



Technical Memorandum

To:	Document Control Desk	From:	Rebecca Bilodeau –Tetra Tech
Company:	NRC	Date:	4/15/09
Re:	Highland Tt Monitor Wells Installation Report	Project #:	180549.2009
CC:	Keith McConnell -NRC Thomas McLaughlin –NRC Mahesh Vidyasagar –ExxonMobil	Bruce Wielinga –AMEC Anna Krzyszowska-Waitkus –WDEQ Rob Boner –Property owner	

This report covers the installation and development of eight monitoring wells at the ExxonMobil Highland Reclamation Project Site located near Douglas, Wyoming. Eight monitoring wells were drilled using hollow stem auger/air rotary drilling and were completed in the shallow water bearing formations. Figure 1 shows the location of the new monitoring wells (Tt-1 through Tt-8) and Table 1 presents the monitor well completion data. Table 2 presents the survey data. The monitor well installation started December 8, 2008 and was completed January 22, 2009.

Monitor Well Installation

Boreholes were drilled by Drilling Engineers Inc., of Fort Collins, Colorado. A CME 75 drill rig utilizing hollow stem augers and air rotary drilling was used to drill the boreholes. Tt-4, Tt-5, Tt-6, Tt-7, and Tt-8 were drilled with 10.25-inch outside diameter (OD) X 6.25-inch inside diameter (ID) hollow stem augers (HSA). Tt-1 was drilled using 12.25-inch OD X 8.25-inch ID HSA as surface casing for 8-inch diameter air rotary drilling (Ken Klaw Bit). Tt-2 and Tt-3 were drilled using both HAS and air rotary drilling methods. The boreholes were logged during drilling by observation of auger flight drill cuttings, air rotary drill cuttings, and Standard Penetration Test (SPT) split spoon samples. SPT sample blow counts were recorded. Borehole logs are presented in Attachment A.

Tt-3 and Tt-8 required multiple boreholes before completion of the monitor well. Tt-3 was initially drilled with air rotary to 90 feet below ground surface (BGS) but thick sandy clays lined the borehole and prevented well completion. Tt-3B was then drilled thirteen feet to the southeast of Tt-3 to 51.5 feet BGS. Again thick sandy clays prevented monitor well construction. Tt-3B was located 20 feet northwest of Tt-3 and was drilled with HAS to 75.5 feet BGS and a monitor well was installed. The Tt-3 borehole log is a composite of boreholes Tt-3, Tt-3A, and Tt-3B. The monitoring well installed in borehole Tt-3B was named Tt-3. Tt-8 also required three attempts (Tt-8, Tt-8A, and Tt-8B) to complete the monitoring well. HSA drilling was used to drill Tt-8 to 60.5 feet BGS. Thick sandy clays within the augers prevented monitor well construction. Tt-8A was located 49.5 feet southeast of BBL-1. Tt-8A was augered to 40 feet BGS and thick sandy clays inside the auger prevented monitor well construction. Tt-8B was located 71.5 feet southeast of BBL-1. Tt-8B was augered to 60.5 feet BGS and a monitor well was installed. The Tt-8 borehole log is a composite of boreholes Tt-8, Tt-8A, and Tt-8B. The monitoring well installed in borehole Tt-8B was named Tt-8.

Table 2 presents well completion summary data and Attachment B includes the monitor well completion diagrams. The 4-inch diameter monitoring wells were constructed from Johnson Schedule 40 PVC. Slotted well screen (0.020-inch) and cap was installed at the depths specified in Table 2. Centralizers were installed within the screen interval and blank casing interval in monitor wells Tt-1 and Tt-2. Carmeuse Industrial Sand's (Colorado Silica Sand) 10-20 filter pack was installed to above the screen (Table 1). As necessary a Cetco coated bentonite pellet seal was installed below the filter pack. Chip bentonite was installed above filter pack to 1 foot below ground surface. The 4-inch PVC was capped with a 4-inch slip

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cap. The surface completions consisted of a five foot long lockable protective steel casing with a four foot square sloping cement pad.

All downhole drilling equipment was decontaminated by washing with potable water before the first borehole and between boreholes.

Monitor well registration with the State of Wyoming was not required.

Monitor Well Pump Installation and Development

Wells were first developed by surging and bailing throughout the screened interval. Grundfos 5SQ05, ½ horsepower, 3-inch, 240 volt electric submersible pumps were installed in each of the monitoring wells by Pronghorn Pump. The pumps were installed at the depths specified in Table 3. Pronghorn Pump then further developed the wells by pumping. Table 3 presents development data including the pump installation depth, total gallons pumped, field parameter data, and pumping rates. Wells Tt-1, Tt-3, Tt-4, Tt-5, and Tt-6 were pumped continuously at the rates specified in Table 3. Wells Tt-2, Tt-7, and Tt-8 could not be pumped continuously at the rates specified in Table 3 and were allowed to recover between pumping cycles.

Development water and drill cuttings were spread on the ground at the well site.

Water Quality Sampling

The wells were sampled February 16-17, 2009 and analyzed for field parameters (pH, conductivity and temperature) and water quality parameters. The results, along with water level data are included in Table 4.

Table 1 Monitor Well Specifications

Well	Total Depth	Bottom Bentonite Seal	Bottom of Filter Pack	Top of Filter Pack	Bottom of PVC	Top of Screen	Stickup
Tt-1	100.0	98.75	93.5	77.6	92.8	87.5	2.5
Tt-2	85.0	82.0	77.0	53.5	75.9	70.6	3.0
Tt-3	75.5	70.0	67.3	34.0	67.3	47.0	3.0
Tt-4	35.5	NA	33.5	7.1	33.3	18.0	3.0
Tt-5	29.0	27.3	25.0	4.0	23.8	13.5	3.0
Tt-6	26.0	26.0	23.5	5.0	23.3	13.0	3.0
Tt-7	31.5	29.2	27.0	3.8	27.0	16.7	3.0
Tt-8	60.5	NA	58.8	20.5	58.8	38.5	2.5

Note: All Depths as feet below ground surface

Table 2 Survey Data

Well	North	East	Cement Pad Elevation (ft)	Top of Flange Elevation (ft)
Tt-1	875807.40	416510.47	5164.42	5166.93
Tt-2	875304.20	415185.25	5140.11	5142.91
Tt-3	873953.89	416639.91	5100.41	5103.26
Tt-4	871562.81	417191.50	5061.65	5064.34
Tt-5	871238.07	417247.12	5057.95	5060.87
Tt-6	871325.94	417583.67	5056.22	5058.88
Tt-7	871699.64	417642.01	5055.22	5058.00
Tt-8	873673.81	415434.56	5091.81	5094.21

Table 3 Well Development Summary

Well	Pump Depth (ft)	Total Gallons Pumped	Pumping Rate (GPM)	pH (s.u.)	Cond. (µS/cm)	Temp. (°C)	Comments
Tt-1	94	1310	2.0	7.70	981	12.1	Continuous pumping rate 2 GPM
Tt-2	76	2160	2.0	6.34	1937	12.0	Continuous pumping rate <2 GPM
Tt-3	60	1496	3.0	7.31	1658	12.4	Continuous pumping rate 3 GPM
Tt-4	34	555	2.0	7.18	1422	12.2	Continuous pumping rate 2 GPM
Tt-5	25	11867	9.0	7.17	1381	9.8	Continuous pumping rate 9 GPM
Tt-6	25	1583	4.5	6.79	2280	11.1	Continuous pumping rate 4.5 GPM
Tt-7	28	1347	2.0	7.09	2230	10.3	Continuous pumping rate <2 GPM
Tt-8	60	250	3.0	6.83	3990	12.0	Continuous pumping rate <3 GPM



Table 4 Water Quality and Field Data

Well ID	As mg/l	Cd mg/l	Cr mg/l	Ni mg/l	Pb mg/l	Se mg/l	Uranium mg/L	Ca mg/l
Tt-1	<0.00095	<0.00021	<0.00068	<0.0005	<0.00005	<0.00099	0.0004	61.9
Tt-2	<0.00095	<0.00021	<0.00068	0.0016	0.00018	<0.00099	0.0123	250
Tt-3	0.0026	<0.00021	<0.00068	0.00074	0.0011	<0.00099	0.0038	222
Tt-4	<0.00095	<0.00021	<0.00068	0.00092	0.00043	<0.00099	0.0269	187
Tt-5	0.002	<0.00021	<0.00068	<0.0005	0.00016	<0.00099	0.0093	78.2
Tt-6	0.0046	<0.00021	<0.00068	0.0012	0.0001	<0.00099	0.0199	227
Tt-7	<0.00095	<0.00021	<0.00068	0.0019	0.00067	0.0025	0.0442	316
Tt-8	0.0017	<0.00021	<0.00068	0.0262	0.00024	0.004	0.117	643

Well ID	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	(NO ₂ +NO ₃)-N mg/l	Bicarbonate mg/l CaCO ₃	Carbonate mg/l CaCO ₃	Alkalinity to pH 4.5 mg/l CaCO ₃
Tt-1	13.7	135	4.36	4.7	<0.04	155	<0.46	155
Tt-2	67.5	103	5.2	16.8	<0.04	187	<0.46	187
Tt-3	51.6	80.1	7.37	47.4	<0.04	175	<0.46	175
Tt-4	42.5	85.9	7.4	21	<0.04	245	<0.46	245
Tt-5	21.4	131	3.2	7.5	<0.04	249	<0.46	249
Tt-6	65.3	274	5.52	28.9	<0.04	310	<0.46	310
Tt-7	76.6	106	5.86	97.7	<0.04	268	<0.46	268
Tt-8	172	194	8.52	267	<0.4	577	<0.46	577

