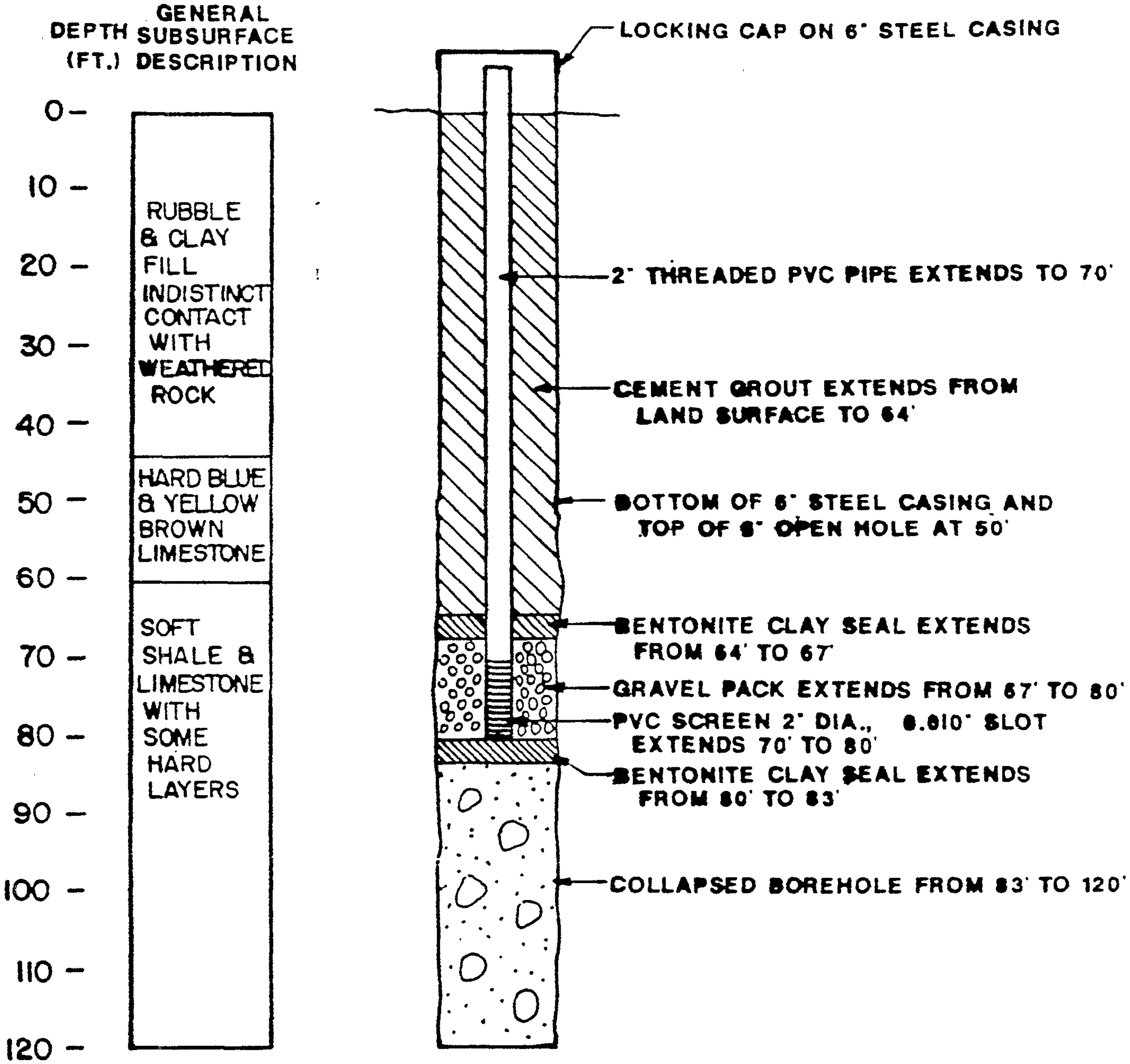
112149

Figure 10



CSP-6 WAS COMPLETED ON 2-13-87
WITH ABUNDANT WATER REPORTED AT 73'

WATER LEVEL ON 2-14-87 = 36.07'
BELOW GROUND SURFACE

ENVIRONMENTAL STRATEGIES CORPORATION

8521 LEESBURG PIKE
SUITE 650
VIENNA, VIRGINIA 22180

MONITORING WELL

CSP-6

HELLERTOWN MANUFACTURING CO.
HELLERTOWN, PENNSYLVANIA

Table 16

Monitoring Well Installation Data[a]

Well	Date Completed	Ground Elevation	Well-Bottom Elevation	Elevation, Top PVC Casing	Elevation, Screened Interval
CSP-1	12-17-84	295.39	261.38	296.25	271.88-261.88
CSP-2	12-20-84	279.10	237.16	280.05	247.66-237.66
CSP-3	12-21-84	278.96	234.25	279.90	244.75-234.75
CSP-4	12-26-84	278.27	232.36	279.59	242.86-232.86
CSP-5A	02-12-87	278.77	200.77	280.72	214.77-204.77
CSP-5B	02-12-87	278.77	181.77	280.71	193.77-183.77
CSP-5C	02-12-87	278.77	159.77	280.73	173.77-163.77
CSP-6	02-13-87	278.78	198.78	280.77	208.78-198.78
CSP-7	02-24-87	292.25	249.45	294.13	269.45-249.45

---

a/ Reference plane for all elevations is mean sea level.

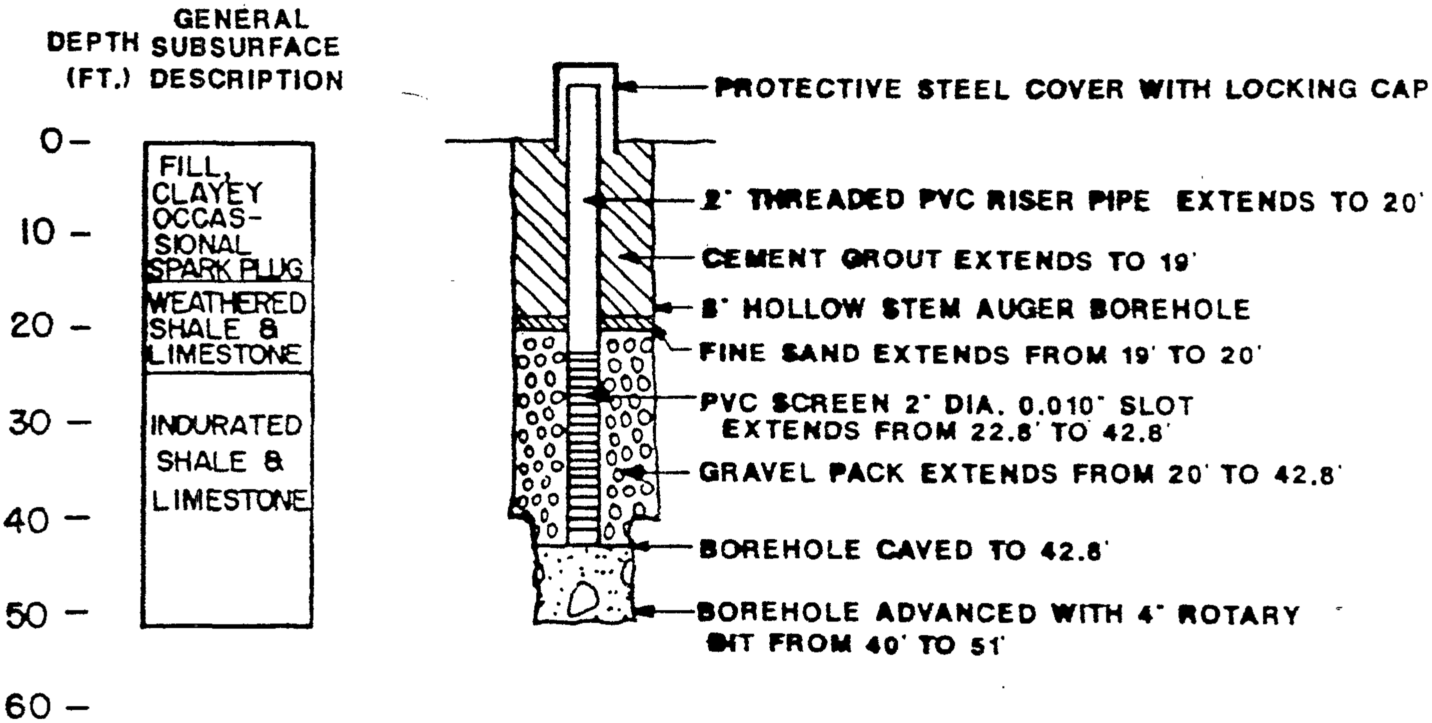
Well CSP-7 was installed on February 24, 1987, on the presumed downgradient (west) side of the underground storage tank area (Figure 7). The well was installed by J.E. Fritts & Associates, Inc., under the supervision of an ESC hydrogeologist. Well CSP-7 was installed in boring A-3 from which split-spoon samples were collected to a depth of 25 feet (Appendix C). The borehole for the well was made with a hollow-stem auger to the point of refusal in rock at 40 feet, and then continued to 51 feet using a roller bit. Water from the municipal system was circulated with the roller bit. Figure 11 is a construction diagram for the well.

4.3.2 Pumping of Wells and Calculation of Transmissivity

All of the monitoring wells except CSP-1 were pumped in February 1987 in order to reduce the turbidity of the water (develop the well) and to obtain valid measurements of water-level recovery from which transmissivity (T) values could be calculated.

The deeper wells, CSP-5A, CSP-5B, CSP-5C, and CSP-6, were developed on February 14, 1987, with an air-lift pumping system. A check valve was installed in the discharge line to prevent air from becoming entrained in the water column in the well. Well CSP-7 was developed during the week of February 17, 1987, with a hand-operated PVC piston pump. This hand pump was used also during the week of February 17, 1987, to pump CSP-2, CSP-3, and CSP-4, and to redevelop CSP-5A. Relatively clear water was produced from all the wells except CSP-3 and CSP-4 which remained turbid. All development equipment was steam cleaned before it was used in the

Figure 11



CSP-7 INSTALLED ON 2-24-87
WATER LEVEL ON 2-27-87 = 33.93' BELOW GROUND SURFACE

ENVIRONMENTAL STRATEGIES CORPORATION 8521 LEESBURG PIKE SUITE 650 VIENNA, VIRGINIA 22180	MONITORING WELL CSP-7 HELLERTOWN MANUFACTURING CO. HELLERTOWN, PENNSYLVANIA

next well. The discharge rates and duration of pumping for each well are given in Table 17.

T values were calculated from semi-log plots of water-level recovery measurements which were made after pumping ceased. Due to the short duration of the tests and the low pumping rates, these T values should be considered as approximations. The water-level recovery measurements and the semi-log plots of water-level recovery are given in Appendix G. T values are summarized in Table 17.

Theoretically the semi-log plots should be straight lines. For wells CSP-5A, CSP-5B and CSP-5C, the plots are curves (Appendix G) which are interpreted as indicating vertical leakage in the formation adjacent to the well. T-value calculations are based on the slope of the semi-log plot of the water-level recovery measurements. For consistency, T-value calculations were made from the slope of the curve between 1 and 10 minutes after the end of pumping.

The highest T values were calculated for CSP-2, CSP-3, and CSP-6, all on the downgradient (west) property line. A decline in T with depth is evident in the CSP-5 well cluster. The relatively low T value in CSP-7 is probably due in part to the fact that the well screen penetrates only 8 or 9 feet of saturated materials below the water table.

The hydraulic conductivity (K) is equal to the transmissivity (T) divided by the aquifer thickness (b). An upper-bound value for K can be estimated by considering the aquifer thickness to be equivalent to the screen length, that is, 10 feet.

Table 17

Duration and Rate of Pumping and Calculated Transmissivity Values

Well	Date	Duration of Pumping (minutes)	Pumping Rate (gpm)	Calculated Transmissivity Values (gpd/ft)	Calculated Transmissivity Values (ft^2/day)
CSP-2	2-27-87	10	3.0	9,900	1,320
CSP-3	2-27-87	16	3.0	11,310	1,510
CSP-4	2-27-87	16	3.0	2,200	290
CSP-5A	2-27-87	20	3.0	1,500	200
CSP-5B	2-14-87	37	2.5	920	120
CSP-5C	2-14-87	39	1.3	60	8
CSP-6	2-14-87	71	5.0	9,430	1,260
CSP-7	2-25-87	19	3.0	570	80

Although pumping rates were low during development, some interference between wells was observed (Appendix G). The water level in well CSP-5B dropped 0.2 foot when well CSP-5C was pumped at 1.3 gpm for 30 minutes. The water level in well CSP-5A dropped 0.3 foot when well CSP-5B was pumped at 2.5 gpm for 30 minutes. The water level in well CSP-4 was observed to drop slightly (less than 0.1 foot) when well CSP-5A was pumped.

4.3.3 Water-Level Elevations and Hydraulic Gradients

Water-level elevations in the monitoring wells and in Saucon Creek on January 4 and 5, 1985, June 24, 1986, November 10, 1986, and February 27, 1987, are given in Table 18. A generalized map of the water table (Figure 12) indicates that the hydraulic gradient across the site is to the west toward Saucon Creek. The higher water level in CSP-2 relative to CSP-3 and CSP-4 indicates that there is also a northward component of groundwater flow, which could explain the better quality of the groundwater samples collected from CSP-2.

The drop in water-level elevation and the apparent hydraulic gradient (Table 19) across the site from east to west are much greater than between the western property boundary and Saucon Creek. This suggests that the transmissivity between the site and Saucon Creek is relatively high due either to a thickening of the aquifer or to the hydraulic conductivity being relatively high.

The water-level elevations in the CSP-5 well cluster show a slight downward gradient from the upper screened interval (CSP-5A)

Table 18

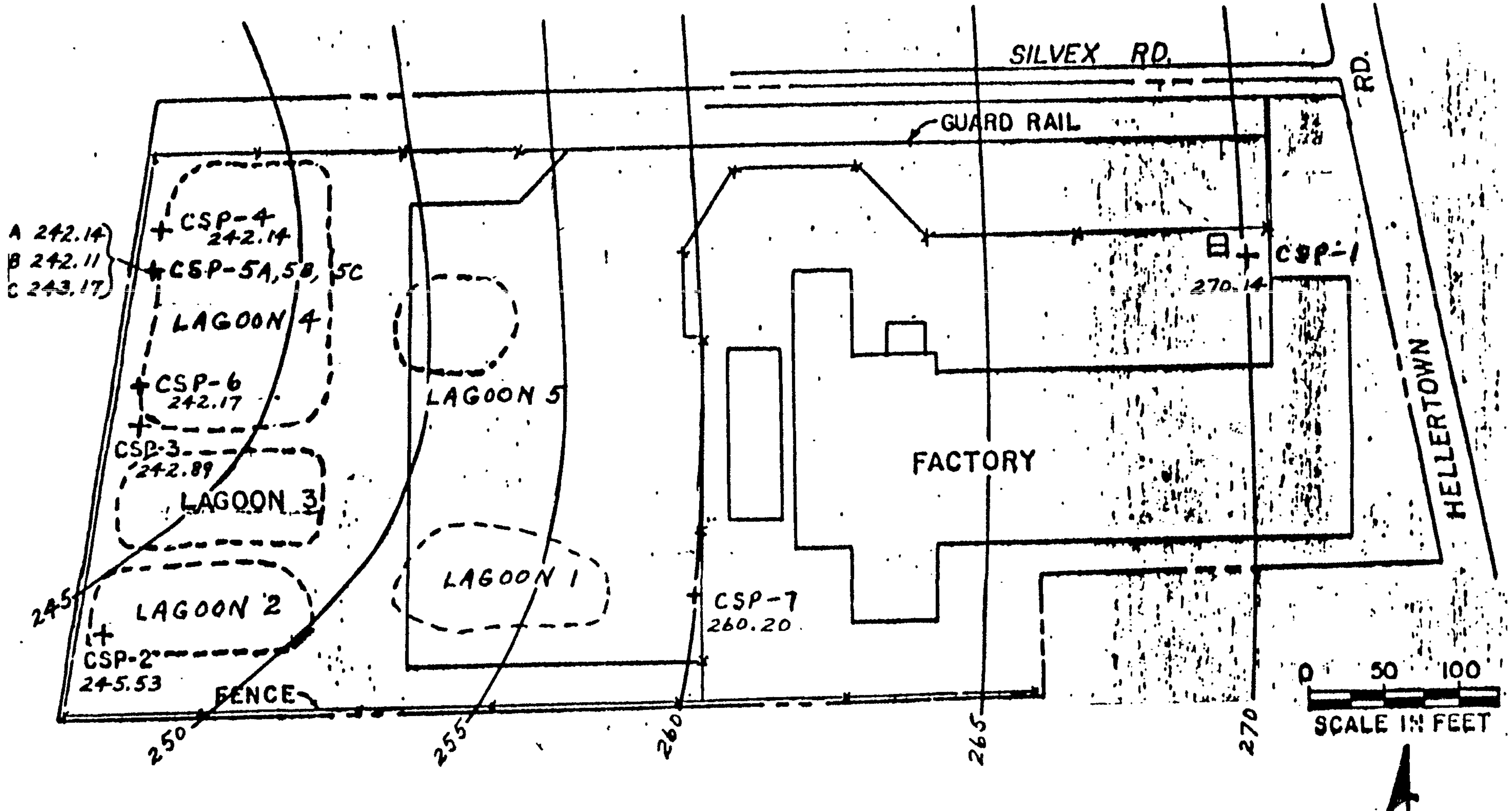
Water Levels in Monitoring Wells and Saucon Creek

	Elevation[a,b]	Water-Level Elevation			
Well No.	Measuring Point	1-4-85	6-24-86	11-10-86	2-27-87
CSP-1	296.25	271.70	271.02	269.80	270.14
CSP-2	280.05	247.43	245.59	245.40	245.53
CSP-3	279.90	244.88	242.80	242.80	242.79
CSP-4	279.59	246.00	243.88	242.14	242.14
CSP-5A	280.72				242.14
CSP-5B	280.71				242.11
CSP-5C	280.73				243.17
CSP-6	280.77				242.17
CSP-7	294.13				260.20
Saucon Creek	245.40		238.90		239.07

---

a/ Elevations are in feet relative to mean sea level.

b/ For the wells the measuring point is the top of the 2-inch PVC casing. For Saucon Creek, the measuring point is the top of concrete on the upstream side of the center pier of the Silvex Road Bridge.



EXPLANATION

+CSP-2
MONITORING WELL
CONTOUR INTERVAL - 5 FT.
DATUM MEAN SEA LEVEL

Figure 12 - Generalized water table map, February 1987

Table 19

Apparent Hydraulic Gradients Across the Hellertown Manufacturing Facility on February 27, 1987

Between	Difference in Water-level Elevation in feet (dh)	Horizontal Distance in in feet (dl)	Hydraulic Gradient (dh/dl)
Wells CSP-4 and CSP-1	28.0	700	0.04
Well CSP-4 and Saucon Creek	3.0	500[a]	0.006
Wells CSP-2 and CSP-7	14.7	400	0.04
Well CSP-2 and Saucon Creek	6.5	500[a]	0.01

---

a/ Approximations

to the middle screened interval (CSP-5B), and a relatively large upward gradient from the lower screened interval (CSP-5C) to the middle interval. The high head in CSP-5C relative to CSP-5B indicates an upward component of flow near the western property boundary in addition to the westerly horizontal flow component. That upward flow can occur is indicated by the fact that the pumping of CSP-5C produced an immediate drawdown in CSP-5B. Further water-level measurements are needed to determine whether vertical head differences vary seasonally.

The fact that all of the relatively shallow downgradient wells appear to be completed in materials of relatively high transmissivity indicates that it is reasonable to infer shallow groundwater flow directions from the observed potentiometric head values. The values of transmissivity and hydraulic gradient suggest groundwater flow velocities on the order of feet per day.

4.3.4 Groundwater Sampling

Monitoring wells CSP-1, CSP-2, CSP-3 and CSP-4 were sampled initially on February 14, 1985, at the time they were completed. The samples were analyzed in the laboratory of the O.H. Materials Company in Findlay, Ohio. A second set of samples was collected from these wells on June 24, 1986, and analyzed in the ETC and Environmental Science Corporation laboratories. A third set of samples was collected by ESC on November 10, 1986.

During the week of February 24, 1987, eight of the nine monitoring wells were sampled. Well CSP-5C, the deepest of the three at the CSP-5 well cluster, was not sampled. All nine wells and two private offsite wells were sampled August 11 and 12, 1987.

4.3.5 Interpretation of Groundwater Flow

Groundwater moving through the fill and natural unconsolidated formations under the site is replenished by the infiltration of precipitation on or near the site. The unpaved areas at the site, where infiltration can occur (and where pollutants can be leached from the unsaturated materials above the water table), include the western quarter of the site; a narrow strip along the south side and adjoining areas just outside the site; a narrow strip on the east side; and the area north of the site which has been backfilled and built up for the Interstate Highway (Figure 1). In addition, east of Hellertown Road, the surface has been disturbed and graded for the cloverleaf interchange for the interstate highway. Water moving through the materials filling lagoons no. 2, 3, and 4 is recharged most directly by infiltrating precipitation on the lagoon areas because they underlie an unpaved area.

On a regional scale, because of its large lateral extent and thickness, the underlying limestone bedrock is a highly transmissive aquifer in which water moves through joints, crevices, and cavernous openings. The water-transmitting openings may be closely spaced or relatively widely spaced and separated by blocks of essentially impervious rock.

All the pores in the fill and unconsolidated sedimentary formations and the fracture openings in the bedrock are saturated below the water table. In some places under the site, the water table appears to be in the basal portion of the mantle of fill and unconsolidated formations, and in others it appears to be in the upper weathered portion of the bedrock. The generalized water-table map (Figure 12) which is based on water-level measurements in the monitoring wells, indicates that the water table is a regular surface. This apparent regularity is believed to be the result of the small number of points (wells) which were used to draw the map. The true configuration must be irregular in view of the heterogeneity of the materials comprising the unconsolidated formations and the irregular distribution and variable size of fractures in the bedrock. The direction of horizontal groundwater movement, which is considered to be normal to the water-table contours, is generally westward toward Saucon Creek which is believed to be a discharge zone. Nevertheless, the precise local flow direction in the horizontal plane may vary somewhat depending on the spatial distribution of permeability. An additional fact that must be considered is that the groundwater moves in three dimensions.

The drilling and test pumping of monitoring wells CSP-5A, CSP-5B, and CSP-5C have yielded significant information on the geologic and hydrologic properties of the bedrock which have important implications regarding the hydraulic properties of the rocks and the movement of pollutants. Wells CSP-5A and CSP-5B appear to be screened in hard and soft limestone and shale which are interpreted to be weathered bedrock. Well CSP-5C, the deepest of the three, is in hard limestone and an underlying bed of soft sandstone which appear to be much less weathered or possibly relatively fresh rock. The calculated apparent transmissivity values decline progressively with depth at this location, the most significant decline being from CSP-5B to CSP-5C. Pumping of well CSP-5C produced an immediate drawdown in CSP-5B, and the static head in CSP-5C is high relative to that in CSP-5B, indicating an upward component of flow in the groundwater system near the western limit of the site. The apparent hydraulic connection between the two water-transmitting zones and the upward component of flow from the deeper one at this location, which is only about 500 feet from Saucon Creek, suggest that the entire groundwater system (bedrock and unconsolidated formations) is discharging in the vicinity of the creek. The high apparent transmissivity value of the uppermost water-transmitting zone relative to that of the lowermost suggests that the fracture system in the weathered zone is more extensive than that in the fresh rock.

This interpretation of the pattern of flow is significant to the offsite movement of pollutants. If the westward flow lines in the overall groundwater system are converging toward a surficial discharge zone along Saucon Creek, the static head at depth in the bedrock should be higher than that in the upper part of the bedrock and in the fill and unconsolidated strata, at least between the location of the CSP-5 well cluster and the creek. This implies that near the western limit of the site, under present conditions, pollutants at the water table in the fill and unconsolidated strata or in the fractures in the upper weathered section of bedrock cannot move downward into deeper zones of the limestone aquifer. The significance of this lies in the fact that the deeper zones in the limestone aquifer supply water to a few wells downgradient from the site. Where the head at depth in the limestone bedrock is lower than that in the overlying weathered bedrock and in the fill and unconsolidated strata, a condition that could exist somewhere east of the CSP-5 well cluster, shallow pollutants could move to deeper zones in the limestone aquifer.

Pollutants in the fill and unconsolidated strata and weathered bedrock probably have moved westward beyond the site boundary, as will be discussed in a subsequent section. The highest concentrations of TCE were found in well CSP-5B. It remains to be determined if pollutants have moved downward into relatively deep zones in the bedrock in other parts of the site, and if these pollutants have then moved westward.

4.3.6 Water Quality

Groundwater and surface water in the vicinity of the site have been sampled on numerous occasions throughout the history of the site. In addition, surface and groundwater sampling efforts are ongoing. The earliest known groundwater sampling results have been previously reported in Table 5. The Sheesley Concrete Company well and Kniha residence well were sampled in 1975. The Sheesley Concrete Company well was used for process water and the Kniha well was not in use at the time.

Four monitoring wells (Wells CSP-1 through CSP-4) were installed and monitored in January 1985. A quarterly well sampling program was part of the work plan proposed to the PADER by ESC. The four CSP wells and three locations on nearby Saucon Creek were sampled by ESC in June 1986. ESC also sampled the four CSP wells in November 1986. Four additional wells (wells CSP-5a, 5b, 5c, and well CSP-6) were installed by ESC in January 1987. Well CSP-7 was installed by ESC in February 1987. ESC subsequently sampled all the CSP wells, except well CSP-5c, in February 1987.

Various combinations of parameters were evaluated during each of the sampling episodes discussed above. The parameters evaluated during each of the ESC sampling episodes have been summarized in Table 20.

4.3.7 Groundwater Sampling Results

The results of previous investigators' groundwater sampling efforts have been summarized in Tables 5 and 21.

Tables 22, 23, 24, and 25 summarize the analytical results for each of the three ESC sample dates, June 1986, November 1986, February 1987, and August 1987. Table 26 summarizes field monitoring data for these dates. Only parameters that were detectable at any one of the sample locations are reported in the tables. Results are not reported if a constituent was not detected at any of the sample locations. The analytical methodologies and laboratory deliverables for the results in Tables 22, 23, and 24 (and for soil samples collected in February 1987) are included in Appendix F. The deliverables for the analyses of June 1986 were previously submitted to the EPA and PADER as Appendix G of the November 7, 1986, ESC report "Remedial Investigation of the Former

Table 20
Analytical Profile Summary

Parameter or Analytical Method	Sample Date(s)	Sample Location									
		Surface Water	Groundwater (CSP Wells)								
		Saucon Creek[a]	1	2	3	4	5a	5b	5c	6	7
Method 624	6/86, 11/86	x	x	x	x	x					
Method 625[b]	6/86	x	x	x	x	x					
Method 625	11/86				x	x					
CLP VOAS	2/87		x	x	x	x	x	x		x	x
CLP Semi-VOAS[b]	2/87		x	x	x	x	x	x		x	x
Barium	6/86, 11/86	x	x	x	x	x					
Chromium	6/86, 11/86	x	x	x	x	x					
Copper	6/86, 11/86	x	x	x	x	x					
Iron	6/86, 11/86	x	x	x	x	x					
Manganese	6/86, 11/86	x	x	x	x	x					
Nickel	6/86, 11/86	x	x	x	x	x					
Sodium	6/86, 11/86	x	x	x	x	x					
Zinc	6/86, 11/86	x	x	x	x	x					
Cyanide	6/86, 11/86	x	x	x	x	x					
CLP Inorganics	2/87		x	x	x	x	x	x		x	x
Fluoride	6/86, 11/86	x	x	x	x	x					
	2/87		x	x	x	x	x	x		x	x
Nitrate	6/86, 11/86	x	x	x	x	x					
	2/87		x	x	x	x	x	x		x	x
Sulfate	6/86, 11/86	x	x	x	x	x					
	2/87		x	x	x	x	x	x		x	x
Phenol	6/86, 11/86	x	x	x	x	x					
TDS	6/86	x	x	x	x	x					
	2/87		x	x	x	x	x	x		x	x
TSS	11/86		x	x	x	x					
TOX	2/87		x	x	x	x	x	x		x	x

---

a/ Saucon Creek was only sampled on 6/86

b/ Without Pesticides and PCBs

Table 21

Groundwater Monitoring Results - January 1985

Parameter	CSP-1	CSP-2	CSP-3	CSP-4
pH	6.65	6.45	6.55	6.55
Specific conductance (umhos/cm)	500	600	800	1,000
Temperature (^{0}C)	11	11	11	11

Conventional Parameters (mg/l)	2332-07 CSP-1	2332-08 CSP-2	2332-09 CSP-3	2332-10 CSP-4	Limit of Detection
Total cyanide	BDL	0.14	0.07	0.06	0.05
Total phenol	BDL	BDL	BDL	BDL	50.0
pH	7.33	7.39	7.38	7.10	--
Total dissolved solids (TDS)	416	484	810	1,018	5.0
Total suspended solids (TSS)	655	106	654	621	5.0
Chloride	42	33	68	57	10.0
Fluoride	0.20	0.50	3.50	1.40	0.10
Nitrates	42	22	20	29	10.0
Sulfates	66.0	97.6	211	333	50.0

Metals (ug/l)	2332-07 CSP-1	2332-08 CSP-2	2339-09 CSP-3	2332-10 CSP-4	Limit of Detection
Cadmium	BDL	2.45	BDL	BDL	1.25
Chromium	BDL	5.36	BDL	BDL	5.00
Lead	BDL	BDL	BDL	BDL	5.00
Nickel	20.3	40.0	28.3	13.9	5.00
Zinc	442.0	BDL	74.0	51.0	20.0

Table 21 (continued)

Groundwater Monitoring Results - January 1985

Volatile Organic Compounds [a]	2332-07 CSP-1	2332-08 CSP-2	2332-09 CSP-3	2332-10 CSP-4	2332-11 Travel Blank	2332-12 Field Blank
Dichloromethane	Low	Low	Low	Low	Low	Low
1,1-Dichloroethylene	ND	ND	ND	Low	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND
Trans-1,2-dichloroethylene chloroform	ND	ND	High	High	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	Low	Medium	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND	ND	ND
Bromodichloroethane	ND	ND	Medium	ND	ND	ND
1,2-Dichloropropane Trans-1,3-Dichloropropane	ND	ND	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND	ND	ND
Bromochloromethane Cis-1,3-Dichloropropane 1,1,2-Dichloroethane	ND	Medium	High	High	ND	ND
Bromoform	ND	ND	ND	ND	ND	ND
Tetrachloroethylene 1,1,2,2-tetrachloroethane	ND	ND	Low	Medium	ND	ND
Benzene	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND

---

a/ ND = Nondetectable
Range: Low = <5.0 ppb; Medium = 5.0 - 50.0 ppb; High = >50.0 ppb

Table 21 (continued)

Groundwater Monitoring Results - January 1985

Groundwater quality[b] Parameters (mg/l)	01 CSP-1	02 CSP-2	03 CSP-3	04 CSP-4	LOD	Secondary Drinking Standard
Chloride	37.9	21.2	45.1	52.3	0.1	250
Iron	BDL	BDL	BDL	1.88	0.1	0.3
Manganese	0.008	0.204	0.232	0.086	0.005	0.05
Sodium	74.0	120	93.0	135	0.1	--
Sulfate	106	114	203	50	0.1	250
Total Phenols	BDL	BDL	37.5	BDL		
pH	8.25	7.90	7.96	7.97		6.5-8.5
SC Specific conductance (umhos/cm)	630	690	1,050	1,230		--
TOC Total organic carbon	BDL	4.0	27	150	2.0	--
Organic chlorides	BDL	0.01	0.21	0.08	0.01	--
Organic bromides	BDL	BDL	BDL	BDL	0.01	--
Organic iodine	0.02	0.03	0.07	0.07	0.02	--

---

b/ BDL = Below detection limit
LOD = Limit of detection

Table 21 (continued)

Groundwater Monitoring Results - January 1985

Parameters (ug/l)[c]	01 CSP-1	02 CSP-2	03 CSP-3	04 CSP-4	LOD	NIPDWR	pMCL
Arsenic	BDL	BDL	BDL	BDL	5.0	50	withdrawn
Barium	11,000	13,000	12,000	11,000	750	1,000	5,000
Cadmium	BDL	BDL	BDL	BDL	2.0	10	5
Chromium	BDL	BDL	BDL	BDL	20	50	100
Lead	BDL	BDL	BDL	BDL	10	50	5
Mercury	BDL	BDL	BDL	BDL	1.0	2.0	2
Selenium	BDL	BDL	BDL	BDL	5.0	10	50
Fluoride	BDL	BDL	1.96	BDL	1.0	4,000	(Final MCL)
Nitrate	8,800	4,900	BDL	4,300	2,200	10,000	NP
Silver	BDL	BDL	BDL	BDL	5.0	50	NP
Radium (pCi/l)	BDL	BDL	BDL	BDL	3.0		
Gross alpha (pCi/l)	BDL	7.0	9.0	8.0	5.0		
Gross beta (pCi/l)	BDL	15.0	14.0	BDL	8.0		
Endrin	BDL	BDL	BDL	BDL	0.2	0.2	0.2
Lindane	BDL	BDL	BDL	BDL	2.0	4.0	0.2
Methoxychlor	BDL	BDL	BDL	BDL	50	100	400
Toxaphene	BDL	BDL	BDL	BDL	3.0	5.0	5.0
2,4-D	BDL	BDL	BDL	BDL	50	100	70
2,4,5-TP Silvex	BDL	BDL	BDL	BDL	5.0	10	50

---

c/ BDL = Below detection limit
LOD = Limit of detection
NP = Not proposed

Table 22

Water Quality Analyses - June 1986

	Groundwater				
Compound	CSP-1	CSP-2	CSP-3	CSP-4	CSP-4 (Dup)
Metals (ug/l)					
Barium	28	59	54	60	<10
Chromium	ND[a]	ND	ND	ND	<10
Copper	ND	ND	ND	ND	10
Iron	ND	ND	ND	ND	490
Manganese	ND	210	540	712	1,200
Nickel	ND	ND	21	ND	10
Sodium	8,930	17,300	177,000	74,700	460,000
Zinc	41	51	100	140	100
Conventionals (mg/l)					
Fluoride	0.21	0.32	2.36	1.27	0.85
Nitrate as N	6.82	5.22	0.16	5.51	9.30
Sulfate as SO_4	95	91	190	290	290
Phenolics, Total	<0.050	<0.050	<0.50	<0.50	<0.01
Cyanide, Total	<0.025	0.113	<0.25	1.14	<0.1
Total Dissolved Solids (TDS)	500	510	920	980	1,021
Organic Priority Pollutants (ug/l)					
Methylene chloride	3.01	ND	ND	4.97	ND
1,2-Trans-dichloroethylene	ND	ND	1,250	190	ND
Trichloroethylene	ND	ND	186	140	111
Vinyl chloride	ND	ND	511	ND	ND
Tetrachloroethylene	ND	ND	ND	20.1	28.0

---

a/ ND - Not detected or detected below blank concentration

Table 23
Groundwater Quality Analysis - November 1986

	Well Number			
	CSP-1	CSP-2	CSP-3	CSP-4
Metals (ug/l)				
Barium	32	61	52	66
Chromium	ND[a]	BMDL[b]	ND	BMDL
Copper	BMDL	BMDL	BMDL	BMDL
Iron	BMDL	BDMDL	BMDL	145,000
Manganese	BMDL	110	500	7,360
Nickel	ND	ND	18	11.0
Sodium	9,110	12,900	191,000	1,480,000
Zinc	29	67	150	150
Conventionals (mg/l)				
Fluoride	0.16	0.21	2.53	0.98
Nitrate as N	5.50	7.93	0.40	4.42
Sulfate as SO_4	85	94.0	180	270
Phenolics, total	<0.05	<0.50	<0.50	<0.05
Cyanide, total	0.539	0.29	1.08	1.23
Total dissolved solids (TDS)	490	890	17,300	14,000
Organic Priority Pollutants (ug/l)				
Benzene	ND	ND	ND	13.5
1,1-Dichloroethane	ND	ND	5.8	ND
1,1-Dichloroethylene	ND	ND	3.44	ND
Methylene chloride	ND	ND	ND	13.9
1,2-Trans-dichloroethylene	ND	ND	1,040	150
Trichloroethylene	ND	3.28	167	103
Vinyl chloride	ND	ND	513	ND
Tetrachloroethylene	ND	ND	ND	19.7
Conductivity (uhmos/cm)	620	770	1,180	1,330
pH	6.8	7.0	7.0	Not tested
Temperature (° F)	55.5	54.0	55.0	53.0
Depth to groundwater (ft)	26.45	34.65	37.10	37.45

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a/ ND = Not detected or detected below blank concentration
BMDL = Below method detection level

Table 24
Groundwater Quality Analyses (ug/l) - Sample Date February 1987

				Sample Designation					
Compound	Detection Limit	Trip Blank		Field Blank		CSP-1		CSP-2	
Metals									
Aluminum	23.0	NA		23	U	[33]		[43]	
Arsenic	1.8	NA		1.8	U	1.8	U	[1.9]	
Barium	1.0	NA		1.0	U	[38]		[56]	
Cadmium	5.0	NA		5.0	U	5.0	U	5.3	
Calcium	9.0	NA		[120]		93,500		72,900	
Chromium	9.0	NA		9.0	U	9.0	U	9.0	U
Cobalt	1.0	NA		1.0	U	1.0	U	1.0	U
Copper	2.0	NA		2.0	U	2.0	U	2.0	U
Iron	2.0	NA		[6.9]		[16]	*E	280	*E
Magnesium	73.0	NA		73	U	60,500		47,600	
Manganese	1.0	NA		1.0	U	1.0	UN	162	E
Potassium	1,000.0	NA		1,000	U	1,000	U	1,000	U
Sodium	1,950.0	NA		1,950	UE	8,800	E	11,900	E
Vanadium	4.0	NA		4	U	4	U	4	U
Zinc	4.0	NA		21		[18]		0.38	
Cyanide	10	NA		10	U	10	U	129	
HSL Organics									
Acetone	10	10	U	18		10	U	10	U
Benzene	12	1.0	J	12	U	12	U	12	U
Chlorobenzene	12	1.5	J	12	U	12	U	12	U
1,1-Dichloroethane	12	5.0	U	12	U	12	U	12	U
1,1-Dichloroethene	12	5.0	U	12	U	12	U	12	U
Tetratchloroethene	12	5.0	U	12	U	12	U	12	U
Toluene	12	1.2	J	3.0	J	12	U	12	U
Trans-1,2-Dichloroethene	5.0	5.0	U	5	U	5	U	5	U
1,1,1-Trichloroethane	5.0	5.0	U	5	U	5	U	5	U
Trichloroethene	5.0	1.1	J	5	U	5	U	6.2	
Vinyl chloride	10.0	10	U	10	U	10	U	10.0	
Benzoic acid	120.0	NA		120	U	120	U	120	U
bis (2-Ethyl-hexyl) phthalate	20.0	NA		3.3	JB	20	U	20	U
Di-n-Butyl phthalate	24.0	NA		24	U	24	U	24	U
Methylene chloride	12.0	5.0	U	12	U	12	U	12	U

Table 24 (continued)
Groundwater Quality Analyses (ug/l) - Sample Date February 1987

		Sample Designation							
Compound	Detection Limit	CSP-3		CSP-3 Blind Dup		CSP-3 Referee Dup		CSP-4	
Metals									
Aluminum	23.0	23	U	23	U	23	U	23	U
Arsenic	1.8	1.8	U	1.8	U	1.8	U	[3]	
Barium	1.0	[34]		[34]		1.0	U	[57]	
Cadmium	5.0	5	U	5	U	5.0	U	5	U
Calcium	9.0	54,100		55,200		52,800		120,000	
Chromium	9.0	9	U	9	U	20		9	U
Cobalt	1.0	[2.4]		[1.2]		1.0	U	1	U
Copper	2.0	2	U	2	U	2.0	U	2	U
Iron	2.0	[76]	*E	[13]	*E	2.0	U	[6.7]	*E
Magnesium	73.0	25,800		26,200		25,400		66,100	
Manganese	1.0	476	E	484	E	530		498	E
Potassium	1,000.0	1,000	U	1,000	U	4,100		1,000	U
Sodium	1,950.0	163,000	E	165,000	E	202,000		65,000	E
Vanadium	4.0	4	U	4	U	4	U	4	U
Zinc	4.0	93		99		120		90	
Cyanide	10.0	1,110		690		10	U	1,330	
HSL Organics									
Acetone	10.0	14.0	J	27.0				11.0	B
Benzene	12.0	12	U	12	U			12	U
Chlorobenzene	12.0	12	U	12	U			12	U
1,1-Dichloroethane	12.0	7.5	J	7.5	J			12	U
1,1-Dichloroethene	12.0	12	U	12	U			12	U
Tetratchloroethene	12.0	12	U	12	U			20.0	
Toluene	12.0	12	U	12	U			5.0	
Trans-1,2-Dichloroethene	5.0	510		480		450		130	
1,1,1-Trichloroethane	5.0	7.5	J	7.5	J			5.0	
Trichloroethene	5.0	210		190		170		120	
Vinyl chloride	10.0	130.0		130.0		110	J	10.0	
Benzoic acid	120.0	120	U	5.0	J			120	U
bis (2-Ethyl-hexyl) phthalate	20.0	20	U	5.5	JB			20	U
Di-n-Butyl phthalate	24.0	24	U	3.2	J			24	U
Methylene chloride	12.0	4.8	J	12	U	100	JB	3.7	JB

Table 24

Groundwater Quality Analyses (ug/l) - Sample Date February 1987

Compound	Detection Limit	Sample Designation							
		CSP-5A		CSP-5B		CSP-6		CSP-7	
Metals									
Aluminum	23.0	23	U	23	U	[56]		23	U
Arsenic	1.8	1.8	U	1.8	U	1.8	U	1.8	U
Barium	1.0	[33]		[25]		[13]		[26]	
Cadmium	5.0	5	U	5	U	5	U	5	U
Calcium	9.0	278,000		260,000		19,300		76,000	
Chromium	9.0	9	U	9	U	9	U	32	
Cobalt	1.0	[7.7]		[1.4]		1.0	U	1.0	U
Copper	2.0	[8.1]		[7.0]		2.0	U	2.0	U
Iron	2.0	650	*E	[47]	*E	[69]	*E	[24]	*E
Magnesium	73.0	157,000		189,000		36,100		51,200	
Manganese	1.0	436		45	E	[9.1]	E	73	
Potassium	1,000.0	[3,510]		[1,700]		31,200		1,000	U
Sodium	1,950.0	39,100	E	31,600	E	90,400	E	21,500	
Vanadium	4.0	[11]		[9.8]		4.0		4	U
Zinc	4.0	45		32		27		[11]	
Cyanide	10.0	308		10	U	117		63	
HSL Organics									
Acetone	10.0	23		71		25		7.5	J
Benzene	12.0	12	U	12	U	12	U	12	U
Chlorobenzene	12.0	12	U	12	U	12	U	5.0	J
1,1-Dichloroethane	12.0	12	U	12	U	12	U	12	U
1,1-Dichloroethene	12.0	12	U	12	U	12	U	1.3	J
Tetratchloroethene	12.0	20		12	U	12	U	5.3	J
Toluene	12.0	12	U	12	U	12	U	12	U
Trans-1,2-Dichloroethene	5.0	350		150		460		20	
1,1,1-Trichloroethane	5.0	5	U	5	U	5	U	22	
Trichloroethene	5.0	310		1,400		240		210	
Vinyl chloride	10.0	10	U	10	U	160		10	U
Benzoic acid	120.0	120	U	120	U	120	U	120	U
bis (2-Ethyl-hexyl) phthalate	20.0	9.3	JB	4.0	JB	4.5	JB	2.8	JB
Di-n-Butyl phthalate	24.0	24	U	24	U	24	U	24	U
Methylene chloride	12.0	11.0		12	U	12	U	12	U

Table 24 (continued)
Groundwater Quality Analyses (mg/l) - Sample Date February 1987

Compound	Detection Limit	Sample Designation			
		Field Blank	CSP-1	CSP-2	CSP-3
Nitrate	1.00	1.0 U	4.6	5.9	1.0
Fluoride	0.19	0.19 U	0.19 U	0.23	2.6
Sulfate	3.00	NA	260	86	150
Total dissolved solids	2.00	NA	690	490	810
Total organic halides	0.010	0.010 U	0.010 U	0.010 U	0.010 U
Phenol	0.010	NA	0.010	0.017	0.010 U

Table 24 (continued)
Groundwater Quality Analyses (mg/l) - Sample Date February 1987

Compound	Detection Limit	Sample Designation				
		CSP-3 (Dup)		CSP-3 Referee Dup	CSP-4	CSP-5A
Nitrate	1.00	1.0	U	0.36	4.1	1.1
Fluoride	0.19	2.5		2.3	0.95	0.40
Sulfate	3.00	150		200	300	900
Total dissolved solids	2.00	1,800		905	950	2,000
Total organic halides	0.010	0.010	U	450	0.013	0.012
Phenol	0.010	0.010	U	0.060	0.010	0.012
Fecal coliform						NA

Table 24 (continued)
Groundwater Quality Analyses (mg/l) - Sample Date February 1987

Compound	Detection Limit	Sample Designation					
		CSP-5B		CSP-6		CSP-7	
Nitrate	1.00	1.0	U	1.0	U	7.1	
Fluoride	0.19	0.19	U	1.3		0.20	
Sulfate	3.00	950		280		160	
Total dissolved solids	2.00	2,000		610		550	
Total organic halides	0.010	0.010	U	0.010	U	0.010	U
Phenol	0.010	0.010	U	0.011		0.016	
Fecal coliform		NA		confluent growth		NA	

Table 24 (continued)
Groundwater Quality Analysis - Sample Date February 1987

Value	If the result is a value greater than or equal to the instrument detection limit but less than the contract required detection limit, the value is reported in brackets (i.e., [10]).
U	Indicates element was analyzed for but not detected. Detection limit cited is the highest detection limit for the constituent at the reported sample locations. Detection limit at a specific sample location could be lower.
E	Indicates a value estimated or not reported due to the presence of interference. Explanatory note included on cover page.
N	Indicates spike sample recovery is not within control limits.
*	Indicates duplicate analysis is not within control limits.
NA	Indicates constituent was not analyzed.
J	Indicates an estimated value.
B	Indicates analyte found in blank as well as sample.
	Referee trip blank contained 6 ug/l methylene chloride.
D	Indicates compounds identified in an analysis at a secondary dilution factor.

