M E M O R A N D U M

August 3, 2007

To: File 742577

From: Steve Rossello

Subject: RHRL – Preliminary Evaluation of Trench Area Groundwater Extraction

cc: Steve Miller, P.E.
James O'Loughlin

The groundwater extraction trench with a downgradient HDPE barrier was installed to extract groundwater from the overburden and shallow bedrock in the South Area. While the HDPE barrier assists with groundwater control, the primary purpose to the HDPE barrier was to limit the potential downgradient migration of NAPL and the secondary purpose was to limit the infiltration of water into the trench from the South Pond.

Paired piezometers were installed to assess the effectiveness of groundwater extraction. One piezometer of each pair was installed in the groundwater extraction trench; the second piezometer of each pair was installed downgradient of the trench and barrier, approximately five feet from the trench piezometer. The trench piezometers were screened in bedrock and in the trench backfill both to measure water levels in the trench and to facilitate collection of groundwater from the shallow bedrock. The downgradient piezometers were screened in the till, just above bedrock. Although the in-trench piezometers are screened both in the trench backfill and the bedrock, the measured water levels represent water levels in the trench because the trench backfill has a much higher hydraulic conductivity than the bedrock. Water levels in a monitoring well that is screened in multiple zones are dominated by the most transmissive zone. The measured hydraulic conductivity of the trench backfill materials is 60 ft/day (2×10^{-2} cm/sec), while the measured average hydraulic conductivity of the bedrock is only 0.3 feet per day. Therefore, it is very unlikely that the water level readings are influenced by the bedrock water levels.

To assess the effectiveness of the groundwater extraction trench, groundwater elevations in the trench piezometers were initially compared to groundwater elevations in the downgradient piezometers. Since July 2006, weekly water-level measurements have been collected from both the monitoring wells and the collection sumps. Water levels are measured manually in the piezometers and with dedicated transducers in the sumps. Groundwater elevations are tabulated on Table 1; supporting data are provided on Table 2. As shown on Table 3, Figure 1, and Figure 2, water levels in the trench have generally been lower than in the downgradient piezometer at locations TMW-1/TMW-2 located at the north end of the trench, and SSC-2/TMW-4 located between sumps S-1 and S-2. Water levels at TMW-7/TMW-8 located at the south end of the trench show almost no gradient between the pair; water levels in the two piezometers are within a few hundredths of a foot. Water levels at piezometer-pair locations SSC-1/TMW-3 located between sumps S-1 and S-2, and SSC-3/TMW-5 located between sumps S-2 and S-3, have been sporadically higher in the trench piezometers than in the respective downgradient piezometers. The water levels at piezometer-pair location SSC-4/TMW-6, located between sumps S-2 and S-3, frequently have been higher in the trench piezometer than in the downgradient piezometer.

As shown on Figure 1, a further review of water-level observations over time shows that groundwater extraction in the trench exerts hydraulic control by lowering water levels in formation outside of the trench. As an example, at the end of September, 2006, the water-levels in the sumps S-1 and S-2 were lowered to below the elevation of the South Pond to better demonstrate hydraulic control. North of sump S-2, the water levels in both the in-trench and in the downgradient piezometers rapidly decreased, demonstrating the hydraulic influence of the trench. The water level in S-3 was also lowered, but due to the high bedrock, could not be lowered below pond level. South of S-2, the water-level changes in the piezometers were less dramatic, likely due to the high bedrock that limited the depth of the trench.

North of S-2, the hydraulic control of the overburden by the groundwater trench is clearly demonstrated by large drawdowns in both the trench and downgradient piezometers and the comparative analysis of trench and downgradient groundwater elevations. While not necessary for hydraulic control, water levels in the piezometers and trench north of S-2 are generally lower than the level of the South Pond, further demonstrating control.

South of S-2, the drawdowns in the trench and piezometers, while less than in the north, are still significant and indicative of groundwater extraction and the mitigation of migration. The water levels in piezometer SSC-4, located in the trench between sumps S-2 and S-3, are frequently higher than in downgradient piezometer TMW-6. Water levels at the end of the trench in MW-8 are about the same as in MW-7, just outside the trench. However, based on the high permeability of the trench backfill, low hydraulic gradient and low permeability of the adjacent till, water in the south portion of the trench is more likely to travel through the high permeability trench backfill to the sumps than migrate to the east.

Groundwater from the shallow bedrock is being collected both through the portions of the trench in direct contact with bedrock and the in-trench piezometers that connect the shallow bedrock with the trench. Upwelling of shallow bedrock groundwater into the trench is aided by the natural upward hydraulic gradients between the bedrock and the overburden documented during the RI.

It is recommended that routine water-level data continue to be collected in accordance with the Draft O&M Plan to further evaluate the influence of sump set points on trench water levels and to assess seasonal influences on the collection system and water levels. It is also recommended that groundwater sampling and analysis pursuant to O&M activities be initiated. The southern end of the groundwater extraction trench was installed to collect low concentrations of VOCs. An analysis of water samples collected from piezometers during O&M activities would provide data to assess the concentrations of VOCs, if present, at the southern end of the trench.

Prior to construction, five monitoring wells were located in the vicinity of the trench alignment (MW-3S, MW-3D, MW-5D, MW-7S, and MW-7D). All but MW-7D were destroyed during construction of the groundwater extraction trench. It is not believed that the loss of the monitoring wells has significantly affected the ability to monitor the effectiveness of the remedy because a dedicated piezometer system was installed to monitor the remedy pursuant to the approved remedial design. Although the exact replacement of the monitoring wells is not necessarily warranted, additional bedrock monitoring wells in the vicinity of the trench would help assess the effects of the trench on shallow bedrock groundwater. Those wells could be used to assess whether hydraulic gradients in the shallow bedrock are towards the trench or to assess hydraulic response during a recovery test as was conducted in the North Area. However, the need for and location of additional monitoring wells in the vicinity of the trench should be determined based on evaluation of groundwater quality data collected from the vicinity of the trench.

TABLE 1

RECOVERY TRENCH WATER ELEVATIONS
RICHARDSON HILL ROAD LANDFILL
SIDNEY CENTER, NEW YORK

	TMW-1	S-1	SSC-1	SSC-2	S-2	SSC-3	SSC-4	S-3	TMW-8	TMW-2	TMW-3	TMW-4	TMW-5	TMW-6	TMW-7	staff gauge
TOC (before 10/18/06):	1754.06		1755.43	1758.14		1760.21	1758.53		1755.23	1754.11	1755.47	1758.29	1760.25	1758.53	1755.46	1743.93
TOC (10/18/06 and after):															1755.3	
Transducer Elevation:		1737.59			1739.94			1743.71								
07/06/06	1745.41	#N/A	1745.03	1744.86	#N/A	1745.84	1746.98	#N/A	1746.72	1745.80	1745.01	1745.07	1746.66	1746.79	1746.72	#N/A
07/10/06	1745.36	#N/A	1744.93	1744.96	#N/A	1745.74	1746.93	#N/A	1746.70	1745.70	1744.93	1745.00	1746.38	1746.70	1746.72	#N/A
07/24/06	1745.59	#N/A	1744.89	1744.94	#N/A	1745.72	1746.81	#N/A	1746.61	1745.32	1744.86	1744.97	1746.15	1746.73	1746.61	#N/A
08/07/06	1745.12	#N/A	1744.80	1744.83	#N/A	1745.65	1746.69	#N/A	1746.60	1745.40	1744.77	1744.84	1746.07	1746.44	1746.55	#N/A
08/15/06	1745.17	#N/A	1744.53	1743.83	#N/A	1745.30	1745.98	#N/A	1745.72	1745.41	1744.44	1743.90	1745.57	1745.81	1745.72	#N/A
08/22/06	1745.49	1744.54	1744.51	1743.79	1743.90	1745.48	1746.04	1744.92	1745.56	1745.27	1744.44	1743.89	1745.57	1746.00	1745.57	#N/A
09/06/06	1745.20	1744.16	1744.40	1743.80	1743.93	1745.55	1746.33	1744.57	1745.62	1745.59	1744.57	1743.99	1745.71	1746.32	1745.64	1742.85
09/12/06	1745.01	1744.14	1744.29	1743.70	1743.82	1746.11	1747.85	#N/A	1747.83	1745.35	1744.27	1743.95	1745.93	1747.42	1747.83	1743.03
09/21/06	1745.05	1744.23	1744.35	1743.74	1743.86	1745.47	1746.15	1744.58	1745.21	1745.38	1744.32	1743.98	1745.57	1746.00	1745.17	1742.95
09/26/06	1745.09	1744.54	1744.43	1743.83	1743.99	1745.46	1746.15	1744.94	1745.21	1745.40	1744.41	1743.96	1745.50	1745.93	1745.20	1743.01
09/29/06	1743.11	1741.78	1741.97	1741.31	1741.26	1745.58	1746.23	1744.92	1745.39	1743.53	1742.03	1741.83	1745.55	1746.12	1745.37	1742.93
10/03/06	1743.42	1742.03	1742.18	1741.29	1741.15	1745.49	1746.40	1744.80	1745.31	1743.87	1742.17	1741.83	1745.49	1746.27	1745.32	1742.87
10/10/06	1742.91	1741.47	1741.84	1741.54	1741.85	1745.33	1746.39	1744.84	1745.19	1743.36	1741.89	1741.84	1745.32	1746.10	1745.18	1742.95
10/18/06	1742.50	1741.20	1741.70	1741.52	1741.92	1745.31	1746.23	1744.54	1745.17	1742.92	1741.70	1741.77	1745.15	1745.99	1745.17	1742.87
10/23/06	1743.75	1742.19	1742.23	1741.30	1741.47	1745.49	1746.50	1744.58	1745.28	1744.20	1742.25	1741.81	1745.42	1746.34	1745.25	1742.71
10/31/06	1744.12	1742.68	1742.53	1741.31	1741.16	1745.53	1746.75	1745.43	1745.61	1744.58	1742.54	1741.92	1745.46	1746.53	1745.60	1742.63
11/07/06	1743.56	1742.11	1742.22	1741.59	1741.83	1745.46	1746.50	1745.64	1745.43	1744.02	1742.27	1741.90	1745.35	1746.25	1745.44	1742.83
11/14/06	1743.39	1742.14	1742.13	1741.14	1741.06	1745.51	1746.53	1745.29	1745.52	1743.81	1742.15	1741.69	1745.35	1746.34	1745.50	1742.85
11/22/06	1744.16	1742.73	1742.73	1741.23	1741.00	1745.50	1746.79	1745.48	1745.50	1744.62	1742.57	1741.79	1745.46	1746.53	1745.50	1742.71
11/29/06	1743.52	1742.15	1742.23	1741.29	1741.38	1745.49	1746.60	1745.66	1745.47	1743.96	1742.23	1741.70	1745.35	1746.33	1745.47	1742.85
12/06/06	1743.63	1742.22	1743.33	1741.59	1741.80	1745.51	1746.63	1745.38	1745.48	1744.10	1742.32	1741.91	1745.35	1746.63	1745.47	1742.83
12/12/06	1743.17	1741.86	1742.06	1741.32	1741.51	1745.47	1746.55	1745.68	1745.42	1743.59	1742.04	1741.66	1745.26	1746.24	1745.40	1742.93
12/19/06	1742.91	1741.74	1741.93	1741.44	1741.54	1745.48	1746.44	1745.53	1745.33	1743.31	1741.97	1741.79	1745.22	1746.17	1745.32	1743.01
12/27/06	1743.64	1742.27	1742.26	1741.29	1741.29	1745.59	1746.58	1745.27	1745.46	1744.07	1742.29	1741.78	1745.39	1746.42	1745.47	1742.89
01/03/07	1743.65	1742.22	1742.33	1741.34	1741.69	1745.61	1746.73	1745.59	1745.45	1744.08	1742.34	1741.78	1745.35	1746.45	1745.42	1742.93
01/09/07	1744.76	1743.36	1743.28	1742.06	1741.92	1745.71	1747.01	1745.25	1745.61	1745.18	1743.26	1742.51	1745.55	1746.80	1745.58	1742.67
01/18/07	1745.81	1744.50	1744.58	1743.44	1743.40	1745.71	1746.88	1745.01	1745.63	1746.19	1744.53	1743.75	1745.65	1746.70	1745.60	1742.73
01/24/07	1744.22	1742.88	1742.88	1741.74	1741.52	1745.71	1747.02	1745.03	1745.42	1744.66	1742.87	1742.18	1745.45	1746.61	1745.40	1743.93
01/31/07	1743.23	1742.02	1742.23	1741.59	1741.51	1745.61	1746.58	1745.04	1746.18	1743.64	1742.22	1741.92	1745.27	1746.23	1745.25	1743.93
02/07/07	1742.85	1741.63	1742.00	1741.65	1741.87	1745.61	1746.43	1746.84	1745.53	1743.21	1741.97	1741.82	1745.17	1746.06	1745.52	1743.93
02/12/07	1742.62	1741.46	1741.76	1741.39	1741.56	1745.59	1746.23	1746.58	1745.51	1742.97	1741.71	1741.54	1745.10	1745.86	1745.48	1743.93
02/21/07	1742.41	1741.29	1741.63	1741.34	1741.55	1745.58	1746.28	1746.81	1745.50	1742.73	1741.59	1741.46	1745.00	1745.70	1745.45	1743.93
02/28/07	1742.36	1741.33	1741.71	1741.65	1741.89	1745.58	1745.95	1746.84	1745.45	1742.67	1741.72	1741.71	1744.99	1745.59	1745.45	1743.93
03/07/07	1742.88	1741.70	1742.00	1741.60	1741.93	1745.58	1746.20	1746.70	1745.58	1743.24	1742.04	1741.84	1745.17	1745.99	1745.55	1743.93
03/14/07	1743.70	1742.36	1742.45	1741.74	1741.61	1745.70	1746.51	1746.41	1745.68	1744.10	1742.48	1742.09	1745.35	1746.33	1745.65	1743.93
03/22/07	1745.73	1744.39	1744.53	1743.43	1743.28	1745.96	1746.78	1745.74	1745.74	1746.14	1744.49	1743.72	1745.55	1746.53	1745.70	1743.93
03/28/07	1749.21	1748.09	1748.48	1747.84	1747.74	1748.01	1748.53	1746.30	1748.38	1749.38	1748.37	1747.87	1747.13	1748.11	1748.36	1742.21
04/03/07	1748.86	1747.79	1748.18	1747.42	1747.25	1747.49	1748.02	1747.46	1747.78	1749.09	1748.04	1747.42	1747.62	1747.87	1747.75	1742.53
04/10/07	1747.01	1746.04	1746.33	1745.46	1745.31	1745.71	1746.83	1745.76	1746.00	1747.31	1746.23	1745.60	1746.61	1746.63	1745.94	1743.93
04/18/07	1748.34	1747.39	1747.68	1746.91	1746.73	1746.79	1746.88	1745.92	1746.08	1748.59	1747.57	1746.99	1746.65	1746.82	1746.05	1743.93
04/24/07	1749.04	1747.63	1748.35	1747.60	1747.41	1747.46	1746.90	1746.01	1746.05	1749.20	1748.20	1747.62	1747.69	1746.75	1746.00	1742.47
05/02/07	1747.26	1746.38	1746.69	1745.93	1745.72	1745.91	1746.66	1746.06	1746.01	1747.56	1746.61	1746.03	1746.75	1746.47	1745.97	1742.66
05/09/07	1745.43	1744.47	1744.71	1743.94	1743.70	1745.70	1746.68	1746.07	1745.87	1745.79	1744.67	1744.16	1745.87	1746.37	1745.83	1742.85
05/15/07	1744.45	1743.39	1743.54	1742.74	1742.50	1745.66	1746.61	1746.04	1745.83	1744.83	1743.54	1743.07	1745.60	1746.28	1745.80	1742.91
05/23/07	1743.36	1742.21	1742.38	1741.62	1741.32	1745.61	1746.43	1746.07	1745.80	1743.71	1742.39	1742.00	1745.40	1746.08	1745.77	1742.95
06/07/07	1740.55	1739.06	1739.73	1740.24	1740.42	1745.53	1746.21	1745.33	1745.28	1741.00	1739.97	1740.47	1745.17	1745.83	1745.23	1743.01
06/14/07	1740.46	1739.04	1739.91	1740.10	1740.25	1745.47	1745.99	1745.49	1745.13	1740.87	1739.91	1740.28	1745.05	1745.55	1745.10	1743.07
06/20/07	1740.42	1738.68	1739.88	1739.94	1740.14	1745.33	1745.89	1745.66	1745.13	1740.79	1739.84	1739.85	1744.95	1745.41	1745.10	1743.05
06/28/07	1740.46	1739.49	1740.03	1739.98	1740.14	1745.16	1745.82	1745.47	1745.16	1740.86	1739.92	1740.14	1744.80	1745.36	1745.14	1743.03

Elevations are in feet
TOC elevations from Lawson Surveying and Mapping (August 2006).
Water elevations at the sumps are calculated using height of water above the transducer recorded by OMI.
Water elevations at the piezometers and staff gauge are calculated using depth from TOC to water recorded by OMI.
In mid October, 2006, inner casing for MW-07 was cut down so that the well could be locked. Both MW-08 and MW-07 were resurveyed.

TABLE 2

TRENCH AREA GROUNDWATER DATA
RICHARDSON HILL ROAD LANDFILL
SIDNEY CENTER, NEW YORK

	DEPTH TO WATER IN FEET												TRANSDUCER			
	SSC-1	SSC-2	SSC-3	SSC-4	TMW-1	TMW-2	TMW-3	TMW-4	TMW-5	TMW-6	TMW-7	TMW-8	S-1	S-2	S-3	staff gauge
07/06/06	10.40	13.28	14.37	11.55	8.65	8.31	10.46	13.22	13.59	11.74	8.74	8.51	#N/A	#N/A	#N/A	#N/A
07/10/06	10.50	13.18	14.47	11.60	8.70	8.41	10.54	13.29	13.87	11.83	8.74	8.53	#N/A	#N/A	#N/A	#N/A
07/24/06	10.54	13.20	14.49	11.72	8.47	8.79	10.61	13.32	14.10	11.80	8.85	8.62	#N/A	#N/A	#N/A	#N/A
08/07/06	10.63	13.31	14.56	11.84	8.94	8.71	10.70	13.45	14.18	12.09	8.91	8.63	#N/A	#N/A	#N/A	#N/A
08/15/06	10.90	14.31	14.91	12.55	8.89	8.70	11.03	14.39	14.68	12.72	9.74	9.51	#N/A	#N/A	#N/A	#N/A
08/22/06	10.92	14.35	14.73	12.49	8.57	8.84	11.03	14.40	14.68	12.53	9.89	9.67	6.95	3.96	1.21	#N/A
09/06/06	11.03	14.34	14.66	12.20	8.86	8.52	10.90	14.30	14.54	12.21	9.82	9.61	6.57	3.99	0.86	1.08
09/12/06	11.14	14.44	14.10	10.68	9.05	8.76	11.20	14.34	14.32	11.11	7.63	7.40	6.55	3.88	#N/A	0.90
09/21/06	11.08	14.40	14.74	12.38	9.01	8.73	11.15	14.31	14.68	12.53	10.29	10.02	6.64	3.92	0.87	0.98
09/26/06	11.00	14.31	14.75	12.38	8.97	8.71	11.06	14.33	14.75	12.60	10.26	10.02	6.95	4.05	1.23	0.92
09/29/06	13.46	16.83	14.63	12.30	10.95	10.58	13.44	16.46	14.70	12.41	10.09	9.84	4.19	1.32	1.21	1.00
10/03/06	13.25	16.85	14.72	12.13	10.64	10.24	13.30	16.46	14.76	12.26	10.14	9.92	4.44	1.21	1.09	1.06
10/10/06	13.59	16.60	14.88	12.14	11.15	10.75	13.58	16.45	14.93	12.43	10.28	10.04	3.88	1.91	1.13	0.98
10/18/06	13.73	16.62	14.90	12.30	11.56	11.19	13.77	16.52	15.10	12.54	10.13	10.06	3.61	1.98	0.83	1.06
10/23/06	13.20	16.84	14.72	12.03	10.31	9.91	13.22	16.48	14.83	12.19	10.05	9.95	4.60	1.53	0.87	1.22
10/31/06	12.90	16.83	14.68	11.78	9.94	9.53	12.93	16.37	14.79	12.00	9.70	9.62	5.09	1.22	1.72	1.30
11/07/06	13.21	16.55	14.75	12.03	10.50	10.09	13.20	16.39	14.90	12.28	9.86	9.80	4.52	1.89	1.93	1.10
11/14/06	13.30	17.00	14.70	12.00	10.67	10.30	13.32	16.60	14.90	12.19	9.80	9.71	4.55	1.12	1.58	1.08
11/22/06	12.70	16.91	14.71	11.74	9.90	9.49	12.90	16.50	14.79	12.00	9.80	9.73	5.14	1.06	1.77	1.22
11/29/06	13.20	16.85	14.72	11.93	10.54	10.15	13.24	16.59	14.90	12.20	9.83	9.76	4.56	1.44	1.95	1.08
12/06/06	12.10	16.55	14.70	11.90	10.43	10.01	13.15	16.38	14.90	11.90	9.83	9.75	4.63	1.86	1.67	1.10
12/12/06	13.37	16.82	14.74	11.98	10.89	10.52	13.43	16.63	14.99	12.29	9.90	9.81	4.27	1.57	1.97	1.00
12/19/06	13.50	16.70	14.73	12.09	11.15	10.80	13.50	16.50	15.03	12.36	9.98	9.90	4.15	1.60	1.82	0.92
12/27/06	13.17	16.85	14.62	11.95	10.42	10.04	13.18	16.51	14.86	12.11	9.83	9.77	4.68	1.35	1.56	1.04
01/03/07	13.10	16.80	14.60	11.80	10.41	10.03	13.13	16.51	14.90	12.08	9.88	9.78	4.63	1.75	1.88	1.00
01/09/07	12.15	16.08	14.50	11.52	9.30	8.93	12.21	15.78	14.70	11.73	9.72	9.62	5.77	1.98	1.54	1.26
01/18/07	10.85	14.70	14.50	11.65	8.25	7.92	10.94	14.54	14.60	11.83	9.70	9.60	6.91	3.46	1.30	1.20
01/24/07	12.55	16.40	14.50	11.51	9.84	9.45	12.60	16.11	14.80	11.92	9.90	9.81	5.29	1.58	1.32	
01/31/07	13.20	16.55	14.60	11.95	10.83	10.47	13.25	16.37	14.98	12.30	10.05	9.05	4.43	1.57	1.33	
02/07/07	13.43	16.49	14.60	12.10	11.21	10.90	13.50	16.47	15.08	12.47	9.78	9.70	4.04	1.93	3.13	
02/12/07	13.67	16.75	14.62	12.30	11.44	11.14	13.76	16.75	15.15	12.67	9.82	9.72	3.87	1.62	2.87	
02/21/07	13.80	16.80	14.63	12.25	11.65	11.38	13.88	16.83	15.25	12.83	9.85	9.73	3.70	1.61	3.10	
02/28/07	13.72	16.49	14.63	12.58	11.70	11.44	13.75	16.58	15.26	12.94	9.85	9.78	3.74	1.95	3.13	
03/07/07	13.43	16.54	14.63	12.33	11.18	10.87	13.43	16.45	15.08	12.54	9.75	9.65	4.11	1.99	2.99	
03/14/07	12.98	16.40	14.51	12.02	10.36	10.01	12.99	16.20	14.90	12.20	9.65	9.55	4.77	1.67	2.70	
03/22/07	10.90	14.71	14.25	11.75	8.33	7.97	10.98	14.57	14.70	12.00	9.60	9.49	6.80	3.34	2.03	
03/28/07	6.95	10.30	12.20	10.00	4.85	4.73	7.10	10.42	13.12	10.42	6.94	6.85	10.50	7.80	2.59	1.72
04/03/07	7.25	10.72	12.72	10.51	5.20	5.02	7.43	10.87	12.63	10.66	7.55	7.45	10.20	7.31	3.75	1.40
04/10/07	9.10	12.68	14.50	11.70	7.05	6.80	9.24	12.69	13.64	11.90	9.36	9.23	8.45	5.37	2.05	
04/18/07	7.75	11.23	13.42	11.65	5.72	5.52	7.90	11.30	13.60	11.71	9.25	9.15	9.80	6.79	2.21	
04/24/07	7.08	10.54	12.75	11.63	5.02	4.91	7.27	10.67	12.56	11.78	9.30	9.18	10.04	7.47	2.30	1.46
05/02/07	8.74	12.21	14.30	11.87	6.80	6.55	8.86	12.26	13.50	12.06	9.33	9.22	8.79	5.78	2.35	1.27
05/09/07	10.72	14.20	14.51	11.85	8.63	8.32	10.80	14.13	14.38	12.16	9.47	9.36	6.88	3.76	2.36	1.08
05/15/07	11.89	15.40	14.55	11.92	9.61	9.28	11.93	15.22	14.65	12.25	9.50	9.40	5.80	2.56	2.33	1.02
05/23/07	13.05	16.52	14.60	12.10	10.70	10.40	13.08	16.29	14.85	12.45	9.53	9.43	4.62	1.38	2.36	0.98
06/07/07	15.70	17.90	14.68	12.32	13.51	13.11	15.50	17.82	15.08	12.70	10.07	9.95	1.47	0.48	1.62	0.92
06/14/07	15.52	18.04	14.74	12.54	13.60	13.24	15.56	18.01	15.20	12.98	10.20	10.10	1.45	0.31	1.78	0.86
06/20/07	15.55	18.20	14.88	12.64	13.64	13.32	15.63	18.44	15.30	13.12	10.20	10.10	1.09	0.20	1.95	0.88
06/28/07	15.40	18.16	15.05	12.71	13.60	13.25	15.55	18.15	15.45	13.17	10.16	10.07	1.90	0.20	1.76	0.90

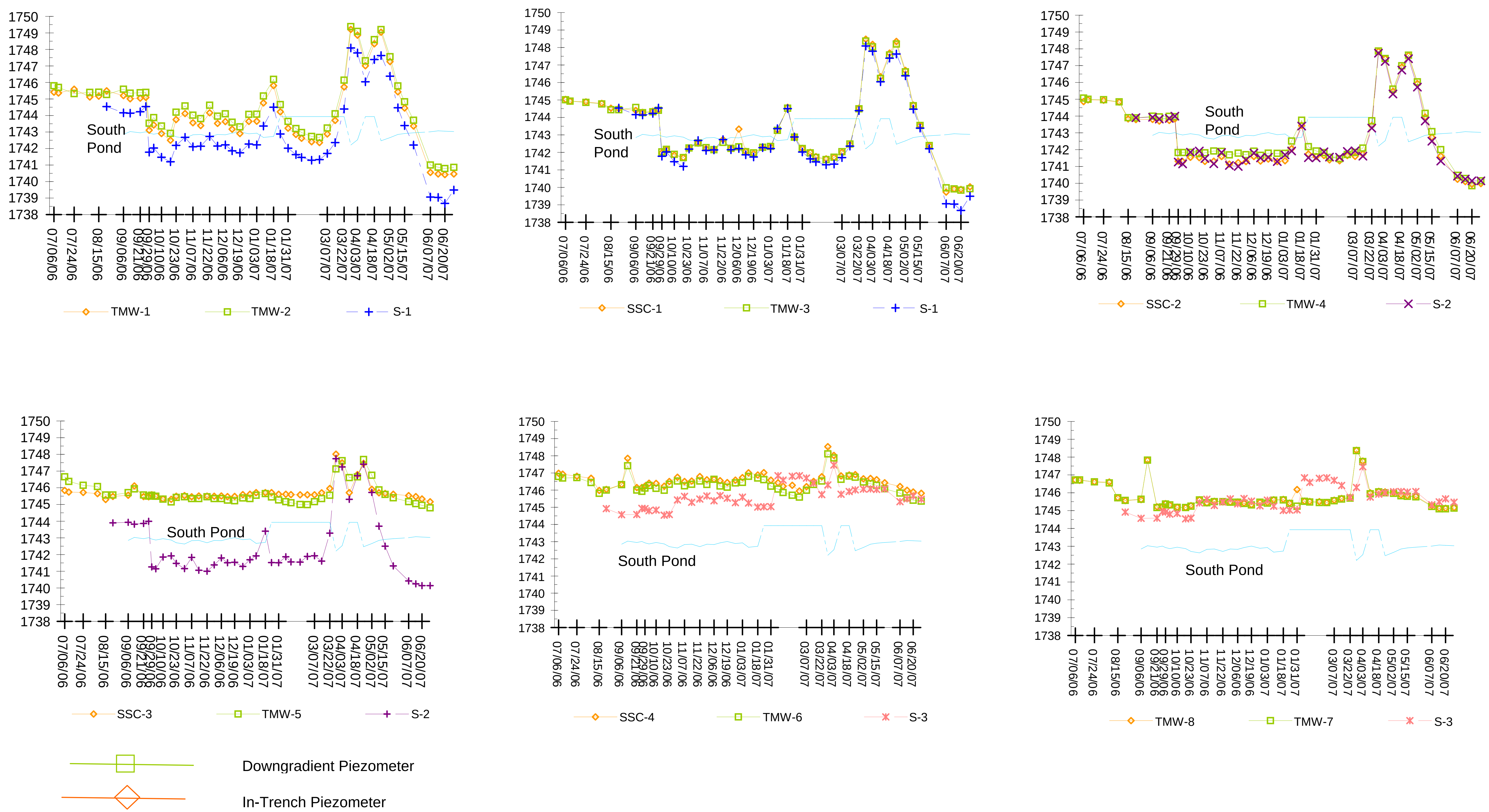
TOC elevations from Lawson Surveying and Mapping (August 2006).
Sump data are feet of water above the transducer recorded by OMI.
Piezometer and staff gauge data are depth in feet from TOC to water recorded by OMI.
In mid October, 2006, inner casing for MW-07 was cut down so that the well could be locked. Both MW-08 and MW-07 were resurveyed.

TABLE 3
WATER LEVEL RELATIONSHIPS BETWEEN PAIRED PIEZOMETERS IN THE GROUNDWATER EXTRACTION TRENCH AREA

Richardson Hill Road Landfill
Sidney Center, New York

Date	TMW-1/TMW-2	SSC-1/TMW-3	SSC-2/TMW-4	SSC-3/TMW-5	SSC-4/TMW-6	TMW-8/TMW-7
7/6/2006	-0.39	**0.02**	-0.21	-0.82	**0.19**	0.00
7/10/2006	-0.34	0.00	-0.04	-0.64	**0.23**	-0.02
7/24/2006	**0.27**	**0.03**	-0.03	-0.43	**0.08**	0.00
8/7/2006	-0.28	**0.03**	-0.01	-0.42	**0.25**	**0.05**
8/15/2006	-0.24	**0.09**	-0.07	-0.27	**0.17**	0.00
8/22/2006	**0.22**	**0.07**	-0.10	-0.09	**0.04**	-0.01
9/6/2006	-0.39	-0.17	-0.19	-0.16	**0.01**	-0.02
9/12/2006	-0.34	**0.02**	-0.25	**0.18**	**0.43**	0.00
9/21/2006	-0.33	**0.03**	-0.24	-0.10	**0.15**	**0.04**
9/26/2006	-0.31	**0.02**	-0.13	-0.04	**0.22**	**0.01**
9/29/2006	-0.42	-0.06	-0.52	**0.03**	**0.11**	**0.02**
10/3/2006	-0.45	**0.01**	-0.54	0.00	**0.13**	-0.01
10/10/2006	-0.45	-0.05	-0.30	**0.01**	**0.29**	**0.01**
10/18/2006	-0.42	0.00	-0.25	**0.16**	**0.24**	0.00
10/23/2006	-0.45	-0.02	-0.51	**0.07**	**0.16**	**0.03**
10/31/2006	-0.46	-0.01	-0.61	**0.07**	**0.22**	**0.01**
11/7/2006	-0.46	-0.05	-0.31	**0.11**	**0.25**	-0.01
11/14/2006	-0.42	-0.02	-0.55	**0.16**	**0.19**	**0.02**
11/22/2006	-0.46	**0.16**	-0.56	**0.04**	**0.26**	0.00
11/29/2006	-0.44	0.00	-0.41	**0.14**	**0.27**	0.00
12/6/2006	-0.47	**1.01**	-0.32	**0.16**	0.00	**0.01**
12/12/2006	-0.42	**0.02**	-0.34	**0.21**	**0.31**	**0.02**
12/19/2006	-0.40	-0.04	-0.35	**0.26**	**0.27**	**0.01**
12/27/2006	-0.43	-0.03	-0.49	**0.20**	**0.16**	-0.01
1/3/2007	-0.43	-0.01	-0.44	**0.26**	**0.28**	**0.03**
1/9/2007	-0.42	**0.02**	-0.45	**0.16**	**0.21**	**0.03**
1/18/2007	-0.38	**0.05**	-0.31	**0.06**	**0.18**	**0.03**
1/24/2007	-0.44	**0.01**	-0.44	**0.26**	**0.41**	**0.02**
1/31/2007	-0.41	**0.01**	-0.33	**0.34**	**0.35**	**0.93**
2/7/2007	-0.36	**0.03**	-0.17	**0.44**	**0.37**	**0.01**
2/12/2007	-0.35	**0.05**	-0.15	**0.49**	**0.37**	**0.03**
2/21/2007	-0.32	**0.04**	-0.12	**0.58**	**0.58**	**0.05**
2/28/2007	-0.31	-0.01	-0.06	**0.59**	**0.36**	0.00
3/7/2007	-0.36	-0.04	-0.24	**0.41**	**0.21**	**0.03**
3/14/2007	-0.40	-0.03	-0.35	**0.35**	**0.18**	**0.03**
3/22/2007	-0.41	**0.04**	-0.29	**0.41**	**0.25**	**0.04**
3/28/2007	-0.17	**0.11**	-0.03	**0.88**	**0.42**	**0.02**
4/3/2007	-0.23	**0.14**	0.00	-0.13	**0.15**	**0.03**
4/10/2007	-0.30	**0.10**	-0.14	-0.90	**0.20**	**0.06**
4/18/2007	-0.25	**0.11**	-0.08	**0.14**	**0.06**	**0.03**
4/24/2007	-0.16	**0.15**	-0.02	-0.23	**0.15**	**0.05**
5/2/2007	-0.30	**0.08**	-0.10	-0.84	**0.19**	**0.04**
5/9/2007	-0.36	**0.04**	-0.22	-0.17	**0.31**	**0.04**
5/15/2007	-0.38	0.00	-0.33	**0.06**	**0.33**	**0.03**
5/23/2007	-0.35	-0.01	-0.38	**0.21**	**0.35**	**0.03**
6/7/2007	-0.45	-0.24	-0.23	**0.36**	**0.38**	**0.05**
6/14/2007	-0.41	0.00	-0.18	**0.42**	**0.44**	**0.03**
6/20/2007	-0.37	**0.04**	**0.09**	**0.38**	**0.48**	**0.03**
6/28/2007	-0.40	**0.11**	-0.16	**0.36**	**0.46**	**0.02**

Numbers are difference between downgradient piezometer and trench piezometer in feet. Negative numbers indicate that the water level in the trench is lower than in the downgradient piezometer. Notes: A bolded, positive number indicates water levels in the trench piezometer are higher than in the downgradient piezometer.

