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TECHNICAL MEMORANDUM FOR PHASE I FIELD ACTIVITIES

SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION PROJECT

ROCKFORD, ILLINOIS

October 1992

Prepared for:

Illinois Environmental Protection Agency
Division of Land Pollution Control

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1.0 INTRODUCTION

This technical memorandum summarizes the field investigation activities for Phase I of the Remedial Investigation/Feasibility Study (RI/FS) at the Southeast Rockford Groundwater Contamination site in Rockford, Illinois. Field activities, which took place from June to October 1991, were conducted by Camp Dresser & McKee Inc. (CDM) and its subcontractors under the direction of the Illinois Environmental Protection Agency (IEPA). The primary aim of this technical memorandum is to describe the methods and procedures used to conduct the on-site investigation, which involved drilling and installing groundwater monitoring wells, well surveying, hydraulic conductivity testing, geophysical logging, and soil and groundwater sampling. In addition, results of the hydrogeologic and contaminant investigations are presented and interpreted in this technical memorandum. This technical memorandum is the mechanism by which the information obtained from the Phase I activities is to be transmitted to the Agency. This information will be used to design the Phase II field activities. At the conclusion of the Phase II field activities a Remedial Investigation Report and Baseline Risk Assessment will be prepared. These reports will contain detailed information describing the study area and its history, potential contaminant sources and potential remedial alternatives.

Previous sampling events in the study area by the Illinois Department of Public Health (IDPH), the USEPA Technical Assistance Team (USEPA TAT) and Illinois Environmental Protection Agency (IEPA) indicated that an east-west trending plume of VOC-contaminated groundwater extends at least from the vicinity of 8th Street and Wills Avenue to the vicinity of 23rd Street and Reed Avenue. VOC-contaminated groundwater was also detected in the general vicinity of River Boulevard located east of the Rock River. The principal VOCs detected in the study area include 1,1,1-trichloroethane (TCA), tetrachloroethene (PCE), trichloroethene (TCE), and their degradation products; total VOCs were detected at combined concentrations up to 894 parts per billion (ppb). In addition to VOC contamination of

groundwater, the sampling efforts by IEPA have indicated that groundwater within the study area is locally contaminated with arsenic, cadmium, chromium, and lead.

During June 1990, Camp Dresser & McKee (CDM), under the direction of IEPA, conducted a groundwater sampling investigation of the area in order to identify affected residents on the margins of the contaminant plume, as part of the Operable Unit remedial investigation (CDM, 1990).

The Phase I study area was expanded from the area defined in the operable unit. This expansion was based on new information provided to IEPA regarding groundwater contamination near the corner of Harrison and Alpine Road. The Phase I study area location is described below.

According to the work plan, the principal objectives of the Phase I RI were to:

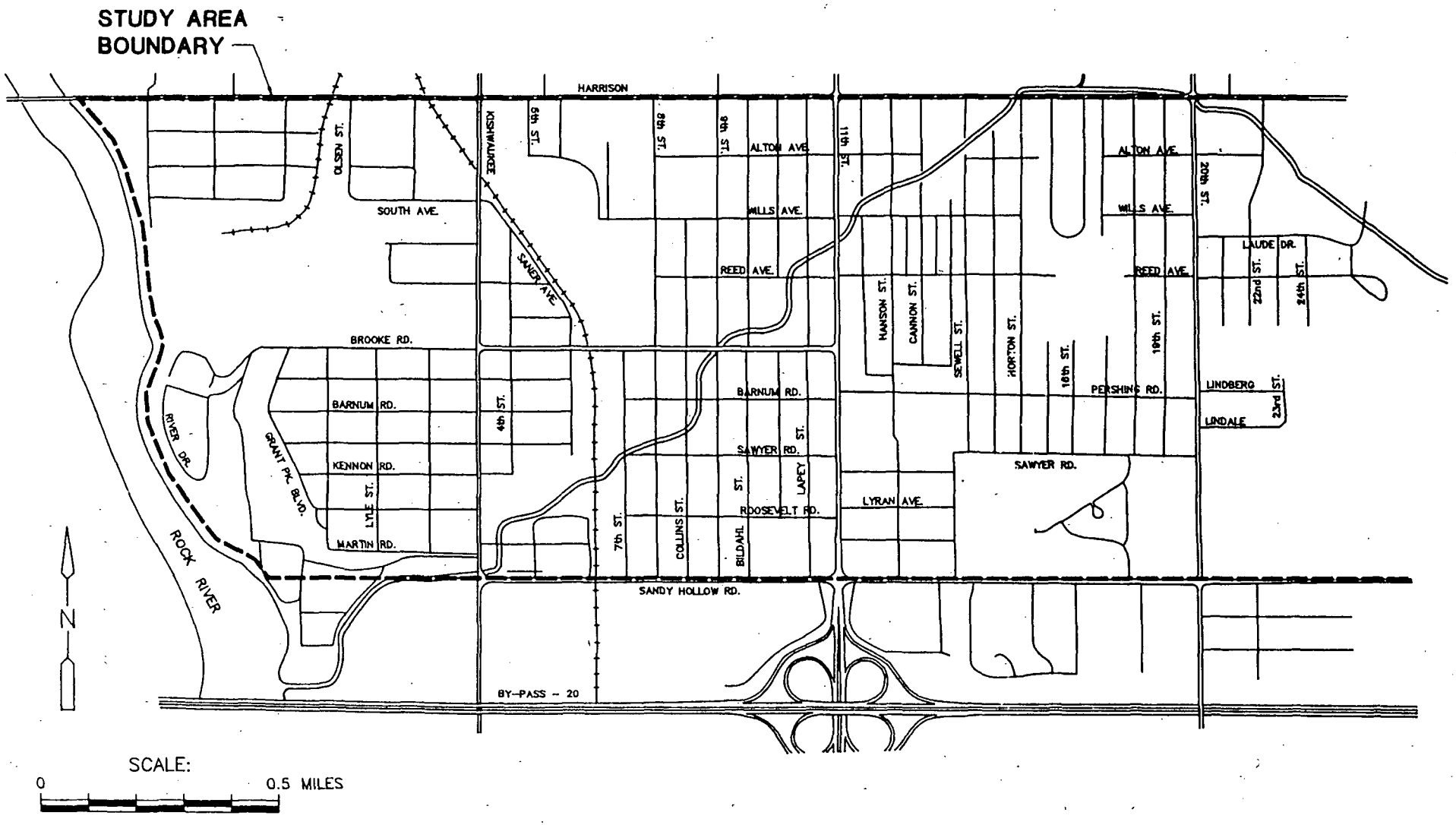
- Gather preliminary information on the nature and distribution of groundwater contamination in the study area;
- Delineate potential source areas;
- Determine aquifer characteristics to allow evaluation of contaminant transport rates and directions;
- Determine the extent of groundwater contamination in the bedrock within the study area;
- Collect data to support groundwater modeling in later phases of the investigation; and

- Obtain information on potential source locations and subsurface conditions to assist in designing Phase II of this Remedial Investigation.

Following the Phase I RI, a more extensive and comprehensive investigation of the contamination problem at the study area will be addressed through a Phase II RI. The detailed scope of work for the Phase II investigation will be based on the results of the Phase I investigation.

The Phase I study area is composed of an eastern and a western portion bounded by the following features: the Rock River on the west, Harrison Avenue on the north, Wendy Lane to the east, and Sandy Hollow Road on the south; 20th Street separates the eastern and western portions (Figures 1-1 and 1-2). The western portion covers T.43N., R.1E., Sections 1 and 2; the eastern portion lies in T.43N., R.2E., Sections 4 through 6. Most of the Phase I field activities addressed in this report occurred within the eastern portion of the study area. Certain activities, such as the soil gas survey and sampling of non-IEPA groundwater monitoring wells, occurred within both portions of the study area.

Section 2 of this report describes the methods and procedures used during the Phase I field investigation. Sections 3 and 4 present and interpret the results of the hydrogeologic and contaminant investigations, respectively. Section 5 gives a summary of the Phase I report and provides recommendations for further work at the study area.



SOUTHEAST ROCKFORD

STUDY AREA
WESTERN SECTION

CDM
environmental engineers, scientists,

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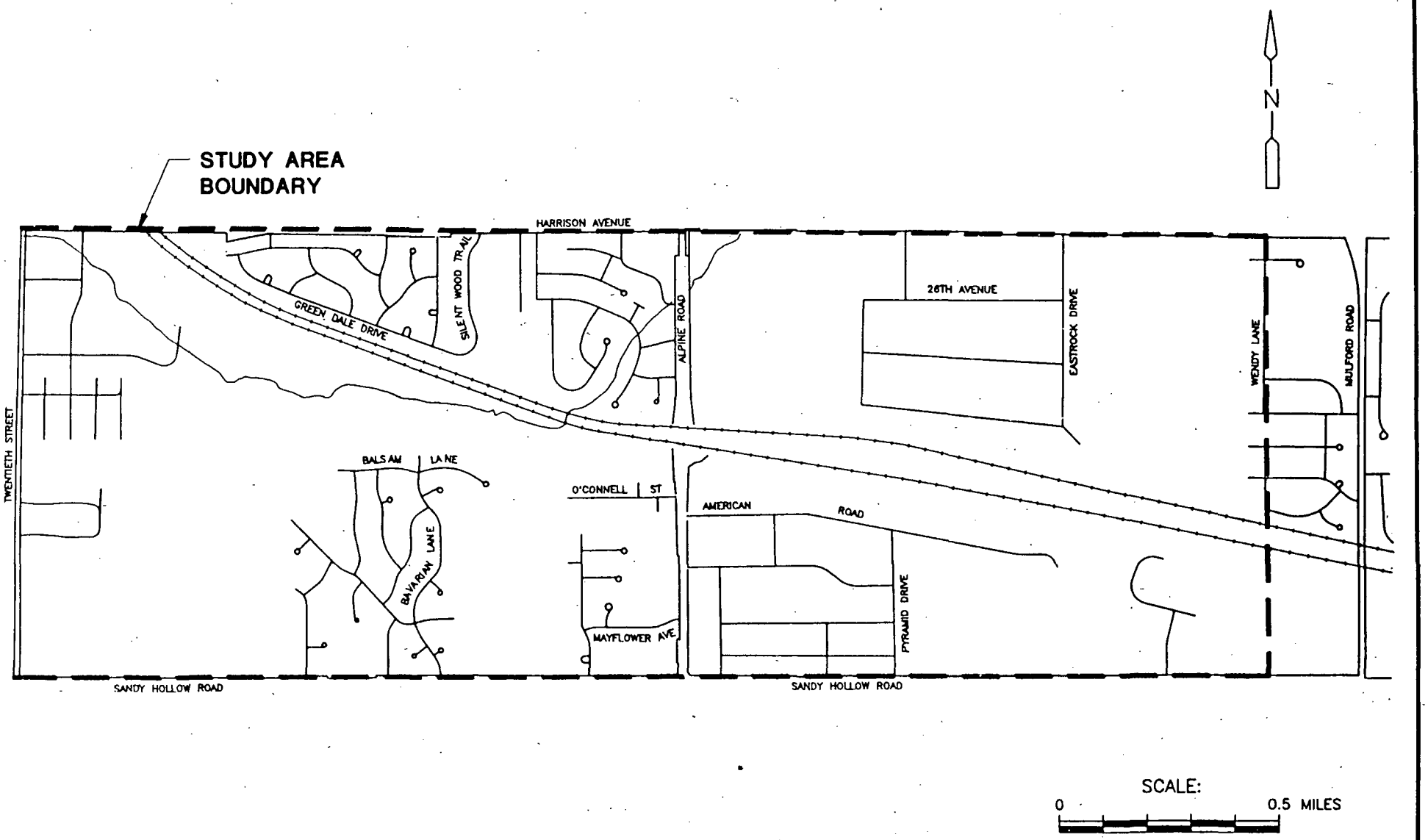

SOUTHEAST ROCKFORD

STUDY AREA
EASTERN SECTION

CDM
environmental engineers, scientists, planners, & management consultants

Figure No. 1-2

2.0 FIELD INVESTIGATION METHODS AND PROCEDURES

2.1 ANALYTICAL PROTOCOLS

As the first task of the Phase I field activities, a soil gas survey was performed over portions of the study area. The soil gas samples were analyzed using a Varian 3300 gas chromatograph as described in Appendix B of the Quality Assurance Project Plan (QAPP; CDM, 1991) and in the Soil Gas Technical Memorandum in Appendix A of this document. The instrument was equipped with an electron capture detector (ECD). Nitrogen was used as the carrier gas. All samples were analyzed for trichloroethene (TCE), 1,1,1-trichloroethane (TCA) and tetrachloroethene (PCE) as the compounds of interest.

Halocarbon compounds detected in the samples were identified by chromatographic retention time. Quantification of compounds was achieved by comparison of the detector response of the sample with the response measured for calibration standards (external standardization). Instrument calibration checks were run periodically throughout the day and system blanks were run at the beginning of the day to check for contamination in the soil gas sampling equipment. Air samples were also routinely analyzed to check for background levels in the atmosphere.

Detection limits for the compounds of interest were a function of the injection volume as well as the detector sensitivity for individual compounds. Thus, the detection limit varied with the sample size. Generally, the larger the injection size the greater the sensitivity. However, peaks for compounds of interest were kept within the linear range of the analytical equipment. If any compound had a high concentration, it was necessary to use small injections, and in some cases to dilute the sample to keep it within linear range. This procedure may have caused increased detection limits for other compounds in the analyses.

During the Southeast Rockford Phase I drilling activities, composite drum samples of RI-generated "waste" and split-spoon soil samples were collected for several types of analyses. Drummed solids and unconsolidated glacial sediments were submitted for chemical analysis to laboratories in the Contract Laboratory Program (CLP), which is administered by the United States Environmental Protection Agency (USEPA). The CLP analyses included Routine Analytical Services (RAS), volatile organic compounds (VOCs), semi-volatile organics, metals, cyanide and polychlorinated biphenyls/pesticides (PCBs/Pest). The analytical protocols can be found in the current CLP Statements of Work, OLM01.0 (also known as 3/90) for organic analyses and (7/88) for inorganic analyses. Selected samples were analyzed for total organic carbon (TOC) using the procedure contained in Appendix C of the QAPP (CDM, 1991). In addition, split-spoon samples of unconsolidated sediments were collected for grain-size analysis and for lithologic purposes.

Groundwater samples were collected from a total of 68 wells during the Phase I field activities. These samples were also analyzed through the USEPA CLP. The semi-volatiles were analyzed using Routine Analytical Services (RAS) protocols specified in the CLP Statement of Work OLM01.0 for organics. The volatile organics, pesticides and inorganics were analyzed using the protocols specified in the Special Analytical Services (SAS) Requests in Appendix C of the QAPP (CDM, 1991). These analyses were performed using protocols that can achieve low quantitation limits to allow for comparison of detected values with applicable drinking water standards.

2.2 FIELD QUALITY CONTROL PROCEDURES

The field quality control procedures for the soil gas survey are described in detail in Appendix B of the QAPP. A minimum of one soil gas duplicate sample was analyzed for every 10 soil gas samples analyzed. In many instances, duplicates were run for every sample due to the necessity of performing serial sample dilution. Field-prepared TCE and 1,1,1-TCA standards were analyzed at the rate of one per five soil gas samples analyzed. An

ambient air sample was analyzed at a minimum of one per 15 soil gas samples. The ambient air sample and analysis functioned as a field blank.

A method blank was analyzed at the rate of one per ten analyzed soil gas samples. The method blank consisted of injecting nitrogen carrier gas into the field gas chromatograph. The method blank served as a check of the chromatograph for contamination derived from routine sampling.

Field quality control procedures for groundwater consisted of the collection and analysis of trip blanks, field blanks, and field duplicates, and samples of water used for decontamination. Field duplicates were collected and analyzed for soil samples. Trip blanks are used to determine whether sample contamination had occurred from sample packaging or shipping. Field blanks serve to reveal possible sample contamination derived from sampling procedures, packaging, or shipping. Field duplicates help to assess the reproducibility of the sampling process and how well the sample represents the environment.

2.2.1 TRIP BLANKS

The liquid trip blanks were prepared by the IEPA CLP laboratory with deionized water and were preserved with hydrochloric acid to a pH <2. The trip blanks were transported to the field and shipped, unopened, with other groundwater samples to the CLP laboratory. Trip blanks are used to check for possible bottle contamination or contamination resulting from packaging and shipping. They were submitted for VOC groundwater samples only, at a frequency of one per cooler as specified in the Sampling and Analysis Plan (SAP; CDM, 1991).

2.2.2 FIELD BLANKS

Field blanks are used to assess whether contamination is introduced to liquid samples by sampling techniques, equipment, ambient field conditions, sample handling, packaging, or shipping.

Field blanks were collected at a frequency of one blank per 10 samples, for a total of seven field blanks. Field blanks were prepared using deionized water supplied in 20-liter plastic bags by VWR Scientific; deionized water for field blanks collected at the industrial facility wells was supplied by Rock Valley Water, Inc. The water was routed through the sampling pump or bailer (after decontamination) that was used for sampling the corresponding monitoring well. Field blanks were filtered and/or preserved in the same manner as the samples.

2.2.3 DECONTAMINATION WATER SAMPLE

One sample was collected of the water used for decontamination of sampling bailers and pumps. The cleaning and initial rinsing of sampling instruments was performed using tap water from the Ken-Rock Community Center near the location of the field trailer. The final rinse of all instruments, except for the sampling pumps, was performed using deionized water; tap water was the final rinse for the interior of the sampling pumps.

2.2.4 FIELD DUPLICATES

To ascertain the reproducibility of data, field duplicates were collected and analyzed for both soil and groundwater samples. Duplicate samples were collected by alternately filling sample containers for each analytical fraction for the sample and then the duplicate. The sample and duplicate were preserved and handled in a like manner. Field duplicates were collected at a frequency of 1 duplicate for every 10 samples for groundwater and drum samples. Due to

poor sample recovery, it was not possible to collect any duplicates for split-spoon soil samples.

2.2.5 SAMPLE HANDLING AND CHAIN-OF-CUSTODY PROCEDURES

Details of the sample handling and chain-of-custody procedures that were followed are outlined in the Final SAP (CDM, 1991), and only a general description is given below. After the analytical samples were collected and preserved as appropriate, they were placed in ice-bearing coolers for the entire time that they remained in CDM's custody. The sample paperwork and sample packaging were done in the CDM field trailer. Sample Traffic Report/Chain of Custody Records were completed and sample tags were affixed to sample containers, which were then placed in coolers with bags of ice and vermiculite packing material. Packing tape was used to seal the coolers and custody seals were secured on the outside with clear tape. Sample coolers were shipped by overnight carrier to the assigned CLP laboratory.

2.3 SOIL GAS SURVEY

A soil gas survey was conducted in the Southeast Rockford Study Area between May 13 and June 6, 1991. CDM procured Tracer Research Corporation (TRC) of Tucson, Arizona to conduct the survey. The soil gas survey was performed to identify areas of soil contamination, and to aid in locating potential contamination source areas in the study area. During the survey a total of 225 soil gas samples were collected and analyzed from six areas within the Southeast Rockford Study Area. Samples were analyzed for 1,1,1-trichloroethane (TCA), trichloroethene (TCE), and tetrachloroethene (PCE). These compounds were chosen for the survey because of their suspected presence in the subsurface soils, and their ability to be easily detected using soil gas technology.

Tracer Research Corporation used a one ton Ford analytical van that was equipped with one gas chromatograph and two Spectra Physics computing integrators. In addition, the van had

two built-in gasoline powered generators that provide the electrical power (110 volts AC) to operate all of the gas chromatographic instruments and field equipment. A specialized hydraulic mechanism consisting of two cylinders and a set of jaws was used to drive and withdraw the sampling probes. A hydraulic hammer was used to assist in driving probes past cobbles and through unusually hard soil. Where there was no van access, sampling probes were hand pounded to depth.

Sampling probes consisted of 7-foot lengths of 3/4 inch diameter hollow steel pipe that were fitted with detachable drive tips. Soil gas probes were advanced to 5 feet below grade.

Once inserted into the ground, the above-ground end of the sampling probes were fitted with a steel reducer and a length of polyethylene tubing leading to a vacuum pump. Gas flow was monitored by a vacuum gauge to insure that an adequate flow was obtained.

To adequately purge the volume of air within the probe, 2 to 5 liters of gas were evacuated with a vacuum pump. During the soil gas evacuation, samples were collected in a glass syringe by inserting a syringe needle through a silicone rubber segment in the evacuation line and down into the steel probe. Ten milliliters of gas were collected for immediate analysis in the TRC analytical field van. Soil gas was subsampled (duplicate injections) in volumes ranging from 1 uL to 2 mL, depending on the VOC concentration at any particular location.

Sample probe vacuums ranged from 1-20 inches Hg. The maximum pump vacuum was measured at 30 inches Hg.

2.4 GROUNDWATER MONITORING WELL DRILLING AND INSTALLATION

The primary objectives of the hydrogeologic portion of the Phase I investigation were to define the local geology and hydrogeology of the study area, to obtain preliminary information on the lateral and vertical extent of the plume of groundwater contamination, and to delineate potential source areas. In order to accomplish these objectives, a total of eleven

monitoring well nests were drilled and installed at various locations across the site. In this section of the Technical Memorandum, we describe the methods and procedures associated with drilling and installing groundwater monitoring wells. In addition to providing general information about the monitoring well nests, this section discusses well development, equipment decontamination procedures, and RI-generated wastes.

2.4.1 GENERAL

During the period June 17 to August 25, 1991, 33 groundwater monitoring wells were drilled and installed at 11 different locations across the site, as shown on Figure 2-1. The actual locations of the installed well nests are similar to the approximate locations given on Table 3-1 and Figure 3-2 of the Final Work Plan (CDM, 1991). Actual nest locations were determined subsequent to approval of the Work Plan based primarily on where property access had been granted and, in some cases, the ease with which locations could be reached by drill rigs and support trucks. Most well nests consisted of three wells, although one location had two wells and another had four. The wells at each nest were screened at different depths and were spaced ten to fifteen feet apart. Each monitoring well was assigned a three-digit number indicating its location and a letter to indicate its relative depth. For example, MW105A is the shallowest well and MW105D is the deepest well at location MW105. Grain size of the sediment or bedrock was the primary criterion used for determining the depth at which well screens were placed. During the initial stages of the field investigation, results of the natural gamma-ray logging were also used to determine the depth of well screen placement; however, the site stratigraphy became better defined as more locations were drilled, and CDM geologists relied mostly on directly observed lithology for guidance in well screen placement. In unconsolidated sediments, silt- and clay-rich intervals were avoided in preference to sand and gravel horizons. In bedrock, well screens were installed in intervals dominated by limestone instead of clay- or shale-rich intervals. The vertical distance between well screens in a given well nest was generally 25 to 60 feet. Subsurface lithologic samples were collected with split-spoon samplers at five-foot intervals

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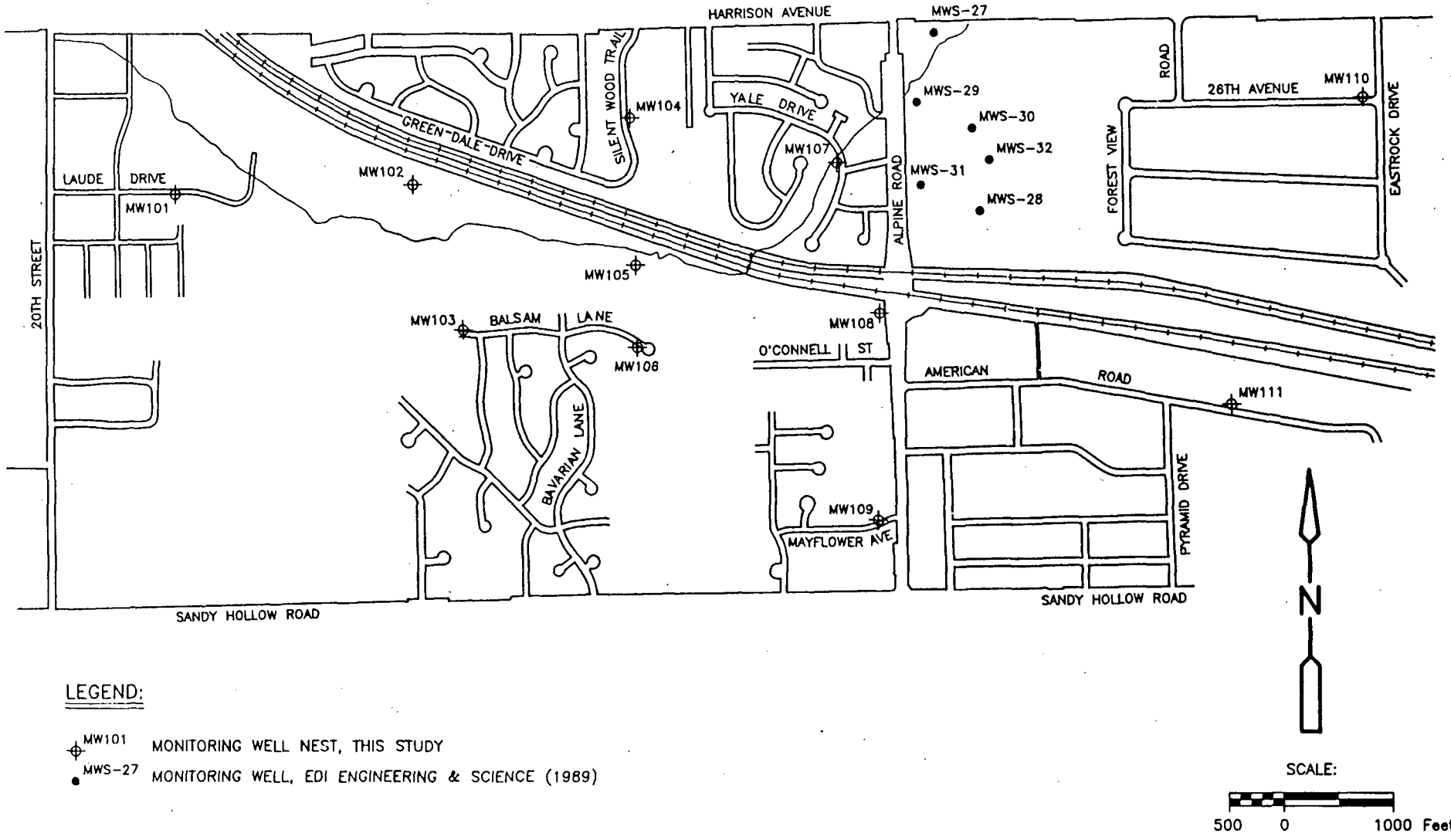


SOUTHEAST ROCKFORD

LOCATION MAP OF PHASE I
MONITORING WELL NESTS

CDM
environmental engineers, scientists,

Figure No. 2-1

below the water table in unconsolidated sediments; drill cuttings were also examined. In bedrock, lithologic samples consisted of cuttings emanating from the borehole, collected at one-foot intervals.

A total of 18 groundwater monitoring wells were installed in unconsolidated sediments and 15 were installed in bedrock. All of the wells were drilled and installed by John Mathes and Associates of Columbia, Illinois under the supervision of CDM geologists. Key information about the Phase I monitoring wells is summarized on Table 2-1. Additional details can be found in the Field Notes (Appendix B) and on the Monitoring Well Construction Summary Sheets (Appendix C).

2.4.2 DRILLING METHODS

Three different drilling methods were used to penetrate the unconsolidated sediments and limestone bedrock: hollow-stem auger, mud rotary, and air rotary. In general, hollow-stem auger (HSA) and mud-rotary techniques were used in unconsolidated sediments and the air-rotary technique was used for drilling in bedrock. Mud rotary was used to set steel casing for bedrock wells, as described below. All HSA drilling was done with a Central Mine Equipment Model 75 (CME 75) rig, and all air-rotary and most of the mud rotary drilling was done with a Gus Pech Model 22R (GP 22R) rig; some mud rotary drilling was also done using the CME 75. Additional details can be found in Appendices C and D.

Hollow-Stem Auger Method. The hollow-stem auger method and CME 75 drill rig were used for each of the 18 monitoring wells drilled in unconsolidated sediments, as well as for setting steel casings for some of the bedrock wells that were subsequently completed with the GP 22R using the air-rotary technique. The drilling of wells in unconsolidated sediments involved using a center bit inside augers with a 4.25-inch inside diameter (ID) and no drilling fluids. This drilling method proved useful down to depths of 150 feet, although the rate of penetration and overall drilling progress were noticeably slower at such depths. HSA drilling

TABLE 2-1. SUMMARY DATA FOR PHA I GROUNDWATER MONITORING WELLS

Well Number	Date Completed	Borehole Depth (feet)	Depth to Base of Screen (feet)	Aquifer Screened	Elevation of Top of Casing (feet)	Elevation of Ground Surface (feet)
MW101A	6/28/91	90	88	unconsolidated	765.62	764.07
MW101B	6/27/91	151	150.1	bedrock	766.62	764.06
MW102A	6/24/91	56.5	35	unconsolidated	788.43	786.47
MW102B	6/25/91	100	98	unconsolidated	788.61	786.60
MW102C	8/08/91	185	184.3	bedrock	789.87	787.68
MW103A	7/01/91	44.5	41	unconsolidated	792.56	790.49
MW103B	7/17/91	76	75	bedrock	792.39	790.36
MW103C	7/17/91	110.9	107.9	bedrock	792.35	790.21
MW104A	7/23/91	77.5	77	unconsolidated	818.10	815.94
MW104B	7/15/91	124	121.9	bedrock	817.37	815.22
MW104C	7/01/91	146.5	146	bedrock	818.25	816.09
MW105A	7/16/91	34	22	unconsolidated	785.57	783.31
MW105B	7/27/91	57	54	unconsolidated	785.78	783.58
MW105C	7/27/91	104	95	unconsolidated	785.66	783.52
MW105D	8/24/91	158	156.8	bedrock	786.21	784.09
MW106A	6/30/91	40.5	40	unconsolidated	805.71	803.70
MW106B	8/12/91	88	86.4	bedrock	805.52	803.59
MW106C	8/12/91	120.5	119.4	bedrock	805.40	803.38
MW107A	7/14/91	38.5	38	unconsolidated	808.86	809.29
MW107B	7/13/91	69	66	unconsolidated	808.87	809.28
MW107C	7/31/91	142	140.4	bedrock	808.70	809.16
MW108A	7/15/91	40	39	unconsolidated	824.90	823.00
MW108B	7/15/91	64	61	unconsolidated	824.93	822.88
MW108C	7/27/91	137	134.3	bedrock	825.16	823.06
MW109A	6/28/91	32.5	32	unconsolidated	850.89	848.68
MW109B	7/23/91	61	60	bedrock	850.47	848.51
MW109C	7/23/91	86	85	bedrock	850.47	848.37
MW110A	7/17/91	43	40	unconsolidated	846.65	844.16
MW110B	8/14/91	76.5	71.3	unconsolidated	846.18	844.06
MW110C	8/21/91	115	111.4	bedrock	846.24	844.18
MW111A	6/27/91	37	35	unconsolidated	832.84	830.71
MW111B	6/26/91	59	58	unconsolidated	832.44	830.67
MW111C	8/10/91	99	97.3	bedrock	833.26	830.65

TABLE 2-2

ILLINOIS STATE WATER SURVEY

ROCKFORD MONITORING WELL DATA

Well #	Location Description	X	Y	Depth (ft)	Date Drilled	8/91 WLE	9/91 WLE	10/91 WLE	12/91 WLE	1/92 WLE	2/92 WLE
MW1	Keye–Mallquist Park	796480	2035051	87.5	11/87						
2	Keye–Mallquist Park	796480	2035051	52.5	11/87	695.6	695.18	695.16	695.61	696.22	696.5
3	Peterson School	795088	2033348	92.5	11/87						
4	Peterson School	795088	2033348	52.5	11/87	695.03	694.51	694.49	694.89	695.44	695.68
5	Keye–Mallquist Park	796480	2035051	125							
6	Peterson School	795088	2033348	125							
7	Rockford Well 11	794967	2038610	62.6	10/89	694.74	694.66	694.64	695.5	696.08	696.32
8	10th Ave. Park (@ Unit Well 38)	792798	2037052	32.57	10/89	694.57	694.16	694.18	694.77	695.27	695.46
9	Kenrock Park (@ Unit Well 35)	795693	2028467	49.88	10/89	696.89	696.57	696.49	696.55		696.9
10	Rockford Well 6	801215	2034859	22.3	10/89	781.53	781.7	782.11	785.75	780.96	779.9
11	Swan Hillman School	806574	2029396	25.39	10/89						
12	Rock River School	791830	2030071	57.55	10/89	692.53	692.13	692.11	693.14	693.21	693.14
13	S. of 24th Dead End, N. of Wesleyan	801536	2033798	96.08	7/90	714.72	714.34	714.28	713.95	714.11	714.16
14	Jacqueline Dead End	803710	2027629	25.03	7/90						
15	W. of 18th, N. of Alton	799728	2030420	51.48	7/90	705.43	705.11	705	704.79	704.79	704.93
16	E. of Kinsey, N. of Drainage Canal	796862	2029806	47.78	7/90	698.91	698.6	698.47	698.45	698.65	698.8
17	E. of Cannon, S. of Drainage Canal	797586	2030063	45.28	7/90	700.17	699.88	699.76	699.68	699.89	699.99
18	W. of 18th on Wills dead end	799728	2029670	73.9	7/90	706.75	706.42	706.31	706.08	706.04	706.18
19	E. of 15th, S. of 23rd	798506	2032425	49.53	7/90	698.86	698.43	698.35	698.44	698.73	699.07
20	W. of 9th, S. of Harrison	795130	2030838	53.6	7/90	694.61	694.15	694.09	694.52	694.97	695.07
21	E. of 11th, N. of Drainage Canal	796539	2029346	46.68	10/90	698.75	698.46	698.35	698.33	698.6	698.62
22	W. of Marshall, N. of Drainage Canal	798104	2030629	45.5	10/90	700.63	700.32	700.21	700.08	700.23	700.41
23	W. of 20th, S. of Harrison Ave.	800378	2030902	60.44	10/90	709.77	709.46	709.35	709.14	709.03	709.16
24	St. Edwards School	797122	2028090	42.88	10/90	700.71	700.46	700.36	700.18	700.23	700.36
25	Rock River Water Reclamation District	792145	2025425	40.24	10/90	689.87	689.67	689.6	691	690.74	690.6
26	Sawyer Playground	799441	2027008	72.27	10/90	706.55	706.15	703.11	705.77	705.62	705.99
27	E. of Horton, S. of Reed	798677	2028982	61.88	10/90	704.14	703.84	703.75	703.51	703.43	703.65
28	W. of 18th on Reed dead end	799723	2029000	99.34	10/90	707.52	707.17	707.08	706.86	706.72	706.95
29	Ken–Rock Park (@ Unit Well 35)	795675	2028463	36.86	10/90	696.88	696.58	696.48	696.54	696.81	696.88
30	E. of 9th, N. of Wills	795238	2029682	50.32	10/90	694.69	694.26	694.18	694.55	694.95	695.04
31	E. of Kinsey, N. of Drainage Canal	796862	2029806	62.48	5/91	698.92	698.63	698.5	698.47	698.66	698.83
32	SE corner of Horton & Alton	793601	2030321	49.98	5/91	701.77	701.48	701.35	701.2	701.33	701.49
33	NW corner of Horton & Wills	793183	2029714	46	5/91	700.91	700.64	700.51	700.34	700.48	700.65
34	NW corner of Marshall & Wills	797914	2029724	44.61	5/91	700.68	700.38	700.26	700.12	700.26	700.42
35	NE corner of Cannon & Wills	797487	2029714	44.79	5/91	700.27	699.99	699.87	699.69	699.89	700.05
36	E. of Cannon, S. of Reed	797506	2028958	49.84	5/91	700.72	700.47	700.35	700.19	700.3	700.44
37	W. of Hanson, N. of Wills	797158	2029714	44.24	5/91	699.53	699.23	699.11	699.06	699.21	699.37
38	E. of Kinsey, between Alton and Harrison	796830	2030660	48.9	5/91	697.35	696.95	696.84	696.98	697.3	697.48
39	W. of Lapey, between Wills and Alton	796103	2029963	50.97	5/91	696.7	696.3	696.2	696.39	696.69	696.84

TABLE 2-2 (Continued)
ILLINOIS STATE WATER SURVEY
ROCKFORD MONITORING WELL DATA

Well #	Location Description	X	Y	Depth (ft)	Date Drilled	8/91 WLE	9/91 WLE	10/91 WLE	12/91 WLE	1/92 WLE	2/92 WLE
MW40	NE corner of 8th & Alton	794560	2030311	65.5	5/91	693.93	693.49	693.44	693.96	694.36	694.4
41	NE corner of 8th & Alton	794560	2030311	85.44	5/91	693.92	693.49	693.43	693.96	694.35	694.41
42	NW corner of 10th & Alton	795745	2030351	53.8	5/91	695.26	694.81	694.73	695.06	695.49	695.62
43	Short 4th dead end	792947	2031287	81.42	5/91	693.46	693.01	692.97	693.55	694.01	694.04
44	E. of Horton on Wills dead end	798581	2029674	52.38	5/91	702.28	702.01	701.88	701.68	701.79	701.93
45	E. of Horton on Wills dead end	798581	2029674	72.4	5/91	702.68	702.4	702.27	702.07	702.18	702.32
46	E. of S. 5th, N. of Park (Rkfd Products)	793157	2030401	75.12	5/91	693.32	692.9	692.85	693.49	693.83	693.85
47	Brooke between Kishwaukee and Foley	792261	2028182	54.94	5/91	691.83	691.49	691.45	692.28	692.51	692.43
48	SE corner of Lapey & Harrison	796163	2030899	50.35	5/91	695.57	695.09	695.02	695.34	695.78	695.98

without the aid of drilling fluids was not used in bedrock. Most of the split-spoon soil samples were collected during HSA drilling.

The HSA method with 8.25-inch augers was used to set casing at locations where bedrock was within about 50 feet of the surface (e.g., MW103, 106, and 109). Using the CME 75 drill rig to turn 8.25-inch augers in unconsolidated sediments proved difficult and time consuming at depths significantly greater than 50 feet; however, where bedrock was less than about 75 feet deep, it was more efficient for the CME 75 to drill and set the well casing in bedrock because the GP 22R required longer set up time. The larger borehole provided by the 8.25-inch augers was necessary so that 6-inch steel casing for the bedrock wells could be properly set. Typically, no drilling fluid was used to advance the borehole through the unconsolidated material down to bedrock, but once bedrock was encountered it was necessary to switch to the mud rotary technique in order to advance the borehole a few more feet before casing was set. Installation of steel casing is described in Subsection 2.4.3, *Well Construction and Installation Methods*.

Mud-Rotary Method. The mud-rotary drilling method was used to drill through unconsolidated sediments and as much as five feet into the underlying limestone prior to setting casing for the bedrock wells. This method, which was used by both drill rigs, involved the circulation of drilling mud down to the drill bit and back up to the surface. The circulation of drilling mud promoted faster penetration rates in both unconsolidated sediments and bedrock by removing drill cuttings from the borehole. At locations MW104 and MW109, repeated loss of mud circulation during bedrock drilling was a problem. This problem was overcome by adding oat hulls to the drilling mud to help seal off the bedrock porosity. After the borehole was drilled to the proper depth, water was used to flush the hole before the steel casing was seated and the annular space grouted with bentonite slurry.

Air-Rotary Method. Air-rotary drilling was used to advance the borehole in bedrock for the 15 monitoring wells that were installed in bedrock. This method circulates pressurized air

down the drill rods and up the open hole. The air serves to cool the bit and remove drill cuttings and water from the borehole. The water and cuttings were then collected at the surface in a large tub and shoveled into drums.

2.4.3 WELL CONSTRUCTION AND INSTALLATION METHODS

Groundwater monitoring wells were constructed and installed according to the specifications given in the Final Work Plan and SAP (CDM, 1991). Each monitoring well was constructed with 2-inch diameter riser pipe, well screen, vented cap, and bottom plug, all of which were made of Type 304 stainless steel. The riser pipe sections were flush-threaded and the threads were wrapped with Teflon tape during installation to inhibit leakage. The well screens were 10 feet long, continuously wound, and had a slot size of 0.010 inches. Coarse silica sand (sieve numbers 20-40) was emplaced from about 1 feet below the bottom plug up to 2 to 3 feet above the top of the well screen. A 1- to 2-foot thick fine silica sand (sieve no. 100) filter collar was installed next, followed by a bentonite seal (Volclay^R or PureGold^R) that was tremmied from the top of the fine sand to 3 feet below the ground surface. The remaining annular space was filled with concrete and a 5.5-inch diameter protective casing with a locking cap was installed to ensure the integrity of the well.

The protective metal casing was 5 feet long and extended several inches above the top of the riser pipe, which typically extended 2 to 3 feet above ground. The protective casing was filled with pea gravel to a few inches below the top of the riser pipe and two small drainage holes were drilled in the casing a few inches above the ground. A square concrete apron measuring approximately 2 feet on a side was installed around the protective casing. The apron was sloped radially away from the concrete plug surrounding the protective casing and was separated from it by a joint designed to minimize the effects of frost heave. Protective steel bumper posts were installed around the well nests. All but one of the eleven well nests had protective casings and bumper posts as described above.

Because MW107 was located in a residential front yard, flush-mount assemblies were used instead of protective casings and bumper posts. The riser pipe extended to about six inches below ground surface and a manhole-type assembly requiring a special opener was installed so that it was flush with the ground surface. The riser pipe was fitted with a vented cap that was secured with a metal bar and lock. A small concrete apron sloped radially away from the flush-mount assembly.

Six-inch steel casing was used in the bedrock monitoring wells to avoid potential cross-contamination between the aquifer in the unconsolidated glacial sediments and the bedrock aquifer. In the bedrock wells, the borehole was first advanced a few feet into bedrock until competent limestone was encountered. The casing was then lowered into the hole and grouted. The grout was allowed to harden for about 15 hours before advancing the borehole with air-rotary drilling. Installation and construction of the bedrock wells was the same as for wells in unconsolidated sediments, except that bedrock wells had 6-inch casing from near the top of bedrock to a few inches below the top of the protective well casing. Monitoring well construction logs are provided in Appendix C.

2.4.4 MONITORING WELL DEVELOPMENT

New monitoring wells were developed between July 26 and August 27, 1991. The method used for developing monitoring wells was dual-line air lift. The development tool consisted of two metal pipes welded together side-by-side. The smaller of the two pipes (the air pipe, with I.D. of approximately 1/4 inch) was also shorter (approximately 2 feet) and fed into the larger metal pipe through a hole cut into the side of the larger pipe, approximately 1 foot from the base. The larger pipe (I.D. approximately 5/8 inches) served as the conduit for water emerging from the formation. Rubber hoses were affixed to both pipes and the assembly was inserted into the well, to the depth of the screened interval. An air compressor was used to supply air through the smaller pipe. Upon entering the larger pipe, the air subsequently moved upward through the larger pipe and hose and back to the surface. (The configuration of the development tool prevented air bubbles from entering the formation).

2.7 HYDRAULIC CONDUCTIVITY TESTING

Hydraulic conductivity testing was performed by CDM personnel from August 26 through 29, 1991. As discussed in the SAP (CDM, 1991), the water level in the well was depressed by the use of air pressure. The set-up that was devised enabled the water level to be depressed by 10 to 15 feet. Constant air pressure was applied until the transducer indicated that the water level in the well had stabilized. Upon turning off the air pressure, the water level in the well recovered in a roughly exponential manner to the equilibrium level that prevailed before applying pressure. Three tests were conducted at each well in order to provide a reliable estimate of hydraulic conductivity. Test results from each well show that recovery times for the water levels were similar for the three tests performed at individual wells.

2.8 WELL SURVEYING

Harold P. Wendler and Associates of Dixon, Illinois conducted site surveying for CDM. Surveying occurred from August 29 to September 24, 1991 and included both vertical and horizontal control. At each well nest location, the elevation of the top of casing and of the ground were surveyed for each well using mean sea level as the datum. Horizontal positions for each well and for intermediate points were determined using an assumed coordinate system that began at the intersection of Sandy Hollow Road and 20th Street. Both vertical and horizontal controls were given to the nearest 0.01 foot. Complete results of the well surveying are given in Appendix G.

2.9 GEOPHYSICAL LOGGING

Wooddell Logging, Inc. (Mattoon, Illinois) conducted geophysical logging of the boreholes for CDM during July and August 1991. The natural gamma-ray logging method was used to log the deepest well at each well nest location. Logging was done after the monitoring wells were completely installed (i.e., after grouting of the annular space), with the exception of

MW105D, where the open borehole was logged from a depth of 139 feet to the end of the boring. The gamma-ray logs were only marginally useful, probably because of the grout filling the 12-inch annular space created by drilling a hole large enough to admit the 6-inch I.D. outer casing. In addition, drilling mud penetrated some distance farther out into the formation. Both the grout and drilling mud contain potassium; their presence will be detected by the gamma-ray detector, thereby strongly masking the contrast in response from clay units compared to sand units. The presence of a thick zone of grout and drilling mud adjacent to the well therefore limited the usefulness of the gamma-ray logs. As a result, the gamma-ray logs are not included in the report.

3.0 RESULTS OF HYDROGEOLOGIC INVESTIGATION

This section of the Technical Memorandum presents and interprets the findings of the Phase I hydrogeologic investigation. The field methods and procedures used to obtain the results have been described in preceding sections.

3.1 GEOLOGY

3.1.1 STRATIGRAPHY OF THE STUDY AREA

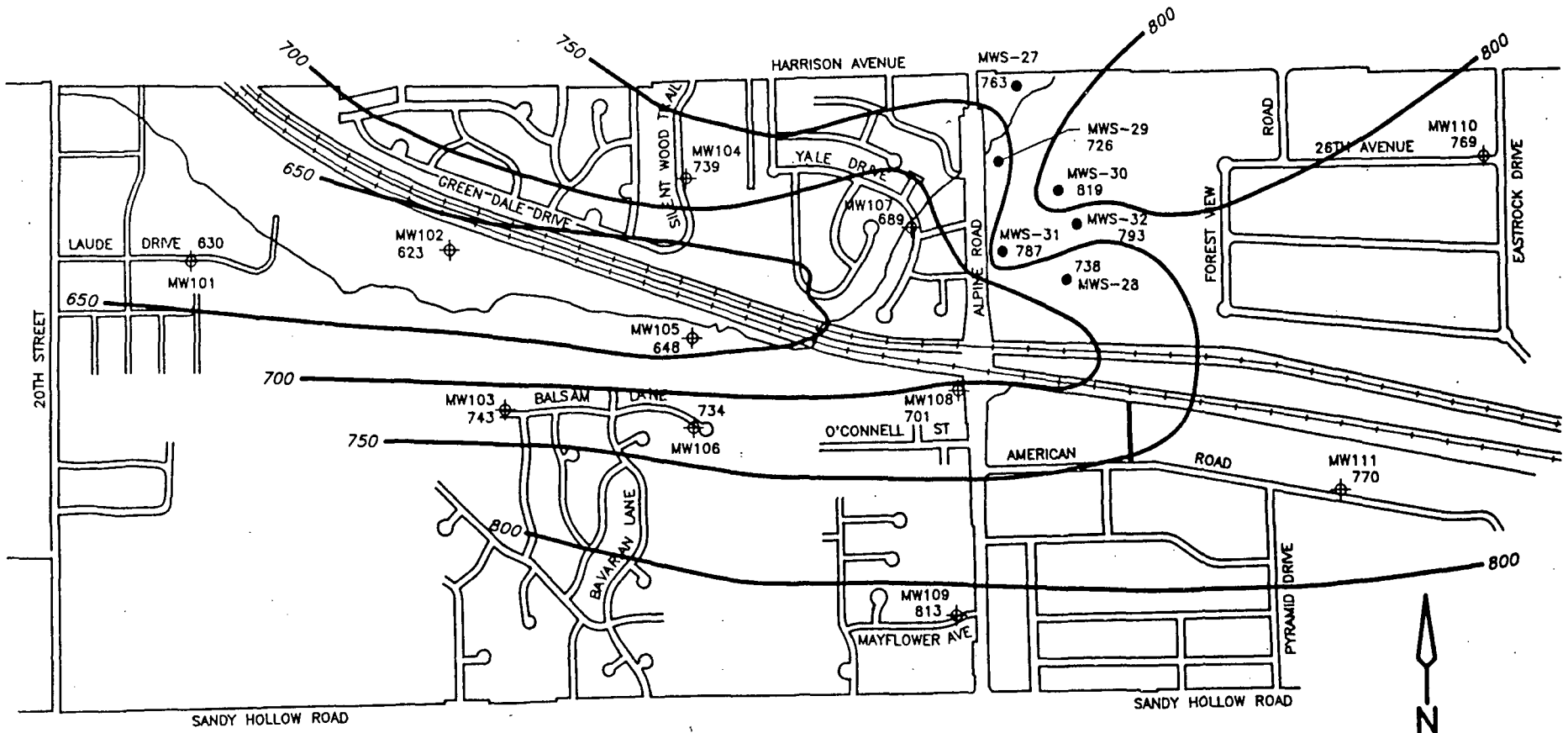
The stratigraphy of the study area consists of bedrock with locally significant subsurface relief that is overlain by unconsolidated glacial sediments of variable thickness. Stratigraphic observations were made during borehole drilling and recorded in a field log book.

Bedrock

Bedrock within the eastern portion of the study area (east of 20th Street) was predominantly tan to brown dolomite with variable but small amounts of chert and shale-rich horizons. The chert fraction of the drill cuttings was generally less than 5 to 10 percent and usually white or light gray. Shale was frequently brown and usually constituted less than 10 percent of the cuttings; small amounts of pale green shale were also observed. The observed lithology of the drill cuttings is consistent with the general description of the Galena Group (Ordovician) given by other workers and with the known areal extent of this stratigraphic unit in the Rockford area (Willman and Kolata, 1978). Distinctive clay units occur within the Galena Group and in the underlying Platteville Group (Willman and Kolata, 1978). These clay beds are bentonites that formed from the alteration of volcanic ash deposited during the Ordovician. Bentonite beds were not identified during Phase I drilling because the units are thin (generally less than 2 inches) in northern Illinois (Willman and Kolata, 1978) and a mineralogical analysis of the clay minerals is needed for proper identification.

Porous zones, described as vuggy, are common throughout the Galena Group (Willman and Kolata, 1978). Vugs are voids in the rock that are larger than one-quarter inch. Although it was not possible to determine the presence of distinct vuggy zones from drill cuttings, it is possible that vugs or vuggy horizons were responsible for the occasional loss of drilling fluids and grout because of the greater porosity and permeability expected in these zones. Fractured zones, which could also be responsible for the loss of drilling fluids, could not be observed during drilling. Although fractured zones were not discussed by Willman and Kolata (1978), such zones could be of local importance (Kolata, personal communication).

Vuggy or fractured zones could be present at or near the bedrock surface or within deeper portions of bedrock. At MW108, loss of grout occurred in the gravelly zone above bedrock. At MW103 and MW109, loss of either drilling mud or grout was encountered in the top 10-20 feet of bedrock. At greater depth in the bedrock at MW103 and MW104, grout loss occurred approximately 50-55 feet below the bedrock surface during well installation. In addition, at location MW104 a localized solution zone containing impermeable, fine-grained sediment was encountered during air-rotary drilling in bedrock. In the depth interval 80 to 100 feet, drill cuttings were predominantly (typically 70-90% by visual estimation) brown, silty/clayey sediment occupying solution cavities in bedrock; bedrock at MW104 is approximately 77 feet deep. Rapid advancement of the drill bit from 80 to 100 feet was accompanied by marked decrease in the volume of groundwater exiting the borehole. In fact, water was added to facilitate drilling. This solution zone was not encountered in a borehole located twelve feet away, suggesting very localized extent of the solution feature. The lack of water indicates that the fine-grained material in the solution cavities is relatively impermeable. Vugs or fractures within bedrock are the most likely explanation for intervals of greater permeability. It should be noted that the three locations (MW103, 108, and 109) at which high permeability zones were encountered near the bedrock surface are located on the flanks of the bedrock valley shown on Figure 3-1. High permeability zones near the bedrock surface could be related to a weathered zone formed during past exposure at the surface before the overlying glacial sediments were deposited.



LEGEND:

MW101 630 — BEDROCK ELEVATION, THIS STUDY

MWS-30 819 — BEDROCK ELEVATION, EDI ENGINEERING & SCIENCE (1989)

650 — BEDROCK ELEVATION CONTOUR

SCALE: 500 0 1000 Feet

ALL ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL

SOUTHEAST ROCKFORD

SUBSURFACE BEDROCK TOPOGRAPHY

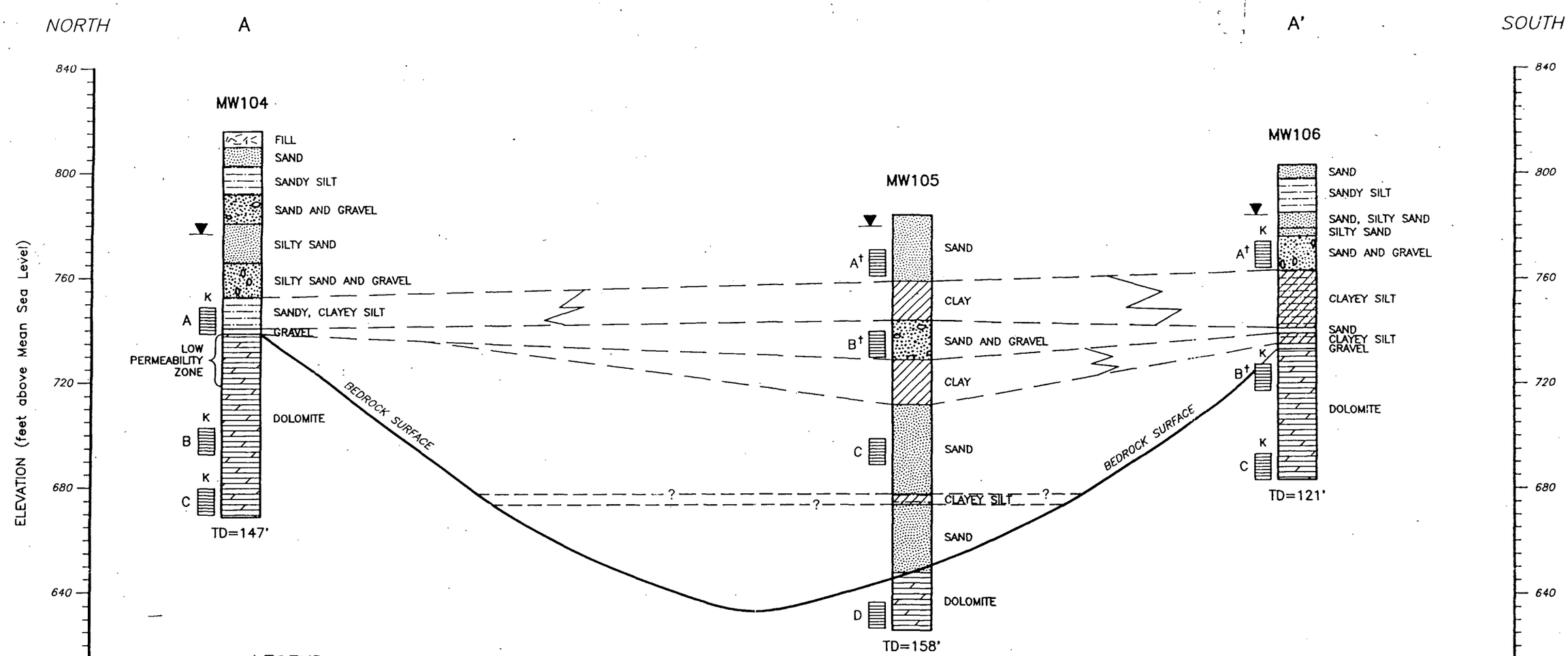
CDM
environmental engineers, scientists, planners, & management consultants

Figure No. 3-1

The subsurface topography of the top of bedrock is shown on Figure 3-1. This figure is largely based on depth to bedrock data obtained during Phase I drilling. The overall shape of the bedrock surface is that of a narrow, east-west valley that deepens toward the west. Two smaller valleys appear to join west of Alpine Road to form the main valley. Maximum observed relief is approximately 190 feet (between MW102 and MW109); the main bedrock valley is about 85 to 90 feet deep between MW104 and MW106 (Figure 3-1). Bedrock elevations from another study (EDI Engineering and Science, 1989) were used to help place the contour lines east of Alpine Road (Figure 3-1). Unconsolidated glacial sediments have filled in the bedrock valleys and buried the entire bedrock surface within the study area.

Unconsolidated Glacial Sediments

A variety of unconsolidated glacial sediments, ranging from silt and clay units to sand and gravel units, are found within the study area. These units are laterally discontinuous over short horizontal distances and vary in thickness between well nest locations, as shown by the cross sections on Figures 3-2, 3-3, and 3-4. For example, the two significant clay layers at MW105 do not exist at either MW104 or MW106, a short distance away (Figure 3-2). These clay units probably pinch out to the north and south, although the upper clay unit may grade laterally into the clayey silts at MW104 and MW106. Similarly, the 15-foot thick sand and gravel unit between the two clay units at MW105 thins to less than 5 feet at MW104 and MW106. Unconsolidated units within the deeper parts of the bedrock valley abut against the sides of the valley. For example, the clayey silt unit below MW105C (Figure 3-2) probably terminates against the bedrock surface to the south and may extend across to the northern flank of the valley. Parallel to the axis of the bedrock valley, the unconsolidated units typically exhibit lateral changes in thickness, grain size, and proportion of fine-grained sediment. The clay units at MW105 do not extend very far to the east or west, whereas some units, such as the sand and gravel in which MW101A, MW102B, and MW105C are completed, is traceable for greater distances than other units (Figure 3-3). The complex lateral relationships and the limited subsurface control allow for general stratigraphic correlations only. The correlations shown on Figures 3-2, 3-3, and 3-4 are included to

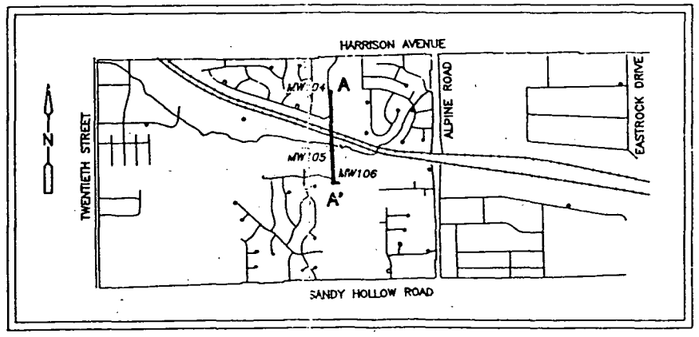


LEGEND:

STATIC WATER LEVEL
MEASURED 9/13/91 IN SHALLOWEST WELL

K
A† MONITORING WELL SCREEN
K INDICATES HYDRAULIC CONDUCTIVITY MEASURED
† INDICATES FEDERAL MCL EXCEEDED

HORIZONTAL SCALE : 1" = 200'
VERTICAL SCALE : 1" = 40'



LINE OF SECTION

SOUTHEAST ROCKFORD

NORTH TO SOUTH GEOLOGIC CROSS-SECTION A-A'

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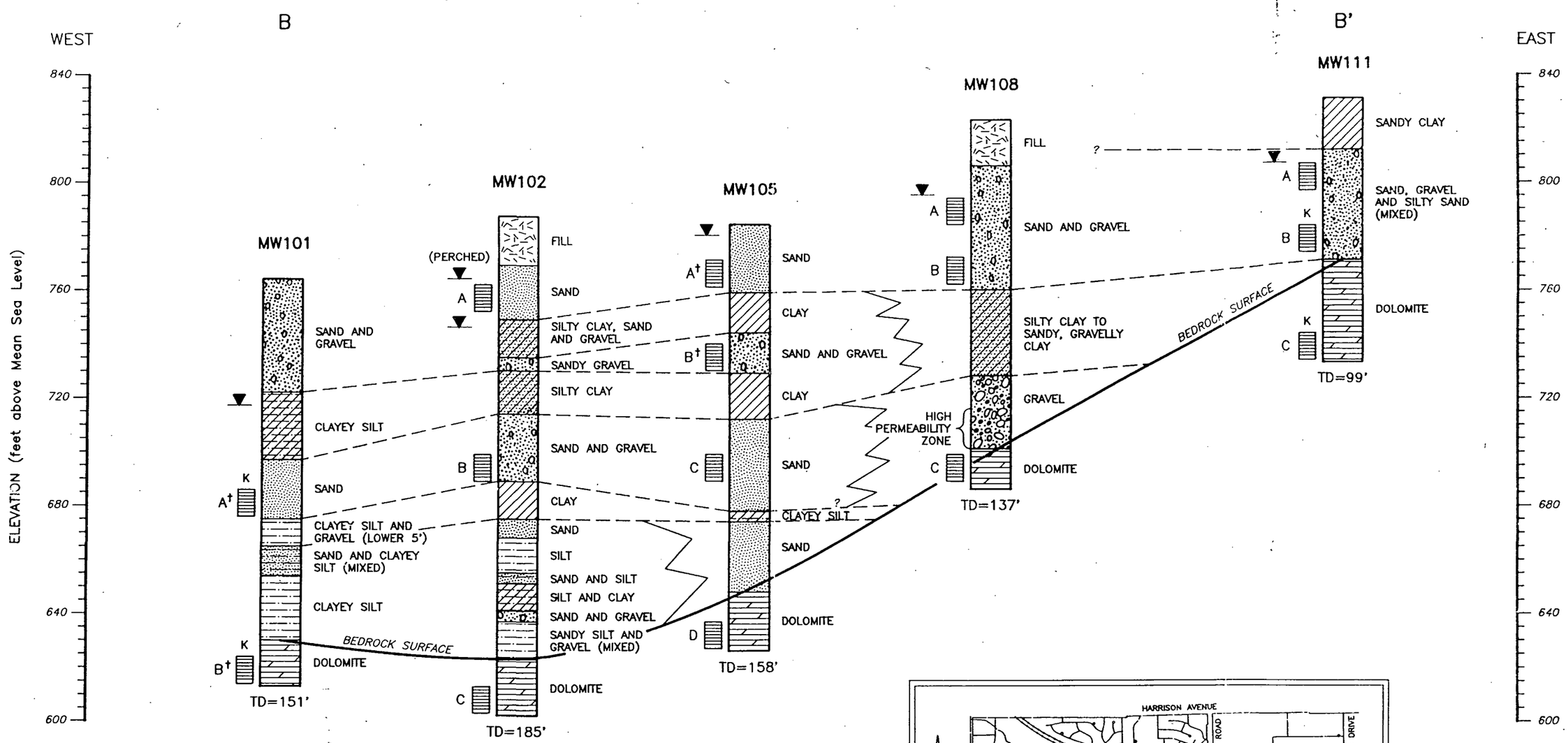
Figure No. 3-2

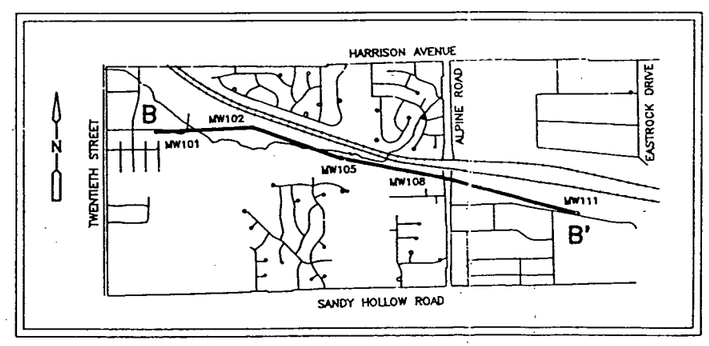


LEGEND:

▼ STATIC WATER LEVEL MEASURED 9/13/91 IN UNCONSOLIDATED SEDIMENTS

K
A† MONITORING WELL SCREEN
K INDICATES HYDRAULIC CONDUCTIVITY MEASURED
† INDICATES FEDERAL MCL EXCEEDED

HORIZONTAL SCALE : 1" = 1000'
VERTICAL SCALE : 1" = 40'



LINE OF SECTION

SOUTHEAST ROCKFORD

EAST TO WEST GEOLOGIC CROSS–SECTION B–B'

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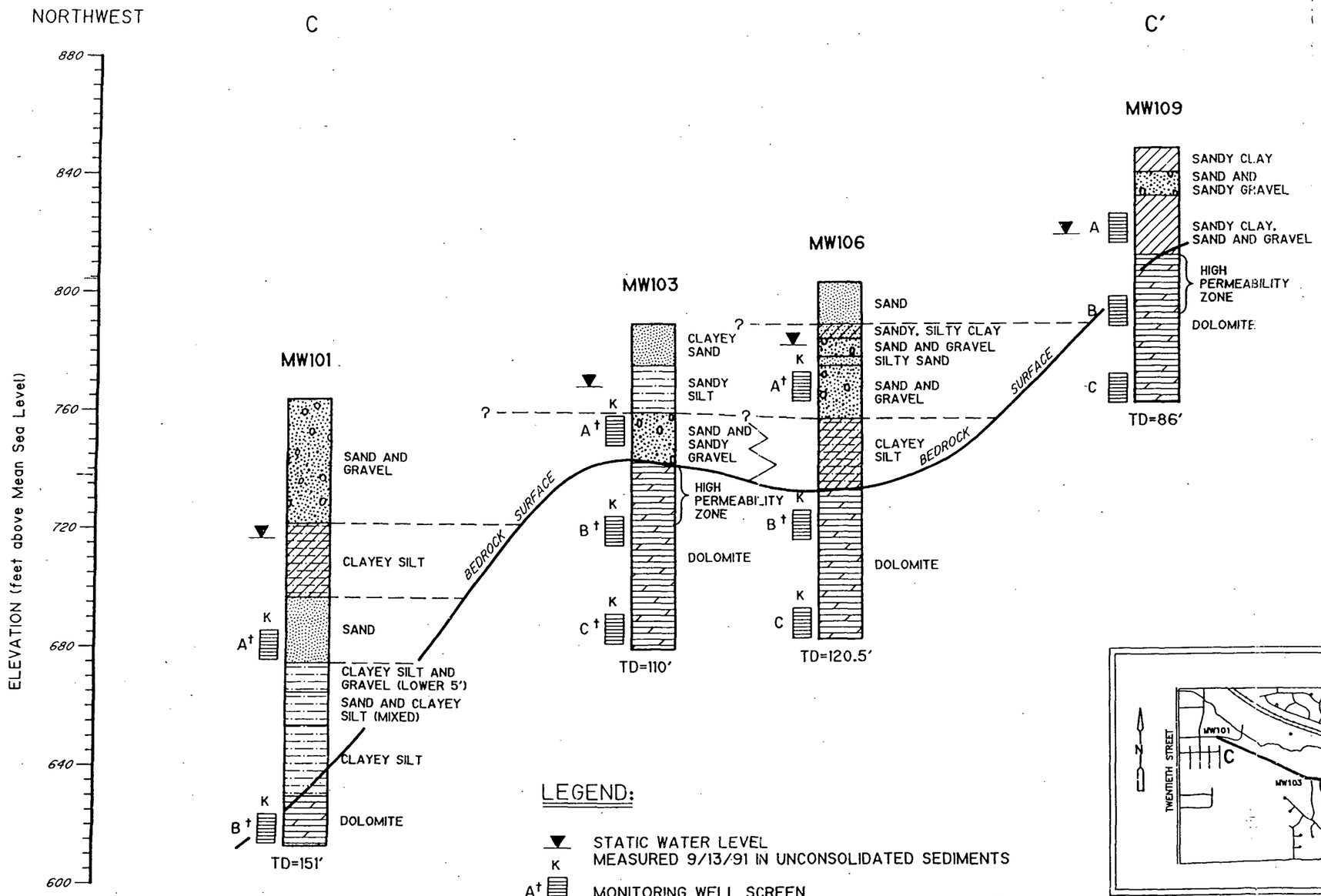
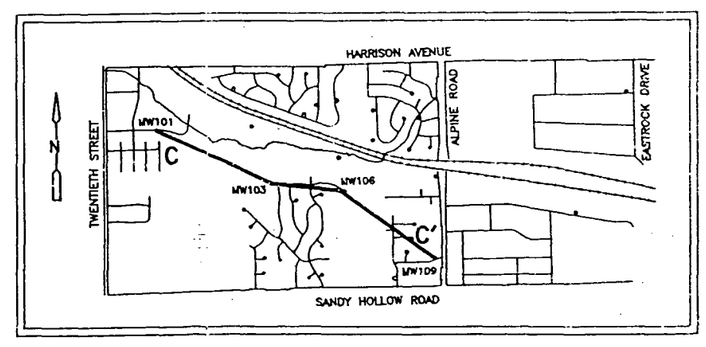
Figure No. 3–3





LINE OF SECTION

SOUTHEAST ROCKFORD

NORTHWEST TO SOUTHEAST GEOLOGIC CROSS-SECTION C-C'

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Figure No. 3-4

illustrate the lateral variations discussed above. Additional boreholes would provide a more refined view of the subsurface stratigraphy.

In the western portion of the study area (west of 20th Street), drilling logs for 17 ISWS wells indicate that sediments down to 85 feet (637 feet elevation, MSL) are predominantly sand and that no clay units are present.

Particle-size analysis of the unconsolidated sediment provides information about the size distribution and the relative amounts of gravel, sand, and silt and clay in the aquifer. Four split-spoon samples of representative aquifer material were sieve analyzed for their particle-size distributions. Results of the particle-size analyses are presented on Table 3-1 and the grain-size curves are given in Appendix F. In general, particle size varies from less than 0.07 mm to approximately 20 mm (0.003-0.8 inches). Sand was the dominant particle size by weight in most samples, except for the sample from MW110, which had roughly equal amounts of sand and gravel. Silt and clay generally composed 10 weight percent of the samples, with the exception of the sample from MW104, which contained 35 percent silt and clay.

Unconsolidated sediments in the Rockford area were deposited in a glacial environment, either subglacially or in a glaciofluvial setting. Poorly sorted, unstratified silt and clay units could have been subglacially deposited. The well sorted, stratified sands and gravels were most likely deposited in a fluvial environment away from the ice margin.

3.2 HYDROGEOLOGY

3.2.1 AQUIFERS

Two groundwater aquifers are identified based on the available lithologic information: one in the unconsolidated glacial sediments and one in the dolomite bedrock. These aquifers will hereafter be referred to as the unconsolidated aquifer and the bedrock aquifer, respectively.

Table 3–1. Particle Size Distribution, Unconsolidated Aquifer

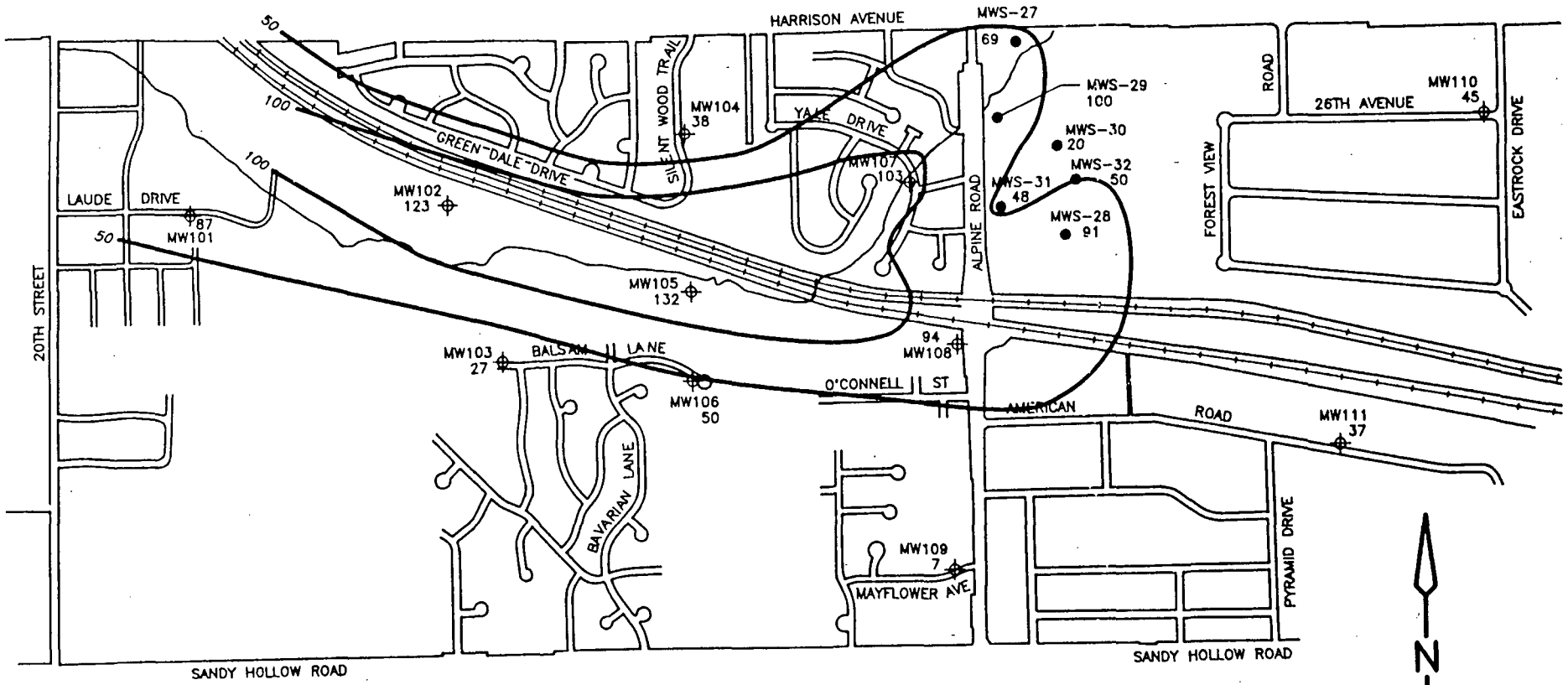
Location	Weight Percent			Description
	Gravel (4.7–20mm)	Sand (0.074–4.7 mm)	Silt and Clay (<0.074 mm)	
MW104	9	56	35	Gray brown clayey SAND, trace gravel
MW105	15	74	11	Gray SAND with gravel, trace clay
MW107	14	77	9	Brown SAND, trace gravel and clay
MW110	49	42	9	Brown gravelly SAND, trace clay

No areally continuous aquitards were encountered in either aquifer, indicating that the unconsolidated and bedrock aquifers are hydraulically connected. Within the unconsolidated aquifer, laterally discontinuous clay layers of significant thickness (15-20 feet) were found, especially in sediments occupying the deeper parts of the buried bedrock valley (e.g. at MW102 and MW105). The clay layers are localized and do not extend across the study area. Locally, clay layers and clay-rich zones probably cause perched water tables, such as at MW102, where there is an 18 foot head difference between the shallow (MW102A) and intermediate (MW102B) depth wells. Although regionally extensive, thin clay-rich horizons occur in the dolomite bedrock (Willman and Kolata, 1978), none were identified in this study. The influence of bedrock vugs or fractures on groundwater flow cannot be assessed using the Phase I data.

The saturated thickness of the unconsolidated aquifer is shown on Figure 3-5. In general, the saturated thickness is greatest in the deeper parts of the bedrock valley and thinnest on the flanks of the valley. Saturated thickness varies from less than 10 feet at MW109 to over 130 feet at MW105. The six data points located immediately east of Alpine Road are the total thickness of the unconsolidated sediment because depth of the water table was not available in these wells; hence, these points represent maximum possible saturated thicknesses.

The concentration of total organic carbon (TOC) in the saturated zone was found to vary with depth in the unconsolidated aquifer (Figure 3-6). In general, TOC values in the predominantly sandy portions of the aquifer were largest near the surface and smaller at depth. At depths less than 50 feet, TOC concentrations were greater than 25,000 mg/kg, whereas below 60 feet the TOC values were less than 6,000 mg/kg. Decreasing TOC with depth suggests that, all other things being equal, less adsorption of groundwater contaminants would occur with increasing depth. TOC data are tabulated in Appendix F.

It should be noted that the TOC concentrations are significantly larger than expected for typical sand and gravel sediments. Typical TOC values are usually less than 5,000 mg/kg



LEGEND:

MW101 87 — SATURATED THICKNESS, THIS STUDY (9/13/91)

MWS-27 69 — MAXIMUM SATURATED THICKNESS, EDI ENGINEERING & SCIENCE (1989)

— 50 — SATURATED THICKNESS

THICKNESS IN FEET

SCALE: 500 0 1000 Feet

SOUTHEAST ROCKFORD

ISOPACH MAP OF SATURATED UNCONSOLIDATED SEDIMENTS

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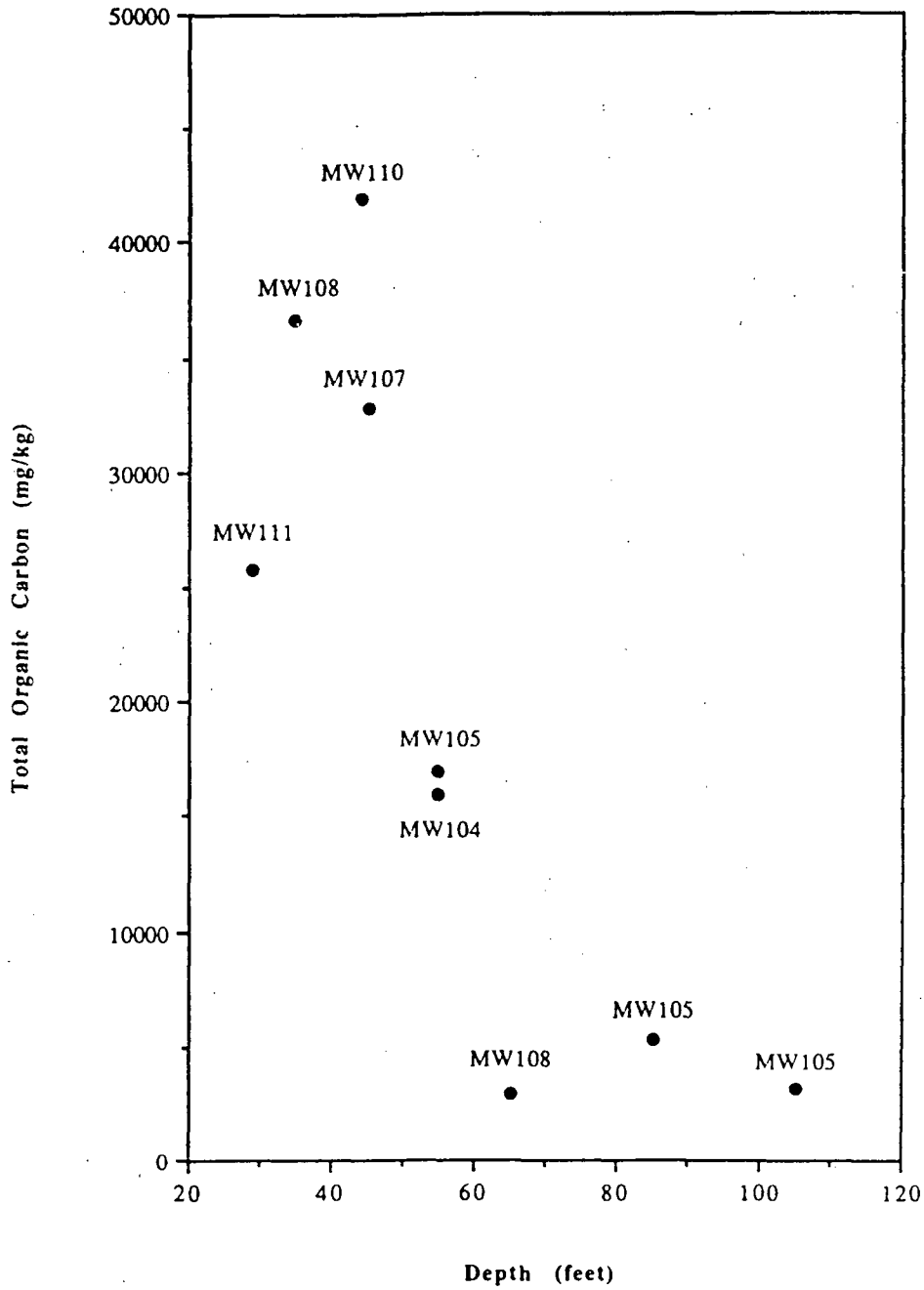
Figure No. 3-5



SOUTHEAST ROCKFORD

TOTAL ORGANIC CARBON vs. DEPTH
IN THE UNCONSOLIDATED AQUIFER

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Figure No. 3-6

(e.g., Schwartenbach and Westfall, 1981). The unusually large concentrations in most of the samples probably result from inaccurate laboratory analyses; therefore the Phase I TOC data should be used with caution. Although the absolute TOC concentrations may be inaccurate, the trend of decreasing TOC concentrations with increasing depth is probably still valid.

3.2.2 GROUNDWATER FLOW DIRECTIONS

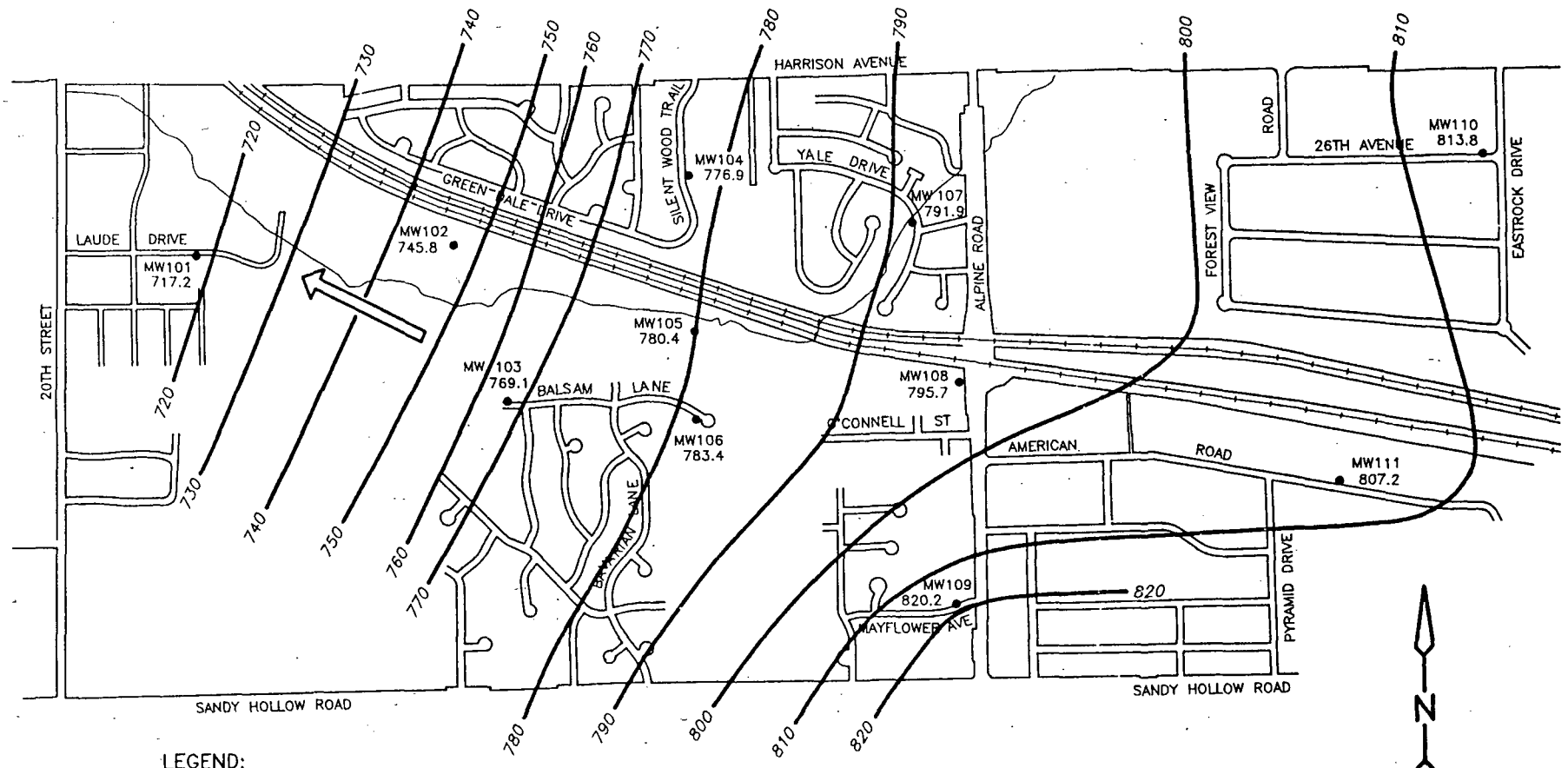
The direction of groundwater flow was determined from water level measurements taken in the monitoring wells. Water level measurements collected through the end of 1991 are summarized on Table 3-2. Water level elevations on September 13, 1991 are contoured on Figures 3-7 and 3-8. In Figure 3-7, elevations for the shallowest wells are plotted, except at location MW102 where the intermediate depth well was used, because of a perched water table at the shallowest horizon. Water level elevations shown on Figure 3-8 are for the deepest bedrock well at each location. The general direction of groundwater flow, which is perpendicular to the contour lines, is to the west in both aquifers. Despite the limited amount of data in the southeast portion of the study area, it appears that a significant north-northwest component of groundwater flow may exist near MW109 and MW111. Additional monitoring wells near Sandy Hollow Road and Pyramid Drive would help resolve this uncertainty.

Closer spacing of the water table contour lines suggest that hydraulic gradients in both aquifers become larger west of Silent Wood Trail and Bavarian Lane (Figures 3-7 and 3-8). East of Bavarian Lane the hydraulic gradients are approximately 0.005 for both aquifers, whereas west of Bavarian Lane they are 0.01 (Table 3-3). The smaller hydraulic gradients east of Alpine Road and south of Harrison Avenue could be influenced by known purge wells in this area (EDI Engineering & Science, 1989). The hydraulic gradient in both aquifers between the eastern edge of the study area and 20th Street is approximately 0.009. Water table elevations in ISWS wells located between 20th and Kishwaukee Streets indicate that the hydraulic gradient is 0.002 in the unconsolidated aquifer (Wehrmann, 1991).

TABLE 3-2. WATER LEVEL DATA FOR PHASE I MONITORING WELLS

Well Number	Elevation of Top of Casing (feet)	8/23/91		9/13/91		11/27/91	
		Depth to Static Water Level (feet)	Elevation of Static Water Level (feet)	Depth to Static Water Level (feet)	Elevation of Static Water Level (feet)	Depth to Static Water Level (feet)	Elevation of Static Water Level (feet)
MW101A	765.62	48.42	717.20	48.43	717.19	48.84	716.78
MW101B	766.62	48.88	717.74	48.89	717.73	49.36	717.26
MW102A	788.43	25.28	763.15	24.40	764.03	23.30	765.13
MW102B	788.61	42.62	745.99	42.82	745.79	43.05	745.56
MW102C	789.87	47.08	742.79	47.40	742.47	48.00	741.87
MW103A	792.56	22.82	769.74	22.92	769.64	23.29	769.27
MW103B	792.39	22.38	770.01	22.50	769.89	22.91	769.48
MW103C	792.35	22.29	770.06	22.41	769.94	22.85	769.50
MW104A	818.10	40.88	777.22	41.19	776.91	42.04	776.06
MW104B	817.37	41.30	776.07	41.69	775.68	42.45	774.92
MW104C	818.25	43.28	774.97	43.64	774.61	44.41	773.84
MW105A	785.57	6.43	779.14	5.15	780.42	4.93	780.64
MW105B	785.78	5.94	779.84	5.68	780.10	5.65	780.13
MW105C	785.66	8.96	776.70	9.05	776.61	9.51	776.15
MW105D	786.21	No Data	No Data	10.09	776.12	10.59	775.62
MW106A	805.71	21.56	784.15	21.99	783.72	22.55	783.16
MW106B	805.52	25.43	780.09	25.68	779.84	26.41	779.11
MW106C	805.40	24.32	781.08	24.60	780.80	25.35	780.05
MW107A	808.86	16.82	792.04	16.96	791.90	17.60	791.26
MW107B	808.87	16.74	792.13	16.88	791.99	17.54	791.33
MW107C	808.70	16.75	791.95	16.95	791.75	17.50	791.20
MW108A	824.90	29.80	795.10	29.47	795.43	30.25	794.65
MW108B	824.93	29.58	795.35	29.23	795.70	30.01	794.92
MW108C	825.16	28.39	796.77	28.48	796.68	29.50	795.66
MW109A	850.89	29.90	820.99	30.65	820.24	30.99	819.90
MW109B	850.47	29.46	821.01	30.19	820.28	30.52	819.95
MW109C	850.47	29.64	820.83	30.37	820.10	30.70	819.77
MW110A	846.65	30.32	816.33	32.87	813.78	33.28	813.37
MW110B	846.18	36.01	810.17	36.82	809.36	38.58	807.60
MW110C	846.24	36.54	809.70	37.29	808.95	39.05	807.19
MW111A	832.84	25.05	807.79	25.66	807.18	26.46	806.38
MW111B	832.44	24.81	807.63	25.37	807.07	26.16	806.28
MW111C	833.26	25.59	807.67	26.15	807.11	26.86	806.40

I:\CAD\1681\3\CG\PPRPT\ FIG3-7 09/30/92 K. HRECZUCH



LEGEND:

MW101 • 717.2 WATER TABLE ELEVATION (9/13/91)

—720— WATER TABLE ELEVATION CONTOUR

⇦ GENERAL DIRECTION OF GROUNDWATER FLOW

SCALE:

500 0 1000 Feet

ALL ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL

SOUTHEAST ROCKFORD

CONTOUR MAP OF WATER LEVEL ELEVATIONS IN UNCONSOLIDATED AQUIFER

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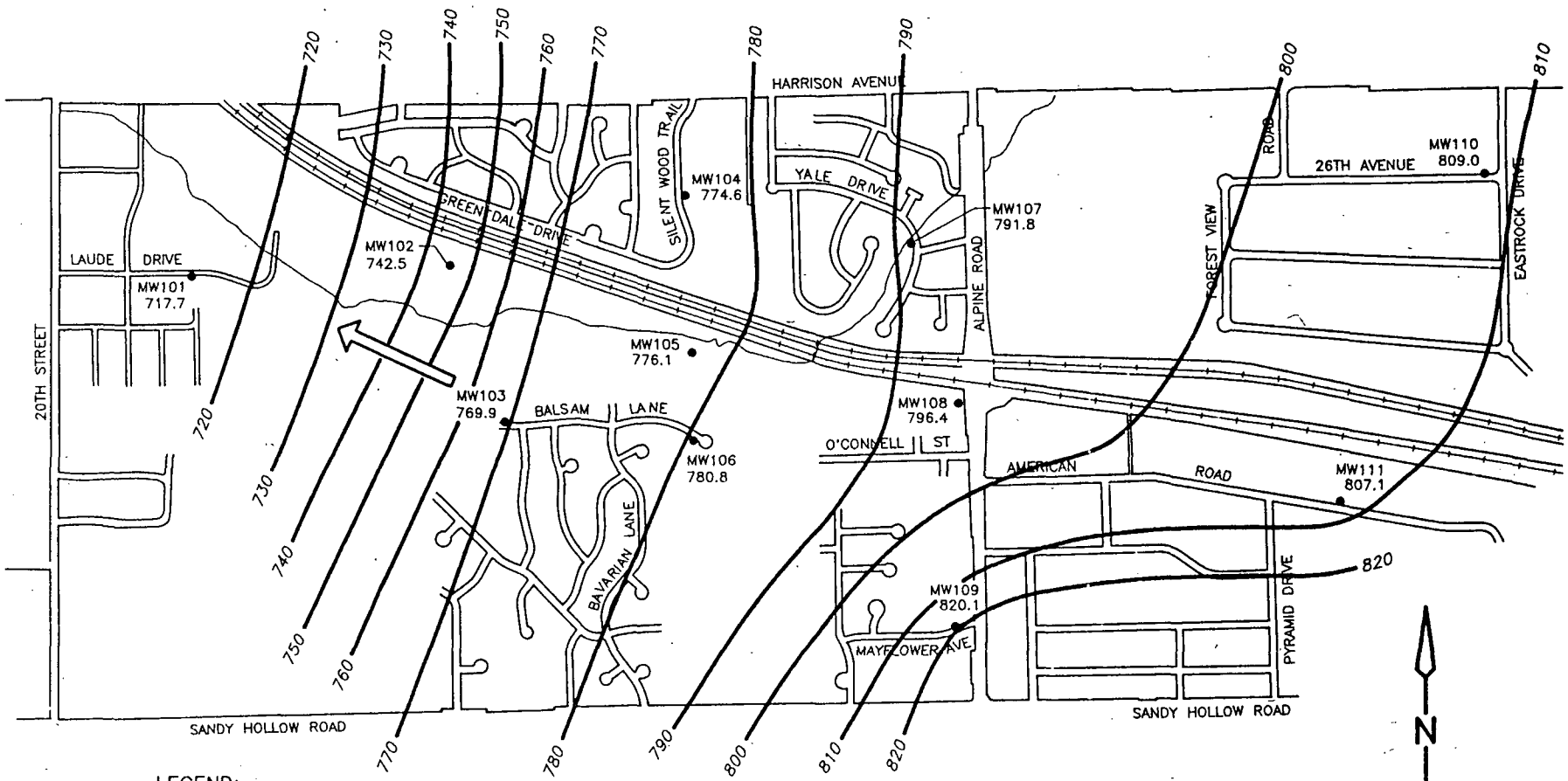
Figure No. 3-7

I:\CAD\1681\3\CG\PPRPT\ FIG3-8 09/30/92 K. HRECZUCH



ALL ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL

SOUTHEAST ROCKFORD

CONTOUR MAP OF WATER LEVEL ELEVATIONS IN BEDROCK AQUIFER

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Figure No. 3-8

Table 3–3. Horizontal Hydraulic Gradients

Unconsolidated Aquifer		Bedrock Aquifer	
Area	Hydraulic Gradient*	Area	Hydraulic Gradient*
East of Bavarian Lane	4.54E-03	East of Bavarian Lane	5.36E-03
West of Bavarian Lane	9.66E-03	West of Bavarian Lane	1.549E-02
Total	8.93E-03	Total	9.31E-03

*Based on water level measurements collected 9/13/91

Vertical hydraulic gradients are present between the unconsolidated and bedrock aquifers, as summarized on Table 3-4. Vertical hydraulic gradients indicate the tendency of groundwater to flow vertically. Downward gradients exist at eight of the eleven monitoring well locations, with the largest occurring at MW106 and MW110. The largest upward hydraulic gradient occurs at MW108, with small upward gradients at MW101 and MW103.

3.2.3 HYDRAULIC CONDUCTIVITY

Hydraulic conductivities in both aquifers were obtained using the slug test method as described in Subsection 2.7, *Hydraulic Conductivity Testing*. The slug test data were analyzed using the AQTESOLV software of Geraghty and Miller and the Bouwer-Rice method. Hydraulic conductivity (K) values are given on Table 3-5 and the complete results are given in Appendix H.

The range of hydraulic conductivities for the unconsolidated aquifer is 5.63×10^{-5} cm/s (1 gpd/ft^2) to 3.31×10^{-2} cm/s (702 gpd/ft^2) with a geometric mean of 8.27×10^{-4} cm/s (17 gpd/ft^2). It should be noted that K for MW101A is in excellent agreement with the mean K obtained by others west of 20th Street (Wehrmann, 1991), suggesting that hydraulic conductivities in the unconsolidated aquifer may increase toward the west. In general, the mean K of the unconsolidated aquifer east of 20th Street corresponds to that for silty sand (Freeze & Cherry, 1979).

The range of hydraulic conductivities for the bedrock aquifer is 3.61×10^{-4} cm/s (8 gpd/ft^2) to 3.98×10^{-3} cm/s (84 gpd/ft^2), with a geometric mean of 9.09×10^{-4} cm/s (19 gpd/ft^2). The mean K for bedrock falls at the top of the range of values for limestone and dolomite (Freeze and Cherry, 1979). These Ks for the bedrock are based on an assumption of intergranular flow rather than fracture-dominated flow. If groundwater in the bedrock aquifer is flowing mainly through fractures, then the conductivity estimates would be somewhat different.

Table 3–4. Vertical Hydraulic Gradients Between Unconsolidated and Bedrock Aquifers

Location	Wells Used	Vertical Hydraulic Gradient	Direction
MW101	A/B	8.2E-03	Up
MW102	B/C	3.9E-02	Down
MW103	A/C	4.5E-03	Up
MW104	A/C	3.3E-02	Down
MW105	A/D	3.2E-02	Down
MW106	A/B	8.4E-02	Down
MW107	A/C	1.5E-03	Down
MW108	A/C	1.2E-02	Up
MW109	A/C	2.6E-03	Down
MW110	A/C	6.8E-02	Down
MW111	A/C	1.1E-03	Down

Table 3-5. Aquifer Hydraulic Conductivities

Unconsolidated Aquifer			Bedrock Aquifer		
Monitoring Well	cm/s	gpd/ft^2	Monitoring Well	cm/s	gpd/ft^2
MW101A	3.31E-02	702	MW101B	1.22E-03	26
MW103A	5.63E-05	1	MW103B	5.00E-04	11
MW104A	1.67E-04	4	MW103C	8.51E-04	18
MW106A	2.23E-03	47	MW104B	3.98E-03	84
MW111B	5.58E-04	12	MW104C	2.17E-03	46
			MW106B	1.20E-03	25
Geometric Mean	*8.27E-04*	*17*	MW106C	4.56E-04	10
			MW110C	3.61E-04	8
			MW111C	4.79E-04	10
			Geometric Mean	*9.09E-04*	*19*

The available data do not indicate a clear trend in hydraulic conductivity with depth (Table 3-5). Of the six well nest locations at which slug tests were conducted, two or more wells were tested at five locations to provide data on the vertical variability of hydraulic conductivity. Two of these locations exhibit increasing K with depth (MW103 and MW104) and two locations display decreasing K with depth (MW101 and MW106). At MW111, K is roughly the same for both the unconsolidated and bedrock aquifers. The mean hydraulic conductivities of the two aquifers are similar (Table 3-5).

3.2.4 GROUNDWATER VELOCITY

Average linear groundwater velocity can be calculated using the following equation:

$$V = [(K)\ (i)]/(7.48)(n)]$$

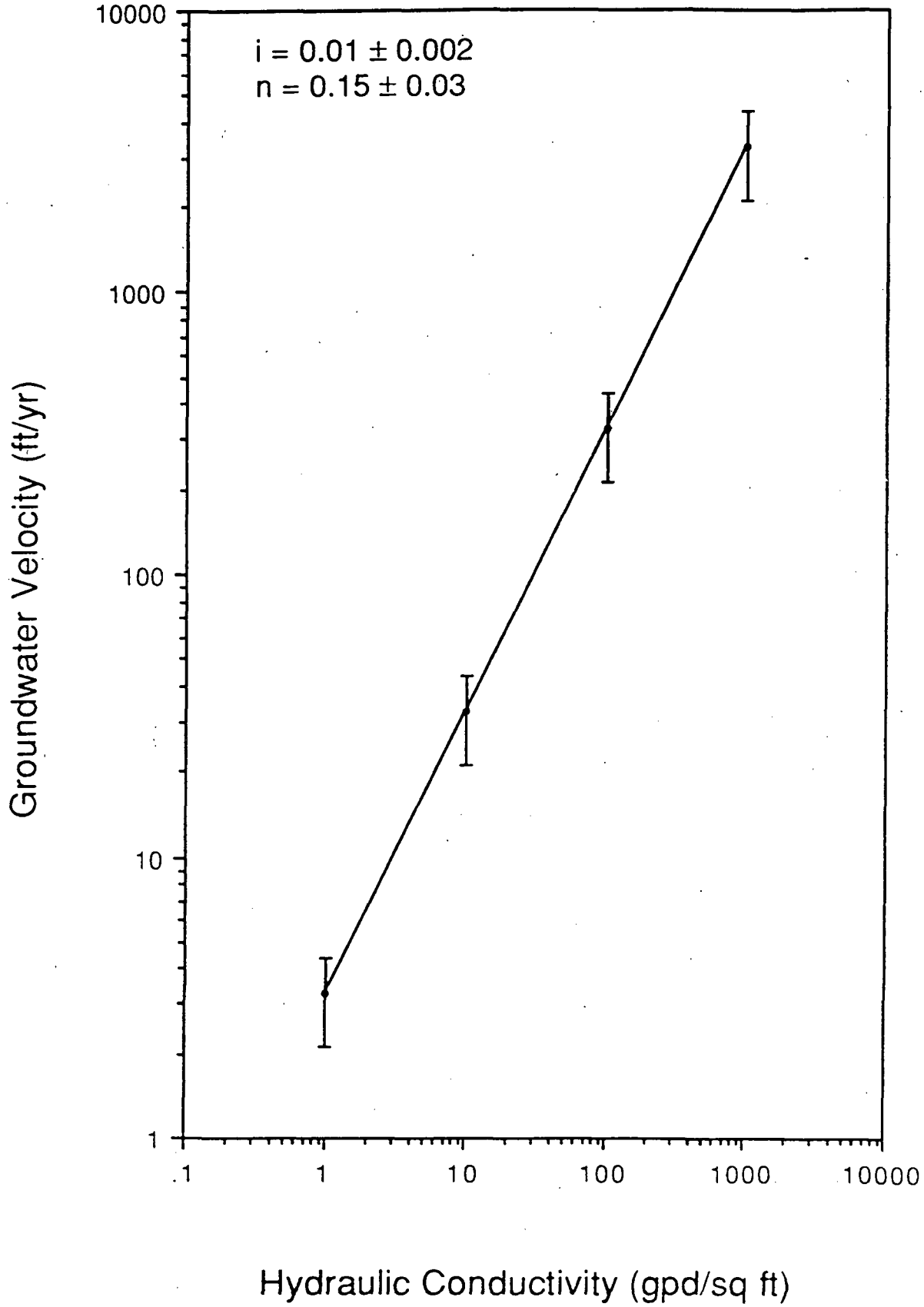
where

V is groundwater velocity (ft/day)
K is hydraulic conductivity (gpd/ft^2)
i is horizontal hydraulic gradient (dimensionless)
7.48 is a conversion factor for K
n is effective porosity (dimensionless)

To illustrate the relationship between hydraulic conductivity (K) and groundwater velocity (V) within the Phase I study area, we include measured values for K and hydraulic gradient (i), and an estimated value for effective porosity, n. Hydraulic conductivity values obtained from slug tests varied from 1 gpd/ft^2 to 702 gpd/ft^2 (Table 3-5). The groundwater velocity calculations were made using K between 1 $\pm$ 0.2 gpd/ft^2 and 1,000 $\pm$ 200 gpd/ft^2, i = 0.01 $\pm$ 0.002, and n = 0.15 $\pm$ 0.03. Effective porosity is obtained from the scientific literature for the types of aquifer materials found in the study area (e.g., Freeze and Cherry, 1979). Twenty percent uncertainty has been assumed for each variable in the groundwater velocity

equation, resulting in 35% uncertainty for V using standard methods for assessing propagation of error. The 20% uncertainties for K, i, and n are somewhat arbitrary; however, they are reasonable estimates given the variability of natural systems.

Results of the groundwater velocity calculations for the unconsolidated aquifer are shown on Figure 3-9. For the K range 1 gpd/ft^2 to 702 gpd/ft^2, the corresponding velocity range is 3 $\pm$ 1 ft/yr to 2,284 $\pm$ 791 ft/yr. Groundwater velocity in silty sands (e.g., MW103A and MW104A) would be at the lower end of this range and at the upper end for sand units (e.g., MW101A). Based on an assumption of intergranular flow, groundwater in bedrock travels at an average velocity of 26 $\pm$ 9 ft/yr to 273 $\pm$ 95 ft/yr (based on the Phase I slug test results for nine monitoring wells [Table 3-5]). Larger groundwater velocities would be expected in any high permeability zones such as fractures. Groundwater contaminants would travel more slowly than groundwater because of retardation effects.



SOUTHEAST ROCKFORD

GROUNDWATER VELOCITY AS A FUNCTION OF HYDRAULIC CONDUCTIVITY

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Figure No. 3-9

4.0 RESULTS OF CONTAMINANT INVESTIGATION

This section presents and interprets the findings of the Phase I contaminant investigation performed from May to October 1991. The field methods and procedures used to obtain the results were described in Section 2.

4.1 USEABILITY OF CHEMICAL DATA

4.1.1 GENERAL

This section describes the quality assurance/quality control measures applied to the chemical data and the effect of these measures on the overall useability of the data. Samples taken included groundwater samples, subsurface soil samples, and drum samples. During the Phase I study, 68 groundwater and 46 soil samples were analyzed. Thirty-four groundwater quality control samples were analyzed, including seven field duplicates, seven field blanks, and 19 trip blanks, and a sample of the decontamination water. Four field duplicates were analyzed for the soil samples.

All samples taken were analyzed through the U.S. EPA's Contract Laboratory Program (CLP). EPA assigned samples to the following CLP laboratories: Compuchem, S-Cubed, Jordan/ABB Environmental, AATS, Wadsworth/Alert, Industrial and Environmental, Ceimic Corporation, PEI, Skinner, Southwest Lab of Oklahoma, Northern Labs, Orlando Labs, Keystone, Clayton, ETS Analytical Services, and Pace. The Routine Analytical Services (RAS) samples for volatile organic analysis were analyzed by Compuchem, S-Cubed, PEI, Jordan, Industrial and Environmental (IEANC), and Wadsworth/Alert. Samples for pesticides were analyzed by Ceimic Corporation, PEI, Jordan/ABB Environmental, S-Cubed, Compuchem, IEANC, and Wadsworth/Alert. Samples for semivolatiles were analyzed by Ceimic Laboratories, PEI, Jordan, Compuchem, IEANC, Wadsworth/Alert, Pace, and Clayton/Novi. Special Analytical Services (SAS) for inorganics, including cyanide, and

TDS/TSS were performed by Skinner, AATS, Northern Labs, Southwest Lab of Oklahoma (SWOK), Orlando Labs, Keystone, and ETS Analytical Services (CENTEC).

The CLP Statement of Work used for soils analysis for organic parameters was SOW 3/90, while that for soils for inorganics was SOW 7/88. Special Analytical Services (SAS) requests were required to measure concentrations of the analytes at levels found in drinking water. SASs were required for volatiles, pesticides and inorganics in groundwater, for total organic carbon soil samples, and for total dissolved solids and total suspended solids in groundwaters. RAS was used for semivolatiles in groundwater. The SASs are outlined in the Southeast Rockford Phase I QAPP (CDM, 1991).

4.1.2 DATA VALIDATION

Data reduction, validation, and recording were conducted in accordance with the U.S. EPA's CLP. Upon receipt of the analytical results from the CLP laboratory, CDM's validation staff reviewed the data. Several data packages were reviewed by Weston/ESAT, a subcontractor for U.S. EPA. All reviewers ensured that the data met the guidelines specified in the U.S. EPA document Laboratory Data Validation Functional Guidelines for Evaluating Organic (2/88) and Inorganic Analyses (7/88). In addition, data was compared against further guidelines as specified in the August 1991 SAS Requests for the Southeast Rockford Phase I Remedial Investigation. Data that did not meet these requirements were either rejected completely or accepted with restrictions, and denoted with data qualifiers. A complete list of the data qualifiers used is provided in Table E-1 in Appendix E.

Data that were qualified were specified in each case narrative by the data validator. Validation documentation is available for review in the Southeast Rockford Phase I project files.

4.1.3 FIELD QUALITY CONTROL SAMPLES

4.1.3.1 Introduction

Field quality control samples consist of trip blanks, field blanks, and field duplicates, and samples of water used for decontamination. Trip blanks are used to determine whether sample contamination occurred during sample packaging or shipping. Field blanks serve to reveal possible sample contamination derived from sampling procedures, packaging, or shipping. Field duplicates help to assess the reproducibility of the sampling process and how well the sample represents the environment. The field quality control samples were collected as described in subsection 2.6. The results of the analysis of the samples and their impact on data useability is discussed in the following subsections.

4.1.3.2 Trip Blanks

Analyses of trip blanks show minimal contamination by volatiles. Methylene chloride, found at concentrations of 1 to 4 ppb in 16 of the 19 samples, was the only compound detected in the trip blanks. Eight of the sixteen samples were qualified with a "B", indicating presence of the compound in the associated laboratory blank. Methylene chloride is not a contaminant of concern at the site, having been found in only one Phase I investigative sample (MW107C at 2 ppb, with a "B" qualifier). Based on the lack of any contaminants of concern detected in the trip blanks, it is concluded that neither sample bottles nor methods of packaging or shipment contributed to contamination detected in groundwater samples. No data were qualified based on trip blank results.

4.1.3.3 Field Blanks

Analyses of field blanks show minimal contamination by volatiles. As shown in Appendix I (Table I-5), the only volatile compounds detected in the field blanks were TCA (up to 3 ppb), toluene (up to 1 ppb), methylene chloride (up to 8 ppb), and chloroform (up to 10

ppb). The samples associated with contaminated field blanks were reviewed and qualified where necessary. Detections of TCA and chloroform in the samples at values of 5 times the blank concentration or less were flagged with a "J" to signify that the value detected in the sample may not be due entirely to site conditions. The presence of toluene and methylene chloride in the field blanks but not in the groundwater monitoring well samples may be due to their presence in the source water. The other analytical scans showed that a number of other constituents were detected in the field blanks. However, these constituents are either not contaminants of concern, or were present at concentrations considerably less than those present in groundwater samples. Overall, the results of field blank analyses show that field methods had minimal deleterious effect on the quality of Phase I groundwater sampling results and did not impact data useability.

4.1.3.4 Decontamination Water Sample

One sample was collected of the water used for decontamination of sampling bailers and pumps. The cleaning and initial rinsing of sampling instruments was performed using tap water from the Ken-Rock Community Center near the location of the field trailer. The final rinse of all sampling instruments, except for the sampling pumps, was performed using deionized water; tap water was the final rinse for the interior of the sampling pumps.

As shown in Table 4-2 (see subsection 4.4.1), the only volatile organics detected in the decontamination water sample (labelled "DECON") were the trihalomethanes chloroform, bromodichloromethane, and dibromochloromethane at a total of 5.9 ppb (the Federal Maximum Contaminant Level [MCL] for total trihalomethanes is 100 ppb). Trihalomethanes are commonly found in such concentrations in municipal water supplies as a byproduct of disinfection procedures. Of the three trihalomethanes detected in the decontamination water sample, bromodichloromethane and dibromochloromethane were detected in only one groundwater monitoring well sample each, at concentrations of 1 ppb. Chloroform was detected in several groundwater monitoring well samples, but only where other chlorinated organic compounds such as TCA were present. This association implies derivation of the

chloroform concentrations from the groundwater rather than from the decontamination procedure.

Of the other analytical scans of the decontamination water, most detections noted were of constituents expected to be present in municipal water supplies, such as sodium, calcium, and potassium. Other detected constituents were either not detected in many groundwater monitoring well samples, or were detected at concentrations considerably below any applicable drinking water standards. The one exception is aluminum, which was detected at 64 ppb, a concentration similar to that found in the groundwater samples and also similar to the proposed Federal Secondary MCL (SMCL), which will range from 50 to 200 ppb. The SMCL for aluminum is flexible to allow for varying water quality and treatment situations at each water utility on a case-by-case basis.

The analysis of the decontamination water shows that, with the possible exception of aluminum, the field decontamination water source had minimal effect on groundwater sample quality.

4.1.3.5 Field Duplicates

To ascertain the reproducibility of the data, field duplicates were collected and analyzed at the rate of 1 duplicate for every 10 water samples. Field duplicates were collected at the same location and depth, and at the same time as the water quality sample. Care was taken to duplicate the sampling methods as exactly as possible from the original sample to the duplicate.

To compare the samples and duplicates, the Relative Percent Difference (RPD) between each sample and its associated duplicate was calculated. The RPD is calculated as the absolute value of [(Sample -Duplicate)/(0.5 (Sample + Duplicate))] x 100.

RPDs less than or equal to 35 percent are generally acceptable, and higher RPDs are not uncommon for environmental sampling. As shown in Table 4-1, RPDs were less than 35 percent for most organic constituents in nearly all samples. The major exception is the sample and duplicate from well MWS-10, for which the detected volatile constituents in the duplicate (MWS-10-D) were approximately a factor of ten greater than those in the associated sample (MWS-10). The explanation for this discrepancy is unknown. However, data collected by the consultant retained by the industrial facility (where the well is located) indicates that the higher values are more likely correct. Aside from MWS-10, RPDs for other samples and duplicates are less than 35 percent except for TCA at MW-21, acetone at MW110B, aluminum at MW-21, iron at MW-12, and several other constituents present at very low concentrations (less than 5 ppb). Sample data reproducibility was thus generally acceptable aside from MWS-10, indicating that sampling procedures did not affect sample quality or data useability.

4.1.4 OVERALL DATA USEABILITY ASSESSMENT

4.1.4.1 General

Considering the large volume of data collected for Phase I, remarkably few analytes were rejected on the basis of laboratory error. In this section, those groundwater contaminants which were considered contaminants of concern for the project and were rejected will be discussed, as will all soil and drum sample contaminants which were rejected. The contaminants of concern for groundwater were those contaminants which exceeded or approached the Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs). Table 4-3 lists the volatile organic, semivolatile organic, and pesticide contaminants of concern. Table 4-4 lists the inorganic contaminants of concern. For soil and drum samples, no particular contaminants of concern were chosen. Drum samples were collected to characterize the drummed waste, which consisted of solid materials brought to the surface or used during borehole drilling (see subsection 2.4.6). Thus, these samples could conceivably

Table 4-1. Southeast Rockford Dupl e Groundwater Samples - Organic Results

Date Sampled	9-6-91		9-6-91		Relative	9-9-91		9-9-91		Relative
Sample Number	MW105D		MW105D-D		Percent	MW107B		MW107B-D		Percent
Organic Traffic Report Number	EMF-40		EMF-38		Difference	EMF-49		EPS-14		Difference
Volatile Organics (ug/L)										
Acetone						<1		10	J	164
1,1-Dichloroethene						1		2		67
1,1-Dichloroethane	5		5		0	1		1	J	0
cis-1,2-Dichloroethene	5		4		22					
trans-1,2-Dichloroethene										
Chloroform										
1,2-Dichloroethane	1		1		0					
1,1,1-Trichloroethane						36		37		3
Trichloroethene										
1,1,2-Trichloroethane										
Tetrachloroethene										
Toluene										
Semivolatile Organics (ug/L)										
Di-n-butylphthalate	0.3	J	<1		108					
Butylbenzylphthalate	1	J	2	J	67	0.9	J	<1		11
Pesticides (ug/L)										
alpha-BHC										
Heptachlor										
Endosulfan I										
4,4'-DDD										

Data Qualifers: **J**=The value presented is an estimated value. **P**= The target compound's concentration differs more than 25% on two different GC colomns; poor quantitation accuracy. **D**=The result reported is from a re-run of the sample at a higher dilution. **E**=The reported result exceeded the calibration range of the analytical run.

Table 4-1. Southeast Rockford Duplic Groundwater Samples - Organic Results

Date Sampled	9-11-91		9-11-91		Relative	9-16-91		9-16-91		Relative
Sample Number	MW110B		MW110B-D		Percent	MW21		MW21-D		Percent
Organic Traffic Report Number	EPS-36		EPS-39		Difference	EPS-83		EPS-85		Difference
Volatile Organics (ug/L)										
Acetone										
1,1-Dichloroethene						1		3		100
1,1-Dichloroethane						14		18		25
cis-1,2-Dichloroethene						15		18		18
trans-1,2-Dichloroethene						1		1		0
Chloroform	2		2		0					
1,2-Dichloroethane						0.6	J	0.7	J	15
1,1,1-Trichloroethane	2		2		0	31	D	49	D	45
Trichloroethene						13		16		21
1,1,2-Trichloroethane										
Tetrachloroethene										
Toluene										
Semivolatile Organics (ug/L)										
Di-n-butylphthalate										
Butylbenzylphthalate	0.9	J	0.8	J	12					
Pesticides (ug/L)										
alpha-BHC	0.0015	JP	0.00099	JP	41					
Heptachlor	0.0012	JP	0.0015	JP	22					
Endosulfan I	<0.01		0.0009	JP	167					
4,4'-DDD	0.0066	J	<0.01		41					

Data Qualifers: J=The value presented is an estimated value. P= The target compound's concentration differs more than 25% on two different GC colomns; poor quantitation accuracy. D=The result reported is from a re-run of the sample at a higher dilution. E=The reported result exceeded the calibration range of the analytical run.

Table 4-1. Southeast Rockford Dupli Groundwater Samples - Organic Results

Date Sampled	10-1-91		10-1-91		Relative	10-2-91		10-2-91		Relative
Sample Number	MWS10		MWS10D		Percent	MWS32		MWS32-D		Percent
Organic Traffic Report Number	EPM-62		EPM-64		Difference	EPM76		EPM78		Difference
Volatile Organics (ug/L)										
Acetone										
1,1-Dichloroethene	4		38		162	240	E	220	E	9
1,1-Dichloroethane	<1		0.9	J	11	4		4		0
cis-1,2-Dichloroethene	<1		2		67	4		4		0
trans-1,2-Dichloroethene						2		2		0
Chloroform						0.5	J	<1		67
1,2-Dichloroethane						2		2		0
1,1,1-Trichloroethane	18		180		164	470	E	440	E	7
Trichloroethene	1		13		171	240	E	220	E	9
1,1,2-Trichloroethane						4		4		0
Tetrachloroethene	2		19		162	110	E	94	E	16
Toluene						6		7		15
Semivolatile Organics (ug/L)										
Di-n-butylphthalate	<1		0.7	J	35	0.8	J	<1		22
Butylbenzylphthalate										
Pesticides (ug/L)										
alpha-BHC										
Heptachlor						<0.01		0.0014	J	151
Endosulfan I										
4,4'-DDD										

Data Qualifers: J=The value presented is an estimated value. P= The target compound's concentration differs more than 25% on two different GC colomns; poor quantitation accuracy. D=The result reported is from a re-run of the sample at a higher dilution. E=The reported result exceeded the calibration range of the analytical run.

contain contaminants which were a result not of site contamination, but of drilling activities. Contaminants of concern were not chosen for soil samples as the SDWA MCLs are inappropriate to compare with soil samples and there are no comparable standards for soils.

4.1.4.2 Organic Contaminants

4.1.4.2.1 Soil and Drum Samples

No organic analytes were rejected in any soil or drum sample. Some analytes were marked as estimated ("J") in the tables in Appendix E, indicating errors that did not have a great effect on the data. In general, the data were of reasonable quality.

Holding times were exceeded by eight days for two soil samples (MW107A and MW107B) and four drum samples (MW109-1, MW109-1D, MW109-2, and MW104-6) for semivolatiles and pesticides. Although only one of these samples showed a positive result, the below detection limit results must be considered to be estimated due to the negative bias. This data was considered useable as qualified because the holding time violation was not severe.

4.1.4.2.2 Groundwater Samples

A total of nine volatile organic analytes were rejected from the 104 samples analyzed. Of these, no analyte was on the list of contaminants of concern.

4.1.4.3 Inorganic Contaminants

4.1.4.3.1 Soil and Drum Samples

A total of 21 analytes from the drum samples and 4 analytes from the subsurface soil samples were rejected. Six drum samples (MW109-1, MW109-1D, MW109-2, MW104-6, MW107-B, MW104-7, MW104-8, MW107-1, and MW108-1) were rejected for antimony

due to the matrix spike recovery having a result less than the instrument detection limit (IDL). Selenium was rejected in four samples (MW109-5, MW110-9, MW110'-9 and MW103-2) due to low spike recovery, while silver was rejected in the same four samples due to high spike recovery. Selenium was also rejected in samples MW101A-1, MW101A-2, MW101A-3, MW101A-4, MW101A-6, MW111-1B, and MW111-1C due to low spike recovery. Because drum samples are not indicative of contamination in the area, the rejection of these samples does not have an effect on the overall data evaluation.

Selenium was rejected in two subsurface soil samples, MW111-1B and MW111-1C, due to low spike recovery. Arsenic was rejected in sample MW111-1C due to low spike recovery. Antimony was rejected in sample MW-107B due to low spike recovery. These elements may be found in normal soils and the rejection of the data does not indicate a problem with the overall usefulness of the results.

4.1.4.3.2 Groundwater Samples

A total of 103 inorganic analytes were rejected from the groundwater samples. Of these, seven analytes were on the list of contaminants of concern. Selenium was rejected in a total of 16 samples, including MW109A, MW108A, MW15, MW107B, MW107A, MW107C, MW106A, MW106B, and MW12. Rejections occurred due to the CRQL (Contract Required Quantitation Limit) standard having a reading below the control limit, because the correlation coefficient for the method of standard addition results was below the control limits, and because dissolved results exceeded total results. Aluminum was rejected in dissolved and total metals samples from MW105D and dissolved and total inorganic samples from MW12, because the dissolved results exceeded the total results by more than 50%. These rejections represent deficiencies in the data for the above samples, and allow no conclusions to be drawn as to the actual levels of the contaminants in these samples.

4.2 RESULTS OF SUBSURFACE SOIL AND DRUM SAMPLING

During the Phase I drilling activities, two types of "soil" samples were collected and submitted for chemical analysis to laboratories participating in the USEPA Contract Laboratory Program (CLP). A total of 42 of the "soil" samples were of solid material generated or used during borehole drilling that were containerized in drums. Nine samples consisted of subsurface soils collected using a split-spoon sampler during borehole drilling. The samples were collected and analyzed as described in subsections 2.1 and 2.4.

The analytical results of the drum and subsurface split-spoon samples collected at the site are presented in Appendices E and F, respectively. The split-spoon subsurface soil samples showed scattered detections of several volatile and semivolatile compounds at levels below the required quantitation limits but above the instrument detection limits. Therefore, all volatile and semivolatile detections in these samples are estimated. These low-level detections may be due to laboratory artifacts, especially in the cases of acetone, toluene and the phthalate compounds. The concentrations present indicate that the unsaturated subsurface soils at these locations are not affecting or being affected by the groundwater contamination. The inorganic data for the subsurface samples was compared to the average values of elements in soil in the eastern U.S. as determined by the U.S. Geological Survey. All concentrations detected were consistent with these average values indicating that metals contamination is not present in the unsaturated subsurface at the soil sample locations.

The soil samples collected from the drums generally consisted of drilling mud and bentonite slurry, lesser amounts of drill cuttings, and groundwater and drilling water. In general, these samples had higher concentrations of the constituents tested for than did the subsurface split-spoon samples. It is likely that the higher inorganic concentrations are due to the presence of the bentonite which has high concentrations of calcium, sodium, and magnesium. The organic compounds that were most frequently detected are not those found in the groundwater but are compounds associated with drum reconditioning and painting.

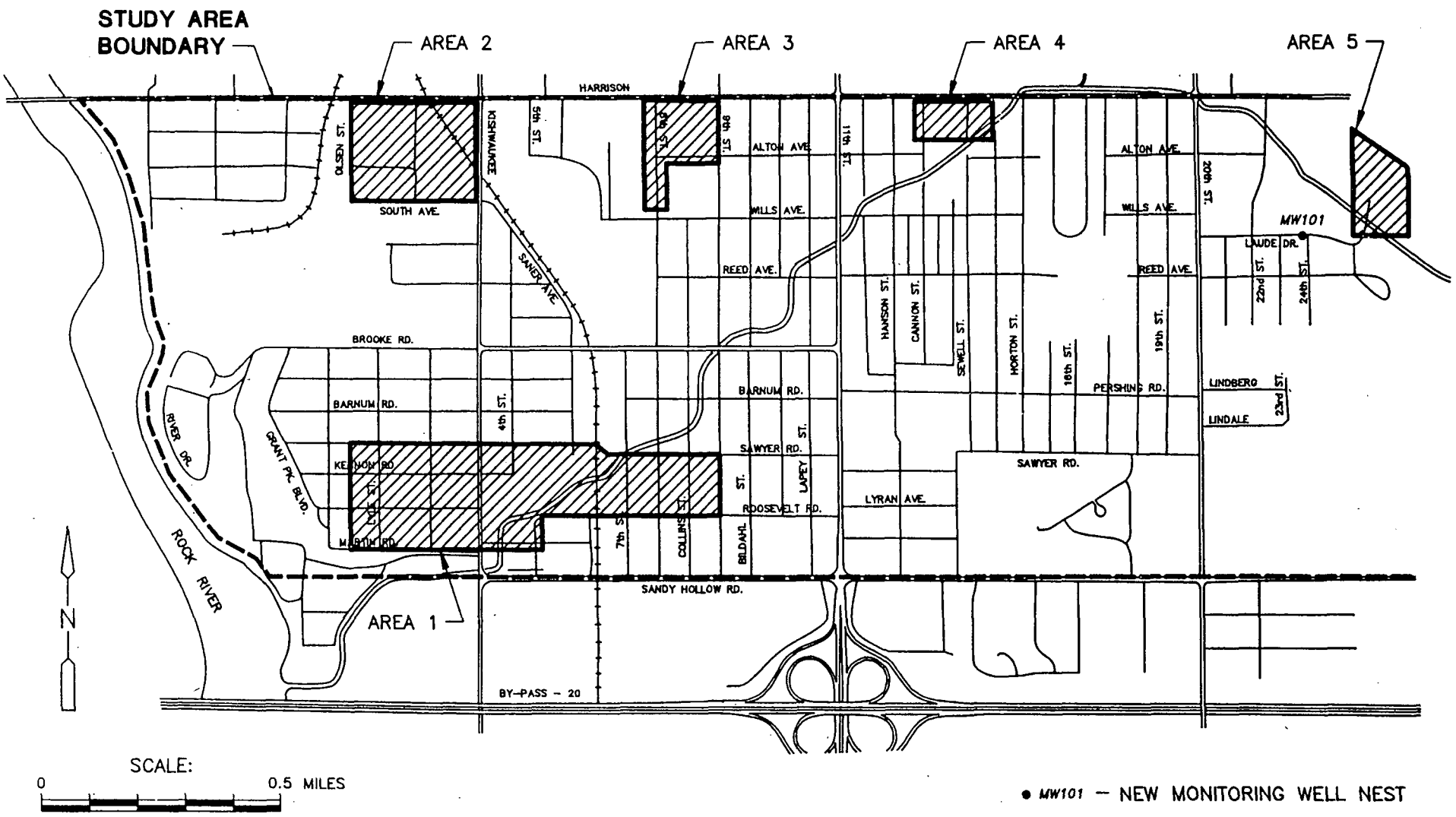
It is suspected that the compounds methylene chloride, acetone, chloroform, toluene, ethylbenzene, xylene, 2-butanone, and the phthalates are present in the drummed soils due to their presence on the interior walls of the drums used to store the soils.

4.3 RESULTS OF SOIL GAS SURVEY

A soil gas survey was conducted in the Southeast Rockford study area as a part of Phase I field investigative activities as described in subsection 2.3. The soil gas survey was performed to identify areas of soil contamination, and to aid in locating potential contamination source areas in the study area. Six specific areas were selected for soil gas investigation, based on the results of groundwater sampling conducted during the Operable Unit phase (see Figures 4-1 and 4-2). At each of these areas, soil gas samples were collected on centers of approximately 200 to 250 feet. Using a portable gas chromatograph, samples were analyzed in the field for 1,1,1-trichloroethane (TCA), trichloroethene (TCE), and tetrachloroethene (PCE). These compounds were selected for the soil gas survey because of their suspected presence in the subsurface soils, and their ability to be easily detected using soil gas technology. After completion of the soil gas survey, a Technical Memorandum was prepared to document the field activities and present the results. This document is presented in Appendix A. The following paragraphs summarize these results and correlate them with groundwater data collected to date, as well as with potential source locations.

The highest concentrations detected in the soil gas survey were found at location SG4-10 in area 4, where 3400 micrograms per liter (ug/l) of TCA, 180 ug/l of TCE, and 14 ug/l of PCE were detected (see Figure 4-3). These were the highest concentrations (by a factor of at least 60) found for TCA and TCE during the survey, and the second highest for PCE.

Additional concentrations of TCA greater than 1 ug/l were found at three points roughly west-northwest from SG4-10 (SG4-1, SG4-2, and SG4-6). The concentrations detected at SG4-10 suggest that there is a nearby source of soil contamination; the lesser concentrations



SOUTHEAST ROCKFORD

PHASE I SOIL GAS SURVEY AREAS
WESTERN SECTION

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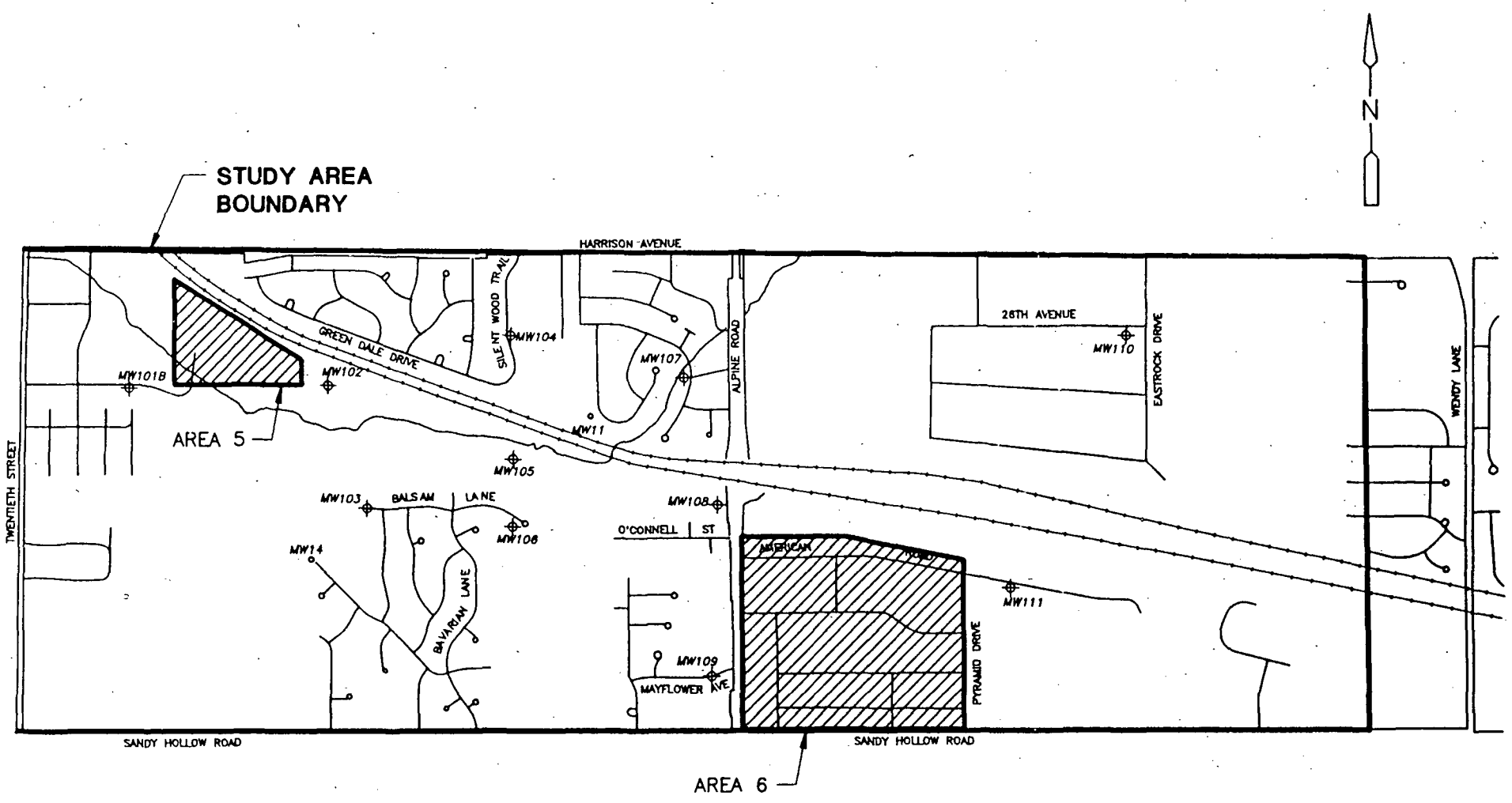
environmental engineers, scientists, planners, & management consultants

Figure No. 4-1



∘ MW14 EXISTING ISWS MONITORING WELL

⊕ MW108 NEW MONITORING WELL NEST

SCALE: 0 0.5 MILES

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PHASE I SOIL GAS SURVEY AREAS
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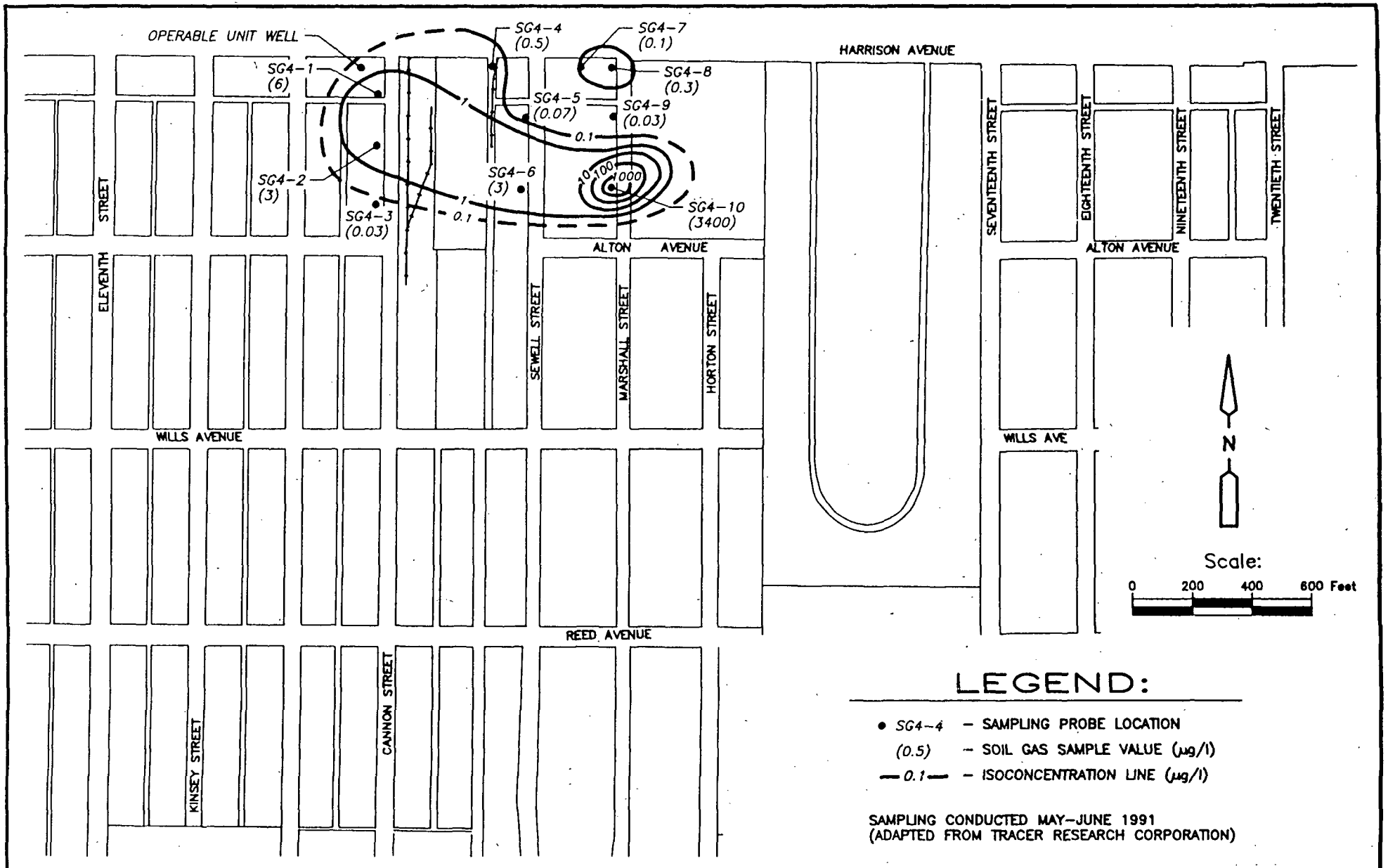
Figure No. 4-2

D:\168 CG\PRRPT\ FIG4-3 06/08/92 B. SELIGA



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PHASE I SOIL GAS STUDY AREA 4
TRICHLOROETHANE (TCA)

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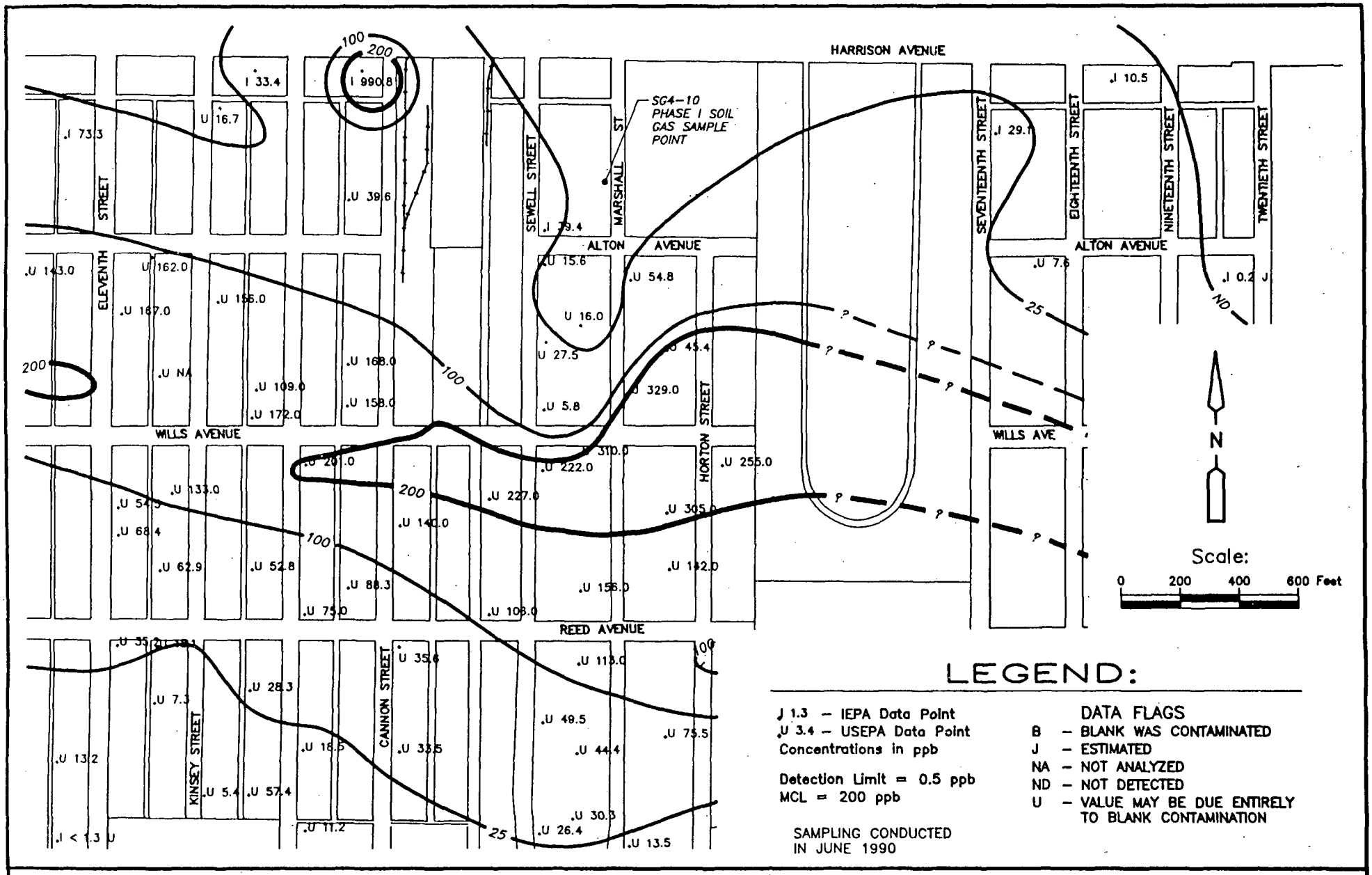
Figure No. 4-3

detected to the west-northwest may be a result of volatilization of TCA from groundwater into the overlying soil. This idea conforms with the results of groundwater sampling conducted in June 1990 as part of the Operable Unit study (CDM 1990). The groundwater sampling shows that there are elevated concentrations of both TCA (990.8 ppb) and TCE (62.4 ppb) at a residential well approximately 1000 feet west-northwest of SG4-10 (compare Figure 4-3 with Figure 4-4, which shows the concentrations of TCA in groundwater in the area of Soil Gas Study Area 4), near the intersection of Cannon Street and Harrison Avenue. This groundwater result was the highest concentration of TCA detected in the Operable Unit; its distinct separation from the main contaminant plume to the south suggests an additional, nearby source of VOC contamination. As shown in Figure 4-5, data from the Illinois State Water Survey (ISWS) shows that groundwater flows west-northwest in this area. Therefore it is likely that the TCA/TCE groundwater contamination near Cannon and Harrison results from downgradient migration of the TCA/TCE contamination defined in the soil gas survey.

The second-largest instance of VOC contamination defined in the soil gas survey was in area 2 at location SG2-9, where PCE was found at a concentration of 120 ug/l. Additional detections of 9 ug/l (SG2-10) and 1 ug/l (SG2-13) were found south and southwest from location SG2-9 (see Figure 4-6). These results correlate with the results of groundwater sampling from the Operable Unit, which shows an elevated concentration of PCE (127.3 ppb) at a well located near Olsen Street and South Avenue, approximately 900 feet southwest from SG2-9 (see Figures 4-6 and 4-7). This was the second-highest concentration of PCE found from groundwater sampling during the Operable Unit; it likely represents downgradient migration of contamination in groundwater from a source near SG2-9, based on the southwesterly direction of groundwater flow in this area (see Figure 4-5). A second major detection of PCE in groundwater (24.0 ppb) was found downgradient (southwest) from the Olsen/South groundwater detection noted above, and may result from the same source. Elevated detections of TCE were also noted from nearby wells in Operable Unit groundwater samples; however, the soil gas survey showed no marked elevations of TCE in study area 2 (highest concentrations were 0.3 ug/l).



