6-MONTH ASSESSMENT REPORT GROUNDWATER EXTRACTION, TREATMENT AND DISCHARGE SYSTEM

Marathon Electric Manufacturing Company
Wausau, Wisconsin

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CONESTOGA-ROVERS & ASSOCIATES

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1.0 INTRODUCTION

In accordance with a Consent Decree, entered with the court on September 9, 1989, Marathon Electric Manufacturing Company (Marathon) proceeded with an extraction well and associated treatment/discharge outlet installation. The purpose of the extraction well is to create a cone of depression capable of containing an identified volatile organic compound (VOC) contaminant plume source in order to prevent further migration toward City production wells. The primary VOC contaminants have been identified as trichloroethene and 1,2-dichloroethene.

The extraction well (EW1) and associated treatment/discharge structures were installed at the Marathon facility between June 1, 1990 and September 28, 1990. The extraction well treatment and discharge system commenced operation on November 14, 1990. The facility is located along the west side of the Wisconsin River within the City of Wausau. Regional and Site location maps are shown on Figures 1.1 and 1.2, respectively. The locations of the extraction well and existing monitoring wells are shown on Figure 1.3.

This 6-Month Assessment Report has been prepared in accordance with the March 1990 Remedial Action Plan (RAP) and summarizes all activities associated with the installation and operation of the groundwater extraction, treatment and discharge system during the first six months of operation, and provides an assessment toward achieving overall objectives of source reduction and control. Section 2.0 summarizes the installation and pump testing of extraction well EW1. Section 3.0

summarizes the well operation and monitoring data. Section 4.0 provides an assessment of the groundwater extraction and treatment system based on the monitoring data collected during the first six months of operation.

2.0 WELL INSTALLATION AND PUMP TESTING

2.1 WELL INSTALLATION

On July 19, 1990, E.H. Rener and Sons Drilling of Elk River, Minnesota, began drilling the extraction well EW1. A 24-inch diameter borehole and steel casing were advanced to the top of the weathered granite, 143.5 feet below ground surface. Soil samples were collected from the drill cuttings at 5-foot intervals for stratigraphic and grain size determination. A 40-foot, 0.02-inch slot, 16-inch diameter well screen with a #20 size sand pack was installed. The screen was welded to a 16-inch diameter, Schedule 40 steel casing which extends from the top of the screen to approximately ground surface.

The details of the well installation were provided in the report entitled "Extraction Well No. 1 Well Installation and Pump Testing, Marathon Electric Manufacturing Company, Wausau, Wisconsin", prepared by Conestoga-Rovers & Associates (CRA) and dated December 14, 1990 (CRA's 1990 report). A copy of the report is included in Appendix A.

2.2 PUMP TESTING

On August 15, 1990, following a three-step pump test, a 24-hour constant rate test pumping program was conducted in extraction well EW1. The details of this test pumping program are provided in CRA's 1990 report presented in Appendix A.

The 24-hour test pumping program was conducted at an average discharge rate of 1,695 gallons per minute. A comprehensive monitoring network consisting of monitoring wells EW1, W52, W52A, C2S, C7S, R4DS, WSWS, WSWD and the Wisconsin River was monitored throughout the pump test.

The geometric means of the transmissivity and storativity values obtained from the test pumping program were determined to be 122,230 gal/day/ft (735 m^2/day) and 4.73 x 10^{-3}, respectively. These values were significantly lower than the transmissivity values ranging from 247,000 gal/day/ft to 716,000 gal/day/ft and the storativity value of 0.24 reported in the document entitled, "Remedial Investigation Report, Wausau Water Supply NPL Site, Wausau, Wisconsin", prepared by Warzyn Engineering Inc. and dated July 28, 1989 (1989 RI Report).

3.0 WELL OPERATION

The groundwater extraction, treatment and discharge system commenced operation on November 14, 1990. Groundwater hydraulic monitoring and sampling have been performed in accordance with the Groundwater Monitoring Program (GMP) and are discussed in the following subsections.

3.1 HYDRAULIC MONITORING

Hydraulic monitoring commenced on November 13, 1990, prior to system startup. Piezometric elevations of the monitored wells for each sampling event are presented in Table 3.1. Shallow well and deep well piezometric elevation contours have been plotted for selected monitoring events and are included in Appendix B.

It is noted that wells IWD, IWM and IWS located on the island were not monitored from November 26, 1990 to April 1, 1991 because they were inaccessible due to weather conditions.

Additional monitoring wells W56, W56A, MW1A, GM1S, MW1, MW2 and MW3 were included in the water level monitoring network beginning in January 1991 in order to more accurately delineate the extent of the cone of depression created by the pumping of extraction well EW1. Monitoring wells MW1, MW2 and MW3 were added to evaluate whether a potential source of groundwater contamination located to the south of the

Marathon property/former City landfill area was being captured by EW1. Monitoring wells MW1A, GM1S, W56 and W56A were added to better define the cone of depression north of EW1 and south of City production well 6 (CW6).

Evaluation of hydraulic monitoring data collected during the first month of operation of the system indicated that the initial pumping rate of approximately 1,550 gpm at extraction well EW1 was creating a larger than necessary cone of depression. The progressive expansion of the cone of depression indicated a potential interference with City production well CW6 and a potential capture of contaminated groundwater south of the Marathon property/former City landfill area. Based on the August 15, 1991 EW1 pump test data, CRA calculated that the pumping rate of EW1 should range between 415 and 800 gpm in order to minimize well interference with CW6 and potential capture of contaminants south of the Marathon property/former City landfill area. The details of this evaluation were provided in the report entitled "Evaluation of the Pumping Rate in Extraction Well No. 1", prepared by CRA and dated January 16, 1991, which is included in Appendix C. The pumping rate was reduced to approximately 800 gpm on January 31, 1991, with written approval provided by the USEPA (Appendix D).

It is to be noted that after the pumping rate was reduced on January 31, 1991, the hydraulic monitoring events were increased from twice per month (as specified in the GMP) to weekly events until May 6, 1991. After the May 6, 1991 sampling event, the hydraulic monitoring events proceeded according to the schedule defined in the GMP.

3.2 GROUNDWATER SAMPLING

Groundwater sampling has proceeded according to the GMP. Table 3.2 summarizes the sampling events for the monitoring wells (C2S, C4D, R2D, R4D, 252, W53A, 253, W54, W55, WSWD, IWD), City production wells (CW3, CW6, CW7, CW9), and extraction well EW1.

It should be noted that monitoring well C2S went dry on November 26, 1990 and the pump was subsequently removed on March 4, 1991. Monitoring well IWD, located on the island, was not sampled between December 4, 1990 and April 2, 1991 due to weather conditions.

On January 21, 1991, the Force Majeure clause specified in the Consent Decree, Section XII, was invoked due to the closure of Radian Laboratory's commercial laboratory. The extraction well samples scheduled for January 21, 1991 were, therefore, omitted from the schedule and the sampling activities originally scheduled for February 4 and 5, 1991 were delayed until February 12 and 13, 1991. These changes were approved by the USEPA (Appendix D). S-Cubed, a Division of Maxwell Laboratories Inc., of San Diego, California, a USEPA approved Contract Laboratory Program (CLP), laboratory was retained on February 5, 1991 to perform subsequent analyses.

3.2.1 Analytical Results

Groundwater samples analyzed for TCL VOCs are summarized on Tables 3.3 to 3.15. In addition, six groundwater samples were collected from monitoring wells C4D, W52, W53A, W54, and EW1 (influent and effluent) on December 3, 1991 for full TCL and TAL analyses. Tables 3.16, 3.17 and 3.18 summarize metals, pesticide/PCB and BNA data for the six locations sampled on December 3, 1991. QA/QC reviews of all the analytical data were performed by CRA and are included in Appendix E. Appropriate data qualifiers have been added to the data summarized on Tables 3.3 through 3.18.

Based on the results of the first round of TCL/TAL analyses on December 3, 1990, there was a possible exceedance of copper and zinc in the discharge stream of the extraction well. The WDNR requested that a sample be collected from the extraction well EW1 discharge and analyzed for metals to determine if there was an exceedance of copper and zinc. Effluent samples were collected on January 30, 1991 and February 6, 1991 for copper and zinc analyses, and the analytical data indicated that copper and zinc concentrations in the effluent were far below the water quality limits. In addition, the six sampling locations previously sampled for complete TCL/TAL analyses were resampled for TAL metals on the March 4, 1991 sampling event. The analytical results are also summarized on Table 3.16. The second round of TAL metals analyses confirms that both copper and zinc concentrations are below the maximum allowable effluent limits for copper (36 μg/L) and zinc (220 μg/L).

4.0 ASSESSMENT OF GROUNDWATER EXTRACTION AND TREATMENT SYSTEM

4.1 HYDRAULIC CONTAINMENT

Figures 4.1 to 4.8 depict the shallow well and deep well piezometric contours prior to system startup, before and after the pumping rate was reduced from approximately 1,550 gpm to 800 gpm on January 31, 1991, and for the most recent hydraulic monitoring event on June 27, 1991. These figures indicate that the cone of depression created by the 1,550 gpm pumping rate extended beyond the desired area of influence defined by the contaminant plume as described in the 1989 RI Report. Furthermore, the cone of depression was causing potential interference with City production well CW6 and capture of potentially contaminated groundwater south of the Marathon property/former City landfill area.

The desired cone of depression for extraction well EW1 is defined approximately by the area north of monitoring wells C4S/C4D, southeast of monitoring wells R1S/R1D, northwest of the island monitoring wells, and south of the monitoring wells R2S/R2D. After the pumping rate was reduced to approximately 800 gpm on January 31, 1991, the shallow and deep well piezometer contours indicate that the desired cone of depression created by EW1 is currently being achieved.

The hydrographs for the monitoring well nests C4S/C4D, R1S/R1D, R3S/R3D, W52A/W52 and WSWS/WSWD, as shown on Figures 4.9 to 4.13 indicate that, during the spring, following the reduction in the pumping rate of EW1 to approximately 800 gpm, the water levels in these monitoring wells began levelling off. Therefore, the cone of depression created by the pumping of EW1 is not expected to change significantly from its present state.

4.2 CONTAMINANT EXTRACTION AND TREATMENT

Since the groundwater extraction, treatment and discharge system began operation on November 14, 1990, approximately 150 pounds of 1,2-dichloroethene and 1,140 pounds of trichloroethene have been extracted from the contaminant plume up to and including July 10, 1991. These values have been calculated assuming constant parameter concentrations between sampling events in conjunction with the EW1 influent VOC analytical results (Table 3.14) and the corresponding EW1 pumping rate.

The EW1 influent concentrations of trichloroethene (Table 3.14) have consistently ranged between 300 μg/L and 500 μg/L, indicating that the extraction well is effectively capturing the high concentration areas of the contaminant plume.

Based on the VOC analytical data for the EW1 influent and effluent (Tables 3.14 and 3.15), the passive VOC stripping rip rap discharge structure has a removal efficiency of approximately 28% for the primary contaminants, trichloroethene and 1,2-dichloroethene . The average concentrations of trichloroethene and 1,2-dichloroethene discharged to the Wisconsin River during the first six months of system operation were approximately 265 μg/L and 51 μg/L respectively. These concentrations are well below the maximum water quality effluent limits of 41,000 μg/L for trichloroethene, and 120,000 μg/L for 1,2-dichloroethene as specified in Table 3.1 of the RAP.

The extraction well EW1 effluent concentrations of 1,2-dichloroethene and trichloroethene on the last sampling date, May 6, 1991, are significantly higher than their corresponding influent concentrations (Tables 3.14 and 3.15). These effluent concentrations are considered to be anomalies.

Concentrations versus time plots for the primary contaminants, trichloroethene and 1,2-dichloroethene, have been plotted for selected wells and are presented in Appendix F. It should be noted that monitoring wells R2D, W52, W55 and IWD have concentration versus time plots which indicate increasing parameter concentrations during specific time periods. This is due to areas of high concentration in the contaminant plume being drawn through these monitoring wells.

As indicated on Tables 3.17 and 3.18 there were no pesticides/PCBs or BNAs detected above CLP detection limits in the six locations sampled. As indicated on Table 3.16, the following metals were not detected, or are far below the water quality effluent limits defined in Table 3.1 of the RAP, in the six locations sampled: aluminum, antimony, arsenic, chromium, mercury, nickel, thallium, and cyanide.

5.0 SUMMARY

When the extraction well EW1 pumping rate of approximately 1,550 gpm was in effect between November 14, 1990 and January 30, 1991, the resulting cone of depression was extensive, causing potential interference with City production well CW6 and capture of potentially contaminated groundwater south of the Marathon property/former City landfill area. Subsequent to reducing the pumping rate to approximately 800 gpm on January 31, 1991, the water level monitoring data indicates that the desired cone of depression is presently being achieved and is stabilizing.

The groundwater sample analyses indicate that approximately 150 pounds of 1,2-dichloroethene and 1,140 pounds of trichloroethene have been extracted from the VOC contaminant plume between November 14, 1990 and July 10, 1991. The EW1 influent concentrations have consistently ranged between 300 µg/L and 500 µg/L, indicating that the extraction well is effectively capturing the high concentration areas of the contaminant plume.

The treatment/discharge structure has been removing primary contaminants at an efficiency of approximately 28%, and the discharge concentrations of the primary contaminants are three orders of magnitude below the water quality effluent limits of 41,000 µg/L for trichloroethene and 120,000 µg/L for 1,2-dichloroethene.

It is recommended that the current extraction well pumping rate of approximately 800 gpm be maintained unless significant changes in the cone of depression are detected in future water level monitoring data or if groundwater modelling to be performed as part of the final remedy for the Wausau Superfund Site indicates that an alternate pumping rate will optimize VOC removal.

It is also recommended that the annual sampling of the six locations (C4D, W52, W53A, W54 and EW1 (influent/effluent)) be reduced to include only TCL VOCs and the following selected metals: barium, beryllium, cadium, cobalt, copper, iron, lead, magnesium, manganese, potassium, selenium, silver, sodium, vandium, and zinc.

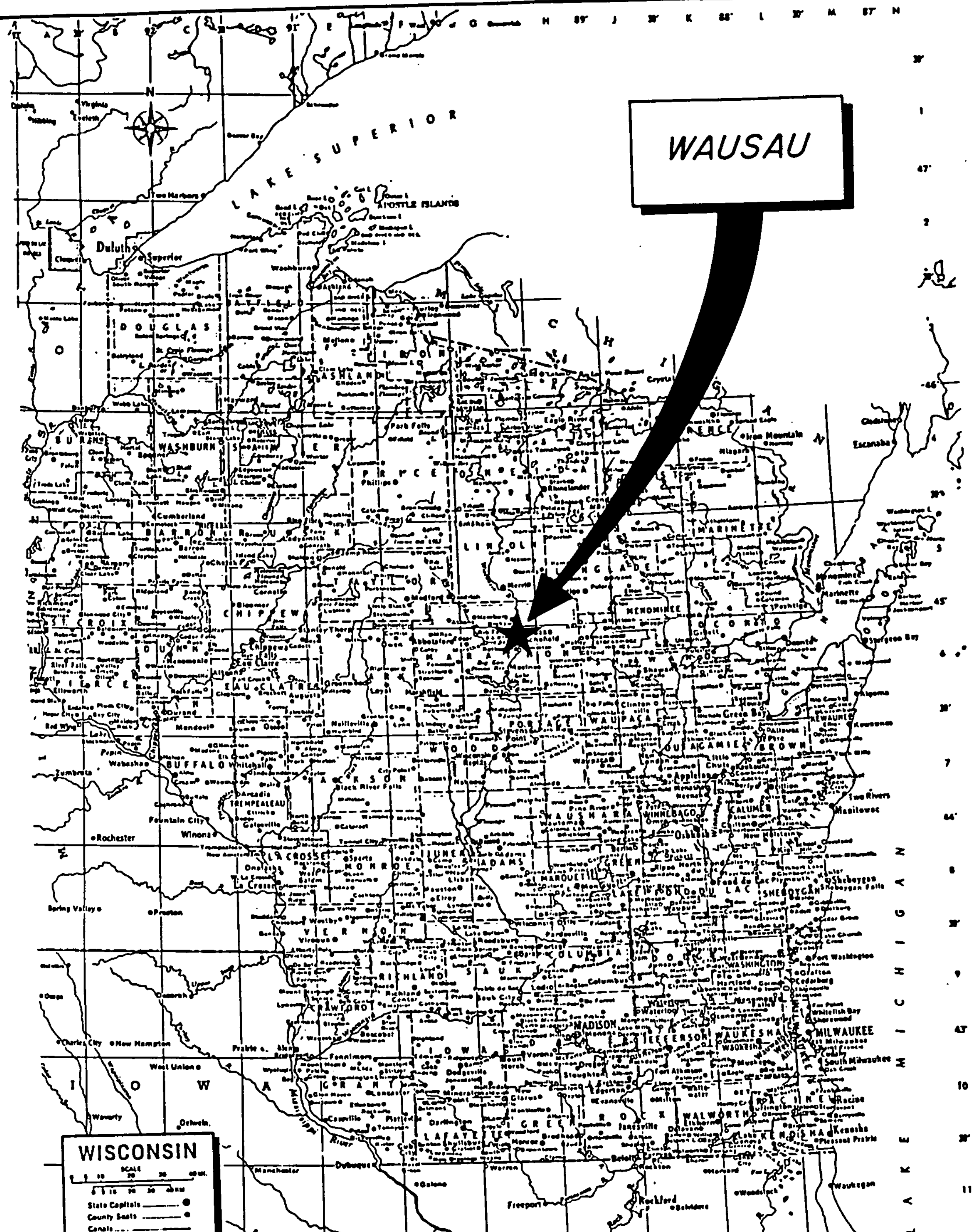


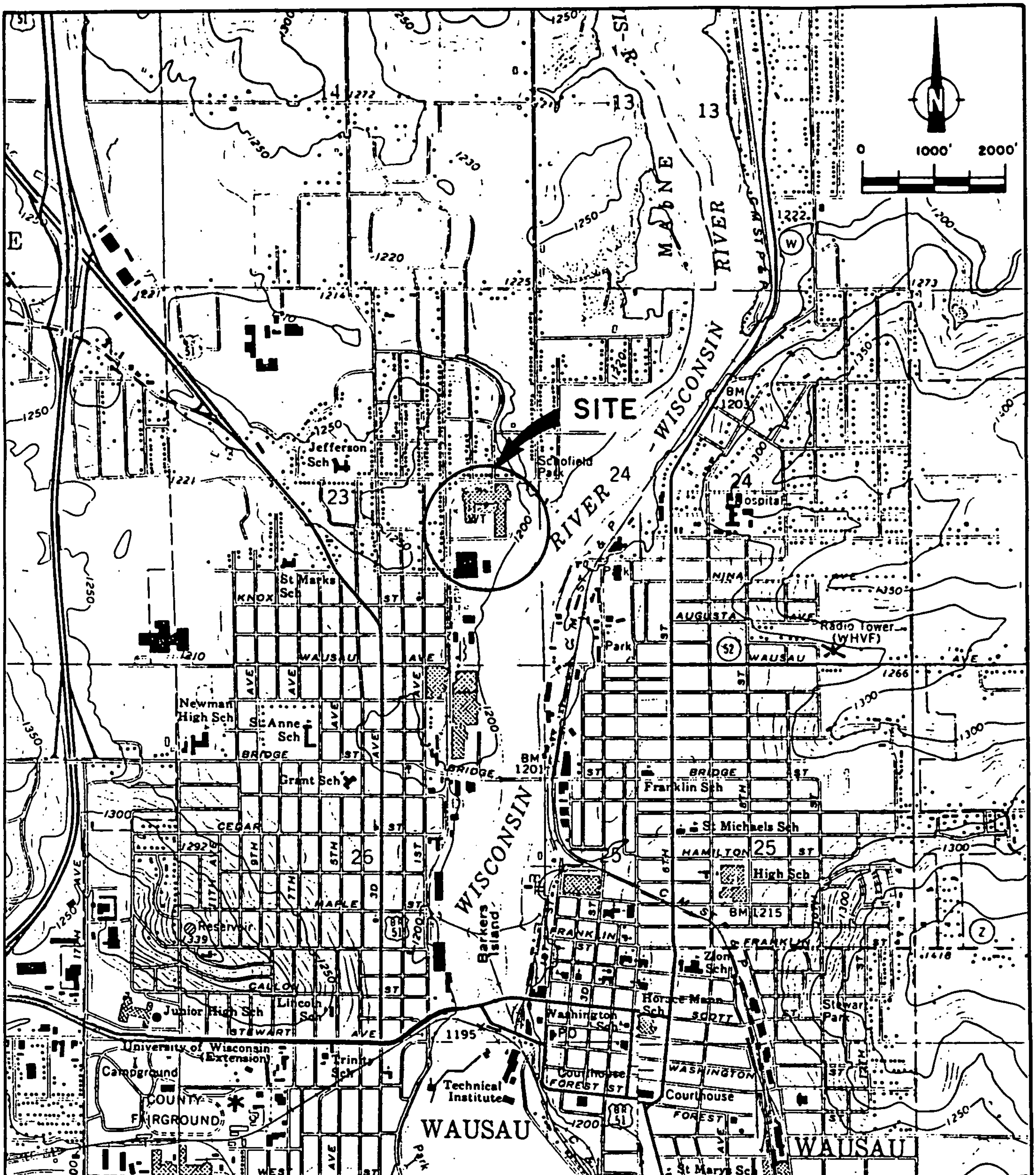
figure 1.1

REGIONAL LOCATION MAP

Marathon Electric Manufacturing Co.

CRA

2115-09/07/91-19-0



SOURCE : U.S.G.S. WAUSAU WEST QUADRANGLE MAP.

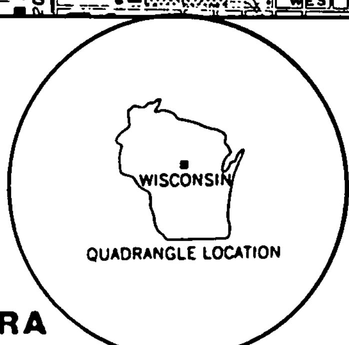


figure 1.2

SITE LOCATION

Marathon Electric Manufacturing Co.

CRA

2115-09/07/91-19-0

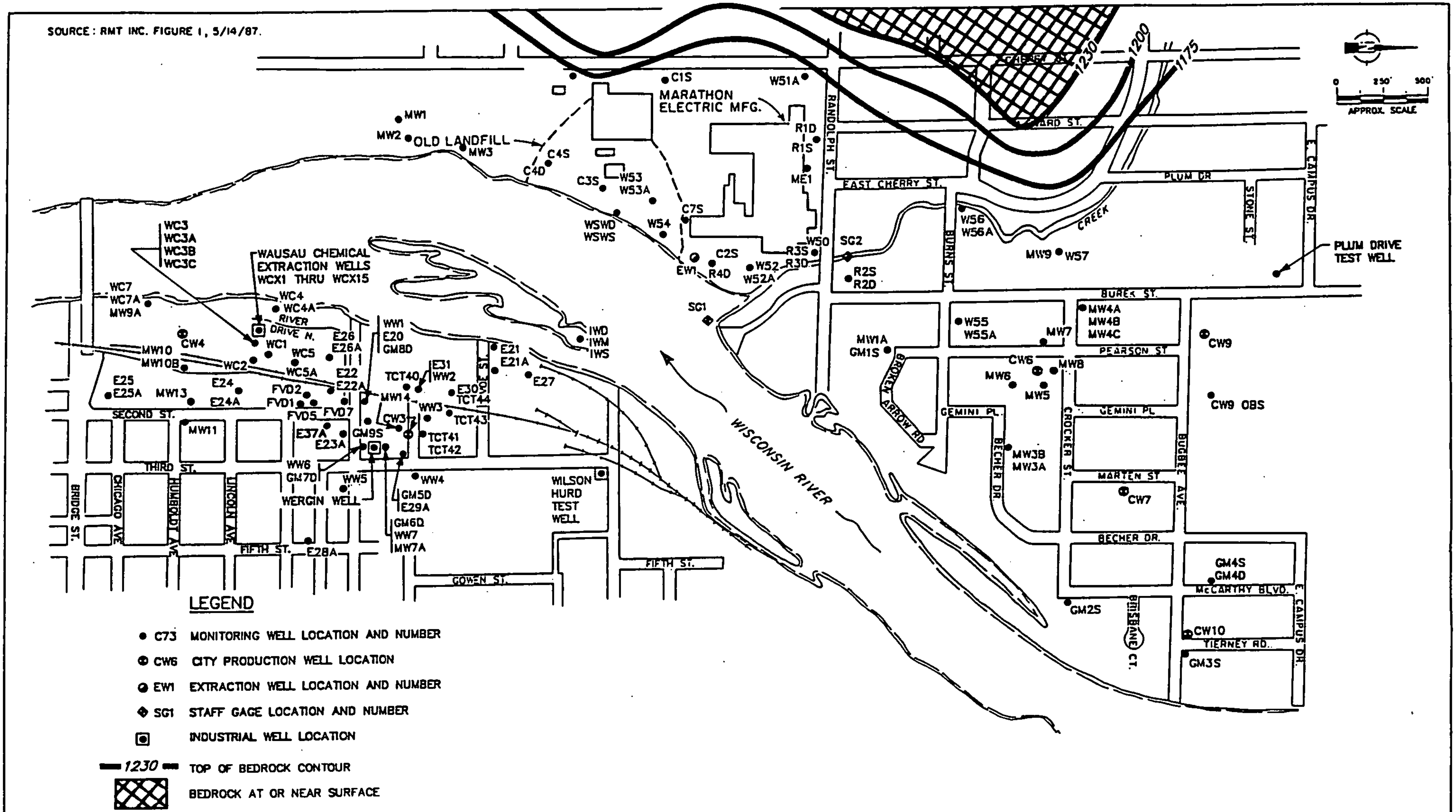


figure 1.3

EXTRACTION WELL AND MONITORING WELL LOCATIONS

Marathon Electric Manufacturing Co.

CRA

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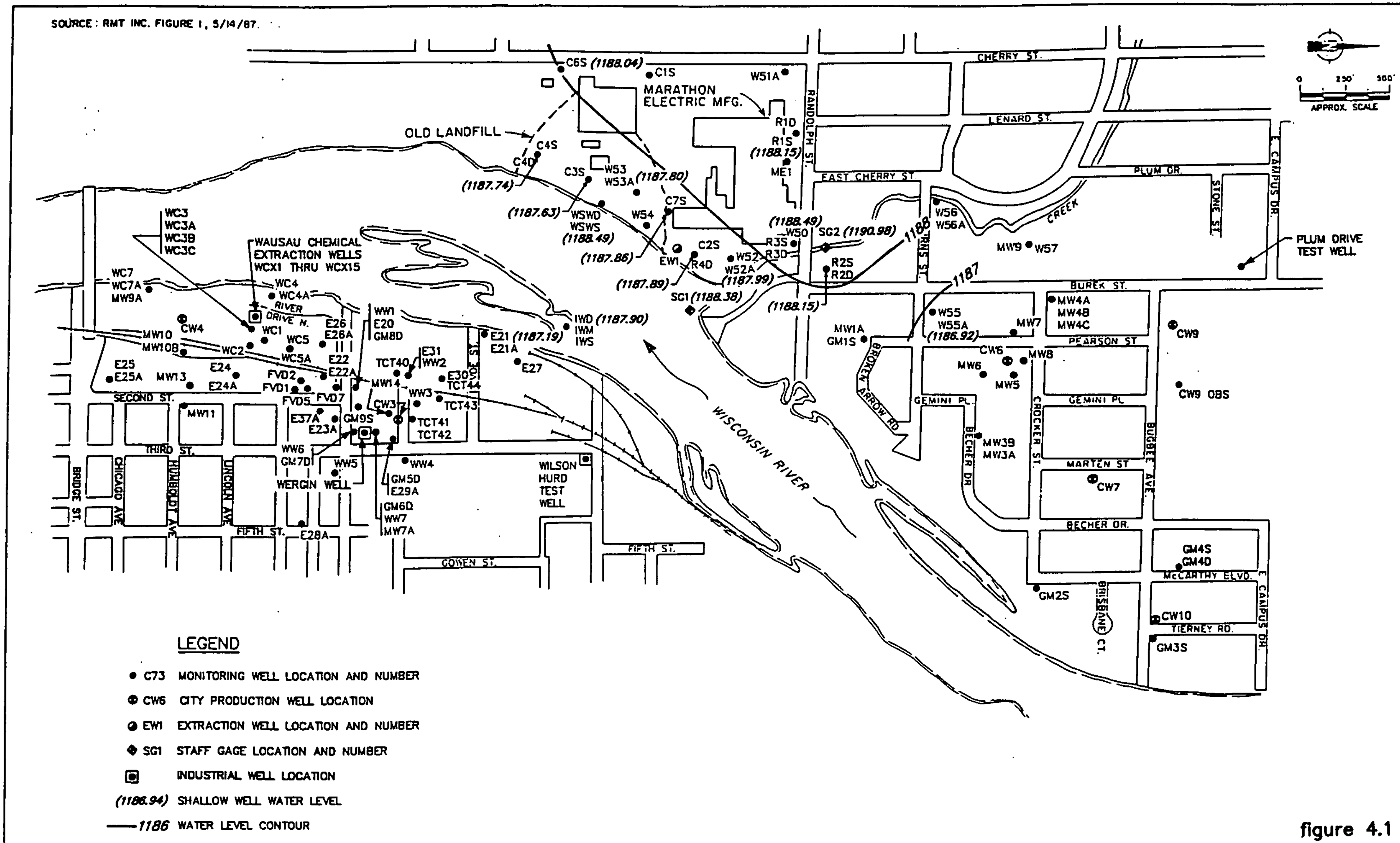


figure 4.1

SHALLOW WELL WATER LEVEL CONTOURS (11/13/90)

Marathon Electric Manufacturing Co.

CRA

2115-09/07/91-19-0

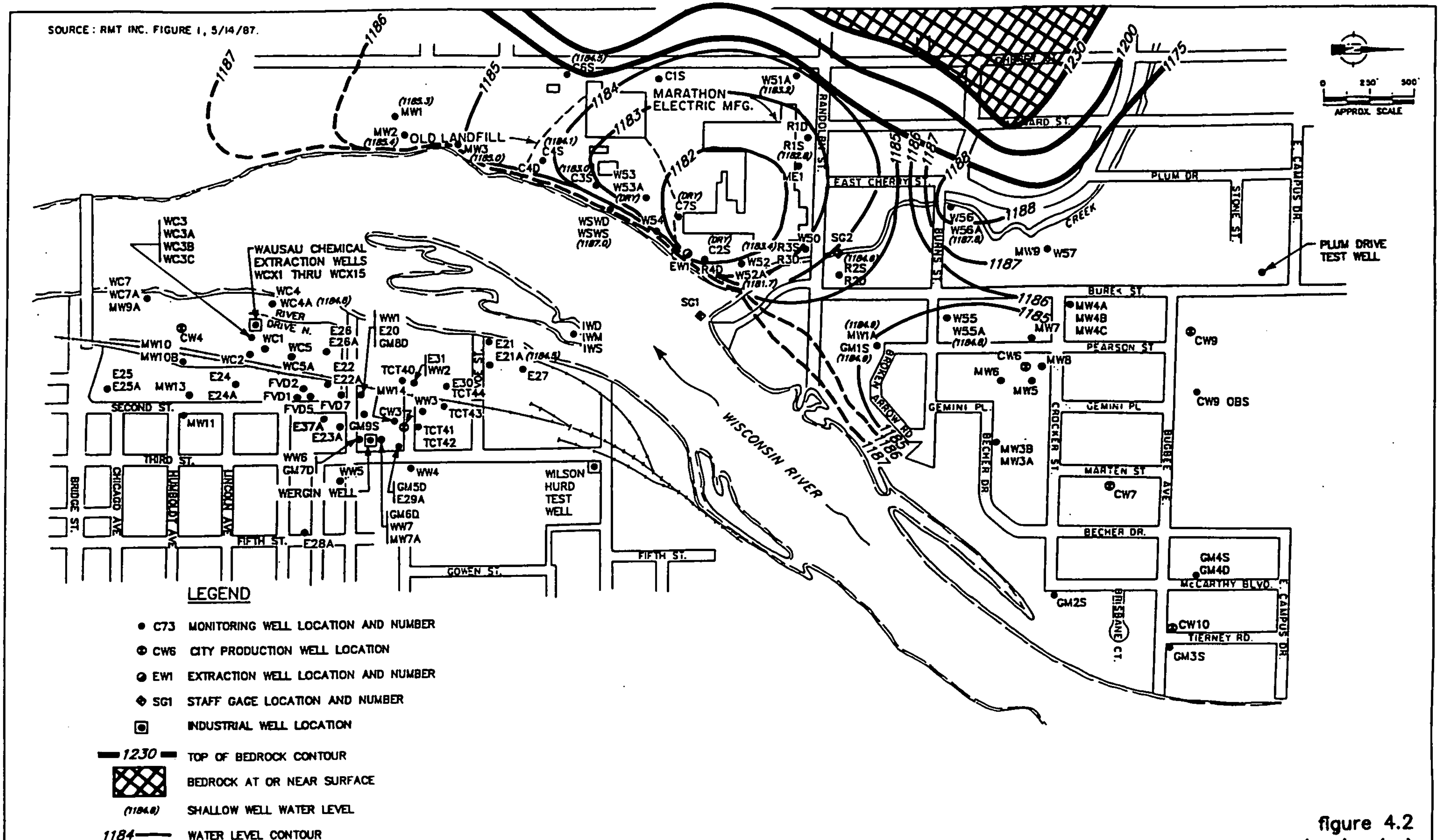


figure 4.2

SHALLOW WELL WATER LEVEL CONTOURS (01/30/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