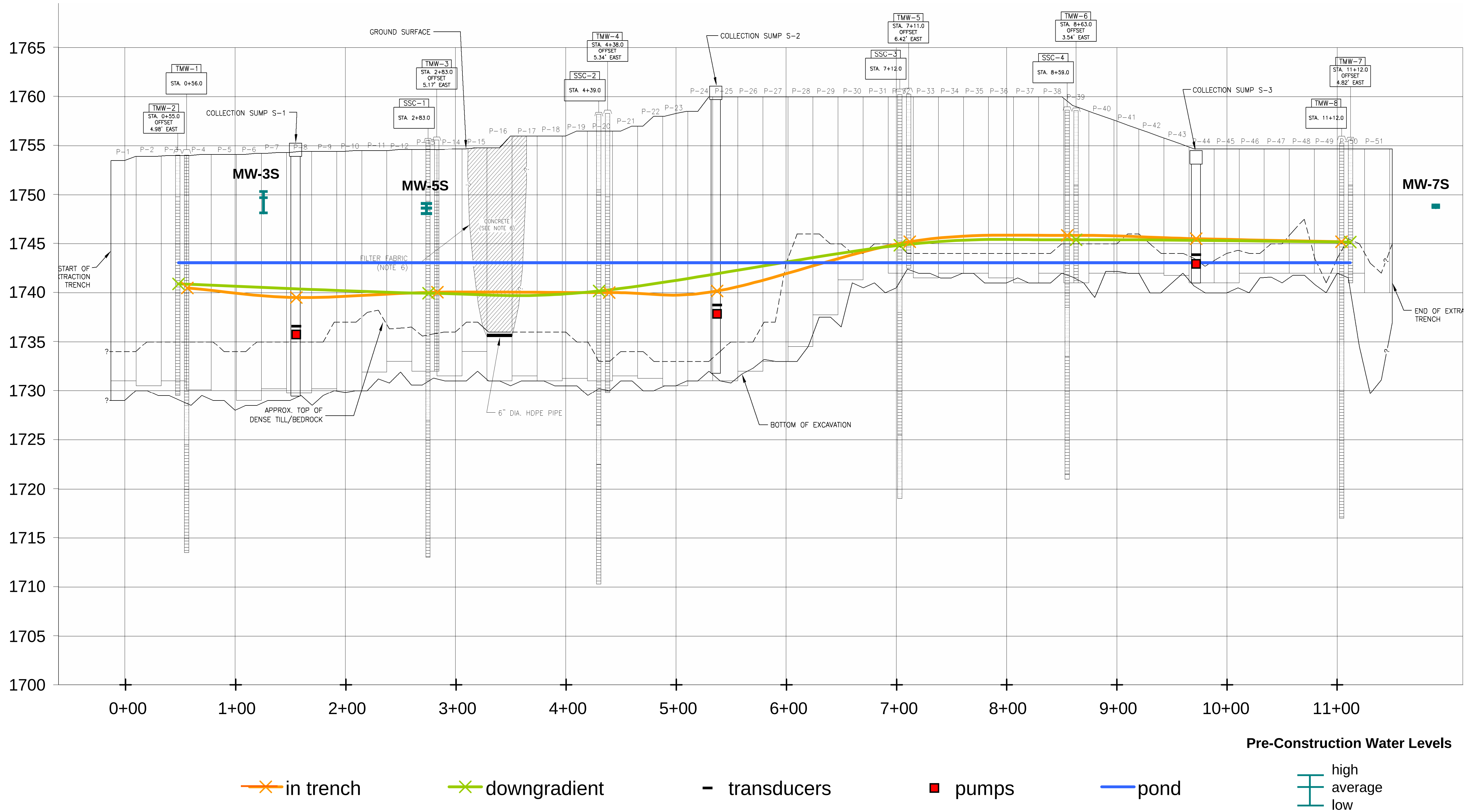


PARSONS

HYDROGRAPHS
JULY 2006 - JUNE 2007
Richardson Hill Road Landfill
Sidney Center, New York

Project No.
742577

Figure 1



PARSONS

TRENCH WATER-LEVEL PROFILES June 28, 2007 Richardson Hill Road Landfill Sidney Center, New York	Project No. 742577 **Figure 2**

PARSONS

Parsons Engineering Science Inc.
A Unit of Parsons Infrastructure & Technology Group
290 Elwood Davis Road, Suite 312 • Liverpool, New York 13088 • (315) 451-9560 • Fax (315) 451-9570 • www.parsons.com

October 27, 2000

Ms. Young S. Chang – Remedial Project Manager
Central New York Remediation Section
New York Remediation Branch
Emergency and Remedial Response Branch
U.S. Environmental Protection Agency, Region II
290 Broadway, 20th Floor
New York, NY 10007-1866

RE: Richardson Hill Road Landfill
Supplemental Design Report

Dear Ms. Chang:

Parsons Engineering Science, Inc. (Parsons ES), on the behalf of Amphenol Corporation (Amphenol) and Honeywell International (Honeywell), is pleased to provide seven copies of the Supplemental Design Report for the Richardson Hill Road Landfill (RHRL) as stated in the Response to Comments letter, dated October 18, 2000. The report includes revised Appendix I, Groundwater Modeling, from the Pre-Design Investigation Report which has been revised to address comments regarding the pump test and groundwater model.

Should you have any questions, please call Mr. Sam Waldo of Amphenol, at (203) 265-8760, Mr. Robert Ford of Honeywell at (973) 455-4947 or Mr. William Long of Parsons ES at (315) 451-9560.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

William J. Long
Design Manager

CC: NYSDEC (6 copies)
K. Wheeler, Neighbors United for Community Health (1 copy)
S. Ampter, Disposal Safety, Inc. (1 copy)
J. Damrath, NYCDEP (1 copy)
M. Derby, TAMS (1 copy)
A. Belensz, Env. Protection Bureau (1 copy)
J. Bianchi, Amphenol (1 copy)
S. Waldo, Amphenol (1 copy)
R. Ford, Honeywell (1 copy)
R. Galloway, Honeywell (1 copy)

GROUNDWATER MODELING FOR THE RICHARDSON HILL ROAD LANDFILL Sidney, New York

Prepared For:

AMPHENOL CORPORATION

40-60 Delaware Avenue
Sidney, NY 13838

and

HONEYWELL, INC.

101 Columbia Road
P.O. Box 2105
Morristown, NJ 07962

Prepared By:

PARSONS ENGINEERING SCIENCE, INC.

290 Elwood Davis Road, Suite 312
Liverpool, New York 13088
Phone: (315) 451-9560
Fax: (315) 451-9570

MARCH 2000
Revised October 2000

SECTION 1

INTRODUCTION AND BACKGROUND

I1.1 INTRODUCTION

A multi-layered MODFLOW (McDonald and Harbough, 1984) model was developed to analyze the proposed overburden and bedrock groundwater extraction systems at both the North and South Areas of the Richardson Hill Road Landfill (RHRL) site. Data from both the pre-design investigation and previous investigations was used to develop the model. This Appendix summarizes the background data used to support the model, describes the model development and calibration, and presents the results of the predictive simulations.

I1.2 SITE LOCATION AND DESCRIPTION

The RHRL site is located on the west side of Richardson Hill Road in northwestern Delaware County, within the Towns of Masonville and Town of Sidney. The site is located in a narrow valley where elevations rise from 1750 feet above mean sea level (amsl) in the valley to more than 2000 feet amsl on the east and west valley walls. The RHRL site consists of two areas, the North Area and the South Area.

The South Area includes an approximately eight-acre landfill, a pond called the South Pond, and a portion of Herrick Hollow Creek. The landfill is situated along a hillside above a drainage ditch, a marsh, and the South Pond. Surface water from the landfill drains into the marsh and South Pond through a drainage ditch that is parallel to the road. Water from the South Pond drains into Herrick Hollow Creek.

The North Area is located approximately 1,000 feet northeast of the landfill and includes two suspected waste disposal areas, each approximately 70 feet by 70 feet in size, and a pond called the North Pond. The North Pond is located on a drainage divide between the Susquehanna and Delaware River basins. Surface water drains mainly towards the Susquehanna basin. Water from the North Pond drains northwards through a series of beaver dams and into Carr's Creek, which is a tributary of the Susquehanna River.

I1.3 SITE GEOLOGY AND HYDROGEOLOGY

The following description of the site geology and hydrogeology is excerpted from the 1995 Remedial Investigation (RI) report (O'Brien & Gere, 1995). The site is located within the Appalachian Uplands Physiographic Province, which is characterized by east-west trending ridges of resistant strata that have been dissected by glacial and stream erosion. The bedrock is generally overlain by Pleistocene-age glacial tills and recent alluvial sediments. The glacial deposits range from three to ten feet thick, but have been documented in excess of 100 feet thick in some valleys.

The bedrock under the site is comprised of thinly bedded sequences of siltstone and shale that interfinger with thicker sequences of sandstone. Bedrock cores taken during the RI indicate that most of the bedrock fractures were bedding-plane fractures within the siltstone and shale. Some fractures, oriented at approximate 45 degrees to bedding planes, were observed within the sandstone units. The fractures within the shale bedrock were generally filled with clay. The fractures within the sandstone were generally filled with silt.

The bedrock at the site is overlain by up to 44 feet of dense, reddish brown to grayish brown glacial till. The till is a heterogeneous mixture of sand, silt, clay, and rock fragments. The valley floor also contains recent alluvial deposits, consisting of sand, silt, clay and peat. Within the RHRL, the till is overlain by up to five feet of fill, consisting of reworked soil mixed with municipal refuse. Geologic data for the site are summarized in Table I-1.

Groundwater elevation data have been collected periodically since 1988. Groundwater flow in the overburden follows the slope of the surface topography. Groundwater in the vicinity of the RHRL flows east to southeast at an average hydraulic gradient of about 0.15 to the South Pond. Overburden groundwater in the North Area appears to flow to the south-southwest toward the South Pond with a hydraulic gradient of about 0.03. Groundwater in the northern portion of the northern area flows to the north towards the North Pond.

Groundwater flow in the shallow bedrock is also controlled by topography. The hydraulic gradients at the RHRL indicate that bedrock groundwater flow is to the east towards the South Pond under an average flow gradient of 0.12. Flow potential from the North Area is to the south to southeast with an average hydraulic gradient of 0.02.

The results of slug tests conducted during the RI (see Table I-3), indicated that the hydraulic conductivity of the overburden ranges from 0.01 to 15 ft/day. However, the overburden hydraulic conductivity is generally less than 1 ft/day. The geometric mean hydraulic conductivity is 0.3 ft/day, while the median hydraulic conductivity is 0.2 ft/day. Three pump tests were conducted during the RI along the general alignment of the proposed interception trench. Transmissivity values calculated from the pump tests ranged from 6 to 450 ft^2/day with a geometric mean of 50 ft^2/day (see Table I-4). Corresponding hydraulic conductivity values ranged from 0.3 to 20 ft/day with a geometric mean of 3 ft/day. Specific yield values ranged from 0.0003 to 0.005 with a geometric mean of 0.001.

The RHRL area has a humid climate where warm summers are followed by long, cold winters. The mean temperature ranges from about 22.5 degrees Fahrenheit (°F) in January to 69.3° F in July (NOAA, 1985). The area receives an average of 40.6 inches of annual precipitation (see Table I-5). The precipitation averages about three inches per month. During the winter months, snowfall amounts generally range from 70 to 100 inches (NOAA, 1985).

I1.4 SITE DATA COLLECTION

I1.4.1 Fracture Trace Analysis

The object of the fracture-trace analysis was to identify any fracture-trace intersections that would provide an optimal location to install a groundwater extraction well. The USGS Trout Creek NY, Walton West NY, Unadilla NY and Franklin NY topographic quadrangles and a large-scale, stereo-pair air photo set were examined. Large sub-regional lineaments, generally corresponding to drainage channels were identified in the vicinity of the site (see Figure I-1). The most significant lineament was the valley in which the RHRL and North Area were located. No secondary fractures were observed in the immediate vicinity of the North Area. The dimensions of the North Area investigation area were too small to expect many fracture traces or to allow large changes in the proposed well locations.

I1.4.2 Aquifer Pumping Tests

Aquifer parameters for the shallow bedrock in the north area were calculated using data from a constant-rate pumping test. One groundwater extraction well and two new observation wells were installed in the bedrock for the pumping test. The wells were installed to depths ranging from 70.8 feet below ground surface (bgs) for O1-2 to 71.5 feet bgs for PW-1. The well depths were selected to be consistent with existing monitoring well MW-9D. A 30-foot screen was placed in each well at approximately 71 feet bgs. The pumping well (PW-1) was constructed using a 6-inch inside diameter (ID) stainless steel well screen and riser. Observation wells O1-1 and O1-2 were installed using 2-inch ID PVC well screen and risers. Shallow steel outer casings, sand packs, bentonite seals, cement-bentonite seals, and well covers were installed in accordance with the procedures in the RDWP. Well construction logs are presented in Appendix I. Observation well O1-1 was installed 89 feet from PW-1 and observation well O1-2 was installed 45 feet from PW-1. Existing monitoring well MW-9D, located 48 feet from PW-1, was also used as a pumping-test observation well (see Figure I-2). Background water levels in bedrock were monitored in existing well MW-11D.

Prior to the constant-rate pumping test, a step-drawdown test was conducted to identify a pumping rate that would not dewater the pumping well during the full test. Three steps of 2, 4 and 6 gpm were conducted for 1 hour each. The step-drawdown test data are presented on Table I-6 and plotted on Figure I-3. Based on the step-drawdown test, a pumping rate of 2.5 gpm was selected for the constant-rate pumping test. At this pumping rate, measurable drawdown would be observed in the observation wells but the pumping well would not be dewatered.

The constant-rate pumping test was conducted for a period of 2800 minutes (approximately two days) with a recovery test of 1400 minutes (approximately 1 day). During the test, background water level trends were measured in monitoring well MW-11 and the drawdown data were corrected for these background trends. However, background water levels during the pumping test varied by only 0.02 feet and were not significant. The constant-rate pumping test drawdowns are presented on Table I-7 and plotted on Figure I-4.

The shallow bedrock system was believed to be a leaky confined system because water levels in the shallow bedrock are typically higher than the top of the bedrock and leakage from the saturated overburden was expected. Therefore, the Hantush and Jacob (1955) method was selected to analyze the pumping test data. The pumping test analyses are presented on Figures I-5a through I-5d. A semi-log, distance drawdown analysis (Cooper and Jacob, 1945) is presented on Figure I-6. Hantush recovery test analyses are presented on Figures I-7a through I-7d. A semi-log, distance recovery analysis (Cooper and Jacob, 1945) is presented on Figure I-8. The results for all of the analyses are summarized on Table I-8.

The maximum drawdowns during the pumping test ranged from 6.3 feet at PW-1 to 1.3 feet at O1-1. At the end of the pumping test, drawdowns were approaching equilibrium conditions as evidenced by the nearly flat slope of the drawdown curves (Figures I-5a through I-5d).

Transmissivity values ranged from 47 ft^2/day (PW-1, recovery) to 124 ft^2/day (O1-1, drawdown). The geometric mean transmissivity was 70 ft^2/day for both the drawdown and recovery tests. Storativity values ranged from 0.004 to 0.00005, typical values for a confined aquifer. The transmissivity values between the drawdown and recovery tests were very consistent. With the exception of observation well O1-1, the transmissivity values were also very consistent between wells.

The drawdown and recovery curves nearly approach the Theis (1935) curve, and therefore r/B values were low (0.002 to 0.1). This suggests that, although a drawdown of 3.8 feet was observed in overburden observation well PW-9S, there was very little leakage between the overburden and bedrock during the test.

No boundary conditions were encountered during the pumping test. A slight flattening of the drawdown curves at approximately 80 minutes into the test suggested that a recharge boundary might have been encountered. However, because the flattening was not observed in the recovery curves, the flattening was likely due to pumping rate variability.

SECTION 2

GROUNDWATER MODELING

I2.1 INTRODUCTION

The objective of the groundwater modeling was to support the evaluation of shallow and deep groundwater extraction systems to be respectively installed in the south and north areas at the Richardson Hill Road Landfill (RHRL), Sidney Center, New York. The scope of work for the groundwater modeling was prescribed in the Remedial Design Work Plan (Parsons ES, 1999).

The four steps involved in conducting this hydraulic modeling included establishing the hydrogeologic setting and conceptual model, model calibration and verification, sensitivity analyses, and predictive simulations. The hydrogeologic framework and conceptual model was based upon topographic data, subsurface characterization data collected during the Richardson Hill Road Landfill and Sidney Landfill Remedial Investigations (RI, O'Brien & Gere, 1995) and the pre-design investigation conducted at the site.

It was recognized that not all of the site characteristics could be reproduced, nor was this necessary to achieve the goal of designing the groundwater extraction systems. Therefore, the intent of the groundwater modeling was to create a tool with just enough complexity to analyze various groundwater extraction conditions. Accordingly, a simple model, with fairly uniform, homogeneous layers, was constructed. A limited amount of vertical discretization (layers) was used to help delineate vertical flow paths and capture zones in overburden and bedrock.

The conceptual model was then translated into a "baseline", steady-state numerical model of the site. The calibration and verification of the numerical model was an iterative process. The steady-state model was first calibrated to long-term, average water levels. A transient simulation of the pumping tests conducted during the remedial design investigation was then run and the model parameters were adjusted to match observed drawdowns. The steady-state model was then recalibrated using the adjusted parameters. The steady-state and transient models were interatively run until reasonable matches to both long-term water levels and aquifer response to pumping were made.

Sensitivity analyses were then conducted on the calibrated model to test key model assumptions and the effect of model parameters upon the uncertainty of the model.

The calibrated and verified model was used to conduct the predictive simulations. Transient and steady-state simulations were run to evaluate the number, location and pumping rates of deep groundwater extraction wells and a shallow groundwater excavation trench.

I2.2 HYDROGEOLOGIC SETTING AND CONCEPTUAL MODEL

The site is located at the groundwater divide separating the Delaware River watershed to the south and the Susquehanna River watershed to the north (USEPA, 1997). The Delaware River watershed is characterized by Herrick Hollow Creek with associated wetlands and beaver ponds. The Susquehanna River watershed is characterized by the North Pond and associated wetlands, Carr's Creek and beaver ponds. The creeks each flow through glaciated hills. The beaver dams, poor surface water drainage, and low permeability soils result in surface water ponding and wetlands in low and shallow relief areas. The RHRL site is located on the west side of the glaciated valley. The South Pond and its associated wetlands are located 75 to 200 feet east of the RHRL in the valley bottom. The North Area is located approximately 1,000 feet north of the RHRL on a topographically raised area in the center of the valley.

Groundwater flow is generally from north to south, from the topographically higher area that forms the groundwater divide near the North Area. Groundwater from the North Area also flows northward from the groundwater divide. Groundwater flow in the valley walls is typically directly down the respective sides of the valley toward the valley floor where it then joins either the southerly or northerly valley bottom flow.

In the RDWP, the overburden groundwater system was conceptualized as a fairly uniform, three layer system of fill and overburden underlain by fractured bedrock. Based upon the results of the pump tests and further evaluation of available slug test data, the conceptual groundwater system was revised to a two-layer system (overburden and bedrock).

The overburden groundwater system was conceptualized as having higher conductivities on the valley floor than on the valley walls. The hydraulic conductivity of the walls was lower than the valley floor because the overburden in the valley walls is till while the overburden in the valley floor is largely alluvium. The RI pump test and slug test results indicate that the overburden on the valley walls had an approximate hydraulic conductivity of 0.3 ft/day while the hydraulic conductivity of the overburden in the valley floor was approximately 3 ft/day.

Based on the pre-design investigation pumping test, the bedrock groundwater system was conceptualized as having a hydraulic conductivity of 2 feet per day on the valley floor (approximately 67 percent of the overburden hydraulic conductivity). Based on the RI slug tests the hydraulic conductivity of the valley walls was estmated to be approximately .03 foot per day. The bedrock underlying the valley floor was conceptualized as being more fractured than the valley walls (hence the presence of the valley) and, therefore, more conductive.

The storage coefficient of both layers was estimated to be 0.01. Vertical hydraulic conductivity was conceptualized as one-tenth the horizontal hydraulic conductivity.

Recharge to the upper layer of the groundwater system, on the valley walls, was assumed to come from precipitation and lateral groundwater flow. Recharge to the upper layer of the groundwater system on the valley floor was assumed to come from precipitation, lateral groundwater flow, and vertical groundwater flow from bedrock. Net recharge from precipitation (precipitation minus runoff and evapotranspiration) was assumed to be 9.5 inches per year (0.0022 ft/day). Recharge to the lower layer of the groundwater system was assumed to come from vertical leakage from the upper layer and lateral groundwater flow.

Discharge from the upper layer of the groundwater system was conceptualized as evapotranspiration, discharge to surface water (creeks, ponds, and wetlands), vertical leakage to the lower layer on the hillsides, and lateral groundwater flow. Discharge from the lower layer was conceptualized as lateral groundwater flow, vertical leakage to the upper layer in the valley floor, and eventual discharge to the creeks, beaver ponds, and associated wetlands.

The final conceptual model was based upon the model calibration and verification. The final conceptual model included two layers, but the hydraulic conductivity of each layer was higher on the valley floor and lower on the valley walls than in the original conceptual model.

I2.3 MODEL DESIGN

I2.3.1 Model Code

The groundwater modeling was conducted using MODFLOW^{win32} (MODFLOW, (McDonald and Harbough, 1984)) as specified in the RDWP. Groundwater flow paths and well capture zones were delineated using MODPATH (Pollock, 1994). Both models are well known, well documented, public domain models. Model data was managed using Microsoft Excel, esi's Groundwater Vistas, and Golden Software's Surfer Version 6.

I2.3.2 Model Domain and Boundary Conditions

The model area was approximately one mile wide by one mile long. This placed the model boundaries several thousand feet from the model pumping centers, and minimized inaccuracy from interference with the model boundaries (See Figure I.-9a). The northern model boundary was placed approximately 1,400 feet north of the North Pond. The southern model boundary was placed approximately 1,850 feet south of the RHRL and the South Pond. The eastern and western boundaries were placed on the ridge tops.

Herrick Hollow Creek, Carr's Creek and the beaver ponds were represented by MODFLOW river nodes. The wetlands were also represented by river nodes, consistent with the conceptual model. The river parameters including width, depths, and bed thickness were obtained from the O'Brien and Gere Downstream Characterization Report (June 1996) and used to characterize the river nodes. The Herrick Hollow Creek, Carr's Creek, and beaver pond nodes were assigned high conductance values (100 ft/day), to allow free drainage to these streams. The total number of river nodes in the model equaled 344. A summary of the river node parameters is provided in Table I.9

I2.3.3 Discretization

The model was discretized into two layers, representing the overburden and bedrock groundwater systems. The top of layer 1 (overburden groundwater-bearing zone) was based upon a topographic map of the area (CNY Land Surveying, 2000) and United States Geologic Survey (USGS) topographic quadrangles. Ground-surface elevations were extracted from the survey computer-aided design (CAD) map, contoured, and imported into the model. Elevations were digitized based on the USGS topographic quadrangle maps in the areas outside the survey. The elevation of the bottom of layer 1 and the top of layer 2 (bedrock groundwater-bearing zone), as well as the top of bedrock was based upon boring data (See Table I.1). Where the thickness of the layers was unknown, the thickness was assigned such that the transmissivity was approximately equal to the average transmissivity. The total saturated thickness of the model was approximately 40 feet. Because the model thickness was approximately one percent of the average model length, discretization into additional layers was not warranted. Furthermore, the geologic and hydraulic conductivity data did not identify distinct, extensive layers with unique properties that would warrant additional discretization.

The model initially contained 97 rows but the number of rows was decreased to 65 rows to eliminate an area south of and far from the RHRL. The initial model row spacing was 100 feet (see Figure I-9a). To adequately delineate flowpaths near the potential extraction well, the row spacing in the vicinity of PW-1 was reduced from the 100-foot grid spacing stepping down to a spacing of 5 feet, using a factor of approximately 1.2 (see Figure 9b). To facilitate model calibration, the grid spacing was further adjusted so that each observation well (PW-9d, O1-1, O1-2) was located close to the center of a model cell.

The model column spacing across most of the area was 100 feet. To adequately delineate flowpaths near a potential extraction trench near the South Pond, the column spacing was stepped down by a factor of 1.2 to a spacing of 5 feet (see Figure 9c). The 100-foot column spacing was expanded to a 200 foot column spacing along the east and west edges of the model. This resulted in 68 columns in the model.

The total number of nodes in the model equaled 13,192 of which 61% (8072) nodes were active nodes. Thirty-two rows on the southern end of the model (2176 nodes) were not required for the design evaluations and were deactivated to simplify the model and allow it to run more easily. The final model had 11,016 nodes of which 73 percent were active.

I2.3.4 Hydraulic Parameters

Both model layers were designated as MODFLOW Type 1 (constant transmissivity, constant storage). Because of the extreme thinness of the model layers, and the large relief, the model cells were offset to a large degree and the model would not converge if MODFLOW Type 1 (variable transmissivity, variable storage) cells were specified. In these cases, MODFLOW Type 1 cells are a suitable simplification (Larson, 1992).

The initial hydraulic conductivity of 3 feet per day assigned to layer 1 (overburden) valley bottom was based on results from three overburden pump tests conducted during the Remedial Investigation (O'Brien & Gere, 1995). The hydraulic conductivity of the overburden on the valley walls was initially assigned a value of 0.3 ft/day based on slug tests conducted during the RI. The hydraulic conductivity of the upper layer, after model calibration and verification, was assigned a value of 4.8 feet per day in the valley bottom and 0.45 feet per day on the valley walls (see Figure I-10). The specific yield and storage coefficients of the upper layer were assigned values of 0.01.

The initial hydraulic conductivity of 2 ft/day per day assigned to the lower layer was based on data from the PW-1 pump test. The bedrock in the valley walls was initially assigned a hydraulic conductivity value of 0.03 ft/day based on slug tests conducted during the RI. The hydraulic conductivity of the lower layer, after model calibration and verification was assigned a value of 2 feet per day in the valley floor and 1 foot per day on the valley walls (see Figure I-10). The lower layer was assigned a specific yield of 0.0001 and a storage coefficient of 0.01.

I2.3.5 Recharge

Precipitation and evapotranspiration were represented together in the model as net recharge. The final value for recharge, after model calibration and verification, was 9.5 inches per year (0.0022 feet per day), or 34% of the 28.08 inches average annual precipitation based on the National Weather Service Database, 1999 or 25% of the 38 inches of average annual precipitation based on the USDOC Climatic Atlas, 1983. Recharge in the northeastern United States is estimated to be approximately 25% of average annual precipitation; therefore, the calibrated model recharge appeared to be reasonable.

I2.3.6 Model Calibration and Verification

The steady-state model was calibrated to steady-state groundwater elevations, which were calculated by averaging the available groundwater elevations for each monitoring well. Table I-2 shows water levels during the period November 1988 through October 1999 that were used for model calibration. As shown in Table I-2, the water level elevations were taken over all four seasons. During calibration of the initial steady-state model, recharge and hydraulic conductivity values were modified until the best fit to observed heads and the smallest error coefficients were achieved. Following the initial calibration, a transient simulation was run to verify the model against the bedrock pumping test. Hydraulic conductivity and recharge were adjusted during the pumping test calibration simulations to achieve a match with observed drawdowns. The hydraulic conductivity and recharge values were then incorporated into the steady-state model and the steady-state model was recalibrated by adjusting recharge. The steady-state and transient pumping test models were then alternatively run until the calibration statistics were minimized and the best match with both heads and drawdown were made.

The steady-state groundwater contours for the shallow and deep groundwater systems are plotted on Figure I-11. Model heads compared reasonably well with the observed heads, and the model groundwater flow directions were similar to observed groundwater flow directions (O'Brien & Gere, 1995). Model heads tended to be biased high at lower water elevations and biased slightly low at the higher elevations (see Figure I-11). Discrepancies between the model heads and observed heads can be attributed to several factors:

- Water levels in some of the valley-wall monitoring wells may represent perched or seasonally perched conditions, while the model assumes a continuously saturated aquifer.

- The model was divided into two discrete layers with each layer having assumed uniform properties on the valley floor and valley walls, while the actual aquifer systems are more heterogeneous.

- The heads measured by the model represent a well fully penetrating the aquifer, while the actual wells partially penetrate the aquifer, or in some cases, may be screened across both aquifers.

- The model heads are measured at the center of the model nodes, while the actual wells are usually offset from the model node centers.

Model drawdowns in the lower groundwater showed a good correlation with the observed drawdowns in the valley but not as good on the valley walls. This was due, in part, to the fact that the pumping and observation wells were located in the valley floor. Drawdowns in the shallow aquifer had a relatively good correlation. Multiple model runs were made with varying combinations of vertical conductance, storage and hydraulic conductivity to match drawdowns in both the deep and shallow groundwater systems. A combination of hydraulic conductivity, recharge and vertical conductance was settled upon which gave the best possible correlation with the lowest possible residual mean and good correlation between the observed range and absolute residual mean.

I2.3.7 Sensitivity Analyses

Sensitivity analyses were conducted to evaluate the sensitivity of the model results to the major hydraulic parameters. To evaluate sensitivity, recharge, horizontal hydraulic conductivity, vertical hydraulic conductivity and river conductance were doubled five times in each of the parameter zones. The results were plotted against a normalized absolute residual mean (ARM). The normalized ARM was calculated by dividing the ARM of the sensitivity run by the ARM of the calibrated model. The model was very sensitive to recharge applied to the valley walls (see Figure I-13) but insensitive to recharge applied to the valley floor. Doubling the recharge on the valley walls resulted in an ARM four times the calibrated ARM. However, increasing recharge on the valley floor had no effect. This is likely due to the fact that a large portion of the valley floor is covered by river nodes.

The model was only slightly sensitive to hydraulic conductivity. The most sensitive zone was bedrock valley walls (layer 2). Increasing hydraulic conductivity by a factor of 16 resulted in an ARM only 1.3 times the calibrated ARM. Increasing the hydraulic conductivity of the valley floor, both bedrock and overburden, by a factor of 16 increased the ARM only by a factor of 1.1. The model was completely insensitive to vertical hydraulic conductivity.

The model was also slightly sensitive to river node conductance. Increasing the river conductance by a factor of 16 in the North Pond increased the ARM only by a factor of 1.1. Increasing the river conductance in the South Pond decreased the ARM by a factor of 0.95.

I2.4 PREDICTIVE SIMULATIONS

Predictive modeling simulations were conducted following model calibration and verification to evaluate a groundwater extraction trench at the base of the hill, below the RHRL and a bedrock extraction well in the North Area. The goal of these evaluations were to:

- predict the length and depth of a groundwater recovery trench between the RHRL and the South Pond;
- calculate the required drawdown in the upper aquifer to attain capture of groundwater coming from the RHRL;
- predict whether capture could be attained in the bedrock zone from pumping in the recovery trench in the shallow zone;
- calculate the total daily discharge of a trench system;

- calculate the impact of a clean-water cut-off trench above the RHRL landfill;
- predict the required pumping rate, radius of influence and number of wells necessary to attain capture of contaminated groundwater at the North Area;
- evaluate the shallow and deep groundwater systems;
- and evaluate the impacts of long-term pumping on the adjacent ponds, drainages and wetlands.

The capture zones for extraction wells and trenches were delineated using the reverse particle tracking option of MODPATH. Pumping rates were derived from the model water balance.

I2.4.1 Shallow Groundwater Extraction (RHRL-South Pond)

The calibrated model was used to evaluate a potential groundwater extraction trench at the base of the hill, below the RHRL. The extraction trench would be an approximately 950-foot long trench used to intercept contaminated groundwater before it reached the South Pond and Herrick Hollow Creek. The groundwater extraction trench was assumed to be excavated to the top of bedrock and backfilled with a permeable material such as coarse sand or gravel. The 950-foot excavation trench was simulated using drain nodes (Figure I.14). The drain nodes were placed along the 950-foot length of the extraction trench between Herrick Hollow Road and the South Pond. An impermeable wall was placed just downgradient of the extraction trench to isolate the extraction trench from the South Pond. The impermeable wall would be installed to the top of bedrock at depth of 17 to 36 feet. The pumping rate of the drain was adjusted until a 5-foot drawdown along the drain was achieved. The model indicated that a pumping rate of approximately 30 gallons per minute (gpm) would be required to intercept the groundwater in the shallow overburden aquifer during average water table and recharge conditions. Based upon the model water balance, approximately 90 percent of the water entering the trench would come from the west (RHRL) and 10 percent from the east (South Pond). The model predicted that groundwater capture in the upper 25 feet of bedrock would also be attained. The simulations predicted narrow capture zones no larger than the length of the extraction trench, thus the reason for the long extraction trench (see Figure I-14).

A simulation was conducted to estimate groundwater extraction rates under peak water table and recharge conditions as in a heavy rain period with spring snowmelt. The recharge in the model was increased from 0.3 inches per day to two inches per day and a 24-hour, transient simulation was conducted. This simulation indicted that a pumping rate of up to 80 gpm would be required during a heavy precipitation event.