Table 25
Groundwater Quality Analyses (ug/l) - Sample Date August 1987

Compound	Detection Limit	Sample Designation Trip Blank		Field Blank		CSP-1		CSP-2	
<u>Metals</u>									
Aluminum	57.0	NA			U		U		U
Arsenic	2.3	NA			U	[2.3]		-[3.5]	
Barium	1.0	NA		3.7	E	[28]	E	[53]	E
Cadmium	4.0	NA			U		U		U
Calcium	9.0	NA		[290]		71,400		71,100	
Chromium	10.0	NA			U		U		U
Cobalt	5.0	NA			U		U		U
Copper	3.0	NA			U		U		U
Iron	2.0	NA		[81]		[15]		[42]	
Magnesium	331.0	NA			U	46,600		47,100	
Manganese	2.0	NA			U		U	90	
Potassium	3,600.0	NA			U		U		U
Sodium	2,800.0	NA			U	7,750		13,100	
Vanadium	6.0	NA			U		U		U
Zinc	4.0	NA		[14]	E	[7.2]	E	[17]	E
Cyanide	10	NA			U		U	215	
Selenium	1.5	NA			U	[1.8]			U
<u>HSL Organics</u>									
Acetone	10	3.7	J	200	B		U		U
Benzene	5.0		U	2.0	J		U		U
Chlorobenzene	5.0		U		U		U		U
1,1-Dichloroethane	5.0		U		U		U		U
1,1-Dichloroethene	5.0		U		U		U		U
Tetrachloroethene	5.0		U		U		U		U
Toluene	5.0		U	170			U		U
Trans-1,2-Dichloroethene	5.0		U		U		U		U
1,1,1-Trichloroethane	5.0		U		U		U		U
Trichloroethene	5.0		U		U		U	3.2	J
Vinyl chloride	10		U		U		U		U
Benzoic acid	100	NA			U		U		U
bis (2-Ethylhexyl) phthalate	20	NA			U	2.0	J	3.4	J
Di-n-Butyl phthalate	20	NA			U		U		U
Methylene chloride	12.0	2.8	J	3.4	JB	1.6	JB	1.4	JB
Ethylbenzene	5.0			2.2	J				

Table 25 (continued)
Groundwater Quality Analyses (ug/l) - Sample Date August 1987

		Sample Designation			
Compound	Detection Limit	CSP-3		CSP-4	
Metals					
Aluminum	57		U	2,120	
Arsenic	2.3		U		U
Barium	1.0	[28]	E	[46]	E
Cadmium	4.0		U		U
Calcium	9.0	40,100		126,000	
Chromium	10		U		U
Cobalt	5.0		U		U
Copper	3.0		U	[19]	U
Iron	2.0	[27]		2,900	
Magnesium	331	19,800		71,200	
Manganese	2.0	313		460	
Potassium	3,000	[3,670]		[3,990]	
Sodium	2,800	170,000		46,000	
Vanadium	6.0		U	[9.6]	
Zinc	4.0	85	E	306	E
Cyanide	10.0	560		710	
Lead	1.0		U	[2.6]	
HSL Organics					
Acetone	10		U		U
Benzene	5.0	1.4	J	1.3	J
Chlorobenzene	5.0		U		U
1,1-Dichloroethane	5.0		U		U
1,1-Dichloroethene	5.0		U		U
Tetratchloroethene	5.0	1.5	J	14	
Toluene	5.0	3.1	J	3.2	J
Trans-1,2-Dichloroethene	5.0	30		69	
1,1,1-Trichloroethane	5.0	5.0			U
Trichloroethene	5.0	56		80	
Vinyl chloride	10	8.2	J		U
Benzoic acid	100		U		U
bis (2-Ethylhexyl) phthalate	20	6.0	J		U
Di-n-Butyl phthalate			U		U
Methylene chloride	20	3.3	JB	1.2	JB
Ethylbenzene	5.0	1.3	J	1.5	J
Total xylenes	5.0	3.9	J	8.3	
4-Methylphenol	20		U	2.2	J
Naphthalene	20		U	22	J
2-Methylnaphthalene	20		U	26	

Table 25 (continued)
Groundwater Quality Analyses (ug/l) - Sample Date August 1987

		Sample Designation									
Compound	Detection Limit	CSP-5A		CSP-5B		CSP-5C		CSP-6		CSP-7	
Metals											
Aluminum	57		U		U		U	[108]		[75]	
Arsenic	2.3	[2.3]		[3.7]			U		U		U
Barium	1.0	[19]	E	[21]	E	[86]	E	[16]	E	[28]	E
Cadmium	4.0		U		U		U		U		U
Calcium		293,000		228,000		68,900		18,100		78,300	
Chromium	10		U		U		U		U	44	
Cobalt	5.0		U		U		U		U		U
Copper	3.0		U		U		U		U		U
Iron	2.0	735		232		[8.9]		155		[95]	
Magnesium	73.0	168,000		164,000		46,200		19,400		50,600	
Manganese	2.0	250		39			U	[2.6]		[3.7]	
Potassium	3,600		U	[4,770]			U	33,900			U
Sodium	2,800	32,400		24,500		10,300		93,700		25,100	
Vanadium	6.0	[13]		[13]			U		U		U
Zinc	4.0	[17]	E	[13]	E	[7.5]	E	[7.3]	E	[11]	E
Cyanide	10.0	228			U		U	620		105	
Selenium		7.5	UE	[7.6]	E		U		U		U
HSL Organics											
Acetone	10.0	23			U		U		U		U
Benzene	5.0		U		U		U		U		U
Chlorobenzene	5.0		U		U		U		U		U
1,1-Dichloroethane	5.0		U		U	9.6			U		U
1,1-Dichloroethene	5.0		U		U		U		U	1.0	J
Tetrachloroethene	5.0	23		2.7	J	3.7	J	1.3	J	5.0	
Toluene	5.0		U		U		U		U		U
Trans-1,2-Dichloroethene	5.0	300	D	120		72		390	D	25	
1,1,1-Trichloroethane	5.0		U		U		U		U	18	
Trichloroethene	5.0	310	D	720	D	1,100	D	260	D	170	
Vinyl chloride	10.0		U		U		U	90			U
Benzoic acid	100		U		U		U		U		U
bis (2-Ethyl-hexyl) phthalate	20	4.0	J		U	2.6	J	6.6	J	5.0	J
Di-n-Butyl phthalate	20		U		U		U		U		U
Methylene chloride	12.0	3.3	J	2.0	JB	3.7	J	2.9	D	1.1	J

Table 25 (continued)
Groundwater Quality Analyses (mg/l) - Sample Date August 1987

		Sample Designation		
Compound	Detection Limit	CSP-1	CSP-2	CSP-3
Chloride	0.50	30	14	18
Nitrate	1.00	8.8	8.1	4.5
Fluoride	0.20	0.2	0.2	2.2
Sulfate	3.00	2,100	88	1,400
Total dissolved solids	2.00	690	590	2,400
Total organic halides	0.010	U	U	U

Table 25 (continued)
Groundwater Quality Analyses (mg/l) - Sample Date August 1987

Compound	Detection Limit	Sample Designation	
		CSP-4	CSP-5A
Chloride	0.50	27	51
Nitrate	1.00	8.4	1.8
Fluoride	0.20	1.0	0.20
Sulfate	3.00	2,500	1,000
Total dissolved solids	2.00	1,100	2,400

Table 25 (continued)
Groundwater Quality Analyses (mg/l) - Sample Date February 1987

		Sample Designation							
Compound	Detection Limit	CSP-5B		CSP-5C		CSP-6		CSP-7	
Chloride	0.50	43		29		25		27	
Nitrate	1.00	1.4		1.9		1.8		6.5	
Fluoride	0.20		U		U	1.2		0.3	
Sulfate	3.00	900		130		180		160	
Total dissolved solids	2.00	2,200		670		530		840	

Table 25 (continued)
Groundwater Quality Analyses (ug/l) - Sample Date August 1987

Compound	Detection Limit	Sample Designation			
		Reichard		Kniha Residence	
HSL Organics					
Acetone	10	8.1	JB	8.1	JB
Benzene	5.0		U	2.0	J
Chlorobenzene	5.0		U		U
1,1-Dichloroethane	5.0		U		U
1,1-Dichloroethene	5.0		U		U
Tetrachloroethene	5.0		U		U
Toluene	5.0		U	1.5	J
Trans-1,2-Dichloroethene	5.0		U		U
1,1,1-Trichloroethane	5.0		U		U
Trichloroethene	5.0		U		U
Vinyl chloride	10		U		U
Methylene chloride	12	2.1	JB	2.1	JB

Table 25 (continued)
Groundwater Quality Analyses (mg/l) - Sample Date August 1987

		Sample Designation	
Compound	Detection Limit	Reichard	
Nitrate	1.00		U
Fluoride	0.20		U
Sulfate	3.00	37	
Total dissolved solids	2.00	NA	
Sulfide	1.0	2.0	

Table 26

Field Mesurements During Well Sampling

Well No.	Ground-Sounded Depth (feet)	water Elevation (feet MSL)	Volume Purged (gal)	Specific Conductance (umhos/cm)	pH	Temp (°F)
June 1986						
CSP-1	35.0	271.05	8.2	7506.60	61.0	
CSP-2	42.3	245.59	6.4	7756.60	58.7	
CSP-3	44.5	243.80	6.0	1,300	6.35	59.0
CSP-4	44.7	243.88	8.0	1,400	6.55	56.5
November 1986						
CSP-1	34.7	269.8	6.7	6206.8	55.5	
CSP-2	42.25	245.4	6.2	7707.0	54.0	
CSP-3	44.30	242.8	5.9	1,180	7.0	55.0
CSP-4	44.15	242.14	6.8	1,330	--	53.0
February 1987						
CSP-1	34.7	270.16	7.75	9606.8	57	
CSP-2	42.25	245.48	6.5	8907.1	57	
CSP-3	44.30	242.79	6		7.0	52
CSP-4	44.15	242.06	6.5	1,300	6.55	52
CSP-5A	76.5	242.15	31	2,000	6.85	58
CSP-5B	97.5	242.11	48	1,850	6.85	56
CSP-5C	117.5	243.18			Not sampled	
CSP-6	82	242.09	35.3	9009.2	58	
CSP-7	45	260.2	9	8508.05	60	

Hellertown Manufacturing Company Facility in Hellertown, Pennsylvania." There are no known laboratory deliverables for the results in Tables 5 and 14. The analytical methodologies for the results summarized in Table 5 are unknown. The analytical methodologies for the results in Table 14 are referenced in the OHM report (Answer 10, CERCLA 104(e) response). Although the credibility of the previous investigator's analytical results are in question, the analyses have been integrated into the following discussion to determine general water quality trends at the site.

The results of sampling the well at the Sheesley Concrete Company do not suggest the presence of a significant contamination source at the HMC. In the Kniha well, trace metal concentrations from the 1975 sampling are generally within contemporary Recommended Maximum Contaminant Levels. Nitrate levels in the Kniha well, however, seem unusually high (33.0 mg/l). Nitrates were utilized in the bluing and blackening processes which predate the sampling event by some 16 years and could be the cause of the elevated nitrate concentrations in the well. As previously noted, the sampling and analytical methodology utilized by the investigator are unknown, which makes it difficult to validate what appears to be an unusually high concentration.

A subsequent investigator (OHM) suggested possible groundwater contamination mediated by the HMC as indicated in their analytical results (Table 21). OHM concluded that only marginal contamination was evident, however. The more significant results of the OHM report are:

- Barium concentrations ranged from 11.0 to 13.0 mg/l in all wells.

- 1,2-Dichloroethane and trichloroethylene were found to exist at concentrations above 50 ug/l.
- Nitrate levels were found to slightly exceed drinking water standards in all wells including the background well. Nitrate concentrations ranged from 20 to 42 mg/l.

The results of the first quarter sampling of the wells by ESC generally confirmed the presence of volatile chlorinated organics detected by OHM in some of the downgradient wells at the HMC. The organic priority pollutants detected in the downgradient wells were not detected in the upgradient well. Trans-1,2-dichloroethylene and trichloroethylene were detected in wells CSP-3 and CSP-4. Methylene chloride and tetrachloroethylene were also detected in CSP-4. Vinyl chloride, which was not detected in CSP-4, was detected in well CSP-3.

Barium and nitrate results were generally much lower than the concentrations detected by OHM. These constituents would not appear as indicative of downgradient water quality effects mediated by the HMC as would sodium, fluoride, or the organics described above. Sodium concentrations in CSP-3 are one to two orders of magnitude greater than the assumed "background" concentration in CSP-1. Fluoride concentrations in CSP-3 and CSP-4 are also about an order of magnitude higher than in the upgradient well. In contrast, nitrate concentrations were almost as high in the upgradient well as in any of the downgradient wells.

The second session of sampling performed by ESC (November 1986) again confirmed the presence of volatile organic compounds in downgradient wells. In addition to the compounds previously detected in CSP-3, small concentrations of 1,1-dichloroethane and 1,1-dichloroethylene were detected. Benzene, which was not detected in the June 1986 samples, was detected in well CSP-4. In addition, the sample from CSP-2 had a small concentration of trichloroethylene.

As noted in Table 20, the samples from wells CSP-3 and CSP-4 were analyzed for priority pollutant pesticides and PCBs in the second sampling session. These constituents were not detected. Also, no other priority pollutant extractables were detected from any of the samples collected in either the first or second sampling sessions.

The results of the inorganic analyses generally supported trends revealed in the first ESC sampling session. Sodium was one to two orders of magnitude greater in CSP-3 and CSP-4 when compared to the upgradient well. Fluoride concentrations were also generally higher in the downgradient wells.

As a result of the proposal to include the HMC on the NPL, ESC elected to utilize a CLP analytical protocol as of the February 1987 sampling effort to ensure that the analytical results could be validated in the future. Consequently, the tabulated results for the third session of sampling differ from the tabulated results for the previous two sessions. The CLP flag qualifiers have been incorporated into the summary table for the results from the third session.

In the third ESC sampling session, ESC addressed the issue of interlaboratory discrepancies raised by the first session's sampling. In the third session, two different analytical laboratories were retained. All analyses were performed using CLP protocol. In order to assess intralaboratory and interlaboratory precision, triplicate samples were collected at one sample point. The primary laboratory received the sample properly labeled and a blind duplicate of the sample. The referee laboratory also received the sample properly labeled.

As indicated in Table 24, there is a high degree of correlation between the analytical results for the volatile organics as detected by the primary laboratory (CSP-3 and CSP-3 blind dup). These results are also similar to the results of the referee laboratory. The primary laboratory detected more constituents than the referee laboratory due to its much lower detection limits for organic HSL compounds. Methylene chloride was detected by the referee laboratory at much higher concentrations than by the primary laboratory. However, methylene chloride was also detected in the trip blank utilized by the referee laboratory.

There is also a high degree of correlation between the analytical results for the inorganic constituents as detected by the primary laboratory in the sample and the blind duplicate of the sample. Nevertheless, the cyanide concentration in the blind duplicate of CSP-3 is around half the concentration in CSP-3. Except for a few discrepancies, there is general agreement between the primary and the referee laboratories. Cyanide was not detected by the referee laboratory in the CSP-3 sample. Potassium, which was not detected by the primary laboratory in either sample, was detected by the referee laboratory.

On first examination, the semivolatile analytical results do not appear comparable. No semivolatiles were detected by the referee laboratory or the primary laboratory for CSP-3, while semivolatiles were detected by the primary laboratory in the blind duplicate of CSP-3. The discrepancies can best be explained as a varying detection limit for each sample set.

A variety of constituents were detected at low concentrations in both the trip blank and the field blank. This contamination detected in the blank affects data interpretation. Nevertheless, the analytical results for the third sampling session corroborate the results from the previous sessions: volatile organic compounds remain the contaminants of concern. The suite of volatile organics detected in wells CSP-3 and CSP-4 remains generally unchanged from the results of the previous two sessions. Acetone, which was previously not an analyte, was detected in wells CSP-3 and CSP-4, and in the newly installed wells: CSP-5a, CSP-5b, CSP-6 and CSP-7. However, acetone also was detected in the field blank. Trichloroethylene and trans-1-2-dichloroethylene were detected in each of the newly installed wells. Tetrachloroethylene was detected in CSP-5a and CSP-7. Vinyl chloride was detected in well CSP-6 and 1,1,1-trichloroethane was detected in well CSP-7.

The monitoring results for well CSP-7 are significant in light of the location of the well with respect to the surface impoundments. Many of the constituents detected in the wells downgradient from the surface impoundments (CSP-3 through CSP-6) were also detected in well CSP-7, a well located upgradient of the surface impoundments (the assumed source of contamination). Reportedly, the area in the vicinity of well CSP-7 was used as an equipment washing and degreasing area which could explain the constituents detected. The analytical results for well CSP-7 suggest that the equipment washing area represents a contamination source.

CLP semivolatiles detected in the data set were limited to benzoic acid, bis(2-ethylhexyl)phthalate, and di-n-butyl phthalate. Bis (2-ethyl-hexyl)phthalate was detected in the blind duplicate of CSP-3, and in CSP-5a, CSP-5b, CSP-6, and CSP-7. This phthalate ester was also detected in the field blank. Di-n-butyl phthalate and benzoic acid were only detected in the blind duplicate of well CSP-3 and were detected at concentrations approaching the detection limit.

The inorganic constituents detected in the third session of sampling support water quality trends previously revealed. Sodium concentrations were at least an order of magnitude higher in wells CSP-3 and CSP-4 when compared to the upgradient well. In addition, cyanide was detected in several downgradient wells, including CSP-3, CSP-4, CSP-5a, CSP-6, and CSP-7. Nitrate concentrations in upgradient and downgradient wells were fairly comparable. The nitrate concentration in well CSP-7 was higher than the nitrate concentration in the upgradient well. Fluoride concentrations were also generally higher in downgradient versus upgradient wells.

Based on the results of the third sampling session, the volatile organic HSL compounds remain the constituents of concern. The constituents detected in the downgradient wells are characteristic of commercial halogenated chemical products used in industrial settings (or their breakdown products). Degreasing operations and dielectric testing activities conducted at the plant may account for the presence of trichloroethylene, methylene chloride, and tetrachloroethylene at the facility. As indicated in the Federal

Register of Wednesday November 13, 1985, p. 46880, the available information on the production, use, and release of halogenated organics into the environment suggests there is some potential for the environmental transformation of a number of these compounds. Laboratory studies have shown that trichloroethylene and tetrachloroethylene can be dechlorinated to form cis- and trans-1,2-dichloroethylene, vinyl chloride, and finally, chlorine and carbon dioxide. Thus, the environmental transformation of commonly used polychlorinated aliphatic degreasing solvents could account for the presence of vinyl chloride and the trans-dichloroethylene compounds in the downgradient wells.

Several inorganic constituents could also be explained by the history of wastewater discharges into the lagoon system. Key inorganic parameters detected in the downgradient wells at the facility that could be associated with the wastewater discharges include cyanide from the electroplating operation and sodium from the bluing and blackening processes.

In evaluating the significance of the groundwater data collected thus far, ESC has compared water quality results with EPA proposed Maximum Contaminant Levels (MCLs). The reasons for this comparison are: 1) that groundwater appears to be the environmental medium most affected at the site; and 2) that groundwater is used in the area as a drinking water source. Municipal officials with the city of Bethlehem report that the water supply wells closest to the site are located along William Street, which is about 2,500 ft to the west, across Saucon Creek. In view of the fact that the area between HMC and Saucon Creek appears to be a significant zone of groundwater discharge, it is unlikely that the HMC could have any effect on the water quality of the domestic wells west of the Creek. Nevertheless, the MCLs provide a perspective for scientific judgment of environmental monitoring data and the progress and success of corrective actions (should any corrective actions be required).

The EPA has proposed MCLs (Federal Register, July 8, 1987) for several of the constituents detected in the groundwater monitoring wells:

Compound	MCL (ug/l)
Vinyl chloride	2.0
Trichloroethylene	5.0
1,2-Dichloroethane	5.0
Benzene	5.0
1,1-Dichloroethylene	7.0
Trans-1,2-dichloroethylene	70.0 (proposed)
1,1,1-Trichloroethane	200.0
Nitrate	1,000.0 (NIPDWR)
Fluoride	2,000.0

The nitrate level is the National Interim Primary Drinking Water Requirement. Nitrate levels in all the wells have remained consistently below the MCL for each of the three sampling sessions. Fluoride levels, however, have been above the MCL in well CSP-3 each time. The MCL for several of the organics listed above, including vinyl chloride, trichloroethylene, 1,1-dichloroethylene, benzene, and trans-1,2-dichloroethylene, were exceeded in several of the wells in each sampling session. For example, the MCLs for vinyl chloride, 1,2-trans-dichloroethylene, and trichloroethylene were consistently exceeded in well CSP-3 for each sampling session.

In response to HMC concerns regarding the effects of the site on nearby domestic wells, ESC proposed and submitted an offsite well sampling program to the EPA on May 8, 1987 (Appendix I). This sampling program includes sampling at least one William Street well and several other offsite wells, including wells at the closed Sheesley Concrete Company, an abandoned well at the Kniha residence, and a well used to monitor past dewatering operations from the nearby Freidensville Mine. The results of the August round of sampling are presented in Table 25.

The results for wells CSP-1 through CSP-7 correspond with previous results for the presence of various compounds and the orders of magnitude of the concentrations in nearly every case. The analytical data for the trip blank and the field blank samples suggest that the complete analytical review should include a review of the detection of several compounds in the quality control samples. Low concentrations of the inorganic metals barium, calcium, iron, and zinc were detected in the field blank, indicating the possibility of slight contamination from the sampling equipment. With the exception of barium, the reported concentrations are below the USEPA CLP required detection limits but above the method detection limit used during the analysis. Barium was detected at a concentration of 3.7 ug/l in the field blank, slightly above the 1.0 ug/l detection limit.

Both the trip blank and the field blank contained detected levels of HSL organics. Acetone and methylene chloride were detected in the trip and field blanks. Benzene, toluene, bis(2-ethylhexyl)phthalate, and ethylbenzene were detected in the field blank. The detected levels of these compounds, with the exception of acetone, were below the method detection limit and are reported as estimated values. The presence of low levels of these HSL organics in well samples will be carefully assessed since the detections in the blanks indicate the possibility of laboratory or field contamination. A general well-by-well comparison is presented below, with the emphasis on the HSL organic parameters.

CSP-1 and CSP-2

There were no changes from previous data for organic compounds other than the possible detection of several compounds below the detection limits and the absence of the low level of vinyl chloride present in the previous sample round.

CSP-3 and CSP-4

Several compounds (trans-1,2-dichloroethylene; trichloroethylene; and vinyl chloride) exhibited concentrations that were an order of magnitude less than the February 1987 sampling in well CSP-3. Well CSP-3 did contain concentrations of the previously undetected compounds, ethylbenzene and total xylenes, below the detection limit. Well CSP-4 contained low concentrations of the previously undetected compounds, ethylbenzene, total xylenes, 4-methylphenol, naphthalene, and 2-methyl naphthalene. The total xylenes and 2-methyl naphthalene concentrations in CSP-4 were slightly above the method detection limit, and the concentrations of the other compounds were below the method detection limit. Otherwise, the results were consistent with previous sampling. Again, several organic compounds present in previous sampling were detected at estimated concentrations below the detection limit.

CSP-5A, CSP-5B, CSP-6, and CSP-7

For these four wells, similar organic compounds were detected, as in February 1987, and the levels were the same order of magnitude. Again, several compounds were detected with estimated concentrations below detection limits. Acetone, detected at a concentration of 71 ug/l in well CSP-5B during the February 1987 sampling, was not detected in the August 1987 sampling.

CSP-5C

This deep well was sampled for the first time on August 11, 1987. The results indicate the presence of 1,1-dichloroethane at 9.6 ppb, trans-1,2-dichloroethylene at 72 ppb, and trichloroethylene at 1,100 ppb. Compounds detected at concentrations below method detection limits in the other wells sampled were also present. These results are consistent with the results from wells CSP-5A and CSP-5B and appear to indicate further vertical migration of contaminants.

The metals analyses for well CSP-5C samples are also consistent with those from wells CSP-5A and CSP-5B. The overall metal results for well CSP-5C do not indicate any elevated metal concentrations of significant concern.

Reichard and Kniha Wells

The Reichard and Kniha wells (Figure 13) were sampled and analyzed for HSL organics. In addition, the Reichard well was sampled for inorganics and volatile purgeable carbon organics using the more sensitive (i.e., lower detection limits) 601 analytical method. The HSL organic scan is performed using GC/MS instrumentation whereas the 601 method for volatile purgeable halocarbon organics is conducted using GC instrumentation alone. GC/MS instrumentation is considered superior to GC instrumentation for compound identifications; however, GC instrumentation alone can achieve lower detection limits than GC/MS analytical methods.

The sampling results for HSL organics indicated detectable concentrations of three compounds: acetone, toluene, and methylene chloride. All three compounds were detected below method detection limits, and acetone and methylene chloride were present in the sample blanks as well. The 601 scan for volatile purgeable halocarbon organics in the Reichard well indicated the presence of extremely low concentrations for chloroform and 1,1,1-trichloroethane. The reported concentrations for these compounds are 0.33 ug/l for chloroform and 1.3 ug/l for 1,1,1-trichloroethane.

The EPA has established limits on the presence of a number of compounds in drinking water. These limits are called maximum contaminant levels (MCLs) and are "the maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a public water system" (40 CFR 141). The MCL is set at a level "at which no known or anticipated adverse

Figure 13 - well locations

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effect on the health or persons would occur" (40 CFR 141). The MCL for total trihalomethanes (of which chloroform is one of the major components), was set at 100 ug/l. The 0.33 ug/l found in the Reichard well is less than 1% of the EPA limit. The EPA has also set an MCL for the quantities of 1,1,1-trichloroethane in drinking water supplies. This limit was set at 200 ug/l. The amount of 1,1,1-trichloroethane detected in the Reichard well, 1.3 ug/l, is less than 1% of the EPA limit.

5.0 Surface Water Investigation

5.1 Surface Water Sampling Results

Three surface water samples were collected on June 23, 1986, from Saucon Creek (Figure 14). In order to discern any obvious surface water quality effects mediated by the site, surface water samples were collected from the closest significant surface water feature.

Sample SW-1 was collected from the north-flowing Saucon Creek, 1,800 feet upstream from the HMC site. The location is approximately 500 feet west of the intersection of Arden Street and Ravana Street (Figure 14).

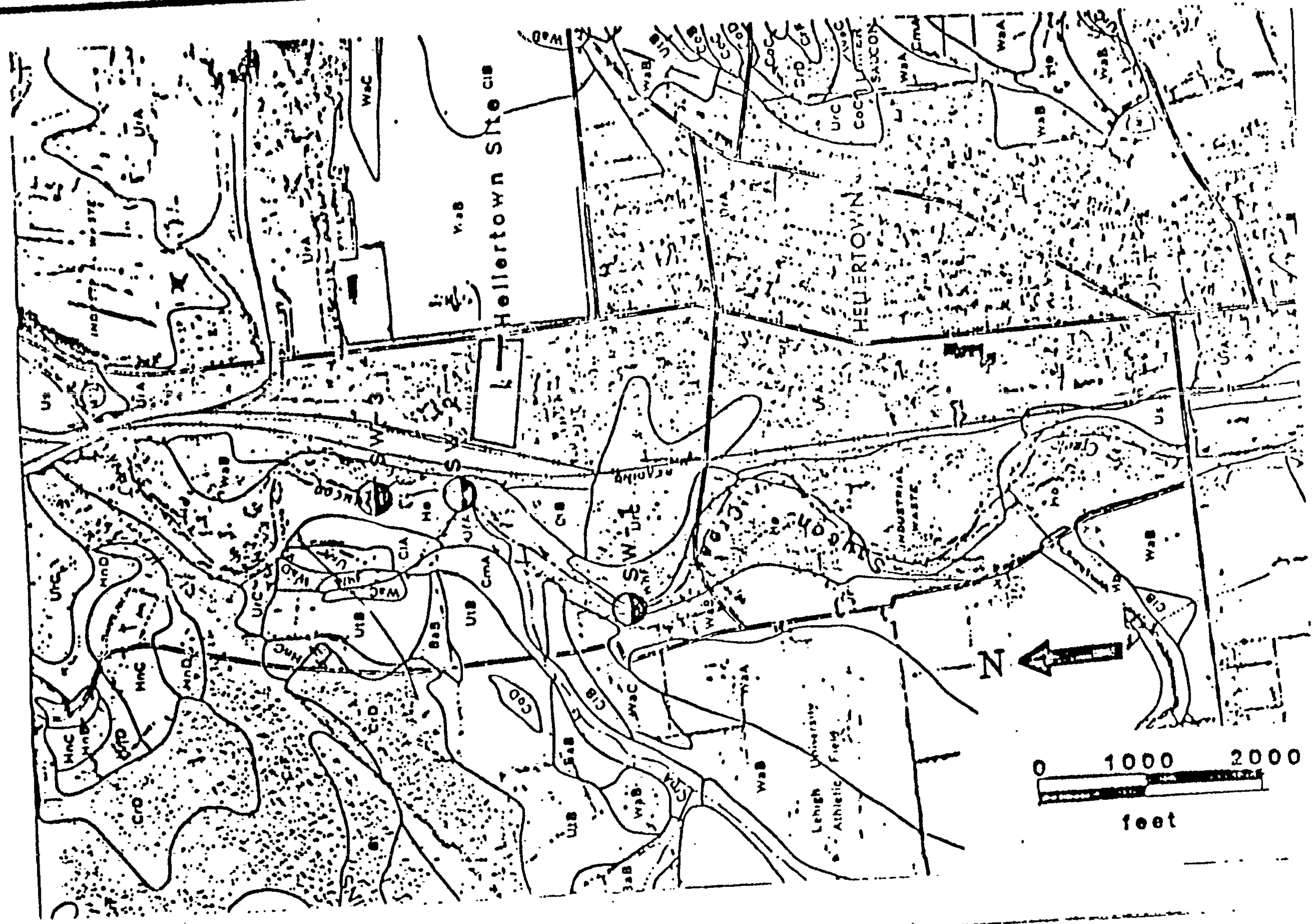
Sample SW-2 was collected from the west side of Saucon Creek, 100 feet upstream from the Silvex Road Bridge. SW-2 is located directly downgradient from the HMC site (Figure 14).

Sample SW-3 was located approximately 1,000 feet downstream from SW-2. The sample was collected on the west side of the creek, 200 feet north of a stone building.

The surface water samples were analyzed for the metals, field parameters, and conventional constituents listed in Table 27. In addition, volatile extractable priority pollutants, pesticides, and PCBs were assessed.

Samples were collected by immersing the containers provided by the laboratory into the stream. The following preservatives were added to the containers immediately after collection and the containers were placed on ice.

33



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ESC

Figure 14 - Locations of stream samples

Table 27

Surface Water Quality Analyses

Compound	SW-1	SW-2	SW-2 (dup)	SW-3
Metals (ug/L)				
Barium	29	33	10	30
Chromium	ND	ND	10	ND
Copper	ND	ND	20	ND
Iron	280	ND	110	270
Manganese	10	8.8	20	13
Nickel	ND	ND	20	ND
Sodium	7,300	7,400	28,500	7,590
Zinc	43	30	20	58
Field Parameters				
pH	7.5	7.6		7.45
Conductivity (uhmos/cm)	400	400		400
Temperature ($^\circ$F)	6.85	68.5		71.0
Conventionals (mg/l)				
Fluoride	15	0.18	0.15	0.17
Nitrate as N	2.28	2.35	3.80	2.32
Sulfate as SO_4	28	31	37	30
Phenolics, Total	<0.025	<0.050	<0.01	<0.50
Cyanide, Total	<0.025	<0.025	<0.1	<0.50
Total Dissolved Solids (TDS)	10	260	382	270
Organic Priority Pollutants (ug/l)				
Methylene chloride	ND[a]	ND	ND	ND
1,2-Trans-dichloroethylene	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND
Tetrachloroethylene	ND	ND	ND	ND

---

a/ ND = Not detected or detected below blank concentration

Parameter	Preservative
Metals	HNO_3
Phenols	H_2SO_4
Cyanides	NaOH
VOAs	Sodium Thiosulfate

Analytical results for detectable analytes are summarized on Table 27.

The stream stage, flow velocity, and discharge were measured at the SW-2 sampling location on June 23, 1986. The stream stage was 78 inches from the top of the concrete on the upstream side of the center span of the Silvex Road Bridge. The flow velocity was one foot per second. The discharge of the stream was calculated to be about 57 cubic feet per second (25,588 gallons per minute).

As indicated in Table 27, no organic priority pollutants were detected in either the upgradient or downgradient surface water samples. The only obvious surface water quality anomaly is the relatively high total dissolved solids concentrations in the downgradient samples (SW-2 and SW-3), which are at least an order of magnitude higher than the concentration detected in upgradient SW-1. The downgradient water quality results for the remainder of the parameters evaluated are generally similar to the upgradient sampling results. The reason for the elevated total dissolved solids content in the downgradient samples is unknown. Inorganic constituents of concern with the potential to affect the total dissolved solids concentration (barium, chromium, copper, cyanide, nitrate, fluoride, and nickel) were not present at unusually high concentrations, so it is unlikely that these constituents could account for the downgradient water quality characteristics.

6.0 Air Investigation

Air investigations to determine the possibility of potential airborne contaminants have involved sampling to determine safe breathing levels during field investigations performed to date. Air monitoring will be conducted during all future site field operations and intrusive activities.

7.0 Biota Investigation

A formal investigation to determine possible contamination to area flora and fauna has not been conducted at this time. An outline of activities to collect pertinent data has been included in the RI Work Plan.

8.0 Bench and Pilot Tests

Bench and pilot studies, should they become necessary, will be conducted in subsequent stages of the project and are outside the scope of work during the RI. However, ESC has proposed actions to further study site conditions and will develop potential remedial alternatives based on possible outcomes of these proposed actions.

8.1 Recommendations

In order to address these concerns, the following recommendations may be offered for consideration as part of the RI Work Plan. These are preliminary in nature and may be modified upon preparation of the Work Plan. It is anticipated that implementing these recommendations will provide essential information about movement of contaminants onsite and offsite and about potential offsite sources of contamination upgradient of the site. In addition, implementing these recommendations will help evaluate the significance of groundwater as an offsite exposure pathway.

1. HMC and ESC will determine if contaminants have moved offsite to the west in the limestone bedrock aquifer, which supplies downgradient wells and discharges to Saucon Creek, by implementing the offsite well sampling program proposed to the EPA in May 1987 (actually performed on August 12, 1987) and by installing three wells in the bedrock to depths of 150 feet at three locations:

a. Due west of well CSP-6, about 50 feet west of the property line.

b. Between wells CSP-5 and CSP-6, about 50 feet west of the property line.

c. Due west of well CSP-4 about 50 feet west of the property line.

2. ESC will determine the quality of groundwater moving onsite from the east in the limestone bedrock aquifer by installing a 150-foot test well in the southeastern corner of the site. This well would also serve as a control point for the potentiometric map of the aquifer which would be used to interpret groundwater flow directions and rates of flow.

3. HMC and ESC will determine the head relationship between the unconfined groundwater and the bedrock aquifer in the center of the site, 50 to 100 feet east of lagoon 5. One shallow well (about 40-50 feet deep) and one deep well (about 150 feet deep) should be installed.

4. ESC will conduct field tests on the abovementioned wells to determine the hydraulic conductivity of the limestone aquifer.

5. ESC will resample the Reichard well and at least two other private wells on William Street that have been identified since the August sampling. This work will be performed in conjunction with a representative from the city of Bethlehem Health Department. ESC also plans to obtain well

log information, if available, on these and any other offsite wells.

8.2 Remedial Alternatives

The results yielded by implementing the recommendations and continuing groundwater monitoring can be incorporated into the site Feasibility Study to develop remedial alternatives. At this point, a limited number of remedial alternatives have been determined to merit consideration and consist of: no action; pave the unpaved portions of the site; or install a groundwater recovery/treatment system. Again, these alternatives are preliminary in nature and may be modified upon preparation of the RI/FS Work Plan.

1. If it can be demonstrated that there is no offsite impairment (or potential for impairment) to public health or the environment, then a "no action" alternative may be justifiable.
2. Since contaminants from the buried lagoons may be leached and transported by groundwater, the extent of leaching would be minimized by reducing the amount of recharge that infiltrates vertically to the water table. This could be accomplished by paving the entire western end of the site. By paving this part of the site, all of the lagoons would be covered. Lagoons 1 and 5 are already mostly covered with pavement. Continued groundwater monitoring would allow the effectiveness of this alternative to be gauged.

3. The installation of a groundwater recovery/treatment system could be sufficient to remediate the contamination of groundwater at the site. Groundwater monitoring could be used to evaluate the effectiveness of this alternative.
4. Another alternative would be a combination of alternatives 2 and 3.

It should be emphasized that implementation of any corrective action will only take place after a complete RI investigation and a complete evaluation of the feasibility through a complete FS of various remedial alternatives.

In order to address site soil contamination, preliminary remedial action alternatives have been offered in the RI Work Plan.

9.0 Public Health and Environmental Concerns

The objective of this chapter is to characterize the site in relation to potential or real health and environmental impacts based on data collected in the RI. Since the RI has not been completed, information to date is limited. Existing data are inadequate to do a thorough risk assessment; however, a preliminary risk assessment has been completed and is presented in the RI Work Plan.

Appendix A - Well survey (preliminary results)

Department of Environmental Resources

TOPOGRAPHIC AND GEOLOGIC SURVEY

Water Well Inventory Report

NPV958

OFFICE USE ONLY

St 42 Co 095 Lat 403535 Long 751927

Sec ____ Acc M Map Hellertown Yr 1958

Physic Prov ______ U.S. Basin ______ Topo S

Aquifer ______ Aquifer 000GRGS

Color and Rock Type	From — To
GRANITE	121 — 620
Hydrologic unit	02040106

Well Site—Township LOWER SAUCON

County ~~LEHIGH~~ NORTH

Well Owner last name YURAS first initial J

Address RD #5

BETHLEHEM PA. 18015

Ownership (CIRCLE ONE) [✓ private] city, corp. co., state, federal, county

Water Use (CIRCLE ONE) [✓ home] public, industry, irrigation, stock, institution

Well Use (CIRCLE ONE) [✓ frequent use] dry hole, recharge, test, abandoned

Depth to Bedrock 120 ft.

Landform at Site (CIRCLE ONE) level, hilltop, valley, hillside

Surface ______ OFFICE USE ONLY

Driller's License 1355

Driller's Name LOUS. PLER WELL DRILLING INC.

Depth to Water Bearing Zones (1) ______ ft

(2) ______ ft. (3) ______ ft (4) ______ ft

Pa. Basin ______ OFFICE USE ONLY

Written Well Location Directions ______

Saltwater Zone yes ____ no ✓ (CHECK ONE)

Well Depth 620 ft.

Casing Length 121 ft

Well Diameter 6 to nearest inch

Well Finish (CIRCLE ONE) [✓ open hole] screen, perforated, slotted, other

Date Drilled month year MAY 1981

Water Level Before Test ______ ft.

Level at End of Test ______ ft.

Yield 1 gpm

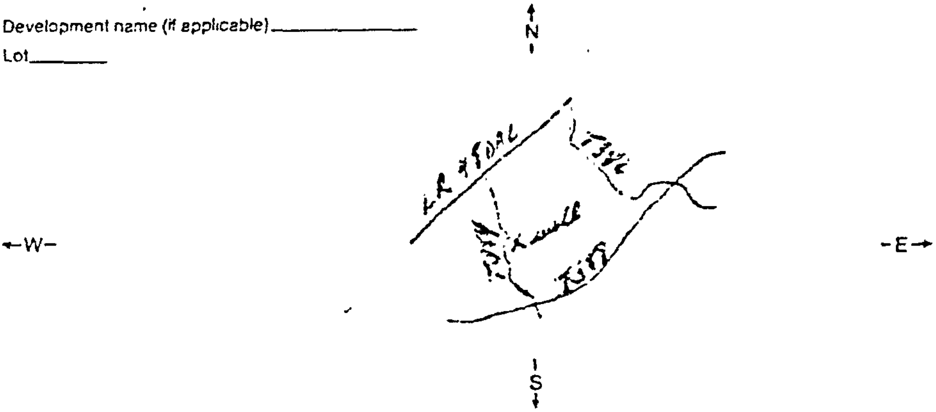
Flow Measure Method bailer, orifice, meter, weir, [✓ watch and bucket] estimate, other (CIRCLE ONE)

Drawdown ______ ft.

Length of Test ______ hr. ______ min.

Development name (if applicable) ______

Lot ______



SKETCH MAP Indicate route no's, intersections, schools, churches, cemeteries, streams, towns and any notable feature such as quarries, bridges, railroads, etc. Be sure to show distances between these features

ER-TGS-15 REV 01-79

MAIL 1ST COPY TO PA. GEOLOGICAL SURVEY

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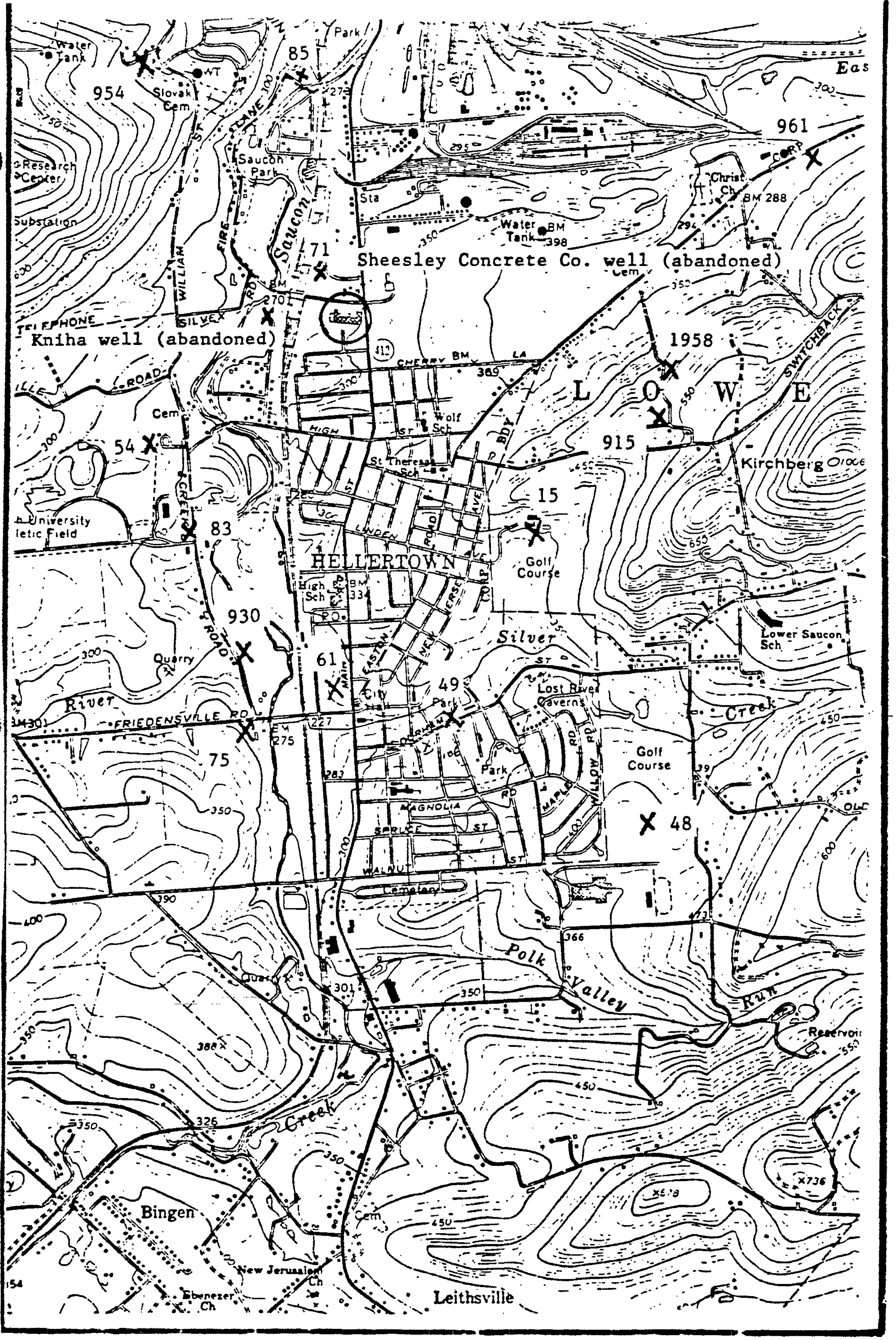

APPENDIX A WELL LOCATIONS

PRELIMINARY WELL SURVEY

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ESC

WRD Exp. (GW)
April 1966

Well No. Np-15

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR GEOLOGICAL SURVEY WATER RESOURCES DIVISION

MASTER CARD

Record by W. A Mcurant Source of data Mr. E. M. Brubaker, Combustion Engr Date 10/31/1952 Map Hellertown 7½'

State Pa 4 2 County (or town) Northampton -- Lower Saucon Twp N P

Latitude: 4 0 3 5 1 2 N Longitude: 0 7 5 1 9 3 3 Sequential number: 1

Lat-long accuracy: 1 T. S, R W, Sec , ¼, ¼, ¼ B & M

Local well number: 1 5 Other number:

Local use: COUNTRY ~~CLUB~~ CLUB Owner or name: Bethlehem Steel Country Club

Owner or name: BETHLEHEM STEEL Address:

Ownership: (C) County, (F) Fed Gov't, (M) City, [✓ (N) Corp or Co], (P) Private, (S) State Agency, (W) Water Dist N

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, [✓ (I) Irr], (M) Med, (N) Ind, (P) P S, (R) Rec, (S) Stock, (T) Instit, (U) Unused, (V) Repressure, (W) Recharge, (Y) Desal-P S, (Z) Desal-other, (Z) Other Irr & Fill Swimming Pool I

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, [✓ (W) Withdraw], (X) Waste, (Z) Destroyed W

DATA AVAILABLE: Well data ☐ Freq. W/L meas.: C Field aquifer char. ☐

Hyd. lab. data: ☐

Qual. water data; type: ☐

Freq. sampling: ☐ Pumpage inventory: yes no, period: ☐

Aperture cards: yes ☐

Log data: ☐

WELL-DESCRIPTION CARD

16" to 12" To 10"

SAME AS ON MASTER CARD Depth well: ft 2 9 5 Meas. [✓ rept] accuracy 6

Depth cased: (first perf.) 247 ft 2 4 7 Casing type: Steel; Diam. 10 in 1 0

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (O) open end, (P) perf., (S) screen, (T) sd. pt., (W) shored, [✓ (X) open hole], (Z) other X

Method Drilled: (A) air rot, (B) bored, [✓ (C) cable], (D) dug, (H) hyd rot., (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) other C

Date Drilled: 1946 9 4 6 Pump intake setting: ft 1 3 0

Driller: M. B. Biery -136, Allentown
name address

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston, (R) rot, (S) submerg, [✓ (T) turb], (Z) other T Deep ~~Shallow~~ D

Power (type): diesel, [✓ elec], nat gas, gasoline, hand, LP gas, wind; H.P. 25 500gpm ☐ Trans. or meter no.

Descrip. MP Gage 3.0 ft ~~above~~ below LSD, Alt. MP

Alt. LSD: 3 6 2 Accuracy: (source) El. of Floor 359.42 O

Water Level 48 Air line ft ~~above~~ below MP; Ft ~~above~~ below LSD 5 1 Accuracy: B

Date meas: 10/31/52 0 5 2 Yield: 375 gpm 3 7 5 Method determined ☐

Drawdown: 28 ft 2 8 Accuracy: rept 6 Pumping period 2 hrs 2

QUALITY OF WATER DATA: Iron ppm ☐ Sulfate ppm ☐ Chloride ppm ☐ Hard. ppm ☐

Sp. Conduct K x 10⁶ ☐ Temp. °F ☐ Date sampled ☐

Taste, color, etc.

Well No.

304959

Well No. NP-15

Latitude-longitude ___ N S ___ (d m s d m s)

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD

Physiographic Province: ______ 0 6 Section: ______

D Drainage Basin: ______ 4 B Subbasin: Saucon Cr X

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, (L) swamp, (O) offshore, (P) pediment, [✓ (S) hillside], (T) terrace, (U) undulating, (V) valley flat ______ 5

MAJOR AQUIFER: ______ system, ______ series C 1 Tomstown aquifer, formation, group 1 E

Lithology: ______ D Origin: ______ C Aquifer Thickness: ______ ft

Length of well open to: ______ ft Depth to top of: ______ ft

MINOR AQUIFER: ______ system, ______ series ______ aquifer, formation, group

Lithology: ______ Origin: ______ Aquifer Thickness: ______ ft

Length of well open to: ______ ft Depth to top of: ______ ft

Intervals Screened: ______

Depth to consolidated rock: ______ ft Source of data: ______

Depth to basement: ______ ft Source of data: ______

Surficial material: ______ Infiltration characteristics: ______

Coefficient Trans: ______ gpd/ft Coefficient Storage: ______

Coefficient Perm: ______ gpd/ft^2; Spec cap: ______ gpm/ft; Number of geologic cards: ______

Rept Yield 500gpm

Hit sand pockets /wam/

Pump on 2 min immediately dropped to 60ft reading & held there constantly 500gpm est pumping /WAm/

1967 – Np 15 runs about 3/4 as much as Np 48

Well No.

GPO 857-700

Np-15

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR GEOLOGICAL SURVEY WATER RESOURCES DIVISION

PENNSYLVANIA SUPPLEMENTARY DATA CARD

Record by ______ Source of data ______ Date ______ Map ______

State ______ [42] County (or town ______ [NP]

Latitude: [40 35 12 N] deg. min. sec. Longitude: [075 19 53] deg. min. sec. Sequential number: [1]

Driller's name: ______ Driller's license no. ______ [—136]

Specific capacity: ______ gpm/ft [13]

Duration of specific capacity test: ______ hr. [2] Source of specific capacity data: ______ [ ]

Water-bearing zones: Total no. of zones: ______ [ ] No. of zone-card: ______ [ ] Source of data on zones: ______ [ ]

Number of zone: ______ Depth of zone: ______ ft. [ ] Yield of zone: ______ gpm [ ]

Number of zone: ______ Depth of zone: ______ ft. [ ] Yield of zone: ______ gpm [ ]

Number of zone: ______ Depth of zone: ______ ft. [ ] Yield of zone: ______ gpm [ ]

Number of zone: ______ Depth of zone: ______ ft. [ ] Yield of zone: ______ gpm [ ]

Number of zone: ______ Depth of zone: ______ ft. [ ] Yield of zone: ______ gpm [ ]

Field quality of water data: pH: ______ [ ] Hardness: ______ gpg [ ]

Specific conductance: ______ micromhos at 25°C [ ]

Bacterial analysis: ______ [ ]

Date of bacterial analysis: ______ [ ] Source of bacterial data: ______ [ ]

Card no.: ______ [#]

Use the following notation for distinguishing letters and numbers: oh Ø zero 0
eye I one 1
zee Ƶ two 2

Do not slash a seven (i.e., 7) as it will be interpreted as a Z.

304961

WRD Exp. (GW)
April 1966

Well No. Np-48

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR GEOLOGICAL SURVEY WATER RESOURCES DIVISION

MASTER CARD

Record by C.R. Wood Source of data R. H. ODENHEIMER , CO Date 11/16/66 Map Hellertown, Pa 7½'

State Pa 4 2 County (or town) Northampton-Lower Saucon N P

Latitude: 4 0 3 4 2 9 N Longitude: 0 7 5 1 9 3 1 Sequential number: 1

Lat-long accuracy: 2 T. ___ S, R ___ , Sec ___ , ___ ¼, ___ ¼, ___ ¼ B & M

Local well number: 4 8 Other number:

Local use: C0 Owner or name: Bethlehem Steel Golf Club

Owner or name: BETHLEHEM STEEL Address: RD#1 Hellertown, Pa

Ownership: (C) County, (F) Fed Gov't, (M) City, [✓ (N) Corp or Co], (P) Private, (S) State Agency, (W) Water Dist N

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, (I) Irr, (M) Med, (N) Ind, (P) P S, (R) Rec, (S) Stock, (T) Instit, (U) Unused, (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desal-other, (Z) Other I

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (0) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, [✓ (W) Withdraw], (X) Waste, (Z) Destroyed W

DATA AVAILABLE: Well data 7 Freq. W/L meas.: 0 Field aquifer char. ☐

Hyd. lab. data: ☐

Qual. water data; type: ☐

Freq. sampling: ☐ Pumpage inventory: yes no, period: ☐

Aperture cards: yes ☐

Log data: D

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD Depth well: 330 ft 3 3 0 Meas. [✓ rept] accuracy 3

Depth cased: (first perf.) 122½ ft 1 2 2 Casing type: steel ; Diam. 18 in 1 8

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (0) open end, (P) perf., (S) screen, (T) sd. pt., (W) shored, [✓ (T) open hole], (Z) other X

Method Drilled: (A) air rot, (B) bored, [✓ (C) cable], (D) dug, (H) hyd rot., (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) other C

Date Drilled: 8/30/60 9 6 0 Pump intake setting: ___ ft

Driller: R H ODENHEIMER ; CO D275 name address

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston, (R) rot, (S) submerg, [✓ (T) turb], (Z) other T Deep Shallow D

Power (type): diesel, elec, nat gas, gasoline, hand, LP gas, wind; H.P. 125 W Trans. or meter no.

