AOI #2

Aquaterra
Technologies, Inc.

Site Investigation Report

Pollock Street Sewer-South Yard
Philadelphia Refinery
Philadelphia, PA

18 October 2002

Prepared for:

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA

Prepared by:

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COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
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GEO00637

By affixing my seal to this document, I am certifying that to the best of my knowledge the information is true and correct. I further certify that I am licensed to practice in the Commonwealth of Pennsylvania and that it is within my professional expertise to verify the correctness of the information.

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INTRODUCTION

Sunoco, Inc. (R&M) is the current owner and operator of a petroleum refinery on 3144 Passyunk Avenue in Philadelphia, PA. The City of Philadelphia owns and maintains several sewers that traverse across Sunoco's Philadelphia Refinery. Concerns regarding the subsurface environmental conditions proximal to the sewers initiated investigations. Groundwater & Environmental Services, Inc. (GES) performed groundwater assessment work in 1993 proximal to the Jackson Street, Pollock Street and 26th Street Sewer. Data obtained during this investigation suggested that different degrees of additional characterization and remediation were warranted at each of the sewers. This report summarizes the historic and current data obtained from the Pollock Street sewer investigations.

Site Background

Point Breeze of the Philadelphia Refinery is situated on the east bank of the Schuylkill River, approximately 2.5 miles north of its confluence with the Delaware River. The refinery is located within the Atlantic Coastal Plain Physiographic Province. The topography at the refinery is nearly flat and is characterized by surface elevations ranging from approximately 10 to 40 feet above mean sea level. The Pollock Street sewer is a storm sewer traversing the South Yard of the refinery from the east to west, entering the refinery property along 26th Street and discharging at the Schuylkill River (Figure 1).

Previous Investigations

In 1993, environmental investigative work was performed by Groundwater and Environmental Services (GES) along the Pollock Street sewer. Eight existing wells (S 46-48, S 53, and S 62-65) were used in this study. Work performed during this investigation included the installation of 45 borings along the sewer trace and three monitoring wells (S 91-S 93). In addition, bail down, slug and groundwater pumping tests were performed.

The GES investigation provided the following results:

- Lithology consists of poorly sorted sand and gravel with significant portions of silts and clays. Lenses of silts and clays were encountered throughout the sand and gravel matrix.
- The lower half of the Pollock Street sewer intercepts the groundwater table. The sewer segment east of MH-3, near 26th St. is situated above the water table.
- A separate-phase petroleum plume was identified along the trace of the sewer. This plume may contact the sewer between RW-101 and MH-7 (See Figure 2).
- Hydraulic conductivity values derived from slug testing ranged from 7.80 x 10-5 cm/sec to 1.08 x 10-2 cm/sec.

- A transmissivity value of 3.985 cm^2/sec was derived from groundwater pumping tests at S-93. This value suggests groundwater flow is semi-restricted through the formation.
- A storativity value of 8.55 x 10-2 was derived from groundwater pumping tests at S-93. This value suggests limited water available for pumping.
- The highly variable grain size and finer grained; clay and silt lenses may limit the transmissivity and storativity of the unconfined aquifer.

In April 1994, Video Pipe Services recorded a visual inspection of the Pollock Street Sewer. In 2002, an evaluation of the infiltration and inflow of petroleum hydrocarbons into the Pollock Street sewer within the refinery was performed by CDM. This evaluation included a review of these videotapes. Their analysis was provided to Sunoco in a Draft report "Combined Sewer Overflow (CSO) Outfall Pipe Infiltrations and Inflow (I/I) Remedial Alternatives Study" (September 2002).

With respect to the infiltration and inflow (I/I) evaluation, CDM reported the following:

- The light presence of mineral deposits was identified at all of the construction joints; however, some construction joints showed defined mineral deposits.
- Light inflow (I/I) was observed at a majority of the construction joints.
- A black oily build-up was encountered along the walls and the top of the sewer throughout its length.
- A petroleum slick was easily identifiable on the water surface along some portions of the sewer.

In addition, CDM recommended that a subsequent televised inspection of the sewer is warranted, given that conditions may have changed since the 1994 videotaped inspection.

Current Hydraulic Control Measures

Discharge Control

To prevent potential discharge of separate-phase petroleum to the Schuylkill River, the outfall has been modified. A skimmer has been placed within the floodgates of the outfall. Separate-phase product on the surface is collected with the skimmer, with collected fluids being pumped to a refinery process sewer.

Recovery Well Operation
Nine Recovery wells were installed in 1994 (RWs 100-RW 109).
Groundwater and product recovery systems operate from seven recovery wells. Reportedly these wells recover approximately 1,270,000 gallons of fluid per quarter (Handex Quarterly Status Report January 28 2002). NAPL recovery rates from RW 102, 103,105 and 106 are on the order of 50-100 gallons of NAPL per well per Quarter. The total volume recovered to date, which does not include gallons recovered by total fluids is approximately 19,000 gallons. The exact amount of separate phase product recovered from RW 101 is unknown, as it has been modified to recover total fluids. The effective radius of influence of all wells has not been determined. The locations of the current recovery wells RW-101 through RW-103 are shown on the Figure 2. Wells RW 104 through RW 109 have not been evaluated at the time of this report

SUPPLEMENTAL SUBSURFACE EVALUATION

The results of the 1993 investigation suggested the Pollock Street sewer might contact NAPL within the subsurface along the sewer trace west of MH-7 and east of RW-101 (Figure 3). The purpose of this supplemental site characterization is to complete additional subsurface delineation of the suspected NAPL adjacent to the Pollock Street Sewer. Specific areas were targeted based on recent operational information from Refinery personnel. This investigation targeted four discrete areas: the process area 869 (near the old C line header), the area south of tanks 298 and 140; the area surrounding RW-101, and the 14 Pump House area. Subsurface investigative activities included historic data review, site reconnaissance, monitoring well installation and monitoring, and product recovery testing

Methods

Drilling and installation of seventeen monitoring wells (PS-1 through PS-17) was performed from 7-16 May 2002. PS-18 was drilled on 15 August 2002. Aquaterra contracted Parratt-Wolff of Syracuse, NY to drill and install the monitoring wells. Wells were placed close to the Pollock Street sewer, but final monitoring well locations were controlled by numerous subsurface utilities within the four areas of interest (Figure 1).

During drilling activities, split spoons were retrieved continuously from ten feet below ground surface until clay was encountered. Observations regarding sediment color, grain-size, and relative moisture content were documented. In addition, relative petroleum impact was noted based upon visual observation and field screening using a photo-ionization detector (PID).
Well construction consisted of 4-inch diameter Schedule 20 PVC casing with a 0.020" screen. Drill logs summarize observations and well construction. (Attached as Appendix

A). In addition, observed intervals of petroleum-impacted sediments are summarized in Table 1.

Wells were developed with a vacuum truck on 15 May 2002. The locations of the completed monitoring wells are shown on Figure 2. Subsequent to well development, static liquid level measurements were collected on 16 May 2002 and 1 August 2002 and are summarized in Table 2.

Results of Subsurface Investigation

Of the four areas initially targeted for investigation, two areas were eliminated as potential product sources. These areas include former Process Area 869 and the area south of tanks 298 and 140. Monitoring wells used to evaluate the former Process Area 869 included MW-92 and PS-7. Borings installed south of tanks 298 and 140 included PS-1, 2,11,12, 13, and 15-17. Although some petroleum impact was observed during drilling at these locations, significant and/or continuous intervals of separate-phase petroleum were not observed.

Monitoring wells PS-11 through 14 and PS-18 were installed to determine the extent of the separate-phase petroleum impact observed at RW-101. Data obtained from these monitoring wells indicate no apparent petroleum impact at this location. The increasing product thickness observed at RW-101 remains of concern.

The investigation results suggest that the fourth area, referred to as the 14 Pump House Area, is a strong potential suspect for product infiltration to the sewer. Monitoring wells installed within this area include PS-3 through PS-10. Of the seven wells installed, four wells contain several feet of separate phase product. Two of these wells (PS-3 and PS-9) are immediately adjacent to the Pollock Street sewer. In addition, existing wells MW-53 and MW-91 show petroleum impact. MW 53 historically measured up to .5' of separate phase product and MW-91 currently has > 2' of separate-phase product.

Static liquid level data obtained on 1 August 2002 are presented on Figure 2. The figure illustrates that all measured separate-phase product occurred at monitoring wells installed within the 14 Pump House Area.

Drilling observations, liquid level data and sewer specification data are presented in a cross-section (Figure 3) to determine the potential for the separate-phase petroleum to infiltrate the sewer within the 14 Pump House Area. As illustrated on the figure, the separate-phase petroleum does contact thesewer proximal to PS-4, between PS-3 and PS-9. This accumulation could serve as a potential source of product infiltration within the sewer.

REMEDIAL FEASIBILITY TESTING

14 Pump House Area

Based upon site investigative activities and observed subsurface conditions proximal to Pollock Street sewer within the 14 Pump House area, remedial feasibility testing was initiated. The focus of this testing is to determine the most effective method of eliminating the separate-phase product source proximal to the sewer.

An interim product recovery system was installed to initiate product containment and determine recoverability at the 14 Pump House area. Remedial system design, permitting and installation of the system in the 14 Pump House area were performed in June and July 2002. Extraction from PS-3 began on 1 August 02. Due to problems with a falling water table throughout the summer, the pumping system was modified and restarted on 7 August 2002.

Liquid level measurements and pump rates were recorded during system operation at PS-3 and are summarized on Table 2. Trends in groundwater elevation and product thickness are presented graphically on Figures 4 and 5. The radius of influence from pumping at PS-3 is shown in Figure 6.

Operation of the product recovery system during the test period affect decreased groundwater elevations and product thickness at PS-3 and MW-91; however, no liquid level changes were observed in PS-4, 6, 8, 9, or 10. An increase in groundwater elevation was observed in PS-5.

A second total fluids pump was added to the system for operation at PS-8 on 13 September 2002. Initial operation of the PS-8 pump was intermittent until October 2002. Liquid level data was collected during simultaneous pumping from PS-3 and PS-8 during the duration of 1-4 October 2002. These data are summarized in Table 2. The data show an increase in groundwater elevations at PS-5 and MW-53 during pumping. Other observation wells show minimal influence during this period. A slight decrease in product thickness was observed at MW-53; however, product thicknesses at PS-4 were not influenced by product recovery at PS-3 and PS-8. Trends in groundwater elevations and product thicknesses are shown graphically in Figures 7 and 8.

Product Recovery Rate

From the period 1 August through 1 September, approximately 749 gallons of NAPL have been recovered from the two 14 Pump House wells PS-3 and PS-8.

The results of the remedial feasibility testing indicate significant head loss at the pumping well with minimal to no influence on the surrounding observation wells. These data

suggest the presence of silt and clay within the heterogeneous sand and gravel matrix and within the subsurface as sediment lenses, restricting groundwater flow within the unconfined aquifer. This observation is supported by the transmissivity and storativity values generated during the 1993 GES investigation.

RW-101 Area

A variable rate drawdown test was performed at RW-101 from 1-4 October 2002. Liquid level data were collected from RW-101 and surrounding monitoring wells. These data are summarized in Table 3. Data obtained from observation wells during the drawdown test show an initial rise in the surrounding water table; however, groundwater elevations dropped to static water table levels after three days of pumping. These data are shown graphically in Figure 9.

Data obtained from RW-101 during the pump test show relatively slight liquid level decreases while groundwater was pumped at 1 and 2 gpm pump rates. Liquid levels begin to drop dramatically when pump rates increase to 3.5 gpm. In addition, as liquid levels drop at this higher pump rate, separate-phase product thickness increases within the well. These data are shown graphically in Figure 10.

