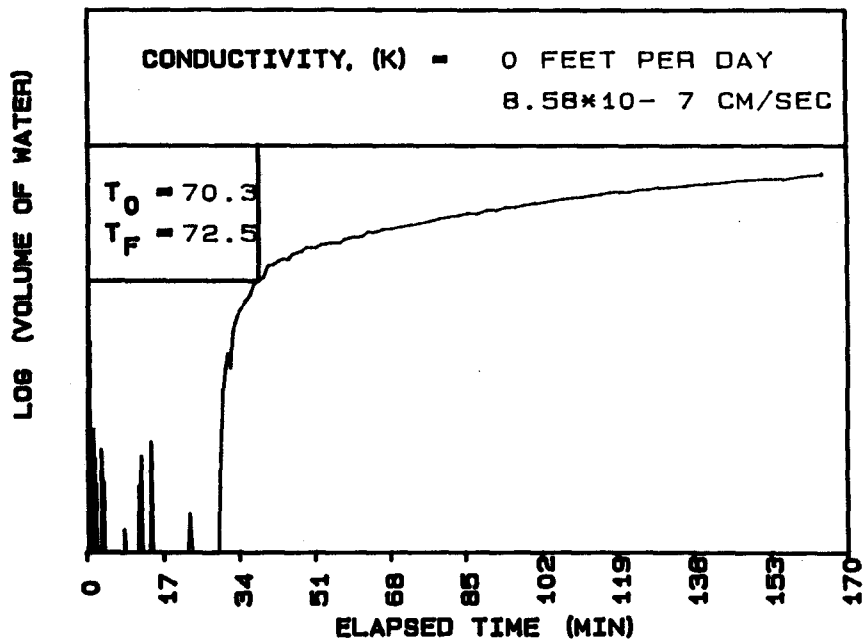


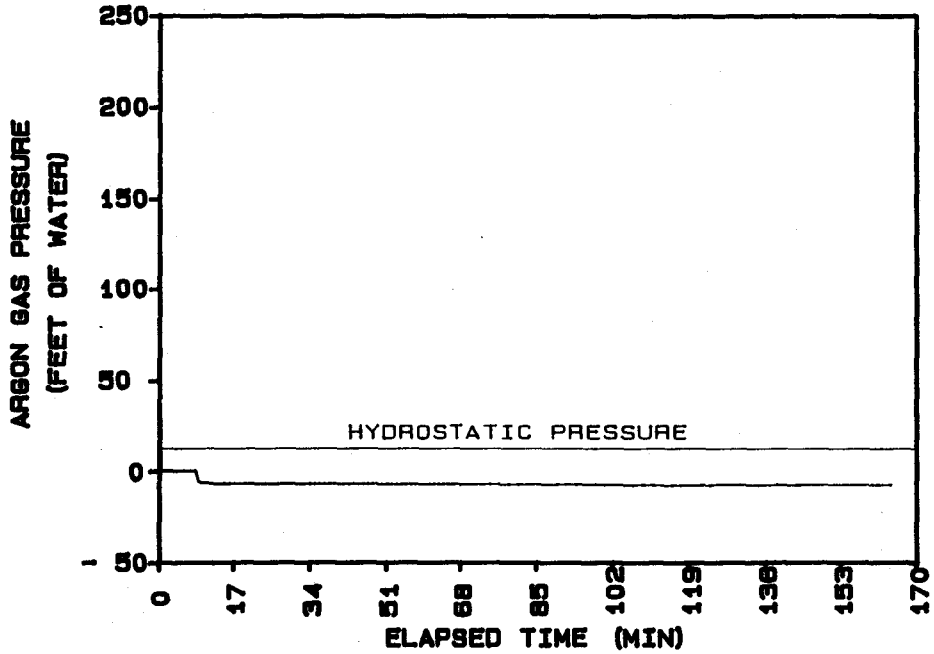
ENSAFE MEMPHIS NSA
LOCATION... 02H2643
TEST DATE
14: 44: 15 12-03-1995

SAMPLE DEPTH (FT) 43
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST



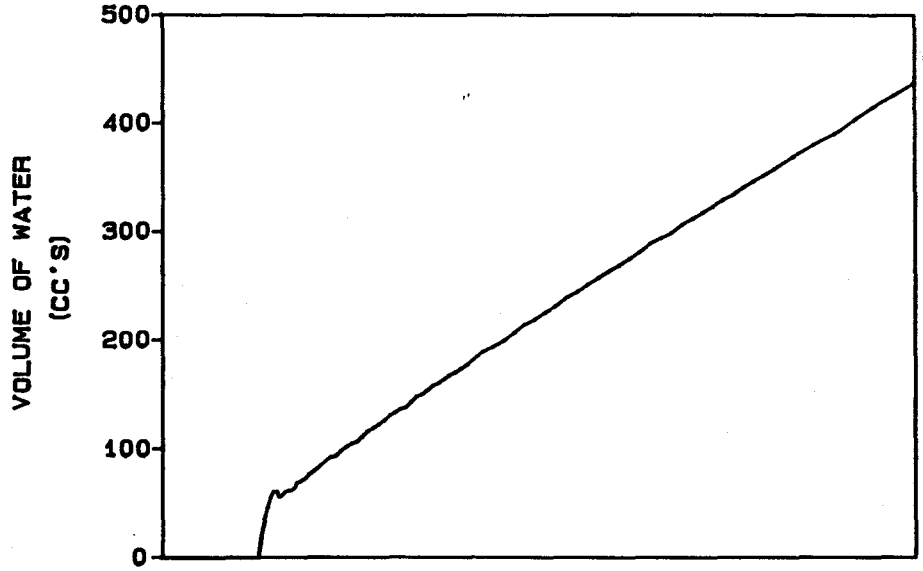


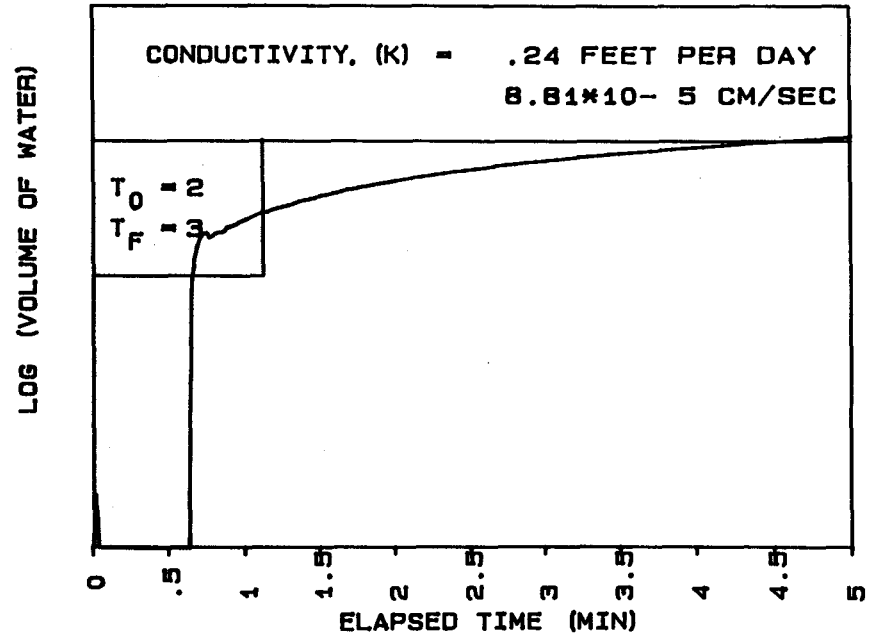


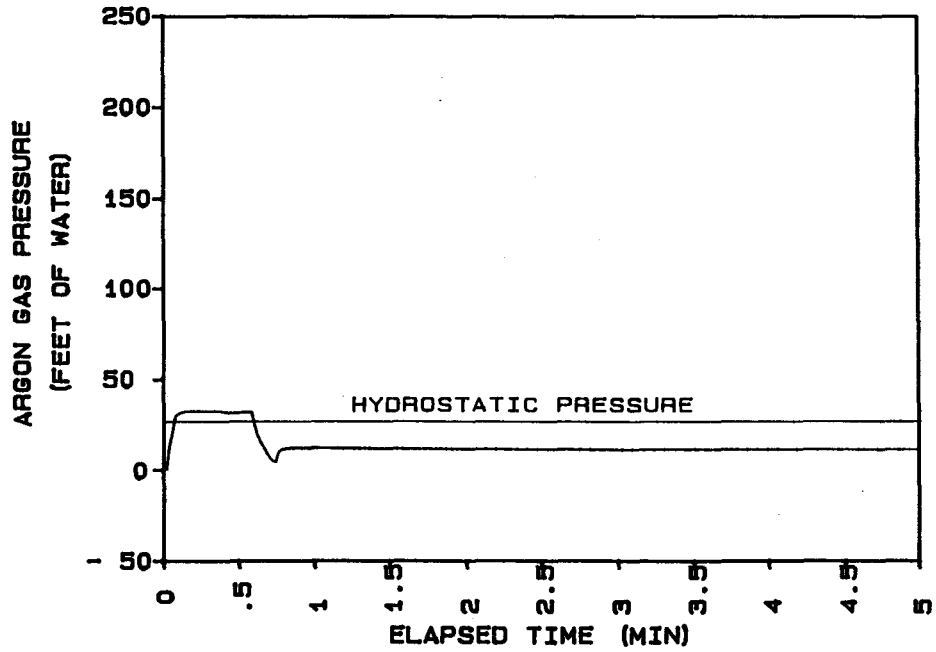
ENSAFE MEMPHIS NSA
LOCATION... 02H2727
TEST DATE
17: 31: 01 12-03-1995

SAMPLE DEPTH (FT) 27
GROUNDWATER DEPTH (FT) 15

HYDROCONE TEST







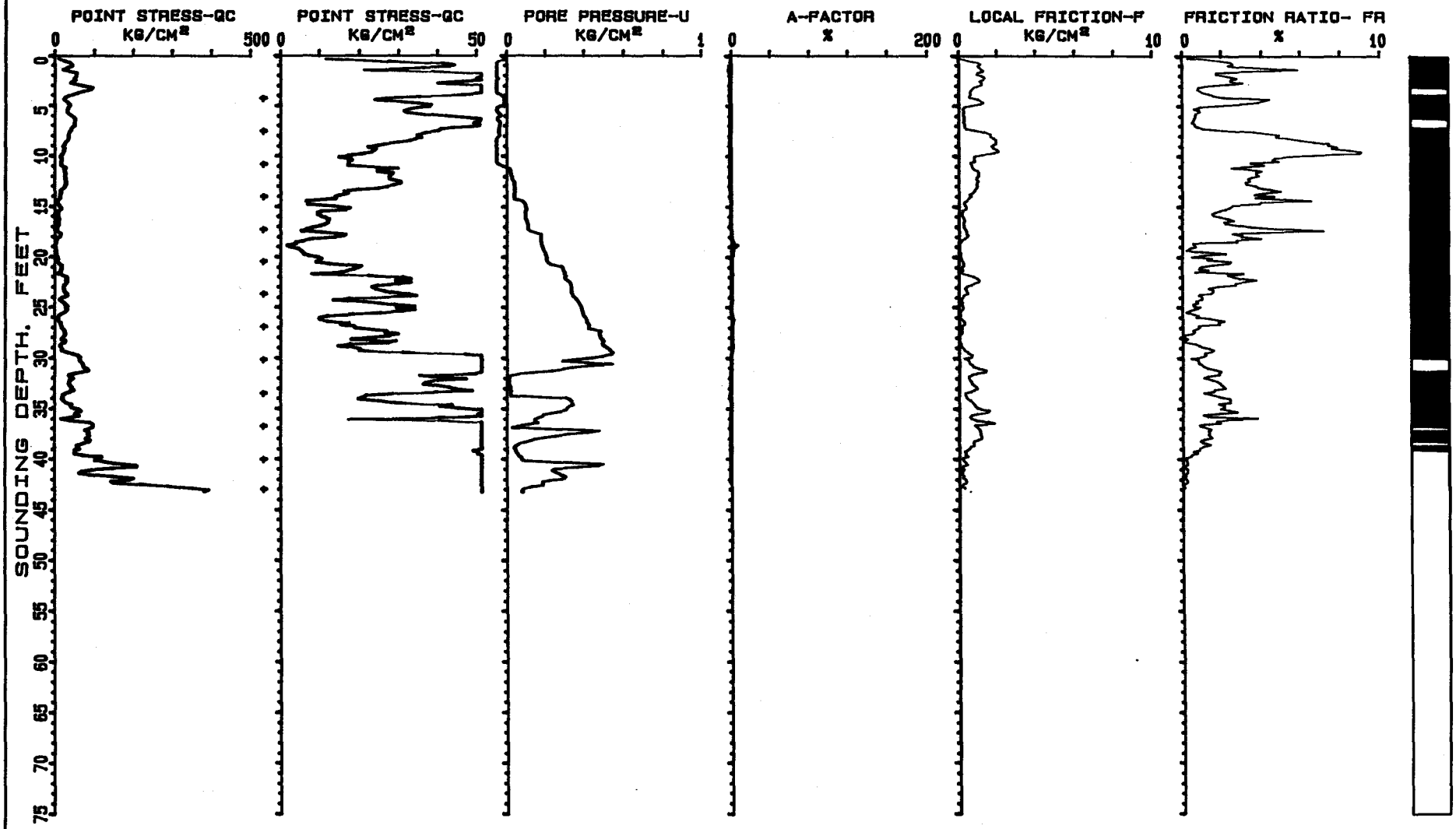
ENSAFE MEMPHIS NSA
LOCATION... 02H2741
TEST DATE
18: 07: 39 12-04-1995

SAMPLE DEPTH (FT) 41
GROUNDWATER DEPTH (FT) 15

SWMU 9

DPT SCREENING INVESTIGATION RESULTS

PIEZOCONE SOUNDING



* PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
SOUNDING # 09-P09
TEST DATE 12-17-1995 13: 49: 14

IN-SITU TECHNOLOGY SOIL BEHAVIOR TABLE
FOR SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
FILE NAME..... 09-P09

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES #	N'	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%) *	FRICTION ANGLE (DEGREES) **	YOUNGS MODULUS (KG/CM2) ***	UNDRAINED SHEAR STRENGTH (KG/CM2) ****	SENSITIVITY	COMP.	OCR
1	CLAYEY FINE SAND	34	.95	13	13	.03	60%-70%	>48	74	--	--	--	--
2	CLAYEY FINE SAND	41.9	1.11	16	16	.061	60%-70%	>48	92	--	--	--	--
3	CLAYEY FINE SAND	51.1	1.2	20	20	.092	60%-70%	>48	112	--	--	--	--
4	SILTY FINE SAND	73.1	.69	18	18	.123	70%-80%	>48	160	--	--	--	--
5	CLAYEY FINE SAND	34.8	.79	13	13	.153	50%-60%	44-46	76	--	--	--	--
6	SILTY TO CLAYEY F.S.	35	.26	11	11	.184	50%-60%	42-44	77	--	--	--	--
7	SILTY FINE SAND	49	.3	12	12	.215	60%-70%	44-46	107	--	--	--	--
8	CLAYEY FINE SAND	41.1	1.05	16	16	.246	60%-70%	42-44	90	--	--	--	--
9	CLAY	31.1	1.85	31	31	.271	--	--	--	1.9	1.6	UD	>6
10	CLAY	22.2	1.63	22	22	.295	--	--	--	1.34	1.3	UD	>6
11	CLAY	17.1	.75	17	17	.32	--	--	--	1.02	2.2	.01	[illegible]
12	SANDY CLAY	25.7	.94	12	12	.348	--	--	--	1.56	2.7	.02	>6
13	SANDY CLAY	28.5	.96	14	14	.375	--	--	--	1.73	2.9	.02	>6
14	SILTY CLAY TO CLAY	19	.71	12	12	.402	--	--	--	1.13	2.6	.01	6
15	SILTY CLAY TO CLAY	10.3	.37	6	6	.43	--	--	--	.58	2.7	.02	6
16	SANDY CLAY	12.5	.23	6	6	.457	--	--	--	.72	5.2	.02	6
17	SANDY CLAY	11.5	.27	5	5	.484	--	--	--	.65	4.1	.02	6
18	SILTY CLAY TO CLAY	11	.37	7	7	.512	--	--	--	.62	2.9	.02	6
19	SANDY CLAY	5.6	.08	2	2	.539	--	--	--	.28	6.3	.03	3
20	SENSITIVE FINE GRAIN	6	0	3	3	.561	--	--	--	.3	80.8	.03	3
21	CLAYEY FINE SAND	13.2	.2	5	5	.592	<40%	32-34	29	--	--	--	--
22	SANDY CLAY	18.9	.42	9	9	.619	--	--	--	1.1	4.4	.01	6
23	CLAYEY FINE SAND	29.1	.74	11	11	.65	<40%	36-38	64	--	--	--	--
24	SILTY TO CLAYEY F.S.	28	.35	9	9	.681	<40%	36-38	61	--	--	--	--
25	SILTY TO CLAYEY F.S.	25.5	.18	8	8	.712	<40%	34-36	56	--	--	--	--
26	SILTY TO CLAYEY F.S.	22.8	.1	7	7	.742	<40%	34-36	50	--	--	--	--
27	CLAYEY FINE SAND	14.5	.2	5	5	.773	<40%	30-32	31	--	--	--	--
28	SILTY TO CLAYEY F.S.	25.2	.08	8	8	.804	<40%	34-36	55	--	--	--	--
29	SILTY TO CLAYEY F.S.	21	.11	7	7	.835	<40%	32-34	46	--	--	--	--
30	SILTY TO CLAYEY F.S.	37.3	.45	12	12	.865	<40%	36-38	82	--	--	--	--

9-P09 CONTINUED ENSAFE

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	SENSITIVITY	COMP.	OCR
31	SILTY FINE SAND	69.5	.74	17	17	.896	40%-50%	38-40	152	--	--	--	--
32	SILTY TO CLAYEY F.S.	58.4	.84	19	19	.927	40%-50%	38-40	128	--	--	--	--
33	CLAYEY FINE SAND	40.8	.76	16	16	.958	<40%	36-38	89	--	--	--	--
34	SILTY TO CLAYEY F.S.	33.9	.47	11	11	.988	<40%	34-36	74	--	--	--	--
35	CLAYEY FINE SAND	35.5	.88	14	14	1.019	<40%	34-36	78	--	--	--	--
36	SILTY TO CLAYEY F.S.	50.3	.95	16	16	1.05	<40%	36-38	110	--	--	--	--
37	SILTY TO CLAYEY F.S.	72.9	1.16	24	24	1.081	40%-50%	38-40	160	--	--	--	--
38	SILTY FINE SAND	84.8	1.11	21	21	1.111	50%-60%	38-40	186	--	--	--	--
39	SILTY FINE SAND	71.7	.68	17	17	1.142	40%-50%	38-40	157	--	--	--	--
40	SILTY FINE SAND	73.3	.3	18	18	1.173	40%-50%	38-40	161	--	--	--	--
41	FINE SAND	155.1	.25	31	31	1.206	70%-80%	42-44	341	--	--	--	--
42	FINE SAND	123.9	.22	24	24	1.239	60%-70%	40-42	272	--	--	--	--

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)
* NORMALLY CONSOLIDATED SANDS
** FOR OVERCONSOLIDATED SANDS,SLIGHTLY REDUCE ABOVE FRICTION ANGLES
*** FOR OVERCONSOLIDATED SANDS, YOUNG'S MODULUS MAY BE AS MUCH AS 3 TO 6 TIMES HIGHER
**** NK OF 16 USED. FOR OVERCONSOLIDATED CLAYS, AN NK OF 17 IS SUGGESTED

THE ABOVE DATA WAS COMPUTED FOLLOWING 'BASIC' GUIDELINES BY P. K. ROBERTSON AND R. G. CAMPANELLA IN THE HANDBOOK 'GUIDELINES FOR USE AND INTERPERTATION OF THE ELECTRONIC CONE PENETRATION TEST'

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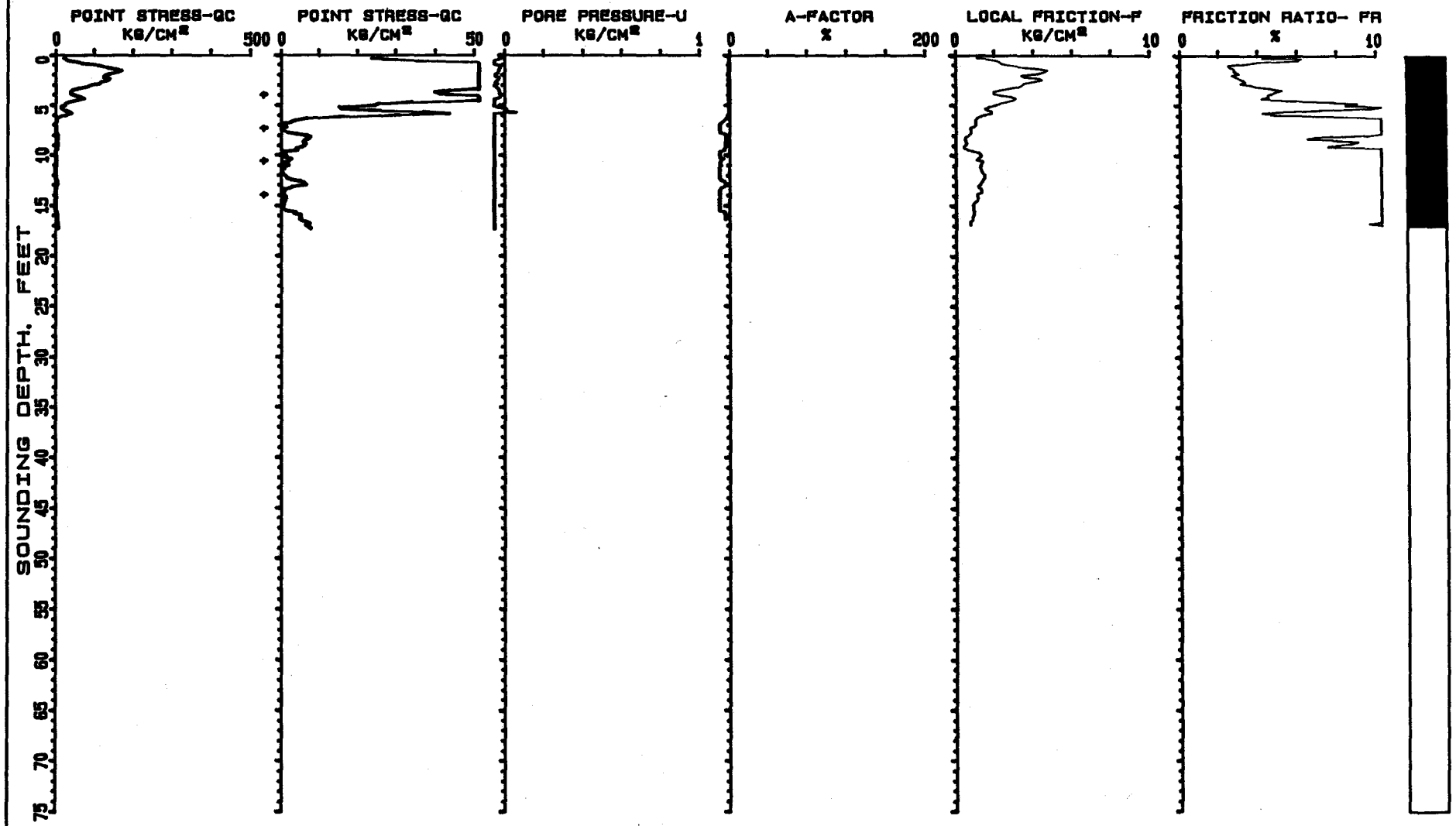
PIEZOCONE SOUNDING



* PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
SOUNDING # 09-P14
TEST DATE 11-21-1995 16:21:26

IN-SITU TECHNOLOGY SOIL BEHAVIOR TABLE
FOR SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
FILE NAME..... 09-P14

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N' #	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%) *	FRICTION ANGLE (DEGREES) **	YOUNGS MODULUS (KG/CM2) ***	UNDRAINED SHEAR STRENGTH (KG/CM2) ****	SENSITIVITY	COMP.	OCR
1	CLAY	46.4	2.37	46	46	.024	--	--	--	2.89	1.9	UD	>6
2	SILTY TO CLAYEY F.S.	134.8	3.94	44	44	.055	>90%	>48	296	--	--	--	--
3	SILTY TO CLAYEY F.S.	128.2	3.79	42	42	.086	>90%	>48	282	--	--	--	--
4	CLAYEY FINE SAND	67.2	2.54	26	26	.117	70%-80%	>48	147	--	--	--	--
5	CLAY	45.8	2.48	45	45	.142	--	--	--	2.84	1.8	UD	>6
6	CLAY	27	1.61	27	27	.167	--	--	--	1.66	1.6	UD	>6
7	SOFT CLAY	8.7	1.04	8	8	.183	--	--	--	.51	.8	UD	6
8	SOFT CLAY	1.4	.73	1	1	.199	--	--	--	.05	.1	UD	1-1.5
9	CLAY	6.7	.5	6	6	.224	--	--	--	.38	1.3	.03	6
10	SOFT CLAY	2.6	.87	2	2	.24	--	--	--	.12	.3	UD	1-1.5
[illegible]	SOFT CLAY	1.3	1.25	1	1	.256	--	--	--	.04	.1	UD	1
[illegible]	SOFT CLAY	.4	1.39	0	0	.272	--	--	--	-.02	0	UD	<1
13	SOFT CLAY	3.5	1.35	3	3	.288	--	--	--	.17	.2	UD	3
14	SOFT CLAY	2.1	1.21	2	2	.304	--	--	--	.08	.1	UD	1-1.5
15	SOFT CLAY	.2	1.01	0	0	.32	--	--	--	-.04	0	UD	<1
16	SOFT CLAY	2.2	.9	2	2	.336	--	--	--	.08	.2	UD	1

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)
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*** FOR OVERCONSOLIDATED SANDS, YOUNG'S MODULUS MAY BE AS MUCH AS 3 TO 6 TIMES HIGHER
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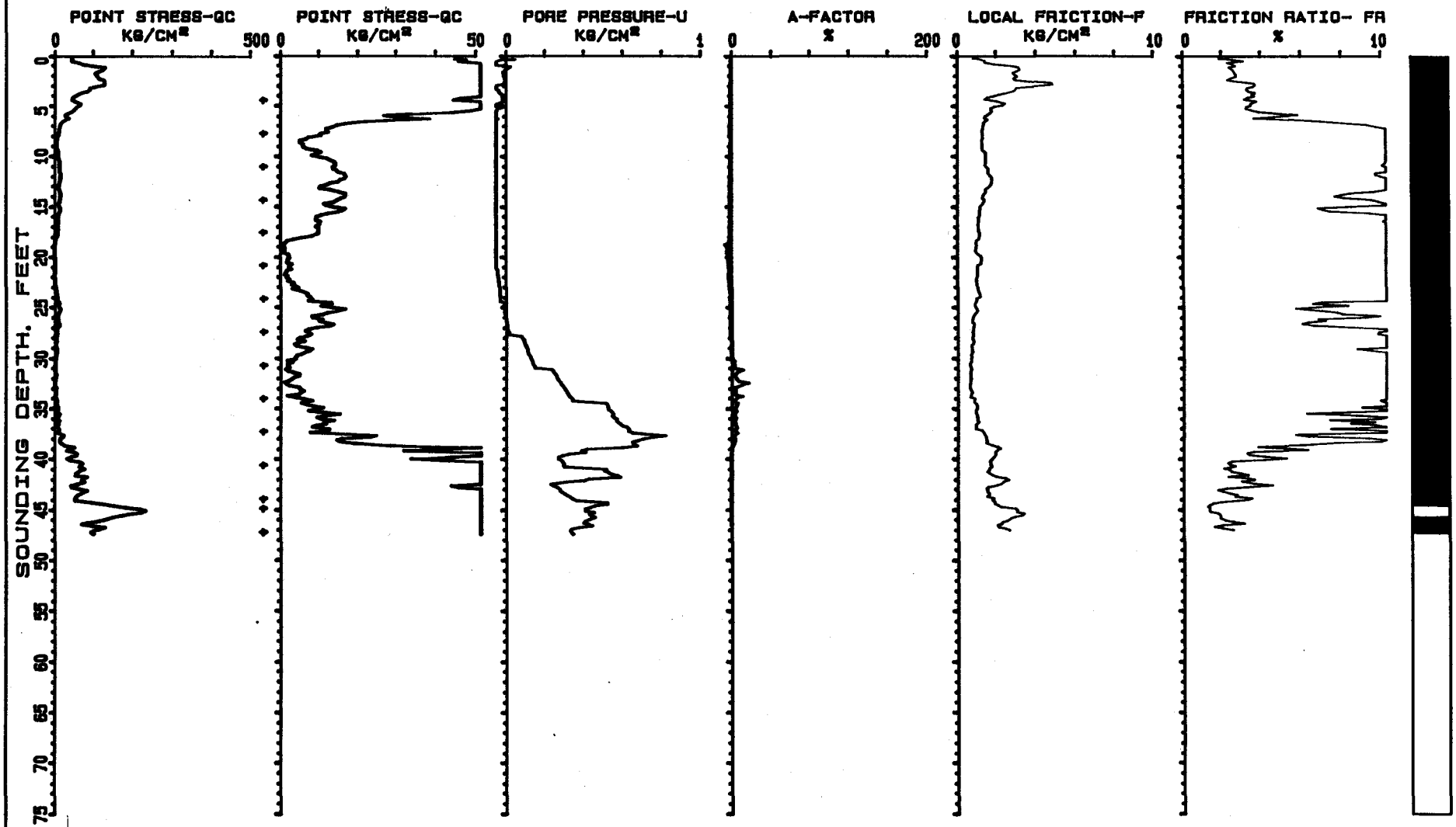
PIEZOCONE SOUNDING



+ PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
SOUNDING # 09-P14A
TEST DATE 11-27-1995 12:13:33

IN-SITU TECHNOLOGY SOIL BEHAVIOR TABLE
FOR SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
FILE NAME..... 09-P14A

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N' #	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%) *	FRICTION ANGLE (DEGREES) **	YOUNGS MODULUS (KG/CM2) ***	UNDRAINED SHEAR STRENGTH (KG/CM2) ****	SENSITIVITY	COMP.	OCR
1	CLAYEY FINE SAND	66.7	2.15	26	26	.03	70%-80%	>48	146	--	--	--	--
2	SILTY TO CLAYEY F.S.	114.3	3.04	38	38	.061	>90%	>48	251	--	--	--	--
3	CLAYEY FINE SAND	121.5	3.73	48	48	.092	>90%	>48	267	--	--	--	--
4	CLAYEY FINE SAND	90	2.74	36	36	.123	70%-80%	>48	198	--	--	--	--
5	CLAYEY FINE SAND	55.4	1.91	22	22	.153	60%-70%	46-48	121	--	--	--	--
6	SANDY CLAY	47.1	1.66	23	23	.181	--	--	--	2.92	2.8	.01	>6
7	CLAY	24.9	1.38	24	24	.206	--	--	--	1.53	1.7	UD	>6
8	CLAY	12	1.27	12	12	.23	--	--	--	.72	.9	.02	6
9	SOFT CLAY	6.5	1.26	6	6	.247	--	--	--	.37	.5	UD	6
10	SOFT CLAY	8	1.36	8	8	.263	--	--	--	.46	.5	UD	6
[illegible]	SOFT CLAY	12.2	1.44	12	12	.279	--	--	--	.72	.8	UD	6
[illegible]	CLAY	14.8	1.59	14	14	.304	--	--	--	.88	.9	.01	6
13	SOFT CLAY	14.4	1.71	14	14	.32	--	--	--	.85	.8	UD	6
14	CLAY	14.1	1.39	14	14	.345	--	--	--	.83	1	.01	6
15	CLAY	13.9	1.26	13	13	.37	--	--	--	.81	1	.01	6
16	CLAY	13.3	1.11	13	13	.395	--	--	--	.77	1.1	.01	6
17	SOFT CLAY	9.6	1.06	9	9	.411	--	--	--	.54	.9	UD	6
18	SOFT CLAY	9.4	1.1	9	9	.427	--	--	--	.52	.8	UD	6
19	SOFT CLAY	3.1	.99	3	3	.443	--	--	--	.12	.3	UD	1-1.5
20	SOFT CLAY	1.4	1.03	1	1	.459	--	--	--	.02	.1	UD	<1
21	SOFT CLAY	2.3	1.16	2	2	.475	--	--	--	.07	.2	UD	1
22	SOFT CLAY	1.9	1.01	1	1	.491	--	--	--	.04	.1	UD	<1
23	SOFT CLAY	3.1	1	3	3	.507	--	--	--	.11	.3	UD	1
24	SOFT CLAY	5.8	1.08	5	5	.524	--	--	--	.28	.5	UD	3
25	CLAY	10.5	.91	10	10	.548	--	--	--	.57	1.1	.02	6
26	CLAY	12	.87	12	12	.573	--	--	--	.66	1.3	.02	6
27	CLAY	11	.77	11	11	.598	--	--	--	.59	1.4	.02	3
28	SOFT CLAY	7.3	.76	7	7	.614	--	--	--	.36	.9	UD	3
29	SOFT CLAY	4.9	.74	4	4	.63	--	--	--	.21	.6	UD	1-1.5
30	SOFT CLAY	6.1	.7	6	6	.647	--	--	--	.28	.8	UD	1-1.5

09-P14A CONTINUED ENSAFE

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	SENSITIVITY	COMP.	OCR
31	SOFT CLAY	2.7	.65	2	2	.663	--	--	--	.06	.4	UD	<1
32	SOFT CLAY	3.2	.65	3	3	.679	--	--	--	.09	.5	UD	1
33	SOFT CLAY	3	.62	3	3	.695	--	--	--	.08	.4	UD	1
34	SOFT CLAY	4.8	.73	4	4	.711	--	--	--	.19	.6	UD	1-1.5
35	SOFT CLAY	7.9	.93	7	7	.727	--	--	--	.38	.8	UD	3
36	CLAY	10.6	.98	10	10	.752	--	--	--	.54	1	.02	3
37	CLAY	11.1	1.02	11	11	.777	--	--	--	.57	1	.02	3
38	CLAY	16.1	1.4	16	16	.802	--	--	--	.88	1.1	.01	6
39	CLAY	26.9	1.78	26	26	.827	--	--	--	1.55	1.5	UD	6
40	SILTY CLAY TO CLAY	46	1.87	30	30	.854	--	--	--	2.74	2.4	UD	6
41	CLAYEY FINE SAND	61.5	1.66	24	24	.885	40%-50%	38-40	135	--	--	--	--
42	CLAYEY FINE SAND	68.1	1.93	27	27	.916	40%-50%	38-40	149	--	--	--	--
43	CLAYEY FINE SAND	63	1.95	25	25	.946	40%-50%	38-40	138	--	--	--	--
44	CLAYEY FINE SAND	66.4	1.62	26	26	.977	40%-50%	38-40	146	--	--	--	--
45	SILTY TO CLAYEY F.S.	127.3	2.27	42	42	1.008	60%-70%	42-44	280	--	--	--	--
46	SILTY FINE SAND	189.1	2.97	47	47	1.039	80%-90%	42-44	416	--	--	--	--

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)
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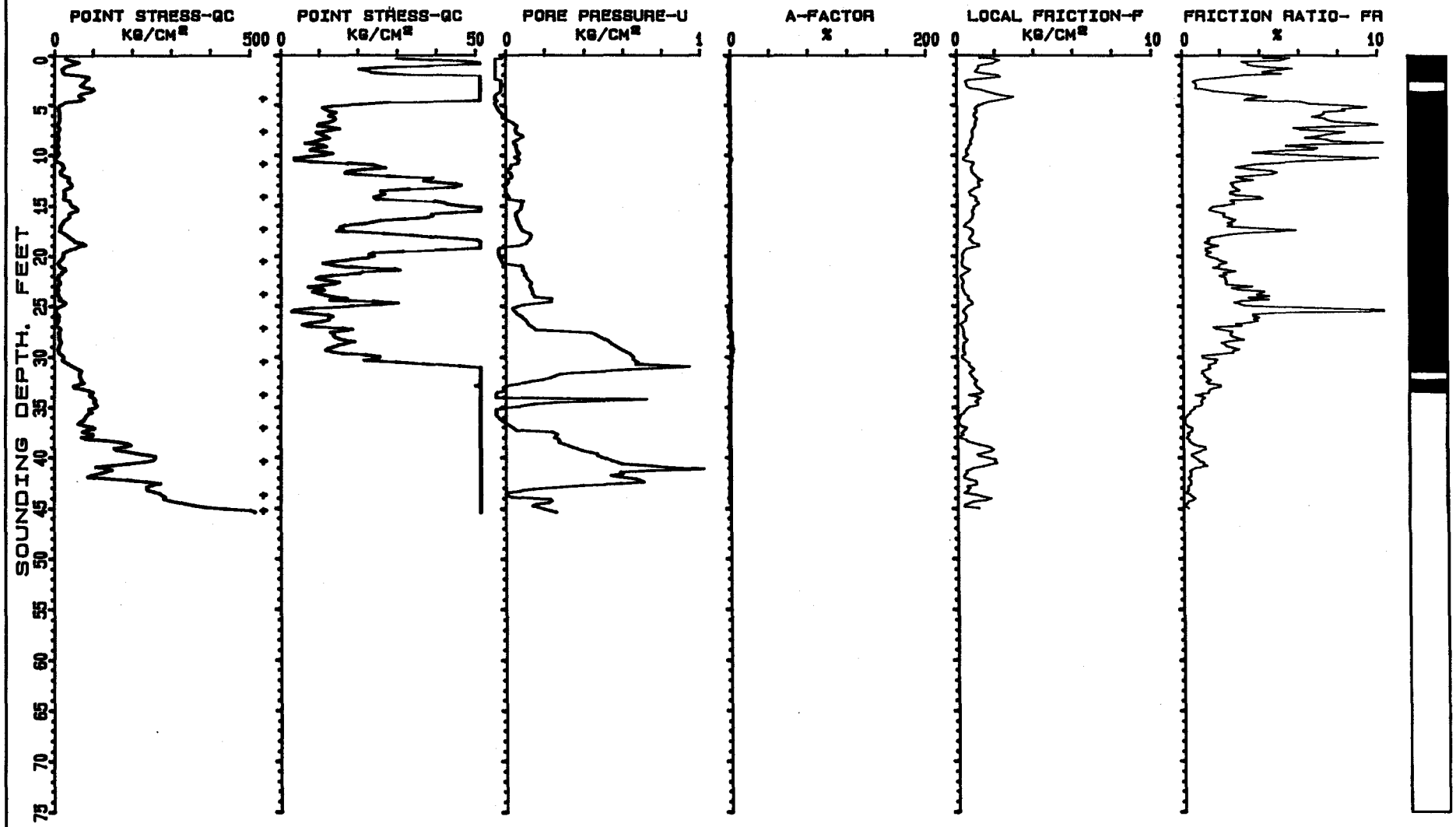
PIEZOCONE SOUNDING



* PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
SOUNDING # 09-P17
TEST DATE 12-17-1995 09: 18: 17

IN-SITU TECHNOLOGY SOIL BEHAVIOR TABLE
FOR SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
FILE NAME..... 09-P17

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N' VALUES	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%)	FRICTION ANGLE (DEGREES)	YOUNGS MODULUS (KG/CM2)	UNDRAINED SHEAR STRENGTH (KG/CM2)	SENSITIVITY	COMP.	OCR
				#			*	**	***	****			
1	SANDY CLAY	47.5	1.72	23	23	.027	--	--	--	2.96	2.7	.01	>6
2	CLAY	27	1.31	27	27	.052	--	--	--	1.68	2	UD	>6
3	SILTY TO CLAYEY F.S.	73.4	1.15	24	24	.083	70%-80%	>48	161	--	--	--	--
4	SILTY TO CLAYEY F.S.	83.9	1.28	27	27	.113	70%-80%	>48	184	--	--	--	--
5	CLAYEY FINE SAND	56.3	2.04	22	22	.144	60%-70%	46-48	123	--	--	--	--
6	CLAY	13.6	.98	13	13	.169	--	--	--	.82	1.3	.01	>6
7	CLAY	12.2	.95	12	12	.194	--	--	--	.73	1.2	.02	6
8	CLAY	11.6	.82	11	11	.219	--	--	--	.69	1.4	.02	6
9	CLAY	10.1	.72	10	10	.244	--	--	--	.59	1.4	.02	6
10	CLAY	10.6	.53	10	10	.269	--	--	--	.62	1.9	.02	6
11	CLAY	10.5	.58	10	10	.293	--	--	--	.61	1.8	.02	6
12	SILTY CLAY TO CLAY	20.9	.82	13	13	.321	--	--	--	1.26	2.5	UD	
13	CLAYEY FINE SAND	36.5	1.13	14	14	.352	50%-60%	40-42	80	--	--	--	--
14	CLAYEY FINE SAND	32.5	.82	13	13	.382	40%-50%	40-42	71	--	--	--	--
15	CLAYEY FINE SAND	34.9	.99	13	13	.413	40%-50%	40-42	76	--	--	--	--
16	SILTY TO CLAYEY F.S.	48.9	.82	16	16	.444	50%-60%	40-42	107	--	--	--	--
17	CLAYEY FINE SAND	27.8	.58	11	11	.475	<40%	38-40	61	--	--	--	--
18	SANDY CLAY	20.3	.71	10	10	.502	--	--	--	1.2	2.8	.02	6
19	SILTY TO CLAYEY F.S.	54.9	.84	18	18	.533	50%-60%	40-42	120	--	--	--	--
20	SILTY TO CLAYEY F.S.	37.1	.41	12	12	.564	<40%	38-40	81	--	--	--	--
21	CLAYEY FINE SAND	17.1	.29	6	6	.594	<40%	34-36	37	--	--	--	--
22	CLAYEY FINE SAND	21	.42	8	8	.625	<40%	34-36	46	--	--	--	--
23	SANDY CLAY	11.3	.25	5	5	.652	--	--	--	.62	4.4	.02	3
24	CLAY	10.1	.41	10	10	.677	--	--	--	.54	2.4	.02	3
25	SANDY CLAY	20.2	.63	10	10	.705	--	--	--	1.17	3.1	.02	6
26	CLAY	9.3	.41	9	9	.73	--	--	--	.48	2.2	.02	3
27	SILTY CLAY TO CLAY	9.8	.31	6	6	.757	--	--	--	.51	3.1	.02	3
28	SANDY CLAY	13.7	.33	6	6	.784	--	--	--	.75	4	.02	3
29	SANDY CLAY	15.7	.38	7	7	.812	--	--	--	.87	4.1	.01	6
30	SANDY CLAY	16.3	.32	8	8	.839	--	--	--	.9	4.9	.01	6

09-P17 CONTINUED ENSAFE

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	SENSITIVITY	COMP.	OCR
31	CLAYEY FINE SAND	34.1	.55	13	13	.87	<40%	36-38	75	--	--	--	--
32	SILTY TO CLAYEY F.S.	65	.75	21	21	.901	40%-50%	38-40	143	--	--	--	--
33	SILTY TO CLAYEY F.S.	64.9	.97	21	21	.931	40%-50%	38-40	142	--	--	--	--
34	SILTY FINE SAND	86	1.09	21	21	.962	50%-60%	40-42	189	--	--	--	--
35	FINE SAND	105.7	.9	21	21	.995	60%-70%	40-42	232	--	--	--	--
36	FINE SAND	91	.27	18	18	1.028	50%-60%	40-42	200	--	--	--	--
37	FINE SAND	77.5	.15	15	15	1.062	40%-50%	38-40	170	--	--	--	--
38	FINE SAND	90.4	.28	18	18	1.095	50%-60%	40-42	198	--	--	--	--
39	FINE SAND	145.3	.9	29	29	1.128	70%-80%	42-44	319	--	--	--	--
40	FINE SAND	199.2	1.47	39	39	1.161	80%-90%	42-44	438	--	--	--	--
41	FINE SAND	207.1	1.59	41	41	1.195	80%-90%	42-44	455	--	--	--	--
42	FINE SAND	118.3	.48	23	23	1.228	60%-70%	40-42	260	--	--	--	--
43	DENSE OR CEMENTED S.	220.1	.73	36	36	1.264	80%-90%	42-44	484	--	--	--	--
44	DENSE OR CEMENTED S.	262.9	.96	43	43	1.301	>90%	44-46	578	--	--	--	--

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)
* NORMALLY CONSOLIDATED SANDS
** FOR OVERCONSOLIDATED SANDS,SLIGHTLY REDUCE ABOVE FRICTION ANGLES
*** FOR OVERCONSOLIDATED SANDS, YOUNG'S MODULUS MAY BE AS MUCH AS 3 TO 6 TIMES HIGHER
**** NK OF 16 USED. FOR OVERCONSOLIDATED CLAYS, AN NK OF 17 IS SUGGESTED

THE ABOVE DATA WAS COMPUTED FOLLOWING 'BASIC' GUIDELINES BY P. K. ROBERTSON AND R. G. CAMPANELLA IN THE HANDBOOK 'GUIDELINES FOR USE AND INTERPERTATION OF THE ELECTRONIC CONE PENETRATION TEST'

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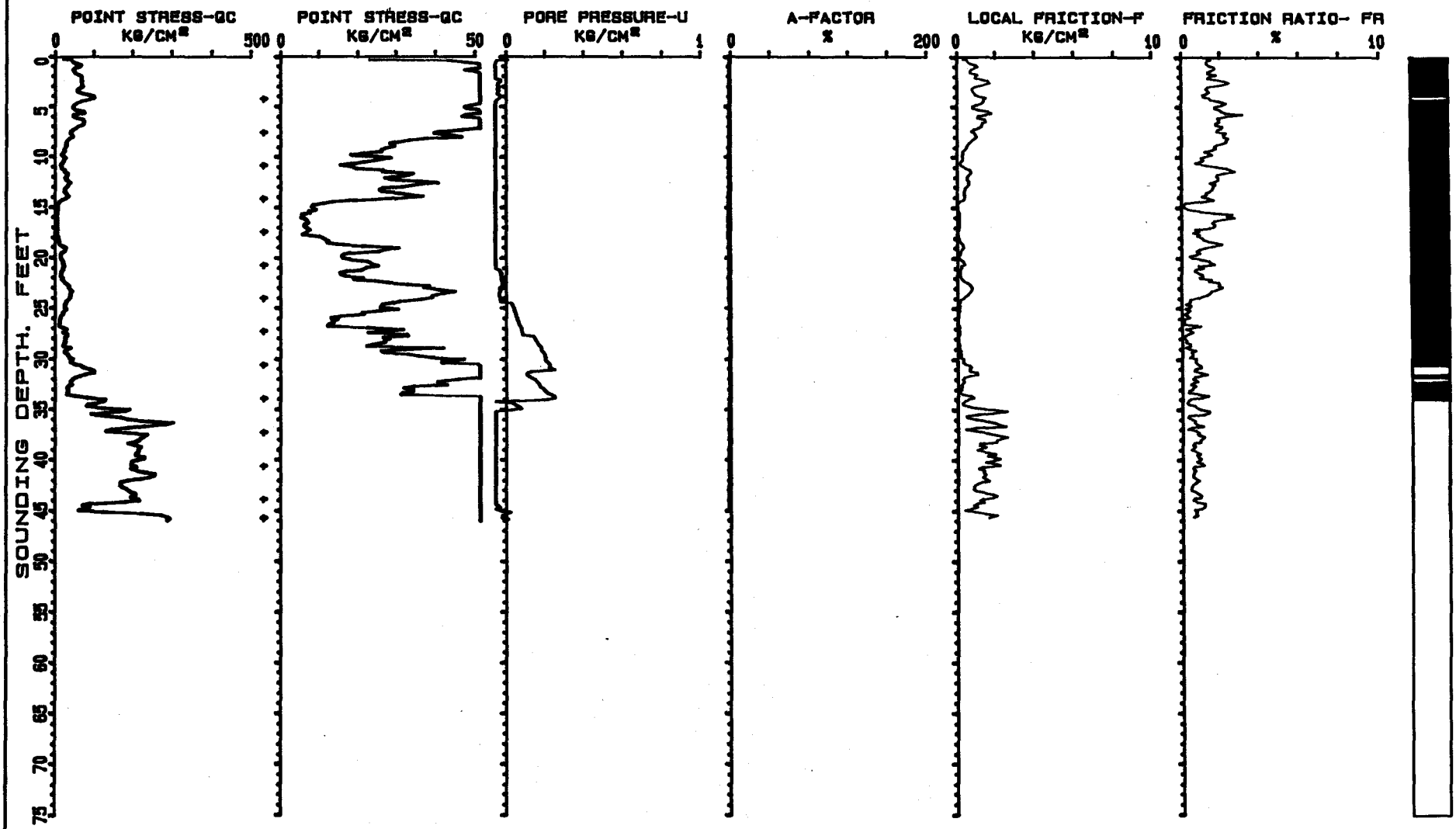
PIEZOCONE SOUNDING



* PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
SOUNDING # 09-P21
TEST DATE 11-30-1995 14:27:51

IN-SITU TECHNOLOGY SOIL BEHAVIOR TABLE
FOR SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
FILE NAME..... 09-P21

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES #	N'	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%) *	FRICTION ANGLE (DEGREES) **	YOUNGS MODULUS (KG/CM2) ***	UNDRAINED SHEAR STRENGTH (KG/CM2) ****	SENSITIVITY	COMP.	OCR
1	SILTY TO CLAYEY F.S.	56.1	.89	18	18	.03	70%-80%	>48	123	--	--	--	--
2	SILTY TO CLAYEY F.S.	54.8	.88	18	18	.061	70%-80%	>48	120	--	--	--	--
3	SILTY TO CLAYEY F.S.	69	1.23	23	23	.092	70%-80%	>48	151	--	--	--	--
4	SILTY TO CLAYEY F.S.	72.7	.98	24	24	.123	70%-80%	>48	159	--	--	--	--
5	SILTY TO CLAYEY F.S.	73.5	1.17	24	24	.153	70%-80%	46-48	161	--	--	--	--
6	CLAYEY FINE SAND	56.7	1.28	22	22	.184	60%-70%	44-46	124	--	--	--	--
7	SILTY TO CLAYEY F.S.	65.9	1.28	21	21	.215	70%-80%	44-46	144	--	--	--	--
8	SILTY TO CLAYEY F.S.	47.2	.93	15	15	.246	60%-70%	42-44	103	--	--	--	--
9	CLAYEY FINE SAND	33.5	.64	13	13	.276	50%-60%	40-42	73	--	--	--	--
10	CLAYEY FINE SAND	24.6	.34	9	9	.307	40%-50%	38-40	54	--	--	--	--
[illegible]	CLAYEY FINE SAND	21.7	.27	8	8	.338	<40%	38-40	47	--	--	--	--
[illegible]	CLAYEY FINE SAND	27	.61	10	10	.369	40%-50%	38-40	59	--	--	--	--
13	CLAYEY FINE SAND	32.8	.54	13	13	.399	40%-50%	40-42	72	--	--	--	--
14	SILTY TO CLAYEY F.S.	30	.4	10	10	.43	40%-50%	38-40	66	--	--	--	--
15	CLAYEY FINE SAND	18.2	.12	7	7	.461	<40%	36-38	40	--	--	--	--
16	SANDY CLAY	7.5	.09	3	3	.488	--	--	--	.4	7.7	.03	3
17	SANDY CLAY	6.4	.1	3	3	.516	--	--	--	.33	5.8	.02	3
18	SENSITIVE FINE GRAIN	7.9	.04	3	3	.538	--	--	--	.42	17.1	.02	3
19	CLAYEY FINE SAND	16.3	.26	6	6	.568	<40%	34-36	35	--	--	--	--
20	SILTY TO CLAYEY F.S.	21.4	.15	7	7	.599	<40%	34-36	47	--	--	--	--
21	CLAYEY FINE SAND	21.3	.26	8	8	.63	<40%	34-36	46	--	--	--	--
22	CLAYEY FINE SAND	18.3	.17	7	7	.661	<40%	34-36	40	--	--	--	--
23	CLAYEY FINE SAND	28.7	.59	11	11	.692	<40%	36-38	63	--	--	--	--
24	SILTY TO CLAYEY F.S.	40.5	.5	13	13	.722	<40%	38-40	89	--	--	--	--
25	SILTY TO CLAYEY F.S.	30.4	.11	10	10	.753	<40%	36-38	66	--	--	--	--
26	SILTY TO CLAYEY F.S.	21.7	.01	7	7	.784	<40%	34-36	47	--	--	--	--
27	CLAYEY FINE SAND	14.5	.04	5	5	.815	<40%	30-32	31	--	--	--	--
28	SILTY TO CLAYEY F.S.	28.1	.07	9	9	.845	<40%	34-36	61	--	--	--	--
29	SILTY TO CLAYEY F.S.	28.5	.09	9	9	.876	<40%	34-36	62	--	--	--	--
30	SILTY TO CLAYEY F.S.	34.2	.21	11	11	.907	<40%	36-38	75	--	--	--	--

09-P21 CONTINUED ENSAFE

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	SENSITIVITY	COMP.	OCR
31	SILTY FINE SAND	59.2	.53	14	14	.938	40%-50%	38-40	130	--	--	--	--
32	SILTY FINE SAND	77.8	.61	19	19	.968	50%-60%	40-42	171	--	--	--	--
33	SILTY TO CLAYEY F.S.	38.6	.21	12	12	.999	<40%	36-38	84	--	--	--	--
34	SILTY FINE SAND	57	.42	14	14	1.03	<40%	38-40	125	--	--	--	--
35	FINE SAND	121.9	.99	24	24	1.063	60%-70%	40-42	268	--	--	--	--
36	FINE SAND	156	1.28	31	31	1.096	70%-80%	42-44	343	--	--	--	--
37	FINE SAND	226.6	1.49	45	45	1.13	80%-90%	44-46	498	--	--	--	--
38	FINE SAND	190.4	1.86	38	38	1.163	80%-90%	42-44	418	--	--	--	--
39	FINE SAND	211.5	1.43	42	42	1.196	80%-90%	42-44	465	--	--	--	--
40	FINE SAND	217.4	1.79	43	43	1.229	80%-90%	42-44	478	--	--	--	--
41	FINE SAND	201.6	1.56	40	40	1.262	80%-90%	42-44	443	--	--	--	--
42	FINE SAND	225.4	1.39	45	45	1.296	80%-90%	42-44	495	--	--	--	--
43	FINE SAND	177.5	1.01	35	35	1.329	70%-80%	42-44	390	--	--	--	--
44	FINE SAND	204.3	1.55	40	40	1.362	70%-80%	42-44	449	--	--	--	--
45	FINE SAND	111.7	.88	22	22	1.395	50%-60%	40-42	245	--	--	--	--

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)
* NORMALLY CONSOLIDATED SANDS
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*** FOR OVERCONSOLIDATED SANDS, YOUNG'S MODULUS MAY BE AS MUCH AS 3 TO 6 TIMES HIGHER
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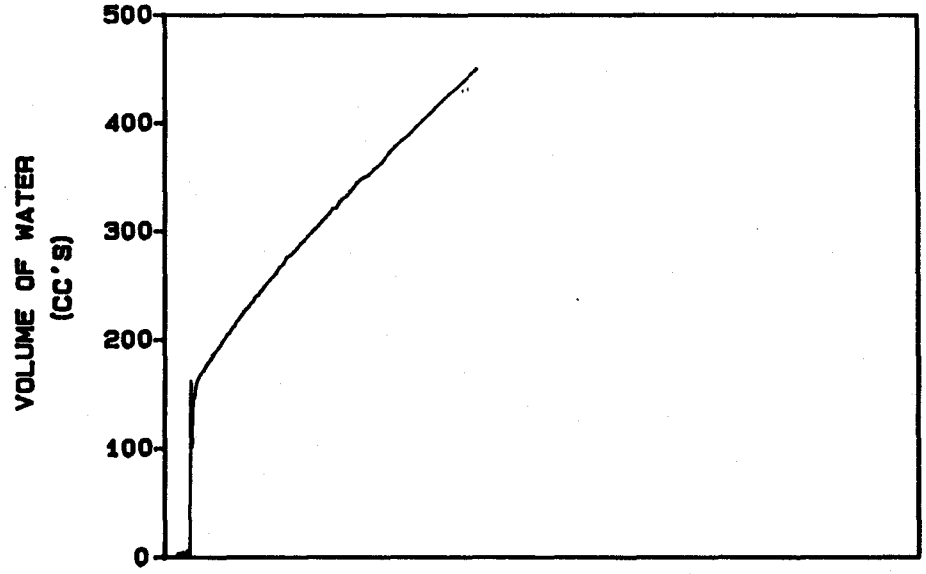
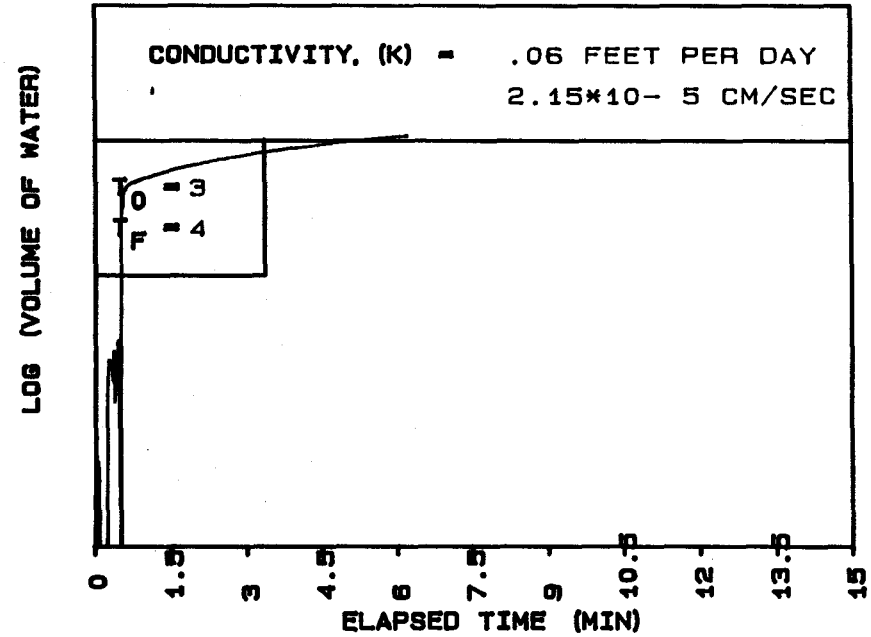
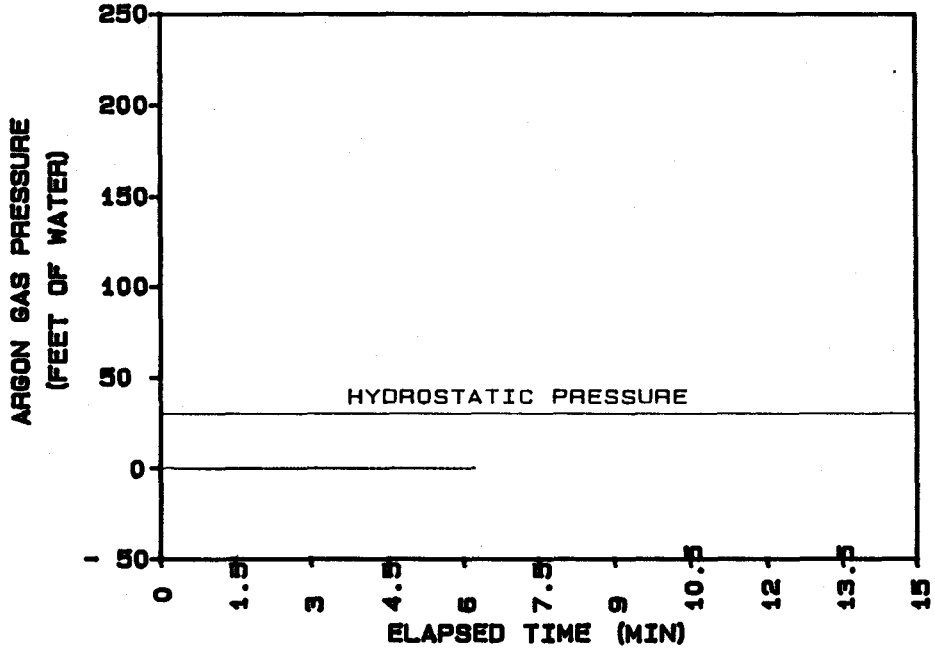
HYDROCONE TEST







ENSAFE MEMPHIS NSA
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TEST DATE
20: 37: 54 12-01-1995

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GROUNDWATER DEPTH (FT) 16

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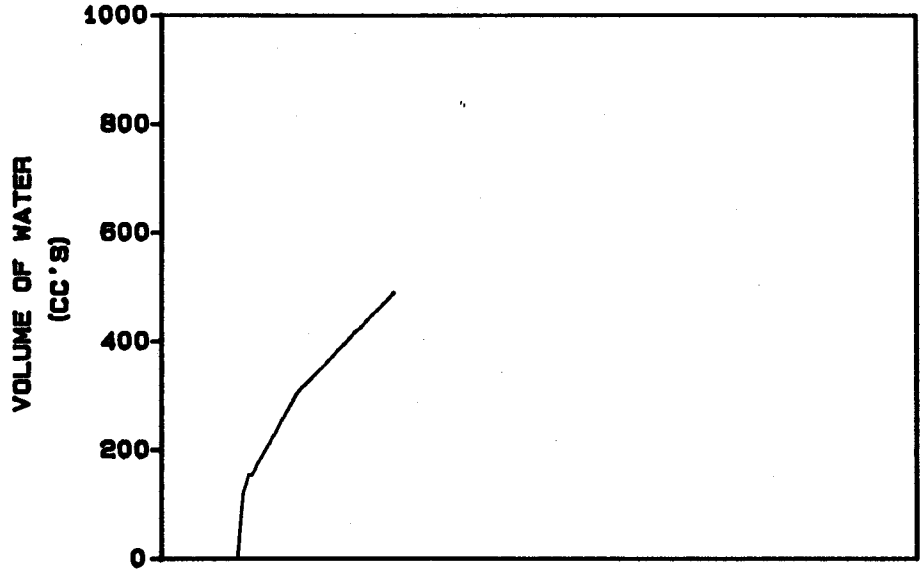

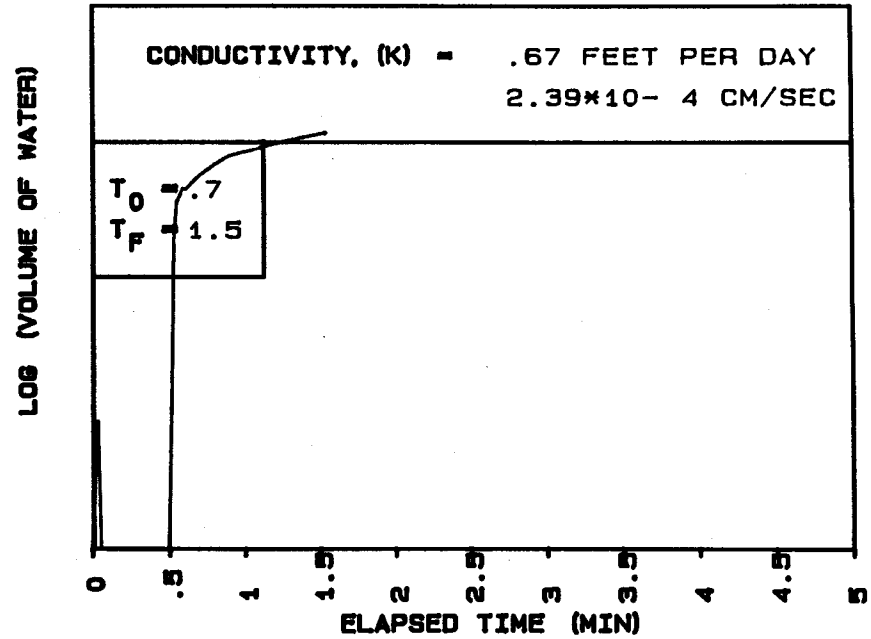

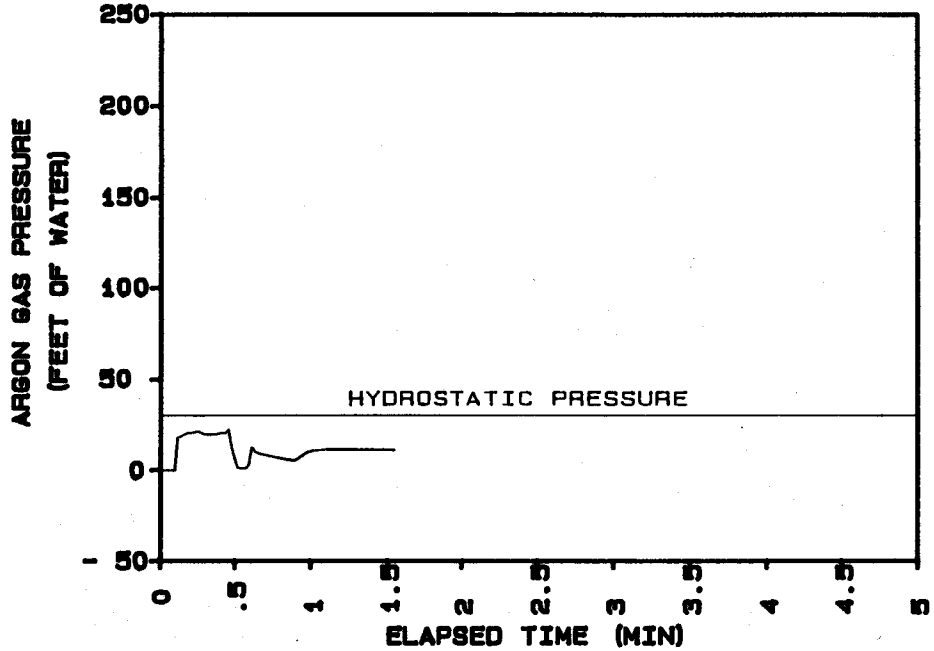

ENSAFE MEMPHIS NSA
LOCATION... 09H1046
TEST DATE
13: 01: 36 12-02-1995

SAMPLE DEPTH (FT) 46
GROUNDWATER DEPTH (FT) 16

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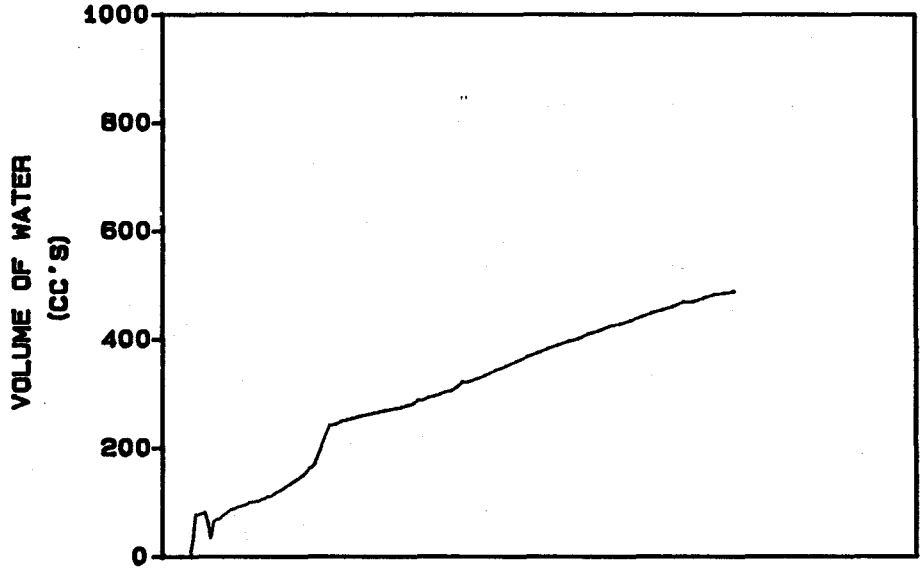
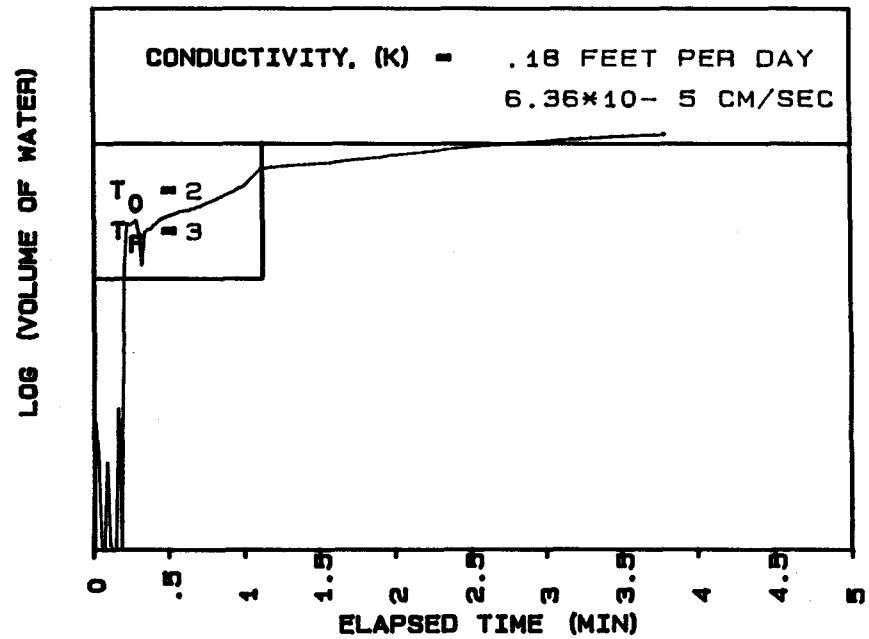
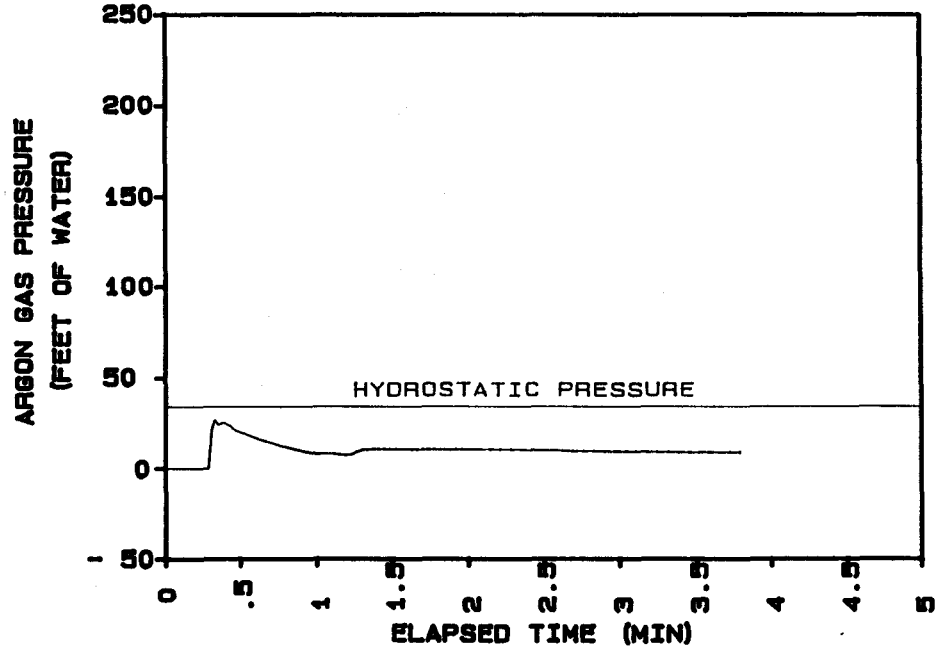


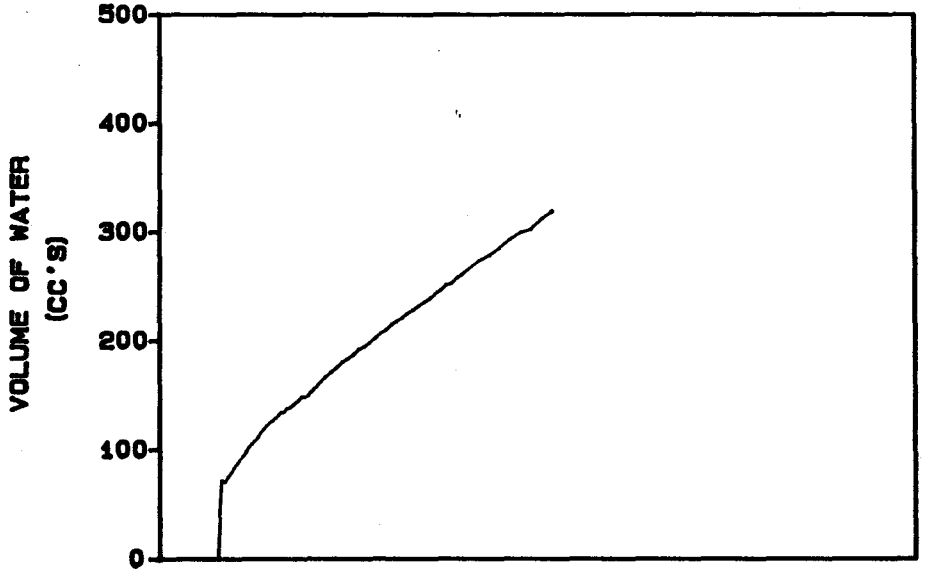


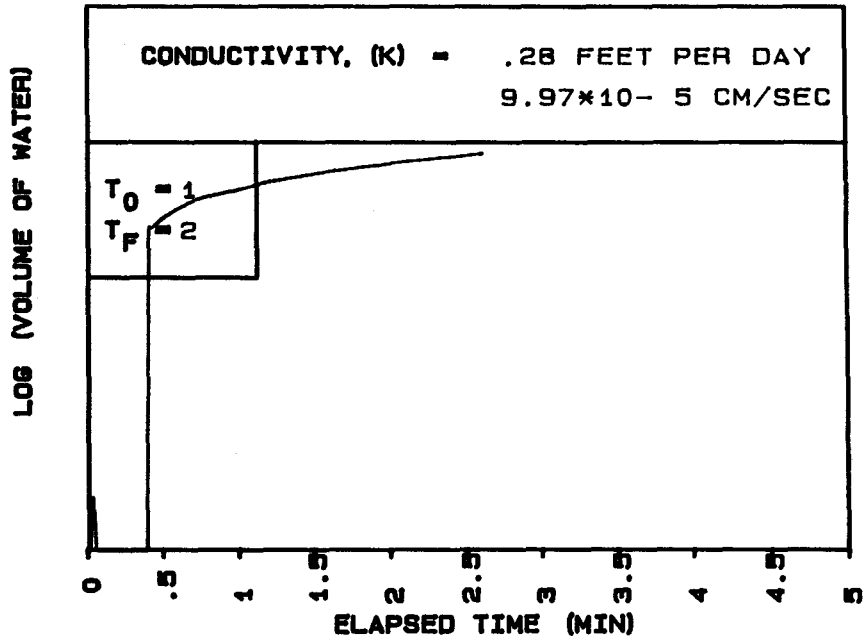


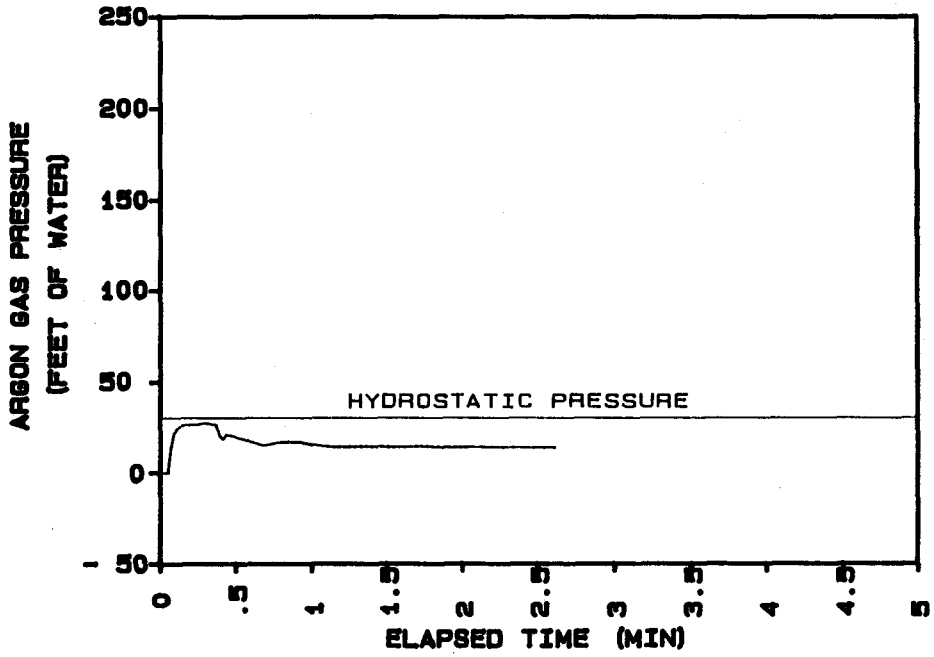
ENSAFE MEMPHIS NSA
LOCATION... 09H1150
TEST DATE
15: 38: 51 12-02-1995

SAMPLE DEPTH (FT) 50
GROUNDWATER DEPTH (FT) 16

HYDROCONE TEST



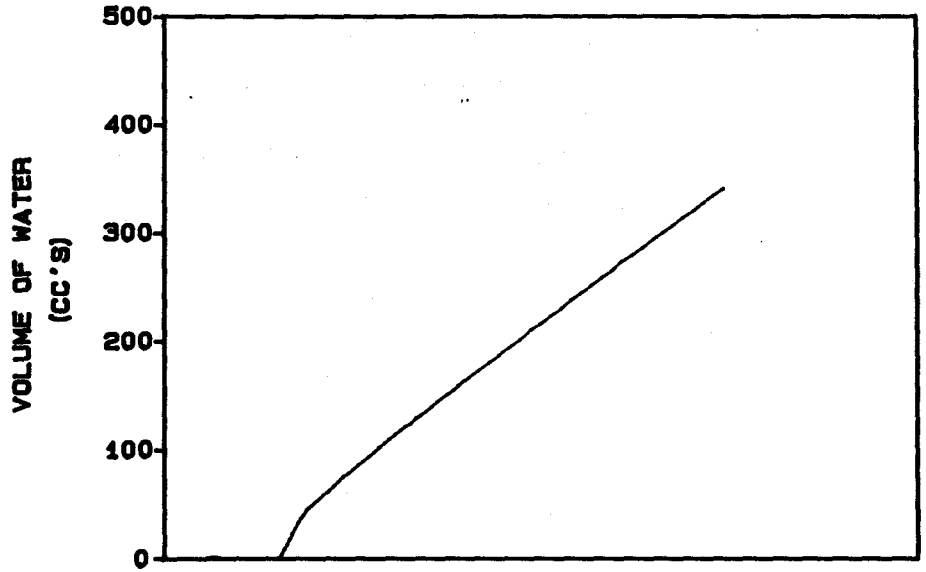


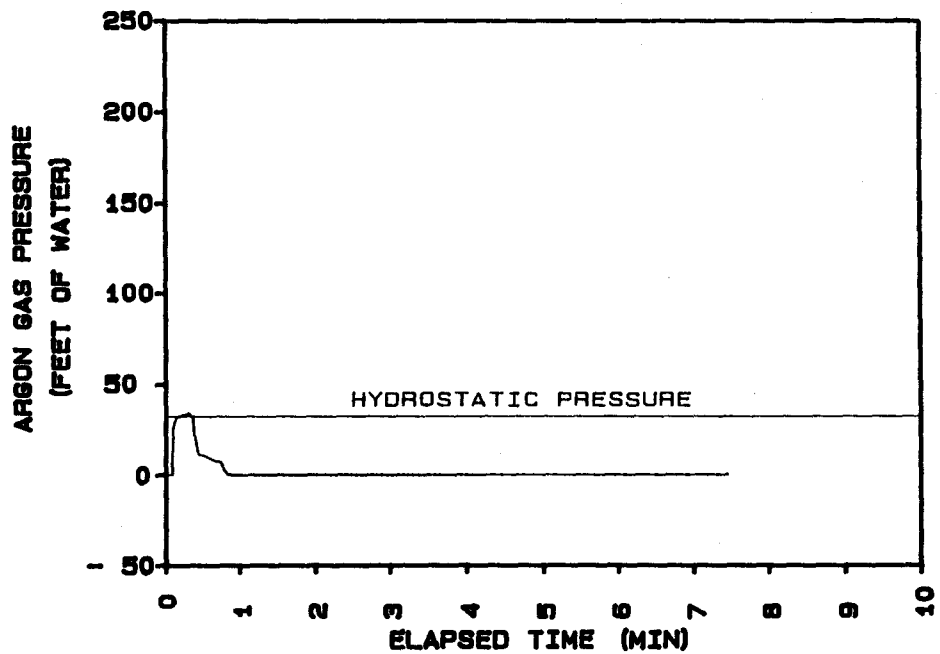


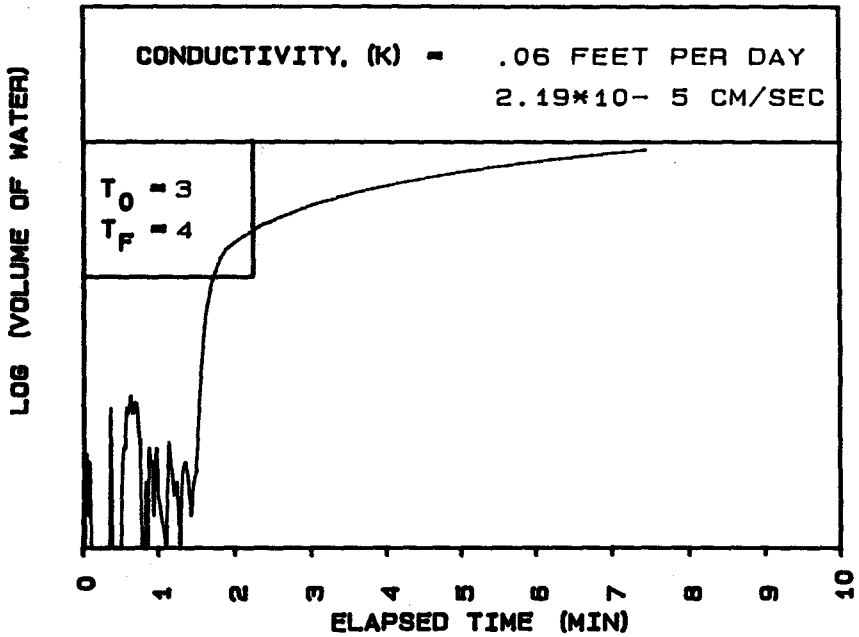
ENSAFE MEMPHIS NSA
LOCATION... 09H1246
TEST DATE
17: 44: 45 12-02-1995

SAMPLE DEPTH (FT) 46
GROUNDWATER DEPTH (FT) 16

HYDROCONE TEST



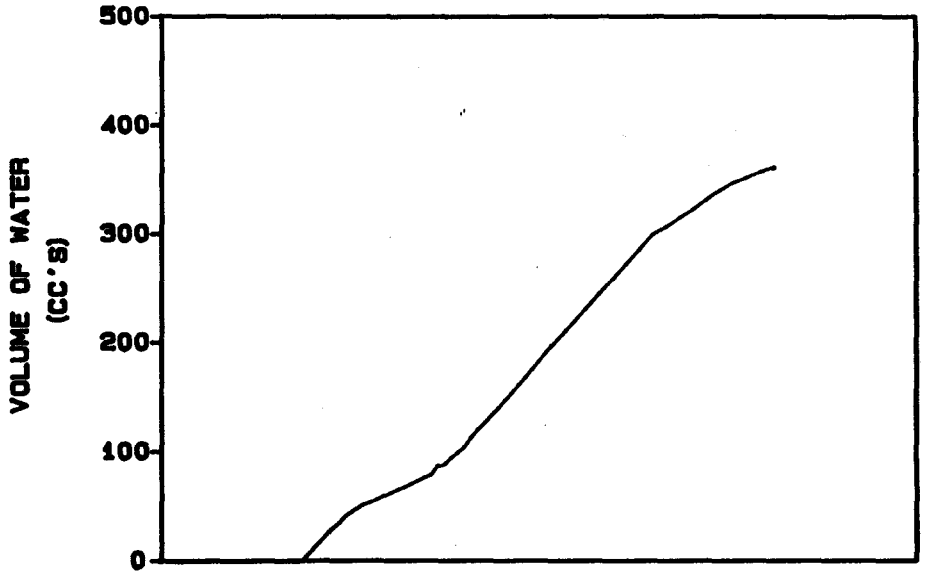


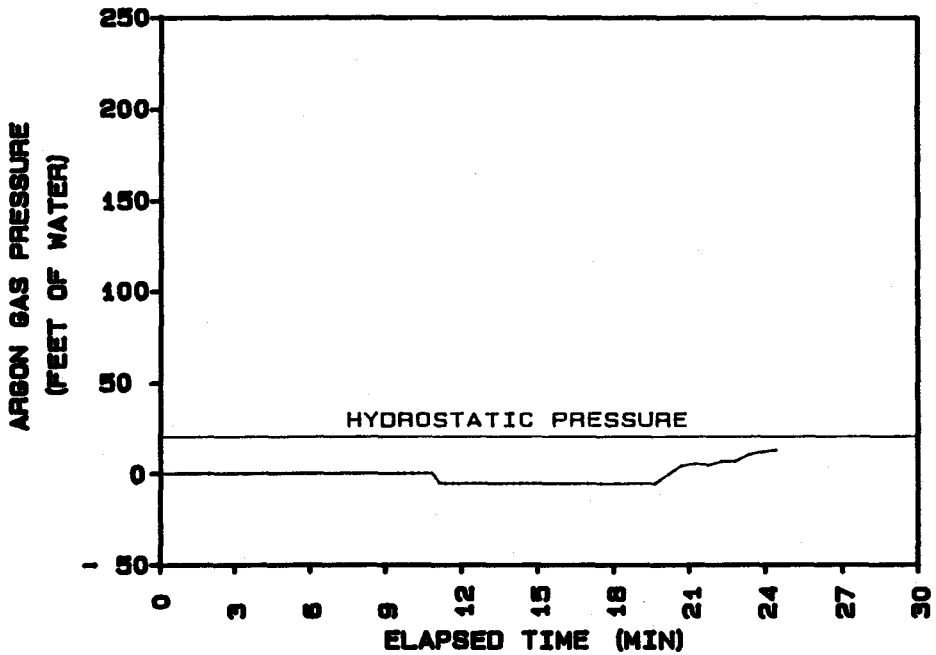


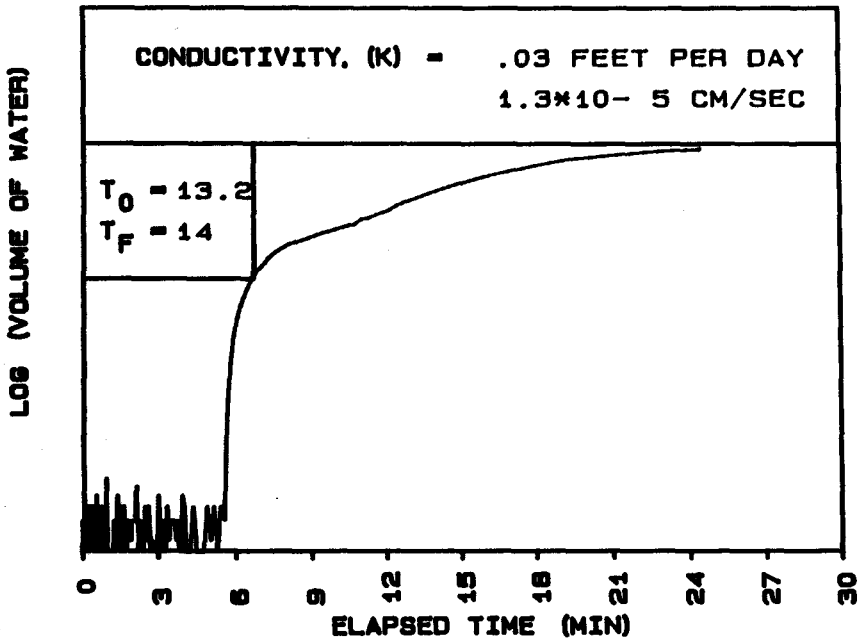
ENSAFE MEMPHIS NSA
LOCATION... 09H1348
TEST DATE
18: 44: 13 12-02-1995

SAMPLE DEPTH (FT) 48
GROUNDWATER DEPTH (FT) 16

HYDROCONE TEST



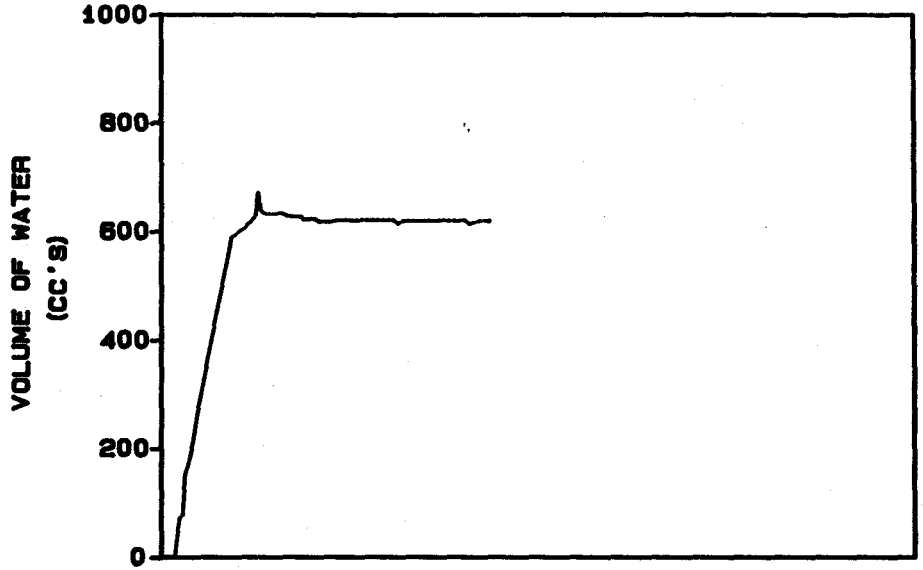


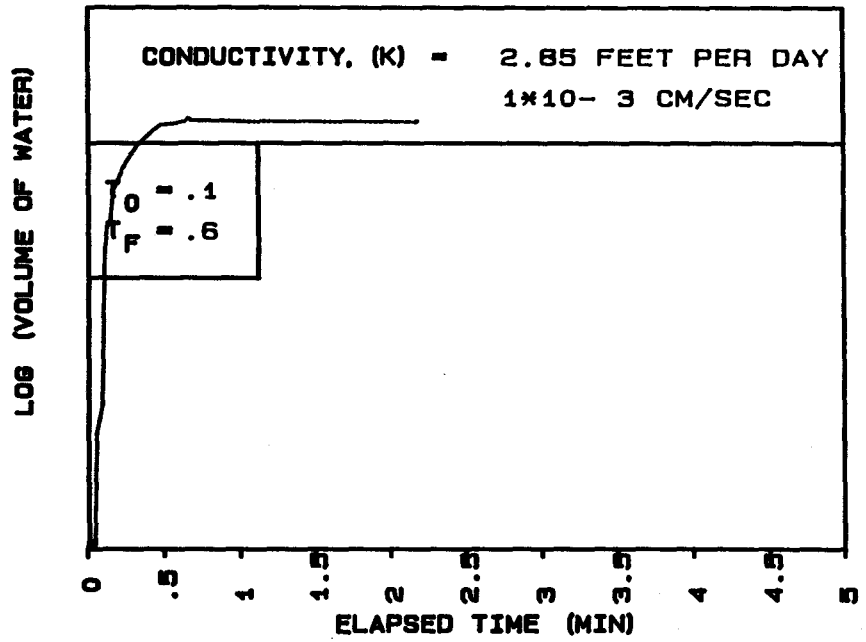


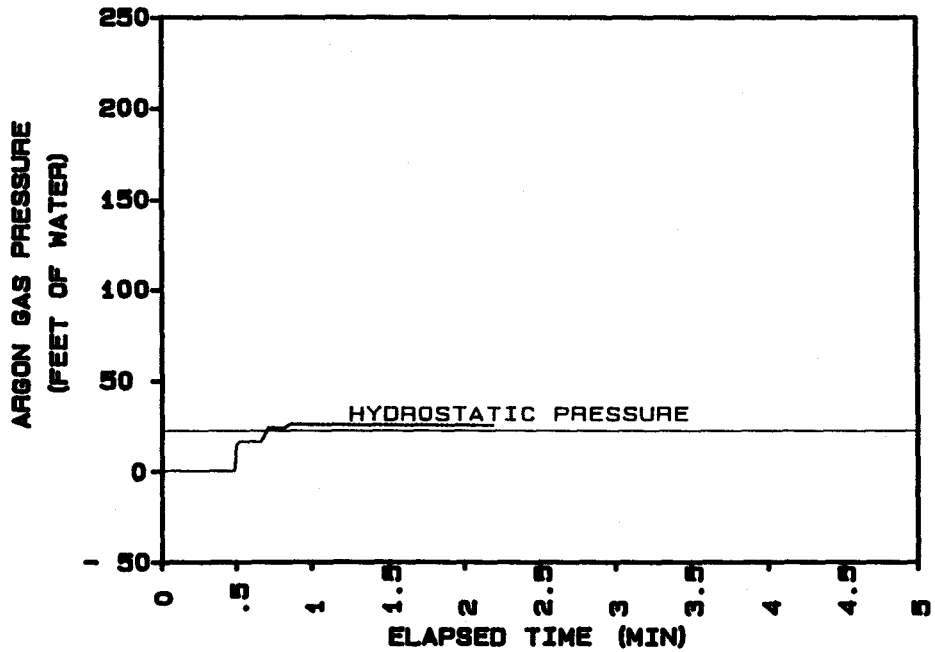
ENSAFE MEMPHIS NSA
LOCATION... 09H1445
TEST DATE
18: 12: 04 11-27-1995

SAMPLE DEPTH (FT) 45
GROUNDWATER DEPTH (FT) 25

HYDROCONE TEST



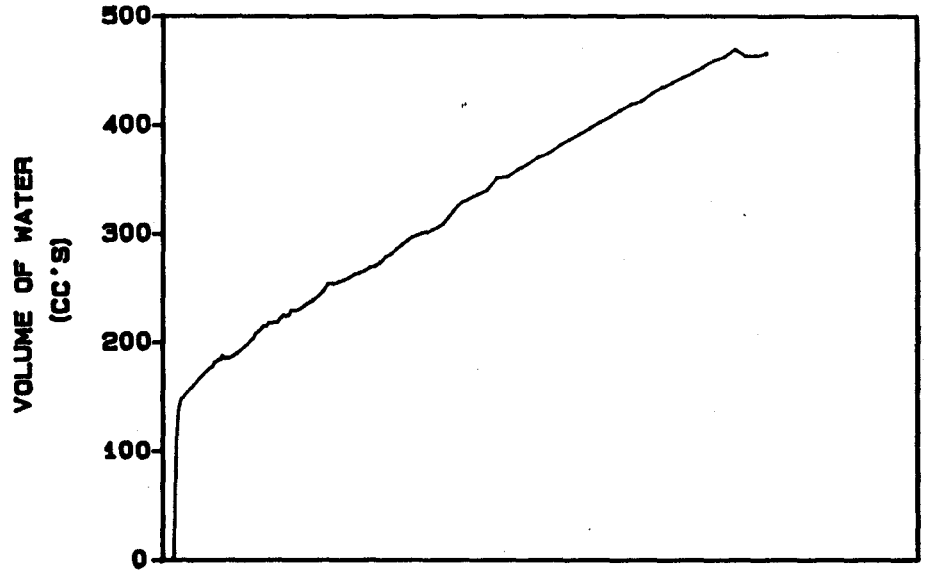


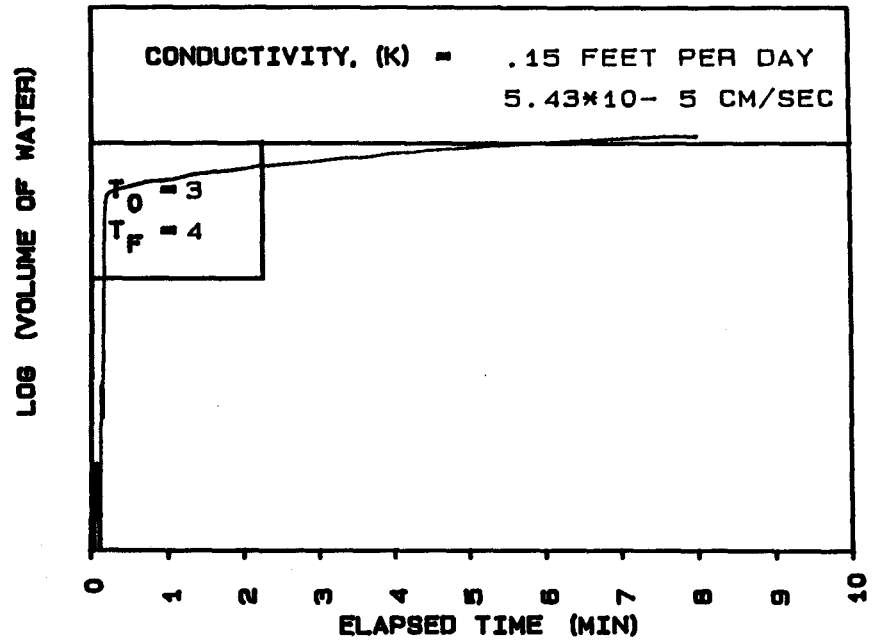


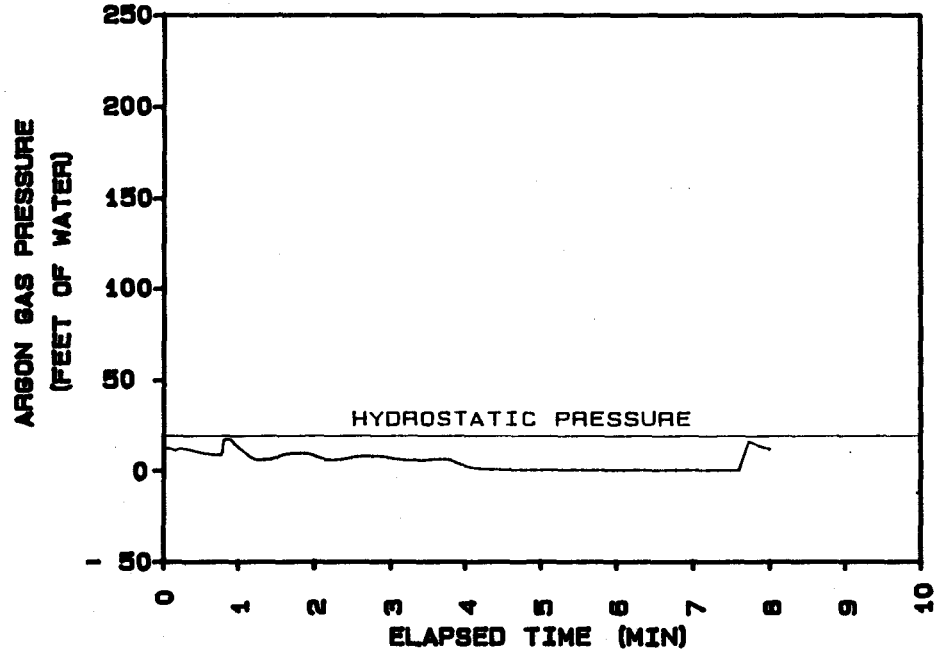
ENSAFE MEMPHIS NSA
LOCATION... 09H1547
TEST DATE
10: 49: 26 11-28-1995