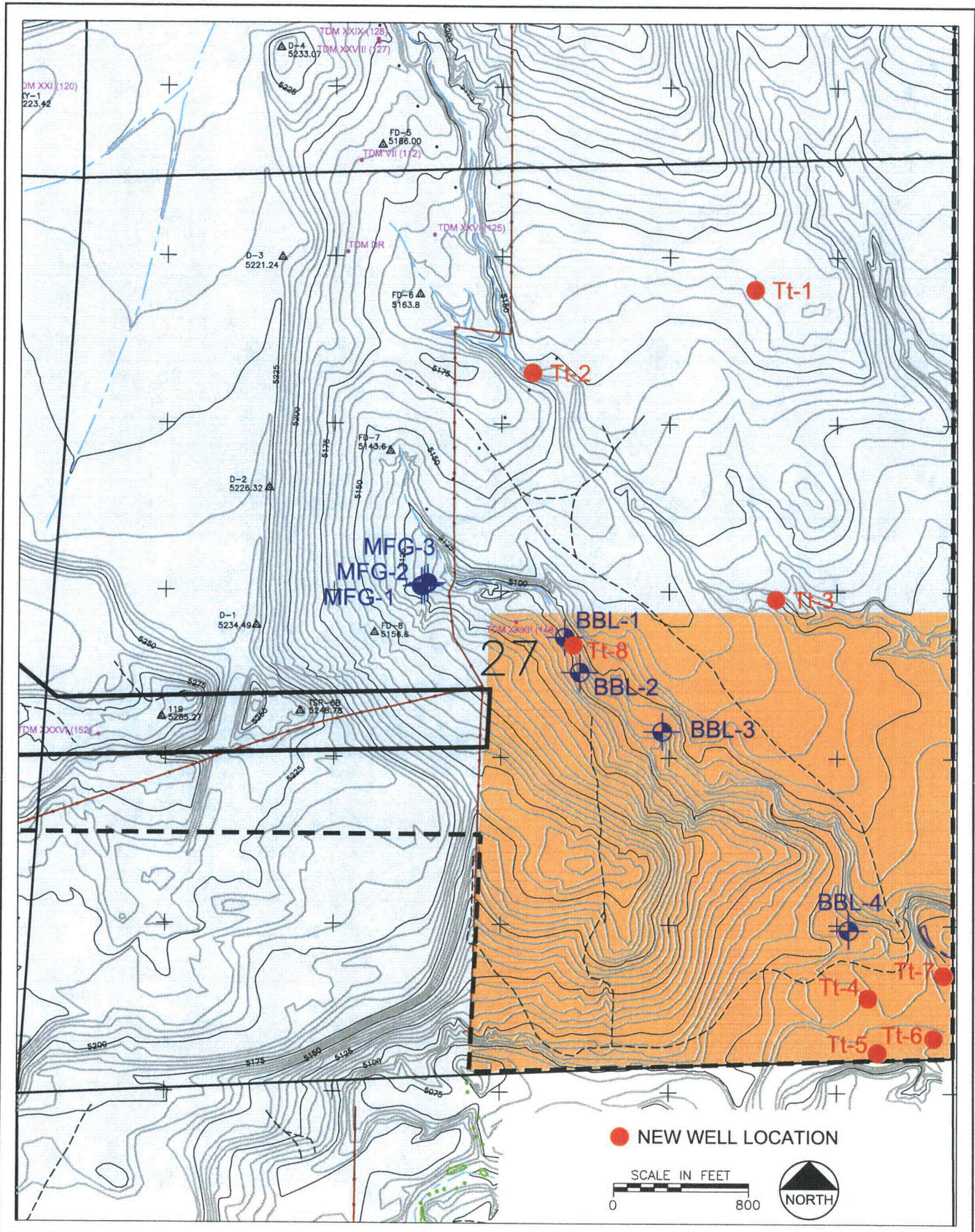


Table 4 Water Quality and Field Data (continued)

Well ID	Alkalinity to pH 8.3	SO ₄	TDS	Gross Alpha	Ra-226	Ra-228	Th-230
	mg/l CaCO ₃	mg/l	mg/l	pCi/L	pCi/L	pCi/L	pCi/L
Tt-1	<0.46	315	637	<0.6	0.3	0.35	<0.2
Tt-2	<0.46	910	1520	1.2	0.5	2.3	<0.1
Tt-3	<0.46	728	1220	0.7	0.32	1.2	<0.1
Tt-4	<0.46	545	1070	1.5	<0.17	0.23	<0.1
Tt-5	<0.46	281	684	<0.6	0.23	0.18	<0.2
Tt-6	<0.46	984	1780	<0.6	0.39	1.1	<0.2
Tt-7	<0.46	964	1740	0.7	<0.17	0.84	<0.1
Tt-8	<0.46	1760	3620	2.2	0.73	3.3	<0.1

Well	Water Level (ft)	pH (su)	Conductivity (µS/cm)	Temperature (C°)
Tt-1	5081.07	7.50	998	10.4
Tt-2	5074.25	7.47	1917	12.5
Tt-3	5061.36	7.30	1562	12.3
Tt-4	5052.34	7.15	1475	12.5
Tt-5	5052.51	7.36	955	9.3
Tt-6	5050.98	7.15	2400	10.2
Tt-7	5048.20	7.08	2200	10.7
Tt-8	5065.01	6.66	4020	12

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Project No. 180549

February 2009



Figure 1
New Well Locations

**Attachment A
Borehole Logs**

**BOREHOLE LOG**BOREHOLE
NO.:PAGE: 1 OF 6DATE: 12/10/08Tt-1**PROJECT INFORMATION**PROJECT: HIGHLAND RECLAMATION PROJECTPROJECT NO.: 180549.2009CLIENT: EXXON MOBIL ENVIRONMENTAL SERVICES CORP.OWNER: EXXON MOBILLOCATION: HIGHLAND MINE SITECONVERSE COUNTY, WYOMING**BOREHOLE LOCATION**

SEE FIGURE . .

FIELD INFORMATIONDATE & TIME ARRIVED: 12/11/08 - 07:40BOREHOLE LOGGED BY: JOE REEDVISITORS: NONEWEATHER: SUNNY, WINDY (10° TO 20°)**DRILLING INFORMATION**DRILLING COMPANY: DRILLING ENGINEERS, INC.START TIME: 12/16/08 - 09:45BORING DEPTH: 100'BORING DIA.: 12 1/4" 0 TO 10', 8" 10' TO 100'DRILLING METHOD: 12 1/4" O.D. x 8 1/4" I.D. HSA 0 TO 10', 8" AIR ROTARY 10' TO 100'SAMPLING METHOD: AUGER FLIGHT, SPT SPLIT SPOON, AIR ROTARY DRILL CUTTINGSTIME DRILLING COMPLETE: 1/5/09 - 13:30**BOREHOLE COMPLETION / ABANDONMENT INFORMATION**START TIME: 1/6/09 - 08:00COMPLETE TIME: 1/6/09 - 11:00INSTRUMENTATION: 4" PVC MONITOR WELLBACKFILL: FILTER PACK, BENTONITE

ELEVATION - TOP OF BORING: _____ RELATIVE TO: _____

GROUNDWATER CONDITIONSAPPROXIMATE WATER LEVEL 2/17/09 83' BGS**FOLLOWING FIELD WORK**TIME OF CLEAN-UP COMPLETE: 1/6/09 - 11:00TIME LEFT SITE: 1/6/09 - 11:00NOTES: _____



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT

PAGE: 2 OF 6

PROJECT NO.: 180549.2009

DATE: 12/16/08

Tt-1

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
0							<p>SILTY SAND (0 TO 7.5') YELLOWISH BROWN (10YR 6/4), DRY TO SLIGHTLY MOIST, LOOSE, FINE SAND, SILT, TRACE CLAY, TRACE ROOTS, SLIGHTLY COHESIVE.</p>
1							
2							
3							
4							
5							
6							
7					NS		
8							<p>SANDY CLAY (7.5' TO 9.5') BROWN (10YR 5/3), SLIGHTLY MOIST, MEDIUM STIFF, FINE SAND.</p> <p>10' - START AIR ROTARY.</p>
9							
10					NS		
11		SPT	42 50/5	1.2			<p>SAND (9.5' TO 13') VERY PALE BROWN (10YR 7/3), DRY, VERY DENSE, FINE TO COARSE SAND, 40% FINE - 30% MEDIUM - 30% COARSE), TRACE SILT.</p>
12							
13							<p>SAND (13' TO 18') BROWNISH YELLOW (10YR 6/6), DRY, VERY DENSE, FINE TO MEDIUM SAND, MOSTLY FINE SAND, TRACE SILT, TRACE COARSE SAND, TRACE FINE GRAVEL.</p>
14							
15							
16							
17							<p>SAND (18' TO 22.5') LIGHT YELLOWISH BROWN (10YR 6/4), DRY TO SLIGHTLY MOIST, FINE TO COARSE SAND, SOME GRAY WEATHERED CLAYSTONE.</p>
18							
19							
20							



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT PAGE: 3 OF 6

PROJECT NO.: 180549.2009 DATE: 12/16/08

Tt-1

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
20						SAND (18' TO 22.5') SEE DESCRIPTION ON PREVIOUS PAGE.	
21							
22							
23						WEATHERED CLAYSTONE (22.5' TO 27') GRAY (10YR 5/1), SLIGHTLY MOIST, IRON STAINED.	
24							
25							
26							
27						SAND (27' TO 29') LIGHT YELLOWISH BROWN (10YR 6/4), MOIST, FINE TO COARSE SAND.	
28							
29							
30						SHALE (29' TO 31') GRAY (10YR 5/1), DRY.	
31							
32						SANDY CLAYSTONE (31' TO 37') GRAY (10YR 5/1), DRY, FINE SAND.	
33							
34							
35						35' - LET SIT 30 MINUTES - DRY.	
36							
37						CLAYEY SAND (37' TO 44') GREENISH GRAY (GLEY2 6/1), SLIGHTLY MOIST TO DRY, FINE SAND, COHESIVE.	
38							
39							
40							



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT

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Tt-1

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION	
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.				
40						CLAYEY SAND (37' TO 44') SEE DESCRIPTION ON PREVIOUS PAGE.		
41								
42								
43								
44								
45								SANDY SHALE / CLAYSTONE (44' TO 55') GREENISH GRAY (GLEY2 6/1), SLIGHTLY MOIST TO DRY, VERY FINE SAND.
46								
47								
48								
49								
50								
51								
52								
53								
54								
55								
56						SHALE (55' TO 66') GRAY (10YR 6/1), SLIGHTLY MOIST TO DRY, TRACE SANDY SHALE.		
57								
58								
59								
60								



BOREHOLE LOG

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DATE: 12/16/08

Tt-1

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
60							SHALE (55' TO 66') SEE DESCRIPTION ON PREVIOUS PAGE.
61							
62							
63							
64							
65							SANDY SHALE AND CLAYEY SANDSTONE (66' TO 71') GRAY (10YR 6/1), DRY, FINE SAND.
66							
67							
68							
69							
70							SAND (71' TO 76') YELLOWISH BROWN (10YR 5/6), SLIGHTLY MOIST, FINE SAND, TRACE CLAY, SLIGHTLY COHESIVE.
71							
72							
73							
74							
75							SANDSTONE (76' TO 79') LIGHT GRAY (10YR 7/1), DRY, VERY DENSE, FINE SAND, TRACE MEDIUM SAND, WELL CEMENTED, HARD.
76							
77							
78							
79							
80							SAND (79' TO 82.5') BROWNISH YELLOW (10YR 6/6), SLIGHTLY MOIST TO MOIST, FINE TO MEDIUM SAND.



BOREHOLE LOG

BOREHOLE NO.:

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PROJECT NO.: 180549.2009

DATE: 12/16/08 & 1/5/09

Tt-1

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
80						SAND (79' TO 82.5') SEE DESCRIPTION ON PREVIOUS PAGE.	
81						80' - LET SIT 15 MIN. DRY.	
82							
83						SAND (82.5' TO 85') GRAY (10YR 6/1), MOIST, FINE TO MEDIUM SAND, TRACE CLAY, SLIGHTLY COHESIVE.	
84							
85						12/16/08 1/5/09	
86						SAND (85' TO 92.5') GRAY (10YR 6/1), WET, FINE TO COARSE SAND, TRACE CLAY, SLIGHTLY COHESIVE.	
87							
88							
89							
90							
91							
92							
93						SHALE (92.5' TO 100') GRAY (10YR 6/1).	
94							
95							
96							
97							
98							
99							
100						E.O.B. = 100.0'	



BOREHOLE LOG

BOREHOLE NO.:

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DATE: 12/11/08

Tt-2

PROJECT INFORMATION

PROJECT: HIGHLAND RECLAMATION PROJECT
PROJECT NO.: 180549.2009
CLIENT: EXXON MOBIL ENVIRONMENTAL SERVICES CORP.
OWNER: EXXON MOBIL
LOCATION: HIGHLAND MINE SITE
CONVERSE COUNTY, WYOMING

BOREHOLE LOCATION

SEE FIGURE . .