A second simulation was conducted with a "clean" water cutoff trench located upgradient of the RHRL (see Figure I-15 for drain location). The cutoff trench was set approximately 5 feet into the water table. This simulation predicted a 15-percent reduction in water passing through the lower extraction trench and treatment system. A value engineering evaluation will be necessary to determine whether an upgradient cutoff trench would be cost effective.

I2.4.2 Bedrock Groundwater Extraction Well (North Area)

Based on the bedrock groundwater pumping test conducted in the North Area, it was estimated that a single well screened in the deep groundwater system could sustain a pumping rate of 2 to 2.5 gpm. To verify this estimate, a simulation was run with a pumping well node placed at the location of PW-1. The capture zone for a 2.25 gpm pumping rate was simulated by placing a circle of particles around the well node and plotting the reversed tracks. It was noted that the capture zone was relatively small (see Figure I-16).

The model predicted a series of recovery wells or a recovery trench would be necessary to maintain a cone of depression large enough to capture or contain contaminated groundwater in the North Area. Steep gradients coming from the valley walls resulted in narrow capture zones for each potential well, as was found in the RHRL-South Pond area.

I2.4.3 Multiple Well System (North Area)

Additional extraction wells, each pumping at approximately 2.5 gpm were added to the simulation until a sufficient capture zone was developed. The final configuration consisted of four extraction wells spaced along a 200-foot long alignment with a combined pumping rate of 10 gpm. The extraction well alignment was oriented north-south through well PW-1 approximately parallel with the valley walls and floor.

I2.5 IMPACTS ON SHALLOW AQUIFER SYSTEM AND WETLANDS

I2.5.1 RHRL-South Pond Area

Model simulations of the recovery trench at the South Pond area, with a drawdown of 5 feet, showed little impact to the South Pond or the associated wetlands. Due to the steep gradients on the valley walls, most of the water recovered by the trench was coming from the hill where the RHRL is located. Furthermore, the downgradient, low-permeability hydraulic barrier between the trench and the South Pond limited infiltration from the pond. The model did not predict capture of groundwater from the areas north, east, or south of the South Pond nor did it predict impacts to the South Pond.

I2.5.2 North Area

Pumping a single well in the deep groundwater system during the pump test resulted in a maximum 6.7 feet of drawdown in the pumping well, and 1 to 5.6 feet of drawdown across the North Area. Pumping the single deep groundwater well resulted in as much as 3.8 feet of drawdown in an observation well screened at the base of the shallow zone.

I2.6 MODEL LIMITATIONS

The model was designed with sufficient complexity to analyze the various groundwater extraction design scenarios. As noted in the introduction, not all of the site characteristics could be reproduced by the model; therefore the model should be evaluated and modified, as necessary, if used for other purposes.

While there was considerable stratigraphic data available for the RHRL, North Area and Sidney Landfill areas, large areas of the model were extrapolated from site data. Therefore, calculations of head and drawdown in those areas should not be considered as accurate as the calculations of head and drawdown in the known areas.

Because of the potential of extracting groundwater from both the shallow (RHRL-South Pond) and deep (North Area) zones, the model was optimized to evaluate pumping from both groundwater systems. The pumping rates and drawdowns in the deep aquifer calculated by the model have been verified against actual pump test data and, therefore, are reasonably accurate. Evaluations of pumping from the shallow groundwater are affected by the bias in the model towards high water level elevations in the center of the valley; therefore, the pumping rates predicted by the model may be somewhat higher than may be encountered.

I2.7 SUMMARY AND CONCLUSIONS

A numerical groundwater model was developed to evaluate pumping from the shallow and deep groundwater systems at the RHRL and North Areas. The model was calibrated against an 11-year record of water levels and verified against a pumping test conducted during the RHRL pre-design investigation.

The results of the modeling in the RHRL-South Pond area indicate that complete capture of the shallow groundwater at the RHRL-South Pond area may be achieved with a single groundwater extraction trench approximately 950 feet in length. The trench will need to be as long as the area requiring capture. The groundwater extraction trench will not pull from beyond the ends of the trench due to the steep gradients on the hillside just above the extraction trench. The capture zone of the trench may reach approximately 25 feet into bedrock, approximately half the assumed thickness of the bedrock water-bearing zone. The medium and deeper bedrock groundwater under RHRL was at MCL's and does not require collection.

The results of the modeling in the North Area indicate that complete capture of the deep groundwater at the North Area can be achieved with four wells located in the center of the North Area, spaced approximately 67 feet apart and pumping at a combined rate of 10 gpm. The impacts to the adjacent North Pond from groundwater extraction in the North Area would be small and unmeasurable.

12.8 REFERENCES

Anderson, M.P. and W.W. Woessner, 1992. *Applied Groundwater Modeling - Simulation of Flow and Advective Transport*. Academic Press, Inc., San Diego, California

ASTM, 1996. "D 5718 - 95, Standard Guide for Documenting a Ground-Water Flow Model Application", *ASTM Standards on Analysis of Hydrologic Parameters and Ground Water Modeling*. American Society for Testing and Materials, West Conshohocken, PA. Bouwer, Herman. 1989. "The Bouwer and Rice Slug Test - An Update". *Ground Water* vol. 27, no. 3, May-June 1989.

Bouwer, H. and R.C. Rice. 1976. "A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells". *Water Resources Research*. vol 12, no. 3, June 1976.

CNY Land Surveying, 2000. Topographic survey of the RHRL area Cooper, H.H. and C.E. Jacob. 1945. "A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Well-Field History". *Transactions*. American Geophysical Union. vol. 27, no. 4. pp. 526-534.

esi, Inc. 1996. *Guide to Using Groundwater Vistas*. Environmental Simulations Inc., Herndon, Virginia.

esi, Inc. 1996. *Guide to Using Modflow^{win32} and Contour^{win32}*. Environmental Simulations Inc., Herndon, Virginia. Hantush, M.S. and C.E. Jacob, 1955. "Non-Steady Radial Flow in an Infinite Leaky Aquifer". *Transactions, American Geophysical Union*. vol. 36, no. 1.

Larson, Stephen, Ph.D., 1992. Personal communication.

McDonald, Michael G. and Arlen W. Harbaugh. 1988. *A Modular Three-Dimensional Finite Difference Ground-Water Flow Model*. Techniques of Water-Resources Investigations of the United States Geological Survey, Book 6, Chapter A1. U.S. Government Printing Office, Washington, D.C.

National Weather Service Database, 2000. National Weather Service NCDS.NOAA.GOV database. Neuman, S.P. 1975. "Analysis of Pumping Test Data from Anisotropic Unconfined Aquifers Considering Delayed Yield". Water Resources Research. vol. 11 no. 2. pp 329-342.

O'Brien and Gere, 1994. Unilateral Administrative Order Report for the Richardson Hill Road Municipal Landfill. Prepared for Amphenol Corporation by O'Brien & Gere Engineers, Inc. November 1994.

O'Brien & Gere, 1995. Remedial Investigation Report for the Richardson Hill Road Municipal Landfill. Prepared for Amphenol Corporation by O'Brien & Gere Engineers, Inc. August 1995.

O'Brien & Gere, 1996. Feasibility Study Report for the Richardson Hill Road Municipal Landfill. Prepared for Amphenol Corporation by O'Brien & Gere Engineers, Inc. July 1996.

O'Brien & Gere, 1996. Downstream Characterization Efforts for the Richardson Hill Road Municipal Landfill. Prepared for Amphenol Corporation by O'Brien & Gere Engineers, Inc. June 1996.

Parsons ES, 1999. Remedial Design Work Plan for the Richardson Hill Road Landfill. Prepared for Amphenol/Honeywell by Parsons ES Inc., August 1999.

Pollock, D.W., 1994. *User's Guide for MODPATH/MODPATH-PLOT, Version 3: A particle tracking post-processing package for MODFLOW, the U.S. Geological Survey finite-difference ground-water flow model.* USGS Open File Report 94-464.

Theis, C.V. 1935. "The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage." *Transactions, American Geophysical Union.* vol. 16, pp. 519-524.

USEPA, 1997. Record of Decision for the Richardson Hill Road Landfill Site. United States Environmental Protection Agency, Region II. September 30, 1997.

USEPA, 1999. Consent Decree for the Richardson Hill Road Landfill Site. United States Environmental Protection Agency, Region II.

TABLE I-1

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Geological Data

LOC-ID (WELL NAME)	SITE	NORTH X-COORD	EAST Y-COORD	GROUND ELEVATION	TOP FILL	FILL THICKNESS	TOP TILL DEPTH	TILL/OVB THICKNESS	TOP BEDROCK DEPTH	BEDROCK THICKNESS	DRILLED DEPTH	FORMATION
MW-1	RHRL	11714.77	7029.99	1805.5	0	5	5	18			23	Overburden (Silt, some fine sand and gravel, tr. Clay)
MW-2	RHRL	11689.44	7111.26	1785.6		0	0	29.5	29.5	0	29.5	Overburden (Silt, some fine sand and gravel, tr. Clay)
MW-3	RHRL	11716.97	7235.98	1752.4		0	0	20			20	Overburden (Very fine-fine Sand to Silt, little to some gravel, little clay)
MW-3D	RHRL	11726.9	7242.63	1753.1		0	0	21	21	28	49	Bedrock (Sandstone)
MW-3DD	RHRL	11734.3	7239.25	1753.4		0	0	21	22	118	140	Bedrock (Siltstone to fine Sandstone)
MW-4S	RHRL	12069.81	7319.95	1760.9		0	0	22	22	1	23	Overburden (fine Sand and Silt, some gravel, little clay), Red Shale
MW-4D	RHRL	12075.32	7321.36	1761		0	0	25	25	22	47	Bedrock (Top weathered shale bedrock at 25')
MW-5S	RHRL	11570.75	7213.44	1753.6		0	0	22	22	0	22	Overburden (fine Sand, some silt and gravel) Description from originalMW-5S.
OP-3(2)	RHRL	0	0	1753.8		0		0		0		
MW-5D	RHRL	11563.35	7211.52	1753.9	0	6	6	26	32	20	52	Bedrock (Fractured shale and sandstone.
MW-6	RHRL	11269.49	7099.87	1765.1		0	0	27.5	27.5	0	27.5	Overburden (Silt to fine Sand, some gravel, little clay). Refusal 27.5'.
MW-7S	RHRL	10685.95	6974.87	1754.7		0	0	22	22	0	22	Overburden (Silt and fine sand, some gravel, trace clay).Refus. 22'.
MW-7D	RHRL	10658.3	6970.57	1754.9		0	0	18	18	22	40	Bedrock (Fine Sandstone)
MW-8	RHRL	12698.9	7890.51	1796.2		0	0	25	25	0	25	Overburden (Silt-fine Sand, rock fragments, gravel). Refusal 25'.
MW-9	RHRL	12587.94	7767.85	1799.5		0	0	40	40	5	45	Overburden (Silt to fine Sand, weathered shale near bottom)
MW-9D	RHRL	12586.12	7775.5	1800.4		0	0	40	40	28	68	Bedrock (Sandstone, thin siltstone lenses)
MW-10	RHRL	12126.82	7842	1763.7		0	0	15			15	Overburden (Silt and Sand, some gravel, little clay
MW-11S	RHRL	11498.97	6515.01	1890.5		0	0	35	35	0.2	35.2	Overburden (Fine Sand,some silt, sandstone chips and fragments)
MW-11D	RHRL	11506.87	6518.5	1889.5		0	0	32.5	32.5	27.7	60.2	Bedrock (Fractured silty shale, lenses of sandstone)
MW-12	RHRL	12020.49	6856.98	1841.9		0	0	44	44	0	44	Overburden (Fine to med. Sand, little silt, trace gravel and boulders)
MW-13	RHRL	12215.04	7581.73	1767		0	0	21	21	0	21	Overburden (Silt, little clay and fine sand, gravel). Refusal 21'.

TABLE I-1

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Geological Data

LOC-ID (WELL NAME)	SITE	NORTH X-COORD	EAST Y-COORD	GROUND ELEVATION	TOP FILL	FILL THICKNESS	TOP TILL DEPTH	TILL/OVB THICKNESS	TOP BEDROCK DEPTH	BEDROCK THICKNESS	DRILLED DEPTH	FORMATION
MW-14	RHRL	12895.17	7658.84	1796.3		0	0	20	20	0.5	20.5	Overburden (Silt and fine sand, weathered rock, little clay)
MW-15	RHRL	12388.12	7813.65	1792		0	0	24	24	0.5	24.5	Overburden (Silt, little clay, sandstone fragments and boulders)
MW-16	RHRL	12596.54	8120.74	1793.3		0	0	20	20	0	20	Overburden (Silt and Sand, little gravel, sandstone, siltstone, weathered)
MW-17	RHRL	11300	6765	1825.4		0	0	25	25	8.5	33.5	Overburden (Sand and Silt, little clay, gravel, boulder). Boulder/Rock?
MW-18S	RHRL	11023.4	6979.7	1762.9		0	0	20	20	0	20	Overburden (Fine Sand and silt, little clay, sandstone fragments, gravel)
MW-18D	RHRL	11028.66	6984.65	1763.1		0	0	20	20	30.2	50.2	Bedrock (Sandstone, fractured, silt in partings)
MW-18DD	RHRL	11037.95	6970.82	1764.8		0	0	20	20	120.4	140.4	Bedrock (Sandstone and mudstone)
MW-19	RHRL	12300.46	7357.37	1793.2		0	0	40	40	0.8	40.8	Overburden (Gravel, sand and silt, clay incr.with depth, weathered SS and SH at bottom
SW-1	RHRL	12659.29	8100.11	1786.2		0		0		0		
SW-2	RHRL	12914.84	7845.04	1785.8		0		0		0		
SW-3	RHRL	12720.62	7547.75	1786.1		0		0		0		
SW-4	RHRL	11638.84	7265.9	1747.3		0		0		0		
SW-5	RHRL	11340.28	7191.53	1747.4		0		0		0		
SW-6	RHRL	11149.04	7266.77	1746.6		0		0		0		
TW-1	RHRL	11048.31	7014.96	1762.7		0	0	14.5	14.5	0.6	15.1	Overburden (Gravel, sand and silt, little clay)
TW-2	RHRL	11345.54	7131.12	1766.2		0	0	34.5	34.5	0.2	34.7	Overburden (Gravel with silt, sand, and clay)
TW-3	RHRL	11785.35	7219.25	1753.5		0	0	22.5	22.5	0.3	22.8	Overburden (Gravel to sand, some silt and clay, boulders)
PZ-1	RHRL	11042.23	7014.43	1762.4		0		0		0		
PZ-2	RHRL	11060.43	7019.79	1761.7		0		0		0		
PZ-3	RHRL	11034.09	6989.64	1762.8		0		0		0		
PZ-4	RHRL	11340.01	7131.32	1765.9		0		0		0		
PZ-5	RHRL	11355.33	7132.66	1765.9		0		0		0		
PZ-6	RHRL	11370.54	7134.49	1765.4		0		0		0		
PZ-7	RHRL	11779.33	7218.69	1753.5		0		0		0		
PZ-8	RHRL	11798.03	7224.11	1753.7		0		0		0		
PZ-9	RHRL	11812.98	7226.97	1753.9		0		0		0		
PW-1	RHRL	12543.29	7746.65									Bedrock

TABLE I-1

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Geological Data

LOC-ID (WELL NAME)	SITE	NORTH X-COORD	EAST Y-COORD	GROUND ELEVATION	TOP FILL	FILL THICKNESS	TOP TILL DEPTH	TILL/OVB THICKNESS	TOP BEDROCK DEPTH	BEDROCK THICKNESS	DRILLED DEPTH	FORMATION
O 1-1	RHRL	12468.23	7698.17									Bedrock
O 1-2	RHRL	12547.28	7791.07									Bedrock
SPIZZIRI		0	0			0		0		0		
MW-1D	SIDNEY	0	0	2061.7		0		0		0		Overburden
MW-2S	SIDNEY	11707.25	9450.67	1952.37		0		0		0		Bedrock
MW-2D	SIDNEY	13150.6	9316.13	1952.82		0		0		0		Bedrock
MW-3S	SIDNEY	13158.16	9325.66	2009.6		0		0		0		Bedrock
MW-3D	SIDNEY	11815.73	8952.97	2009.83		0		0		0		Bedrock
MW-4S	SIDNEY	11796.29	8948.28	1974.83		0		0		0		Bedrock
MW-4D	SIDNEY	11155.2	8587.54	1975.27		0		0		0		Overburden
MW-5S	SIDNEY	11170.07	8581.58	1935.38		0		0		0		Bedrock
MW-5D	SIDNEY	12430.47	8886.58	1935.68		0		0		0		Bedrock
MW-6S	SIDNEY	12413.9	8880.02	1856.28								Bedrock
MW-6D	SIDNEY	13081.12	8535.73	1856.55								Bedrock
MW-7S	SIDNEY	13094.55	8548.14	1786.97								Bedrock
MW-7D	SIDNEY	14025.63	8431.66	1787.05								Overburden
MW-8S	SIDNEY	14044.45	8436.55	1804.02								Bedrock
MW-8D	SIDNEY	133368.84	8273.66	1804.65								Bedrock
MW-8DD	SIDNEY	13350.84	8268.36	1804.4								Bedrock
MP MW-9S	SIDNEY	13336.31	8265.48	1809.3								Bedrock
MP MW-9D	SIDNEY	12827.85	8315.53	1809.33								Bedrock
MP MW-10S	SIDNEY	12848.48	8313.54	1858.32								Bedrock
MP MW-10D	SIDNEY	11967.41	8300.96	1857.77								Bedrock
MP MW-11S	SIDNEY	11982.46	8305.26	1768.79								Bedrock
MP MW-11D	SIDNEY	11807.06	7631.96	1769.3								Overburden
MP MW-12S	SIDNEY	11791.56	7618.09	1764.1								Bedrock
MP MW-12D	SIDNEY	11152.16	7549.94	1764.93								Bedrock
MP MW-12DD	SIDNEY	11161.06	7553.86	1763.1								Bedrock
MW-13S	SIDNEY	11167.82	7543.84	1981.49								Bedrock
MW-14S	SIDNEY	13082.3	9453.89	1938.34								Bedrock
MW-15S	SIDNEY	13385.01	9299.63	1939.12								Bedrock
MW-16S	SIDNEY	13165.34	9223.75	1945.69								Bedrock
MW-17	SIDNEY	13071.95	9229.58	2047								Bedrock
MW-18	SIDNEY	11940.83	9884.16	2049.9								Bedrock
MW-19	SIDNEY	11673.16	9762.87	2028.8								Bedrock
MW-20	SIDNEY	11304.31	9638.7	2012.8								Bedrock
MW-21	SIDNEY	10978.79	9042.59	1915.3								Bedrock
MW-22	SIDNEY	10374.36	8374.11	1833.9								Bedrock
MP MW-23	SIDNEY	11443.17	7956.01	1805.3								Bedrock
MW-24	SIDNEY	0	0	2005.5								Overburden

TABLE I-1

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Geological Data

LOC-ID (WELL NAME)	SITE	NORTH X-COORD	EAST Y-COORD	GROUND ELEVATION	TOP FILL	FILL THICKNESS	TOP TILL DEPTH	TILL/OVB THICKNESS	TOP BEDROCK DEPTH	BEDROCK THICKNESS	DRILLED DEPTH	FORMATION
MW-25	SIDNEY	11692.68	10066.99	1996.5								Bedrock
B-1	SIDNEY	11213.14	9901.68	1939.48								Bedrock
B-2	SIDNEY	12997.28	9150.33	1839.64								Bedrock
B-3	SIDNEY	13211.69	8448.23	1798.46								Bedrock
B-4	SIDNEY	12765.69	8276.63	2069.73								Bedrock
B-5	SIDNEY	11972.01	9435.71	2046.59								Bedrock
B-6	SIDNEY	11467.78	9326.65	2009.75								Bedrock
B-7	SIDNEY	11758.09	8931.08	1928.95								Bedrock
MPI-1	SIDNEY	11559.31	8451.94									Bedrock
MPI-2	SIDNEY	0	0									
EW-1	SIDNEY	0	0						20	72	92	Bedrock
PZ-1	SIDNEY	0	0									Bedrock
PZ-2	SIDNEY	0	0									Bedrock
PZ-3	SIDNEY	0	0									Bedrock
PZ-4	SIDNEY	0	0									Bedrock
SW-1	SIDNEY	0	0									
SW-2	SIDNEY	12648.27	8108.05									

TABLE I-2

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation

Groundwater Elevation Data

LOC-ID (WELL NAME)	SITE	NORTH X-COORD	EAST Y-COORD	GROUND ELEVATION	CASING ELEVATION	GROUNDWATER ELEVATION (FEET AMSL) COUNT	MIN	MAX	RANGE	AVERAGE	MEDIAN
MW-1	RHRL	11714.77	7029.99	1805.5	1807.87	11	1786.79	1792.09	5.30	1789.70	1790.06
MW-2	RHRL	11689.44	7111.26	1785.6	1787.69	11	1758.88	1762.35	3.47	1759.75	1759.14
MW-3	RHRL	11716.97	7235.98	1752.4	1752.11	10	1748.10	1750.27	2.17	1749.65	1749.91
MW-4S	RHRL	12069.81	7319.95	1760.9	1763.18	11	1756.30	1760.53	4.23	1758.66	1759.03
MW-4D	RHRL	12075.32	7321.36	1761	1768.09	1	1762.50	1762.50	0.00	1762.50	1762.50
MW-5S(2)	RHRL	11570.75	7213.44	1753.6	1753.68	10	1748.03	1749.05	1.02	1748.59	1748.60
MW-5D	RHRL	11563.35	7211.52	1753.9	1753.49	10	1748.49	1750.09	1.60	1749.20	1749.16
MW-6	RHRL	11269.49	7099.87	1765.1	1766.98	10	1758.19	1762.64	4.45	1760.15	1759.85
MW-7S	RHRL	10685.95	6974.87	1754.7	1754.52	10	1748.65	1748.92	0.27	1748.76	1748.75
MW-8	RHRL	12698.9	7890.51	1796.2	1798.58	11	1786.81	1791.29	4.48	1788.65	1788.14
MW-9	RHRL	12587.94	7767.85	1799.5	1801.42	11	1778.19	1783.91	5.72	1780.88	1780.58
MW-9D	RHRL	12586.12	7775.5	1800.4	1801.97	1	1768.59	1768.59	0.00	1768.59	1768.59
MW-10	RHRL	12126.82	7842	1763.7	1765.67	11	1761.69	1763.57	1.88	1762.32	1762.30
MW-11S	RHRL	11498.97	6515.01	1890.5	1892.42	5	1873.79	1883.06	9.27	1879.31	1880.44
MW-11D	RHRL	11506.87	6518.5	1889.5	1891.43	5	1834.71	1872.69	37.98	1842.83	1834.83
MW-12	RHRL	12020.49	6856.98	1841.9	1843.74	5	1804.29	1808.24	3.95	1806.25	1806.16
MW-13	RHRL	12215.04	7581.73	1767	1768.89	5	1761.15	1762.49	1.34	1761.82	1761.70
MW-14	RHRL	12895.17	7658.84	1796.3	1798.51	5	1786.49	1787.41	0.92	1786.91	1786.84
MW-15	RHRL	12388.12	7813.65	1792	1794.35	5	1780.95	1785.62	4.67	1783.11	1782.66
MW-16	RHRL	12596.54	8120.74	1793.3	1795.33	5	1787.56	1789.56	2.00	1788.44	1788.42
MW-17	RHRL	11300	6765	1825.4	1827.51	4	1793.51	1794.30	0.79	1794.03	1794.16
MW-18S	RHRL	11023.4	6979.7	1762.9	1764.93	4	1760.40	1761.93	1.53	1761.08	1760.99
MW-18D	RHRL	11028.66	6984.65	1763.1	1764.93	4	1746.78	1748.65	1.87	1747.88	1748.04
MW-19	RHRL	12300.46	7357.37	1793.2	1795.6	1	1771.60	1771.60	0.00	1771.60	1771.60
SW-1	RHRL	12659.29	8100.11	1786.2	1790.02	3	1786.59	1786.91	0.32	1786.77	1786.82
SW-2	RHRL	12914.84	7845.04	1785.8	1789.68	4	1786.08	1786.87	0.79	1786.54	1786.61
SW-3	RHRL	12720.62	7547.75	1786.1	1790.04	4	1786.22	1786.93	0.71	1786.62	1786.67
SW-4	RHRL	11638.84	7265.9	1747.3	1750.57	4	1748.08	1748.33	0.25	1748.19	1748.17
SW-5	RHRL	11340.28	7191.53	1747.4	1750.96	4	1748.04	1748.37	0.33	1748.17	1748.14
SW-6	RHRL	11149.04	7266.77	1746.6	1750.59	4	1748.08	1748.31	0.23	1748.18	1748.17
MW-1S	SIDNEY	0	0	2062.04	2063.92	5	2004.24	2037.16	32.92	2022.04	2027.77

TABLE I-2

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Groundwater Elevation Data

LOC-ID		NORTH	EAST	GROUND	CASING	GROUNDWATER ELEVATION (FEET AMSL)					
(WELL NAME)	SITE	X-COORD	Y-COORD	ELEVATION	ELEVATION	COUNT	MIN	MAX	RANGE	AVERAGE	MEDIAN
MW-1D	SIDNEY	11707.25	9450.67	2061.7	2063.06	20	1942.08	1967.42	25.34	1952.36	1951.04
MW-2S	SIDNEY	13150.6	9316.13	1952.37	1953.89	27	1884.05	1921.26	37.21	1900.56	1902.41
MW-2D	SIDNEY	13158.16	9325.66	1952.82	1954.86	29	1847.56	1880.70	33.14	1856.81	1854.84
MW-3S	SIDNEY	11815.73	8952.97	2009.6	2011.2	20	1965.10	1975.95	10.85	1972.96	1973.51
MW-3D	SIDNEY	11796.29	8948.28	2009.83	2011.37	20	1966.37	1972.05	5.68	1970.40	1970.61
MW-4S	SIDNEY	11155.2	8587.54	1974.83	1976.53	20	1946.37	1956.61	10.24	1951.36	1951.64
MW-4D	SIDNEY	11170.07	8581.58	1975.27	1977.07	20	1901.09	1915.16	14.07	1906.71	1907.84
MW-5S	SIDNEY	12430.47	8886.58	1935.38	1936.78	27	1889.64	1912.82	23.18	1895.19	1893.26
MW-5D	SIDNEY	12413.9	8880.02	1935.68	1936.17	23	1862.87	1883.29	20.42	1872.84	1872.54
MW-6S	SIDNEY	13081.12	8535.73	1856.28	1857.97	20	1831.19	1839.68	8.49	1834.07	1833.85
MW-6D	SIDNEY	13094.55	8548.14	1856.55	1858.08	20	1790.40	1794.52	4.12	1792.62	1792.67
MW-7S	SIDNEY	14025.63	8431.66	1786.97	1789.29	23	1777.76	1783.49	5.73	1780.66	1780.83
MW-7D	SIDNEY	14044.45	8436.55	1787.05	1788.66	23	1761.47	1768.58	7.11	1764.62	1764.82
MW-8S	SIDNEY	133368.8	8273.66	1804.02	1805.91	23	1778.71	1788.63	9.92	1786.22	1786.11
MW-8D	SIDNEY	13350.84	8268.36	1804.65	1806.33	23	1776.44	1785.87	9.43	1778.00	1777.53
MW-8DD	SIDNEY	13336.31	8265.48	1804.4	1805.3	6	1760.04	1770.26	10.22	1766.92	1768.19
MP MW-9S	SIDNEY	12827.85	8315.53	1809.3	1810.81	23	1793.00	1800.00	7.00	1795.14	1794.95
MP MW-9D	SIDNEY	12848.48	8313.54	1809.33	1810.98	23	1767.54	1773.41	5.87	1769.29	1769.07
MP MW-10S	SIDNEY	11967.41	8300.96	1858.32	1859.92	20	1824.40	1829.07	4.67	1826.62	1826.77
MP MW-10D	SIDNEY	11982.46	8305.26	1857.77	1859.01	20	1802.73	1817.56	14.83	1808.52	1807.93
MP MW-11S	SIDNEY	11807.06	7631.96	1768.79	1771.53	20	1749.33	1763.65	14.32	1753.01	1752.63
MP MW-11D	SIDNEY	11791.56	7618.09	1769.3	1770.9	20	1749.20	1762.99	13.79	1752.20	1751.78
MP MW-12S	SIDNEY	11152.16	7549.94	1764.1	1764.76	20	1741.38	1750.68	9.30	1747.86	1748.25
MP MW-12D	SIDNEY	11161.06	7553.86	1764.93	1766.39	20	1734.19	1744.95	10.76	1741.86	1742.37
MP MW-12DD	SIDNEY	11167.82	7543.84	1763.1	1764.29	6	1696.61	1703.26	6.65	1700.88	1701.72
MW-13S	SIDNEY	13082.3	9453.89	1981.49	1983.02	26	1911.23	1934.48	23.25	1915.99	1912.63
MW-14S	SIDNEY	13385.01	9299.63	1938.34	1939.67	29	1879.06	1904.20	25.14	1882.71	1882.22
MW-15S	SIDNEY	13165.34	9223.75	1939.12	1940.61	29	1869.50	1916.57	47.07	1896.28	1901.63
MW-16S	SIDNEY	13071.95	9229.58	1945.69	1947.1	29	1876.95	1933.20	56.25	1902.28	1904.78
MW-17	SIDNEY	11940.83	9884.16	2047	2058.77	5	1919.16	1950.17	31.01	1935.27	1928.85
MW-18	SIDNEY	11673.16	9762.87	2049.9	2051.92	4	1894.50	1914.64	20.14	1902.89	1901.22

TABLE I-2

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Groundwater Elevation Data

LOC-ID		NORTH	EAST	GROUND	CASING	GROUNDWATER ELEVATION (FEET AMSL)					
(WELL NAME)	SITE	X-COORD	Y-COORD	ELEVATION	ELEVATION	COUNT	MIN	MAX	RANGE	AVERAGE	MEDIAN
MW-19	SIDNEY	11304.31	9638.7	2028.8	2030.36	6	1907.51	1928.06	20.55	1919.46	1920.07
MW-20	SIDNEY	10978.79	9042.59	2012.8	2015.84	5	1969.13	1969.29	0.16	1969.24	1969.26
MW-21	SIDNEY	10374.36	8374.11	1915.3	1918.04	4	1883.92	1896.80	12.88	1887.72	1885.09
MW-22	SIDNEY	11443.17	7956.01	1833.9	1836.56	5	1745.61	1767.13	21.52	1759.63	1760.51
MP MW-23	SIDNEY	0	0	1805.3	1807.3	8	1790.19	1798.68	8.49	1793.92	1793.38
MW-24	SIDNEY	11692.68	10066.99	2005.5	2007.48	5	1868.09	1902.38	34.29	1884.90	1881.49
MW-25	SIDNEY	11213.14	9901.68	1996.5	1997.9	4	1839.93	1895.87	55.94	1857.39	1846.87
B-1	SIDNEY	12997.28	9150.33	1939.48	1942.75	20	1898.85	1917.80	18.95	1904.03	1903.14
B-2	SIDNEY	13211.69	8448.23	1839.64	1841.75	20	1810.84	1815.74	4.90	1813.36	1813.21
B-3	SIDNEY	12765.69	8276.63	1798.46	1800.6	20	1783.78	1785.64	1.86	1784.75	1784.71
B-4	SIDNEY	11972.01	9435.71	2069.73	2072.65	20	2005.87	2008.82	2.95	2007.20	2006.75
B-5	SIDNEY	11467.78	9326.65	2046.59	2049.41	20	2003.78	2014.39	10.61	2004.87	2004.41
B-6	SIDNEY	11758.09	8931.08	2009.75	2011.79	20	1966.37	1974.57	8.20	1970.08	1970.08
B-7	SIDNEY	11559.31	8451.94	1928.95	1931.57	19	1861.29	1868.25	6.96	1863.99	1863.87
MPI-1	SIDNEY	0	0		1761.03	13	1757.67	1758.56	0.89	1758.01	1757.83
MPI-2	SIDNEY	0	0		1766.67	13	1763.27	1764.68	1.41	1763.81	1763.76
EW-1	SIDNEY	0	0			6	1864.53	1902.95	38.42	1879.27	1877.41
PZ-1	SIDNEY	0	0			4	1868.58	1902.86	34.28	1877.54	1869.35
PZ-2	SIDNEY	0	0			4	1870.22	1902.97	32.75	1881.00	1875.40
PZ-3	SIDNEY	0	0			6	1866.94	1903.08	36.14	1875.39	1870.39
PZ-4	SIDNEY	0	0			6	1872.67	1902.89	30.22	1878.82	1873.12

TABLE I-3
Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
RI Slug Test Results

LOC_ID	Ground Elevation	Casing Elev.	Northing	Easting	Well Depth	K (ft/day)
OVERBURDEN						
MW-1	1805.5	1807.87	11714.77	7029.99	22.5	4.E-02
MW-3	1752.4	1752.11	11716.97	7235.98	19.5	2.E+01
MW-4S	1760.9	1763.18	12069.81	7319.95	22.5	8.E+00
MW-5S	1753.6	1753.68	11570.75	7213.44	18.5	1.E-02
MW-6	1765.1	1766.98	11269.49	7099.87	20.5	5.E-02
MW-7S	1754.7	1754.52	10685.95	6974.87	19.7	9.E-02
MW-8	1796.2	1798.58	12698.90	7890.51	24.5	5.E-02
MW-9	1799.5	1801.42	12587.94	7767.85	44.5	5.E-01
MW-10	1763.7	1765.67	12126.82	7842.00	14.0	7.E+00
MW-11S	1890.5	1892.42	11498.97	6515.01	32.8	3.E+00
MW-12	1841.9	1843.74	12020.49	6856.98	43.8	2.E-02
MW-13	1767.0	1768.89	12215.02	7581.73	20.1	2.E-01
MW-14	1796.3	1798.51	12895.17	7658.84	20.0	2.E-01
MW-15	1792.0	1794.35	12388.12	7813.65	24.3	7.E-01
MW-16	1793.3	1795.33	12950.40	8117.30	19.1	6.E-01
MW-18S	1762.9	1764.93	11023.40	6979.70	19.1	1.E+00
MW-19	1793.2	1795.60	12300.46	7357.37	39.6	3.E-02
			Geometric Mean:			0.3
BEDROCK						
MW-5D	1753.9	1753.49	11653.35	7211.52	51.5	7.E+00
MW-7D	1754.9	1754.37	10658.30	6970.57	38.1	3.E-04
MW-11D	1889.5	1891.43	11506.87	6518.50	60.2	2.E-01
MW-18D	1763.1	1764.93	11018.66	6984.65	50.2	3.E-03
			Geometric Mean:			0.03

Source: O'Brien & Gere, 1995. Slug tests analyzed using the methodology of Bouwer and Rice (1976).