Descrip. MP ___ ft above below LSD . Alt. MP

Alt. LSD: 4 1 0 Accuracy: (source) 4

Water Level 84 ft above below MP; Ft above below LSD 8 4 Accuracy: D

Date meas: 8/ /60 8 6 0 Yield: 550 gpm 5 5 0 Method determined ☐

Drawdown: 15 ft 1 5 Accuracy: 3 Pumping period 15 hrs 1 5

QUALITY OF WATER DATA: Iron ___ ppm ☐ Sulfate ___ ppm ☐ Chloride ___ ppm ☐ Hard. ___ ppm ☐

Sp. Conduct ___ K x 10⁶ ☐ Temp. ___ °F ☐ Date sampled ☐

Taste, color, etc.

Well No.

~~304062~~

Well No. NP-48

Latitude-longitude ___ d m s N S d m s

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD 1 19

Physiographic Province: ___ [0 6] 20 21 Section: ___

[D] 22 Drainage Basin: ___ [` 4 B] 23 25 Subbasin: Saucon Cr [X] 26

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, [✓ (H) hilltop], (K) sink, (L) swamp, (O) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, (V) valley flat ___ 27 [H]

MAJOR AQUIFER: ___ system, ___ series [C 1] 28 29 Tomstown aquifer, formation, group [1 E] 30 31

Lithology: ___ [D] 32 33 Origin: ___ [6] 34 Aquifer Thickness: ___ ft

[ ] 35 37 Length of well open to: ___ ft [ ] 38 40 Depth to top of: ___ ft [ ] 41 43

MINOR AQUIFER: ___ system, ___ series [ ] 44 45 ___ aquifer, formation, group [ ] 46 47

Lithology: ___ [ ] 48 49 Origin: ___ [ ] 50 Aquifer Thickness: ___ ft

[ ] 51 53 Length of well open to: ___ ft [ ] 54 56 Depth to top of: ___ ft [ ] 57 59

Intervals Screened: ___

Depth to consolidated rock: ___ ft [ ] 60 63 Source of data: ___ 64 [ ]

Depth to basement: ___ ft [ ] 65 68 Source of data: ___ 69 [ ]

Surficial material: ___ [ ] 70 71 Infiltration characteristics: ___ 72 [ ]

Coefficient Trans: ___ gpd/ft [ ] 73 75 Coefficient Storage: ___ [ ] 76 78

Coefficient Perm: ___ gpd/ft²; Spec cap: ___ gpm/ft; Number of geologic cards: ___ [ ] 79

DTWBZ: 315

V.L.O.Y Wossgr SS

from spring 1962 to Ap 1967
pump run 580 hrs/yr
5yr)2902 hrs

(About 700 hrs in 1966)
1000 gpm

Well No.

Drl log

0-118	ground
118-155	SS
155-175	soft SS
175-190	soft ls
190-330	ls

GPO 857-700

Np-48

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR GEOLOGICAL SURVEY WATER RESOURCES DIVISION

PENNSYLVANIA SUPPLEMENTARY DATA CARD

Record by ______ Source of data ______ Date ______ Map ______

State ______ 42 County (or town ______ NP

Latitude: 40 deg. 34 min. 29 sec. N Longitude: 075 deg. 19 min. 31 sec. Sequential number: 1

Driller's name: ______ Driller's license no. ______ 0275

Specific capacity: ______ gpm/ft 37

Duration of specific capacity test: ______ hr. 15 Source of specific capacity data: ______ 2

Water-bearing zones: Total no. of zones: ______ 1 No. of zone-card: ______ 1 Source of data on zones: ______ 2

Number of zone: ______ Depth of zone: ______ ft. 315 Yield of zone: ______ gpm

Number of zone: ______ Depth of zone: ______ ft. Yield of zone: ______ gpm

Number of zone: ______ Depth of zone: ______ ft. Yield of zone: ______ gpm

Number of zone: ______ Depth of zone: ______ ft. Yield of zone: ______ gpm

Number of zone: ______ Depth of zone: ______ ft. Yield of zone: ______ gpm

Field quality of water data: pH: ______ Hardness: ______ gpg

Specific conductance: ______ micromhos at 25°C

Bacterial analysis: ______

Date of bacterial analysis: ______ Source of bacterial data: ______

Card no.: ______ #

Use the following notation for distinguishing letters and numbers: oh Ø zero 0
eye I one 1
zee Z two 2

Do not slash a seven (i.e., 7) as it will be interpreted as a Z.

WRD Exp. (GW)
April 1966

Well No. Np-49

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR GEOLOGICAL SURVEY WATER RESOURCES DIVISION

MASTER CARD

Record by C. R. Wood Source of data R. H. ODENHEIMER CO. Date 11/15/66 Map Hellertown 7½

State Pa 4 0 County (or town) Northampton-Lower Saucon N P

Latitude: 4 0 3 4 4 4 N deg min sec N Longitude: 0 7 5 2 0 0 9 degrees min sec Sequential number: 1

Lat-long accuracy: ☐ T. S, R W, Sec , ¼, ¼, ¼

Local well number: 4 9 Other number: B & M #1

Local use: U G H Owner or name: Borough of Hellertown

Owner or name: H E L L E R T O W N B O R O Address: Hellertown, Pa

Ownership: (C) County, (F) Fed Gov't, [✓ (M) City], (N) Corp or Co, (P) Private, (S) State Agency, (W) Water Dist 67 M

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, (I) Irr, (M) Med, (N) Ind, [✓ (P) P S], (R) Rec, (S) Stock, (T) Instit, (U) Unused, (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desal-other, (Z) Other 68 P

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, [✓ (W) Withdraw], (X) Waste, (Z) Destroyed 69 W

DATA AVAILABLE: Well data 7 Freq. W/L meas.: 0 Field aquifer char. 72 ☐

Hyd. lab. data: 73 ☐

Qual. water data; type: 74 ☐

Freq. sampling: ☐ Pumpage inventory: yes no, period: 76 ☐

Aperture cards: yes 77 ☐

Log data: D

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD Depth well: 347 ft 3 4 7 Meas. [✓ rept] accuracy 24 3

Depth cased: (first perf.) 79½ ft 8 0 Casing type: Steel; Diam. 16" OD in 1 6

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (O) open end, (P) perf., (S) screen, (T) sd. pt., (W) shored, [✓ (X) open hole], (Z) other X

Method Drilled: (A) air rot, (B) bored, [✓ (C) cable], (D) dug, (H) hyd rot., (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) other C

Date Drilled: 1/6/64 9 6 4 Pump intake setting: ft

Driller: R. H. ODENHEIMER CO. name, address

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston, (R) rot, (S) submerg, [✓ (T) turb], (Z) other ☐ Deep ☐

Power (type): diesel, [✓ elec], nat gas, gasoline, hand, LP gas, wind; H.P. 750 gpm 60 HP ☐ Trans. or meter no.

Descrip. MP ft above below LSD. Alt. MP

Alt. LSD: 3 0 3 Accuracy: (source) 47 3

Water Level At LSD ft above below MP; Ft above below LSD 0 Accuracy: 52 D

Date meas: 1/2/64 9 6 4 Yield: 1000 gpm 1 0 0 0 Method determined ☐

Drawdown: 55 ft 5 5 Accuracy: 3 Pumping period 24 hrs 2 4

QUALITY OF WATER DATA: Iron ppm ☐ Sulfate ppm ☐ Chloride ppm ☐ Hard. ppm ☐

Sp. Conduct K x 10⁶ ☐ Temp. °F ☐ Date sampled ☐

Taste, color, etc.

4½' X 18" OD Casing

Well No.

Well No. NP-49

Latitude-longitude ___ d m s N S d m s

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD 1 17 Physiographic Province: ___ 0 6 (20 21) Section: ___

D (22) Drainage basin: ___ 4 B (23 25) Subbasin: Saucon Cr

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, (L) swamp, (O) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, [✓ (V) valley flat] 27 V

MAJOR AQUIFER: ___ system, ___ series C 1 (28 29) Tor. twn aquifer, formation, group 1 E (30 31)

Lithology: ___ D (32 33) Origin: ___ 6 (34) Aquifer Thickness: ___ ft

Length of well open to: ___ ft (35 37) Depth to top of: ___ ft (38 40) (41 43)

MINOR AQUIFER: ___ system, ___ series (44 45) ___ aquifer, formation, group (46 47)

Lithology: ___ (48 49) Origin: ___ (50) Aquifer Thickness: ___ ft

Length of well open to: ___ ft (51 53) Depth to top of: ___ ft (54 56) (57 59)

Intervals Screened: ___

Depth to consolidated rock: ___ ft (60 63) Source of data: ___ (64)

Depth to basement: ___ ft (65 68) Source of data: ___ (69)

Surficial material: ___ (70 71) Infiltration characteristics: ___ (72)

Coefficient Trans: ___ gpd/ft (73 75) Coefficient Storage: ___ (76 78)

Coefficient Perm: ___ gpd/ft^2; Spec cap: ___ gpm/ft; Number of geologic cards: ___ (79)

DTWBZ: 280, 320, 330, 345

dd 45' at 650 gpm

$25,000 cost to drl. well, put in pump, build well house, engineering, etc

Have connection with Bethlehem for emergency use

Drl log

0-25 grand
25-280 shale
280-347 ls.

Well No.

GPO 857-700

Np-49

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR GEOLOGICAL SURVEY WATER RESOURCES DIVISION

PENNSYLVANIA SUPPLEMENTARY DATA CARD

Record by ______ Source of data ______ Date ______ Map ______

State ______ 42 County (or town) ______ NP

Latitude: 40 deg. 34 min. 44 sec. N Longitude: 075 deg. 20 min. 09 sec. Sequential number: 1

Driller's name: ______ Driller's license no. ______ 0275

Specific capacity: ______ gpm/ft 18

Duration of specific capacity test: ______ hr. 24 Source of specific capacity data: ______ 2

Water-bearing zones: Total no. of zones: ______ 4 No. of zone-card: ______ 1 Source of data on zones: ______ 2

Number of zone: ______ Depth of zone: ______ ft. 280 Yield of zone: ______ gpm

Number of zone: ______ Depth of zone: ______ ft. 320 Yield of zone: ______ gpm

Number of zone: ______ Depth of zone: ______ ft. 330 Yield of zone: ______ gpm

Number of zone: ______ Depth of zone: ______ ft. 345 Yield of zone: ______ gpm

Number of zone: ______ Depth of zone: ______ ft. Yield of zone: ______ gpm

Field quality of water data: pH: ______ Hardness: ______ gpg

Specific conductance: ______ micromhos at 25°C

Bacterial analysis: ______

Date of bacterial analysis: ______ Source of bacterial data: ______

Card no.: ______ #

Use the following notation for distinguishing letters and numbers: oh Ø zero 0
eye I one 1
zee Ƶ two 2

Do not slash a seven (i.e., 7) as it will be interpreted as a 2.

304987

NEW JERSEY ZINC WELL [illegible]

X54

NAME BENZAK, Louis UNIVERSITY 8-4316

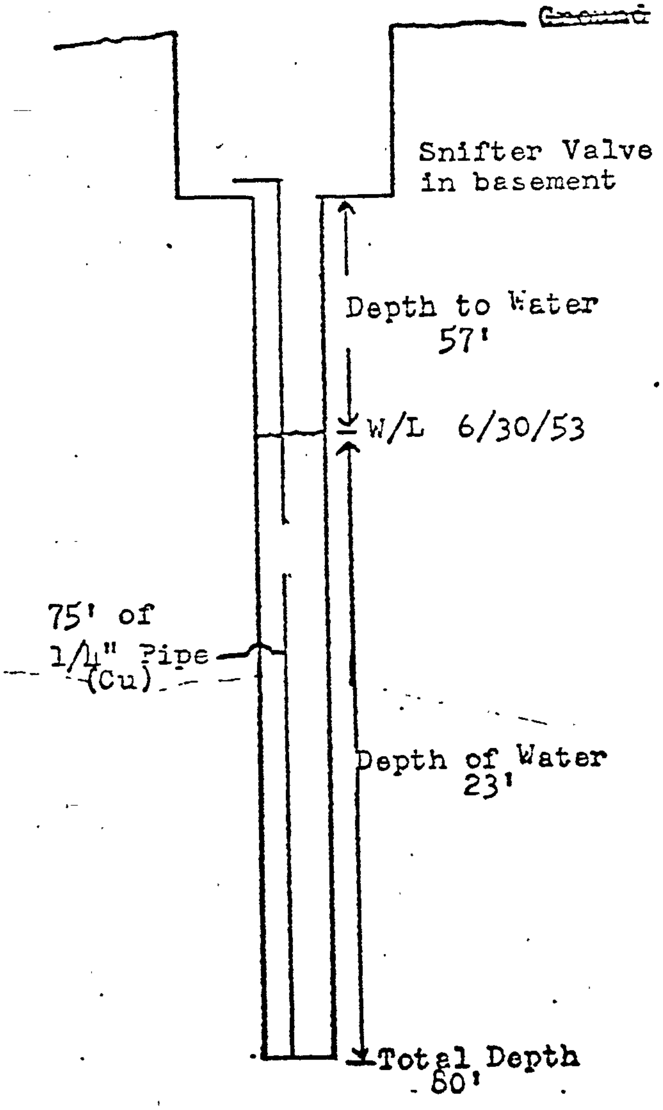
LOCATION N 16950 E 24200

NUMBER X 54

INSTALLATION BY M. G. Harmony **DATE** June 30, 1953

LENGTH OF 1/4" PIPE 75.50'

LENGTH OF DROP PIPES



REMARKS

Used our own ¼" Copper tubing
1 - ¼" O.D. Friction Coupling
1 - 1/8" Snifter Valve
Labor - 2½ Hrs.
Total Cost $15.20

No USGS Schedule for this well

approx. location
40°35'24" 75°52'06"
elevation = 309 ft.

Friedensville, Pa., Project

Source of Data: Well records of New Jersey Zinc Company
Date obtained: April 8, 1958

Drilled Well No.	Present Depth
7	231
8	No record
11	95±
12	200±
25	79
26	140±
27	250
39	212
41	117
42	148
x 51 (See also Np-83)	90±
x 54	80
58	148
72	112
80	No record
81	135
82	149
88	210
90	132
101	136
104	249
108	73
111	101
115	40±
165	65
169	190
178	134
217	90±
229	76
236	120±
240	275
261	102
262	104
264	76
272	90±
280	178
285	176
295	169
296	136
299	400
300	120±
302	112
306	185
309	106
310	223
314	128
315	101
323	82
325	81±
326	214

WRD Exp. (GW)
April 1966

Well No. Np-61

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR GEOLOGICAL SURVEY WATER RESOURCES DIVISION

Earl D. Mumme

MASTER CARD

Record by C. R. Wood Source of data R. H. ODENHEIMER & CO. Date NOV 30 1968 Map Hellertown 7½'

State Pa 4 8 County (or town) ~~[illegible]~~ Northamp. Co-Hellertown N P

Latitude: 4 0 3 4 4 8 N Longitude: 0 7 5 2 0 3 2 (degrees min sec) Sequential number: 1

Lat-long accuracy: 1 T. ___ N/S, R ___ E/W, Sec ___, ___ ¼, ___ ¼, ___ ¼

Local well number: 6 1 Other number: B & M #2

Local use: [illegible] H Owner or name: Hellertown Borough

Owner or name: HELLERTOWN BORO Address:

Ownership: (C) County, (F) Fed Gov't, [✓ (M) City], (N) Corp or Co, (P) Private, (S) State Agency, (W) Water Dist — M

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, (I) Irr, (M) Med, (N) Ind, [✓ (P) P S], (R) Rec, (S) Stock, (T) Instit, (U) Unused, (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desal-other, (Z) Other — P

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, [✓ (W) Withdraw], (X) Waste, (Z) Destroyed — W

DATA AVAILABLE: Well data ☐ Freq. W/L meas.: ___ 0 Field aquifer char. ☐

Hyd. lab. data: ☐

Qual. water data; type: ☐

Freq. sampling: ☐ Pumpage inventory: yes no, period: ☐

Aperture cards: yes ☐

Log data: D

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD Depth well: 355 ft 3 5 5 Meas. rept accuracy 3

Depth cased: (first perf.) 51 ft 5 1 Casing type: ; Diam. 16 in 1 6

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (O) open end, (P) perf., (S) screen, (T) sd. pt., (W) shored, [✓ (X) open hole] (Z) other — X

Method Drilled: (A) air rot, (B) bored, [✓ (C) cable], (D) dug, (H) hyd rot., (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) other — C

Date Drilled: 6/15/66 9 6 6 Pump intake setting: ___ ft

Driller: R. H. ODENHEIMER & CO. (name) ___ (address)

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston, (R) rot, (S) submerg, [✓ (T) turb], (Z) other T Deep ~~Shallow~~ D

Power (type): diesel, elec, nat gas, gasoline, hand, LP gas, wind; H.P. 750 60 ☐ Trans. or meter no.

Descrip. MP ___ ft above/below LSD. Alt. MP

Alt. LSD: 283 2 8 3 Accuracy: (source) 3

Water Level 5 ft above/below MP; Ft above/below LSD 5 Accuracy: ☐

Date meas: 6/7/66 6 6 6 Yield: 1000 gpm 1 0 0 0 Method determined ☐

Drawdown: 10 ft 1 0 Accuracy: ☐ Pumping period 48 hrs 4 8

QUALITY OF WATER DATA: Iron ppm ☐ Sulfate ppm ☐ Chloride ppm ☐ Hard. ppm ☐

Sp. Conduct K x 10⁶ ☐ Temp. °F ☐ Date sampled ☐

Taste, color, etc.

Well No.

304970

Well No. NP-61

Latitude-longitude ____ d m s N S d m s

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD 1 19 | Physiographic Province: ____ | 0 6 20 21 | Section: ____

D 22 | Drainage basin: ____ | 4 B 23 25 | Subbasin: Saucon Cr | X 26

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, (L) swamp, (O) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, [✓ (V) valley flat] ____ 27 V

MAJOR AQUIFER: ____ system, ____ series | C 3 28 29 | Allentown aquifer, formation, group | 4 G 30 31

Lithology: ____ | L 32 33 | Origin: ____ | 6 34 | Aquifer Thickness: ____ ft

35 37 | Length of well open to: ____ ft | 38 40 | Depth to top of: ____ ft | 41 43

MINOR AQUIFER: ____ system, ____ series | 44 45 | ____ aquifer, formation, group | 46 47

Lithology: ____ | 48 49 | Origin: ____ | 50 | Aquifer Thickness: ____ ft

51 53 | Length of well open to: ____ ft | 54 56 | Depth to top of: ____ ft | 57 59

Intervals Screened: ____

Depth to consolidated rock: ____ ft | 60 63 | Source of data: ____ | 64

Depth to basement: ____ ft | 65 68 | Source of data: ____ | 69

Surficial material: ____ | 70 71 | Infiltration characteristics: ____ | 72

Coefficient Trans: ____ gpd/ft | 73 75 | Coefficient Storage: ____ | 76 78

Coefficient Perm: ____ gpd/ft^2; Spec cap: ____ gpm/ft; Number of geologic cards: ____ | 79

DTWBZ: 110, 127, 330, 345

$35,000 for land

$30,000 for pump, engineering, drilling, well house, piping, etc

Well No.

Drl log

0-20 ground

20-355 ls

GPO 857-700

304971

Np-61

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR GEOLOGICAL SURVEY WATER RESOURCES DIVISION

PENNSYLVANIA SUPPLEMENTARY DATA CARD

Record by ________ Source of data ________ Date ________ Map ________

State ________ 42 County (or town ________ WP

Latitude: 403448N (deg. min. sec.) Longitude: 0752032 (deg. min. sec.) Sequential number: 1

Driller's name: ________ Driller's license no. ________ 0275

Specific capacity: ________ gpm/ft 1/00

Duration of specific capacity test: ________ hr. 48 Source of specific capacity data: ________ 2

Water-bearing zones: Total no. of zones: ________ 4 No. of zone-card: ________ 1 Source of data on zones: ________ 2

Number of zone: ________ Depth of zone: ________ ft. 110 Yield of zone: ________ gpm

Number of zone: ________ Depth of zone: ________ ft. 127 Yield of zone: ________ gpm

Number of zone: ________ Depth of zone: ________ ft. 330 Yield of zone: ________ gpm

Number of zone: ________ Depth of zone: ________ ft. 345 Yield of zone: ________ gpm

Number of zone: ________ Depth of zone: ________ ft. Yield of zone: ________ gpm

Field quality of water data: pH: ________ Hardness: ________ gpg

Specific conductance: ________ micromhos at 25°C

Bacterial analysis: ________

Date of bacterial analysis: ________ Source of bacterial data: ________

Card no.: ________ #

Use the following notation for distinguishing letters and numbers:

oh	Ø	zero	0
eye	I	one	1
zee	Z	two	2

Do not slash a seven (i.e., 7) as it will be interpreted as a 2.

WRD Exp. (GW)
April 1966

Well No. Np-71

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR — GEOLOGICAL SURVEY — WATER RESOURCES DIVISION

MASTER CARD

Record by C. R. Wood Source of data R. H. Odenheimer Co Date 1/17/67 Map Hellertown 7½'

State Pa 4 2 County (or town) Northampton - Lower Saucon N P

Latitude: 4 0 3 5 5 1 N (deg, min, sec; N S) Longitude: 0 7 5 2 0 3 4 (degrees, min, sec) Sequential number: 1

Lat-long accuracy: 1 T. ___ N S, R. ___ E W, Sec ___, ___ ¼, ___ ¼, ___ ¼ ___ B & M

Local well number: 71 Other number: ___

Local use: ___ Owner or name: The Sheesley Co

Owner or name: THE SHEESLEY CO Address: 2209 Lehigh St Allentown, Pa

Ownership: (C) County, (F) Fed Gov't, (M) City, [✓ (N) Corp or Co,] (P) Private, (S) State Agency, (W) Water Dist ___ 67 N

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, (I) Irr, (M) Med, [✓ (N) Ind,] (P) P S, (R) Rec, (S) Stock, (T) Instit, (U) Unused, (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desal-other, (Z) Other ___ 68 N

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, [✓ (W) Withdraw,] (X) Waste, (Z) Destroyed 69 W

DATA AVAILABLE: Well data ☐ 70 Freq. W/L meas.: ___ ☐ 71 Field aquifer char. 72 ☐

Hyd. lab. data: ___ 73 ☐

Qual. water data; type: ___ 74 ☐

Freq. sampling: ___ ☐ 75 Pumpage inventory: yes no, period: ___ 76 ☐

Aperture cards: ___ yes 77 ☐

Log data: ___ ☐ 78 79

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD Depth well: 102 ft 1 0 2 Meas. rept ___ accuracy 24 3

Depth cased: (first perf.) 70 ft 7 0 Casing type: Steel; Diam. 6 in 6

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (O) open end, (P) perf., (S) screen, (T) sd. pt., (W) shored, [✓ (X) open hole,] (Z) ___ other X

Method Drilled: [✓ (A) air rot,] (B) bored, (C) cable, (D) dug, (H) hyd rot., (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) ___ other A

Date Drilled: 1/17/67 9 6 7 Pump intake setting: ___ ft

Driller: R. H. Odenheimer Co (name), ___ (address)

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston, (R) rot, [✓ (S) submerg,] (T) turb, (Z) other S ; Deep ~~Shallow~~ D

Power (type): diesel, [✓ elec] nat gas, gasoline, hand, LP gas, wind; H.P. ___ ☐ Trans. or meter no. ___

Descrip. MP ___ ft above below LSD . Alt. MP ___

Alt. LSD: 267 2 6 7 Accuracy: (source) ___ 47 3

Water Level 20 ft ~~above~~ below MP; Ft ~~above~~ below LSD 2 0 Accuracy: Drlr. ☐

Date meas: 1/18/67 1 6 7 Yield: 150 gpm 1 5 0 Method determined ☐

Air Test

Drawdown: ___ ft ☐ Accuracy: ___ ☐ Pumping period ½ hrs ☐

QUALITY OF WATER DATA: Iron ___ ppm ☐ Sulfate ___ ppm ☐ Chloride ___ ppm ☐ Hard. ___ ppm ☐

Sp. Conduct ___ K x 10^6 ☐ Temp. ___ °F ☐ Date sampled ___ ☐

Taste, color, etc. ___

Well No.

~~504973~~

Well No. NP 71

Latitude-longitude N S d m s d m s

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD

Physiographic Province: 0 6 Section:

D Drainage Basin: 4 B Subbasin: Saucon Creek X

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, (L) swamp, (O) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, [✓ (V) valley flat] V

MAJOR AQUIFER: system, series C 1 Tomstown aquifer, formation, group 1 E

Lithology: D Origin: C Aquifer Thickness: ft

Length of well open to: ft Depth to top of: ft

MINOR AQUIFER: system, series aquifer, formation, group

Lithology: Origin: Aquifer Thickness: ft

Length of well open to: ft Depth to top of: ft

Intervals Screened:

Depth to consolidated rock: ft Source of data:

Depth to basement: ft Source of data:

Surficial material: Infiltration characteristics:

Coefficient Trans: gpd/ft Coefficient Storage:

Coefficient Perm: gpd/ft^2; Spec cap: gpm/ft; Number of geologic cards:

DTWBZ: 70, 72, 100

near Hellertown - readymix plant

Drl log

Ground	0-25
ls	25-102

Well No.

GPO 857-700

304974

Np-71

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR GEOLOGICAL SURVEY WATER RESOURCES DIVISION

PENNSYLVANIA SUPPLEMENTARY DATA CARD

Record by ______ Source of data ______ Date ______ Map ______

State ______ 42 County (or town) ______ NP

Latitude: 5 40 deg. 35 min. 51 sec. N 11 Longitude: 12 075 deg. 15 20 min. 34 sec. 18 Sequential number: 1 19

Driller's name: ______ Driller's license no. 20 0275 23

Specific capacity: ______ gpm/ft 24 27

Duration of specific capacity test: ______ hr. 28 31 Source of specific capacity data: ______ 32

Water-bearing zones: Total no. of zones: ______ 3 33 No. of zone-card: ______ 1 34 Source of data on zones: ______ 2 35

Number of zone: ______ Depth of zone: ______ ft. 36 ~~70~~ 38 Yield of zone: ______ gpm 39 41

Number of zone: ______ Depth of zone: ______ ft. 42 72 44 Yield of zone: ______ gpm 45 47

Number of zone: ______ Depth of zone: ______ ft. 48 100 50 Yield of zone: ______ gpm 51 53

Number of zone: ______ Depth of zone: ______ ft. 54 56 Yield of zone: ______ gpm 57 59

Number of zone: ______ Depth of zone: ______ ft. 60 62 Yield of zone: ______ gpm 63 65

Field quality of water data: pH: ______ 66 . 68 Hardness: ______ gpg 69 70

Specific conductance: ______ micromhos at 25°C 71 74

Bacterial analysis: ______ 75

Date of bacterial analysis: ______ 76 78 Source of bacterial data: ______ 79

Card no.: ______ # 80

Use the following notation for distinguishing letters and numbers:

oh Ø zero 0
eye I one 1
zee Z two 2

Do not slash a seven (i.e., 7) as it will be interpreted as a 2.

Considered part of 72' zone

304975

WRD Exp. (GW)
April 1966

Well No. Np-75

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR GEOLOGICAL SURVEY WATE RESOURCES DIVISION

MASTER CARD

Record by C. R. Wood Source of data Joseph Szakos Date 8/9/67 Map ~~Allentown~~ ~~East 7½~~ Hellertown

State Pa 4 ~~1~~ 2 County (or town) Northampton Lower Saucon Twp N P

Latitude: 4 0 3 4 4 2 N (deg, min, sec) Longitude: 0 7 5 2 0 4 7 (degrees, min, sec) Sequential number: 1

Lat-long accuracy: 1 T. ___ N S, R ___ E W, Sec ___, ___ ¼, ___ ¼, ___ ¼ ___ B & M

Local well number: 75 Other number:

Local use: Owner or name: Helena Nowicki

Owner or name: NOWICKI HELENA Address: RD#5 Bethlehem

Ownership: (C) County, (F) Fed Gov't, (M) City, (N) Corp or Co, [✓ (P) Private], (S) State Agency, (W) Water Dist 67 P

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, [✓ (H) Dom], (I) Irr, (M) Med, (N) Ind, (P) P S, (R) Rec, (S) Stock, (T) Instit, (U) Unused, (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desal-other, (Z) Other 2 houses 68 H

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, [✓ (W) Withdraw], (X) Waste, (Z) Destroyed 69 W

DATA AVAILABLE: Well data ☐ 70 Freq. W/L meas.: ☐ 71 Field aquifer char. 72 ☐

Hyd. lab. data: ☐

Qual. water data; type: ☐

Freq. sampling: ☐ 75 Pumpage inventory: yes no. period: 76 ☐

Aperture cards: yes 77 ☐

Log data: 78 79

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD (1–19) Depth well: 90 ft 90 (20–23) ~~Meas.~~ rept accuracy 24 6

Depth cased: (first perf.) ft (25–28) Casing type: Steel ; Diam. 6 in 6 (29–30)

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (O) open end, (P) perf., (S) screen, (T) sd. pt., (W) shored, [✓ (X) open hole], (Z) other 31 X

Method Drilled: (A) air rot, (B) bored, [✓ (C) cable], (D) dug, (H) hyd rot., (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) other 32 C

Date Drilled: (33–35) Pump intake setting: ft (36–38)

Driller: name, address

Lift (type): (A) air, (B) bucket, (C) cent, [✓ (J) jet], (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston, (R) rot, (S) submerg, (T) turb, (Z) other 39 J Deep Shallow 40 ☐

Power (type): diesel, [✓ elec], nat gas, gasoline, hand, LP gas, wind; H.P. 41 5 Trans. or meter no.

Descrip. MP well lid ~~[illegible]~~ Top of casing 4 ft ~~above~~ below LSD. Alt. MP

Alt. LSD: 280 280 (42–45) Accuracy: (source) 47 3

rept

Water Level 15 ft ~~above~~ below MP; Ft ~~above~~ below LSD 19 (48–51) Accuracy: 52 ☐

Date meas: July 1965 53 765 55 Yield: gpm (56–60) Method determined 61 ☐

Drawdown: ft (62–64) Accuracy: 65 ☐ Pumping period hrs (66–68)

QUALITY OF WATER DATA: Iron ppm 69 ☐ Sulfate ppm 70 ☐ Chloride ppm 71 ☐ Hard. ppm 72 ☐

Sp. Conduct K x 10^6 73 ☐ Temp. °F (74–76) Date sampled (77–78)

Taste, color, etc.

Well No.

Well No. NP-75

Latitude-longitude ___ ° ' " N S ___ ° ' "

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD (1–19)

Physiographic Province: ___ 0 6 (20–21)

Section: ___

D (32) Drainage Basin: ___ 4 B (33–35)

Subbasin: Saucon Cr X (36)

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, (L) swamp, (O) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, [✓ (V) valley flat] ___ (37) V

MAJOR AQUIFER: ___ system, ___ series C 3 (38–39) Allentown aquifer, formation, group 4 G (30–31)

Lithology: ___ L (32–33) Origin: ___ 6 (34) Aquifer Thickness: ___ ft

☐ (35–37) Length of well open to: ___ ft ☐ (38–40) Depth to top of: ___ ft ☐ (41–43)

MINOR AQUIFER: ___ system, ___ series ☐ (44–45) ___ aquifer, formation, group ☐ (46–47)

Lithology: ___ ☐ (48–49) Origin: ___ ☐ (50) Aquifer Thickness: ___ ft

☐ (51–53) Length of well open to: ___ ft ☐ (54–56) Depth to top of: ___ ft ☐ (57–59)

Intervals Screened: ___

Depth to consolidated rock: ___ ft ☐ (60–63) Source of data: ___ ☐ (64)

Depth to basement: ___ ft ☐ (65–68) Source of data: ___ ☐ (69)

Surficial material: ___ ☐ (70–71) Infiltration characteristics: ___ ☐ (72)

Coefficient Trans: ___ gpd/ft ☐ (73–75) Coefficient Storage: ___ ☐ (76–78)

Coefficient Perm: ___ gpd/ft² Spec cap: ___ gpm/ft; Number of geologic cards: ___ ☐ (79)

Well No. ___

GPO 857-700

9-1874-C (GW)
April 1966

Well No. NP-83

WE'L SCHEDULE

U. S. DEPT. OF THE INTERIOR   GEOLOGICAL SURVEY   WATER RESOURCES LIVISION

MASTER CARD

Record by C. R. Wood   Source of data N. J. Zinc Co   Date 8/2/67   Map ~~Allentown East 7½~~ Hellertown 7½'

State Pa   4 [illegible] 2   County (or town) Northampton - Lower Saucon   N P

Latitude: 4 0 3 5 1 1 N (N/S) deg min sec   Longitude: 0 7 5 2 1 0 0 degrees min sec   Sequential number: 1

Lat-long accuracy: 7   T. ____ N/S, R ____ E/W, Sec ____, ____ ¼, ____ ¼, ____ ¼ ____ B & M

Local well number: 8 3   Other number: N.J. Zinc DW 51

Local use: T Y   Owner or name: Lehigh University

Owner or name: L E H I G H U N I V E R S I   Address: ____

Ownership: (C) County, (F) Fed Gov't, (M) City, [✓ (N) Corp or Co,] (P) Private, (S) State Agency, (W) Water Dist ____ 67 N

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, (I) Irr, (M) Med, (N) Ind, (P) P S, (R) Rec, (S) Stock, (T) Instit, (U) Unused, (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desal-other, (Z) Other ____ 68 ☐

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, [✓ (W) Withdraw,] (X) Waste, (Z) Destroyed 69 W

DATA AVAILABLE: Well data ☐ 70   Freq. W/L meas.: ____ ☐ 71   Field aquifer char. 72 ☐

Hyd. lab. data: ____ 73 ☐

Qual. water data; type: ____ 74 ☐

Freq. sampling: ____ ☐ 75   Pumpage inventory: yes no, period: ____ 76 ☐

Aperture cards: ____ yes 77 ☐

Log data: ____ ☐ 78 79

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD   Depth well: 90± ft   9 0   Meas. rept ____ accuracy 24 ☐

Depth cased: (first perf.) ____ ft ☐   Casing type: Steel; Diam. 6 in   6

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (O) open end, (P) perf., (S) screen, (T) sd. pt., (W) shored, [✓ (X) open hole,] (Z) ____ other   X 31

Method Drilled: (A) air rot, (B) bored, [✓ (C) cable,] (D) dug, (H) hyd rot., (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) ____ other   C 32

Date Drilled: ____ ☐ 33 35   Pump intake setting: ____ ft ☐ 36 38

Driller: ____ name, ____ address

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston, (R) rot, (S) submerg, (T) turb, (Z) other ☐ 39   Deep Shallow ☐ 40

Power (type): diesel, elec, nat gas, gasoline, hand, LP gas, wind; H.P. ____ ☐ 41   Trans. or meter no. ____

Descrip. MP ____ ft above below LSD. Alt. MP ____

Alt. LSD: 288   2 8 8 42 45   Accuracy: (source) ____ 47 3

Water Level ____ ft above below MP; Ft above below LSD ☐ 48 51   Accuracy: ____ 52 ☐

Date meas: ____ 53 ☐ 55   Yield: ____ gpm ☐ 56 60   Method determined ☐ 61

Drawdown: ____ ft ☐ 62 64   Accuracy: ____ ☐ 65   Pumping period ____ hrs ☐ 66 68

QUALITY OF WATER DATA: Iron ____ ppm ☐ 69   Sulfate ____ ppm ☐ 70   Chloride ____ ppm ☐ 71   Hard. ____ ppm ☐ 72

Sp. Conduct ____ K x 10^6 ☐ 73   Temp. ____ °F ☐ 74 76   Date sampled ____ ☐ 77 79

Taste, color, etc. ____

Well No.

304978

Well No. NP-83

Latitude-longitude: N S d m s d m s

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD

Physiographic Province: 0 6 Section:

D Drainage Basin: 4 B Subbasin: Saucon Cr X

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, (L) swamp, (O) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, [✓ (V) valley flat] V

MAJOR AQUIFER: system, series C 3 Allentown Fm aquifer, formation, group 4 G

Lithology: L Origin: 6 Aquifer Thickness: ft

Length of well open to: ft Depth to top of: ft

MINOR AQUIFER: system, series aquifer, formation, group

Lithology: Origin: Aquifer Thickness: ft

Length of well open to: ft Depth to top of: ft

Intervals Screened:

Depth to consolidated rock: ft Source of data:

Depth to basement: ft Source of data:

Surficial material: Infiltration characteristics:

Coefficient Trans: gpd/ft Coefficient Storage:

Coefficient Perm: gpd/ft^2; Spec cap: gpm/ft; Number of geologic cards:

WT EL	July 31, 1953	258.01 MSL
WT El	Mar 22, 1966	245.26 MSL
	Mar 19, 1964	250 MSL
	June 22, 1964	253.06 MSL

Well No.

6

GPO 857-700

304979

WRD Exp. (GW)
April 1966

Well No. Np-85

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR — GEOLOGICAL SURVEY — WATER RESOURCES DIVISION

MASTER CARD

Record by C. R. Wood Source of data Ellie & Popper Date 4/18/68 Map Hellertown 7½'

State Pa | 4 | 2 | County (or town) Northampton - Bethlehem | N | P |

Latitude: | 4 0 | 3 6 | 1 8 | N | (deg, min, sec) Longitude: | 0 7 5 | 2 0 | 3 8 | (degrees, min, sec) Sequential number: | 1 |

Lat-long accuracy: | 1 | T. ____ N/S, R ____ E/W, Sec ____ , ____ ¼, ____ ¼, ____ ¼ ____ B & M

Local well number: | 8 5 | Other number: Saucon Valley Well

Local use: | E M | Owner or name: Bethlehem Dept. of Public

Owner or name: | C I T Y O F B E T H L E H | Address: Works, 11 E. Church St, Bethlehem

Ownership: (C) County, (F) Fed Gov't, [✓ (M) City], (N) Corp or Co, (P) Private, (S) State Agency, (W) Water Dist ____ 67 | M |

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, (I) Irr, (M) Med, (N) Ind, (P) P S, (R) Rec, (S) Stock, (T) Instit, [✓ (U) Unused], (V) Repressure, (W) Recharge, (X) Desal-P S, (Y) Desal-other, (Z) Other ____ 68 | U |

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, [✓ (O) Obs], (P) Oil-gas, (R) Recharge, (T) Test, (U) Used, (W) Withdraw, (X) Waste, (Z) Destroyed 69 | 0 | 0

DATA AVAILABLE: Well data ☐ 70 Freq. W/L meas.: Recorder installed 6-17-69 | C | 71 Field aquifer char. 72 ☐

Hyd. lab. data: ____ 73 ☐

Qual. water data; type: ____ 74 ☐

Freq. sampling: ____ ☐ 75 Pumpage inventory: yes, no, period: ____ 76 ☐

Aperture cards: ____ yes 77 ☐

Log data: in File (Co Area) | D | | 78 79

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD Depth well: 344 ft | 3 4 4 | rept ____ accuracy 24 | 6 |

Depth cased (first perf.): 73 ft | 7 3 | Casing type: steel ; Diam. 12 in | 1 2 |

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (O) open end, (P) perf., (S) screen, (T) sd. pt., (W) shored, [✓ (X) open hole], (Z) other ____ | X | 31

Method Drilled: (A) air rot, (B) bored, [✓ (C) cable], (D) dug, (H) hyd rot., (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, (Z) other ____ | C | 32

Date Drilled: 1966 | 9 6 6 | Pump intake setting: ____ ft | | | | 36 38

Driller: Samuel Stothoff 0226, Flemington, N. J. (name, address)

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), [✓ (N) none], (P) piston, (R) rot, (S) submerg, (T) turb, (Z) other | N | 39 Deep Shallow ☐ 40

Power (type): diesel, elec, nat gas, gasoline, hand, LP gas, wind; H.P. ____ ☐ 41 Trans. or meter no. ____

Descrip. MP top of [illegible] 1 ft [✓ above] below LSD . Alt. MP ____

Alt. LSD: 230 | 2 3 0 | Accuracy: (source) rept by city 47 | 3 |

Water Level 6.5 ft above [✓ below] MP; Ft above below LSD | 6 | Accuracy: ____ 52 ☐

Date meas: May 18, 1966 | 5 6 6 | Yield: 1240 gpm | 1 2 4 0 | Method determined ☐ 61

Drawdown: 69.5 ft | 7 0 | Accuracy: rept ☐ 65 Pumping period 94 hrs | 9 4 |

QUALITY OF WATER DATA: Iron ____ ppm ☐ Sulfate ____ ppm ☐ 70 Chloride ____ ppm ☐ 71 Hard. ____ ppm ☐ 72

Sp. Conduct ____ K x 10⁶ ☐ 73 Temp. ____ °F | | | 74 76 Date sampled ____ | | | 77 79

Taste, color, etc. Very poor quality - phenolic wastes have contaminated GW in vicinity of well

Well No.

304980

Well No. NP 85

Latitude-longitude ___ d m s N S d m s

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD 1 19 Physiographic Province: 0 6 20 21 Section: Great Valley

D 22 Drainage Basin: Lehigh R. 4 B 23 25 Subbasin: Saucon Cr X 26

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, (L) swamp, (O) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, [✓ (V) valley flat] 27 V

MAJOR AQUIFER: Cambrian system, ___ series C 1 28 29 ~~Tomstown~~ Leithsville aquifer, formation, group 1 E 30 31

Lithology: ___ D 32 33 Origin: ___ 6 34 Aquifer Thickness: ___ ft

35 37 Length of well open to: ___ ft 38 40 Depth to top of: ___ ft 41 43

MINOR AQUIFER: ___ system, ___ series 44 45 ___ aquifer, formation, group 46 47

Lithology: ___ 48 49 Origin: ___ 50 Aquifer Thickness: ___ ft

51 53 Length of well open to: ___ ft 54 56 Depth to top of: ___ ft 57 59

Intervals Screened: ___

Depth to consolidated rock: ___ ft 60 63 Source of data: ___ 64

Depth to basement: ___ ft 65 68 Source of data: ___ 69

Surficial material: ___ 70 71 Infiltration characteristics: ___ 72

Coefficient Trans: ___ gpd/ft 73 75 Coefficient Storage: ___ 76 78

Coefficient Perm: ___ gpd/ft^2; Spec cap: ___ gpm/ft; Number of geologic cards: ___ 79

City has Geol log

Well No.

GPO 857-700

304981

Np-85

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR GEOLOGICAL SURVEY WATER RESOURCES DIVISION

PENNSYLVANIA SUPPLEMENTARY DATA CARD

Record by ________ Source of data ________ Date ________ Map ________

State ________ 42 County (or town ________ WP

Latitude: 403618W deg. min. sec. Longitude: 0752028 deg. min. sec. Sequential number: 1

Driller's name: ________ Driller's license no. 0226

Specific capacity: ________ gpm/ft 18

Duration of specific capacity test: ________ hr. 94 Source of specific capacity data: ________ 3

Water-bearing zones: Total no. of zones: ________ No. of zone-card: ________ Source of data on zones: ________

Number of zone: ________ Depth of zone: ________ ft. Yield of zone: ________ gpm

Number of zone: ________ Depth of zone: ________ ft. Yield of zone: ________ gpm

Number of zone: ________ Depth of zone: ________ ft. Yield of zone: ________ gpm

Number of zone: ________ Depth of zone: ________ ft. Yield of zone: ________ gpm

Number of zone: ________ Depth of zone: ________ ft. Yield of zone: ________ gpm

Field quality of water data: pH: ________ Hardness: ________ gpg

Specific conductance: ________ micromhos at 25°C

Bacterial analysis: ________

Date of bacterial analysis: ________ Source of bacterial data: ________

Card no.: ________ #

Use the following notation for distinguishing letters and numbers: oh Ø zero 0
eye I one 1
zee Z two 2

Do not slash a seven (i.e., 7) as it will be interpreted as a Z.

