

MEMORANDUM

TO: *Mike DuMond*
Mike DuMond, SNL-DOE Oversight, AQB-NMED
FROM: *WPM* William P. Moats, SNL-DOE Oversight, HW&RMB-NMED
DATE: December 6, 1991
RE: Mixed Waste Landfill, Tech Area III, Sandia National
Labs

I am currently assessing the as-built construction of ground water monitor wells at the Mixed Waste Landfill (MWL), located in Tech Area III, Sandia National Laboratories. Further information is needed to complete this evaluation. Please relay the following requests for additional information to John Olav Johnsen, AIP contact, U.S. Department of Energy.

1. If possible, please provide detailed site maps of the MWL showing the boundaries of the facility, survey control points, topography, road access, and the locations of all ground water monitor wells, test pits, and soil borings.

2. Please clarify what the screen slot sizes are for monitor wells MWL-BW1, MWL-MW2, and MWL-MW3. Are they truly 0.0010" or are they actually 0.0100"?

3. If they exist, please provide azimuth measurements for the deviation (borehole orientation) surveys conducted for monitor wells MWL-BW1, MWL-MW2, and MWL-MW3.

4. For monitor well MWL-MW1, please provide additional information on the following:

- A. Geologic and geophysics logs
- B. Well recovery test data
- C. Development records
- D. Drilling contractor
- E. Drilling equipment
- F. Name of hydrogeologist/company
- G. Ground elevation
- H. Top of casing (ELEVATION)
- I. Total depth (well/pilot)
- J. Depth of first water encounter
- K. Static water level (following development)
- L. Estimated yield
- M. Pumps
- N. Borehole deviation surveys
- O. Sterilization procedure for well installation
- P. Well screen
 - slot size
 - type of couplings
 - bottom cap
- Q. Depth interval of annular sealant/backfill
- R. Risers
 - type of couplings

- centralizers
- S. Protective Casing
 - materials
 - diameter
 - length
 - annular sealants between casing and riser
 - annular sealants between casing and borehole
- T. Well Protection
 - type cover
 - well cap
 - cement pad
 - protective posts
 - signs

5. For monitor well MWL-MW3, please provide additional information on the following:
 - A. Development records
 - B. Well recovery test data (also has MWL-MW3 been properly developed at this time?)
 - C. Estimated yield

6. For monitor wells MWL-BW1, MWL-MW2, and MWL-MW3, please provide additional information on the following:
 - A. Drilling equipment
 - B. Ground elevation
 - C. Top of casing (ELEVATION)
 - D. Depth of first water encounter
 - E. Static water level (following development)
 - F. Pumps
 - G. Sterilization procedure for well installation
 - H. Well protection
 - well cap
 - cement pad
 - protective posts
 - signs

7. For monitor well MWL-BW1, please indicate the type of annular sealant between the protective casing and the borehole.

8. One of the geologic logs of MWL-BW1 has soil units which have been categorized using the Unified Soil Classification System. Were these soil types based on visual inspection or are they based on actual tests? If any geotechnical testing has been performed on soil samples from the MWL, I would like to get copies of the results.

9. Please provide a list of all soil borings and test pits located at the MWL.

WELL DEVELOPMENT RECORD

FACILITY CODE	<u>SNLA</u>	LOG DATE	<u>10/10/89</u>
LOCATION ID	<u>MWL-MW3</u>	ACCEPTANCE CODE	
LOGGER CODE	<u>EE</u>		

INSTALLATION DATE(S) 8/20/89

BOREHOLE TOTAL DEPTH (FT) 478.0 WELL TOTAL DEPTH [h₃] (FT) 478.8

BOTTOM OF FILTER PACK [h₂] (FT) 478.0 WELL CASING DIAMETER [d₂] (FT) 0.42

BOREHOLE DIAMETER [d₁] 1.02 SCREEN LENGTH (FT) 20.0

SCREENED INTERVAL (FT) 451.3 - 471.3

DEPTH-TO-WATER [h₁] BEFORE WELL DEVELOPMENT (FT) 461.18 (9/27/85)

BOREHOLE VOLUME [V₁] CALCULATION (in gals)

$$\frac{d_1^2 3.1415}{4} (h_2 - h_1) \times 7.48 \left(\frac{\text{gal}}{\text{ft}^3} \right) \quad \underline{102.8} \quad [V_1] \text{ gals per 1 bore volume}$$

WELL CASING VOLUME [V₂] CALCULATION (in gals)

$$\frac{d_2^2 3.1415}{4} (h_3 - h_1) \times 7.48 \left(\frac{\text{gal}}{\text{ft}^3} \right) \quad \underline{18.3} \quad [V_2] \text{ gals per 1 well volume}$$

ASSUME THE FILTER PACK IN THE ANNULUS BETWEEN THE BOREHOLE AND WELL CASING TO HAVE A POROSITY OF 30%. THEREFORE:

$$V_1 - V_2 * 0.30 = \underline{25.35} [V_3] \text{ GALS IN THE FILTER PACK BETWEEN THE BOREHOLE AND WELL CASING. IN SUMMARY, 1 FILTER PACK AND WELL CASING VOLUME EQUALS } [V_2 + V_3] \underline{43.6} \text{ GALS.}$$

QUANTITY OF MUD/WATER _____

LOST DURING DRILLING (GAL) 0

REMOVED BEFORE WELL INSERTION (GAL) 0

ADDED DURING GRANULAR FILTER PLACEMENT (GAL) ~2000 (circulated to thin mud)

ADDED DURING WELL DEVELOPMENT (GAL) ~4500 (continuous circulation)

TYPE AND SIZE CAPACITY OF PUMP AND/OR BAILER Bennett 2gpm / 6gal bailer

TYPICAL PUMPING RATE (GAL/MIN) 1.0

ESTIMATED RECHARGE RATE (GAL/MIN) _____

DESCRIPTION OF DEVELOPMENT TECHNIQUE Screen and sump jetted w/ ~4500 gals fresh H₂O;

well was then bailed dry 2 times w/ complete recharge in between. Intermittent pumping was

used to complete the development. 90 gal fresh water added, surged and bailed.