SAMPLE DEPTH (FT) 47
GROUNDWATER DEPTH (FT) 25

HYDROCONE TEST



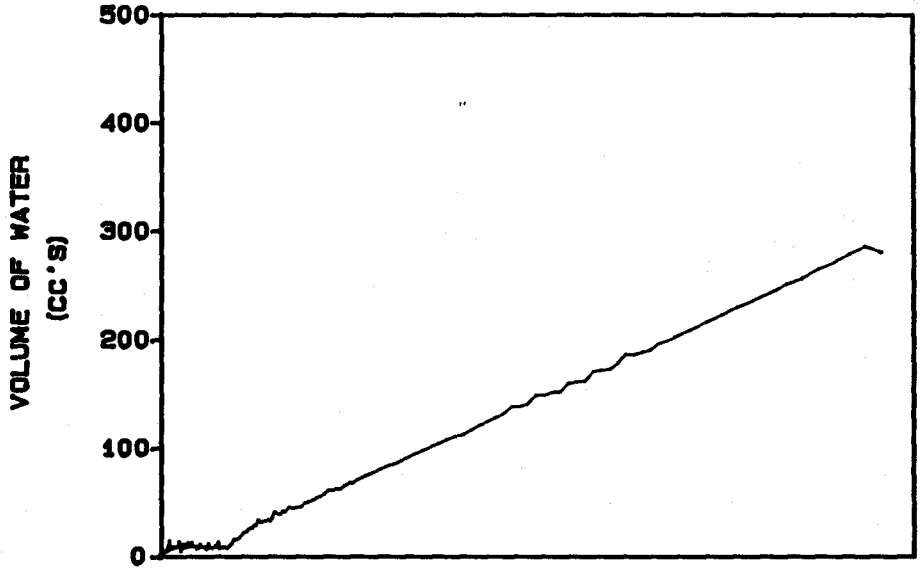


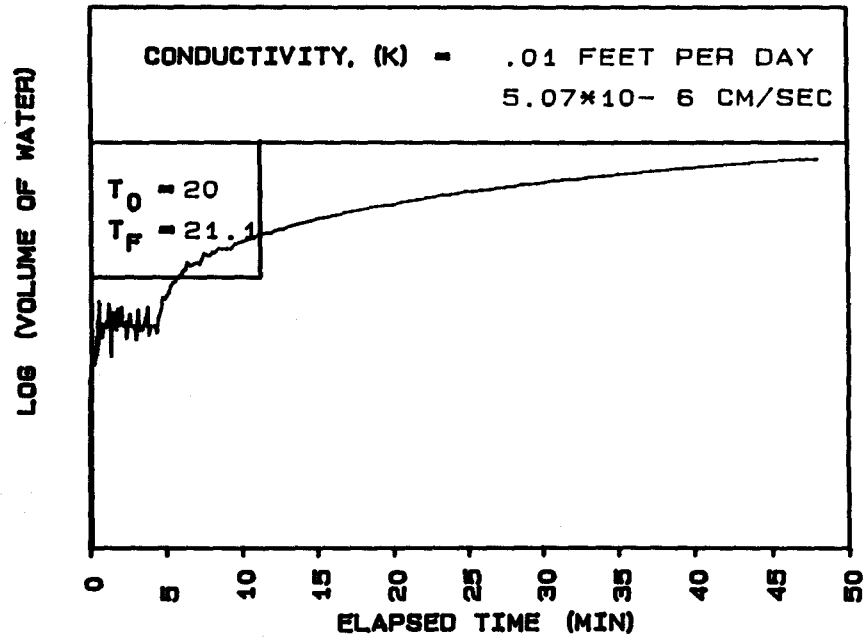


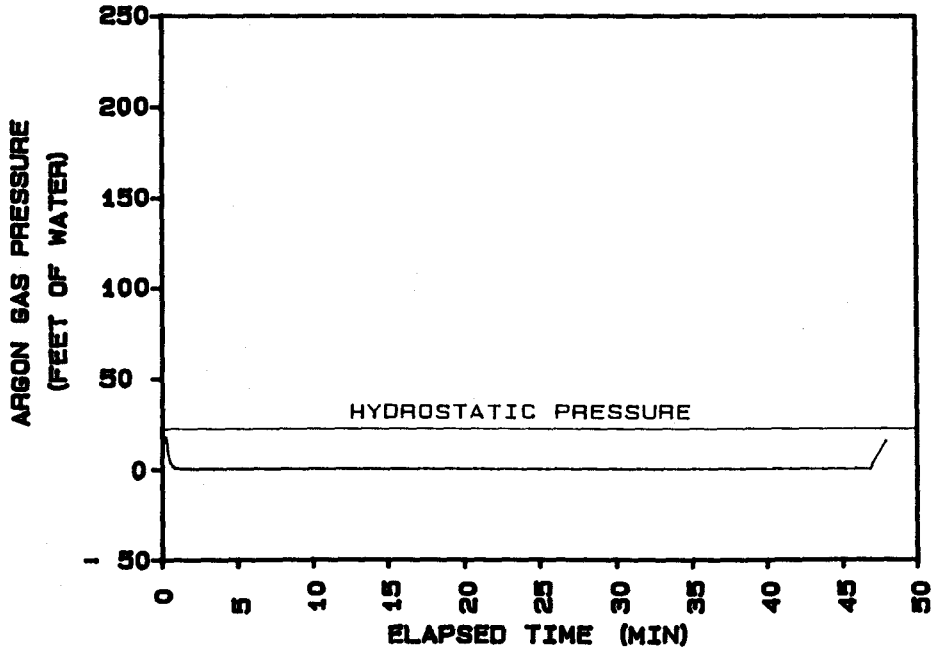
ENSAFE MEMPHIS NSA
LOCATION... 09H1644
TEST DATE
14: 51: 31 11-29-1995

SAMPLE DEPTH (FT) 44
GROUNDWATER DEPTH (FT) 25

HYDROCONE TEST



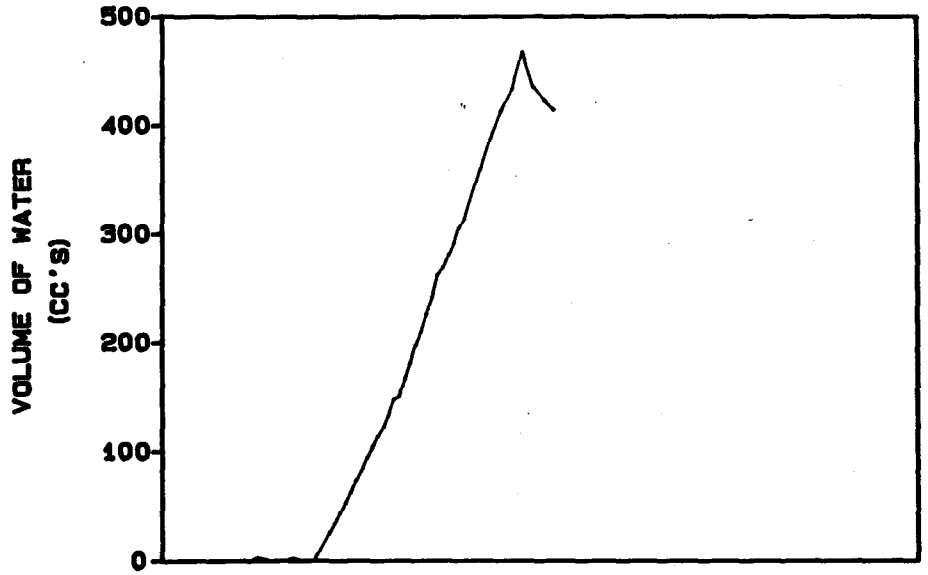


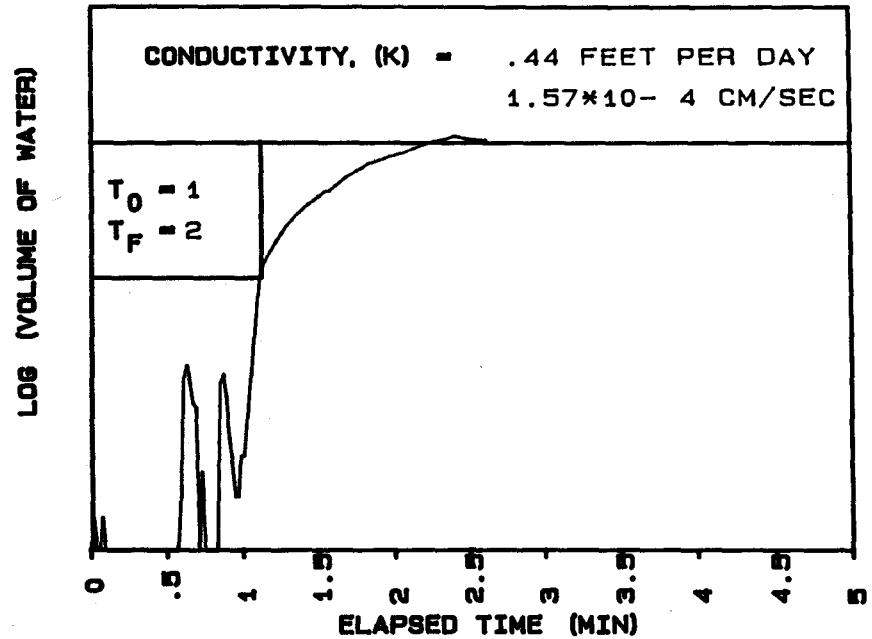


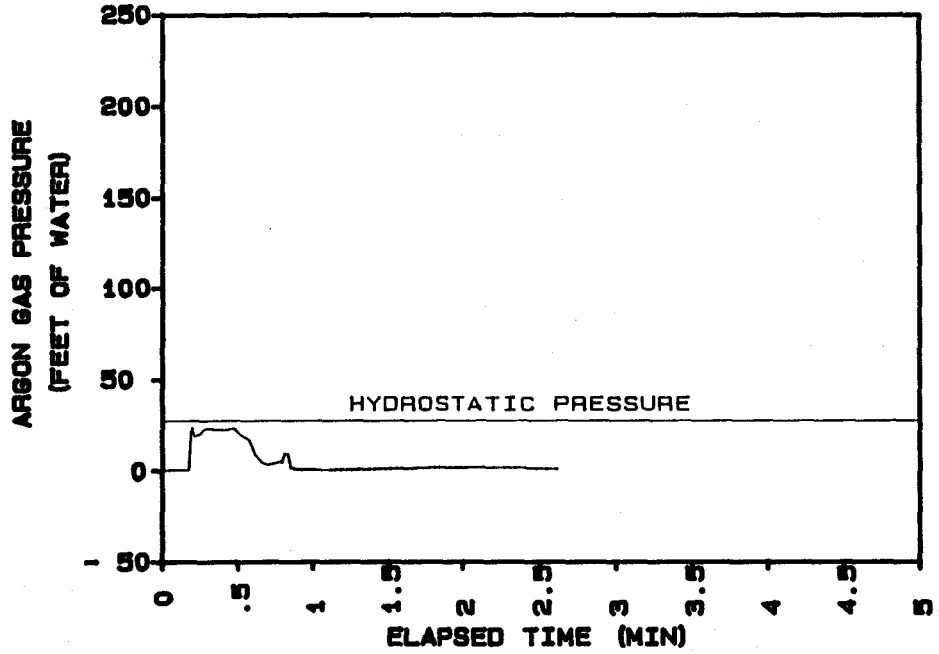
ENSAFE MEMPHIS NSA
LOCATION... 09H1747
TEST DATE
17: 19: 10 11-29-1995

SAMPLE DEPTH (FT) 47
GROUNDWATER DEPTH (FT) 25

HYDROCONE TEST







ENSAFE MEMPHIS NSA
LOCATION... 09H1852
TEST DATE
20: 17: 48 11-29-1995

SAMPLE DEPTH (FT) 52
GROUNDWATER DEPTH (FT) 25

HYDROCONE TEST

VOLUME OF WATER (CC'S)

DATA NOT AVAILABLE

LOG (VOLUME OF WATER)

CONDUCTIVITY, (K) =

T_O =
T_F =

DATA NOT AVAILABLE

ELAPSED TIME (MIN)

ARGON GAS PRESSURE (FEET OF WATER)

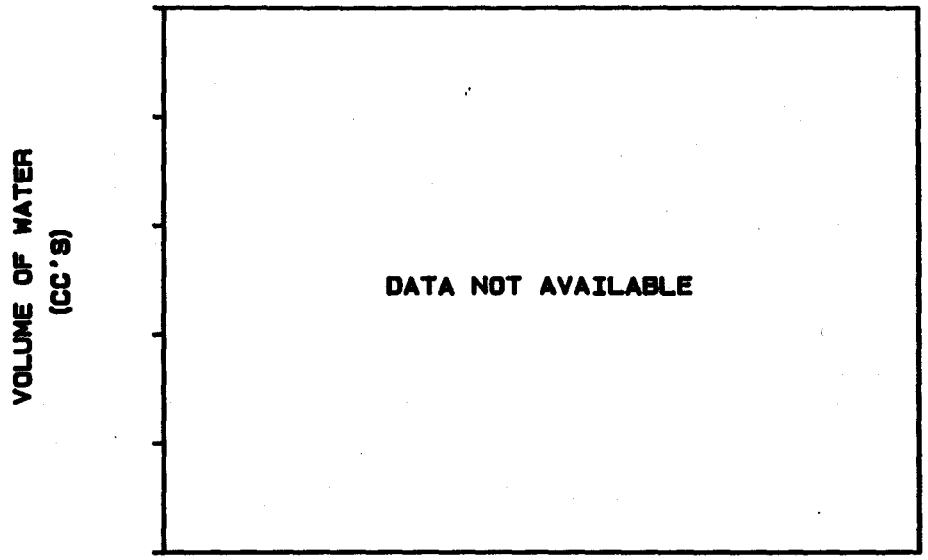
DATA NOT AVAILABLE

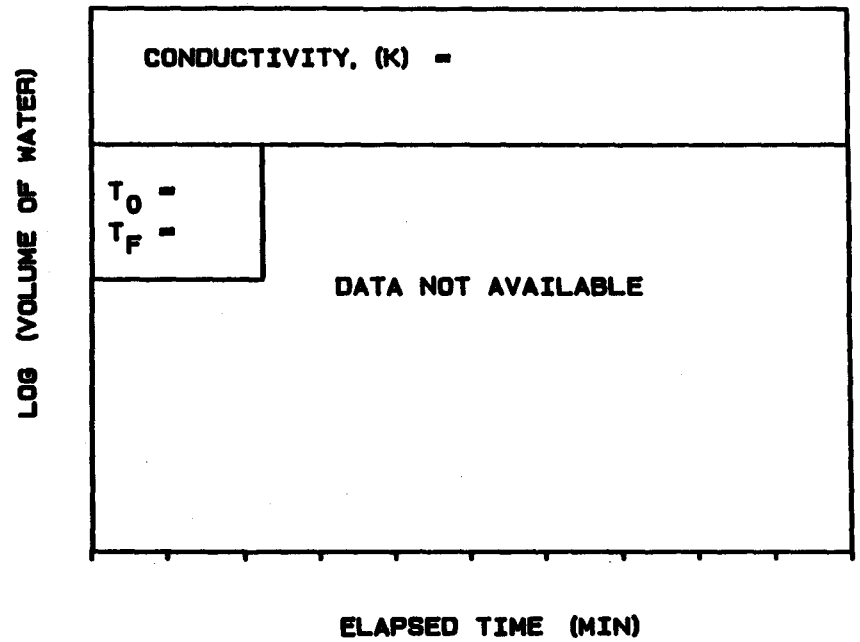
ELAPSED TIME (MIN)

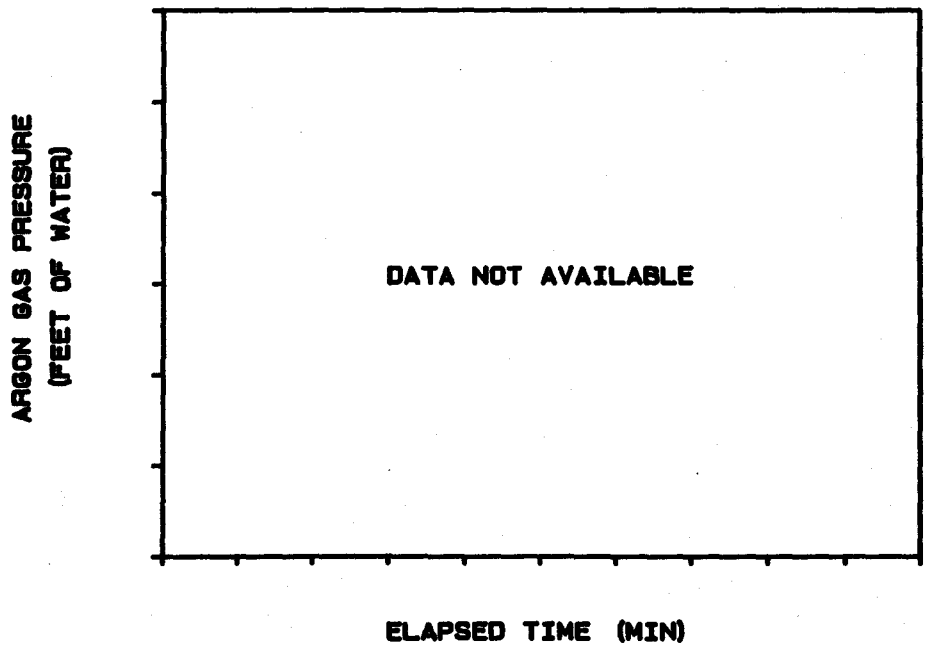
ENSAFE MEMPHIS NSA
LOCATION... 09H1946

DATA NOT AVAILABLE

HYDROCONE TEST



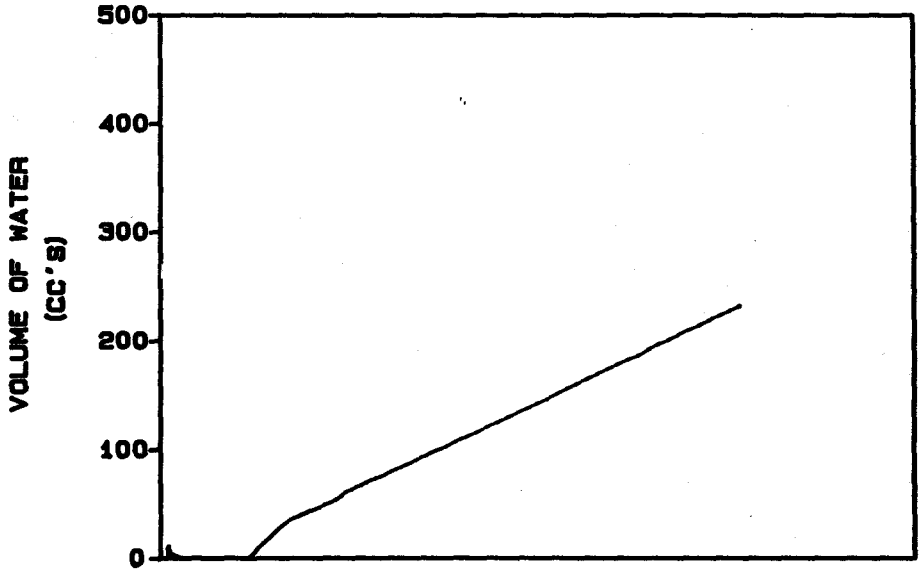


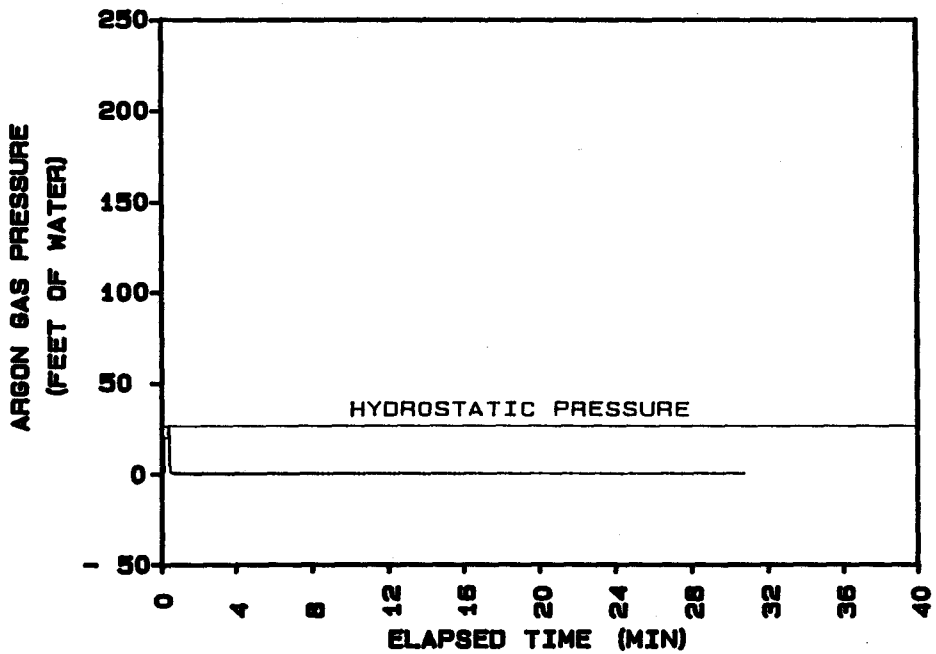


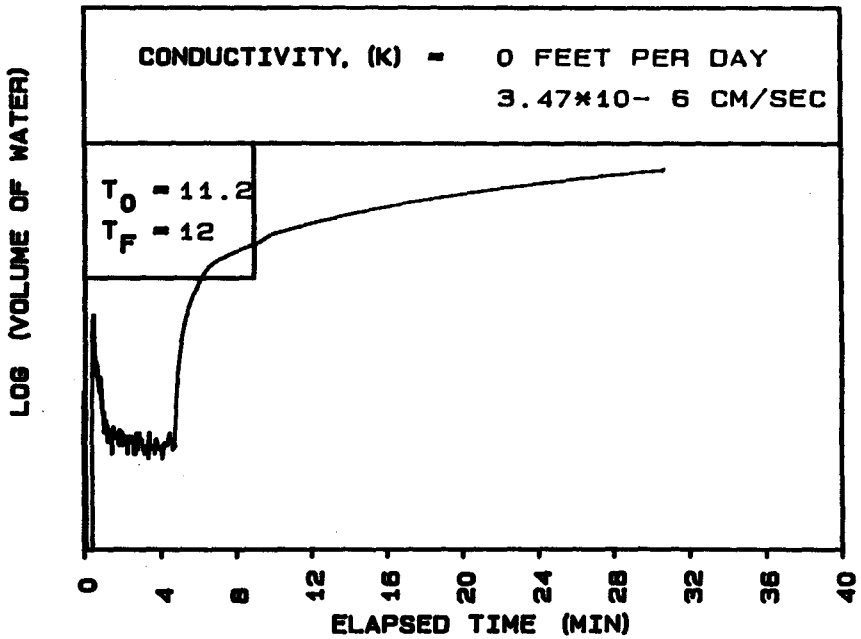
ENSAFE MEMPHIS NSA
LOCATION... 09H2052

DATA NOT AVAILABLE

HYDROCONE TEST



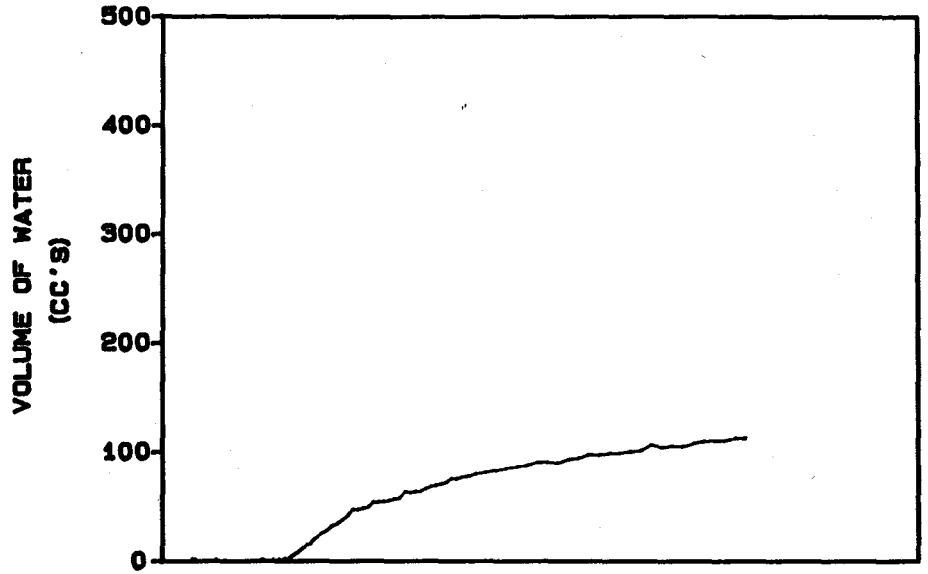


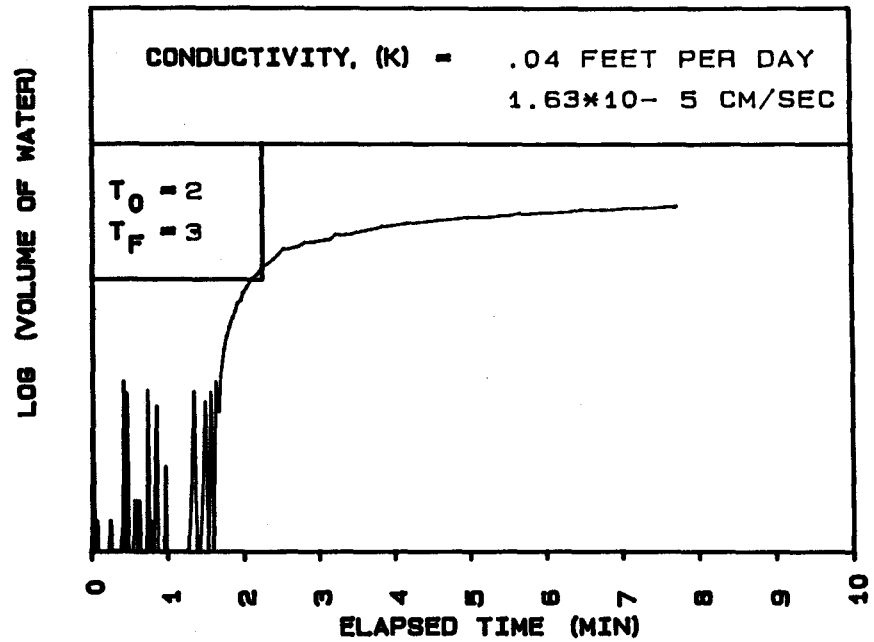


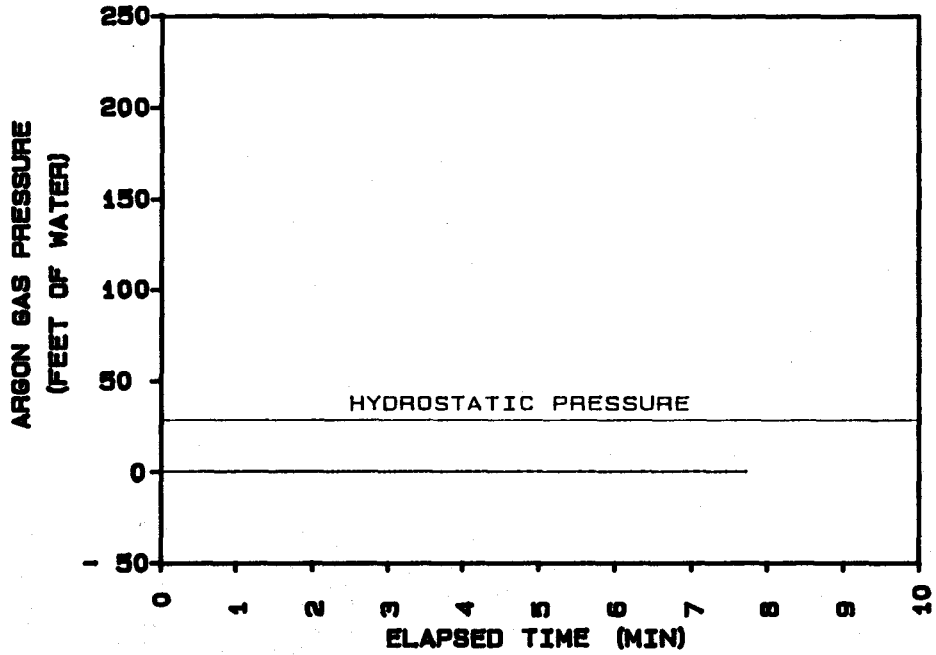
ENSAFE MEMPHIS NSA
LOCATION... 09H2142
TEST DATE
18: 30: 33 11-30-1995

SAMPLE DEPTH (FT) 42
GROUNDWATER DEPTH (FT) 18

HYDROCONE TEST



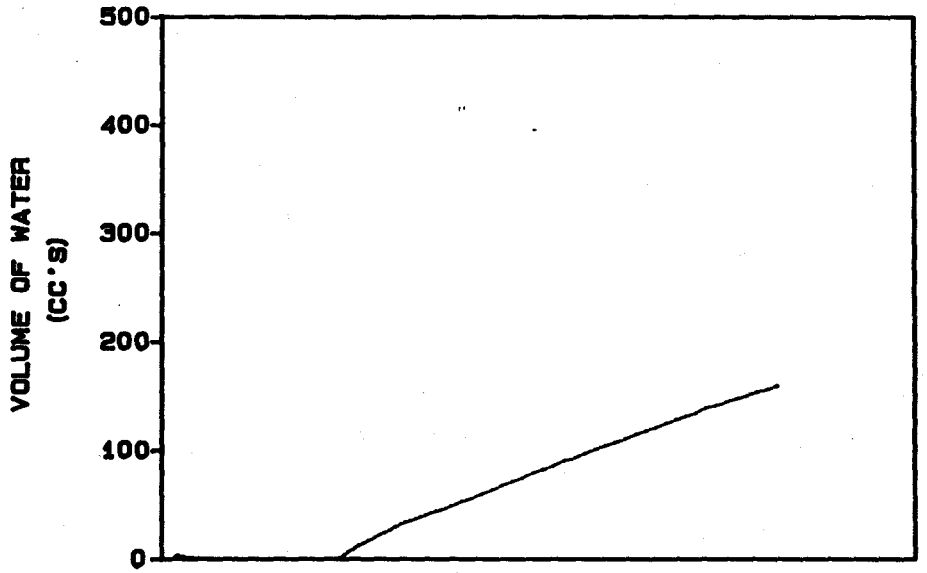


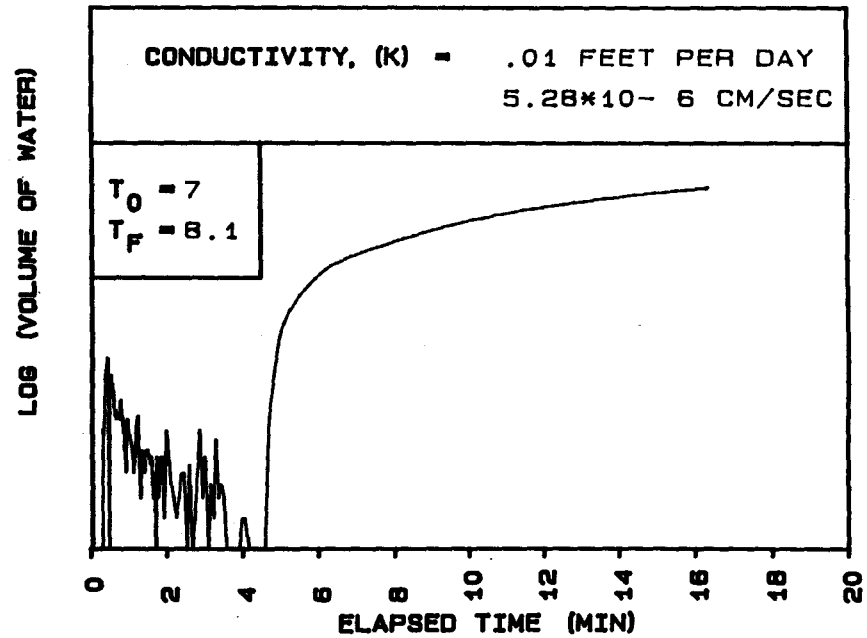


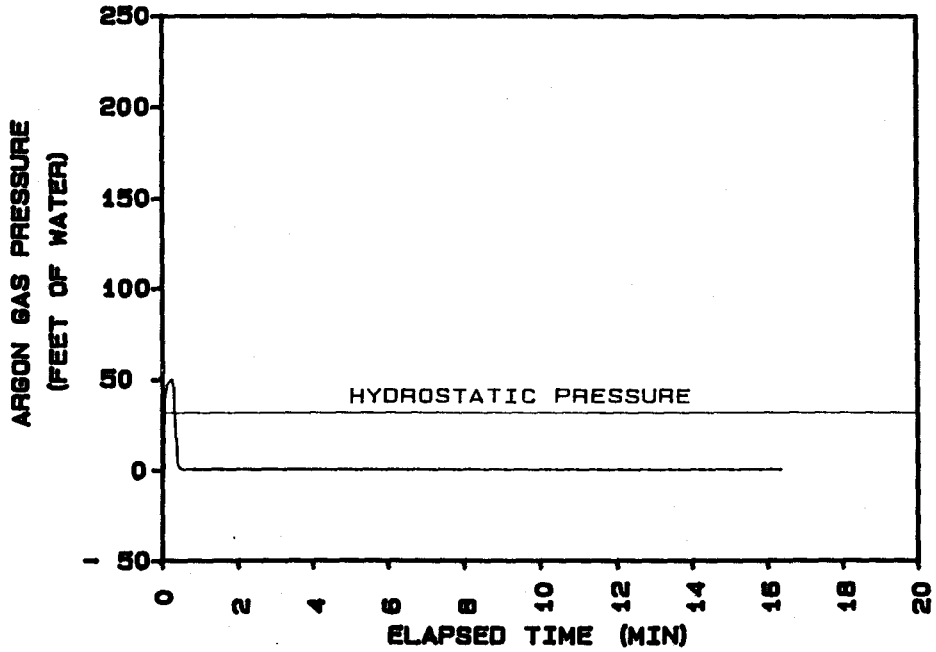
ENSAFE MEMPHIS NSA
LOCATION... 09H2244
TEST DATE
15: 01: 42 12-01-1995

SAMPLE DEPTH (FT) 44
GROUNDWATER DEPTH (FT) 16

HYDROCONE TEST







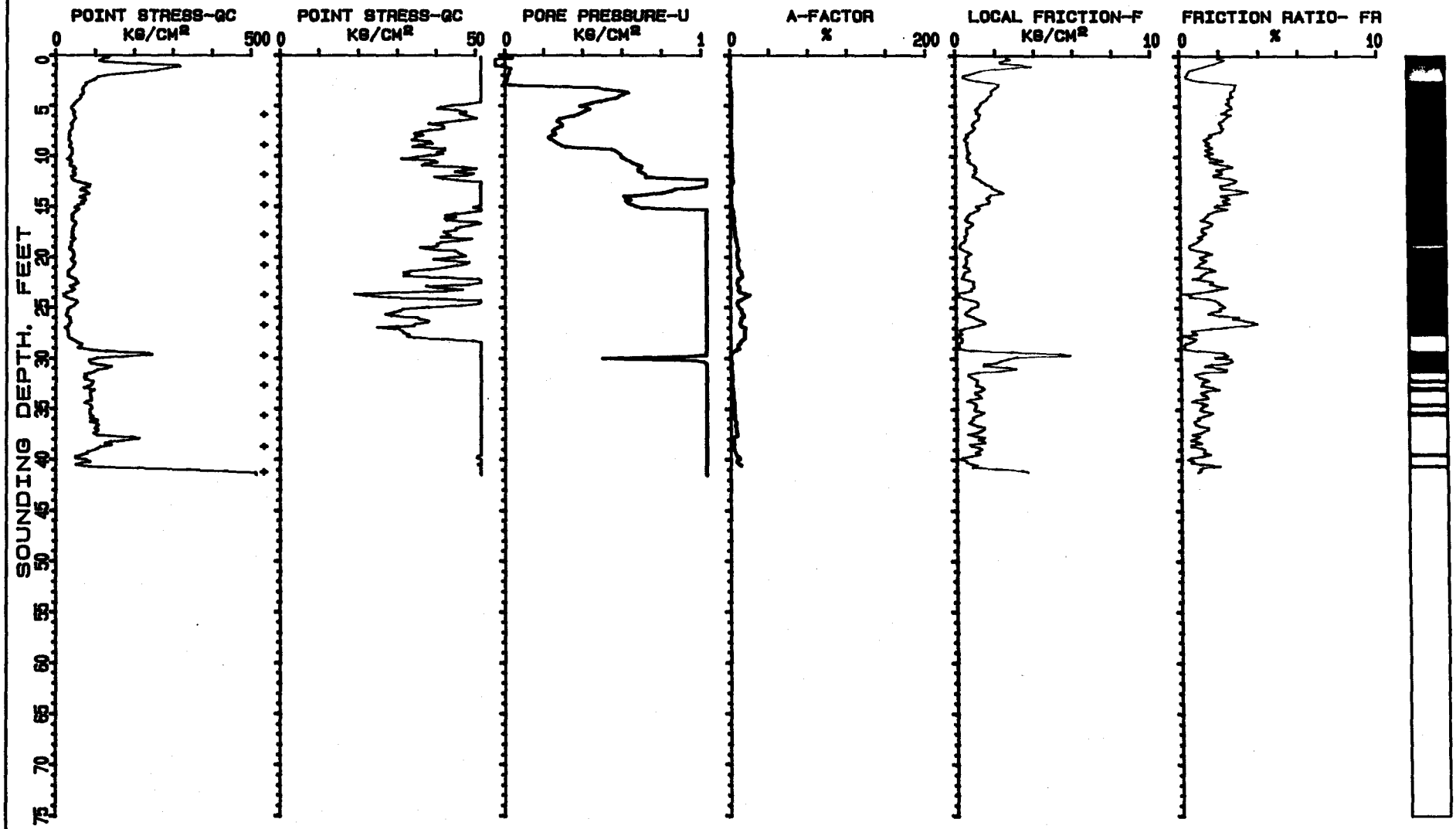
ENSAFE MEMPHIS NSA
LOCATION... 09H2347
TEST DATE
17: 35: 56 12-01-1995

SAMPLE DEPTH (FT) 47
GROUNDWATER DEPTH (FT) 16

SWMU 14

DPT SCREENING INVESTIGATION RESULTS

PIEZOCONE SOUNDING



* PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
SOUNDING # 14-P05
TEST DATE 11-07-1995 16: 06: 55

IN-SITU TECHNOLOGY SOIL BEHAVIOR TABLE
FOR SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
FILE NAME..... 14-P05

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N' #	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%) *	FRICTION ANGLE (DEGREES) **	YOUNGS MODULUS (KG/CM2) ***	UNDRAINED SHEAR STRENGTH (KG/CM2) ****	SENSITIVITY	COMP.	OCR
1	SILTY FINE SAND	175.2	2.9	43	43	.03	>90%	>48	385	--	--	--	--
2	DENSE OR CEMENTED S.	246	1.23	41	41	.067	>90%	>48	541	--	--	--	--
3	SILTY FINE SAND	96.1	1.38	24	24	.098	80%-90%	>48	211	--	--	--	--
4	CLAYEY FINE SAND	70.2	1.8	28	28	.128	70%-80%	>48	154	--	--	--	--
5	CLAYEY FINE SAND	57.1	1.35	22	22	.159	60%-70%	46-48	125	--	--	--	--
6	CLAYEY FINE SAND	44.4	1.07	17	17	.19	60%-70%	44-46	97	--	--	--	--
7	CLAYEY FINE SAND	44.2	.9	17	17	.221	60%-70%	42-44	97	--	--	--	--
8	CLAYEY FINE SAND	38.5	.68	15	15	.251	50%-60%	42-44	84	--	--	--	--
9	SILTY TO CLAYEY F.S.	36	.49	12	12	.282	50%-60%	42-44	79	--	--	--	--
10	SILTY TO CLAYEY F.S.	39.1	.56	13	13	.313	50%-60%	40-42	86	--	--	--	--
11	CLAYEY FINE SAND	36.7	.77	14	14	.344	50%-60%	40-42	80	--	--	--	--
12	SILTY TO CLAYEY F.S.	45.9	.92	15	15	.375	50%-60%	40-42	100	--	--	--	--
13	CLAYEY FINE SAND	55.9	1.42	22	22	.405	60%-70%	42-44	122	--	--	--	--
14	SILTY TO CLAYEY F.S.	77	1.9	25	25	.436	70%-80%	42-44	169	--	--	--	--
15	SILTY TO CLAYEY F.S.	67.8	1.41	22	22	.467	60%-70%	42-44	149	--	--	--	--
16	SILTY TO CLAYEY F.S.	50.4	.79	16	16	.498	50%-60%	40-42	110	--	--	--	--
17	SILTY TO CLAYEY F.S.	46	.62	15	15	.528	40%-50%	40-42	101	--	--	--	--
18	SILTY TO CLAYEY F.S.	44.6	.47	14	14	.559	40%-50%	38-40	98	--	--	--	--
19	SILTY TO CLAYEY F.S.	42.9	.3	14	14	.59	40%-50%	38-40	94	--	--	--	--
20	SILTY TO CLAYEY F.S.	42.4	.47	14	14	.621	40%-50%	38-40	93	--	--	--	--
21	SILTY TO CLAYEY F.S.	44.6	.49	14	14	.651	40%-50%	38-40	98	--	--	--	--
22	SILTY TO CLAYEY F.S.	35	.4	11	11	.682	<40%	36-38	77	--	--	--	--
23	SILTY TO CLAYEY F.S.	44.9	.72	14	14	.713	40%-50%	38-40	98	--	--	--	--
24	SILTY TO CLAYEY F.S.	32.1	.31	10	10	.744	<40%	36-38	70	--	--	--	--
25	CLAYEY FINE SAND	44.4	.89	17	17	.775	<40%	38-40	97	--	--	--	--
26	CLAYEY FINE SAND	31.2	.69	12	12	.805	<40%	36-38	68	--	--	--	--
27	CLAYEY FINE SAND	34.1	.91	13	13	.836	<40%	36-38	75	--	--	--	--
28	SILTY FINE SAND	31	0	7	7	.867	<40%	34-36	68	--	--	--	--
29	SILTY FINE SAND	51.9	0	12	12	.898	<40%	38-40	114	--	--	--	--
30	SILTY TO CLAYEY F.S.	148.4	3.21	49	49	.928	70%-80%	42-44	326	--	--	--	--

14-P05 CONTINUED ENSAFE

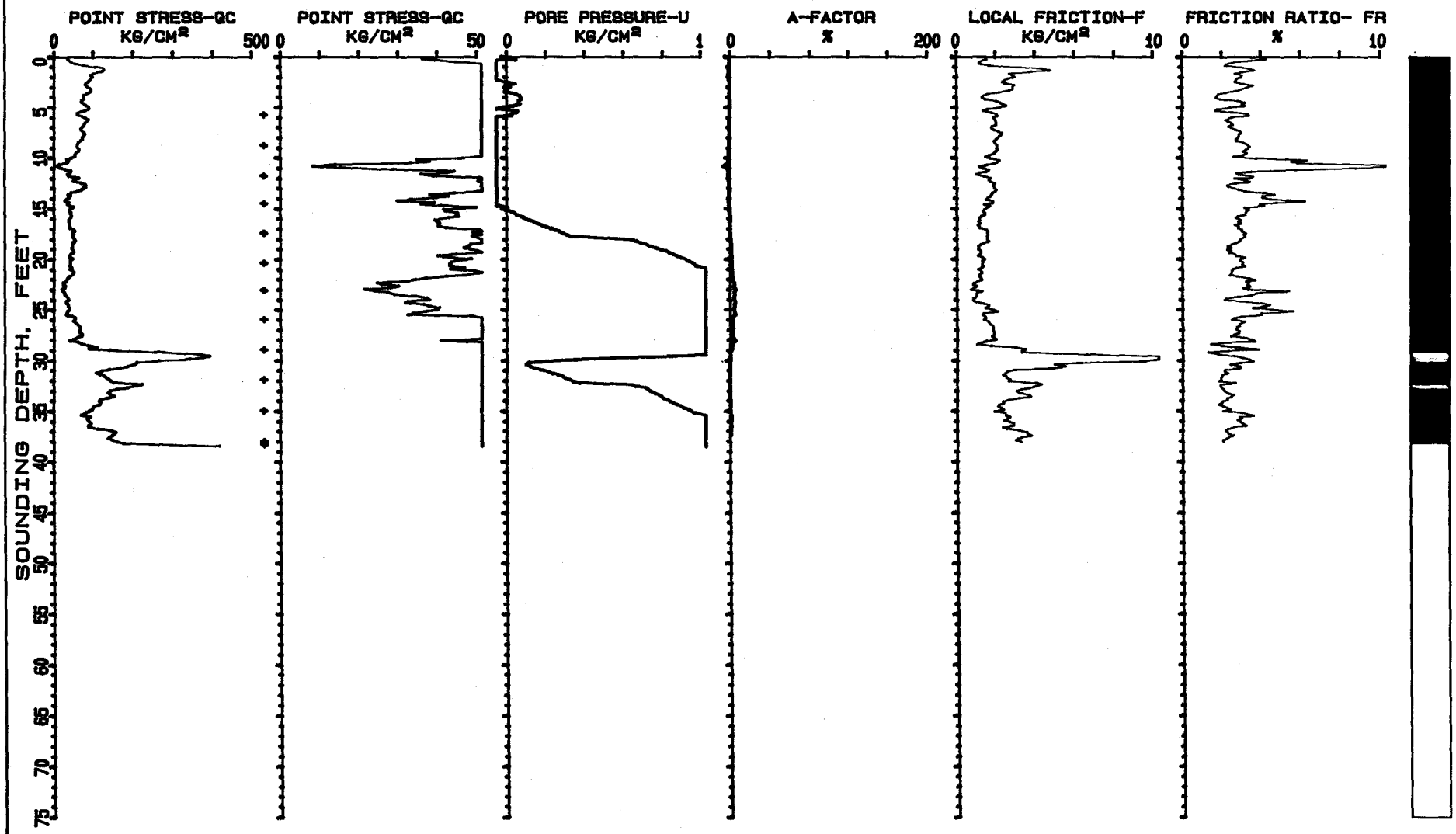
DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	SENSITIVITY	COMP.	OCR
31	SILTY TO CLAYEY F.S.	107	2.12	35	35	.959	60%-70%	40-42	235	--	--	--	--
32	SILTY FINE SAND	92	1.01	23	23	.99	50%-60%	40-42	202	--	--	--	--
33	SILTY TO CLAYEY F.S.	82.8	1.12	27	27	1.021	50%-60%	40-42	182	--	--	--	--
34	SILTY FINE SAND	87.6	.92	21	21	1.051	50%-60%	40-42	192	--	--	--	--
35	SILTY FINE SAND	85.7	.82	21	21	1.082	50%-60%	38-40	188	--	--	--	--
36	SILTY FINE SAND	88.4	.96	22	22	1.113	50%-60%	38-40	194	--	--	--	--
37	SILTY FINE SAND	99.2	.99	24	24	1.144	50%-60%	40-42	218	--	--	--	--
38	FINE SAND	130.6	1.05	26	26	1.177	60%-70%	40-42	287	--	--	--	--
39	FINE SAND	144.5	1.04	28	28	1.21	60%-70%	40-42	317	--	--	--	--
40	SILTY FINE SAND	73.4	.57	18	18	1.241	40%-50%	38-40	161	--	--	--	--

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)
* NORMALLY CONSOLIDATED SANDS
** FOR OVERCONSOLIDATED SANDS,SLIGHTLY REDUCE ABOVE FRICTION ANGLES
*** FOR OVERCONSOLIDATED SANDS, YOUNG'S MODULUS MAY BE AS MUCH AS 3 TO 6 TIMES HIGHER
**** NK OF 16 USED. FOR OVERCONSOLIDATED CLAYS, AN NK OF 17 IS SUGGESTED

THE ABOVE DATA WAS COMPUTED FOLLOWING 'BASIC' GUIDELINES BY P. K. ROBERTSON AND R. G. CAMPANELLA IN THE HANDBOOK 'GUIDELINES FOR USE AND INTERPERTATION OF THE ELECTRONIC CONE PENETRATION TEST'

ADDITIONAL LOCAL CORRELATIONS DEVELOPED BY IN-SITU TECHNOLOGY HAVE ALSO BEEN USED IN COMPUTING THE ABOVE DATA. IT IS THE POLICY OF IN-SITU TECHNOLOGY TO CONTINUALLY UPGRADE AND MODIFY C.P.T CORRELATIONS AS PUBLISHED RESEARCH AND LOCAL EXPERIENCE GROWS.

PIEZOCONE SOUNDING



* PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
SOUNDING # 14-P06
TEST DATE 11-07-1995 17:29:26

IN-SITU TECHNOLOGY SOIL BEHAVIOR TABLE
FOR SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
FILE NAME..... 14-P06

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N' VALUES	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%)	FRICTION ANGLE (DEGREES)	YOUNGS MODULUS (KG/CM2)	UNDRAINED SHEAR STRENGTH (KG/CM2)	SENSITIVITY	COMP.	OCR
				#			*	**	***	****			
1	CLAYEY FINE SAND	63.7	2.28	25	25	.03	70%-80%	>48	140	--	--	--	--
2	CLAYEY FINE SAND	112	3.46	44	44	.061	>90%	>48	246	--	--	--	--
3	CLAYEY FINE SAND	89.8	2.68	35	35	.092	80%-90%	>48	197	--	--	--	--
4	SILTY TO CLAYEY F.S.	89.4	2.02	29	29	.123	70%-80%	>48	196	--	--	--	--
5	SILTY TO CLAYEY F.S.	78	1.97	26	26	.153	70%-80%	46-48	171	--	--	--	--
6	SILTY TO CLAYEY F.S.	75.6	1.81	25	25	.184	70%-80%	46-48	166	--	--	--	--
7	SILTY TO CLAYEY F.S.	81.7	1.96	27	27	.215	70%-80%	46-48	179	--	--	--	--
8	CLAYEY FINE SAND	75.8	2.12	30	30	.246	70%-80%	44-46	166	--	--	--	--
9	CLAYEY FINE SAND	68.3	2.06	27	27	.276	70%-80%	44-46	150	--	--	--	--
10	CLAYEY FINE SAND	61	1.84	24	24	.307	60%-70%	42-44	134	--	--	--	--
11	CLAY	31	1.71	31	31	.332	--	--	--	1.89	1.8	UD	--
12	SANDY CLAY	40.3	1.49	20	20	.359	--	--	--	2.47	2.6	.01	>6
13	CLAYEY FINE SAND	69.3	1.88	27	27	.39	60%-70%	42-44	152	--	--	--	--
14	CLAYEY FINE SAND	53.8	1.78	21	21	.421	60%-70%	42-44	118	--	--	--	--
15	SILTY CLAY TO CLAY	38.4	1.62	25	25	.448	--	--	--	2.34	2.3	UD	>6
16	CLAYEY FINE SAND	44.6	1.32	17	17	.479	50%-60%	40-42	98	--	--	--	--
17	CLAYEY FINE SAND	40.8	1.2	16	16	.51	40%-50%	38-40	89	--	--	--	--
18	CLAYEY FINE SAND	49.3	1.57	19	19	.541	40%-50%	40-42	108	--	--	--	--
19	CLAYEY FINE SAND	50.3	1.3	20	20	.571	40%-50%	40-42	110	--	--	--	--
20	CLAYEY FINE SAND	46.5	1.25	18	18	.602	40%-50%	38-40	102	--	--	--	--
21	CLAYEY FINE SAND	44.8	1.28	17	17	.633	40%-50%	38-40	98	--	--	--	--
22	CLAYEY FINE SAND	43.8	1.19	17	17	.664	40%-50%	38-40	96	--	--	--	--
23	SANDY CLAY	28.2	.95	14	14	.691	--	--	--	1.67	2.9	.02	6
24	SANDY CLAY	30.3	.99	15	15	.718	--	--	--	1.8	3	.01	6
25	SILTY CLAY TO CLAY	36.8	1.53	24	24	.746	--	--	--	2.2	2.4	UD	6
26	SANDY CLAY	43.5	1.53	21	21	.773	--	--	--	2.62	2.8	.01	6
27	CLAYEY FINE SAND	61.1	1.79	24	24	.804	40%-50%	38-40	134	--	--	--	--
28	CLAYEY FINE SAND	66.5	1.84	26	26	.835	40%-50%	38-40	146	--	--	--	--
29	CLAYEY FINE SAND	74.8	2.19	29	29	.865	50%-60%	40-42	164	--	--	--	--
30	DENSE CLAYEY F. S.	281.6	8.01	140									
					140	.899	>90%	44-46	619	--	--	--	--

14-P06 CONTINUED ENSAFE

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	SENSITIVITY	COMP.	OCR
31	SILTY TO CLAYEY F.S.	218.4	5.26	72	72	.929	>90%	44-46	480	--	--	--	--
32	SILTY TO CLAYEY F.S.	127.3	2.56	42	42	.96	60%-70%	42-44	280	--	--	--	--
33	SILTY TO CLAYEY F.S.	170.6	3.54	56	56	.991	70%-80%	42-44	375	--	--	--	--
34	SILTY TO CLAYEY F.S.	136.6	3.05	45	45	1.022	70%-80%	42-44	300	--	--	--	--
35	SILTY TO CLAYEY F.S.	107.8	2.25	35	35	1.052	60%-70%	40-42	237	--	--	--	--
36	CLAYEY FINE SAND	86.1	2.56	34	34	1.083	50%-60%	38-40	189	--	--	--	--
37	CLAYEY FINE SAND	102.2	2.88	40	40	1.114	50%-60%	40-42	224	--	--	--	--
38	SILTY TO CLAYEY F.S.	148.4	3.41	49	49	1.145	70%-80%	42-44	326	--	--	--	--

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)
* NORMALLY CONSOLIDATED SANDS
** FOR OVERCONSOLIDATED SANDS,SLIGHTLY REDUCE ABOVE FRICTION ANGLES
*** FOR OVERCONSOLIDATED SANDS, YOUNG'S MODULUS MAY BE AS MUCH AS 3 TO 6 TIMES HIGHER
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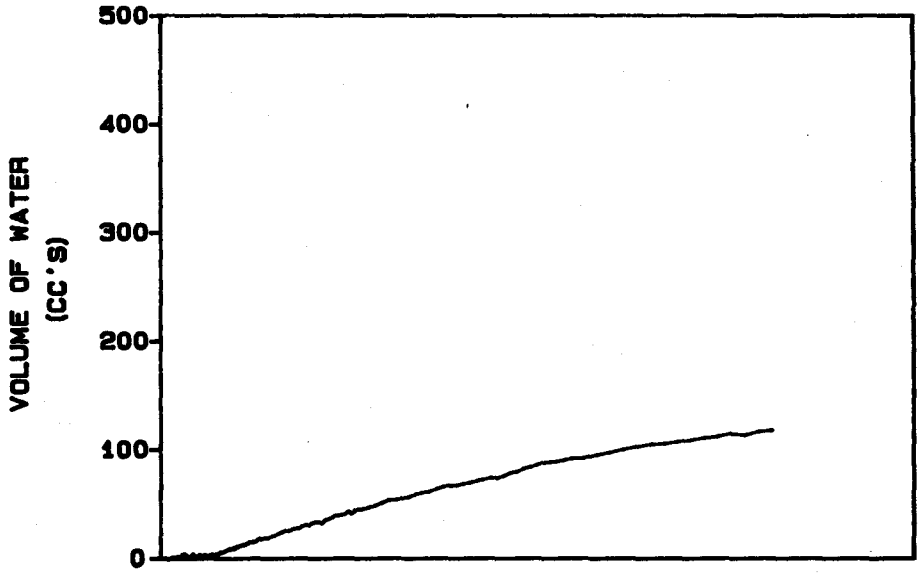
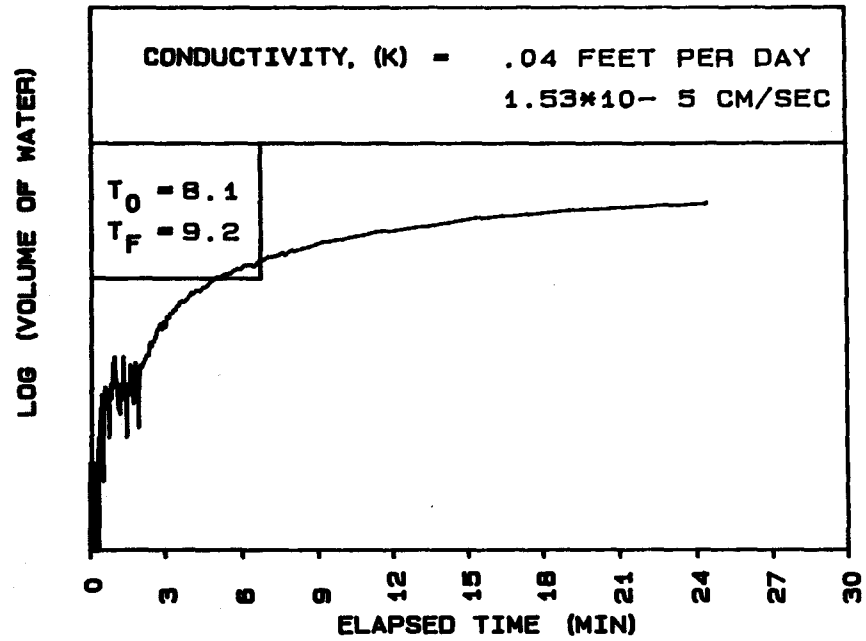
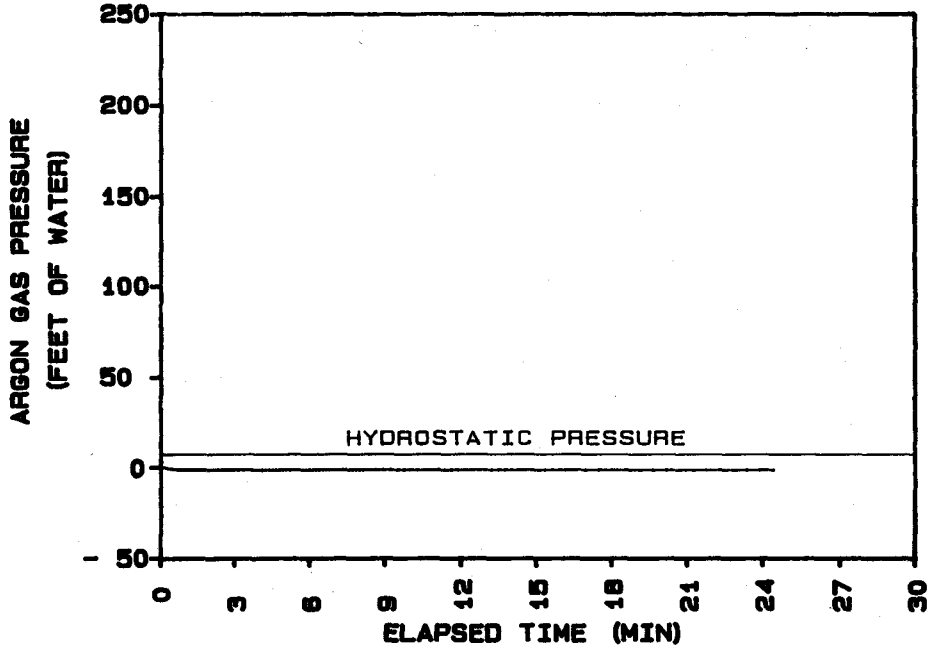
HYDROCONE TEST



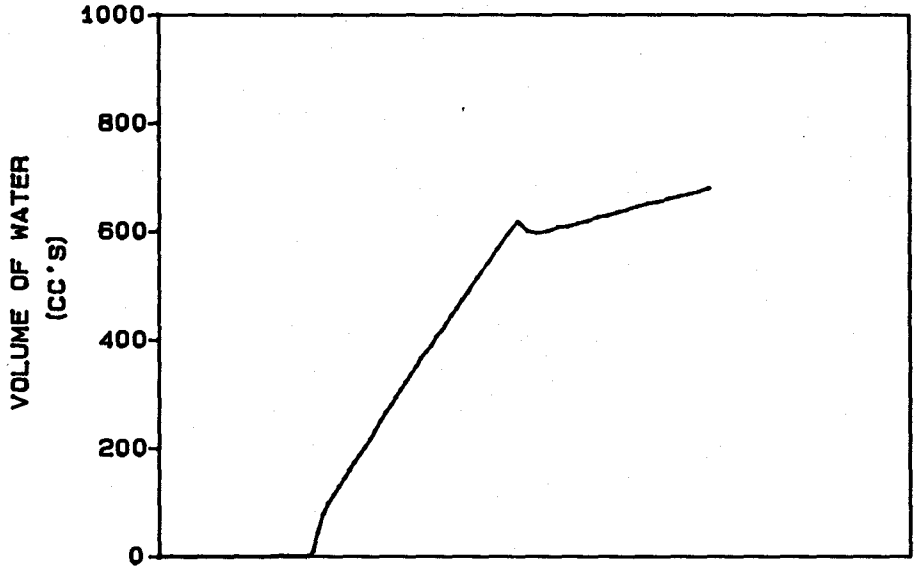


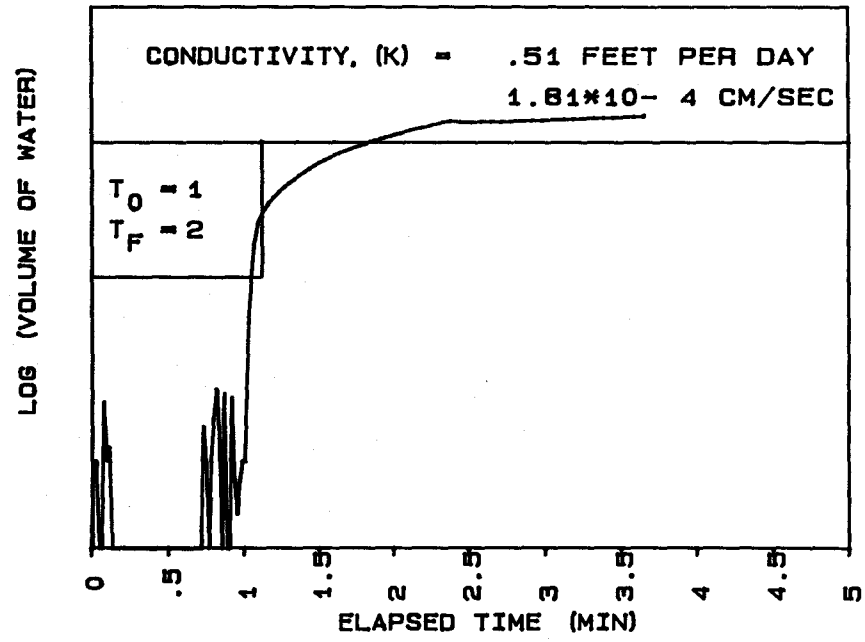


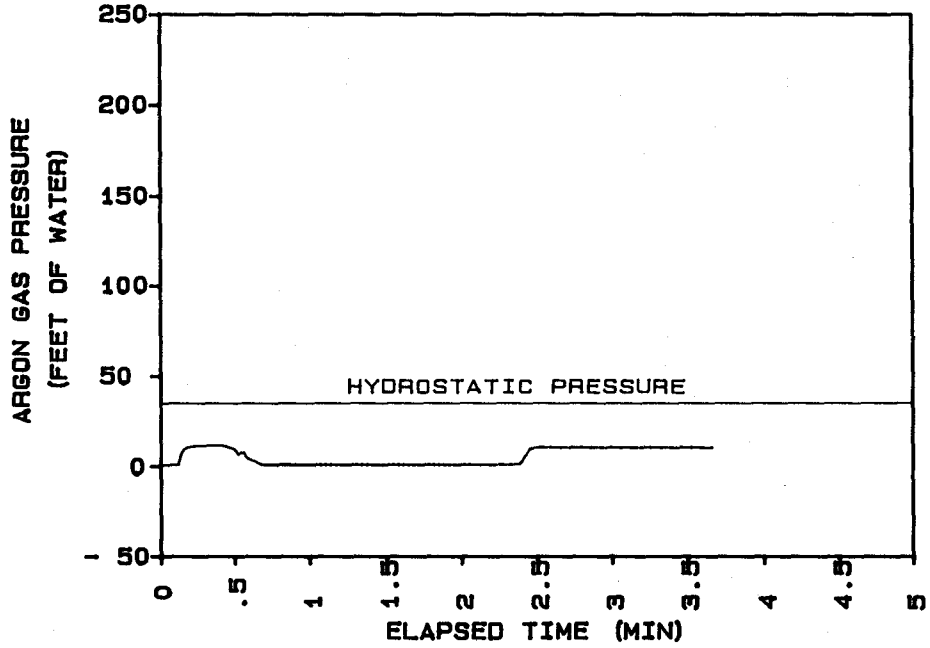
ENSAFE MEMPHIS NSA
LOCATION... 14H0512
TEST DATE
14: 49: 58 11-13-1995

SAMPLE DEPTH (FT) 12
GROUNDWATER DEPTH (FT) 5

HYDROCONE TEST



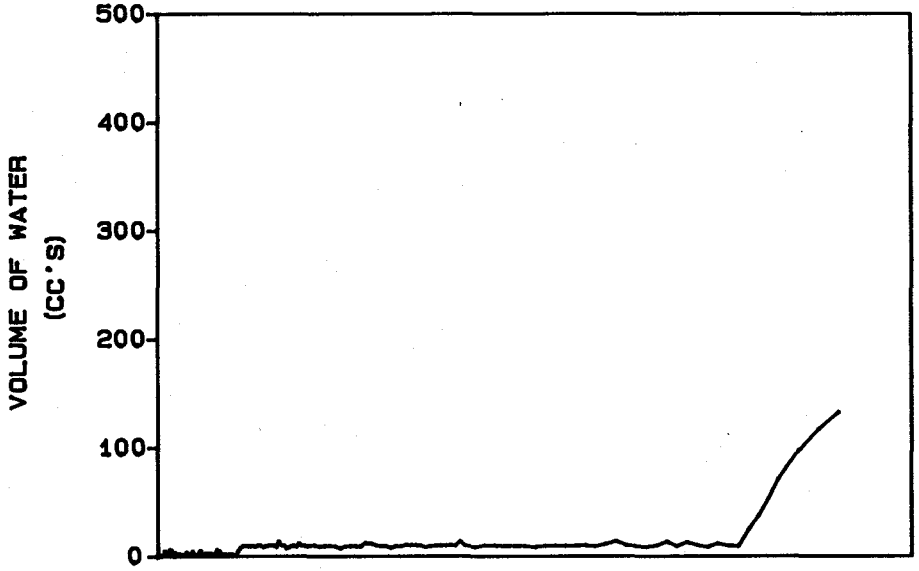


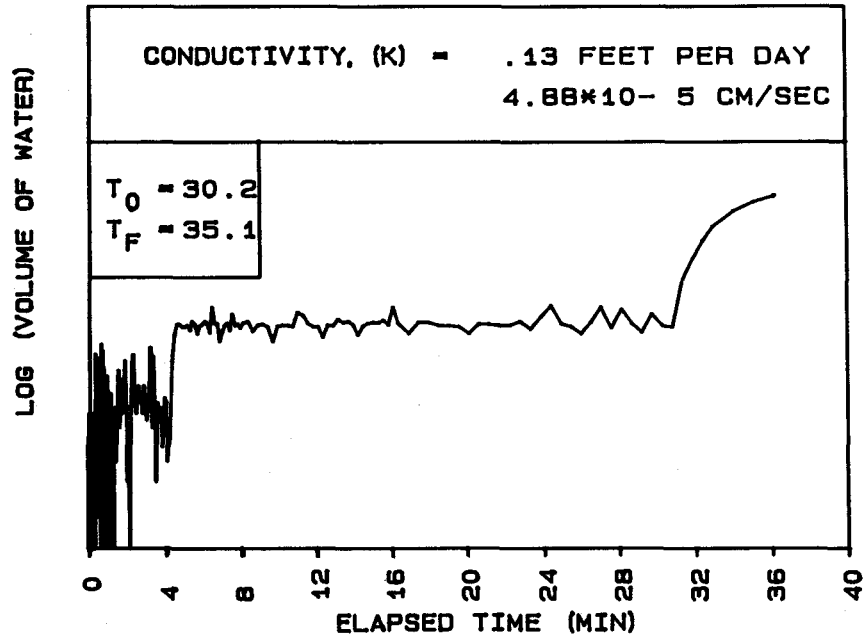


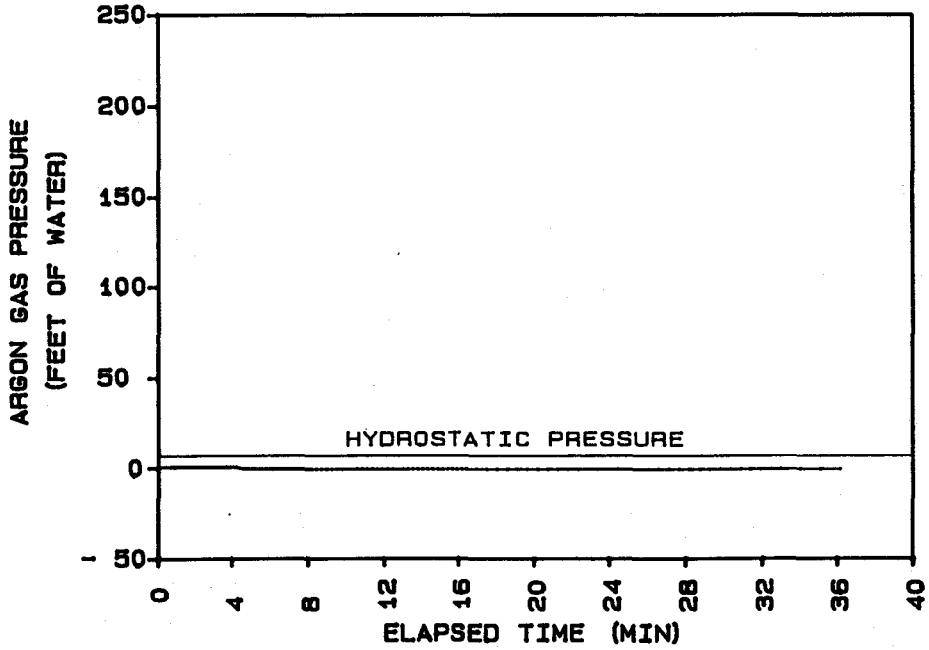
ENSAFE MEMPHIS NSA
LOCATION... 14H0545
TEST DATE
16: 41: 24 11-13-1995

SAMPLE DEPTH (FT) 45
GROUNDWATER DEPTH (FT) 11

HYDROCONE TEST







ENSAFE MEMPHIS NSA
LOCATION... 14H0711
TEST DATE
15: 41: 32 11-14-1995

SAMPLE DEPTH (FT) 11
GROUNDWATER DEPTH (FT) 5

GEOLOGICAL LOGGING SYSTEMS

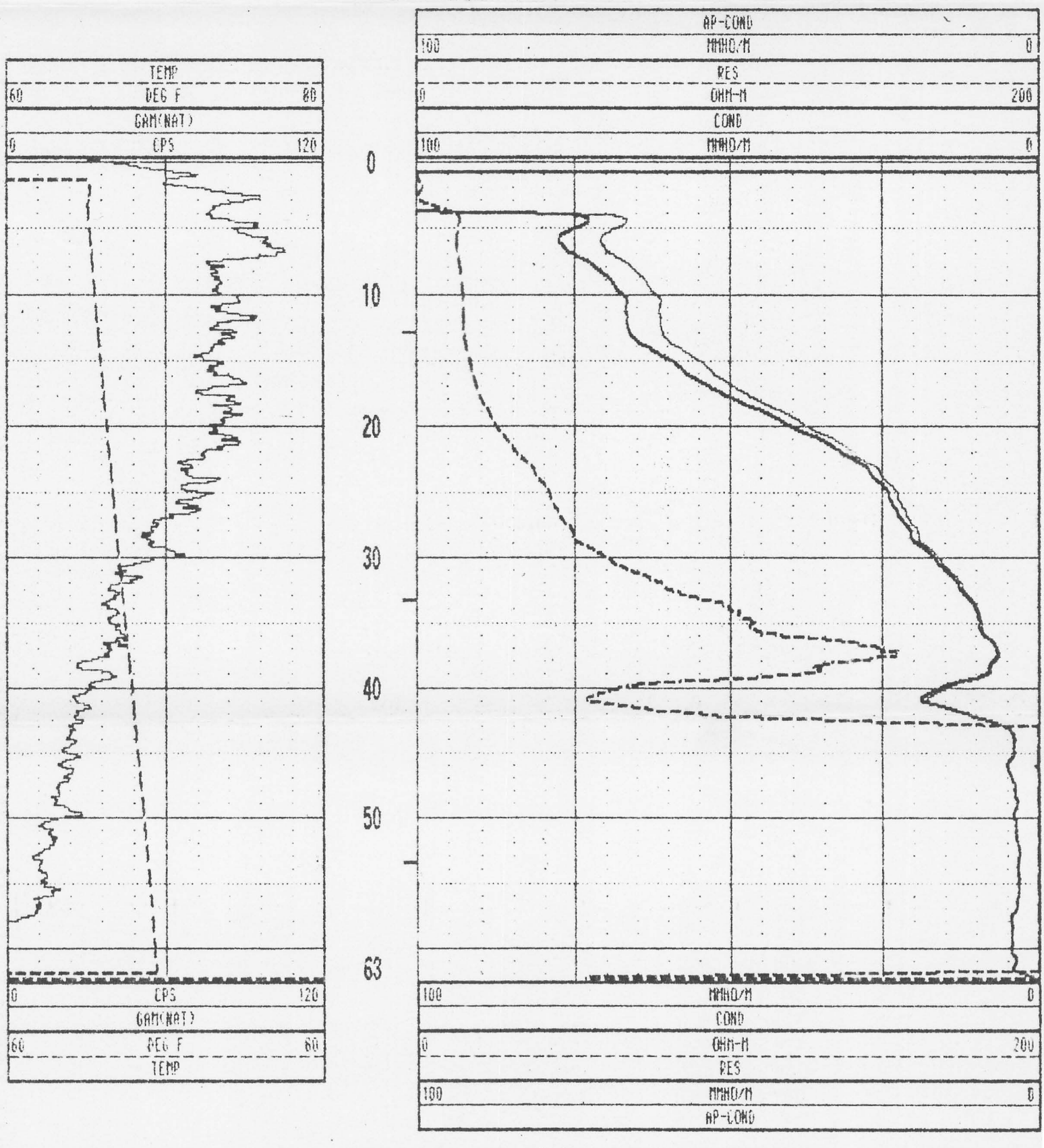
002G13DA

COMPANY	: ENSAFE,ALLEN & HOSHALL			OTHER SERVICES:	
WELL	: 002G13DA			9511	
LOCATION/FIELD	: NAS MEMPHIS			RUN ONE	
COUNTY	: SHELBY			OPEN	
STATE	: TENNESSEE				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 05/22/96	PERMANENT DATUM	: GL	ELEVATIONS	
DEPTH DRILLER	: 65	ELEV. PERM. DATUM:		KB	:
LOG BOTTOM	: 62.60	LOG MEASURED FROM:	GL	DF	: -
LOG TOP	: -2.90	DRL MEASURED FROM:	GL	GL	: 267.0
CASING DRILLER	: 65	LOGGING UNIT	: 05		
CASING TYPE	: PVC	FIELD OFFICE	: BLUEFIELD		
CASING THICKNESS	: .25	RECORDED BY	: J T GILBERT		
BIT SIZE	: 8	BOREHOLE FLUID	: WATER	FILE	: ORIGIN
MAGNETIC DECL.	: -	RM	:	TYPE	: 9511C
MATRIX DENSITY	: 2.65	RM TEMPERATURE	:	LOG	: 8
FLUID DENSITY	: 1.2	MATRIX DELTA T	:	PLOT	: 9510C
NEUTRON MATRIX	: SANDSTONE	FLUID DELTA T	:	THRESH	: 9000

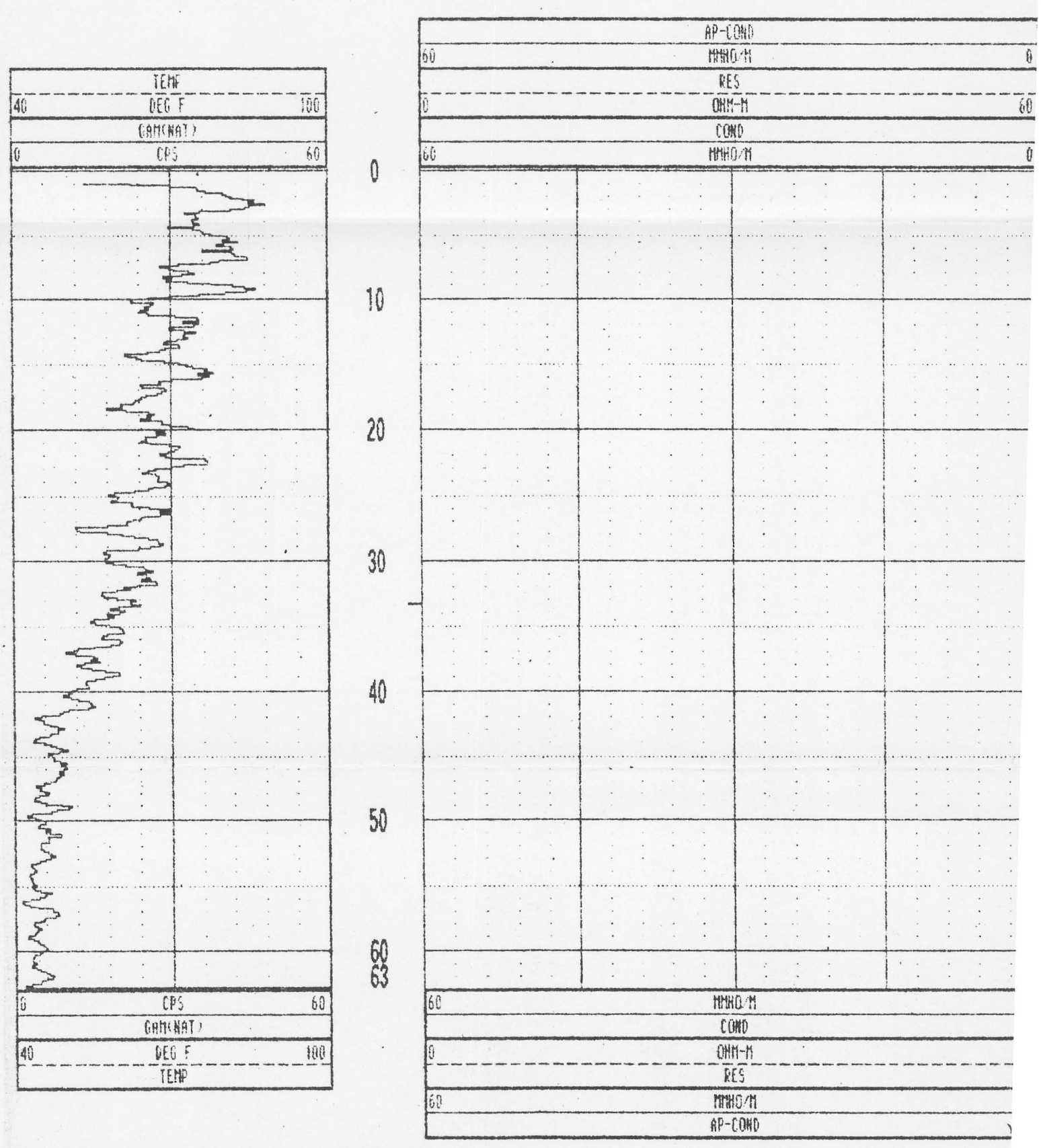
REMARKS :

ELECTRIC LOG INTERPRETATION IS EMPIRICAL IN NATURE. EXTREME HOLE COND WILL MAKE COMPLETELY ACCURATE INTERPRETATIONS DIFFICULT.

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



002G13DA 05/22/96 976



002G13DA 05/22/96 1025

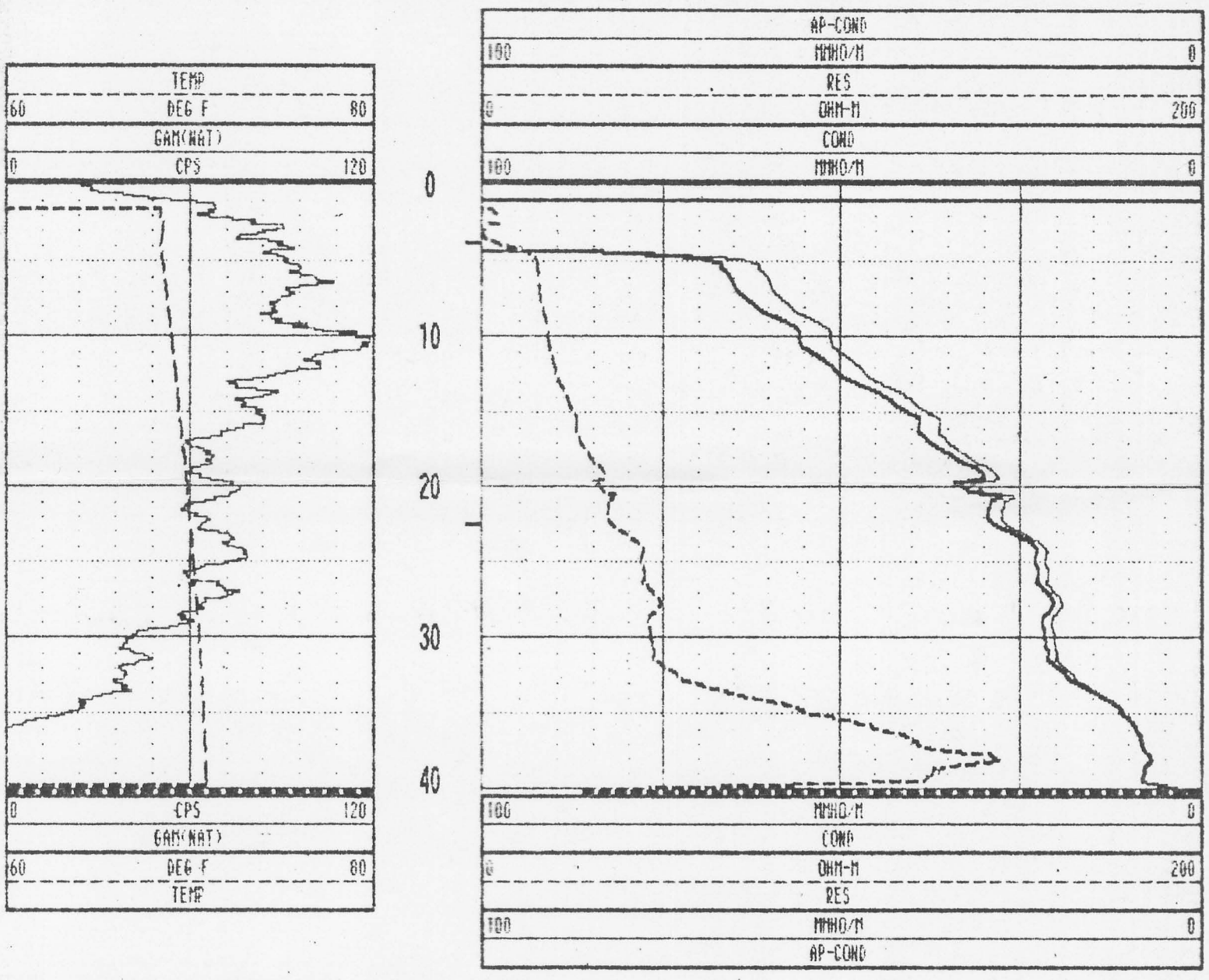
GEOLOGICAL LOGGING SYSTEMS

002G11DA

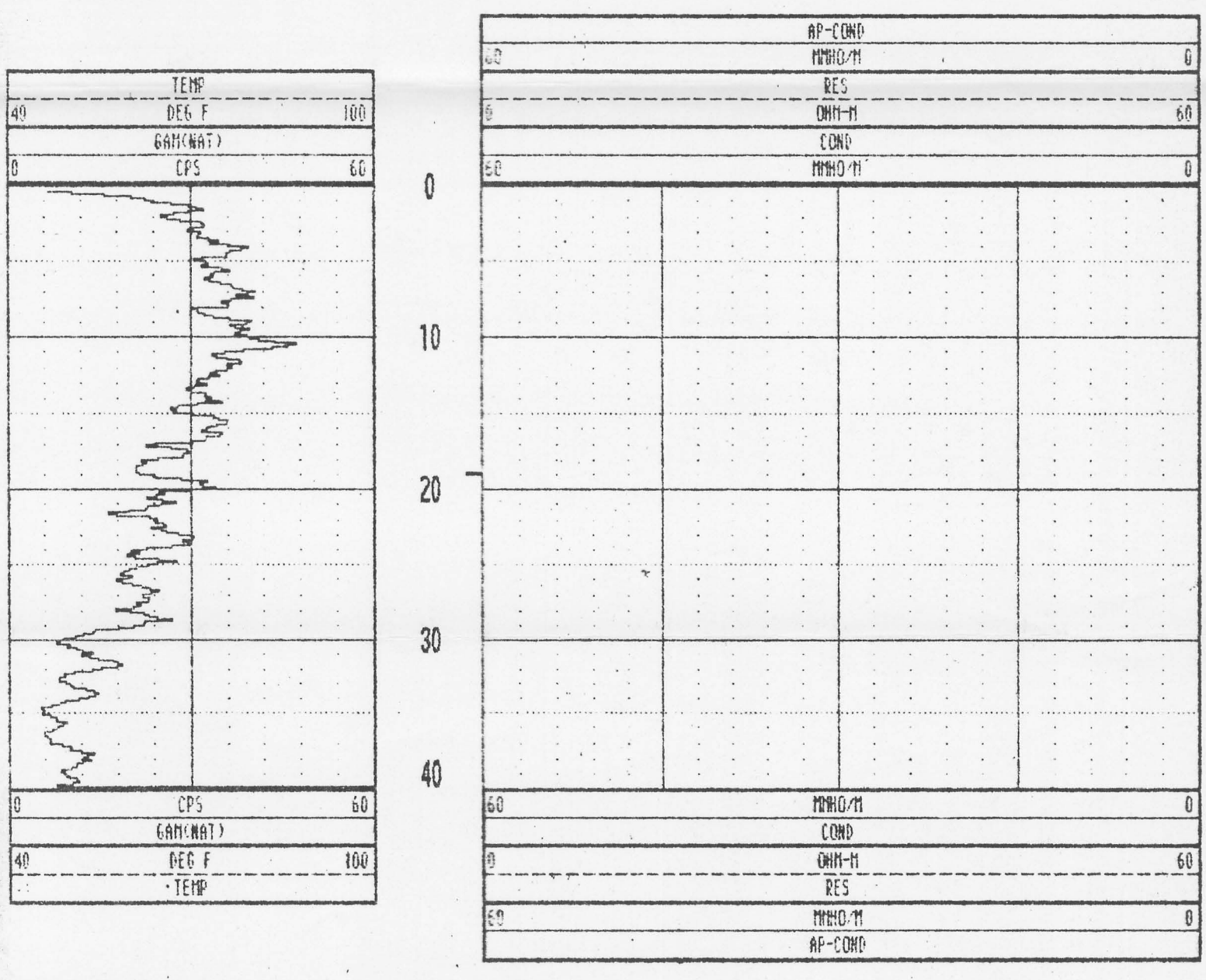
COMPANY	: ENSAFE,ALLEN & HOSHALL			OTHER SERVICES:	
WELL	: 002G11DA			9511	
LOCATION/FIELD	: NAS MEMPHIS			RUN ONE	
COUNTY	: SHELBY			OPEN	
STATE	: TENNESSEE				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 05/22/96	PERMANENT DATUM	: GL	ELEVATIONS	
DEPTH DRILLER	: 42.2	ELEV. PERM. DATUM:		KB	:
LOG BOTTOM	: 40.40	LOG MEASURED FROM:	GL	DF	: -
LOG TOP	: -2.80	DRL MEASURED FROM:	GL	GL	: 265.2
CASING DRILLER	: 42	LOGGING UNIT	: 05		
CASING TYPE	: PVC	FIELD OFFICE	: BLUEFIELD		
CASING THICKNESS	: .25	RECORDED BY	: J T GILBERT		
BIT SIZE	: 8	BOREHOLE FLUID	: WATER	FILE	: ORIGIN
MAGNETIC DECL.	: -	RM	:	TYPE	: 9511C
MATRIX DENSITY	: 2.65	RM TEMPERATURE	:	LOG	: 0
FLUID DENSITY	: 1.2	MATRIX DELTA T	:	PLOT	: 9510C
NEUTRON MATRIX	: SANDSTONE	FLUID DELTA T	:	THRESH	: 9000
REMARKS	:				

ELECTRIC LOG INTERPRETATION IS EMPIRICAL IN NATURE. EXTREME HOLE COND WILL MAKE COMPLETELY ACCURATE INTERPRETATIONS DIFFICULT.

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



002G11DA 05/22/96 976



002G11DA 05/22/96 1025

GEOLOGICAL LOGGING SYSTEMS

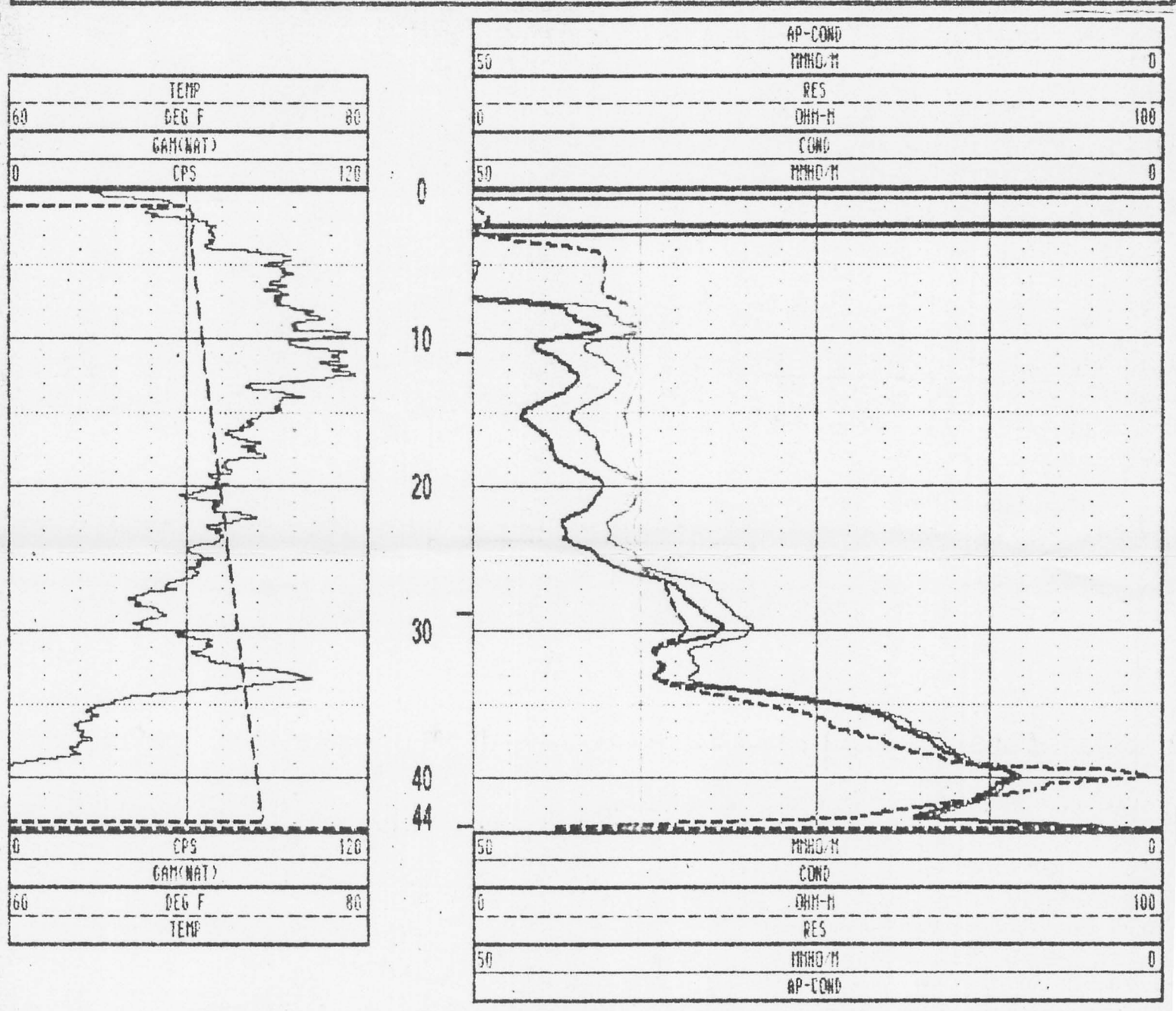
002G09DA

COMPANY	: ENSAFE,ALLEN & HOSHALL			OTHER SERVICES:	
WELL	: 002G09DA			9511	
LOCATION/FIELD	: NAS MEMPHIS			RUN ONE	
COUNTY	: SHELBY			OPEN	
STATE	: TENNESSEE				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 05/22/96	PERMANENT DATUM	: GL	ELEVATIONS	
DEPTH DRILLER	: 46	ELEV. PERM DATUM:		KB	:
LOG BOTTOM	: 43.60	LOG MEASURED FROM:	GL	DF	: -
LOG TOP	: -3.30	DRL MEASURED FROM:	GL	GL	: 265.5
CASING DRILLER	: 46	LOGGING UNIT	: 05		
CASING TYPE	: PVC	FIELD OFFICE	: BLUEFIELD		
CASING THICKNESS	: .25	RECORDED BY	: J T GILBERT		
BIT SIZE	: 8	BOREHOLE FLUID	: WATER	FILE	: ORIGIN
MAGNETIC DECL.	: -	RM	:	TYPE	: 9511C
MATRIX DENSITY	: 2.65	RM TEMPERATURE	:	LOG	: 4
FLUID DENSITY	: 1.2	MATRIX DELTA T	:	PLOT	: 9510C
NEUTRON MATRIX	: SANDSTONE	FLUID DELTA T	:	THRESH	: 9000

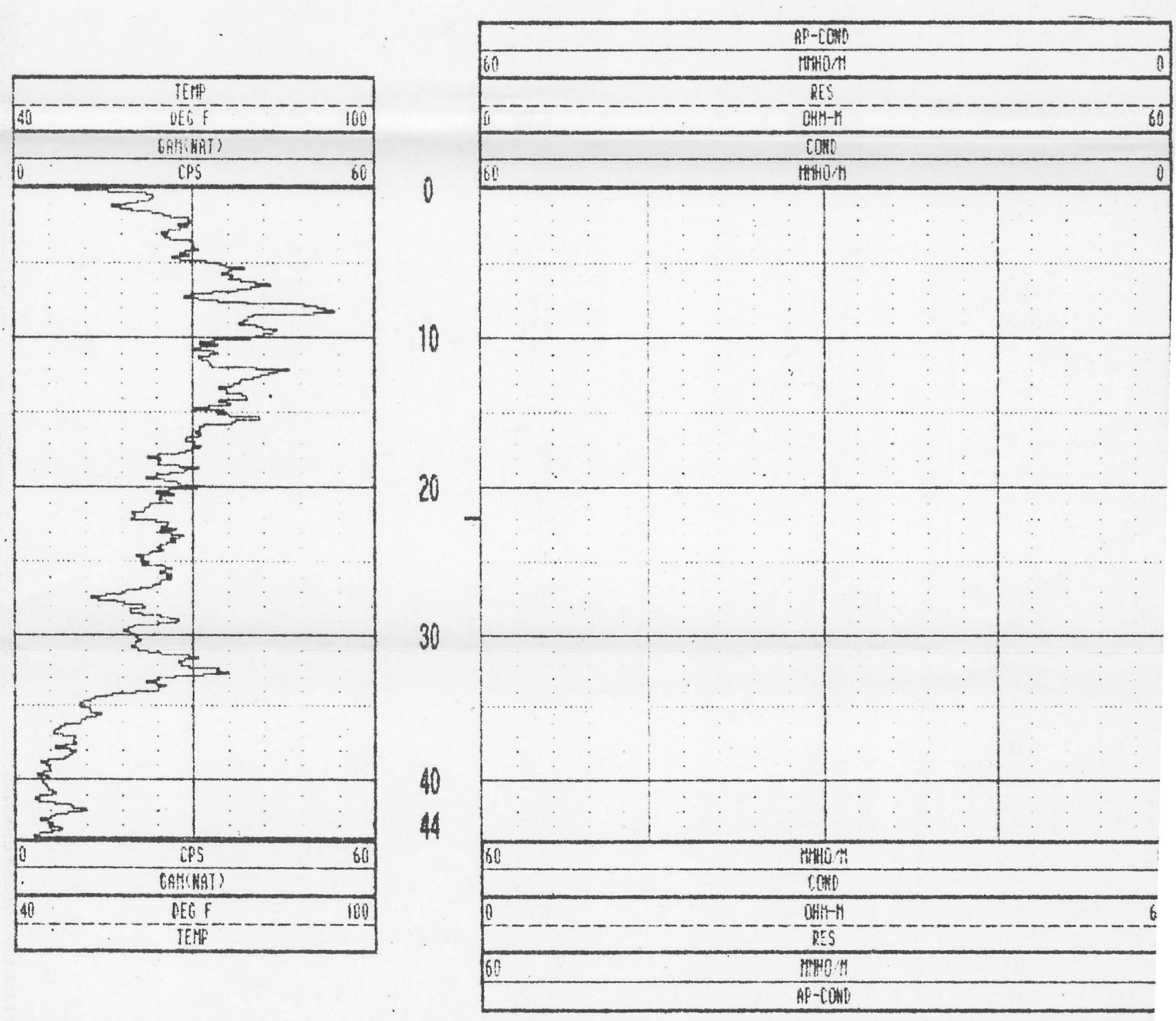
REMARKS :

ELECTRIC LOG INTERPRETATION IS EMPIRICAL IN NATURE. EXTREME HOLE COND WILL MAKE COMPLETELY ACCURATE INTERPRETATIONS DIFFICULT.