SOUTHEAST ROCKFORD

OPERABLE UNIT GROUNDWATER SAMPLING
1,1,1-TRICHLOROETHANE (TCA)

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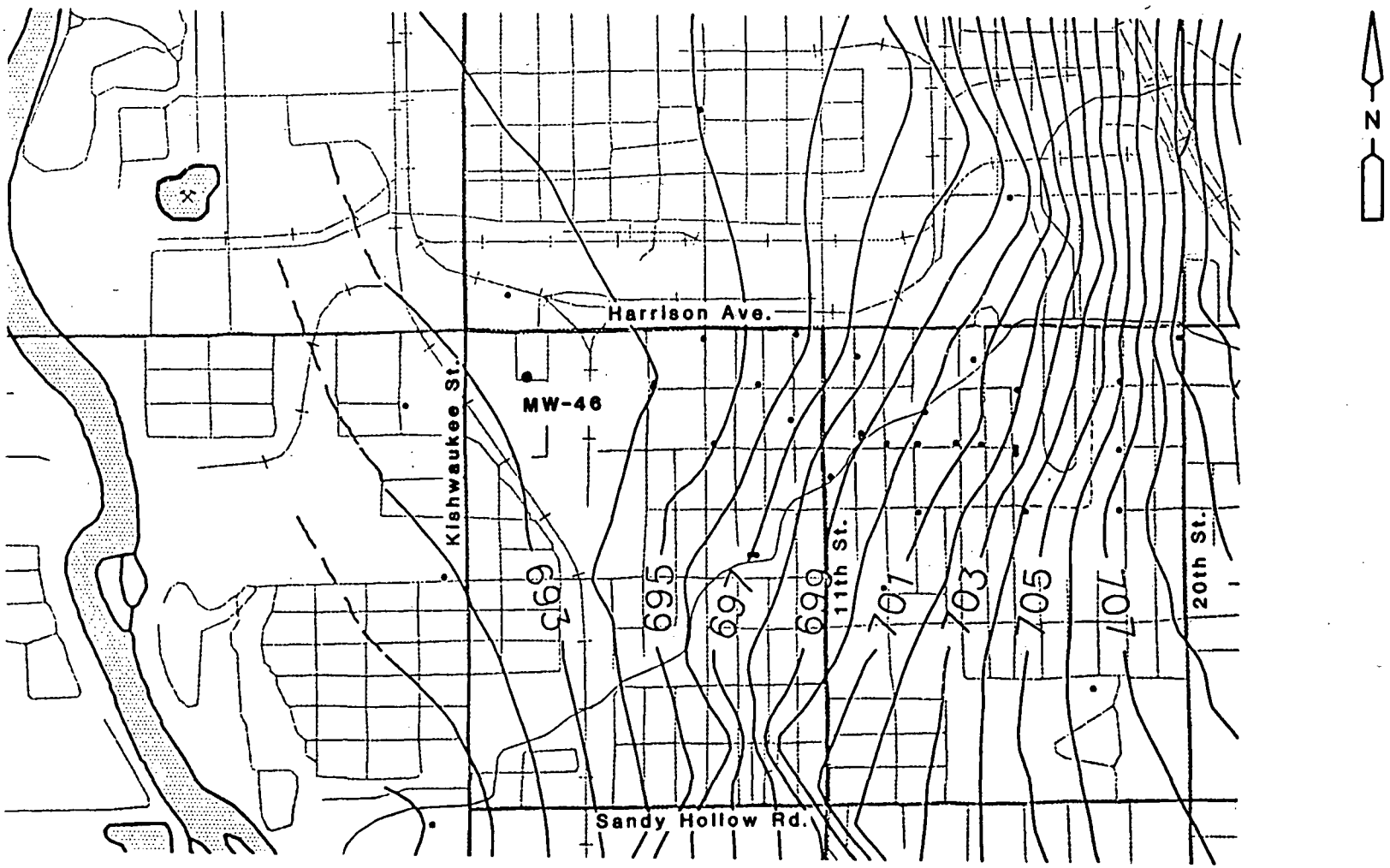
Figure No. 4-4



NOTE : Contours compiled by Illinois State Water Survey from August 1991 water level data.

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GROUNDWATER CONTOURS
FOR UNCONSOLIDATED AQUIFER
WESTERN PORTION OF STUDY AREA

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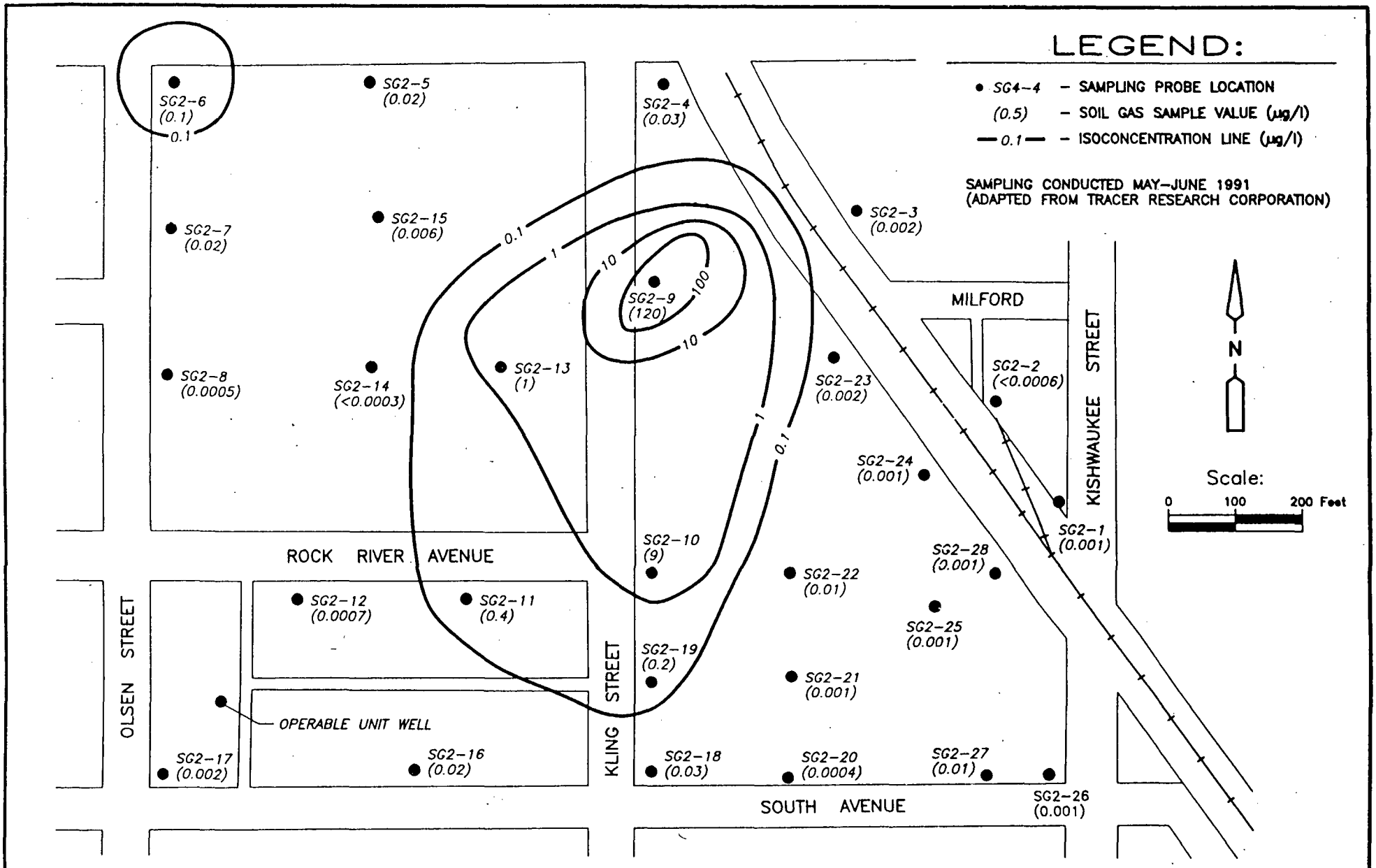
Figure No. 4-5



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PHASE I SOIL GAS STUDY AREA 2
TETRACHLOROETHENE (PCE)

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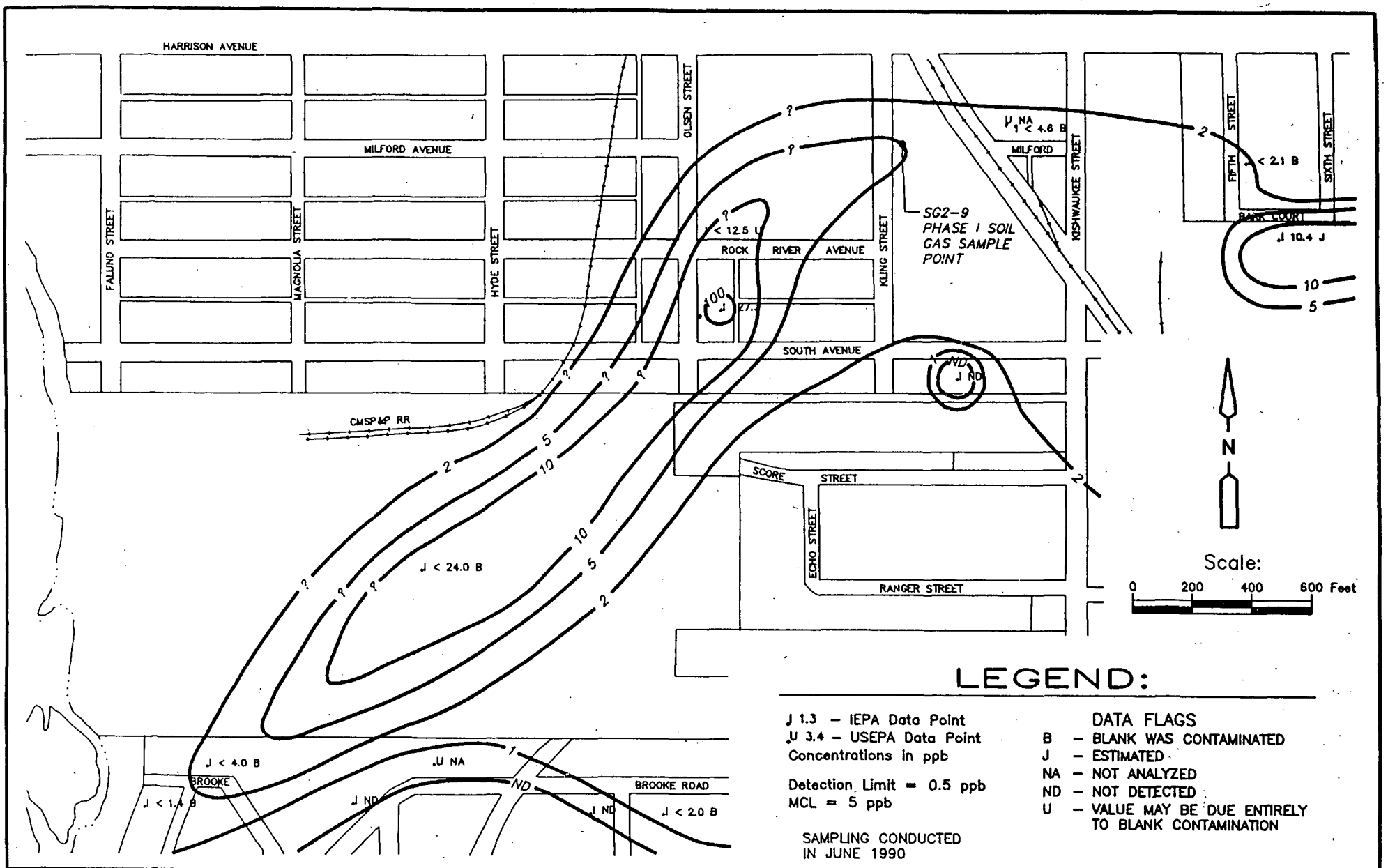
Figure No. 4-6



SOUTHEAST ROCKFORD

OPERABLE UNIT GROUNDWATER SAMPLING
TETRACHLOROETHENE (PCE)

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Figure No. 4–7

The soil gas survey in study area 3 suggested a possible source of minor soil contamination (please refer to Figure 3 in Appendix A). A single location in area 3 (SG3-1) had soil gas concentrations greater than 1 ug/l, containing PCE, TCA and TCE at 5, 4, and 3 ug/l, respectively. A potential source area at or near SG3-1 may be reflected in a groundwater sample collected from MW-46 (a new ISWS well), roughly 1250 feet southwest of SG3-1. Groundwater in MW-46 contained some of the highest concentrations of PCE (95 ppb) found in the Southeast Rockford study area to date. This well also showed elevated levels of TCE (129 ppb) and TCA (45 ppb) as discussed in subsection 4.4.1. The southwesterly flow of groundwater in the area (see Figure 4-5) supports the idea of a contaminant source upgradient from MW-46 possibly near soil gas location SG3-1.

The soil gas survey at study areas 1, 5 and 6 did not define any likely sources of soil contamination. However, in area 1, one soil gas sample location (SG1-28) displayed a concentration of a target compound greater than 1 ug/l (PCE at 4 ug/l). This location is approximately 500 feet east-southeast of the highest detection of PCE (545 ppb at 621 Kennon) from the Operable Unit groundwater sampling. If there is a source of VOC contamination in this area, it may be located north of SG1-28 where soil-gas sample coverage is sparse. Such a location would be more directly upgradient (east-northeast) of the groundwater PCE detection noted above.

The highest concentrations of the target compounds found in soil gas samples from area 5 were from two locations which had 2 ug/l and 1 ug/l of TCA. Such low-level concentrations cannot be considered indicative of a source of soil contamination by VOCs. However, a contaminant source may exist in this general area, as suggested by ppm-level VOC concentrations defined in Phase I groundwater sampling from nearby well nest MW101 (discussed in subsection 4.4.1).

In soil gas study area 6, no target compounds were detected at concentrations greater than 1 ug/l.

In summary, the soil gas survey helped to define likely source areas of soil VOC contamination in study areas 2 and 4, and suggested possible areas of minor soil VOC contamination in study areas 1 and 3. In addition to the soil gas sample results, the existence of these source areas is suggested by the general concurrence of the soil gas results with groundwater contaminants detected in wells downgradient from the suspected source areas. The groundwater detections in these wells (in areas 1 through 4) are parts of relatively small areas of groundwater contamination. This idea is based on the results of previous groundwater sampling programs, which suggest that these contaminated areas are contributors to downgradient portions of the extensive plume originating near MW106 (the large plume is discussed in greater detail in subsection 4.4.1). Depending on property access, additional investigation may be advisable in study areas 1, 2, 3 and 4, in order to better define the limits of soil VOC contamination. Soil gas study area 5 showed no VOC concentrations suggestive of a source, but a nearby source may exist, based on ppm-level VOC concentrations in the nearby downgradient well nest MW101 (see subsection 4.4.1). No further investigation of soil gas study area 6 appears warranted.

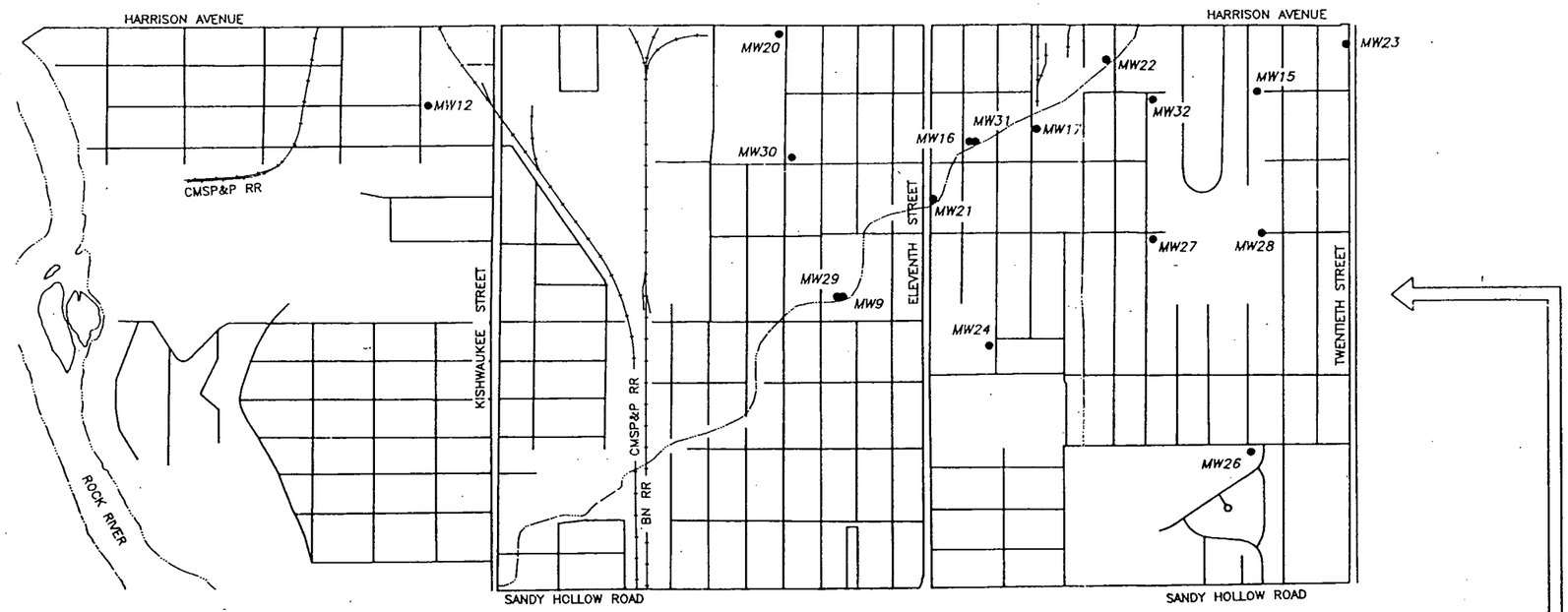
4.4 NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

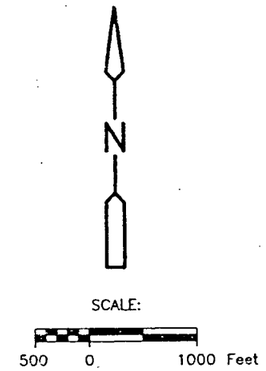
This subsection presents the results of Phase I water quality sampling for the unconsolidated and bedrock aquifers in the Southeast Rockford study area. In addition, the results of two other groundwater sampling efforts are used in this discussion: 1991 sampling conducted by ISWS personnel at ISWS wells, and the Operable Unit phase sampling of residential and industrial wells conducted by CDM in 1990. The purpose of this subsection is to present an assessment of the nature and extent of contamination of the groundwater in the study area. Contaminant concentrations are compared to available applicable standards for groundwater or drinking water. Groundwater contamination is related to potential contaminant sources in the study area. The fate and transport of contaminants is outlined with respect to specific compounds.

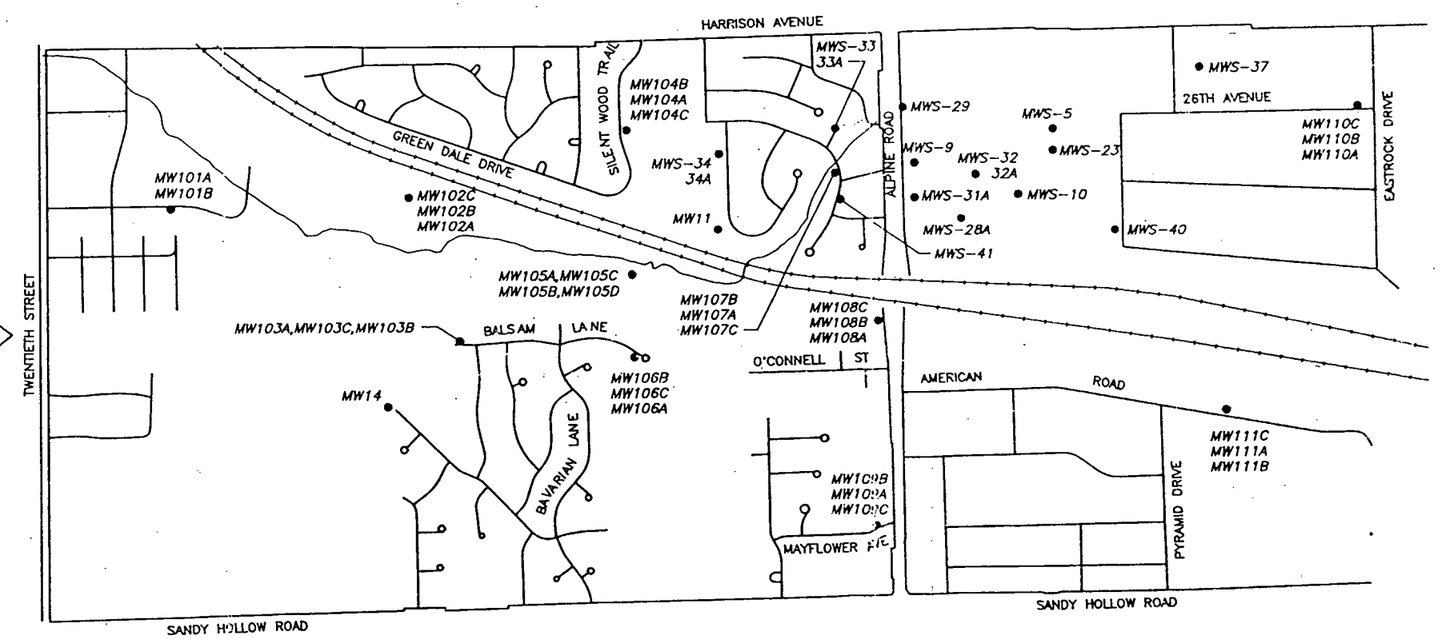
During the Phase I remedial investigation, three groups of monitoring wells were sampled: 1) the 33 new monitoring wells constructed during Phase I; 2) 19 existing ISWS wells; 3) 16 existing and newly-constructed monitoring wells on and near the industrial facility southeast of Harrison Avenue and Alpine Road. These wells are shown in Figure 4-8. The sampling, analytical and field quality control procedures are described in Section 2 of this Technical Memorandum. The Phase I wells are clustered in well nests of two to four (generally three) wells of differing depths. Well nest locations are referred to by the prefix "MW" followed by a 3-digit number beginning with "1". A single-letter suffix of A, B, C or D defines the relative depth of a well in the particular well nest, with A being the shallowest and D the deepest. ISWS wells are labelled with an "MW" prefix followed by a one- or two-digit number. Monitoring wells at the industrial facility are denoted in this report by an "MWS" prefix followed by a one- or two-digit number. A letter suffix of "A" or "B" indicates that the well is screened in the unconsolidated aquifer. The labelling of these facility wells is the same as that used by the facility operator, with the exception of the additional "S" used in the prefix.

The processes that generally determine the fate of organic chemicals in groundwater in the study area are hydrologic transport, biodegradation, and sorption. The effects of sorption on a compound can be approximated by its distribution coefficient (K_d), which is generally proportional to the n-octanol/water partition coefficient (K_{ow}). The higher these numbers are, the more susceptible the compound is to adsorption by the solid material of the aquifer. However, owing to their fairly low values for K_{ow}, most contaminants of concern in the study area have fairly low potential for adsorption and are therefore moderately to highly mobile in groundwater environments. Therefore, sorption may not be a dominant process in the study area; it does, however, need to be included in the analysis of contaminant transport.

Biodegradation may proceed in the subsurface in the study area, but biodegradation rates probably vary for specific contaminants. In the study area, there is good evidence for







LEGEND:

- • MW30 — LOCATION AND NUMBER OF ILLINOIS STATE WATER SURVEY MONITORING WELL
- • MW105A — LOCATION AND NUMBER OF PHASE I (CDM) MONITORING WELL
- • MWS-34A — LOCATION AND NUMBER OF MONITORING WELL AT INDUSTRIAL FACILITY

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MONITORING WELLS SAMPLED DURING PHASE I

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Figure No. 4-8

biodegradation breaking down TCE and TCA, while forming certain other compounds. The degradation or daughter products may undergo further degradation.

Certain halogenated hydrocarbons, such as PCE, TCE and TCA, are known to degrade biologically in a methane-generating environment. The process is known as reductive dehalogenation, and each degradation step results in a daughter compound containing one less chlorine atom than the parent. Other degradation processes, such as the degradation of TCA to 1,1-DCE, are abiological (abiotic) and can occur under a variety of chemical conditions.

Hydrologic transport results in downgradient migration of contaminants in the unconsolidated and bedrock aquifers. Hydrologic transport operates for all contaminants, and is likely the predominant control over the fate and transport of most contaminants.

4.4.1 VOLATILES

Table 4-2 summarizes the results of the Phase I water quality sampling program for the study area. It is apparent from the table that the chlorinated organic solvents are the major contaminants in site groundwater, in terms of both frequency and abundance. In order of decreasing abundance, the volatile organics detected in the study area in Phase I were 1,1,1-trichloroethane (TCA), cis-1,2-dichloroethene (cis-1,2-DCE), 1,1-dichloroethane (1,1-DCA), trichloroethene (TCE), 1,1-dichloroethene (1,1-DCE), and tetrachloroethene (PCE); found at much lower concentrations were chloroform, 1,2-dichloroethane (1,2-DCA), 1,1,2-trichloroethane, trans-1,2-dichloroethene (trans-1,2-DCE), vinyl chloride, toluene, benzene, chlorobenzene, and chloroethane. There are existing or proposed federal and state drinking water standards (Maximum Contaminant Levels or MCLs) for many of these compounds. These standards are presented in Table 4-3, which also shows the number and proportion of detections that are above the standards. In this table, the maximum result for either sample or duplicate (seven duplicates were collected) was used in the compilations. Table 4-3 also shows the concentration ranges for each compound in the wells sampled during Phase I, and

Table 4-2. Volatile Organic Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-4-91		9-4-91		9-4-91		9-4-91		9-4-91		9-5-91	
Sample Number	MW101B		MW101A		MW102A		MW102B		MW102C		MW103A	
Organic Traffic Report Number	EPS-01		EPS-03		EPS-06		EPS-07		EPS-09		EMF-17	
Volatile Organics (ug/L)												
Chloromethane												
Bromomethane												
Vinyl Chloride												
Chloroethane												
Methylene Chloride												
Acetone												
1,1-Dichloroethene	940	E	65		1	J			32		68	D
1,1-Dichloroethane	2900	E	170		11	J			89		200	D
cis-1,2-Dichloroethene	2800	E	250		7	J			68		690	D
trans-1,2-Dichloroethene	55										6	
Chloroform	130				0.9	J					11	
1,2-Dichloroethane	62											
2-Butanone												
1,1,1-Trichloroethane	12000	E	710		19	J			92		670	D
Bromodichloromethane												
1,2-Dichloropropane												
Trichloroethene	3600	E	180		1	J			26		210	D
Dibromochloromethane												
1,1,2-Trichloroethane	60										4	
Benzene												
Trans-1,3-Dichloropropene												
Bromoform												
4-Methyl-2-Pentanone												
2-Hexanone												
Tetrachloroethene	1200	E							4	J	110	E
1,1,2,2-Tetrachloroethane												
Toluene												
Chlorobenzene												
Styrene												
1,2-Dibromo-3-Chloropropane												
1,3-Dichlorobenzene												
1,4-Dichlorobenzene												
1,2-Dichlorobenzene												

Data Qualifiers: **J**=The value presented is an estimated value. **B**=The analyte is also found in the associated lab blank. **E**=The reported result exceeded the calibration range of the analytical run. **D**=The result reported is from a re-run of the sample at a higher dilution. **R**=The data is unuseable.

Table 4-2. Volatile Organic Results fo: :oundwater Samples, Southeast Rockford

Date Sampled	9-5-91		9-5-91		9-5-91		9-6-91		9-6-91		9-6-91	
Sample Number	MW103B		MW103C		MW104A		MW104C		MW104B		MW105B	
Organic Traffic Report Number	EMF-18		EMF-21		EMF-25		EMF-23		EMF-28		EMF-30	
Volatile Organics (ug/L)												
Chloromethane												
Bromomethane												
Vinyl Chloride											5	J
Chloroethane												
Methylene Chloride												
Acetone												
1,1-Dichloroethene	190		140				1		2		4	J
1,1-Dichloroethane	140		140				1		4		78	
cis-1,2-Dichloroethene	130		170								110	
trans-1,2-Dichloroethene											4	J
Chloroform	24	J	22	J								
1,2-Dichloroethane											13	
2-Butanone												
1,1,1-Trichloroethane	1000		1200		0.7	J	9	J	12		81	
Bromodichloromethane												
1,2-Dichloropropane												
Trichloroethene	380		380				0.6	J			25	
Dibromochloromethane												
1,1,2-Trichloroethane												
Benzene												
Trans-1,3-Dichloropropene												
Bromoform												
4-Methyl-2-Pentanone												
2-Hexanone												
Tetrachloroethene	130		110									
1,1,2,2-Tetrachloroethane												
Toluene												
Chlorobenzene												
Styrene												
1,2-Dibromo-3-Chloropropane												
1,3-Dichlorobenzene												
1,4-Dichlorobenzene												
1,2-Dichlorobenzene												

Data Qualifiers: **J**=The value presented is an estimated value. **B**=The analyte is also found in the associated lab blank. **E**=The reported result exceeded the calibration range of the analytical run. **D**=The result reported is from a re-run of the sample at a higher dilution. **R**=The data is unuseable.

Table 4-2. Volatile Organic Results f[illegible] Groundwater Samples, Southeast Rockford

Date Sampled	9-6-91		9-6-91	9-9-91	9-9-91	9-9-91
Sample Number	MW105A	MW105C	MW105D	MW106A	MW106B	MW107A
Organic Traffic Report Number	EMF-32	EMF-35	EMF-40	EMF-43	EMF-46	EMF-47
Volatile Organics (ug/L)						
Chloromethane						
Bromomethane						
Vinyl Chloride						
Chloroethane						
Methylene Chloride						
Acetone						
1,1-Dichloroethene				94		
1,1-Dichloroethane	25	6	5	250	3	
cis-1,2-Dichloroethene	55	5	5	4100	4	
trans-1,2-Dichloroethene	2 J					
Chloroform		5				
1,2-Dichloroethane		1	1			
2-Butanone						
1,1,1-Trichloroethane	24	3 J		6000	6 J	110
Bromodichloromethane		1				
1,2-Dichloropropane						
Trichloroethene	9	0.9 J			8	
Dibromochloromethane						
1,1,2-Trichloroethane						
Benzene						
Trans-1,3-Dichloropropene						
Bromoform						
4-Methyl-2-Pentanone						
2-Hexanone						
Tetrachloroethene	2 J			43 J	3	
1,1,2,2-Tetrachloroethane						
Toluene				59 J		
Chlorobenzene						
Styrene						
1,2-Dibromo-3-Chloropropane						
1,3-Dichlorobenzene						
1,4-Dichlorobenzene						
1,2-Dichlorobenzene						

Data Qualifiers: **J**=The value presented is an estimated value. **B**=The analyte is also found in the associated lab blank. **E**=The reported result exceeded the calibration range of the analytical run. **D**=The result reported is from a re-run of the sample at a higher dilution. **R**=The data is unuseable.

Table 4-2. Volatile Organic Results for .oundwater Samples, Southeast Rockford

Date Sampled	9-9-91	9-9-91	9-9-91	9-10-91	9-10-91	9-10-91
Sample Number	MW107B	MW107C	MW106C	MW109C	MW109B	MW109A
Organic Traffic Report Number	EMF-49	EPS-11	EPS-16	EPS-18	EPS-24	EPS-26
Volatile Organics (ug/L)						
Chloromethane						
Bromomethane						
Vinyl Chloride						
Chloroethane						
Methylene Chloride		2 B				
Acetone						
1,1-Dichloroethene	1					
1,1-Dichloroethane	1		3			
cis-1,2-Dichloroethene			2			
trans-1,2-Dichloroethene						
Chloroform						
1,2-Dichloroethane			0.9 J			
2-Butanone						
1,1,1-Trichloroethane	36		2 J		2 J	0.6 J
Bromodichloromethane						
1,2-Dichloropropane						
Trichloroethene			2			
Dibromochloromethane						
1,1,2-Trichloroethane						
Benzene						
Trans-1,3-Dichloropropene						
Bromoform						
4-Methyl-2-Pentanone						
2-Hexanone						
Tetrachloroethene			1			
1,1,2,2-Tetrachloroethane						
Toluene						
Chlorobenzene						
Styrene						
1,2-Dibromo-3-Chloropropane						
1,3-Dichlorobenzene						
1,4-Dichlorobenzene						
1,2-Dichlorobenzene						

Data Qualifiers: **J**=The value presented is an estimated value. **B**=The analyte is also found in the associated lab blank. **E**=The reported result exceeded the calibration range of the analytical run. **D**=The result reported is from a re-run of the sample at a higher dilution. **R**=The data is unuseable.

Table 4-2. Volatile Organic Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-10-91	9-10-91	9-10-91	9-10-91	9-11-91	9-11-91
Sample Number	MW108B	MW110A	MW108C	MW108A	MW110B	MW110C
Organic Traffic Report Number	EPS-27	EPS-30	EPS-32	EPS-34	EPS-36	EPS-41
Volatile Organics (ug/L)						
Chloromethane						
Bromomethane						
Vinyl Chloride						
Chloroethane						
Methylene Chloride						
Acetone		R	R	R		
1,1-Dichloroethene						
1,1-Dichloroethane	0.6 J		0.6 J			
cis-1,2-Dichloroethene						
trans-1,2-Dichloroethene						
Chloroform					2	
1,2-Dichloroethane						
2-Butanone		R	R	R		
1,1,1-Trichloroethane	1 J			3 J	2	
Bromodichloromethane						
1,2-Dichloropropane						
Trichloroethene				0.5 J		
Dibromochloromethane						
1,1,2-Trichloroethane						
Benzene						
Trans-1,3-Dichloropropene						
Bromoform						
4-Methyl-2-Pentanone						
2-Hexanone						
Tetrachloroethene						
1,1,2,2-Tetrachloroethane						
Toluene						
Chlorobenzene						
Styrene						
1,2-Dibromo-3-Chloropropane						
1,3-Dichlorobenzene						
1,4-Dichlorobenzene						
1,2-Dichlorobenzene						

Data Qualifiers: **J**=The value presented is an estimated value. **B**=The analyte is also found in the associated lab blank. **E**=The reported result exceeded the calibration range of the analytical run. **D**=The result reported is from a re-run of the sample at a higher dilution. **R**=The data is unuseable.

Table 4-2. Volatile Organic Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-11-91	9-11-91	9-11-91	9-12-91	9-12-91	9-12-91
Sample Number	MW111A	MW111B	MW111C	MW11	MW27	MW28
Organic Traffic Report Number	EPS-45	EPS-47	EPS-49	EPS-53	EPS-55	EPS-58
Volatile Organics (ug/L)						
Chloromethane						
Bromomethane						
Vinyl Chloride						
Chloroethane						
Methylene Chloride						
Acetone						
1,1-Dichloroethene	4	9			7	50
1,1-Dichloroethane		1			20	100
cis-1,2-Dichloroethene	15	40			23	100
trans-1,2-Dichloroethene						
Chloroform					1	
1,2-Dichloroethane					0.7 J	
2-Butanone						
1,1,1-Trichloroethane	19	48			41 J	170
Bromodichloromethane						
1,2-Dichloropropane						
Trichloroethene	11	14			18	67
Dibromochloromethane						
1,1,2-Trichloroethane						
Benzene						
Trans-1,3-Dichloropropene						
Bromoform						
4-Methyl-2-Pentanone						
2-Hexanone						
Tetrachloroethene	12	15			0.6 J	
1,1,2,2-Tetrachloroethane						
Toluene						
Chlorobenzene						
Styrene						
1,2-Dibromo-3-Chloropropane						
1,3-Dichlorobenzene						
1,4-Dichlorobenzene						
1,2-Dichlorobenzene						

Data Qualifiers: J=The value presented is an estimated value. B=The analyte is also found in the associated lab blank. E=The reported result exceeded the calibration range of the analytical run. D=The result reported is from a re-run of the sample at a higher dilution. R=The data is unuseable.

Table 4-2. Volatile Organic Results fc roundwater Samples, Southeast Rockford

Date Sampled	9-12-91	9-12-91	9-13-91	9-13-91	9-16-91	9-16-91
Sample Number	MW23	MW26	MW24	MW14	MW20	MW22
Organic Traffic Report Number	EPS-61	EPS-63	EPS-65	EPS-67	EPM-31	EPS-72
Volatile Organics (ug/L)						
Chloromethane						
Bromomethane						
Vinyl Chloride						
Chloroethane					5	
Methylene Chloride						
Acetone						
1,1-Dichloroethene					9	0.8 J
1,1-Dichloroethane	4				140 D	3
cis-1,2-Dichloroethene	3	3			35 D	3
trans-1,2-Dichloroethene						
Chloroform						
1,2-Dichloroethane						
2-Butanone						
1,1,1-Trichloroethane	16		2		36 D	22
Bromodichloromethane						
1,2-Dichloropropane						
Trichloroethene	2				4	2
Dibromochloromethane		1				
1,1,2-Trichloroethane					1	
Benzene					5	
Trans-1,3-Dichloropropene						
Bromoform						
4-Methyl-2-Pentanone						
2-Hexanone						
Tetrachloroethene						
1,1,2,2-Tetrachloroethane						
Toluene						
Chlorobenzene						
Styrene						
1,2-Dibromo-3-Chloropropane						
1,3-Dichlorobenzene						
1,4-Dichlorobenzene						
1,2-Dichlorobenzene						

Data Qualifiers: J=The value presented is an estimated value. B=The analyte is also found in the associated lab blank. E=The reported result exceeded the calibration range of the analytical run. D=The result reported is from a re-run of the sample at a higher dilution. R=The data is unuseable.

0 0 2 0

Table 4-2. Volatile Organic Results f[illegible] [illegible]roundwater Samples, Southeast Rockford

Date Sampled	9-16-91		9-16-91		9-16-91		9-16-91		9-17-91		9-17-91	
Sample Number	MW16		MW30		MW17		MW21		DECON		MW9	
Organic Traffic Report Number	EPS-74		EPS-76		EPS-78		EPS-83		EPN-51		EPS-87	
Volatile Organics (ug/L)												
Chloromethane												
Bromomethane												
Vinyl Chloride												
Chloroethane												
Methylene Chloride												
Acetone												
1,1-Dichloroethene	30	D	0.6	J	4		1					
1,1-Dichloroethane	52	D	14		16		14				0.9	J
cis-1,2-Dichloroethene	64	D	11		8		15				2	
trans-1,2-Dichloroethene	1		2				1					
Chloroform									3	J	0.7	J
1,2-Dichloroethane	2		0.5	J			0.6	J				
2-Butanone												
1,1,1-Trichloroethane	180	BD	50	D	15	J	31	D				
Bromodichloromethane									2			
1,2-Dichloropropane					0.5	J						
Trichloroethene	48	D	17		2		13				2	J
Dibromochloromethane									0.9	J		
1,1,2-Trichloroethane	1											
Benzene												
Trans-1,3-Dichloropropene												
Bromoform												
4-Methyl-2-Pentanone												
2-Hexanone												
Tetrachloroethene	2											
1,1,2,2-Tetrachloroethane												
Toluene												
Chlorobenzene												
Styrene												
1,2-Dibromo-3-Chloropropane												
1,3-Dichlorobenzene												
1,4-Dichlorobenzene												
1,2-Dichlorobenzene												

Data Qualifiers: **J**=The value presented is an estimated value. **B**=The analyte is also found in the associated lab blank. **E**=The reported result exceeded the calibration range of the analytical run. **D**=The result reported is from a re-run of the sample at a higher dilution. **R**=The data is unuseable.

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Table 4-2. Volatile Organic Results fu ıroundwater Samples, Southeast Rockford

Date Sampled	9-17-91	9-17-91	9-17-91	9-17-91	9-30-91	9-30-91
Sample Number	MW12	MW29	MW31	MW32	MWS32A	MWS23
Organic Traffic Report Number	EPS-89	EPS-91	EPS-93	EPS-97	EPM-36	EPM-38
Volatile Organics (ug/L)						
Chloromethane						
Bromomethane						
Vinyl Chloride						
Chloroethane						
Methylene Chloride						
Acetone						
1,1-Dichloroethene			16	2	81	150
1,1-Dichloroethane	1		42 D	9		110
cis-1,2-Dichloroethene	2		49 D	7		20 J
trans-1,2-Dichloroethene			0.6 J			
Chloroform	0.8 J		4 J			
1,2-Dichloroethane			1			
2-Butanone						
1,1,1-Trichloroethane			120 D	14 J	340	770
Bromodichloromethane						
1,2-Dichloropropane						
Trichloroethene	2 J		30 D	2	36	53
Dibromochloromethane						
1,1,2-Trichloroethane						
Benzene						
Trans-1,3-Dichloropropene						
Bromoform						
4-Methyl-2-Pentanone						
2-Hexanone						
Tetrachloroethene			0.8 J		50	160
1,1,2,2-Tetrachloroethane						
Toluene						
Chlorobenzene						
Styrene						
1,2-Dibromo-3-Chloropropane						
1,3-Dichlorobenzene						
1,4-Dichlorobenzene						
1,2-Dichlorobenzene						

Data Qualifiers: **J**=The value presented is an estimated value. **B**=The analyte is also found in the associated lab blank. **E**=The reported result exceeded the calibration range of the analytical run. **D**=The result reported is from a re-run of the sample at a higher dilution. **R**=The data is unuseable.

Table 4-2. Volatile Organic Results fo. oundwater Samples, Southeast Rockford

Date Sampled	9-30-91	9-30-91	10-1-91	9-30-91	10-1-91	10-1-91
Sample Number	MWS29	MWS33	MWS33A	MWS34A	MWS28A	MWS34
Organic Traffic Report Number	EPM-41	EPM-45	EPM-47	EPM-49	EPM-52	EPM-54
Volatile Organics (ug/L)						
Chloromethane						
Bromomethane						
Vinyl Chloride						
Chloroethane						
Methylene Chloride						
Acetone						
1,1-Dichloroethene						
1,1-Dichloroethane	0.6 J					2
cis-1,2-Dichloroethene						
trans-1,2-Dichloroethene						
Chloroform						
1,2-Dichloroethane						
2-Butanone						
1,1,1-Trichloroethane	0.9 J	2		2	11	19
Bromodichloromethane						
1,2-Dichloropropane						
Trichloroethene						2
Dibromochloromethane						
1,1,2-Trichloroethane						
Benzene		0.6 J				
Trans-1,3-Dichloropropene						
Bromoform						
4-Methyl-2-Pentanone						
2-Hexanone						
Tetrachloroethene						
1,1,2,2-Tetrachloroethane						
Toluene						
Chlorobenzene						
Styrene						
1,2-Dibromo-3-Chloropropane						
1,3-Dichlorobenzene						
1,4-Dichlorobenzene						
1,2-Dichlorobenzene						

Data Qualifiers: **J**=The value presented is an estimated value. **B**=The analyte is also found in the associated lab blank. **E**=The reported result exceeded the calibration range of the analytical run. **D**=The result reported is from a re-run of the sample at a higher dilution. **R**=The data is unuseable.

Table 4-2. Volatile Organic Results fo. ..roundwater Samples, Southeast Rockford

Date Sampled	10-1-91	10-1-91	10-1-91	10-1-91	10-2-91	10-1-91
Sample Number	MWS9	MWS41	MWS37	MWS10	MWS31A	MWS40
Organic Traffic Report Number	EPM-56	EPM-58	EPM-60	EPM-62	EPM-67	EPM-69
Volatile Organics (ug/L)						
Chloromethane						
Bromomethane						
Vinyl Chloride						
Chloroethane						
Methylene Chloride						
Acetone						
1,1-Dichloroethene	43			4	3	
1,1-Dichloroethane					0.6 J	
cis-1,2-Dichloroethene						
trans-1,2-Dichloroethene						
Chloroform					1	
1,2-Dichloroethane						
2-Butanone						
1,1,1-Trichloroethane	400			18	84 J	
Bromodichloromethane						
1,2-Dichloropropane						
Trichloroethene	22 J			1		
Dibromochloromethane						
1,1,2-Trichloroethane						
Benzene						
Trans-1,3-Dichloropropene						
Bromoform						
4-Methyl-2-Pentanone						
2-Hexanone						
Tetrachloroethene	25			2	0.6 J	
1,1,2,2-Tetrachloroethane						
Toluene						
Chlorobenzene					12	
Styrene						
1,2-Dibromo-3-Chloropropane						
1,3-Dichlorobenzene						
1,4-Dichlorobenzene						
1,2-Dichlorobenzene						

Data Qualifiers: **J**=The value presented is an estimated value. **B**=The analyte is also found in the associated lab blank. **E**=The reported result exceeded the calibration range of the analytical run. **D**=The result reported is from a re-run of the sample at a higher dilution. **R**=The data is unuseable.

Table 4-2. Volatile Organic Results f roundwater Samples, Southeast Rockford

Date Sampled	9-13-91		10-2-91		10-2-91	
Sample Number	MW15		MWS5		MWS32	
Organic Traffic Report Number	EPS69		EPM74		EPM76	
Volatile Organics (ug/L)						
Chloromethane						
Bromomethane						
Vinyl Chloride						
Chloroethane						
Methylene Chloride						
Acetone		R				
1,1-Dichloroethene	4		340		240	E
1,1-Dichloroethane	16		2100	E	4	
cis-1,2-Dichloroethene	13		250		4	
trans-1,2-Dichloroethene					2	
Chloroform	0.6	J			0.5	J
1,2-Dichloroethane					2	
2-Butanone						
1,1,1-Trichloroethane	32	E	1300	E	470	E
Bromodichloromethane						
1,2-Dichloropropane						
Trichloroethene	5		50		240	E
Dibromochloromethane						
1,1,2-Trichloroethane					4	
Benzene			32	J		
Trans-1,3-Dichloropropene						
Bromoform						
4-Methyl-2-Pentanone						
2-Hexanone						
Tetrachloroethene			120		110	E
1,1,2,2-Tetrachloroethane						
Toluene			14000	E	6	
Chlorobenzene						
Styrene						
1,2-Dibromo-3-Chloropropane						
1,3-Dichlorobenzene						
1,4-Dichlorobenzene						
1,2-Dichlorobenzene						

Data Qualifiers: J=The value presented is an estimated value. B=The analyte is also found in the associated lab blank. E=The reported result exceeded the calibration range of the analytical run. D=The result reported is from a re-run of the sample at a higher dilution. R=The data is unuseable.

Table 4-3
Comparison of Organic Groundwater Results at Southeast Rockford to Federal MCLs and Illinois Groundwater Quality Standards
(all values in ppb)

Compound (a)	Federal MCL	Illinois Standards*	Range of Phase I samples	Proportion of Phase I samples with detectable concentrations (b)	Proportion of Phase I samples exceeding MCLs
Volatile Organics					
Vinyl Chloride	2	2	<1-5J	1/68 (1.5%)	1/68 (1.5%)
Chloroethane	-	-	<1-5	1/68 (1.5%)	
1,1-Dichloroethene	7	7	<1-940E	30/68 (44.1%)	19/68 (27.9%)
1,1-Dichloroethane	-	-	<1-2,900E	35/68 (51.5%)	
cis-1,2-Dichloroethene	70	-	<1-4,100	35/68 (51.5%)	9/68 (13.2%)
trans-1,2-Dichloroethene	100	-	<1-55	8/68 (11.8%)	none
Chloroform	100 (c)	-	<1-130	9/68 (13.2%)	1/68 (1.5%)
1,2-Dichloroethane	5	5	<1-62	7/68 (10.3%)	2/68 (2.9%)
1,1,1-Trichloroethane	200	200	<1-12,000E	47/68 (69.1%)	11/68 (16.2%)
Trichloroethene	5	5	<1-3,600E	34/68 (50%)	24/68 (35.3%)
1,1,2-Trichloroethane	-	-	<1-60	5/68 (7.3%)	
Benzene	5	5	<1-32J	2/68 (2.9%)	2/68 (2.9%)
Tetrachloroethene	5	5	<1-1,200E	18/68 (26.5%)	13/68 (19.1%)
Toluene	1,000	1,000	<1-14,000E	3/68 (4.4%)	1/68 (1.5%)
Chlorobenzene	100	100	<1-12	1/68 (1.5%)	none
Semi-volatile Organics					
2-Methylphenol	-	-	<10-85	1/65 (1.5%)	
4-Methylphenol	-	-	<10-54	2/65 (3.1%)	
2,4-Dimethylphenol	-	-	<10-12	1/65 (1.5%)	
di-n-Butylphthalate	-	-	<10-10	1/65 (1.5%)	
Pesticides					
gamma BHC (Lindane)	0.2	0.2	<0.01-0.082J	1/62 (1.6%)	none
Heptachlor	0.4	0.4	<0.01-0.039J	1/62 (1.6%)	none
Heptachlor epoxide	0.2	0.2	<0.01-0.079J	1/62 (1.6%)	none
Endrin	0.2	2	<0.02-0.19J	1/62 (1.6%)	none

(a): Results are given for any compound detected at greater than or equal to 25% of the more conservative MCL, or any compound reported at greater than or equal to the Contract Required Quantitation Limits (CRQL).

(b): Detectable concentrations are those which are equal to or exceed the CRQL.

(c): Denotes standard for total trihalomethanes, which comprise chloroform, bromoform, dibromochloromethane, and bromodichloromethane.

* : Illinois Groundwater Quality Standards, 35 Ill. Adm. Code, Subpart C, Section 620.410, November 7, 1991.

the number and proportions of detections at or above the Contract Required Quantitation Limit (CRQL; 1 ppb for most volatiles). Table 4-3 (last column) shows that ten volatile organic compounds were detected in groundwater in the study area at concentrations considerably greater than their respective existing MCLs. The ten compounds are vinyl chloride; 1,1-DCE; cis-1,2-DCE; chloroform; 1,2-DCA; 1,1,1-TCA; TCE; benzene; PCE; and toluene. However, trans-1,2-DCE was detected in one well at greater than 50% of its MCL. Thus, it is also a contaminant of potential concern.

Background Water Quality

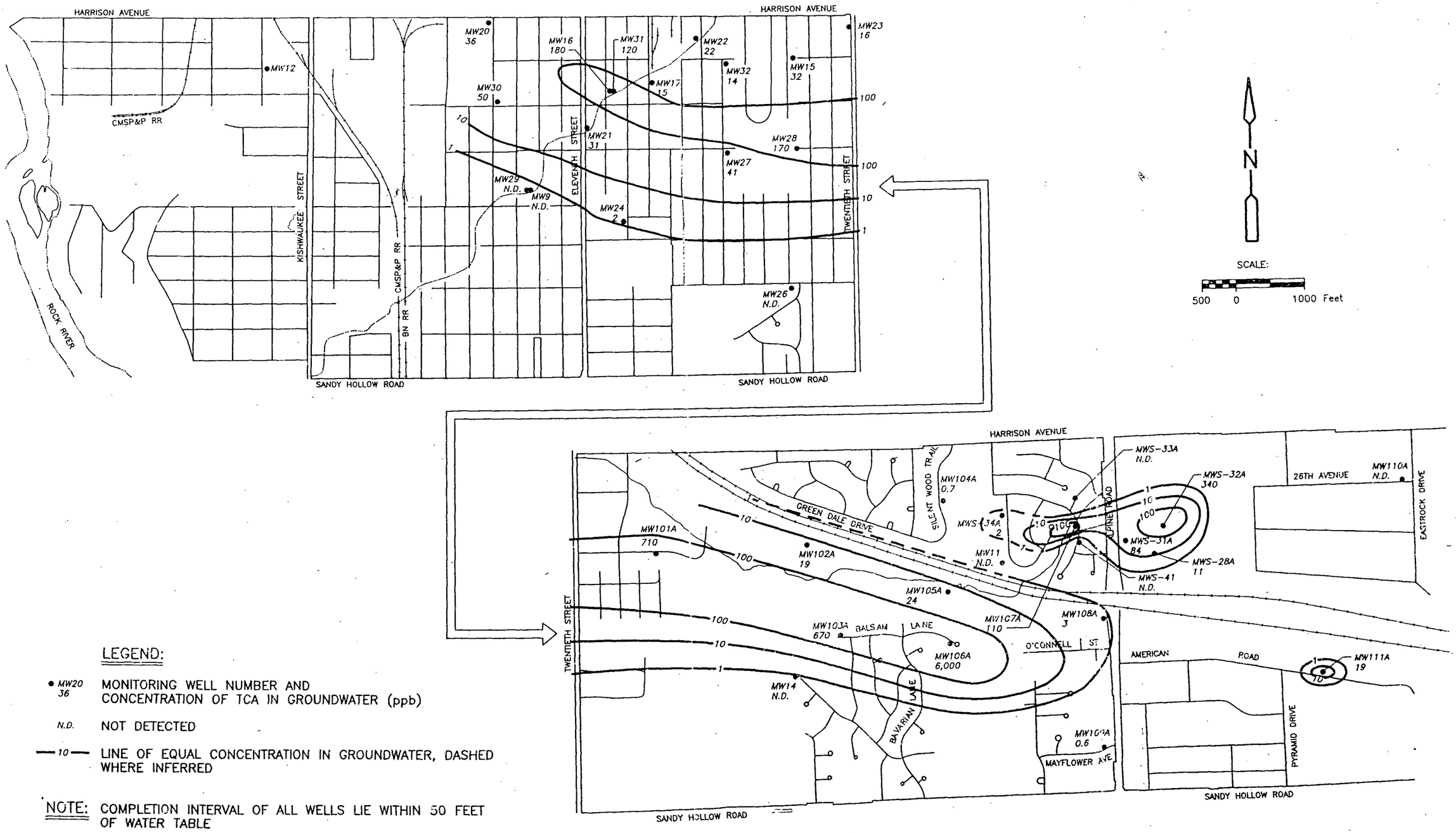
Well nests MW110 and 111 were originally designed to provide data on background water quality for the Southeast Rockford study area. These wells are located upgradient of the likely sources thought to have been responsible for the contamination observed in groundwater prior to Phase I, and were expected to be free of any synthetic chemicals such as chlorinated organic solvents. However, the occurrence of TCA and other chlorinated organics in MW110B (total of chlorinated organic compounds is 4 ppb), MW111A (61 ppb), and MW111B (127 ppb) indicates that this original assumption was incorrect. The detections at MW111 may result from a source at least a moderate distance upgradient (to the east), because the peak concentrations are in the intermediate well (MW111B); if the source of contamination were close to the well, the peak concentrations would be expected to reside in the shallow portion of the aquifer, represented by well MW111A. In addition, a source very near MW111 would likely have been detected in the soil gas survey of area 6, which extended to approximately 150 feet west of MW111. Wherever the source of contamination at MW111 is located, the contamination there does not appear to be related to the main contaminant plume which extends from MW106 to the west-northwest. The reason for this is that chlorinated organics are almost nonexistent in well nests MW108 and 109, located roughly downgradient of MW111. The ppm-level concentrations observed at MW106 downgradient probably originate from a source located much nearer MW106, because the bulk of contamination (greater than 99%) there resides in the shallow well (MW106A) of the nest.

Several wells in the upgradient (eastern) part of the study area lack detectable volatile organics, as at MW110A, MW110C, and MW111C. Along with the low concentrations of volatiles observed in well nests MW108 and 109, these wells probably represent background groundwater quality. The slightly higher concentrations observed in wells MW110B, MW111A and MW111B appear to be related to small contaminant plumes separate from the zones of highest groundwater contamination located to the west (downgradient).

TCA

Based on the results of Phase I groundwater sampling, TCA was the most frequently detected organic compound, as well as the most abundant (see Tables 4-2 and 4-3). The Phase I TCA results for groundwater are shown in Figures 4-9 and 4-10. Figure 4-9 shows TCA results for wells screened in the unconsolidated (sand and gravel) aquifer. These are shallow wells screened within 50 feet of the water table, and comprise all the ISWS wells in the western portion of the study area, some of the industrial facility wells in the northeastern part of the study area, and the "A" wells of the 11 well nests installed during Phase I in summer 1991. Figure 4-10 displays TCA results for wells screened in the bedrock aquifer. These are deeper wells screened between 50 and 150 feet below the water table. This group comprises wells east of 20th Street including some of the industrial facility wells in addition to the deep wells (mainly "C" wells) of the 11 Phase I well nests.

Comparison of Figures 4-9 and 4-10 shows that the unconsolidated and underlying bedrock aquifers contain contaminant plumes of generally similar shape and concentration. The two primary features of both figures are: 1) a zone of high TCA concentrations extending at least from MW103 to MW101; and 2) an additional zone of moderately high TCA concentrations centered on the industrial facility southeast of Alpine Road and Harrison Avenue. One difference is that the unconsolidated aquifer contains its highest TCA concentrations at MW106, while the bedrock aquifer contains 2 to 6 ppb (MW106C and MW106B, respectively) of TCA at this location. Downgradient (west-northwest) of MW106, the peak



LEGEND:

- • MW20 36 — MONITORING WELL NUMBER AND CONCENTRATION OF TCA IN GROUNDWATER (ppb)
- N.D. — NOT DETECTED
- —10— LINE OF EQUAL CONCENTRATION IN GROUNDWATER, DASHED WHERE INFERRED

NOTE: COMPLETION INTERVAL OF ALL WELLS LIE WITHIN 50 FEET OF WATER TABLE

SOUTHEAST ROCKFORD

1,1,1–TRICHLOROETHANE IN GROUNDWATER
UNCONSOLIDATED AQUIFER

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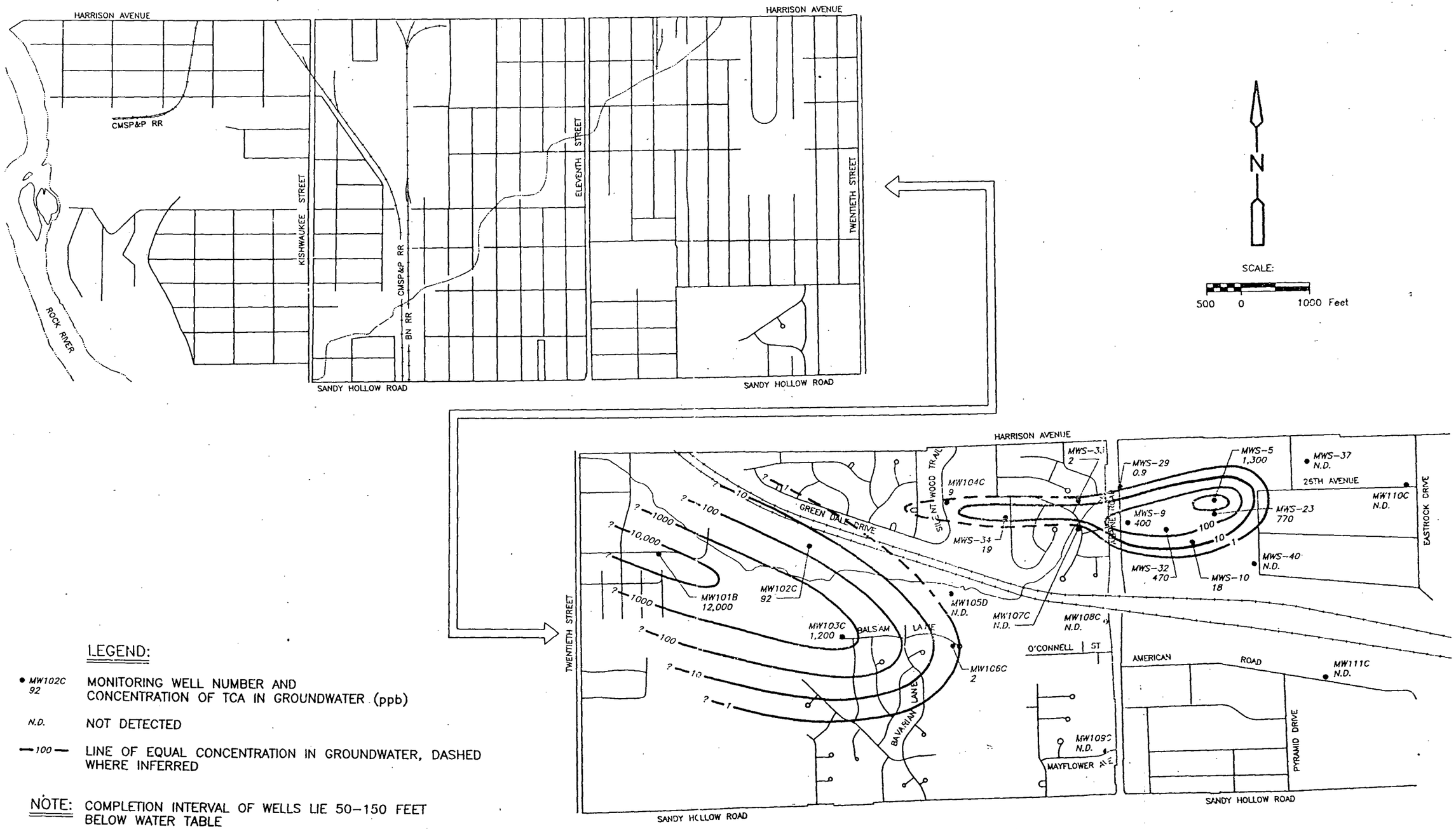
Figure No. 4–9



LEGEND:

- • MW102C 92 — MONITORING WELL NUMBER AND CONCENTRATION OF TCA IN GROUNDWATER (ppb)
- N.D. — NOT DETECTED
- —100— LINE OF EQUAL CONCENTRATION IN GROUNDWATER, DASHED WHERE INFERRED

NOTE: COMPLETION INTERVAL OF WELLS LIE 50–150 FEET BELOW WATER TABLE

SOUTHEAST ROCKFORD

1,1,1–TRICHLOROETHANE IN GROUNDWATER – BEDROCK AQUIFER

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Figure No. 4–10

levels of TCA are found in the bedrock aquifer, as shown by the results at MW103 and MW101. This downward migration of contamination is consistent with the predominance of downward hydraulic gradients in the area from 20th Street to Alpine Road, and consistent with the idea that the unconsolidated and bedrock aquifers are hydraulically connected (discussed in subsection 3.2.2). Though slight upward hydraulic gradients (less than 0.01 ft/ft) exist in the area (as at MW101 and MW103), the strongest gradients (up to 0.08) are downward (as at MW106 and other well nests). The relatively strong downward gradient between MW106A and MW106B, combined with the shallow depth of contamination at this location, suggest that the source of groundwater contamination at MW106 is located a relatively short distance (less than one-half mile) upgradient (east). This idea is supported by the fact that TCA was nearly undetected at the upgradient well nests MW108 and MW109, as well as in soil gas survey area 6, located just east of Alpine Road.

By far the highest TCA concentrations found in any well sampled in Phase I were in the bedrock aquifer well MW101B (12,000 ppb). TCA concentrations in MW101B were at least double those of upgradient wells at nests MW103 and MW106. The origin of these elevated concentrations cannot be determined based on the current data. Two possible explanations appear most likely:

1) MW101 is located nearer the center-line of the plume. For instance, near the eastern nests (MW103 and MW106), the most contaminated portion of the contaminant plume may be located north or south of these wells.

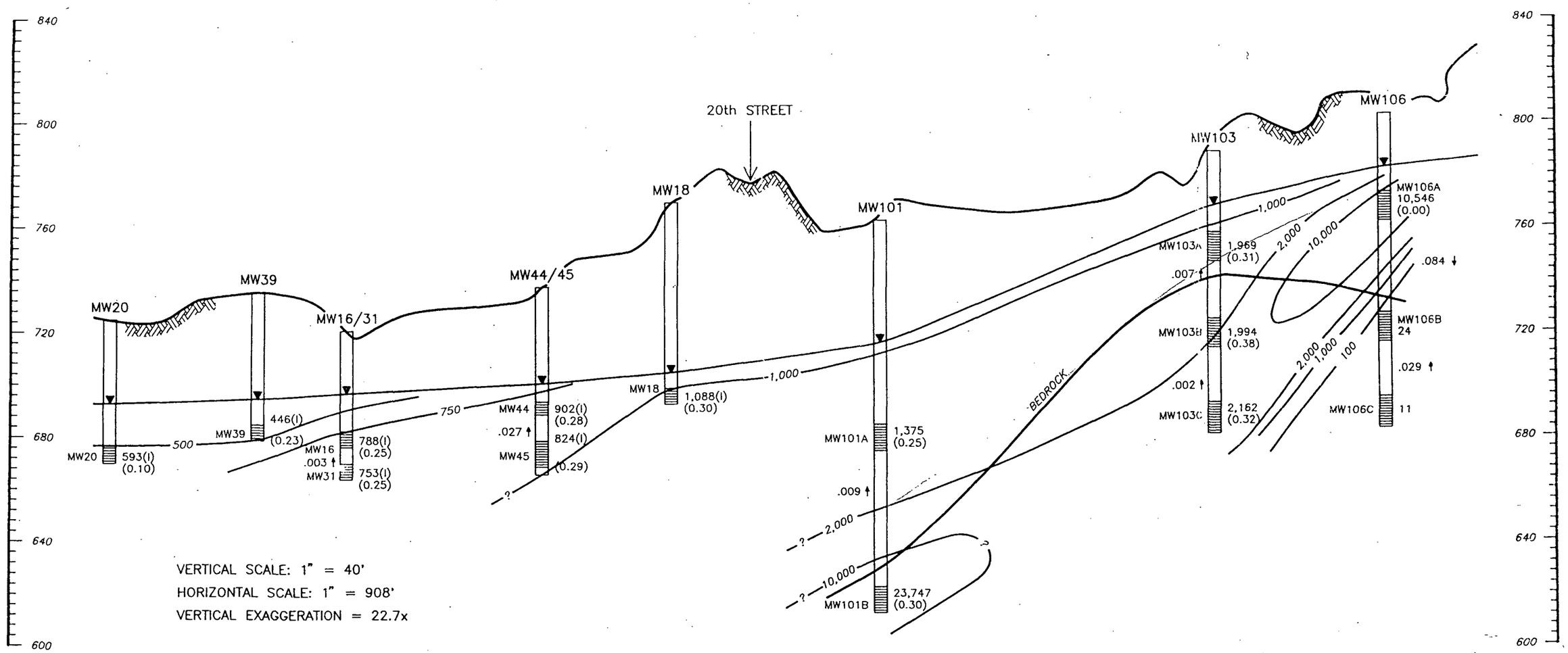
2) An additional source may contribute to the contaminant plume between MW103 and MW101. Because the bedrock is much more contaminated at MW101 than the unconsolidated aquifer, the hypothetical additional source would likely be located a considerable distance upgradient from MW101, such as a short distance north or west of MW103. Alternatively, the hypothetical source may possibly be a deep injection well upgradient from MW101.

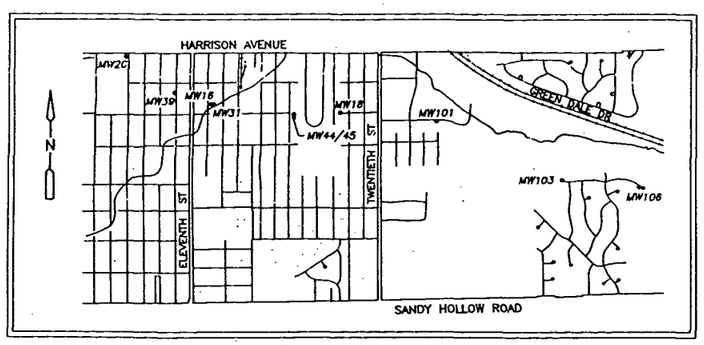
The relative ease of contaminant migration from the unconsolidated aquifer to the underlying bedrock in the area between MW106 and MW101 is consistent with the idea that the two aquifers are connected hydraulically, as postulated in subsection 3.2. This downward migration is conveyed in Figure 4-11, which is a cross-section that follows the approximate center-line of the contaminant plume from MW106 to MW20. In addition to the concentration of total chlorinated organics, the cross-section shows groundwater elevations, the contact between the unconsolidated and bedrock aquifers, and vertical hydraulic gradients between adjacent wells in well nests.

The downgradient fate of the elevated concentrations in MW101B is not known, because there are no nearby downgradient wells screened at an equivalent depth. As shown in Figure 4-11 (as well as ISWS groundwater sampling results), well nests located west of 20th Street do not show a great contrast in contaminant concentrations between shallow and deep wells.

The approximate center-line of the TCA contaminant plume (as defined from unconsolidated aquifer wells) proceeds westerly from MW101 to Marshall Street at a point just north of ISWS well MW27 (see Figure 4-9); beyond this point the plume's center-line extends to the west-northwest to approximately the intersection of 9th and Harrison (near ISWS MW-20). Based on Operable Unit and ISWS sampling results, the center-line then migrates to the west-southwest, to the area of Brooke and River Boulevard near the Rock River. These changes in the orientation of the TCA contaminant plume may be due to the influence of industrial pumping wells. For instance, pumping wells exist in the unconsolidated aquifer near Eighth and Harrison, Fifth and Park Court, and north of Brooke Road and Grant Boulevard. These locations are near the center-line of the plume; pumping at these or other nearby wells has likely pulled the contaminant plume toward them.

In the downgradient direction from MW101 to MW20, the TCA contaminant plume in the unconsolidated aquifer exhibits conformable behavior: concentrations decline in a fairly orderly fashion (see Figures 4-9 and 4-11), and the plume retains a fairly constant width of





LINE OF SECTION

LEGEND:

MW103A 1,969 (0.31)
.007
MW103B 1,994 (0.38)

MONITORING WELL NUMBER, SCREENED INTERVAL, AND PARTS PER BILLION (ppb) OF TOTAL CHLORINATED ORGANICS. NUMBERS IN PARENTHESES REPRESENT RATIOS OF TCE TO TCA (ppb/ppb).

NUMBERS ADJACENT TO ARROWS INDICATE MAGNITUDE OF VERTICAL HYDRAULIC GRADIENTS IN ADJACENT WELLS IN A NEST. ARROWS INDICATE DIRECTION OF THE VERTICAL GRADIENT.

(I) INDICATES SAMPLES COLLECTED BY ILLINOIS STATE WATER SURVEY IN AUG. 1991. ALL OTHER SAMPLES WERE COLLECTED BY CDM IN PHASE I (SEP. 1991)

1,000 — LINE OF EQUAL CONCENTRATION OF TOTAL CHLORINATED ORGANICS

GROUNDWATER SURFACE

SOUTHEAST ROCKFORD

CROSS-SECTION OF GROUNDWATER CONTAMINANT PLUME
TOTAL CHLORINATED ORGANICS

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Figure No. 4-11

between one-fourth and one-half mile (more extensive sampling surveys from the Operable Unit phase and by the ISWS also support these points).

Downgradient (west-southwest) from MW20, Phase I groundwater sampling was not conducted. However, soil-gas surveys were performed in areas 1, 2 and 3; in addition, groundwater sampling results exist for some of the area, from the sampling conducted during the Operable Unit and by the ISWS. This groundwater sampling shows that the contaminant plume becomes wider and changes chemically, from a plume dominated by TCA to one containing elevated concentrations of other chlorinated organics including TCE, PCE, 1,2-DCA, 1,1-DCA, cis-1,2-DCE, and vinyl chloride at concentrations similar to or greater than that of TCA. Rather than being a definable contaminant plume, the area west and southwest of MW20 is better described as a broad area of various degrees of groundwater contamination. Within this area are discrete hot spots of contamination of a certain chemical composition; these hot spots probably signify the contributions of nearby contaminant sources. The existence of three such sources was suggested by the results of the soil-gas survey in areas 1, 2 and 3. As discussed in subsection 4.2, soil-gas hits of PCE in areas 1, 2 and 3, and of TCA in area 3 both correlate with elevated groundwater detections downgradient from these locations. Further evidence for the existence of additional contaminant sources in the area is presented below under the results for other groundwater contaminants.

A second major area of elevated TCA concentrations defined by Phase I groundwater sampling is centered on the large industrial facility located southeast of Harrison Avenue and Alpine Road. Concentrations of TCA reach 1300 ppb in well MWS-5, which is near the origin of a TCA plume oriented roughly east-west (see Figure 4-10). This orientation conforms with the westerly groundwater gradients that prevail in the area (see subsection 3.2.2). In this area, bedrock is much shallower than to the west; accordingly, in the area from MWS-5 to MWS-9, contaminant concentrations in the bedrock are greater than in the unconsolidated aquifer. West of MWS-9, peak contaminant concentrations are in the

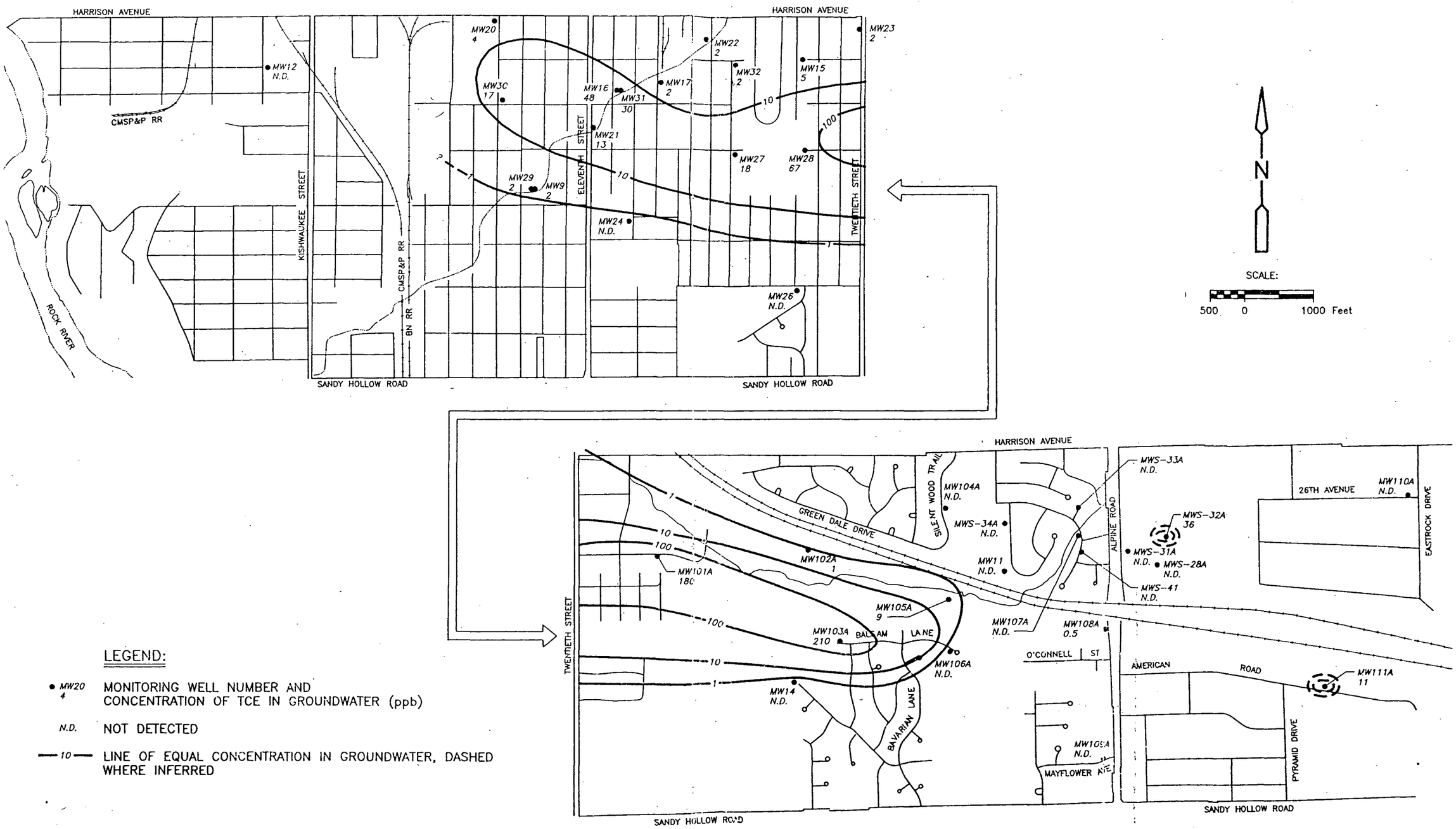
unconsolidated aquifer, as shown in the results from MW107 located one block west of Alpine Road. The reason for this appears to be a function of largely horizontal contaminant migration coupled with a decline in the bedrock surface to the west, as discussed in subsection 3.1.

TCE

TCE was generally the second most abundant organic compound detected in Phase I groundwater samples, and was the compound with the most detections greater than the federal and state Maximum Contaminant Level (MCL) of 5 ppb (see Table 4-3). The distribution of TCE in groundwater in the study area generally mirrors that of TCA. The TCE contaminant plumes in the unconsolidated and bedrock aquifers are shown in Figures 4-12 and 4-13, respectively.

The areas of TCE groundwater contamination defined in Phase I are found in two distinct areas: 1) a plume extending from near MW103 to the west-northwest to MW101 and locations farther downgradient (nearly coincident with the MW106 TCA plume); 2) a smaller plume centered on the industrial facility southeast of Harrison Avenue and Alpine Road and is oriented roughly east-west. Again similar to TCA, a downward migration of the TCE plume is apparent in the area between MW103 and MW101. At MW103, TCE is present in the unconsolidated aquifer (MW103A) at 210 ppb, while the bedrock wells each contain 380 ppb. In contrast, at MW101 downgradient, TCE is present at much higher concentrations in the bedrock well (MW101B, at 3,600 ppb) than the unconsolidated aquifer well (MW101A, at 180 ppb).

Subject to certain limitations, groundwater passing through a particular source area will tend to acquire the chemical signature of that source. Thus, the ratio of two unrelated compounds can be characteristic of a specific source of contamination. TCE is not related to TCA by any known degradation process. Figure 4-14 displays the ratio of TCE to TCA for Phase I



LEGEND:

- • MW20 4 — MONITORING WELL NUMBER AND CONCENTRATION OF TCE IN GROUNDWATER (ppb)
- N.D. — NOT DETECTED
- —10— LINE OF EQUAL CONCENTRATION IN GROUNDWATER, DASHED WHERE INFERRED

SOUTHEAST ROCKFORD

TRICHLOROETHENE IN GROUNDWATER – UNCONSOLIDATED AQUIFER

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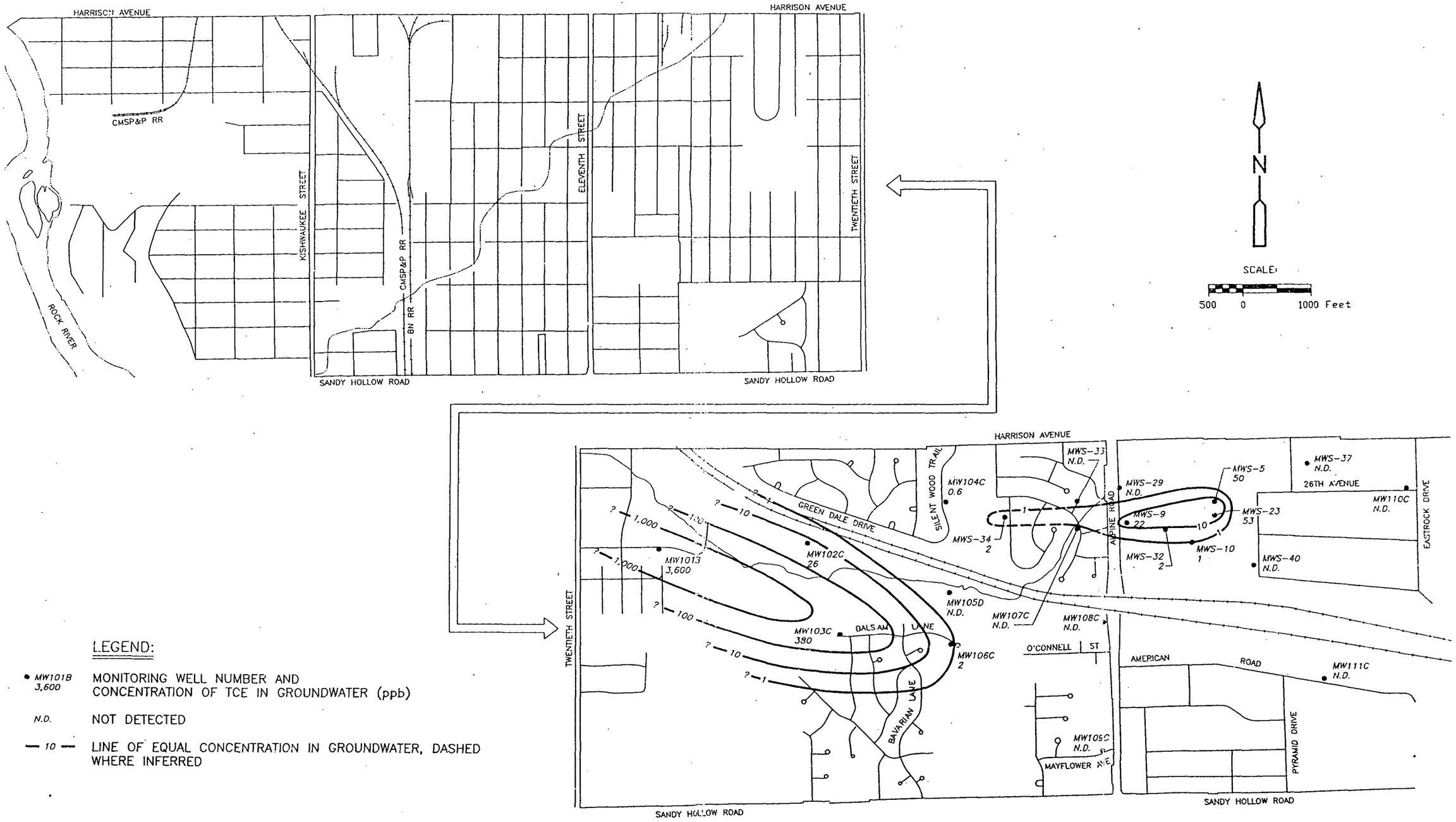
Figure No. 4–12



LEGEND:

- • MW101B 3,600 — MONITORING WELL NUMBER AND CONCENTRATION OF TCE IN GROUNDWATER (ppb)
- N.D. — NOT DETECTED
- — 10 — LINE OF EQUAL CONCENTRATION IN GROUNDWATER, DASHED WHERE INFERRED

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TRICHLOROETHENE IN GROUNDWATER – BEDROCK AQUIFER

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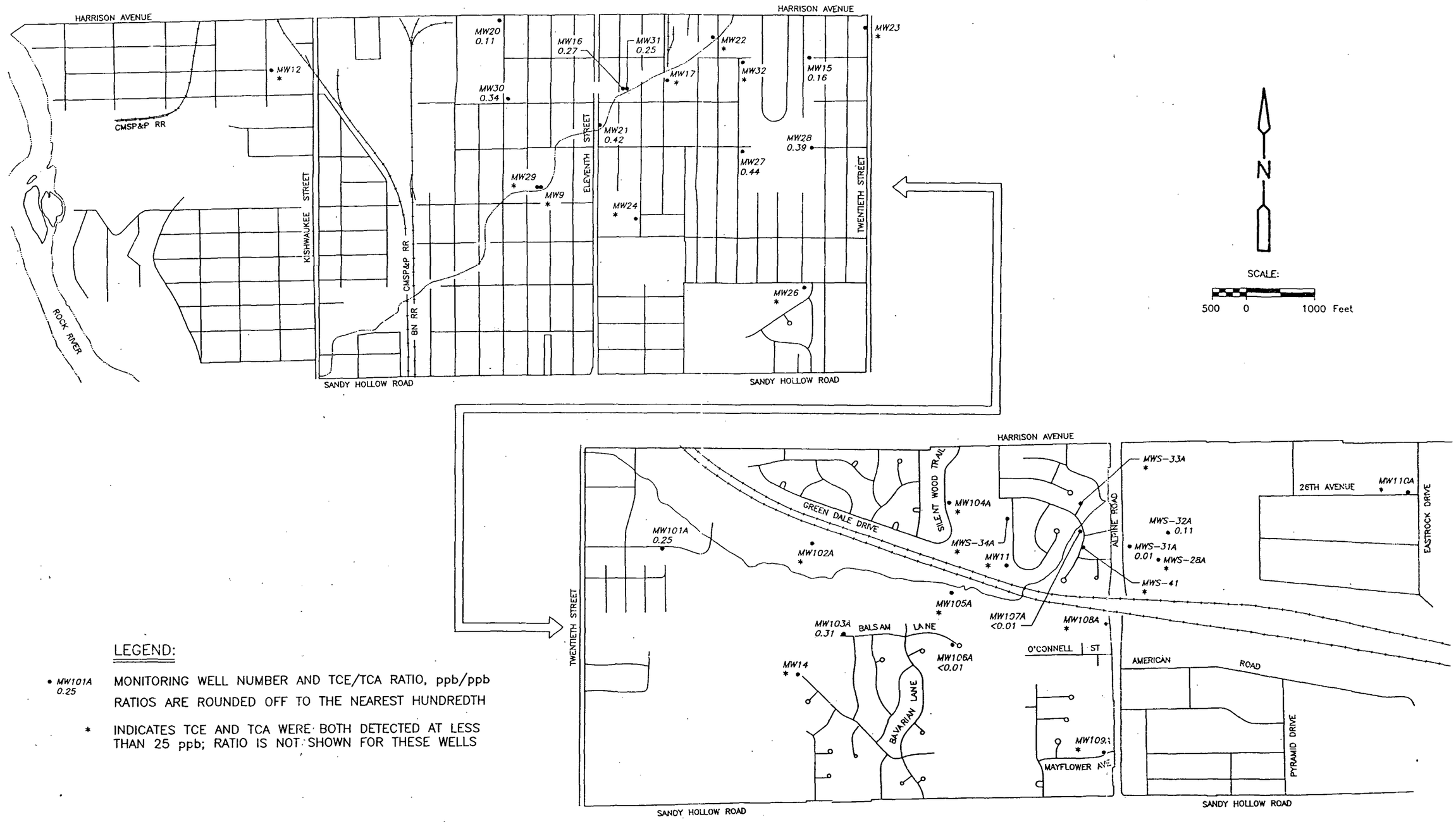
Figure No. 4–13



LEGEND:

- • MW101A 0.25 — MONITORING WELL NUMBER AND TCE/TCA RATIO, ppb/ppb RATIOS ARE ROUNDED OFF TO THE NEAREST HUNDREDTH
- * — INDICATES TCE AND TCA WERE BOTH DETECTED AT LESS THAN 25 ppb; RATIO IS NOT SHOWN FOR THESE WELLS

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TCE/TCA RATIO, UNCONSOLIDATED AQUIFER

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Figure No. 4-14

unconsolidated aquifer groundwater samples; the ratio is also shown in the cross-section of Figure 4-11. Owing to the difficulty in accurately quantifying very low concentrations of contaminants, this ratio is subject to great fluctuation at low concentrations. For this reason, the ratio is displayed only for wells where either TCA or TCE is present at greater than 25 ppb.

These figures show that the ratio is fairly consistent throughout the portion of the larger plume extending from MW103 to at least MW16. In this area, the ratio of TCE to TCA ranges from 0.16 to 0.44, generally being close to 0.30. The consistency of the ratio may indicate that this portion of the plume derives contamination from one specific source. However, more than one source may be involved if either 1) the various sources have similar ratios of TCE to TCA; or 2) any additional sources affecting the plume are considerably smaller than the source which gives the plume its characteristic TCE/TCA ratio, such that the influence of the smaller sources is damped out.

The chemical character of the plume appears to change near MW20 at Eighth and Harrison. At that location, the TCE/TCA ratio decreases to 0.11, and certain other compounds (1,1-DCA and cis-1,2-DCE) are present at concentrations much higher than are present upgradient of MW20. Proceeding downgradient (southwest) from MW20, TCE results suggest that the contaminant plume continues to vary in composition, and that the contaminated area widens significantly (see Figure 3-4 of the Operable Unit report; CDM 1990). While TCE is generally less than 50 ppb a short distance upgradient from MW20, there were several discrete detections of TCE greater than 100 ppb that were defined in other sampling efforts (the Operable Unit phase and ISWS sampling). These results suggest that the area west and southwest of MW20 is more strongly affected by downgradient sources.

One difference between the distribution of TCE and TCA is that TCE was not detected at MW106A, where TCA was found at a concentration of 6,000 ppb. This occurrence is anomalous for Phase I sampling results, because TCE was detected in the 14 other wells

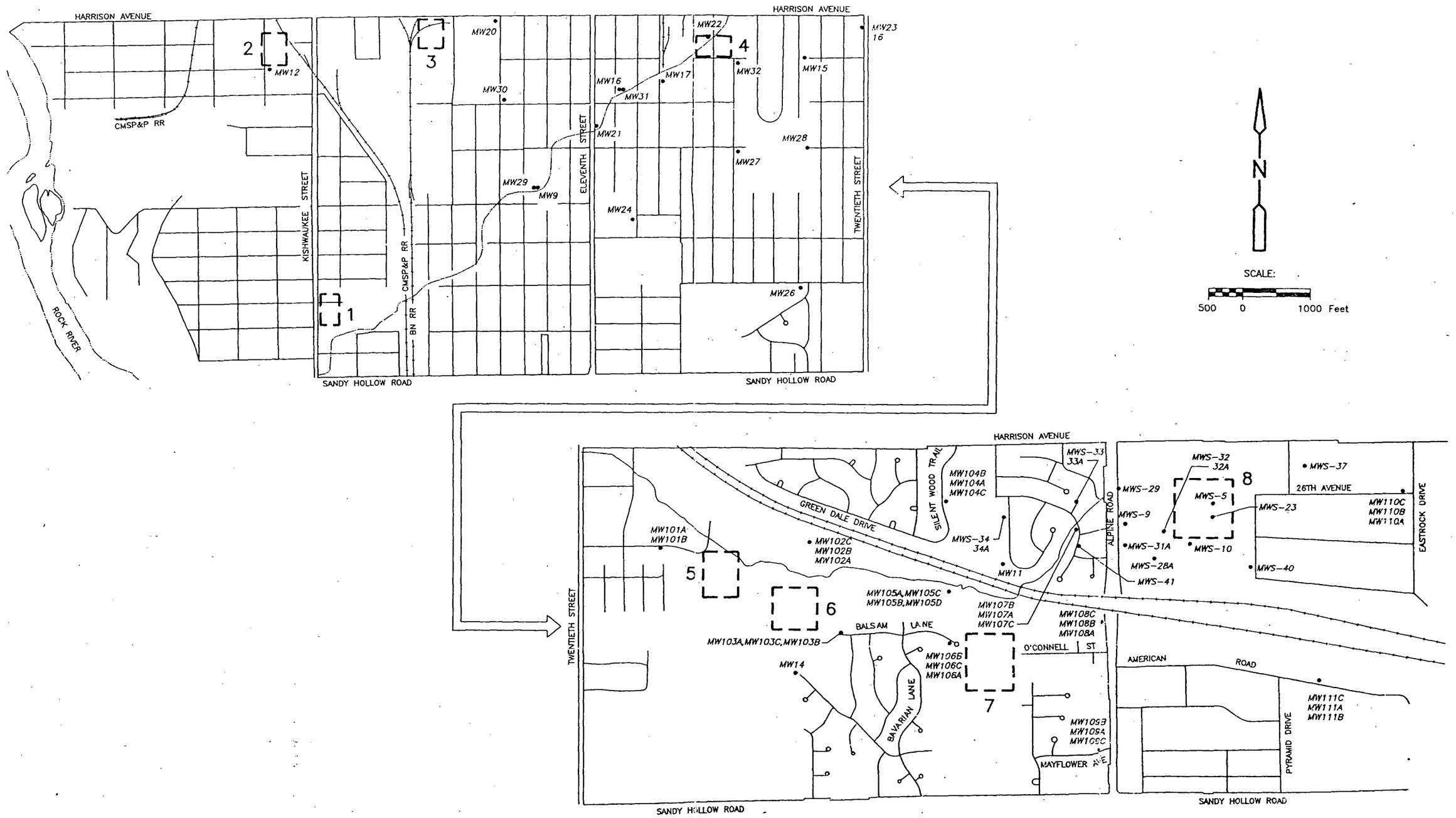
where TCA was found at concentrations of at least 120 ppb. Further, TCE was found in other Phase I wells at the same order of magnitude as cis-1,2-DCE (which is a common degradation product of TCE); however, cis-1,2-DCE was detected at 4,100 ppb in MW106A, while TCE was not detected. Additional groundwater sampling at this location is needed to evaluate whether TCE is present at MW106A. It is possible that TCE may be present there but that its detection was obscured by the high concentrations of TCA and cis-1,2-DCE. If TCE is indeed not present at this location, then its consistent presence downgradient suggests a source of TCE between MW106 and MW103.

The second zone of TCE concentrations noted in Phase I samples is an east-west plume centered on the facility located southeast of Harrison Avenue and Alpine Road. These concentrations are generally lower than in the larger (MW106) plume. In fact, the ratio of TCE to TCA is typically smaller in the facility plume than in the MW106 plume. Based on the wells where either TCE or TCA was detected at greater than 25 ppb, six of the seven wells in the facility plume had TCE/TCA ratios less than 0.16, while one well had a ratio of 0.51. Overall, the TCE/TCA ratio (generally less than 0.16) in the facility plume is less than that of samples from the larger plume downgradient from MW103 (generally between 0.16 and 0.44).

The various potential source areas are plotted on Figure 4-15. This figure includes potential source areas suggested by the results of Phase I work including both the soil gas survey and the groundwater sampling effort. In addition to the distribution of TCA and TCE in groundwater, the results for other compounds discussed below support the existence of these potential source areas.

PCE

Tetrachloroethene or PCE was detected in 18 of 68 Phase I groundwater samples, 13 of which exceeded the federal MCL of 5 ppb (see Table 4-3 above). The distribution of PCE



SOUTHEAST ROCKFORD

POTENTIAL CONTAMINANT SOURCE AREAS
DEFINED IN PHASE I

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Figure No. 4–15

in groundwater follows that of TCA and TCE in a general way, except that it has migrated less distance from likely source areas than the former contaminants.

All detections of PCE greater than 15 ppb fall into the two plumes of groundwater contamination defined by TCA and TCE distributions. The highest PCE concentrations are found within the larger contaminant plume near MW103 and MW101. MW101B contained 1,200 ppb in the Phase I sample; wells MW103A, B, and C ranged from 110 to 130 ppb, and MW106A contained 43 ppb. Unlike TCA and TCE, however, there has been no further significant migration downgradient. The highest concentration west of 20th Street was 2 ppb at MW16, a relatively greater decline than for TCA or TCE.

Downgradient from MW20, however, other groundwater sampling surveys (Operable Unit and ISWS sampling) have shown seven detections of PCE greater than 10 ppb, three of which were 95 ppb or greater. These detections suggest the existence of local sources of PCE, which is consistent with the results of the soil-gas surveys conducted during this investigation.

The second area of PCE groundwater contamination defined in Phase I was coincident with the TCA and TCE plumes at the facility off Harrison and Alpine. In this area, PCE was detected in three wells at concentrations between 100 and 160 ppb (MWS23, MWS5 and MWS32), 10 to 20% of the concentration of TCA. However, as noted for the plume near MW103, PCE in this plume has not migrated as far as TCA. PCE was present at no more than 1 ppb in downgradient wells MWS31A and MW107A, only about 1% of the TCA concentrations of 84 and 110 ppb, respectively.

Additional unexpected detections of PCE were noted at upgradient wells MW111A and MW111B at 12 and 15 ppb, respectively. These detections are not part of either plume noted above. As noted in the foregoing discussion of background water quality, several other chlorinated organics are present in each of these wells. Based on both groundwater

and soil-gas data, these contaminants do not appear to have migrated far downgradient from this location. The source of the contaminants detected at MW111 is unknown.

Other Chlorinated Organic Compounds

In order of decreasing abundance, the following additional chlorinated volatile organic compounds were detected in Phase I groundwater samples: cis-1,2-DCE, 1,1-DCA, 1,1-DCE, chloroform, 1,2-DCA, 1,1,2-trichloroethane, trans-1,2-DCE, chlorobenzene, vinyl chloride, and chloroethane (see Tables 4-2 and 4-3 above).

Of this group of compounds, five are known to be common biodegradation products (directly or indirectly) of TCA or TCE (Olsen and Davis, 1990). The compounds 1,1-DCA, 1,1-DCE, and cis-1,2-DCE have been reported to form through the biodegradation of TCA, while cis-1,2-DCE has been also reported to form by the biodegradation of TCE. Chloroethane can form by the biodegradation of either 1,1-DCA or cis-1,2-DCE, while vinyl chloride has been reported to form as a result of biodegradation of either 1,1-DCE or trans-1,2-DCE.

1,1-DCE, 1,1-DCA, and cis-1,2-DCE

In the area covered by Phase I groundwater sampling, the compounds 1,1-DCE, 1,1-DCA and cis-1,2-DCE have distributions very similar to that of TCA and TCE. They are found in two plumes which are centered on the area near and downgradient from MW103, and on the industrial facility southeast of Harrison Avenue and Alpine Road. The highest concentrations were found in the larger (MW106) plume, at MW101B (contained highest concentrations of 1,1-DCE [940 ppb] and 1,1-DCA [2,900 ppb]) or MW106A (contained highest concentration of cis-1,2-DCE [4,100 ppb]). Proceeding downgradient from MW101, concentrations of these compounds generally decrease steadily for an additional mile, to at least as far as MW16/MW31. In this portion of the plume (MW106 to MW16/MW31), these contaminants are present in roughly similar proportions, resulting in a distinctive plume fingerprint. At

MW20, the relative proportions of compounds changes significantly. At this location 1,1-DCA and cis-1,2-DCE are present at their highest ratios relative to TCA and TCE, respectively. In the area southwest (roughly downgradient) of MW20, other sampling efforts (CDM, 1990; ISWS) show the occurrence of at least four distinct fingerprints that correspond to relatively small contaminated areas. One area is dominated by 1,1-DCA, TCA and 1,1-DCE (in order of high to low concentrations); one is characterized by 1,2-DCA/TCE/PCE; two others are predominantly cis-1,2-DCE/PCE/TCE/vinyl chloride and PCE/TCE/cis-1,2-DCE. These fingerprints contrast with the TCA/cis-1,2-DCE/1,1-DCA/TCE fingerprint of the area upgradient from MW20.

The second major area of groundwater contamination by 1,1-DCE, 1,1-DCA and cis-1,2-DCE is in the area of the industrial facility southeast of Harrison and Alpine. The distribution of these contaminants is nearly the same as that of TCA in this plume. However, the facility plume has a different fingerprint of these compounds when compared to the larger plume near MW106. The compound 1,1-DCE is consistently much higher than cis-1,2-DCE in the facility plume (1,1-DCE/cis-1,2-DCE ratio ranges from 1.36 to 60; see Table 4-2 above), while in the larger plume the opposite is true (1,1-DCE/cis-1,2-DCE ratio ranges from 0.02 to 1.46, all but one being less than 1.00).

The distributions of 1,1-DCE, 1,1-DCA and cis-1,2-DCE in groundwater in the study area are consistent with the idea that they originate at least in part through the biodegradation of TCA and/or TCE. The compounds 1,1-DCE and 1,1-DCA are limited to areas where TCA is abundant (greater than about 50 ppb), such as the facility plume, the MW106 plume, and in soil gas study area 3 near 8th Street and Alton Avenue; cis-1,2-DCE is mainly limited to areas containing elevated TCE in groundwater (the MW106 plume, in soil gas study areas 1 and 2, and to a lesser extent, the facility plume). This preferential association of potential biodegradation daughter products with parent compounds suggests that biodegradation is an important process influencing the fate, transport, and formation of various site contaminants.

Chloroform, 1,2-DCA, 1,1,2-TCA, and trans-1,2-DCE

These four chlorinated organic compounds have similar groundwater distributions and peak concentrations (see Tables 4-2 and 4-3 above). Each was detected at its highest concentration at MW101B, and all but one detection were found in the large plume between MW106 and MW20. A single detection between 1 and 5 ppb of each compound was found in the industrial facility plume. These compounds are not common byproducts of degradation processes. Rather, their occurrence in the study area likely reflects low-volume disposal of these compounds as solvents or as contaminants in other solvents.

Chlorobenzene, Vinyl Chloride and Chloroethane

Chlorobenzene was found from a single unconsolidated aquifer well in the facility plume (MWS-31A at 12 ppb). Vinyl chloride and chloroethane were detected in a single well in the larger (MW103-area) plume, both at a concentration of 5 ppb (vinyl chloride at MW105B and chloroethane at MW20). These contaminants commonly form through biodegradation of other chlorinated organic compounds; their association with their potential parent compounds, as well as with other degradation products, suggest that their presence in the study area is due to biodegradation. Vinyl chloride was also detected at concentrations significantly above the MCL of 2 ppb at two wells southwest of MW20 (sampled during the Operable Unit phase; CDM 1990).

Toluene and Benzene

Toluene and benzene are chemically similar compounds that degrade relatively easily in an oxygen-rich environment such as the unsaturated zone or in near-surface groundwater environments. Studies have shown relatively rapid degradation of these compounds in groundwater within a distance of 1000 feet of source areas (e.g., Olsen and Davis, 1990). Therefore, their presence in the near-surface in the study area probably indicates that a source of contamination is nearby.

The distributions of toluene and benzene in the study area are consistent with relatively rapid degradation of these compounds in the groundwater. For instance, toluene was detected at a concentration of 14,000 ppb at MWS-5 in the facility plume, but only one other nearby well (MWS-32 at 7 ppb) showed detectable levels of toluene. Therefore, the detections of toluene and/or benzene at MWS-5, MWS-32, MW106A and MW20 strongly suggest the existence of contaminant sources a short distance (less than 1000 feet) upgradient. Sources at these locations were also suggested on the basis of the distribution of chlorinated organic compounds.

4.4.2 SEMIVOLATILE ORGANICS

The results for semivolatile organics in Phase I groundwater samples are shown in Appendix I, Table I-4. There was only one significant occurrence of semivolatile organics in Phase I groundwater samples, at MW106A near the upgradient end of the larger contaminant plume defined by volatiles concentrations. This sample contained 4-methylphenol (54 ppb), 2,4-dimethylphenol (12 ppb) and di-n-butylphthalate (10 ppb) at concentrations at or above the Contract Required Quantification Limit (CRQL), and 2-methylphenol (8 ppb), naphthalene (7 ppb) and 2-methylnaphthalene (1 ppb) at lower concentrations. These semivolatile detections are consistent with the fact that MW106A contained the second-highest concentrations of total volatile organic compounds.

All other detections of semivolatile organic compounds were of various phthalate compounds, and all were below the CRQL. The repeated low-level detections of these compounds at many wells suggest that these detections are not due to contamination in the study area.

4.4.3 PESTICIDES

The occurrence of pesticides in Phase I groundwater samples mirrored that of semivolatile organics. MW106A contained seven pesticide compounds (gamma-BHC, heptachlor epoxide, dieldrin, 4,4'-DDE, endrin, endosulfan sulfate, and gamma-chlordane) at concentrations

greater than their respective CRQLs (generally 0.010 ppb; see Tables I-1 and I-2 in Appendix I for CRQLs and complete results). Of these compounds, gamma-BHC, heptachlor epoxide and endrin were detected at approximately 40%, 80% and 95% of their respective federal or state MCLs (see Table 4-3). Based on the lack of downgradient detections above the CRQL for any of these compounds, there is no evidence of significant migration of pesticides in groundwater.

Two wells in the facility plume (MWS-32A and 33A) contained concentrations of heptachlor and/or alpha-chlordane at concentrations greater than the CRQL of 0.010 ppb. Heptachlor was detected in MWS-33A at approximately 40% of its state MCL of 0.10 ppb. As for the compounds detected at MW106A, heptachlor and alpha-chlordane were not detected above the CRQL at other nearby wells, and likely have not migrated significantly in groundwater.

4.4.4 INORGANICS

A total of 52 groundwater samples were collected and analyzed for inorganic constituents in Phase I (the 33 new monitoring wells and 19 ISWS wells; results are listed in Table I-3 of Appendix I). The unfiltered or "total metals" samples are not representative of in-situ groundwater, because of the frequent presence of abundant suspended solids (which contain concentrations of metals) in the monitoring wells.

The remainder of this discussion of inorganic results will be limited to consideration of filtered samples (designated "dissolved" in Appendix I). Among the constituents analyzed, no samples exceeded primary MCLs. Secondary MCLs of aluminum, iron, and manganese were exceeded for a number of samples, as summarized in Table 4-4. Unlike organic contaminants, these metals do not display well-defined plumes of contamination.

Aluminum was detected at concentrations greater than 50 ppb in 17 of the 51 wells sampled in Phase I. However, the federal secondary MCL may range from 50 to 200 ppb based on local conditions (Jan. 30, 1991 Federal Register, p. 3573). Because the range of this

Table 4-4
Comparison of Inorganic Groundwater Results at Southeast Rockford to Federal MCLs and Illinois Groundwater Quality Standards (all values in ppb)

Compound (b)	Federal MCL	Illinois Standards*	Range of Phase I samples	Proportion of Phase I samples with detectable concentrations (c)	Proportion of Phase I samples exceeding MCLs
Aluminum	50-200**	-	<32 - 3,340	41/51 (80.4%)	22/51 (43.1%)***
Iron	300**	5,000	<6 - 5,220	42/51 (82.3%)	11/51 (21.6%)
Manganese	50**	150	<2 - 667	44/51 (86.3%)	19/51 (37.2%)
Arsenic	50	50	<1 - 44.4	13/51 (25.5%)	none
Selenium	10	50	<1 - 6.5	4/51 (7.8%)	none

(a):Results are given for filtered groundwater samples only.

(b): Results are given for any compound detected at greater than or equal to 50% of the more conservative MCL.

(c): Detectable concentrations are those which are equal to or exceed the Instrument Detection Limit.

* : Illinois Groundwater Quality Standards, 35 Ill. Adm. Code, Subpart C, Section 620.410, November 7, 1991.

**: Indicates secondary MCL (SMCL), recommended but not promulgated.

***: Indicates the number of exceedences of the more conservative MCL.

standard is below the CRQL for aluminum of 100 ppb, the subsequent discussion incorporates detections of aluminum between the instrument detection limit (approximately 32 ppb) and the CRQL. The four Phase I-sampled wells that exceeded 200 ppb were MW102A, 111A, 109A, and 110B, located outside the major areas of organic contamination. The other wells containing higher than 50 ppb aluminum are scattered across a large proportion of the area sampled, and do not show significant exceedances of what would probably be considered background concentrations in groundwater (nearly all contained between 50 and 100 ppb, while most remaining wells contained detectable concentrations between 32 and 50 ppb). Nineteen detections of aluminum greater than 50 ppb were found in the 36 unconsolidated wells sampled for inorganics. The scattered occurrence of these aluminum exceedances, coupled with the apparently high background of aluminum, suggest that most detections of aluminum in the 50 to 200 ppb range (and perhaps those greater than 200 ppb) may result from natural conditions such as the presence of clays (which contain abundant aluminum), common in the unconsolidated sediments. This is supported by the general correlation of aluminum with total suspended solids (TSS; shown in Table I-4 of Appendix I), both of which are especially abundant in the "A" wells of MW102 through MW111. In contrast to the unconsolidated aquifer, only three of the 15 bedrock aquifer wells sampled for inorganics contained aluminum at greater than 50 ppb, the highest concentration being 57.6 at MW101B.

Iron was detected at concentrations greater than the secondary MCL of 300 ppb in 11 of the 51 wells sampled in Phase I. Similar to the results for aluminum, these exceedances were scattered across a wide portion of the study area, and the highest concentrations (at MW102A, 109C, MW20, and MW106A) were found generally outside the areas of peak organic contamination. Assignment of a "background" concentration for iron is difficult because of its high solubility in chemically reducing environments, which characterize many deep groundwaters. This characteristic of iron may account for the relative abundance of iron in deep wells such as MW105C and D, MW108C and MW109C. On the other hand, high concentrations of iron in shallow wells may signify nearby sources of contamination. Any downgradient migration of iron from these wells appears limited, however. For

instance, wells downgradient of MW102A and 106A contain concentrations of iron approximately 5% or less of the upgradient wells.

The secondary MCL for manganese of 50 ppb was exceeded at 19 of the 51 wells sampled in Phase I for inorganics. Manganese, like iron, is relatively immobile in oxidizing chemical environments; it is even more mobile than iron in slightly reducing environments (Hem, 1989). This mobility may account for the exceedances of standards at seven bedrock wells (15 bedrock wells were sampled) as well as one or more wells in deeper portions of the unconsolidated aquifer (such as MW105C). Other exceedances of the manganese standard may be related to the occurrence of abundant TSS and clays (such as MW102A, 103A, 104A, 105A, 106A, 110A, and MW11). The concentration of manganese at MW20 may relate to the existence of a potential contaminant source nearby, as discussed under organic compounds. As for iron, however, there is no evidence of extensive downgradient migration of manganese from the areas containing peak concentrations (MW102A, 106A and 105B).

Arsenic was reported at a concentration of 44.4 ppb from well MW102C. All other results for arsenic were less than 25% of the MCL of 50 ppb. The concentration of arsenic at MW102C is suspect, however, because all other inorganic constituents in this sample except for magnesium were undetected. No other investigative sample contained such low concentrations of inorganics (particularly major elements such as calcium, sodium, potassium and magnesium). Therefore, the lack of other detections to go along with arsenic at MW102C suggests that the detection may be erroneous. In addition, the lack of other detections of arsenic at similar concentrations indicates that it is not a mobile contaminant in groundwater in the study area.

Selenium was reported at a concentration of 6.5 ppb in well MW20, at 5.6 ppb in MW23 and 5.1 ppb in MW26. These are the only samples with greater than 50% of the MCL of 10 ppb, all others containing less than 2 ppb. These wells are at least a half-mile from each other, and detections were not found in intervening monitoring well locations. This pattern indicates that selenium is probably not transported great distances in groundwater in the study

area, with the possible exception of areas downgradient from MW20. The detection at MW20 may relate to input of a nearby source of contamination, as suggested by a change in the organic plume fingerprint there, and possibly by the exceedances of iron and manganese at MW20.

No other inorganic constituents were present in any Phase I groundwater samples at concentrations greater than 50% of their respective MCLs.

In summary, the only inorganic constituents with occurrences exceeding standards were aluminum, iron and manganese, which exceeded secondary MCLs (not health-based) at a number of widely-spaced wells. A large proportion of these exceedances probably do not reflect environmental contamination, but are a function of natural conditions such as high amounts of clay in the shallow aquifer, and chemically reducing environments in parts of the bedrock aquifer.

The only inorganic constituents that are of potential concern with respect to primary MCLs (health-based criteria) are selenium and arsenic, though neither exceeded standards in any Phase I groundwater sample. The three detections of selenium greater than 50% of the MCL were at widely-spaced wells, indicating that extensive migration of selenium is not occurring in study area groundwater. The single detection of arsenic that approaches the MCL is suspect, because of the low to nondetectable concentrations of all other inorganics in that sample.

4.4.5 FATE AND TRANSPORT OF GROUNDWATER CONTAMINANTS

Groundwater contamination in the Southeast Rockford study area is characterized by numerous exceedances of primary drinking water standards (MCLs) by volatile organic compounds. Localized instances (one to three samples each) of detections approaching primary MCLs were reported for several pesticides, and for arsenic and selenium.

Exceedances of secondary MCLs by aluminum, iron and manganese probably reflect a combination of natural concentrations and localized contamination.

Based on these patterns, the volatile organic compounds are the only contaminants that have migrated significantly in study area groundwater. There are two main areas of groundwater contamination defined by chlorinated organic compounds: 1) near and downgradient (west-northwest) of well nest MW106; and 2) centered on the industrial facility southeast of Harrison Avenue and Alpine Road. The previous Operable Unit sampling effort shows that several smaller contaminated areas exist downgradient (west and southwest) of the MW106-area plume (i.e., in soil gas study areas 1, 2, and 3), based on contaminant distributions and contaminant ratios in groundwater in those areas.

The most abundant chlorinated organic contaminants (TCA, cis-1,2-DCE, 1,1-DCA, TCE, and 1,1-DCE) in study-area groundwater have broadly similar distributions, reflecting their similarity in physical and chemical properties. These properties include fairly low solubilities in water (less than 0.5%; Montgomery and Welkom, 1990) and moderate organic carbon partition coefficients (the latter allow extensive migration in the study area aquifers, which are relatively poor in organic carbon). In addition, the contaminants have low susceptibility to chemical and biological degradation in the saturated zone (due to the mildly oxidizing to mildly reducing chemical conditions; rapid biodegradation would require methanogenic conditions, which probably do not exist in study area groundwater). Though biodegradation is not rapid, it is occurring in the subsurface, based on the presence of compounds such as 1,1-DCA, 1,1-DCE, cis-1,2-DCE, chloroethane and vinyl chloride. These compounds are not used in large quantities for industrial or other purposes, but are common products of the biodegradation of TCA and TCE.

The distribution of PCE is areally more restricted than the major chlorinated compounds discussed above, being limited to locations near potential source areas. This pattern is likely due to the fact that PCE is considerably less soluble in water and has a slightly higher organic-carbon partition coefficient than the other chlorinated compounds (Montgomery and

Welkom, 1990). These properties probably combine to limit the mobility of PCE in groundwater in the study area.

Vinyl chloride, chloroethane and PCE are chlorinated organic compounds that have a much more restricted occurrence than the chlorinated compounds discussed above. The most likely origin of vinyl chloride and chloroethane in the study area groundwater is as products of the biodegradation of 1,1-DCE, 1,1-DCA, and cis-1,2-DCE (which are in turn biodegradation products of TCA and TCE). Both compounds are highly volatile, however (vapor pressures of vinyl chloride and chloroethane are 2600 and 1100 mm Hg, respectively [Montgomery and Welkom, 1990], higher than atmospheric pressure); this volatility may account for the lack of high concentrations detected for these compounds. In addition, vinyl chloride can degrade in an aerobic environment. Aerobic conditions may prevail in portions of the study area aquifer system, which may help to explain the lack of high concentrations of vinyl chloride in the groundwater.

The volatile organic compounds toluene and benzene have a very restricted areal distribution, having been detected only in several wells located near potential source areas. These non-chlorinated compounds have similar vapor pressures, solubilities in water, and organic carbon partition coefficients as the major organic contaminants and PCE. However, toluene and benzene are especially susceptible to biodegradation in an oxidizing environment (e.g., Olsen and Davis, 1990). The unsaturated zone and the upper portion of the saturated zone probably provide the oxidizing conditions necessary to effectively degrade toluene and benzene in the subsurface. Such biodegradation likely accounts for the areally restricted distribution of toluene and benzene in groundwater in the study area.

The specific rate of migration of the contaminant plume front is difficult to estimate, based on the available data; this is also true for the average contaminant velocity for many specific contaminants. The average contaminant velocity can be calculated by dividing the average groundwater velocity by the retardation factor, which is specific to the contaminant. Retardation is most strongly controlled by the proportion of organic carbon in the solid

aquifer material, because of the high capacity of organic carbon to adsorb organic chemicals. However, the proportion of organic carbon is unknown for the aquifers in the study area. The attempt was made in Phase I to collect this information, but the results of total organic carbon (TOC) analysis are highly suspect, ranging from approximately 0.4 to 4.5%. Values of this magnitude for TOC are high for sands and gravels, the types of aquifer materials collected for the analyses; samples with reported values of several percent of TOC would have been recognized in the field as containing humic materials.

Owing to the unreliability of the TOC data, it is not now possible to estimate retardation factors for the various contaminants. However, the estimate obtained previously (subsection 3.2.4) for average groundwater velocity can be used to provide a general estimate of the rate of contaminant migration. Typical retardation factors for TCA and most other organic contaminants are expected to fall between 1 and 2, based on the low expected TOC values for the study area aquifers. Based on the expected range of retardation factors, it is likely that average contaminant velocities could be as slow as one-half the velocity of groundwater.

The reliability of contaminant migration estimates depend on the accuracy of the estimate of groundwater velocity. The velocity estimate in turn depends on the accuracy of hydraulic conductivity, effective porosity, and hydraulic gradient. The hydraulic gradient is probably known to a high degree of accuracy, but the other two parameters are subject to more variability. The effective porosity was not measured; it may be less than the range stated (0.10 to 0.20), which would increase contaminant migration rates. Hydraulic conductivity is more prone to variability, based on the wide range of the values calculated for the unconsolidated aquifer from slug tests (subsection 3.2.3). Hydraulic conductivities should be measured for potential pathways of contaminant migration in order to decrease the estimated range of groundwater and contaminant velocities.

Contaminant migration velocities may be quite rapid if there exist higher-conductivity zones in the subsurface upgradient of MW101. Two types of higher-conductivity zones are possible: 1) a zone or zones of well-sorted sand and gravel of the type seen in the screened

interval at MW101A; 2) a zone at the upper surface of the bedrock characterized by high permeabililty due to the presence of fractures, cavities, and/or weathered blocks of dolomite; the existence of local cavities near the bedrock surface was suggested during drilling (see subsection 3.1.1). If either of these two types of higher-conductivity zones is laterally continuous in the area upgradient from MW101, then contaminant migration rates would likely be quite rapid. In such an event, potential contaminant source 7 and possibly potential source 8 could be related to the groundwater contamination observed at MW101.

An assessment of the downgradient fate of groundwater contaminants requires an accurate estimate of the rate of contaminant migration. This average contaminant velocity is also important in assessing the question of contaminant source, as well as in assessing the feasibility of certain remedial alternatives (such as plume capture). The available data provide an estimated range for contaminant velocity, but several parameters are either unknown or are subject to considerable uncertainty. Specifically, more information is needed to quantify accurately the hydraulic conductivity and effective porosity, and whether zones of higher hydraulic conductivity are present across a wide area upgradient of MW101. Answers to these questions will assist in the assessment of the source(s) of groundwater contamination, the ultimate fate of contaminants, and the cleanup of contamination.

Comparison of Phase I estimates of hydraulic conductivity with the hydraulic conductivities determined by the Illinois State Water Survey (ISWS; Wehrmann 1991) for wells to the west of MW101 suggests that the character of the unconsolidated aquifer changes between MW103 and MW101. Unconsolidated aquifer wells located downgradient (west) of MW101 have conductivities on the order of forty times that of wells upgradient of MW101 (730 gal/day/ft^2 compared to 17 gal/day/ft^2). Well MW101A has a high conductivity similar to that of wells located to the west; this is consistent with the coarse sand in the screened interval. In addition, shallower portions of this boring contain abundant gravel, which was noted in portions of wells to the west. Proceeding downgradient (east to west), the location of the transition from low to high conductivities in the unconsolidated aquifer is probably located somewhere between well nests MW101 and MW103. If this transition is located near

MW103, the expected migration rates for contaminants traversing the path from MW103 to MW101 would be considerably faster.

The higher hydraulic conductivities in the unconsolidated aquifer downgradient (west) from MW101 likewise allow faster contaminant transport than the area upgradient from MW101. Based on ISWS data, calculations of average groundwater velocity west of MW101 yield a result of approximately 440 ft/year. Depending on the proportion of organic carbon in the aquifer, the average contaminant velocity for TCA is probably between 220 and 440 ft/year. Using a contaminant velocity of 400 ft/year, TCA would travel the 6500 feet between MW101 and ISWS well MW20 in approximately 16 years. If the initiation of contaminant release to the environment was approximately 1950 (chlorinated solvents became commercially available in the late 1940s), and the onset of contamination at MW20 is assumed to be approximately 1985 (by 1982, contamination had reached municipal well 35, which is located roughly 1,000 feet upgradient of MW20; after being shut off, well 35 is no longer in the plume), then contaminants would have had approximately 35 years to reach the area of MW20. Based on the fingerprint of the plume and its steadily decreasing contaminant concentrations from MW101 to MW20, a major contaminant source affecting the plume is probably located upgradient of MW101. At this time, however, potential sources located farther upgradient cannot be similarly evaluated, due to the lack of sufficient information in the area upgradient from MW101.

5.0 SUMMARY AND RECOMMENDATIONS

5.1 SUMMARY

Geology

- Unconsolidated glacial sediments overlie dolomite, which forms an east-west subsurface valley nearly 200 feet deep. Glacial sediments are thickest within the bedrock valley and thinnest on the valley flanks.

- Bedrock has relatively uniform lithology; glacial sediments are lithologically variable and laterally discontinuous over short distances.

- Relatively higher-permeability zones within dolomite may be related to vugs, fractures, or solution zones. These zones are present at or near the bedrock surface and possibly deeper.

Hydrogeology

- Two hydraulically-connected aquifers (one in unconsolidated sediments and one in dolomite) are present and no areally extensive aquitards were identified.

- The general direction of groundwater flow is westward. Horizontal hydraulic gradients are roughly twice as large west of Bavarian Lane than east of it. Vertical hydraulic gradients exist between the two aquifers, with downward gradients being more prevalent.

- The mean hydraulic conductivity of the unconsolidated aquifer (8.3×10^{-4}cm/s) corresponds to silty sand, with values ranging from silty sand (5.6×10^{-5}cm/s) to clean sand (3.3×10^{-2} cm/s). The mean hydraulic conductivity of the bedrock aquifer (9.1×10^{-4}cm/s) falls at the high end of the range expected for dolomite.

Soil Gas

- Potential source areas (1-4) were identified in four of the six soil gas survey areas. Identification of potential source areas was based on elevated concentrations of PCE, TCA and/or TCE in the soil gas.

- These soil gas hits correlate with small areas of groundwater contamination in the western portion of the study area. This result is based on previous groundwater sampling, which showed that wells downgradient of

the soil gas hits contain a similar combination of contaminants as were reported from the corresponding soil gas hits.

Groundwater Contamination

- Phase I sampling results indicate two major areas of groundwater contamination of volatile organic compounds: 1) a large area near and downgradient (west-northwest) from well nest MW106; and 2) a smaller area centered on the industrial facility southeast of the intersection of Harrison Avenue and Alpine Road.

- Though several localized detections were reported, there is no evidence of significant migration of semivolatile, pesticide, or most inorganic contaminants in groundwater. Exceedances of secondary MCLs by aluminum, iron, and manganese probably reflect a combination of natural concentrations and localized contamination.

- Previous sampling efforts show that several smaller plumes exist downgradient (west and southwest) of the downgradient extent of the MW106 plume (i.e., west and southwest of MW20), based on contaminant distributions and ratios.

- The most abundant and widespread organic contaminants in groundwater in the study area are the chlorinated organic compounds TCA, cis-1,2-DCE, 1,1-DCA, TCE, 1,1-DCE, and PCE.

- Biodegradation probably accounts for the presence of certain compounds (cis-1,2-DCE, 1,1-DCA, 1,1-DCE, chloroethane, and vinyl chloride) that are not generally used in large quantities for industrial or other purposes, but are common degradation products of TCA and TCE.

- The two major areas of organic groundwater contamination appear to have different ratios of TCE to TCA, and of 1,1-DCE to cis-1,2-DCE.

- Different contaminant fingerprints are present in the small downgradient plumes (west and southwest of MW20) defined in previous groundwater sampling surveys. These contaminant fingerprints are consistent with the existence of nearby potential contaminant sources, as suggested by the soil gas survey results.

- Phase I groundwater sampling suggests potential source areas in the following areas: 1) upgradient from well nest MW106 (Area 7); 2) upgradient from well nest MW101 (Areas 5 and 6); and 3) at the industrial facility southeast of Harrison Avenue and Alpine Road (Area 8).

- The rate of migration of the groundwater contaminant plume is not well constrained, owing to uncertainties in the fraction of total organic carbon, hydraulic conductivity, and the effective porosity of the aquifer materials. In addition, the age and location of contaminant sources are not known with enough accuracy to provide sufficient constraint on the distance and time involved in contaminant migration.

5.2 RECOMMENDATIONS

- Historical information on the study area should be gathered to determine the origin and timing of any contaminant release to soil or groundwater (based on evidence such as aerial photographs, and the nature and timing of industrial operations).

- For plume characterization, Phase II groundwater analysis should be limited to volatile organic compounds.

- Investigate potential source areas upgradient of MW106 (Area 7) and upgradient of MW101 (Areas 5 and 6) by conducting detailed geophysical surveys, soil gas and/or drilling and sampling programs. Source area samples should be analyzed for the full target compound list of chemicals.

- Perform a focussed investigation at the four western potential source areas (1-4) by installing monitoring wells and/or soil borings, collecting soil and groundwater samples, and perhaps conducting geophysical surveys.

- Investigate the area upgradient of well nest MW111, which was intended to provide background groundwater quality information but contained elevated levels of several volatile organic compounds.

- Install monitoring wells to determine whether the major plume and industrial plume are connected.

- Define the extent of groundwater contamination in the bedrock and deep portions of the unconsolidated aquifer downgradient from MW101, which contained the highest contaminant concentrations.

- Perform groundwater modelling in order to: 1) assist in defining data gaps; 2) assist in performing contaminant tracking in order to predict future contaminant distribution and to help locate potential source areas; 3) calibrate hydraulic heads and constrain aquifer parameters; 4) evaluate the existence and influence on contaminant transport of a high-permeability zone along the upper surface of the bedrock; 5) evaluate the hydraulic connection between the aquifers and the Rock River, and the extent to which the river acts as a barrier

to contaminant migration; 6) evaluate the location and effect of discharge zones from the contaminated bedrock into the unconsolidated aquifer west of well nest MW101; and 7) evaluate the feasibility of remedial alternatives.

- Examine the role of higher-permeability zones in the bedrock aquifer by installing monitoring wells, performing slug tests, and possibly conducting pump tests in these areas.

- Collect undisturbed samples of aquifer materials to enable accurate determination of effective porosity and contaminant adsorption/desorption (through column tests), both of which are critical in determining contaminant migration rates.

- Evaluate the existence and extent of any DNAPLs (dense non-aqueous phase liquids) in the subsurface through the collection of subsurface soil samples in potential source areas.

- Using the Phase I data and preliminary groundwater modelling techniques, areas should be identified that are likely to be impacted by future plume movement. A residential well survey and residential well sampling should be conducted in these areas to provide data for the risk assessment. Vinyl chloride should be evaluated at low concentrations to provide useful risk information.

- Based on the Phase I data, there may be a potential in hot spots of the plume for VOC vapors to migrate from the water table, through the vadose zone and into confined spaces such as residential basements. Monitoring for those compounds should be conducted in basements located in areas of high contamination in the upper aquifer.

6.0 REFERENCES

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APPENDIX A

TECHNICAL MEMORANDUM FOR SHALLOW SOIL GAS INVESTIGATION

CDM

TECHNICAL MEMORANDUM
FOR
SHALLOW SOIL GAS INVESTIGATION

SOUTHEAST ROCKFORD

ROCKFORD, ILLINOIS

Camp Dresser & McKee

TECHNICAL MEMORANDUM
FOR
SHALLOW SOIL GAS INVESTIGATION

SOUTHEAST ROCKFORD

ROCKFORD, ILLINOIS

October 1991

1681-01.3

1.0 INTRODUCTION

A soil gas survey was conducted in the Southeast Rockford Study Area between May 13 and June 6, 1991. Tracer Research Corporation (TRC) of Tucson, Arizona was contracted by CDM to conduct the survey. The soil gas survey was performed to identify areas of high soil contamination, and to aid in locating potential contamination source areas in the study area. During the survey a total of 225 soil gas samples were collected and analyzed from six areas within the Southeast Rockford Study Area. Samples were analyzed for 1,1,1-trichloroethane (TCA), trichloroethene (TCE), and tetrachloroethene (PCE). These compounds were chosen for the survey because of their suspected presence in the subsurface soils, and their ability to be easily detected using soil gas technology.

2.0 STAKING SOIL GAS SAMPLE LOCATIONS

The work plan submitted to IEPA estimated that 558 locations in the Southeast Rockford Study Area would be sampled. CDM provided IEPA community relations personnel with maps showing areas where access was requested for the survey. IEPA undertook the task of obtaining access for the survey. After access agreements were received for the six areas, soil gas locations were staked. In the work plan, locations were positioned in such a way as to create a 200 foot grid pattern in the study area. Unfortunately, limited access to residential as well as industrial properties prevented this. Areas were staked to provide the most coverage of the area possible, and in some cases, rights-of-way were used to fill in areas where individual access was denied. Two hundred twenty seven soil gas sample locations were staked. Staking was done prior to sampling to allow the utility companies time to clear the location for subsurface lines and conduits.

Prior to staking a soil gas sample location, CDM first determined where access was granted. This was done by examining access agreements provided by the community relations personnel of the IEPA. These signed agreements greatly expedited the soil gas sample location staking process. An information brochure, prepared by the IEPA community relations personnel was given to each business and resident who granted access to their property. The information brochure explained that the utility companies would be arriving on their property in a short time to clear the location. It also explained when TRC would be arriving to collect the soil gas sample. An IEPA contact and phone number were included in the brochure.

3.0 UTILITY CLEARANCE

The Joint Utility Locating Information for Excavators (J.U.L.I.E.) was contacted and provided with information on the area where we would be working. All utilities in the Southeast Rockford Service Area were notified and a joint utility meeting was scheduled. Utilities represented at the meeting were Illinois Bell Communications, Northern Illinois Gas Company, and Commonwealth Edison Electric Company. Other utilities such as Rockford City Water Department, Rock River Reclamation District, Rockford Cable Television, and GTE were also notified.

Each soil gas sample location was marked with a pin flag and a fluorescent pink circle of paint. A map and a brief description of the location was given to the utility companies. Due to the large amount of locations, the utility companies agreed to clear all the locations in a given area before moving on to another area. The utility company stated that a cleared location would be free of utilities up to 18 inches in any direction. No utilities were encountered or damaged during the soil gas sampling.

4.0 SOIL GAS SURVEY

After soil gas locations were cleared in a given area, soil gas samples were collected. Two methods were used to collect soil gas samples. A brief description of each method will be included in this section.

4.1 METHOD 1 - SAMPLE COLLECTION USING TEDLAR BAGS

As described in the approved work plan, Tedlar bags were initially used to collect soil gas samples. A 7-foot sample probe was pushed into the ground using a hydraulic unit located in the rear of the TRC vehicle. The probe was pushed to a depth of 5 feet. A loose fitting aluminum driving point was attached to the end of the probe to guide the probe into the ground. The probe was then pulled off the point approximately 1-2 inches. This created an annular space in which the soil gas could be evacuated from the ground. A section of Tygon tubing was cut and a galvanized nipple was inserted into the tubing. This tubing was then placed on the top of the probe. A copper compression fitting was placed on the galvanized nipple. One quarter inch copper tubing was placed into the compression fitting and tightened. The other end of the copper tubing was connected to a Tedlar bag inside an evacuation box. A copper tube leading from the open space in the evacuation box was directed to the high volume vacuum pump located in the vehicle. A diagram of this device can be found in Figure 4-1.

Before a soil gas sample was collected, the probe was purged of ambient air. Purging was done by disconnecting the brass compression fitting on the galvanized nipple and connecting a silicone hose to it. The silicone hose was connected to the high volume vacuum pump and the pump was then activated. Approximately 2 to 5 liters of soil gas were purged before sampling.

The copper tube was then re-installed on the galvanized nipple via the compression fitting. The vacuum pump was activated. This created a vacuum in the evacuation box thus forcing the Tedlar bag to evacuate sample from the probe directly into the bag. After the sample was collected, the valve on the Tedlar bag was closed and the sample was given to the gas chromatograph (GC) operator also located in the TRC vehicle.

A detailed description of the GC/soil gas sample injection method, as well as the QA/QC procedures for the injections, can be found in Appendix A.

4.2 METHOD 2 - SAMPLE COLLECTION USING SYRINGE METHOD

The syringe method is similar to the Tedlar bag method with the exception of the evacuation box and the copper fittings. A 7-foot soil gas probe is pushed 5 feet into the ground using the hydraulic unit located in the vehicle. The probe is pulled off the aluminum point approximately 1-2 inches. A section of tygon tubing is placed over a galvanized nipple. The tube is then placed over the probe. A section of silicone tubing is connected to the nipple and the other end is connected to the high volume vacuum pump (see Figure 4-2). The pump is activated and 2 to 5 liters of soil gas are purged from the probe. While the vacuum is still running, a syringe is inserted into the silicone tubing. The syringe is then purged by drawing sample into the syringe then exhausting it back into the silicone tube. This is done 2 to 3 times to insure that no ambient air is in the syringe. A 10 milliliter sample is drawn into the syringe. The syringe is removed from the silicone tube and capped. The syringe is given directly to the GC operator where the analysis is completed. A detailed summary of GC/soil gas sample injection methods and QA/QC procedures can be found in Appendix A.

4.3 COMPARISON OF SAMPLE COLLECTION METHODS

CDM began the soil gas sampling using the Tedlar bag collection method. After collecting 4 samples, it became apparent that there were several problems with this collection method. The processes of removing the silicone hose to connect the evacuation box after

purging the probe could re-introduce ambient air into the sampling probe. Secondly, the copper tubing assembly could not be properly decontaminated between samples, so a new assembly had to be manufactured for each sample. This proved to be very time consuming and costly.

CDM discussed these problems with IEPA and it was decided that six sample locations would be sampled using both the Tedlar bag and the syringe method to compare the results of the methods. Table 4-3 illustrates that the results from these two methods are in good agreement. Figure 4-3 shows chromatograms from both methods for one of the sample locations.

Because of the comparability of the results from the two methods and the problems associated with the Tedlar bag method, it was decided by IEPA that the remaining samples would be collected using the syringe method only.

4.4 SOIL GAS SAMPLE AREAS

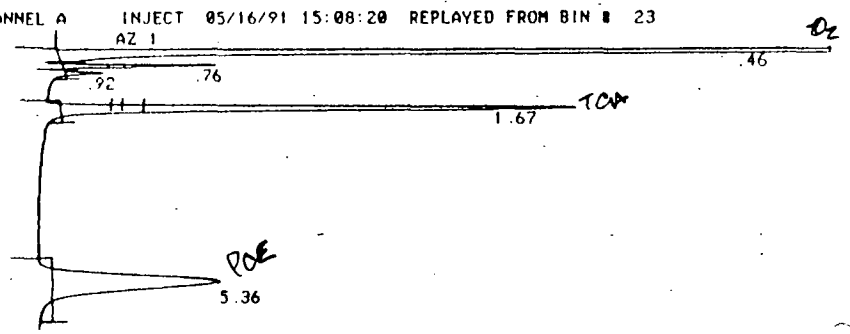
The soil gas sample areas are described in the Results Section of the TRC report in Appendix A. The sample locations are presented in Figures 1-6 in Appendix B of TRC's report.

1. CHROMATOGRAM REPROCESSING

BIN (25) = 23 FILE (1.) =

PRESS 'INJECT' TO BEGIN.

CHANNEL A INJECT 05/16/91 15:08:20 REPLAYED FROM BIN # 23



CDM/ROCKFRD/1-91-234S/ECD 05/16/91 15:08:20 CH= "A" PS= 1.

FILE 1. METHOD 0. RUN 27 INDEX 27 BIN 23

PEAK#	AREA%	RT	AREA	BC
1	86.703	0.46	4026915	02
2	0.891	0.76	41403	02
3	0.384	0.92	17820	03
4	5.72	1.67	265660	01
5	6.303	5.36	292722	01
TOTAL	100.		4644520	

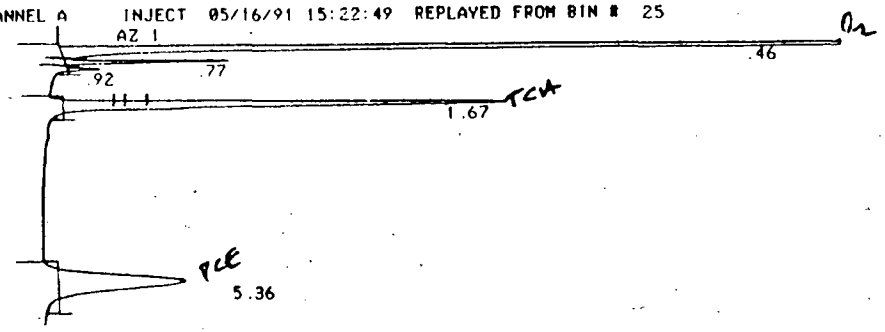
CHROMATOGRAM FOR SG-1-21
SYRINGE METHOD

1. CHROMATOGRAM REPROCESSING

BIN (24) = 25 FILE (1.) =

PRESS 'INJECT' TO BEGIN.

CHANNEL A INJECT 05/16/91 15:22:49 REPLAYED FROM BIN # 25



CDM/ROCKFRD/1-91-234S/ECD 05/16/91 15:22:49 CH= "A" PS= 1.

FILE 1. METHOD 0. RUN 29 INDEX 29 BIN 25

PEAK#	AREA%	RT	AREA	BC
1	88.603	0.46	3923736	02
2	0.978	0.77	43290	02
3	0.341	0.92	15101	03
4	5.095	1.67	225620	01
5	4.984	5.36	220694	01
TOTAL	100.		4428441	

CHROMATOGRAM FOR SG-1-21
TEDLAR BAG METHOD

SOUTHEAST ROCKFORD, ILLINOIS

COMPARISON OF CHROMATOGRAMS FOR SYRINGE AND TEDLAR BAG COLLECTION METHODS

CDM
environmental engineers, scientists, planners, & management consultants

Figure No. 4-3

5.0 DISCUSSION OF RESULTS

During the survey a total of 225 soil gas samples were collected. These samples were collected from six areas. Of these six areas, only two contained points of elevated contamination in the soil gas. Those areas were Areas 2 and 4. Elevated levels of TCA, TCE, and PCE were detected in Area 4 (greater than 1 ug/L). Elevated levels of PCE (greater than 1 ug/L) were detected in Area 2.

The highest concentration of PCE found in Area 2 was 120 ug/L. Detection at this level indicates the likely presence of PCE locally in the soil. A possible source of this PCE contamination could be the Kishwaukee Auto Parts Store or adjacent junk yard, both of which are located in the area of elevated contamination (see Tracer report, Appendix A).

The compounds PCE, TCE, and TCA were found in Area 4. These compounds were detected at elevated levels. The highest concentration of PCE in this area was 14 ug/L. The highest concentration of TCE in this area was 180 ug/L and the highest detect of PCE was 3400 ug/L.

According to a long time local resident, a furniture refinishing business was previously located in Area 4 where the elevated readings of TCA, TCE, and PCE occurred. This facility could possibly have been a source of the contamination (see Appendix A).

Areas 1 and 3 contained small concentrations (less than or equal to 5 ug/L) of VOCs in soil gas. These concentrations are equivocal concerning whether a source is nearby. Areas 5 and 6 did not show significant concentrations (above 1 ug/L) of the target contaminants. Although the contaminants were detected via soil gas, they were detected near the detection limit of the instrument (GC). Therefore, it is unlikely that these concentrations in areas 5 and 6 are indicative of a local source. Further representation of this can be found in the data and isoconcentration maps found in Appendix A.