CRA

2115-09/07/91-19-0

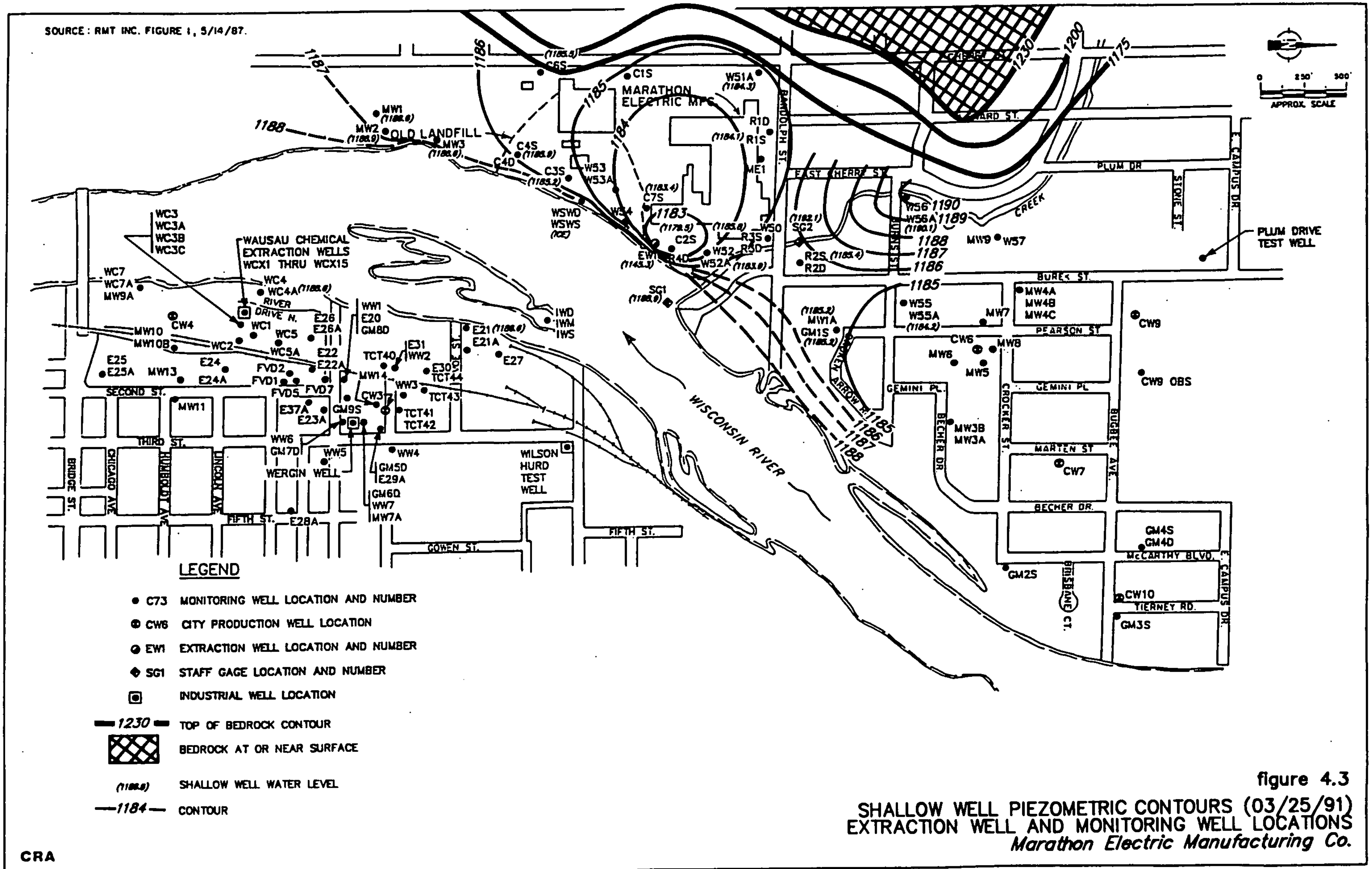


figure 4.3

SHALLOW WELL PIEZOMETRIC CONTOURS (03/25/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-09/07/91-19-0

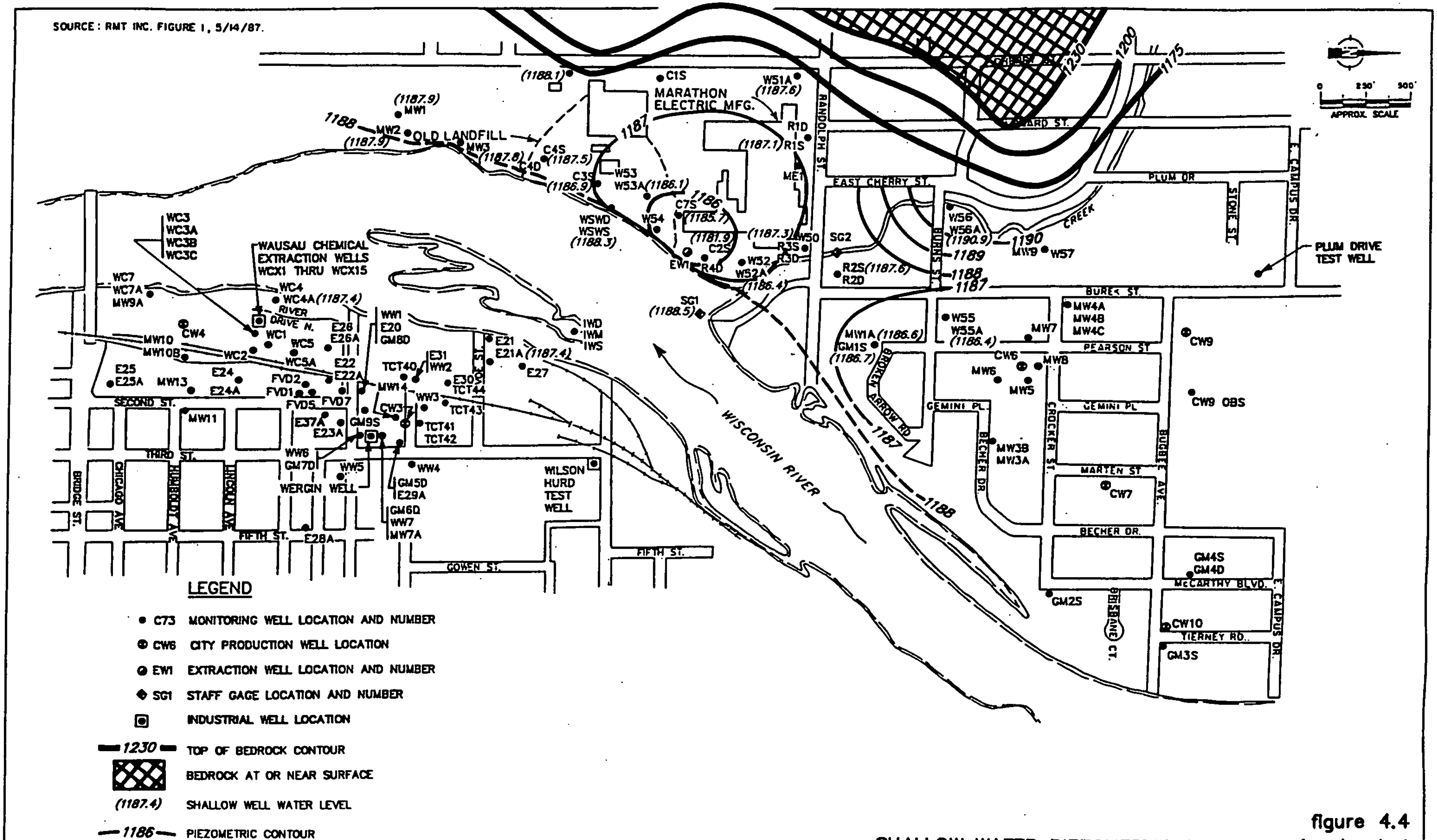


figure 4.4

SHALLOW WATER PIEZOMETRIC CONTOURS (06/27/91)
EXTRACTION WELL AND MONITORING WELL LOCAITONS
Marathon Electric Manufacturing Co.

CRA

2115-05/07/91-19-0

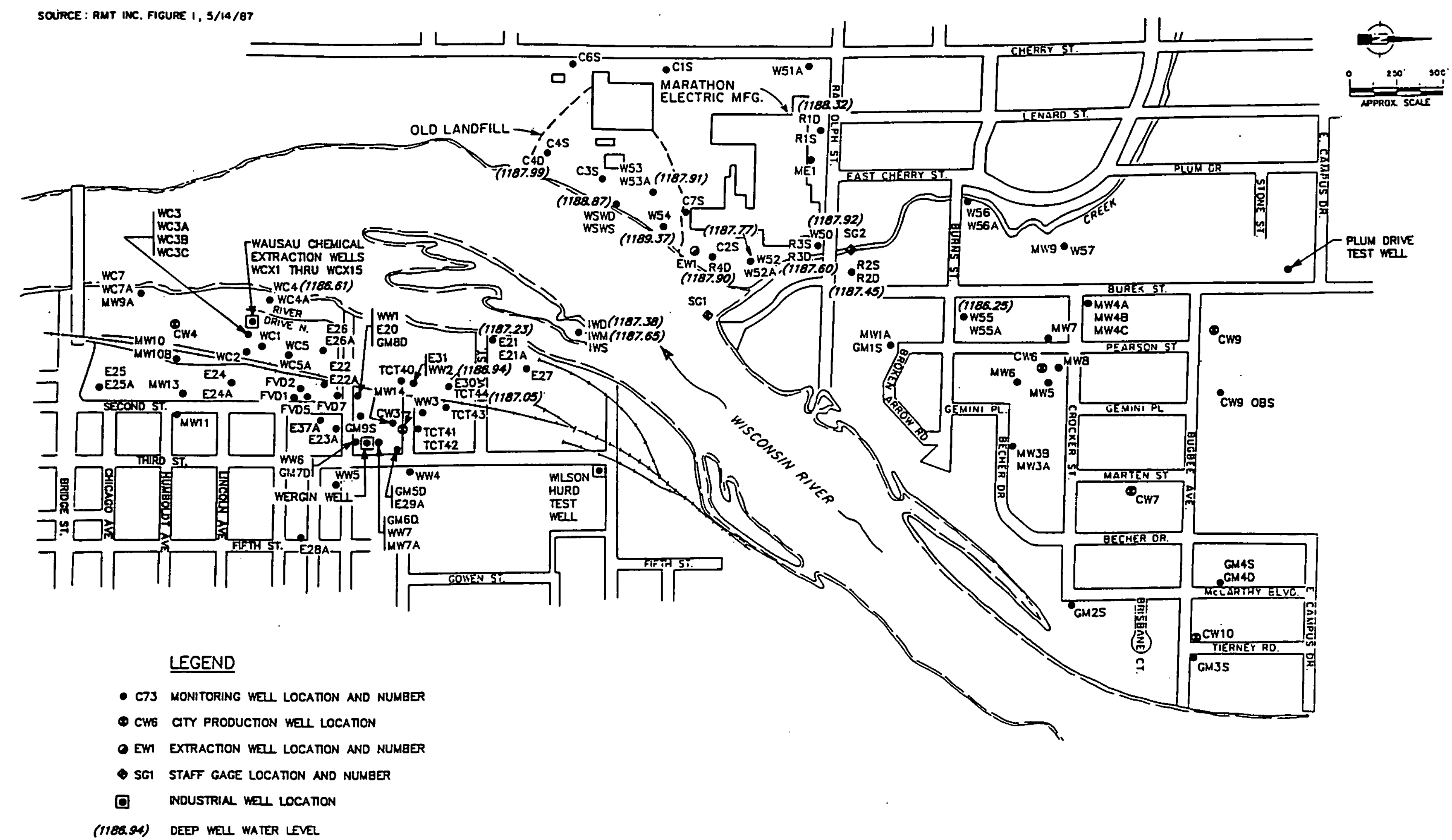


figure 4.5
DEEP WELL WATER LEVEL ELEVATIONS (11/13/90)
Marathon Electric Manufacturing Co.

CRA

2115-09/07/91-19-0

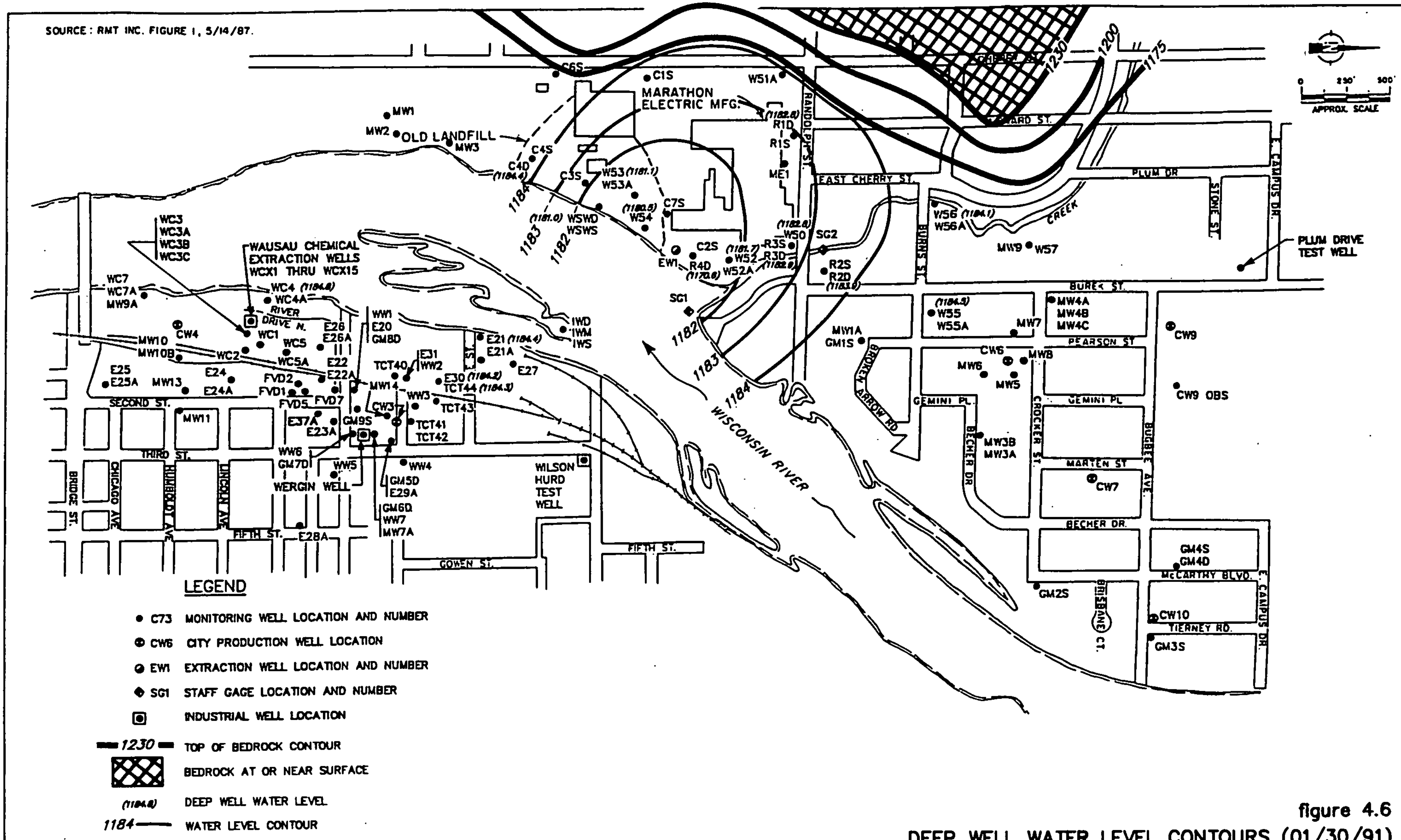


figure 4.6

DEEP WELL WATER LEVEL CONTOURS (01/30/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

CRA

2115-09/07/91-19-0

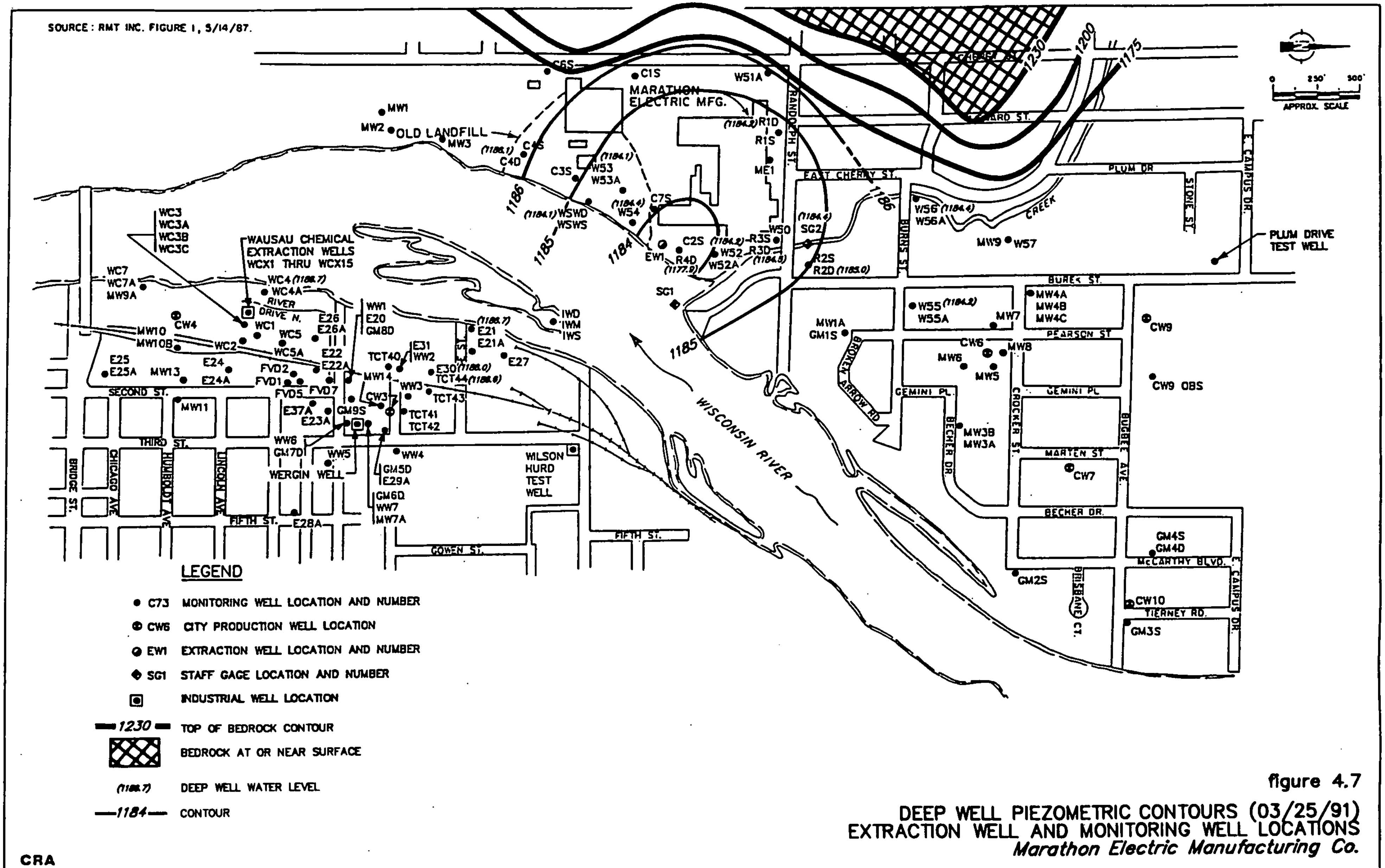


figure 4.7

DEEP WELL PIEZOMETRIC CONTOURS (03/25/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

CRA

2115-09/07/91-19-0

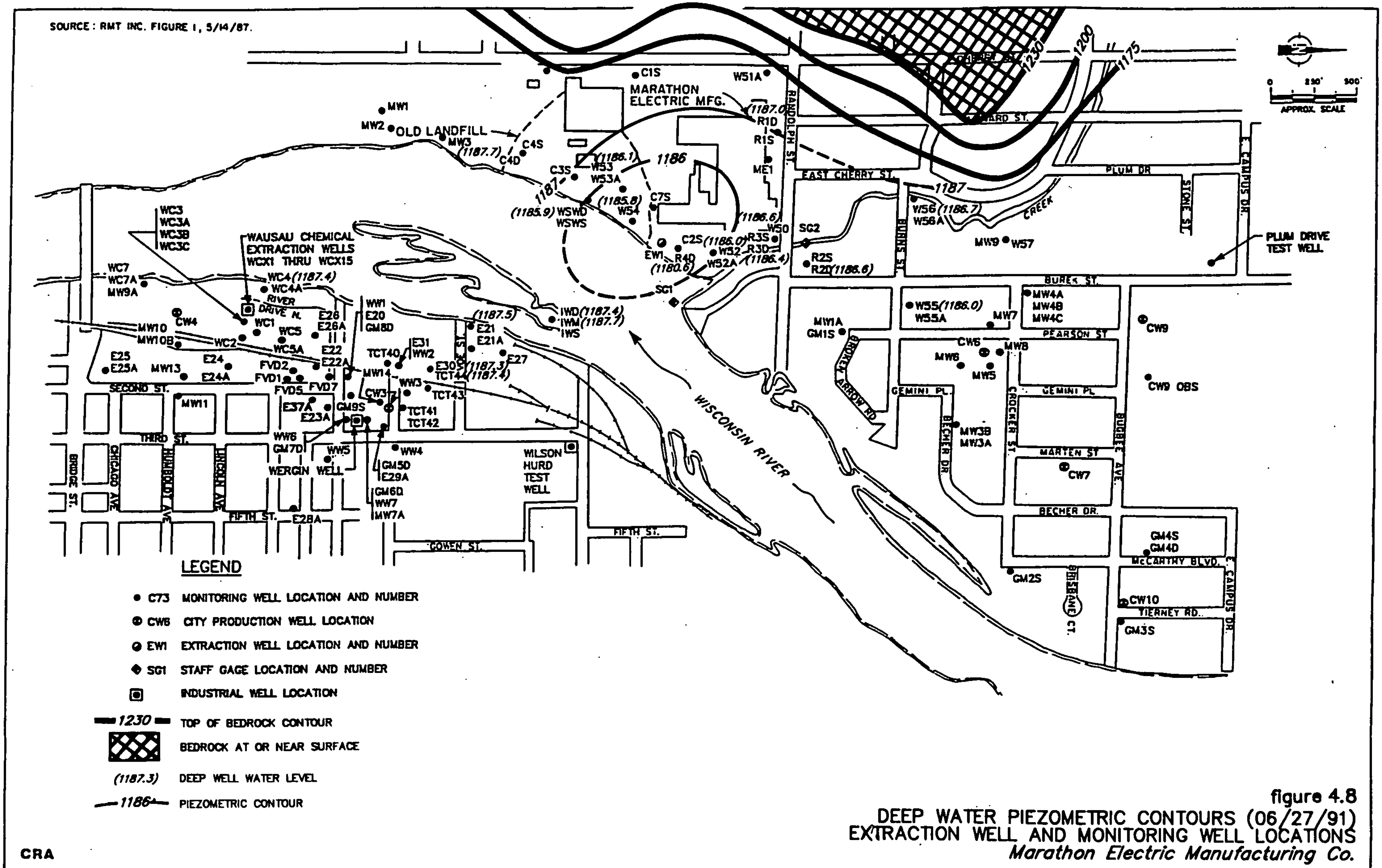
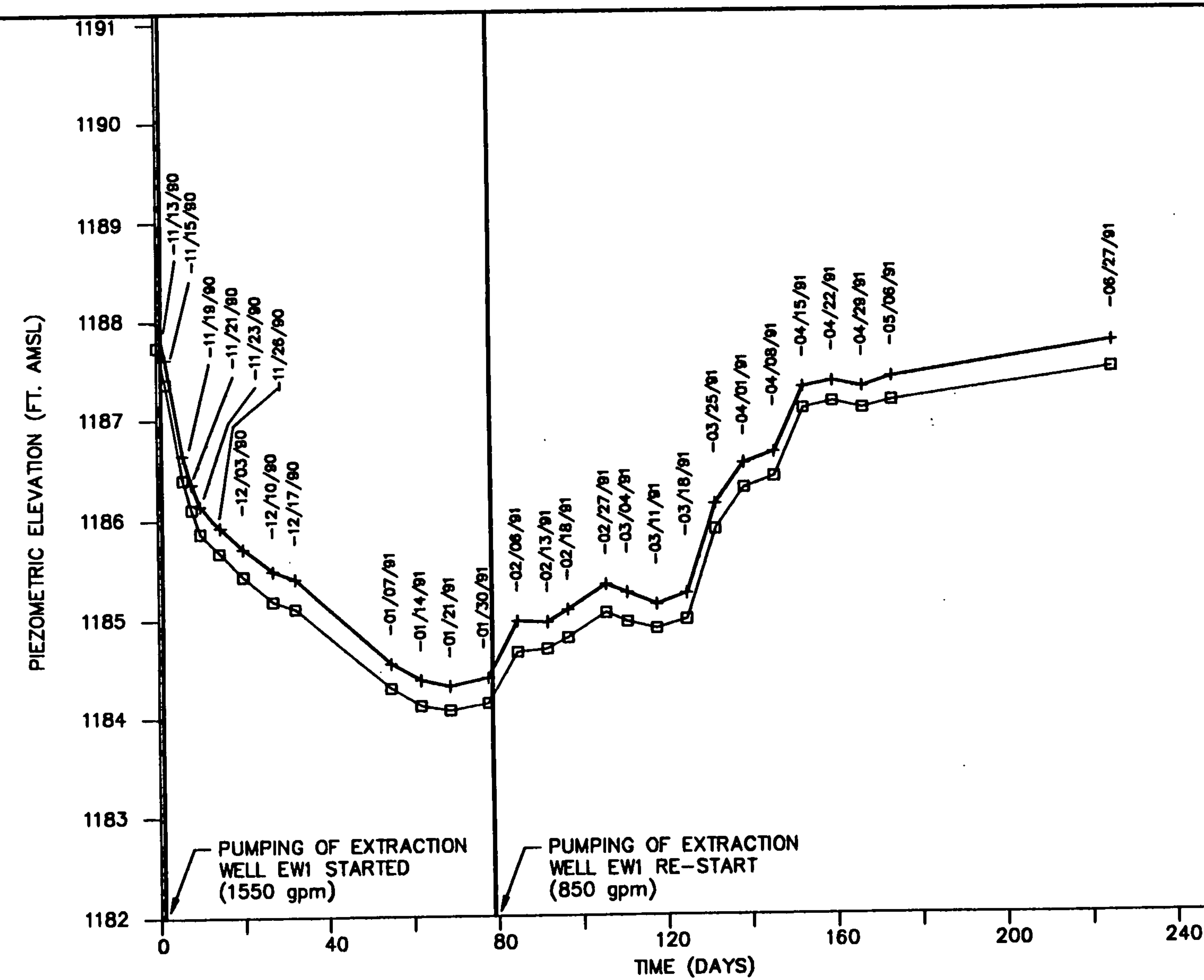


figure 4.8
DEEP WATER PIEZOMETRIC CONTOURS (06/27/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-05/07/91-19-0



LEGEND

□ SHALLOW WELL (C4S)

\+ DEEP WELL (C4D)

figure 4.9

HYDROGRAPH FOR MONITORING WELL NEST C4S AND C4D
WAUSAU WATER SUPPLY NPL SITE
Marathon Electric Manufacturing Co.

CRA

2115-03/07/91-19-0 (G-06)

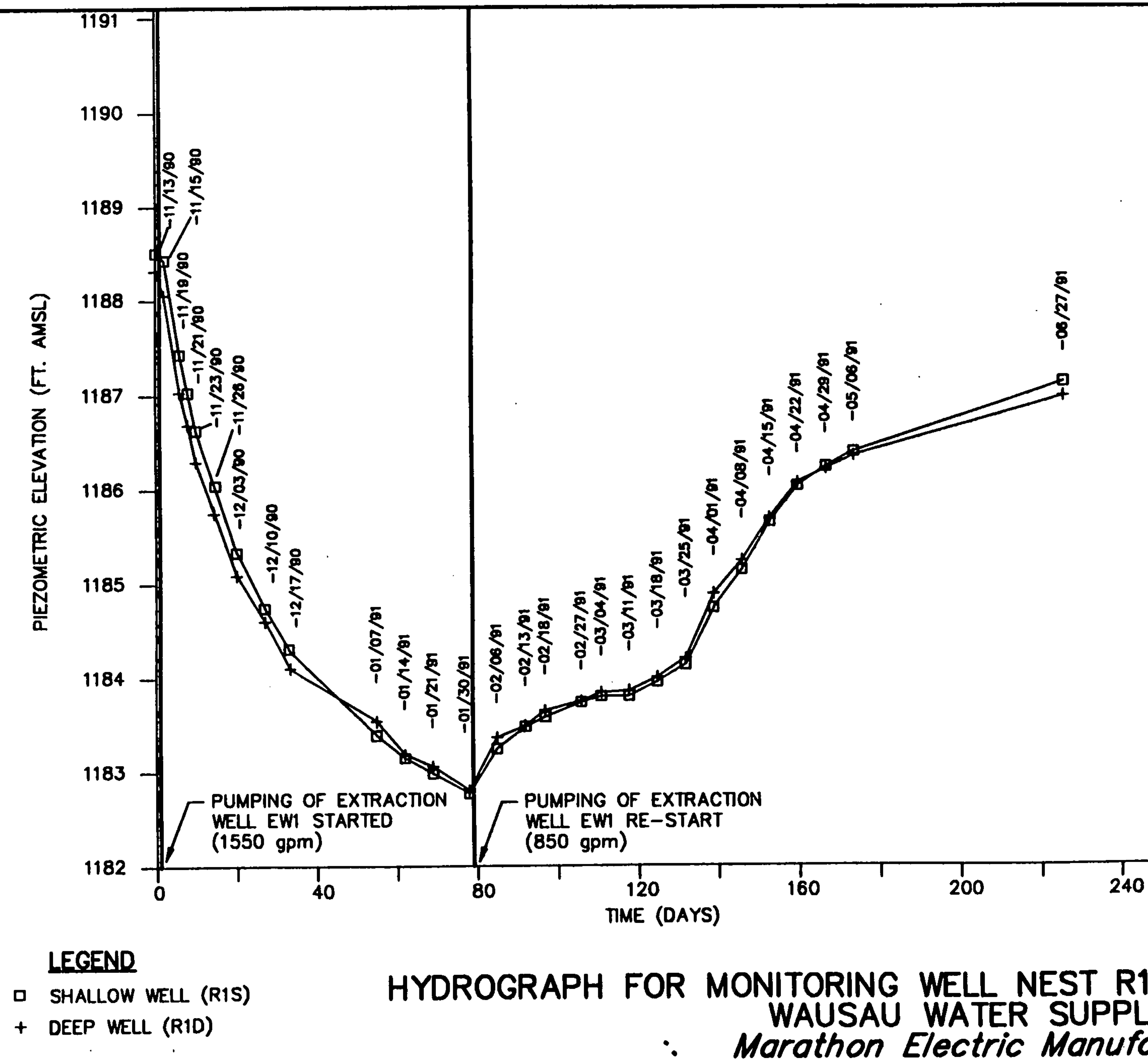


figure 4.10

HYDROGRAPH FOR MONITORING WELL NEST R1S AND R1D
WAUSAU WATER SUPPLY NPL SITE
Marathon Electric Manufacturing Co.

CRA

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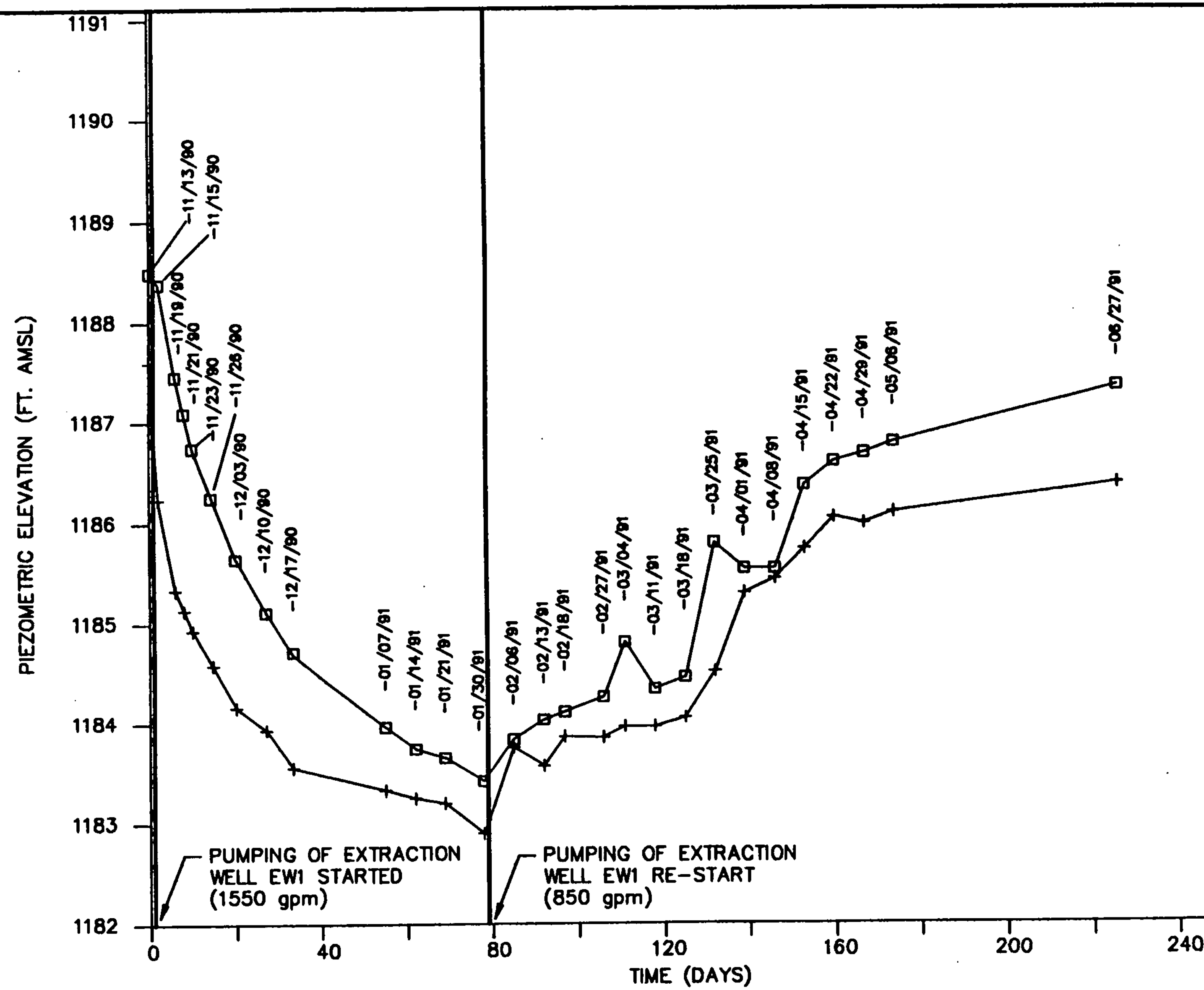

LEGEND

□ SHALLOW WELL (R3S)

+ DEEP WELL (R3D)

figure 4.11

HYDROGRAPH FOR MONITORING WELL NEST R3S AND R3D
WAUSAU WATER SUPPLY NPL SITE
Marathon Electric Manufacturing Co.