CONCLUSIONS

Additional monitoring wells are needed in the vicinity of RW 101 and 102, south of the sewer between the 860 Unifiner/Reformer Process Unit and the sewer.

A video inspection of the sewer should be performed to determine the exact location of NAPL seeps to the interior of the sewer under current conditions. This will facilitate targeting of specific areas that may need additional subsurface evaluation.

Additional subsurface investigation proximal to the sewer is warranted. The location of this additional investigation(s) will be determined by the results of the video inspection. Additional recovery wells may be recommended, if necessary subsequent to this study.

Further evaluation of the current RW 100 series wells is necessary prior to recommending the appropriate modifications to the current Pollock Street product recovery network. This evaluation will determine if mechanical modification of the pumping systems is warranted, or whether adjustments in flow rates/ pumping levels will improve product recoverability and hydraulic capture.

The design of the recovery system at the 14 Pump House Area should be completed based on the remedial testing performed during August to October 2002. An evaluation of alternative recovery methodologies will be made prior to implementation of the final remediation installation.

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SCHEDULE

A schedule for the continued evaluation is presented below:

Oct-Nov 2002:	Installation of two additional recovery wells at the 14 Pump House Finalization of the total fluids recovery test at the 14 Pump house Evaluation of RW 100 series wells Additional monitoring of all PS wells Performance of the sewer video study
December 2002:	Additional investigation of the RW101, Tank 298/140 areas
January 2003:	Soil and groundwater investigation targeted at areas identified by the sewer video study
February 2003:	Final report of the Pollock Street investigation.

TABLES

SUNOCO, INC.
Philadelpha Refinery
Pollock Street Sewer

TABLE 1
Observed Intervals of Petroleum Impact

Boring	Depth to Impact	Depth Impact Ends	Sediments In Impacted Zone	Impact Description	Highest PID Reading
1	18	28	S&G	sheen	
2	24	26	S	fuel	
3	14	27	S&G	product, black tarry	465
4					1255
5	20	22	S	stain, strong odor	
6	18	27	S	product, sheen	603
7	23	23	S&G	black layer of fuel	480
8	16	23	S	oily, spoon black w/c	1100
9	18	23	S	black oil stain	
10					
11	17	20	S	slight odor, heavy oil	
12	25	25	S	sheen	189
13	18	20	S	saturated w/oil	
14					
15	18	20	S&G	fuel	
16					
17					

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POLLOCK STREET SEWER
PHILADELPHIA, PA

TABLE 2
Pump Test Data- 14 Pump House Area

Product Thickness

	8/1/2002	8/6/2002	8/8/2002	9/26/2002	10/1/2002	10/2/2002	10/3/2002	10/4/2002
MW-53	2.15	0.01	0			1.99	1.6	1.55
PS-3*	1.83	0.01	0	3.38		3.16		
PS-4	3.7	3.51	3.19	3.58		3.6	3.49	3.74
PS-8	5.1	4.86	4.92	0.98		1.63		

* pumping

Groundwater Elevation

	8/1/2002	8/6/2002	8/8/2002	9/26/2002	10/1/2002	10/2/2002	10/3/2002	10/4/2002
MW-91	1.06	-0.50	-0.59					
MW-53						-3.07	-1.68	-1.75
PS-3*	-3.68	-7.38	-7.41	-0.22		-0.19		
PS-4	-1.15	-1.11	-1.12	-1.45		-1.46	-1.27	-1.41
PS-5*	-2.86	-0.49	-0.59	-3.20		-3.21	-0.75	-0.83
PS-6	-0.57	-0.58	-0.66	-0.85		-0.86	-0.51	-0.70
PS-8	-1.71	-1.62	-1.76	-1.11		-0.66		
PS-9	-1.41	-1.41	-1.58	-1.77		-1.80	-1.71	-1.81
PS-10	-1.34	-1.33	-1.45	-1.69		-1.74	-1.57	-1.67

14 Pump House Test

Operating Wells	3	3	3	3 & 8	3 & 8	3 & 8	3 & 8	3 & 8
Time					13:07	8:45	13:45	10:00
Totalizer Reading				114820	114990	115212	115419	115495
Effluent Reading				6350	6431	6527	6621	6684
Hour Meter					170	222.00	207	76

SUNOCO, INC.
Philadelpha Refinery
Pollock Street Sewer

TABLE 3
RW-101 Pump Test

Date/Time	Elapsed Time	DTP	DTW	Product Thickness (ft)	Groundwater Elevation	Pump Rate (gpm)	Product Totalizer	Totalizer	Pressure
10/1/2002 9:00	0	18.15	18.16	0.01	3.27	1.6	0	1717843	56
10/1/2002 10:40	1:40:00								
10/1/2002 10:48	1:48:00		19.58	0.00	1.84				
10/1/2002 10:55	1:55:00	19.64	19.65	0.01	1.78	1.4			
10/1/2002 11:05	2:05:00	19.74	19.75	0.01	1.68				
10/1/2002 11:35	2:35:00	19.85	19.87	0.02	1.57				
10/1/2002 12:32	3:32:00	19.96	19.97	0.01	1.46	2		60	60
10/1/2002 13:15	4:15:00	20.04	20.05	0.01	1.38				
10/1/2002 14:16	5:16:00					2.7		1718070	50
10/1/2002 14:36	5:36:00	21.23	21.28	0.05	0.18			1718120	
10/1/2002 15:12	6:12:00	21.37	21.43	0.06	0.04			1718210	
10/2/2002 8:00	23:00:00	22.22	22.45	0.23	-0.86	2.5		1720883	
10/2/2002 8:30	23:30:00					3.5			40
10/2/2002 9:45	24:45:00	25.8	26.00	0.20	-4.43			1721195	
10/2/2002 13:20	28:20:00	26.11	26.37	0.26	-4.76			1721888	
10/3/2002 12:30	51:30:00	26.3	26.62	0.32	-4.96			1725734	
10/4/2002 9:30	72:30:00	26.1	27.35	1.25	-4.99			1729086	

OBSERVATION WELLS

Product Thickness

Date	10/1/2002 9:00	10/3/2002 12:30	10/4/2002 9:30
PS-11	0.01	trace	trace
PS-12	0	0.01	
PS-13	0	trace	
PS-14	0	trace	
PS-16	0		
RW-101	1.25	0.32	1.25

Groundwater Elevation

Date	10/1/2002 9:00	10/1/2002 10:40	10/1/2002 11:40	10/1/2002 12:30	10/1/2002 14:10	10/1/2002 15:15	10/2/2002 8:00	10/2/2002 9:45	10/2/2002 13:20	10/3/2002 12:30	10/4/2002 9:30
PS-11	3.64	3.79	3.79	3.81	3.82	3.82	3.75	3.74	3.73	3.7	3.64
PS-12	3.45	3.62	3.63	3.63	3.64	3.64	3.56	3.54	3.53	3.5	3.45
PS-13	3.58	3.74	3.74	3.74	3.74	3.74	3.64	3.63	3.62	3.58	3.53
PS-14	3.24	3.45	3.47	3.47	3.48	3.47	3.35	3.34	3.34	3.29	3.24
PS-16	3.96	4.08	4.11	4.12	4.15	4.16	4.11	4.11	4.11	4.05	3.96