APPENDIX A

TRACER RESEARCH CORPORATION

SHALLOW SOIL GAS

INVESTIGATION REPORT

FOR THE

SOUTHEAST ROCKFORD SITE

JUNE 1991

Tracer Research Corporation

PREPARED FOR:

Camp, Dresser & McKee
200 West Adams Street
Suite 1600
Chicago, Illinois 60606-5208
(312)786-1313

SHALLOW SOIL GAS INVESTIGATION

SOUTHEAST ROCKFORD

ROCKFORD, ILLINOIS

JUNE 1991

SUBMITTED BY:

2-91-234-T
291234T.REP

Tracer Research Corporation

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CAMP, DRESSER & MCKEE/S.E. ROCKFORD, ILLINOIS SITE JOB #1-91-234-S
05/20/91
CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.01	<0.0003	0.0006
SG-2-8-5'	0.1	<0.006	0.0005
SG-2-10-5'	0.05	0.001	9
SG-2-11-5'	0.02	<0.003	0.4
SG-2-12-5'	0.2	<0.003	0.0007
SG-2-19-5'	0.2	<0.002	0.2
SG-2-18-5'	0.5	0.004	0.03
SG-2-20-5'	0.01	<0.003	0.0004
SG-2-21-5'	0.1	<0.001	0.001
SG-2-22-5'	0.04	<0.003	0.01
SG-2-23-5'	0.03	<0.003	0.002
SG-2-24-5'	0.1	<0.001	0.001
SG-2-25-5'	0.01	<0. 0003	0.001
SG-2-26-5'	0.1	<0.0006	0.001
SG-2-27-5'	0.1	0.3	0.01
SG-2-28-5'	0.01	<0.0006	0.001
AIR	0.002	0.0003	0.0003

Analyzed by: S. Dugan
Proofed by: Kduess

CAMP, DRESSER & MCKEE/S.E.ROCKFORD, ILLINOIS SITE JOB #1-91-234-S
05/21/91
CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.002	0.0007	0.0007
SG-2-1-5'	0.3	0.1	0.001
SG-2-2-5'	0.02	0.001	<0.0006
SG-2-3-5'	0.01	0.007	0.002
SG-2-16-5'	0.5	<0.0003	0.02
SG-2-17-5'	0.03	<0.0003	0.002
SG-3-1-5'	4	3	5
SG-3-2-5'	0.5	0.08	0.3
AIR	0.001	<0.0003	0.0003

Analyzed by: S. Dugan
Proofed by: Guess

CAMP, DRESSER & MCKEE/S.E. ROCKFORD, ILLINOIS SITE JOB #1-91-234-S
05/23/91
CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.001	0.0004	0.0003
SG-3-3-5'	<0.1	0.01	0.1
SG-3-4-5'	0.0004	0.0004	0.006
SG-3-11-5'	0.04	0.002	0.01
SG-3-12-5'	0.03	0.002	0.02
SG-3-13-5'	0.1	0.2	0.03
SG-3-5-5'	0.4	0.03	0.1
SG-3-6-5'	0.2	0.001	0.007
SG-3-7-5'	0.003	0.0007	0.006
SG-3-8-5'	0.2	<0.0008	0.1
SG-3-9-5'	0.2	0.003	0.03
SG-3-10-5'	0.01	0.0004	0.005
SG-3-14-5'	0.1	0.0008	0.06
SG-3-15-5'	0.1	0.0007	0.03
SG-3-16-5'	0.02	0.0008	0.02
SG-3-17-5'	0.09	0.006	0.03
SG-4-1-5'	6	0.3	0.1
SG-4-2-5'	3	0.5	0.2
SG-4-3-5'	0.03	0.0008	0.01
SG-4-4-5'	0.5	0.01	0.05
SG-4-5-5'	0.07	0.004	0.1
SG-4-6-5'	3	<0.004	0.3
AIR	0.001	0.003	0.0003

Analyzed by: S. Dugan
Proofed by: K. Swass

CAMP, DRESSER & MCKEE/S.E.ROCKFORD, ILLINOSIS SITE JOB #1-91-234-S
05/24/91
CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.002	0.003	0.001
SG-4-7-5'	0.1	0.001	0.02
SG-4-8-5'	0.3	<0.002	0.05
SG-4-9-5'	0.03	0.002	0.003
SG-4-10-5	3400	180	14
AIR	0.001	<0.0005	<0.0003

Analyzed by: S. Dugan
Proofed by: Guess

CAMP, DRESSER & MCKEE/S.E. ROCKFORD, ILLINIOS SITE JOB #1-91-234-S
05/28/91
CONDENSED DATA

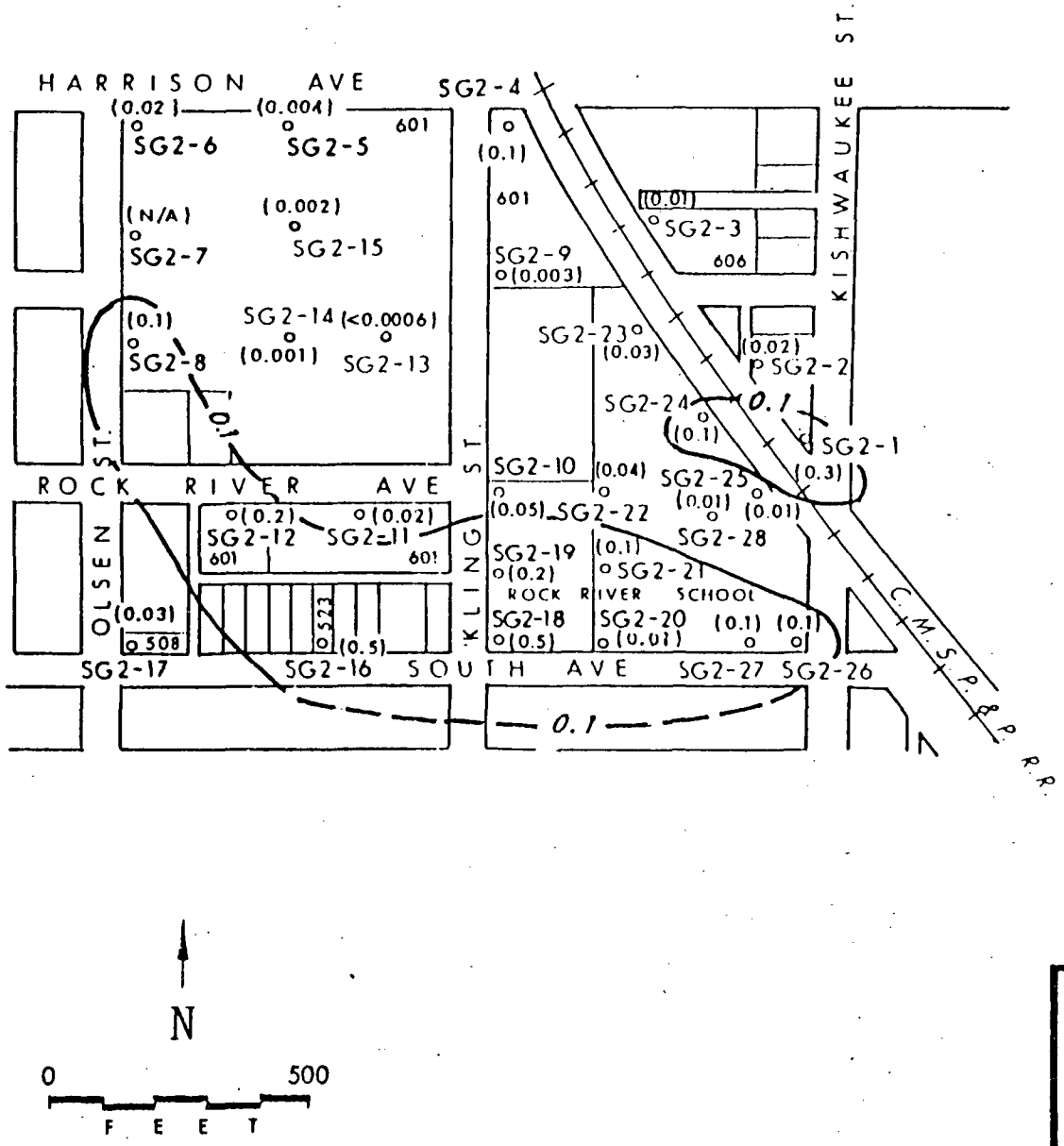
SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.001	0.002	<0.0002
SG-5-1-5'	0.2	<0.004	0.01
SG-5-2-5'	2	<0.004	0.008
SG-5-3-5'	0.003	0.0008	0.0008
SG-5-4-5'	0.2	0.002	0.02
SG-5-5-5'	0.007	0.001	0.002
AIR	0.0009	0.0008	0.0009
SG-5-6-5'	0.002	0.001	0.0004
SG-5-7-5'	0.001	0.002	0.0004
SG-5-8-5'	0.0007	0.001	<0.0002
SG-5-33-5'	0.2	<0.001	0.001
SG-5-9-5'	0.001	0.002	<0.0002
SG-5-11-5'	0.3	0.01	<0.0008
SG-5-12-2'	0.002	0.004	<0.0004
AIR	0.001	0.001	0.0002

Analyzed by: S. Dugan
Proofed by: K. Kuess

CAMP, DRESSER & MCKEE/S.E. ROCKFORD, ILLINOIS SITE JOB #1-91-234-S
05/29/91
CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.002	0.001	0.0002
SG-5-10-3'	0.005	0.0006	0.0006
SG-5-13-5'	0.003	0.0007	0.0008
SG-5-14-4'	0.001	0.001	<0.0005
SG-5-15-5'	0.003	0.0007	0.0006
SG-5-16-5'	0.1	0.0007	<0.0004
AIR	0.001	0.0009	<0.0002
SG-5-17-5'	0.08	0.001	0.002
SG-5-18-5'	0.2	0.002	0.001
SG-5-19-5'	0.07	<0.001	0.008
SG-5-20-5'	0.3	0.001	0.008
SG-5-21-5'	0.2	0.001	0.008
SG-5-23-5'	0.1	0.001	0.0007
SG-5-22-5'	0.0008	0.001	<0.0004
SG-5-24-5'	0.0006	0.002	<0.0004
SG-5-25-5'	0.008	0.001	0.003
SG-5-26-5'	0.0004	0.001	0.0008
SG-5-27-3'	0.01	0.003	0.0007
AIR	0.0008	0.0007	<0.0004
SG-5-28-5'	0.003	0.001	0.001

Analyzed by: S. Dugan
Proofed by: [illegible]



EXPLANATION

o SG1-3	Sampling Probe Location
(0.5)	Soil Gas Sample Value (µg/l)
0.1	Isoconcentration Line (µg/l)

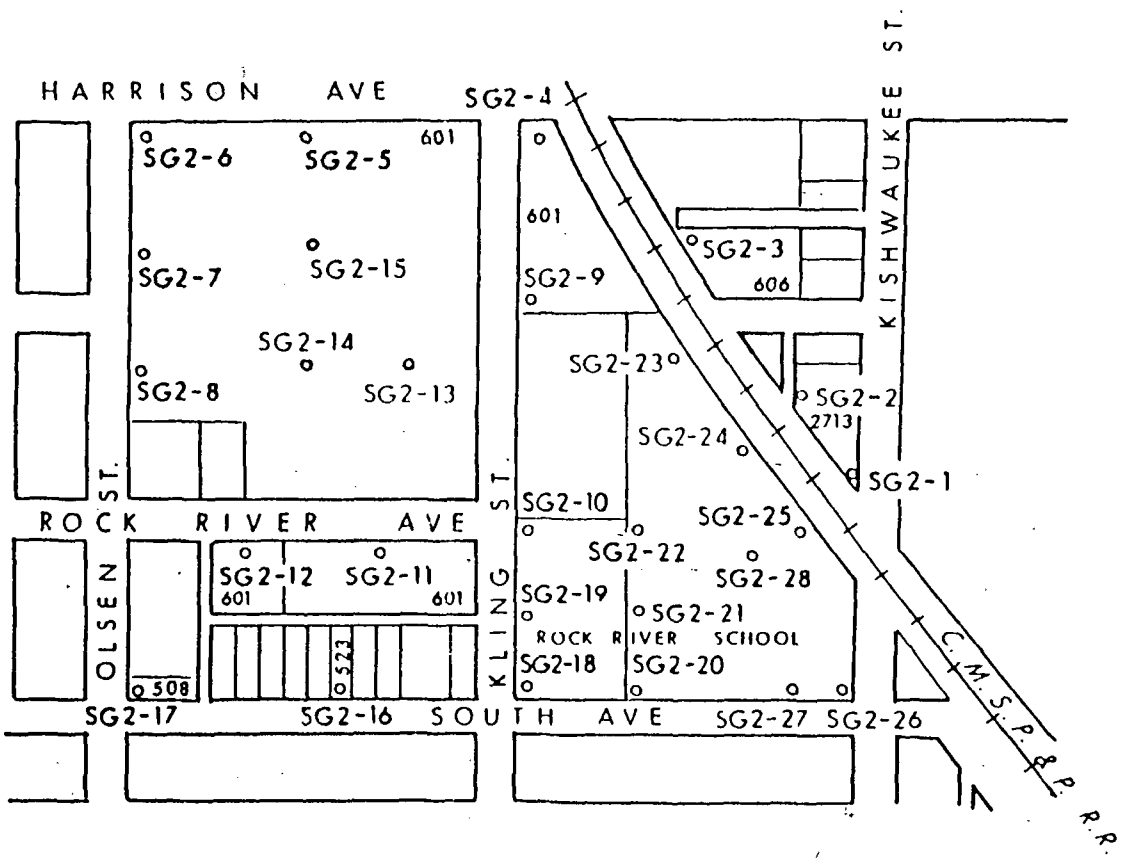
CAMP, DRESSER, & MCKEE

SOUTHEAST ROCKFORD STUDY AREA 2

ROCKFORD, ILLINOIS

TRICHLOROETHANE (TCA)

Figure 2a



EXPLANATION

o SG1-3 Sampling Probe Location

CAMP, DRESSER, & MCKEE

SOUTHEAST ROCKFORD
STUDY AREA 2

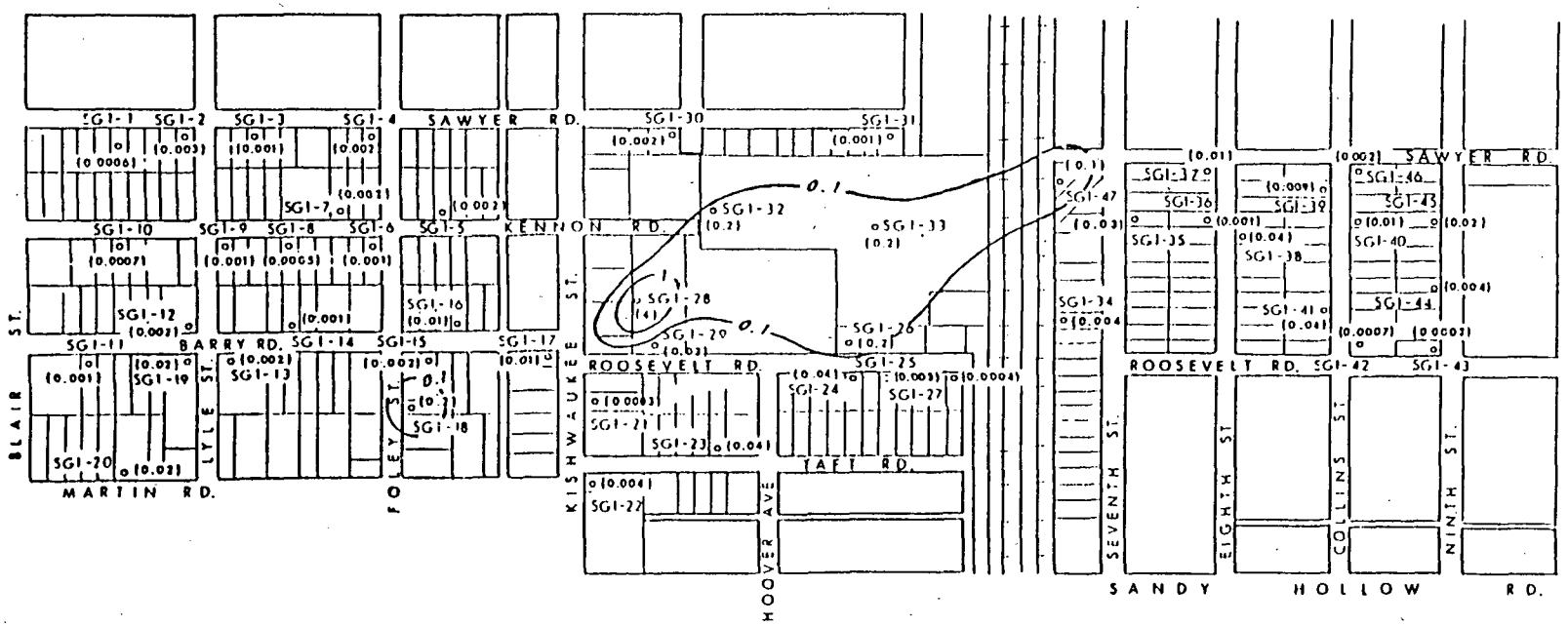
ROCKFORD, ILLINOIS

SAMPLING LOCATIONS

Figure 2

EXPLANATION

o SG1-3	Sampling Probe Location
(0.5)	Soil Gas Sample Value (µg/l)
0.1	Isoconcentration Line (µg/l)



CAMP, DRESSER, & MCKEE

SOUTHEAST ROCKFORD
STUDY AREA 1

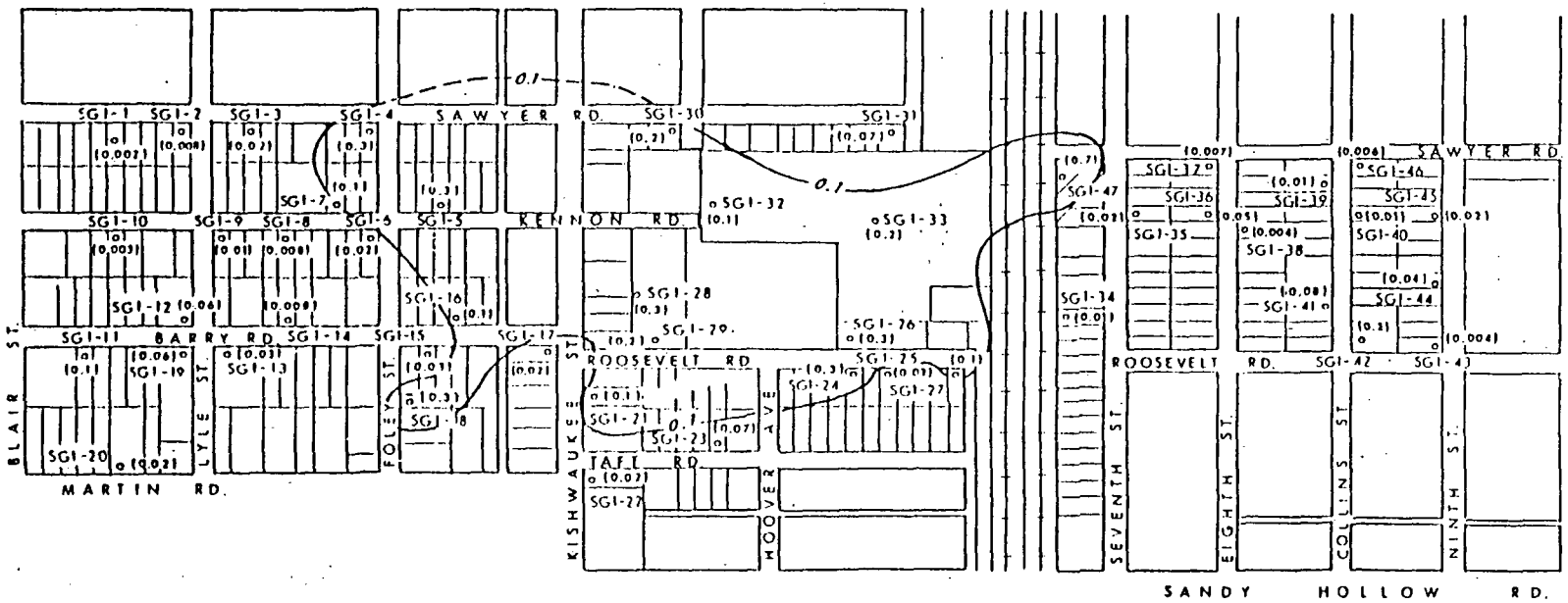
ROCKFORD, ILLINOIS

TETRACHLOROETHENE (PCE)

Figure 1b

EXPLANATION

o SG1-3	Sampling Probe Location
(0.5)	Soil Gas Sample Value (µg/l)
0.1	Isoconcentration Line (µg/l)



N

0 500 1000

FEET

CAMP, DRESSER, & MCKEE

SOUTHEAST ROCKFORD STUDY AREA I

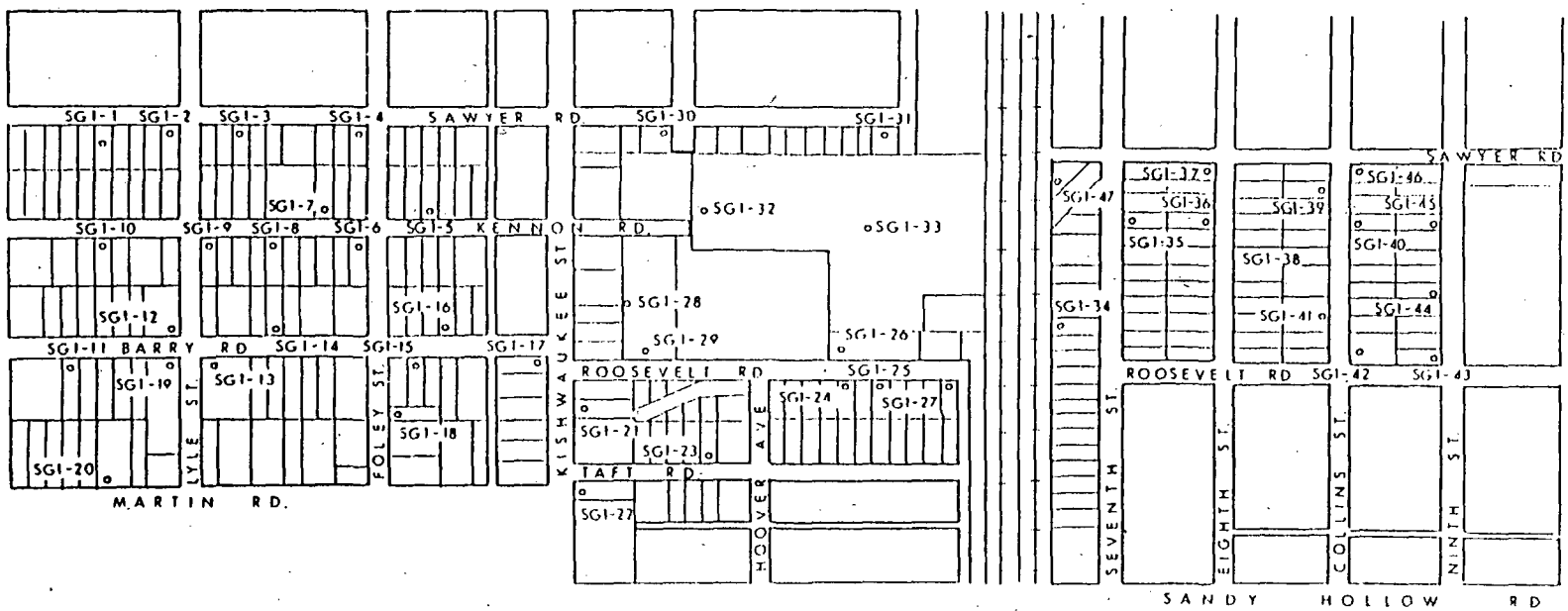
ROCKFORD, ILLINOIS

TRICHLOROETHANE (TCA)

Figure 1a

EXPLANATION

o SG1-3 Sampling Probe Location



N

0 500 1000

FEET

CAMP, DRESSER, & MCKEE

SOUTHEAST ROCKFORD
STUDY AREA 1

ROCKFORD, ILLINOIS

SAMPLING LOCATIONS

Figure 1

APPENDIX B: FIGURES

CAMP, DRESSER & MCKEE/S.E. ROCKFORD, ILLINOIS SITE JOB #1-91-234-S
06/06/91
CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.002	<0.002	<0.001
SG-6-87-5'	0.002	<0.002	<0.001
SG-6-88-3'	0.0009	<0.002	<0.001
SG-6-89-5'	0.03	<0.002	0.2
SG-6-90-5'	0.005	<0.002	0.005
SG-6-91-5'	0.01	<0.002	0.002
SG-6-92-5'	0.05	<0.002	0.004
SG-6-93-5'	0.002	<0.002	<0.001
SG-6-82-5'	0.09	<0.002	0.08
SG-6-81-5'	0.006	<0.002	0.01
AIR	0.004	<0.002	<0.001

Analyzed by: M. Stivers
Proofed by: K. Kuess

CAMP, DRESSER & MCKEE/S.E. ROCKFORD, ILLINOIS SITE JOB #1-91-234-S
06/05/91
CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.003	<0.001	<0.0007
SG-6-29-5'	0.002	<0.001	<0.0007
SG-6-30-5'	0.005	<0.001	<0.0007
SG-6-31-4'	0.001	<0.001	<0.0007
SG-6-32-5'	0.003	<0.001	0.008
SG-6-33-5'	0.001	<0.001	0.002
SG-6-34-3'	0.009	<0.001	0.01
SG-6-35-5'	0.04	<0.001	0.2
SG-6-36-5'	0.002	<0.003	<0.002
SG-6-37-5'	0.03	<0.001	0.006
SG-6-38-5'	0.0008	<0.001	<0.0007
AIR	0.0008	<0.001	<0.0007
SG-6-39-5'	0.009	<0.001	<0.0007
SG-6-40-5'	0.009	<0.001	0.002
SG-6-41-5'	0.004	<0.001	<0.0007
SG-6-42-5'	0.01	<0.001	0.004
SG-6-43-5'	0.003	<0.001	<0.0007
SG-6-77-5'	0.006	<0.001	0.001
SG-6-83-5'	0.005	<0.001	<0.0007
SG-6-84-5'	0.005	<0.001	<0.0007
SG-6-85-5'	0.004	<0.001	0.02
SG-6-86-5'	0.005	<0.001	<0.0007
AIR	0.001	<0.001	<0.0007

Analyzed by: M. Stivers
Proofed by: K. Kuess

CAMP, DRESSER & MCKEE/S.E. ROCKFORD, ILLINOIS SITE JOB #1-91-234-S
06/04/91
CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.002	<0.001	<0.0007
SG-6-8-5'	0.006	<0.001	<0.0007
SG-6-9-5'	0.004	<0.002	<0.001
SG-6-10-5'	0.0009	<0.002	0.08
SG-6-11-5'	0.007	<0.002	0.006
SG-6-12-5'	0.001	<0.002	<0.001
SG-6-13-5'	0.004	<0.002	0.02
SG-6-14-5'	0.004	<0.002	<0.001
SG-6-15-5'	0.003	<0.002	<0.001
SG-6-16-5'	0.004	<0.002	<0.001
SG-6-17-5'	0.005	<0.002	<0.001
AIR	0.001	<0.002	<0.001
SG-6-18-5'	0.005	<0.002	<0.001
SG-6-19-5'	0.005	<0.002	<0.001
SG-6-20-5'	0.004	<0.002	<0.001
SG-6-21-3'	0.002	<0.002	<0.001
SG-6-22-5'	0.004	<0.002	<0.001
SG-6-23-5'	0.003	<0.002	<0.001
SG-6-24-5'	0.005	<0.002	<0.001
SG-6-25-2'	0.004	<0.002	0.05
SG-6-26-5'	0.004	<0.002	<0.001
SG-6-27-5'	0.005	<0.002	<0.001
SG-6-28-5'	0.005	<0.002	0.004
AIR	0.002	<0.002	<0.001

Analyzed by: M. Stivers
Proofed by: K. Fuess

CAMP, DRESSER & MCKEE/S.E. ROCKFORD, ILLINOIS SITE JOB #1-91-234-S
06/03/91
CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.002	<0.002	<0.001
SG-6-53-5'	0.001	<0.002	<0.001
SG-6-54-5'	0.002	<0.002	<0.001
SG-6-55-3'	0.009	<0.002	<0.001
SG-6-45-3'	0.002	<0.002	<0.001
SG-6-46-5'	0.002	<0.002	0.001
SG-6-47-4'	0.06	<0.002	0.002
AIR	0.0009	<0.002	<0.001
SG-6-48-5'	0.002	<0.002	<0.001
SG-6-49-5'	0.009	<0.002	0.002
SG-6-50-5'	0.006	<0.002	0.001
SG-6-51-5'	0.004	<0.002	<0.001
SG-6-52-5'	0.01	<0.002	<0.001
SG-6-44-5'	0.01	<0.002	<0.001
SG-6-1-3.5'	0.01	<0.002	0.001
SG-6-2-5'	0.005	<0.002	<0.001
SG-6-3-5'	0.006	<0.002	<0.001
SG-6-4-5'	0.002	<0.002	<0.001
SG-6-5-5'	0.004	<0.002	<0.001
SG-6-6-5'	0.002	<0.002	<0.001
SG-6-7-5'	0.004	<0.002	0.001
AIR	0.001	<0.002	<0.001

Analyzed by: M. Stivers
Proofed by: K. Luss

Tracer Research Corporation

CAMP, DRESSER & MCKEE/S.E. ROCKFORD, ILLINOIS SITE JOB #1-91-234-S
05/31/91
CONDENSED DATA

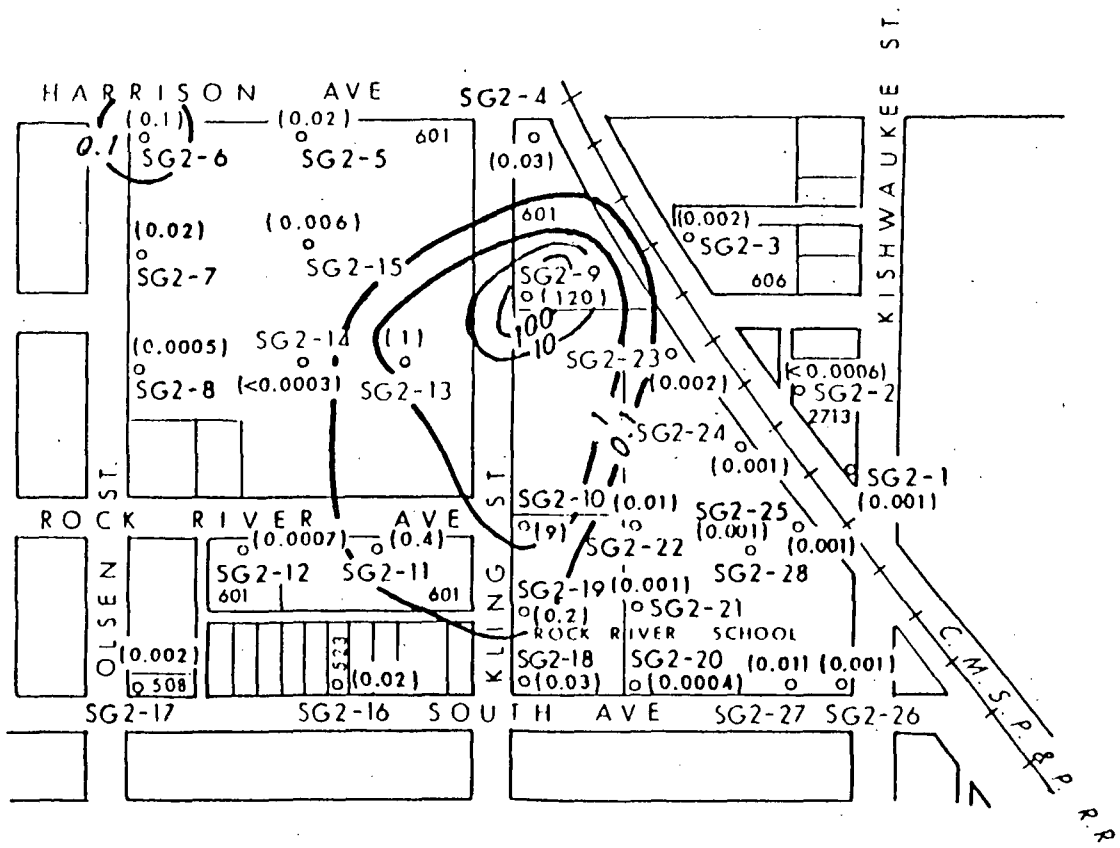
SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.0009	<0.0002	<0.0002
SG-6-69-5'	0.004	0.0004	0.0003
SG-6-68-5'	0.004	0.0007	0.0006
SG-6-67-5'	0.02	0.0004	0.002
SG-6-66-5'	0.008	0.0006	0.002
SG-6-65-5'	0.008	0.0006	0.0008
SG-6-64-5'	0.002	0.0006	0.0003
SG-6-63-5'	0.005	0.0009	0.0009
SG-6-62-5'	0.005	0.0006	0.002
SG-6-58-5'	0.01	0.001	0.001
SG-6-59-5'	0.01	0.0007	0.001
SG-6-60-5'	0.01	0.0005	0.002
SG-6-61-5'	0.007	0.0006	0.002
SG-6-56-5'	0.005	0.0006	0.002
SG-6-57-5'	0.02	0.0007	0.008
AIR	0.0009	0.0004	0.0002

Analyzed by: S. Dugan
Proofed by: K. Lucas

CAMP, DRESSER & MCKEE/S.E. ROCKFORD, ILLINOIS SITE JOB #1-91-234-S
05/30/91
CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.001	0.008	0.0002
SG-5-29-5'	0.02	0.0008	0.001
SG-5-30-5'	1	<0.0008	0.002
SG-5-31-5'	0.1	0.002	0.002
SG-5-32-5'	0.08	0.0008	0.001
AIR	0.001	0.001	0.0002
SG-6-76-5'	0.002	0.001	0.0003
SG-6-74-5'	0.008	0.0008	0.0008
SG-6-75-5'	0.2	0.0008	0.0004
SG-6-73-5'	0.03	0.0008	0.005
SG-6-72-5'	0.1	0.0008	0.004
SG-6-71-5'	0.3	0.0008	0.009
SG-6-70-5'	0.1	0.0008	0.01
SG-6-94-5'	0.06	0.0004	0.006
AIR	0.002	0.0006	0.0002

Analyzed by: S. Dugan
Proofed by: K. Guess



EXPLANATION

o SG1-3	Sampling Probe Location.
(0.5)	Soil Gas Sample Value (µg/l)
0.1	Isoconcentration Line (µg/l)

CAMP, DRESSER, & MCKEE

SOUTHEAST ROCKFORD STUDY AREA 2

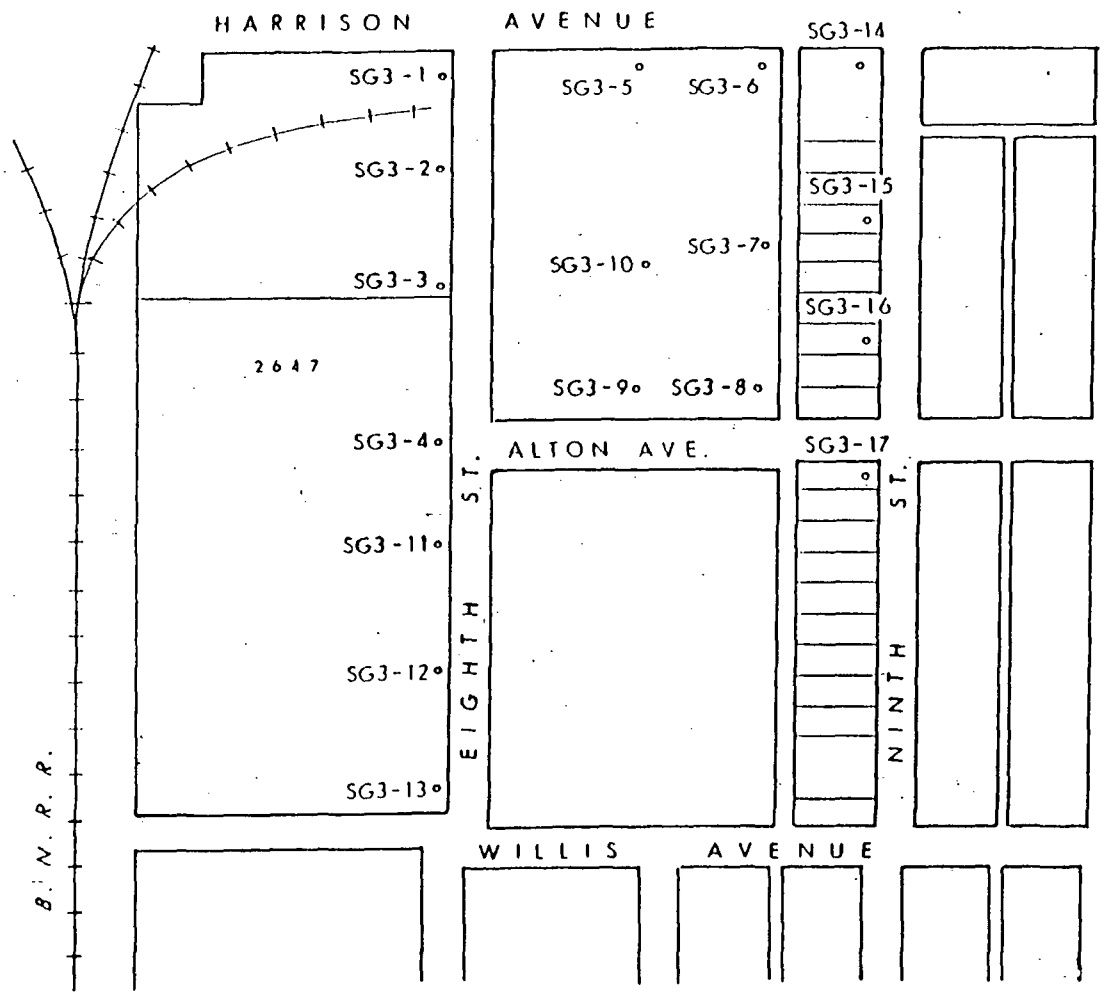
ROCKFORD, ILLINOIS

TETRACHLOROETHENE (PCE)

Figure 2b

1-91-234-S

Tracer Research Corporation



EXPLANATION

o SG3-10 Sampling Probe Location

N

0 500

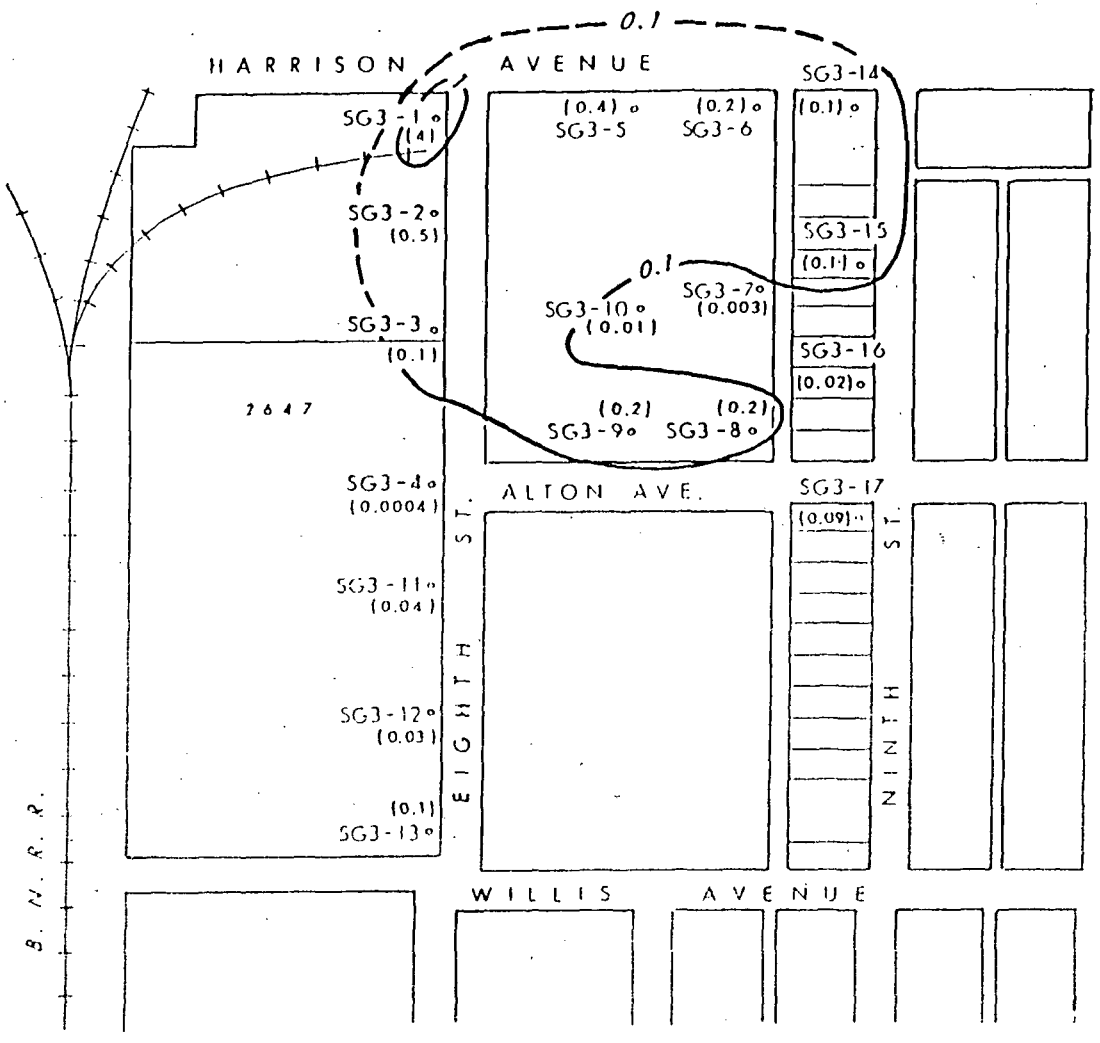
FEET

CAMP, DRESSER, & MCKEE

SOUTHEAST ROCKFORD
STUDY AREA 3

ROCKFORD, ILLINOIS

SAMPLING LOCATIONS



EXPLANATION

∘ SG1-3	Sampling Probe Location
(0.5)	Soil Gas Sample Value (µg/l)
0.1	Isoconcentration Line (µg/l)

N

0 500

FEET

CAMP, DRESSER, & MCKEE

SOUTHEAST ROCKFORD STUDY AREA 3

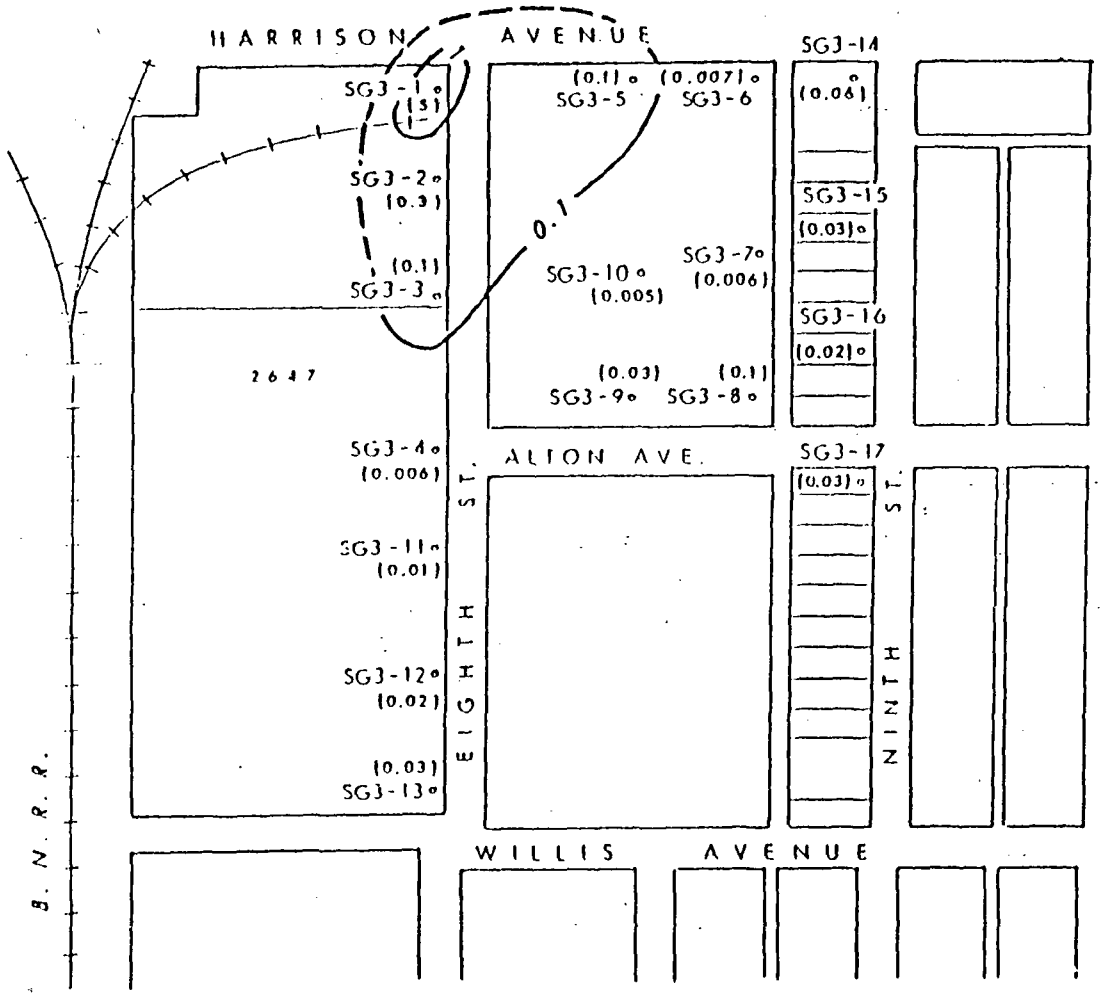
ROCKFORD, ILLINOIS

TRICHLOROETHANE (TCA)

Figure 3a

1-91-234-S

Tracer Research Corporation



EXPLANATION

o SG1-3	Sampling Probe Location
(0.5)	Soil Gas Sample Value (µg/l)
0.1	Isoconcentration Line (µg/l)

N

0 500

FEET

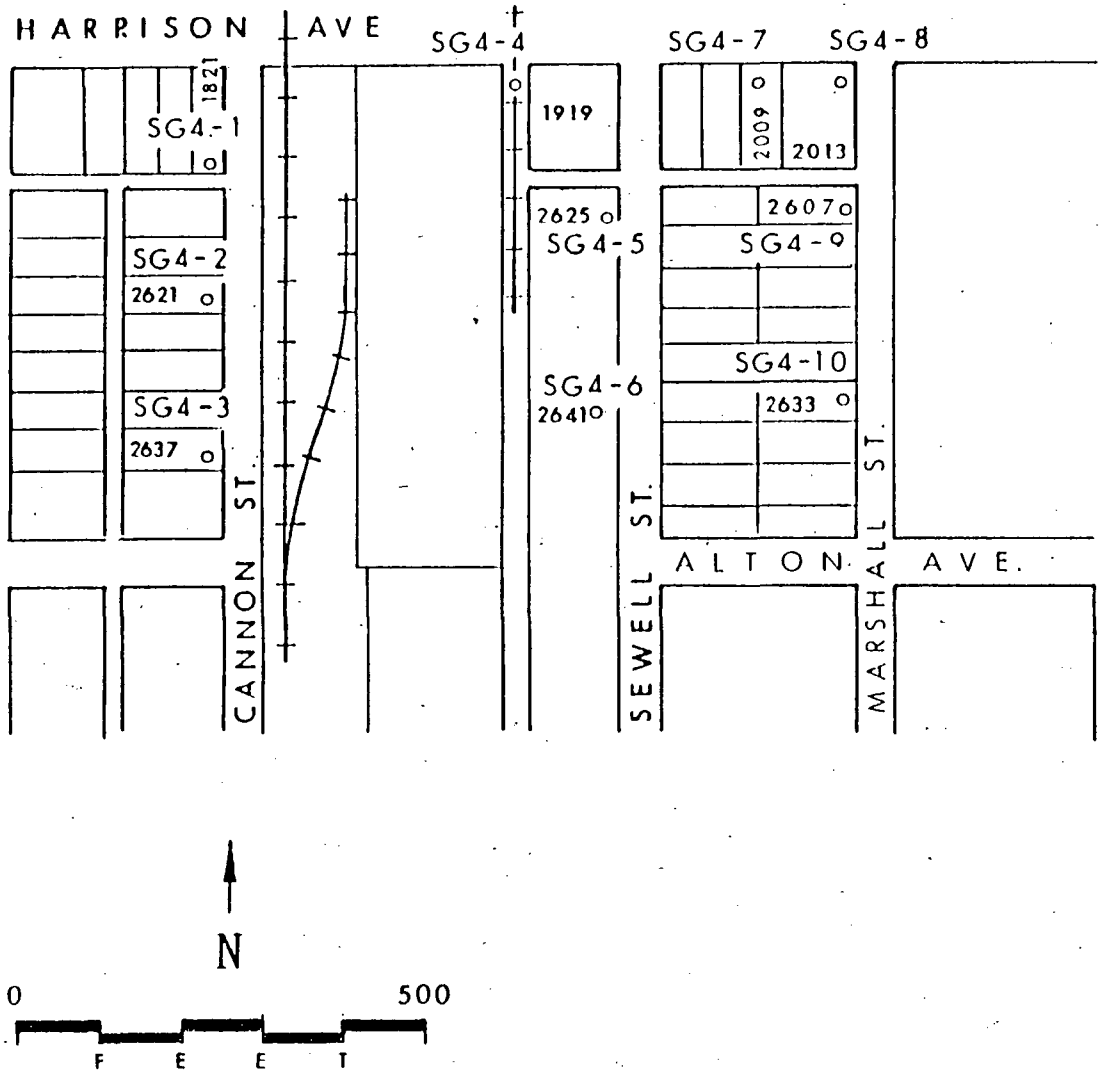
CAMP, DRESSER, & MCKEE

SOUTHEAST ROCKFORD
STUDY AREA 3

ROCKFORD, ILLINOIS

TETRACHLOROETHENE (P[illegible])

Figure 3b



EXPLANATION

o SG4-6 Sampling Probe Location

CAMP, DRESSER, & MCKEE

SOUTHEAST ROCKFORD
STUDY AREA 4

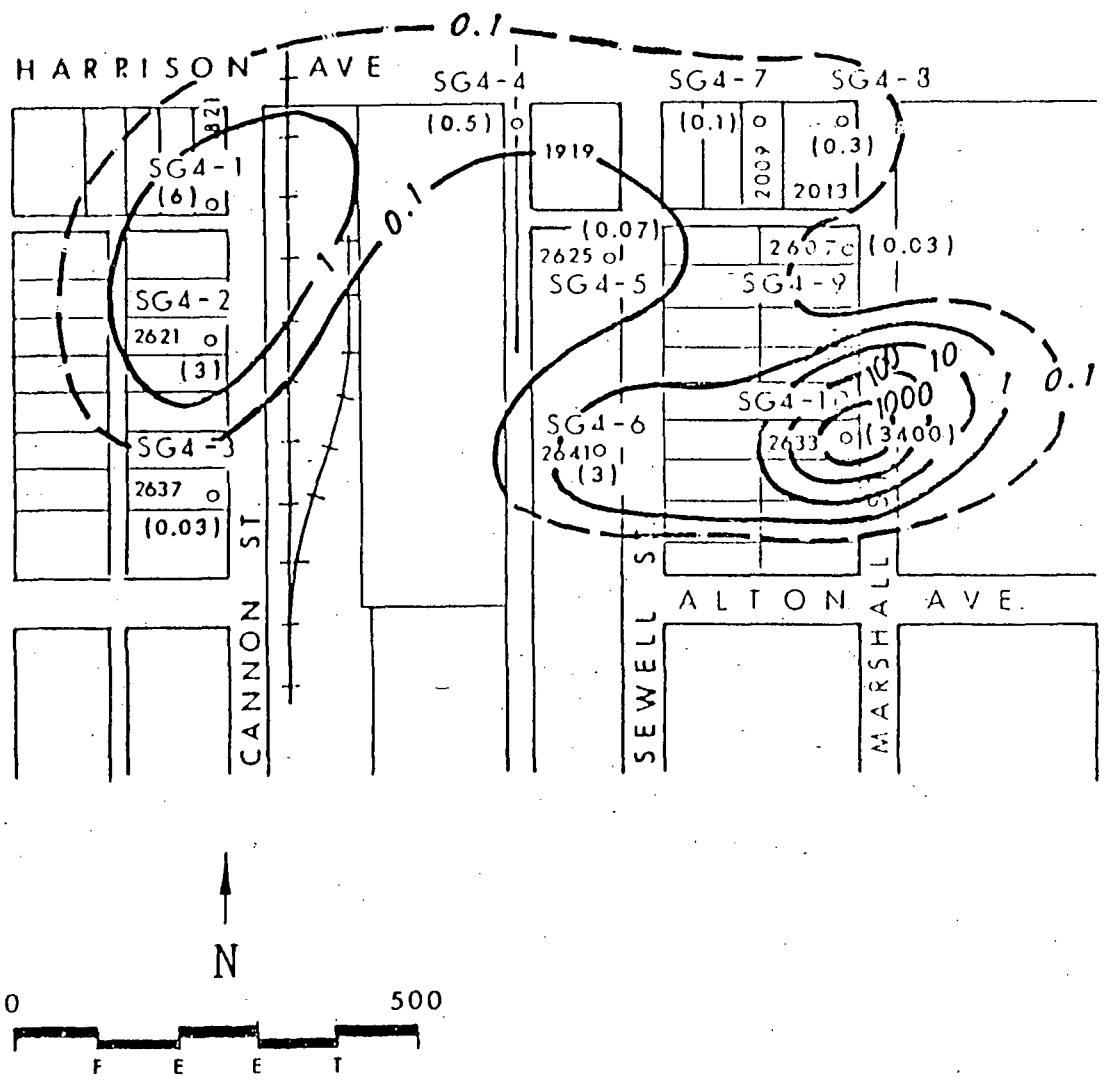
ROCKFORD, ILLINOIS

SAMPLING LOCATIONS

Figure 4

1-91-234-S

Tracer Research Corporation



EXPLANATION

o SG1-3	Sampling Probe Location
(0.5)	Soil Gas Sample Value (µg/l)
0.1	Isoconcentration Line (µg/l)

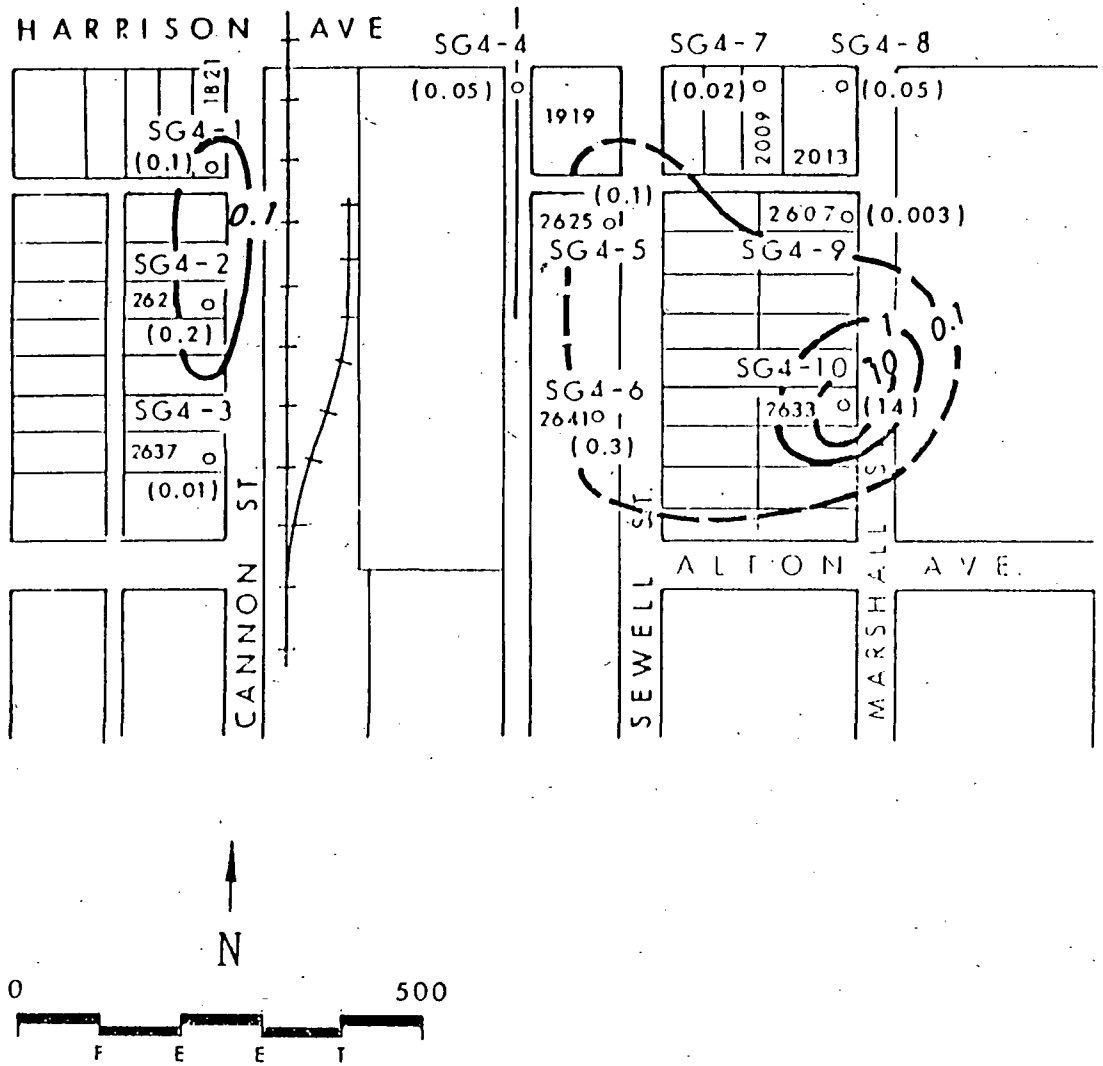
CAMP, DRESSER, & MCKEE

SOUTHEAST ROCKFORD STUDY AREA 4

ROCKFORD, ILLINOIS

TRICHLOROETHANE (T)

Figure 4a



EXPLANATION

o SG1-3	Sampling Probe Location
(0.6)	Soil Gas Sample Value (µg/l)
0.1	Isoconcentration Line (µg/l)

CAMP, DRESSER, & MCKEE

SOUTHEAST ROCKFORD STUDY AREA 4

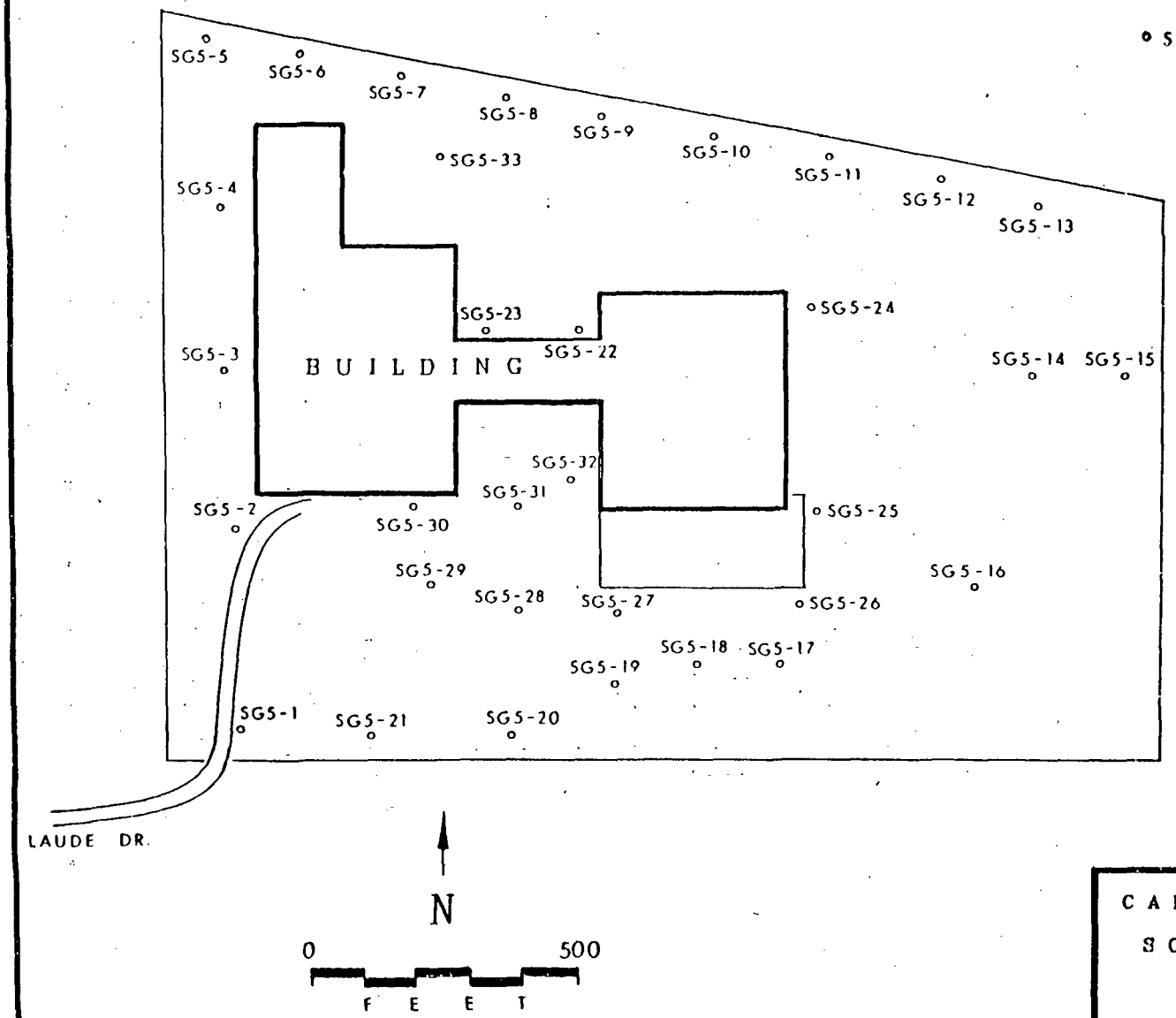
ROCKFORD, ILLINOIS

TETRACHLOROETHENE (PCE)

Figure 4b

1-91-234-S

Tracer Research Corporation



EXPLANATION

∘ SG5-33 Sampling Probe Location

CAMP, DRESSER, & MCKEE

SOUTHEAST ROCKFORD
STUDY AREA 5

ROCKFORD, ILLINOIS

SAMPLING LOCATIO

CONTENTS

PAGE NO.	REFERENCE	DATE

TUESDAY JUNE 18, 1991

Activity: Begin monitoring well drilling at MW-101

Personnel: Ed Clark, Quinton Nowak, John McMullan (driller & helpers from John Mathes & Associates), Dave Julius (also from Mathes), Mark Sorensen (CDM, recording), Snehal Bhagat (CDM).

1415 - Set up for drilling at MW-101 well next - deep well w/ mud rotary rig (Gus Pech Brat 22R). Location: in right-of-way on south side of Lando Drive across from Potter, Foran and Tee Co. at 2530 Lando Drive (E. of 22nd St.)

1445 - S Bhagat goes to get folding tables to use for sampling schem

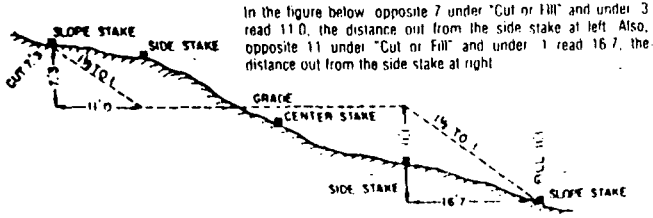
1530 - S Bhagat back at site & replaces M Sorensen, who goes off to check on drilling

Mark Sorensen (this day's notes required)

DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING

Roadway of any Width. Side Slopes 1½ to 1.

In the figure below opposite 7 under "Cut or Fill" and under 3, read 11.0, the distance out from the side stake at left. Also, opposite 11 under "Cut or Fill" and under 1 read 16.7, the distance out from the side stake at right.



Cut or Fill	0	1	2	3	4	5	6	7	8	9	Cut or Fill
	Distance out from Side or Shoulder Stake										
0	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	0
1	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.9	1
2	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	2
3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9	3
4	6.0	6.2	6.3	6.5	6.6	6.8	6.9	7.1	7.2	7.4	4
5	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6	8.7	8.9	5
6	9.0	9.2	9.3	9.5	9.6	9.8	9.9	10.1	10.2	10.4	6
7	10.5	10.7	10.8	11.0	11.1	11.3	11.4	11.6	11.7	11.9	7
8	12.0	12.2	12.3	12.5	12.6	12.8	12.9	13.1	13.2	13.4	8
9	13.5	13.7	13.8	14.0	14.1	14.3	14.4	14.6	14.7	14.9	9
10	15.0	15.2	15.3	15.5	15.6	15.8	15.9	16.1	16.2	16.4	10
11	16.5	16.7	16.8	17.0	17.1	17.3	17.4	17.6	17.7	17.9	11
12	18.0	18.2	18.3	18.5	18.6	18.8	18.9	19.1	19.2	19.4	12
13	19.5	19.7	19.8	20.0	20.1	20.3	20.4	20.6	20.7	20.9	13
14	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.4	14
15	22.5	22.7	22.8	23.0	23.1	23.3	23.4	23.6	23.7	23.9	15
16	24.0	24.2	24.3	24.5	24.6	24.8	24.9	25.1	25.2	25.4	16
17	25.5	25.7	25.8	26.0	26.1	26.3	26.4	26.6	26.7	26.9	17
18	27.0	27.2	27.3	27.5	27.6	27.8	27.9	28.1	28.2	28.4	18
19	28.5	28.7	28.8	29.0	29.1	29.3	29.4	29.6	29.7	29.9	19
20	30.0	30.2	30.3	30.5	30.6	30.8	30.9	31.1	31.2	31.4	20
21	31.5	31.7	31.8	32.0	32.1	32.3	32.4	32.6	32.7	32.9	21
22	33.0	33.2	33.3	33.5	33.6	33.8	33.9	34.1	34.2	34.4	22
23	34.5	34.7	34.8	35.0	35.1	35.3	35.4	35.6	35.7	35.9	23
24	[illegible]	36.2	36.3	36.5	36.6	36.8	36.9	37.1	37.2	37.4	24
25	[illegible]	[illegible]	37.8	38.0	38.1	38.3	38.4	38.6	38.7	38.9	25
26	[illegible]	39.2	39.3	39.5	39.6	39.8	39.9	40.1	40.2	40.4	26
27	40.5	40.7	40.8	41.0	41.1	41.3	41.4	41.6	41.7	41.9	27
28	42.0	42.2	42.3	42.5	42.6	42.8	42.9	43.1	43.2	43.4	28
29	43.5	43.7	43.8	44.0	44.1	44.3	44.4	44.6	44.7	44.9	29
30	45.0	45.2	45.3	45.5	45.6	45.8	45.9	46.1	46.2	46.4	30
31	46.5	46.7	46.8	47.0	47.1	47.3	47.4	47.6	47.7	47.9	31
32	48.0	48.2	48.3	48.5	48.6	48.8	48.9	49.1	49.2	49.4	32
33	49.5	49.7	49.8	50.0	50.1	50.3	50.4	50.6	50.7	50.9	33
34	51.0	51.2	51.3	51.5	51.6	51.6	51.9	52.1	52.2	52.4	34
35	52.5	52.7	52.8	53.0	53.1	53.3	53.4	53.6	53.7	53.9	35
36	54.0	54.2	54.3	54.5	54.6	54.8	54.9	55.1	55.2	55.4	36
37	55.5	55.7	55.8	56.0	56.1	56.3	56.4	56.6	56.7	56.9	37
38	57.0	57.2	57.3	57.5	57.6	57.8	57.9	58.1	58.2	58.4	38
39	58.5	58.7	58.8	59.0	59.1	59.3	59.4	59.6	59.7	59.9	39
40	60.0	60.2	60.3	60.5	60.6	60.8	60.9	61.1	61.2	61.4	40

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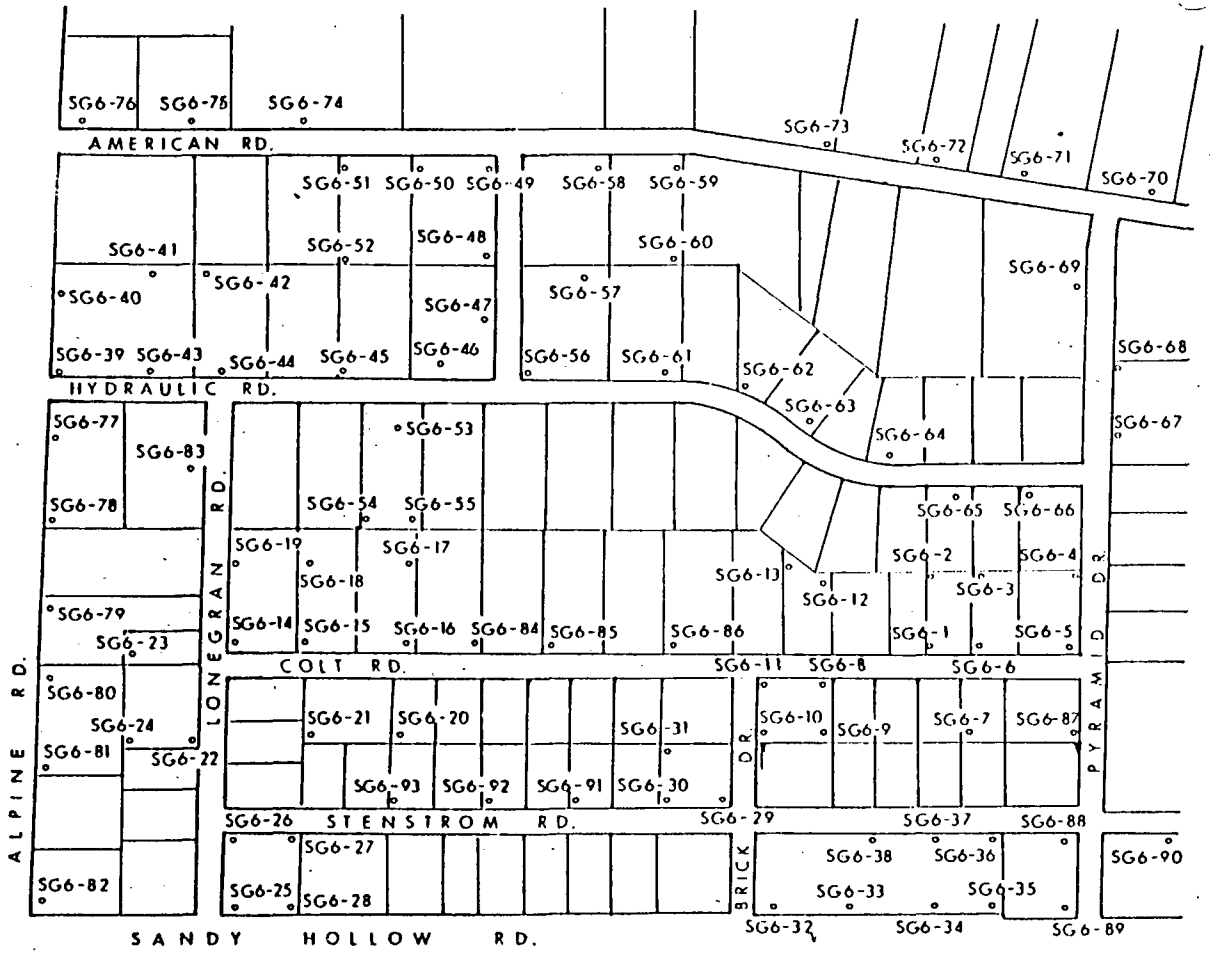
APPENDIX B

FIELD NOTES



EXPLANATION

° SG6-9 Sampling Probe Location

N

0 100 200

FEET

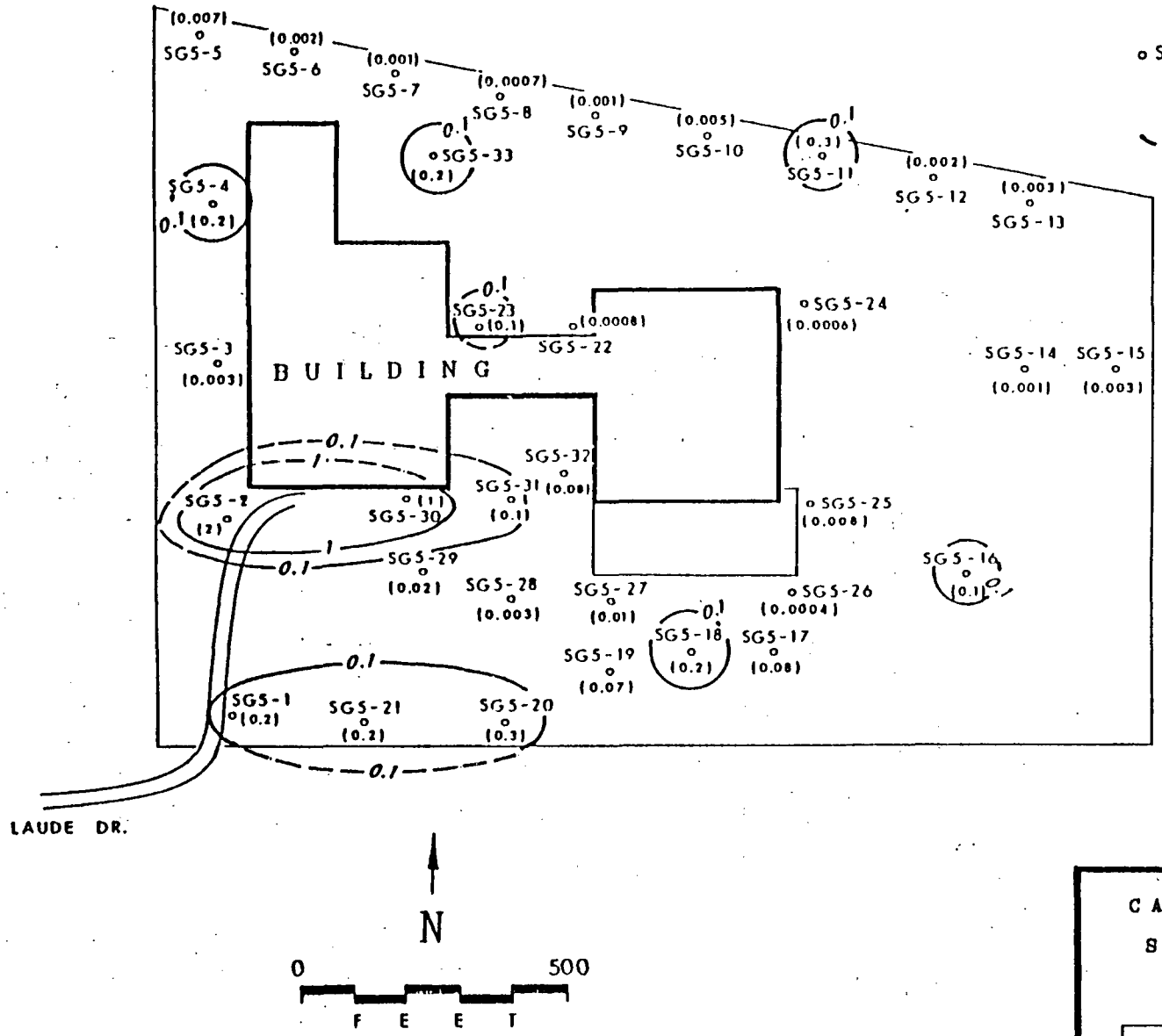
CAMP, DRESSER, & MCKEE

SOUTHEAST ROCKFORD
STUDY AREA 6

ROCKFORD, ILLINOIS

SAMPLING LOCATIONS

Figure 8



CAMP, DRESSER, & MCKEE

SOUTHEAST ROCKFORD
STUDY AREA 5

ROCKFORD, ILLINOIS

TRICHLOROETHANE (TCA)

Figure 6a

locations. Note that these notes are re-copied — June 18 only — because field books were not available. All other notes ~~are~~ M.S. from June 19 on are original.

1530 — Drillers continue to set up over MW101 for mud rotary.

1730 — The 16-inch mud conductor pipe won't go into the hole more than about 4 feet — because of caving of the gravel. So now have mixed mud to circulate in the — conductor pipe to try to keep hole open & bring pipe down

1750 — ~~Com~~ M.S. Circulated mud in hole and got conductor down to ~6 feet, but broke a cable. Stop & begin repairs. CDM leaves site ~ 1820 —

Mark Sorensen Snehal Bhagat

①

6-19-91 WEDNESDAY

~~Activity~~: Drilling at MW101

Personnel: Ed Clark, Quinton Nowak, John McMullan (John Mathes & Associates - drillers), Steve Washburn (IEPA), Snehal Bhagat (CDM), Mark Sorensen (CDM, recording until 1500), Troy Carlson (CDM, recording after 1500).

Weather: 92°, sunny, light SE winds

In the morning work on repairs to pull-down cable.

1400 — Resume drilling, but without pull down capability.

1415 — Drilled to 17' & prepare to take split spoon but don't have the properly threaded connection for the jars.

1500 Troy Carlson arrives.

1510 M. Sorensen and S. Washburne leave for meeting w/ V. Wood and Eckbert.

1605 THREADED CONNECTION FOR SPLIT-SPOON RECEIVED & BACK ON SITE AT MW101 -

Mark Sorensen

(2)

6-19-91

MW101 IS LOCATED ON SOUTH SIDE OF LAUDE DRIVE ACROSS POTTER FORM & TIE CO AT 2530 LAUDE DRIVE.

USING MUD-ROTARY DRILLING & SPLIT SPOON (SS)

1620 COLLECTED S.S. SAMPLE AT 17-19'. DID NOT SAVE A SAMPLE SINCE ONLY HAD ≈ 50% RECOVERY CONSISTING OF MAINLY GRAVEL AND WHAT APPEARED TO BE MUD (PREMIUM GEL BENTONITE). DRILLING DOWN TO 27' TO TRY ANOTHER S.S. PULLED UP ROD & RAN DOWN AGAIN TO CLEAN OUT CAVE-IN (~5') THEN, ATTACH SPLIT SPOON TO SAMPLE 27-29'.

1700 SPLIT SPOON REFUSAL AT 27', WILL DRILL DOWN ANOTHER 10' BEFORE ATTEMPTING ANOTHER S.S.

1710 DOWN TO 37, PULLED OUT BIT, [illegible] OF CAVE IN RESULTED.

1730 3 DRUMS HAVE BEEN FILLED WITH CUTTINGS AT MW101. BLOWING OUT [illegible]

[signature]

6-19-91

(3)

1745 SPLIT SPOON SAMPLE AT 37-39' CONSISTED MAINLY OF BENTONITE PUMPING MUD AND FINE MED. SAND AND SOME GRAVEL, POSSIBLE LIMESTONE. NO SAMPLE COLLECTED.

1755 QUIT DRILLING FOR THE DAY. DRILLING CREW IS CLEANING UP

1825 ALL PERSONNEL LEAVE SITE.

[signature]

THURSDAY, JUNE ~~19~~ 20 M.S., 1991

Activity: Drilling & sampling at MW101 nest (MW101-1)

Personnel: E Clark, Q Nowak (Mathes), S Bhagat, M Sorensen (CDM, recording)

Weather: 85°, sunny

0820 – Drillers go to site & will drill down to 47' for next sample.

0855 – Collect split spoon at 47-49'. OVA: b.g.

Sample consists of mod yellow brown silt, ~~5~~ M.S. w/ little to ~~to~~ some clay; one pebble-sized drop-stone. Saturated

0930 – Drilled to 57'; now collect spoon @ 57-59'. OVA: b.g.

Consists of mod brownish gray clayey silt, plastic, saturated; trace subangular granules suggest this is a till.

0955 – Drilled to 67'; collect split spoon @ 67-69'. OVA: b.g.

Sample descrip: 67-67.5' is mod brownish gray clayey silt w/ [illegible]

(5)

trace pebbles (subangular pebbles); plastic

67.5-68.2' is ~~5~~ M.S. light yellow-brown sand, fine to medium-grained, mod well sorted (SP), subangular to angular, 95% quartz w/ remainder being feldspar, dark minerals & carbonate grains; saturated. One >15" limestone pebble.

1015 – Drilled to 77' & collect split spoon, but no recovery

1035 – Collect additional split spoon at ~78-80'. OVA: b.g.

Sample: coarse to fine sand, well graded SW, saturated, as above

Recovery: 2"; appears to be in place (can see mud cake only on outer rim of sample

1055 – Drill to 87' & collect split spoon sample. OVA: b.g.

Recovery: 13"

Sample consists of lt yel brn

– [illegible] 20 M.S.

sand, med to fine, mod well sorted (SP), subangular, saturated. No gravel but trace silt or clay.
Head space: 0.1 ppm

1115 – Drilled to 97' & collect split spoon at 97-99' OVA.
Recovery: ~3" of broken gravel
Sample description: pieces of broken gravel.

1135 – Drill to U.S. from 97 to 102', & had gravel from 97 to 99'. Run sand sifter and mix in 1 bag of bentonite (using Premium Gel from American Colloid).

1155 – Collect split spoon at 102-104' OVA b.g. Recovery 16".
Description: 102-102.5' is clayey silt w/ tr. angular to subang. granules and pebbles; mod brn gray to gray-brown, wet. Also contains a small (1/8") wood twig & a pyrite/marcasite granule!

102.5-103.3' is grayish brown sand, coarse to fine w/ trace to little granules & pebbles which are subangular to subrounded; tr grayish clay/silt; saturated; SW; sand is 90-95% qtz; U.S. pebbles are carbonate, greenstone, granite, chert, etc.

1305 – Drillers are back & resume drilling.

1325 – Drilled to 107' Now collect U.S. split spoon, 107-109' OVA (not rinsed).
Recovery: 7"
Description: 107-107.1' is grayish brown clayey silt w/ trace grains & pebbles. ML
107.1-107.6' is grayish brown sand, fine to coarse, wet, tr granules & pebbles. SW

1335 – Driller reports slower drilling & she till (grayish brown clayey silt w/ tr grains) in cuttings — 110-115'; drilling cased up 115-117'.

1400 - Collect split spoon at 117-119'. Recovery: 24"
Sample consists of ~~brownish~~ M.S. mod brown (~~to~~ M.S. 117-117.1') to brownish gray clayey silt (remainder) w/ trace to little (~5%) subang to angular ~~pebb~~ M.S. granules & pebbles w/ no prefferred orientation. No bedding observed exc. that the ~~brown~~ M.S. color change at 117.1' is sharp, and at a 35° angle. Saturated to moist.

1430 - Collect spoon @ 127-129'
Recovery: 6"
Sample consists of dk brown (organic-rich?) to gray brown clayey silt w/ 5% grains & pebb's; mixed in are some pebbles >1.5"

1500 - Drilling got rough and slow at 134'; soon began getting cuttings of light gray to buff gray limestone/dolomite, & decreasing proportions of the clayey silt till & granules from 134 to 136'. This is definitely bedrock, based on drilling action, lithology of cuttings & size/shape of cuttings (angular carbonate chips up to 1½") The drillers will pull the drill rods & bit out, then fix the pull-down cable in order to use the 9½" bit to ream out the hole, then set 6" casing. Will set the well ~10-20' into bedrock. Intermediate well will go (or perhaps 2 wells) in sand zone between 67.5 and 99'. Need a bedrock well here, because there's no ~~t~~ M.S. aquifer material >5' thick between 99 & 134'. Shallow well will go @ ~30-40' depth.

1540 - MS goes to MW102 rig, then to stake locations for JULIE clearance. Driller does repairs on rig; leaves at 1745.

FRIDAY JUNE 21, 1991

Activity: Reaming & casing to bedrock at MW101

Personnel: E Clark, Q Nowak, J McMullan (Mather), M Sorensen (CDM, recording)

Weather: 85°; warming to about 90°; fair, winds light & variable

0700 – Drillers at site to finish repairs & ream out hole w/ 9½" bit

0830 – The 9½" bit isn't working well – appar. is an air rotary bit & w/ hole too narrow to allow proper mud pressure (backpressure developing), so go to M.S. enlarge holes.

1020 – Have reamed to 100'; mud hose bursts.

1055 – Fixed hose; resume drilling.

1120 – Drilled to 120'

1210 – Have drilled to bedrock; now continue circulating mud; cuttings are primarily fractured lime

1225 – Begin pulling drill string (9½" bit)

1430 – Retrieved 6" casing; weld a metal flange hose fitting to bottom of casing; attach grout hose to this fitting & re-install casing

1505 – Casing hung up at ~95', M.S. and can't push it down, so they M.S. will pull casing and come back next week with a larger (~11") bit.

MONDAY, JUNE 24, 1991

Activity: Reaming, setting casing, & grouting at MW 101

Personnel: C Clark, Q Nowak, J McMullan (Mathes), M Sorensen (CDM, recording)

Weather: 82°, fair, light SW winds.

1050 - Drillers arrive at MW101 and find that their new generator was stolen over the weekend.

1145 - They have enlarged the holes on the 11-inch bit to allow effective mud drilling; now begin reaming hole w/ the 11-inch bit — first mix more mud.

1220 - Have drilled to 34'; cuttings show sand & gravel almost exclusively.

1250 - Have drilled to 64'; cuttings show brownish-gray silt/clay which ~~became~~ M.S. showed up in cuttings from below ~45'; loc brown silt & yellow-brown fine sand, ~~but both~~ M. Sorensen

1300 - Drilled to 74'; cuttings changed over to sand & gravel, perhaps at

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(13) ~~11~~ SSR

about 67' & below.

1310 - At 84', cuttings of 74-84' show mainly sand & gravel w/ lesser (~20%) brownish-gray clayey silt.

1320 - At 94' cuttings are ~60% bra-gray clayey silt

1450 - Took lunch break & have now drilled to 104'; cuttings were initially sand, & became more clay-rich @ base. However, hard to get handle on units here because they just resumed drilling; after a break, the first cuttings tend to be sand (the larger chunks of clay may have sunk during the break)

1455 - ~~Run on sand sifter~~ M.S. correction - Hook up sand sifter

1505 - Drilled to 114'; mixed cuttings of brownish-gray clay (≈50%) & sand/gravel.

Also note many wood fragments in cuttings ⇒ till.

1530 - Drilled to 129' but stop to ~~add~~ mix M.S.

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more mud

1610 - Have been having trouble (the last 20-30 mins.) with the intake ~~to the~~ MS hose for the mud tub.

1715 - Bit plugged up while they were looking for new valve for intake hose, so trip out. Will ~~to~~ re-drill 134-136 tomorrow

TUESDAY JUNE 25, 1991

Activity: Re-drill 134-136 feet at MW191, seat 6" casing, grout annular space, move drums, decon, sample drums

Personnel: E Clark, Q Nowak, J McMullan (Mathes), M Sorensen (CDM recording), S Bhagat (in p.m., sampling drums)

Weather: 85°, clear, light SE wind

0730 - Drillers at site; MS & CDM team find trailer broken into @ Ten Rock. S Bhagat will call police & make report

0800 - MS meets w/ JULIE for utilities clearance. Drillers will re-drill 134-136, then set 6" casing.

1100 - Have set casing & grouted 3 tubs (~125 gallons each) in annular space; tremie hose is just above bottom of 6" casing

1125 - Installed another 110 gallons cement-bentonite grout, MS then grout displaced drilling mud

1425 from hole. Begin sampling drill cuttings from drums. Analyses = Full organics and full Inorganics.

SAMPLE	TIME	DRUM #'s SAMPLED
MW101A-1	1425	MW101-1 thru MW101-6
MW101A-2	1440	MW101-7 thru MW101-12
MW101A-3	1510	MW101-13 thru MW101-18
MW101A-4	1535	MW101-19 thru MW101-24
MW101A-5	1600	MW101-25 thru MW101-30
MW101A-6	1625	MW101-31 thru ~~MW101-36~~

M Sorensen → MW101-40

1800 – Clean up & leave site for day.

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WEDNESDAY, JUNE 26, 1991

Activity: Drilling bedrock from 136' at MW101

Personnel: E Clark, G Nowak, J McMullan (Mathes), M Sorensen (CDM, recording)

Weather: 75° (rising to ~92°), moderate SE wind, clear & hazy

0730 – Drillers at site: cut off the 6" casing to ~3' stickup (the casing was 141'1" long and had a 5-foot stickup before cutting, therefore ~~was~~ is M.S. sitting at 136' – top of rock. Note that when they set it, the casing nearly bounced, & thus is probably sitting right on solid rock.)

Also steam-cleaned 6" drill pipe & hooked up air compressor.

0850 – MS arrives (after checking on other rig – Rob & Tim are at MW-111). The drillers are tripping down the 6-inch pipe

0935 – Drillers need ~~an~~ M.S. properly

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threaded adaptor for the conductor that will direct cuttings into the mud tub.

1045 - Have welded on new piece for conductor and set up for air-rotary drilling. Now pump in air to evacuate water from hole.

1050 - Blew a hole in an air hose; repair it. Bit at 136' still.

1220 - Repaired & set up hose; resume blowing in air (note that the air won't damage the annular grout seal, because there is a PVC cap on bottom of 6" casing), & then advance bit, which is a down-the-hole air hammer.

Log of cuttings

136-139' med to light gray limestone, finely crystalline (xln), w/ ~~loc~~ M.S. some brownish coatings that cause rusty brown water. Near base get many mod. brown frag's

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139-147' - the brown limestone at top (~139-140') grades soon into

hard, mod. dark gray limestone w/ ~~the~~ M.S. some chips showing thin (≤ ½ mm) laminae & local veins of black material; some mottling of same. All is carbonate (limestone/dolomite exc. for some (<1%) black chips that are siliceous. Producing tan-colored water (cleaner than above), & drilling rate is slow.

147-151' - the above gray ls. grades to a brown limestone around 147', which quickly yields to a buff-colored (lt. yel. brown) limestone, finely xln; some porosity between some zones w/ sand-like grains; some rusty brown coatings; rel. soft b/c drilling is rel. fast; produces a ~~white~~ M.S. yellowish-white (milky) water @ fast rate (like others).

1310 - Stop drilling @ 151', because we're getting good production of water (~900 gals. in 50 mins. drilling across 136-151') drum the water

1350 - Drillers return from lunch & trip drill pipe out of hole.

1430 - Measure water level: 45.8' below ground surface (bgs)

Got well materials; will set screen at 141-151', 5 feet into the carbonate bedrock. Should easily produce water.

1510 - Begin tripping in well screen & pipe; set centralizers @ 136' (15' above well bottom) & each 40' above thereafter.

First cleaned drill pipe; using teflon tape on interior of threads.

1545 - Well bottom is sitting @ 150'-10"

1600 - Pour in 1 bag sand (20/40 sieve size) & measure annular space as sand falls.

1610 - 1 bag sand brought ann. space up to ~~145.8~~ M.S. 145'4": 5'8" for this bag. Now add a second bag of 20/40 sieve sand

1640 - Coarse (20/40) sand came up to M.S.

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M.Sorensen ~~139'3"~~ 139.3' (1' above top of screen); now add fine sand (100 mesh sieve size)

1705 - Fine sand has filled annular space up to 138.3'; probably some is still sinking, so have ≥ 1' fine sand. Now prepare to mix Volclay grout

1835 Have gotten the ½" grout hose down; install volclay grout, tremie-ing up from base of open annular space: They cut holes in side of hose near base to avoid jetting grout into the fine sand of sandpack. This will prevent sand from moving.

1850 - Installed 1 tub grout. Mix second tub

1905 - Install grout from 2nd tub, which brings it to surface. Will top it off tomorrow if necessary.

Mark Sorensen 6-26-91

THURSDAY, JUNE 27, 1991

Activity: Complete installation at MW101; begin drilling at MW104

Personnel: E Clark, A Nowak, J McMullan (John Mather), M Sorensen (COM, recording)

Weather: 77°, fair, light SE winds, to rise to 97° & humid

0730 - Drillers at site & top off grout, which sank down ~6'; install protective casing

0830 - Weld on protective cover, spray off mud tub etc., load up; decon

1130 - Move off MW101 & over to 104.

1300 - Setting up at MW104.

1415 - Broke & fixed a weld on sub. Then had to move over 2' to avoid a boulder near surface.

1540 - Re-welded the sub that broke; resume drilling with the ~16" auger to make hole for the mud conductor pipe

1545 - Drilled auger to 6'; attempt to set conductor - went down ~5' & needs to go farther, so use 11" bit & now mix mud for mud rotary drilling

1625 - Began drilling w/ mud rotary & 11-inch bit, but we appear to have hit a water line - the hole is making ~~or 2 gals per minute~~ ~10 gals per minute.

1645 - MS & E Clark reached the city employee who did the locating, & he is sending someone out to look at leak

Pulling off site.

1830 Randy Gangoni from City of Rockford arrives at MW104 next & says we probably hit the active side of a service line. They will have a crew out tonight to fix it & will bring someone out tomorrow at 8 to do the locate. MS leaves site @ 1845

FRIDAY, JUNE 28, 1991

Activity: Drilling at west MW104

Personnel: M Sorensen (CDM, recording), E Clark, Q Nowak, J McMullan (Mathes drillers)

Weather: 80° & fair w/ light to moderate S winds

0800 - Arrive at site & find the water leak repaired & a line marked - parallel to street & apparently a main!

0815 - MS goes back to trailer to ask if locators are coming.

0845 - City water locators arrive. We did hit the main - put a 1-inch hole in the 8-inch main. Locators found the service line (1½-inch).

0915 - Move out a spot ~6½' from gas line & 3½' from water main

0930 - Begin augering

0945 - Hit boulder @ 5', so move forward a few feet.

1000 - Succeeded in getting auger to 5'. Set up for rotary drilling

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1040 - Begin drilling mud rotary; using mud that was already mixed yesterday (they drummed it for the evening to move out from leak)

1100 - Collect split spoon sample 18-20'. Recovery: 15". Sample consists of mod orange brown v fine sandy ~~silty~~ silt - MSorensen - w/ ~8% angular to subang. pebbles & granules. Moist & possibly saturated but this could reflect yesterday's leak in water line.

1115 - Collect 28-30' spoon. Recov.: 4". Sample is mod or brn sand & gravel, silty, moist but not saturated.

Notes: Driller noted sand at 6'-10', becoming silty w/ gravel (primarily sand) at 18-20'; sand & gravel 20' and down.

1130 - Cycloloting mud w/ bit @ 38'

1140 - Collect spoon at 38-40'. Recovery: 5". OVA: 6.3. Description: v fine silty sand ~~but~~ M.S.

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w/ ~8% granis & pebbles which are ang to subang.; moist, mod orange bn. No discernible bedding; prob. a till.
There was much sluff before collecting sample.

1145 - Driller reports tougher drilling below 43'

1200 - Collect 48-50' split spoon ~~Ad~~ M.S.
Advance/Recov: 8"/4"; OVA bg
Sample: v fine sandy silt or silty sand, mod orange bn w/ lue films & weathering spots of Fe oxides; ~8% granis/pebbles, ang. to subang and of random orientation (TILL); not cohesive, moist.

1300 - Resume drilling at 48'. Drilling remains quite hard 48-58'; cuttings show broken gravel, sand & the fine sandy silt clumps perhaps 25% - this is same as 38-48' cuttings

1330 Spoon from 58-60'. Recov. <1"
OVA:

Sample is loose sluffed gravel & several brown silty sand clots.

1340 - Note that drilling action changed at 63', concurrent w/ a change in cuttings to a lt-med gray clayey silt w/ ~10% subrounded to subang. granis & pebbles. Pebble lithology largely carbonate & chert; could suggest we're near bedrock.

1355 - Collect 68-70' split spoon Recovery 11" OVA: bg.
Description: 68.0-68.3 and 68.6-68.9' are ~~SILT~~, M.S. v. fine sandy, clayey SILT w/ some (~10%) granules & pebbles which are subang to subrdd, and are carbonate, chert & dk gray phyllitic shale. Many pebbles are subhorizontal & a few vertical. Moist & sl. plastic. ML
68.3-68.6 is gravelly sand, med to coarse, w/ subrdd to subang pebbles. Saturated.

Gray @ 68.0-68.05; mod. orange bn elsewhere - M.S. Anderson 6-25-91

1455 - ~~Begin trip out~~ M.S. Have tripped out the drill pipe; prepare to ream

hole to 11-inch diameter. Getting 6-inch outer casing.

Note: Hit bedrock at 77': carbonate fragments, pebble to coarse-sand-sized. Hole cleans up ~~of~~ M.S. so that other cuttings are gone (till, sands disappear).

1500 - Setting up for 11-inch hole ~~drilled~~ w/ mud rotary - reamed - M.S.

Note: Driller reported gravelly zone (rounded-subrdd. gvl.) at 75-77'.

1540: In reaming the 11-inch hole, noted that cuttings at 25-35' were sand & gravel w/ some brown silty till; 35-40': brown silty till; 40-45': mixed sand & gvl & brown silty till.

1600 -: 45-50': silty till w/ some sand & gvl. 50-55': sand & gvl w/ lesser (~15%) silty till, brown & some gray.

1620 - 55-63': sand + gvl w/ lesser (~15%) silty till; 63-65': gray clayey

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sandy silt.

65-75': subequal proportions of brown (loc gray) silty till and gravel/sand

75-77' same as above

77-79': angular limestone (dol frags, buff + loc. dk gray; a few rounded pebbles. Bedrock.

1705 - Circulate mud in hole & prepare to set casing (6-inch) & then will grout annular space w/ cement/bentonite. Set casing @ 79'.

1845 SNEHAL BHARAT (CDM) now recording notes. Drillers are repairing an engine breakdown on the rig truck.

1855 Rig is fixed and second tub of grout is being tremied.

1905 Remainder of annulus grouted - grout bubbling to top of mud conductor pipe.

1910 Tremie pipe removed and mud conductor pipe removed from hole. Preparing to leave site. NOTE: Casing was emplaced from appx 1730 to 1800, after which

Snehal Bharat 6-28-91

grouting process began.
1930 Leave site for the day and return to trailer.
1945 Leave trailer.

Sushil Bhagat
6-28-91

SATURDAY JUNE 29, 1991

Activity: Bedrock drilling w/ air rotary at MW104

Personnel: E Clark, Q Novak, J McMullan (driller from Mathes), S Bhagat, M Sorensen (CDM; MS recording).

Weather: 75°, fair, light to moderate S winds, supposed to get up to 90°

0730 - Drillers at site and pump mud (drilling mud) into drums. Move rig over a few inches to center it over 6" casing.

0830 - Setting up for air drilling & trip the rods into hole: again will use a down-the-hole air hammer.

0940 - The air compressor can't be started. Ed goes to rental people to get a serviceman out here.

1110 - Attempted to change battery of air compressor to get it started but didn't work. Wait for repairman to come.

1335 - Drillers have had air compressor fixed, and blown water out of column. Begin drilling into limestone: water being produced is an orange-brown

1400 - Have drilled to 91'. The limestone/dolomite is producing 55-60 gals per minute - have already produced ~700 gal. Water is tan-colored - cleaned up somewhat below 85'. Cuttings: dolomite/limestone, buff, finely to v finely xln to fine & sandy (prob. secondary porosity); rare selic. limestone/chert; from 82' on is loc abun ~~choc~~ M.S. clay, loc. shaly, that is comm. laminated on sub-millimeter scale w/ chocolate brn & dk yel brn bands; these ~~o~~ M.S. are very ~~soft~~ M.S. soft. 50% of cuttings at 83'; 10-40% elsewhere.

1420 - Water becoming a milky tan, below ~95'. Note that water produced upon affixing next drill segment at 91' was again orange-brown

1425 - Drilled to 101'. Water production similar to above segment. Cuttings 91-101' are same as above, with ~~clay~~ M.S. brown clay (bentonitic ?) constituting 30% of cuttings at 92', 10% at ~~91, 93 &~~ M.S. 91, 93-95', and 2-5% at 96-101'.

1433 - Resume drilling at 101'.

1445 - At 110', air compressor overheated. Water production is higher in the 101-110' interval.

1535 - ~~At~~ M.S. Compressor has cooled; resume drilling at 111'. Cuttings 101-111' are same as above exc. that 111' cuttings have ~15% white chips, some w/ dk-mod. brn gray cherty areas; the white chips are carbonate, occas. partly silicified. Proportion of brown clay: 20% at 102 & ~~96~~ 106, M.S. and 1-10% elsewhere (<1% at 111').

1600 - Have drilled to 121'; cuttings 111-121' are again dolomite/limestone.

buff, med to v finely crystalline and ~10% is sugary. Brown clay, soft + v finely laminated to veined: choc bn + dk yel bn w/ loc grn gray spots. 1-10% exc. @ 116', where its ~20%. White chips comm. have dk-mod bn gray chert in their cores; the white zones are ~~non~~ M.S. carbonate or loc partly silicified. These white-gray carb-chert chips are trace to 5% (5% at 113 & 120').

1630- Have drilled to 131'. Water production was high from 111-131' + a milky tan.

Cuttings 121-131' are buff to grayish buff carbonate, fine-grained + loc. sugary. At 123' there's 8% white to gray carbonate/chert composite chips (mostly white carbonate, 80-90%). Tr bn. clay, 3% at 131'. Tr soft grayish green shale below 123'. Note some echinoderm fragments

1710- Drilled to 141' Good water production of slightly milky water. Cuttings are same as above; fairly uniform proportion of brown clay (~3%) and ~~green~~ (M.S. grayish olive green shale/clay (trace) throughout; rare Fe ox coatings & no silicified zones or chert observed!

1735 Drilled to 146.5' Water production high and quality high (nearly clear). Cuttings 141-146.5 show carbonate as above but color is mod brownish gray (transition zone @ 141-142). Otherwise same as above. Note a few echinoderm frag's. Note that the roughly constant ~~f~~ M.S. proportions of brn clay/shale and gray green clay/shale, along w/ their softness, suggests that they continued to sluff into the hole after being penetrated. Alternatively, these could simply be frequent interbed.

136-146'.

1740 - Begin pulling drill pipe, but at 1745 rig jack fell off wood blocks

Note: probably another bed of green clay/shale at ~146' where they constitute ~~27 of chips~~ ~8% of sample. Note: this is a (M. Sorensen) sub. shale, not a clay, because it has planar partings. The brown clay found at 82' is probably not a shale, because it doesn't have planar partings.

1825 - Rig came off blocks again, so leave it till tomorrow.

Mark Sorensen 6-30-91

SUNDAY, JUNE 30, 1991

Activity: Well installation of deep well at MW104 west and perhaps begin drilling intermediate well

Weather: 80° & fair, to rise to 90°; lt-mod SE winds

Personnel: E Clark, Q Nowak, J McMullan (Mather driller), J Okagat, M Sorensen (COM, recording).

~~0904~~ 0940 M.S. - Drillers have found railroad ties to use as blocks beneath the rig jack.

1010 - Begin tripping drill pipe out of hole.

1055 - Decon well pipe.

1115 - Measure water level in hole: 37.4'

1140 - Well screen & pipe are in hole & sitting at 146'. Begin pouring coarse sand for sand pack (20/40 sieve size)

1300 - After lunch break, sand has come up to 136' - want to have sand at least to 134', so add ½ bag more.

30 - M.S.

1320 - Coarse sand tops off at 133', so now add fine (100) sand —

1345 - Fine sand has filled annular space up to 130.8"; now mix grout (Volclay) —

1425 - Tremied in 1 tub of grout. -

1440 - Tremie in 2nd tub of grout —

1450 - Tremied in 2nd tub & water is still not coming out of hole — must be quite conductive in the bedrock (surficial units are — cased off with the 6" casing).

1520 - Have mixed & installed 3rd tub of Volclay grout - still no water coming out of hole. Mix @ 4th, a thick one of ~100 gals. —

1545 - Installed 4th ~~4th~~ tub grout — still no fluid exiting annular — space.

1605 - Add 2 bags Pure Gold bentonite chips, medium-sized.

1625 - Mixed & now install 5th tub grout.

1650 - Leave site for day —

MONDAY 01 JULY 1991

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0800: Arrive at location MW104 to finish grouting annular space around riser pipe.

PERSONNEL: E. Clark, A. Nowak, J. McMullan (John Mathes); M. Sorenson and S. Bhagat (CDM, S.B. recording)

WEATHER: Sunny, ~75°F, slight breeze.

0815: Tremie 6th tub of grout down the hole. Top of grout at depth of 80 feet before grouting today.

0825: Finish tremeing grout. Drillers ~~decanning~~ cleaning tremie pipe and mud tub. Top of grout is now 2-3 feet below ground surface.

0845: Drillers decanning rig and drill pipe.

0900: Begin setting up for mud-rotary drilling, appx. 10 feet north of the previously installed well.

0925: Begin drilling hole for mud-conductor pipe.

0945: Continue drilling hole for mud-conductor pipe. Gravel and cobbles are being encountered.

1015: E. Clark leaves to speak with M. Sorensen.

1035: E. CLARK returns to location MW104. Drillers are attempting to remove a boulder from the hole by breaking it up into smaller pieces and removing them.

1045: A large rock (~25 cm long) is removed from hole. Drilling for mud-conductor pipe resumes but there are more rocks in the hole.

1105: Drilling completed. Mud-conductor pipe placed in hole and mud tub being positioned.

1130: Begin mixing drilling mud.

1145: Drilling mud mixed. Begin advancing tri-cone rotary bit and circulating drilling mud in the hole.

1200: Bottom of hole at approx. 14.5 feet. Drillers break for lunch.

1215: S. Bhagat leaves for lunch.

1255. Return to location MW104.

1310: Resume mud-rotary drilling at

Sushil Bhagat 7-1-91

MW104. Begin at ~14.5 feet.

1365: Bottom of hole at ~45 feet.

1430: M. SORENSEN and E. CLARK leave to inspect another drilling location.

1500: M. Sorensen and E. CLARK return.

1525: Repairs being made to intake portion of mud hose — new end piece and filter valve are installed.

1540: Resume mud-rotary drilling at depth of ~45 feet.

1545: WEATHER: has become cloudy and overcast and breezy; ~75°F.

1700- Have drilled to 76'; driller felt bedrock at 73' here. At 76' are losing much mud down hole; we & M.S. will stop drilling mud rotary here & pull rods, set 6" casing.

Note: Cuttings show many limestone & chert fragments, and also a tan to white silty material that was not seen at other location — could have missed it

Mark Sorensen Sushil Bhagat 7-1-91

1720 - The hole is caving, so they will mix some extra thick mud tomorrow to stabilize it before casing & grouting.

M.S.

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TUESDAY, JULY 2, 1991

Activity: Drilling & setting casing at MW104 intermediate well

Personnel: E Clark, Q Novak & J McMullan (Mather drillers), S Bhagat & M Sorensen (CDM; MS recording)

Weather: 80°, fair, winds light & variable

0730 - Drillers are on-site & mixing a thick mud to block circulation losses

0930 - They attempted to drill down to get into more solid material, & found that they were in gravel at 76' — this zone continued to 78', where they hit bedrock. Drilled mud rotary to 82', where they suddenly lost much mud down the hole again. This time the drill string ~~by~~ M.S. dropped ~6-7" suggesting a sizeable void. Begin collecting composite samples of material insi[illegible] of drums.

S. Bhagat

SAMPLE ID	TIME	DRUM #'s SAMPLED
MW104-1	0930	MW104-1 thru MW104-6
MW104-2	1010	MW104-7 thru MW104-12
MW104-3	1035	MW104-13 thru MW104-18
MW104-4	1320	MW104-19 thru MW104-24
MW104-5	1110 on 7/3/91	MW104-25 thru MW104-27

1045 - ~~Stop~~ M.S. Have drilled to 85' & getting limestone in cuttings. Driller said it was more competent near 85', so will stop drilling & attempt to set the 6-inch casing.

Note: M.S. at trailer from 0850 to 0935 to meet the gamma loggers from Fromm Geophysical (Mequon, WI). Bring them to MW104, where they decon their cable & detector & log MW104 (deep).

M.S Performing logging at MW104 starting at 1048.

1110 - Have tripped out drill pipe, now trip in 6-inch casing.

1150: Casing will not fit completely down the hole, although tremie pipe does fit.

Snehal Bhagat 7-2-91

1210: Drillers break for lunch.

1215: SSB breaks for lunch.

1300: Return to site and resume drum sampling.

1345: Drillers return to site. 6 inch casing is still stuck. Appx. 12 feet remains too high. E. Clark believes gravel zone is responsible. Tremie pipe was probably small enough to fit to the bottom of the hole.

NOTE: Jetting water down the hole failed to clear the obstruction.

1430: Casing above the table cut off and drillers are preparing to drill through the hole obstruction.

1525 - Positioning the last section of 6" casing, & welding it in. Will then drill down inside the 6 inch. Also repairing hoses.

1600 to 1620 - Cleaning out 7' of blow-in inside the 6" casing; now will have to cut the 6" again just to

Snehal Bhagat Mark Sa.... 7-2-91

~~made~~ M.S. add one drill rod.

1700 - Cut 6" casing, added 1 drill rod, welded 6" casing back together so that they won't lose it if there's another void.

1830 - Have gotten 6" casing down to within 2 feet of bottom & now bit is plugged off.

1900 - Back at trailer - place chain-of-custody seals on cooler containing today's drum samples

WEDNESDAY, JULY 3, 1991

Activity: Setting casing & drilling into bedrock at MW104 (intermediate well in next)

Personnel: E Clark, P Novak, J McMullan (drillers from Mathes), M Sorensen (CDM, recording)

Weather: 75°, fair, light-moderate SSW winds; to rise to 83° today

0805 - CDM arrives at site; drillers are tripping out the drill pipe (bit plugged up last nite)

0845 - Have tripped out drill rod; bit is no longer plugged; trip in the drill rods. Casing (6-inch) is sitting at 82', 3' above the target

0905 - Tripped in; now re-attach (weld) 6" casing segment to avoid losing it if it drops in borehole during cleaning out of the blow-in. M.S.

0925 - Mix mud

1010 - Resume drilling out the blow-in

1030 - Drilled out the blow-in & set the casing at desired depth

of 85'.

1105 - Tremied in 1 tub grout for the annular space outside 6" casing.

1110 - Collected (by S Bhagat) composite sample of drums ~~25~~ MS MW104-25 through MW104-27 - matrix spike duplicate sample.

1200 - Have tremied in 4 tubs of cement-bentonite grout, and grout came up to ~16-18' - it rose no higher throughout - much of the last tub. Will let it set over weekend & top off the grout on Monday; then will drill down into bedrock.

Mark Sorensen 7-~~8~~3-91 - MSorensen

MONDAY, JULY 8, 1991

Activity: Drilling down & setting intermediate well at MW104

Personnel: C Clark, R Nowak, J McMullan (drillers from John Mathes & Associates), M Sorensen (CDM, recording).

Weather: 75°. light winds from NW; predicted high of low 80's.

1050 - Drillers go to MW104 to set up.

1100 - MS meets water & sewer people at MW104 for clearance of drilling locations MW105, 108, & 110.

1110 - Measure grout in annular space of 6" casing - cement-bentonite grout tops out at 29' after setting over weekend. Will fill annular space w/ grout, then drill down into bedrock.

1220 - Have filled annular space with cement-bentonite grout & within ~4" of surface. Break for lunch.

1330 - Drillers are cutting the 6" casing & re-welding the fitting on it to adapt to air drilling.

MS

1445 - Begin air rotary drilling —

1515 - At 85-85.5' is buff to tan gray limestone/dolomite, angular chips w/ a few (~15%) subrounded to rounded pebbles.

From 85.5-90' is the chocolate brown bentonitic clay w/ laminae & rivulets of yellow brown material; also in this zone have some buff limestone: 40% of cuttings at 86', 30% at 88', & only 10% at 90'. Who ~~ho~~ knows why we didn't hit this in the deep hole (MW104C). 12 feet away! Producing some water but probably from the rubbly zone at 85-85.5'. —

1525 - Drill stem is getting gummed up due to a lack of adequate water to carry up the cuttings, so they will rig up a "T" to supply water to the air as a spray. This should ~~help~~ M.S. help carry up the mud & keep the hole & casing (6") open. —

1735 - Got the water "T" hooked up to the air line; begin circulating in hole. 90 — M. Sorensen

1820 - Cuttings from ~~85~~ 90 to 91.5' were the brown clay w/ var. proportions of buff limestone & gray to red chert, & a few rounded black pebbles, appar. siliceous carbonate seen elsewhere. 10 to 30% of these non-clay constituents. The remainder is clay —

1820 - From 91.5-95.5' the hole drilled harder & produced some of its own water. The cuttings are 25-50% limestone (50% at 95') & remainder clay —

1830 - From 95.5 to 100' the drill string descended w/out any pull-down force; material very soft; cuttings show consolidated and "mushy" or soupy clay — could be fill-in of a cavern or fault.

TUESDAY, JULY 9, 1991

Activity: Drill ~~[illegible]~~ M.S. intermediate well at MW104

Personnel: E Clark, D Novak, J McMullen (drillers from Mathes), M Sorensen (CDM, recording)

Weather: 65°, mostly cloudy, light SE winds; predicted high of 75°.

0735 - Discuss situation with drillers. It looks like we're in some kind of void due to fractures or karst — this would account for the yellow-brown muck produced from 85.5 to 100'. This muck apparently filled the voids. Ed is worried about losing too much grout here, & about being able to clean up the hole. In addition, even if we hit solid limestone below 100', we would be setting the screen some 20' below where we originally wanted it. So we will abandon this hole and move ~12'

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to the north and try again to set the intermediate well

0930 - Go with E Clark to check on placement of third well at MW 109, where Tim is drilling today

1100 - Have moved over to M.S. by ~ 10' to N of previous hole & now begin assembling

1130 - Have drilled hole for the conductor pipe; now put it in hole & move mud rig in place

1315 - Begin mixing mud for drilling to bedrock

1345 - Begin mud drilling w/ 11-inch bit

1445 - Have drilled to 45'. Cuttings at 20-~~25~~ 35' were mud gravel/sand and brown silt w/ embedded gvl; silt clots ~30-40% of cuttings, but less near 35'. At 35-45' is mainly gvl/sand w/ only ~15% brown silt @ 35', gradually decr. to 5% at 45'

1530 - Drilled to 55'; cuttings 45-55' were gravel/sand w/ some (5-25%) brn silty

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till; 55 – 58' increasing proportion of brown and gray silty till; 58–65': gray silty till (poss. clayey) ~60% w/ lesser gvl/sand. Swells during drilling. —

1630 – Have drilled to ~~79~~ M.S. 80'3", approx. 2'3" into limestone ~~(buff~~ M.S. — bedrock. Cuttings 65–77': approx. 25% brown silty till w/ some gray & some cream. Mainly a mod brown color rather than the yellow brown seen higher up. The cream color is more abun (~5%) near base. ~~77~~ M.S. – ~~79~~ 80'3" drilled hard, ~~as~~ M.S. – requiring ~20 mins. for 2', cuttings were buff limestone w/ some white, & some bn gray chert — these are all small chips; some bn clay remained in ~~cir~~ M.S. circulation, ~~but probably wash~~ M.S. and is probably either wash or just remained in circulation — they are only small clots

1655 – Pull drill rods.

1725 – Begin lowering the 6-inch casing

1805 – Begin grouting annular space around 6-inch casing —

1825 – Complete grouting (cement-bentonite) of annular space – it took 1 full tub (~150 gals.) grout

1830 – Leave site for day; drillers cleaning up site for night —

WEDNESDAY, JULY 10, 1991

Activity: Drilling bedrock ~~pro~~ portion of intermediate well at west MW104

Personnel: E Clark, Q Nowak, J McMullen (drillers from Mathes), K Lantz, M Sorensen (CDM, MS recording)

Weather: 72°, fair, light S winds

0730 - Drillers deconning

0830 - Weld on a section of 6-inch casing to enable air-rotary drilling; set up for air drilling

1010 - Got air hammer bit to bottom, but its plugged with blow-in that apparently broke through the PVC cap at base of 6" casing. So now must pull out drill stem

1035 - Spraying out & cleaning air hammer

1130 - With air bit at bottom, applied air but notice that air bubbles are coming up outside the 6" casing — this indicates that the grout seal is not adequate; also

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~~the~~ MS the 6" casing fell by ~6". Therefore must pull out drill rods and either ① pull casing (6") and re-drill set casing again, or ② pressure-grout the annulus to set at least the lower portion of annulus of 6-inch.

1330 - After calling Kelvin, Ed Clark says the safest way to ensure getting the job done is to pull the casing & re-drill.

1415 - Begin pulling the 6" casing

1455 - Pulled out 3 sections of casing; the 4th is lost in the hole!

1630 - Begin tripping in drill pipe: pipe has a "fishing" tool on the end to try to thread onto the

1700 - Failed in their first attempt at retrieving the 20-foot casing. Discuss the situation at both drilling locations. Leave site at 1740.

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THURSDAY, JULY 11, 1991

Activity: Fishing for lost casing at MW104B

Personnel: E Clark, Q Novak, J McMullen (drillers - John Mathes & Associates), M Sorensen (CDM, recording)

Weather: 72°, fair, light to moderate winds from the ESE - M.S.

0800 - Drillers doing set-up & maintenance work.

0820 - Begin fishing for 6-inch casing section

1000 - MS went to Tim Crank's rig to discuss what that rig should do. Decided to set casing there (rather than drill down with mud rotary which took them 3 hrs. for a 5-foot interval) & move on to MW107 location. At MW104 they have used the 11 inch ~~bit~~ M.S. bit to ream out the hole. Now will run in the 5 7/8" bit with fishing tool attached to drill to casing top, then attempt to feel the casing & rotate the fishing tool onto the threads.

1100 - They appear to have latched onto the 6-inch casing section; however, it's hard pulling it up.

1145 - Brought the casing up to surface! Now must rig up a weld to hold casing in place when they unscrew it from the fishing tool.

1215 - They got the casing section out, but not the last 8-inch segment.

1315 - Trip in drill rods to again clean out hole & try to latch onto the 8-inch section of 6-inch casing. Break down the fishing tool.

1450 - Cleared out the hole to 78'; driller feels something at bottom of hole.

1545 - MS went to call W Dawson re oat hulls & oat bran as lost circulation material. Drillers' attempt at fishing failed & now bit is plugged. Pulling rods.

1630 - Pulled fishing tool out: it had screwed onto the casing but hadn't held it, because the 3 threaded flanges on the fishing tool are bent & the threads flattened. Clean off the tool & will then re-make it

1700 - MS leaves MW104 site to help with paperwork & sample shipment. E Clark working on building a new tool.

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JULY - M Sorensen (6)

FRIDAY, ~~MAY~~ 12, 1991

Activity: Fishing casing from MW104B and drilling at MW104-B (intermediate depth).

Personnel: E Clark, Q Nowak, J McMullen (drillers from Mathes), M Sorensen (CDM, recording).

Weather: 80°, drizzle, light S winds; to clear up by noon

0745: Drillers trip down the drill rod with new tool on it.

0925 - Made one attempt to latch onto the 8-inch section of 6-inch casing but failed; will make one more try.

1040: Failed to retrieve casing, so will grout up the hole & move over to drill another

1050 - Begin decomming, emptying mud tub, etc.

1125 - Pulling mast down

1148 - Moved 10 feet north; begin augering 16-inch hole to accomodate the mud conductor pipe.

1210 - Break for lunch.

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1410- Drillers have mixed mud, including oat bran to reduce losses of mud to the formation. Will sample this next week. Now proceed down with 11-inch — toothed steel drill bit. (Bearings on carbide button bit are wearing out). Just before lunch I spoke with Tim Crank, who said not to bother sending an additional person out here (CDM person) to sit their rig, because they probably won't be ready to drill until tomorrow. If ready today, they have other things they can do, he says.

1505- Have drilled to 55'. Cuttings were brown silty till, 20-40'; subequal till & gravel/sand from 40-55'; gray till exceeds brown till below ~53'.

Now cleaning clots out of mud tub, unclogging mud intake hose.

1540- Have drilled to 75'. Cuttings

show 55-73': unsorted till, gvl & sand; till is dominantly gray from 55 to ~67' & brown w/ some gray & cream from 67-73'. From 73-75' is a hard-drilling zone containing a mixture of limestone chips, rounded gravel (mainly non-limestone) & till (brown & gray). Drinks much drilling mud @ 75'. Probably in the gravel zone right above bedrock.

1545- Mixing more mud.

1605- Drilled 75-85 very quickly, particularly 80-85', which took perhaps 30 seconds! Cuttings show the yellow brown to orange brown mucky silt seen at the hole drilled on 7/8/91 (85.5 to 100' at that location). Perhaps 25% subangular gravel, largely carbonate; could be in another fracture or void situation ~~below~~ 85' in rubbly zone at top of bedrock.

1645- Mix more mud.

1745- Drilled 85-105'. Cuttings 85 to 101' were the ~~muck~~ M.S. brown silty/clayey muck w/ limestone pebbles/chips. Hit rock at 101' sandy & somewhat friable limestone chips. Below ~95' were getting many clots of ~~white~~ M.S. cream-colored clayey material — these continued to 105'.

1815- Drilled 105-107' — fairly hard limestone w/ tr. chert & more of the white clay clots. Note: a soft zone above at 104', but only a couple inches.

1835- Leave site for day.

Mark Sorensen 7-12-91

SATURDAY JULY 13 1991

Activity: Setting casing for intermediate well at west MW104

Personnel: C Clark, Q Novak, J McMullen (Mathes), M Sorensen (COM recording)

Weather: overcast, 72°, light to moderate N winds; chance of rain 30%

0800- Drillers begin work. Clean out hole in preparation of setting casing.

0930- Hole bottom is apparently at 110', ~~but~~ M.S. they measured wrong yesterday. Go for casing (6-inch).

1015- Begin installing sections of 6-inch casing; putting ~~tack~~ M.S. tac-welds on each junction.

1140- Got casing to 109'5", and also tremie pipe. Now mix grout.

1215- Have installed 1 tub grout.

1300- Have installed 3 tubs grout; get more cement.

1420- Check grout level — approx 5 ft below mud, so pull out conductor.

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pipe & then cut off the top of 6-inch casing, empty mud tub.

1505 - ~~Weld~~ M.S. Weld on a threaded collar to top of 6-inch casing to allow placement of the air diverter when we drill into bedrock tomorrow.

1525 - Setting up for air-hammer drilling; trip in drill pipe.

1610 - Leave site for day.

SUNDAY, JULY 14, 1991

Activity: Drilling bedrock for intermediate well at west 104

Personnel: G Clark, Q Novak, J McMullen (Mather), M Sorensen (CDM, recording)

Weather: Clear, 72°, light N to NW winds, predicted high of 80°.

0815 - Drillers arrive at site & trip down drill rod w/ air hammer bit

0905 - Turn on air (bit at bottom). No water emerging from hole, so bit must be plugged. Trip out rods & clean bit

0930 - Turn on air again w/ bit @ hole bottom; hole produces water; commence drilling at 109'5".

1030 - Have drilled to total depth, 124'. Now trip out drill pipe.

~~Drilling~~ M.S.

109.5-115.5': drilling penetration fairly rapid, making good water ≥50 gpm. Cuttings show 50% limestone, buff, fine to med xln (crystalline)

loc. sandy & friable; ~50% ~~beat~~ M.S. brown (~~ch~~ M.S. dark chocolate brown and ~~to~~ M.S. dk yellow brown bands, veins & laminae) bentonitic clay. Trace (<1%) chert & partially silicified limestone.

115.5-120': very rapid drilling w/ almost no bit chattering — this is a void space.

120-124': brown bentonitic clay ~50%; buff limestone as at 109-115.5' constitutes 30% at 120', decreasing to ~20% at 124'; white to — brn gray composite nodules (commonly show rounded margins) & chips of chert/partly silicified limestone. At 120' are a few (<5%) round, flattish pebbles of brown lithographic limestone.

1030 to 1045 — Ream the hole & clean it out. Observe that large volumes of water are coming from the 115.5-120' void, perhaps 60-100 gpm. Also observe that

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cuttings produced during this reaming are coming from the ~~115.5~~ M.S. 120-124' zone, and are more predominantly chert & limestone: ~55% chert/part silic. limestone, ~25% buff limestone, ~20% bentonite.

Note: the 115.5-120' zone was fairly clear of fill, containing rel small quantities of brown — much. This will be a good zone for setting the well. Will set well at 113-123'.

1045 - Trip in well pipe

1105 - Pour in sand pack; well is sitting at 122.5', so will insert sand to ~~122~~ 112' M.S., then 1' of fine sand, then volclay grout to surface

1150 - Added 3½ bags coarse (20/40 sieve) sand and hole has come up only 5', to 117.5' so will break for lunch & get more sand.

1410 - Have now added 6½ bags coarse sand, which have brought annulus up to 114.3'.

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Note: ~~E~~ M.S. Examination of cuttings in mud tub shows there is much calcareous sand from the air-drilled portion of the hole (109.5-124.0') — this is probably from the sandy-textured limestone noted above (both buff-colored) —
Measure water levels: MW104B (intermediate well) at 38.6' bgs; MW104C (deep) at 40.0'. —

1425 - Go for more sand —

1630 - Coarse sand tops out at 112.0'; fine sand at 111.0'; go for 1 bag Hole Plug to add an extra layer of buffer between well screen & the 6-inch steel casing. —

1700 - Inserted bentonite chips (Hole Plug) to top out at 110.5'. —
Now mix grout (Volclay) —

1705 - Tremie grout into hole w/ tremie rods just above bottom —

1735 - Tremie in 2nd tub grout —

1745 - Grout coming to surface, having displaced water; remove tremie rods; [illegible]

1755 - Leave site for day —

MONDAY, JULY 15, 1991

Activity: Final grouting & cleaning up at MW104B (intermediate), begin bedrock drilling @ MW103.

Personnel: E Clark, Q Nowak, J McMullen (Mathes), M Sorensen (CDM, recording)

Weather: Clear, 70°, light variable winds, predicted high of 90°.

0815: Drillers arrive at site and will top off the Volclay grout, finish decon & pull off this site. MS leaves to do errands.

1045: Drillers pull off MW104 & onto MW103. T Crank has already set 2 casings to bedrock here using auger rig.

1220: Begin drilling at bottom of 6-inch casing. ~~Drill~~ M.S

1235 - Drilled 48.3-51'. Cuttings: buff to light gray limestone (dolomitic perhaps), fine to medium-crystalline and locally sandy (incl. many granules in cuttings). Brown bentonitic clay ~15%

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1350 - Resume drilling at 51'

1420 - Drilled 51-61'. Drilling speed slow; water production v high; water changes from tan @ 51' to milky white & nearly clear @ 61'. Cuttings show (52-61' samples on the foot) a buffish-gray dolomitic limestone, finely to med. xln with sandy texture (including crinoid stem fragments) on margins of many chips. (Density of ~1 sandy margin per ½ inch?) Brown bentonitic clay 15% at 52', 10% at 56', trace to 4% elsewhere. Tr chalk at 52'.

1500 - Drilled 61-71'. Drilling speed - slow, water production high, and milky white in color. Cuttings: grayish buff to buffish gray dolic limestone as above. Brown bentonitic clay: 5% at 62, 63 & 71', trace to 2% elsewhere. Chalk 20% at 67', 5% at 70', accompanied by bn gray chert.

1545 - Drilled 71-81'. Drilling v slow;

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water production high, water color milky white. Cuttings show buffish gray to grayish buff dolic limestone as above, w/ M.S. perhaps more sandy. Brown clay 8% at 72', 5% at 81' (could be stuff at 81 from turning on air? M.S. sampled collected then); no chert, chalk or shale observed.

1615 - Drilled 81-91'. ~~Wat~~ M.S. Drilling rate slow but faster than 71-81'; drilled faster & produced more water below 85'. Water a tan to milky color. Cuttings shows grayish buff L.S. as above; bn bent. ie clay 5% at 87'. <2% elsewhere (probably falling in from above, even at 32' M.S. sample). Chert/partly silicified limestone constitutes 40% of cuttings at 90', 10% at 88', 1% at 84' & none to trace elsewhere.

1655 Drilled 91-101'. Drilled slow, water characteristics same as 81-91'. Cuttings show grayish buff to buffish gray

limestone as above. Bn clay 5% at 91'; trace elsewhere (sluffed in from above). L.S. is yellow brown @ 96' (more Fe stained) & contains more fine chips than elsewhere (- ie, more fractured). ~~Chert~~ M.S. Composite chips of lt bn gray chert & white partly silic. L.S. constitute 90% at 93', 20% at 97', 30% at ~~98~~ M.S. 99' & 100'.

1730 - Drilled 101-110'. Water milky & producing rapidly; drilled fairly slowly. Cuttings: dolic limestone as above, but color changes from a grayish buff at 102-106', to a brownish gray at 107-109' and a med gray at 110'; the ~~gray~~ M.S. 107-110' zone has some black carbonaceous laminae & coatings (v. thin). Chert & bn clay rare (<< 1%). The color change noted above is similar to that seen at MW101 (bedrock well).

1745 - Have pulled drill rods; now insert well pipe - length 110'11'.

1800 - Begin installing coarse sand for

sand pack

1830 - Coarse sand ~~has~~ has N.S. filled annular space up to 96'; install fine sand here at MW 103. (MW103C)

1845 - Fine sand comes up to 94.5'

Mark Sorensen 7-15-91

(77)

TUESDAY JULY 16, 1991

Activity:

Weather: 67° clear skies, expected high of 90°.
Personnel: Ed Clark, Quentin Nowak, John McMullan (Mathes), Troy Carlson (CDM-recording)

0820 Drillers arrive at MW103 site. DTW @ MW-103C is 19.6'. Top of fine sand filter pack is at 94.5'. This is same depth as yesterday (7-15-91) therefore, no cave in resulted.

0835 Drillers mixing up batch of volclay grout

0850 Drillers setting up tremie pipe to grout well 103C.

0930 Mixing 2nd batch of volclay grout.

0940 J. McMullan left to pick up more volclay. Ed Clark feels we'll have to let grout set for awhile and then top it off. MW103C is taking more grout than expected. One gallon of grout should fill 1.5 feet in a 6" hole.

0955 Driller helper (Julie) back on-site with wood pallet.

7-16-91 Troy Carlson

1015 Pumping (tremie) more grout into MW103C. A total of 375 gallons has been placed in MW 103C. Grout started coming out of port.

1045 Removing tremie pipe.

1055 Cutting 6" black casing & moving drums onto pallet.

1110 Set Protective Cap inside of 6" casing, welding the two pipes together MW103C. Also setting up MW-103B to place rotary air system on.

MW103C used ~~12~~ 2 bags sand

1200 Back for lunch

1300 Back on site, setting up rig over MW-103B. Using rotary air hammer system.

MW-103B is already drilled w/ 6" casing down to bedrock at ~~48.5~~ 50.5'

1350 Began rotary air drilling @ 50.5'

51-52' reddish-tan water, medium output of water. Predominantly limestone w/ trace of clay

52-60' Torrid water with medium output compared to MW103C.

52-60' limestone w/ small trace of red clay

OVA readings thus far are all non-detect.

1430 At a depth of 61.5' adding another 10' flight to drill further.

At 61' the cuttings contained ≈ 80% limestone & 20% dolomite? Medium H_2O output with a tan color.

67-68' slow drilling, medium H_2O output water appears milky white. Predominantly limestone.

68' consists of ≈ 60% white (dolomite?) and 40% limestone, no clay present.

70-71 consisted primarily of limestone w/ a trace of dolomite. Medium H_2O output with a milky white hue.

Water is cold @ 72°

1550 Completed drilling to depth of 76'. Samples continued to be limestone w/ trace dolomite w/ milky water output.

Screen & 1st joint, 20 ft 8" - Screen is 10 ft and into are additional

Mill Riser 20 ft 0.5"

20 ft & 0.5"

20 ft [illegible]

INTRODUCTION

A shallow soil gas investigation was performed by Tracer Research Corporation (TRC) at the Southeast Rockford site located in Rockford, Illinois. The investigation was conducted from May 13, 1991 to June 6, 1991 under contract to Camp, Dresser & McKee. The purpose of the investigation was to delineate the extent of possible contamination in the subsurface.

During this survey, a total of 225 soil gas samples were collected and analyzed. Samples were analyzed for volatile organic compounds from the following suite:

COMPOUND	DETECTOR
1,1,1-trichloroethane (TCA)	ECD
trichloroethene (TCE)	ECD
tetrachloroethene (PCE)	ECD

The compounds in this suite were chosen as target compounds because of their suspected presence in the subsurface and amenability to soil gas technology. Soil gas samples were screened on a gas chromatograph equipped with an electron capture detector (ECD).

SHALLOW SOIL GAS INVESTIGATION - METHODOLOGY

Shallow soil gas investigation refers to a method developed by TRC for investigating underground contamination from volatile organic chemicals (VOCs) such as industrial solvents, cleaning fluids and petroleum products by looking for their vapors in the shallow soil gas. The method involves pumping a small amount of soil gas out of the ground through a hollow probe driven into the ground and analyzing the gas for the presence of volatile contaminants. The presence of VOCs in shallow soil gas indicates the observed compounds may either be in the vadose zone near the probe or in groundwater below the probe. The soil gas technology is most effective in mapping low molecular weight halogenated solvent chemicals and petroleum hydrocarbons possessing high vapor pressures and low aqueous solubilities. These compounds readily partition out of the groundwater and into the soil gas as a result of their high gas/liquid partitioning coefficients. Once in the soil gas, VOCs diffuse vertically and horizontally through the soil to the ground surface where they dissipate into the atmosphere. The contamination acts as a source and the above ground atmosphere acts as a sink, and typically a concentration gradient develops between the two. The concentration gradient in soil gas between the source and ground surface may be locally distorted by hydrologic and geologic anomalies (e.g. clays, perched water); however, soil gas mapping generally remains effective because distribution of the contamination is usually broader in areal extent than the local geologic barriers and is defined using a large database. The presence of geologic obstructions on a small scale tends to create anomalies in the soil gas-groundwater correlation, but generally does not obscure the broader areal picture of the contaminant distribution.

Soil gas contaminant mapping helps to reduce the time and cost required to delineate underground contamination by volatile contaminants. The soil gas investigation does this by outlining the general areal extent of contamination. Conventional bore holes or observation wells are used to verify both the presence and extent of the subsurface

contamination as indicated in the soil gas survey. In this manner, soil gas contaminant mapping can assist in determining the placement of monitoring wells. Thus the likelihood of drilling unnecessary monitoring wells is reduced. The soil gas survey is not intended to be substitute for conventional methodology, but rather to enable conventional methods to be used efficiently.

EQUIPMENT

Tracer Research Corporation utilized a one ton Ford analytical van that was equipped with one gas chromatograph and two Spectra Physics computing integrators. In addition, the van had two built-in gasoline powered generators that provide the electrical power (110 volts AC) to operate all of the gas chromatographic instruments and field equipment. A specialized hydraulic mechanism consisting of two cylinders and a set of jaws was used to drive and withdraw the sampling probes. A hydraulic hammer was used to assist in driving probes past cobbles and through unusually hard soil. Where there was no van access, sampling probes were hand pounded to depth.

SOIL GAS SAMPLING PROCEDURES

Sampling probes consisted of 7 foot lengths of 3/4 inch diameter hollow steel pipe that were fitted with detachable drive tips. Soil gas probes were advanced 2 to 5 feet below grade. Once inserted into the ground, the above-ground end of the sampling probes were fitted with a steel reducer and a length of polyethylene tubing leading to a vacuum pump. Gas flow was monitored by a vacuum gauge to insure that an adequate flow was obtained.

To adequately purge the volume of air within the probe, 2 to 5 liters of gas was evacuated with a vacuum pump. During the soil gas evacuation, samples were collected in a glass syringe by inserting a syringe needle through a silicone rubber segment in the evacuation line and down into the steel probe. Ten milliliters of gas were collected for

immediate analysis in the TRC analytical field van. Soil gas was subsampled (duplicate injections) in volumes ranging from 1 uL to 2 mL, depending on the VOC concentration at any particular location.

Sample probe vacuums ranged from 1-20 inches Hg. The maximum pump vacuum was measured at 30 inches Hg.

ANALYTICAL PROCEDURES

A Varian 3300 gas chromatograph was used for the soil gas analyses. It was equipped with an electron capture detector (ECD). Compounds were separated on a 6' by 1/8" OD packed column with OV-101 as the stationary phase in a temperature controlled oven. Nitrogen was used as the carrier gas.

Halocarbon compounds detected in the samples were identified by chromatographic retention time. Quantification of compounds was achieved by comparison of the detector response of the sample with the response measured for calibration standards (external standardization). Instrument calibration checks were run periodically throughout the day and system blanks were run at the beginning of the day to check for contamination in the soil gas sampling equipment. Air samples were also routinely analyzed to check for background levels in the atmosphere.

Detection limits for the compounds of interest were a function of the injection volume as well as the detector sensitivity for individual compounds. Thus the detection limit varied with the sample size. Generally, the larger the injection size the greater the sensitivity. However, peaks for compounds of interest were kept within the linear range of the analytical equipment. If any compound had a high concentration, it was necessary to use small injections, and in some cases to dilute the sample to keep it within linear range. This may have caused decreased detection limits for other compounds in the analyses.

The detection limits for the halocarbon compounds were approximately 0.0002 ug/L.

Detection limits were dependant upon the conditions of the measurement, in particular, the sample size. If any component being analyzed was not detected, the detection limit for that compound in that analysis is given as a "less than" value (e. g. < 0.1 ug/L). Detection limits obtained from GC analyses were calculated from the current response factor, the sample size, and the estimated minimum peak size (area) that would have been visible under the conditions of the measurement.

QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Tracer Research Corporation's normal quality assurance procedures were followed in order to prevent any cross-contamination of soil gas samples. These procedures are described below:

- Steel probes are used only once during the day and then washed with high pressure soap and hot water spray or steam-cleaned to eliminate the possibility of cross-contamination. Enough probes are carried on each van to avoid the need to reuse any during the day.
- Probe adaptors (TRC's patented design) are used to connect the sample probe to the vacuum pump. The adaptor is designed to eliminate the possibility of exposing the sample stream to any part of the adaptor. Associated tubing connecting the adaptor to the vacuum pump is replaced periodically as needed during the job to insure cleanliness and good fit. At the end of each day the adaptor is cleaned with soap and water and baked in the GC oven.
- Silicone tubing (which acts as a septum for the syringe needle) is replaced as needed to insure proper sealing around the syringe needle. This tubing does not directly contact soil gas samples.
- Glass syringes are usually used for only one sample per day and are washed and baked out at night. If they must be used twice, they are purged with carrier gas

(nitrogen) and baked out between probe samplings.

- Injector port septa through which soil gas samples are injected into the chromatograph are replaced on a daily basis to prevent possible gas leaks from the chromatographic column.
- Analytical instruments are calibrated each day by analytical standards from Chem Service, Inc. Calibration checks are also run after approximately every five soil gas sampling locations.
- Subsampling syringes are checked for contamination prior to sampling each day by injecting nitrogen carrier gas into the gas chromatograph.
- Prior to sampling each day, system blanks are run to check the sampling apparatus (probe, adaptor, 10 cc syringe) for contamination by drawing ambient air from above ground through the system and comparing the analysis to concurrently sampled ambient air analysis.
- All sampling and subsampling syringes are decontaminated each day and no such equipment is reused before being decontaminated. Microliter size subsampling syringes are reused only after a nitrogen carrier gas blank is run to insure it is not contaminated by the previous sample.
- Soil gas pumping is monitored by a vacuum gauge to insure that an adequate gas flow from the vadose zone is maintained. A reliable gas sample can be obtained if the sample vacuum gauge reading is at least 2 inches Hg less than the maximum pump vacuum.

RESULTS

A total of two hundred and twenty-five soil gas samples were collected and analyzed in the field. Analytical data is condensed in Appendix A. Isoconcentration contour maps with sampling locations and compound concentrations are in Appendix B.

Ambient air samples were collected during the course of the investigation to help evaluate the level of significance for the selected VOC's. The level of significance is simply the level above which concentrations are considered to be significant in terms of groundwater or soil contamination. The level of significance for each target compound is based on several factors; concentrations in ambient air, background levels, and TRC's past experience. Based on the evaluation of these factors, the level of significance for the selected target compounds was determined to be approximately 0.1 ug/L for halocarbons. In other words, soil gas concentrations of TCA, TCE, and PCE greater than 0.1 ug/L may indicate possible VOC contamination in the soil or groundwater.

Study Area 1 covers an area from Blair Street on the west to Ninth Street on the east, and from Sawyer Road on the north to Taft Road on the south. Forty-six locations were sampled and analyzed for TCA, TCE, and PCE (Figure 1). The highest level of TCA was found at sampling location SG-1-47-5' (0.7 ug/L) and forms the eastern most boundary of an irregular shaped TCA plume (Figure 1a). PCE was detected at a concentration of 4 ug/L at SG-1-28-5' and forms the anchor of a PCE plume that stretches approximately 1600 feet to the northeast and is approximately 500 feet wide (Figure 1b).

Study Area 2 is bounded by Harrison Avenue on the north, South Avenue on the south, Olsen Street on the west, and Kishwaukee Street on the east (Figure 2). Samples were collected from twenty-eight locations for analysis. Sampling locations SG-2-16-5' and SG-2-18-5' had the highest detected concentrations TCA (0.5 ug/L) and form the central portion of a plume that is approximately 1600 feet by 400 feet (Figure 2a). SG-2-9-5' had

a concentration of 120 ug/L for PCE and is the center of a plume that is 800 feet by 600 feet (Figure 2b). The centers of these two plumes are approximately 800 feet apart indicating independent sources.

Study Area 3 contains seventeen sample locations found between Eighth and Ninth Streets, and Alton and Willis Avenues. TCA, TCE, and PCE were found in their highest levels of 4, 3, and 5 ug/L respectively, at SG-3-1-5. Due to the plume configuration and its location just east of a solvent storage area, it is likely that this is the source for the VOC's seen at this study area.

At Study Area 4, ten soil gas samples were collected from Harrison to Alton Avenues between Cannon and Marshall Streets (Figure 4). Sample SG-4-10-5' had high concentrations of TCA (3400 ug/L), TCE (180 ug/L), and PCE (14 ug/L). This was the highest level of VOC's seen at any of the six study areas and forms the center of an irregular shaped plume (Figures 4a and 4b). This is likely to be ~~the~~ a potential source area of the contamination at this study area, however more testing to the east would be necessary to determine the eastern boundary of the plume.

Study Area 5 contained thirty-three sampling locations located around the U C Industries Building (Figure 5). TCA was found at several isolated locations in this study area, of which the highest concentration was 2 ug/L at SG-5-2-5' (Figure 5a).

A large section was covered by Study Area 6 stretching from American to Sandy Hollow Roads, and Alpine Road to Pyramid Drive(Figure 6). Ninety-one samples were collected and analyzed from this section. No significant levels of the target VOC's were found at this site.

CONCLUSIONS

Of the three selected VOC's TCA was the most prevalent having been detected at levels considered significant at five of the six study areas examined (Figures 1a, 2a, 3a, 4a,

and 5a). TCE, on the other hand, was found at relatively few locations at high concentrations. Significant concentrations of PCE were found at Study Areas 1, 2, 3, and 4 (Figures 1b, 2b, 3b, and 4b).

Areas of high levels of target VOC's indicating possible source areas of contamination with regional importance are found in Study Areas 2 and 4 (Figures 2b, 4a, and 4b). Further investigations are needed to better define the source and extent of subsurface contamination.