TABLE I-4
Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
RI Pump Test Results

Pumping Well	Test Duration (minutes)	Flow Rate (gpm)	Observation Well	Transmissivity (gpd/ft)(1)	Transmissivity (ft^2/day)	Hydraulic Conductivity (gpd/ft^2)(1)	Hydraulic Conductivity (ft/day)	Specific Yield(1)
TW-1	1140	0.87	PZ-1	114	15	9	1	0.001
			PZ-2	154	21	12	2	0.0008
			PZ-3	722	97	70	9	0.004
			MW-18S	1093	146	73	10	0.005
TW-2	1440	0.25	PZ-4	42	6	2	0.3	0.004
			PZ-5	84	11	5	1	0.0006
			PZ-6	104	14	6	1	0.0003
			MW-6	198	26	11	1	0.002
TW-3	1030	2.6	PZ-7	766	102	39	5	0.003
			PZ-8	921	123	47	6	0.0006
			PZ-9	1186	159	61	8	0.0003
			MW-3	3342	447	172	23	0.0003
		Geometric Mean:		**345**	**46**	**21**	**3**	**0.001**

(1) Source: O'Brien & Gere, Results analyzed using the methodology of Neuman (1975).

TABLE I-5

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation

NOAA Precipitation Data (inches)

Year:	January	February	March	April	May	June	July	August	September	October	November	December	Annual Average
1895	2.83	1.83	1.56	3.09	2.38	2.73	2.68	3.47	1.94	2.16	4.09	3.66	32.42
1896	1.55	6.30	4.28	1.25	2.69	3.20	5.12	2.31	4.78	2.80	3.12	0.86	38.26
1897	2.03	2.16	2.92	2.80	3.57	3.73	7.36	2.95	1.77	0.97	4.96	4.29	39.51
1898	3.93	3.19	2.15	3.09	4.57	2.99	2.62	6.19	2.40	6.10	4.14	2.55	43.92
1899	2.23	2.99	4.10	1.57	2.86	2.50	3.38	2.00	4.52	2.18	2.03	3.29	33.65
1900	3.01	4.39	4.00	1.61	2.37	2.65	4.26	2.50	1.95	3.37	4.88	2.35	37.34
1901	1.80	1.27	3.37	5.57	5.31	3.21	4.07	5.57	3.22	2.00	2.40	5.53	43.32
1902	2.03	3.69	3.28	3.08	2.03	5.16	7.67	2.31	3.55	4.92	1.20	4.63	43.55
1903	2.76	3.45	4.26	2.75	0.63	7.08	4.32	6.12	1.15	7.01	1.62	2.83	43.98
1904	3.33	2.40	3.12	3.52	3.04	3.44	4.80	3.80	4.09	3.31	0.91	2.17	37.93
1905	3.31	1.44	2.39	2.52	1.69	5.56	5.25	4.15	3.70	2.92	1.88	3.14	37.95
1906	1.61	1.85	3.45	2.77	3.83	4.32	3.29	3.41	2.34	4.64	1.91	3.09	36.51
1907	2.50	1.58	1.73	2.92	3.36	3.31	2.53	1.38	6.33	4.86	3.79	4.32	38.61
1908	2.33	4.01	2.70	2.78	4.94	2.60	3.78	2.64	1.03	2.44	1.00	2.37	32.62
1909	3.07	4.69	3.00	4.00	2.84	2.86	2.51	2.46	2.77	1.39	1.97	2.75	34.31
1910	4.33	4.69	0.97	3.86	3.49	2.93	2.13	2.52	3.38	2.03	2.92	2.27	35.52
1911	2.21	2.67	2.57	2.14	2.06	4.01	2.05	5.12	3.38	4.25	2.83	2.46	35.75
1912	1.92	2.37	4.07	3.89	3.89	1.08	2.70	3.73	3.85	3.23	2.99	2.84	36.56
1913	3.93	1.95	5.09	3.77	2.68	1.92	1.79	2.55	2.55	6.44	3.35	2.25	38.27
1914	2.46	2.29	3.44	4.39	3.48	3.18	3.02	3.93	0.85	1.37	2.16	3.48	34.05
1915	4.66	4.22	0.66	1.75	2.50	3.29	5.56	5.87	2.21	3.20	1.93	4.29	40.14
1916	1.53	3.88	3.27	3.36	4.16	4.87	2.67	1.85	3.51	1.63	2.33	2.88	35.94
1917	2.62	2.02	3.00	2.09	3.90	5.85	3.74	4.00	1.63	7.20	0.59	2.45	39.09
1918	2.51	2.69	2.36	3.35	3.45	3.64	2.96	2.67	5.36	2.96	1.74	2.64	36.33
1919	2.03	1.97	3.50	3.30	5.00	2.83	5.02	3.88	2.90	3.51	3.30	1.72	38.96
1920	2.06	3.35	2.40	3.26	1.90	3.87	5.21	3.53	4.49	1.87	4.12	4.71	40.77
1921	1.61	2.78	2.77	3.25	2.50	2.75	3.43	2.70	2.22	2.17	5.64	1.20	33.02
1922	1.96	2.56	3.54	2.71	3.47	8.08	3.07	4.15	1.46	2.20	0.93	2.41	36.54
1923	4.42	1.87	2.10	2.54	2.18	3.44	2.59	1.69	2.95	3.79	2.89	2.83	33.29
1924	3.10	2.84	0.91	4.69	4.39	2.70	3.13	3.49	6.46	0.07	1.99	1.50	35.27
1925	3.42	2.66	3.20	2.59	2.50	4.22	4.98	2.27	4.37	4.36	3.48	2.53	40.58
1926	2.23	3.80	2.04	2.77	1.67	3.69	2.88	4.84	3.41	5.11	3.68	2.20	38.32
1927	2.07	3.41	1.88	2.09	4.61	2.27	4.81	4.79	1.95	7.14	7.21	4.58	46.81
1928	2.13	2.94	2.91	3.89	1.67	6.23	4.70	4.40	2.34	2.18	2.31	0.77	36.47
1929	2.90	2.87	2.87	6.34	4.22	3.44	2.95	2.43	2.91	3.86	2.88	3.50	41.17
1930	2.48	1.69	3.01	2.26	3.04	4.30	2.05	1.93	2.12	1.67	2.18	1.78	28.51
1931	2.50	2.07	1.92	3.71	4.55	3.63	6.44	3.44	3.10	1.92	2.28	1.50	37.06
1932	4.27	2.46	4.00	1.87	3.06	3.79	4.87	3.78	1.38	7.38	5.37	1.23	43.46

TABLE I-5
Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
NOAA Precipitation Data (inches)

Year:	January	February	March	April	May	June	July	August	September	October	November	December	Annual Average
1933	1.40	2.19	3.52	3.96	2.77	1.90	2.88	8.06	5.09	2.83	1.67	3.00	39.27
1934	2.43	1.34	2.79	3.34	2.38	4.39	3.44	3.40	5.68	1.99	2.90	2.77	36.85
1935	3.93	2.18	2.33	2.97	2.64	4.04	9.09	1.73	3.12	4.30	5.02	1.87	43.22
1936	3.52	1.69	6.07	3.57	2.79	2.05	1.41	5.75	2.83	4.32	2.80	3.15	39.95
1937	4.90	2.77	2.54	3.33	3.34	5.53	3.49	5.70	2.98	4.85	2.66	2.25	44.34
1938	3.14	2.37	2.26	2.60	3.12	3.73	5.32	4.88	7.44	1.38	2.97	3.24	42.45
1939	2.57	3.73	3.04	3.10	1.56	2.67	1.82	2.65	3.31	3.79	1.59	2.76	32.59
1940	1.22	3.24	5.26	3.86	3.82	3.91	2.41	4.17	2.71	1.99	3.23	3.62	39.44
1941	2.00	1.91	2.44	1.90	2.27	3.19	5.25	3.32	1.47	3.40	2.11	2.98	32.24
1942	1.74	1.64	4.07	1.83	5.43	3.53	5.04	3.86	4.99	3.47	3.37	6.24	45.21
1943	2.48	2.06	2.97	4.12	6.33	3.94	4.55	4.30	0.55	5.53	3.28	0.87	40.98
1944	1.24	2.15	3.56	3.25	3.11	4.23	2.25	3.41	4.44	3.27	3.29	2.79	36.99
1945	3.82	2.81	2.35	3.76	5.22	5.14	5.66	2.45	6.03	4.51	5.25	1.81	48.81
1946	1.38	2.99	1.86	1.87	6.75	4.43	4.50	3.28	4.16	2.82	1.15	2.46	37.65
1947	3.00	1.64	3.40	4.48	6.65	4.34	6.35	2.39	2.63	1.66	3.91	2.29	42.74
1948	2.66	2.39	3.54	4.43	5.10	5.06	3.80	3.48	1.24	2.43	4.27	4.63	43.03
1949	3.58	1.90	1.56	3.40	4.23	1.99	4.38	4.35	3.82	2.02	2.31	2.80	36.34
1950	3.56	4.20	3.30	2.44	2.84	3.98	3.78	4.98	3.38	1.88	4.53	4.07	42.94
1951	2.87	4.20	4.29	2.99	2.36	4.39	5.49	2.75	3.27	2.64	4.57	4.15	43.97
1952	3.15	2.22	3.25	3.94	4.67	2.67	5.98	3.10	3.27	1.69	2.98	4.12	41.04
1953	3.82	2.39	4.15	4.25	5.05	2.56	2.56	1.78	3.90	3.64	2.13	3.18	39.41
1954	2.91	2.64	2.94	4.05	4.28	3.42	2.47	4.45	3.10	2.16	5.56	3.38	41.36
1955	1.07	3.53	4.01	2.70	2.82	2.82	1.99	8.83	2.95	8.76	2.60	1.76	43.84
1956	2.31	3.90	5.60	4.63	2.92	3.25	4.98	2.99	4.85	1.99	2.37	4.04	43.83
1957	1.89	1.38	1.71	3.95	3.65	3.17	4.04	2.29	3.98	2.34	2.56	4.26	35.22
1958	4.42	3.80	2.95	4.35	3.91	3.61	4.90	2.97	4.40	4.46	3.30	1.12	44.19
1959	3.57	2.21	3.21	3.17	1.75	3.18	2.44	4.51	1.87	6.38	5.74	4.17	42.20
1960	2.87	3.96	1.86	3.92	4.32	5.75	3.42	4.07	6.89	2.12	1.57	1.19	41.94
1961	1.78	3.37	3.35	5.18	3.63	4.68	4.21	4.49	1.21	1.51	3.68	2.23	39.32
1962	3.10	3.10	1.78	4.89	1.27	2.96	2.47	3.55	3.13	4.58	2.68	2.86	36.37
1963	2.29	2.21	3.38	2.11	3.61	2.94	3.84	4.08	2.11	0.31	5.32	2.45	34.65
1964	4.04	2.21	4.18	3.73	1.97	1.77	2.84	2.20	1.24	0.96	2.18	4.14	31.46
1965	2.89	2.21	1.92	2.86	1.53	2.12	2.57	4.08	4.33	2.89	2.60	1.93	31.93
1966	2.80	2.72	3.20	2.24	3.28	2.96	2.71	2.44	4.42	2.21	3.33	3.04	35.35
1967	1.37	1.87	3.32	2.94	3.99	3.95	4.46	4.80	2.58	3.50	3.74	3.17	39.69
1968	1.91	0.59	3.47	2.72	6.28	5.49	1.57	3.17	3.37	3.53	5.38	4.09	41.57
1969	2.01	1.54	1.48	4.20	3.26	4.21	4.32	2.67	1.79	2.50	5.78	6.28	40.04
1970	1.25	2.50	2.66	3.24	3.65	2.14	5.68	3.37	4.18	3.39	3.10	3.47	38.63

TABLE I-5
Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation

NOAA Precipitation Data (inches)

Year:	January	February	March	April	May	June	July	August	September	October	November	December	Annual Average
1971	1.95	4.83	3.16	1.89	3.45	2.21	4.99	4.53	2.63	2.15	4.01	4.05	39.85
1972	1.92	3.98	4.11	3.49	5.66	9.11	2.98	3.32	2.20	3.44	7.97	5.04	53.22
1973	2.68	1.76	2.71	5.01	5.55	6.84	2.29	2.98	3.08	2.62	2.27	7.66	45.45
1974	2.88	2.46	4.16	2.77	4.24	4.32	5.35	3.66	5.19	1.49	4.05	4.08	44.65
1975	3.49	3.55	3.10	2.50	4.44	4.37	5.00	5.64	6.22	4.31	3.59	3.08	49.29
1976	4.46	3.33	3.33	4.19	4.21	5.48	4.76	5.31	3.56	7.32	1.40	2.20	49.55
1977	1.73	2.69	6.41	3.53	2.70	3.61	3.13	4.57	9.29	6.62	5.37	5.41	55.06
1978	6.62	1.44	2.52	1.92	3.72	4.08	3.29	4.43	3.19	3.69	1.66	4.02	40.58
1979	7.10	1.93	3.63	3.91	4.79	1.61	3.09	3.68	6.00	3.98	4.32	1.47	45.51
1980	1.01	1.05	6.31	4.42	1.19	5.54	3.13	2.66	2.96	3.65	3.25	1.90	37.07
1981	0.90	5.74	1.02	3.40	3.70	4.22	3.98	1.96	5.51	5.53	2.01	2.98	40.95
1982	2.52	3.03	2.92	3.59	3.39	6.38	2.53	2.00	2.46	1.12	4.47	2.21	36.62
1983	2.93	1.99	3.91	8.73	4.52	4.20	1.65	4.15	2.40	2.79	4.54	6.07	47.88
1984	1.80	3.74	3.30	4.96	7.98	2.55	5.28	3.29	2.35	2.38	3.36	3.25	44.24
1985	1.27	1.72	2.71	1.83	3.30	3.90	3.74	3.17	6.14	2.78	5.54	2.36	38.46
1986	3.02	3.49	3.46	2.81	3.94	5.44	5.34	4.14	2.39	2.99	5.30	2.63	44.95
1987	3.76	0.50	1.95	6.55	2.10	3.74	4.66	4.18	5.73	4.37	2.49	1.97	42.00
1988	1.58	2.96	2.07	2.56	4.13	1.12	5.55	4.78	2.08	3.11	4.48	1.37	35.79
1989	1.39	1.94	2.99	1.97	7.27	5.97	3.84	2.69	4.91	4.69	3.46	1.33	42.45
1990	4.07	3.61	2.80	3.35	6.33	3.39	2.99	5.52	2.27	6.60	3.66	5.27	49.86
1991	2.34	1.73	3.47	3.95	2.99	1.79	3.03	4.12	3.95	2.90	3.87	3.09	37.23
1992	1.77	1.88	3.38	3.40	3.95	3.45	6.38	3.80	3.20	3.15	4.19	3.48	42.03
1993	2.59	2.50	4.77	6.78	1.34	3.85	1.99	2.71	4.73	3.38	4.90	3.31	42.85
1994	3.98	2.07	5.16	3.62	2.97	5.82	4.47	6.22	3.00	0.91	3.49	2.74	44.45
1995	3.31	2.35	1.98	2.63	2.30	2.14	3.42	1.85	3.29	7.82	4.54	2.53	38.16
1996	6.02	2.06	2.57	5.59	4.97	5.27	6.52	3.33	5.65	3.95	5.08	6.50	57.51
1997	2.28	2.39	4.09	2.83	3.36	2.53	2.47	3.88	3.48	1.74	5.46	3.34	37.85
1998	4.18	3.30	3.71	4.13	4.90	7.54	3.49	1.96	2.50	3.10	1.71	1.54	42.06
1999	5.53	1.45	4.33	2.21									Annual Average
Monthly Average:	2.78	2.67	3.13	3.39	3.58	3.83	3.89	3.65	3.44	3.38	3.34	3.07	40.13

Source: NOAA CLIMVIS Database (http://www.ncdc.noaa.gov/onlineprod/drought/), precipitation record for NYS NOAA Region 2

TABLE I-6

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Step-Drawdown Test
November 15, 1999

2 gpm		4 gpm		6 gpm	
Elapsed Time (min)	Drawdown (ft)	Elapsed Time (min)	Drawdown (ft)	Elapsed Time (min)	Drawdown (ft)
0.00	#N/A	58.00	4.81	116.00	11.94
0.01	#N/A	58.01	4.89	116.01	11.94
0.02	#N/A	58.02	4.83	116.02	11.95
0.03	#N/A	58.03	4.83	116.03	12.03
0.03	#N/A	58.03	4.88	116.03	11.89
0.04	#N/A	58.04	4.89	116.04	11.97
0.05	#N/A	58.05	4.91	116.05	11.98
0.06	#N/A	58.06	4.94	116.06	11.95
0.07	#N/A	58.07	5.00	116.07	11.95
0.08	#N/A	58.08	5.00	116.08	11.95
0.08	#N/A	58.08	5.03	116.08	11.97
0.09	#N/A	58.09	5.05	116.09	11.97
0.10	#N/A	58.10	5.06	116.10	11.97
0.11	#N/A	58.11	5.05	116.11	11.98
0.12	#N/A	58.12	5.06	116.12	12.00
0.13	#N/A	58.13	5.10	116.13	12.02
0.13	#N/A	58.13	5.08	116.13	12.02
0.14	#N/A	58.14	5.14	116.14	12.03
0.15	#N/A	58.15	5.14	116.15	12.03
0.16	#N/A	58.16	5.19	116.16	12.06
0.17	#N/A	58.17	5.22	116.17	12.03
0.18	#N/A	58.18	5.25	116.18	12.05
0.18	#N/A	58.18	5.27	116.18	12.06
0.19	#N/A	58.19	5.27	116.19	12.06
0.20	0.03	58.20	5.28	116.20	12.05
0.21	0.08	58.21	5.28	116.21	12.06
0.22	0.13	58.22	5.28	116.22	12.06
0.23	0.21	58.23	5.30	116.23	12.06
0.23	0.28	58.23	5.32	116.23	12.03
0.24	0.30	58.24	5.33	116.24	12.05
0.25	0.33	58.25	5.35	116.25	12.05
0.26	0.41	58.26	5.38	116.26	12.05
0.27	0.47	58.27	5.38	116.27	12.06
0.28	0.50	58.28	5.41	116.28	12.06
0.28	0.52	58.28	5.46	116.28	12.03
0.29	0.61	58.29	5.47	116.29	12.06
0.30	0.65	58.30	5.49	116.30	12.06
0.31	0.68	58.31	5.50	116.31	12.06
0.32	0.72	58.32	5.52	116.32	12.08
0.33	0.79	58.33	5.54	116.33	12.09
0.33	0.85	58.33	5.52	116.33	12.09
0.35	0.83	58.35	5.54	116.35	12.09
0.37	0.91	58.37	5.58	116.37	12.13
0.38	0.99	58.38	5.63	116.38	12.11
0.40	0.96	58.40	5.66	116.40	12.11
0.42	0.98	58.42	5.71	116.42	12.11
0.43	1.04	58.43	5.69	116.43	12.13

TABLE I-6

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Step-Drawdown Test
November 15, 1999

2 gpm		4 gpm		6 gpm	
Elapsed Time (min)	Drawdown (ft)	Elapsed Time (min)	Drawdown (ft)	Elapsed Time (min)	Drawdown (ft)
0.45	1.01	58.45	5.72	116.45	12.14
0.47	1.05	58.47	5.76	116.47	12.14
0.48	1.12	58.48	5.82	116.48	12.14
0.50	1.07	58.50	5.85	116.50	12.17
0.52	1.10	58.52	5.83	116.52	12.20
0.53	1.18	58.53	5.83	116.53	12.24
0.55	1.13	58.55	5.88	116.55	12.24
0.57	1.12	58.57	5.91	116.57	12.24
0.58	1.18	58.58	5.98	116.58	12.24
0.60	1.20	58.60	5.99	116.60	12.27
0.62	1.16	58.62	6.02	116.62	12.25
0.63	1.20	58.63	6.04	116.63	12.25
0.65	1.46	58.65	6.05	116.65	12.24
0.67	1.27	58.67	6.10	116.67	12.24
0.68	1.29	58.68	6.09	116.68	12.27
0.70	1.37	58.70	6.05	116.70	12.27
0.72	1.40	58.72	6.10	116.72	12.30
0.73	1.37	58.73	6.15	116.73	12.30
0.75	1.46	58.75	6.18	116.75	12.31
0.77	1.49	58.77	6.21	116.77	12.33
0.78	1.48	58.78	6.23	116.78	12.31
0.80	1.57	58.80	6.23	116.80	12.33
0.82	1.60	58.82	6.24	116.82	12.35
0.83	1.60	58.83	6.23	116.83	12.36
0.85	1.62	58.85	6.26	116.85	12.39
0.87	1.71	58.87	6.32	116.87	12.41
0.88	1.70	58.88	6.35	116.88	12.38
0.90	1.71	58.90	6.37	116.90	12.38
0.92	1.81	58.92	6.37	116.92	12.42
0.93	1.81	58.93	6.37	116.93	12.39
0.95	1.81	58.95	6.38	116.95	12.42
0.97	1.89	58.97	6.40	116.97	12.41
0.98	1.90	58.98	6.42	116.98	12.44
1.0	1.89	59.0	6.45	117.0	12.42
1.2	2.17	59.2	6.67	117.2	12.58
1.4	2.34	59.4	6.86	117.4	12.69
1.6	2.45	59.6	6.94	117.6	12.82
1.8	2.60	59.8	7.11	117.8	12.96
2.0	2.74	60.0	7.23	118.0	13.10
2.2	2.74	60.2	7.28	118.2	13.21
2.4	2.88	60.4	7.33	118.4	13.30
2.6	2.89	60.6	7.33	118.6	13.43
2.8	2.99	60.8	7.39	118.8	13.46
3.0	3.05	61.0	7.44	119.0	13.51
3.2	3.18	61.2	7.50	119.2	13.59
3.4	3.30	61.4	7.60	119.4	13.68
3.6	3.43	61.6	7.71	119.6	13.76

TABLE I-6

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Step-Drawdown Test
November 15, 1999

2 gpm		4 gpm		6 gpm	
Elapsed Time (min)	Drawdown (ft)	Elapsed Time (min)	Drawdown (ft)	Elapsed Time (min)	Drawdown (ft)
3.8	3.46	61.8	7.74	119.8	13.81
4.0	3.52	62.0	7.82	120.0	13.90
4.2	3.59	62.2	7.85	120.2	13.97
4.4	3.70	62.4	7.88	120.4	14.04
4.6	3.73	62.6	7.93	120.6	14.08
4.8	3.84	62.8	7.99	120.8	14.15
5.0	3.88	63.0	8.02	121.0	14.19
5.2	3.99	63.2	8.08	121.2	14.25
5.4	4.03	63.4	8.15	121.4	14.30
5.6	4.09	63.6	8.18	121.6	14.37
5.8	4.23	63.8	8.24	121.8	14.42
6.0	4.36	64.0	8.27	122.0	14.45
6.2	4.51	64.2	8.27	122.2	14.48
6.4	4.59	64.4	8.30	122.4	14.56
6.6	4.66	64.6	8.35	122.6	14.63
6.8	4.77	64.8	8.43	122.8	14.63
7.0	4.88	65.0	8.49	123.0	14.70
7.2	4.94	65.2	8.48	123.2	14.75
7.4	5.02	65.4	8.54	123.4	14.78
7.6	5.08	65.6	8.62	123.6	14.86
7.8	5.13	65.8	8.62	123.8	14.86
8.0	5.17	66.0	8.68	124.0	14.96
8.2	5.19	66.2	8.68	124.2	14.96
8.4	5.21	66.4	8.74	124.4	15.03
8.6	5.28	66.6	8.74	124.6	15.03
8.8	5.32	66.8	8.81	124.8	15.11
9.0	5.30	67.0	8.82	125.0	15.14
9.2	5.36	67.2	8.87	125.2	15.14
9.4	5.41	67.4	8.89	125.4	15.25
9.6	5.41	67.6	8.95	125.6	15.25
9.8	5.47	67.8	8.95	125.8	15.32
10.0	5.55	68.0	8.98	126.0	15.30
12.0	5.91	70.0	9.28	128.0	15.57
14.0	6.42	72.0	9.56	130.0	15.82
16.0	6.65	74.0	9.78	132.0	16.03
18.0	6.94	76.0	9.94	134.0	16.34
20.0	7.03	78.0	10.14	136.0	16.80
22.0	6.90	80.0	10.35	138.0	17.19
24.0	6.56	82.0	10.47	140.0	17.63
26.0	5.88	84.0	10.60	142.0	18.18
28.0	5.49	86.0	10.73	144.0	18.79
30.0	5.22	88.0	10.79	146.0	19.52
32.0	5.08	90.0	10.90	148.0	20.49
34.0	5.05	92.0	11.02	150.0	21.29
36.0	4.99	94.0	11.12	152.0	22.19
38.0	4.92	96.0	11.21	154.0	23.10
40.0	4.88	98.0	11.29	156.0	24.00

TABLE I-6

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation

Step-Drawdown Test

November 15, 1999

2 gpm		4 gpm		6 gpm	
Elapsed Time (min)	Drawdown (ft)	Elapsed Time (min)	Drawdown (ft)	Elapsed Time (min)	Drawdown (ft)
42.0	4.86	100.0	11.37	158.0	24.76
44.0	4.81	102.0	11.45	160.0	25.56
46.0	4.81	104.0	11.56	162.0	26.50
48.0	4.78	106.0	11.64	164.0	27.46
50.0	4.77	108.0	11.70	166.0	28.39
52.0	4.77	110.0	11.73	168.0	29.38
54.0	4.80	112.0	11.79	170.0	30.42
56.0	4.78	114.0	11.84	172.0	31.32
58.0	4.73	116.0	11.86	174.0	32.23

TABLE I-7a

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Constant-Rate Pumping Test

		CORRECTED DRAWDOWN (FEET)					BACKGROUND CORRECTION
Time	Elapsed Time (MINUTES)	PW 1	OW 1-1	OW 1-2	MW-9D	MW-9S	MW-11D
11/1/96 8:49 AM	#N/A	#N/A	#N/A	#N/A	#N/A		0.00
11/1/96 8:49 AM	0.008	0.08	0.01	0.02	0.02		0.02
11/1/96 8:49 AM	0.017	0.11	0.01	0.02	0.02		0.02
11/1/96 8:49 AM	0.025	0.14	0.01	0.02	0.02		0.02
11/1/96 8:49 AM	0.033	0.20	0.02	0.03	0.02		0.02
11/1/96 8:49 AM	0.042	0.27	0.01	0.03	0.02		0.02
11/1/96 8:49 AM	0.050	0.30	0.01	0.03	0.02		0.02
11/1/96 8:49 AM	0.058	0.33	#N/A	0.02	#N/A		0.00
11/1/96 8:49 AM	0.067	0.38	0.01	0.04	0.02		0.02
11/1/96 8:49 AM	0.075	0.46	0.02	0.04	0.02		0.02
11/1/96 8:49 AM	0.083	0.46	0.01	0.05	0.02		0.02
11/1/96 8:49 AM	0.092	0.47	0.01	0.05	0.02		0.02
11/1/96 8:49 AM	0.100	0.53	0.01	0.05	0.02		0.02
11/1/96 8:49 AM	0.108	0.57	0.01	0.06	0.02		0.02
11/1/96 8:49 AM	0.117	0.58	0.01	0.06	0.02		0.02
11/1/96 8:49 AM	0.125	0.61	0.01	0.07	0.02		0.02
11/1/96 8:49 AM	0.133	0.61	0.01	0.07	0.02		0.02
11/1/96 8:49 AM	0.142	0.63	0.02	0.07	0.02		0.02
11/1/96 8:49 AM	0.150	0.68	0.00	0.08	0.02		0.02
11/1/96 8:49 AM	0.158	0.65	#N/A	0.07	0.02		0.00
11/1/96 8:49 AM	0.167	0.72	0.01	0.09	0.03		0.02
11/1/96 8:49 AM	0.175	0.71	#N/A	0.07	0.02		0.00
11/1/96 8:49 AM	0.183	0.74	0.01	0.10	0.03		0.02
11/1/96 8:49 AM	0.192	0.75	0.01	0.10	0.03		0.02
11/1/96 8:49 AM	0.200	0.77	0.02	0.11	0.03		0.02
11/1/96 8:49 AM	0.208	0.77	0.01	0.12	0.03		0.02
11/1/96 8:49 AM	0.217	0.79	0.01	0.12	0.03		0.02
11/1/96 8:49 AM	0.225	0.79	0.01	0.13	0.03		0.02
11/1/96 8:49 AM	0.233	0.80	0.01	0.14	0.03		0.02
11/1/96 8:49 AM	0.242	0.80	0.01	0.14	0.03		0.02
11/1/96 8:49 AM	0.250	0.82	0.01	0.14	0.03		0.02
11/1/96 8:49 AM	0.258	0.85	0.01	0.15	0.03		0.02
11/1/96 8:50 AM	0.267	0.82	0.01	0.15	0.03		0.02
11/1/96 8:50 AM	0.275	0.83	0.01	0.16	0.03		0.02
11/1/96 8:50 AM	0.283	0.83	0.02	0.17	0.03		0.02
11/1/96 8:50 AM	0.292	0.82	0.02	0.17	0.05		0.02
11/1/96 8:50 AM	0.300	0.82	0.02	0.17	0.05		0.02
11/1/96 8:50 AM	0.308	0.79	#N/A	0.16	0.03		0.00
11/1/96 8:50 AM	0.317	0.80	0.01	0.18	0.05		0.02
11/1/96 8:50 AM	0.325	0.82	0.00	0.19	0.05		0.02
11/1/96 8:50 AM	0.333	0.80	0.02	0.19	0.05		0.02
11/1/96 8:50 AM	0.350	0.80	0.01	0.20	0.05		0.02
11/1/96 8:50 AM	0.367	0.79	0.01	0.21	0.05		0.02
11/1/96 8:50 AM	0.383	0.79	0.02	0.22	0.06		0.02
11/1/96 8:50 AM	0.400	0.79	0.02	0.23	0.06		0.02
11/1/96 8:50 AM	0.417	0.79	0.01	0.24	0.06		0.02
11/1/96 8:50 AM	0.433	0.75	#N/A	0.23	0.05		0.00
11/1/96 8:50 AM	0.450	0.79	0.02	0.25	0.06		0.02
11/1/96 8:50 AM	0.467	0.79	0.02	0.26	0.06		0.02
11/1/96 8:50 AM	0.483	0.82	0.02	0.27	0.06		0.02
11/1/96 8:50 AM	0.500	0.82	0.02	0.28	0.08		0.02
11/1/96 8:50 AM	0.517	0.79	0.01	0.29	0.06		0.02
11/1/96 8:50 AM	0.533	0.77	0.02	0.30	0.08		0.02
11/1/96 8:50 AM	0.550	0.77	0.02	0.31	0.08		0.02
11/1/96 8:50 AM	0.567	0.79	0.00	0.31	0.08		0.02
11/1/96 8:50 AM	0.583	0.79	0.01	0.32	0.08		0.02
11/1/96 8:50 AM	0.600	0.82	0.02	0.32	0.08		0.02
11/1/96 8:50 AM	0.617	0.83	0.02	0.33	0.10		0.02
11/1/96 8:50 AM	0.633	0.80	#N/A	0.32	0.08		0.00
11/1/96 8:50 AM	0.650	0.83	0.00	0.35	0.10		0.02
11/1/96 8:50 AM	0.667	0.82	0.01	0.36	0.10		0.02