CRA

2115-03/07/91-19-0 (G-08)

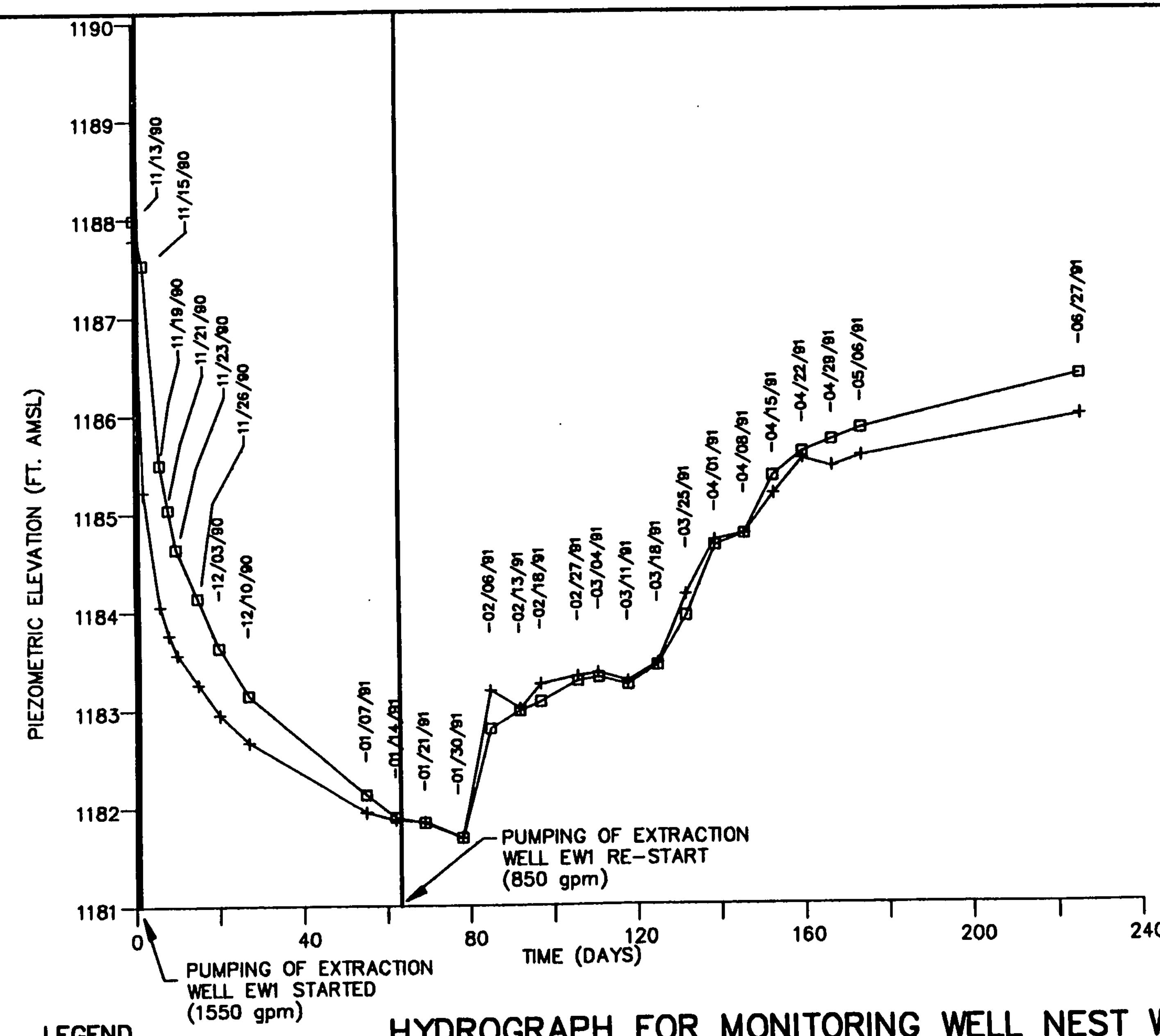

figure 4.12

HYDROGRAPH FOR MONITORING WELL NEST W52 AND W52A
WAUSAU WATER SUPPLY NPL SITE
Marathon Electric Manufacturing Co.

CRA

2115-03/07/91-19-0 (G-09)

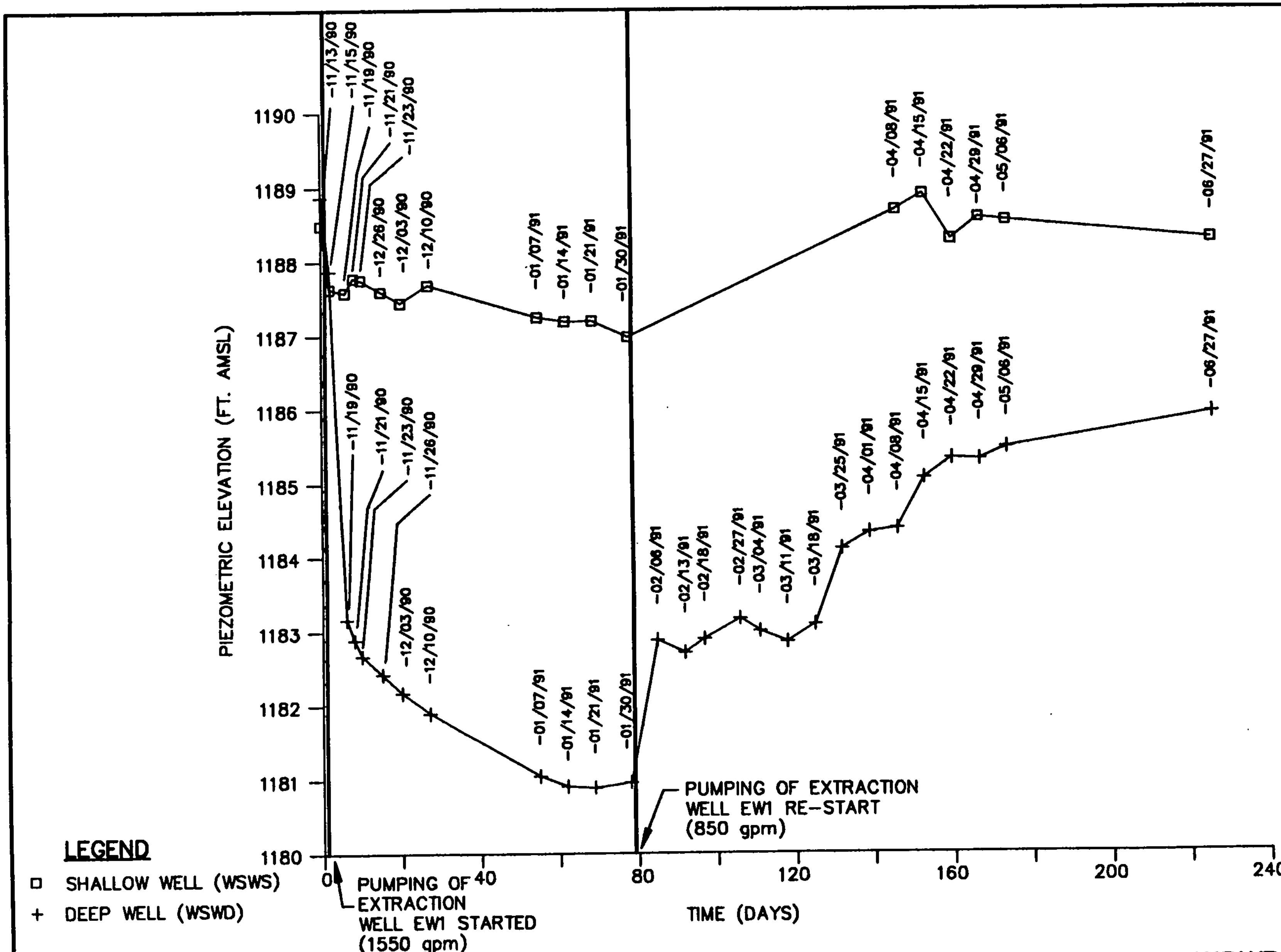

figure 4.13

HYDROGRAPH FOR MONITORING WELL NEST WSWD AND WSWS
WAUSAU WATER SUPPLY NPL SITE
Marathon Electric Manufacturing Co.

CRA

2115-03/07/91-19-0 (G-10)

TABLE 3.1

PIEZOMETRIC ELEVATIONS
GROUNDWATER MONITORING PROGRAM
MARATHON ELECTRIC COMPANY
WAUSAU, WISCONSIN

Monitoring Well No.	*Top of Casing Elevation (ft. AMSL)*	*Piezometric Elevations (ft. AMSL)*							
		11/13/90	*11/15/90*	*11/19/90*	*11/21/90*	*11/23/90*	*11/26/90*	*12/03/90*	*12/10/90*
C1S	1,223.69	1,195.08	1,194.99	1,194.69	1,194.66	1,194.46	–	1,194.34	1,193.94
C2S (1)	1,216.23	1,187.89	1,181.09	Dry	Dry	Dry	Dry	Dry	Dry
C3S	1,220.24	1,187.63	1,186.84	1,185.51	1,185.21	1,184.95	–	1,184.43	1,184.14
C4S	1,216.84	1,187.74	1,187.37	1,186.40	1,186.11	1,185.87	–	1,185.43	1,185.18
C4D	1,216.50	1,187.99	1,187.62	1,186.64	1,186.36	1,186.14	1,185.99	1,185.71	1,185.48
C6S	1,221.69	1,188.04	1,188.04	1,187.66	1,187.40	1,187.10	–	1,186.17	1,185.91
C7S (2)	1,221.00	1,187.86	1,185.89	1,183.67	1,183.24	1,182.90	–	1,182.07	1,181.72
R1S	1,222.13	1,188.51	1,188.43	1,187.43	1,187.03	1,186.63	–	1,185.33	1,184.74
R1D	1,222.39	1,188.32	1,188.06	1,187.03	1,186.69	1,186.30	–	1,185.09	1,184.60
R2S	1,209.88	1,188.15	1,187.84	1,187.12	1,186.94	1,186.79	–	1,186.08	1,185.58
R2D	1,209.66	1,187.43	1,187.35	1,185.85	1,185.72	1,185.61	1,185.69	1,184.87	1,184.81
R3S	1,215.29	1,188.49	1,188.38	1,187.46	1,187.09	1,186.74	–	1,185.64	1,185.11
R3D	1,215.53	1,187.60	1,186.23	1,185.33	1,185.13	1,184.93	–	1,184.16	1,183.93
R4D	1,219.07	1,187.90	1,175.19	1,173.47	1,173.03	1,172.81	1,172.43	1,172.12	1,171.75
E21	1,197.61	1,187.23	1,186.95	1,185.45	1,185.23	1,185.08	–	1,185.89	1,184.92
E21A	1,197.95	1,187.19	1,186.55	1,185.39	1,185.15	1,185.03	–	1,185.85	1,184.87
E30	1,204.58	1,186.94	1,186.86	1,184.60	1,184.33	1,184.19	–	1,185.83	1,184.13
TCT44	1,204.57	1,187.05	1,186.97	1,184.75	1,184.47	1,184.29	–	1,185.92	1,184.27
W50	1,215.67	1,187.92	1,187.20	1,186.00	1,185.69	1,185.41	–	1,184.48	1,184.11
W51A	1,224.50	Blockage	1,188.93	1,188.48	1,188.20	1,187.87	–	1,186.40	1,185.76
W52A	1,219.08	1,187.99	1,187.53	1,185.50	1,185.04	1,184.63	–	1,183.63	1,183.14
W52	1,219.25	1,187.77	1,185.22	1,184.05	1,183.76	1,183.56	1,183.32	1,182.95	1,182.67
W53A (3)	1,217.12	1,187.80	1,186.05	1,183.95	1,183.55	1,183.27	1,182.92	1,181.60	1,182.29
W53	1,216.91	1,187.91	1,185.98	1,184.01	1,183.63	1,183.33	1,183.01	1,182.73	1,182.33
W54	1,216.44	1,189.37	1,185.31	1,183.17	1,182.80	1,182.54	1,182.24	1,181.92	1,181.61
W55A	1,217.40	1,186.92	1,186.48	1,186.43	1,186.48	1,186.45	–	1,185.63	1,185.39
W55	1,217.29	1,186.24	1,185.64	1,186.29	1,186.29	1,186.29	1183.30*	1,184.88	1,185.43
W56	–	–	–	–	–	–	–	–	–
W56A	–	–	–	–	–	–	–	–	–
IWD	1,192.08	1,187.38	1,186.78	1,185.62	1,185.48	1,185.35	–	–	–
IWM	1,192.91	1,187.65	1,187.05	1,185.91	1,185.77	1,185.65	–	–	–
IWS	1,193.17	1,187.90	1,187.52	1,187.00	1,187.01	1,186.92	–	–	–
WSWD	1,193.25	1,188.87	1,187.87	1,183.17	1,182.89	1,182.67	–	1,182.17	1,181.89
WSWS	1,193.24	1,188.49	1,187.63	1,187.58	1,187.78	1,187.75	–	1,187.44	1,187.68
WC4	1,196.86	1,186.61	1,186.61	1,185.76	1,185.58	1,185.46	–	1,185.91	1,185.39
WC4A	1,196.69	–	1,186.59	1,185.76	1,185.58	1,185.46	–	1,185.89	1,185.39
MW1A	–	–	–	–	–	–	–	–	–
GM1S	–	–	–	–	–	–	–	–	–
MW1	–	–	–	–	–	–	–	–	–
MW2	–	–	–	–	–	–	–	–	–
MW3	–	–	–	–	–	–	–	–	–
EW1	–	–	–	–	–	–	–	–	–
Staff Gages									
SG1	1,189.37	1,188.36	1,187.88	1,187.75	1,187.96	1,187.89	–	1,187.83	1,188.35
SG2	1,193.94	1,191.58	1,191.88	1,191.57	1,191.61	1,191.52	–	1,191.54	1,191.73

Notes:

*	Measured on 11/27/90.
(1)	Bottom of well measured at approximately 1,178.8 ft. AMSL.
(2)	Bottom of well measured at approximately 1,181.3 ft. AMSL.
(3)	Bottom of well measured at approximately 1,181.7 ft. AMSL.

TABLE 3.1

PIEZOMETRIC ELEVATIONS
GROUNDWATER MONITORING PROGRAM
MARATHON ELECTRIC COMPANY
WAUSAU, WISCONSIN

Monitoring Well No.	*Top of Casing Elevation (ft. AMSL)*	*Piezometric Elevations (ft. AMSL)*							
		12/17/90	*01/07/91*	*01/14/91*	*01/21/91*	*01/30/91*	*02/06/91*	*02/13/91*	*02/18/91*
C1S	1,223.69	1,193.62	1,193.13	1,193.13	1,192.74	1,192.54	1,192.51	1,191.95	1,191.68
C2S (1)	1,216.23	Dry	Dry	Dry	Dry	Dry	1,178.33	1,178.18	1,178.38
C3S	1,220.24	1,184.10	1,183.24	1,183.06	1,183.02	1,183.06	1,183.95	1,183.96	1,184.05
C4S	1,216.84	1,185.14	1,184.30	1,184.12	1,184.07	1,184.14	1,184.66	1,184.69	1,184.80
C4D	1,216.50	1,185.40	1,184.55	1,184.38	1,184.32	1,184.40	1,184.97	1,184.96	1,185.08
C6S	1,221.69	1,185.65	1,184.86	1,184.29	1,184.53	1,184.47	1,184.71	1,184.86	1,184.94
C7S (2)	1,221.00	1,181.50	Dry	Dry	Dry	Dry	1,182.25	1,182.28	1,182.41
R1S	1,222.13	1,184.29	1,183.39	1,183.15	1,182.98	1,182.77	1,183.25	1,183.48	1,183.58
R1D	1,222.39	1,184.12	1,183.54	1,183.19	1,183.06	1,182.80	1,183.37	1,183.49	1,183.65
R2S	1,209.88	1,185.27	1,185.03	1,184.94	1,184.90	1,184.57	1,184.78	1,184.64	1,184.77
R2D	1,209.66	1,184.32	1,184.39	1,184.34	1,184.30	1,183.90	1,184.40	1,184.15	1,184.50
R3S	1,215.29	1,184.70	1,183.96	1,183.74	1,183.65	1,183.42	1,183.83	1,184.03	1,184.11
R3D	1,215.53	1,183.58	1,183.33	1,183.25	1,183.20	1,182.90	1,183.75	1,183.57	1,183.86
R4D	1,219.07	1,171.60	1,170.87	1,170.54	1,170.45	1,170.58	1,176.77	1,176.18	1,176.51
E21	1,197.61	1,185.83	1,183.99	1,183.85	1,184.19	1,184.42	1,185.01	1,184.22	1,184.49
E21A	1,197.95	1,185.79	1,183.93	1,183.80	1,183.77	1,184.45	1,184.95	1,184.15	1,184.44
E30	1,204.58	1,185.83	1,183.09	1,182.95	1,182.92	1,184.24	1,184.74	1,183.29	1,183.83
TCT4	1,204.57	1,185.92	1,183.20	1,183.06	1,183.03	1,184.31	1,184.82	1,183.39	1,183.83
W50	1,215.67	1,183.71	1,183.27	1,183.13	1,183.07	1,182.79	1,183.53	1,183.53	1,183.72
W51A	1,224.50	1,185.16	1,183.98	1,183.65	1,183.45	1,183.20	1,183.52	1,183.77	1,183.87
W52A	1,219.08	1,182.79	1,182.13	1,181.90	1,181.84	1,181.69	1,182.80	1,182.98	1,183.07
W52	1,219.25	1,182.41	1,181.95	1,181.87	1,181.85	1,181.69	1,183.18	1,183.00	1,183.25
W53A (3)	1,217.12	1,182.17	Dry	Dry	Dry	Dry	1,182.81	1,182.78	1,182.91
W53	1,216.91	1,182.21	1,181.39	1,181.19	1,181.16	1,181.07	1,182.41	1,182.86	1,182.91
W54	1,216.44	1,181.49	1,180.65	1,180.51	1,180.47	1,180.49	1,183.54	1,183.46	1,182.59
W55A	1,217.40	1,184.75	1,185.58	1,185.62	1,185.62	1,184.84	1,184.59	1,183.97	1,184.39
W55	1,217.29	1,184.21	1,185.57	1,185.64	1,185.66	1,184.46	1,184.25	1,183.89	1,184.69
W56	1,200.17	--	1,184.97	1,184.91	1,184.86	1,184.12	1,184.16	1,183.87	1,184.40
W56A	1,200.95	--	1,188.19	1,188.07	1,188.00	1,187.77	1,187.73	1,187.67	1,187.58
IWD	1,192.08	--	--	--	--	--	--	--	--
IWM	1,192.91	--	--	--	--	--	--	--	--
IWS	1,193.17	--	--	--	--	--	--	--	--
WSWD	1,193.25	1,181.86	1,181.05	1,180.91	1,180.89	1,180.96	1,182.88	1,182.71	1,182.90
WSWS	1,193.24	1,187.49	1,187.24	1,187.18	1,187.19	1,186.97	ice	ice	ice
WC4	1,196.86	1,185.93	1,184.53	1,184.40	1,184.36	1,184.77	1,185.00	1,184.56	1,184.76
WC4A	1,196.69	1,185.93	1,184.52	1,184.39	1,184.37	1,184.76	1,185.01	1,184.57	1,184.75
MW1A	1,215.79	--	1,185.51	1,185.54	1,185.54	1,184.86	1,184.84	1,184.52	1,184.99
GM1S	1,216.07	--	1,185.53	1,185.55	1,185.57	1,184.94	1,184.91	1,184.57	1,184.99
MW1	1,221.86	--	--	1,185.22	1,185.18	1,185.32	1,185.57	1,185.46	1,185.56
MW2	1,220.25	--	--	1,185.25	1,185.22	1,185.37	1,185.60	1,185.46	1,185.58
MW3	1,218.75	--	--	1,184.98	1,184.91	1,185.03	1,185.33	1,185.26	1,185.37
EW1	1,218.30	--	--	1,130.80	1,130.80	1,130.80	1,130.80	1,145.53	1,146.30
Staff Gages									
SG1	1,189.37	1,187.81	1,187.72	1,187.72	1,187.68	1,187.66	1,187.93	1,187.70	ice
SG2	1,193.94	1,191.54	1,191.38	1,191.40	1,191.38	1,191.24	1,191.42	1,191.41	1,191.29

Notes:

(1) Bottom of well measured at approximately 1,178.8 ft. AMSL.
(2) Bottom of well measured at approximately 1,181.3 ft. AMSL.
(3) Bottom of well measured at approximately 1,181.7 ft. AMSL.

TABLE 3.1

PIEZOMETRIC ELEVATIONS
GROUNDWATER MONITORING PROGRAM
MARATHON ELECTRIC COMPANY
WAUSAU, WISCONSIN

Monitoring Well No.	*Top of Casing Elevation (ft. AMSL)*	*Piezometric Elevations (ft. AMSL)*							
		02/27/91	*03/04/91*	*03/11/91*	*03/18/91*	*03/25/91*	*04/01/91*	*04/08/91*	*04/15/91*
C1S	1,223.69	1,191.61	1,191.60	1,191.59	1,191.70	1,198.36	1,197.55	1,196.83	1,197.45
C2S (1)	1,216.23	1,178.62	1,178.53	1,178.38	1,178.71	1,179.48	1,179.90	1,179.97	1,180.60
C3S	1,220.24	1,184.29	1,184.22	1,184.14	1,184.25	1,185.20	1,185.56	1,185.70	1,186.34
C4S	1,216.84	1,185.05	1,184.96	1,184.89	1,184.98	1,185.88	1,186.29	1,186.40	1,187.08
C4D	1,216.50	1,185.33	1,185.25	1,185.13	1,185.24	1,186.13	1,186.53	1,186.64	1,187.30
C6S	1,221.69	1,185.11	1,185.16	1,185.15	1,185.25	1,185.45	1,183.24	1,186.49	1,187.01
C7S (2)	1,221.00	1,182.65	1,182.60	1,182.51	1,182.74	1,183.36	1,183.90	1,184.01	1,184.64
R1S	1,222.13	1,183.74	1,183.80	1,183.80	1,183.95	1,184.13	1,184.74	1,185.14	1,185.65
R1D	1,222.39	1,183.75	1,183.84	1,183.86	1,184.00	1,184.20	1,184.89	1,185.24	1,185.69
R2S	1,209.88	1,184.82	1,184.86	1,184.93	1,184.99	1,185.40	1,177.67	1,187.00	1,187.51
R2D	1,209.66	1,184.42	1,184.58	1,184.61	1,184.64	1,185.01	1,185.93	1,186.07	1,186.07
R3S	1,215.29	1,184.26	1,184.81	1,184.34	1,184.46	1,185.80	1,185.54	1,185.84	1,186.37
R3D	1,215.53	1,183.85	1,183.96	1,183.96	1,184.05	1,184.52	1,185.30	1,185.44	1,185.74
R4D	1,219.07	1,176.81	1,176.52	1,176.03	1,176.89	1,177.89	1,177.92	1,178.11	1,178.35
E21	1,197.61	1,185.41	1,184.72	1,184.60	1,184.67	1,186.65	1,185.95	1,185.76	1,187.37
E21A	1,197.95	1,185.37	1,184.65	1,184.54	1,184.60	1,186.63	1,185.91	1,185.71	1,187.36
E30	1,204.58	1,185.23	1,184.12	1,183.75	1,183.83	1,185.98	1,185.08	1,184.89	1,187.20
TCT44	1,204.57	1,185.33	1,184.13	1,183.87	1,183.96	1,186.58	1,185.20	1,184.90	1,187.29
W50	1,215.67	1,183.80	1,183.88	1,183.88	1,183.99	1,184.35	1,185.19	1,185.41	1,185.83
W51A	1,224.50	1,183.95	1,184.08	1,184.10	1,184.19	1,184.30	1,184.58	1,184.93	1,185.34
W52A	1,219.08	1,183.28	1,183.31	1,183.24	1,183.43	1,183.93	1,184.64	1,184.76	1,185.36
W52	1,219.25	1,183.33	1,183.36	1,183.27	1,183.45	1,184.15	1,184.70	1,184.76	1,185.17
W53A (3)	1,217.12	1,183.16	1,183.08	1,182.98	1,183.20	1,184.00	1,184.38	1,184.52	1,185.16
W53	1,216.91	1,183.18	1,182.99	1,185.00	1,182.96	1,184.05	1,184.44	1,184.57	1,185.22
W54	1,216.44	1,182.84	1,183.20	1,182.64	1,182.83	1,184.44	1,184.99	1,184.19	1,184.82
W55A	1,217.40	1,184.14	1,184.42	1,184.55	1,184.56	1,184.22	1,185.71	1,186.37	1,186.38
W55	1,217.29	1,183.81	1,184.77	1,184.95	1,184.74	1,184.21	1,186.31	1,186.49	1,185.67
W56	1,200.17	1,184.03	1,184.52	1,184.61	1,184.63	1,184.44	1,185.80	1,186.37	1,186.07
W56A	1,200.95	1,187.57	1,187.96	1,187.89	1,188.03	1,190.09	1,190.63	1,192.35	1,191.30
IWD	1,192.08	–	–	–	–	–	–	1,186.23	1,187.33
IWM	1,192.91	–	–	–	–	–	–	1,186.51	1,187.59
IWS	1,193.17	–	–	–	–	–	–	1,188.09	1,188.67
WSWD	1,193.25	1,183.17	1,183.00	1,182.86	1,183.09	1,184.11	1,184.33	1,184.38	1,185.07
WSWS	1,193.24	ice	ice	ice	ice	ice	ice	1,188.69	1,188.90
WC4	1,196.86	1,185.41	1,185.04	1,185.04	1,185.08	1,186.72	1,186.21	1,186.11	1,187.18
WC4A	1,196.69	1,185.40	1,185.05	1,185.05	1,185.11	1,186.55	1,186.34	1,186.43	1,187.33
MW1A	1,215.79	1,184.64	1,185.07	1,185.13	1,185.06	1,185.19	1,186.49	1,186.63	1,186.50
GM1S	1,216.07	1,184.71	1,185.06	1,185.12	1,185.08	1,185.22	1,186.50	1,186.65	1,186.61
MW1	1,221.86	1,185.85	1,185.71	1,185.68	1,185.68	1,186.82	1,187.08	1,187.19	1,187.87
MW2	1,220.25	1,185.90	1,185.75	1,185.69	1,185.71	1,186.87	1,187.10	1,187.27	1,187.95
MW3	1,218.75	1,185.65	1,185.53	1,185.49	1,185.53	1,186.59	1,186.89	1,187.03	1,187.73
EW1	1,218.30	1,146.30	1,144.30	1,143.30	1,145.30	1,145.30	1,145.30	1,146.30	1,145.30
Staff Gages									
SG1	1,189.37	ice	ice	ice	1,187.67	1,188.91	1,188.75	1,188.68	1,189.02
SG2	1,193.94	1,191.27	1,191.56	1,191.60	1,191.76	1,192.05	1,192.05	1,192.04	1,191.95

Notes:

(1) Bottom of well measured at approximately 1,178.8 ft. AMSL.
(2) Bottom of well measured at approximately 1,181.3 ft. AMSL.
(3) Bottom of well measured at approximately 1,181.7 ft. AMSL.

TABLE 3.1

PIEZOMETRIC ELEVATIONS
GROUNDWATER MONITORING PROGRAM
MARATHON ELECTRIC COMPANY
WAUSAU, WISCONSIN

Monitoring Well No.	*Top of Casing Elevation (ft. AMSL)*	*Piezometric Elevations (ft. AMSL)*			
		04/22/91	*04/29/91*	*05/06/91*	*06/27/91*
C1S	1,223.69	1,197.39	1,197.25	1,196.99	1,196.92
C2S (1)	1,216.23	1,181.13	1,181.13	1,181.23	1,181.87
C3S	1,220.24	1,186.48	1,186.42	1,186.52	1,196.90
C4S	1,216.84	1,187.15	1,187.08	1,187.16	1,187.48
C4D	1,216.50	1,187.36	1,187.30	1,187.40	1,187.75
C6S	1,221.69	1,187.39	1,187.52	1,187.69	1,188.11
C7S (2)	1,221.00	1,185.00	1,185.05	1,185.17	1,185.71
R1S	1,222.13	1,186.03	1,186.24	1,186.40	1,187.13
R1D	1,222.39	1,186.07	1,186.22	1,186.36	1,186.98
R2S	1,209.88	1,187.53	1,187.38	1,187.34	1,187.64
R2D	1,209.66	1,186.54	1,186.42	1,186.50	1,186.63
R3S	1,215.29	1,186.60	1,186.68	1,186.79	1,187.35
R3D	1,215.53	1,186.05	1,185.99	1,186.10	1,186.38
R4D	1,219.07	1,179.71	1,179.77	1,779.77	1,180.60
E21	1,197.61	1,187.43	1,186.36	1,186.41	1,187.48
E21A	1,197.95	1,187.41	1,186.33	1,186.56	1,187.45
E30	1,204.58	1,187.40	1,185.43	1,186.04	1,187.35
TCT44	1,204.57	1,187.50	1,185.37	1,186.03	1,187.42
W50	1,215.67	1,186.13	1,186.11	1,186.22	1,186.65
W51A	1,224.50	1,185.76	1,186.10	1,186.36	1,187.55
W52A	1,219.08	1,185.60	1,185.72	1,185.84	1,186.38
W52	1,219.25	1,185.53	1,185.45	1,185.55	1,185.96
W53A (3)	1,217.12	1,185.44	1,185.45	1,185.58	1,186.07
W53	1,216.91	1,185.49	1,185.49	1,185.61	1,186.11
W54	1,216.44	1,185.16	1,185.16	1,185.28	1,185.85
W55A	1,217.40	1,186.81	1,186.38	1,186.30	1,186.43
W55	1,217.29	1,186.63	1,186.41	1,186.34	1,185.92
W56	1,200.17	1,186.65	1,186.59	1,186.60	1,186.71
W56A	1,200.95	1,190.58	1,190.47	1,190.21	1,190.87
IWD	1,192.08	1,187.31	1,188.28	1,186.90	1,187.45
IWM	1,192.91	1,187.55	1,186.99	1,188.21	1,187.73
IWS	1,193.17	1,188.23	1,188.31	1,188.33	1,188.15
WSWD	1,193.25	1,185.33	1,185.31	1,185.47	1,185.93
WSWS	1,193.24	1,188.29	1,188.58	1,188.54	1,188.29
WC4	1,196.86	1,187.28	1,186.68	1,186.78	1,187.42
WC4A	1,196.69	1,187.39	1,186.87	1,186.91	1,187.44
MW1A	1,215.79	1,186.83	1,186.63	1,186.71	1,186.63
GM1S	1,216.07	1,186.91	1,186.65	1,186.73	1,186.73
MW1	1,221.86	1,187.82	1,187.66	1,187.74	1,187.92
MW2	1,220.25	1,185.83	1,186.69	1,187.78	1,187.95
MW3	1,218.75	1,187.67	1,187.56	1,187.64	1,187.82
EW1	1,218.30	1,152.30	1,152.30	1,153.30	1,153.30
Staff Gages					
SG1	1,189.37	1,188.44	1188.72	1,188.81	1,188.45
SG2	1,193.94	1,191.74	1192.08	1,191.83	1,191.58

Notes:

(1) Bottom of well measured at approximately 1,178.8 ft. AMSL.
(2) Bottom of well measured at approximately 1,181.3 ft. AMSL.
(3) Bottom of well measured at approximately 1,181.7 ft. AMSL.

TABLE 3.2

SAMPLE KEY/FIELD DATA
MARATHON ELECTRIC MANUFACTURING CORP.

Sample Source	*Date Stamped*	*Sample Number*	*Analyses*	*Purge Volume (gal.)*	*pH*	*Conductivity (µmhos)*	*Temp. °C*	*Appearance*
C2S	11/14/90	W-111490-JM-008	VOCs	5	6.00	360	12.3	Clear, No Odor
	11/15/90	W-111590-RRR-023	VOCs	3	6.07	440	12.8	Clear, No Odor
	11/26/90	dry						
	12/03/90	dry						
	12/10/90	dry						
	01/07/91	dry						
	02/12/91	dry						
	03/04/91	pump pulled						
C4D	11/14/90	W-111490-JM-005	VOCs	6	5.92	380	10.6	–
	11/16/90	W-111690-RRR-033	VOCs	6	6.20	380	11.1	Clear
	11/26/90	W-112690-JM-050	VOCs	6	6.73	398	9.7	–
	12/03/90	W-120390-MB-042	VOCs, BNAs Pest/PCB, Metals	6	6.12	390	10.1	Clear, No Odor
	12/10/90	W-121090-RR-054	VOCs	6	6.10	400	10.7	–
	01/07/91	W-010791-RR-068 MS/MSD	VOCs	6	5.81	420	10.0	–
	01/07/91	W-010791-RR-069 (Dup)	VOCs	–	–	–	–	–
	02/12/91	W-021291-RR-085	VOCs	6	5.80	490	10.4	–
	03/04/91	W-030491-RR-102 MS/MSD	VOCs, Metals	6	6.47	470	10.2	–
	03/04/91	W-030491-RR-107 (Dup)	VOC, Metals	–	–	–	–	–
	04/01/91	W-040191-RR-122	VOCs	6	6.15	530	11.2	–
	05/06/91	W-050691-RR-139	VOCs	6	5.67	570	10.4	
R2D	11/14/90	W-111490-RRR-015	VOCs	6	6.79	270	10.7	Slightly Cloudy, No Odor
	11/14/90	W-111490-RRR-016 (Dup)	VOCs	–	–	–	–	–
	11/15/90	W-111590-JM-027	VOCs	6	6.88	280	11.7	Clear, No Odor
	11/26/90	W-112690-JM-044	VOCs	6	7.15	300	9.3	Clear, No Odor
	12/04/90	W-120490-MB-044	VOCs	6	6.30	300	9.5	Clear, No Odor
	12/11/90	W-121190-RR-058	VOCs	6	6.85	320	9.9	–
	01/08/91	W-010891-RR-075	VOCs	6	6.88	310	9.6	–
	02/13/91	W-021391-RR-097	VOCs	6	5.81	310	9.5	–
	03/05/91	W-030591-RR-110	VOCs	6	6.24	310	9.9	–
	04/02/91	W-040291-RR-130 MS/MSD	VOCs	6	8.11	310	9.7	–
	04/02/91	W-040291-RR-131 (Dup)	VOCs	–	–	–	–	–
	05/07/91	W-050791-RR147	VOCs	6	6.46	290	9.8	

TABLE 3.2

SAMPLE KEY/FIELD DATA
MARATHON ELECTRIC MANUFACTURING CORP.

Sample Source	*Date Stamped*	*Sample Number*	*Analyses*	*Purge Volume (gal.)*	*pH*	*Conductivity (µmhos)*	*Temp. °C*	*Appearance*
R4D	11/14/90	W-111490-RRR-007	VOCs	6	5.99	450	11.4	Clear, No Odor
	11/15/90	W-111590-RRR-024	VOCs	6	6.06	500	12.3	Clear, No Odor
	11/26/90	W-112690-JM-041	VOCs	6	6.50	450	10.8	–
	12/04/90	W-120490-MB-046	VOCs	6	6.35	375	10.9	Clear, No Odor
	12/11/90	W-121190-RR-059	VOCs	6	6.18	400	11.5	–
	01/07/91	W-010791-RR-073	VOCs	6	6.34	370	9.5	–
	02/12/91	W-021291-RR-90 MS/MSP	VOCs	6	5.45	290	11.6	–
	02/12/91	W-021291-RR-91 (Dup)	VOCs	–	–	–	–	–
	03/04/91	W-030491-RR-106	VOCs	6	6.30	280	11.4	–
	04/01/91	W-040291-RR-123	VOCs	6	6.20	380	11.2	–
	05/06/91	W-050691-RR140 (MS/MSD)	VOCs	6	6.10	300	11.8	–
	05/06/91	W-050691-RR-151 (Dup)	VOCs	–	–	–	–	–
W52	11/14/90	W-111490-CH-009	VOCs	6	6.92	283	11.1	Clear, No Odor
	11/15/90	W-111590-JM-025	VOCs	6	7.17	292	11.6	Clear, No Odor
	11/15/90	W-11590-JM-026 (Dup)	VOC	–	–	–	–	–
	11/26/90	W-112690-JM-042	VOCs	6	7.42	310	9.3	Cloudy
	12/04/90	W-120490-MB-045	VOCs, BNAs, Pest/PCB, Metals	6	6.95	283	10.4	Clear, No Odor
	12/11/90	W-121190-RR-060	VOCs	6	7.39	320	10.6	–
	01/07/91	W-010791-RR-074	VOCs	6	6.79	340	9.8	–
	02/12/91	W-021291-RR-089	VOCs	6	6.88	370	10.3	–
	03/04/91	W-030491-RR-105	VOCs, Metals	6	7.15	370	10.2	–
	04/01/91	W-040191-RR-124	VOCs	6	7.29	410	10.3	–
	05/06/91	W-050691-RR-141	VOCs	6	7.14	380	9.9	
W53A	11/14/90	W-111490-CH-004	VOCs	6	6.29	780	11.3	Clear, No Odor
	11/15/90	W-111590-RRR-020	VOCs	6	6.26	786	11.8	Clear, No Odor
	11/26/90	W-112690-JM-037	VOCs	5	6.40	1190	11.2	Clear, No Odor
	11/26/90	W-112690-JM-038 (Dup)	VOCs	–	–	–	–	–
	12/03/90	W-120390-MB-039	VOCs, BNAs, Pest/PCB, Metals	5	6.00	1180	11.0	Clear, No Odor
	12/10/90	W-121090-RR-056	VOCs	5	6.73	1140	11.5	–
	01/07/91	dry						
	02/12/91	W-021291-RR-087	VOCs	5	7.42	350	10.6	–

TABLE 3.2

SAMPLE KEY/FIELD DATA
MARATHON ELECTRIC MANUFACTURING CORP.