APPENDIX A: ANALYTICAL DATA

CAMP, DRESSER & MCKEE/S.E. ROCKFORD, ILLINOIS SITE JOB #1-91-234-S

05/13/91

CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.002	<0.0009	<0.0002
SG-1-47-5'	0.7	<0.009	0.1
05/14/91			
AIR	0.002	<0.0004	<0.0002
SG-1-35-5'	0.02	0.001	0.03
SG-1-34-5'	0.01	0.0007	0.004
SG-1-37-5'	0.007	0.001	0.01
SG-1-38-5'	0.004	0.0009	0.04
SG-1-36-5'	0.05	0.0007	0.001
SG-1-45-5'	0.02	0.0007	0.02
SG-1-44-5'	0.04	<0.0004	0.004
SG-1-43-5'	0.004	<0.0004	0.0002
SG-1-46-5'	0.006	<0.0004	0.002
SG-1-39-5'	0.01	<0.0004	0.009
SG-1-40-5'	0.01	<0.0004	0.01
SG-1-41-5'	0.08	0.001	0.04
SG-1-42-5'	0.2	<0.0004	0.0007

Analyzed by: S. Dugan

Proofed by: K. Luess

CAMP, DRESSER & MCKEE/S.E. ROCKFORD, ILLINOIS SITE JOB #1-91-234-S
05/15/91
CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.002	0.0006	<0.0004
SG-1-10-5'	0.003	0.0006	0.0007
SG-1-9-5'	0.01	0.001	0.001
SG-1-8-5'	0.008	0.008	0.0005
SG-1-7-5'	0.1	0.01	0.002
SG-1-6-5'	0.02	0.004	0.001
SG-1-5-5'	0.3	0.0008	0.002
SG-1-28-5'	0.3	0.02	4
SG-1-29-5'	0.2	<0.08	0.03
SG-1-32-5'	0.1	0.005	0.2
SG-1-33-5'	0.2	<0.001	0.2
SG-1-11-5'	0.1	<0.0004	0.001
SG-1-12-5'	0.06	<0.001	0.002
AIR	0.002	<0.0004	<0.0002

Analyzed by: Dugan
Proofed by: [illegible]

CAMP, DRESSER & MCKEE/S.E. ROCKFORD, ILLINOIS SITE JOB #1-91-234-S
05/16/91
CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.002	0.006	0.002
SG-1-13-5'	0.03	<0.0004	0.002
SG-1-14-5'	0.008	<0.0004	0.001
SG-1-15-5'	0.03	<0.0008	0.002
SG-1-16-5'	0.1	<0.001	0.01
SG-1-18-5'	0.3	0.1	0.2
SG-1-17-5'	0.02	<0.0006	0.01
SG-1-21-5'	0.1	<0.004	0.06
SG-1-22-5'	0.02	<0.004	0.004
SG-1-23-5'	0.07	<0.0008	0.04
SG-1-24-5'	0.3	<0.0008	0.04
SG-1-25-5'	0.03	<0.0008	0.003
SG-1-26-5'	0.3	<0.0008	0.2
SG-1-27-5'	0.1	<0.0008	0.0004
AIR	0.0006	<0.0008	<0.0002

Analyzed by: S. Dugan
Proofed by: K. Kuess

CAMP, DRESSER & MCKEE/S.E. ROCKFORD, ILLINOIS SITE JOB #1-91-234-S
05/17/91
CONDENSED DATA

SAMPLE	TCA ug/l	TCE ug/l	PCE ug/l
AIR	0.002	<0.0005	<0.0003
SG-1-1-5'	0.002	<0.001	0.0006
SG-1-3-5'	0.02	0.004	0.001
SG-1-4-5'	0.3	0.06	0.002
SG-1-30-5'	0.2	0.05	0.002
SG-1-31-5'	0.07	<0.001	0.001
SG-1-2-5'	0.008	<0.001	0.0003
SG-1-19-5'	0.06	<0.001	0.02
SG-1-20-5'	0.02	<0.002	0.02
SG-2-9-5'	0.003	0.04	120
SG-2-4-5'	0.1	<0.005	0.03
SG-2-5-5'	0.07	<0.005	0.02
SG-2-15-5'	0.002	<0.005	0.006
SG-2-14-5'	0.001	0.0005	<0.0003
SG-2-13-5'	<0.0006	0.3	1
SG-2-6-5'	0.02	0.04	0.1
SG-2-7-5'	0.004	<0.002	0.02
AIR	0.002	<0.0005	0.0005

Analyzed by: S. Dugan
Proofed by: [illegible]

Wendy Dewan substituting for Troy Carlson - Bottom of screen at 75' - 8½ ft of course sand and last foot and a half of fine sand Troy Carlson, back at site 1610 hours -
Course Sand to 63 ft

1645 Fine silica sand 61-63'
1655 Began tremuing volclay into MW-103B.
Volclay grout → 0-63'
1730 Done grouting MW-103B. Drillers are cleaning up to end the day.
1740 All leave MW 103 site
CDM - Carlson going over to MW-110 to help Sue Bhegat
1800 Carlson & Bhegat leave MW-110 to go to trailer
1855 Carlson & Bhegat leave for the day

Troy Carlson 7/6/91

WEDNESDAY JULY 17, 1991

0725 CDM (Carlson) & Drillers on-site at MW103 location.
Depths to grout at MW 103B and MW103C are ≈ 58' and 15' respectively. Will top off the borings with volclay.
0745 Drillers mixing more volclay

Personnel: CDM-Carlson (recording)
Ed Clark, John McMullan & Quintin Nowak (Mathes)
Weather: ≈ 70; p. cloudy, slight breeze out of the southeast.
Activity: Installing MW's at MW103 location.
0825 Began tremuing grout into MW-103B
0900 Done w/ grout, MW-103C isn't holding the grout. Going to mix another batch of volclay w/ oat hulls. MW-103B seems to be holding the grout.
MW 103C took ≈ 82 gallons volclay & did not hold. MW-103B took ≈ 30 gallons. Will also top off 103B w/ volclay & oat hulls.

Troy Carlson 7/16/91

PER ED CLARK (INVOICES)

* TIME ABOVE & BEYOND SCOPE OF WORK TO GROUT (VOCLAY) MW-103B&C.

7/16/91 1 HR.
7/17/91 2.5 HRS.

* CHARLIE ROBERTS
CALVIN
WENDY DEWAR

Last batch of voclay/cut hulls consisted of ≈ 120 gallons w/ 5 bags voclay and ≈ 10 gallons of cut hulls.

1000 Finished adding voclay mix to MW-103B&C. Used ≈ 30 gals for both wells. Drillers cleaning up area and decontaminating equipment.

1100 Drillers leaving MW-103 location w/ drums. Picked up drums from MW-109, MW-108 & MW-107. Unloading drums from all locations at MW-104 locations. All drums have been sampled except for MW-103 location cuttings.

1215 C.S. leave MW-104 location to truck for lunch.

1315 Back @ MW-104 location to unload remaining drums. Jim Clark drove his drilling rig over to MW-103 location to leave over the 4 day break. Ed Clarks rig is also at MW-104.

1345 At MW-103 loading all equipment and securing vehicles.

1400 Going over daily rates (costs) w/ Ed Clark.

7-22-91 MONDAY

Activity: Installation of MW's, beginning today at MW104 (SHALLOW) with Jim Cranks rig.

MW104 Personnel: Jim Crank, Gary Queen (MATHES); Troy Carlson (COM)

MW109 Ed Clark, Jeff Crank, Julio (David Julius) Sue Bhagat (COM).

Weather: ≈ 81° and cloudy, intermittent showers this am with chance of T-storms later today.

0900 Sue & Troy @ COM trailer

0930 Mathes arrives at trailer, heading over to MW103 location to pick-up drilling rigs.

1050 Jim Cranks rig @ MW104 location

DTW @ MW104C = 42.44
− 2.10 STICK-UP
40.34'

Replacing carbide bits on HSA head.

1120 Began drilling w/ 4.25" HSA at MW-104A.

Troy Carlson

(89)

70 drums stored @ MW104 location
3 empty drums; Total 73.

1125 Added 2nd flight, using rod w/ HSA to sample below the water table.

1135 Added 4th flite, 1140 5th flite added

1145 Added 6th flite. 1150 7th flite

1153 Added 8th flite

1155 Down to 39'; DTW = 40.34'

Tripped out rod, Breaking for lunch.

1250 Drillers getting H_2O to mix grout.

1315 Drillers back on site @ MW-104.

1330 Drilling down to 44'.

Split Spoon collected sample at 44-46' for grain size analysis.

Blow count: 18/25/27/24

95% recovery

silty, very fine sandy silt, sand is very fine to coarse w/ ≈ 5% pebbles, silty sand is brown; moist

1400 Split spoon @ 49-51' for grain size analysis.

B.C. = 9/30/47/~~55~~ 50 @ 5.5"

90% recovery

very fine sand silt, sand is very fine to coarse, brown hue, wet sample

Troy Carlson 7-22-91

1430 Split-spoon sample collected at 54 - 56' for TOC (Carbon).
B.C. = 9/16/36/47
Brown silty sand w/ gravel
1455 Tripping out rod, at a depth of ≈ 77.5'
1530 Setting screen + casing
1545 Well set, adding # 20-40 coarse sand. 65-77'
1720 Adding #100 sieve fine sand 64-65'
1755 All leave MW-104
Done for the day

7-23-91 TUESDAY

0730 Jim Crank & Gary Queen (MATTES)
Jay Carlson (CDM) on-site @ MW-104 location
WEATHER: 81° P. cloudy w/ wind out of the north.
Activity: Setting up to grout the annular space from 8-64' at MW-104A.
0740 Mixing up volclay grout
0845 2 more auger flites to pull, still treming volclay into annular space.
0900 MW-104A installed (complete)
Began deconning augers etc. 1005 decon done.
1020 Drillers leaving MW-104 to pick-up 8.25" augers + bit, casing, fuel etc and moving to MW-110 location.
1130 Ed & Gary (Drillers) back @ MW-110 location with materials. Setting up rig with 8.25" I.D. HSA.
1155 Breaking for lunch
1300 Back on site @ MW-110.
1330 Down 15' w/ 8.25" HSA.
1345 Down 20', hit gravel
1400 Down 34'

Bedrock at 43.5'.

1430 Down to 44', = ~~3 feet~~ at Bedrock
Setting up for rotary mud drilling

1500 Mixing up batch of Premium Gel Bentonite.

1530 Begin rotary mud drilling, slow drilling at 44.5'.

1540 Down to 46.5' - good BR.
Cutting casing to total 48.5', resulting in 2' stick-up.

1600 Trying to unplug bit, pumping H_2O down.

1630 Still trying to unplug bit.

1730 Tripped out rod. Installing casing

1800 Casing installed (48.5 total feet)
Pulling up auger flites.

1835 All auger flites removed.

1845 Grout installed, will top off tomorrow.
Decanning equipment etc.

1725 All personnel leave site.

6 drums generated today at MW110.

7-23-91 [signature]

7-24-91 WEDNESDAY

89

Weather: P. cloudy = 75°, high of = 86°
Slight breeze out of west.
Personnel: Jim Crank, Gary Dexter (MAYTEST) & Mary Carlson (CDM)
Activity: Installing MW's at MW-110 location.

0730 Drillers on-site at MW 110 location
Moved drill rig = 12' west of MW casing set yesterday at 46.5'

0800 Replacing carbide teeth on 8.25" HSA.

0830 Gary left to pick-up drums.

0835 Began augering

0850 Down 14', waiting for drums to contain cuttings.

0915 Began drilling again

0920 Down to 19'.

0950 Down to 44', all cuttings are drummed.

0955 Setting tricone bit and rod in hole.

1000 Drillers helper leaving to pick-up bentonite and cement. Setting up for mud rotary.

1030 Mixing up more Premium Gel mud.

1035 Begin mud rotary at 44'.

7-24-91 [signature]

1050 Mud rotary w/ 8.25" bit to a depth of 46.5', ≈ 2' into bedrock.
1055 Tripping out rod.
1120 Rod & bit out of borehole.
Mixing cement/bentonite batch.
Lowering casing into hole, casing will have 2' stick-up, total length casing will be 48.5'.
1200 Installing 2nd length of casing.
1215 Casing installed, beginning to pull up auger flites.
1255 Last auger flite pulled.
1300 Break for lunch.
1405 Drillers back @ MW110 location.
1420 T. Carlson leaves to do sampling of containerized drums. S. Bhagat now recording. Drillers mixing grout for the second casing installed at MW110. Topping off grout in both casings
1440 Drillers begin decoming and preparing to move off this site.
1600 Move off MW110.
1610 Arrive at MW 107 and be

24 July 91

(91)

Set up to drill with 4.25 inch augers to bedrock. Plan to take first split spoon at 74'-76'.
1700 Bottom of augers at 29 feet.
1730 Bottom of augers at 69 feet. Begin tripping out rod.
1740 Rod out of hole. Have 5 feet of blow in at bottom of hole. Jetting water down the hole to remove blow in.
1805 Leave site for the day.
1810 Return to trailer.
1830 Leave trailer for the day.

Sudhal Bhagat
24 July 1991

JULY 25, 1991 THURSDAY

Weather: ≈ 78; clear skies, breeze out of north
Personnel: Jim Crank & Gary Green (Mathes), Jay Carlsy (CDM - recording)
Activity: Augering down to bedrock w/ 4.25" HSA at MW-107 location

0730 Drillers & CDM at MW-107 location setting up to start augering at 69 feet.

0800 Begin augering @ 69' - no blow-in from yesterday @ MW-107C
Down to 73', begin tripping out rod.

0810 Collecting split spoon sample at a depth of 74-76'.
B.C. = 11/22/33/50 = 6"
% Recovery = 95% HNu = b.g.
Description: sample consists of dark brown to reddish brown ~~clayey~~ UCS sandy silt with approx. 5% grains and pebbles.

0830 Drilling down to 79' to collect another S. spoon sample @ 79-81'.

0850 Collected S.S. sample @ 79-81'
Tripping out rod.
7-25-91 Jay Carlsy

Blow count = 13/28/36/32
% recovery = 95% HNu = b.g.
Description: Dark brown with traces of Fe oxide, sandy silt w/ ≈ 5% pebbles

0915 Down to 84' with augers, wet saturated cuttings @ surface.
Tripping out rod.
Going to the down-the-hole hammer to collect the next split-spoon sample.

0930 Collected S.S. sample @ 84-86'
B.C. = 17/21/28/31
% recovery = 95% HNu = b.g.
Description: dark brown clayey silt with ≈ 10% pebbles (gravel)

0940 Augering down to 89 feet to collect next sample. Tripping out rod.
Going back to the rod system to collect S.S. samples since we are still in glacial till.

0955 Collected S.S. sample @ 89-91'
Blow count = 12/20/27/55-45"
% recovery = 100% HNu = b.g.
Description: top 6" (as above), rest is a gray sandy clay w/ ≈ 5% pebbles
7-25-91 Jay Carlsy

1010 Augering down to 94'.
* Auger refusal @ 91'.
Chipping out rod, will attempt another S.S. sample.
1045 Collected S.S sample @ 91-91.5
B.C. = 50-5"
% recovery = 20% HNu = bg.
Description: dark brown sandy silt with ≈10% pebbles.
Will slurry this boring up.
Need to pick up Premium gel to slurry up the borehole.
1130 Break for lunch
1230 Back on-site @ MW-107 location.
Pulling up augers.
1325 All augers pulled out of boring.
1350 Mixing of slurry.
1400 Boring MW-107C capped off w/ slurry.
Begin deconning and cleaning up
1515 Full drum over MW-107C, all cleaned up.
Going to MW-108 location to repair Jim's drilling rig.

1620 Drillers (Jim + Gary) at MW-105 location.
Replaced 2 carbide teeth on 4.25" HSA bit.
1635 Began drilling
1700 Bound to 39.1 Will collect S.S sample @ 39-41'.
1715 B.C. 5/10/11/18
% recovery = 100% HNu = bg
Description: top 12", dark grey clay, bottom 4" - fine to coarse sand w/ silt, clay.
Collected S.S sample @ 44-46'
1735 5/10/18/23
% recovery = 80% HNu = bg
Description: predominantly coarse sand with pebbles (10%) tan to brown in color
1745 Augered down to 49'.
1755 Collected S.S. sample @ 49-51'
B.C 6/15/23/17
% recovery = 65% HNu = bg.
Description: brown sand (coarse-med) & gravel with traces of Fe ox.
1800 Done for the day - going to trailer

Drums from MW-109, 110, & 103 were sampled 7-24-91 and shipped via Fed. Ex. today 7-25-91. Called SMO @ 703/557-5587 (Eleanor). Copied COC's, ITR & OTR, & airbills.

1900 Done for the day

7/25/91 [signature]

FRI, 26 July 1991

(97)

0715 Arrive at trailer. WEATHER: Cool (~70°F), sunny, slight breeze.

0730 Arrive at location MW105. Drill rig (CME75) has been vandalized overnight. Windshield and door windows have been shattered but no other vandalism is readily apparent.

0745 Drillers leave to inform ED CLARK and call MATHES office. (883)

0800 Water level measured in MW ~~106A~~ 105A, WL = 3.7 feet.

0900 Drillers return to location MW ~~106~~ 105. (888) Police arrive and Tim CRANK gives them particulars of the vandalism.

0915 Cleaning out glass from the rig's cab.

0940 HNu checks - gives kick with magic marker pen.

0945 Tripping rod down the hole. Bottom of augers are at 49 feet. Will collect next split spoon from 54-56 feet.

0950 Turning eleventh auger.

0958 Driving 54'-56' split spoon.
BC = 10/15/11/13 ; Recovery = 16"
Top 8 inches, brown coarse sand and gravel. Gravel is rounded; sand is also rounded. Also contains some limestone pebbles 3-4 cm. HNu = BG. TOC collected.
Bottom 8 inches, gray, plastic clay with granules and rare pebbles.
Pebbles vary from angular to rounded.

1010 Driving 59'-61' split spoon.
BC: 10/12/14/21 ; Recovery = 18".
Top 13", gray clay till with angular v. coarse to granule-sized pieces, reddish lamination in upper 8"; limestone clast.
Bottom 5", containing a 1" coarse sand layer and rest is gray clay till with rounded to subangular granules.
HNu = BG

1030 Driving 64'-66' spoon.
BC: 4/5/6/9; Recovery = 24".
Entire 24" is gray clay till

containing angular to well-rounded clasts ranging from very coarse sand up to 1 inch. Lithologies of clasts are varied. HNu = BG.

1055 Driving 69'-71' split spoon.
BC = 13/30/50 (for 4 inches). Spoon refusal after 16 inches. Recovery = 15 inches. Entire 15 inches is gray clay till without any observable clasts. Bottom 3" contains some light gray/reddish laminae. Nose contains a 1/4" very fine sand horizon. HNu = BG.

1130 Driving 74'-76' split spoon.
BC = 8/20/35/37. Recovery = 17 inches.
Top 7", tan/brown, well sorted fine sand.
Bottom 10", coarse sand and gravel with clasts up to 2". Mixed lithologies for clasts. Sand is angular to subrounded; clasts are mostly rounded. Grain sig. sample collected - composite entire spoon (74'-76'). HNu = BG

1153 Driving 79'-81' split spoon.
BC = 26/27/32/30; Recovery = 18".
Top 5", tan/brown, well-sorted med sand grading downward to poorly sorted coarse to very coarse sand and gravel. Gravel ranges from angular to rounded.
Bottom 13", tan, coarse sand and gravel; poorly sorted. Large clasts (up to 2 inches) are mostly subrounded limestone and non-carbonate lithologies. HNu = BG.
1210 Drillers break for lunch.
1220 S. BHARAT breaks for lunch.
1315 Return to MW105 from lunch. Repairmen are fixing broken windshield and door windows to rig's cab. Will continue drilling. HNu checks — gives kick with magic marker pen.
1350 Have heave in augers. Bottom of augers now at 84 feet. Jetting water down the hole to remove heave.
1400 Driving 84'-86' split spoon.
BC = 14/28/33/43. Recovery = 20".
Entire spoon contains tan to gray, med to coarse sand that is well sorted and contains common gravel. Gravel is subangular to subrounded and is of variable lithology, including limestone and some igneous/metamorphic clasts.
HNu = BG.
1410 Auto Glass Repairmen leave.
1435 Driving 89'-91' split spoon.
BC = 27/47/51/46. Recovery = 20".
Top 5", well sorted, brown/gray med sand.
Next 6", well sorted, brown/gray coarse sand with some subrounded gravel.
Bottom 9", mixed med sand and gravel. Gray. Gravel is well rounded through subangular and of mixed lithology, although limestone is predominant. HNu = BG. Some clasts are 2 inches and of an igneous/metamorphic origin.

1510 Driving 94'-96' split spoon.
BC = 17/21/25/28. Recovery = 13"
Entire spoon is tan/gray mixed coarse sand and gravel. Gravel is well rounded to subangular. Gravel is mostly limestone (subang.) and quartz (well rounded, mostly). Limestone clasts tend to be larger than the quartz ones. HNu = BG.

1550 Driving 99'-101' split spoon.
BC = 25/25/20/23. Recovery = 12"
Entire spoon is gray/tan, mixed coarse sand and gravel. Gravel is predominantly limestone (some silicified limestone), subangular; non carbonate lithologies are rare, but present. HNu = BG.

1605 Driller leaves to get additional 4.25 inch augers.

1625 Driller returns with augers.

1630 Resume drilling.

1650 Driving 104'-~~109~~ 106' split spoon. (SSB)
BC = 12/24/38/48. Recovery = 18"
Entire spoon is a beautiful

tan/gray, well sorted, medium to coarse sand with a horizon having some gravel which is subrounded to rounded. HNu = BG.

1720 Tripping out rod from hole. Plan to set a well screen from 85' to 95' because drillers are out of useable rod and augers cannot be left in the hole overnight at this depth. In addition, drillers do not want to leave the rig at this location overnight due to last night's vandalism. So, a well will be set at 95 feet in the time remaining in this work day.

1740 Well material arrives. HNu checks — gives kick with magic marker pen.

1745 Decanning well material. Lowering well screen and riser pipe into hole. Screen is 0.010 stainless, wirewound Type 304. Riser is Type 304 stainless.

1800 Pouring coarse silica sand (20-40 sieve). Driller says caving was up to appx. 95 feet.
1815 Coarse sand @ ~94 feet.
1830 Coarse sand @ ~91 feet.
1835 Bottom of augers now @ 89 feet. Continue pouring sandpack and pulling augers.
1900 Bottom of augers now @ ~82 feet.
1905 Coarse sand poured to 82 feet. Begin pouring fine sand (100 sieve).
1920 Fine sand poured to 81 feet. Bottom of augers now @ appx. 81 feet. Will leave in hole overnight. Smooth tube with redhead placed on top of augers with bolts. Preparing to leave site for the day.
1940 Leave location MW 105 for the day.
NOTE: CDM Personnel today was S. BHAGAT (recording) and for J. MATHES ASSOC., TIM CRANK & GARY QUEEN.
1950 Leave trailer for the day.

Sushil Bhagat
26 JULY 1991

SAT. 27 JULY 1991

0715 Arrive at the CDM Field Trailer.
0730 Take water level measurement in MW 106A, near ECKBERG PINE MANOR PARK at the east end of BALSAM LANE. WL = 18.9'
0740 Arrive at location MW 105. PERSONNEL: S. BHAGAT (CDM, recording); J. MATHES, T. CRANK and G. QUEEN. WEATHER: Clear & sunny, ~70°F, calm.

ACTIVITY: Grouting the well that was installed yesterday (7/26) at MW 105 and which is screened from 85 to 95 feet. Next, another well will be drilled and installed in the unconsolidated material at location MW 105; this well is to be screened from 44 to 54 feet below grade. Hence, the plan is to have a total of three (3) wells installed in the unconsolidated sediments at location MW 105.

0745 Drillers setting up rig over hole,

as the rig was kept at location MW103 last night to avoid further vandalism to the driller's equipment. Upon arriving at location MW105 this morning, no further vandalism or any other type of molestation of the drill site was apparent. The augers in the hole (with smooth tube bolted to the top) were secure and not compromised. Redhead at top of tube.

0800 Fill out daily paysheets with Tim CRANK for 7/24, 7/25, and 7/26.

0810 Drillers are mixing VOLCLAY grout.

0820 Pulling augers from the hole and grouting.

0930 All augers are now out of the hole. Hole around riser pipe grouted to the surface. This well will be MW105C. It is located roughly 13 feet East-Southeast of MW105A.

27 July '91

0935 CONSTRUCTION DETAILS for MW105C:

VOLCLAY GROUT	Surface - 81'
FINE SILICA SAND (100)	81' - 82'
COARSE SILICA SAND (20-40)	82' - 95'
WELL SCREEN	85' - 95'
CAVE IN	95' - 104'

0940 Drillers decanning rig and augers and preparing to drill next borehole at MW105.

0945 Drill rig moved appx. 10 feet east-southeast of MW105C. This borehole will become MW105B and the plan is to set it at 54 ft.

1015 Turning first auger (4.25") at MW105B.

1020 Driller replacing carbide tips on the lead 4.25-inch auger, and replacing bottom plate in lead auger.

~~1040~~ 1050 Finish decanning augers.

1100 Turning second auger. Burning down to 55 feet with bottom plate in lead auger.

1122 Bottom of augers now at 5[illegible] feet.

1130 Break for lunch

1235 Return to location MW105 from lunch.

1305 Drillers return from lunch and from getting well materials, sand, grout, etc. for setting the well (MW105B) this afternoon.

1310 Deconning well material.

1320 Pounding out bottom plate with down-the-hole hammer.

1325 Lowering well screen (wirewound, Type 304 stainless, 0.010) down the hole. Lowering riser pipe down the hole. Have 60.5 feet total of well material. Thus, need 6.5 feet of stick up.

1335 Begin pouring coarse silica sand (20-40 sieve) and pulling augers.

1415 Augers now @ 49 feet. Continue pouring coarse sand.

1445 Coarse sand poured to 42 feet.

1455 Fine sand (100 sieve) poured to 41 feet. Mixing Volclay grout.

1510 Pulling up augers and grouting with tremie hose.

27 July '91

1530 All augers out of hole.

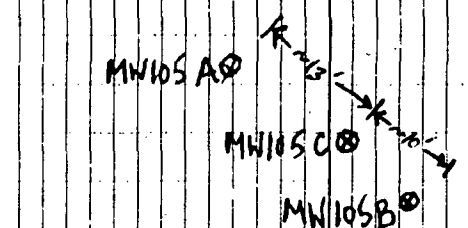
1540 Deconning augers and rig.

1620 Fill out daily paysheet for today with Tim Crank.

1625 Well Construction Details, MW105B:

Volclay Grout	~3'-41'
Fine Sand (100)	41'-42'
Coarse Sand (20-40)	42'-57'
Screen	44'-54'

1630 General sketch of well nest at location MW105:



1640 Finish deconning.

1700 Leave site for the day. Rig left at MW103 for the night.

Sushil Bhagat
27 July 1991

SUN. 28 JULY 1991

0730 Arrive at CDM trailer.

0745 Arrive at location MW 106, at East end of BARSAM LANE.

WEATHER: Clear & sunny, ~75°F, slight breeze from Southeast

CDM Personnel: S. BHAGAT (recording)

MATHES: T. CRANK (driller) & G. QUEEN

ACTIVITY: Attempt to drill down to bedrock at MW 106 and then set a well deep in the unconsolidated material. Will burn down to 69 feet and collect the first split-spoon sample.

0755 Turn first auger. HNu = BG. HNu checks — gives kick with magic marker pen. The current borehole is located appx. 10 feet north-northwest of MW106A.

0845 Bottom of augers now @ 64 feet. Turning fourteenth (14) auger.

0850 Auger refusal at ~ 68 feet. Jet hole with water and try advancing augers. Still have auger refusal. Jet hole with

water again. Will attempt to drive a split spoon. Driller does not think augers refusal is due to bedrock because the augers were not "bouncing around" enough (i.e., it does not "feel" like bedrock to him).

0855 Tripping out rod.

0905 Driving 68' - 70' spoon. BC = 50 for ½ inch. REFUSAL. Nose of the split spoon contains a small amount weathered-looking, red yellowish brown limestone as well as blow in material (clayey med sand and blades of grass). The combination of auger & spoon refusal and the material in the nose of the spoon indicate that bedrock at location MW 106 is at 68 feet.

0915 REVISED ACTIVITY: Will fill the borehole that was just drilled with a thick mud slurry. Then

will advance 8.25-inch augers down the same hole to bedrock and set 6-inch casing at 1'-2' into bedrock.

0935 Mixing mud slurry using bentonite (Premium Gel, American Colloid Co.).

0945 Begin pulling augers from hole.

1010 All augers are out of the hole.

1015 Decanning augers.

1040 Finish decanning augers.

1100 Materials for drilling with 8.25-inch HSA and mud rotary arrive.

1115 Begin drilling with 8.25 inch augers. WEATHER UPDATE: Has become overcast; wind is still out of the southeast.

1145 Bottom of augers now @ 67 feet. Have refusal of 8.25-inch augers at this depth.

1155 Break for lunch.

1305 Return to MW 106 from lunch. Setting up for mud-rotary drilling.

28 July '91

1310 Lowering drill bit and pipe down the hole. WEATHER UPDATE: Still overcast, but breeze is now from the east-southeast.

1345 Begin mud-rotary drilling. ~~at 67 feet.~~ Have cave in at approx. 50 feet.

1405 Bottom of bit now @ ~56 feet. Still drilling through cave-in inside of augers. Cuttings are sand.

1440 @ 68 feet now.

1450 Rig out of fuel.

1505 G. Queen returns with fuel. Resume drilling.

1515 @ 70.5 feet now. Must clear cave in inside augers.

1530 Cave in cleared. Drill another ½ foot to see lithology of cuttings.

1535 Cuttings are a mix of limestone, silicified limestone, and a significant amount of igneous

and/or metamorphic fragments. Will drill another 5 feet.

1600 Drilling rate measured to be 65 seconds to drill 6 inches.

1615 Drilling rate = 105 seconds to drill 6 inches.

1620 Now @ 76 feet. Cuttings are the same as before. After consulting with M. SORENSEN and ED CLARK, decide to set 6 inch casing at 76 feet.

1645 Tripping out rod.

1700 All rod is out of the hole. Deconning rod and rig. 8 1/4" redhead bolted to top auger and 4 1/4" redhead bolted to top of 8 1/4" redhead. Bottom of augers is at ~~68~~ 67 feet. SSB

1730 Leave MW106 for the day.

1745 Leave trailer for the day.

Suhal Bhagat
28 JULY 1991

MON. 29 JULY 1991 (115)

0715 Arrive at trailer.

0740 Arrive at location MW106.
WEATHER: Heavily overcast, cool (~ 65°F), slight breeze from west-northwest. Drillers are obtaining water and welding a collar onto a short section of 6-inch casing.
ACTIVITY: Set casing inside of borehole drilled yesterday. Then drill another borehole at MW106 and set another casing in bedrock.

0810 Drillers arrive at MW106. The augers left overnight appear unmolested, as does the rest of the site. Preparing to set 6-inch casing at 76 feet (in bedrock).
PERSONNEL: S. Bhagat (CDM, recording); T. CRANK & G. QUEEN (J. MATHES & ASSOC.).

0915 Have four (4) feet of cave in. Rod tripped in. Mixing drilling mud so that cave in can be removed.

to use air hammer to attempt to jar it loose (the casing was set to 46.5', far above the bedrock at 76', so the casing is useless).

1235 – The casing is coming up, thanks to the "Julio bar" that they have stuck into 2 holes in upper part of casing.

1345 – After getting stuck again, the casing ~~is coming up~~ M.S. came up. Eat a sandwich & then lock up the rig, trucks, etc. Secure the ~~well~~ hole by putting a ~~[illegible]~~ M.S. drum on it (inverted) and placing kelly on the drum.

M.S. –

1430 – Leave site for weekend.

MONDAY, AUGUST 19, 1991

Activity: Drilling at MW110C

Personnel: E Clark, G Nowak, J McMullan (Mathes), M Sorensen (CDM, recording)

Weather: 65°, moderate winds from NNW, overcast; should clear in p.m.

0955 – Arrive at trailer; drillers are there; take bottle & cooler deliveries at trailer; drillers remove their stuff from trailer, drop off rental car.

1125 – Begin augering (16") at existing hole for MW110C which had been drilled by T Crank. ~~They will~~ M.S. He had erroneously cased the hole to 46.5', thinking they were in bedrock, while bedrock turned out to be at ~76'. So we will use the same hole, after having ~~cased~~ M.S. pulled the casing last Wednesday; will ream hole to 46.5', & then continue on into bedrock after casing the hole to bedrock.

1130 – Set up and conductor & tub.

the till. In drilling 67-77', we had gravel & sand from 67 to ~75', then ~1' of lt creamy brown clayey till with granules, then lt yel. brown limestone, sucrosic, with 5-10% white to gray chert/limestone. Owing to the thick gravel zone between the existing well here (at 40') and bedrock (at 76') we will set a second well in the overburden, at 74 or 73', just above the brown clayey till.

1715 - The rods are stuck; go back down to re-open the hole & then will attempt to set well.

1750 - Pull drill rods

1800 - Begin installing well pipe & screen.

1810 - Well is sitting at 72', and tremie is suspended at 66'. We will complete the well tomorrow.

1815 - Leave site for day

Mark Sorensen 8-13-91

WEDNESDAY AUGUST 14, 1991 (141)

Activity: Well installation at MW110B; attempt to pull casing & drill at MW110C

Personnel: E Clark, Q Nowak, J McMullen, (Mathes), M Sorensen (CDM, recording)

Weather: 70° fair, light NW winds

0755: Arrive at MW110 where drillers are preparing to tremie-pump down a sand pack. The addition of the mixture of sand + freshwater should ~~cause~~ M.S. cause the mud cake to cave around the well screen (suspended at 61.4-72')

0825 - Sand came up to 65.5', so get 1 more bag sand

0915 - Poured another 1½ bags 20/40 sand & got annulus up to 59'; now add 100 sieve size sand to ~58', then will grout.

1055 - Grouted MW110B to surface & moved over to MW110C to attempt to pull that casing

1130 - Unsuccessful in pulling up the casing with the kelly, so will now s[illegible] up

TUESDAY, AUGUST 13, 1991

Activity: Decon repair, hopefully drilling at MW110

Personnel: E Clark, A Nowak, J McMullan (Mathes), M Sorensen (CDM recording)

Weather: fair 60° calm, to rise to 85° with chance of thunderstorms

0745 - Arrive at MW106 where drillers have just begun deconning.

0800 - The steam cleaner hose broke again, so JM & QN go to buy a new one.

0845 - Resume deconning

0855 - Done deconning; load up, etc.

0910 - Move off MW106 nest to go to MW110 nest (post office)

1020 - Arrive at MW110 with parts picked up at Fed Ex. MW110 is located on NE corner of 26th Ave. & Eastrock Drive, ~80'-100' W. of Eastrock & 15' N of 26th on US Postal Serv. ~~property~~ M.S. parcel.

1035 - Begin putting in new packing, etc. & replacing pump parts for the Mission impeller pump (mud pump)

1330-1430 - Drillers on lunch break.

1510 - Tripped in with 6" rotary bit and attempting to get mud pump going (it was just replaced); will go inside the 6-inch casing that had already been set here by T Crank, but which did not extend to bedrock. ~~Will~~ M.S. We will drill mud rotary until we reach bedrock, & then perhaps try to either pull or drive the 6" casing.

1525 - Drilled to 47'; cuttings show multi-lithologic gravel

1540 - Drilled to 57', but are still in heavy gravel.

1600 - Drilled to 67', and still in gravel & sand. We are already 27' below the ~~last~~ M.S. ~~of~~ M.S. existing well here (40'), so we will probably set ~~a~~ M.S. ~~well in the unconsolidated zone~~ M.S. - a second well in this unconsolidated zone.

1710 - Begin pulling drill pipe; will attempt to set well at 73 or 74', just above

1125- Back at rig, they have installed filter pack & now are installing second tub of grout.

1145- Lunch break.

1245- Move off MW106C and onto MW-106B - casing there is set at 71', at top of bedrock

1300- Clean out mud tub; set up for air drilling at MW106B; trip down.

1345- Drilled 71-81' in 15 minutes; produced tan water at 50gpm. Cuttings show ~~finely~~ M.S. finely crystalline to medium xln limestone, lt yel. bn, somewhat sucrosic (& porous between grains) Bentonite is 15% at 72 & 73', 10% at 74', 5% at 75', ≤1% elsewhere; Zoned chips of chert/pt. silicified limestone constitute ~10% at 81'.

1405- Drilled 81-88'; produced M.S. tan water at ~60gpm. Limestone as above; bentonite 5% at 82' & ≤1% below 82'. 1% chert 82', trace below 82'. Now trip out drill rods.

1505- Suspended well in hole at 87'; installed coarse sand to 75'; fi

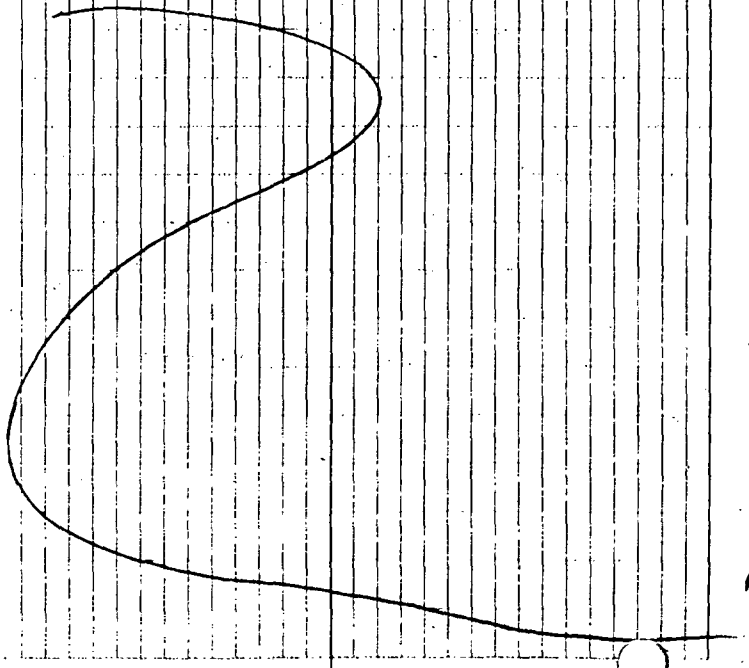
Mark Sorensen 8-12-91

sand to 74'; now begin to mix grout.

1605- Have installed 1 tub grout & now tremie in the second.

1625- Have grouted MW106B to surface; now top off MW106C, which had been grouted before lunch & had gone down to ~27'.

1735- Have cleaned up site; leave site for day. Will decon, move to MW-110 & do pump repairs tomorrow (Grants arrive at FeBCx at 10am).



Mark Sor...

35% of rock at 99', 5% at 100'.

1205 - Drilled 100.5 - 110.5'. Producing tan-~~water~~ M.S. gray water at 30-40 gpm. Pale yel brn limestone as above, but 95% chert/ft. silicified limestone at ~~96~~ 102', 25% at ~~98~~ 108', 2% at ~~99~~ 109'; olive green, soft shale is ½ to 1% at ~~96~~ 106' ~~100~~ 110'; ~3% bentonite at 101', tr elsewhere. Rusty coatings on chert at ~~96~~ 106'; Tr ochre @ 103 & 108'.

1735 - Drilled 110.5 - 120.5'. Producing water as above. Cuttings show finely-crystalline limestone ~~spr~~ M.S. as above, but color is pale yel brn 111-116' & then lt brn gray at 117-120'. 90% chert/sil. limestone at 112, 15% at 113'. The gray zones have dk gray films ~~on~~ M.S. on many chips.

1745 - Leave site for day.

MONDAY, AUGUST 12, 1991 (135)

Activity: Well installation at MW106C; drilling at MW106B

Personnel: E Clark, J McMullen, Q Novak (Mathes), M Sorensen (CDM)

Weather: Fair, calm, 70°

0740: Arrive at site where drillers are setting up.

0800 - Trip out drill rods & bit

0820 - Wait for well pipe & screen

0825 - E Clark goes to call K Yount

0915 - JM arrives with well pipe & steam cleaner (hose just replaced).

0935 - Steam-cleaned well pipe & now measure it: 130' 9¾", including 10' 7" for screen + bottom plug. Will set the well at 120' and probably not use the last 10' 7" section. Now trip in well pipe.

0955 - Well pipe is resting at 120'; now begin pouring sand (20/40 sieve) for filter pack. Instructed them to pour coarse sand to 107', fine to 106', and then grout. MS goes to call Vice.

somewhat clayey, coming up from hole in the 46.5-50.5' interval. The material continues to close in on the hole, requiring repetitive reaming of this interval in an attempt to stabilize it.

1140 - Stop drilling and decide what to do. ~~We~~ M.S.

1215 - We will rig down from this spot and move to MW106 next (Ekberg Park), where 2 casings are set to bedrock. Here at MW111, T Crank must not have gone all the way to bedrock.

1325 - Begin rigging down - pull rods, clean out mud tub, disassemble air diverter, etc.

1445 - Arrive at MW106 and set up for air drilling beyond casing in bedrock.

1525 - Have set up & welded on the air diverter & fitting; now trip in drill pipe & air hammer.

1540 - Begin drilling at 76.5'.

1550 - Drilled 76.5-80.5'. Produced tan to gray water at ~25 gpm.

11 " P..... 8-11-91

Cuttings collected roughly on the foot show a uniform, pale yellow brown (elsewhere termed "buff") limestone, finely xln (crystalline), somewhat sucrosic, and with some rusty brown staining.

1620 - Drilled 80.5-90.5'. Produced tan water at ~30 gpm - 40 gpm. Cuttings show limestone as above, but w/ bentonite throughout: soft, clayey fragments of dk bn w/ subordinate laminae or reticulg of yellow bn, up to 7mm thick chips generally w/ laminae parallel to chip boundaries. 15% bentonite at 81-83', ~~5%~~ M.S. 0-3% at 84-89', 20% at 90'. Tr chert at 84 & 86'.

1640 - Drilled 90.5-100.5'. Produced a tan-gray water at perhaps 40 gpm. Cuttings show a uniform, pale yellow brown limestone as above; bentonite ~15% at 91', 2-4% at 92-94' (probably stuff from 90 & 91'), rare elsewhere. Zoned white to lt bn gray chips are part. silic. limestone & chert, & constitute

Mark Sorensen 8-11-91

at 98'; begin pouring coarse sand.

1600 - Coarse sand came up to 85'; fine sand to 84'; now mix grout.

1630 - Grout returning to surface. Shovel out mud at M.S. tub, clean out grout tub. Put on protective casing & weld it.

1725 - Leave site for day.

SUNDAY AUGUST 11, 1991

Activity: Repairs on rig in a.m., bedrock drilling at MW111C 110C M.S.

Personnel: E Clark, D Novak, J McMullen (Mather), S Bhagat (CDM, observing until 1100), M Sorensen (CDM, observing after 1040).

Weather: 75°, light to moderate winds from N & NW, fair.

In the a.m. until 0950 drillers were at MW111 taking apart the Mission pump, the impeller pump that moves the mud. It's badly worn & has a hole in a wear plate, so can't be used until they get replacement parts - that will be Tuesday. So in the meantime we will do air drilling at locations where casings are already set. S Bhagat reports that they moved from MW111 to MW110 west at 0950, they began setting up for air rotary drilling.

1100 - Trip in air hammer & drill rods.

1115 - Begin drilling at 46.5', the base of casing set by T Crank.

1135 - Have been setting sand & gravel,

SATURDAY 10 AUGUST 1991

0730 Arrive at trailer.

0750 Arrive at location MW 111. ED CLARK is at rig performing maintenance.

WEATHER: ~60°F, sunny, clear skies, and calm.

PERSONNEL: E. CLARK, Q. NOWAK, and J. MCMULLAN (J. MATHES & Assoc); S. BHAGAT (CDM, recording).

ACTIVITY: Drillers will be transporting drums this morning while grout (around casing set yesterday) sets. Then, bedrock drilling with air rotary will begin.

0830 Q. NOWAK and J. MCMULLAN arrive with air compressor and empty drums.

0835 Preparing for air-rotary drilling and moving drum-laden pallets away from borehole vicinity into adjacent open field.

0850 Finish moving drums aside.

1040 Begin lowering drill pipe down hole.

Sohal Bhagat

M Sorensen recording from here on — this material is continued from Book #2 which ended on its page 153.

Cuttings from 92 to 99' (samples collected on the foot) show limestone same as above, except color is a buff (lt yel. bn.) at 93-~~97~~ 96', grayish buff at 97-99', and buffish gray at 92. Texture as above, but also notice a few good echinoderm & brachiopod fossils, and trace bn shale 94-99'.

1440 - Measured SWL in MW111C = 22.70' below ground surface. Now begin tripping in well pipe. Will set well at ~98', 40' below the adjacent MW111B. There is only one bedrock well at this location, so we are splitting the difference between the typical depths below bedrock for bedrock wells (~25' and 60' below bedrock surface).

1455 - Well pipe resting with bottom

1720 Doing paperwork and packaging for samples just collected today.

1930 Finish packaging samples. Custody seals affixed to both sample coolers. Leave trailer for the day.

Sachal Bhagat
07 AUGUST 1991

THURS. 08 AUGUST 1991

1500 Arrive at trailer.

ACTIVITY: Finish packing samples collected yesterday and doing paperwork.

1700 Deliver sample coolers to FED EX for shipment to labs.

1730 Arrive at location MW111 and speak with M. SORENSEN.

1800 Leave location MW111 and go to trailer.

1810 Leave trailer for the day.

Sachal Bhagat
08 AUGUST 1991

1230 Begins to rain.
1345 Rain ends. Resume sampling.
*Note that HNu readings were taken in the headspace of all drums used for a given composite sample, as each drum was opened.
1630 Go to location MW108 to collect remaining drum composite samples
1955 Leave location MW108 for the day.
2015 Leave CDM trailer for the day.
Samples in possession of S. BHAGAT.

Sohal Bhagat
06 AUGUST 1991

WED. 07 AUGUST 1991 (125)

0730 Arrive at trailer.
WEATHER: Cloudy and drizzling rain, ~70°F.
ACTIVITY: Do CLP paperwork for samples collected yesterday and finish collecting drum composite samples at location MW108.
PERSONNEL: S. BHAGAT (CDM Recording). Packaging samples collected yesterday.
1130 Still raining.
1330 Rain stops
1430 Finish sample packaging.
1445 Arrive at location MW108 to collect drum composite samples.

SAMPLE ID	DATE	TIME	HNu*	DRUM #'s USED
MW108-2	8/7/91	1515	BG	MW108-6 thru -12.
MW108-3	8/7	1530	BG	MW108-13 thru -19.
MW108-4	8/7	1550	BG	MW108-20 thru -25.

*Headspace of all drums used in composite sample, as drums were opened.

1710 Leave location MW108 and go to trailer.

MON. 05 AUGUST 1991

0930 Arrive at trailer. Trailer was not broken into.

1000 Drillers arrive. PERSONNEL: S. Bhagat (recording) and M. Sorensen from CDM. ED Clark, QUINTIN NOWAK, JOHN McMULLAN, and DAVID JULIUS from JOHN MATHES & Assoc. Sorensen will be at drill rig and Bhagat will sample drums of drill cuttings and other containerized material.

1300 Return to trailer from exchanging rental car at BUDGET in downtown Rockford.

1330 Locating, counting, and numbering drums to be sampled. Drums yet to be sampled are located at Mun. Well #19, and at locations MW 107 and MW 108.

1800 Leave site for the day.

Sushil Bhagat
05 AUGUST

TUE. 06 AUGUST 1991 (123)

0730 Arrive at trailer.
ACTIVITY: Collect composite samples of containerized material generated from drilling activities. Sampler is S. Bhagat (CDM, recording).

0900 Arrive at drum staging area at Municipal Well #19 Setting up for drum composite sampling. HNu checks with magic marker pen.
WEATHER: Partly sunny, ~75°F, slight breeze.

SAMPLE ID	DATE	TIME	HNu*	DRUM #'s USED
MW107-2	8/6/91	1000	BG	MW107-6 thru -10 and MW107-20.
MW107-3 (MS/MSD)	8/6	1055	BG	MW107-24 thru -29
MW107-4	8/6	1215	BG	MW107-30 thru -35.
MW107-5	8/6	1500	BG	MW107-36 thru -40, MW107-23 and -42.
MW107-5 DUP	8/6	1515	BG	Same as above.
MW107-6	8/6	1735	BG	MW107-11 thru -16.
MW107-7	8/6	1835	BG	MW107-17 thru -19, -21 thru -22, and -41.

1720 Arrive at location MW107 to confer with M. SORENSEN about drilling and sampling for remainder of project.
1745 Arrive at CDM trailer.
1800 Leave trailer for the day.

30 July 1991

WED. 31 July 1991 (121)

0800 Arrive at trailer. Go to location MW107 to confer with M. SORENSEN.
0930 Return to trailer and fill out CLP Paperwork and drilling/soil boring logs.
1200 Break for lunch.
1300 Return from lunch.
1430 Leave site for the weekend.

31 July 1991

Tues. July 30, 1991

0725 Arrive at trailer.
0740 Arrive at location MW106. Drillers are getting casing.
0750 Drillers arrive with casing. Drillers leave to get water and materials from other rig. WEATHER: Sunny, ~75°F, Calm. PERSONNEL: S. BHAGAT (CDM, recording); T. CRANK and G. QUEEN (J. MATHES & Assoc.
0830 Drillers return, ACTIVITY: Drill ~2 feet into bedrock with mud-rotary method and set 6 inch casing.
0835 Begin setting up over augers — the rig was kept at MW103 last night to avoid vandalism. Site at MW106 does not appear to have been vandalized or molested in any way.
0845 Tripping rod down the hole.
0945 Bottom of bit now @ 71 feet.
1005 Fill out daily paysheets for

30 July '91 (114)

7/28 and 7/29 with Tim Crank.

1010 Cutting 6-inch casing.
1015 Tripping out drilling rod from hole.
1040 Mixing bentonite (Premium Gel) grout.
1100 Lowering 6-inch casing into hole.
1150 Casing in hole. Have 74 feet of casing in the hole.
1155 Begin pulling augers from hole.
1230 All augers (14) out of the hole
1235 Begin deconning augers.
1248 Break for lunch.
1350 Return from lunch. Grouting annular space around casing. Drillers preparing to do final decon of CME/75 rig and equipment.
1400 Begin decon.
1645 Finish deconning site & equipment. Two ~~casing~~ casings capped. The casings are set at ~76 feet and at 71 feet.
1700 Move off location MW106.
1715 Leave location MW106 for the d...

29 July '91 (117)

0950 Cavein removed — hole is open to 76 feet. Removing rod.

1010 All rod out of hole. Mixing grout.

1020 Tremeing grout down hole with tremie hose.

1023 Lowering first section of 6-inch casing down hole.

1110 All casing in the hole. Cutting 2.5 feet of stick up. Casing at 76'.

1130 Begin pulling 8 1/4 inch augers.

1230 All augers out of ground. Break for lunch.

1330 Return to MW 106 from lunch. Rig moved appx. 12 feet north-northwest of casing that was set earlier today. Deconning augers.

1455 Finish decon.

1515 Turning first 8.25-inch auger.

1525 Augers moved next to rig. Turning second auger.

1640 Refusal of 8 1/4" augers at 67 feet

1710 ~~1510~~ Drillers leave to get water and supplies

1735 ~~1535~~ Drillers return

~~1650~~ 1750 Redhead attached to top auger with bolts. Cleaning drill site. Will set casing in the morning.

1800 Leave location MW 106 for the day. Augers are at 67 feet.

1815 Leave trailer for the day.

Suhail Bhagat
29 July 1991

1300 - Have drilled & reamed to ~~48'~~ 46' M.S.; hit some limestone at about ~~48'~~ 46' M.S., or just a hard gravel layer. Have been having trouble with drilling mud getting too thick because of mixing with the grout that Frank had installed previously in this hole.

1325 to 1440 - Lunch break after drilling to 48'.

1530 - Have drilled to ~~58'~~ 56' - M.S. 8/19/91 - have been in coarse to medium gravel.

1555 Have drilled to ~66' - still in gravel & sand.

1620 - Have drilled to 76'; had medium to fine gravel & sand to 75', then the light brown till, ~~seen~~ M.S. as seen at other hole.

~~1830~~ 1730 - Drilled to 80'; we're in bedrock: cuttings show 90-95% buff limestone, 0-10% white chert & ~~a~~ M.S. <5% exotic pebbles. The limestone and chert are angular chips. Hit it at 75.5'. Measure casing; leave for day at 1805.

TUESDAY, AUGUST 20, 1991 — (145)

Activity: Set casing at MW110C; more drums.

Personnel: E Clark, G Novak, J McMullan (Mathes), M Sorensen (EPM recording)

Weather: 60°, fair, light to moderate NW winds; predicted high is 77°.

0745 Arrive at site where drillers are setting up.

0755 Use mud to clean out 5' of fall in at hole bottom.

0810 - Cleared hole; trip out rods.

0845 - Begin assembling, dropping in & welding the 6" casing to 4 drill.

0935 - 6" casing is in & resting at ~77.5'

0940 - Washed out bottom and got the casing to bottom: 80'3".

1000 - Tremie in first batch grout for annular space around 6" casing.

1100 - Have grouted to surface; clean out mud tub.

1115-1200 - Repair work on trash pump.

1200 - Finish cleaning mud tub.

1215-1320 - Lunch.

1320 - Weld on casing (6") collar at MW-

110C; clean up site.

1350 - Leave MW110C - will drill into rock tomorrow. Go to MW111 to move drums to U.S. from there to the city well location.

1425 - MS goes to trailer to make calls & decide on which ISWS wells to sample. E Clark & Q Novak continue moving drums, & J McMullen is constructing well pads.

1730 - Check on drillers: they have moved drums from MW111, 108 & 104; ~3 loads remain at various sites. J McMullen has completed pads at all but the last 3 wells to be drilled.

~~1715~~ 1815 - Leave city well storage site & quit for day.

WEDNESDAY, AUGUST 21, 1991 — (147)

Activity: Bedrock drilling at MW110C
Personnel: E Clark, Q Novak, J McMullen (Mathes), M Sorensen (CDM, recording).
Weather: 65°; mostly cloudy, light winds from S, predicted 85° & fair

0750 - Arrive at MW111C where drillers are setting up for air drilling.

0835 - Drilled 80-81', the first foot below the foot of the 6" casing.

0855 - Drilled 81-91', producing lt brown water at ~5 gpm. Cuttings show a lt yel brn limestone, fine-grained, largely sucrosic in texture (with intergranular porosity); color grades to lt brn gray at 90 & 91'; few ~~two~~ U.S. white bryozoan frags at 89'; many ~~lt~~ U.S. gray & rusty surface stains at 91'; rare chert & no shale seen.
The bryozoans are calcareous.

0925 - Drilled 91-101', producing tan to gray water at ~8 gpm. Cuttings, limestone, finely crystalline, yellow browns at 92-93' & 99-101', and [illegible]

zoned chips of part. silicified lime-
stone-chert, respectively, at 92'.
Somewhat sucrosic throughout, &
with a few coral & bryo fossils;
to chert at 101'.

0940- Drilled 101-111'. Producing gray to
tan water at 8-10 gpm. Cuttings:
~~tt~~ M.S. yel bn limestone as above; rare
chert & fossils.

0955- Drilled 111-115'. Producing water
as above. Cuttings: limestone as
above, but color is yel bn @ 114-115';
gray at 113', and mixed yel bn & gray
at 112'; some rusty stains at
115'; rare chert

1020- Will set this well at -112';
coarse sand from 115-99', fine
sand 99-98', Volclay grout 98'-3'.
MS goes to trailer to call Office.
Also received more coolers & sampl
jars.

1155- Back at rig at MW110C; drillers
at lunch.

1300- Back from lunch, drillers report
Mon[illegible]

that they did set coarse & fine
sand to depths noted above; now
are first tub grout.

1340- Grout coming to surface from
annular space; continue loading
up & cleaning up site.

1430- Mixed another tub grout & now
grout MW110C and B to surface.

1525- Leave MW110C M.S. next (post office)
location & head to MW105 (moto-
cycle track) next.

1645- At MW105D, have gone down 5'
with the 16" auger, set the mud
conductor, and are set up for mud
rotary drilling — now awaiting water.

1725- Mixed mud; now begin drilling
MW105D with 12" tri cone rotary bit.

1900- Drilled to 65'. Leave site for
day.

THURSDAY, AUGUST 22, 1991

Activity: Drilling, set casing at MW105D

Personnel: E Clark, J McMullan, Q Nowak (Mather), M Sorensen (CDM, recording)

Weather: 70°; clear, light-moderate W wind, predicted high of 85°

0745 - Arrive at site.

0800 - Drillers arrive, begin setting up for continuation of mud rotary.

0835 - Have cleaned out hole to 15'; resume drilling down.

0900 - Have drilled to 75'; cuttings show fine gravel & sand. MS goes to call office.

1040 - Arrive back at site, where drilling has proceeded to 94'; drillers report sand & fine gravel.

1145 - Lunch

1255 - Q Nowak has arrived with bentonite

1410 - Have drilled to ~~104'~~ 105' - M. Sorensen 8-22-91; hit some rough gravel at about 100', but its mainly been fine gravel & sand; have been having trouble preventing fall-in.

1435 - Drilled to 115'; had brown si[illegible] till 108-113', then boulder 113-113.5', then

were in sand & gravel

1505 - Have drilled to 125'; sand & gravel to 117', then tough drilling & increasing proportion of limestone chips in cuttings suggests may be in bedrock, but the 124-125' zone drilled smoothly, so we don't yet know for sure.

1615 - Drilled to 139', 2.5' into bedrock. Drilling from ~~126~~ 125 to 136.5' was fairly easy, & was sand & gravel. At 136.5' and down to 139', drilling was very slow; cuttings became ~75% limestone chips w/ cherty chips, both very angular & somewhat coarser than the subangular to rounded pebbles of other lithologies.

1645 - Kept circulation on for 30 minutes, because we're still having problems with fall-in. Now prepare the 6" casing, including welding together some short pieces.

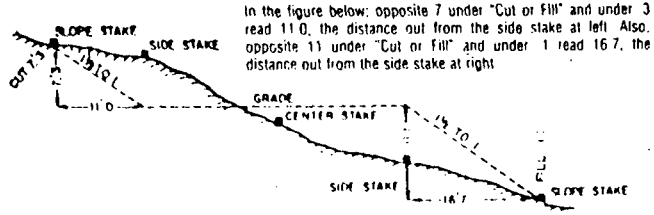
1745 - Have welded short pieces of casing together as well as casing collars;

1810 - Cleaned out hole (8' of 1[illegible]-in) again & now begin to ream out [illegible]

DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING

Roadway of any Width. Side Slopes 1½ to 1.

In the figure below: opposite 7 under "Cut or Fill" and under 3 read 11.0, the distance out from the side stake at left. Also, opposite 11 under "Cut or Fill" and under 1 read 16.7, the distance out from the side stake at right.



Cut or Fill	0	1	2	3	4	5	6	7	8	9	Cut or Fill
	Distance out from Side or Shoulder Stake										
0	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	0
1	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.9	1
2	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	2
3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9	3
4	6.0	6.2	6.3	6.5	6.6	6.8	6.9	7.1	7.2	7.4	4
5	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6	8.7	8.9	5
6	9.0	9.2	9.3	9.5	9.6	9.8	9.9	10.1	10.2	10.4	6
7	10.5	10.7	10.8	11.0	11.1	11.3	11.4	11.6	11.7	11.9	7
8	12.0	12.2	12.3	12.5	12.6	12.8	12.9	13.1	13.2	13.4	8
9	13.5	13.7	13.8	14.0	14.1	14.3	14.4	14.6	14.7	14.9	9
10	15.0	15.2	15.3	15.5	15.6	15.8	15.9	16.1	16.2	16.4	10
11	16.5	16.7	16.8	17.0	17.1	17.3	17.4	17.6	17.7	17.9	11
12	18.0	18.2	18.3	18.5	18.6	18.8	18.9	19.1	19.2	19.4	12
13	19.5	19.7	19.8	20.0	20.1	20.3	20.4	20.6	20.7	20.9	13
14	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.4	14
15	22.5	22.7	22.8	23.0	23.1	23.3	23.4	23.6	23.7	23.9	15
16	24.0	24.2	24.3	24.5	24.6	24.8	24.9	25.1	25.2	25.4	16
17	25.5	25.7	25.8	26.0	26.1	26.3	26.4	26.6	26.7	26.9	17
18	27.0	27.2	27.3	27.5	27.6	27.8	27.9	28.1	28.2	28.4	18
19	28.5	28.7	28.8	29.0	29.1	29.3	29.4	29.6	29.7	29.9	19
20	30.0	30.2	30.3	30.5	30.6	30.8	30.9	31.1	31.2	31.4	20
21	31.5	31.7	31.8	32.0	32.1	32.3	32.4	32.6	32.7	32.9	21
22	33.0	33.2	33.3	33.5	33.6	33.8	33.9	34.1	34.2	34.4	22
23	34.5	34.7	34.8	35.0	35.1	35.3	35.4	35.6	35.7	35.9	23
24	36.0	36.2	36.3	36.5	36.6	36.8	36.9	37.1	37.2	37.4	24
25	37.5	37.7	37.8	38.0	38.1	38.3	38.4	38.6	38.7	38.9	25
26	39.0	39.2	39.3	39.5	39.6	39.8	39.9	40.1	40.2	40.4	26
27	40.5	40.7	40.8	41.0	41.1	41.3	41.4	41.6	41.7	41.9	27
28	42.0	42.2	42.3	42.5	42.6	42.8	42.9	43.1	43.2	43.4	28
29	43.5	43.7	43.8	44.0	44.1	44.3	44.4	44.6	44.7	44.9	29
30	45.0	45.2	45.3	45.5	45.6	45.8	45.9	46.1	46.2	46.4	30
31	46.5	46.7	46.8	47.0	47.1	47.3	47.4	47.6	47.7	47.9	31
32	48.0	48.2	48.3	48.5	48.6	48.8	48.9	49.1	49.2	49.4	32
33	49.5	49.7	49.8	50.0	50.1	50.3	50.4	50.6	50.7	50.9	33
34	51.0	51.2	51.3	51.5	51.6	51.8	51.9	52.1	52.2	52.4	34
35	52.5	52.7	52.8	53.0	53.1	53.3	53.4	53.6	53.7	53.9	35
36	54.0	54.2	54.3	54.5	54.6	54.8	54.9	55.1	55.2	55.4	36
37	55.5	55.7	55.8	56.0	56.1	56.3	56.4	56.6	56.7	56.9	37
38	57.0	57.2	57.3	57.5	57.6	57.8	57.9	58.1	58.2	58.4	38
39	58.5	58.7	58.8	59.0	59.1	59.3	59.4	59.6	59.7	59.9	39
40	60.0	60.2	60.3	60.5	60.6	60.8	60.9	61.1	61.2	61.4	40

FIELD BOOK #2

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CONTENTS #2

PAGE NO.	REFERENCE	DATE
CDM	Trailer (815) 226-9257	

6/18 (Tues Mon)

①

Southeast Rockford
Phase I Remedial Investigation

1105 Arrive at MW102 well nest site. Will drill this borehole to bedrock with 4¼" hollow stem augers - Anticipate that this will be the deepest borehole, but since there may be more than 3 wells here, can't call it MW102C - Therefore will call it MW102-1 and number all wells drilled at this nest chronologically in field notes and rename later.

1130 Drillers not yet here. Set up HNu - Charge OK, calibrated on 6/14, gives kick for Sharpie Marker.

140 Drillers Tim Crank & Gary Queen arrive.

155 Begin drilling MW102-1. Looks like the area is fill, but people at UC industries told drillers it is natural. Drilling through brownish tan clayey sand w. Gravel and Cobbles.

205 Pulling Split Spoon 8-10' - Blow Count = 4/8/6/5' 10" recovery. Brown and black sandy clay w. Gravel and Roots. Abrupt change in color [illegible]

(2)

6/18

Material has septic odor.

210 Dave Julius arrives.

215 Drilling through brownish tan Sandy Clay w. Gravel and Cobbles @ 25'. Black material appears to be a very thin layer.

220 Pulling 28-30 spoon. Hit water at approximately 23. Had some heave into augers. Blow Count = 9/12/20/22. Filling augers w. water to reduce heave.

230 Spoon locked in Auger.

240 Trying to get heaved sand out of augers. 28-30' Spoon. Uniform ~~coarse~~ fine grayish tan fine to medium sand. Loose, wet, no readings on HNu.

255 Test breathing zone, cuttings w HNu - 0ppm. Still in sand w occasional gravel and cobbles @ 45'. Head space on 102-1 8-10' 0.5 ppm. 28-30' 0ppm.

305 Preparing to pull 53-55 spoon. Blow count = 7/17/13/17.
53-54' - Tan Sandy gravel - Gravel is well-rounded, averages about 0.5 cm in diam

(3)

6/18

54-55 Dk Grey Silty Till w. angular limestone gravel clasts. Material is moist, tightly packed, and crumbly - 2" coarse sand seam near base of spoon.

330 Still in Silty Till @ 55' - Stop drilling, will confer w. Mark & Wendy.

335 Head Space: 53-54 - 0 ppm 54-55: 0ppm.

340 Leave site to confer w. Mark - Decide to pull off of 102-1 and drill to fill in left boring w. 8 1/4" augers.

415 Return to MW 102 site, ~~&~~ drillers are pulling off of boring to set up 8 feet to the west.

450 Begin drilling MW 102-2.

500 @ 9 ft drilling through brownish tan ~~sandy~~ clayey sand w. Gravel.

510 Hit black material in cuttings at 13-14' Probably old soil and organic material buried by fill - decaying organic material probably accounts for septic smell.

515 Lt. Orangish-tan clayey fine sand w. gravel grains in cuttings @ 15'. Lots of gravel at 19'.

520 Coarse Gravel zone from 19-23' water @ 23'

6/18/19

small 1cm thick sand seam at 68.5'

300 Break for soda after setting up wireline hammer for split spoons.

320 Resume drilling. Head Space Analysis 58-60 - 0ppm 63-65 - 0ppm, 68-70 - 0ppm.

330 Pulling 73-75 Spoon. BC = 1, 3, 2, 4. Lt. Gray fine to medium sand w. occasional coarse sand & Gravel grains. Running silt layer at base of spoon - 2" thick.

355 Pulling 78-80 spoon BC = 7/12/21/10 Lt. gray well sorted fine to med. sand w. 0.5' lt. Gray silt seam - Sharp contact on top and bottom of silt seam.

Note: - The notes above for 6/18 and 6/19 are transcribed from loose leaf notes taken in field. Hence forth, notes ~~are~~ will be taken directly in this field book.

410 Driller notes that drilling got tougher @ 81'

420 Head Space 73-75 = 0ppm 78-80 = 0ppm.

430 Driving 83-85' spoon BC = 21, 750 for 3" 1 foot recovery. Gravelly Clay at bottom, Clayey Coarse sand, gravel, and cobbles

6/18/19

at top.

440 Break for Soda

455 Start up again @ 85. Hit a soft layer at about 87'.

520 Pounding 88-90 spoon - About 1' heave in borehole BC = 16/34/50/50 1.25' recov. Lt gray fine to medium sand w. rare coarse sand and Gravel grains. Well sorted fine sand seam from 88.25 - 88.5'

545 Soft interval 88-93 w. cobbles interspersed throughout interval

555 Pounding 93-95 Split Spoon BC = 15/12/12/13 Coarse sand and Gravel w. Pebbles at base

610 Head Space analysis 83-85 0ppm 88-90 0ppm. 93-95 = 0ppm

620 Leave Drill Site for Day.

630 Stop at other drill site, load up and return to trailer

650 Leave site for day.

[signature]

6/19/91

(10)

6/~~18~~20 (Thurs)

730 Arrive at Trailer, discuss drilling program w. Tim & Ed, fill out daily log from 6/19

820 Arrive at drill site, Tim & Gary are setting up. Test HNu - battery Ok, gives Kick on Magic Marker.

840 About 2 ft of heave in the augers.

905 Driving 98-100' Spoon BC = 2/4/22/20 1 foot recovery - Lower 8" uniform Gray Clay - Moist, no silt sand or gravel anywhere in clay interval. Upper 4" sand & Gravel - Contact w. clay is sharp but above contact is sandy clay w Gravel Grading up to sand & gravel. Contact is at about 9.8.5'

940 Tim says drilling got a little tougher at around 100'

455 Pounding 103-105 Spoon - BC = 8/11/18/27 Recovery = 1 foot Dk gray to med gray Moist stiff clay. Clay has dk gray varves

1010 Drillers leave site to get drill rods / augers.

1030 Return to Rig, Julio stops by. Head Space on 98-100 - 0 ppm 103-105 - 0 ppm Scanned mouth of augers and drillers breathing zone - No readings.

(11)

6/~~18~~20

1050 Julio returns to site. Advancing augers to 108

1105 Driving 108-110 Split spoon BC = 4/21/37/22 Dk gray moist stiff clay - W. rare gravel & coarse sand grains. All of the clay from 98.5 - 110 is very stiff & cohesive, difficult to cut w. spatula. The plugs from the split spoons break rather than bend. Recovery = 1 ft.

1130 Pulling 113-115 BC = 1/2/2/8 Recovery = 9" Grayish brown dark medium to coarse sand and Gravel. 1-1-inch thick sandy clay zone in middle.

1145 Driller Tim says he noticed difference in drilling at 117'.

1200 Driving 118-120 Spoon BC = 6/12/31/25 Recovery = 21" Top 9" Brownish Gray Well sorted medium sand. Bottom 14" = Brownish Gray Silty Clay Till w. Gravel Contact is sharp, but bottom 3/4" of ~~ct~~ sand is very clayey

1215 Break for lunch

100 Return to Rig. Head Space analysis 108-110 = 0 ppm 113-115 = 0 ppm 118-120 = 0 ppm

130 Driving 123-125 Spoon BC = 5/16/25/28 Recovery = 14" Lt Greenish Gray uniform

(12)

6/20

Uniform pliable silt. Middle 10". Top 2" = Dk gray sandy clay. Bottom 2" = Uniform lt. greenish gray very fine sand.

150 Advancing boring to 128' - Drilling got harder at 126'

210 Driving 128-130 spoon BC = 7/12/28/34
Recovery = 13" Lt. Greenish gray pliable silt

250 Confer w. Mark & drillers about how to proceed. Will try to drill as deep as we can here, figure out the lithology, then if we still don't have a good sand to screen the well in, will pull back and backfill, sealing off the clay & silt intervals with bentonite chips

310 Driving 133-135 spoon - Drilling was easy in 128-133 interval. BC = 2/3/4/21
Recovery = 15" Interbedded med. sand, fine sand, and silt. All are lt. greenish gray, all are very well sorted except 2" interval in med. sand, which has gravel.

340 Pulling 138-140 spoon BC = 9/6/7/15
Lt greenish gray uniform well-sorted

6/20

(13)

silt. Lt Brownish streaks on lower end, irregular dark gray mottling in 2" zone 2" from top. Recovery = 13".

350 Head Space. 123-125 = 0 ppm. 128-130 = 0 ppm
133-135 = 0 ppm

410 Driving ~~138~~-143-145 BC = 5/6/11/22
Recovery = 16" Laminated Dk grayish brown to Lt Gray Clay. Laminations are horizontal. At the top grades into sandy clay. Pebbles in lower 2".

435 Advancing boring to 150.
Head Space 143-145 = 0 ppm.
148-150 = 0.25 ppm, not sustained.

445 Pounding 148-150 spoon BC = 4/22/50 for 3"
Recovery = 10" Sandy Gravel at base - Gravel is coarse angular limestone or dolomite fragments - We may be in the weathered zone immediately above bedrock.
~~Top 4" is mixed silt~~ Top 2" is tan fine to medium sand, next lower 2" is stiff tightly packed fine sand

505 Begin backfilling - nothing to set well in so we will backfill up to 100' clay and set well above that.

(14)

6/20

510 Bottom of boring is at 148 (150.5 from 2.5' stick-up) Begin adding chips

520 Pulled augers back to 138' Bottom of hole is at 144'. Driller is continuously measuring bottom of hole with a weighted tape as bentonite is slowly poured in from top. Bentonite used is Pure Gold Medium Chips

535 Bottom of hole is at 139 - 4 bags bentonite chips used. Remove another auger flight Bottom of augers at 133'.

540 Head space 143-145 = 0 ppm 148-150 = 0 ppm

550 Bridging inside augers at 126 - drive it through with drill rods.

610 Dr Augers are at 123' - still have bridging problem - Ask drillers to knock it out w. drill rod. Block is at 121' (from top of augers).

625 Measure bottom of hole w weighted tape. Bottom is at 125, base of augers.

645 Pack up and leave drill site for day.

655 Leave Trailer.

[signature]
6/20/91

(15)

6/21 (Fri)

730 Arrive at Trailer. Drillers are already at drill site.

800 Arrive at MW102 site. Tim & Gary are setting up. Initial Daily Drilling Log. Bottom of hole is at 124 from top of augers, that's 1 foot of heave overnight.

815 Bottom of hole is at 121 now, augers are at 118'.

825 Bottom of boring at 116'

830 Augers bridged, lower Drill rod to knock out bridge.

855 Bottom of hole is at 112'.

915 Bottom of augers at 103.5' and bottom of hole is at 105.5'.

920 Auger bridged, pushing out with rod.

945 Bottom of augers at 98'. Bottom of hole at 99'.

950 Bottom of hole at 98.6' - Seal from 99' to 110' is good — sealed with bentonite chips (Pure Gold).
TOTAL # of Pure Gold = 8 BAGS (50 lbs. each)

1000 Begin pulling rod from hole.

1015 All rod pulled from hole.

(16) 6/21

1020 Begin pouring Filter Pack (sand) into hole. Coarse sand.

1025 Filter pack poured to 98'. Filter pack depth interval is 98.0' to 98.6'.

1035 Begin installing stainless steel screen (10') and riser pipe (10' ea).

1050 Screen and riser pipe placed in hole. Screen is Type 304 Stainless Steel

1100 Pouring coarse sand between screen and augers. Bags of sand = 0.5

1110 Well has seized against auger due to coarse sand. Trying to dislodge casing from augers by jetting down. Still seized.

1120 Jet down again. Jetting is unsuccessful.

1130 Tim Crank leaves to discuss seizure situation with ED CLARK and M. SORENSEN

1155 Tim returns, attempting to remove well from augers.

1210 Top 10' of riser pipe removed. Continue removing riser pipe.

1[illegible] Finish removing riser pipe.

6/21 (17)

1225 Begin mixing Volclay to abandon borehole.
# of Volclay bags = 2+2 = 4
# of Intimix bags = 2+2 = 4

1305 Begin pulling augers and tremie Volclay from bottom.

1350 Finish pulling augers and tremieing hole.

1355 Begin decon and putting equipment away.

1415 Finish decon and drillers preparing to leave.

1425 Drillers leave location MW102.

1440 Go to MW101, confer w. Mark & Drillers

1530 Return to field trailer, clean up, look at Municipal Well logs

1605 Leave trailer, head for Chicago.

6/21/91

6/24 (Mon)

930 Arrive at Trailer - Drillers not yet here.

1025 Drillers arrive at Trailer.

1050 Arrive at Drill site - Drillers begin set-up for MW102-3.

1130 Measure water level at MW102-1. DL WL = 27.5'. Bottom of Augers is at 56.5 feet. Could use 8 1/4" borehole (MW102-1) for casing as originally planned, so we will set ~~a~~ for the observation well (MW102A) here from 25 to 35' and backfill from 56 to 36 (top of fill)

1155 Bottom of boring is at 52', drillers are adding extension.

1210 Bottom of Boring is at 46.5'.

1200 Bridging is occurring inside the augers - Assembling drill rods to knock out obstruction.

1110 Break for lunch.

105 Return from lunch - Drillers still gone

245 Drillers return to rig. Begin trying to get good of bentonite chips out of augers. Bottom of augers is at 36'.

6/24

315 Knocked Plug out, Bottom of boring is @ 35.2', which is below Bottom of augers.

330 6" Sand installed in bottom of boring

350 Installing well - 10' Screen, 3-10-foot riser pipes

415 Installing Sand Pack, measuring rate of sand pack rise continuously w Tape. Sand Pack is at 31'.

440 Sand Pack is at 28

455 Top of sand Pack is at 23.5. Begin installing Fine sand filter Collar

540 Top of filter Collar is at 21.5'
7 bags of Coarse sand, 3 of fine sand and 4 bags of Volclay mud.

600 Grouting well via tremmie pipe.

620 Well is grouted up - Well construction is: 35.5 - 35 Sand, 35 - 23.5 = Coarse Sand pack, 23.5 - 21.5, = Fine Sand filter collar, 21.5 - 3', Volclay Grout. Well is screened from 25' - 35' below Grade

645 Protective casing installed, site cleaned up, leave MW102 for day.

700 Leave trailer for day

6/24/91

6/25 (Tues)

730 Arrive at trailer - Trailer has been broken into, Refrigerator, Walkie Talkies, & other items are missing. USEPA trailer was also burglarized.

745 Go over 6/21 and 6/24 drilling logs w Tim.

800 Arrive at MW102, prepare to drill MW102-3.
We will drill this location straight to 98' with center plate.

825 Begin drilling MW102-3

840 Check breathing zone, nothing w. HNu - No response. Borehole is @ 20'

845 First wet cuttings at surface when bottom of augers is @ 35'

900 Boring advanced to 65'

920 Bottom of boring is at 100'.

930 Flushing augers w water.

940 Pounding out knock-out plate. Will use Colorado Silica Sand Inc 20-40 sand for filter pack. Checked sand w. screen. Sand doesn't get through.

1000 Assembling riser pipe and screen and lowering into well.

6/25

1010 Begin emplacing sand pack.

1030 Top of sand pack is at 94'.

1105 Top of Sand Pack is at 87.5'

1110 Top of Sand Pack at 86' - Begin installing 2' fine sand filter collar.

1130 Top of filter collar is at 84.5'.

1140 Filter collar is at 84', break for lunch.

1250 Return to site - Drillers not back from lunch yet.

100 Drillers return. Begin mixing Volclay Grout.

200 Pumping 1st rod of grout into well.

240 Mixing up 4th mix of grout (50 gal rods)

310 Borehole MW102-3 grouted to surface.
Cleaning up site to move to next location.

320 Leave drill site to discuss new location w Mark.

1410 Arrive at MW111 site, set up on MW111-1

1455 Begin pounding MW111-1 RL 1'-3'.
BC = 5/6/5/4 Recovery = 10"
Dk Brown Silty Soil

1505 Pounding MW111-1A 4'-6' BC = 2/2/3/5
Recovery = 10" - Not enough recovery.
Will collect VOC samples only. HNu = 0
Reddish Brown Moist Silty Clay w Gra

(22)

6/25

515 Pulling 9-11' Spoon BC = 6/12/20/26
Recovery = 16" Brown to Tan Sandy
Clay Till w. Pebbles

525 Advancing Boring to 19'

530 Driving ~~19-21'~~ 14-16' RL Spoon MW 111-1 B.
BC = 20/50/02/16 Recovery = 20"
Brown Sandy Clay Till w. Gravel.
HNu = 0

545 Difficulty drilling ~~21-25'~~ 16'-19'. Head Space
9-11' = 0 ppm 19-21' = 0.25 ppm sustained
Very rough drilling at ~~21~~ 16' RL.

605 Steam coming out of borehole because
of rough drilling at 19' - Check w. HNu -
No response No organic odor to steam.

610 Pulling 19-21' Spoon BC: 19/19/18/21
Recovery = 18" - Bottom 7" Tan fine to
medium uniform well sorted Sand. 4"
Zone w mixed Sand and Clay laminae
Top 7" Brown Sandy Clay Till w. Pebbles.
Spoon is wet, so we must be near
water table.

635 Driving 24-26' Spoon BC = 7/27/50-4.5"
will try to drive 3rd 6" to get adequate
Sample recovery. BC = 7/27/79/75 tor

(23)

6/25

last 5". This will be Sample MW 111-1C
Recovery = 24" approx 14" = Orangish Tan
Medium well ~~sorted~~ Sand. Lower 4" of
Sand zone is Gravelly. Lower 10"
Orangish Tan Sandy Clay Till w. Pebbles

700 Leave drill site, return to trailer.

720 Leave Trailer for Day

[signature]
6/25/79

6/26 (Wed)

730 Arrive at Trailer

755 Arrive at MW111-1 - Drillers are setting up, bottom of boring @ 24' Fill out Daily Log for 6/25.

805 Water is at 20.3' in MW111-1 - No readings at mouth of augers w. HNu

820 Begin pounding 29-31' spoon BC: 16/31/35/34 Recovery = 24" Top 6" = Orangish Tan fine to med Well-sorted Sand Middle 12" = laminated well sorted silt Grading into iron-stained compacted pebbly silt Grading back into laminated silt which is Fe-stained at base. Lower 6" = Well sorted tan medium sand - Sand grains are subangular. Contacts with silt are sharp

855 Easy drilling 29-34'. No cuttings brought up to surface

900 Pounding 34-36 spoon - 1st 4" blow BC = -/29/29/23 Recovery = 22" Upper 12" = Med to Coarse Tan Sand - Grains are subangular. Next 3" = Tightly packed Fe-stained silty sand w. abundant fine gravel grains. Lower

6/26

7" = Tightly packed Tan Silty and Gravelly Sand. About equal proportions of silt gravel and sand - Gravel is well rounded pebbles.

920 Pounding 39-41 Spoon BC = 9/30/40/54 Recovery = 24" Top 10" = Tan medium to Coarse poorly sorted sand - Sharp contact w. middle 4" - Well sorted fine orangish tan sand w. strange irregularly shaped fine silt body, Fe-stained at edges ~~Lower 10"~~ BC Next 8" - Lt. Tan Pebbly silt w. irregular Fe-stained blotches Lowest 2" - Med to Coarse well-sorted orangish tan Sand.

950 Boring advanced to 44' - Center Plug is stuck in Augers. Head Space 29-31 = 0 ppm 34-36 = 0 ppm 39-41 = 0 ppm

1000 Begin pounding 44-46' spoon BC = 6/18/22/20 Recovery = 22" Interbedded Med sand and fine silty sand w. 1 2"-thick pebbly interval. The whole spoon is orangish tan to grayish tan in color.

1025 Pounding 49-51 Spoon BC = 14/50/50-

6/26

49 - 51' Spoon - Mixed med sand to pebbly med. sand to sandy Gravel at base. Recovery = 16" this sandy zone is compacted - spoons form plugs, but plugs crumble easily between fingers. Material is moist, but not wet

1045 Begin pounding 54-56' spoon BC = 65/100 - for 1 foot only - couldn't drive further. 12" recovery - Top 3" Tan med well sorted sand. Middle 8" Gravelly Tightly packed, silt - coarse sand and gravel - Lowest part of gravel is angular recrystalized dolomite. Bottom 1" - Chunk of Fe & Mn-stained Silty Tan Dolomite

1110 Very tough drilling down to 59' - Drill rig bounces and chatters in this interval.

1120 Pounding 59-61' Spoon BC = 10/40/62 Pull spoon after 18" Brown to Tan, well packed Silt sand and gravel, and cobbles, Central zones are Fe-stained, gravel is rounded. Well sorted med sand at top of spoon - probably blown in.

1130 Head Space 44-46' = 0 49-51' = 0

6/26

54-56' = 0 ppm.

1145 Break for lunch.

1225 Return to MW111-1. Begin Drilling to 64'

1250 Reached @ 59'. Will install well in tightly packed material 48-58'.

100 Leave site to discuss well placement w. Mark

130 Return to MW111 - Well set one well 48 to 58' and a 2nd 25-35'. We are having blow-in problems at MW111-1 - Almost 6' have blown inside augers. Drillers tried to get it out, and lots of fine sand came out but still have lots of heave.

225 Well is assembled and in borehole, trying to get well to desired interval by jetting and lifting up on augers to remove blow. About 2' of blow inside augers next to screen.

240 Top of ~~screen at~~ RL Filter Pack is at 54' - Measuring w. weighted tape as filter pack is installed.

300 Top of filter pack is @ 52'

335 Top of filter pack is @ 46' - Begin sealing

6/26

fine sand filter collar

355 Filter collar top is @ 45'. Begin mixing Volclay

410 Grouting borehole with 1st tub of grout.

445 Mixing 2nd tub o' Grout

500 Well MW111-1 grouted to surface. We will install 3 wells at this location, so 111-1 will be MW111-B.

Well construction for MW111-B

Screen 48-58 Sand Pack 58-46'

Filter Collar: 46-45' Volclay 45-3'.

515 Move over to drill shallow well MW111-A about 6' west of MW111-B.

520 Begin drilling MW111-A

540 Wet cuttings coming up @ 25'

615 MW111-A is @ 34' - knock off for day.

625 Stop off and talk to Mark at MW101 leave site for day.

[illegible]
6/26/91

6/27 (Thurs)

730 Arrive at trailer

758 Arrive at MW111 site, drillers are setting up, drilling down to 37'.

800 Run over daily drilling log for 6/26

Gary is de-conning well materials.

810 Knocking out bottom plug, assembling well and placing in augers.

840 Sand pack in @ 37' leave drill site for phone call.

905 Return to MW111A - Filter Pack @ 29.5'

945 Top of Coarse Sand Pack is @ 23' - Sand used was 20-40 Colorado Silica Sand.

Begin installing fine sand filter collar using 100 Colorado Silica Sand.

955 Top of filter collar is @ 22'.

1015 Begin grouting well w. Volclay.

1030 Well is grouted, Begin Auger De-Con.

1100 Drillers leave site to get 8¼" augers and casing for MW111C

110 Return to MW111 - Drillers are just starting to drill MW111C - Bedrock well. Will drill to Bedrock w. 8¼ augers, set 6" Casing, then move over to another location and let mud rig finish it.

[illegible]

6/27

130 Augers are @ 15' (10') Check cuttings & driller's breathing zone w. HNu - no response.

140 Difficulty drilling @ 15'

150 Augers are stuck - Julio drilling, having difficulty backing augers up.

200 Sheared "Red Head" in 1/2 - The Red Head connects the rotating shaft of the drill rig to the top of the augers.

220 Tim returns, drillers bypass "Red Head" and begin backing augers out of boring.

225 Drillers want to drill this deep boring with the Mud-Rotary rig, so leave site to find new location to set up on.

330 Begin set-up @ MW101 - Discussed well depths w Mark - Will set one well 78 - 88 and second well a few feet below water table.

400 Drillers cut holes in "smooth tube" so that it can be used

415 Begin drilling MW101 B - intermediate well @ 101 location across from Potter Farm and 710.

430 Augers hit boulder @ 3', dislodging

6/27

knock-out plate - Pull auger, replace plate & resume drilling

440 Augers are @ 24' - Cuttings are tan sand & Gravel.

450 Augers are still dry @ 39'

455 Standing water in Augers @ 44'

505 Augers @ 60', cuttings are still orange tan Sand & gravel.

530 Boring is advanced to ~~100'~~ 90' rc. Check mouth of augers w. HNu - No elevated readings

600 Knock out plate knocked out of bottom of augers

630 Riser Pipe & Well Screen, Assembled, and lowered in boring.

635 Installing coarse sand filter pack - Top of sand is @ 88'.

655 Top of sand is @ 84'

720 Top of sand is @ 78'

730 Top of coarse sand @ 76', begin placing fine sand filter collar.

735 Will let sand settle until AM.

740 Leave site for day.

6/28 (Fri)

735 Arrive at Trailer, pack up supplies and equipment for day

755 Arrive at MW101 site - Drillers are mixing grout. Measure water level in augers - 46.2'. Top of sand pack is @ 74.5 for MW101 A. Battery on HNu is ok, instrument gives positive response on magic marker

815 Pumping Volclay grout into well via tremie pipe

845 Leave site to talk with Mark - Water table @ 46' and silt from 45 - 68' means no point in setting a shallow well at 101 location.

915 Return to site of MW101A - will move over to MW109 next. Drillers are mixing 2nd tub of grout

950 Getting ready to top off grout in MW101 A - All augers have been removed from boring and are being de-conned.

1040 Leaving 101 well Next site. Well construction for MW101A: screen 78'-88' Coarse Sand filter Pack 40-76' Fine Sand Filter Collar

6/28

76 - 74.5', Volclay Grout 74.5 - Surface.

1110 Begin set up @ MW109-1

1125 Begin drilling MW109-1.
Cuttings @ 3 ft - Brown Sandy Clay. Checked cuttings at base of augers w. HNu - no elevated readings

1130 Pounding 4'-6' spoon BC = 2/2/2/3
Recovery = 16" Reddish Brown Sandy Clay w. subrounded 1-3cm Pebbles MW109-1A

1135 Pounding 9-11' Spoon BC = 6/12/18/32
Lt Tan to Brownish Tan fine to med sand w. subangular pebbles. Differing colors form stratification are stratified

1150 Soft Drilling 11-14'. Begin Pounding 14'-16' Spoon - This will be MW109-1B
BC = 20/37/97+ Recovery = 14"
Brownish Tan Sandy Gravel w. Cobbles
Cobbles and Gravel are abundant, making up 50% of sample. Base of sample was crystalline Limestone or Dolomite - could be cobble or boulder, or may be top of bedrock. Above Lms was 3" thick fine to med sand seam.

1205 Break for lunch

6/28

1240 Return to MW109-1. Head space
4-6: 0 ppm 9-11: 0.5 ppm 11-13: 0 ppm
0.5 ppm in 9-11' was not sustained.

1255 Begin pounding 19-21' split spoon.
BC = 22/75+ Recovery = 8"
Brown Silty Clay Till. Dry, extremely
well lithified. Some fine gravel & pebbles.

110 Begin pounding 24-26' BC = 44/105
MW109C - Interbedded Brown Sandy Clay
Till w fine gravel and fine to med sand
w. clay and gravel. Some Fe staining.
Recovery = 10", so VOC samples only.
Top of spoon is med clayey sand which
appears to grade into till - lower 8"
of spoon is Till with 1 1"-thick sand
seam. Correction - Recovery was
sufficient to collect Metals samples also.

125 Pounding 29-31' spoon. BC = 26/120+
24-26' Sample was dry except for
sand intervals which were moist.
This sample is wet. Recovery = 10"
Top 4": Brownish Tan fine to med Sand
grading to fine sandy clay. Lower 6":
Angular sandy Gravel - Lt tan to Dk

6/28

reddish brown Fe staining - This interval
is about 75% gravel and the gravel is
almost all Lt yellowish tan Fe stained
vuggy Sandy Dolomite.

1100 Head space 19-21: 0 ppm 29-31 0 ppm

1145 Augers having difficulty penetrating 32'.
Water Table at 25.2'

155 Auger refusal @ 32.5'. Spoke w Mark &
decided to set well @ 32'. This well
will be MW109A.

300 Assembling well & lowering into borehole

315 Emplacing Coarse Sand Filter Pack.

330 Coarse Sand is @ 28'.

400 Coarse Sand is @ 23'. Measuring continu-
ously with weighted tape.

420 Top of sand pack is @ 20. Begin adding
fine sand filter collar.

435 Filter collar top @ 19'. Begin grouting well

520 Well MW109A Grouted to surface.
MW109A: Screen 22-32' Coarse Sand
filter pack 32.5 - 20, Fine Sand Filter
Collar 20-19', Vol clay Grout 19 - Surf.

600 Leave Site for day.

6/29/91

6/29 (Sat)

730 Arrive at Trailer

805 Arrive at MW 104 Meet Tim and fill in Drilling Logs from 6/27 & 6/28

855 Begin drilling MW106-1

900 Pounding 4-6' Spoon BC = 2/2/2/1
Recovery = 3" Orangish Brown well-sorted medium sand. Grains are dominantly Quartz, extremely well rounded.

905 Pounding 9-11' Spoon BC = 6/15/18/15
Recovery = 15" Lt Orangish Tan Fine to medium sand. Some cross-bedding, Fine & Med sands are segregated

915 Pounding 14-16' Spoon BC = 20/50/67+
Recovery = 16" Check mouth of augers (@ 19 w. PID - No response. Tan fine sandy silt Till w. gravel. Material has very little Clay and is very tightly packed. Gravel makes up 10% of sample & is dominated by subangular Lms pebbles 0.5 to 1.5 cm.

930 Pounding 19-21' Spoon BC = 20/25/37/32
Tan Fe-stained fine to Med sand, water level = 18.4' → w. ~~silt~~ thin silt laminae. Laminae are surrounded

by thin bands of Fe-staining

950 Drilling 21-24'

1000 Pounding 24-26' Spoon BC = 5/25/31/27
Recovery = 15" Top 7" - Tan Med to coarse sand & Gravel. Bottom 8" Tightly packed silty sand & Gravel w. abundant cobbles. Cobbles make up 6" of this zone.

1010 29-31' Spoon BC = 3/25/22/18
Beige-Tan Poorly sorted coarse sand and gravel w. cobbles. Recovery = 17"
1 thin (2") beige silt zone near top of spoon.

1015 34-36' Spoon BC = 6/12/17/19
Recovery = 14" DK gray coarse sand & Gravel. ~~Coarse~~ Material is tightly packed and silty intervals within the spoon are cohesive, forming clays which crumble easily into sand. Gravel and coarse sand varies in composition and angularity, but most is well rounded limestone or quartz. One 1-inch Fe-stained silt bed is in middle of spoon.

1110 Head Space analyses are erratic - with swings in each sample - HNu is prob

6/29

being adversely affected by humidity from wet samples. ~~MW 19~~ 19-21' sample gave 16 ppm kick, then needle on HNu abruptly dropped below zero. Smelled sample and noted no organic odors. Other samples behaved in similar manner.

1120 Driving 39-41 spoon BC = 6/17/19/23
Recovery = 15" Tan to Brown Med to Coarse Sand and Gravel HNu = 0 ppm Lower 6" of spoon is tightly packed, upper 9" is loose. Gravel is about 80% Lms and Qtz grains, 10% basalt, and 10% other. All grains are well rounded. Vast majority 0.25 to 0.75 cm.

1105 44-46' Spoon BC = 14/26/30/27
Lt Tan ~~to~~ Coarse sand and Gravel.
Recovery = 17" - Upper 14" is Lt. yellowish tan Sand and Gravel - Same as 41' spoon, except proportion of gravel is higher (~25%), gravel grains are larger (1-3 cm), and more angular. Lower 3" is moist brown silty till w. gravel.

1150 49-51' Spoon BC = 6/8/12/13.
Recovery = 19" Dark Gray Plastic Moist

6/29

Clayey Silt w. Moderate amounts of floating coarse sand and Gravel grains composed of grey Lms and Qtz Grains are mostly subrounded, Lms makes up 90% of Gravel. 3" interval of coarse brown to Tan Sand & Gravel w. abrupt contact at top of spoon - Probably blow in

1210 Break for lunch. Boring 106-1 is @ 50'

1250 Return to Drill Rig

105 Easy drilling 49-54' Begin pounding 54-56' spoon BC = 6/14/29/16
Recovery = 21" Upper 12" Dk gray Plastic moist Clayey Silt w. Gravel & 1 small sand seam. ~~Low~~ (Same material as 49-51' spoon) Lower 9" Mottled Dk Brown Sandy Clay till w. rare gravel, and 2 large Cobbles. Lower unit has 1 0.5 cm greenish silt seam w. red-brown Fe Staining on either contact.

130 Pounding 59-61' Spoon BC = 9/13/17/21
Recovery = 16" Top 8" Laminated Dark gray clay w. a few thin silt strata. Some black twigs and carbonaceous material

6/29

near the base of this unit. Lower 8" - Lt Grey to Brownish Gray fine laminated silt. No Gravel grains or coarse sand anywhere in this spoon. Silt seams in upper portion of spoon has are surrounded by dark gray to blackish discolored zone

150 Tim hit cobbles @ 63'

155 64-66' Spoon — BC = 7/20/30/55 Recovery = 21" Top is well sorted med reddish brown sand grading into poorly sorted coarse sand which grades into Tan Silty Till w. Gravel, pebbles, and local Fe-staining. Sand/Till contact is about 8" from top of spoon.

210 Drilling obstruction @ 67' will try to pin rods and drill through

220 Can't drill through obstruction - Auger refusal @ 68'.

310 We will have to grout this hole and move over to set well - This will eliminate 19' of backfilling and will expedite well drilling at this location. Begin mixing Volclay grout

340 Begin grouting MW106-1 from bottom

6/29

via tremmie pipe.

450 Well is grouted, Drillers De-conning and setting up a few feet W of 106-1. Rig leaves rig to talk to Mark about screening

510 Return to rig, begin drilling MW106A - will set screen from 30-40' —

530 Bottom of boring is @ 25'

540 Boring is advanced to 39'.

545 Clean up site and head for 2nd rig.

610 Leave site for day.

Mark Fan
6/29/91

6/30 (Sun)

820 Arrive at trailer, load up

830 Arrive at Rig, drillers are assembling MW106A and placing in augers. Bottom of boring is @ 40.5'.

930 Top of Coarse Sand Filter pack is @ 33.6'

955 Top of Coarse Sand Filter pack @ 27.3'.

1005 Top of Fine Sand Filter Collar @ 26'

1015 Drillers begin mixing grout - leave site to look over Quarry

1030 Return to Rig - Quarry has vertical fractures which would allow fracture analysis and is in two levels - upper level has about 50' vertical faces, lower has 20' faces - No one is present at trailer to talk to about access. Some machinery is around and road looks well used, so quarry is probably still active.

1110 106 Site cleaned up, move to 103 location

1145 Set up at MW103 - knock off for lunch

1255 Return to MW103-1. Begin Drilling

115 Check mouth of augers @ 9' - HNu - 0 ppm

125 Begin pounding 9-11 spoon BC = 24/5/6 Recovery = 15" Beige Clayey fine sand w. pebbles, Moist, uniform, plastic

6/30

140 Water level = 18.9'. Begin Pounding 19-21 spoon BC = 4/3/10/12. HNu mouth of augers - Background. Recovery = 21" HNu = Background. Beige fine sandy clay till w. pebbles and some sand seams - Fe-staining around pebbles and sand seams - Moist, plastic

157 Pounding 24-26 spoon. BC = 18/100/58/30 Recovery = 18" HNu = 0. Brown Sandy Silt Till w. occasional cobbles and fine gravel. well graded, dry, crumbly.

210 Check mouth of augers @ 29' - HNu = 0 Begin pounding 29-31' spoon ~~BC =~~ BC = 14/24/18/20. Recovery = 24" Top 1' = Cobbles & Brown Silty Clay Till interbedded w. Med Sand. Bottom 1' = Mottled Reddish Brown to greenish brown silty Till w. rare fine gravel grains. Gravel grains are angular.

235 34-36' spoon - Spoon sank in 12" by its own weight. BC = -/-/6/12 Recovery = 24" Interbedded Fine to Med. Sand and coarse sand Reddish Tan at top, Tan at bottom, in fa

6/30

Angular gravel grains in some zones.

250 Pounding 39-41' spoon BC = 22/55/71+ Recovery = 18" Upper 6" = Tan med to coarse sand Lower 12" = Lt yellowish Tan fine sandy gravel - this looks like weathered zone - Material is 50% coarse angular gravel with single composition - sandy Dolomite Fe - and Mn - stained.

310 Very difficult drilling 40 - 44'

325 Pounding 44-46 spoon BC = 85 for 6". Recovery = 6" Yellowish Tan fractured Rubbly Dolomite w. fine sand.

340 Auger refusal @ 44.5'

350 Setting well to clean out augers.

405 Backfilling 44.5 - 42' w. Holeplug.

410 Backfill @ 43' - Begin sanding. Weather becoming bad. - Lightning nearby Bob Putman - Estuary Engineer's Mgr. (815) 397-9521 ext 252. Has been watching the operation for past 1 hr. Lives nearby & stopped off out of curiosity

425 Rain beginning - knock off for the day

7/1 (Mon)

730 Arrive at trailer

755 Arrive at Rig. Augers pulled from borehole and jetted uncides out. Borehole caved to 18'

800 Augers are back in boring, drillers knocking out bottom plate.

815 Installing sand pack - ~~screen to 40'~~, Top of sand pack is @ 39'. Correction: Screen is 31 - 41.5' (Lower 0.5' of screen is threaded area and bottom plug - Not open to formation)

900 Top of sand pack is @ 35'

1045 Having problem w. blowin - jetted boring out @ 29.5'

1115 Experiencing a lot of blow-in problems at 29' - Jetted blow-in out to base of augers @ 29' - Top of pack was last measured at 31', so blow-in may be in 31 - 29' interval. Tim doesn't want to drill down to 31 for fear of damaging well which is already in sand pack. Began adding fine sand at 29'

1130 Fine sand collar top at 28'.

1145 Grouting well 28' to surface.

7/1

Note – when attempting to solve blow-in problem, water often flowed from the well after jetting – This was presumably caused by blow-in displacing the water in the augers. After water level stabilized (blow-in stopped) bubbles were observed rising in the water column – There was no odor and the HNu did not indicate VOC levels in excess of background. This may indicate some sort of geochemical reaction, or may be related to a perched water table at 18.4'. It seems unlikely that the ~~oo~~ bubbles were jetted into the well along with the water.

1205 Knock off for lunch after filling out 6/30 Daily drilling log. —

1205 Return to rig – Drillers are still at lunch. On reflection, bubbles may have been caused by leakage through O-rings above the water table. —

100 Drillers return, pull up to new location to attempt to case to bedrock.

120 Begin drilling MW103-2 with 8¼" augers

140 Augers are @ 21'

7/1

155 Broke "2' Hex extension" with augers @ 26'.

235 Stopped at Gregory Anderson Quarry across (S side) of Sandy Hollow across from terminus of Bavarian Dr. Spoke w. Dale Olsen about coming down to quarry to take a look around and measure some fractures and look over the lithology – Dale is a very nice low-key individual – Said to stop by any time. Also mentioned that lower level of quarry is much tougher than upper – more dolomitic.

250 Return to site, drilling again @ 40'.

305 8¼" Auger refusal @ 48' – Will ream inside of augers w. 7 7/8" tri-cone bit. Tri-cone bit is 1.6' long.

See B Vg 455 Note

325 Setting up to drill water rotary. 46.5' of drill stem + bit. ~~Augers are sitting on~~ Drill stem is sitting on about 6' of material inside augers

345 Begin drilling

410 Drilling @ 46' – Deconning Black Pipe Casing Casing w. ASTM A53G-B Sch 40 EBW

(48)

7/1

19.05 lbs/ft T/C.

450 Boring is advanced to just under 49' - Steam cleaning Black Pipe - still appeared to be oily after 1st re-con

455 Tim says Bedrock is @47 not 48. Seems correct, because bit penetration slowed noticeably at 47.

600 Black Pipe Casing is in borehole - 51 feet of piping put together, 3-foot stick up, begin mixing grout

615 Bentonite mixed - will knock off for day and grout borehole tomorrow

630 Leave Trailer.

7/1/91

(49)

7/2 (Tues)

730 Arrive @ Trailer

755 Arrive at MW103 location, Drillers are mixing grout

810 Grout Hose plugged?

900 Could dislodge block from hose - Remove Casing and hose from well

945 Drillers put HDPE (?) Plug on the bottom of the casing, pumped grout into borehole, and lowered plugged casing into grouted boring

1015 Casing grouted, drillers are removing augers from borehole

1030 Stop at other site for geophysical logging. Fromm Applied Technology - Arthur Fromm is running Natural Gamma well. They spoke about doing Azimuthal Resistivity to catch fracture orientations from surface. Arthur says logging method, speed, etc should give a vertical resolution of about 6".

1200 Knock off for lunch

100 Return to site. Drillers have moved rig and are ready to drill and set casing for 2nd MW103 bedrock well.

7/2

125 Begin augering 2nd bedrock boring.
210 Augers are @ 30'.
240 Bottom of augers @ 45.5 - Auger refusal
Begin lowering Tri-cone bit to ream
inside of augers.
320 Tricone bit drilling through bedrock
at 49'.
350 End of boring @ 50.5 - Top of bedrock
@ 48.5'
1125 Mixing grout
520 Casing is assembled and in boring
w grout. The grout seal in the
annulus between casing and formation
was emplaced by pumping grout into
open boring from bottom via tremmie
pipe; Placing plastic cap on casing, then
lowering into borehole. Drillers are now
removing the augers and topping off grout
periodically
600 Augers completely removed from boring,
~~beginning~~ packing up to leave ~~boring~~
MW103 location.
630 Leave trailer for day

[signature]
7/3/91

7/3 (Wed)

730 Arrive at trailer
805 Arrive at MW103 site, drillers setting up to
top off grout at easternmost cased
well - This well lost a lot of grout over-
night. Added 50 gal of grout and top of
grout is still 15' from surface.
830 Wells grouted, drillers cleaning up site
950 Site cleaned up - move over to Ed's rig
1000 Stop at Eds rig, talk w. Mark.
1200 Fill out drilling logs for 7/2 & 7/3
1230 Leave site after discussing next well
location w drillers.
330 Visit Quarry
445 Leave site for day.

[signature]
7/3/91

MON. 8 JULY 1991

0930 Arrive at trailer.
WEATHER: SUNNY, 80°F, dry, slight breeze.
1030 Drillers arrive at trailer.
1105 Arrive at location MW 109 next to SPEEDWAY on Alpine Rd. Plan is to have the "shallow" rig drill down to bedrock (appx. 32') and set one or two well casings.
1120 Water level in MW 109A is 23.94 feet below ground level.
1125 Drillers arrive at MW 109 and begin setting up, appx. 12' west of MW109A.
PERSONNEL: TIM CRANK, GARY QUEEN (John Mathos Assoc.) SNEHAL BHAGAT (CDM, Recording)
1200 Augers, casing, and water truck arrive. Set up over hole.
1205 Drill first auger (8.25")
1210 Break for lunch.
1315 Return to location MW 109. Drillers have gone to get drums.
1335 Drillers return with drums.
1340 Begin drilling with second auger.

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1342 HNu = BG midway thru second auger (drill cuttings). All cuttings are being drummed.
1350 Begin turning third auger.
1357 Begin turning fourth auger. Drill cuttings equal BG (HNu).
1400 T. Crank goes to Sutherland's to get wrench to fix slight hydraulic fluid leak. Begin downtime.
1410 T. CRANK returns. Examining hydraulic fluid. Bolt at the base of the tower is loose and is stripped. Bolt and helicoil removed.
1600 Bolts and helicoils (two each) installed. End downtime for rig maintenance.
1603 Begin turning fifth auger. HNu reading of cuttings = BG.
1610 Helicoil comes out. Insert new helicoil.
1622 Will try to continue drilling with the rig as is. Finish this hole, if possible.
1630 Begin turning sixth auger. HNu = BG

8 July 91

1635 Finish turning sixth auger. Bottom of augers at ~ 30'.

1640 Begin turning seventh auger. HNu = BG.

1643 Auger refusal after appx. 0.5' of advancement. Bottom of augers still at ~ 30'.

1445 Begin preparation for mud-rotary drilling.

1705 Begin mixing drilling mud.

1718 Begin circulating mud down the hole. Flushing.

1732 Begin mud-rotary drilling at 30'.

1750 Drill pipe advanced from 31' to 33' on its own accord — most likely a void in bedrock. Lost two tubs of mud (~250 gal.).

1805 Add another 5' of pipe.

1815 D. Julius goes to get additional mud.

1830 D. Julius returns. Begin mixing drilling mud.

1835 Bottom of bit at ~ 32.5'. Begin mud rotary drilling.

8 July 91

1845 Drill to 35'. Solid rock. No return on mud. Pull pipe up inside augers, which are at 30'. T. Grmsk notes that 33'-35' was easy drilling and that hard drilling was encountered at 35'. Will continue in the morning.

1855 Leave location MW109 for the day. Return to trailer.

1930 Leave trailer for the day.

8 July 91

Tuesday. 9 July '91

0740 Arrive at MW 109. John Mathis personnel. T. Crank & G. Queen. CDM personnel: S. Bhagat & R. Lantz.
Weather. Cloudy, 70°F.

755 Mixing tub of mud - Will drill 1 or 2 feet into solid bedrock then set casing. Bottom of MW 109-2 is at 35'.

820 Bottom of boring is @ 37' in 1 foot of solid rock.

840 Al Wehrman & Mark Varlgen from ISWS stop by to discuss project

905 Have lost 2 tubs of drilling mud in boring.

940 Have lost 5 tubs of drilling mud. Will try to auger into disrupted zone, then mud rotary into solid rock to set casing.

950 Hole has caved to 32.5' after removal of drill rods.

1000 Augers are down to 30.5'

1025 Auger refusal @ 35' - Prepare to drill into bedrock w/ mud rotary.

1100 Drill bit penetrating rock @ 38'. Cuttings consist of Tan to Orangish-Tan fine sandy dolomite. Some Fe-and black (Mn?)

7/9/91

staining. Some (<1%) chert frags in cuttings.

1105 Hit another void @ 38.5' - Lost whole tub of drilling mud again

1130 Trying to drill past lost-circulation zone. Bit is at 39.5' in solid rock, but drilling mud is not returning to mouth of T. Bottom of boring is at 39.2'.

1150 Break for lunch

100 Return to rig, Drillers are tripping out drill rod and will try to auger below 2nd lost circulation zone

125 Can't Auger past lost circulation - No cave in bottom of augers - Pump water into Augers to displace drilling mud so that we can drop in hole plug to seal off lost circulation.

150 Water level in MW109-2 is very low - measure in adjacent well - WL = 24.4 Drillers have added 1 bag holeplug to well

215 Circulation restored, continue drilling - Bit is @ 39.5' - 1' into solid rock.

1425 Drill rod being tripped out of hole.

1440 Finish tripping out rod and begin preparations for setting 6" casing

7/9/91

315 Add grout to borehole and begin assembling 6" casing and lowering into borehole.

340 Black pipe casing installed down to 39.0', 0.5' into solid rock interval.

520 ~~Well is installed~~ RL Black Pipe Casing at MW109-2 is installed. Well is requiring a lot of grout - have used 2-200 gal tubs of grout so far, but grout is not approaching surface. Mixing 3rd tub.

540 Boring sucked up 3rd 200 gal tub of grout. Will add 1 bag hole plug and continue grouting tomorrow.

600 Leave site to talk w. Mark S.

640 Leave Trailer for day

[signature]
7/9/91

WED. 10 JULY 1991

0730 Arrive at trailer. Call Region V for sample space.

0810 Arrive at location MW109. Rig is set up appx. 12 feet EAST of MW109A.
WEATHER: Warm (~80°F), sunny, slight breeze.
MATHES: TIM CRANK AND GARY QUEEN; CDM: SNEHAL BHAGAT (recording).

0815 Begin turning first auger (8.25 inch).

0820 Begin turning second auger. Drill cutting HNu = BG.

0830 Begin turning third auger. HNu = BG.

0840 G. Queen leaves to get water and empty drums.

0845 Fill out drilling paysheets.

0850 Inside of casing that was set 7-9-91 is open to bottom of hole (39'), as measured with weighted tape.

0855 Begin turning fourth auger. HNu = BG. This auger turns noticeably harder (slower) than previous three augers did, according to T. Crank.

0905 Water level in MW109A is 24.6 feet. G. Queen returns.

0910 Begin turning fifth auger. HNu = BG. Augers still turning slowly.

0915 Bottom of augers at 20 feet. Fifth auger still not in the hole.

0925 Still turning fifth auger — it is appx. half way in the ground. Steam is exiting the borehole. Cuttings are warm/hot to the touch. HNu = BG.

0935 Finish turning fifth auger. Bottom of augers at ~ 24 feet.

0940 Begin turning sixth auger. HNu = BG.

0945 Bottom of sixth auger now at ground level. Steam still exiting from borehole. Cuttings are hot to touch.

10 July '91

0950 T. Crank & G. Queen go to get water and confer with ED CLARK.

1005 Drillers return. Resume turning sixth auger. Still slow turning. Steam exiting from borehole.

1020 Bottom of augers at appx. 28 feet. Begin setting up for mud-rotary drilling with augers due to slow turning without hole lubrication.

1040 Begin mixing drilling mud

1047 Begin circulating mud downhole.

1050 Begin mud-rotary drilling inside augers to remove material.

1055 Bottom of bit at appx. 26.5 feet.

1103 Bedrock encountered at 30 feet, based on drilling speed. Cuttings consist of tan to buff limestone and some dark brown silt and clay.

1110 Bottom of bit at 31 feet.

1115 Bottom of bit at 31.5 feet.

1125 Loss of circulation at 32 feet. Fill water tank on rig.
1140 Begin mixing drilling mud.
1145 Finish mixing mud and begin circulating it downhole. No return of drilling mud.
1155 Bottom of rotary bit is at 33.5 feet. Drilled through solid rock for the last 1 foot.
1200 Break for lunch.
1320 Discuss drilling options with ED Clark.
1355 Return to MW109. Turn seventh auger to ~ 32.5 feet.
1405 SSB, REL, & T. Crank go discuss drilling options/strategy with ED CLARK. Decide that for now, at MW109, will drill down to depth of other casing (~39 ft.) with mud rotary.
1435 Return to MW109 and begin tripping in drill pipe.
1450 In casing set on 7-9-91, water level is 24.8 feet below surf.

1455 Begin mixing drilling mud.
1500 Begin mud-rotary drilling at 33.5 feet.
1510 Bottom of bit now at ~35 feet. No return on drilling mud.
1515 Begin mixing another tub of mud. Drill down to 36.5 feet. No return. Add another 5 foot section of pipe and resume drilling. Drill to 37.5 feet. No return.
1550 Begin mixing yet another tub of mud.
1610 Begin drilling at 37.5 feet.
1617 Bottom of ~~casing~~ (SSB) bit at 39.5 feet. No return.
1715 Leave MW109 for the day and go to confer with MARK SORENSEN and ED CLARK about drilling problems/strategies.
1720 S. Bhagat returns to trailer to do CLP Paperwork.
1830 Leave trailer for day.

Suhail Bhagat
7-10-91

7/11/91 (Thurs)

730 Arrive at Trailer

755 Arrive at MW-109 site (Speedway). Drillers are mixing tub of grout

815 Grout borehole MW109-2 (westernmost) casing - Grout is very deep in hole, lost several tubs during original grout attempt on 7/9. Added Holeplug

825 Pumped tub of grout into annulus - didn't come up appreciably, grout surface is still way down in borehole

840 Mark S. arrives, discusses drilling strategy - decide to install casing in MW109-3. Add more Holeplug to MW109-2. 2 bags

1015 Tim returns after conferring w. Kelvin - will case all bedrock wells. Begin preparing to install casing in MW109-3

1115 Casing installed to 39.5' in MW109-3 (easternmost well). Added 3 bags of holeplug in an effort to close off lost circulation zone.

1130 Grouted 109-3 up to surface w. 3/4 tub of cement - bentonite grout. Does not appear to be any fluid loss from boring. 3/4 tub is about 100 gal.

7/11

1150 Grouting 109-2 to surface.

1200 Drillers leave for lunch

100 Drillers return, top off grout in both cased boreholes

130 Drillers packing up, beginning DeCon.

155 Leave site to check route to 107 site (Yale & Carthage)

250 Checked 107 area, Drillers setting up to drill ~~107-A~~ 107-1 will collect analytical samples from this hole.

315 Begin drilling MW107-1

325 Pounding 4-6' Split Spoon BC = 4/4/6/7 Recovery = 10" Black Silty to med sandy clay w. orangish tan sand seam. Small Fe-stained halos around some grains 1.5"-diameter rounded lime grain at bottom of spoon

335 Pounding 14-16' Spoon BC = 5/12/19/16 4-6' sample had enough recovery for vols only - This was sample 107-1A 14-16 will be 107-B sample - Moist Tan Silty Med Sand w. abundant gravel Gravel is well rounded, ranging up to 5 cm in diameter. Some Fe-stained Halos

7/11

sample was plastic, bent easily, and had sand seam near base, allowing sample to break into halves. Recovery = 20".

410 Pounding 19-21 Spoon BC = 10/20/22/20
Recovery = 22" Water Level = 11.6'.
Tan tightly consolidated Sandy Silt w. abundant fine to med angular gravel. bottom 2" of spoon is Grey Silty Clay w. abundant gravel. Fe-staining and along fracture and around some grains

425 Pounding 24-26 Spoon BC = 5/16/20/16
Recovery = 18" Bing Zeng from ISWS stops by - wants to observe drilling and collect samples of subsurface materials. Bottom 12" - coarse angular Sandy gravel. Gravel and small cobbles make up ~80% of this interval. Middle 3" - Beige Sandy Silt w. gravel and Fe-staining. Top of this interval is 1 cm thick very dark Fe-stained band - looks like rusted metal - very dark reddish brown and flaky. Upper 3" = Grey Silty Clay w. rare gravel. Top most 1" = Beige moist plastic clayey

7/11

sand. Drilling got "tighter" @ 27'

450 Pounding 29-31 Spoon BC = 8/20/18/24
Recovery = 20" Beige Mixed Med to Coarse Sand and Sandy Gravel w. cobbles. Some zones within sand are Fe-stained, adjacent zones have no staining at all. Gravel and coarse sand is sub-rounded

505 Pounding 34-36 Spoon BC = 22/30/37/43
Recovery = 24" Upper 14" = Interbedded medium and coarse subangular sand, mostly well-sorted. Lower 10" = Cobbles and Gravel packed in fine sand and silt matrix w. irregular Fe-staining. Largest cobbles are carbonates.

525 Pounding 39-41 Spoon BC = 15/28/37/37
Recovery = 22" Poorly Sorted Med to Coarse Sand - lower 12" contains abundant Cobbles and Gravel. 2 fine sand seams intersect spoon - One of them is between Cobbles

555 Lowell - Property Owner stopped by to check on operation - he was concerned about schedule and is very agreeable.

600 Drillers discover problem w. one of the

(68.) 7/11

hydraulic cylinders

615 Drillers are trying to fix problem w. rig

700 Leave Drill site

730 Leave Trailer for day.

[signature]

7/11/91

NOTE: CME 75 rig was down for maintenance 7/12/91 — no drilling

(69)

7-13-91 (SAT.)

815 Arrived at Trailer going over protocol & site briefing
CDM Reps: M. Rys
M. Sorensen
Weather very overcast / light drizzle

0915 At M107 to begin Drilling
Mathes Rep: Gary Queen
Tom Crank

0925 Drillers begin Drilling

0935 Rig out of water, trying to wash heave out of augers.

0942 Aquifer starts at 24 ft

0951 Pulling rod to lower split spoon

1001 28-28-21-17 : Blow count for 44-46 ft sample. 16" recovery
Top 6" shattered limestone w/ large cobbles bottom 10"
med-coarse gravel & cobble
Fe-stained bands throughout
Will make this a TOC sample

1010 Drilling to 49 ft to sample
Drilling getting easier at 47 ft

1017 Driving 49-51 sample

1017 Blowcounts 49-51': 2-3-15-16
Full recovery
upper 10" = Tight sandy clay w/ pebbles (green)
2" silty sand (brown)
bottom 5" fine - coarse cobbles w/ Fe stains.
1030 DRILLING TO 54 ft
1037 DRILLING 54-56 ft spoon
BC: 21/24/26/21
90% recovered
top 4" - sandy clay w/ pebbles
bottom 18" coarse sand - coarse cobbles
many cobbles - upper & lower portion Fe stained
1052 DRILLING TO 59 ft. HARDER DRILLING @ 56 ft.
1105 DRILLING 59-61 ft. BC: 16/30/26/28
90% recovery
top 6" coarse sand w/ small pebbles
bottom 12" fine - coarse pebbles w/ Fe-stained bands. chunk of limestone at end of spoon

1125 DRILLING TO 64 ft
1136 DRILLING 64-66 ft. BC: 24/36/26/4
75% recovery.
fine - coarse pebble.
top 4" = fine - coarse pebble/gravel
next 4" = coarse gravel w/ crimson Fe stain
next 4" shattered limestone
bottom 4" - fine - coarse pebbles w/ coarse sand matrix.
1159 Breaking for lunch.
1300 Resumed after lunch. Resume drilling
1328 DRILLING 69-71 ft BC: 7/14/22/30
18" of recovery: 18" of brown fine sandy clay w/ small pebble. Driller feels we ran into wood 67 ft
1352 Setting well screen 56-66 ft interval. Pulling up auger & filling hole w/ bentonite chips.
~ 5 ft feet of heave in bottom of auger. Will wash this out.
1435 Breaking down 4-Rod. Well will be set w/ flush mounts

SHALLOW WELL TO SCREEN 28-38
FOOT INTERVAL.

1506 lowering screen in hole.
SCREENED INTERVAL: 56-66 ft
SAND pack: 66.5-54 ft
fine sand: 54-53 ft
Volclay: 53-SURFACE

1510 ADDING SAND PACK

1522 CASING DROPPED IN HOLE AFTER lifting auger. NEED TO RAISE CASING

1541 STILL TRYING TO lift CASING.

1552 ADDING MORE SANDPACK

1653 SAND PACK IN HOLE

1700 GROUTING IN THE HOLE

1721 AUGERS OUT OF THE HOLE. TOPPING HOLE WITH GROUT
4 Bags of Volclay
2 BAGS of Sand

1725 DRILLERS RINSING off AUGERS & GROUT TUB

1735 LEAVING SITE for DAY

Mark G. [illegible]

SUN. 14 July 1991

0800 Arrive at trailer.
WEATHER — Sunny, 75-80°F, calm. S. BHARAT (CDM, recording).
0820 Converse with M. SORENSEN.
0830 Stop by location MW107. Drillers preparing to start drilling.
0845 Visit locations MW 105, 108, MW 110.
0920 Return to MW107 to begin drilling what will be the shallow well, MW107A.
0935 Begin turning first auger.
0940 Turning second auger.
0943 Turning third auger.
0945 Turning fourth auger.
0955 Turning fifth auger.
1000 Turning sixth auger.
1005 Turning seventh auger.
1010 Turning eighth auger.
1025 Lowering well screen (.010) and riser pipe downhole. Bottom of hole at 38.5 feet.
1035 Trimming out riser pipe because plate still in bottom of augers.

1040 Knocking out plate at bottom of augers. Flushing hole with water. Riser pipe already inserted down the hole.

1050 Tripping out riser pipe and well screen. Flush borehole with water.

1100 Trip in well screen and riser pipe. Screen and pipe are TYPE 304 Stainless Steel.

1105 Plate removed. Begin adding coarse sand and lifting augers.

1125 Still adding sand pack. This well is MW107 A:

Screened Interval → 28'-38'
COARSE SAND → 25'-38.5'
FINE SAND → 24'-25'.

1150 Finish adding fine sand.

1200 Break for lunch.

1305 Return from lunch.

1315 Begin mixing grout.

1325 Tremieing grout in riser pipe annulus.

1340 Grouting complete - ~14 ft BGL.

1340 Decontaminating augers and cleaning up.

1430 Putting numbers on drums. Five drums at location MW107 contain drill cuttings and mud and extra grout. Preparing to move off this location.

1440 Leave location MW107.

1445 Arrive at location MW108 and begin setting up at hole.

1515 Turning first auger. The top 10' to 15' at MW108 is fill material. Augers are 4.25" ID.

1530 Turning third auger. Fill material is dark brown to black, clayey fine sand to silt.

1540 Waiting for containerization drums to arrive.

1545 Turning fourth auger. Drill cuttings changed color to brown at appx. 16' to 17'.

1550 Drums arrive. Driller noted significantly tougher turning of augers at appx. 17 feet.

1552 Cuttings at 17 feet are brown, fine sand to very fine sand, well sorted; dry.

1555 Pounding 19-21' spoon BC = 8/18/30/32; 19" recovery. Top 13" → Tan, well sorted med-fine grained sand; dry. Bottom 6" → Reddish brown med. sand with pebbles; dry.

1610 Driving 29-31' spoon. BC = 22/26/29/30; 20" recovery; Top 12" → Brown, coarse sand and pebbles; pebbles are of different lithologies. Middle 7" → Tan, poorly sorted gravel and coarse sand. Gravel is more dominant than in the upper 12" of this spoon. Bottom 1" → A dark red/brown sandstone chunk. Moist.

1620 Water encountered in borehole.

1625 Water level 27.5 feet, as measured with electronic water-level indicator.

14 July 1991

1635 Driving 34'-36' spoon BC = 10/20/20/20 18" recovery. Saturated. Top 4" → Brown/tan, medium sand grading downward into pebbles. Middle 7" → Brown, mixed gravel and sand and pebbles. Bottom 7" → Brown, coarse sand and pebbles. ~~Moist.~~ 10C sample collected here. Composited over entire spoon. Sample ID = MW108-A.

1640 Drillers tightening hammer on rig.

1700 Turning eighth auger.

1705 Driving 39'-41' spoon, BC = 16/30/30/50. 24" Recovery. Top 12" → Brown, coarse sand grading downward to pebbly zone. Bottom 12" → Brown, mixed sand and gravel and some pebbles at the top, large limestone (gray) in nose of spoon. Could indicate that

bedrock is close.
1720 Shutting down rig and
putting away equipment.
1730 Leave location MW 108 for the day
and go to MW 104.
1755 Return to trailer.
1815 Leave trailer for the day.
NOTE. No lithologic samples
were collected from MW 108
today. Only one TOC sample collected.

Sheet
14 July 1991

MON, 15 July 1991

0745 Arrive at trailer
0810 Arrive at location MW 108.
WEATHER: Sunny, 75-80°F,
calm.
CDM: Snehal Bhagat (recording)
J. MATHES: Tim Crank & Gary Queen.
0830 Water Level = 26.5 feet in
borehole drilled yesterday (7/14).
0845 Turning ninth auger. 4.25" ID.
HNu = BG. No change in the
rate of auger advancement (i.e.,
same as yesterday). HNu checks.
0855 Driving 44'-46' spoon. BC = 15/28/22/26.
19" recovery. HNu = BG.
Top 7" → Brown, sand and
gravel. Med-coarse sand.
Middle 6" → Coarse sand & gravel
with larger gravel than
above.
Bottom 6" → Brown, med-coarse
sand with rare ~~[illegible]~~ gravel.
0910 Driving 49'-51' spoon. BC = 3/10/14/19.
14" recovery. HNu = BG. Brown
coarse sand with gravel & some pebbles.

0925 Driving 54'-56' spoon.
BC = 12/17/18/18. 17" recovery.
Mixed coarse sand (Brown), and gravel. HNu = BG.

0940 Driving 59'-61' spoon.
BC = 14/23/32/32. Recovery = 18"
Top 4" → well sorted, brown med to coarse sand.
Bottom 14" → Tan/brown, mixed very coarse sand & gravel. HNu = BG.

1015 Driving 64'-66' spoon.
BC = 16/16/18/26. Recovery = 12".
Dk gray silty till containing gravel. HNu = BG. Total Organic ~~Compound~~ Carbon sample collected at this interval (64'-66'). SAMPLE ID = MW108-B. Driller noted drilling rate change at ~63 feet. Therefore, plan to set bottom of screen ~~at~~ just above the till at ~63 feet. Total depth ~~drilled~~ penetrated into till is ~3 feet (63'-66')

1030 Drillers leave to get well installation material. Troy Carlson (CDM) arriv[illegible].

15 July 1991

1100 Drillers return. Begin preparation for well installation. Decon well screen and riser pipe.

1120 Pouring sandpack. Two feet of hole plug (62'-64'), and one foot of coarse sand (61'-62'). Bottom of screen will be set at 61 feet.

1140 Continue adding sandpack (coarse sand) and pulling augers. Riser pipe is in hole.

1155 Coarse sand poured. This well is MW108B.

CONSTRUCTION DETAILS for MW108B:

FINE SAND → 47'-49'
COARSE SAND → 49'-62'
HOLE PLUG → 62'-64'
SCREENED INTERVAL → 51'-61'

1200 Break for lunch.

1305 Return from lunch.

1310 Preparing to grout the well.

1315 Pulling augers and tremeing grout down the hole. 2.5 feet stick up.

NOTE: FRANK BEACH, a City of [illegible]kford

Alderman, stopped by at appx 1130 to ask what we were doing. He is a business associate of Glen Eckberg

1330 All augers are out of the hole.

1335 Decanning augers and preparing to drill next borehole.

1440 Move off MW108B and onto MW108A. Setting up over hole. Lead auger has bottom plate. This well will be MW108A and it is located appx. 10 feet South of MW108B.

1425 Turning first auger (4.25" ID)

1430 Turning second auger. HNu reading of drill cuttings is BG. Still in fill material at 14 feet.

1435 Turning third auger. HNu = BG.

1438 Turning fourth auger. HNu = BG. Drilling change felt by driller at appx 17 feet.

1445 Turning fifth auger. HNu = BG.

1445 Turning sixth auger. HNu = BG.

1447 Turning seventh auger. HNu = BG.

1452 Turning eighth auger. HNu = BG.

15 July '91

1505 Pounding out bottom auger plate with down hole hammer.

1510 Lowering 10 foot screen and 10 foot sections of riser pipe into hole. Screen and riser are TYPE 304 stainless.

1535 Pouring sandpack starting at 40 feet. Bottom of screen is at 39 feet.

Construction Details for MW108A:

Fine Sand <--> 26' - 27'

Coarse Sand <--> 27' - 40'

Screen <--> 29' - 39'

1710 Mixing grout.

1720 Grouting MW108A and pulling up augers.

1730 MW108A grouted to surface. MW108B topped off with grout to surface.

1740 Decanning augers and putting equipment away.

1800 Move off location MW108 and move rigs & equipment to location MW103 for the night. Will set up at location MW105 in the morning.

1815 S&B leaves location MW108 for the day.

1820 Arrive at MW103 where the other rig is currently located.

1830 Return to trailer with Troy Carlson to do CLP paperwork and package drum composite samples that were collected today. Discuss details of field activities with M. SORENSEN and T. CARLSON.

1900 Begin paperwork and packaging of drum composite samples.

2015 Finish paperwork for samples. Samples packaged and put into cooler with ice. Custody seals placed on cooler

2030 Leave trailer for day.

DRUM COMPOSITE SAMPLES:

ID	DATE	TIME	DRUMS SAMPLED
MW109-1	7/11/91	1225	MW109-1 thru MW109-6
MW109-1DUP	7/11	1240	MW109-1 thru MW109-6
MW109-2	7/11	1255	MW109-7 thru MW109-10
MW107-1	7/15	1715	MW107-1 thru MW107-5

In addition to the samples above, the

15 July '91

following analytical soil samples have been collected:

SOIL SAMPLES

ID	DATE	TIME
MW107-A	7/11/91	1525
MW107-B	7/11	1535

Sandra Bhagat
15 July 1991

Tues. 16 July 1991

0715 Arrive at trailer. Custody seals on sample coolers are not broken.

0745 Arrive at MW 105 and await driller's arrival.

0815 Drilling crew arrives. Move to MW 105, east end of Balsam Lane and north of it. Setting up over hole.

0905 Driving 4'-6' spoon
BC = 1/3/3/4 Recovery = 6".
Top 4" → Brown, med sand with gravel. HNu = BG
Bottom 2" → Brown, clayey silt & fine sand with rare gravel. HNu = BG.

0915 Driving 14'-16' spoon
BC = 4/5/12/16. Recovery = 24"
HNu = BG
Brown, med to coarse sand with some gravel. Very moist.

0920 Water level = 6.1 feet (elect. level indicator). Therefore, will begin sampling spoons every five feet.

16 July '91

0935 Driving 19'-21' spoon
BC = 4/5/7/10 Recovery = 21".
HNu = BG. Brown, med to coarse sand for the entire spoon, with rare gravel.

0955 Driving 24'-26' spoon
BC = 2/4/4/7. Recovery = 18"
HNu = BG
Top 15" → Brown/tan, well-sorted fine sand
Bottom 3" → Brown/tan, well-sorted fine sand with clay.

1015 Driving 29'-31' spoon
BC = 13/7/7/7. Recovery = 20"
Brown to reddish brown, silty clay. Somewhat plastic. Nose of the spoon contains a gray, very plastic clay. HNu = BG.

1025 Driving 34'-36' spoon
BC = 4/6/9/13 Recovery = 23"
Entire spoon is dark gray, very plastic clay — same material as in nose of previous spoon (29'-31'). HNu = BG

1035 Will not continue drilling deeper at this hole because gray clay was present at 26 feet and from 34 to 36 feet; sand & gravel was encountered down to appx. 24 feet. Therefore, will backfill up to between 20'-25' and set a well.

1045 Drillers leave to get well installation material. Bottom of the augers is now at 34 feet.

1110 Drillers return. Plan on backfilling with hole plug to appx. 23 feet and set the well screen from 12 to 22 feet.

1115 Begin dropping hole plug down the borehole.

1145 Hole plug up to 23 feet.

1150 Wendy Sowers (CDM) and Steve Washburn (IEPA) stop by to discuss project.

1210 Break for lunch.

1245 Go to trailer to call CDM office, Chicago. Xerox paperwork from previous sample shipment.

16 July '91

1325 Return to MW105.

1330 Pouring sand pack (coarse sand) and pulling augers.

1410 Sandpack is now at 14 feet. Continue pouring sandpack.

1435 Coarse sand poured to 10 feet. Begin pouring fine sand.

1500 Fine Sand poured to 9 feet. Mixing grout.

1510 Grouting well. This well is MW105A. SSB

1520 Well grouted to surface. SSB

CONSTRUCTION DETAILS for MW105A

FINE SAND → 9'-10'
COARSE SAND → 10'-23'
SCREEN ↔ 12'-22'
HOLE PLUG → 23'-34'

Well screen and risers pipe are Type 304 Stainless.

1330 SSB goes to MW103. Drillers decanning at MW106.

1350 Move off MW105. SSB

1600 Arrive at MW110, located near corner of EASTROCK DR. and 21st

just south of the Post Office. The Rock River Reclamation District has marked sewer lines (green). Proximity of sewer and water lines to curb requires that drilling must take place ~ 10 feet in from the curb to avoid penetrating any underground lines.

1640 Setting up over hole.

1650 Turning first auger (4.25" ID) at MW110.

1655 Driving 4'-6' spoon.
BC = 1/2/2/1. Recovery = 7".
Reddish, brown, well sorted, med to coarse sand. HNu = BG.

1707 Driving 14'-16' spoon.
BC = 5/13/14/20. Recovery = 15"
Top 14" → Reddish brown, med sand with gravel. HNu = BG.
Bottom 1" → Tan/brown, coarse sand and gravel. HNu = BG.

1725 Driving 24'-26' spoon.
BC = 10/19/25/30. Recovery = 19"
Tan, coarse sand, poor to moderately

16 July '91

sorted. Bottom three inches are slightly reddish brown. Gravel is common in the upper 16". HNu = BG. Bottom 3" is slightly moist.

1750 Driving 34'-36' spoon.
BC = 40/57 (4"). Recovery = 18"
Refusal of spoon. Top 8" is blow in. Brown, med sand with some gravel, especially in bottom five inches. Slightly moist. HNu = BG.

1805 Tim Crank says a ~~new~~ bad filter is responsible for slowed hammering. Need to get new filter. Drillers leave site for the day.

1815 SSD leaves MW110 for the day.

1830 Arrive at trailer with Troy Carlson to do CLP Paperwork.

1900 Finish paperwork and package samples with ice in cooler with custody seals. Leave trailer for day.

Sushil Bhagat 16 July 1991

WED. 17 July 1991

0710 Arrive at trailer. Gather equipment
0740 Arrive at MW103.
0755 Arrive at MW110, CDM: SNEHAL BHAGAT (recording); J. MATHOS: T. CRANK and G. Queen.
WEATHER: Sunny, 80°F, breezy.
0800 Setting up for drilling
0810 Begin turning augers. Hard drilling for entire auger.
0805 Water level = 26.5 feet.
0820 Driving 39'-41' spoon.
BC = 8/25/25/34. Recovery = 16"
HNu = BG. Tan sand & gravel. Sand is coarse-grained & poorly sorted. Gravel is predominantly limestone.
SAMPLE for GRAIN SIZE collected at this interval, 39'-41'. Angular gravel.
0835 Fill out pay sheets with T. CRANK for 7/5 and 7/16/91.
0845 Turning ninth auger.
0848 Auger refusal at ~43 feet.
0855 Driving 43'-45' spoon. BC: 25/34/50 (for ~2.5"). Spoon refusal after 14.5" of driving. Recovery = 12"

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HNu = BG. Tan to reddish brown coarse sand and gravel. Sand is poorly sorted; gravel is commonly Fe-oxide stained and is limestone. Bottom 3" is predominantly dark reddish brown-stained limestone. Driller thinks this is bedrock.
TOTAL ORGANIC CARBON sample taken at this interval (43'-44').
0940 Begin pouring sand (coarse) into hole.
1025 Coarse sand at ~31 feet now. Plan to set screen from 30' to 40'.
1040 Coarse sand to 28 feet.
1055 Fine sand to 27 feet.
1110 Mixing grout
1115 Tremieing grout downhole
1125 Grouting complete to surface. Begin deconning augers.
CONSTRUCTION DETAILS FOR MW110A:
FINE SAND → 27'-28'
COARSE SAND → 28'-~~30'~~ 43' (SSB)
SCREEN → 30'-40'
GROUT → 27' to SURFACE.

1200 Move off location MW 110 and head for MW 104.

1205 Arrive at MW104. Drums containing cuttings, drilling material are being unloaded at this location

1225 Break for lunch

1325 Return from lunch. Finish storing drums at MW104.

1400 Fill out paychecks with T. CRANK.

1530 Finish sample paperwork and packaging samples in coolers. Take coolers to FED EX. on Pyramid Drive.

1535 Leave trailer for day

1545 Drop off sample coolers at FED EX. Return to Chicago.

Scott Bhagat
17 July 1991

MONDAY 22 JULY 1991

0830 Arrive at CDM Trailer. Get coolers and sample jars from Kien Tyson (USEPA trailer). Twelve 16 quart coolers were received. Sample jars consisted of 203 VOA and 1003 (?) narrow mouthed jars.
WEATHER: Humid ~90°F, partly cloudy. Rain fell overnight.

0930 Drillers arrive and go off to set up.
CDM Personnel: S. BHAGAT & Troy Carlson.
New Mathes person is JEFF CRANK, who replaces JOHN McMULLAN.

1045 Arrive at location MW 109 (Speedway). Air ROTARY rig will set the intermediate and deep wells by drilling through the casings previously set by the other rig. Drillers setting up for air rotary drilling. CDM Rep is S. BHAGAT (recording). JOHN MATHES

Reps: Ed Clark, Quintin ~~Williams~~ NOWAK (SSB), & Jeff Crank.

1205 Break for lunch.

1305 Return to MW 109 from lunch.

1315 Begin lowering pipe into hole.

1325 Pressuring hole with air.
WEATHER: Sunny, very Hot and HUMID (~95°F); slight breeze.

1330 Begin air rotary drilling at location MW 109 at a depth of 39 feet. This casing is located appx. 12 feet west of MW 109 A.

1335 Bedrock at 40 feet is Tan limestone; no clay or silicified limestone. No lithologic change at 41 feet.

1345 Driller noted a "soft" spot in bedrock @ 42 feet. Pipe dropped a few inches, slightly greater volume of water came out of hole. Bedrock @ 42 feet is a tan/brownish limestone. Cuttings significantly finer.

1350 At 43 feet, bedrock is a

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light brown limestone (~50%) and brown shale (50%). @ 44 feet, have ~60% limestone and 40% shale.

1355 @ 45 feet, tan limestone (~85%) and some brown shale (~15%). Proportion of shale may have some influence on the color of the

(SSB) 1400 limestone.

~~1600~~ Same lithology @ 46 feet as at 45 feet. Tan limestone appr 90%, brown shale ~10%. No obvious silicification encountered yet. Lithology & proportions @ 47 feet same as above.

(SSB) Rare silicification present

(SSB) ~~1605~~ @ 48 feet, have nearly 100% tan limestone; small fraction of shale probably blow in. @ 49 feet, same as above.

(SSB) 1610 ~~1610~~ @ 50 feet, same as above.

Summary of Bedrock Lithology 40'-50'
40'-41' → Tan limestone
42' → Tan/brownish limestone
43'-44' → Shaly limestone; brown the

42' - 43' interval roughly corresponds to the "soft" drilling noted above.

45' - 50' Predominantly tan limestone with some brown shale

(SSB) 1415 @ 45 feet (~ 15%) decreasing to less than 5% @ 50 feet.

1615 Bit now @ ~ 51 feet. Bedrock

(SSB) 1425 @ 51 feet is tan limestone.

1625 @ 52 feet → Tan limestone (85%), brown shale (~ 15%). @ 53 feet.

(SSB) 4 Same as above.

1630 @ 54 feet, same as above.

1635 @ 55 feet, same as above.

1640 @ 56 feet, same as above.

1645 @ 57 feet, same as above.

1648 @ 58 feet, same as above except

(SSB) slightly brownish in color.

1652 @ 59 feet, yellowish tan limestone; insignificant amount of brown shale (<5%) — could be

(SSB) slow in color of water changed to a more yellowish brown.

1655 @ 60 feet, lithology same as @ 59 feet.

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1458 @ 61 feet, same as above except no shale observed.

1500 Add another 10 foot section of drill pipe

1504 Resume drilling.

1505 @ 62 feet, same as above

@ 63 feet, same as above

1512 @ 64 feet, same as above except limestones less yellow in color. Water is also less yellow. More of a creamy gray.

1515 @ 65 feet → light gray limestone. Insignificant shale.

1518 @ 66 feet, same as above except slightly darker gray limestone.

1521 @ 67 feet, same as above

1523 @ 68 feet, same as above

1526 @ 69 feet, same as above.

WEATHER UPDATE: Has become cloudy, but remaining hot & humid; breeze has picked up.

1529 @ 70 feet, same as above.