WELL DEVELOPMENT RECORD

INITIAL DEVELOPMENT WATER

COLOR light brown

ODOR none

CLARITY cloudy

FINAL DEVELOPMENT WATER

COLOR _____

ODOR _____

CLARITY _____

INSTRUMENT DESCRIPTIONS

WATER LEVEL INDICATOR MODEL NUMBER SOLINST #101 P2/m2/750 ft

pH METER MODEL AND SERIAL NUMBER Cambridge Conduct/T/pH; SN 02-01-005-02

CONDUCTIVITY MODEL AND METER SERIAL NUMBER see above

TURBIDITY METER MODEL AND SERIAL NUMBER Orbeco-Hellige Model # 965-10; SN 02-03-001

OTHER _____

COMMENTS _____

WELL DEVELOPMENT RECORD

INITIAL DEVELOPMENT WATER

COLOR Light brown

ODOR None

CLARITY Cloudy

FINAL DEVELOPMENT WATER

COLOR Light brown

ODOR None

CLARITY Cloudy.

INSTRUMENT DESCRIPTIONS

WATER LEVEL INDICATOR MODEL NUMBER Solinst SN 06564

pH METER MODEL AND SERIAL NUMBER YSI 3500 SN B9000208

CONDUCTIVITY MODEL AND METER SERIAL NUMBER YSI 3500 SN B9000208

TURBIDITY METER MODEL AND SERIAL NUMBER Monitek 21PE SN L-3695

OTHER _____

COMMENTS Poor recharge. Fresh water was added on three occasions to enhance development. Development completed on 4/14/90.

**WELL DEVELOPMENT RECORD
PARAMETER MEASUREMENTS**

DATE	TIME	TOTAL VOL WITHDRAWN		PH	Ec (μmhos/cm)	TEMP (°F)	TURB. (NTU)	IM CONE (ml of sed.)	COMMENTS
		GALS	BORE VOL						
8/23/89	1530	—	—	8.4	390	81.6	>1000	—	mnts on circulated jetting water
10/2/89	1130	14		9.45	680	67.2	>1000	—	
"	1145	25		9.21	553	67.0	>1000	—	
10/9/89	1510	32		8.66	558	73.2	>1000	—	Begin Bennett pump development.
10/11/89	1006	35		8.76	483	65.2	65.0	—	474.0 Before pumping
10/17/89	0940	38		8.33	455	58.0	53.3	—	
"	0945	42		8.25	452	60.5	47.7	—	
"	0953	44		8.36	453	60.6	24.7	—	
11/29/89	0926	49		8.92	442	57.3	>1000	—	Water agitated w/ bailer to remove
"	1015	71		8.98	449	52.6	>1000	—	mud; Temp meter cold.
12/13/89	1100	—	—	—	—	—	—	—	Flush and pump well w/ 170 gals.
1/19/90	1430	—	—	—	—	—	—	—	Purge and flush, remove 16 gals. from hose (last of the introduced water).
1/2/90	1107	87.9		7.64	471	61.7	—	—	
1/9/90	1212	100.3		—	—	—	—	—	No instruments available.
1/17/90	1533	112.15	2.57	7.59	489	63.5	—	—	
1/24/90	1340	123.9	2.84	7.85	242	62.4	—	—	
2/6/90	0915	135		7.65	520	62.6	—	—	
2/22/90	0950	163	3.75	7.81	608	67.28	—	—	Bailed
4/14/90	0800	—	—	—	—	—	—	—	Flush and bail well w/ 90 gals.

J. Marking 6/27/90
FORM COMPLETED BY/DATE

WELL DEVELOPMENT RECORD

FACILITY CODE SNLA LOG DATE 6/8/90
 LOCATION ID MWL-MWI ACCEPTANCE CODE _____
 LOGGER CODE EE

INSTALLATION DATE(S) 4OCT89
 BOREHOLE TOTAL DEPTH (FT) 478.67 WELL TOTAL DEPTH [h₃] (FT) 478.0
 BOTTOM OF FILTER PACK [h₂] (FT) 478.67 WELL CASING DIAMETER [d₂] (FT) 0.42
 BOREHOLE DIAMETER [d₁] 0.83 SCREEN LENGTH (FT) 20.0
 SCREENED INTERVAL (FT) 456 - 476
 DEPTH-TO-WATER [h₁] BEFORE WELL DEVELOPMENT (FT) 454.62

BOREHOLE VOLUME [V₁] CALCULATION (in gals)

$$\frac{d_1^2 3.1415}{4} (h_2 - h_1) \times 7.48 \left(\frac{\text{gal}}{\text{ft}^3} \right) \quad \underline{97.33} \quad [V_1] \text{ gals per 1 bore volume}$$

WELL CASING VOLUME [V₂] CALCULATION (in gals)

$$\frac{d_2^2 3.1415}{4} (h_3 - h_1) \times 7.48 \left(\frac{\text{gal}}{\text{ft}^3} \right) \quad \underline{24.23} \quad [V_2] \text{ gals per 1 well volume}$$

ASSUME THE FILTER PACK IN THE ANNULUS BETWEEN THE BOREHOLE AND WELL CASING TO HAVE A POROSITY OF 30%. THEREFORE:

$$V_1 - V_2 \times 0.30 = \underline{21.93} \quad [V_3] \text{ GALS IN THE FILTER PACK BETWEEN THE BOREHOLE AND WELL CASING. IN SUMMARY, 1 FILTER PACK AND WELL CASING VOLUME EQUALS } [V_2 + V_3] \quad \underline{46.16} \text{ GALS.}$$

QUANTITY OF MUD/WATER _____

LOST DURING DRILLING (GAL) 0

REMOVED BEFORE WELL INSERTION (GAL) 0

ADDED DURING GRANULAR FILTER PLACEMENT (GAL) 0

ADDED DURING WELL DEVELOPMENT (GAL) 0

TYPE AND SIZE CAPACITY OF PUMP AND/OR BAILER 6 gal bailer / 1/2 gpm Bennett pump.

TYPICAL PUMPING RATE (GAL/MIN) 1/2 gal. per minute

ESTIMATED RECHARGE RATE (GAL/MIN) UNK

DESCRIPTION OF DEVELOPMENT TECHNIQUE Bailed to remove fine-grained sediments, surged, pumped until stable parameters achieved.