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SEPTEMBER 16, 1985                            BUR. OF TOPO. AND GEOLOGIC SURVEY
                                      DEPT. OF ENVIR    NTAL RESOURCES, HARRISBURG, PA 17120
NORTHAMTON COUNTY                                GR  .DWATER INVENTORY SYSTEM
                                                      REPORT TYPE P

[WELL LOCATIONS HAVE NOT BEEN FIELD CHECKED.]
                ---- ---                                     *****  WATER-BEARING ZONES ,  *****          B
                                    D I              ZONES                                        H       A
                                    R I                      FIRST   SECOND   THIRD   FOURTH      A       C
                                    I C              S     S                                      R       T     S
                                    L .   SPEC  DUR  O T M O  D   Y   D   Y   D   Y   D   Y       D             O
                                    L                U O A U  E   I   E   I   E   I   E   I       N       A A D U
                  WELL S C  BWQM    E N   CAP.  CAP. R T J R  P   E   P   E   P   E   P   E       E  SPEC N N A R
                       E T          R O              C A O C  T   L   T   L   T   L   T   L       S       A A T C
TOWNSHIP          NO.  Q Y  CODE    S .  GPM/FT TEST E L R E  H   D   H   D   H   D   H   D  PH   S  COND L L E E
•••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••
XXXXXXXXXXXXXXXXX XXXX X XX XX-XX.X XXXX  XXXX  XXXX X X X X XXX XXX XXX XXX XXX XXX XXX XXX X.XX XX XXXX X XXX X

LOWER SAUCON       260 1 48          275               2   2  80  25  97                      .00
LOWER SAUCON       261 1 48          275               2   2  77  20 100                      .00
LOWER SAUCON       262 1 48          275               3   2 115  25 138     189              .00
LOWER SAUCON       263 1 48          275               1   2  45  20                          .00
LOWER SAUCON       913 1 48  6-22.0   75               1   2 112  24                          .00
LOWER SAUCON       914 1 48          264               2   2 100  30 204                      .00
LOWER SAUCON       915 1 48  6-22.0 1016               2   2  60  25  75                      .00
LOWER SAUCON       916 1 48  6-22.0  275               2   2  50  15 110                      .00
LOWER SAUCON       917 1 48          275               1   2 375   5                          .00
LOWER SAUCON       918 1 48          275               1   2 146  60                          .00
LOWER SAUCON       919 1 48          275               1   2 150  30                          .00
LOWER SAUCON       920 1 48          275               2   2 100  40 120                      .00
LOWER SAUCON       921 1 48  6-22.0 1016               1   2 128  12                          .00
LOWER SAUCON       922 1 48          275               3   2  64  20  82      96              .00
LOWER SAUCON       923 1 48          275               2   2 140  10 160                      .00
LOWER SAUCON       924 1 48          275               1   2 250  20                          .00
LOWER SAUCON       925 1 48          275               1   2  65  25                          .00
LOWER SAUCON       926 1 48          275               3   2  70 150  72     100              .00
LOWER SAUCON       927   48          275               3   2 140  10 165     248              .00
LOWER SAUCON       928 1 48          275               2   2 125  15 140                      .00
LOWER SAUCON       929 1 48  6-22.0 1016               2   2  20  30  55                      .00
LOWER SAUCON       930 1 48  6-22.0 1016               2   2  15  30  30                      .00
LOWER SAUCON       931 1 48          275               2   2  75  10  96                      .00
LOWER SAUCON       932 1 48          275               1   2  80  15                          .00
LOWER SAUCON       933 1 48          275               1   2 285   5                          .00
LOWER SAUCON       934 1 48  6-22.0 1016               1   2  50  25                          .00
LOWER SAUCON       935 1 48  6-22.0 1016               2   2  13   5  30                      .00
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SEPTEMBER 16, 1985                          BUR. OF TOPO. AND GEOLOGIC SURVEY                          PAGE:   32
                                  DEPT. OF ENVIRONMENTAL RESOURCES, HARRISBURG, PA 17120
NORTHAMTON COUNTY                               GROUNDWATER INVENTORY SYSTEM
                                                       REPORT TYPE A
 [WELL RECORDS HAVE NOT BEEN FIELD CHECKED.]                                                           F
               ---- ---                                                     O W    W   I
                                                                                        A   W A W  E F E   Q Q   A L
                                                                                        C   N T E  L R L H / / P P O
                                                                                        C A E E L  L E D Y W W U E G
                                                   USGS  PA          LATITUDE  LONGITUDE U G R R L    Q   D     M R
                                                                                        R E S      D   C   T F P T D
                   WELL  S  C                      SUB-  SUB-  QUAD  D  M  S   D  M  S  A N H U U  A W H L Y R A U A
                    -    E  T                                        E  I  E   E  I  E  C C I S S  T / A A P E G R T
 TOWNSHIP          NO.   Q  Y     **  OWNER  **    BAS.  BAS.  CODE  G  N  C   G  N  C  Y Y P E E  A L R B E Q E E A
..................................................................................................................
XXXXXX)XXXXXXXXXXX XXXX  X  XX    XXXXXXXXXXXXXXX  XX-XX XX-X  XXXX  XX XX XX  XX XX XX X X X X X  X X X X X X X X XX

LOWER SAUCON        260  1  48    SEAMAN JOSEPH                                           S P H W  2 0             D
LOWER SAUCON        261  1  48    UNGIRAN JOHN                                            S P H W  2 0             D
LOWER SAUCON        262  1  48    PODHAYNY M                                              S P H W  2 0             D
LOWER SAUCON        263  1  48    VASSA STEVE                                             S P H W  2 0             D
LOWER SAUCON        913  1  48    PRITULSKY JOHN   2-C   4-B   206D  40 33 38  75 21 10 3 S P H W  4 0             D
LOWER SAUCON        914  1  48    MYERS            2-C   4-B                            4 S P H W  1 0             D
LOWER SAUCON        915  1  48    PETERS C D       2-C   4-B   206D  40 35 28  75 19 29 3 S P H W  3 0             D
LOWER SAUCON        916  1  48    KEMMERER ROBERT  2-C   4-0   206B                     4 S P H W  4 0             D
LOWER SAUCON        917  1  48    PEEKE LACHIAN    2-C   4-B                            4 S P H W  4 0             D
LOWER SAUCON        918  1  48    STRAIN JAMES     2-C   4-B                            4 S P H W  4 0             D
LOWER SAUCON        919  1  48    UHLER DALE       2-C   4-B                            4 S P H W  4 0             D
LOWER SAUCON        920  1  48    UHLER DALE       2-C   4-B                            4 S P H W  5 0             D
LOWER SAUCON        921  1  48    WOLF RICHARD     2-C   4-B   206D  40 33 13  75 21 38 3 S P H W  1 0             D
LOWER SAUCON        922  1  48    WERKHEISER EDW   2-C   4-B                            4 S P H W  4 0             D
LOWER SAUCON        923  1  48    GIORDANO VERNA   2-C   4-B                            4 S P H W  4 0             D
LOWER SAUCON        924  1  48    BELLHORN WILLIM  2-C   4-B                            4 S P H W  4 0             D
LOWER SAUCON        925  1  48    ANTONELLI ALF    2-C   4-B                            4 S P H W  4 0             D
LOWER SAUCON        926  1  48    THE SHEESLEY CO  2-C   4-B                            4 S N N W  4 0             D
LOWER SAUCON        927     48    MIKLETZ DANIEL   2-C   4-B                            4 S P H W  4 0             D
LOWER SAUCON        928  1  48    GIRL SCOUTS      2-C   4-B                            4 S P H W  4 0             D
LOWER SAUCON        929  1  48    HERMAN RAYMOND   2-C   4-B   206D                     4 S P H W  1 0             D
LOWER SAUCON        930  1  48    GEYER EDWIN      2-C   4-B   206D  40 33  9  75 21 10 3 S P H W  3 0             D
LOWER SAUCON        931  1  48    BECKER LAWRENCE  2-C   4-B                            4 S P H W  4 0             D
LOWER SAUCON        932  1  48    UHLER DALE       2-C   4-B                            4 S P H W  4 0             D
LOWER SAUCON        933  1  48    WALLACH MARTIN   2-C   4-B                            4 S P H W  4 0             D
LOWER SAUCON        934  1  48    STOKE STEPHEN    2-C   4-B   206D  40 35  6  75 19 16 3 S P H W  2 0             D
LOWER SAUCON        935  1  48    KRAY JOSEPH      2-C   4-B   206D  40 35  4  75 19 15 3 S P H W  1 0             D
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  SEPTEMBER 16, 1985                             BUR. OF TOPO. AND GEOLOGIC SURVEY                                     PAGE:   33
                                      DEPT. OF ENVIRONMENTAL RESOURCES, HARRISBURG, PA 17120
  NORTHAMTON COUNTY                                GROUNDWATER INVENTORY SYSTEM
                                                           REPORT TYPE A
  [WELL RECORDS HAVE NOT BEEN FIELD CHECKED.]                                                               F
                     ---- ---                                                                  O W    W     I
                                                                                           A   W A W  E  F  E     Q  Q     A  L
                                                                                           C   N T E  L  R  L  H  /  /  P  P  O
                                                                                           C A E E L  L  E  D  Y  W  W  U  E  G
                                                      USGS  PA         LATITUDE  LONGITUDE U G R R L     Q     D        M  R
                                                                                           R E S      D     C     T  F  P  T  D
                   WELL  S  C                         SUB- SUB- QUAD   D  M  S   D  M  S   A N H U U  A  W  H  L  Y  R  A  U  A
                         E  T                                          E  I  E   E  I  E   C C I S S  T  /  A  A  P  E  G  R  T
 TOWNSHIP           NO.  O  Y       **   OWNER   **   BAS. BAS. CODE   G  N  C   G  N  C   Y Y P E E  A  L  R  B  E  Q  E  E  A
.........................................................................................................................................
XXXXXXXXXXXXXXXX    XXXX X  XX      XXXXXXXXXXXXXXX   XX-XX XX-X XXXX  XX XX XX  XX XX XX  X X X X X  X  X  X  X  X  X  X  X  XX

LOWER SAUCON        936  1  48      MAKOS JOHN        2-C  4-B  206D                       4 S P H W  1  0                    D
LOWER SAUCON        937  1  48      TALABER WILLIAM   2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        938  1  48      DANYLUK WILLIAM   2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        939  1  48      NOCEK MARY        2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        940  1  48      MESSIC LOUIS      2-C  4-B  206D                       4 S P H W  1  0                    D
LOWER SAUCON        941  1  48      VALOS BAKING CO   2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        942  1  48      DELEON ALEX       2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        943  1  48      STRAIN JOHN       2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        944  1  48      SCHRANTZ JAMES    2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        945  1  48      BLOSS KENNETH     2-C  4-B                             4 S P H W  3  0                    D
LOWER SAUCON        946  1  48      EVANS ROBERT      2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        947  1  48      MEDEI GENE        2-C  4-B                             4 S P H W  3  0                    D
LOWER SAUCON        948  1  48      HANOVER HOMES     2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        949  1  48      WALLACH MARTIN    2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        950  1  48      CRESSMAN GLENN    2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        951  1  48      FISHER JOHN       2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        952  1  48      GRASIC VINCE      2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        953  1  48      BARTHOLOMEW H     2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        954  1  48      PALIK ALBERT      2-C  4-B  206D   40 33 43  75 21 38  3 S P H W  1  0                    D
LOWER SAUCON        955  1  48      KARDOS EDWARD     2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        956  1  48      LAWRENCE HARRY    2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        957  1  48      SHOOK DONALD      2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        958  1  48      MERTUS LOUIS      2-C  4-B                             4 S P H W  3  0                    D
LOWER SAUCON        959  1  48      KRAMER JACOB      2-C  4-B                             4 S P H W  1  0                    D
LOWER SAUCON        960  1  48      FISCHEL J & SON   2-C  4-B                             4 S P H W  2  0                    D
LOWER SAUCON        961  1  48      BUDDOCK MIKE      2-C  4-B  206D   40 36  8  75 19     3 S P H W  1  0                    D
LOWER SAUCON        962  1  48      BILLARD DAVID     2-C  4-B  206D                       4 S P H W  1  0                    D
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    SEPTEMBER 16, 1985                            BUR. OF TOPO. AND GEOLOGIC SURVEY
                                        DEPT. OF ENVIRO    TAL RESOURCES, HARRISBURG, PA 17120
    NORTHAMTON COUNTY                                    GR    WATER INVENTORY SYSTEM
                                                             REPORT TYPE B
    [WELL LOCATIONS HAVE NOT BEEN FIELD CHECKED.]                                                                ** FIELD CHEMISTRY
                    ---- ---                      D   Y
                                                  R   R     L D                                                          S
                                    A             I         I E         A        A              M      A             C H P
                                    C             L   D   S F E    ALT. C        C              E      C           S H A E
                                    C           F L   R P E T P         C        C              T      C           U L R C
                                    U           I     I U T   / P LAND/ U        U              H DRAW U   PUMP    L O D
                                    R           N M   L M T M S O       R        R                     R         I F R N C   T DATE
                   WELL  S  C WELL  A DEPTH DIA I E   L P I E H W SURF/ A  WATER A DATE YIELD   D DOWN A  PERIOD R A I E O   E
                         E  T       C           S T   E   N T A E       C        C              E      C         O T D S N   M SAM-
   TOWNSHIP        NO.   Q  Y DEPTH Y CASED IN. H H   D   G H L R DATUM Y  LEVEL Y MEAS ( GPM ) T (FT) Y ( HRS ) N E E S D   P PLED
  .................................................................................................................................
  XXXXXXXXXXXXXXXX XXXX  X XX XXXXX X XXXXX XXX X X XXX XXX X X X XXXXX X +XXXXX X X/XX XXXXX.X X XXXX X XXXX.XX X X X X X XXX X/XX

  LOWER SAUCON      260  1 48   102 3    26   6 X A 972  90                   30 D 2/72    25.0 0            .00
  LOWER SAUCON      261  1 48   102 3    60   6 X A 969                       30 D 9/69    20.0 0            .49
  LOWER SAUCON      262  1 48   195 3    30   6 X A 970                       90 D 7/70    25.0 0            .49
  LOWER SAUCON      263  1 48    52 3    16   6 X A 969                       30 D 9/69    20.0 0            .49
  LOWER SAUCON      913  1 48   201 3    96   6 X C 966                 5    110 D 7/66    24.0      2 3     .49
  LOWER SAUCON      914  1 48   214 3    61   6 X A 966                 5    100 D 8/66    30.0     60 3    1.00
  LOWER SAUCON      915  1 48    75 3    41   6 X C 966                 5     63 D 6/66    25.0     11 3    2.00            52
  LOWER SAUCON      916  1 48   113 3    20   6 X A 666                 5        D 6/66    15.0        3     .49
  LOWER SAUCON      917  1 48   378 3   311   6 X C 966                 5        D 6/66     5.0        3   40.49
  LOWER SAUCON      918  1 48   150 3   140   6 X A 966                 5        D 7/66    60.0        3     .49
  LOWER SAUCON      919  1 48   160 3   1[illegible]   6 X A 966                 5        D 8/66    30.0        3     .49
  LOWER SAUCON      920  1 48   125 3    78   6 X A 966                 5        D 8/66    40.0        3     .49
  LOWER SAUCON      921  1 48   140 3    20   6 X C 966                 5     30 D 9/66    12.0        3    2.00            52
  LOWER SAUCON      922  1 48   104 3    26   6 X A 966                 5        D 0/66    20.0        3     .49
  LOWER SAUCON      923  1 48   177 3    45   6 X A 966                 5        D N/66    10.0        3     .49
  LOWER SAUCON      924  1 48   260 3   207   6 X C 966                 5        D 0/66    20.0        3    8.00
  LOWER SAUCON      925  1 48    77 3    68   6 X A 966                 5        D 0/66    25.0        3     .49
  LOWER SAUCON      926  1 48   102 3    70   6 X A 967                 5        D 1/67   150.0        3     .49
  LOWER SAUCON      927    48   254 3   125   6 X A 967                 5        D 2/67    10.0        3     .49
  LOWER SAUCON      928  1 48   155 3    90   6 X A 967                 5        D 3/67    15.0        3     .49
  LOWER SAUCON      929  1 48    55 3    54   6 X C 967                 5     35 D 4/67    30.0        3    3.00            54
  LOWER SAUCON      930  1 48    50 3         6 X C 967                 5     30 D 5/67    30.0        3    2.00            52
  LOWER SAUCON      931  1 48   100 3    28   6 X A 967                 5        D 7/67    10.0        3     .49
  LOWER SAUCON      932  1 48    82 3    42   6 X A 967                 5        D 7/67    15.0        3     .49
  LOWER SAUCON      933  1 48   320 3   110   6 X A 967                 5        D 7/67     5.0        3     .49
  LOWER SAUCON      934  1 48    58 3    54   6 X C 967                 5     30 D 8/67    25.0        3    2.00            54
  LOWER SAUCON      935  1 48    85 3    13   6 X C 967                 5     68 D 8/67     5.0     50 3    3.00            52
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  SEPTEMBER 16, 1985                            BUR. OF TOPO. AND GEOLOGIC SURVEY                                   PAGE:   33
                                     DEPT. OF ENVIRONMENTAL RESOURCES, HARRISBURG, PA 17120
  NORTHAMTON COUNTY                                 GROUNDWATER INVENTORY SYSTEM
                                                          REPORT TYPE B
  [WELL LOCATIONS HAVE NOT BEEN FIELD CHECKED.]                                                               ** FIELD CHEMISTRY
                  ---- ---                      D   Y
                                                R   R     L D                                                           S
                                  A             I         I E         A        A              M      A             C H P
                                  C             L   D   S F E    ALT. C        C              E      C           S H A E
                                  C           F L   R P E T P         C        C              T      C           U L R C
                                  U           I     I U T   / P LAND/ U        U              H DRAW U  PUMP     L O D
                                  R           N M   L M T M S O       R        R                     R         I F R N C T DATE
                 WELL  S C   WELL A DEPTH DIA I E   L P I E H W SURF/ A  WATER A DATE YIELD   D DOWN A  PERIOD R A I E O E
                       E T        C           S T   E   N T A E       C        C              E      C         O T D S N M SAM-
 TOWNSHIP        NO.-  Q Y  DEPTH Y CASED IN. H H   D   G H L R DATUM Y  LEVEL Y MEAS ( GPM ) T (FT) Y ( HRS ) N E S S D P PLED
................................................................................................................................
XXXXXXXXXXXXXXXX XXXX  X XX XXXXX X XXXXX XXX X X XXX XXX X X X XXXXX X +XXXXX X X/XX XXXXX.X X XXXX X XXXX.XX X X X X X XXX X/XX

LOWER SAUCON      936  1 48    86 3    85   6 X C 967                 5     35 D 9/67     8.0        3    3.00            52
LOWER SAUCON      937  1 48   152 3    91   6 X A 967                 5     20 D N/67     3.0              .49
LOWER SAUCON      938  1 48   190 3    55   6 X A 968                 5    110 D 2/68    10.0              .49
LOWER SAUCON      939  1 48   104 3    41   6 X A 968                 5     84 D 4/68    20.0              .49
LOWER SAUCON      940  1 48    96 3    35   6 X C 968                 5     45 D 4/68    15.0      5 3     .00            52
LOWER SAUCON      941  1 48    50 3    15   6 X A 968                 5     25 D 9/68     8.0              .49
LOWER SAUCON      942  1 48    67 3    17   6 X A 968                 5     28 D 9/68    10.0              .00
LOWER SAUCON      943  1 48   130 3   108   6 X A 968                 5    100 D 4/68    30.0              .00
LOWER SAUCON      944  1 48   180 3   135   6 X A 968                 5    144 D 4/68    30.0              .49
LOWER SAUCON      945  1 48   102 3    46   6 X A 968                 5     65 D 5/68    20.0              .49
LOWER SAUCON      946  1 48   123 3    85   6 X A 968                 5     78 D 6/68     6.0              .49
LOWER SAUCON      947  1 48    96 3    69   6 X A 968                 5     60 D 5/68    25.0              .49
LOWER SAUCON      948  1 48    83 3    69   6 X A 968                 5     64 D 7/68    25.0              .49
LOWER SAUCON      949  1 48   171 3   166   6 X A 958                 5    134 D N/58     5.0             1.00
LOWER SAUCON      950  1 48   248 3    50   6 X A 969                 5     75 D 6/69     5.0              .49
LOWER SAUCON      951  1 48   200 3   168   6 X A 969                 5     75 D 6/69    15.0              .00
LOWER SAUCON      952  1 48   147 3    79   6 X A 969                 5     40 D 6/69    30.0              .00
LOWER SAUCON      953  1 48   157 3    28   6 X A 969                 5     35 D 4/69     3.0              .49
LOWER SAUCON      954  1 48   125 3   115   6 X C 968                 5     37 D N/68    20.0        3     .00            52
LOWER SAUCON      955  1 48   150 3    17   6 X A 968                 5     40 D 7/68     5.0              .49
LOWER SAUCON      956  1 48   104 3    58   6     968                 5     15 D 7/68    12.0              .49
LOWER SAUCON      957  1 48   115 3    50   6 X A 968                 5     65 D 7/68    12.0              .49
LOWER SAUCON      958  1 48   165 3   158   6 X C 968                 5     86 D 4/68    15.0     54 3    9.00
LOWER SAUCON      959  1 48    80 3    68   6 X C 9[illegible]                 5     44 D 8/66    15.0      3 3    4.00
LOWER SAUCON      960  1 48   200 3    47   6 X A 967                 5     80 D D/67     8.0        3     .49
LOWER SAUCON      961  1 48   132 3         6 X C 967                 5     4[illegible]0/67    12.0      5      3.00
LOWER SAUCO       962  1 48   203 3   182   6 X C 967                 5    1[illegible]/67    30.0     12 3     .00            52
```

SEPTEMBER 16, 1985 BUR. TOPO. AND GEOLOGIC SURVEY
DEPT. OF ENVIRO TAL RESOURCES, HARRISBURG, PA 17120
NORTHAMTON COUNTY GROUNDWATER INVENTORY SYSTEM
REPORT TYPE C

[WELL LOCATIONS HAVE NOT BEEN FIELD CHECKED.]

							**** MAJOR AQUIFER ****								**** aquifer MINOR AQUIFER ****												SURF MAT.		TRANS COEF		STORE COEF	
TOWNSHIP	WELL NO.	SEQ	CTY	PROVINCE	SECTION	TOPO SET	SYSTEM	SERIES	FORM	LITHOLOGY	ORIGIN	AQUIFER THICKNESS	LENGTH OF WELL OPEN	DEPTH TO TOP OF	SYSTEM	SERIES	FORM	LITHOLOGY	ORIGIN	AQUIFER THICKNESS	LENGTH OF WELL OPEN	DEPTH TO TOP OF	DEPTH TO CONSOL ROCK	SOURCE	DEPTH TO BASEMENT	SOURCE	LITH	INFILT	SIG FIG	TEN POW	SIG FIG	TEN POW
XXXXXXXXXXXXXXXX	XXXX	X	XX	XX	X	X	X	X	XX	XX	X	XXX	XXXX	XXXX	X	X	XX	XX	X	XXX	XXXX	XXXX	XXXXX	X	XXXXX	X	XX	X	XX	X	XX	X
LOWER SAUCON	936	1	48	9	A					G			1	80									60	D			U					
LOWER SAUCON	937	1	48	9	A					V				80				V				140	85	D			S					
LOWER SAUCON	938	1	48	9	A					L				160				L				185	49	D			U					
LOWER SAUCON	939	1	48	9	A					L				86				L				92	35	D			U					
LOWER SAUCON	940	1	48	9	A		Z	-	2W	H				35	Z	-	2W	V				96	35	D			U					
LOWER SAUCON	941	1	48	9	A					V				35				V				46	5	D			U					
LOWER SAUCON	942	1	48	9	A					H				38				H				65	12	D			U					
LOWER SAUCON	943	1	48	9	A					L				125									103	D			U					
LOWER SAUCON	944	1	48	9	A					L				150				L				173	130	D			U					
LOWER SAUCON	945	1	48	9	A					L				76				L				82	40	D			U					
LOWER SAUCON	946	1	48	9	A								38	104								120	80	D			U					
LOWER SAUCON	947	1	48	9	A					L				70				L				92	56	D			U					
LOWER SAUCON	948	1	48	9	A					L			14	75									65	D			U					
LOWER SAUCON	949	1	48	9	A					G				175									160	D			U					
LOWER SAUCON	950	1	48	9	A					H			198	75				H				238	45	D			U					
LOWER SAUCON	951	1	48	9	A					G				175									163	D			U					
LOWER SAUCON	952	1	48	9	A					H			68	99				H				143	73	D			U					
LOWER SAUCON	953	1	48	9	A					H			129	152									23	D			U					
LOWER SAUCON	954	1	48	9	A		C	-	4G	F				115									49	D			U					
LOWER SAUCON	955	1	48	9	A					V			133	90				V				145	12	D			U					
LOWER SAUCON	956	1	48	9	A					V				72				V				83	53	D			U					
LOWER SAUCON	957	1	48	9	A					L				78				L				112	45	D			U					
LOWER SAUCON	958	1	48	9	A					S				100										D								
LOWER SAUCON	959	1	48	9	A					G				80										D			U					
LOWER SAUCON	960	1	48	9	A					H				85				H				115	40	D			U					
LOWER SAUCON	961	1	48	9	A		Z	-	2W	P				132										D			U					
LOWER SAUCON	962	1	48	9	A					F				100				F				150	150	D			U					

SEPTEMBER 16, 1985

NORTHAMTON COUNTY

BUR. OF TOPO. AND GEOLOGIC SURVEY
DEPT. OF ENVIRONMENTAL RESOURCES, HARRISBURG, PA 17120
GROUNDWATER INVENTORY SYSTEM
REPORT TYPE P

[WELL LOCATIONS HAVE NOT BEEN FIELD CHECKED.]

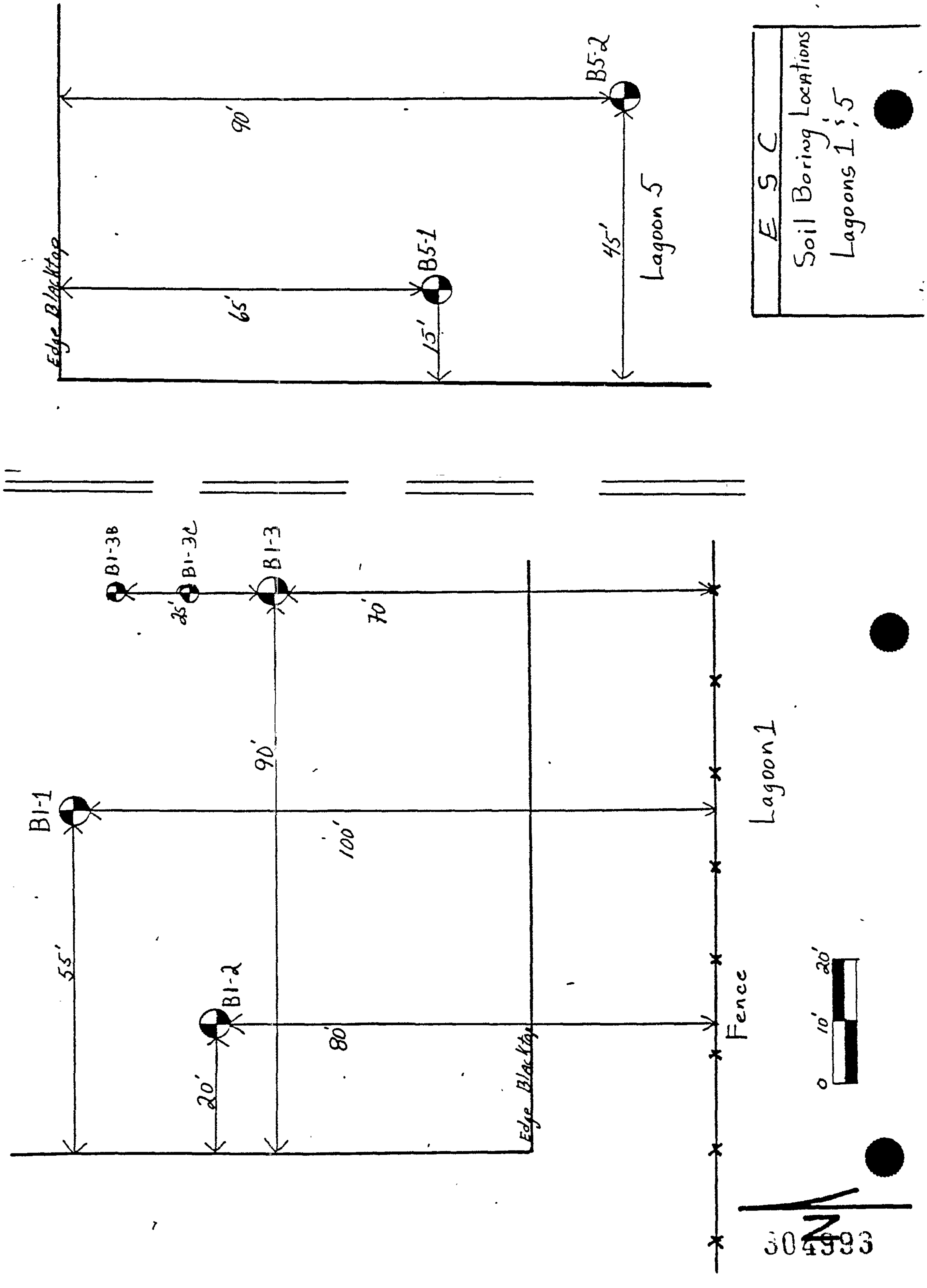
								ZONES				***** WATER-BEARING ZONES *****													
												FIRST		SECOND		THIRD		FOURTH							
TOWNSHIP	WELL NO.	SEQ	CTY	BWQM CODE	DRILLERS LIC. NO.	SPEC CAP. GPM/FT	DUR CAP. TEST	SOURCE	TOTAL	MAJOR	SOURCE	DEPTH	YIELD	DEPTH	YIELD	DEPTH	YIELD	DEPTH	YIELD	PH	HARDNESS	SPEC COND	BACT ANAL	ANAL DATE	SOURCE
XXXXXXXXXXXXXXXX	XXXX	X	XX	XX-XX.X	XXXX	XXXX	XXXX	X	X	X	X	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X.XX	XX	XXXX	X	XXX	X
LOWER SAUCON	936	1	48	6-22.0	1016				1		2	80	8							.00					
LOWER SAUCON	937	1	48		275				2		2	80	3	140						.00					
LOWER SAUCON	938	1	48		275				2		2	160	10	185						.00					
LOWER SAUCON	939	1	48		275				3		2	86	20	92		100				.00					
LOWER SAUCON	940	1	48	6-22.0	1016				2		2	35	15	96						.00					
LOWER SAUCON	941	1	48		275				2		2	35	8	46						.00					
LOWER SAUCON	942	1	48		275				2		2	38	10	65						.00					
LOWER SAUCON	943	1	48		275				1		2	125	30							.00					
LOWER SAUCON	944	1	48		275				2		2	150	30	173						.00					
LOWER SAUCON	945	1	48		275				3		2	76	20	82		100				.00					
LOWER SAUCON	946	1	48		275				2		2	104	6	120						.00					
LOWER SAUCON	947	1	48		275				2		2	70	25	92						.00					
LOWER SAUCON	948	1	48		275				1		2	75	25							.00					
LOWER SAUCON	949	1	48		275				1		2	175	5							.00					
LOWER SAUCON	950	1	48		275				2		2	75	5	238						.00					
LOWER SAUCON	951	1	48		275				1		2	175	15							.00					
LOWER SAUCON	952	1	48		275				2		2	99	30	143						.00					
LOWER SAUCON	953	1	48		275				1		2	152	3							.00					
LOWER SAUCON	954	1	48	6-22.0	1016				1		2	115	20							.00					
LOWER SAUCON	955	1	48		275				2		2	90	5	145						.00					
LOWER SAUCON	956	1	48		275				3		2	72	12	83		96				.00					
LOWER SAUCON	957	1	48		275				2		2	78	12	112						.00					
LOWER SAUCON	958	1	48		92				1		2	160	15							.00					
LOWER SAUCON	959	1	48		1016				1		2	80	15							.00					
LOWER SAUCON	960	1	48		275				2		2	85	8	115						.00					
LOWER SAUCON	961	1	48	6-22.0	1016				1		2	132	12							.00					
LOWER SAUCON	962	1	48	6-22.0	1016				2		2	100	30	150						.00					

```
  SEPTEMBER 16, 1985                           BUR.    TOPO. AND GEOLOGIC SURVEY
                                     DEPT. OF ENVIR     TAL RESOURCES, HARRISBURG, PA 17120
  NORTHAMTON COUNTY                              GROUNDWATER INVENTORY SYSTEM
                                                         REPORT TYPE C
  [WELL LOCATIONS HAVE NOT BEEN FIELD CHECKED.]
                  ---- ---            ****  MAJOR AQUIFER  ****  ****  MINOR AQUIFER  ****                      SURF  TRANS STORE
                                              L     T  L W                 L     T  L W
                               P   T          I     H  E E  D              I     H  E E  D  $          D  B     MAT. COEF  COEF
                               R S O          T   A I  N L  E              T   A I  N L  E  E          E  A          S T   S T
                               O E P  S S     H O Q C  G L  P T    S S     H O Q C  G L  P TP $    $   P  S  $   I   I E   I E
                               V C O  Y E     O R U K  T    T O    Y E     O R U K  T    T OT O    O   T  E  O   N   G N   G N
                               I T    S R  F  L I I N  H O  H P    S R  F  L I I N  H O  H PH N R  U   H  M  U  L F
                    WELL S  C  N I S  T I  O  O G F E    P         T I  O  O G F E    P       S Q  R      E  R  I I  F P   F P
                         E  T  C O E  E E  R  G I E S  O E  T O    E E  R  G I E S  O E  T OT O C  C   T  N  C  T L  I O   I O
 TOWNSHIP           NO.  Q  Y  E N T  M S  M  Y N R S  F N  O F    M S  M  Y N R S  F N  O FO L K  E   O  T  E  H T  G W   G W
-------------------------------------------------------------------------------------------------------------------------------
XXXXXXXXXXXXXXXX   XXXX  X XX XX X X  X X XX XX X XXX XXXX XXXX    X X XX XX X X>A XXXX XXXX  XXXXX  X  XXXXX  X  XX X  XX X  XX X