1534 Adding another 10 foot section of drill pipe.

1536 Resume drilling.
1538 @ 71 feet, same as above.
1541 @ 72 feet, same as above.
1544 @ 73 feet, same as above.
1547 @ 74 feet, same as above.
1550 @ 75 feet, same as above.
1553 @ 76 feet, same as above.
1556 @ 77 feet, same as above.
1558 Pumping rate measured at discharge end of hose. It took 9 seconds to fill a 5 gallon bucket.
1559 @ 78 feet, same as above.
1601 @ 79 feet, same as above
1602 @ 80 feet, same as above except color is slightly yellower and particle size of cuttings is somewhat smaller.
1605 @ 81 feet. Back to a gray limestone similar to the interval from 65 - 79 feet.
1609 Add another 10 foot section of drill pipe.
1610 Resume drilling.
1615 @ 82 feet, gray limestone with lovely

1096 of limestone being silicified. No change in drilling rate noted by driller.
1617 @ 83 feet, gray limestone with essentially no silicification or shale.
1622 @ 84 feet, gray limestone with a 50% silicification, which is whitish to a gray (vitreous) color
1624 @ 85 feet, gray limestone without silicification.
1626 @ 86 feet, same as above.
1630 Begin tripping out drill pipe. This well will be screened from 75-85 feet. Riser pipe being decorried. This will be MW109C.
1643 Screen 10' 8 1/4"
Riser 10' even
Riser 10' 1/4"
20' 1/2"
20' 1/2"
20' 3/4"
TOTAL WELL MATERIAL 90' 10 1/4"

1645 Begin lowering well material into hole. Screen is 0.010 stainless steel, 10 feet long. Riser is Type 304 Stainless Steel. Centralizers for the 2 inch well material are being installed at ~15 foot intervals. Four centralizers were installed. Less well material is in hole.

1700 Pouring coarse sand into hole.

1715 Filter pack poured to depth of 73 feet. Begin pouring fine silica sand.

1725 Fine sand poured to 72 feet.

CONSTRUCTION DETAILS for MW 109C:

FINE SAND -> 12' - 73' (100 grit)
COARSE SAND -> 73' - 86' (20-40)
SCREEN -> 75' - 85'

1730 Leave location MW 109 for the day. Return to trailer.

1730 Leave trailer for the day.

S. A. Bhagat

22 July 1991

TUES. 23 JULY 1991

0730 Arrive at trailer.

0740 Arrive at MW109 where drillers are preparing to grout MW109C, the deep bedrock well at the SPEEDWAY location.

WEATHER: Sunny, ~70-75°F, slight breeze, much less humid than yesterday.

CDM PERSONNEL: S. BHAGAT (recording)

J. MATHES: ED CLARK, QUINTIN ~~WILLIAMS~~ NOWAK, JEFF CRANK, and DAVID JULIUS (intermittently).

0910 Annular space between 2" riser and 6" black casing tremied with grout containing oat hulls.

0920 Drillers preparing to move over to MW 109 B, which is the easternmost borehole at location MW 109. Grout in MW109C is to the surface; will let it set and top it off when MW109B is grouted, if necessary.

1040 Lowering 6 inch down-the-hole air hammer into casing for MW109B.

1115 Begin air rotary drilling at MW109B. Begin at 39.5 feet, which is where 6 in casing is set.

1120 @ 40 feet, bedrock is tan limestone with some fragments exhibiting Fe oxide staining.

1124 @ 41 feet, same as above.

1131 @ 42 feet. Tan limestone (~80%) and yellowish brown limestone (~20%). Driller notes slight soft spot at ~ 42.5 feet. Also note slightly greater volume of water.

1135 @ 43 feet, tan to yellow brown limestone (80%), brown shale (~20%) and very minor silicification (1-2%) which is generally white or clear quartz.

1140 @ 44 feet, same as above except 1-2% black angular fragments, possibly of igneous origin. Water color has so far been cloudy, creamy brown.

1145 @ 45 feet, tan/brown limestone (60%)

and non-carbonate material (40%). Non carbonate material consists of quartz (some are rounded, white to clear), angular & rounded black fragments (igneous), brown shale, and very minor red volcanic fragments with phenocrysts.

1148 @ 46 feet, tan limestone (90%) and brown shale (10%). No obvious silicification or non-carbonate lithologies observed.

1153 @ 47 feet. Encountered another minor soft zone - increased water volume. Tan to gray limestone (95%), yellowish brown limestone (5%). Cuttings are slightly smaller in size at this depth.

1157 @ 48 feet, tan limestone with v. minor (1-2%) brown shale. Cuttings slightly larger-sized than previous sample.

1201 @ 49 feet, tan limestone, no obvious silicification; yellow/brown limestone

and brown shale compose less than 5% of the sample.

1206 @ 50 feet, tan limestone with rare silicification.

1208 @ 51 feet, same as above. Pallets from HUBER PALLETS arrives. Using forklift to load pallets onto MATHES trailer.

1217 Finish loading pallets.

1220 Break for lunch.

1320 Return from lunch.

1335 @ 52 feet, tan limestone and appx 1-2% brown shale

1341 @ 53 feet, same as above.

1347 @ 54 feet, tan limestone, no shale.

1352 @ 55 feet, same as above except brown shale <1%.

1357 @ 56 feet, same as above.

1401 @ 57 feet, same as above.

1407 @ 58 feet, same as above.

1411 @ 59 feet, same as above.

1415 @ 60 feet, same as above.

1418 @ 61 feet, same as above.

1420 Tripping drill pipe out of hole.

23 July '91

1435 Drill pipe and downhole air hammer are out of hole.

1440 Measuring well material.

Screen 10' 8"

Riser 10 1/4 — 58' + 48" + 1 1/4"

SSB Riser ~~19~~ 20 3/4" — 58' + 4"

SSB Riser ~~19~~ 20 1/4 — 62' 1 1/4"

60' 9 1/4 of TYPE 304 Stainless.

5' 8"

~~65' 9 1/4"~~ TOTAL WELL MATERIAL

66' 5 1/4" (TYPE 304 & 10 ft, 0.010 screen)

1450 Lowering riser and well screen into hole. Centralizers being fastened to riser pipe.

1500 Well pipe in place. Begin pouring sand pack (coarse sand, 20-40).

1510 Sandpack poured to 48 feet. Begin pouring fine sand (100 grit).

1515 Fine sand poured to 47 feet.

CONSTRUCTION DETAILS for MW109B:

FINE SAND (100 grit) → 47'-48'

COARSE SAND (20-40) → 48'-61'

SCREEN (.010 stainless) → 50'-60'

1520 Prepare to mix grout (Volclay).

1605 Grout mixed. Begin tremeing grout into annular space between riser pipe and 6 inch black casing. No oat hulls used in this batch of grout.

1620 Finish tremeing hole. ED CLARK goes to make phone call to MATHES.

1630 ED CLARK returns. Drillers leave to get water.

1655 Drillers return and begin mixing another tub of grout.

1715 Tremeing second tub of VOLCLAY grout down hole. Oat hulls are being added to grout.

1730 Finish tremeing grout down hole.

1735 Begin mixing more VOLCLAY grout.

1800 Tremeing grout down hole. Oat hulls being added to grout.

1805 Topping off grout in MW109C, which is appx 20 feet below grade.

1810 Topping off grout in MW109B.

1815 Drillers cleaning equipment and preparing to shut down for the day

23 JULY 91

Will let grout sit overnight in MW109B and check the level in the morning.

1835 Leave MW109 for the day and go to MW110 to talk with T. CARLSON.

1855 Arrive at CDM trailer.

1930 Leave trailer for the day.

[signature] 23 July 1991

WED. 24 July 1991

0915 Arrive at trailer.

Note. The following drum composite samples were sent by FED EX for [illegible] organics and inorganics on [illegible] 17 July 1991.

SAMPLE ID	DATE	TIME	DRUM #'S USED
MW104-7	7/15/91	1400	MW104-34 thru MW104-[illegible]
MW104-8	7/15	[illegible]	MW104-41 and -42
MW107-1	7/15	1215	MW107-1 thru MW107-5
MW108-1	7/16	1545	MW108-1 thru MW108-5

0810 Arrive at location MW109. CDM Personnel: S. Bhasat and M. Sorensen. Maths Assoc: Ed Clark, Quintin NOWAK, and Jeff Crank. Weather: Sunny, ~70°F, slight breeze. Drillers are preparing to move off location MW109.

0935 Move off location MW109.

0940 Arrive at location MW108 and begin set up.

[illegible] to 1115 - Forces at MW108 to [illegible] used at 109

1210 - [illegible] the 14 inch hole to accom-

Mark Sorensen 7-24-91 -

odate the mud conductor pipe

1320 Install mud conductor pipe, set mud tub, etc.

1340 Mix mud for mud rotary drilling here at MW108 -

1415 - Begin drilling with mud rotary; will drill to 77' & then collect first formation sample (samples were collected down to 66' during drilling of the shallow & intermediate wells here). -

1555 - Have drilled to 67'; cuttings at this depth show much gravel ½ to 1 inch in diameter.

1640 - Have drilled to 77' and attempted to stabilize hole by circulating, but gravel continues to fall in - probably from the thick sand & gravel some above 63'. Also see gray silty clay till w/ gravel in cuttings - seen below 63' during drilling of MW108B (Now drilling MW108C) -

Mark Sorensen 7-24-91 -

1705 - Have drilled to 87'; will attempt split spoon sample here. Drilling changed from silty till above 81' to a medium gravel with many gray limestone & black shale fragments below 81'. Driller called 66-68' interval a gravel, with 68-81' the till, gray.

1715 - Retrieve 87-89" split spoon sample. Advance/recovery: 18/2" OVA: b.g.
Sample consists of gravelly M.S. sandy gravelly clay, mod. gray & locally grayish white, relatively soft; contains several large (~2") chunks of limestone. May simply be a more gravelly phase of the till.

1735 - Have drilled to 97; cuttings show mixed gray silty till & gravel.

1745 - Retrieve 97-99' split spoon. Adv/recov. 12"/6". OVA b.g.

Sample consists of sand & gravel. Sand is fine to coarse; gravel is subangular to rounded pebbles & cobbles of limestone, quartz/jasper, shale & granite.
Based on cuttings, call the 87-95' interval the gray till of gravelly sandy clay.

1805 - Drilled to 107'; cuttings show mainly gravel, subrounded (~80%) w/ remainder being gray clayey till. At 106' hit a hard zone that yielded an increase in lt gray to white limestone chips.

1820 - Drilled to 117'; we may be in a soft limestone bedrock, because although the drilling was fairly easy, got increasing proportions of white limestone, commonly sandy.

1830 - Retrieve spoon from 117' — contains 2 sandy limestone chips, buff; despite sandy texture is crystalline. [illegible] @ 1850

THURSDAY, JULY 25, 1991 —

Activity: Drilling & setting casing at MW108C —

Personnel: C Clark, Q Nowak, J Crank (Mathes Assoc.), M Sorensen (CDM, recording). —

Weather: Clear, light N wind, 70°F —

0745 - Arrive at MW108 drillsite, where drillers are tripping out 6" rotary bit; will trip in 12" bit to ream out hole & u.s. to bedrock; then set casing.

1005 - Have reamed hole to 77'; its taking 5-15 mins. to stabilize hole & wash out excess cuttings — after drilling each 10-foot section.

1200 - Have reamed hole to 115'; had limestone from ~106-110', but then went back into gravel at 110-115', apparently. Break for lunch.

1310 - Resume drilling/reaming. —

1435 - Have drilled/reamed to 119.5', & have been in bedrock since 117'.

Mark Sorensen 7-25-91 —

Having difficulty keeping the hole open — the gravel zones above 117' continue to cave in; therefore must mix a thicker mud —

1515 - Pull out drill string & will then attempt to set the 6" casing.

1630 - Installed the 6-inch casing, making spot welds at each junction. Got casing down to 119'2", so now will prepare to grout.

1710 - Mix second tub grout for annular space around 6" casing —

1750 - Install 3rd tub grout —

1820 - Install 4th tub grout. —

1835 - Chunks of grout coming to surface, so stop grouting now. Leave site for day; will start late tomorrow to give grout extra time to set —

Mark Sorensen 7-25-91 —

FRIDAY, JULY 26, 1991 —

Activity: Drilling bedrock & installing MW108C —

Personnel: E Clark, O Nowak, J Crank (Mathes), M Sorensen (CDM recording)

Weather: fair 72°, light N winds —

0930 Arrive at drillsite, drillers apparently still dealing with drums which are arriving this a.m.

0955 - Drillers arrive at MW108 & begin preparing for air drilling

1000 - 1040 MS goes to MW105 to give radio to S Bhagat —

1040 - Drillers moving mud tub, cutting 6-inch casing, setting up air diverter & compressor, hoses —

1135 - Gave Dave Julius (Mathes) a list of wells to develop — will start with wells drilled by hollow-stem auger. He will decon first & I will check on his progress after lunch —

1150 - Trip in air hammer & drill pipe

1215 - Break for lunch —

1310 Continue tripping in drill pipe

[illegible] 7-21-91

there have been a couple spots ~~wh~~ MS with material on inside of the 6" casing, below ~90' —

1345 - Begin drilling @ 119.5' —

1415 - Have been getting gravel blow-in; only at 121' depth. Must have had only ~~on~~ MS a 2.5' zone of limestone. —

1440 - Have drilled from 121-131'. — We are in limestone, though some rounded gravel up to 1" is caving in. Producing much — milky brown to tan water, — approx. 100 gpm. Cuttings show the bedrock consists of buff limestone/dolomite, med to v fine-grained and predominantly sucrosic in — texture; local echinoderm fragments & brachiopod molds. Remainder of — bedrock cuttings consist of compound fragments of partly silicified limestone (white) that grade to a bluish-gray zone (sometimes), and in a few fragments, to a brownish gray

[illegible] 7-21-91

core of chert with forams or other fossil fragments commonly visible. These compound chips constitute ~5% of cuttings at 126, 128 & 129', and ~15% at 127, 130 & 131'. These ~~fo~~ M.S. chips them- ~~serlin~~ M.S. selves are more cherty (~50% chert) at 130 & 131' & less cherty (<5% chert) above. The 129-131' zone produced even more water than above.

1525- ~~Lim~~ M.S. Drilled to 137'; water production v. high (≥100 gpm); water cleaner, being milky & slightly turn. Cuttings again show (131-137') buff limestone w/ ~~chl~~ M.S. compound chips that are as above (and note that the white, slightly silicified zones are only v slightly silicified & are chalky & rel. soft.) (Also note that the fossils in these compound chips are preferentially silicified to the brown

Mark Sorensen 7-26-91—

ish gray.

Chalk/chert chips constitute proportions of 20% at 132', 5% at 133', 30% at 134', 15% at 135, 5% at 136' & 30% at 137'. Note: observed no bentonite or shale in this boring.

~~1615~~ M. Sorensen

1545-1615- Checked ~~of~~ M.S. on D Julius, who had just completed well development of MW104A by pumping & surging. He will decon & then go to MW111A to develop that well.

1615- Back at MW108C, preparing to install well. Measure the well screen & casing: 140' 11½", including the screen section which is 10' 8¼". Install the well pipe with centralizers every 40' beginning at just above top of screen.

1630- Setting screen bottom at 135'; will install coarse (20/40) sand to 123', fine sand to 122' & benton-

Mark Sorensen 7-26-91—

ite chips (Volclay Plug) from 119-
122'. Then Volclay grout from
0 to 119'.

1745 - Coarse sand installed up to
122'; install fine (100 sieve) sand

1805 - Fine sand is up to 122'; install
bentonite chips.

1835 - The bentonite chips have
plugged at ~29' (water table
surface); try several things to
knock them free.

1920 - Got the chips free by using
an compressor; will grout
tomorrow, leave for day.

SATURDAY, JULY 27, 1991

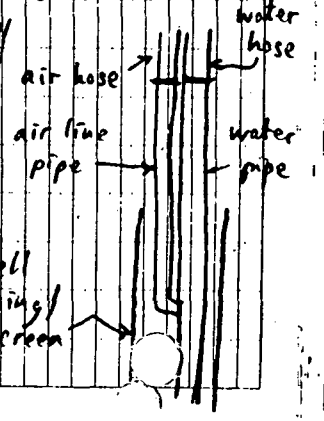
Activity: Complete installation of MW108C; move onto MW107C & begin drilling.

Personnel: E Clark, J Novak, J Crawl (Mathes), M Sorensen (CDM, recording)

Weather: 70°, fair, light SE winds

0810 - Arrive at site; take drillers back to motel because they switched truck keys.

0945 - The drillers are mixing Volclay grout; go over to observe well development being done at MW111A by D Julius (Mathes). He is using an air lift system that employs an air hose that feeds into the water line (see sketch). The air goes down the air line & then up the water line, ~~not coming in contact with the formation~~ M Sorensen



swelling the water

out of the formation and out of the well. The air comes into contact with the formation only when the turn up the air pressure all the way, which forces some air out of the pipe & into the formation. This is surging the formation with air. Most of this surged air then comes back up the holes when the pressure is turned off. (They alternate turning the pressure to max. & then turning it off, M.S. on a time scale of a second or two. Told him to surge the entire length of the screen several times during development, followed by normal air lift pumping to clean up the well. Each surging period lasts 5-10 minutes, & M.S. consists of the alternating of turning the pressure on ~~& off~~ M.S. to max. & then off for the total screen

Mark Sorensen 7-27-91

length. MW111B pumped the total volume of 140 gals, but MW111A pumps much slower — will pump 45 gals there, unless it cleans up earlier.

1105 - Pump fifth tub grout; have used oat hulls in grout for last 2 tubs & still haven't gotten any return of fluid out of hole. The gravel @ 119-122' must be drinking much grout.

1120 - Get more Volclay

1145 - Lunch

1300 - Picked up more materials; now mix more grout.

1350 - Finally getting a tan water returning from hole during installation of 7th tub grout.

1400 - The returning water has changed to a Volclay-colored grayish green, but is still thin; mix a small batch.

1510 - Finally finished grouting, good thick grout returning from hole.

1625 - Drillers have pulled off & cleaned up. Go to check of D Julicos @ MW103

Mark Sorensen 7-27-91

(124) SUNDAY, JULY 28, 1991

Activity: Drilling at MW107C

Personnel: E Clark, Q Nowak, J Crank (Mathez), M Sorensen (COM, recording)

Weather: 75°, mostly ~~cloud~~ M.S. cloudy, light-moderate S winds

0830 - Arrive at MW108

0845 - Drillers arrive at MW108; will now move over to MW107

0930 - Auger down w/ 16" bit to set conductor pipe

0945 - Augered to ~5' but have hit an obstruction, cylindrical, on E side of hole. It is concrete ~~or~~ M.S. pipe or a rock.

1015 - Decided to cut the conductor pipe so that it will rest above the obstruction; the bit will fit around the obstruction (even the 12" bit will fit, according to driller).

1055 - Begin going down in the hole; this hole has already been drilled to 91' by T Crank w/ augers. ~~They~~ M.S. He then filled it with a thick bentonite slurry (on (125) probably Tuesday, 7/25) and put a full barrel on top of hole to prevent accidents, etc. We are drilling down in this previously drilled hole. Will collect first sample at ~97'. Hope to set a well somewhere between 95 & 120'. Samples collected from 74 to 91' here are all silty & clayey tills, so must first hit sand, gravel ~~of~~ M.S. or bedrock before setting well. May have to set casing instead & set well in the bedrock. Existing wells here ~~at~~ M.S. are at depths of ~38' and 66', so we don't want to go deeper than 120' unless we have to.

1140 - Bit got stuck; had to pull rods, which had much mud head (20' worth), in turn spraying mud all over. Now clean it up.

1200 - Got bit unplugged by ramming the "jam" used for split spoon inside it; continue down in hole.

1215 - Break for lunch

1325 - Drillers got drunk & now will continue going down in the pilot hole of MW107C.

1415 - Have drilled to 97'; attempt to collect split spoon sample here. Cuttings 91-97' show ~40% buff limestone chips & fragments, ~50% sand & granules, multilithologic and ~~0.5~~ U.S. ~10% till, which includes brown sandy silt & gray clayey silt.

1440 - Retrieve split spoon from 98-100'. Adv/recov. 12/5". OVA: b.g. Sample description: 98-98.4' in chamber is fine SAND SW with ~20% fine ~~sa~~ U.S. to coarse subrounded pebbles and ~15% silt or clay. Mod. yel bn to orange bn. Also contain 2 buff limestone chips ≥ 2" in diameter.

1515 - Retrieve 108-110' split spoon. Cuttings were same as 91-97' interval. Adv/recovery: ~~18~~ U.S. 24/18". OVA: b.g. Sample descr.: 108-108.2' is sandy clay, tan, plastic, w/ ~15% fine

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pebbles. 108.2-109.5' is silty sand, w/ ~25-30% silt/clay and ~10% granules & pebbles; mod tannish brown to 2 zones 3 & 5" thick of or. bn; sand is v fine to med & mainly fine. SM; saturated.

1630 - Have drilled to 126'. Cuttings from 108-120 were similar to above. Skipped sample at 118' because material was very hard. At 120' it became even harder, with very slow drilling 120-126'. Cuttings in this interval became ~95% buff limestone & white to tn gray chert chips; rare clay/silt brown & gray, as well as Qtz & jasper, greenstone granules & pebbles. After drilling 6' into this competent material, U.S. ~~we'll~~ have decided to pull out rods to set casing tomorrow.

1640 - Bit is sticking on the way out at 104'.

1645-1715 - Check on D. Julian developing MW104-B and C. C was clear from start, B remains cloudy brown. Will pump ~~tho~~ U.S. there

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for another 45 minutes or so, unless it cleans up before that. Yesterday evening OK'd completion of development at MW103 wells.

1725 Pulled rods from MW107C; will ream with 12-inch tomorrow & set 6-inch casing & grout. Then will set well in bedrock. The 91-120' interval was too silty to set a well, so a bedrock well @ ~130 to 140' screened interval will be acceptable. Leave site for day

MONDAY, JULY 29, 1991

Activity: Reaming & setting casing at MW107C

Personnel: E Clark, Q Nowak, J Crank (Mathes), M Sorensen (CDM, recording).

Weather: 68° overcast, light north-winds

0740 - Arrive at site; drillers are setting up; T Crank here to do some welding

0755 - Begin reaming ~~MW108C~~ MW107C - M Sorensen 7/29 with 12" bit.

1030 - Have drilled to ~124'; drilling action & increasing proportion of bedrock cuttings indicate we hit bedrock at 120'. Will drill/ream to 126' & then prepare to set casing.

1150 - Got drums & casing; lunch break.

[1100-1145] MS goes to call in hours, get gas, ice.

1330 - Have circulated mud in hole ~~at~~ M.S. with bit at 126' to stabilize hole; now pull drilling rods

1505 - Have set casing on bedrock at 126'; now will mix grout to fill annular space

1520 - Tremie in first tub's m[illegible] of cement-

bentonite grout.

1605 - Have tremied in 2 tube grout & are getting good mud return.

1715 - Getting grout returning from hole, grouting thus complete. Putting lids on drums & putting drums & pallets on trailer, & filling these with drilling mud. Will remove these drums tonight.

1805 - Leave site for day.

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THUESDAY, JULY 30, 1991

Activity: Bedrock drilling & well installation at MW107C; observe well development at MW102A.

Personnel: E Clark, Q Novak, J Crank (Mathes), M Sorensen (CDM, recording).

Weather: 65°, fair, moderate NW winds.

0900 - E Clark's crew is moving drums away from MW107 & to city well 19 for storage; drums will be sampled for characterization next week.

0920 - Check on T Crank's rig - they have drilled 4' into competent limestone & will set casing there.

0940-1040 - Check on well development at MW102A; pumping at ~8 gal/hour, and periodically surging. Water is still silty after surging, and pumping for 6½ hours. Will surge ~twice more, M.S. pump till water cleans up, & then stop developing here. There is probably silty material below 30' (no spoon

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samples from 30-38): 28-30' spoon showed uniform sand but 38-40' showed silty clay till. Therefore ~~to~~ M.S. this well will probably not clean up completely. —
After 7 hours, will have pumped ~56 gallons, or ~48 well volumes. —

1105 - Drillers arrive back at MW107 and after moving drums; now set up for air rotary drilling - remove mud conductor pipe, ~~&~~ M.S. weld air diverter "T" onto casing, etc. —

1155 - Affix new bit to air hammer; carbide buttons on old one ~~have~~ M.S. are sticking out considerably (steel has worn down around them). —

1215 - Trip down air rotary string —

1235 - Break for lunch. —

1335 - Resume tripping in drill pipe —

1405 - Begin drilling bedrock w/ air hammer here at MW107C —

1420 - Drillers go to get drums to contain water from formation. Have drilled 126-131'; drilling fairly

rapidly & producing tan water at ~30 gpm —
Cuttings from 126-131' show buff limestone, v finely to med xln, commonly sucrosic in texture & w/ local small vugs; a few Fe oxide-stained surfaces, esp. at 126' where it gives cuttings a yellow-brown color. 10-30% pebbles of exotic character (mainly mafic igneous & metamorphic) in top 3'; competent grout pieces in whole 5' interval (a slightly greenish gray & containing small vesicles), esp. @ 129 to 131' — shows that some grout probably travelled down along fractures in rock. —

1515 - Drillers return with only 8 drums; fill them with water & mud from drilling. —

1600-1645 - MS goes to MW109 where D Julius is developing MW109A & B; B is pumping at ~38 gal/hr & ~~has~~ M.S. cleaned up rapidly with M.S. spinning. Developed it 3 hrs, ~110 gal (~18 well

volumes). MW109A is developing slowly, owing to only 7' of head & presence of clay & silt in the formation - will surge then pump 'till clean, then surge & pump 'till clean, repeating this to get at least 20 well volumes (similar to MW102A)

1645 - Back at MW107A, they have just begun drilling beyond ~~132'~~ 131'.

1705 - Have drilled 131-137'; now it's drilling quite ~~so~~ M.S. slowly, and producing a milky ~~dk~~ M.S. gray water at ~30 gpm.

Cuttings from 132-137' show light gray (132-134') to buff (135') to lt. buffish gray (136-137') limestone that is finely to medium xln and commonly sucrosic w/ local small vugs. At 134 there are ~½ mm laminations of black carbonaceous material interbedded with the gray limestone.

1740 - Leave site for day.

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WEDNESDAY, JULY 31, 1991

Activity: Complete bedrock drilling & set well at MW107C

Personnel: E Clark, Q Nowak, J Crank (Mathes), M Sorensen (CDM, recording)

Weather: 65°, light S winds, clear, predicted high of 90°

0715 - MS arrives at site. Drillers have pumped yesterday's drilling water & are starting compressor for the final 5' of bedrock drilling

0740 - Have drilled 137-142'; water is milky gray and producing at ~40 gal/min. Drilling fairly hard. Cuttings show lt gray limestone same as above with dk gray wavy laminae interbedded ~~& some dk brown films on a few chips~~ M.S. (<1 mm) with the gray limestone & some dk brown films on a few chips. At 142' color is a mod bluish gray. To yel bn chips at 141 & 142. Lithologic sample of 140' cuttings. Dk gray laminae mainly at 138-140 (~5% of cuttings).

M. S. 7-31-91

0755 - Pull drill rods.

0825 - Measure well pipe = 140'9". Will set this well (MW107C) at 141', sand (coarse) from 141' to ~128.5' fine sand from 128.5-127.5', grout 127.5-3', then cement. This is a flush-mounted well, so well pipe will be 3" below ground surface without requiring cutting. Install well pipe.

0855 - Well screen & pipe are at bottom, at 141'1", and will top out at 2 3/4" below ground. Begin pouring coarse sand.

0923 - Coarse sand is up to 129'; 1'5" above top of screen. Now install fine sand.

0953 - Fine sand is up to 128'; now mix Volclay grout.

1040 - Grouted to surface; load up materials, clean up site

1105 - Removed ~~mud~~ M.S. mud tub; now cut the 6" casing & will clean up ground around the hole.

1155 - Break for lunch

1310 - Move rig & vehicles outr. MW102C; decon; sign daily log.

1410 - Leave site for weekend.

(138) MONDAY, AUGUST 5, 1991 —

Activity: Drilling at MW102C

Personnel: E Clark, Q Nowak, D Julius ~~replaced by noon~~ M.S (only until J.M arrives), J McMullen (Mathes drilling subcontractors), M Sorensen (CDM geologist, observing & recording) —

Weather: 70°. moderate SE winds, partly cloudy —

0945 - Arrive at trailer —

1000 - Mathes personnel arrive —

1030 - Mathes drillers arrive at MW102 & begin setting up for drilling.

1105 - Have drilled 5' with 16" auger to setting the mud conductor pipe

1115 - J McMullen arrives —

1140 - Break for lunch; drillers will return rental car —

1300 - Mix mud to prepare for mud rotary drilling —

1400 - Drilled to 33' and circulated mud with bit at that depth in an

Mark Sorensen 8-5-91 —

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attempt to collect sample, but much gravel remains in circulation. So skip this sample and drill on. —

1415 - At 44' hit gray silty till, containing subangular to angular granules & pebbles as well as clay. —

1430 - Have drilled to 57'; till was ~44 to 55.5', followed by sand & gravel.

1550 - Have drilled to 97'; sand & gravel in cuttings, consistent with what was found here on 6/18 & 6/19. —

1630 - At 127', have been having mucky clayey till that drills soft & gums up the bit. —

1650 - At 130.5' hit a seam of coarse, rounded gravel with the typical med gray till as well as some more plastic lt greenish gray clayey till

1655 - Had gravel for only ~2 feet; then back to the plastic till —

1715 - At 147' ~~hit~~ have hit a mixture of brown silty till, lt gr gray clayey till, gr gray silt, med to dk ~~gr~~ gray silty till, granules, and limestone chips. —

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1715- ~~Have~~ drilled to 154' Had some limestone at 147.5-148.5', then clay to ~150 & then apparently limestone below that, perhaps soft or perhaps mixed with till.

1735- At 157' cuttings show ~45% buff limestone chips, 35% ~~brown~~ M.S. yellow-brown silty till & ~20% multilithologic granules. Attempt to clean hole for spoon sample.

1755- Retrieve 157' split spoon sample. Adv./recovery: 4/4" OVB: not working. Sample consists of subangular buff limestone cobbles ~~with~~ M.S. (~60%) with lt grayish brown to yellow brown sandy silt containing subrounded to rounded pebbles of various lithologies.

1825- Hit limestone at 164.5', and it has been solid down to 167'; trip out drill rods & will drill into the limestone another 3' tomorrow; setting casing tomorrow. 1855- Leave MW102C for day.

Activity: Drilling at MW102C
Personnel: G Clark, A Novak, J McMullen (Mathes), M Sorensen (CDM, recording).
Weather: 65°; moderate E winds, partly ~~clear~~ M.S. cloudy

0745- Arrive at site where drillers are shoveling out mud tub of gravel.
0800- ~~Start~~ M.S. Resume tripping out drill rods
0820- Have tripped out; lubricate kelly.
0830- Begin reaming hole w/ 12" bit
1030- Reamed to 75'; MS goes to check on well development at MW108 next with D Julian. MW108C quickly cleaned up (bedrock well); MW108B is pumping quickly, but each episode of surging produces brown water; after pumping for 3 hrs., surge again & will stop pumping when it cleans up (will have pumped >500 gal or ~30 well volumes) - this aquifer must be silty. MW108A not producing much water w/ dual line, so insert single line to try to get the silt etc. out. After pumping

with single line for ≥1 hour, then will insert dual line developer to pump, removing any air bubbles that may have entered aquifer during single line surging & pumping.

1130 - Back at MW102C, drilling at 11'5"

1215 - Lunch break

1320 - Resume drilling/reaming MW102C.

1435 - Have drilled to 165' & are in limestone. Will go ~5' into the bedrock. Cuttings showing angular, buff limestone chips with ≈5% cream-colored silt containing granules (till?)

1505 - Have drilled 4' into the bedrock, to 168.5'. It is very solid, so we will stop here to set casing.

1535 - Have circulated mud with bit at bottom to clean out cuttings from hole; still getting some caving, but now pull rods & will attempt to set casing (6" casing w/ length of 187'7").

1605 - Go to MW107 where D Julius is developing well. MW107B is doing fine: 5 gal in 1 min 20 sec.; have surged ~7 times &

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pumped 1530 until 1730. MW-107A pumping slowly — ~20 gal/hr. Will pump until it clears up ~~the test time~~ M.S after surging at 1715.

1755 - Back at MW102C, they have pulled drill rods & set casing at 168.5'. Now begin mixing 1st bat of cement bentonite grout to seal annular space around 6" casing.

1845 - Tremie in 2nd bat grout.

2015 - Tremie in 7th bat grout; are getting very close to grouting complete annulus.

2020 - Grout returning from hole, so grouting is complete.

2035 - Leave site for day. Drillers pulling tremie pipe.

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(144) WEDNESDAY, AUGUST 7, 1991

Activity: Bedrock drilling at MW102C

Personnel: E Clark, Q Nowak, J McMullen (Mather), M Sorensen (CDM, recording)

Weather: 75°, rain all morning, wind from SE

Drillers spent the morning loading drums onto pallets & decanning drums at MW101; also cleaning up mud tub, etc. used in mud drilling & begin preparing for air drilling. Need to let the grout set a good ~16 hours.

1330 - After lunch, meet drillers at site. They must still do some repairs - replace oil filter on rig, also cut casing (6") and affix "T" diverter for air drilling.

1545 - Begin tripping in rods with air hammer at bottom

1610 - Inject some water into the air to clean out some of the muck inside the 6-inch casing. (Going down slowly inside casing because of the muck.)

1705 - Begin air drilling at MW102C

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at 168.5'

1710 - Drilled 168.5-170.5'; hole is producing a brownish water at ~10 gpm. Cuttings sample at 170' shows a brownish gray to grayish brown limestone, lithographic (cryptocrystalline) and compact (no intergranular porosity).

1745 - Have drilled 170.5-180.5'; producing tan to gray water at ~20 gpm. Cuttings collected on the fort from 171 to 180' show lithographic limestone, w/ no intergranular porosity, locally shaly (~1%); color is brownish gray to grayish brown, both w/ grayish shadowy wisps, at 171 & 172'; also some white colored coral or bryozoans here. At 173-180' color is lt grayish brown, ~5% dk brown shale at 173'.

1815 - Have drilled 180.5-185.0' (total depth). Producing lt gray water at ~30 gpm. Cuttings show v fine-grained limestone, loc finely sucrosic (+ mainly without intergranular porosity).

M.S.

At 181 & 182' color is lt ~~brownish~~ grayish brown ~~gray~~ and there's ~10% dk br shaly lime. At 183' color is lt ~~br gray~~ M.S. grayish brown w/ some bluish gray mottling. At 184 & 185' color changes to lt gray w/ some bluish gray mottling; this zone is slightly argillaceous. The mottling from 183-185' is indistinct and permeates the rock (is not surficial).

Note: on lines 1 through 3 of this page, colors should read grayish brown & not brownish gray.

1840 - Leave site for day.

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THURSDAY, AUGUST 8, 1991

Activity: Well installation at MW102C

Personnel: E Clark, G Nowak, J McMullen (Mathes), M Sorensen (CDM, recording).

Weather: 65°, overcast, moderate ESE winds, showers likely

0805 - Drillers arrive at site; begin tripping out drill pipe

0920 - D Julius came ~~to~~ M.S. with power auger & is now going to install bumper posts. Deconned & measured well pipe (total length 190'-11", including 10'8" screen section with plug on bottom). Now install well pipe & will attempt to set well at 184'; using 5 centralizers.

0955 - Well pipe is in; decide to set well at 185'; coarse sand to 172', fine sand to 171', then grout to 3'. Measure water level: 43' 6". Now install coarse sand.

1040 - Have installed coarse sand to 172' and fine sand to 171'; now trip in tremie pipe.

1055 - Mix Volclay grout to fill

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annular space from 171' to ~3'

1110 - Install 1st tub grout

1200 - 2nd tub grout is in; mix a small 3rd batch.

1220 - Topped off grout, pull tremie rod, go to lunch.

1440 - MS arrived back at MW102C - after making calls. Drillers are decomming & pulling ~~stuff~~ M.S. off site. After lunch, grout had gone down a few feet and they topped off the hole with bentonite chips.

1550 - Pull rig off hole; moving & loading other supplies & tools.

1615 - Leave UC Industries & MW102C, and head for MW111C (near Fed Ex)

1700 - Begin augering 16" hole for the mud conductor pipe.

1745 - Leave site for day

Activity: Drilling at MW111C (Fed Ex area)

Personnel: E Clark, O Novak, J McMullen (Mather), M Sorensen (COM, recording)

Weather: 65°, fair, light-moderate NE winds

0800 - Drillers arrive on-site & begin setting up for mud rotary.

0825 - Begin mixing mud for drilling.

0840 - Begin drilling down with mud rotary.

0920 - Retrieve split spoon collected from 25-30' interval. Adv/recov.: 12"/6". Sample collected for TOC (4 oz. = 2-2 oz. bottles).
Sample consists of poorly sorted sand and fine gravel; sand is coarse to fine, and there is ~30% clay/silt in upper 2" only. One large pebble.

0945 - After doing errands, continue drilling at 25'.

1030 - At 56' now, and have hit some tough gravel, subrounded, w/ ~60-70% limestone pebbles - probably close to U.S. rock.

1045 - Drilling very slowly, at 1" cuttings

are ~80% buff limestone chips, 10% brown silty fill & 10% mafic & qtz pebbles. Pull rods & switch to 12" bit

1110 - Begin drilling & reaming the 6" hole with the 12" bit (mud rotary). —

1205 - Drilled to ~54'; lunch break. —

1315 - Resume drilling. —

1420 - Drilled to 65.5'. (Hard drilling from ~56 to 60' — mainly gravel in cuttings — subrounded, medium pebbles (~ 3/4" diam.) At 60' drilling became more consistent — smoother (not bouncy), but still fairly slow. Cuttings here indicate we're in bedrock: at 65' they are ~80% buff limestone 10% white chert, ~10% jasper & mafic pebbles ~~which~~ M.S. and granules which are commonly subrounded; the chert & limestone are angular chips, — mainly. The jasper & mafic pebbles, along with some of the limestone (pebbles) are apparently fall-in, because they proportionally increased in the cuttings when we turned

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off the drill rotation but kept mud circulating (we were not advancing), so the fall-in increased relative to the cuttings originating right at the drill bit. —

1435 - Wait for casing to arrive —

1455 - Go get casing (6") —

1540 - Arrive back with casing, water.

1550 - Recirculated at 65.5' & now pull drill rods; then will set casing (6

1610 - Tremie pipe (to grout annular space around the 6") is in; now install the 6" casing. —

1650 - 6" casing is sitting at 65'2", which is acceptable (4" from bottom of hole, but we're ~5' into bedrock). —

1715 - Have installed 1 tub grout; now mix second tub.

1745 - Grouting of annular space around the 6" casing is completed. —

1755 - Leave site for day. —

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(152) SATURDAY, AUGUST 10, 1991

Activity: Drilling bedrock at MW-111C

Personnel: F Clark, J McMullen, Q Nowak (Mathes), S Bhagat (CDM, observing & recording in other field book for 0800-1030), M Sorensen (CDM, recording in this book after 1030).

1035- MS arrives at MW111C site. Drillers have moved drums out of way here, and have been setting up for ~~am~~ M.S. air rotary drilling this a.m.

1105- Begin air drilling at MW111C

1130- Drilled 65.5-~~70'~~ 71' - M.S.; produced gray water at ~5 gpm. Cuttings show a buff limestone, v fine-grained, ~~&~~ M.S. sucrosic in part, with a few small vugs; ~~and~~ M.S. white to brownish-gray (zoned) chips of partly silicified limestone (white) & chert constitute ~10% at each interval. A few exotic subrounded mafic pebbles & grout pebbles (mainly at 6[illegible] for the grout) are present throughout.

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1155- Drilled to ~~80'~~ 81' M.S.; drilled fairly easily; produced a tan somewhat frothy water at ~8 gpm. Cuttings very fine to fine-grained limestone, yellow-brown (~~71-78'~~ 72-79' M.S.) to grayish buff or buffish gray (~~79-80'~~ 80-81' M.S.). Quite sucrosic throughout; rare chert. ~10% of chips have rusty coatings in ~~75-79'~~ 76-80' M.S. interval. Overall quite soft, as shown by small size of chips.

1225- Drilled to 91'. Producing gray to tan water at ~10 gpm. Very fine to medium-grained limestone, buffish gray (182-185' & 187-191') and buff (186' - i.e., a light yellow bn). Fairly sucrosic & w/ a few micro-vugs. Almost no other constituents except for ~15% zoned composite chips of part. silicified limestone (white)/chert (lt bn gray) at 85'.

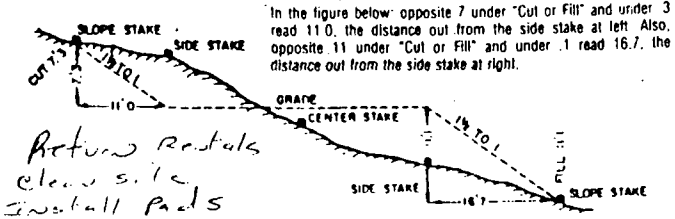
1340- Resume drilling after lunch at 91

1355- Drilled 91-99' (T.D.). Produces tan to gray water @ ~10 gpm. (Continued in Book #

DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING

Roadway of any Width. Side Slopes 1½ to 1.

In the figure below opposite 7 under "Cut or Fill" and under 3 read 11.0, the distance out from the side stake at left. Also, opposite 11 under "Cut or Fill" and under .1 read 16.7, the distance out from the side stake at right.



Return Restals
clean site
Install Pads

Cut or Fill	0	1	2	3	4	5	6	7	8	9	Cut or Fill
	Distance out from Side or Shoulder Stake										
0	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	0
1	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.9	1
2	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	2
3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9	3
4	6.0	6.2	6.3	6.5	6.6	6.8	6.9	7.1	7.2	7.4	4
5	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6	8.7	8.9	5
6	9.0	9.2	9.3	9.5	9.6	9.8	9.9	10.1	10.2	10.4	6
7	10.5	10.7	10.8	11.0	11.1	11.3	11.4	11.6	11.7	11.9	7
8	12.0	12.2	12.3	12.5	12.6	12.8	12.9	13.1	13.2	13.4	8
9	13.5	13.7	13.8	14.0	14.1	14.3	14.4	14.6	14.7	14.9	9
10	15.0	15.2	15.3	15.5	15.6	15.8	15.9	16.1	16.2	16.4	10
11	16.5	16.7	16.8	17.0	17.1	17.3	17.4	17.6	17.7	17.9	11
12	18.0	18.2	18.3	18.5	18.6	18.8	18.9	19.1	19.2	19.4	12
13	19.5	19.7	19.8	20.0	20.1	20.3	20.4	20.6	20.7	20.9	13
14	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.4	14
15	22.5	22.7	22.8	23.0	23.1	23.3	23.4	23.6	23.7	23.9	15
16	24.0	24.2	24.3	24.5	24.6	24.8	24.9	25.1	25.2	25.4	16
17	25.5	25.7	25.8	26.0	26.1	26.3	26.4	26.6	26.7	26.9	17
18	27.0	27.2	27.3	27.5	27.6	27.8	27.9	28.1	28.2	28.4	18
19	28.5	28.7	28.8	29.0	29.1	29.3	29.4	29.6	29.7	29.9	19
20	30.0	30.2	30.3	30.5	30.8	30.8	30.9	31.1	31.2	31.4	20
21	31.5	31.7	31.8	32.0	32.1	32.3	32.4	32.6	32.7	32.9	21
22	33.0	33.2	33.3	33.5	33.6	33.8	33.9	34.1	34.2	34.4	22
23	34.5	34.7	34.8	35.0	35.1	35.3	35.4	35.6	35.7	35.9	23
24	36.0	36.2	36.3	36.5	36.6	36.8	36.9	37.1	37.2	37.4	24
25	37.5	37.7	37.8	38.0	38.1	38.3	38.4	38.6	38.7	38.9	25
26	39.0	39.2	39.3	39.5	39.6	39.8	39.9	40.1	40.2	40.4	26
27	40.5	40.7	40.8	41.0	41.1	41.3	41.4	41.6	41.7	41.9	27
28	42.0	42.2	42.3	42.5	42.6	42.8	42.9	43.1	43.2	43.4	28
29	43.5	43.7	43.8	44.0	44.1	44.3	44.4	44.6	44.7	44.9	29
30	45.0	45.2	45.3	45.5	45.6	45.8	45.9	46.1	46.2	46.4	30
31	46.5	46.7	46.8	47.0	47.1	47.3	47.4	47.6	47.7	47.9	31
32	48.0	48.2	48.3	48.5	48.6	48.8	48.9	49.1	49.2	49.4	32
33	49.5	49.7	49.8	50.0	50.1	50.3	50.4	50.6	50.7	50.9	33
34	51.0	51.2	51.3	51.5	51.6	51.8	51.9	52.1	52.2	52.4	34
35	52.5	52.7	52.8	53.0	53.1	53.3	53.4	53.6	53.7	53.9	35
36	54.0	54.2	54.3	54.5	54.6	54.8	54.9	55.1	55.2	55.4	36
37	55.5	55.7	55.8	56.0	56.1	56.3	56.4	56.6	56.7	56.9	37
38	57.0	57.2	57.3	57.5	57.6	57.8	57.9	58.1	58.2	58.4	38
39	58.5	58.7	58.8	59.0	59.1	59.3	59.4	59.6	59.7	59.9	39
40	60.0	60.2	60.3	60.5	60.6	60.8	60.9	61.1	61.2	61.4	40

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THURSDAY AUGUST 22 1991 (continued)

[Drilling water at MW105D with Ed Clark's rig]

1900 - There was 20' of fall-in when they inserted the tremie pipe (casing not yet inserted); tried to jet out the fall-in, but it's continuing to close in. So tomorrow will knock out the plug in bottom of 6" casing before inserting it, then with casing in hole, jet water down casing to try to make it drop.

1915 - Leave site for day

FRIDAY, AUGUST 23, 1991

Activity: Set casing to bedrock at MW105D; move drums; possibly some well development

Personnel: Ed Clark, Quintin Novak, John McMullan (John Mather & Associates, drillers), Mark Sorensen (CDM, recording)

Weather: 65°, partly cloudy; light & variable winds, predicted high 85°.

0745: Arrive at drillsite where drillers are also arriving. Cut & weld several casing + M.S. segments to use ~~as~~ M.S. to allow jetting of water inside the casing as they insert casing.

0925 - Have welded a top plug, fitting & bail hoist to allow water jetting down the casing; now trip in the 6" casing (144'8" total length), spot-welding along joints.

1010 - 6" casing went down to ~115', where it stopped due to cave-in; then jetted in ~~water~~ mud - M.S., whereby it quickly sank down another 10'; now affix the last 6" casing section.

1025 - Affixed last section of casing, jetted down and got casing to hole bottom at 139'. Now pumping fresh water into casing to get mud out.

1040 - Plug off top of casing so that grout doesn't get in. Now prepare to mix cement-bentonite grout.

1125 - Have tremied in 1 tub grout & now tremie in the second.

1140 - Mixing 3rd tub grout.

1215 - Tremied in 3rd tub; now need cement, so go to lunch.

1345 - Tremied in 4th tub grout & grout returns to surface; now will let grout set overnight & do cleanup.

1435 - Leave MW105D; drillers will decon drums at Post Office (MW110 next) & then load those & others & transport to city well 19 storage area.

1500 - Met geophysical logger at trailer, give him map & take him to MW102C to gamma log.

1605 - Check w/ S Bhagat, who is doing water level survey; leave for day.

Mark Sorensen 8-23-91

Mark Sorensen 8-23-91

SATURDAY, AUGUST 24, 1991 —

Activity: Bedrock drilling and well installation at MW105D —

Personnel: E Clark, J McMullan, Q Nowak (Mather), M Sorensen, C Almanza — (CDM; MS recording)

0810 - Arrive at drillsite;

0820 - Drillers arrive

1000 - Have set up for air drilling

1040 - Drilled 139-151'. Produces tan water ~~that~~ M.S. at ~8 gpm. Cuttings show fine to very finely crystalline limestone, lt ~~brown~~ M.S. grayish brown (140-143 & 146-147), lt yel bn @ 144 & 145, and bn gray at 148-150; predominantly not sucrosic except in the ~~yel bn~~ M.S. zone of 144 ~~& 145~~ to 147'; some rusty stains at 142 to 144'; a few black surficial coating at 148-150'. No shale bentonite or chert; rare calcareous fossils at 147'. —

1110 - Drilled 151-158' Producing dirty tan water that quickly cleaned up ~~at~~ M.S. - within ~1 foot, producing 8-10 gpm. Cuttings show limestone as

Mark Sorensen 8-24-91

above; however, color is lt gy bn @ 151 & 152', gray @ 153', bn gray @ 154-156', & yel bn at 157 & 158. Fairly sucrosic @ 155-158'; greenish gray mottling (~~sh ghosts~~ M.S. ghosts) at 154-156'; few calcite veinlets at 158'.

1155 - Lunch break

1315 - Pull rods from hole & will then set well at 157'.

1340 - Set up gamma logger at MW105D.

1435 - Begin installing sand (coarse 20/40) filter pack around well; screen is at 147-157' & the bottom plug extends to 157.4' Will add ~~fine sand from~~ M.S. coarse sand from 158-145'; fine sand 145-144' then Volclay grout.

1510 Coarse sand at 144.8' ~~at~~ installing 1' of fine sand.

1525 Fine sand at 138.7' installing Vo Clay

Mark Sorensen

(6)

1545 installing Vaclay.
Vaclay mixed 1 Bag initiator
Per Bag of vaclay.

1730 Vaclay at surface, Mathes
Dissembling rig and cleaning
equipment.

1800 left site, Mathes still
Cleaning up. Protective
casing will be put on
tomorrow. lock plug will
be pull on well for the night.

Craig A Almazo

Sunday August 25, 1991 (7)

9.00 AM Arrived on site, Mathes
still cleaning up. Protective
Casing has been put on
MW 105 D.

11.00 Mathes personnel are leaving
with exception of Quentin.
Quentin will spend rest of
day returning equipment rentals,
Cleaning site, and installing
well pads.

I am leaving site. No well
development will be done
today. left this site
at 12:30.

Craig A Almazo

8/27 (Tues)

8:00 Set-up at MW103 well nest

Static Water Level @ MW103-B = 22.49'

Static water level (swl) measured by transducer = -37.78'

MW103B test 2

time, t	head, h	t	h	t	h
6.5	36.80	1.16	33.97	0.18	29.09
6.0	36.77	1.08	33.74	0.16	28.96
5.5	36.75	1.00	33.48	0.15	28.81
5.0	36.72	0.91	33.21	0.13	28.66
4.5	36.67	0.83	32.91	0.11	28.51
4.0	36.58	0.75	32.53	0.10	28.35
3.5	36.47	0.66	32.11	0.08	28.19
3.0	36.28	0.58	31.71	0.06	28.01
2.5	35.99	0.50	31.27	0.05	27.83
2.0	35.51	0.41	30.76	0.03	27.64
1.91	35.40	0.33	30.23	0.03	27.61
1.83	35.29	0.31	30.11	0.02	27.55
1.75	35.16	0.30	30.00	0.02	27.51
1.66	35.04	0.28	29.88	0.02	27.47
1.58	34.90	0.26	29.76	0.01	27.42
1.5	34.74	0.25	29.62	0.01	27.35
1.41	34.58	0.23	29.51	0.00	27.28
1.33	34.38	0.21	29.38	0.00	27.16
1.25	34.19	0.20	29.25	0.00	26.55
				0.00	32.44

Transcribed from 8/26 Notes by R. Lantz:

Well MW-103B Test 1 Pressure held steady @ 8 psi Equil level = 39.27'

5.00	39.02	0.75	30.43	0.06	21.73
4.50	38.92	0.66	29.70	0.05	21.37
4.00	38.75	0.58	28.91	0.03	20.99
3.50	38.49	0.50	28.03	0.03	20.92
3.00	38.08	0.41	27.09	0.02	20.84
2.50	37.45	0.33	26.04	0.02	20.74
2.00	36.48	0.31	25.83	0.02	20.65
1.91	36.27	0.30	25.61	0.01	20.53
1.83	36.04	0.28	25.37	0.01	20.43
1.75	35.79	0.26	25.12	0.00	20.32
1.66	35.52	0.25	24.85	0.00	20.17
1.58	35.23	0.23	24.57	0.00	19.73
1.50	34.90	0.21	24.32	0.00	22.09
1.41	34.50	0.20	24.07	0.00	22.09
1.33	34.13	0.18	23.80		
1.25	33.72	0.16	23.54		
1.16	33.28	0.15	23.27		
1.08	32.80	0.13	22.97		
1.00	32.28	0.11	22.67		
0.91	31.71	0.10	22.37		
0.83	31.10	0.08	22.08		

8/27 (cont'd.)

MW103B Test 3 8/27 10:51
used the In-Situ printer to dump the data (see paper tape)
MW103C Test 1 8/27 11:40
MW103C Test 2 8/27 11:54
MW103C Test 3 8/27 12:01

1340 - Measure water level (from top of 2" casing) at MW103A: 22.91'
MW103C: 22.37'

MW103A, test 1 8/27 13:42
— bad test?
MW103A, test 2 8/27 14:14
MW103A test 3 8/27 15:14
MW103A test 4 8/27 15:58

~~Mea~~ ~~After~~ M.S. test 4: began entering the measured depth to water as reference level. In test 3, entered the equilibrium transducer level of 20.31. (Test 4: 22.91')

1645 - Go to MW111B (48-58' screened depth) and measure water level: 24.95' below top of casing. Now perform test:
MW111B, test 1 8/27 1644

Mark Sorensen 8-27-91

(11)

[Notes from 8/26 Transcribed in this field book on 8/27.]

Activity: Well development
Personnel: A Novak, M Sorensen
Weather: 95° fair but hazy, S wind.

1400 - Meet A Novak @ MW106 west where he is attempting to restart air compressor (Has already pumped MW106B & C for ½ hour each).

1425 - R Lantz & C Almanza stopped by & are looking for parts for the slug test apparatus they are constructing.

1515 - Finished developing at MW106B & C, where both wells are producing clear ~~to slightly~~ M.S. water at 200 gal/hour. Now go to trailer to make calls, take Quinton to return the forklift, get equipment to splice hose.

1655 - Back at MW105 to develop well MW105D.

1815 - MW105D is developing well-water only slightly cloudy and producing M.S.

Mark Sorensen ~~8-26-91~~ 8-27-91

water at ~100 gal/hour. Told Quintin to pump another 45 minutes (surged this one once). Back to trailer & meet CAlmanza & R Lanty who have succeeded ~~on~~ M.S. in completing one slug test at MW103B.

Mark Sorensen 8/27/91 (Notes for 8/26/91)

Continued from page 10]

MW111B, test 2 8/27 1706

MW111B, test 3 8/27 1725

At 1750, left site for day

Mark Sorensen 8-27-91

WEDNESDAY, AUGUST 28, 1991

Activity: Slug testing

Personnel: M Sorensen, CAlmanza

Weather: sunny, light winds, humid, predicted high of 92°

0905 - Fill air tank, then go to MW-111C to conduct 3 slug tests.

Slug test MW111C 8/28 0958 — test 1

Slug test 2 MW111C 8/28 1036

Test 3 MW111C 8/28 1055

1130 - Fill tank with air & go to MW-104.

MW104C, test 1 8/28 at 1154

Test 1 appears to be bad (no head differences)

MW104C test 2 8/28 1204

Mark Sorensen 8-28-91

MW104C test 3 8/28 1211
MW104C test 4 " 1219
Measure water level at MW-104A: 40.99' from TIC (top of inner or 2" casing) Enter this as the reference & then ~~insert a~~ M.S conduct tests at MW104A
Also measured water level at MW104B: 41.43'
MW104A test 1: 8/28, 1446
" " 2 " 1506
" " 3 " 1528
MW104B test 1 " 1552
" " 2 " 1603
" " 3 " 1624
1650 - Finish at well nest 104 & move to MW101 nest; measure water level at MW101A: 48.50'
MW101A test 1: 8/28, 1659
" " 2 " 1706
" " 3 "
1735 - Leave site for day

Mark Sorensen 8/28/91

THURSDAY, AUGUST 29, 1991

Activity: Slug testing
Personnel: C Almanza, M Sorensen (recording)
Weather: fair, hazy, humid, predicted high is 90°
0810 - Measure water level at MW-101B: 49.02' from TIC
Then conduct slug tests at MW ~~100~~ M.S 101B (see paper tape):
MW101B test 1 8/29, 0830
" " 2 " 0912
" " 3 " 0926
1010 Refill tank with air & then go to MW106 nest; measure water level at MW106B: 25.62'
Slug tests: MW106B test 1 8/29 @ 1031
" " 2 " 1049
" " 3 " 1101
Measure water level at MW-106C: 24.52'
MW106BC M.S test 1 8/29 1213
" " 2 " 1234
This well seems to have leaky casing - doesn't hold pressure

Mark Sorensen 8-29-91

constantly leaks

1240 - Measure water level in MW-~~16~~ M.S. 106A: 21.73

MW106A. test 1 8/29 1254

" " 2 " 1315

" " 3 " 1324

1400 - Move to MW110B to do slug tests, but the casing leaks. Try 110C.

MW110C - test 1, 8/29, 1424

" " 2 " 1434

Leave site for week.

Mark Sorensen 8-29-91

Wednesday 9/4/91

1430 Setting up to sample MW-101A.

Personnel: Mike Nugent (CDM Atlanta), M Sorensen.

1431 Water level taken in MW-101A.

water is 48.60 ft below top of Casing

HNU reading when well opened 0 ppm

1436 Set up to purge MW-101A

purge vol (gal)	pH	Conductivity (uS/cm)	Temp (°F)	Water Color
2	7.46	6.97 x 100	72.7	tan cloudy
10	7.52	6.57 x 100	65.2	clear
15	7.57	6.53 x 100	62.3	clear
21	7.61	6.51 x 100	58.9	clear

pH meter calibrated this morning meter is Cambridge Scientific Ind serial no. 9012

1515 Generator ran out of gas. Mark Sorensen is going to get more gas.

1558 Finished purge of MW-101A

25 gallons was purged.

1600 Sampling MW-101A.

1705 Small slivers of electrical tape are noted in the VOA samples taken MW-101A.

9/4/91

1712 Leaving MW-101A site to decontaminate the pump for MW-101B.

1804 Setting up to purge and sample MW-101B.

1807 Water level measurement taken on MW-101B. Water level below top of casing is 49.01 ft. HNU reading taken inside the top of well. HNU reading 0 ppm.

1824 Starting Purge of MW-101B.

Purge Vol. (Gal)	pH	Conductivity mS/cm	Temp (°F)	Water Color
5	7.72	6.29 x 100	57.6	Clear
25	7.68	6.19 x 100	56.2	Slightly cloudy
35	7.65	6.10 x 100	56.1	Slightly cloudy/clay
48	7.66	6.06 x 100	55.9	Clear
52	7.67	6.05 x 100	55.7	Clear

1843 ~~Et~~ Water in MW-101B was ~~to~~ sampled ~~and~~ for chlorine. No chlorine was present.

Michael Nugent 9/4/91

9/4/91

1854 Black plastic shavings were observed around the top of the casing and possibly in the well on MW-101B

1901 Samples are being taken on MW-101B

1932 Sampling complete on MW-101B loading Van ~~and~~ to head back to the CDM Trailer.

Michael Nugent 9/4/91

Thursday 9/5/91

0944 Setting up on monitor well MW-103C to purge and sample

0958 pH meter serial no. 9012 calibrated

1001 MW-103C opened and an HNU reading was taken the meter reading was 0ppm.

1005 Water level measurement taken in MW-103C. The water level was 22.56 ft. below the top of casing.

1022 Purging MW-103C

Purge vol. (gal)	pH	Conductivity µS/cm	Temp °F	Water Color
5	7.77	5.81 x 100	57.1	clear
25	7.51	5.92 x 100	55.1	slightly tan
35	7.54	5.77 x 100	54.8	slightly tan
45	7.34	5.73 x 100	55.0	clear

Drum water was tested for Chlorine and found to have 0.02 mg/l chlorine present

1113 50 gallons was purged from MW-103C.

Michael Nugent 9/5/91

9/5/91

1115 Sample is being taken from MW-103C.

1200 - Completed collection of sample & leave site now.

1442 Setting up to purge and sample MW-103A.

1445 MW-103A was opened and a HNU reading was taken. HNU reading was 0ppm. A water level reading was also taken. The water level was 23.06 ft below the top of casing.

1456 Started purge of MW-103A.

Purge vol. (gal)	pH	Conductivity (µS/cm)	Temp (°F)	Water Color
2	7.13	1.56 x 1000	63.0	Clear
5	6.98	1.54 x 1000	61.8	Tan Cloudy
9	7.20	1.39 x 1000	58.2	Tan Cloudy
11	7.27	1.24 x 1000	57.7	Tan Cloudy

Chlorine test performed No chlorine was detected

1556 Sample taken of MW-103A

9/5/91

1627 Completed sampling of MW-103A.

1628 Setting up ~~st~~ to ~~sample~~ ~~to~~ purge and sample MW-103B.

1630 ~~a~~ Monitor well MW-103B was opened and ~~the~~ an HNu reading was taken ~~[illegible]~~. The HNu reading was 0ppm. The water level in the well is 22.60 ft below the top of the casing.

1643 Starting purge of MW-103B

purge vol. (gal)	pH	Conductivity us/cm	Temp °F	Water Color
5	7.60	5.60 x 100	58.5	clear
15	7.59	5.40 x 100	55.6	clear
20	7.61	5.38 x 100	55.3	clear
28	7.62	5.43 x 100	56.2	clear

Chlorine test performed. no chlorine present.

1704 - Purged 30 gal. Begin collecting filtered samples.

Michael Nugent 9/5/91

9/5/91

1705 Sample being taken from MW-103B.

1733 Sampling of MW-103B complete.

Michael Nugent 9/5/91

Friday 9/6/91

0907 Setting up to purge and sample MW-105A. HNU reading taken when the well was opened. 0ppm measured on the HNU. Water level measured in the well MW-105A at 6.29 ft below the top of casing.

0909 Starting purge of MW-105A.

Purge vol (gal)	pH	Conductivity µS/cm	Temp °F	Water Color
2	7.39	5.80 x 100	58.8	tan
4	7.42	5.97 x 100	60.6	tan
6	7.44	6.03 x 100	61.0	tan

0945 Began collecting filtered samples

1029 Set up and ready to purge and sample MW-105B. HNU reading upon opening well was 0ppm. Water level in well is 6.08 ft below the top of casing in MW-105B.

1038 Starting purge of MW-105B

Michael Barnett 9/6/91

9/6/91 (25)

MW-105B.

Purge vol (gal)	pH	Conductivity µS/cm	Temp °F	Water Color
4	7.82	6.59 x 100	56.8	clear
12	7.69	6.95 x 100	54.8	very slightly cloudy
20	7.74	6.95 x 100	54.5	clear
28	7.72	6.87 x 100	53.2	clear
32	7.74	6.95 x 100	54.4	clear

36 gallons purged from MW-105B.

1105 Started sampling MW-105B.

1133 Sampling complete on MW-105B.

1427 Setting up to purge and sample MW-105C. HNU reading upon opening MW-105C to 0ppm. Water level for MW-105C is 9.22 ft

Purge Vol (Gal)	pH	Conductivity (µmhos)	Temp °F	Water Color
4	7.90	624	57.4	Clear
16	7.66	690	55.0	Cloudy-Clearing
28	7.54	680	55.8	"
36	7.68	675	54.4	"
44	7.71	[illegible]	[illegible]	"

9/6/91

1511 Sample being taken from the pump on MW-105C.

1530 Sample taken for rinsate (Equipment) Blank MW-105C(R) sample was poured through a decontaminated bailer and filtered samples were filtered through the mast-flex Centrifugal pump.

1609 Completed Sampling MW-105C and MW-105C(R) and Setting up to purge and sample MW-105D.

1610 MW-105D has been opened. HNU reading in MW-105D was 0ppm. The water level in the well is at 10.24 feet below top of casing.

Michael Mergent 9/6/91

9-6-91

(27)

MW 105D Purge Volume is 75 gallons

Purge Volume Gal	pH	Cond. (umhos)	Temp °F	Water Color
4	7.90	585	56.3	Slightly Cloudy
20	8.01	566	55.5	Clear
40	8.12	520	55.5	Clear
60	8.03	505	55.2	Clear
75	8.06	493	55.1	"

80 gallons purged

MW 105D Sampled at 1730

Duplicate sample taken on MW 105D it is MW 105D(D) taken at 1800

MW 105D has a slower recharge rate than MW 105 B and C

Steady max flow rate of ≈ 1.33 gpm

1805 Completed sampling of MW-105D and MW-105D(D) (Duplicate). Leaving the MW-105 well site.

Michael Mergent 9/6/91

9-9-91 Monday

1010 Setting up to sample MW-106B
Water level in MW-106B is 25.77 ft below top of casing.
HNU reading when well was opened is 0ppm.

1037 Starting purge of MW-106B

Purge vol (gal)	pH	Conductivity us/cm	Temp °F	water color
8	7.34	6.93 x 100	62.2	clear
16	7.32	6.78 x 100	59.3	clear
24	7.35	6.70 x 100	57.4	clear
32	7.33	6.74 x 100	58.2	clear

Chlorine test taken on water from MW-106B no chlorine present in the well. PH meter ~~[illegible]~~ serial no. 9011 calibrated this morning with buffer solution of 7.0 and 10.0
purge completed on MW-106B a total of 35 gallons was purged from the well.

1106 Sample being taken on MW-106B.
Filtering apparatus was left in the first teams sampling van. Mark went to get it.

Michael [illegible] et al.

9/9/91

1456 MW-106C is being opened an HNU reading was taken. The measurement was 0ppm. The water level in ~~the~~ MW-106C is ~~at~~ 24.63 ft below the top of casing.

1511 Starting purge of MW-106C

Purge Vol (gal)	pH	Conductivity us/cm	Temp °F	Water Color
8	7.36	5.06 x 100	63.4	clear
16	7.36	4.88 x 100	57.8	slightly cloudy
32	7.40	5.32 x 100	58.8	very slightly cloudy
~~40~~ 49	7.41	5.50 x 100	59.9	clear

Chlorine test performed in MW-106C No free chlorine detected.

1544 Sample being taken from MW-106C
A total of 54 gallons was purged from MW-106C.

1618 Completed sampling of MW-106C

1619 Setting up to sample MW-106B

9/9/91

1622 Starting purge of MW-106A. HNU reading on open well is 0ppm. Water level in MW-106A is 21.94 ft below the top of casing.

Purge Vol (gal.)	pH	Conductivity µS/cm	Temp °F	Water Color
2	7.43	7.67x100	66.0	Tan cloudy
5	7.60	7.82x100	66.9	Tan cloudy
8	~~7.39~~ 7.43	7.37x100	61.9	Tan cloudy clearing
11	~~7.49~~ 7.36	7.49x100	61.2	Tan cloudy

Purged approximately 14 gallons.

1728 Started sampling MW-106A.

1730 Started sampling MW-106A Matrix spike!

1834 Completed sampling of MW-106A.

Michael Mergent 9/9/91

9/10/91 Tuesday

(31)

0825 Calibrated pH meter serial no. 9012 with 7.0 and 10.0 buffer solution

0853 Setting up to purge and sample MW-109B. HNU reading upon opening the well is 0ppm. The water level in the well is 30.23 feet below the top of casing.

0910 Starting purge of MW-109B.

Purge Vol (gal.)	pH	Conductivity µS/cm	Temp °F	Water Color
4	7.82	7.16x100	59.8	Slightly cloudy
8	8.62	7.04x100	60.8	Clear
12	9.06	6.99x100	60.6	Clear
17	7.78	7.12x100	63.7	Clear
20	8.19	6.92x100	62.3	Clear

Well ~~was~~ MW-109B was slow to recover and well was ~~drying~~ pumping dry.

1002 - Pumping additional volume to allow readings to stabilize

24 gal	pH	conduct. µS/cm	temp. °F	clear
	8.33	6.93x100	61.6	Clear

Michael Mergent 9/10/91

9/10/91

1006 Samples being taken from MW-109B. 25 gallons was purged from the well.

1032 Completed sampling of MW-109B.

1033 Setting up to purge and sample MW-109A. HNu reading taken upon opening well was 0ppm. Water level in well is at 30.67 feet below the top of casing.

1045 Starting purge of MW-109A.

Purge Vol (gal)	pH	Conductivity us/cm	Temp °F	Water Color
1	8.76	1.12x1000	64.8	Tan cloudy
2	8.08	105x1000	66.8	tan
3	8.71	9.80x100	61.1	tan
5	8.55	9.86x100	62.1	tan

Purged ~~at~~ a total of 6 gallons

1100 Began collecting sample

1204 Completed sampling of MW-109B.

9/10/91

1510 Setting to purge and sample MW-109C. A rinsate equipment blank (Field blank) will be poured prior to purging MW-109C. This blank will be taken through the Grundfos submersible pump.

1521 Field blank MW-109C(A) taken. D.I. water was used and was pumped through the pump and hose used in sampling.

1549 HNu reading upon opening MW-109C was 0ppm. Water level in MW-109C was 30.36 feet below the top of casing.

1556 Starting purge of MW-109C.

Purge Vol (gal)	pH	Conductivity us/cm	Temp °F	Water Color
8	7.33	6.38x100	58.2	clear
16	7.31	6.38x100	56.9	clear
24	7.42	6.35x100	55.2	clear
~~24~~ 32	7.38	6.36x100	55.6	clear

9/10/91

Chlorine test performed on MW-109C show no chlorine in the well water. Total purge on MW-109C was 36 gallons.

1615 Sample being taken from MW-109C

1038 Completed sampling of MW-109C

1652 Setting up on MW-110A to purge and sample it. HNU reading when well was opened was 0ppm. Water level is at 30.57 feet below the top of casing.

1701 Begin purging at MW110A

purge volume (gal.)	pH	temp (°C)	conductiv (µS/cm)	Water color
2	7.46	67.0	4.37×1000	tan
4	7.51	61.6	1.18×1000	tan
5	7.26	59.9	1.18×1000	tan
6	7.20	59.2	1.16×1000	tan

1726 Begin collecting sample

Michael Nugent 9/10/91

9/10/91

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1951 Completed sampling of MW-110A. Sampling was delayed due to a dropped bailer down the well.

Michael Nugent 9/10/91

9/11/91 Wednesday

0959 Setting up to purge and sample MW-110C. HNU reading upon opening the well was 0ppm. The water level in the well 37.31 ft below the top of casing.

1019 Starting purge of MW-110C.

Purge Vol (gal)	pH	Conductivity µS/cm	Temp °F	Water Color
8	7.89	5.30 x 100	56.7	clear
16	8.40	5.29 x 100	55.7	clear
24	9.22	5.28 x 100	55.6	very slightly cloudy
32	8.55	5.30 x 100	56.5	very slightly cloudy
38	8.39	5.21 x 100	55.2	clear

pH meter, serial no. [illegible] calibrated this morning with 7.0 and 10.0 buffer solutions

Purge cont	pH	Conductivity	Temp	Water Color
44	9.21	5.15 x 100	54.2	clear
56	9.03	5.19 x 100	55.1	clear

Chlorine test showed no chlorine in MW-110C.

1100 Sample been taken from MW-110C.

Michael Nugent 9/11/91

9/11/91

1110 Sample matrix blanks of MW-110C taken.

1405 Setting up to purge and sample MW-110B. HNU reading upon opening well was 0ppm. Water level in the well to 36.78 feet below the top of casing in MW-110B.

1423 Started purge of MW-110B.

Purge Vol (gal)	pH	Conductivity µS/cm	Temp °F	Water Color
4	9.17	9.37 x 100	58.4	very slightly cloudy
8	10.68	1.05 x 1000	56.4	slightly cloudy, almost clear
12	10.38	1.28 x 1000	56.3	same as above
16	10.08	1.27 x 1000	56.2	very cloudy
19	9.42	1.28 x 1000	56.4	very cloudy, almost clear

Total of 24 gallons purged from the well MW-110B.

1445 Started sampling of MW-110B.

1453 Completed sampling of MW-110B

1455 Sampling MW-110B duplicate

1522 Completed sampling of MW-110B

9/12/91

0851 Setting up to purge and sample the State well MW-11. HNU reading upon opening well is 0ppm. Water level in well is at 21.26 feet below the top of casing. Sounded depth of well is at 25.37 feet below the top of casing.

0901 Starting purge of MW-11. 2 gallons will be purged from the well.

Purge Vol. (gal)	pH	Conductivity uS/cm	Temp °F	Water Color
2	7.69	2.10×1000	62.8	tan cloudy
4	7.40	1.54×1000	58.5	tan cloudy
6	7.38	1.48×1000	57.9	tan cloudy
8	7.35	1.44×1000	58.8	tan cloudy

pH meter ~~701~~ serial no 7012 calibrated this morning with pH buffer solution of 7.0 and 10.0.

0920 Began sampling well MW11 (State Water Survey well)

Michael C Nugent 9/12/91

9/12/91

1012 Completed sampling of MW-11

1031 Setting up to purge and sample State monitor well MW-23. HNU reading upon opening the well is 0 ppm. The water level in the well is 35.33 feet below the top of casing.

1047 Starting purge of MW-23. 16 gallons will be ~~be~~ purged from the well.

Purge Vol. (gal)	pH	Conductivity uS/cm	Temp °F	Water Color
4	7.91	8.96×100	~~57.6~~ 58.4	slightly cloudy
8	8.37	9.12×100	59.4	clear
12	8.06	8.87×100	55.9	clear
16	7.94	8.81×100	55.6	clear

Completed purge of MW-23. ~~[illegible]~~ 20 gallons of water was purged from the well. A chlorine test performed on the water showed no chlorine present in the water.

9/12/91

1114 Sampling MW-23.

1130 Completed sampling MW-23.

1518 Setting up to purge and sample stationmaster well MW-28. A dedicated pump was removed from the well and a HNu reading was taken in the well. A measurement of 0 ppm was recorded. The water level in the well was measured at 72.58 ft below the top of casing.

1524 Starting purge of MW-28. 16 gallons will be purged from the well MW-28.

Purge Vol (gal)	pH	Conductivity us/cm	Temp °F	Water Color
4	8.96	8.11 x 100	58.5	brown cloudy
8	7.43	8.19 x 100	57.6	slightly cloudy
12	7.40	8.51 x 100	59.8	slightly cloudy
16	7.14	8.53 x 100	59.9	slightly cloudy

Chlorine test performed on MW-28 water. No chlorine was present.

Michael Nugent 9/12/91

9/12/91

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1605 Sample being taken in MW-28. 18 gallons was purged from the well.

1630 Completed sampling MW 28; now clean up & depart site.

Michael Nugent 9/12/91

9/13/91 Friday

0947 Calibrating pH meter, serial no. K9970115 with 7.0 and 10.0 buffer solution

1014 Setting up to purge + sample State MW 15. HNU reading upon opening the well is 0 ppm. A dedicated pump was removed from the well The depth to water is 41.04 feet below the top of the casing

1032 Starting purge of MW MW 15 6 gallons will be purged

Purge vol (gal)	pH SU	Cond µS/cm	Temp. °C	Color
2	7.38	9.13x100	14.1	brown cloudy
4	7.11	8.10x100	5[illegible].6	[illegible]
6	7.72	8.24x100	14.2	clearer

1130 Cl test performed - no free Cl present in the well water

1145 sample being taken

[illegible] 9/13

9/13/91 (43)

1211 Completed sampling of MW-15

1408 A round of water level readings from the CDM monitor wells is being taken.

monitor well no.	Depth to water from top of casing (ft.)
MW-101A	48.43
MW-101B	48.89
MW-102A	24.40
MW-102B	42.82
MW-102C	47.40
MW-103A	22.92
MW-103B	22.50
MW-103C	22.41
MW-105A	5.15
MW-105B	5.68
MW-105C	9.05
MW-105D	10.09
MW-106A	21.99
MW-106B	25.68
MW-106C	24.00
MW-109A	30.65
MW-109B	30.19

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monitor well no.	Depth of water below top of casing (ft)
MW-109C	30.37
MW-108A	29.47
MW-108B	29.23
MW-108C	28.48
MW-111A	25.66
MW-111B	25.37
MW-111C	26.15
MW-110A	32.87
MW-110B	~~36.88~~ 36.82
MW-110C	37.29
MW-107A	16.96
MW-107B	16.88
MW-107C	16.95
MW-104A	41.19
MW-104B	41.69
MW-104C	43.64

1633 Water level measurements completed

Michael Nugent 9/13/91

9/16/91

(45)

0949 Setting up to purge and sample State Monitor well no. 22 MW-22. HNU - 0 ppm
PH meter serial no. ~~[illegible]~~ K9976115 calibrated with 10.0 and 7.0 Buffer solution

9 56 Water level 24.85 ft (TOC) in MW-22.

1002 Starting Purge of MW-22.

Purge vol (gal)	pH	Conductivity us/cm	Temp °F	Water Color
2	7.93	7.46 x 100	60.2	Brown Cloudy
4	7.58	9.45 x 100	58.0	Brown Clearing
8	7.65	7.22 x 100	56.6	Slightly Cloudy
10	7.62	7.22 x 100	56.6	Slightly Cloudy

Chlorine test performed on water from MW-22. No chlorine was present.

1017 Completed purge of MW-22 a total of 14 gallons of water was purged from the well.

1018 Sample being taken of MW-22
1043 completed work at well.

9/16/91 [illegible]

9/16/91

1345 Setting up to purge and sample Slat monitor well MW-21. HNU - 0ppm

water level reading: 27.65 ft (TOC)

13:59 - Starting purge of MW-21.

Purge vol (gal)	pH	Conductivity µS/cm	Temp °F	Water Color
2	7.90	7.39 x 100	61.3	slightly cloudy
4	7.81	7.22 x 100	58.8	clear
8	7.85	7.18 x 100	58.1	clear
10	7.74	7.16 x 100	58.5	clear

Chlorine test performed on MW-22 well water. No chlorine was present. 14 gallons of water was purged from MW-22.

1414 Sample being taken from MW-22.

14:30 Duplicate sample of MW-22 being taken.

14:35 Work at well completed.

[illegible] 9/16/91

9/16/91

1550 Setting up to purge and sample Slat Monitor well MW-30. HNU reading upon opening well was 0ppm. Water level in well is 34.20 feet below the top of casing.

1603 Starting to purge MW-30.

Purge vol (gal)	pH	Conductivity µS/cm	Temp °F	Water Color
2	7.87	7.69 x 100	63.50	slightly cloudy
4	7.74	6.68 x 100	59.7	Clear
8	7.68	6.46 x 100	57.0	Clear
10	7.83	9.48 x 100	67.1	Clear
14	7.73	7.50 x 100	66.8	Clear

Chlorine test performed on MW-30 well water. No chlorine was present. 14 gallons of water was purged from the well MW-30.

1619 Sample is being taken from MW-30

[illegible] 9/16/91

9/17/91

0813 Setting up to purge and sample ~~MW~~ State monitor well MW-9. HNu reading in opened well 0 ppm. Water level in well is at 21.56 feet below the top of casing.

PV, gal	T, °F	cond µmho×1000	pH	Water color
4	58.6	9.98	7.92	tan cloudy
8	60.1	10.08	8.00	tan cloudy
12	61.9	10.21	8.01	tan cloudy clearing
16	60.5	11.56	8.10	slightly cloudy

pH meter (calibrated in a.m.) and 10 pH buffers.
Chlorine test performed. No chlorine was present in the well water.
16 gallons of water was purged from the well. The well went dry two times.

0914 Sample being taken from MW-9

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0945 Completed sampling of MW-9.

10.59 begin Well 29
setting equipment
HNu 0 ppm
~~well~~ water level is
21.59 feet below top of casing. Well purge is 10 gallons.

PV, gal	T, °F	cond µmho×1000	pH	Water color
2	62.5	1.17	7.83	clear
4	60.5	1.13	7.85	clear
8	60.7	1.12	7.76	clear
10	58.8	1.11	7.80	clear

11.28 purged 12 gallons before sampling well.
1127 no Cl_2 present.

1155 Completed sampling of MW-29.

1450 Setting up to purge and sample State Monitor well MW-32. HNu reading 0 ppm upon opening the well.

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1455 depth to water 32.82 ft below top of casing

1502 Starting purge of MW-32.

Purge Vol. (gal)	pH	Conductivity µ/cm	Temp °F	Water Color
2	7.67	1.29 x 1000	64.4	Clear
4	7.69	1.22 x 1000	58.8	Clear
8	7.73	1.21 x 1000	57.9	Clear
10	7.73	1.19 x 1000	56.7	Clear

Chlorine test performed on well MW-32 water. No chlorine was found to be present. 14 gallons of water was purged from MW-32.

1518 Sample being taken from MW-32.

1544 Completed the sampling of MW-32.

Michael Mugent 9/17/91

(51)

MONDAY, SEPTEMBER 30, 1991

Activity: Monitoring well sampling at Sundstrand facility, southeast of Alpine & Harrison.

Personnel: Peter Miller, Peter Barys, Carol Radelaugh, ~~Jim~~ M.S. Jim Grippa (Harding-Lawson Associates), Al Munn, ~~Darrell~~ M.S. (Sundstrand)

Weather: 62°, fair, strong SW winds.

0815 - Meet Bob Miller (Sundstrand), Carol & Al at Sundstrand office (2-story bldg. facing Harrison). Ironed out sample locations & protocol.

0845 - Go to MWS 32A (stands for Mon. Well Sundstand 32A) & meet Peter & Peter of Harding Lawson Assoc. (HLA). Begin purging the well. Water level = 46.16 feet.

0920 - Begin collecting water sample from ~~MW3~~ M.S. MWS-32A - we are taking 4 VOC vials, 2 pesticides & one BNA.

pH = 7.23, conductiv. = 580 µmho/cm readings taken by HLA

Mark Sorensen 9-30-91

HLA personnel are collecting the samples, alternating the filling of our bottles with filling theirs. In order to avoid bailer leakage, they are finding it necessary to shake the bailer once to seat the check ball.

1105 - After buying ice & dropping off Yan Yan at the trailer, M.S. goes back to meet with the bailer team which just began purging at well ~~MW23~~ M.S. MWS-23 SE of building 6.

1148 - Read swl (static water level) at MWS-23 after purging 11.5 gals: 42.14. Total depth = 68.18' below top of 2". Initial water level was 41.62'. f M.S.

1200 - Begin collecting ground water sample from MWS-23.

1240 - Lunch break

1310 - Go to MWS-~~29~~ M.S 29, where ~~Al~~ M.S. Jim Grippa & ~~Carol~~ M.S. Carol R. are completing purging.

1335 - Begin collecting sample from 29

Mark Sorensen 9-30-91

Readings: conductivity 500 µmho/cm, pH = 8.0, temp 11.9°C

SWL = 32.0 before sampling

1355 - Sampling is complete; now decon the pump (using Bennett pump which uses air) by running 5 gals. distilled water through pump & hose (3 hose volumes).

1405 - Now collect a rinsate blank ~~15~~ M.S sample, which is MWS29(R), using 5-gal tub of distilled water

1515 - At MWS33, they are preparing to purge the well. SWL =

1550 - Go to MWS34A - completing purge SWL before ~~pumping~~ bailing - M.S. = 35.75'; after bailing ~~swl~~ M.S. 3.4 gal (total purged), swl = 35.80'

1600 - Collect sample at MW34A.

Note: The other bailed wells (MWS23 ~~(MW23~~ & 34A) haven't had sand, & the bailer hasn't leaked; however, they still shake the bailer once to seat the check ball

The other crew is taking their

M.S.

Mark Sorensen 9-30-91

volatile directly through the Bennett pump - this is questionable because the pump puts air down the well ~~They~~ M.S

Final purge water parameters: cond = µmho/cm, pH = temp =

1630 - Go to MW33 - purging is complete Final parameters: cond = 460 µmho/cm pH 7.22; temp 12.1; d.o. = ~~mg/l~~ M.S 5.5 mg/l

MW33 also sampled by Bennett pump. Collected MW33 starting at 1635

1655 - Leave site & go to package samples

Mark Sorensen 9-30-91

TUESDAY, OCTOBER 1, 1991

Activity: Groundwater sampling at Sundstrand facility with HLA (Harding Lawson Assoc.) personnel

Personnel: P Miller, P Barry, C Radebaugh, J Grippa (HLA), M Sorensen (CDM, recording)

Weather: 55°, mostly cloudy, calm, high predicted in mid-70s

0740 - Meet P Miller & P Barry at MWS-33A just E of Yale Drive.

0815 - Begin collecting MW533A sample. Parameters: cond. 1320 µmho/cm pH: 7.12; temp: 12.5°C swl: 10.28; 26.9 after bailing 7.18 gals.

0840 - Go to ~~MW2~~ M.S MWS-28A where pump team has finished purging. Parameters: pH = 7.29; temp 12.3°C; cond = 500 µmho/cm; d.o. = 1.8 mg/l; swl = 32.75

0850 - Collect groundwater sample from MWS28A; then go drop off samples, get ice.

1005 - Meet bailer team at MWS-41 on Yale S. of Carthage, where they are

Mark Sorensen 10-1-91

completing purging.
Final parameters: temp = 16.5°C, cond. = 960 µmhos/cm, pH = 7.11; M.S.
Swl before bailing = 10.48'; after bailing 3.6 gal in 25 min.: 11.03'; total depth of well = 25.03'.
Note: T.D. of MW33A was 31.67.
1010 - Collect sample at MWS-41
1040 - Go to MWS-34 - Bennett pump team.
1045 - Collect MWS-34; final parameters: pH = 7.26; temp: 12.7°C; cond: 600 µmho/cm; d.o.: 1.4 mg/l. Swl (before purging) = 35.83'.
1315 - Drop off sample bottles at MWS-37 on Forest View ½ block S. of Harrison (E side); HLA personnel will sample this well.
1335 - Begin sampling at MWS-9; final parameters: cond. = 600 µmho/cm; pH = 8.0; temp = 14.1°C; d.o. = 5.8 mg/l; swl = 39.96'.
1355 - Check again on MWS-37 sample now being conducted. Sample was collected beginning at 1320. Final water quality para

Marla Sorensen 10-1-91

meters: pH = 7.45; temp = 12.3°C; cond.: 590 µmho/cm. Swl before bailing: 49.61'; after bailing 4 gal in 15 min: 51.28'; total well depth = 61.21'.
1530 - Go to MWS-10 where purging is complete; parameters: pH = 7.96; cond = 600 µmhos/cm; temp 12.8°C; d.o. = 7.0 mg/l; Swl = 42.62 before purging.
1535 - Collect sample through Bennett pump for MWS-10.
1555 - Go to MWS-40 where bailing team has just completed purging. Located 20' W of Forest View, 160' N of 28th Ave.
1605 - Begin sampling MWS-40. Final parameters: pH = 6.99; cond. 870 µmho/cm; temp: 14.0°C; Swl = 25.90 before purging & 26.28 after purging (bailing) 4.6 gal in 25 minutes (total purged = 6.9 gal)
1650 - Begin sampling rinsate blank at MWS-40, to be called MWS-40(R). Sampled with bailer (decon'd) w/ distilled water.

M Sorensen 12-16-91

Note: Collected duplicate at MWS-10, called MWS-10(R), beginning at 1545.

1725 - Go back to trailer M.S. to pack samples

Mark Sorensen 10-1-91

(59)

WEDNESDAY, OCTOBER 2, 1991

Activity: Mon. well sampling at Sundstrand facility.

Personnel: J Grippa, C Radebaugh, P Miller, P Barry (Sundstrand's consultant HLA), M Sorensen (CDM, recording)

Weather: 63°, mostly cloudy, moderate SW winds.

0840 - Meet bailing sampling team at MW31A where they are ready to sample. MS/MSD sample: double volume for BNA only (others are SAS). Final parameters: temp 13.0°C, pH = 7.07, conductivity = 680 µmho/cm; SWL = 41.55 before bailing & 41.60 after bailing 1.96 gals in 9 minutes.

0845 - Begin collecting MWS-31A sample.

0930 - Go to MWS-5 E of Sundstrand plant but on their property in area of highest VOC concentrations. ~~MWS~~ MWS-5 is located ~100'N of MWS-23 & adjacent (20'E of) air strippers & several ft. S of MWS-1,2&3; ~50' S of

Mark Sorensen 10-2-91

PW-1(3), the purge well.

1055 – They have been noticing a distinct odor emanating from MWS-5; microtip showed 357 ppm at mouth of well. Now go to MWS-32 where the Bennett pump sampling team is almost done purging.

1105 – Begin sampling at MWS-32

1107 – Begin sampling MWS-32(D). Final parameters at cond 450 µmho/cm; pH = 7.92; temp 12.8°C; d.o. 9.6; SWL 46.25' before purging.

1135 – Go back to MWS-5 to pick up sample collected by HLA bailer sampling team. Final parameters: pH = 6.96; cond.: 640 µmho/cm; temp = 13.7°C

SWL before bailing: 43.27' (T.D. = 68.10'); 44.43' after bailing 8.16 gals. in 26 minutes.

They began sampling at 1110.

1150 – Leave Sundstrand for day & week. In afternoon clean up trailer & leave

WEDNESDAY, NOVEMBER 27, 1991

Pressure water levels

Personnel: S Bhagat, M Sorensen (recorder)

MW111	A		26.46'
	B		26.16'
	C		26.86'
108	A		30.25
	B		30.01
	C		29.50
110	A		33.28
	B		38.58
	C		39.05
107	A		17.60
107	B		17.54
	C		17.50
104	A		47.04
	B		47.45
	C		44.41
109	A		30.99
	B		30.52
	C		30.70
106	A		22.55
	B		26.41
	C		25.35
105	A		4.93

MW105B	5.65
MW105C	9.51
D	10.59
103 A	23.29
B	22.91
C	22.85
101 A	48.84
B	49.36
102 A	23.30
B	43.05
C	48.00

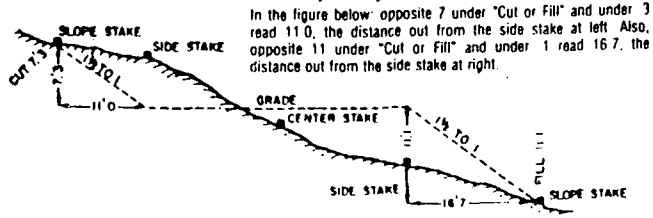
Complete water level survey at 1245 pm. Note: all water levels were measured from top of 2" well casing.

Alan G Sorensen Nov. 27 1991

DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING

Roadway of any Width. Side Slopes 1½ to 1.

In the figure below opposite 7 under "Cut or Fill" and under 3 read 11.0, the distance out from the side stake at left. Also, opposite 11 under "Cut or Fill" and under 1 read 16.7, the distance out from the side stake at right.



Cut or Fill	0	1	.2	.3	.4	.5	.6	.7	.8	.9	Cut or Fill
	Distance out from Side or Shoulder Stake										
0	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	0
1	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.9	1
2	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	2
3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9	3
4	6.0	6.2	6.3	6.5	6.6	6.8	6.9	7.1	7.2	7.4	4
5	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6	8.7	8.9	5
6	9.0	9.2	9.3	9.5	9.6	9.8	9.9	10.1	10.2	10.4	6
7	10.5	10.7	10.8	11.0	11.1	11.3	11.4	11.6	11.7	11.9	7
8	12.0	12.2	12.3	12.5	12.6	12.8	12.9	13.1	13.2	13.4	8
9	13.5	13.7	13.8	14.0	14.1	14.3	14.4	14.6	14.7	14.9	9
10	15.0	15.2	15.3	15.5	15.6	15.8	15.9	16.1	16.2	16.4	10
11	16.5	16.7	16.8	17.0	17.1	17.3	17.4	17.6	17.7	17.9	11
12	18.0	18.2	18.3	18.5	18.6	18.8	18.9	19.1	19.2	19.4	12
13	19.5	19.7	19.8	20.0	20.1	20.3	20.4	20.6	20.7	20.9	13
14	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.4	14
15	22.5	22.7	22.8	23.0	23.1	23.3	23.4	23.6	23.7	23.9	15
16	24.0	24.2	24.3	24.5	24.6	24.8	24.9	25.1	25.2	25.4	16
17	25.5	25.7	25.8	26.0	26.1	26.3	26.4	26.6	26.7	26.9	17
18	27.0	27.2	27.3	27.5	27.6	27.8	27.9	28.1	28.2	28.4	18
19	28.5	28.7	28.8	29.0	29.1	29.3	29.4	29.6	29.7	29.9	19
20	30.0	30.2	30.3	30.5	30.6	30.8	30.9	31.1	31.2	31.4	20
21	31.5	31.7	31.8	32.0	32.1	32.3	32.4	32.6	32.7	32.9	21
22	33.0	33.2	33.3	33.5	33.6	33.8	33.9	34.1	34.2	34.4	22
23	34.5	34.7	34.8	35.0	35.1	35.3	35.4	35.6	35.7	35.9	23
24	36.0	36.2	36.3	36.5	36.6	36.8	36.9	37.1	37.2	37.4	24
25	37.5	37.7	37.8	38.0	38.1	38.3	38.4	38.6	38.7	38.9	25
26	39.0	39.2	39.3	39.5	39.6	39.8	39.9	40.1	40.2	40.4	26
27	40.5	40.7	40.8	41.0	41.1	41.3	41.4	41.6	41.7	41.9	27
28	42.0	42.2	42.3	42.5	42.6	42.8	42.9	43.1	43.2	43.4	28
29	43.5	43.7	43.8	44.0	44.1	44.3	44.4	44.6	44.7	44.9	29
30	45.0	45.2	45.3	45.5	45.6	45.8	45.9	46.1	46.2	46.4	30
31	46.5	46.7	46.8	47.0	47.1	47.3	47.4	47.6	47.7	47.9	31
32	48.0	48.2	48.3	48.5	48.6	48.8	48.9	49.1	49.2	49.4	32
33	49.5	49.7	49.8	50.0	50.1	50.3	50.4	50.6	50.7	50.9	33
34	51.0	51.2	51.3	51.5	51.6	51.8	51.9	52.1	52.2	52.4	34
35	52.5	52.7	52.8	53.0	53.1	53.3	53.4	53.6	53.7	53.9	35
36	54.0	54.2	54.3	54.5	54.6	54.8	54.9	55.1	55.2	55.4	36
37	55.5	55.7	55.8	56.0	56.1	56.3	56.4	56.6	56.7	56.9	37
38	57.0	57.2	57.3	57.5	57.6	57.8	57.9	58.1	58.2	58.4	38
39	58.5	58.7	58.8	59.0	59.1	59.3	59.4	59.6	59.7	59.9	39
40	60.0	60.2	60.3	60.5	60.6	60.8	60.9	61.1	61.2	61.4	40

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CONTENTS

PAGE NO.	REFERENCE	DATE

THURSDAY 22 AUGUST 1991 (1)

ACTIVITY: Packaging and sample shipment of drum composite samples collected yesterday for full organics and full inorganics analyses.

1400 Relinquished the following samples at FED EX:

SAMPLE ID	DATE ↓	TIME ↓	HNu* ↓	DRUM #'s USED
MW111-1	8/21/91	0935	B4	MW111-1 thru -6
MW111-1DUP		0950		Same as above
MW111-2		1100	B4	MW111-7 thru -12
MW111-3		1235	B4	MW111-13 thru -18
MW111-4		1355	B4	MW111-19 thru -24
MW111-5		1545	B4	MW111-25 thru -30
MW110-1		1700	B4	MW110-19 thru -26
MW110-2		1745	B4	MW110-27 thru -34
MW110-2DUP		1750		Same as above.

* Headspace of drums as they were opened.

In addition the following drum composite sample was shipped 11 July 1991:

SAMPLE ID	DATE	TIME	DRUM #'s USED
MW104-6	7/11/91	1405	MW104-28 thru -34

The following were shipped by FED EX 12 AUGUST 1991 for TOTAL ORGANIC CARBON analysis. Samples are from split spoons.

SAMPLE ID	DATE	TIME	DEPTH (ft. BGL)
MW107	7/13/91	1001	44-46
MW108-A	7/14/91	1635	34-36
MW108-B	7/15/91	1015	64-66
MW110	7/17/91	0855	43-44
MW104	7/22/91	1430	54-56
MW105-A	7/26/91	0958	54-56
MW105-B	7/26/91	1400	84-86
MW105-C	7/26/91	1650	104-106
MW111	8/9/91	0920	28-29

Sushil Bhagat
22 AUGUST 1991

FRIDAY 23 AUGUST 1991

0815 Arrive at trailer.

ACTIVITY: Fill out well logs, await arrival of geophysical loggers (FROM APPLIED TECHNOLOGY), and conduct water-level measurements in all existing monitoring wells.

1100 No sign of geophysical loggers.

1200 Call Kelvin Yount of MATHES & ASSOCIATES and inquire about loggers. Kelvin didn't know where they were. Break for lunch.

1300 Return to trailer from lunch. Still no loggers.

1335 Begin water-level survey. All measurements taken with an electric water level indicator.

MW	DATE	TIME	DEPTH TO WATER (TOC)
101A	8/23/91	1352	48.42 feet
101B		1354	48.88
102A		1402	25.28
102B		1404	42.62
102C		1406	47.08
102 A		1408	25.29

MW	DATE	TIME	DEPTH TO WATER (TOC)
104A	8/23/91	1420	40.88 feet
104B		1422	41.30
104C		1424	43.28
107A		1434	16.82
107B		1436	16.74
107C		1438	16.75
110A		1448	30.32
110B		1450	36.01
110C		1452	36.54
108A		1504	29.80
108B		1506	29.58
108C		1508	28.39
111A		1516	25.05
111B		1518	24.81
111C		1520	25.59
109A		1531	29.90
109B		1533	29.46
109C		1535	29.64
103A		1551	22.82
103B		1553	22.38
103C		1555	22.29
106A		1600	21.56
106C		1602	24.32
106B		1604	25.43

23 Aug. 91

MW	DATE	TIME	DEPTH TO WATER (TOC)
105A	8/23/91	1624	6.43 feet
105B		1625	5.94
105C		1626	8.96
1700	Return to trailer.		
1800	Leave trailer for the weekend.		

23 August 1991

⑥ 9-4-91 Weather Sunny 80°

MW-102B
Purged ~~29~~ 40 P.N. gallons

Purge Volume Gal.	PH	Cond. (umhos)	Temp °C	Remarks
10	6.93	636	68.3	Clear
20	7.33	596	62.0	"
29	7.22	583	59.5	Clear
40	7.22	571	58.0	

Chlorine-test total - negative
Flow rate while purging 2 gpm
Conductivity meter on X100 scale

Sampled - 1605

MW-102C Purge Volume 69 gallons
Start Purge 5:30

Purge Volume Gal.	PH	X100 Cond. (umhos)	Temp °C	Remarks
~~15~~ 20	7.04	542	61.5	Slightly turbid
~~30~~ 40	7.17	561	58.0	Clearer
69	7.20	557	58.0	Slightly turbid

Flow Rate = 4.0 G.P.M.
Total Chlorine test - negative
P.N.

9-4-91 ⑦

MW-102C sampled at 1806

1815 Collecting VOA sample with bailer, observed black & plastic scrapings on surface of H2O in bailer

We used no black plastic material which is similar to that found in the well.

9-5-91

MW-102A - Purge Volume = 8
Will be purged by bailer

Purge Volume gal.	PH	X100 Cond. (umhos)	Temp °C	Remarks
2	7.56	1007	65	Purge H2O is very silty, purging 8 gal, then collect sample
4	7.48	1036	60	
6	7.42	1031	58.2	

Total Chlorine test - Negative
Sampled at 1330

P.N

(8) 9-5-91

MW-104A - Purge Volume 21 gallons

Purge Volume Gal.	PH	Scale X100 (Cond. umhos)	Temp (°C)	Remarks
7	7.10	863	67.6	Muddy
14	7.16	854	67.2	Clearing
21	7.25	812	59.6	

MW-104A dried up after pumping 8 gallons - will let recharge for 15 minutes then purge again

Ran dry again at 18 gallons - will wait 10 minutes then purge 3 more gallons for a total of 3 well volumes.

Total Chlorine test - Sampled turned pink when reads 0.9 ÷ 5 = .08 mg/L

MW 104A sampled at 1615

HNu - venting well 0 ppm.

(9) 9-6-91

MW-104B - Purge Vol. gallons

Purge Vol (gal.)	pH	Scale X100 umhos	Temp °C	Remarks
0800 -				
HNu - venting well = 0 ppm MW104B				
" = 0 ppm MW104C				
14	7.35	653	58.5	muddy silty
28	7.33	646	56.3	Clear
42	7.37	639	56.6	Clear

Began purge @0855

Total Chlorine - negative

MW 104B Sampled at 0925

(10) 9-6-91 - Sunny 80°

MW-104C Purge Volume = 53 gallons

Purge Volume gal.	PH	Cond. (umhos)	Temp °F	Remarks
12	7.37	593	59.4	Clear
24	7.36	580	57.7	Clear
36	7.40	570	56.6	Clear
53	7.40	562	56.1	Clear

Total Chlorine - pink 0.5 on color meter

Stop Purge at 1115

MW 104C Sampled at 1130

P.N

9-9-91 - Cloudy 70° (11)

MW-107B - Purge Volume 26 gal.
Purged 30 gallons

Purge Volume Gal	PH	Cond. (umhos)	Temp °F	Water Color
6	7.29	759	67.3	Slightly
12	7.43	718	58.2	Muddy
18	7.49	719	58.5	Cloudy
26	7.70	725	59.6	Clearing
30	7.76	727	59.2	Clear

Total Chlorine Test - Neg.

HNU Reading is 0ppm

MW 107B Sampled at 1095

Duplicate taken of MW 107B it is designated MW 107B(D) taken at 1100

PH meter calibrated - 0800 with buffers 4 and 7

P.N.

(12) 9-9-91

MW-107A - Purge Volume 12 gal.

MW-107A

Purge Volume Gallons	PH	Cond. (mmhos)	Temp °F	water Color
4	7.82	428	70.3	~~[illegible]~~ red
8	7.87	1014	68.8	
12	7.82	985	65.4	

Total Chlorine test - water too dirty See 107B

MW-107A Sampled at ~~2:30~~ 14:30 pm

HNu reading 0 ppm

9-9-91 (13)

MW 107C purge volume 63 gal.
purge volume = P.V.

P.V.	pH	cond. mmhos	T °F	water color & [illegible]
~~[illegible]~~	~~7.82~~	~~428~~	~~70.3~~	~~[illegible]~~
8	8.21	661	64.8	Clear
16	8.50	641	62.7	"
32	8.25	645	63.3	"
48	8.29	628	61.4	"
63	purged 63		64 gallons	

Cl_2 test - See 107B

Total Cl_2 test

MW 107C sampled at ~~[illegible]~~ 1600 P.M.

HN reading 0 ppm

(14) 9-10-91 Sunny 70°

MW 108A Purge Volume - 6 gallons.
PH Meter calibrated 0800

MW 108A

Purge Volume (Gal)	PH	Cond (umhos)	Temp (°F)	Water Color and (other Remarks)
2	7.40	8.67	60.9	Tan - cloudy
4	7.41	8.63	60.0	" "
6	7.40	8.79	60.3	clearing slightly

HNU reading 0 ppm
MW 108A sampled at 0830

MW 108B Purge Volume - 17 gallons. (Purged 18 gal)

Purge Volume Gal	PH	Cond (umhos)	Temp °F	Water Color and (other remarks)
6	7.53	678	58.2	light brown - muddy
12	7.53	670	57.1	slightly Cloudy clearing
18	7.41	674	55.0	Clear

MW 108B sampled at 10:30 am
Total Chlorine test - Negative
*Conductivity meter on 100 scale

PN

9-10-91 (15)

MW 108C - Purge Volume - 55 gallons. (Purged 60 gallons)

Purge Volume Gal.	PH	Cond (umhos)*	Temp °F	Water Color and (other remarks)
10	7.50	561	64.6	clear
20	7.46	543	59.5	↓
30	7.38	569	58.2	↓
40	7.49	579	61.1	↓
50	7.49	571	59.2	↓
60	7.45	571	57.3	↓

HNU reading 0 ppm
MW108C sampled at 1500 pm

Total Cl. test - dark on 108B

*Conductivity meter on x100 scale.

P.N.

(10) 9-10-91

MW-111A Purge Volume 6 gallons (Purged 9 gallons)
Will purge with [illegible] water

MW 111A

Purge Volume Gallons	PH	Cond (umhos)	Temp °F	Water Color
2	7.53	673	60.5	Brown/Muddy
4	7.55	678	57.6	"
6	7.62	596	60.5	"
8	7.79	555	60.8	Clearing Slightly

HNU (PPM) = 0

MW 111A Sampled at 1630

9-11-91 Cloudy 60° (17)

MW-111 Rinsate blank taken with Organic Free H_2O pumped through a grundfos pump (deconed with city water, alconox) taken at 1030

MW 111C - Purge Volume - 37 gallons

MW 111C

Purge Volume (Gal)	PH	Cond (umhos)	Temp °F	Water Color
8	7.50	461	55.7	Clear
16	7.98	657	59.8	Light tan cloudy
24	7.68	655	55.4	Turbid clearing
32	7.81	651	59.6	Clear
37	7.80	648	55.0	Clear

Total Chlorine test - Neg
HNU - 0 PPM
MW 111C sampled at 1105

pH meter calibrated 9am

P.N.

(18) 9-11-91

MW-111C Purge Volume - 18 gallons.
(Purged 32 gallons)

MW-111C

Purge Volume Gallons	PH	Cond. (umhos)	Temp °F	Water Color
6	7.79	770	57.1	Cloudy
10 PN	8.18	769	55.8	Cloudy
14	8.79	769	55.2	Clearing
18	9.00	780	56.3	Clear
24		777	56.0	"

(MW-111C Sampled at 1500

28	8.52	779	56.0	
32	9.00	772	55.2	

Purged 32 gallons total, pH did not stabilize

P.N.

(19) 9-12-91 (19)

9:15 MW 26 begin sampling of state wells

Water level from top of well casing - 53.74' Well Depth 72.27
Water level 53.74
Water Column 18.53
Purge Volume = 10 gallons

MW-26

Purge Volume Gallons	PH	Cond. (umhos)	Temp °F	Water Color
2		740	56.2	Cloudy
4		792	57.1	Clearing
6		750	57.0	Clear
8		746	56.9	"
10		798	56.8	"

Total Chlorine - Negative
MW-26 sampled at 1000

P.N.

(20) 9-12-91

1050 set up to purge and sample MW-19 Will purge with bailer

MW-19 Total Depth 25.03
Water level 13.10
Water Column 11.93
Purge Volume 6 gallons

Purge Volume Gal.	Cond. (umhos)	Temp °F	Water Color
2	1000	~~60.56~~ 60.5	highly silty
4			
6			

well went dry after 1st reading, waited 15 min, bailed but very little water present no recharge in 15 min.

3:15 Water level 20.26 ft.
well purged dry ≈1.5 gallon
sample later (9-13)

N.

9-12-91 (21)

MW-18

Purge Volume Gallons	Cond. (umhos)	Temp °F	Water Color

Could not sample MW-18 at this time because there is a data logger downhole.
1545

P.N.

(22) 9-12-91

MW-27 Well depth 61.88

~~Water level 49.17 ft (TOC)~~

~~Water Column 49.17 ft. (TOC)~~

water column ~~Purge Volume~~ = ~~12.69~~ 12.71

purge volume = 7 gallons

MW-27

Purge Volume Gallons	Cond. (umhos)	Temp °F	water Color
2	555	~~57.3~~ 56.3	
4	574	54.9	tan
6	580	54.9	Turbid - Tan
8	588	55.0	slightly Cloudy Clearing

Purged 10 gallons

MW-27 sampled at 16:40

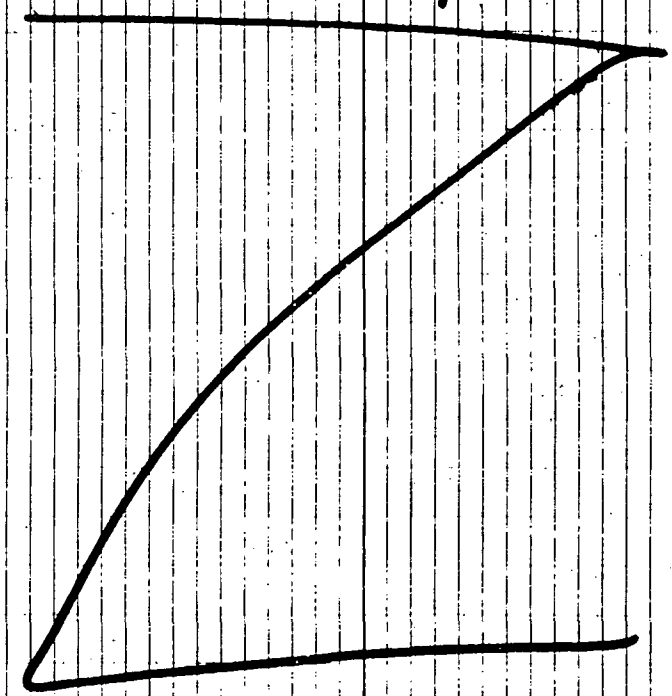
P.N

9-13-91 (23)

1000 Samples taken from MW-14 - Well was purged dry 2 times

water level 11.90 ft (TOC)

- took particular 3 VOA samples only at 1000



P.N.

(24) 9-13-91
1040
MW24

well depth 42.88
water level 31.29
Water column 11.59
(PV) purge volume, gallons 6

PV	cond	Temp F	pH*	color
2	506	56.8		Clear
4	583	55.3		Clear
6	635	55.2		"

purged gallons
MW 24 sampled at 1100
Total Chlorine - did not perform
* pH meter broken cannot take measurements
HNU - 0 PPM
PH meter/Cond. Temp is not working properly - will purge 5 well volumes ≅ 12 gallons then sample
DN

9-16-91 (25)

MW-20

well depth 55.60
water level 30.20
Water Column 23.40
Purge Volume - 11.7
≈ 12

MW-20

Purge Volume Gal.	PH*	Cond (umhos)	Temp °F	Water color
4	6.95	964	59.5	cloudy
8	7.84	955	"	"
12	9.50	958	60.5	

Total Chlorine - Neg.

MW-20 sampled at 1030

* PH READING MAY NOT BE ACCURATE

P.N.

(26) 9-16-91

MW-17R rinsate taken at 1345 through Grundfos pump and hose, VOAs taken through deconed bailer

9-16-91 (27)

MW17

well depth	45.28
water level	26.92
water column	18.36
purge volume	9.18
	≈ 10 gal

MW17

Purge volume Gal	pH	Cond. (µmhos)	Temp	water color
2	5.73	939	60.7	yellow
6	5.79	898	57.4	clear
10	5.90	892	55.6	"
12	5.87	896	56.0	"

TOTAL CHLORINE - NEG.

MW17 sampled at 14.45

YYM

(28) 9-16-91

MW16

well depth 47.78
water level 29.45
water column 18.33
purge volume 9.17
≈10 gal *

purge volume gal	pH	Cond.	Temp	water color
4	6.10	859	59.2	clear
8	6.00	840	57.3	"
12	5.90	843	56.7	"

TOTAL CHLORINE
MW16 sampled at 16:20
MS/MSD taken at MW-16
- double volume

* purged 12 gal.

Y.Y.M.

9-17-91 (29)

MW12

well depth 57.55
water level 38.79
water column 18.76
purge volume 9.38
≈ 10.00 *

purge vol. gal	pH	Cond	Temp °F	water color
4	6.20	550	59.4	clear
8	6.21	538	57.3	"
12	6.09	545	57.3	"

TOTAL CHLORINE - Neg.
MW12 sampled at 08.52 am
duplicate sample taken designated as MW12D sampled at 0915

* purged 12 gal

Y.Y.M

(30) 9-17-91

MW31

Well depth	62.48
Water level	29.24
Water column	33.24
purge volume	16.62
	≈ 17.00 *

MW31

purge vol. gal	pH	Cond.	Temp	water color
4	6.76	791	58.3	clear
8	7.00	789	56.0	✓
12	7.90	770	55.8	✓
16	8.10	765	56.5	✓
20	8.90	745	56.9	✓
24	8.72	734	57.2	

MW31 sampled at 11:45 am

HNU - 0 ppm

* purged 24 gal

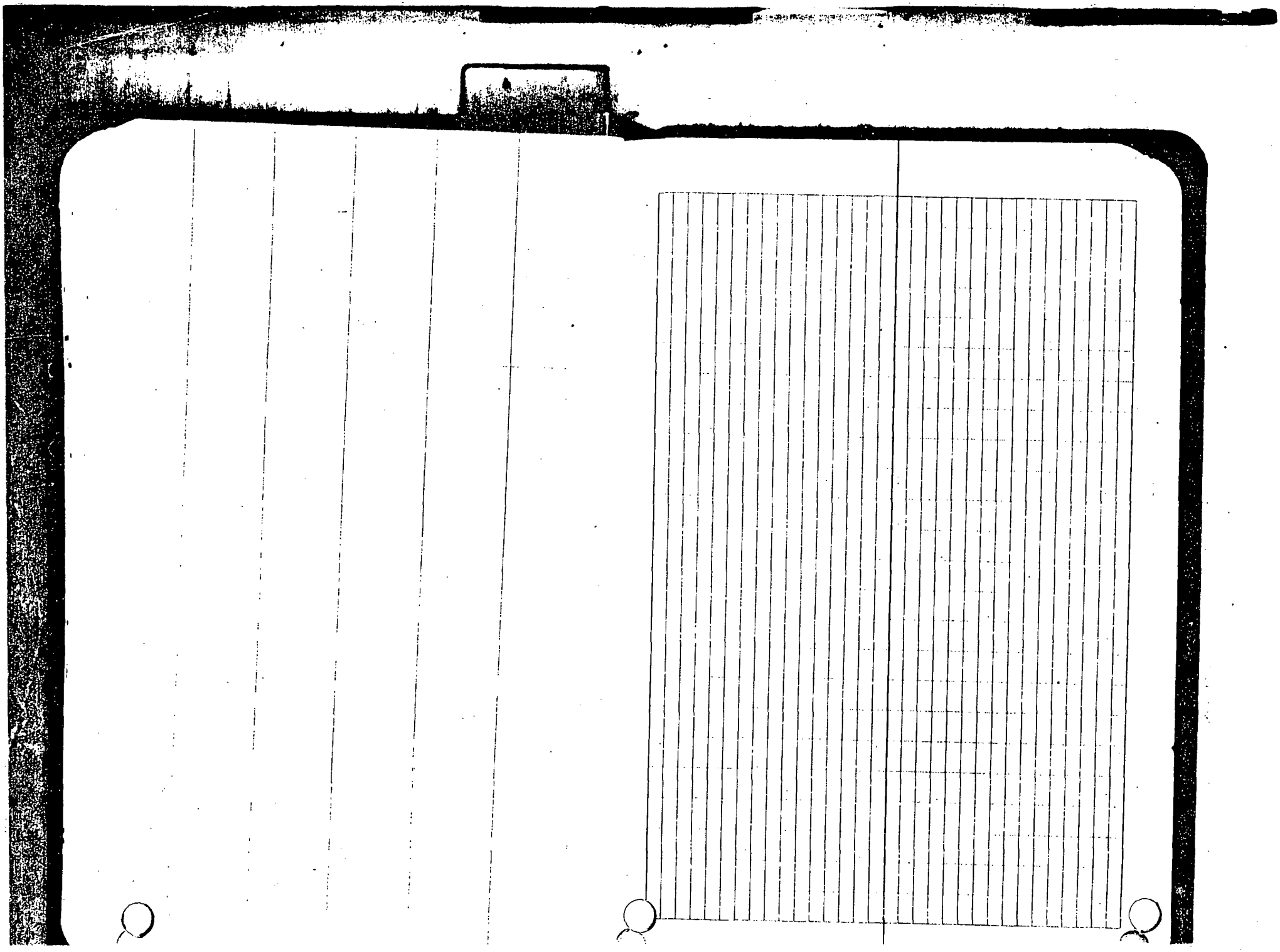
YYM

9-17-91 (31)

MW-31R rinsate taken at 11:20 am through Grundfos pump and hose, VOA taken through deconed bailer

1550 Sample taken of Kyn Rock Community Center water supply. Sample was poured through hose used to ~~decon~~ supply decon station H_2O

YYM



APPENDIX C

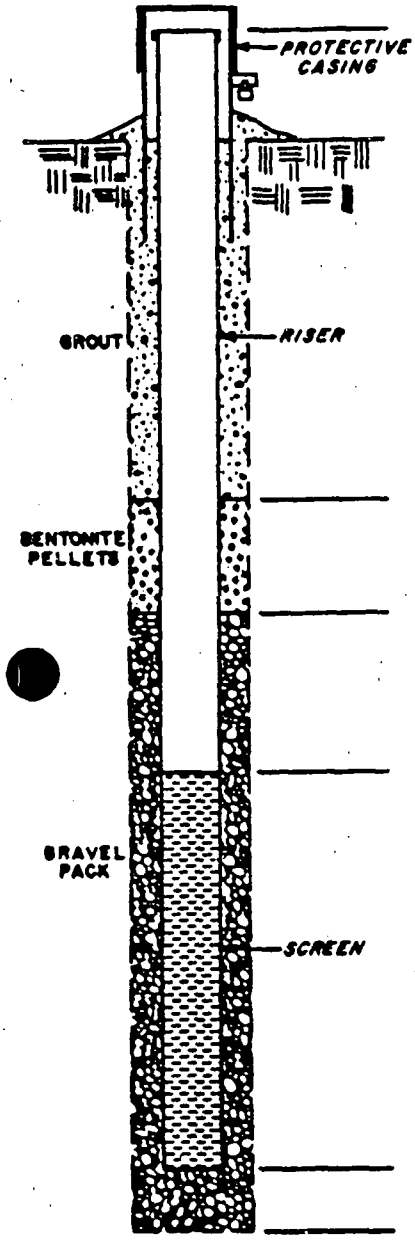
MONITORING WELL CONSTRUCTION SUMMARIES

CDM

environmental engineers, scientists, planners & management consultants

WELL CONSTRUCTION SUMMARY

Project: SE Rockford Client: IEPA Well No: MW101A



DRILLING SUMMARY

Drilling Co: J. Matthes & Assoc. Drillers: Tim Crank

Drill Rig Make/Model: CME 75

Borehole Diameters: 8.25" Drilling Fluid: NA

Bits/Depths: 4.25" HSA

Total Depth: 90' Depth to Water: 46'

Supervisory Geologist: R. Lantz

WELL DESIGN

Casing Material: 304 Stainless Diameter: 2" Length: ~90.5'

Screen Material: 304 Stainless Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 78'-88'

Filter Material: Silica Sand Setting: 76'-90' (20-40 sieve); 74.5'-76' (10 sieve)

Seals Material: Setting:

Grout: Volclay Setting: 3'-74.5'

Surface Casing Material: 5.5" steel Setting: -2 to 3'; set in concrete

TIME LOG

	Started	Completed
Drilling:	6/27/91 @ 1615	6/27/91 @ 1730
Installation:	6/27/91 @ 1820	6/28/91 @ 0950
Development:	7/28/91 @ 1030	7/28/91 @ 1330

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~46'

Pumping Depth to Water: not measured

Pumping Rate: 1.7 gpm Specific Capacity: n.a.

Volume Pumped: 300 gal

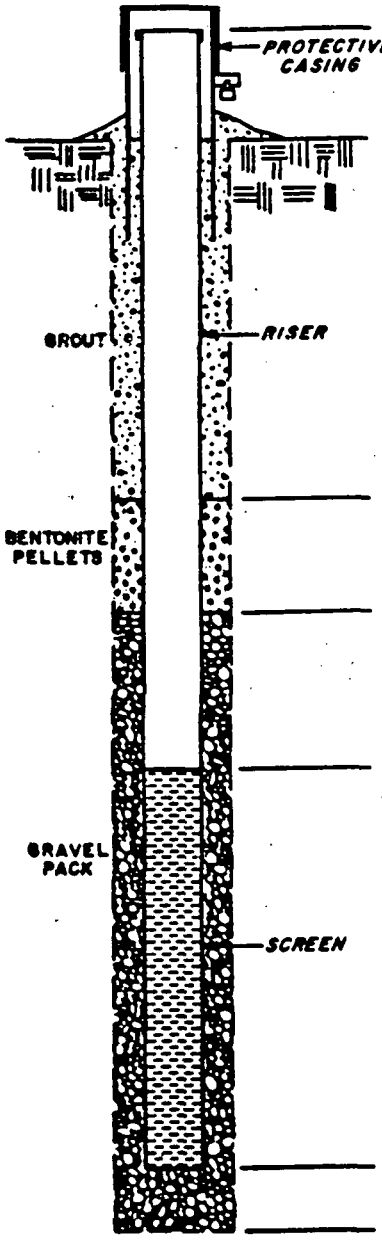
NY-5

CDM

environmental engineers, scientists, planners & management consultants

WELL CONSTRUCTI

Project: SE Rockford Client: IEPA Well No: MW-101 B



DRILLING SUMMARY

Drilling Co: John Mathes & Assoc. Drillers: Ed Clark

Drill Rig Make/Model: Gus Pech Brat 22R

Borehole Diameters: 0-136': 11"; 136-151': 6" Drilling Fluid: 0-136': bentoni

Bits/Depths: 0-136': 11" tri-cone rotary; 136-151': 6" down-the-hole air

Total Depth: 151' Depth to Water: 45.8' (bedroc

Supervisory Geologist: Mark Sorensen, CDM-Chicago

WELL DESIGN

Casing Material: 6" steel / type 304 stainless Diameter: 6" / 2" Length: 138' / 143'

Screen Material: wire-wound 304 ss Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 140.1 - 150.1'

Filter Material: 140-151': med sand (20/40 sieve sizes) / 139-140': fine sand (100 sieve size) ~~Setting~~:

~~Seals Material~~: Volclay Setting: 0 - 139'

Grout: Cement-bentonite Setting: 0 - 136' (outside the 6"

Surface Casing Material: 6" blk pipe Setting: -2.8 to 136'

(this outer casing is grouted w/ cement/bentonite gr its annular space)

TIME LOG

	Started	Completed
Drilling:	6/18/91	6/26/91 @ 1310
Installation:	6/26/91, 1510	6/27/91, 0930
Development:	7/28/91, 1130	7/28/91, 1345

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~46'

Pumping Depth to Water: unknown

Pumping Rate: 2.5 gpm Specific Capacity: unknow

Volume Pumped: 300 gal.

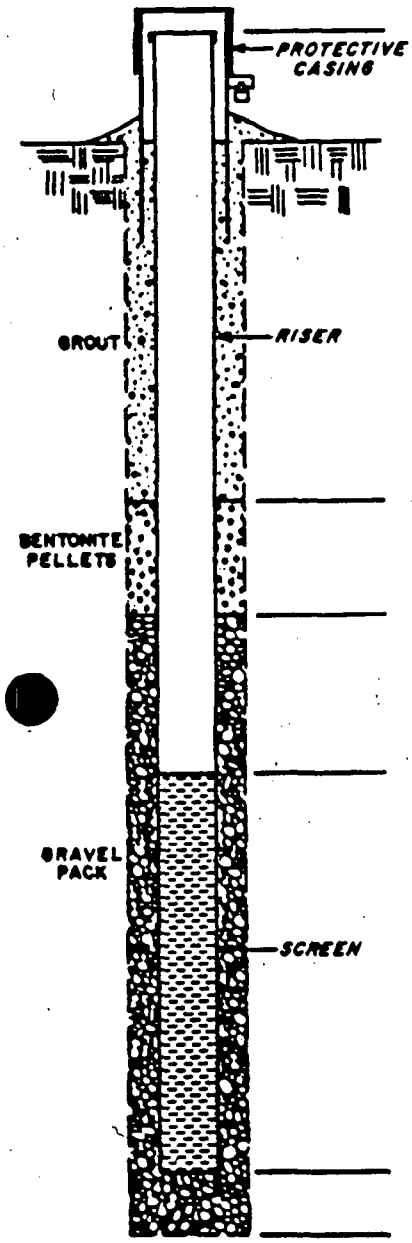
NY-5

CDM

environmental engineers, scientists, planners & management consultants

WELL CONSTRUCTION SUMMARY

Project: SE ROCKFORD Client: IEPA Well No: MW102A



DRILLING SUMMARY

Drilling Co: J. MATHES & ASSOC. Drillers: TIM CRANK

Drill Rig Make/Model: CME 75

Borehole Diameters: 8.25" Drilling Fluid: NA

Bits/Depths: 4.25" HSA

Total Depth: 56.5' Depth to Water: ~28'

Supervisory Geologist: R. LANTZ

WELL DESIGN

Casing Material: 304 STAINLESS Diameter: 2" Length: ~28'

Screen Material: 304 STAINLESS Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 25'-35'

Filter Material: SILICA SAND Setting: 23.5'-35.5' (20-40 SIEVE), 21.5'-23 (100 SIEV

Seals Material: BENTONITE (PURE GOLD) Setting: 35.5'-56.5'

Grout: VOLCLAY Setting: 3'-21.5'

Surface Casing Material: 5.5" steel Setting: -2 to 3' (set in concrete)

TIME LOG

	Started	Completed
Drilling:	6/18/91 @ 1355	6/18/91 @ 1505
Installation:	6/24/91 @ 1530	6/24/91 @ 1820
Development:	7/29/91 @ 1400	~~7/29~~ 7/30/91 @ 1145

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~28'

Pumping Depth to Water: not measured

Pumping Rate: 8 gal/hr Specific Capacity: n.a.

Volume Pumped: 62 gal

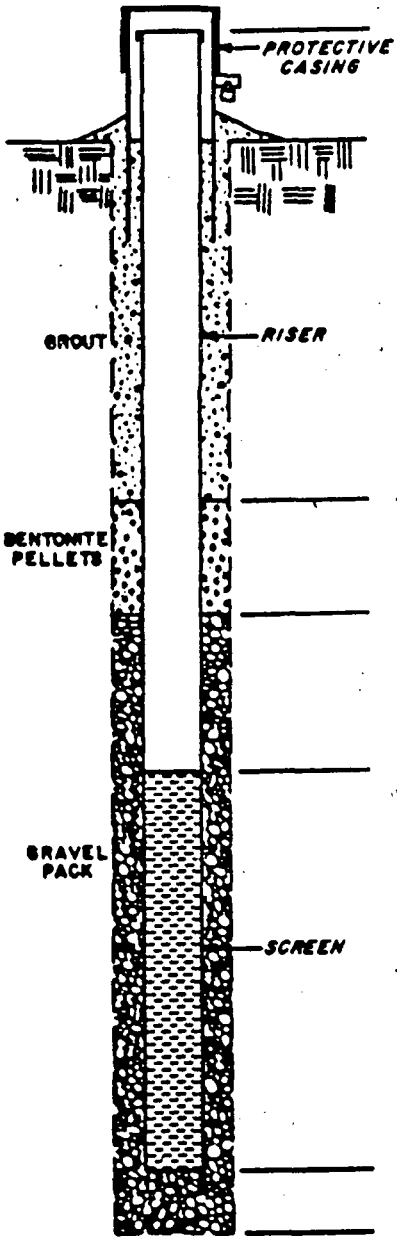
NY-5

CDM

environmental engineers, scientists, planners & management consultants

WELL CONSTRUCTION

Project: SE ROCKFORD Client: IEPA Well No: MW102B



DRILLING SUMMARY

Drilling Co: J. MATHES & ASSOC. Drillers: TIM CRANK

Drill Rig Make/Model: CME 75

Borehole Diameters: 8.25" Drilling Fluid: NA

Bits/Depths: 4.25" HSA

Total Depth: 100' Depth to Water:

Supervisory Geologist: R. LANTZ

WELL DESIGN

Casing Material: 304 STAINLESS Diameter: 2" Length: ~91'

Screen Material: 304 STAINLESS Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 88'-98'

Filter Material: SILICA SAND Setting: 86'-100' (20-40 SIEVE); 84'-86' (loose

Seals Material: Setting:

Grout: VOLCLAY Setting: 3'-84'

Surface Casing Material: 5.5" steel Setting: -2 to 3'; set in concrete

TIME LOG	Started	Completed
Drilling:	6/25/91 @ 0825	6/25/91 @ 0920
Installation:	6/25/91 @ 1000	6/25/91 @ 1510
Development:	7/29/91 @ 1400	7/29/91 @ 1615

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~40'

Pumping Depth to Water: not measured

Pumping Rate: 300 gal/hr Specific Capacity: n.a.

Volume Pumped: 675 gal

NY-5

CDM

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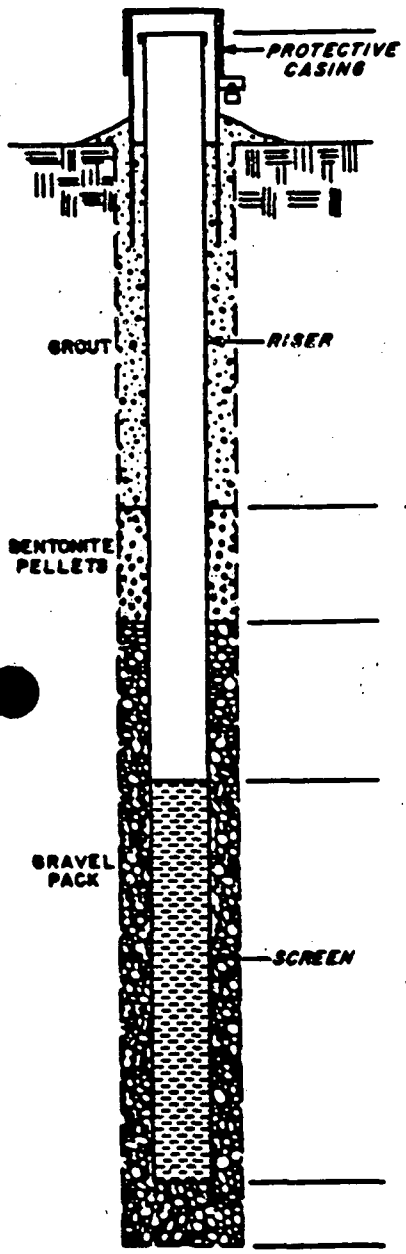
WELL CONSTRUCTION SUMMARY

Project: SE Rockford Client: IEPA Well No: MW102C



DRILLING SUMMARY

Drilling Co: Mathes Drillers: E Clark, Q Nowak, J McMul

Drill Rig Make/Model: Gus Pech Brat 22R

Borehole Diameters: 12" to 168.5'; 6" to 185' Drilling Fluid: bentonite mud

Bits/Depths: 12" tricone roller bit 0-168.5'; 6" air hammer 168.5-185.0'

Total Depth: 185.0' Depth to Water: 43.5' swl (bedro ~25' to w.t.

Supervisory Geologist: M Sorensen

WELL DESIGN

Casing Material: 6" steel / type 304 ss Diameter: 6" / 2" Length: 170' (set a / 176' 16

Screen Material: wire-wound ty. 304 Diameter: 2" Length: 10' 8" (inc

Slot Size: 0.010" Setting: 174.3-184.3'

Filter Material: coarse sand / fine sand Setting: 172-185' / 171-172'

~~Seal Material~~ cement-bentonite Setting: 3-168' (outside the 6" casing

Grout: Volclay Setting: 3-171'

Surface Casing Material: 5.5" steel Setting: -2.5 to 2.5', set in concret and welded to 6" casing

TIME LOG

	Started	Completed
Drilling:	8/5/91 @ 1100	8/7/91 @ 1840
Installation:	8/8/91 @ 0920	8/8/91 @ 1330
Development:		

WELL DEVELOPMENT

Method: dual-line air-lift

Static Depth to Water: 43.6'

Pumping Depth to Water: unknown

Pumping Rate: Specific Capacity: unknown

Volume Pumped:

NY-5

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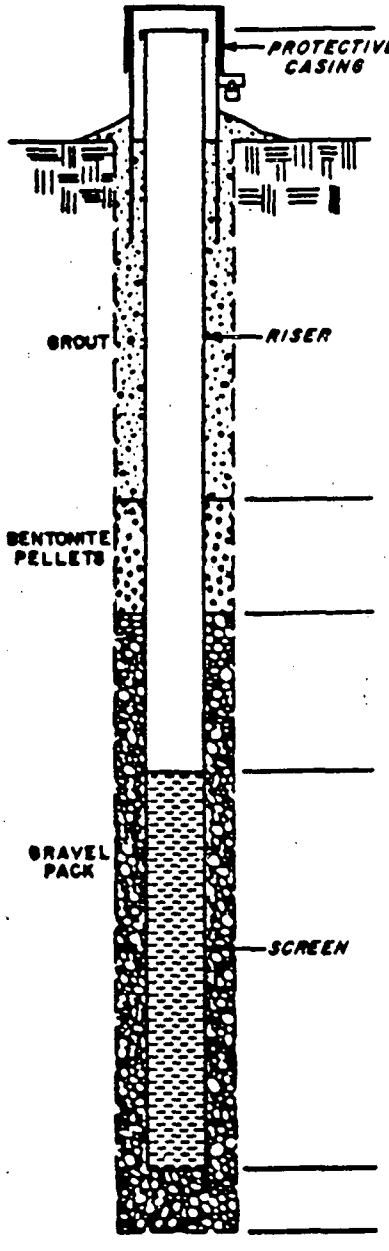
WELL CONSTRUCTION

Project: SE ROCKFORD Client: IEPA Well No: MW103A



DRILLING SUMMARY

Drilling Co: J-MATHES & ASSOC. Drillers: TIM CRANK

Drill Rig Make/Model: CME 75

Borehole Diameters: 8.25" Drilling Fluid: NA

Bits/Depths: 4.25" HSA

Total Depth: 44.5' Depth to Water: ~21'

Supervisory Geologist: R. LANTZ

WELL DESIGN

Casing Material: 304 STAINLESS Diameter: 2" Length: ~34'

Screen Material: 304 STAINLESS Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 31'-41'

Filter Material: SILICA SAND Setting: 29'-42' (20-40 SIEVE); 28'-29' (1

Seals Material: BENTONITE (PURE GOLD) Setting: 42'-44.5'

Grout: VOLCLAY Setting: 2'-28'

Surface Casing Material: 5.5" steel Setting: -2 to 3'; set in concrete

TIME LOG	Started	Completed
Drilling:	6/30/91 @ 1255	6/30/91 @ 1540
Installation:	6/30/91 @ 1605	7/1/91 @ 1145
Development:	7/27/91 @ 1430	7/27/91 @ 1645

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~21'

Pumping Depth to Water: not measured

Pumping Rate: 0.2 gpm Specific Capacity: n.a.

Volume Pumped: 24 gal

NY-5

CDM

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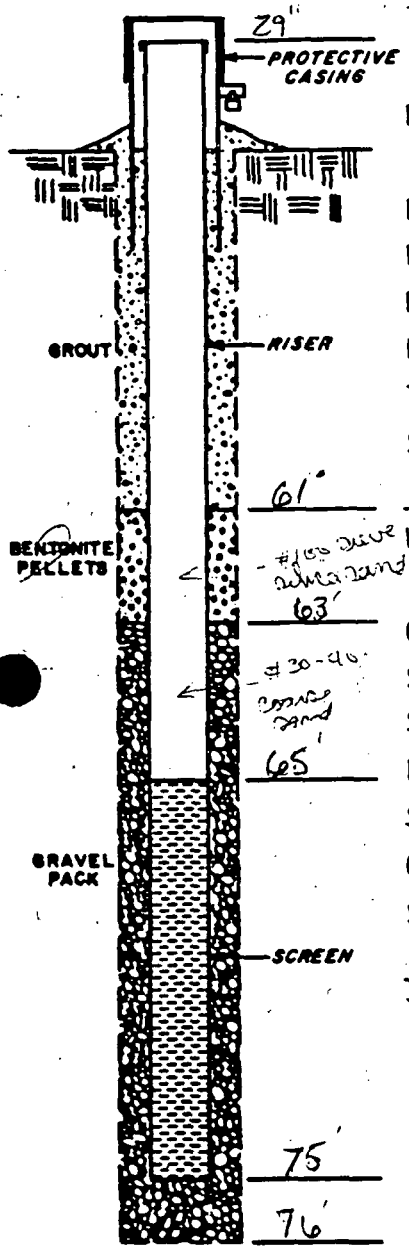
WELL CONSTRUCTION SUMMARY

Project: SOUTHEAST ROCKFORD Client: IEPA Well No: MW-103B



DRILLING SUMMARY

Drilling Co: JOHN MATHEZ and ASSOC. Drillers: ED CLARK

Drill Rig Make/Model: GUS PECH BRAT 22R

Borehole Diameters: 0-50.5': 8.25"; 50.5-76': 6" Drilling Fluid: 50.5-76': stay air

Bits/Depths: 0-50.5': HSA 8.25"; 50.5-76': 6" down-the-hole air hammer

Total Depth: 76' Depth to Water: ~20'

Supervisory Geologist: TROY CARLSON CDM-CHICAGO

WELL DESIGN

Casing Material: black pipe / Type 304 SS Diameter: 6" / 2" Length: 53' / 67'

Screen Material: WIRE-WRAPPED SS Diameter: 2" Length: 10.8'

Slot Size: 0.010" Setting: 65-75'

Filter Material: 63-76' med sand; 61-63' fine sand Setting: 20-40 sieve size; 100 sieve size

~~Seals Material~~: VOLCLAY Setting: 0-61'

Grout: CEMENT-BENTONITE Setting: 0-50.5' (outside 6" casing only)

Surface Casing Material: 6" blk pipe Setting: -2.42' to 50.5' (seated in bedrock)

THIS OUTER CASING IS GROUTED WITH CEMENT/BENTONITE GROUT IN ITS ANNULAR SPACE.

TIME LOG	Started	Completed
Drilling:	7/1/91 @ 1320	7/16/91 @ 1550
Installation:	7/16/91 @ 1600	7/17/91
Development:	7/27/91 @ 1515	7/27/91 @ 1645

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~20'

Pumping Depth to Water: unknown

Pumping Rate: 1.7 gpm Specific Capacity: unknown

Volume Pumped: 150 gallons

NY-5

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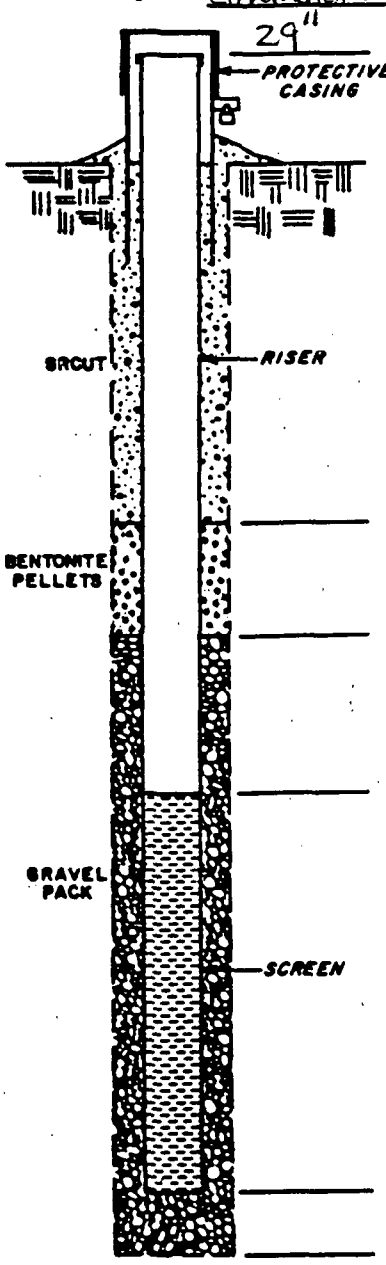
WELL CONSTRUCTI[illegible]

Project: SOUTHEAST ROCKFORD Client: IEPA Well No: MW403C



DRILLING SUMMARY

Drilling Co: JOHN MATHES & ASSOC. Drillers: ED. CLARK

Drill Rig Make/Model: GUS PECK BRAT 22R

Borehole Diameters: 0-48.3: 8.25"; 48.3-110.11: 6" Drilling Fluid: 0-48.3 HSA, 48.

Bits/Depths: 8.25" HSA TO 48.3'; 48.3 TO 110'11": 6" down the hole air hammer

Total Depth: 110'11" Depth to Water: 19.5'

Supervisory Geologist: TROY CARLSON CDM-CHICAGO

WELL DESIGN

Casing Material: black pipe / TYPE 304 STAINLESS Diameter: 6" / 2" Length: 51' / 107'11"

Screen Material: WIRE WOUND 304 SS Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 97.9'-107.9'

Filter Material: 96-116'11" 94.5-96' MED SAND FINE SAND Setting: 20-40 SIEVE SIZE 100 SIEVE SIZE

~~Seal Material~~: VOLCLAY Setting: 0-94.5'

Grout: cement-bentonite Setting: 0-48.3' (outside the

Surface Casing Material: 6" BLK PIPE Setting: -2.42-48.3'

THIS OUTER CASING IS GROUTED W/ THE CEMENT BENTONITE GROUT ON ITS AN[illegible]

TIME LOG	Started	Completed
Drilling:	7/2/91 @ 1325	7/15/91 @ 1730
Installation:	7/15/91 @ 1745	7/16/91 / 7/17/91
Development:	7/28/91 @ 0830	7/28/91 @ 1015

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: 19.5'

Pumping Depth to Water: unknown

Pumping Rate: 1.7 gpm Specific Capacity: unkn[illegible]

Volume Pumped: 250 gal.