FIELD INFORMATION

DATE & TIME ARRIVED: 12/11/08 - 07:40
BOREHOLE LOGGED BY: JOE REED
VISITORS: NONE
WEATHER: SUNNY, WINDY (20°)

DRILLING INFORMATION

DRILLING COMPANY: DRILLING ENGINEERS, INC.
START TIME: 12/11/08 - 12:30
BORING DEPTH: 85' BORING DIA.: 12 1/4" 0 TO 15', 10 1/4" 15' TO 64', 8" 64' TO 85'
DRILLING METHOD: 10 1/4" O.D. x 6 1/4" I.D. HSA 0 TO 64', 12 1/4" O.D. x 8 1/4" I.D. HSA 0 TO 15', AIR ROTARY 15' TO 85'
SAMPLING METHOD: AUGER FLIGHT, SPT SPLIT SPOON, AIR ROTARY DRILL CUTTINGS
TIME DRILLING COMPLETE: 12/12/08 - 16:50

BOREHOLE COMPLETION / ABANDONMENT INFORMATION

START TIME: 12/13/08 - 08:00 COMPLETE TIME: 12/13/08 - 11:25
INSTRUMENTATION: 4" PVC MONITOR WELL BACKFILL: FILTER PACK, BENTONITE
ELEVATION - TOP OF BORING: _____ RELATIVE TO: _____

GROUNDWATER CONDITIONS

APPROXIMATE WATER LEVEL 2/17/09 65' BGS

FOLLOWING FIELD WORK

TIME OF CLEAN-UP COMPLETE: 12/13/08 - 11:25 TIME LEFT SITE: 12/13/08 - 11:25

NOTES: 6 1/4" I.D. HSA TO 64', 8, 8 1/4" I.D. HSA TO 15', AIR ROTARY, 15' TO 85'.



BOREHOLE LOG

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Tt-2

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
0							SILTY CLAYEY SAND / SANDY CLAYEY SILT (0 TO 10') LIGHT YELLOWISH BROWN (10YR 6/4), DRY, LOOSE, FINE SAND, TRACE ROOTS.
1							
2							
3							
4							
5				NS			
6							
7							
8							
9				NS			
10							SANDY CLAY (10' TO 14') DARK YELLOWISH BROWN (10YR 4/4), SLIGHTLY MOIST TO MOIST, MEDIUM STIFF, FINE SAND.
11							
12							
13							
14							SAND (14' TO 16') YELLOWISH BROWN (10YR 5/6), MOIST, LOOSE TO MEDIUM DENSE, FINE SAND, TRACE MEDIUM SAND, TRACE SILT, TRACE CLAY, SLIGHTLY COHESIVE.
15		SPT	5 5 6	1.5			
16							CLAY (16' TO 19.5') DARK YELLOWISH BROWN (10YR 4/4), SLIGHTLY MOIST TO MOIST, MEDIUM STIFF, TRACE FINE SAND, TRACE ORGANICS.
17							
18							
19							
20							INTERBEDDED SANDS, CLAYEY SAND AND SANDY CLAY (19.5' TO 29.5') SEE DESCRIPTION NEXT PAGE.
		SPT	4 7 7	1.3			



BOREHOLE LOG

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Tt-2

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
20							INTERBEDDED SANDS, CLAYEY SAND AND SANDY CLAY (19.5' TO 29.5') YELLOWISH BROWN (10YR 5/6), SLIGHTLY MOIST TO MOIST, MEDIUM DENSE / MEDIUM STIFF TO STIFF, VERY FINE SAND, VARYING AMOUNTS OF CLAY.
21							
22							
23							
24							24' - TRACE ROOTS.
25		SPT	3 4 5	1.3			
26							
27					NS		
28							
29							
30		SPT	4 7 12	1.1			CLAY (29.5' TO 34') LIGHT BROWNISH GRAY (10YR 6/2), DRY TO SLIGHTLY MOIST, STIFF, TRACE FINE SAND, TRACE IRON STAINING.
31							
32					NS		
33							
34							
35		SPT	25 27 35	1.5			CLAYEY SAND (34' TO 35.5') VERY PALE BROWN (10YR 7/3), SLIGHTLY MOIST, VERY DENSE, FINE SAND, TRACE SILT.
36							
37					NS		
38							
39							
40		SPT	40 50/2	1.0			SAND (39' TO 40') BROWNISH YELLOW (10YR 6/6), SLIGHTLY MOIST, VERY DENSE, FINE TO MEDIUM SAND, TRACE SILT.



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Tt-2

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
40							
41							
42					NS		
43							
44							INTERBEDDED SANDS, CLAYEY SAND, SANDY CLAY (44' TO 45') YELLOWISH BROWN (10YR 6/6), SLIGHTLY MOIST, VERY DENSE / HARD, FINE SAND, MEDIUM SAND, TRACE SILT, VARYING AMOUNT OF CLAY.
45		SPT	50/5	0.4			
46							SANDSTONE (45' TO 45.5') VERY PALE BROWN (10YR 7/4), DRY, VERY DENSE, FINE TO MEDIUM SAND, HARD CEMENTED SANDSTONE.
47					NS		
48							
49							INTERBEDDED SANDS, CLAYEY SAND, SANDY CLAY (49' TO 71') YELLOWISH BROWN (10YR 6/6), SLIGHTLY MOIST, VERY DENSE / HARD, FINE SAND, MEDIUM SAND, TRACE SILT, VARYING AMOUNTS OF CLAY.
50		SPT	50/5	0.5			
51							
52					NS		
53							
54							
55		SPT	40 50/2	0.8			
56							
57					NS		
58							
59							
60		SPT	30 50/3	0.9			



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT

PAGE: 5 OF 6

PROJECT NO.: 180549.2009

DATE: 12/11/08

Tt-2

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
60						<p>INTERBEDDED SANDS, CLAYEY SAND, SANDY CLAY (49' TO 71') SEE DESCRIPTION ON PREVIOUS PAGE.</p>	
61							
62					NS		
63							
64						<p>12/11/08 64' - START AIR ROTARY. 12/12/08</p>	
65		SPT	35 50/3	0.9			
66					NS		
67						67' - TRACE GRAY SHALE.	
68							
69					NS		
70							
71						<p>SAND (71' TO 75') GRAY (10YR 6/1), WET, FINE TO COARSE SAND.</p>	
72							
73							
74							
75						<p>SHALE (75' TO 85') DARK GRAY (10YR 4/1), WET.</p>	
76					NS		
77							
78							
79							
80							



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT

PAGE: 6 OF 6

PROJECT NO.: 180549.2009

DATE: 12/12/08

Tt-2

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
80						SHALE (75' TO 85') SEE DESCRIPTION ON PREVIOUS PAGE. E.O.B. = 85.0'	
81							
82							
83							
84							
85							
86							
87							
88							
89							
90							
91							
92							
93							
94							
95							
96							
97							
98							
99							
100							



BOREHOLE LOG

BOREHOLE NO.:

PAGE: 1 OF 6

DATE: 1/6/09 TO 1/13/09

Tt-3

PROJECT INFORMATION

PROJECT: HIGHLAND RECLAMATION PROJECT
PROJECT NO.: 180549.2009
CLIENT: EXXON MOBIL ENVIRONMENTAL SERVICES CORP.
OWNER: EXXON MOBIL
LOCATION: HIGHLAND MINE SITE
CONVERSE COUNTY, WYOMING

BOREHOLE LOCATION

SEE FIGURE . .

FIELD INFORMATION

DATE & TIME ARRIVED: 1/6/09 - 13:30
BOREHOLE LOGGED BY: JOE REED
VISITORS: NONE
WEATHER: WINDY, COLD

DRILLING INFORMATION

DRILLING COMPANY: DRILLING ENGINEERS, INC.
START TIME: 1/6/09 - 15:45
BORING DEPTH: 90' BORING DIA.: 12 1/4" 0 TO 10', 10 1/4" 0' to 75.5', 8" 10' TO 90'
DRILLING METHOD: 10 1/4" O.D. x 6 1/4" I.D. HSA 0 TO 64', AIR ROTARY
SAMPLING METHOD: AUGER FLIGHT, SPT SPLIT SPOON, AIR ROTARY DRILL CUTTINGS
TIME DRILLING COMPLETE: 1/13/09 - 09:10

BOREHOLE COMPLETION / ABANDONMENT INFORMATION

START TIME: 1/13/09 - 10:20 COMPLETE TIME: 1/13/09 - 16:15
INSTRUMENTATION: 4" PVC MONITOR WELL BACKFILL: FILTER PACK, BENTONITE
ELEVATION - TOP OF BORING: _____ RELATIVE TO: _____

GROUNDWATER CONDITIONS

APPROXIMATE WATER LEVEL 2/16/09 38' BGS

FOLLOWING FIELD WORK

TIME OF CLEAN-UP COMPLETE: 1/13/09 - 16:15 TIME LEFT SITE: 1/13/09 - 16:15

NOTES: THIS BOREHOLE LOG IS A COMPOSITE OF THREE BOREHOLES (Tt-3, Tt-3A, AND Tt-3B). Tt-3 WAS DRILLED 90', Tt-3A WAS DRILLED TO 51.5', Tt-3 AND Tt-3A WAS DRILLED WITH AIR ROTARY AND ABANDONED DUE TO CLAYS. Tt-3B WAS AUGERED TO 75.5' AND MONITOR WELL WAS INSTALLED, THE WELL IS LABELED Tt-3. Tt-3A IS 13' SOUTH EAST OF Tt-3, Tt-3B IS 20' NORTH WEST OF Tt-3.



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT

PAGE: 2 OF 6

PROJECT NO.: 180549.2009

DATE: 1/6/09 TO 1/13/09

Tt-3

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
0							SANDY SILTY CLAY (0 TO 3') LIGHT YELLOWISH BROWN (10YR 6/4), DRY, LOOSE TO MEDIUM STIFF, FINE SAND, TRACE ROOTS.
1							
2							
3							SAND (3' TO 6.3') LIGHT YELLOWISH BROWN (10YR 6/4), DRY, MEDIUM DENSE, FINE TO MEDIUM SAND, TRACE COARSE SAND.
4							
5							SANDY CLAY / CLAYEY SAND (6.3' TO 11') LIGHT YELLOWISH BROWN (10YR 6/4), DRY TO MOIST, MEDIUM STIFF TO VERY STIFF, FINE SAND, TRACE WHITE (HCI, MEDIUM), MOISTURE INCREASES WITH DEPTH.
6		SPT	6 5 5	1.5			
7							
8							SAND (11' TO 12') LIGHT YELLOWISH BROWN (10YR 6/4), SLIGHTLY MOIST, MEDIUM DENSE, FINE TO COARSE SAND.
9							
10							
11		SPT	7 7 12	1.2			
12							SANDY CLAY (12' TO 20') LIGHT YELLOWISH BROWN (10YR 6/4), MOIST, MEDIUM STIFF, FINE SAND, TRACE MEDIUM SAND.
13							
14							
15							
16							
17							
18							
19							
20							



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT PAGE: 3 OF 6

PROJECT NO.: 180549.2009 DATE: 1/6/09 TO 1/13/09

Tt-3

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
20							INTERBEDDED SANDY CLAY AND CLAYEY SAND (20' TO 40') YELLOWISH BROWN (10YR 5/4), SLIGHTLY MOIST TO MOIST, STIFF / MEDIUM DENSE, FINE SAND, TRACE MEDIUM SAND, TRACE COARSE SAND.
21		SPT	5 5 6	1.5			
22							
23							
24							
25							
26		SPT	5 7 8	1.5			
27							
28							
29							
30							30' - TRACE WHITE (HCI MEDIUM).
31		SPT	4 4 5	1.5			
32							
33							
34							34' TO 34.5' - SOME COARSE SAND.
35							35' TO 37' - SOME COARSE SAND.
36		SPT	4 4 5	1.5			35' TO 40' - INCREASING MOISTURE TO ALMOST WET, COLOR CHANGE TO GRAYISH BROWN (10YR 5/2).
37							
38							
39							
40							