WELL DEVELOPMENT RECORD

INITIAL DEVELOPMENT WATER

COLOR Clear

ODOR None

CLARITY Clear

FINAL DEVELOPMENT WATER

COLOR Clear

ODOR None

CLARITY Clear

INSTRUMENT DESCRIPTIONS

WATER LEVEL INDICATOR MODEL NUMBER Solinst SN 06564

pH METER MODEL AND SERIAL NUMBER YSI 3500 SN B9000208

CONDUCTIVITY MODEL AND METER SERIAL NUMBER YSI SN B9000208

TURBIDITY METER MODEL AND SERIAL NUMBER Monitek 21 PE SN L-3695

OTHER _____

COMMENTS Development continued on 6/8/90 when MW-1 was pumped with a Bennett pump and parameters measured. (See attached sheet.)

WELL DEVELOPMENT RECORD
PARAMETER MEASUREMENTS

DATE	TIME	TOTAL VOL WITHDRAWN		pH	Ec (µmhos/cm)	TEMP (°C)	TURB. (NTU)	IM CONE (ml of sed.)	COMMENTS
		GALS	BORE VOL						
10/5/89		UNK	UNK	7.55	640	22.0	21	-	Initial Development, bailed
6/8/90	1515	5		7.35	622	20.9	350	-	Continued Development
	1525	10		7.45	620	20.9	38	-	Pumped with Bennett
	1532	15		7.45	620	21.0	4.5	-	pump.
	1540	20		7.45	618	20.9	4.5	-	
	1549	25		7.4	618	21.0	5.5	-	
	1556	30		7.3	616	20.8	5.5	-	
	1604	35		7.3	621	20.8	6.7	-	
	1612	40		7.33	625	21.0	6.0	-	
✓	1620	45		7.35	625	21.0	5.5	-	
									Stopped pumping
									after removing 47 gal.
									No more containers
									available for purge
									water.

J. Manakip 6/27/90
FORM COMPLETED BY/DATE

WELL DEVELOPMENT RECORD

FACILITY CODE SN432 LOG DATE 13 Oct 88

LOCATION ID 0001 (RMW-1) ACCEPTANCE CODE _____

LOGGER CODE RFW

INSTALLATION DATE(S) _____

WELL TOTAL DEPTH (FT) 476 SCREENED INTERVAL (FT) 456 - 476

SCREEN LENGTH (FT) 20

HEIGHT WELL CASING ABOVE GROUND SURFACE (FT) 2.0

WATER LEVEL MEASUREMENT PRIOR TO WELL DEVELOPMENT (FT) 456.27

WATER LEVEL MEASUREMENT AFTER WELL DEVELOPMENT (FT) _____

QUANTITY OF MUD/WATER

LOST DURING DRILLING (GAL.) _____

REMOVED PRIOR TO WELL INSERTION (GAL.) _____

ADDED DURING GRANULAR FILTER PLACEMENT (GAL.) _____

ADDED DURING WELL DEVELOPMENT (GAL.) _____

QUANTITY OF FLUID IN WELL PRIOR TO DEVELOPMENT

STANDING IN WELL (GAL.) _____

CONTAINED IN SATURATED ANNULUS (GAL.) _____

(ASSUME 30% POROSITY)

TYPE AND SIZE/CAPACITY OF PUMP AND/OR BAKER

TYPICAL PUMPING RATE (GAL/MIN) _____

ESTIMATED RECHARGE RATE (GAL/MIN) _____

DESCRIPTION OF DEVELOPMENT TECHNIQUE

INITIAL DEVELOPMENT WATER

COLOR brown, slight greenish tinge

ODOR

CLARITY large percentage fines

FINAL DEVELOPMENT WATER

COLOR

ODOR

CLARITY

INSTRUMENT DESCRIPTIONS

WATER LEVEL INDICATOR

^{serial}
MODEL NUMBER

pH METER Cole Parmer Digisense

^{serial}
MODEL NUMBER 535403

CONDUCTIVITY METER

^{serial}
MODEL NUMBER

OTHER

PARAMETER MEASUREMENTS

RMW-1

TIME	TOTAL VOLUME WITHDRAWN		pH	Ec (µmhos/cm)	TEMP (°C)	TURBIDITY (NTU)	IMHOFF CONC. (ml. of sediment)	COMMENT
	GALS	BORE VOLUME						
1130	0.0	0.0	—	—	—	—	—	Start pumping
1145	6	0.15	8.1	400	21	>100	—	Water level 4.8
1235	40	1.0	7.84	510	21	>100	—	Stop pumping
1045	—	—	—	—	—	—	—	Water level 4.8 Sand bed level
1122	6.0	0.15	7.32	600	21	>100	—	
1153	30		7.32	600	21	>100	—	
1208	40	1.0	7.33	600	21	>100	—	Stop pumping Water level 4.8
1715	6		7.53	630	22	>100	—	Water level 4.8
1742	30		7.58	630	21.5	>100	—	
1752	40	1.0	7.38	620	21.0	>100	—	16.4 clay
1710	—	—	—	—	—	—	—	Water level 4.8 Sand bed level
1720	6	.15	7.50	630	22.0	22	—	
1742	18		7.62	640	22.0	>100	—	
1810	40		7.44	640	21.3	>100	—	
0700-0700	40	1.0	—	—	—	—	—	Buried dry
0936	—	—	—	—	—	—	—	Water level 4.8 Begin pumping
0939	6	.15	7.38	620	21.2	18	—	
1016	40	1.0	7.67	620	21	>100	—	Buried dry
1515	—	—	—	—	—	—	—	Water level 4.8 Bore 1
1525	6		7.55	640	22	21	—	
1547	30		7.58	640	22	>100	—	
1558	40		7.58	630	21.5	>100	—	Buried dry

0-10 FT

10-20 FT

20-30 FT

30-40 FT

BOREHOLE LOG (SOIL)

PAGE 1 OF 3

FACILITY CODE 5NA32
 LOCATION ID 900+ MWL-MWI RMA
 COORDINATES (FT):
 NORTH 1452661.099 EAST 411661.747
 GROUND ELEVATION (FT MSL) _____
 LOCATION TYPE BH
 COMMENTS RMW-1
TOP OF CASING ELEVATION - 5381.03 FEET MSL

DRILLER CODE WDC
 COMPLETION DATE 28 Sept 88
 DIAMETER (IN) 14/10
 DEPTH (FTFD) 480.5
 CONSTRUCTION METHOD R/A
 ACCEPTANCE CODE _____

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT)
28 Sept 88	6:40	454.67

LOCATION DESCRIPTION
Technical Area 3 Radioactive waste burial site - 35' north of the west edge of the source burial site.