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



002G09DA 05/22/96 976



002G09DA 05/22/96 1025

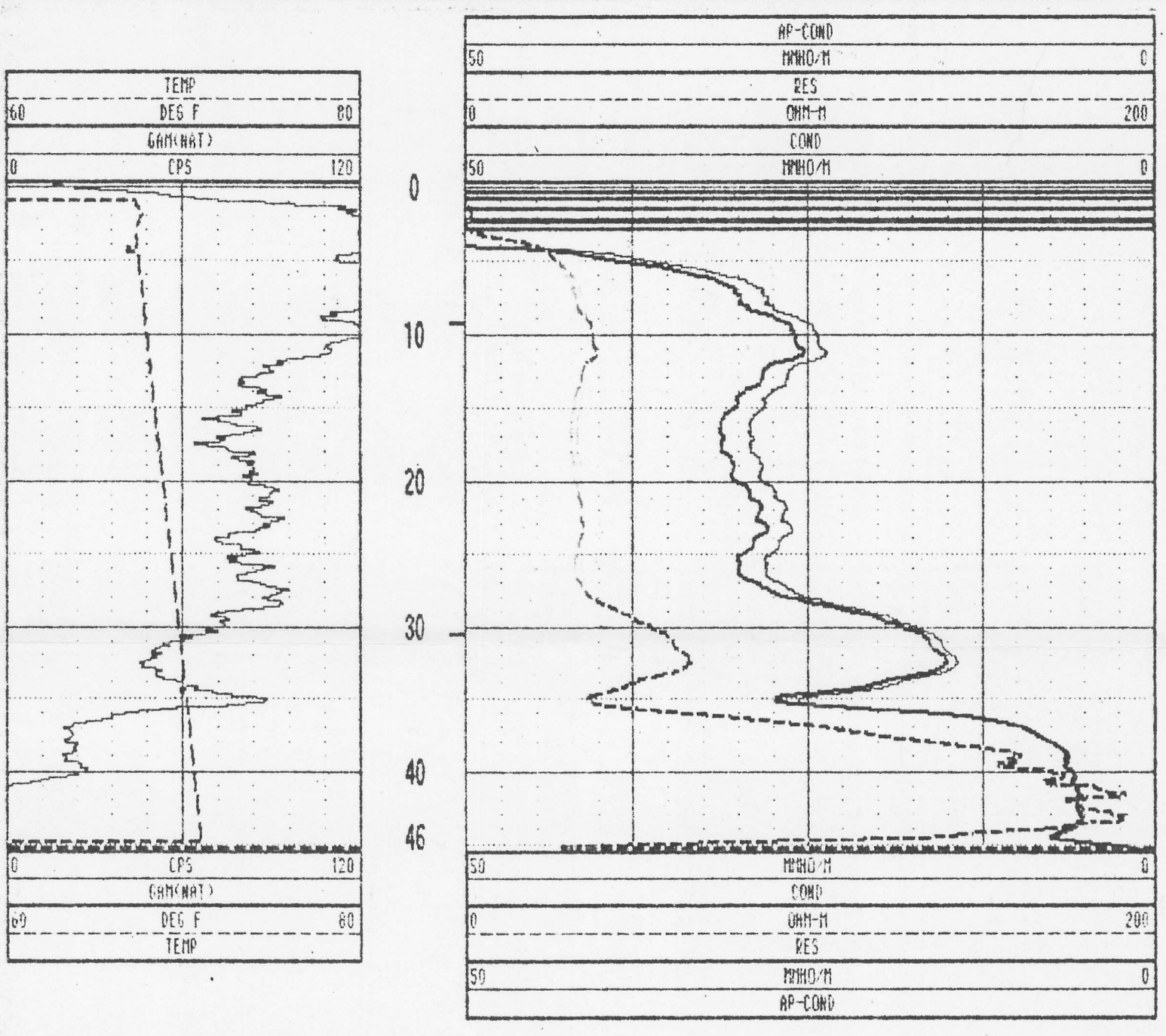
GEOLOGICAL LOGGING SYSTEMS

002G03DA

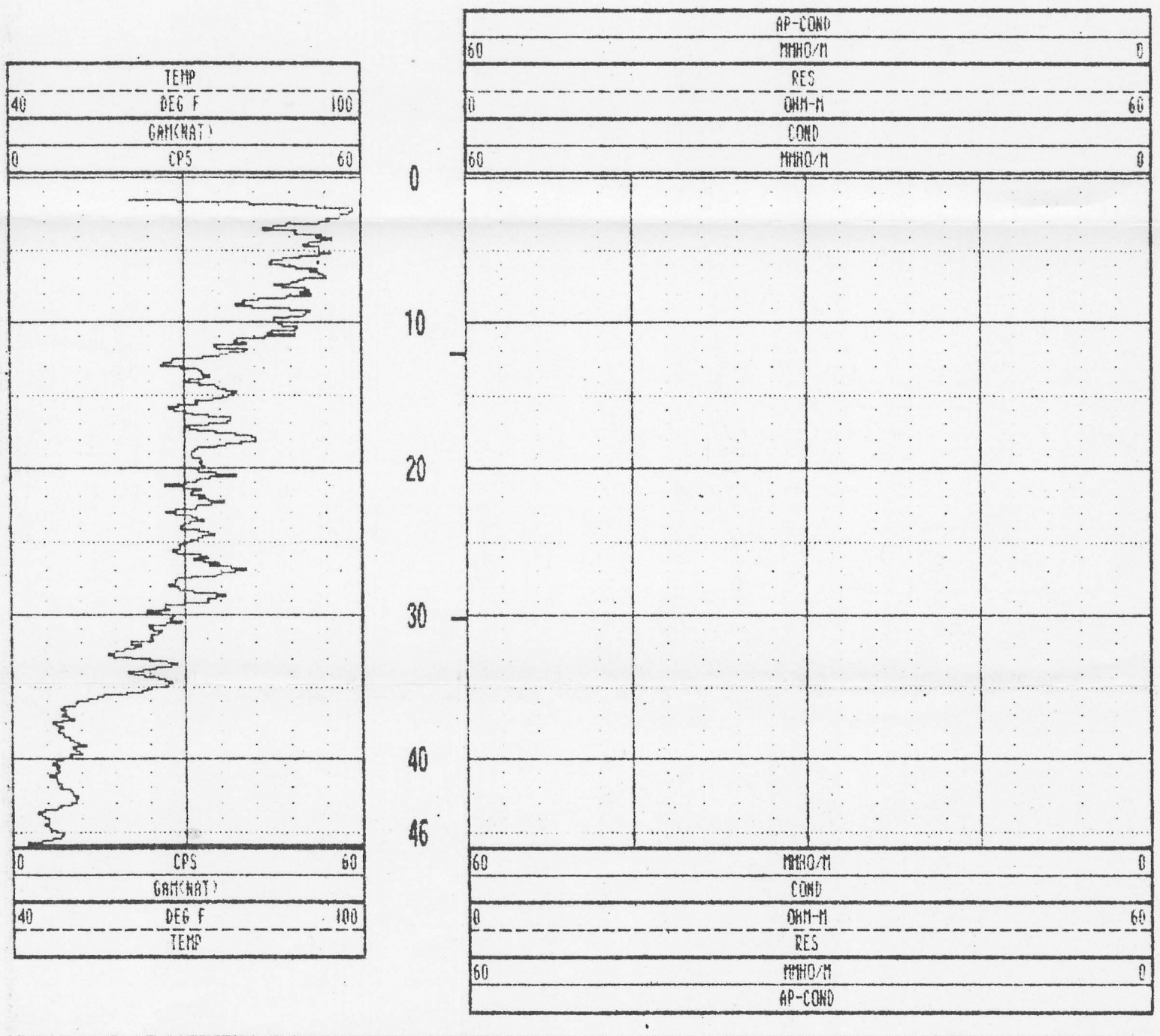
COMPANY	: ENSAFE,ALLEN & HISHALL			OTHER SERVICES:	
WELL	: 002G03DA			9511	
LOCATION/FIELD	: NAS MEMPHIS			RUN ONE	
COUNTY	: SHELBY			OPEN	
STATE	: TENNESSEE				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 05/22/96	PERMANENT DATUM	: GL	ELEVATIONS	
DEPTH DRILLER	: 48	ELEV. PERM. DATUM	:	KB	:
LOG BOTTOM	: 45.50	LOG MEASURED FROM	: GL	DF	: -
LOG TOP	: -3.40	DRL MEASURED FROM	: GL	GL	: 267.2
CASING DRILLER	: 48	LOGGING UNIT	: 05		
CASING TYPE	: PVC	FIELD OFFICE	: BLUEFIELD		
CASING THICKNESS	: .25	RECORDED BY	: J T GILBERT		
BIT SIZE	: 8	BOREHOLE FLUID	: WATER	FILE	: ORIGIN
MAGNETIC DECL.	: -	RM	:	TYPE	: 9511C
MATRIX DENSITY	: 2.65	RM TEMPERATURE	:	LOG	: 6
FLUID DENSITY	: 1.2	MATRIX DELTA T	:	PLOT	: 9510C
NEUTRON MATRIX	: SANDSTONE	FLUID DELTA T	:	THRESH	: 9000
REMARKS	:				

ELECTRIC LOG INTERPRETATION IS EMPIRICAL IN NATURE. EXTREME HOLE COND WILL MAKE COMPLETELY ACCURATE INTERPRETATIONS DIFFICULT.

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

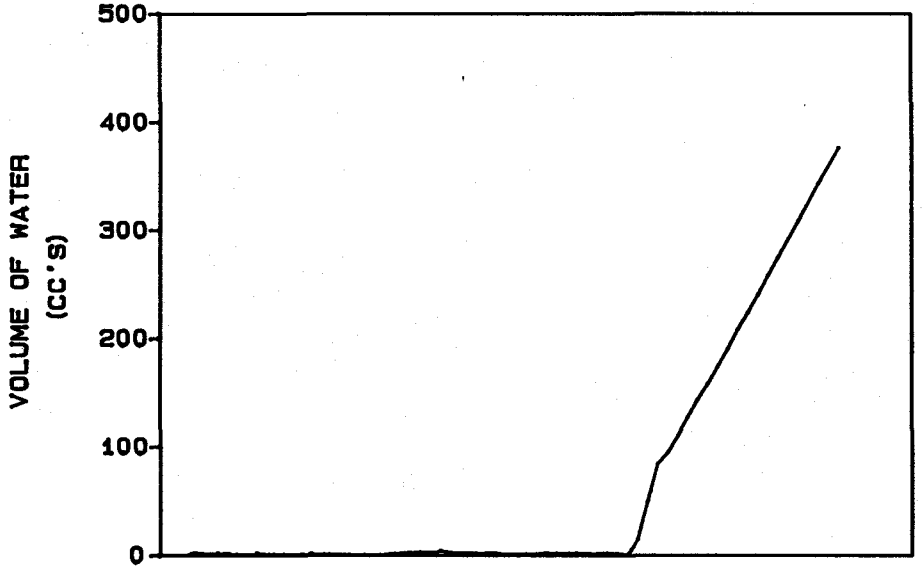


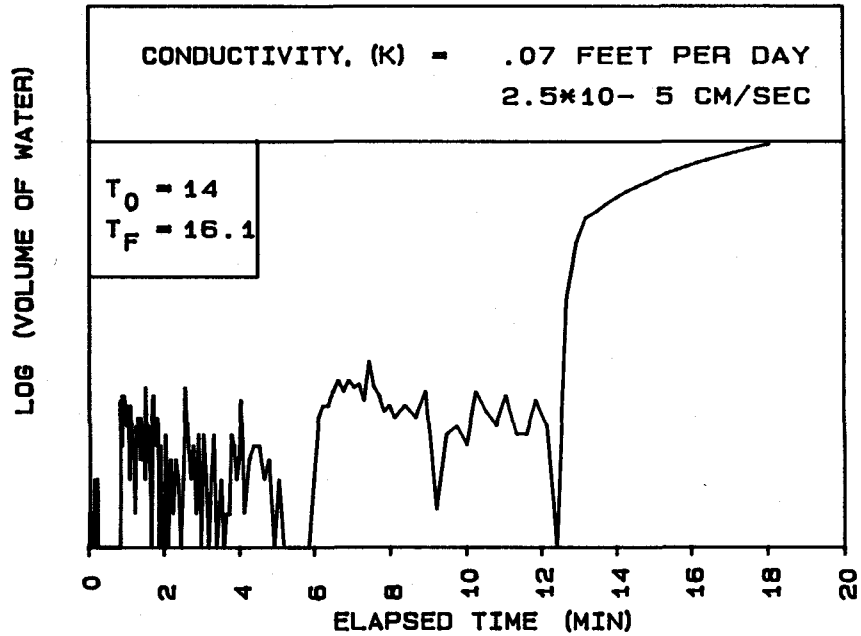
002G03DA 05 22/96 975

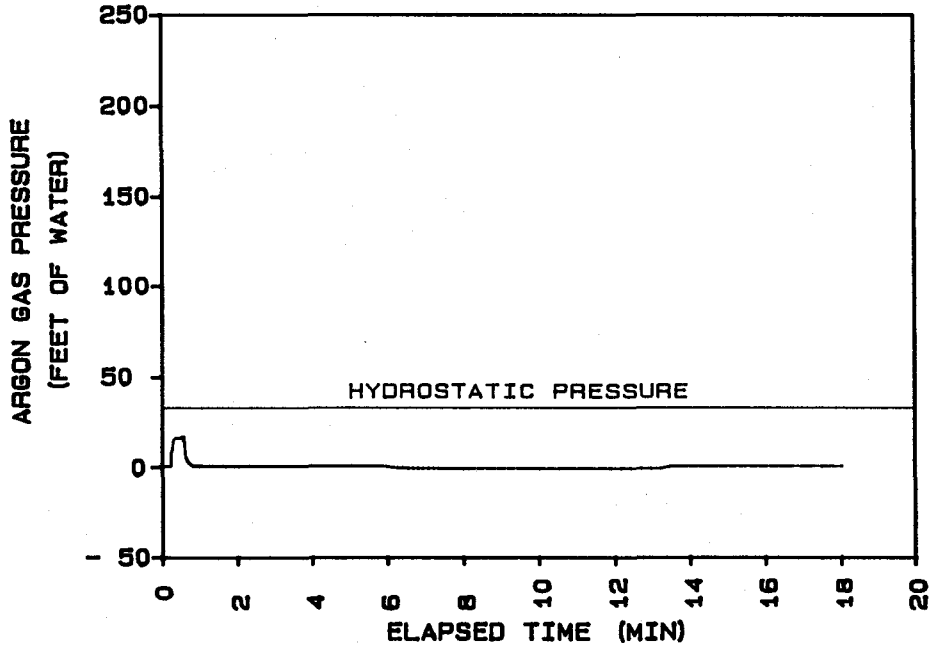


002G03DA 05 22/96 1025

HYDROCONE TEST



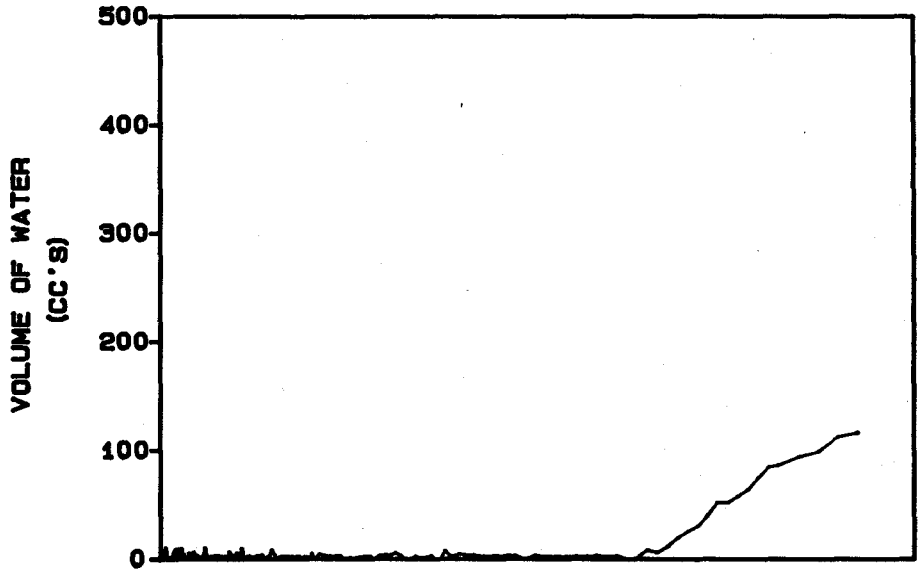


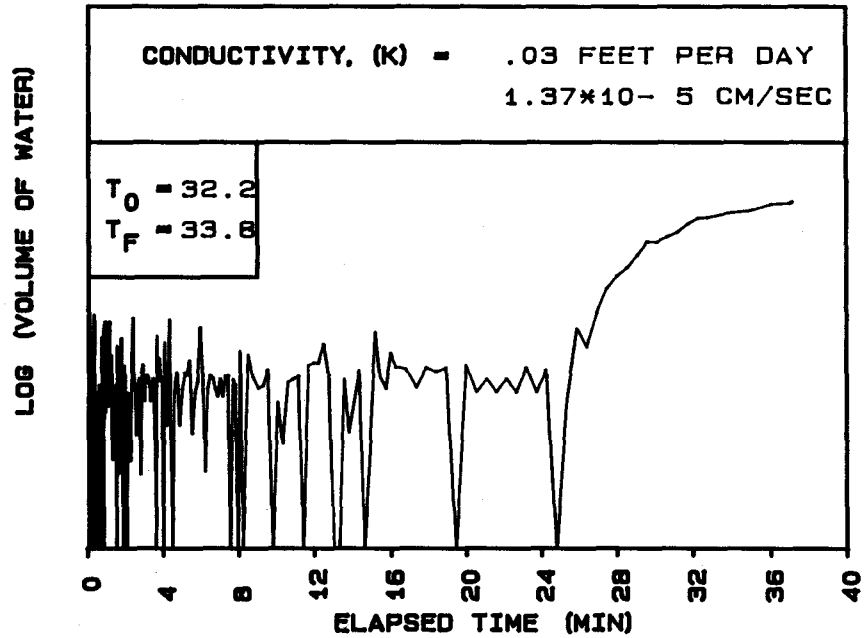


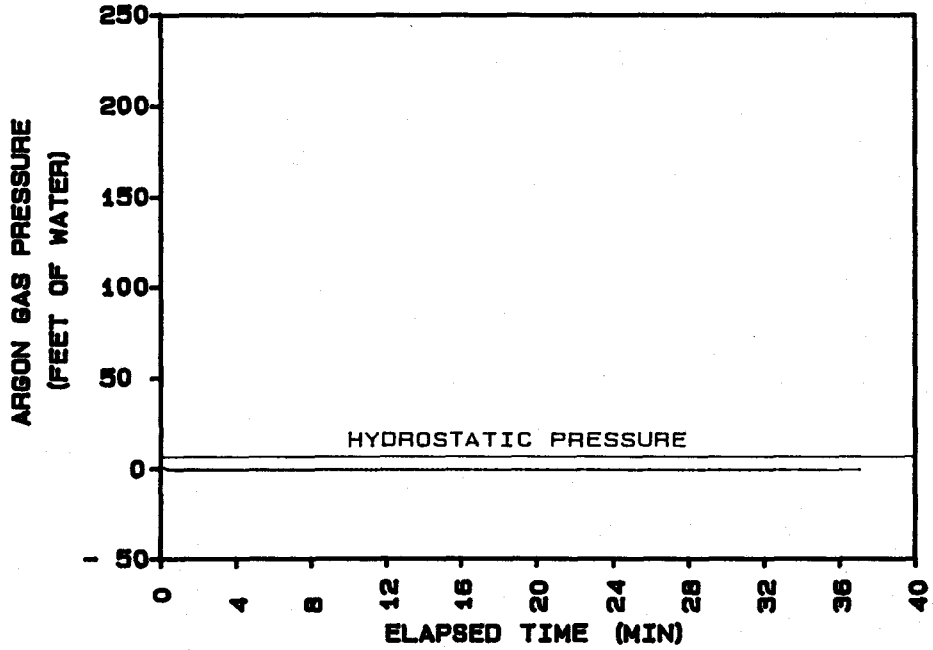
ENSAFE MEMPHIS NSA
LOCATION... 14H0743
TEST DATE
17: 39: 31 11-14-1995

SAMPLE DEPTH (FT) 43
GROUNDWATER DEPTH (FT) 11

HYDROCONE TEST



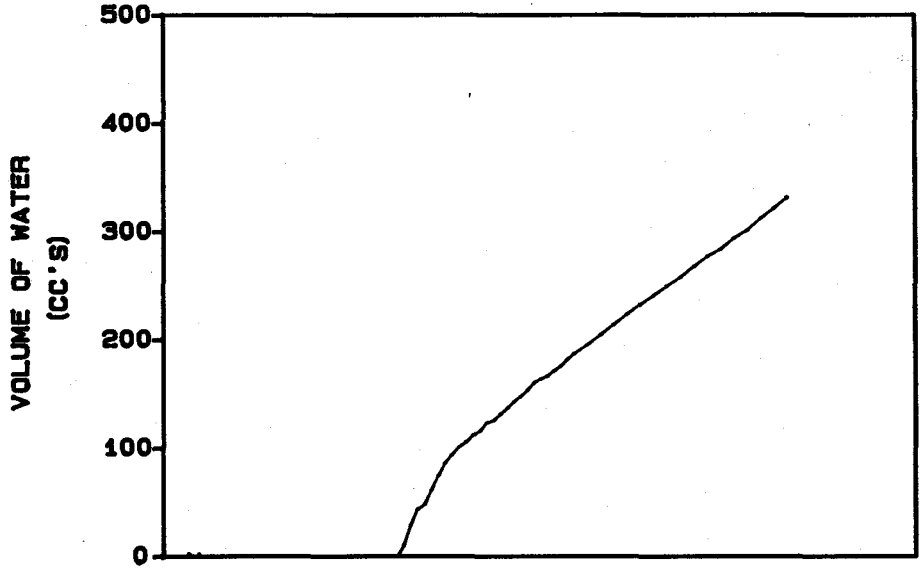


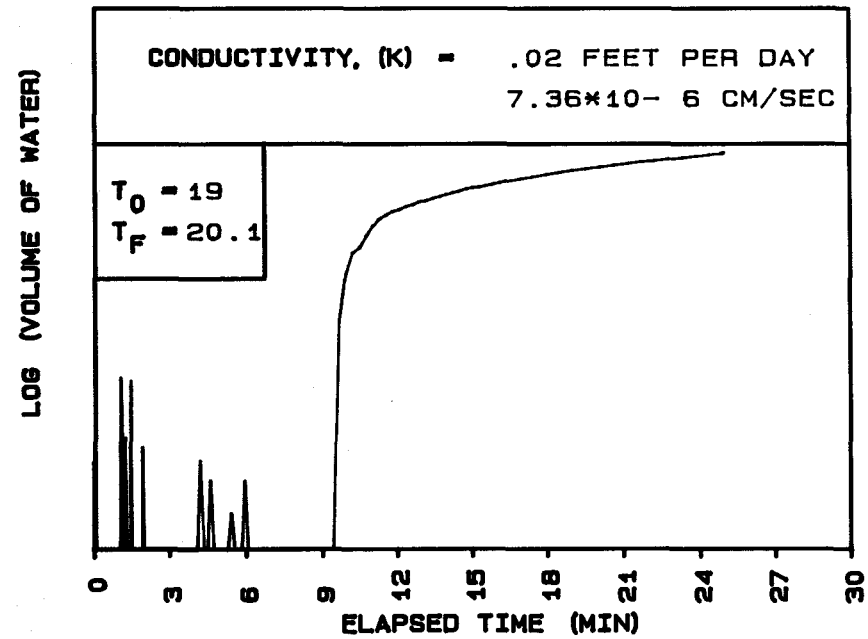


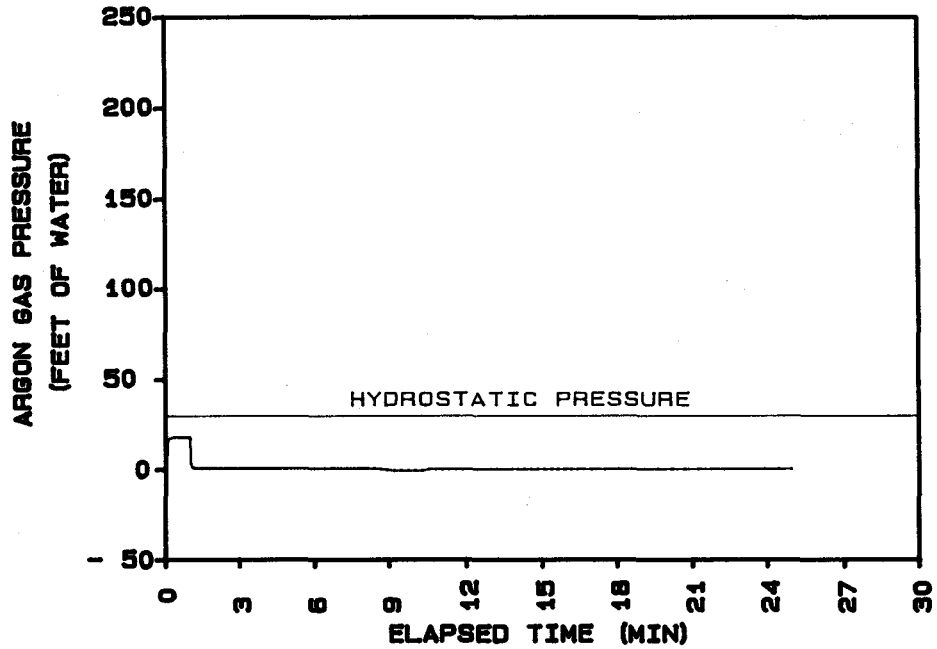
ENSAFE MEMPHIS NSA
LOCATION... 14H0811
TEST DATE
10: 23: 43 11-15-1995

SAMPLE DEPTH (FT) 11
GROUNDWATER DEPTH (FT) 5

HYDROCONE TEST



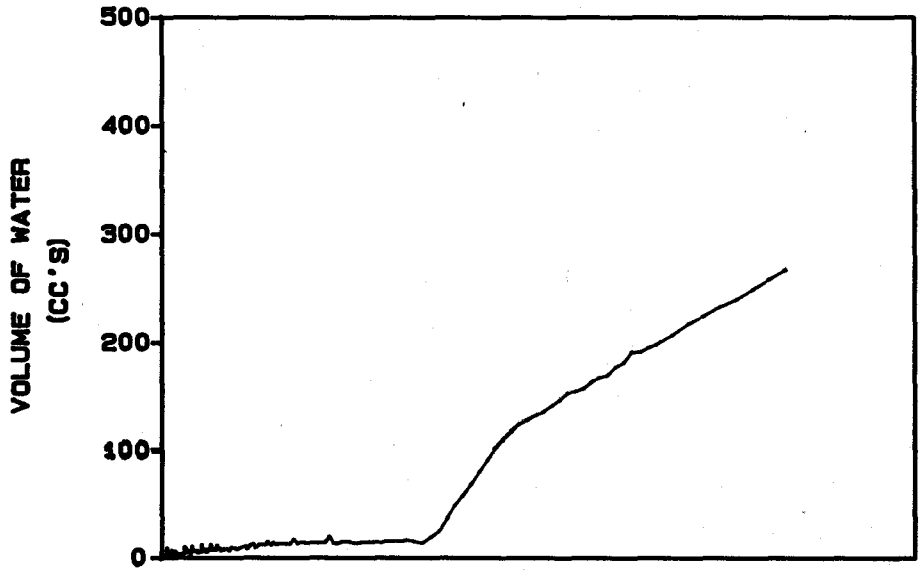


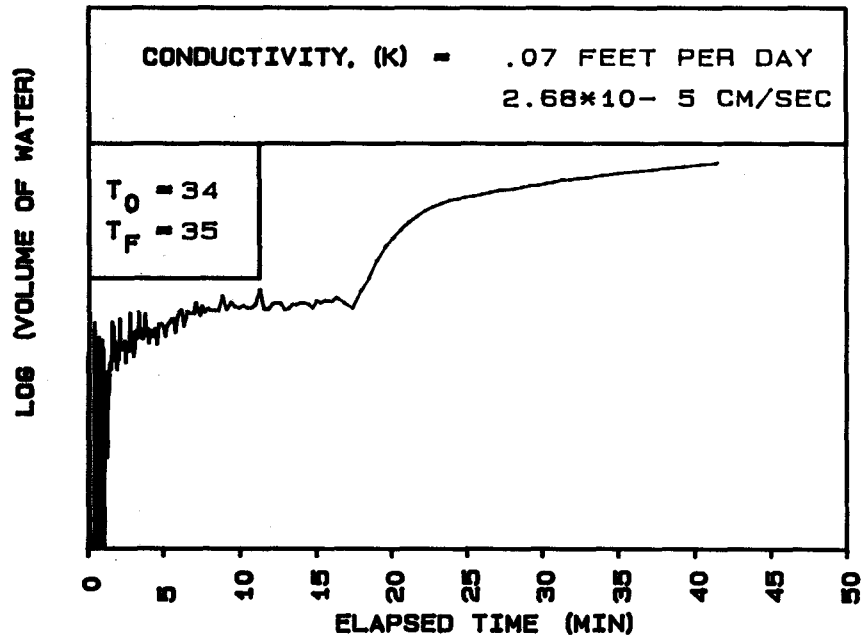


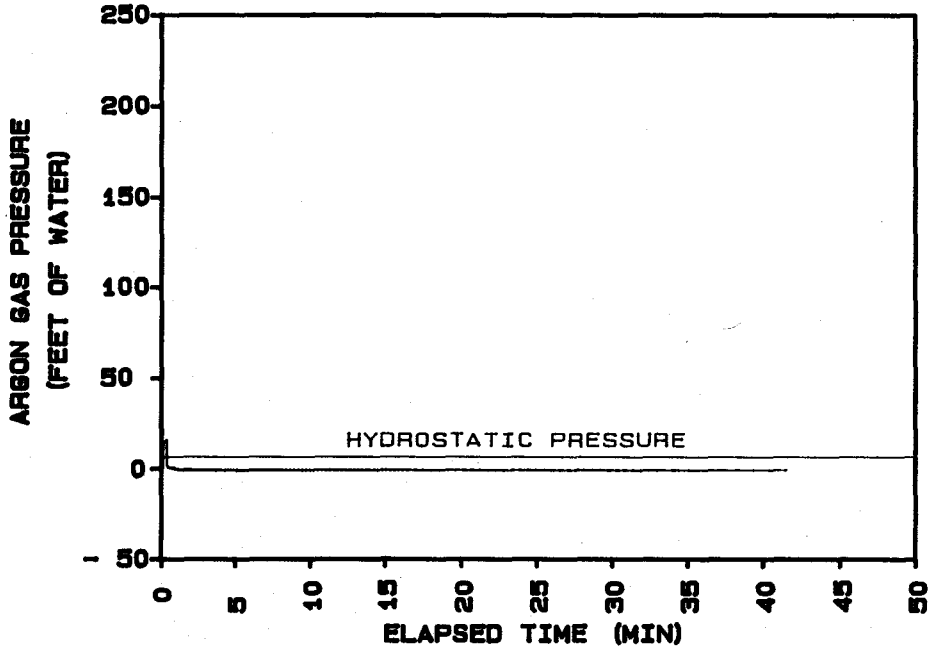
ENSAFE MEMPHIS NSA
LOCATION... 14H0840
TEST DATE
12: 44: 58 11-15-1995

SAMPLE DEPTH (FT) 40
GROUNDWATER DEPTH (FT) 11

HYDROCONE TEST



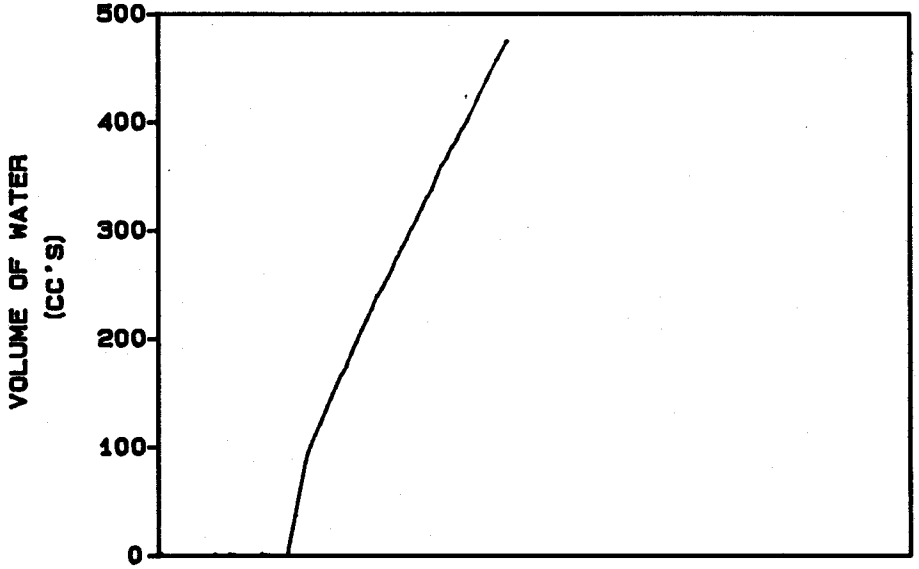


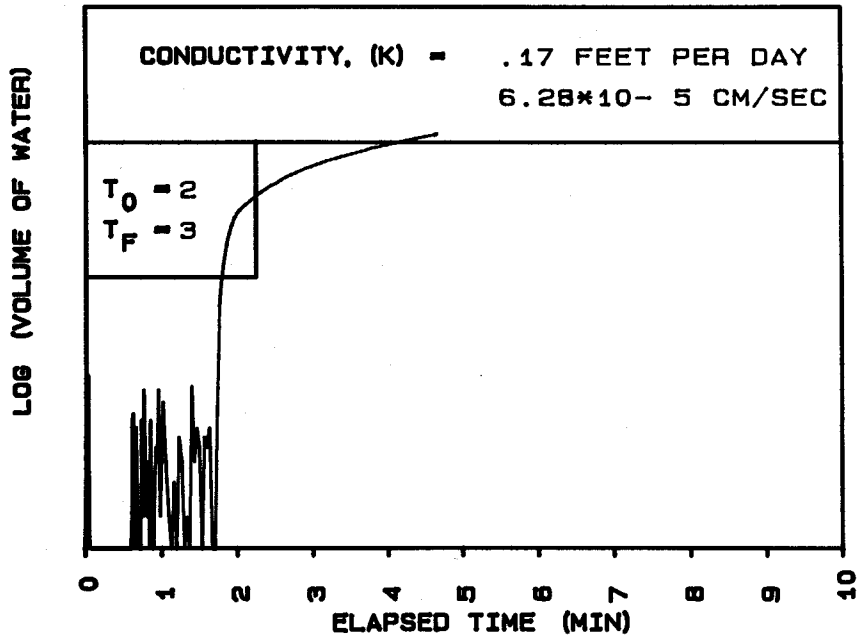


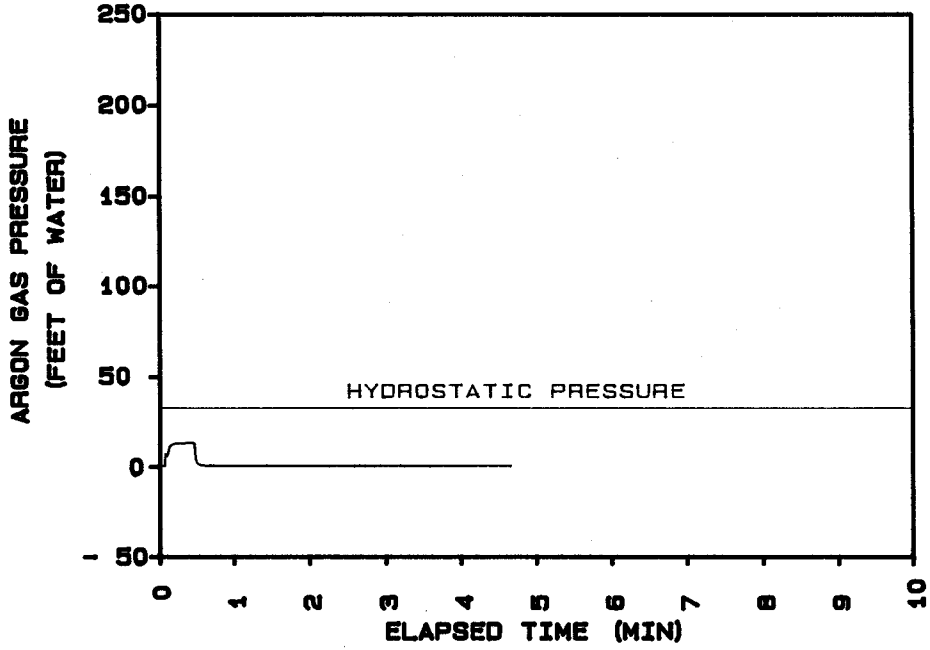
ENSAFE MEMPHIS NSA
LOCATION... 14H0911
TEST DATE
15: 00: 13 11-15-1995

SAMPLE DEPTH (FT) 11
GROUNDWATER DEPTH (FT) 5

HYDROCONE TEST



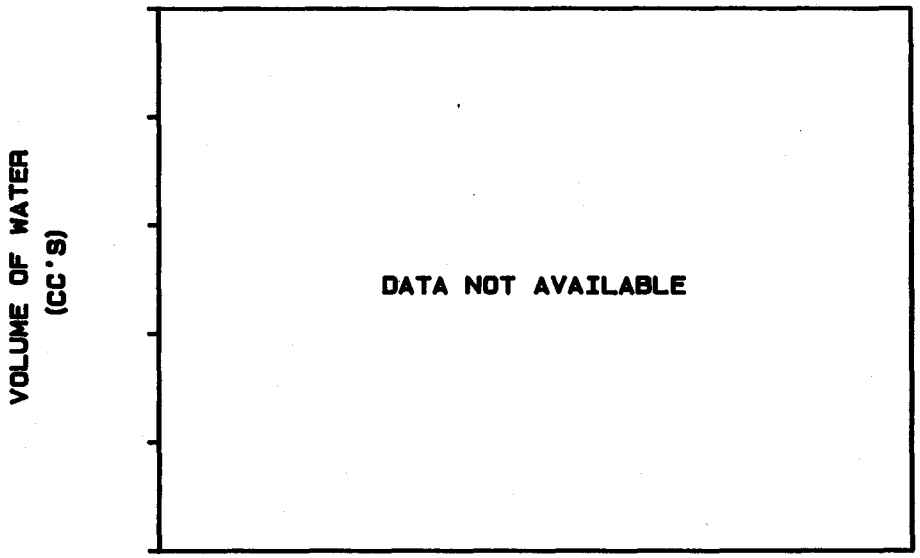


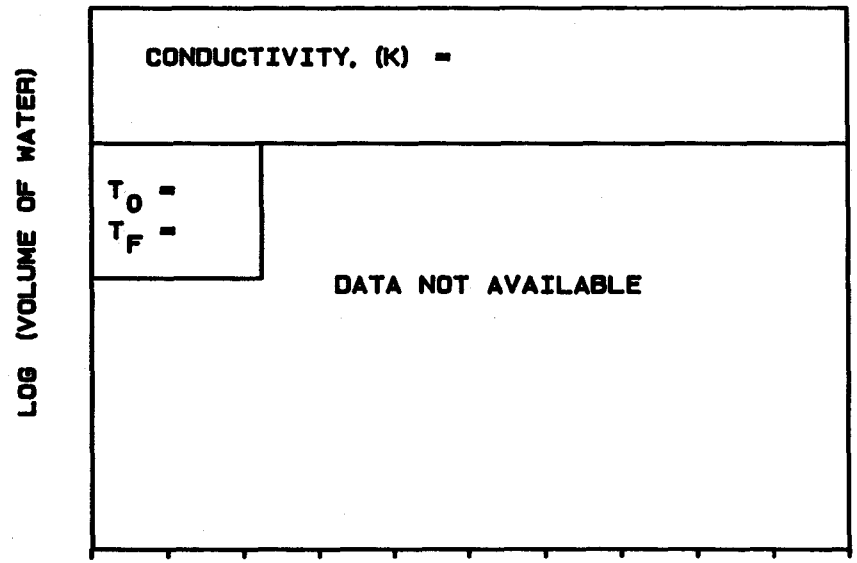


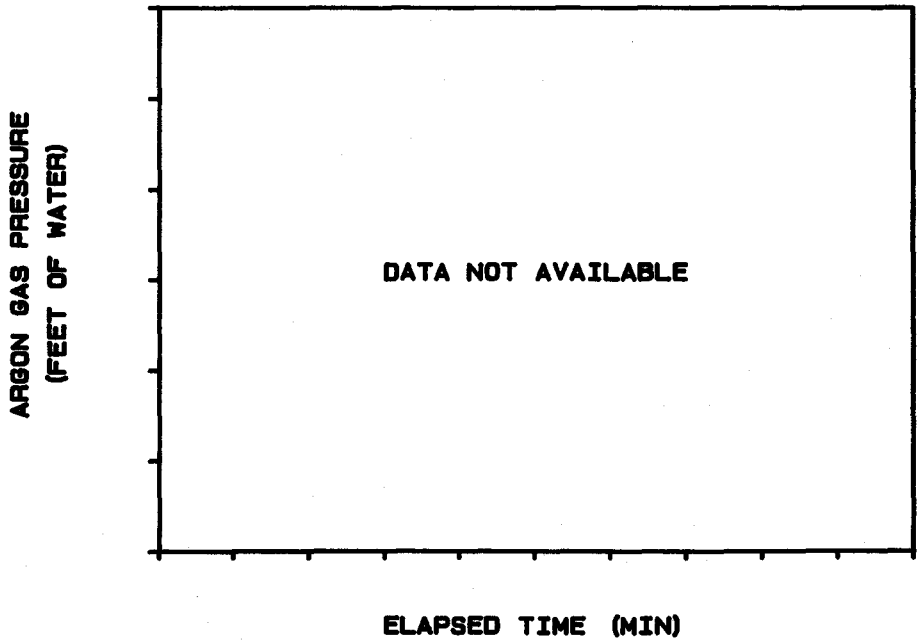
ENSAFE MEMPHIS NSA
LOCATION... 14H0943
TEST DATE
17: 08: 48 11-15-1995

SAMPLE DEPTH (FT) 43
GROUNDWATER DEPTH (FT) 11

HYDROCONE TEST



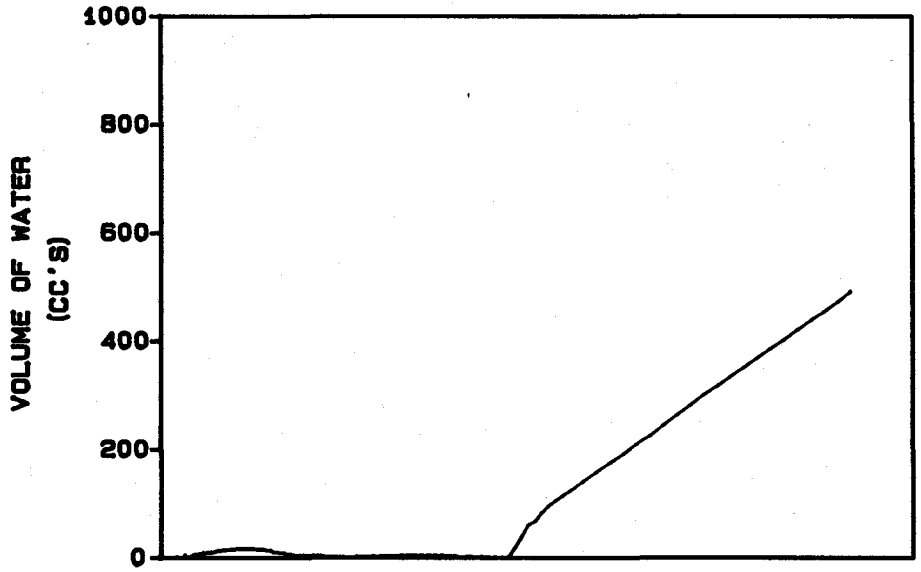


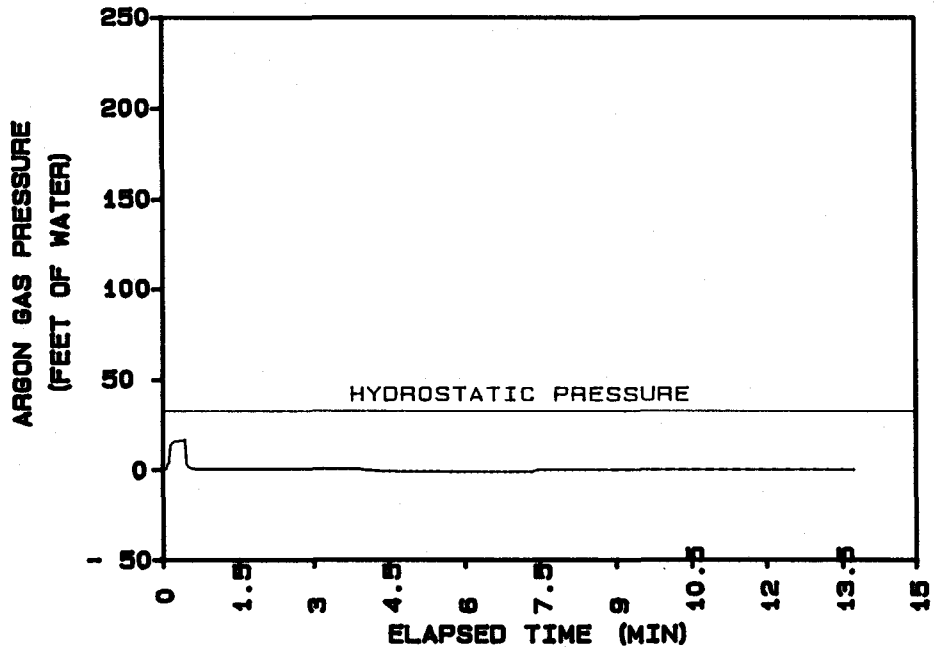


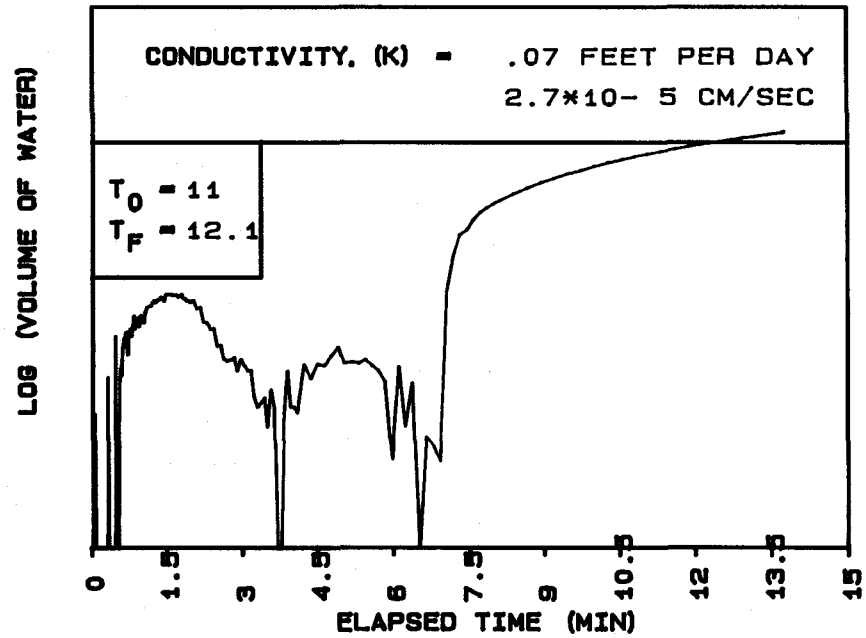
ENSAFE MEMPHIS NSA
LOCATION... 14H1011

DATA NOT AVAILABLE

HYDROCONE TEST



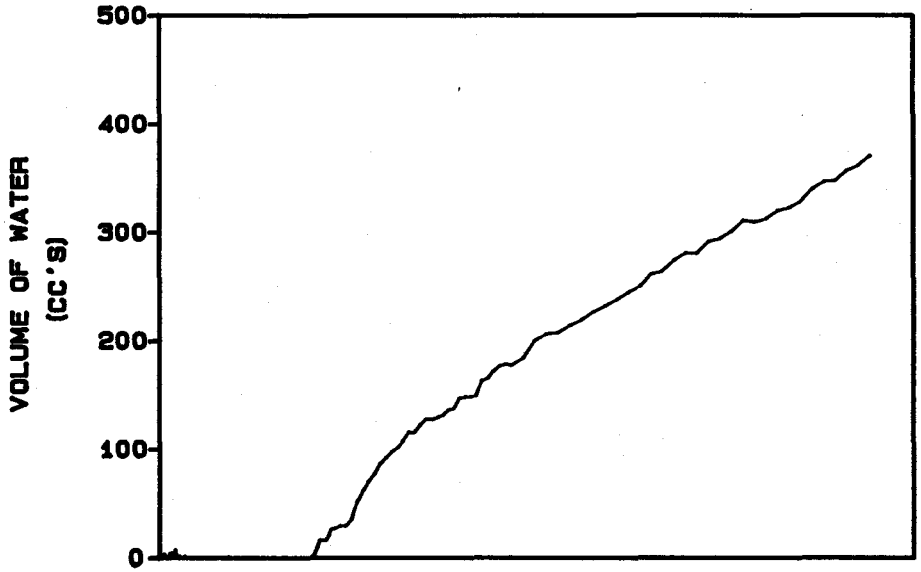


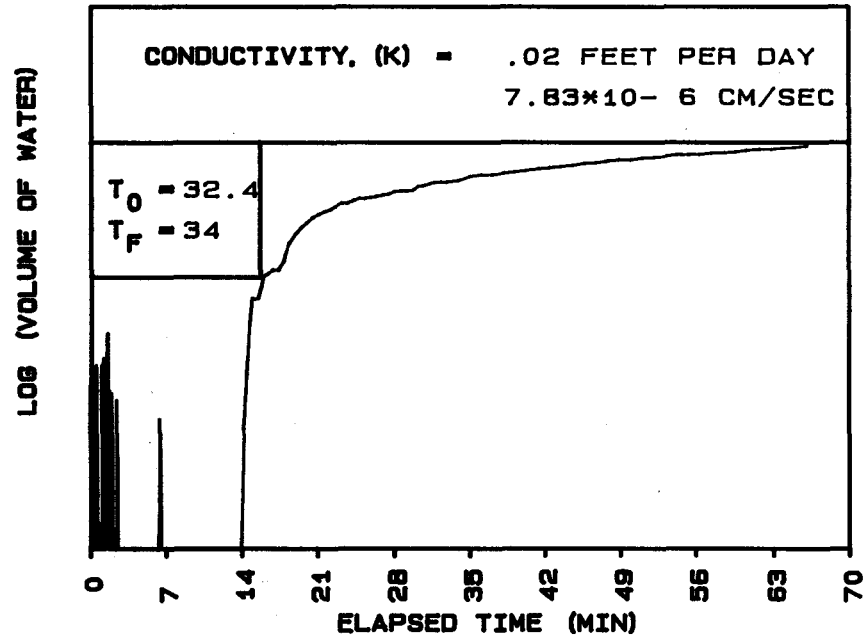


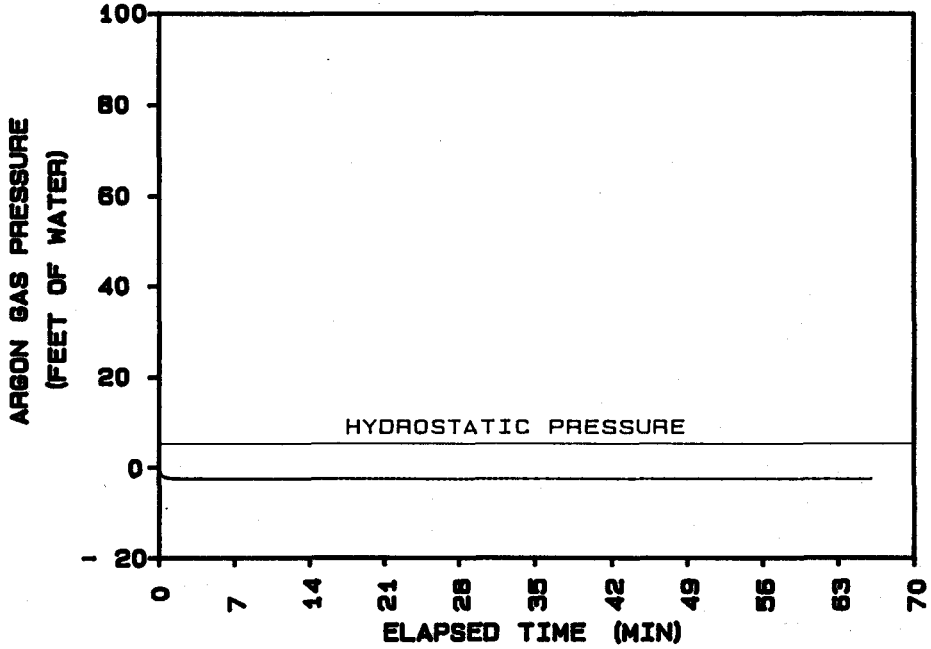
ENSAFE MEMPHIS NSA
LOCATION... 14H1043
TEST DATE
11: 23: 29 11-16-1995

SAMPLE DEPTH (FT) 43
GROUNDWATER DEPTH (FT) 11

HYDROCONE TEST



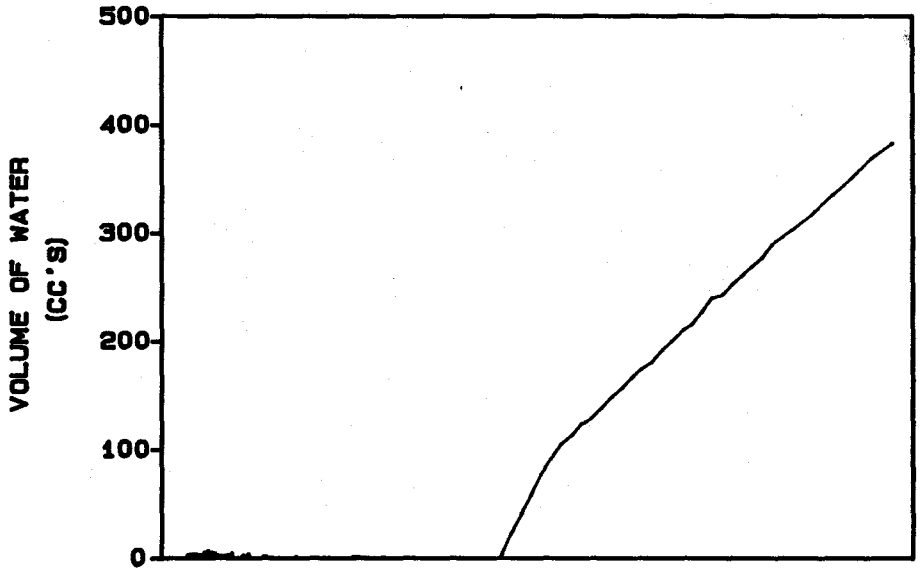


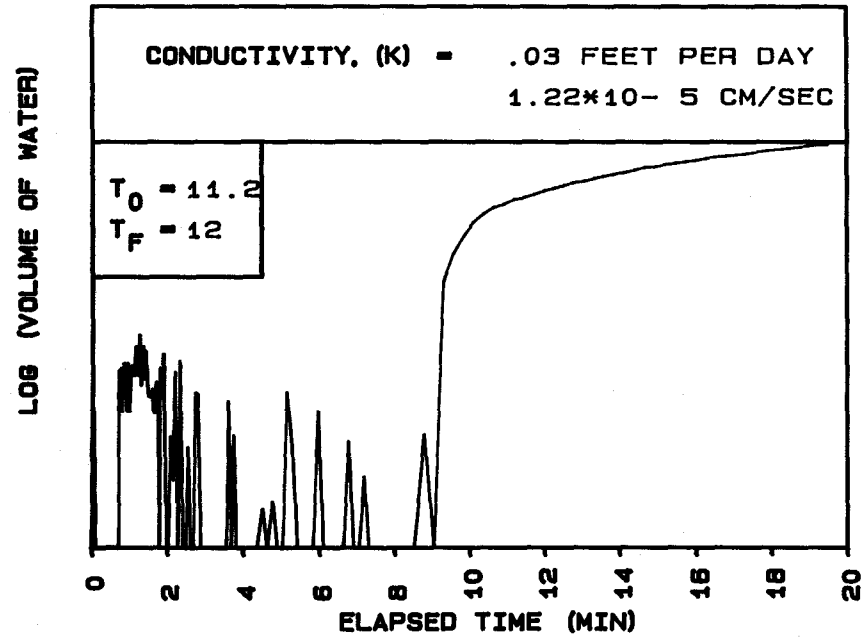


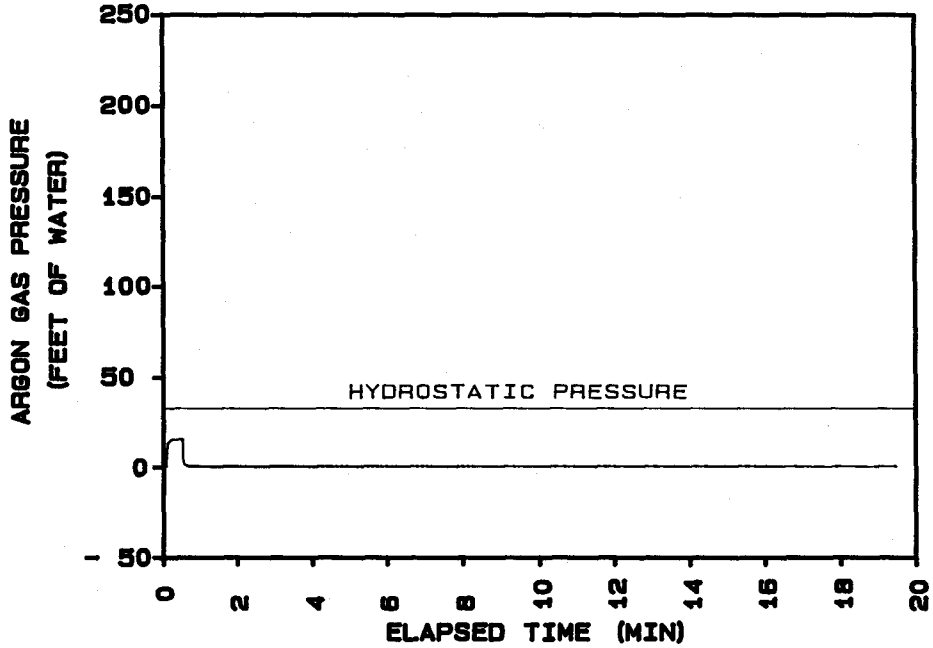
ENSAFE MEMPHIS NSA
LOCATION... 14H1110
TEST DATE
14: 17: 00 11-16-1995

SAMPLE DEPTH (FT) 10
GROUNDWATER DEPTH (FT) 5

HYDROCONE TEST



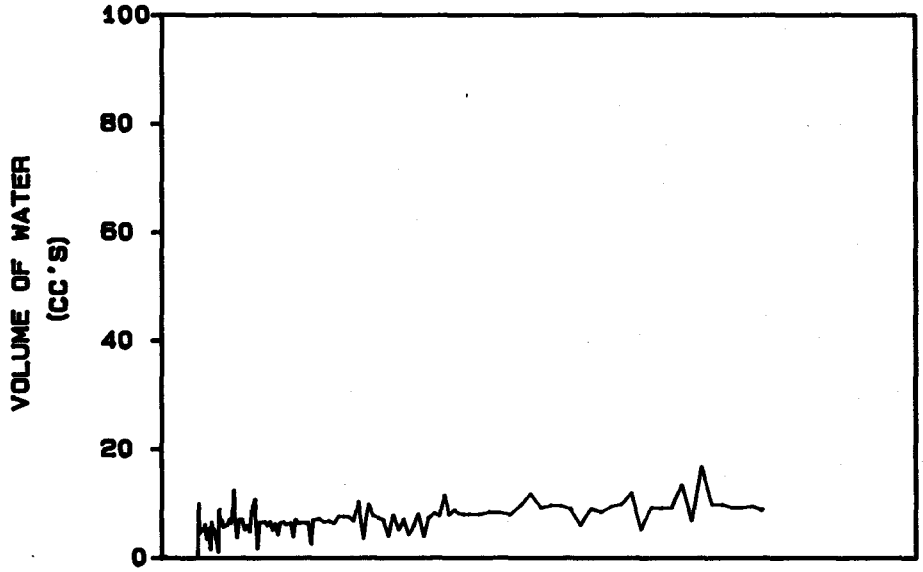


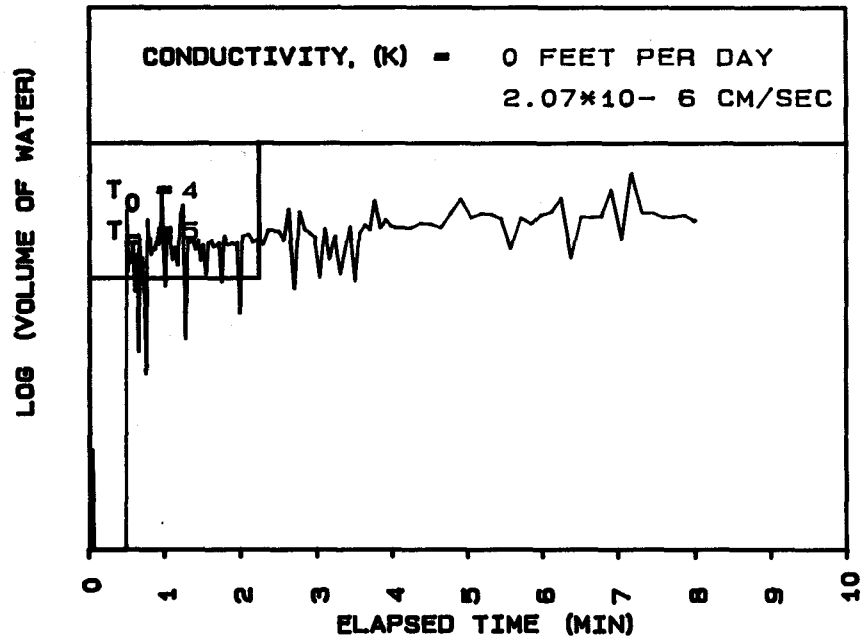


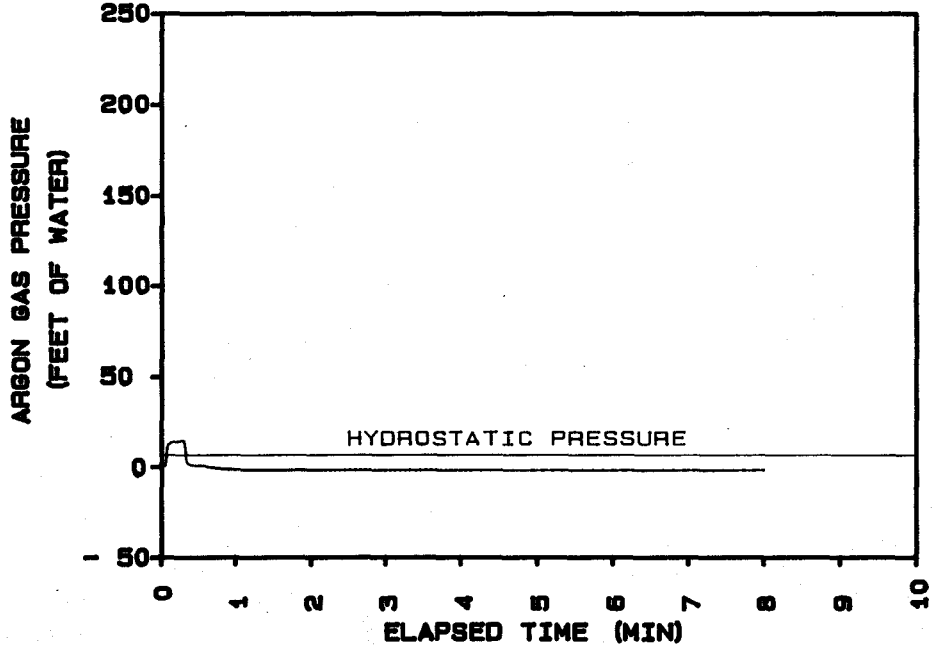
ENSAFE MEMPHIS NSA
LOCATION... 14H1143
TEST DATE
16: 15: 32 11-16-1995

SAMPLE DEPTH (FT) 43
GROUNDWATER DEPTH (FT) 11

HYDROCONE TEST



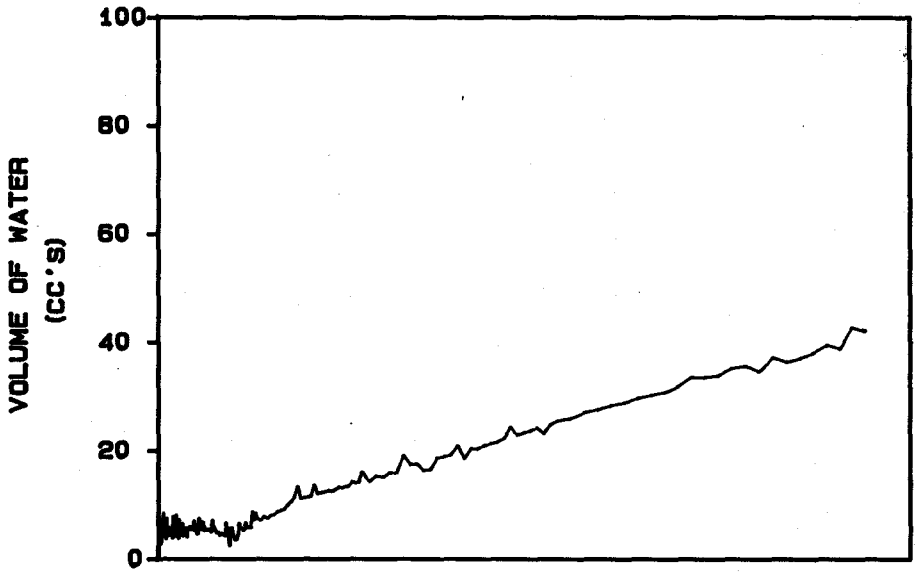


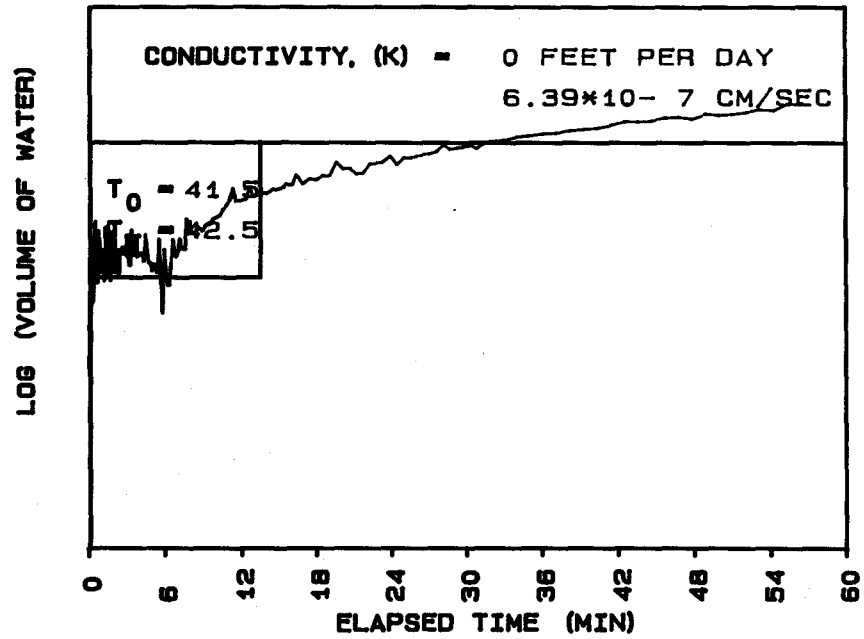


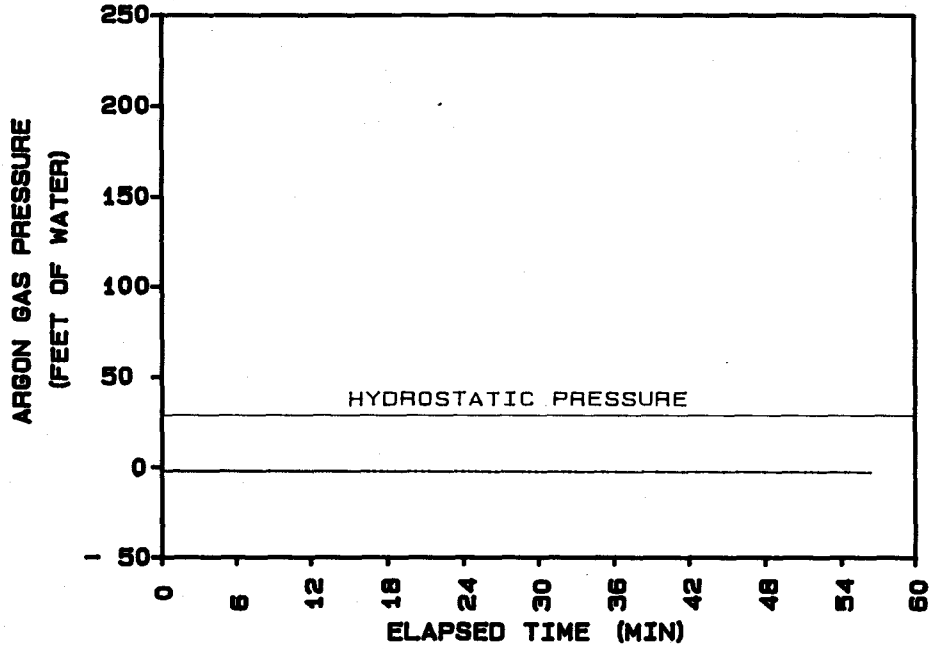
ENSAFE MEMPHIS NSA
LOCATION... 14H1211
TEST DATE
17: 51: 51 11-16-1995

SAMPLE DEPTH (FT) 11
GROUNDWATER DEPTH (FT) 5

HYDROCONE TEST



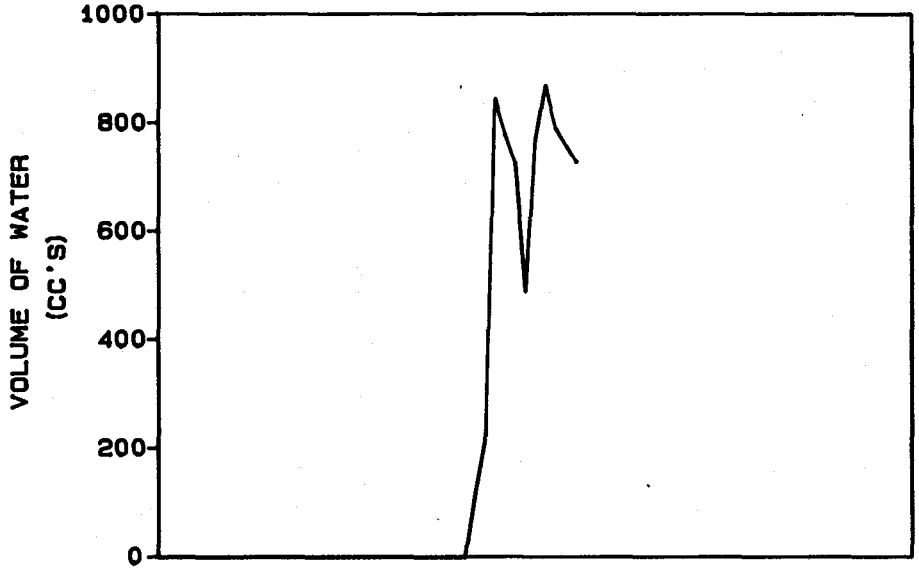


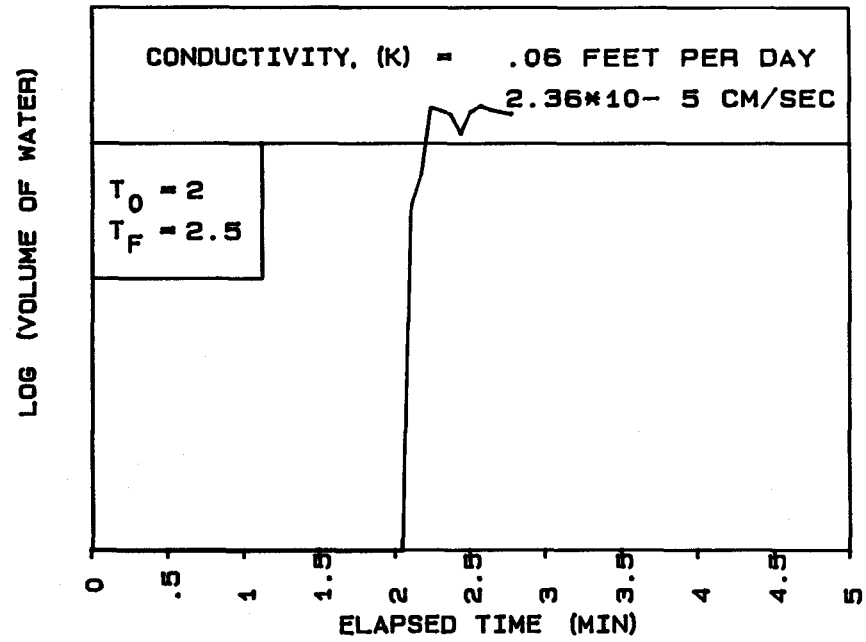


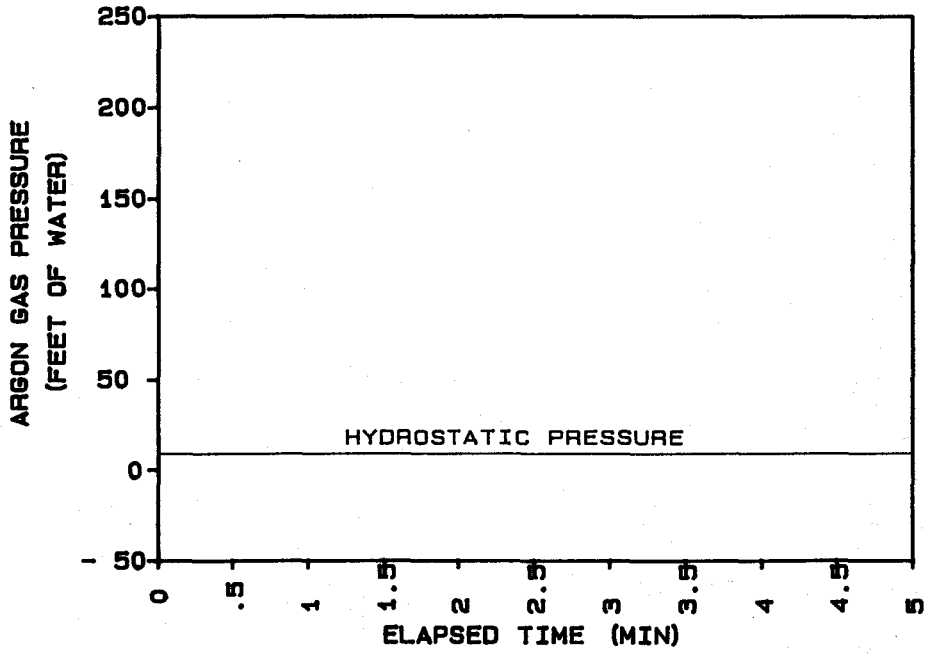
ENSAFE MEMPHIS NSA
LOCATION... 14H1239
TEST DATE
10: 28: 03 11-17-1995

SAMPLE DEPTH (FT) 39
GROUNDWATER DEPTH (FT) 11

HYDROCONE TEST



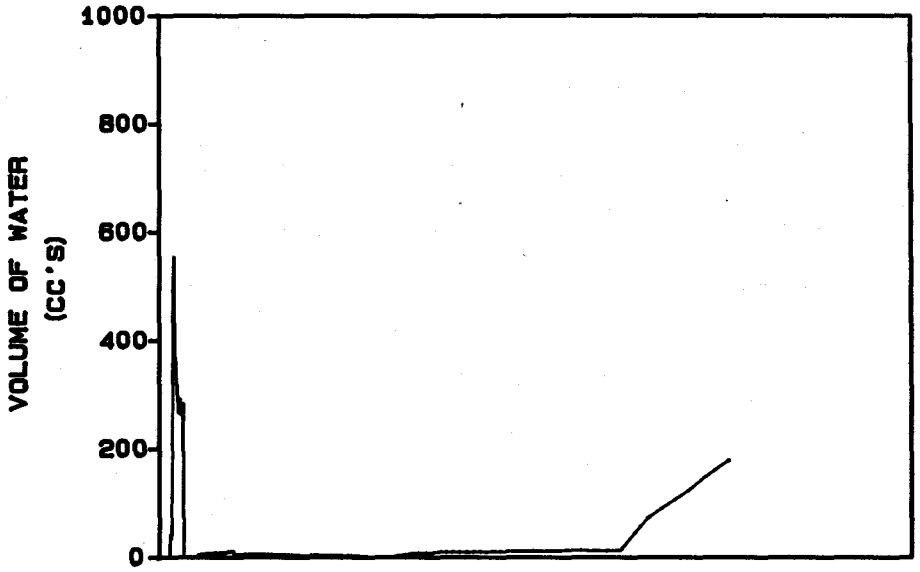


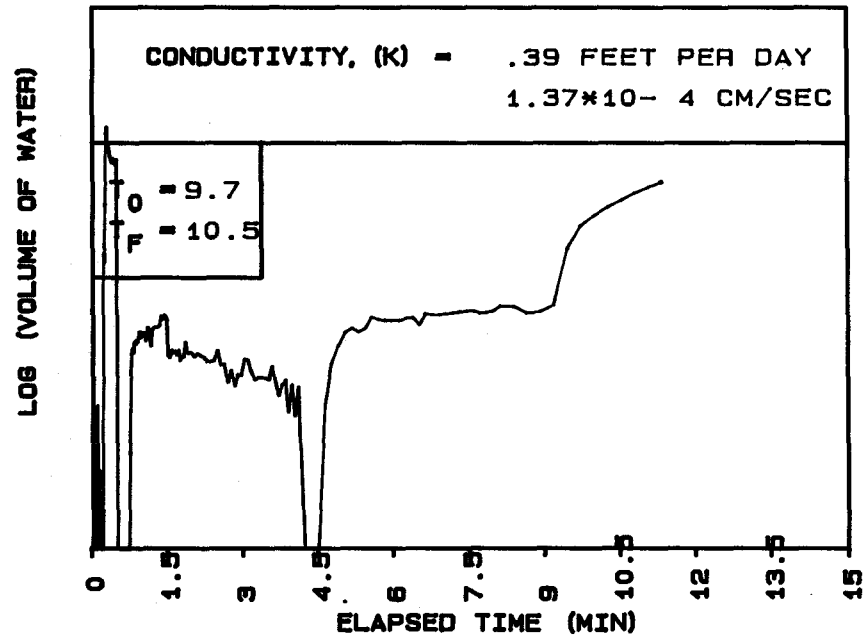


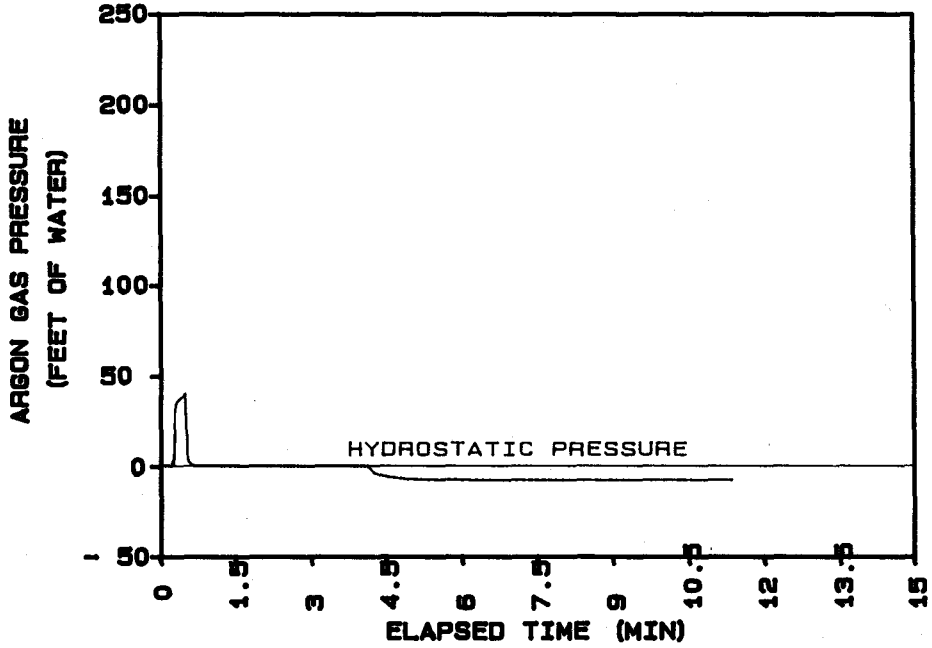
ENSAFE MEMPHIS NSA
LOCATION... 14H1313
TEST DATE
12: 24: 01 11-19-1995

SAMPLE DEPTH (FT) 13
GROUNDWATER DEPTH (FT) 5

HYDROCONE TEST



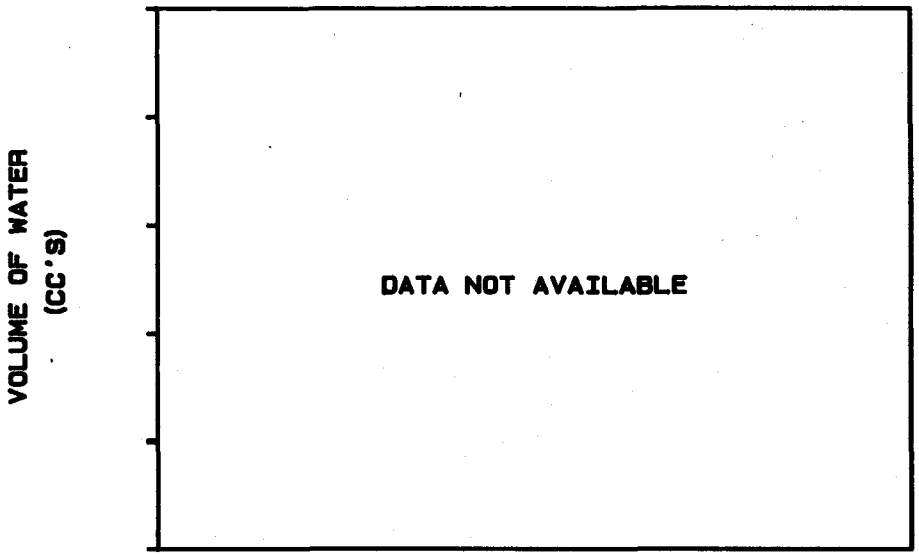


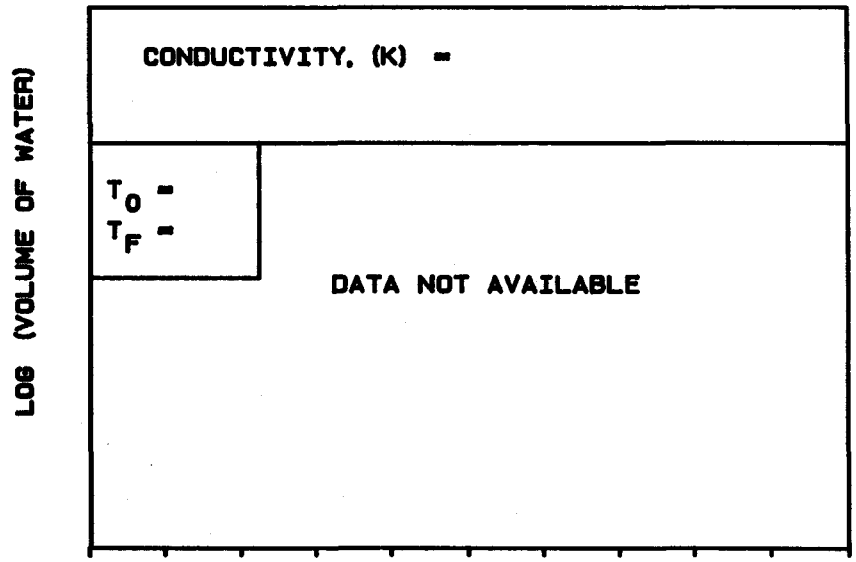


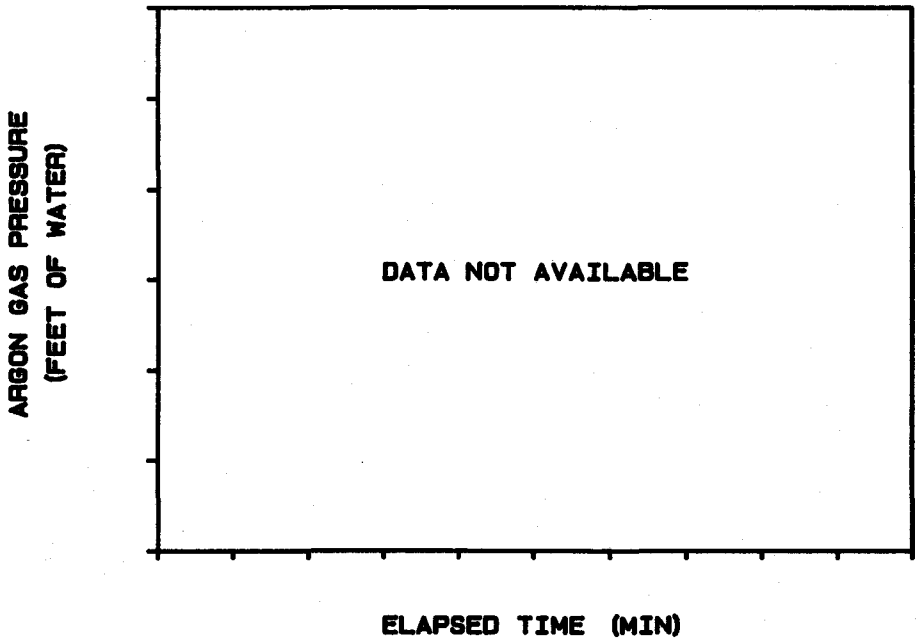
ENSAFE MEMPHIS NSA
LOCATION... 14H1411
TEST DATE
15: 30: 41 11-17-1995

SAMPLE DEPTH (FT) 11
GROUNDWATER DEPTH (FT) 11

HYDROCONE TEST







ENSAFE MEMPHIS NSA
LOCATION... 14H1437

DATA NOT AVAILABLE

HYDROCONE TEST

VOLUME OF WATER (CC'S)

DATA NOT AVAILABLE

LOG (VOLUME OF WATER)

CONDUCTIVITY, (K) =

T_O =
T_F =

DATA NOT AVAILABLE

ELAPSED TIME (MIN)

ARGON GAS PRESSURE (FEET OF WATER)

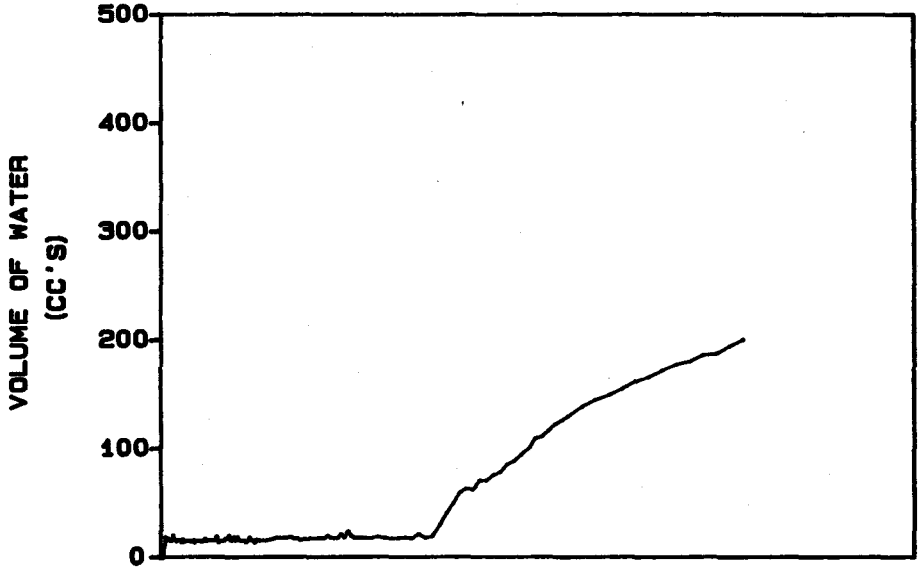
DATA NOT AVAILABLE

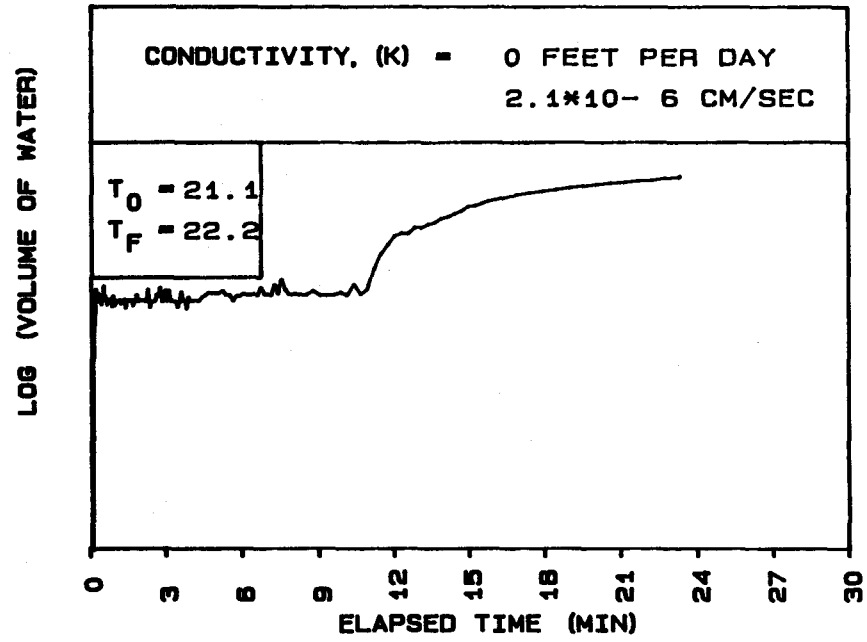
ELAPSED TIME (MIN)

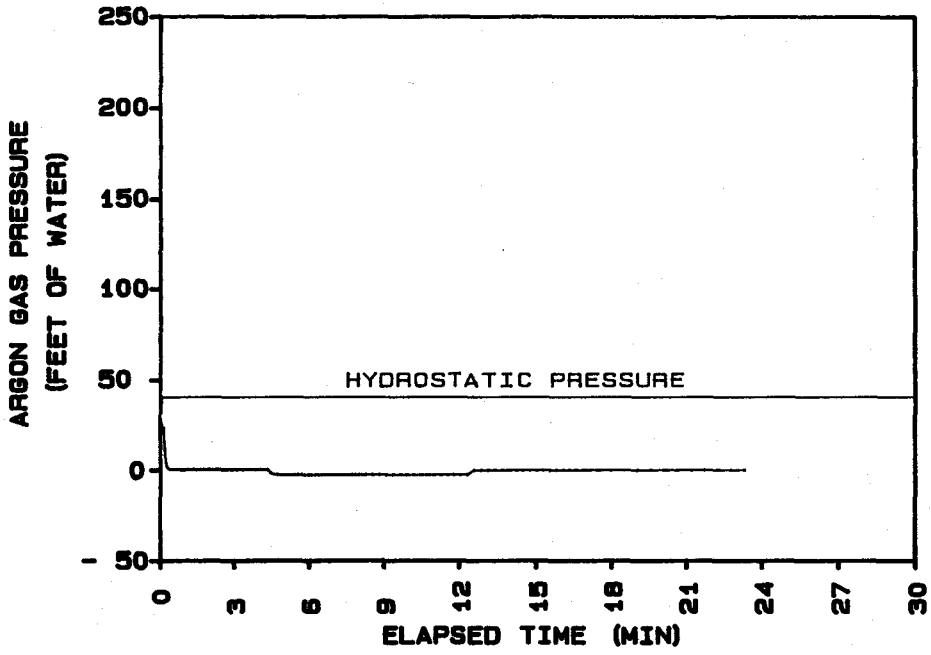
ENSAFE MEMPHIS NSA
LOCATION... 14H1513

DATA NOT AVAILABLE

HYDROCONE TEST







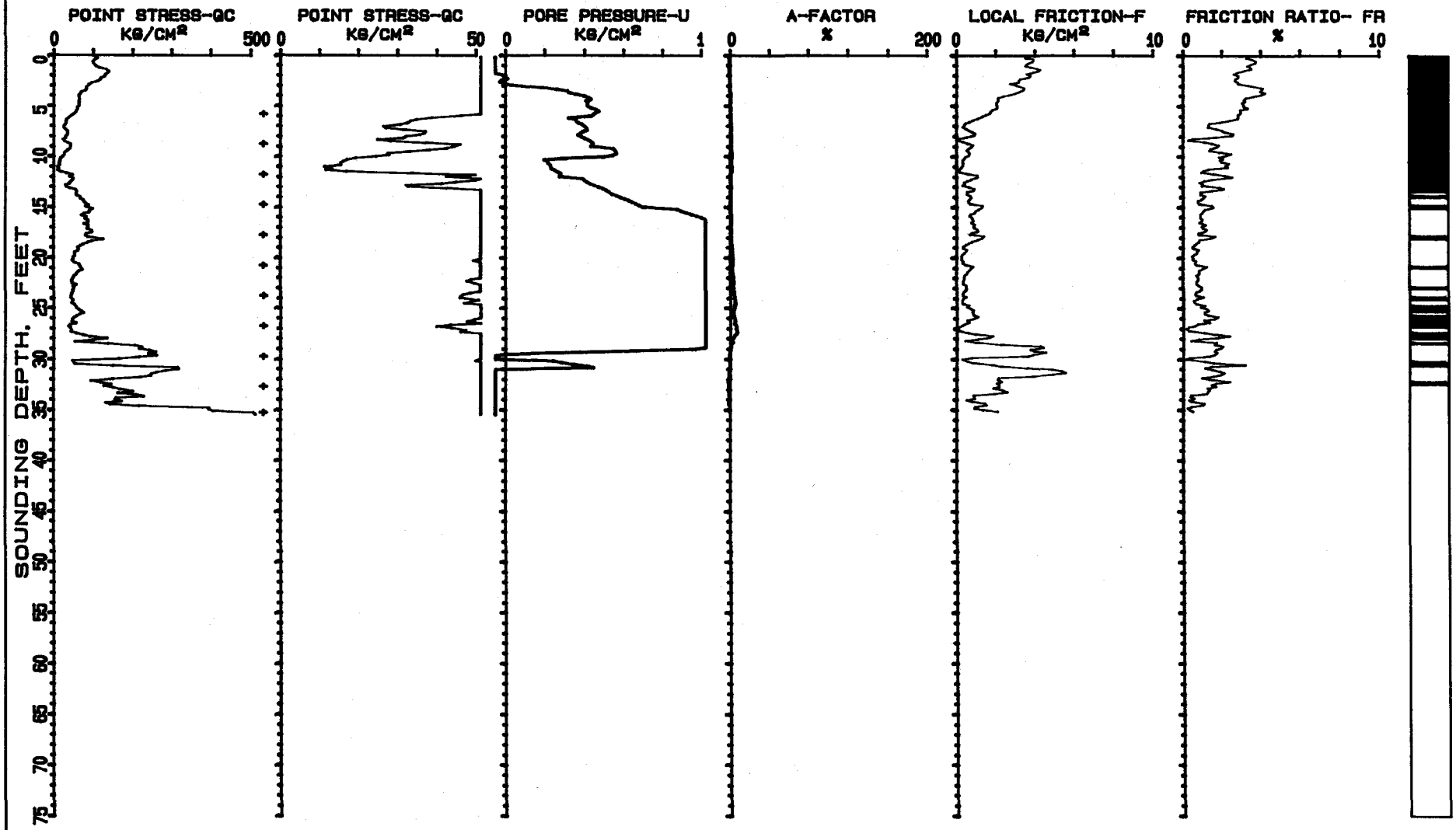
ENSAFE MEMPHIS NSA
LOCATION... 14H1543
TEST DATE
18: 50: 37 11-18-1995

SAMPLE DEPTH (FT) 45
GROUNDWATER DEPTH (FT) 5

SWMU 65

DPT SCREENING INVESTIGATION RESULTS

PIEZOCONE SOUNDING



+ PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
SOUNDING # 65-P01
TEST DATE 11-08-1995 11:28:58

IN-SITU TECHNOLOGY SOIL BEHAVIOR TABLE
FOR SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
FILE NAME..... 65-P01

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N' VALUES #	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%) *	FRICTION ANGLE (DEGREES) **	YOUNGS MODULUS (KG/CM2) ***	UNDRAINED SHEAR STRENGTH (KG/CM2) ****	SENSITIVITY	COMP.	OCR
1	CLAYEY FINE SAND	104.2	3.7	41	41	.03	>90%	>48	229	--	--	--	--
2	CLAYEY FINE SAND	124.6	3.89	49	49	.061	>90%	>48	274	--	--	--	--
3	SILTY TO CLAYEY F.S.	114.3	3.24	38	38	.092	>90%	>48	251	--	--	--	--
4	CLAYEY FINE SAND	80.4	3.07	32	32	.123	70%-80%	>48	176	--	--	--	--
5	CLAYEY FINE SAND	66.8	2.14	26	26	.153	70%-80%	46-48	146	--	--	--	--
6	CLAYEY FINE SAND	61.2	1.77	24	24	.184	70%-80%	46-48	134	--	--	--	--
7	CLAYEY FINE SAND	38.6	.74	15	15	.215	50%-60%	42-44	84	--	--	--	--
8	CLAYEY FINE SAND	32.2	.67	12	12	.246	50%-60%	42-44	70	--	--	--	--
9	SILTY TO CLAYEY F.S.	33.7	.47	11	11	.276	50%-60%	40-42	74	--	--	--	--
10	SILTY TO CLAYEY F.S.	37.2	.62	12	12	.307	50%-60%	40-42	81	--	--	--	--
11	CLAYEY FINE SAND	19.5	.35	7	7	.338	<40%	38-40	42	--	--	--	--
12	CLAYEY FINE SAND	21.7	.49	8	8	.369	<40%	38-40	47	--	--	--	--
13	SILTY TO CLAYEY F.S.	44.6	.59	14	14	.399	50%-60%	40-42	98	--	--	--	--
14	SILTY TO CLAYEY F.S.	49.3	.71	16	16	.43	50%-60%	40-42	108	--	--	--	--
15	SILTY FINE SAND	76.5	.9	19	19	.461	60%-70%	42-44	168	--	--	--	--
16	SILTY FINE SAND	86.6	.87	21	21	.492	70%-80%	42-44	190	--	--	--	--
17	SILTY FINE SAND	84.2	.88	21	21	.523	60%-70%	42-44	185	--	--	--	--
18	SILTY FINE SAND	89.4	1.06	22	22	.553	60%-70%	42-44	196	--	--	--	--
19	SILTY FINE SAND	87.6	.6	21	21	.584	60%-70%	42-44	192	--	--	--	--
20	SILTY FINE SAND	59	.36	14	14	.615	50%-60%	40-42	129	--	--	--	--
21	SILTY FINE SAND	59.2	.53	14	14	.646	50%-60%	40-42	130	--	--	--	--
22	SILTY FINE SAND	65	.5	16	16	.676	50%-60%	40-42	143	--	--	--	--
23	SILTY FINE SAND	52.3	.43	13	13	.707	40%-50%	38-40	115	--	--	--	--
24	SILTY FINE SAND	49.2	.36	12	12	.738	40%-50%	38-40	108	--	--	--	--
25	SILTY TO CLAYEY F.S.	52.3	.52	17	17	.769	40%-50%	38-40	115	--	--	--	--
26	SILTY TO CLAYEY F.S.	65.4	.85	21	21	.799	50%-60%	40-42	143	--	--	--	--
27	SILTY FINE SAND	48.1	.3	12	12	.83	<40%	38-40	105	--	--	--	--
28	SILTY TO CLAYEY F.S.	60.9	1.04	20	20	.861	40%-50%	38-40	133	--	--	--	--
29	SILTY FINE SAND	147.2	2.65	36	36	.892	70%-80%	42-44	323	--	--	--	--
30	FINE SAND	229.5	2.52	45	45	.925	>90%	44-46	504	--	--	--	--

5-P01 CONTINUED ENSAFE

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	SENSITIVITY	COMP.	OCR
31	SILTY FINE SAND	159.3	2.76	39	39	.956	70%-80%	42-44	350	--	--	--	--
32	SILTY FINE SAND	248.2	3.77	62	62	.986	>90%	44-46	546	--	--	--	--
33	SILTY FINE SAND	137.3	2.22	34	34	1.017	70%-80%	42-44	302	--	--	--	--
34	FINE SAND	183.6	1.22	36	36	1.05	80%-90%	42-44	403	--	--	--	--

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)
* NORMALLY CONSOLIDATED SANDS
** FOR OVERCONSOLIDATED SANDS,SLIGHTLY REDUCE ABOVE FRICTION ANGLES
*** FOR OVERCONSOLIDATED SANDS, YOUNG'S MODULUS MAY BE AS MUCH AS 3 TO 6 TIMES HIGHER
**** NK OF 16 USED. FOR OVERCONSOLIDATED CLAYS, AN NK OF 17 IS SUGGESTED

THE ABOVE DATA WAS COMPUTED FOLLOWING 'BASIC' GUIDELINES BY P. K. ROBERTSON AND R. G. CAMPANELLA IN THE HANDBOOK 'GUIDELINES FOR USE AND INTERPERTATION OF THE ELECTRONIC CONE PENETRATION TEST'

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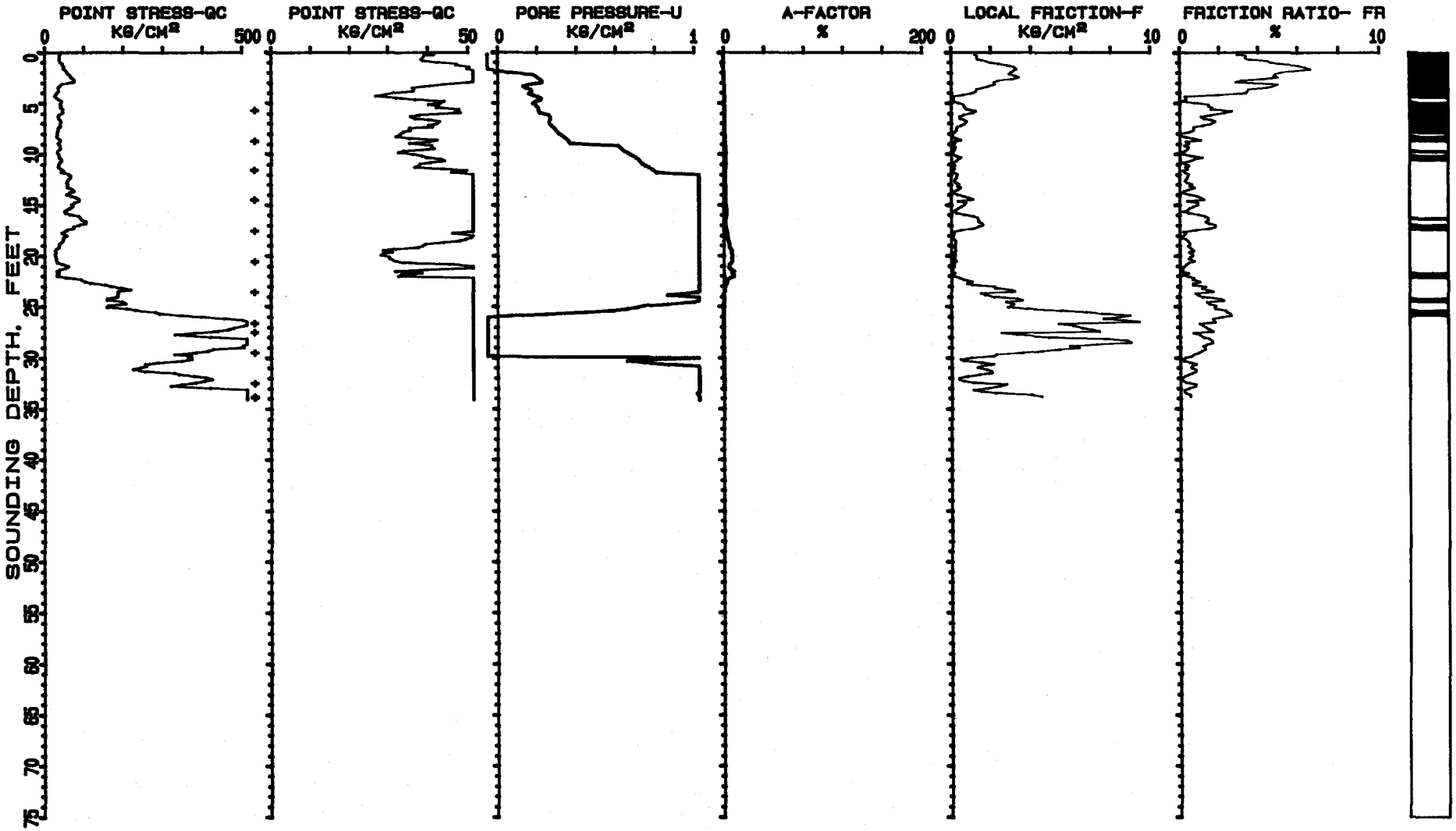
PIEZOCONE SOUNDING



+ PUSH INTERRUPTED TO ADD ROD
PORE PRESSURE DECAY DATA MAY BE AVAILABLE

FILE #..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
SOUNDING # 65-P06
TEST DATE 11-08-1995 09: 35: 45

IN-SITU TECHNOLOGY SOIL BEHAVIOR TABLE
FOR SOUTHEASTERN UNITED STATES SOILS

JOB NAME ..... ENSAFE
MEMPHIS NSA
MILLINGTON TENNESSEE
FILE NAME..... 65-P06

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N' #	VERTICAL EFFECTIVE STRESS (KG/CM2)	RELATIVE DENSITY (%) *	FRICTION ANGLE (DEGREES) **	YOUNGS MODULUS (KG/CM2) ***	UNDRAINED SHEAR STRENGTH (KG/CM2) ****	SENSITIVITY	COMP.	OCR
1	SILTY CLAY TO CLAY	39.5	1.74	26	26	.027	--	--	--	2.46	2.2	UD	>6
2	CLAY	49.9	2.97	49	49	.052	--	--	--	3.11	1.6	UD	>6
3	SANDY CLAY	68.4	2.77	34	34	.079	--	--	--	4.26	2.4	0	>6
4	SANDY CLAY	44.9	1.55	22	22	.106	--	--	--	2.79	2.8	.01	>6
5	SILTY TO CLAYEY F.S.	35	.29	11	11	.137	60%-70%	44-46	77	--	--	--	--
6	SILTY TO CLAYEY F.S.	44.5	.8	14	14	.168	60%-70%	44-46	97	--	--	--	--
7	SILTY TO CLAYEY F.S.	40.6	.57	13	13	.199	60%-70%	44-46	89	--	--	--	--
8	SILTY TO CLAYEY F.S.	37.5	.2	12	12	.23	50%-60%	42-44	82	--	--	--	--
9	SILTY FINE SAND	36	.05	9	9	.26	50%-60%	42-44	79	--	--	--	--
10	SILTY FINE SAND	37.6	.04	9	9	.291	50%-60%	42-44	82	--	--	--	--
[illegible]	SILTY FINE SAND	39.1	.11	9	9	.322	50%-60%	40-42	86	--	--	--	--
[illegible]	SILTY FINE SAND	42	.03	10	10	.353	50%-60%	40-42	92	--	--	--	--
13	SILTY FINE SAND	60.9	.26	15	15	.383	60%-70%	42-44	133	--	--	--	--
14	SILTY FINE SAND	64.3	.3	16	16	.414	60%-70%	42-44	141	--	--	--	--
15	SILTY FINE SAND	76.1	.67	19	19	.445	70%-80%	42-44	167	--	--	--	--
16	SILTY FINE SAND	63	.44	15	15	.476	60%-70%	42-44	138	--	--	--	--
17	SILTY TO CLAYEY F.S.	92	1.39	30	30	.506	60%-70%	42-44	202	--	--	--	--
18	SILTY FINE SAND	66.4	.45	16	16	.537	50%-60%	40-42	146	--	--	--	--
19	SILTY FINE SAND	46.9	.15	11	11	.568	40%-50%	40-42	103	--	--	--	--
20	SILTY TO CLAYEY F.S.	32.1	.17	10	10	.599	<40%	36-38	70	--	--	--	--
21	SILTY TO CLAYEY F.S.	33.2	.15	11	11	.629	<40%	36-38	73	--	--	--	--
22	SILTY FINE SAND	43.7	.02	10	10	.66	40%-50%	38-40	96	--	--	--	--
23	SILTY FINE SAND	94.7	1.03	23	23	.691	60%-70%	42-44	208	--	--	--	--
24	FINE SAND	191.2	2.28	38	38	.724	80%-90%	44-46	420	--	--	--	--
25	SILTY FINE SAND	181.1	2.97	45	45	.755	80%-90%	44-46	398	--	--	--	--
26	SILTY TO CLAYEY F.S.	240.2	6.24	80	80	.786	>90%	44-46	528	--	--	--	--
27	FINE SAND	468.2	7.43	93	93	.819	>90%	>48	1030	--	--	--	--
28	FINE SAND	435.9	5.27	87	87	.852	>90%	46-48	958	--	--	--	--
29	FINE SAND	486.7	6.91	97	97	.885	>90%	>48	1070	--	--	--	--
30	DENSE OR CEMENTED S.	399.6	2.76	66	66	.922	>90%	46-48	879	--	--	--	--

65-P06 CONTINUED ENSAFE

DEPTH FEET	SOIL BEHAVIOR TYPE	PT (KG/CM2)	LF (KG/CM2)	N VALUES	N'	VERTICAL STRESS	RELATIVE DENSITY	FRICTION ANGLE	YOUNGS MODULUS	UNDRAINED SHEAR ST	SENSITIVITY	COMP.	OCR
31	DENSE OR CEMENTED S.	304.4	1.29	50	50	.959	>90%	44-46	669	--	--	--	--
32	DENSE OR CEMENTED S.	311.2	1.24	51	51	.995	>90%	44-46	684	--	--	--	--
33	DENSE OR CEMENTED S.	386.8	1.45	64	64	1.032	>90%	46-48	850	--	--	--	--

\# N'=POINT STRESS*(.2+.04*FRICTION RATIO)
* NORMALLY CONSOLIDATED SANDS
** FOR OVERCONSOLIDATED SANDS,SLIGHTLY REDUCE ABOVE FRICTION ANGLES
*** FOR OVERCONSOLIDATED SANDS, YOUNG'S MODULUS MAY BE AS MUCH AS 3 TO 6 TIMES HIGHER
**** NK OF 16 USED. FOR OVERCONSOLIDATED CLAYS, AN NK OF 17 IS SUGGESTED

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ATTACHMENT 4

SOIL BORING/MONITORING WELL LOGS
GEOPHYSICAL LOGS
GEOTECHNICAL ANALYSES

SWMU 2

SOIL BORING/MONITORING WELL LOGS
AND
GEOTECHNICAL LABORATORY RESULTS

EnSafe/Allen & Hoshall

Boring 002S0029

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Geologist: *D. Ladd, W. Parks*
Started at *0750 on 2-6-96*	Surface Elevation: *266.60 feet msl*
Completed at *0915 on 2-6-96*	Drilling Method: *Rotasonic*
Total Depth: *55.0 feet*	Drilling Company: *Alliance Environmental, Inc.*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					BG		OL	(0-35') Upper Alluvium (see descriptions below).	
								(0-3.5') Soil and roots.	
			1	56	BG				263.1
								(3.5-16') Silt (see descriptions below).	
5					BG			(3.5-6') Silt, moderate yellowish-brown mottled with light olive gray, with considerable iron staining.	
					BG			(6-16') Silt, olive gray to light olive gray mottled with moderate yellowish-brown.	
					BG				
10							ML		
			2	70	BG			Moist from 12' to 16'.	
					BG			Contains iron-manganese nodules from 13' to 16'.	
15					BG			Mottled with dark yellowish-orange near 16'.	
									250.6
			3	100	BG			No description available, collected Shelby tube from 16' to 19' for geotechnical analysis.	
					BG				247.6
20								(19-30') Silt (see descriptions below).	
					BG			(19-26') Silt, olive gray to greenish-gray, with a very few snail fragments, moist.	
								With very fine sand below 22'.	
			4	100	BG			Contains roots below 23'.	
							ML	Contains iron-manganese nodules from 24' to 26'.	
25					BG				
					BG			(26-30') Silt, sandy (very fine-grained), olive gray to greenish-gray becoming light olive gray near 30', contains snail shell fragments, moist.	
								Large piece of wood at 28'.	
					BG			Percentage of sand increases near 30'.	
30							SM		236.6

EnSafe/Allen & Hoshall

Boring 002S0029

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Geologist: *D. Ladd, W. Parks*
Started at *0750 on 2-6-96*	Surface Elevation: *266.60 feet msl*
Completed at *0915 on 2-6-96*	Drilling Method: *Rotasonic*
Total Depth: *55.0 feet*	Drilling Company: *Alliance Environmental, Inc.*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			5	105	BG		SM	(30-35') Silty sand, fine to medium-grained, olive gray to light olive gray, contains a few snail shell fragments, moist.	236.6
					BG			Contains silty seams and small pieces of gravel near 35'.	
35					BG			(35-50') Deeper Alluvium (see descriptions below).	231.6
					BG		SW	(35-37.5') Sand, fine to coarse-grained, with gravel up to 0.5" in longest dimension, olive gray, moist. Wet below 36'.	229.1
			6	113	BG		SC GW / SC GW	(37.5-38.5') Sand and gravel. Sand is very clayey and medium to coarse-grained, gravel is up to 1.5" in longest dimension, color is light gray mottled with olive-gray; wet.	228.1
40			7	0				(38.5-40') Sand and gravel; sand is clayey, medium to coarse-grained, and moderate yellowish-brown; gravel is up to 2" in longest dimension and mostly dark gray.	226.6
					BG			No description available, attempted to collect a Shelby tube sample from 40' to 43', no recovery.	223.6
45					BG		GW SW	(43-46') Gravel up to 2" in longest dimension and sand, medium to coarse-grained, moderate yellowish-brown to dark yellowish-orange, wet.	220.6
					BG		SW	(46-47') Sand, fine to coarse-grained, light gray to pinkish-gray, with some pinkish-orange grains, becoming much coarser with gravel near 47'.	219.6
			8	77	BG		SW GW	(47-50') Sand, medium to very coarse-grained, and gravel up to 4" in longest dimension, moderate yellowish-brown, wet.	
50					BG		SP	(50-54.5') Cockfield Formation: Sand, fine-grained, light gray to pinkish-gray, wet from 52' to 53'.	216.6
					BG				
55					BG		SC	(54.5-55') Clayey sand, fine-grained, moderate yellowish-brown to dark yellowish-orange.	212.1 / 211.6
								Terminated soil boring at 55'.	
60									

EnSafe/Allen & Hoshall

Boring 002S0030

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Geologist: *D. Ladd, W. Parks*
Started at *1015 on 2-1-96*	Surface Elevation: *265.60 feet msl*
Completed at *1150 on 2-1-96*	Drilling Method: *Rotasonic*
Total Depth: *50.0 feet*	Drilling Company: *Alliance Environmental, Inc.*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					9		OL GW	(0-24') Upper Alluvium (see descriptions below). (0-4') Soil, gravel, and asphalt.	
			1	40	6				261.6
5					6		ML	(4-15') Silt, moderate yellowish-brown mottled with light olive gray and olive gray.	
					6			(4-10') Silt, moderate yellowish-brown mottled with light olive gray, with iron-manganese nodules.	
					6				
10			2	70				(10-15') Clayey silt, moderate yellowish-brown mottled with olive gray, becoming moist near 15'.	
					6				
					6				
15					6				250.6
			3	100				No recovery from 15 to 16'. No description available, collected Shelby tube sample from 16' to 19'	
					7				246.6
20					6		CL ML	(19-24') Clay and silt, olive gray to greenish-gray, wet.	
			4	67					
					6				
							SW ML	(24-48') Deeper Alluvium (see descriptions below).	241.6
25					6			(24-25') Sand, fine to medium-grained, and silt, olive gray to greenish-gray, with snail shell fragments, wet.	240.6
					7		ML SP	(25-26') Silt and sand, very fine-grained, olive-gray to greenish- gray, with snail shell fragments, moist.	
					6				
30									

EnSafe/Allen & Hoshall

Boring 002S0030

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Geologist: *D. Ladd, W. Parks*
Started at *1015 on 2-1-96*	Surface Elevation: *265.60 feet msl*
Completed at *1150 on 2-1-96*	Drilling Method: *Rotasonic*
Total Depth: *50.0 feet*	Drilling Company: *Alliance Environmental, Inc.*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			5	96	6				
					6		ML SP	(26-37.5') Same as above, with some areas smeared dark greenish-gray, becoming less moist near 36'.	
35					6				
					6				
			6	100			SM	(37.5-39') Silty sand, fine to coarse-grained, olive gray with snail shell fragments, wet.	228.1
					6		SW GW	(39-40') Sand, medium to very coarse-grained, and gravel, olive gray, wet.	226.6
40			7	100			SW GW	No description available, collected Shelby tube sample from 40' to 43'	225.6
									222.6
45			8	107	6		SP GW	(43'-47.5') Very coarse-grained sand and gravel up to 2" in longest dimension, moderate yellowish-brown mottled with very light gray material, wet.	
					6				218.1
					6		SP GW	(47.5-48.5') Gravel up to 3" in longest dimension, and sand, very coarse, very light gray, wet. maximum of 3", color changes to very light gray.	217.6
50							CL ML	(48-50') Cockfield Formation: Clay, sandy and silty, dusky yellowish-brown with sandy seams.	215.6
55									
60									

Terminated soil boring at 50' and grouted to full depth.