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT

PAGE: 4 OF 6

PROJECT NO.: 180549.2009

DATE: 1/6/09 TO 1/13/09

Tt-3

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
40							<p>INTERBEDDED SANDY CLAY AND CLAYEY SAND (40' TO 61') DARK GREENISH GRAY (GLEY 4/1) AND GRAYISH BROWN (10YR 5/2), WET, SOFT TO STIFF, FINE SAND.</p> <p>45' - COLOR CHANGE TO DARK GRAY (10YR 4/1), TRACE MEDIUM SAND, TRACE COARSE SAND, TRACE BLACK ORGANICS.</p> <p>50' - COLOR CHANGE TO GRAY (GLEY1 5), FINE TO COARSE SAND.</p> <p>51.5' - T.D. Tt-3A.</p>
41		SPT	5 5 8	1.5			
42							
43							
44							
45							
46		SPT	4 6 10	1.5			
47							
48							
49							
50							
51		SPT	6 8 10	1.5			
52							
53							
54							
55							
56		SPT	4 4 9	1.5			
57							
58							
59							
60							



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT

PAGE: 5 OF 6

PROJECT NO.: 180549.2009

DATE: 1/6/09 TO 1/13/09

Tt-3

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
60							INTERBEDDED SANDY CLAY AND CLAYEY SAND (40' TO 61') SEE DESCRIPTION ON PREVIOUS PAGE.
61		SPT	14 16 12	1.5			
62							CLAY WITH ROCK FRAGMENTS (61' TO 61.5') DARK GRAY (10YR 4/1), MOIST, HARD, ROCK FRAGMENTS IN CLAY MATRIX. 63' TO 66' - VERY HARD DRILLING.
63							
64							
65							SAND (65' TO 65.4') GRAY (10YR 5/1), WET, MEDIUM DENSE, FINE TO COARSE SAND.
66		SPT	20 30 50/4	1.5			
67							SAND (65.4' TO 70') GRAY (10YR 5/1), MOIST, VERY DENSE, FINE SAND.
68							
69							SAND (70' TO 80') GRAY (10YR 5/1), MOIST, VERY DENSE, FINE SAND, TRACE CLAY, TRACE ORGANICS, NO CEMENTATION. 71' - HARD CEMENTED LAYER.
70							
71		SPT	50/4	0.5			
72							75' - T.D. Tt-3B.
73							
74							
75							
76		SPT	50/5	0.4			
77							
78							
79							
80							



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT

PAGE: 6 OF 6

PROJECT NO.: 180549.2009

DATE: 1/6/09 TO 1/13/09

Tt-3

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
80						SANDY CLAY (80' TO 90') HARD DRILLING. POOR TO NO RETURNS. HARDER	
81							
82							
83							
84							
85							
86							
87							
88							
89							
90							
91						E.O.B. = 90.0' T.D. Tt-3.	
92							
93							
94							
95							
96							
97							
98							
99							
100							



BOREHOLE LOG

BOREHOLE NO.:

PAGE: 1 OF 3

DATE: 12/10/08

Tt-4

PROJECT INFORMATION

PROJECT: HIGHLAND RECLAMATION PROJECT

PROJECT NO.: 180549.2009

CLIENT: EXXON MOBIL ENVIRONMENTAL SERVICES CORP.

OWNER: EXXON MOBIL

LOCATION: HIGHLAND MINE SITE

CONVERSE COUNTY, WYOMING

BOREHOLE LOCATION

SEE FIGURE . .

FIELD INFORMATION

DATE & TIME ARRIVED: 12/10/08 - 09:30

BOREHOLE LOGGED BY: JOE REED

VISITORS: NONE

WEATHER: COLD, WINDY

DRILLING INFORMATION

DRILLING COMPANY: DRILLING ENGINEERS, INC.

START TIME: 09:40

BORING DEPTH: 35.5' BORING DIA.: 10 1/4"

DRILLING METHOD: 10 1/4" O.D. x 6 1/4" I.D. HSA

SAMPLING METHOD: AUGER FLIGHT, SPT SPLIT SPOON

TIME DRILLING COMPLETE: _____

BOREHOLE COMPLETION / ABANDONMENT INFORMATION

START TIME: 12:30 COMPLETE TIME: 15:50

INSTRUMENTATION: 4" PVC MONITOR WELL BACKFILL: FILTER PACK, BENTONITE

ELEVATION - TOP OF BORING: _____ RELATIVE TO: _____

GROUNDWATER CONDITIONS

APPROXIMATE WATER LEVEL 2/17/09 9' BGS

FOLLOWING FIELD WORK

TIME OF CLEAN-UP COMPLETE: 16:00 TIME LEFT SITE: 16:00

NOTES: _____



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT

PAGE: 2 OF 3

PROJECT NO.: 180549.2009

DATE: 12/10/08

Tt-4

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
0							<p>SAND (0 TO 8.5') LIGHT YELLOWISH BROWN (10YR 6/4), SLIGHTLY MOIST, LOOSE, FINE SAND, TRACE MEDIUM SAND, ANGULAR TO SUBROUNDED SAND, TRACE SILT, TRACE ROOTS.</p>
1							
2							
3							
4							
5							
6							
7				NS			
8							
9							
10							
11							
12							
13				NS			
14							<p>CLAYEY SAND (8.5' TO 12.5') DARK YELLOWISH BROWN (10YR 4/4), MOIST, COHESIVE, FINE SAND, TRACE MEDIUM, TRACE SILT, MOISTURE INCREASES WITH DEPTH.</p>
15							
16							
17							
18							
19							
20							
14		SPT	2 2 3	1.5			<p>SAND (12.5' TO 21.5') GARY (10YR 5/1), WET, LOOSE, FINE TO COARSE SAND, TRACE CLAY, TRACE SILT.</p>
15							
16							
17							
18							
19							
20							



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT

PAGE: 3 OF 3

PROJECT NO.: 180549.2009

DATE: 12/10/08

Tt-4

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
20						SAND (12.5' TO 21.5') SEE DESCRIPTION ON PREVIOUS PAGE.	
21						21.5' - HARDER DRILLING.	
22						SAND AND CLAYEY SAND (21.5' TO 32') YELLOWISH BROWN (10YR 5/4) WET, MEDIUM DENSE, FINE SAND, SOME MEDIUM SAND, TRACE COARSE, TRACE SILT, CLAY (COHESIVE).	
23							
24							
25		SPT	3 4 8	1.5			
26							
27							
28							
29							
30							
31							
32						CLAY / WEATHERED CLAYSTONE? (32' TO 35.5') GRAY (10YR 5/1), SLIGHTLY MOIST, VERY STIFF TO HARD.	
33							
34							
35		SPT	6 13 25	1.0			
36						E.O.B. = 35.5'	
37							
38							
39							
40							



BOREHOLE LOG

BOREHOLE NO.:

PAGE: 1 OF 3

DATE: 1/9/09

Tt-5

PROJECT INFORMATION

PROJECT: HIGHLAND RECLAMATION PROJECT

PROJECT NO.: 180549.2009

CLIENT: EXXON MOBIL ENVIRONMENTAL SERVICES CORP.

OWNER: EXXON MOBIL

LOCATION: HIGHLAND MINE SITE

CONVERSE COUNTY, WYOMING

BOREHOLE LOCATION

SEE FIGURE . .

FIELD INFORMATION

DATE & TIME ARRIVED: 1/9/09 - 10:10

BOREHOLE LOGGED BY: JOE REED

VISITORS: NONE

WEATHER: COLD, WINDY

DRILLING INFORMATION

DRILLING COMPANY: DRILLING ENGINEERS, INC.

START TIME: 10:35

BORING DEPTH: 29' BORING DIA.: 10 1/4"

DRILLING METHOD: 10 1/4" O.D. x 6 1/4" I.D. HSA

SAMPLING METHOD: AUGER FLIGHT, SPT SPLIT SPOON

TIME DRILLING COMPLETE: 12:15

BOREHOLE COMPLETION / ABANDONMENT INFORMATION

START TIME: 13:00 COMPLETE TIME: 14:35

INSTRUMENTATION: 4" PVC MONITOR WELL BACKFILL: FILTER PACK, BENTONITE

ELEVATION - TOP OF BORING: _____ RELATIVE TO: _____

GROUNDWATER CONDITIONS

APPROXIMATE WATER LEVEL 2/17/09 5' BGS

FOLLOWING FIELD WORK

TIME OF CLEAN-UP COMPLETE: 14:35 TIME LEFT SITE: 14:35

NOTES: _____



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT **PAGE:** 2 OF 3

PROJECT NO.: 180549.2009 **DATE:** 1/9/09

Tt-5

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
0							SANDY SILTY CLAY (0 TO 7') YELLOWISH BROWN (10YR 5/6), DRY, LOOSE / SOFT, FINE SAND, TRACE ROOTS.
1							
2							
3							
4							
5							
6							
7							CLAY (7' TO 9') DARK GARY (10YR 4/1), MOIST TO WET, MEDIUM STIFF, FINE SAND.
8							
9							SAND (9' TO 24') GRAY (10YR 5/1), WET, LOOSE, FINE TO COARSE SAND, TRACE FINE AND MEDIUM GRAVEL, CLAYEY LAYERS (10mm).
10							
11		SPT	4 4 5	1.5			
12							
13					NS		
14							
15							
16		SPT	1 1 1	1.2			
17							
18							
19							
20							



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT PAGE: 3 OF 3

PROJECT NO.: 180549.2009 DATE: 1/9/09

Tt-5

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
20							SAND (9' TO 24') SEE DESCRIPTION ON PREVIOUS PAGE. 20' - LESS CLAY (1-10mm)
21		SPT	3 3 4	1.5			
22							
23					NS		
24						24' - HARDER DRILLING.	
25							CLAY WITH SANDSTONE FRAGMENTS (24' TO 29') GRAYISH BROWN (10YR 5/1), MOIST, MEDIUM DENSE TO DENSE, FINE SAND, TRACE MEDIUM SAND, TRACE COARSE SAND, 20mm OF BLACK ORGANIC IN SHOE, SOME LOOSE SAND, MIXTURE OF MATERIALS BUT MOSTLY ROCK FRAGMENTS AND SAND IN CLAY MATRIX, SOME CLAYSTONE ROCK FRAGMENTS.
26		SPT	12 12 15	1.5			
27					NS		
28		SPT	9 7 12	1.2			
29						E.O.B. = 29'	
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							



BOREHOLE LOG

BOREHOLE NO.:

Tt-6

PAGE: 1 OF 3

DATE: 1/11/09

PROJECT INFORMATION

PROJECT: HIGHLAND RECLAMATION PROJECT

PROJECT NO.: 180549.2009

CLIENT: EXXON MOBIL ENVIRONMENTAL SERVICES CORP.

OWNER: EXXON MOBIL

LOCATION: HIGHLAND MINE SITE
CONVERSE COUNTY, WYOMING

BOREHOLE LOCATION

SEE FIGURE . .

FIELD INFORMATION

DATE & TIME ARRIVED: 1/11/09 - 08:20

BOREHOLE LOGGED BY: JOE REED

VISITORS: NONE

WEATHER: COLD, WINDY

DRILLING INFORMATION

DRILLING COMPANY: DRILLING ENGINEERS, INC.