FIGURES

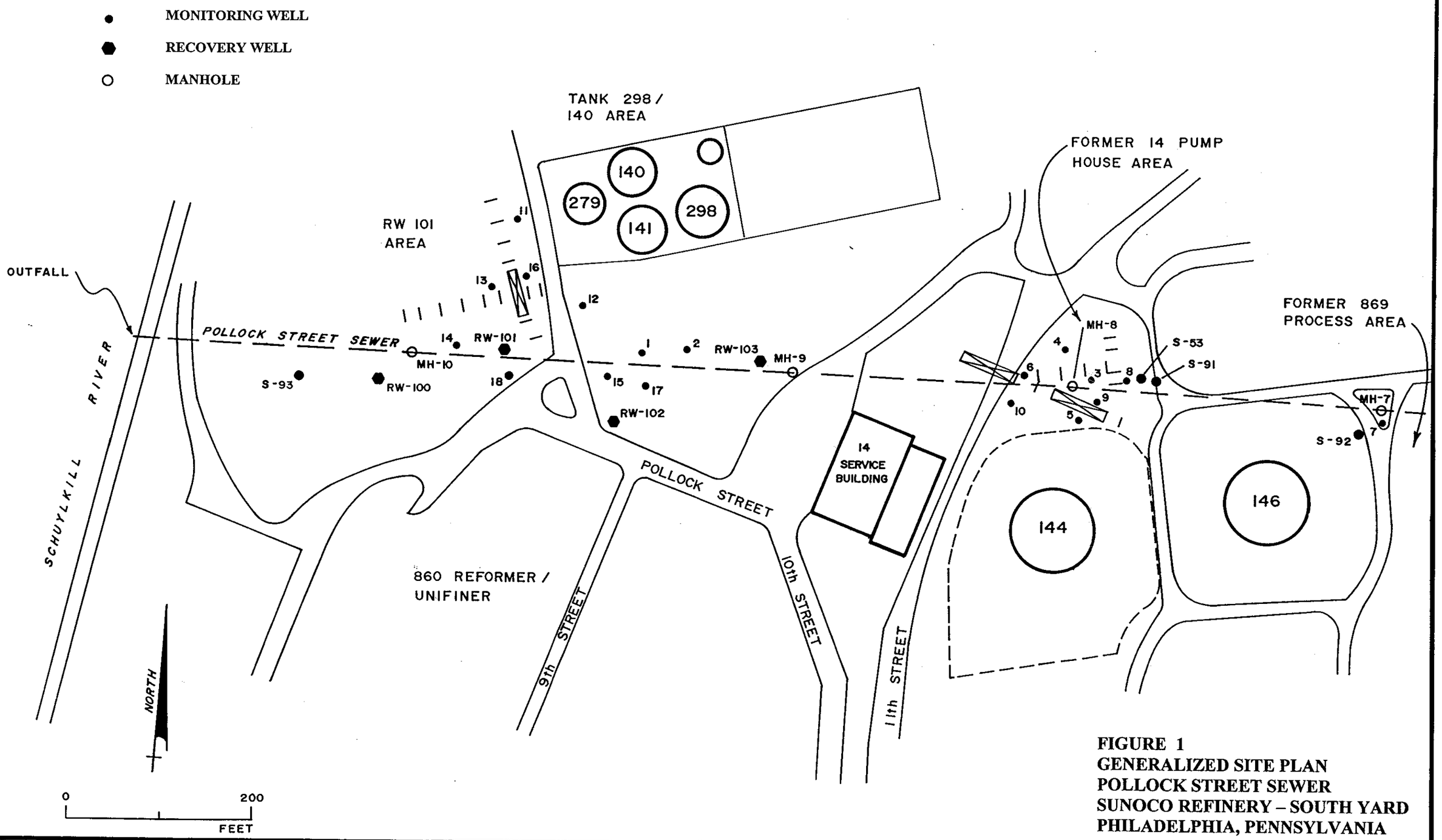


FIGURE 1
GENERALIZED SITE PLAN
POLLOCK STREET SEWER
SUNOCO REFINERY – SOUTH YARD
PHILADELPHIA, PENNSYLVANIA

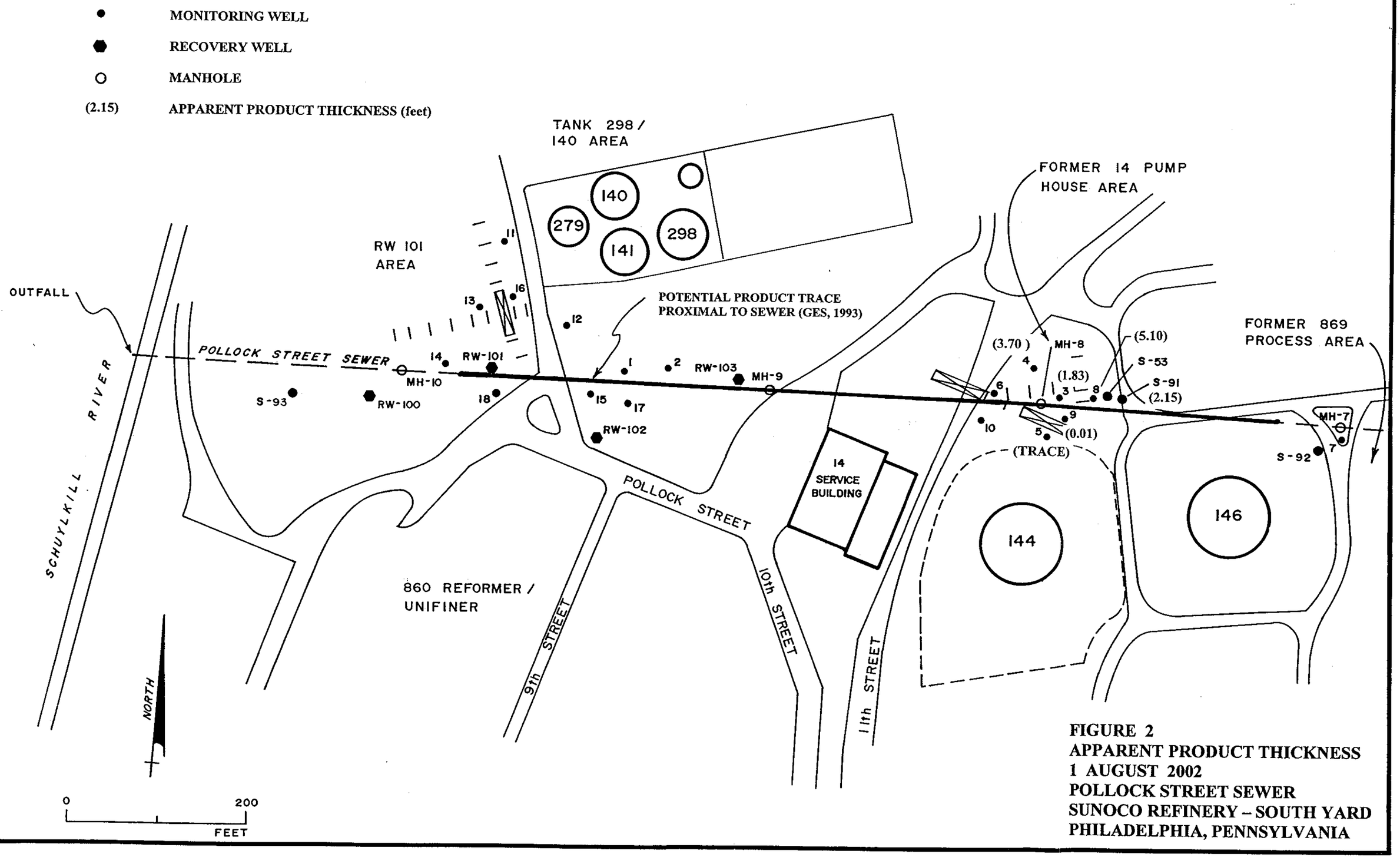


FIGURE 2
APPARENT PRODUCT THICKNESS
1 AUGUST 2002
POLLOCK STREET SEWER
SUNOCO REFINERY – SOUTH YARD
PHILADELPHIA, PENNSYLVANIA

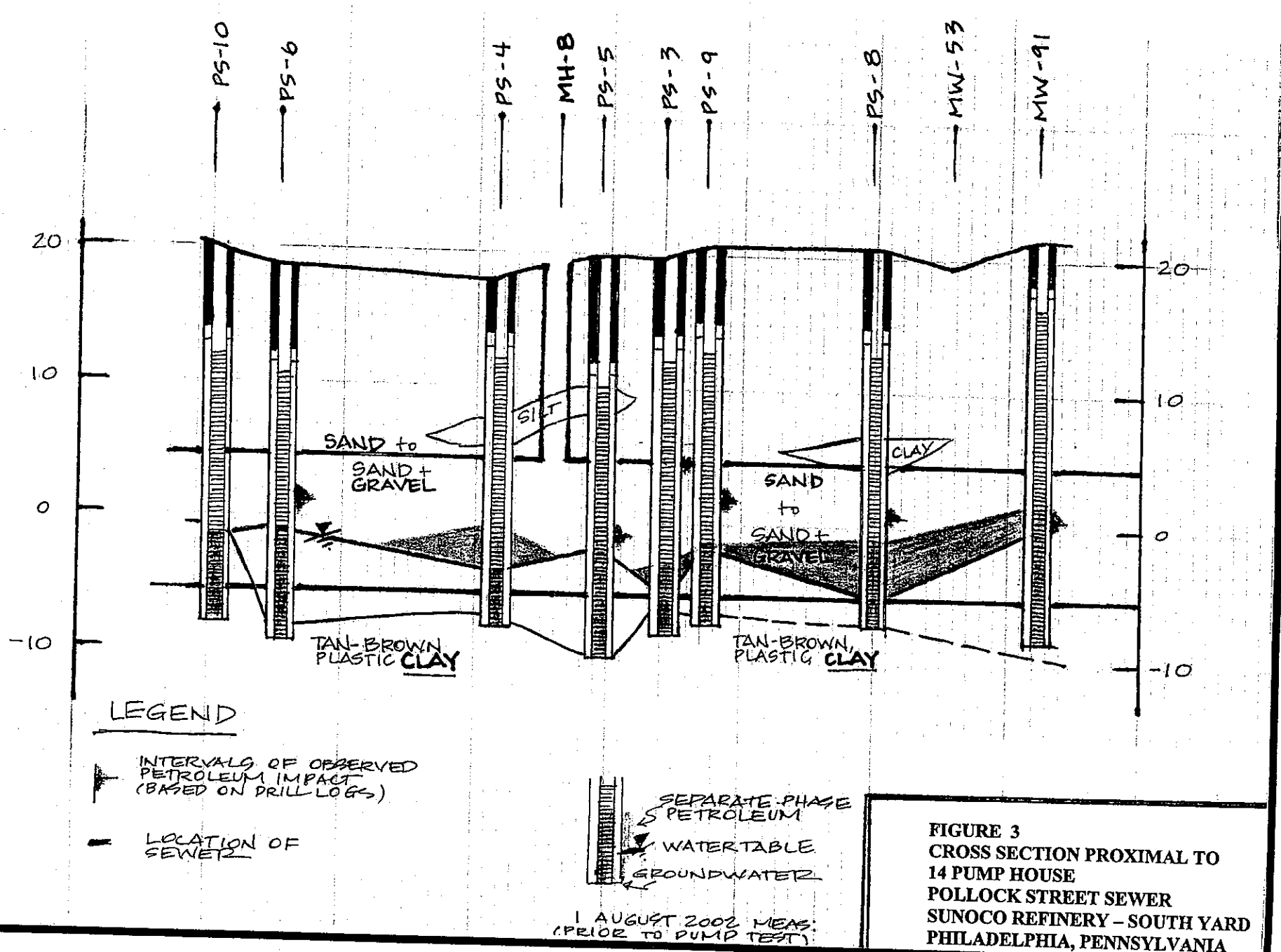
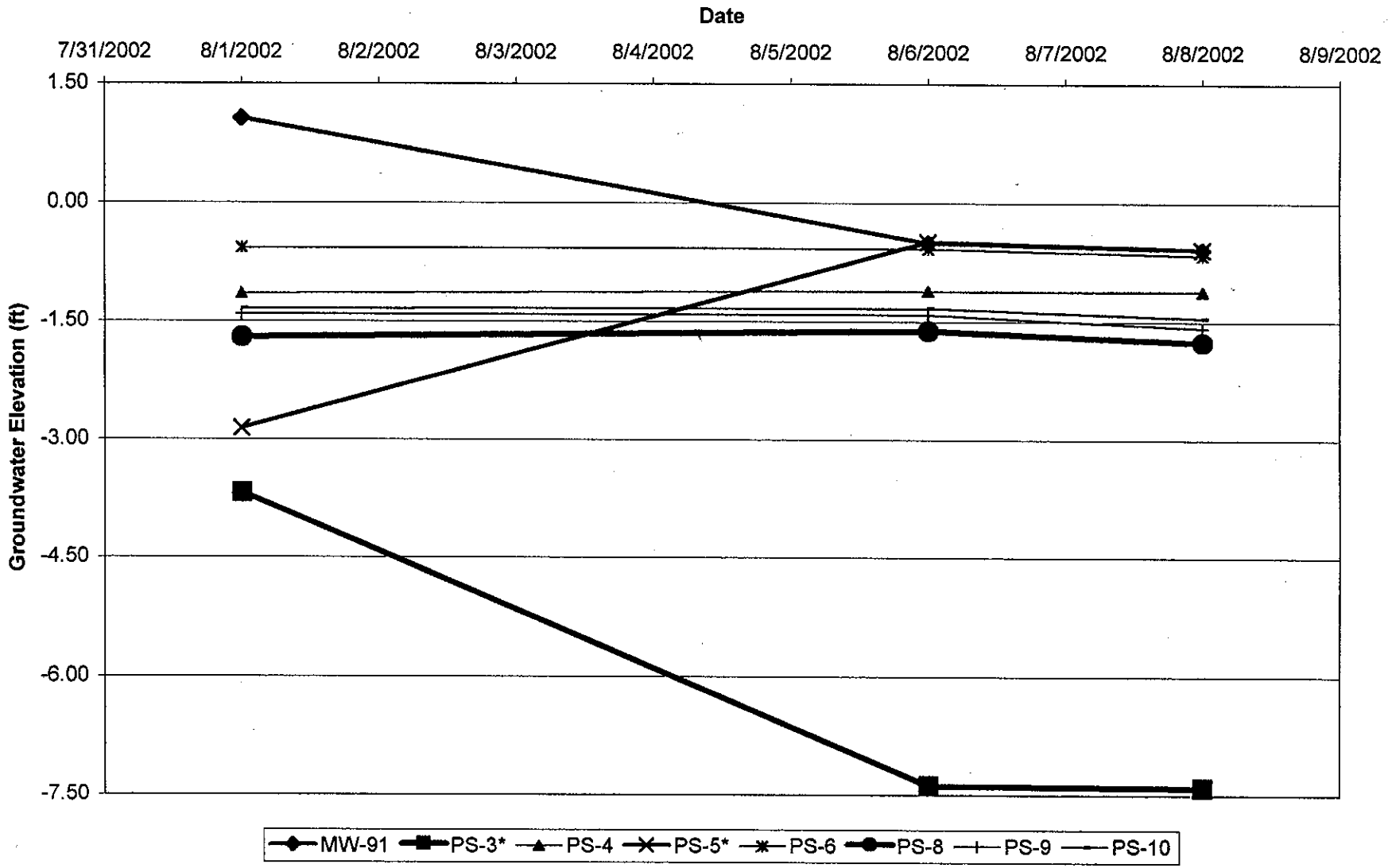


FIGURE 3
CROSS SECTION PROXIMAL TO 14 PUMP HOUSE
POLLOCK STREET SEWER
SUNOCO REFINERY – SOUTH YARD
PHILADELPHIA, PENNSYLVANIA