Organic vapor readings may be attributed to moisture response of the instrument.

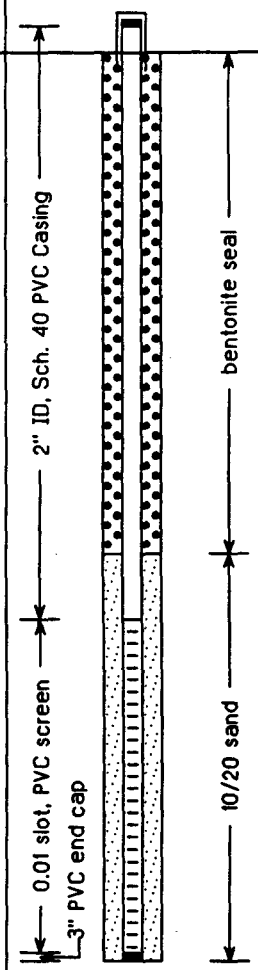
EnSafe/Allen & Hoshall

Monitoring Well 002G01UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *266.72 feet msl*
Started at *0800 on 2-13-96*	TOC Elevation: *269.30 feet msl*
Completed at *0900 on 2-13-96*	Depth to Groundwater: *11.52 feet* Measured: *4/9/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *257.78 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *27.0 feet*
Geologist: *J. Kingsbury*	Well Screen: *17 to 27 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
		◢	1					(0-27') Upper Alluvium (see descriptions below).	
								Clayey silt, moderate yellowish brown to light brown.	
5								Some organics and iron staining (5'-6').	
								Clayey silt, moderate yellowish brown, moist, abundant organic and iron specks from 6' to 10' becoming less frequent from 10' to 16'.	
		◢	2					speckles.	
10									
							ML		
15		◢	3					Clayey silt, olive green with dark yellowish orange mottling.	
								Silt, light olive gray to greeenish-gray, wet at 20', some minor sand 25' to 26', sulfur-like odor.	
20									
25									
								Same as above, shell and small snail fragments, organic debris	239.7
								Boring terminated at 27'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log of adjacent monitoring well 002G01DA.	
30									
35									
40									

WELL DIAGRAM



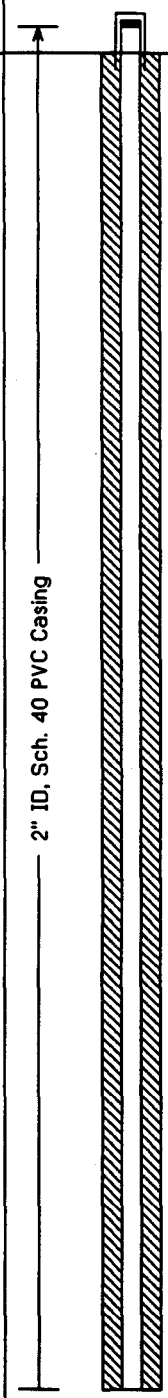
EnSafe/Allen & Hoshall

Monitoring Well 002G01DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *266.90 feet msl*
Started at *1400 on 2-12-96*	TOC Elevation: *269.55 feet msl*
Completed at *1645 on 2-12-96*	Depth to Groundwater: *6.49 feet* Measured: *4/10/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *263.06 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *68.0 feet*
Geologist: *J. Kingsbury*	Well Screen: *48 to 58 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
								(0-39') Upper Alluvium (see descriptions below).	
			1	66	BG			Clayey silt, moderate yellowish-brown to light brown.	
5								Some organics and iron staining (5'-6').	
								Clayey silt, moderate yellowish brown, moist, abundant organic and iron specks from 6' to 10' becoming less frequent from 10' to 16'.	
10			2	90	BG				
15								Clayey silt, olive green with dark yellowish-orange mottling.	
								Silt, light olive gray to greenish-gray, wet at 20', some minor sand 25' to 26', sulfur-like odor.	
20			3	100	BG		ML		
25								Same as above, shell and small snail fragments, organic debris, wood at 28'.	
30			4	100	BG				
35									
40							SW GW	(39-59') Deeper Alluvium (see descriptions below).	227.9

WELL DIAGRAM



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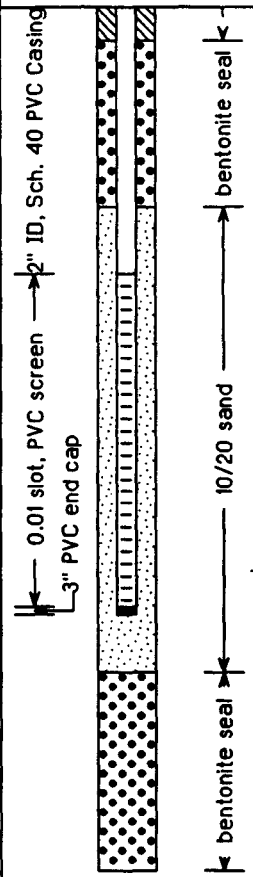
Monitoring Well 002G01DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *266.90 feet msl*
Started at *1400 on 2-12-96*	TOC Elevation: *269.55 feet msl*
Completed at *1645 on 2-12-96*	Depth to Groundwater: *6.49 feet* Measured: *4/10/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *263.06 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *66.0 feet*
Geologist: *J. Kingsbury*	Well Screen: *48 to 58 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
45			5	30	BG		SW/GW	(39-48') Sand and gravel, light yellowish-brown. Contact is approximate; location unceratin due to poor return in the core barrel.	218.9
50			6	120	BG		SW	Sand, light yellowish-brown, gravel from 48' to 56'.	210.9
55							SW/GW	Sand and gravel, light yellowish brown.	207.9
60			7	100	BG		SC	Gravel is up to 3" diameter. Cockfield Formation: Silty fine-grained sand, tan to light brown at contact. Changes to medium-gray, silty and clayey fine-grained sand below, micaceous, mottled with light brown silt and fine sand.	200.9
65								Soil boring terminated at 66'.	
70									
75									
80									

WELL DIAGRAM



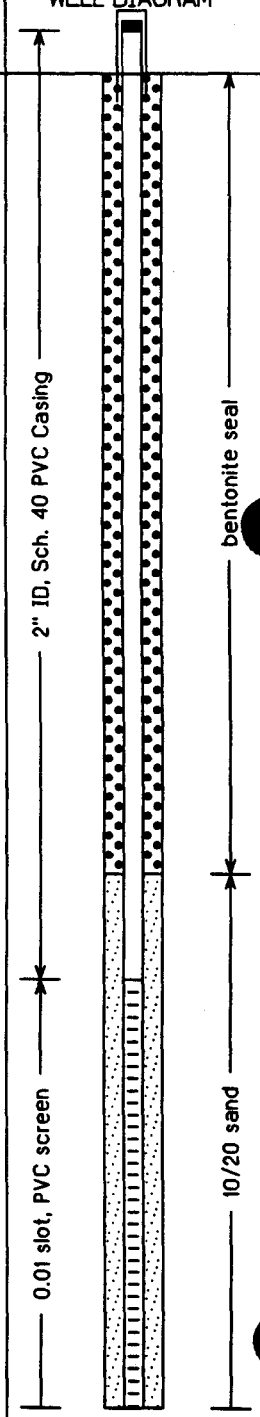
EnSafe/Allen & Hoshall

Monitoring Well 002G02UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.43 feet msl*
Started at *1150 on 2-12-96*	TOC Elevation: *269.57 feet msl*
Completed at *1230 on 2-12-96*	Depth to Groundwater: *10.64 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *258.93 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *27.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *17 to 27 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			1				OL	(0-27') Upper Alluvium (see descriptions below).	266.4
								(0-1') Soil.	
							ML	(1-15') Silt (see descriptions below).	
								(1-4') Silt, very clayey, moderate yellowish-brown.	
5								(4-6') Silt, moderate yellowish-brown, very dry from 4' to 5'.	
								(6-15') Silt, moderate yellowish-brown mottled with some light olive gray, with considerable iron staining and iron-manganese nodules, especially from 14' to 15'.	
			2						
10									
								(14-15') Becoming moist.	
15			3						252.4
							ML	(15-27') Silt, clayey, dark greenish-gray (see descriptions below).	
								(15-16') Silt, very clayey, dark greenish-gray, moist.	
								(16-26') Same as above with some snail shell fragments.	
20									
								Slightly sandy from 23' to 26'.	
25									

WELL DIAGRAM



EnSafe/Allen & Hoshall	Monitoring Well 002G02UA
Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 – Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.43 feet msl*
Started at *1150 on 2-12-96*	TOC Elevation: *269.57 feet msl*
Completed at *1230 on 2-12-96*	Depth to Groundwater: *10.64 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic – 4" core barrel inside 6" casing*	Groundwater Elevation: *258.93 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *27.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *17 to 27 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
							ML	(26-27') Same as above, becoming mottled with olive gray material.		
								Soil boring terminated at 27'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log of adjacent monitoring well 002G02DA.	240.4	10/20 sand
30										
35										
40										
45										
50										

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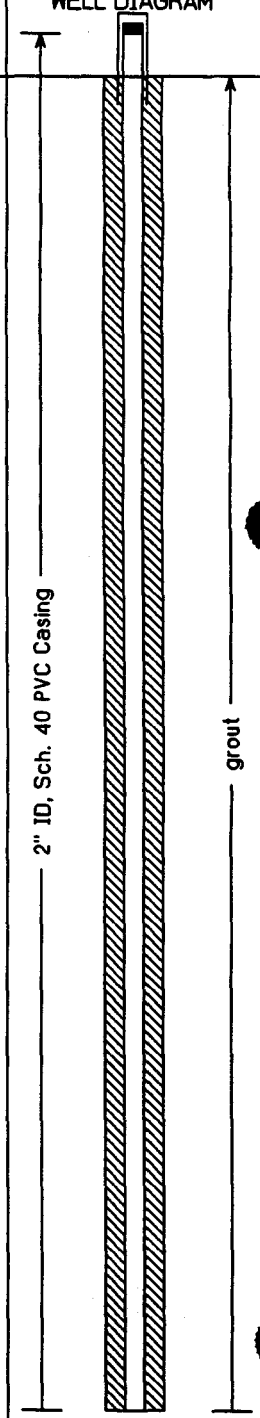
Monitoring Well 002G02DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.09 feet msl*
Started at *0745 on 2-7-96*	TOC Elevation: *269.56 feet msl*
Completed at *0843 on 2-7-96*	Depth to Groundwater: *9.74 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *259.82 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *56.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *41 to 51 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							OL	(0-38') Upper Alluvium (see descriptions below).	266.1
								(0-1') Soil.	
			1	90	BG			(1-15') Silt (see descriptions below).	
								(1-4') Silt, very clayey, moderate yellowish-brown.	
5								(4-6') Silt, moderate yellowish-brown, very dry from 4' to 5'.	
								(6-15') Silt, moderate yellowish-brown mottled with some light olive gray, with considerable iron staining and manganese nodules, especially from 14 to 15'.	
							ML		
10			2	46	BG				
								(14-15') Becoming moist.	
15									252.1
								(15-27') Silt, clayey, dark greenish-gray (see descriptions below).	
								(15-16') Silt, very clayey, dark greenish-gray, moist.	
								(16-26') Same as above, with some snail shell fragments.	
20							ML		
			3	89	BG				
								Slightly sandy from 23' to 26'.	
25									

WELL DIAGRAM



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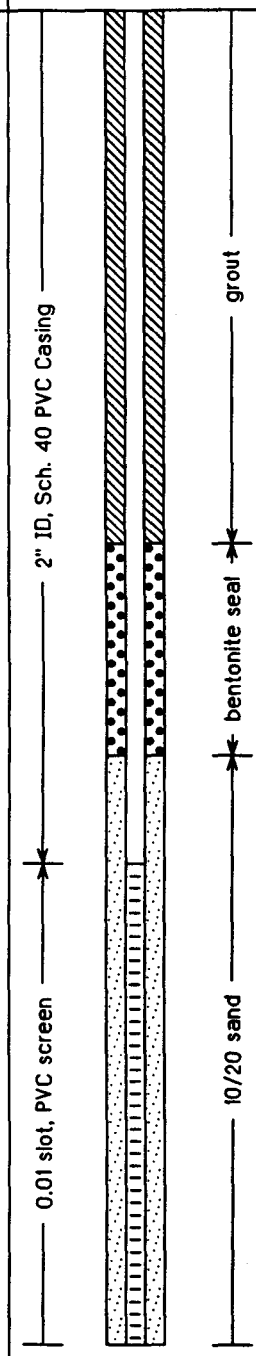
Monitoring Well 002G02DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.09 feet msl*
Started at *0745 on 2-7-96*	TOC Elevation: *269.56 feet msl*
Completed at *0843 on 2-7-96*	Depth to Groundwater: *9.74 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *259.82 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *56.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *41 to 51 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							ML	(26-27') Same as above, becoming mottled with olive gray.	240.1
							ML	(27-30') Sandy silt, olive gray, moist.	237.1
30			4	100	BG		SM	(30-31') Silty sand; medium to coarse-grained, olive gray, wet, wood at 30'.	236.1
							ML	(31-32') Sandy silt; olive gray, moist.	235.1
							SM	(32-33') Silty sand; medium to coarse-grained with small diameter gravel, olive gray, wet, wood at 33'.	234.1
35							ML	(33-37.5') Silt (see descriptions below). (33-36') Clayey silt, olive gray with some snail shell fragments, moist. Some greenish-gray color material at 33.5'. (36-37.5') Same as above, becoming slightly sandy.	229.1
							SW GW	(38-53') Deeper Alluvium (see descriptions below).	
40			5	100	BG		SM GW	(38-40.5') Sand and gravel; sand is fine to coarse-grained, gravel is up to 0.5" in longest dimension, light olive gray to olive gray, with olive gray clay seams, wet. Wood at 38.5' and 40'.	226.6
							SM GW	(40.5-45') Silty sand and gravel; sand is coarse to very coarse- grained, gravel is up to 1.5" in longest dimension; mostly olive gray at 40.5' becoming moderate yellowish-brown mottled with light gray below, wet.	
45							SW	Becoming lighter in color near 45'.	222.1
							SW GW	(45-46') Sand, medium to coarse-grained, dark yellowish-orange, with a few small pieces of gravel.	221.1
							SW GW	(46-50') Gravel and sand; gravel is up to 3.5" in longest dimension; moderate yellowish-brown to dark yellowish-orange, wet.	
50									217.1

WELL DIAGRAM



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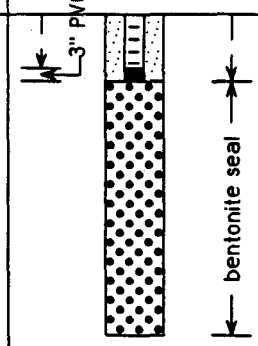
Monitoring Well 002G02DA

Project: *NSA Memphis*	Location: *Millington, TN SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.09 feet msl*
Started at *0745 on 2-7-96*	TOC Elevation: *269.56 feet msl*
Completed at *0843 on 2-7-96*	Depth to Groundwater: *9.74 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *259.82 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *56.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *41 to 51 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			6	95	BG		SW GW	(50-51') Sand, medium to very coarse-grained and gravel up to 2" in longest dimension. Moderate yellowish-brown mottled with light gray material, wet.	217.1
							CL ML	(51.5-53') Silty and sandy clay with gravel up to 2.5" in longest dimension. Very light gray mottled with moderate yellowish-brown and dark yellowish-orange material. Wet.	215.6
55							SP SC	Cockfield Formation: Sand, fine-grained, very light gray mottled with moderate yellowish-brown and dark yellowish-orange material, slightly clayey, wet from 53' to 54'. With splotches of light brownish-gray material at 55', becoming very fine dark yellowish-orange sand below 55'.	214.1
								Terminated soil boring at 56'.	211.1
60									
65									
70									
75									

WELL DIAGRAM



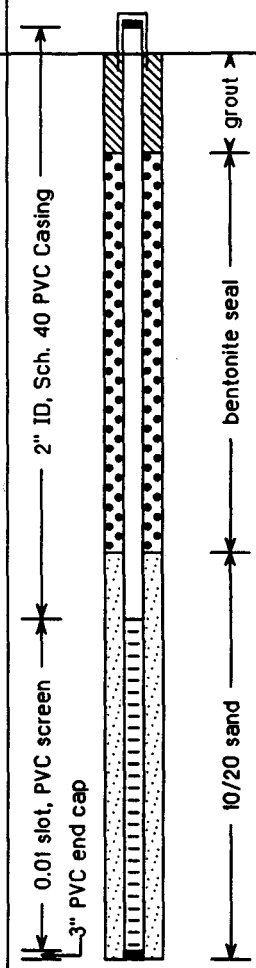
EnSafe/Allen & Hoshall

Monitoring Well 002G03UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 – Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.28 feet msl*
Started at *1400 on 2-6-96*	TOC Elevation: *269.73 feet msl*
Completed at *1500 on 2-6-96*	Depth to Groundwater: *13.09 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic – 4" core barrel inside 6" casing*	Groundwater Elevation: *256.64 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *27.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *17 to 27 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
		■	1				OL/GP	(0-27') Upper Alluvium (see descriptions below).	
								(0-2') Soil, gravel and asphalt.	265.3
5							ML	(2-6') Clayey silt; olive gray to light olive gray to greenish-gray. Contains some iron-manganese nodules.	261.3
								(6-13.5') Silt, moderate yellowish-brown and mottled with light olive gray material.	
10		■	2				ML	(11.5-13.5') Becoming moist with iron staining and iron-manganese nodules.	253.8
15		■	3					(13.5-27') Silt (see descriptions below). (13.5-26') Silt, olive gray to greenish-gray. Moist.	
20							ML	Iron-manganese nodules below 20', becoming more moist with scattered shell fragments. Becoming slightly sandy below 22'.	
25								Wood fragment at 25.5'.	
								(26-27') Sandy and clayey silt with iron-manganese nodules.	240.3
30								Terminated soil boring at 27'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log of adjacent monitoring well 002G03DA.	
35									
40									

WELL DIAGRAM



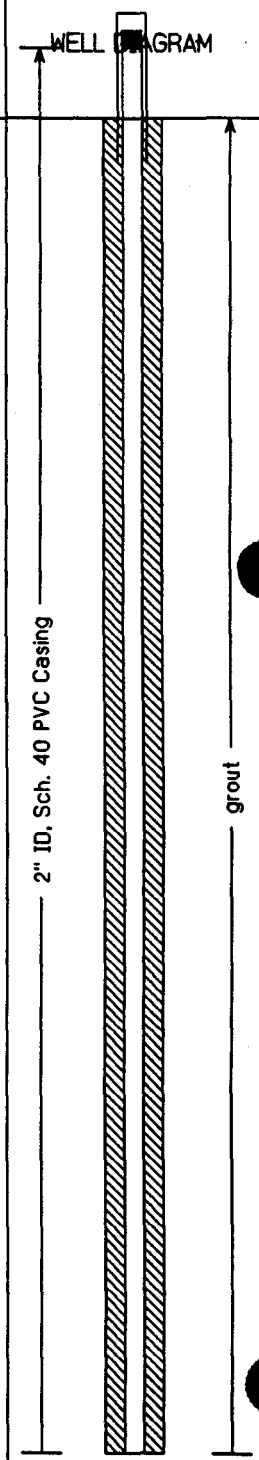
EnSafe/Allen & Hoshall

Monitoring Well 002G03DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.16 feet msl*
Started at *1015 on 2-6-96*	TOC Elevation: *269.62 feet msl*
Completed at *1150 on 2-6-96*	Depth to Groundwater: *10.91 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *258.71 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *60.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *38 to 48 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							OL GP	(0-29') Upper Alluvium (see descriptions below). (0-2') Soil, gravel, and asphalt.	265.2
			1	42	1.5		ML	(2-6') Clayey silt; olive gray to light olive gray to greenish-gray. Contains some iron-manganese nodules.	261.2
5									
10			2	83	BG		ML	(6-13.5') Silt, moderate yellowish-brown mottled with light olive gray material. (11.5-13.5') Becoming moist with iron staining and iron-manganese nodules.	253.7
15							ML	(13.5-30') Silt (see descriptions below). (13.5-26') Silt, olive gray to greenish-gray. Moist.	

WELL DIAGRAM



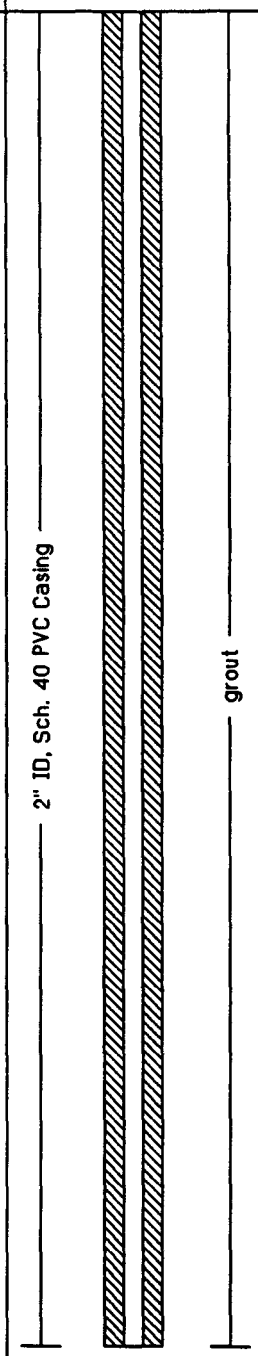
EnSafe/Allen & Hoshall

Monitoring Well 002G03DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 – Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.16 feet msl*
Started at *1015 on 2-6-96*	TOC Elevation: *269.62 feet msl*
Completed at *1150 on 2-6-96*	Depth to Groundwater: *10.91 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic – 4" core barrel inside 6" casing*	Groundwater Elevation: *258.71 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *60.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *38 to 48 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
20			3	65	BG		ML	Iron-manganese nodules below 20', becoming more moist with scattered shell fragments. Becoming slightly sandy below 22'. Wood fragment at 25.5'.	
25								(26-30') Sandy and clayey silt with iron-manganese nodules. Wood fragments from 28' to 29'.	
30							SW	(29-48') Deeper Alluvium (see descriptions below).	238.2

WELL DIAGRAM



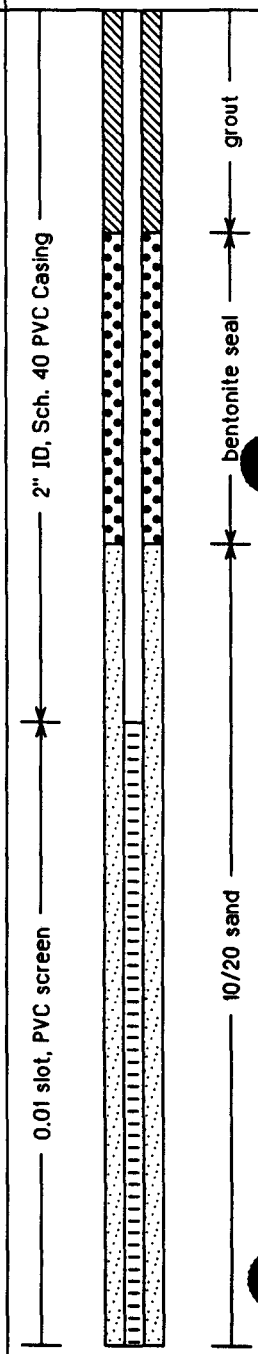
EnSafe/Allen & Hoshall

Monitoring Well 002G03DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.16 feet msl*
Started at *1015 on 2-6-96*	TOC Elevation: *269.62 feet msl*
Completed at *1150 on 2-6-96*	Depth to Groundwater: *10.91 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *258.71 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *60.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *38 to 48 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			4	66	BG		SW	(29-35') Sand, fine to medium-grained, olive gray in color. Coarsens downward. Moist. Contains few snail shell fragments.	
35							SW	(35-38') Sand, medium to coarse (see descriptions below). (35-36') Sand, medium to coarse-grained, olive gray, wet. (36-38') Sand, medium to coarse, olive gray to light olive gray color. Coarser with gravel near 38'.	232.2
			5	95	BG		SW SC	(38-39.5') Sand, slightly clayey with gravel, medium to very coarse- grained, moderate yellowish-brown, wet.	229.2
							SW SC	Clay and sand with gravel, light gray mottled with moderate yellowish- brown.	227.7
40			6					Shelby tube sample collected from 40' to 43', no lithologic description available.	227.2
45							SW GW	(43-45.5') Sand, medium to very coarse-grained, and gravel up to 1.5" in longest dimension. Moderate yellowish-brown color mottled with some light gray material. Less gravel near 45.5'. Wet.	224.2

WELL DIAGRAM



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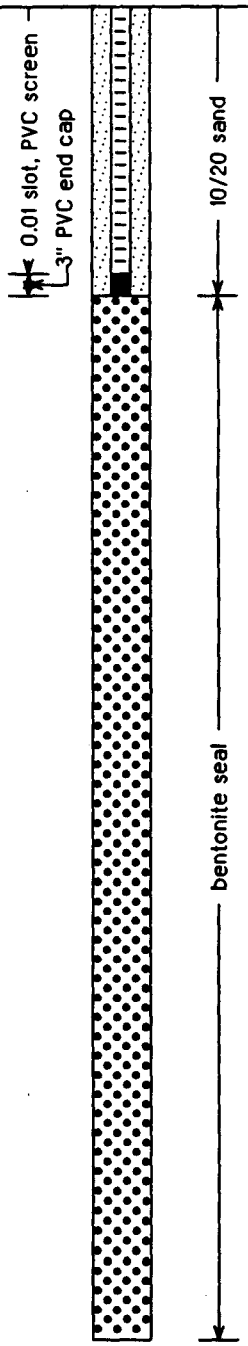
Monitoring Well 002G03DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.16 feet msl*
Started at *1015 on 2-6-96*	TOC Elevation: *269.62 feet msl*
Completed at *1150 on 2-6-96*	Depth to Groundwater: *10.91 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *258.71 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *60.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *38 to 48 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							SW GW		221.7
							SP	(45.5-46') Sand; fine to medium-grained, light gray with some pinkish-gray.	221.2
			7	121	BG		SW GW	(46-46.5') Sand, medium to coarse-grained, and gravel; moderate yellowish-brown, wet.	220.7
							SW GW	(46.5-48') Sand, medium to very coarse-grained, and gravel; olive-gray color, wet. Bottom 3" is moderate yellowish-brown sand and gravel, with gravel piece up to 3" in longest dimension.	219.2
								(48-54') Cockfield Formation: Sand; fine-grained.	
50								(48-49.5') Light gray.	
								(49.5-50') Dusky yellow.	
							SP	(50-54') Light gray.	
									213.2
								(54-60') Clay (see descriptions below).	
55			8	110	BG			(54-58') Silty and sandy clay; olive gray with sand seams, olive gray, dark yellowish-orange sand at top. Lignite seam near 58'.	
							CL		
								(58-60') Clay; olive gray in color.	
								Terminated soil boring at 60'.	
60									207.2

WELL DIAGRAM



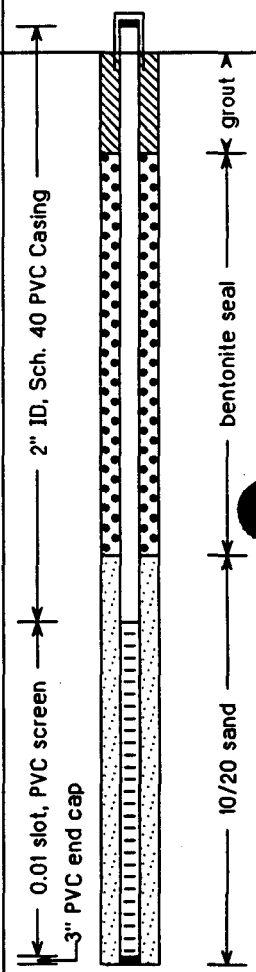
EnSafe/Allen & Hoshall

Monitoring Well 002G04UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 – Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *266.53 feet msl*
Started at *1455 on 2-5-96*	TOC Elevation: *268.76 feet msl*
Completed at *1515 on 2-5-96*	Depth to Groundwater: *8.91 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic – 4" core barrel inside 6" casing*	Groundwater Elevation: *259.85 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *27.25 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *17 to 27 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
		◢	1				OL	(0-27') Upper Alluvium (see descriptions below). (0-3.5') Soil and roots.	263
5							ML	(3.5-16') Silt (see descriptions below). (3.5-6') Silt, moderate yellowish-brown mottled with light olive gray, with considerable iron staining.	
10		◢	2					(6-16') Silt, olive gray to light olive gray mottled with moderate yellowish-brown. Moist from 12' to 16'. Contains iron-manganese nodules from 13' to 16'.	
15		◢	3					Mottled with dark yellowish-orange near 16'.	250.5
								No description available, collected Shelby tube from 16' to 19' for geotechnical analysis.	247.5
20							ML	(19-27') Silt (see descriptions below). (19-26') Silt, olive gray to greenish-gray, with a very few snail shell fragments, moist. With very fine sand below 22'. Contains roots below 23'.	
25								Contains iron-manganese nodules from 24' to 26'.	239.5
30								(26-27') Silt, sandy (very fine-grained), olive gray to greenish-gray, contains snail shell fragments, moist. Terminated soil boring at 27'. Note: No samples were collected for lithologic description; these descriptions were transferred from the log of adjacent soil boring 002S0029DA.	
35									
40									

WELL DIAGRAM



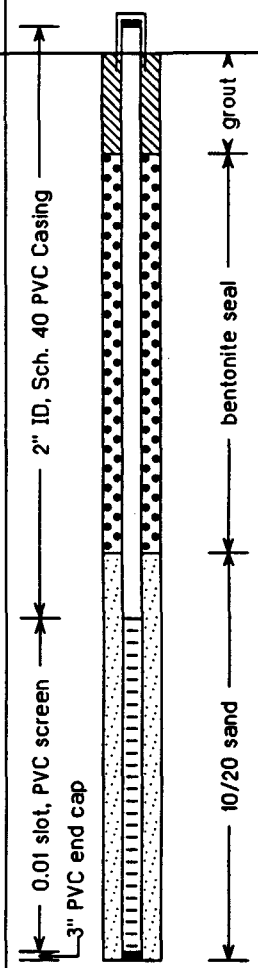
EnSafe/Allen & Hoshall

Monitoring Well 002G05UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 – Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.14 feet msl*
Started at *1315 on 2-5-96*	TOC Elevation: *269.39 feet msl*
Completed at *1400 on 2-5-96*	Depth to Groundwater: *11.45 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic – 4" core barrel inside 6" casing*	Groundwater Elevation: *257.94 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *27.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *17 to 27 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
		■	1					(0-27') Upper Alluvium (see descriptions below).	
								(0-15.5') Silt; moderate yellowish-brown mottled with some light olive gray material. Contains sattered iron-manganese nodules.	
5									
							ML		
		■	2						
10								Slightly moist near 11'.	
								Becoming mottled with some dark greenish-gray material near 14'.	
15		■	3						251.6
								Increase in percentage of iron-manganese nodules near 15.5'.	
								(15.5-26') Silt, dark greenish-gray, slightly moist.	
20							ML	Becoming light olive gray to greenish gray with depth.	
								Snail shell fragments near 20'.	
25									241.1
								No description available due to no sample recovery from 26' to 27'.	240.1
								Terminated soil boring at 27'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log of adjacent monitoring well 002G05DA.	
30									
35									
40									

WELL DIAGRAM



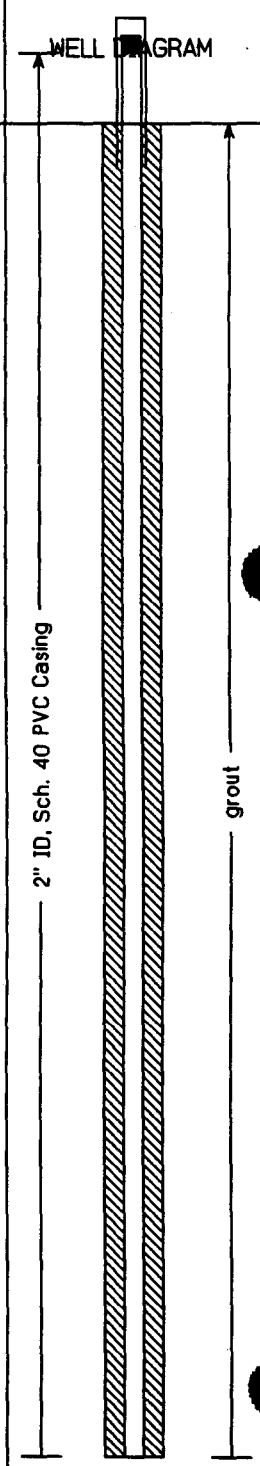
EnSafe/Allen & Hoshall

Monitoring Well 002G05DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.16 feet msl*
Started at *0850 on 2-5-96*	TOC Elevation: *269.33 feet msl*
Completed at *1030 on 2-5-96*	Depth to Groundwater: *12.99 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *256.34 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *55.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *40.5 to 50.5 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
								(0-34') Upper Alluvium (see descriptions below).	
					BG			(0-15.5') Silt (see descriptions below).	
								Moderate yellowish-brown and mottled with some light olive gray Contains scattered iron-manganese nodules.	
			1	88	BG				
5					BG				
					BG		ML		
					BG				
10			2	80	BG			Slightly moist near 11'.	
					BG				
								Becoming mottled with some dark greenish-gray material near 14'.	
15					BG				

WELL DIAGRAM



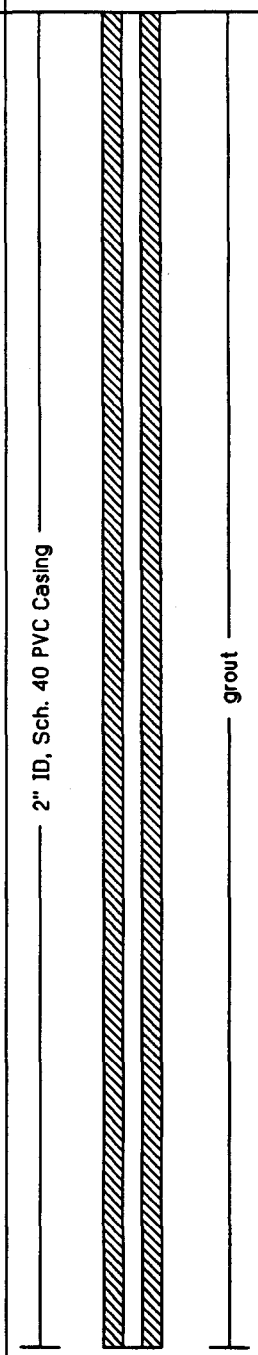
EnSafe/Allen & Hoshall

Monitoring Well 002G05DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 – Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.16 feet msl*
Started at *0850 on 2-5-96*	TOC Elevation: *269.33 feet msl*
Completed at *1030 on 2-5-96*	Depth to Groundwater: *12.99 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic – 4" core barrel inside 6" casing*	Groundwater Elevation: *256.34 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *55.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *40.5 to 50.5 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
	X							Increase in percentage of iron-manganese nodules near 15.5'.	251.7
								(15.5-26') Silt (see descriptions below).	
								Dark greenish-gray, slightly moist.	
					BG			Becoming light olive gray to greenish-gray with depth.	
					BG				
20								Snail shell fragments near 20'.	
			3	75	BG		ML		
					BG				
25					BG				
							ML	No description available due to no sample recovery.	241.2
				0					
	X							(28-34') Silt and very-fine grained sand with rare snail shell fragments, moist.	239.2
					BG		ML SP		
30									

WELL DIAGRAM



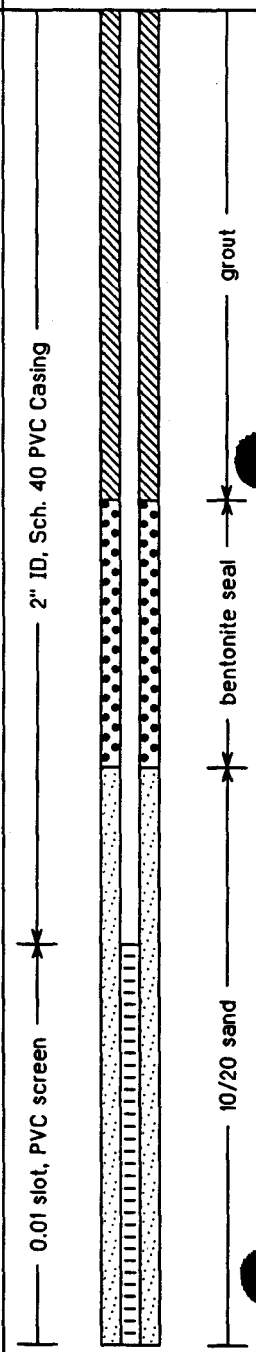
EnSafe/Allen & Hoshall

Monitoring Well 002G05DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 – Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.16 feet msl*
Started at *0850 on 2-5-96*	TOC Elevation: *269.33 feet msl*
Completed at *1030 on 2-5-96*	Depth to Groundwater: *12.99 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic – 4" core barrel inside 6" casing*	Groundwater Elevation: *256.34 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *55.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *40.5 to 50.5 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			4	71	BG	ML SP		
					BG			
						SM	(34-50') Deeper Alluvium (see descriptions below). (34-34.5') Sand, fine to coarse-grained, mixed with silt, olive gray to greenish-gray with snail shell fragments, moist.	233.2
						ML		232.7
35					BG			232.2
						ML	(34.5-35') Silt; olive gray to greenish-gray. Dry.	
					BG		(35-37') Clayey silt with some fine to medium-grained sand and a few pieces of dark-colored gravel, olive-gray, moist. Wood at 35.5'.	230.2
						SM	(37-39') Silty sand, fine to very coarse-grained, with quartz and chert gravel, olive gray, wet.	
					BG			228.2
						ML	(39-39.5') Silt; olive gray to light brownish-gray. Dry.	227.7
40			5	100		SW GW	(39.5-41') Sand, coarse to very coarse-grained, and gravel up to 2.5" in longest dimension, olive gray near 39.5', then very light gray mottled with moderate yellowish-brown, wet.	
					BG			226.2
						SP GW	(41-43') Sand and gravel; sand is very coarse-grained, some gravel appears weathered; moderate yellowish-brown mottled with some light olive gray material, wet.	
					BG			224.2
						SP GW	(43-43.5') Sand and gravel, dark yellowish-orange in color, wet.	223.7
						GW SW	(43.5-44') Gravel and sand, wet; gravel is gray and red in color and up to 1.5" in longest dimension, sand is light gray.	223.2
						GW SW		
45					BG			

WELL DIAGRAM



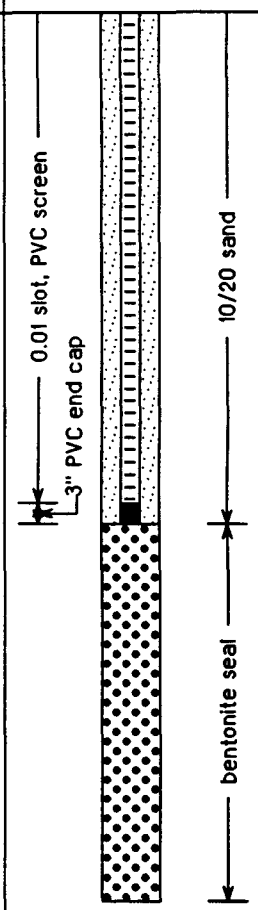
EnSafe/Allen & Hoshall

Monitoring Well 002G05DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.16 feet msl*
Started at *0850 on 2-5-96*	TOC Elevation: *269.33 feet msl*
Completed at *1030 on 2-5-96*	Depth to Groundwater: *12.99 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *256.34 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *55.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *40.5 to 50.5 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							GW/SW	(44-46') Gravel and sand; gravel is up to 3" in longest dimension and dark gray, sand is moderate yellowish-brown to dark yellowish-orange, wet.	221.2
							GW/SW		220.7
					BG			(46-46.5') Gravel and sand; gravel is up to .75" in longest dimension, sand is coarse-grained and moderate yellowish-brown to dark yellowish-orange, wet.	
							GW/SW	(46.5-50') Gravel and sand; gravel is up to 3" in longest dimension, sand is very coarse-grained and moderate yellowish-brown to dark yellowish-orange, wet.	
					BG				
50			6	93	BG				217.2
					BG		SC	(50-52.5') Cockfield Formation: clayey sand; fine-grained, stained moderate yellowish-brown to dark yellowish-orange with some very light gray seams of material.	
									214.7
					BG		SP	(52.5-55') Sand, fine-grained, very light gray color mottled with some dark yellowish-orange material.	
					BG				
55								Soil boring terminated at 55'.	212.2
60									

WELL DIAGRAM



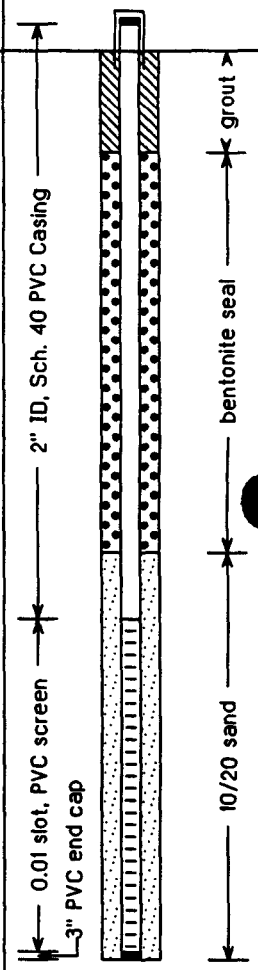
EnSafe/Allen & Hoshall

Monitoring Well 002G06UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.82 feet msl*
Started at *1350 on 2-2-96*	TOC Elevation: *269.61 feet msl*
Completed at *1515 on 2-2-96*	Depth to Groundwater: *16.74 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *252.87 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *27.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *17 to 27 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
		◢	1				OL GP	(0-27') Upper Alluvium (see descriptions below). (0-.5) Soil, gravel, and asphalt.	
5							ML	(.5-15') Silt, mostly moderate yellowish-brown to light olive gray. (.5-6') Silt; moderate yellowish-brown mottled with light olive gray material. Some iron staining and rare iron-manganese nodules.	
		◢	2					(6-14') Percentage of light olive gray-colored material decreases down to 14'.	
10									
								(14-15') Becoming mostly light olive gray to greenish-gray mottled with moderate yellowish-brown. Abundant iron staining and iron- manganese nodules just above 15'.	252.8
15		◢	3				ML	(15-19') Silt, olive gray to dark greenish-gray. Wet from 16-19'.	248.8
20							ML	(19-25') Silt, dark greenish-gray mottled with brownish-gray material. Some snail shell fragments present. Some iron/manganese nodules at 24'. Wood at 25'.	242.8
25							ML	(25-27') Silt, olive gray to greenish-gray in color. Rare snail shell fragments and wet below 26'.	240.8
30								Soil boring terminated at 27'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log of adjacent monitoring well 002G06DA.	
35									
40									

WELL DIAGRAM



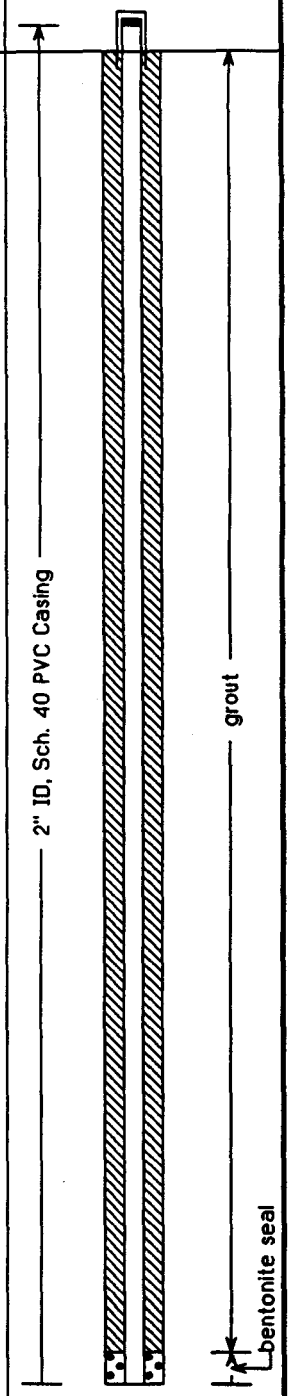
EnSafe/Allen & Hoshall

Monitoring Well 002G06DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.86 feet msl*
Started at *0925 on 2-2-96*	TOC Elevation: *269.69 feet msl*
Completed at *1030 on 2-2-96*	Depth to Groundwater: *16.52 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *253.17 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *55.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *44.5 to 54.5 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							OL/GP	(0-32') Upper Alluvium (see descriptions below).	
			1	75	8			(0-.5') Soil, gravel, and asphalt.	
5							ML	(.5-15') Silt, mostly moderate yellowish-brown to light olive gray. (.5-6') Silt; moderate yellowish-brown mottled with light olive gray material. Some iron staining and rare iron-manganese nodules.	
10			2	53	5			(6-14') Percentage of light olive gray-colored material decreases down to 14'.	
15								(14-15') Becoming mostly light olive gray to greenish-gray mottled with moderate yellowish-brown. Abundant iron staining and iron- manganese nodules just above 15'.	252.9
							ML	(15-19') Silt, olive gray to dark greenish-gray. Wet from 16-19'.	248.9
20			3	50	5		ML	(19-25') Silt, dark greenish-gray mottled with brownish-gray material. Some snail shell fragments present.	
25								Some iron-manganese nodules at 24'. Wood at 25'.	242.9
							ML	(25-29') Silt, olive gray to greenish-gray in color. Rare snail shell fragments and wet from 26-29'.	238.9
30			4	78	4		SM/ML	(29-32') Sand, very fine-grained, and silt; greenish-gray, rare snail shell fragments, wet. Becoming olive gray in color near 32'.	235.9
							SW/SC	(32-54') Deeper Alluvium (see descriptions below).	
35								(32-36') Sand, fine to coarse-grained, with clay seams. Olive-gray in color with rare snail shell fragments, wet. Wood near 34'.	231.9
							SW	(36-39') Sand, fine to coarse-grained, olive gray, with scattered gravel and snail shell fragments, wet.	228.9
40							SW		

WELL DIAGRAM



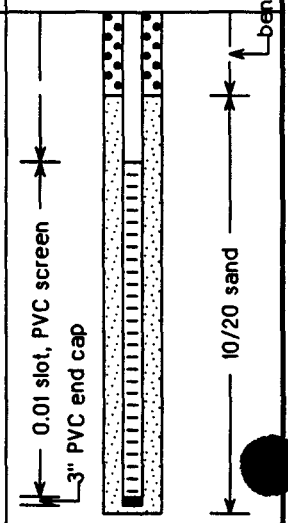
EnSafe/Allen & Hoshall

Monitoring Well 002G06DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 – Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.86 feet msl*
Started at *0925 on 2-2-96*	TOC Elevation: *269.69 feet msl*
Completed at *1030 on 2-2-96*	Depth to Groundwater: *16.52 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic – 4" core barrel inside 6" casing*	Groundwater Elevation: *253.17 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *55.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *44.5 to 54.5 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			5	90	4		SW	(39–44') Sand, fine to coarse, olive gray with gravel up to 1" in longest dimension. Rare snail shell fragments, wet. Clay seams (3" to 5" thick) at 40', 41', 42', and 43.5'.	223.9
45							SW GW	(44–46.5') Sand, very coarse-grained, and gravel up to 2.5" in longest dimension. Moderate yellowish-brown mottled with light olive gray material, wet.	221.4
							ML	(46.5–48') Sandy silt; light olive gray to light gray in color. A 2" thick sand and gravel seam occurs at 47'. Wet.	219.9
50			6	106	4		SP GW	(48–51') Sand and gravel; sand is very coarse-grained and gravel is up to 3" in longest dimension. Moderate yellowish-brown mottled with light gray, wet. Clay seams near 51'.	216.9
							SW GW	(51–54.5') Sand is now medium to coarse-grained and gravel is up to 2.5" in longest dimension. Moderate yellowish brown, wet.	213.9
55							CL SP	(54–55') Cockfield Formation: Silty clay with very fine-grained sand. Dusky yellowish-brown to moderate yellowish-brown. Lignitic material at top.	212.9
60									
65								Terminated soil boring at 55'.	
70									
75									
80									

WELL DIAGRAM



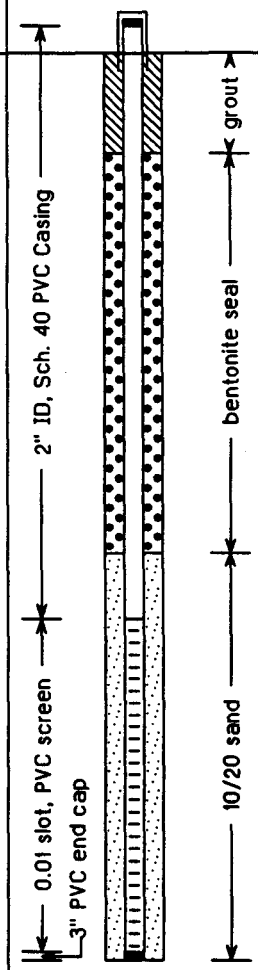
EnSafe/Allen & Hoshall

Monitoring Well 002G07UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *268.10 feet msl*
Started at *1405 on 2-1-96*	TOC Elevation: *268.21 feet msl*
Completed at *1530 on 2-1-96*	Depth to Groundwater: *15.56 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *252.65 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *27.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *17 to 27 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
		◢	1				OL GP	(0-27') Upper Alluvium (see descriptions below). (0-4') Soil, gravel, and asphalt.	262.1
5							ML	(4-15') Silt, moderate yellowish-brown mottled with light olive gray and olive gray. (4-10') Silt, moderate yellowish-brown mottled with light olive gray, with iron-manganese nodules.	
		◢	2						
10								(10-15') Clayey silt, moderate yellowish-brown mottled with olive gray, becoming moist near 15'.	
15		◢	3					No recovery from 15' to 16'. No description available; collected a Shelby tube sample from 16' to 19'.	251.1
20							CL ML	(19-24') Clay and silt, olive gray to greenish-gray, wet.	247.1
							SW ML	(24-27') Fluvial Deposits (see descriptions below).	242.1
25							ML SP	(24-25') Sand, fine to medium-grained, and silt, olive gray to greenish-gray, with snail shell fragments, wet.	241.1 239.1
30								(25-27') Silt and sand, very fine-grained, olive-gray to greenish- gray, with snail shell fragments, moist.	
35								Terminated soil boring at 27'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log of adjacent soil boring 002S0030DA.	
40									

WELL DIAGRAM



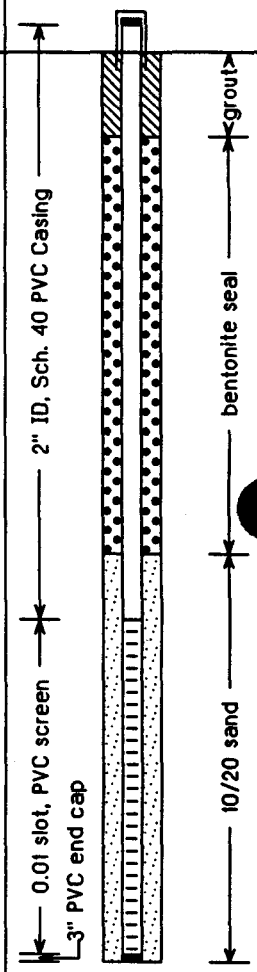
EnSafe/Allen & Hoshall

Monitoring Well 002G08UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.05 feet msl*
Started at *0800 on 2-1-96*	TOC Elevation: *269.37 feet msl*
Completed at *1010 on 2-1-96*	Depth to Groundwater: *17.34 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *252.03 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *27 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *17 to 27 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							OL GP	(0-27') Upper Alluvium (see descriptions below).	266
			1				CL ML	(0-.5') Concrete.	
								(.5-1') Soil and gravel.	263
5								(1-4') Silt and clay.	
								(1-2') Clayey silt; light olive gray to greenish-gray and mottled with moderate yellowish-brown material.	
			2					(2-4') Silty clay; dark greenish-gray.	
10							ML	(4-18') Silt, clayey (see descriptions below).	
								(4-5') Clayey silt, light olive gray mottled with moderate yellowish- brown material.	
15			3					(5-15') Moderate yellowish-brown mottled with olive gray material, contains iron-manganese nodules.	
								Becoming moist; more clay-rich with less olive gray-colored material from 14-18'.	249
20							ML SP	(18-27') Silt and very fine-grained sand. Olive gray to greenish-gray in color. Contains snail shell fragments. Top of Fluvial Deposits estimated at 22'.	
								Sand, jelly-like, lighter in color, wet at 27'.	
25								Wood fragments scattered throughout from 24' to 27'.	
								Terminated soil boring at 27'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log of adjacent monitoring well 002G08DA.	240
30									
35									
40									

WELL DIAGRAM



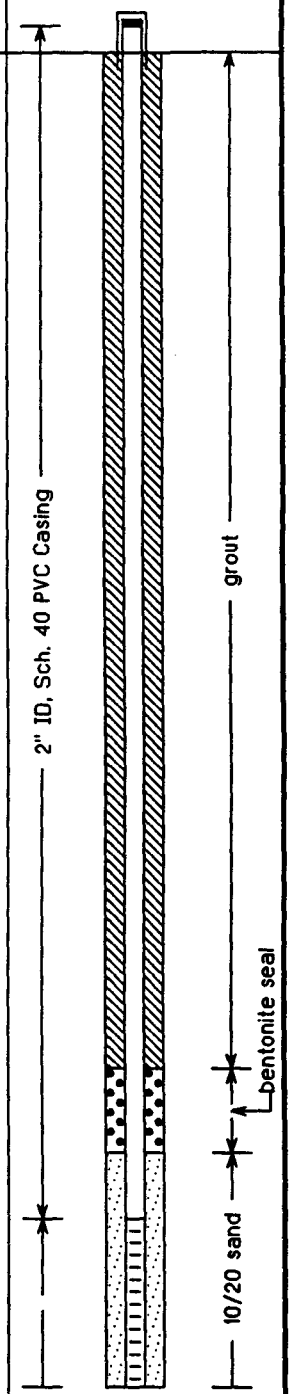
EnSafe/Allen & Hoshall

Monitoring Well 002G08DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 – Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.10 feet msl*
Started at *0930 on 1-31-96*	TOC Elevation: *269.33 feet msl*
Completed at *1425 on 1-31-96*	Depth to Groundwater: *17.54 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic – 4" core barrel inside 6" casing*	Groundwater Elevation: *251.79 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *51.5 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *35 to 45 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					BG		OL GP	(0-22') Upper Alluvium (see descriptions below).	266.1
			1	100	BG		CL ML	(0-.5') Concrete.	
								(.5-1') Soil and gravel.	263.1
5					BG			(1-4') Silt and clay.	
					BG			(1-2') Clayey silt, light olive gray to greenish-gray and mottled with moderate yellowish-brown material.	
					BG			(2-4') Silty clay; dark greenish-gray.	
10			2	53	BG		ML	(4-18') Silt, clayey (see descriptions below).	
					BG			(4-5') Clayey silt, light olive gray mottled with moderate yellowish- brown material.	
15					BG			(5-15') Moderate yellowish-brown mottled with olive gray material. Contains iron-manganese nodules from 5' to 18'.	
					BG			Becoming moist; more clay-rich with less olive gray-colored material from 14-18'.	249.1
					BG			(18-29') Silt and very fine-grained sand. Olive gray to greenish-gray in color. Contains snail shell fragments. Top of Deeper Alluvium deposits estimated at 22'.	
20			3	90	BG				
					BG		ML SP	Sand, jelly-like, lighter in color, wet at 22'.	
25					BG			Wood fragments scattered throughout from 24' to 41'.	
			4	96	BG				
					BG				238.1
30					BG		SW ML	(29-33') Silt and sand; sand is fine to coarse-grained.	
			4	96				Olive gray to greenish-gray with snail shell fragments, wood scattered throughout, wet.	
					BG				234.1
35					BG		SW ML	(33-39') Sand, fine to very coarse-grained, and silt, olive gray to greenish-gray, with snail shell fragments, wood scattered throughout, wet.	
					BG				
					BG				228.1
40			5	100			SW ML		

WELL DIAGRAM



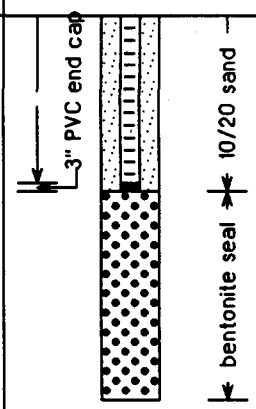
EnSafe/Allen & Hoshall

Monitoring Well 002G08DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 – Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.10 feet msl*
Started at *0930 on 1-31-96*	TOC Elevation: *269.33 feet msl*
Completed at *1425 on 1-31-96*	Depth to Groundwater: *17.54 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic – 4" core barrel inside 6" casing*	Groundwater Elevation: *251.79 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *51.5 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *35 to 45 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					BG		SW	(39-41') Sand, fine to coarse-grained, and silt, olive gray to greenish-gray, with snail shell fragments, with wood scattered throughout, wet.	226.1
							ML		225.1
							SM		224.1
					BG		SP GW	(41-42') Sand, fine to coarse-grained, and silt with gravel up to 2.5" in longest dimension. Olive gray to greenish-gray, wet.	
45					BG		SP GW	(42-43') Very coarse-grained sand and gravel up to 2"in longest dimension. Moderate yellowish-brown, wet.	222.1
					BG		CL		
50			6	75	BG			(43-45') Gravel up to 2" in longest dimension, and sand, very coarse, very light gray mottled with moderate yellowish-brown, wet.	
					BG				215.6
55								(45-51.5') Cockfield Formation: Clay, dusky to dark yellowish-brown with light olive gray fine-grained sand laminations. Becoming very sandy near base of soil boring; sand is fine to medium-grained and light olive gray in color.	
60								Terminated soil boring at 51.5'.	
65									
70									
75									
80									

WELL DIAGRAM



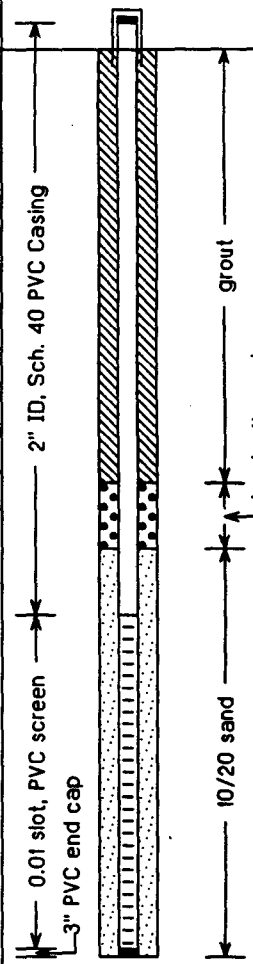
EnSafe/Allen & Hoshall

Monitoring Well 002G09UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *265.68 feet msl*
Started at *1320 on 1-30-96*	TOC Elevation: *268.09 feet msl*
Completed at *1500 on 1-30-96*	Depth to Groundwater: *16.19 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *251.90 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *27 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *17 to 27 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
		◢	1				OL GW	(0-26') Upper Alluvium (see descriptions below). (0-3.5') Soil and gravel (fill).	262.2
5							ML	(3.5-8') Clayey silt; moderate yellowish-brown mottled with light olive gray material containing iron-manganese nodules.	257.7
10		◢	2				ML	(8-19') Silt, very clayey, moderate yellowish-brown to dark yellowish- brown mottled with medium gray material. Abundant iron-manganese nodules from 9' to 11'. Moist with some iron-manganese nodules from 13' to 15'. Less iron-manganese nodules, becoming more dark yellowish-orange from 15-19'.	
15		◢	3						246.7
20							ML	(19-23') Silt, clayey, olive gray to greenish-gray, becoming just olive gray from 22' to 23', containing snail shell fragments.	242.7
25							SM	(23-27') Silty sand; fine to medium-grained, olive gray in color, with snail shell fragments, moist to wet. Top of Deeper Alluvium deposits estimated at 26'. Wet below 25'.	238.7
30								Terminated soil boring at 27'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log of adjacent monitoring well 002G09DA.	
35									
40									

WELL DIAGRAM



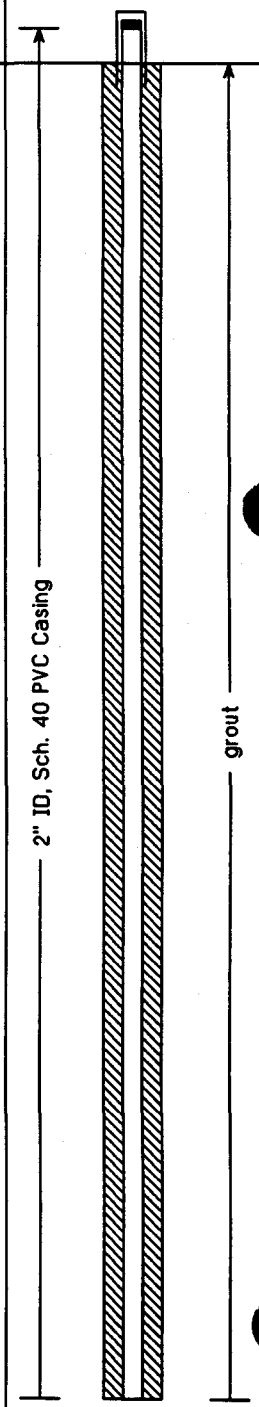
EnSafe/Allen & Hoshall

Monitoring Well 002G09DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 – Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *265.51 feet msl*
Started at *0830 on 1-30-96*	TOC Elevation: *267.96 feet msl*
Completed at *0945 on 1-30-96*	Depth to Groundwater: *17.15 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic – 4" core barrel inside 6" casing*	Groundwater Elevation: *250.81 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *55.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *36 to 46 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			1	75	8, 6		OL/GW	(0-26') Upper Alluvium (see descriptions below). (0-3.5') Soil and gravel (fill).	262
5					5, 6		ML	(3.5-8') Clayey silt; moderate yellowish-brown mottled with light olive gray material containing iron-manganese nodules.	257.5
10			2	98	5, 6, 6, 4, 5		ML	(8-19') Silt, very clayey, moderate yellowish-brown to dark yellowish- brown mottled with medium gray material. Abundant iron-manganese nodules from 9' to 11'. Moist with some iron-manganese nodules from 13' to 15'. Less iron-manganese nodules, becoming more dark yellowish-orange from 15-19'.	246.5
15									
20			3	90	2, 5		ML	(19-23') Silt, clayey (see descriptions below). (19-22') Silt, clayey, olive gray to greenish-gray, containing snail shell fragments. (22-23') Same as above, but olive gray in color.	242.5
25			4	100	6, 6, 5		SM/SW	(23-27.5') Sand, fine to medium, silty, olive gray in color, with snail shell fragments, moist to wet, wet below 25'. Top of Deeper Alluvium deposits estimated at 26'. (27.5-28') Sand, fine to very coarse-grained, olive gray, with snail shell fragments, wet.	237.5
30					5		ML	(28-31') Silt; olive gray in color with snail shell fragments. Wet. Vegetation near 29'.	

WELL DIAGRAM



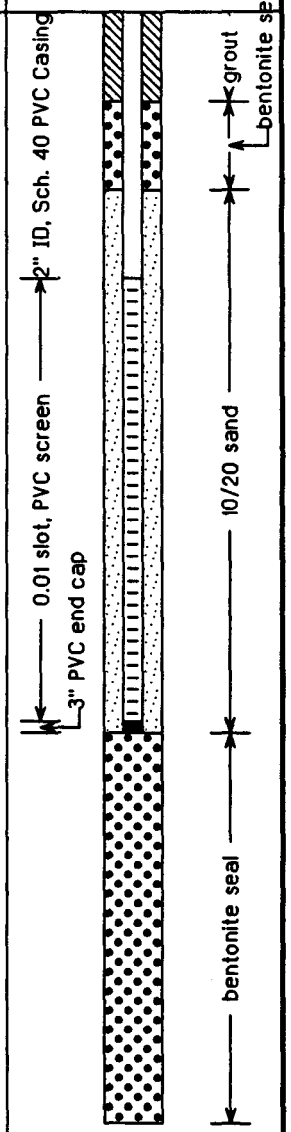
EnSafe/Allen & Hoshall

Monitoring Well 002G09DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *265.51 feet msl*
Started at *0830 on 1-30-96*	TOC Elevation: *267.96 feet msl*
Completed at *0945 on 1-30-96*	Depth to Groundwater: *17.15 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *250.81 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *55.0 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *36 to 46 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							ML		234.5
			4	100	3, 8		SM	(31-34') Silty sand, very fine-grained becoming progressively coarser near 34', olive gray to light olive gray near 34', with snail shell fragments, wet.	231.5
35					6, 6		SW, SW, SM	(34-34.5') Coarse to very coarse-grained sand with gravel. Light olive gray to greenish-gray, containing snail shell fragments, wet. (34.5-35') Sand, very fine to medium-grained, light olive gray to greenish-gray, wet.	231, 230.5
40			5	390	7, 5		SP/GW	(35-38') Silty sand, very fine to very coarse-grained, with quartz and chert gravel up to 1" in longest dimension, olive gray, wet. (38-43') Sand and gravel; sand is fine to very coarse-grained, gravel is up to 1"in longest dimension; moderate yellowish-brown mottled with light gray material, wet.	227.5
					6		SP	(43-44') Coarse-grained sand, moderate yellowish-brown mottled with medium light gray material, wet.	222.5
45					6		SW/GW	(44-46') Sand and gravel, gravel and sand (see descriptions below).	221.5
50			6	102	5, 5, 6		CL	(44-45') Sand and gravel; sand is very coarse-grained and gravel is up to 1.5" in longest dimension; moderate yellowish-brown mottled with medium light gray material, wet. (45-46') Gravel up to 1.5" in longest dimension, and sand, dark yellowish-brown to moderate yellowish-brown; becoming clayey near 46'.	219.5
					5, 5			(46-55') Cockfield Formation: Clay, dusky yellowish-brown to dark yellowish-brown. With light olive gray sandy seams below 52'.	
55								With some lignite seams below 53'.	210.5
60								Terminated soil boring at 55'.	

WELL DIAGRAM



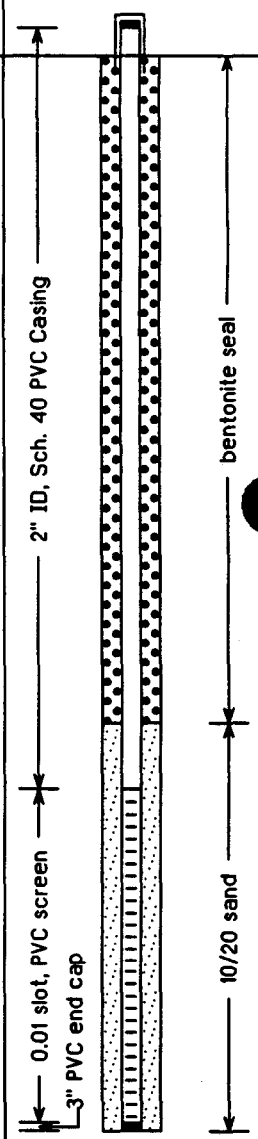
EnSafe/Allen & Hoshall

Monitoring Well 002G10UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *270.36 feet msl*
Started at *1400 on 2-13-96*	TOC Elevation: *270.19 feet msl*
Completed at *1445 on 2-13-96*	Depth to Groundwater: *8.79 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *261.40 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *32.0 feet*
Geologist: *J. Kingsbury*	Well Screen: *22 to 32 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
		■	1					(0-32') Upper Alluvium (see descriptions below). Silt and clay (fill material) from 0' to 6', moderate brown to moderate gray color.	
5									
								Moderate gray to light yellowish-brown, slightly moist.	264.4
10							ML CL		
		■	2					Mottling with dark yellowish-orange material with some organic material from 13' to 16'.	
15									254.4
								Silt, moderate brown to light gray with dark orangish-yellow mottling from 16' to 25'. Organic material present. Moist. Becomes wet at 20'.	
20		■	3						
							ML	Color change at 25' to light greenish-gray and olive gray. Shell fragments present. Wet. Silt with minor clay and sand. Moderate greenish-gray with common snail shells. Wet.	
25									
30									238.4
								Terminated soil boring at 32'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log of adjacent monitoring well 002G10DA.	
35									
40									

WELL DIAGRAM



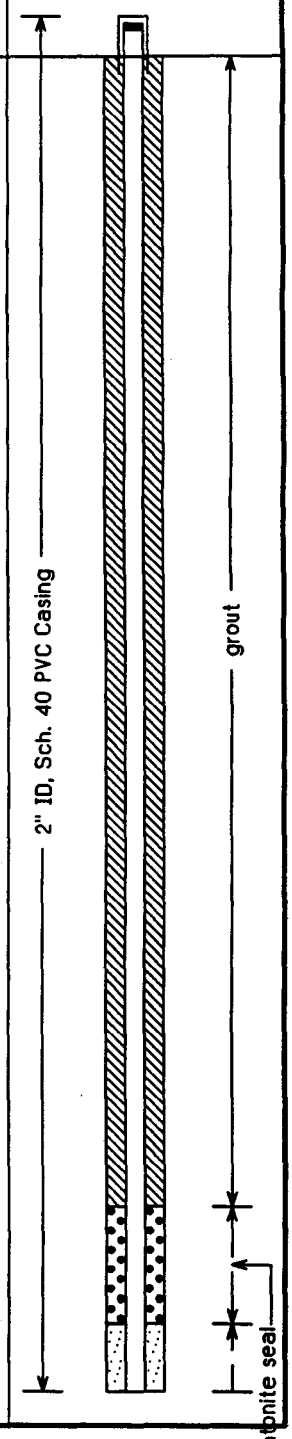
EnSafe/Allen & Hoshall

Monitoring Well 002G10DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 – Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *270.36 feet msl*
Started at *1220 on 2-12-96*	TOC Elevation: *270.17 feet msl*
Completed at *1400 on 2-12-96*	Depth to Groundwater: *9.36 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic – 4" core barrel inside 6" casing*	Groundwater Elevation: *260.81 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *56.0 feet*
Geologist: *J. Kingsbury*	Well Screen: *40 to 50 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					4			(0-36') Upper Alluvium (see descriptions below).	
			1	67	4			Silt and clay (fill material) from 0' to 6', moderate brown to moderate gray in color.	
5					2				
					3			Moderate gray to light yellowish-brown, slightly moist.	264.4
					3				
10			2	35	3		ML CL		
					3			Mottling with dark yellowish-orange material with some organic material from 13' to 16'.	
15					3				254.4
					4			Silt, moderate brown to light gray with dark orangish-yellow mottling from 16' to 25'. Organic material present. Moist.	
					3				
20			3	90	3			Wet at 20'.	
					3				
25					3			Color change at 25' to light greenish-gray to olive gray. Shell fragments present. Wet.	
					2		ML	Silt with minor clay and sand. Moderate greenish-gray with common snail shells. Wet.	
			4	100					
					2				
30			4	100	2				
					2				
35					3				234.4
					2		SW SM	(36-50') Deeper Alluvium (see descriptions below).	
40					2				

WELL DIAGRAM



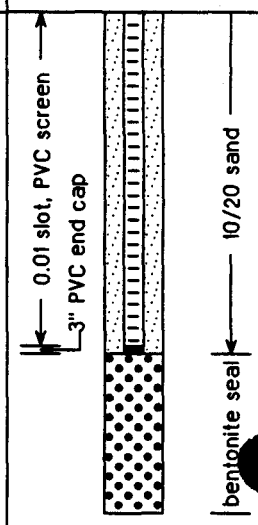
EnSafe/Allen & Hoshall

Monitoring Well 002G10DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *270.36 feet msl*
Started at *1220 on 2-12-96*	TOC Elevation: *270.17 feet msl*
Completed at *1400 on 2-12-96*	Depth to Groundwater: *9.36 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *260.81 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *56.0 feet*
Geologist: *J. Kingsbury*	Well Screen: *40 to 50 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			5	85	2		SW SM	(36-45') Sand with gravel. Silt seams from 38-42', with thicknesses ranging from 6 to 12 inches. Sand is brownish-gray to light yellowish-brown.	
					2				
45					2		GC GM	Gravel in a silt and clay matrix with minor sand. Very hard, dry to moist.	225.4
					3		SW GW	Sand and gravel, light yellowish-brown to light yellowish gray.	224.4
					2				
50								Color change to dark orangish-yellow.	220.4
			6	120	2		CL ML	Cockfield Formation: Dark brownish-gray clay with interbeds of silt and fine sand. Fine to medium-grained sand lense at 55'.	
					2				
55					2				
								Terminated soil boring at 56'. Note: PID response likely due to moisture in samples.	214.4
60									
65									
70									
75									
80									

WELL DIAGRAM



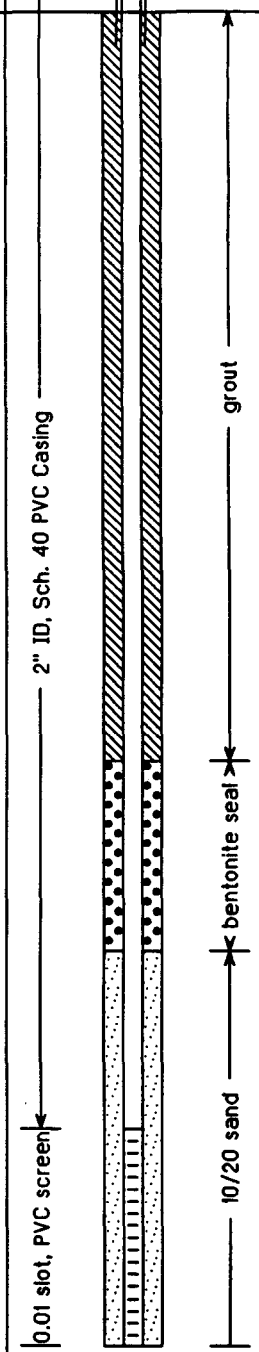
EnSafe/Allen & Hoshall

Monitoring Well 002G11UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *265.12 feet msl*
Started at *1500 on 1-17-96*	TOC Elevation: *266.91 feet msl*
Completed at *1300 on 1-18-96*	Depth to Groundwater: *3.92 feet* Measured: *4/8/96*
Drilling Method: *4 1/4" ID Hollow-Stem Auger with 5' Flights*	Groundwater Elevation: *262.99 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *26.75 feet*
Geologist: *J. Carmichael, W. Parks, D. Ladd*	Well Screen: *16.75 to 26.75 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			1					(0-27') Upper Alluvium (see descriptions below).	
								(0-1') Fill and skeet fragments.	264.1
								(1-24') Silt, clayey (see descriptions below).	
								(1-2') Clayey silt; yellowish-brown to brownish-gray in color.	
								(2-6') Silt, clayey, dark yellowish-brown with dark yellowish-orange staining. Trace of organic material.	
5								Finely laminated and contains small iron-manganese nodules from 4-6'.	
								(6-8') Silt, decreasing clay content and increasing iron-manganese nodule content. Yellowish-brown to light olive gray color, moist.	
			2					(8-18') Silt, slightly clayey, yellowish-gray to light olive gray color, moist.	
10							ML	Increase in dark yellowish-orange staining, moisture content, and iron-manganese content from 10-14'.	
			3					Stained dark yellowish-orange in color from 14-16'. Very moist from 14-15'.	
15								Less staining from 16-18'. Very moist from 16-17' (water came up the borehole when auger was advanced).	
								(18-19') Silt, slightly clayey, medium gray in color. Moist.	
								(19-20') Silt, slightly clayey, yellowish-gray to light olive gray, moist.	
20									

WELL DIAGRAM



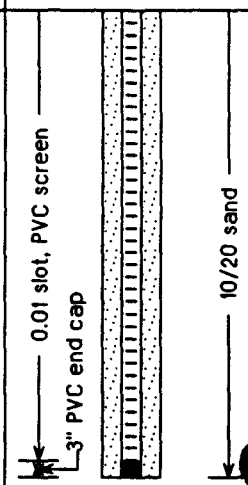
EnSafe/Allen & Hoshall

Monitoring Well 002G11UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *265.12 feet msl*
Started at *1500 on 1-17-96*	TOC Elevation: *266.91 feet msl*
Completed at *1300 on 1-18-96*	Depth to Groundwater: *3.92 feet* Measured: *4/8/96*
Drilling Method: *4 1/4" ID Hollow-Stem Auger with 5' Flights*	Groundwater Elevation: *262.99 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *26.75 feet*
Geologist: *J. Carmichael, W. Parks, D. Ladd*	Well Screen: *16.75 to 26.75 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							ML	(20-22') Silt, slightly clayey, medium light gray to light gray, stained moderate brown. Moist. (22-24') Clayey silt, pale yellowish-brown to pale brown in color. Moist.	241.1
25							ML	(24-27') Silt (see descriptions below). (24-26') Silt; medium gray to brownish-gray with patches of dark yellowish-orange material. Moist. (26-27') Silt, light olive gray to medium gray, slightly moist.	238.1
								Soil boring terminated at 27'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log of adjacent monitoring well 002G11DA.	
30									
35									
40									

WELL DIAGRAM



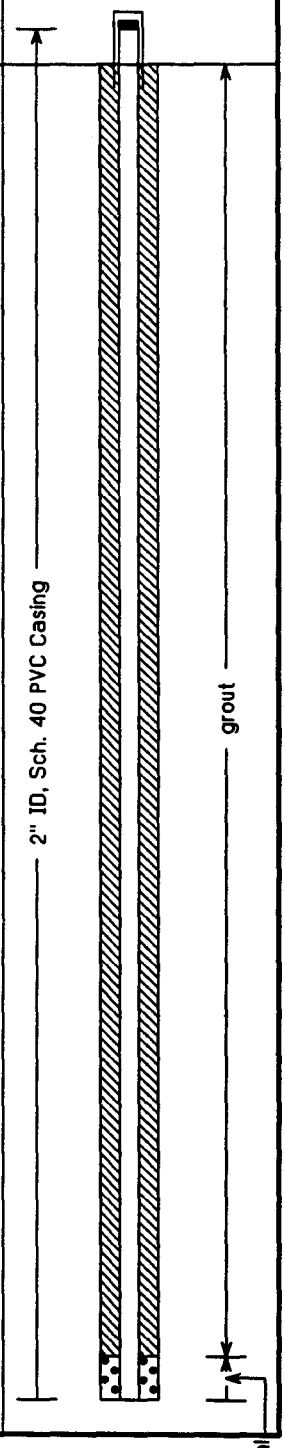
EnSafe/Allen & Hoshall

Monitoring Well 002G11DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *265.17 feet msl*
Started at *1010 on 1-16-96*	TOC Elevation: *266.77 feet msl*
Completed at *0915 on 1-17-96*	Depth to Groundwater: *4.17 feet* Measured: *4/8/96*
Drilling Method: *4 1/4" ID Hollow-Stem Auger, 5' Flights*	Groundwater Elevation: *262.60 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *46.0 feet*
Geologist: *J. Carmichael, W. Parks, D. Ladd*	Well Screen: *32.2 to 42.2 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			1	42	BG			(0-33') Upper Alluvium (see descriptions below).	264.2
								(0-1') Fill and skeet fragments.	
			2	71	BG			(1-24') Silt, clayey (see descriptions below).	
								(1-2') Clayey silt, yellowish-brown to brownish-gray in color.	
5			3	73	BG			(2-6') Silt, clayey, dark yellowish-brown with dark yellowish-orange staining. Trace of organic material.	
			4	83	BG			Finely laminated and contains small iron-manganese nodules from 4-6'.	
			5	96	BG			(6-8') Silt, decreasing clay content and increasing iron-manganese nodule content. Yellowish-brown to light olive gray, moist.	
10			6	100	BG			(8-18') Silt, slightly clayey yellowish-gray to light olive gray color, moist.	
			7	100	BG		ML	Increase in dark yellowish-orange staining, moisture content, and iron-manganese content from 10-14'.	
15			8	100	BG			Stained dark yellowish-orange in color from 14-16'. Very moist from 14-15'.	
			9	100	BG			Less staining from 16-18'. Very moist from 16' to 17' (water came up the borehole when auger was advanced).	
			10	92	BG			(18-19') Silt, slightly clayey, medium gray in color. Moist.	
20			11	83	BG			(19-20') Silt, slightly clayey, yellowish-gray to light olive gray, moist.	
			12	100	BG			(20-22') Silt, slightly clayey, medium light gray to light gray, stained moderate brown, moist.	
								(22-24') Silt, clayey, pale yellowish-brown to pale brown color, moist.	241.2
25			13	100	BG			(24-28') Silt (see descriptions below).	
			14	100	BG		ML	(24-26') Silt; medium gray to brownish-gray with patches of dark yellowish-orange material. Moist.	237.2
			15	100	BG		ML	(26-28') Silt; light olive gray to medium gray. Slightly moist.	
30								(28-33') Silt, sandy (see descriptions below).	

WELL DIAGRAM



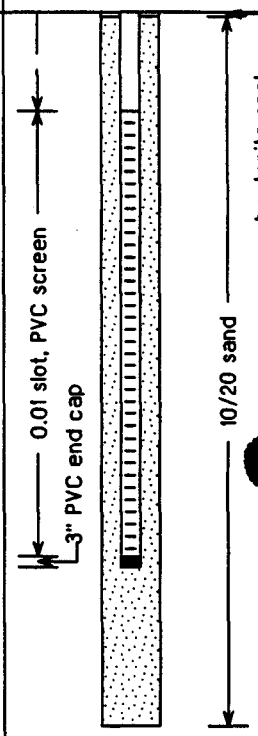
EnSafe/Allen & Hoshall

Monitoring Well 002G11DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *265.17 feet msl*
Started at *1010 on 1-16-96*	TOC Elevation: *266.77 feet msl*
Completed at *0915 on 1-17-96*	Depth to Groundwater: *4.17 feet* Measured: *4/8/96*
Drilling Method: *4 1/4" ID Hollow-Stem Auger, 5' Flights*	Groundwater Elevation: *262.60 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *46.0 feet*
Geologist: *J. Carmichael, W. Parks, D. Ladd*	Well Screen: *32.2 to 42.2 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			16	100	BG		ML	(28-30') Sandy silt; light olive gray to medium gray in color, slightly moist.	
			17	100	BG			(30-32') Silt, sandy, light olive gray, slightly moist, contains pockets of small red carbonaceous material.	232.2
35			18	71	BG			(32-33') Silt, sandy, medium light gray to medium gray, moist.	
			19	92	BG		SW/GW	(33-43') Deeper Alluvium (see descriptions below).	
			20	58	BG			(33-34') Sand, fine to coarse-grained, light olive gray color, wet.	
40			21	88	BG			(34-36.25') Sand, fine to coarse-grained, with clay, silt, and gravel up to .5" in longest dimension. Light brownish-gray to pale red, moist. Coantains silt and clay from 34-35'.	
			22	92	BG			(36.25-38') Clayey sand with gravel up to 1" in longest dimension, olive gray to medium gray, moist.	222.2
45			23	83	BG		CL	(38-40') Sand and gravel, light olive gray to pale brown. Gravel content increases with depth.	
								(40-42') Sand and gravel, olive gray to brownish-gray stained dark yellowish-orange, wet.	219.2
								(42-43') Sand and gravel, light olive gray, wet.	
50								(43-46') Cockfield Formation: Clay, brownish-gray to dusky brown, finely micaceous, with fine-grained sand laminae from 44' to 46'.	
								Terminated soil boring at 46'.	
55									
60									

WELL DIAGRAM



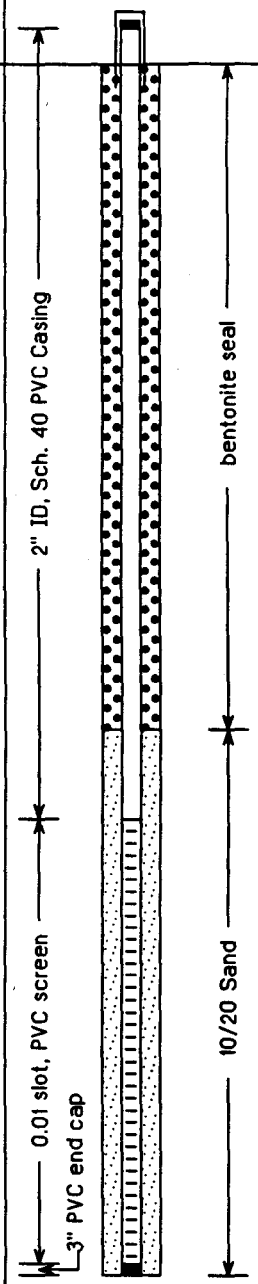
EnSafe/Allen & Hoshall

Monitoring Well 002G12UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *266.64 feet msl*
Started at *1030 on 1-23-96*	TOC Elevation: *268.63 feet msl*
Completed at *1200 on 1-29-96*	Depth to Groundwater: *12.87 feet* Measured: *4/8/96*
Drilling Method: *4 1/4" ID Hollow-Stem Auger with 5' Flights*	Groundwater Elevation: *255.76 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *28.0 feet*
Geologist: *J. Kingsbury*	Well Screen: *17 to 27 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
		■	1	58	4			(0-28') Upper Alluvium (see descriptions below).	
			2	75	6			Silt and clay; light brown to dark yellowish-brown color from 0'-2'.	
5			3	50	5			Light brown to yellowish-brown color. Many small iron-manganese nodules. Staining with orange rust-colored material. Dry.	
			4	75	4			Grayish-brown to light brown color, stained dark orange to rust- colored. Iron-manganese nodules common. Dry.	
		■	5	100	3			Slightly moist. Fewer iron-manganese nodules, very slightly moist.	
10			6	92	3			Increase in percentage of iron-manganese nodules; increase in moisture content from 11.5' to 12'.	
			7	92	3		ML CL	Yellowish-brown to light olive gray color. Decreased staining and percentage of iron-manganese nodules. Moist.	
15		■	8	96	3			Medium yellowish-brown to light olive gray, moist.	
			9	92	3			Silt and clay, moist. Increased staining. Light olive gray.	
20			10	100	4			Color change to medium gray at 18.5'. Some staining with black material (iron/manganese or organics).	
			11	100	4				
			12	100	3			Decreased moisture content.	
25			13	100	4			Clay and silt; greenish-gray, dry.	
			14	100	4				
30								Terminated soil boring at 28'. Note: PID response likely due to moisture content of soil.	238.6

WELL DIAGRAM



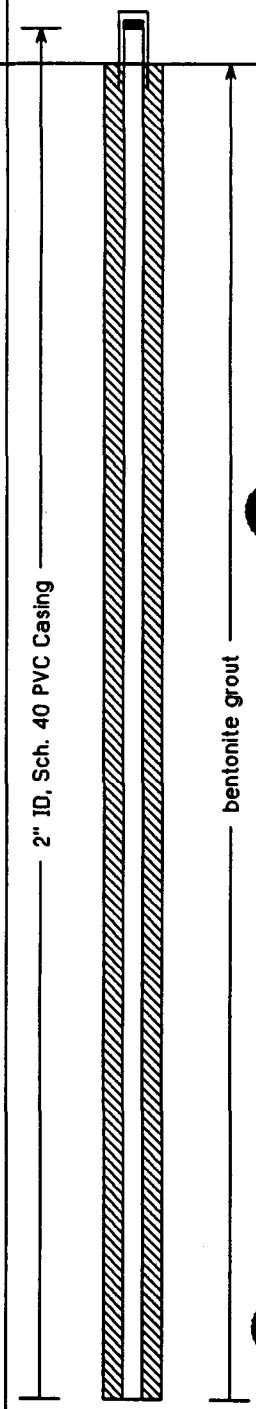
EnSafe/Allen & Hoshall

Monitoring Well 002G12DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *266.56 feet msl*
Started at *1300 on 1-29-96*	TOC Elevation: *268.63 feet msl*
Completed at *1400 on 1-30-96*	Depth to Groundwater: *6.02 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic*	Groundwater Elevation: *262.61 feet msl*
Drilling Company: *Alliance Drilling*	Total Depth: *50.0 feet*
Geologist: *J. Kingsbury, R. Thomas*	Well Screen: *38.5 to 48.5 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
								(0-35') Upper Alluvium (see descriptions below).	
								Silt and clay; light brown to dark yellowish-brown color from 0'-2'.	
5								Light brown to yellowish-brown color. Many small iron-manganese nodules. Staining with orange rust-colored material. Dry.	
								Grayish-brown to light brown color, stained dark orange to rust- colored. Iron-manganese nodules common. Dry.	
								Dry to slightly moist.	
10								Fewer iron-manganese nodules, very slightly moist.	
								Increase in percentage of iron-manganese nodules; increase in moisture content from 11.5' to 12.0'.	
							ML CL	Yellowish-brown to light olive gray color. Decreased staining and percentage of iron-manganese nodules. Moist.	
15								Medium yellowish-brown to light olive gray, moist.	
								Silt and clay, moist. Increased staining.	
								Light olive gray.	
20								Color change to medium gray at 18.5'. Some staining with black material (iron/manganese or organics).	
25								Decreased moisture content.	
								Clay and silt; greenish-gray, dry.	
									238.6
30			1	75	BG		ML	Clayey silt, light olive gray to medium gray color. Some orangish- brown staining. Mostly dry.	