START TIME: 08:35

BORING DEPTH: 26' BORING DIA.: 10 1/4"

DRILLING METHOD: 10 1/4" O.D. x 6 1/4" I.D. HSA

SAMPLING METHOD: AUGER FLIGHT, SPT SPLIT SPOON

TIME DRILLING COMPLETE: 09:35

BOREHOLE COMPLETION / ABANDONMENT INFORMATION

START TIME: 10:00 COMPLETE TIME: 11:25

INSTRUMENTATION: 4" PVC MONITOR WELL BACKFILL: FILTER PACK, BENTONITE

ELEVATION - TOP OF BORING: _____ RELATIVE TO: _____

GROUNDWATER CONDITIONS

APPROXIMATE WATER LEVEL 2/17/09 5' BGS

FOLLOWING FIELD WORK

TIME OF CLEAN-UP COMPLETE: 11:25 TIME LEFT SITE: 11:25

NOTES: _____



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT

PAGE: 2 OF 3

PROJECT NO.: 180549.2009

DATE: 1/11/09

Tt-6

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
0							SANDY SILTY CLAY (0 TO 6') YELLOWISH BROWN (10YR 5/9), DRY, LOOSE TO SOFT, FINE SAND, TRACE ROOTS.
1							
2							
3							
4							
5							
6		SPT	1 2 2	1.1			SANDY CLAY (6' TO 8') GREENISH GRAY (GLEYS 2/5/1), MOIST, SOFT, FINE SAND, TRACE IRON STAINING.
7							
8							SAND (8' TO 13') GRAY (10YR 5/1), WET, LOOSE, FINE TO COARSE SAND WITH CLAY / SANDY CLAY LAYERS, GRAYISH BROWN (2.5YR 5/2), STIFF, 20-40mm.
9							
10							
11		SPT	2 2 2	1.5			SAND (13' TO 18') GRAY (10YR 5/1), WET, LOOSE, FINE TO COARSE SAND.
12							
13							
14					NS		SAND (13' TO 18') GRAY (10YR 5/1), WET, LOOSE, FINE TO COARSE SAND.
15							
16		SPT	4 4 5	1.5			
17							CLAYEY SAND (18' TO 23') GRAYISH BROWN (10YR 5/2), WET, MEDIUM DENSE, FINE SAND, TRACE MEDIUM SAND, TRACE COARSE SAND, TRACE FINE GRAVEL, WITH SANDY CLAY LAYERS.
18							
19							
20							



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT PAGE: 3 OF 3

PROJECT NO.: 180549.2009 DATE: 1/11/09

Tt-6

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
20							CLAYEY SAND (18' TO 23') SEE DESCRIPTION ON PREVIOUS PAGE.
21		SPT	3 8 8	1.5			
22							SAND AND GRAVEL IN CLAY MATRIX (23' TO 26') GRAYISH BROWN (10YR 5/2), MOIST, VERY STIFF / MEDIUM DENSE, FINE GRAVEL (ROCK FRAGMENTS), FINE TO COARSE SAND, TRACE IRON STAINING, TRACE DARK ORGANIC. 26' - VERY HARD. E.O.B. = 26'
23							
24							
25		SPT	8 12 12	1.3			
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							



BOREHOLE LOG

BOREHOLE NO.:

PAGE: 1 OF 3

DATE: 1/11/09

Tt-7

PROJECT INFORMATION

PROJECT: HIGHLAND RECLAMATION PROJECT
PROJECT NO.: 180549.2009
CLIENT: EXXON MOBIL ENVIRONMENTAL SERVICES CORP.
OWNER: EXXON MOBIL
LOCATION: HIGHLAND MINE SITE
CONVERSE COUNTY, WYOMING

BOREHOLE LOCATION

SEE FIGURE . .

FIELD INFORMATION

DATE & TIME ARRIVED: 1/11/09 - 11:35
BOREHOLE LOGGED BY: JOE REED
VISITORS: NONE
WEATHER: COLD, WINDY

DRILLING INFORMATION

DRILLING COMPANY: DRILLING ENGINEERS, INC.
START TIME: 12:15
BORING DEPTH: 31.5' BORING DIA.: 10 1/4"
DRILLING METHOD: 10 1/4" O.D. x 6 1/4" I.D. HSA
SAMPLING METHOD: AUGER FLIGHT, SPT SPLIT SPOON
TIME DRILLING COMPLETE: 13:10

BOREHOLE COMPLETION / ABANDONMENT INFORMATION

START TIME: 13:40 COMPLETE TIME: 15:30
INSTRUMENTATION: 4" PVC MONITOR WELL BACKFILL: FILTER PACK, BENTONITE
ELEVATION - TOP OF BORING: _____ RELATIVE TO: _____

GROUNDWATER CONDITIONS

APPROXIMATE WATER LEVEL 2/17/09 7' BGS

FOLLOWING FIELD WORK

TIME OF CLEAN-UP COMPLETE: 15:30 TIME LEFT SITE: 15:30

NOTES: _____



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT

PAGE: 2 OF 3

PROJECT NO.: 180549.2009

DATE: 1/11/09

Tt-7

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
0							SILTY SANDY CLAY (0 TO 2.5') PALE BROWN (10YR 6/3), DRY, LOOSE TO SOFT, FINE SAND, TRACE ROOTS.
1							
2							
3							SANDY CLAY / CLAYEY SAND (2.5' TO 10') BROWN (10YR 4/3), SLIGHTLY MOIST TO MOIST, FINE SAND.
4							
5							
6		SPT	2 2 3	0.5			
7							
8							
9							
10							CLAY TO SANDY CLAY (10' TO 16.5') MOTTLED BROWN (10YR 5/3) AND GRAY (10YR 5/1), MOIST, SOFT TO MEDIUM STIFF, FINE SAND, TRACE ORGANICS.
11		SPT	2 2 4	1.5			
12							
13							
14							
15							
16		SPT	3 3 3	1.5			
17							CLAYEY SAND / SANDY CLAY (16.5' TO 27') BROWN (10YR 5/3), WET, STIFF TO MEDIUM DENSE, FINE TO COARSE SAND.
18							
19							
20							

12' - WET.



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT

PAGE: 3 OF 3

PROJECT NO.: 180549.2009

DATE: 1/11/09

Tt-7

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
20						<p>CLAYEY SAND / SANDY CLAY (16.5' TO 27') SEE DESCRIPTION ON PREVIOUS PAGE.</p> <p>23' - HARDER.</p>	
21		SPT	3 3 6	1.5			
22							
23							
24						<p>SANDSTONE (27' TO 31.5') LIGHT YELLOWISH BROWN (2.5YR 6/4), SLIGHTLY MOIST, HARD, FINE TO COARSE SAND, HIGHLY WEATHERED.</p> <p>E.O.B. = 31.5'</p>	
25							
26		SPT	4 4 6	1.5			
27							
28						<p>E.O.B. = 31.5'</p>	
29							
30							
31		SPT	12 8 20	1.5			
32							
33							
34							
35							
36							
37							
38							
39							
40							

**BOREHOLE LOG**BOREHOLE
NO.:PAGE: 1 OF 4DATE: 1/14/09 TO 1/20/09Tt-8**PROJECT INFORMATION**

PROJECT: HIGHLAND RECLAMATION PROJECT
PROJECT NO.: 180549.2009
CLIENT: EXXON MOBIL ENVIRONMENTAL SERVICES CORP.
OWNER: EXXON MOBIL
LOCATION: HIGHLAND MINE SITE
CONVERSE COUNTY, WYOMING

BOREHOLE LOCATION

SEE FIGURE ..

FIELD INFORMATION

DATE & TIME ARRIVED: 1/14/09 - 9:50
BOREHOLE LOGGED BY: JOE REED
VISITORS: NONE
WEATHER: WINDY, COLD

DRILLING INFORMATION

DRILLING COMPANY: DRILLING ENGINEERS, INC.
START TIME: 1/14/09 - 10:10
BORING DEPTH: 60.5' BORING DIA.: 10 1/4"
DRILLING METHOD: 10 1/4" O.D. x 6 1/4" I.D. HSA
SAMPLING METHOD: AUGER FLIGHT, SPT SPLIT SPOON
TIME DRILLING COMPLETE: 1/20/09 - 16:00

BOREHOLE COMPLETION / ABANDONMENT INFORMATION

START TIME: 1/21/09 - 07:45 COMPLETE TIME: 12:20
INSTRUMENTATION: 4" PVC MONITOR WELL BACKFILL: FILTER PACK, BENTONITE
ELEVATION - TOP OF BORING: _____ RELATIVE TO: _____

GROUNDWATER CONDITIONS

APPROXIMATE WATER LEVEL 2/16/09 26' BGS

FOLLOWING FIELD WORK

TIME OF CLEAN-UP COMPLETE: 12:20 TIME LEFT SITE: 12:20

NOTES: THIS BOREHOLE LOG IS A COMPOSITE OF THREE BOREHOLES (Tt-8, Tt-8A, AND Tt-8B). Tt-8 WAS DRILLED TO 60.5
BUT THICK SANDY CLAY INSIDE HSA PREVENTED COMPLETION. Tt-8A DRILLED TO 40' BUT THICK SANDY CLAY INSIDE HSA
FORCED ABANDONMENT. Tt-8B DRILLED TO 60.5' AND MONITOR WELL INSTALLED IN Tt-8B AND LABELED Tt-8. Tt-8 IS 6' E OF
BBL-1. Tt-8A IS 49.5' SOUTH EAST OF BBL-1. Tt-8B IS 71.5' SOUTH EAST OF BBL-1.



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT

PAGE: 2 OF 4

PROJECT NO.: 180549.2009

DATE: 1/14/09 TO 1/20/09

Tt-8

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
0							CLAYEY SAND (0 TO 8') BROWN (10YR 5/3), SLIGHTLY MOIST, LOOSE, FINE SAND, TRACE MEDIUM AND COARSE SAND, COHESIVE, SOME SANDY CLAY.
1							
2							
3							
4							
5							CLAYEY SAND / SANDY CLAY (8' TO 12') BROWN (10YR 5/3), SLIGHTLY MOIST TO MOIST, MEDIUM DENSE / STIFF, FINE SAND, TRACE WHITE (HCI WEAK).
6		SPT	2 4 5	1.3			
7							
8							
9							
10							CLAY (12' TO 18') YELLOWISH BROWN (10YR 5/4), MOIST, STIFF.
11		SPT	3 7 9	1.2			
12							
13							
14							
15							SANDY CLAY / CLAYEY SAND (18' TO 23') YELLOWISH BROWN (10YR 5/6), MOIST TO ALMOST WET, MEDIUM DENSE / STIFF, FINE SAND, TRACE IRON STAINING.
16		SPT	3 4 6	1.4			
17							
18							
19							
20							



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT PAGE: 3 OF 4

PROJECT NO.: 180549.2009 DATE: 1/14/09 TO 1/20/09

Tt-8

DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
20						SANDY CLAY / CLAYEY SAND (18' TO 23') SEE DESCRIPTION ON PREVIOUS PAGE.	
21		SPT	3 5 5	1.5			
22						----- SANDY CLAY / CLAYEY SAND (23' TO 33') MOTTLED YELLOW BROWN (10YR 5/4) AND GRAY (10YR 5/1), MOIST TO ALMOST WET, MEDIUM STIFF, FINE SAND, TRACE ORGANICS.	
23							
24						----- SANDY CLAY / CLAYEY SAND (23' TO 33') MOTTLED YELLOW BROWN (10YR 5/4) AND GRAY (10YR 5/1), MOIST TO ALMOST WET, MEDIUM STIFF, FINE SAND, TRACE ORGANICS.	
25		SPT	2 3 4	1.5			
26						----- SANDY CLAY / CLAYEY SAND (23' TO 33') MOTTLED YELLOW BROWN (10YR 5/4) AND GRAY (10YR 5/1), MOIST TO ALMOST WET, MEDIUM STIFF, FINE SAND, TRACE ORGANICS.	
27							
28						----- SANDY CLAY / CLAYEY SAND (23' TO 33') MOTTLED YELLOW BROWN (10YR 5/4) AND GRAY (10YR 5/1), MOIST TO ALMOST WET, MEDIUM STIFF, FINE SAND, TRACE ORGANICS.	
29							
30						----- SANDY CLAY / CLAYEY SAND (23' TO 33') MOTTLED YELLOW BROWN (10YR 5/4) AND GRAY (10YR 5/1), MOIST TO ALMOST WET, MEDIUM STIFF, FINE SAND, TRACE ORGANICS.	
31		SPT	3 3 4	1.5			
32						----- SANDY CLAY / CLAYEY SAND (23' TO 33') MOTTLED YELLOW BROWN (10YR 5/4) AND GRAY (10YR 5/1), MOIST TO ALMOST WET, MEDIUM STIFF, FINE SAND, TRACE ORGANICS.	
33							
34						----- CLAYEY SAND (33' TO 40.7') GRAY (10YR 5/1), WET, MEDIUM DENSE, FINE AND MEDIUM SAND.	
35							
36		SPT	3 5 8	1.5		----- CLAYEY SAND (33' TO 40.7') GRAY (10YR 5/1), WET, MEDIUM DENSE, FINE AND MEDIUM SAND.	
37							
38						----- CLAYEY SAND (33' TO 40.7') GRAY (10YR 5/1), WET, MEDIUM DENSE, FINE AND MEDIUM SAND.	
39							
40						----- CLAYEY SAND (33' TO 40.7') GRAY (10YR 5/1), WET, MEDIUM DENSE, FINE AND MEDIUM SAND.	