SUNOCO, INC.
Philadelphia Refinery
Pollock Street Sewer
Figure 4

Groundwater Elevations- Pumping from PS-3



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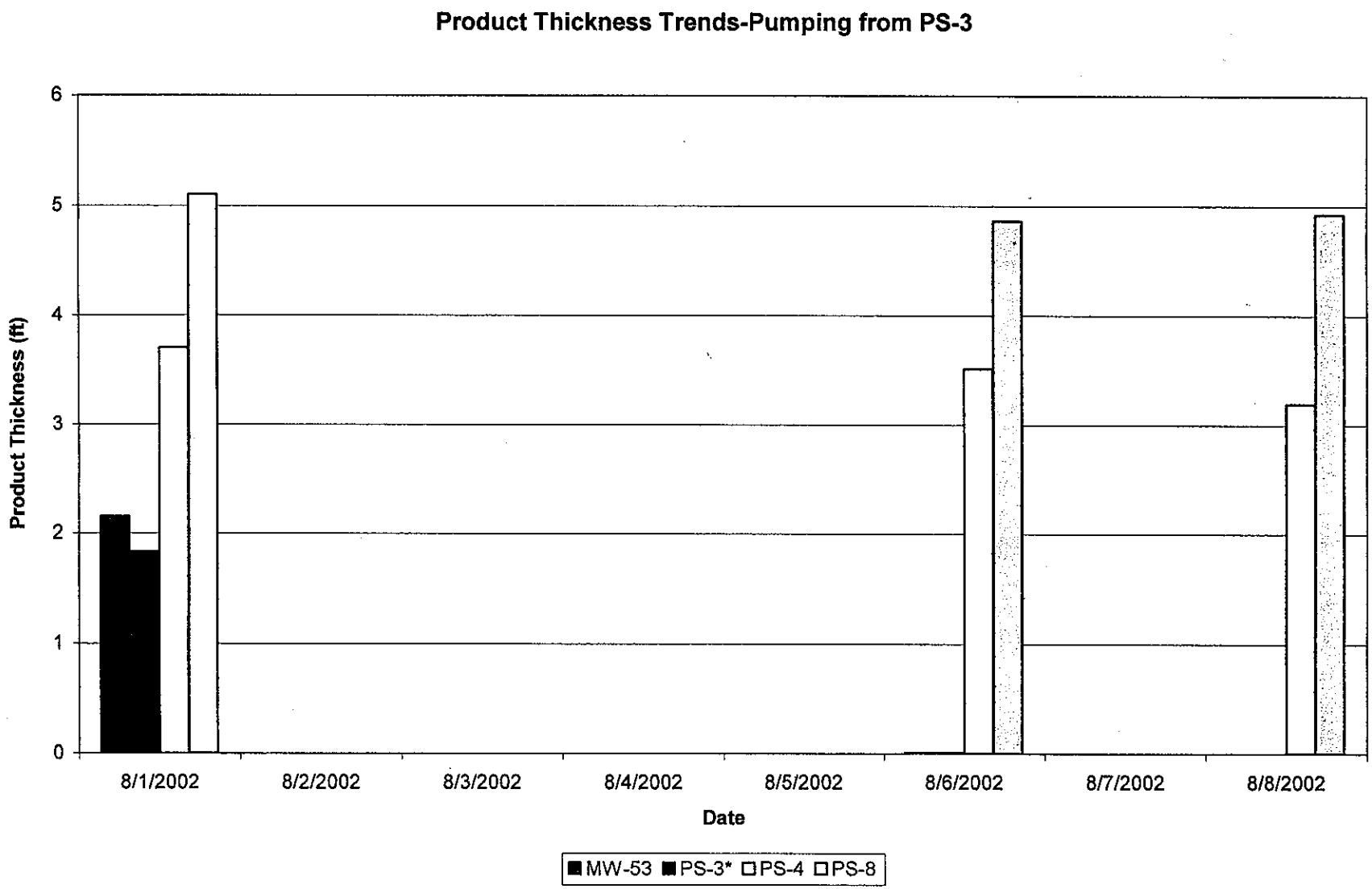
Pollock Street Sewer

Figure 5



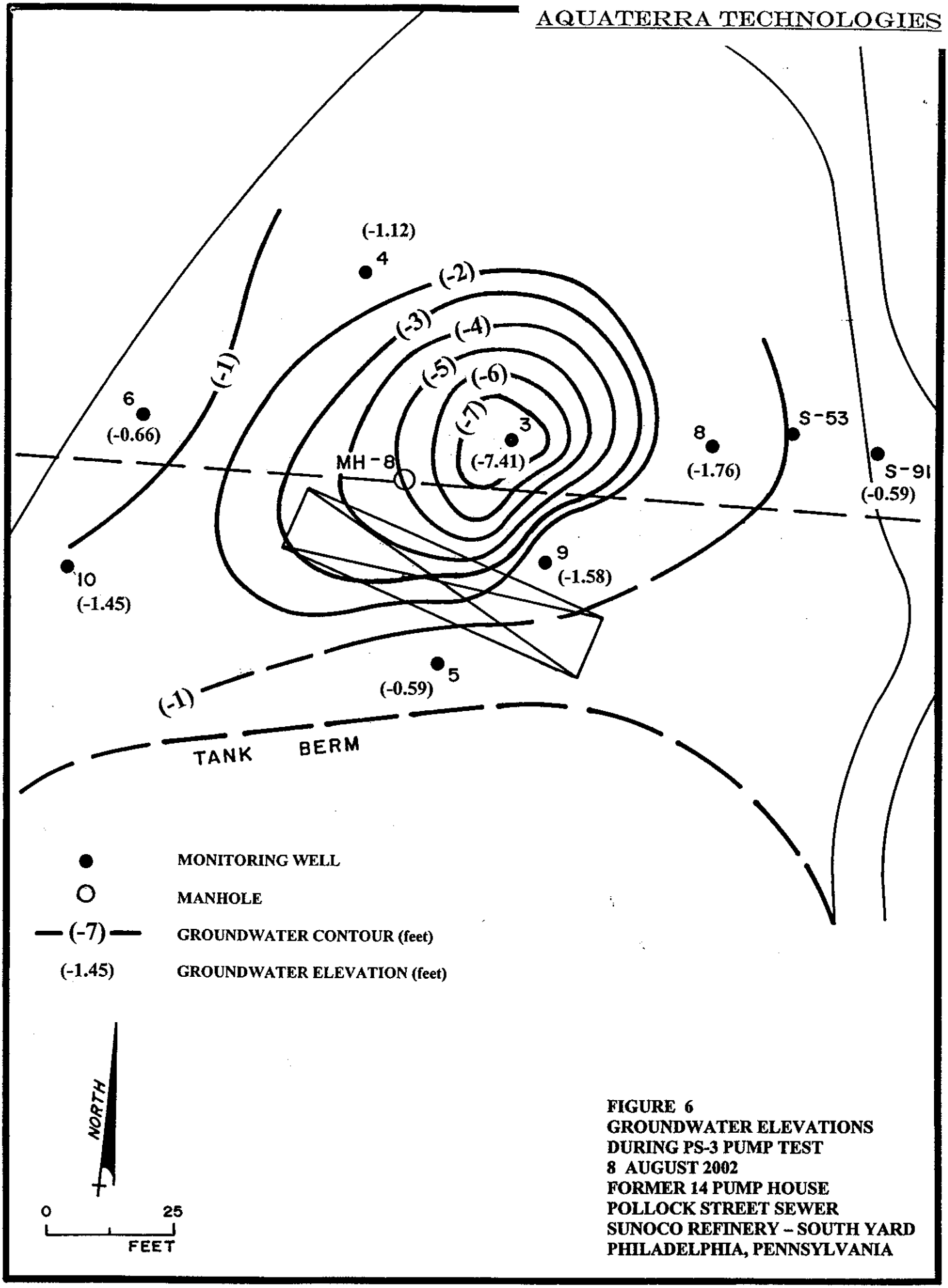
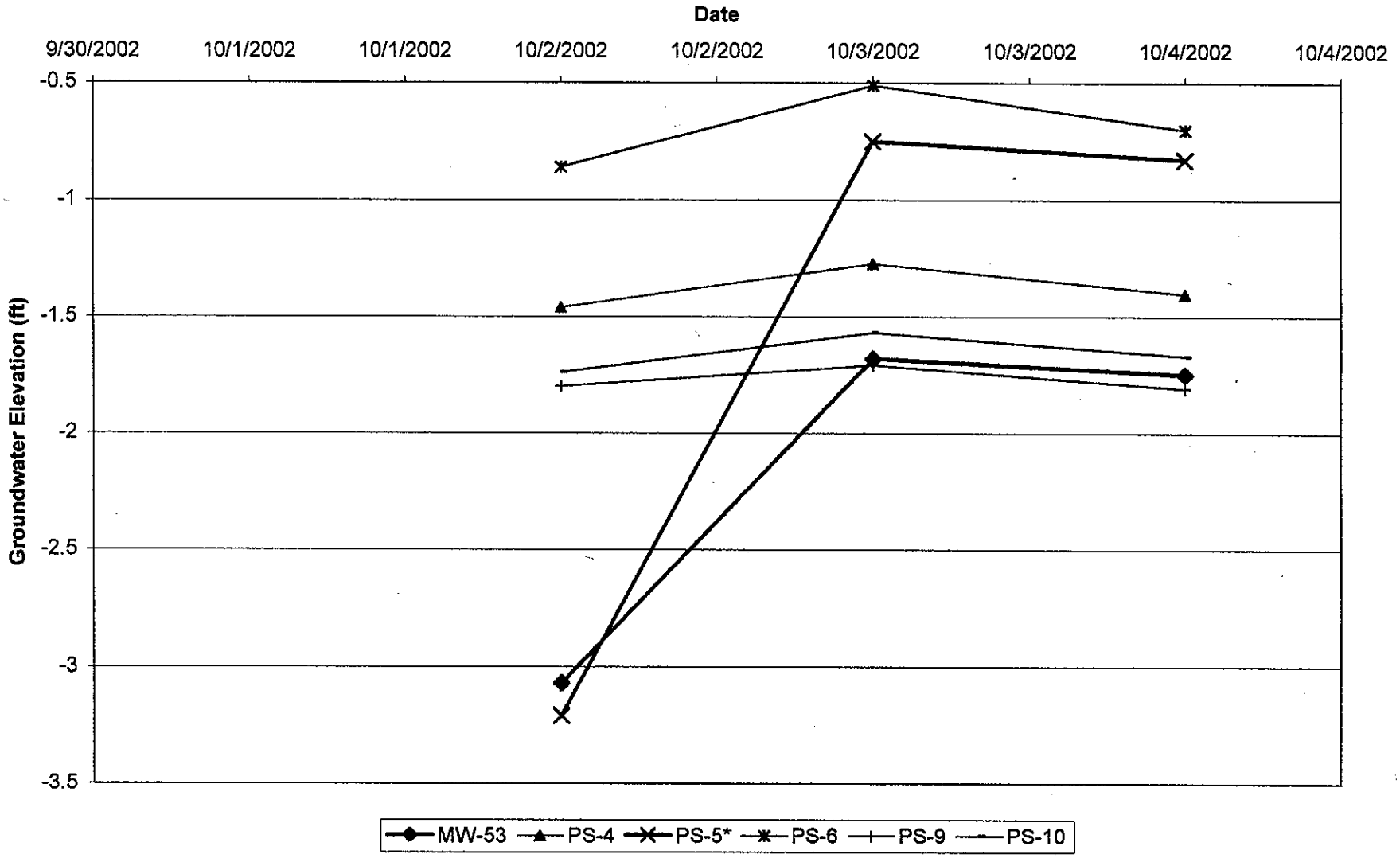


FIGURE 6
GROUNDWATER ELEVATIONS
DURING PS-3 PUMP TEST
8 AUGUST 2002
FORMER 14 PUMP HOUSE
POLLOCK STREET SEWER
SUNOCO REFINERY – SOUTH YARD
PHILADELPHIA, PENNSYLVANIA