WELL DIAGRAM



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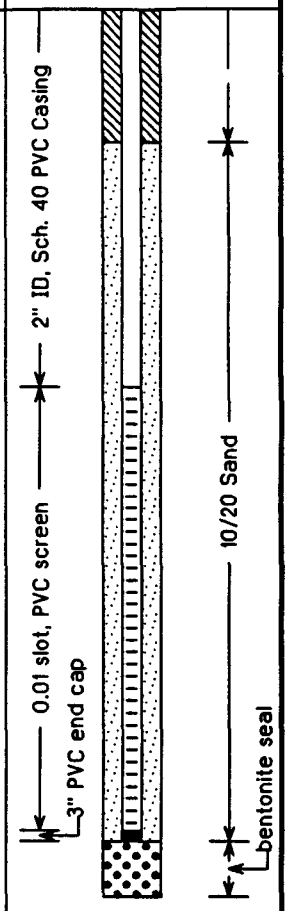
Monitoring Well 002G12DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 – Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *266.56 feet msl*
Started at *1300 on 1-29-96*	TOC Elevation: *268.63 feet msl*
Completed at *1400 on 1-30-96*	Depth to Groundwater: *6.02 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic*	Groundwater Elevation: *262.61 feet msl*
Drilling Company: *Alliance Drilling*	Total Depth: *50.0 feet*
Geologist: *J. Kingsbury, R. Thomas*	Well Screen: *38.5 to 48.5 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			2	75	BG		ML	Contains streaks of fine to medium-grained sand approximately 1 to 2 inches thick, light olive-gray to medium gray.	
			3	83	BG				
							SC SM	Silt, sand, and clay, light olive gray.	232.6
35			4	100	BG		SW	(35-51') Deeper Alluvium (see descriptions below).	231.6
								(35-36') Sand; fine to coarse-grained, yellowish-gray to yellowish- brown color.	230.6
								Start five-foot split-spoon intervals.	
40			5	67	BG		SW GW	Sand and gravel; gravel up to 1" in diameter. Yellowish-gray to yellowish-brown in color.	226.6
									224.6
45			6	83	BG		SW GW	Sand and gravel, yellowish-brown to yellowish-gray.	221.6
									219.6
50			7	75	BG		SW	Sand with rare gravel, light olive gray, matrix resembles reworked Cockfield Formation from 50' to 51'. Cockfield Formation contact is at 51'.	216.6
							SC SM	Sand, fine to medium-grained, finely lignitic and micaceous, is present from 51' to 51.5'.	215.6
								Sand with silt and clay.	
55								Terminated soil boring at 51.5'. Note: Sample lithology and PID readings from 0' to 28' obtained during the advancement of 002G12UA. Lithology and PID readings from 28' to 51.5' obtained during the advancement of 002G12DA.	
60									

WELL DIAGRAM



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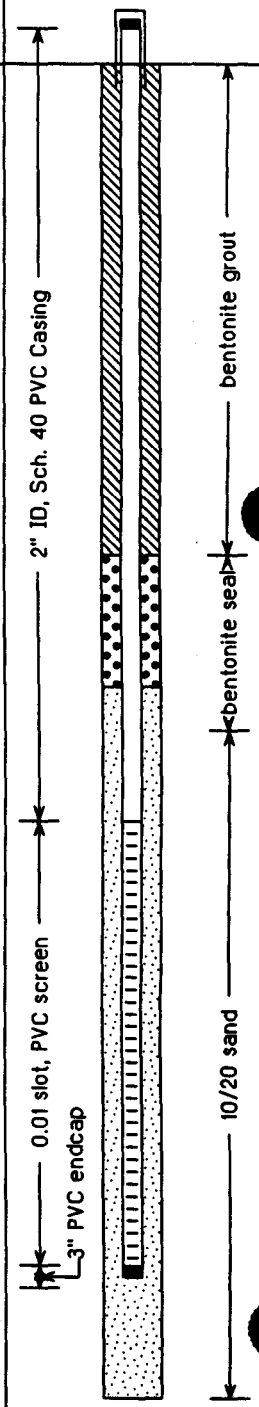
Monitoring Well 002G13UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.13 feet msl*
Started at *1400 on 1-22-96*	TOC Elevation: *268.96 feet msl*
Completed at *0845 on 1-23-96*	Depth to Groundwater: *3.30 feet* Measured: *4/8/96*
Drilling Method: *4 1/4" ID Hollow-Stem Auger With 5" Flights*	Groundwater Elevation: *265.66 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *30.0 feet*
Geologist: *D. Ladd, J. Kingsbury, A. Choate*	Well Screen: *17 to 27 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							OL	(0-30') Upper Alluvium (see descriptions below).	
							CL ML	Clay and silt, dark yellowish-brown, moist, with organic material and roots.	265.1
								Silty clay/clayey silt, greenish-gray and moderate yellowish-brown, slightly moist, soft to slightly firm, with some dark iron staining.	263.1
5							ML	Clayey silt, greenish-gray and moderate yellowish-brown, with iron/ manganese inclusions and organic material, slightly moist.	
								Iron-manganese nodules increasing in percentage and size (up to .5" in diameter).	
10								Some staining with a dark yellowish-orange material.	
								Increase in clay percentage.	
								Clayey silt, light olive gray color stained light brown to dark yellowish-orange. Moisture content increasing as iron/manganese nodules decrease in percentage.	
15								Very moist at 14' becoming less moist near 16', rare iron/manganese nodules.	
								Clayey silt, medium gray to light olive gray stained light brown to dark yellowish-orange, very moist.	
									248.1
20							CL	Silty clay, medium light to medium gray, wet.	
								Dark greenish-gray to grayish-olive green color, wet.	
								Very moist.	
25								Light olive gray to grayish-olive green color. Very moist and soft.	
									239.1
30							ML	Clayey silt, slightly moist, soft.	237.1

WELL DIAGRAM



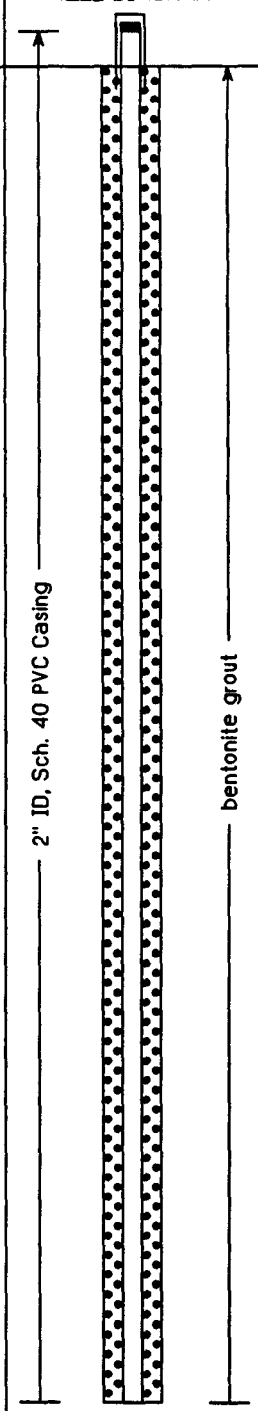
EnSafe/Allen & Hoshall

Monitoring Well 002G13MA

Project: *NAS Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.23 feet msl*
Started at *1300 on 1-21-96*	TOC Elevation: *269.20 feet msl*
Completed at *1145 on 1-22-96*	Depth to Groundwater: *5.38 feet* Measured: *4/8/96*
Drilling Method: *4 1/4" ID Hollow-Stem Auger With 5' Flights*	Groundwater Elevation: *263.82 feet msl*
Drilling Company: *Alliance Drilling*	Total Depth: *46.0 feet*
Geologist: *D. Ladd, J. Kingsbury, A. Choate*	Well Screen: *36 to 46 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
		◣	1		BG		OL	(0-34') Upper Alluvium (see descriptions below).	
							ML CL	Clay and silt, dark yellowish-brown, moist, with organic material and roots.	265.2
								Silty clay/clayey silt, greenish-gray and moderate yellowish-brown, slightly moist, soft to slightly firm, with some dark iron staining.	263.2
5								Clayey silt, greenish-gray and moderate yellowish-brown, with iron/manganese inclusions and organic material, slightly moist.	
		◣	2		BG			Iron-manganese nodules increasing in percentage and size (up to .5" in diameter).	
10								Some staining with a dark yellowish-orange material.	
							ML	Increase in clay percentage.	
								Clayey silt, light olive gray color stained light brown to dark yellowish-orange. Moisture content increases and the percentage of iron/manganese nodules decreases.	
15		◣	3		BG			Very moist at 14' becoming less moist near 16', rare iron/manganese nodules.	
								Clayey silt, medium gray to light olive gray stained light brown to dark yellowish-orange, very moist.	248.2
20								Silty clay, medium light to medium gray, wet.	
								Dark greenish-gray to grayish-olive green color, wet.	
								Very moist.	
							CL	Light olive gray to grayish-olive green color. Very moist and soft.	
25									239.2
							ML	Clayey silt, light olive gray to grayish-olive green color, slightly moist, soft.	
30									

WELL DIAGRAM



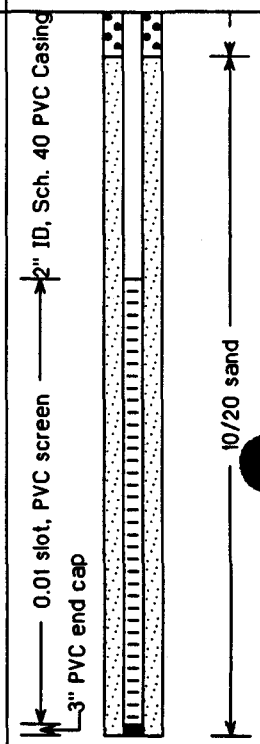
EnSafe/Allen & Hoshall

Monitoring Well 002G13MA

Project: *NAS Memphis*	Location: *Millington, TN. SWMU#2 – Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.23 feet msl*
Started at *1300 on 1-21-96*	TOC Elevation: *269.20 feet msl*
Completed at *1145 on 1-22-96*	Depth to Groundwater: *5.38 feet* Measured: *4/8/96*
Drilling Method: *4 1/4" ID Hollow-Stem Auger With 5' Flights*	Groundwater Elevation: *263.82 feet msl*
Drilling Company: *Alliance Drilling*	Total Depth: *46.0 feet*
Geologist: *D. Ladd, J. Kingsbury, A. Choate*	Well Screen: *36 to 46 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							ML	Sandy silt with rare coarse subangular sand grains. Wet. Olive gray color, wet, soft. Sandy silt with fine to coarse-grained sand between 34' and 35' fining downward to fine-grained sand between 35' and 36', soft. Top of Deeper Alluvium deposits estimated at 34'.	231
35							SW GW	Sand and gravel, gravel up to 1" in diameter, light olive gray.	229.7
							SW SM	Silty sand, light olive gray	227.2
40								Silty sand with some gravel, light olive gray to light gray. No sample collected from 40' to 46' due to heaving sand.	
45									221.2
								Terminated soil boring at 46'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log for monitoring well 002G13DA.	
50									
55									
60									

WELL DIAGRAM



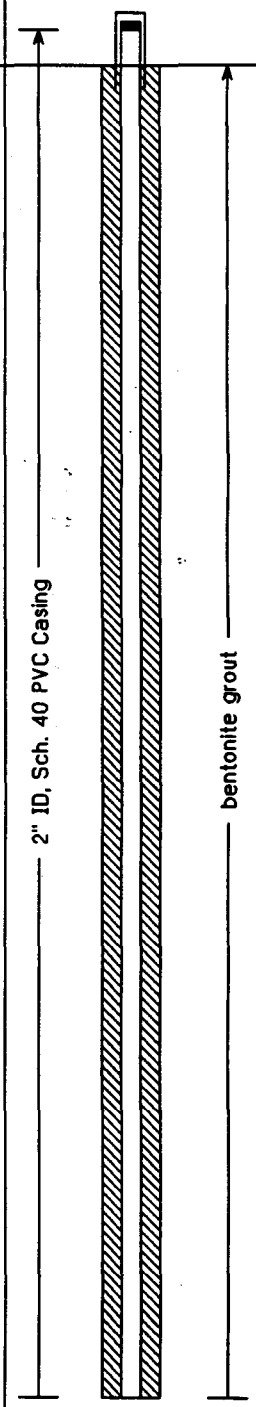
EnSafe/Allen & Hoshall

Monitoring Well 002G13DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.05 feet msl*
Started at *1110 on 1-19-96*	TOC Elevation: *269.12 feet msl*
Completed at *1130 on 1-20-96*	Depth to Groundwater: *5.36 feet* Measured: *4/8/96*
Drilling Method: *4 1/4" ID Hollow-Stem Auger, 5' Flights*	Groundwater Elevation: *263.76 feet msl*
Drilling Company: *Alliance Drilling*	Total Depth: *67.0 feet*
Geologist: *D. Ladd, J. Kingsbury, A. Choate*	Well Screen: *55 to 65 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			1	46	BG		OL	(0-34') Upper Alluvium (see descriptions below).	
			2	83	BG		CL ML	Clay and silt, dark yellowish-brown, moist, with organic material and roots.	265
5			3	88	3			Silty clay/clayey silt, greenish-gray and moderate yellowish-brown, slightly moist, soft to slightly firm, with some dark iron staining.	263
			4	79	2.5		ML	Clayey silt, greenish-gray and moderate yellowish-brown, with iron/ manganese inclusions and organic material, slightly moist.	
			5	100	2			Iron-manganese nodules increasing in percentage and size (up to .5" in diameter).	
10			6	108	BG			Some staining with a dark yellowish-orange material. Increase in clay percentage.	
			7	108	BG			Clayey silt, light olive gray color stained light brown to dark yellowish-orange. Moisture content increasing as iron/manganese nodules decrease in percentage.	
15			8	108	BG			Very moist at 14' becoming less moist near 16', rare iron/manganese nodules.	
			9	108	BG			Clayey silt, medium gray to light olive gray stained light brown to dark yellowish-orange, very moist.	
			10	100	BG				248
20			11	92	BG		CL	Silty clay, medium light to medium gray, wet. Dark greenish-gray to grayish-olive green color, wet.	
			12	100	BG			Very moist.	
25			13	96	BG			Light olive gray to grayish-olive green color. Very moist and soft.	
			14	96	BG				239
30			15	96	BG		ML	Clayey silt, light olive gray to grayish-olive green color, slightly moist, soft.	

WELL DIAGRAM



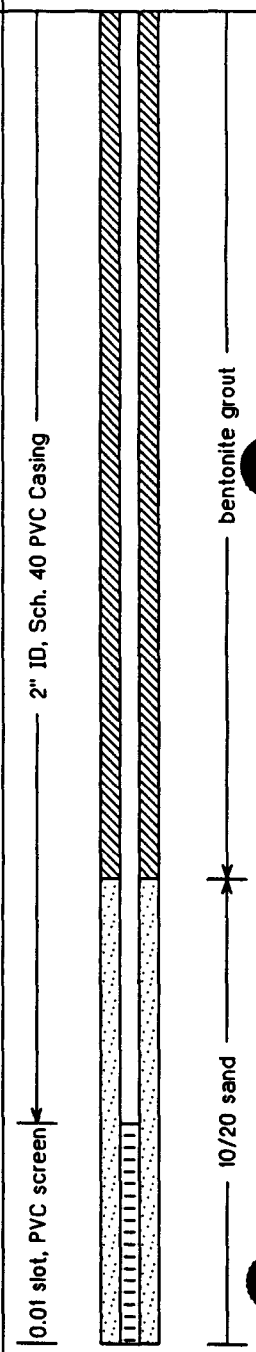
EnSafe/Allen & Hoshall

Monitoring Well 002G13DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.05 feet msl*
Started at *1110 on 1-19-96*	TOC Elevation: *269.12 feet msl*
Completed at *1130 on 1-20-96*	Depth to Groundwater: *5.36 feet* Measured: *4/8/96*
Drilling Method: *4 1/4" ID Hollow-Stem Auger, 5' Flights*	Groundwater Elevation: *263.76 feet msl*
Drilling Company: *Alliance Drilling*	Total Depth: *67.0 feet*
Geologist: *D. Ladd, J. Kingsbury, A. Choate.*	Well Screen: *55 to 65 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			16	33	BG		ML	Sandy silt with rare coarse subangular sand grains. Wet.	
			17	83	BG			Olive gray color, wet, soft.	
35			18	79	BG			Sandy silt with fine to coarse sand between 34' and 35' fining downward to fine-grained sand between 35' and 36', soft. Top of Deeper Alluvium deposits estimated at 34'.	230.9
			19	100	BG		SW GW	Sand and gravel, gravel up to 1" in longest dimension, light olive gray.	229.5
			20	100	BG		SW	Silty sand, light olive gray.	
40								Silty sand with some gravel, light olive gray to light gray.	227
45								No sample collected from 40' to 46' due to heaving sand.	
			21	96	BG		SW GW	Sand and gravel, light olive gray. Wet. Considerable iron-staining at 47.5'.	221
								No sample collected from 48' to 51'.	219
50									
			22	100	BG		SW GW	Sand and gravel, dark yellowish-orange changing to yellowish-gray color near 53'.	216
								No sample collected from 53' to 56'.	214
55									
			23	100	BG		SW GW	Sand and gravel, yellowish-gray to pale yellowish-brown. Gravel up to 1" in longest dimension. Locally stained dark yellowish-orange, wet.	211
								No sample collected from 58' to 61'.	209
60									

WELL DIAGRAM



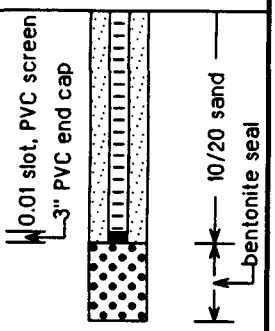
EnSafe/Allen & Hoshall

Monitoring Well 002G13DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *267.05 feet msl*
Started at *1110 on 1-19-96*	TOC Elevation: *269.12 feet msl*
Completed at *1130 on 1-20-96*	Depth to Groundwater: *5.36 feet* Measured: *4/8/96*
Drilling Method: *4 1/4" ID Hollow-Stem Auger, 5' Flights*	Groundwater Elevation: *263.76 feet msl*
Drilling Company: *Alliance Drilling*	Total Depth: *67.0 feet*
Geologist: *D. Ladd, J. Kingsbury, A. Choate*	Well Screen: *55 to 65 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			24	141	BG		SW GW	Sand and gravel, moderate yellowish-brown to dark yellowish-brown color.	206
								Color change to dusky yellow brown. Wet.	204.6
								No sample collected from 62.5' to 65'.	
65			25	100	BG		SW GW SP	Fine to coarse-grained sand and gravel, olive-gray to light olive gray. Fining downward and turning dark yellowish-orange to light brown in color near 65.5'.	202.1 201.1 200.1
								Cockfield Formation: Sand, fine-grained, dark yellowish-orange to light brown, wet. Terminated soil boring at 67'.	
70									
75									
80									
85									
90									

WELL DIAGRAM



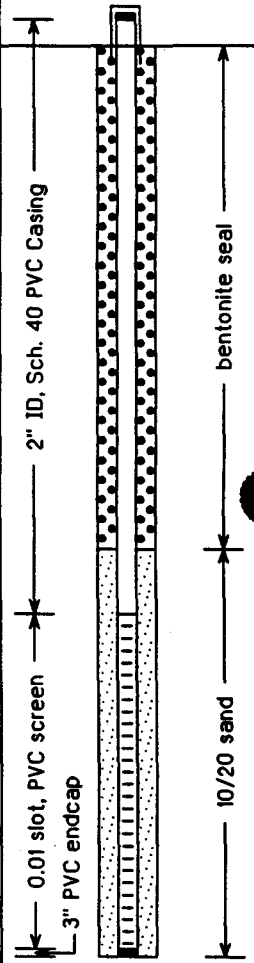
EnSafe/Allen & Hoshall

Monitoring Well 002G14UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *269.17 feet msl*
Started at *1455 on 2-14-96*	TOC Elevation: *271.23 feet msl*
Completed at *1530 on 2-14-96*	Depth to Groundwater: *5.50 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *265.73 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *27.0 feet*
Geologist: *J. Kingsbury*	Well Screen: *17 to 27 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
		◥	1					(0-27') Upper Alluvium (see descriptions below). Clayey silt, dark yellowish-brown to brownish-gray.	
5								Some organic material between 5' and 6'.	
10		◥	2				ML	Silt, light yellowish-brown to yellowish-gray mottled with dark orangish-yellow material. Organic material (specks) common from 10' to 16', very moist.	
15		◥	3					Common iron staining from 16' to 20'.	
20								Silt and clay, olive gray to greenish-gray, wet.	249.2
25							ML CL	Slightly moist between 25' and 27'.	242.2
30								Terminated soil boring at 27'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log of adjacent monitoring well 002G14DA.	
35									
40									

WELL DIAGRAM



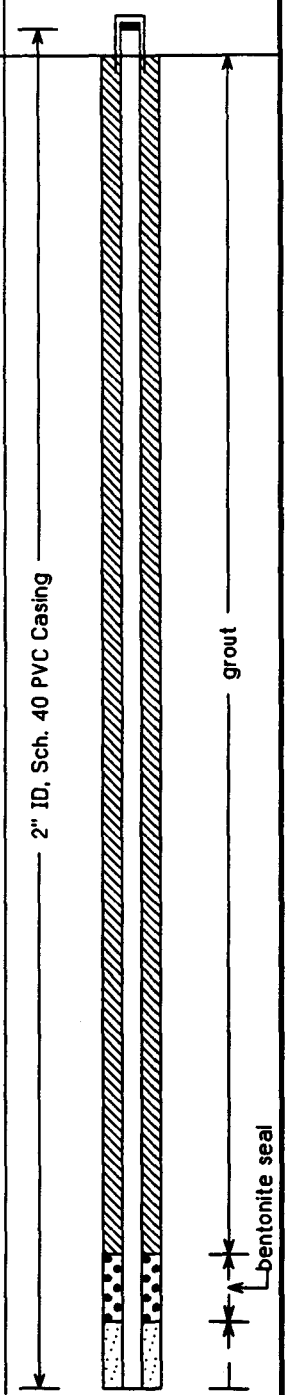
EnSafe/Allen & Hoshall

Monitoring Well 002G14DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 - Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *269.00 feet msl*
Started at *1213 on 2-14-96*	TOC Elevation: *271.00 feet msl*
Completed at *1400 on 2-14-96*	Depth to Groundwater: *6.90 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" core barrel inside 6" casing*	Groundwater Elevation: *264.10 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *76.0 feet*
Geologist: *J. Kingsbury*	Well Screen: *40 to 50 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
								(0-32') Uper Alluvium (see descriptions below).	
			1	83	3			Clayey silt, dark yellowish-brown to brownish-gray	
5								Some organic material between 5' and 6'.	
10			2	80	BG		ML	Silt, light yellowish-brown to yellowish-gray mottled with dark orangish-yellow material. Organic material (specks) common from 10' to 16'. Very moist.	
15								Common iron staining from 16' to 20'.	
20			3	90	BG			Silt and clay, olive-gray to greenish-gray, wet.	249
25							ML/CL	Slightly moist between 25' and 29'.	
30			4	90	BG			Light olive gray color; mottled with brown to reddish-brown material.	
								(32-66') Deeper Alluvium (see descriptions below).	237
35							ML/SM	Light olive gray silt to fine sand. No mottling. Wet.	233
							SM	More sand from 36' to 39'.	230
40							SP		

WELL DIAGRAM



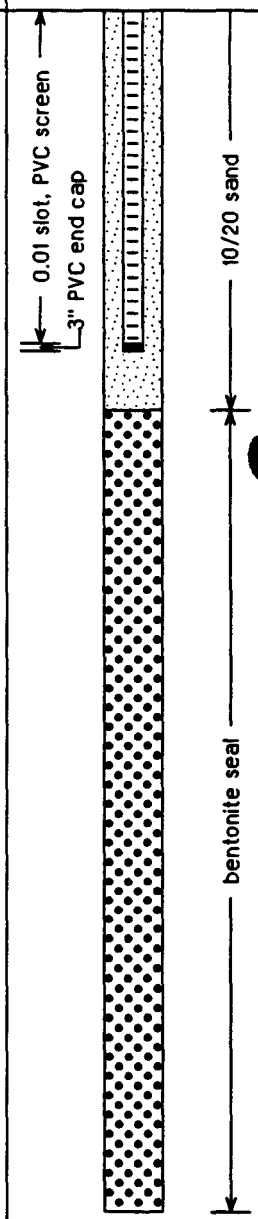
EnSafe/Allen & Hoshall

Monitoring Well 002G14DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU#2 – Southside Landfill*
Project No.: *106-08420*	Surface Elevation: *269.00 feet msl*
Started at *1213 on 2-14-96*	TOC Elevation: *271.00 feet msl*
Completed at *1400 on 2-14-96*	Depth to Groundwater: *6.90 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic – 4" core barrel inside 6" casing*	Groundwater Elevation: *264.10 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *76.0 feet*
Geologist: *J. Kingsbury*	Well Screen: *40 to 50 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			5	90	BG		SP	Coarse-grained sand with rare gravel. Dusky yellow color from 40' to 41' changing to olive gray in color from 42' to 43'.	226
45							SP GW	Sand and gravel, reddish-brown to dark orangish-yellow.	223
							SP	Coarse-grained sand with some gravel. Dark orangish-yellow to reddish-brown becoming dusky yellow around 49' to 50'.	219
50			6	110	BG		SP	Sand, fine-grained, yellowish-gray to very light yellowish-brown, finely micaceous, wet.	
55									
60			7	90	BG				
65								Some ironstone and reddish-brown sand.	203
							CL ML	Cockfield Formation: clay and silt, dark gray.	
70			8	100	BG				
75									193
								Terminated soil boring at 76'.	
80									

WELL DIAGRAM



EnSafe/Allen & Hoshall

Monitoring Well 002G09DA

Project: NSA Memphis	Location: Millington, TN. SWMU #2–Southside Landfill
Project No.: 106–08420	Surface Elevation: 265.51 feet msl
Started at 0830 on 1–30–96	TOC Elevation: 267.96 feet msl
Completed at 0945 on 1–30–96	Depth to Groundwater: 17.15 feet Measured: 4/8/96
Drilling Method: Rotosonic–4" core barrel inside 6" casing	Groundwater Elevation: 250.81 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 55.0 feet
Geologist: D. Ladd, W. Parks	Well Screen: 36 to 46 feet

CASING TYPE: 2" PVC

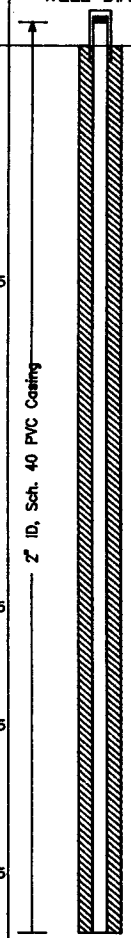
TOP OF LOG = GROUND SURFACE

DATE LOGGED: 05/23/96

NOTES

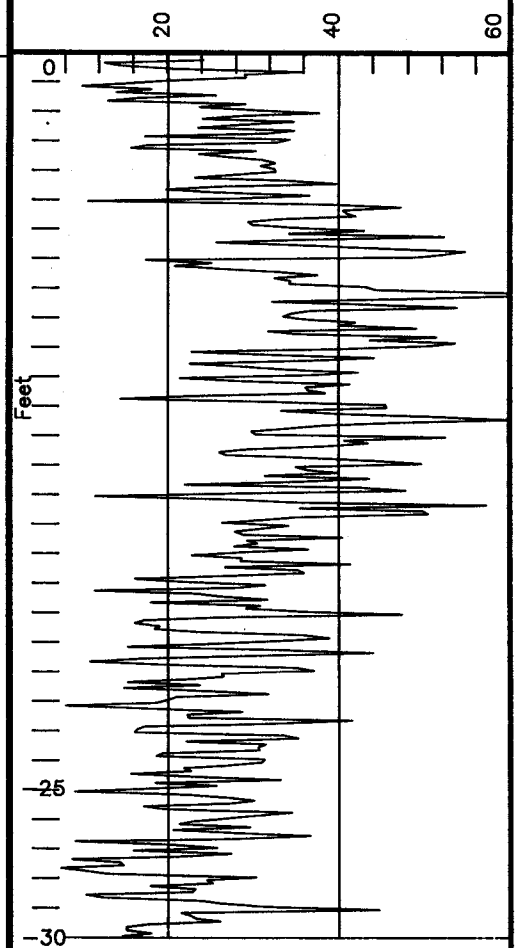
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft–msl)
			1	75	8, 6	OL GW	(0–26') Upper Alluvium (see descriptions below). (0–3.5') Soil and gravel (fill).	
					5, 6	ML	(3.5–8') Clayey silt; moderate yellowish–brown mottled with light olive gray material containing iron–manganese nodules.	262
10			2	98	5, 6, 6, 4, 5	ML	(8–19') Silt, very clayey, moderate yellowish–brown to dark yellowish– brown mottled with medium gray material. Abundant iron–manganese nodules from 9' to 11'. Moist with some iron–manganese nodules from 13' to 15'. Less iron–manganese nodules, becoming more dark yellowish–orange from 15–19'.	257.5
20			3	90	2, 5	ML	(19–23') Silt, clayey (see descriptions below). (19–22') Silt, clayey, olive gray to greenish–gray, containing snail shell fragments. (22–23') Same as above, but olive gray in color.	246.5
25			4	100	6, 6, 5	SM SW	(23–27.5') Sand, fine to medium, silty, olive gray in color, with snail shell fragments, moist to wet, wet below 25'. Top of Deeper Alluvium deposits estimated at 26'. (27.5–28') Sand, fine to very coarse–grained, olive gray, with snail shell fragments, wet.	242.5
30					5	ML	(28–31') Silt; olive gray in color with snail shell fragments. Wet. Vegetation near 29'.	237.5

WELL DIAGRAM



GAMMA RAY LOG

COUNTS PER SECOND



RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

SWMU 2
SOUTHSIDE LANDFILL

DWG DATE: 12/10/96

DWG NAME: 94GL29

LOGGED BY:
GEOLOGICAL LOGGING SYSTEMS

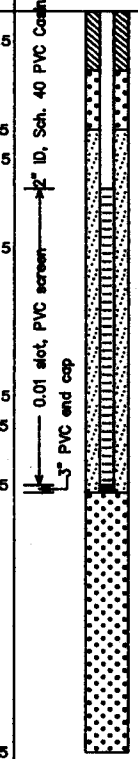
EnSafe/Allen & Hoshall

Monitoring Well 002G09DA

Project:	NSA Memphis	Location:	Millington, TN.SWMU#2 – Southside Landfill
Project No.:	106-08420	Surface Elevation:	265.51 feet msl
Started at	0830 on 1-30-96	TOC Elevation:	267.96 feet msl
Completed at	0945 on 1-30-96	Depth to Groundwater:	17.15 feet Measured: 4/8/96
Drilling Method:	Rotasonic-4" core barrel inside 6" casing	Groundwater Elevation:	250.81 feet msl
Drilling Company:	Alliance Environmental, Inc.	Total Depth:	55.0 feet
Geologist:	D. Ladd, W. Parks	Well Screen:	36 to 46 feet

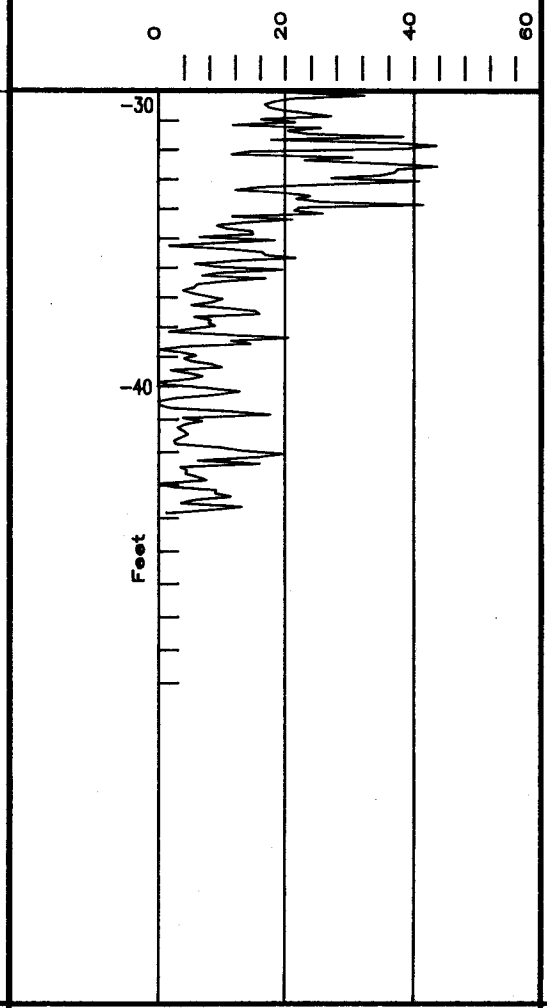
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					3		ML		234.5
			4	100	8		SM	(31–34') Silty sand, very fine-grained becoming progressively coarser near 34', olive gray to light olive gray near 34', with small shell fragments, wet.	231.5
35					6		SW	(34–34.5') Coarse to very coarse-grained sand with gravel. Light olive gray to greenish-gray, containing small shell fragments, wet.	231
							SW		230.5
					6		SM	(34.5–35') Sand, very fine to medium-grained, light olive gray to greenish-gray, wet.	
					7		SP GW	(35–38') Silty sand, very fine to very coarse-grained, with quartz and chert gravel up to 1" in longest dimension, olive gray, wet.	227.5
40			5	390	5			(38–43') Sand and gravel; sand is fine to very coarse-grained, gravel is up to 1"in longest dimension; moderate yellowish-brown mottled with light gray material, wet.	
					6		SP	(43–44') Coarse-grained sand, moderate yellowish-brown mottled with medium light gray material, wet.	222.5
45					6		SW GW		221.5
					5		CL	(44–46') Sand and gravel, gravel and sand (see descriptions below).	219.5
					5			(44–45') Sand and gravel; sand is very coarse-grained and gravel is up to 1.5" in longest dimension; moderate yellowish-brown mottled with medium light gray material, wet.	
50			6	102	6			(45–46') Gravel up to 1.5" in longest dimension, and sand, dark yellowish-brown to moderate yellowish-brown; becoming clayey near 46'.	
					5			(46–55') Cockfield Formation: Clay, dusky yellowish-brown to dark yellowish-brown.	
					5			With light olive gray sandy seams below 52'.	
55								With some lignite seams below 53'.	210.5
								Terminated soil boring at 55'.	
60									

WELL DIAGRAM



GAMMA RAY LOG

COUNTS PER SECOND



CASING TYPE: 2" PVC

TOP OF LOG = GROUND SURFACE

DATE LOGGED: 05/23/96

NOTES

RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

SWMU 2
SOUTHSIDE LANDFILL

DWG DATE: 12/10/96

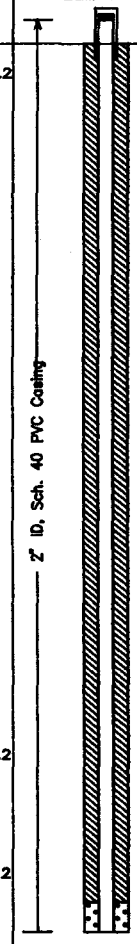
DWG NAME: 94GL29A

LOGGED BY:
GEOLOGICAL LOGGING SYSTEMS

EnSafe/Allen & Hoshall	Monitoring Well 002G11DA
Project: NSA Memphis	Location: Millington,TN.SWMU#2–Southside Landfill
Project No.: 106–08420	Surface Elevation: 265.17 feet msl
Started at 1010 on 1–16–96	TOC Elevation: 266.77 feet msl
Completed at 0915 on 1–17–96	Depth to Groundwater:4.17 feet Measured: 4/8/96
Drilling Method: 4 1/4" ID Hollow–Stem Auger, 5' Flights	Groundwater Elevation:262.60 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 46.0 feet
Geologist: J. Carmichael, W. Parks, D. Ladd	Well Screen: 32.2 to 42.2 feet

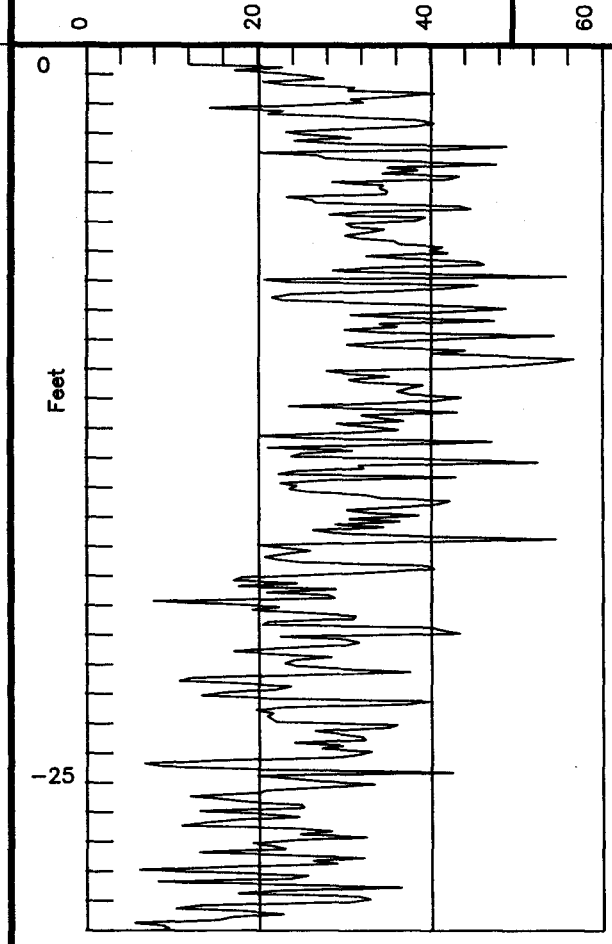
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft–msl)
			1	42	BG			(0–33') Upper Alluvium (see descriptions below).	264.2
								(0–1') Fill and skeet fragments.	
			2	71	BG			(1–24') Silt, clayey (see descriptions below).	
								(1–2') Clayey silt, yellowish–brown to brownish–gray in color.	
5			3	73	BG			(2–6') Silt, clayey, dark yellowish–brown with dark yellowish–orange staining. Trace of organic material.	
			4	83	BG			Finely laminated and contains small iron–manganese nodules from 4–6'.	
			5	96	BG			(6–8') Silt, decreasing clay content and increasing iron–manganese nodule content. Yellowish–brown to light olive gray, moist.	
10			6	100	BG			(8–18') Silt, slightly clayey yellowish–gray to light olive gray color, moist.	
			7	100	BG		ML	Increase in dark yellowish–orange staining, moisture content, and iron–manganese content from 10–14'.	
15			8	100	BG			Stained dark yellowish–orange in color from 14–16'. Very moist from 14–15'.	
			9	100	BG			Less staining from 16–18'. Very moist from 16' to 17' (water came up the borehole when auger was advanced).	
			10	92	BG			(18–19') Silt, slightly clayey, medium gray in color. Moist.	
20			11	83	BG			(19–20') Silt, slightly clayey, yellowish–gray to light olive gray, moist.	
			12	100	BG			(20–22') Silt, slightly clayey, medium light gray to light gray, stained moderate brown, moist.	
								(22–24') Silt, clayey, pale yellowish–brown to pale brown color, moist.	241.2
25			13	100	BG			(24–28') Silt (see descriptions below).	
			14	100	BG		ML	(24–26') Silt; medium gray to brownish–gray with patches of dark yellowish–orange material. Moist.	237.2
			15	100	BG		ML	(26–28') Silt; light olive gray to medium gray. Slightly moist.	
30								(28–33') Silt, sandy (see descriptions below).	

WELL DIAGRAM



GAMMA RAY LOG

COUNTS PER SECOND



CASING TYPE: 2" PVC

TOP OF LOG = GROUND SURFACE

DATE LOGGED: 05/23/96

NOTES

RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

SWMU 2
SOUTHSIDE LANDFILL

DWG DATE: 12/10/96

DWG NAME: 94G0211

LOGGED BY:
GEOLOGICAL LOGGING SYSTEMS

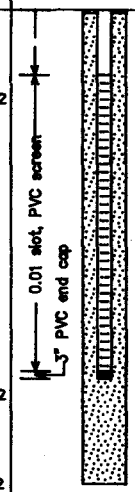
EnSafe/Allen & Hoshall

Monitoring Well 002G11DA

Project: NSA Memphis	Location: Millington, TN. SWMU#2–Southside Landfill
Project No.: 106–08420	Surface Elevation: 265.17 feet msl
Started at 1010 on 1–16–96	TOC Elevation: 266.77 feet msl
Completed at 0915 on 1–17–96	Depth to Groundwater: 4.17 feet Measured: 4/8/96
Drilling Method: 4 1/4" ID Hollow-Stem Auger, 5' Flights	Groundwater Elevation: 262.60 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 46.0 feet
Geologist: J. Carmichael, W. Parks, D. Ladd	Well Screen: 32.2 to 42.2 feet

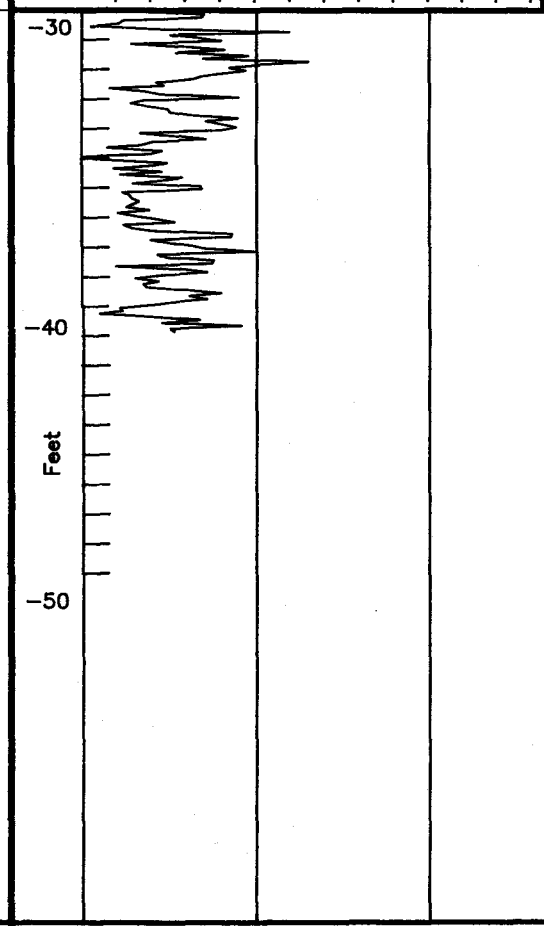
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft–msl)
			16	100	BG		ML	(28–30') Sandy silt; light olive gray to medium gray in color, slightly moist.	
			17	100	BG			(30–32') Silt, sandy, light olive gray, slightly moist, contains pockets of small red carbonaceous material.	232.2
35			18	71	BG			(32–33') Silt, sandy, medium light gray to medium gray, moist.	
			19	92	BG			(33–43') Deeper Alluvium (see descriptions below).	
							SW GW	(33–34') Sand, fine to coarse–grained, light olive gray color, wet.	
			20	58	BG			(34–36.25') Sand, fine to coarse–grained, with clay, silt, and gravel up to .5" in longest dimension. Light brownish–gray to pale red, moist. Coantains silt and clay from 34–35'.	
40			21	88	BG				
			22	92	BG			(36.25–38') Clayey sand with gravel up to 1" in longest dimension, olive gray to medium gray, moist.	222.2
45			23	83	BG		CL	(38–40') Sand and gravel, light olive gray to pale brown. Gravel content increases with depth.	
								(40–42') Sand and gravel, olive gray to brownish–gray stained dark yellowish–orange, wet.	219.2
								(42–43') Sand and gravel, light olive gray, wet.	
50								(43–46') Cockfield Formation: Clay, brownish–gray to dusky brown, finely micaceous, with fine–grained sand laminae from 44' to 46'.	
								Terminated soil boring at 46'.	
55									
60									

WELL DIAGRAM



GAMMA RAY LOG

COUNTS PER SECOND



CASING TYPE: 2" PVC

TOP OF LOG = GROUND SURFACE

DATE LOGGED: 05/23/96

NOTES

RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

SWMU 2
SOUTHSIDE LANDFILL

DWG DATE: 12/10/96

DWG NAME: 94G0211A

LOGGED BY:
GEOLOGICAL LOGGING SYSTEMS

EnSafe/Allen & Hoshall

Monitoring Well 002G13DA

Project: NSA Memphis	Location: Millington,TN.SWMU#2–Southside Landfill
Project No.: 106–08420	Surface Elevation: 267.05 feet msl
Started at 1110 on 1–19–96	TOC Elevation: 269.12 feet msl
Completed at 1130 on 1–20–96	Depth to Groundwater:5.36 feet Measured: 4/8/96
Drilling Method: 4 1/4" ID Hollow–Stem Auger, 5' Flights	Groundwater Elevation:263.76 feet msl
Drilling Company: Alliance Drilling	Total Depth: 67.0 feet
Geologist: D. Ladd, J. Kingsbury, A. Choate	Well Screen: 55 to 65 feet

GAMMA RAY LOG

COUNTS PER SECOND

CASING TYPE: 2" PVC

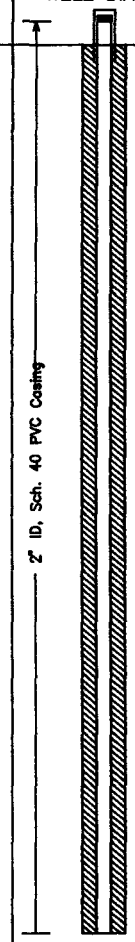
TOP OF LOG = GROUND SURFACE

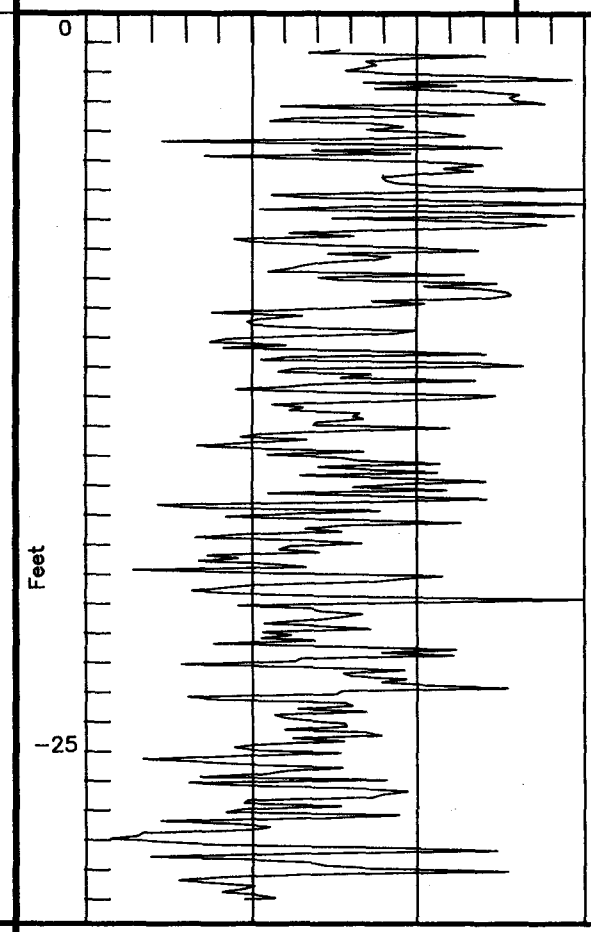
DATE LOGGED: 05/23/96

NOTES

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft–msl)
			1	46	BG		OL	(0–34') Upper Alluvium (see descriptions below).	
			2	83	BG		CL ML	Clay and silt, dark yellowish–brown, moist, with organic material and roots.	265
5			3	88	3			Silty clay/clayey silt, greenish–gray and moderate yellowish–brown, slightly moist, soft to slightly firm, with some dark iron staining.	263
			4	79	2.5			Clayey silt, greenish–gray and moderate yellowish–brown, with iron/ manganese inclusions and organic material, slightly moist.	
			5	100	2			Iron–manganese nodules increasing in percentage and size (up to .5" in diameter).	
10			6	108	BG		ML	Some staining with a dark yellowish–orange material. Increase in clay percentage.	
			7	108	BG			Clayey silt, light olive gray color stained light brown to dark yellowish–orange. Moisture content increasing as iron/manganese nodules decrease in percentage.	
15			8	108	BG			Very moist at 14' becoming less moist near 16', rare iron/manganese nodules.	
			9	108	BG			Clayey silt, medium gray to light olive gray stained light brown to dark yellowish–orange, very moist.	
			10	100	BG			Silty clay, medium light to medium gray, wet.	248
20			11	92	BG			Dark greenish–gray to grayish–olive green color, wet.	
			12	100	BG		CL	Very moist.	
25			13	96	BG			Light olive gray to grayish–olive green color. Very moist and soft.	
			14	96	BG				
			15	96	BG		ML	Clayey silt, light olive gray to grayish–olive green color, slightly moist, soft.	239
30									

WELL DIAGRAM





RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

SWMU 2
SOUTHSIDE LANDFILL

DWG DATE: 12/10/96

DWG NAME: 94GL213

LOGGED BY:
GEOLOGICAL LOGGING SYSTEMS

EnSafe/Allen & Hoshall

Monitoring Well 002G13DA

Project: NSA Memphis	Location: Millington,TN.SWMU#2-Southside Landfill
Project No.: 106-08420	Surface Elevation: 267.05 feet msl
Started at 1110 on 1-19-96	TOC Elevation: 269.12 feet msl
Completed at 1130 on 1-20-96	Depth to Groundwater:5.36 feet Measured: 4/8/96
Drilling Method: 4 1/4" ID Hollow-Stem Auger, 5' Flights	Groundwater Elevation: 263.76 feet msl
Drilling Company: Alliance Drilling	Total Depth: 67.0 feet
Geologist: D. Ladd, J. Kingsbury, A. Choate	Well Screen: 55 to 65 feet

GAMMA RAY LOG

COUNTS PER SECOND

CASING TYPE: 2" PVC

TOP OF LOG = GROUND SURFACE

DATE LOGGED: 05/23/96

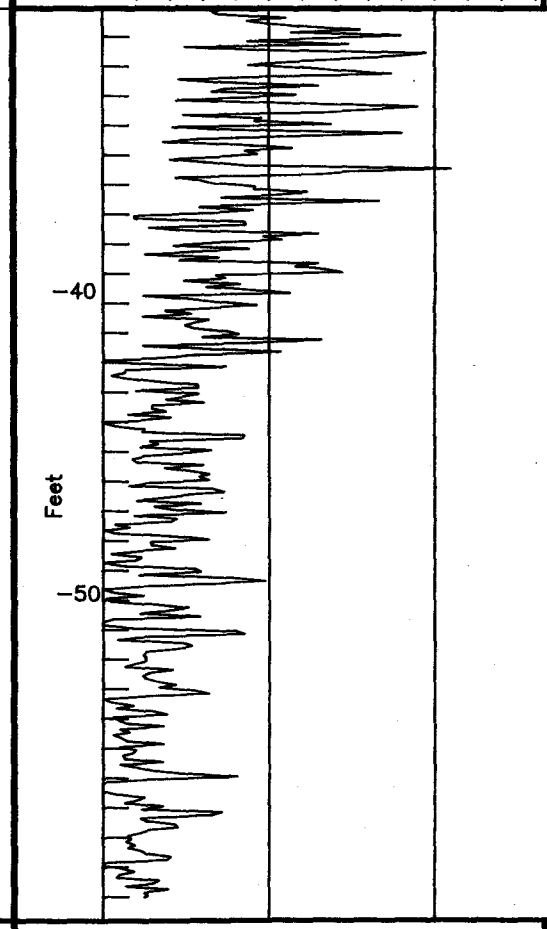
NOTES

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			16	33	BG			Sandy silt with rare coarse subangular sand grains. Wet.	
			17	83	BG		ML	Olive gray color, wet, soft.	
35			18	79	BG			Sandy silt with fine to coarse sand between 34' and 35' fining downward to fine-grained sand between 35' and 36', soft. Top of Deeper Alluvium deposits estimated at 34'.	
			19	100	BG		SW GW	Sand and gravel, gravel up to 1" in longest dimension, light olive gray.	230.9
								Silty sand, light olive gray.	229.5
			20	100	BG		SW	Silty sand with some gravel, light olive gray to light gray.	
40								No sample collected from 40' to 46' due to heaving sand.	227
45									
			21	96	BG		SW GW	Sand and gravel, light olive gray. Wet. Considerable iron-staining at 47.5'.	221
								No sample collected from 48' to 51'.	219
50									
			22	100	BG		SW GW	Sand and gravel, dark yellowish-orange changing to yellowish-gray color near 53'.	216
								No sample collected from 53' to 56'.	214
55									
			23	100	BG		SW GW	Sand and gravel, yellowish-gray to pale yellowish-brown. Gravel up to 1" in longest dimension. Locally stained dark yellowish-orange, wet.	211
								No sample collected from 58' to 61'.	209
60									

WELL DIAGRAM

2" ID, Sch. 40 PVC Casing

0.01 slot, PVC screen



RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

SWMU 2
SOUTHSIDE LANDFILL

DWG DATE: 10/31/96

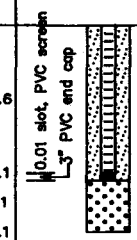
DWG NAME: 94GL213A

LOGGED BY:
GEOLOGICAL LOGGING SYSTEMS

EnSafe/Allen & Hoshall	Monitoring Well 002G13DA
Project: NSA Memphis	Location: Millington, TN. SWMU#2–Southside Landfill
Project No.: 106–08420	Surface Elevation: 267.05 feet msl
Started at 1110 on 1–19–96	TOC Elevation: 269.12 feet msl
Completed at 1130 on 1–20–96	Depth to Groundwater: 5.36 feet Measured: 4/8/96
Drilling Method: 4 1/4" ID Hollow-Stem Auger, 5' Flights	Groundwater Elevation: 263.76 feet msl
Drilling Company: Alliance Drilling	Total Depth: 67.0 feet
Geologist: D. Ladd, J. Kingsbury, A. Choate	Well Screen: 55 to 65 feet

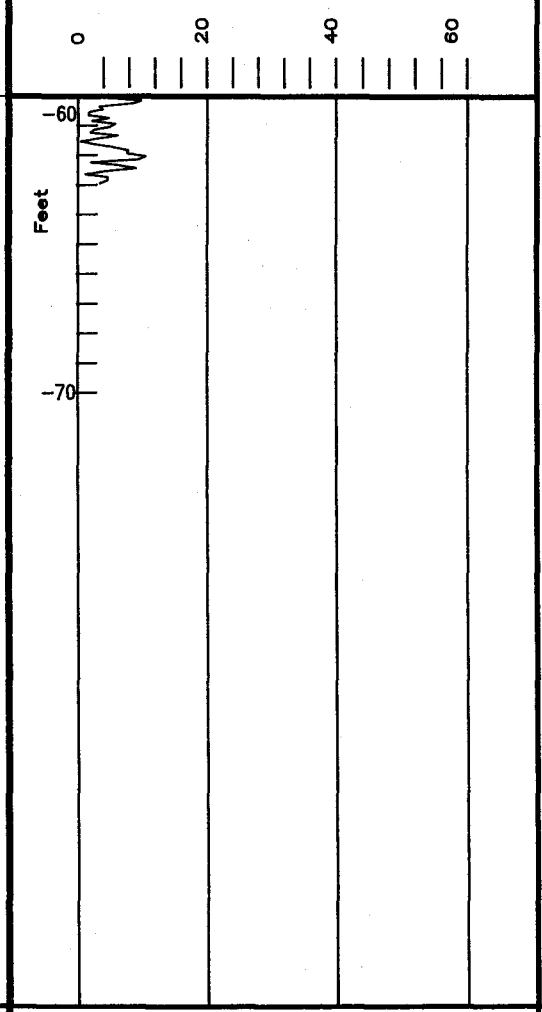
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft–msl)
			24	141	BG		SW GW	Sand and gravel, moderate yellowish–brown to dark yellowish–brown color.	208
								Color change to dusky yellow brown. Wet.	204.6
								No sample collected from 62.5' to 65'.	
65			25	100	BG		SW GW SP	Fine to coarse–grained sand and gravel, olive–gray to light olive gray. Fining downward and turning dark yellowish–orange to light brown in color near 65.5'.	202.1 / 201.1 / 200.1
								Cockfield Formation: Sand, fine–grained, dark yellowish–orange to light brown, wet. Terminated soil boring at 67'.	
70									
75									
80									
85									
90									

WELL DIAGRAM



GAMMA RAY LOG

COUNTS PER SECOND



CASING TYPE: 2" PVC

TOP OF LOG = GROUND SURFACE

DATE LOGGED: 05/23/96

NOTES

RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

SWMU 2
SOUTHSIDE LANDFILL

DWG DATE: 10/31/96

DWG NAME: 94GL213B

LOGGED BY:
GEOLOGICAL LOGGING SYSTEMS

TRI STATE
TESTING SERVICES, INC.

Measurement of Hydraulic Conductivity

Client: EnSafe/Allen & Hoshall

Date of Report: 02/28/96 Project No.: E-3-157

Client's Project No.: 0106090000

Sample I.D.: 002S002919

Soil Description: Light Gray Clayey Silt

Test Media: City of Memphis Water

	Pre-Test	Post Test
Wet Density (Lbs/ft^3)	123.9	121.3
Dry Density (Lbs/ft^3)	95.7	96.0
Moisture (% Dry Wt)	29.5	26.4
Porosity (n)	.41	.40
Degree of Saturation (%)	1.0	1.0
Specific Gravity (ASTM D-854)	2.58	---

Permeability

Temperature Correction, $R_t = 1.024$

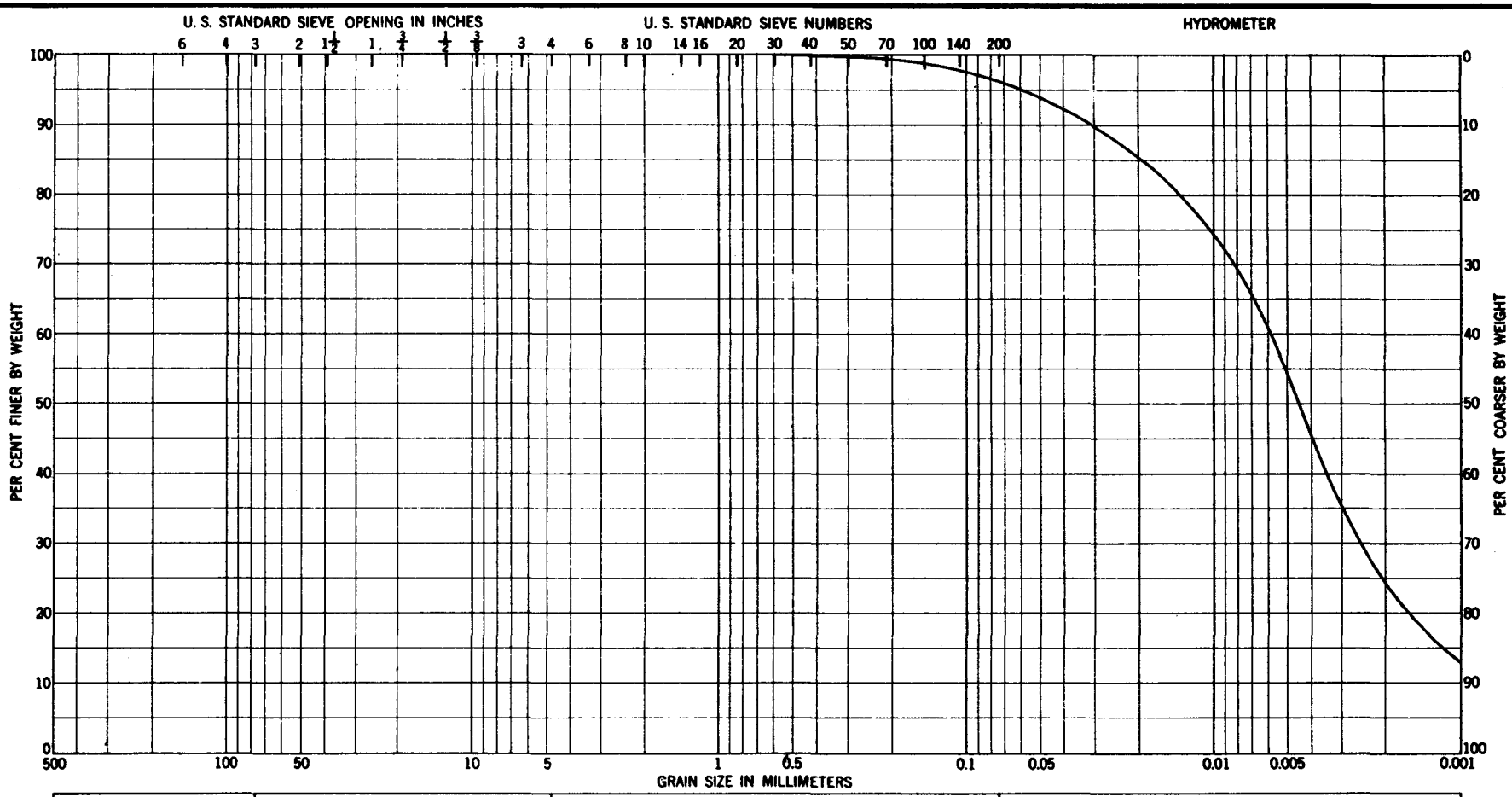
$K_1 = 6.6 \times 10^{-7}$ cm/sec
$K_2 = 6.3 \times 10^{-7}$ cm/sec
$K_3 = 6.9 \times 10^{-7}$ cm/sec
$K_4 = 6.4 \times 10^{-7}$ cm/sec

Coefficient of Permeability, $K_{20} = 6.8 \times 10^{-7}$ cm/sec

Tested in accordance with ASTM D-5084-90.

Lab No. P-96-010 Reviewed By: David D. McCray

6756 Buckles Cove Memphis, TN 38133 901-385-1199 Fax 901-386-6614



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
002 S0029 19			30			

Project EnSafe/A&H # 010609000

Area

Boring No.

Date 02/28/96

GRADATION CURVES

TRI-STATE TESTING SERVICES, INC.

TRI STATE
TESTING SERVICES, INC.

Measurement of Hydraulic Conductivity

Client: EnSafe/Allen & Hoshall

Date of Report: 02/26/96 Project No.: E-3-157

Client's Project No.: 0106090000

Sample I.D.: 002S003019

Soil Description: Light Gray Clayey Silt

Test Media: City of Memphis Water

	Pre-Test	Post Test
Wet Density (Lbs/ft^3)	119.1	119.4
Dry Density (Lbs/ft^3)	95.4	88.2
Moisture (% Dry Wt)	24.8	35.3
Porosity (n)	.42	.46
Degree of Saturation (%)	.91	1.0
Specific Gravity (ASTM D-854)	2.62	---

Permeability

Temperature Correction, R_t = 1.009

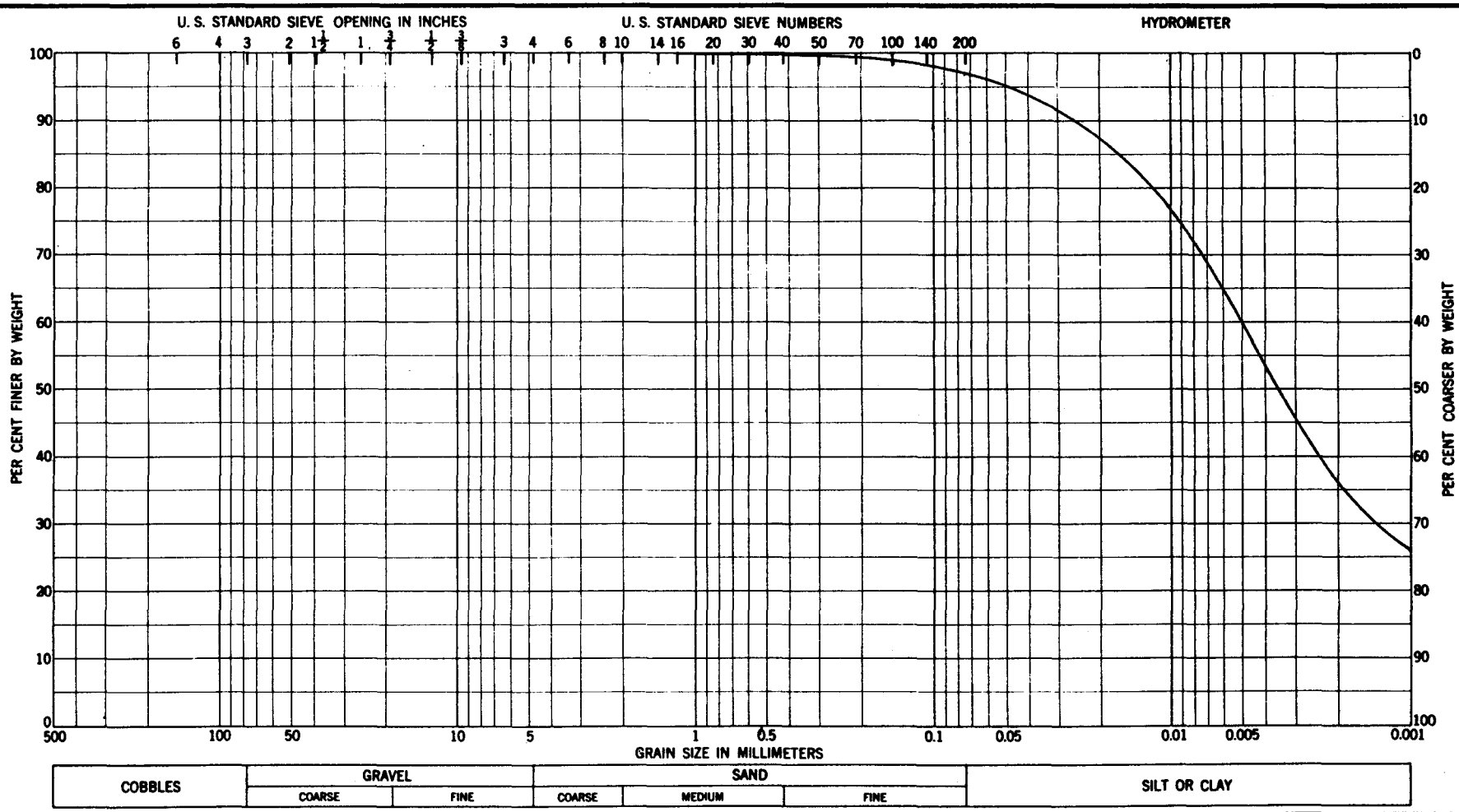
$K_1 = 3.3 \times 10^{-6}$ cm/sec
$K_2 = 1.1 \times 10^{-6}$ cm/sec
$K_3 = 2.3 \times 10^{-6}$ cm/sec
$K_4 = 2.4 \times 10^{-6}$ cm/sec

Coefficient of Permeability, $K_{20} = 2.3 \times 10^{-6}$ cm/sec

Tested in accordance with ASTM D-5084-90.

Lab No. P-96-007 Reviewed By: David D. McCray

6756 Buckles Cove Memphis, TN 38133 901-385-1199 FAX 901-386-6614



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
002S003019			25			

Project EnSafe/A&H # 010609000

Area

Boring No.

Date 02/26/96

GRADATION CURVES

TRI-STATE TESTING SERVICES, INC.

TRI STATE
TESTING SERVICES, INC.

Measurement of Hydraulic Conductivity

Client: EnSafe/Allen & Hoshall

Date of Report: 02/26/96 Project No.: E-3-157

Client's Project No.: 0106090000

Sample I.D.: 002S003043

Soil Description: Coarse Sand with gravel & some clay

Test Media: City of Memphis Water

	Pre-Test	Post Test
Wet Density (Lbs/ft^3)	123.5	126.6
Dry Density (Lbs/ft^3)	112.1	110.4
Moisture (% Dry Wt)	10.2	14.7
Porosity (n)	.33	.34
Degree of Saturation (%)	.55	.96
Specific Gravity (ASTM D-854)	2.69	---

Permeability

Temperature Correction, R_t = 1.056

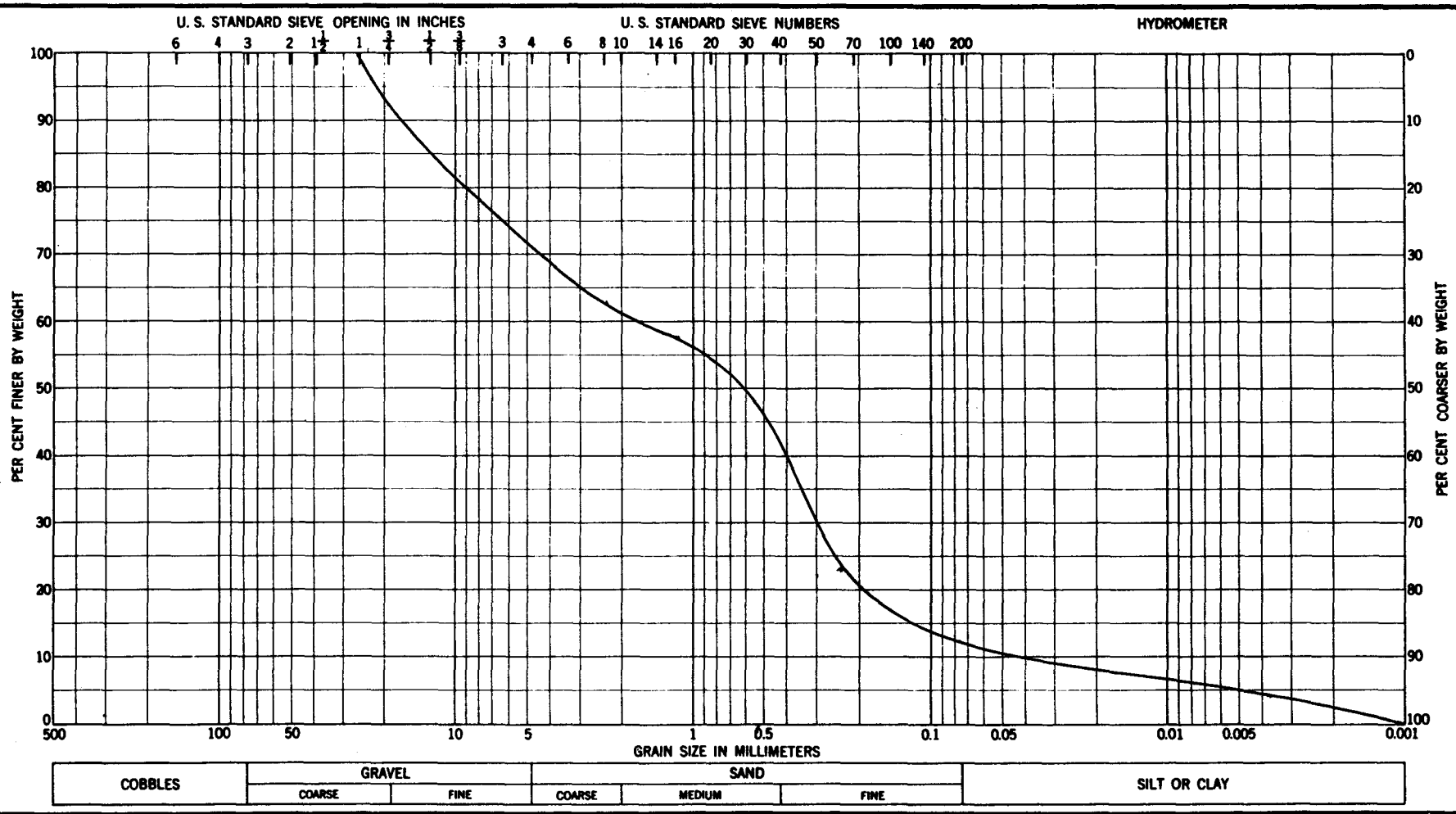
$K_1 = 1.4 \times 10^{-4}$ cm/sec
$K_2 = 3.4 \times 10^{-4}$ cm/sec
$K_3 = 4.2 \times 10^{-4}$ cm/sec
$K_4 = 3.8 \times 10^{-4}$ cm/sec

Coefficient of Permeability, $K_{20} = 3.4 \times 10^{-4}$ cm/sec

Tested in accordance with ASTM D-5084-90.

Lab No. P-96-008 Reviewed By: David D. McCray

6756 Buckles Cove Memphis, TN 38133 901-385-1199 FAX 901-386-6614



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
002S003048			10			

Project EnSafe/A&H # 010609000

Area

Boring No.

Date 02/26/96

GRADATION CURVES

TRI-STATE TESTING SERVICES, INC.

TRI STATE
TESTING SERVICES, INC.

Measurement of Hydraulic Conductivity

Client: EnSafe/Allen & Hoshall

Date of Report: 02/27/96 Project No.: E-3-157

Client's Project No.: 0106090000

Sample I.D.: 002S03DA43

Soil Description: Clean Sand with some small gravel

Test Media: City of Memphis Water

	Pre-Test	Post Test
Wet Density (Lbs/ft^3)	127.6	130.4
Dry Density (Lbs/ft^3)	115.3	115.9
Moisture (% Dry Wt)	10.7	12.5
Porosity (n)	.29	.30
Degree of Saturation (%)	.79	1.0
Specific Gravity (ASTM D-854)	2.68	---

Permeability

Temperature Correction, R_t = 1.031

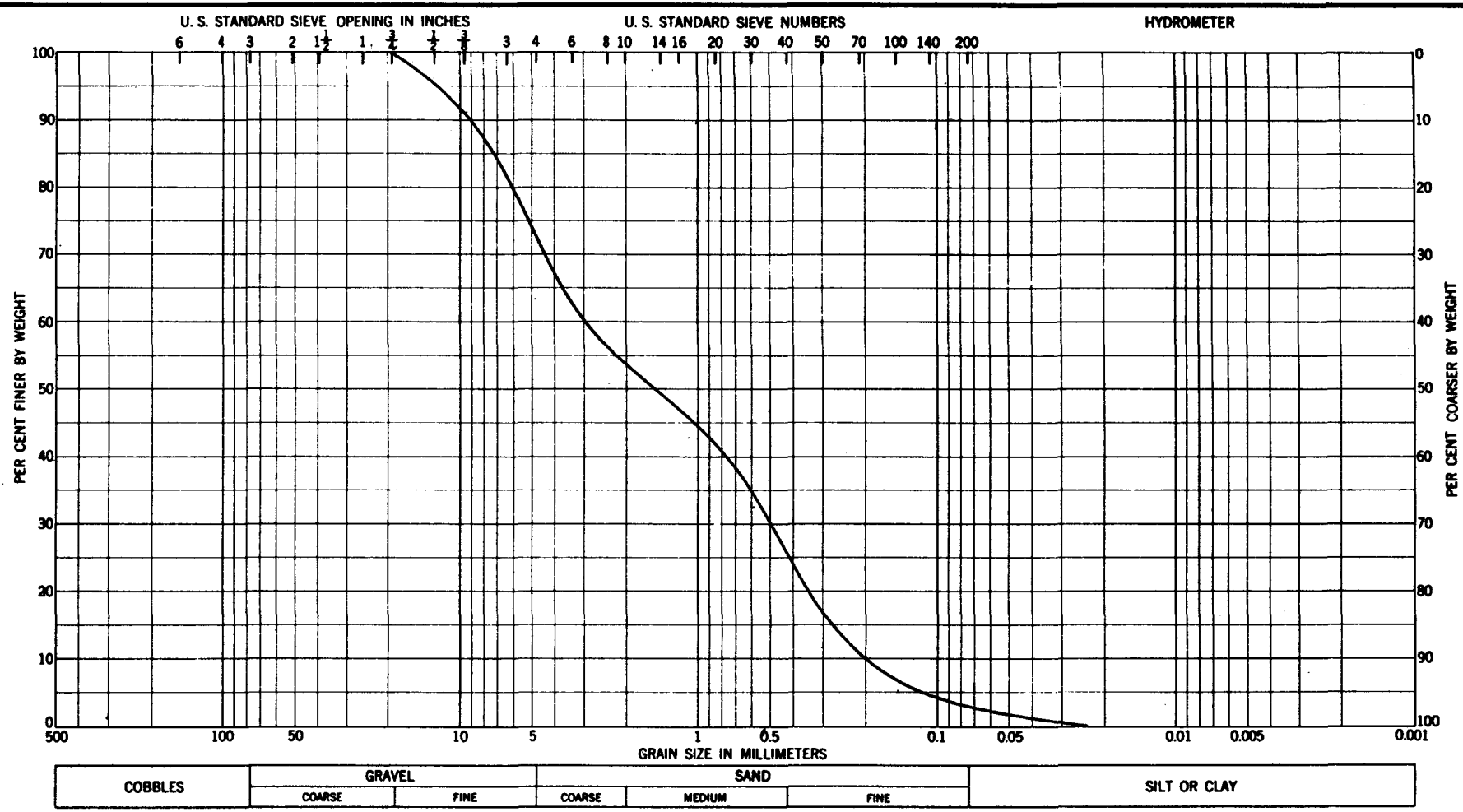
K_1 = 8.6 X 10^{-4} cm/sec
K_2 = 8.4 X 10^{-4} cm/sec
K_3 = 8.7 X 10^{-4} cm/sec
K_4 = 8.2 X 10^{-4} cm/sec

Coefficient of Permeability, K_{20} = 8.6 X 10^{-4} cm/sec

Tested in accordance with ASTM D-5084-90.

Lab No. P-96-009 Reviewed By: David D. McCray

6756 Buckles Cove Memphis, TN 38133 901-385-1199 FAX 901-386-6614



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
002S03DA43			11			

Project EnSafe/A&H # 010609000

Area

Boring No.

Date 02/27/97

GRADATION CURVES

TRI-STATE TESTING SERVICES, INC.

SWMU 9

SOIL BORING/MONITORING WELL LOGS
AND
GEOTECHNICAL LABORATORY RESULTS

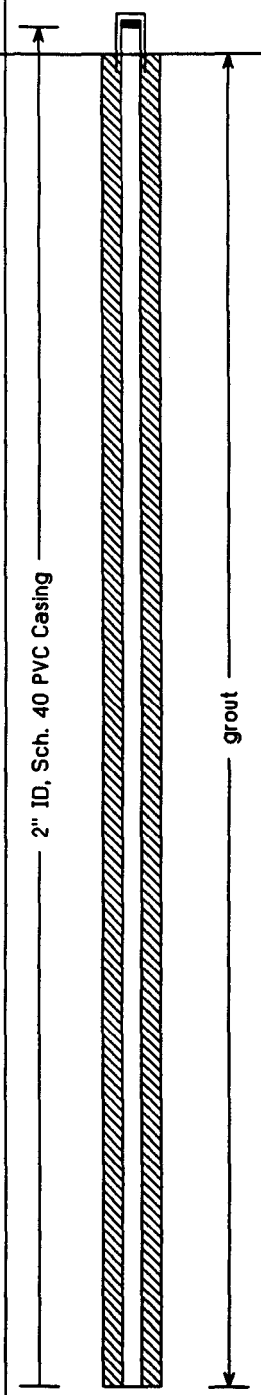
EnSafe/Allen & Hoshall

Monitoring Well 009G01DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #9 (Sewage Lagoons)*
Project No.: *0106-22111*	Surface Elevation: *269.69 feet msl*
Started at *1230 on 2-15-96*	TOC Elevation: *271.62 feet msl*
Completed at *1500 on 2-15-96*	Depth to Groundwater: *19.87 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *251.75 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *66 feet*
Geologist: *J.A. Kingsbury*	Well Screen: *46 to 56 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					BG			(0-39') Upper Alluvium (see descriptions below).	
			1	50	BG		ML CL	(0-6') Silt and clay, brown to dark yellowish-brown in color with some organic material.	
5					BG				263.7
					BG			(6-39') Silt (see descriptions below).	
					BG			(6-16) Medium brown in color, with some iron, organic material and dark orangish-yellow staining, moist.	
10			2	40	BG				
					BG				
15					BG				
					BG			Shelby Tube sample collected from 16-18' for geotechnical analysis. (18-24') Mottled yellowish-brown and yellowish-gray in color with dark orangish-yellow to reddish-brown iron staining.	
					BG				
20			3	70	BG				
					BG		ML		
25					BG			(24-26') Light olive gray to greenish-gray in color. Wet.	
					BG			(26-29') Greenish-gray in color.	
					BG			(29-39') Sandy silt with common snail shells. Greenish-gray to olive gray in color between 29' and 34'.	
30			4	90	BG				
					BG			Brownish-gray in color between 34' and 39'. Some snail shells present.	
35					BG				
					BG				
					BG		SP	(39-56') Deeper Alluvium (see descriptions below).	230.7
40									

WELL DIAGRAM



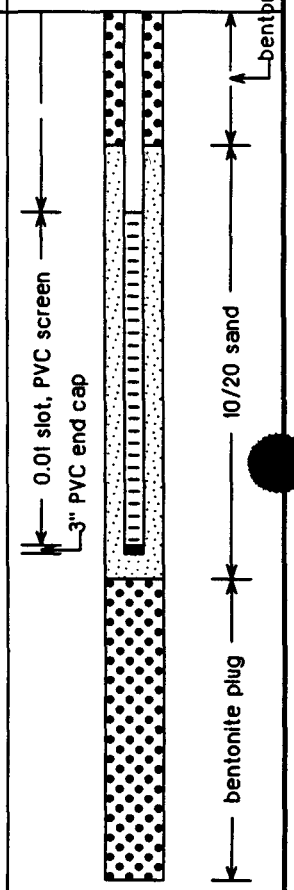
EnSafe/Allen & Hoshall

Monitoring Well 009G01DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #9 (Sewage Lagoons)*
Project No.: *0106-22111*	Surface Elevation: *269.69 feet msl*
Started at *1230 on 2-15-96*	TOC Elevation: *271.62 feet msl*
Completed at *1500 on 2-15-96*	Depth to Groundwater: *19.87 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *251.75 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *66 feet*
Geologist: *J.A. Kingsbury*	Well Screen: *46 to 56 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			5	90	BG		SP	(39-42') Coarse-grained sand, light olive gray in color.	227.7
					BG		GW	(42-42.5') Gravel lense.	227.2
							SP	(42.5-43') Coarse-grained sand.	226.7
							ML	(43-45') Silt, very light gray to moderate gray in color.	224.7
45					BG		SW	(45-48') Sand with some gravel, yellowish-gray in color.	221.7
					BG				
					BG				
50			6	70	BG		SW GW	(48-56') Sand and gravel. Gravel is up to 3" in longest dimension. Dusky yellow to yellowish-gray in color.	
					BG				
55					BG				213.7
					BG			Cockfield Formation: Fine-grained sand, light olive gray, finely lignitic and micaceous.	
					BG				
60			7	90	BG		SP		
					BG				
65					BG				203.7
								Terminated soil boring at 66'.	
70									
75									
80									

WELL DIAGRAM



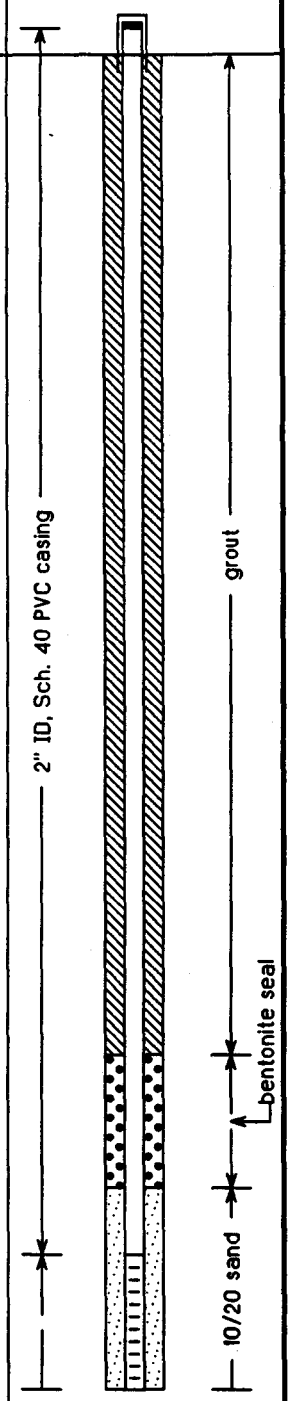
EnSafe/Allen & Hoshall

Monitoring Well 009G02DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #9 (Sewage Lagoons)*
Project No.: *0106-22111*	Surface Elevation: *268.85 feet msl*
Started at *0930 on 2-16-96*	TOC Elevation: *270.80 feet msl*
Completed at *1100 on 2-16-96*	Depth to Groundwater: *11.65 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *259.15 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *56 feet*
Geologist: *J.A. Kingsbury*	Well Screen: *36 to 46 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					BG			(0-40') Upper Alluvium (see descriptions below).	
			1	83	BG			(0-4') Fill material. Silt, moderate brown in color with some iron-staining. Wood fragments that appear to be burnt.	
5					BG			(4-40') Silt (see descriptions below).	
					BG			(4-6') Light olive gray to light brown in color. Dry.	
					BG			Clayey silt. Moderate yellowish-brown to light gray in color, mottled with some dark orangish-yellow-colored material. Moist. Organic material present from 6' to 18'.	
10			2	80	BG				
					BG				
15					BG			Increased iron staining from 15' to 16'.	
					BG				
					BG			Silt, greenish-gray to olive gray in color from 18' to 28'. Wet, with snail shells throughout.	
20			3	70	BG		ML		
					BG				
25					BG				
					BG				
					BG			Color change to brownish-gray. Thin sand lenses, occasionally as thick as 6", are present from 28' to 40'.	
30			4	90	BG				
					BG				
35					BG				
					BG			Shelby Tube collected from 36-38'.	
					BG				
40							SP		228.9

WELL DIAGRAM



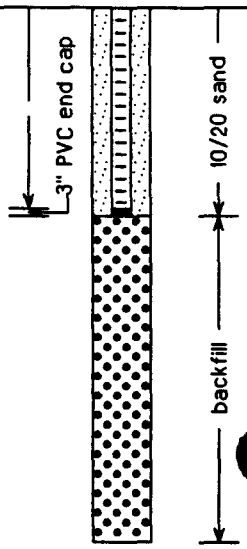
EnSafe/Allen & Hoshall

Monitoring Well 009G02DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #9 (Sewage Lagoons)*
Project No.: *0106-22111*	Surface Elevation: *268.85 feet msl*
Started at *0930 on 2-16-96*	TOC Elevation: *270.80 feet msl*
Completed at *1100 on 2-16-96*	Depth to Groundwater: *11.65 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *259.15 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *56 feet*
Geologist: *J.A. Kingsbury*	Well Screen: *36 to 46 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
									228.9
			5	100	BG			(40-46.5') Deeper Alluvium (see descriptions below).	
					BG		SP	(40-46') Coarse-grained sand, yellowish-gray to dusky yellow. Some gravel (< 1" in longest dimension) is present from 45' to 46.5.	
45					BG				
									222.9
					BG		SM	(46-46.5') Silt and sand, olive-gray in color.	222.4
					BG		CL	Cockfield Formation: Clay, dark brown in color, hard. Fine-grained sand streaks are present from 46.5' to 56'.	
50			6	110	BG				
									216.9
					BG		SC	The percentage of sand incresases to greater than 50 percent from 52' to 56'.	
55					BG				
									212.9
								Soil boring terminated at 56'.	
60									
65									
70									
75									
80									

WELL DIAGRAM



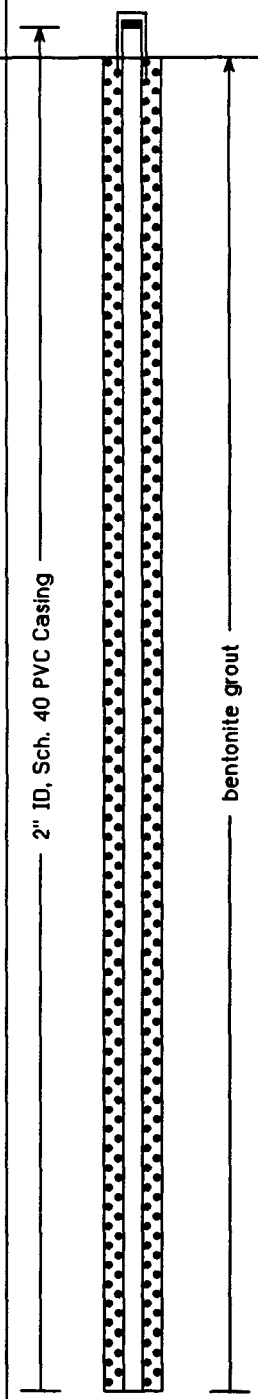
EnSafe/Allen & Hoshall

Monitoring Well 009G03DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #9 (Sewage Lagoons)*
Project No.: *0106-08420*	Surface Elevation: *267.18 feet msl*
Started at *1300 on 1-31-96*	TOC Elevation: *269.05 feet msl*
Completed at *1200 on 2-1-96*	Depth to Groundwater: *15.79 feet* Measured: *4/8/96*
Drilling Method: *Hollow-Stem Auger/3" diameter split spoon*	Groundwater Elevation: *253.26 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *62 feet*
Geologist: *J.A. Kingsbury*	Well Screen: *45 to 55 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
		◢	1	75	BG		ML	(0-34') Upper Alluvium (see descriptions below).	
			2	92	BG			(0-2') Clayey silt. Light brown to light yellowish-brown and brownish- orange in color.	
5			3	67	BG			(2-4') Silt, light brown in color. Some debris with burnt wood are also present. Appears to be fill.	263.2
			4	83	BG		ML CL	(4-6') Silt and clay, light gray to moderate gray color with black plant debris. Organic odor.	
		◢	5	96	BG			From 6' to 10', silt and clay is light gray to greenish-gray in color with moderate brown specks of material. Slightly moist from 6' to 8', and moist from 8' to 10'.	
10			6	79	BG				257.2
			7	71	BG		ML	(10-14') Silt, greenish-gray to light gray/brown color. Moist.	
		◢	8	92	BG			(14-34') Silt and clay, greenish-gray in color. Moist. Prevalent iron staining from 16' to 20'.	253.2
15			9	71	BG				
			10	100	BG			Abundant organic debris from 18' to 19'.	
20			11	71	BG			Greenish-gray to olive gray in color from 20' to 22'.	
			12	83	BG		ML CL	Light olive gray to light greenish-gray from 22' to 34'. Moist. Some organic specks of material present.	
25			13	67	BG				
			14	83	BG				
			15	100	BG				
30			16	92	BG				
			17	100	BG			With minor amount of sand near 34'.	
35			18	83	BG		SW	Contact with Deeper Alluvium deposits estimated at 34'.	233.2

WELL DIAGRAM



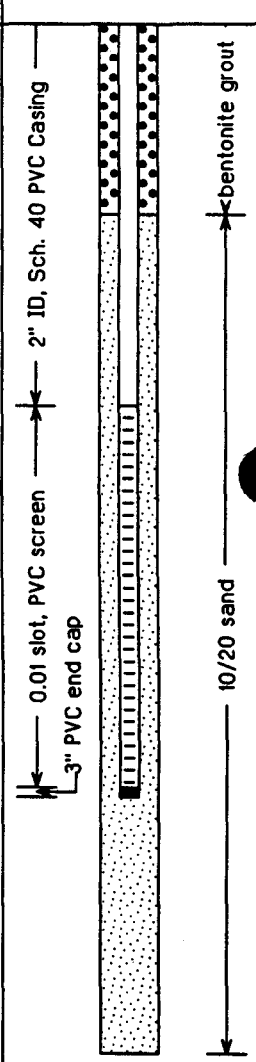
EnSafe/Allen & Hoshall

Monitoring Well 009G03DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #9 (Sewage Lagoons)*
Project No.: *0106-08420*	Surface Elevation: *267.18 feet msl*
Started at *1300 on 1-31-96*	TOC Elevation: *269.05 feet msl*
Completed at *1200 on 2-1-96*	Depth to Groundwater: *15.79 feet* Measured: *4/8/96*
Drilling Method: *Hollow-Stem Auger/3" diameter split spoon*	Groundwater Elevation: *253.26 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *62 feet*
Geologist: *J.A. Kingsbury*	Well Screen: *45 to 55 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							SW	(34-37') Sand, fine to coarse-grained, medium olive gray in color. Some silt lenses present.	
			19	100	BG		ML	(37-38') Silt, light olive gray.	230.2
			20	100	BG		SW	(38-39.5') Sand.	229.2
							ML	(39.5-40') Silt.	227.7
40			21	100	BG		SW	(40-42') Sand, fine to coarse-grained, light olive gray in color at 40' changing to yellowish brown/gray near 42'.	227.2
			22	100	BG		SW GW		225.2
			23	92	BG		SP	(42-43') Sand and gravel, light olive gray to yellowish-gray.	224.2
45								(43-45') Coarse-grained sand, yellowish-gray.	222.2
			24	100	BG		SC GC	(45-49') Sand and gravel in a clay matrix. Yellow gravel, light gray clay.	
			25	100	BG			Sand and gravel with some clay, light olive gray to yellowish-gray in color.	218.2
50			26	100	BG		SW GW	(49-53') Sand and gravel. Yellowish-brown to reddish-brown.	
			27	100	BG				214.2
			28	0	BG			No sample recovery from 53' to 60'.	
55									
60									207.2
			29	100	BG		SP	Cockfield Formation: very fine-grained sand, light gray in color, finely lignitic.	206.2
							ML CL	Silt and clay, light brown to light gray.	205.2
								Terminated soil boring at 62'.	
65									
70									

WELL DIAGRAM



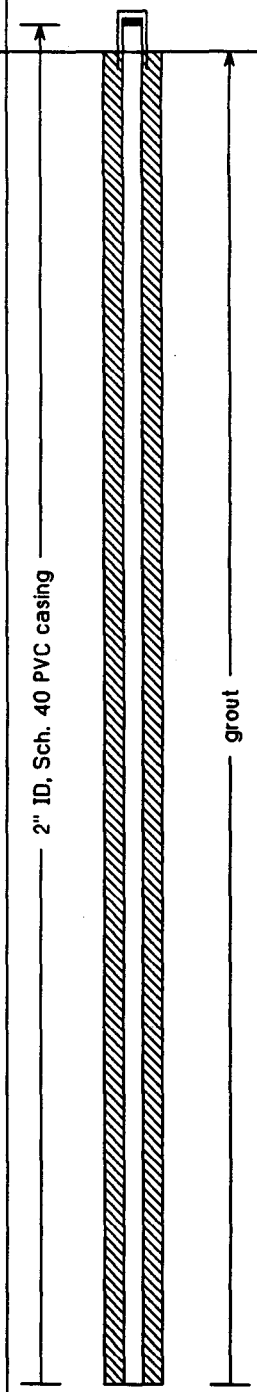
EnSafe/Allen & Hoshall

Monitoring Well 009G04DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #9 (Sewage Lagoons)*
Project No.: *0106-08420*	Surface Elevation: *268.15 feet msl*
Started at *0745 on 2-15-96*	TOC Elevation: *270.09 feet msl*
Completed at *1000 on 2-15-96*	Depth to Groundwater: *19.89 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *250.20 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *76 feet*
Geologist: *J.A. Kingsbury*	Well Screen: *62 to 72 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					BG			(0-41') Upper Alluvium (see descriptions below).	
					BG		ML	(0-6') Clayey silt, brown in color. Appears to be fill material used during levee construction.	
5					BG				
			1	50					262.1
					BG			Slightly silty clay, brownish-gray in color. Very stiff.	
					BG				
10			2	85	BG		CL	Increasing silt fraction. Mottling with olive gray-colored silt. Dark greenish-yellow staining is present with iron/organic specks.	
					BG				
15					BG				
									252.1
					BG			(16-42') Silt (see descriptions below).	
					BG			(16-22') Yellowish-brown to yellowish-gray in color with dark orangish-yellow staining. Moist to wet.	
20			3	100	BG				
					BG			(22-26') Color change to predominantly gray. Wet.	
25					BG				
					BG			(26-34') Olive gray to greenish-gray in color, with common snail shells. Wet.	
					BG		ML		
30			4	120	BG				
					BG				
35					BG			Increasing clay fraction from 34' to 36'. Brownish-gray in color.	
					BG			(36-38') Brownish-gray in color, dry.	
					BG			(38-42') Contains some scattered gravel and a few sand lenses. Contact with Deeper Alluvium deposits (41-72') estimated at 41'.	
40									

WELL DIAGRAM



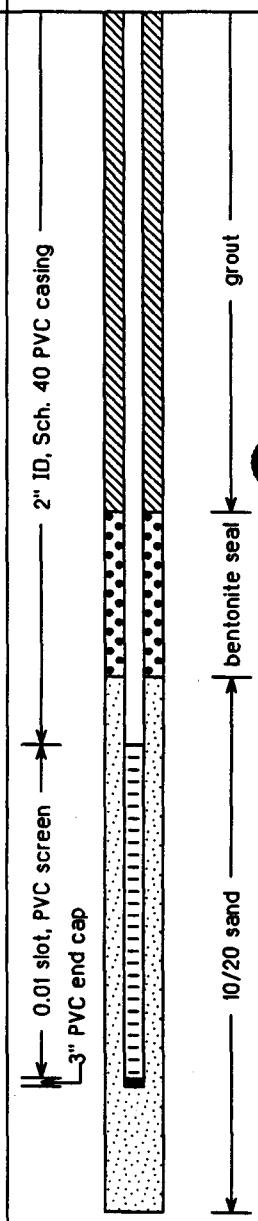
EnSafe/Allen & Hoshall

Monitoring Well 009G04DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #9 (Sewage Lagoons)*
Project No.: *0106-08420*	Surface Elevation: *268.15 feet msl*
Started at *0745 on 2-15-96*	TOC Elevation: *270.09 feet msl*
Completed at *1000 on 2-15-96*	Depth to Groundwater: *19.89 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *250.20 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *76 feet*
Geologist: *J.A. Kingsbury*	Well Screen: *62 to 72 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			5	60	BG		ML		
					BG		SW/GW	(42-55') Sand and gravel; gravel is up to 2" in longest dimension. Yellowish-gray to light olive gray in color.	226.1
45					BG				
					BG			Minor clay fraction in sand and gravel from 46' to 52'. Yellowish- gray to very light gray in color.	
					BG				
50			6	90	BG				
					BG			Sand and gravel, yellowish-gray to light yellowish-brown from 52' to 56'.	
55					BG		SM/GC	Sand and gravel with intersitial silt and clay. Dark orangish-yellow to reddish-brown from 55' to 56'.	213.1 / 212.1
					BG		SW/GW	Sand and gravel with minor clay, gravel is up to 3" in longest dimension, dark yellowish-brown to reddish-brown from 56' to 72'.	
60			7	90	BG				
					BG				
65					BG				
					BG				
70			8	80	BG				196.1
					BG		SP	Cockfield Formation: Fine to medium-grained sand, very light gray to very light olive gray, micaceous and finely lignitic.	
75					BG				192.1
								Soil boring terminated at 76'.	
80									