LITHOLOGIC LOG

LOGGER CODE RFW

DEPTH (FT)	SAMPLE INTERVAL	SAMPLE RECOVERY	SAMPLE RETAINED	SAMPLE METHOD	SAMPLE ID	BLOW COUNT (PER 6 IN)	N VALUE	USCS	VISUAL DESCRIPTION
0.0-0.5	0.5	100%	0.5	G	0001	na		SM	Silty sand; some silt, fine to med. sand, trace coarse sand.
0.75-10.5	10.0	100%	10.5	S	0002	5, 11, 13		SM	Silty sand; some silt, fine to med. sand, trace fine to coarse gravel.
11.5-20.0								SM	S.
20.0-21.5	21.5	100%	21.5	S	0003	5-10-10		SM	Silty sand; trace silt and coarse gravel.
	20-22	100%	20-22	G	0004				fine to fine sand
30-31.5	31.5	100%	31.5	S	0004	3-7-11		SM	Silty sand; trace silt and coarse gravel, predom. v. fine to fine sand

ACCEPTANCE CODES: A-ACCEPTABLE R-RECONNAISSANCE U-UNACCEPTABLE N-NOT DETERMINED

CONSTRUCTION METHODS:

- A - AIR ROTARY
- B - BORED OR AUGERED
- C - CABLE-TOOL
- D - DUG
- H - HYDRAULIC-ROTARY
- J - JETTED

- P - AIR-PERCUSSION
- R - REVERSE ROTARY
- T - TRENCHING
- V - DRIVEN
- W - DRIVE AND WASH
- Z - OTHER (SPECIFY)

SAMPLE METHODS:

- A - AUGER CUTTINGS
- S - 2" O.D. 1.38" I.D. DRIVE SAMPLE
- U - 3" O.D. 2.42" I.D. TUBE SAMPLE
- T - 3" O.D. THIN-WALLED SHELBY TUBE
- O - OTHER (SPECIFY)

COMPLETE BOLD DATA FOR ENTRY INTO TMS
 BHD-002 (3/88)

[Signature] 28 Sept 88
 FORM COMPLETED BY/DATE
[Signature] 5-2-89
 TECHNICAL REVIEWER/DATE
[Signature] 11/28/89
 UPDATED WITH COORDINANTS

BOREHOLE LOG (SOIL)

PAGE 2 OF 3

FACILITY CODE SN/A32

LOCATION ID ECOT MWL-MW1 BM

COMPLETION DATE 28 Sept 83

LITHOLOGIC LOG

DEPTH (FT)	SAMPLE INTERVAL	SAMPLE RECOVERY	SAMPLE RETAINED	SAMPLE METHOD	SAMPLE ID	BLOW COUNT (PER 6 IN)	N VALUE	USCS	VISUAL DESCRIPTION
31.5-40								SM	Silty sand; predom. v. fine to fine sand, trace silt, trace coarse sand
40-41.5	40-41.5	100%	40-41.5	S	0005	8-14-26		SM	Silty sand; predom. v. fine to fine sand, trace silt, trace coarse sand
	40-42	100%	40-42	G	0002A				
41.5-51.5	50-51.5	65%	50-51.5	S	0006	4-15-15		SM	Silty sand; predom. v. fine to fine sand, trace silt, trace coarse sand; contains interm. hard fine to coarse gravel lenses.
51.5-62	60-62	100%	60-62	G	0005A			SM	Silty sand; predom. v. fine to fine sand, trace silt, trace coarse sand.
62-75								SM	Silty sand (as above)
75-78								SP	Gravelly sand; some fine to coarse gravel, predom. fine to med sand, trace silt.
78-100	80-82	100%	80-82	G	0004A			SM	Silty sand, some silt; v. fine to fine sand.
100-101.5	100-101.5	100%	100-101.5	S	0007	6-14-29		SC	Clayey silty sand; trace silt, some clay, low plasticity; grades to silty sand (SM).
	100-102	100%	100-102	G	0005A				
102-240	120-122	100%	120-122	G	0006A			SM	Silty sand, trace silt, trace clay, predom. fine to med sand. I-term. near gravel lenses @ 142', 165' (Dr. K's descrip.)
	140-142	100%	140-142	G	0007A				
	160-162	100%	160-162	G	0008A				
	180-182	100%	180-182	G	0009A				
	198-200	100%	198-200	G	0010A				
	200-201.5	100%	200-201.5	S	0008	5-8-20			
	220-222	100%	220-222	G	0011A				
240-260	240-242	100%	240-242	G	0012A			SM	Silty sand, some silt, fine predom. v. fine to med sand, trace fine gravel, trace clay; v. low plasticity.
260-265	260-262	100%	260-262	G	0013A			GM	Silty sandy gravel, some silt, some fine sand, predom. fine gravel, trace coarse gravel, trace clay.
265-320	280-282	100%	280-282	G	0014A			SM	Silty sand; some silt, predom. v. fine to fine sand, trace fine gravel, trace clay.
	295-300	100%	295-300	G	0015A				
	300-301.5	65%	300-301	S	0009	12-19-retrial			

COMPLETE BOLDDED DATA FOR ENTRY INTO TABS
B-10-002 (3/88)

FORM COMPLETED BY/DATE

TECHNICAL REVIEWER/DATE

[Signature] 28 Sept 83

[Signature] 5-2-89

BOREHOLE LOG (SOIL)