SUNOCO, INC.
Philadelphia Refinery
Pollock Street Sewer
Figure 7

Groundwater Elevation Trends- Pumping from PS-3 and PS-8



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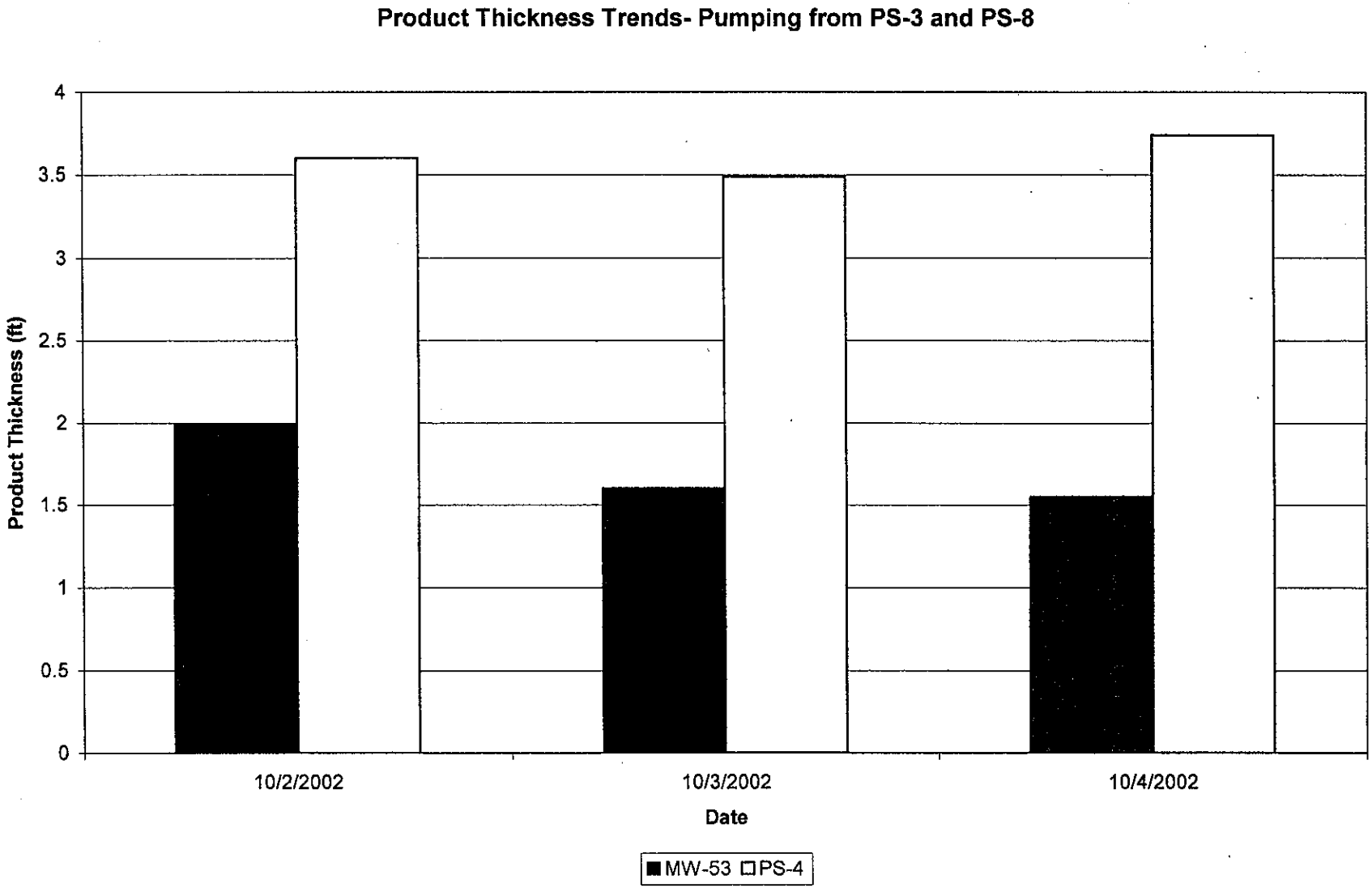
Pollock Street Sewer

Figure 8



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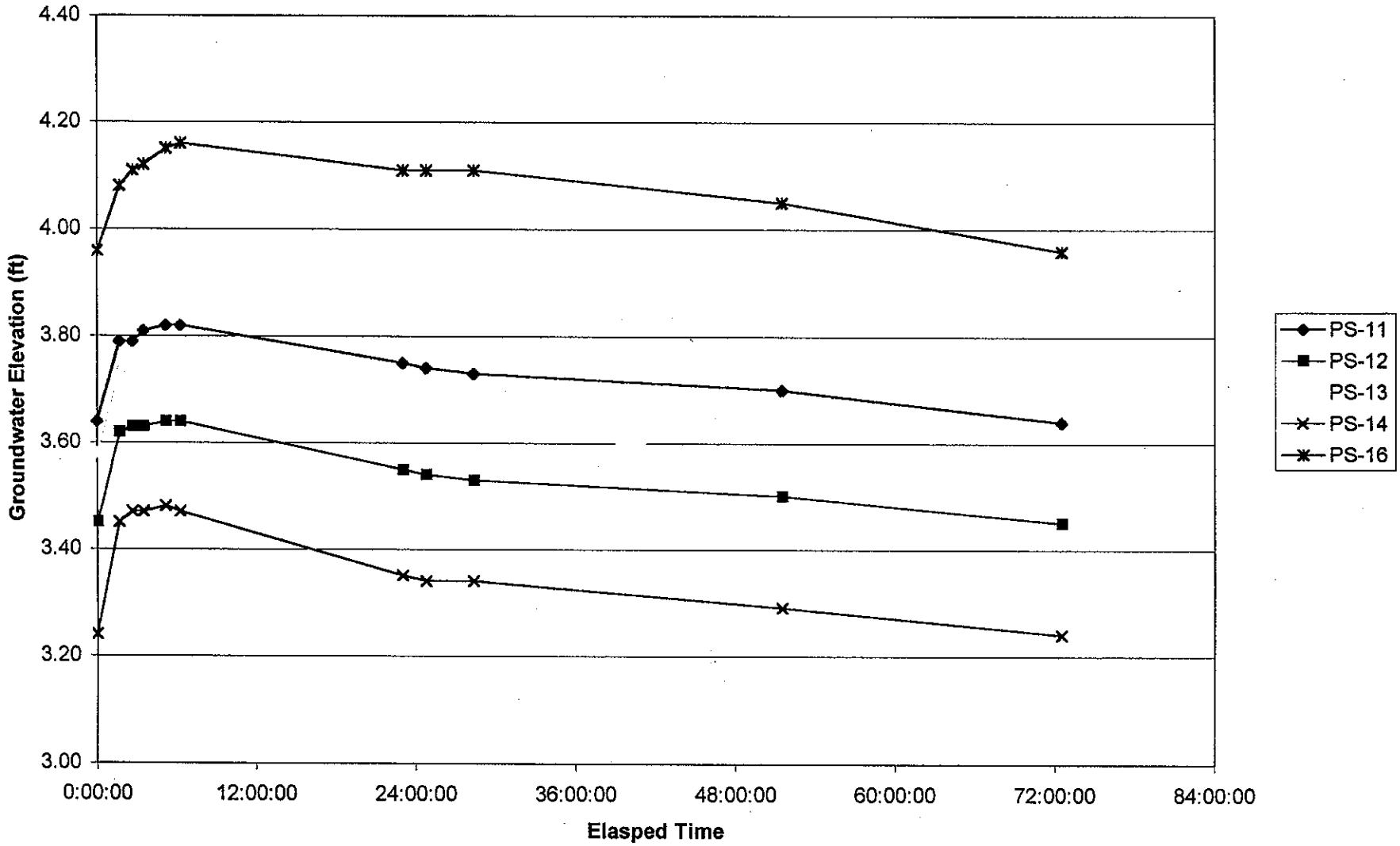
Pollock Street Sewer
Figure 9

Groundwater Elevation Trends- Pumping from RW-101



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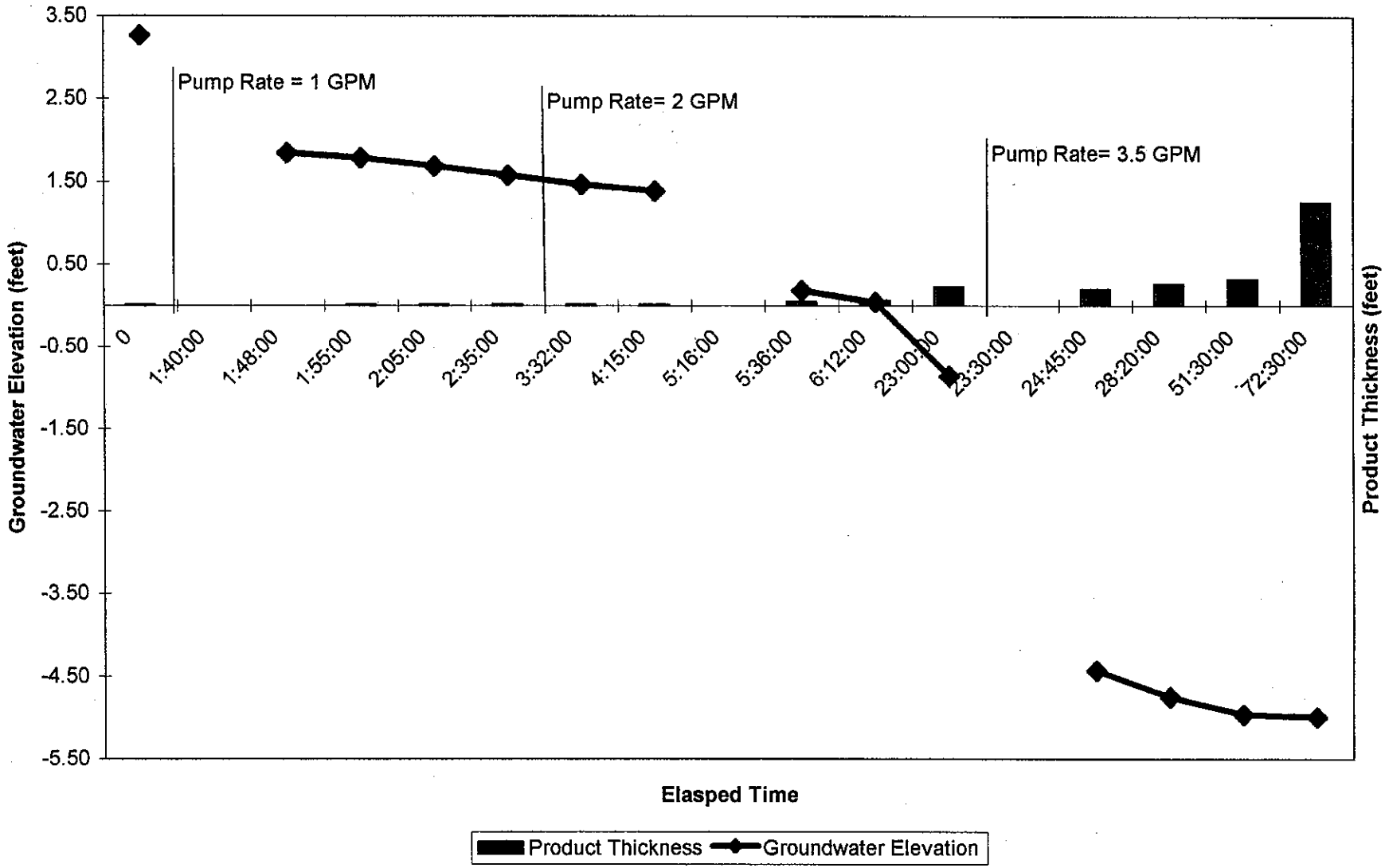
Pollock Street Sewer
Figure 10