WELL DIAGRAM



EnSafe/Allen & Hoshall	Monitoring Well 009G04DA
Project: NSA Memphis	Location: Millington, TN. SWMU #9 (Sewage Lagoons)
Project No.: 0106-08420	Surface Elevation: 268.15 feet msl
Started at 0745 on 2-15-96	TOC Elevation: 270.09 feet msl
Completed at 1000 on 2-15-96	Depth to Groundwater: 19.89 feet Measured: 4/8/96
Drilling Method: Rotasonic-4" inner core barrel/6" OD casing	Groundwater Elevation: 250.20 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 76 feet
Geologist: J.A. Kingsbury	Well Screen: 62 to 72 feet

GAMMA RAY LOG

COUNTS PER SECOND

CASING TYPE: 2" PVC

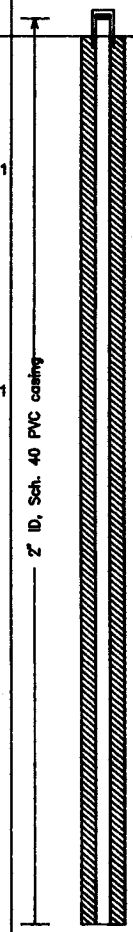
TOP OF LOG = GROUND SURFACE

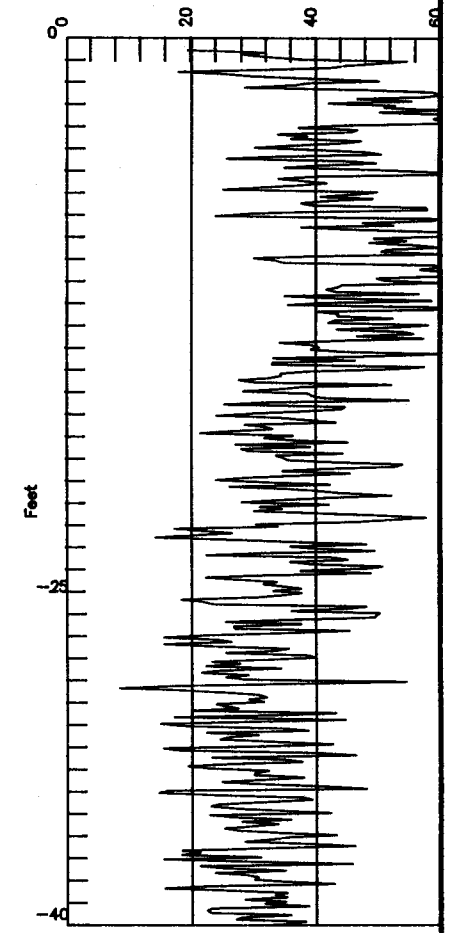
DATE LOGGED: 05/22/96

NOTES

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					BG			(0-41') Upper Alluvium (see descriptions below).	
					BG		ML	(0-6') Clayey silt, brown in color. Appears to be fill material used during levee construction.	
5					BG				
			1	50					262.1
					BG			Slightly silty clay, brownish-gray in color. Very stiff.	
					BG				
10					BG			Increasing silt fraction. Mottling with olive gray-colored silt. Dark greenish-yellow staining is present with iron/organic specks.	
			2	85			CL		
					BG				
15					BG				
									252.1
					BG			(16-42') Silt (see descriptions below).	
					BG			(16-22') Yellowish-brown to yellowish-gray in color with dark orangish-yellow staining. Moist to wet.	
20					BG				
			3	100					
					BG			(22-26') Color change to predominantly gray. Wet.	
25					BG				
					BG			(26-34') Olive gray to greenish-gray in color, with common snail shells. Wet.	
					BG		ML		
30									
			4	120	BG				
					BG				
35					BG			Increasing clay fraction from 34' to 36'. Brownish-gray in color.	
					BG			(36-38') Brownish-gray in color, dry.	
					BG			(38-42') Contains some scattered gravel and a few sand lenses. Contact with Deeper Alluvium deposits (41-72') estimated at 41'.	
40									

WELL DIAGRAM





RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

SWMU 9
SEWAGE LAGOONS

DWG DATE: 12/10/96

DWG NAME: 94GL904

LOGGED BY:
GEOLOGICAL LOGGING SYSTEMS

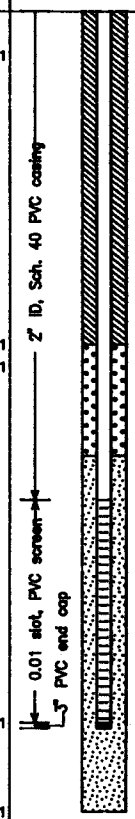
EnSafe/Allen & Hoshall

Monitoring Well 009G04DA

Project: NSA Memphis	Location: Millington, TN. SWMU #9 (Sewage Lagoons)
Project No.: 0106-08420	Surface Elevation: 268.15 feet msl
Started at 0745 on 2-15-96	TOC Elevation: 270.09 feet msl
Completed at 1000 on 2-15-96	Depth to Groundwater: 19.89 feet Measured: 4/8/96
Drilling Method: Rotasonic-6" inner core barrel/8" OD casing	Groundwater Elevation: 250.20 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 76 feet
Geologist: J.A. Kingsbury	Well Screen: 62 to 72 feet

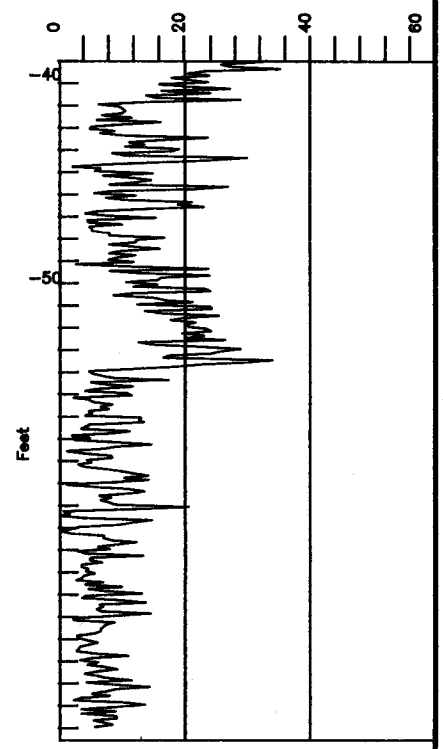
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			5	60	BG		ML		
					BG			(42-55') Sand and gravel; gravel is up to 2" in longest dimension. Yellowish-gray to light olive gray in color.	226.1
45					BG				
					BG			Minor clay fraction in sand and gravel from 46' to 52'. Yellowish-- gray to very light gray in color.	
					BG		SW GW		
50					BG				
			6	90	BG			Sand and gravel, yellowish-gray to light yellowish-brown from 52' to 56'.	
					BG				
55					BG		SM GC	Sand and gravel with interstitial silt and clay. Dark orangish-yellow to reddish-brown from 56' to 58'.	213.1 / 212.1
					BG				
					BG			Sand and gravel with minor clay, gravel is up to 3" in longest dimension, dark yellowish-brown to reddish-brown from 58' to 72'.	
60			7	90	BG				
					BG		SW GW		
65					BG				
					BG				
70			8	80	BG				
					BG		SP	Cockfield Formation: Fine to medium-grained sand, very light gray to very light olive gray, micaceous and finely lignitic.	196.1
75					BG				192.1
								Soil boring terminated at 76'.	
80									

WELL DIAGRAM



GAMMA RAY LOG

COUNTS PER SECOND



CASING TYPE: 2" PVC

TOP OF LOG = GROUND SURFACE

DATE LOGGED: 05/22/96

NOTES

RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

SWMU 9
SEWAGE LAGOONS

DWG DATE: 12/10/96

DWG NAME: 94GL904A

LOGGED BY:
GEOLOGICAL LOGGING SYSTEMS

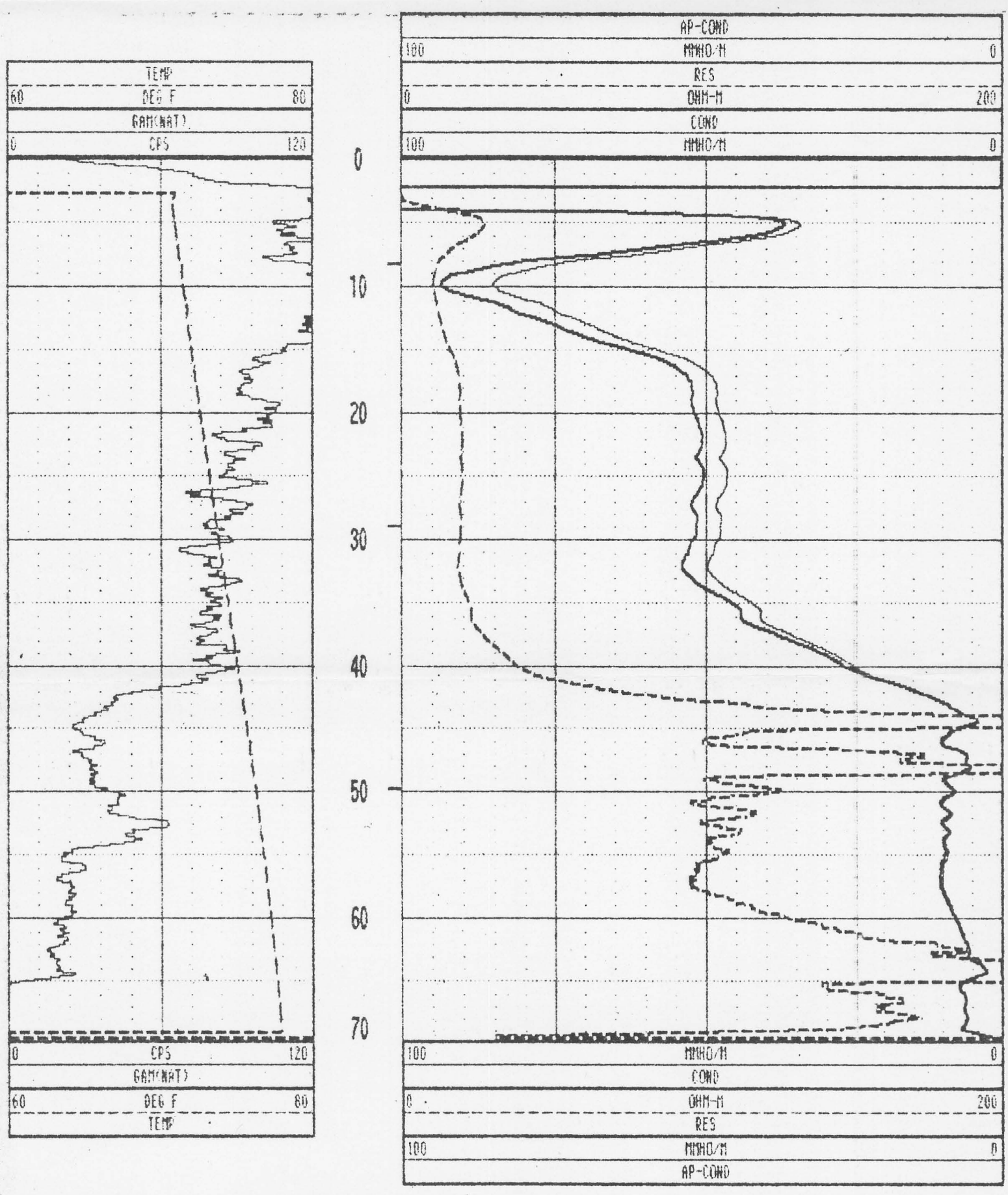
GEOLOGICAL LOGGING SYSTEMS

009G04DA

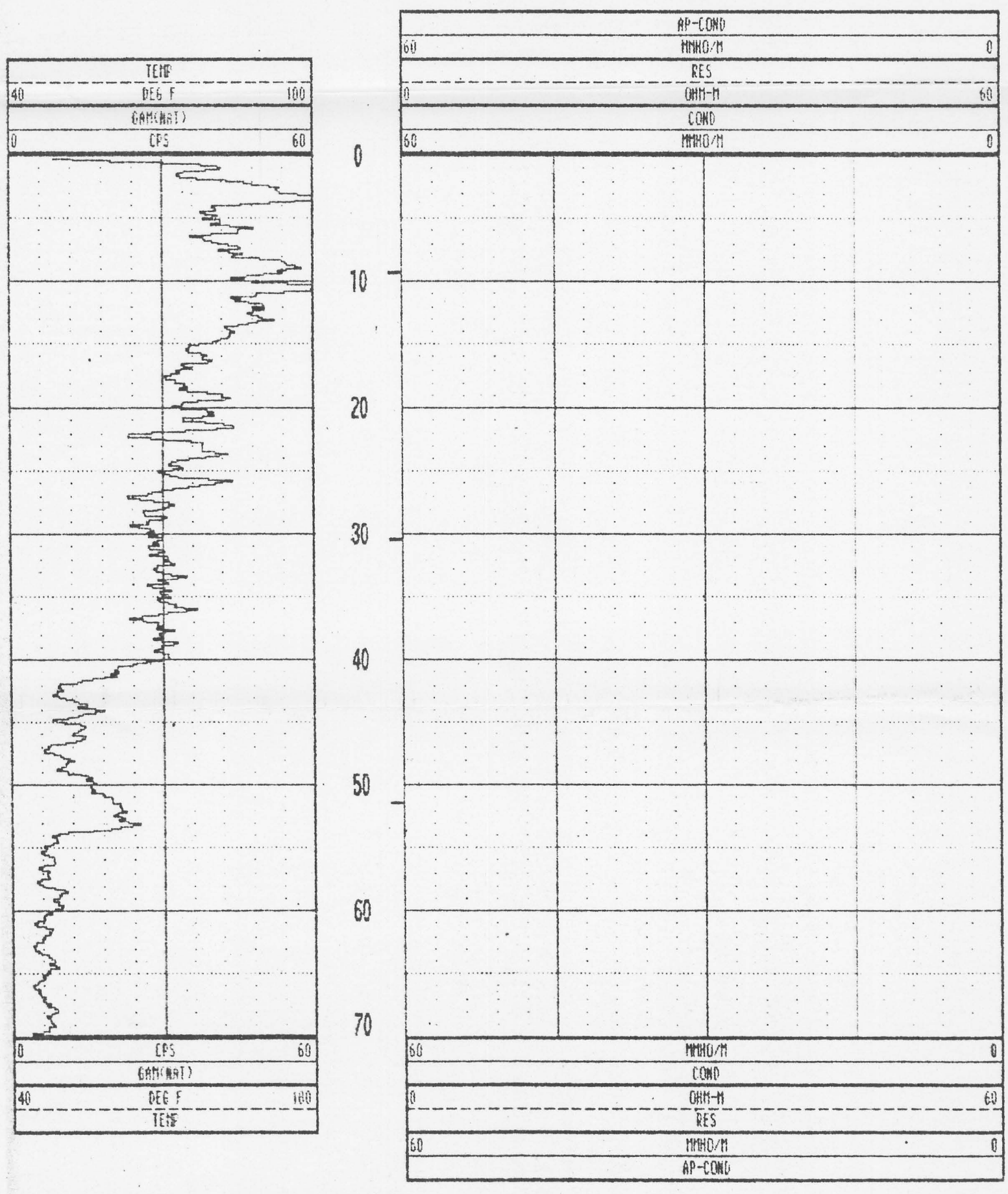
COMPANY	: ENSAFE,ALLEN & HOSHALL			OTHER SERVICES:	
WELL	: 009G04DA			9511	
LOCATION/FIELD	: NAS MEMPHIS			RUN ONE	
COUNTY	: SHELBY			OPEN	
STATE	: TENNESSEE				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 05/23/96	PERMANENT DATUM	: GL	ELEVATIONS	
DEPTH DRILLER	: 72	ELEV. PERM. DATUM:		KB	:
LOG BOTTOM	: 69.70	LOG MEASURED FROM:	GL	DF	: -
LOG TOP	: -1.60	DRL MEASURED FROM:	GL	GL	: 268.1
CASING DRILLER	: 72	LOGGING UNIT	: 05		
CASING TYPE	: PVC	FIELD OFFICE	: BLUEFIELD		
CASING THICKNESS	: .25	RECORDED BY	: J T GILBERT		
BIT SIZE	: 8	BOREHOLE FLUID	: WATER	FILE	: ORIGIN
MAGNETIC DECL.	: -	RM	:	TYPE	: 9511C
MATRIX DENSITY	: 2.65	RM TEMPERATURE	:	LOG	: 0
FLUID DENSITY	: 1.2	MATRIX DELTA T	:	PLOT	: 9510C
NEUTRON MATRIX	: SANDSTONE	FLUID DELTA T	:	THRESH	: 9000
REMARKS	:				

ELECTRIC LOG INTERPRETATION IS EMPIRICAL IN NATURE. EXTREME HOLE COND WILL MAKE COMPLETELY ACCURATE INTERPRETATIONS DIFFICULT.

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



009G04DA 05/23/96 976



009G04DA 05/23/96 1025

STATE
TESTING SERVICES, INC.

Measurement of Hydraulic Conductivity

Client: EnSafe/Allen & Hoshall

Date of Report: 02/29/96 Project No.: E-3-157

Client's Project No.: 0106090000

Sample I.D.: 009S01DA18

Soil Description: Tan & Light Gray Silty Clay

Test Media: City of Memphis Water

	Pre-Test	Post Test
Wet Density (Lbs/ft^3)	122.1	120.5
Dry Density (Lbs/ft^3)	91.3	91.0
Moisture (% Dry Wt)	33.8	32.4
Porosity (n)	.43	.44
Degree of Saturation (%)	1.0	1.0
Specific Gravity (ASTM D-854)	2.59	---

Permeability

Temperature Correction, R_t = 1.043

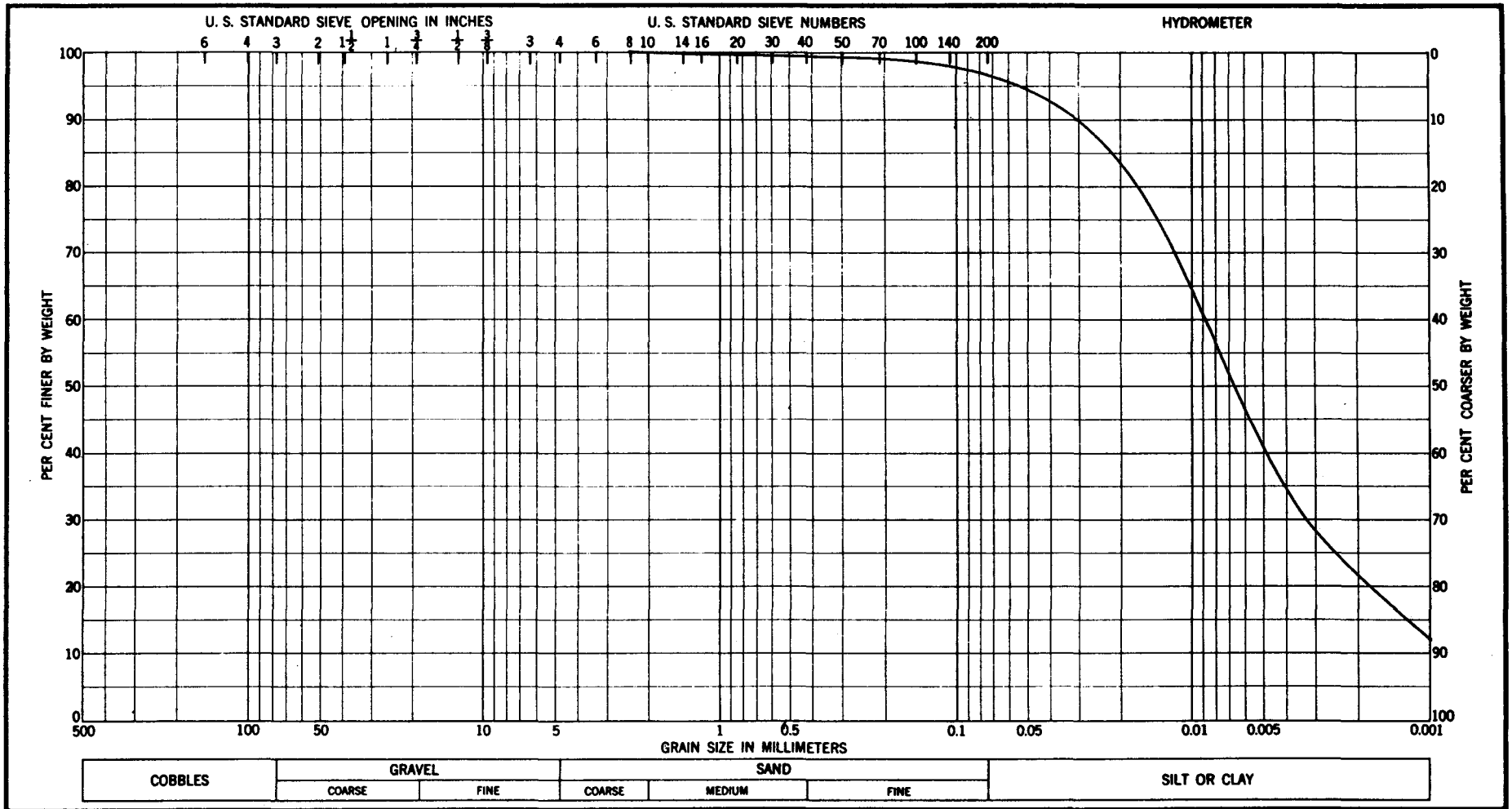
$K_1 = 9.0 \times 10^{-7}$ cm/sec
$K_2 = 8.5 \times 10^{-7}$ cm/sec
$K_3 = 9.4 \times 10^{-7}$ cm/sec
$K_4 = 9.9 \times 10^{-7}$ cm/sec

Coefficient of Permeability, $K_{20} = 9.6 \times 10^{-7}$ cm/sec

Tested in accordance with ASTM D-5084-90.

Lab No. P-96-011 Reviewed By: David D. McCray

6756 Buckles Cove Memphis, TN 38133 901-385-1199 FAX 901-386-6614



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
009S01DA18	16'-18'		34			

Project EnSafe/A&H # 010609000

Area

Boring No.

Date 02/29/96

GRADATION CURVES

TRI-STATE TESTING SERVICES, INC.

SWMU 14

SOIL BORING/MONITORING WELL LOGS
AND
GEOTECHNICAL LABORATORY RESULTS

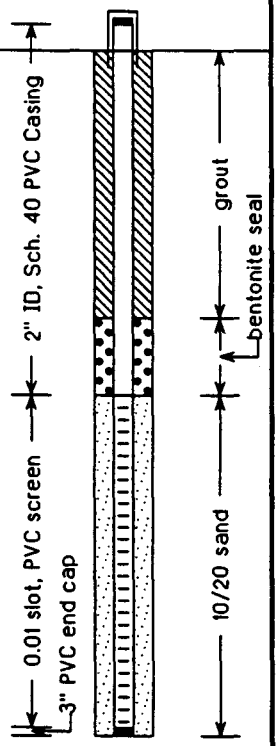
EnSafe/Allen & Hoshall

Monitoring Well 014G01LS

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #14 (S-140/7th Ave. Ditch)*
Project No.: *0106-08420*	Surface Elevation: *267.37 feet msl*
Started at *1030 on 1-29-96*	TOC Elevation: *269.17 feet msl*
Completed at *1245 on 1-29-96*	Depth to Groundwater: *6.79 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *262.38 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *20.59 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *10.34 to 20.34 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
		■	1				OL	(0-1') Soil and gravel.	266.4
							GW		
							ML	(1-3.5') Silt and clay (see descriptions below).	
								(1-2') Clayey silt. Dark yellowish-brown to dusky yellowish-brown in in color.	263.9
5		■	2				CL	(2-3.5') Silty clay. Dark yellowish-brown to dusky yellowish-brown in in color.	
								(3.5-7') Clay, silty, pale yellowish-brown, mottled with light olive gray-colored material.	260.4
		■	3					Collected Shelby Tube from 7' to 10'. No sample for description.	257.4
10								(10-16') Clay and silt (see descriptions below).	
							CL	(10-15.5') Clay, silty, moderate yellowish-brown in color, mottled with light olive gray-colored silt. Iron-staining and iron-manganese nodules present near 15'.	
15									251.4
							ML	(15.5-16') Clayey silt, moderate yellowish-brown in color mottled with light olive gray to greenish-gray. Iron-manganese nodules and iron staining present.	
20								(16-20.5') Clayey silt, greenish-gray mottled with moderate yellowish-brown material near 16'. Iron staining increases with depth.	246.8
25								Soil boring terminated at approximately 20.5'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log of adjacent monitoring well 014G01LF.	
30									
35									
40									

WELL DIAGRAM



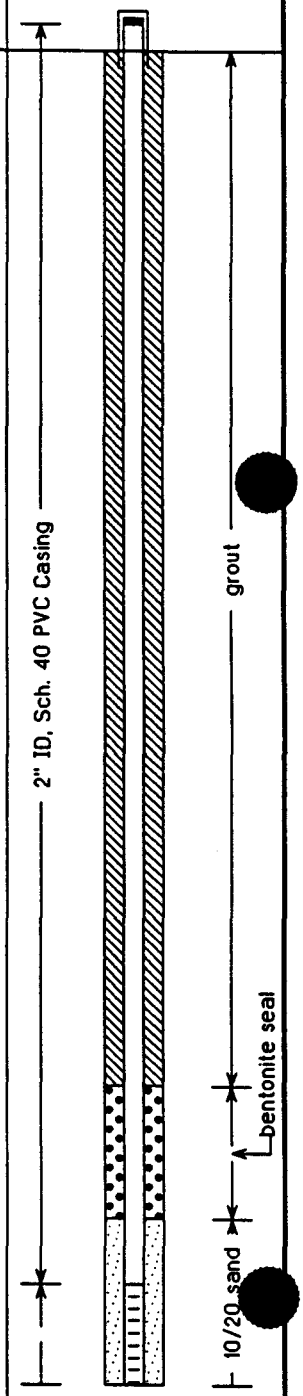
EnSafe/Allen & Hoshall

Monitoring Well 014G01LF

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #14 (S-140/7th Ave. Ditch)*
Project No.: *0106-08420*	Surface Elevation: *267.24 feet msl*
Started at *1320 on 1-29-96*	TOC Elevation: *269.11 feet msl*
Completed at *1530 on 1-29-96*	Depth to Groundwater: *7.46 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *261.65 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *51 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *37 to 47 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					BG		OL GW	(0-1') Soil and gravel.	266.2
							ML	(1-3.5') Silt and clay (see descriptions below).	
			1	100	BG			(1-2') Clayey silt. Dark yellowish-brown to dusky yellowish-brown in color.	263.7
5					5		CL	(2-3.5') Silty clay. Dark yellowish-brown to dusky yellowish-brown in color.	
					4				260.2
			2	83	3			(3.5-7') Clay, silty, pale yellowish-brown, mottled with light olive gray-colored material.	
10								No description available; collected a Shelby tube sample from 7' to 10' for geotechnical analysis.	257.2
					BG			(10-16') Clay and silt (see descriptions below).	
			3	155	BG		CL	(10-15.5') Clay, silty, moderate yellowish-brown in color, mottled with light olive gray-colored silt. Iron-staining and iron-manganese nodules present near 15'.	
					4				
15					BG				
					BG			(15.5-16') Clayey silt, moderate yellowish-brown in color mottled with light olive gray to greenish-gray. Iron-manganese nodules and iron staining present.	251.2
					BG				
20			4	97	BG		ML	(16-26) Clayey silt, greenish-gray mottled with moderate yellowish-brown material near 16'. Iron staining increases with depth.	
					BG				
					BG				
25					BG				
								Iron-manganese nodules present near 26'.	
					BG				240.2
					BG		ML	(27-32') Silt, clayey, moderate yellowish-brown in color, mottled with light olive gray to very light gray-colored material, with some hard siliceous clayey material, contains a large siliceous clay concretion at 27'.	
30			5	135	BG				
									235.2
					BG		ML	(32-35') Clayey silt, moderate yellowish-brown mottled slightly with light olive gray to very light gray-colored material.	
35					BG				232.2
								(35-47') Fluvial Deposits (see descriptions below).	
					BG		ML SC	(35-40') Silt, clay, and sand, with some scattered gravel, dusky yellow color mottled with light olive gray to very light gray material, moist.	
			6	113	BG				
40									227.2

WELL DIAGRAM



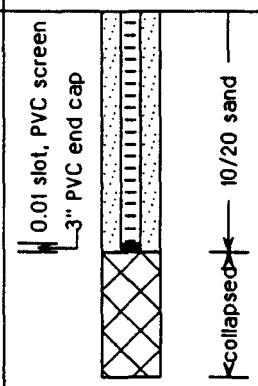
EnSafe/Allen & Hoshall

Monitoring Well 014G01LF

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #14 (S-140/7th Ave. Ditch)*
Project No.: *0106-08420*	Surface Elevation: *267.24 feet msl*
Started at *1320 on 1-29-96*	TOC Elevation: *269.11 feet msl*
Completed at *1530 on 1-29-96*	Depth to Groundwater: *7.46 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *261.65 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *51 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *37 to 47 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			7	93				No description available; collected a Shelby tube sample from 40' to 43' for geotechnical analysis.	227.2
			8	125	BG		SM/GW	(43-43.5') Silt, sand, and gravel (up to 1" in longest dimension), very light gray, wet.	224.2 / 223.7
45					BG		SW/GW	(43.5-47') Sand and gravel. Sand is fine to very coarse-grained, and gravel (up to 1.5" in longest dimension) from 44' to 45'. Moderate yellowish-brown to light gray, wet. Longest dimension of gravel increases to up to 3.5" at 47'.	
					BG				220.2
			9	142	BG		SP/CL		
					BG				
50					BG			(47-51') Cockfield Formation: Very fine-grained sand, silt, and clay. Dusky yellowish-brown mottled with light olive gray near 47'.	216.2
								Soil boring terminated at 51'.	
55									
60									
65									
70									
75									
80									

WELL DIAGRAM



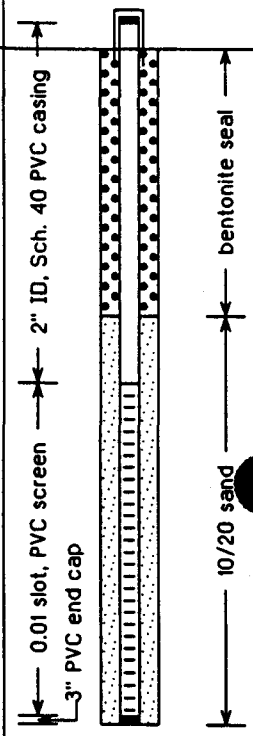
EnSafe/Allen & Hoshall

Monitoring Well 014G02LS

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #14 (S-140/7th Ave. Ditch)*
Project No.: *0106-08420*	Surface Elevation: *268.44 feet msl*
Started at *0850 on 2-14-96*	TOC Elevation: *270.12 feet msl*
Completed at *0915 on 2-14-96*	Depth to Groundwater: *7.61 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *262.51 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *20.25 feet*
Geologist: *A. Choate, C. Ivey*	Well Screen: *10 to 20 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							ML GC	(0-3') Gravel, silt, clay, and bricks from 0' to 3' (fill).	
									265.4
5			1	100	BG		CL	(3-6') Clay, brownish-gray in color	
									262.4
10							ML CL	Silt and clay, light olive gray to dark yellowish-brown in color from 6' to 9'. Silt and clay, yellowish-gray to yellowish-brown in color from 9' to 20'. Moist, with iron-staining and specks of organic material.	
15			2	120	BG				
20									248.4
25								Soil boring terminated at 20'. Note: This is a replacement well. The original well was installed a few feet away on 1/23/96 but was subsequently abandoned due to faulty construction. Analytical samples indicated on this boring log were collected from the soil boring associated with the original well.	
30									
35									
40									

WELL DIAGRAM



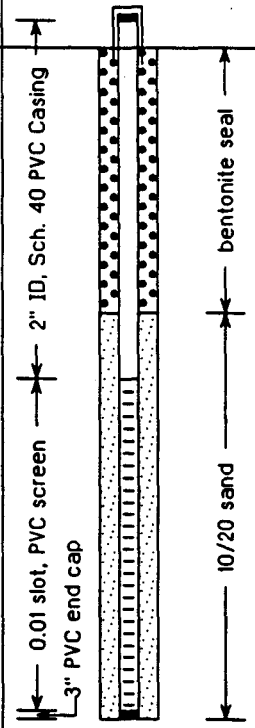
EnSafe/Allen & Hoshall

Monitoring Well 014G03LS

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #14 (S-140/7th Ave. Ditch)*
Project No.: *0106-08420*	Surface Elevation: *268.64 feet msl*
Started at *0745 on 2-14-96*	TOC Elevation: *271.09 feet msl*
Completed at *0815 on 2-14-96*	Depth to Groundwater: *8.39 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *262.70 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *20.25 feet*
Geologist: *J.A. Kingsbury*	Well Screen: *10 to 20 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					BG			(0-8') Clay with some silt, dark brown to brownish-gray in color.	
					5		CL ML		
5			1	70	5				
					6				
					6			(8-20') Silt, light yellowish-brown to yellowish-gray in color with dark orangish-yellow mottling and specks of organic material. Moist.	260.6
10					6				
					5		ML		
15			2	90	5			Small concretion present at 15'.	
					5				
					5				
20								Soil boring terminated at 20'.	248.6
25									
30									
35									
40									

WELL DIAGRAM



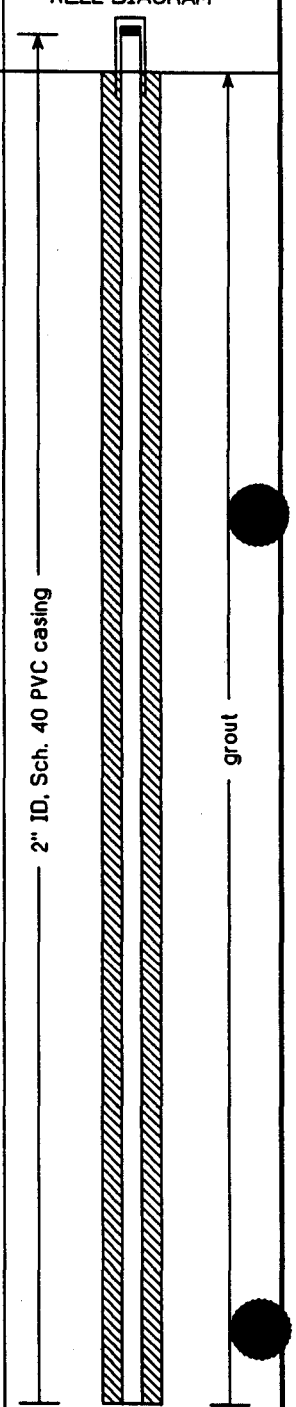
EnSafe/Allen & Hoshall

Monitoring Well 014G04LF

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #14 (S-140/7th Ave. Ditch)*
Project No.: *0106-08420*	Surface Elevation: *268.82 feet msl*
Started at *1330 on 1-23-96*	TOC Elevation: *270.88 feet msl*
Completed at *1530 on 1-23-96*	Depth to Groundwater: *8.79 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *262.09 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *55 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *39 to 49 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					BG		OL GW	(0-2.5') Soil, gravel, brick, grass and roots (fill material).	
			1	46	BG		CL	(2.5-5') Silty clay. Dark yellowish-brown in color.	266.3
5					BG		ML	(5-20.5') Clayey silt. Moderate yellowish-brown to light olive gray in color. Mottled with light olive gray and olive gray-colored material. Iron-manganese nodules near 5'.	263.8
					BG				
					BG			Moist near 7.5'.	
10			2	107	BG			(10-12') Very moist.	
					8			Iron-manganese nodules near 11'.	
					8				
15					6				
					6				
					6				
20			3	121	6		ML	(20.5-23') Clayey silt is light olive gray in color with considerable dark yellowish-orange to moderate yellowish-brown colored iron staining. Some iron/manganese nodules are present	248.3
					6.5		CL	(23-30') Silty clay, greenish-gray in color with some dark yellowish- orange to moderate yellowish-brown iron-staining near 23'. Iron-staining and mottled light olive brown in color near 30'.	245.8
25					6.5				
					6.5				
					5			Fluvial Deposits (30-50') contact estimated at 30'.	
30							SP		238.8

WELL DIAGRAM



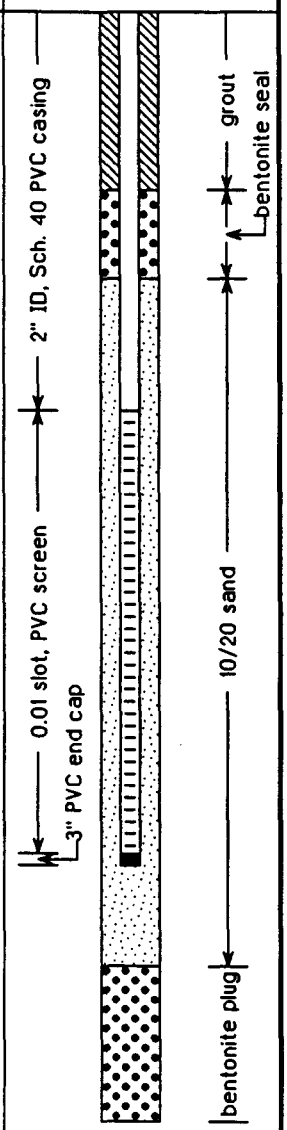
EnSafe/Allen & Hoshall

Monitoring Well 014G04LF

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #14 (S-140/7th Ave. Ditch)*
Project No.: *0106-08420*	Surface Elevation: *268.82 feet msl*
Started at *1330 on 1-23-96*	TOC Elevation: *270.88 feet msl*
Completed at *1530 on 1-23-96*	Depth to Groundwater: *8.79 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *262.09 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *55 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *39 to 49 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
									238.8
			4	127	5		SP	(30-32') Sand, very fine-grained, moderate yellowish-brown in color mottled light gray-colored material.	236.8
					5		SM SC	(32-35') Sand (very fine to coarse-grained), silt, and clay. Moderate yellowish-brown in color mottled with light gray material. Moist near 34'. Becomes mostly very fine-grained sand and silt near 35'.	233.8
35					5		ML CL	(35-37') Silt and clay, greenish-gray in color mottled with moderate yellowish-brown material.	231.8
					4.5		SM SC	(37-38') Sand, silt, and clay. Olive gray to light brownish-gray in color.	230.8
					5.5		SC GM	(38-39') Silty and clayey sand and gravel. Light olive gray to moderate yellowish-brown in color. Wet.	229.8
40			5	113	5		GW GC	(39-42.5') Gravel, sand, and clay. Light olive gray in color, mottled with moderate yellowish-brown and dark yellowish-orange-colored material. Very cohesive and moist.	226.3
					5				
45					5		SW GW	(42.5-46.5') Sand (medium to coarse-grained) and gravel (up to 1" in longest dimension. Light gray in color mottled with moderate yellowish-brown material. Wet.	
			6	95	4				
					5		GW	(46.5-48') Sand is medium to very coarse-grained. Moderate yellowish-brown to dark yellowish-orange, wet.	220.8
50					5		SP SM	(48-49.5') Gravel (up to 4" in longest dimension) with sand. Moderate yellowish-brown in color. Wet.	218.8
			7	163	4.5			(50-55') Cockfield Formation (see description below).	
55					5			Very fine-grained silty sand, moderate yellowish-brown to dusky yellowish brown with light olive gray laminations.	213.8
								Soil boring terminated at 55'.	
60									

WELL DIAGRAM



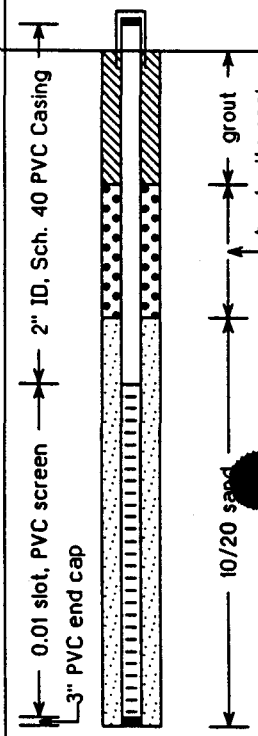
EnSafe/Allen & Hoshall

Monitoring Well 014G05LS

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #14 (S-140/7th Ave. Ditch)*
Project No.: *0106-08420*	Surface Elevation: *268.24 feet msl*
Started at *1445 on 1-21-96*	TOC Elevation: *270.12 feet msl*
Completed at *1605 on 1-21-96*	Depth to Groundwater: *9.84 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *260.28 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *20.25 feet*
Geologist: *A. Choate, C. Ivey*	Well Screen: *10 to 20 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							OL	(0-1.5') Soil and grass.	268.7
			1	108	BG		ML CL	(1.5-20') Silt and clay (see descriptions below). (1.5-6') Silt and clay, dark yellowish-brown in color, becoming dark yellowish-brown to pale yellowish-brown in color near 6'. Dry.	
5									
								Clayey silt, dark yellowish-brown to dark yellowish-orange in color mottled with medium light gray-colored material. Slightly moist. Contains iron-manganese nodules.	
10			2	118	BG				
15								Wet from 15' to 16'. The percentage of iron-manganese nodules increases near 16'.	
			3	142	BG			(16-20') Very clayey silt, light olive gray in color mottled with dark yellowish-brown to dark yellowish-orange material. The percentage of mottled material decreases with depth. Very moist. Contains iron-manganese nodules.	248.2
20								Terminated soil boring at 20'.	
25									
30									
35									
40									

WELL DIAGRAM



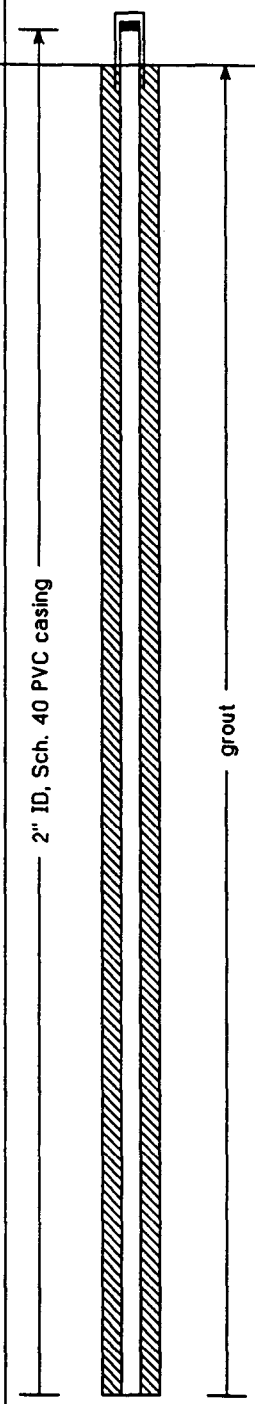
EnSafe/Allen & Hoshall

Monitoring Well 014G06LF

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #14 (S-140/7th Ave. Ditch)*
Project No.: *0106-08420*	Surface Elevation: *268.62 feet msl*
Started at *1450 on 1-20-96*	TOC Elevation: *270.57 feet msl*
Completed at *0850 on 1-21-96*	Depth to Groundwater: *10.32 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *260.25 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *56 feet*
Geologist: *A. Choate, C. Ivey*	Well Screen: *39 to 49 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					BG		OL	(0-2') Soil, roots, and brick fragments. Soil is dark yellowish-brown to moderate yellowish-brown.	266.6
			1	72	BG		ML/CL	(2-17') Clayey silt and silty clay (see descriptions below).	
5					BG			(2-6.5') Very clayey silt. Moderate yellowish-brown to dark yellowish- brown in color. Color becomes lighter near 6.5'.	
					BG			(6.5-17') Silty clay. Moderate yellowish-brown in color mottled with yellowish-gray-colored material. Contains iron-manganese nodules. Slightly moist, becoming more moist, oxidized, and stained dark yellowish-orange near 11'.	
					BG				
10									
			2	89	BG				
					BG				
15					BG				
					BG				251.6
					BG		ML	(17-37') Silt, clayey (see descriptions below). (17-26') Clayey silt. Light olive gray to greenish-gray in color. Slightly moist. Becoming stiff near 26'.	
20									
			3	95	BG				
					BG				
25					BG				
					BG			(26-32') Clayey silt, moderate yellowish-brown in color mottled with light olive-gray material. The percentage of light olive gray material progressively decreases from 26' to 32'. Iron concretions are present near 26'. Slightly moist at 26' becoming more moist near 32'.	
					BG				
30									

WELL DIAGRAM



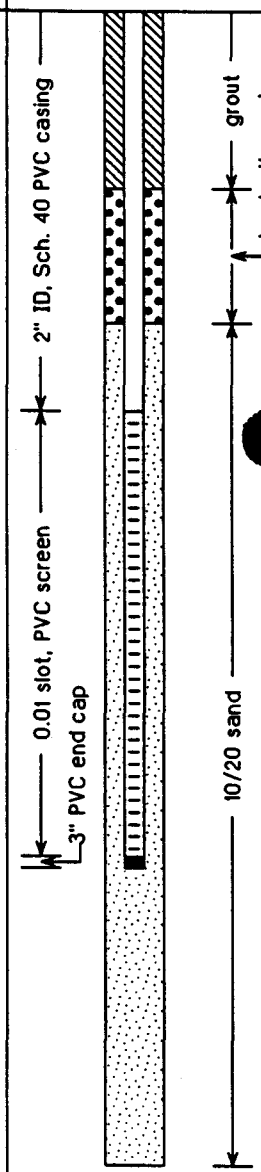
EnSafe/Allen & Hoshall

Monitoring Well 014G06LF

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #14 (S-140/7th Ave. Ditch)*
Project No.: *0106-08420*	Surface Elevation: *268.62 feet msl*
Started at *1450 on 1-20-96*	TOC Elevation: *270.57 feet msl*
Completed at *0850 on 1-21-96*	Depth to Groundwater: *10.32 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *260.25 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *56 feet*
Geologist: *A. Choate, C. Ivey*	Well Screen: *39 to 49 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			4	113	BG				
					BG		ML	(32-36') Silt, clayey, moderate yellowish-brown in color and slightly moist.	
35					BG				
					BG			(36-37') Clayey silt, moderate yellowish-brown in color mottled with light olive gray material, slightly moist.	231.6
					BG			(37-49') Fluvial Deposits (see descriptions below). (37-49') Sand and gravel (see descriptions below).	
40			5	97	BG			(37-38') Fine-grained sand and silt with gravel (up to 2" in longest dimension). Moderate yellowish-brown.	
					BG		SM GW	(38-42') Sand, fine, and gravel (up to 2" in longest dimension), silty, moderate brown mottled with pale yellowish-brown material.	
45					BG			(42-45') Sand (fine to coarse-grained) and gravel (up to 2" in longest dimension). Moderate brown to dark yellowish-orange in color. Wet.	
					BG			(45-49') Sand, medium to coarse, and gravel (up to 2" in longest dimension), moderate yellowish-brown to dark yellowish-orange. Wet.	
					BG				219.6
50			6	114	BG			(49-56') Cockfield Formation (see description below).	
					BG		SM CL	Silty, very fine-grained sand with silty clay laminations. Sand is dusky yellowish brown in color; clay laminations are light gray in color.	
55					BG			Becoming waxy near 56'.	
								Soil boring terminated at 56'.	212.6
60									

WELL DIAGRAM

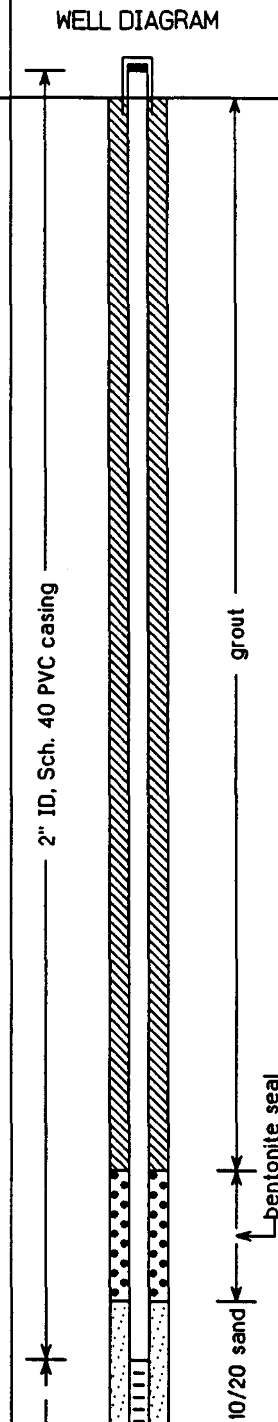


EnSafe/Allen & Hoshall

Monitoring Well 014G07LF

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #14 (S-140/7th Ave. Ditch)*
Project No.: *0106-08420*	Surface Elevation: *268.88 feet msl*
Started at *1000 on 1-22-96*	TOC Elevation: *270.63 feet msl*
Completed at *1145 on 1-22-96*	Depth to Groundwater: *9.30 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *261.33 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *50 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *38 to 48 feet*

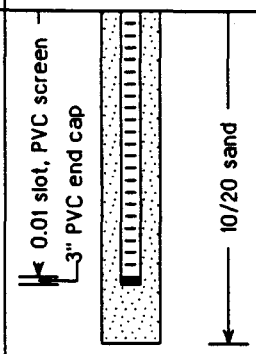
DEPTH IN FEET	SAMPLE NO.	% RECOVERY	PID (ppm)	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
0–5	1	50	BG BG BG BG	OL	(0-5') Soil, concrete, and rubble (fill). Note: Concrete was encountered at 2' below ground surface.	263.9
5–22	2, 3	139	BG BG BG BG BG BG BG BG BG	CL / ML	(5-22') Clay and silt (see descriptions below). (5-12') Silty clay. Dark yellowish-brown in color mottled with moderate yellowish-brown to dark yellowish-orange-colored material. Mottling increases in content progressively near 12'. Hard from 4' to 7'. Silt content increases near 11'. (12-16') Silty clay, olive gray to light olive gray in color mottled with moderate yellowish-brown to dark yellowish-orange-colored material. Contains iron-manganese nodules, increasing in percentage around 16'. (16-22') Clayey silt. Moderate yellowish-brown in color mottled with light olive gray-colored material. Contains scattered iron- manganese nodules. Dark yellowish-orange staining near 21'.	246.9
22–32.5	4	118	BG BG BG BG BG	ML	(22-32.5') Silt (see descriptions below). (22-25') Silt, medium dark gray to medium gray, mottled with some moderate yellowish-brown material near 22' where a few scattered iron-manganese nodules are located. (25-31.5') Silt, olive gray to greenish-gray in color, mottled with moderate yellowish-brown near 32.5'. Contains iron staining and iron-manganese nodules mostly near 29'. (31.5-32.5') Silt, moderate yellowish-brown mottled with light gray.	236.4
32.5–36			BG BG	ML	(32.5-36') Clayey silt, moderate yellowish-brown in color. Mottled with light gray material near 34'.	232.9
36–40			BG BG	SM / GW	(36-48') Fluvial Deposits (see descriptions below). (36-43.5') Sand, silty, with gravel (see descriptions below). (36-37.5') Silty sand (very fine-grained) with gravel. Moderate yellowish-brown in color.	



EnSafe/Allen & Hoshall	Monitoring Well 014G07LF
Project: *NSA Memphis*	Location: *Millington, TN. SWMU #14 (S-140/7th Ave. Ditch)*
Project No.: *0106-08420*	Surface Elevation: *268.88 feet msl*
Started at *1000 on 1-22-96*	TOC Elevation: *270.63 feet msl*
Completed at *1145 on 1-22-96*	Depth to Groundwater: *9.30 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *261.33 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *50 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *38 to 48 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			5	107	BG		SM/GW	Very silty sand (fine to coarse-grained) and gravel (up to 2" in longest dimension) subangular to rounded. Moderate yellowish-brown in color mottled with light olive gray and some dark yellowish- orange-colored material. From 37.5' to 41.5', sample is very difficult to split.	
					BG				225.4
45					BG		SW/GW	(43.5-48') Sand and gravel, gravel and sand (see descriptions below).	
					BG				
			6	120	BG		SM	(43.5-46') Sand (medium to coarse-grained) and gravel (up to 2" in longest dimension). Dark yellowish-orange to moderate yellowish- brown in color. Wet.	220.9
50								(46-48') Gravel and sand, dark yellowish-orange to moderate yellowish- brown. Wet.	218.9
55								(48-50') Cockfield Formation (see description below).	
60								Very fine-grained silty sand. Mottled with gray to light gray-colored very fine-grained sand, which decreases with depth. Becomes clayey near 50'.	
								Soil boring terminated at 50'.	
65									
70									
75									
80									

WELL DIAGRAM



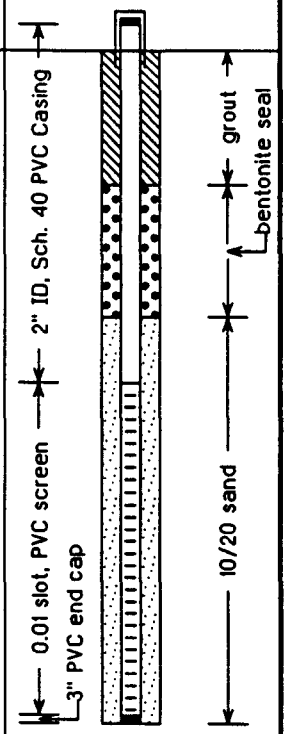
EnSafe/Allen & Hoshall

Monitoring Well 014G08LS

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #14 (S-140/7th Ave. Ditch)*
Project No.: *0106-08420*	Surface Elevation: *268.52 feet msl*
Started at *1500 on 1-22-96*	TOC Elevation: *268.14 feet msl*
Completed at *1530 on 1-22-96*	Depth to Groundwater: *6.48 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *261.66 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *20.25 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *10 to 20 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			1	40	1 BG BG		OL	(0-5') Fill material: Soil, with bits of concrete and grass and roots.	
5					BG BG BG			(5-17') Clay and silt (see descriptions below). (5-7') Silty clay. Moderate yellowish-brown to dark yellowish-orange in color and mottled with light olive gray-colored material. Slightly moist.	263.5
10			2	82	BG BG BG		CL ML	(7-16') Clayey silt. Moderate yellowish-brown to dark yellowish- orange in color mottled with light olive gray and some dark yellowish- orange material. Slightly moist.	
15					BG BG BG			Moisture content increases near 16'. Sparse iron-manganese nodules are present near 16'.	252.5
20			3	75			ML	(16-17') Clayey silt moderate yellowish-brown to dark yellowish-orange in color and mottled with olive gray to light olive gray-colored material. Considerable iron staining. Contains iron-manganese nodules. Moist.	248.5
25								(17-20') Silt, clayey, olive gray to light olive gray in color slightly mottled with dark yellowish-orange-colored material. Contains iron-manganese nodules, moist.	
30								Terminated soil boring at 20'.	
35									
40									

WELL DIAGRAM



EnSafe/Allen & Hoshall

Monitoring Well 014G04LF

Project: NSA Memphis	Location: Millington, TN. SWMU #14 (S-140/7th Ave. Ditch)
Project No.: 0106-08420	Surface Elevation: 268.82 feet msl
Started at 1330 on 1-23-96	TOC Elevation: 270.88 feet msl
Completed at 1530 on 1-23-96	Depth to Groundwater: 8.79 feet Measured: 4/8/96
Drilling Method: Rotasonic-4" inner core barrel/6" OD casing	Groundwater Elevation: 262.09 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 55 feet
Geologist: D. Ladd, W. Parks	Well Screen: 39 to 49 feet

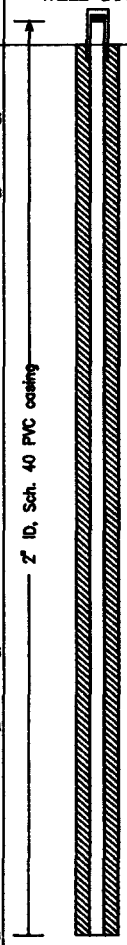
GAMMA RAY LOG
COUNTS PER SECOND

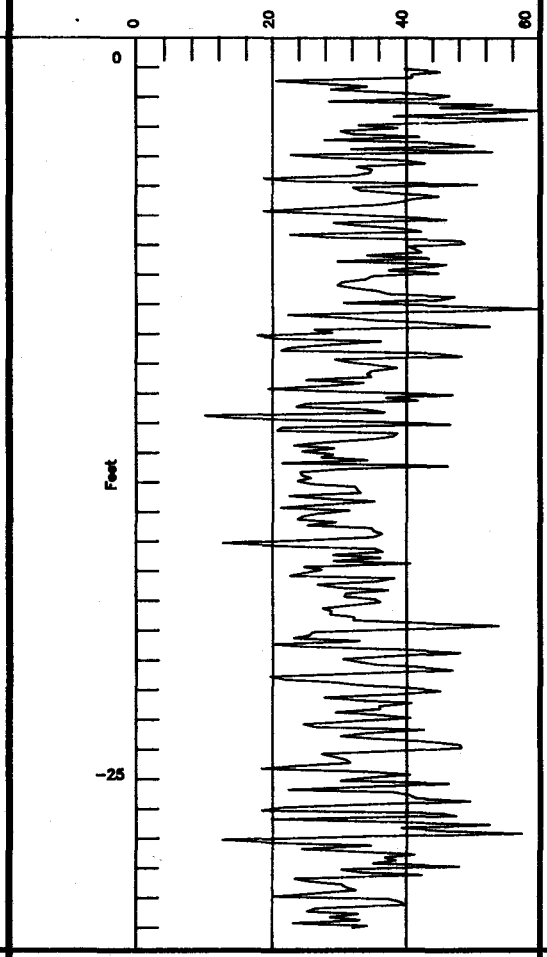
CASING TYPE: 2" PVC
TOP OF LOG = GROUND SURFACE
DATE LOGGED: 05/22/96

NOTES

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					BG		OL GW	(0-2.5') Soil, gravel, brick, grass and roots (fill material).	
			1	46	BG		CL	(2.5-5') Silty clay. Dark yellowish-brown in color.	266.3
5					BG		ML	(5-20.5') Clayey silt. Moderate yellowish-brown to light olive gray in color. Mottled with light olive gray and olive gray-colored material. Iron-manganese nodules near 5'.	263.8
					BG				
					BG			Moist near 7.5'.	
10			2	107	BG			(10-12') Very moist.	
					8			Iron-manganese nodules near 11'.	
					8				
15					6				
					6				
					6				
20			3	121	6		ML	(20.5-23') Clayey silt is light olive gray in color with considerable dark yellowish-orange to moderate yellowish-brown colored iron staining. Some iron/manganese nodules are present	248.3
					6.5		CL	(23-30') Silty clay, greenish-gray in color with some dark yellowish- orange to moderate yellowish-brown iron-staining near 23'. Iron-staining and mottled light olive brown in color near 30'.	245.8
25					6.5				
					6.5				
					5			Fluvial Deposits (30-50') contact estimated at 30'.	
30							SP		238.8

WELL DIAGRAM





RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

SWMU 14
BUILDING S-140 AND
SEVENTH AVENUE DRAINAGE DITCH

DWG DATE: 12/10/96
DWG NAME: 94GL144

LOGGED BY:
GEOLOGICAL LOGGING SYSTEMS

EnSafe/Allen & Hoshall	Monitoring Well 014G04LF
Project: NSA Memphis	Location: Millington, TN. SWMU #14 (S-140/7th Ave. Ditch)
Project No.: 0106-08420	Surface Elevation: 268.82 feet msl
Started at 1330 on 1-23-96	TOC Elevation: 270.88 feet msl
Completed at 1530 on 1-23-96	Depth to Groundwater 8.79 feet Measured: 4/8/96
Drilling Method: Rotosonic-4" inner core barrel/8" OD casing	Groundwater Elevation: 262.09 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 55 feet
Geologist: D. Ladd, W. Parks	Well Screen: 39 to 49 feet

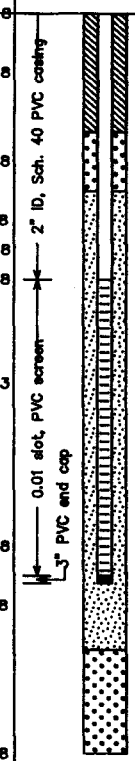
GAMMA RAY LOG
COUNTS PER SECOND

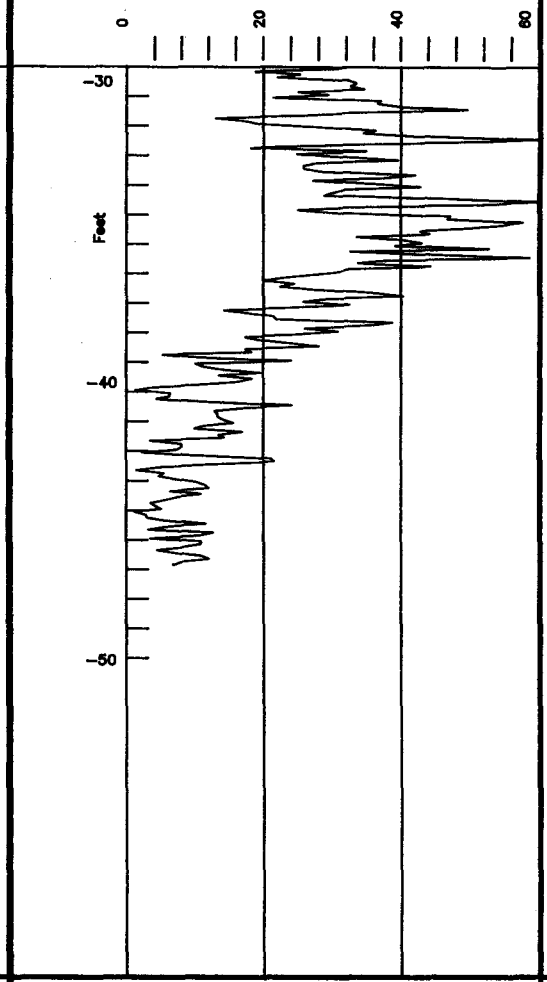
CASING TYPE: 2" PVC
TOP OF LOG = GROUND SURFACE
DATE LOGGED: 05/22/96

NOTES

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			4	127	5		SP	(30-32') Sand, very fine-grained, moderate yellowish-brown in color mottled light gray-colored material.	238.8
					5		SM SC	(32-35') Sand (very fine to coarse-grained), silt, and clay. Moderate yellowish-brown in color mottled with light gray material. Moist near 34'. Becomes mostly very fine-grained sand and silt near 35'.	236.8
35					5		ML CL	(35-37') Silt and clay, greenish-gray in color mottled with moderate yellowish-brown material.	233.8
					4.5		SM SC	(37-38') Sand, silt, and clay. Olive gray to light brownish-gray in color.	231.8
					5.5		SC GM	(38-39') Silty and clayey sand and gravel. Light olive gray to moderate yellowish-brown in color. Wet.	230.8
40			5	113	5		GW GC	(39-42.5') Gravel, sand, and clay. Light olive gray in color, mottled with moderate yellowish-brown and dark yellowish-orange-colored material. Very cohesive and moist.	229.8
					5		SW GW	(42.5-46.5') Sand (medium to coarse-grained) and gravel (up to 1" in longest dimension. Light gray in color mottled with moderate yellowish-brown material. Wet.	226.3
45					5				
			6	95	4		GW	(46.5-48') Sand is medium to very coarse-grained. Moderate yellowish-brown to dark yellowish-orange, wet.	220.8
50					5				
					5		SC SM	(48-49.5') Gravel (up to 4" in longest dimension) with sand. Moderate yellowish-brown in color. Wet.	218.8
			7	163	4.5			(50-55') Cockfield Formation (see description below).	
55					5			Very fine-grained silty sand, moderate yellowish-brown to dusky yellowish brown with light olive gray laminations.	213.8
60								Soil boring terminated at 55'.	

WELL DIAGRAM





RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

SWMU 14
BUILDING S-140 AND
SEVENTH AVENUE DRAINAGE DITCH

DWG DATE: 12/10/96 | DWG NAME: 94GL144A

LOGGED BY:
GEOLOGICAL LOGGING SYSTEMS

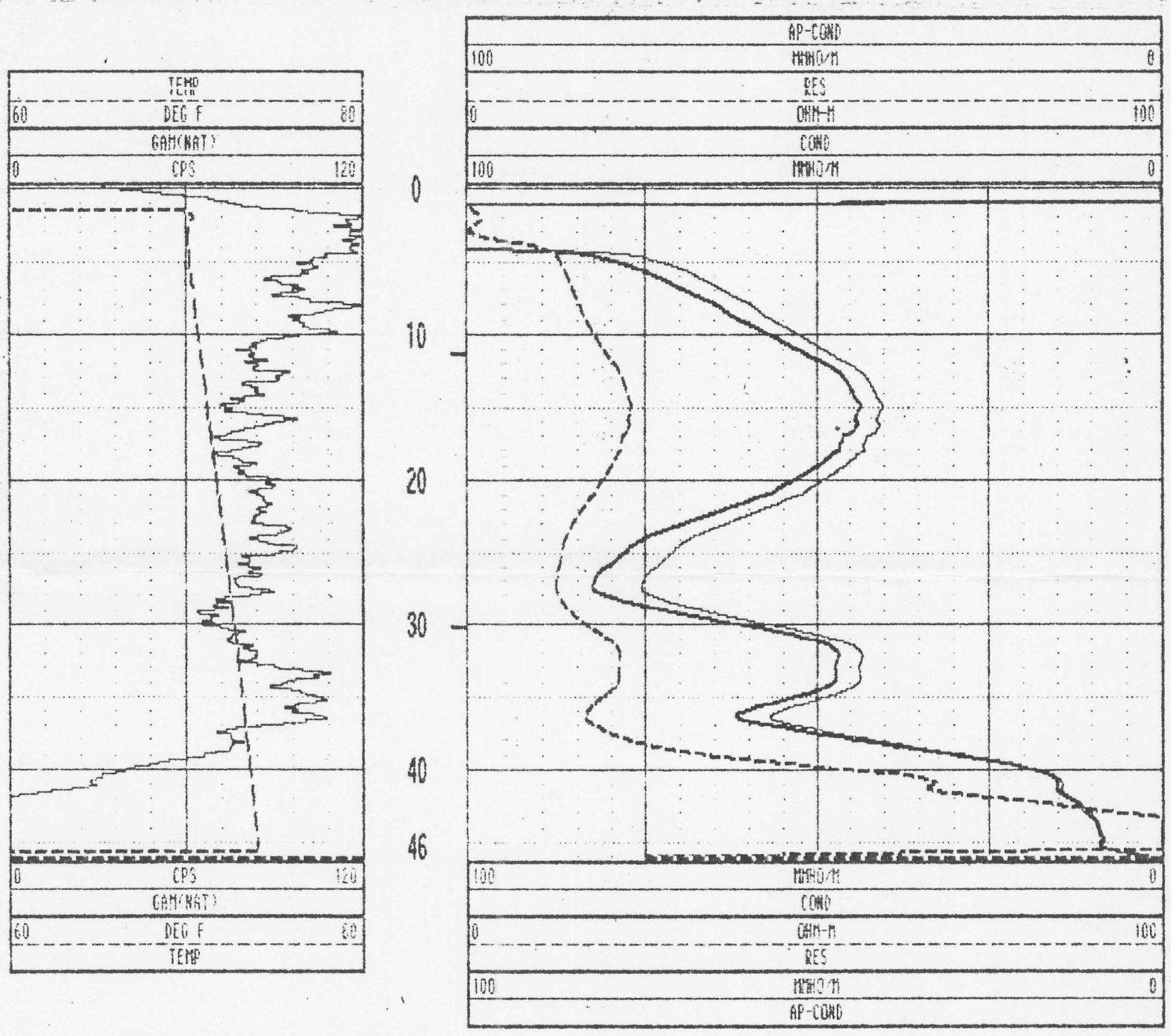
GEOLOGICAL LOGGING SYSTEMS

014G04LF

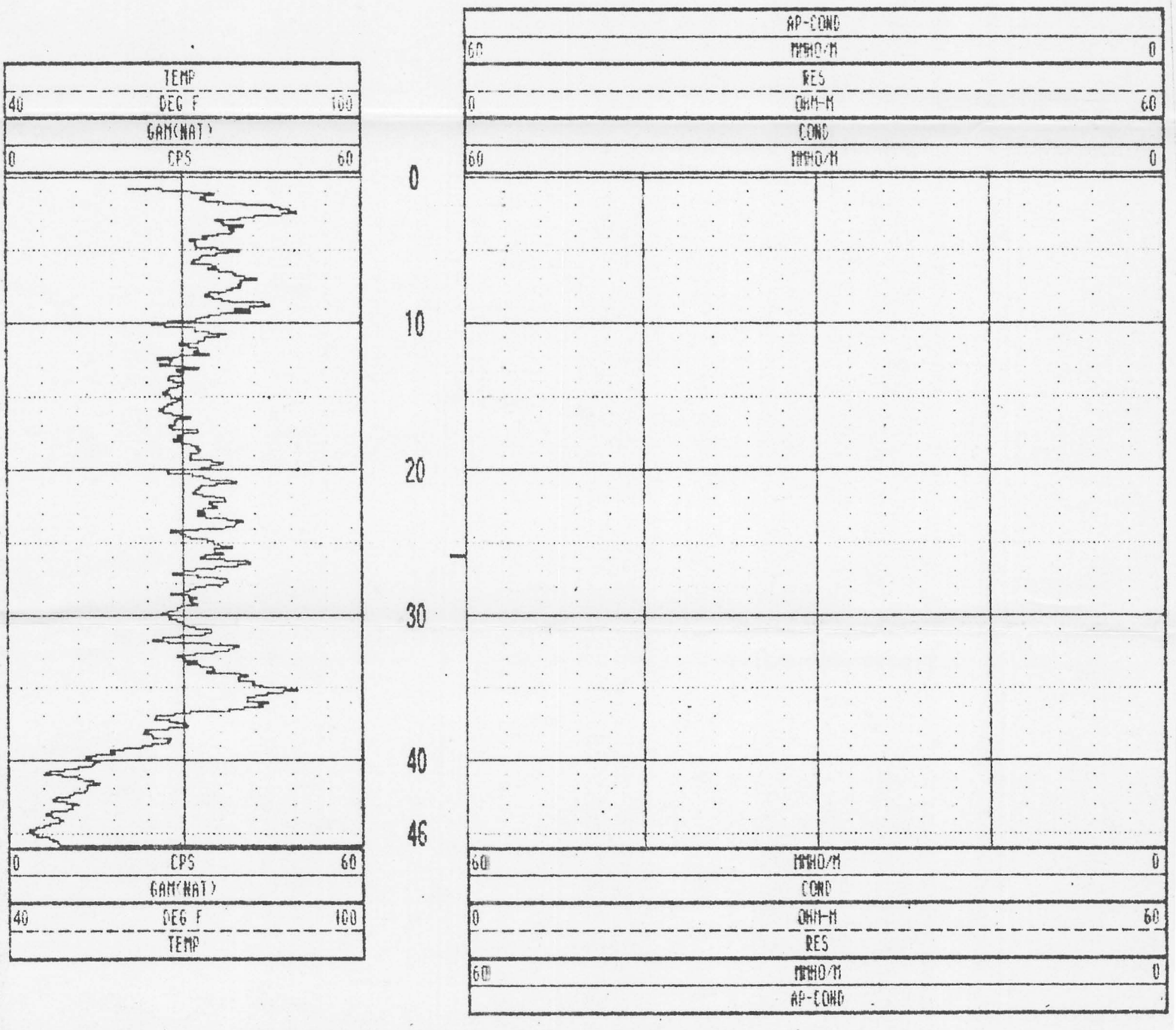
COMPANY	: ENSAFE,ALLEN & HOSHALL			OTHER SERVICES:	
WELL	: 014G04LF			9511	
LOCATION/FIELD	: NAS MEMPHIS			RUN ONE	
COUNTY	: SHELBY			OPEN	
STATE	: TENNESSEE				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 05/22/96	PERMANENT DATUM	: GL	ELEVATIONS	
DEPTH DRILLER	: 51.5	ELEV. PERM. DATUM:		KB	:
LOG BOTTOM	: 46.30	LOG MEASURED FROM:	GL	DF	: -
LOG TOP	: -2.80	DRL MEASURED FROM:	GL	GL	: 268.8
CASING DRILLER	: 51.5	LOGGING UNIT	: 05		
CASING TYPE	: PVC	FIELD OFFICE	: BLUEFIELD		
CASING THICKNESS	: .25	RECORDED BY	: J T GILBERT		
BIT SIZE	: 8	BOREHOLE FLUID	: WATER	FILE	: ORIGIN
MAGNETIC DECL.	: -	RM	:	TYPE	: 9511C
MATRIX DENSITY	: 2.65	RM TEMPERATURE	:	LOG	: 4
FLUID DENSITY	: 1.2	MATRIX DELTA T	:	PLOT	: 9510C
NEUTRON MATRIX	: SANDSTONE	FLUID DELTA T	:	THRESH	: 9000
REMARKS	:				

ELECTRIC LOG INTERPRETATION IS EMPIRICAL IN NATURE. EXTREME HOLE COND WILL MAKE COMPLETELY ACCURATE INTERPRETATIONS DIFFICULT.

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



014G04LF 05/22/96 976



014G04LF 05/22/96 1025

TRI STATE
TESTING SERVICES, INC.

Measurement of Hydraulic Conductivity

Client: EnSafe/Allen & Hoshall

Date of Report: 02/22/96 Project No.: E-3-157

Client's Project No.: 0106090000

Sample I.D.: 014S01LF10

Soil Description: Light Gray Clayey Silt

Test Media: City of Memphis Water

	Pre-Test	Post Test
Wet Density (Lbs/ft^3)	120.0	117.8
Dry Density (Lbs/ft^3)	90.8	92.6
Moisture (% Dry Wt)	32.1	27.2
Porosity (n)	.44	.43
Degree of Saturation (%)	1.00	.95
Specific Gravity (ASTM D-854)	2.59	---

Permeability

Temperature Correction, R_t = 1.000

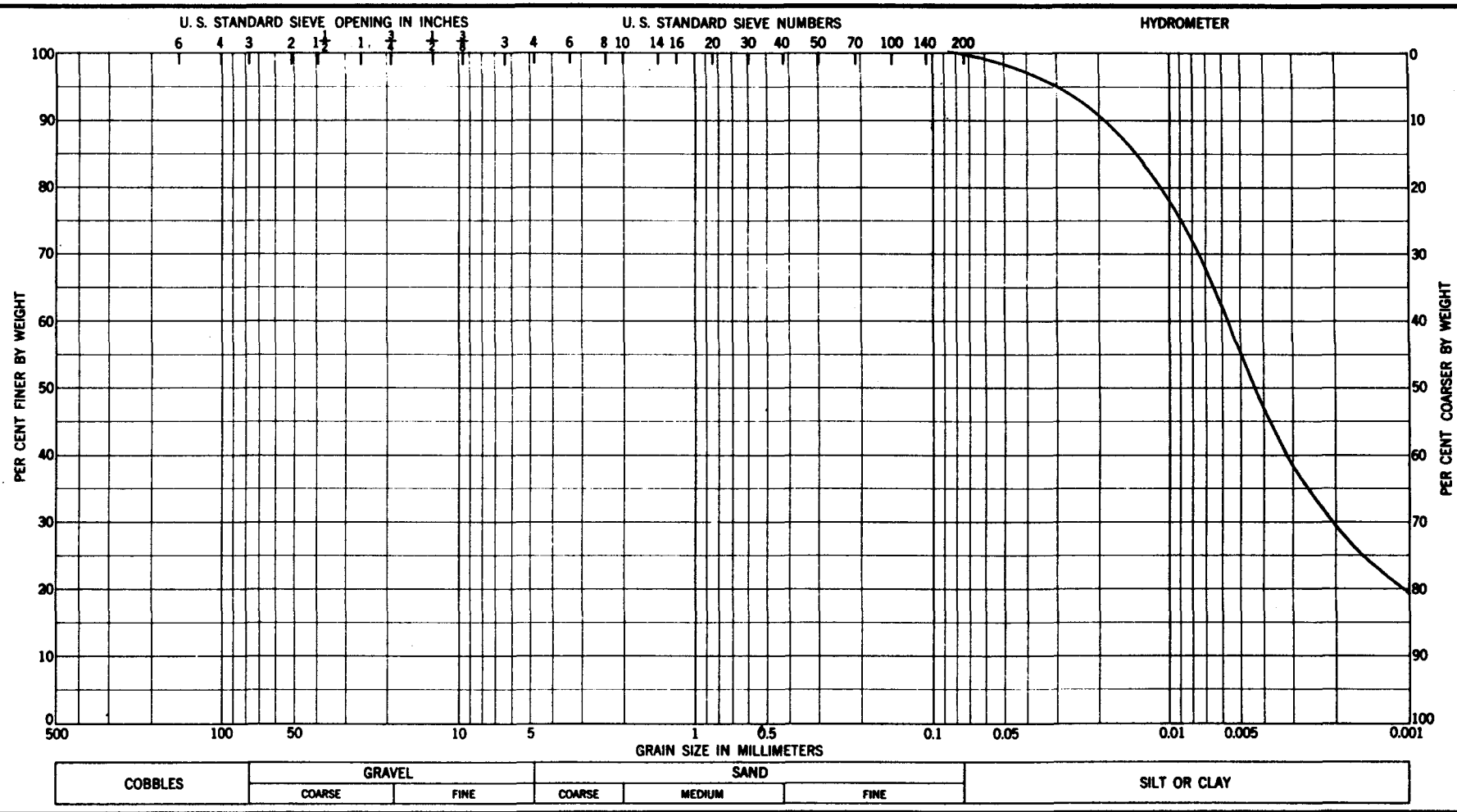
$K_1 = 4.4 \times 10^{-7}$ cm/sec
$K_2 = 3.9 \times 10^{-7}$ cm/sec
$K_3 = 4.0 \times 10^{-7}$ cm/sec
$K_4 = 4.3 \times 10^{-7}$ cm/sec

Coefficient of Permeability, $K_{20} = 4.2 \times 10^{-7}$ cm/sec

Tested in accordance with ASTM D-5084-90.

Lab No. P-96-005 Reviewed By: David D. McCray

6756 Buckles Cove Memphis, TN 38133 901-385-1199 Fax 901-386-6614



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
014S01LF10	7-10'		32	--	--	--

Project EnSafe/A&H # 010609000

Area

Boring No.

Date 02/23/96

GRADATION CURVES

TRI-STATE TESTING SERVICES, INC.

TRI STATE
TESTING SERVICES, INC.

Measurement of Hydraulic Conductivity

Client: EnSafe/Allen & Hoshall

Date of Report: 02/22/96 Project No.: E-3-157

Client's Project No.: 0106090000

Sample I.D.: 014S01LF43

Soil Description: Light Gray & Tan Silty Clay with Sand and small gravel

Test Media: City of Memphis Water

	Pre-Test	Post Test
Wet Density (Lbs/ft^3)	127.0	133.4
Dry Density (Lbs/ft^3)	105.2	113.5
Moisture (% Dry Wt)	20.7	17.5
Porosity (n)	.32	.26
Degree of Saturation (%)	1.0	1.20
Specific Gravity (ASTM D-854)	2.47	---

Permeability

Temperature Correction, R_t = 1.010

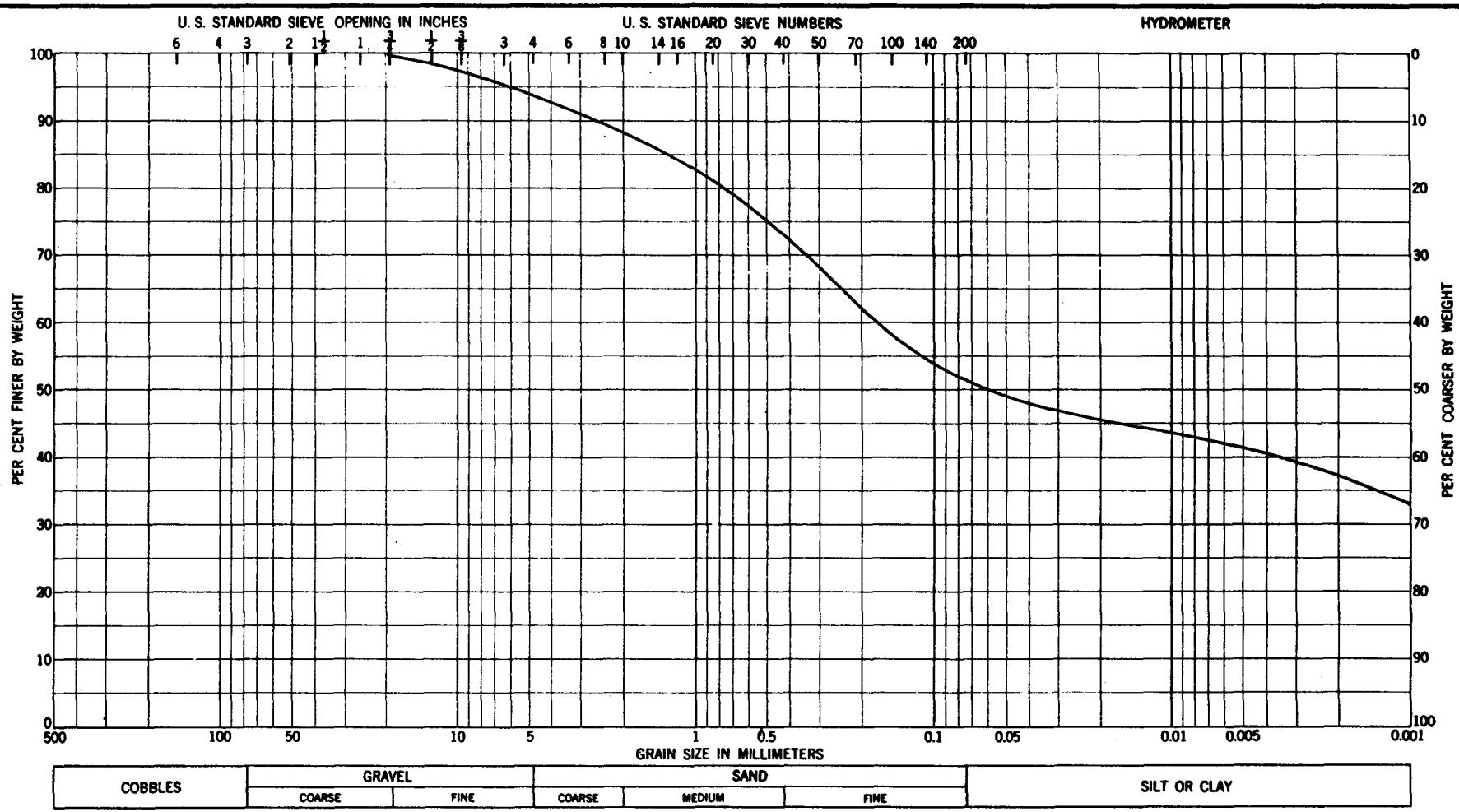
$K_1 = 3.7 \times 10^{-7}$ cm/sec
$K_2 = 4.0 \times 10^{-7}$ cm/sec
$K_3 = 4.2 \times 10^{-7}$ cm/sec
$K_4 = 4.1 \times 10^{-7}$ cm/sec

Coefficient of Permeability, $K_{20} = 4.0 \times 10^{-7}$ cm/sec

Tested in accordance with ASTM D-5084-90.

Lab No. P-96-006 Reviewed By: David D. McCray

6756 Buckles Cove Memphis, TN 38133 901-385-1199 Fax 901-386-6614



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
014S01LF43	40-43'		21	--	--	--

Project EnSafe/A&H # 010609000

Area

Boring No.

Date 02/23/96

GRADATION CURVES

TRI-STATE TESTING SERVICES, INC.

SWMU 59

SOIL BORING/MONITORING WELL LOGS
AND
GEOTECHNICAL LABORATORY RESULTS

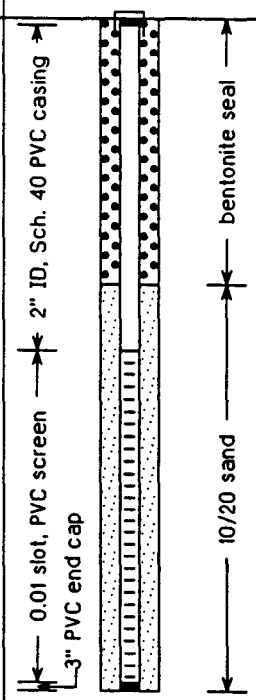
EnSafe/Allen & Hoshall

Monitoring Well 059G01LS

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #59 (Old Pesticide Shop)*
Project No.: *0106-08420*	Surface Elevation: *263.40 feet msl*
Started at *1000 on 3-4-96*	TOC Elevation: *263.24 feet msl*
Completed at *1046 on 3-4-96*	Depth to Groundwater: *7.55 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *255.69 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *20.25 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *10 to 20 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			1	100			GW	(0-1') Asphalt and gravel fill.	262.4
			2	100			OL GW	(1-2') Soil and gravel fill.	261.4
			3	100			ML	(2-7') Clayey silt, olive gray in color, moist, with a trace of organic material.	
5					1.6				
			4	83	1.8				256.4
					2.4		CL	(7-11') Silty clay, olive gray in color. Contains organic material. Iron-staining from 9' to 11'.	
10					2.0				252.4
					1.6			(11-20') Clay, olive gray to light olive gray in color with dark yellowish-orange iron-staining. Contains abundant iron-manganese nodules.	
15			5	120	1.6		CL		
					1.8			Less dark yellowish-orange iron-staining from 16' to 17'.	
					2.0				
20								Terminated soil boring at 20'.	243.4
25									
30									
35									
40									

WELL DIAGRAM



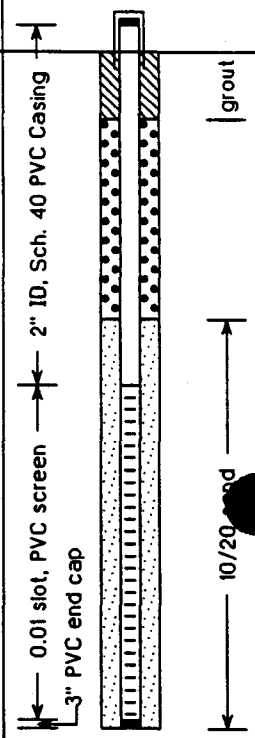
EnSafe/Allen & Hoshall

Monitoring Well 059G02LS

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #59 (Old Pesticide Shop)*
Project No.: *0106-08420*	Surface Elevation: *263.16 feet msl*
Started at *0822 on 3-2-96*	TOC Elevation: *265.18 feet msl*
Completed at *0900 on 3-2-96*	Depth to Groundwater: *10.14 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *255.04 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *20.25 feet*
Geologist: *D. Ladd, C. Ivey*	Well Screen: *10 to 20 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							OL	(0-2') Soil, moderate yellowish-brown in color with roots.	261.2
							ML	(2-4.5') Silt, moderate yellowish-brown mottled with olive gray material, predominantly near 4.5'.	258.7
5			1	65			ML	(4.5-9') Clayey silt, olive gray in color. Contains iron-manganese nodules. Mottled with moderate yellowish-brown colored material near 9'. Moist from 5' to 6'. Dry and crumbly from 7' to 8'.	254.2
10							ML CL	(9-18.5') Silt and silty caly (see descriptions below). (9-10') Silt. Moderate yellowish-brown in color mottled with olive gray-colored material. Very common iron-manganese nodules.	
15			2	75				(10-18') Silty clay. Olive gray in color and mottled with moderate yellowish-brown-colored material, mostly moderate yellowish-brown near 10' and again at 18'. Very common iron-manganese nodules.	244.7
20							CL	(18-18.5') Silt. Moderate yellowish-brown in color mottled with olive gray-colored material. Dry. Contains common iron-manganese nodules.	243.2
25								(18.5-20') Clay, olive gray in color, moist.	
30								Terminated soil boring at 20'. Note: Due to the potential for significant contamination in this soil boring, no samples were field screened for organic vapors so that the well could be completed in minimal time.	
35									
40									

WELL DIAGRAM



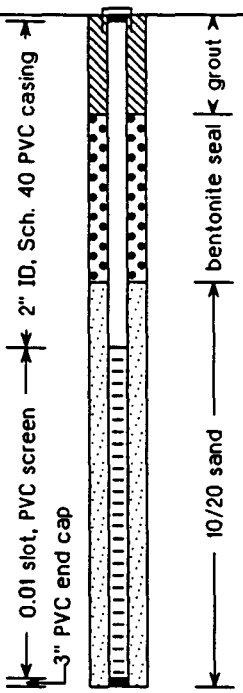
EnSafe/Allen & Hoshall

Monitoring Well 059G03LS

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #59 (Old Pesticide Shop)*
Project No.: *0106-08420*	Surface Elevation: *263.54 feet msl*
Started at *1237 on 3-4-96*	TOC Elevation: *263.35 feet msl*
Completed at *1330 on 3-4-96*	Depth to Groundwater: *9.50 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *253.85 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *20.25 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *10 to 10 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			1				OL GW	(0-1') Asphalt, soil, and gravel fill.	262.5
5			2				ML	(1-12') Silt. Moderate yellowish-brown in color mottled with light olive gray material. Organic material and less light olive gray material from 2' to 12'. Moist from 7' to 10'.	
10			3					Very moist from 10' to 12'.	251.5
								No description available; collected a Shelby tube sample from 12' to 15'.	248.5
15							ML	(15-16') Silt, moderate yellowish-brown in color mottled with light olive gray material.	247.5
							ML	(16-20') Silt, light olive gray in color, mottled with a light moderate yellowish-brown material.	243.5
20								Terminated soil boring at 20'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log for adjacent monitoring well 059G03UF.	
25									
30									
35									
40									

WELL DIAGRAM



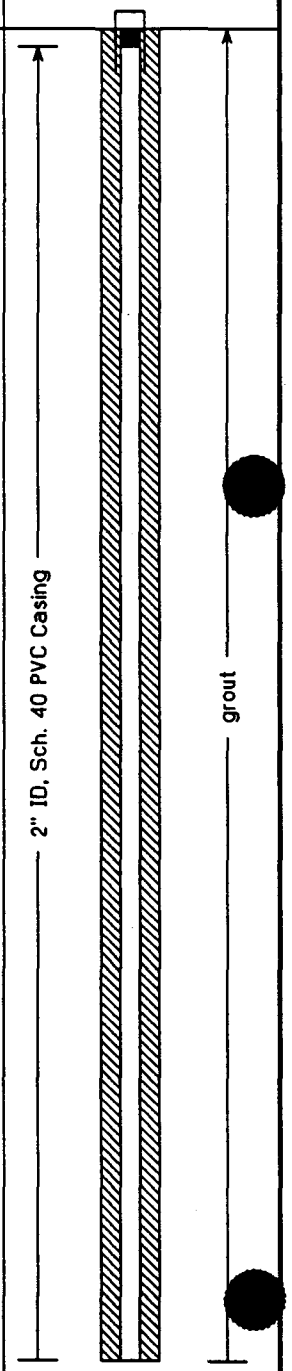
EnSafe/Allen & Hoshall

Monitoring Well 059G03UF

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #59 (Old Pesticide Shop)*
Project No.: *0106-08420*	Surface Elevation: *263.51 feet msl*
Started at *1337 on 3-4-96*	TOC Elevation: *263.32 feet msl*
Completed at *1457 on 3-4-96*	Depth to Groundwater: *14.63 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - "4 inner core barrel/6" OD casing*	Groundwater Elevation: *248.69 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *56 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *44 to 54 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
	X		1	100			OL GW	(0-1') Asphalt, soil, and gravel fill.	
					.8				262.5
	X		2	100				(1-12') Silt, moderate yellowish-brown in color mottled with light olive gray-colored material. Contains organic and less light olive gray material from 2' to 12'.	
					1.0				
5					1.0				
							ML		
			3	95	2.2			Moist from 7' to 10'.	
					1.0				
10								Very moist from 10' to 12'.	
					1.2				
									251.5
								No description available; collected Shelby tube sample from 12' to 15'.	
			4	83					
15					.6		ML		248.5

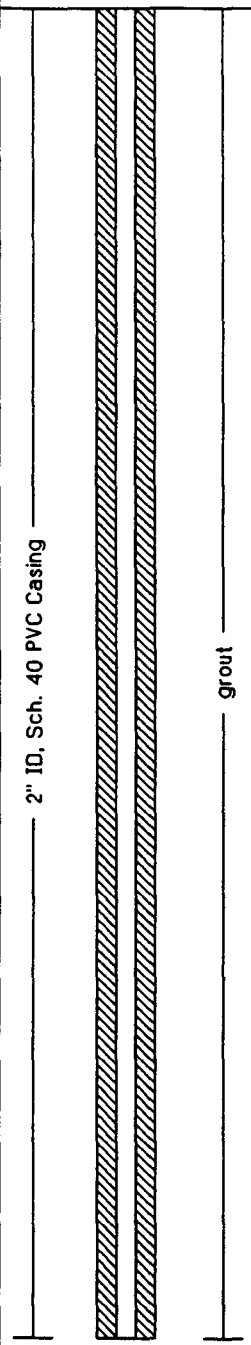
WELL DIAGRAM



EnSafe/Allen & Hoshall	Monitoring Well 059G03UF
Project: *NSA Memphis*	Location: *Millington, TN. SWMU #59 (Old Pesticide Shop)*
Project No.: *0106-08420*	Surface Elevation: *263.51 feet msl*
Started at *1337 on 3-4-96*	TOC Elevation: *263.32 feet msl*
Completed at *1457 on 3-4-96*	Depth to Groundwater: *14.63 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - "4 inner core barrel/6" OD casing*	Groundwater Elevation: *248.69 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *56 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *44 to 54 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							ML	(15-16') Silt, moderate yellowish-brown in color mottled with light olive gray-colored material.	248.5
					1.4		ML	(16-22') Silt, light olive gray in color, mottled with a light moderate yellowish-brown-colored material from 16' to around 20'.	247.5
					1.6				
20			5	82	2.0				
					1.4		ML	(22-26') Silt, moderate yellowish-brown to dusky yellow in color. Contains iron-staining and iron-manganese nodules.	241.5
25					0.8				
					1.2		ML	(26-31') Silt, moderate yellowish-brown to dark yellowish-orange in color mottled with dark yellowish-brown-colored material.	237.5
					1.4				
30									

WELL DIAGRAM



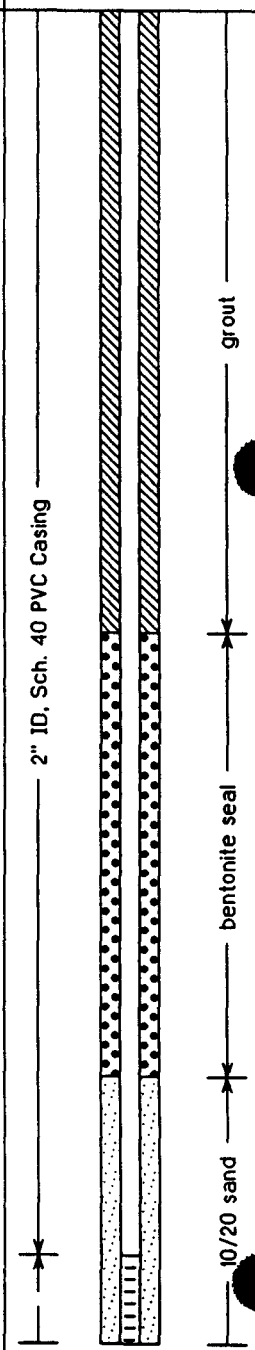
EnSafe/Allen & Hoshall

Monitoring Well 059G03UF

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #59 (Old Pesticide Shop)*
Project No.: *0106-08420*	Surface Elevation: *263.51 feet msl*
Started at *1337 on 3-4-96*	TOC Elevation: *263.32 feet msl*
Completed at *1457 on 3-4-96*	Depth to Groundwater: *14.63 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - "4 inner core barrel/6" OD casing*	Groundwater Elevation: *248.69 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *56 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *44 to 54 feet*

DEPTH IN FEET	SAMPLE NO.	% RECOVERY	PID (ppm)	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
	6	100	1.4	ML		232.5
			1.4	ML	(31-35') Silt, moderate yellowish-brown in color mottled with very fine, very light gray colored sand. Dark yellowish-orange staining and iron-manganese nodules are present near 35'.	
35			1.4	SW	(35-36.5') Sand, very fine-grained, very light gray in color mottled with dark yellowish-orange material. Wet.	228.5
				SW GW	Contains some coarse dark yellowish-orange sand from 36' to 36.5'.	227
	7	100	2.4	CL	(36.5-37') Sand (medium to very coarse-grained) and gravel. Moderate yellowish-brown to dark yellowish-orange in color.	226.5
			2.6	SM	(37-39') Sandy clay, moderate yellowish-brown to dark yellowish- orange in color mottled with very light gray-colored material. Becomes mostly pale yellowish-brown in color near 39'.	224.5
40					Top of Fluvial Deposits estimated at 39'.	223.5
	8	100			(39-40') Silty sand, medium to coarse-grained, with scattered gravel. Moderate yellowish-brown to dark yellowish-orange. Wet.	
					No description available; collected a Shelby tube sample from 40' to 43'.	
			1.4	SW GW	(43-44.5') Sand, fine to very coarse-grained, moderate yellowish-brown to dark yellowish-orange, and gravel, up to .75" in longest dimension, angular to rounded, composed of quartz and chert, wet.	220.5
	9	125				219
45			1.2	SW GW		

WELL DIAGRAM



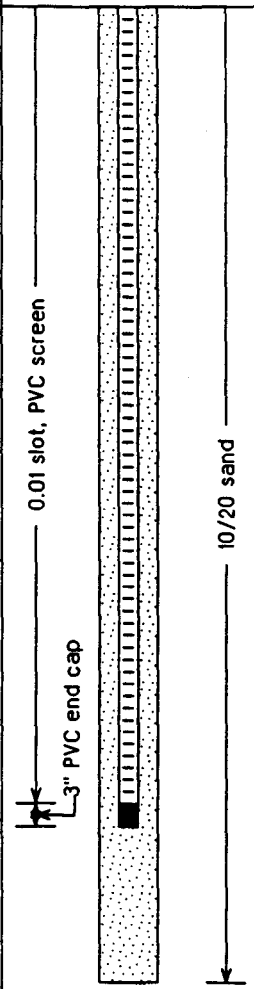
EnSafe/Allen & Hoshall

Monitoring Well 059G03UF

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #59 (Old Pesticide Shop)*
Project No.: *0106-08420*	Surface Elevation: *263.51 feet msl*
Started at *1337 on 3-4-96*	TOC Elevation: *263.32 feet msl*
Completed at *1457 on 3-4-96*	Depth to Groundwater: *14.63 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - "4 inner core barrel/6" OD casing*	Groundwater Elevation: *248.69 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *56 feet*
Geologist: *D. Ladd, W. Parks*	Well Screen: *44 to 54 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					1.2		SW/GW	(44.5-47.5') Sand, coarse to very coarse-grained, moderate yellowish- brown to dark yellowish-orange, and gravel, up to 2.5" in longest dimension, composed mostly of angular chert, wet.	216
							SW/GW	(47.5-48') Sand, fine to coarse-grained, very light gray and mottled with dark yellowish-orange, and gravel, up to 1.5" in longest dimension, composed mostly of angular to rounded quartz and chert, wet.	215.5
					1.0		SW		214.5
50							SW/GW	(48-49') Sand, fine to medium-grained, with rare quartz gravel. Yellowish-gray in color mottled with dark yellowish-orange material, slightly micaceous, wet.	
			10	130	1.6			(49-51.5') Sand (fine to coarse-grained) and gravel (mostly quartz and chert); dark yellowish-orange in color mottled with yellowish-gray material; micaceous; wet.	212
					1.6		SW/GW	(51.5-53.5') Sand, fine to very coarse-grained, and gravel (quartz and chert) is up to .75" in longest dimension; yellowish-gray and wet.	210
55					0.8		SW	(53.5-56') Sand, fine to medium-grained, with rare gravel. Yellowish- gray color, micacous, wet.	207.5
60								Terminated soil boring at 56'.	