NY-5

CDM

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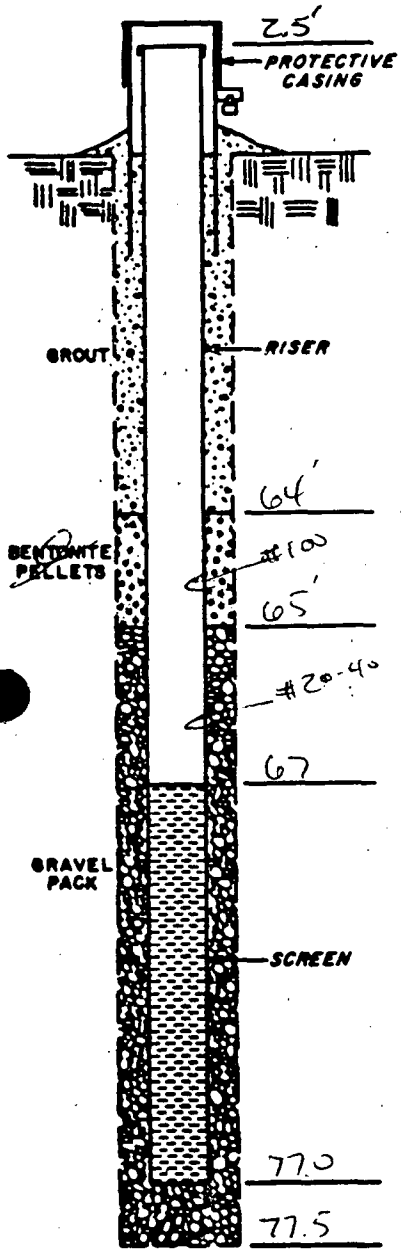
WELL CONSTRUCTION SUMMARY

Project: SOUTHEAST ROCKFORD Client: IEPA Well No: MW 104A



DRILLING SUMMARY

Drilling Co: JOHN MATHES & ASSOC. Drillers: TIM CRANK

Drill Rig Make/Model: CV75

Borehole Diameters: 4.25" HSA Drilling Fluid: 0-77' HSA

Bits/Depths: 4.25" HSA

Total Depth: 77.5' Depth to Water: 37.4'

Supervisory Geologist: TROY CARLSON - CDM

WELL DESIGN

Casing Material: TYPE 304 S.S. Diameter: 2" Length: 80'

Screen Material: WIREWOUND 304 S.S. Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 67-77'

Filter Material: 65-77' MED. SAND, 64-65' FINE SAND Setting: #20-40 SIEVE SAND, #100 SIEVE SAND

Seals Material: VOLCLAY Setting: 3-64'

Grout: VOLCLAY Setting: 3-64'

Surface Casing Material: 5.5" protective casing Setting: -2.5 → 2.5' (set in concrete)

TIME LOG

	Started	Completed
Drilling:	7-22-91 @ 1120	7-22-91 @ 1455
Installation:	7-22-91 @ 1545	7-23-91 @ 0900
Development:	7-26-91 @ 1315	7-26-91 @ 1545

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: 37.4'

Pumping Depth to Water: not measured

Pumping Rate: not measured Specific Capacity:

Volume Pumped:

NY-5

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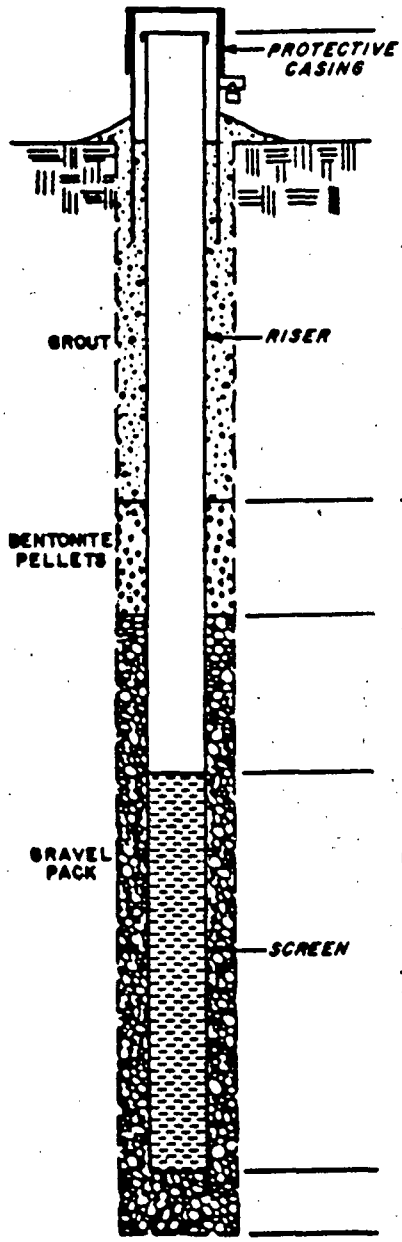
WELL CONSTRUCTIO[illegible]

Project: SE Rockford Client: IEPA Well No: MW104B



DRILLING SUMMARY

Q N[illegible]

Drilling Co: Mathes Drillers: E Clark, J McMulla[illegible]

Drill Rig Make/Model: Gus Peck Brat 22R

Borehole Diameters: 0-109.5': 12"; 109.5-124': 6" Drilling Fluid: 0-109.5': bentonit[illegible]

Bits/Depths: 0-109.5': 12" tri-cone rotary; 109.5-124': air hammer

Total Depth: 124' Depth to Water: ~~[illegible]~~ 38[illegible]

Supervisory Geologist: M Sorensen

WELL DESIGN

Casing Material: 6" steel / 304 stainless Diameter: 6" / 2" Length: 111' (to [illegible] / 114'

Screen Material: 304 stainless Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 111.9' - 121.9'

Filter Material: coarse sand Setting: 112-123'

Seals Material: fine sand; bentonite chips Setting: 111-112'; 110.5-111.0'

Grout: Volclay; cement-bentonite outside 6" casing Setting: 2-110.5'; 2-109.4'

Surface Casing Material: 5.5" steel Setting: -3 to 2; welded to 6" cas[illegible] and set in concrete

TIME LOG

	Started	Completed
Drilling:	7/12/91 @ 1148	7/14/91 @ 1030
Installation:	7/14/91 @ 1045	7/15/91 @ 0830
Development:	7/28/91 @ 1445	7/28/91 @ 1800

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: 38.6'

Pumping Depth to Water: not measured

Pumping Rate: 100 gal/hour Specific Capacity: not measu[illegible]

Volume Pumped: 325 gal

NY-5

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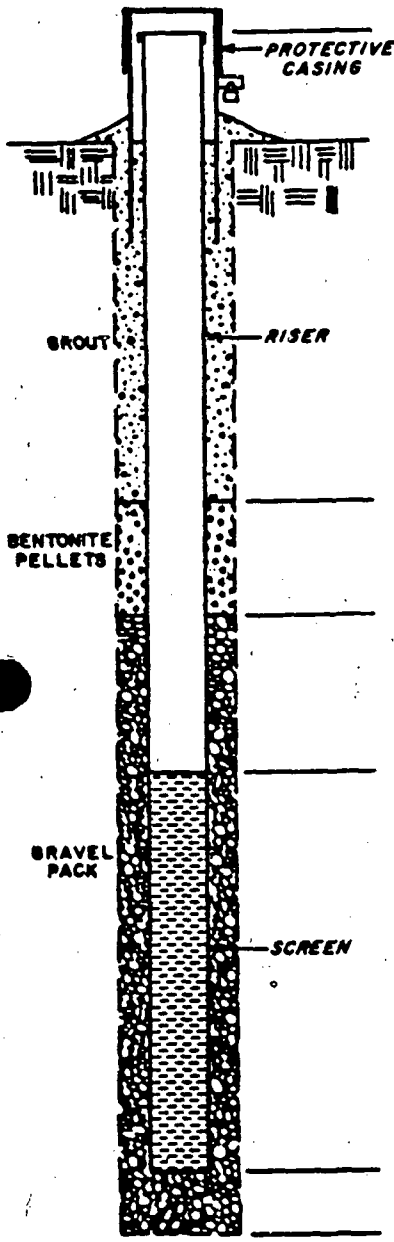
WELL CONSTRUCTION SUMMARY

Project: SE Rockford Client: IEPA Well No: MW104 C (deep)



DRILLING SUMMARY

Drilling Co: Mathes Drillers: E Clark

Drill Rig Make/Model: Gus Pech Brat 22R

Borehole Diameters: 16": 0-6'; 11": 6-79'; 6" @ 79-146.5' Drilling Fluid: bentonitic mud 6-79', air 79-146.5'

Bits/Depths: 11" mud rotary @ 6-79'; 6" down-the-hole air hammer @ 79-146.5

Total Depth: 146.5' Depth to Water: 37.4'

Supervisory Geologist: M Sorensen, S Bhagat

WELL DESIGN

Casing Material:	blackpipe / type 304 stainless	Diameter:	6" / 2"	Length:	81' (set a / 139'
Screen Material:	" "	Diameter:	2"	Length:	10'
Slot Size:	0.010"	Setting:	136-146'		
Filter Material:	Coarse sand / Fine sand	Setting:	133-146.5' / 130.8-133.0'		
~~Seals Material:~~	Volclay	Setting:	3-130.8'		
Grout:	cement-bentonite	Setting:	3-79' (only outside the 6" casing)		
Surface Casing Material:	5.5" steel	Setting:	-2 to 3'; welded to 6" casing and set in concrete		

TIME LOG

	Started	Completed
Drilling:	6/28/91 @ 0930	6/29/91 @ 1735
Installation:	6/30/91 @ 1115	7/1/91 @ 0825
Development:	7/28/91 @ 1430	7/28/91 @ 1700

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: 37.4'

Pumping Depth to Water: unknown

Pumping Rate: 1.25 gpm Specific Capacity: unknown

Volume Pumped: 185 gals.

NY-5

CDM

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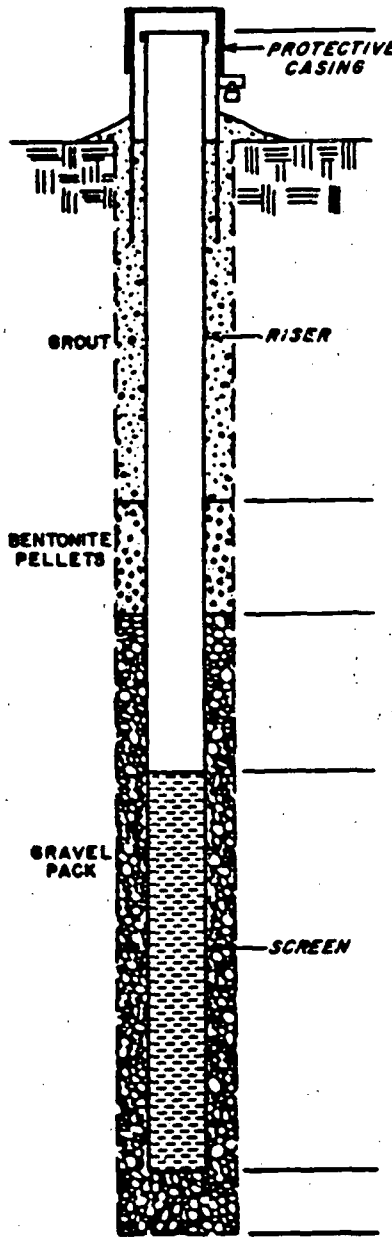
WELL CONSTRUCTION

Project: SE ROCKFORD Client: IEPA Well No: MW105A



DRILLING SUMMARY

Drilling Co: J. MATHES & ASSOC. Drillers: TIM CRANK

Drill Rig Make/Model: CME 75

Borehole Diameters: 8.25" Drilling Fluid: NA

Bits/Depths: 4.25" HSA down to

Total Depth: 34' Depth to Water: ~6 ft. during

Supervisory Geologist: S. BHAGAT

WELL DESIGN

Casing Material: TYPE 304 STAINLESS Diameter: 2 inch Length: free

Screen Material: TYPE 304 STAINLESS Diameter: 2 inch Length: 10 feet

Slot Size: 0.010" Setting: 12'-22'

Filter Material: SILICA SAND (20-40 SIEVE) Setting: 10'-23'

Seals Material: SILICA SAND (100 SIEVE) Setting: 9'-10'

Grout: VOLCLAY Setting: 3'-9'

Surface Casing Material: 5.5" steel Setting: -2 to 3' (set in concrete)

Hole Plug from 23'-34' (backfill)

TIME LOG

	Started	Completed
Drilling:	7/16/91 @ 0905	7/16/91 @ 1025
Installation:	7/16/91 @ 1330	7/16/91 @ 1520
Development:	8/5/91 @ 1330	8/5/91 @ 1545

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: 6 ft.

Pumping Depth to Water: not measured

Pumping Rate: 100 gal/hr Specific Capacity: not meas

Volume Pumped: 225 gal.

NY-5

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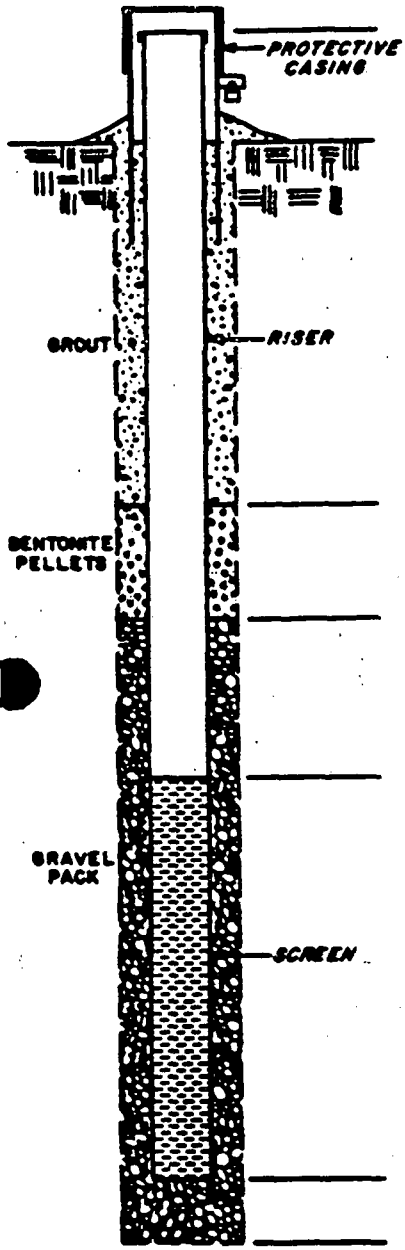
WELL CONSTRUCTION SUMMARY

Project: SE Rockford Client: IEPA Well No: MW105B



DRILLING SUMMARY

Drilling Co: J. Matites & Assoc. Drillers: Tim Crank

Drill Rig Make/Model: CME 75

Borehole Diameters: 8.25" Drilling Fluid: NA

Bits/Depths: 4.25" HSA down to 57 feet.

Total Depth: 57 ft. Depth to Water: ~5'

Supervisory Geologist: S. Bhagat

WELL DESIGN

Casing Material: Type 304 Stainless Steel Diameter: 2" Length: 46.5'

Screen Material: Type 304 Stainless Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 44'-54'

Filter Material: Silica Sand (20-40 sieve) Setting: 42'-57'

Seals Material: Silica Sand (100 sieve) Setting: 41'-42'

Grout: Volclay Setting: 3'-41'

Surface Casing Material: 5.5" steel Setting: -2 to 3'; set in concrete

TIME LOG

	Started	Completed
Drilling:	7/27/91 @ 1015	7/27/91 @ 1122
Installation:	7/27/91 @ 1325	7/27/91 @ 1530
Development:	8/5/91 @ 1500	8/5/91 @ 1630

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: 5'

Pumping Depth to Water: not measured

Pumping Rate: 300 gal/hr Specific Capacity: not measured

Volume Pumped: ~450 gal

NY-5

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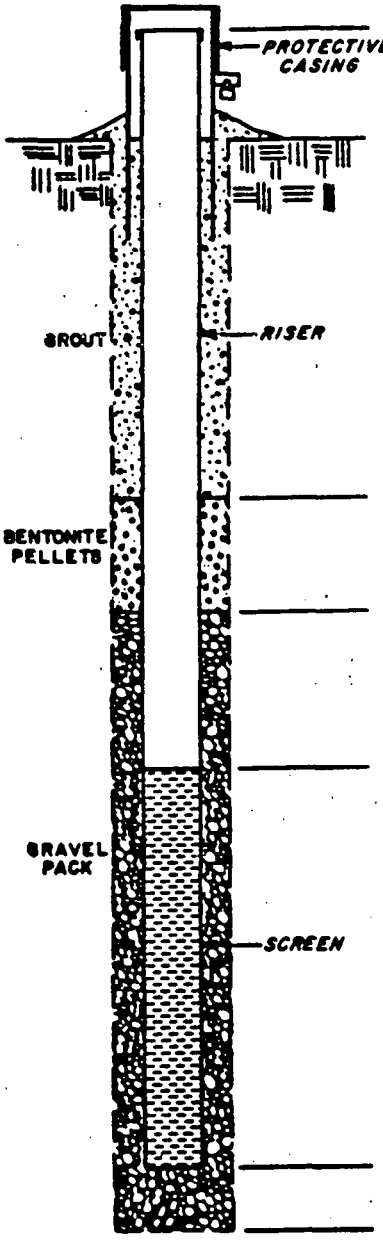
WELL CONSTRUCTIO

Project: SE Rockford Client: IEPA Well No: MW 105C



DRILLING SUMMARY

Drilling Co: J. Mathes & Assoc. Drillers: Tim Crank

Drill Rig Make/Model: CME 75

Borehole Diameters: 8.25 in Drilling Fluid: NA

Bits/Depths: 4.25 in HSA down to 104 feet.

Total Depth: 104 ft. Depth to Water: ~5'

Supervisory Geologist: T. Carlson and S. Bhagat

WELL DESIGN

Casing Material: Type 304 Stainless Diameter: 2 inch Length: 87.5

Screen Material: 304 Stainless Diameter: 2 inch Length: 10 feet

Slot Size: 0.010 in Setting: 85-95 ft.

Filter Material: Silica Sand (20-40 sieve) Setting: 82-95 ft.

Seals Material: Silica Sand (100 sieve) Setting: 81-82 ft.

Grout: Volclay Setting: Surface - 81 ft.

Surface Casing Material: 5.5" steel Setting: -2 to 3 feet

TIME LOG	Started	Completed
Drilling:	7/25/91 @ 1635	7/26/91 @ 1650
Installation:	7/26/91 @ 1745	7/27/91 @ 0930
Development:	8/5/91 @ 1330	8/5/91 @ 1500

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~5'

Pumping Depth to Water: not measured

Pumping Rate: 300 gal/hr Specific Capacity: not me

Volume Pumped: ~450 gal.

NY-5

CDM

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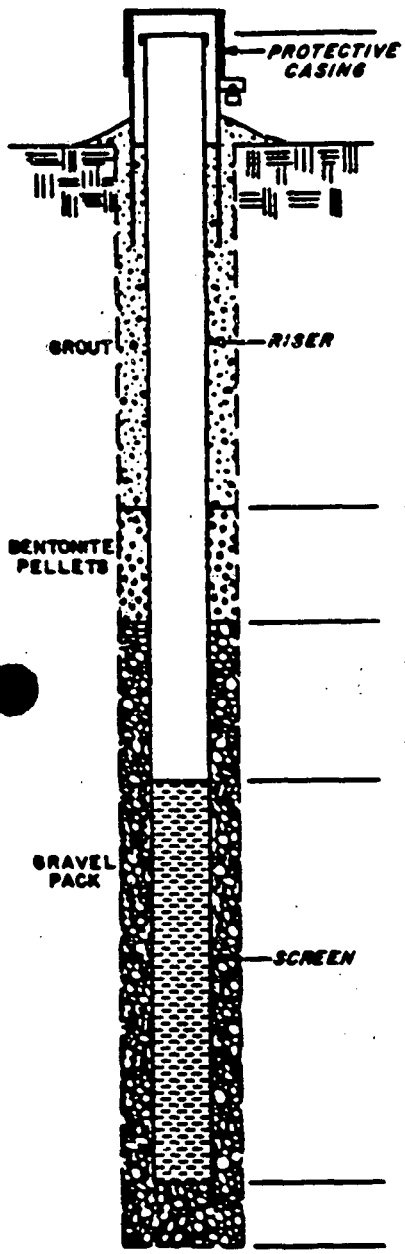
WELL CONSTRUCTION SUMMARY

Project: SE Rockford Client: IEPA Well No: MW105D



DRILLING SUMMARY

Drilling Co: Mathes Drillers: E Clark, J McMullen, Q Nowak

Drill Rig Make/Model: Gus Pech Brat 22R

Borehole Diameters: 0-139'; 12"; 139-158': 6" Drilling Fluid: bentonite mud;

Bits/Depths: 0-139': 12" tri-cone rotary; 139-158': 6" air hammer

Total Depth: 158' Depth to Water:

Supervisory Geologist: M Sorensen

WELL DESIGN

Casing Material: steel / type 304 stainless Diameter: 6" / 2" Length: 141' (set at de / 149'

Screen Material: wire-wound stainless Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 146.8-156.8 (plug at bottom extends

Filter Material: coarse sand / fine sand Setting: ~~144-145~~ 145-158 / 139-145 - M.S.

~~Seals Material~~: Volclay Setting: 2-139'

Grout: cement-bentonite Setting: 2-139' (only outside the 6" cas

Surface Casing Material: 5.5" steel Setting: -3 to 2 (welded to 6" casing and set in concrete)

TIME LOG

	Started	Completed
Drilling:	8/21/91, 1640	8/24/91 @ 1110
Installation:	8/24/91 @ 1435	8/24/91 @ 1730
Development:	8/26/91 @ 1700	8/26/91 @ 1900

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~8'

Pumping Depth to Water: unknown

Pumping Rate: 100 gal/hr Specific Capacity: unknown

Volume Pumped: ~180 gal

NY-5

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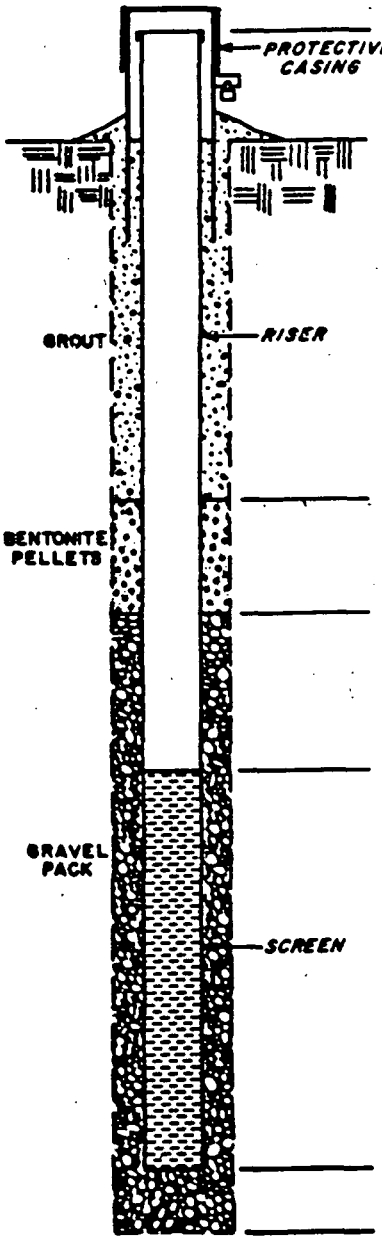
WELL CONSTRUCTIO[illegible]

Project: SE ROCKFORD Client: IEPA Well No: MW106A



DRILLING SUMMARY

Drilling Co: J. MATHES & ASSOC. Drillers: TIM CRANK

Drill Rig Make/Model: CME/75

Borehole Diameters: 8.25" Drilling Fluid: NA

Bits/Depths: 4.25" HSA down to 40.5'

Total Depth: 40.5' Depth to Water: ~20'

Supervisory Geologist: R. LANTZ

WELL DESIGN

Casing Material: 304 STAINLESS Diameter: 2" Length: 32.5

Screen Material: 304 STAINLESS Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 30'-40'

Filter Material: SILICA SAND (20-40 SIEVE) Setting: 27'-40.5'

Seals Material: SILICA SAND (100 SIEVE) Setting: 26'-27'

Grout: VOLCLAY Setting: 0'-26'

Surface Casing Material: " steel Setting: -2 to 3' (set in concret

TIME LOG	Started	Completed
Drilling:	6/29/91 @ 1710	6/30/91 @ 0830
Installation:	6/30/91 @ 0830	6/30/91 @ 1110
Development:	8/5/91 @ 1630	8/5/91 @ 1825

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~20'

Pumping Depth to Water: not measured

Pumping Rate: 2.0 gpm Specific Capacity: not me[illegible]

Volume Pumped: 230 gal.

NY-5

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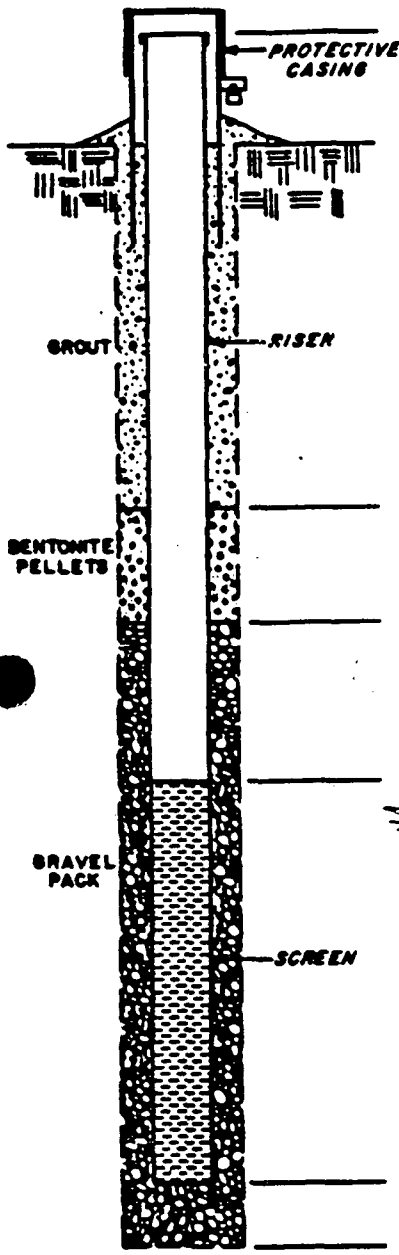
WELL CONSTRUCTION SUMMARY

Project: SE Rockford Client: IEPA Well No: MW106B



DRILLING SUMMARY

Drilling Co: Mathes Drillers: E Clark, J McMullan, R Nowak

Drill Rig Make/Model: Gus Pech Brat 22R

Borehole Diameters: 0-67: 12" 67-71: 8" 71-88': 6" Drilling Fluid: 0-67': none (augered) 67-71: bentonite; 71- air

Bits/Depths: 0-67': 8¼ auger; 67-71': 8" tri-cone; 71-88': 6" air hammer

Total Depth: 88' Depth to Water: 25.68 (TIC)

Supervisory Geologist: M Sorensen

WELL DESIGN

Casing Material: 6" blackpipe / type 304 stainless Diameter: 6" / 2" Length: 73' (-2+ / 80'

Screen Material: " " Diameter: 2" Length: 10' 7"

Slot Size: 0.010 Setting: 76.4-87.0' (incl. 0.6' plug @

Filter Material: coarse sand / fine sand Setting: 75-88 / 74-75

[redacted] cement-bentonite Setting: 3-71' (only outside 6" c

Grout: Volclay Setting: 3-74'

Surface Casing Material: 5.5" steel Setting: -3 to 2 (welded to 6" pip and set in concrete)

TIME LOG

	Started	Completed
Drilling:	8-12-91 at 1330	8-12-91 at 1405
Installation:	8-12-91 at 1415	8/12/91 at 1630
Development:	8/26/91 at ~1300	8/26/91 at 1515

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~24'

Pumping Depth to Water: unknown

Pumping Rate: 200 gal/hr Specific Capacity: unknown

Volume Pumped: ~300 gal

NY-5

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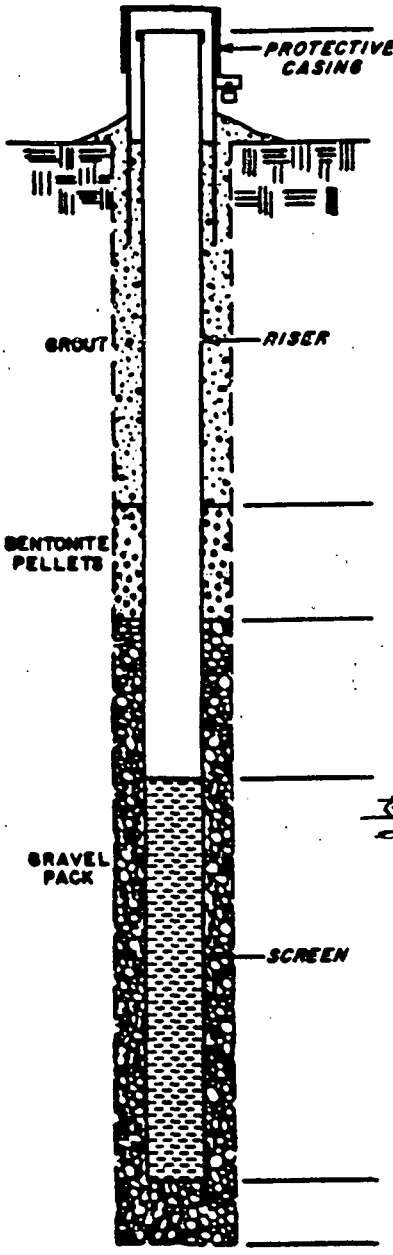
WELL CONSTRUCTIO

Project: # SE Rockford Client: IEPA Well No: MW106C



DRILLING SUMMARY

QA

Drilling Co: Mathes Drillers: E Clark, J McMu

Drill Rig Make/Model: Gus Pech Brat 22R

Borehole Diameters: 0-76.5': 12"; 76.5-120.5: 6" Drilling Fluid: 0-67: none (aug 76.5: bentonite; 7

Bits/Depths: 0-67': 8¼" auger; 67-76.5': 8" rotary; 76.5-120.5': air hammer

Total Depth: 120.5' Depth to Water: ~23'

Supervisory Geologist: M Sorensen

WELL DESIGN

Casing Material: blackpipe / type 304 stainless Diameter: 6" / 2" Length: 80' (set / 112'

Screen Material: " " Diameter: 2" Length: 7

Slot Size: 0.010 Setting: 109.4-120.0'

Filter Material: coarse sand / fine sand Setting: 107-120' / 106-107'

[redacted] cement-bentonite grout Setting: 3-78' (outside the 6" cas

Grout: Volclay Setting: 3-106'

Surface Casing Material: 5.5" steel Setting: -3 to 2' (welded to 6" ca and both set in concrete, 0 t

TIME LOG

	Started	Completed
Drilling:	8/11/91 at 1540	8/11/91 at 1735
Installation:	8/12/91 at 0935	8/12/91 at 1145
Development:	8/26/91 at ~1300	8/26/91 at 1515

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~23'

Pumping Depth to Water: unknown

Pumping Rate: 200 gal/hr. Specific Capacity: unknown

Volume Pumped: ~300 gal.

NY-5

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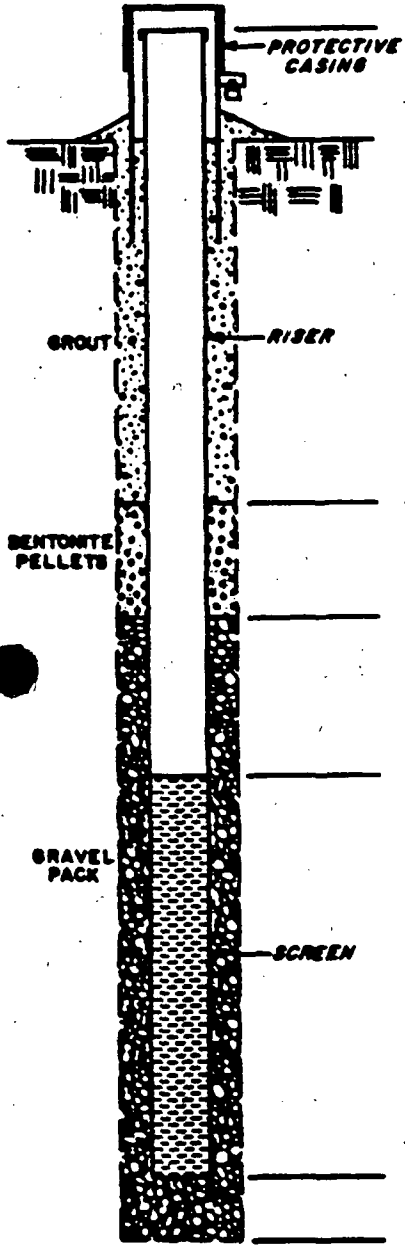
WELL CONSTRUCTION SUMMARY

Project: SE ROCKFORD Client: IEPA Well No: MW107A



DRILLING SUMMARY

Drilling Co: J. MATHES & ASSOC. Drillers: T. CRANK

Drill Rig Make/Model: CME 75

Borehole Diameters: 8.25" Drilling Fluid: NA

Bits/Depths: 4.25" HSA

Total Depth: 38.5' Depth to Water: 15'

Supervisory Geologist: S. BHAGAT

WELL DESIGN

Casing Material: 304 STAINLESS Diameter: 2" Length: ~30.5'

Screen Material: 304 STAINLESS Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 28'-38'

Filter Material: SILICA SAND (20-40 and #2 SAND) Setting: 24'-38.5'

Seals Material: Setting:

Grout: VOLCLAY; CONCRETE Setting: 1'-24'; 0-1'

Surface Casing Material: none (flush-mounted) Setting:

TIME LOG

	Started	Completed
Drilling:	7/14/91 @ 0935	7/14/91 @ 1010
Installation:	7/14/91 @ 1025	7/14/91 @ 1340
Development:	8/6/91 @ 1530	8/6/91 @ 1830

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: 15'

Pumping Depth to Water: not measured

Pumping Rate: 0.5 gpm Specific Capacity: not measured

Volume Pumped: 90 gal

NY-5

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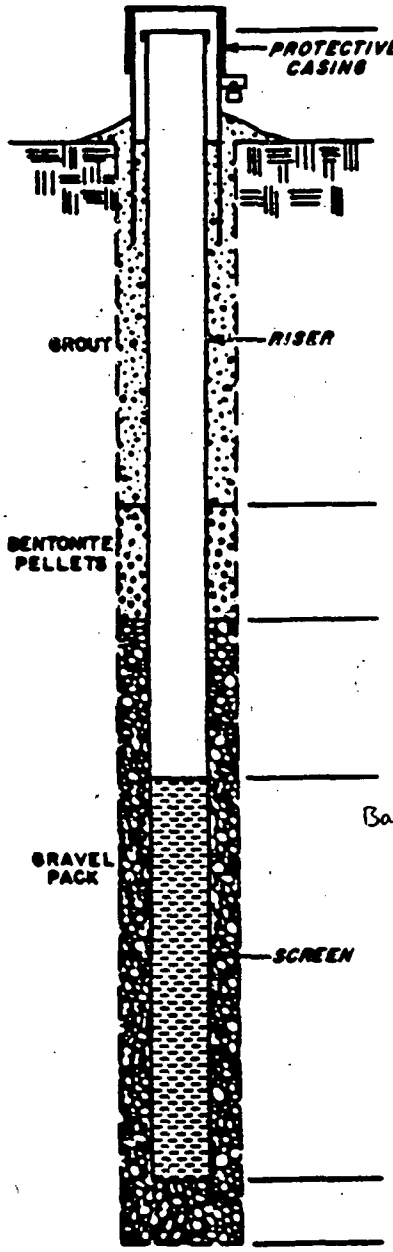
WELL CONSTRUCT

Project: SE ROCKFORD Client: IEPA Well No: MW 107B



DRILLING SUMMARY

Drilling Co: J. MATHES & ASSOC. Drillers: TIM CRANK

Drill Rig Make/Model: CME 75

Borehole Diameters: 8.25" Drilling Fluid: NA

Bits/Depths: 4.25" HSA down to 69'

Total Depth: 69' Depth to Water: ~12' during

Supervisory Geologist: R. E. LANTZ, M. G. RYS.

WELL DESIGN

Casing Material: 304 STAINLESS Diameter: 2" Length: ~58.5

Screen Material: 304 STAINLESS Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 56'-66'

Filter Material: SILICA SAND (20-40 and 100 sieve) Setting: 53'-66.5'

Backfill Material: BENTONITE CHIPS Setting: 66.5'-69'

Grout: VOLCLAY Setting: 0'-53'

Surface Casing Material: none (flush-mounted) Setting:

TIME LOG

NOTE: No drilling occurred 7/12/91 — rig da

	Started	Completed
Drilling:	7/11/91 @ 1515	7/13/91 @ 1328
Installation:	7/13/91 @ 1456	7/13/91 @ 1721
Development:	8/6/91 @ 1530	8/6/91 @ 1745

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: 12'

Pumping Depth to Water: not measured

Pumping Rate: 2.5 gpm Specific Capacity: not measu

Volume Pumped: 338 gal

NY-5

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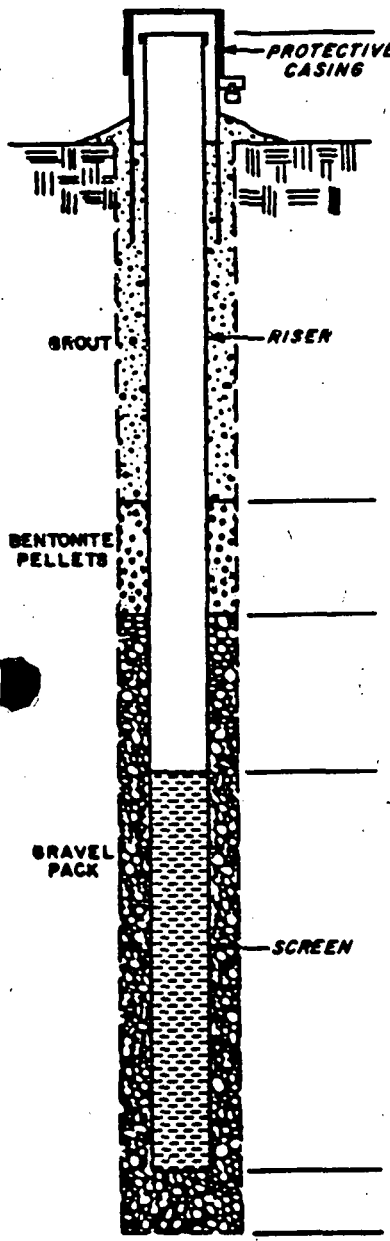
WELL CONSTRUCTION SUMMARY

Project: SE Rockford Client: IEPA Well No: MW107C



DRILLING SUMMARY

Drilling Co: Mathes Drillers: E Clark, G Nowak, J Crank

Drill Rig Make/Model: Gus Pech / Brat 32R

Borehole Diameters: 0-126': 12"; 126-142': 6" Drilling Fluid: 0-126': bentonite mud; 126-142': air

Bits/Depths: 0-126': 12" tri-cone rotary; 126-142': air hammer

Total Depth: 142' Depth to Water: 16.7'

Supervisory Geologist: M Sorensen

WELL DESIGN

Casing Material: black pipe (outer casing), type 304 stainless Diameter: 6", 2" Length: 125.5', 130'

Screen Material: wire-wound ty. 304 Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 130'5" - 141'1" (incl. 8" plug @)

Filter Material: coarse sand, fine sand Setting: 129-142', 128-129'

~~Seal Material~~: Volclay grout Setting: 3-128'

Grout: cement-bentonite Setting: 3-125.5 (only outside the 6" ca

Surface Casing Material: 5.5" steel Setting: welded onto 6" casing, which extends from 0.5' to 126'.

TIME LOG

	Started	Completed
Drilling:	7/24/91 @ 1610	7/31/91, 0745
Installation:	7/31/91, 0800	7/31/91, 1100
Development:	8/6/91 @ 1745	8/6/91, 1945

WELL DEVELOPMENT

Method: air lift & surge

Static Depth to Water: 16.7'

Pumping Depth to Water: unknown

Pumping Rate: 2.5 gpm Specific Capacity: unknown

Volume Pumped: 300 gal.

NY-5

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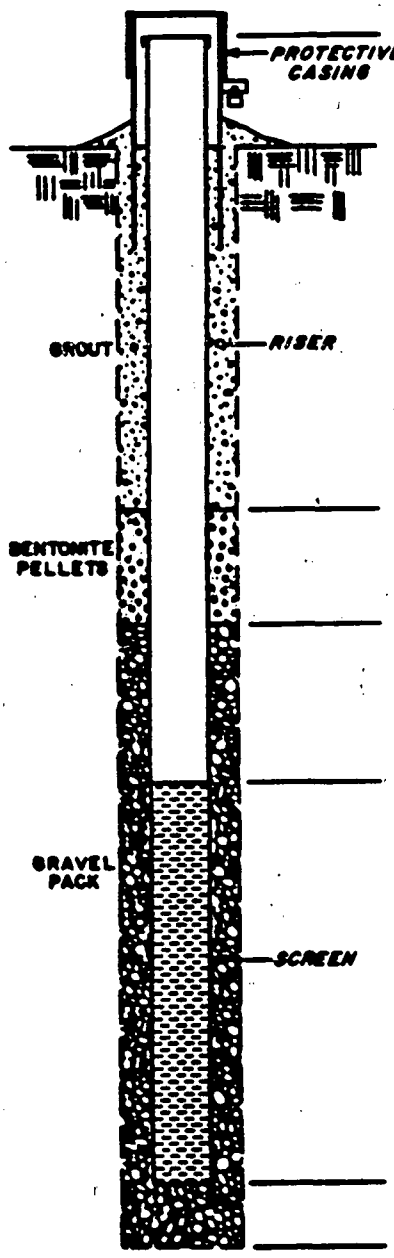
WELL CONSTRUCTI

Project: SE ROCKFORD Client: IEPA Well No: MW108A



DRILLING SUMMARY

Drilling Co: J. MATHES & ASSOC. Drillers: TIM CRANK

Drill Rig Make/Model: CME 75

Borehole Diameters: 8.25" Drilling Fluid: NA

Bits/Depths: 4.25" HSA to 40'

Total Depth: 40' Depth to Water: ~28'

Supervisory Geologist: S. BHAGAT

WELL DESIGN

Casing Material: 304 STAINLESS Diameter: 2" Length: ~31.5

Screen Material: 304 STAINLESS Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 29'-39'

Filter Material: SILICA SAND Setting: 26'-27' (100 SIEVE); 27'-40' (20-

Seals Material: Setting:

Grout: VOLCLAY Setting: 2'-26'

Surface Casing Material: 5.5" steel Setting: -2 to 3'; set in concrete

TIME LOG

	Started	Completed
Drilling:	7/15/91 @ 1425	7/15/91 @ 1452
Installation:	7/15/91 @ 1510	7/15/91 @ 1730
Development:	8/6/91 @ 1000	8/6/91 @ 1400

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~28'

Pumping Depth to Water: not measured

Pumping Rate: 0.3 gpm Specific Capacity: not measur

Volume Pumped: 75 gal

NY-5

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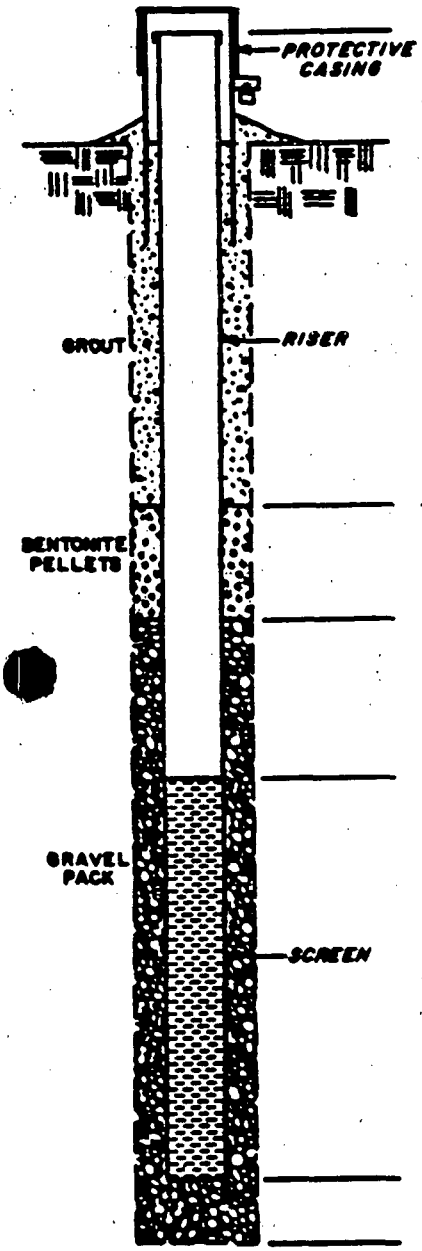
WELL CONSTRUCTION SUMMARY

Project: SE Rockford Client: IEPA Well No: MW 108B



DRILLING SUMMARY

Drilling Co: J. Mathes & Assoc. Drillers: Tim Crank

Drill Rig Make/Model: CME 75

Borehole Diameters: 8.25" Drilling Fluid: NA

Bits/Depths: 4.25" HSA to 64'

Total Depth: 64' Depth to Water: ~28'

Supervisory Geologist: S. Bhagat

WELL DESIGN

Casing Material: 304 Stainless Diameter: 2" Length: ~53.5'

Screen Material: 304 Stainless Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 51'-61'

Filter Material: Silica Sand Setting: 47'-49' (100 sieve); 49'-62' (20-40 sie

Seals Material: Bentonite Chips Setting: 62'-64'

Grout: Volclay Setting: 2'-47'

Surface Casing Material: 5.5" steel Setting: -2 to ~3'; set in concrete (c

TIME LOG

	Started	Completed
Drilling:	7/14/91 @ 1515	7/15/91 @ 1015
Installation:	7/15/91 @ 1120	7/15/91 @ 1330
Development:	8/6/91 @ 0730	8/6/91 @ 1230

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~28'

Pumping Depth to Water: not measured

Pumping Rate: 2.5 gpm Specific Capacity: not measured

Volume Pumped: 750 gal

NY-5

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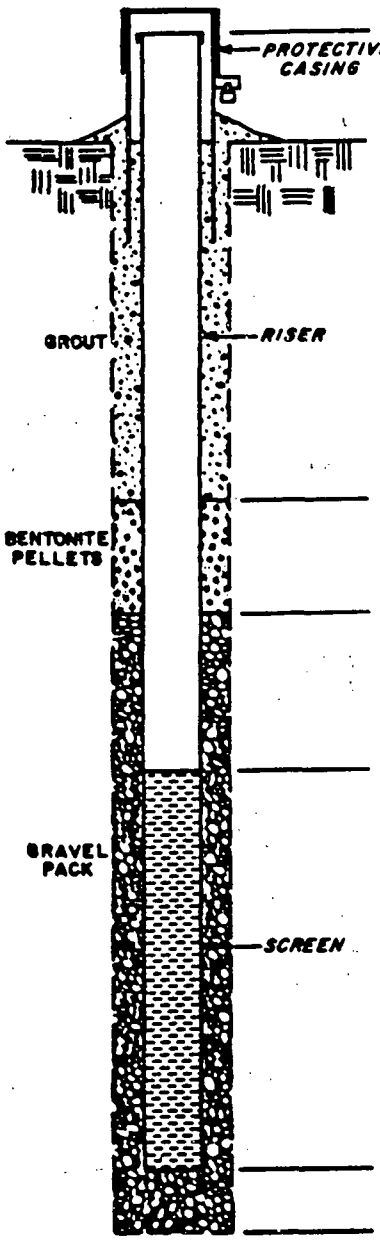
WELL CONSTRUCTION

Project: SE Rockford Client: IEPA Well No: MW108C



DRILLING SUMMARY

Drilling Co: Mathes Drillers: E Clark, G Nowak,

Drill Rig Make/Model: Gus Pech Brat 22R

Borehole Diameters: 0-7': 16"; 7-119.5': 12"; 119.5-137': 6" Drilling Fluid: 0-119.5': bentonite; 119.5-137': air

Bits/Depths: 0-119.5': 12" rotary; 119.5-137': 6" air hammer

Total Depth: 137' Depth to Water: ~26.5'

Supervisory Geologist: M Sorensen

WELL DESIGN

Casing Material: black pipe / type 304 stainless Diameter: 6" / 2" Length: 121.5' (c / 126'

Screen Material: " " Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 124.3 - 134.3'

Filter Material: coarse sand / fine sand Setting: 124-135' / 122-124'

Seals Material: Setting:

Grout: Volclay; cement-bentonite Setting: 3-122'; 3-119.5' (c-b grout is ou co

Surface Casing Material: 5.5" steel Setting: -3 to 2; welded to 6" p and set in concrete (0-3')

TIME LOG	Started	Completed
Drilling:	7/24/91 @ 1310	7/26/91 @ 1530
Installation:	7/26/91 @ 1630	7/27/91 @ 1510
Development:	8/6/91 @ 0730	8/6/91 @ 1000

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~26.5'

Pumping Depth to Water: unknown

Pumping Rate: 5 gpm Specific Capacity: unknown

Volume Pumped: 700 gal

NY-5

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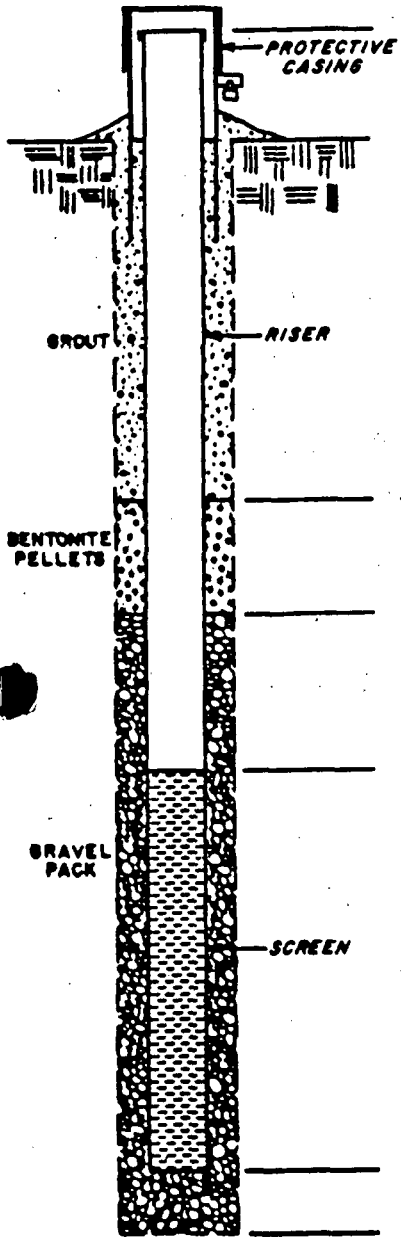
WELL CONSTRUCTION SUMMARY

Project: SE ROCKFORD Client: IEPA Well No: MW109A



DRILLING SUMMARY

Drilling Co: J. MATITES & ASSOC. Drillers: TIM CRANK

Drill Rig Make/Model: CME 75

Borehole Diameters: 8.25" Drilling Fluid: NA

Bits/Depths: 4.25" HSA

Total Depth: 32.5' Depth to Water: ~25'

Supervisory Geologist: R. LANTZ

WELL DESIGN

Casing Material: 304 STAINLESS Diameter: 2" Length: ~25'

Screen Material: 304 STAINLESS Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 22'-32'

Filter Material: SILICA SAND Setting: 20'-32.5' (20-40 SIEVE); 19'-20' (1.0 SIE

Seals Material: Setting:

Grout: VOLCLAY Setting: 2'-19'

Surface Casing Material: 5.5" steel Setting: -2 to 3; set in concrete (0-

TIME LOG

	Started	Completed
Drilling:	6/28/91 @ 1125	6/28/91 @ 1355
Installation:	6/28/91 @ 1500	6/28/91 @ 1720
Development:	7/30/91 @ 1630	7/30/91 @ 1800

WELL DEVELOPMENT

Method: DUAL LINE AIR LIFT.

Static Depth to Water: 25'

Pumping Depth to Water: not measured

Pumping Rate: 1.3 GPM Specific Capacity: not measured

Volume Pumped: 113 gal.

NY-5

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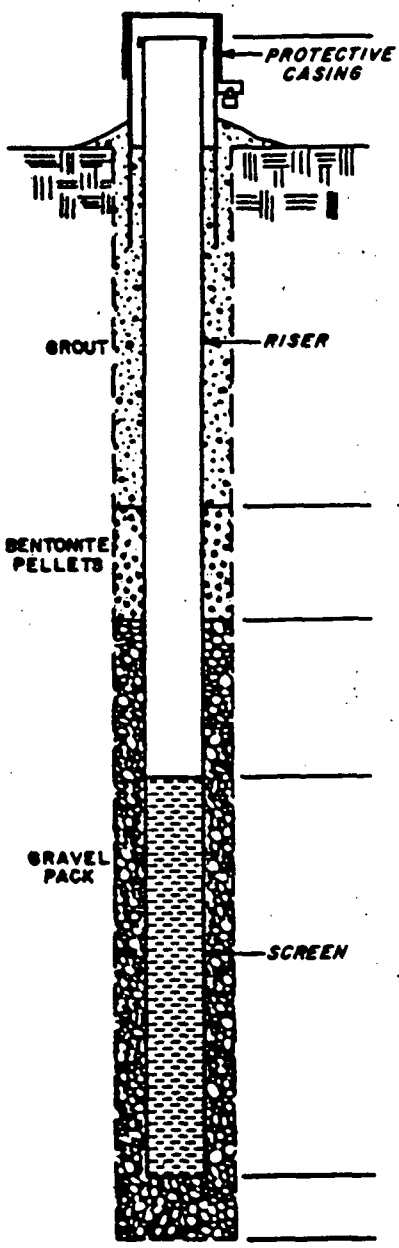
WELL CONSTRUCTIO

Project: SE Rockford Client: IEPA Well No: MW109B



DRILLING SUMMARY

Drilling Co: J. MATHES & ASSOC. Drillers: ED CLARK, TIM C

Drill Rig Make/Model: CME 75 (0'-39.5')

Borehole Diameters: 12" from 0-39.5'; 6" below Drilling Fluid: MUD (30'-39.5' AIR (39.5'-6

Bits/Depths: 0-39.5': 8 1/4" auger; 39.5-61': 6" air hammer

Total Depth: 61' Depth to Water: ~28'

Supervisory Geologist: R. LANTZ, S. BHAGAT

WELL DESIGN

Casing Material: {blackpipe / 304 STAINLESS} Diameter: {6" / 2"} Length: {41.5' / ~53'}

Screen Material: 304 STAINLESS Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 50'-60'

Filter Material: SILICA SAND (20-40 SIEVE) Setting: 48'-61'

Seals Material: SILICA SAND (100 SIEVE) Setting: 47'-48'

Grout: Volclay; cement-bentonite Setting: 2-47'; 2-39.5' (outside 6" ca

Surface Casing Material: 5.5" steel Setting: -2 to 3'; welded to 6" cas and set in concrete (0-2')

TIME LOG

	Started	Completed
Drilling:	7/23/91 @ 1115	7/23/91 @ 1420
Installation:	7/23/91 @ 1450	7/23/91 @ 1800
Development:	7/30/91 @ 1330	7/30/91 @ 1600

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~28'

Pumping Depth to Water: not measured

Pumping Rate: 0.6 GPM Specific Capacity: not meas

Volume Pumped: 94 gal

NY-5

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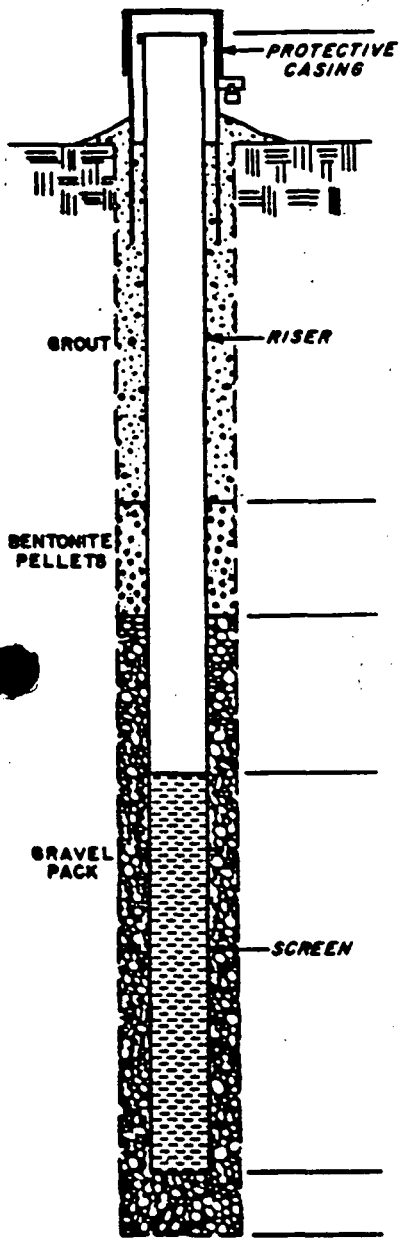
WELL CONSTRUCTION SUMMARY

Project: SE Rockford Client: IEPA Well No: MW109C



DRILLING SUMMARY

Drilling Co: J. MATHES ASSOC. Drillers: ED CLARK, T. ERAN

Drill Rig Make/Model: CME 75 (0'-39'); GUS PECH BRAT 22R (39'-86

Borehole Diameters: 12.25" (0'-30'); 8" (30'-39'); 6" (39'-86') Drilling Fluid: MUD (30'-39') AIR (39'-86')

Bits/Depths: 8.25" hollow-stem auger (0-30'); 8" tri-cone; 6" air hammer

Total Depth: 86 ft. Depth to Water: ~28'

Supervisory Geologist: S. BHAGAT, R. LANTZ

WELL DESIGN

Casing Material: black pipe / 304 STAINLESS Diameter: 6 in. / 2 in. Length: ~41 ft. / ~78 ft

Screen Material: 304 STAINLESS Diameter: 2 in. Length: 10 ft.

Slot Size: 0.010" Setting: 75'-85'

Filter Material: SILICA SAND (20-40 SIEVE) Setting: 73'-86'

Seals Material: SILICA SAND (100 SIEVE) Setting: 72'-73'

Grout: Volclay; cement-bentonite Setting: 2-72'; 2-39' (outside 6" casing only)

Surface Casing Material: 5.5" steel Setting: -2 to 3'; welded to 6" casing and set in concrete (0-2')

TIME LOG

	Started	Completed
Drilling:	7/22/91 @ 1330	7/22/91 @ 1630
Installation:	7/22/91 @ 1645	7/23/91 @ 0910
Development:	7/30/91 @ 1630	7/30/91 @ 1800

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~28'

Pumping Depth to Water: not measured

Pumping Rate: 0.8 GPM Specific Capacity: not measured

Volume Pumped: 75 gal

NY-5

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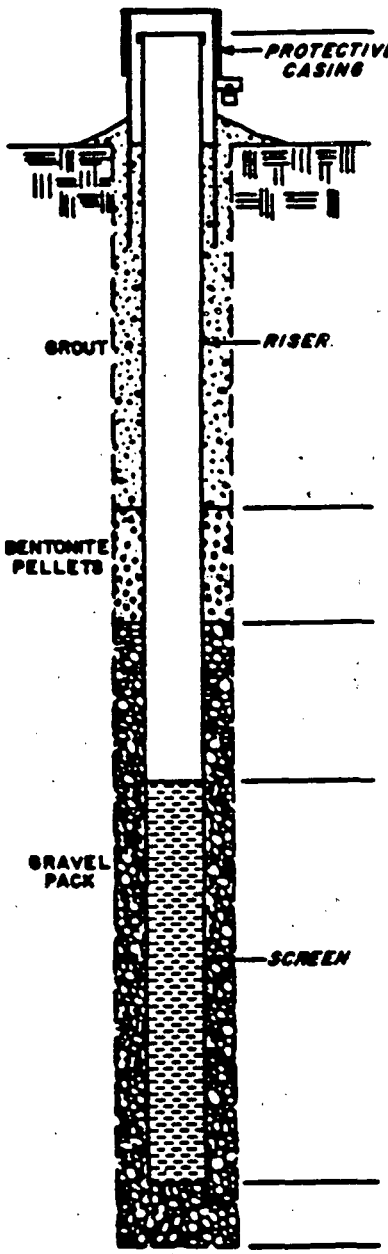
WELL CONSTRUCTION

Project: SE Rockford Client: IEPA Well No: MW110A



DRILLING SUMMARY

Drilling Co: J. Mathes & Assoc. Drillers: Tim Crank

Drill Rig Make/Model: CME 75

Borehole Diameters: 8.25" Drilling Fluid: NA

Bits/Depths: 4.25" HSA down to 43'

Total Depth: 43' Depth to Water: ~26.5' during drilling

Supervisory Geologist: S. Bhagat

WELL DESIGN

Casing Material: 304 Stainless Diameter: 2" Length: 32.5

Screen Material: 304 Stainless Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 30'-40'

Filter Material: Silica Sand (20-40 sieve) Setting: 28'-43'

Seals Material: Silica Sand (100 sieve) Setting: 27'-28'

Grout: Volclay Setting: 2'-27'

Surface Casing Material: 5.5" steel Setting: -2 to 3'; set in concret

TIME LOG

	Started	Completed
Drilling:	7/15/91 @ 1650	7/17/91 @ 0848
Installation:	7/17/91 @ 0940	7/17/91 @ 1125
Development:	7/27/91 @ 1130	7/27/91 @ 1400

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~26.5'

Pumping Depth to Water: not measured

Pumping Rate: not measured Specific Capacity: not measure

Volume Pumped: not measured

NY-5

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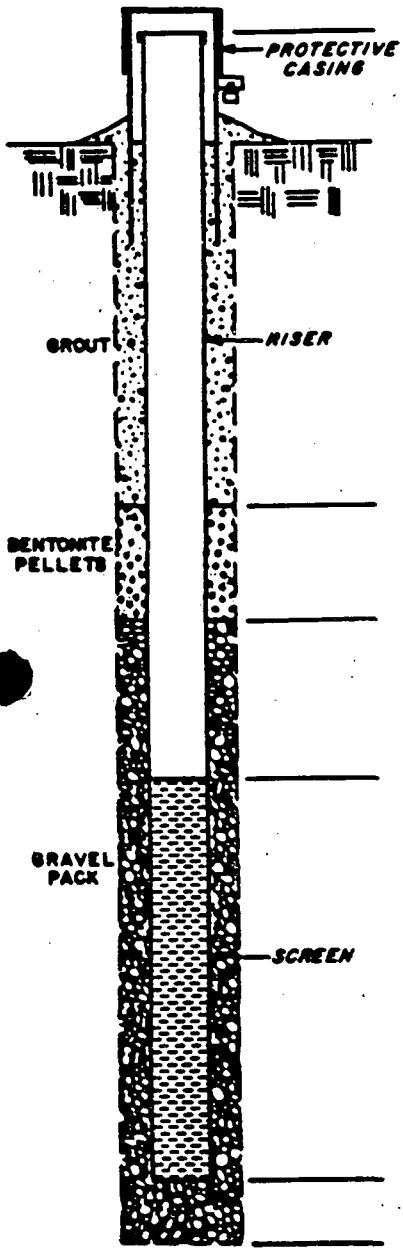
WELL CONSTRUCTION SUMMARY

Project: SE Rockford Client: IEPA Well No: MW110B



DRILLING SUMMARY

Q Nowak

Drilling Co: Mathes Drillers: E Clark, J McMullan

Drill Rig Make/Model: Gus Pech Brat 22R

Borehole Diameters: 0-46.5': 12"; 46.5-76.5': 6" Drilling Fluid: 0-46.5': none (auger); 46.5-76.5': bentonite

Bits/Depths: 0-46.5': 8¼" auger; 46.5-76.5': 5⅞" tricone rotary

Total Depth: 76.5' Depth to Water: ~35'

Supervisory Geologist: M Sorensen

WELL DESIGN

Casing Material: type 304 stainless Diameter: 2" Length: 64'

Screen Material: wire-wound stainless Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 61.3 - 71.3' (bottom cap is 0.7

Filter Material: coarse sand / fine sand Setting: 59-72 / 58-59

Seals Material: Setting:

Grout: Volclay Setting: 3 - 58'

Surface Casing Material: 5.5" steel Setting: ~2.5 to 2.5'; set in concrete (~0 to 2')

TIME LOG

	Started	Completed
Drilling:	7/23/91, 1300	8/13/91, 1710
Installation:	8/13/91, 1800	8/14/91, 1055
Development:		

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~35'

Pumping Depth to Water: not measured

Pumping Rate: Specific Capacity: not measured

Volume Pumped:

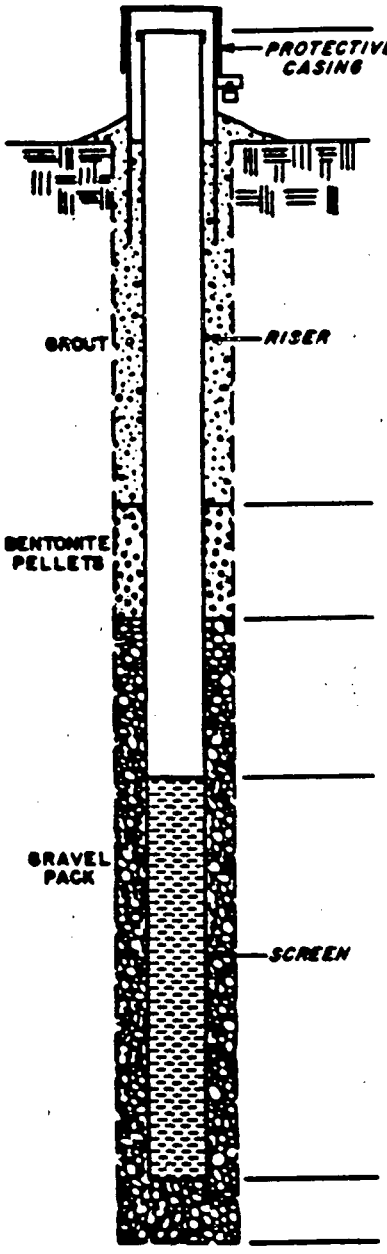
NY-5

CDM

environmental engineers, scientists, planners & management consultants

WELL CONSTRUCTI

Project: SE Rockford Client: IEPA Well No: MW110C



DRILLING SUMMARY

Drilling Co: Mathes Drillers: E Clark, Q Nowak, J McN

Drill Rig Make/Model: Gus Pech Brat 22R

Borehole Diameters: 0-80': 12" 80-115': 6" Drilling Fluid: bentonite mud air: 80-115'

Bits/Depths: 0-80': 12" tri-cone rotary; 80-115': 6" air hammer

Total Depth: 115' Depth to Water: ~35'

Supervisory Geologist: M Sorensen

WELL DESIGN

Casing Material: blackpipe / type 304 stainless Diameter: 6" / 2" Length: 82' / 104'

Screen Material: wire-wound stainless Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 101.4 - 111.4 (the 7" bot rests

Filter Material: coarse sand Setting: 99-115

~~Seal~~ Material: fine sand Setting: 98-99

Grout: cement-bentonite (outside 6" casing) Volclay Setting: ~2-80 (outside the 6" casi ~2-98

Surface Casing Material: 5.5" steel Setting: 3 to -2 (welded to 6" pipe and set in concret

TIME LOG

	Started	Completed
Drilling:	8/19/91, 1125	8/21/91, 0955
Installation:	8/21/91, 1020	8/21/91, 1435
Development:		

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~35'

Pumping Depth to Water: unknown

Pumping Rate: Specific Capacity: unknown

Volume Pumped:

NY-5

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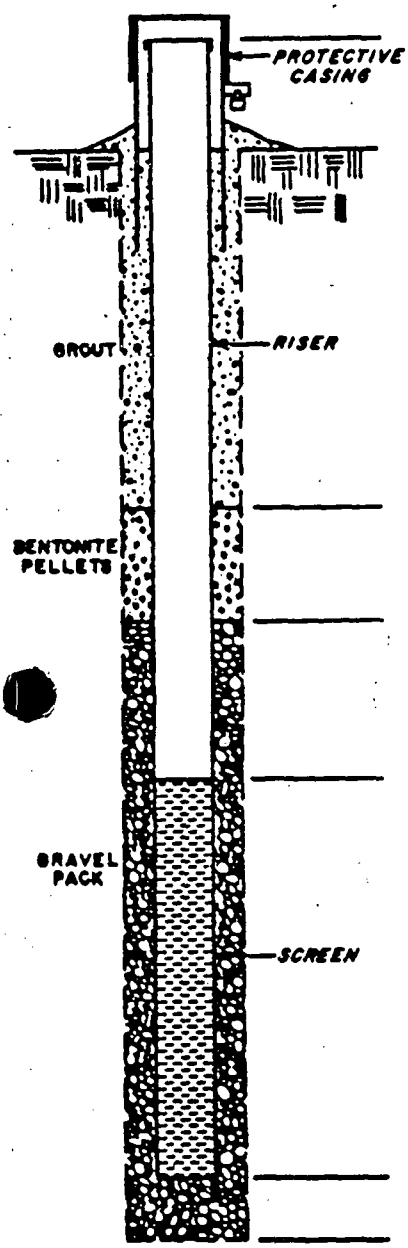
WELL CONSTRUCTION SUMMARY

Project: SE ROCKFORD Client: IEPA Well No: MW111A



DRILLING SUMMARY

Drilling Co: J. MATHES & ASSOC. Drillers: TIM CRANK

Drill Rig Make/Model: CME 75

Borehole Diameters: 8.25" Drilling Fluid: NA

Bits/Depths: 4.25" HSA

Total Depth: 37' Depth to Water: 23'

Supervisory Geologist: R. LANTZ

WELL DESIGN

Casing Material: 304 STAINLESS Diameter: 2" Length: ~27.5'

Screen Material: 304 STAINLESS Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 25'-35'

Filter Material: SILICA SAND Setting: 23'-37' (20-40 SIEVE); 22'-23' (100 SIEV

Seals Material: Setting:

Grout: VOLCLAY Setting: 3'-22'

Surface Casing Material: 5.5" steel Setting: -2 to 3'; set in concrete

TIME LOG

	Started	Completed
Drilling:	6/26/91 @ 1720	6/27/91 @ 0800
Installation:	6/27/91 @ 0810	6/27/91 @ 1030
Development:	7/26/91 @ 1625	7/27/91 @ 1115

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~23'

Pumping Depth to Water: not measured

Pumping Rate: 8 gal/hr Specific Capacity: not measured

Volume Pumped: 45 gal

NY-5

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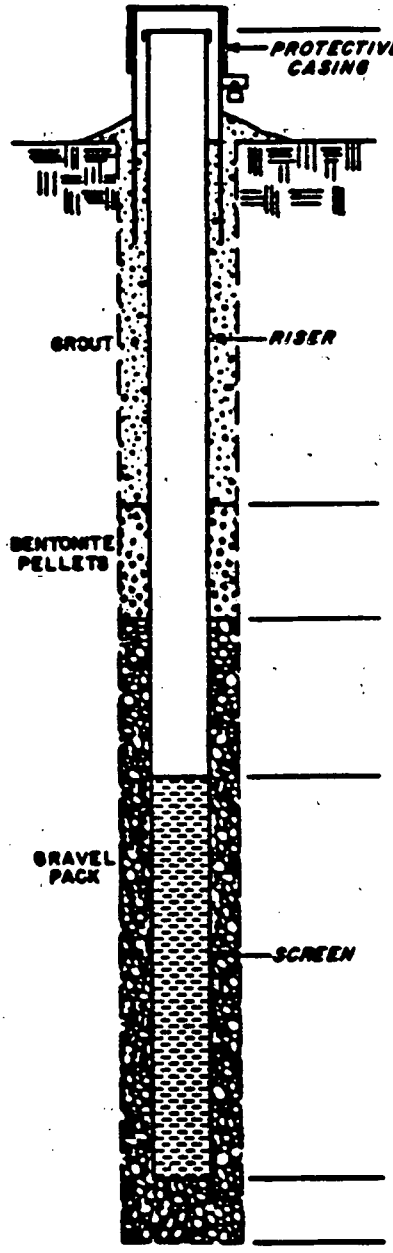
WELL CONSTRUCTI

Project: SE ROCKFORD Client: IEPA Well No: MW 111B



DRILLING SUMMARY

Drilling Co: J. MATHES & ASSOC. Drillers: TIM CRANK

Drill Rig Make/Model: CME 75

Borehole Diameters: 8.25" Drilling Fluid: NA

Bits/Depths: 4.25" HSA

Total Depth: 59' Depth to Water: ~23'

Supervisory Geologist: R. LANTZ

WELL DESIGN

Casing Material: 304 STAINLESS Diameter: 2" Length: ~50.5

Screen Material: 304 STAINLESS Diameter: 2" Length:

Slot Size: 0.010" Setting: 48'-58'

Filter Material: SILICA SAND Setting: 46'-58' (20-40 SIEVE); 45'-46'

Seals Material: Setting:

Grout: VOLCLAY Setting: 3'-45'

Surface Casing Material: 5.5" steel Setting: -2 to 3'; set in concrete

TIME LOG

	Started	Completed
Drilling:	6/25/91 @ 1655	6/26/91 @ 1250
Installation:	6/26/91 @ 1425	6/26/91 @ 1700
Development:	7/26/91 @ 1625	7/26/91 @ 1900

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: 23'

Pumping Depth to Water: not measured

Pumping Rate: ~55 gal/hr Specific Capacity: not measure

Volume Pumped: 140 gal

NY-5

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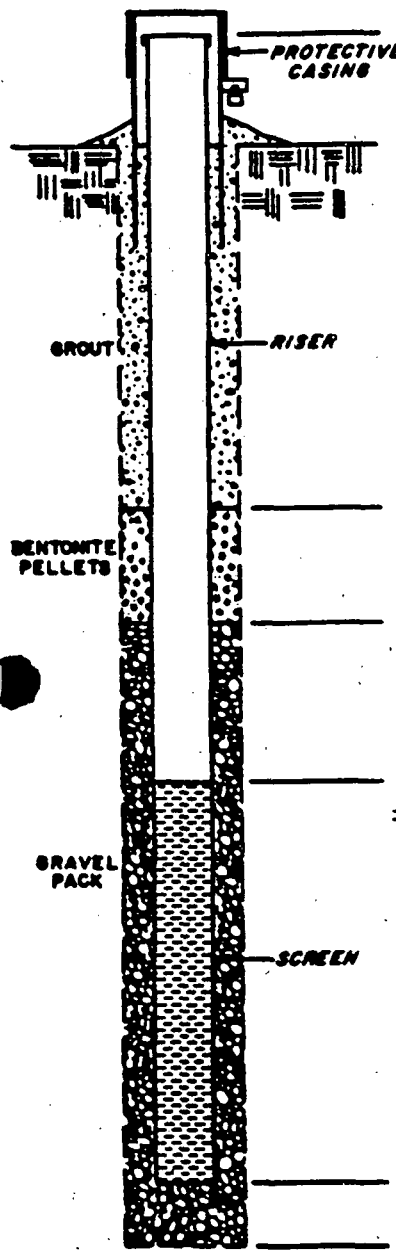
WELL CONSTRUCTION SUMMARY

Project: SE Rockford Client: IEPA Well No: MW111C



DRILLING SUMMARY

Drilling Co: Mathes Drillers: E Clark, Q Nowak, J McMul

Drill Rig Make/Model: Gus Pech Brat 22R

Borehole Diameters: 0-65.5': 12"; 65.5-99': 6" Drilling Fluid: 0-65.5': mud; 65.-99': air

Bits/Depths: 0-65.5': 12" tricone rotary; 65.5-99': 6" air hammer

Total Depth: 99' Depth to Water: 20.3'; swl in bedrock: 22.7

Supervisory Geologist: M Sorensen

WELL DESIGN

Casing Material: blackpipe / type 304 stainless Diameter: 6" / 2" Length: 67' (to 6' above) / 90'

Screen Material: wire-wound stainls. Diameter: 2" Length: 10'

Slot Size: 0.010" Setting: 87.3 - 98.0' (incl. 0.7' plug @ bottom)

Filter Material: coarse sand (20/40 sieve) / fine sand (100 sieve) Setting: 85-98' / 84-85'

~~Seals Material~~: Cement-bentonite Setting: 3-65.5' (outside the 6" casing)

Grout: Volclay Setting: 3-84'

Surface Casing Material: 5.5" steel Setting: -2 to 3 (welded to 6" casing; concrete fills hole from 0-3')

TIME LOG

	Started	Completed
Drilling:	8/9/91 at 0840	8/10/91 at 1355
Installation:	8/10/91 at 1440	8/10/91 at 1630
Development:		

WELL DEVELOPMENT

Method: dual-line air lift

Static Depth to Water: ~20'

Pumping Depth to Water: unknown

Pumping Rate: Specific Capacity: unknown

Volume Pumped:

NY-5

APPENDIX D

BOREHOLE LOGS

Limp, Dresser & McKee, Inc. One Center Plaza, Boston, Massachusetts 02108

oil Boring Log **Well Installation and Completion Data**

IEPA Site Southeast Rockford Job No. 1681-3 Surveyed Elevation: Ground 764.06

ate Drilled 6/18 to 6/26/91 Well No. MW101B Boring Co. John Mathes Top of Casing 766.62 Screen Length 10'

otal Depth 151' Boring Method Used Mud rotary (0-136'); air rotary (136-151') Piezometer Casing Size & Type 2" stainless 3

eld Geologist M Sorensen Organic Vapor Instruments Used OVA Water Table Depth 46'

Depth (feet)	Samp. No.	Blows per 6" ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
10								
		N.A.	17-19'	24"/7'		Sample consists of probable fall-in material: gravel & drilling mud	GW?	
20								
		N.A.	27-29'	refusal ~~24"/7'~~	M.S.	[No recovery]		
30								
		N.A.	37-39'	24"/7'		Sample consists of probable fall-in material: fine to med sand, some gravel, & bentonite mud.	SW-GW?	
40								42'?
		N.A.	47-49'		b.g.	Mod. yel. bn silt w/ little to some clay; one pebble "drop-stone." Saturated.	ML	
50								
		N.A.	57-59'		b.g.	Mod bn gray clayey silt, plastic, saturated; tr subang grans.	MH	

Remarks: Probably a till.

Camp, Dresser & McKee, Inc. One Center Plaza, Boston, Massachusetts 021

Soil Boring Log **Well Installation and Completion D**

page 2 of

Client _____ Site _____ Job No. _____ Surveyed Elevation: Grou

Date Drilled _____ Well No. MW101B Boring Co. _____ Top of Casing _____ Screen Length

Total Depth _____ Boring Method Used _____ Piezometer Casing Size & Type _____

Field Geologist _____ Organic Vapor Instruments Used _____ Water Table Depth

Depth (feet)	Samp. No.	Blows per 6" ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
								Depth of stratig. contact
60								
		N.A.	67-69'	24/15"	b.g.	67.0-67.5': mod bn gray clayey SILT, tr subang pebbs, plastic	MH	67.5'
70						67.5-68.2': Fine to med SAND, lt yel bn, mod well sorted, subang to ang; 95% Qtz w/ access feld, mafics & carbonate grains. Saturated.	SP	
		N.A.	78-80'	24/2"	b.g.	78-78.2': Coarse to fine SAND SW well graded, saturated; sim. in other respects to above sand	SW	
80								
		N.A.	87-89'	24"/13"	b.g.; but head space = 0.1 ppm	87-88.1': Med to fine SAND, lt yel bn, mod. well sorted, subang; tr silt/clay. Saturated. Note: At 94' cuttings are 60% silt/clay.	SP	? 89'?
90								
		N.A.	97-99'	24"/3"	—	97-97.3': broken gravel. Note: drilling action suggests gvl ends at 99'.	ML-GW?	99'
100								
		N.A.	102-104'	24/16"	b.g.	102-102.5': clayey SILT, mod brn gray to gray bn, tr ang to subangular pebbs & grans; a small wood twig & a marcasite grain; WET	SP-ML (mixed)	
		N.A.	107-109'	24/7"	—			
110								110'
		[next page begins at 110']				102.5-103.3': C. to fn. SAND, gy bn, tr to little subang & subrdd grans/pebbs; tr gy clay/silt; Saturated		
						107-107.1': Clayey SILT, gy bn, w/ trace grans/pebbs		
						107.1-107.6': Fn to c SAND, gy bn, tr grans/pebbs, wet. SW.		

Remarks:

Camp, Dresser & McKee, Inc. One Center Plaza, Boston, Massachusetts 02108

Soil Boring Log

Well Installation and Completion Data

Client _____ Site _____ Job No. _____ Surveyed Elevation: Ground _____

Date Drilled _____ Well No. MW101B Boring Co. _____ Top of Casing _____ Screen Length _____

Total Depth _____ Boring Method Used _____ Piezometer Casing Size & Type _____

Field Geologist _____ Organic Vapor Instruments Used _____ Water Table Depth _____

Depth (feet)	Samp. No.	Blows per 6" ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
110						Note: Drilling slows below 110'; also at this depth see gy bn clayey silt in cuttings	ML	110'
		N.A.	117-119'	24/24"	—	117-119': clayey SILT, bn gray (exc. at 117.0-117.1 where it's mod bn), ~5% subang to ang grans & pebbs w/ no preferred orienta; no bedding; saturated to moist	ML	
120								
		N.A.	127-129'	24/6"	—	127-129': clayey SILT, dk bn (org-rich?) to gy bn; 5% grans & pebbs, some > 1.5"	ML	
130								
						Drilling slows at 134'; soon get cuttings of lt gy to buff gy limestone/dolomite, angular.		134'
		Cuttings log	136-139'	NA	—	136-139': Limestone/dol, mod-lt gy, finely xln, some brown coatings that cause water to be rusty brown (this is ground water). LS is mod bn near 139'	Limestone (mod-lt gy) (mod bn)	
140								

Remarks:

Note: Mud rotary method used for drilling 0-136'; air rotary w/ down-the-hole air hammer used to drill 136-151' (T.D.).

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Soil Boring Log **Well Installation and Completion D**

page 4

Client _____ Site _____ Job No. _____ Surveyed Elevation: Ground

Date Drilled _____ Well No. MW101B Boring Co. _____ Top of Casing _____ Screen Length

Total Depth _____ Boring Method Used _____ Piezometer Casing Size & Type _____

Field Geologist _____ Organic Vapor Instruments Used _____ Water Table Depth

Depth (feet)	Samp. No.	Blows per 6" ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
140		[Log of cuttings]				139-147': mod bn limest/dol at 139-140' grades into a hard, mod dk gy limest/dol w/ thin (≤ ½ mm) laminae & veinlets of blk material; some mottling of same. Few (<1%) blk chips, siliceous. Saturated & producing a tan-colored water. Slow drilling.	(mod-dk gy) (bn) (buff)	
150								
151'						147-151': the above gy ls/dol grades to a brown ls near 147', which soon yields to a buff ls, finely xln; some chips ~~ar~~ are fine to v finely granular & porous; some rusty bn coatgs; rel. soft (drills faster than 139-147'). Saturated, rapidly producing a milky water.		151' E.O.B. Screened interval 141-151'
160								

Remarks:

Camp, Dresser & McKee, Inc. One Center Plaza, Boston, Massachusetts 0210

Soil Boring Log

Well Installation and Completion Dat

MW102 A: 786.
B: 786.

Client IEPA Site SE ROCKFORD Job No. 1681 Surveyed Elevation: Ground A

Drilled 6/18-6/20/91 Well No. MW102B Boring Co. J. MATHES Top of Casing MW102A: 788.43 B: 788.61 Screen Length 10'

Total Depth _____ Boring Method Used 4.25" HSA Piezometer Casing Size & Type 2" STAINLESS

Field Geologist R. LANTZ Organic Vapor Instruments Used HNu Water Table Depth 23'

Depth (feet)	Samp. No.	Blows per 6" _____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
		4/9/6/5	8'-10'	10"	0.5	Black, sandy clay w/ roots.		
10							CL	
						?		
20								
								▽ 23'
		9/12/20/22	28'-30'	—	0	Uniform grayish tan, fine to med sand.		
30							SP	
		6/15/26/45	38'-40'	12"	—	Gray to brown, silty clay till w/ gravel.		?
40								
		10/28/20/15	43'-45'	18"	0	Sandy clay and coarse sand & gravel, grayish brown	CL-SP	
		21/48/50+	48'-50'	12"	0	Sand and silty clay till, brown to gray		
50								
		9/17/13/17	53'-55'	—	0	Tan, sandy gravel	GP	
		9/18/18/25	58'-60'	18"	0	Gray, silty clay till	CL-ML	
60								

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BORING NUMBER: MW102

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day
		11/11/14/15	63'-65'	24"	0	Gray, silty clay till		
70		6/11/18/19	68'-70'	—	0	Gray, silty clay till	CL-ML	
		1/3/2/4	73'-75'	—	0	Light gray, fine to med sand.		
80		7/12/21/10	78'-80'	—	0	Light gray, fine to med sand	SP	
		21/50+	83'-85'	12"	0	Gravelly clay & clayey coarse sand.	SM	
90		16/34/50/50	88'-90'	15"	0	Light gray, fine to med sand		
		15/12/12/13	93'-95'	—	0	Coarse sand and gravel	SP	
100		2/4/22/20	98'-100'	12"	0	Coarse sand & gravel. Lower 8": Uniform gray clay.		98.3'
		8/11/18/27	103'-105'	12"	0	Dark to med gray, moist, stiff clay	CL	
110		9/21/37/22	108'-110'	12"	0	Dark to med gray, moist, stiff clay		
		1/2/2/8	113'-115'	9"	0	Grayish brown, med to coarse sand & gravel	SP	
120		6/12/31/25	118'-120'	21"	0	Brownish gray, well sorted med sand. Lower 14": Brownish gray silty clay till		118.6'
		5/16/25/28	123'-125'	14"	0	Greenish gray, pliable silt	ML	
130		7/12/28/34	128'-130'	13"	0	Greenish gray, pliable silt		
		2/3/4/21	133'-135'	15"	0	Interbedded med/fine sand & silt	SP-ML	
140		9/6/7/15	138'-140'	13"	0.25	Light greenish gray, pliable silt	ML	

NY-2

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BORING NUMBER: MW102B

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
140		5/6/11/22	143'-145'	16"	0	Laminated dark grayish brown clay	CL	
150		9/22/50(3")	148'-150'	10"	0	Med sand and sandy gravel.	SP	EOB 148.9'
						[see MW102C log for description of 150-185']		

NY-2

Camp, Dresser & McKee, Inc. One Center Plaza, Boston, Massachusetts 021

Soil Boring Log **Well Installation and Completion Da**

Client IEPA Site SE Rockford Job No. 1681-3 Surveyed Elevation: Ground 787

Date Drilled 8/5-8/7/91 Well No. MW102C Boring Co. Mathes Top of Casing 789.87 Screen Length

Total Depth 185 Boring Method Used mud rotary & air rotary Piezometer Casing Size & Type 2" stainle

Field Geologist M Sorensen Organic Vapor Instruments Used OVA Water Table Depth ~

shallow aqu

swl in bedrock aq.: 43.

Depth (feet)	Samp. No.	Blows per 6" ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
						[see MW102B log for upper 150 feet]		
150			150-157' (cuttings sample)			150-157': Cuttings show a mixed zone of buff limestone (45% at 157'), yellow-bn silty till (~35%) and multilithologic granules (20%)	ML-GW (mixed zone)	
155								
		N.A.	157-159' (split spoon)	4/4"	not working	157-159': Mixture of subangular limestone cobbles (~60%) and lt gy bn to yel bn sandy silt containing subrounded to rounded pebbles of various lithologies.	ML-GW	
160								
162.5								

Remarks:

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BORING NUMBER: MW 102 C

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
162.5							ML-GW	
165			164.5-168.5' (cuttings)			164.5-168.5': Cuttings show buff limestone chips w/ ≤5% cream-colored silt containing granules	Lime-stone	
167.5								
170			168.5-170.5' (cuttings)			168.5-170.5': Brownish gray to grayish brown limestone, lithographic (cryptocrystalline) and without intergranular porosity. Producing brownish water at ~10 gpm.	(buff) (bn gy to gy bn)	6" steel casing set at 168.5'
172.5			170.5-180.5' (cuttings samples, collected on the foot)			170.5-180.5': Lithographic to vfine-grained limestone w/o intergranular porosity, loc. shaly (gen. <1%). Color at 171 & 172' is bn gray to gy bn, both containing dk gy shadowy wisps. At 173-180', color is lt gy bn; 5% dk bn shale at 173'. Produces tan to gray water at 20 gpm.	(lt gy bn)	dk bn shale (5%)
175								
177.5								
180			180.5-185.0' (cuttings samples, collected on the foot)			180.5-185.0': Vfine limestone, loc. finely sucrosic but mainly w/o intergranular porosity. At 181 & 182' color is lt gy bn and there is ~10% dk bn shaly limestone		~10% dk bn shaly limestone
182.5								

NY-2

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BORING NUMBER: MW102

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Da
182.5						180.5–185.0 cuttings (cont'd.) At 183' color is lt gy bn w/ some bluish gray mottling; at 184 & 185' color shifts to lt gy w/ some bluish gray mottling; sl argillaceous. Produces lt gy water at ~30 gpm.	(lt gy bn) (lt gy)	
185.0 (T.D.)							T.D. = 185'	← sl. argill

NY-2

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oil Boring Log — Well Installation and Completion Data

IEPA Site SE ROCKFORD Job No. 1681 Surveyed Elevation: Ground 790.49

ate Drilled 6/30-7/1/91 Well No. MW103A Boring Co. J. MATHES Top of Casing 792.56' Screen Length 10'

otal Depth 44.5' Boring Method Used 4.25" HSA Piezometer Casing Size & Type 2" STAINLESS

ield Geologist R. LANTZ Organic Vapor Instruments Used HNu Water Table Depth 18.9'

Depth (feet)	Samp. No.	Blows per 6" ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
5								
10		2/4/5/6	9'-11'	15"	0	Beige, clayey fine sand w/pebbles, moist, uniform, plastic	SC	clayey fine sand
15								?
20		4/7/10/12	19'-21'	21"	BG	Beige, fine sandy clay till w/ pebbles and rare sand seams. moist, plastic.		▽ 18.9'
25		18/40/38/30	24'-26'	18"	0	Brown, sandy silt till w/occasional cobbles & fine gravel.	ML	Brown sandy silty till
30		14/24/18/20	29'-31'	24"	0	Reddish brown silty till w/gravel. Clay common in top 1'. Cobbles rare in bottom 1'.		
35		-/-/6/12	34'-36'	24"	—	Reddish tan, fine to med. & coarse sand		?
40		22/55/71+	39'-41'	18"		Tan/yellow, coarse sand to fine sandy gravel. Mostly dolomite gravel; angular.	SP	Med to coarse sand
45		85 (for 6")	44'-44.5'	6"		Yellowish tan fractured, rubbley dolomite w/fine sand.		39.5' weathered zone. 44.5' Augers refusal.
						[see log of MW103B/C for description of 45-110' interval]		

Remarks: 34'-36' Spoon sank 12" by its own weight.
Auger refusal @ 44.5'

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Soil Boring Log **Well Installation and Completion**

Client IEPA Site Southeast Rockford Job No. 1681-3 Surveyed Elevation: Ground A MW103B: 792.39 MW103C: 792.35 MW103B: (MW103C: 79

Date Drilled 7/1-7/16/91 Well No. MW103B/C Boring Co. Mathes Top of Casing A Screen Length 10'

Total Depth 110' Boring Method Used 0-48': Hollow-stem auger 48-110': Air hammer Piezometer Casing Size & Type 2" type 304

Field Geologist M Sorensen Organic Vapor Instruments Used none (air drilling) Water Table Depth ~ 2

Depth (feet)	Samp. No.	Blows per 6' lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipm Install
						See MW103A log for description of 0-45' interval		
44								
							weathered zone	
							Limestone	
48			48.3-51' (bedrock cuttings samples collected on the foot)			48.3-51': Buff to lt gray limestone fine to med. crystalline but loc. sandy (incl. many granules in cuttings); ~15% bn clay, bentonitic		bn b
52			51-61' (bedrock cuttings samples collected on the foot)			51-61': Buffish gray limestone, finely to med crystalline w/ sandy texture (incl. crinoid stem frags) on margins of many chips (~1 sandy margin per ½ inch). Bn bentonitic clay is 15% at 52', 10% at 56', tr to 4% elsewhere; tr chalk @52'.	(grayish buff)	
56								
60			61-71' (bedrock cuttings samples collected on the foot)			61-71': Limestone as above, grayish buff to buffish gray. Bn bentonitic clay: 5% at 62, 63 & 71'; tr to 2% elsewhere. Chalk/bn gray chert composite chips are 20% at 67', 5% at 70'	Lime-stone	
64								

Remarks:

page 1 of 3

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BORING NUMBER: MW103 B/C

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
64							Lime-stone	
								chert
68								
			71-81' (bedrock cuttings samples collected on the foot)			71-81': Buffish gray to grayish buff limestone as above, but somewhat more sandy in texture. Bn bentonitic clay ~8% at 72', 5% at 81'.		
72								
76								
							Lime-stone (grayish buff)	
80								
			81-91' (bedrock cuttings samples collected on the foot)			81-91': grayish buff limestone as above; bn bentonitic clay ~5% at 82', <2% elsewhere (probably falling in from above, even at 82'); chalk/chert chips are 40% at 90', 10% at 88', 1% at 89', tr to none elsewhere		
84								
88								
								chert
			91-101' (bedrock samples of cuttings collected on the foot)			91-101': grayish buff to buffish gray limestone as above, exc. limestone is yel bn & more fractured at 96'. Bn bent'ic clay is 5% at 91', tr elsewhere; chert/chalk chips are 90% at 93', 20% at 97', 30% at 99 & 100'		
92								chert
96							Lime-stone	

NY-2

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BORING NUMBER: MW103 B/C

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
96							Limestone	
								chert
								chert
100			101-110' (bedrock cuttings samples collected on the foot)			101-110': Limestone as above, exc. color is grayish buff at 102-106', bn gray at 107-109', mod gray at 110'; blk carbonac. coatings at 107-110'.		
104							Lime-stone	
							(grayish buff)	
							(bn gray)	
108								
110							(mod gray)	T.D. = 110' (MW103C)

NY-2

Camp, Dresser & McKee, Inc. **200 W. Adams, Suite 1600 Chicago, Illinois 60606**

Soil Boring Log **Well Installation and Completion Data**

Client IEPA Site SE ROCKFORD Job No. 1681-3 Surveyed Elevation: Ground 815.94

Date Drilled 7/22/91 Well No. MW104A Boring Co. J. MATHES & ASSOC Top of Casing 818.10 Screen Length 10'

Total Depth 77' Boring Method Used 4.25" HSA Piezometer Casing Size & Type 2" TYPE 304

Field Geologist T. CARLSON Organic Vapor Instruments Used _____ Water Table Depth ~38'

Depth (feet)	Samp. No.	Blows per 6' _____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
5								
10								
15								
20								
25								
30								
35								
40						Brown, very fine sandy silt with ~5% pebbles		
45		18/25/27/24	44-46	95%		Brown, very fine sand silt		
50		for 5.5" 9/30/47/50	49-51	90%		Brown silty sand with gravel		
55		9/16/36/47	54-56					

Remarks:

Camp, Dresser & McKee, Inc. One Center Plaza, Boston, Massachusetts 021

Soil Boring Log **Well Installation and Completion D**

MW104B:
MW104C:

Client IEPA Site SE Rockford Job No. 1681-3 Surveyed Elevation: Grou B: 817.37 C: 818.25

Date Drilled 6/27-6/29/91 Well No. MW104 Boring Co. Mathes Top of Casing Screen Length

Total Depth 146.5' Boring Method Used mud rotary 0-79'; air rotary 79-146.5' Piezometer Casing Size & Type 2" stainle

Field Geologist M Sorensen Organic Vapor Instruments Used OVA Water Table Depth

Depth (feet)	Samp. No.	Blows per 6" ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
0							Fill: dk bn loam	
							Sand	
10								
20		N.A.	18-20'	24/15"	—	18-20': V.fn. sandy silt, mod. or bn, w/ ~8% ang. to subang. pebb's & gran's; moist	ML	
						Note: cuttings at 25-35' are largely sand & gvl		
30		N.A.	28-30'	24/4"	—	28-~~30'~~ 28.3': Sand & gravl, silty, mod. or. bn, moist	SW-GW	
40		N.A.	38-40'	24/5"	b.g.	38-38.4': Silty, vfn SAND, w/ ~8% subang to ang gran's & pebb's; mod or bn; moist. No discernible bedding, suggesting till.	SM-ML	
50		N.A.	48-50'	8"/4"	b.g.	48-48.3': Silty, vfn SAND, or v fn sandy silt w/ ~8% pebb's & gran's which are subang & of random orientation; sand is vfn to coarse; mod or bn w/ some Fe ox spots & films; not cohesive; moist.	SM-ML	
		[continued at 50' on next page]						

Remarks:

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BORING NUMBER: MW104

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
50						Cuttings at 50-63' are sand & gravel w/ some silty till, ~~bn~~ as above		
55							GW-ML	
			58-60'	24/<1"	b.g.	58-58.05': Silty sand, or bn, and loose slufted gvl		
60								
						Cuttings at 63 to ~68' are gray clayey sandy silt w/ ~10% subrdd to subang gran's & pebb's; pebb's are largely carbonate & chert, possibly suggesting bedrock is near	ML	
65								
			68-70'	24/11"	b.g.	68.0-68.3': rfn sandy, clayey SILT w/ some (~10%) gran's & pebb's which are carb, cht & dk gy phyllitic shale (soft); many pebb's subhoriz. & a few vertical; sl plastic; moist; gray at 68-68.05' but otherwise mod or-bn	SW	
70							ML	
75						68.3-68.6': gravelly SAND, med to c-gr, saturated	GW	
			77-91' cuttings samples collected on the foot			68.6-68.9': same as 68.0-68.3' 75-77' cuttings show subrounded gravel	Limestone (buff)	6" casin seated (79'.
80						Cuttings in bedrock 77-91': Limestone, dolomitic, buff, finely to vfinely xln to finely sandy & porous; rare (<<1%) white to bn gray chips (comm. zoned like a chert nodule w/ bn gy inside white) which are cht (bn gy) surrounded or adj. to partly silic to unsilic limes		
85							Limestone	Brown clay (50%)
90								one (the white zones

[cont'd.]

NY-2

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BORING NUMBER: MW1C

Log of Boring

Depth (feet)	Samp. No.	Blows per 6 lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remark (Time of
90			91-101' cuttings samples collected on the foot			Cuttings at 77-91' (cont'd.) At 82' & below is loc abun. clay, shaly, chocolate bn w/ common laminae or irreg. zones of dk yel bn clay. on submillimeter scale; soft; 50% of cuttings at 83' and 10-40% elsewhere. Producing 55-60 gpm; water is or bn @ 79-85' & tan 85-91'.	Limestone (buff)	
95								
100			101-111' cuttings samples collected on the foot			91-101' cuttings: same as 81-91', exc. bn clay (bentonitic?) is ~30% of cuttings at 92' and 2-10% elsewhere. Aquifer water is tan, & production similar to 81-91'.		
105								
110			111-121' cuttings samples collected on the foot			101-111' cuttings: same as 81-91', exc. 15% white/bn gy zoned carb/cht frags (many frag's lack the chert) at 111'. Bn clay: 20% at 102 & 106'; 1-10% elsewhere. Water production > 60 gpm & clarity similar.		Chert (of cut; Chert 5%
115								
120			121-131' cuttings samples collected on the foot			111-121': same as 81-91' exc. 5% cht at 113 & 120', elsewhere tr to ~2%; bn clay 20% at 116', elsewhere 1-10%; see loc greenish-gray spots in the bn clay. Water production high, color milky tan.	(buff) (buff to gy buff)	←Chert 5
125						121-131': same as 81-91' exc. color is buff to grayish buff; 8% white/bn gy carb/chert at 123'; bn clay is tr exc. @ 131' where it's 3%; tr soft grayish gn shale below 123'; some echinoderm frag's	Limestone	Chert (gray-gn ct appea.
130								

NY-2

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BORING NUMBER: MW104

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
130			131-141' cuttings samples collected on the foot			Cuttings log: 121-131' (cont'd.) Water production high; color a milky tan. 131-141': same as 81-91' exc. bn clay (~3%) and gy-gn shale (trace) uniform throughout; rare fe oxide coatings; no chert or silic. zones. Water production high; sl. milky.	(buff to gy buff) (buff) Lime-stone	
135								
								Screen @ 136-146'
140			141-146.5' cuttings samples collected on the foot			141-146.5': dol'ic limestone as in 81-91' exc. that color is lt-mod bn gy (transition zone at 141-142'); few echinoderm frag's; grn gy shale tr exc @ 146', where it's 8-10% — could be a marker bed.	(lt-mod bn gy)	
145								grayish green shale (8
							T.D. 146.5'	
150								

NY-2

Camp, Dresser & McKee, Inc. **200 W. Adams, Suite 1600 Chicago, Illinois 6060**

Soil Boring Log **Well Installation and Completion Da**

MW105A

B: 78.

C: 783

Client IEPA Site SE ROCKFORD Job No. 1681-3 Surveyed Elevation: Ground

A: 785.57 B: 785.78 C: 785.66

Date Drilled 7/16/91 and 7/25-7/27/91 Well No. LOCATION MW 105 Boring Co. J. MATHES & ASSOC. Top of Casing Screen Length 10 ft.

Total Depth 104 ft Boring Method Used HOLLOW-STEM AUGER (4¼") Piezometer Casing Size & Type 2 in. 304 STAINLESS

Field Geologist S. BHAGAT Organic Vapor Instruments Used HNu Water Table Depth ~6' during

Depth (feet)	Samp. No.	Blows per 6" ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Depth of Stratigraphic Contact
5		1/3/3/4	4'-6'	6"	BG	Brown, med sand with gravel. Bottom 2" is brown, clayey silt & fine sand with rare gravel.		
10								
15		4/9/12/14	14'-16'	24"	BG	Brown, med to coarse sand with some gravel. Very moist.	SP	
20		4/5/7/10	19'-21'	21"	BG	Brown, med to coarse sand with rare gravel.		
25		2/4/6/7	24'-26'	18"	BG	Brown/tan, well-sorted fine sand; some clay in bottom 3".		25.3'
30		13/7/7/7	29'-31'	20"	BG	Brown/reddish brown, silty clay; somewhat plastic. Note of spoon contains gray, plastic clay.		
35		4/6/9/13	34'-36'	23"	BG	Dark gray, plastic clay.	CH	
40		5/10/11/18	39'-41'	60%	BG	Top 12": dark gray clay. Bottom 4": fine to coarse sand with silt & clay.		40'
45		5/10/18/23	44'-46'	80%	BG	Tan/brown coarse sand with pebbles (10%)		
50		6/15/23/17	49'-51'	65%		Brown, med to coarse sand + gravel w/ tr. Fe-oxide.	SP -GP	
55		10/15/11/13	54'-56'	16"	BG	Top 8": BROWN COARSE SAND & GRAVEL; ROUNDED. LIMESTONE PEBBLES 3-4cm. Bottom 8": GRAY PLASTIC CLAY WITH GRANULES AND RARE PEBBLES. PEBBLES ANGULAR-ROUNDED.	CH	54.7'

Remarks: page 1 of 2.

Camp, Dresser & McKee, Inc. **200 W. Adams, Suite 1600 Chicago, Illinois 60606**

Soil Boring Log **Well Installation and Completion Data**

Client IEPA Site SE ROCKFORD Job No. 1681-3 Surveyed Elevation: Ground _____

Date Drilled 7/16/91 and 7/25-7/27/91 Well No. LOCATION MW105 Boring Co. J. MATHES & ASSOC. Top of Casing _____ Screen Length _____

Total Depth 104ft Boring Method Used 4¼" HSA Piezometer Casing Size & Type 2in. STAINLESS ST

Field Geologist S. BURGAI Organic Vapor Instruments Used HNu Water Table Depth _____

Depth (feet)	Samp. No.	Blows per 6" _____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
60		10/12/14/21	59'-61'	18"	BG	GRAY CLAY TILL WITH ANGULAR, V. COARSE TO GRANULE-SIZED CLASTS. REDDISH LAMINATIONS IN UPPER 8".		
65		4/5/6/9	64'-66'	24"	BG	GRAY CLAY TILL WITH ANGULAR TO WELL-ROUNDED CLASTS, VERY COARSE SAND THROUGH 1 INCH. VARIABLE LITHOLOGY.	CH	
70		13/30/50 (4")	69'-71'	15"	BG	→ GRAY CLAY TILL. NO CLASTS.		
75		8/20/35/37	74'-76'	17"	BG	Top 7": Tan/brown, well sorted fine sand. Bottom 7": Coarse sand + gravel.		~72.5'
80		20/27/32/30	79'-81'	18"	BG	Tan/brown, well-sorted med sand to coarse sand + gravel.		
85		14/28/33/43	84'-86'	20"	BG	Tan/gray, well sorted, med to coarse sand and some gravel.		
90		27/47/51/46	89'-91'	20"	BG	Brown/gray, well sorted med sand. Bottom 9": Gray med sand + gravel.	SP	
95		17/21/25/28	94'-96'	13"	BG	Tan/gray coarse sand + gravel.		
100		25/25/20/23	99'-101'	12"	BG	Gray/tan coarse sand + gravel.		
105		12/24/38/48	104'-106'	18"	BG	Tan/gray, well sorted, med. to coarse sand. Thin gravel layer, subrounded to rounded.		105.5' = E.O.B.
						[see log of MW105D for description of 106-153' interval]		

Remarks: page 2 of 2.

Camp, Dresser & McKee, Inc. **200 W. Adams, Suite 1600 Chicago, Illinois 606(**

Soil Boring Log **Well Installation and Completion Da**

Client IEPA Site SE Rockford Job No. 1681-3 Surveyed Elevation: Ground 784.05

Date Drilled 8/21-8/24/91 Well No. MW105 D Boring Co. Mathes Top of Casing 786.21 Screen Length 10'

Total Depth 158' Boring Method Used 0-139': mud rotary; 139-158': air rotary Piezometer Casing Size & Type 2" I.D. stain

Field Geologist M Sorensen Organic Vapor Instruments Used — Water Table Depth ~6'

Depth (feet)	Samp. No.	Blows per 6' ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipmen Installed
						Note: See other MW105 log for description of 0 to 106' interval; no split-spoon samples were collected from this boring, and gaw this log is based only on cuttings.		
106						106-110': brown silty till	---	
108							ML	
						110-113.5': sand & gravel		~110'
112						113-113.5': boulder		
						113.5-136.5': sand & gravel (tougher drilling at 117-124' indicates higher proportion of gravel)	SP	
116							---	
							SP-GP	
120								
124								

Remarks:

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BORING NUMBER: MW105D

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
124							SP	
128								
132								
136			136.5-158' [cuttings samples collected on the foot]				SP	136.5'
140						136.5-158': Limestone, finely to v. finely crystalline; texture is predominantly not sucrosic, except at 144-147' & 155-158'; color ranges from lt grayish bn (@136.5-143, 146, 147, 151, 152') to lt yel bn (@ 144, 145, 157 & 158) to bn gray (at 148, 149, 150, 154, 155 & 156) to gray (@ 153'). Some rusty stains at 142-144'; a few black surficial coatings at 148-150'.	Lime-stone (lt. gy bn)	6" steel casing set at 139'; 139-158' interval drilled by air rotary method
144							(lt yel bn)	
148							(lt gy bn)	
152							(bn gy)	
156							(lt gy bn)	
158							(gy)	
							(bn gy)	
							(lt yel bn)	T.D. = 158'

NY-2

Camp, Dresser & McKee, Inc. One Center Plaza, Boston, Massachusetts 02

Soil Boring Log — Well Installation and Completion D

Client IEPA Site Southeast Rockford Job No. 1681-3 Surveyed Elevation: Grou 0

Date Drilled 6/29-6/30/91 Well No. MW106 A Boring Co. Mathes Top of Casing 805.71 Screen Length

Total Depth 68' Boring Method Used Hollow-stem auger Piezometer Casing Size & Type 2" ty. 304 s

Field Geologist R. Lautz Organic Vapor Instruments Used Water Table Depth

Depth (feet)	Samp. No.	Blows per 6" ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
								Depth of obs stratigraphic
		2/2/2/1	4-6	3"		orangish brn well-sorted medium sand	SP	
10		6/15/18/15	9-11	15"		Lt. Orangish Tan fine to med sand (some cross-bedding) rare Pebbles		
		20/22/67	14-16	16"		Tan fine sandy silt Till w. gravel, tightly packed, w. subangular lms pebbles	ML	
20		20/25/37/32	19-21			Tan Fe-stained fine to med sand w. thin silt laminae	SP-SM	SWL = 18.4
		5/23/31/27	24-26	15"		Top 7": Tan med to coarse sand & Gravel; Bot. 8": Tightly packed silty sand & gravel w. abundant cobbles	SM	24.6'
30		8/25/22/18	29-31	17"		Tan poorly sorted coarse sand & Gravel w. Cobbles	SP-GP	
		6/12/17/19	34-36	14"		Dk gray coarse sand & gravel		
40		6/17/18/23	39-41	15"		Tan to brown med to coarse sand & Gravel		
		14/26/30/37	44-46	17"		Lt tan coarse sand & gravel		
50		6/8/12/12	49-51	14"		Dk Gray moist plastic clayey silt w/ coarse sand & gravel grains	MH	
		6/14/29/16	54-56	21"		Dk gray plastic moist clayey silt w. gravel and 1 small sand seam		
		9/13/17/21	59-61	16"		Laminated Dk gray clay w thin silt strata		

Remarks: pg 1 of 2.

Camp, Dresser & McKee, Inc. **200 W. Adams, Suite 1600 Chicago, Illinois 60606**

Soil Boring Log **Well Installation and Completion Data**

Client _____ Site _____ Job No. _____ Surveyed Elevation: Ground _____

Date Drilled _____ Well No. MW106A Boring Co. _____ Top of Casing _____ Screen Length _____

Total Depth _____ Boring Method Used _____ Piezometer Casing Size & Type _____

Field Geologist _____ Organic Vapor Instruments Used _____ Water Table Depth _____

Depth (feet)	Samp. No.	Blows per 6" _____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
60						Reddish brown, well sorted, med. sand grading to poorly sorted coarse sand. Bottom 13" is tan silty till with gravel, pebbles, & local Fe-staining.	MH	
		7/20/21/55	64'-66'	21"			SP-SW	64.7'
65							MH	
70						Drilling obstruction encountered at ~68' — Auger Refusal.		T.D. = 68'
						[see log of MW106B/C for description of 68-120.5' interval]		

Remarks: page 2 of 2.

Camp, Dresser & McKee, Inc. **200 W. Adams, Suite 1600 Chicago, Illinois 60**

Soil Boring Log **Well Installation and Completion**

Client IEPA Site SE Rockford Job No. 1681-3 Surveyed Elevation: Ground MW106B: MW106C: 8

Date Drilled 8/11-8/12 Well No. MW106 B & C Boring Co. Mathes Top of Casing B: 805.52 C: 805.40 Screen Length 10'

Total Depth 120.5 Boring Method Used Hollow-stem auger (unconsolidated) Air hammer (bedrock) Piezometer Casing Size & Type 2" type 304

Field Geologist M Sorensen Organic Vapor Instruments Used — Water Table Depth 20'

Depth (feet)	Samp. No.	Blows per 6' ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipm Installe
						See MW106A for log of 0-71'; log of 71'-76.5' given here is based on cuttings from MW106B; log of 76.5-120.5' based on MW106C cuttings.		
70								
72			71-76.5' [cuttings samples collected on the foot]			71-76.5': Fine to med.-crystalline limestone, lt yellow brown, somewhat sucrosic (i.e., with intergranular porosity); ~~brown~~ dk bn bentonite (containing yellow bn laminations & veinlets) constitutes 15% of cuttings at 72 & 73', 10% at 74', 5% at 75', <1% ~~below 75'~~ at 76' (sluffed below 73', most likely).	Limestone (lt yel bn)	dk bn bento
74								
76			76.5-80.5' [cuttings collected on the foot]			76.5-80.5': uniform pale yel bn limestone, finely crystalline, somewhat sucrosic, and w/ some rusty bn staining.		
78								
80								
82			80.5-90.5' [cuttings collected on the foot]			80.5-90.5': Limestone as in 76.5-80.5 interval, but with bentonite chips up to 7 mm wide, 15% at 81-83', 0-3% at 84-89', 20% at 90'. Tr chert at 84 & 86'.		dk bn bento
84								
86								

Remarks:

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BORING NUMBER: MW106 B/C

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
86							Lime-stone	
88								
90								dk bn bentonite
92			90.5-100.5' [cuttings collected on the foot]			90.5-100.5': Limestone as in 76.5-80.5 interval, w/ bentonite comprising 15% of cuttings at 91', 2-4% at 92-94', rare elsewhere; zoned white to lt bn gray chips are partly silicified limestone & chert respectively, and constitute 35% of rock at 99', 5% at 100'.		
94								
96								
98								chert
100			100.5-110.5' [cuttings samples collected on the foot]			100.5-110.5': Limestone as in 76.5-80.5' interval, but chert comprises 95% at 106', 25% at 108', 2% at 109'; soft, olive green shale is 0.5 to 1% at 106 to 110'; ~3% bentonite at 101', tr elsewhere. Rusty coatings on chert at 106'; tr ochre at 103 & 108'.		
102								
104								
106								olive gn shale; chert
108								chert; olive gn shale
110			110.5-120.5' [cuttings samples collected on the foot]			110.5-120.5': Limestone as in 76.5-80.5' zone, exc. that color is pale yel bn at 110.5-116' and then lt bn gray at 117-120'. 90% chert/ptly. sil. limestone at 112'; 15% at 113'. The gray zones have dk gray films on many chips.		
112								chert
114							Lime-stone	
116							(lt yel bn)	color change
118							(lt bn gray)	
120.5								120.5'

NY-2

Camp, Dresser & McKee, Inc. **200 W. Adams, Suite 1600 Chicago, Illinois 60**

Soil Boring Log **Well Installation and Completion D**

MW107A
MW107B: 80

Client IEPA Site Southeast Rockford Job No. 1681-3 Surveyed Elevation: Ground A
MW107A: 808.86
B: 808.87

Date Drilled 7/11-7/13/91 Well No. MW107B/A Boring Co. Mathes Top of Casing A Screen Length 10'

Total Depth 71' Boring Method Used Hollow-stem auger Piezometer Casing Size & Type 2" type 304 s

Field Geologist RLantz, MRys Organic Vapor Instruments Used _____ Water Table Depth 17'

Depth (feet)	Samp. No.	Blows per 6' _____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipme Installe
5		4/4/6/7	4'-6'	10"		Black silty to med sandy clay with orange/ish tan sand seams.	ML-SM	
10								
15		5/12/19/16	14'-16'	20"		Tan silty med-sand with abundant gravel.		
20		10/20/22/20	19'-21'	22"		Tan sandy silt w/abundant fine to med angular gravel. Bottom 2" is gray silty clay w/abundant gravel.		
25		5/16/20/16	24'-26'	18"		Top 3" is gray silty clay. Middle 3" is beige sandy silt w/gravel. Bottom 12" is coarse angular sandy gravel.		24.5'
30		8/20/18/24	29'-31'	20"		Beige, med to coarse sand & sandy gravel.	SP	
35		22/30/37/43	34'-36'	24"		Interbedded med to coarse subang. sand, mostly well sorted. Bottom 10" is cobbles + gravel in fine sand + silt matrix.		
40		15/28/37/37	39'-41'	22"		Poorly sorted med to coarse sand. Lower 12" has abund. cobbles + gravel.		
45		28/28/21/17	44'-46'	16"		Med to coarse gravel & cobbles	SP-GP	
50		2/3/5/16	49'-51'	24"		Top 10": Tight sandy clay with pebbles. Mid 2": Brown silty sand. Bottom 5": Fine to coarse cobbles.	ML-SM	~46'
55		21/24/26/21	54'-56'	90%		Top 4": Sandy clay with pebbles. Bottom 18": Coarse cobbles & some coarse sand; some Fe staining (top & bottom).		5
60		16/30/22/28	59'-61'	90%		Coarse sand and pebbles.	SP-GP	

Remarks: Page 1 of 2.

Camp, Dresser & McKee, Inc. **200 W. Adams, Suite 1600 Chicago, Illinois 60606**

Soil Boring Log **Well Installation and Completion Data**

Client _____ Site _____ Job No. _____ Surveyed Elevation: Ground _____

Date Drilled _____ Well No. MW107B/A Boring Co. _____ Top of Casing _____ Screen Length _____

Total Depth _____ Boring Method Used _____ Piezometer Casing Size & Type _____

Field Geologist _____ Organic Vapor Instruments Used _____ Water Table Depth _____

Depth (feet)	Samp. No.	Blows per 6' _____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
						Fine to coarse pebbles.		
65		24/36/25/[illegible]	64'-66'	75%			GP	
						Sandy clay w/small pebble		67'
70		7/14/22/30	69'-71'	18"			ML	
						Note: Samples from 74 to 91' were collected from the auger-drilled portion of MW107C.		
75		11/22/33/50	74-76'	23"	b.g.	Dk bn to rd bn sandy silt w/ 5% grans & pebbs		
80		13/28/36/32	79-81'	23"	b.g.	Dk bn sandy silt w/~5% pebbs		
85		17/21/28/31	84-86'	23"	b.g.	Dk bn clayey silt w/ ~10% pebbs		
90		12/20/27/55	89-91	22.5"	b.g.	Top 6": Dk bn clayey silt w/~10% pebbs Bottom 16.5": gray sandy clay w/ ~5% pebbs	ML	
						[see log of MW107C for depths greater than 91']		

Remarks: Page 2 of 2.

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Soil Boring Log — **Well Installation and Completion D**

Client IEPA Site SE Rockford Job No. 1681-3 Surveyed Elevation: Ground 80

Date Drilled 7/28/91-7/31/91 (for 91-142') Well No. MW107C Boring Co. Mathes Top of Casing 808.70 Screen Lengt

Total Depth 142' Boring Method Used Mud rotary (91-126'); air rotary (126-142') Piezometer Casing Size & Type 2" stain

Field Geologist M Sorensen Organic Vapor Instruments Used OVA Water Table Depth ~1 unconf aquif

Depth (feet)	Samp. No.	Blows per 6" ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
			(Split spoon)					
						[see MW107B log for description of 0 to 91-foot interval of depth]		
90								
						91-98': Cuttings show ~40% buff limestone chips & fragments, ~50% sand & granules (multilithologic), and ~10% till, incl. bn sandy silt & gray clayey silt.	GM-SM?	
95								
		N.A.	98-100'	12/5"	b.g.	98-98.4': Fine SAND (SW) with ~20% subrounded pebbs (fine to coarse) and ~15% silt or clay. Mod yel bn to orange bn. Also contains 2 buff limestone chips > 2" diameter.	SM	
100								
							GM-SM?	
105						98-108: Cuttings same as 91-98' interval.		
		N.A.	108-110'	24/18"	b.g.	108-108.2': Sandy clay, tan, plastic, w/ ~15% fine pebbs	SM	CL
110						108.2-109.5': Silty sand, mod tan-bn exc for 2 zones 3 & 5" thick of orange bn. Contains ~25-30% silt/clay & ~10% granules & pebbs. Sand is vfine to med., mainly fine; SM. Saturated.		
115						108-115's Cuttings are same as 91-98' interval.		

Remarks:

page 1 of 2

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BORING NUMBER: MW107C

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
115						115-120': Cuttings are same as 91-98' interval	SM?	
120			120-126' [bedrock cuttings samples collected on the foot]			120-126': Cuttings are buff limestone & white to bn-gray chert/chalk chips, with small proportions (quickly decreasing to 5%) subrounded gravel (greenstone, qtz & jasper) and bn & gy silt/clay	Limestone; chert (local) @ 120-126'	
125			126-131' [bedrock cuttings samples collected on the foot]			126-131': Buff limestone, v fn to med xln, comm sucrosic texture & w/ local small vugs; a few Fe-stained surfaces, mainly at 126', where color overall is yel bn.	buff; lt gray	126-131' produces water at ~30 gpm; tan color
130			131-137' [bedrock cuttings samples collected on the foot]			131-137': Lt gray (131-134') to buff (135') to lt buffish gray (136 & 137') limestone that is fine-med xln, comm sucrosic & has loc sm vugs. At 134' are ~½ mm laminations of black carbonac. material interbdd w/ the limestone.	dk gy laminae; Limestone	131-137' drills slowly, produces milky gray water at ~30 gpm
135			137-142' [Bedrock cuttings samples collected on the foot]			137-142': Lt gy limestone as above, exc. laminae are wavy, dk gy & up to 1mm; some dk bn films on a few chips; at 142' color is a mod bluish gy; at 141 & 142' are tr yel bn chips; dk gy laminae mainly at 138-140' (~5% of cuttings).		T.D. = 142'
140		Lithologic sample @ 140'				Note: No shale or bentonite		137-142' drills slowly & produces milky gray water at ~40 gpm
145								

NY-2

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Soil Boring Log **Well Installation and Completion I**

MW108A: 8
MW108B: 823.

Client IEPA Site SE Rockford Job No. 1681-3 Surveyed Elevation: Ground A
MW108A: 825.16
B: 824.90

Date Drilled 7/14-7/15/91 Well No. MW108B/A Boring Co. Mathes Top of Casing A Screen Length 10'

Total Depth 66' Boring Method Used Hollow-stem auger Piezometer Casing Size & Type 2" type 304

Field Geologist S Bhagat Organic Vapor Instruments Used _____ Water Table Depth ~27

Depth (feet)	Samp. No.	Blows per 6' _____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipme Installe
						Top 13": Tan, well sorted, med to fine sand. Bottom 6": Reddish brn med sand with pebbles. Dry.	SP	
20		8/18/30/32	19'-21'	19"				
						Brown/tan, coarse sand & gravel. Gravel dominant in bottom 8". Moist.		(26-29 clayey identif. m log)
30		22/26/29/30	29'-31'	20"			CL	
						Brown/tan, med to coarse sand and gravel. Saturated.	SP-GP	
35		10/20/20/21	34'-36'	18"				
						Brown, coarse sand + gravel.		
40		16/30/30/50	39'-41'	24"				
						Brown, med to coarse sand and gravel. Gravel common in top 13".		
45		15/28/22/26	44'-46'	19"	BG			
						Brown, coarse sand and gravel		
50		3/10/14/19	49'-51'	14"	BG			
						Brown, coarse sand and gravel	SP-GP	
55		12/17/18/18	54'-56'	17"	BG			
						Tan/brown, med to coarse sand and gravel, mostly in bottom 14".		
60		14/23/32/32	59'-61'	18"	BG			
						Dark gray silty till with gravel.		
65		16/16/18/26	64'-66'	12"	BG		ML	
70						[See log of MW108C for description of 66-137' interval]		T.D. (MW 108B)=

Remarks: Top 17' at location MW108 is fill material. Therefore, first split-sp was taken 19'-21'. Fill is mostly dk brn/black, clayey, fine sand to silt.

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oil Boring Log — Well Installation and Completion Data

IEPA Site SE Rockford Job No. 1681-3 Surveyed Elevation: Ground 827.88

ite ..illed 7/24-7/26/91 Well No. MW108C Boring Co. Mathes Top of Casing 824.93 Screen Length 10'8 1/4"

otal Depth 137' Boring Method Used Mud rotary (0-119.5'), air rotary (119.5-137') Piezometer Casing Size & Type 2" type 304 stai

eld Geologist M Sorensen Organic Vapor Instruments Used OVA Water Table Depth ~26.5

Depth (feet)	Samp. No.	Blows per 6" ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	~~Equipment Installed~~ Drilling Notes
						Note: see MW108B/A log for details regarding depths of 0-66 feet.		
66							ML	
							GM?	Much gravel in cuttings
70							CL	gray silty clay in cuttings
80							GM?	Many gray limestone & black shale pebbles in cuttings
	—	N.A.	87-89'	18"/2"	b.g.	87-87.2': Sandy gravelly clay, mod. gray & lic. grayish white, containing several lg. limestone chunks	CL-GM	
90								
	—	N.A.	97-99'	12"/6"	b.g.	97-97.5': Sand & gvl; sand is fine to coarse; gvl is subang. to rounded pebbs & cobbles of limestone, qtz/jasper, shale, & granite	SP-GM?	Subrounded gravel w/ ~20% gray silty till in cuttings
100								
						106.5-110': hard drilling accompanied by an increase in lt gray to white limest. chips	Limestone boulder?	
110						110-117' cuttings show mixed gravel (subrdd.) & limest. chips	GP	
	—	N.A.	117-119'	2"/1"		117-117.1': buff sandy limestone chips	Limestone boulder?	

Remarks:

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BORING NUMBER: MW108

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day
120							GP	6" casing s 119.2'
			122-131' [bedrock	cuttings	collected	122-131' cuttings: Limestone/dolomite, buff, med. to vfinely ~~gra~~ M-S crystalline, sucrosic in texture; loc. echino frag's & brach molds. Remainder of cuttings consist of compound frags of chalky white limestone, loc. ptly silic'd., that sometimes grade to a bluish-gray zone; and in fewer cases, grade further to brownish-gray chert w/ forams or other fossil frags comm visible. These compound chips comprise trace to none at 122-125', 5% at 126', 128 & 129', & 15% at 127', 130 & 131'; the chips themselves are more cherty at 130-131 than above (~50% chert cf. ~~5% cht)	Lime-stone (buff)	122-131' interval produces much w (~100 gp that is milky to tan produces most wa @ 122' 130
			on the	foot]			chert	
130			131-137' [bedrock	cuttings	samples			
			collected	on the	foot]			T.D. = 137'
140						131-137': Buff, sucrosic limestone/dol'ite as above Note also that the fossils in the compound chalk/chert chips are preferent. silic'd. Propor. of compd chalk/chert chips: 20% at 132'; 5% 133' 30% 134' 15% 135' 5% 136' 30% 137'		131-137' zo produces ≥100 gpm water th is milky slightly
						Note: No bentonite or shale observed		

NY-2

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oil Boring Log — Well Installation and Completion Data

ient IEPA Site SE ROCKFORD Job No. 1681 Surveyed Elevation: Ground 848.68

ed 6/28/91 Well No. MW109A Boring Co. J. MATHES Top of Casing 850.89' Screen Length 10'

ital Depth 32.5' Boring Method Used 4.25" HSA Piezometer Casing Size & Type 2" STAINLESS

eld Geologist R. LANTZ Organic Vapor Instruments Used HNu Water Table Depth 25.2'

Depth (feet)	Samp. No.	Blows per 6" ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
5		2/2/2/3	4'-6'	16"	0	Reddish brown sandy clay w/pebbles	CL	
10		6/12/18/32	9'-11'	—	0.5	Tan, fine to med sand w/subang. pebbles		
15		20/67/97+	14'-16'	14"		Tan, sandy gravel w/cobbles	SP-GP	
20		22/75+	19'-21'	8"	0	Brown silty clay till w/gravel.		
		44/105	24'-26'	10"		Brown sandy clay till with fine gravel and fine to med sand w/clay and gravel.	CL-SP (mixed)	▽ 25.2'
30		26/100+	29'-31'	10"	0	Tan/brown, fine to med sand & sandy clay. Lower 6": Fe-stained, tan dolomite gravel.		
								32.5' Auger refusal
						[see log of MW109 B/C for description of 40-86' interval]		

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Soil Boring Log **Well Installation and Completion**

MW10, C: 84

Client IEPA Site Southeast Rockford Job No. 1681-3 Surveyed Elevation: Ground A MW109B: 850.47 C: 850.47

Date Drilled 7/22-7/23/91 Well No. MW109B/C Boring Co. Mathes Top of Casing A Screen Length 10'

Total Depth 86' Boring Method Used {Hollow-stem auger (surface to bedrock) / Air rotary (bedrock interval)} Piezometer Casing Size & Type 2" type 304 s

Field Geologist S. Bhagat Organic Vapor Instruments Used none (air drilling) Water Table Depth ~2.

Depth (feet)	Samp. No.	Blows per 6' ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipm Installe
						See log of MW109A for description of 0-40' interval.		
40			40-50' samples of bedrock collected on the foot			40-50': Limestone, tan, exc. @ 42' (tan to bn) and 43-44' (lt bn to bn); soft drilling at 42-43' prob. corresponds to more fractured zone (cuttings finer); bn bentonitic clay is 50% of cuttings at 43', 40% at 44', 15% at 45', 10% at 46 & 47', trace at 48-50'.	Lime-stone (tan)	
44							tan-bn) (lt bn-bn) (tan)	more fra zo bn. c
48								
52			51-60' samples of bedrock collected on the foot			51-60': Tan limestone with ~15% bn clay exc. @ 59 & 60', where it is trace; color tan exc. @ 58' (brownish tan) & @ 59 & 60' (yellowish tan)	Lime-stone	bn cla
56							(tan)	

Remarks:

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BORING NUMBER: MW109 B/C

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
56							(tan) (bn tan)	bn clay
60			61-70' cuttings of bedrock collected on the foot			61-70': Limestone; color grades from a yellowish tan (61-63') to creamy gray (64') to lt gray (65') to mod gray (66-70'). Bn clay tr to absent.	(yel tan) (creamy gray) (lt gray) (gray)	
64								
68								
72			71-80' cuttings of bedrock collected on the foot			71-80': Limestone; mod gray exc. at 80' (yellowish gray); also, cuttings are smaller at 80'	Lime-stone	
76								
80			81-86' cuttings of bedrock collected on the foot			81-86': Limestone, mod gray; ~10% is silicified (white to vitreous gray) at 82' and 5% at 84'	(gray) (yel gray) (gray)	more-fractured zone
84							Lime-stone	silicification
86								T. D. = 86'

NY-2

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Soil Boring Log **Well Installation and Completion Dat**

Client IEPA Site SE ROCKFORD Job No. 1681-3 Surveyed Elevation: Ground 844.16

Date Drilled 7/16-7/17/91 Well No. MW 110A Boring Co. Mathes Top of Casing 846.65' Screen Length 10'

Total Depth 43' Boring Method Used Hollow-stem auger Piezometer Casing Size & Type 2" type 304 s

Field Geologist S. Bhagat Organic Vapor Instruments Used _____ Water Table Depth ~30'

Depth (feet)	Samp. No.	Blows per 6" _____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
5		1/2/2/1	4'-6'	7"	BG	Reddish brown, well sorted, med to coarse sand.	SP	
10								
15		5/13/14/20	14'-16'	15"	BG	Top 14": Reddish brown, med sand and gravel. Bottom 1": tan/brown, coarse sand and gravel		
20								
25		10/19/25/30	24'-26'	19"	BG	Tan, poor to mod sorted, coarse sand with common gravel. Bottom 3" is reddish brown and slightly moist.		
30								
35		40/57 (4")	34'-36'	18"	BG	Top 8" is blown in. Bottom 10" is brown sand with some gravel, esp. in bottom 5". Moist.	SP	
40		8/25/25/34	39'-41'	16"	BG	Tan sand & gravel. Sand is coarse and poorly sorted. Gravel is mostly limestone and angular.	SP-GP	
45		spoon refusal 25/34/50/25	43'-45'	12"	BG	Tan/reddish brown, poorly sorted coarse sand & gravel. Gravel is mostly Fe-oxide stained limestone. Bottom 3" is mostly dark reddish brown-stained limestone.		44'
						[see log of MW110 B/C for description of 45-115' interval]		

Remarks: Both auger refusal (4.25') and spoon refusal occurred at ~43'.

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Soil Boring Log **Well Installation and Completion Data**

MW110B: 844.
C: 844.

Client IEPA Site SE Rockford Job No. 1681-3 Surveyed Elevation: Ground MW110B: 846.18 C: 846.24

Date Drilled 8/19-8/21/91 Well No. MW110C and B Boring Co. Mathes Top of Casing Screen Length 10'

Total Depth 115' Boring Method Used mud & air rotary Piezometer Casing Size & Type 2" stainless steel

Field Geologist M Sorensen Organic Vapor Instruments Used — Water Table Depth ~30'

Note: For depths of 0 to 44', see log for MW110A

Depth (feet)	Samp. No.	Blows per 6" ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
						Note: All descriptions are based on cuttings from mud rotary (44-80) and air rotary (80-115); see log of MW110A for log of 0-44 ft.		
44						44 to 46': zone with limestone boulders or cobbles	GP	
						46 to ~57': coarse to medium gravel, tough-drilling.		
48								
52								
							GP	
56								
						57 to 74.5': gravel and sand; gravel is medium to fine	GW	
60								
64								

Remarks:

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BORING NUMBER: MW110 C

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Da
64.5								
68								
72								
							GW	
						74.5 to 75.5': Lt creamy brown clayey till with granules	CL	
76						75.5 to 80.0': Limestone, lt yel bn, fine-grained, with 0 to 10% white chert & <5% rounded multilithologic pebbles	Lime-stone	
							◎ ◎	chert
80						80 to 91': Limestone, finely crystalline, largely sucrosic in texture (i.e., sandy & with intergranular porosity), lt yel bn exc. at 90 & 91', where color grades to lt bn gray. Rare chert & no shale or bentonite. Few white, calcareous bryozoan frags at 89'; many gray & rusty surficial stains at 91'.		
84								
88							lt yel bn	bryozoans
							lt bn gray	
92						91-101': Limestone, finely crystalline, somewhat sucrosic, yel bn at 92-93' and 99-101') and lt-mod gy at 94-98'. ~10% zoned white to lt bn gy (part. silicified limestone to chert, respectively) chips at	yel bn ◎ ●	chert
							lt-mod gray	
96								

NY-2

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BORING NUMBER: MW110C

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
96						92', and tr chert/pt. silic. limestone at 101'. Few scattered coral & bryo fossils.	lt-mod gray	
							#	bryozoans (scattered)
							yel bn	
100						101 to 111': Limestone as above w/ rare chert and fossils; color is yel bn.		
								chert
104								
108								
						111-115': Limestone as above, but color is yel bn at 114 & 115', gray at 113', and mixed yel bn & gray at 112'; rare chert; some rusty stains at 115'.		
112							gray	
							yel bn	
116								T.D.
						Note: Drillhole produced water at 5 to 10 gpm throughout zone drilled by air rotary (80-115')		

NY-2

Camp, Dresser & McKee, Inc. One Cellier Plaza, Boston, Massachusetts

Soil Boring Log

Well Installation and Completion D

MW111A: 8

Client IEPA Site Southeast Rockford Job No. 1681-3 Surveyed Elevation: Grou 8

MW111A: 832.84

Date Drilled 6/25-6/27/91 Well No. MW111A/B Boring Co. Mathes Top of Casing B: 832.44 Screen Length

Total Depth 59' Boring Method Used Hollow-stem auger Piezometer Casing Size & Type 2"

Field Geologist R. Lautz Organic Vapor Instruments Used Water Table Depth ~

Depth (feet)	Samp. No.	Blows per 6" ____ lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	Equipment Installed
		5/6/5/4	1'-3'	10"		DK-brown silty soil.		
5		2/2/3/5	4'-6'	10"		Reddish brown, moist silty clay w/gravel.	CL	
10		6/12/20/21	9'-11'	16"	0	Brown/tan sandy clay till with gravel		
15		20/52/62/66	14'-16'	20"	0	Brown sandy clay till with gravel.		
20		19/18/18/21	19'-21'	18"	0.25	Top 7": Brown sandy clay till w/pebbles. Bottom 11": Tan, well-sorted, fine to med. sand with 4" mixed sand + clay.	CL	~19.6'
25		for 5" 7/22/79/25	24'-26'	24"		Top 14": Orangish tan, well sorted, med sand w/4" gravel zone. Bottom 10": Orangish tan sandy clay till w/pebbles.	SP-ML (mixed)	
30		16/31/35/34	29'-31'	24"	0	Orangish tan, well sorted med sand and silt and pebbly silt.		
35		-/29/29/23	34'-36'	22"	0	Tan, med to coarse sand and silty sand with gravel.	SP-SM	
40		4/30/40/54	39'-41'	24"	0	Tan, poorly sorted, med to coarse sand and lt tan pebbly silt	SP-ML	
45		6/18/22/40	44'-46'	22"	0	Orangish tan, interbedded med sand and fine silty sand		
50		for 3" 14/50/50	49'-51'	16"	0	Mixed sand and gravel.	SP-SM	
55		(1 foot only) 65/100	54'-56'	12"	0	Tan, med to coarse silty sand & gravel.		
60		10/40/62	59'-61'	18"		Brown/tan, silty sand and gravel	ML-SM	

Remarks: Auger refusal at ~59'.

[see log of MW111C for description of 60-99' interval]

E.O.B.

Camp, Dresser & McKee, Inc. **200 W. Adams, Suite 1600 Chicago, Illinois 60606**

Soil Boring Log **Well Installation and Completion Data**

Client IEPA Site SE Rockford Job No. 1681-3 Surveyed Elevation: Ground 830.65

Date Drilled 8/9-8/10/91 Well No. MW 111C Boring Co. Mathes Top of Casing 833.21 Screen Length 10'

Total Depth 99' Boring Method Used Mud rotary 0-65.5' Air rotary 65.5-99' Piezometer Casing Size & Type 2" stainless 30

Field Geologist M Sorensen Organic Vapor Instruments Used OVA Water Table Depth 20.3' (

swl (bedrock) = 22.70 (8/10

Depth (feet)	Samp. No.	Blows per 6' N.A. lbs.	Sample Interval	Adv./ Recov.	Org. Vap. - PPM	Sample Description	Strata. Change	~~Equipment Installed~~ Remarks
						[see MW 111B log for description of 0 to 60 feet]		
60						(0 to 65.5' drilled by mud rotary) 60-65.5' cuttings show ~80% buff limestone, 10% white chert/part. silicified limestone, ~10% jasper/rhyolite & granules and mafic pebbles. The latter are comm. rounded, while the limestone & chert are mainly angular chips. 65.5-71.0': Buff limestone, vfine-grained, sucrosic in part, a few small vugs; ~10% throughout of zoned chips of chert (lt bn gray) - part. silicified limestone (white). A few exotic subrdd pebbs (mafic & grout).	Lime-stone, buff	SP/SM
64								65.5-99' drilled air rota
68								chert
72								
76								

Remarks:

CDM

environmental engineers, scientists, planners & management consultants

BORING NUMBER: MW 111

Log of Boring

Depth (feet)	Samp. No.	Blows per 6" lbs.	Sample Interval	Adv./ Recov.	Org. Vap. (PPM)	Sample Description	Strata Change	Remarks (Time of Day)
76						71-81': V. fine to fine-grained limestone, yellow brown (71-79') to buffish gray (80-81'); rare chert; quite sucrosic throughout; from 76-80', ~10% of chips have rusty coatings.	(yellow brown) (buffish gray)	rusty coat
80						81-91': V. fine to medium-grained limestone, buffish gray (81-85' and 87-91') and buff (at 86'-ie, yel bn). Fairly sucrosic & with a few micro-vugs. At 85' are ~15% zoned chert - part. silic. limest. (lt bn gray - white)	(buff)	chert/partly silicified li
84								
88								
92						91-99': Limestone as above, but color is buffish gray at 92', buff at 93-96', and grayish buff at 97-99'. Trace bn shale 94-99'; tr echinoderm & brachiopod casts/molds	(buffish gray) (buff)	
96							(grayish buff)	tr bn shal.
								T. D. = 99'
100								

NY-2

APPENDIX E

ANALYTICAL RESULTS FOR DRUM SOIL SAMPLES

TABLE E-1
EXPLANATION OF DATA QUALIFIERS

THE FOLLOWING QUALIFIERS APPLY TO THE ORGANIC DATA:

J: indicates that the value presented is an estimated value.

B: indicates that the analyte is also found in the associated laboratory blank. It indicates possible contribution to the reported value from laboratory contamination.

E: indicates that the reported result exceeded the calibration range of the analytical run.

D: indicates that the result reported is from a re-run of the sample at a higher dilution.

THE FOLLOWING QUALIFIERS APPLY TO THE INORGANIC DATA:

U: indicates that the compound was analyzed for, but not detected.

N: indicates that the spiked sample recovery was not within control limits.

B: when applied to inorganic results, this indicates that the reported value is less than the Contract Required Quantitation Limit (CRQL) but greater than the Instrument Detection Limit (IDL).

E: indicates that the reported value is an estimate because of the presence of interference.

M: indicates that duplicate injection precision was not met.

S: indicates that the reported value was determined by the Method of Standard Additions (MSA).

W: indicates that the post-digestion spike for Furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.

***:** indicates that duplicate analysis is not within control limits.

R: indicates that data is unuseable.

Table E-2. Southeast Rockf Drummed Soils - Organic Results

Date Sampled	6-25-91		6-25-91		6-25-91		6-25-91		6-25-91		6-25-91	
Sample Number	MW101A-1		MW101A-2		MW101A-3		MW101A-4		MW101A-5		MW101A-6	
Organic Traffic Report Number	EBT-00		EBT-01		EBT-02		EBT-03		EBT-04		EBT-05	
Volatile Organics (ug/Kg)												
Methylene Chloride												
Acetone			320		170		130					
Carbon Disulfide			7	J								
1,2-Dichloroethene												
Chloroform			10	J	16	J	5	J	5	J	3	J
1,2-Dichloroethane												
2-Butanone												
1,1,1-Trichloroethane			7	J	11	J			6	J		
Trichloroethene					18	J	8	J	10	J	6	J
1,1,2-Trichloroethane												
Benzene									3	J		
4-Methyl-2-Pentanone												
2-Hexanone												
Tetrachloroethene												
Toluene			10	J	7	J	11	J				
Ethylbenzene			10	J								
Total Xylenes			24				10	J				
Semivolatile Organics (ug/Kg)												
Phenanthrene			100	J								
Di-n-bytylphthalate												
Bis (2-ethylhexyl) phthalate	89	J	1400		340	J	1700		380	J	130	J
Di-n-octyl phthalate			720	J			650	J	170	J	70	J

Note: Blank cell indicates that analyte was not detected.

Table E-2. Southeast Rockford Drummed Soils - Organic Results

Date Sampled	7-2-91		7-2-91		7-2-91		7-2-91		7-3-91		7-11-91	
Sample Number	MW104-1		MW104-2		MW104-3		MW104-4		MW104-5		MW109-1	
Organic Traffic Report Number	EBT-12		EBT-13		EBT-14		EBT-15		EBT-16		EBT-17	
Volatile Organics (ug/Kg)												
Methylene Chloride	170		420		180		90		360			
Acetone	200		140		170		98		160			
Carbon Disulfide	9	J	8	J	9	J	6	J	7	J		
1,2-Dichloroethene												
Chloroform					6	J						
1,2-Dichloroethane												
2-Butanone	18	J							24			
1,1,1-Trichloroethane	8	J	6	J	7	J	2	J				
Trichloroethene												
1,1,2-Trichloroethane												
Benzene												
4-Methyl-2-Pentanone												
2-Hexanone												
Tetrachloroethene												
Toluene	4	J	3	J	4	J			4	J	3	J
Ethylbenzene												
Total Xylenes												
Semivolatile Organics (ug/Kg)												
Phenanthrene												
Di-n-bytylphthalate												
Bis (2-ethylhexyl) phthalate			670	J	450	J	430	J	200	J		
Di-n-octyl phthalate												

Note: Blank cell indicates that analyte was not detected.