Groundwater Elevation and Product Thickness Trends at RW-101



APPENDIX A
DRILL LOGS

Aquaterra Technologies, Inc.
Subsurface Log: PS-1

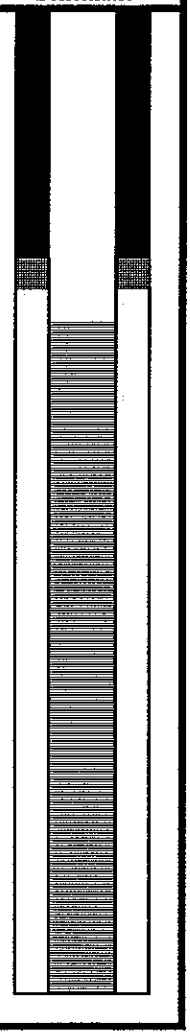
Project Name: Philadelphia Refinery
Owner: Sunoco, Inc. (R&M)
Location: Pollock Street Sewer
Permit No.: N/A
Boring Number: PS-1
Log By: Kevin Martin
Date: 7-May-02
Casing Elevation: N/A
Driller: Parratt - Wolff
Borehole Dia: 6-inch
Screen Diameter: 4" **Length:** 20' **Slot Size:** 0.020" **Water Level (Init):** 16.5
Casing Diameter: 4" **Length:** 10' **Type:** PVC
Drilling Method: Hollow Stem Auger Drilling **Sample Method:** Split-Spoon/Grab **Rig Type:**

Construction Details

Total Well Depth: 30
Bentonite Interval: 8-9
Screen Interval: 10-30
Cement/Grout Interval: 0-8
Sand Pack Interval: 9-30
Sand Pack Type: No. 2 sand
Completion Details: Completed with 8-inch manhole cover and locking cap

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
0				
	2		Auger to 10 feet.	
	4			
	6			
	8			
10	10		Gray, brown, SILT & fine-coarse SAND, some fine-medium gravel (moist)	
	12			
15	14		Brown, fine-coarse SAND and fine-med GRAVEL (moist)	
	16			
	18		Black, fine-coarse SAND and fine-med GRAVEL, trace silt (wet, sheen)	
20	20		Black, fine-coarse SAND and fine-med GRAVEL (wet, sheen)	
	22			
	24		Green weathered shale (dry)	
25				
	26		Brown fine-coarse SAND, some fine-med gravel, trace silt (wet, sheen)	
30	28		Brown CLAY and SILT (moist)	
	30			
			Bottom of boring at 30 feet below ground surface.	



Aquaterra Technologies, Inc.
Subsurface Log: PS-2

Project Name: Philadelphia Refinery
Location: Pollock Street Sewer
Boring Number: PS-2
Casing Elevation:
Screen Diameter: 4" **Length:** 20'
Casing Diameter: 4" **Length:** 10'
Drilling Method: Hollow Stem Auger Drilling

Owner: Sunoco, Inc. (R&M)
Permit No.: N/A
Log By: Kevin Martin
Driller: Parratt - Wolff
Slot Size: 0.020"
Type: PVC
Sample Method: Split-Spoon/Grab

Date: 7-May-02
Borehole Dia: 6-inch
Water Level (Init): NA
Rig Type:

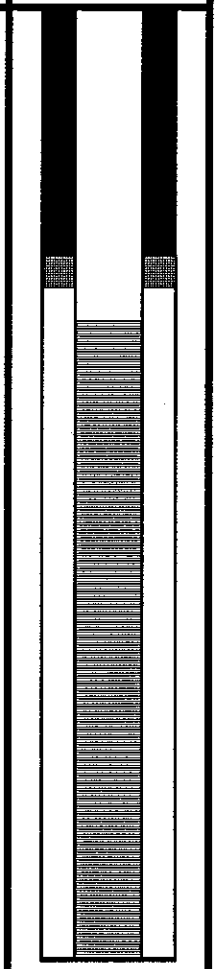
Construction Details

Total Well Depth: 30
Screen Interval: 10-30
Sand Pack Interval: 9-30
Completion Details: Completed with 8-inch manhole cover and locking cap

Bentonite Interval: 8-9
Cement/Grout Interval: 0-9
Sand Pack Type: No. 2 sand

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2				
4				
6				
8				
10			Black SILT and fine-coarse SAND (moist)	
12			Black fine-coarse SAND, some fine gravel, trace SILT (moist-wet)	
14				
16				
18				
20				
22				
24			observed fuel in sample	
26				
28				
30			Bottom of boring at 30 feet below ground surface.	



Aquaterra Technologies, Inc.
Subsurface Log: PS-3

Project Name: Philadelphia Refinery
Location: Pollock Street Sewer
Boring Number: PS-3
Casing Elevation: N/A
Screen Diameter: 4" **Length:** 20'
Casing Diameter: 4" **Length:** 8'
Drilling Method: Hollow Stem Auger Drilling

Owner: Sunoco, Inc. (R&M)
Permit No.: N/A
Log By: Kevin Martin
Driller: Parratt - Wolff
Slot Size: 0.020"
Type: PVC
Sample Method: Split-Spoon/Grab

Date: 8-May-02
Borehole Dia: 6-inch
Water Level (Init): 14
Rig Type:

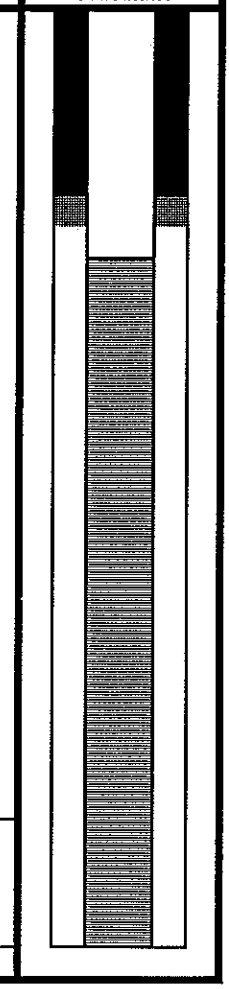
Construction Details

Total Well Depth: 28
Screen Interval: 8-28
Sand Pack Interval: 7-28
Completion Details: Completed with 8-inch manhole cover and locking cap

Bentonite Interval: 6-7
Cement/Grout Interval: 0-6
Sand Pack Type: No. 2 sand

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2				
4				
6				
8				
10				
12				
14	14-16	465	Brown fine to coarse SAND and GRAVEL (wet) (product)	
16				
18	18-20	83		
20				
22				
24			Black, coarse SAND 4 inch lense of Green CLAY	
			Sandy GRAVEL (black, tarry oil)	
26			Coarse SAND (wet, less product)	
			Tan, plastic CLAY	
28				
30				
			Bottom of boring at 28 feet below ground surface	



Aquaterra Technologies, Inc.
Subsurface Log: PS-4

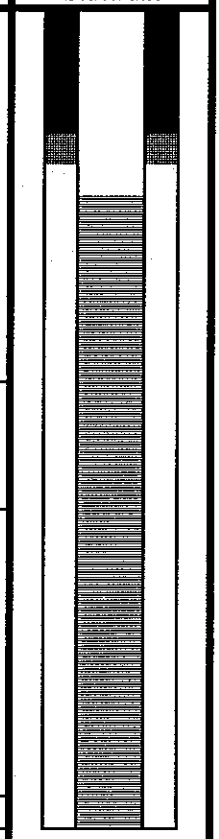
Project Name: Philadelphia Refinery
Location: Pollock Street Sewer
Boring Number: PS-3
Casing Elevation: N/A
Screen Diameter: 4" **Length:** 20'
Casing Diameter: 4" **Length:** 8
Drilling Method: Hollow Stem Auger Drilling
Owner: Sunoco, Inc. (R&M)
Permit No.: N/A
Log By: Kevin Martin
Driller: Parratt - Wolff
Slot Size: 0.020"
Type: PVC
Sample Method: Split-Spoon/Grab
Date: 8-May-02
Borehole Dia: 6-inch
Water Level (Init): 6
Rig Type:

Construction Details

Total Well Depth: 26
Screen Interval: 6-26
Sand Pack Interval: 5-26
Completion Details: Completed with 8-inch manhole cover and locking cap
Bentonite Interval: 4-5
Cement/Grout Interval: 0-4
Sand Pack Type: No. 2 sand

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2			Auger to 10'	
4				
6				
8				
10	10 to 12		Brown, SILT, some clay, some fine-coarse SAND (wet)	
12	12 to 14		Gray, SILT and CLAY, fine-coarse FMC sand (wet)	
14	14-16		Gray, fine-coarse SAND, some silt, some fine-med gravel (wet)	
16	16-18			
18	18-20		Brown, fine-coarse SAND, some fine-gravel	
20	20-22	1,255		
22	22-24	640	Brown, coarse SAND and GRAVEL	
24	24-26			
26	26-28	1.7	Dark brown, plastic clay	
			Bottom of boring at 26 feet below ground surface.	



Aquaterra Technologies, Inc.
Subsurface Log: PS-5

Project Name: Philadelphia Refinery
Location: Pollock Street Sewer
Boring Number: PS-5
Casing Elevation: N/A
Screen Diameter: 4" **Length:** 20'
Casing Diameter: 4" **Length:** 10'
Drilling Method: Hollow Stem Auger Drilling
Owner: Sunoco, Inc. (R&M)
Permit No.: N/A
Log By: Kevin Martin
Driller: Parratt - Wolff
Slot Size: 0.020"
Type: PVC
Sample Method: Split-Spoon/Grab
Date: 8-May-02
Borehole Dia: 6-inch
Water Level (Init): 8
Rig Type:

Construction Details

Total Well Depth: 30
Screen Interval: 10-20
Sand Pack Interval: 9-20
Completion Details: Completed with 8-inch manhole cover and locking cap
Bentonite Interval: 8-9
Cement/Grout Interval: 0-8
Sand Pack Type: No. 2 sand

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2				
4				
6				
8			Auger to 10'	
10	10-12		Dark gray, silty CLAY (wet)	
12	12-14	201	Dark gray clayey SAND, some gravel (wet)	
14	14-16			
16	16-18			
18	18-20			
20	20-22		Dark brown, fine-coarse SAND and fine-medium GRAVEL (wet) (stain, strong fuel odor)	
22	22-24			
24	24-26			
26	26-28			
28	28-30	36	28-29: Gray, coarse SAND	
		5	29-29.5: Brown SAND	
30			29.5: Tan CLAY	
			Bottom of boring at 30 feet below ground surface	

Aquaterra Technologies, Inc.
Subsurface Log: PS-6

Project Name: Philadelphia Refinery **Owner:** Sunoco, Inc. (R&M)
Location: Pollock Street Sewer **Permit No.:** N/A
Boring Number: PS-6 **Log By:** Kevin Martin **Date:** 9-May-02
Casing Elevation: N/A **Driller:** Parratt - Wolff **Borehole Dia:** 6-inch
Screen Diameter: 4" **Length:** 20' **Slot Size:** 0.020" **Water Level (Init):** 16
Casing Diameter: 4" **Length:** 8 **Type:** PVC
Drilling Method: Hollow Stem Auger Drilling **Sample Method:** Split-Spoon/Grab **Rig Type:**

Construction Details

Total Well Depth: 28 **Bentonite Interval:** 6-7
Screen Interval: 8-28 **Cement/Grout Interval:** 0-6
Sand Pack Interval: 7-28 **Sand Pack Type:** No. 2 sand
Completion Details: Completed with 8-inch manhole cover and locking cap

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2				
4				
6			Auger to 14'	
8				
10				
12				
14	14-16	337	Medium-coarse, poorly sorted SAND and GRAVEL (dry)	
16	16-18	314	Red-grn-brwn, fine-coarse SAND and fine-coarse GRAVEL (wet)	
18	18-20	603	(product at 18')	
20	20-22	364	Brown, fine-medium SAND, little gravel (wet)	
22	22-24	287		
24	24-26		No sample	
26	26-28	47	26-27: Dark, coarse SAND, some clay (wet, sheen) 27: CLAY	
28				
			Bottom of boring at 28 feet below ground surface	