BOREHOLE LOG

BOREHOLE NO.:

PROJECT: HIGHLAND RECLAMATION PROJECT **PAGE:** 4 OF 4
PROJECT NO.: 180549.2009 **DATE:** 1/14/09 TO 1/20/09

Tt-8

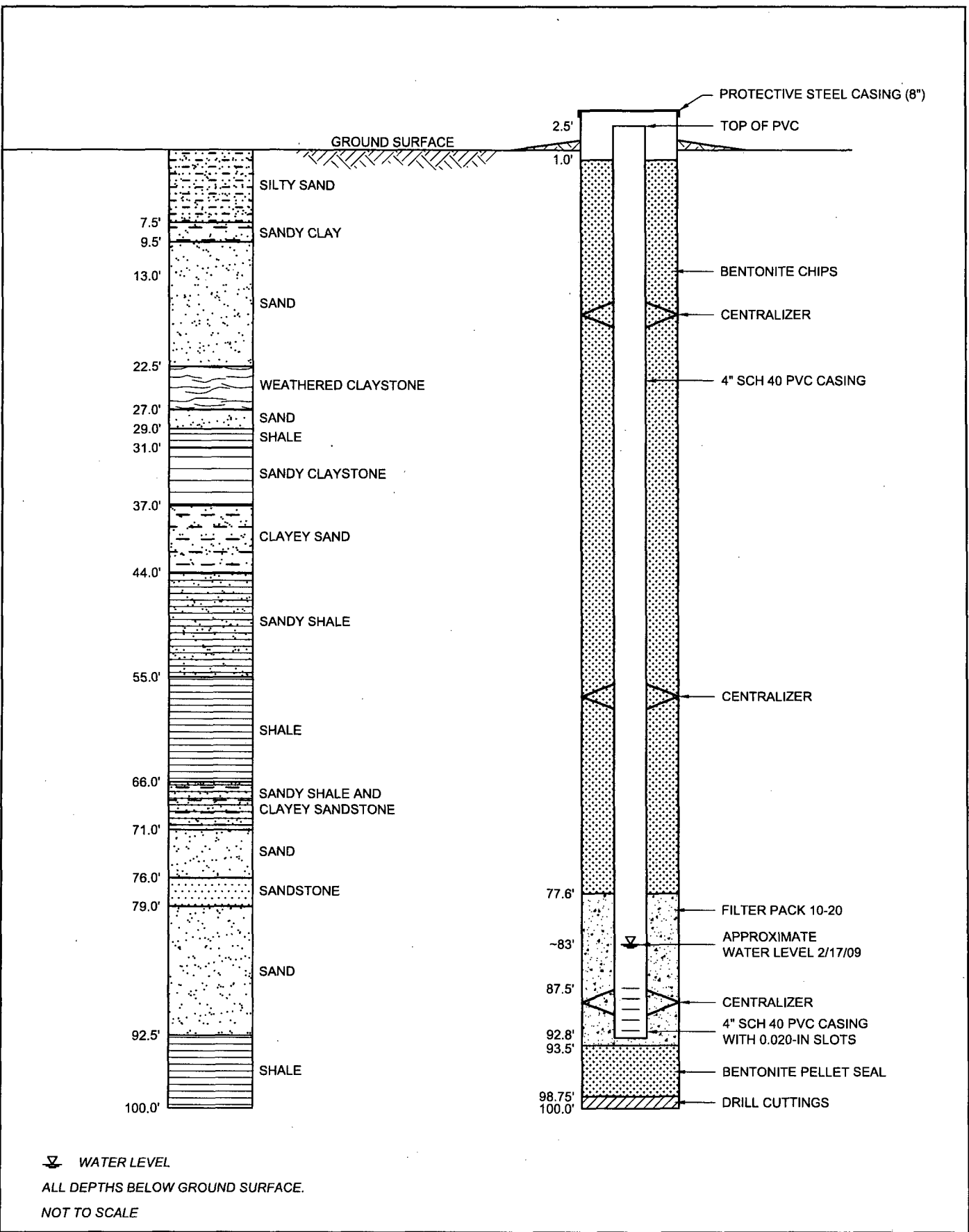
DEPTH (FT)	CORE RECOV.	DRIVE SAMPLES			ADD'L SAMPLES	LITHOLOGY GRAPHIC	SOIL DESCRIPTION
		SAMPLE TYPE	BLOWS (PER 6")	RECOV.			
40							
41		SPT	12 35 50/3	1.5			SAND (40.7' TO 43') YELLOWISH BROWN (10YR 6/4), WET, DENSE TO VERY DENSE, FINE TO MEDIUM SAND, TRACE COARSE SAND, TRACE FINE GRAVEL, TRACE CLAY (COHESIVE), SANDS ANGULAR TO SUBROUNDED.
42							
43							SAND (43' TO 48') BROWNISH YELLOW (10YR 6/6), WET, VERY DENSE, FINE TO MEDIUM SAND, TRACE COARSE SAND, TRACE FINE GRAVEL, TRACE CLAY (COHESIVE), TRACE ORGANICS.
44							
45							
46		SPT	50/4	0.4			SAND (48' TO 60') GRAY (10YR 6/1), WET, VERY DENSE, FINE TO COARSE SAND, ANGULAR TO SUBROUNDED SAND, TRACE ORGANICS.
47							
48							
49							
50							CLAYEY SAND / SANDY CLAY (60' TO 60.5') GREENISH GRAY (GLE Y2 6/1), MOIST, VERY DENSE, FINE SAND.
51		SPT	50/5	0.3			
52							
53							
54							
55							
56		SPT	50/5	0.4			
57							
58							
59							
60		SPT	50/5	0.4			

51' - HARD.

E.O.B. = 60.5'