Table E-2. Southeast Rockf[illegible] Drummed Soils - Organic Results

Date Sampled	7-11-91		7-11-91		7-11-91		7-15-91		7-15-91		7-15-91	
Sample Number	MW109-1D		MW109-2		MW104-6		MW104-7		MW104-8		MW107-1	
Organic Traffic Report Number	EBT-18		EBT-19		EBT-20		EBT-23		EBT-24		EBT-25	
Volatile Organics (ug/Kg)												
Methylene Chloride									41	B		
Acetone			35	J	110	J			190	J	32	J
Carbon Disulfide												
1,2-Dichloroethene												
Chloroform	0.7	J										
1,2-Dichloroethane							2	J			2	J
2-Butanone	14	J			20	J	41	J				
1,1,1-Trichloroethane												
Trichloroethene												
1,1,2-Trichloroethane							3	J				
Benzene												
4-Methyl-2-Pentanone	14	J										
2-Hexanone	2	J										
Tetrachloroethene												
Toluene	2	J	1	J	4	J						
Ethylbenzene												
Total Xylenes	3	J	7									
Semivolatile Organics (ug/Kg)												
Phenanthrene												
Di-n-bytylphthalate												
Bis (2-ethylhexyl) phthalate					2800	J					93	J
Di-n-octyl phthalate					120	J						

Note: Blank cell indicates that analyte was not detected.

Table E-2. Southeast Rockford Drummed Soils - Organic Results

Date Sampled	7-15-91	8-21-91	8-21-91	8-21-91	8-21-91	8-21-91
Sample Number	MW108-1	MW111-1	MW111-1D	MW111-2	MW111-3	MW111-4
Organic Traffic Report Number	EBT-26	EBT-27	EBT-28	EBT-29	EBT-30	EBT-31
Volatile Organics (ug/Kg)						
Methylene Chloride						
Acetone					35 J	
Carbon Disulfide	1 J					
1,2-Dichloroethene						
Chloroform						
1,2-Dichloroethane						
2-Butanone				250		
1,1,1-Trichloroethane			3 J			
Trichloroethene						
1,1,2-Trichloroethane						
Benzene						
4-Methyl-2-Pentanone						
2-Hexanone						
Tetrachloroethene		4 J	5 J		4 J	
Toluene				52 J		
Ethylbenzene						
Total Xylenes						
Semivolatile Organics (ug/Kg)						
Phenanthrene						
Di-n-bytylphthalate						
Bis (2-ethylhexyl) phthalate						
Di-n-octyl phthalate						

Note: Blank cell indicates that analyte was not detected.

Table E-2. Southeast Rockf Drummed Soils - Organic Results

Date Sampled	8-21-91		8-21-91		8-21-91		8-21-91		7-24-91		7-24-91	
Sample Number	MW111-5		MW110-1		MW110-2		MW110-2D		MW109-5		MW110-9	
Organic Traffic Report Number	EBT-32		EBT-33		EBT-34		EBT-35		EMF-01		EMF-02	
Volatile Organics (ug/Kg)												
Methylene Chloride												
Acetone	180	BJ										
Carbon Disulfide												
1,2-Dichloroethene												
Chloroform												
1,2-Dichloroethane												
2-Butanone					8	J						
1,1,1-Trichloroethane												
Trichloroethene												
1,1,2-Trichloroethane												
Benzene												
4-Methyl-2-Pentanone												
2-Hexanone												
Tetrachloroethene												
Toluene			11	J								
Ethylbenzene												
Total Xylenes												
Semivolatile Organics (ug/Kg)												
Phenanthrene												
Di-n-bytylphthalate									190	J	220	J
Bis (2-ethylhexyl) phthalate									460			
Di-n-octyl phthalate												

Note: Blank cell indicates that analyte was not detected.

Table E-2. Southeast Rockford Drummed Soils - Organic Results

Date Sampled	7-24-91		7-24-91		8-6-91		8-6-91		8-6-91		8-6-91	
Sample Number	MW110'-9		MW103-2		MW107-2		MW107-3		MW107-4		MW107-5	
Organic Traffic Report Number	EMF-03		EMF-04		EMF-05		EMF-06		EMF-07		EMF-08	
Volatile Organics (ug/Kg)												
Methylene Chloride												
Acetone												
Carbon Disulfide												
1,2-Dichloroethene			3	J								
Chloroform												
1,2-Dichloroethane												
2-Butanone							790	B			480	B
1,1,1-Trichloroethane			3	J								
Trichloroethene												
1,1,2-Trichloroethane												
Benzene												
4-Methyl-2-Pentanone												
2-Hexanone												
Tetrachloroethene												
Toluene							190		18	J	590	
Ethylbenzene												
Total Xylenes			2	J							9	J
Semivolatile Organics (ug/Kg)												
Phenanthrene												
Di-n-bytylphthalate	300	J										
Bis (2-ethylhexyl) phthalate			130	J	99	J	430	J	410	J	440	J
Di-n-octyl phthalate												

Note: Blank cell indicates that analyte was not detected.

Table E-2. Southeast Rockf Drummed Soils - Organic Results

Date Sampled	8-6-91		8-6-91		8-6-91		8-7-91		8-7-91		8-7-91	
Sample Number	MW107-5D		MW107-6		MW107-7		MW108-2		MW108-3		MW108-4	
Organic Traffic Report Number	EMF-09		EMF-10		EMF-11		EMF-12		EMF-13		EMF-14	
Volatile Organics (ug/Kg)												
Methylene Chloride												
Acetone					250							
Carbon Disulfide												
1,2-Dichloroethene												
Chloroform												
1,2-Dichloroethane												
2-Butanone	2300											
1,1,1-Trichloroethane												
Trichloroethene												
1,1,2-Trichloroethane												
Benzene												
4-Methyl-2-Pentanone												
2-Hexanone												
Tetrachloroethene												
Toluene	1100						170				51	J
Ethylbenzene												
Total Xylenes												
Semivolatile Organics (ug/Kg)												
Phenanthrene												
Di-n-bytylphthalate												
Bis (2-ethylhexyl) phthalate	410	J	570	J	240	J	500	J	360	J	340	J
Di-n-octyl phthalate												

Note: Blank cell indicates that analyte was not detected.

Table E-3. Southeast Rockfc Drummed Soils - Inorganic Results

Date Sampled	7-24-91		7-24-91		7-24-91		7-24-91		8-6-91		8-6-91	
Sample Number	MW109-5		MW110-9		MW110'-9		MW103-2		MW107-2		MW107-3	
Inorganic Traffic Report Number	MEKR-01		MEKR-02		MEKR-03		MEKR-04		MEKR-05		MEKR-06	
Metals (mg/Kg)												
Aluminum	2660		4160		3720		4620		3300		4030	J
Antimony	4.4	UJ	8.9	BJ	9.9	BJ	7.1	BJ	8.8	U	15.9	UJ
Arsenic	1.5	B	3		3.9		3.8		7		6.2	J
Barium	8.9	B	23.9	B	21.2	B	21	B	27.8	B	43	BJ
Beryllium	0.25	U	0.23	U	0.22	U	0.27	U	0.41	B	0.61	UJ
Cadmium	0.49	U	0.46	U	0.45	U	0.53	U	1.4	U	2.4	UJ
Calcium	211000		66000		70700		178000		75800		98200	J
Chromium	4.5		11.7		8.7		5.7		11.2		10.5	J
Cobalt	1.2	B	4.3	B	3.9		2.6	B	3.7	B	5.5	UJ
Copper	1.8	B	7.7		7.1		4.9	B	8.5		9.6	BJ
Iron	4370		7880		8020		6450		9690		11200	J
Lead	1.6	J	4	J	4.3	J	4.1	J	6.8		8.3	J
Magnesium	112000	J	31700	J	35600	J	93700	J	37200		50000	J
Manganese	212		233		214		345		241		327	J
Mercury	0.12	U	0.12	U	0.11	U	0.13	U	0.17	U	0.3	UJ
Nickel	2	U	8.7	B	6.8	B	4.5	B	9.1	U	16.5	UJ
Potassium	346	B	893	B	835	B	651	B	6.33	B	641	BJ
Selenium	R		R		R		R		0.68	U	1.2	UJ
Silver	R		R		R		R		1	U	1.8	UJ
Sodium	1320		1360		1200		1910		1140	B	1200	BJ
Thallium	0.25	U	0.23	U	0.22	U	0.27	U	0.68	U	1.2	UJ
Vanadium	9.2	B	13		13.3		10.6	B	13.5	B	16.3	BJ
Zinc	4.8	BJ	20.8	J	19	J	12.7	J	27.2		32.3	J
Cyanide	10	U	10	U	10	U	10	U	0.85	U	1.5	UJ

Table E-3. Southeast Rockford Drummed Soils - Inorganic Results

Date Sampled	8-6-91		8-6-91		8-6-91		8-6-91		8-6-91		8-7-91	
Sample Number	MW107-4		MW107-5		MW107-5D		MW107-6		MW107-7		MW108-2	
Inorganic Traffic Report Number	MEKR-07		MEKR-08		MEKR-09		MEKR-10		MEKR-11		MEKR-12	
Metals (mg/Kg)												
Aluminum	4530	J	3770	J	4270	J	2190	J	2930	J	4070	J
Antimony	17	UJ	21.6	UJ	21.4	UJ	10.9	UJ	12.1	UJ	29.4	UJ
Arsenic	5.5	BJ	6.3	BJ	7.5	BJ	4.8	J	3.5	BJ	8.7	BJ
Barium	49.4	BJ	37.6	BJ	41.2	BJ	23.5	BJ	34.6	BJ	65.2	BJ
Beryllium	0.66	UJ	0.83	UJ	0.82	UJ	0.42	UJ	0.47	UJ	1.1	UJ
Cadmium	2.6	UJ	3.3	UJ	3.3	UJ	1.7	UJ	1.9	UJ	4.5	UJ
Calcium	83300	J	92000	J	101000	J	62700	J	76500	J	74300	J
Chromium	11.4	J	9.7	J	11.3	J	7.6	J	7.2	J	11.3	BJ
Cobalt	5.9	UJ	7.5	UJ	7.4	UJ	3.8	UJ	4.2	UJ	10.2	UJ
Copper	10.3	BJ	7.1	BJ	7.8	BJ	6.4	BJ	7.1	BJ	12.4	BJ
Iron	12300	J	9550	J	10500	J	7760	J	9060	J	12000	J
Lead	9.8	J	7.2	J	7.2	J	6.5	J	7.5	J	11.9	J
Magnesium	42200	J	43200	J	47500	J	31400	J	38800	J	36700	J
Manganese	338	J	276	J	301	J	210	J	266	J	311	J
Mercury	0.33	UJ	0.41	UJ	0.41	UJ	0.21	UJ	0.23	UJ	0.56	UJ
Nickel	17.7	UJ	22.4	UJ	22.2	UJ	11.3	UJ	12.6	UJ	30.5	UJ
Potassium	915	BJ	672	UJ	733	BJ	406	BJ	547	BJ	915	UJ
Selenium	1.3	UJ	1.7	UJ	1.6	UJ	0.84	UJ	0.93	UJ	2.3	UJ
Silver	2	UJ	2.5	UJ	2.5	UJ	1.3	UJ	1.4	UJ	3.4	UJ
Sodium	1350	BJ	1240	BJ	1240	BJ	1100	BJ	1140	BJ	3420	BJ
Thallium	1.3	UJ	1.7	UJ	1.6	UJ	0.84	UJ	0.93	UJ	2.3	UJ
Vanadium	16.8	BJ	13.1	BJ	15.2	BJ	10.6	BJ	12.1	BJ	14.9	BJ
Zinc	38	J	29.4	J	30.7	J	28.1	J	27.4	J	45.5	J
Cyanide	1.6	UJ	2.1	UJ	2.1	UJ	1	UJ	1.2	UJ	2.8	UJ

Table E-3. Southeast Rockfc Drummed Soils - Inorganic Results

Date Sampled	8-7-91		8-7-91		6-25-91		6-25-91		6-25-91		6-25-91	
Sample Number	MW108-3		MW108-4		MW101A-1		MW101A-2		MW101A-3		MW101A-4	
Inorganic Traffic Report Number	MEKR-13		MEKR-14		MEAF-32		MEAF-33		MEAF-34		MEAF-35	
Metals (mg/Kg)												
Aluminum	4370	J	4000	J	1010		4080		5000		6200	
Antimony	26.3	UJ	29.9	UJ	4.1	U	7.1	U	11.5	U	14.8	U
Arsenic	9	BJ	9.8	BJ	1.2	BJ	18.7	J	4.5	BJ	4	BJ
Barium	66.2	BJ	63.6	BJ	9.4	B	34.2	B	43.6	B	53.5	B
Beryllium	1	UJ	1.1	UJ	0.24	U	0.8	B	0.68	U	0.87	U
Cadmium	4	U	4.6	UJ	0.73	U	1.3	U	2	U	2.6	U
Calcium	74400	J	73000	J	39800		43400		56300		65400	
Chromium	9.5	BJ	10.4	BJ	1.7	U	5.5		5.6	B	11.9	
Cobalt	9.1	UJ	10.3	UJ	0.97	U	2.2	B	3.1	B	4	B
Copper	11.5	BJ	11.5	BJ	2.7	U	4.6	U	7.5	U	9.6	U
Iron	12300	J	11500	J	3680		7770		9220		10700	
Lead	11.9	J	16.4	J	3.8		8.2		10.5		12.2	
Magnesium	37900	J	36100	J	17300		21900		27700		30700	
Manganese	321	J	301	J	107		218		258		297	
Mercury	0.51	UJ	0.57	UJ	0.1	UJ	0.23	UJ	0.35	UJ	0.39	UJ
Nickel	27.3	UJ	31	UJ	2.5	B	5.9	B	6.6	B	9.2	B
Potassium	1120	BJ	931	UJ	180	B	532	B	759	B	903	B
Selenium	2	UJ	2.3	UJ	R		2.8	J	R		R	
Silver	3	UJ	3.4	UJ	0.97	U	1.7	U	2.7	U	3.5	U
Sodium	3410	BJ	3250	BJ	330	B	1410	B	1560	B	1860	B
Thallium	2	UJ	2.3	UJ	0.25	U	0.42	U	0.72	UJ	0.77	U
Vanadium	15.7	BJ	13.3	BJ	4.1	B	9.2	B	10.8	B	12.3	B
Zinc	45.2	J	42.8	J	12.6		29.5		35		49.9	
Cyanide	2.5	UJ	2.9	UJ	6.1	U	11.4	U	18.4	U	21	U

Table E-3. Southeast Rockford Drummed Soils - Inorganic Results

Date Sampled	6-25-91		6-25-91		7-2-91		7-2-91		7-2-91		7-2-91	
Sample Number	MW101A-5		MW101A-6		MW104-1		MW104-2		MW104-3		MW104-4	
Inorganic Traffic Report Number	MEAF-36		MEAF-37		MEAF-43		MEAF-44		MEAF-45		MEAF-46	
Metals (mg/Kg)												
Aluminum	3620		3530		5310		5990		4220		5150	
Antimony	9.1	U	7.1	U	7.9	UJ	8.1	UJ	9.7	BJ	6.9	UJ
Arsenic	2.2	BJ	2.4	BJ	3.8	B	4.2	B	4.1		3.8	
Barium	33.7	B	38.2	B	38.3	B	42.3	B	29.8	B	36.8	B
Beryllium	0.54	U	0.42	U	0.48	BJ	0.75	BJ	0.33	U	0.41	U
Cadmium	1.6	U	1.2	U	1.4	U	1.4	U	0.99	U	1.2	U
Calcium	35600		40100		68500		75100		60900		74400	
Chromium	4.1	B	8.5		8.9		10.7		6.9		9.4	
Cobalt	2.2	U	2.7	B	5.2	B	6.4	B	5	B	5.8	B
Copper	5.9	U	4.6	U	6.9	B	9.2	B	7.2	B	7	B
Iron	6730		9400		10100		11200		8240		9750	
Lead	12.4		11.1		8.8	J	9.9	J	7.7	J	10.1	J
Magnesium	17800		20200		36300		39600		33300		39900	
Manganese	184		222		288	J	310	J	240	J	281	J
Mercury	0.24	UJ	0.22	UJ	0.23	U	0.22	U	0.14	U	0.16	U
Nickel	4.2	B	7.7	B	5.6	B	8.1	B	7.1	B	7.5	B
Potassium	496	B	475	B	876	B	973	B	673	B	797	B
Selenium	R		R		1.8	UJ	2	UJ	1.3	UJ	1.5	UJ
Silver	2.2	U	1.7	U	1.8	U	1.9	U	1.3	U	1.6	U
Sodium	1490	B	1560	B	1660	B	1770	B	1310	B	1650	B
Thallium	0.54	U	0.41	UJ	0.46	U	0.5	U	0.32	U	0.37	U
Vanadium	7	B	9.4	B	9.9	B	12.6	B	9	B	11	B
Zinc	28.2		53.9		36.4		45.2		31.9		35.9	
Cyanide	14	U	11.4	U	11.8	U	12.4	U	8.5	U	9.9	U

Table E-3. Southeast Rockfo. rummed Soils - Inorganic Results

Date Sampled	7-3-91		7-11-91		7-11-91		7-11-91		7-11-91		7-15-91	
Sample Number	MW104-5		MW109-1		MW109-1D		MW109-2		MW104-6		MW104-7	
Inorganic Traffic Report Number	MEAF-47		MEAF-82		MEAF-83		MEAF-84		MEAF-85		MEAF-87	
Metals (mg/Kg)												
Aluminum	3310		2950		3470		4680		15200		7580	
Antimony	9.9	UJ	R		R		R		R		R	
Arsenic	2.8	B	1.6	B	1.8	B	2	B	6.1		9.3	
Barium	49.5	B	15	B	16.8	B	27.1	B	45.1	B	24.8	B
Beryllium	0.92	BJ	0.24	B	0.25	B	0.29	B	0.81	B	0.28	B
Cadmium	1.8	U	0.92	U	0.96	U	0.9	U	1.8	U	3.7	
Calcium	55600		71300		65000		42000		53800		94100	
Chromium	4.1	U	9.3		12.6		9.6		17		6.5	
Cobalt	2.3	U	2.6	B	3.1	B	3	B	4	B	4.8	B
Copper	6.4	U	16.3		12.5		13.3		22.2		10.4	
Iron	8080		6040		6580		7430		21000		14000	J
Lead	12.5	J	4.01	J	3.1	J	3.9	J	8.4	J	6.2	
Magnesium	31100		33300		28500		21300		27800		55000	
Manganese	252	J	185		185		240		297		269	J
Mercury	0.27	U	0.12	U	0.12	U	0.11	U	0.22	U	0.14	U
Nickel	3.5	U	6	B	6.4	B	6.3	B	16.4	B	13	
Potassium	415	B	418	B	695	B	471	B	1460	B	741	B
Selenium	2.2	UJ	3.5	U	0.72	U	0.67	U	1.3	U	0.59	UJ
Silver	2.3	U	0.69	U	0.72	U	0.71	BJ	2	BJ	0.84	U
Sodium	3280		362	U	377	U	353	U	1090	B	844	B
Thallium	0.55	U	0.46	UJ	0.48	UJ	0.45	UJ	0.88	U	0.59	B
Vanadium	5.2	B	8.6	B	10.1	B	10.2	B	16.4	B	6.9	B
Zinc	32.4		17.7		18.5		21.2		44.9		36.6	
Cyanide	15.2	U	2.1	U	2.4	U	2	U	4.1	U	1.3	U

Table E-3. Southeast Rockford Drummed Soils - Inorganic Results

Date Sampled	7-15-91		7-15-91		7-16-91		8/21/91		8/21/91		8-21-91	
Sample Number	MW104-8		MW107-1		MW108-1		MW111-1		MW111-1D		MW111-2	
Inorganic Traffic Report Number	MEAF-88		MEAF-89		MEAF-90		MEAF-91		MEAF-92		MEAF-93	
Metals (mg/Kg)												
Aluminum	4360		4230		2990		7370	J	5770	J	7410	J
Antimony	R		R		R		40.2	UJ	38.6	UJ	67.1	UJ
Arsenic	1.8		2.4		1.6	B	6.3	BJ	5	BJ	8.4	BJ
Barium	47.8	B	22	B	14.8	B	61.5	BJ	53.2	BJ	90.1	BJ
Beryllium	0.52	B	0.17	U	0.19	U	0.8	UJ	0.77	UJ	1.3	UJ
Cadmium	2		2.3		2		3.2	UJ	3.1	UJ	5.4	UJ
Calcium	30300		61700		78100		75500	J	63500	J	94600	J
Chromium	2.4	U	7.2		9		5.7	BJ	5.4	UJ	9.4	UJ
Cobalt	2.1	U	4.1	B	3.6	B	4.8	UJ	4.6	UJ	8.1	UJ
Copper	1.7	U	7.6		6.8		49.3	J	27.9	J	44.1	J
Iron	9010	J	8890	J	8080	J	14400	J	12200	J	16100	J
Lead	7.8		4.4		4.6		15.3	J	14.2	J	22.3	J
Magnesium	14900		32000		38100		35600	J	29700	J	44400	J
Manganese	235	J	228	J	268	J	381	J	329	J	420	J
Mercury	0.17	U	0.07	U	0.11	U	0.38	UJ	0.35	UJ	0.64	UJ
Nickel	3.8	B	7.7		6.6	B	12	UJ	11.6	UJ	20.1	UJ
Potassium	449	B	653	B	565	B	345	UJ	331	UJ	576	UJ
Selenium	0.66	UJ	0.31	UJ	0.44	UJ	2.4	UJ	2.3	UJ	4	UJ
Silver	1	U	0.52	U	0.56	U	2.4	UJ	2.3	UJ	4	UJ
Sodium	2200		245	B	202	B	3200	BJ	2960	BJ	5690	BJ
Thallium	0.4	B	0.31	B	1.1	U	4	UJ	3.9	UJ	6.7	UJ
Vanadium	2.7	B	10.9		5.9	B	9.5	BJ	6.3	BJ	4.6	BJ
Zinc	27.3		26		25.4		46.1	J	40.3	J	56.1	J
Cyanide	1.8	U	0.94	U	0.87	U	7.7	UJ	6.6	UJ	12.8	UJ

Table E-3. Southeast Rockfo[illegible]rummed Soils - Inorganic Results

Date Sampled	8-21-91		8-21-91		8-21-91		8-21-91		8-21-91		8-21-91	
Sample Number	MW111-3		MW111-4		MW111-5		MW110-1		MW110-2		MW110-2D	
Inorganic Traffic Report Number	MEAF-94		MEAF-95		MEAF-96		MEAF-97		MEAF-98		MEAF-99	
Metals (mg/Kg)												
Aluminum	2350	J	2230	J	3400	J	2570	J	4170	J	3380	J
Antimony	24.8	UJ	23.9	UJ	22.8	UJ	17	UJ	24.3	UJ	21.1	UJ
Arsenic	4.1	BJ	2.9	BJ	2.5	BJ	2.6	B	4.8	BJ	3.2	BJ
Barium	38.4	BJ	31.2	BJ	22.9	BJ	21.4	B	31.1	BJ	27.5	BJ
Beryllium	0.5	UJ	0.48	UJ	0.46	UJ	0.34	U	0.49	UJ	0.42	UJ
Cadmium	2	UJ	1.9	UJ	1.8	UJ	1.4	U	1.9	UJ	1.7	UJ
Calcium	64000	J	56800	J	169000	J	95000		102000	J	106000	J
Chromium	3.8	BJ	3.3	UJ	5.5	J	7.5	J	7.6	J	7.3	J
Cobalt	3	UJ	2.9	UJ	2.7	UJ	2	U	2.9	UJ	2.5	UJ
Copper	16.4	J	13.4	J	13.1	J	11.1		21.2	J	20.5	J
Iron	10000	J	6920	J	6220	J	7090		11500	J	8920	J
Lead	10.4	J	6.8	J	5.7	J	5.3		8.8	J	5.9	J
Magnesium	30900	J	27400	J	79600	J	39900		44900	J	45700	J
Manganese	302	J	217	J	249	J	205		251	J	240	J
Mercury	0.25	UJ	0.24	UJ	0.23	UJ	0.15	U	0.24	UJ	0.19	UJ
Nickel	7.4	UJ	7.2	UJ	6.8	UJ	5.1	U	7.3	UJ	6.3	UJ
Potassium	213	UJ	205	UJ	196	UJ	146	U	208	UJ	181	UJ
Selenium	1.5	UJ	1.4	UJ	1.4	UJ	1	U	1.5	UJ	1.3	UJ
Silver	1.5	UJ	1.4	UJ	1.4	UJ	1	U	1.5	UJ	1.3	UJ
Sodium	1690	BJ	1670	BJ	1330	BJ	734	B	1510	BJ	1240	BJ
Thallium	2.5	UJ	2.4	UJ	2.3	UJ	1.7	U	2.4	UJ	2.1	UJ
Vanadium	4	BJ	2.6	BJ	4.2	BJ	4.6	B	8.4	BJ	6	BJ
Zinc	30.7	J	19.7	J	17.6	J	24.2		29.3	J	20.9	J
Cyanide	4.8	UJ	4.1	UJ	3.9	UJ	3.1	U	4.5	UJ	3.9	UJ

APPENDIX F

ANALYTICAL AND GRAIN SIZE RESULTS FOR SUBSURFACE SOIL SAMPLES

Table F-1. Southeast Rockford Surface Soil Samples - Organic Results

Date Sampled	6-25-91	6-25-91	6-25-91	6-28-91	6-28-91	6-28-91
Sample Number	MW111-1A	MW111-1B	MW111-1C	MW109-1A	MW109-1B	MW109-1C
Organic Traffic Report Number	EBT-06	EBT-07	EBT-08	EBT-09	EBT-10	EBT-11
Depth Sampled	4-6'	14-16'	24-26'	4-6'	14-16'	24-26'
Volatile Organics (ug/kg)						
Methylene Chloride						
Acetone				6 J		6 J
Carbon Disulfide						
1,2-Dichloroethene						
Chloroform		1 J				
1,2-Dichloroethane						
2-Butanone						
1,1,1-Trichloroethane		2 J				
Trichloroethene						
1,1,2-Trichloroethane						
Benzene						
4-Methyl-2-Pentanone						
2-Hexanone						
Tetrachloroethene						
Toluene	1 J		2 J			
Ethylbenzene						
Total Xylenes						
Semivolatile Organics (ug/kg)						
Phenanthrene						
Di-n-butylphthalate						
Bis (2-ethylhexyl) phthalate	130 J	75 J		100 J		
Di-n-octyl phthalate	70 J					

Note: Blank cell indicates analyte was not detected

Table F-1. Southeast Rockford Subsurface Soil Samples - Organic Results

Date Sampled	7-11-91		7-11-91	
Sample Number	MW107-A		MW107-B	
Organic Traffic Report Number	EBT-21		EBT-22	
Depth Sampled	4-6'		14-16'	
Volatile Organics (ug/kg)				
Methylene Chloride				
Acetone				
Carbon Disulfide				
1,2-Dichloroethene				
Chloroform				
1,2-Dichloroethane				
2-Butanone				
1,1,1-Trichloroethane				
Trichloroethene				
1,1,2-Trichloroethane				
Benzene				
4-Methyl-2-Pentanone				
2-Hexanone	2	J		
Tetrachloroethene				
Toluene	1	J	1	J
Ethylbenzene				
Total Xylenes				
Semivolatile Organics (ug/kg)				
Phenanthrene				
Di-n-butylphthalate				
Bis (2-ethylhexyl) phthalate				
Di-n-octyl phthalate				

Note: Blank cell indicates analyte was not detected

Table F-2. Southeast Rockford Surface Soil Samples - Inorganic Results

Date Sampled	6-25-91	6-25-91	6-28-91	6-28-91	6-28-91	7-11-91
Sample Number	MW111-1B	MW111-1C	MW109-1A	MW109-1B	MW109-1C	MW107-B
Inorganic Traffic Report Number	MEAF-38	MEAF-39	MEAF-40	MEAF-41	MEAF-42	MEAF-86
Depth Sampled	14-16'	24-26'	4-6'	14-16'	24-26'	14-16'

Metals (mg/kg)

Aluminum	4280		867		10700		1690		2730		2240	
Antimony	3.3	U	3.5	U	3.8	UJ	3.2	UJ	3.3	UJ		R
Arsenic	4.2	J		R	4.1		2.1		1.7	B	4.5	
Barium	15.5	B	3.6	B	68.5		11.8	B	11.4	B	10.8	B
Beryllium	0.19	U	0.21	U	0.71	BJ	0.19	BJ	0.2	BJ	0.25	B
Cadmium	0.58	U	0.62	U	0.68	U	0.56	U	0.58	U	0.88	U
Calcium	63700		46300		951	B	82100		58800		85700	
Chromium	7		2.5		12		4.2		6.1		5.7	
Cobalt	4.1	B	0.82	U	5.1	B	3.1	B	2.6	B	3	B
Copper	8.1		2.3	U	11.5		6.3		5.6		14.3	
Iron	9200		3120		13000		4860		5210		10000	
Lead	3.2		2.6		6.8	J	3.9	J	3	J	4.69	J
Magnesium	31200		19400		1750		42000		28300		41300	
Manganese	213		87.8		335	J	195	J	142	J	234	
Mercury	0.09	UJ	0.1	UJ	0.1	U	0.09	U	0.1	U	0.1	U
Nickel	9.1		2.1	B	10.6		4.3	B	4.6	B	7.1	B
Potassium	937	B	157	B	507	B	199	B	492	B	449	B
Selenium		R		R	0.88	UJ	0.78	UJ	0.76	UJ	0.66	U
Silver	0.77	U	0.82	U	0.9	U	0.74	U	0.77	U	0.66	U
Sodium	97.9	B	57.1	BJ	44.1	BJ	151	B	89.1	B	344	U
Thallium	0.19	U	0.2	U	0.47	B	0.19	UJ	0.19	UJ	0.44	UJ
Vanadium	12.1		6.4	B	20.8		7.3	B	8.4	B	9.4	B
Zinc	29.3		13.7		30.2		19.2		17.7		24.8	
Cyanide	5	U	5.3	U	5.4	U	4.9	U	4.9	U	2.2	U

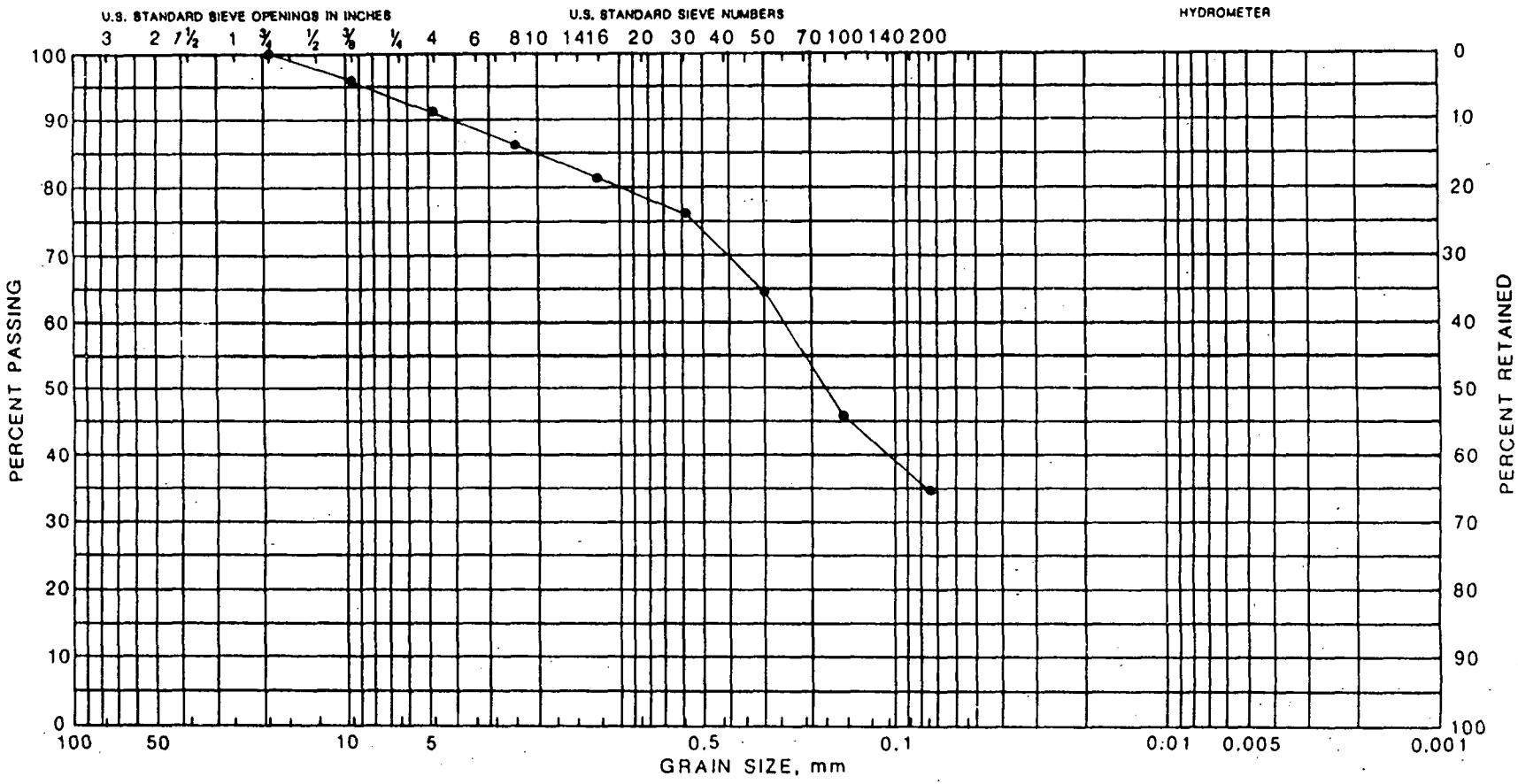
Table F-3. Soil Sample Results - Total Organic Carbon

Date Sampled	7-26-91	7-26-91	8-9-91
Sample Number	MW105-B	MW105-C	MW111
Organic Traffic Report Number	6593E-07	6593E-08	6593E-09
Depth Sampled	84'-86'	104'-106'	28'-29'
Total Organic Carbon (mg/Kg)	5,300	3,170	25,800

Table F-3. Soil Sample Results - Total Organic Carbon

Date Sampled	7-13-91	7-14-91	7-15-91	7-17-91	7-22-91	7-26-91
Sample Number	MW107	MW108-A	MW108-B	MW110	MW104	MW105-A
Organic Traffic Report Number	6593E-01	6593E-02	6593E-03	6593E-04	6593E-05	6593E-06
Depth Sampled	44'-46'	34'-36'	64'-66'	43'-44'	54'-56'	54'-56'
Total Organic Carbon (mg/Kg)	32,800	36,700	2,930	42,000	15,900	17,000

PARTICLE S. E ANALYSIS

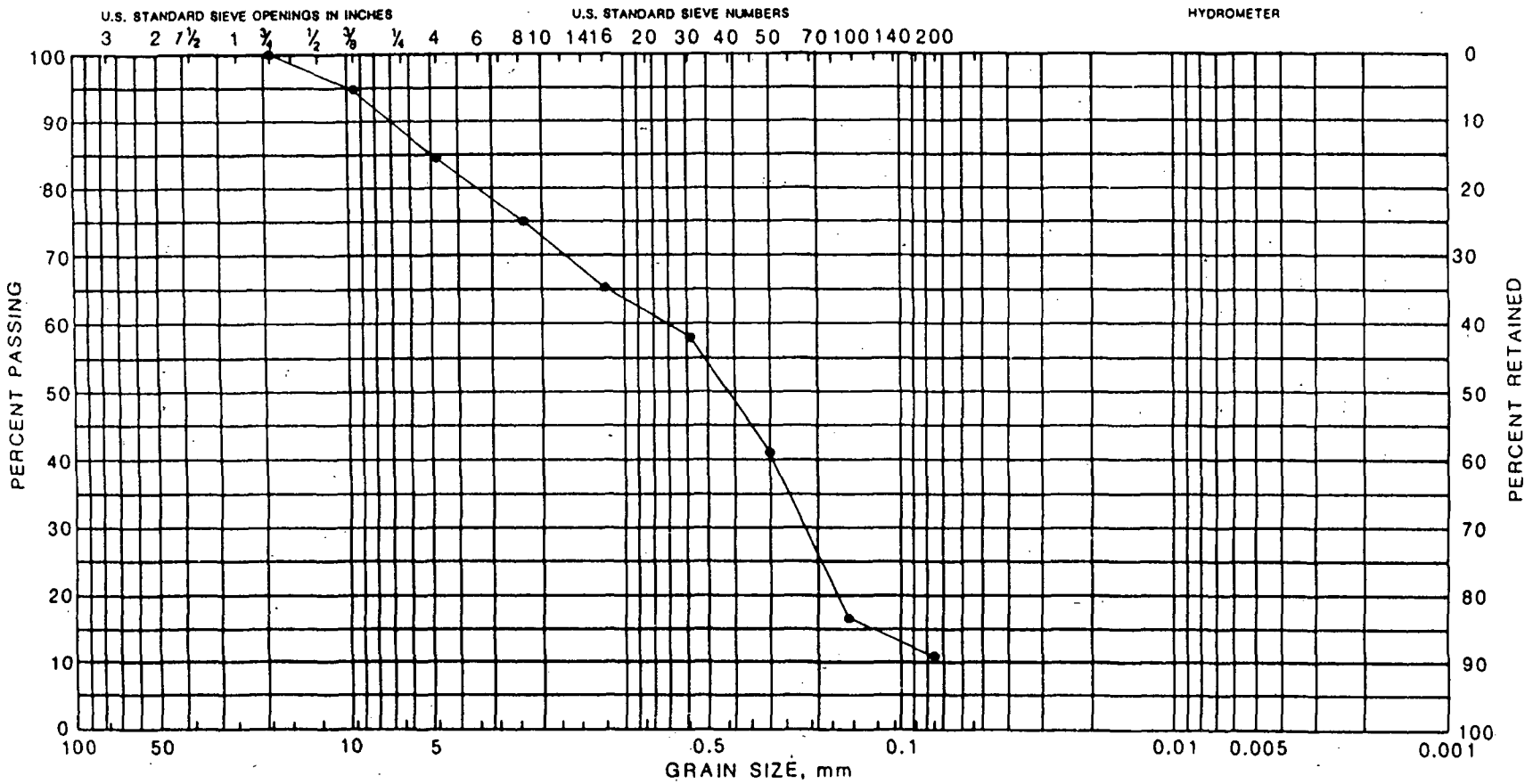


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

JOB NO. 133723 PROJECT South East Rockford Study Area

CURVE	BORING	SAMPLE	DEPTH,FT.	DESCRIPTION
1	MW-104	-	44-46	Gray-Brown Clayey SAND Trace Gravel, SC

PARTICLE SIZE ANALYSIS

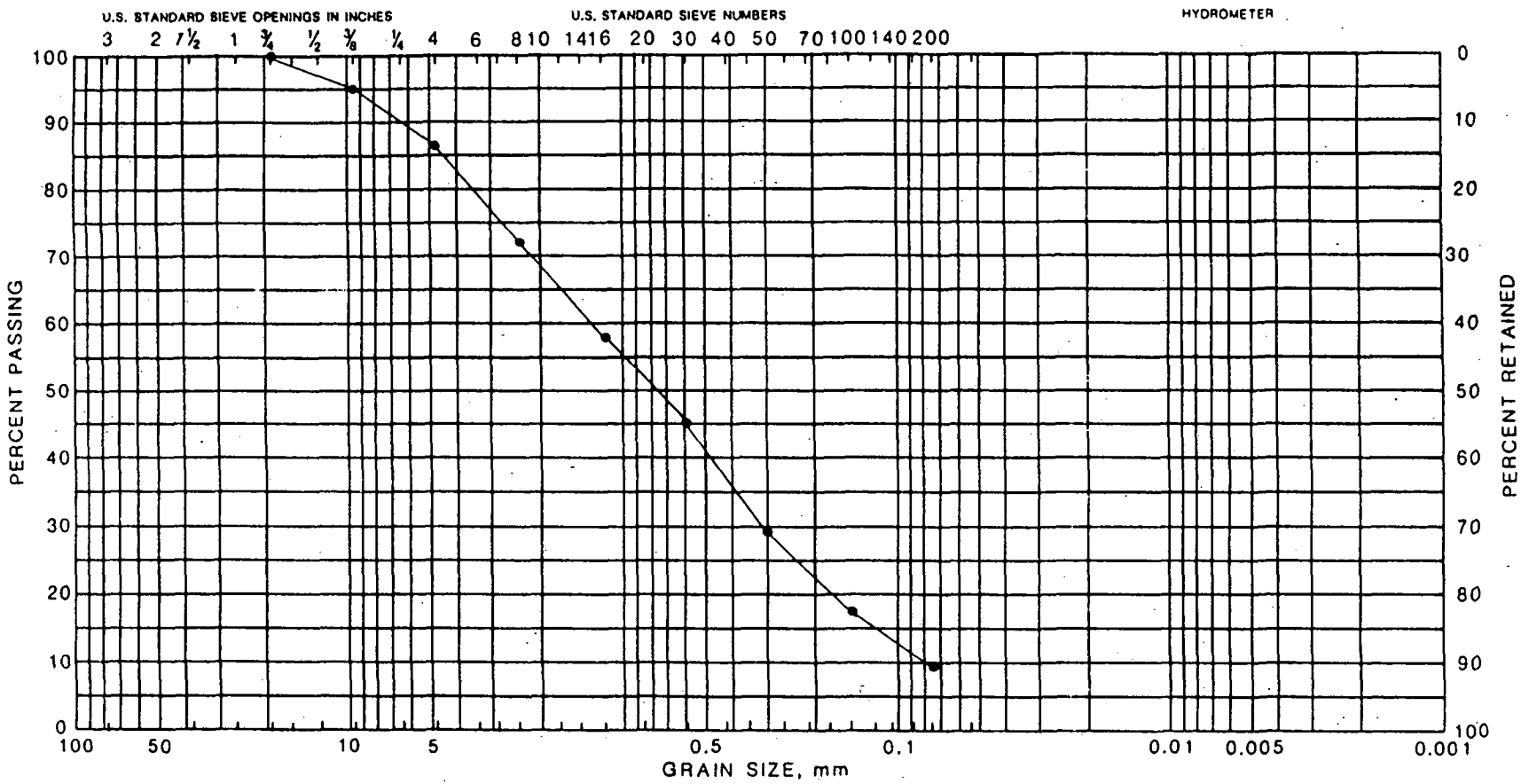


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

JOB NO. 133723 PROJECT South East Rockford Study Area

CURVE	BORING	SAMPLE	DEPTH,FT.	DESCRIPTION
2	MW-105	-	74-76	Gray SAND w/Gravel Trace Clay, SP-SC

PARTICLE SIZE ANALYSIS

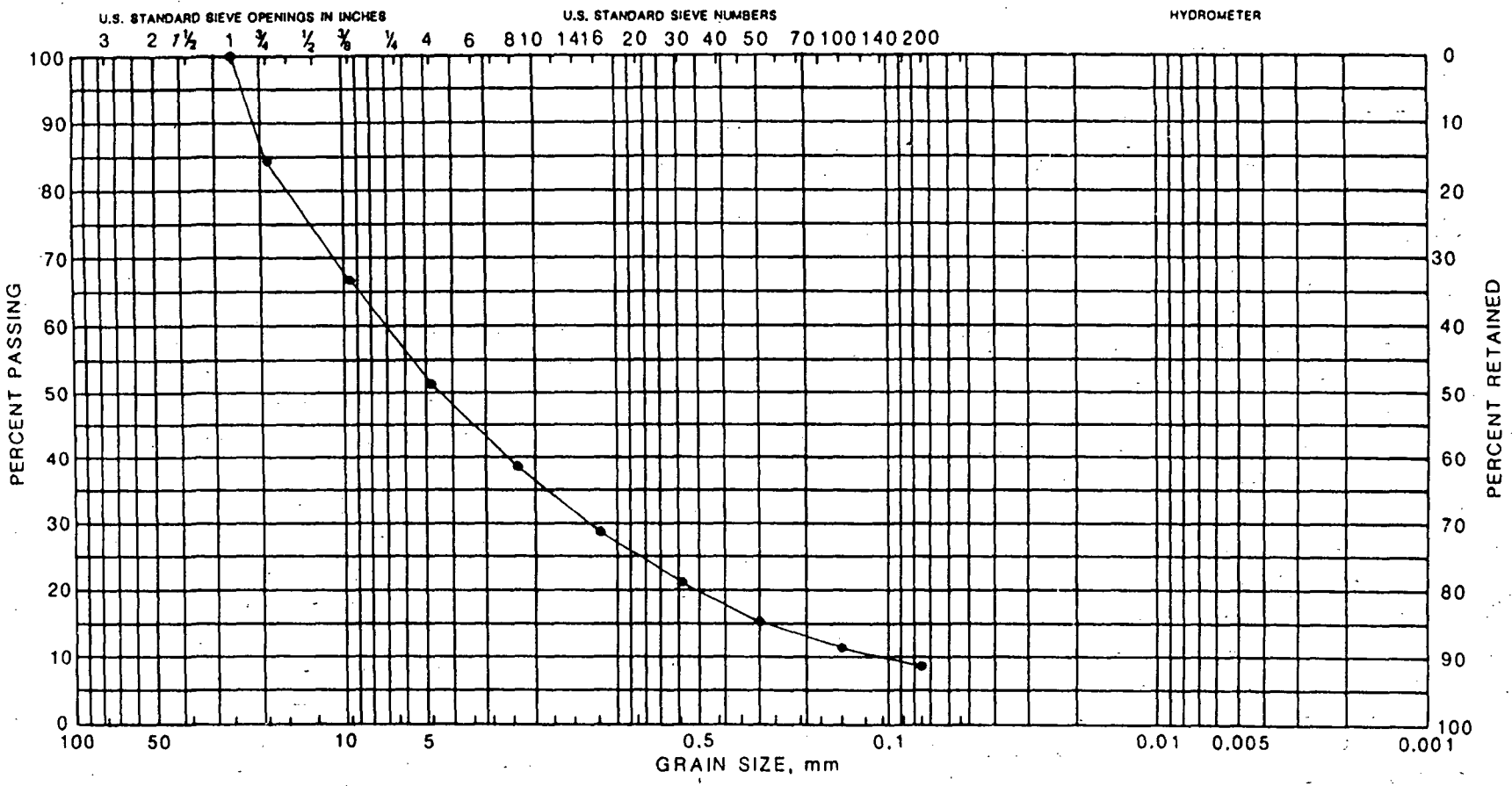


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

JOB NO. 133723 PROJECT South East Rockford Study Area

CURVE	BORING	SAMPLE	DEPTH,FT.	DESCRIPTION
3	MW-107	-	39-41	Brown SAND Trace Gravel, Clay, SP-SC

PARTICLE SIZE ANALYSIS



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

JOB NO. 133723 PROJECT South East Rockford Study Area

CURVE	BORING	SAMPLE	DEPTH,FT.	DESCRIPTION
4	MW-110	-	39-41	Brown Gravelly SAND Trace Clay, SP-SC

APPENDIX G

RESULTS OF WELL SURVEYING

CAMP, DRESSER, MCKEE
S.E. ROCKFORD - TEST WELL LOCATIONS

DESCRIPTION	NORTHING	EASTING	WELL CASING ELEV	GROUND ELEV.
MONITOR WELL 101A	13746.432	11152.490	765.62	764.07
MONITOR WELL 101B	13745.427	11161.352	766.62	764.06
MONITOR WELL 102A	13826.707	13338.405	788.43	786.47
MONITOR WELL 102B	13837.220	13349.809	788.61	786.60
MONITOR WELL 102C	13851.034	13347.454	789.87	787.68
MONITOR WELL 103A	12529.851	13798.978	792.56	790.49
MONITOR WELL 103B	12530.080	13822.398	792.39	790.36
MONITOR WELL 103C	12530.093	13811.123	792.35	790.21
MONITOR WELL 104A	14429.443	15338.233	818.10	815.94
MONITOR WELL 104B	14451.441	15332.147	817.37	815.22
MONITOR WELL 104C	14423.178	15339.082	818.25	816.09
MONITOR WELL 105A	13125.190	15386.112	785.57	783.31
MONITOR WELL 105B	13106.733	15397.279	785.78	783.58
MONITOR WELL 105C	13114.655	15393.484	785.66	783.52
MONITOR WELL 105D	13089.857	15407.250	786.21	784.09
MONITOR WELL 106A	12369.634	15413.051	805.71	803.70
MONITOR WELL 106B	12389.259	15396.229	805.52	803.59
MONITOR WELL 106C	12378.248	15405.689	805.40	803.38
MONITOR WELL 107A	14027.696	17236.745	808.86	809.29
MONITOR WELL 107B	14032.118	17235.234	808.87	809.28
MONITOR WELL 107C	14021.528	17238.819	808.70	809.16
MONITOR WELL 108~~A~~ C	12674.713	17631.559	825.16	823.06
MONITOR WELL 108~~B~~ A	12687.303	17631.457	824.90	823.00
MONITOR WELL 108~~C~~ B	12698.561	17631.578	824.93	822.88
MONITOR WELL 109A	10827.218	17606.600	850.89	848.68
MONITOR WELL 109B	10832.662	17614.945	850.47	848.51
MONITOR WELL 109C	10818.242	17597.184	850.47	848.37
MONITOR WELL 110A	14612.460	22068.585	846.65	844.16
MONITOR WELL 110B	14611.928	22056.734	846.18	844.06
MONITOR WELL 110C	14611.605	22044.792	846.24	844.18
MONITOR WELL 111A	11869.629	20846.193	832.84	830.71
MONITOR WELL 111B	11868.575	20852.730	832.44	830.67
MONITOR WELL 111C	11872.818	20828.479	833.26	830.65

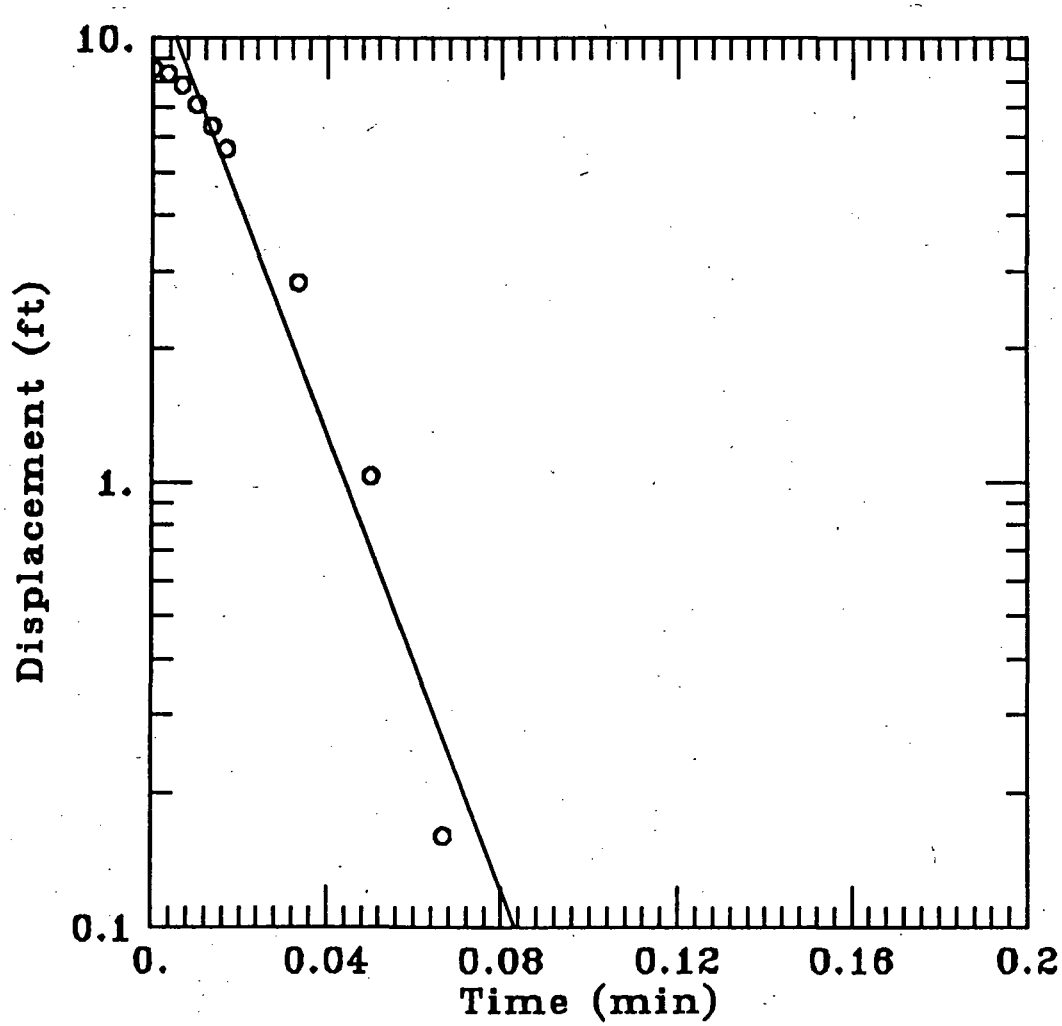
center of STREET INTERSECTION LOCATIONS

DESCRIPTION	NORTHING = y	EASTING = x
SANDY HOLLOW & 20TH ST.	10000.00	10000.00
LAUDE DRIVE & 20TH ST.	13759.423	9998.044
HARRISON AVE. & 20TH ST.	15271.912	9996.235
HARRISON AVE. & OHIO PARKWAY	15249.335	12940.409
HARRISON AVE. & ALPINE ROAD	15357.880	17746.648
EAST ROCK DRIVE & 26TH AVE.	14584.404	22209.693
ALPINE ROAD & CARTHAGE DRIVE	14067.541	17764.095
ALPINE ROAD & O'CONNELL ST.	12234.064	17786.861
ALPINE ROAD & AMERICAN ROAD	12030.414	17788.755
ALPINE ROAD & MAYFLOWER AVE.	10860.902	17801.592
ALPINE ROAD & SANDY HOLLOW ROAD	10114.802	17808.345

APPENDIX H

RESULTS OF HYDRAULIC CONDUCTIVITY ANALYSIS

mw101a test 1



DATA SET:
mw101a1.dat
11/21/91

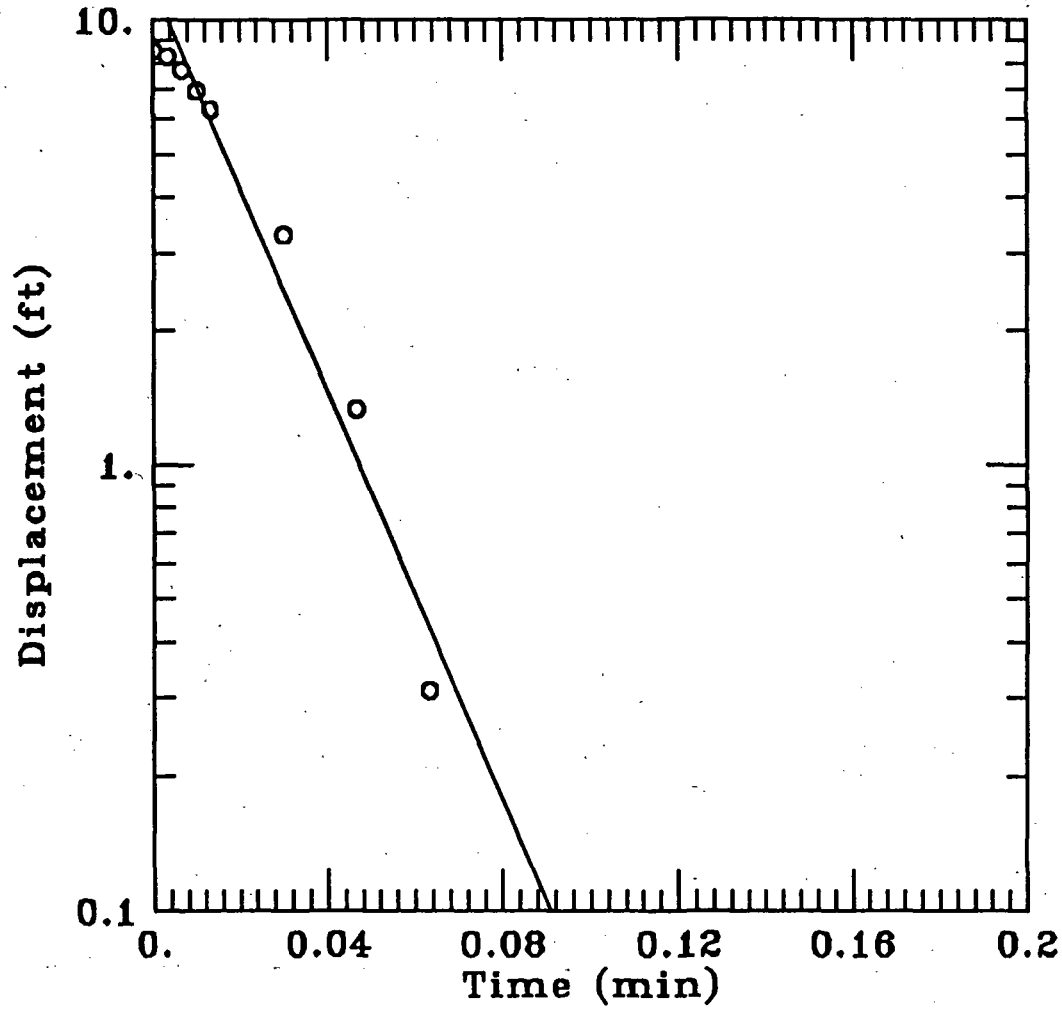
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.06882 ft/min
y0 = 13.39 ft

TEST DATA:
H0 = 8.52 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 21.5 ft
H = 42. ft

mw101a test 2



DATA SET:
mw101a2.dat
11/21/91

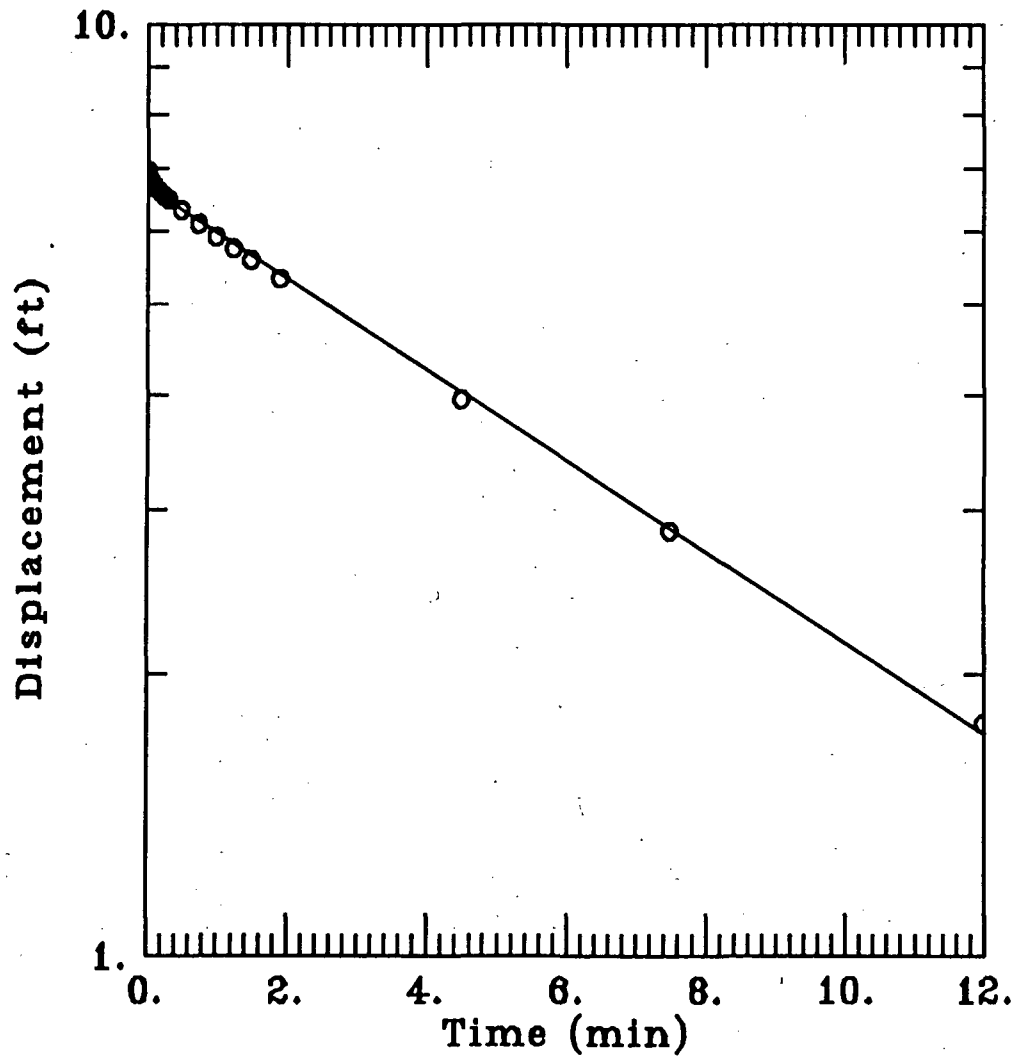
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.06141 ft/min
y0 = 11.91 ft

TEST DATA:
H0 = 8.52 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 21.5 ft
H = 42. ft

mw103a test 1



DATA SET:
mw103a1.dat
11/21/91

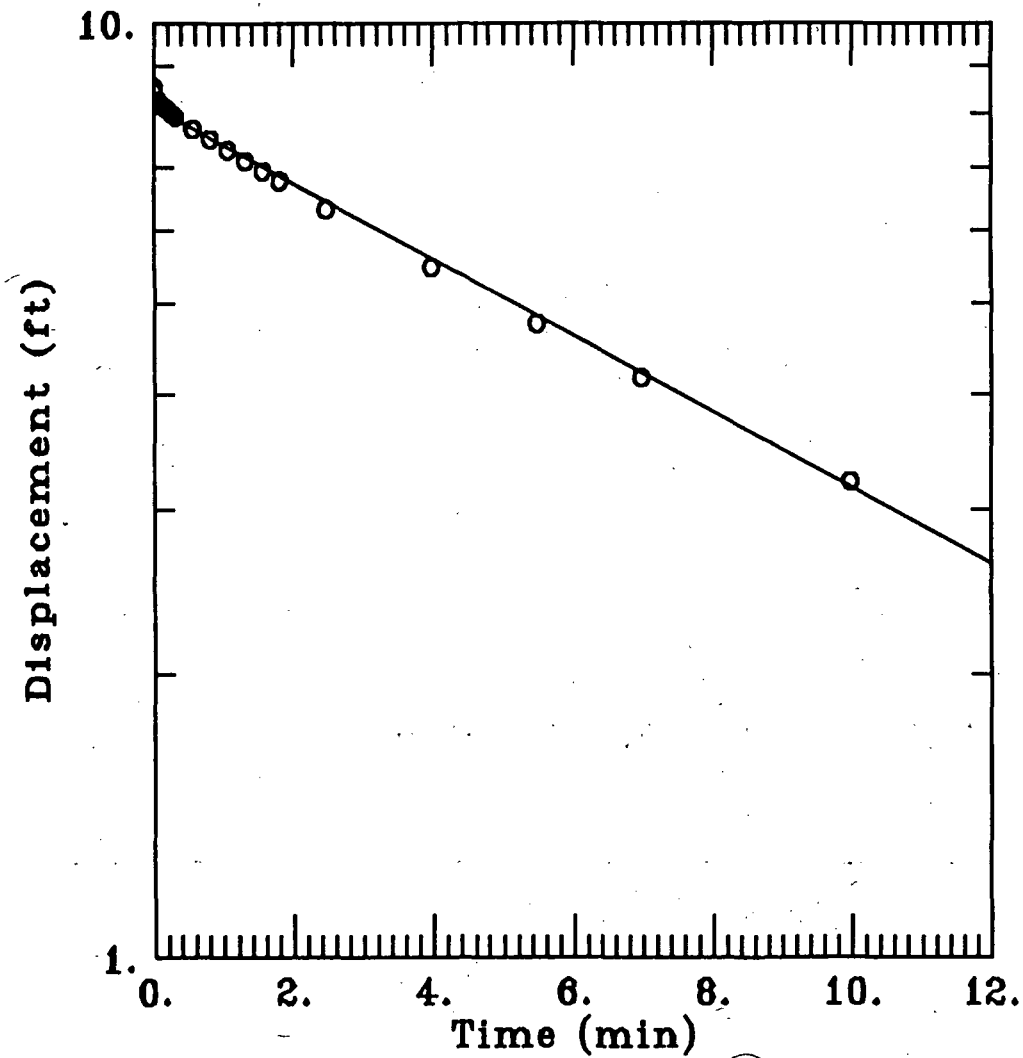
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.0001176 ft/min
y0 = 6.674 ft

TEST DATA:
H0 = 8.96 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 12. ft
H = 22. ft

mw103a test 2



DATA SET:
mw103a2.dat
11/21/91

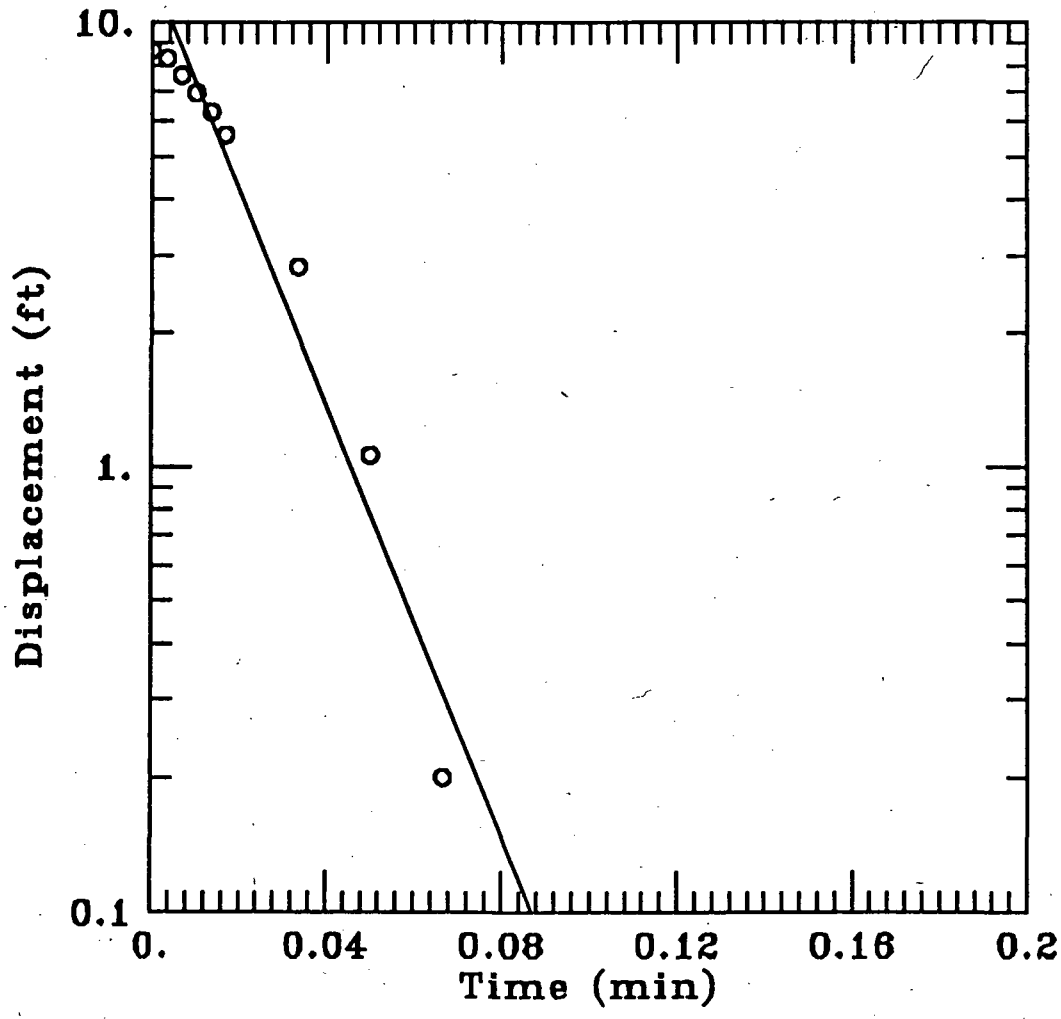
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 9.8145E-05 ft/min
y0 = 8.142 ft

TEST DATA:
H0 = 8.53 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 12. ft
H = 22. ft

mw101a test 3



DATA SET:
mw101a3.dat
11/21/91

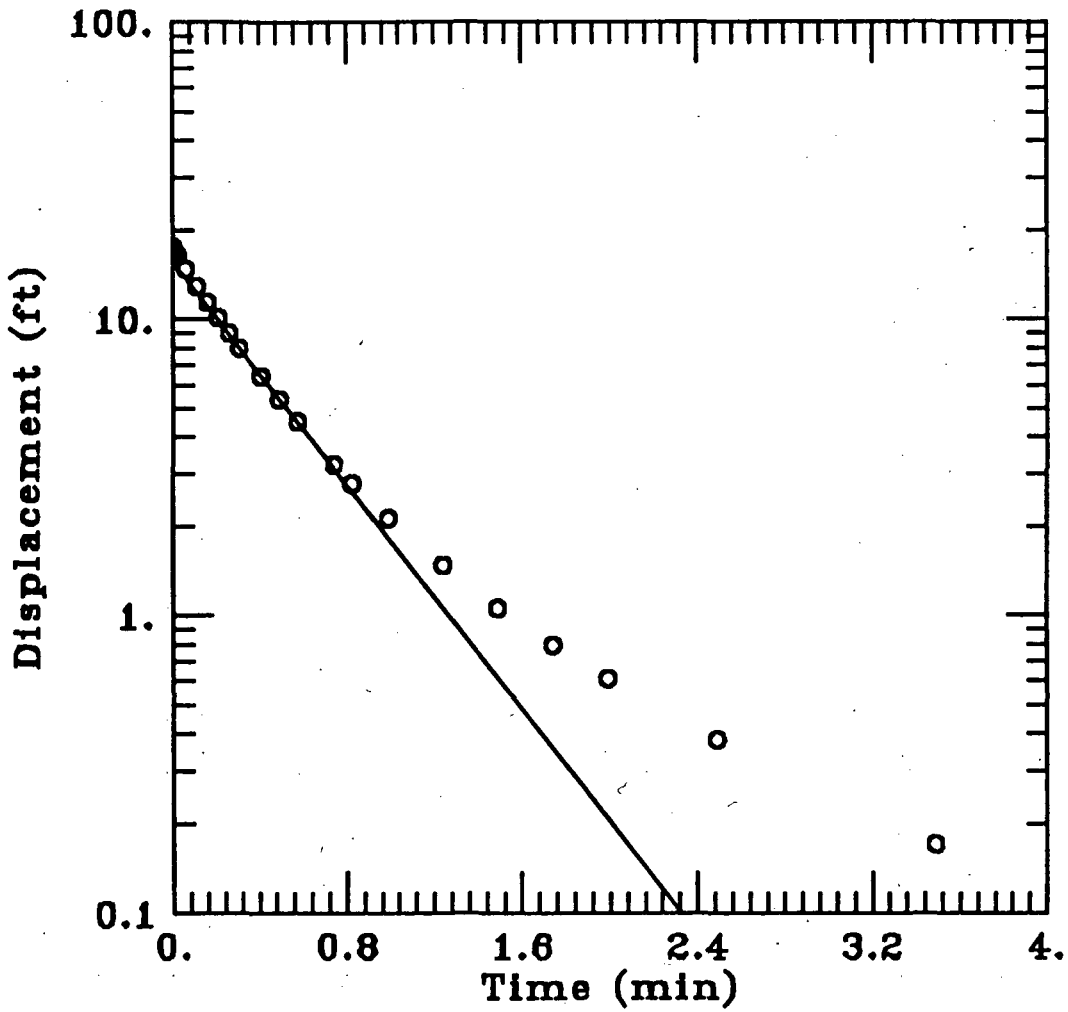
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.08526 ft/min
y0 = 12.88 ft

TEST DATA:
H0 = 8.65 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 21.5 ft
H = 42. ft

mw101b test 1



DATA SET:
mw101b1.dat
12/06/91

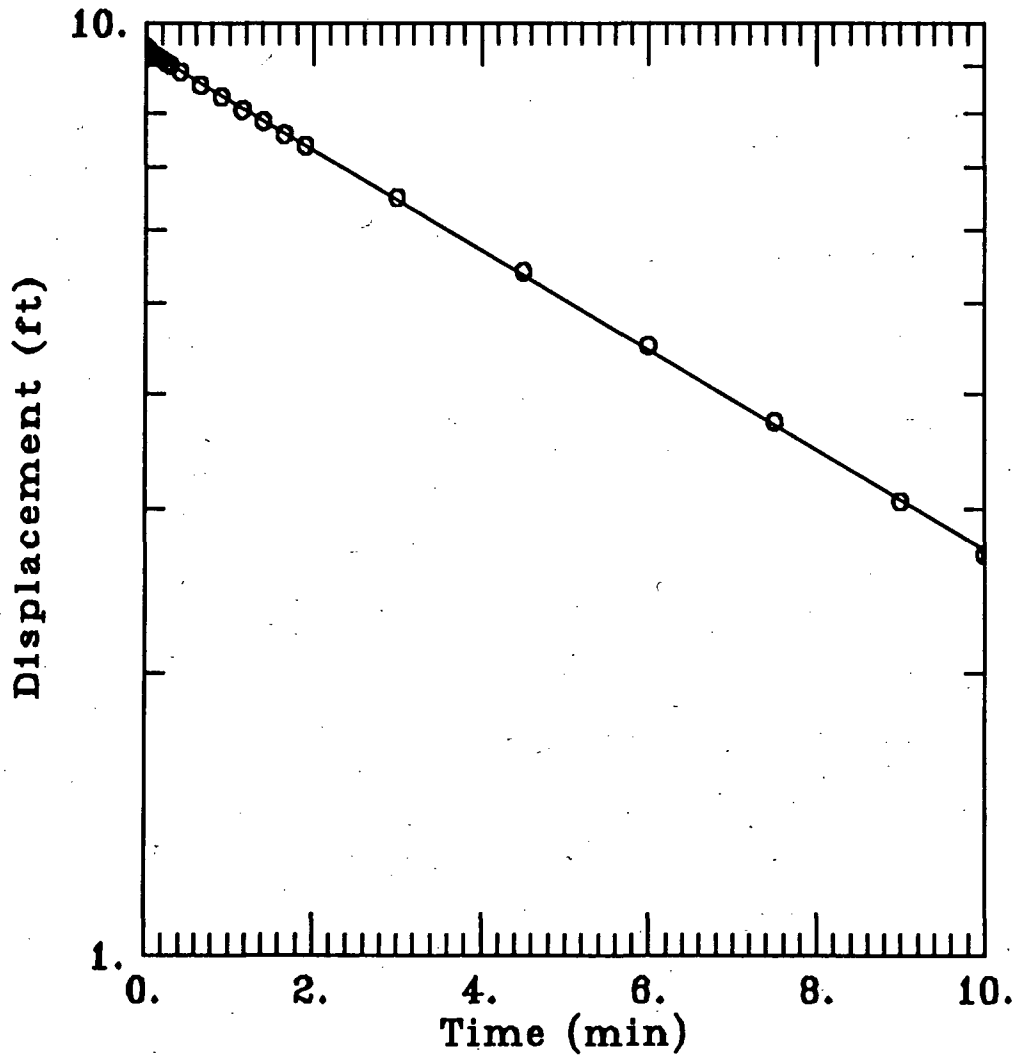
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.002874 ft/min
y0 = 15.82 ft

TEST DATA:
H0 = 17.48 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 105. ft

mw103a test 3



DATA SET:
mw103a3.dat
11/21/91

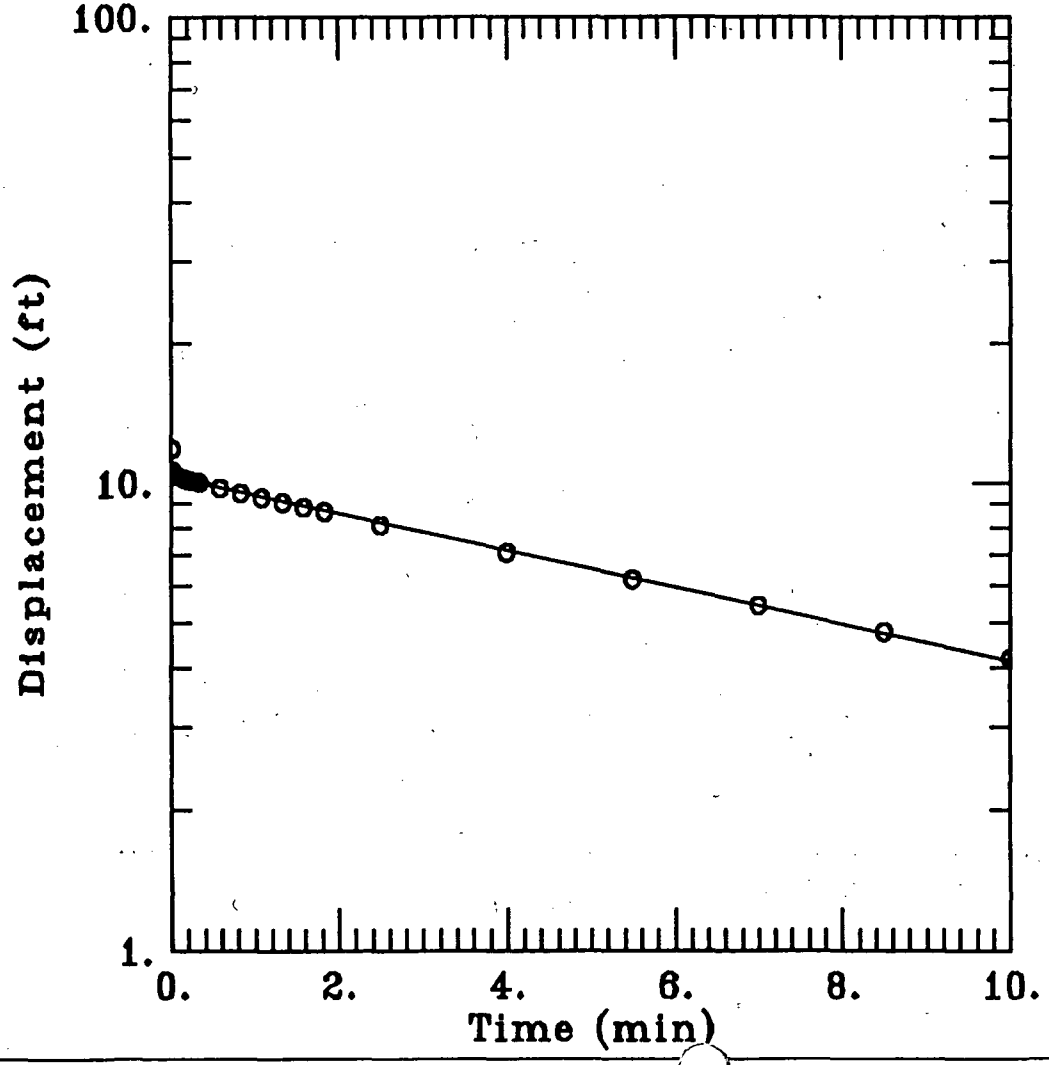
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.0001321 ft/min
y0 = 9.348 ft

TEST DATA:
H0 = 9.41 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 12. ft
H = 25. ft

mw103a test 4



DATA SET:
mw103a4.dat
11/21/91

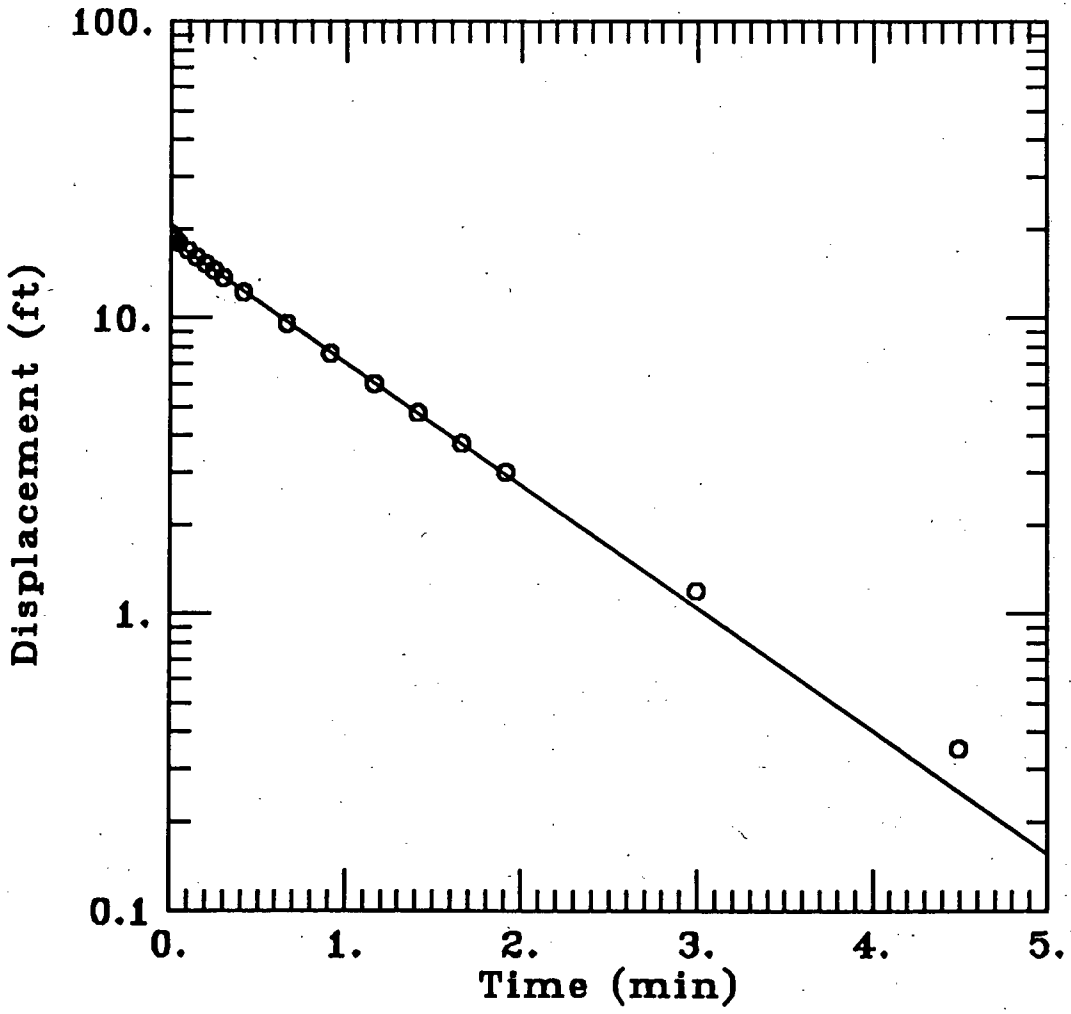
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETER
K = 9.5383E-05 ft/min
y0 = 10.29 ft

TEST DATA:
H0 = 11.81 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 12. ft
H = 22. ft

mw103b test 1



DATA SET:
mw103b1.dat
11/22/91

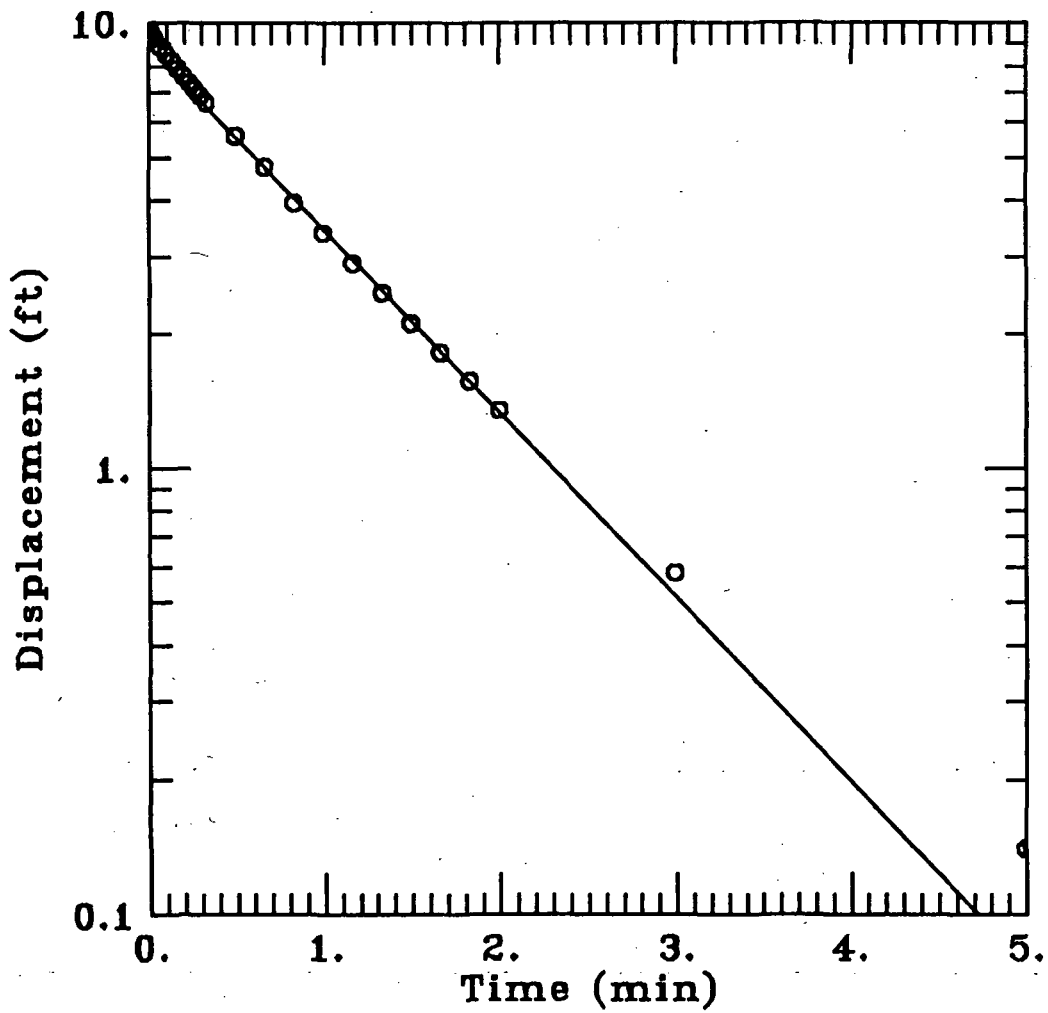
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.0009726 ft/min
y0 = 18.25 ft

TEST DATA:
H0 = 19.1 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 55. ft

mw103b test 2



DATA SET:
mw103b2.dat
11/22/91

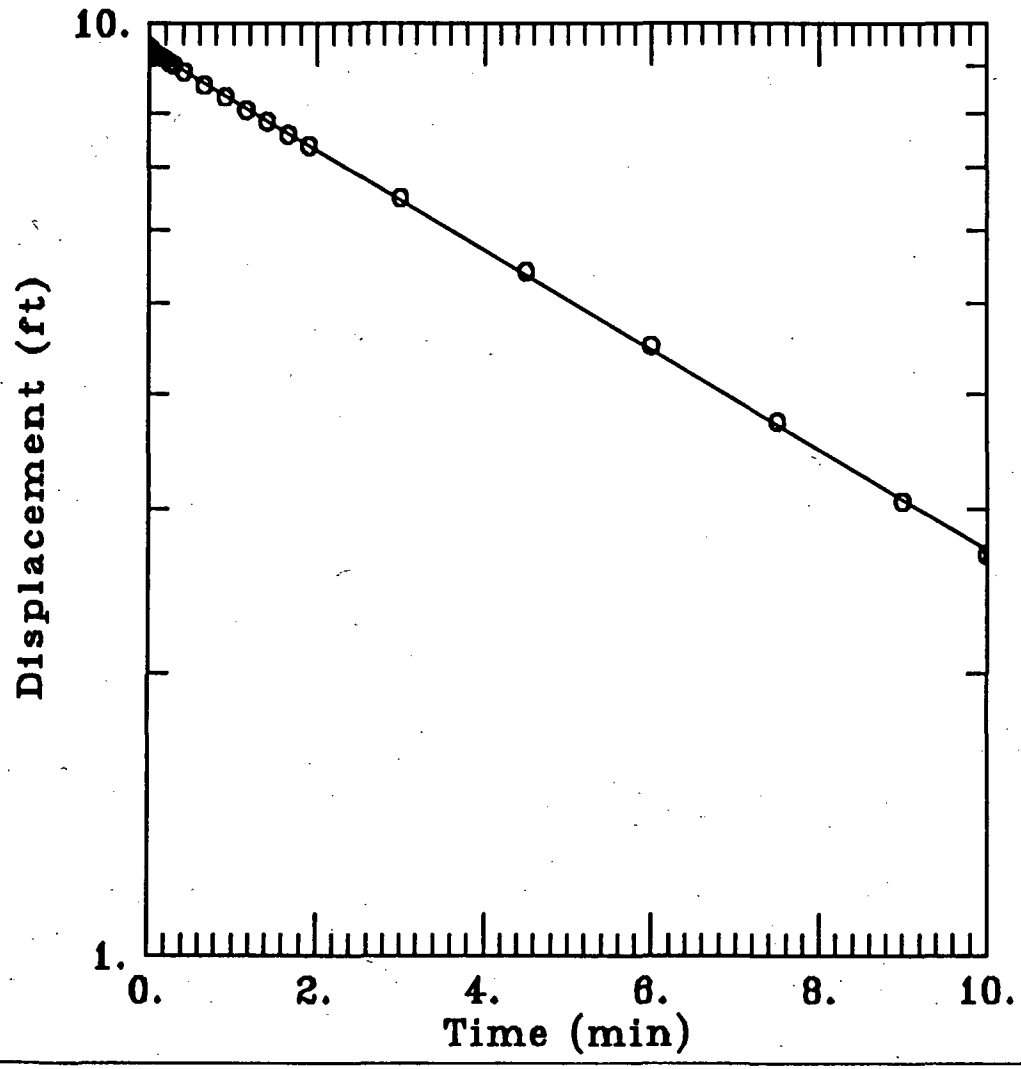
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.0009708 ft/min
y0 = 8.913 ft

TEST DATA:
H0 = 9.7 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 55. ft

mw103a test 3



DATA SET:
mw103a3.dat
11/21/91

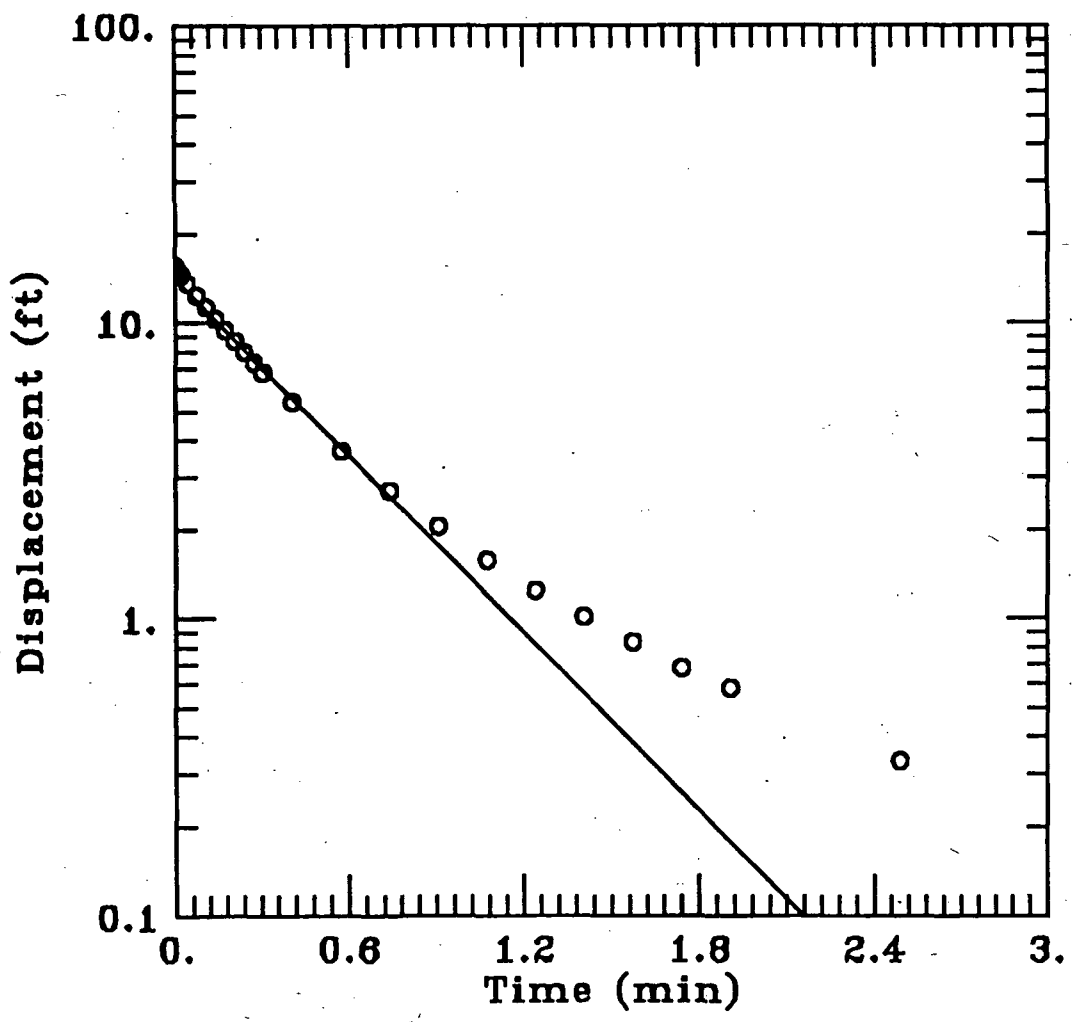
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.0001321 ft/min
y0 = 9.348 ft

TEST DATA:
H0 = 9.41 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 12. ft
H = 25. ft

mw101b test3



DATA SET:
mw101b3.dat
11/22/91

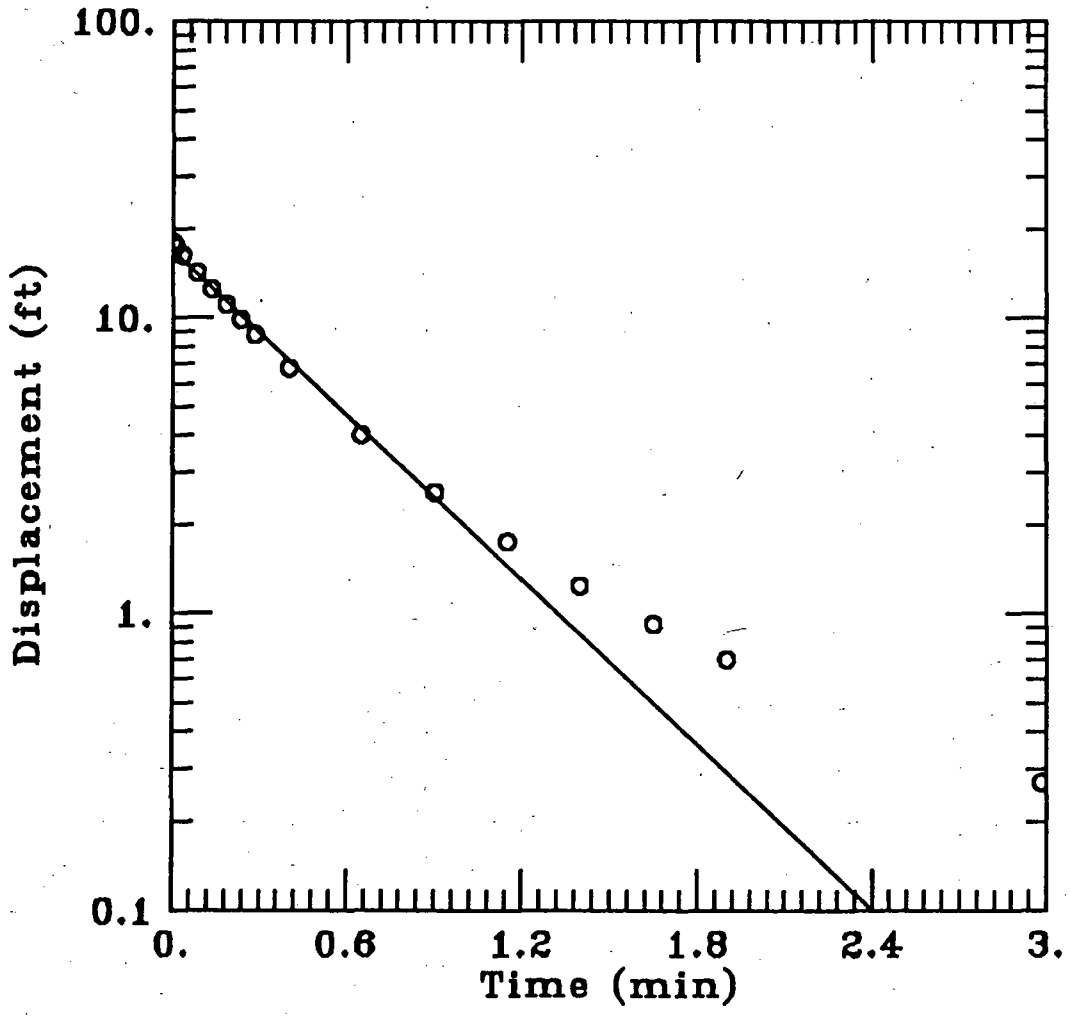
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.002507 ft/min
y0 = 14.08 ft

TEST DATA:
H0 = 15.53 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 105. ft

mw101b test 2



DATA SET:
mw101b2.dat
11/22/91

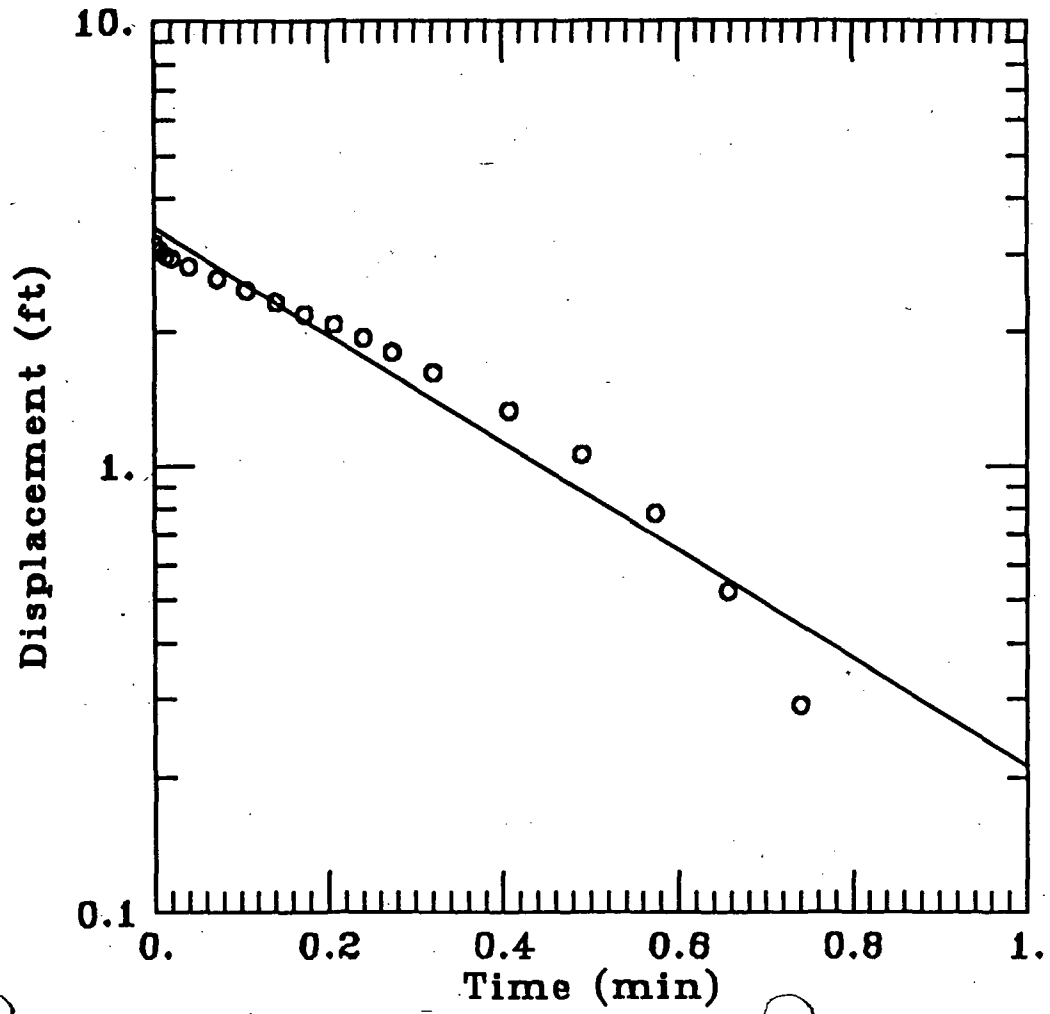
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.002335 ft/min
y0 = 18.88 ft

TEST DATA:
H0 = 18.01 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 105. ft

mw103c test 1



DATA SET:
mw103c1.dat
12/05/91

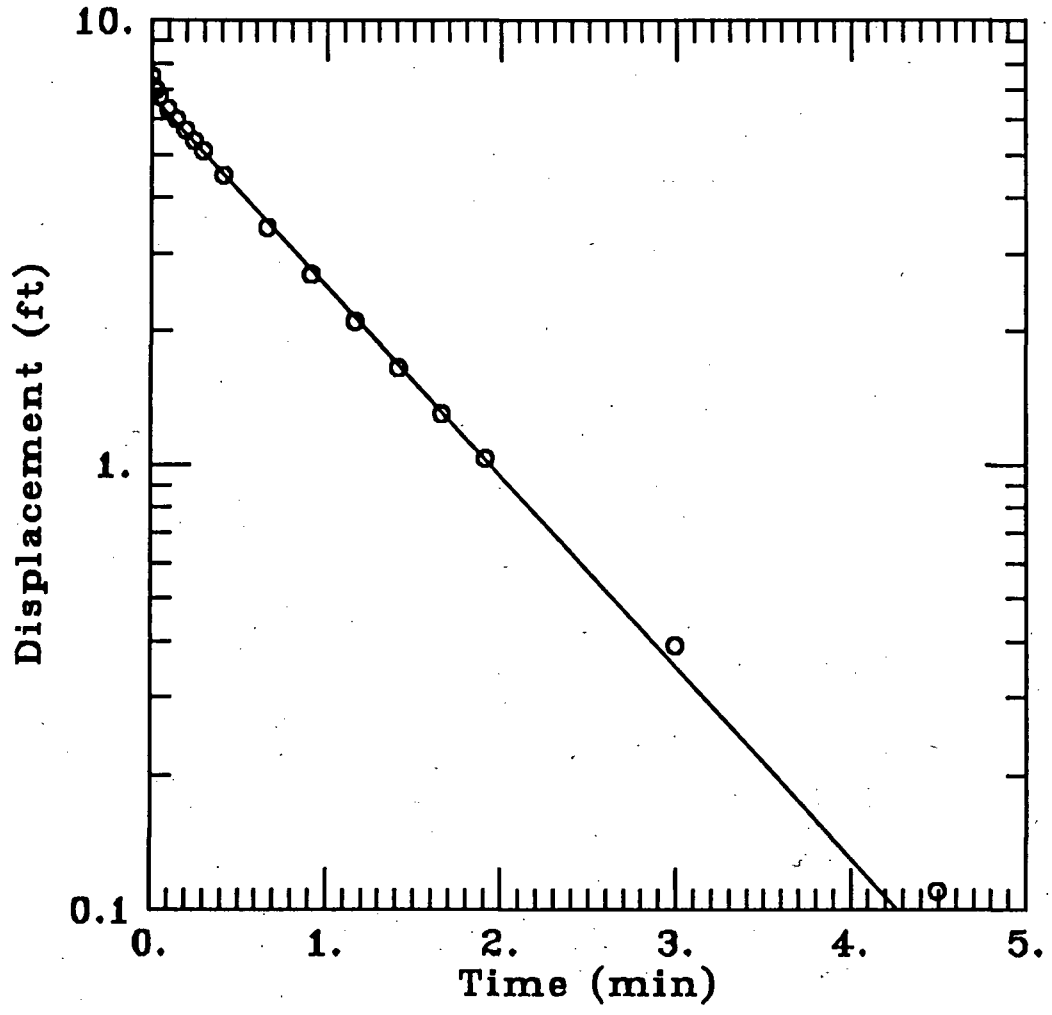
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.002986 ft/min
y0 = 3.485 ft

TEST DATA:
H0 = 3.16 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 88. ft

mw103b test 3



DATA SET:
mw103b3.dat
11/22/91

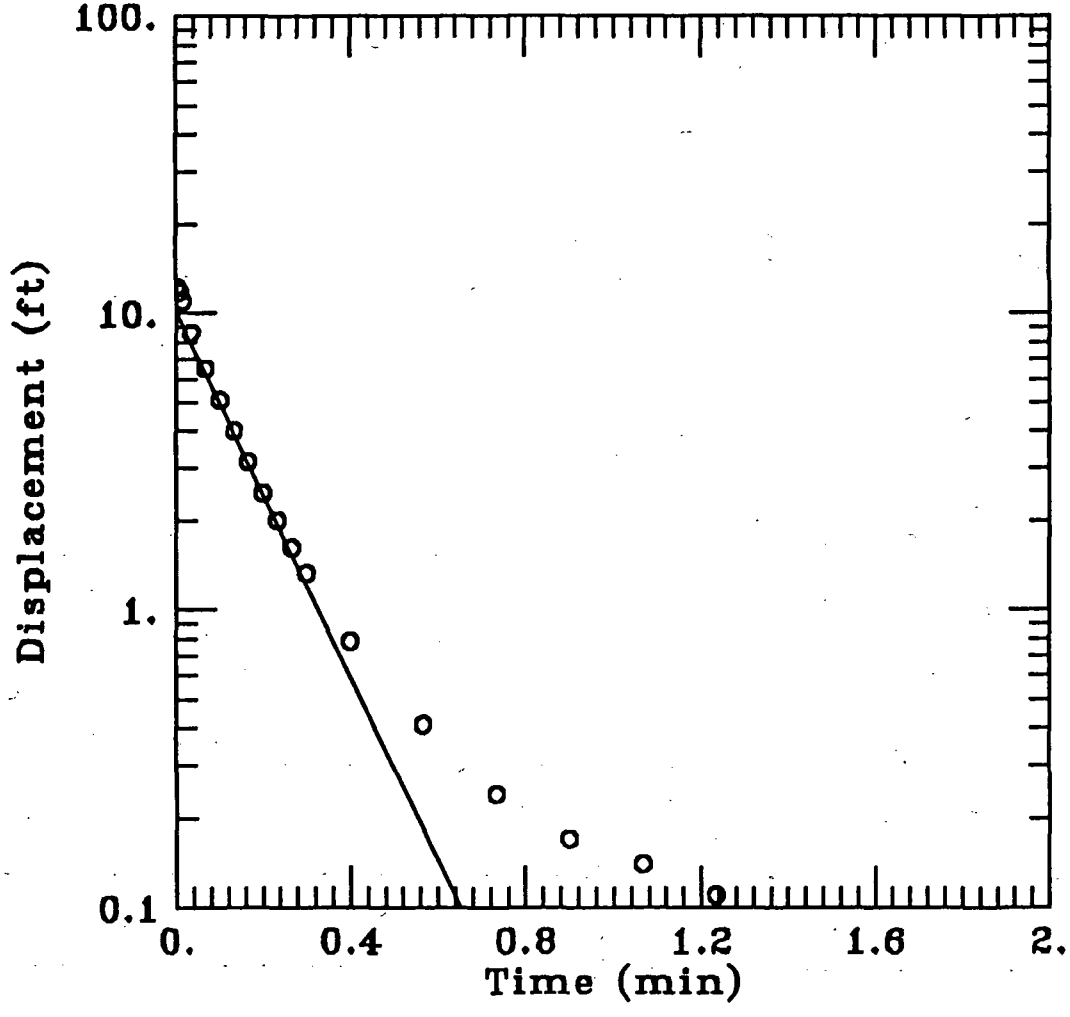
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.001008 ft/min
y0 = 6.781 ft

TEST DATA:
H0 = 7.49 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 55. ft

mw104b test 1



DATA SET:
mw104b1.dat
12/04/91

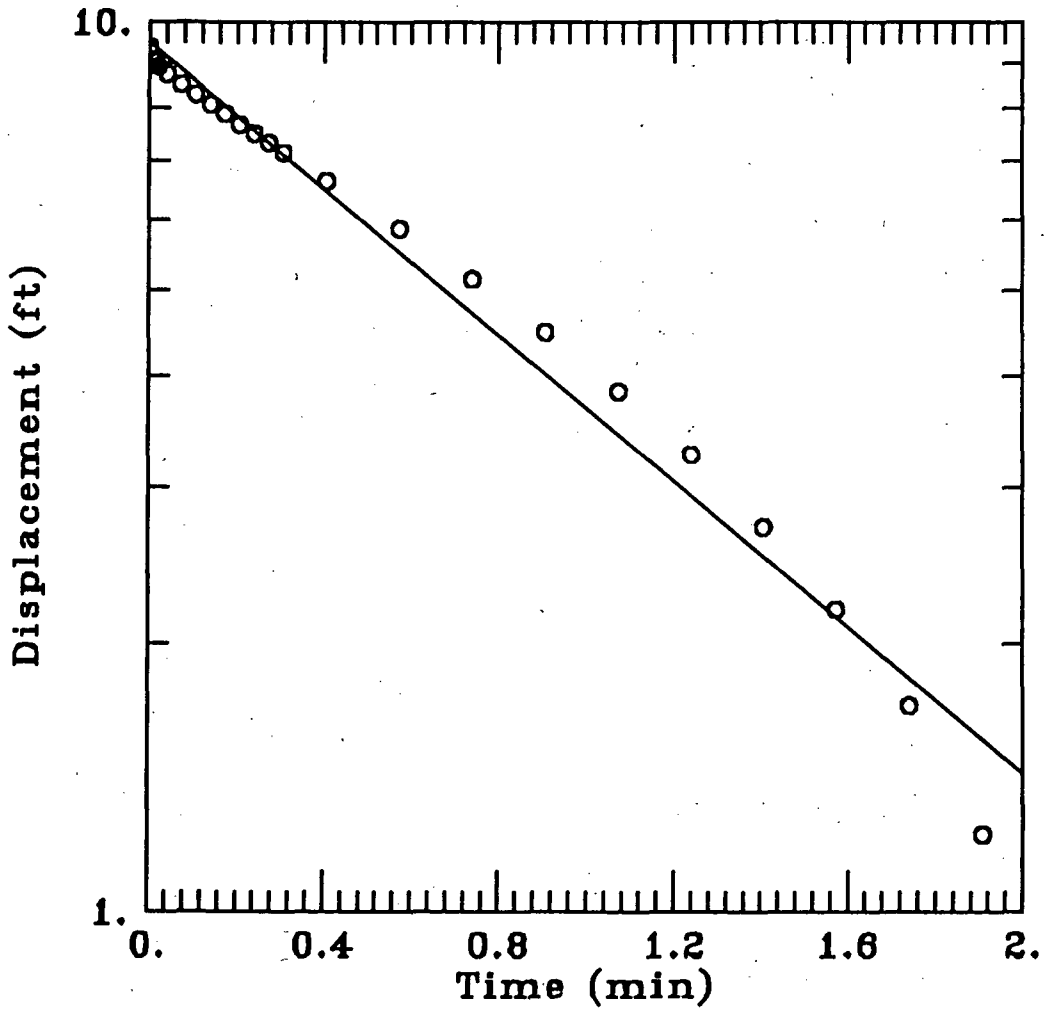
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.007559 ft/min
y0 = 10.06 ft

TEST DATA:
H0 = 12.27 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 83. ft

mw103c test 2



DATA SET:
mw103c2.dat
11/21/91

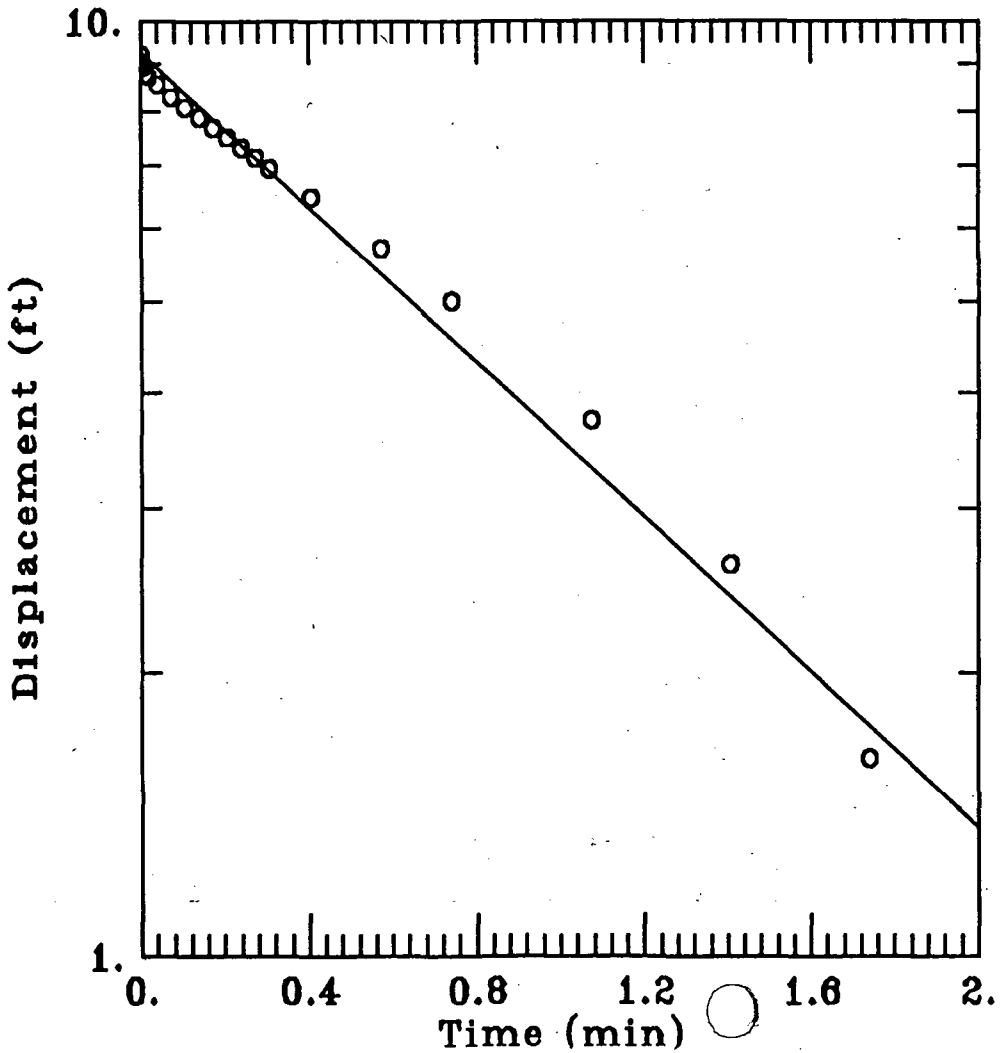
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.001015 ft/min
y0 = 9.479 ft

TEST DATA:
H0 = 9.37 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 88. ft

mw103c test 3



DATA SET:
mw103c3.dat
11/21/91

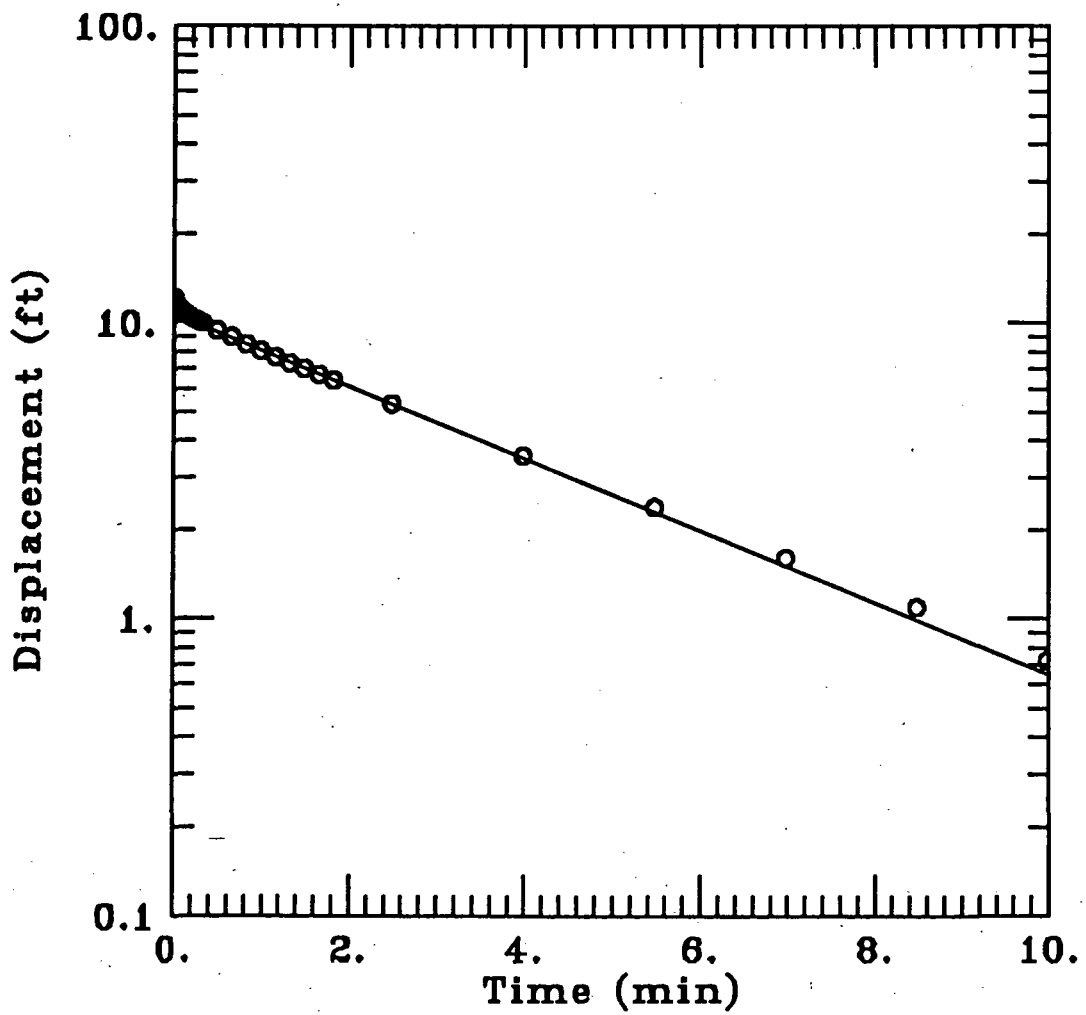
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.001026 ft/min
y0 = 9.269 ft

TEST DATA:
H0 = 9.2 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 88. ft

mw104a test 1



DATA SET:
mw104a1.dat
12/05/91

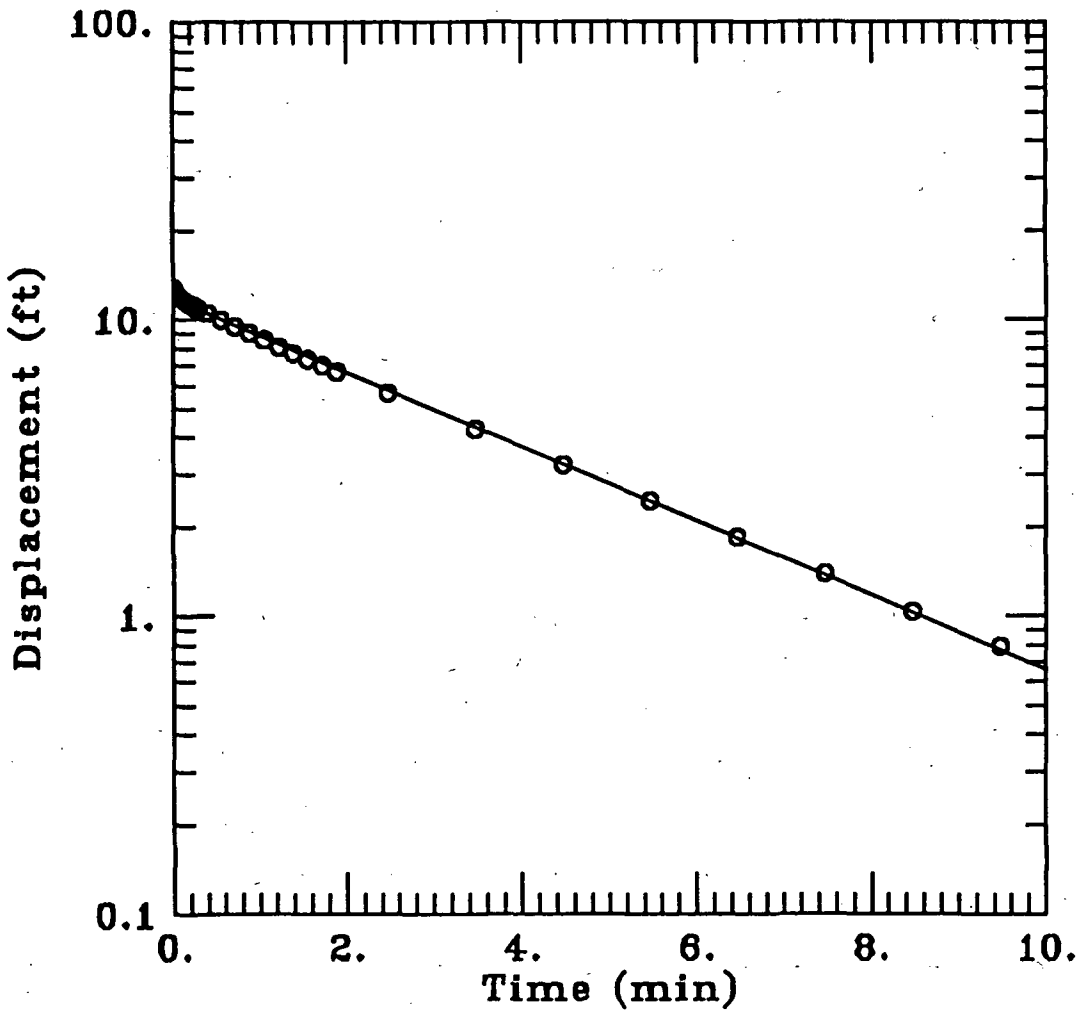
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.0003228 ft/min
y0 = 10.58 ft

TEST DATA:
H0 = 12.06 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 4. ft
H = 39. ft

mw104a test 2



DATA SET:
mw104a2.dat
12/05/91

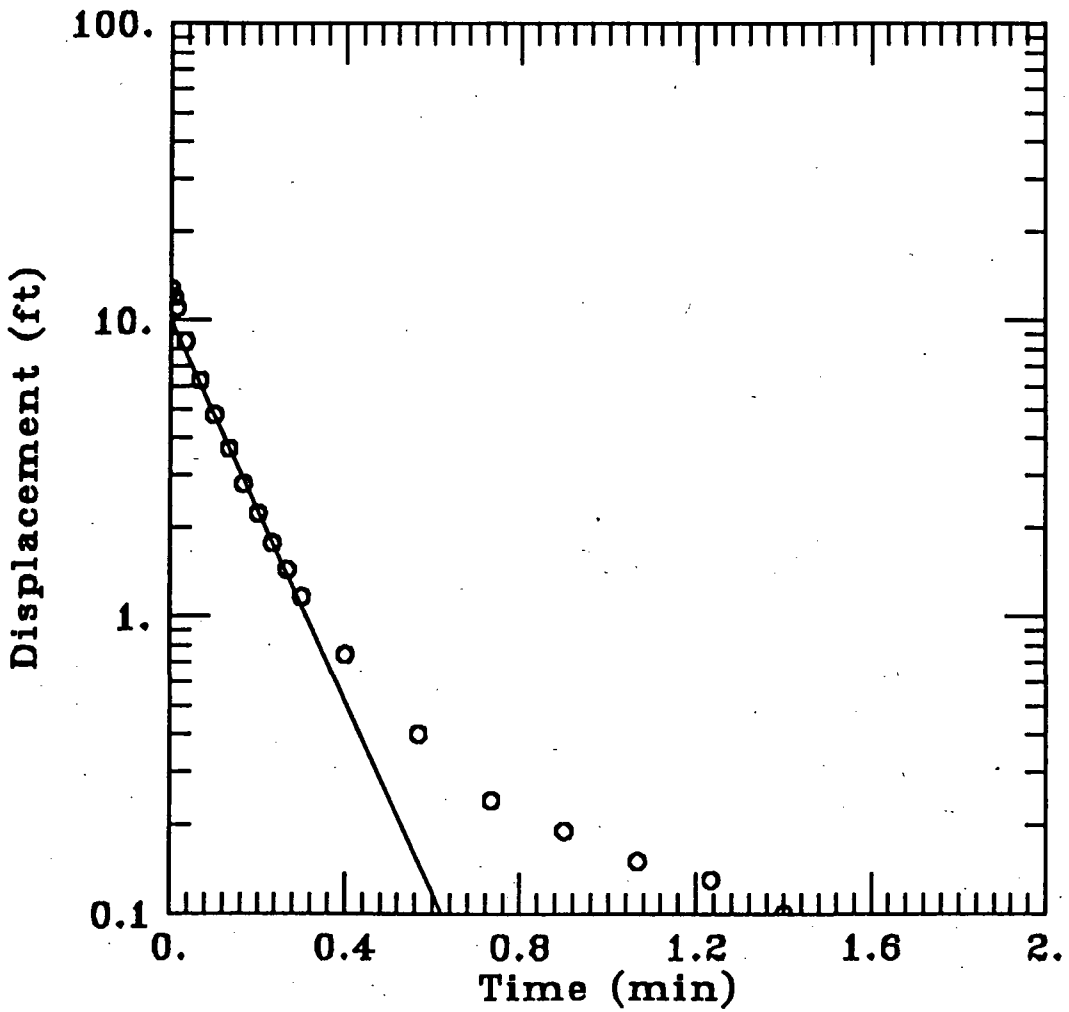
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.0003321 ft/min
y0 = 11.74 ft

TEST DATA:
H0 = 12.73 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 4. ft
H = 39. ft

mw104b test 2



DATA SET:
mw104b2.dat
12/04/91

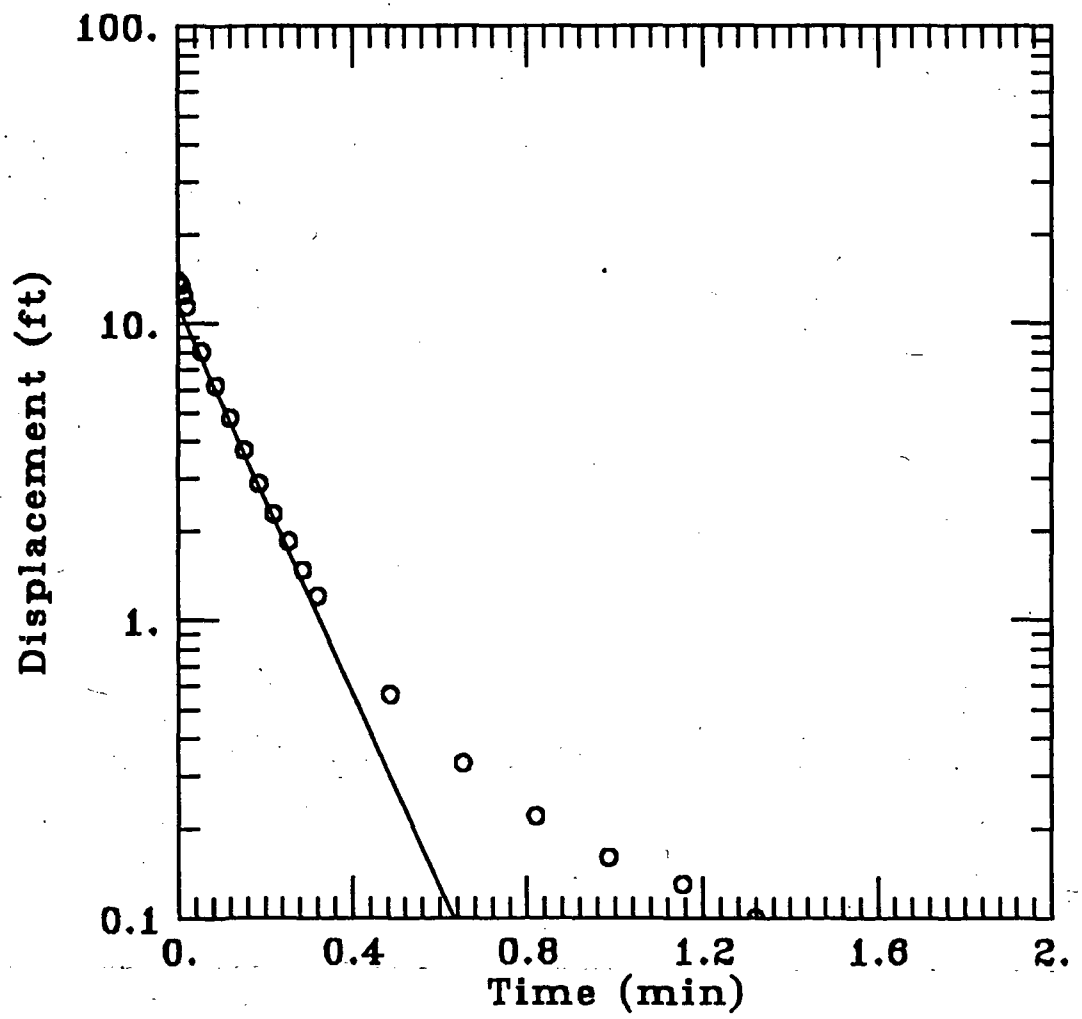
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.00794 ft/min
y0 = 10.06 ft

TEST DATA:
H0 = 12.74 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 83. ft

mw104b test 3



DATA SET:
mw104b3.dat
12/04/91

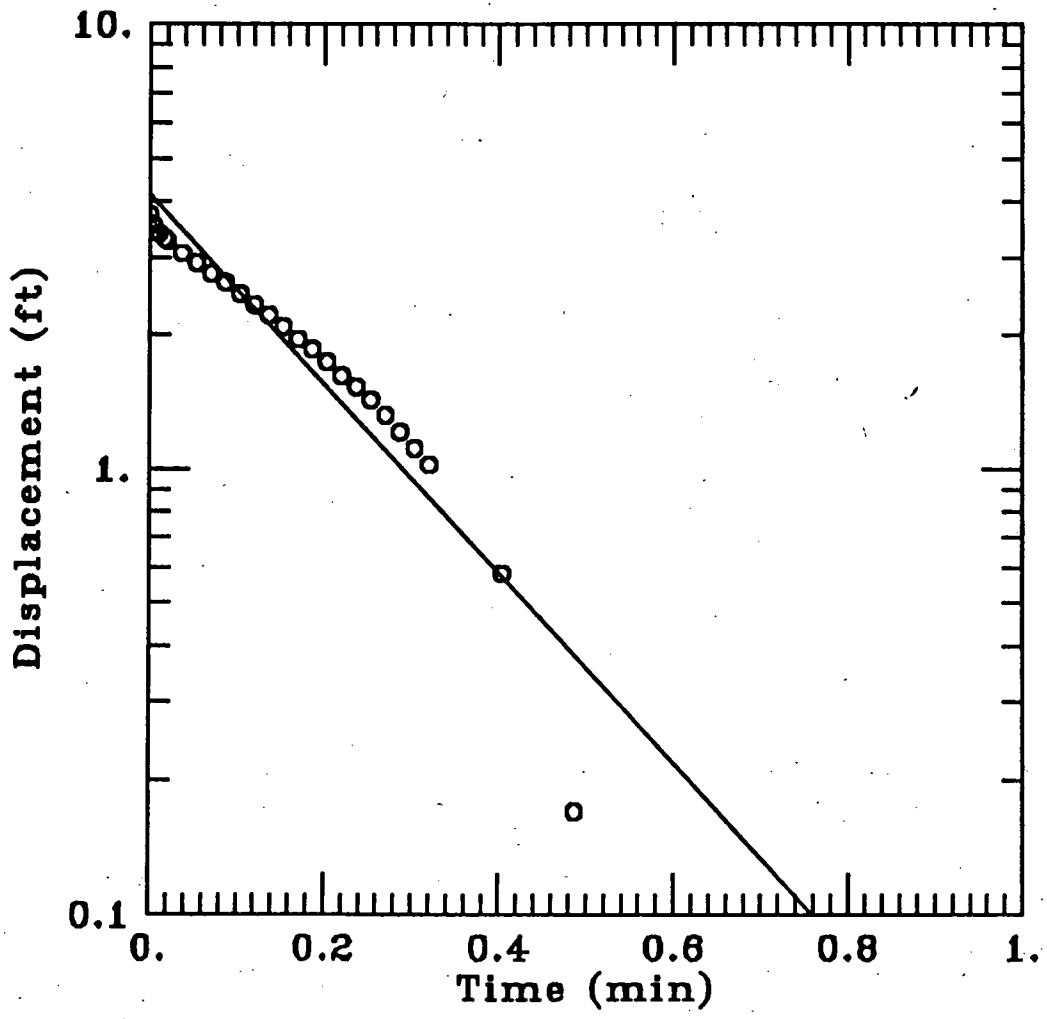
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.008002 ft/min
y0 = 11.45 ft

TEST DATA:
H0 = 13.91 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 83. ft

mw104c test 2



DATA SET:
mw104c2.dat
12/05/91

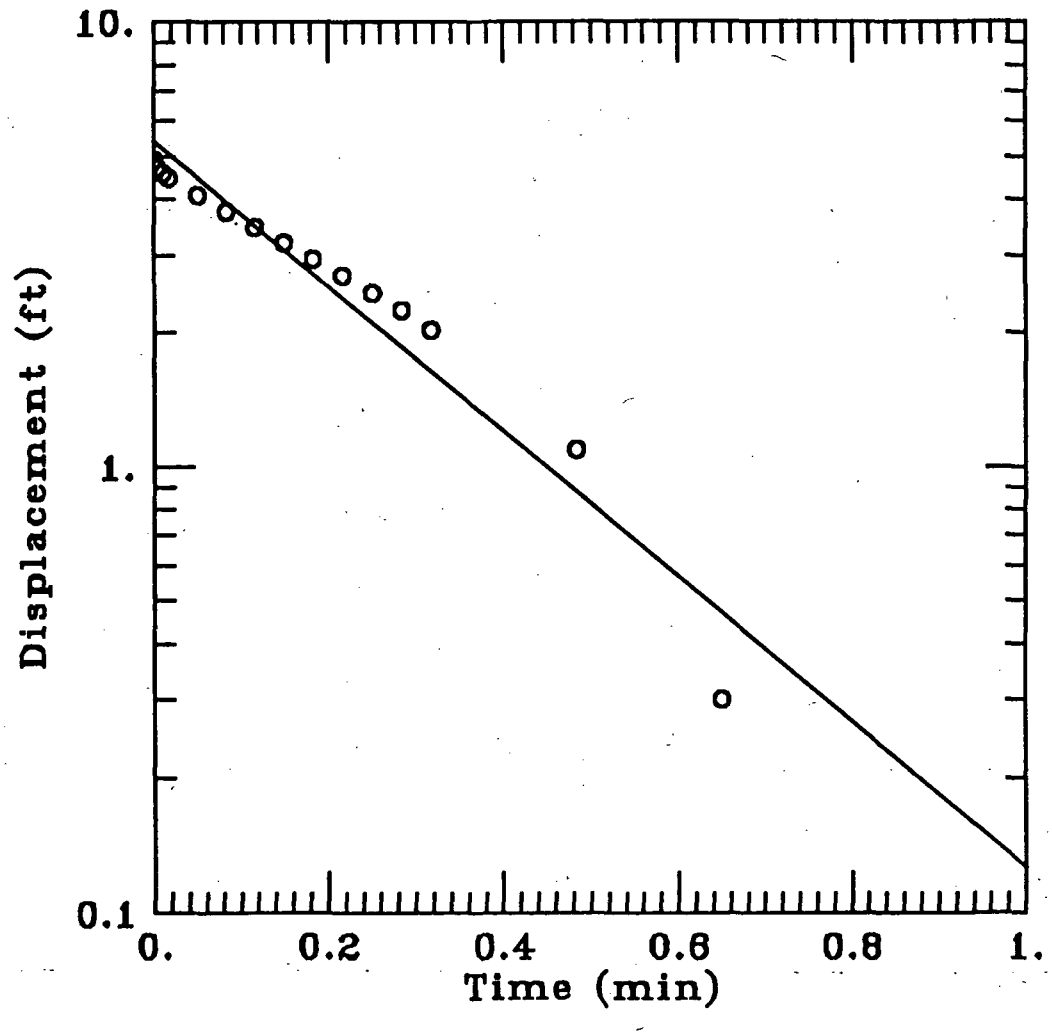
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.005393 ft/min
y0 = 4.14 ft

TEST DATA:
H0 = 3.73 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 108. ft

mw104c test 3



DATA SET:
mw104c3.dat
12/03/91

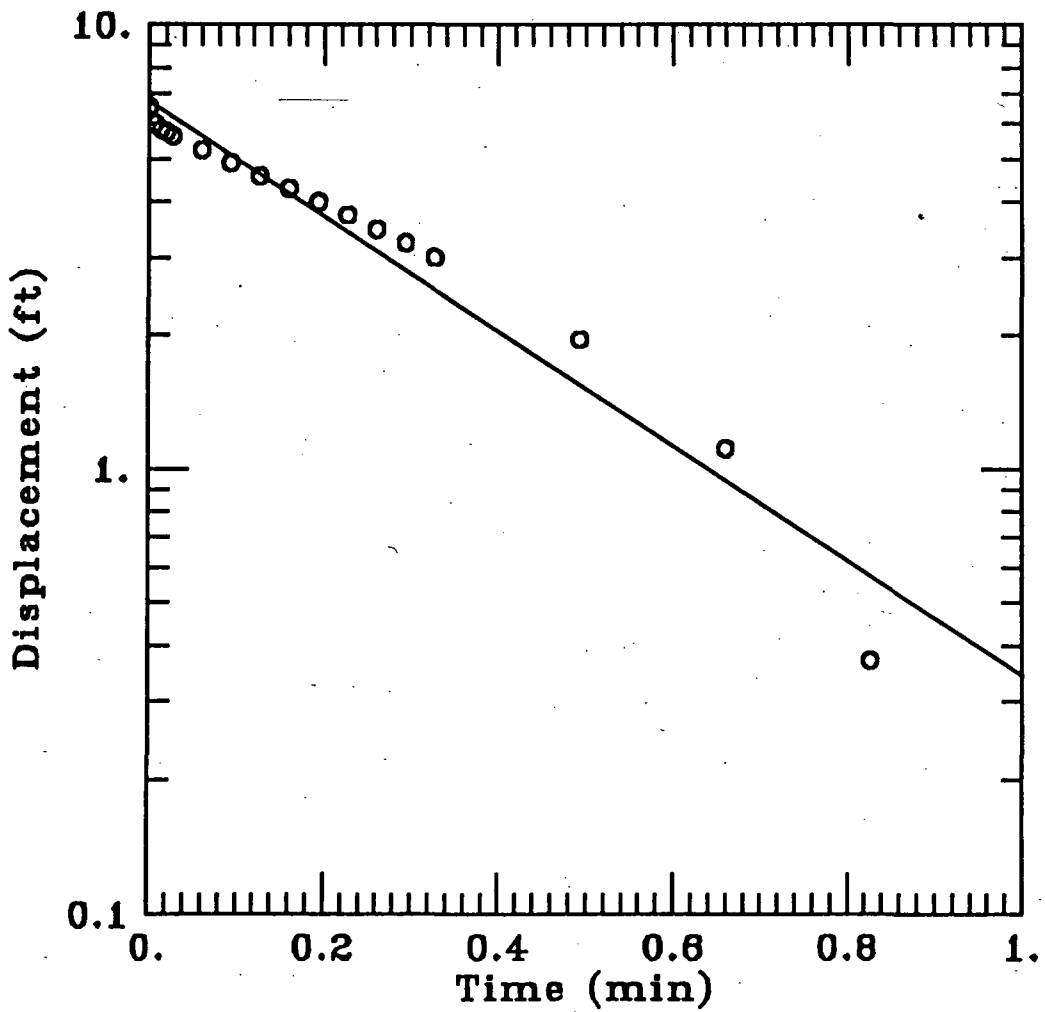
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.004125 ft/min
y0 = 5.408 ft