 LOWER SAUCON       260  1 48                 Z         76   80            7              97   21  D             U
 LOWER SAUCON       261  1 48                 V         42   77            V             100   55  D            BU
 LOWER SAUCON       262  1 48                 L        165  115            L             138   20  D             U
 LOWER SAUCON       263  1 48                8F         36   45                                10  D             U
 LOWER SAUCON       913  1 48  9 A S  C - 1E  L        105  112                                98  D             P
 LOWER SAUCON       914  1 48  9 A            L        153  100            L             204   49  D             U
 LOWER SAUCON       915  1 48  9 A    C - 9H  V         34   60    C - 9H  L              75   43  D
 LOWER SAUCON       916  1 48  9 A    C - 1E  L         93   50    C - 1E  L             110   10  D             U
 LOWER SAUCON       917  1 48  9 A            G         67  375                               300  D             U
 LOWER SAUCON       918  1 48  9 A            V         10  146                               134  D             U
 LOWER SAUCON       919  1 48  9 A            G         30  150                               130  D             U
 LOWER SAUCON       920  1 48  9 A            G         47  100            G             120   72  D             U
 LOWER SAUCON       921  1 48  9 A    C - 4G  L        120  128                                 8  D
 LOWER SAUCON       922  1 48  9 A            V         78   64            V              82   20  D             U
 LOWER SAUCON       923  1 48  9 A           9L        132  140           9L             160   40  D             U
 LOWER SAUCON       924  1 48  9 A            G         53  250                                                  G
 LOWER SAUCON       925  1 48  9 A            V          9   65                                63  D             G
 LOWER SAUCON       926  1 48  9 A            L         32   70            L              72   25  D             U
 LOWER SAUCON       927    48  9 A            L        129  140            L             165  120  D             U
 LOWER SAUCON       928  1 48  9 A            G         65  125            G             140   85  D             U
 LOWER SAUCON       929  1 48  9 A            V          1   20            V              55   55  D             U
 LOWER SAUCON       930  1 48  9 A    C - 4G  F              15    C - 4G  L              30   23  D             F
 LOWER SAUCON       931  1 48  9 A            L         72   75            L              96   20  D             U
 LOWER SAUCON       932  1 48  9 A            Z         40   80                                35  D             U
 LOWER SAUCON       933  1 48  9 A            H        210  285                               100  D             U
 LOWER SAUCON       934  1 48  9 A    Z - 2W  G          4   50                                58  D             U
 LOWER SAUCON       935  1 48  9 A    Z - 2W  H         72   13    Z - 2W  H              30   13  D             U
```

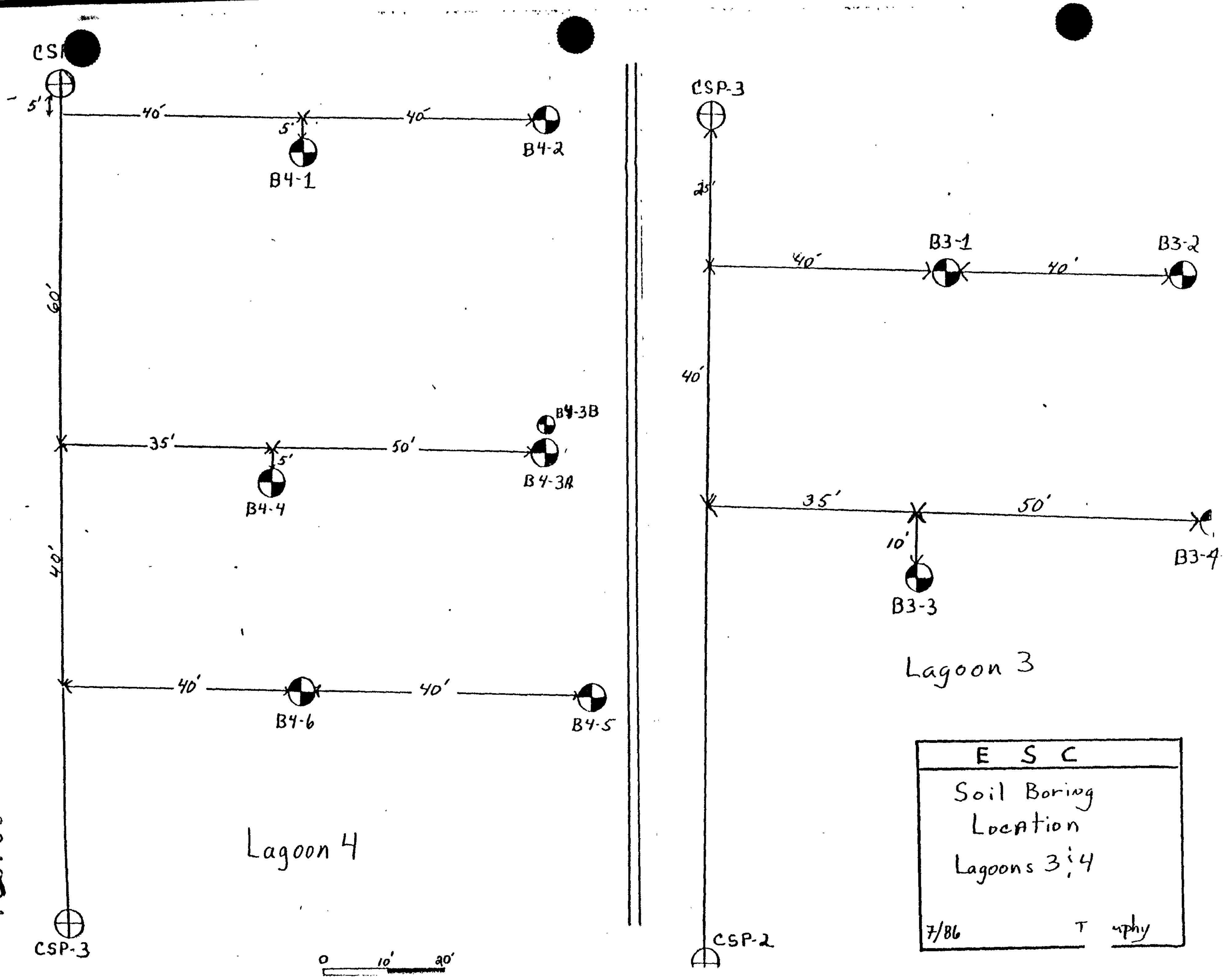
Appendix B - Location of soil borings collected June 1986
Depth of soil samples;
Logs of borings collected June 1986

Location of surface impoundment borings



E S C

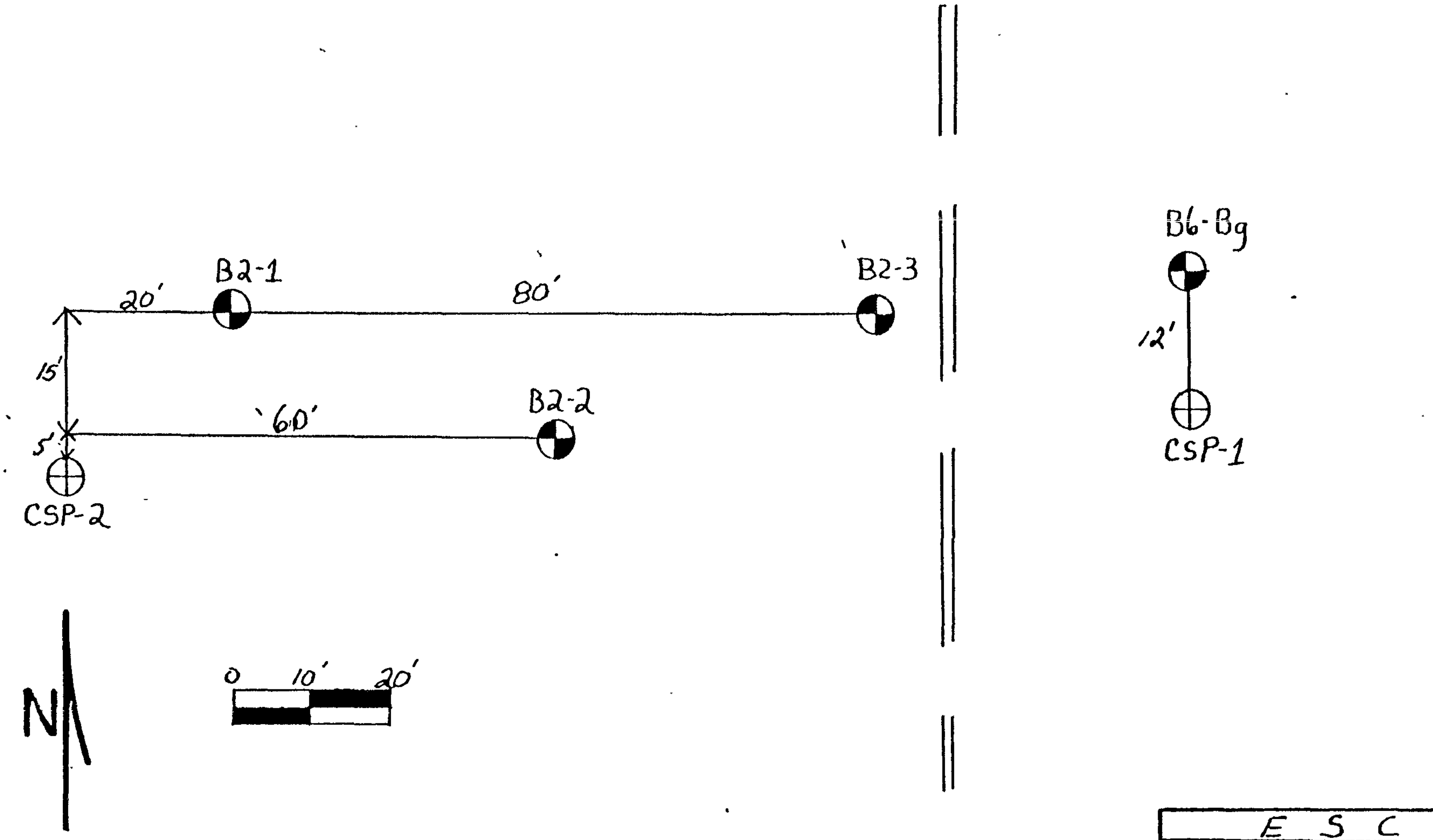
Soil Boring Locations
Lagoons 1 & 5



E S C

Soil Boring
Location
Lagoons 3 & 4

7/86 T urphy



E S C

Soil Boring Locations
Lagoon 2 and
Background

7/86 ...mphy

Depth of soil samples collected in June 1986

Appendix B

List of Soil Samples from Soil Borings Collected in June 1986
Hellertown Site

LAGOON	BORING	SAMPLE	ANALYSIS		ARCHIVED	STORED
		DEPTH	ETC#	ESC	ETC#	ONSITE
1	B1-1	5-6.5				x
		10-11.5				x
		15-16.5	m6617			
		20-22				x
		25-30	m6613	x		
		35-36.5				x
	B1-2	5.6.5				x
		10-11.5			m6614	
		13-17.2(grab)	m6615			
	B1-3	5.6.5				x
		10-11.5			m6611	
		15-17	m6610			
2	B2-1	5-6.5				x
		10-11.5				x
		17-19			m7262	
		21-26.5	m7261	x		
		30-31.5	m7260			
		35-36.5				x
		40-41.5				x

	B2-2	5-6.5				x
		10-11.5			m7270	
		15-16.5				x
		20-25.5	m7273			
		25.5-28.5	m7271			
	B2-3	5-6.5				x
		10-11.5			m7274	
		15-16.5				x
		20-22	m7272	x		
3	B3-1	5-6.5				x
		10-11.5				x
		17-19				x
		19-23	m7279			
		25-31.5	m7280			
		35-36.5				x
	B3-2	5-6.5				x
		10-11.5				x
		15-21	m7265			
		23-25	m7266			
		30-31.5			m7267	
		35-36.5				x
	B3-3	5-6.5				x
		10-11.5				x
		15-21	m7268			
		25-26.5	m7269			
	B3-4	5-6.5				x
		10-12	m7263			
		15-16.5	m7264			

	B4-6	5-6.5				x
		10-11.5				x
		17-21	m7275			
5	B5-1	5-6.5				x
		10-11.5				x
		16-21	m6612	x		
		25-26.5	m6608			
		30-31.5			m6609	
		35-36.5				x
	B5-2	5-6.5				x
		10-11.5			m6619	
		16.5-20	m6618	x		
		20-21	m6622			
Background	B6-Bg	5-6.5				x
		10-11.5				x
		15-18	m6620	x		
		20-21.5	m6621			
TOTALS			31	7	9	47

WATER SAMPLES

Surface samples	Groundwater samples
SW -1	CSP-1
SW-2	CSP-2
SW-3	CSP-3
	CSP-4

4	B4-1	0-1.5				x
		5-6.5				x
		10-11.5				x
		17-22.5	m7276	x		
		25-27	m7278			
		30-31.5				x
	B4-2	0-1.5				x
		5-6.5				x
		10-11.5				x
		15-16.5				x
		20-21.5	m6607			
		25-26.5				x
		30-31.5	m6606			
		30-30.2			m6605	
	B4-3	0-1.5				x
		5-7				x
		10-11.5				x
		15-16.5				x
		17-22	m6603			
		25-26.5	m6604			
	B4-4	0-2				x
		5-6.5				x
	B4-5	10-11.5				x
		17-21	m7277			

Logs of borings collected June 1986

ESC
Boring Log

Project
Hellertown Manufacturing
Hellertown, PA

Boring No. B1-1

e 6-30-86

Driller Martin-Huber

Drill Method hollow Auger

Hole size 8"

Sample Method 2" Split Spoon

Ground Elev.

Depth Groundwater

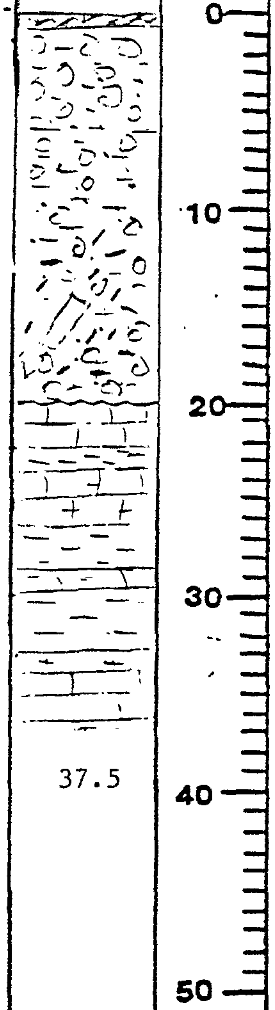
Total Depth 37.5

Grout Depth Surface

Logged By Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval
3	5-7-16	15"	S
0	3 -3-2	12"	S
15	3-100/0"		S*
	25-20-34	18"	S
-	3-15-30-22	15"	S*
	12-12-51/54	15"	S*
	-	6"	S*
-	51/5"	NR	S
0	33-41-51/3	7"	S

Graphic Log **Depth**



Description

Surface Blacktop Asphalt
Fill - Red Brown silt w/ Limestone fragments, green shade to silt dry to slightly moist
10-11-5 - Fill As above grades into orange brown silt, very moist wood fragments and spark plugs in cuttings
15-16-5 - Fill? Top 7" As above grades into light brown silt, very moist wood fragments and spark plug in cuttings
20-22 Wx Limestone light gray to light brown
25-30 Wx Limestone and shale - wx shale is orange brown moist, wx Limestone is light brown dry
35-36.5 wx Limestone and shale as above

refusal @ 37.5
Bedrock

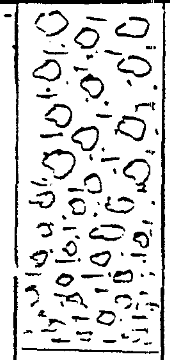
Comments

Spark plugs in cuttings

* sent to lab for analysis combined 25-30'

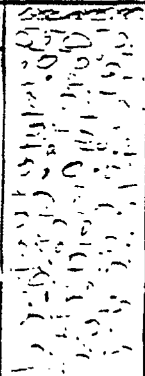
ESC
Boring Log

Project Hellertown Manufacturing Hellertown, PA				**Boring No.** B1-2
te 6-30-86	**Driller** Martin-Huber	**Drill Method** hollow Auger	**Hole size** 8"	**Sample Metho** 2" split spoon
Ground Elev.	**Depth Groundwater**	**Total Depth** 17.5'	**Grout Depth** surface	**Logged By** Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval	Graphic Log	Depth	Description	Comments
					0	Fill - Grown silt with sand, gravel and many pink granite cobbles dry Fill - As above, cobbles are granite and limestone slightly moist 13-17.2 - grades gray sandy silt, moist	
40	20-21-24	10"	S		10		color change @ 13' Sample 13-17.0 taken from cuttings 17-17.2 combined with 13-17 @ Lab
400-600	20-21-18	12"	S				
400 0+		5.5"	S*	17.5	20	Refusal @ 17.5'	- Sample stored @ Lab * - Sample sent to Lab for analysis
					30		
					40		
					50		

ESC
Boring Log

Project	Hellertown Manufacturing Hellertown, PA		**Boring No.**	B1-3
e 6-30-86	**Driller** Martin-Huber	**Drill Method** hollow Auger	**Hole size** 8"	**Sample Method** 2" split spoon
Ground Elev.	**Depth Groundwater**	**Total Depth** 19'	**Grout Depth** surface	**Logged By** Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval	Graphic Log	Depth	Description	Comments
					0	Surface - Blacktop (Asphalt)	
-	-	6"	S			Fill - Brown sandy silt w/gravel to cobble size rock fragments	
30	6-3-2	9"	S		10	Fill - As above green gray sandy silt w/gravel	Color change at 8'
20-25	13-29-51/6	3"	S*			51-16.5 - As above, green gray sandy silt w/gravel	Rock jammed in spoon sample from inside Auger at 15-17'
				19'			
					20	Auger broke off in hole moved 25' south refusal @ 4' moved 15' north refusal @ 5'	
					30		Sample stored in lab * Sample sent to lab for analysis
					40		
					50		

ESC
Boring Log

Project
Hellertown Manufacturing
Hellertown, PA

Boring No. B2-1

6-30-86

Driller Martin-Huber

Drill Method hollow Auger

Hole size 8"

Sample Metho 2" split spoon

Ground Elev.

Depth Groundwater

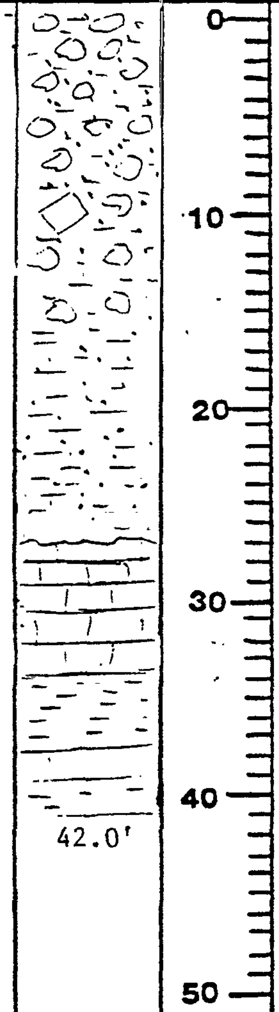
Total Depth 42.0'

Grout Depth 18'

Logged By Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval
2	6-5-3	3"	S
10	6-1-2	3"	S
210	20-22-18	18"	S
	20-22-67	12"	S*
6.5	5-6-3-4	12"	S*
combined	-		S*
5000	3-10-18-23	24"	S*
20	60-55-48		S*
90	7-4-17		S
10	10-6-48		S

Graphic Log / **Depth**



Description

<u>Fill</u> - Rod brown silt w/ boulders dry

<u>Fill</u> - brown sandy silt w/rock fragments and concrete

<u>Fill</u> - Red brown silt, soft wet

<u>19-21</u> As above

<u>21-26.5</u> - Sludge zone dark gray silt with layers of dark brown silty clay and light pale green laminations. Some layers mottled very dark gray

<u>26.5-27.5</u> Bottom 12" wx light brown limestone(?) dry to slightly moist

<u>30-31.5</u> - wx limestone bedrock

<u>35-36.5</u> wx silty shale to red brown clayey silt w/limestone rock fragments

<u>40-41.5</u> wx limestone

Refusal @ 42'

Comments

Note change

Very high OVA reading

Top bedrock @ 26.5

* 21-26.5 combined for analysis
30-31.5 - Sent to lab for analysis
17-19 - Sent to lab for storage

ESC
Boring Log

Project
Hellertown Manufacturing
Hellertown, PA

Boring No. B2-2

e 6- 28-86

Driller Martin-Huber

Drill Method hollow Auger

Hole size 8"

Sample Method 2" split spoon

Ground Elev.

Depth Groundwater

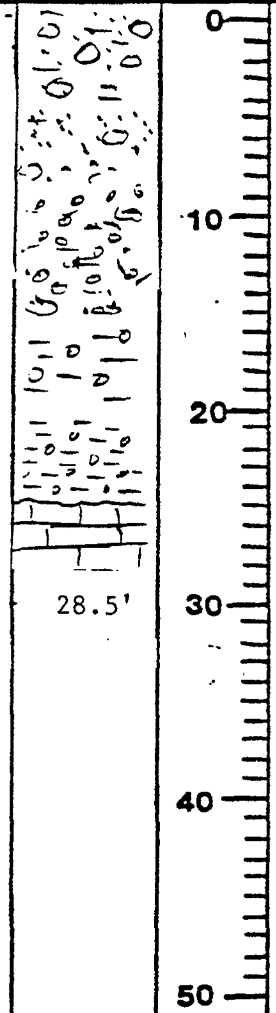
Total Depth 28.5

Grout Depth surface

Logged By Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval
4	6-7-9	12"	S
70	-	9"	S
2	4-3-7	2"	S
	23-2-6	10"	S*
1000	1-3-4-7	8"	S*
	4-3-7-42	20"	S*
0	30-55-40	10"	S*

Graphic Log **Depth**



Description

Fill - Red brown to brown silt
Fill light gray sand with brown silt layers and limestone fragments dry to slightly moist
10-11.5 Fill ? medium gray silty sand w/gravel moist
15-16.5 As above
20-25.0 Sludge zone greenish gray silty gravel, Black & light green laminations in bottom 2 feet, firm to soft, moist to wet
25.5 to 28.5 - wx limestone light brown with greenish tint, crumble dry

Refusal @ 28.5

Comments

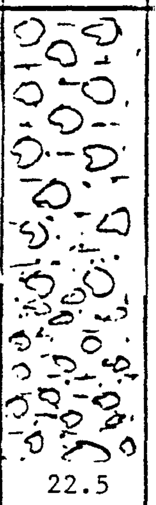
Color change @ 7-10'

Black and green laminations similar to that seen in B2-1

Sample sent to lab for storage
* 20-25.5 combined for analysis 25.5-27.5 - Also sent to lab for analysis

ESC
Boring Log

Project Hellertown Manufacturing Hellertown, PA				Boring No. B2-3
te 6-28-86	Driller Martin-Huber	Drill Method hollow Auger	Hole size 8"	Sample Metho 2" split spoon
Ground Elev.	Depth Groundwater	Total Depth 22.5'	Grout Depth 3'	Logged By Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval	Graphic Log	Depth	Description	Comments
				 22.5	0	Fill - Reddish brown silt w/gravel and boulders	
0	--	2"	S				Top 12' drilling difficult due to boulder
	-	NR	S		10	15-16.5 - greenish gray sand and gravel - wet 20-22 - As above more silt and clay	Note color change @ 13'
20	18-12-14		S				
30	21-20-18-9		S*		20	Refusal @ 22.5' hit boulder possibly bedrock Boring never reached the sludge zone present in B2-1 & B2-2	
					30		Sample stored at Lab * Sample sent to lab for analysis
					40		
					50		

305007

ESC
Boring Log

Project
Hellertown Manufacturing
Hellertown, PA

Boring No.
B3-1

[illegible]e 6-26-86

Driller Martin-Huber

Drill Method hollow Auger

Hole size 8"

Sample Method 2" split spoon

Ground Elev.

Depth Groundwater

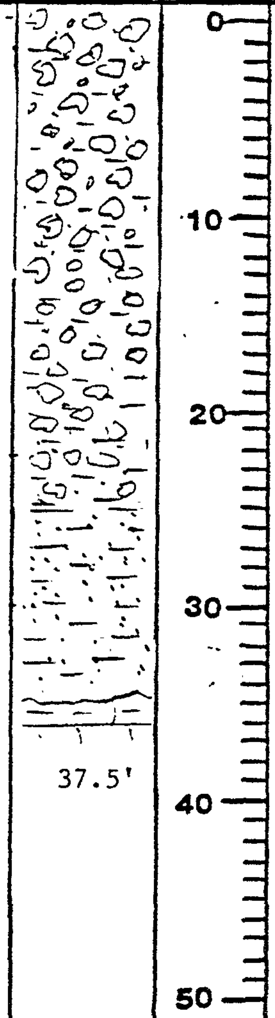
Total Depth 37.5

Grout Depth surface

Logged By Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval
-	4-11-11	3"	S
-	6-21-8		S
100-150	5-5-5-5	24"	S
	6-8-10-6	4"	S*
[illegible]-20	6-10-7-6	12"	S*
20	10-11-8-9	20"	S*
10	35-22-2		S

Graphic Log / **Depth**



Description

Fill - Red brown silt w/ sand and gravel
Fill - greenish gray silt gravel and rock fragments moist wet large Mica flakes(?)
25-31.5 Red brown clayey silt w/sand moist
35-36.5 wx bedrock composed of micacous silty shale and limestone

Refusal @ 37.5

Comments

Note color change water @ 9'

Broke Auger on Boulder @ 17' moved hole 3' north

25-31.5 below fill no real sludge zone observed as in B3-3 & lagoons

* combined samples 19-23 and sent to lab for analysis

ESC
Boring Log

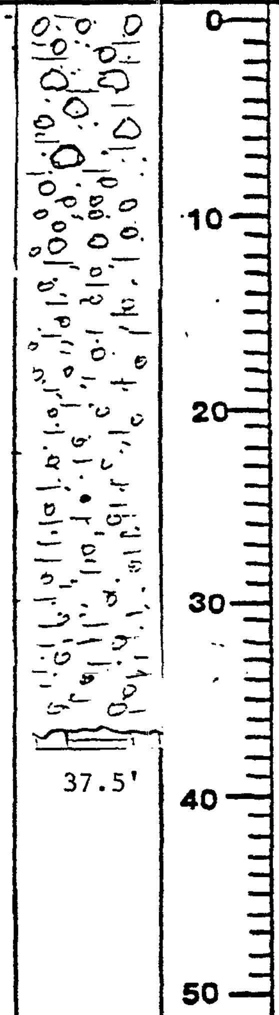
	Project Hellertown Manufacturing Hellertown, PA	**Boring No.** B3-2

te	**Driller**	**Drill Method**	**Hole size**	**Sample Metho**
6-26-86 6-27-86	Martin-Huber	hollow Auger	8"	2" split spoon

Ground Elev.	**Depth Groundwater**	**Total Depth**	**Grout Depth**	**Logged By**
		37.5	20'	Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval
NR			
-	16-11-8	10"	S
28	5-11-100	8"	S
93	3-7-13-18	4"	S*
150	6-7-11-14	22"	S*
150	12-15-14-15	14"	S*
50	2-3-4	10"	S
2	2-2-2	8"	S

Graphic Log **Depth**



Description

Fill - Red brown silt and sand w/gravel and limestone fragments dry

Fill ? greenish gray stickey silt w/minor gravel and pebbles

15-21 - medium green gray clayey silt with minor gravel - slightly moist layer at red brown silt @ 18.9-19.0, Firm few pebbles

23-25 - Red brown clayey silt w/gravel firm, moist

30-31.5 - As above with layer of mottled light gray silt - dry to slightly moist

35-36.5 As above - soft moist

Refusal @ 37.5 Bedrock

Comments

Note color change

15-19 is the potentially contaminate horizon

Note Color change

* combined 15-21 for analysis 23-35 sent for analysis 30-31.5 sent to lab for storage

ESC
Boring Log

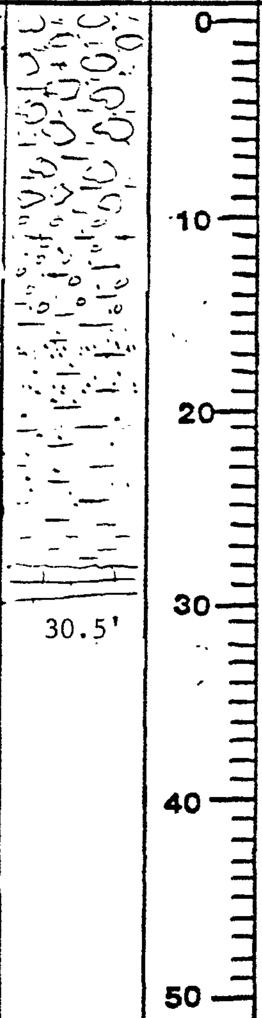
Project	Boring No.
Hellertown Manufacturing Hellertown, PA	B3-3

e	Driller	Drill Method	Hole size	Sample Method
6-27-86	Martin-Huber	hollow Auger	8"	2" split spoon

Ground Elev.	Depth Groundwater	Total Depth	Grout Depth	Logged By
		30.5	surface	Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval
0	9-5-5	4"	S
20	8-4-5	6"	S
170	3-1-2-3	8"	S*
175	4-22-4	12"	S*
[illegible]	4-4-5-7	18"	S*
40 to 2	5-4-4	14"	S*

Graphic Log **Depth**



Description

Fill - light brown sandy silt w/boulders, dry
10-11.5 - dark greenish gray silt w/clay gravel and Mica flakes
17-21 - dark greenish gray grading to dark gray clayey silt. Alternating layers of silt and clayey silt.
25-26.5 - Top 6" As above bottom 8" Red brown clayey silt w/thin black laminations

drilled into wx bedrock @ 28' refused @ 30.5

Comments

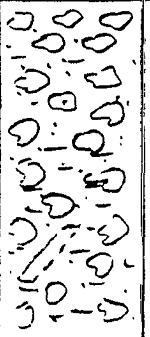
color change @18'

sample collected from top 6" and black laminations note color change

* 17-21 combined for analysis 25-26.5 Also sent to lab

ESC
Boring Log

Project	Hellertown Manufacturing Hellertown, PA			**Boring No.**	B3-4
e 6-27-86	**Driller** Martin-Huber	**Drill Method** hollow Auger	**Hole size** 8"	**Sample Metho** 2" split spoon	
Ground Elev.	**Depth Groundwater**	**Total Depth** 16'	**Grout Depth** surface	**Logged By** Tom Murphy	

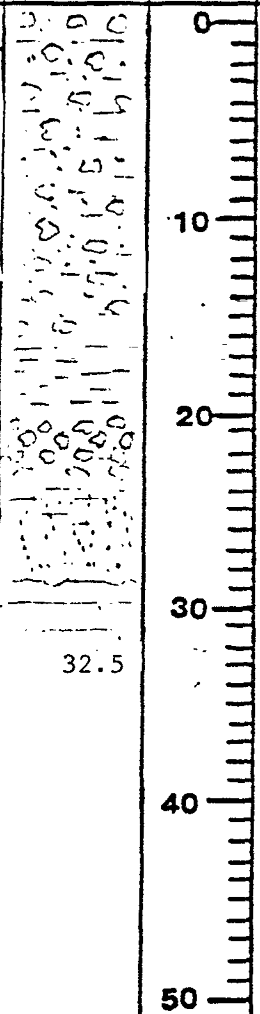
OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval	Graphic Log	Depth	Description	Comments
					0	Fill - Red brown silt with boulders	
50	15-15-13	15"	S			Fill? dark gray silt w/ gravel and boulders hard, dry	Note color change
5ppm	2-3-4-5	7"	S*		10	Fill dark gray clayey silt w/finished wood pieces and rock fragments	
-	-	3"	S*	16'		1st refusal @21.5' moved 5' west	
					20	15-16 - Recovered very wx rock fragments Fill Material?	
					30	2nd refusal @ 16.3'	*Samples sent to lab for analysis
					40		
					50		

ESC
Boring Log

Project	Champion Spark Plug Hellertown, PA			**Boring No.** B4-1
[illegible]e 6-26-86	**Driller** Martin-Huber	**Drill Method** Hollow Auger	**Hole size** 8"	**Sample Method** 2" Split Spoon
Ground Elev.	**Depth Groundwater**	**Total Depth** 32.5	**Grout Depth** 17	**Logged By** Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval
NR	-	8"	S
NR	5-7-14	7"	S
2	5-7-7	14"	S
50	5-8-11	10"	S*
[illegible]	4-5-6-6	6"	S*
[illegible]	6-4-2-2	4"	S*
2	-	24"	S*
NR	32-100-5		S

Graphic Log / **Depth**



Description

Fill - Topsoil, red brown silt with gravel, dry.

Fill - Red brown fine grained sand with clay and pebbles.

Fill - as above, more limestone fragments.

17-18.5 - light gray sandy silt with clay.

18.5-22.5 - sludge zone dark gray to black sandy silt with gravel bottom 1.5 feet composed of fresh limestone fragments. Material is wet to saturated.

25-27 - red brown silt with clay and gravel.

30-31.5 - wx. light gray limestone bedrock.

Refusal @32.5

Comments

Color change at 17'

HNU - 100

Below slug zone

HNU - 25

*To lab for analysis combined 17-22-5

ESC
Boring Log

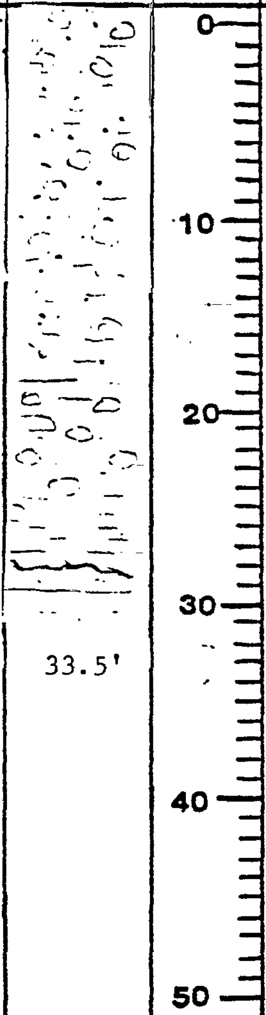
Project	Champion Spark Plug Hellertown, PA	**Boring No.** B4-2

e	**Driller**	**Drill Method**	**Hole size**	**Sample Metho**
6-25-86	Martin-Huber	Hollow Auger	8" diam.	2" diam. Split Spoon

Ground Elev.	**Depth Groundwater**	**Total Depth**	**Grout Depth**	**Logged By**
		33.5'	17'	Tom Murphy

OVA (ppm)	**Sample Blows**	**Sample Recovery**	**Sample Interval**
NR-0	-	-	S
NR	3-4-2	4"	S
NR	7-4-6	8"	S
2	3-8-8	8"	S
	3-3-3	9"	S*
NR	4-2-2	6"	S
NR	10-12-11	18"	S*

Graphic Log **Depth**



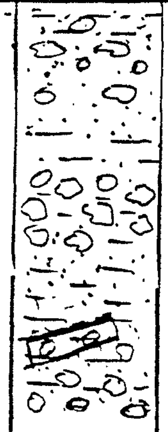
Description	**Comments**
Fill - Reddish brown silt with gray large size pebbles.	Question OVA Reading - Low Hydrogen
Fill - As above - gray boulder chips, dry.	
Fill - Mottled brown and yellow brown silt with sand. Moist.	
Fill - As above - brown silt with pebbles and sand. Large size pebbles at base. Moist.	color change @20' from red br. t green gray.
20-21.5 - Sludge, zone greenish gray silt with gravel and plastic. Moist.	Hit water @25'
25-26.5 - Sludge zone, greenish gray silt with gravel and sand. Wet.	Bedrock @30.5
30-31.5 - Top 4" dark gray silt. Moist to wet. - Bottom 14" - wet limestone Bedrock	*Samples sent to Lab for analysis
Refusal @33.5	
The color change may prevent the beginning of the sludge zone.	

ESC Boring Log

e 6-25-86	**Driller** Martin-Huber	**Drill Method** Hollow Auger	**Hole size** 8"	**Sample Method** Split Spoon
Ground Elev.	**Depth Groundwater**	**Total Depth** 20.2	**Grout Depth** 0'-to surface	**Logged By** Tom Murphy

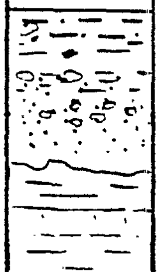
Project
Champion Spark Plug
Hellertown, PA

Boring No.
B4-3A

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval	Graphic Log	Depth	Description	Comments
	7-25-23		S		0	Fill - Topsoil, reddish brown silt with sand, gravel and pebbles.	OVA reading questionable due to low hydrogen levels.
470?	2-3-3	17"	S			Fill - As above - moist.	
30	2-1-4		S		10	Fill - As above - saturated layer of gravel and sand.	Water encountered @10'.
165	10-10-8	14"	S			Fill, cement, dry.	
5	100/2"	2"	S	20.2	20	Sludge? 20-20.2 silt w/ sand, black saturated water.	Note: moved 4' north drilled B4-3B
						Refusal due to boulder.	
					30		
					40		
					50		

ESC
Boring Log

Project	Champion Spark Plug Hellertown, PA
Boring No.	B4-3B
te	6-25-86
Driller	Martin-Huber
Drill Method	Hollow Auger
Hole size	8"
Sample Metho	Split Spoon
Ground Elev.	
Depth Groundwater	
Total Depth	30.2
Grout Depth	To surface
Logged By	Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval	Graphic Log	Depth	Description	Comments
					0	0 to 20' Samples logged on Boring B4-3A	Location of B4-3B is 4' north of B4-3A
					10	<u>17-19</u> <u>Fill</u> - Reddish brown clayey silt.	Combined 17-22 for lab analysis.
75	NR	8"	S*			<u>20-27</u> silt <u>Top 4"</u> - Black "sludge zone" mostly sand and gravel, saturated.	
75	1-1-1-5 24"	22"	S*		20		
30	10-20-21	18"	S*			Bottom 18" - light gray sand and gravel, wet.	
	100/2"	2"	S		30	<u>25-26.5</u> - wx. shale and limestone, yellow, gray green and wet.	Strange odor
				30.2'		<u>30-30.2</u> - Bedrock	
					40	Refusal @30.2 Bedrock	*Send to lab for analysis
					50		

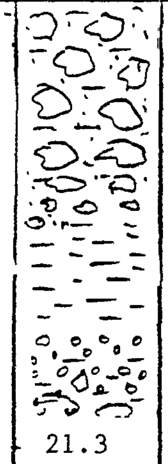
ESC
Boring Log

Project		Champion Spark Plug Hellertown, PA		**Boring No.** B4-4
L[illegible]e 6-26-86	**Driller** Martin-Huber	**Drill Method** Hollow Auger	**Hole size** 8"	**Sample Method** 2" Split Spoon
Ground Elev.	**Depth Groundwater**	**Total Depth** 9'	**Grout Depth**	**Logged By** Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval	Graphic Log	Depth	Description	Comments
NR	-	6"	S		0	Fill - Red brown silt with gravel and boulders.	large boulders prevented penetration abandoned.
1	8-6-5	3"	S			1st refusal @9'	
					10	moved 5' south 2nd refusal @2'	
						moved 5' east 3rd refusal @8.5'	
					20		
					30		
					40		
					50		

ESC
Boring Log

Project	Champion Spark Plug Hellertown, PA		**Boring No.**	B4-5
te	**Driller**	**Drill Method**	**Hole size**	**Sample Metho**
6-26-86	Martin-Huber	Hollow Auger	8"	2" Split Spoo
Ground Elev.	**Depth Groundwater**	**Total Depth**	**Grout Depth**	**Logged By**
		21.3	Surface	Tom Murphy



OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval	Depth	Description	Comments
				0	<u>Fill</u> - Red brown silt with gravel and boulders, dry.	Water encountered @9.5'
0	13-9-11		S	10	<u>Fill</u> - Red brown silt with sand and clay - wet.	
					17-21 Sludge? dark gray gravel with silt, wet.	HNU-13
0	12-15-17-15	18"	S*			Note color change @17'
0	3-9-5-3	12"	S*	20	Refusal @21.3' due to boulders?	
					Sample 17-21 appears to have penetrated the top of the ~~slug~~ SLUDGE zone?	
				30		*combined and sent to lab for analysis.
				40		
				50		

ESC Boring Log

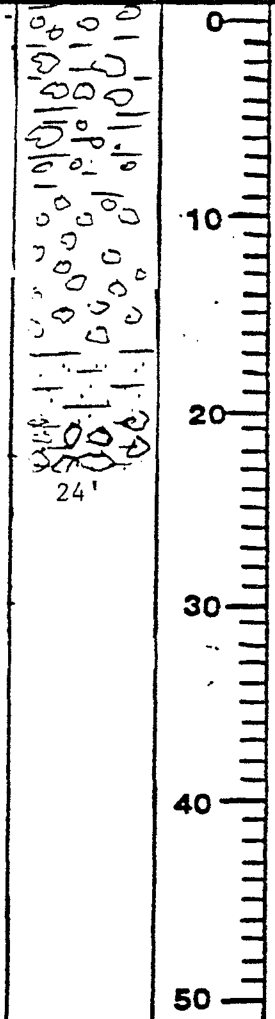
Project	Boring No.
Champion Spark Plug Hellertown, PA	B4-6

e	Driller	Drill Method	Hole size	Sample Method
6-26-86	Martin-Huber	Hollow Auger	8"	2" Split Spoon

Ground Elev.	Depth Groundwater	Total Depth	Grout Depth	Logged By
		24'	Surface	Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval
NR	5-8-17		S
2	41-16-14		S
200	22-10-6-	18"	S*
	3-6-19-	12"	S*
	7-9-77	NR	S

Graphic Log / Depth



Description

Fill - Red brown silt with gravel, dry.

Fill - dark brown silt with clay and gravel, moist.

17-21
Sludge zone - dark gray silty sand with gravel green gray layers firm, moist. Spark plug present in 19-21'

Refusal @24'

Reached Sludge Zone but did not get below in wx bedrock.

Comments

Note: 1st sample @5-6.5'