Attachment B
Well Completion Diagrams

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▽ WATER LEVEL
ALL DEPTHS BELOW GROUND SURFACE.
NOT TO SCALE

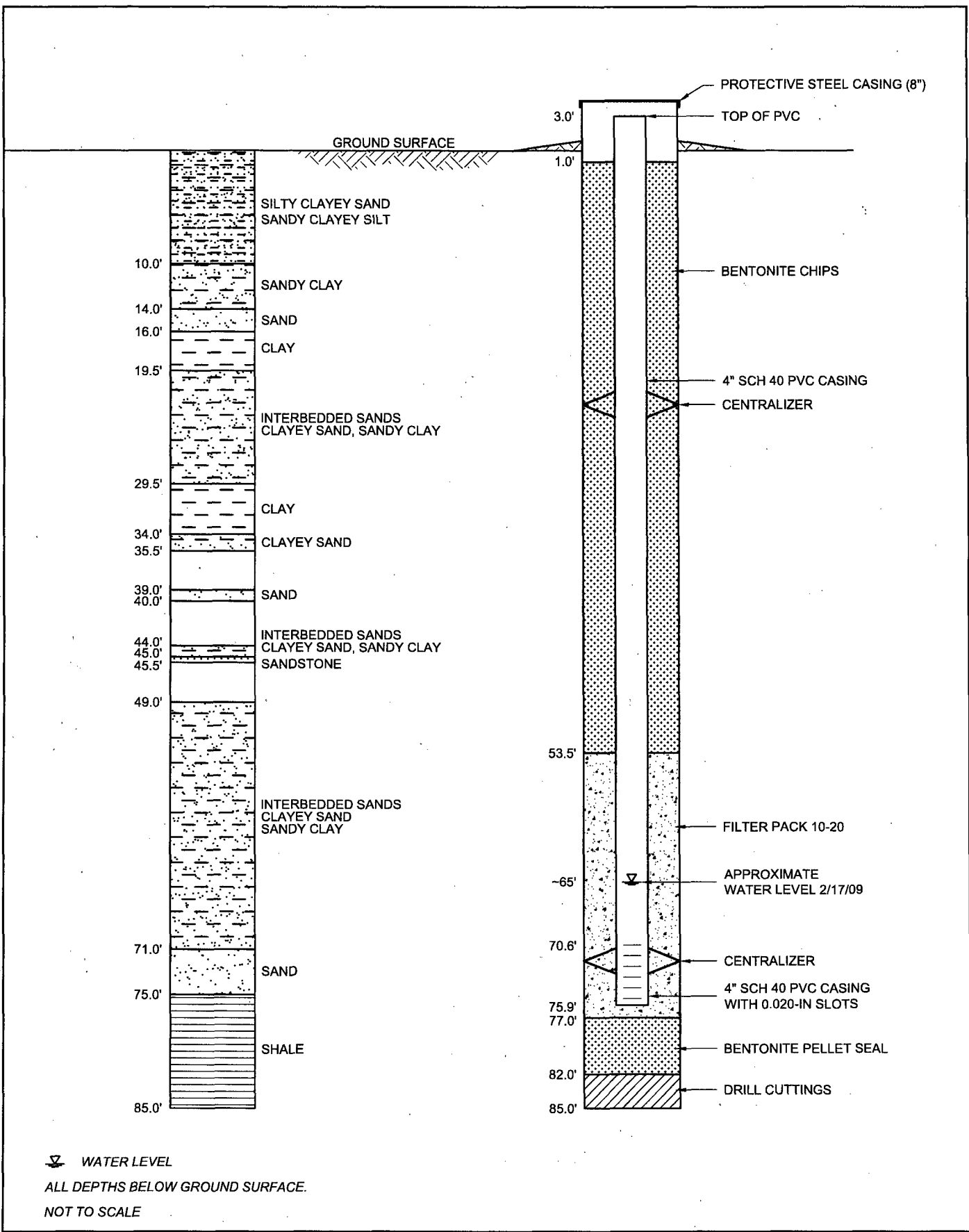
Project No. 180549.2009

February 2009



COMPLETION DIAGRAM
BOREHOLE Tt-1

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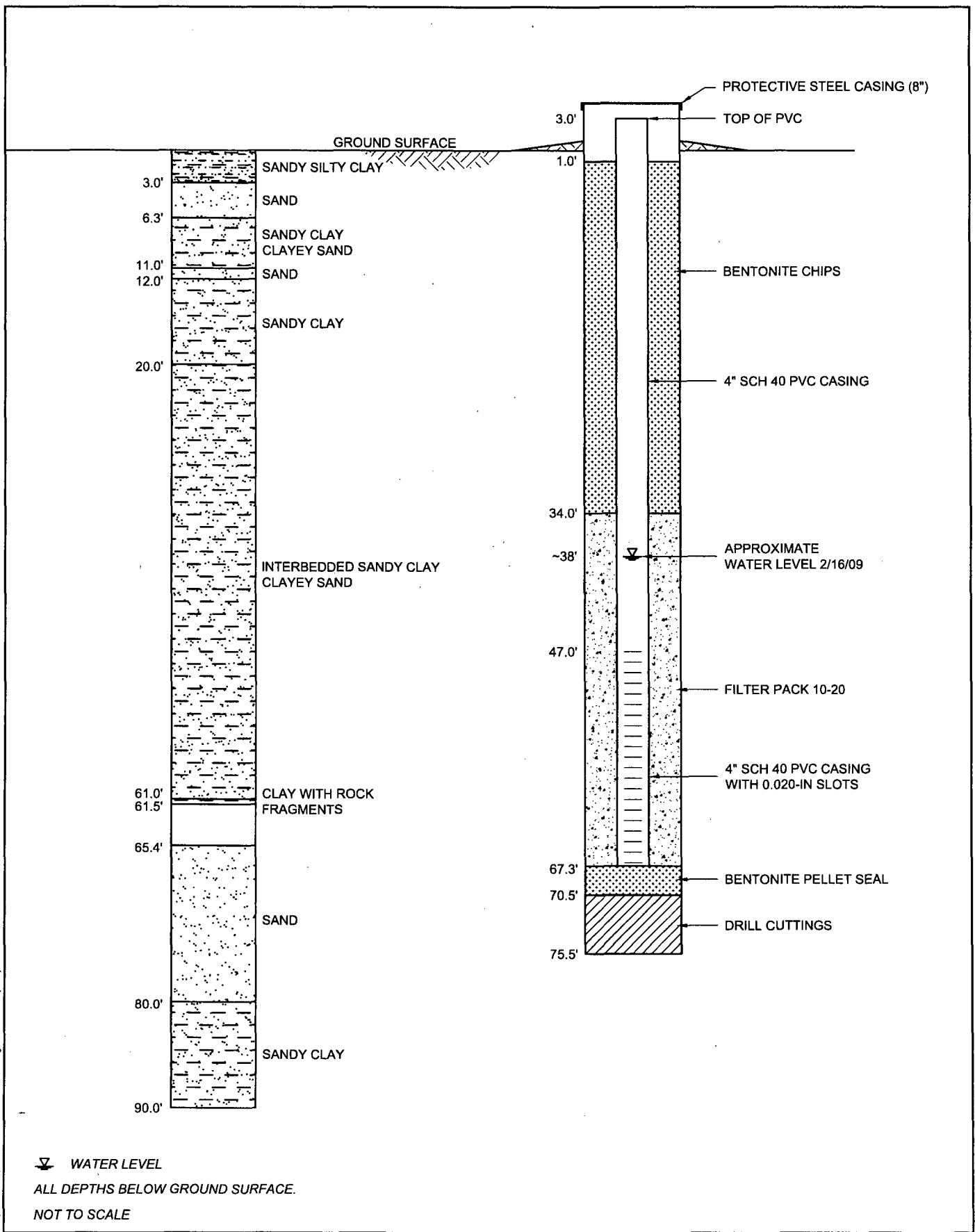
Project No. 180549.2009

February 2009



**COMPLETION DIAGRAM
BOREHOLE Tt-2**

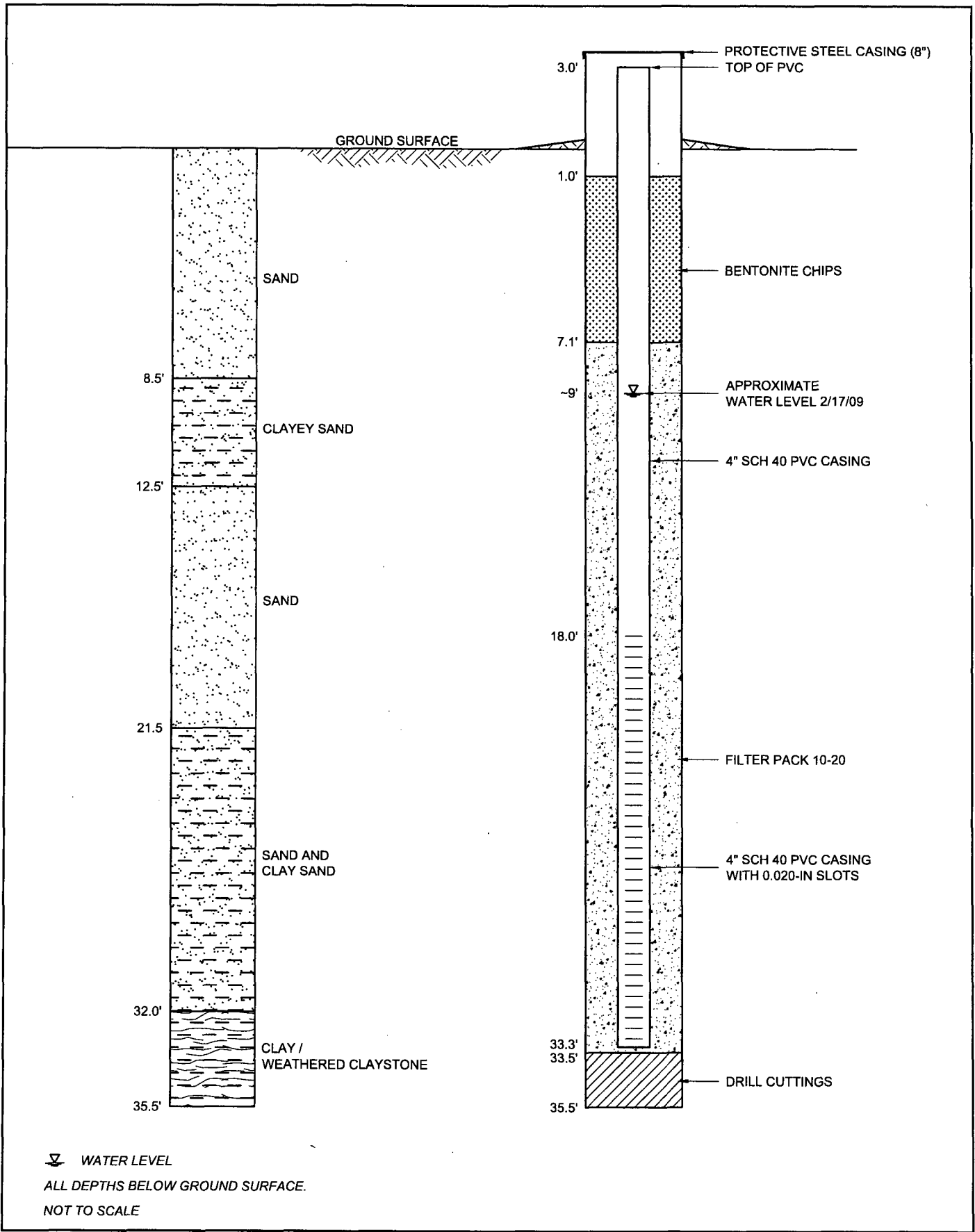
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▽ WATER LEVEL
 ALL DEPTHS BELOW GROUND SURFACE.
 NOT TO SCALE



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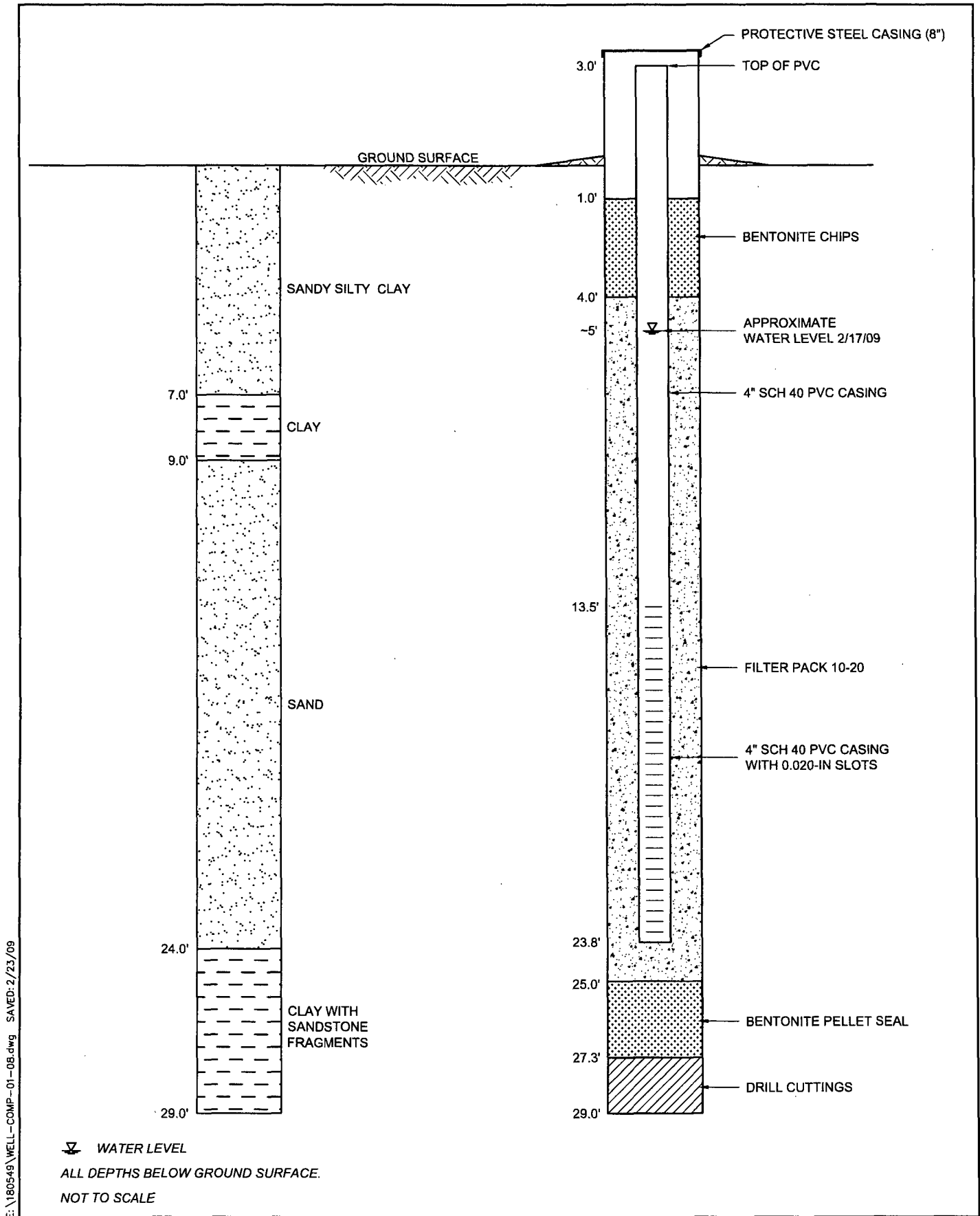
▽ WATER LEVEL
ALL DEPTHS BELOW GROUND SURFACE.
NOT TO SCALE