Sample Source	*Date Stamped*	*Sample Number*	*Analyses*	*Purge Volume (gal.)*	*pH*	*Conductivity (µmhos)*	*Temp. °C*	*Appearance*
W53A Cont'd	03/04/91	W-030491-RR-104	VOCs, Metals	5	7.20	290	10.4	–
	04/02/91	W-040291-RR-132	VOCs	5	8.13	220	11.5	–
	05/07/91	W-050791-RR-150	VOCs	5	6.85	190	10.8	–
W53	11/13/90	W-111390-RRR-002	VOCs	7.5	6.90	385	9.9	Clear, No Odor
	11/15/90	W-111590-RRR-021	VOCs	6	7.35	380	10.9	Clear, No Odor
	11/15/90	W-111590-RRR-022 (Dup)	VOCs	–	–	–	–	–
	11/26/90	W-112690-JM-039	VOCs	6	8.62	460	9.5	–
	12/03/90	W-120390-MB-040	VOCs	6	6.75	590	9.3	Clear, No Odor
	12/03/90	W-120390-MB-041 (dup)	VOCs	–	–	–	–	–
	12/10/90	W-121090-RR-057 (MS/MSD)	VOCs	6	6.94	540	9.8	–
	01/07/91	W-010791-RR-071	VOCs	6	7.51	520	7.8	–
	02/12/91	W-021291-RR-086	VOCs	6	7.24	100	10.1	–
	03/04/91	W-030491-RR-103	VOCs	6	7.50	730	9.7	–
	04/02/91	W-040291-RR-133	VOCs	6	8.95	860	10.1	–
	05/07/91	W-050791-RR-149	VOCs	6	6.78	720	10.2	–
W54	11/13/90	W-111390-MB-001	VOCs	20	–	–	–	Clear, No Odor
	11/15/90	W-111590-JM-019	VOCs	16	7.10	680	11.8	Clear, No Odor
	11/26/90	W-112690-JM-036	VOCs	17	7.48	480	10.2	Slightly gray
	12/03/90	W-120390-MB-038	VOCs, BNAs, Pest/PCBs, Metals	17	7.60	560	9.2	–
	12/10/90	W-120990-RR-053	VOCs	15	7.46	350	10.4	–
	12/10/90	W-120990-RR-055 (Dup)	VOCs	–	–	–	–	–
	01/07/91	W-010791-RR-072	VOCs	15	6.67	250	10.2	–
	02/12/91	W-021291-RR-088	VOCs	15	9.83	370	10.2	–
	03/05/91	W-030591-RR-111	VOCs, Metals	15	7.19	180	8.5	–
	04/02/91	W-040291-RR-134	VOCs	15	9.56	250	5.1	–
	05/07/91	W-050791-RR_148	VOCs	15	6.93	170	3.4	–
W55	11/14/90	W-111490-018 (MS/MSD)	VOCs	6	6.80	320	9.8	Cloudy Gray, No Odor
	11/14/90	W-111490-RRR-017 (Dup)	VOCs	–	–	–	–	–
	11/16/90	W-111690-RRR-032	VOCs	6	7.52	310	9.6	Clear, No Odor
	11/27/90	W-112790-JM-049	VOCs	6	6.64	310	9.3	Gray, Cloudy
	12/04/90	W-120490-MB-043 (MS/MSD)	VOCs	6	6.88	280	8.6	Gray, cloudy, No Odor
	12/11/90	W-121190-RR-061	VOCs	6	7.60	330	9.4	–

TABLE 3.2

SAMPLE KEY/FIELD DATA
MARATHON ELECTRIC MANUFACTURING CORP.

Sample Source	*Date Stamped*	*Sample Number*	*Analyses*	*Purge Volume (gal.)*	*pH*	*Conductivity (µmhos)*	*Temp. °C*	*Appearance*
W55 Cont'd	01/08/91	W-010891-RR-076	VOCs	6	6.99	310	9.2	–
	02/13/91	W-021391-RR-092	VOCs	6	6.93	400	9.0	–
	03/05/91	W-030591-RR-108	VOCs	6	7.10	370	8.9	–
	04/02/91	W-040291-RR-129	VOCs	6	8.32	380	9.3	–
	05/07/91	W-050791-RR-146	VOCs	6	7.08	380	9.4	–
WSWD	11/14/90	W-111490-RRR-013	VOCs	6	6.70	290	9.5	Cloudy (Rusty), No Odor
	11/16/90	W-111690-MB-028	VOCs	6	6.72	280	9.8	Light Orange Color, No Odor
	11/27/90	W-112790-JM-045	VOCs	6	6.57	510	9.2	Clear
	12/04/90	W-120490-MB-047	VOCs	6	6.37	430	8.6	Slight off color, No Odor
	12/11/90	W-121190-RR-062	VOCs	6	6.75	430	8.6	–
	01/08/91	W-010891-RR-077	VOCs	6	6.27	470	8.1	–
	02/13/91	W-021391-RR-093	VOCs	6	5.74	540	6.0	–
	03/05/91	W-030591-RR-109	VOCs	6	5.92	550	4.9	–
	04/01/91	W-040191-RR-125	VOCs	6	6.85	570	4.6	–
	05/06/91	W-050691-RR-142	VOCs	6	6.67	540	6.6	–
IWD	11/14/90	W-111490-RRR-014	VOCs	6	6.62	448	10.1	Cloudy (Rusty), No Odor
	11/16/90	W-111690-MB-029	VOCs	6	6.48	470	9.8	Clear, No Odor
	11/27/90	W-112790-JM-046	VOCs	6	6.59	360	9.3	Clear
	12/04/90	Not sampled						
	12/11/90	Not sampled						
	01/07/91	Not sampled						
	02/13/91	Not sampled						
	03/04/91	Not sampled						
	04/02/91	Not sampled						
	05/07/91	W-050791-RR-152	VOCs	6	6.81	240	8.4	
CW3	11/14/90	W-111490-MB-003	VOCs	NA	–	–	–	–
	11/16/90	W-111690-MB-030	VOCs	NA	–	–	–	–
	12/03/90	W-120390-MB-036	VOCs	NA	–	–	–	–
	01/07/91	W-010791-RR-066	VOCs	NA	–	–	–	–
	02/12/91	W-021291-RR-081	VOCs	NA	–	–	–	–
	03/04/91	W-030491-RR-100	VOCs	NA	–	–	–	–
	04/01/91	W-040191-RR-120	VOCs	NA	–	–	–	–
	05/06/91	W-050191-RR-135	VOCs	NA	–	–	–	–

TABLE 3.2

SAMPLE KEY/FIELD DATA
MARATHON ELECTRIC MANUFACTURING CORP.

Sample Source	*Date Stamped*	*Sample Number*	*Analyses*	*Purge Volume (gal.)*	*pH*	*Conductivity (µmhos)*	*Temp. °C*	*Appearance*
CW6	11/14/90	W-111490-MB-006	VOCs	NA	–	–	–	–
	11/16/90	W-111690-MB-031	VOCs	NA	–	–	–	–
	12/03/90	W-120390-MB-037	VOCs	NA	–	–	–	–
	01/07/91	W-010791-RR-067	VOCs	NA	–	–	–	–
	02/12/91	W-021291-RR-082	VOCs	NA	–	–	–	–
	03/04/91	W-030491-RR-101	VOCs	NA	–	–	–	–
	04/01/91	W-040191-RR-121	VOCs	NA	–	–	–	–
	05/06/91	W-050691-RR-136	VOCs	NA	–	–	–	–
CW7	02/12/91	W-021291-RR-083	VOCs	NA	–	–	–	–
	05/06/91	W-050691-RR-137	VOCs	NA	–	–	–	–
CW9	02/12/91	W-021291-RR-084	VOCs	NA	–	–	–	–
	05/06/91	W-050691-RR-138	VOCs					
EW1 (Influent)	11/14/90	W-111490-RRR-010	VOCs	NA	5.99	390	11.3	Clear, No Odor
	11/14/90	W-111490-RRR-011 (Dup)	VOCs	NA				
	11/16/90	W-111690-RRR-034	VOCs	NA	–	–	–	–
	11/19/90	PW-112790-JM-001	VOCs	NA	–	–	–	–
	11/23/90	PW-112390-RRR-003	VOCs	NA	–	–	–	–
	11/27/90	PW-112790-JM-005 (MS/MSD)	VOCs	NA	–	–	–	–
	11/29/90	PW-112990-RRR-009	VOCs	NA	5.95	710	11.8	Clear, No Odor
	11/29/90	PW-112990-RRR-010 (Dup)	VOCs	NA	–	–	–	–
	12/04/90	W-120490-MB-048	VOCs, BNAs,	NA	–	–	–	–
	12/04/90	W-120490-MB-050 (Dup)	Pest/PCBs, Metals					
	12/06/90	PW-120690-MH-011	VOCs	NA	6.75	545	11.9	Clear, No Odor
	12/06/90	PW-120690-MH-012 (Dup)	VOCs	NA	–	–	–	–
	12/11/90	W-121190-RR-063	VOCs	NA	–	–	–	–
	12/17/90	PW-121790-JM-014 (MS/MSD)	VOCs	NA	–	–	–	–
	12/17/90	PW-121790-JM-015 (Dup)	VOCs	NA	–	–	–	–
	01/08/91	W-010891-RR-078	VOCs	NA	–	–	–	–
	01/08/91	W-010891-RR-079 (Dup)	VOCs	NA	–	–	–	–
	02/13/91	W-021391-RR-094	VOCs	NA	–	–	–	–

TABLE 3.2

SAMPLE KEY/FIELD DATA
MARATHON ELECTRIC MANUFACTURING CORP.

Sample Source	*Date Stamped*	*Sample Number*	*Analyses*	*Purge Volume (gal.)*	*pH*	*Conductivity (µmhos)*	*Temp. °C*	*Appearance*
	03/05/91	W-030591-RR-112	VOCs, Metals	NA	–	–	–	–
	03/05/91	W-030591-RR-113 (Dup)	VOCs, Metals	NA	–	–	–	–
	04/01/91	W-040191-RR-126	VOCs	NA	–	–	–	–
	05/06/91	W-050691RR-143	VOCs	NA	–	–	–	–
	05/06/91	W-050691RR-144 (Dup)	VOCs	NA	–	–	–	–
EW1 (Effluent)	11/14/90	W-111490-RRR-012	VOCs	NA	6.31	390	11.1	Clear, No Odor
	11/16/90	PW-111690-RRR-035	VOCs	NA	–	–	–	Clear, No Odor
	11/19/90	PW-111990-RRR-002	VOCs	NA	–	–	–	Clear
	11/23/90	PW-112390-RRR-004	VOCs	NA	–	–	–	–
	11/27/90	PW112790-JM-006	VOCs	NA	–	–	–	–
	11/27/90	PW112790-JM-007 (Dup)	VOCs	NA	–	–	–	–
	11/29/90	PW-112990-RRR-008	VOCs	NA	6.35	370	10.9	–
	12/04/90	W-120490-MB-049	VOCs, BNAs, Pest/PCBs, Metals	NA	6.56	350	10.9	–
	12/06/90	PW-120690-MN-013	VOCs	NA	6.89	380	10.1	Clear, No Odor
	12/11/90	W-121190-RR-064	VOCs	NA	6.77	370	10.9	–
	12/11/90	W-1211190-RR-065 (Dup)	VOCs	NA	–	–	–	–
	12/17/90	PW-121790-JM-016	VOCs	NA	6.96	620	10.9	–
	01/08/91	W-010891-RR-080	VOCs	NA	–	–	–	–
	02/13/91	W-021391-RR-095	VOCs	NA	6.20	290	9.3	–
	02/13/91	W-021391-RR-096 (Dup)	VOCs	NA	–	–	–	–
	03/05/91	W-030591-RR-114	VOCs	NA	7.27	290	10.4	–
	03/05/91	W-030591-RR-115	Metals	NA	7.27	290	10.4	–
	04/01/91	W-040191-RR-127	VOCs	NA	6.86	300.00	9.80	–
	04/01/91	W-040191-RR-128 (Dup)	VOCs	NA	–	–	–	–
	05/06/91	W-050691-RR-145	VOCs	NA	7.92	270.00	9.30	–

Note: NA = Not Applicable

TABLE 3.3

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELL C2S

Parameter (µg/L) *VOCs*	*C2S* *11/14/90*	*11/15/90*
Chloromethane	ND80	ND20
Bromomethane	ND80	ND20
Vinyl Chloride	ND80	ND20
Chloroethane	ND80	ND20
Methylene Chloride	44U	13U
Acetone	ND80J	ND20J
Carbon Disulfide	ND40	ND10
1,1-Dichloroethene	ND40	ND10
1,1-Dichloroethane	ND40	ND10
1,2-Dichloroethene (total)	13J	3J
Chloroform	ND40	ND10
1,2-Dichloroethane	ND40	ND10
2-Butanone	ND80J	ND20J
1,1,1-Trichloroethane	ND40	ND10
Carbon Tetrachloride	ND40	ND10
Vinyl Acetate	ND80	ND20
Bromodichloromethane	ND40	ND10
1,2-Dichloropropane	ND40	ND10
cis-1,3-Dichloropropene	ND40	ND10
Trichloroethene	1500	390J
Dibromochloromethane	ND40	ND10
1,1,2-Trichloroethane	ND40	ND10
Benzene	ND40	ND10
Trans-1,3-Dichloropropene	ND40	ND10
Bromoform	ND40	ND10
4-Methyl-2-Pentanone	ND80	ND20J
2-Hexanone	ND80	ND20J
Tetrachloroethene	ND40	ND10
1,1,2,2-Tetrachloroethane	ND40	ND10
Toluene	ND40	ND10
Chlorobenzene	ND40	ND10
Ethylbenzene	ND40	ND10
Styrene	ND40	ND10
Total Xylenes	ND40	ND10

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.4

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELL C4D

Parameter (µg/L) *VOCs*	*C4D* *11/14/90*	*11/16/90*	*11/26/90*	*12/03/90*	*12/10/90*	*01/07/91*	*01/07/91 Dup*	*02/12/91*	*03/04/91 MS/MSD*	*03/04/91*	*04/03/91*	*05/06/91*
Chloromethane	ND2	ND2J	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2
Bromomethane	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2
Vinyl Chloride	ND2	ND2	ND2	ND2	ND2	ND2	ND2	2.2	ND2	1.3J	3.8	3.3
Chloroethane	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2
Methylene Chloride	0.4U	0.5U	ND1	0.5U	0.6U	0.2U	0.3U	ND1	ND1	ND1	ND1	ND1
Acetone	ND2J	ND2J	ND2J	ND2J	ND2J	ND2J	ND2	6.9UJ	ND2UJ	ND2UJ	3J	ND2
Carbon Disulfide	ND1	ND1	ND1	ND1	0.3J	ND1	ND1	ND1	ND1	ND1	ND1	ND1
1,1-Dichloroethene	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
1,1-Dichloroethane	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
1,2-Dichloroethene (total)	1	0.9J	1	0.9J	0.95	1	1	ND1	ND1	ND1	1	ND1
Chloroform	0.9J	0.9J	0.9J	0.6J	0.5J	0.2J	0.3J	ND1	ND1	ND1	ND1	ND1
1,2-Dichloroethane	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
2-Butanone	ND2	ND2	ND2	ND2J	ND2J	ND2J	ND2	ND2R	ND2UJ	ND2UJ	ND2	ND2R
1,1,1-Trichloroethane	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Carbon Tetrachloride	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Vinyl Acetate	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2R
Bromodichloromethane	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
1,2-Dichloropropane	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
cis-1,3-Dichloropropene	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Trichloroethene	12J	11	10	9	11	5J	5J	6.5	3.4 J	4.1 J	4.6J	4.3
Dibromochloromethane	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
1,1,2-Trichloroethane	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Benzene	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Trans-1,3-Dichloropropene	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Bromoform	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
4-Methyl-2-Pentanone	ND2	ND2	ND2	ND2	ND2J	ND2	ND2	ND2	ND2	ND2	ND2	ND2
2-Hexanone	ND2	ND2	ND2	ND2	ND2J	ND2	ND2	ND2	ND2	ND2	ND2	ND2
Tetrachloroethene	ND1	ND1	ND1	ND1	ND1	3	3	7.5	7.2	7.2	12	8.7
1,1,2,2-Tetrachloroethane	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Toluene	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Chlorobenzene	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Ethylbenzene	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Styrene	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Total Xylenes	ND1	ND1	ND1	ND1	ND1J	ND1	ND1	ND1	ND1	ND1	ND1	ND1

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.5

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELL R2D

Parameter (µg/L) VOCs	*R2D 11/14/90*	*11/14/90 Dup*	*11/15/90*	*11/26/90*	*12/04/90*	*12/11/90*	*12/11/90 Reanalysis*	*01/08/91*	*02/12/91*	*02/12/91 Diluted*
Chloromethane	ND20	ND20	ND20	ND40	ND80	ND50	ND80	ND98J	ND2	ND100
Bromomethane	ND20	ND20	ND20	ND40	ND80	ND50	ND80	ND98	ND2	ND100
Vinyl Chloride	ND20	ND20	ND20	ND40	ND80	ND50	ND80	ND98	ND2	ND100
Chloroethane	ND20	ND20	ND20	ND40	ND80	ND50	ND80	ND98	ND2	ND100
Methylene Chloride	ND10	ND10	13U	19U	100U	7U	25U	50U	ND1	53U
Acetone	ND20J	ND20J	ND20J	ND40J	ND80J	ND50J	ND80J	ND98J	ND2J	ND100J
Carbon Disulfide	ND10	ND10	ND10	ND20J	ND40	ND25	ND40	ND49	ND1	ND50
1,1-Dichloroethene	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
1,1-Dichloroethane	ND10	ND10	ND10	ND20	ND40	ND25	ND40J	ND49	ND1	ND50
1,2-Dichloroethene (total)	8J	8J	8J	27	35J	44	43D	48J	24	ND50
Chloroform	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
1,2-Dichloroethane	ND10	ND10	ND10	ND20	ND40	ND25J	ND40J	ND49	ND1	ND50
2-Butanone	ND20J	ND20J	ND20J	ND40	ND80J	ND50J	ND80J	ND98	ND2R	ND100R
1,1,1-Trichloroethane	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
Carbon Tetrachloride	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
Vinyl Acetate	ND20	ND20	ND20	ND40J	ND80	ND50J	ND80J	ND98	ND2	ND100
Bromodichloromethane	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
1,2-Dichloropropane	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
cis-1,3-Dichloropropene	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
Trichloroethene	240	250	260	750	1100	1200	1200	1500J	650	2400
Dibromochloromethane	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
1,1,2-Trichloroethane	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
Benzene	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
Trans-1,3-Dichloropropene	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
Bromoform	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
4-Methyl-2-Pentanone	ND20	ND20	ND20J	ND40	ND80	ND50J	ND80J	ND98	ND2	ND100
2-Hexanone	ND20	ND20	ND20J	ND40J	ND40	ND50J	ND80J	ND98	ND2	ND100
Tetrachloroethene	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
1,1,2,2-Tetrachloroethane	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
Toluene	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
Chlorobenzene	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
Ethylbenzene	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
Styrene	ND10	ND10	ND10	ND20	ND40	ND25	ND40	ND49	ND1	ND50
Total Xylenes	ND10	ND10	ND10	ND20	ND40	ND25J	ND40J	ND49	ND1	ND50

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.5

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELL R2D

Parameter (μg/L) VOCs	*03/04/91*	*03/04/91 Diluted*	*04/03/91*	*04/03/91 Diluted*	*04/03/91 Dup*	*04/03/91 Dup-Diluted*	*05/07/91*	*05/07/91 Diluted*
Chloromethane	ND2	ND200 UJ	ND2	ND100	ND2	ND100	ND2UJ	ND100
Bromomethane	ND2	ND200	ND2	ND100	ND2	ND100	ND2	ND100
Vinyl Chloride	ND2	ND200	ND2	ND100	ND2	ND100	ND2	ND100
Chloroethane	ND2	ND200	ND2	ND100	ND2	ND100	ND2	ND100
Methylene Chloride	ND1	190	ND1	83D	ND1	ND50	ND1	ND50
Acetone	ND UJ	ND200UJ	ND2J	290UJ	ND2J	ND100J	ND2	ND100UJ
Carbon Disulfide	ND1	ND100	ND1U	ND50	ND1U	ND50	ND1	ND50
1,1-Dichloroethene	ND1	ND100	ND1	ND50	ND1	ND50	1.2	ND50
1,1-Dichloroethane	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
1,2-Dichloroethene (total)	24	ND100	25	ND50	27	ND50	24	ND50
Chloroform	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
1,2-Dichloroethane	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
2-Butanone	ND2R	ND200UJ	ND2	ND100	ND2	ND100	ND2R	ND100R
1,1,1-Trichloroethane	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
Carbon Tetrachloride	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
Vinyl Acetate	ND2	ND200	ND2J	ND100	ND2	ND100	ND2R	ND100
Bromodichloromethane	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
1,2-Dichloropropane	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
cis-1,3-Dichloropropene	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
Trichloroethene	650	2700	690J	2700D	780J	2100D	880J	270D
Dibromochloromethane	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
1,1,2-Trichloroethane	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
Benzene	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
Trans-1,3-Dichloropropene	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
Bromoform	ND1	ND100UJ	ND1	ND50	ND1	ND50	ND1	ND50
4-Methyl-2-Pentanone	ND2	ND200	ND2J	ND100	ND2	ND100	ND2	ND100
2-Hexanone	ND2UJ	ND200	ND2	ND100	ND2	ND100	ND2	ND100
Tetrachloroethene	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
1,1,2,2-Tetrachloroethane	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
Toluene	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
Chlorobenzene	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
Ethylbenzene	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
Styrene	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50
Total Xylenes	ND1	ND100	ND1	ND50	ND1	ND50	ND1	ND50

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.6

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELL R4D

Parameter (µg/L) *VOCs*	*R4D* *11/14/90*	*11/15/90*	*11/26/90*	*12/04/90*	*12/11/90*	*01/07/91*	*02/12/91*	*02/12/91 Dup*	*03/04/91*	*04/03/91*	*04/03/91 Diluted*	*05/06/91*	*05/06/91 Dup*	*05/06/91 Dup-Diluted*
Chloromethane	ND14	ND20	ND2J	ND4	ND5	4	ND2	ND2	ND2	ND2	ND10	ND2UJ	ND2UJ	ND4
Bromomethane	ND14	ND20	ND2	ND4	ND5	ND2	ND2	ND2	ND2	ND2	ND10	ND2	ND2	ND4
Vinyl Chloride	ND14	ND20	ND2	ND4	ND5	ND2	ND2	ND2	ND2	ND2	ND10	ND2	ND2	ND4
Chloroethane	ND14	ND20	ND2	ND4	ND5	ND2	ND2	ND2	ND2	ND2	ND10	ND2	ND2	ND4
Methylene Chloride	8U	13U	ND1	4U	0.9U	0.2U	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
Acetone	ND14J	ND20J	ND2J	ND4J	ND5J	ND2	ND2J	ND2J	ND2UJ	ND2J	ND10J	ND2	ND2	ND4UJ
Carbon Disulfide	ND7	ND10	ND1J	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
1,1-Dichloroethene	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
1,1-Dichloroethane	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
1,2-Dichloroethene (total)	27	8J	0.9J	11	21	1	ND1	ND1	ND1	2.8	ND5	ND1	ND1	ND2
Chloroform	ND7	ND10	1	0.8J	0.9J	1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
1,2-Dichloroethane	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
2-Butanone	ND14J	ND20J	ND2	ND4J	ND5J	ND2	ND2R	ND2R	ND2UJ	ND2	ND10	ND2R	ND2R	ND4R
1,1,1-Trichloroethane	ND7	ND10	ND1	ND2	ND3	0.2J	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
Carbon Tetrachloride	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
Vinyl Acetate	ND14	ND20	ND2	ND4	ND5	ND2	ND2	ND2	ND2	ND2	ND10J	ND2R	ND2R	ND4R
Bromodichloromethane	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
1,2-Dichloropropane	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
cis-1,3-Dichloropropene	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
Trichloroethene	230	300	17	45	64	23J	28J	32	31	80J	110D	58	74J	58D
Dibromochloromethane	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
1,1,2-Trichloroethane	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
Benzene	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
Trans-1,3-Dichloropropene	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
Bromoform	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
4-Methyl-2-Pentanone	ND14	ND20J	ND2	ND4	ND5J	ND2	ND2	ND2	ND2	ND2	ND10J	ND2	ND2	ND4
2-Hexanone	ND14	ND20J	ND2	ND4	ND5J	ND2	ND2	ND2	ND2UJ	ND2	ND10	ND2	ND2	ND4
Tetrachloroethene	3J	2J	ND1	ND2	0.5J	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
1,1,2,2-Tetrachloroethane	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
Toluene	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
Chlorobenzene	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
Ethylbenzene	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
Styrene	ND7	ND10	ND1	ND2	ND3	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2
Total Xylenes	ND7	ND10	ND1	ND2	ND3J	ND1	ND1	ND1	ND1	ND1	ND5	ND1	ND1	ND2

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.7

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELL W52

Parameter (µg/L) VOCs	W52 11/14/90	11/15/90	11/15/90 *Dup*	11/26/90	12/04/90	12/11/90	01/07/91	02/12/91	02/12/91 *Diluted*	03/04/91	03/04/91 *Diluted*	04/03/91	04/03/91 *Diluted*	05/06/91	05/06/91 *Diluted*
Chloromethane	ND4	ND4	ND4	ND6	ND10	ND8	ND12J	ND2	ND40	ND2	ND40	ND2	ND40	ND2	ND100
Bromomethane	ND4	ND4	ND4	ND6	ND10	ND8	ND12	ND2	ND40	ND2	ND40	ND2	ND40	ND2	ND100
Vinyl Chloride	ND4	ND4	ND4	ND6	ND10	ND8	ND12	ND2	ND40	ND2	ND40	ND2	ND40	ND2	ND100
Chloroethane	ND4	ND4	ND4	ND6	ND10	ND8	ND12	ND2	ND40	ND2	ND40	ND2	ND40	ND2	ND100
Methylene Chloride	1U	1U	1U	4U	7U	8U	7U	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Acetone	ND4J	ND4J	ND4J	ND6J	ND10J	ND8J	ND12J	ND2J	ND40J	ND2UJ	ND40UJ	3.7J	ND40J	ND2	ND100UJ
Carbon Disulfide	ND2	ND2	ND2	ND3J	ND5	ND4	ND6	ND1	ND20	1.9	ND20	ND1	ND20	ND1	ND50
1,1-Dichloroethene	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
1,1-Dichloroethane	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
1,2-Dichloroethene (total)	ND2	ND2	ND2	ND3	ND5	ND4	ND6	2	ND20	2.5	ND20	4.5	ND20	9.4	ND50
Chloroform	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
1,2-Dichloroethane	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
2-Butanone	ND4J	ND4J	ND4J	ND6	ND10J	ND8J	ND12	ND2R	ND40R	ND2R	ND40UJ	ND2	ND40	ND2R	ND100R
1,1,1-Trichloroethane	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Carbon Tetrachloride	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Vinyl Acetate	ND4	ND4	ND4	ND6J	ND10	ND8	ND12	ND2	ND40	ND2	ND40	ND2	ND40J	ND2R	ND100
Bromodichloromethane	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
1,2-Dichloropropane	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
cis-1,3-Dichloropropene	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Trichloroethene	64	56	55	84	130	100	140J	500	1000	480	1000	490J	850D	750J	1900D
Dibromochloromethane	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
1,1,2-Trichloroethane	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Benzene	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Trans-1,3-Dichloropropene	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Bromoform	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
4-Methyl-2-Pentanone	ND4	ND4	ND4	ND6	ND10	ND8	ND12	ND2	ND40	ND2	ND40	ND2	ND40J	ND2	ND100
2-Hexanone	ND4J	ND4	ND4	ND6J	ND10	ND8	ND12	ND2	ND40	ND2UJ	ND40	ND2	ND40	ND2	ND100
Tetrachloroethene	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
1,1,2,2-Tetrachloroethane	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Toluene	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Chlorobenzene	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Ethylbenzene	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Styrene	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Total Xylenes	ND2	ND2	ND2	ND3	ND5	ND4	ND6	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.8

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELLS W53A AND W53

Parameter (µg/L) VOCs	W53A 11/14/90	11/15/90	11/26/90	11/26/90 Dup	12/03/90	12/10/90	02/12/91	02/12/91 Diluted	03/04/91	04/03/91	05/07/91
Chloromethane	ND6	ND8	ND6	ND10J	ND2	ND2	ND2	ND4	ND2	ND2	ND2UJ
Bromomethane	ND6	ND8	ND6	ND10	ND2	ND2	ND2	ND4	ND2	ND2	ND2
Vinyl Chloride	ND6	ND8	ND6	ND10	ND2	ND2	ND2	ND4	ND2	ND2	ND2
Chloroethane	ND6	ND8	ND6	ND10	ND2	ND2	ND2	ND4	ND2	ND2	ND2
Methylene Chloride	1U	2U	ND3	3U	0.5U	0.4U	ND1	ND2	ND1	ND1	ND1
Acetone	ND6J	ND8J	ND6J	ND5J	ND2J	ND2J	ND2J	3.6J	ND2UJ	1.5J	ND2
Carbon Disulfide	ND3	ND4	ND3J	ND5J	ND1	3	ND1	ND2	ND1	ND1	ND1
1,1-Dichloroethene	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
1,1-Dichloroethane	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
1,2-Dichloroethene (total)	2J	3J	2J	ND5	2	2	2.8	ND2	1.5	1.2	ND1
Chloroform	ND3	ND4	ND3	ND5	ND1	ND1	3.5	2.2	1.3	ND1	ND1
1,2-Dichloroethane	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
2-Butanone	ND6J	ND8J	ND6	ND10	ND2J	ND2J	ND2R	ND4R	ND2R	ND2	ND2R
1,1,1-Trichloroethane	0.8J	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
Carbon Tetrachloride	ND3	ND4	ND3	ND5	ND1	ND1	ND1	2.5	1.7	ND1	ND1
Vinyl Acetate	ND6	ND8	ND6J	ND10	ND2	ND2	ND2	ND4	ND2	ND2J	ND2R
Bromodichloromethane	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
1,2-Dichloropropane	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
cis-1,3-Dichloropropene	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
Trichloroethene	71	120	100	100	24	16	72	42	26	65	19
Dibromochloromethane	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
1,1,2-Trichloroethane	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
Benzene	ND3	ND4	ND3	ND5	0.2J	0.3J	ND1	ND2	ND1	ND1	ND1
Trans-1,3-Dichloropropene	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
Bromoform	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
4-Methyl-2-Pentanone	ND6	ND8	ND6	ND10	ND2	ND2J	ND2	ND4	ND2	ND2J	ND2
2-Hexanone	ND6J	ND8	ND6J	ND10	ND2	ND2J	ND2	ND4	ND2UJ	ND2	ND2
Tetrachloroethene	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
1,1,2,2-Tetrachloroethane	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
Toluene	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
Chlorobenzene	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
Ethylbenzene	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
Styrene	ND3	ND4	ND3	ND5	ND1	ND1	ND1	ND2	ND1	ND1	ND1
Total Xylenes	ND3	ND4	ND3	ND5	ND1	ND1J	ND1	ND2	ND1	ND1	ND1

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.8

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELLS W53A AND W53

Parameter (µg/L) *VOCs*	W53 *11/13/90*	*11/15/90*	*11/15/90* *Dup*	*11/26/90*	*12/03/90*	*12/03/90* *Dup*	*12/10/90*	*01/07/91*	*02/12/91*	*02/12/91* *Diluted*	*03/04/91*	*03/04/91* *Diluted*	*04/03/91*	*05/07/91*
Chloromethane	ND26	ND20	ND20	ND20J	ND14	ND14	ND25	ND20	ND2	ND10	ND2	ND10	ND2	ND2UJ
Bromomethane	ND26	ND20	ND20	ND20	ND14	ND14	ND25	ND20	ND2	ND10	ND2	ND10	ND2	ND2
Vinyl Chloride	ND26	ND20	ND20	ND20	ND14	ND14	ND25	ND20	ND2	ND10	ND2	ND10	ND2	ND2
Chloroethane	ND26	ND20	ND20	ND20	ND14	ND14	ND25	ND20	ND2	ND10	ND2	ND10	ND2	ND2
Methylene Chloride	22U	35U	27U	47U	24U	21U	8U	25U	51U	48U	16U	18U	8.4J	4.7U
Acetone	ND26J	ND20J	ND20J	ND20J	ND14J	ND14J	ND25J	ND20J	12UJ	ND10J	ND2UJ	ND10UJ	1.9J	ND2
Carbon Disulfide	ND13	ND10	ND10	ND10J	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
1,1-Dichloroethene	ND13	ND10	ND10	ND10	ND7	ND7	ND13J	ND10	ND1	ND5	ND1	ND5	ND1	ND1
1,1-Dichloroethane	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
1,2-Dichloroethene (total)	190	190	170	170	110	100	220	180	37	28	23	23	12	7.4
Chloroform	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	7.6
1,2-Dichloroethane	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
2-Butanone	ND26J	ND20J	ND20J	ND20	ND14J	ND14J	ND25J	ND20	ND2R	ND10R	ND2R	ND10UJ	ND2	ND2R
1,1,1-Trichloroethane	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
Carbon Tetrachloride	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	7
Vinyl Acetate	ND26	ND20	ND20	ND20	ND14	ND14	ND25	ND20	ND2	ND10	ND2	ND10	ND2J	ND2R
Bromodichloromethane	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
1,2-Dichloropropane	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
cis-1,3-Dichloropropene	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
Trichloroethene	340	360	320	290	200	190	360J	290J	110	93	73	73	51	53
Dibromochloromethane	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
1,1,2-Trichloroethane	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
Benzene	ND13	ND10	ND10	ND10	ND7	ND7	ND13J	ND10	ND1	ND5	ND1	ND5	ND1	ND1
Trans-1,3-Dichloropropene	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
Bromoform	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
4-Methyl-2-Pentanone	ND26J	ND20J	ND20	ND20	ND14	ND14	ND25J	ND20	ND2	ND10	ND2	ND10	ND2J	ND2
2-Hexanone	ND26J	ND20J	ND20	ND20	ND14	ND14	ND25J	ND20	ND2	ND10	ND2UJ	ND10	ND2	ND2
Tetrachloroethene	ND13	ND10	ND10	3J	1J	ND7	3J	2J	ND1	ND5	ND1	ND5	ND1	ND1
1,1,2,2-Tetrachloroethane	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
Toluene	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
Chlorobenzene	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
Ethylbenzene	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
Styrene	ND13	ND10	ND10	ND10	ND7	ND7	ND13	ND10	ND1	ND5	ND1	ND5	ND1	ND1
Total Xylenes	ND13	ND10	ND10	ND10	ND7	ND7	ND13J	ND10	ND1	ND5	ND1	ND5	ND1	ND1