Note: placed OVA into hollow stem Auger - reading of 2,000 ppm

*To lab for analysis.

ESC
Boring Log

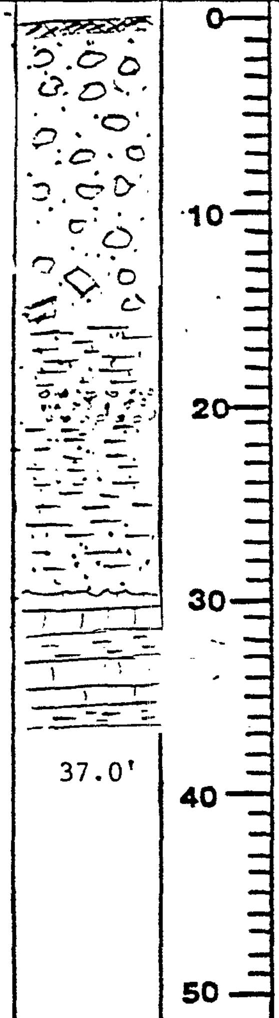
Project	Boring No.
Champion Spark Plug Hellertown, PA	B5-1

te	Driller	Drill Method	Hole size	Sample Metho
6-30-86	Martin-Huber	Hollow Auger	8"	2" Split Spoon

Ground Elev.	Depth Groundwater	Total Depth	Grout Depth	Logged By
		37'	12'	Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval
2000	7-14-14	14"	S
1500	3-4-6	12"	S
	9-16-33-9	22"	S*
700	16-5 1/2"	5"	S*
	20-8-77	12"	S*
130	4-4-5	16"	S*
25	30-42-42	18"	S
35	8-3-5	6"	S

Graphic Log / **Depth**



Description

Surface - Blacktop (asphalt)

Fill - green gray sandy silt with gravel to cobble size rock fragments.

10-11.5 - Fill - As above, moist.

11.5-15 - As above, with red brick at base.

16-21 - Sludge zone - very dark gray sandy silt grades to black sticky, resin-coated; pea-size gravel layer @19' to 20.5'. Few mottled orange brown silt layers between 17 and 18.5. At 21' back to green gray silt.

25-26.5 - top 6" thin layers of gray and green gray silt to fine sand. Bottom 10" - orange brown coarse to fine sand and silt, crumbly, dry.

Wx. bedrock @ 29.5' interbedded tan limestone and soft orange silty shale.

35-365. - As above, very wet and soft.

Refusal @37.0'

Comments

spark plugs in fill

Note: color an grain size change @16'.

Color change @26'

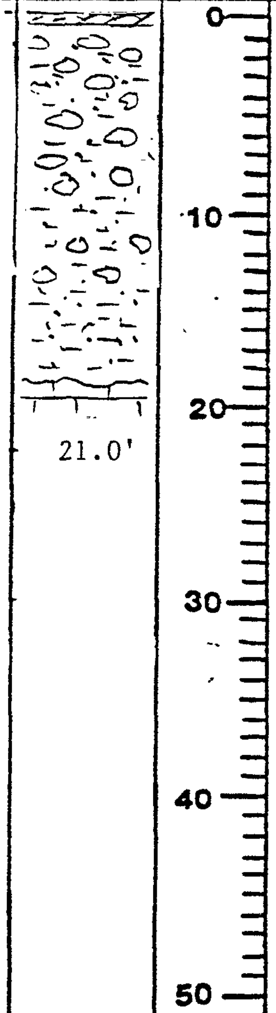
Note color change @26'

ESC
Boring Log

Project	Champion Spark Plug Hellertown, PA			**Boring No.** B5-2
[illegible]e 7-1-86	**Driller** Martin-Huber	**Drill Method** Hollow Auger	**Hole size** 8"	**Sample Method** 2" Split Spoon
Ground Elev.	**Depth Groundwater**	**Total Depth** 21.0	**Grout Depth** Surface	**Logged By** Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval
70	4-6-12	12"	S
20	2-6-6	12	S
20	4-4-5-5	20"	S*
	7-6-7-27	24"	S*
	20-21-5½	10"	S*

Graphic Log / **Depth**



21.0'

Description

Surface - Blacktop (Asphalt)

Fill - green gray sandy silt with grável and cobble size rock fragments.

Fill - as above, bottom 4" light ton wx limestone(?) green (copper) colored material

16-17 - red brown silt with wx rock fragments.

17-19 - green gray to dark gray mottled with light brown sandy silt.

19-21 - red brown to brown sandy silt with wx limestone fragments. Bottom 6" wx light brown limestone.

Refusal @21'

Comments

green gray silt is same as that in B5-1 (5 to 15)

Auger broke off @12' moved 3' north drilled to 16'

This may be very weathered bedrock

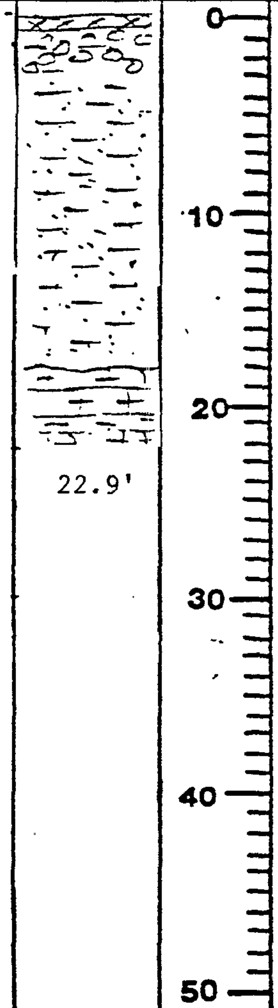
Sample sent to lab for storage
* 16-20 combined for analysis
20-21 sent to lab for analysis

ESC
Boring Log

Project	Champion Spark Plug Hellertown, PA		**Boring No.**	B6-Bg (Background)
e 7-1-86	**Driller** Martin-Huber	**Drill Method** Hollow Auger	**Hole size** 8"	**Sample Metho** 2" Split Spoon
Ground Elev. 104.5	**Depth Groundwater**	**Total Depth** 22.9'	**Grout Depth** Surface	**Logged By** Tom Murphy

OVA (ppm)	Sample Blows	Sample Recovery	Sample Interval
0	5-5-6	18"	S
0	5-3-3	2"	S
0	7-9-15	8"	S*
0	20-5¼"	6"	S*
	18-30-5	1/3" 10"	S*

Graphic Log **Depth**



Description

Surface - Blacktop (Asphalt) gravel fill

5-6.5 - red brown, yellow brown to orange brown clayey silt with rock fragments - dry.

10-11.5 - as above, no rock fragments.

15-18 - red brown silt and sand with light brown silty clay (wx limestone?) dry to moist.

20-21.3 - as above, wx shale and large size bedrock.

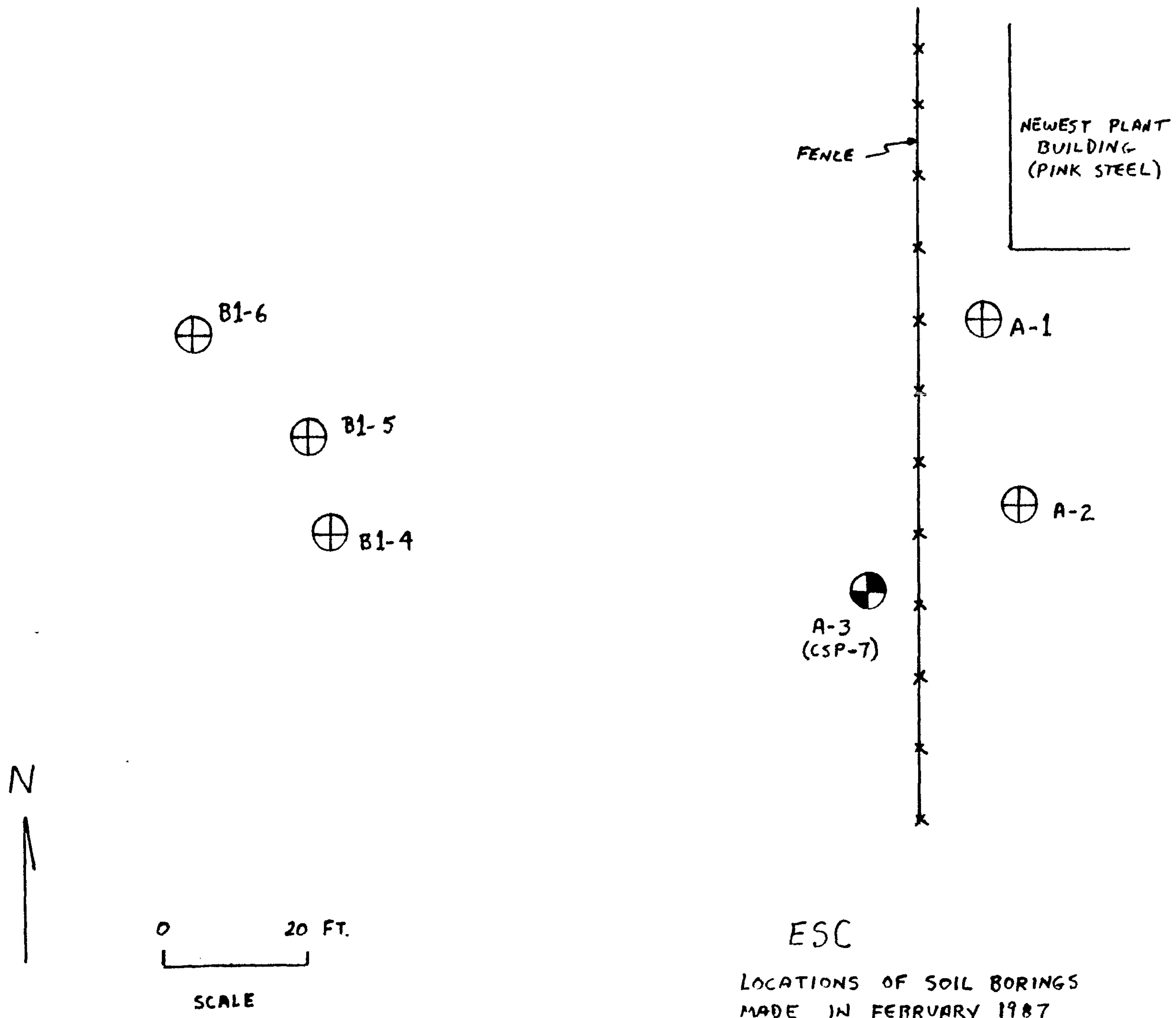
Refusal @22.9'

Bedrock difficult to pick soil horizon appears to be material composed of weathered bedrock.

Comments

*15-18 combined for lab analysis
20-21 sent to lab for analysis

Appendix C - Location and depths of soil samples collected in February 1987



ESC

LOCATIONS OF SOIL BORINGS
MADE IN FEBRUARY 1987

ESC BORING LOG

PROJECT
HELLERTOWN MANUFACTURING
HELLERTOWN, PA

BORING NO. A-1

DATE 2-26-87

DRILLER J.E. FRITTS

DRILL METHOD HOLLOW STEM AUGER

HOLE SIZE 8"

SAMPLE METHOD SPLIT SPOON

GROUND ELEV.

DEPTH GROUNDWATER NOT ENCOUNTERED

TOTAL DEPTH 14'

GROUT DEPTH 14' TO LAND SURFACE

LOGGED BY M. SCHULTZ

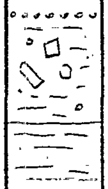
HNU (ppm)	SAMPLE BLOWS	SAMPLE RECOVERY	SAMPLE INTERVAL	GRAPHIC LOG	DEPTH	DESCRIPTION	COMMENTS
0	4-6-9-2	12"	S-1		0	0-1 ASPHALT OVER CRUSHED STONE	
1.4	2-3-4-5	6"	S-2			1-7 SILT, SOME CLAY, MODERATELY PLASTIC, SLIGHTLY MOIST, BROWN	
4	36-7-6-7	1"	S-3				
2	4-3-3-6	16"	S-4			7-13 CLAY AND SILT, PLASTIC, MOIST, LIGHT RED-BROWN	
3	3-3-5-8	16"	S-5		10		
3.1	8-7-6-6	18"	S-6				
2.3	2-4-6-6	12"	S-7			14-15 WEATHERED ROCK; MICACEOUS FINE-GRAINED SANDSTONE	
					20		
					30		
					40		
					50		

ESC BORING LOG

PROJECT	BORING NO.
HELLERTOWN MANUFACTURING HELLERTOWN, PA.	A-2

DATE	DRILLER	DRILL METHOD	HOLE SIZE	SAMPLE METH
2-26-87	J.E. FRITTS	HOLLOW STEM AUGER	8"	SPLIT SPOON

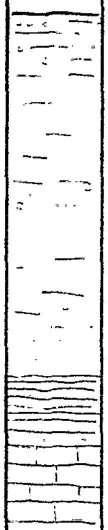
GROUND ELEV.	DEPTH GROUNDWATER	TOTAL DEPTH	GROUT DEPTH	LOGGED BY
	NOT ENCOUNTERED	8'	8' TO LAND SURFACE	M. SCHULTZ

HNU (ppm)	SAMPLE BLOWS	SAMPLE RECOVERY	SAMPLE INTERVAL	GRAPHIC LOG	DEPTH	DESCRIPTION	COMMENTS
1.6	2-7-8-10	6"	S-1		0	0-1 CRUSHED STONE	
15	4-12-14-16	12"	S-2			1-6 FILL SILT, CLAY, STONES, WOOD, 1" SILT LAYER AT 6' IS DISCOLORED (GRAY) AND HAS HIGH HNU	
15	6-8-3-4	18"	S-3*			6-9 CLAY AND SILT, LIGHT RED-BROWN, MOIST, PLASTIC	
9	3-5-7-6	18"	S-4				
					10		
					20		* SENT TO L FOR ANALYSIS
					30		
					40		
					50		

ESC
BORING LOG

PROJECT	BORING NO.
HELLERTOWN MANUFACTURING HELLERTOWN, PA.	A-3[1] (CSP-7)

DATE	DRILLER	DRILL METHOD	HOLE SIZE	SAMPLE METHOD
2-24-87	J. E. FRITTS	HOLLOW STEM AUGER	8"	SPLIT SPOON
GROUND ELEV.	**DEPTH GROUNDWATER**	**TOTAL DEPTH**	**GROUT DEPTH**	**LOGGED BY**
	32' ON 2-27-87	51'	See Well Const. Diagram	M. SCHULTZ

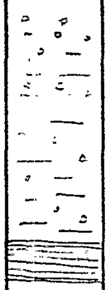
HNU (ppm)	SAMPLE BLOWS	SAMPLE RECOVERY	SAMPLE INTERVAL	GRAPHIC LOG	DEPTH	DESCRIPTION	COMMENTS
4	7-14-21-16	12"	S-1		0	FILL - ASPHALT UNDERLAIN WITH CRUSHED STONE	
4	2-6-2-3	12"	S-2			FILL CLAY, STONES, SOME SILT	SPARK PLUGS
4	2-5-3-3	12"	S-3			5-7 SILT SOME CLAY, TRACE SAND MODERATELY PLASTIC, SOFT, MOIST RED-BROWN	
3	7-11-10-10	12"	S-4				
5	3-4-5-6	18"	S-5*			7-9 CLAY, SOME STONES, STIFF	SPARK PLUG
					10	9-16 CLAY, SOFT, PLASTIC, MOIST, LIGHT RED-BROWN	
4.5	5-6-65-64	3"	S-6				
4	11-22-13-13	18"	S-7		20	19-21 WEATHERED SHALE, DISTINCT HORIZONTAL LAMINATIONS, DRY TO MOIST, TAN	
4	23-33-38-30	18"	S-8			24-26 WEATHERED LIMESTONE, DRY, GRAY	
					30	BORING CONTINUED TO 51' THROUGH ROCK	
					40		* SENT TO LAB FOR ANALYSIS
					50		

1. WELL CSP-7 WAS INSTALLED IN THIS BORING

ESC
BORING LOG

PROJECT HELERTOWN MANUFACTURING HELLERTOWN, PA	**BORING NO.** F1-4	

DATE 2-25-87	**DRILLER** J.E. FRITTS	**DRILL METHOD** HOLLOW STEM AUGER	**HOLE SIZE** 8"	**SAMPLE METH** SPLIT SPOON
GROUND ELEV.	**DEPTH GROUNDWATER** NOT ENCOUNTERED	**TOTAL DEPTH** 14'	**GROUT DEPTH** 14' TO LAND SURFACE	**LOGGED BY** M SCHULTZ

HNU (ppm)	SAMPLE BLOWS	SAMPLE RECOVERY	SAMPLE INTERVAL	GRAPHIC LOG	DEPTH	DESCRIPTION	COMMENTS
					0	0-4 SILT AND ROCK, BROWN	
	CUTTING TO 4'						
3	15-100/1'	3"	S-1			4-6 STONES AND CLAY, BROWN, MOIST	
2.5	28-18-36-39	6"	S-2				
1	9-18-7-20	6"	S-3			6-12 SILT, CLAY, AND STONES, GRAY, DRY TO MOIST	
1	4-5-8-8	12	S-4		10		
1	4-5-4-6	12"	S-5			12-14 WEATHERED SHALE, GRAY-BROWN, AND GREEN (POSSIBLY DISCOLORATION), SLIGHT ODOR, DRY	
					20		
					30		
					40		
					50		

ESC
BORING LOG

PROJECT HELLERTOWN MANUFACTURING HELLERTOWN, PA.	**BORING NO.** B1-5	

DATE 2-25-87	**DRILLER** J.E. FRITTS	**DRILL METHOD** HOLLOW STEM AUGER	**HOLE SIZE** 8"	**SAMPLE METHOD** SPLIT SPOON
GROUND ELEV.	**DEPTH GROUNDWATER** NOT ENCOUNTERED	**TOTAL DEPTH** 18.6'	**GROUT DEPTH** 18.6' TO LAND SURFACE	**LOGGED BY** M. SCHULTZ

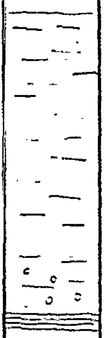
HNU (ppm)	SAMPLE BLOWS	SAMPLE RECOVERY	SAMPLE INTERVAL	GRAPHIC LOG	DEPTH	DESCRIPTION	COMMENTS
					0	0-12.6 SILT AND CLAY, SOME STONES, GRAY-BROWN	
	CUTTINGS TO 4'						
1	2-4-17-18/4"	10"	S-1				
1	2-2-2-8	18"	S-2				
3	2-2-3-3	12"	S-3			GRAY LAYER, 1" THICK IN MIDDLE OF SPOON AT 10', SOME ODOR	ODOR, DISCOLORATION
	2-3-6-6	0			10	10.6-12.6 NO RECOVERY	
4.4	5-5-4-2	1"	S-5			12.6-17.6 SILT AND CLAY WITH SOME SAND AND ROCK FRAGMENTS, LIGHT GREEN (POSSIBLY DISCOLORATION) AND LIGHT YELLOW-BROWN, MOIST,	
0.5	2-2-7-11	25"	S-6				SOME ODOR
0.5	6-6-13-15	24"	S-7				
					20	17.6-18.6 WEATHERED SHALE, MICACEOUS, GREEN AND YELLOW-BROWN	
					30		
					40		
					50		

ESC
BORING LOG

PROJECT	BORING NO.
HELLERTOWN MANUFACTURING HELLERTOWN, PA.	E1-6

DATE	DRILLER	DRILL METHOD	HOLE SIZE	SAMPLE METHOD
2-25-87	J.E. FRITTS	HOLLOW STEM AUGER	8"	SPLIT SPOON

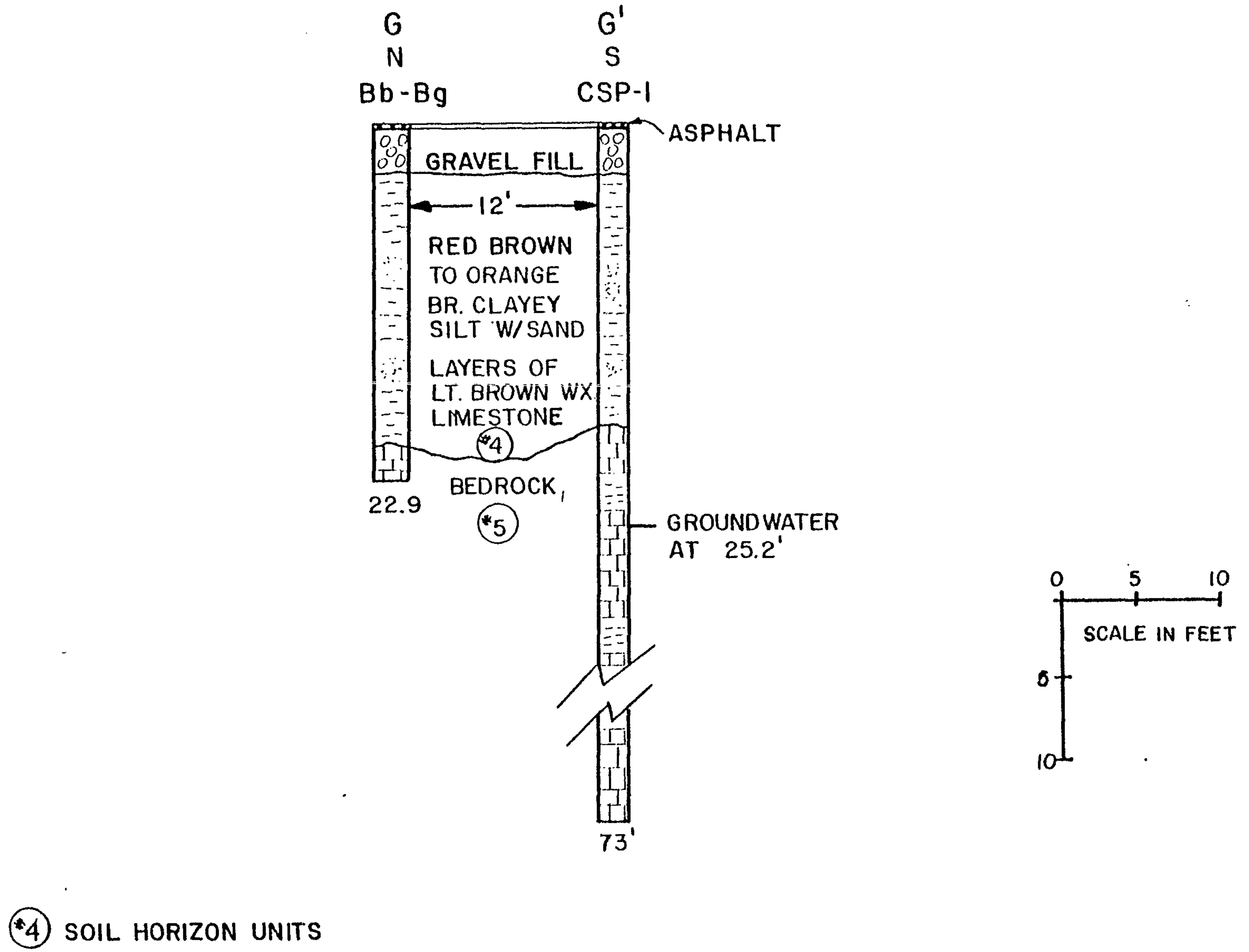
GROUND ELEV.	DEPTH GROUNDWATER	TOTAL DEPTH	GROUT DEPTH	LOGGED BY
		16'	16' TO LAND SURFACE	M. SCHULTZ

HNU (ppm)	SAMPLE BLOWS	SAMPLE RECOVERY	SAMPLE INTERVAL	GRAPHIC LOG	DEPTH	DESCRIPTION	COMMENTS
	CUTTINGS TO 4'				0		
0	5-5-5-5	3"	S-1			0-14.5 FILL SILT AND CLAY, DARK BROWN, SLIGHTLY MOIST TO MOIST	
	5-9-11-7	0					
0	3-2-2-4	18"	S-2				
	2-3-5-2	4"	S-3		10		
	2-4-2-3	0 (15")[1]	-			12-16 INCLUDES A 6-INCH SLUDGE ZONE, DARK BROWN TO BLACK SILT, CLAY, AND ROCK, ODOR, V. MOIST	SPARK PLUG, ODOR, DISCOLORATION
0.5	3-5-10-9	0.5	S-4*				
						16.0-16.5 WEATHERED SHALE, GREEN AND YELLOW-BROWN, MOIST	
					20		
					30		* SENT TO LAB FOR ANALYSIS
					40		
					50		

1. AFTER FAILING TO RECOVER ANY SAMPLE IN 1.25" SPLIT SPOONS BETWEEN 12' AND 16' A 2" SPLIT SPOON WAS DRIVEN THROUGH THIS INTERVAL TO 16.5' AND A 15" SAMPLE (S-4) WAS RECOVERED

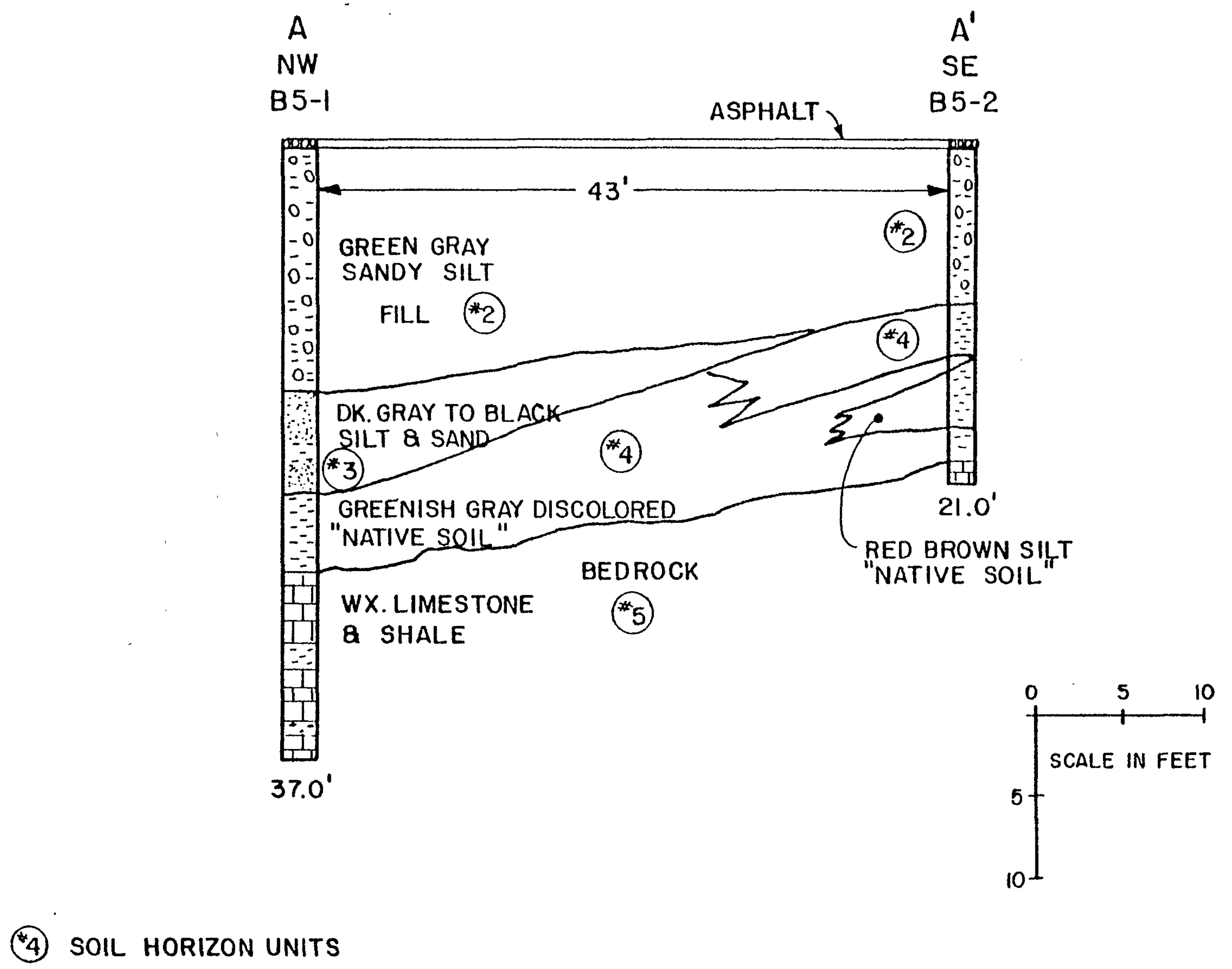
L

Appendix D - Lagoon cross-sections



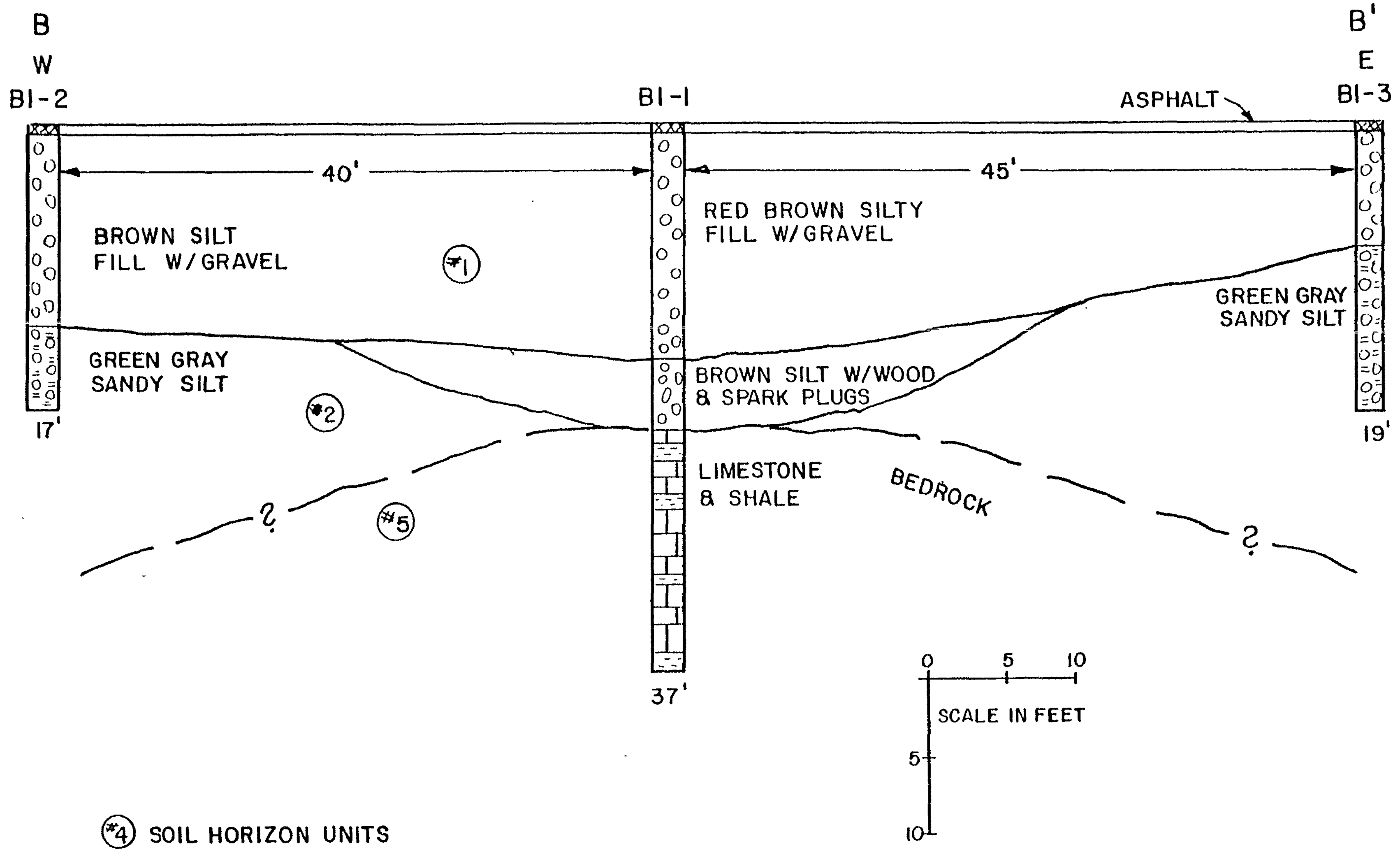
ENVIRONMENTAL STRATEGIES CORPORATION
8521 LEESBURG PIKE • SUITE 650
VIENNA, VIRGINIA 22180 • (703) 821-3700

CROSS SECTION G-G'
BACKGROUND BORING
HELLERTOWN SITE



ENVIRONMENTAL STRATEGIES CORPORATION
8521 LEESBURG PIKE • SUITE 650
VIENNA, VIRGINIA 22180 • (703) 821-3700

CROSS SECTION A-A'
LAGOON 5
HELLERTOWN SITE



ENVIRONMENTAL STRATEGIES CORPORATION
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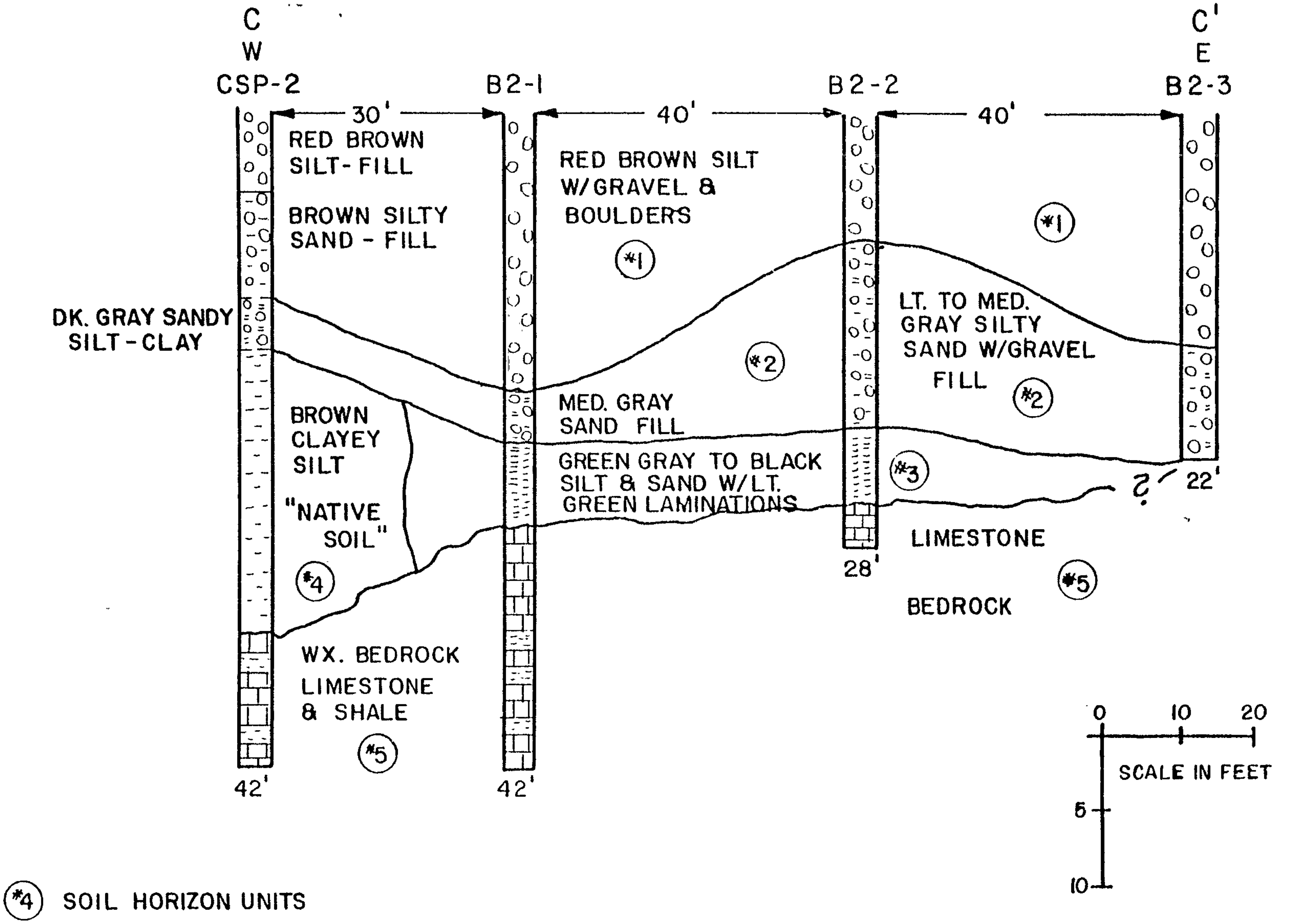
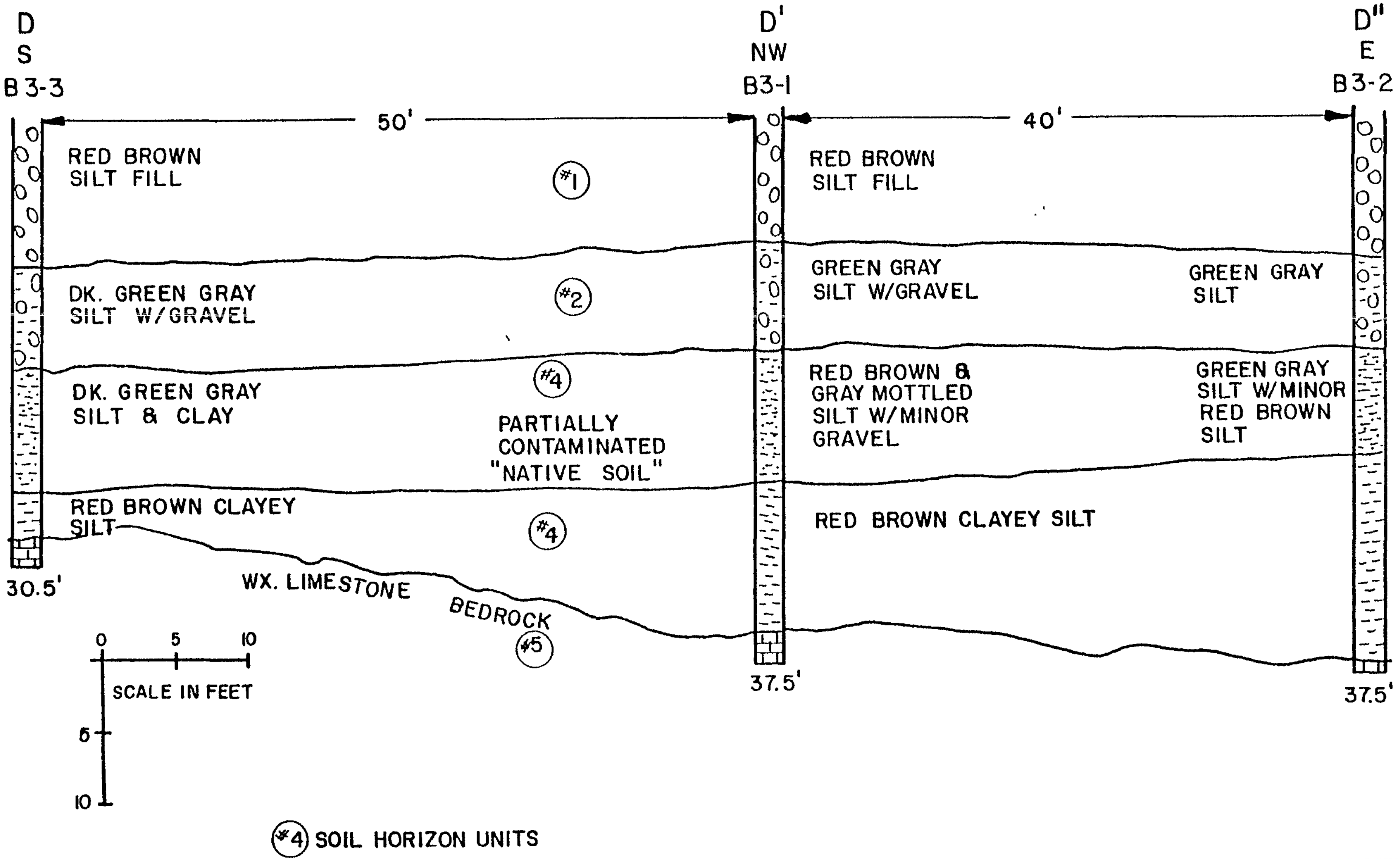
VIENNA, VIRGINIA 22180 • (703) 821-3700

CROSS SECTION B-B'
LAGOON I
HELLERTOWN SITE



ENVIRONMENTAL STRATEGIES CORPORATION
8521 LEESBURG PIKE • SUITE 650
VIENNA, VIRGINIA 22180 • (703) 821-3700

FIGURE
CROSS SECTION C-C'
LAGOON 2
HELLERTOWN SITE



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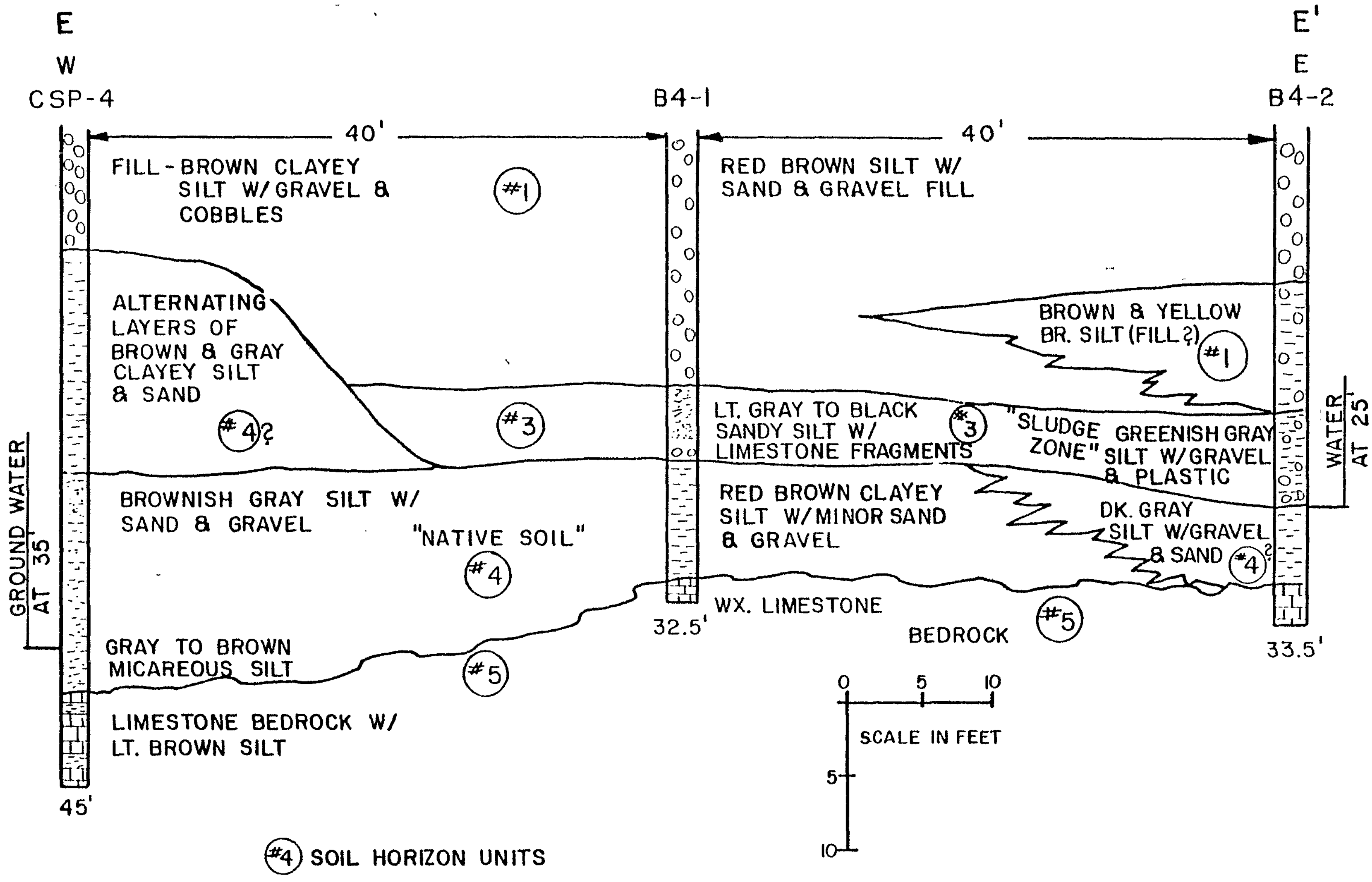
CROSS SECTION D-D''
LAGOON 3
HELLF' TOWN SITE



ENVIRONMENTAL STRATEGIES CORPORATION
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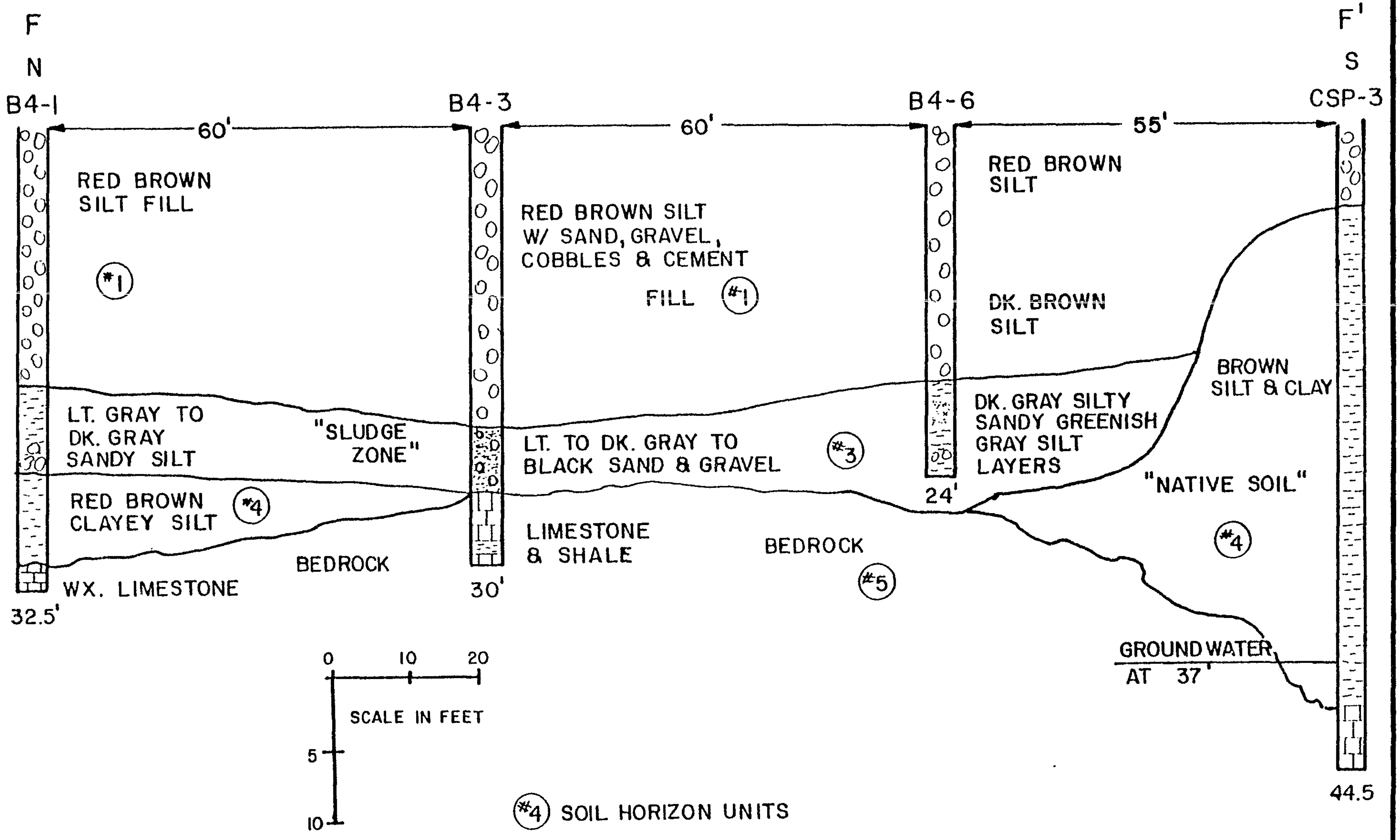
VIENNA, VIRGINIA 22180 • (703) 821-3700

EAST-WEST CROSS SECTION E-E'
LAGOON 4
HELLERTOWN SITE



ENVIRONMENTAL STRATEGIES CORPORATION
8521 LEESBURG PIKE • SUITE 650
VIENNA, VIRGINIA 22180 • (703) 821-3700

NORTH-SOUTH CROSS SECTION F-F'
LAGOON 4
HELLERTOWN SITE

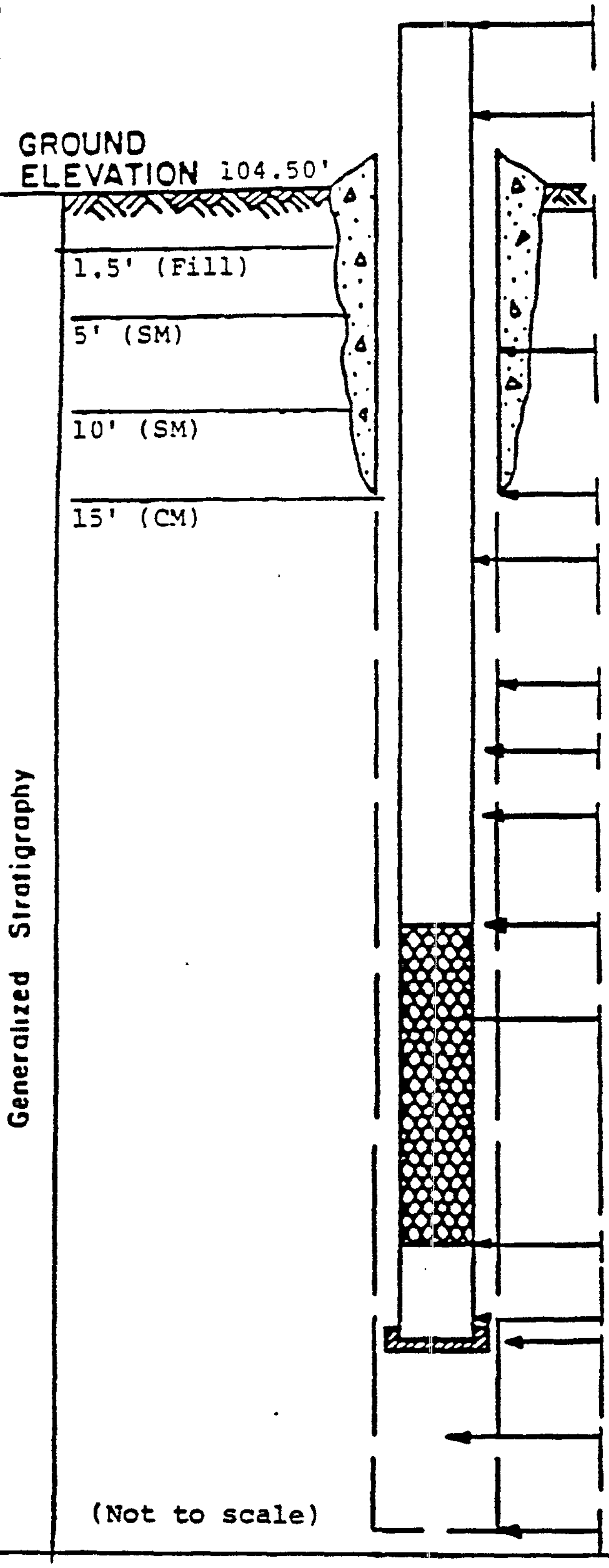
Appendix E - Boring logs for wells CSP-1, 2, 3 and 4

OBSERVATION WELL CONSTRUCTION SUMMARY

PROJECT Champion Spark Plug Co.
SITE Hellertown, PA
COORDINATES
DATE COMPLETED 12/17/84
SUPERVISED BY J. Barone

O.H. MATERIALS CO.
OHM
THE ENVIRONMENTAL SERVICES COMPANY

WELL NO. CSP - 1
AQUIFER



Elevation of reference point 105.37'
Height of reference point above ground surface 0.87'
Depth of surface seal 1.5'
Type of surface seal: Concrete
I. D. of surface casing N/A
Type of surface casing: N/A
Depth of surface casing N/A
I. D. of riser pipe 2"
Type of riser pipe: 2" PVC Schedule 40
Diameter of borehole 8"
Type of filler: Bentonite-Cement
Elevation / depth of top of seal 99.5'
Type of seal: Bentonite
Type of gravel pack Uniform Sand
Elev./depth of top of gravel pack 83.0'
Elevation / depth of top of screen 81.0'
Description of screen Schedule 40 0.020 PVC Slotted Screen
I. D. of screen section 2"
Elevation / depth of bottom of screen 71.0'
Elev. / depth of bottom of gravel pack 70.5'
Elev. / depth of bottom of plugged blank section 70.5'
Type of filler below plugged section Native Soil
Elevation of bottom of borehole 31.5

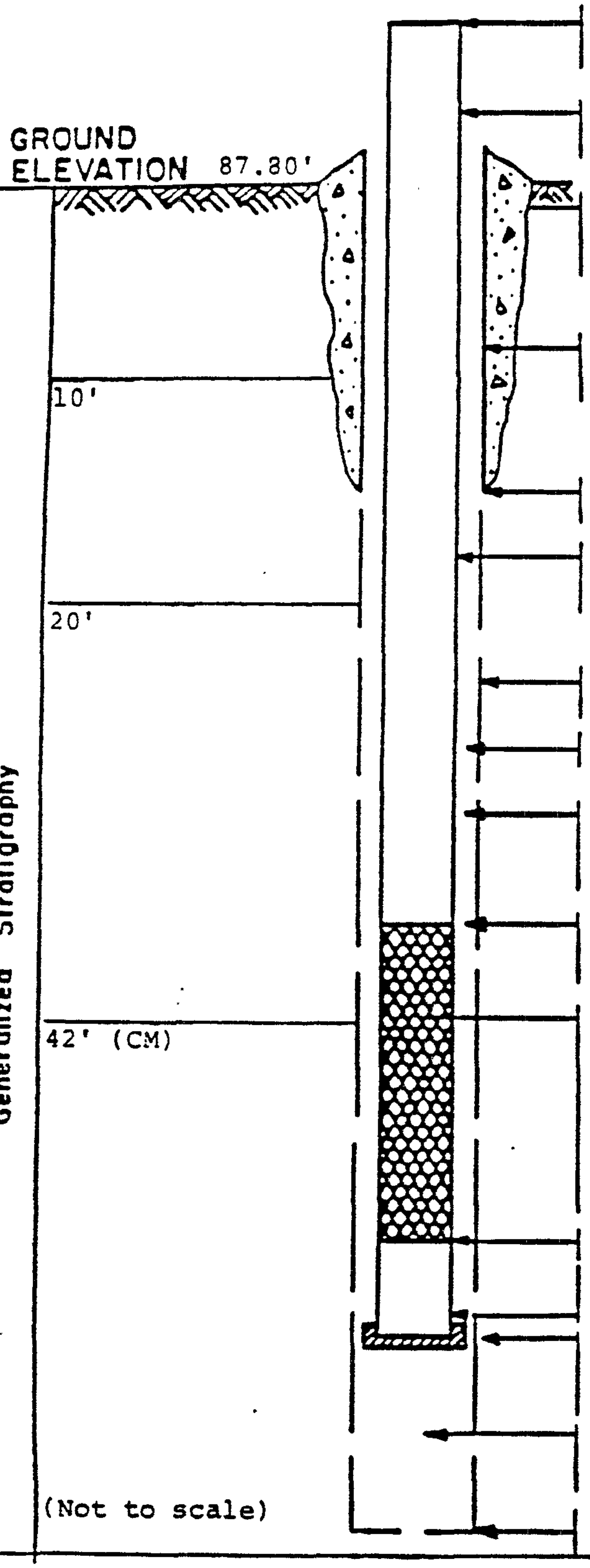
DRAWING
DATE
BY
REVISIONS
CHECKED BY/DATE
APPROVED BY/DATE
DRAWN BY
DATE

OBSERVATION WELL CONSTRUCTION SUMMARY

PROJECT Champion Spark Plug Co.
SITE Hellertown, PA
COORDINATES
DATE COMPLETED 12/20/84
SUPERVISED BY J. Barone

O.H. MATERIALS CO.
OHM
THE ENVIRONMENTAL SERVICES COMPANY

WELL NO. CSP - 2
AQUIFER



Elevation of reference point	89.19'
Height of reference point above ground surface	1.39'
Depth of surface seal	1.5'
Type of surface seal: Concrete	
I. D. of surface casing	N/A
Type of surface casing: N/A	
Depth of surface casing	N/A
I. D. of riser pipe	2"
Type of riser pipe: 2" PVC Schedule 40	
Diameter of borehole	8"
Type of filler: Bentonite-Cement	
Elevation / depth of top of seal	84.3'
Type of seal: Bentonite	
Type of gravel pack Uniform Sand	
Elev./depth of top of gravel pack	58.8'
Elevation / depth of top of screen	56.8'
Description of screen Schedule 40 0.020 PVC Slotted Screen	
I. D. of screen section	2"
Elevation / depth of bottom of screen	46.8'
Elev. / depth of bottom of gravel pack	46.3'
Elev. / depth of bottom of plugged blank section	46.3'
Type of filler below plugged section Native Soil	
Elevation of bottom of borehole	43.8'

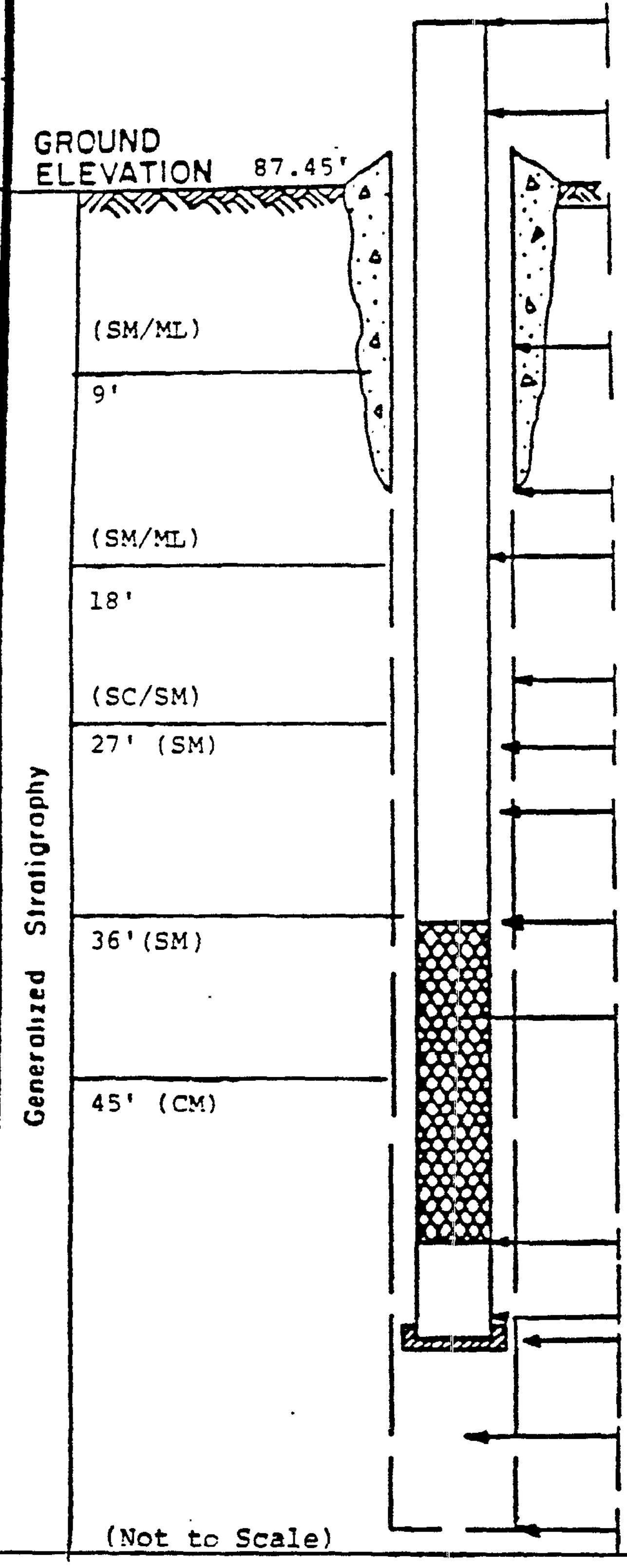
DRAWN BY
DATE
CHECKED BY/DATE
APPROVED BY/DATE

OBSERVATION WELL CONSTRUCTION SUMMARY

PROJECT Champion Spark Plug
SITE Hellertown, PA
COORDINATES
DATE COMPLETED 12/21/84
SUPERVISED BY M. Erikson

O.H. MATERIALS CO.
OHM
THE ENVIRONMENTAL SERVICES COMPANY

WELL NO. CSP-3
AQUIFER



Elevation of reference point 89.1'

Height of reference point above ground surface 1.65'

Depth of surface seal 1.5'

Type of surface seal: Concrete

I.D. of surface casing N/A
Type of surface casing: N/A

Depth of surface casing N/A

I.D. of riser pipe 2"
Type of riser pipe: 2" PVC Schedule 40

Diameter of borehole 8"

Type of filler: Bentonite-Cement

Elevation / depth of top of seal 81.45'
Type of seal: Bentonite

Type of gravel pack Uniform Sand
Elev./depth of top of gravel pack 55.95'

Elevation / depth of top of screen 53.95'
Description of screen Schedule 40 0.020 PVC Slotted Screen

I.D. of screen section 2"

Elevation / depth of bottom of screen 43.95'

Elev. / depth of bottom of gravel pack 43.45'

Elev. / depth of bottom of plugged blank section 43.45'

Type of filler below plugged section Native Soil

Elevation of bottom of borehole 42.95'

DRAWING NO.
DATE
REVISIONS
CHECKED BY/DATE
APPROVED BY/DATE
DRAWN BY
DATE

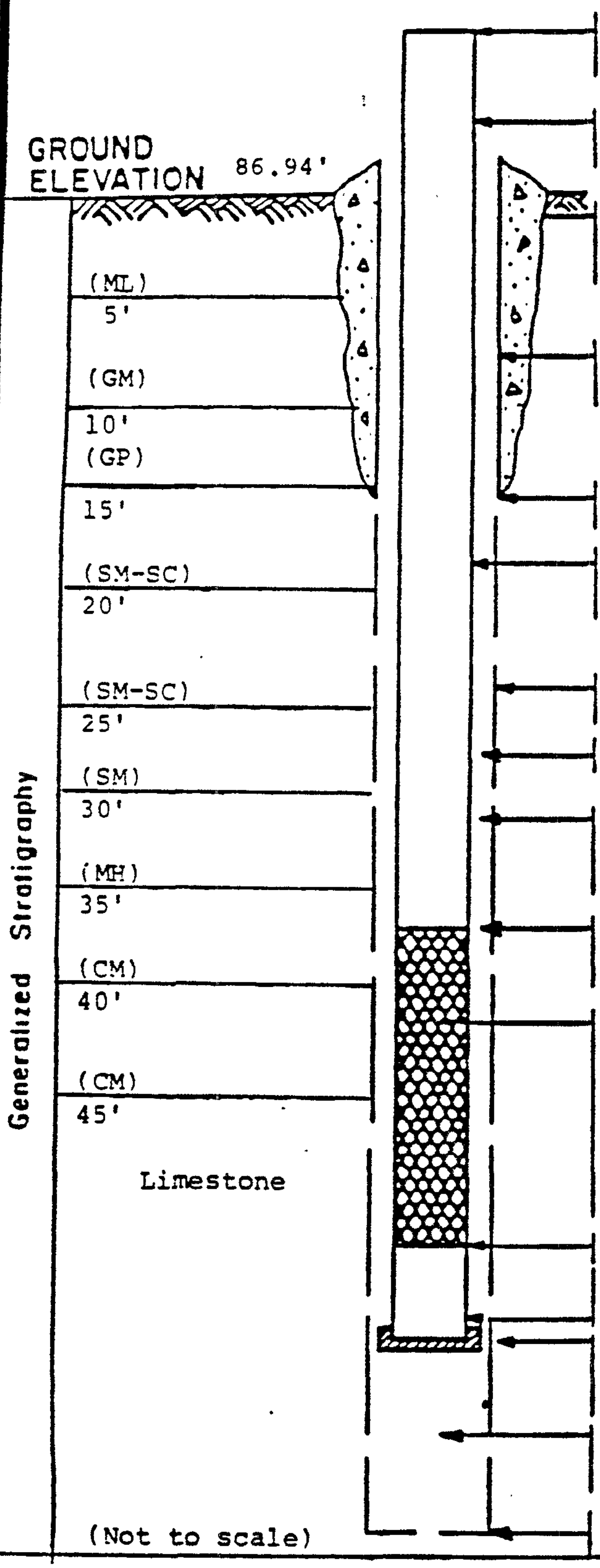
OHM

OBSERVATION WELL CONSTRUCTION SUMMARY

PROJECT Champion Spark Plug
SITE Hellertown, PA
COORDINATES NW Corner of Site
DATE COMPLETED 12/26/84
SUPERVISED BY R. Beckwith

O.H. MATERIALS CO.
OHM
THE ENVIRONMENTAL SERVICES COMPANY

WELL NO. CSP-4
AQUIFER



Elevation of reference point 88.73'

Height of reference point above ground surface 1.79'

Depth of surface seal 1.5'

Type of surface seal: Concrete

I. D. of surface casing N/A

Type of surface casing: N/A

Depth of surface casing N/A

I. D. of riser pipe 2"

Type of riser pipe: 2" PVC Schedule 40

Diameter of borehole 6"

Type of filler: Bentonite-Cement

Elevation / depth of top of seal 81.04'

Type of seal: Bentonite

Type of gravel pack Uniform Sand

Elev./depth of top of gravel pack 54.5'

Elevation / depth of top of screen 52.0

Description of screen Schedule 40 0.020 PVC Slotted Screen

I. D. of screen section 2"

Elevation / depth of bottom of screen 42.0'

Elev. / depth of bottom of gravel pack 41.5'

Elev. / depth of bottom of plugged blank section 41.5'

Type of filler below plugged section N/A

Elevation of bottom of borehole 41.0'

APPROVED BY/DATE

DATE

OHM

Appendix F - Installation of well clusters CSP-5 and CSP-6

Sandvik Coromant rock drilling tools

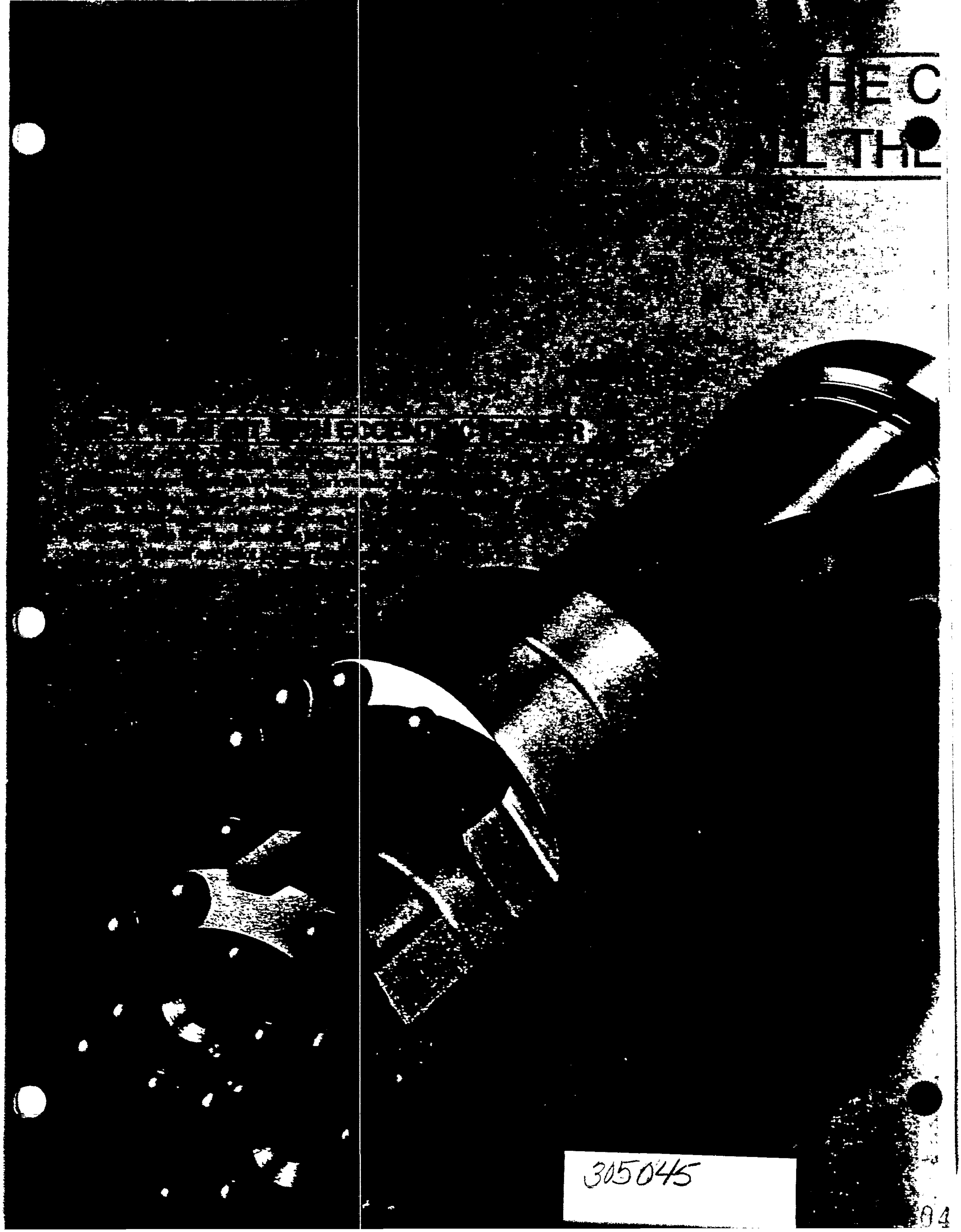
Atlas Copco

The ODEX method

for overburden drilling

305044

SANDVIK
Coromant



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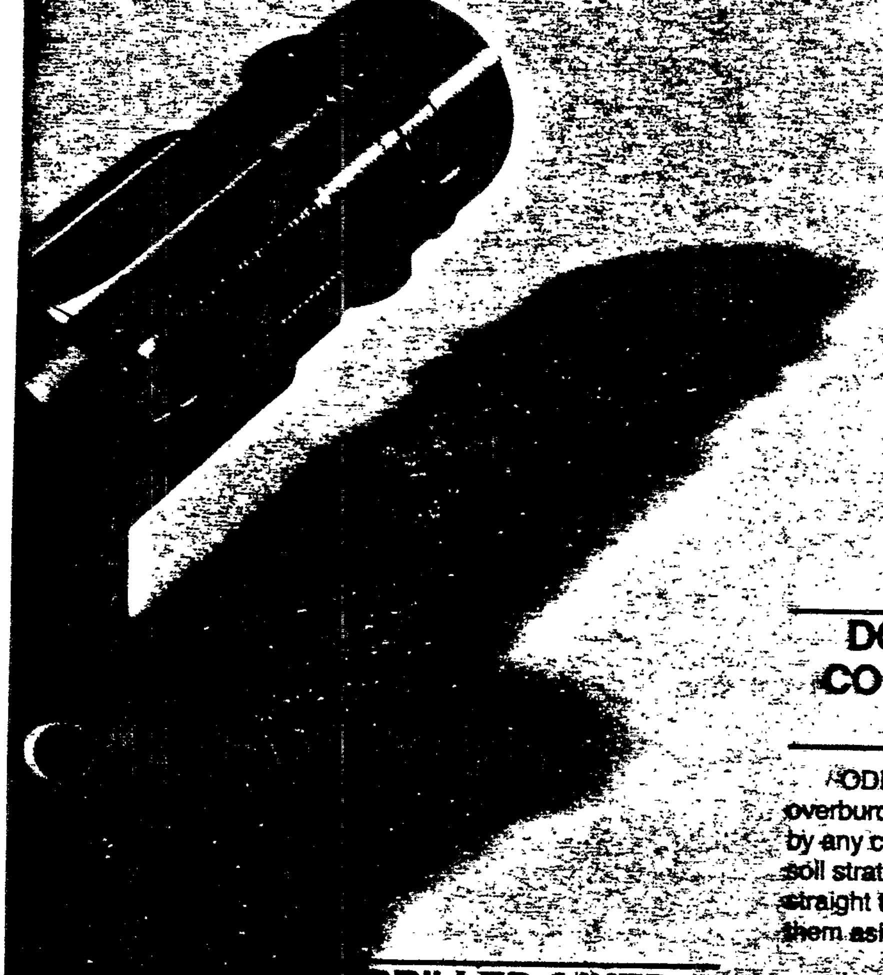
04

RRECT METHOD
IFFERENCE



DON'T WORRY ABOUT THE COMPOSITION OF THE OVERBURDEN FORMATION

ODEX is specifically designed to handle tricky overburden drilling and its performance is not impaired by any changes in the formation ranging from loose soil stratum to homogeneous rock. The method cuts straight through stones and boulders or shoulders them aside.

DRILLED, LINED EPTH OF 100 m (330') RE, DEPENDING ON FORMATION

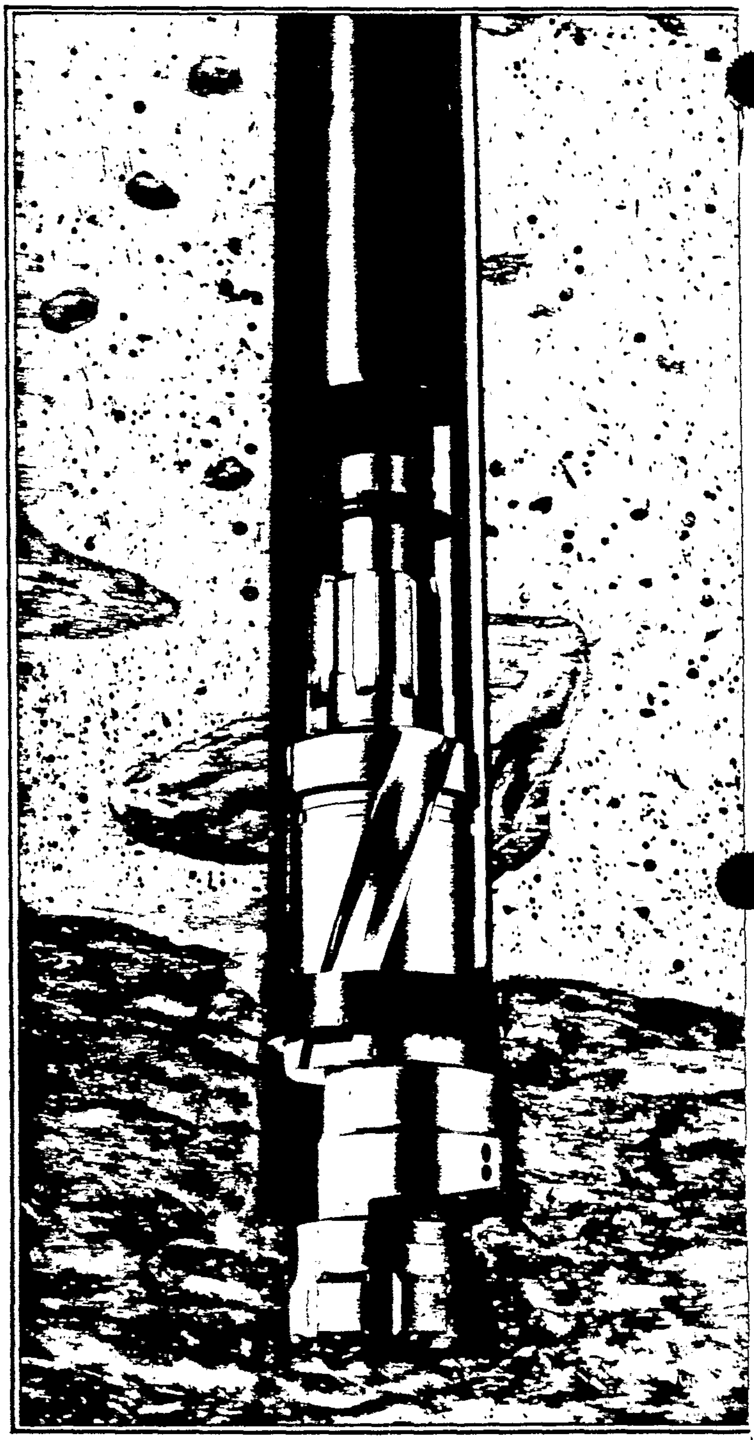
[illegible] encountered in overburden forma- [illegible] make overburden drilling [illegible] types of drilling tools. [illegible] Atlas Copco and Sandvik have developed [illegible] ODEX method [illegible]

ODEX – A VALUABLE CONTRIBUTION TO PROFITABLE DRILLING OPERATIONS

Typical situations where ODEX is at its best: [illegible] anchoring [illegible] grouting [illegible]

305046

ODEX EQUIPME



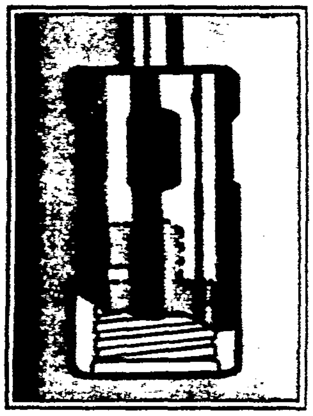
The pilot bit drills the bottom of the hole. As rotation commences, the reamer is forced out, widens the hole and cuts a passage for the smooth descent of the casing.

Cuttings are flushed upwards inside the casing tubes.

ECONOMIES FROM THE USE OF NON-MACHINED STEEL TUBES

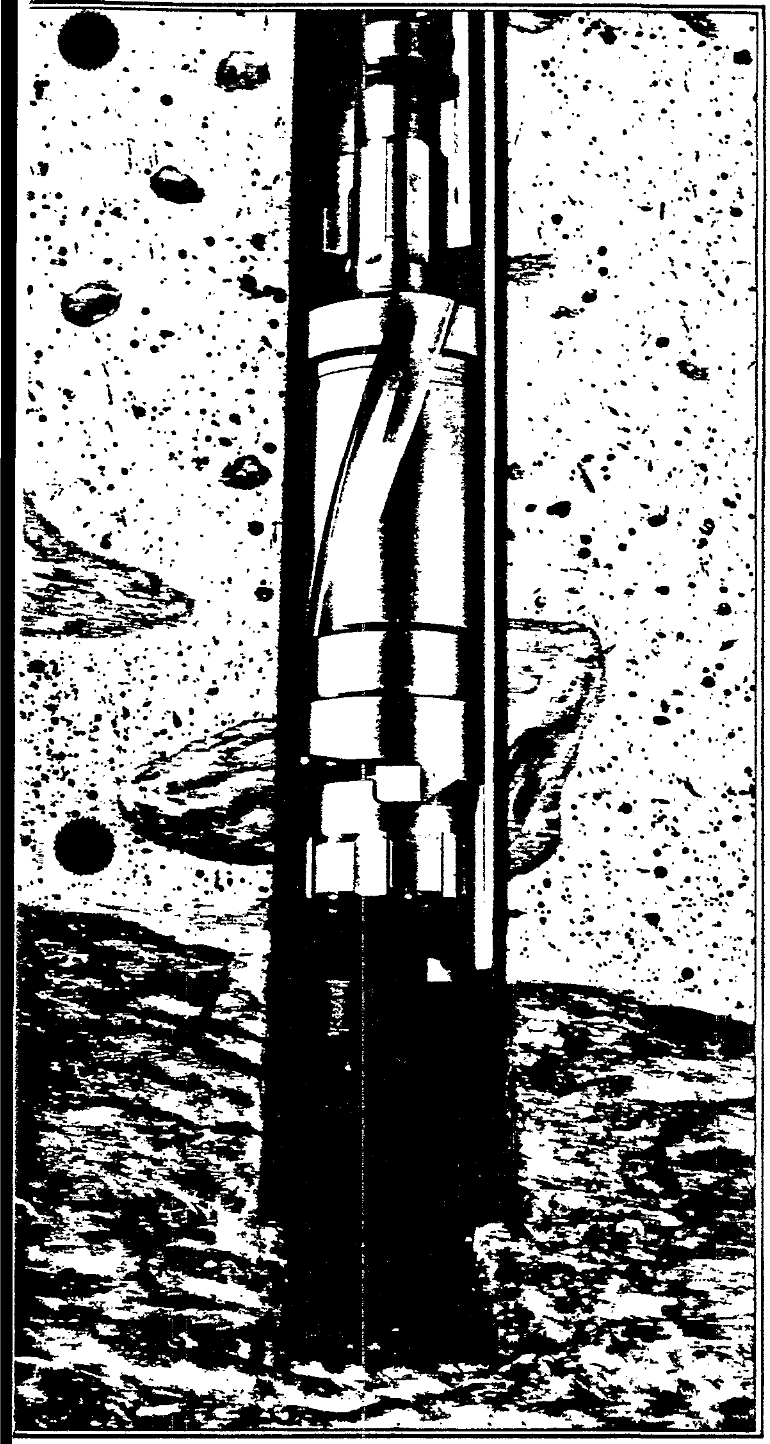
The use of threaded casing tubes is an expensive matter when the casing is left in position to stabilise the hole walls. Using the ODEX method, relatively thin non-machined steel tubes can be used right from the start. Specify the correct standard size, making sure that they can be welded.

SPECIAL GROUTING/ LIFTING DEVICE



Cement is pumped down through a special injection sleeve fitted in place of the driving cap. Casing tubes are withdrawn as grouting operations proceed.

NT ON THE JOB



On completion of drilling, the ODEX equipment is put into reverse and the reamer will be automatically retracted to enable it to pass upwards through the casing tubes.

Standard drilling equipment is used for continued drilling through the casing tubes once the solid bed rock has been reached.

Casing tubes can be left in position to stabilise the hole or withdrawn after the installation of cables, plastic tubes or other equipment.

SPECIFYING THE FLUSHING METHOD

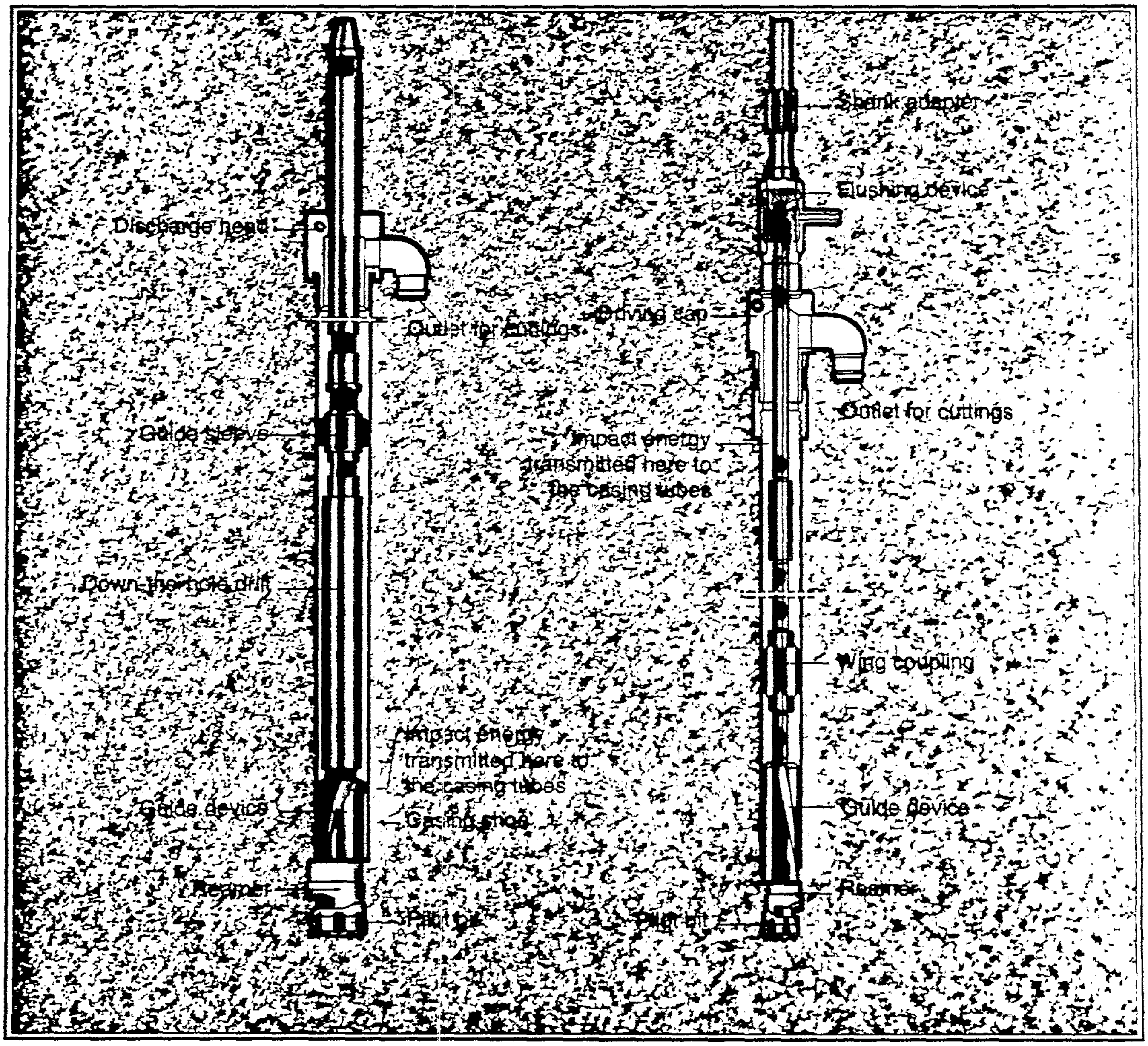
Air or water flushing is adequate for holes down to depths of about 15 m (50'). Below this depth, foam flushing has shown itself the most effective means for removing cuttings.

Foam breaks down cuttings and lifts them out. It also lubricates and seals hole walls to assist the downward passage of casing tubes. For this reason, foam is once again the preferred choice in formations where high friction is likely to be encountered. The use of foam cuts wear and tear on equipment and flushing performance is not impared when passing through cavities or fissured rock.

Foam flushing also economises on water: consumption is only one-sixth to one-tenth that of normal water flushing. The recommended mixture is between 0.5 and 4 parts Atlas Copco DFA 51 concentrate to 100 parts water.

The Atlas Copco foam concentrate is biologically degradable non-pollutant and quite safe to work with.

ODEX AVAILABLE FOR DOWN-THE-HOLE DRILLS AND TOP HAMMER OPTIONS



DOWN-THE-HOLE PRINCIPLE

No impact energy is lost in the drill tubes which only transmit rotation to the ODEX equipment.

As the hammer works in the drill hole, the impact energy to the casing tubes must be imparted there. A special casing shoe is used in down-the-hole drilling with the ODEX method to engage the ODEX bit guide.

Flushing fluid is removed through a discharge head.

TOP HAMMER PRINCIPLE

ODEX equipment for top hammers operates in the traditional manner with impact and rotation transmitted through extension rods.

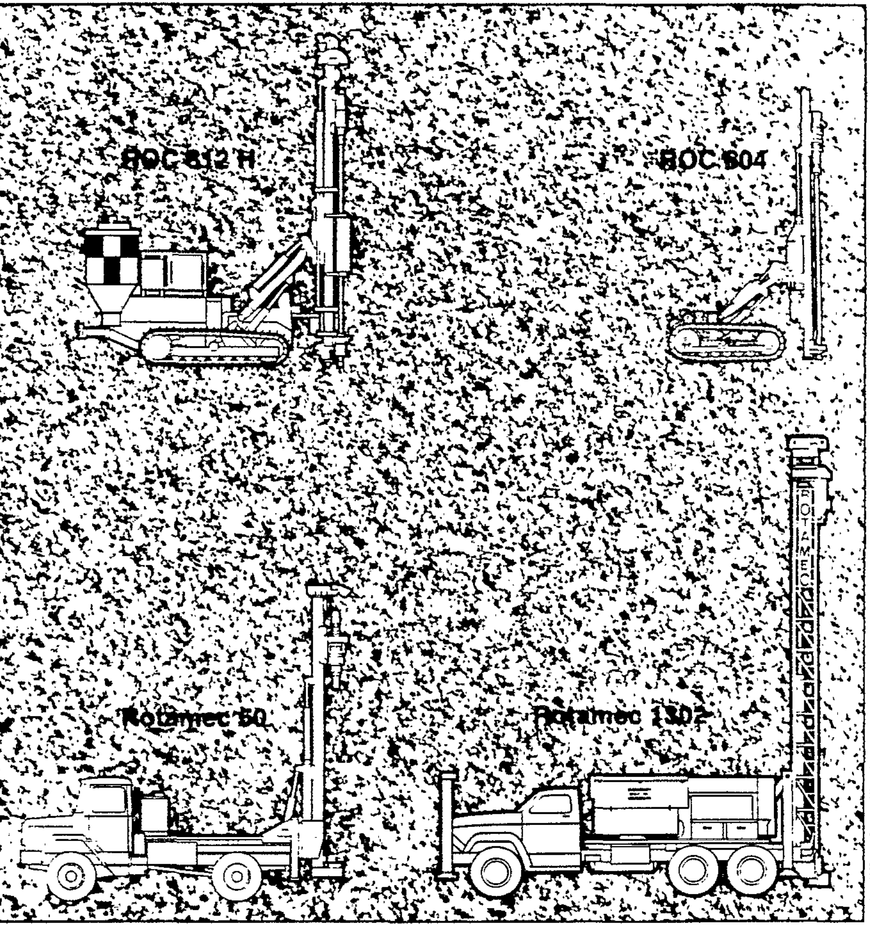
To drive casing tubes down the hole, a shank adapter is used to transfer impact energy from the rock drill to a driving cap above the casing tube. The casing is driven down into the hole without rotation.

A rubber hose is connected to the driving cap to lead off the flushing fluid.

ATLAS COPCO RIGS FOR ODEX DRILLING

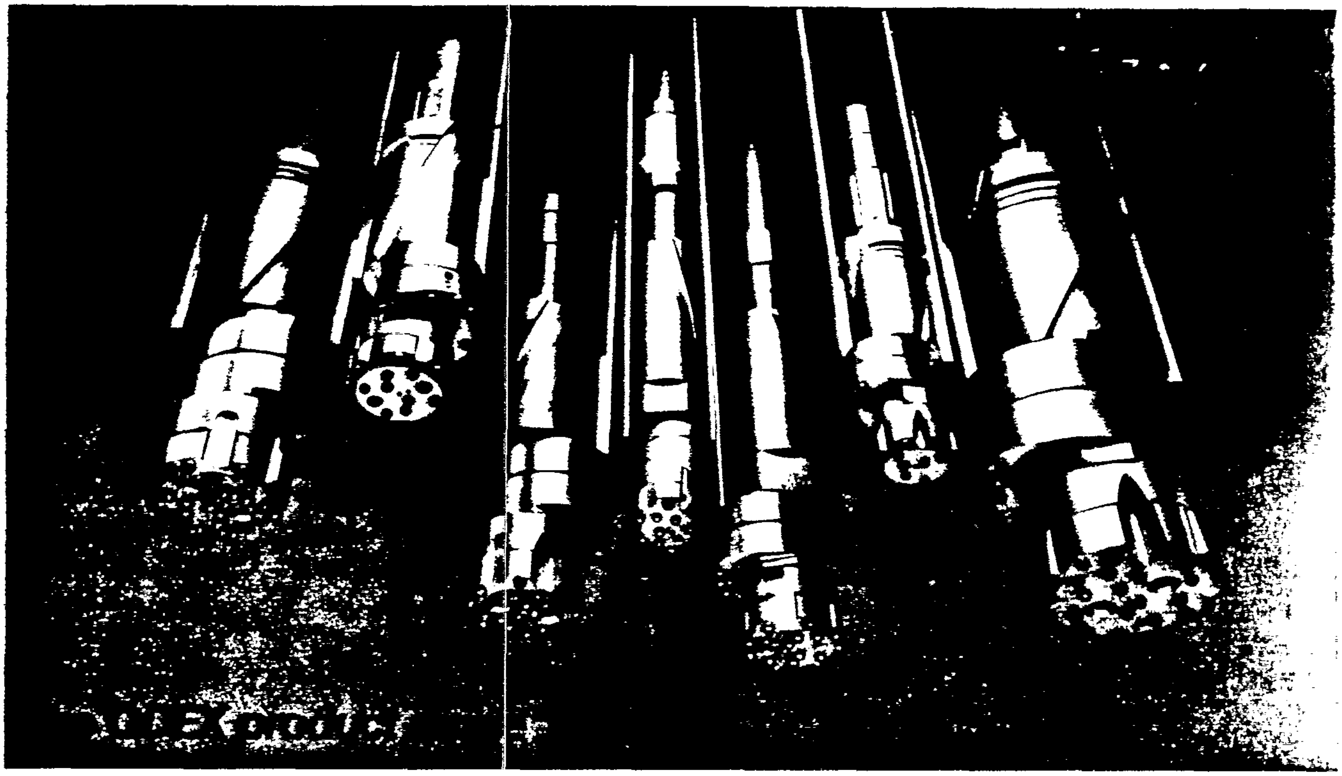
The Atlas Copco range of products for surface drilling contains a large number of drill rigs suitable for drilling with ODEX equipment.

The choice of different sizes and designs enables them to cover a wide range of different applications. A comprehensive selection of useful auxiliary equipment for mechanised rod handling, welding or foam flushing, help individualise each rig to performance expectations.



Rig	Carrier type	Lifting capacity max kN	Torque max. Nm	ODEX type and suitable rock drill				Application*		
								Wwd	E	C
For top hammers				**76**	**127**					
ROC 601	crawler	17.7	800	BBE 57	BBE 57					●
ROC 812H	crawler	20.0	1,000	COP 1238	COP 1238					●
For DHT hammers				**90**	**115, 140**	**165**	**215**			
Rotamec 30	3-wheeled wagon, crawler	51.8	4,750	COP 32	COP 42	COP 62		●		●
Rotamec 50DH	truck, crawler trailer	80.9	7,440		COP 42	COP 62		●		
Rotamec 160	truck, trailer	188.0	8,185		COP 42	COP 62	"8 inch"	●		
Rotamec 1302	truck	164.0	12,600		COP 42	COP 62	"8 inch"	●		
Mobile Drill B40-L	truck, crawler, trailer	31.3	8,080		COP 42	COP 62			●	●
Mobile Drill B80	truck, crawler, trailer	66.8	8,080		COP 42	COP 62		●	●	●
ROC 604	crawler	39.0	4,000	COP 32	COP 42			●		●

*Wwd = water well drilling, E = exploration, C = construction



Type*	Rock drill	Recommended casing dimensions metric standard (mm)	American standard (in)	Drill tube diam.		Reamed diam.	
				mm	(in.)	mm	(in.)
For top hammers							
ODEX 76 W/T	**BBE 57** **COP 1238**	W: max. O.D. 89 min. I.D. 78 min. wall thickness 4.5 mm T: 88.9 × 77.8 R.H. thread	$3\frac{1}{2}$ $3\frac{1}{16}$ $3\frac{1}{2} \times 3\frac{1}{16}$	R 38	($1\frac{1}{2}$)	96	($3\frac{25}{32}$)
ODEX 127 W/T	**BBE 57** **COP 1238**	W: max. O.D. 142 min. I.D. 128 min. wall thickness 5 mm T: 140 × 128 R.H. thread	$5\frac{10}{16}$ $5\frac{1}{16}$ $5\frac{1}{2} \times 5\frac{1}{32}$	R 38	($1\frac{1}{2}$)	162	($6\frac{3}{8}$)
For DTH hammers							
ODEX 90 W/T	**COP 32** **A 30–15**	W: max. O.D. 115 min. I.D. 102 min. wall thickness 5 mm T: 114.3 × 101.6 L.H. thread	$4\frac{1}{2}$ 4 $4\frac{1}{2} \times 4$	76	(3)	123	($4\frac{13}{16}$)