PAGE 3 OF 3

FACILITY CODE SN432

LOCATION ID 500T MWL-MWL *fm*

COMPLETION DATE 28 Sept 88

LITHOLOGIC LOG


DEPTH (FT)	SAMPLE INTERVAL	SAMPLE RECOVERY	SAMPLE RETAINED	SAMPLE METHOD	SAMPLE ID	BLOW COUNT (PER 6 IN)	N VALUE	USCS	VISUAL DESCRIPTION
320-325	320-322	100%	320-322	G	0018A			SM	Silty sand some silt, predom. v. fine r.
	320-322	100%	320-322	G	0019A				Fine sand, trace clay and fine gravel. Gravel clasts have CaCO ₃ nod.
	320-322	100%	320-322	G	0018A				
325-384	325-382	100%	325-382	G	0019A			ML	Clayey silt; some clay, trace v. fine r. Fine sand, predom. silt; low plasticity.
387-400	387-400	100%	387-400	G	0020A			SM	Silty sand some silt, trace clay and coarse sand, predom. v. fine to fine sand.
400-402	400-405	100%	400-405	S	0010	9-15-30		ML	Clayey silt; some clay, trace v. fine sand, predom. silt. Low plastic.
402-423	402-422	100%	402-422	G	0021A			SM	Silty sand; some silt, trace clay and fine gravel, predom. v. fine sand.
423-425								GM	Silty sandy gravel. Some sand, trace silt, predom. fine gravel.
425-440								SM	Silty sand, some silt, predom. v. fine fine sand.
440-450	440-442	100%	440-442	G	0022A			ML	Clayey silt; some clay, predom. silt trace v. fine to fine sand.
450-454								GM	Silty sandy gravel. Some fine sand trace silt, predom. fine gravel.
454-467	454-462	100%	454-462	G	0023A			SM	Silty sand; some silt, trace clay, trace fine gravel, predom. v. fine-fine sand.
467-472								GM	Silty sandy gravel some fine sand trace silt, trace clay, predom. fine gravel.
472-479								SM	Silty sand; some silt, trace clay, predom. fine sand.
477-480.5	477-480.5	100%	477-480.5	S	0011	5-12-25		ML	Clayey silt; some clay, predom. silt, trace v. fine sand. Low plasticity.

COMPLETE BOLDED DATA FOR ENTRY INTO TMS
BHO-002 (3/88)

[Signature] 28 Sept 88
FORM COMPLETED BY/DATE

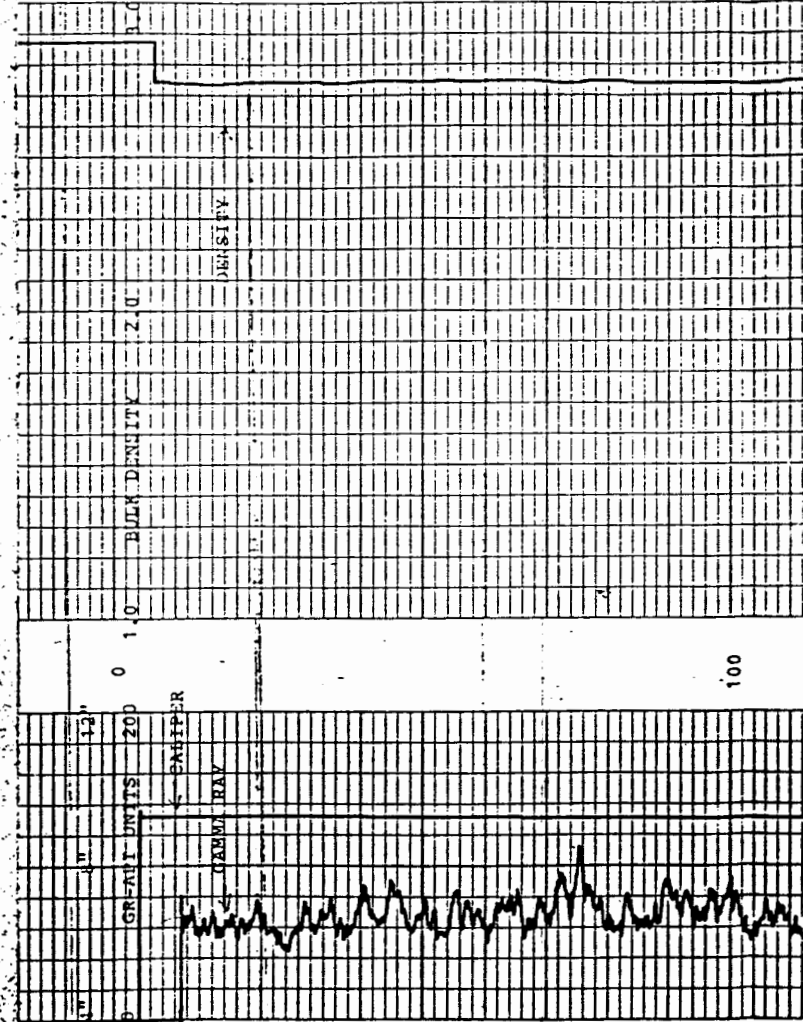
[Signature] 5-2-89
TECHNICAL REVIEWER/DATE

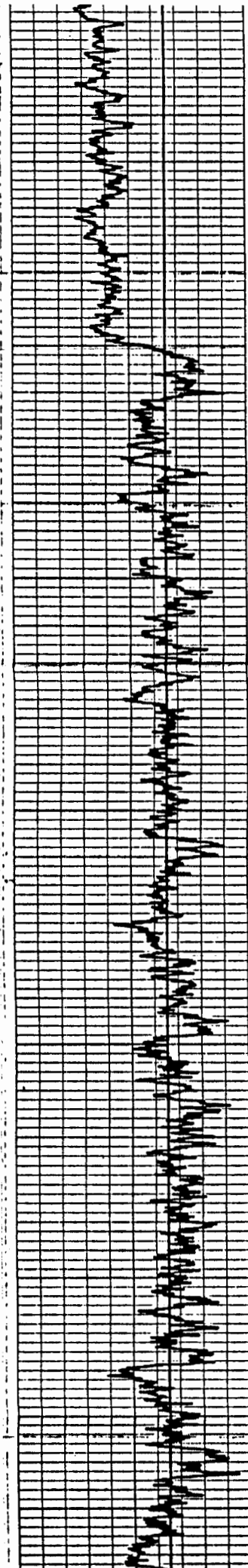
17EWS 4A
4C

		GR, DEN, RES, CAL.	
PLUG NO.	COMPANY THE WATER DEVELOPMENT CORP.		
	WELL RM-W1		
	FIELD SANDIA BASE		
	COUNTY BERNALILLO	STATE N.M.	
LOCATION	OTHER SERVICES:		
SEC. _____ T. _____ R. _____	GR-NEUTRON 3 ARM CALIPER		
PERMANENT DATUM GROUND LEVEL	ELEV.	ELEV. K.B.	
LOG MEASURED FROM G.L. 0	FT. ABOVE PERM. DATUM	D.F.	
DRILLING MEASURED FROM G.L.		G.L.	
DATE	10-1-88		
RUN NO.	ONE		
TYPE LOG	COMB.		
DEPTH-DRILLER	480		
DEPTH-LOGGER	479		
BOTTOM LOGGED INTERVAL	478		
TOP LOGGED INTERVAL	SURFACE		
TYPE FLUID IN HOLE	WATER		
SALINITY, PPM CL.			
DENSITY			
LEVEL	457		
MAX. REC. TEMP., DEG. F.			
OPERATING ISO TIME	1 HOUR		
RECORDED BY	PEARSON		
WITNESSED BY	MR. MIGNARDOT		
BORE-HOLE RECORD		CASING RECORD	
RUN NO.	BY	FROM	TO
1		SURF.	200
	12"	200	480
		SIZE	WGT.
		13	3/8
		FROM	TO
		SURF.	200