WELL DIAGRAM



EnSafe/Allen & Hoshall

Monitoring Well 059G03UF

Project: NSA Memphis	Location: Millington,TN.SWMU #59 (Old Pesticide Shop)
Project No.: 0106-08420	Surface Elevation: 263.51 feet msl
Started at 1337 on 3-4-96	TOC Elevation: 263.32 feet msl
Completed at 1457 on 3-4-96	Depth to Groundwater:14.63 feet Measured: 4/8/96
Drilling Method: Rotasonic-4" inner core barrel/6" OD casing	Groundwater Elevation:248.69 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 56 feet
Geologist: D. Ladd, W. Parks	Well Screen: 44 to 54 feet

GAMMA RAY LOG

COUNTS PER SECOND

CASING TYPE: 2" PVC

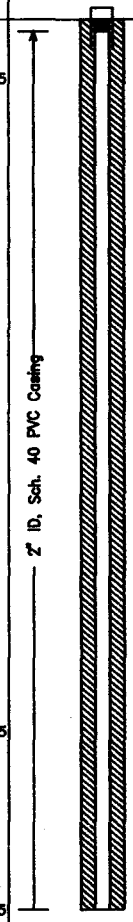
TOP OF LOG = GROUND SURFACE

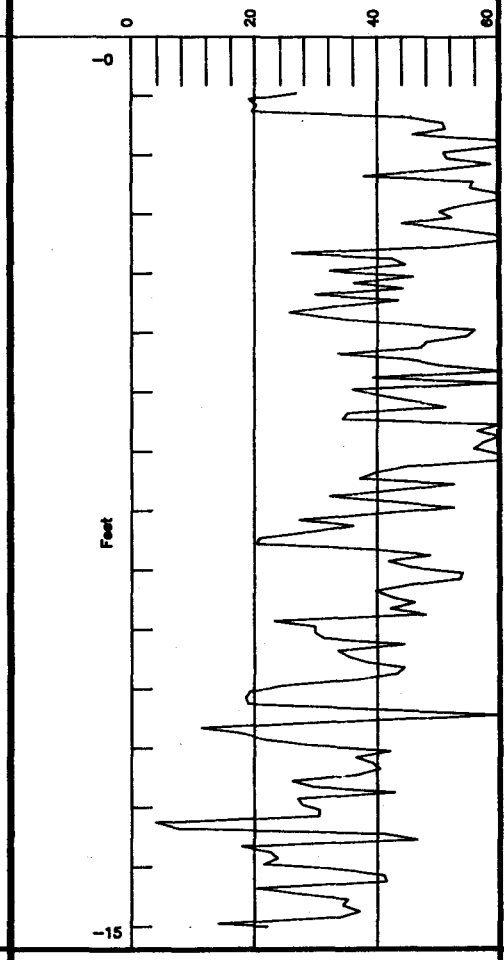
DATE LOGGED: 05/22/96

NOTES

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			1	100	.8		OL GW	(0-1') Asphalt, soil, and gravel fill.	262.5
			2	100	1.0		ML	(1-12') Silt, moderate yellowish-brown in color mottled with light olive gray-colored material. Contains organic and less light olive gray material from 2' to 12'.	
5					1.0				
			3	95	2.2			Moist from 7' to 10'.	
					1.0				
10					1.2			Very moist from 10' to 12'.	
			4	83	.6		ML	No description available; collected Shelby tube sample from 12' to 15'.	251.5
15									248.5

WELL DIAGRAM





RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

SWMU 59
OLD PESTICIDE SHOP

DWG DATE: 12/10/96

DWG NAME: 94GL593

LOGGED BY:
GEOLOGICAL LOGGING SYSTEMS

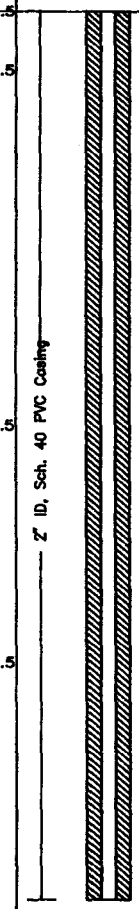
EnSafe/Allen & Hoshall

Monitoring Well 059G03UF

Project: NSA Memphis	Location: Millington, TN. SWMU #59 (Old Pesticide Shop)
Project No.: 0106-08420	Surface Elevation: 263.51 feet msl
Started at 1337 on 3-4-96	TOC Elevation: 263.32 feet msl
Completed at 1457 on 3-4-96	Depth to Groundwater: 14.63 feet Measured: 4/8/96
Drilling Method: Rotasonic-4" inner core barrel/6" OD casing	Groundwater Elevation: 248.69 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 56 feet
Geologist: D. Ladd, W. Parks	Well Screen: 44 to 54 feet

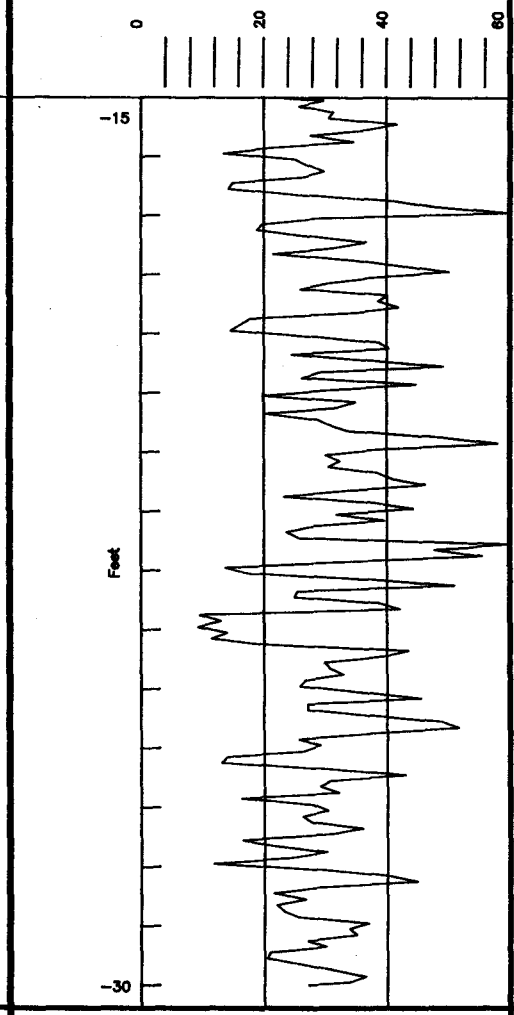
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							ML	(15-16') Silt, moderate yellowish-brown in color mottled with light olive gray-colored material.	248.5
					1.4		ML	(16-22') Silt, light olive gray in color, mottled with a light moderate yellowish-brown-colored material from 16' to around 20'.	247.5
					1.6				
20			5	82	2.0				
					1.4		ML	(22-26') Silt, moderate yellowish-brown to dusky yellow in color. Contains iron-staining and iron-manganese nodules.	241.5
25					0.8				
					1.2		ML	(26-31') Silt, moderate yellowish-brown to dark yellowish-orange in color mottled with dark yellowish-brown-colored material.	237.5
					1.4				
30									

WELL DIAGRAM



GAMMA RAY LOG

COUNTS PER SECOND



CASING TYPE: 2" PVC

TOP OF LOG = GROUND SURFACE

DATE LOGGED: 05/22/96

NOTES

RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

SWMU 59
OLD PESTICIDE SHOP

DWG DATE: 12/10/96

DWG NAME: 94GL593A

LOGGED BY:
GEOLOGICAL LOGGING SYSTEMS

EnSafe/Allen & Hoshall

Monitoring Well 059G03UF

Project: NSA Memphis	Location: Millington,TN.SWMU #59(Old Pesticide Shop)
Project No.: 0106-08420	Surface Elevation: 263.51 feet msl
Started at 1337 on 3-4-96	TOC Elevation: 263.32 feet msl
Completed at 1457 on 3-4-96	Depth to Groundwater:14.63 feet Measured: 4/8/96
Drilling Method: Rotosonic-4" inner core barrel/6" OD casing	Groundwater Elevation:248.69 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 56 feet
Geologist: D. Ladd, W. Parks	Well Screen: 44 to 54 feet

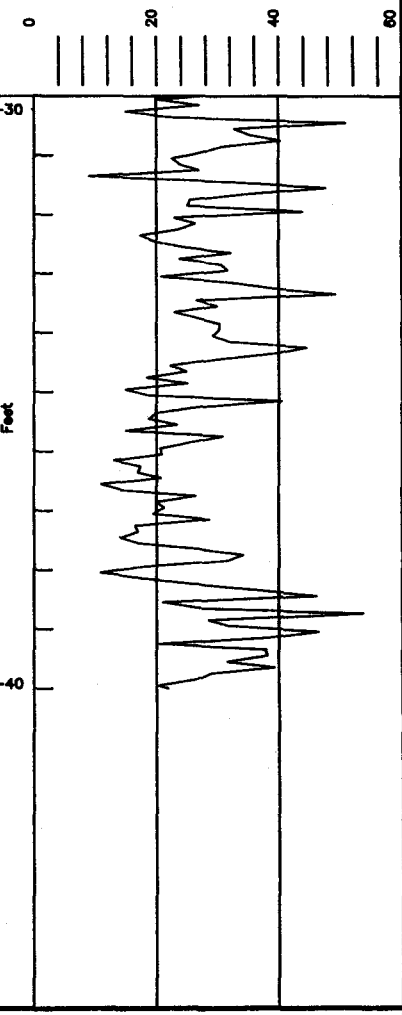
DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							ML		
			6	100	1.4			(31-35') Silt, moderate yellowish-brown in color mottled with very fine, very light gray colored sand. Dark yellowish-orange staining and iron-manganese nodules are present near 35'.	232.5
					1.4		ML		
35					1.4		SW	(35-36.5') Sand, very fine-grained, very light gray in color mottled with dark yellowish-orange material. Wet.	228.5
							SW GW	Contains some coarse dark yellowish-orange sand from 36' to 36.5'.	227
					2.4		CL	(36.5-37') Sand (medium to very coarse-grained) and gravel. Moderate yellowish-brown to dark yellowish-orange in color.	226.5
			7	100					
					2.6		SM	(37-39') Sandy clay, moderate yellowish-brown to dark yellowish- orange in color mottled with very light gray-colored material. Becomes mostly pale yellowish-brown in color near 39'	224.5
40								Top of Fluvial Deposits estimated at 39'.	223.5
								(39-40') Silty sand, medium to coarse-grained, with scattered gravel. Moderate yellowish-brown to dark yellowish-orange. Wet.	
			8	100				No description available; collected a Shelby tube sample from 40' to 43'.	
					1.4		SW GW	(43-44.5') Sand, fine to very coarse-grained, moderate yellowish-brown to dark yellowish-orange, and gravel, up to .75" in longest dimension, angular to rounded, composed of quartz and chert, wet.	220.5
			9	125					219
45					1.2		SW GW		

WELL DIAGRAM

2" ID, Sch. 40 PVC Casing

GAMMA RAY LOG

COUNTS PER SECOND



CASING TYPE: 2" PVC

TOP OF LOG = GROUND SURFACE

DATE LOGGED: 05/23/96

NOTES

RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

SWMU 59
OLD PESTICIDE SHOP

DWG DATE: 12/10/96

DWG NAME: 94GL593B

LOGGED BY:
GEOLOGICAL LOGGING SYSTEMS

EnSafe/Allen & Hoshall	Monitoring Well 059G03UF
Project: NSA Memphis	Location: Millington,TN.SWMU #59(Old Pesticide Shop)
Project No.: 0106-08420	Surface Elevation: 263.51 feet msl
Started at 1337 on 3-4-96	TOC Elevation: 263.32 feet msl
Completed at 1457 on 3-4-96	Depth to Groundwater:14.63 feet Measured: 4/8/96
Drilling Method: Rotosonic-4" inner core barrel/6" OD casing	Groundwater Elevation:248.69 feet msl
Drilling Company: Alliance Environmental, Inc.	Total Depth: 56 feet
Geologist: D. Ladd, W. Parks	Well Screen: 44 to 54 feet

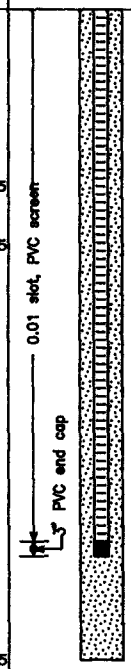
GAMMA RAY LOG
COUNTS PER SECOND

CASING TYPE: 2" PVC
TOP OF LOG = GROUND SURFACE
DATE LOGGED: 05/23/96

NOTES

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					1.2		SW GW	(44.5-47.5') Sand, coarse to very coarse-grained, moderate yellowish- brown to dark yellowish-orange, and gravel, up to 2.5" in longest dimension, composed mostly of angular chert, wet.	216
							SW GW	(47.5-48') Sand, fine to coarse-grained, very light gray and mottled with dark yellowish-orange, and gravel, up to 1.5" in longest dimension, composed mostly of angular to rounded quartz and chert, wet.	215.5
					1.0		SW		214.5
50							SW GW	(48-49') Sand, fine to medium-grained, with rare quartz gravel. Yellowish-gray in color mottled with dark yellowish-orange material, slightly micaceous, wet.	
			10	130	1.6			(49-51.5') Sand (fine to coarse-grained) and gravel (mostly quartz and chert); dark yellowish-orange in color mottled with yellowish-gray material; micaceous; wet.	212
					1.6		SW GW	(51.5-53.5') Sand, fine to very coarse-grained, and gravel (quartz and chert) is up to .75" in longest dimension; yellowish-gray and wet.	210
55					0.8		SW	(53.5-56') Sand, fine to medium-grained, with rare gravel. Yellowish- gray color, micaceous, wet.	
								Terminated soil boring at 56'.	207.5
60									

WELL DIAGRAM



RCRA FACILITY INVESTIGATION
NSA MEMPHIS
MILLINGTON, TENNESSEE

SWMU 59
OLD PESTICIDE SHOP

DWG DATE: 12/10/96
DWG NAME: 94GL593C

LOGGED BY:
GEOLOGICAL LOGGING SYSTEMS

STATE
TESTING SERVICES, INC.

Measurement of Hydraulic Conductivity

Client: EnSafe/Allen & Hoshall

Date of Report: 03/22/96 Project No.: E-3-157

Client's Project No.: 0106090000

Sample I.D.: 0059S03UF15

Soil Description: Brown & Gray Clayey Silt

Test Media: City of Memphis Water

	Pre-Test	Post Test
Wet Density (Lbs/ft^3)	139.4	139.9
Dry Density (Lbs/ft^3)	107.6	107.7
Moisture (% Dry Wt)	29.5	29.9
Porosity (n)	.36	.34
Degree of Saturation (%)	.99	1.0
Specific Gravity (ASTM D-854)	2.66	---

Permeability

Temperature Correction, $R_t = 1.008$

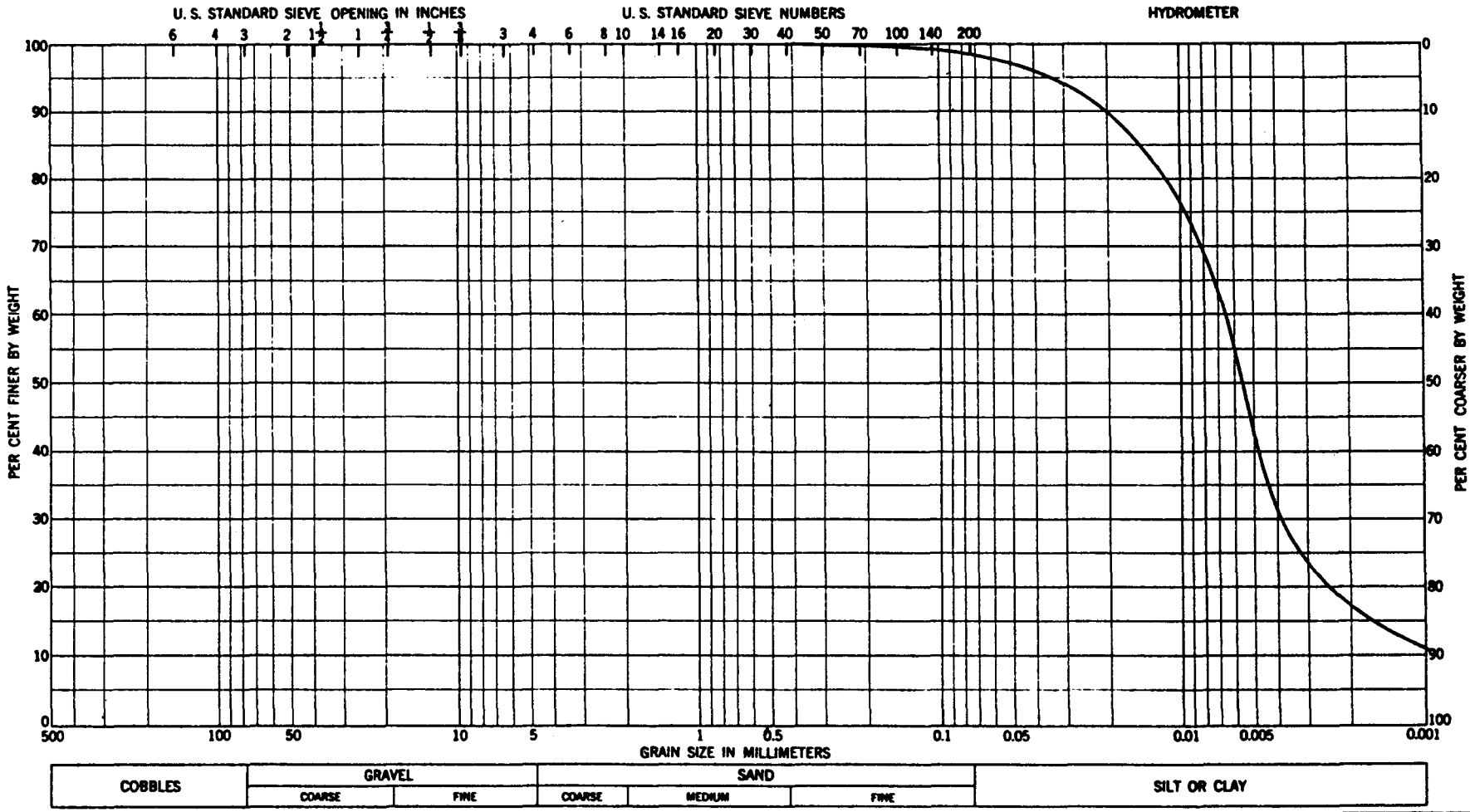
$K_1 = 6.0 \times 10^{-7}$ cm/sec
$K_2 = 4.1 \times 10^{-7}$ cm/sec
$K_3 = 7.2 \times 10^{-7}$ cm/sec
$K_4 = 5.5 \times 10^{-7}$ cm/sec

Coefficient of Permeability, $K_{20} = 5.7 \times 10^{-7}$ cm/sec

Tested in accordance with ASTM D-5084-90.

Lab No. P-96-017 Reviewed By: David D. McCray

6756 Buckles Cove Memphis, TN 38133 901-385-1199 Fax 901-386-6614



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
059S034F15			30	--	--	--

Project EnSafe/A&H # 010609000

Area

Boring No.

Date 03/22/96

GRADATION CURVES

TRI-STATE TESTING SERVICES, INC

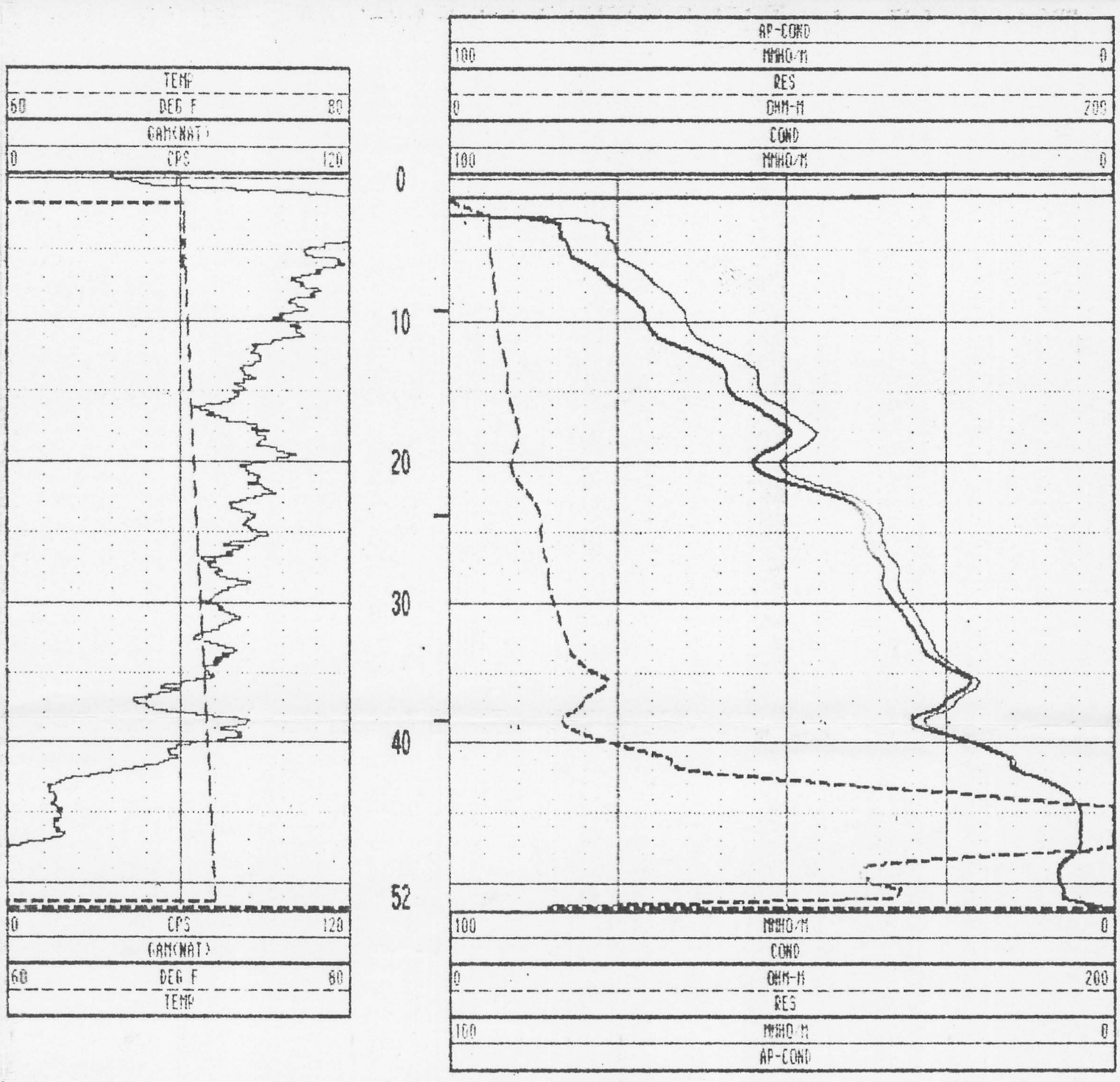
GEOLOGICAL LOGGING SYSTEMS

059G03UF

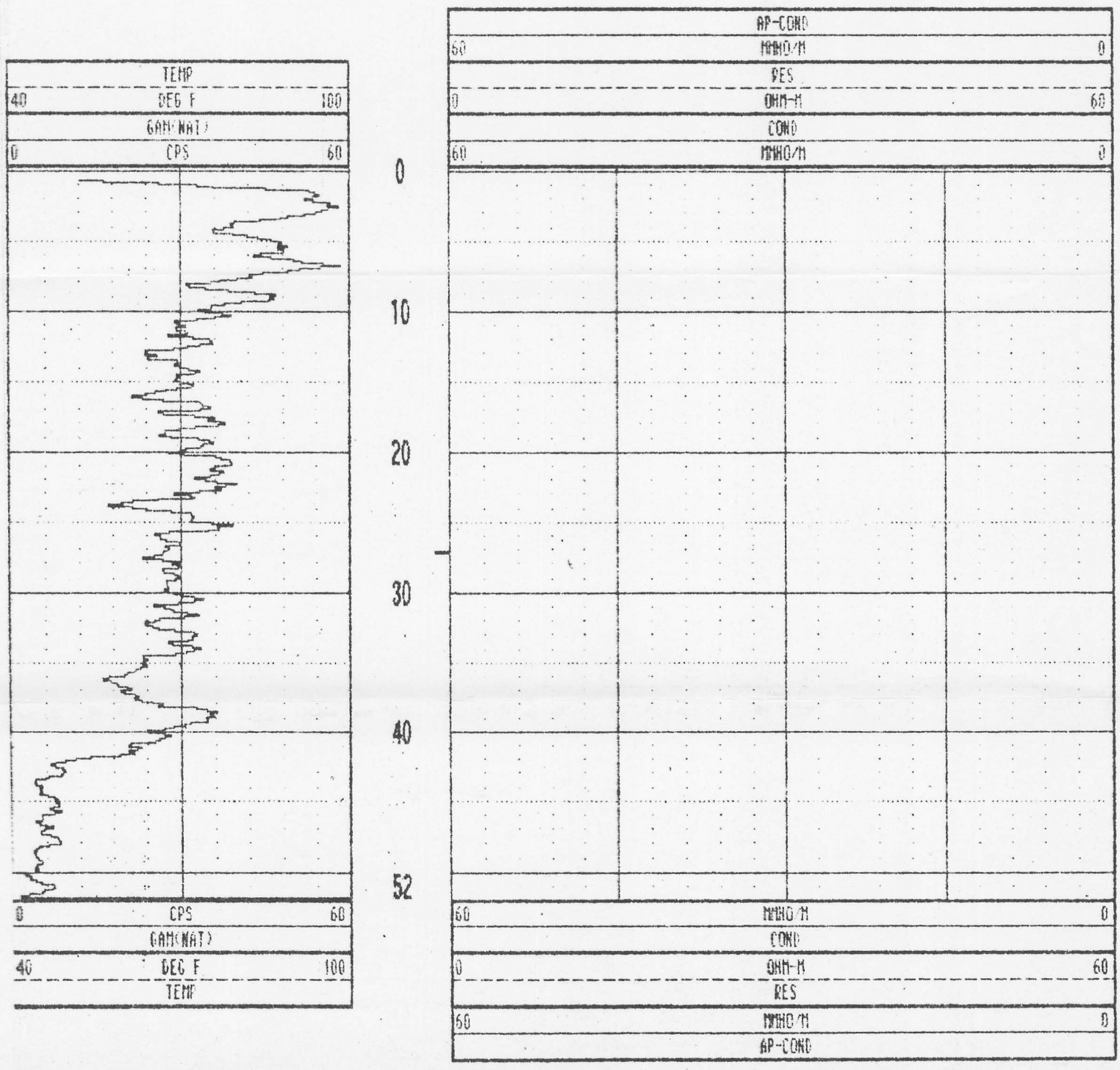
COMPANY	: ENSAFE,ALLEN & HOSHALL			OTHER SIRVICES:	
WELL	: 059G03UF			9511	
LOCATION/FIELD	: NAS MEMPHIS			RUN ONE	
COUNTY	: SHELBY			OPEN	
STATE	: TENNESSEE				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 05/22/96	PERMANENT DATUM	: GL	ELEVATIONS	
DEPTH DRILLER	: 50	ELEV. PERM. DATUM:		KB	:
LOG BOTTOM	: 52.00	LOG MEASURED FROM:	GL	DF	: -
LOG TOP	: -2.50	DRL MEASURED FROM:	GL	GL	: 263.5
CASING DRILLER	: 50	LOGGING UNIT	: 05		
CASING TYPE	: PVC	FIELD OFFICE	: BLUEFIELD		
CASING THICKNESS	: .25	RECORDED BY	: J T GILBERT		
BIT SIZE	: 8	BOREHOLE FLUID	: WATER	FILE	: ORIGIN
MAGNETIC DECL.	: -	RM	:	TYPE	: 9511C
MATRIX DENSITY	: 2.65	RM TEMPERATURE	:	LOG	: 8
FLUID DENSITY	: 1.2	MATRIX DELTA T	:	PLOT	: 9510C
NEUTRON MATRIX	: SANDSTONE	FLUID DELTA T	:	THRESH	: 9000
REMARKS	:				

ELECTRIC LOG INTERPRETATION IS EMPIRICAL IN NATURE. EXTREME HOLE COND WILL MAKE COMPLETELY ACCURATE INTERPRETATIONS DIFFICULT.

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



059G03UF 05/22/96 976



059G03UF 05/22/96 1025

GRI STATE
TESTING SERVICES, INC.

Measurement of Hydraulic Conductivity

Client: EnSafe/Allen & Hoshall

Date of Report: 03/22/96 Project No.: E-3-157

Client's Project No.: 0106090000

Sample I.D.: 059S03UF43

Soil Description: Brown Sandy Gravel

Test Media: City of Memphis Water

	Pre-Test	Post Test
Wet Density (Lbs/ft^3)	136.7	148.7
Dry Density (Lbs/ft^3)	115.7	130.0
Moisture (% Dry Wt)	18.2	14.4
Porosity (n)	.30	.22
Degree of Saturation (%)	.97	1.0
Specific Gravity (ASTM D-854)	2.65	---

Permeability

Temperature Correction, R_t = 1.043

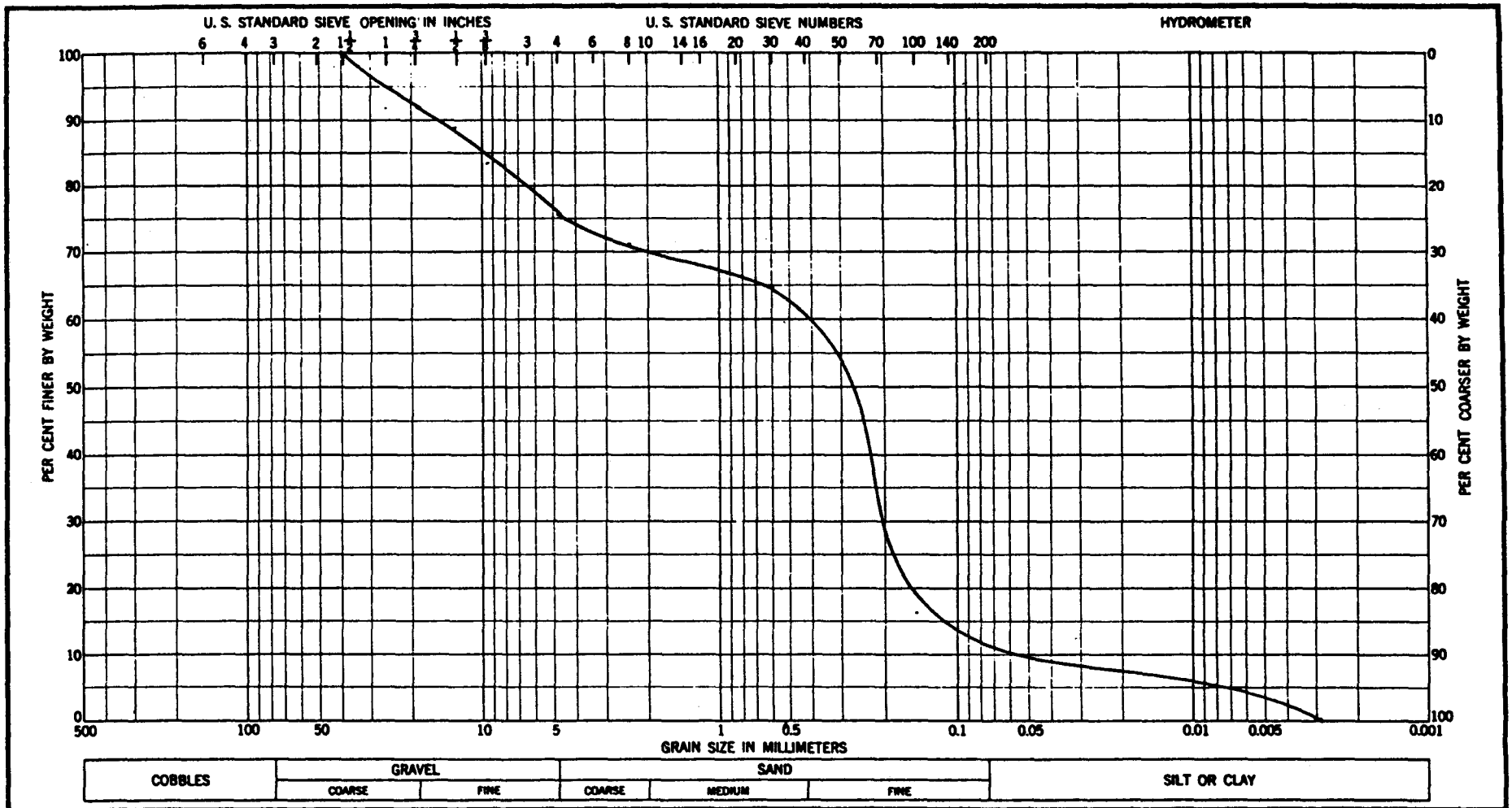
$K_1 = 1.4 \times 10^{-4}$ cm/sec
$K_2 = 2.7 \times 10^{-4}$ cm/sec
$K_3 = 4.3 \times 10^{-4}$ cm/sec
$K_4 = 1.5 \times 10^{-4}$ cm/sec

Coefficient of Permeability, $K_{20} = 2.6 \times 10^{-4}$ cm/sec

Tested in accordance with ASTM D-5084-90.

Lab No. P-96-018 Reviewed By: David D. McCray

6756 Buckles Cove Memphis, TN 38133 901-385-1199 Fax 901-386-6614



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
059S03UF43	40-43'		18	--	--	--

Project EnSafe/A&H # 010609000

Area

Boring No.

Date 03/22/96

GRADATION CURVES

TRI-STATE TESTING SERVICES, INC.

NAVY CLEAN
ENSAFE/ALLEN & HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

CLIENT EnSafe
ADDRESS 5724 Summer Trees Dr.
PROJECT NAME/NUMBER 0106 09000
MEDIA STATUS: (A, B, OR C)

PROJECT MANAGER A. Choate
TELEPHONE NO. 9013727962
FAX. NO. 3722454
SAMPLERS: (SIGNATURE) Alison Choate

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTANNERS	Hydraulic Conductivity	Porosity	Bulk Density	Particle Size	Percent Moisture	Specific Grav	REMARKS
0595MW0315	3/4/96	1400	soil	3" dia. Shelby Tub	-	-	1	X	X	X	X	X	X	X	
0595MW0343	3/4/96	1422	soil	3" dia. Shelby T	-	-	1	X	X	X	X	X	X	X	

RELINQUISHED BY:	DATE	RELINQUISHED BY:	DATE	RELINQUISHED BY:	DATE	RELINQUISHED BY:	DATE
SIGNATURE Alison Choate	3/4/96	SIGNATURE		SIGNATURE		SIGNATURE	
PRINTED Alison Choate	TIME	PRINTED	TIME	PRINTED	TIME	PRINTED	TIME
COMPANY EnSafe	1700	COMPANY		COMPANY		COMPANY	
REASON Analysis		REASON		REASON		REASON	

METHOD OF SHIPMENT: direct transport
SHIPMENT NO.
SPECIAL INSTRUCTION:

COMMENTS:

AFTER ANALYSIS, SAMPLES ARE TO BE:
- ☐ DISPOSED OF (ADDITIONAL FEE)
- ☐ STORED (90 DAYS MAX)
- ☐ STORED OVER 90 DAYS (ADDITIONAL FEE)
- ☐ RETURNED TO CUSTOMER

SWMU 65

SOIL BORING/MONITORING WELL LOGS
AND
GEOTECHNICAL LABORATORY RESULTS

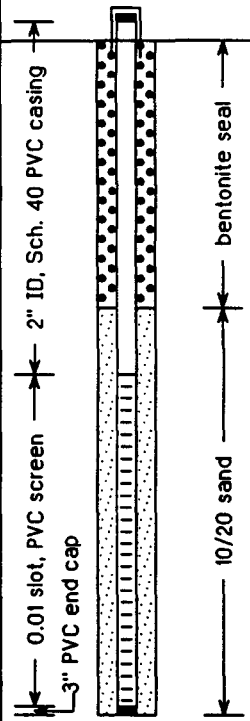
EnSafe/Allen & Hoshall

Monitoring Well 065G05UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #65 (Training Mock-Up Site)*
Project No.: *0106-08420*	Surface Elevation: *264.10 feet msl*
Started at *1230 on 2-17-96*	TOC Elevation: *266.04 feet msl*
Completed at *1320 on 2-17-96*	Depth to Groundwater: *3.99 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *262.05 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *20.25 feet*
Geologist: *J. Kingsbury*	Well Screen: *10 to 20 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					BG			(0-20') Upper Alluvium (see descriptions below).	
					BG		CL	Clay, brownish-gray in color, hard and dry.	
5			1	100	BG				259.1
					BG			Silt. From 5' to 8', is very light brown in color and moist.	
					BG			From 8' to 18', silt is yellowish-brown to yellowish-gray in color, with specks of organic material and some orangish-colored staining.	
10					BG				
					BG		ML		
15			2	70	BG				
					BG				
					BG			At 18', color changes to greenish-gray/olive gray. Very moist to wet with some snail shells present.	244.1
20								Terminated soil boring at 20'.	
25									
30									
35									
40									

WELL DIAGRAM



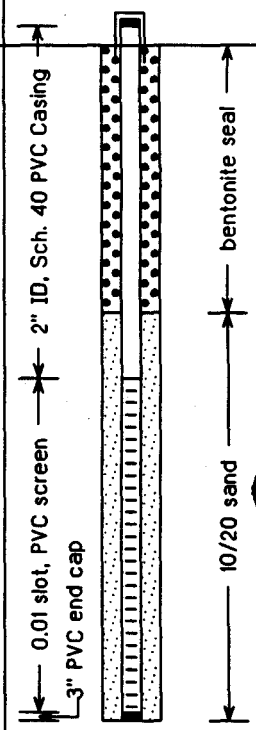
EnSafe/Allen & Hoshall

Monitoring Well 065G06UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #65 (Training Mock-Up Site)*
Project No.: *0106-08420*	Surface Elevation: *264.25 feet msl*
Started at *0930 on 2-17-96*	TOC Elevation: *266.28 feet msl*
Completed at *1045 on 2-17-96*	Depth to Groundwater: *4.90 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *261.38 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *20.25 feet*
Geologist: *J. Kingsbury*	Well Screen: *10 to 20 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
		◢	1				ML	(0-20') Upper Alluvium (see descriptions below).	
								Silt. Light brown to yellowish-brown in color.	262.2
							CL	Clay. Brownish-gray to light brown in color. Hard.	
5									258.2
		◢	2					Silt. Yellowish-gray to yellowish-brown in color. Rare organics with iron-stained haloes around them from 6' to 12'.	
10							ML		
		◢	3					From 12' to 14', increase in orange-colored iron staining and mottling. Silt is yellowish-brown to with some gray, and moist.	250.2
15								No description available; collected Shelby tube sample from 14' to 16' in 65MW06DA.	248.2
							ML	Silt, yellowish-brown with some gray, with orange-colored iron staining and mottling, moist to wet.	
20									244.2
								Terminated soil boring at 20'. Note: No samples were collected for lithologic description. These descriptions were transferred from the log of adjacent monitoring well 65MW06DA.	
25									
30									
35									
40									

WELL DIAGRAM



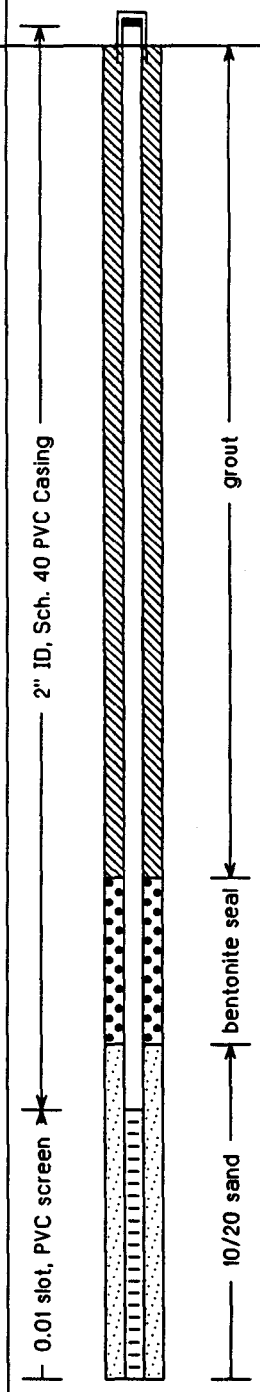
EnSafe/Allen & Hoshall

Monitoring Well 065G06DA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #65 (Training Mock-Up Site)*
Project No.: *0106-08420*	Surface Elevation: *264.18 feet msl*
Started at *0815 on 2-17-96*	TOC Elevation: *266.12 feet msl*
Completed at *0930 on 2-17-96*	Depth to Groundwater: *9.62 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *256.50 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *46 feet*
Geologist: *J. Kingsbury*	Well Screen: *32 to 42 feet*

DEPTH IN FEET	SAMPLE NO.	% RECOVERY	PID (ppm)	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			BG	ML	(0-29') Upper Alluvium (see descriptions below).	
	1	25	BG		Silt. Light brown to yellowish-brown in color.	262.2
5			BG	CL	Clay. Brownish-gray to light brown in color. Hard.	258.2
			BG	ML	Silt. Yellowish-gray to yellowish-brown in color. Rare organics with iron-stained haloes around them from 6' to 12'.	
10	2	120	BG			
			BG			
			BG		From 12' to 14', increase in orange-colored iron staining and mottling. Silt is yellowish-brown to with some gray, and moist.	250.2
15	3	100			No description available; collected Shelby tube sample from 14' to 16'.	248.2
			BG	ML	Silt, yellowish-brown with some gray, with orange-colored iron staining and mottling, moist to wet.	
20	4	90	BG		From 20' to 34', clayey silt, olive gray to brownish-gray, with some snail shells, moist.	
			BG			
25			BG			
			BG		With lenses of sand from 28' to 34'.	
30			BG		Top of Deeper Alluvium deposits estimated at 29'.	
	5	83	BG			
35			BG	SW	Sand, dusky yellow to olive gray, with gravel up to 1" in longest dimension. Percentage of gravel increases with depth to 38'.	230.2
			BG			226.2
	6	100			No description available; collected Shelby tube sample from 38' to 40'.	
40				SW/GW		224.2

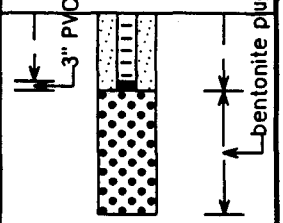
WELL DIAGRAM



EnSafe/Allen & Hoshall	Monitoring Well 065G06DA
Project: *NSA Memphis*	Location: *Millington, TN. SWMU #65 (Training Mock-Up Site)*
Project No.: *0106-08420*	Surface Elevation: *264.18 feet msl*
Started at *0815 on 2-17-96*	TOC Elevation: *266.12 feet msl*
Completed at *0930 on 2-17-96*	Depth to Groundwater: *9.62 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *256.50 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *46 feet*
Geologist: *J. Kingsbury*	Well Screen: *32 to 42 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					BG		SW GW	Sand and gravel.	224.2
			7	125	BG		CL	Cockfield Formation: Brown stiff clay with fine-grained sand interbeds.	222.2
45					BG				218.2
								Terminated soil boring at 46'.	
50									
55									
60									
65									
70									
75									
80									

WELL DIAGRAM



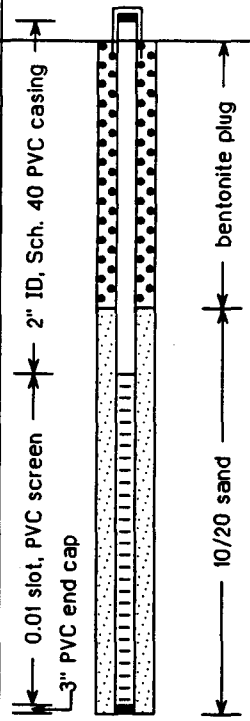
EnSafe/Allen & Hoshall

Monitoring Well 065G07UA

Project: *NSA Memphis*	Location: *Millington, TN. SWMU #65 (Training Mock-Up Site)*
Project No.: *0106-08420*	Surface Elevation: *262.85 feet msl*
Started at *1100 on 2-17-96*	TOC Elevation: *264.86 feet msl*
Completed at *on 2-17-96*	Depth to Groundwater: *4.13 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic - 4" inner core barrel/6" OD casing*	Groundwater Elevation: *260.73 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *20.25 feet*
Geologist: *J. Kingsbury*	Well Screen: *10 to 20 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
					BG		ML	(0-20') Upper Alluvium (see descriptions below).	
					BG			Fill material is present from 0' to 2'. Silt with some gravel, brown in color.	260.9
5			1	100	BG		CL	Clay, brown in color, hard and dry.	
					BG				
					BG				253.9
10					BG			Silt, yellowish-gray to yellowish-brown in color, moist.	
					BG			Some mottling with dark yellowish-orange stained material from 10' to 20'.	
15			2	70	BG		ML		
					BG				
					BG			Silt exhibits a color change near 20' to olive gray/greenish-gray.	
20								Terminated soil boring at 20'.	242.9
25									
30									
35									
40									

WELL DIAGRAM



GEOLOGICAL LOGGING SYSTEMS

065G06DA

COMPANY	: ENSAFE,ALLEN & HOSHALL		
WELL	: 065G06DA		
LOCATION/FIELD	: NAS MEMPHIS		
COUNTY	: SHELBY		
STATE	: TENNESSEE		
SECTION	:	TOWNSHIP :	RANGE :

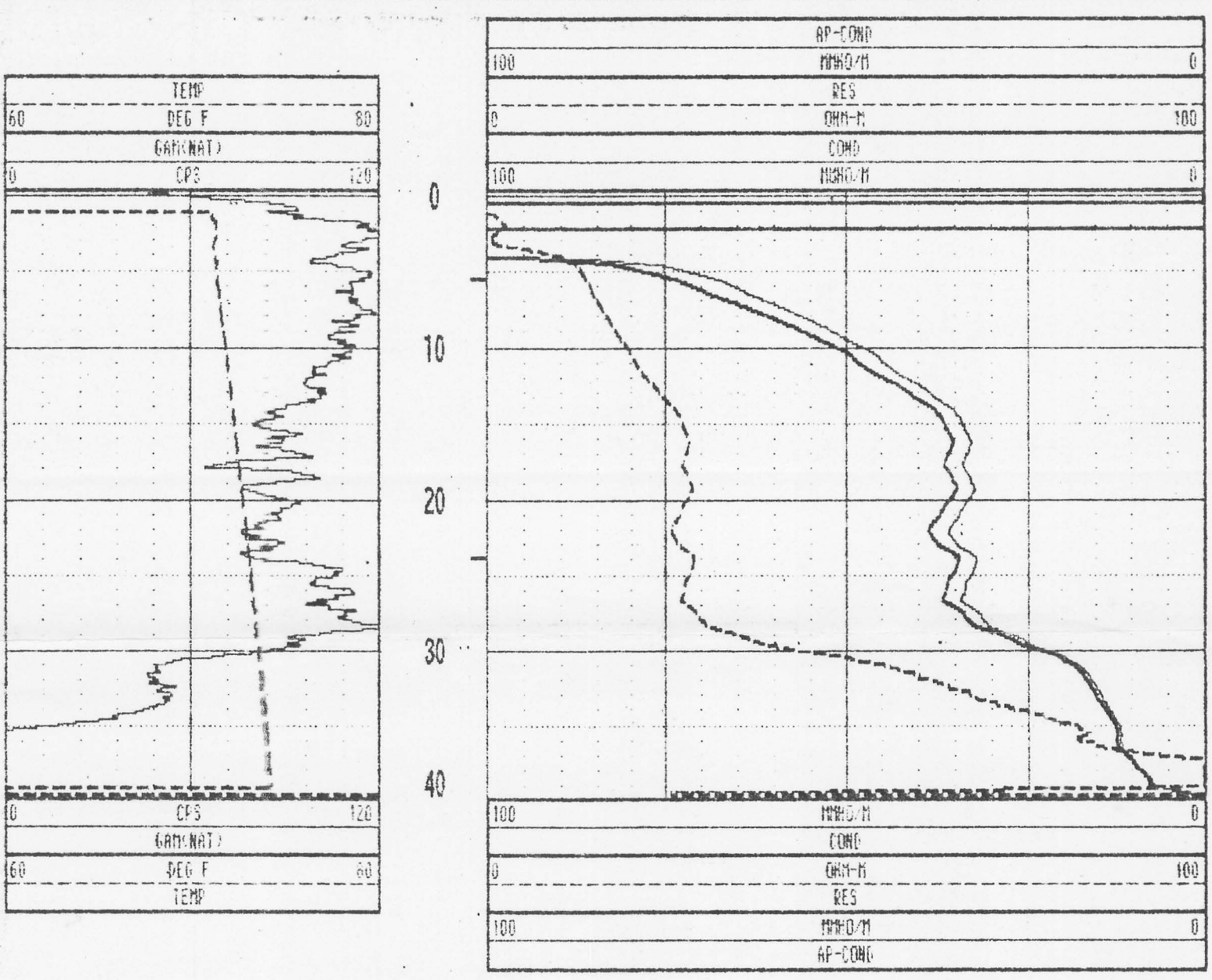
OTHER SERVICES
9511
RUN TWO
OPEN

DATE	: 05/23/96	PERMANENT DATUM	: GL	ELEVATIONS	
DEPTH DRILLER	: 42	ELEV. PERM. DATUM	:	KB	:
LOG BOTTOM	: 39.80	LOG MEASURED FROM	: GL	DF	: -
LOG TOP	: -3.20	DRL MEASURED FROM	: GL	GL	: 264.2
CASING DRILLER	: 42	LOGGING UNIT	: 05		
CASING TYPE	: PVC	FIELD OFFICE	: BLUEFIELD		
CASING THICKNESS	: .25	RECORDED BY	: J T GILBERT		
BIT SIZE	: 8	BOREHOLE FLUID	: WATER	FILE	: ORIGIN
MAGNETIC DECL.	: -	RM	:	TYPE	: 9511C
MATRIX DENSITY	: 2.65	RM TEMPERATURE	:	LOG	: 2
FLUID DENSITY	: 1.2	MATRIX DELTA T	:	PLOT	: 9510C
NEUTRON MATRIX	: SANDSTONE	FLUID DELTA T	:	THRESH	: 9000

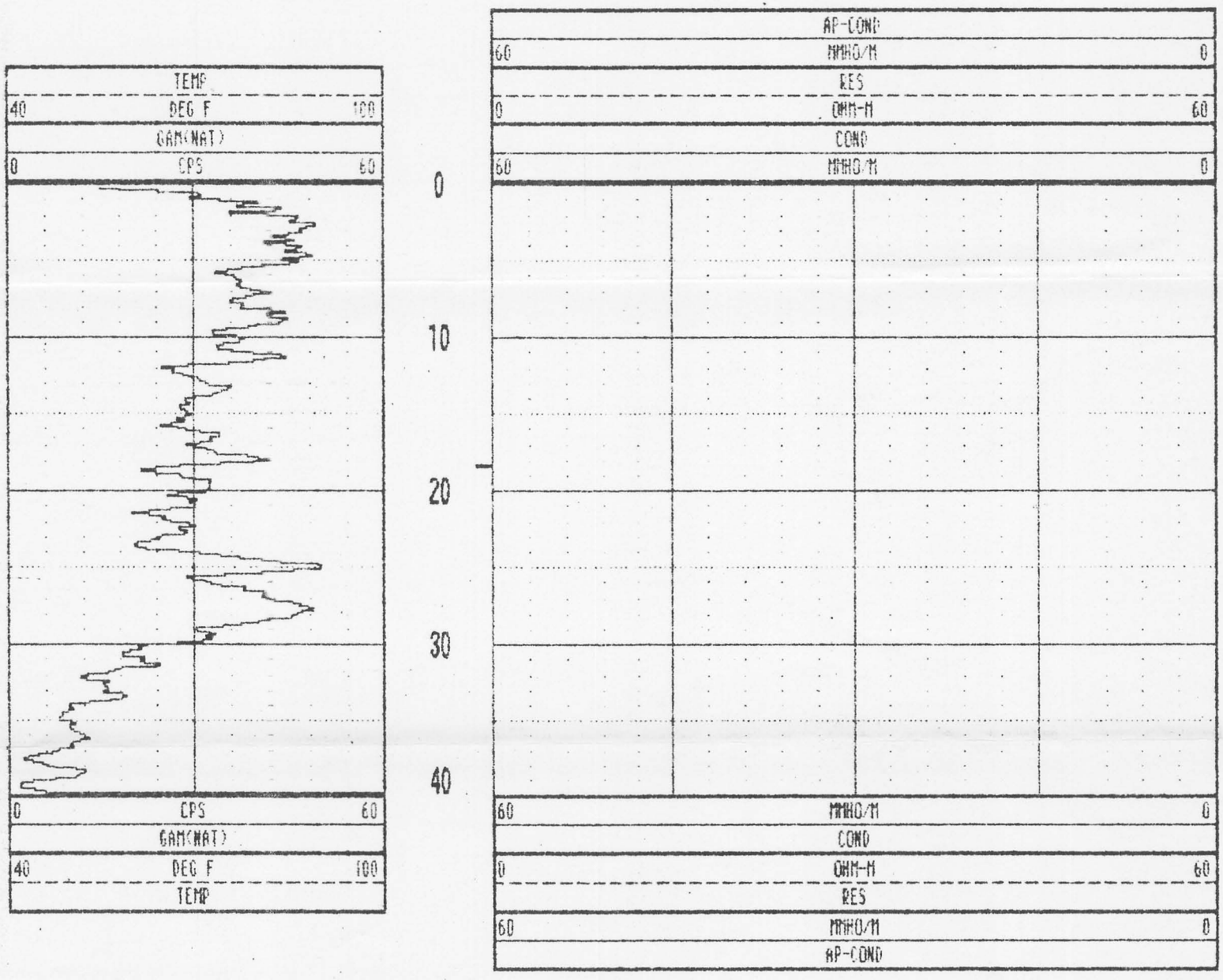
REMARKS :

ELECTRIC LOG INTERPRETATION IS EMPIRICAL IN NATURE. EXTREME HOLE COND WILL MAKE COMPLETELY ACCURATE INTERPRETATIONS DIFFICULT.

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



065G06DA 05/23/96 976



065G06DA 05/23/96 1025

TRI STATE
TESTING SERVICES, INC.

Measurement of Hydraulic Conductivity

Client: EnSafe/Allen & Hoshall

Date of Report: 03/01/96 Project No.: E-3-157

Client's Project No.: 010609000

Sample I.D.: 065S06DA16

Soil Description: Gray & Brown Clayey Silt

Test Media: City of Memphis Water

	Pre-Test	Post Test
Wet Density (Lbs/ft^3)	124.8	125.6
Dry Density (Lbs/ft^3)	96.5	97.6
Moisture (% Dry Wt)	29.3	28.7
Porosity (n)	.43	.42
Degree of Saturation (%)	1.0	1.0
Specific Gravity (ASTM D-854)	2.70	---

Permeability

Temperature Correction, $R_t = 1.041$

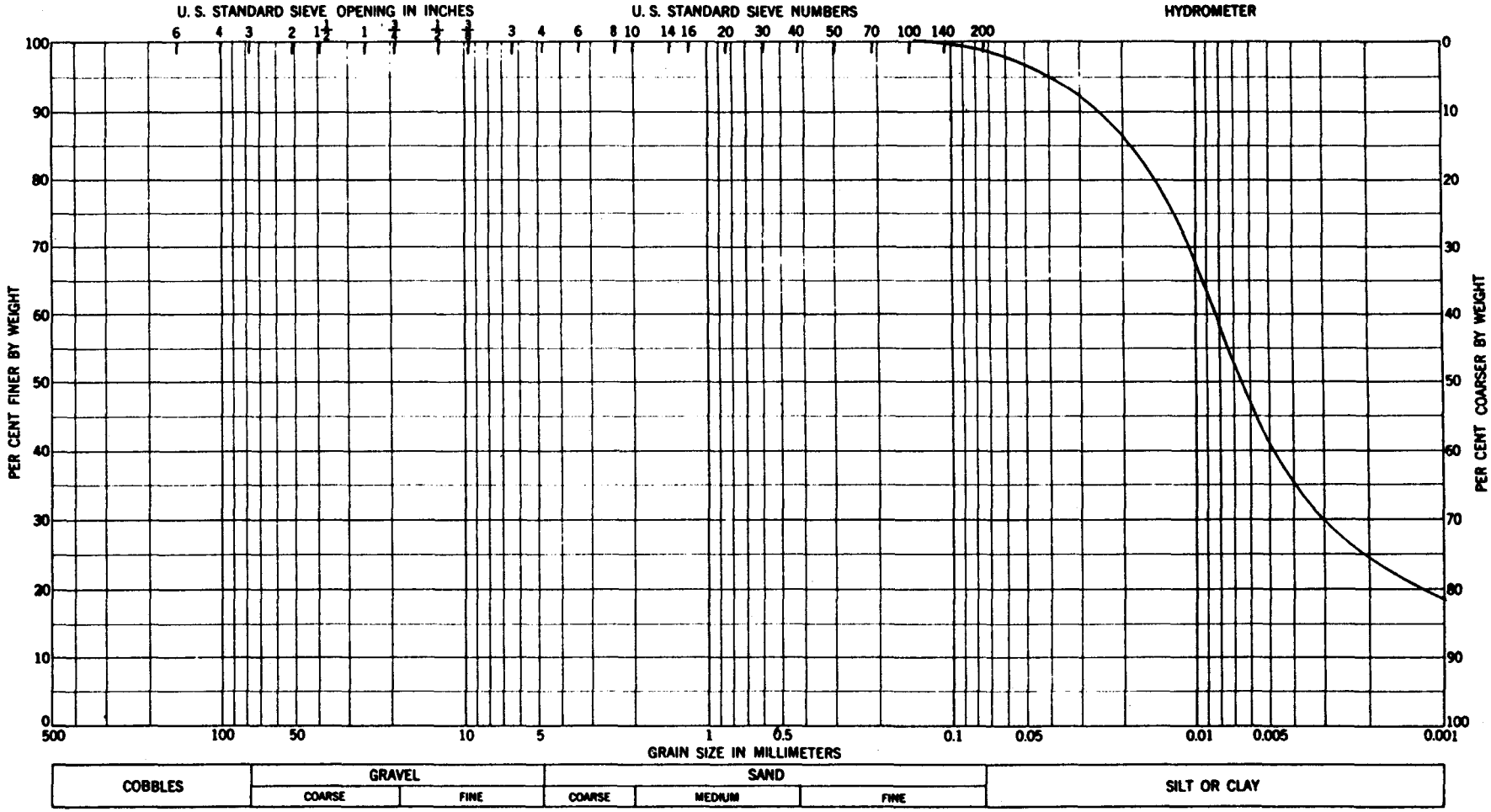
$K_1 = 4.6 \times 10^{-6}$ cm/sec
$K_2 = 4.0 \times 10^{-6}$ cm/sec
$K_3 = 5.1 \times 10^{-6}$ cm/sec
$K_4 = 4.7 \times 10^{-6}$ cm/sec

Coefficient of Permeability, $K_{20} = 4.8 \times 10^{-6}$ cm/sec

Tested in accordance with ASTM D-5084-90.

Lab No. P-96-012 Reviewed By: David D. McCray

6756 Buckles Cove Memphis, TN 38133 901-385-1199 FAX 901-386-6614



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
065506DA16			29			

Project EnSafe/A&H # 010609000

Area

Boring No.

Date 03/01/96

GRADATION CURVES

TRI-STATE TESTING SERVICES, INC.

TRI STATE
TESTING SERVICES, INC.

Measurement of Hydraulic Conductivity

Client: EnSafe/Allen & Hoshall

Date of Report: 03/01/96 Project No.: E-3-157

Client's Project No.: 0106090000

Sample I.D.: 065S06DA40

Soil Description: Gray gravelly Sand with trace of silt

Test Media: City of Memphis Water

	Pre-Test	Post Test
Wet Density (Lbs/ft^3)	136.9	137.4
Dry Density (Lbs/ft^3)	127.8	120.6
Moisture (% Dry Wt)	7.1	13.9
Porosity (n)	.20	.24
Degree of Saturation (%)	.71	1.0
Specific Gravity (ASTM D-854)	2.57	---

Permeability

Temperature Correction, R_t = 1.000

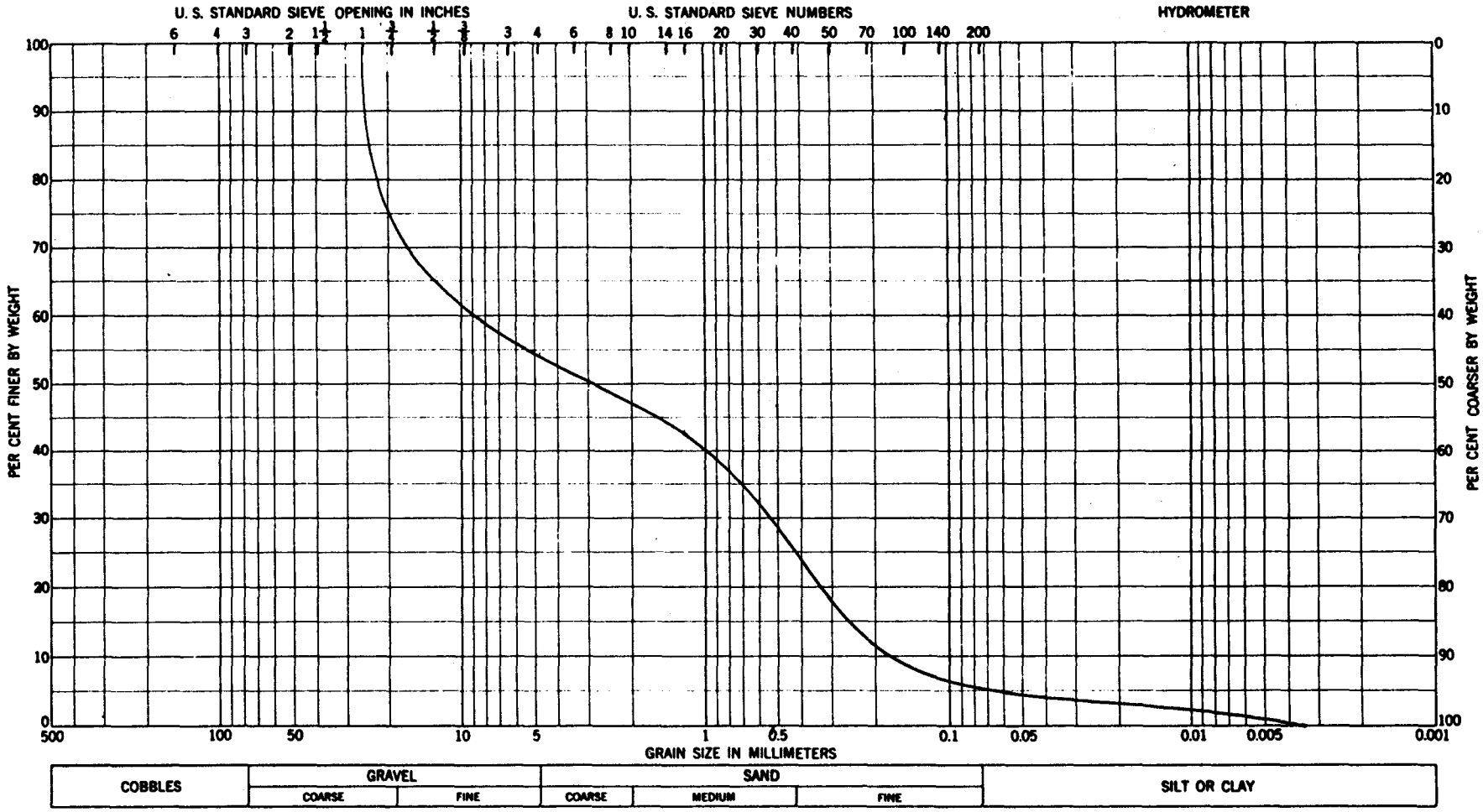
$K_1 = 1.9 \times 10^{-4}$ cm/sec
$K_2 = 2.0 \times 10^{-4}$ cm/sec
$K_3 = 1.1 \times 10^{-4}$ cm/sec
$K_4 = 1.8 \times 10^{-4}$ cm/sec

Coefficient of Permeability, $K_{20} = 1.8 \times 10^{-4}$ cm/sec

Tested in accordance with ASTM D-5084-90.

Lab No. P-96-013 Reviewed By: David D. McCray

6756 Buckles Cove Memphis, TN 38133 901-385-1199 FAX 901-386-6614



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
065S06DA40			7			

Project EnSafe/A&H # 010609000

Area

Boring No.

Date 03/01/96

GRADATION CURVES

TRI-STATE TESTING SERVICES, INC.

BACKGROUND WELLS

SOIL BORING/MONITORING WELL LOGS

Environmental & Safety Designs, Inc.

Monitoring Well ~~BG-02-LF~~ OBGG02LF

Project: *NAS Memphis*	Location: *Millington, TN. Background Site #2*
Project No.: *N0094*	Surface Elevation: *feet msl*
Started at *0745 on 1-17-95*	TOC Elevation: *feet msl*
Completed at *0845 on 1-17-95*	Depth to Groundwater: *feet* Measured:
Drilling Method: *Rotasonic*	Groundwater Elevation: *feet msl*
Drilling Company: *North Star Drilling*	Total Depth: *87.0 feet*
Geologist: *Jack Carmichael and William Parks*	Well Screen: *67 to 77 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
85							SC			bentonite
			11	100	BG			End of boring at 87'.		
90										
95										
100										
105										
110										
115										
120										

EnSafe (SM)

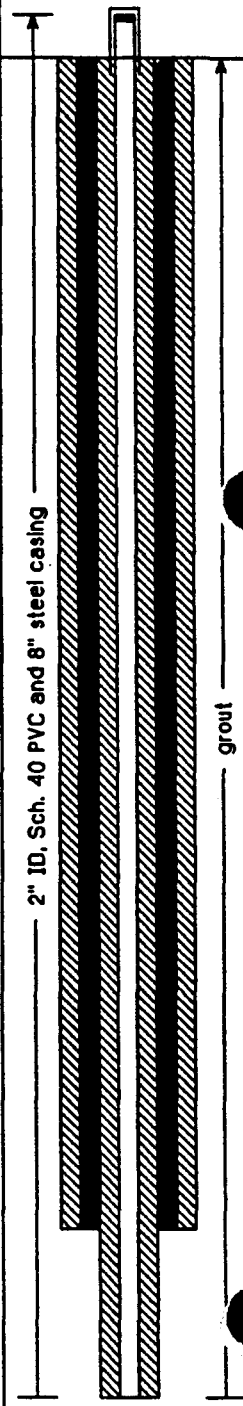
Environmental & Safety Designs, Inc.

Monitoring Well ~~BG-04-LF~~ OBGG04LF

Project: *NAS Memphis*	Location: *Millington, TN - Background Site #4*
Project No.: *N0094*	Surface Elevation: *feet msl*
Started at *1000 on 1-11-95*	TOC Elevation: *feet msl*
Completed at *1115 on 1-11-95*	Depth to Groundwater: *feet* Measured:
Drilling Method: *Rotasonic*	Groundwater Elevation: *feet msl*
Drilling Company: *North Star Drilling*	Total Depth: *76.0 feet*
Geologist: *Jack Carmichael*	Well Screen: *60 to 70 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
								Fill and debris.	
			1	100	BG			Silty clay, pale olive with reddish brown mottling, stiff.	
5									
10								Clayey silt, yellow gray to yellow brown, mottled with reddish brown.	
			2	100	BG			Clayey silt, yellow gray to yellow brown mottled yellowish orange, laminated, low plasticity.	
15									
20			3	100	BG		ML	Silt, medium gray, massive, low plasticity, traces of iron inclusions.	
25								Silt, clayey, medium gray stained yellowish orange, plastic.	
			4	100	BG				
30								Silt, clayey, yellow gray to olive gray.	
35			5	100	BG				
40							GP	Sand, silty, with gravel, yellowish gray to yellowish brown, mottled yellow orange, moist to wet	

WELL DIAGRAM



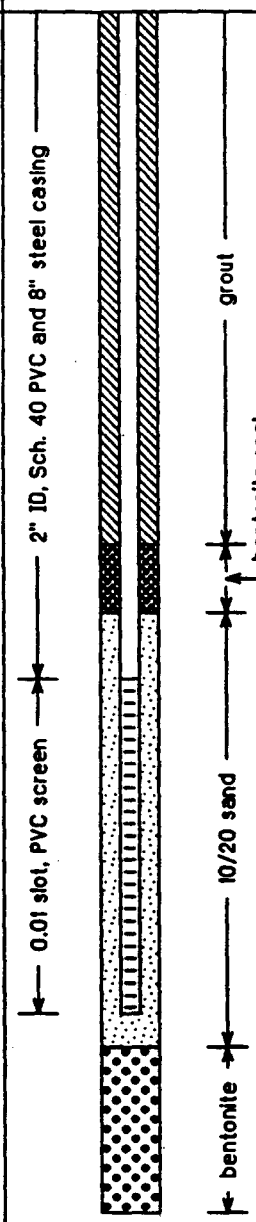
Environmental & Safety Designs, Inc.

Monitoring Well ~~BG-04-LF~~ OBGG04LF

Project: *NAS Memphis*	Location: *Millington, TN. Background Site #4*
Project No.: *N0094*	Surface Elevation: *feet msl*
Started at *1000 on 1-11-95*	TOC Elevation: *feet msl*
Completed at *1115 on 1-11-95*	Depth to Groundwater: *feet* Measured:
Drilling Method: *Rotasonic*	Groundwater Elevation: *feet msl*
Drilling Company: *North Star Drilling*	Total Depth: *76.0 feet*
Geologist: *Jack Carmichael*	Well Screen: *60 to 70 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			6	108	BG			Gravel, sandy, fine to very coarse sand, traces of silt, wet, yellow gray.	
45			7	100	BG				
50									
55			8	90	BG		GP	Same as above with color changing to dark yellowish orange to moderate yellowish brown.	
60									
65			9	85	BG				
70								Sand with clay, sand is yellow gray stained yellowish orange, clay light brownish gray, moist to wet.	
							SC	Sand, very fine, clay, medium dark gray, olive black laminations.	
75			10	100	BG			End of boring at 76'	
80									

WELL DIAGRAM



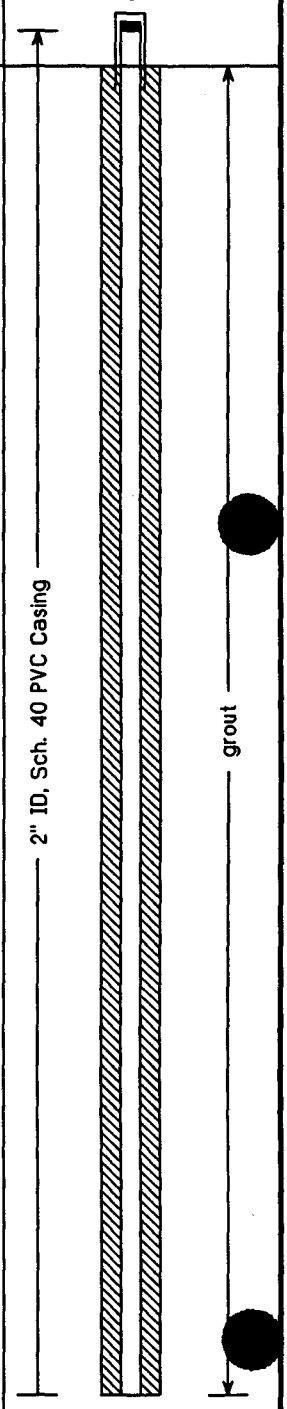
EnSafe/Allen & Hoshall

Monitoring Well OBGG11UA

Project: *NSA Memphis*	Location: *Millington, TN. Background Location #11*
Project No.: *0106-08420*	Surface Elevation: *261.81 feet msl*
Started at *0800 on 3-18-96*	TOC Elevation: *263.84 feet msl*
Completed at *1300 on 3-18-96*	Depth to Groundwater: *16.42 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic*	Groundwater Elevation: *247.42 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *76.0 feet*
Geologist: *J. Kingsbury*	Well Screen: *38 to 48 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							GP/GM	Gravel and silt (fill)	
									259.8
			1	100	BG			Brown silt with some dark yellowish-orange staining and organic flecks	
5								Silt, yellowish brown mottled with yellowish gray, moist	
10			2	90	BG			Silt, olive gray to greenish-gray, wet	
15							ML	Silt, brownish-gray to greenish-gray, wet	
								Large wood fragment	
20								With sand streaks between 22' and 26', wet	
25			3	105	BG				
30									

WELL DIAGRAM



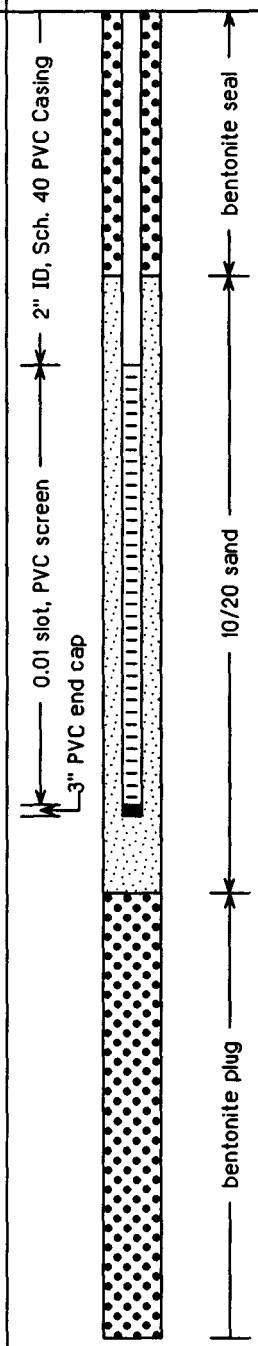
EnSafe/Allen & Hoshall

Monitoring Well OBGG11UA

Project: *NSA Memphis*	Location: *Millington, TN. Background Location #11*
Project No.: *0106-08420*	Surface Elevation: *261.81 feet msl*
Started at *0800 on 3-18-96*	TOC Elevation: *263.84 feet msl*
Completed at *1300 on 3-18-96*	Depth to Groundwater: *16.42 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic*	Groundwater Elevation: *247.42 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *76.0 feet*
Geologist: *J. Kingsbury*	Well Screen: *38 to 48 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							ML	With sand streaks between 30' and 36', wet Silt and sand, olive-gray	224.8
35									
40							SW/GW	Sand and gravel, reddish-brown to orangish-yellow	217.8
45			4	100	BG		SW	Sand, coarse-grained, with some gravel, grayish-yellow to dusky yellow	209.8
50									
55							GW/GC	Gravel with some sand and clay in the matrix, grayish-yellow to 54' turning to reddish-brown at 56'.	205.8
							SW/GW	Sand and gravel, reddish-brown to yellowish-orange	202.8
60							GW	Gravel lense between 59' and 61'	

WELL DIAGRAM



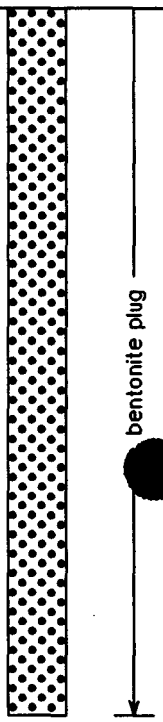
EnSafe/Allen & Hoshall

Monitoring Well OBGG11UA

Project: *NSA Memphis*	Location: *Millington, TN. Background Location #11*
Project No.: *0106-08420*	Surface Elevation: *261.81 feet msl*
Started at *0800 on 3-18-96*	TOC Elevation: *263.84 feet msl*
Completed at *1300 on 3-18-96*	Depth to Groundwater: *16.42 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic*	Groundwater Elevation: *247.42 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *76.0 feet*
Geologist: *J. Kingsbury*	Well Screen: *38 to 48 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
			5	100	BG		GW		200.8
							SW/GW	Predominantly sand with several layers of iron-cemented gravel 1" to 2" thick, maximum diameter of gravel is 2"	
65									
									192.8
70			6	120	BG		SP/CL	Cockfield Formation: sand, fine-grained and olive-gray, with some seams of brown clay and organic material	
75									185.8
								Soil boring terminated at 76'.	
80									
85									
90									

WELL DIAGRAM



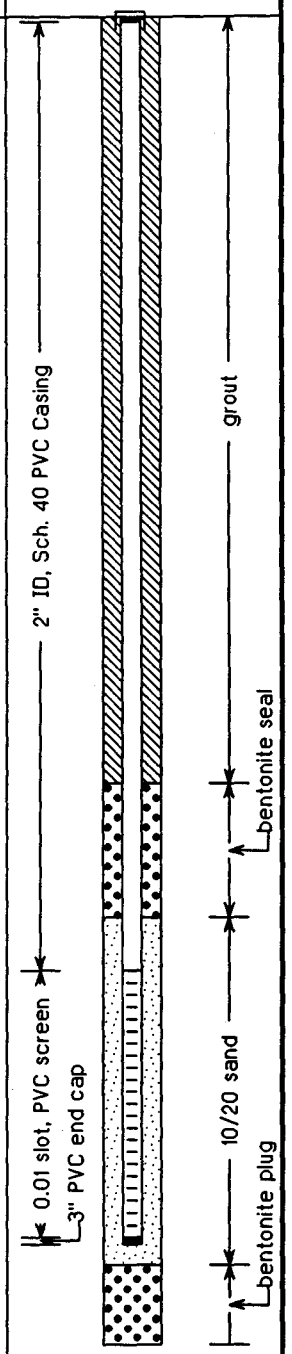
EnSafe/Allen & Hoshall

Monitoring Well OBGG12UF

Project: *NSA Memphis*	Location: *Millington, TN. Background Location #12*
Project No.: *0106-08420*	Surface Elevation: *268.90 feet msl*
Started at *1415 on 2-18-96*	TOC Elevation: *268.71 feet msl*
Completed at *1530 on 2-18-96*	Depth to Groundwater: *9.09 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic*	Groundwater Elevation: *259.62 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *66.0 feet*
Geologist: *J. Kingsbury*	Well Screen: *36 to 46 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							SP SC	Asphalt, sand, and clay (fill)	
			1	100	BG				265.9
5							CL ML	Clay and silt, gray	
									262.9
10			2	90	BG		ML	Silt, yellowish-brown to yellowish-gray with organic specks and iron staining, moist	
15									252.9
							CL	Clay with some silt, brownish-gray, stiff	
20									248.9
25			3	75	BG		ML	Silt, light olive gray with some reddish-brown staining and mottling	
30									238.9
							SP	Fine sand, tan to yellowish-brown	
									234.9
35							SW	Sand, medium to coarse-grained, reddish-brown to light brown	
									232.9
40							SW GW	Sand and gravel, reddish-brown, majority of gravel from 40' to 47', with gravel up to 2" diameter	
45			4	100	BG				
									221.9
50							SC SM	Cockfield Formation: sand, silt, and clay, light olive gray to light yellowish-brown, micaceous, finely lignitic, with streaks of clay throughout	

WELL DIAGRAM



EnSafe/Allen & Hoshall

Monitoring Well OBGG12UF

Project: *NSA Memphis*	Location: *Millington, TN. Background Location #12*
Project No.: *0106-08420*	Surface Elevation: *268.90 feet msl*
Started at *1415 on 2-18-96*	TOC Elevation: *268.71 feet msl*
Completed at *1530 on 2-18-96*	Depth to Groundwater: *9.09 feet* Measured: *4/8/96*
Drilling Method: *Rotasonic*	Groundwater Elevation: *259.62 feet msl*
Drilling Company: *Alliance Environmental, Inc.*	Total Depth: *66.0 feet*
Geologist: *J. Kingsbury*	Well Screen: *36 to 46 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
55										
60			5	80	BG		SC SM			bentonite plug
65									202.9	
								Soil boring terminated at 66.0'.		
70										
75										
80										
85										
90										
95										
100										

★ Change BG log IDs

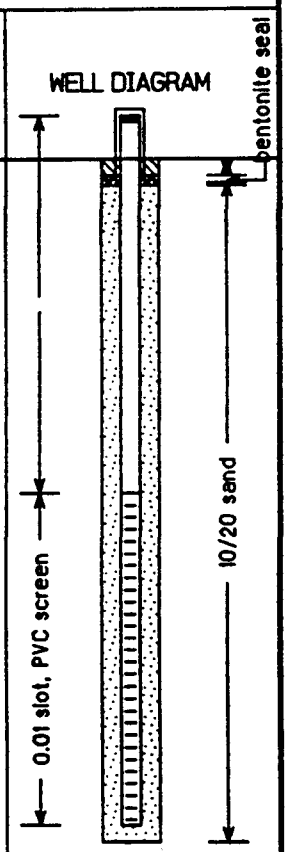
Environmental & Safety Designs, Inc.

Monitoring Well ~~BG-02-S~~ OBGG-02LS

Project: *NAS Memphis*	Location: *Millington, TN. Background Site #2*
Project No.: *N0094*	Surface Elevation: *feet msl*
Started at *0745 on 1-12-95*	TOC Elevation: *feet msl*
Completed at *0845 on 1-12-95*	Depth to Groundwater: *feet* Measured:
Drilling Method: *Rotasonic*	Groundwater Elevation: *feet msl*
Drilling Company: *North Star Drilling*	Total Depth: *20.0 feet*
Geologist: *Jack Carmichael and William Parks*	Well Screen: *10 to 20 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
								Fill and roots.	
			1	75	BG			Silt, clayey, yellow brown to gray brown, moist, soft.	
5									
10							ML	Silt, clayey, yellow gray to olive gray, stained yellow orange, laminated with orange to brown thin striations.	
			2	50	BG				
15			3	87.5	BG				
20			4	75	BG			Log information taken form the boring for the lower fluvial well BG-2.	
25									
30									
35									
40									

WELL DIAGRAM



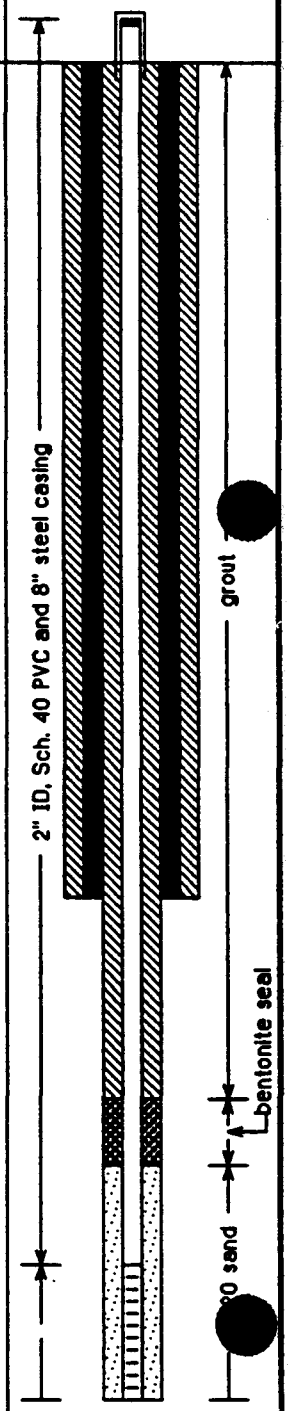
Environmental & Safety Designs, Inc.

Monitoring Well ~~BG-02-UF~~ OBGG02UF

Project: *NAS Memphis*	Location: *Millington, TN. Background Site #2*
Project No.: *N0094*	Surface Elevation: *feet msl*
Started at *0745 on 1-17-95*	TOC Elevation: *feet msl*
Completed at *0845 on 1-17-95*	Depth to Groundwater: *feet* Measured:
Drilling Method: *Rotasonic*	Groundwater Elevation: *feet msl*
Drilling Company: *North Star Drilling*	Total Depth: *46.0 feet*
Geologist: *Jack Carmichael and William Parks*	Well Screen: *36 to 46 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
								Fill and roots.	
			1	75	BG			Silt, clayey, yellow brown to gray brown, moist, soft.	
5									
10								Silt, clayey, yellow gray to olive gray, stained yellow orange, laminated with orange to brown thin striations.	
			2	50	BG				
15							ML		
			3	87.5	BG				
20			4	75	BG				
			5	100	BG			Silt, clayey, light olive gray to yellow gray with iron staining, trace gravel.	
25								Silt, clayey, light olive gray, less iron staining.	
30								Sand, silty, trace clay, some gravel, yellow brown to gray brown.	
								Sand, medium to coarse with gravel, orange brown to yellow.	
35							GP		
			6	108	BG			Sand, fine, with trace gravel, grayish pink to grayish orange, some yellow orange mottling.	
40									

WELL DIAGRAM



Environmental & Safety Designs, Inc.

Monitoring Well ~~BG-02-UF~~ OBG02UF

Project: *NAS Memphis*	Location: *Millington, TN. Background Site #2*
Project No.: *N0094*	Surface Elevation: *feet msl*
Started at *0745 on 1-17-95*	TOC Elevation: *feet msl*
Completed at *0845 on 1-17-95*	Depth to Groundwater: *feet* Measured:
Drilling Method: *Rotasonic*	Groundwater Elevation: *feet msl*
Drilling Company: *North Star Drilling*	Total Depth: *46.0 feet*
Geologist: *Jack Carmichael and William Parks*	Well Screen: *36 to 46 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
45							GP	Same as above but dark yellowish orange.		10/20 sand
			7	90	BG			Log information taken form the boring for the lower fluvial well BG-2.		
50										
55										
60										
65										
70										
75										
80										

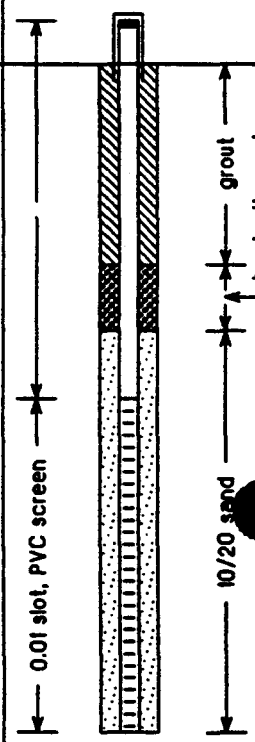
Environmental & Safety Designs, Inc.

Monitoring Well ~~BG-04-S~~ OBGG04LS

Project: *NAS Memphis*	Location: *Memphis, TN*
Project No.: *N0094*	Surface Elevation: *feet msl*
Started at *1000 on 1-11-95*	TOC Elevation: *feet msl*
Completed at *1115 on 1-11-95*	Depth to Groundwater: *feet* Measured:
Drilling Method: *Rotasonic*	Groundwater Elevation: *feet msl*
Drilling Company: *North Star Drilling*	Total Depth: *20.0 feet*
Geologist: *Jack Carmichael*	Well Screen: *10 to 20 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
								Fill and debris.	
			1	100	BG			Silty clay, pale olive with reddish brown mottling, stiff.	
5									
10							ML	Clayey silt, yellow gray to yellow brown, mottled with reddish brown.	
			2	100	BG			Clayey silt, yellow gray to yellow brown mottled yellowish orange, laminated, low plasticity.	
15									
20			3	100	BG			Log information taken from the boring for the lower fluvial well bg-4.	
25									
30									
35									
40									

WELL DIAGRAM



EnSafe (SM)

Environmental & Safety Designs, Inc.

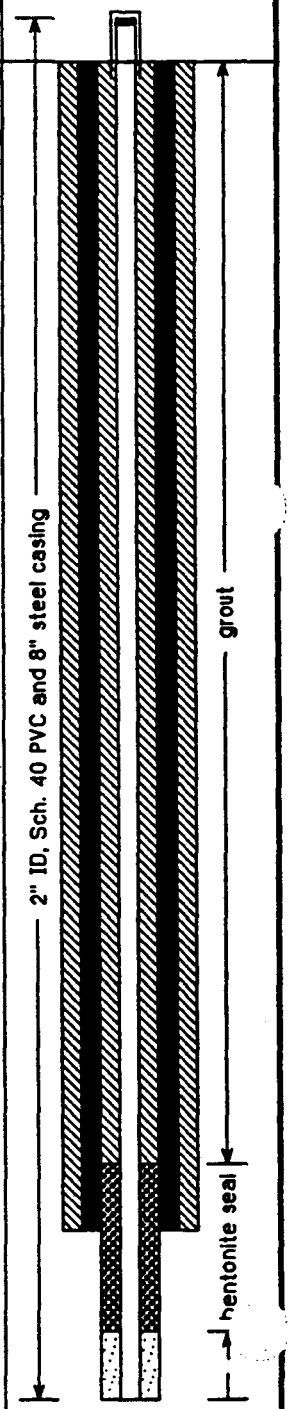
Monitoring Well ~~BG-04-UF~~

CBGG04UF

Project: *NAS Memphis*	Location: *Millington, TN. Background Site #4*
Project No.: *N0094*	Surface Elevation: *feet msl*
Started at *1000 on 1-16-95*	TOC Elevation: *feet msl*
Completed at *1115 on 1-16-95*	Depth to Groundwater: *feet* Measured:
Drilling Method: *Rotasonic*	Groundwater Elevation: *feet msl*
Drilling Company: *North Star Drilling*	Total Depth: *50.0 feet*
Geologist: *Jack Carmichael*	Well Screen: *40 to 50 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
								Fill and debris.	
			1	100	BG			Silty clay, pale olive with reddish brown mottling, stiff.	
5									
10								Clayey silt, yellow gray to yellow brown, mottled with reddish brown.	
			2	100	BG			Clayey silt, yellow gray to yellow brown mottled yellowish orange, laminated, low plasticity.	
15									
20			3	100	BG		ML	Silt, medium gray, massive, low plasticity, traces of iron inclusions.	
25								Silt, clayey, medium gray stained yellowish orange, plastic.	
			4	100	BG				
30								Silt, clayey, yellow gray to olive gray.	
35			5	100	BG				
40							GP	Sand, silty, with gravel, yellowish gray to yellowish brown, mottled yellow orange, moist to wet	

WELL DIAGRAM



Environmental & Safety Designs, Inc.

Monitoring Well ~~BG-04-UF~~ OBGG04UF

Project: *NAS Memphis*	Location: *Millington, TN. Background Site #4*
Project No.: *N0094*	Surface Elevation: *feet msl*
Started at *1000 on 1-16-95*	TOC Elevation: *feet msl*
Completed at *1115 on 1-16-95*	Depth to Groundwater: *feet* Measured:
Drilling Method: *Rotasonic*	Groundwater Elevation: *feet msl*
Drilling Company: *North Star Drilling*	Total Depth: *50.0 feet*
Geologist: *Jack Carmichael*	Well Screen: *40 to 50 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)	WELL DIAGRAM
			6	108	BG			Gravel, sandy, fine to very coarse sand, traces of silt, wet, yellow gray.		0.01 slot, PVC screen; 10/20 sand
45			7	100	BG		GP			
50								Log information taken from the boring for the lower fluvial well bg-4.		
55			8	90	BG					
60										
65										
70										
75										
80										

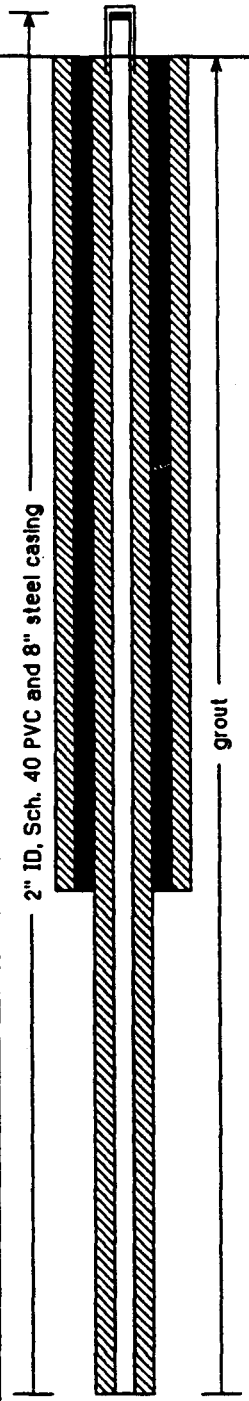
Environmental & Safety Designs, Inc.

Monitoring Well ~~BG-02-LF~~ OBGG02LF

Project: *NAS Memphis*	Location: *Millington, TN. Background Site #2*
Project No.: *N0094*	Surface Elevation: *feet msl*
Started at *0745 on 1-17-95*	TOC Elevation: *feet msl*
Completed at *0845 on 1-17-95*	Depth to Groundwater: *feet* Measured:
Drilling Method: *Rotasonic*	Groundwater Elevation: *feet msl*
Drilling Company: *North Star Drilling*	Total Depth: *87.0 feet*
Geologist: *Jack Carmichael and William Parks*	Well Screen: *67 to 77 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
								Fill and roots.	
5			1	75	BG			Silt, clayey, yellow brown to gray brown, moist, soft.	
10			2	50	BG			Silt, clayey, yellow gray to olive gray, stained yellow orange, laminated with orange to brown thin striations.	
15			3	87.5	BG		ML		
20			4	75	BG				
25			5	100	BG			Silt, clayey, light olive gray to yellow gray with iron staining, trace gravel. Silt, clayey, light olive gray, less iron staining.	
30								Sand, silty, trace clay, some gravel, yellow brown to gray brown. Sand, medium to coarse with gravel, orange brown to yellow.	
35			6	108	BG		GP	Sand, fine, with trace gravel, grayish pink to grayish orange, some yellow orange mottling.	
40									

WELL DIAGRAM



Environmental & Safety Designs, Inc.