ODEX 115 W/T	**COP 42** **DHD 24** **DHD 340 A** **A 34–15**	W: max. O.D. 142 min. I.D. 128 min. wall thickness 5 mm T: 140 × 128 L.H. thread	$5\frac{10}{16}$ $5\frac{1}{16}$ $5\frac{1}{2} \times 5\frac{1}{16}$	76 or 89	(3) ($3\frac{1}{2}$)	152	(6)
ODEX 140 W	**DHD 15** **DHD 350** **A 43–15**	max. O.D. 171 min. I.D. 157 min. wall thickness 5 mm	$6\frac{5}{8}$ $6\frac{1}{8}$	89 or 114	($3\frac{1}{2}$) ($4\frac{1}{2}$)	187	($7\frac{3}{8}$)
ODEX 165 W	**COP 62** **DHD 16** **DHD 360** **A 53–15**	max. O.D. 196 min. I.D. 183 min. wall thickness 5.5 mm	$7\frac{5}{8}$ $7\frac{1}{8}$	114	($4\frac{1}{2}$)	212	($8\frac{11}{32}$)
ODEX 215 W	**DHD 380** **A 63–15**	max. O.D. 257 min. I.D. 241 min. wall thickness 6 mm	10 $9\frac{1}{2}$	114 or 140	($4\frac{1}{2}$) ($5\frac{1}{2}$)	278	($10\frac{15}{16}$)

*T = threaded casing tubes
W = welded casing tubes

**SANDVIK COROMANT ROCK DRILLING TOOLS
SOLD AND SERVICED
BY THE WORLD-WIDE ATLAS COPCO ORGANISATION**

Atlas Copco

SANDVIK
Rock Tools

305050

nd in Sweden Halls Offset, Växjö

Appendix G - Water level recovery measurements and semi log plots of water level recovery

INSTALLATION OF CSF-5 WELL CLUSTER AND WELL CSF-6

CSP-5 WELL CLUSTER

2-10-87 Steam clean all downhole equipment.

Drill with air hammer with 8 inch bit to 58'.

Pull drilling tools in order to set and grout 6-inch steel surface casing. The objective being to seal off surficial materials and drill open hole in the more consolidated materials at depth.

After pulling drilling tools the borehole is observed to be blocked by numerous boulders making it impossible to set surface casing.

2-11-87 Advance 6-inch steel casing to 80 feet using the ODEX drilling method. With this method the 6-inch casing is advanced immediately behind a rotary bit which has an outside diameter a fraction of an inch larger than the casing. Cuttings come up through the casing. A brochure describing the ODEX drilling method is included at the end of this appendix.

Remove ODEX bit and drill through the 6-inch steel casing to 119' using a 5 1/2 inch air hammer.

Set the lower two screens shown on Figure 2 (wells CSF-5B and CSF-5C). The gravel pack and the bentonite clay seal are emplaced by pouring down the open borehole. The bentonite is in pellet form. Measurements of gravel pack and clay seal thickness are made to the nearest 0.1 foot using a weighted steel tape.

2-12-87 Pull back the 6-inch steel casing to 60 feet.

Set screen for CSP-5A from 64' to 74'.

Install gravel pack and bentonite clay seal as shown on Figure 2.

Set a tremie pipe at 55' and pump grout. The grout mix is 60 gal. water + 8 bags of cement (94 lb) + 1 bag of powdered bentonite (50 lb). This fills much of the 6-inch steel casing with cement.'

Pull 6-inch casing to 38' to allow grout to contact the borehole and make a tight seal.

2-13-87 Sounding annular space indicates that the top of the grout is at 40'. The remainder of the annular space is filled with grout.

CSP-6

2-12-87 Steam clean all downhole equipment.

Advance 6-inch steel casing to 40 feet using the ODEX drilling method.

2-13-87 Advance 6-inch casing to 60 feet using the ODEX drilling method.

Remove ODEX bit and drill to 120' with 5 1/2 inch air hammer.

After removing drilling tools the borehole collapses to 83'.

Add 3' of bentonite to seal the bottom of the hole.

Set screen from 70' to 80', gravel pack to 67' and bentonite clay to 64' (see Figure 3).

Pump grout through tremie pipe set at 60'.

Raise 6-inch steel casing from 60' to 50' and pump more grout. The following amount of grout was pumped to bring the level to land surface: 180 gallons of water + 24 bags of cement + 3 bags of bentonite.

Following completion of CSP-6 all downhole equipment was steam cleaned prior to taking offsite.

Appendix H - Laboratory deliverables for sampling dates - 11/86 - 2/87

PUMPING TEST FORM

ENVIRONMENTAL STRATEGIES CORPORATION

PROJECT________ WELL CSP-2 LOCATION________ PAGE 1 OF 1

SCREEN________ M.P.________ HT. ABOVE G.S.________ W.L. MEAS. W/________

r________ PUMPING WELL________ Q________ ORIFICE________ WEATHER________

___DRAWDOWN ___RECOVERY ___LOCATION SKETCH

TEST START________

TEST END________

DATE TIME	t	HELD	WET	D.T.W.	s			MANO-METER	Q	WATER TEMP.	
2-27-87											
9:45	CSP	-2	PUMPING	BEGINS	AT 3	GPM					
9:55	CSP	-2	PUMPING	ENDS							
	RECOVERY										
9:55.5	0.5	35	-0.22	34.78							
9:56	1	35	-0.24	34.76							
9:59	4	35	-0.29	34.71							

PUMPING TEST FORM

ENVIRONMENTAL STRATEGIES CORPORATION

PROJECT_____ WELL CSP-3 LOCATION_____ PAGE 1 OF 2

SCREEN_____ M.P._____ HT. ABOVE G.S._____ W.L. MEAS. W/_____

r_____ PUMPING WELL_____ Q_____ ORIFICE_____ WEATHER_____

__DRAWDOWN __RECOVERY __LOCATION SKETCH

TEST START_____

TEST END_____

DATE TIME	t	HELD	WET	D.T.W.	s			MANO-METER	Q	WATER TEMP.	
2-14-87											
8:18		35	+1.83	36.83							
14:17	-	35	+1.85	36.85							
14:26	CSP-6 PUMPING BEGINS AT 5 GPM										
14:50		35	+1.84	36.84							
15:28		35	+1.86	36.86							
15:37	CSP-6 PUMPING STOPS										

PUMPING TEST FORM

ENVIRONMENTAL STRATEGIES CORPORATION

PROJECT______ WELL CSP-3 LOCATION______ PAGE 2 OF 2

SCREEN______ M.P.______ HT. ABOVE G.S.______ W.L. MEAS. W/______

r______ PUMPING WELL______ Q______ ORIFICE______ WEATHER______

___DRAWDOWN ___RECOVERY ___LOCATION SKETCH

TEST START______

TEST END______

DATE TIME	t	HELD	WET	D.T.W.	s			MANO-METER	Q	WATER TEMP.	
2-27-87											
11:00	CSP	-3 PUMPING		BEGINS	AT	3	GPM				
11:16	CSP	-3 PUMPING		ENDS							
Recovery											
11:16.5	0.5	40	-1.96	38.04							
11:17	1	40	-1.99	38.01							
11:18	2	40	-2.01	37.99							
11:20	4	40	-2.02	37.98							
11:22	6	40	-2.03	37.97							

CSP- 4 1 2

LOCATION SKETCH

TEST START
END

DATE TIME	t	HOLD	WET	D.T.W.	s			BARO-METER	Q	WATER TEMP.	
12-14-87											
8:20		35 +	2.15	37.15							
11:57		35 +	2 15	37.15							
12:00	CSP-5A BEGINS PUMPING AT 2 GPM										
12:32		35 +	2.20	37.20							
12:36	CSP-5A PUMPING ENDS										
12:58		35 +	2.28	37 28							
14:12		35 +	2.15	37.15							

PUMPING TEST FORM

ENVIRONMENTAL STRATEGIES CORPORATION

PROJECT______ WELL CSP-4 LOCATION______ PAGE 2 OF 2

SCREEN______ M.P.______ HT. ABOVE G.S.______ W.L. MEAS. W/______

r______ PUMPING WELL______ Q______ ORIFICE______ WEATHER______

___DRAWDOWN ___RECOVERY ___LOCATION SKETCH

TEST START______

TEST END______

DATE TIME	t	HELD	WET	D.T.W.	s			MANO— METER	Q	WATER TEMP.	
2-27-87											
8:44		48	-10.55	37.45							
12:56		48	-10.56	37.44							
13:00	CSP-5A BEGINS PUMPING				AT	3	GPM				
13:10	10	48	-10.51	37.49							
13:20	20	48	-10.50	37.50							
13:20	CSP-5A ENDS PUMPING										
13:25.5	5.5	48	-10.53	37.47							
:32	12	48	-10.54	37.46							
14:30	CSP-4 PUMPING BEGINS AT				3	GPM					
14:46	CSP-4 PUMPING ENDS										
RECOVERY											
14:46.5	0.5	40	-1.60	38.40							
14:47	1	40	-1.72	38.28							
14:48	2	40	-1.82	38.18							
14:49	3	40	-1.89	38.11							
14:52	6	40	-2.00	38.00							
14:55	9	40	-2.04	37.96							

PUMPING TEST FORM

ENVIRONMENTAL STRATEGIES CORPORATION

PROJECT ______ WELL CSP-5A LOCATION ______ PAGE 1 OF 2

SCREEN ______ M.P. ______ HT. ABOVE G.S. ______ W.L. MEAS. W/ ______

r ______ PUMPING WELL ______ Q ______ ORIFICE ______ WEATHER ______

___DRAWDOWN ___RECOVERY ___LOCATION SKETCH

TEST START ______

TEST END ______

DATE TIME	t	HELD	WET	D.T.W.	s			MANO-METER	Q	WATER TEMP.	
2-14-87											
8:08		40	- 1.66	38.34							
9:53	CSP	-5C BEGINS		PUMPING	AT	1.3	GPM				
10:28		40 -	1.64	38.36							
10:32	CSP-	5C	ENDS	PUMPING							
10:55		40 -	1.67	38.33							
10:56	CSP-	5B BEGINS		PUMPING	AT	2.5	GPM				
11:13		40 -	1.38	38.62							
11.24		40 -	1.39	38.61							
11:25		40 -	1.37	38.63							
11:33	CSP-	5B	ENDS	PUMPING							
11:45		40 -	1.61	38.39							
12:00	PUMPING		BEGINS,	RATE =			, INTAKE	AT	65'		
12:38	PUMP	OFF									
RECOVERY											
12:40	2	40 +	1.09	41.09							
12:41	3	40 -	0.15	39.85							
12.42	4	40 -	0.76	39.24							
12:43	5	40 -	1.05	38.95							
12:44	6	40 -	1.17	38.83							
12:45	7	40 -	1.25	38.75							
12:46	8	40 -	1.30	38.70							
12.47	9	40 -	1.34	38.66							
12:48	10	40 -	1.39	38.61							
12:56	18	40 -	1.47	38.53							
14:10	74	40 -	1.57	38.43							
14:53	117	40 -	1.60	38.40							
15:33	157	40 -	1.59	38.41							

PUMPING TEST FORM

ENVIRONMENTAL STRATEGIES CORPORATION

PROJECT______ WELL CSP-5A LOCATION______ PAGE 2 OF 2

SCREEN______ M.P.______ HT. ABOVE G.S.______ W.L. MEAS. W/______

r______ PUMPING WELL______ Q______ ORIFICE______ WEATHER______

__DRAWDOWN __RECOVERY __LOCATION SKETCH

TEST START______

TEST END______

DATE TIME	t	HELD	WET	D.T.W.	s			MANO-METER	Q	WATER TEMP.	
2-27-87											
8:32		49	-10.42	38.58							
13:00	CSP-5A BEGINS PUMPING				AT	3	GPM				
13:20	CSP-5A ENDS PUMPING										
13:20.7	0.7	40	+ 0.63	40.63							
13.21	1	40	- 0.25	39.75							
13:21.5	1.5	40	- 0.79	39.21							
13:22	2	40	-0.99	39.01							
13:23	3	40	-1.20	38.80							
13:24	4	40	-1.27	38.73							
13:25	5	40	-1.34	38.66							
13:27	7	40	-1.39	38.61							
13:37	17	40	-1.44	38.56							

PUMPING TEST FORM

ENVIRONMENTAL STRATEGIES CORPORATION

PROJECT_____ WELL CSP-5E LOCATION_____ PAGE 1 OF 1

SCREEN_____ M.P._____ HT. ABOVE G.S._____ W.L. MEAS. W/_____

r_____ PUMPING WELL_____ Q_____ ORIFICE_____ WEATHER_____

__DRAWDOWN __RECOVERY __LOCATION SKETCH

TEST START_____
TEST END_____

DATE TIME	t	HELD	WET	D.T.W.	s			MANO— METER	Q	WATER TEMP.	
2-14-87											
8:06		40	-1.51	38.49							
9:36		40	-1.56	38.44							
9:53	CSP-5C	BEGINS		PUMPING	AT	1.5	GPM				
9:57		40	-1.53	38.47							
10:10		40	-1.39	38.61							
10:25		40	-1.36	38.64							
10:32	CSP-5C	ENDS		PUMPING							
10:49		40	-1.46	38.54							
10:56	PUMPING	BEGINS,	RATE = 2.5		GPM	INTAKE ≈		80'			
11:33	PUMP	OFF									
RECOVERY											
11:35	2	40	-0.58	39.42							
11:36	3	40	-1.01	38.99							
11:37	4	40	-1.16	38.84							
11:38	5	40	-1.23	38.77							
11:39	6	40	-1.29	38.71							
11:40	7	40	-1.33	38.67							
11:41	8	40	-1.37	38.63							
11:42	9	40	-1.38	38.62							
11:43	10	40	-1.39	38.61							
11:49	16	40	-1.43	38.57							
11:53	20	40	-1.47	38.53							
14:04		40	-1.47	38.53							
14:55		40	-1.49	38.51							
15:31		40	-1.43	38.53							

PUMPING TEST FORM

ENVIRONMENTAL STRATEGIES CORPORATION

PROJECT____ WELL CSP-5C LOCATION____ PAGE 1 OF 1

SCREEN____ M.P. TOP OF PVC HT. ABOVE G.S.____ W.L. MEAS. W/ ELECTRIC TAPE

r____ PUMPING WELL____ Q 1.3 gpm ORIFICE____ WEATHER____

__DRAWDOWN __RECOVERY __LOCATION SKETCH

TEST START____
END____

DATE TIME	t	HELD	~~WET~~	D.T.W.	s			MANO-METER	Q	WATER TEMP.	
2-14-87											
8:04		35	+2.56	37.56							
9:53	PUMPING BEGINS, RATE = 1.3 GPM, INTAKE IS AT 85', METHOD IS AIRLIFT										
10:32	PUMP OFF										
RECOVERY											
10:34	2	45	-0.70	44.30							
10:35	3	45	-2.22	42.78							
10 36	4	40	+1.76	41.76							
10:37	5	40	+1.07	41,07							
10 38	6	40	+0.62	40.62							
10 39	7	40	+0,19	40,19							
40	8	40	-0.11	39,89							
10 41	9	40	-0.36	39,64							
10:42	10	40	-0.58	39 42							
10:43	11	40	-0.77	39.23							
10:44	12	40	-0.90	39.10							
10:45	13	40	-1.05	38.95							
10:46	14	40	-1.17	38 83							
10:47	15	40	-1.30	38.70							
10:54	22	40	-1.64	38.36							

PUMPING TEST FORM

ENVIRONMENTAL STRATEGIES CORPORATION

PROJECT ______ WELL CSP-6 LOCATION ______ PAGE 1 OF 1

SCREEN ______ M.P. ______ HT. ABOVE G.S. ______ W.L. MEAS. W/ ______

r ______ PUMPING WELL ______ Q ______ ORIFICE ______ WEATHER ______

____DRAWDOWN ____RECOVERY ____LOCATION SKETCH

TEST START ______
TEST END ______

DATE TIME	t	HELD	WET	D.T.W.	s			MANO-METER	Q	WATER TEMP.	
2-14-87											
8:14		40	-1.80	38.20							
11:07		40	-1.78	38.22							
11:27		40	-1.76	38.24							
11:46		40	-1.77	38.23							
12:36		40	-1.77	38.23							
14:15		40	-1.77	38.23							
14.26	PUMPING BEGINS AT			5	GPM						
15:37	PUMPING ENDS										
RECOVERY											
15:38.3	1.3	40	-1.46	38.54							
5:38.8	1.8	40	-1.47	38.53							
15:39.5	2.5	40	-1.48	38.52							
15:40.3	3.3	40	-1.50	38.50							
15:41	4	40	-1.51	38.49							
15:42	5	40	-1.52	38.48							
15:43	6	40	-1.53	38.47							
15:44	7	40	-1.53	38.47							
15:47	10	40	-1.55	38.45							
15:56	19	40	-1.59	38.41							
15:62	25	40	-1.62	38.38							

PUMPING TEST FORM

ENVIRONMENTAL STRATEGIES CORPORATION

PROJECT ____ WELL CSP-7 LOCATION ____ PAGE 1 OF 1

SCREEN ____ M.P. ____ HT. ABOVE G.S. ____ W.L. MEAS. W/ ____

r ____ PUMPING WELL ____ Q ____ ORIFICE ____ WEATHER ____

___DRAWDOWN ___RECOVERY ___LOCATION SKETCH

TEST START ____

TEST END ____

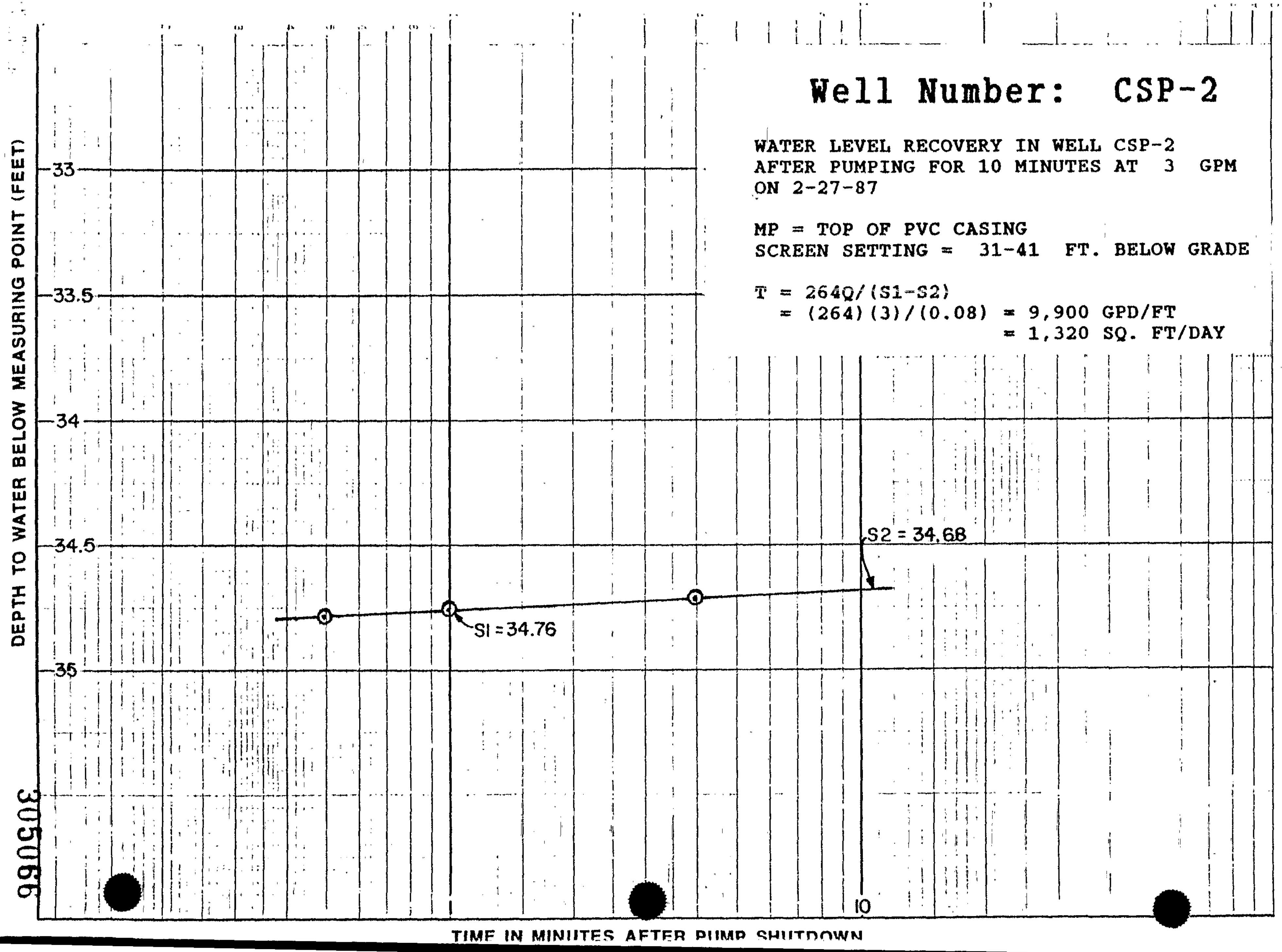
DATE TIME	t	HELD	WET	D.T.W.	s			MANO-METER	Q	WATER TEMP.	
2-25-87											
17:25		35	-0.95	34.05							
17:26	CSP	-7	PUMPING	BEGINS	AT	3	GPM				
17:45	CSP	-7	PUMPING	ENDS							
RECOVERY											
17:46	1	35	+0.65	35.65							
17:47	2	35	+0.18	35.18							
17:48	3	35	-0.11	34.89							
17:49	4	35	-0.33	34.67							
17:50	5	35	-0.42	34.58							
17:51	6	35	-0.53	34.47							
17:53	8	35	-0.64	34.36							
7:58	13	35	-0.72	34.28							

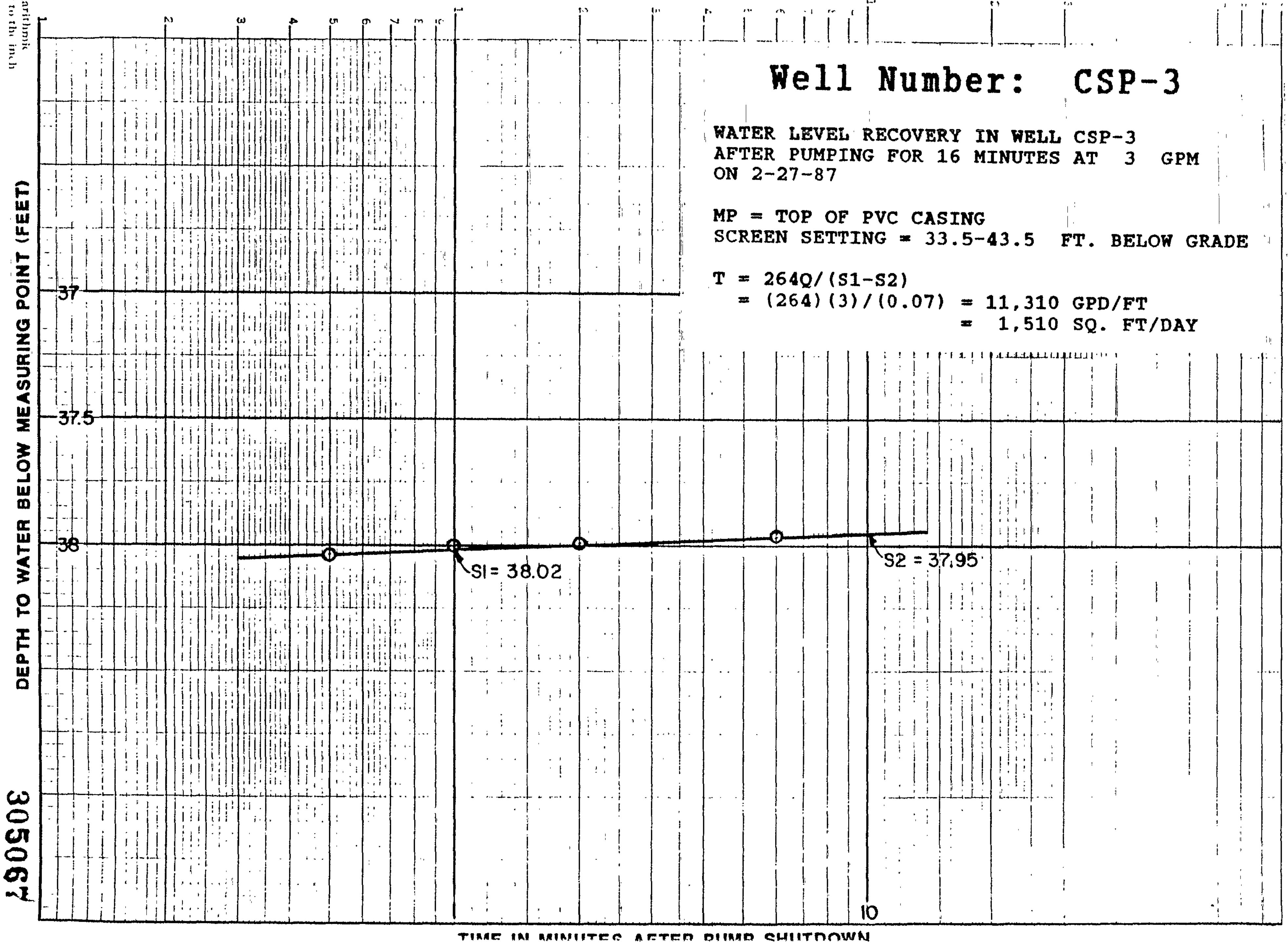
Well Number: CSP-2

WATER LEVEL RECOVERY IN WELL CSP-2
AFTER PUMPING FOR 10 MINUTES AT 3 GPM
ON 2-27-87

MP = TOP OF PVC CASING
SCREEN SETTING = 31-41 FT. BELOW GRADE

T = 264Q/(S1-S2)
= (264)(3)/(0.08) = 9,900 GPD/FT
= 1,320 SQ. FT/DAY



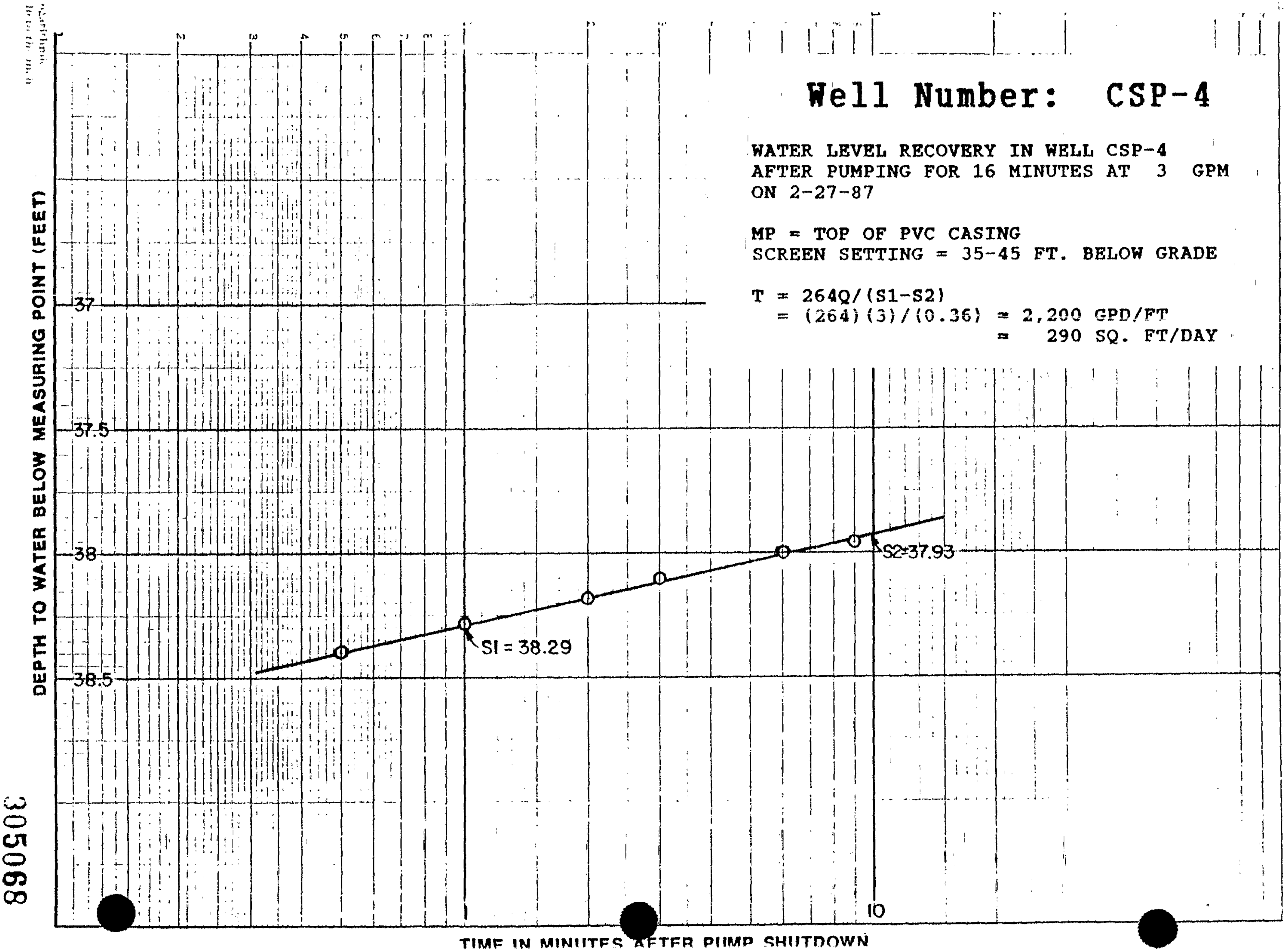


Well Number: CSP-3

WATER LEVEL RECOVERY IN WELL CSP-3
AFTER PUMPING FOR 16 MINUTES AT 3 GPM
ON 2-27-87

MP = TOP OF PVC CASING
SCREEN SETTING = 33.5-43.5 FT. BELOW GRADE

$$T = 264Q/(S1-S2)$$
$$= (264)(3)/(0.07) = 11,310 \text{ GPD/FT}$$
$$= 1,510 \text{ SQ. FT/DAY}$$

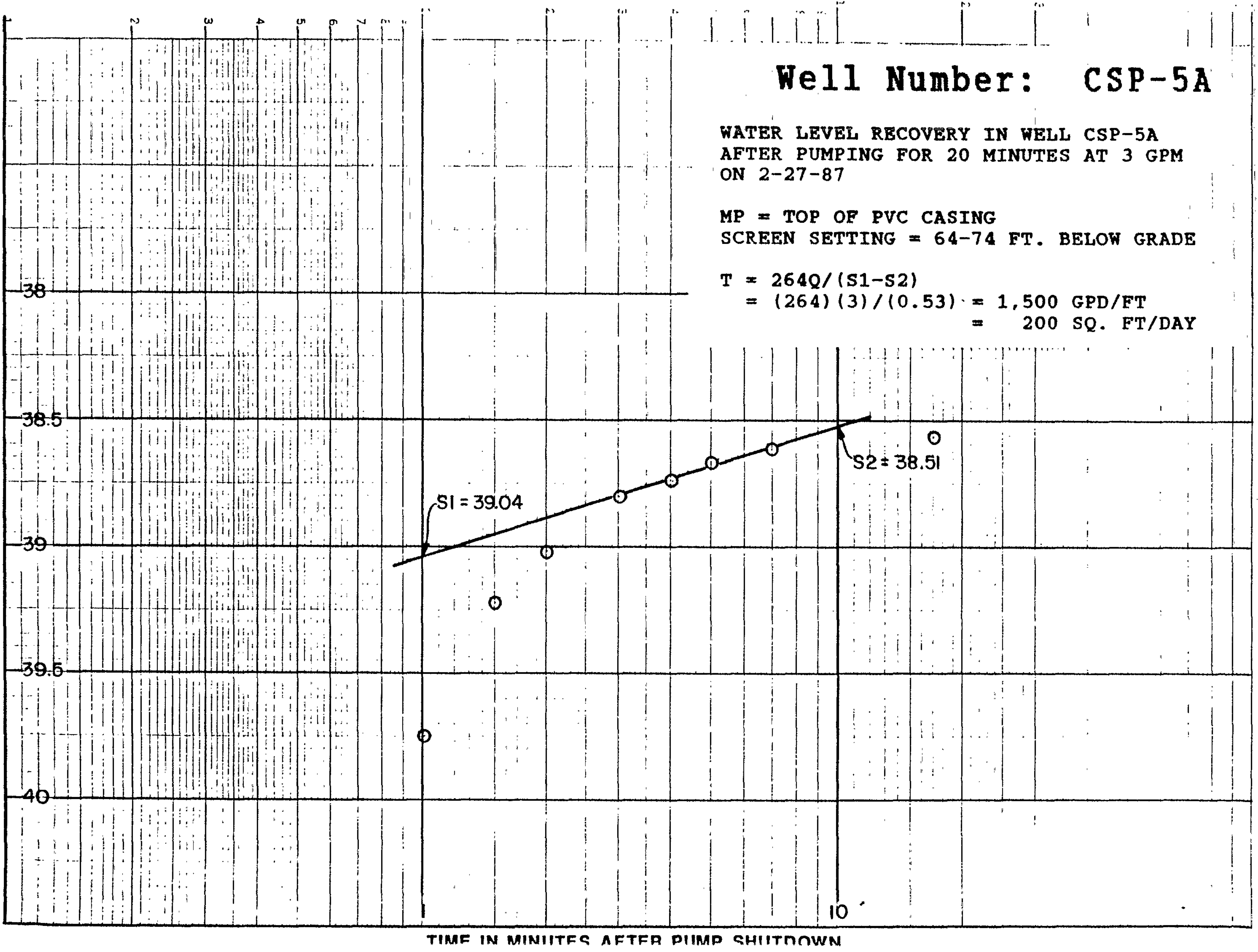


Well Number: CSP-4

WATER LEVEL RECOVERY IN WELL CSP-4
AFTER PUMPING FOR 16 MINUTES AT 3 GPM
ON 2-27-87

MP = TOP OF PVC CASING
SCREEN SETTING = 35-45 FT. BELOW GRADE

T = 264Q/(S1-S2)
= (264)(3)/(0.36) = 2,200 GPD/FT
= 290 SQ. FT/DAY



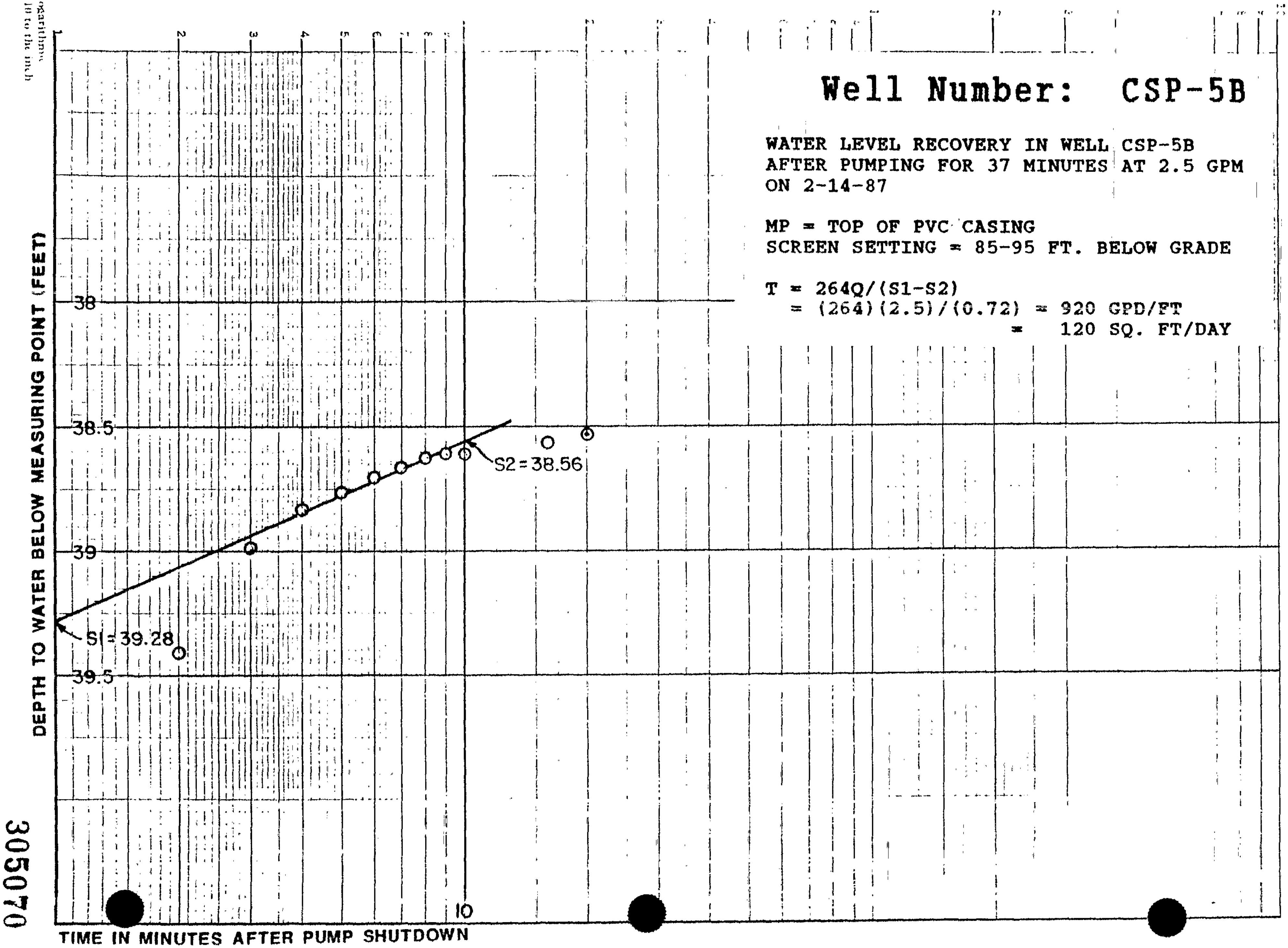
Well Number: CSP-5A

WATER LEVEL RECOVERY IN WELL CSP-5A
AFTER PUMPING FOR 20 MINUTES AT 3 GPM
ON 2-27-87

MP = TOP OF PVC CASING
SCREEN SETTING = 64-74 FT. BELOW GRADE

T = 264Q/(S1-S2)
= (264)(3)/(0.53) = 1,500 GPD/FT
= 200 SQ. FT/DAY

Semi-Logarithmic
3 Cycles x 10 to the inch

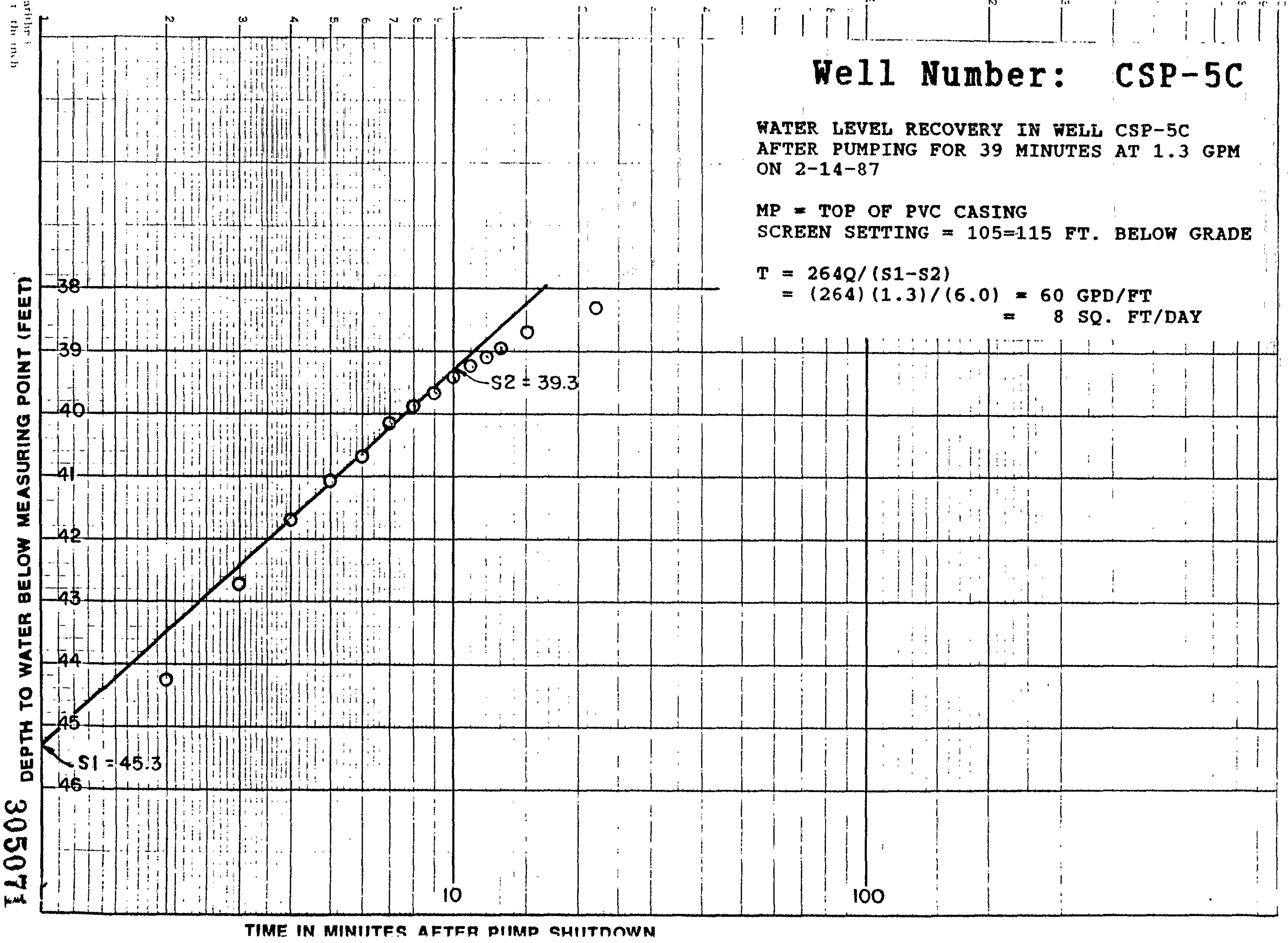


Well Number: CSP-5B

WATER LEVEL RECOVERY IN WELL CSP-5B
AFTER PUMPING FOR 37 MINUTES AT 2.5 GPM
ON 2-14-87

MP = TOP OF PVC CASING
SCREEN SETTING = 85-95 FT. BELOW GRADE

$T = 264Q/(S1-S2)$
$= (264)(2.5)/(0.72) = 920$ GPD/FT
$=$ 120 SQ. FT/DAY



Well Number: CSP-5C

WATER LEVEL RECOVERY IN WELL CSP-5C
AFTER PUMPING FOR 39 MINUTES AT 1.3 GPM
ON 2-14-87

MP = TOP OF PVC CASING
SCREEN SETTING = 105=115 FT. BELOW GRADE

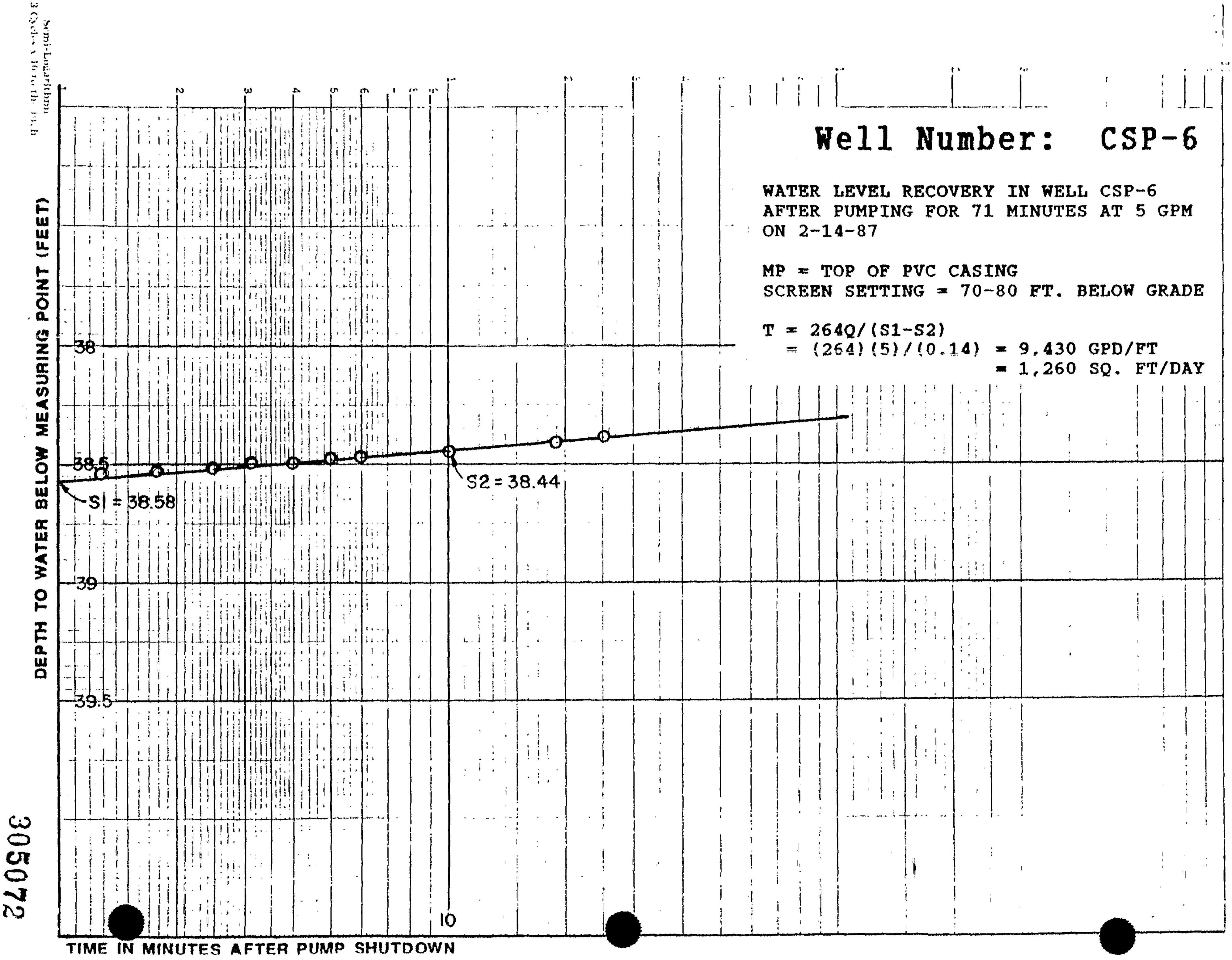
T = 264Q/(S1-S2)
= (264)(1.3)/(6.0) = 60 GPD/FT
= 8 SQ. FT/DAY

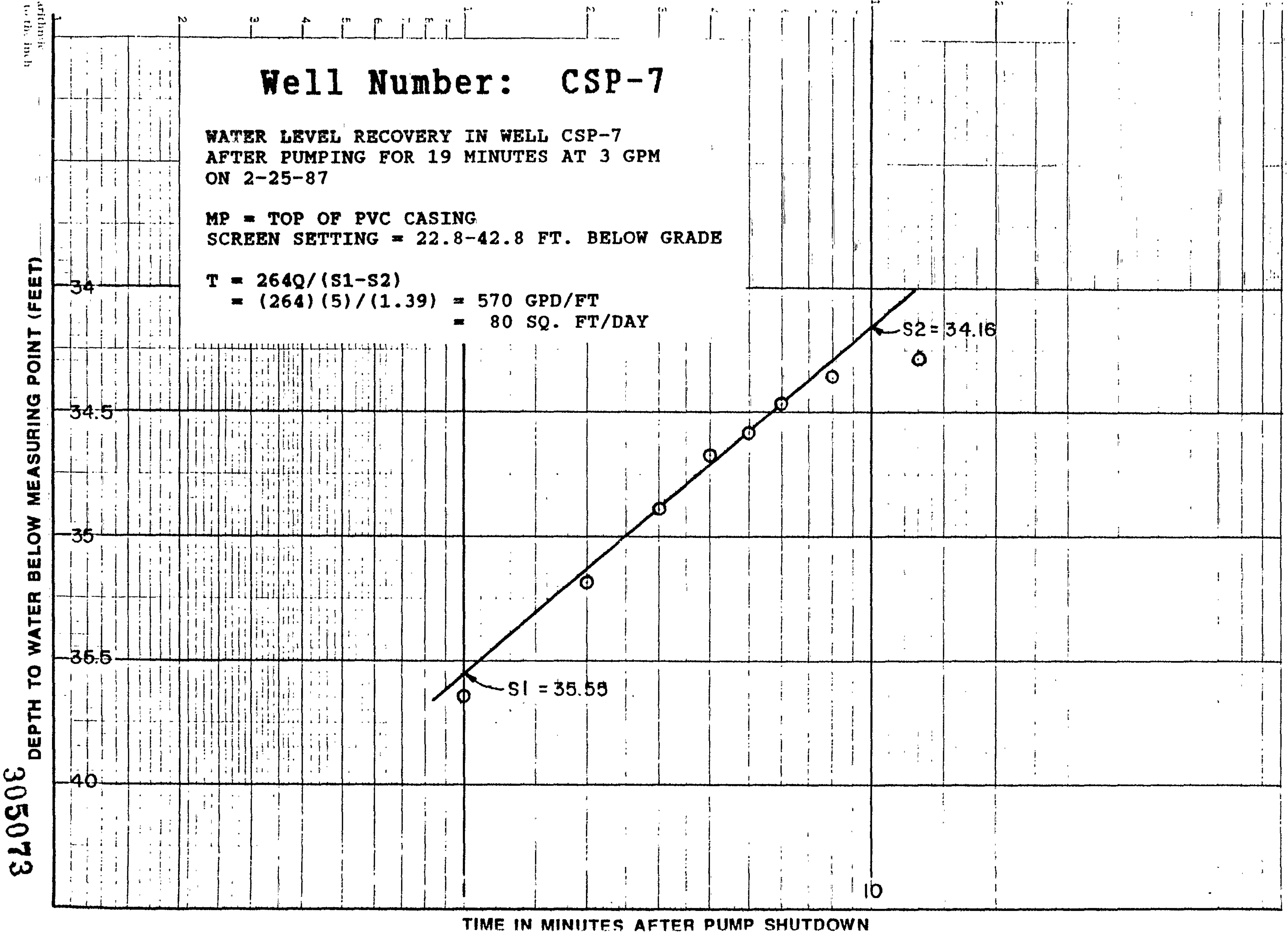
Well Number: CSP-6

WATER LEVEL RECOVERY IN WELL CSP-6
AFTER PUMPING FOR 71 MINUTES AT 5 GPM
ON 2-14-87

MP = TOP OF PVC CASING
SCREEN SETTING = 70-80 FT. BELOW GRADE

T = 264Q/(S1-S2)
= (264)(5)/(0.14) = 9,430 GPD/FT
= 1,260 SQ. FT/DAY





Well Number: CSP-7

WATER LEVEL RECOVERY IN WELL CSP-7
AFTER PUMPING FOR 19 MINUTES AT 3 GPM
ON 2-25-87

MP = TOP OF PVC CASING
SCREEN SETTING = 22.8-42.8 FT. BELOW GRADE

T = 264Q/(S1-S2)
= (264)(5)/(1.39) = 570 GPD/FT
= 80 SQ. FT/DAY

Semi-Logarithmic
3 Cycles x 10 to the inch

Appendix I - Off-site well sampling program

PROPOSAL TO SAMPLE OFF-SITE WELLS IN THE VICINITY OF THE HELLERTOWN MANUFACTURING COMPANY IN HELLERTOWN, PENNSYLVANIA

PREPARED
BY

ENVIRONMENTAL STRATEGIES CORPORATION
8521 LEESBURG PIKE
SUITE 650
VIENNA, VIRGINIA 22180

MAY 8, 1987

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Scope of Work

The presence of contaminants in surficial groundwater at the Hellertown Manufacturing Company (HMC) site has been confirmed based on the results of several sampling episodes over the past two years. There is insufficient information at present to determine if contaminants have migrated off-site. If such a migration has occurred, it would have been driven by the west-northwest groundwater gradient, and contaminants would have discharged to nearby Saucon Creek. In the beginning of 1987, several deep bedrock wells were installed and monitored at the facility. Information from this work raises the possibility that contaminant migration off-site could occur through a route other than the one described above. To better elucidate and verify patterns of potential contaminant migration, Environmental Strategies Corporation (ESC) proposes to sample several off-site wells.

The constituents of greatest concern are Hazardous Substance List (HSL) volatile organic compounds, including vinyl chloride, trichloroethylene, tetrachloroethylene, methylene chloride and trans-1,2-dichloroethylene. These constituents have been detected in several wells at the HMC and have the potential to migrate. Consequently, the proposed sampling effort will concentrate on these constituents.

The criteria for selecting the off-site wells to be sampled are based on the "necessary and sufficient" philosophy advocated by the EPA in the CERCLA Remedial Investigation Guidance Document, June 1985. Four wells have been identified for sampling in this initial monitoring effort. Reportedly, two of the wells, the Kniha well, and well 71 (Sheesly Concrete Company) are not in use, but they are located between the site and the likely area of groundwater discharge along Saucon Creek (Table 1; Figure 1). A third well, (Well A, the William Street well) is located in the direction of groundwater flow from the site, although it is west of Saucon Creek. Nevertheless, the William Street well will be sampled because it figured so prominently in the HRS scoring for the site and because it appears to be an active off-site well in proximity to the site.

A well located west of the HMC was used to monitor groundwater surface elevations when the Friedensville Zinc Mine was operational. The well (designated as 54) is located on Lehigh University property.

Relevant Standard Operating Procedures for collection of the water samples from the ESC Quality Assurance Plan have been included for review and evaluation (Appendix A). Water supply wells with functional pumping systems will be sampled as indicated in SOP FS-6. Wells lacking functional pumping systems will be sampled using SOP FS-5. At least two VOA vials of sample will be collected at each location. Four VOA vials of sample from drinking water wells will be collected to facilitate achieving lower detection limits. Field conditions may dictate that a hybrid methodology combining aspects of both SOPs is appropriate. Any modifications to the supplied SOPs will be thoroughly documented in the field and provided to the EPA.

Table 1

Identification of Wells to be Sampled

Well Designation	Well Description	Depth (ft)
71	Sheesly Concrete Co.	102
Kniha Well	Kniha Well	unknown
Well A	William St. Well	unknown
54	Lehigh University	80

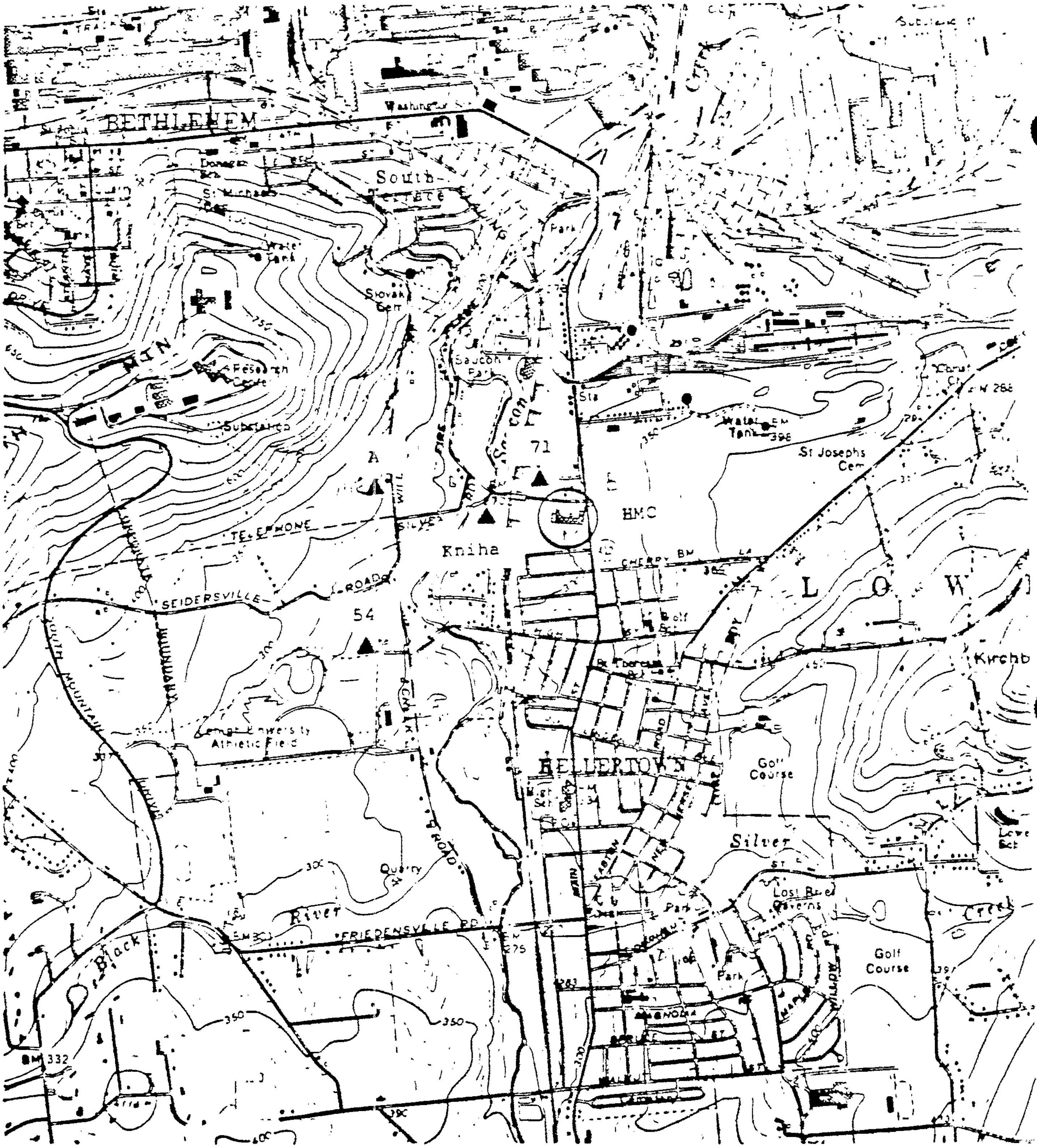

Figure 1 - Well locations

ENVIRONMENTAL STRATEGIES CORPORATION
8521 LEESBURG PIKE, SUITE 650
VIENNA, VIRGINIA 22180
703-821-3700

ESC proposes to use an EPA contract laboratory, and have all samples analyzed for the HSL volatiles using EPA CLP analyses. A data package containing CLP deliverables will be submitted with all analytical results. Data quality objectives for precision and accuracy are based on the analytical methods employed under the CLP. Table 2 summarizes the analytical detection limits for the volatile HSL compounds. If needed, the analytical laboratory will implement standardized methodologies for achieving lower detection limits so that constituent levels can be quantified at or below Recommended Maximum Contaminant Levels for drinking water. For quality control purposes, a minimum of 5% of all samples collected will be replicated. The replicates will be blind to the laboratory. In addition, a trip blank (and field blank, if appropriate) will accompany each sample shipment.

Public Relations

ESC will integrate this sampling effort into the site specific public relations plan that is in preparation by the EPA. This information will also be part of the total Remedial Investigation effort being undertaken by ESC. It is anticipated that ultimately both ESC and the EPA will have contact with the relevant individuals. ESC will require site access and specific information on the sampling points. Once the EPA has established contact with the relevant individuals, ESC intends to gather as much information as possible by telephone before initiating the sampling. The planning phase will be followed by telephone communications with relevant individuals regarding the proposed sampling date.

Table 2

List of Volatile Organic Compounds for Testing and Contract Required Detection Limits

Volatiles	Detection limits (low) Water ug/l
Chloromethane	10
Bromomethane	10
Vinyl chloride	10
Chloroethane	10
Methylene chloride	5
Acetone	10
Carbon disulfide	5
1,1-Dichloroethylene	5
1,1-Dichloroethane	5
trans-1,2-Dichloroethylene	5
Chloroform	5
1,2-Dichloroethane	5
2-Butanone	10
1,1,1-Trichlrorethane	5
Carbon tetrachloride	5
Vinyl acetate	10
Bromodichloromethane	5
1,1,2,2-Tetrachloroethane	5
1,1-Dichloropropane	5
trans-1,3-Dichloropropene	5
Trichloroethylene	5
Dibromochloromethane	5
1,1,2-Trichloroethane	5
Benzene	5
cis-1,3-Dichloropropene	5
2-Chloroethyl vinyl ether	10
Bromoform	5
2-Hexanone	10
4-Methyl-2-pentanone	10
Tetrachloroethylene	5
Toluene	5
Chlorobenzene	5
Ethyl benzene	5
Styrene	5
Total xylenes	5

Once the sampling plan has been implemented, the analytical results will be interpreted and provided to the EPA who can make them available at the designated local information repositories.

Schedule

Following the EPA review of this document, ESC's intention is to sample the four identified wells during the week of May 18, 1987.

Appendix A - Standard operating procedures

Title: SOP FS-1 - Reference Point Location

Scope: This operating procedure describes ways and means of locating stable reference points for later use in documenting sampling point locations.

Purpose: The purpose of this procedure is to assure that reference points are established in the field that are relocatable at a future time if needed.

Equipment Needed: Tape measure, brunton compass, straight-edge

Procedures:

1. Select two prominent, permanent landmarks at the site such as a building, telephone pole, or extraordinary tree.