Project No. 180549.2009

February 2009



COMPLETION DIAGRAM BOREHOLE Tt-4



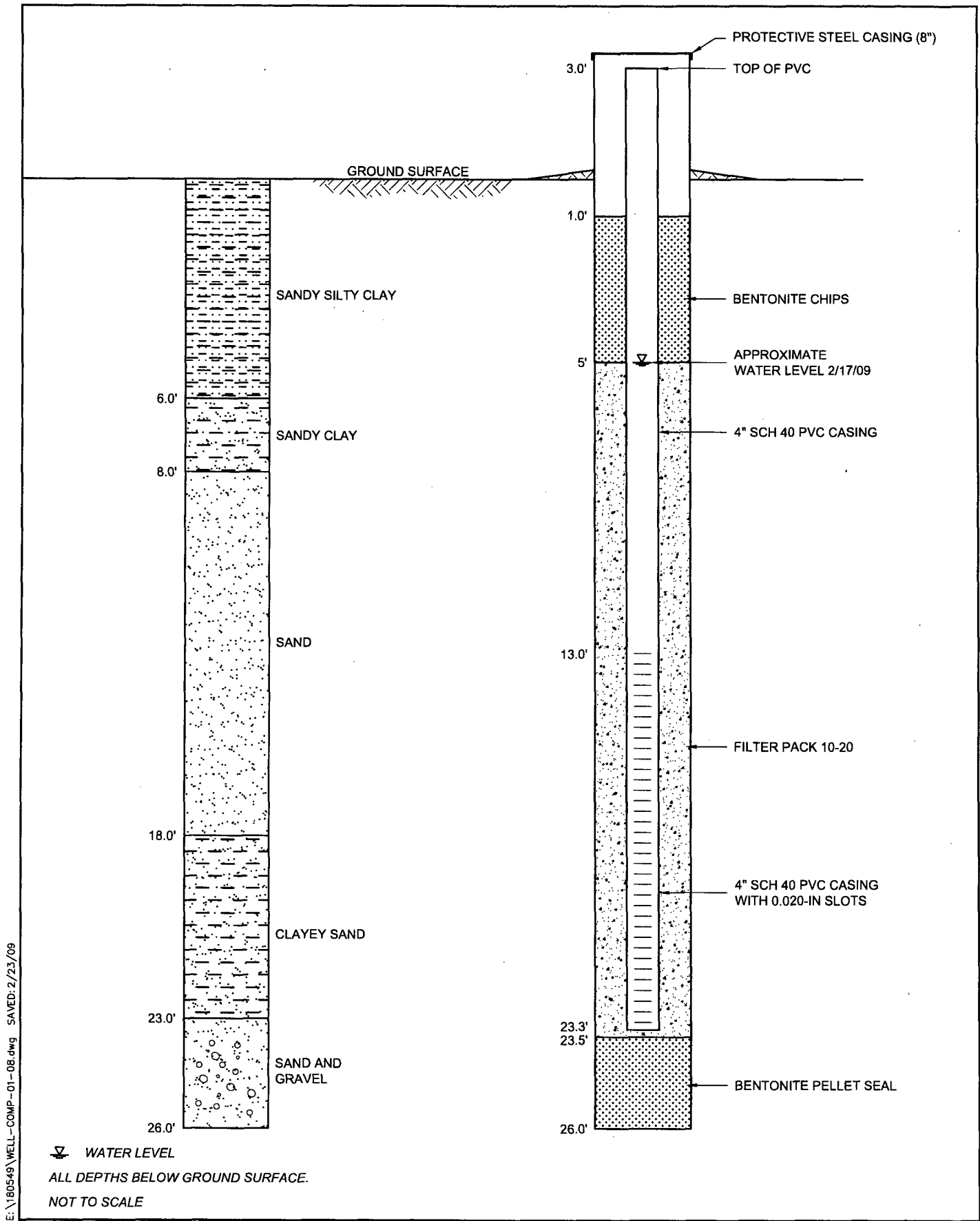
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**COMPLETION DIAGRAM
BOREHOLE Tt-5**



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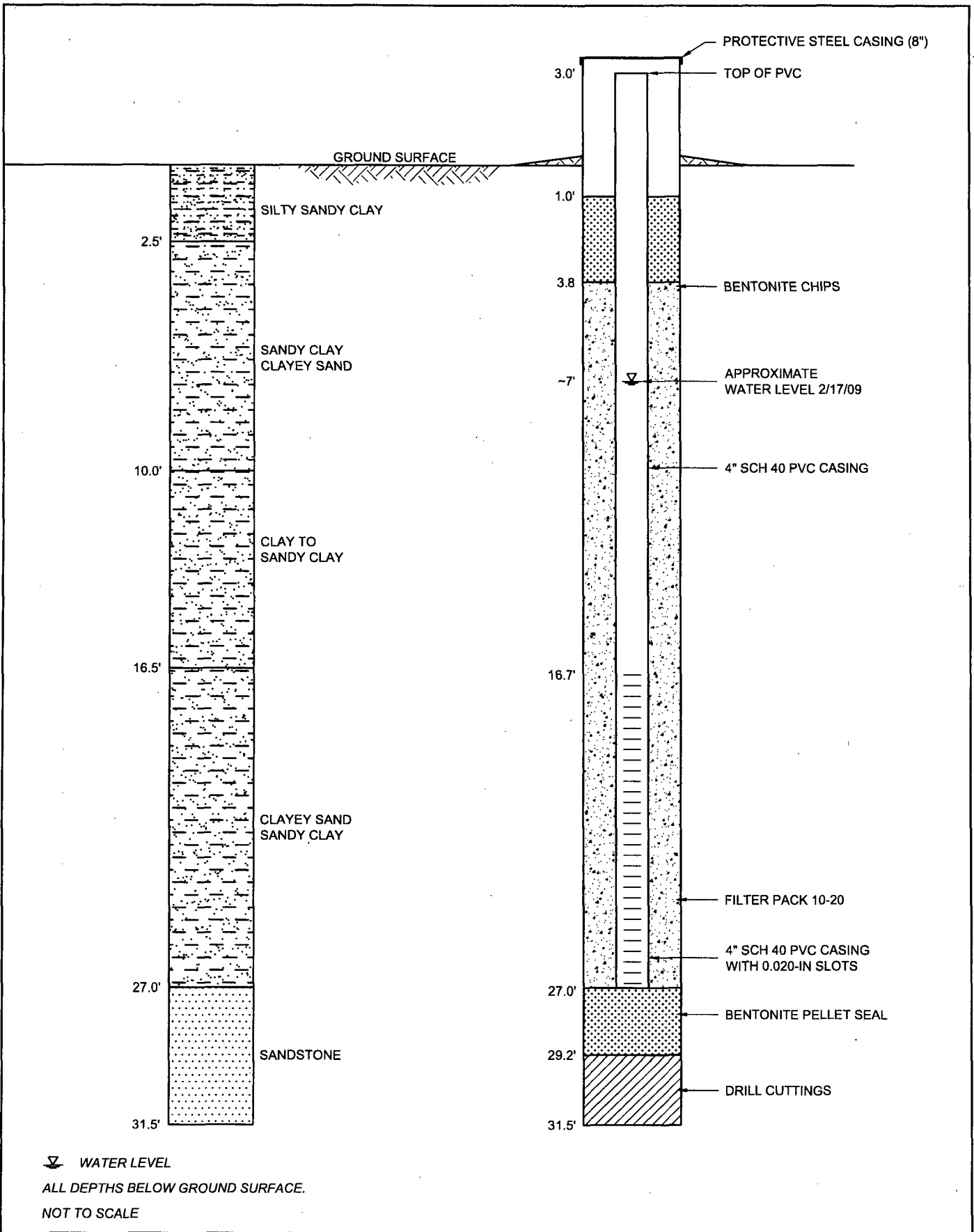
Project No. 180549.2009

February 2009



**COMPLETION DIAGRAM
BOREHOLE Tt-6**

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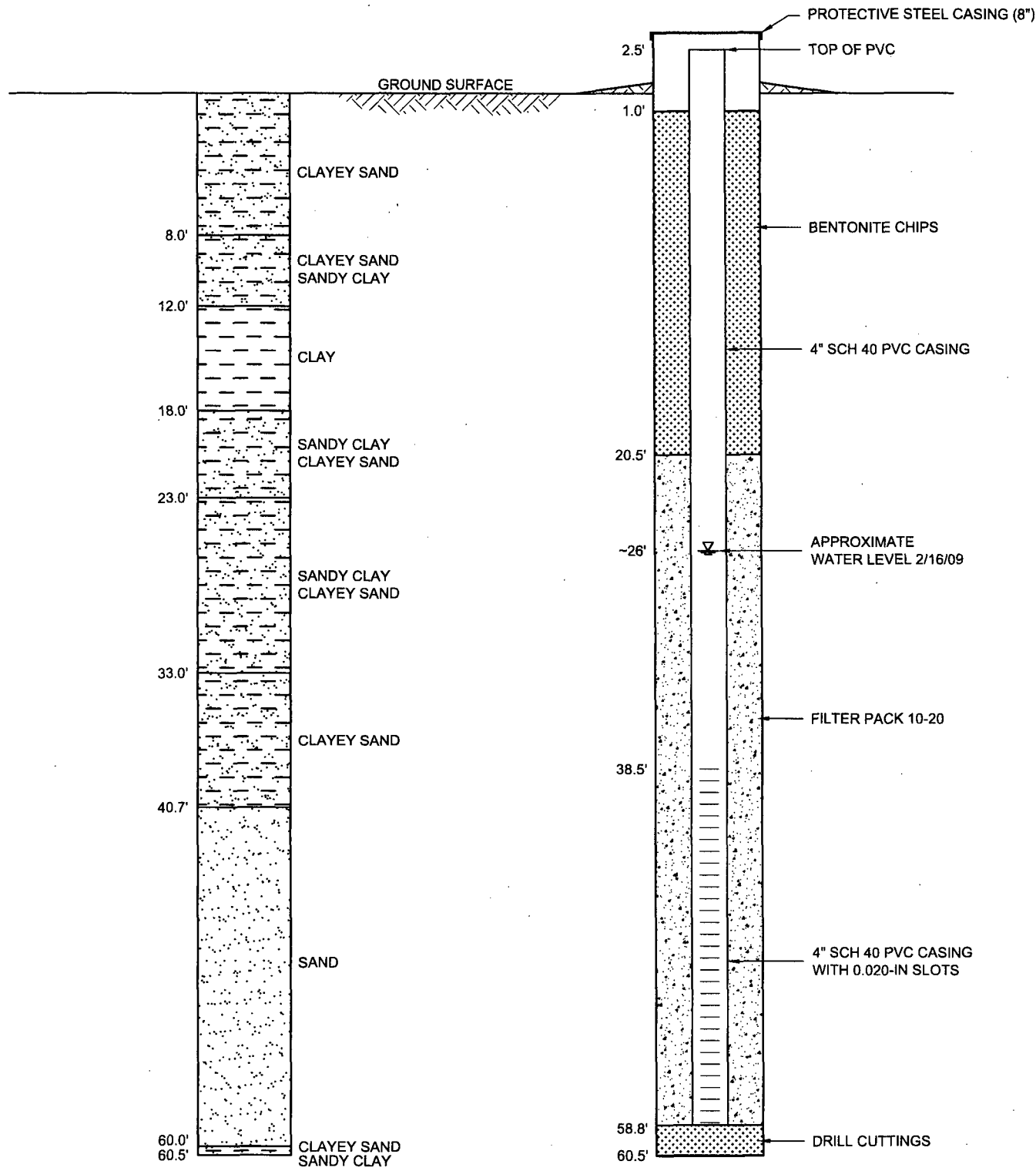
Project No. 180549.2009

February 2009



**COMPLETION DIAGRAM
BOREHOLE Tt-7**

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▽ WATER LEVEL
 ALL DEPTHS BELOW GROUND SURFACE.
 NOT TO SCALE