TABLE I-7a

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Constant-Rate Pumping Test

Time	Elapsed Time (MINUTES)	CORRECTED DRAWDOWN (FEET) PW 1	OW 1-1	OW 1-2	MW-9D	MW-9S	BACKGROUND CORRECTION MW-11D
11/1/96 8:50 AM	0.683	0.79	#N/A	0.35	0.08		0.00
11/1/96 8:50 AM	0.700	0.80	0.01	0.37	0.10		0.02
11/1/96 8:50 AM	0.717	0.82	0.01	0.37	0.11		0.02
11/1/96 8:50 AM	0.733	0.80	0.01	0.38	0.11		0.02
11/1/96 8:50 AM	0.750	0.82	0.01	0.39	0.11		0.02
11/1/96 8:50 AM	0.767	0.82	0.00	0.39	0.11		0.02
11/1/96 8:50 AM	0.783	0.82	#N/A	0.39	0.10		0.00
11/1/96 8:50 AM	0.800	0.86	0.01	0.41	0.13		0.02
11/1/96 8:50 AM	0.817	0.88	0.01	0.41	0.13		0.02
11/1/96 8:50 AM	0.833	0.86	0.02	0.42	0.13		0.02
11/1/96 8:50 AM	0.850	0.86	0.01	0.43	0.13		0.02
11/1/96 8:50 AM	0.867	0.86	0.01	0.44	0.13		0.02
11/1/96 8:50 AM	0.883	0.86	0.02	0.44	0.13		0.02
11/1/96 8:50 AM	0.900	0.90	0.00	0.45	0.14		0.02
11/1/96 8:50 AM	0.917	0.90	0.00	0.46	0.14		0.02
11/1/96 8:50 AM	0.933	0.88	0.01	0.46	0.14		0.02
11/1/96 8:50 AM	0.950	0.86	0.00	0.46	0.14		0.02
11/1/96 8:50 AM	0.967	0.88	0.01	0.47	0.14		0.02
11/1/96 8:50 AM	0.983	0.90	0.01	0.48	0.14		0.02
11/1/96 8:50 AM	1.000	0.90	#N/A	0.47	0.13		0.00
11/1/96 8:50 AM	1.200	0.94	#N/A	0.53	0.16		0.00
11/1/96 8:51 AM	1.400	1.04	#N/A	0.61	0.21		0.02
11/1/96 8:51 AM	1.600	1.05	0.03	0.67	0.24		0.02
11/1/96 8:51 AM	1.800	1.15	0.01	0.72	0.26		0.02
11/1/96 8:51 AM	2.000	1.20	0.01	0.77	0.29		0.02
11/1/96 8:51 AM	2.2	1.23	#N/A	0.81	0.30		0.00
11/1/96 8:52 AM	2.4	1.31	0.01	0.87	0.35		0.02
11/1/96 8:52 AM	2.6	1.35	#N/A	0.90	0.35		0.00
11/1/96 8:52 AM	2.8	1.40	0.02	0.97	0.40		0.02
11/1/96 8:52 AM	3.0	1.46	0.02	1.01	0.41		0.02
11/1/96 8:52 AM	3.2	1.53	0.02	1.04	0.45		0.02
11/1/96 8:53 AM	3.4	1.56	0.02	1.09	0.46		0.02
11/1/96 8:53 AM	3.6	1.57	0.00	1.12	0.49		0.02
11/1/96 8:53 AM	3.8	1.62	0.03	1.16	0.51		0.02
11/1/96 8:53 AM	4.0	1.64	0.01	1.18	0.52		0.00
11/1/96 8:53 AM	4.2	1.72	0.03	1.24	0.56		0.02
11/1/96 8:54 AM	4.4	1.75	0.02	1.28	0.57		0.02
11/1/96 8:54 AM	4.6	1.81	0.02	1.31	0.60		0.02
11/1/96 8:54 AM	4.8	1.84	0.01	1.32	0.60		0.00
11/1/96 8:54 AM	5.0	1.84	0.01	1.36	0.64	0.32	0.00
11/1/96 8:54 AM	5.2	1.89	0.01	1.39	0.65		0.00
11/1/96 8:55 AM	5.4	1.90	0.01	1.42	0.67		0.00
11/1/96 8:55 AM	5.6	1.93	0.01	1.44	0.68		0.00
11/1/96 8:55 AM	5.8	1.93	0.02	1.47	0.70		0.00
11/1/96 8:55 AM	6.0	1.98	0.03	1.51	0.75		0.02
11/1/96 8:55 AM	6.2	1.97	0.02	1.53	0.75		0.00
11/1/96 8:56 AM	6.4	2.03	0.02	1.54	0.76		0.00
11/1/96 8:56 AM	6.6	2.06	0.03	1.58	0.79		0.02
11/1/96 8:56 AM	6.8	2.09	0.01	1.59	0.79		0.00
11/1/96 8:56 AM	7.0	2.09	0.02	1.61	0.81		0.00
11/1/96 8:56 AM	7.2	2.11	0.02	1.63	0.83		0.00
11/1/96 8:57 AM	7.4	2.12	0.01	1.66	0.83		0.00
11/1/96 8:57 AM	7.6	2.16	0.04	1.69	0.86		0.02
11/1/96 8:57 AM	7.8	2.19	0.01	1.70	0.86		0.00
11/1/96 8:57 AM	8.0	2.22	0.03	1.72	0.87		0.00
11/1/96 8:57 AM	8.2	2.20	0.02	1.74	0.89		0.00
11/1/96 8:58 AM	8.4	2.25	0.03	1.76	0.91		0.00
11/1/96 8:58 AM	8.6	2.27	#N/A	1.80	0.94		0.02
11/1/96 8:58 AM	8.8	2.30	0.05	1.81	0.95		0.02
11/1/96 8:58 AM	9.0	2.34	0.03	1.82	0.95		0.00
11/1/96 8:58 AM	9.2	2.31	0.03	1.84	0.97		0.00

TABLE I-7a

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Constant-Rate Pumping Test

Time	Elapsed Time (MINUTES)	CORRECTED DRAWDOWN (FEET) PW 1	OW 1-1	OW 1-2	MW-9D	MW-9S	BACKGROUND CORRECTION MW-11D
11/1/96 8:59 AM	9.4	2.34	0.05	1.86	0.98		0.00
11/1/96 8:59 AM	9.6	2.33	0.03	1.87	0.98		0.00
11/1/96 8:59 AM	9.8	2.33	0.03	1.88	1.00		0.00
11/1/96 8:59 AM	10.0	2.33	0.03	1.88	1.00		0.00
11/1/96 9:01 AM	12.0	2.38	0.06	1.99	1.10	0.72	0.02
11/1/96 9:03 AM	14.0	2.60	0.06	2.08	1.16		0.00
11/1/96 9:05 AM	16.0	2.80	0.06	2.26	1.26		0.00
11/1/96 9:07 AM	18.0	3.00	0.08	2.41	1.35		0.00
11/1/96 9:09 AM	20.0	3.13	0.10	2.54	1.45	1.02	0.00
11/1/96 9:11 AM	22.0	3.24	0.10	2.66	1.51		0.00
11/1/96 9:13 AM	24.0	3.37	0.11	2.76	1.57		0.00
11/1/96 9:15 AM	26.0	3.48	0.13	2.85	1.65		0.00
11/1/96 9:17 AM	28.0	3.54	0.13	2.94	1.70	1.30	0.00
11/1/96 9:19 AM	30.0	3.70	0.14	3.01	1.75		0.00
11/1/96 9:21 AM	32.0	3.73	0.15	3.08	1.79		0.00
11/1/96 9:23 AM	34.0	3.82	0.18	3.17	1.86		0.02
11/1/96 9:25 AM	36.0	3.90	0.20	3.21	1.89	1.50	0.00
11/1/96 9:27 AM	38.0	3.93	0.20	3.27	1.94		0.00
11/1/96 9:29 AM	40.0	4.04	0.20	3.33	1.99		0.00
11/1/96 9:31 AM	42.0	4.14	0.20	3.42	2.03		0.00
11/1/96 9:33 AM	44.0	4.23	0.22	3.48	2.06	1.67	0.00
11/1/96 9:35 AM	46.0	4.33	0.24	3.55	2.13		0.02
11/1/96 9:37 AM	48.0	4.34	0.26	3.59	2.14		0.00
11/1/96 9:39 AM	50.0	4.44	0.25	3.64	2.18		0.00
11/1/96 9:41 AM	52.0	4.45	0.26	3.69	2.21	1.84	0.00
11/1/96 9:43 AM	54.0	4.51	0.28	3.74	2.26		0.00
11/1/96 9:45 AM	56.0	4.55	0.29	3.77	2.27		0.00
11/1/96 9:47 AM	58.0	4.61	0.29	3.81	2.29		0.00
11/1/96 9:49 AM	60.0	4.62	0.29	3.84	2.32		0.00
11/1/96 9:51 AM	62.0	4.92	0.32	3.96	2.37		0.00
11/1/96 9:53 AM	64.0	5.05	0.31	4.14	2.46		0.00
11/1/96 9:55 AM	66.0	5.03	0.36	4.16	2.51		0.02
11/1/96 9:57 AM	68.0	5.02	0.35	4.15	2.51		0.00
11/1/96 9:59 AM	70.0	4.97	0.36	4.16	2.53		0.00
11/1/96 10:01 AM	72.0	4.94	0.37	4.15	2.54		0.00
11/1/96 10:03 AM	74.0	4.95	0.39	4.16	2.54		0.02
11/1/96 10:05 AM	76.0	4.92	0.36	4.14	2.54	2.20	0.00
11/1/96 10:07 AM	78.0	4.92	0.37	4.14	2.56		0.00
11/1/96 10:09 AM	80.0	4.95	0.40	4.17	2.56		0.02
11/1/96 10:11 AM	82.0	4.97	0.39	4.15	2.56		0.00
11/1/96 10:13 AM	84.0	4.95	0.40	4.17	2.57	2.24	0.00
11/1/96 10:15 AM	86.0	4.97	0.41	4.18	2.59		0.00
11/1/96 10:17 AM	88.0	4.95	0.41	4.18	2.59		0.00
11/1/96 10:19 AM	90.0	4.95	0.43	4.20	2.60		0.00
11/1/96 10:21 AM	92.0	4.99	0.43	4.20	2.60		0.00
11/1/96 10:23 AM	94.0	4.99	0.42	4.21	2.62		0.00
11/1/96 10:25 AM	96.0	4.99	0.43	4.22	2.64		0.00
11/1/96 10:27 AM	98.0	5.03	0.43	4.23	2.64		0.00
11/1/96 10:29 AM	100.0	5.02	0.44	4.25	2.65	2.33	0.00
11/1/96 10:49 AM	120.0	5.11	0.50	4.34	2.73		0.00
11/1/96 11:09 AM	140.0	5.19	0.52	4.41	2.80		0.00
11/1/96 11:29 AM	160.0	5.24	0.55	4.49	2.86	2.54	0.00
11/1/96 11:49 AM	180.0	5.32	0.59	4.54	2.92		0.00
11/1/96 12:09 PM	200.0	5.39	0.63	4.60	2.97		0.02
11/1/96 12:29 PM	220.0	5.46	0.63	4.64	3.00	2.70	0.00
11/1/96 12:49 PM	240.0	5.47	0.66	4.67	3.03		0.00
11/1/96 1:09 PM	260.0	5.50	0.68	4.71	3.06		0.00
11/1/96 1:29 PM	280.0	5.50	0.69	4.73	3.10	2.82	0.00
11/1/96 1:49 PM	300.0	5.55	0.71	4.75	3.13		0.00
11/1/96 2:09 PM	320.0	5.49	0.73	4.75	3.14	2.87	0.00
11/1/96 2:29 PM	340.0	5.47	0.73	4.73	3.13		0.00

TABLE I-7a

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Constant-Rate Pumping Test

Time	Elapsed Time (MINUTES)	CORRECTED DRAWDOWN (FEET)					BACKGROUND CORRECTION
		PW 1	OW 1-1	OW 1-2	MW-9D	MW-9S	MW-11D
11/1/96 2:49 PM	360.0	5.49	0.75	4.74	3.14		0.00
11/1/96 3:09 PM	380.0	5.52	0.77	4.76	3.18	2.90	0.00
11/1/96 3:29 PM	400.0	5.58	0.78	4.80	3.21		0.00
11/1/96 3:49 PM	420.0	5.58	0.79	4.82	3.22		0.00
11/1/96 4:09 PM	440.0	5.58	0.80	4.83	3.24	2.97	0.00
11/1/96 4:29 PM	460.0	5.61	0.81	4.85	3.26		0.00
11/1/96 4:49 PM	480.0	5.68	0.82	4.88	3.29	3.00	0.00
11/1/96 5:09 PM	500.0	5.66	0.84	4.88	3.29		0.00
11/1/96 5:29 PM	520.0	5.65	0.84	4.89	3.30		0.00
11/1/96 5:49 PM	540.0	5.62	0.83	4.88	3.29		-0.02
11/1/96 6:09 PM	560.0	5.63	0.86	4.90	3.32	3.04	0.00
11/1/96 6:29 PM	580.0	5.69	0.87	4.92	3.33		0.00
11/1/96 6:49 PM	600.0	5.72	0.88	4.96	3.37		0.00
11/1/96 7:09 PM	620.0	5.74	0.88	4.98	3.38	3.10	0.00
11/1/96 7:29 PM	640.0	5.74	0.89	4.99	3.40		0.00
11/1/96 7:49 PM	660.0	5.77	0.90	5.02	3.41		0.00
11/1/96 8:09 PM	680.0	5.79	0.91	5.03	3.43		0.00
11/1/96 8:29 PM	700.0	5.77	0.92	5.04	3.43		0.00
11/1/96 8:49 PM	720.0	5.80	0.92	5.04	3.45	3.14	0.00
11/1/96 9:09 PM	740.0	5.82	0.95	5.06	3.48		0.02
11/1/96 9:29 PM	760.0	5.82	0.94	5.06	3.46		0.00
11/1/96 9:49 PM	780.0	5.85	0.95	5.08	3.48	3.18	0.00
11/1/96 10:09 PM	800.0	5.85	0.94	5.08	3.48		-0.02
11/1/96 10:29 PM	820.0	5.85	0.96	5.10	3.49		0.00
11/1/96 10:49 PM	840.0	5.84	0.94	5.08	3.48	3.22	-0.02
11/1/96 11:09 PM	860.0	5.80	0.96	5.07	3.49		0.00
11/1/96 11:29 PM	880.0	5.79	0.97	5.05	3.48		0.00
11/1/96 11:49 PM	900.0	5.85	0.97	5.09	3.51		0.00
11/2/96 12:09 AM	920.0	5.85	0.98	5.12	3.53		0.00
11/2/96 12:29 AM	940.0	5.90	0.98	5.15	3.54		0.00
11/2/96 12:49 AM	960.0	5.93	1.00	5.14	3.56		0.00
11/2/96 1:09 AM	980.0	5.85	0.99	5.10	3.53		0.00
11/2/96 1:29 AM	1000.0	5.85	1.00	5.11	3.53		0.00
11/2/96 4:49 AM	1200.0	5.99	1.05	5.21	3.62		0.00
11/2/96 8:09 AM	1400.0	6.15	1.12	5.37	3.73	3.43	0.00
11/2/96 11:29 AM	1600.0	6.20	1.16	5.43	3.81		0.00
11/2/96 2:49 PM	1800.0	6.21	1.18	5.46	3.84	3.63	0.00
11/2/96 6:09 PM	2000.0	6.20	1.19	5.43	3.81		-0.02
11/2/96 9:29 PM	2200.0	6.29	1.23	5.53	3.89	3.69	0.00
11/3/96 12:49 AM	2400.0	6.28	1.25	5.52	3.89		0.00
11/3/96 4:09 AM	2600.0	6.32	1.25	5.54	3.91	3.70	0.00
11/3/96 7:29 AM	2800.0	6.31	1.27	5.55	3.92	3.79	0.00

TABLE I-7b

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Recovery Test

	CORRECTED DRAWDOWN (FEET)					BACKGROUND CORRECTION
Elapsed Time (MINUTES)	PW 1	OW 1-1	OW 1-2	MW-9D	MW-9S	MW-11D
#N/A	#N/A	#N/A	#N/A	#N/A		0.00
#N/A	#N/A	0.02	0.02	0.02		0.02
#N/A	#N/A	0.02	0.02	0.02		0.02
#N/A	0.11	0.02	0.02	0.02		0.02
#N/A	0.03	0.02	0.02	0.02		0.02
#N/A	0.05	0.02	0.02	0.02		0.02
#N/A	0.06	0.02	0.02	0.02		0.02
#N/A	0.08	#N/A	#N/A	#N/A		0.00
#N/A	0.09	0.02	0.02	0.02		0.02
#N/A	0.13	0.02	0.02	0.02		0.02
#N/A	0.16	0.01	0.02	0.02		0.02
#N/A	0.16	0.02	0.02	0.02		0.02
#N/A	0.17	0.02	0.02	0.02		0.02
#N/A	0.42	0.02	0.02	0.02		0.02
#N/A	0.28	0.02	0.02	0.02		0.02
#N/A	0.20	0.02	0.02	0.02		0.02
#N/A	0.27	0.02	0.02	0.02		0.02
#N/A	0.30	0.02	0.02	0.02		0.02
#N/A	0.33	0.01	0.02	0.02		0.02
#N/A	0.31	0.01	0.01	#N/A		0.00
#N/A	0.39	0.02	0.02	0.02		0.02
#N/A	0.41	0.01	0.01	#N/A		0.00
#N/A	0.42	0.02	0.03	0.02		0.02
#N/A	0.47	0.02	0.03	0.02		0.02
#N/A	0.50	0.01	0.03	0.02		0.02
#N/A	0.49	0.02	0.04	0.02		0.02
#N/A	0.53	0.02	0.04	0.02		0.02
#N/A	0.57	0.02	0.04	0.02		0.02
#N/A	0.58	0.02	0.04	0.02		0.02
#N/A	0.60	0.02	0.04	0.02		0.02
#N/A	0.61	0.02	0.04	0.02		0.02
#N/A	0.64	0.02	0.04	0.02		0.02
#N/A	0.66	0.02	0.05	0.02		0.02
#N/A	0.68	0.02	0.05	0.02		0.02
#N/A	0.69	0.02	0.05	0.02		0.02
#N/A	0.69	0.02	0.05	0.02		0.02
#N/A	0.72	0.02	0.06	0.02		0.02
#N/A	0.60	#N/A	0.04	#N/A		0.00
#N/A	0.93	0.02	0.06	0.02		0.02
#N/A	0.74	0.02	0.07	0.02		0.02
#N/A	0.52	0.02	0.07	0.02		0.02
#N/A	0.83	0.02	0.08	0.03		0.02
#N/A	0.90	0.02	0.08	0.02		0.02
#N/A	1.04	0.02	0.09	0.02		0.02
#N/A	0.75	0.01	0.09	0.03		0.02
#N/A	1.48	0.02	0.10	0.03		0.02
#N/A	0.49	#N/A	0.09	0.02		0.00
#N/A	0.77	0.01	0.10	0.03		0.02
#N/A	0.50	0.02	0.10	0.03		0.02
#N/A	0.97	0.06	0.11	0.03		0.02
#N/A	0.50	0.05	0.12	0.03		0.02
#N/A	0.68	0.02	0.12	0.03		0.02
#N/A	0.83	#N/A	0.12	0.03		0.02
#N/A	0.69	0.02	0.13	0.03		0.02
#N/A	1.07	0.02	0.13	0.03		0.02
#N/A	0.83	0.01	0.14	0.03		0.02
#N/A	0.61	0.01	0.14	0.03		0.02
#N/A	0.06	0.02	0.14	0.05		0.02
#N/A	0.50	#N/A	0.13	0.02		0.00

TABLE I-7b

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Recovery Test

Elapsed Time (MINUTES)	CORRECTED DRAWDOWN (FEET) PW 1	OW 1-1	OW 1-2	MW-9D	MW-9S	BACKGROUND CORRECTION MW-11D
#N/A	0.38	0.02	0.15	0.05		0.02
#N/A	0.60	0.01	0.15	0.05		0.02
#N/A	0.57	#N/A	0.14	0.03		0.00
#N/A	0.66	0.02	0.15	0.05		0.02
#N/A	0.71	0.03	0.15	0.05		0.02
#N/A	0.50	0.02	0.16	0.05		0.02
#N/A	0.52	0.02	0.16	0.05		0.02
#N/A	0.38	0.01	0.16	0.05		0.02
#N/A	0.39	#N/A	0.15	0.03		0.00
#N/A	0.31	0.02	0.17	0.05		0.02
#N/A	#N/A	0.02	0.17	0.05		0.02
#N/A	0.20	0.02	0.17	0.05		0.02
#N/A	0.28	0.02	0.17	0.05		0.02
#N/A	0.27	#N/A	0.17	0.05		0.02
#N/A	0.31	0.02	0.16	0.05		0.02
#N/A	0.25	0.02	0.16	0.05		0.02
0.017	#N/A	0.01	0.16	0.05		0.02
0.033	#N/A	0.02	0.16	0.05		0.02
0.050	#N/A	0.02	0.16	0.05		0.02
0.067	0.03	0.01	0.15	0.05		0.02
0.083	0.08	0.02	0.15	0.05		0.02
0.100	0.09	#N/A	0.13	0.03		0.00
0.300	0.41	#N/A	0.14	0.05		0.00
0.500	0.58	0.02	0.17	0.06		0.02
0.700	0.74	0.02	0.21	0.08		0.02
0.900	0.85	0.00	0.26	0.08		0.02
1.100	0.94	0.02	0.31	0.10		0.02
1.300	1.02	0.01	0.35	0.10		0.00
1.500	1.13	0.02	0.41	0.13		0.02
1.700	1.18	0.01	0.44	0.14		0.00
1.900	1.27	0.03	0.51	0.17		0.02
2.100	1.35	0.02	0.56	0.19		0.02
2.300	1.42	0.01	0.61	0.21		0.02
2.500	1.48	0.01	0.65	0.24		0.02
2.700	1.54	0.00	0.70	0.25		0.02
2.900	1.59	0.00	0.75	0.29		0.02
3.100	1.64	#N/A	0.78	0.29		0.00
3.300	1.70	0.03	0.84	0.33		0.02
3.500	1.76	0.02	0.88	0.35		0.02
3.700	1.81	0.01	0.92	0.38		0.02
3.900	1.84	0.01	0.95	0.38		0.00
4.100	1.87	0.01	0.98	0.40	0.32	0.00
4.300	1.92	#N/A	1.02	0.43		0.00
4.500	1.97	#N/A	1.06	0.45		0.00
4.700	2.01	0.02	1.10	0.46		0.00
4.900	2.04	#N/A	1.13	0.48		0.00
5.100	2.11	0.03	1.18	0.52		0.02
5.300	2.12	#N/A	1.20	0.52		0.00
5.500	2.15	0.02	1.24	0.54		0.00
5.700	2.22	0.04	1.28	0.57		0.02
5.900	2.23	0.01	1.30	0.59		0.00
6.100	2.26	0.03	1.33	0.60		0.00
6.300	2.30	0.05	1.36	0.62		0.00
6.500	2.33	0.01	1.39	0.65		0.00
6.700	2.37	0.02	1.43	0.68		0.02
6.900	2.39	0.03	1.44	0.68		0.00
7.100	2.42	#N/A	1.47	0.70		0.00
7.300	2.45	0.02	1.49	0.71		0.00
7.500	2.49	0.01	1.51	0.73		0.00

TABLE I-7b

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Recovery Test

Elapsed Time (MINUTES)	CORRECTED DRAWDOWN (FEET) PW 1	OW 1-1	OW 1-2	MW-9D	MW-9S	BACKGROUND CORRECTION MW-11D
7.700	2.52	0.03	1.56	0.76		0.02
7.900	2.55	0.04	1.59	0.78		0.02
8.100	2.56	0.02	1.59	0.78		0.00
8.300	2.58	0.01	1.62	0.79		0.00
8.500	2.61	0.02	1.64	0.81		0.00
8.700	2.64	0.03	1.67	0.84		0.00
8.900	2.66	0.03	1.69	0.84		0.00
9.100	2.69	0.01	1.71	0.86		0.00
11.100	2.93	0.07	1.94	1.00	0.72	0.02
13.100	3.10	0.05	2.10	1.11		0.00
15.100	3.27	0.06	2.26	1.22		0.00
17.100	3.43	0.09	2.39	1.30		0.00
19.100	3.55	0.09	2.52	1.40	1.02	0.00
21.100	3.68	0.12	2.64	1.46		0.00
23.100	3.81	0.13	2.74	1.54		0.00
25.100	3.90	0.15	2.84	1.60		0.00
27.100	3.99	0.15	2.92	1.67	1.30	0.00
29.100	4.07	0.17	3.01	1.72		0.00
31.100	4.15	0.18	3.08	1.76		0.00
33.100	4.25	0.20	3.16	1.83		0.02
35.100	4.29	0.20	3.21	1.86	1.50	0.00
37.100	4.36	0.21	3.27	1.89		0.00
39.100	4.42	0.22	3.32	1.94		0.00
41.100	4.48	0.24	3.38	1.97		0.00
43.100	4.53	0.24	3.42	2.00	1.67	0.00
45.100	4.59	0.26	3.48	2.05		0.02
47.100	4.62	0.27	3.51	2.06		0.00
49.100	4.66	0.27	3.55	2.10		0.00
51.100	4.70	0.28	3.59	2.11	1.84	0.00
53.100	4.75	0.29	3.63	2.14		0.00
55.100	4.78	0.30	3.66	2.16		0.00
57.100	4.81	0.31	3.70	2.19		0.00
59.100	4.84	0.33	3.73	2.22		0.00
61.100	4.88	0.33	3.76	2.22		0.00
63.100	4.91	0.33	3.79	2.26		0.00
65.100	4.95	0.35	3.83	2.29		0.02
67.100	4.95	0.34	3.84	2.29		0.00
69.100	4.99	0.35	3.86	2.30		0.00
71.100	5.02	0.36	3.88	2.32		0.00
73.100	5.05	0.39	3.92	2.37		0.02
75.100	5.06	0.38	3.93	2.35	2.20	0.00
77.100	5.08	0.38	3.96	2.37		0.00
79.100	5.13	0.41	3.99	2.40		0.02
81.100	5.13	0.40	4.00	2.41		0.00
83.100	5.14	0.40	4.01	2.41	2.24	0.00
85.100	5.17	0.41	4.03	2.43		0.00
87.100	5.19	0.41	4.05	2.45		0.00
89.100	5.21	0.42	4.06	2.46		0.00
91.100	5.22	0.41	4.08	2.46		0.00
93.100	5.24	0.43	4.10	2.48		0.00
95.100	5.24	0.45	4.12	2.49		0.00
97.100	5.27	0.45	4.13	2.51		0.00
99.100	5.28	0.45	4.15	2.51	2.33	0.00
119.100	5.41	0.49	4.27	2.60		0.00
139.100	5.50	0.54	4.35	2.68		0.00
159.100	5.58	0.59	4.44	2.76	2.54	0.00
179.100	5.65	0.61	4.49	2.80		0.00
199.100	5.71	0.65	4.57	2.86		0.02
219.100	5.72	0.65	4.59	2.87	2.70	0.00

TABLE I-7b

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Recovery Test

Elapsed Time (MINUTES)	CORRECTED DRAWDOWN (FEET) PW 1	OW 1-1	OW 1-2	MW-9D	MW-9S	BACKGROUND CORRECTION MW-11D
239.100	5.77	0.68	4.63	2.92		0.00
259.100	5.80	0.70	4.66	2.95		0.00
279.100	5.83	0.73	4.69	2.99	2.82	0.00
299.100	5.85	0.73	4.71	3.00		0.00
319.100	5.88	0.75	4.74	3.03	2.87	0.00
339.100	5.90	0.78	4.76	3.05		0.00
359.100	5.93	0.78	4.78	3.08		0.00
379.100	5.93	0.80	4.80	3.10	2.90	0.00
399.100	5.96	0.80	4.81	3.11		0.00
419.100	5.98	0.82	4.83	3.13		0.00
439.100	5.99	0.83	4.84	3.16	2.97	0.00
459.100	6.01	0.83	4.86	3.18		0.00
479.100	6.01	0.85	4.87	3.18	3.00	0.00
499.100	6.02	0.86	4.88	3.21		0.00
519.100	6.04	0.86	4.89	3.21		0.00
539.100	6.02	0.85	4.89	3.21		-0.02
559.100	6.05	0.88	4.91	3.24	3.04	0.00
579.100	6.05	0.88	4.92	3.24		0.00
599.100	6.07	0.89	4.93	3.24		0.00
619.100	6.07	0.89	4.93	3.26	3.10	0.00
639.100	6.09	0.89	4.94	3.26		0.00
659.100	6.09	0.90	4.95	3.27		0.00
679.100	6.10	0.91	4.95	3.27		0.00
699.100	6.10	0.91	4.96	3.29		0.00
719.100	6.12	0.91	4.97	3.29	3.14	0.00
739.100	6.13	0.94	4.99	3.32		0.02
759.100	6.12	0.92	4.97	3.30		0.00
779.100	6.12	0.93	4.98	3.30	3.18	0.00
799.100	6.12	0.92	4.97	3.30		-0.02
819.100	6.13	0.94	5.00	3.32		0.00
839.100	6.13	0.93	4.98	3.32	3.22	-0.02
859.100	6.15	0.94	5.00	3.33		0.00
879.100	6.15	0.95	5.01	3.33		0.00
899.100	6.15	0.95	5.01	3.35		0.00
919.100	6.16	0.96	5.02	3.35		0.00
939.100	6.16	0.96	5.02	3.35		0.00
959.100	6.16	0.96	5.02	3.37		0.00
979.100	6.18	0.98	5.03	3.37		0.00
999.100	6.16	0.98	5.04	3.37		0.00
1199.100	6.20	1.00	5.06	3.41		0.00
1399.100	6.21	1.01	5.07	3.41	3.43	0.00

TABLE I-8

Richardson Hill Road Landfill
Honeywell, Inc. and Amphenol Corporation
Constant-Rate Pumping Test Results

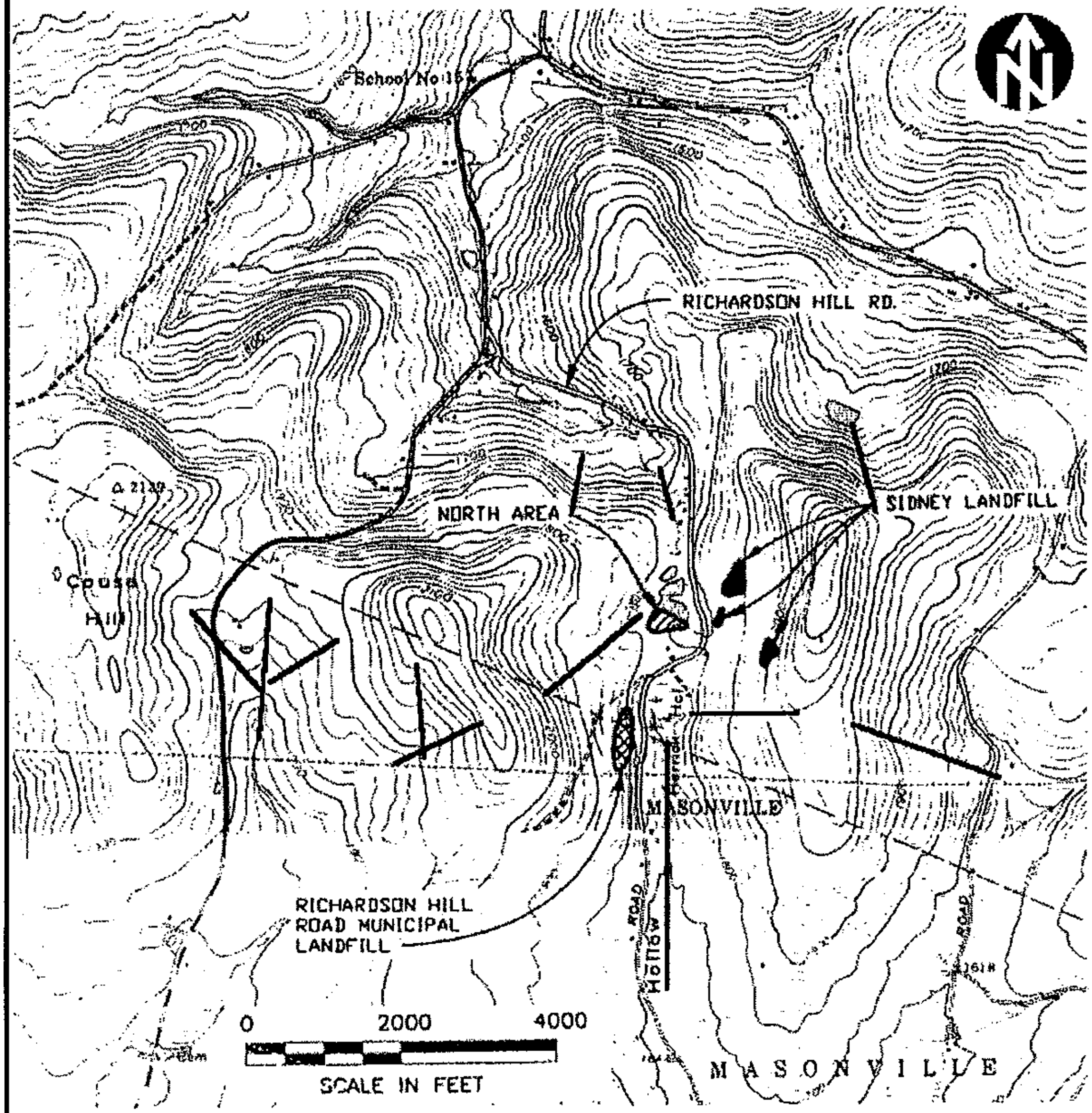
WELL	GEOLOGIC UNIT	SCREEN LENGTH (feet)	SCREEN BOTTOM (feet)	ANALYSIS METHOD	TRANSMISSIVITY (ft^2/day)	STORATIVITY
DRAWDOWN						
O1-1	Bedrock	30	71	Hantush[1]	124	6.E-04
O1-2	Bedrock	30	70.8	Hantush	59	2.E-05
MW-9D	Bedrock	15	67.1	Hantush	55	7.E-05
PW-1	Bedrock	30	71.5	Hantush	59	4.E-02
GEOMETRIC MEAN					**70**	**4.E-04**
Distance-Drawdown	Bedrock			Cooper-Jacob[2]	12	4.E-03
RECOVERY						
O1-1	Bedrock	30	71	Hantush	121	1.E-05
O1-2	Bedrock	30	70.8	Hantush	59	2.E-05
MW-9D	Bedrock	15	67.1	Hantush	59	3.E-04
PW-1	Bedrock	30	71.5	Hantush	47	2.E-02
GEOMETRIC MEAN					**70**	**2.E-04**
Distance-Drawdown	Bedrock			Cooper-Jacob[2]	12	2.E-03

(1) Hantush, M.S. and C.E. Jacob, 1955. "Non-Steady Radial Flow in an Infinite Leaky Aquifer". Transactions, American Geophysical Union. vol. 36, no. 1.

(2) Cooper, H.H. and C.E. Jacob. 1945. "A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Well-Field History". Transactions. American Geophysical Union. vol. 27, no. 4. pp. 526-534.