2. Draw a sketch of the site in the field logbook indicating the approximate position of these two points. Label the sketch: "Field reference locations." Label all pertinent features; identify the type of tree and its girth, if appropriate. Note utility pole number. Label the points OR-1 and OR-2.
3. Select a permanent landmark offsite, such as a utility pole or street intersection. Add this spot to the field reference location sketch.
4. Use a straight-edge to draw a line from the offsite reference to each of the onsite reference points. Terminate the line with an arrow at the onsite points.
5. Stand at the offsite reference point and determine the bearing to each onsite reference, using the Brunton compass. Record the bearing above the line to each point as an azimuth. (Note: verify that the magnetic declination of the compass is correctly set for the area prior to noting the azimuth)
6. Add a north pointing arrow to the sketch.
7. Measure the distance from the offsite reference point to each of the onsite reference points, and record the measured distance below each line, respectively.
8. Standing at onsite reference point OR-1, measure the bearing to OR-2. Use a straight-edge to draw a line between the two points which terminates in an arrow at OR-2. Label above the line the azimuth bearing.

9. Measure the distance between OR-1 and OR-2 and record the measured distance below the line.

10. Reference points are now located.

Title: SOP FS-2 - Location of sampling points in the field

Scope: This operating procedure describes ways and means of locations of sampling points used in the field.

Purpose: The purpose of this procedure is to assure that sampling points used during investigations are relocatable in the future and are accurately represented in subsequent reports.

Equipment Needed: Tape measure, stakes, brunton compass, straight-edge, hammer, waterproof marker, surveyor's flagging.

Procedures:

1. Prepare a sketch of the site including prominent landmarks, reference points OR-1 and OR-2 (see FS-1), and a north arrow. Label the sketch "sample locations - *** samples" where "***" is the kind of samples that will be taken (soil, surface water, sediment, groundwater, eg.).

2. Refer to the site sampling plan and determine how many samples are to be taken and their approximate locations.

3. Pick-up enough surveyor's stakes to mark all the sample points, plus three "extras."

4. Proceed to the first spot indicated on the site sampling plan. Reconnoiter the area and place a stake at a point representative of potential contamination in the vicinity.

5. Stand near the stake and obtain the bearing between the selected point and each of the reference points. Add the selected point to the sketch including an assigned sample number. Write assigned sample number in waterproof marker on the stake and tie surveyor's flagging to the stake.

6. Prepare a table in the field logbook with headings "sample no.", "bearing to OR-1", and "comments."

7. Complete entries for each column. Comments will document pertinent details of the selected sampling point such as soil staining, dead vegetation, etc.

8. Repeat for each proposed sample point. Use additional stakes to mark any location where contaminant conditions not reflected in the sampling plan are found.

Title: SOP FS-3 - Sample Container Requirements

Scope: This operating procedure describes ways and means of selecting the appropriate container for environmental samples prior to site inspection sampling.

Purpose: The purpose of this procedure is to assure that sample volumes and preservations are sufficient for analytical services required under EPA approved protocols.

Equipment Needed: Sample containers, shipping containers, sample labels, waterproof marker.

Procedures:

1. Refer to Table FS-3.1 for minimum sample volume and glassware types(s) allowed for sampling a particular matrix and compound class.
2. Select the appropriate jar(s) from those provided by the laboratory and verify that the laboratory has provided the correct number of jars for the project per sampling plan requirements.
3. Report any discrepancies to the QAD immediately.
4. Apply sample labels to containers and label project name.
5. Proceed with sampling.

Table FS-3.1

Compound(s)	Matrix	Volume(min)	Glassware
Inorganic-Metals	Solid	6 oz	1 6-oz. glass jar
	Aqueous	1000 ml	1 100-ml glass jar
Volatile Organics	Solid	240 ml	1 glass jar with teflon-liner
	Aqueous	80 ml	2 40-ml glass vials
Extractable Organics	Solid	6 oz	1 6-oz glass jar
	Aqueous	4000 ml	4 1000-ml glass jars
Pesticides	Solid	6 oz	1 6-oz glass jar - teflon lid
	Aqueous	1000 ml	1 1000-ml glass jar - teflon lid
Phenols	Solid	6 oz	1 500-ml glass jar
Dioxin	Soil		
Dioxin	Oil		
Dioxin	Aqueous		
Dioxin	Combustion byproduct		

Title: SOP FS-4 - Field Decontamination Procedure

Scope: This operating procedure describes ways and means of decontaminating equipment used during environmental sampling on uncontrolled hazardous waste sites.

Purpose: The purpose of this procedure is to assure good quality control in field operations, uniformity between different field personnel, and a means to allow tracability of possible causes of error in analytical results. Following this procedure will minimize the potential for cross-contamination of environmental samples during site inspection activities.

Equipment Needed: distilled water, organic-free distilled water, tree-sprayer, 5-gallon pail, phosphate free detergent, reagent grade acetone, 10% nitric acid solution, nylon scrub brush, aluminum foil, paper towels, plastic trash bag, long handled bottle brush, steam cleaner.

Procedures:

1. Select an area of the site removed from sampling locations, downwind and downgradient. The decontamination process must not contribute to the possibility of cross-contamination of sample points.

2. Fill a 5-gallon pressurized "tree-sprayer" can with tap water from a plastic jug.

3. Thoroughly wash all grit, grime, mud, particulate matter, etc., from the equipment being decontaminated.

4. Put 1 gallon of tap water into a 5-gallon stainless steel pail and add 1 cup detergent (Alconox or equivalent).

5. Wash equipment in the pail using a nylon scrub brush or long handled bottle brush.

6. Rinse all residual detergent from the equipment with the tree-sprayer.

7. If equipment is to be used to sample for inorganics, wash with 10% nitric acid solution.

8. If equipment is to be used to sample for organics wash with acetone. If an acetone wash is used allow equipment to air dry before step 9.

9. Give the equipment a final thorough rinse with organic-free distilled water from a glass jug or squeeze bottle.

10. Dry and then wrap the equipment securely in aluminum foil or reuse the equipment within 1/2 hour.

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Title: SOP FS-5 - Groundwater Sampling - Bailer

Scope: This operating procedure describes ways and means of obtaining groundwater samples from monitoring wells with a bailer.

Purpose: The purpose of this procedure is to assure good quality control in field operations, uniformity between different field personnel, and a means to allow tracability of possible causes of error in analytical results.

Equipment Needed: Sampler container with labels, water proof marker, field tracking form, tape measure with weights, plastic trash bag, H-Nu, flashlight, calculator, teflon bailer(s), monofilament bailer rope, decontamination equipment, pH meter, conductivity meter, filter equipment.

Procedures:

1. Verify that the well to be sampled is located and numbered on plans correctly by locating it in accordance with FS-2.

2. Position an H-Nu to detect any organic vapors being emitted upon removal of the well's cap (see FS-6 for H-Nu operation procedures).

3. Remove the well cap and record H-Nu response in the field logbook.

4. Use a flashlight to inspect the water surface in the well. Note any observable floating contaminants in the field logbook.

5. Prepare a table in the field logbook with "well number," "depth to water," "depth to bottom of casing," and "stickup" as column headings.

6. Record the well number and measure and record the stickup of the casing above ground surface. From the top of the casing, measure the depth to water (DTW) with a weighted tape and record to the nearest 0.041 feet. Measure and record the depth of the bottom of the casing (DTB) to the nearest 0.01 ft.

7. Calculate the volume of standing water in the well using:

$$vol = [(DTB - DTW) * 0.022]\ ft^3$$

for a 2-inch ID well, or

$$vol - [(DTB - DTW) * 0.087]\ ft^3$$

for a 4-inch ID well.

8. Determine how many gallons or liters are required to remove three well volumes. Record this in the field logbook.

9. Carefully lower the bailer into the well and allow it to sink ½-inch below the water surface. Remove this bail of surficial water and inspect it for floating contaminants. If any are found, or if the sampling plan requires, secure samples for analysis.

10. Continue bailing at a uniform rate. Each time, empty the bailer into a calibrated container that allows the volume bailed from the well to be determined. Upon completion of enough bails to remove 3 casing volumes of water, empty the container at least 25 feet downgradient from the well.

11. Use the bailer to gently obtain samples from the well. Sample first for VOA analyses (see FS-3), taking care to remove all air bubbles from the vial and minimize agitation. Obtain a sample for metals analysis last.

12. As soon as possible after collecting a sample measure and record the field pH and conductivity (FS-7 and FS-10).

13. Affix labels to each sample container and complete all required data. Record sample number, well number, time of sampling, date, and the sampler's initials on the sample tracking form and in the field logbook.

14. Inspect the well for soundness of protective casing and surface grout seal. Note observations of water color, suspended particulates, discoloration of casing, if the well cap is vented or not, casing size, diameter, and material, any unusual occurrences during sampling, and pertinent weather details.

15. Thoroughly decontaminate (FS-4) all equipment used; discard used monofilament line, rags, towels, gloves, etc. in a plastic garbage bag.

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Title: SOP FS-6 - Groundwater Sampling - Home Faucet

Scope: This operating procedure describes ways and means of obtaining groundwater samples from private domestic wells, public water supply wells, industrial supply wells, or other wells specifically designed to deliver a continuous water supply to a consumer.

Purpose: The purpose of this procedure is to assure good quality control in field operations, uniformity between different field personnel, and a means to allow tracability of possible causes of error in analytical results.

Equipment Needed: Sample containers with labels, water proof marker, field tracking form, pH meter, conductivity meter, filter equipment.

Procedures:

1. Locate the home by plotting or otherwise denoting the home on a U.S.G.S. topographic map.
2. Sketch the site, including roads, driveways, house and building locations, well location, north arrow, land use, and any other pertinent observations.
3. From the homeowner, determine the age of the well, depth, existence of a "water well completion report form," knowledge of taste/odor/corrosion problems in the area, type and age of piping in the house, past land uses in the area, existence and location of homeowner's and neighbor's septic system, existence of any other wells, buried tanks, or former buried tanks onsite, and any other pertinent details.
4. Select a faucet for sampling in as direct a line to the well as possible. Do not choose a faucet following water purifiers, softeners, filters, or neutralizers.
5. Open the faucet and estimate the discharge.
6. Note the starting time on the field logbook and allow the water to run long enough to drain the pressure tank and piping, or five minutes, whichever is shortest. Note completion time.
7. After five minutes of purging, decrease the discharge to effect non-turbulent flow and obtain a sample for field determination of pH, and conductivity. Refer to FS-7

and FS-10 for these procedures. DO NOT completely shut off the water flow until after all samples have been taken.

8. Under non-turbulent flow conditions, obtain VOA samples (see FS-3) by completely filling the sample vial with a minimum of agitation. Leave no headspace.

9. Slightly increase the discharge rate, if needed, to efficiently fill the remainder of the sample containers. Note: Unless the water is noticeably turbid, samples for metals analysis need not be filtered. Record in the field logbook if filtering was performed.

10. Note on the sample tracking form if metals samples are filtered or unfiltered.

11. Affix labels to all sample containers and record all information.

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Title: SOP FS-7 pH Meter: Use and Calibration

Scope: This procedure describes ways and means of using and properly calibrating digital pH equipment in the field. Manufacturer's recommendations accompanying the instrument should also be consulted if difficulties occur.

Purpose: The purpose of this procedure is to assure good quality control in field operations, uniformity between different field personnel, and a means to allow traceability of possible causes of error in analytical results. This procedure is used for a semi-quantitative analysis of the acidity of water samples and to evaluate the consistency of water quality during groundwater sampling. Precise pH measurement must include temperature compensation during measurement.

Equipment needed: pH meter and equipment, buffers, plastic, cups, waterproof marker, distilled water, plastic trash bag.

Procedures:

1. Remove pH meter from the box and check that batteries are operable.
2. Turn power on and allow meter to stabilize for 3 to 5 minutes. Note: Some electronic equipment is strongly affected by extremes in temperature. Avoid leaving electronic equipment in direct sunlight or on cold ground.
3. Determine from the sampling plan if conditions are expected to be acidic of alkaline.
4. Select pH buffers 7 and 4, if acidic conditions are expected, or 7 and 0 if alkaline conditions are expected.
5. Take two clean, dry plastic cups and label each one with the selected pH of the buffers.
6. Place about 10 ml of each buffer in their respective cups and replace the buffers in the case.
7. Remove the protective cap from the probe tip and rinse the probe with distilled water.

8. Place the probe in the pH 7 buffer and very gently swirl. When the readout stabilizes adjust the readout to 7.0 with the span pot adjustment.

9. Remove the probe from the buffer and rinse thoroughly with distilled water.

10. Place the probe in the other calibration buffer. When the readout stabilizes, adjust to the proper pH reading with the calibration dial.

11. Rinse the probe and recalibrate to pH 7.

12. Note in the field logbook which pH buffers were used for calibration.

13. Calibration frequency: Calibration is needed

    a) every time the instrument is turned on
    b) following significant temperature changes (if allowed to sit in direct sunlight, e.g.)
    c) when erratic behavior is noted
    d) when the pH of the target sample does not fall within the calibration range.

14. place about 30 ml of sample in a plastic cup.

15. Rinse the probe tip thoroughly with distilled water then place the probe in the sample and very gently swirl.

16. When the readout stabilizes, record the pH indicated in the field logbook with sample location, date, time, project number, and sampler's initials.

17. Rinse all parts of the probe that have come in contact with the sample with distilled water, discard the sample, used cups, and buffers. Replace the protective cap on the pH probe and return the instrument to its case.

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Title: SOP FS-8 HNU Calibration

Scope: This procedure describes ways and means of calibrating an HNU photoionization detector in the laboratory prior to field use. This procedure is applicable for detection of organic compounds in the atmosphere so that appropriate safety measures can be taken. Its utility as a quantitative measuring system may be questionable.

Purpose: The purpose of this procedure is to assure good quality control in field operations, uniformity between different field personnel, and a means to allow traceability of possible causes of error in analytical results.

Equipment needed: HNU, rotameter, "T" connector, calibration gas.

Procedures:

1. Note: this is a procedure that must be done no more than 1 day prior to use in the field.

2. Check that the function switch is in the "off" position then attach the probe to the detector.

3. Turn the function switch to the "battery check" position and recharge the battery if required.

4. Turn the function switch to "standby" and zero the readout.

5. Connect open side of a "T" connector to a pressurized container of calibration gas, the second side to a rotameter and the third side directly to the 8" extension to the photoionization probe.

6. Open the valve of the pressurized container. With the SPAN setting at 5.0 and the function switch at 0-200 until a steady reading is obtained.

7. If the reading is the same as the instrument specific reading (76) the calibration exercise is complete. If the reading has changed adjust the span pot so that the instrument readout matches the exact value of the calibration gas. Consult the manufacturer's instrument manual accompanying the instrument for these values.

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Title: SOP FS-9 HNU - Field use

Scope: This procedure describes ways and means of properly using an HNU photoionization detector in the field. This procedure does not detail the philosophy of air release monitoring for Site Inspection or Hazard Ranking Documentation purposes.

Purpose: The purpose of this procedure is to assure good quality control in field, operations, uniformity between different field personnel, and a means to allow traceability of possible causes of error in analytical results.

Equipment needed: Calibrated HNU

Procedures:

1. Turn the function switch to the "off" position and connect the probe. Twist the probe connector until a distinct snap and lock is felt.
2. Turn the function switch to the "battery check" position. Battery charge must be within the green battery arc on the scaleplate for use.
3. Turn the function switch to the "on" position. Check for the UV light flow in the probe - briefly.
4. Turn the function switch to the standby position and rotate the zero pot until the meter readout is zero. Allow 15-20 seconds for stabilization. Note: This electronic zero adjustment must be made whenever the span pot is adjusted and every time the power is turned on.
5. Set the range setting to 0-20. Note the range setting, span pot setting, and time in the field logbook.
6. Trace detection sensitivity can be heightened by span pot adjustment. Consult owners manual and record all adjustments in the field logbook.
7. Record individually all positive indications. Offscale readings on the low range must be duplicated at higher scale ranges and recorded.
8. Note that the HNU photoionization detector indicates the presence of many highly toxic gasses. When detection occurs, inform the site safety officer of site project

officer immediately and move to a safe area until proper safety precautions are determined.

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Title: SOP FS-10 Conductivity Meter - Field Calibration and Use

Scope: This procedure describes ways and means of obtaining conductivity measurements in aqueous media in the field using portable, hand-held equipment.

Purpose: The purpose of this procedure is to assure good quality control in field operations, uniformity between different field personnel, and a means to allow traceability of possible causes of error in analytical results. This methodology provides semi-quantitative results for use in determining relative variations in conductivity between two samples.

Equipment needed: Conductivity meter, reference solutions, plastic cup, plastic trash bag, thermometer, distilled water.

Procedures:

1. Check the battery level before using the instrument. The indicated level must be greater than 7.0 volts. Choose a calibration method and record method used in the field logbook.

DRY STANDARDIZATION

2. Set the function switch to "CON," the range switch to 1,000 and the temperature compensator to 250.

3. Unplug the cell.

4. Adjust the "STANDARDIZE" control for a reading of 1,000. Note: this procedure standardizes all ranges!

WET STANDARDIZATION

2. Plug in the cell.

3. Select range of interest based on expected conditions.

4. Obtain a known reference solution from the case. Note: Reference solutions must be checked quarterly (see equipment maintenance records) and replaced when a 25% variation is noted.

5. Measure the temperature of the reference solution.

6. Set "TEMPERATURE COMPENSATOR" to temperature of the reference solution.

7. Adjust "STANDARDIZE" to read the value of the reference.

USE

1. With the instrument standardize with either the wet or dry procedure, select range of interest or if concentration is unknown, select highest range.
2. Pour about 50 ml of sample into a clean, dry plastic cup.
3. Measure the temperature of the sample and set the temperature compensator to the temperature of the sample.
4. Immerse the probe into the sample and gently stir. The cell must be immersed not less than 3/4 of an inch and must not come in contact with the walls or bottom of the sample container.
5. Change the range switch until the display reads below 1,500. Full scale readings of up to 50% higher than the scale range are within calibration.
6. Record sample number, date, time, project, samplers' initials and results in the field logbook.
7. Thoroughly rinse probe top with distilled water before measuring another sample or putting the equipment away.

Figure 1 - Well locations

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