<u>Notes:</u>

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.9

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELL W54

Parameter (µg/L) *VOCs*	*W54* *11/13/90*	*11/15/90*	*11/26/90*	*12/03/90*	*12/10/90*	*12/10/90 (Dup)*	*01/07/91*	*02/12/91*	*03/04/91*	*04/03/91*	*05/07/91*
Chloromethane	ND4	ND4	ND2J	0.5J	ND2	ND2	ND2	ND2	ND2	ND2	ND2UJ
Bromomethane	ND4	ND4	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2
Vinyl Chloride	ND4	ND4	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2
Chloroethane	ND4	ND4	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2
Methylene Chloride	ND1U	2U	ND1	0.8U	0.3U	0.4U	.2U	ND1	ND1	ND1	ND1
Acetone	ND4J	ND4J	ND2J	2UJ	ND2J	ND2J	ND2	ND2J	ND2UJ	ND2J	ND2
Carbon Disulfide	ND2	ND2	ND1J	ND1	0.3J	ND1	ND1	ND1	ND1	ND1	ND1
1,1-Dichloroethene	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
1,1-Dichloroethane	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
1,2-Dichloroethene (total)	ND4	4	2	0.9J	0.4J	0.4J	.5J	ND1	ND1	ND1	ND1
Chloroform	ND2	ND2	ND1	ND1	ND1	ND1	ND1	30	1.2	ND1	ND1
1,2-Dichloroethane	ND2J	ND2J	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
2-Butanone	ND4	ND4	ND2	ND2J	ND2J	ND2J	ND2	ND2R	ND2UJ	ND2	ND2R
1,1,1-Trichloroethane	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Carbon Tetrachloride	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Vinyl Acetate	ND4	ND4	ND2	ND2	ND2	ND2	ND2	ND2	ND2	ND2J	ND2R
Bromodichloromethane	ND2	ND2	ND1	ND1	ND1	ND1	ND1	3.4	ND1	ND1	ND1
1,2-Dichloropropane	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
cis-1,3-Dichloropropene	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Trichloroethene	48	58	19	19	6	6	2J	3.3	6.1 J	5.7J	12
Dibromochloromethane	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
1,1,2-Trichloroethane	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Benzene	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Trans-1,3-Dichloropropene	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Bromoform	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
4-Methyl-2-Pentanone	ND4	ND4J	ND2	ND2	ND2J	ND2J	ND2	ND2	ND2	ND2J	ND2
2-Hexanone	ND4J	ND4J	ND2	ND2	ND2J	ND2J	ND2	ND2	ND2UJ	ND2	ND2
Tetrachloroethene	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
1,1,2,2-Tetrachloroethane	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Toluene	ND2	ND2	ND1	0.3J	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Chlorobenzene	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Ethylbenzene	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Styrene	ND2	ND2	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1	ND1
Total Xylenes	ND2	ND2	ND1	ND1	ND1J	ND2J	ND2	ND1	ND1	ND1	ND1

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.10

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELL W55

Parameter (µg/L)	*W55*														
VOCs	*11/14/90*	*11/14/90 Dup*	*11/16/90*	*11/27/90*	*12/04/90*	*12/11/90*	*01/08/91*	*02/12/91*	*02/12/91 Diluted*	*03/04/91*	*03/04/91 Diluted*	*04/03/91*	*04/03/91 Diluted*	*05/07/91*	*05/07/91 Diluted*
Chloromethane	ND100	ND100	ND100J	ND80	ND100	ND100	ND120J	ND2	ND100	ND2	ND200 UJ	ND2	ND100	ND2UJ	ND100
Bromomethane	ND100	ND100	ND100	ND80	ND100	ND100	ND120	ND2	ND100	ND2	ND200	ND2	ND100	ND2	ND100
Vinyl Chloride	ND100	ND100	ND100	ND80	ND100	ND100	ND120	ND2	ND100	ND2	ND200	ND2	ND100	ND2	ND100
Chloroethane	ND100	ND100	ND100	ND80	ND100	ND100	ND120	ND2	ND100	ND2	ND200	ND2	ND100	ND2	ND100
Methylene Chloride	ND50	ND50	74U	34U	29U	85U	56U	ND1	51U	ND1	ND100	ND1	ND50	ND1	ND50
Acetone	ND100J	ND100J	ND100J	ND80J	ND100J	ND100J	ND120J	ND2J	ND100J	ND2UJ	ND200UJ	ND2J	64UJ	ND2	ND100UJ
Carbon Disulfide	ND50	ND50	ND50	ND40J	ND50	ND50	ND59	ND1	ND50	ND1	ND100	1.5	ND50	ND1	ND50
1,1-Dichloroethene	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	1.1	ND50	1.3	ND50
1,1-Dichloroethane	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
1,2-Dichloroethene (total)	28J	27J	33J	42	33J	32J	41J	13	ND50	15	ND100	15	ND50	14	ND50
Chloroform	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
1,2-Dichloroethane	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
2-Butanone	ND100J	ND100J	ND100	ND80	ND100J	ND100J	ND120	ND2R	ND100R	ND2R	ND200UJ	ND2	ND100	ND2R	ND100R
1,1,1-Trichloroethane	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
Carbon Tetrachloride	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
Vinyl Acetate	ND100	ND100	ND100	ND80J	ND100	ND100	ND120	ND2	ND100	ND2	ND200	ND2J	ND100	ND2R	ND100
Bromodichloromethane	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
1,2-Dichloropropane	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
cis-1,3-Dichloropropene	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
Trichloroethene	1900	1800	1700	1500	1600J	1900	1900J	710	3200	720	3300	860J	3300D	830J	230D
Dibromochloromethane	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
1,1,2-Trichloroethane	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
Benzene	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
Trans-1,3-Dichloropropene	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
Bromoform	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100UJ	ND1	ND50	ND1	ND50
4-Methyl-2-Pentanone	ND100	ND100	ND100	ND80J	ND100	ND100	ND120	ND2	ND100	ND2	ND200	ND2J	ND100	ND2	ND100
2-Hexanone	ND100	ND100	ND100	ND80	ND100	ND100	ND120	ND2	ND100	ND2UJ	ND200	ND2	ND100	ND2	ND100
Tetrachloroethene	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
1,1,2,2-Tetrachloroethane	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
Toluene	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
Chlorobenzene	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
Ethylbenzene	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
Styrene	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50
Total Xylenes	ND50	ND50	ND50	ND40	ND50	ND50	ND59	ND1	ND50	ND1	ND100	ND1	ND50	ND1	ND50

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.11

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELL WSWD

Parameter (µg/L)	*WSWD*													
VOCs	***11/14/90***	***11/16/90***	***11/27/90***	***12/04/90***	***12/11/90***	***01/08/91***	***02/12/91***	***02/12/91 Diluted***	***03/04/91***	***03/04/91 Diluted***	***04/03/91***	***04/03/91 Diluted***	***05/06/91***	***05/06/91 Diluted***
Chloromethane	ND20	ND20	ND20	ND20	ND12	ND6J	ND2	ND10	ND2	ND10	ND2	ND10	ND2	ND10
Bromomethane	ND20	ND20	ND20	ND20	ND12	ND6	ND2	ND10	ND2	ND10	ND2	ND10	ND2	ND10
Vinyl Chloride	ND20	ND20	ND20	ND20	ND12	ND6	ND2	ND10	ND2	ND10	ND2	ND10	ND2	ND10
Chloroethane	ND20	ND20	ND20	ND20	ND12	ND6	ND2	ND10	ND2	ND10	ND2	ND10	ND2	ND10
Methylene Chloride	11U	5U	7U	25U	5U	2U	ND1	5U	ND1	ND5	ND1	ND5	ND1	ND5
Acetone	ND20J	ND20J	ND20J	ND20J	ND12J	ND6J	1.6J	ND10J	ND2UJ	ND10UJ	ND2J	ND10J	ND2	ND10UJ
Carbon Disulfide	ND10	ND10	ND10J	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
1,1-Dichloroethene	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
1,1-Dichloroethane	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
1,2-Dichloroethene (total)	14	2	49	26	14	7	9.8	9.2	11	10	12	9.9D	8.9	9.5D
Chloroform	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
1,2-Dichloroethane	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
2-Butanone	ND20J	ND20J	ND20	ND20J	ND12J	ND6	ND2R	ND10R	ND2R	ND10UJ	ND2	ND10	ND2R	ND10R
1,1,1-Trichloroethane	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
Carbon Tetrachloride	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
Vinyl Acetate	ND20	ND20	ND20J	ND20	ND12	ND6	ND2	ND10	ND2	ND10	ND2J	ND10	ND2R	ND10
Bromodichloromethane	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
1,2-Dichloropropane	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
cis-1,3-Dichloropropene	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
Trichloroethene	270	230	260	230	190	97J	100	110	96	86	100J	100D	80J	89D
Dibromochloromethane	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
1,1,2-Trichloroethane	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
Benzene	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
Trans-1,3-Dichloropropene	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
Bromoform	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
4-Methyl-2-Pentanone	ND20	ND20	ND20J	ND20	ND12	ND6	ND2	ND10	ND2	ND10	ND2J	ND10	ND2	ND10
2-Hexanone	ND20	ND20	ND20	ND20	ND12	ND6	ND2	ND10	ND2UJ	ND10	ND2	ND10	ND2	ND10
Tetrachloroethene	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
1,1,2,2-Tetrachloroethane	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
Toluene	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
Chlorobenzene	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
Ethylbenzene	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
Styrene	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5
Total Xylenes	ND10	ND10	ND10	ND10	ND6	ND3	ND1	ND5	ND1	ND5	ND1	ND5	ND1	ND5

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.12

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELL IWD

Parameter (µg/L) *VOCs*	*IWD* *11/14/90*	*11/16/90*	*11/27/90*	*05/07/91*	*05/07/91 Diluted*
Chloromethane	ND10	ND10J	ND10	ND2	ND40
Bromomethane	ND10	ND10	ND10	ND2	ND40
Vinyl Chloride	ND10	ND10	ND10	ND2	ND40
Chloroethane	ND10	ND10	ND10	ND2	ND40
Methylene Chloride	ND5	2U	4U	ND1	ND20
Acetone	ND10J	ND10J	ND10J	ND2UJ	ND40UJ
Carbon Disulfide	ND5	ND5	ND5J	ND1	ND20
1,1-Dichloroethene	ND5	ND5	ND5	ND1	ND20
1,1-Dichloroethane	ND5	ND5	ND5	ND1	ND20
1,2-Dichloroethene (total)	42	ND5	28	27	23D
Chloroform	ND5	ND5	ND5	ND1	ND20
1,2-Dichloroethane	ND5	ND5	ND5	ND1	ND20
2-Butanone	ND10J	ND10	ND10	ND2R	ND40R
1,1,1-Trichloroethane	ND5	ND5	ND5	ND1	ND20
Carbon Tetrachloride	ND5	ND5	ND5	ND1	ND20
Vinyl Acetate	ND10	ND10	ND10J	ND2	ND40
Bromodichloromethane	ND5	ND5	ND5	ND1	ND20
1,2-Dichloropropane	ND5	ND5	ND5	ND1	ND20
cis-1,3-Dichloropropene	ND5	ND5	ND5	ND1	ND20
Trichloroethene	130	140	110	290J	330D
Dibromochloromethane	ND5	ND5	ND5	ND1	ND20
1,1,2-Trichloroethane	ND5	ND5	ND5	ND1	ND20
Benzene	ND5	ND5	ND5	ND1	ND20
Trans-1,3-Dichloropropene	ND5	ND5	ND5	ND1	ND20
Bromoform	ND5	ND5	ND5	ND1	ND20
4-Methyl-2-Pentanone	ND10	ND10	ND10	ND2	ND40
2-Hexanone	ND10	ND10	ND10J	ND2	ND40
Tetrachloroethene	ND5	ND5	ND5	2.5	ND20
1,1,2,2-Tetrachloroethane	ND5	ND5	ND5	ND1	ND20
Toluene	ND5	ND5	ND5	ND1	ND20
Chlorobenzene	ND5	ND5	ND5	ND1	ND20
Ethylbenzene	ND5	ND5	ND5	ND1	ND20
Styrene	ND5	ND5	ND5	ND1	ND20
Total Xylenes	ND5	ND5	ND5	ND1	ND20

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.13

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELLS CW3, CW6, CW7 AND CW9

Parameter (µg/L) *VOCs*	*CW3* *11/14/90*	*11/16/90*	*12/03/90*	*01/07/91*	*02/12/91*	*03/04/91*	*03/04/91 Diluted*	*04/03/91*	*05/06/91*
Chloromethane	ND4	ND6J	ND4	ND3J	ND2	ND2	ND10	ND2	ND2
Bromomethane	ND4	ND6	ND4	ND3	ND2	ND2	ND10	ND2	ND2
Vinyl Chloride	ND4	ND6	ND4	ND3	ND2	ND2	ND10	ND2	ND2
Chloroethane	ND4	ND6	ND4	ND3	ND2	ND2	ND10	ND2	ND2
Methylene Chloride	1U	2U	1U	.7U	ND1	ND1	ND5	ND1	ND1
Acetone	ND4J	2J	ND4J	ND3J	31J	ND2UJ	ND10UJ	ND2J	32
Carbon Disulfide	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
1,1-Dichloroethene	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
1,1-Dichloroethane	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
1,2-Dichloroethene (total)	7	7	7	6	3.5	3.8	ND5	3.8	3.7
Chloroform	0.3J	ND3	0.5J	ND2	ND1	ND1	ND5	ND1	ND1
1,2-Dichloroethane	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
2-Butanone	ND4J	ND6	ND4J	ND3	ND2R	ND2R	ND10UJ	6.5	ND2R
1,1,1-Trichloroethane	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
Carbon Tetrachloride	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
Vinyl Acetate	ND4	ND6	ND4	ND3	ND2	ND2	ND10	ND2	ND2R
Bromodichloromethane	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
1,2-Dichloropropane	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
cis-1,3-Dichloropropene	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
Trichloroethene	50	62	59	41J	54	47	120	47	40
Dibromochloromethane	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
1,1,2-Trichloroethane	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
Benzene	2	ND3	4	5	8.8	7.4	ND5	7.7	7.4
Trans-1,3-Dichloropropene	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
Bromoform	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
4-Methyl-2-Pentanone	ND4	ND6	ND4	ND3	ND2	ND2	ND10	ND2	ND2
2-Hexanone	ND4J	ND6	ND4	ND3	ND2	ND2UJ	ND10	ND2	ND2
Tetrachloroethene	4	6	8	8	12	13	ND5	13	11
1,1,2,2-Tetrachloroethane	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
Toluene	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
Chlorobenzene	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
Ethylbenzene	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
Styrene	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1
Total Xylenes	ND2	ND3	ND2	ND2	ND1	ND1	ND5	ND1	ND1

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.13

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELLS CW3, CW6, CW7 AND CW9

Parameter (µg/L) *VOCs*	*CW6* *11/14/90*	*11/16/90*	*12/03/90*	*01/07/91*	*02/12/91*	*02/12/91 Diluted*	*03/04/91*	*04/03/91*	*05/06/91*	*05/06/91 Diluted*
Chloromethane	ND10	ND8J	ND10	ND4	ND2	ND10	ND2	ND2	ND2	ND10
Bromomethane	ND10	ND8	ND10	ND4	ND2	ND10	ND2	ND2	ND2	ND10
Vinyl Chloride	ND10	ND8	ND10	ND4	ND2	ND10	ND2	ND2	ND2	ND10
Chloroethane	ND10	ND8	ND10	ND4	ND2	ND10	ND2	ND2	ND2	ND10
Methylene Chloride	2U	3U	2U	1U	ND1	ND5	ND1	ND1	ND1	ND5
Acetone	ND10J	ND8J	ND10J	ND4J	ND2J	ND10J	ND2UJ	ND2J	ND2	ND10UJ
Carbon Disulfide	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
1,1-Dichloroethene	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
1,1-Dichloroethane	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
1,2-Dichloroethene (total)	1J	1J	1J	1J	ND1	ND5	ND1	ND1	ND1	ND5
Chloroform	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
1,2-Dichloroethane	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
2-Butanone	ND10J	ND8J	ND10J	ND4	ND2R	ND10R	ND2R	ND2	ND2R	ND10R
1,1,1-Trichloroethane	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
Carbon Tetrachloride	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
Vinyl Acetate	ND10	ND8	ND10	ND4	ND2	ND10	ND2	ND2	ND2R	ND10R
Bromodichloromethane	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
1,2-Dichloropropane	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
cis-1,3-Dichloropropene	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
Trichloroethene	110	120	130	68J	150	140	110	55	110J	130D
Dibromochloromethane	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
1,1,2-Trichloroethane	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
Benzene	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
Trans-1,3-Dichloropropene	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
Bromoform	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
4-Methyl-2-Pentanone	ND10	ND8	ND10	ND4	ND2	ND10	ND2	ND2	ND2	ND10
2-Hexanone	ND10J	ND8	ND10	ND4	ND2	ND10	ND2UJ	ND2	ND2	ND10
Tetrachloroethene	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
1,1,2,2-Tetrachloroethane	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
Toluene	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
Chlorobenzene	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
Ethylbenzene	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
Styrene	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND5
Total Xylenes	ND5	ND4	ND5	ND2	ND1	ND5	ND1	ND1	ND1	ND1

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.13

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELLS CW3, CW6, CW7 AND CW9

Parameter (µg/L)	*CW7*		*CW9*	
VOCs	*02/12/91*	*05/06/91*	*02/12/91*	*05/06/91*
Chloromethane	ND2	ND2	ND2	ND2
Bromomethane	ND2	ND2	ND2	ND2
Vinyl Chloride	ND2	ND2	ND2	ND2
Chloroethane	ND2	ND2	ND2	ND2
Methylene Chloride	ND1	ND1	1.1U	ND1
Acetone	5.7UJ	ND2	6.1UJ	ND2
Carbon Disulfide	ND1	ND1	ND1	ND1
1,1-Dichloroethene	ND1	ND1	ND1	ND1
1,1-Dichloroethane	ND1	ND1	ND1	ND1
1,2-Dichloroethene (total)	ND1	ND1	ND1	ND1
Chloroform	ND1	ND1	ND1	ND1
1,2-Dichloroethane	ND1	ND1	ND1	ND1
2-Butanone	ND2R	ND2R	ND2R	ND2R
1,1,1-Trichloroethane	ND1	ND1	ND1	ND1
Carbon Tetrachloride	ND1	ND1	ND1	ND1
Vinyl Acetate	ND2	ND2R	ND2	ND2R
Bromodichloromethane	ND1	ND1	ND1	ND1
1,2-Dichloropropane	ND1	ND1	ND1	ND1
cis-1,3-Dichloropropene	ND1	ND1	ND1	ND1
Trichloroethene	ND1	ND1	ND1	ND1
Dibromochloromethane	ND1	ND1	ND1	ND1
1,1,2-Trichloroethane	ND1	ND1	ND1	ND1
Benzene	ND1	ND1	ND1	ND1
Trans-1,3-Dichloropropene	ND1	ND1	ND1	ND1
Bromoform	ND1	ND1	ND1	ND1
4-Methyl-2-Pentanone	ND2	ND2	ND2	ND2
2-Hexanone	ND2	ND2	ND2	ND2
Tetrachloroethene	ND1	ND1	ND1	ND1
1,1,2,2-Tetrachloroethane	ND1	ND1	ND1	ND1
Toluene	ND1	ND1	ND1	ND1
Chlorobenzene	ND1	ND1	ND1	ND1
Ethylbenzene	ND1	ND1	ND1	ND1
Styrene	ND1	ND1	ND1	ND1
Total Xylenes	ND1	ND1	ND1	ND1

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.14

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELL EW1 (INFLUENT)

Parameter (µg/L)	*EW1 (Influent)*										
VOCs	*11/14/90*	*11/14/90 Dup.*	*11/16/90*	*11/19/90*	*11/23/90*	*11/27/90*	*11/29/90*	*11/29/90 Dup*	*12/04/90*	*12/04/90 Dup*	*12/06/90*
Chloromethane	ND20	ND20	ND20	ND30J	ND30J	ND32	ND20	*ND20*	ND30	ND32	ND30J
Bromomethane	ND20	ND20	ND20	ND30	ND30	ND32	ND20	*ND20*	ND30	ND32	ND30
Vinyl Chloride	ND20	ND20	ND20	ND30	ND30	ND32	ND20	*ND20*	ND30	ND32	ND30
Chloroethane	ND20	ND20	ND20	ND30	ND30	ND32	ND20	*ND20*	ND30	ND32	ND30
Methylene Chloride	9U	ND10	8U	ND15	ND15	ND16	ND10	*ND10*	36U	36U	20U
Acetone	ND20J	ND20J	ND20J	ND30J	ND30J	ND32J	ND20J	*ND20J*	ND30J	ND32J	ND30J
Carbon Disulfide	ND10	ND10	ND10	ND15	ND15J	ND16	ND10	*ND10*	ND15	ND16	ND15
1,1-Dichloroethene	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
1,1-Dichloroethane	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
1,2-Dichloroethene (total)	130	110	110	110	89	80	80	*80*	75	78	93
Chloroform	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
1,2-Dichloroethane	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
2-Butanone	ND20J	ND20J	ND20J	ND30	ND30	ND32R	ND20R	*ND20R*	ND30J	ND32J	ND30J
1,1,1-Trichloroethane	ND10	ND10	ND10	ND15	7J	11J	10	*11*	8J	9J	9J
Carbon Tetrachloride	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
Vinyl Acetate	ND20	ND20	ND20	ND30J	ND30J	ND32	ND20	*ND20*	ND30	ND32	ND30
Bromodichloromethane	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
1,2-Dichloropropane	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
cis-1,3-Dichloropropene	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
Trichloroethene	290	260	330	490	450	400	380J	*380J*	440J	440J	470J
Dibromochloromethane	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
1,1,2-Trichloroethane	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
Benzene	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
Trans-1,3-Dichloropropene	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
Bromoform	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
4-Methyl-2-Pentanone	ND20	ND20J	ND20	ND30	ND30	ND32	ND20J	*ND20J*	ND30	ND32	ND30
2-Hexanone	ND20	ND20J	ND20	ND30	ND30	ND32	ND20J	*ND20J*	ND30	ND32	ND30
Tetrachloroethene	2J	2J	5J	4J	3J	ND16J	2J	*2J*	ND15	ND16	ND15
1,1,2,2-Tetrachloroethane	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
Toluene	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
Chlorobenzene	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
Ethylbenzene	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
Styrene	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15
Total Xylenes	ND10	ND10	ND10	ND15	ND15	ND16	ND10	*ND10*	ND15	ND16	ND15

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.14

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELL EW1 (INFLUENT)

Parameter (µg/L) VOCs	*EW1 (Influent) 12/06/90 Dup*	*12/11/90*	*12/17/90*	*12/17/90 Reanalysis*	*12/17/90 Dup*	*12/17/90 'up-Reanalysis*	*01/08/91*	*01/08/91 Dup*	*02/12/91*	*02/12/91 Diluted*	*03/04/91*
Chloromethane	ND30J	ND28	ND20	ND40J	ND20	ND40J	ND20	*ND20*	3.2	ND20	ND2
Bromomethane	ND30	ND28	ND20	ND40J	ND20	ND40J	ND20	*ND20*	ND2	ND20	ND2
Vinyl Chloride	ND30	ND28	ND20	ND40J	ND20	ND40	ND20	*ND20*	ND2	ND20	ND2
Chloroethane	ND30	ND28	ND20	ND40J	ND20	ND40	ND20	*ND20*	ND2	ND20	ND2
Methylene Chloride	16U	14U	3U	4U	3U	ND20	9U	*8U*	ND1	ND10	ND1
Acetone	ND30J	ND28J	ND20J	ND40J	ND20J	ND40J	ND20J	*ND20J*	ND2J	ND20J	ND2UJ
Carbon Disulfide	ND15	ND14	ND10	ND20J	ND10	ND20J	ND10	*ND10*	ND1	ND10	ND1
1,1-Dichloroethene	ND15	ND14	ND10	ND20	ND10	ND20	ND10	*ND10*	ND1	ND10	ND1
1,1-Dichloroethane	ND15	ND14	ND10J	ND20	ND10J	ND20	ND10	*ND10*	ND1	ND10	ND1
1,2-Dichloroethene (total)	89	84	76	75D	83	72D	60	*60*	25	25	22
Chloroform	ND15	ND14	ND10	ND20	ND10	ND10	ND20	*ND10*	ND1	ND10	ND1
1,2-Dichloroethane	ND15	ND14	ND10J	ND20	ND10J	ND10	ND20	*ND10*	ND1	ND10	ND1
2-Butanone	ND30J	28J	ND20J	ND40J	ND20J	ND20J	ND40	*ND20*	ND2R	ND20R	ND2R
1,1,1-Trichloroethane	9J	6	4J	ND20	5J	ND20	ND20	*ND10*	ND1	ND10	ND1
Carbon Tetrachloride	ND15	ND14	ND10	ND20	ND10	ND20	ND20	*ND10*	ND1	ND10	ND1
Vinyl Acetate	ND30	ND28	ND20J	ND40	ND20J	ND20	ND40	*ND20*	ND2	ND20	ND2
Bromodichloromethane	ND15	ND14	ND10	ND20	ND10	ND40	ND20	*ND10*	ND1	ND10	ND1
1,2-Dichloropropane	ND15	ND14	ND10	ND20	ND10	ND40	ND20	*ND10*	ND1	ND10	ND1
cis-1,3-Dichloropropene	ND15	ND14	ND10	ND20	ND10	ND40	ND20	*ND10*	ND1	ND10	ND1
Trichloroethene	460	470	440	500DJ	450	460D	320J	*290J*	310	470	290
Dibromochloromethane	ND15	ND14	ND10	ND20	ND10	ND20	ND10	*ND10*	ND1	ND10	ND1
1,1,2-Trichloroethane	ND15	ND14	ND10	ND20	ND10	ND20	ND10	*ND10*	ND1	ND10	ND1
Benzene	ND15	ND14	ND10	ND20	ND10	ND20	ND10	*ND10*	ND1	ND10	ND1
Trans-1,3-Dichloropropene	ND15	ND14	ND10	ND20	ND10	ND20	ND10	*ND10*	ND1	ND10	ND1
Bromoform	ND15	ND14	ND10	ND20	ND10	ND20	ND10	*ND10*	ND1	ND10	ND1
4-Methyl-2-Pentanone	ND30	ND28	ND20J	ND40	ND20J	ND40	ND20	*ND20*	ND2	ND20	ND2
2-Hexanone	ND30	ND28	ND20J	ND40	ND20J	ND40	ND20	*ND20*	ND2	ND20	ND2UJ
Tetrachloroethene	ND15	ND14	ND10	ND20	ND10	ND20	ND10	*ND10*	ND1	ND10	1.3
1,1,2,2-Tetrachloroethane	ND15	ND14	ND10	ND20	ND10	ND20	ND10	*ND10*	ND1	ND10	ND1
Toluene	ND15	ND14	ND10	ND20	ND10	ND20	ND10	*ND10*	ND1	ND10	ND1
Chlorobenzene	ND15	ND14	ND10	ND20	ND10	ND20	ND10	*ND10*	ND1	ND10	ND1
Ethylbenzene	ND15	ND14	ND10	8DJ	ND10	ND20	ND10	*ND10*	ND1	ND10	ND1
Styrene	ND15	ND14	ND10	ND20	ND10	ND20	ND10	*ND10*	ND1	ND10	ND1
Total Xylenes	ND15	ND14	ND10J	46J	ND10J	ND20J	ND10	*ND10*	ND1	ND10	ND1

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
R = data was rejected, analyte may or may not be present.

TABLE 3.14

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELL EW1 (INFLUENT)

Parameter (µg/L) VOCs	*EW1 (Influent) 03/04/91 Diluted*	*03/04/91 Dup*	*03/04/91 Dup-Diluted*	*04/03/91*	*04/03/91 Diluted*	*05/06/91*	*05/06/91 Diluted*	*05/06/91 Dup*	*05/06/91 Dup-Diluted*
Chloromethane	ND20	ND2	ND40	ND2	ND40	ND2	ND40	ND2UJ	ND100
Bromomethane	ND20	ND2	ND40	ND2	ND40	ND2	ND40	ND2	ND100
Vinyl Chloride	ND20	ND2	ND40	ND2	ND40	ND2	ND40	ND2	ND100
Chloroethane	ND20	ND2	ND40	ND2	ND40	ND2	ND40	ND2	ND100
Methylene Chloride	ND20	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Acetone	ND20UJ	ND2UJ	ND40UJ	ND2J	ND40J	ND2	ND40UJ	ND2	ND100UJ
Carbon Disulfide	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
1,1-Dichloroethene	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
1,1-Dichloroethane	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
1,2-Dichloroethene (total)	22	24	20	21	ND20	16	ND20	15	ND50
Chloroform	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
1,2-Dichloroethane	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
2-Butanone	ND20UJ	ND2R	ND40UJ	ND2	ND40	ND2R	ND40R	ND2R	ND100R
1,1,1-Trichloroethane	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Carbon Tetrachloride	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Vinyl Acetate	ND20	ND2	ND40	ND2	ND40	ND2R	ND40R	ND2R	ND100
Bromodichloromethane	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
1,2-Dichloropropane	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
cis-1,3-Dichloropropene	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Trichloroethene	370	300	370	340J	420D	290E	430D	270J	29D
Dibromochloromethane	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
1,1,2-Trichloroethane	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Benzene	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Trans-1,3-Dichloropropene	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Bromoform	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
4-Methyl-2-Pentanone	ND20	ND2	ND40	ND2	ND40J	ND2	ND40	ND2	ND100
2-Hexanone	ND20	ND2UJ	ND40	ND2	ND40	ND2	ND40	ND2	ND100
Tetrachloroethene	ND10	ND1	ND20	1.2	ND20	ND1	ND20	ND1	ND50
1,1,2,2-Tetrachloroethane	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Toluene	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Chlorobenzene	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Ethylbenzene	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Styrene	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50
Total Xylenes	ND10	ND1	ND20	ND1	ND20	ND1	ND20	ND1	ND50

Notes:

NDx = not detected at quantitation limit x.
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D = secondary dilution was performed to obtain result.
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TABLE 3.15

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELL EW1 (EFFLUENT)

Parameter (µg/L) VOCs	*EW1 (Effluent) 11/14/90*	*11/16/90*	*11/19/90*	*11/23/90*	*11/27/90*	*11/27/90 Dup*	*11/29/90*	*12/04/90*	*12/06/90*	*12/11/90*	*12/11 90 Dup*	*12/17/90*	*12/17/90 Reanalysis*
Chloromethane	ND20	ND10J	ND30J	ND30J	ND20	ND20	ND20	ND20	ND20J	ND20	ND20	ND20	ND20J
Bromomethane	ND20	ND10	ND30	ND30	ND20	ND20	ND20	ND20	ND20	ND20	ND20	ND20	ND20J
Vinyl Chloride	ND20	ND10	ND30	ND30	ND20	ND20	ND20	ND20	ND20	ND20	ND20	ND20	ND20
Chloroethane	ND20	ND10	ND30	ND30	ND20	ND20	ND20	ND20	ND20	ND20	ND20	ND20	ND20
Methylene Chloride	10U	4U	ND15	ND15	4U	4U	ND10	24U	13U	4U	4U	3U	ND10
Acetone	ND20J	ND10J	ND30J	ND30J	ND20J	ND20J	ND20J	ND20J	ND20J	ND20J	ND20J	ND20J	ND20J
Carbon Disulfide	ND10	ND5	ND15	ND15J	ND10	ND10	ND10	ND10	ND10	4J	ND10	5J	ND10J
1,1-Dichloroethene	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
1,1-Dichloroethane	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	3J	ND10	ND10	ND10J	ND10
1,2-Dichloroethene (total)	99	75	72	71	60	65	60	64	62	62	49	58	50
Chloroform	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
1,2-Dichloroethane	ND10J	ND5	ND15	ND15	ND10R	ND10R	ND10R	ND10	ND10	ND10	ND10	ND10J	ND10J
2-Butanone	ND20	ND10	ND30	ND30	ND20	ND20	ND20	ND20J	ND20J	ND20J	ND20J	ND20J	ND20J
1,1,1-Trichloroethane	ND10	ND5	ND15	ND15	5J	6J	6J	6J	5J	3J	3J	3J	3J
Carbon Tetrachloride	ND10	ND5	ND15J	ND15J	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
Vinyl Acetate	ND20	ND10	ND30	ND30	ND20	ND20	ND20	ND20	ND20	ND20	ND20	ND20J	ND20J
Bromodichloromethane	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
1,2-Dichloropropane	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
cis-1,3-Dichloropropene	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
Trichloroethene	210	190	340	340J	250	260	250J	320	260	300	240	290	290
Dibromochloromethane	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
1,1,2-Trichloroethane	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
Benzene	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
Trans-1,3-Dichloropropene	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
Bromoform	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
4-Methyl-2-Pentanone	ND20	ND10	ND30	ND30	ND20	ND20	ND20J	ND20	ND20	ND20	ND20	ND20J	ND20J
2-Hexanone	ND20	ND10	ND30	ND30	ND20	ND20	ND20J	ND20	ND20	ND20	ND20	ND20J	ND20J
Tetrachloroethene	ND10	3J	ND15	ND15	ND10J	ND10J	ND10	ND10	ND10	ND10	ND10	ND10	ND10
1,1,2,2-Tetrachloroethane	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
Toluene	ND10J	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
Chlorobenzene	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
Ethylbenzene	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
Styrene	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10
Total Xylenes	ND10	ND5	ND15	ND15	ND10	ND10	ND10	ND10	ND10	ND10	ND10	ND10J	ND10J

Notes:

NDx = not detected at quantitation limit x.
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J = the associated numerical value is an estimated quantity.
D = secondary dilution was performed to obtain result.
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TABLE 3.15

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
VOLATILE ORGANIC COMPOUNDS (VOCs)
WELL EW1 (EFFLUENT)