TABLE I-9
RIVER NODE SUMMARY

REACH	K_V (ft/day)	STREAM DEPTH (ft)	STREAM BED THICKNESS (ft)
NORTH POND	100	2-3	1-1.5
CARR'S CREEK	100	0.5-1	0.5-1
SOUTH POND	100	2-3	1-1.5
HERRICK HOLLOW CREEK	100	0.5-1	0.5-1



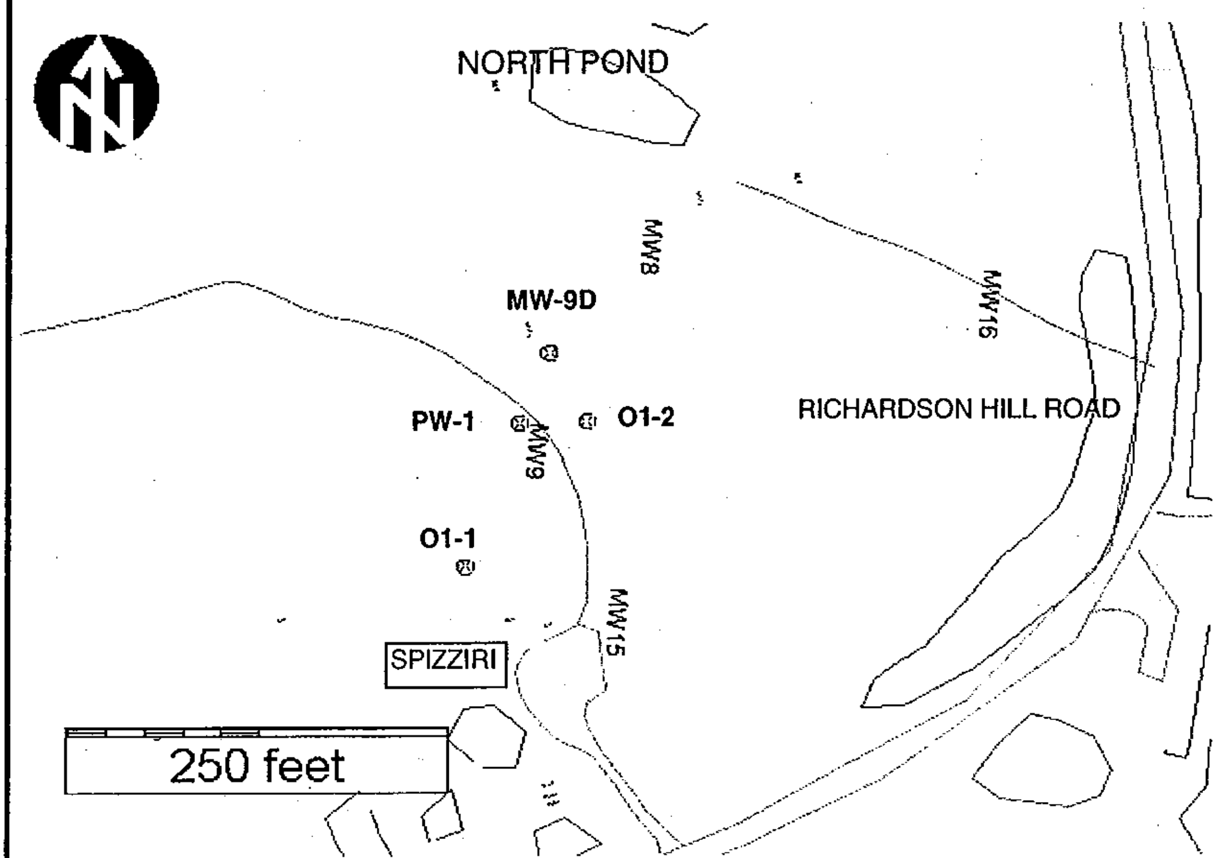
KEY

Lineament

Base map from O'Brien & Gere, 1995
Adapted from the USGS Trout Creek NY, Walton West NY, Unadilla NY and Franklin NY 7-1/2 minute quadrangles.

Richardson Hill Road

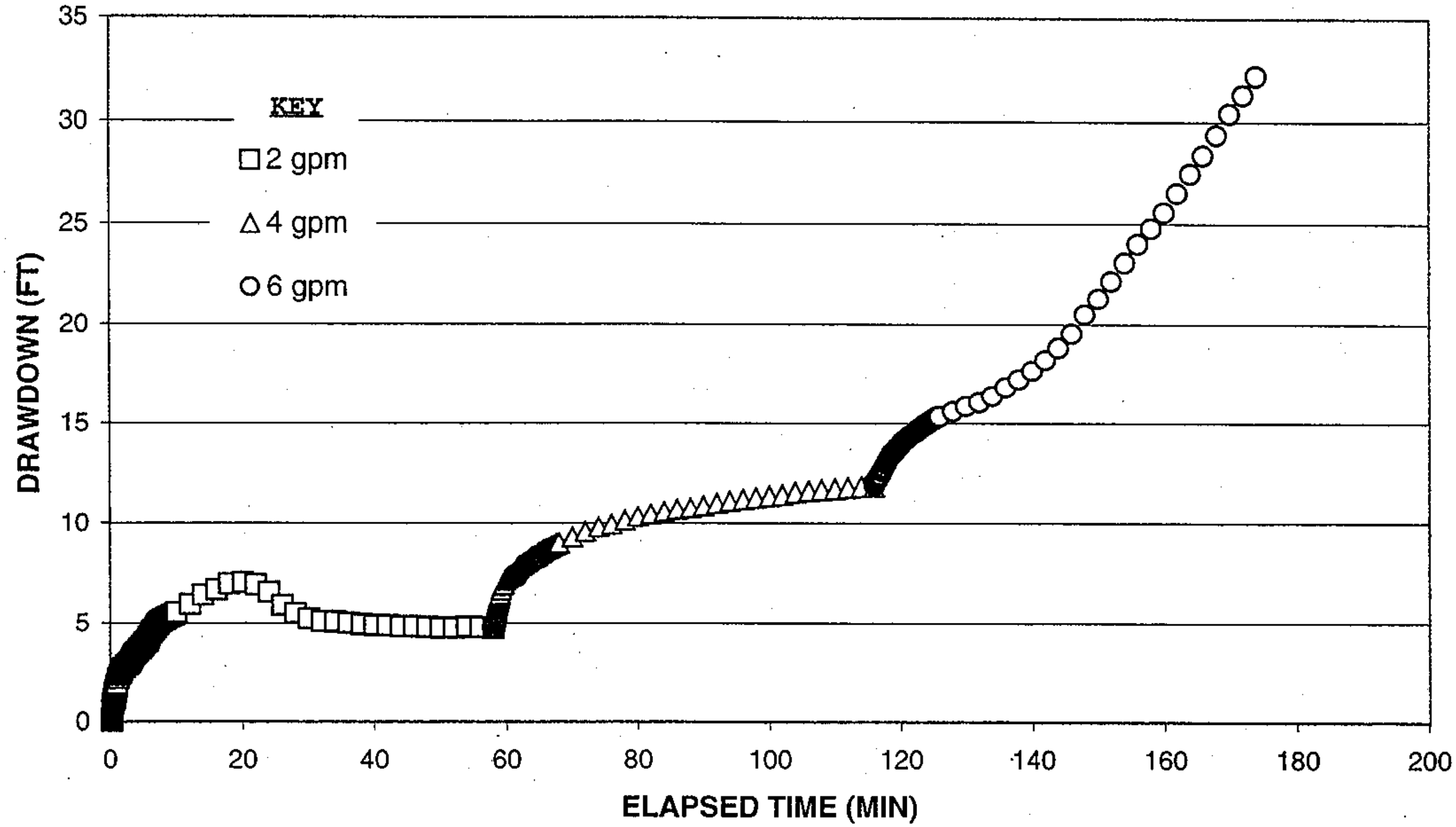
PARSONS ENGINEERING SCIENCE, INC. DESIGN · RESEARCH · PLANNING 290 ELWOOD DAVIS ROAD SUITE 312 LIVERPOOL, NY 13088 (315) 451-9560 · OFFICES IN PRINCIPAL CITIES	FIGURE I-1 Topographic Map Lineaments



Richardson Hill Road

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING
290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560
OFFICES IN PRINCIPAL CITIES

FIGURE I-2
PW-1 PUMPING TEST
WELL LOCATIONS



Richardson Hill Road Landfill

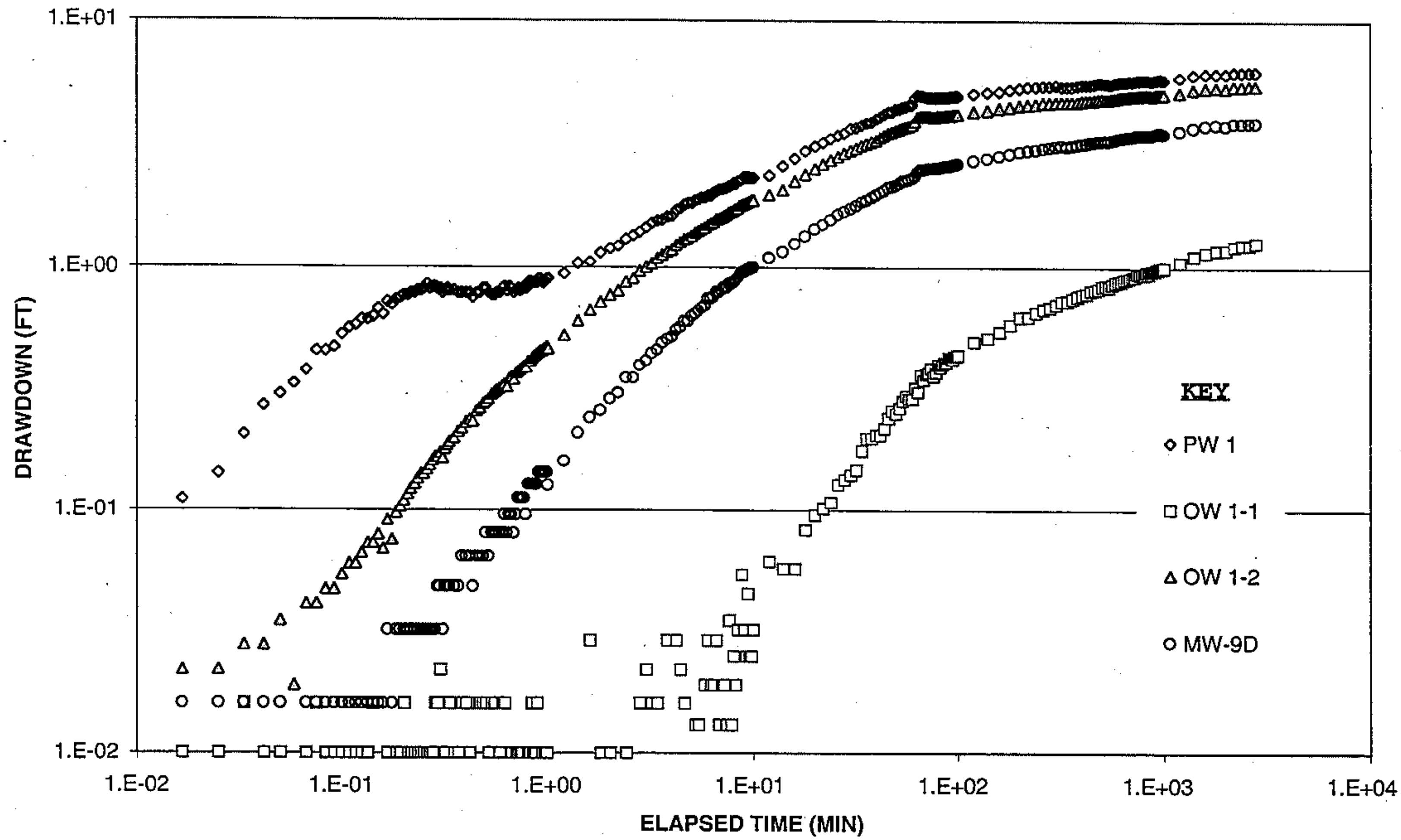
PARSONS ENGINEERING SCIENCE, INC.

DESIGN • RESEARCH • PLANNING

290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560

OFFICES IN PRINCIPAL CITIES

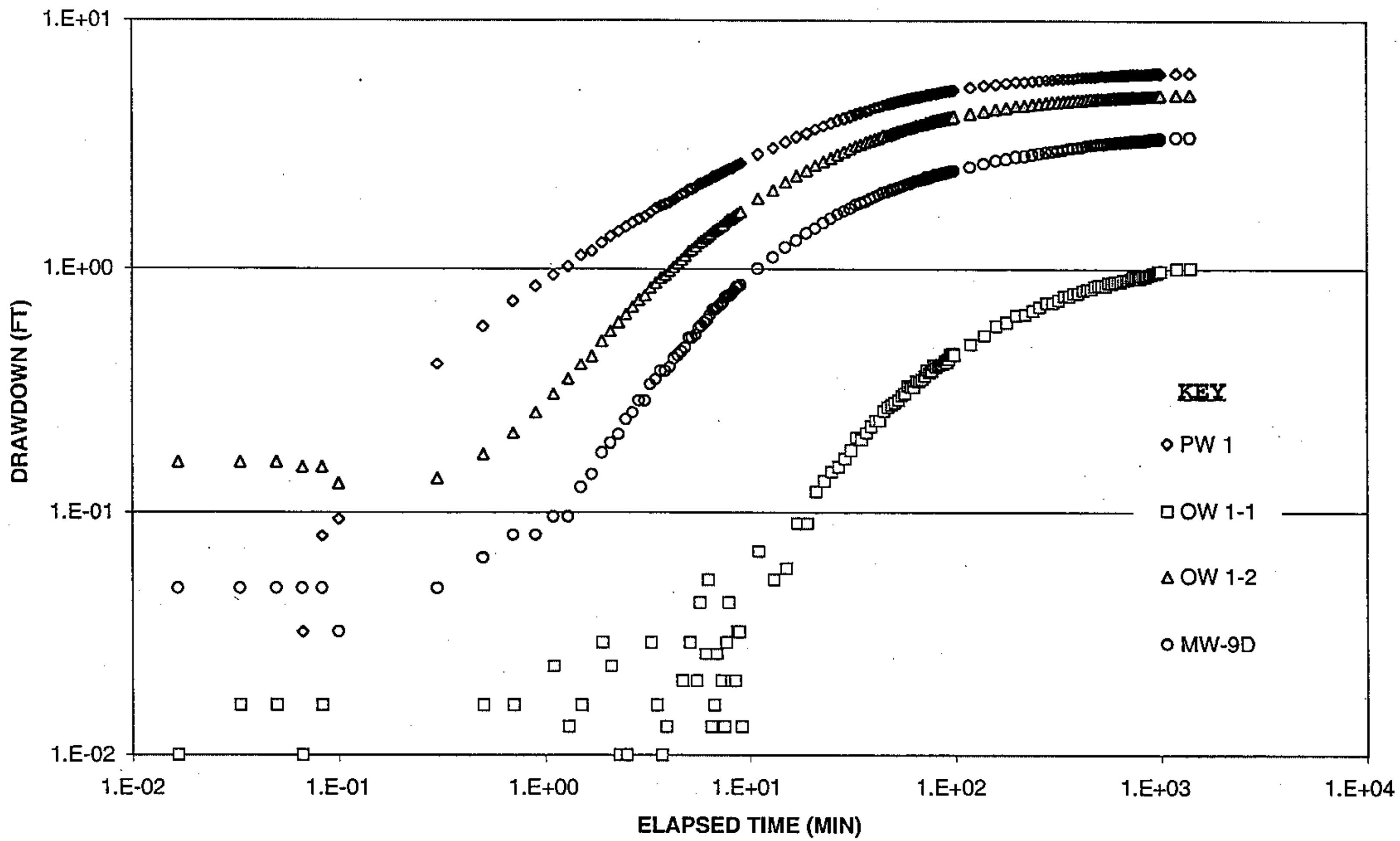
FIGURE I-3
STEP-DRAWDOWN TEST



Richardson Hill Road Landfill

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING
290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560
OFFICES IN PRINCIPAL CITIES

FIGURE I-4a
CONSTANT-RATE PUMPING TEST



Richardson Hill Road Landfill

PARSONS ENGINEERING SCIENCE, INC.

DESIGN • RESEARCH • PLANNING

290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560

OFFICES IN PRINCIPAL CITIES

FIGURE I-4b
CONSTANT-RATE RECOVERY TEST

CALCULATIONS[1]

$$T = \frac{Q}{4\pi s} Wu, r/B$$

$= \frac{0.30\ ft^3/min \times 0.50}{12.56637 \times 0.29\ feet}$

$= 4.07E\text{-}02\ ft^2/min$

$$S = \frac{4\ u\ T\ t}{r^2}$$

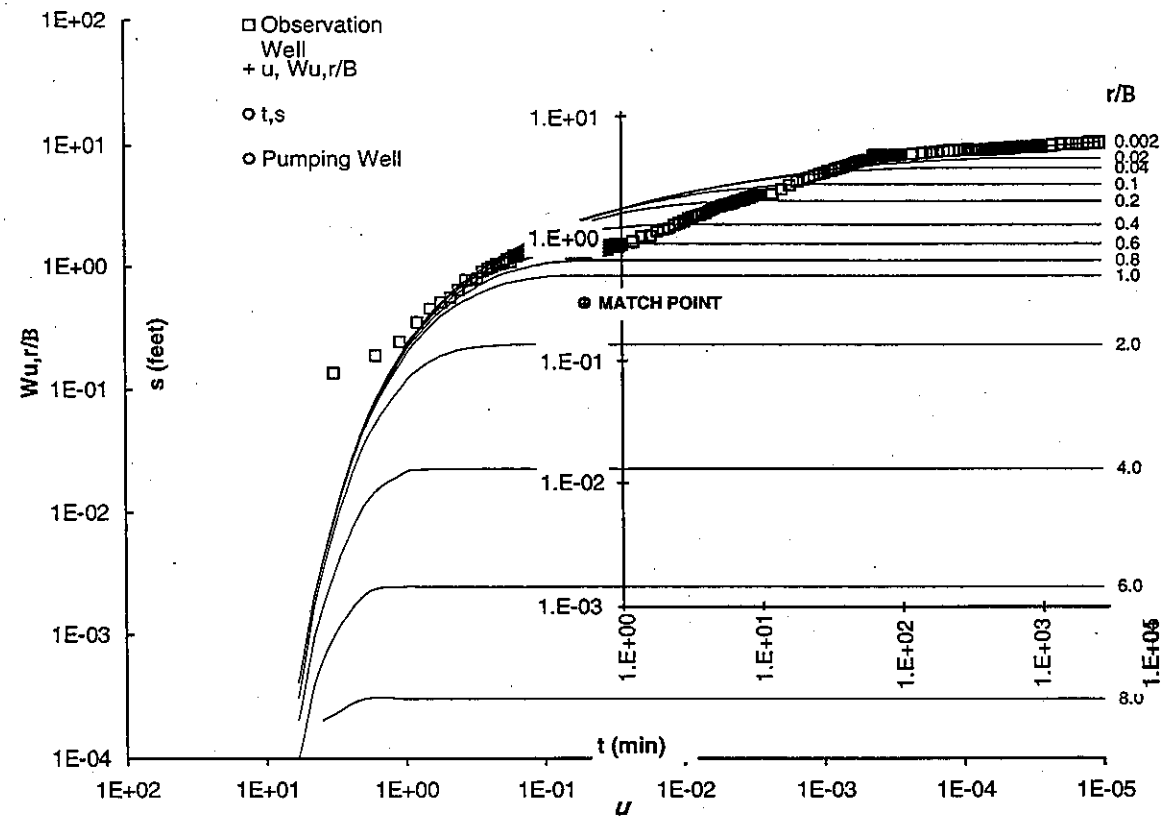
$= (4 \times 0.05 \times 4.07E\text{-}02\ ft2/min \times 0.54\ min) / (0.33\ feet)^2$

$= 4.04E\text{-}02$

$$K' = \frac{Sb'(r/B)^2 / u}{t}$$

$= (4.04E\text{-}02 \times 60\ feet \times 0.002^2 / 0.05) / 0.54\ min$

$= 3.59E\text{-}04\ ft/min$



(1) Hantush, M.S. and C.E. Jacob, 1955. "Non-Steady Radial Flow in an Infinite Leaky Aquifer". Transactions, American Geophysical Union. vol. 36, no. 1.

RICHARDSON HILL ROAD

MATCH POINT					PUMPING AND AQUIFER DATA				AQUIFER CONSTANTS				
u	Wu,r/B	s (feet)	t (minutes)	r/B	Q (gpm)	Q (ft^3/min)	r (feet)	b' (feet)	T (ft^2/min)	T (ft^2/day)	S	K' (ft/min)	K' (ft/day)
0.05	0.50	0.29	0.54	0.002	2.25	0.30	0.33	60	4.07E-02	59	4.04E-02	3.59E-04	5.17E-01

PARSONS ENGINEERING SCIENCE, INC.

DESIGN • RESEARCH • PLANNING

290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560

OFFICES IN PRINCIPAL CITIES

FIGURE I-5a
PW-1 CONSTANT-RATE PUMPING TEST
PUMPING WELL PW-1

CALCULATIONS[1]

$$T = \frac{Q}{4\pi s} Wu, r/B$$

$= \dfrac{0.30\ ft^3/min \times 0.50}{12.56637 \times 0.14\ feet}$

$= 8.62E\text{-}02\ ft^2/min$

$$S = \frac{4\ u\ T\ t}{r^2}$$

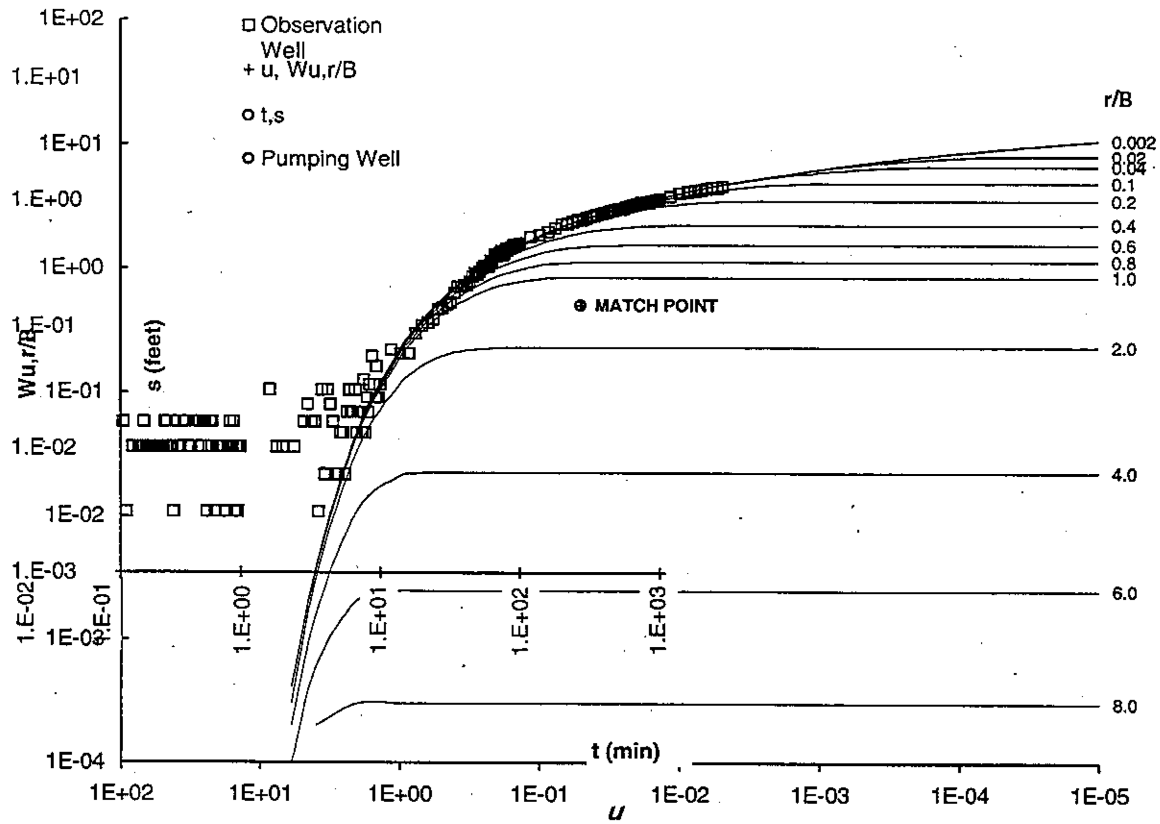
$= (4 \times 0.05 \times 8.62E\text{-}02\ ft2/min \times 274\ min) / (89.00\ feet)^2$

$= 5.96E\text{-}04$

$$K' = \frac{Sb'(r/B)^2/u}{t}$$

$= (5.96E\text{-}04 \times 60\ feet \times 0.002^2 / 0.05) / 274\ min$

$= 1.04E\text{-}08\ ft/min$



(1) Hantush, M.S. and C.E. Jacob, 1955. "Non-Steady Radial Flow in an Infinite Leaky Aquifer". Transactions, American Geophysical Union. vol. 36, no. 1.

RICHARDSON HILL ROAD

MATCH POINT					PUMPING AND AQUIFER DATA				AQUIFER CONSTANTS				
u	Wu,r/B	s (feet)	t (minutes)	r/B	Q (gpm)	Q (ft³/min)	r (feet)	b' (feet)	T (ft²/min)	T (ft²/day)	S	K' (ft/min)	K' (ft/day)
0.05	0.50	0.14	274	0.002	2.25	0.30	89	60	8.62E-02	124	5.96E-04	1.04E-08	1.50E-05

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING
290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560
OFFICES IN PRINCIPAL CITIES

FIGURE I-5b
PW-1 CONSANT-RATE PUMPING TEST
OBSERVATION WELL O1-1

CALCULATIONS[1]

$$T = \frac{Q}{4\pi s} Wu,r/B$$

= 0.30 ft³/min X 0.50 / 12.56637 X 0.29 feet

= 4.07E-02 ft²/min

$$S = \frac{4\ u\ T\ t}{r^2}$$

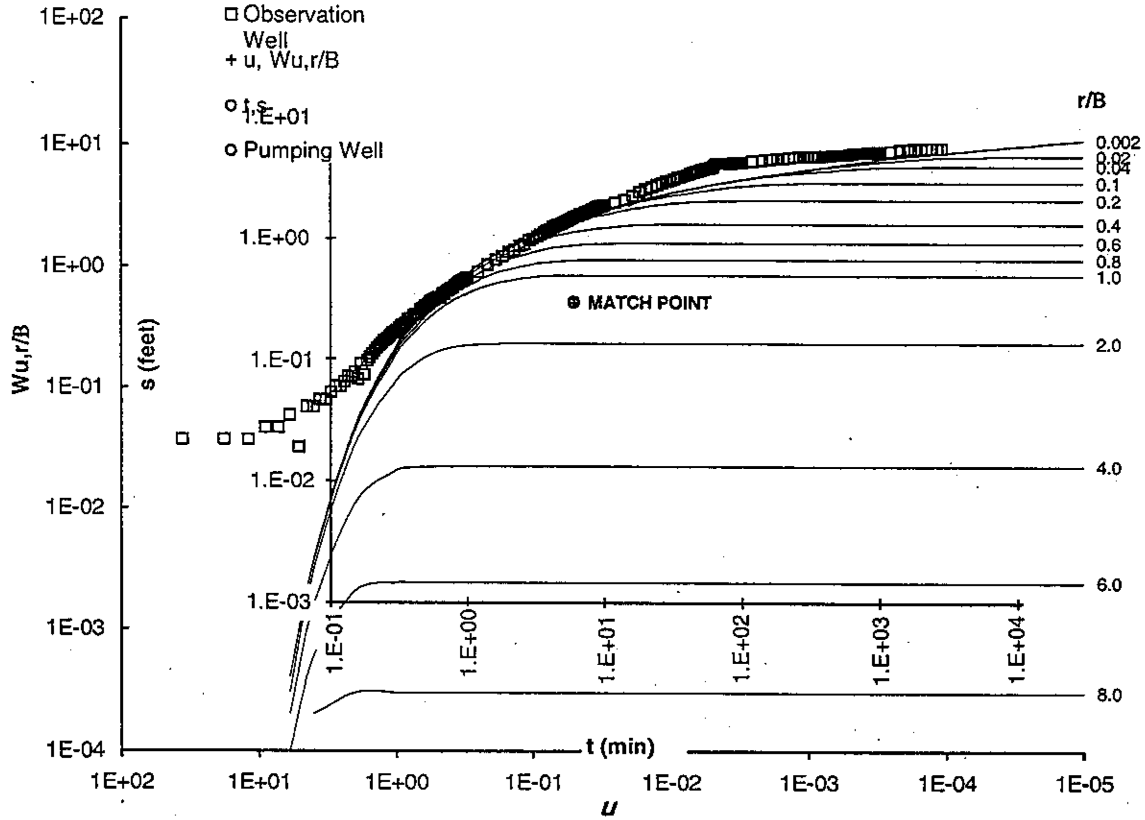
= (4 X 0.05 X 4.07E-02 ft2/min X 6 min) / (44.60 feet)²

= 2.45E-05

$$K' = \frac{Sb'(r/B)^2/u}{t}$$

= (2.45E-05 x 0.002² / 60 feet X 0.05) / 6 min

= 1.96E-08 ft/min



(1) Hantush, M.S. and C.E. Jacob, 1955. "Non-Steady Radial Flow in an Infinite Leaky Aquifer". Transactions, American Geophysical Union. vol. 36, no. 1.

RICHARDSON HILL ROAD

MATCH POINT					PUMPING AND AQUIFER DATA				AQUIFER CONSTANTS				
u	Wu,r/B	s (feet)	t (minutes)	r/B	Q (gpm)	Q (ft³/min)	r (feet)	b' (feet)	T (ft²/min)	T (ft²/day)	S	K' (ft/min)	K' (ft/day)
0.05	0.50	0.29	6	0.002	2.25	0.30	44.6	60	4.07E-02	59	2.45E-05	1.96E-08	2.83E-05

PARSONS ENGINEERING SCIENCE, INC.

DESIGN • RESEARCH • PLANNING

290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560

OFFICES IN PRINCIPAL CITIES

FIGURE I-5c
PW-1 CONSTANT-RATE PUMPING TEST
OBSERVATION WELL O1-2

CALCULATIONS[1]

$$T = \frac{Q}{4\pi s} Wu, r/B$$

$= \dfrac{0.30 \ ft^3/min \ X \qquad 0.50}{12.56637 \quad X \qquad 0.31 \ feet}$

$= 3.83E\text{-}02 \ ft^2/min$

$$S = \frac{4\ u\ T\ t}{r^2}$$

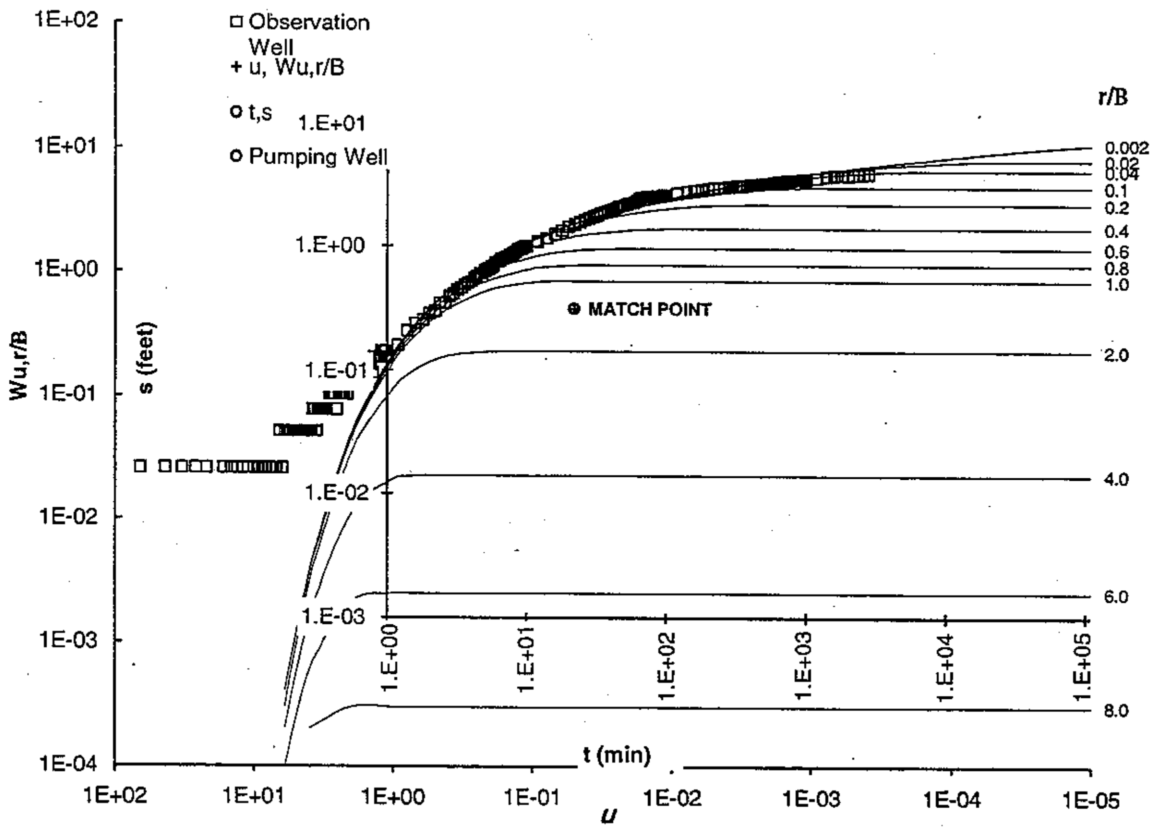
$= (4 \ X \quad 0.05 \times \quad 3.83E\text{-}02 \ ft2/min \ X$
$22 \ min) \ /(\quad 47.80 \ feet)^2$

$= 7.38E\text{-}05$

$$K' = \frac{Sb'(r/B)^2/u}{t}$$

$= (\quad 7.38E\text{-}05 \ x \qquad 60 \ feet \ X$
$0.04^2 \quad / \qquad 0.05 \ ) \ /$
$22 \ min$

$= 6.44E\text{-}06 \ ft/min$



(1) Hantush, M.S. and C.E. Jacob, 1955. "Non-Steady Radial Flow in an Infinite Leaky Aquifer". Transactions, American Geophysical Union. vol. 36, no. 1.