TEST DATA:
H0 = 4.9 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 109. ft

mw104c test 4



DATA SET:
mw104c4.dat
12/05/91

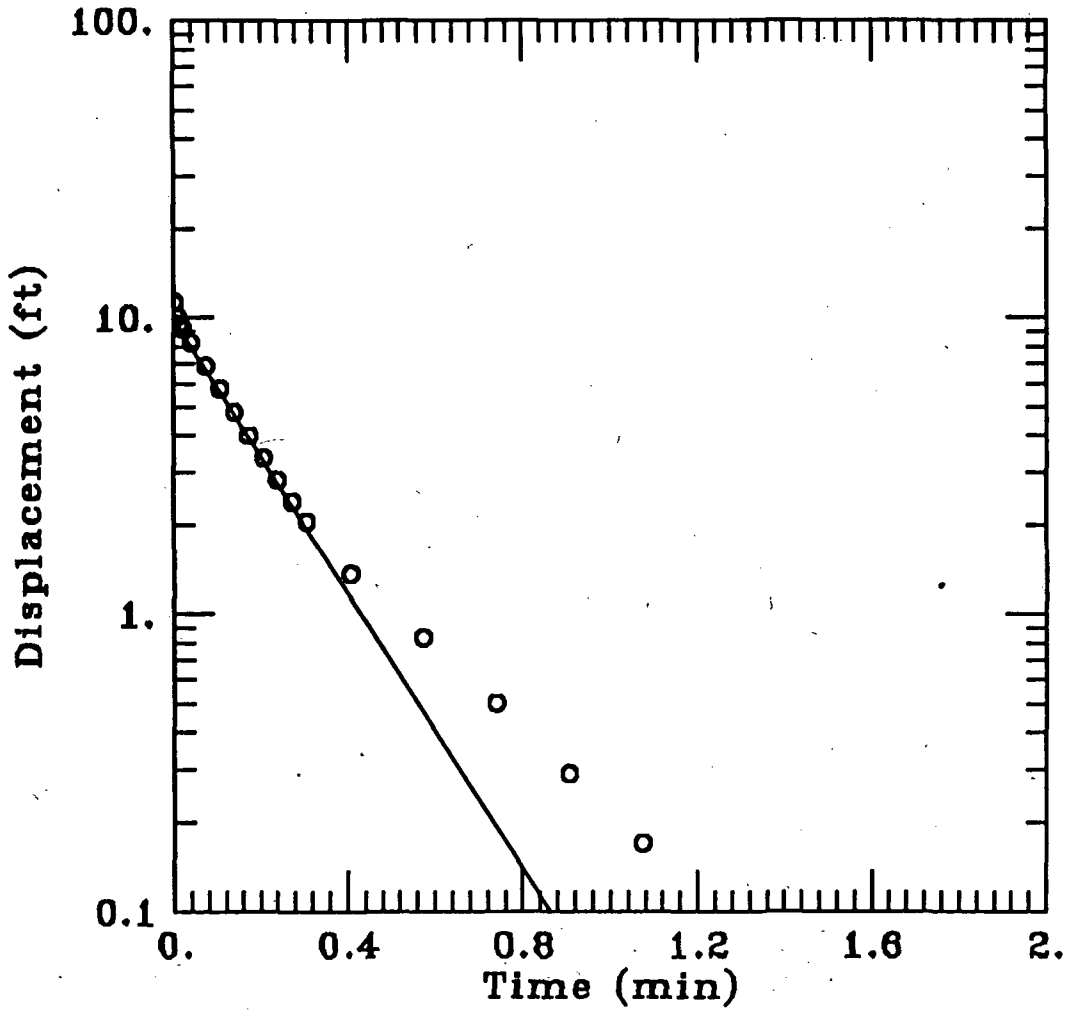
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.003269 ft/min
y0 = 6.732 ft

TEST DATA:
H0 = 6.53 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 109. ft

mw106a test 1



DATA SET:
a:\mw106a1.dat
12/06/91

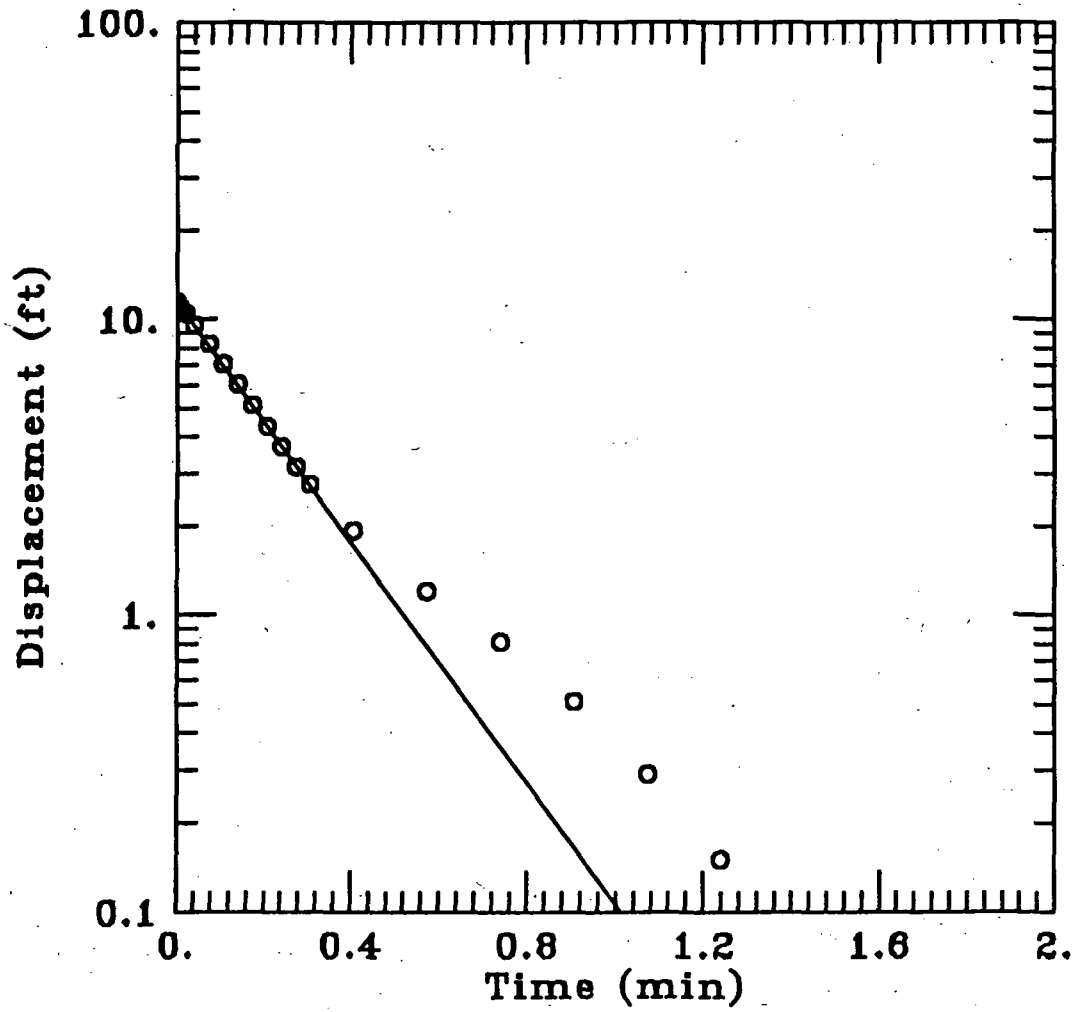
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.004724 ft/min
y0 = 9.801 ft

TEST DATA:
H0 = 11.27 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 20. ft
H = 22. ft

mw106a test 2



DATA SET:
mw106a2.dat
12/03/91

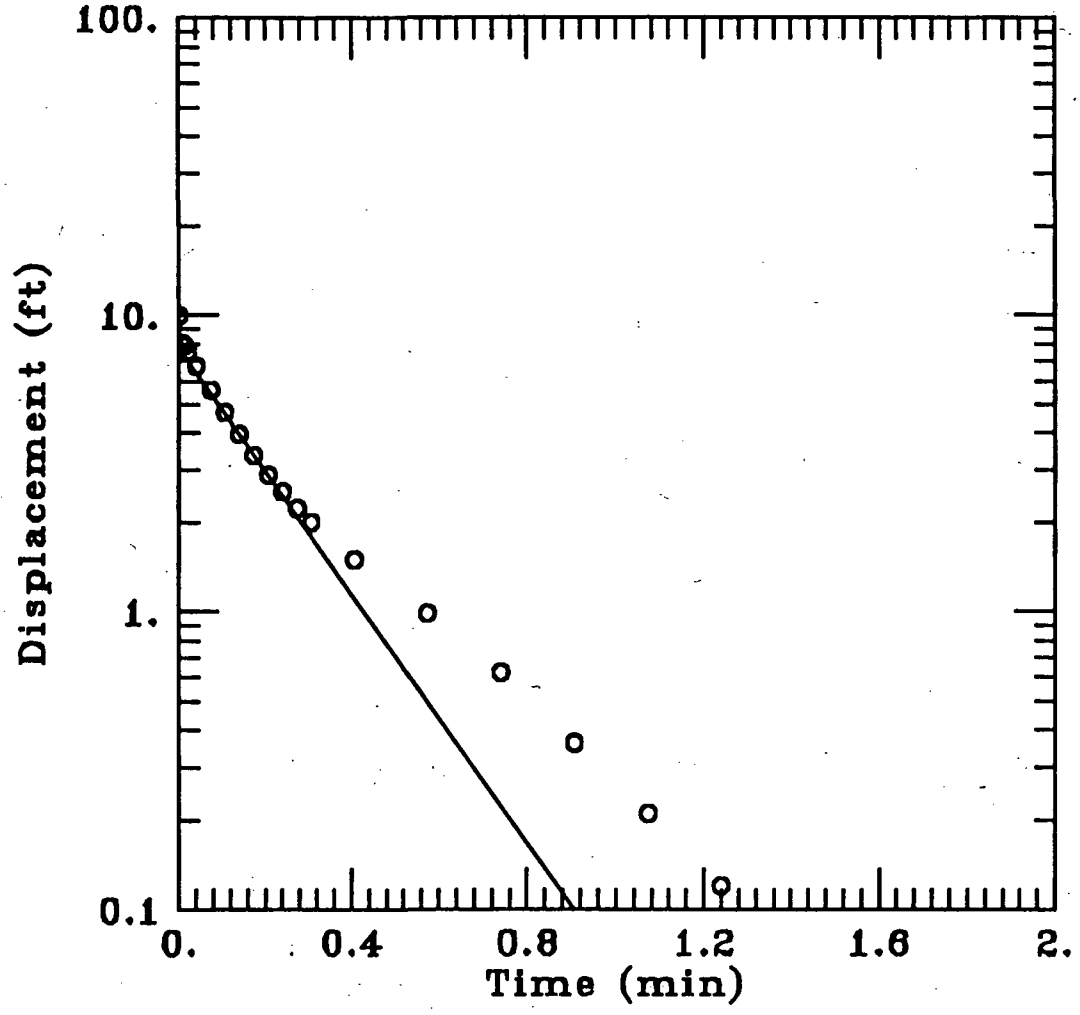
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.004161 ft/min
y0 = 11.45 ft

TEST DATA:
H0 = 11.4 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 28. ft
H = 22. ft

mw106a test 3



DATA SET:
mw106a3.dat
12/03/91

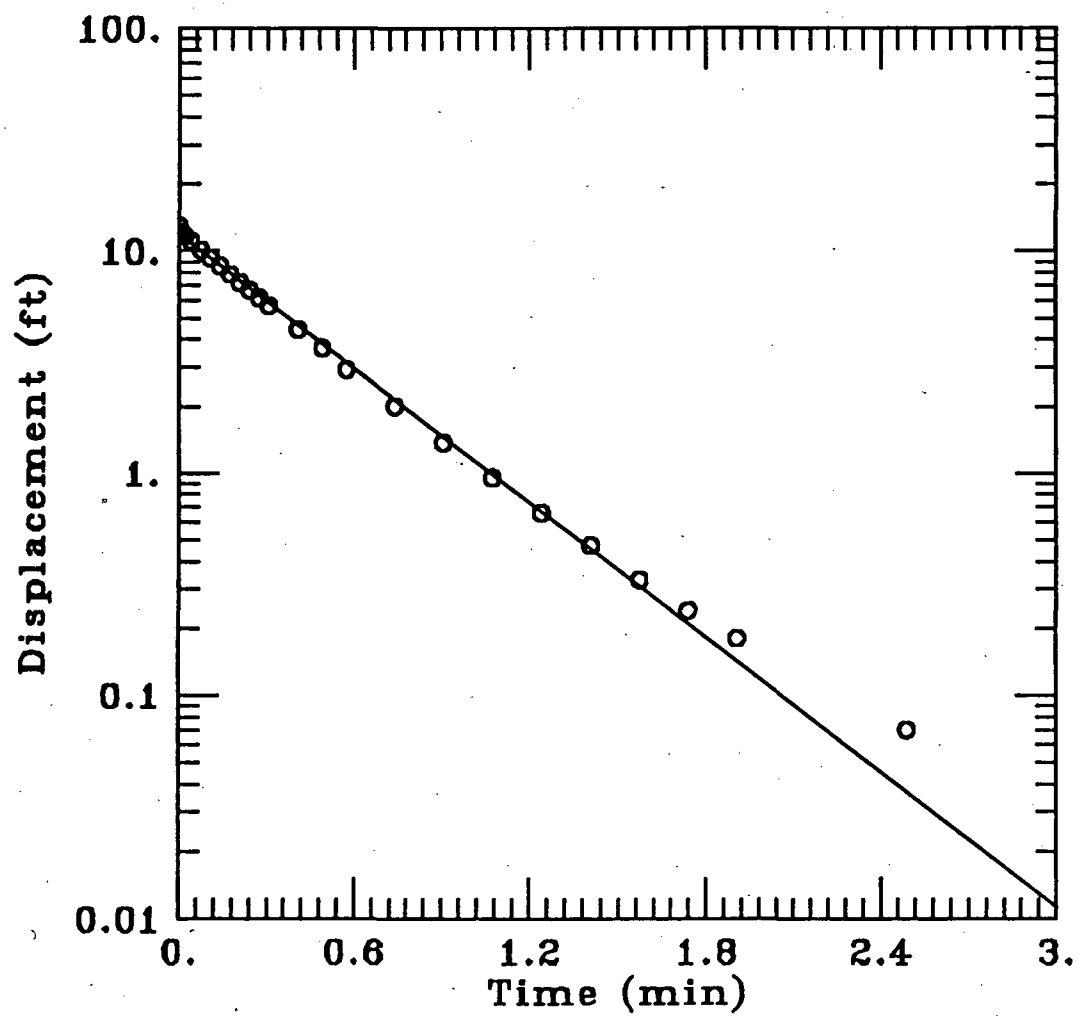
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.004267 ft/min
y0 = 7.782 ft

TEST DATA:
H0 = 9.93 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 29. ft
H = 22. ft

mw106b test 1



DATA SET:
mw106b1.dat
11/20/91

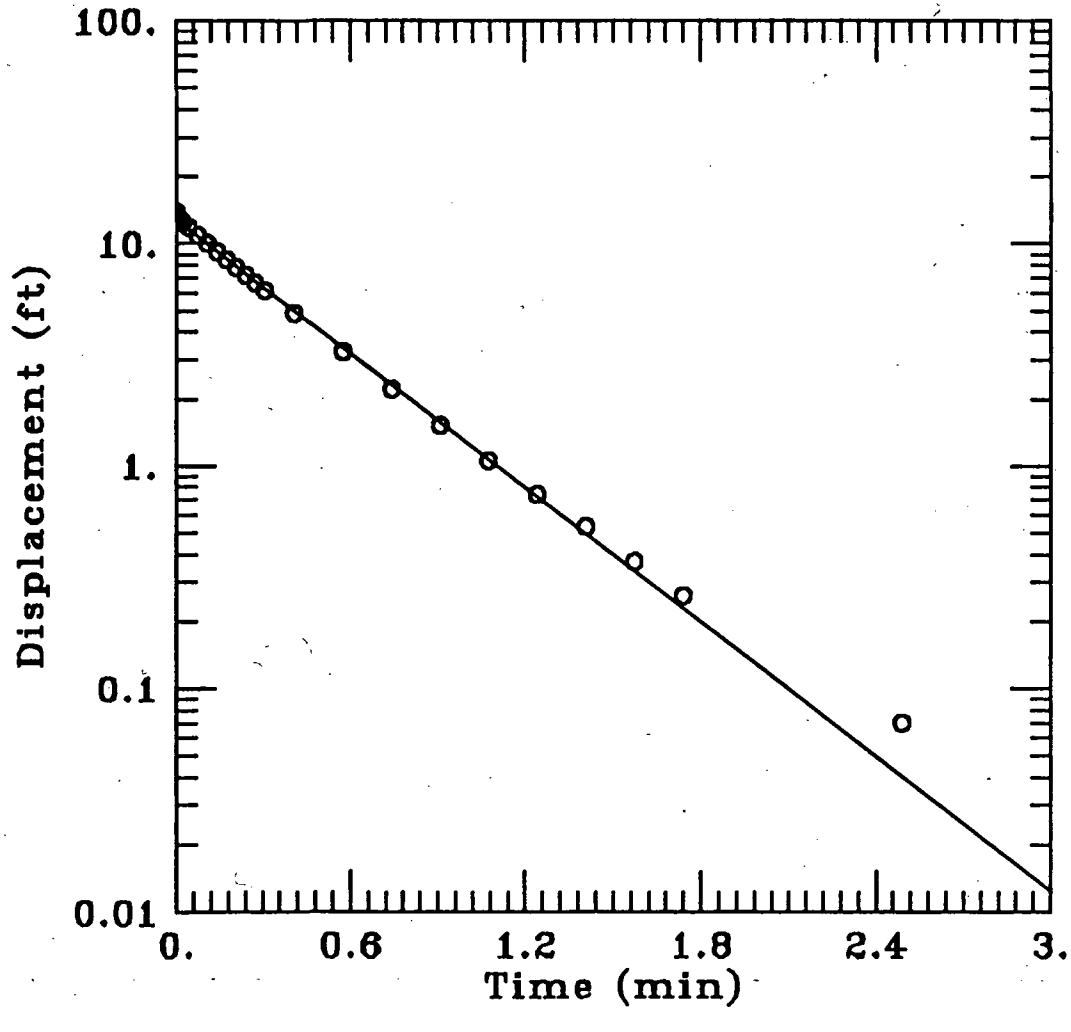
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.002395 ft/min
y0 = 11.88 ft

TEST DATA:
H0 = 12.97 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 61. ft

mw106b test 2



DATA SET:
mw106b2.dat
11/20/91

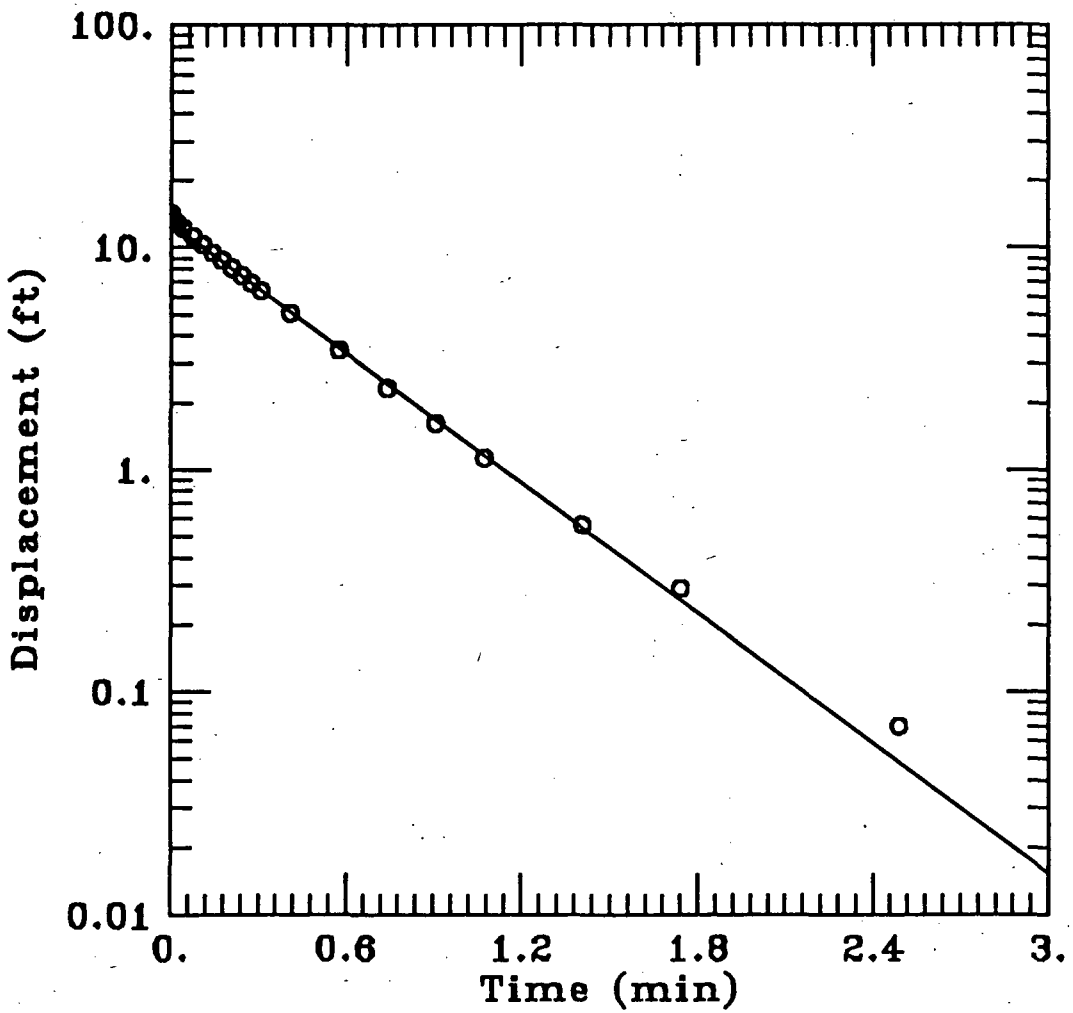
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.002384 ft/min
y0 = 12.74 ft

TEST DATA:
H0 = 13.82 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 61. ft

mw106b test 3



DATA SET:
mw106b3.dat
11/20/91

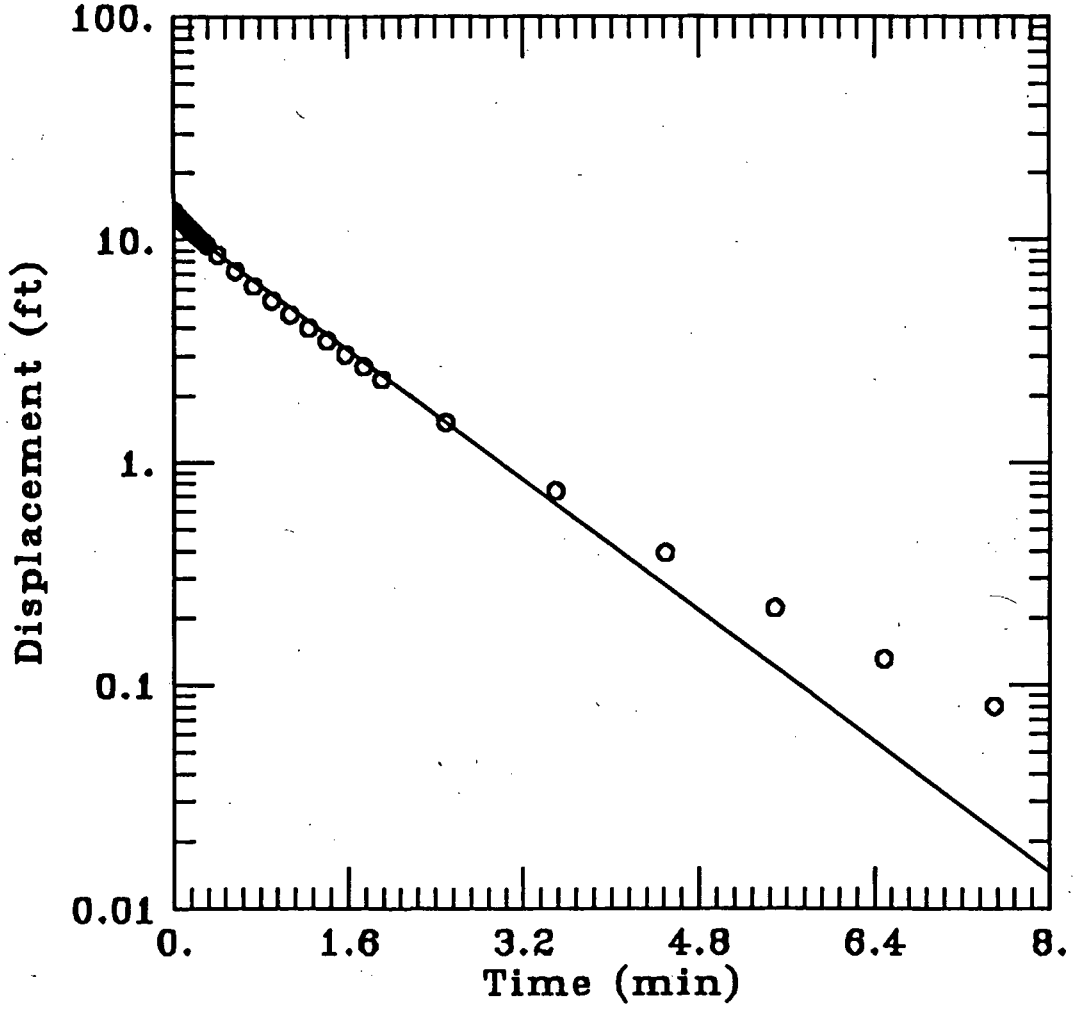
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.002312 ft/min
y0 = 12.74 ft

TEST DATA:
H0 = 14.17 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 61. ft

mw106c test 1



DATA SET:
mw106c1.dat
11/20/91

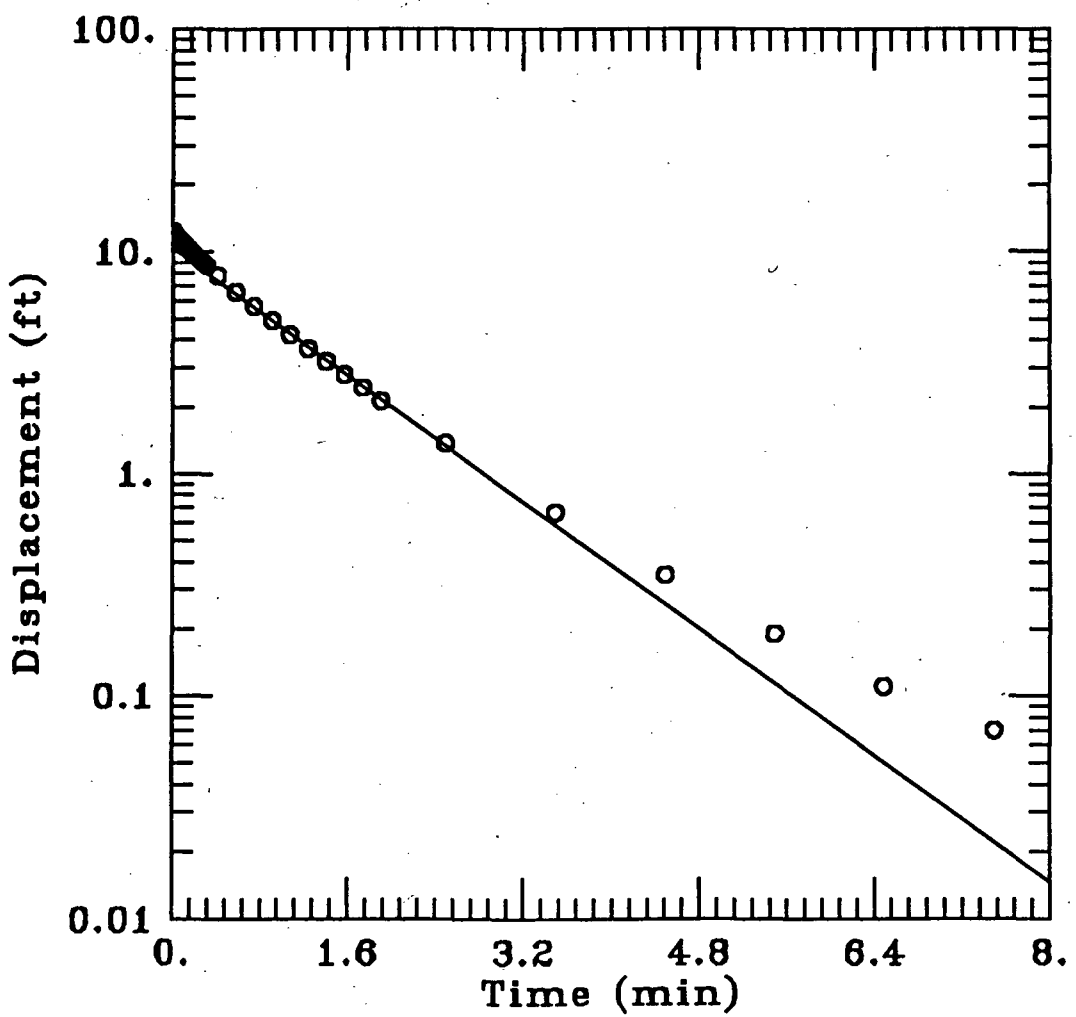
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.00091 ft/min
y0 = 12.3 ft

TEST DATA:
H0 = 13.41 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 96. ft

mw106c test 2



DATA SET:
mw106c2.dat
11/20/91

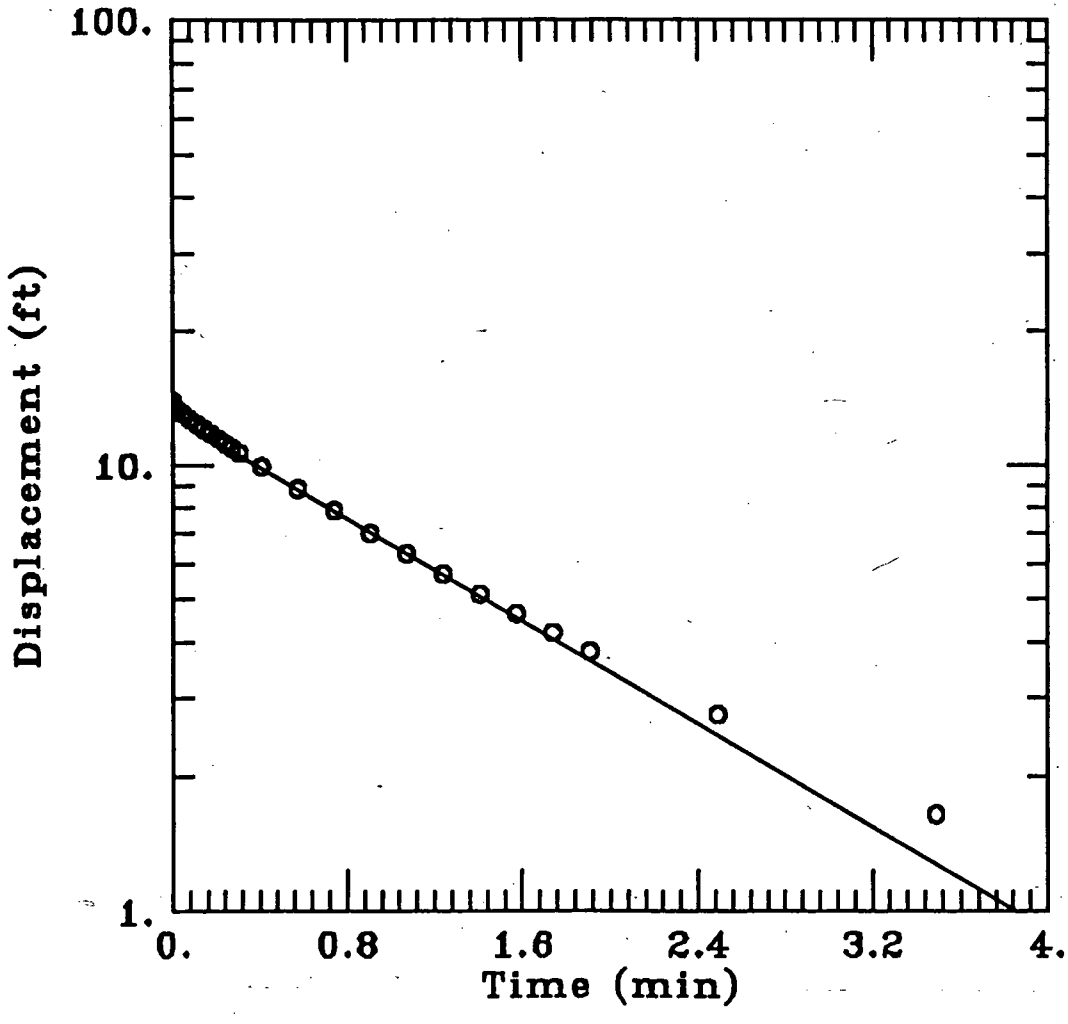
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.0008867 ft/min
y0 = 10.35 ft

TEST DATA:
H0 = 12.35 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 96. ft

mw110c test1



DATA SET:
mw110c1.dat
12/06/91

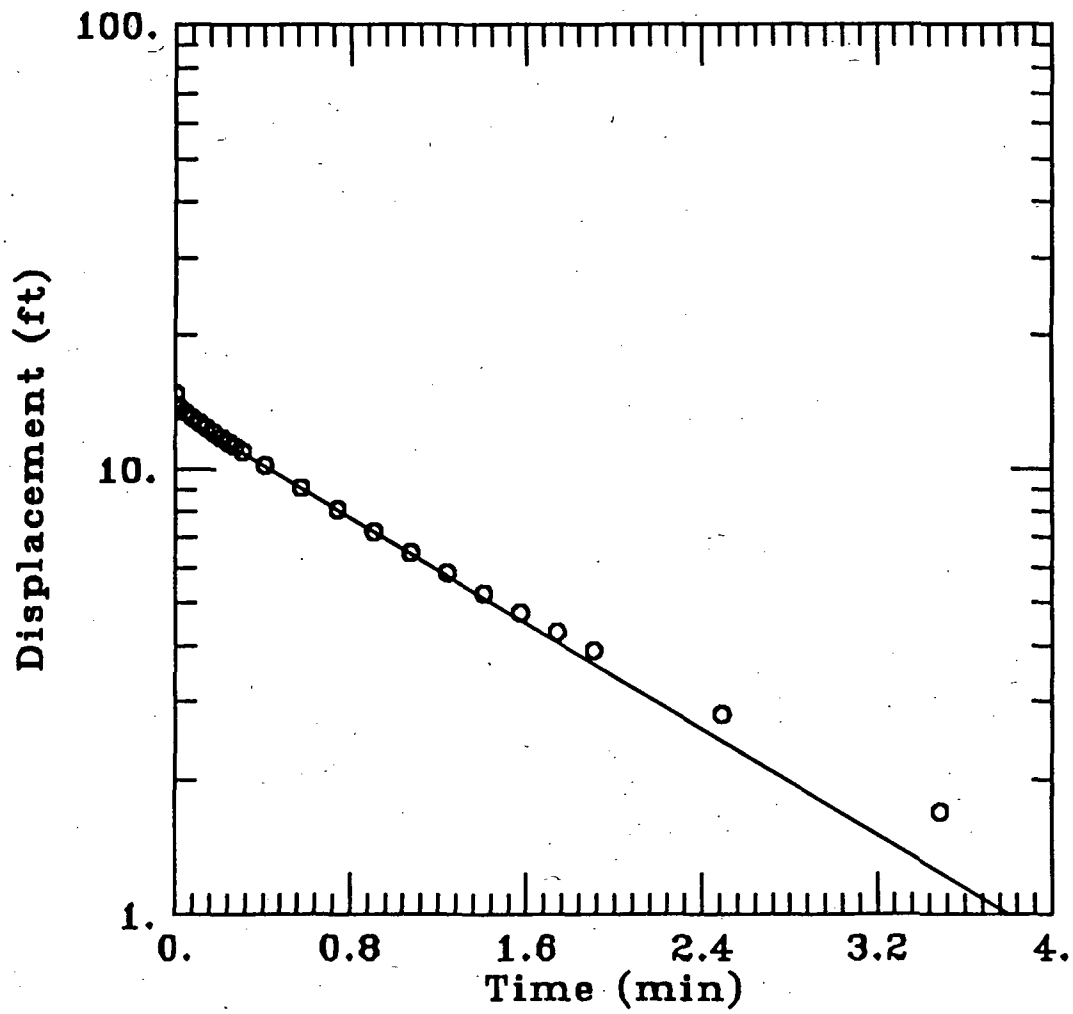
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.0007011 ft/min
y0 = 12.88 ft

TEST DATA:
H0 = 13.9 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 76. ft

mw110c test 2



DATA SET:
mw110c2.dat
12/04/91

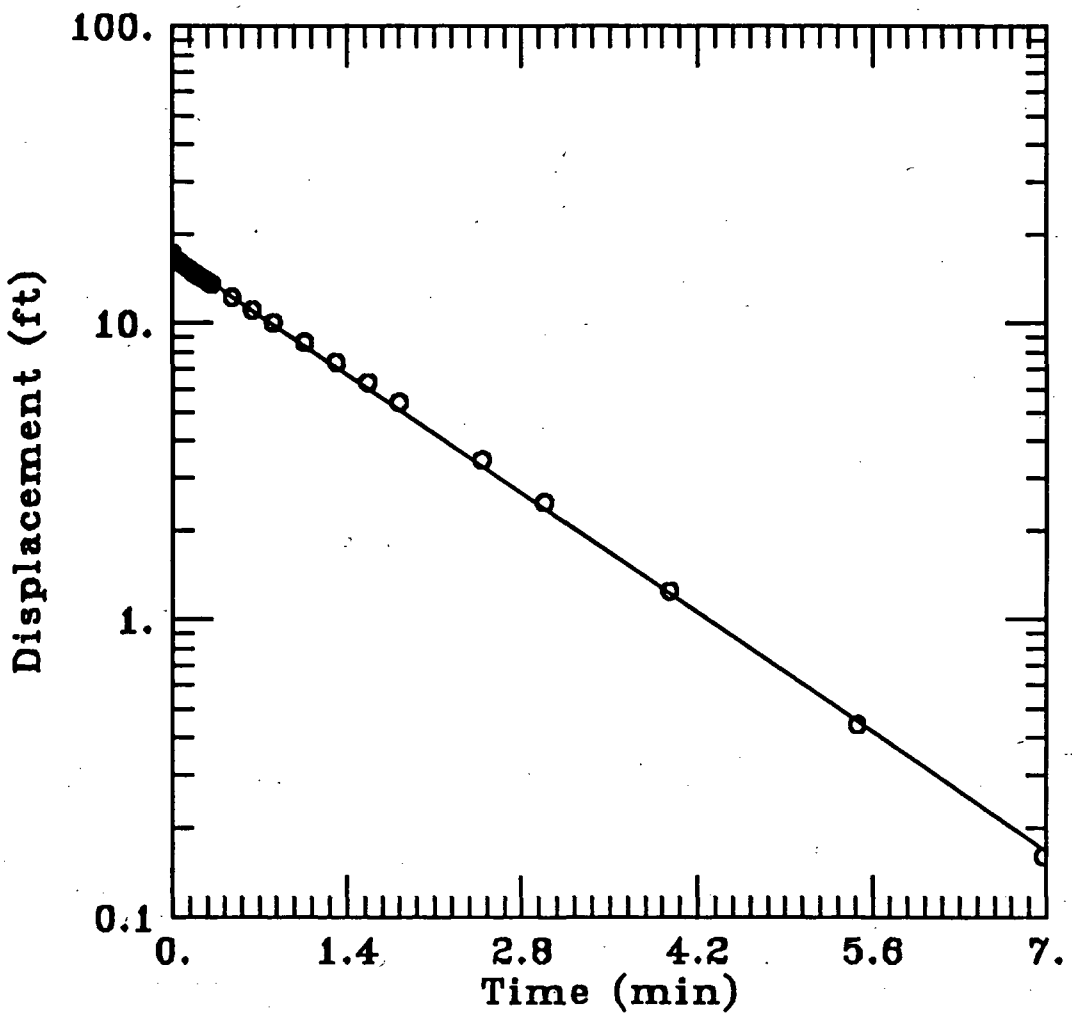
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.0007199 ft/min
y0 = 13.34 ft

TEST DATA:
H0 = 14.76 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 76. ft

mw111b test 1



DATA SET:
mw111b1.dat
12/03/91

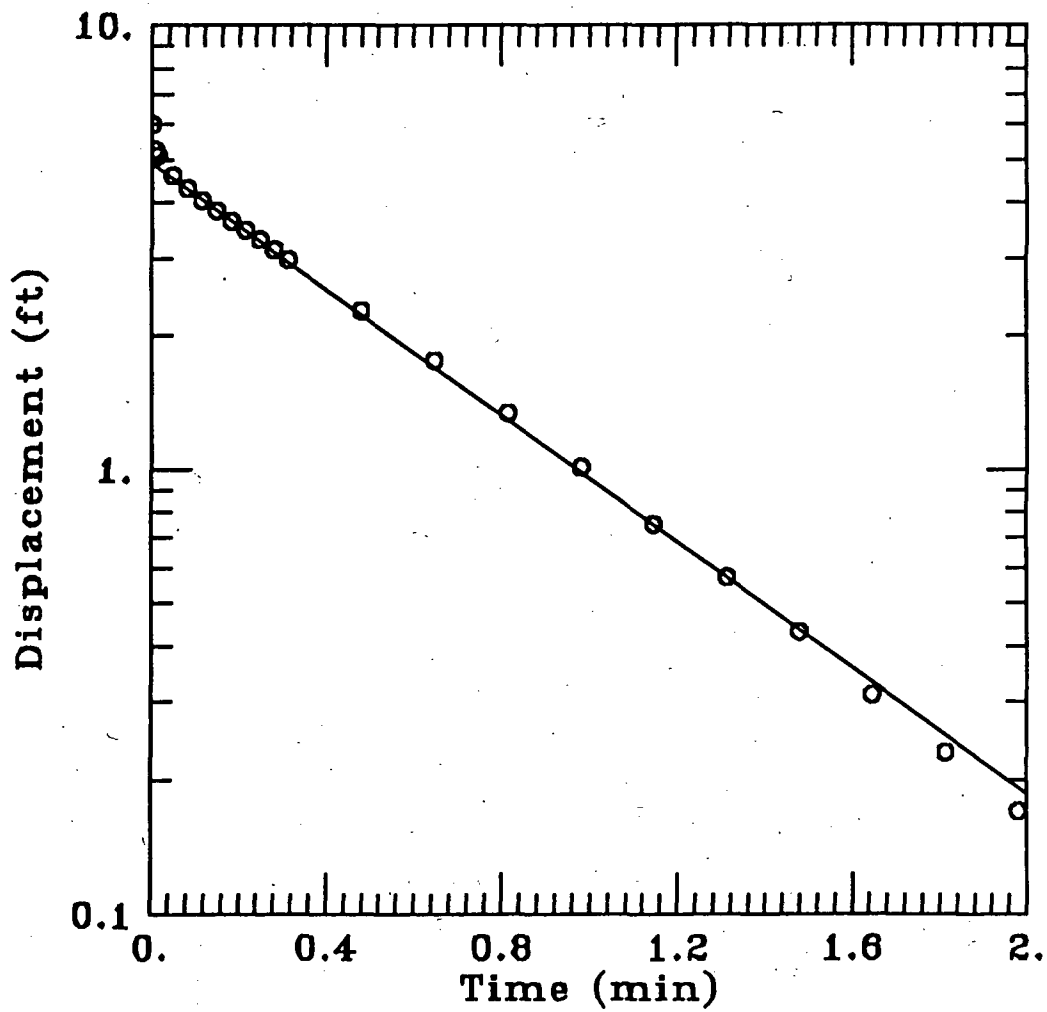
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.0006336 ft/min
y0 = 16.9 ft

TEST DATA:
H0 = 17.19 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 41. ft
H = 35. ft

mw111b test 2



DATA SET:
MW111B2.DAT
12/04/91

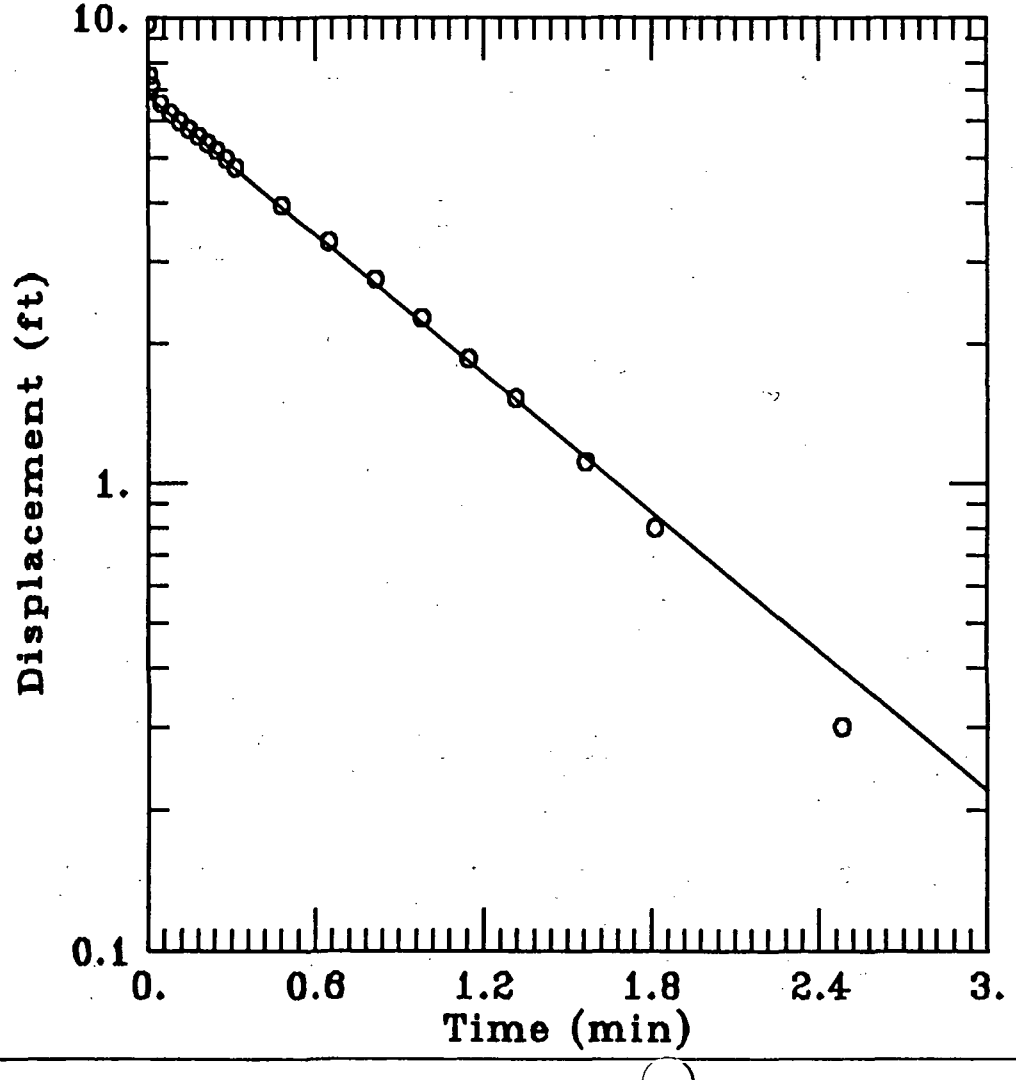
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.001566 ft/min
y0 = 4.87 ft

TEST DATA:
H0 = 5.99 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 41. ft
H = 35. ft

mw111b test 3



DATA SET:
mw111b3.dat
11/21/91

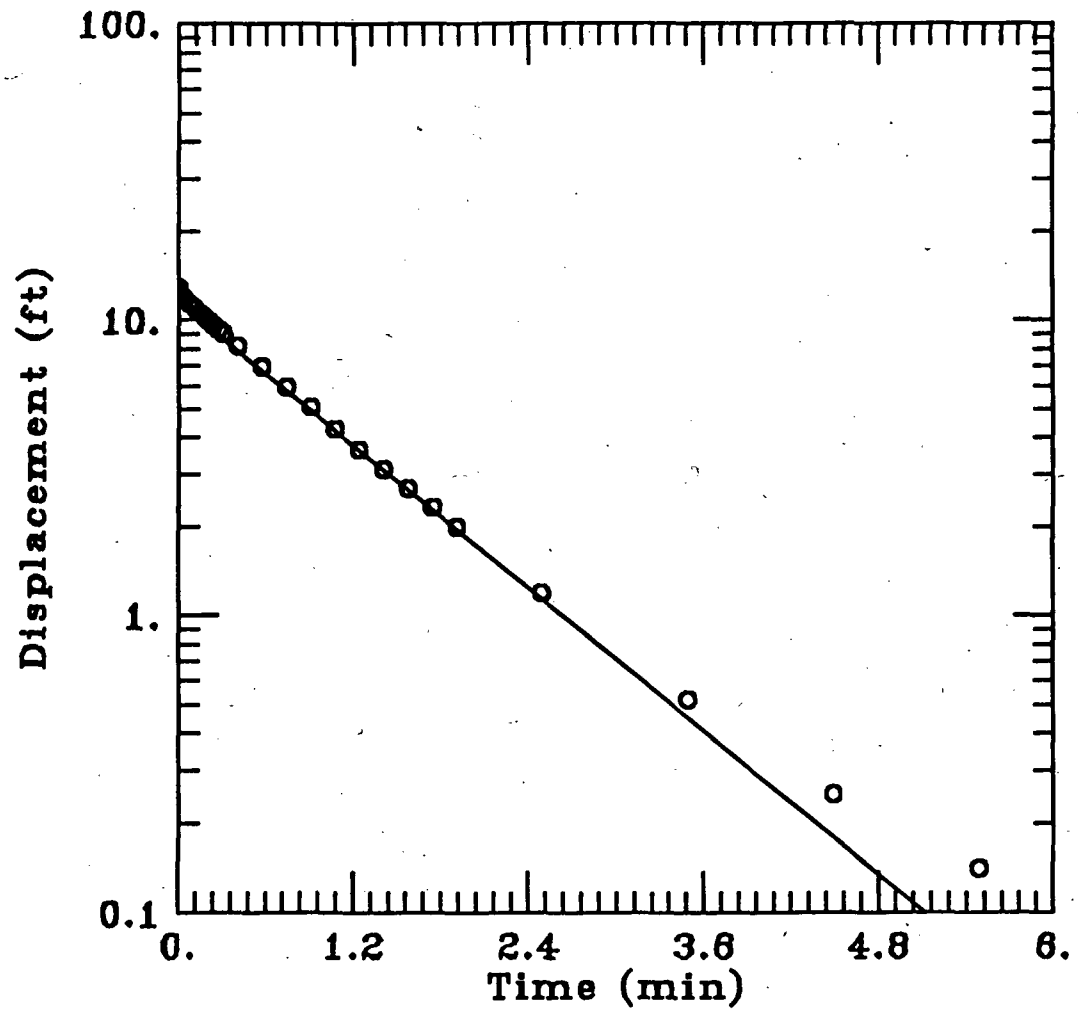
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETER
K = 0.001097 ft/min
y0 = 6.761 ft

TEST DATA:
H0 = 9.66 ft
rc = 0.0833 ft
rw = 0.35 ft
L = 10. ft
b = 41. ft
H = 35. ft

mw111c test 1



DATA SET:
mw111c1.dat
12/08/91

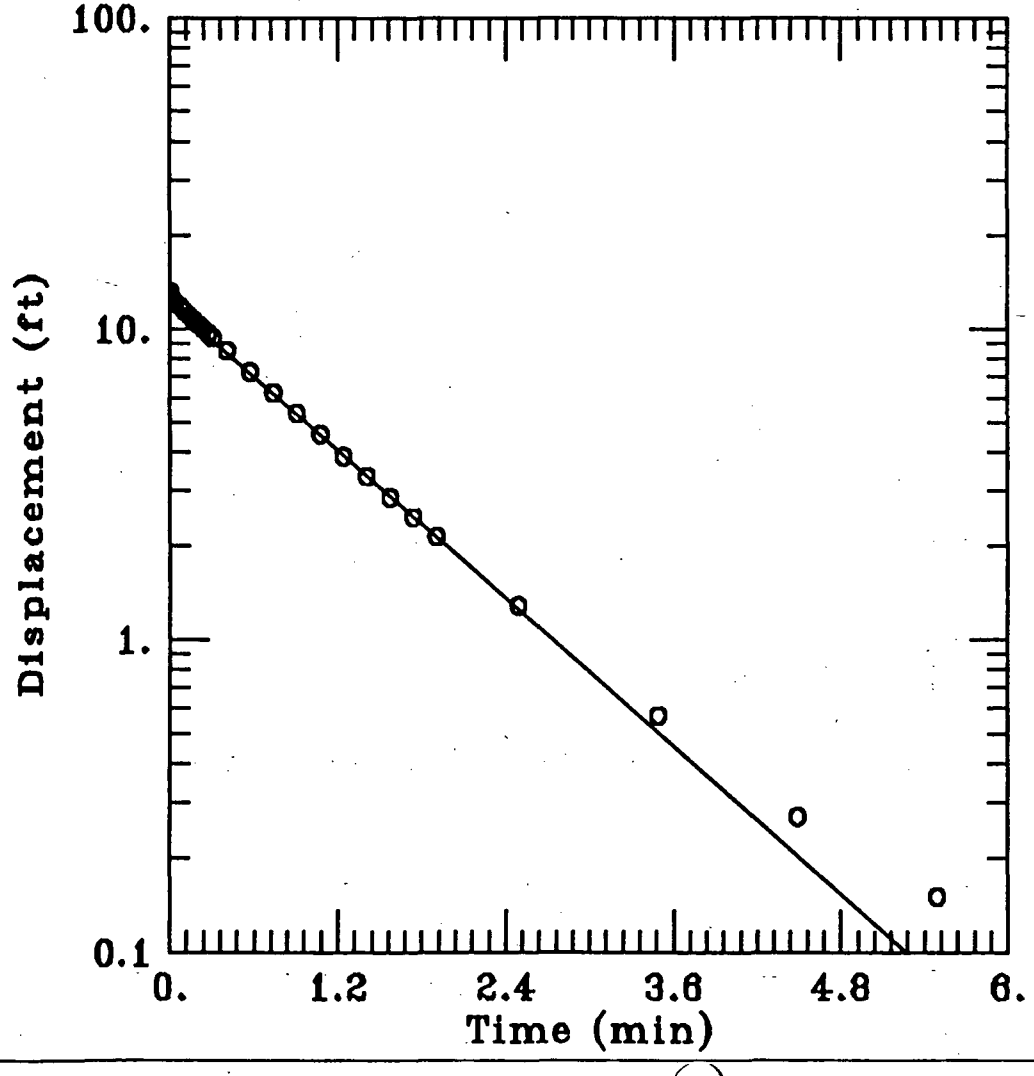
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.0006767 ft/min
y0 = 11.45 ft

TEST DATA:
H0 = 12.83 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 75. ft

mw111c test 2



DATA SET:
mw111c2.dat
11/21/91

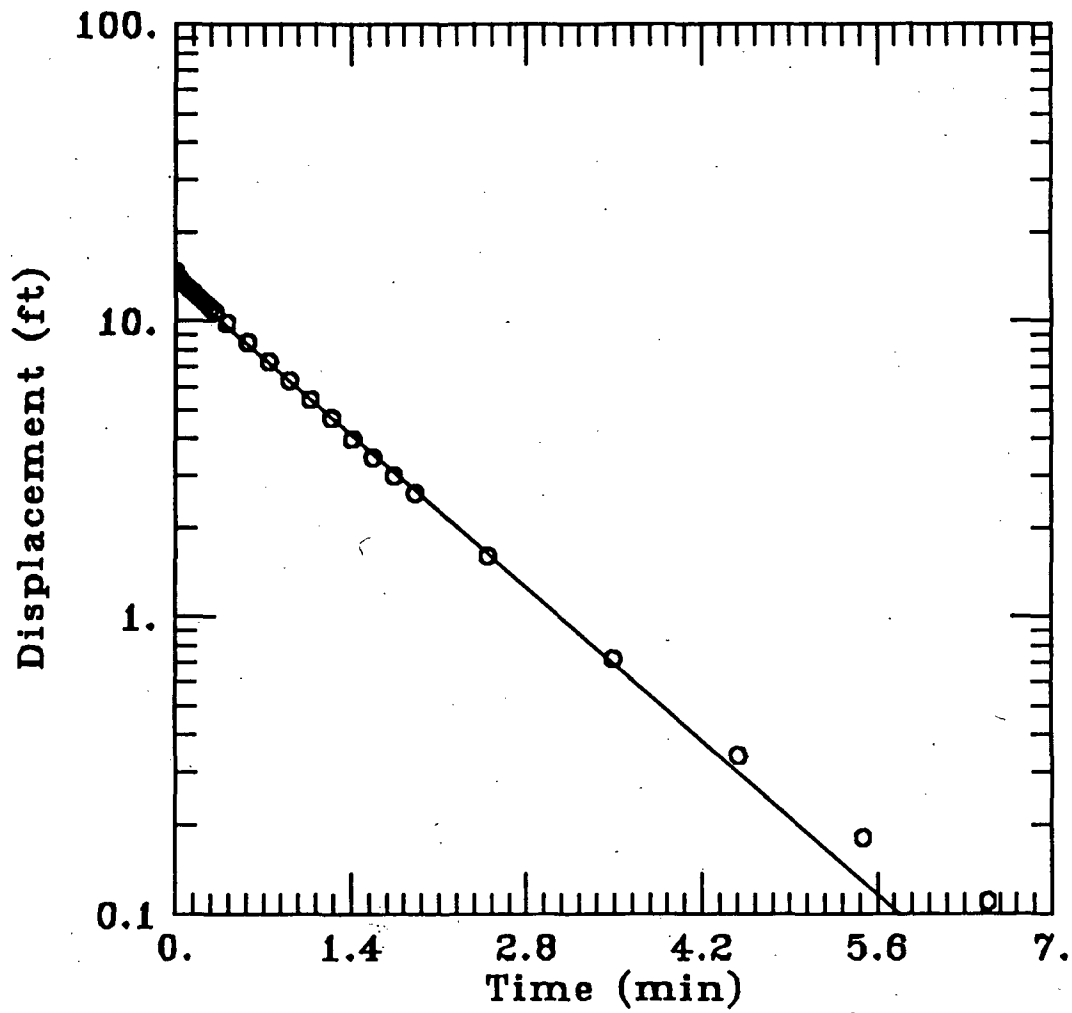
AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETER
K = 0.0009593 ft/min
y0 = 12.06 ft

TEST DATA:
H0 = 13.15 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 75. ft

mw111c test 3



DATA SET:
mw111c3.dat
12/04/91

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.0008854 ft/min
y0 = 13.47 ft

TEST DATA:
H0 = 14.64 ft
rc = 0.0833 ft
rw = 0.25 ft
L = 10. ft
b = 200. ft
H = 75. ft

APPENDIX I

ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES

TABLE I-1
CONTRACT REQUIRED QUANTITATION LIMITS (CRQL) FOR SEMIVOLATILE ORGANICS IN GROUNDWATER

Semivolatiles	CAS Number	Quantitation Limits Water ug/L
Phenol	108-95-2	10
bis(2-Chloroethyl)ether	111-44-4	10
2-Chlorophenol	95-57-8	10
1,3-Dichlorobenzene	541-73-1	10
1,4-Dichlorobenzene	106-46-7	10
1,2-Dichlorobenzene	95-50-1	10
2-Methylphenol	95-48-7	10
2,2'-oxybis (1-Chloropropane)#	108-60-1	10
4-Methylphenol	106-44-5	10
N-Nitroso-di-n-dipropylamine	621-64-7	10
Hexachloroethane	67-72-1	10
Nitrobenzene	98-95-3	10
Isophorone	78-59-1	10
2-Nitrophenol	88-75-5	10
2,4-Dimethylphenol	105-67-9	10
bis(2-Chloroethoxy)methane	111-91-1	10
2,4-Dichlorophenol	120-83-2	10
1,2,4-Trichlorobenzene	120-82-1	10
Naphthalene	91-20-3	10
4-Chloroaniline	106-47-8	10
Hexachlorobutadiene	87-68-3	10
4-Chloro-3-methylphenol	59-50-7	10
2-Methylnaphthalene	91-57-6	10
Hexachlorocyclopentadiene	77-47-4	10
2,4,6-Trichlorophenol	88-06-2	10
2,4,5-Trichlorophenol	95-94-4	50

(Continued)

CONTRACT REQUIRED QUANTITATION LIMITS (CRQL) FOR LOW LEVEL VOLATILE ORGANICS IN GROUNDWATER

Volatiles	CAS Number	Quantitation Limits Water ug/L
Chloromethane	74-87-3	1
Bromoethane	74-83-9	1
Vinyl Chloride	75-01-4	1
Chloroethane	75-00-3	1
Methylene Chloride	75-09-2	2
Acetone	67-64-1	5
Carbon Disulfide	75-15-0	1
1,1-Dichloroethene	75-35-4	1
1,1-Dichloroethane	75-34-3	1
cis-1,2-Dichloroethene	156-59-4	1
trans-1,2-Dichloroethene	156-60-5	1
Chloroform	67-66-3	1
1,2-Dichloroethane	107-06-2	1
2-Butanone	78-93-3	5
Bromochloromethane	74-97-5	1
1,1,1-Trichloroethane	71-55-6	1
Carbon Tetrachloroethane	56-23-5	1
Bromodichloromethane	75-27-4	1
1,2-Dichloropropane	78-87-5	1
cis-1,3-Dichloropropene	10061-01-5	1
Trichloroethene	79-01-6	1
Dibromochloromethane	124-48-1	1
1,1,2-Trichloroethane	79-00-5	1
Benzene	71-43-2	1
trans-1,3-Dichloropropene	10061-02-6	1
Bromoform	75-25-2	1

(Continued)

CONTRACT REQUIRED QUANTITATION LIMITS (CRQL) FOR LOW LEVEL VOLATILE ORGANICS IN GROUNDWATER

Volatiles	CAS Number	Quantitation Limits Water ug/L
4-Methyl-2-pentanone	108-10-1	5
2-Hexanone	591-78-6	5
Tetrachloroethene	127-18-4	1
1,1,2,2-Tetrachloroethane	79-34-5	1
1,2-Dibromethane	106-93-4	1
Toluene	108-88-3	1
Chlorobenzene	108-90-7	1
Ethylbenzene	100-41-4	1
Styrene	100-42-5	1
Xylenes (total)	1330-20-7	1
1,3-Dichlorobenzene	541-73-1	1
1,4-Dichlorobenzene	106-46-7	1
1,2-Dichlorobenzene	95-50-1	1
1,2-Dibromo-3-chloropropane	96-12-8	1

SPECIAL ANALYTICAL SERVICES REQUIRED QUANTITATION LIMITS FOR INORGANIC PARAMETERS IN GROUNDWATER

Compound	Required Instrument Detection Limit ug/L		
	GFAA	ICP	OTHER
Metal:			
Aluminum		100	
Antimony	5		
Arsenic	5		
Barium		50	
Beryllium		5	
Cadmium	0.5		
Calcium		1000	
Chromium		10	
Cobalt		10	
Copper		10	
Iron		100	
Lead	2		
Magnesium		1000	
Manganese		10	
Mercury			0.2
Nickel		20	
Potassium		2000	
Selenium	2		
Silver		5	
Sodium		1000	
Thallium	2		
Vanadium		10	
Zinc		20	
Cyanide			10

Table I-9. TDS and TSS Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-17-91		9-17-91	
Sample Number	MW12-D		DECON	
Inorganic Traffic Report Number	6670E-61		6670E-62	
Total Dissolved Solids & Total Suspended Solids (mg/L)				
Total Dissolved Solids	287.00		303.00	
Total Suspended Solids	0.50		0.50	U

Table I-2. Pesticide Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-4-91	9-4-91	9-4-91	9-4-91	9-4-91	9-5-91
Sample Number	MW101B	MW101A	MW102A	MW102B	MW102C	MW103A
Organic Traffic Report Number	EPS-01	EPS-03	EPS-06	EPS-07	EPS-09	EMF-17
Pesticides (ug/L)						
alpha-BHC						
beta-BHC						
delta-BHC			0.0028 JP			
gamma-BHC (Lindane)						0.0011 JP
Heptachlor						
Aldrin						
Heptachlor epoxide			0.00099 JP			
Endosulfan I			0.0017 JP			
Dieldrin			0.0017 JP			
4,4'-DDE			0.0019 JP			
Endrin						
Endosulfan II						
Endosulfan sulfate						
Endrin ketone						
4,4'-DDD						
4,4'-DDT			0.0055 JP			
Methoxychlor						
alpha-Chlordane						
gamma-Chlordane			0.0014 J			

Table I-9. TDS and TSS Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-17-91	9-17-91	9-17-91	9-17-91	9-17-91	9-17-91
Sample Number	MW9	MW18	MW29	MW31	MW31-R	MW32
Inorganic Traffic Report Number	6670E-55	6670E-56	6670E-57	6670E-58	6670E-59	6670E-60
Total Dissolved Solids & Total Suspended Solids (mg/L)						
Total Dissolved Solids	514.00	302.00	477.00	492.00	30.00	695.00
Total Suspended Solids	17.00	0.50 U	0.50 U	0.50 U	0.50 U	2332.00

Table I-2. Pesticide Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-6-91				9-6-91		9-6-91		9-6-91		9-9-91		
Sample Number	MW105A		MW105C		MW105C-R		MW105D-D		MW105D		MW106A		
Organic Traffic Report Number	EMF-32		EMF-35		EMF-36		EMF-38		EMF-40		EMF-43		
Pesticides (ug/L)													
alpha-BHC	0.0022	JP									0.0074	JP	
beta-BHC											0.003	JP	
delta-BHC											0.0016	JP	
gamma-BHC (Lindane)											0.082	J	
Heptachlor											0.0015	JP	
Aldrin											0.0027	JP	
Heptachlor epoxide											0.079	J	
Endosulfan I													
Dieldrin											0.16	J	
4,4'-DDE											0.13	PJ	
Endrin	0.0019	JP									0.19	J	
Endosulfan II											0.0057	JP	
Endosulfan sulfate											0.17	PJ	
Endrin ketone											0.0026	JP	
4,4'-DDD													
4,4'-DDT													
Methoxychlor													
alpha-Chlordane													
gamma-Chlordane											0.13	J	

Table I-2. Pesticide Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-10-91		9-10-91		9-10-91		9-10-91		9-10-91			
Sample Number	MW109C		MW109C-R		MW109B		MW109A		MW108B			
Organic Traffic Report Number	EPS-18		EPS-22		EPS-24		EPS-26		EPS-27		PR780	
Pesticides (ug/L)												
alpha-BHC			0.00094	JP								
beta-BHC												
delta-BHC												
gamma-BHC (Lindane)											0.024	
Heptachlor					0.0016	JP					0.073	
Aldrin											0.024	
Heptachlor epoxide							0.00092	J				
Endosulfan I												
Dieldrin												
4,4'-DDE												
Endrin											0.048	
Endosulfan II											0.021	
Endosulfan sulfate												
Endrin ketone												
4,4'-DDD												
4,4'-DDT											0.029	
Methoxychlor											0.13	
alpha-Chlordane											0.013	
gamma-Chlordane												

Table I-2. Pesticide Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-10-91		9-10-91		9-10-91		9-11-91		9-11-91		9-11-91	
Sample Number	MW110A		MW108C		MW108A		MW110B		MW110B-D		MW110C	
Organic Traffic Report Number	EPS-30		EPS-32		EPS-34		EPS-36		EPS-39		EPS-41	
Pesticides (ug/L)												
alpha-BHC							0.0015	JP	0.00099	JP		
beta-BHC												
delta-BHC												
gamma-BHC (Lindane)												
Heptachlor	0.00072	JP	0.00074	JP			0.0012	JP	0.0015	JP	0.0013	J
Aldrin												
Heptachlor epoxide					0.0013	JP						
Endosulfan I					0.0013	JP			0.0009	JP		
Dieldrin												
4,4'-DDE												
Endrin												
Endosulfan II												
Endosulfan sulfate												
Endrin ketone												
4,4'-DDD							0.0066	J				
4,4'-DDT												
Methoxychlor												
alpha-Chlordane												
gamma-Chlordane												

Table I-2. Pesticide Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-11-91		9-11-91		9-11-91		9-11-91		9-12-91		9-12-91	
Sample Number	MW111A		MW111B		MW111C		MW111C-R		MW11		MW27	
Organic Traffic Report Number	EPS-45		EPS-47		EPS-49		EPS-51		EPS-53		EPS-55	
Pesticides (ug/L)												
alpha-BHC							0.00045	JP				
beta-BHC			0.0023	JP					0.0025	JP		
delta-BHC					0.00026	JP						
gamma-BHC (Lindane)												
Heptachlor					0.00099	JP					0.00088	JP
Aldrin												
Heptachlor epoxide							0.0013	JP			0.0011	JP
Endosulfan I												
Dieldrin			0.00059	JP					0.0016	J		
4,4'-DDE							0.00061	JP				
Endrin												
Endosulfan II												
Endosulfan sulfate												
Endrin ketone												
4,4'-DDD	0.0036	J										
4,4'-DDT												
Methoxychlor												
alpha-Chlordane												
gamma-Chlordane												

Table I-2. Pesticide Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-5-91	9-5-91	9-5-91	9-6-91	9-6-91	9-6-91
Sample Number	MW103B	MW103C	MW104A	MW104C	MW104B	MW105B
Organic Traffic Report Number	EMF-18	EMF-21	EMF-25	EMF-23	EMF-28	EMF-30
Pesticides (ug/L)						
alpha-BHC						
beta-BHC						
delta-BHC						
gamma-BHC (Lindane)			0.0013 JP			
Heptachlor						
Aldrin						
Heptachlor epoxide						
Endosulfan I						
Dieldrin						
4,4'-DDE						
Endrin						
Endosulfan II						
Endosulfan sulfate						
Endrin ketone						
4,4'-DDD						
4,4'-DDT						
Methoxychlor						
alpha-Chlordane						
gamma-Chlordane						

Table I-2. Pesticide Results for Gr[illegible]dwater Samples, Southeast Rockford

Date Sampled	9-17-91	9-16-91	9-16-91	9-16-91	9-16-91	9-16-91
Sample Number	DECON	MW22	MW16	MW30	MW17	MW17-R
Organic Traffic Report Number	EPN-51	EPS-72	EPS-74	EPS-76	EPS-78	EPS-80
Pesticides (ug/L)						
alpha-BHC						
beta-BHC						
delta-BHC						
gamma-BHC (Lindane)						
Heptachlor						
Aldrin						
Heptachlor epoxide						
Endosulfan I						
Dieldrin						
4,4'-DDE						
Endrin						
Endosulfan II						
Endosulfan sulfate						
Endrin ketone						
4,4'-DDD						
4,4'-DDT						
Methoxychlor						
alpha-Chlordane						
gamma-Chlordane						

Table I-2. Pesticide Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-9-91	9-9-91	9-9-91	9-9-91	9-9-91	9-9-91
Sample Number	MW106B	MW107A	MW107B	MW107C	MW107B-D	MW106C
Organic Traffic Report Number	EMF-46	EMF-47	EMF-49	EPS-11	EPS-14	EPS-16
Pesticides (ug/L)						
alpha-BHC	DO					
beta-BHC	NOT					
delta-BHC	USE					
gamma-BHC (Lindane)	FORM I					
Heptachlor						
Aldrin						
Heptachlor epoxide						
Endosulfan I						
Dieldrin						
4,4'-DDE						
Endrin						
Endosulfan II						
Endosulfan sulfate						
Endrin ketone						
4,4'-DDD						
4,4'-DDT						
Methoxychlor						
alpha-Chlordane						
gamma-Chlordane						

Table I-2. Pesticide Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-17-91		9-17-91				9-30-91		9-30-91		9-30-91	
Sample Number	MW31-R		MW32				MWS32A		MWS23		MWS29	
Organic Traffic Report Number	EPS-95		EPS-97		PP588		EPM-36		EPM-38		EPM-41	
Pesticides (ug/L)												
alpha-BHC	0.0023	JP										
beta-BHC												
delta-BHC												
gamma-BHC (Lindane)					0.032	P						
Heptachlor					0.11	P					0.0012	J
Aldrin					0.035							
Heptachlor epoxide												
Endosulfan I	0.0017	JP										
Dieldrin	0.002	J					0.0011	JP				
4,4'-DDE	0.001	JP										
Endrin					0.065		0.00093	JP				
Endosulfan II					0.023	P						
Endosulfan sulfate							0.0016	JP				
Endrin ketone												
4,4'-DDD												
4,4'-DDT					0.039							
Methoxychlor					0.18							
alpha-Chlordane	0.0012	JP			0.016		0.098	P				
gamma-Chlordane	0.0015	JP										

Table I-2. Pesticide Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-10-91		9-10-91		9-10-91		9-11-91		9-11-91		9-11-91	
Sample Number	MW110A		MW108C		MW108A		MW110B		MW110B-D		MW110C	
Organic Traffic Report Number	EPS-30		EPS-32		EPS-34		EPS-36		EPS-39		EPS-41	
Pesticides (ug/L)												
alpha-BHC							0.0015	JP	0.00099	JP		
beta-BHC												
delta-BHC												
gamma-BHC (Lindane)												
Heptachlor	0.00072	JP	0.00074	JP			0.0012	JP	0.0015	JP	0.0013	J
Aldrin												
Heptachlor epoxide					0.0013	JP						
Endosulfan I					0.0013	JP			0.0009	JP		
Dieldrin												
4,4'-DDE												
Endrin												
Endosulfan II												
Endosulfan sulfate												
Endrin ketone												
4,4'-DDD							0.0066	J				
4,4'-DDT												
Methoxychlor												
alpha-Chlordane												
gamma-Chlordane												

Table I-2. Pesticide Results for Groundwater Samples, Southeast Rockford

Date Sampled	10-1-91		10-1-91		10-1-91		10-1-91		10-1-91		10-2-91	
Sample Number	MWS9		MWS41		MWS37		MWS10		MWS10D		MWS31A	
Organic Traffic Report Number	EPM-56		EPM-58		EPM-60		EPM-62		EPM-64		EPM-67	
Pesticides (ug/L)												
alpha-BHC												
beta-BHC			0.0019	JP								
delta-BHC												
gamma-BHC (Lindane)												
Heptachlor												
Aldrin												
Heptachlor epoxide											0.0013	JP
Endosulfan I					0.0023	JP						
Dieldrin												
4,4'-DDE												
Endrin			0.0014	JP								
Endosulfan II												
Endosulfan sulfate												
Endrin ketone												
4,4'-DDD												
4,4'-DDT												
Methoxychlor			0.0068	JP							0.0078	JP
alpha-Chlordane												
gamma-Chlordane											0.0013	JP

Table I-2. Pesticide Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-12-91		9-12-91		9-12-91		9-13-91		9-13-91		9-16-91	
Sample Number	MW28		MW23		MW26		MW24		MW14		MW20	
Organic Traffic Report Number	EPS-58		EPS-61		EPS-63		EPS-65		EPS-67		EPM-31	
Pesticides (ug/L)												
alpha-BHC	0.00039	JP			0.00028	JP						
beta-BHC			0.0019	JP								
delta-BHC												
gamma-BHC (Lindane)												
Heptachlor							0.00043	J				
Aldrin												
Heptachlor epoxide			0.0011	JP								
Endosulfan I												
Dieldrin												
4,4'-DDE												
Endrin												
Endosulfan II												
Endosulfan sulfate												
Endrin ketone												
4,4'-DDD	0.0017	J							0.0052	JP		
4,4'-DDT												
Methoxychlor												
alpha-Chlordane												
gamma-Chlordane												

Table I-2. Pesticide Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-13-91
Sample Number	MW15
Organic Traffic Report Number	EPS69

Pesticides (ug/L)		
alpha-BHC		
beta-BHC		
delta-BHC		
gamma-BHC (Lindane)		
Heptachlor		
Aldrin		
Heptachlor epoxide		
Endosulfan I		
Dieldrin	0.0013	J
4,4'-DDE		
Endrin		
Endosulfan II		
Endosulfan sulfate		
Endrin ketone		
4,4'-DDD		
4,4'-DDT		
Methoxychlor		
alpha-Chlordane		
gamma-Chlordane		

Table I-2. Pesticide Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-16-91		9-16-91		9-17-91		9-17-91		9-17-91		9-17-91	
Sample Number	MW21		MW21-D		MW9		MW12		MW29		MW31	
Organic Traffic Report Number	EPS-83		EPS-85		EPS-87		EPS-89		EPS-91		EPS-93	
Pesticides (ug/L)												
alpha-BHC												
beta-BHC												
delta-BHC												
gamma-BHC (Lindane)												
Heptachlor												
Aldrin												
Heptachlor epoxide												
Endosulfan I												
Dieldrin												
4,4'-DDE												
Endrin												
Endosulfan II												
Endosulfan sulfate												
Endrin ketone												
4,4'-DDD												
4,4'-DDT												
Methoxychlor												
alpha-Chlordane												
gamma-Chlordane											0.0007	JP

Table I-3. Inorganic Chemical Results of Groundwater Samples, Southeast Rockford

Date Sampled	9-9-91		9-9-91		9-10-91		9-10-91		9-10-91		9-10-91	
Sample Number	MW106C		MW106C		MW109C		MW109C		MW109B		MW109B	
Inorganic Traffic Report Number	MEPD-38		MEPD-37		MEPD-40		MEPD-39		MEPD-44		MEPD-43	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum	452		54.5	B	51.8	B	38.6	B	81.5	B	72.3	B
Antimony	2	U	2	U	2	U	2	U	2	U	2	U
Arsenic	1	B	1.5	B	1	U	1.5	B	1	U	1	U
Barium	30.6	B	30	B	37.3	B	36.9	B	70.5		69	
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Calcium	81,900		81,600		92,100		90,700		85,500		85,100	
Chromium	8	U	8	U	8	U	8	U	8	U	8	U
Cobalt	6	U	6	U	6	U	6	U	6	U	6	U
Copper	5	UJ	5	UJ	5	UJ	5	UJ	5	U	5	U
Iron	683		98.4	B	1,870		1,840		31.2	B	7.2	B
Lead	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
Magnesium	37,600		37,500		41,600		41,800		41,800		41,700	
Manganese	67.3	J	79.6	J	123		120		99.5		92.7	
Mercury	0.2	UJ	0.2	UJ	0.2	UJ	0.2	UJ	0.2	UJ	0.2	UJ
Nickel	16	U	16	U	16	U	16	U	41.9		36.7	
Potassium	1,150	B	859	B	1,510	B	1,300	B	2,030		1,640	B
Selenium	2	UJ	2	UJ	2	UJ	2	UJ	2	UJ	2	UJ
Silver	4	U	4	U	4	U	4	U	4	U	4	U
Sodium	6,360		6,440		5,360		5,240		9,900		10,000	
Thallium	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	8	UJ	8	UJ	8	UJ	8	UJ	8	U	8	U
Zinc	11	U	11	U	11	U	11	U	11	U	11	U
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-2. Pesticide Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-30-91		9-30-91		10-1-91		9-30-91		10-1-91		10-1-91	
Sample Number	MWS29-R		MWS33		MWS33A		MWS34A		MWS28A		MWS34	
Organic Traffic Report Number	EPM-43		EPM-45		EPM-47		EPM-49		EPM-52		EPM-54	
Pesticides (ug/L)												
alpha-BHC	0.00033	JP										
beta-BHC			0.0027	JP								
delta-BHC												
gamma-BHC (Lindane)												
Heptachlor	0.0017	JB			0.039	J						
Aldrin												
Heptachlor epoxide					0.002	JP						
Endosulfan I												
Dieldrin					0.0014	JP						
4,4'-DDE			0.00099	J								
Endrin					0.0012	JP						
Endosulfan II												
Endosulfan sulfate												
Endrin ketone												
4,4'-DDD	0.0015	JP										
4,4'-DDT												
Methoxychlor					0.011	JP						
alpha-Chlordane	0.00041	JPB			0.016	P						
gamma-Chlordane	0.0004	JP										

Table I-3. Inorganic Chemical Results - Groundwater Samples, Southeast Rockford

Date Sampled	9-10-91		9-10-91		9-10-91		9-10-91		9-10-91		9-10-91	
Sample Number	MW108C		MW108C		MW108A		MW108A		MW110B		MW110B	
Inorganic Traffic Report Number	MEPD-52		MEPD-51		MEPD-54		MEPD-53		MEPD-56		MEPD-55	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum	132		38.4	B	11,100		80.3	B	4,790	J	284	
Antimony	2	U	2	U	37.2	J	2	U	2	UJ	2	U
Arsenic	3.8	BJ	4	BJ	21		1	UJ	3	BJ	1	UJ
Barium	45.2	B	44.6	B	80.2		26.7	B	81.1		54.3	
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	0.1	UJ	0.1	UJ		R	0.1	UJ		R	0.16	BJ
Calcium	73,800		74,200		160,000		104,000		80,200		74,200	
Chromium	8	U	8	U	74.1		8	U	8	U	8	U
Cobalt	6	U	6	U	16.5		6	U	6	U	6	U
Copper	5	U	5	U	74.3		5	U	5	UJ	5	U
Iron	1,170		1,110		45400.00		55.4	B	2,970	J	187	
Lead	1.9	B	1	U		R		R		R		R
Magnesium	37,200		37,400		81,200		50,100		43,100		38,600	
Manganese	55.9		56.2		500		12.9		95.8		46.7	
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	16	UJ	16	UJ	62.9	J	16	UJ	16	UJ	16	UJ
Potassium	444	U	444	U	3,910		1,250	B	2,030		1,790	B
Selenium	2	U	2	U	2	U		R	2	U	2	U
Silver	4	U	4	U	4	U	4	U	4	U	4	U
Sodium	3,810		3,860		26,700		27,600		112,000		101,000	
Thallium	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	8	UJ	8	UJ	34.7	J	8	UJ	8	UJ	8	UJ
Zinc	11	U	13.8	B	213		12.5	B	33.7		26.8	
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-2. Pesticide Results for Groundwater Samples, Southeast Rockford

Date Sampled	10-1-91		10-1-91		10-2-91		10-2-91		10-2-91			
Sample Number	MWS40		MWS40-R		MWS32		MWS5		MWS32-D		PES	
Organic Traffic Report Number	EPM-69		EPM-71		EPM 76		EPM74		EPM78		PQ454	
Pesticides (ug/L)												
alpha-BHC												
beta-BHC												
delta-BHC	0.000165	J	0.0026	JP								
gamma-BHC (Lindane)							0.00053	JP			0.029	
Heptachlor									0.0014	J	0.15	
Aldrin			0.00097	JPB							0.031	
Heptachlor epoxide												
Endosulfan I												
Dieldrin											0.0037	JB
4,4'-DDE											0.0012	JPB
Endrin											0.059	B
Endosulfan II							0.0026	JP			0.024	P
Endosulfan sulfate											0.0058	JPB
Endrin ketone												
4,4'-DDD			0.0014	JP								
4,4'-DDT											0.035	
Methoxychlor											0.095	J
alpha-Chlordane			0.0006	JP							0.012	P
gamma-Chlordane	0.00065	JP									0.0013	JPB

Table I-3. Inorganic Chemical Results Groundwater Samples, Southeast Rockford

Date Sampled	9-6-91		9-6-91		9-6-91		9-6-91		9-6-91		9-6-91	
Sample Number	MW105B		MW105B		MW105A		MW105A		MW105C		MW105C	
Inorganic Traffic Report Number	MEPD-14		MEPD-13		MEPD-16		MEPD-15		MEPD-17		MEPD-18	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum	59.7	B	69	B	119,000		121		169		58.1	B
Antimony	2	UJ	2	UJ	4	UJ	4	UJ	2	UJ	2	UJ
Arsenic	1	U	1	U	11.6		1	U	1	U	1	U
Barium	66.2		64.7		506		46.2	B	46.1	B	46.4	B
Beryllium	1	U	1	U	7.3		1	U	1	U	1	U
Cadmium	0.1	U	0.1	U		R	0.1	U	0.1	U	0.1	U
Calcium	95,500		95,500		632,000		82,700		101,000		100,000	
Chromium	8	U	8	U	202		8	U	8	U	8	U
Cobalt	6	U	6	U	68.3		6	U	6	U	6	U
Copper	5	UJ	5	UJ	262		8.4	BJ	5	UJ	5	UJ
Iron	71.6	B	17.8	B	205,000		121		1,210		1,070	
Lead	1	U	1	U		R	1	U	1	U	1	U
Magnesium	45,900		46,000		289,000		38,100		45,700		45,900	
Manganese	469		468		2,740		196		93.7		85.2	
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	16	U	16	U	195		16	U	16	U	16	U
Potassium	1,250	B	1,090	B	28,800		2,250		1,860	B	2,310	
Selenium	1	U	1	U	1	U	1	U	1	U	1	U
Silver	4	UJ	4	UJ	4	UJ	4	UJ	4	UJ	4	UJ
Sodium	18,900		18,900		13,900		14,300		11,100		11,700	
Thallium		R	1	U		R	1	U	1	U	1	U
Vanadium	8	UJ	8	UJ	274		8	UJ	8	UJ	8	UJ
Zinc	11	U	11	U	800		11	U	11	U	11	U
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-3. Inorganic Chemical Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-10-91		9-10-91		9-10-91		9-10-91		9-10-91		9-10-91	
Sample Number	MW109A		MW109A		MW108B		MW108B		MW110A		MW110A	
Inorganic Traffic Report Number	MEPD-46		MEPD-45		MEPD-48		MEPD-47		MEPD-50		MEPD-49	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum	106,000		391		139		86.8	B	55,800		48.6	B
Antimony		R	2	U	2	U	2	U	5.6	J	2	U
Arsenic	9.8	J	1	U	1	U	1	U	16.1		1	UJ
Barium	632		45.8	B	24.1	B	23	B	377		69.5	
Beryllium	5.4		1	U	1	U	1	U	2.3	B	1	U
Cadmium	1.1	J	0.1	U	0.1	U	0.1	U		R	0.2	U
Calcium	1,160,000		97,000		91,000		86,500		640,000		126,000	
Chromium	450		16.6		8	U	8	U	171		8	U
Cobalt	40		6	U	6	U	6	U	42.3		6	U
Copper	131			R	5	U	5	U	180		10.6	
Iron	164,000		412		240		6	U	109,000		6	U
Lead	84.3		1	UJ	37.7	B	1	UJ		R		R
Magnesium	459,000		49,300		41,900		40,300		299,000		61,200	
Manganese	4,120		31.2		3	B	2	U	2,060		118	
Mercury	0.2	UJ	0.2	UJ	0.2	UJ	0.2	UJ	0.2	U	0.2	U
Nickel	276		42.2		16	U	16	U	111		16	UJ
Potassium	17,700		6,590		536	B	961	B	16,500		2,550	
Selenium		R	2	UJ	2	UJ	2	UJ	4	UJ	2	U
Silver	4	U	4	U	4	U	4	U	4	U	4	U
Sodium	30,200		32,700		9,700		9,920		38,300		38,800	
Thallium	1	U	1.4	B	1.5	B	1	U	1.2	B	1	U
Vanadium	152		8	U	8	U	8	U	123		8	UJ
Zinc	362		11	U	11	U	11	U	312		15.9	B
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-3. Inorganic Chemical Results Groundwater Samples, Southeast Rockford

Date Sampled	9-17-91		9/17/91		9-17-91		9-17-91		9-17-91		9-17-91	
Sample Number	MW31		MW31		MW32		MW32		DECON		DECON	
Inorganic Traffic Report Number	MEMR-58		MEMR-57		MEMR-62		MEMR-61		MEMR-66		MEMR-65	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum	179	J	32	UJ	32	UJ	34.4	BJ	65.4	B	64	BJ
Antimony	2	U	2	U	2	UJ	2	UJ	2	U	2	U
Arsenic	2	U	2	U	2	U	2	U	1.5	BJ	2	U
Barium	30.9	B	30.5	B	34.4	B	35.5	B	230		218	
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Calcium	90,900		91,400		92,200		92,400		62,800		63,300	
Chromium	8	U	8	U	8	U	8	U	8	U	8	U
Cobalt	6.2	B	6	U	6	U	6	B	6	U	6	U
Copper	5	U	5	U	5	UJ	5.6	BJ		R		R
Iron	14.6	B	7.9	B	57.9	B	40.7	B	412		29.1	B
Lead	1	U	1	U	1	U	1	U		R	1	U
Magnesium	41,800		41,500		40,900		40,900		34,100		32,200	
Manganese	4.6	B	3.7	B	10.4		9.3	B	4	BJ	3.3	B
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	16	U	16	U	41.2		33.9		16	U	16	U
Potassium	1,380	B	1,440	B	1680	BJ	2,300	J	2170	J	2,620	J
Selenium	2	U	2	U	2	U	2	U	1	UJ	2	UJ
Silver	4	U	4	U	4	U	4	U	4	U	4	U
Sodium	17,900		17,500		42,800		42,900		4,010		4,350	
Thallium	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	8	U	8	U	8	U	8	U	8	UJ	8	U
Zinc	11	U	11	U	11	U	11	U	11	U	11	U
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-3. Inorganic Chemical Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-11-91		9-11-91		9-5-91		9-5-91		9-6-91		9-6-91	
Sample Number	MW111C		MW111C		MW104A		MW104A		MW104B		MW104B	
Inorganic Traffic Report Number	MEPD-66		MEPD-65		MEPD-10		MEPD-09		MEPD-11		MEPD-12	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum	578		39.2	B	17,900		76	B	437		32	U
Antimony	2	U	2	U	2	UJ	2	UJ	2	UJ	2	UJ
Arsenic	1	U	1	U	5.2		1	U	1	U	1	U
Barium	61		62		197		46.5	B	24.6	B	23.4	B
Beryllium	1	U	1	U	1	B	1	U	1	U	1	U
Cadmium	0.1	U	0.1	U		R	0.1	U	0.2	U	0.1	U
Calcium	65,600		65,000		637,000		115,000		93,200		93,100	
Chromium	8	U	8	U	76.8		8	U	8	U	8	U
Cobalt	6	U	6	U	6	U	6	U	6	U	6	U
Copper	5	UJ	5	UJ	28.5	J	5	UJ	5	UJ	5	UJ
Iron	334		15.7	B	23,500		36.5	B	447		10.6	B
Lead	1	U	1	U		R	1	U	1	U	1	U
Magnesium	32,700		32,500		345,000		56,200		43,800		43,700	
Manganese	132		138		1,450		60.7		13		10.7	
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	16	UJ	16	UJ	53.9		16	U	16	U	16	U
Potassium	581	B	634	B	5,780		702	B	967	B	1,040	B
Selenium	2	U	2	U	1	UJ	1	U	1	U	1	U
Silver	4	U	4	U	4	UJ	4	UJ	4	UJ	4	UJ
Sodium	3,020		3,210		6,120		5,970		10,800		10,700	
Thallium	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	8	UJ	8	UJ	27.6	J	8	UJ	8	UJ	8	UJ
Zinc	11.3	B	11	U	66.5		11	U	11	U	11	U
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-3. Inorganic Chemical Results Groundwater Samples, Southeast Rockford

Date Sampled	9-11-91		9-11-91		9-11-91		9-11-91		9-11-91		9-11-91	
Sample Number	MW110C		MW110C		MW111A		MW111A		MW111B		MW111B	
Inorganic Traffic Report Number	MEPD-60		MEPD-59		MEPD-62		MEPD-61		MEPD-64		MEPD-63	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum	67.4	B	45.7	B	28,300		536		91.5	B	38.5	B
Antimony		R		R		R		R		R		R
Arsenic	1.3	BJ	1.1	BJ	7.2	J	1	UJ	1	UJ	1.5	BJ
Barium	41.9	B	41.9	B	200		50.7		34.7	B	34.4	B
Beryllium	1	U	1	U	1.2	B	1	U	1	U	1	U
Cadmium	0.1	U	0.1	U		R	0.1	U	0.1	U	0.1	U
Calcium	72,000		71,400		289,000		93,500		87,700		87,600	
Chromium	8	U	8	U	69.3		8	U	8	U	8	U
Cobalt	6	UJ	6	UJ	35.5	J	6	UJ	6	UJ	6	UJ
Copper	5	UJ	6	BJ	104		5	UJ	5	UJ	5	UJ
Iron	70.3	B	19	B	88,300		1,290		158		20	B
Lead	1	UJ	1	UJ	63.3	J	1	UJ	1	UJ	1	UJ
Magnesium	36,500		36,600		137,000		44,400		42,600		42,200	
Manganese	59.9		61.7		2,020		33.4		18.4		14.8	
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	16	U	16	U	81.3		16	U	16	U	16	U
Potassium	444	UJ	654	BJ	8,950		2,000	B	668	BJ	815	BJ
Selenium	2	UJ	2	UJ	2	UJ	2	UJ	2	UJ	2	UJ
Silver	4	U	4	U	4	U	4	U	4	U	4	U
Sodium	3,850		4,050		8,640		8,470		6,210		6,190	
Thallium	1	U	1	UJ	2.1		1	U	1	U	1	U
Vanadium	8	U	8	U	77		8	U	8	U	8	U
Zinc	11	U	11	U	320		11	U	11	U	11	U
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-3. Inorganic Chemical Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-4-91		9-4-91		9-16-91		9-16-91		9-17-91		9-17-91	
Sample Number	MW102C		MW102C		MW20		MW20		MW29		MW29	
Inorganic Traffic Report Number	MEPH-10		MEPH-03		MEMR-52		MEMR-51		MEMR-56		MEMR-55	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum	130		32	U	62.4	BJ	32	UJ	46.4	BJ	37.5	BJ
Antimony	2	UJ	2	UJ	2	U	2	U	2	U	2	U
Arsenic	40.5		44.4		6.2	J	7.1	J	2	U	2	U
Barium	59		2	U	73.9		73.7		29	B	28.5	B
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Calcium	90,600		36	U	85,000		83,900		96,100		96,600	
Chromium	8	U	8	U	8	U	8	U	16.5		8	U
Cobalt	6	U	6	U	7	B	6	U	6	U	6	U
Copper	5	UJ	5	UJ	5	U	5	U	5	U	5	U
Iron	347		6	U	1,510		1,560		139		21.5	B
Lead	1	U	1	U	1	U	1	U	1	U	1	U
Magnesium	40,400		211	B	44,500		44,100		40,700		40,500	
Manganese	15.3		2	U	356	J	360	J	10.5		10.6	
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	16	U	16	U	16	U	16	U	53		39.4	
Potassium	977	B	444	U	2,610		2,000	B		R		R
Selenium	1	U	1	U	4.7	J	6.5	J	2	U	2	U
Silver	4	UJ	4	UJ	4	U	4	U	4	U	4	U
Sodium	5,440		140	U	39,900		40,000		18,800		18,900	
Thallium	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	8	UJ	8	UJ	8	U	8	U	8	U	8	U
Zinc	11	U	11	U	11	U	11	U	11	U	11	U
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-3. Inorganic Chemical Results Groundwater Samples, Southeast Rockford

Date Sampled	9-13-91		9-13-91		9-9-91		9-9-91		9-9-91		9-9-91	
Sample Number	MW24		MW24		MW107B		MW107B		MW106A		MW106A	
Inorganic Traffic Report Number	MEPD-80		MEPD-79		MEPD-32		MEPD-25		MEPD-28		MEPD-26	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum	34	BJ	47.8	BJ	351		32	U	5,940		63.2	B
Antimony		R		R	4	UJ	2	U	2	U	2	U
Arsenic	1	UJ	1	UJ	1	U	1	U	15.4		4.8	B
Barium	28.2	B	28.2	B	24	B	22.6	B	112		72.9	
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	0.1	U	0.1	U	0.1	U	0.1	U		R	0.1	U
Calcium	94,900		96,000		91,900		93,100		118,000		93,100	
Chromium	8	U	8	U	8	U	8	U	21.9		8	U
Cobalt	6	UJ	6	UJ	6	U	6	U	7	B	6	U
Copper	5	UJ	5	UJ	6.3	B	5	U	55.8		5	U
Iron	17.5	B	7.4	B	865		6	U	22,900		1,560	
Lead	1.1	BJ	1	UJ	1	U	1	U	32.6		1	U
Magnesium	45,000		45,300		44,300		43,400		56,300		42,600	
Manganese	2.1	B	2.1	B	48.5		36.8	J	1,290		521	
Mercury	0.2	U	0.2	U	0.2	UJ	0.2	UJ	0.2	UJ	0.2	UJ
Nickel	24.7		22.3		16	U	16	U	42	J	16	U
Potassium	459	BJ	683	BJ	661	B	699	B	2,850		1,320	B
Selenium	2	UJ	2	UJ		R		R	1.5	BJ		R
Silver	4	U	4	U	4	U	4	U	4	U	4	U
Sodium	15,900		16,000		7,410		7,410		24,200		24,600	
Thallium	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	8	U	8	U	8	U	8	U	25		8	U
Zinc	11	U	11	U	11	U	11	U	137		11	U
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-3. Inorganic Chemical Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-12-91		9-12-91		9-12-91		9-12-91		9-13-91		9-13-91	
Sample Number	MW23		MW23		MW26		MW26		MW15		MW15	
Inorganic Traffic Report Number	MEPD-76		MEPD-75		MEPD-78		MEPD-77		MEPD-82		MEPD-81	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum	158	J	41.2	BJ	57.2	BJ	32	UJ	1,510	J	60.3	BJ
Antimony	2	U	2	U	2	U	2	U	2	U	2	U
Arsenic	2	U	2	U	2	U	2	U	3.1	B	2	U
Barium	22.3	B	22.1	B	30.8	B	31.5	B	47.2	B	34.2	B
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	0.1	U	0.1	U	0.1	U	0.1	U		R	0.1	U
Calcium	92,700		90,900		94,000		94,600		102,000		92,800	
Chromium	16.2		8	U	8	U	8	U	72.2		8	U
Cobalt	6	U	6	U	6	U	6	U	6	U	6	U
Copper	5	U	5	U	5	U	6.7	B	9.8	BJ	12.1	J
Iron	445		8.5	B	69.4	B	6	U	8,660		386	
Lead	1	U	1	U	1	U	1	U	5.7		1	U
Magnesium	42,800		41,300	J	43,100		43,700		46,600		42,000	
Manganese	13.6		3.7	B	8.4	B	3.2	B	121	J	42.3	J
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	16	U	16	U	16	U	16	U	30.8		16	U
Potassium	1,050	BJ	1,230	BJ		R		R	2,890		2,590	
Selenium	5.6	J	5.6	J	4.4	J	5.1	J		R		R
Silver	4	U	4	U	4	U	4	U	4	U	4	U
Sodium	20,500		20,400		27,700		28,100		35,900		36,500	
Thallium	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	8	U	8	U	8	U	8	U	8	U	8	U
Zinc	11	U	11.3	B	11	U	11	U	38.4		28.6	
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-3. Inorganic Chemical Results f[illegible]roundwater Samples, Southeast Rockford

Date Sampled	9-17-91		9-17-91		9-16-91		9-16-91		9-16-91		9-16-91	
Sample Number	MW12		MW12		MW22		MW22		MW16		MW16	
Inorganic Traffic Report Number	MEMR-54		MEMR-53		MEPD-84		MEPD-83		MEPD-86		MEPD-85	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum		R		R	532		32.2	B	39.3	BJ	48.1	BJ
Antimony		R		R	2	U	2	U	2	U	2	U
Arsenic	1.2	BJ	1	BJ	1	UJ	1	UJ	1	U	1	U
Barium	16.3	B	17.2	B	36.7	B	33.6	B	28	B	27	B
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	0.1	U		R		R	0.1	U	0.1	U	0.1	U
Calcium	63,900		62,700		92,300		91,600		92,300		92,100	
Chromium	8	U	8	U	143		8	U	8	U	8	U
Cobalt	6	U	6	U	6.8	B	6	U	6	U	6	U
Copper	5	U	5	U	5	U	5	U	5	U	5	U
Iron	248		90.4	B	2,500		49.3	B	124		98.5	B
Lead		R		R		R		R		R		R
Magnesium	26,200		26,100		40,900		40,300		42,400		43,500	
Manganese	2	UJ	2	UJ	39.8	J	19.6	J	2	UJ	2.7	BJ
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	19.3	BJ	16	U	168		121		43.4	J	47.7	J
Potassium	1,520	B	1,460	B		R		R	1,390	B	1,820	B
Selenium	1.4	BJ	1.6	BJ	1	UJ	1	UJ	1	UJ	1	UJ
Silver	4	U	4	U	4	U	4	U	4	U	4	U
Sodium	9,240		9,420		30,200		32,700		17,400		17,500	
Thallium	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	8	UJ	8	UJ	8	UJ	8	UJ	8	UJ	8	UJ
Zinc	11	U	11	U	11	U	11	U	11	U	11.4	B
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-3. Inorganic Chemical Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-12-91		9-12-91		9-12-91		9-12-91		9-12-91		9-12-91	
Sample Number	MW11		MW11		MW27		MW27		MW28		MW28	
Inorganic Traffic Report Number	MEPD-70		MEPD-69		MEPD-72		MEPD-71		MEPD-74		MEPD-73	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum	51,400		44.4	B	976		32	U	1,370		33.8	B
Antimony		R		R		R		R		R		R
Arsenic	6.9	J	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
Barium	237		33	B	37.3	B	29	B	33.3	B	26.4	B
Beryllium	1.8	B	1	U	1	U	1	U	1	U	1	U
Cadmium		R	0.1	U		R	0.1	U		R	0.1	U
Calcium	476,000		87,800		99,000		92,500		97,900		87,900	
Chromium	182		8	U	8	U	8	U	19.7		8	U
Cobalt	37.4	J	6	UJ	6	UJ	6	UJ	6	UJ	6	UJ
Copper	112		7.4	BJ	5	UJ	5	UJ	5	UJ	5	UJ
Iron	90,300		10.2	B	3,160		28.6	B	2,100		247	
Lead	57.5	J	1	UJ	6	J	1.9	BJ	4.4	J	6.1	J
Magnesium	226,000		45,100		46,800		44,200		44,900		40,800	
Manganese	2,110		77.3		232		14.2		49.7		9.8	B
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	170		16	U	46.9		41.2		16.3	B	16	U
Potassium	15,400		2,130		1,380	B	1,230	B	1,380	B	803	B
Selenium	4	UJ	2	UJ	2	UJ	4	UJ	2	UJ	2	UJ
Silver	4	U	4	U	4	U	4	U	4	U	4	U
Sodium	97,900		101,000		19,400		19,200		14,300		14,200	
Thallium	1	B	1	U	1	U		R	1	U	1	U
Vanadium	112		8	U	8	U	8	U	8	U	8	U
Zinc	298		12.9	B	11.1	B	11	U	11	U	11	U
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-3. Inorganic Chemical Results f Groundwater Samples, Southeast Rockford

Date Sampled	9-17-91		9-17-91		9-5-91		9-5-91		9-5-91		9-5-91	
Sample Number	MW9		MW9		MW103A		MW103A		MW103B		MW103B	
Inorganic Traffic Report Number	MEPD-98		MEPD-97		MEPD-01		MEPD-02		MEPD-03		MEPD-04	
Sample Type	Total		Dissolved		Total		Dissolved		Dissolved		Total	
Metals (ug/L)												
Aluminum	1,060		46.6	B	6000		100		32	U	94.6	B
Antimony	2.1	BJ	2	U	2	UJ	2	U	2	U	2	U
Arsenic	1	U	1	U	5.4		2	UJ	2	UJ	2	UJ
Barium	60.5		53.7		108		59.3		27.4	B	28.5	B
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium		R	0.1	U		R	0.11	BJ	0.1	U	0.1	U
Calcium	102,000		96,900		157,000		123,000		79,000		81,400	
Chromium	8	U	8	U	14.2		8	U	8	U	8	U
Cobalt	6	U	6	U	6	U	6	U	6	U	6	U
Copper	5	U	5	U	22.1		11.6		7.8	BJ	5	UJ
Iron	931		9.4	B	6920	J	24.2	BJ	6	UJ	16.8	BJ
Lead	6.2			R		R	1	U	1	U	1	U
Magnesium	46,100		42,900		80,700		63,600		37,300		37,600	
Manganese	146		108		329		108		14		14.8	
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	16	U	16	U	16	U	16	U	16	U	16	U
Potassium	1940	B	1830	B	3750		2050		549	BJ	444	UJ
Selenium	1	UJ	1	UJ		R	1	U	1	U	1	U
Silver	4	U	4	U	4	U	4	U	4	U	4	U
Sodium	18,500		18,500		55,700		53,400		6,470		6,700	
Thallium	1	U		R	1	U	1	U	1	U	1	U
Vanadium	8	UJ	8	UJ	9.4	B	8	U	9.2	B	8	UJ
Zinc	11	U	11	U	38.6		14.5	B	11	UJ	11	U
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-3. Inorganic Chemical Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-16-91		9-16-91		9-16-91		9-16-91		9-16-91		9-16-91	
Sample Number	MW30		MW30		MW17		MW17		MW21		MW21	
Inorganic Traffic Report Number	MEPD-88		MEPD-87		MEPD-90		MEPD-89		MEPD-94		MEPD-93	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum	67.7	B	52.2	B	47.3	BJ	61.6	BJ	47.9	BJ	54.9	BJ
Antimony	2	U	2	U	2	U	2	U	2	UJ	2.6	BJ
Arsenic	1	U	1	U	1	U	1	U	1	U	1	U
Barium	35.3	B	35.7	B	30.6	B	31.3	B	30.3	B	28.8	B
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Calcium	96,500		96,100		95,200		95,300		91,600		92,100	
Chromium	8	U	8	U	8	U	8	U	11.4		8	U
Cobalt	6	U	6	U	6	U	6	U	6	U	6	U
Copper	5	U	5	U	5	U	5	U	5	U	5	U
Iron	37.6	B	9.6	B	48.4	B	30.3	B	148		34.7	B
Lead		R		R		R	1	U		R	1	U
Magnesium	39,300		39,200		44,600		45,000		42,300		42,200	
Manganese	2	UJ	2	UJ	2	UJ	2	UJ	6.8	BJ	3.2	BJ
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	21.3	J	24.2	J	45.7	J	44.6	J	85.1		76.6	J
Potassium	1,560	B	1,670	B	1920	B	1,790	B	1,310	B	1,030	B
Selenium	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
Silver	4	U	4	U	4	U	4	U	4	U	4	U
Sodium	24,500		23,900		23,800		23,800		19,300		19,200	
Thallium	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	8	UJ	8	UJ	8	UJ	8	UJ	8	UJ	8	UJ
Zinc	11	U	11	U	11	U	11	U	11	U	11	U
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-3. Inorganic Chemical Results - Groundwater Samples, Southeast Rockford

Date Sampled	9-6-91		9-6-91		9-4-91		9-4-91		9-5-91		9-4-91	
Sample Number	MW105D		MW105D		MW101B		MW101A		MW102A		MW102B	
Inorganic Traffic Report Number	MEPD-23		MEPD-24		MEPH-01		MEPH-02		MEPH-04		MEPH-05	
Sample Type	Total		Dissolved		Dissolved		Total		Dissolved		Dissolved	
Metals (ug/L)												
Aluminum		R		R	57.6	BJ	167	J	3340	J	141	J
Antimony	2	U	2	U	2	U	2	U		R	2	U
Arsenic	4.2	BJ	2.9	BJ	2	U	2	U	12.3	J	2	U
Barium	46.1	B	45	B	26.1	B	28.5	B	91		35	B
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	0.1	BJ	0.79	J	0.1	U	0.1	U		R	0.12	BJ
Calcium	76,400		76,300		88,600		93,000		116,000		89,000	
Chromium	8	U	8	U	8	U	11.4		8.6	B	8	U
Cobalt	6	U	6	U	6	U	6	U	6	U	6	U
Copper	5	U	5.9	BJ	8.1	BJ		R	23	J	5	U
Iron	1060		991		14.1	B	368		5220		1040	
Lead	7.7	J	2	UJ	1	U	1	U		R	1	U
Magnesium	36400.0		36,100		41,300		42,000		56,100		42,300	
Manganese	79.6	J	77.1	J	3.3	BJ	12.2	J	667	J	84.1	J
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	16	U	16	U	16	U	16	U	19.1	B	16	U
Potassium	832	B	1020	B	1000	BJ		R	8190		584	B
Selenium	1	U		R	1	U	1	U		R	1	U
Silver	4	U	4	U	4	U	4	U	4	U	4	U
Sodium	7,370		7,240		10,800		15,100	J	117,000		6,360	
Thallium	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	8	U	8	U	8	U	8	U	8	U	8	U
Zinc	11	U	11	U	11	U	11	U	52.2		11	U
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-3. Inorganic Chemical Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-5-91		9-5-91		9-6-91		9-6-91		9-6-91		9-6-91	
Sample Number	MW103C		MW103C		MW104C		MW104C		MW105D		MW105D	
Inorganic Traffic Report Number	MEPD-05		MEPD-06		MEPD-07		MEPD-08		MEPD-21		MEPD-22	
Sample Type	Dissolved		Total		Dissolved		Total		Dissolved		Total	
Metals (ug/L)												
Aluminum	40.4	B	234		53.3	B	51	B	39.4	B	222	
Antimony	2	U	2	U	2	U	2	U	2	U	2	U
Arsenic	2	UJ	2	U	2	U	2	U	3.6	B	3.4	B
Barium	29.3	B	29	B	22.3	B	22.8	B	44.7	B	47	B
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	0.11	BJ	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Calcium	83,500		83,900		86,500		86,600		76,500		76,800	
Chromium	8	U	8	U	8	U	8	U	8	U	8	U
Cobalt	6	U	6.3	B	6	U	6	U	6	U	6	U
Copper		R		R	6.7	BJ	5.9	BJ	5	U	5.4	BJ
Iron	18.8	BJ	280	J	6	UJ	13.1	BJ	1020	J	1030	J
Lead	1	U	17.7		1	U	1	U	1	U	1	U
Magnesium	38,300		38,700		40,600		40,700		35,500		36,100	
Manganese	19.6		20.6		11.9		11.6		77.2		86.5	J
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	16	U	16	U	16	U	16	U	16	U	16	U
Potassium		R	799	BJ	558	BJ	444	UJ	831	BJ	615	BJ
Selenium	1	U	1	U	1	U	1	U	1	U	1	U
Silver	4	U	4	U	4	U	4	U	4	U	4	U
Sodium		R	9,980	J	4,970		4,950		7,080		8,000	
Thallium	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	8	U	8	U	8	U	8	U	8	U	8	U
Zinc	11	U	11	U	11	U	11	U	11	U	11	U
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-4. Semivolatile Organic Compound Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-4-91	9-4-91	9-4-91	9-4-91	9-5-91	9-5-91
Sample Number	MW101B	MW101A	MW102B	MW102C	MW102A	MW103A
Organic Traffic Report Number	EPS-02	EPS-04	EPS-08	EPS-10	EPS-05	EMF-17
Semivolatile Organics (ug/L)						
Isophorone						
2-Methylphenol						
4-Methylphenol						
2,4-Dimethylphenol						
Naphthalene						
2-Methylnaphthalene						
Diethylphthalate						
Di-n-butylphthalate	0.2 J					
Butylbenzylphthalate	2 J	0.7 J	1 J	1 J		
Bis (2-ethylhexyl) phthalate						
Di-n-octylphthalate						

Table I-3. Inorganic Chemical Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-4-91		9-4-91		9-5-91		9-4-91	
Sample Number	MW101B		MW101A		MW102A		MW102B	
Inorganic Traffic Report Number	MEPH-06		MEPH-07		MEPH-08		MEPH-09	
Sample Type	Total		Dissolved		Total		Total	
Metals (ug/L)								
Aluminum	879	J	32	UJ	103,000	J	41.8	BJ
Antimony	2	U	2	U		R	2	U
Arsenic	2	U	2	U	9.4	J	2	U
Barium	27.8	B	28.3	B	504	J	35.4	B
Beryllium	1	U	1	U	5.2	J	1	U
Cadmium	0.1	U	0.1	U		R	0.1	U
Calcium	89,700		91,600		628,000	J	91,100	
Chromium	8	U	8	U	225	J	8	U
Cobalt	6	U	6	U	75.6	J	6	U
Copper	6.3	BJ		R	163	J		R
Iron	540		16.4	B	162000	J	1090	
Lead	1	U	1	U		R	1	U
Magnesium	42,100		42,800		291,000	J	42,900	
Manganese	19.2	J	6.9	BJ	4420	J	87.2	J
Mercury	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	16	U	16	U	207	J	16	U
Potassium	706	BJ		R	33400	R		R
Selenium	1	U	1	U		R	1	U
Silver	4	U	4	U	4	UJ	4	U
Sodium	11,000		18,000	J	116,000	J		R
Thallium	1	U	1	U	3.1	J	1	U
Vanadium	8	U	8	U	173	J	8	U
Zinc	11	U	11	U	691	J	11	U
Cyanide	10	U	10	U	10	U	10	U

Table I-4. Semivolatile Organic Compound Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-6-91	9-6-91	9-6-91	9-6-91	9-6-91	9-9-91
Sample Number	MW105A	MW105C	MW105C-R	MW105D	MW105D-D	MW106A
Organic Traffic Report Number	EMF-33	EMF-34	EMF-37	EMF-39	EMF-41	EMF-44
Semivolatile Organics (ug/L)						
Isophorone			1 J			
2-Methylphenol						8 J
4-Methylphenol						54
2,4-Dimethylphenol						12
Naphthalene						7 J
2-Methylnaphthalene						1 J
Diethylphthalate						
Di-n-butylphthalate			0.3 J	0.3 J		10
Butylbenzylphthalate		0.9 J		1 J	2 J	
Bis (2-ethylhexyl) phthalate		0.4 J				
Di-n-octylphthalate						

Table I-4. Semivolatile Organic Compound Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-5-91	9-5-91	9-5-91	9-6-91	9-6-91	9-6-91
Sample Number	MW103B	MW103C	MW104A	MW104C	MW104B	MW105B
Organic Traffic Report Number	EMF-19	EMF-20	EMF-26	EMF-22	EMF-27	EMF-31
Semivolatile Organics (ug/L)						
Isophorone						
2-Methylphenol						
4-Methylphenol						
2,4-Dimethylphenol						
Naphthalene						
2-Methylnaphthalene						
Diethylphthalate						
Di-n-butylphthalate						
Butylbenzylphthalate	3 J	1 J	1 J	1 J	1 J	2 J
Bis (2-ethylhexyl) phthalate					1 J	
Di-n-octylphthalate						

Table I-4. Semivolatile Organic Compound Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-10-91	9-10-91	9-10-91	9-10-91	9-10-91	9-10-91
Sample Number	MW109C	MW109C-R	MW109A	MW108B	MW110A	MW108C
Organic Traffic Report Number	EPS-19	EPS-21	EPS-25	EPS-28	EPS-31	EPS-33
Semivolatile Organics (ug/L)						
Isophorone						
2-Methylphenol						
4-Methylphenol						
2,4-Dimethylphenol						
Naphthalene						
2-Methylnaphthalene						
Diethylphthalate						
Di-n-butylphthalate		0.4 J	5 J			
Butylbenzylphthalate		3 J				
Bis (2-ethylhexyl) phthalate		0.7 J				
Di-n-octylphthalate						

Table I-4. Semivolatile Organic Compound Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-9-91		9-9-91		9-9-91		9-9-91		9-9-91		9-9-91	
Sample Number	MW106B		MW107A		MW107B		MW107C		MW107B-D		MW106C	
Organic Traffic Report Number	EMF-45		EMF-48		EMF-50		EPS-12		EPS-15		EPS-17	
Semivolatile Organics (ug/L)												
Isophorone												
2-Methylphenol												
4-Methylphenol												
2,4-Dimethylphenol												
Naphthalene												
2-Methylnaphthalene												
Diethylphthalate							0.9	J				
Di-n-butylphthalate												
Butylbenzylphthalate	2	J			0.9	J	1	J			5	J
Bis (2-ethylhexyl) phthalate												
Di-n-octylphthalate											7	JC

Table I-4. Semivolatile Organic Compound Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-16-91		9-16-91		9-16-91		9-16-91		9-17-91		9-17-91	
Sample Number	MW17		MW17-R		MW21		MW21-D		MW12-D		DECON	
Organic Traffic Report Number	EPS-79		EPS-81		EPS-84		EPS-86		EMF-52		EPN-52	
Semivolatile Organics (ug/L)												
Isophorone			2	J								R
2-Methylphenol												R
4-Methylphenol												R
2,4-Dimethylphenol												R
Naphthalene												R
2-Methylnaphthalene												R
Diethylphthalate												R
Di-n-butylphthalate												R
Butylbenzylphthalate			6	JC					2	JC		R
Bis (2-ethylhexyl) phthalate			9	JC								R
Di-n-octylphthalate												R

Table I-4. Semivolatile Organic Compound Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-12-91		9-13-91		9-13-91		9-16-91		9-16-91		9-16-91	
Sample Number	MW26		MW24		MW15		MW22		MW16		MW30	
Organic Traffic Report Number	EPS-64		EPS-66		EPS-70		EPS-73		EPS-75		EPS-77	
Semivolatile Organics (ug/L)												
Isophorone												
2-Methylphenol												
4-Methylphenol												
2,4-Dimethylphenol												
Naphthalene												
2-Methylnaphthalene												
Diethylphthalate												
Di-n-butylphthalate												
Butylbenzylphthalate	1	JC	1	JC								
Bis (2-ethylhexyl) phthalate												
Di-n-octylphthalate												

Table I-4. Semivolatile Organic Compound Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-30-91	9-30-91	9-30-91	9-30-91	9-30-91	10-1-91
Sample Number	MWS32A	MWS23	MWS29	MWS29-R	MWS33	MWS33A
Organic Traffic Report Number	EPM-37	EPM-39	EPM-42	EPM-44	EPM-46	EPM-48
Semivolatile Organics (ug/L)						
Isophorone						
2-Methylphenol						
4-Methylphenol						
2,4-Dimethylphenol						
Naphthalene						
2-Methylnaphthalene						
Diethylphthalate						
Di-n-butylphthalate						
Butylbenzylphthalate						
Bis (2-ethylhexyl) phthalate		0.7 J				
Di-n-octylphthalate						

Table I-4. Semivolatile Organic Compound Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-10-91	9-11-91	9-11-91	9-11-91	9-11-91	9-11-91
Sample Number	MW108A	MW110B	MW110-D	MW110C	MW111A	MW111B
Organic Traffic Report Number	EPS-35	EPS-37	EPS-40	EPS-42	EPS-46	EPS-48
Semivolatile Organics (ug/L)						
Isophorone						
2-Methylphenol						
4-Methylphenol						
2,4-Dimethylphenol						
Naphthalene						
2-Methylnaphthalene						
Diethylphthalate						
Di-n-butylphthalate						
Butylbenzylphthalate		0.9 J	0.8 J			
Bis (2-ethylhexyl) phthalate						
Di-n-octylphthalate						

Table I-4. Semivolatile Organic Compound Results for Groundwater Samples, Southeast Rockford

Date Sampled	10-1-91	10-1-91	10-2-91	10-1-91	10-1-91	10-2-91
Sample Number	MWS10	MWS10D	MWS31A	MWS40	MWS40-R	MWS5
Organic Traffic Report Number	EPM-63	EPM-65	EPM-68	EPM-70	EPM-72	EPM-75
Semivolatile Organics (ug/L)						
Isophorone						
2-Methylphenol						58
4-Methylphenol						29
2,4-Dimethylphenol						
Naphthalene						
2-Methylnaphthalene						
Diethylphthalate						
Di-n-butylphthalate		0.7 J	0.5 J			0.6 J
Butylbenzylphthalate						
Bis (2-ethylhexyl) phthalate			1 J			
Di-n-octylphthalate						

Table I-4. Semivolatile Organic Compound Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-17-91		9-17-91		9-17-91		9-17-91		9-17-91		9-17-91	
Sample Number	MW9		MW12		MW29		MW31		MW31-R		MW32	
Organic Traffic Report Number	EPS-88		EPS-90		EPS-92		EPS-94		EPS-96		EPS-98	
Semivolatile Organics (ug/L)												
Isophorone									2	J		
2-Methylphenol												
4-Methylphenol												
2,4-Dimethylphenol												
Naphthalene												
2-Methylnaphthalene												
Diethylphthalate												
Di-n-butylphthalate												
Butylbenzylphthalate	2	JC	2	JC			1	J	3	J	1	J
Bis (2-ethylhexyl) phthalate											2	J
Di-n-octylphthalate												

Table I-5. Field Blank Results for Groundwa Samples - Organic Compounds, Southeast Rockford

Date Sampled	9-6-91		9-10-91		9-11-91		9-16-91		9-17-91		9-30-91	
Sample Number	MW105C-R		MW109C-R		MW111C-R		MW17-R		MW31-R		MWS29-R	
Sample Matrix	GW		GW		GW		GW		GW		GW	
Volatile Organics (ug/L)												
Methylene Chloride							5				3	BJ
Chloroform							2				10	
1,1,1-Trichloroethane	2		0.8	J			3					
Toluene	1											
Semivolatile Organics (ug/L)												
Isophorone	1	J			1	J	2	J	2	J		
Di-n-butylphthalate	0.3	J	0.4	J								
Butylbenzylphthalate			3	J	4	J	6	JC	3	J		
Bis (2-ethylhexyl) phthalate			0.7	J	1	J	9	JC				
Pesticides (ug/L)												
alpha-BHC			0.00094	JP	0.00045	JP			0.0023	JP	0.00033	JP
delta-BHC												
Heptachlor											0.0017	JB
Aldrin												
Heptachlor epoxide					0.0013	JP						
Endosulfan I									0.0017	JP		
Dieldrin									0.002	J		
4,4'-DDE					0.00061	JP			0.001	JP		
4,4'-DDD											0.0015	JP
alpha-Chlordane									0.0012	JP	0.00041	JPB
gamma-Chlordane									0.0015	JP	0.0004	JP

Table I-4. Semivolatile Organic Compound Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-30-91	10-1-91	10-1-91	10-1-91	10-1-91	10-1-91
Sample Number	MWS34A	MWS28A	MWS34	MWS9	MWS41	MWS37
Organic Traffic Report Number	EPM-50	EPM-51	EPM-55	EPM-57	EPM-59	EPM-61
Semivolatile Organics (ug/L)						
Isophorone						
2-Methylphenol						
4-Methylphenol						
2,4-Dimethylphenol						
Naphthalene						
2-Methylnaphthalene						
Diethylphthalate						
Di-n-butylphthalate						0.9 JC
Butylbenzylphthalate						
Bis (2-ethylhexyl) phthalate						0.6 J
Di-n-octylphthalate						

Table I-6. Field Blank Results for Groundwater Samples - Inorganic Constituents, Southeast Rockford

Date Sampled	9-10-91		9-10-91		9-11-91		9-11-91		9-6-91		9-6-91	
Sample Number	MW109C-R		MW109C-R		MW111C-R		MW111C-R		MW105C-R		MW105C-R	
Inorganic Traffic Report Number	MEPD-42		MEPD-41		MEPD-68		MEPD-67		MEPD-20		MEPD-19	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum	32	U	32	U	NA		32	U	32	U	32	U
Antimony	2	U	2	U	NA		2	U	2	UJ	2	UJ
Arsenic	1	U	1	U	NA		1	U	1	U	1	U
Barium	2	U	2	U	NA		2	U	2	U	2	U
Beryllium	1	U	1	U	NA		1	U	1	U	1	U
Cadmium	0.1	U	0.1	U	NA		0.1	U	0.1	U	0.1	U
Calcium	174	B	235	B	NA		299	B		R		R
Chromium	8	U	8	U	NA		8	U	8	U	8	U
Cobalt	6	U	6	U	NA		6	U	6	U	6	U
Copper	5	U	17.8		NA		5	U		R		R
Iron	8	B	6	U	NA		15.90	B	6	U	6	U
Lead	1	U	1	U	NA		1	U	1	U	1	U
Magnesium	74	U	74	U	NA		74	U	74	U	74.6	B
Manganese	2	U	2	U	NA		2	U	2	U	2	U
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	16	U	16	U	NA		16	U	16	U	16	U
Potassium	444	U	444	U	NA		444	U		R		R
Selenium	2	U	2	U	NA		2	U	1	U	1	U
Silver	4	U	4	U	NA		4	U	4	UJ	4	UJ
Sodium	178	B	542	B	NA		140	U		R		R
Thallium	1	U	1	U	NA		1	U	1	U	1	U
Vanadium	8	U	8	U	NA		8	U	8	UJ	8	UJ
Zinc	11	U	11	U	NA		11	U	11	U	11	U
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

NA-Constituent not analyzed because aliquots were sent for mercury and cyanide only

Table I-4. Semivolatile Organic Compound Results for Groundwater Samples, Southeast Rockford

Date Sampled	10-2-91	10-2-91
Sample Number	MWS32	MWS32-D
Organic Traffic Report Number	EPM-77	EPM-79

Semivolatile Organics (ug/L)				
Isophorone				
2-Methylphenol				
4-Methylphenol				
2,4-Dimethylphenol				
Naphthalene				
2-Methylnaphthalene				
Diethylphthalate				
Di-n-butylphthalate	0.8	J		
Butylbenzylphthalate				
Bis (2-ethylhexyl) phthalate				
Di-n-octylphthalate				

Table I-7. Trip Blank Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-5-91		9-10-91									
Sample Number	Trip Blank		Trip Blank		Trip Blank		Trip Blank		Trip Blank		Trip Blank	
Organic Traffic Report Number	EMF-24		EPS-13		EPS-20		EPS-29		EPS-38		EPS-59	
Volatile Organics (ug/L)												
Methylene Chloride	1	BJ	1	BJ	2		2		1	J	3	B
Acetone												
1,1-Dichloroethene												
1,1-Dichloroethane												
cis-1,2-Dichloroethene												
trans-1,2-Dichloroethene												
Chloroform												
1,2-Dichloroethane												
1,1,1-Trichloroethane												
Trichloroethene												
1,1,2-Trichloroethane												
Tetrachloroethene												
Toluene												

Table I-5. Field Blank Results for Groundwater Samples - Organic Compounds, Southeast Rockford

Date Sampled	10-1-91
Sample Number	MWS40-R
Sample Matrix	GW

Volatile Organics (ug/L)		
Methylene Chloride	8	BJ
Chloroform	10	
1,1,1-Trichloroethane		
Toluene		
Semivolatile Organics (ug/L)		
Isophorone		
Di-n-butylphthalate		
Butylbenzylphthalate		
Bis (2-ethylhexyl) phthalate		
Pesticides (ug/L)		
alpha-BHC		
delta-BHC	0.0026	JP
Heptachlor		
Aldrin	0.00097	JPB
Heptachlor epoxide		
Endosulfan I		
Dieldrin		
4,4'-DDE		
4,4'-DDD	0.0014	JP
alpha-Chlordane	0.0006	JP
gamma-Chlordane		

Table I-7. Trip Blank Results for Groundwater Samples, Southeast Rockford

Date Sampled						9/4/91						
Sample Number	Trip Blank		Trip Blank		Trip Blank		Trip Blank		Trip Blank		Trip Blank	
Organic Traffic Report Number	EPM-53		EPM-66		EPS71		EPM73		EPM80		EMF15	
Volatile Organics (ug/L)												
Methylene Chloride	4	BJ	4	B	3						3	J
Acetone												
1,1-Dichloroethene												
1,1-Dichloroethane												
cis-1,2-Dichloroethene												
trans-1,2-Dichloroethene												
Chloroform												
1,2-Dichloroethane												
1,1,1-Trichloroethane												
Trichloroethene												
1,1,2-Trichloroethane												
Tetrachloroethene												
Toluene												

Table I-6. Field Blank Results for Groundwater Samples - Inorganic Constituents, Southeast Rockford

Date Sampled	9/17/91		9-17-91		9-16-91		9-16-91	
Sample Number	MW31-R		MW31-R		MW17-R		MW17-R	
Inorganic Traffic Report Number	MEMR-60		MEMR-59		MEPD-92		MEPD-91	
Sample Type	Total		Dissolved		Total		Dissolved	
Metals (ug/L)								
Aluminum	32	UJ	32	UJ	46.2	B	32	U
Antimony	2	U	2	U	2	U	2	U
Arsenic	2	U	2	U	1	U	1	U
Barium	2	U	2	U	2	U	2	U
Beryllium	1	U	1	U	1	U	1	U
Cadmium	0.1	U	0.1	U	0.1	U	0.1	U
Calcium	242	B	224	B	143	B	219	B
Chromium	8	U	8	U	8	U	8	U
Cobalt	6	UJ	8	BJ	6	U	6	U
Copper	5.2	B	5	U		R		R
Iron	6	U	6	U	6	U	6	U
Lead	1	U	1	U		R		R
Magnesium	74	U	74	U	74	U	74	U
Manganese	2.6	B	2.6	B	2	UJ	2	UJ
Mercury	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	16	U	16	U	16	U	16	U
Potassium	444	U	444	U	444	U	1,900	B
Selenium	2	U	2	U	1	UJ	1	UJ
Silver	4	U	4	U	4	B	4	U
Sodium	140	UJ	181	BJ		R		R
Thallium	1	U	1	U	1	U	1	U
Vanadium	8	U	8	U	8	UJ	8	UJ
Zinc	11	U	11	U	11	U	11	U
Cyanide	10	U	10	U	10	U	10	U

Table I-8. Duplicate Results for Groundwater Samples - Inorganic Constituents, Southeast Rockford

Date Sampled	9-11-91		9-11-91		9-10-91		9-10-91		9-17-91		9-17-91	
Sample Number	MW110B-D		MW110B-D		MW110B-D		MW110B-D		MW12-D		MW12-D	
Inorganic Traffic Report Number	MEPD-58		MEPD-57		MEPD-56		MEPD-55		MEMR-64		MEMR-63	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum	1,840	J	224		4,790	J	284		41	BJ	32	UJ
Antimony	2	U	2	U	2	UJ	2	U	2	U	2	U
Arsenic	1	U	2.1	B	3	BJ	1	UJ	2	U	2	U
Barium	64.3		55.8		81.1		54.3		16.2	B	15.8	B
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	0.11	B	0.26	B		R	0.16	BJ	0.1	U	0.1	U
Calcium	79,300		75,500		80,200		74,200		63,100		63,100	
Chromium	8	U	8	U	8	U	8	U	8	U	8	U
Cobalt	6	U	6	U	6	U	6	U	6	U	6	U
Copper	5	UJ	5	UJ	5	UJ	5	U	5	U	5	U
Iron	1,110	J	154		2,970	J	187		231	J	262	J
Lead	1	B	1	U		R		R	1	U	1	U
Magnesium	41,000		39,000		43,100		38,600		25,100		25,000	
Manganese	67.2		46.6		95.8		46.7		6.3	B	5.8	B
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	16	UJ	16	UJ	16	UJ	16	UJ	16	U	16	U
Potassium	1,440	B	1,540	B	2,030		1,790	B	1,190	BJ	1,330	BJ
Selenium	2	U		R	2	U	2	U	2	UJ	2	UJ
Silver	4	U	4	U	4	U	4	U	4	U	4	U
Sodium	99,800		102,000		112,000		101,000		9,450		9,640	
Thallium	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	8	UJ	8	UJ	8	UJ	8	UJ	8	U	8	U
Zinc	41.5		17.7	B	33.7		26.8		11	UJ	12.9	BJ
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-7. Trip Blank Results for Groundwater Samples, Southeast Rockford

Date Sampled		9-17-91	9-18-91	9-19-91		9-30-91
Sample Number	Trip Blank	Trip Blank	Trip Blank	Trip Blank	Trip Blank	Trip Blank
Organic Traffic Report Number	EPS-60	EPS-82	EPM-35	EPM-33	EPM-34	EPM-40
Volatile Organics (ug/L)						
Methylene Chloride	4 B	4	4 B		4 B	4 J
Acetone						
1,1-Dichloroethene						
1,1-Dichloroethane						
cis-1,2-Dichloroethene						
trans-1,2-Dichloroethene						
Chloroform						
1,2-Dichloroethane						
1,1,1-Trichloroethane						
Trichloroethene						
1,1,2-Trichloroethane						
Tetrachloroethene						
Toluene						

Table I-8. Duplicate Results for Groundwater Samples - Inorganic Constituents, Southeast Rockford

Date Sampled	9-16-91		9-16-91		9-16-91		9-16-91	
Sample Number	MW21-D		MW21-D		MW21-D		MW21-D	
Inorganic Traffic Report Number	MEPD-96		MEPD-95		MEPD-94		MEPD-93	
Sample Type	Total		Dissolved		Total		Dissolved	
Metals (ug/L)								
Aluminum	43	B	34.7	B	47.9	BJ	54.9	BJ
Antimony	2	UJ	2.3	BJ	2	UJ	2.6	BJ
Arsenic	1	U	1	U	1	U	1	U
Barium	29.1	B	28.8	B	30.3	B	28.8	B
Beryllium	1	U	1	U	1	U	1	U
Cadmium	0.1	U	0.1	U	0.1	U	0.1	U
Calcium	93,900		92,000		91,600		92,100	
Chromium	8	U	8	U	11.4		8	U
Cobalt	6	U	6	U	6	U	6	U
Copper	5	U	5	U	5	U	5	U
Iron	111		33.6	B	148		34.7	B
Lead		R		R		R	1	U
Magnesium	43,000		42,400		42,300		42,200	
Manganese	4.3	BJ	5.6	BJ	6.8	BJ	3.2	BJ
Mercury	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	81.1	J	89.7	J	85.1		76.6	J
Potassium	1,230	B	1,300	B	1,310	B	1,030	B
Selenium	1	UJ	1	UJ	1	UJ	1	UJ
Silver	4	U	4	U	4	U	4	U
Sodium	19,300		19,500		19,300		19,200	
Thallium	1	U	1	U	1	U	1	U
Vanadium	8	UJ	8	UJ	8	UJ	8	UJ
Zinc	11	U	11	U	11	U	11	U
Cyanide	10	U	10	U	10	U	10	U

Table I-7. Trip Blank Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-6-91
Sample Number	Trip Blank
Organic Traffic Report Number	EMF29

Volatile Organics (ug/L)

Methylene Chloride	3	J
Acetone	9	J
1,1-Dichloroethene		
1,1-Dichloroethane		
cis-1,2-Dichloroethene		
trans-1,2-Dichloroethene		
Chloroform		
1,2-Dichloroethane		
1,1,1-Trichloroethane		
Trichloroethene		
1,1,2-Trichloroethane		
Tetrachloroethene		
Toluene		

Table I-9. TDS and TSS Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-4-91	9-4-91	9-5-91	9-4-91	9-4-91	9-5-91
Sample Number	MW101B	MW101A	MW102A	MW102B	MW102C	MW103A
Inorganic Traffic Report Number	6670E-01	6670E-02	6670E-03	6670E-04	6670E-05	6670E-06
Total Dissolved Solids & Total Suspended Solids (mg/L)						
Total Dissolved Solids	450.00	458.00	799.00	429.00	407.00	492.00
Total Suspended Solids	8.50	3.00	4750.00	1.50	4.00	258.00

Table I-8. Duplicate Results for Groundwater Samples - Inorganic Constituents, Southeast Rockford

Date Sampled	9-17-91		9-17-91		9-9-91		9-9-91		9-9-91		9-9-91	
Sample Number	MW12-D		MW12-D		MW107B-D		MW107B-D		MW107B-D		MW107B-D	
Inorganic Traffic Report Number	MEMR-54		MEMR-53		MEPD-36		MEPD-35		MEPD-32		MEPD-25	
Sample Type	Total		Dissolved		Total		Dissolved		Total		Dissolved	
Metals (ug/L)												
Aluminum		R		R	287		32	U	351		32	U
Antimony		R		R	2	U	2	U	4	UJ	2	U
Arsenic	1.2	BJ	1	BJ	1	U	1	U	1	U	1	U
Barium	16.3	B	17.2	B	23.4	B	22.9	B	24	B	22.6	B
Beryllium	1	U	1	U	1	U	1	U	1	U	1	U
Cadmium	0.1	U		R	0.1	U	0.1	U	0.1	U	0.1	U
Calcium	63,900		62,700		92,200		90,900		91,900		93,100	
Chromium	8	U	8	U	8	U	8	U	8	U	8	U
Cobalt	6	U	6	U	6	U	6	U	6	U	6	U
Copper	5	U	5	U	5	U	5	U	6.3	B	5	U
Iron	248		90.4	B	666		6	U	865		6	U
Lead		R		R	1	U	1	U	1	U	1	U
Magnesium	26,200		26,100		44,100		43,600		44,300		43,400	
Manganese	2	UJ	2	UJ	45.6		36.3	J	48.5		36.8	J
Mercury	0.2	U	0.2	U	0.2	UJ	0.2	UJ	0.2	UJ	0.2	UJ
Nickel	19.3	BJ	16	U	16	U	16	U	16	U	16	U
Potassium	1,520	B	1,460	B	444	U	720	B	661	B	699	B
Selenium	1.4	BJ	1.6	BJ		R		R		R		R
Silver	4	U	4	U	4	U	4	U	4	U	4	U
Sodium	9,240		9,420		7,470		7,580		7,410		7,410	
Thallium	1	U	1	U	1	U	1	U	1	U	1	U
Vanadium	8	UJ	8	UJ	8	U	8	U	8	U	8	U
Zinc	11	U	11	U	11	U	11	U	11	U	11	U
Cyanide	10	U	10	U	10	U	10	U	10	U	10	U

Table I-9. TDS and TSS Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-6-91		9-6-91		9-6-91		9-6-91		9-6-91		9-9-91	
Sample Number	MW105A		MW105C		MW105C		MW105D		MW105D-D		MW106A	
Inorganic Traffic Report Number	6670E-13		6670E-14		6670E-15		6670E-16		6670E-17		6670E-18	
Total Dissolved Solids & Total Suspended Solids (mg/L)												
Total Dissolved Solids	422.00		459.00		500.00		365.00		359.00		492.00	
Total Suspended Solids	3640.00		10.50		0.50	U	7.00		5.50		144.00	

Table I-9. TDS and TSS Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-10-91		9-10-91		9-10-91		9-10-91		9-10-91		9-10-91	
Sample Number	MW109C		MW109C-R		MW109B		MW109A		MW108B		MW110A	
Inorganic Traffic Report Number	6670E-25		6670E-26		6670E-27		6670E-28		6670E-29		6670E-30	
Total Dissolved Solids & Total Suspended Solids (mg/L)												
Total Dissolved Solids	400.00		851.00		472.00		684.00		462.00		851.00	
Total Suspended Solids	1.50		0.50	U	0.50	U	5820.00		0.50	U	1268.00	

Table I-9. TDS and TSS Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-5-91	9-5-91	9-6-91	9-5-91	9-6-91	9-6-91
Sample Number	MW103B	MW103C	MW104-C	MW104A	MW104B	MW105B
Inorganic Traffic Report Number	6670E-07	6670E-08	6670E-09	6670E-10	6670E-11	6670E-12

Total Dissolved Solids & Total Suspended Solids (mg/L)

Total Dissolved Solids	498.00	567.00	460.00	359.00	471.00	491.00
Total Suspended Solids	1.50	4.00	2.50	908.00	2.00	1.50

Table I-9. TDS and TSS Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-11-91	9-11-91	9-11-91	9-12-91	9-12-91	9-12-91
Sample Number	MW111B	MW111C	MW111C-R	MW11	MW27	MW28
Inorganic Traffic Report Number	6670E-37	6670E-38	6670E-39	6670E-40	6670E-41	6670E-42
Total Dissolved Solids & Total Suspended Solids (mg/L)						
Total Dissolved Solids	407.00	306.00	19.00	698.00	460.00	424.00
Total Suspended Solids	3.50	16.00	1.00	5028.00	11.00	51.00

Table I-9. TDS and TSS Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-10-91	9-10-91	9-11-91	9-11-91	9-11-91	9-11-91
Sample Number	MW108C	MW108A	MW110B	MW110B-D	MW110C	MW111A
Inorganic Traffic Report Number	6670E-31	6670E-32	6670E-33	6670E-34	6670E-35	6670E-36
Total Dissolved Solids & Total Suspended Solids (mg/L)						
Total Dissolved Solids	336.00	537.00	660.00	665.00	332.00	441.00
Total Suspended Solids	11.00	732.00	168.00	61.00	0.50 U	1964.00

Table I-9. TDS and TSS Results fo[illegible] [illegible]roundwater Samples, Southeast Rockford

Date Sampled	9-16-91		9-16-91		9-16-91		9-16-91		9-16-91		9-16-91	
Sample Number	MW16		MW30		MW17		MW17-R		MW21		MW21-D	
Inorganic Traffic Report Number	6670E-49		6670E-50		6670E-51		6670E-52		6670E-53		6670E-54	
Total Dissolved Solids & Total Suspended Solids (mg/L)												
Total Dissolved Solids	439.00		466.00		558.00		19.00		502.00		508.00	
Total Suspended Solids	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U

Table I-9. TDS and TSS Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-12-91	9-12-91	9-13-91	9-13-91	9-16-91	9-16-91
Sample Number	MW23	MW26	MW24	MW15	MW20	MW22
Inorganic Traffic Report Number	6670E-43	6670E-44	6670E-45	6670E-46	6670E-47	6670E-48
Total Dissolved Solids & Total Suspended Solids (mg/L)						
Total Dissolved Solids	472.00	514.00	477.00	522.00	20.00	468.00
Total Suspended Solids	0.50 U	1.50	0.50	69.00	0.50 U	17.00

Table I-9. TDS and TSS Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-17-91		9-17-91	
Sample Number	MW12-D		DECON	
Inorganic Traffic Report Number	6670E-61		6670E-62	
Total Dissolved Solids & Total Suspended Solids (mg/L)				
Total Dissolved Solids	287.00		303.00	
Total Suspended Solids	0.50		0.50	U

Table I-9. TDS and TSS Results for Groundwater Samples, Southeast Rockford

Date Sampled	9-17-91	9-17-91	9-17-91	9-17-91	9-17-91	9-17-91
Sample Number	MW9	MW18	MW29	MW31	MW31-R	MW32
Inorganic Traffic Report Number	6670E-55	6670E-56	6670E-57	6670E-58	6670E-59	6670E-60
Total Dissolved Solids & Total Suspended Solids (mg/L)						
Total Dissolved Solids	514.00	302.00	477.00	492.00	30.00	695.00
Total Suspended Solids	17.00	0.50 U	0.50 U	0.50 U	0.50 U	2332.00