Parameter (µg/L) VOCs	*EW1 (Effluent)* 01/08/90	02/12/91	02/12/91 Diluted	02/12/91 Dup	02/12/91 Dup-Diluted	03/04/91	03/04/91 Diluted	04/03/91	04/03/91 Diluted	04/03/91 Duplicate	04/03/91 Dup-Diluted	05/06/91	05/06/91 Diluted
Chloromethane	ND20	ND2	ND20	ND2	ND20	ND2	ND20	ND2	ND20	ND2	ND20	ND2UJ	ND20
Bromomethane	ND20	ND2	ND20	ND2	ND20	ND2	ND20	ND2	ND20	ND2	ND20	ND2	ND20
Vinyl Chloride	ND20	ND2	ND20	ND2	ND20	ND2	ND20	ND2	ND20	ND2	ND20	ND2	ND20
Chloroethane	ND20	ND2	ND20	ND2	ND20	ND2	ND20	ND2	ND20	ND2	ND20	ND2	ND20
Methylene Chloride	8U	ND1	ND10	ND1	18U	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
Acetone	ND20J	ND2J	ND20J	ND2J	78J	ND2UJ	ND20UJ	4J	ND20J	ND1J	163UJ	ND2	ND20UJ
Carbon Disulfide	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
1,1-Dichloroethene	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
1,1-Dichloroethane	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
1,2-Dichloroethene (total)	46	17	18	18	19	15	16	15	12D	15	14D	9.9	75D
Chloroform	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
1,2-Dichloroethane	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
2-Butanone	ND20	ND2R	ND20R	ND2R	ND20R	ND2R	ND20UJ	ND2	ND20	ND2	ND20	ND2R	ND20R
1,1,1-Trichloroethane	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
Carbon Tetrachloride	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
Vinyl Acetate	ND20	ND2	ND20	ND2	ND20	ND2	ND20	ND2	ND20J	ND2J	ND20J	ND2R	ND20R
Bromodichloromethane	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
1,2-Dichloropropane	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
cis-1,3-Dichloropropene	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
Trichloroethene	200J	250	300	230	300	220	240	250J	270D	280J	350D	200J	640D
Dibromochloromethane	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
1,1,2-Trichloroethane	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
Benzene	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
Trans-1,3-Dichloropropene	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
Bromoform	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
4-Methyl-2-Pentanone	ND20	ND2	ND20	ND2	ND20	ND2	ND20	ND2	ND20J	ND2J	ND20	ND2	ND20
2-Hexanone	ND20	ND2	ND20	ND2	ND20	ND2UJ	ND20UJ	ND2	ND20	ND2	ND20	ND2	ND20
Tetrachloroethene	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
1,1,2,2-Tetrachloroethane	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
Toluene	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
Chlorobenzene	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
Ethylbenzene	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
Styrene	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10
Total Xylenes	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10	ND1	ND10

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
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TABLE 3.16

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
METALS

Parameter (µg/L)	*C4D*		*W52*		*W53A*		*W54*		*EW1 (Influent)*			*EW1 (Effluent)*	
Metals	*12/03/90*	*03/04/91*	*12/04/90*	*03/04/91*	*12/03/90*	*03/04/91*	*12/03/90*	*03/04/91*	*12/04/90*	*12/04/90 (Dup)*	*03/04/91*	*12/04/90*	*03/04/91*
Aluminum	188U	ND72	771J	ND72	ND38.5	264	750	300	ND38.5	ND38.5	ND72	66.3U	ND72
Antimony	28.2J	ND56	170J	ND56	41.9J	ND56	27.3J	ND56	19.1J	13J	ND56	18.5J	ND56
Arsenic	ND3	ND1	ND3J	ND1	ND3	ND1	ND3	ND1	ND3	ND3	ND1	ND3	ND1
Barium	54.9J	13U	641J	63U	114J	59U	131J	ND32	59.4J	35.1J	46U	57.6J	44U
Beryllium	ND0.3	ND2	16.4J	ND2	ND0.3	ND2	ND0.3	ND2	ND0.3	ND0.3	ND2	ND0.3	ND2
Cadmium	3.8J	ND3	20.2J	5	ND1.7	ND3	ND1.7	8	ND1.7	ND1.7	ND3	3.1J	ND3
Calcium	43000J	50200	30400J	37700	106000J	29700	61100J	27700	32400J	18700J	27400	30600J	26600
Chromium	ND1.7	ND7	61.6J	ND7	ND1.7	27	2.6J	ND7	ND1.7	ND1.7	ND7	ND1.7	ND7
Cobalt	6.5J	ND15	157J	ND15	ND1.7	ND15	2.8J	ND15	4.2J	2.7J	ND15	7.2J	ND15
Copper	178J	25	270J	19J	15.3UJ	51	27.4UJ	35	54.4J	63.6J	24J	176J	21J
Iron	173	ND70	1380J	992	52U	3280	641	634	1290	1050	1450	1100	1330
Lead	ND1J	ND1	34.7J	21.6	ND1J	46.7	3.6J	13.6	38.9J	ND1J	2J	ND1J	ND1
Magnesium	11600	15400	14500J	13700	27900	10500	24400	2570J	10700J	6150J	7750	10200	7430J
Manganese	431J	2430	3480J	4220	3.1J	39	226J	157	373J	219J	471	357J	455
Mercury	ND0.1	ND0.2UJ	ND0.1	ND0.2UJ	ND0.1	ND0.2UJ	ND0.1	ND0.2UJ	ND0.1	0.11J	ND0.2UJ	ND0.1	ND0.2UJ
Nickel	18.8J	ND32	163J	ND32	ND10.7	ND32	ND10.7	ND32	ND10.7	ND10.7	ND32	14.5J	ND32
Potassium	1430J	8340	1430J	1390	5910	9380	11700	4080J	ND970	2190J	1390	2170J	ND1390
Selenium	ND3	9.8	ND3J	2J	ND3	3J	4.4J	ND1	ND3	ND3	ND1	ND3	ND1
Silver	ND8.4	ND11	18.5J	ND11	ND8.4	ND11	ND8.4	ND11	ND8.4	ND8.4	ND11	ND8.4	ND11
Sodium	12800J	21200	15300J	12800	61700J	12300	16300J	9460	21300J	12000J	15900	19800J	15900
Thallium	ND2	ND3R	ND2	3.4R	ND2	ND3R	ND2	ND3R	ND2	ND2	ND3R	ND2	ND3R
Vandium	ND2	ND19	149J	ND19	ND2	ND19	ND2	ND19	ND2	ND2	ND19	ND2	ND19
Zinc	158J	56U	16100J	16800	356J	2490	1240J	1340	90.8J	90.6J	119U	56.3J	55U
Cyanide	ND10J	–	ND10J	--	ND10J	–	ND10J	–	ND10J	ND10J	–	ND10J	–

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
R=data was rejected, analyte may or may not be present

TABLE 3.16

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
METALS

Parameter (µg/L)	*C4D*		*W52*		*W53A*		*W54*		*EW1 (Influent)*			*EW1 (Effluent)*	
Metals	*12/03/90*	*03/04/91*	*12/04/90*	*03/04/91*	*12/03/90*	*03/04/91*	*12/03/90*	*03/04/91*	*12/04/90*	*12/04/90 (Dup)*	*03/04/91*	*12/04/90*	*03/04/91*
Aluminum	188U	ND72	771J	ND72	ND38.5	264	750	300	ND38.5	ND38.5	ND72	66.3U	ND72
Antimony	28.2J	ND56	170J	ND56	41.9J	ND56	27.3J	ND56	19.1J	13J	ND56	18.5J	ND56
Arsenic	ND3	ND1	ND3J	ND1	ND3	ND1	ND3	ND1	ND3	ND3	ND1	ND3	ND1
Barium	54.9J	13U	641J	63U	114J	59U	131J	ND32	59.4J	35.1J	46U	57.6J	44U
Beryllium	ND0.3	ND2	16.4J	ND2	ND0.3	ND2	ND0.3	ND2	ND0.3	ND0.3	ND2	ND0.3	ND2
Cadmium	3.8J	ND3	20.2J	5	ND1.7	ND3	ND1.7	8	ND1.7	ND1.7	ND3	3.1J	ND3
Calcium	43000J	50200	30400J	37700	106000J	29700	61100J	27700	32400J	18700J	27400	30600J	26600
Chromium	ND1.7	ND7	61.6J	ND7	ND1.7	27	2.6J	ND7	ND1.7	ND1.7	ND7	ND1.7	ND7
Cobalt	6.5J	ND15	157J	ND15	ND1.7	ND15	2.8J	ND15	4.2J	2.7J	ND15	7.2J	ND15
Copper	178J	25	270J	19J	15.3UJ	51	27.4UJ	35	54.4J	63.6J	24J	176J	21J
Iron	173	ND70	1380J	992	52U	3280	641	634	1290	1050	1450	1100	1330
Lead	ND1J	ND1	34.7J	21.6	ND1J	46.7	3.6J	13.6	38.9J	ND1J	2J	ND1J	ND1
Magnesium	11600	15400	14500J	13700	27900	10500	24400	2570J	10700J	6150J	7750	10200	7430J
Manganese	431J	2430	3480J	4220	3.1J	39	226J	157	373J	219J	471	357J	455
Mercury	ND0.1	ND0.2UJ	ND0.1	ND0.2UJ	ND0.1	ND0.2UJ	ND0.1	ND0.2UJ	ND0.1	0.11J	ND0.2UJ	ND0.1	ND0.2UJ
Nickel	18.8J	ND32	163J	ND32	ND10.7	ND32	ND10.7	ND32	ND10.7	ND10.7	ND32	14.5J	ND32
Potassium	1430J	8340	1430J	1390	5910	9380	11700	4080J	ND970	2190J	1390	2170J	ND1390
Selenium	ND3	9.8	ND3J	2J	ND3	3J	4.4J	ND1	ND3	ND3	ND1	ND3	ND1
Silver	ND8.4	ND11	18.5J	ND11	ND8.4	ND11	ND8.4	ND11	ND8.4	ND8.4	ND11	ND8.4	ND11
Sodium	12800J	21200	15300J	12800	61700J	12300	16300J	9460	21300J	12000J	15900	19800J	15900
Thallium	ND2	ND3R	ND2	3.4R	ND2	ND3R	ND2	ND3R	ND2	ND2	ND3R	ND2	ND3R
Vandium	ND2	ND19	149J	ND19	ND2	ND19	ND2	ND19	ND2	ND2	ND19	ND2	ND19
Zinc	158J	56U	16100J	16800	356J	2490	1240J	1340	90.8J	90.6J	119U	56.3J	55U
Cyanide	ND10J	--	ND10J	--	ND10J	--	ND10J	--	ND10J	ND10J	--	ND10J	--

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
R=data was rejected, analyte may or may not be present.

TABLE 3.17

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
PESTICIDES AND PCBs

Parameter (µg/L)	*C4D*	*W52*	*W53A*	*W54*	*EW1 (Influent)*		*EW1 (Effluent)*
Pesticides	*12/03/90*	*12/04/90*	*12/03/90*	*12/03/90*	*12/04/90*	*12/04/90 (Dup)*	*12/04/90*
alpha-BHC	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025
beta-BHC	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025
delta-BHC	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025
gamma-BHC	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025
Heptachlor	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025
Aldrin	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025
Heptachlor epoxide	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025
Endosulfan I	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025
Dieldrin	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025	ND0.025
4,4'-DDE	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05
Endrin	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05
Endosolfan II	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05
4,4'-DDD	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05
Endosulfan Sulfate	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05
4,4'-DDT	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05
Methoxychlor	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25
Endrin ketone	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05	ND0.05
alpha-Chlordane	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25
gamma-chlordane	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25
Toxaphene	ND0.50	ND0.50	ND0.50	ND0.50	ND0.50	ND0.50	ND0.50
PCBs							
Aroclor-1016	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25
Aroclor-1221	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25
Aroclor-1232	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25
Aroclor-1242	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25
Aroclor-1248	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25	ND0.25
Aroclor-1254	ND0.50	ND0.50	ND0.50	ND0.50	ND0.50	ND0.50	ND0.50
Aroclor-1260	ND0.50	ND0.50	ND0.50	ND0.50	ND0.50	ND0.50	ND0.50

Notes:

NDx = not detected at quantitation limit x.

TABLE 3.18

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
BNAs

Parameter (µg/L)	*C4D*		*W52*		*W53A*	*W54*	*EW1 (Influent)*			*EW1 (Effluent)*
BNAs	*12/03/90*	*12/03/90 Reanalysis*	*12/04/90*	*12/04/90 Reanalysis*	*12/03/90*	*12/03/90*	*12/04/90*	*12/04/90 Reanalysis*	*12/04/90 Dup*	*12/04/90*
3-Nitroaniline	ND50	ND50J	ND50	ND50J	ND50	ND50	ND50	ND50J	ND50	ND50
Acenaphthene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
2,4-Dinitrophenol	ND50	ND50J	ND50R	ND50R	ND50	ND50	ND50R	ND50J	ND50	ND50
4-Nitrophenol	ND50J	ND50J	ND50R	ND50R	ND50J	ND50J	ND50R	ND50J	ND50J	ND50J
Dibenzofuran	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
2,4-Dinitrotoluene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Diethylphthalate	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
4-Chlorophenyl-phenylether	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Fluorene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
4-Nitroaniline	ND50	ND50J	ND50	ND50J	ND50	ND50	ND50	ND50J	ND50	ND50
4,6-Dinitro-2-Methylphenol	ND50	ND50J	ND50R	ND50R	ND50	ND50	ND50R	ND50J	ND50	ND50
N-Nitrosodiphenylamine (1)	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
4-Bromophenyl-phenylether	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Hexachlorobenzene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Pentachlorophenol	ND50	ND50J	ND50R	ND50R	ND50	ND50	ND50R	ND50J	ND50	ND50
Phenanthrene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Anthracene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Di-n-Butylphthalate	ND10	ND10J	0.3J	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Fluoranthene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Pyrene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Butylbenzylphalate	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
3,3'-Dichlorobenzidine	ND20	ND20J	ND20	ND20J	ND20	ND20	ND20	ND20J	ND20	ND20
Benzo(a)Anthracene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Chrysene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Bis(2-ethylhexyl)phthalate	4J	1UJ	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Di-n-Octyl Phthalate	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Benzo(b)Fluoranthene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Benzo(k)Fluoranthene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Benzo(a)Pyrene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Indeno(1,2,3-cd)Pyrene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Dibenz(a,h) Anthracene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Benzo(g,h,i)Perylene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10

Notes:

NDx = not detected at quantitation limit x.
U = the analyte was detected but was attributed to laboratory contamination.
J = the associated numerical value is an estimated quantity.
R = data was rejected, analyte may or may not be present.

TABLE 3.18

GROUNDWATER SAMPLE ANALYTICAL DATA SUMMARY
BNAs

Parameter (µg/L) BNAs	*C4D* 12/03/90	*C4D* 12/03/90 Reanalysis	*W52* 12/04/90	*W52* 12/04/90 Reanalysis	*W53A* 12/03/90	*W54* 12/03/90	*EW1 (Influent)* 12/04/90	*EW1 (Influent)* 12/04/90 Reanalysis	*EW1 (Influent)* 12/04/90 Dup	*EW1 (Effluent)* 12/04/90
Phenol	ND10	ND10J	ND10R	ND10R	ND10	ND10	ND10R	ND10J	ND10	ND10
bis(2-Chloroethyl)Ether	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
2-Chlorophenol	ND10	ND10J	ND10R	ND10R	ND10	ND10	ND10R	ND10J	ND10	ND10
1,3-Dichlorobenzene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
1,4-Dichlorobenzene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Benzyl Alcohol	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
1,2-Dichlorobenzene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
2-Methylphenol	ND10	ND10J	ND10	ND10R	ND10	ND10	ND10R	ND10J	ND10	ND10
bis(2-Chloroisopropyl) Ether	ND10J	ND10R	ND10	ND10J	ND10J	ND10J	ND10J	ND10J	ND10J	ND10J
4-Methylphenol	ND10	ND10J	ND10R	ND10R	ND10	ND10	ND10R	ND10J	ND10	ND10
N-Nitroso-Di-n-Propylamine	ND10	ND10J	ND10J	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Hexachloroethane	ND10	ND10J	ND10R	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Nitrobenzene	ND10	ND10R	ND10	ND10R	ND10	ND10	ND10	ND10R	ND10	ND10
Isophorone	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
2-Nitrophenol	ND10	ND10J	ND10R	ND10R	ND10	ND10	ND10R	ND10J	ND10	ND10
2,4-Dimethylphenol	ND10	ND10J	ND10R	ND10R	ND10	ND10	ND10R	ND10J	ND10	ND10
Benzoic Acid	ND50R	ND50J	ND50R	ND50R	ND50R	ND50R	ND50R	ND50J	ND50R	ND50R
bis(2-Chloroethoxy)Methane	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
2,4-Dichlorophenol	ND10	ND10J	ND10R	ND10R	ND10	ND10	ND10R	ND10J	ND10	ND10
1,2,4-Trichlorobenzene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Naphthalene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
4-Chloroaniline	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Hexachlorobutadiene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
4-Chloro-3-Methylphenol	ND10	ND10J	ND10R	ND10R	ND10	ND10	ND10R	ND10J	ND10	ND10
2-Methylnaapthalene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Hexachlorocyclopentadiene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
2,4,6-Trichlorophenol	ND10	ND10J	ND10R	ND10R	ND10	ND10	ND10R	ND10J	ND10	ND10
2,4,5-Trichlorophenol	ND50	ND50J	ND50R	ND50R	ND50	ND50	ND50R	ND50J	ND50	ND50
2-Chloronaphthalene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10J	ND10J	ND10	ND10
2-Nitroaniline	ND50	ND50J	ND50	ND50J	ND50	ND50	ND50	ND50J	ND50	ND50
Dimethyl Phthalate	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10
Acenaphthylene	ND10J	ND10J	ND10J	ND10J	ND10J	ND10J	ND10J	ND10J	ND10J	ND10J
2,6-Dinitrotoluene	ND10	ND10J	ND10	ND10J	ND10	ND10	ND10	ND10J	ND10	ND10

Notes:

NDx = not detected at quantitation limit x.
J = the associated numerical value is an estimated quantity.
R = data was rejected, analyte may or may not be present.

APPENDIX A

EXTRACTION WELL NO. 1

WELL INSTALLATION AND PUMP TESTING REPORT

EXTRACTION WELL NO. 1
WELL INSTALLATION AND PUMP TESTING

Marathon Electric Manufacturing Company
Wausau, Wisconsin

DECEMBER 1990
REF. NO. 2115 (16)

CONESTOGA-ROVERS & ASSOCIATES

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1.0 INTRODUCTION

This report outlines the installation and pump testing of extraction well one at Marathon Electric Company in Wasau, Winsconsin.

Well installation details are presented in Section 2. Pump testing procedures and results are presented in Section 3.

2.0 WELL INSTALLATION

E. H. Renner and Sons Drilling of Elk River, Minnesota, was awarded the drilling contract by Marathon Electric. The drilling and well installation was conducted with a Bucyrus-Erie 36L cable tool drilling rig. The rig was brought on site on July 18, 1990, and drilling began on July 19. The drilling and well installation was completed on August 8, 1990.

2.1 DRILLING PROCEDURES

A 24-inch diameter borehole and casing was advanced by cable tool drilling techniques to the top of the weathered granite(143.5 feet below ground surface). Drill cuttings were removed from the borehole with a 16-inch diameter trap-bottom bailer. The 24-inch diameter steel casing was driven as the hole advanced to prevent the hole from collapsing during the drilling procedure.

Soil samples were collected from the drill cuttings at five-foot intervals for stratigraphic and grain size determination. The grain size analyses were conducted by Johnson Screens to determine the well screen specifications.

During drilling, the work space, downhole and soil cuttings were monitored for organic vapors with an OVA flame ionization detector. Readings were recorded at approximately one to two and at half hour intervals and did not exceed background levels (1.5 ppm). Table 1 summarizes the readings.

2.2 SCREEN SELECTION

The selection of the well screen was based on the requirements of the well as stated in the Work Plan and the results of the grain size analyses. The specifications require a 16-inch diameter screen and a minimum pumping rate of 1,600 gallons per minute. The purpose of the grain size analysis was to determine if the slot size calculated for the screen would retain the formation or if a sand pack would be necessary.

A minimum slot size for the required well screen transmitting capacity is dependent on the open area of the screen. The transmitting capacity equation is as follows:

$$A = Q/V$$

where: Q = transmitting capacity (1,600 gpm)
V = entrance velocity (0.1 ft/sec)
A = open area of screen interval (ft^2)

A transmitting capacity of 1,600 gallons per minute, as specified in the Work Plan, requires an open area of 35.6 ft^2. The entrance velocity of 0.1 ft./sec is an empirical standard and exceeding this value can cause excessive turbulence at the well screen which leads to higher pumping

TABLE 1

OVA READINGS DURING DRILLING OF EW1
MARATHON ELECTRIC
WAUSAU, WISCONSIN

			OVA Reading (ppm)		
Date	*Time*	*Depth (ft BGS)*	*Work Sample*	*Space*	*Down Hole*
7/19/90	-	0 - 28	-	-	-
7/20/90	10:35	28 - 29	0	0	0
	11:45	41 - 42	0	0	0
	14:00	50 - 51	0	0	0
7/23/90	10:37	55 - 56	0	0	0
	11:30	59 - 60	0	0	0
	14:00	64 - 65	-	0	0
	14:18	69 - 71	0	0	0
	15:30	79 - 81	0	0	0
	16:40	84 - 86	0	0	0
	19:15	89 - 91	0	0	0
7/24/90	12:30	98	0	0	0
	13:30	104 - 106	0	0	0
	14:30	109 - 101	0	0	0
	16:15	119 - 121	0	0	0
7/25/90	09:00	124 - 126	0	0	0
	10:55	134 - 136	0	0	0
	17:45	141	0	0	0

Note:

Background level at 1.5 ppm.

costs and shortens screen life. The relationship between slot size and open area for continuous slot screens is illustrated on Table 2.

To achieve an open area of at least 35.6 ft^2, for a 16-inch diameter, 40-foot screen, requires a minimum slot size of 0.060 inches. This is based on the percent open area for a continuous slot screen as presented on Table 2.

The grain size curves from Johnson Screens, as shown in Appendix A, indicate a fine to medium grained sand. Typically, a screen should be sized to retain 40 percent of the formation materials. In this case that would require a 0.020 inch slot screen. The tendency would have been for the fine grained sand of the formation to be pumped through the screen. Therefore, a sand pack would have to be installed that would be retained by the slot size of the screen and filter the natural formation. Johnson recommended a #20 size sand pack for the well.

2.3 WELL INSTALLATION PROCEDURES

The well screen was placed at the top of the weathered granite and designed to penetrate the bottom third of the aquifer. The screen was welded to 16-inch diameter schedule 40 steel casing from the top of the screen to approximately ground surface.

The bottom of the screen was provided with a centralizer prior to installation to insure a 4-inch annulus between the screen and the

TABLE 2

OPEN AREAS OF SCREENS

Diameter	Slot Size	Continuous Slot in^2/ft	Continuous Slot %	Louvered (Maximum open area) in^2/ft	Louvered (Maximum open area) %	Bridge Slot in^2/ft	Bridge Slot %	Mill Slotted (Vertical) in^2/ft	Mill Slotted (Vertical) %	Plastic Continuous Slot in^2/ft	Plastic Continuous Slot %	Slotted Plastic in^2/ft	Slotted Plastic %
4" ID	20	44	25	-	-	-	-	-	-	22	13	-	-
	60	90	52	-	-	19	12	8	5	52	30	18	11
8" ID	30	80	25	-	-	-	-	-	-	57	18	26	8
	60	135	41	10	3	17	6	15	5	93	29	47	14
	95	165	51	15	5	-	-	23	7	-	-	-	-
12" ID	30	77	16	-	-	12	3	-	-	-	-	-	-
	60	135	28	20	4	33	7	21	5	-	-	51	11
	95	182	38	30	7	-	-	32	7	-	-	-	-
	125	214	45	39	9	68	14	43	9	-	-	-	-
16" OD	30	97	16	-	-	16	3	-	-	-	-	52	9
	60	169	28	24	4	35	6	27	5	-	-	-	-
	95	228	38	35	6	-	-	41	7	-	-	-	-
	125	268	45	47	8	78	13	55	9	-	-	-	-

borehole. The annulus around the screen was filled with #20 size sand pack to 17.5 feet above the top of the screen. As the sand pack was installed, the 24-inch casing was pulled back to the top of the screen.

The stratigraphic and instrumentation log for extraction well EW1 is presented in Appendix B.

2.4 WELL DEVELOPMENT

Following installation, the well was developed by surging with a 16-inch surge block. Surging removes the fine grained sediment and increases the natural permeability of the previously undisturbed sediment around the screen area. The majority of the sediment was removed from the well with a trap-bottom bailer and the well was brought to a silt-free condition during the subsequent pumping tests.

3.0 PUMPING TEST

3.1 PUMPING TEST EQUIPMENT

The extraction well was pumped with a Fairbanks-Morris vertical shaft 14LC Western Land Roller 6-stage turbine pump and powered by an 871 Detroit engine. The pump was set above the top of the well screen.

Pumping rates were measured using a circular orifice plate and manometer. The discharge rate was controlled at the generator with the throttle.

Aquifer drawdown was monitored at the extraction well (EW1) and at monitoring wells R4D, C2S, 52A, 52, C7S, WSWD and WSWS, and the Wisconsin River near WSWS. Drawdown measurements were collected manually at specific time intervals using an electric water level tape.

3.2 PUMPING TEST PROCEDURES

3.2.1 Step Test

The step test was performed prior to the constant rate test and was used to determine the capacity of the extraction well. Capacity is determined from the specific capacity values developed from the step tests and the available drawdown.

The step test involved three pumping rates at 910, 1,240 and 1,680 gallons/minute and lasted 60 minutes for each step. Table 3 illustrates the results of the test and Appendix C presents the data. Pumped water was discharged to the treatment/discharge manhole. Based on this test the well has a specific capacity of 32 gpm per foot of drawdown. The consistency in values over the test range indicates that the well efficiency range was not exceeded.

3.2.2 Constant Rate Pumping Test

After completion of the step test, a 24-hour constant rate pumping test was performed. The pumping rate for EW1 averaged 1,695 gallons per minute. The water was discharged into the manhole.

During the pumping test, EW1 and R4D were intensively monitored for purposes of calculating transmissivities. A comprehensive network of wells was monitored for purposes of mapping the piezometric surface during the test. The comprehensive network included EW1, 52, 52A, C2S, C7S, R4D, WSWS, WSWD and the Wisconsin River.

Prior to the start of the pumping test, water levels were taken at 18 and 6 hours before the start of the test. This was done to determine the background water elevations.

At the start of the pumping test, water levels were taken on EW1 and R4D every minute for the first 10 minutes and at two minute

TABLE 3

STEP TEST RESULTS
EXTRACTION WELL EW1

Pumping Rate (Q) (gpm)	*Time (dt) (min)*	*Drawdown (ds) (ft)*	*Specific Capacity Q/ds (gpm/ft)*
910	60	28.32	32.1
1,240	60	38.66	32.1
1,680	60	52.70	31.9

Depth to Static Groundwater:	29.58 ft.
Depth to top of Pump:	90.00 ft.
Available Drawdown:	60.42 ft.
Theoretical Capacity:	1,933 gpm

intervals for the second ten minutes. From 20 minutes to 60 minutes water levels were taken at 5-minute intervals, from 60 minutes to 4 hours water levels were taken at progressively longer intervals. After 4 hours water levels were taken every hour and the comprehensive wells were periodically monitored.

3.2.3 Recovery Test

After 24 hours and the pump was turned off, an eight hour recovery test was conducted. Water levels were monitored as the aquifer regained equilibrium. The measurement intervals were the same as that of pumping test.

3.3 PUMP TEST RESULTS

A summary of periodically recorded water levels in the wells monitored during the pump and recovery tests is presented in Table 4.

Drawdown after 23 hours of pumping is tabled in Table 5 and is illustrated in Figures 1 and 2 for upper and lower wells respectively. Water elevations after 23 hours of pumping in the upper and lower wells are contoured in Figures 3 and 4 respectively.

A summary of calculated storativities and transmissivities for wells EW1 and R4D is shown in Table 6. Averaging values from the

TABLE 4

WELLS MONITORED DURING THE PUMPING AND RECOVERY TEST

Well	*TOC Elevation (AMSL)*	*Water Elevations* *8/13/90 p.m.*	*8/14/90 07:30*	*8/14/90 13:10*	*8/14/90 15:45*	*8/15/90 05:15*	*8/15/90 12:45*	*8/15/90 19:50*	*8/16/90 05:45*
WSWD	1193.46	1187.95	1188.02	1187.77	1186.31	1185.46	1185.22	1187.02	1187.37
WSWS	1193.24	1188.32	1188.32	1188.30	1188.22	1188.03	1187.89	1188.23	1188.07
RIVER (BY WSWS)	1190.72	-	1188.39	1188.43	1188.41	1188.37	1188.25	1188.47	1188.22
C7S	1221.00	1187.75	1187.78	1187.55	1187.35	1186.30	1185.98	1186.36	1186.78
52A	1219.08	1187.84	1187.84	1187.81	1187.78	1187.53	1187.34	1187.24	1187.19
52	1219.18	1187.53	1187.54	1187.40	1186.05	1185.46	1185.28	1186.82	1186.99
C2S	1219.24	1187.70	1187.74	1187.10	1186.32	1184.44	1183.99	1185.79	1186.59
R4D	1219.24	1187.69	1187.74	1187.37	1177.10	1176.83	1175.82	1186.39	1186.89
EW1	1217.35	1187.78	1187.80	1187.39	1135.57	1134.52	1134.50	1186.35	1186.88

TABLE 5

DRAWDOWN OF THE MONITORING WELLS AFTER 23 HOURS OF PUMPING

Well	*Drawdown (feet)*	*Distance form the Pumping Well (feet)*
WSWD	2.73	184
WSWS	0.43	186
C7S	1.80	254
52	2.25	435
52A	0.50	446
R4D	11.84	42
C2S	3.71	50
EW1	53.28	0

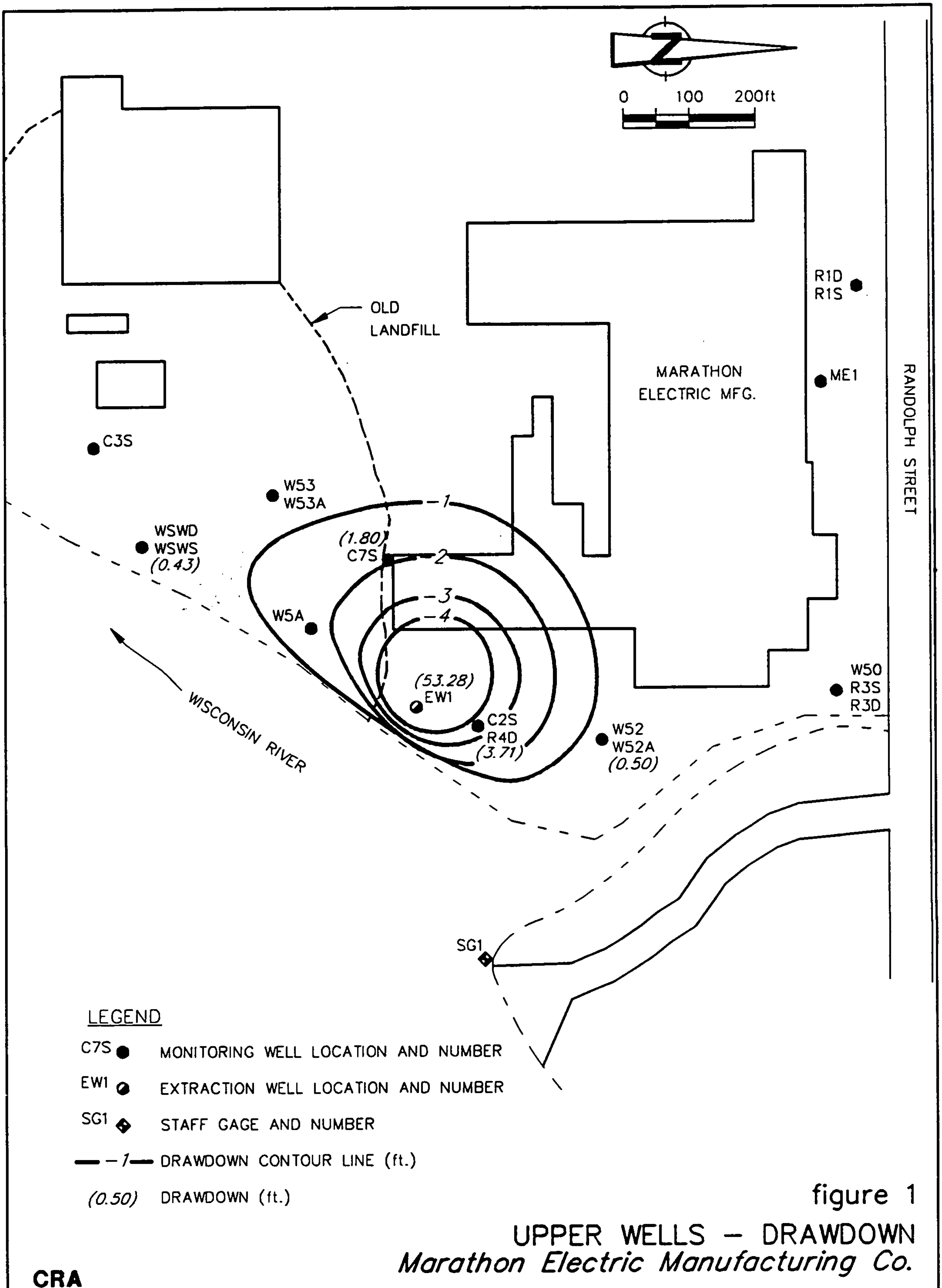


figure 1

UPPER WELLS – DRAWDOWN

Marathon Electric Manufacturing Co.