RICHARDSON HILL ROAD

MATCH POINT					PUMPING AND AQUIFER DATA				AQUIFER CONSTANTS				
u	Wu,r/B	s (feet)	t (minutes)	r/B	Q (gpm)	Q (ft^3/min)	r (feet)	b' (feet)	T (ft^2/min)	T (ft^2/day)	S	K' (ft/min)	K' (ft/day)
0.05	0.50	0.31	22	0.04	2.25	0.30	47.8	60	3.83E-02	55	7.38E-05	6.44E-06	9.27E-03

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING
290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560
OFFICES IN PRINCIPAL CITIES

FIGURE I-5d
PW-1 CONSTANT-RATE PUMPING TEST
OBSERVATION WELL MW-9D

CALCULATIONS[1]

$$T = \frac{0.366Q}{\Delta s}$$

$= \frac{0.366 \times 0.30 \text{ ft}^3/\text{min}}{13.60 \text{ feet}}$

$= 8.09E\text{-}03 \text{ ft}^2/\text{min}$

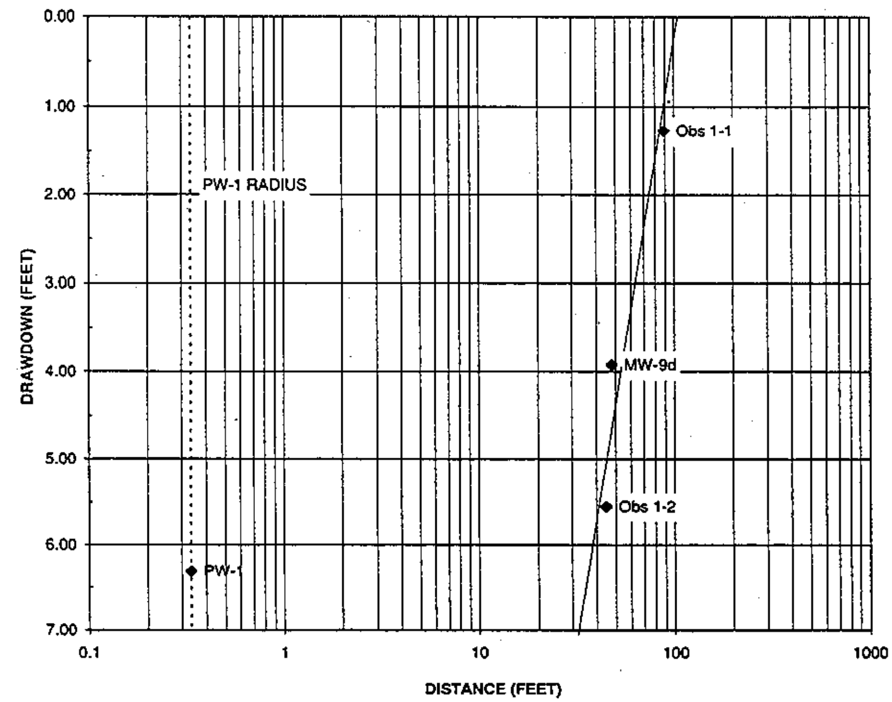
$$S = \frac{2.25Tt}{r_o^2}$$

$= \frac{2.25 \times 8.09E\text{-}03 \text{ ft}^2/\text{min} \times 2.80E{+}03 \text{ min.}}{105.0^2}$

$= 4.11E\text{-}03$

WELL DATA		
WELL	Radius (feet)	Drawdown (feet)
PW-1	0.333	6.31
Obs 1-1	89.3	1.27
Obs 1-2	44.6	5.55
MW-9d	47.8	3.92

Q = pumping rate (ft³/min)
r = radius of or from the pumping well (ft)
s = drawdown (ft)
m = aquifer saturated thickness (feet)
r = radius of or from the pumping well (ft)
T = transmissivity (ft²/min)
S = storage coefficient
K = hydraulic conductivity (ft/min)



(1) Cooper, H.H. Jr. and C.E. Jacob. 1945. "A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Well-Field History". *Transactions. American Geophysical Union*. vol. 27, no. 4. pp. 526-534.

RICHARDSON HILL ROAD SITE											
GRAPH DATA			PUMPING AND AQUIFER DATA				AQUIFER CONSTANTS				
R_o (feet)	Δs (feet)		t (minutes)	Q (gal/min)	Q (ft³/min)	m (feet)	T (ft²/min)	T (ft²/day)	S	K (ft/day)
105	13.60		2800	2.25	0.30	60	8.09E-03	12	4.11E-03	1.94E-01

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING
290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560
OFFICES IN PRINCIPAL CITIES

FIGURE I-6
PW-1 CONSTANT-RATE PUMPING TEST
DISTANCE-DRAWDOWN ANALYSIS

P:\724586\TECH\PUMPTEST\Pump Test Jacob.xls\DDN

CALCULATIONS[1]

$$T = \frac{Q}{4\pi s} Wu,r/B$$

= (0.30 ft³/min X 0.50) / (12.56637 X 0.45 feet)

= 2.63E-02 ft²/min

$$S = \frac{4\ u\ T\ t}{r^2}$$

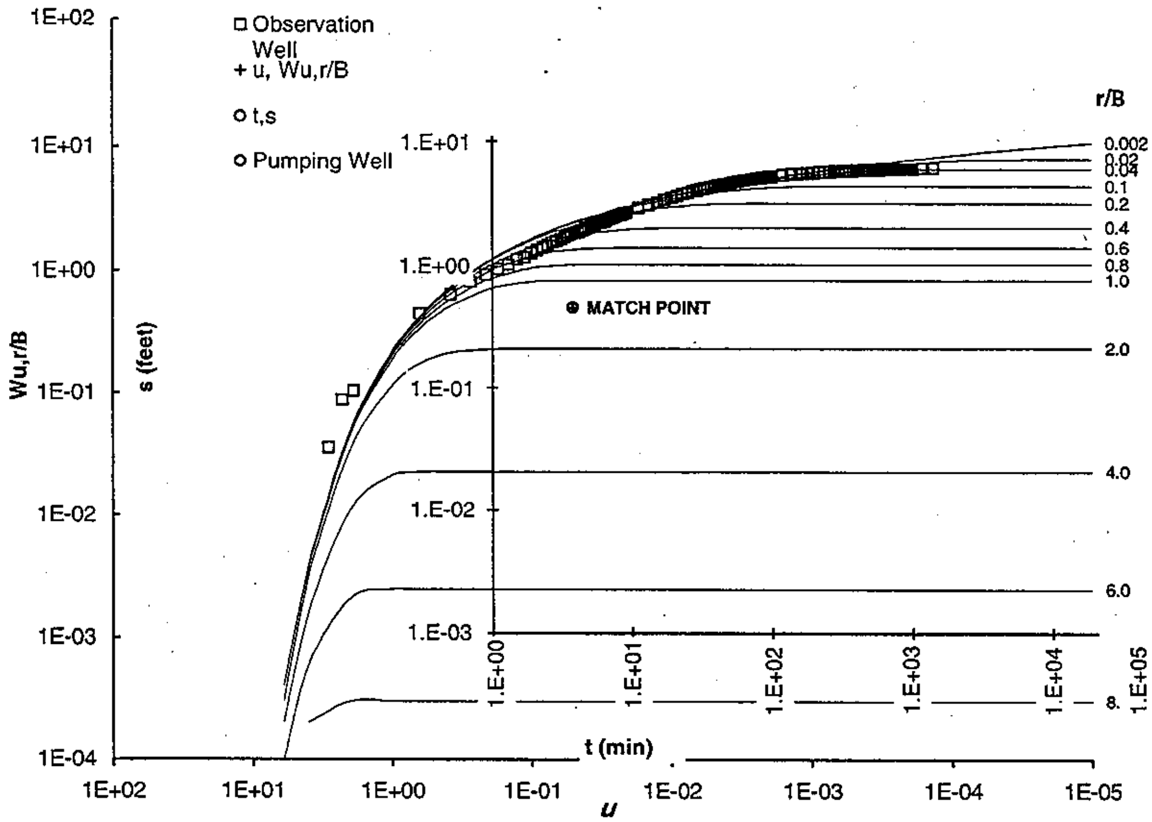
= (4 X 0.05 X 2.63E-02 ft2/min X 3.8 min) / (0.33 feet)²

= 1.84E-01

$$K' = \frac{Sb'(r/B)^2 / u}{t}$$

= (1.84E-01 x 60 feet X 0.03² / 0.05) / 3.8 min

= 5.22E-02 ft/min



(1) Hantush, M.S. and C.E. Jacob, 1955. "Non-Steady Radial Flow in an Infinite Leaky Aquifer". Transactions, American Geophysical Union. vol. 36, no. 1.

RICHARDSON HILL ROAD

MATCH POINT					PUMPING AND AQUIFER DATA				AQUIFER CONSTANTS				
u	Wu,r/B	s (feet)	t (minutes)	r/B	Q (gpm)	Q (ft³/min)	r (feet)	b' (feet)	T (ft²/min)	T (ft²/day)	S	K' (ft/min)	K' (ft/day)
0.05	0.50	0.45	3.8	0.03	2.25	0.30	0.33	60	2.63E-02	38	1.84E-01	5.22E-02	7.52E+01

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING
290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560
OFFICES IN PRINCIPAL CITIES

FIGURE I-7a
PW-1 CONSTANT-RATE PUMPING TEST (RECOVERY)
PUMPING WELL PW-1

CALCULATIONS[1]

$$T = \frac{Q}{4\pi s} Wu, r/B$$

$= \dfrac{0.30\ ft^3/min \times 0.50}{12.56637 \times 0.14\ feet}$

$= 8.38E\text{-}02\ ft^2/min$

$$S = \frac{4\,u\,T\,t}{r^2}$$

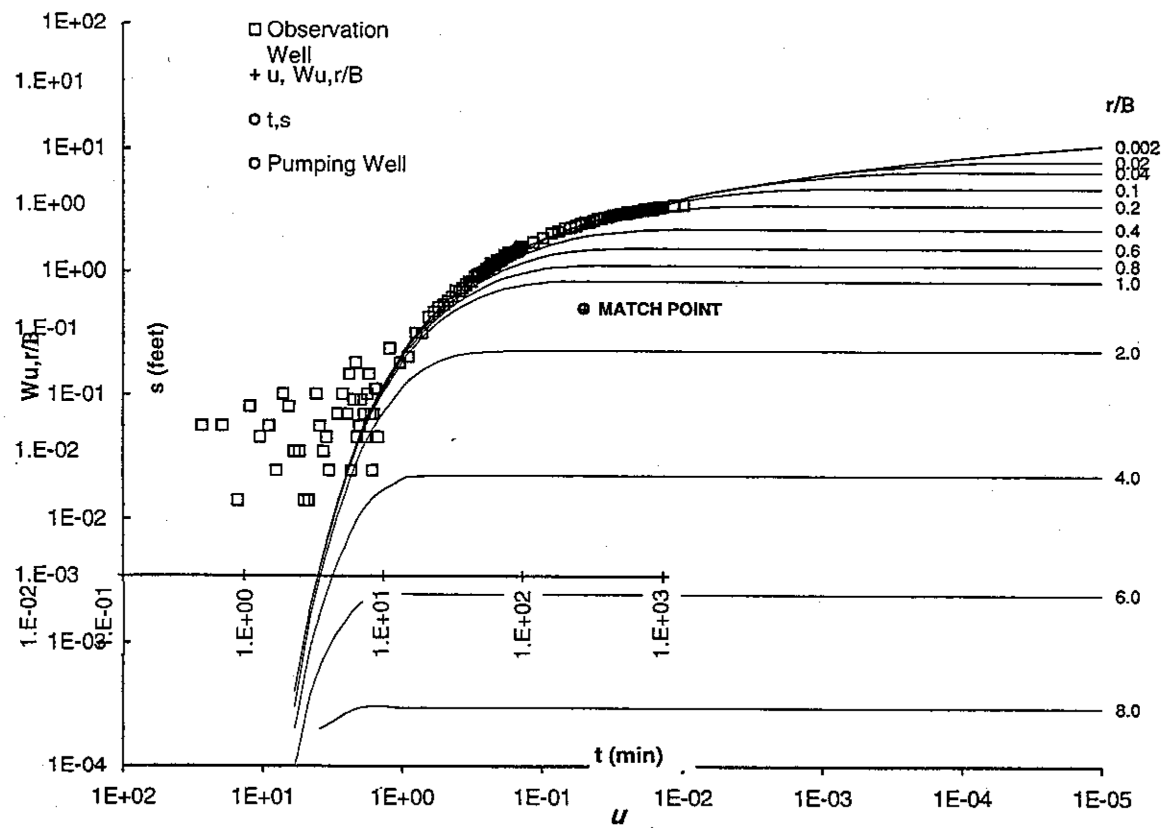
$= (4 \times 0.05 \times 8.38E\text{-}02\ ft2/min \times 274\ min) / (89.00\ feet)^2$

$= 5.80E\text{-}04$

$$K' = \frac{Sb'(r/B)^2/u}{t}$$

$= (5.80E\text{-}04 \times 60\ feet \times 0.07^2 / 0.05) / 274\ min$

$= 1.24E\text{-}05\ ft/min$



(1) Hantush, M.S. and C.E. Jacob, 1955. "Non-Steady Radial Flow in an Infinite Leaky Aquifer". Transactions, American Geophysical Union. vol. 36, no. 1.

RICHARDSON HILL ROAD

MATCH POINT					PUMPING AND AQUIFER DATA				AQUIFER CONSTANTS				
u	Wu,r/B	s (feet)	t (minutes)	r/B	Q (gpm)	Q (ft^3/min)	r (feet)	b' (feet)	T (ft^2/min)	T (ft^2/day)	S	K' (ft/min)	K' (ft/day)
0.05	0.50	0.14	274	0.07	2.25	0.30	89	60	8.38E-02	121	5.80E-04	1.24E-05	1.79E-02

PARSONS ENGINEERING SCIENCE, INC.

DESIGN • RESEARCH • PLANNING

290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560

OFFICES IN PRINCIPAL CITIES

FIGURE I-7b

PW-1 CONSTANT-RATE PUMPING TEST (RECOVERY)

OBSERVATION WELL O1-1

CALCULATIONS[1]

$$T = \frac{Q}{4\pi s} Wu, r/B$$

$= \dfrac{0.30 \text{ ft}^3/\text{min} \times 0.50}{12.56637 \times 0.50 \text{ feet}}$

$= 2.39E\text{-}02 \text{ ft}^2/\text{min}$

$$S = \frac{4\,u\,T\,t}{r^2}$$

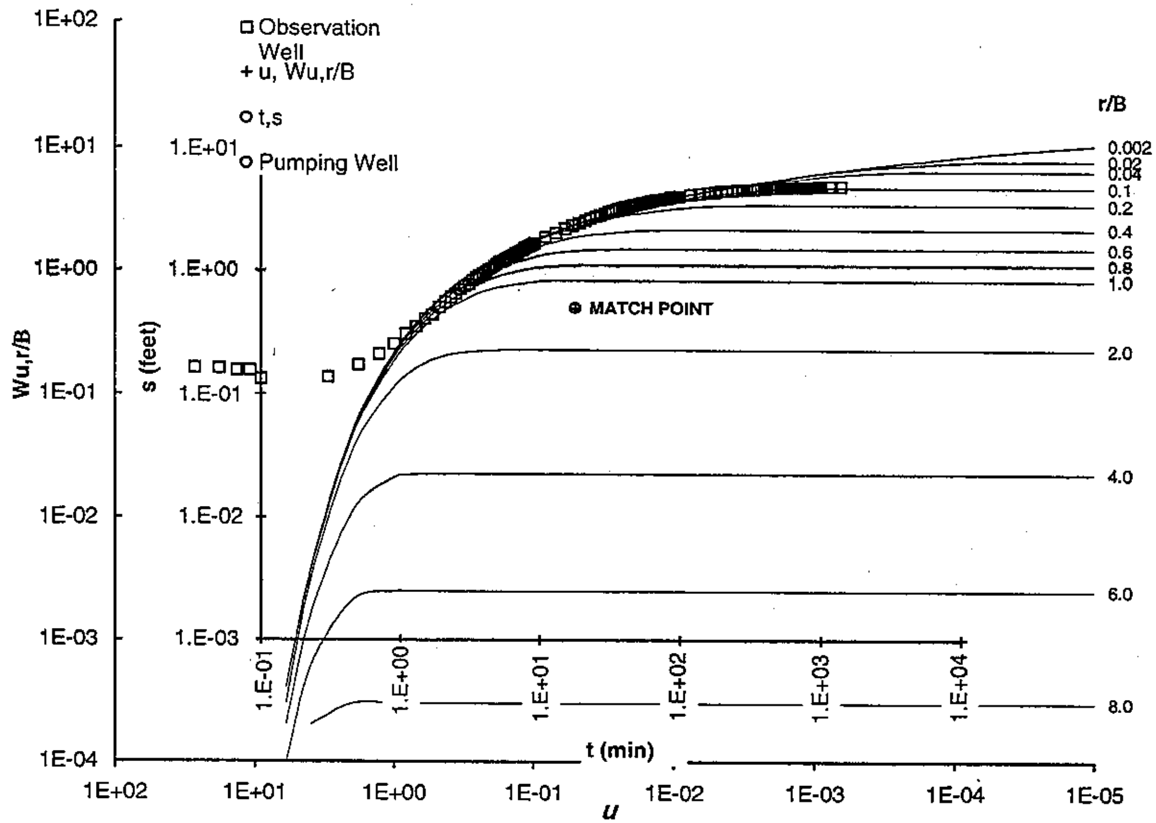
$= (4 \times 0.05 \times 2.39E\text{-}02 \text{ ft2/min} \times 18 \text{ min}) / (44.60 \text{ feet})^2$

$= 4.33E\text{-}05$

$$K' = \frac{S b' (r/B)^2 / u}{t}$$

$= (4.33E\text{-}05 \times 60 \text{ feet} \times 0.1^2 / 0.05) / 18 \text{ min}$

$= 2.89E\text{-}05 \text{ ft/min}$



(1) Hantush, M.S. and C.E. Jacob, 1955. "Non-Steady Radial Flow in an Infinite Leaky Aquifer". Transactions, American Geophysical Union. vol. 36, no. 1.

RICHARDSON HILL ROAD

MATCH POINT					PUMPING AND AQUIFER DATA				AQUIFER CONSTANTS				
u	Wu,r/B	s (feet)	t (minutes)	r/B	Q (gpm)	Q (ft³/min)	r (feet)	b' (feet)	T (ft²/min)	T (ft²/day)	S	K' (ft/min)	K' (ft/day)
0.05	0.50	0.50	18	0.1	2.25	0.30	44.6	60	2.39E-02	34	4.33E-05	2.89E-05	4.16E-02

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING
290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560
OFFICES IN PRINCIPAL CITIES

FIGURE I-7c
PW-1 CONSTANT-RATE PUMPING TEST (RECOVERY)
OBSERVATION WELL O1-2

CALCULATIONS[1]

$$T = \frac{Q}{4\pi s} Wu, r/B$$

$= \frac{0.30 \text{ ft}^3/\text{min} \times 0.50}{12.56637 \times 0.37 \text{ feet}}$

$= 3.23E-02 \text{ ft}^2/\text{min}$

$$S = \frac{4\, u\, T\, t}{r^2}$$

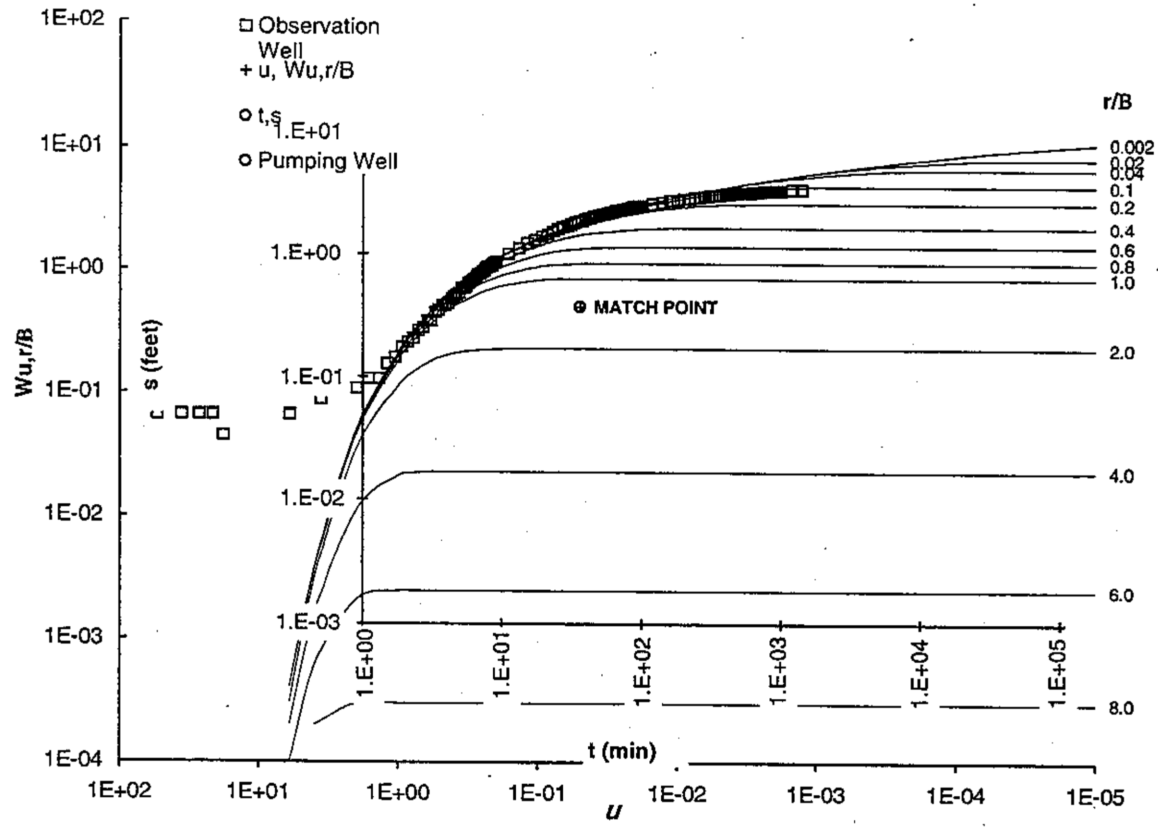
= (4 X 0.05 X 3.23E-02 ft2/min X 36 min) / (47.80 feet)^2

= 1.02E-04

$$K' = \frac{Sb'(r/B)^2/u}{t}$$

= (1.02E-04 x 60 feet X 0.1^2 / 0.05) / 36 min

= 3.39E-05 ft/min



(1) Hantush, M.S. and C.E. Jacob, 1955. "Non-Steady Radial Flow in an Infinite Leaky Aquifer". Transactions, American Geophysical Union. vol. 36, no. 1.

RICHARDSON HILL ROAD

MATCH POINT					PUMPING AND AQUIFER DATA					AQUIFER CONSTANTS				
u	Wu,r/B	s (feet)	t (minutes)	r/B	Q (gpm)	Q (ft^3/min)	r (feet)	b' (feet)	T (ft^2/min)	T (ft^2/day)	S	K' (ft/min)	K' (ft/day)
0.05	0.50	0.37	36	0.1	2.25	0.30	47.8	60	3.23E-02	47	1.02E-04	3.39E-05	4.89E-02

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING
290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560
OFFICES IN PRINCIPAL CITIES

FIGURE I-7d
PW-1 CONSTANT-RATE PUMPING TEST (RECOVERY)
OBSERVATION WELL MW-9D

P:\724586\TECH\PUMPTEST\MW-9D.xls\MW-9D RECOVERY

CALCULATIONS[1]

$$T = \frac{0.366Q}{\Delta s}$$

$= \dfrac{0.366 \times 0.30 \text{ ft}^3/\text{min}}{13.60 \text{ feet}}$

$= 8.09E\text{-}03 \text{ ft}^2/\text{min}$

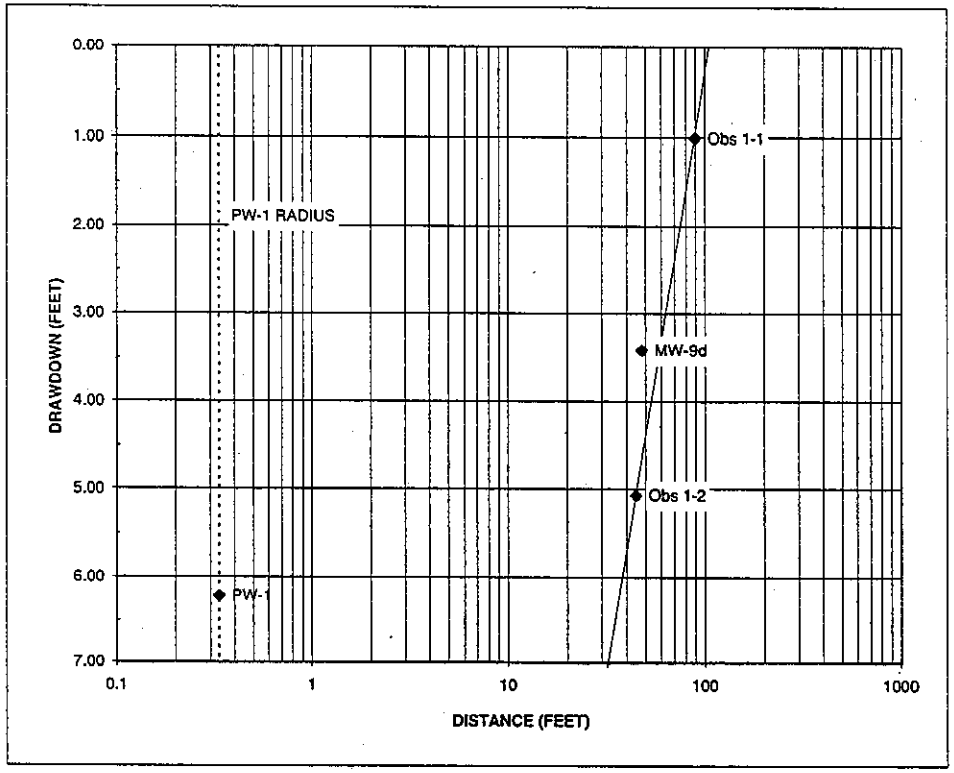
$$S = \frac{2.25Tt}{r_o^2}$$

$= \dfrac{2.25 \times 8.09E\text{-}03 \text{ ft}^2/\text{min} \times 1.40E{+}03 \text{ min.}}{105.0^2}$

$= 2.06E\text{-}03$

WELL DATA		
.WELL	Radius (feet)	Drawdown (feet)
PW-1	0.333	6.21
Obs 1-1	89.3	1.01
Obs 1-2	44.6	5.07
MW-9d	47.8	3.41

Q = pumping rate (ft³/min)
r = radius of or from the pumping well (ft)
s = drawdown (ft)
m = aquifer saturated thickness (feet)
r = radius of or from the pumping well (ft)
T = transmissivity (ft²/min)
S = storage coefficient
K = hydraulic conductivity (ft/min)



(1) Cooper, H.H. Jr. and C.E. Jacob. 1945. "A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Well-Field History".
Transactions. American Geophysical Union. vol. 27, no. 4. pp. 526-534.

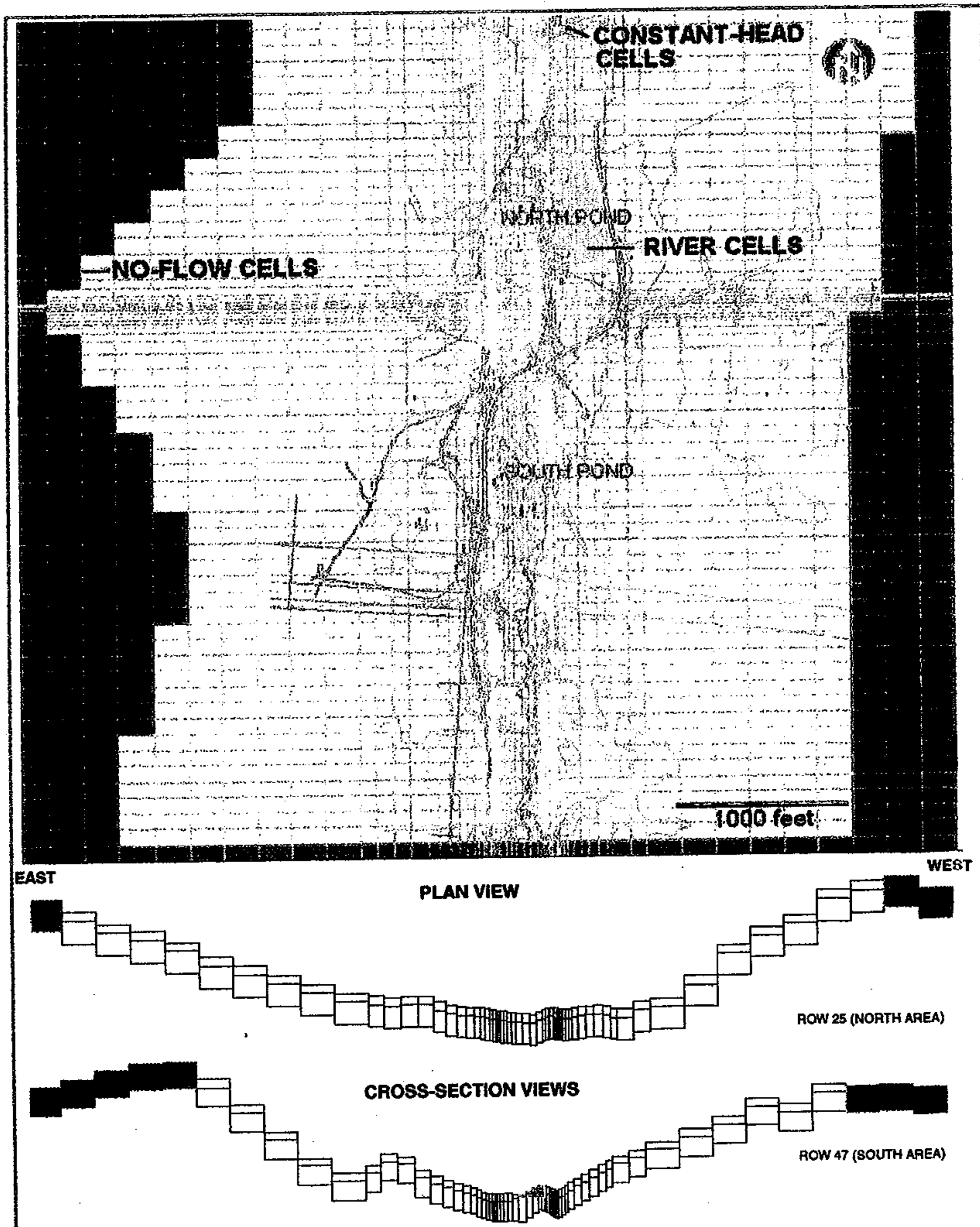
RICHARDSON HILL ROAD SITE

GRAPH DATA			PUMPING AND AQUIFER DATA				AQUIFER CONSTANTS			
R_0 (feet)	Δs (feet)		t (minutes)	Q (gal/min)	Q (ft³/min)	m (feet)	T (ft²/min)	T (ft²/day)	S	K (ft/day)
105	13.60		1400	2.25	0.30	60	8.09E-03	12	2.06E-03	1.94E-01

PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING
290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560
OFFICES IN PRINCIPAL CITIES

FIGURE I-8
PW-1 CONSTANT-RATE PUMPING TEST (RECOVERY)
DISTANCE-DRAWDOWN ANALYSIS

P:\724586\TECH\PUMPTEST\Pump Test Jacob.xls\RECOV



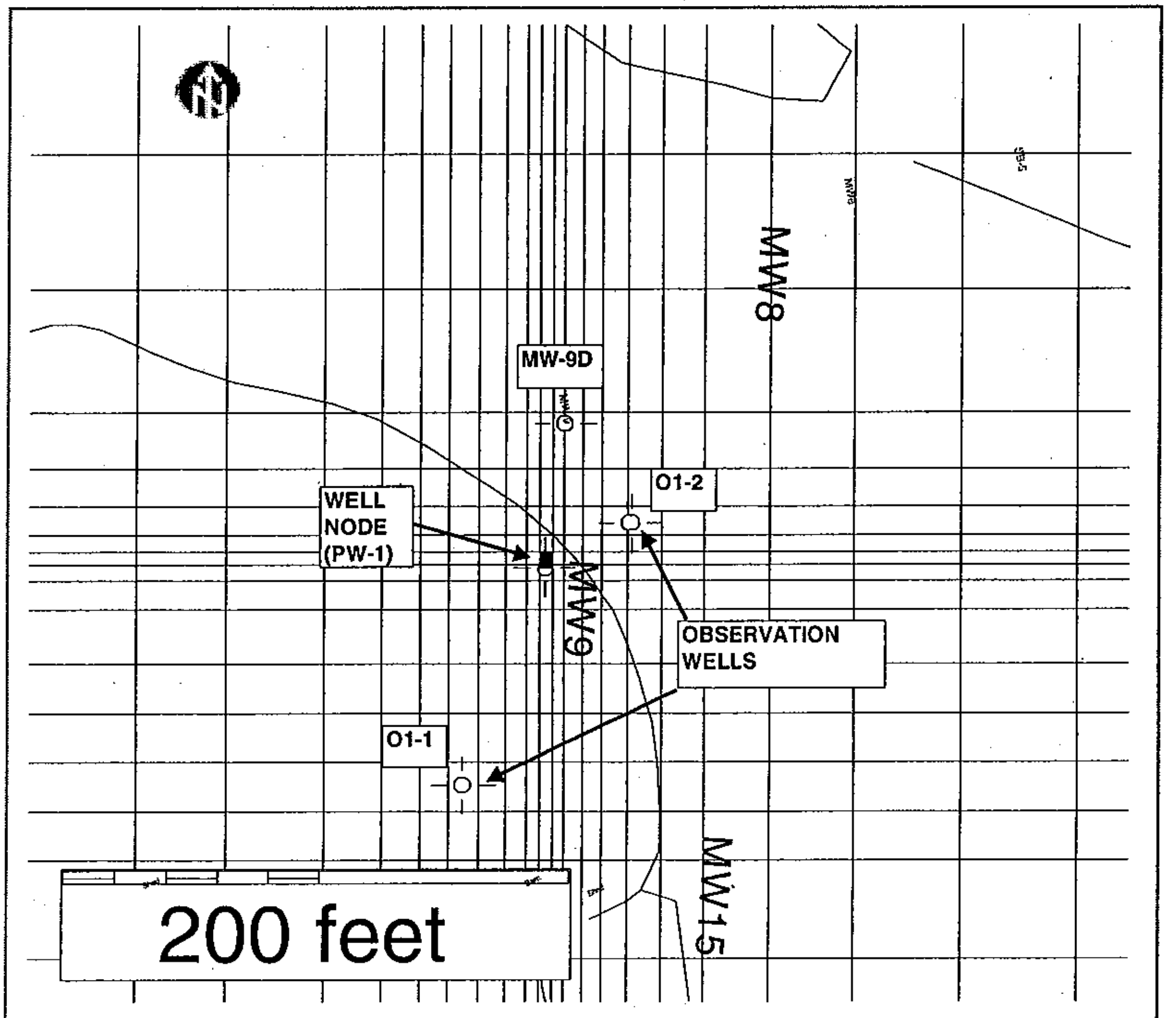
PARSONS

PARSONS ENGINEERING SCIENCE, INC.