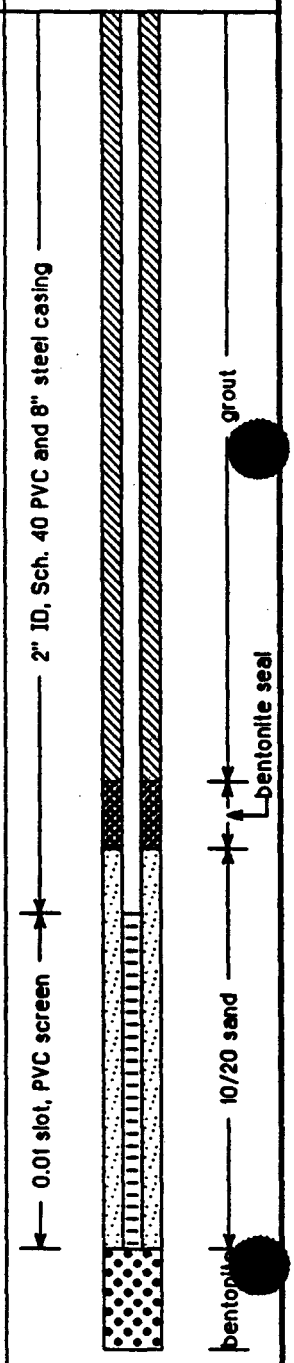
Monitoring Well BG-02-LF

OBGG02LF

Project: *NAS Memphis*	Location: *Millington, TN. Background Site #2*
Project No.: *N0094*	Surface Elevation: *feet msl*
Started at *0745 on 1-17-95*	TOC Elevation: *feet msl*
Completed at *0845 on 1-17-95*	Depth to Groundwater: *feet* Measured:
Drilling Method: *Rotasonic*	Groundwater Elevation: *feet msl*
Drilling Company: *North Star Drilling*	Total Depth: *87.0 feet*
Geologist: *Jack Carmichael and William Parks*	Well Screen: *67 to 77 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
45								Same as above but dark yellowish orange.	
			7	90	BG			Sand, gravelly, silty, dark yellowish orange, wet.	
50									
55									
			8	100	BG		GP	Sand, very fine to fine, silty, traces of clay, yellowish gray to grayish orange.	
60									
65									
			9	105	BG				
70									
75									
			10	120	BG		SC	Sand, fine, clayey and silty, moderate gray to brownish gray, laminated, soft to stiff.	
80									

WELL DIAGRAM

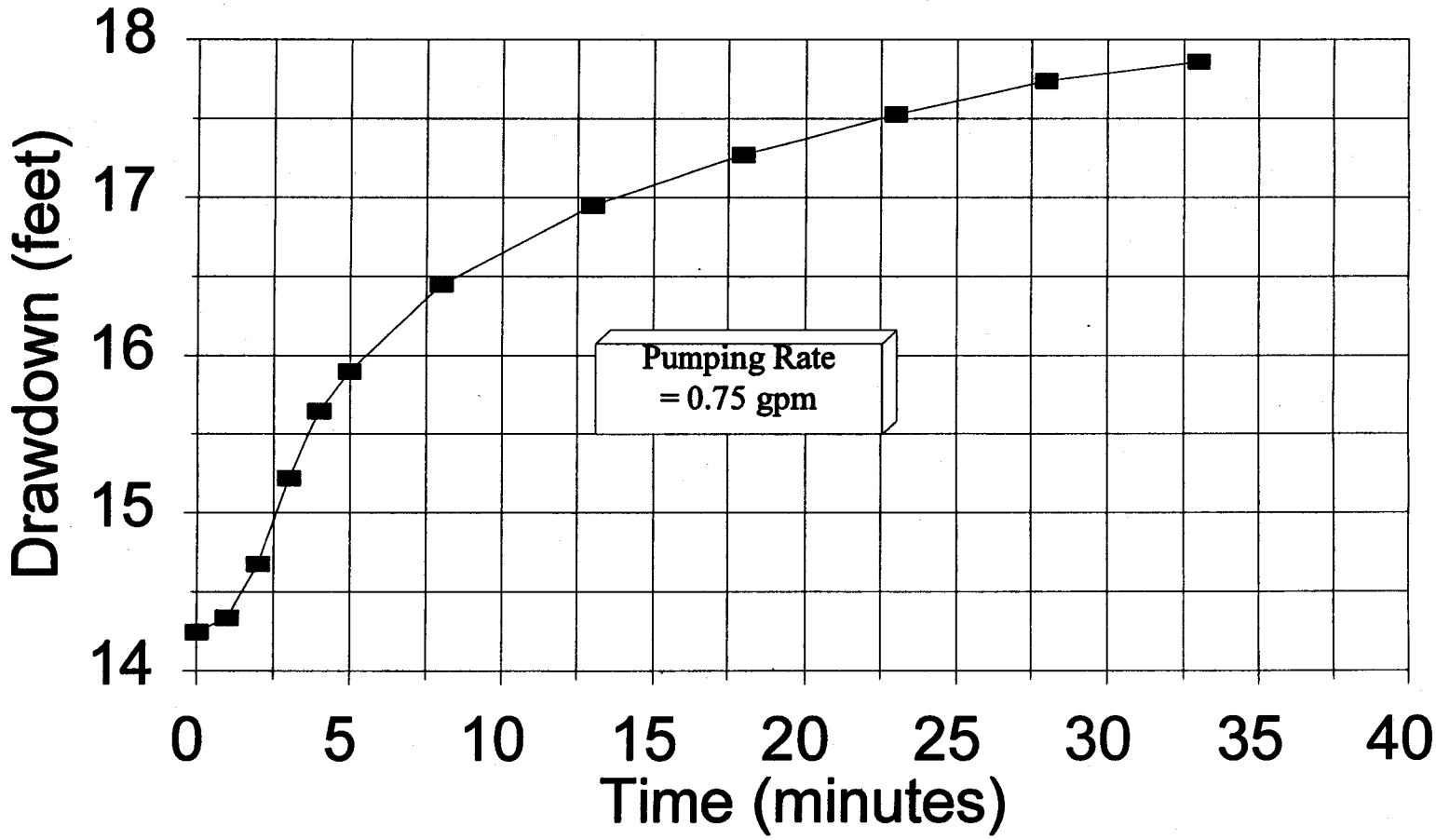


ATTACHMENT 5

ASSEMBLY E SPECIFIC CAPACITY TEST RESULTS AND DATA INPUT FILES

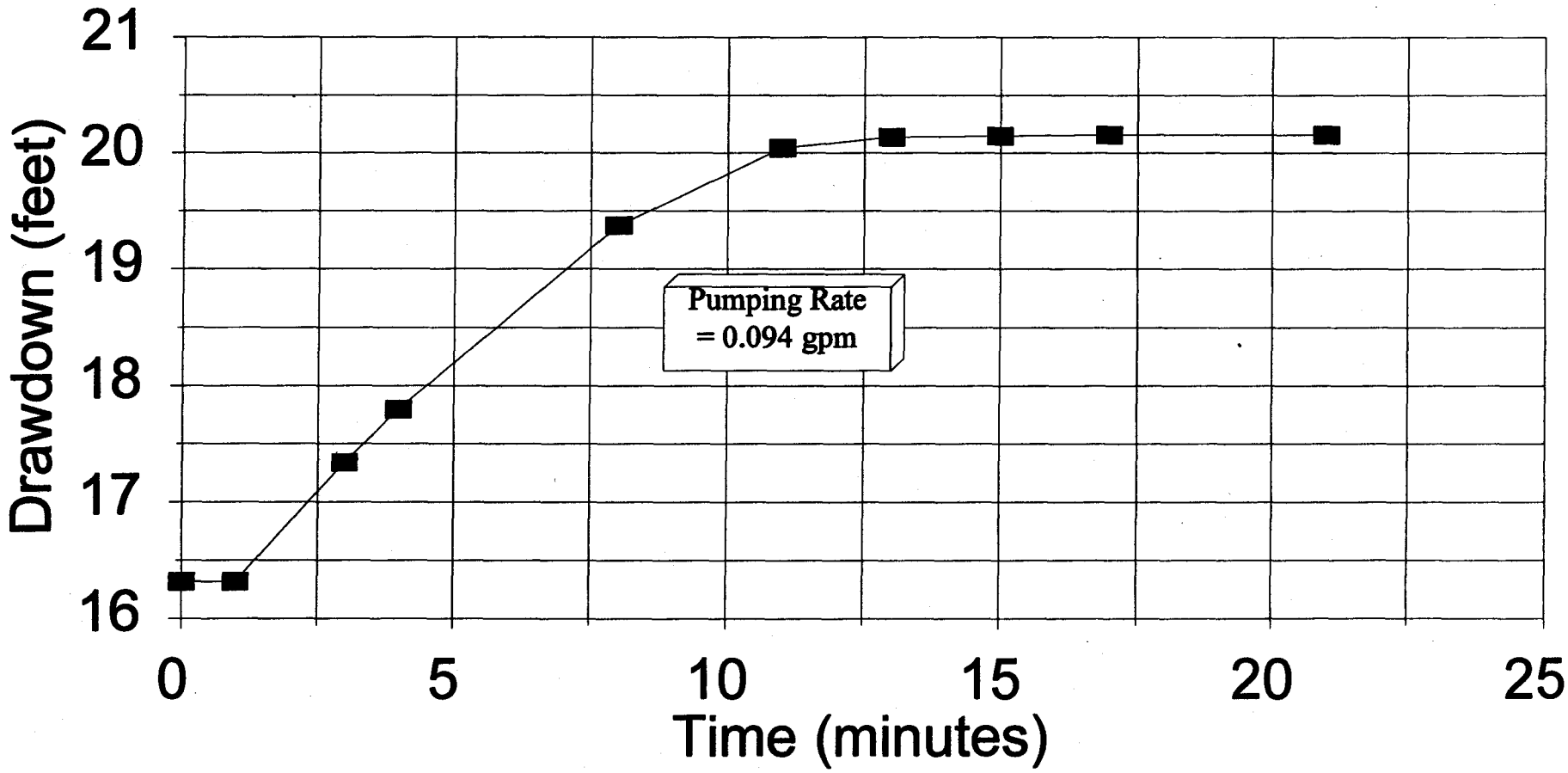
Specific Capacity Test

002G03DA



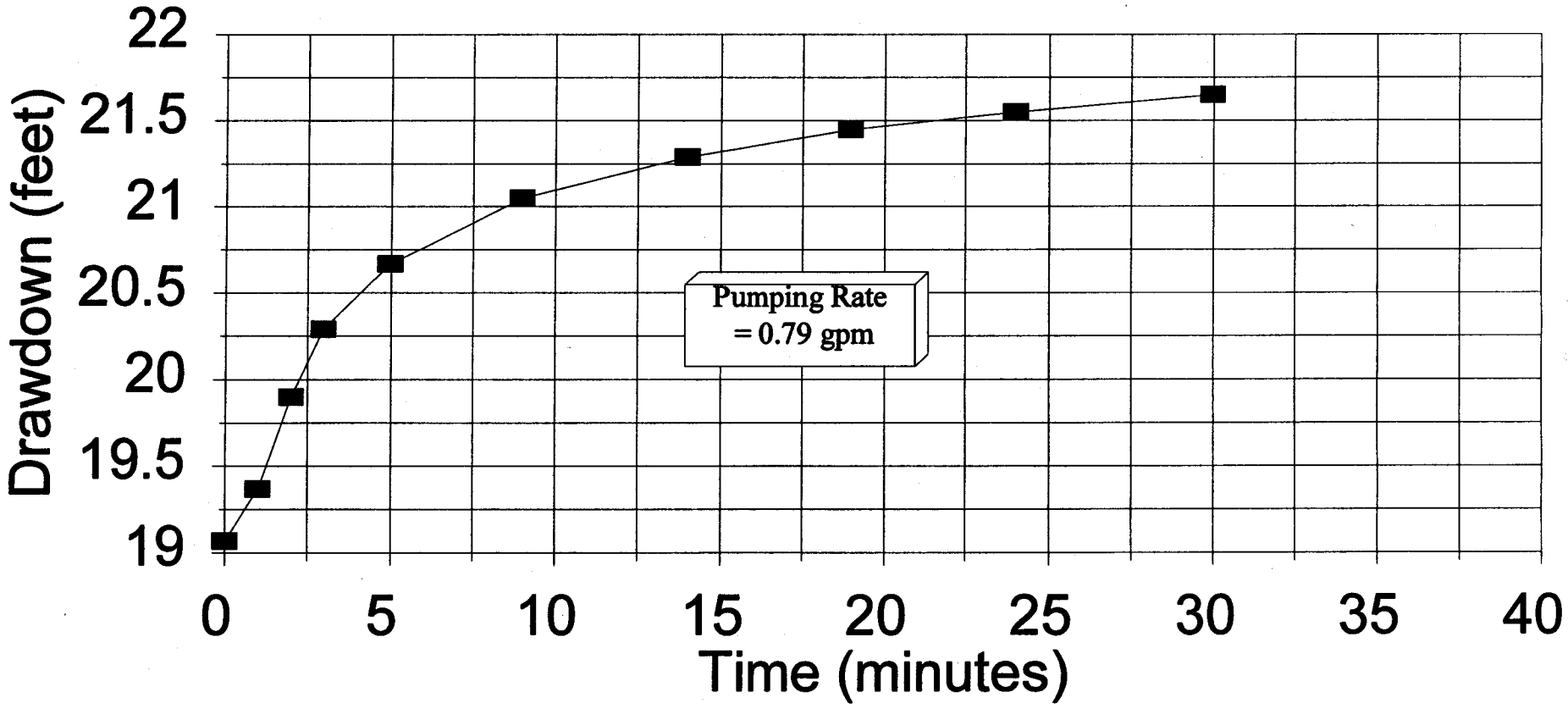
Specific Capacity Test

002G03UA



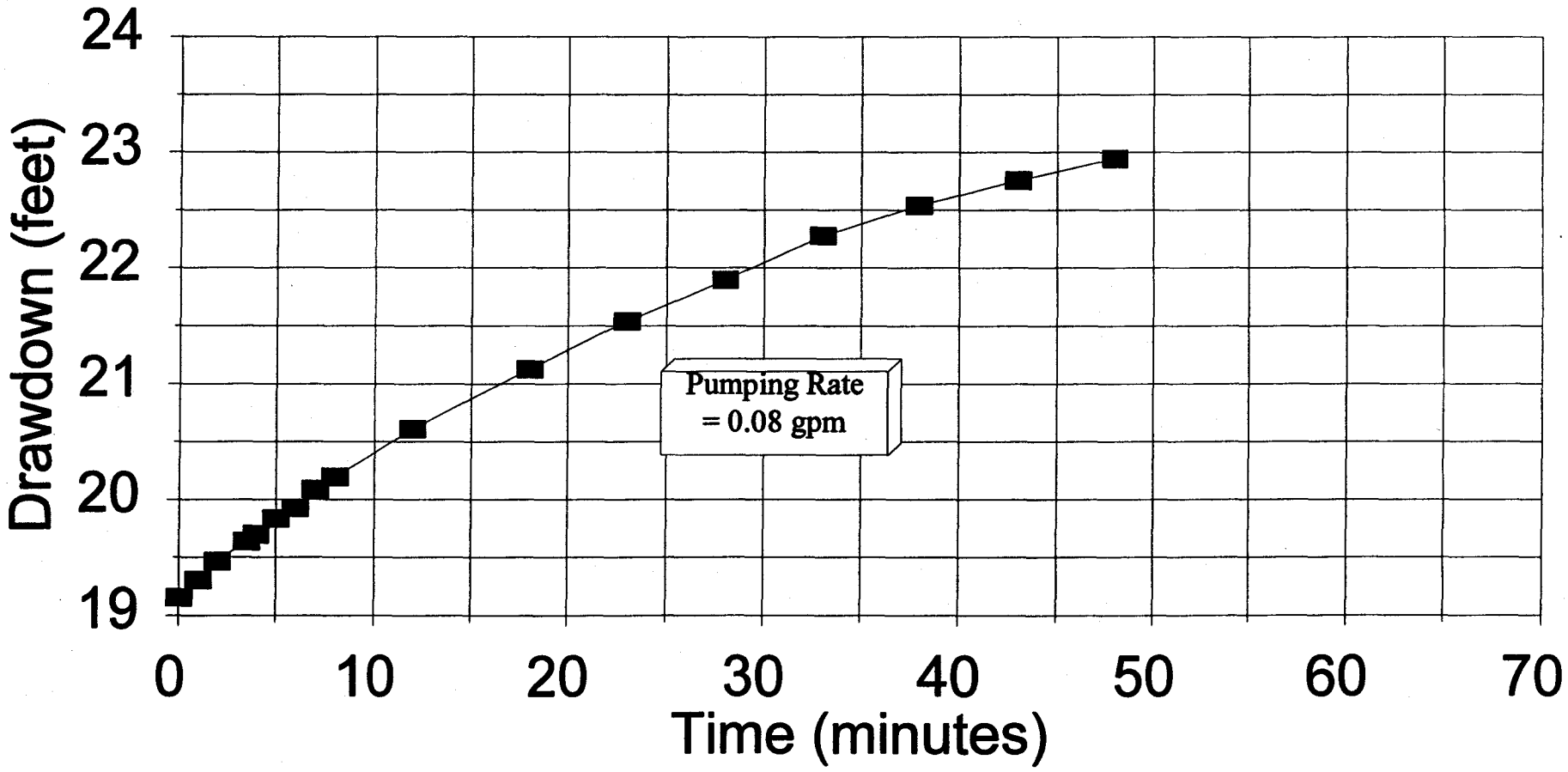
Specific Capacity Test

002G09DA



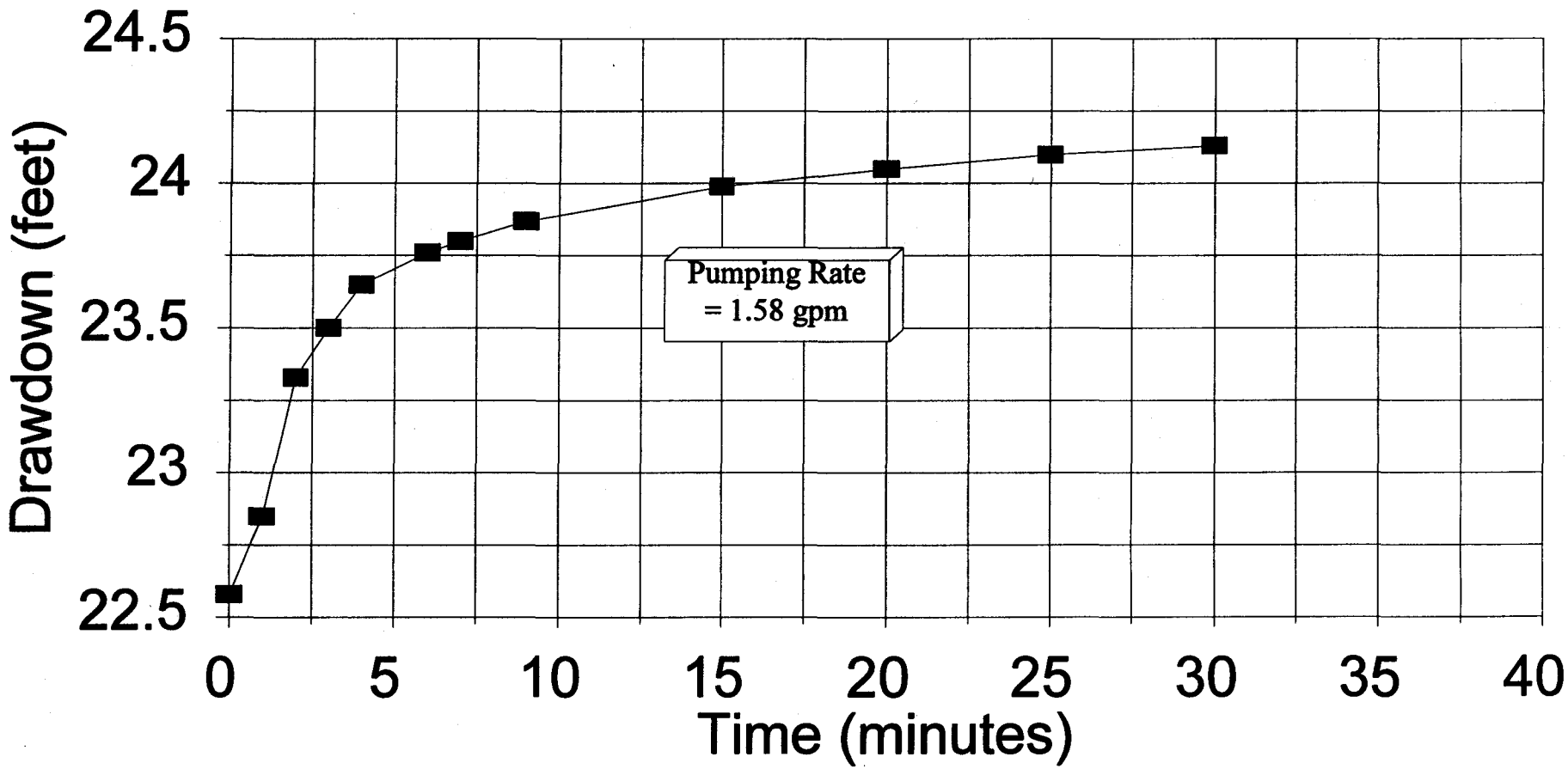
Specific Capacity Test

002G09UA



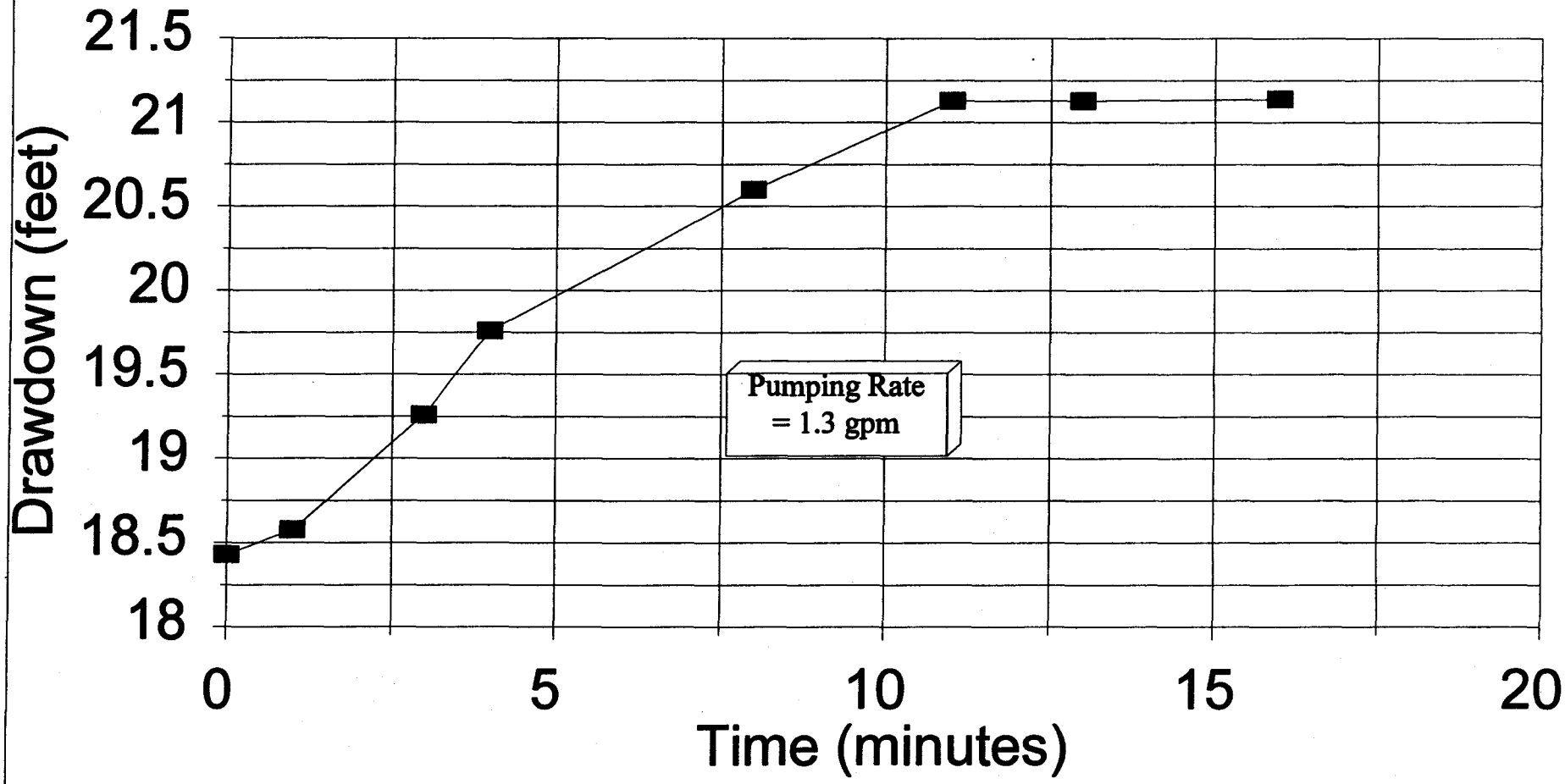
Specific Capacity Test

009G01DA



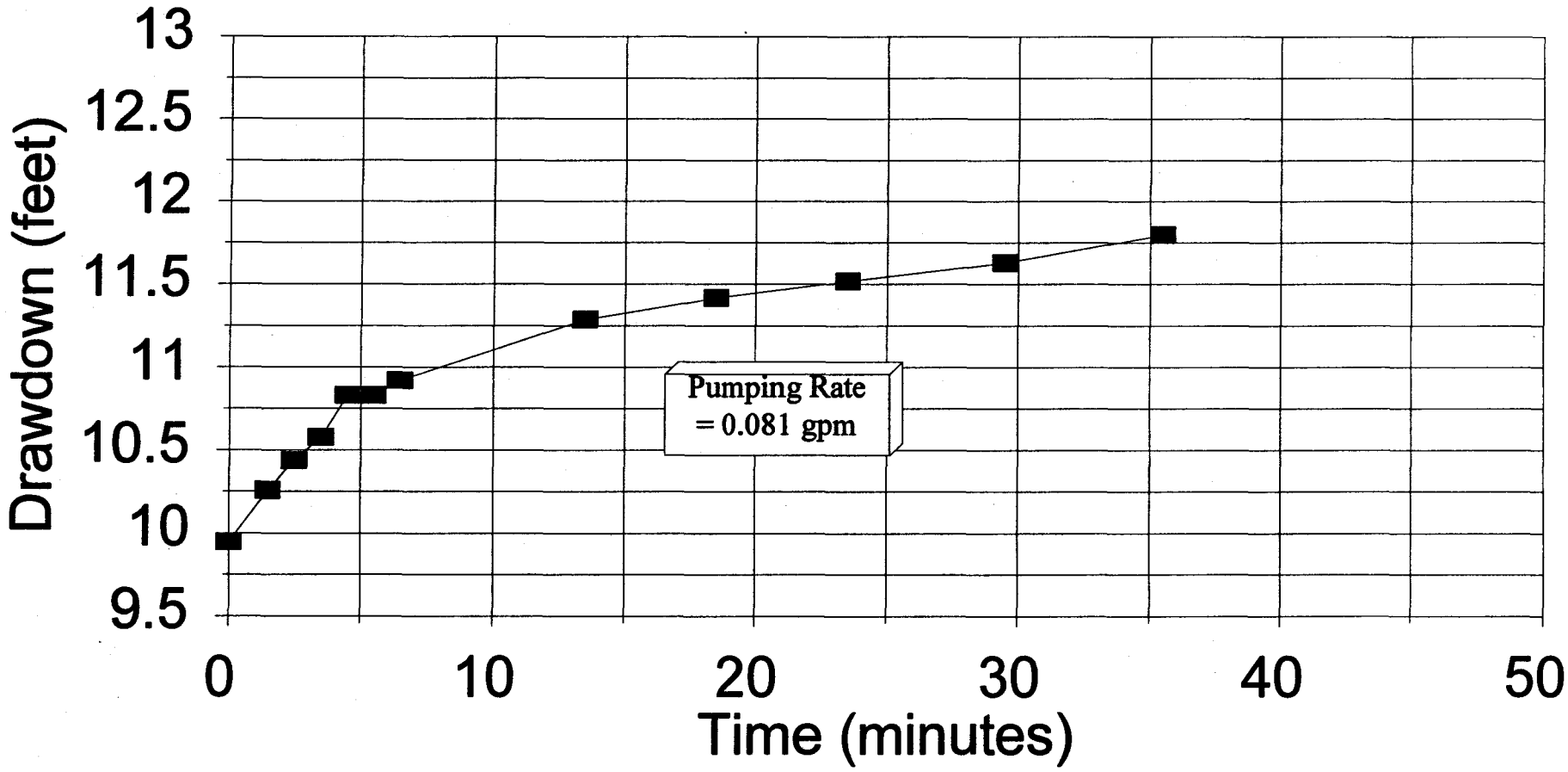
Specific Capacity Test

009G03DA



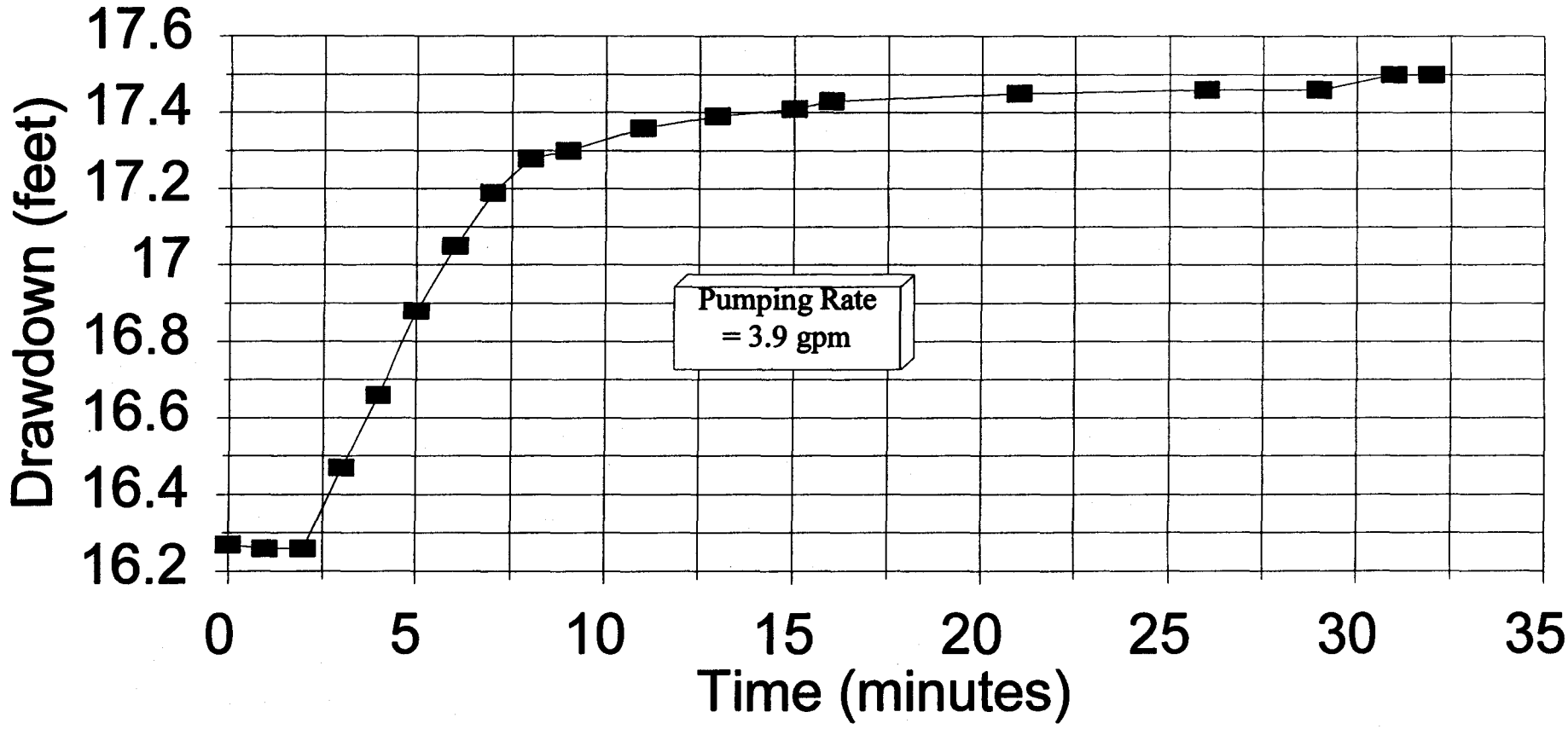
Specific Capacity Test

014G07LF



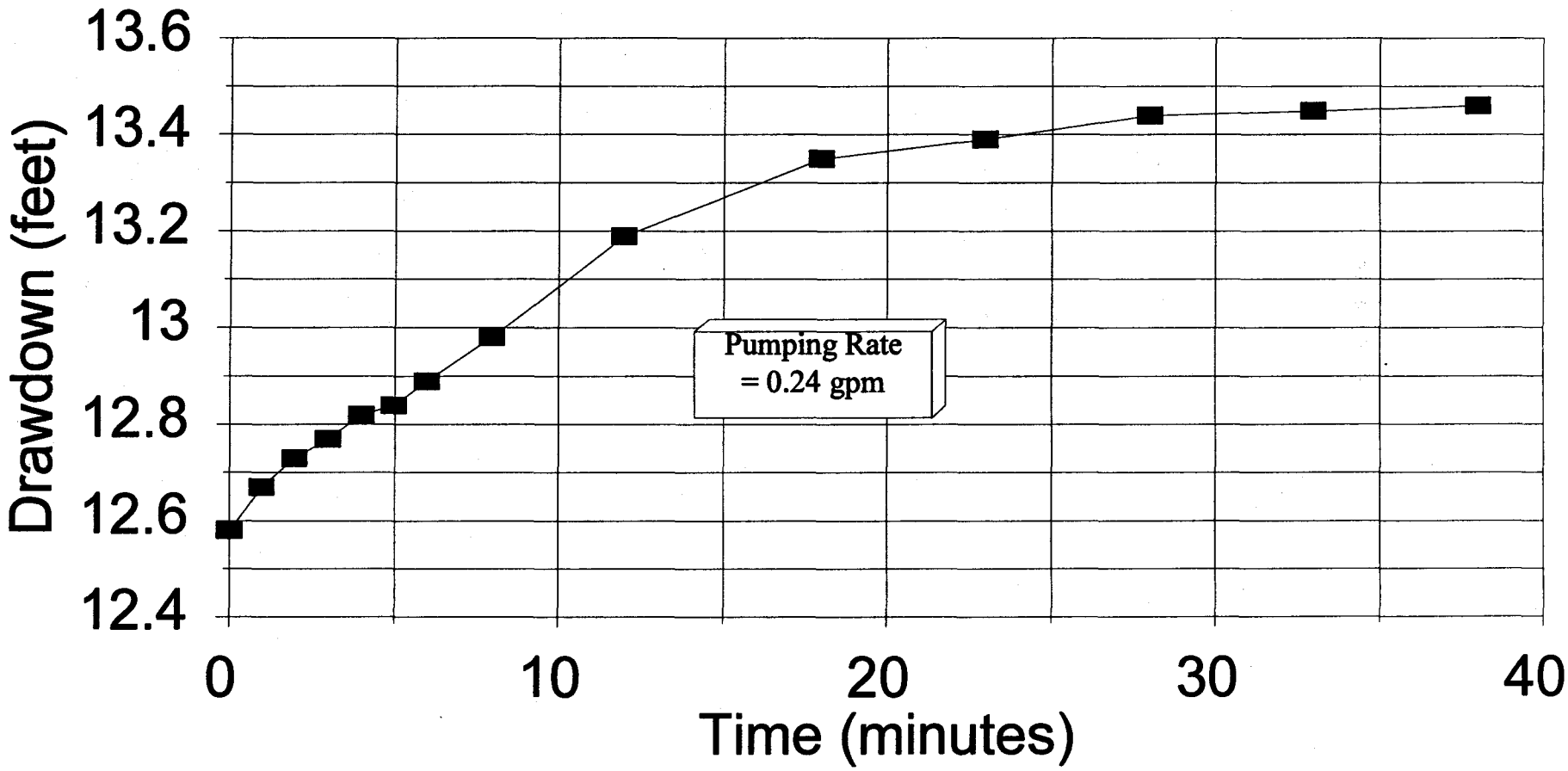
Specific Capacity Test

059G03UF



Specific Capacity Test

065G06DA



TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 2G03UA

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	16.32
DEPTH TO WATER DURING TEST (FT OR M).....=	20.14
DURATION OF THE TEST (HRS).....=	.22
PUMPING RATE (GPM OR CUB.M/S).....=	.094
THICKNESS OF AQUIFER (FT OR M).....=	12
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.000696
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	2.460733E-02
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	4.77337E-05
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	3.977808E-06
NUMBER OF ITERATIONS.....=	3

WELL NUMBER.....= 2G03DA

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	14.25
DEPTH TO WATER DURING TEST (FT OR M).....=	17.86
DURATION OF THE TEST (HRS).....=	.55
PUMPING RATE (GPM OR CUB.M/S).....=	.75
THICKNESS OF AQUIFER (FT OR M).....=	19
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0000228
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	.2077564
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	8.833193E-04
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	4.649049E-05
NUMBER OF ITERATIONS.....=	3

WELL NUMBER.....= 2 G09UA

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	19.16
DEPTH TO WATER DURING TEST (FT OR M).....=	23.5
DURATION OF THE TEST (HRS).....=	1.166
PUMPING RATE (GPM OR CUB.M/S).....=	.08
THICKNESS OF AQUIFER (FT OR M).....=	5
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	5
STORAGE COEFFICIENT.....=	.000006
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	1.843318E-02
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	5.3305E-05
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	1.0661E-05
NUMBER OF ITERATIONS.....=	2

WELL NUMBER.....= 2 G09DA

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	19.07
DEPTH TO WATER DURING TEST (FT OR M).....=	21.65
DURATION OF THE TEST (HRS).....=	.5
PUMPING RATE (GPM OR CUB.M/S).....=	.79
THICKNESS OF AQUIFER (FT OR M).....=	15
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.000018
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	.3062019
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.132542E-03
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	7.550278E-05
NUMBER OF ITERATIONS.....=	3

WELL NUMBER.....= 9G01DA

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	22.58
DEPTH TO WATER DURING TEST (FT OR M).....=	24.13
DURATION OF THE TEST (HRS).....=	.5
PUMPING RATE (GPM OR CUB.M/S).....=	1.58
THICKNESS OF AQUIFER (FT OR M).....=	17
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.00002
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	1.019364
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	4.302742E-03
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	2.531025E-04
NUMBER OF ITERATIONS.....=	3

WELL NUMBER.....= 9G03DA

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	18.43
DEPTH TO WATER DURING TEST (FT OR M).....=	21.13
DURATION OF THE TEST (HRS).....=	.18
PUMPING RATE (GPM OR CUB.M/S).....=	1.3
THICKNESS OF AQUIFER (FT OR M).....=	21
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0000252
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	.4814832
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	2.176555E-03
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	1.036455E-04
NUMBER OF ITERATIONS.....=	3

WELL NUMBER.....= 14 G07LF

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	9.95
DEPTH TO WATER DURING TEST (FT OR M).....=	11.63
DURATION OF THE TEST (HRS).....=	.49
PUMPING RATE (GPM OR CUB.M/S).....=	.081
THICKNESS OF AQUIFER (FT OR M).....=	12
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0000144
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	4.821428E-02
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.428461E-04
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	1.190384E-05
NUMBER OF ITERATIONS.....=	3

WELL NUMBER.....= 59 G03UF

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	16.27
DEPTH TO WATER DURING TEST (FT OR M).....=	17.45
DURATION OF THE TEST (HRS).....=	.35
PUMPING RATE (GPM OR CUB.M/S).....=	3.9
THICKNESS OF AQUIFER (FT OR M).....=	33
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.00004
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	3.305295
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	2.299535E-02
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	6.968288E-04
NUMBER OF ITERATIONS.....=	4

WELL NUMBER.....= 65 G06 DA

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	12.58
DEPTH TO WATER DURING TEST (FT OR M).....=	13.44
DURATION OF THE TEST (HRS).....=	.47
PUMPING RATE (GPM OR CUB.M/S).....=	.24
THICKNESS OF AQUIFER (FT OR M).....=	13
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0000156
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	.27907
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	9.494165E-04
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	7.303204E-05
NUMBER OF ITERATIONS.....=	3

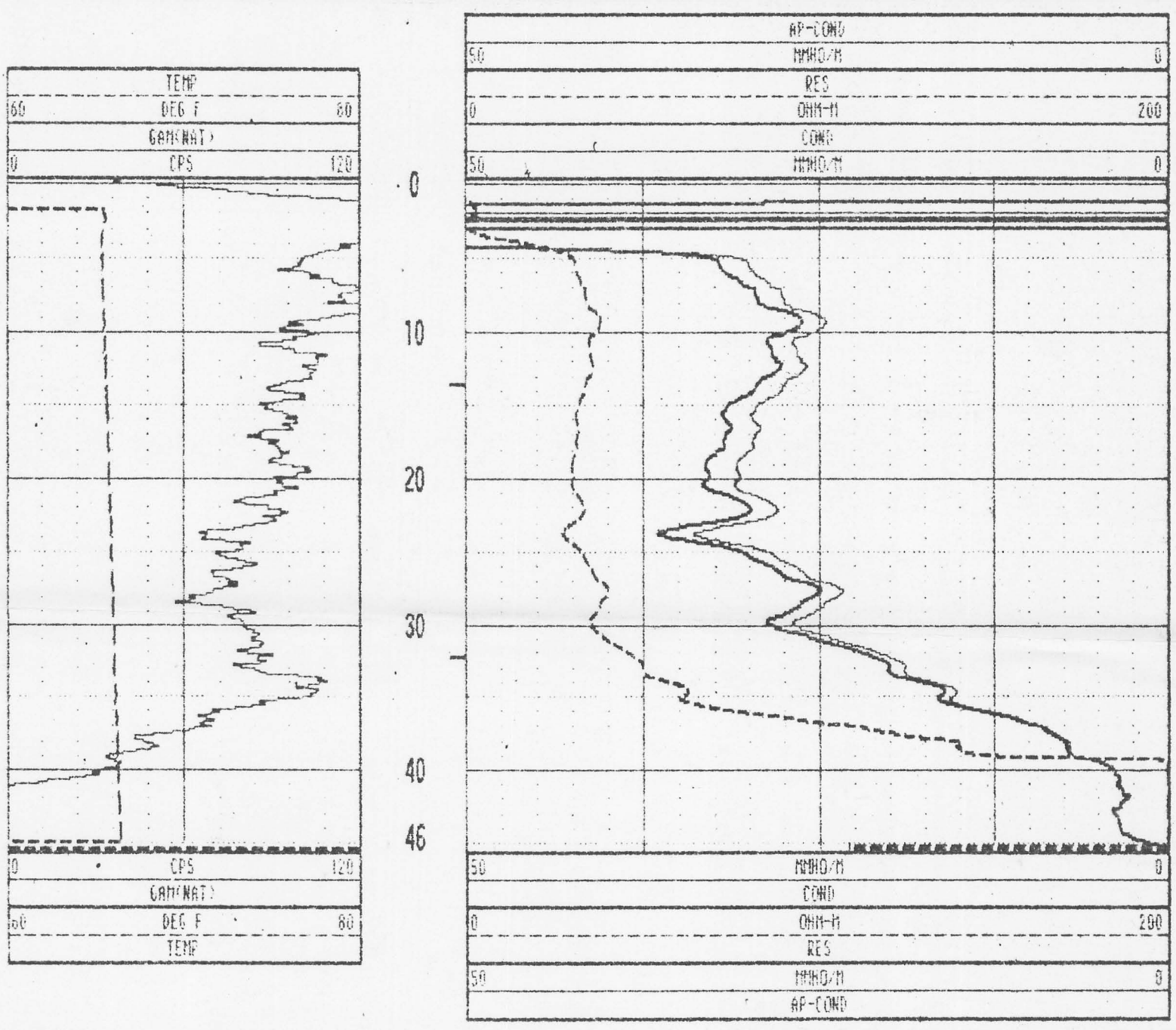
GEOLOGICAL LOGGING SYSTEMS

OBGG11UA

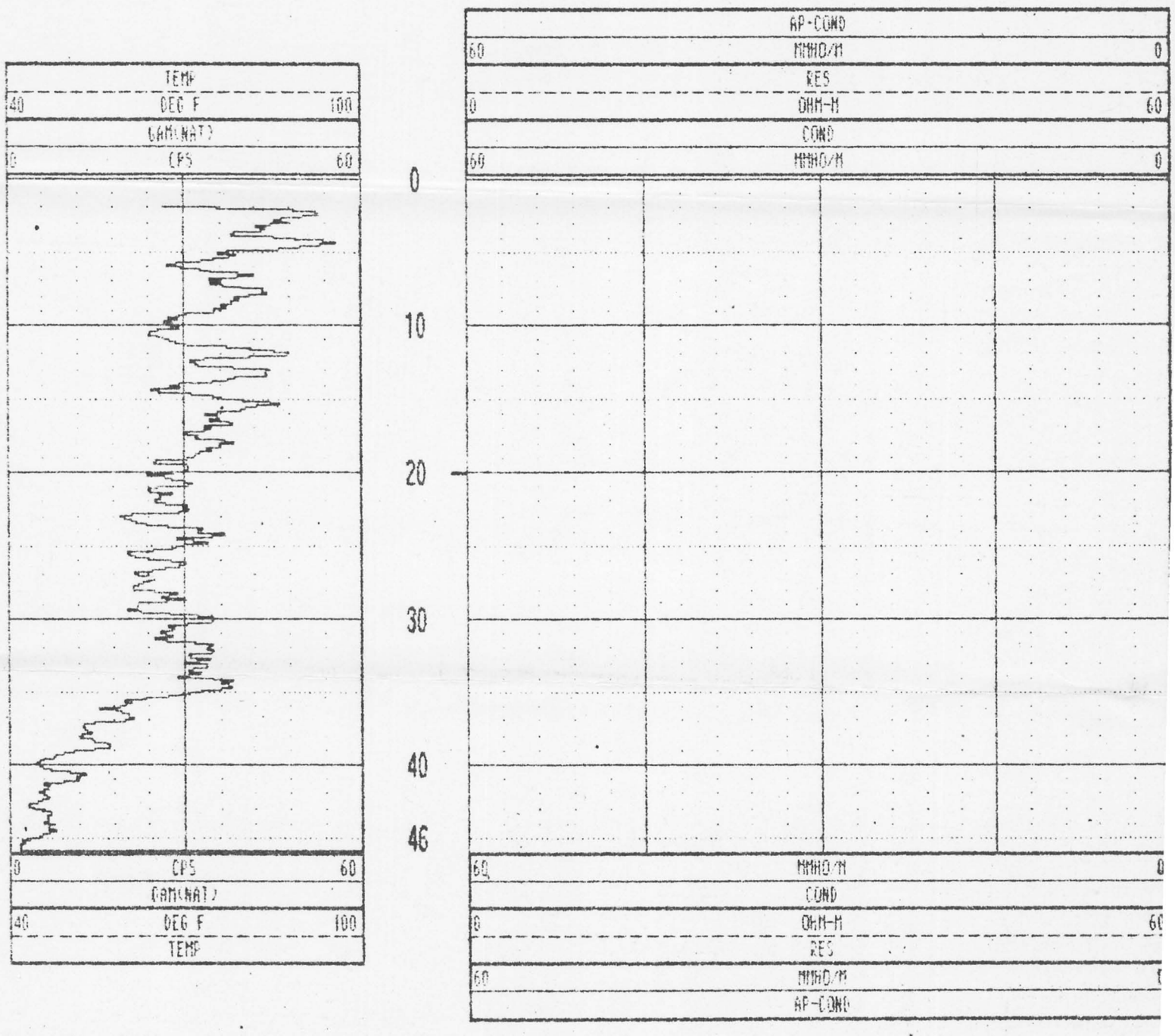
COMPANY	: ENSAFE,ALLEN & HOSHALL			OTHER SERVICES:	
WELL	: OBGG11UA			9511	
LOCATION/FIELD	: NAS MEMPHIS			RUN ONE	
COUNTY	: SHELBY			OPEN	
STATE	: TENNESSEE				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 05/21/96	PERMANENT DATUM	: GL	ELEVATIONS	
DEPTH DRILLER	: 48	ELEV. PERM. DATUM:		KB	:
LOG BOTTOM	: 45.60	LOG MEASURED FROM:	GL	DF	: -
LOG TOP	: -2.60	DRL MEASURED FROM:	GL	GL	: 261.8
CASING DRILLER	: 48	LOGGING UNIT	: 05		
CASING TYPE	: PVC	FIELD OFFICE	: BLUEFIELD		
CASING THICKNESS	: .25	RECORDED BY	: J T GILBERT		
BIT SIZE	: 8	BOREHOLE FLUID	: WATER	FILE	: ORIGIN
MAGNETIC DECL.	: -	RM	:	TYPE	: 9511C
MATRIX DENSITY	: 2.65	RM TEMPERATURE	:	LOG	: 2
FLUID DENSITY	: 1.2	MATRIX DELTA T	:	PLOT	: 9510C
NEUTRON MATRIX	: SANDSTONE	FLUID DELTA T	:	THRESH	: 9000
REMARKS	:				

ELECTRIC LOG INTERPRETATION IS EMPIRICAL IN NATURE. EXTREME HOLE COND WILL MAKE COMPLETELY ACCURATE INTERPRETATIONS DIFFICULT.

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



OBGG11UA 05/21/96 976



OBGG11UA 05/21/96 1025

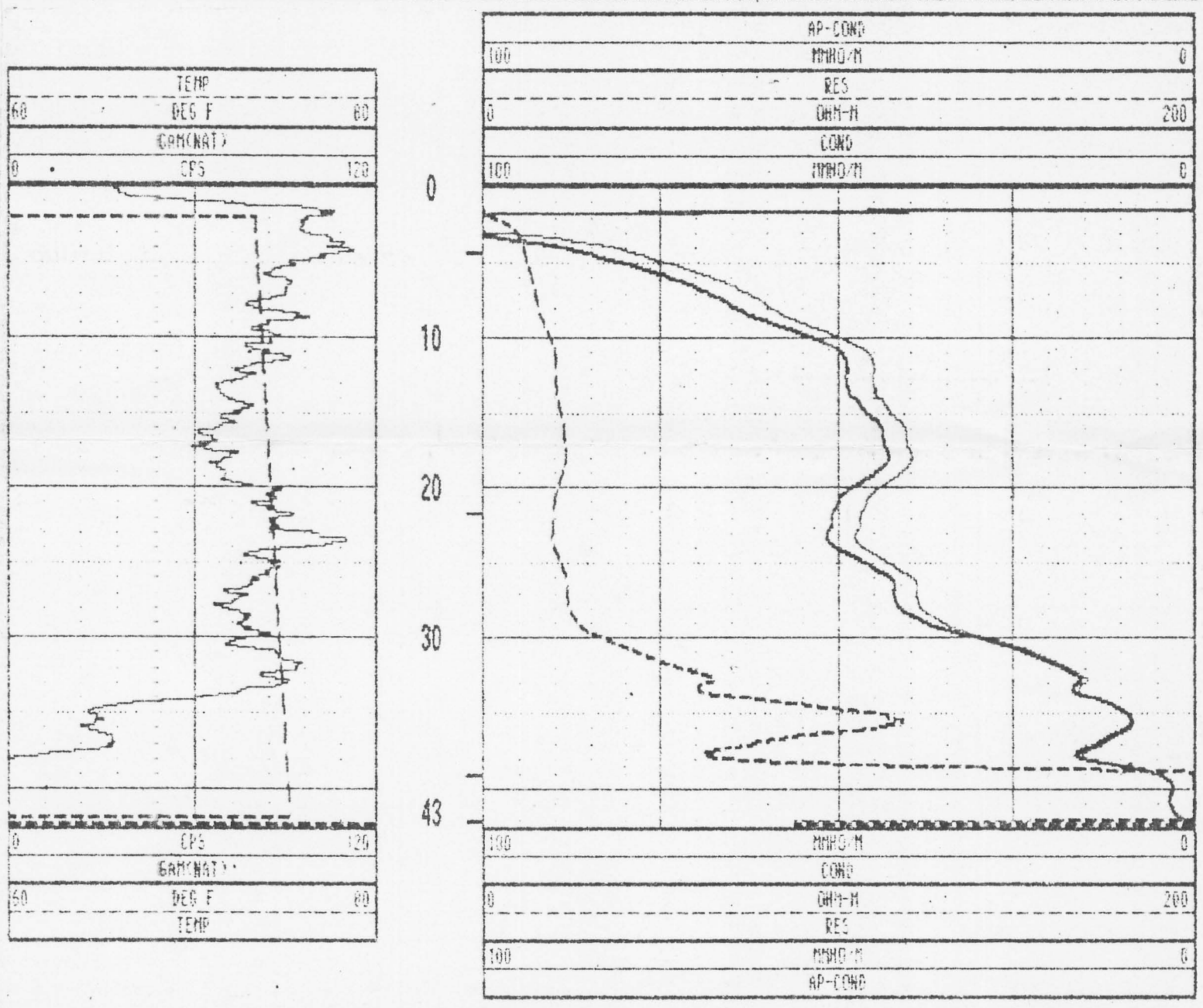
GEOLOGICAL LOGGING SYSTEMS

OBGG12UF

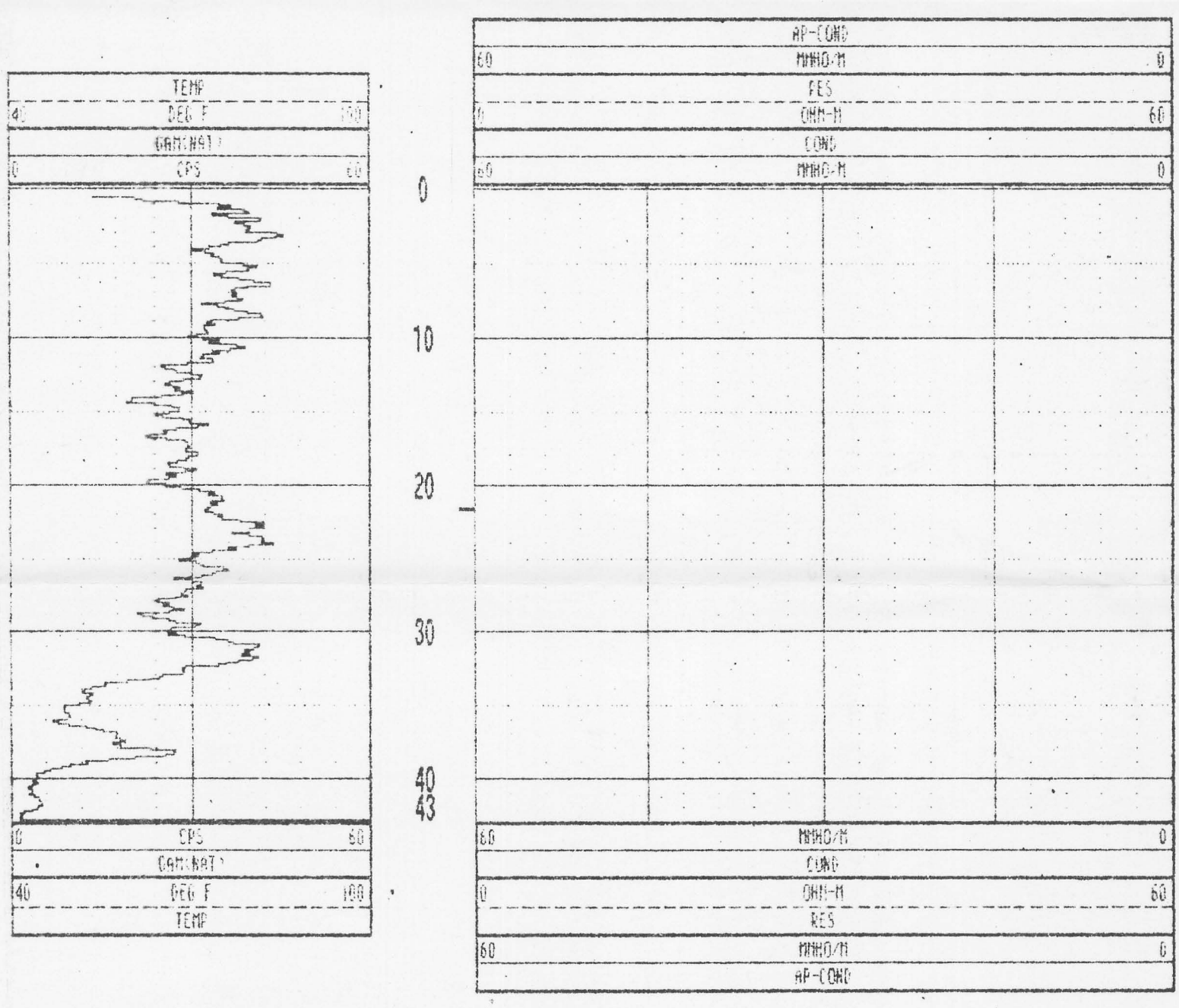
COMPANY	: ENSAFE,ALLEN & HOSHALL			OTHER SERVICES:	
WELL	: OBGG12UF			9511	
LOCATION/FIELD	: NAS MEMPHIS			RUN ONE	
COUNTY	: SHELBY			OPEN	
STATE	: TENNESSEE				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 05/21/96	PERMANENT DATUM	: GL	ELEVATIONS	
DEPTH DRILLER	: 46	ELEV. PERM. DATUM:		KB	:
LOG BOTTOM	: 42.50	LOG MEASURED FROM:	GL	DF	: -
LOG TOP	: -2.30	DRL MEASURED FROM:	GL	GL	: 268.9
CASING DRILLER	: 46	LOGGING UNIT	: 05		
CASING TYPE	: PVC	FIELD OFFICE	: BLUEFIELD		
CASING THICKNESS	: .25	RECORDED BY	: J T GILBERT		
BIT SIZE	: 8	BOREHOLE FLUID	: WATER	FILE	: ORIGIN
MAGNETIC DECL.	: -	RM	:	TYPE	: 9511C
MATRIX DENSITY	: 2.65	RM TEMPERATURE	:	LOG	: 2
FLUID DENSITY	: 1.2	MATRIX DELTA T	:	PLOT	: 9510C
NEUTRON MATRIX	: SANDSTONE	FLUID DELTA T	:	THRESH	: 9000
REMARKS	:				

ELECTRIC LOG INTERPRETATION IS EMPIRICAL IN NATURE. EXTREME HOLE COND WILL MAKE COMPLETELY ACCURATE INTERPRETATIONS DIFFICULT.

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



OBGG12UF 05/21/96 976



OBGG12UF 05/21/96 1025

ATTACHMENT 6

ASSEMBLY E INVESTIGATIVE-DERIVED WASTE TECHNICAL MEMORANDUMS

EnSafe / Allen & Hoshall

a joint venture for professional services

Program Management Office
Shelby Oaks Plaza
5909 Shelby Oaks Dr.
Suite 201
Memphis, TN 38134
Phone (901) 383-9115
Fax (901) 383-1743

EnSafe/Allen & Hoshall Branch Offices:

Charleston
935 Houston Northcutt Blvd.
Suite 113
Mt. Pleasant, SC 29464
Phone (803) 884-0029
Fax (803) 856-0107

Cincinnati
400 TechneCenter Dr.
Suite 301
rd, OH 45150
(513) 248-8449
13) 248-8447

Pensacola
2114 Airport Blvd.
Suite 1150
Pensacola, FL 32504
Phone (904) 479-4595
Fax (904) 479-9120

Norfolk
303 Butler Farm Road
Suite 113
Hampton, VA 23666
Phone (804) 766-9556
Fax (804) 766-9558

Raleigh
5540 Centerview Drive
Suite 205
Raleigh, NC 27606
Phone (919) 851-1886
Fax (919) 851-4043

Nashville
311 Plus Park Blvd.
Suite 130
Nashville, TN 37217
Phone (615) 399-8800
Fax (615) 399-7467

s
uller Drive
26
Irving, TX 75038
Phone (214) 791-3222
Fax (214) 791-0405

MEMORANDUM

TO: Rob Williamson
NSA Memphis Public Works Environmental Division

Mark Taylor
SOUTHNAVFACENGCOM

FROM: Robert Smith
EnSafe/Allen & Hoshall

SUBJECT: Characterization of Investigation-Derived Waste from Assembly E SWMUs: NSA Memphis RFI, Millington, Tennessee; CT0-106

DATE: October 14, 1996

Beginning in November 1995, EnSafe/Allen & Hoshall conducted a RCRA Facility Investigation at Naval Support Activity (NSA) Memphis. Investigation derived waste (IDW) was generated during the investigation.

The IDW consisted of two types of media: soil/formation material, and water. The water was generated from activities such as decontamination of soil and groundwater sampling equipment, development of groundwater monitoring wells, and purging of the monitoring wells prior to sampling. The water was contained in a 2,000 gallon polyethylene tank at Facility S-775. Each time the tank reached its capacity, a sample was collected by E/A&H for analysis by an offsite laboratory for waste characterization parameters. The analytical results from the IDW characterization were then submitted to the City of Millington's contracted engineer, Mr. James Cox of Fisher & Arnold Engineering for discharge approval. Upon receiving discharge approval from Mr. Cox, the contents of the tank were discharged to the sanitary sewer system via an onsite oil/water separator. The 2,000 gallon tank has been cycled a total of 13 times since the beginning of the Assembly E investigation.

The second media type, soil/formation material, was generated during drilling activities, which included drilling spoils and soil/mud generated during the decontamination of the drilling and sampling equipment. Formation material consisted of all subsurface material (sand, gravel, clay) brought to the surface during the drilling/sampling activities. All material generated was containerized in 168 DOT-approved, lined, 55-gallon drums, and were properly labeled and staged in the NSA Memphis IDW storage area (Facility N-1665), where they presently remain. During a recent inspection of the IDW containers, E/A&H found that all labels

placed on the drums have become illegible preventing the correlation of individual drums with specific boring locations. This IDW characterization has been conducted as a basis for disposal and is based the on the concentrations of compounds detected in the Assembly E soil borings.

CHARACTERIZATION

A total of 101 compounds were detected during the Assembly E RFI Investigation. Each compound has been characterized based on the U.S. Environmental Protection Agency (USEPA) Hazardous Waste Rules as outlined in Title 40 of the Code of Federal Regulations, Part 261 (40 CFR 261), and the guidelines set forth by Tennessee Department of Environment and Conservation (TDEC), Division of Solid Waste Management (DSWM).

Of the 101 compounds detected, the following six compounds were defined in 40 CFR 261.30 as being "F-listed" hazardous wastes. F-listed wastes, by definition, are compounds from specific sources, which have been listed due to their Hazard Code (i.e., Toxicity, Ignitability, Corrosivity). The criteria for the selection of these compounds, as well as the USEPA Region III Risk-Based Concentration (RBC) and pertinent ignitability data, is presented in Table 1:

Table 1

NSA Memphis RFI; Assembly E IDW Characterization

F-Listed Wastes

Compound	Hazardous Waste Code as defined in 40 CFR 261	Maximum Detected Concentration (µg/kg)	Residential RBC (µg/kg)	Flashpoint (ignitability) (°C/°F))	Selection Criteria as defined in 40 CFR 261
Trichloroethylene	F001	19.0	58,000	N/A	Toxicity
Methylene Chloride	F002	5.0	85,000	N/A	Toxicity
Tetrachloroethene	F002	23.0	12,000	N/A	Toxicity
4-methyl-2-pentanone (MIBK)	F003	170	N/A	17.8°C/64°F	Ignitability
Acetone	F003	48000	7,800,000	0°C/0°F	Ignitability
2-butanone (MEK)	F005	3600	47,000,000	-8.75°C/16°F	Ignitability, Toxicity

Notes:

N/A = Data not available

According to 40 CFR 261.3(a)(2)(iii), "A solid waste, as defined in § 261.2, is a hazardous waste if....it is a mixture of a solid waste and a hazardous waste that is listed in Subpart D of this part solely because it exhibits one or more of the characteristics of hazardous waste identified in subpart C of this part, ***unless the resultant mixture no longer exhibits any characteristics of hazardous waste identified in subpart C of this part.....***"

According to 40 CFR 261.30, the F001 and F002 wastes (trichloroethylene, methylene chloride, and tetrachloroethene) were listed due to their toxicity, and the F005 waste (MEK) was listed due to its toxicity and ignitability. Also, according to 40 CFR 261.30, the F003 (MIBK and Acetone)

wastes were listed due to their ignitability. Because of the low contaminant concentrations detected and the medium (i.e., soil) in which they are contained, soil found at the Assembly E SWMUs does not exhibit the ignitable characteristic. However, because toxicity cannot be physically defined as ignitability can, it would be difficult to prove that the soil/F001, soil/F002, and soil/F005 mixtures are not toxic.

The Land Disposal Restriction (LDR) Guide #5 provides the following discussion of the Contained-In Interpretation (USEPA Office of Solid Waste Management dated November 13, 1986). "The contained-in policy states that any mixture of a non-solid waste and a RCRA listed hazardous waste must be managed as a hazardous waste as long as the material contains (i.e., is above health based levels) the listed hazardous waste." The contained in policy was developed to address contaminated environmental media (i.e., soil, groundwater, surface water), as opposed to the mixture rule which governs mixtures of hazardous and solid wastes. E/A&H has previously confirmed that TDEC's DSWM concurs with and applies the USEPA contained-in policy using RBCs as health-based levels.

Characterization of the soil/formation material generated during the RFI will be based on the contained in policy. Past disposal of soil at NSA Memphis has also applied the contained-in policy in this situation (Memorandum, *Characterization of Investigation Derived Waste from Assembly A SWMUs;* CTO-094; June 6, 1995). A comparison of the soil boring data to the residential RBCs for soil (Table 1) shows that the maximum concentrations of the potentially listed hazardous wastes contained in the IDW do not exceed the health-based risk levels.

Petroleum Constituents

As part of the full scan analytical parameter list associated with the investigation, each sample collected was submitted for total petroleum hydrocarbon (TPH) analysis using the Tennessee-

modified USEPA methods 8015 for gasoline range organics (GRO) and diesel range organics (DRO). The maximum detected concentrations of TPH-GRO and TPH-DRO were 260 mg/kg and 650 mg/kg, respectively; however, the average detected concentrations of TPH-GRO and TPH-DRO were 7.5 mg/kg and 49.8 mg/kg, respectively; with 4% of the samples analyzed exceeding 100 mg/kg TPH. Because labels on the drums containing the IDW are illegible, individual sample results cannot be correlated to the representative IDW on a drum by drum basis. Therefore, all IDW must be characterized together as one unit; for this reason, the average of all detected results was used in the characterization process. Based on the low average concentration of petroleum constituents detected, and the infrequency of detections exceeding 100 mg/kg of TPH, the material would not meet the TDEC DSWM criteria for a petroleum contaminated soil of 100 mg/kg TPH.

NON-HAZARDOUS IDW DISPOSAL

Options for the disposal of the non-hazardous IDW include:

1. All soil and formation material can be spread or buried at an existing SWMU (e.g., Salvage Yard #2, SWMU 41) on property being retained by the Navy, preferably in a single, predetermined area to facilitate future locating and sampling of the material, if necessary. The spreading of this material at an existing SWMU would eliminate the potential for creating a future SWMU and material handling activities should blend the IDW, creating a more homogeneous mixture, which would be more representative of the average concentrations discussed previously.

2. All soil can be sent to a TDEC-approved, non-hazardous landfill.

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Memorandum

Date: January 24, 1997

To: NSA Memphis, BRAC Cleanup Team

From: Robert Smith, E/A&H

Re: Assembly E IDW Drum Screening Results

E/A&H has recently completed the drum screening activities associated with the NSA Memphis Assembly E investigation derived waste (IDW). The drum screening, conducted at the request of the BCT, was in response to the *Characterization of Investigation-Derived Waste from Assembly E SWMUs* memorandum (E/A&H, October 14, 1996) which stated that 4% of the samples collected during the Assembly E RFI contained petroleum hydrocarbon concentrations exceeding 100 mg/kg.

The screening activities were conducted following the procedures outlined in the *Drum Screening Procedures, Assembly E IDW* memorandum (E/A&H, December 9, 1996) presented to the BCT, with one procedural change made at the request of Mr. Jim Morrison (Tennessee Department of Environment and Conservation [TDEC]). In addition to collecting headspace data from each drum, a sample was also collected from each drum and placed in an air tight bag (i.e., zip-lock), and the contents of the bag were subsequently screened using a flame ionization detector (FID).

At the request of TDEC, their office was notified prior to beginning any screening activities; however, due to technical difficulties associated with the instruments (i.e, PID, FID), no work was performed while TDEC was on site.

The data, presented in the attached table and associated graph, indicate that 6 out of the 160 (3.75%) drums screened exhibited elevated organic vapor concentrations in relation to the rest of the drums. Due to varying factors associated with organic vapor readings and containerized soil (i.e., painted surfaces on the interior of the drum, moisture, etc.), the organic vapor levels detected may or may not be indicative of the petroleum concentration of the drum contents.

The available disposal options for the Assembly E IDW include onsite disposal (identical to the Assembly A IDW), however, the petroleum levels in the soil may need to be confirmed by collecting samples of the material contained in the 6 drums exhibiting elevated headspace readings. If the BCT decides the data is needed, composite samples will be collected from each drum using a stainless steel hand auger to allow the samplers to obtain material from 3 points within the material contained in each drum. These composite samples, a total of 6, would be submitted for total petroleum hydrocarbon analysis by EPA Method 418.1.

Should the analytical data indicate that the petroleum levels of any of the drums exceed the current TDEC definition of a petroleum contaminated soil (presently 100 ppm TPH), that drum will be segregated for disposal under the TDEC Special Waste Policy. The remaining soil may be spread onsite, at a location agreed upon by the NSA Memphis Public Works Office and the BCT.

Naval Support Activity Memphis RCRA Facility Investigation
Assembly E Investigation Derived Waste Drum Organic Vapor Screening Log (ppm)

Drum	Headspace	Baggie
1	73	2
2	**600**	**1600**
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	27	0
9	0	0
10	10	0
11	**4**	**3100**
12	0	0
13	0	0
14	0	< 1
15	0	0
16	**7700**	**0**
17	0	0
18	0	0
19	0	0
20	0	0
21	0	0
22	0	0
23	0	0
24	0	0
25	0	0
26	0	0
27	0	0
28	0	0
29	0	0
30	0	0
31	0	0
32	13	7
33	20	45
34	0	0
35	0	0
36	< 1	< 1

Naval Support Activity Memphis RCRA Facility Investigation
Assembly E Investigation Derived Waste Drum Organic Vapor Screening Log (ppm)

Drum	Headspace	Baggie
37	0	< 1
38	0	3
39	5	< 1
40	< 1	0
41	< 1	0
42	< 1	0
43	< 1	0
44	< 1	0
45	0	0
46	0	0
47	0	< 1
48	0	0
49	0	0
50	0	0
51	0	0
52	0	0
53	0	0
54	0	0
55	0	0
56	0	0
57	0	0
58	0	0
59	0	0
60	0	0
61	0	0
62	0	0
63	**0**	**4257**
64	0	0
65	0	0
66	0	0
67	0	0
68	0	0
69	**4651**	**217**
70	2	0
71	0	0
72	0	0
73	0	0

Naval Support Activity Memphis RCRA Facility Investigation
Assembly E Investigation Derived Waste Drum Organic Vapor Screening Log (ppm)

Drum	Headspace	Baggie
74	165	83
75	0	730
76	0	0
77	0	0
78	0	0
79	0	0
80	0	0
81	0	0
82	0	0
83	0	0
84	110	105
85	0	0
86	0	0
87	0	0
88	0	0
89	0	0
90	0	0
91	0	0
92	0	0
93	0	0
94	0	0
95	0	0
96	0	0
97	222	0
98	8	0
99	0	0
100	0	0
101	0	0
102	0	238
103	0	0
104	-	-
105	-	-
106	0	0
107	0	0
108	0	0
109	0	0
110	-	-

Naval Support Activity Memphis RCRA Facility Investigation
Assembly E Investigation Derived Waste Drum Organic Vapor Screening Log (ppm)

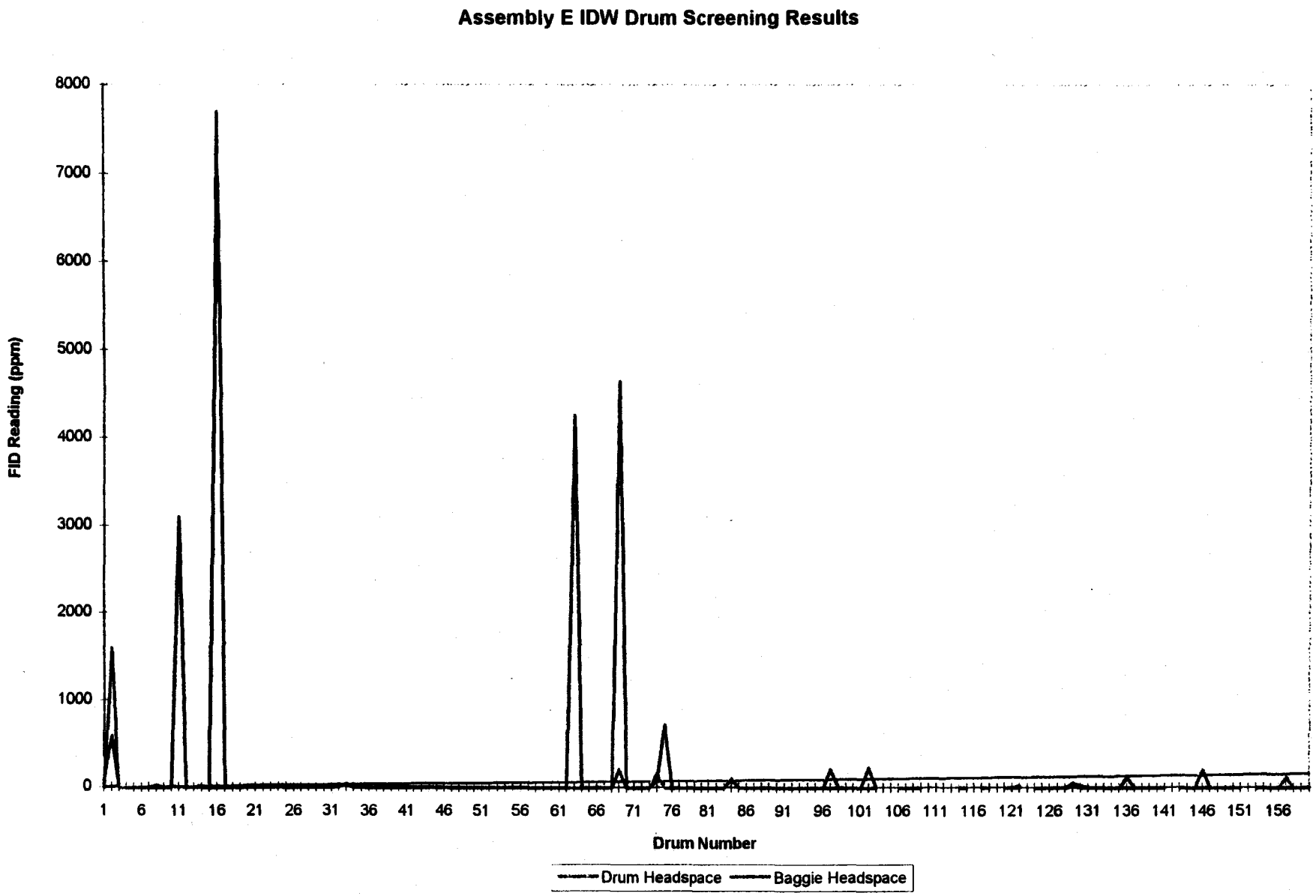
Drum	Headspace	Baggie
111	–	–
112	0	0
113	–	–
114	5	0
115	0	0
116	–	–
117	0	0
118	0	0
119	–	–
120	0	0
121	0	0
122	20	0
123	–	–
124	0	0
125	0	0
126	0	0
127	0	0
128	0	0
129	57	14
130	29	0
131	0	0
132	0	0
133	0	0
134	0	0
135	0	0
136	121	0
137	0	0
138	0	0
139	0	0
140	0	0
141	0	0
142	–	–
143	0	0
144	0	0
145	0	0
146	224	0
147	0	0

Naval Support Activity Memphis RCRA Facility Investigation
Assembly E Investigation Derived Waste Drum Organic Vapor Screening Log (ppm)

Drum	Headspace	Baggie
148	0	0
149	0	0
150	0	0
151	0	0
152	-	-
153	0	0
154	0	0
155	0	0
156	0	0
157	123	0
158	0	0
159	0	0
160	13	0

Notes:
- = Data not available due to inaccessibility to drum, or drum contained waste plastic sheeting.
Bolded items indicate elevated organic vapor readings, relative to all drums screened.

NSA Memphis Assembly E IDW Screening Results



ATTACHMENT 7

TECHNICAL MEMORANDUM
SURFACE SOIL (0 TO 1 FOOT) BACKGROUND DIELDRIN CONCENTRATIONS AT NSA MEMPHIS

TECHNICAL MEMORANDUM

TO: Mark Taylor/David Porter, SOUTHDIV
Tonya Barker/Rob Williamson, NSA Memphis
Jack Carmichael, USGS
Brian Donaldson, EPA
Jim Morrison, TDEC
Brenda Duggar, MSCHD
E/A&H Project Team

FROM: Brian Mulhearn, EnSafe/Allen & Hoshall

DATE: June 3, 1997

RE: Surface Soil (0 to 1 foot) Background Dieldrin Concentrations at NSA Memphis

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During the July 24, 1996 BRAC Cleanup Team (BCT) meeting, the BCT decided that the June 2, 1995 *Soil Dieldrin Technical Memorandum* should be re-submitted and finalized to clarify how the anthropogenic background reference concentration (RC) will be used that should be considered when making risk management decisions involving dieldrin. This memo addresses USEPA and TDEC's comments on dieldrin memos submitted in the past. Two-times the arithmetic mean soil dieldrin concentrations, resulting in an RC of 0.262 mg/kg for dieldrin, will not be used to eliminate dieldrin as a chemical of potential concern in baseline risk assessments. Dieldrin will be retained as a chemical of potential concern in human health risk assessments unless it is eliminated based on comparisons to USEPA's risk-based screening concentrations. However, the maximum dieldrin concentration reported at a site will be compared to the RC, and exceedances will be discussed as appropriate. The dieldrin RC was determined as discussed in the June 2 memo, which is the source of the text below.

Chlorinated pesticides (specifically dieldrin) were used extensively in the 1950s and 1960s during a U.S. Department of Agriculture white fringed beetle quarantine. NSA Memphis has record that the agents were applied aerially for their intended purpose over the majority of the facility. During the RCRA Facility Investigation, dieldrin and other chlorinated pesticides were detected in most surface soil and some subsurface soil samples collected at both SWMUs and background locations. Due to the ubiquitous presence of dieldrin in site soil, the following assessment was

performed to support risk management decisions to be made by the BCT. Figure 1 shows reported surface soil dieldrin concentrations at the original NSA Memphis background locations.

Table 1 shows concentrations ranged from below quantitation limits to 0.311 mg/kg with a mean of 0.131 mg/kg at background locations. Standard risk assessment methods were used to evaluate the significance of the reported concentrations. Default assumptions for residential and occupational exposure scenarios were used to project dieldrin-related carcinogenic risk through incidental ingestion and dermal contact soil pathways, which were detailed in the November 15, 1996 Technical Memorandum, *General Human Health Risk Assessment (HHRA) Approach for NSA Memphis*. For each exposure scenario, risk was estimated using the maximum and mean SWMU-specific dieldrin concentrations. The results of this process are provided in Table 2, including concentrations at SWMUs ranging from below quantitation limits to 0.609 mg/kg (average of the duplicate results at SWMU 5, boring 4).

As shown in Table 2, SWMU 5 had the highest projected soil pathway risk associated with dieldrin at maximum concentrations (2.2E-5). The SWMU 5 risk estimate was approximately twice that of the corresponding background. When mean concentrations were used as the exposure point concentration, SWMU 8 dieldrin risk was found to be the highest although it did not differ appreciably from background. USEPA's generally acceptable range for carcinogenic risk is 1E-6 to 1E-4. In no instance (onsite or background) did dieldrin risk projections exceed 1E-4. This finding indicates that dieldrin concentrations reported at each SWMU do not necessitate remedial action in the absence of other significant carcinogenic risk contributors.

Soil dieldrin is not expected to pose a substantial threat to shallow groundwater at any SWMU or background location. This conclusion is based on the strong soil binding properties of the compound as well as empirical data for subsurface soil that show significant vertical migration has not occurred.

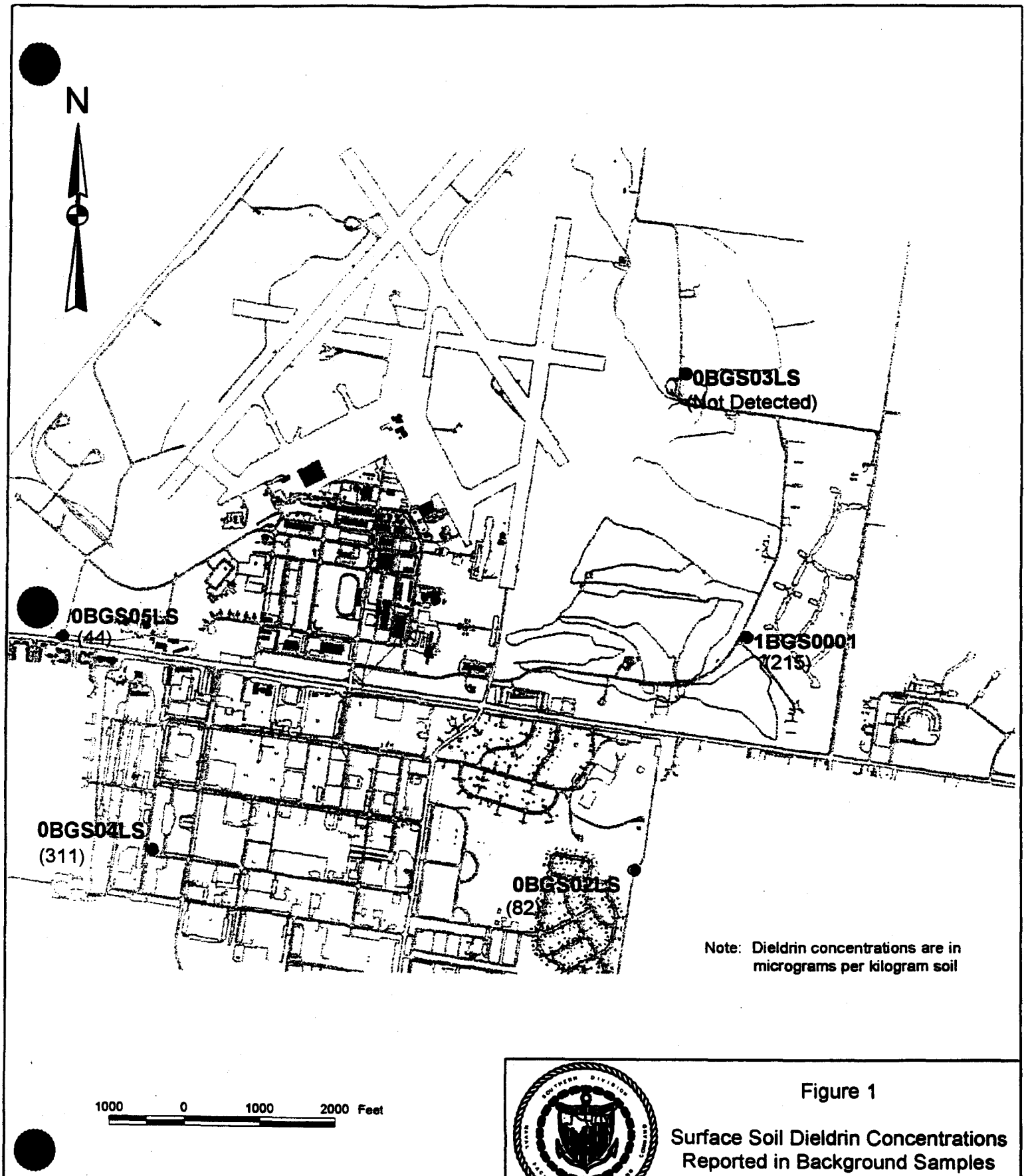

Figure 1

Surface Soil Dieldrin Concentrations Reported in Background Samples NSA Memphis

Table 1
Summary of Dieldrin Concentrations
Reported at NSA Memphis
Background Locations

Location	Concentration (mg/kg)	Qualifier
1BGS000101	0.215	D
OBGS02LS01	0.082	D
OBGS03LS01	0.004	U
OBGS04LS01	0.311	D
OBGS05LS01	0.044	

Notes:
D = sample diluted by Laboratory
U = analyte not detected
The arithmetic mean dieldrin concentration (i.e., 0.131 mg/kg) was calculated assuming one-half of the detection limit was present in sample 0BGS03LS01.

Table 2
NSA Memphis Dieldrin Risk Estimates

Location	Maximum Dieldrin (mg/kg)	Mean Dieldrin (mg/kg)	Residential Risk-Based Max.	Residential Risk-Based Mean	Occupational Risk-Based Max.	Occupational Risk-Based Mean
SWMU 1	0.192	NA	7.04E-6	NA	1.12E-6	NA
SWMU 3	0.023	0.0072	8.43E-7	2.64E-7	1.34E-7	4.19E-8
SWMU 5	0.609	0.126	2.23E-5	4.62E-6	3.54E-6	7.33E-7
SWMU 7	0.055	0.0095	2.02E-6	3.48E-7	3.20E-7	5.52E-8
SWMU 8	0.471	0.144	1.73E-5	5.28E-6	2.74E-6	8.37E-7
SWMU 60	0.069	0.0155	2.53E-6	5.68E-7	4.01E-7	9.01E-8
Background	0.311	0.131	1.14E-5	4.80E-6	1.81E-6	7.62E-7

Note:
The calculations above are based on a slope factor of 16 kg-day/mg.

A historical use discussion is also helpful to provide a frame of reference for evaluating reported soil dieldrin (and other chlorinated pesticide) concentrations. Information provided by NSA Memphis states that chlorinated pesticides (primarily chlordane) were previously used until

the late 1980's for termite control around buildings. Although chlordane was used as a single active ingredient application, mixtures including dieldrin, aldrin, and heptachlor were also common in the pest control trade. Standard application rates resulted in soil concentrations of 500 to 1,000 mg/kg total chlorinated pesticides. For comparison, a 10:1 chlordane:dieldrin mixture used for general subterranean termite control would have resulted in residual soil dieldrin concentrations of 50 to 100 mg/kg. These residual application concentrations are 50 to 100 times higher than the maximum soil dieldrin concentration reported in NSA Memphis surface soil.

This memo is intended to provide an RC for dieldrin and a risk-based framework for decision making regarding how the dieldrin issue is resolved. Although standard risk assessment techniques will be applied, final resolution of this issue will require a consensus risk management decision. Of paramount importance is the determination of what level of risk is acceptable in light of the extent of dieldrin. EnSafe/Allen & Hoshall as the contractor can only provide the facts and suggestions for a viable risk management strategy. The following paragraph outlines suggestions based on currently available information and the preceding risk evaluation.

Dieldrin was used at NSA Memphis as intended, which has been documented and has resulted in dieldrin's widespread extent. Consequently, institutional controls are considered to be the most appropriate means of dealing with the dieldrin issue from a human health perspective. These controls may include (but are not limited to) public/worker awareness, access restrictions and maintenance of adequate vegetative cover to minimize contact. The focus of future investigative efforts should center around prevention of further migration (i.e., surface runoff), and evaluation of sensitive ecological receptor points (i.e., terrestrial habitats, drainage systems, streams, and lakes.) These areas should be emphasized as little control can be exercised over the animals who use them.

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the
DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND

WATER-RESOURCES INVESTIGATIONS
REPORT 95-4011
Kingsbury, J.A., and Carmichael, J.K., Hydrogeology of post-Wilcox Group stratigraphic units in the area of the Naval Air Station Memphis, near Millington, Tennessee

INTRODUCTION

The Naval Air Station (NAS) Memphis is a major training facility for the U.S. Department of the Navy (Navy). Located near the city of Millington in northwestern Shelby County, Tennessee (fig. 1), NAS Memphis consists of North and South Complexes that are divided by Navy Road and together encompass about 3,490 acres. Major operational areas at NAS Memphis include an airfield, training facilities, and a hospital in the North Complex, and housing and training facilities in the South Complex. Beginning in 1995, NAS Memphis is scheduled for realignment of its primary mission operations and partial closure under the Base Realignment and Closure Act of 1990.

As a result of the type of operations conducted at NAS Memphis, concerns have been raised regarding the release of hazardous materials to the environment; specifically, soil, ground-water, and surface-water contamination from past and present waste-management practices. Sixty-seven Solid Waste Management Units (SWMU's) have been identified at the facility pursuant to the Navy Installation Restoration Program and the Hazardous and Solid Waste Amendments (HSWA) section of the Resource Conservation and Recovery Act (RCRA) permit issued to NAS Memphis by the U.S. Environmental Protection Agency in 1986. These SWMU's presently are under investigation as part of the RCRA Corrective Action Program being conducted at the base. The objective of the Corrective Action Program is to obtain information to fully characterize the nature, extent, and rate of migration of contaminants from SWMU's and to interpret these data to determine appropriate corrective measures.

The Navy's engineering field division, Southern Division Naval Facilities Engineering Command (SOUTHDIV), is providing engineering and contract services to NAS Memphis to support compliance with the HSWA permit and the associated Corrective Action Program. The U.S. Geological Survey (USGS), in cooperation with SOUTHDIV, is providing technical assistance in an investigation of the hydrogeology at NAS Memphis under the Corrective Action Program. The purpose of this report is to summarize hydrogeologic information and geotechnical data collected from five stratigraphic test holes drilled in April 1994 near several SWMU's located within the NAS Memphis North Complex. The report briefly describes geologic and hydrologic characteristics of the strata from land surface to about 1,000 feet in depth.

HYDROGEOLOGY

NAS Memphis is located in the north-central part of the Mississippi embayment, a broad syncline that plunges southward along an axis that approximates the Mississippi River. In the NAS Memphis area, the embayment contains more than 2,500 feet of unconsolidated to semiconsolidated sediments of Cretaceous, Tertiary, and Quaternary age that overlie "bedrock" of Paleozoic age. Post-Wilcox Group stratigraphic units described in this report include, from youngest to oldest, the alluvium and loess of Quaternary age; the fluvial deposits of Tertiary(?) and Quaternary age; and the Cockfield Formation, Cook Mountain Formation, and Memphis Sand of Tertiary age (fig. 2). The description of the post-Wilcox units is based on information and data from the five stratigraphic test holes and from geophysical logs of other test holes and wells at locations within and near NAS Memphis.

Alluvium

Alluvium is present beneath the alluvial plains of streams in the NAS Memphis area. The alluvium in the Memphis area generally consists of silt and clay in the upper part and sand and gravel in the lower part (Parks, 1990). The principal stream in the NAS Memphis area is Big Creek, which forms the southern boundary of the South Complex (fig. 1). Little specific information is available concerning the stratigraphic sequence beneath the Big Creek alluvial plain in the NAS Memphis area. Sediments in about the upper 10 feet in test hole Sh:V-74 and upper 15 feet in Sh:U-99 (fig. 3) are interpreted as alluvium because these sites are near small tributaries to Big Creek. These sediments are primarily silt with some clay (fig. 2) and are similar in lithology to the loess from which they probably were reworked.

Loess

Loess is the near surface unit in upland areas of the NAS Memphis area. The loess ranges from about 15 to 45 feet in thickness and is predominantly silt and clay that contains some fine sand (fig. 2). The loess is reworked or absent beneath the alluvial plains of streams. Because of the low permeability of silt and clay, the loess retards movement of recharge water to the underlying fluvial deposits, and can serve as an upper confining unit to the fluvial deposits aquifer in the NAS Memphis area. Locally, however, the loess is saturated and contains water-bearing zones. The rate of ground-water movement in the loess is slow; wells screened in the loess are pumped dry quickly. Samples of the loess collected from three of the test holes had laboratory determined porosities ranging from 38 to about 45 percent and vertical hydraulic conductivities ranging from 3.4×10^{-4} to 1.5×10^{-3} ft/d (table 1).

Fluvial Deposits

The fluvial deposits underlie the loess in upland parts of the NAS Memphis area and consist of sand and gravel with minor amounts of clay (fig. 2). Generally, gravel and sandy gravel are present in the lower part of the formation. The gravel is predominantly chert, with some pebbles as large as 2 inches in the longest dimension. Locally, the sand and gravel may be cemented, forming thin layers of ferruginous sandstone or conglomerate. Two levels of fluvial deposits have been identified in the NAS Memphis area. The southern part of the area is underlain by deposits with a basal altitude of about 200 feet above sea level (fig. 3). This lower level of fluvial deposits ranges from about 30 to 60 feet in thickness. The northern part of the NAS Memphis area is underlain by fluvial deposits with a basal altitude of about 300 feet above sea level (fig. 3). This higher level of fluvial deposits ranges from about 10 to 35 feet in thickness. The fluvial deposits make up the fluvial deposits aquifer. The two levels of fluvial deposits could be hydraulically connected and, if so, could be considered to be a single aquifer.

Cockfield Formation

The Cockfield Formation is the uppermost unit in the Claiborne Group (fig. 2). The Cockfield Formation consists of sand, silt, clay, and lignite. Beds in the Cockfield Formation are lenticular and can be discontinuous over short distances (Parks and Carmichael, 1990a). Throughout much of the NAS Memphis area, the upper part of the Cockfield Formation consists of clay and silt and serves as a lower confining unit for the overlying fluvial deposits aquifer. Locally, however, some parts of the Cockfield Formation consist of relatively thick sections of fine and fine to medium sand. Thickness of the Cockfield Formation is variable as a result of erosional surfaces at the top and base of the formation. The thickness ranges from about 35 to 180 feet in the NAS Memphis area (fig. 3). The thickest section of the Cockfield Formation is in the northern part of the area beneath the base of the higher level fluvial deposits (section A–A′, fig. 3). Sand beds or lenses in the Cockfield Formation make up the Cockfield aquifer. Where sand beds in the Cockfield Formation underlie the fluvial deposits, the two units probably are hydraulically continuous.

Cook Mountain Formation

The Cook Mountain Formation of the Claiborne Group consists predominantly of clay and silt (fig. 2); however, minor lenses of silty fine sand may be present locally. The Cook Mountain Formation contains the most areally extensive clay in the upper part of the Claiborne Group in Shelby County (Parks, 1990). Most of the test holes drilled for this investigation did not penetrate the entire Cook Mountain Formation, but geophysical logs from other test holes and wells in the area that penetrate the entire formation indicate that the thickness ranges from about 15 to 50 feet (fig. 3). The Cook Mountain Formation serves as the lower confining unit for the Cockfield aquifer and the upper confining unit for the Memphis aquifer. Clay samples from the Cook Mountain Formation were collected in four of the test holes for mineralogical and geotechnical (table 1) analysis. Results from x-ray diffraction analysis of the <1 micron-size clay particles separated from each of the samples indicated interstratified smectite, well-crystallized kaolinite, and minor amounts of illite (B. Jones and D. Webster, USGS, written commun., 1994). Porosities of the samples ranged from about 30 to 42 percent and vertical hydraulic conductivities ranged from 8.1×10^{-6} to 1.6×10^{-5} ft/d (table 1).

Memphis Sand

The Memphis Sand (fig. 2) is a thick deposit of primarily fine to very coarse sand with lenses of clay, silt, and lignite at various stratigraphic horizons (Parks and Carmichael, 1990b). Clays and silts commonly are present in the upper part of the Memphis Sand, causing difficulty in distinguishing between the Memphis Sand and Cook Mountain Formation on geophysical logs of stratigraphic test holes (Kingsbury and Parks, 1993). In the NAS Memphis area, the Memphis Sand ranges from about 865 to 880 feet thick (fig. 2), based on test holes drilled previously at and near the facility. The Memphis Sand makes up the Memphis aquifer, which supplies water to industries and municipalities in Shelby County. Water used at NAS Memphis is withdrawn from the Memphis aquifer and the deeper Fort Pillow aquifer of the Wilcox Group (Parks and Carmichael, 1989). In 1993, about 0.8 Mgal/d were withdrawn from the Memphis aquifer and about 1.2 Mgal/d were withdrawn from the Fort Pillow aquifer for the water supply at NAS Memphis (R. Harris, NAS Memphis water plant, oral commun., 1994). As part of this investigation, two production wells screened in the Memphis aquifer at the North Complex were sampled for tritium analysis to determine if relatively young water from shallower sources has entered the aquifer through the upper confining unit. The samples essentially were free of tritium, indicating that water in the Memphis aquifer in the area of the two wells has not been affected by leakage of younger water from shallower sources.

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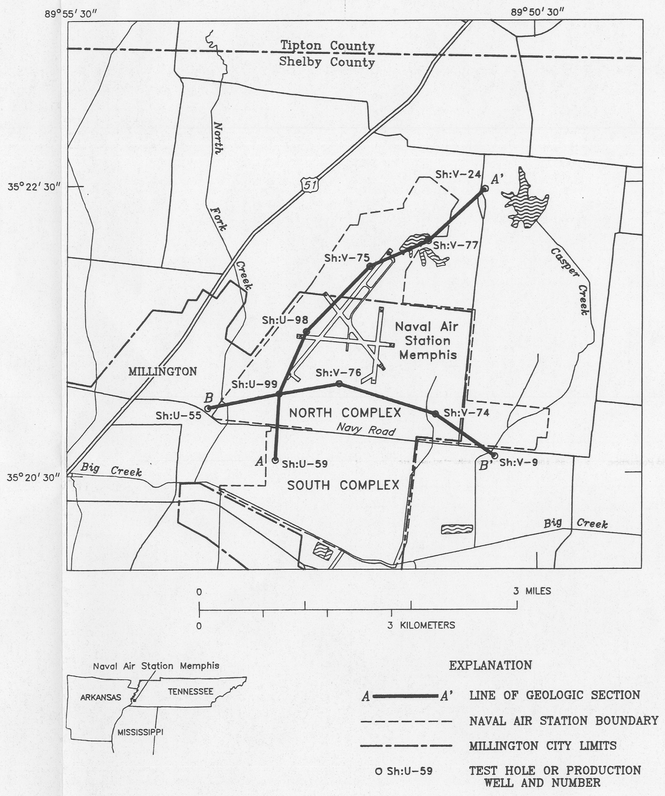

Figure 1. Locations of the Naval Air Station Memphis and geologic sections A–A′ and B–B′.

System	Series	Group	Stratigraphic unit (and local name)	Thickness (in feet)	Lithology
Quaternary	Holocene and Pleistocene		Alluvium (alluvial deposits)	0-15	Silt and clay
	Pleistocene		Loess	15-45	Silt and clay, with minor fine sand.
Quaternary and Tertiary(?)	Pleistocene and Pliocene(?)		Fluvial deposits (terrace deposits)	10-60	Sand, gravel, with minor clay and ferruginous sandstone.
Tertiary	Eocene	Claiborne	Cockfield Formation	35-180	Sand, silt, clay, and lignite.
			Cook Mountain Formation	15-50	Clay, silt, and minor sand.
			Memphis Sand	865-880	Sand, silt, clay, and minor lignite. Overlies the Flour Island Formation of the Wilcox Group.

Figure 2. Post-Wilcox Group stratigraphic units underlying the Naval Air Station Memphis area.

Table 1. Selected geotechnical properties of the loess and Cook Mountain Formation clay

[Analyses conducted by Inberg-Miller Engineers, Cheyenne, Wyoming; USGS, U.S. Geological Survey; ft, foot; lbs/ft³, pounds per cubic foot; ft/d, feet per day; LL, liquid limit; PL, plastic limit; PI, plasticity index]

USGS and (test hole) number	Sample depth (ft)	Sample classification	Moisture content (percent)	Dry density (lbs/ft³)	Specific gravity	Porosity (percent)	Atterberg limits LL	PL	PI	Vertical hydraulic conductivity (ft/d)
Loess										
Sh:V-75 (3)	11-13	Lean clay	25.5	103.3	2.71	38.9	29.6	19.0	10.6	3.4×10^{-4}
Sh:U-99 (4)	13-15	Silt	28.7	105.5	2.73	38.0	29.4	27.4	2.0	1.5×10^{-3}
Sh:V-76 (5)	11-13	Lean clay	30.9	93.7	2.73	45.1	43.6	22.2	21.4	4.5×10^{-4}
Cook Mountain Formation clay										
Sh:V-74 (1)	209-211	Lean clay	16.9	116.0	2.69	30.8	41.6	15.3	26.3	8.1×10^{-6}
Sh:U-98 (2)	199-200	Lean clay	25.5	106.9	2.73	37.2	43.5	17.4	26.1	4.5×10^{-5}
Sh:V-75 (3)	218-220	Sandy clay	35.9	97.5	2.69	42.0	37.3	14.1	23.2	1.6×10^{-4}
Sh:V-76 (5)	195-197	Fat clay	24.7	115.7	2.67	30.4	60.6	20.5	40.1	4.0×10^{-5}

CONVERSION FACTORS, VERTICAL DATUM, AND WELL-NUMBERING SYSTEM

Multiply	By	To obtain
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
acre	0.4047	square hectometer
foot per day (ft/day)	30.48	centimeter per day
million gallons per day (Mgal/d)	0.04381	cubic meters per second

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Tennessee District well-numbering system: Wells in Tennessee are identified according to the numbering system that is used by the U.S. Geological Survey, Water Resources Division. The well number consists of three parts: (1) an abbreviation of the name of the county in which the well is located; (2) a letter designating the 7 1/2-minute topographic quadrangle on which the well is plotted; quadrangles are lettered from left to right across the county beginning in the southwest corner of the county; and (3) a number generally indicating the numerical order in which the well was inventoried. For example, Sh:U-99 indicates that the well is located in Shelby County on the "U" quadrangle and is identified as well 99 in the numerical sequence.

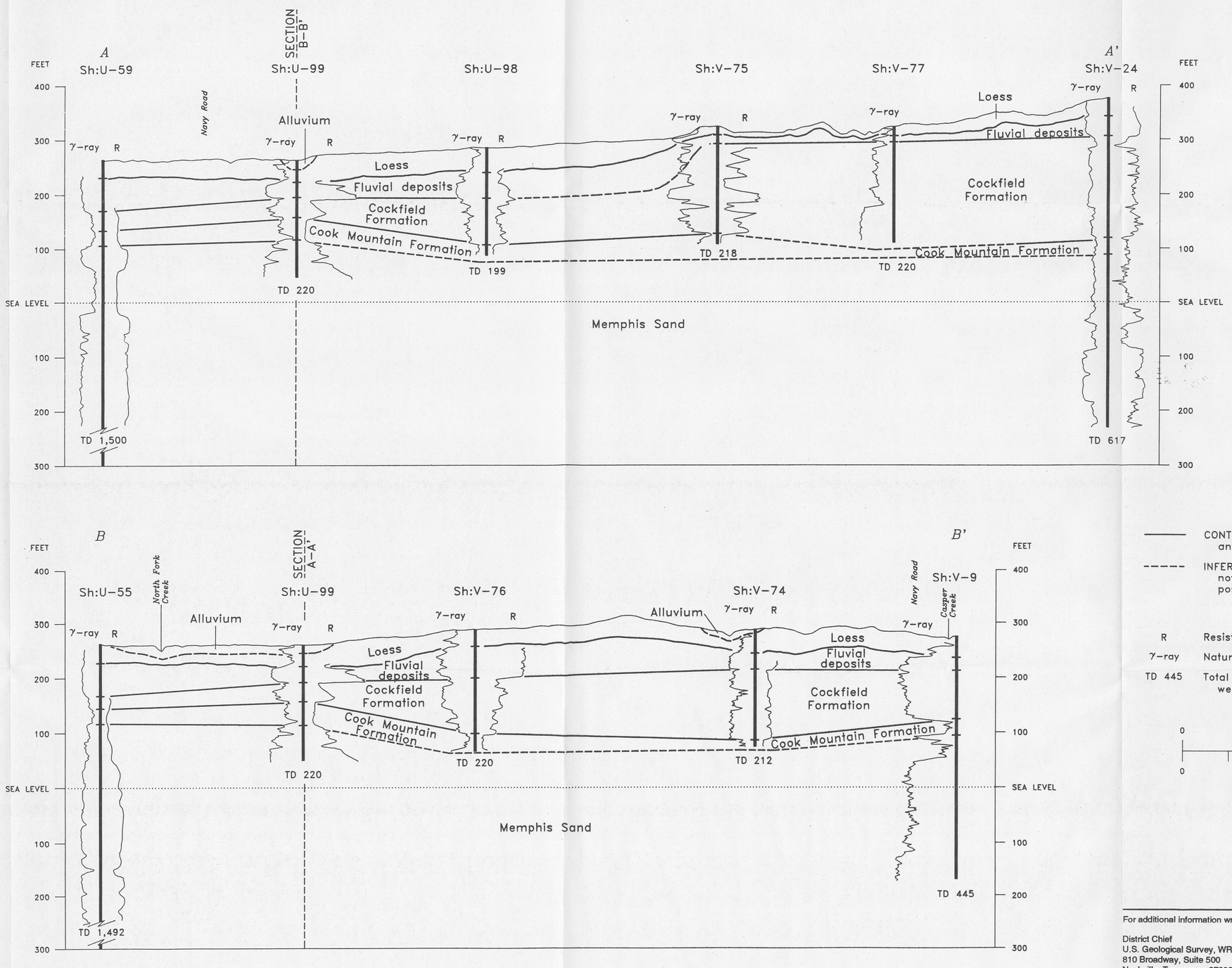

Figure 3. Geologic sections along lines A–A′ and B–B′.

EXPLANATION

——— CONTACT--Based on lithologic information and geophysical log control

- - - - - INFERRED CONTACT--Present, but data are not available or inadequate to establish position with greater definition

GEOPHYSICAL LOGS

R Resistivity (short normal) log

γ-ray Natural gamma-ray log

TD 445 Total depth of test hole or well, in feet

0 2,000 4,000 FEET

0 500 1,000 METERS

For additional information write to:

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U.S. Geological Survey, WRD
810 Broadway, Suite 500
Nashville, Tennessee 37203

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Denver, CO 80225

HYDROGEOLOGY OF POST-WILCOX GROUP STRATIGRAPHIC UNITS IN THE AREA OF THE NAVAL AIR STATION MEMPHIS, NEAR MILLINGTON, TENNESSEE

By
James A. Kingsbury and John K. Carmichael

1995

NAVY ROAD
SWMU 59
SWMU 14
SWMU 46
SWMU 38
SWMU 38
SWMU 65
SWMU 2
SWMU 9
754
BIG CREEK
DRAINAGE CANAL
SOUTH GATE
PERIMETER ROAD
SEVENTH AVENUE
SINGLETON PARKWAY
BIG CREEK DRAINAGE
MOBILE PARK
LEGEND
SWMU 14 SWMU NO. AND LOCATION
CONTOURS (2' INTERVAL)
300 0 300
SCALE FEET
SOURCE: U.S. NAVY
RFI WORK PLAN
NAS MEMPHIS
MILLINGTON, TN.
FIGURE 1
LAND SURFACE ELEVATION MAP
SOUTHSIDE OF NAS MEMPHIS
Dr by: E/AH
Tr by: E/AH
Ck by: A. CHOATE
App by: E/AH
Sheet 1
Date: 09/19/95
DWG Name: 106LSETS
Of 1