2115-11/12/90-16-0 (P-02)

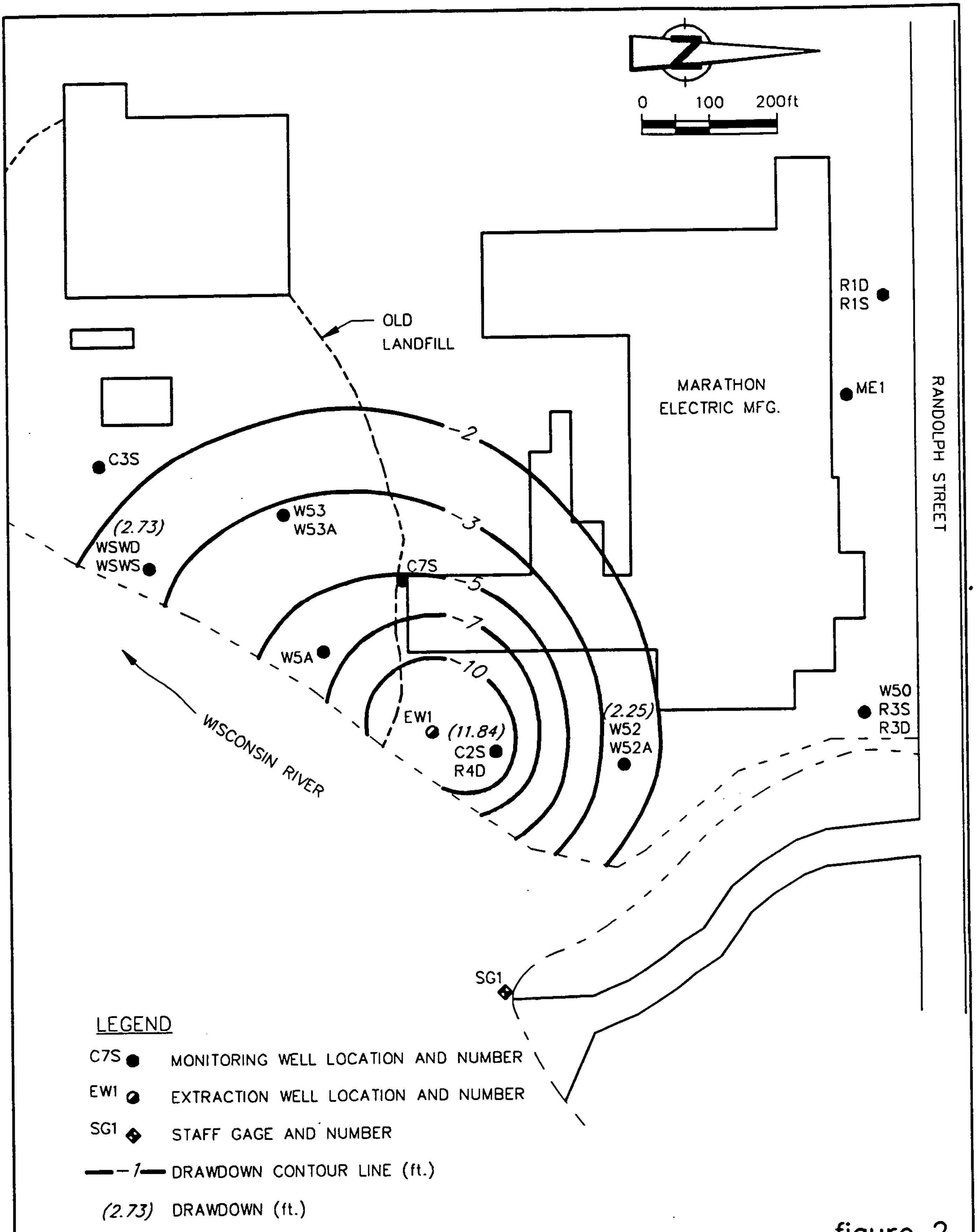


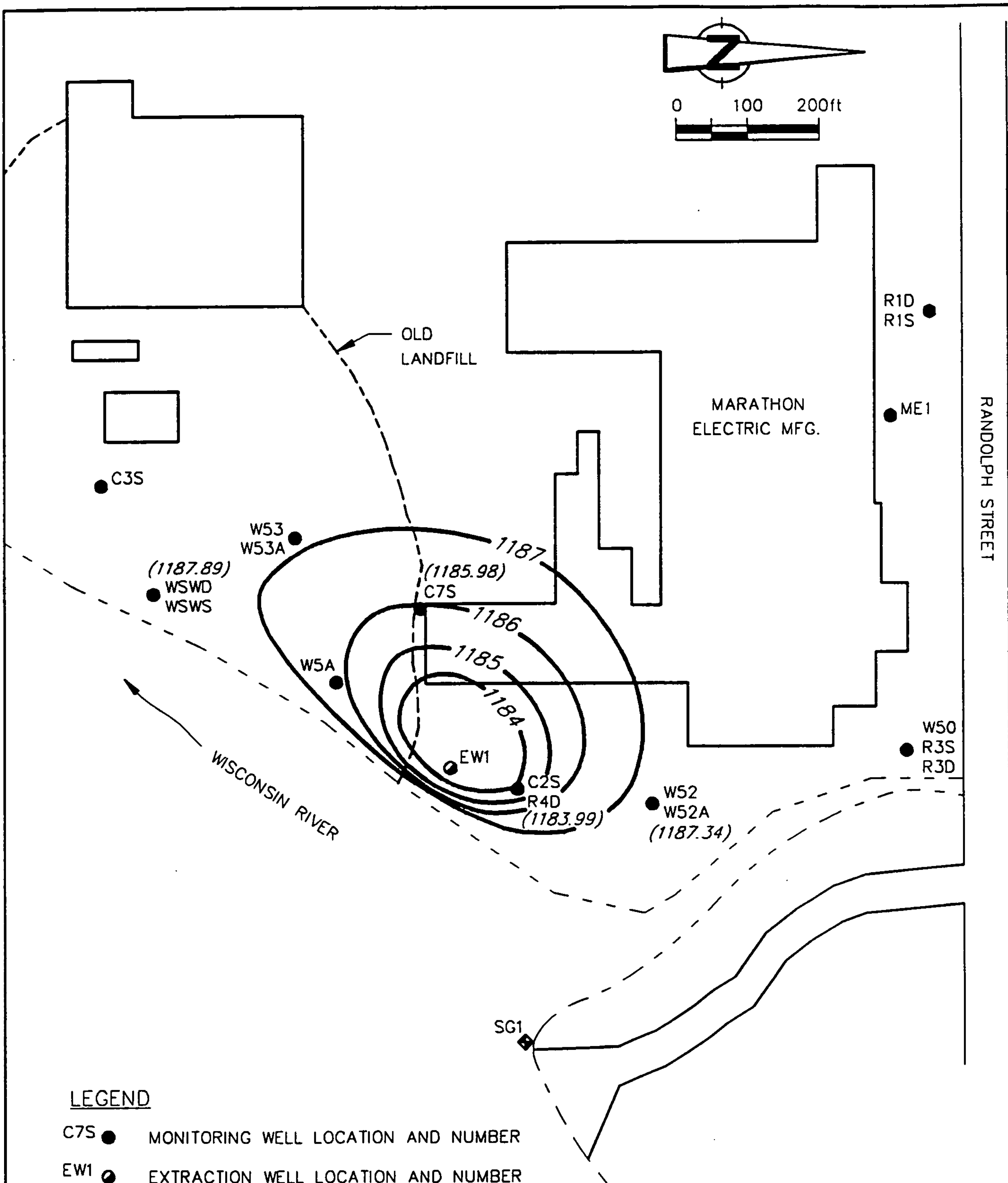
figure 2

LOWER WELLS – DRAWDOWN

Marathon Electric Manufacturing Co.

CRA

2115-11/12/90-16-0 (P-03)



LEGEND

C7S ● MONITORING WELL LOCATION AND NUMBER

EW1 ◐ EXTRACTION WELL LOCATION AND NUMBER

SG1 ◈ STAFF GAGE AND NUMBER

—*1187*— WATER LEVEL CONTOUR (ft.)

(1185.98) WATER LEVEL ELEVATIONS (ft.)

figure 3

UPPER WELLS – WATER ELEVATIONS

Marathon Electric Manufacturing Co.

CRA

2115-11/12/90-16-0 (P-04)

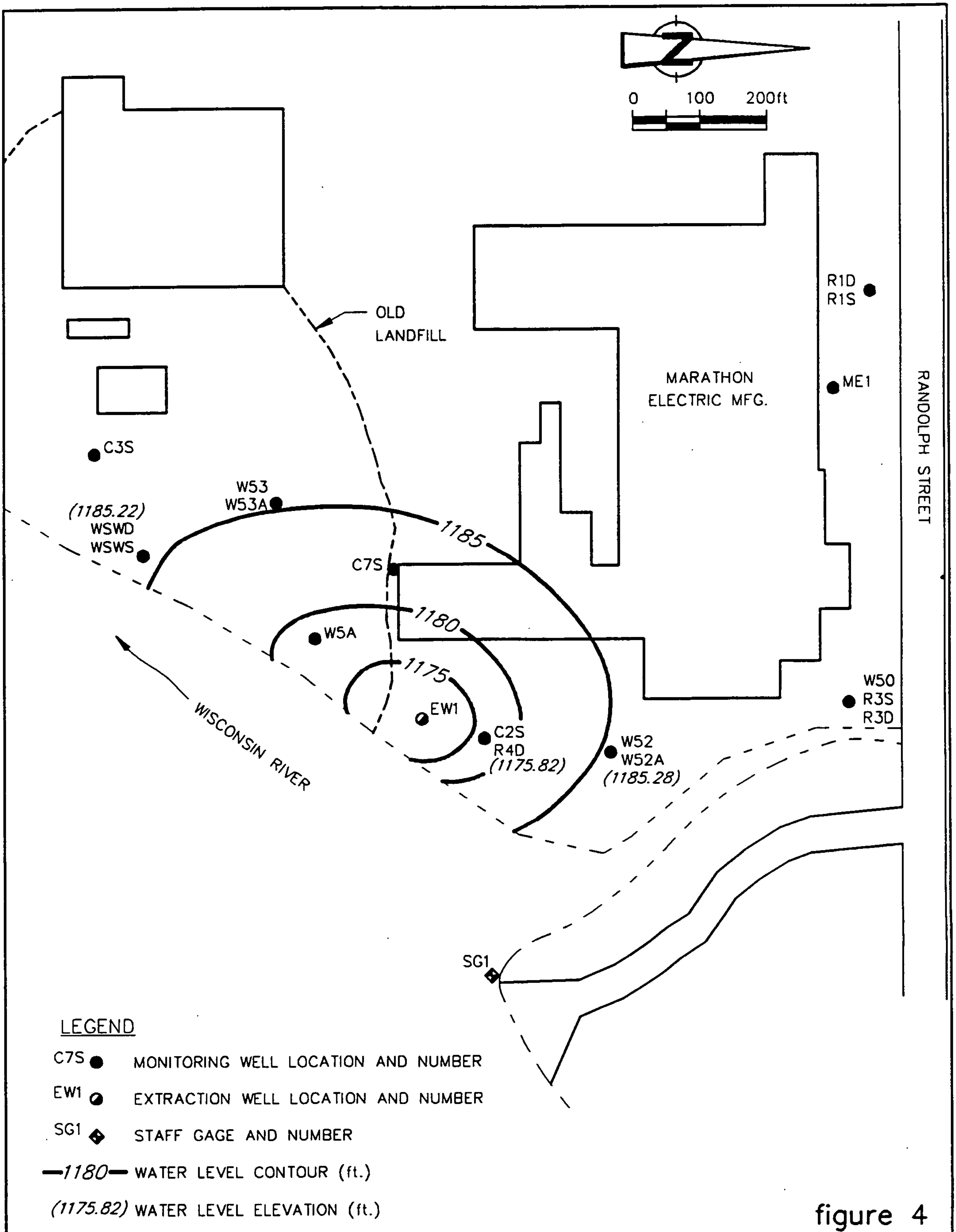


figure 4

LOWER WELLS – WATER ELEVATIONS
Marathon Electric Manufacturing Co.

CRA

2115-11/12/90-16-0 (P-05)

TABLE 6

SUMMARY OF TRANSMISSIVITY AND STORATIVITY FROM DRAWDOWN AND RECOVERY TEST

Well	*Type of Test*	*Transmissivity (m^2/sec)*	*Storativity*
EW1	Drawdown	9.7×10^{-3}	--
R4D	Drawdown	1.2×10^{-3}	8.3×10^{-4}
R4D (early)	Recovery	6.7×10^{-3}	2.7×10^{-2}
R4D (late)	Recovery	6.7×10^{-3}	--
EW1	Recovery	6.7×10^{-2}	--

drawdown and recovery tests, the transmissivity ranged from 3.8×10^{-2} to 4×10^{-3} at wells EW1 and R4D, respectively. Calculated values for storativity at well R4D ranged from 2.7×10^{-2} to 8.3×10^{-4}. Calculations and data for pumping and recovery tests are presented in Appendices D and E respectively.

APPENDIX A

GRAIN SIZE ANALYSIS

Johnson screens
Johnson Filtration Systems Inc.
P.O. Box 64118 • St. Paul, MN 55164
TEL. 612-636-3900 or 1-800-328-9891
TELEX 29-7451
SEND SAMPLES TO: 1950 OLD HWY 8, NEW BRIGHTON, MN 55112

SAND ANALYSIS

BY: Bill Schafer

Job Name MARAthon Elect Date

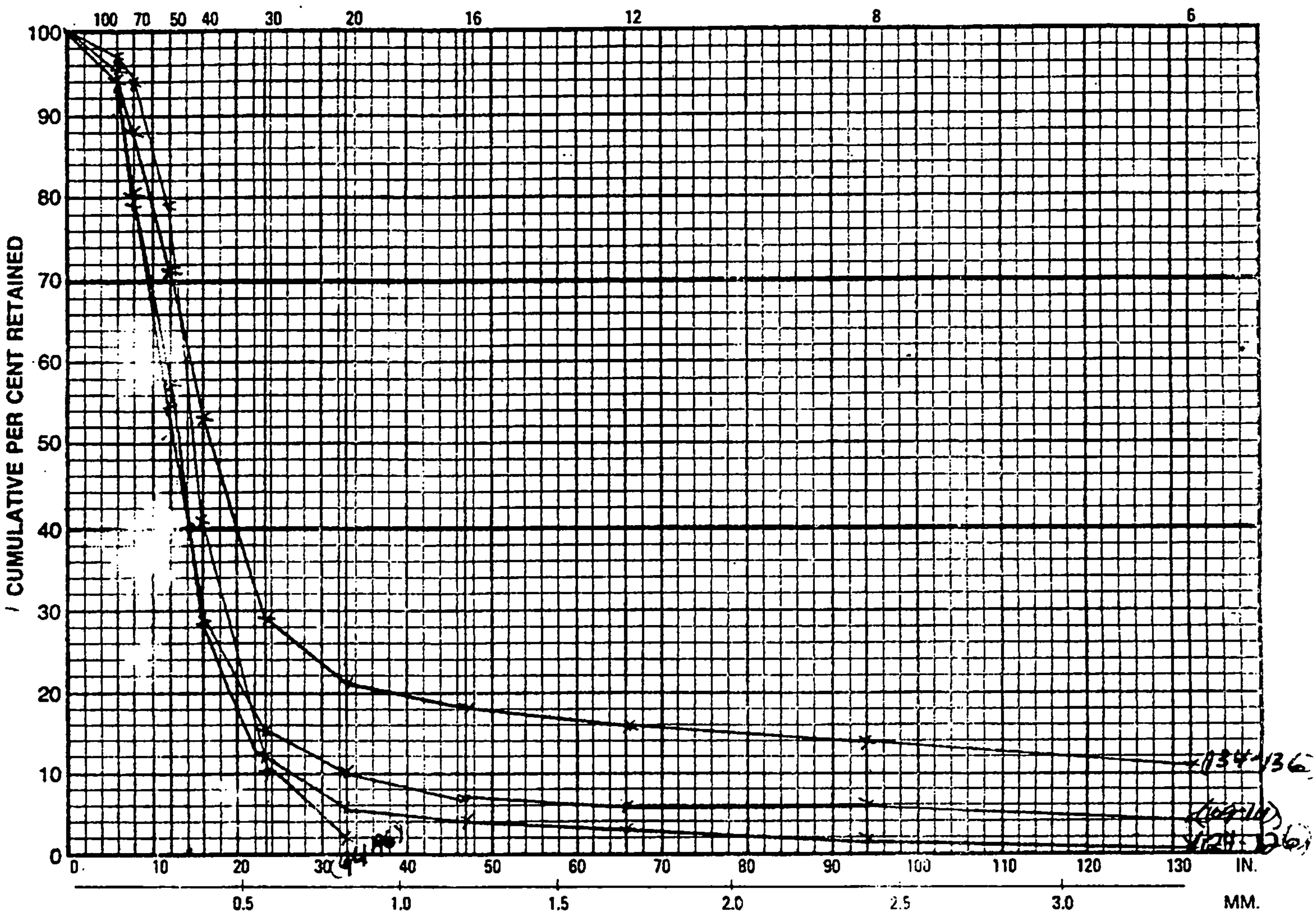
City State Zip

Driller Renner 427 0533 (FAX) Phone

Engineer CRA / St. Paul & Waterloo Phone

Remarks

U.S. STANDARD SIEVE NUMBERS



SLOT OPENING AND GRAIN SIZE IN THOUSANDTHS OF AN INCH AND MM.

U.S. SIEVE NO.	SLOT OPENING IN.	SLOT OPENING MM.	SAMPLE DEPTHS			
6	.132	3.36				
8	.094	2.38				
12	.066	1.68				
16	.047	1.19				
20	.033	0.84				
30	.023	0.60				
40	.016	0.42				
50	.012	0.30				
70	.008	0.21				
100	.006	0.15				

Comments 134'-136 37 ... 35 ...
(94-96) Represents (94-106)
(109-111) Represents (109-125)
(124-126) Represents (124-131)

SCREEN RECOMMENDATIONS: DIAM. (134-136) Represent (134
(142-143) Represent (142-146)

SLOT	SETTING	LENGTH

SO MANY CONSIDERATIONS ENTER INTO THE MAKING OF A GOOD WELL THAT WHILE WE BELIEVE SLOT SIZES FURNISHED OR RECOMMENDED

Johnson screens
Johnson Filtration Systems Inc.
P.O. Box 64118 • St. Paul, MN 55164
TEL. 612-636-3900 or 1-800-328-9891
TELEX 29-7451
SEND SAMPLES TO: 1950 OLD HWY 8, NEW BRIGHTON, MN 55112

SAND ANALYSIS

BY: Bill Schafer

Job Name Marathon Electric Date

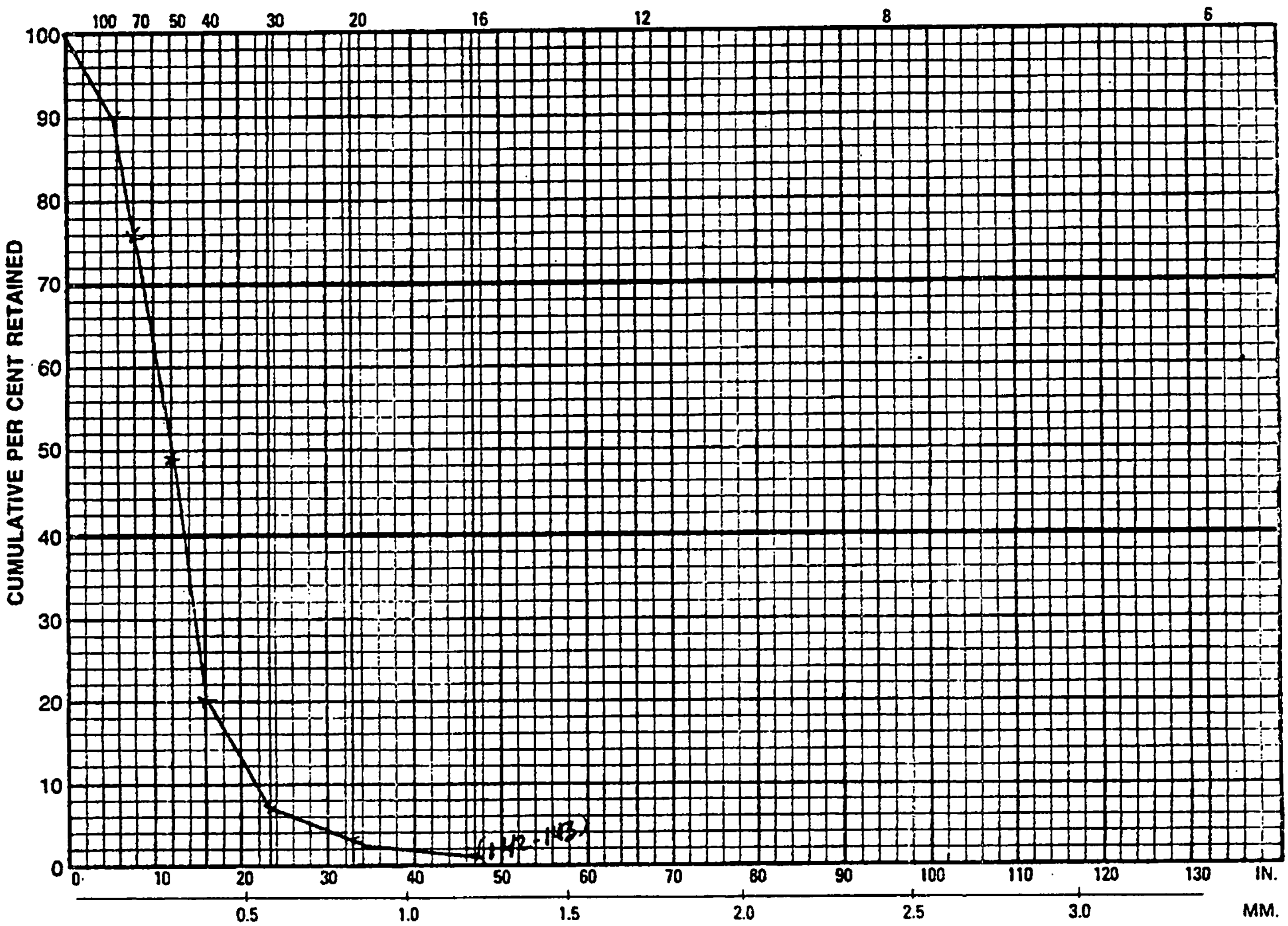
City State Zip

Driller Phone

Engineer Phone

Remarks

U.S. STANDARD SIEVE NUMBERS



SLOT OPENING AND GRAIN SIZE IN THOUSANDTHS OF AN INCH AND MM.

Post-It™ brand fax transmittal memo 7671 | # of pages ▸ 2

To PETE STORLIE	From Bill Schafer
Co. CRA	Co. Johnson Filtration
Dept.	Phone # 638-3120
Fax # 639-0923	Fax #

Comments

SCREEN RECOMMENDATIONS: DIAM.

SLOT	SETTING	LENGTH

50	.012	0.30					
70	.008	0.21					
100	.006	0.15					

APPENDIX B

STRATIGRAPHIC & INSTRUMENTATION LOG

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

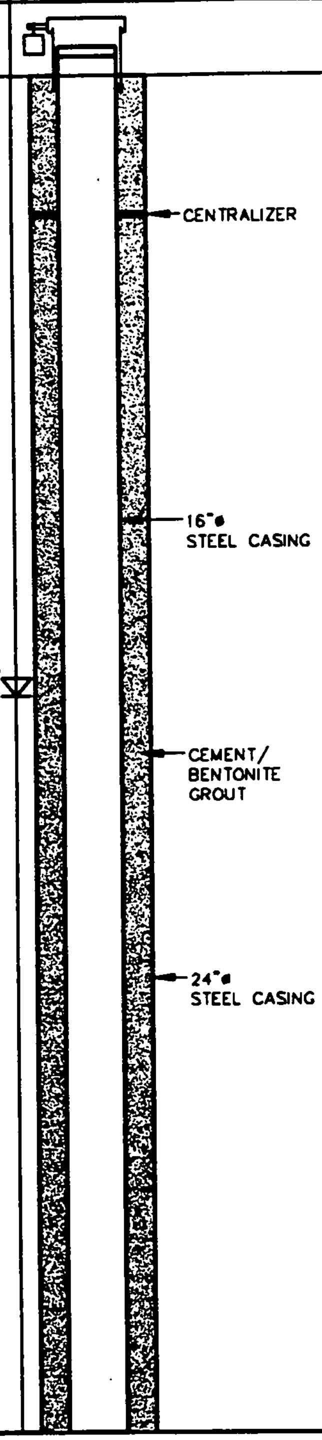
(L-01)

PROJECT NAME: MARATHON ELECTRIC
PROJECT NO.: 2115
CLIENT: MARATHON
LOCATION: WAUSAU, WI

HOLE DESIGNATION: EW1 (Page 1 of 3)
DATE COMPLETED: JULY 19, 1990
DRILLING METHOD: 24" OD CT
CRA SUPERVISOR: P. STORLIE

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	SAMPLE NUMBER
	REFERENCE POINT (Top Of Riser)	1217.35	
	GROUND SURFACE (Approximate)	1215.9	
	Open hole previously excavated to approximate 7.5 FT. below ground surface		
5.0			
	SW-SAND, trace fine gravel, trace to little silt, fine to coarse grained, brown, dry		1CT
10.0		1205.9	
	GP-GRAVEL, sandy, fine grained, brown, dry	1203.9	
	SP-SAND, little fine to medium gravel, trace silt, medium to coarse graded, brown, dry		2CT
15.0	Same, except trace gravel, no silt		
	Same, except fine to medium grained sand		3CT
20.0			
	Same, except, trace coarse gravel, medium coarse sand		4CT
25.0			
			5CT
30.0		1183.9	
	Same, except fine to medium grained sand		6CT
35.0	Same, except trace medium to fine gravel		7CT
40.0	Same, except less gravel		8CT
45.0	Same, except no gravel		9CT
50.0			10CT
55.0	Same, except trace gravel		11CT
60.0			12CT
65.0	Same, except color becomes light reddish-brown		13CT

MONITOR INSTALLATION



SAMPLE: NUMBER | STATE | 'N' VALUE | HNu (ppm)

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

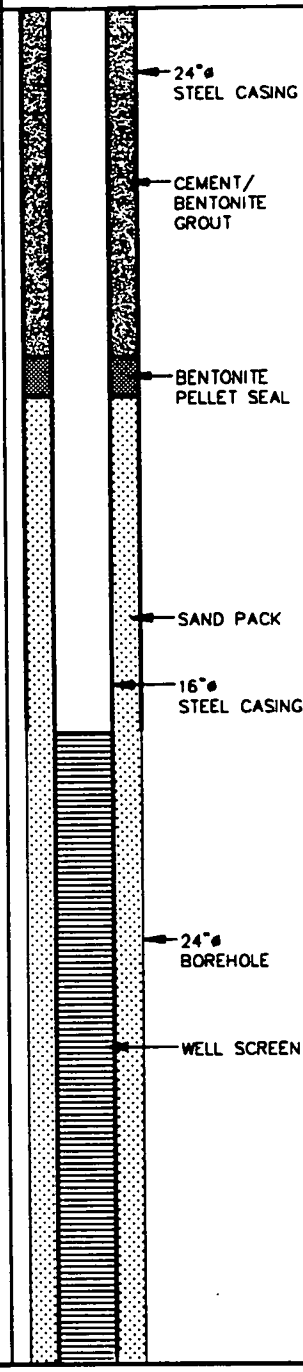
(L-01)

PROJECT NAME: MARATHON ELECTRIC
PROJECT NO.: 2115
CLIENT: MARATHON
LOCATION: WAUSAU, WI

HOLE DESIGNATION: EW1 (Page 2 of 3)
DATE COMPLETED: JULY 19, 1990
DRILLING METHOD: 24" OD CT
CRA SUPERVISOR: P. STORLIE

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	SAMPLE NUMBER	SAMPLE STATE	'N' VALUE	HNu (ppm)
	Same, except no gravel					
70.0			14CT	X		
75.0			15CT	X		
80.0			16CT	X		
	Same, except little coarse gravel Same, except trace gravel					
85.0			17CT	X		
90.0			18CT	X		
	Same, except no gravel					
95.0			19CT	X		
	Same, except trace fine gravel					
100.0			20CT	X		
	Same, except becomes fine grained sand, brown					
105.0			21CT	X		
110.0			22CT	X		
115.0			23CT	X		
120.0			24CT	X		
125.0			25CT	X		
	Same, except gravel content increasing slightly					
130.0			26CT	X		
	Same, except sand becomes medium to fine grained, light brown					

MONITOR INSTALLATION



NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ◯ WATER FOUND ▽ STATIC WATER LEVEL ▼

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

(L-01)

PROJECT NAME: MARATHON ELECTRIC

PROJECT NO.: 2115

CLIENT: MARATHON

LOCATION: WAUSAU, WI

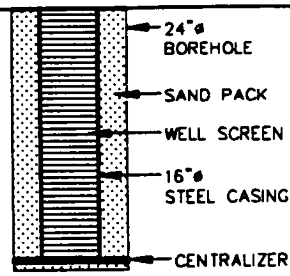
HOLE DESIGNATION: EW1 (Page 3 of 3)

DATE COMPLETED: JULY 19, 1990

DRILLING METHOD: 24" OD CT

CRA SUPERVISOR: P. STORLIE

DEPTH ft BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	STATE	'N' VALUE	HNU (ppm)
135.0	Same, except medium to coarse gravel			27CT	X		
140.0	Same, except trace silt			28CT	X		
	SP-SAND, little fine to medium gravel, trace silt, light brown	1072.4		29CT	X		
145.0	Top of bedrock at 143.5 FT. BGS. hard drilling, trace small fragments of reddish granite						
	END OF HOLE @ 143.5 FT. BGS						
150.0							
155.0							
160.0							
165.0							
170.0							
175.0							
180.0							
185.0							
190.0							
195.0							



SCREEN DETAILS:
Screened Interval:
102.5 to 143.0' BGS
Length -40.5'
Diameter -16.0"
Slot # 60
Material -Stainless Steel
Sand pack interval:
85.0 to 143.5' BGS
Material -# 20 Sand

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS ⬭ WATER FOUND ▽ STATIC WATER LEVEL ▼

APPENDIX C

STEP TEST DATA

STEP DRAWDOWN DATA (EW1)
MARATHON ELECTRIC
WAUSAU, WISCONSIN

Step 1 (910 gpm)

Elapsed Time (min)	*Water Level (ft. BTOC)*	*Drawdown (ft)*
0	29.58	0
0.5	53.62	24.04
1	55.10	25.52
1.5	55.40	25.82
2	55.51	25.93
2.5	55.64	26.06
3	55.84	26.26
4	56.00	26.42
5	56.36	26.78
6	56.46	26.88
7	56.54	26.96
8	56.80	27.22
9	56.81	27.23
10	56.89	27.31
12	57.02	27.44
15	57.18	27.60
17	57.30	27.72
20	57.44	27.86
25	57.64	28.06
30	57.62	28.04
35	57.80	28.22
45	57.85	28.27
60	57.90	28.32

Step 2 (1,240 gpm)

Elapsed Time (min)	*Water Level (ft. BTOC)*	*Drawdown (min)*
60	57.90	28.32
60.5	67.00	37.42
61	67.30	37.72
61.5	67.42	37.84
62	67.44	37.86
62.5	67.46	37.88
63	67.45	37.87
64	67.45	37.87
65	67.63	38.05
66	67.68	38.10
67	67.81	38.23
68	67.75	38.17
70	67.85	38.27
72	67.89	38.31
75	68.06	38.48
77	68.17	38.59
80	68.22	38.64
85	68.05	38.47
90	68.16	38.58
95	68.24	38.66
105	68.24	38.66
120	68.24	38.66

Step 3 (1,680 gpm)

Elapsed Time (min)	*Water Level (ft. BTOC)*	*Drawdown (ft)*
120	68.24	38.66
120.5	79.40	49.82
121	80.55	50.97
121.5	80.78	51.20
122	81.01	51.43
122.5	81.17	51.59
123	81.26	51.68
124	81.50	51.92
125	81.67	52.09
126	81.81	52.23
127	81.89	52.31
128	81.97	52.39
130	82.09	52.51
132	82.10	52.52
135	82.15	52.57
137	82.19	52.61
140	82.20	52.62
145	82.20	52.62
150	82.22	52.64
155	82.22	52.64
165	82.27	52.69
180	82.28	52.70

APPENDIX D

DRAWDOWN DATA AND CALCULATIONS

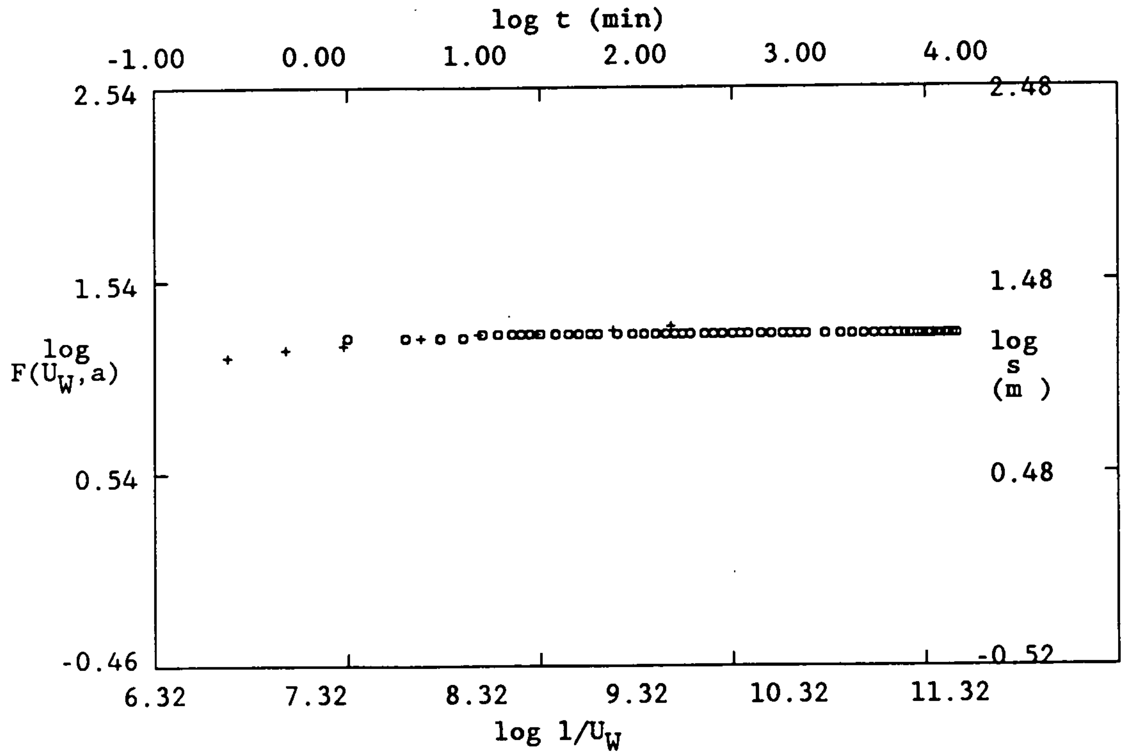
Data for Large Diameter Well Test

Well Name: EW1 Date of Test: 8-14-90
Aquifer Thickness (b): 115.000 ft
Pumped Well Discharge(Q) = 1695.000 gpm
Effective Radius of Well = 0.750 ft
Radius of Casing(rc) over Water Level Decline = 0.750 ft

Entry No.	Time(t) (min)	Drawdown(s) (ft)
********	************	************
1	1.000	49.000
2	2.000	50.600
3	3.000	51.100
4	4.000	51.280
5	5.000	51.360
6	6.000	51.400
7	7.000	51.500
8	8.000	51.510
9	9.000	51.530
10	10.000	51.560
11	12.000	51.570
12	14.000	51.680
13	16.000	51.720
14	18.000	51.770
15	20.000	51.900
16	25.000	51.920
17	30.000	51.980
18	35.000	51.980
19	40.000	52.050
20	45.000	52.060
21	50.000	52.060
22	55.000	52.100
23	60.000	52.120
24	70.000	52.100
25	80.000	52.160
26	90.000	52.240
27	100.000	52.300
28	110.000	52.400
29	120.000	52.380
30	140.000	52.380
31	160.000	52.440
32	180.000	52.440
33	200.000	52.560
34	220.000	52.510
35	240.000	52.620
36	300.000	52.740
37	360.000	52.800
38	420.000	52.500
39	480.000	52.540
40	540.000	52.820
41	600.000	52.900

42	660.000	52.880
43	720.000	52.900
44	780.000	53.000
45	840.000	53.000
46	910.000	53.080
47	960.000	53.200
48	1020.000	53.250
49	1080.000	53.250
50	1140.000	53.400
51	1200.000	53.350
52	1275.000	53.250
53	1320.000	53.230
54	1375.000	53.250
55	1430.000	53.200