THIS READING AND LOG CONFORMS TO API RP 31
SOLD HERE

EQUIPMENT DATA	
RUN NO.	ONE
LOG TYPE	C-2
TOOL MODEL NO.	1-11/16"
DIAMETER	





200

300

400

FLUID LEVEL



GAMMA RAY NEUTRON
3 ARM CALIPER

RUN NO. _____

COMPANY THE WATER DEVELOPMENT CORP.

WELL RM-W1

FIELD SANDIA BASE

COUNTY BERNALILLO STATE N.M.

LOCATION: _____ OTHER SERVICES: GR-DEN-RES CAL.

SEC. _____ T. _____ R. _____

PERM DATUM: GROUND LEVEL ELEV. _____

MEASURED FROM G.L. 0 FT. ABOVE PERM. DATUM D.F. _____

LOG MEASURED FROM G.L. G.L. _____

E	10-1-88
E NO.	ONE
E LOG	GRN-CAL
TH-DRILLER	480
TH-LOGGER	479
TOM	INTERVAL
LOG	SERIAL
E FLUID IN HOLE	WATER
ALUMIN. PPM CL	
DENSITY	
TEMP.	457
E. REC. TEMP. DEG. F.	
STARTING RIG TIME	1 HOUR
ORDERED BY	PEARSON
TESTED BY	MR. MIGBARDCT

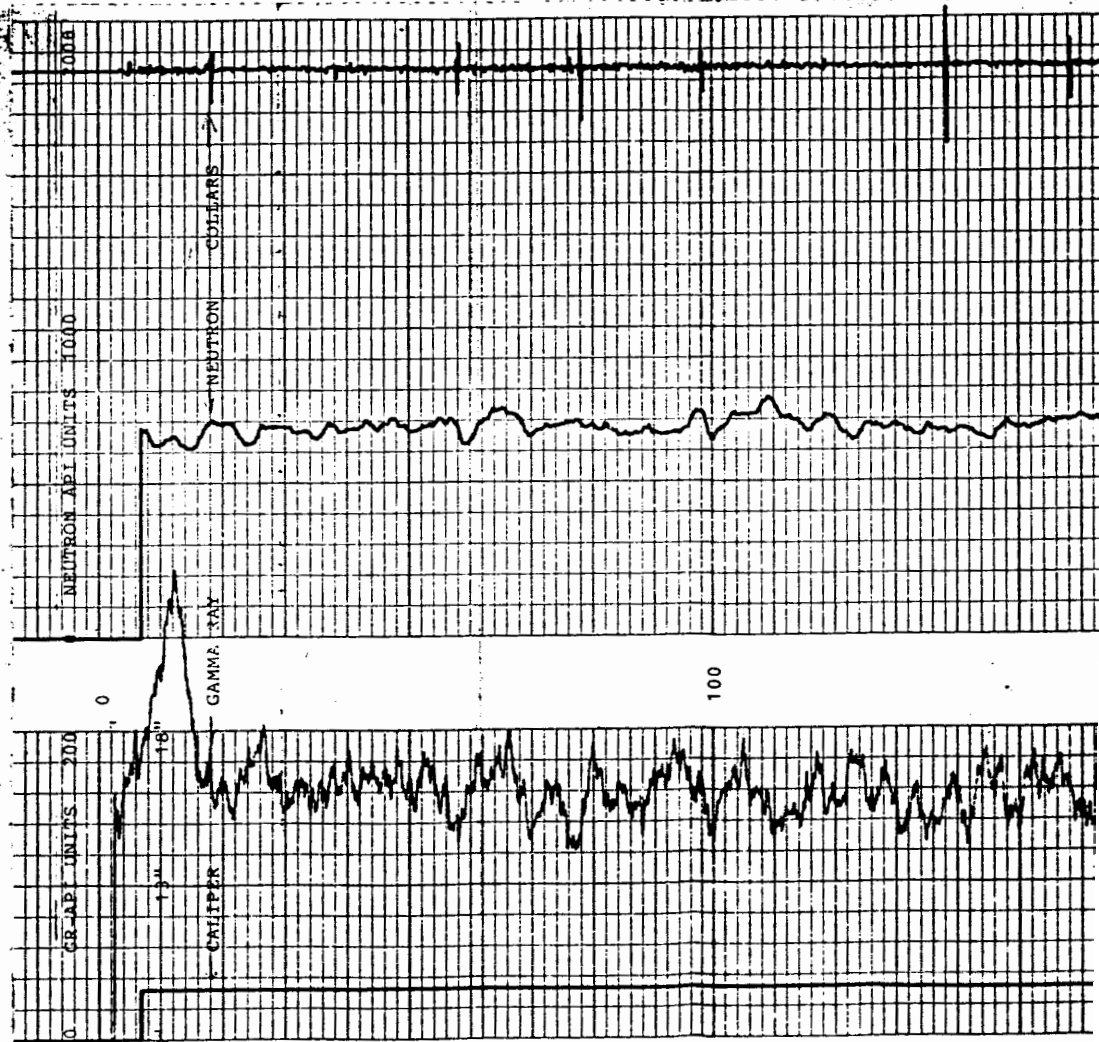
IN	BORE-HOLE RECORD			CASING RECORD		
	BT	FROM	TO	SIZE	WGT.	FROM TO
1		SURF	200	13 3/8		SURF 200
	12"	200	480			