Aquaterra Technologies, Inc.
Subsurface Log: PS-7

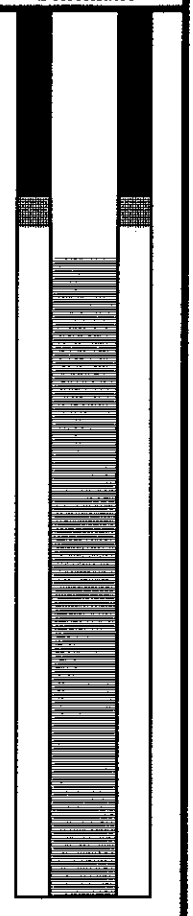
Project Name: Philadelphia Refinery **Owner:** Sunoco, Inc. (R&M)
Location: Pollock Street Sewer **Permit No.:** N/A
Boring Number: PS-7 **Log By:** Kevin Martin **Date:** 9-May-02
Casing Elevation: N/A **Driller:** Parratt - Wolff **Borehole Dia:** 6-inch
Screen Diameter: 4" **Length:** 20' **Slot Size:** 0.020" **Water Level (Init):** NA
Casing Diameter: 4" **Length:** 8 **Type:** PVC
Drilling Method: Hollow Stem Auger Drilling **Sample Method:** Split-Spoon/Grab **Rig Type:**

Construction Details

Total Well Depth: 28 **Bentonite Interval:** 6-7
Screen Interval: 8-28 **Cement/Grout Interval:** 0-6
Sand Pack Interval: 7-28 **Sand Pack Type:** No. 2 sand
Completion Details: Completed with 8-inch manhole cover and locking cap

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2				
4				
6				
8			Hydro Vac to 10 ft bgs	
10			Light gray SILT and fine SAND (wet)	
12				
14	14-16			
16	16-18	360		
18	18-20		17.5': Red-gray-brown, fine-coarse SAND and fine-med GRAVEL, trace silt (wet, no odor)	
20	20-22			
22	22-24	480		
24	24-26		23': (black, layer of fuel) Gray, fine-coarse SAND and fine-med.GRAVEL (wet)	
26	26-28			
28			27.5': Brown CLAY (wet)	
			Bottom of boring at 28 feet below ground surface	



Aquaterra Technologies, Inc.
Subsurface Log: PS-8

Project Name: Philadelphia Refinery
Location: Pollock Street Sewer
Boring Number: PS-8
Casing Elevation: N/A
Screen Diameter: 4" **Length:** 20'
Casing Diameter: 4" **Length:** 8'
Drilling Method: Hollow Stem Auger Drilling

Owner: Sunoco, Inc. (R&M)
Permit No.: N/A
Log By: Kevin Martin
Driller: Parratt - Wolff
Slot Size: 0.020"
Type: PVC
Sample Method: Split-Spoon/Grab

Date: 10-May-02
Borehole Dia: 6-inch
Water Level (Init): NA
Rig Type:

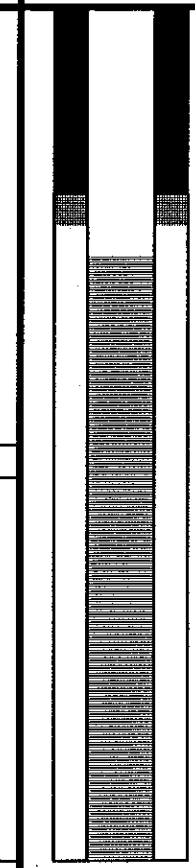
Construction Details

Total Well Depth: 28
Screen Interval: 8-28
Sand Pack Interval: 7-28
Completion Details: Completed with 8-inch manhole cover and locking cap

Bentonite Interval: 6-7
Cement/Grout Interval: 0-6
Sand Pack Type: No. 2 sand

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2				
4			Auger to 14 ft bgs	
6				
8				
10				
12				
14	14-16	145	Gray, yellow,brown, semi-plastic CLAY (moist)	
			15.5': Sandy CLAY	
16	16-18	467	Med to coarse SAND, some gravel (oily,clear)	
18	18-20	1,100		
20	20-22		(spoon wet with black oil)	
22	22-24			
24	24			
26	26			
28	28-30		Brown plastic CLAY	
			Bottom of boring at 28 feet below ground surface	



Aquaterra Technologies, Inc.
Subsurface Log: PS-9

Project Name: Philadelphia Refinery
Location: Pollock Street Sewer
Boring Number: PS-9
Casing Elevation: N/A
Screen Diameter: 4" **Length:** 20'
Casing Diameter: 4" **Length:** 10'
Drilling Method: Hollow Stem Auger Drilling

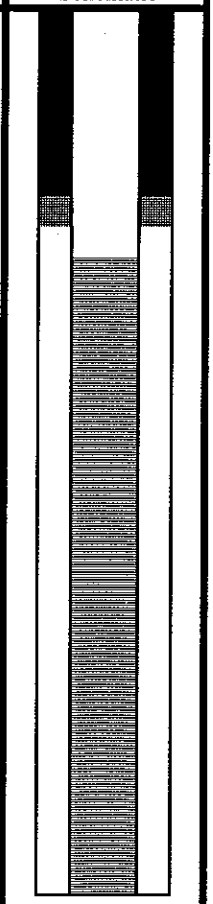
Owner: Sunoco, Inc. (R&M)
Permit No.: N/A
Log By: Kevin Martin **Date:** 13-May-02
Driller: Parratt - Wolff **Borehole Dia:** 6-inch
Slot Size: 0.020" **Water Level (Init):** NA
Type: PVC
Sample Method: Split-Spoon/Grab **Rig Type:**

Construction Details

Total Well Depth: 28
Screen Interval: 8-28
Sand Pack Interval: 7-28
Completion Details: Completed with 8-inch manhole cover and locking cap

Bentonite Interval: 6-7
Cement/Grout Interval: 0-6
Sand Pack Type: No. 2 sand

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2			Auger to 18 ft bgs	
4				
6				
8				
10				
12				
14				
16				
18	18-20		Gray, fine-coarse SAND, some gravel (oily)	
20	20-22		22: black oil stain (wet)	
22	22-24			
24			Auger to 28 ft bgs	
26				
28				
			Bottom of boring 28 feet below ground surface	

Aquaterra Technologies, Inc.
Subsurface Log: PS-10

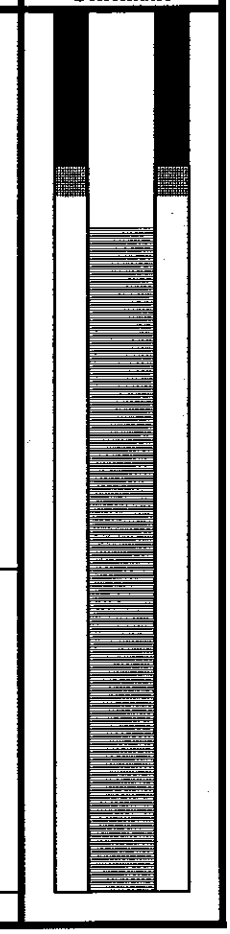
Project Name: Philadelphia Refinery
Owner: Sunoco, Inc. (R&M)
Location: Pollock Street Sewer
Permit No.: N/A
Boring Number: PS-10
Log By: Kevin Martin
Date: 13-May-02
Casing Elevation: N/A
Driller: Parratt - Wolff
Borehole Dia: 6-inch
Screen Diameter: 4" **Length:** 20
Slot Size: 0.020"
Water Level (Init): NA
Casing Diameter: 4" **Length:** 8
Type: PVC
Drilling Method: Hollow Stem Auger Drilling
Sample Method: Split-Spoon/Grab
Rig Type:

Construction Details

Total Well Depth: 28
Bentonite Interval: 6-7
Screen Interval: 8-28
Cement/Grout Interval: 0-6
Sand Pack Interval: 7-28
Sand Pack Type: No. 2 sand
Completion Details: Completed with 8-inch manhole cover and locking cap

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2				
4				
6				
8				
10				
12			Auger to 18', No sample	
14				
16				
18	18-20		Gray, fine-coarse, clayey SAND (wet)	
			Sandy CLAY	
20	20-22		Sandy CLAY and GRAVEL, trace wood	
22				
24				
26				
28				
			Bottom of boring at 28 feet below ground surface	



Aquaterra Technologies, Inc.
Subsurface Log: PS-11

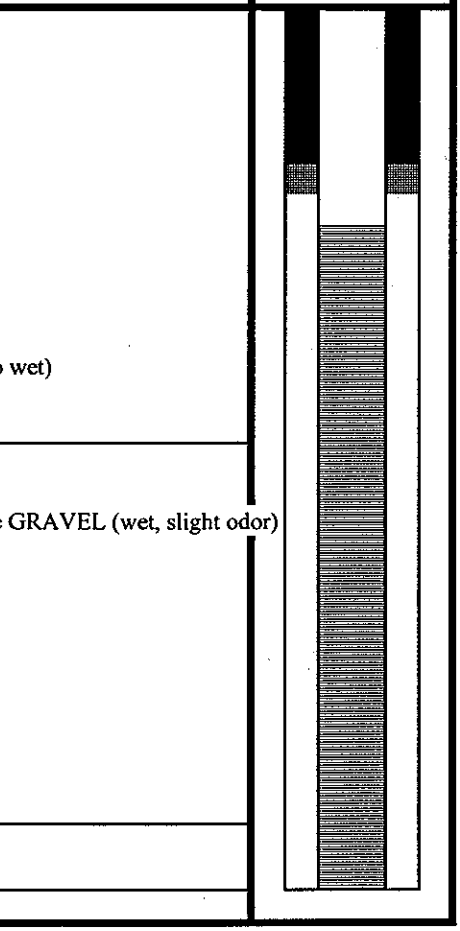
Project Name: Philadelphia Refinery **Owner:** Sunoco, Inc. (R&M)
Location: Pollock Street Sewer **Permit No.:** N/A
Boring Number: PS-11 **Log By:** Kevin Martin **Date:** 14-May-02
Casing Elevation: N/A **Driller:** Parratt - Wolff **Borehole Dia:** 6-inch
Screen Diameter: 4" **Length:** 20 **Slot Size:** 0.020" **Water Level (Init):** NA
Casing Diameter: 4" **Length:** 8 **Type:** PVC
Drilling Method: Hollow Stem Auger Drilling **Sample Method:** Split-Spoon/Grab **Rig Type:**

Construction Details

Total Well Depth: 28 **Bentonite Interval:** 6-7
Screen Interval: 8-28 **Cement/Grout Interval:** 0-6
Sand Pack Interval: 7-28 **Sand Pack Type:** No. 2 sand
Completion Details: Completed with 8-inch manhole cover and locking cap

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2				
4			Hydro Vac to 10'	
6				
8				
10				
12	12-14		Brown, CLAY; some silt, trace fine gravel (moist to wet)	
14	14-16			
16	16-18		15': Brown, fine-coarse well graded SAND (wet)	
18	18-20		17': Brown-gray, fine-coarse SAND and fine-coarse GRAVEL (wet, slight odor)	
20	20-22		20': (heavy oil)	
22				
24				
26				
28			27.5': Brown CLAY (wet)	
			Bottom of boring at 28 feet below ground surface	



Aquaterra Technologies, Inc.
Subsurface Log: PS-12

Project Name: Philadelphia Refinery
Location: Pollock Street Sewer
Boring Number: PS-12
Casing Elevation: N/A
Screen Diameter: 4" **Length:** 20
Casing Diameter: 4" **Length:** 8
Drilling Method: Hollow Stem Auger Drilling
Owner: Sunoco, Inc. (R&M)
Permit No.: N/A
Log By: Kevin Martin
Driller: Parratt - Wolff
Slot Size: 0.020"
Type: PVC
Sample Method: Split-Spoon/Grab
Date: 14-May-02
Borehole Dia: 6-inch
Water Level (Init): NA
Rig Type:

Construction Details

Total Well Depth: 28
Screen Interval: 8-28
Sand Pack Interval: 7-28
Completion Details: Completed with 8-inch manhole cover and locking cap
Bentonite Interval: 6-7
Cement/Grout Interval: 0-6
Sand Pack Type: No. 2 sand

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2				
4				
6				
8				
10				
12				
14	14-16		Gray, fine-coarse SAND and GRAVEL (moist-wet)	
16	16-18		Coarse SAND and GRAVEL	
			Grades to a fine-coarse SAND and GRAVEL	
18	18-20			
20	20-22	67	Gray fine, running SAND	
			Black, stained fine-coarse SAND and GRAVEL	
22	22-24	161	22': Rock, mica-schist	
		112	Fine-coarse SAND and GRAVEL	
24	24-26	189	Fine-coarse SAND and GRAVEL (wet)	
		6.5	25': Brown, fine-coarse SAND (moist, sheen)	
26	26-28		Fine-coarse SAND and GRAVEL	
			27.8': Gray, plastic CLAY	
28				
			Bottom of boring at 28 feet below ground surface	

Aquaterra Technologies, Inc.
Subsurface Log: PS-13

Project Name: Philadelphia Refinery
Owner: Sunoco, Inc. (R&M)
Location: Pollock Street Sewer
Permit No.: N/A
Boring Number: PS-13
Log By: Kevin Martin
Date: 14-May-02
Casing Elevation: N/A
Driller: Parratt - Wolff
Borehole Dia: 6-inch
Screen Diameter: 4" **Length:** 20
Slot Size: 0.020"
Water Level (Init): NA
Casing Diameter: 4" **Length:** 8
Type: PVC
Drilling Method: Hollow Stem Auger Drilling
Sample Method: Split-Spoon/Grab
Rig Type:

Construction Details

Total Well Depth: 28
Bentonite Interval: 6-7
Screen Interval: 8-28
Cement/Grout Interval: 0-6
Sand Pack Interval: 7-28
Sand Pack Type: No. 2 sand
Completion Details: Completed with 8-inch manhole cover and locking cap

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2				
4				
6			Auger to 18 ft bgs	
8				
10				
12				
14				
16				
18	18-20		Gray, coarse SANDY gravel (saturated with black oil)	
20	20-22		Coarse SAND and GRAVEL (wet, no oil)	
22				
24	24-26		Medium-coarse SAND and GRAVEL (no oil)	
26				
28				
			Bottom of boring at 28 feet below ground surface	

Aquaterra Technologies, Inc.
Subsurface Log: PS-14

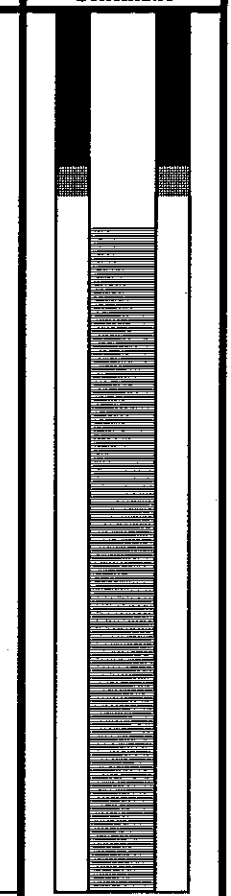
Project Name: Philadelphia Refinery
Owner: Sunoco, Inc. (R&M)
Location: Pollock Street Sewer
Permit No.: N/A
Boring Number: PS-14
Log By: Kevin Martin
Date: 15-May-02
Casing Elevation: N/A
Driller: Parratt - Wolff
Borehole Dia: 6-inch
Screen Diameter: 4" **Length:** 20
Slot Size: 0.020"
Water Level (Init): NA
Casing Diameter: 4" **Length:** 8
Type: PVC
Drilling Method: Hollow Stem Auger Drilling
Sample Method: Split-Spoon/Grab
Rig Type:

Construction Details

Total Well Depth: 28
Bentonite Interval: 6-7
Screen Interval: 8-28
Cement/Grout Interval: 0-6
Sand Pack Interval: 7-28
Sand Pack Type: No. 2 sand
Completion Details: Completed with 8-inch manhole cover and locking cap

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2				
4				
6			Auger to 18 ft bgs	
8				
10				
12				
14				
16				
18	18-20		Brown, fine-coarse SAND, some fine-coarse GRAVEL (wet)	
20	20-22			
22	22-24			
24				
26				
28				
			Bottom of boring at 28 feet below ground surface	



Aquaterra Technologies, Inc.
Subsurface Log: PS-15

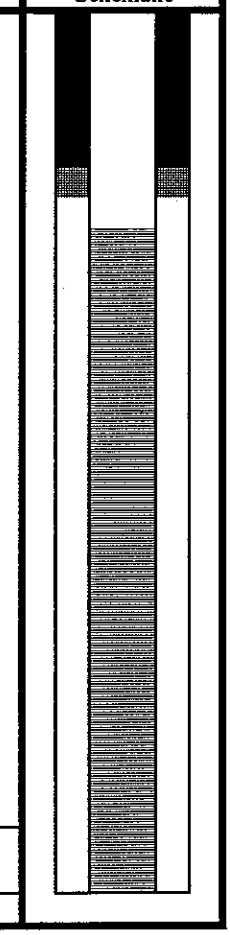
Project Name: Philadelphia Refinery **Owner:** Sunoco, Inc. (R&M)
Location: Pollock Street Sewer **Permit No.:** N/A
Boring Number: PS-15 **Log By:** Kevin Martin **Date:** 15-May-02
Casing Elevation: N/A **Driller:** Parratt - Wolff **Borehole Dia:** 6-inch
Screen Diameter: 4" **Length:** 20 **Slot Size:** 0.020" **Water Level (Init):** 18
Casing Diameter: 4" **Length:** 8 **Type:** PVC
Drilling Method: Hollow Stem Auger Drilling **Sample Method:** Split-Spoon/Grab **Rig Type:**

Construction Details

Total Well Depth: 28 **Bentonite Interval:** 6-7
Screen Interval: 8-28 **Cement/Grout Interval:** 0-6
Sand Pack Interval: 7-28 **Sand Pack Type:** No. 2 sand
Completion Details: Completed with 8-inch manhole cover and locking cap

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2				
4				
6			Hydro Vac to 10 ft bgs	
8				
10			Auger to 18 ft bgs	
12				
14				
16				
18	18-20		Black-stained, wet (fuel)	
20	20-22			
22	22-24		Brown, fine-coarse SAND and fine-coarse GRAVEL (wet)	
24				
26				
28			27': CLAY	
			Bottom of boring at 28 feet below ground surface	



Aquaterra Technologies, Inc.
Subsurface Log: PS-16

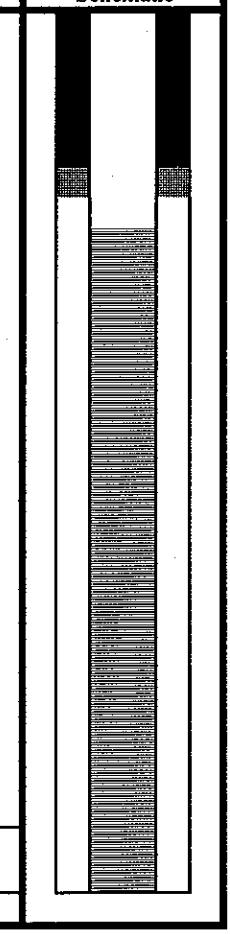
Project Name: Philadelphia Refinery
Owner: Sunoco, Inc. (R&M)
Location: Pollock Street Sewer
Permit No.: N/A
Boring Number: PS-16
Log By: Kevin Martin
Date: 15-May-02
Casing Elevation: N/A
Driller: Parratt - Wolff
Borehole Dia: 6-inch
Screen Diameter: 4" **Length:** 20
Slot Size: 0.020"
Water Level (Init): 18
Casing Diameter: 4" **Length:** 8
Type: PVC
Drilling Method: Hollow Stem Auger Drilling
Sample Method: Split-Spoon/Grab
Rig Type:

Construction Details

Total Well Depth: 28
Bentonite Interval: 6-7
Screen Interval: 8-28
Cement/Grout Interval: 0-6
Sand Pack Interval: 7-28
Sand Pack Type: No. 2 sand
Completion Details: Completed with 8-inch manhole cover and locking cap

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2				
4			Hydro Vac to 10 ft bgs	
6				
8				
10			Auger to 18 ft bgs	
12				
14				
16				
18	18-20		Dark brown, fine-coarse SAND and fine-coarse GRAVEL (wet)	
20	20-22			
22	22-24		Brown, fine-coarse SAND and fine-coarse GRAVEL (wet)	
24				
26				
28			27': CLAY	
			Bottom of boring at 28 feet below ground surface	



Aquaterra Technologies, Inc.
Subsurface Log: PS-17

Project Name: Philadelphia Refinery **Owner:** Sunoco, Inc. (R&M)
Location: Pollock Street Sewer **Permit No.:** N/A
Boring Number: PS-17 **Log By:** Kevin Martin **Date:** 15-May-02
Casing Elevation: N/A **Driller:** Parratt - Wolff **Borehole Dia:** 6-inch
Screen Diameter: 4" **Length:** 20 **Slot Size:** 0.020" **Water Level (Init):** 18
Casing Diameter: 4" **Length:** 8 **Type:** PVC
Drilling Method: Hollow Stem Auger Drilling **Sample Method:** Split-Spoon/Grab **Rig Type:**

Construction Details

Total Well Depth: 28 **Bentonite Interval:** 6-7
Screen Interval: 8-28 **Cement/Grout Interval:** 0-6
Sand Pack Interval: 7-28 **Sand Pack Type:** No. 2 sand
Completion Details: Completed with 8-inch manhole cover and locking cap

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology	Well Construction Schematic
2				
4				
			Hydro Vac to 10 ft bgs	
6				
8				
10			Auger to 18 ft bgs	
12				
14				
16				
			17': Encounter wood	
18	18-20		Brown, fine-coarse SAND and fine-coarse GRAVEL (wet)	
20	20-22		20': Encounter wood	
22	22-24		Black, fine-coarse SAND (wet)	
24				
26				
			27': CLAY	
28				
			Bottom of boring at 28 feet below ground surface	

Aquaterra Technologies, Inc.
Subsurface Log: PS-18

Project Name: Philadelphia Refinery
Owner: Sunoco, Inc. (R&M)
Location: Pollock Street Sewer
Permit No.: N/A
Boring Number: PS-18
Log By: Kevin Martin
Date:
Casing Elevation: N/A
Driller: Parratt - Wolff
Borehole Dia:
Screen Diameter: N/A **Length:** N/A
Slot Size: N/A
Water Level (Init):
Casing Diameter: N/A **Length:** N/A
Type: N/A
Drilling Method: Hollow Stem Auger
Sample Method: Split-Spoon/Grab
Rig Type:

Construction Details

Total Well Depth: 22
Bentonite Interval: N/A
Screen Interval: N/A
Cement/Grout Interval: N/A
Sand Pack Interval: N/A
Sand Pack Type: N/A
Completion Details: Completed with 8-inch manhole cover and locking cap

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Lithology
2			
4			Hydro Vac to 10 ft bgs
6			
8			
10			
12			
14			
16			Auger to 18 ft bgs
			concrete
18	18-20		Air rotary through 6" concrete
20	20-22		void space to22' moving water
22			
24			
26			
28			