FIGURE I-9a
MODEL GRID AND BOUNDARIES
SITEWIDE

JOB NUMBER	DATE	SHEET 1 OF 3
734586.05080	March, 2000	

P:\734586\TECH\MODEL\RH_model figures.xls\GRID [I.1]

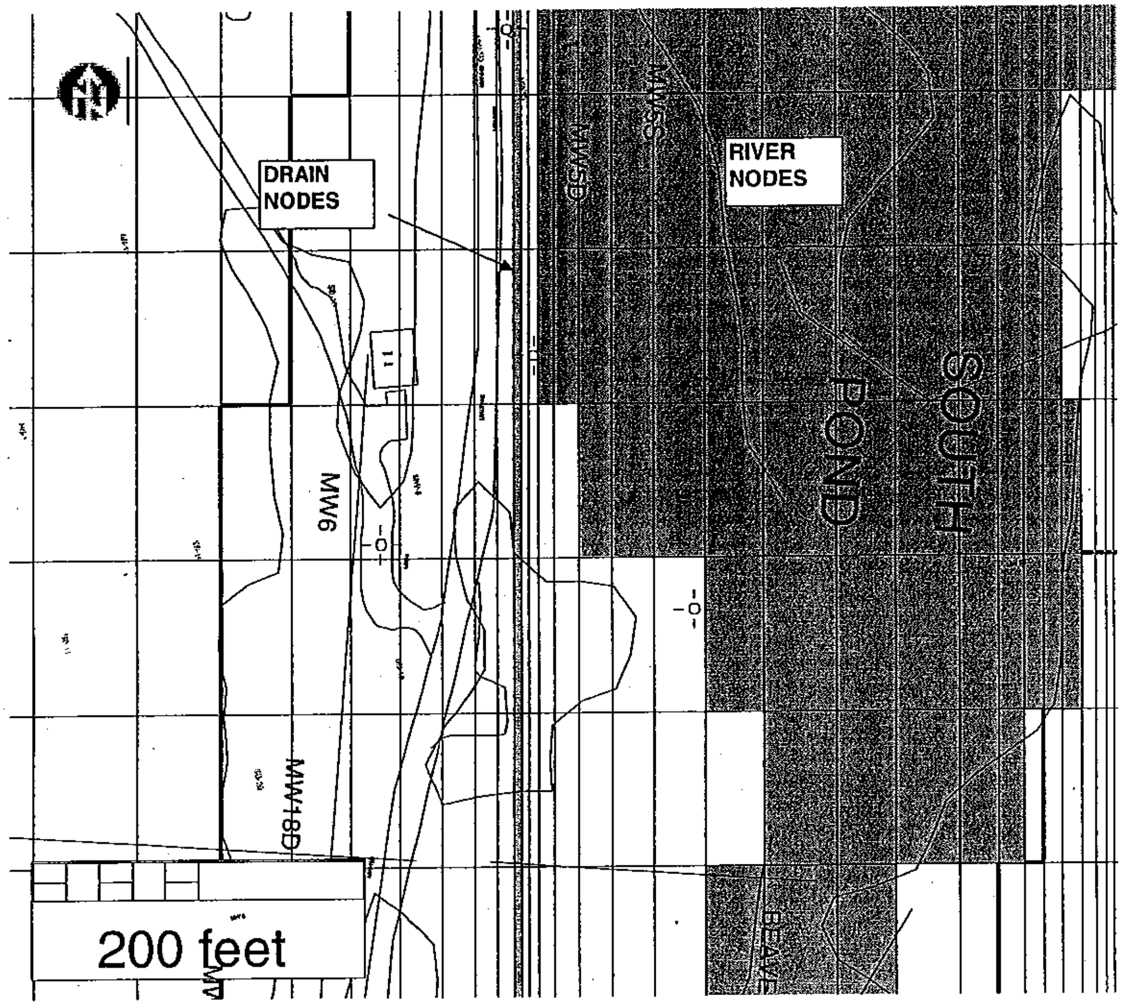


PARSONS

PARSONS ENGINEERING SCIENCE, INC.

FIGURE I-9b
MODEL GRID AND BOUNDARIES
NORTH AREA

JOB NUMBER	DATE	SHEET 2 OF 3
734586.05080	March, 2000	

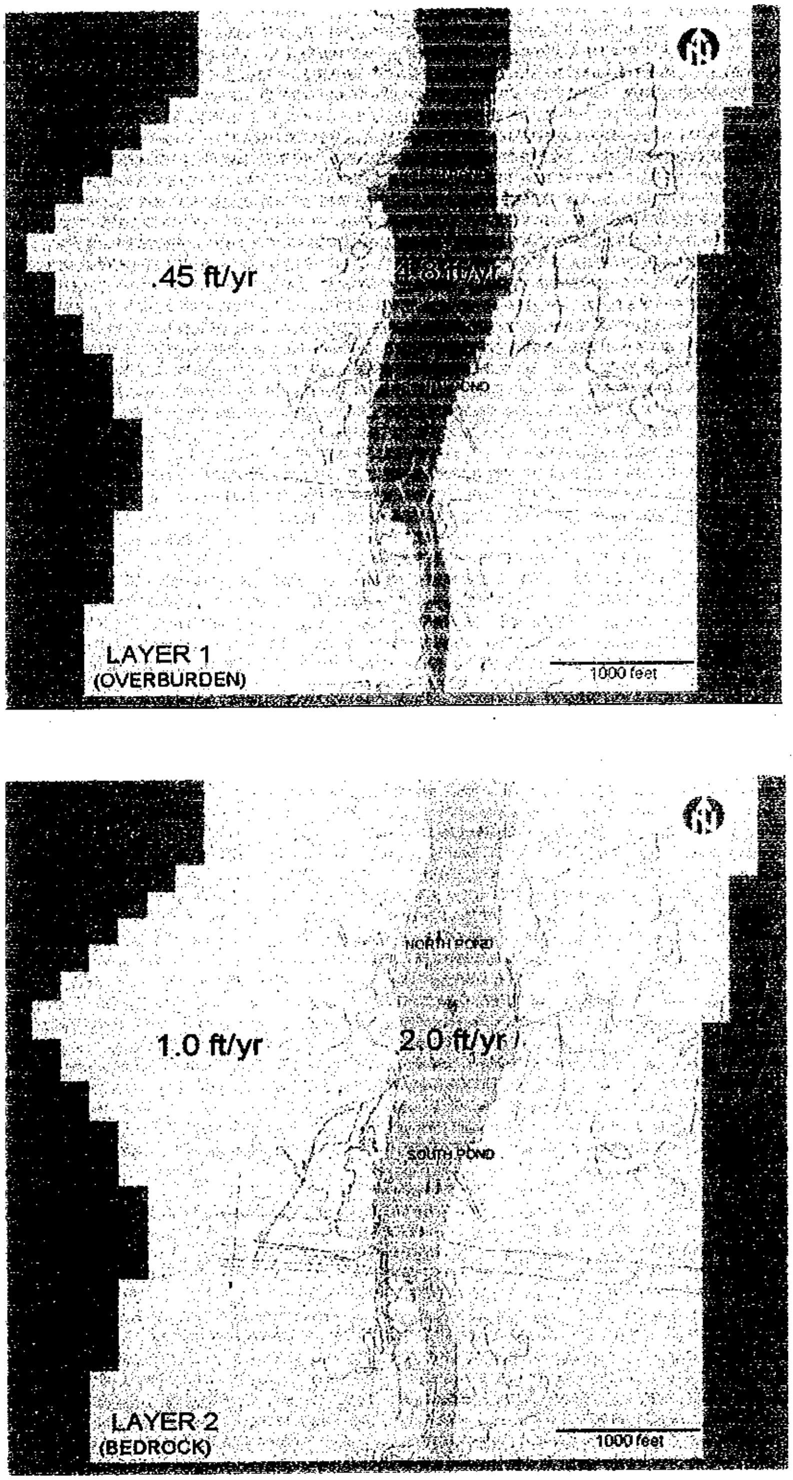


PARSONS

PARSONS ENGINEERING SCIENCE, INC.

FIGURE I-9c
MODEL GRID AND BOUNDARIES
SOUTH AREA

JOB NUMBER	DATE	SHEET 3 OF 3
734586.05080	March, 2000	

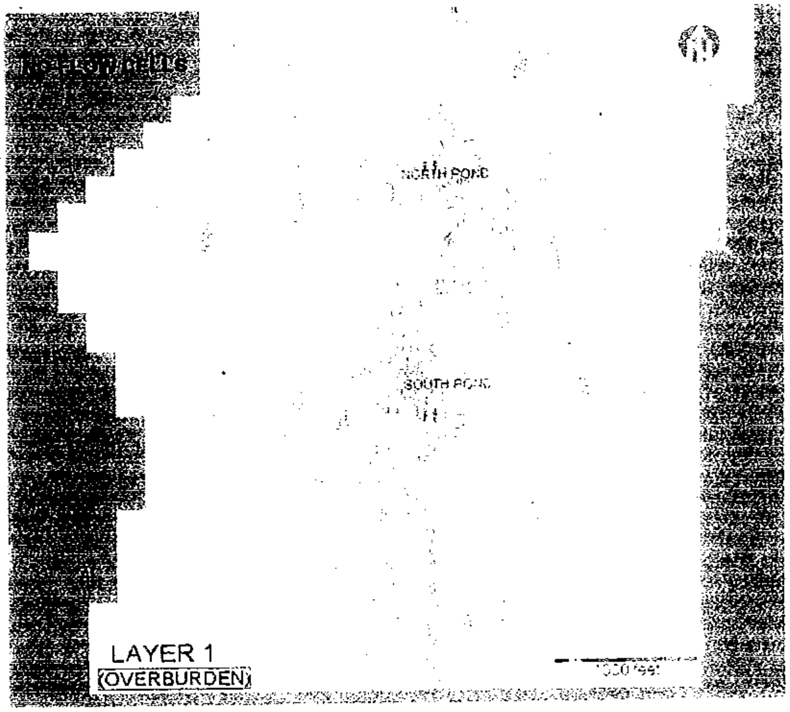


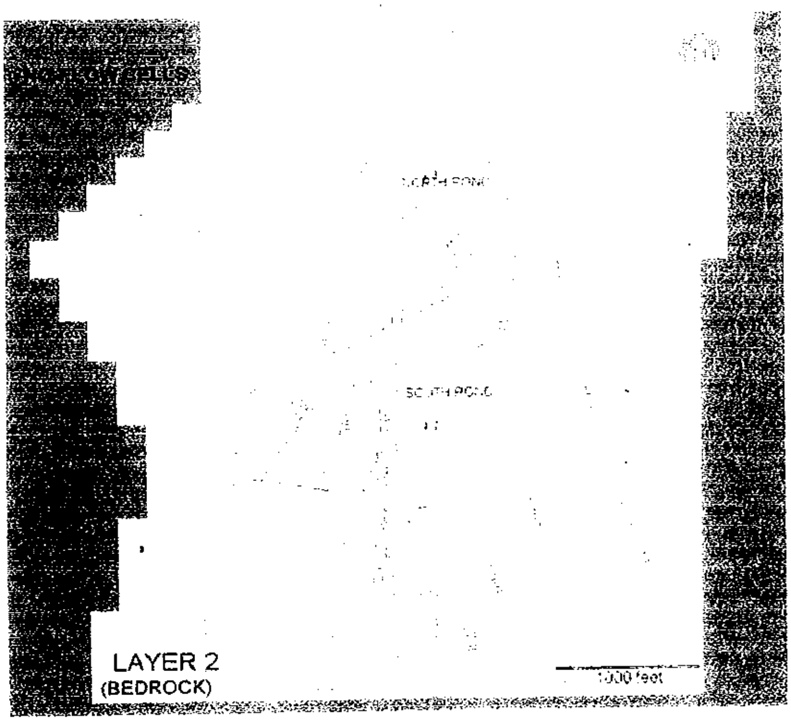
PARSONS

PARSONS ENGINEERING SCIENCE, INC.

FIGURE I-10
HYDRAULIC CONDUCTIVITY ZONATION

JOB NUMBER	DATE	SHEET 1 OF 1
734566.05060	March 2004	





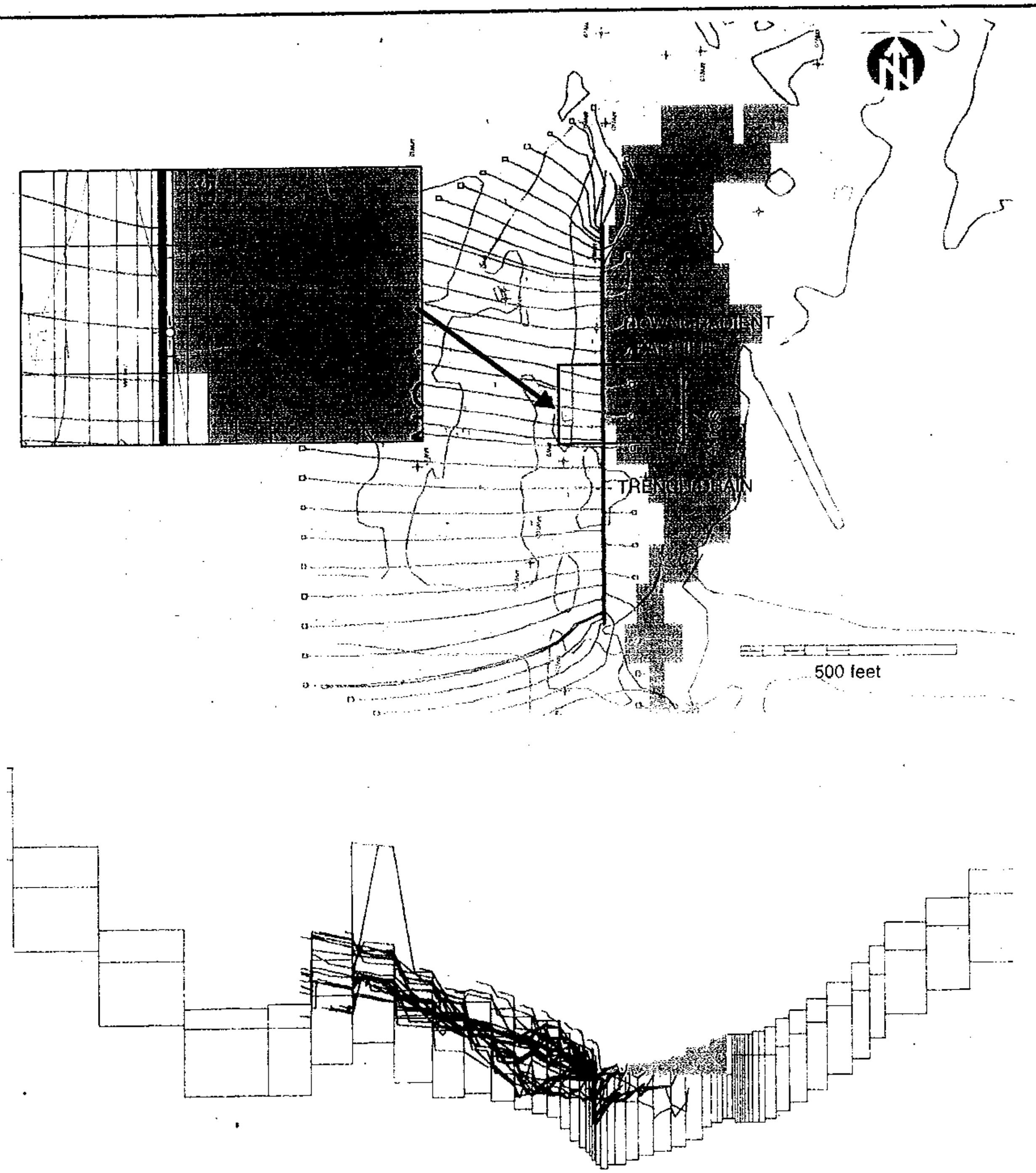
PARSONS

PARSONS ENGINEERING SCIENCE, INC.

FIGURE I-11

CALIBRATED HEADS

JOB NUMBER	DATE	SHEET



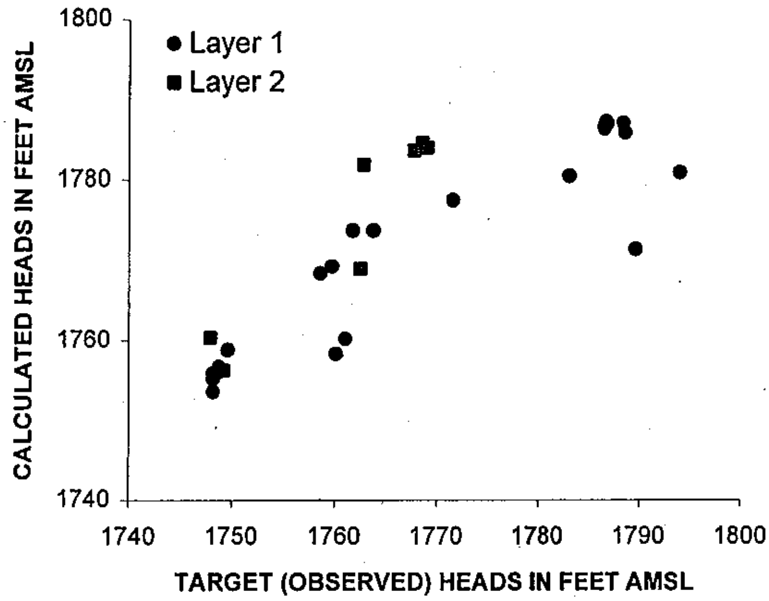
PARSONS

PARSONS ENGINEERING SCIENCE, INC.

FIGURE I-14

CAPTURE ZONE FOR TRENCH/DRAIN

JOB NUMBER	DATE	SHEET 1 OF 1
734586.05000	March, 2000	



Layer 1

Name	Observed	Computed	Residual
MPI-2	1763.8	1773.7	-9.9
MW-1	1789.7	1771.4	18.3
MW-11S	1879.3	1798.6	80.7
MW-12	1806.3	1793.1	13.2
MW-13	1761.8	1773.7	-11.9
MW-14	1786.9	1787.0	-0.1
MW-15	1783.1	1780.4	2.7
MW-16	1788.4	1787.1	1.4
MW-17	1794.0	1780.9	13.2
MW-18S	1761.1	1760.2	0.9
MW-19	1771.6	1777.5	-5.9
MW-2	1759.8	1769.2	-9.5
MW-3	1749.7	1758.8	-9.2
MW-4S	1758.7	1768.4	-9.7
MW-5S(2)	1748.6	1755.9	-7.3
MW-6	1760.2	1758.3	1.8
MW-7S	1748.8	1756.7	-7.9
MW-8	1788.7	1785.9	2.8
SW-1	1786.8	1787.3	-0.5
SW-2	1786.5	1786.6	-0.1
SW-3	1786.6	1786.4	0.3
SW-4	1748.2	1755.9	-7.7
SW-5	1748.2	1755.1	-7.0
SW-6	1748.2	1753.6	-5.4

Layer 2

Name	Observed	Computed	Residual
MW-11D	1842.8	1798.5	44.3
MW-18D	1747.9	1760.4	-12.5
MW-4D	1762.5	1768.9	-6.4
MW-5D	1749.2	1756.2	-7.0
MW-9D	1768.5	1784.5	-16.0
O_1-1	1762.8	1781.8	-19.0
O_1-2	1769.0	1784.0	-15.0
PW-1	1767.8	1783.7	-15.9

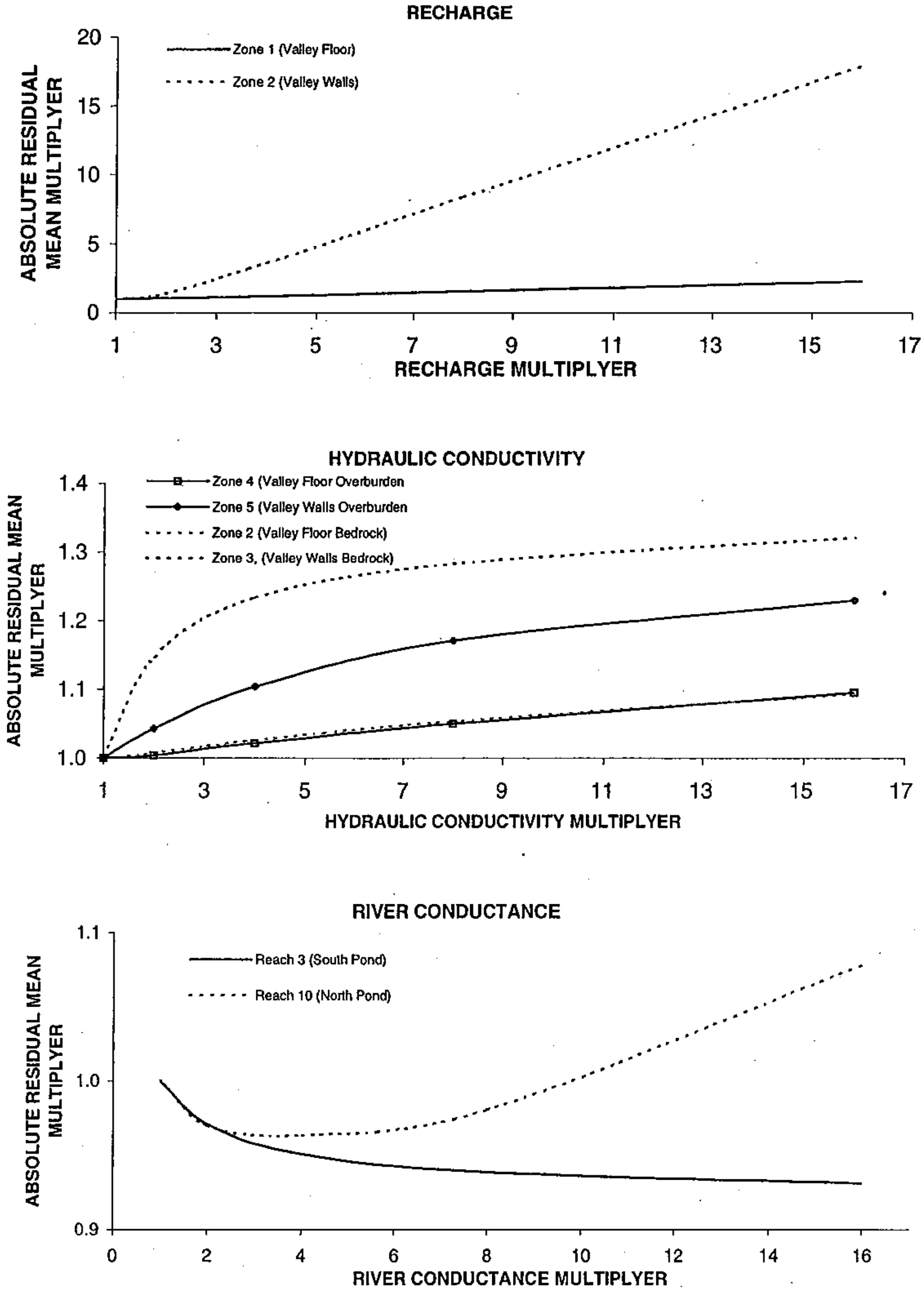
Model Statistics

Residual Mean	-0.1
Res. Std. Dev.	18.8
Sum of Squares	11316.2
Abs. Res..Mean	11.4
Min. Residual	-19.0
Max. Residual	80.7
Head Range	131.4
Std/Head Range	0.14

Richardson Hill Road

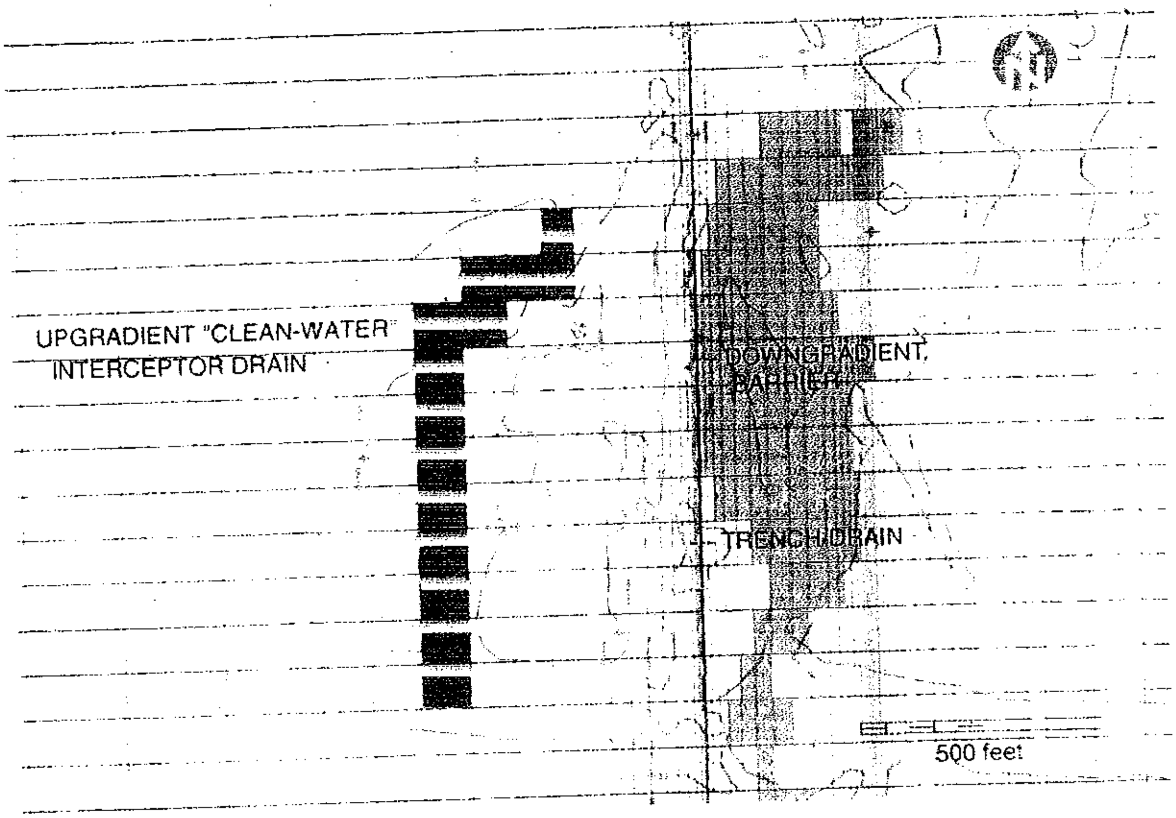
PARSONS ENGINEERING SCIENCE, INC.
DESIGN · RESEARCH · PLANNING
290 ELWOOD DAVIS ROAD SUITE 312 LIVERPOOL, NY 13088 (315) 451-9560
OFFICES IN PRINCIPAL CITIES

FIGURE I-12
Model Calibration and Statistics



Richardson Hill Road Site

PARSONS ENGINEERING SCIENCE, INC. DESIGN • RESEARCH • PLANNING 290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560 OFFICES IN PRINCIPAL CITIES	FIGURE I-13 SENSITIVITY ANALYSES RESULTS



RICHARDSON HILL ROAD

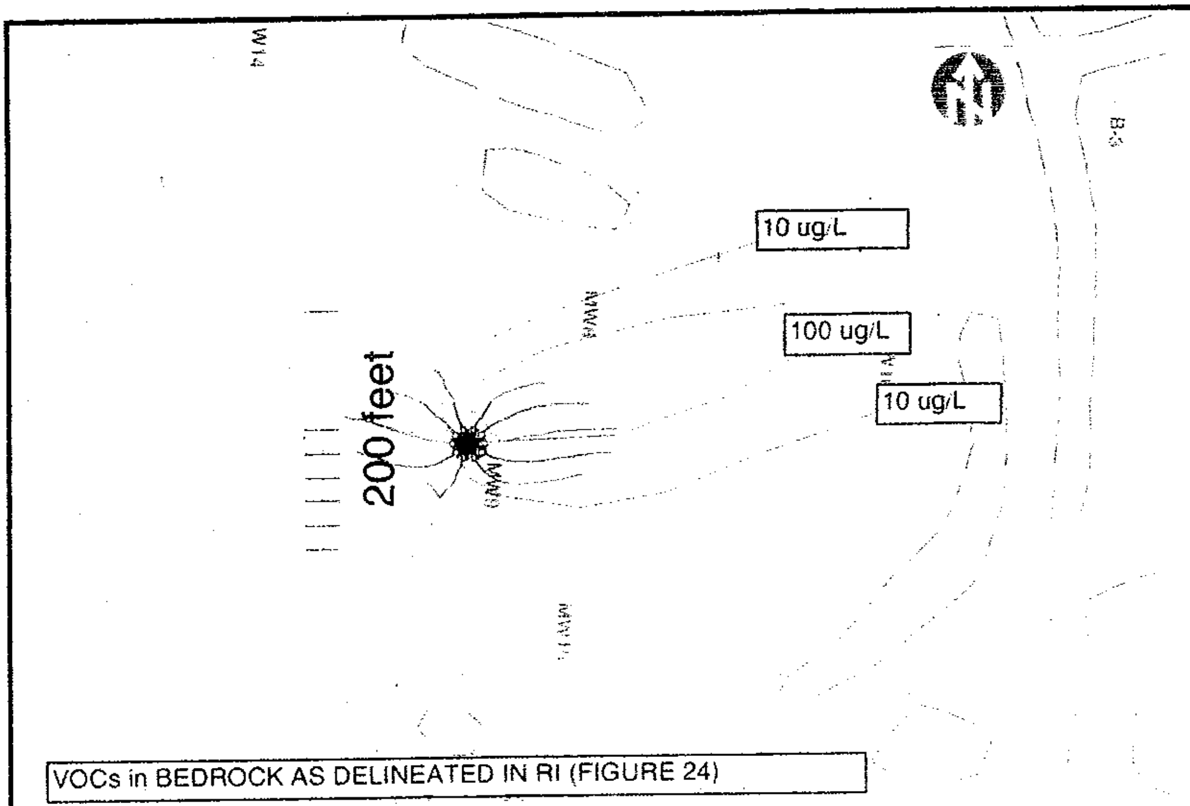
PARSONS ENGINEERING SCIENCE, INC.

DESIGN • RESEARCH • PLANNING

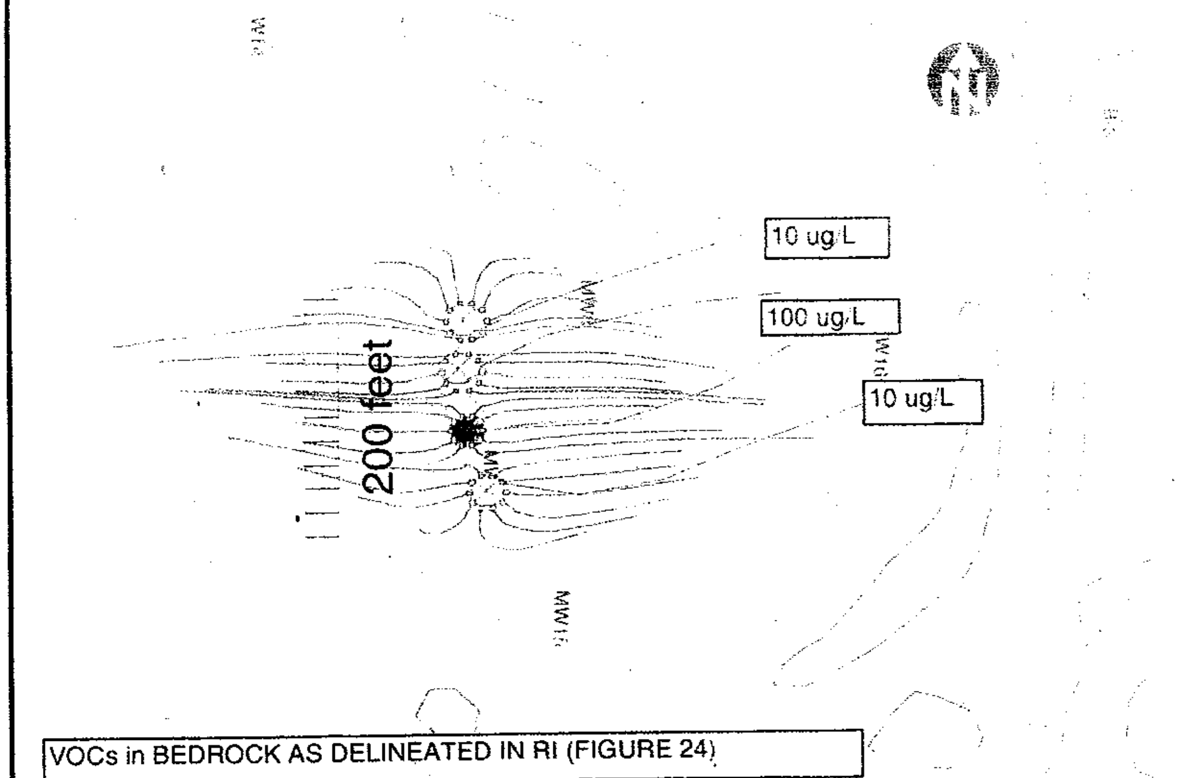
290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560

OFFICES IN PRINCIPAL CITIES

FIGURE I-15
CLEAN-WATER INTERCEPTOR
DRAIN LOCATION



ONE WELL (PW-1) WITH A DISCHARGE OF 2.5 GPM



FOUR WELLS WITH A TOTAL DISCHARGE OF 10 GPM

RICHARDSON HILL ROAD

PARSONS ENGINEERING SCIENCE, INC. DESIGN • RESEARCH • PLANNING 290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, NY 13088 • (315) 451-9560 OFFICES IN PRINCIPAL CITIES	**FIGURE I-16** **NORTH AREA** **GROUNDWATER EXTRACTION**