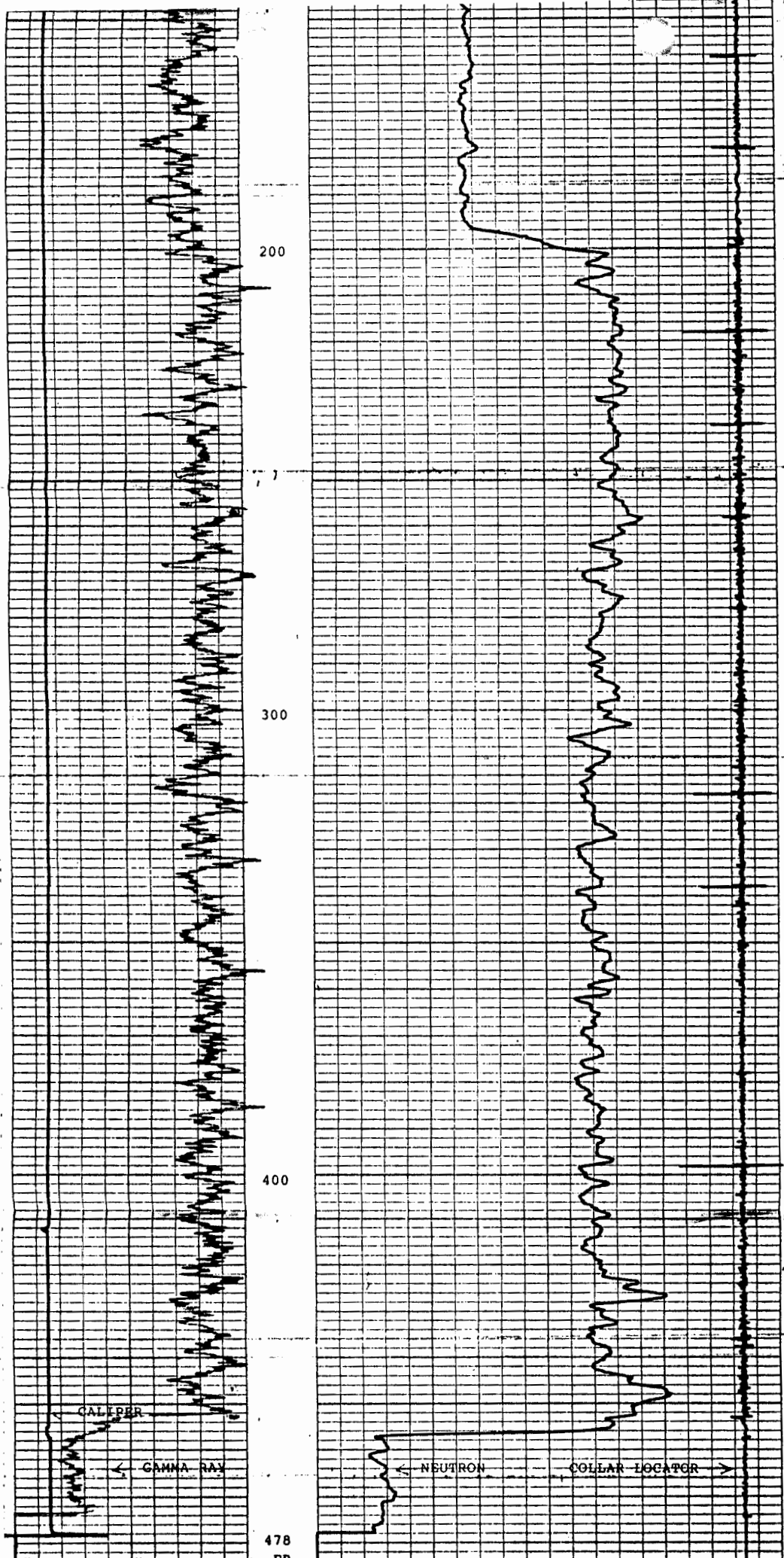
THIS HEADING AND LOG CONFORMS TO API RP 31

RUN NO.	ONE
LOG TYPE	N-N
TOOL MODEL NO.	3 CUMBER
RUN NO.	ONE
LOG TYPE	GO 450
TOOL MODEL NO.	1 11/16"
RUN NO.	ONE
TOOL MODEL NO.	GO 450
DIAMETER	1 11/16"

EQUIPMENT DATA

FOLD HERE





200

300

400

CALIPER

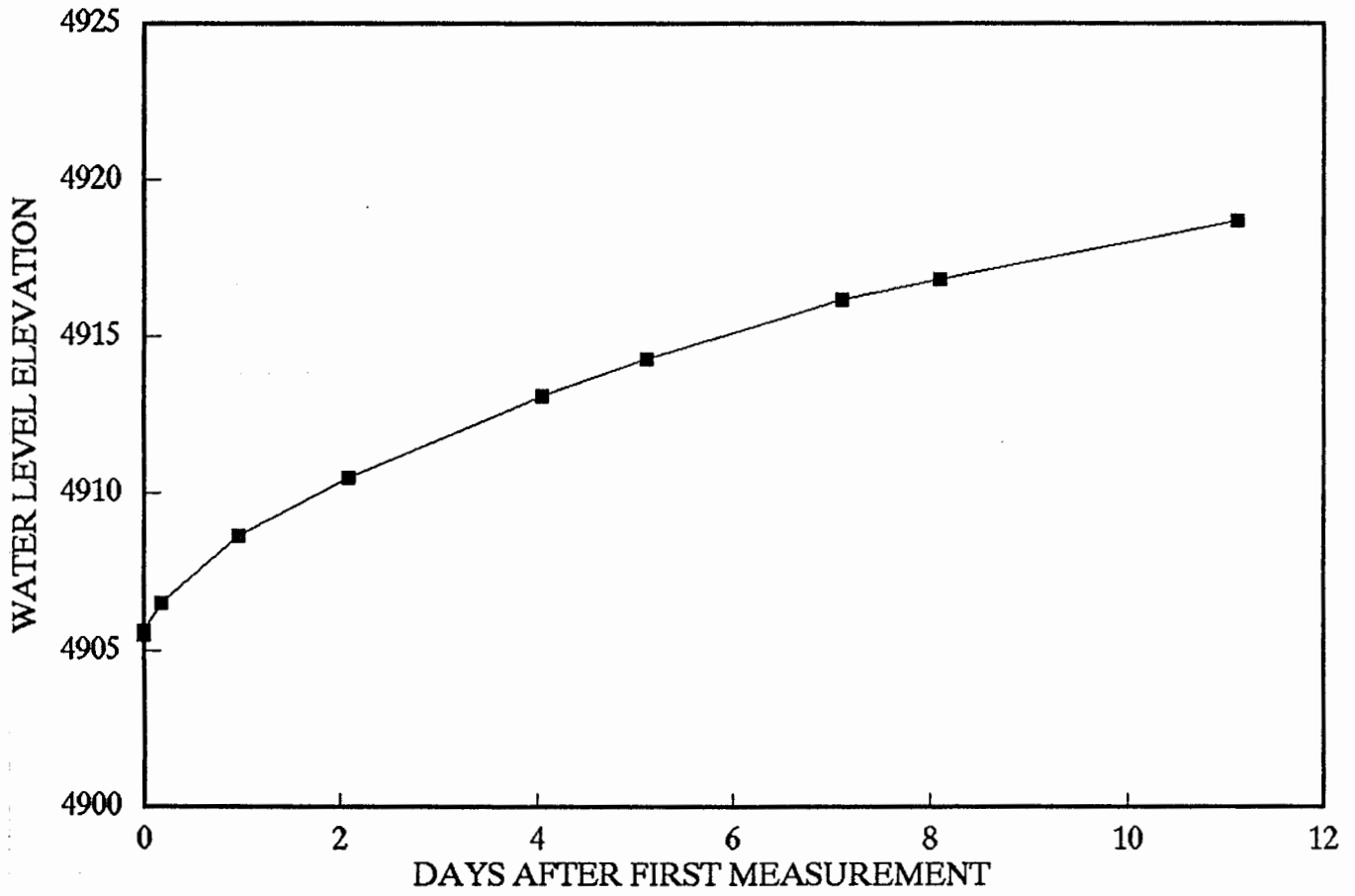
GAMMA RAY

NEUTRON

COLLAR LOCATOR

478
FR

MWL-MW3 WATER LEVEL MEASUREMENTS



First measurement collected 2-22-90, 1015am.
Water level measured from top of well casing.

ITEM 5

Water Level Measurements at MWL-MW3

Date	Time	Water Level	Elevation	Mins	Hours	Days
22-Feb	1015	475.850	4905.510	0.00	0	0
	1019	475.800	4905.560	4.00	0.066667	0.002778
	1025.15	475.750	4905.610	10.25	0.170833	0.007118
	1450	474.850	4906.510	275.00	4.583333	0.190972
23-Feb	925	472.725	4908.635	1390.00	23.16667	0.965278
24-Feb	1228	470.875	4910.485	3013.00	50.21667	2.092361
26-Feb	1138	468.250	4913.110	5843.00	97.38333	4.057639
27-Feb	1308	467.070	4914.290	7373.00	122.8833	5.120139
01-Mar	1558	465.180	4916.180	10243.00	170.7167	7.113194
02-Mar	1215	464.540	4916.820	11666.00	194.4333	8.101389
05-Mar	1245	462.650	4918.710	16015.98	266.933	11.12221
			5381.360	0.00		0
			5381.360	0.00		0
			5381.360	0.00		0
			5381.360	0.00		0
		460.650	4920.710	-2.00		

Table 3-2

SOIL BORING COMPLETION DATA
(Chronological order of completion)

Soil Boring	Planned Depth (feet)	Actual Depth (feet)	Dates of Drilling	Drilling Time (hours)	Sampling Method	No. Samples Collected	Comments
SB-18	150	150	9-7-89/9-9-89	16	Split Spoon	21	Water added down hole to loosen materials.
SB-14	100	100	9-11-89/9-12-89	10	Split Spoon	15	Screened (5 ft) PVC pipe set at 35 feet.
SB-12	100	80	9-12-89/9-12-89	6.5	Split Spoon	15	Screened PVC (5 ft) set at 51 feet.
SB-15	100	100	9-12-89/9-13-89	9	Split Spoon	15	Screened (5 ft) PVC pipe set at 45 feet.
SB-13	100	95	9-12-89/9-13-89	9	Split Spoon	13	Screened PVC (5 ft) set at 81 feet broken auger at 95 feet-recovered
SB-3	100	100	9-13-89/9-14-89	7	Split spoon	14	
SB-9	150	131	9-13-89/9-15-89	15	Split Spoon Core (a)	16	Continuous core sampling started at 45 feet.
SB-16	100	110	9-14-89/9-18-89	10	Split Spoon	15	HNU malfunction-interrupted drilling. Aluminum access tube placed to 30 feet.
SB-2	150	128	9-18-89/9-19-89	12	Core (a)	18	HNU readings in excess of two ppm, dense gravel and cobble 105-128 ft.
SB-11	100	90	9-19-89/9-19-89	8	Split Spoon	17	Aluminum access tube 30 feet.
SB-7	100	100	9-20-89/9-20-89	6	Split Spoon	15	High HNU readings from 10 to 30 feet.
SB-5	150	150	9-20-89/9-21-89	14	Core (a)	22	

(a) Continuous core sampling.

[QT]SX3034:D2722, #3488, PM = 10

Table 3-2 (Cont.)

Soil Boring	Planned Depth (feet)	Actual Depth (feet)	Dates of Drilling	Drilling Time (hours)	Sampling Method	No. Samples Collected	Comments
SB-4	100	100	9-21-89/9-21-89	6	Split Spoon	14	
*SB-1	100	75	9-25-89/9-26-89	8	Core (a)	15	30° angle (from vertical)
*SB-6	100	80	9-27-89/9-28-89	11	Core (a)	13	First Attempt to 35 feet second attempt approx. 15 ft W of first.
*SB-8	100	93.5	6-12-90/6-13/90	12.5	Core (a)	19	Added 10 gallons of water to ease drilling. 15° angle (from vertical)
*SB-10	100	80	6-14-90/6-15-90	13	Core (a)/ Split Spoon	18	15° angle (from vertical)
*SB-17	100	93.5	6-19-90/6-22-90	17	Core (a)/ Split Spoon	16	Drilled in level B protective equipment 30° angle (from vertical, directed toward trench D)

*ANGLE BORINGS: Actual completed depth is linear feet of the angled boring.
(a) Continuous core sampling.