DRAWDOWN EW1-PUMPING TEST(EW1)



o - Data

\+ - Type Curve
Large Diameter: alpha = -5.0

<u>SOLUTION</u>

Transmissivity = 9.681E-0003 sq m/sec
Aquifer Thick. = 3.505E+0001 m
Hydraulic Cond.= 2.762E-0004 m/sec

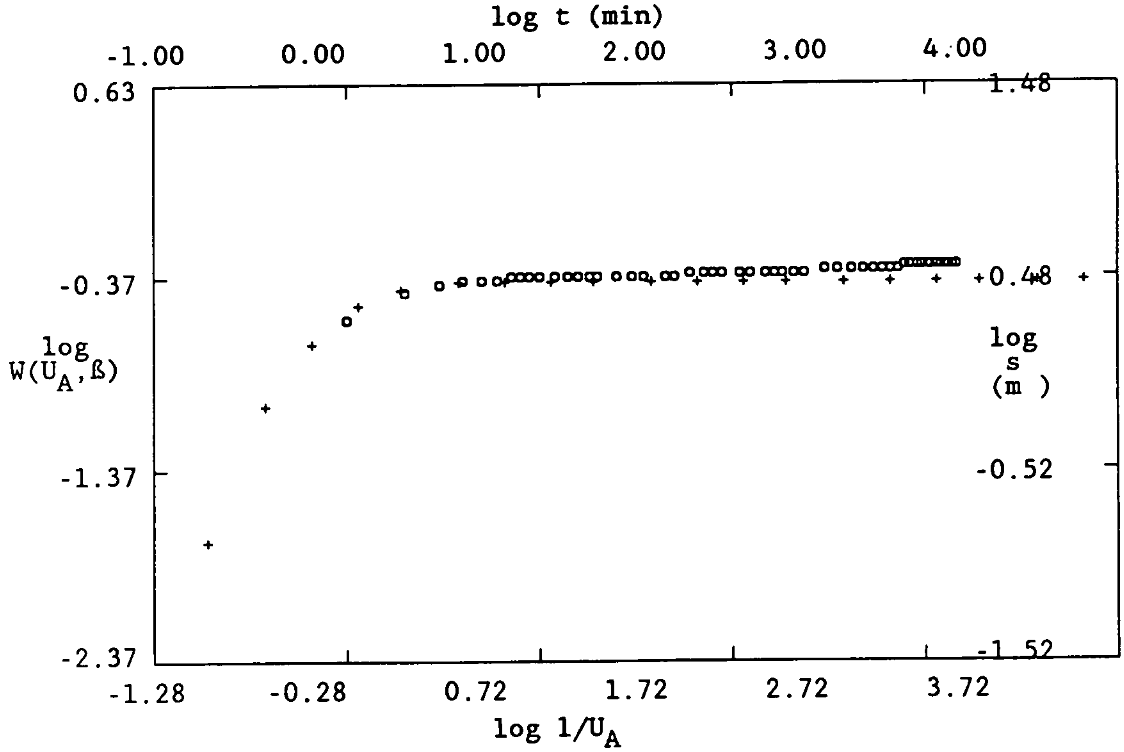
Data for Pump Test

Well Name: R4D   Date of Test: 8-14-90
Aquifer Thickness (b): 115.000 ft
Pumped Well Discharge(Q) = 1695.000 gpm
Radius of Pumping Well = 0.750 ft
Distance of Observation Well from Pumping Well = 42.000 ft

Entry No.	Time(t) (min)	Drawdown(s) (ft)	t / d^2 (min/sq ft)
1	1.000	6.070	5.669E-0004
2	2.000	8.420	1.134E-0003
3	3.000	9.150	1.701E-0003
4	4.000	9.450	2.268E-0003
5	5.000	9.610	2.834E-0003
6	6.000	9.710	3.401E-0003
7	7.000	9.790	3.968E-0003
8	8.000	9.830	4.535E-0003
9	9.000	9.860	5.102E-0003
10	10.000	9.890	5.669E-0003
11	12.000	9.940	6.803E-0003
12	14.000	9.990	7.937E-0003
13	16.000	10.020	9.070E-0003
14	18.000	10.040	1.020E-0002
15	20.000	10.080	1.134E-0002
16	25.000	10.110	1.417E-0002
17	30.000	10.140	1.701E-0002
18	35.000	10.160	1.984E-0002
19	45.000	10.200	2.551E-0002
20	50.000	10.210	2.834E-0002
21	60.000	10.250	3.401E-0002
22	70.000	10.280	3.968E-0002
23	80.000	10.310	4.535E-0002
24	90.000	10.330	5.102E-0002
25	110.000	10.400	6.236E-0002
26	124.000	10.430	7.029E-0002
27	148.000	10.470	8.390E-0002
28	165.000	10.510	9.354E-0002
29	182.000	10.550	1.032E-0001
30	210.000	10.630	1.190E-0001
31	236.000	10.660	1.338E-0001
32	301.000	10.800	1.706E-0001
33	357.000	10.900	2.024E-0001
34	420.000	10.890	2.381E-0001
35	480.000	10.940	2.721E-0001
36	540.000	11.090	3.061E-0001
37	600.000	11.140	3.401E-0001
38	660.000	11.140	3.741E-0001
39	720.000	11.190	4.082E-0001
40	780.000	11.240	4.422E-0001
41	840.000	11.290	4.762E-0001

42	910.000	11.350	5.159E-0001
43	960.000	11.390	5.442E-0001
44	1020.000	11.440	5.782E-0001
45	1080.000	11.470	6.122E-0001
46	1140.000	11.540	6.463E-0001
47	1200.000	11.570	6.803E-0001
48	1275.000	11.590	7.228E-0001
49	1319.000	11.600	7.477E-0001
50	1378.000	11.610	7.812E-0001
51	1438.000	11.640	8.152E-0001

DRAWDOWN R4D-PUMPING TEST(EW1)



o - Data

\+ - Type Curve
Unconfined Elastic: beta = 0.80

SOLUTION

Transmissivity = 1.191E-0003 sq m/sec
Aquifer Thick. = 3.505E+0001 m
Hydraulic Cond.= 3.398E-0005 m/sec
Storativity = 8.309E-0004

APPENDIX E

RECOVERY TEST DATA AND CALCULATIONS

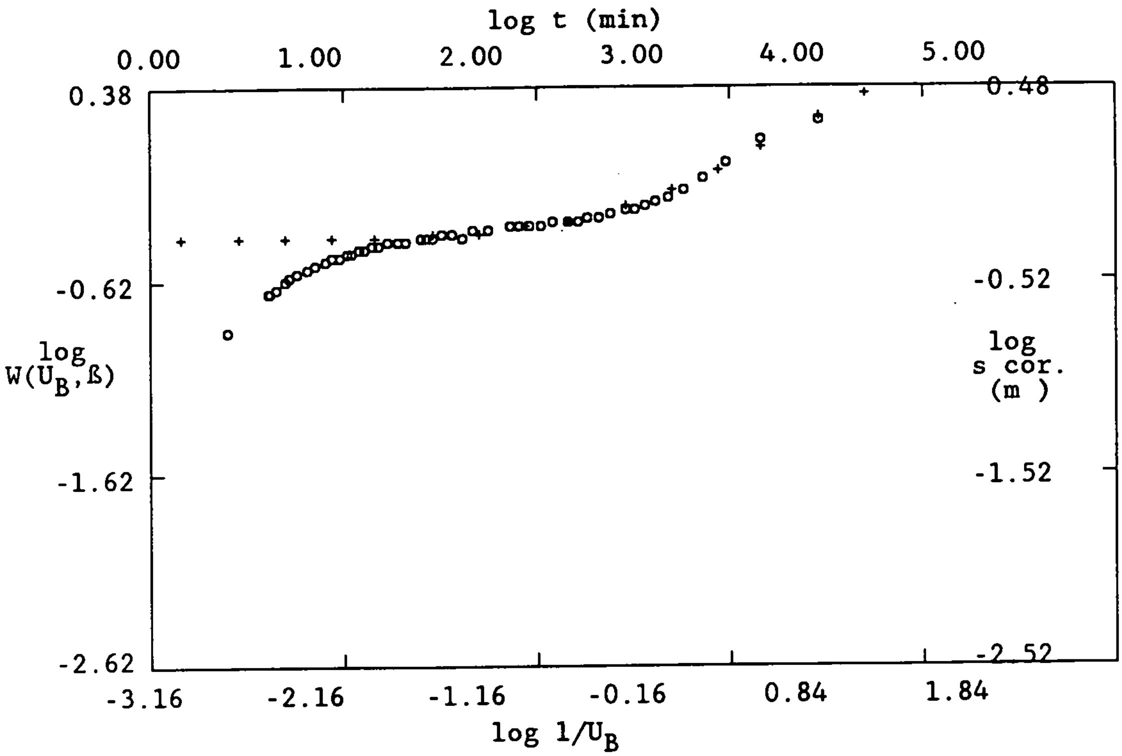
Data for Pump Test

Well Name: R4D(rec)　　　　Date of Test: 8-15-90
Aquifer Thickness (b): 115.000 ft
Pumped Well Discharge(Q) = 1695.000 gpm
Radius of Pumping Well = 0.750 ft
Distance of Observation Well from Pumping Well = 42.000 ft

Entry No.	Time(t) (min)	Drawdown(s) (ft)	t / d^2 (min/sq ft)
********	************	************	*************
1	2881.000	6.690	1.633E+0000
2	1441.000	5.380	8.169E-0001
3	961.000	4.040	5.448E-0001
4	721.000	3.300	4.087E-0001
5	577.000	2.910	3.271E-0001
6	481.000	2.670	2.727E-0001
7	412.000	2.530	2.336E-0001
8	361.000	2.410	2.046E-0001
9	321.000	2.340	1.820E-0001
10	289.000	2.280	1.638E-0001
11	241.000	2.190	1.366E-0001
12	207.000	2.130	1.173E-0001
13	181.000	2.090	1.026E-0001
14	161.000	2.040	9.127E-0002
15	145.000	2.020	8.220E-0002
16	121.000	1.980	6.859E-0002
17	104.000	1.950	5.896E-0002
18	91.000	1.920	5.159E-0002
19	81.000	1.900	4.592E-0002
20	73.000	1.880	4.138E-0002
21	56.000	1.830	3.175E-0002
22	47.000	1.800	2.664E-0002
23	41.000	1.700	2.324E-0002
24	36.000	1.740	2.041E-0002
25	32.000	1.720	1.814E-0002
26	29.000	1.700	1.644E-0002
27	27.000	1.670	1.531E-0002
28	25.000	1.650	1.417E-0002
29	21.000	1.620	1.190E-0002
30	19.000	1.590	1.077E-0002
31	17.000	1.560	9.637E-0003
32	15.000	1.530	8.503E-0003
33	14.000	1.500	7.937E-0003
34	13.000	1.470	7.370E-0003
35	12.000	1.440	6.803E-0003
36	11.000	1.420	6.236E-0003
37	10.500	1.390	5.952E-0003
38	9.600	1.350	5.442E-0003
39	8.800	1.320	4.989E-0003
40	8.100	1.270	4.592E-0003
41	7.100	1.200	4.025E-0003

42	6.400	1.150	3.628E-0003
43	5.800	1.090	3.288E-0003
44	5.200	1.040	2.948E-0003
45	5.000	1.010	2.834E-0003
46	4.430	0.930	2.511E-0003
47	4.170	0.890	2.364E-0003
48	4.050	0.870	2.296E-0003
49	2.520	0.540	1.429E-0003

RECOVERY R4D-PUMPING TEST(EW1)



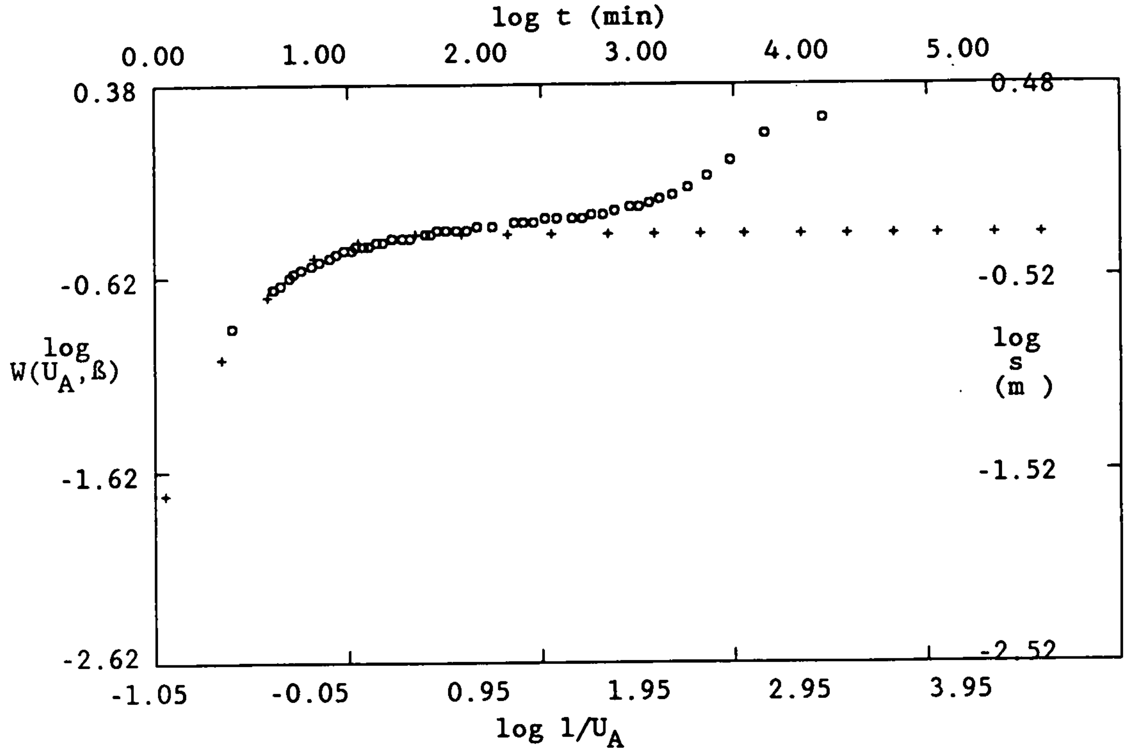
o - Data

\+ - Type Curve
Unconfined Delayed: beta = 0.80

SOLUTION

Transmissivity = 6.697E-0003 sq m/sec
Aquifer Thick. = 3.505E+0001 m
Hydraulic Cond.= 1.911E-0004 m/sec
Specific Yield = 3.544E+0000

RECOVERY R4D-PUMPING TEST(EW1)



o - Data

\+ - Type Curve
Unconfined Elastic: beta = 0.80

SOLUTION

Transmissivity = 6.697E-0003 sq m/sec
Aquifer Thick. = 3.505E+0001 m
Hydraulic Cond.= 1.911E-0004 m/sec
Storativity = 2.751E-0002

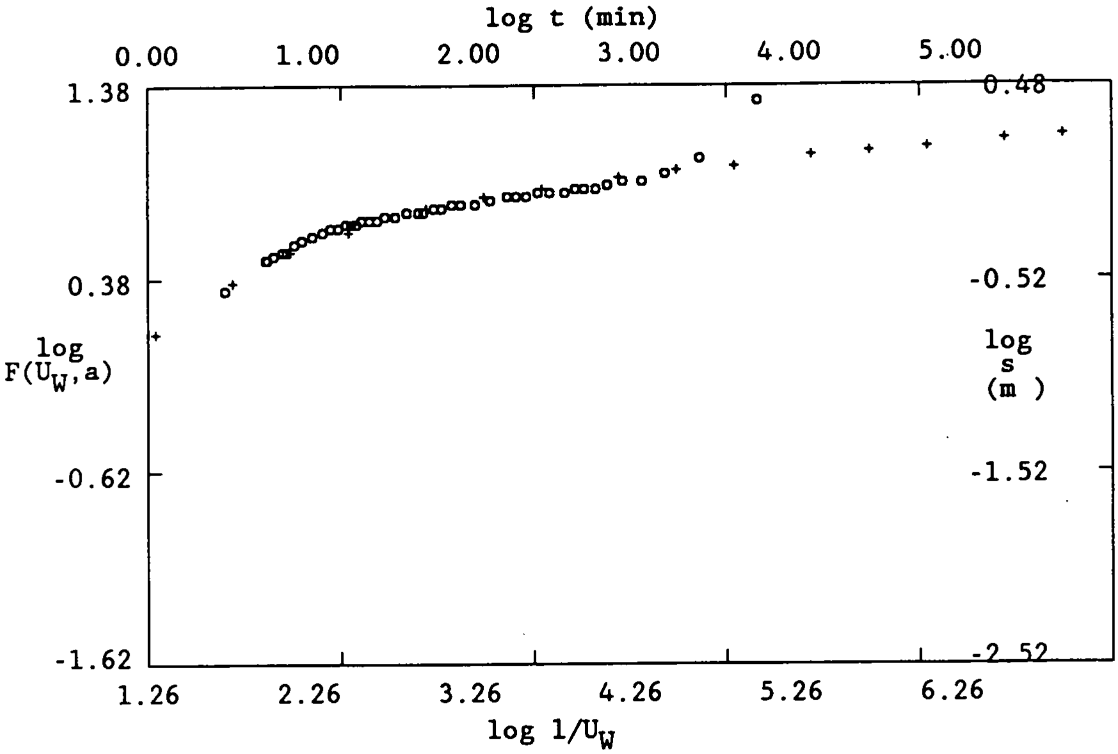
Data for Large Diameter Well Test

Well Name: EW1(REC)   Date of Test: 8-15-90
Aquifer Thickness (b): 115.000 ft
Pumped Well Discharge(Q) = 1695.000 gpm
Effective Radius of Well = 0.750 ft
Radius of Casing(rc) over Water Level Decline = 0.750 ft

Entry No.	Time(t) (min)	Drawdown(s) (ft)
********	************	************
1	1441.000	8.400
2	721.000	4.200
3	481.000	3.400
4	361.000	3.200
5	289.000	3.100
6	241.000	3.000
7	207.000	2.950
8	181.000	2.900
9	161.000	2.850
10	145.000	2.800
11	121.000	2.750
12	104.000	2.700
13	91.000	2.650
14	81.000	2.600
15	73.000	2.580
16	59.000	2.490
17	49.000	2.420
18	42.000	2.380
19	37.000	2.360
20	33.000	2.300
21	30.000	2.270
22	27.000	2.230
23	25.000	2.210
24	22.000	2.180
25	19.000	2.130
26	17.000	2.080
27	15.400	2.040
28	14.100	2.000
29	13.000	1.960
30	12.100	1.920
31	11.300	1.900
32	10.600	1.870
33	9.700	1.800
34	9.000	1.780
35	8.100	1.700
36	7.100	1.630
37	6.300	1.560
38	5.800	1.500
39	5.300	1.410
40	5.020	1.400
41	4.440	1.310

42	4.200	1.260
43	4.060	1.240
44	2.520	0.870

RECOVERY EW1-PUMPING TEST(EW1)



o - Data

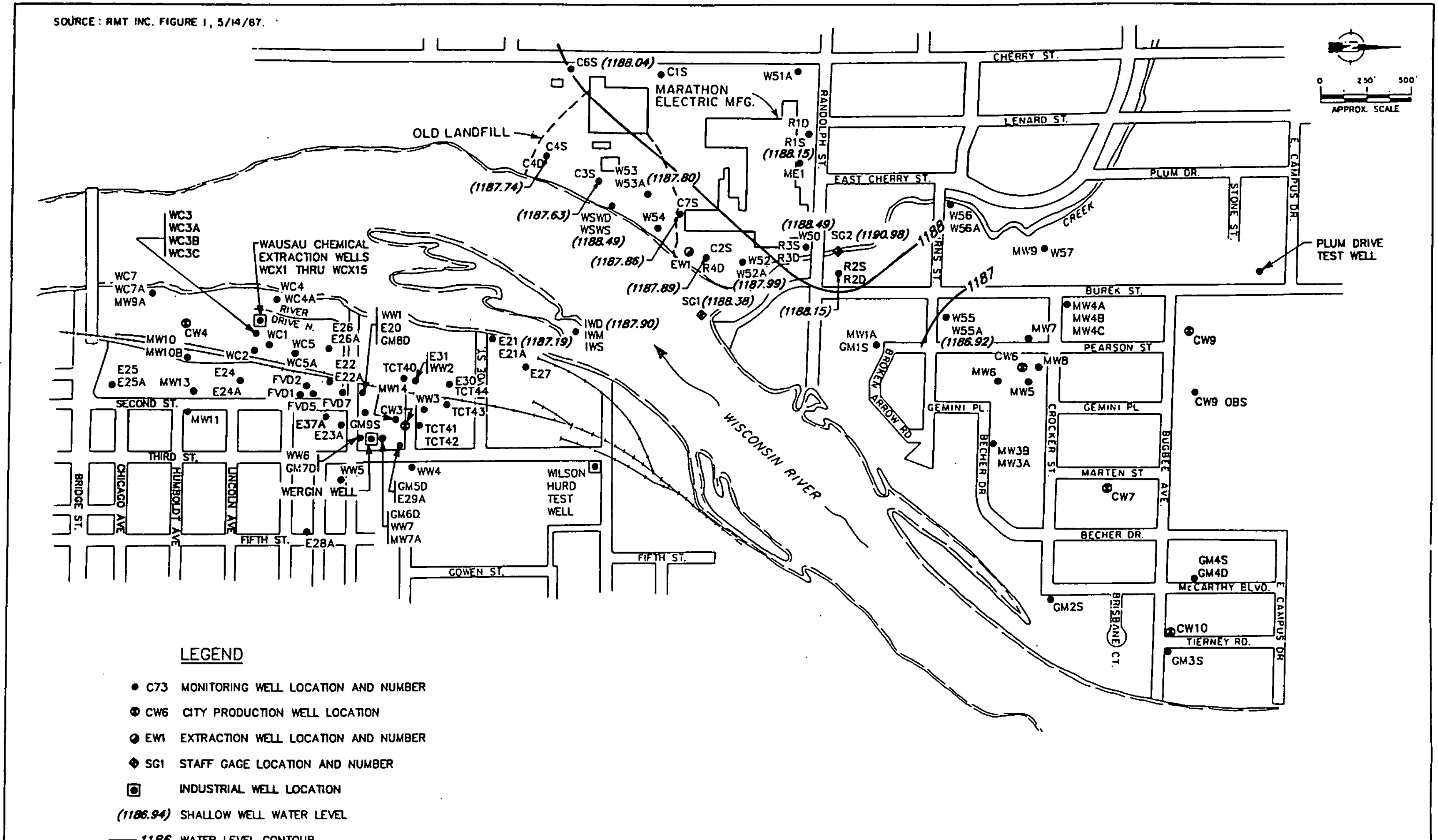
+ - Type Curve
Large Diameter: alpha = -1.0

SOLUTION

Transmissivity = 6.697E-0002 sq m/sec
Aquifer Thick. = 3.505E+0001 m
Hydraulic Cond.= 1.911E-0003 m/sec

APPENDIX B

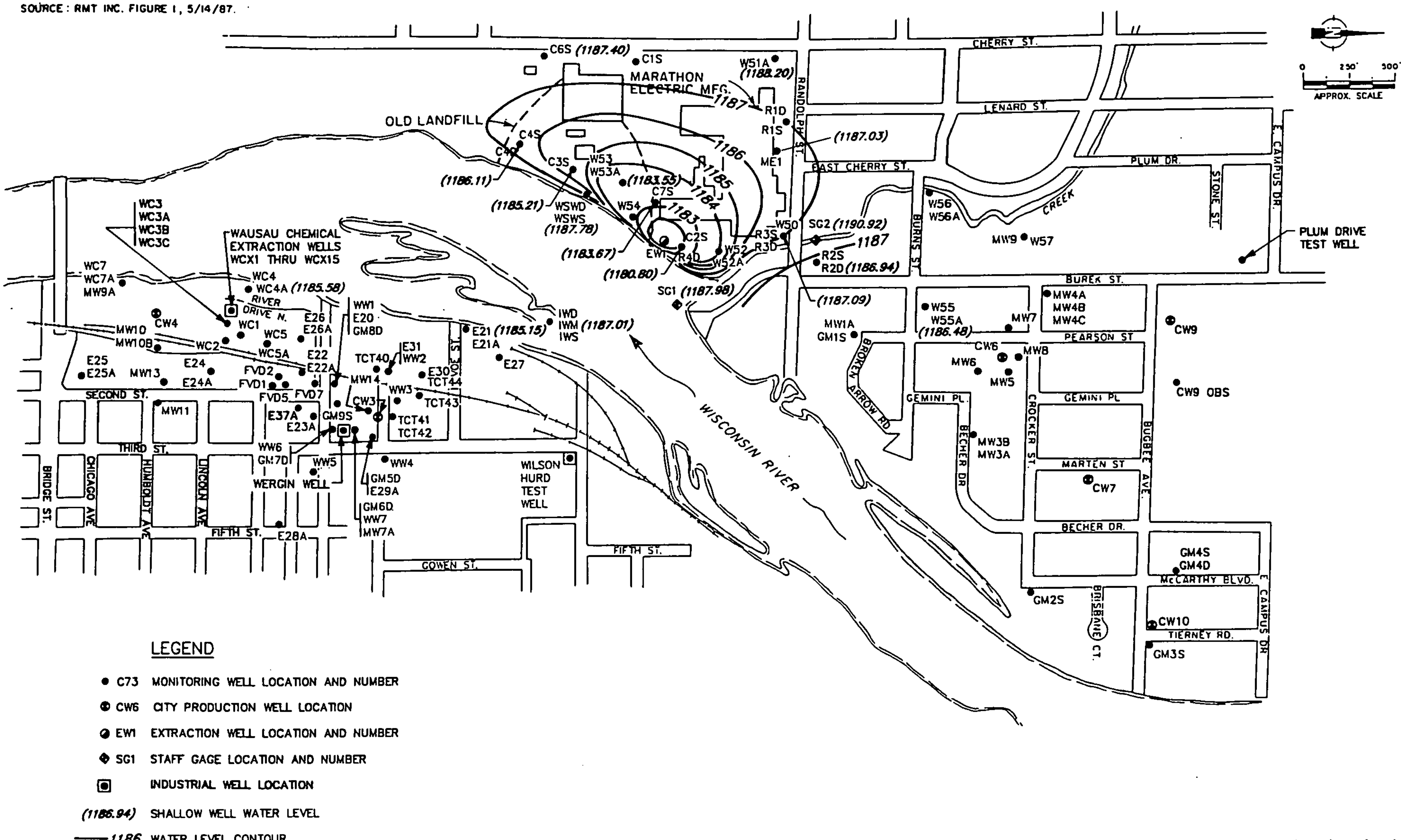
SHALLOW WELL AND DEEP WELL WATER LEVEL CONTOURS



SHALLOW WELL WATER LEVEL ELEVATIONS (11/13/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

CRA

2115-16/01/91-18-0

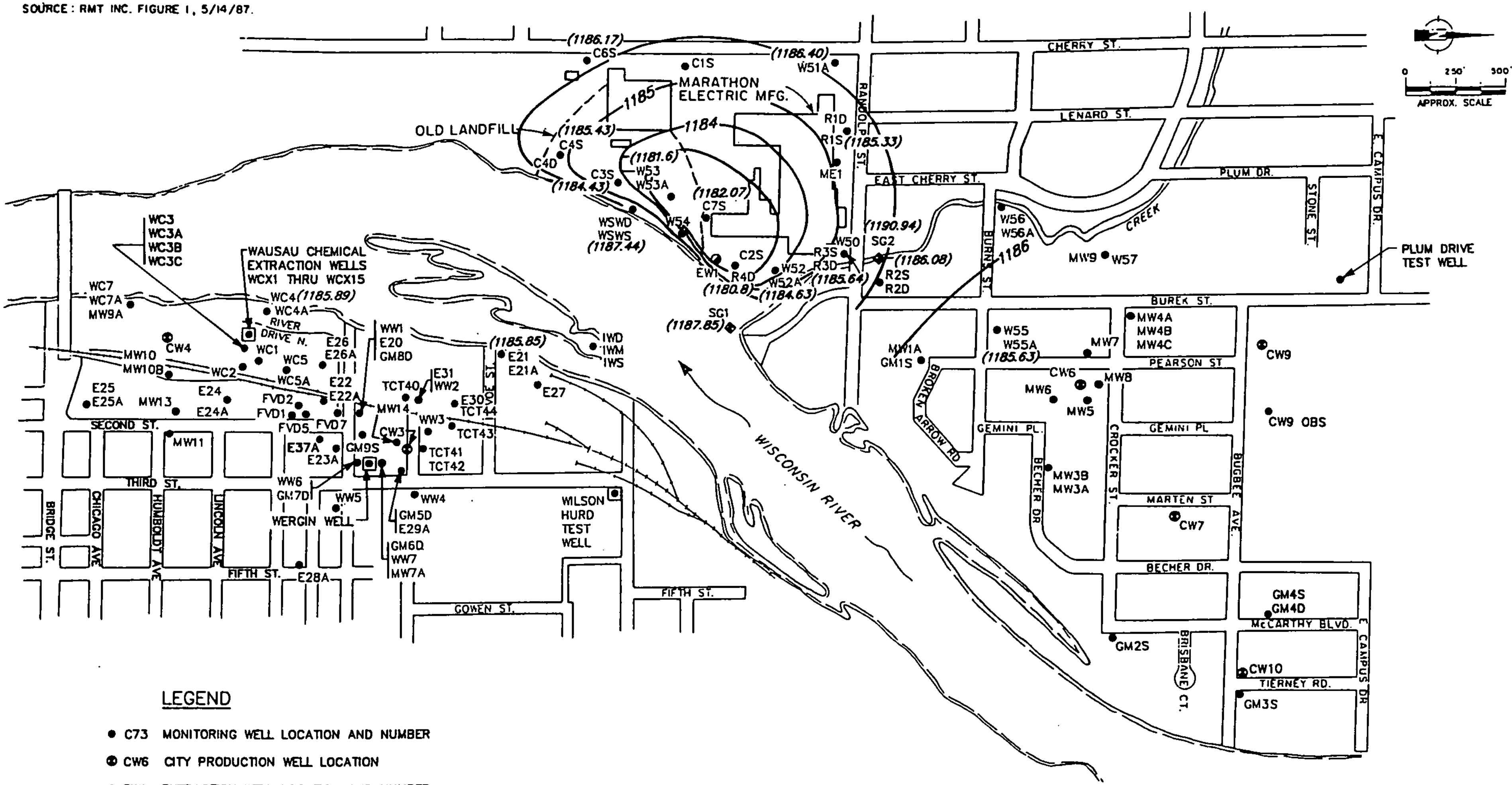


SHALLOW WELL WATER LEVEL ELEVATIONS (11/21/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

CRA

2115-16/01/91-18-0

SOURCE: RMT INC. FIGURE 1, 5/14/87.



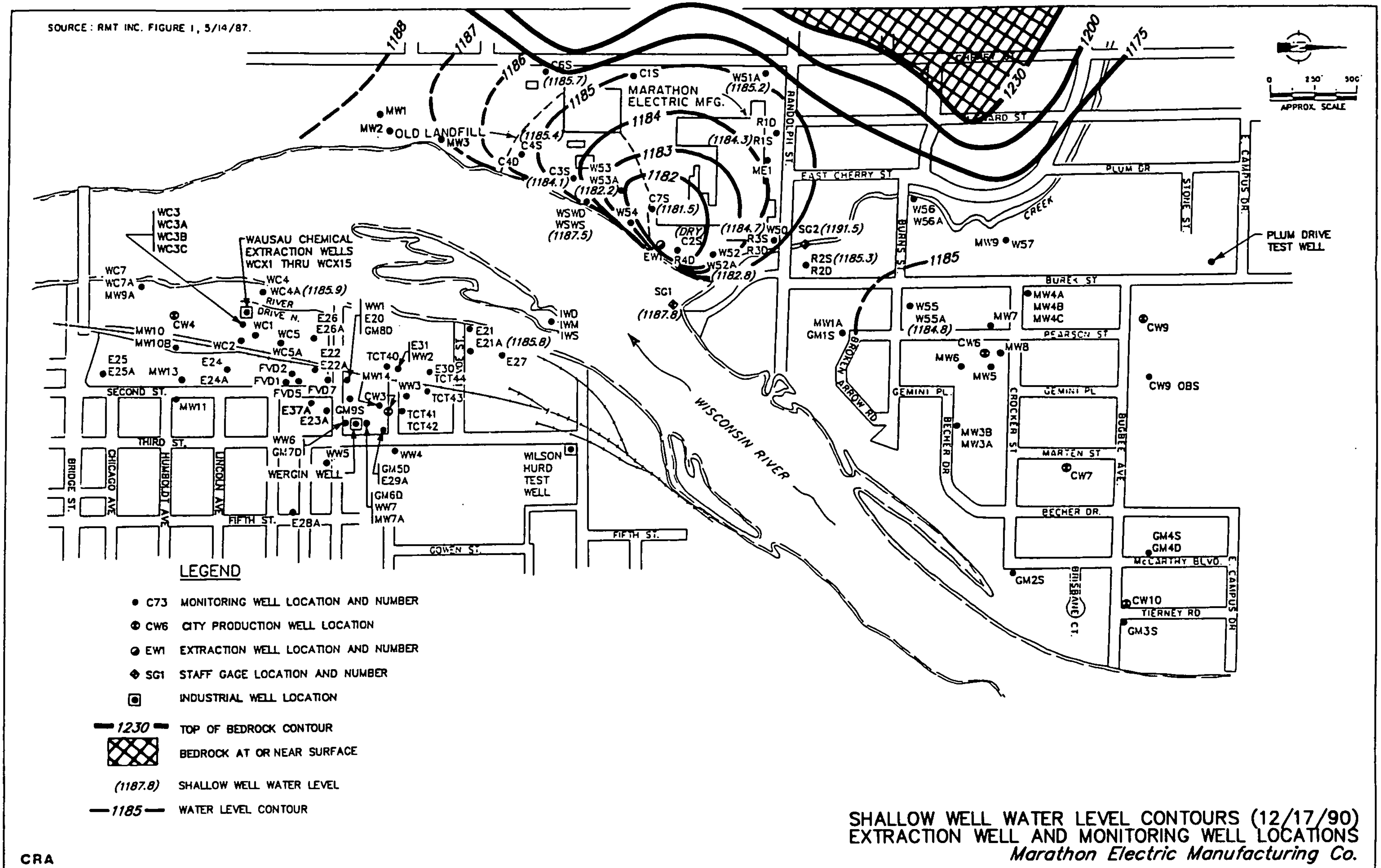
LEGEND

- ● C73 MONITORING WELL LOCATION AND NUMBER
- ⊕ CW6 CITY PRODUCTION WELL LOCATION
- EW1 EXTRACTION WELL LOCATION AND NUMBER
- SG1 STAFF GAGE LOCATION AND NUMBER
- INDUSTRIAL WELL LOCATION
- *(1186.94)* SHALLOW WELL WATER LEVEL
- —*1186*— WATER LEVEL CONTOUR

SHALLOW WELL WATER LEVEL ELEVATIONS (12/03/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

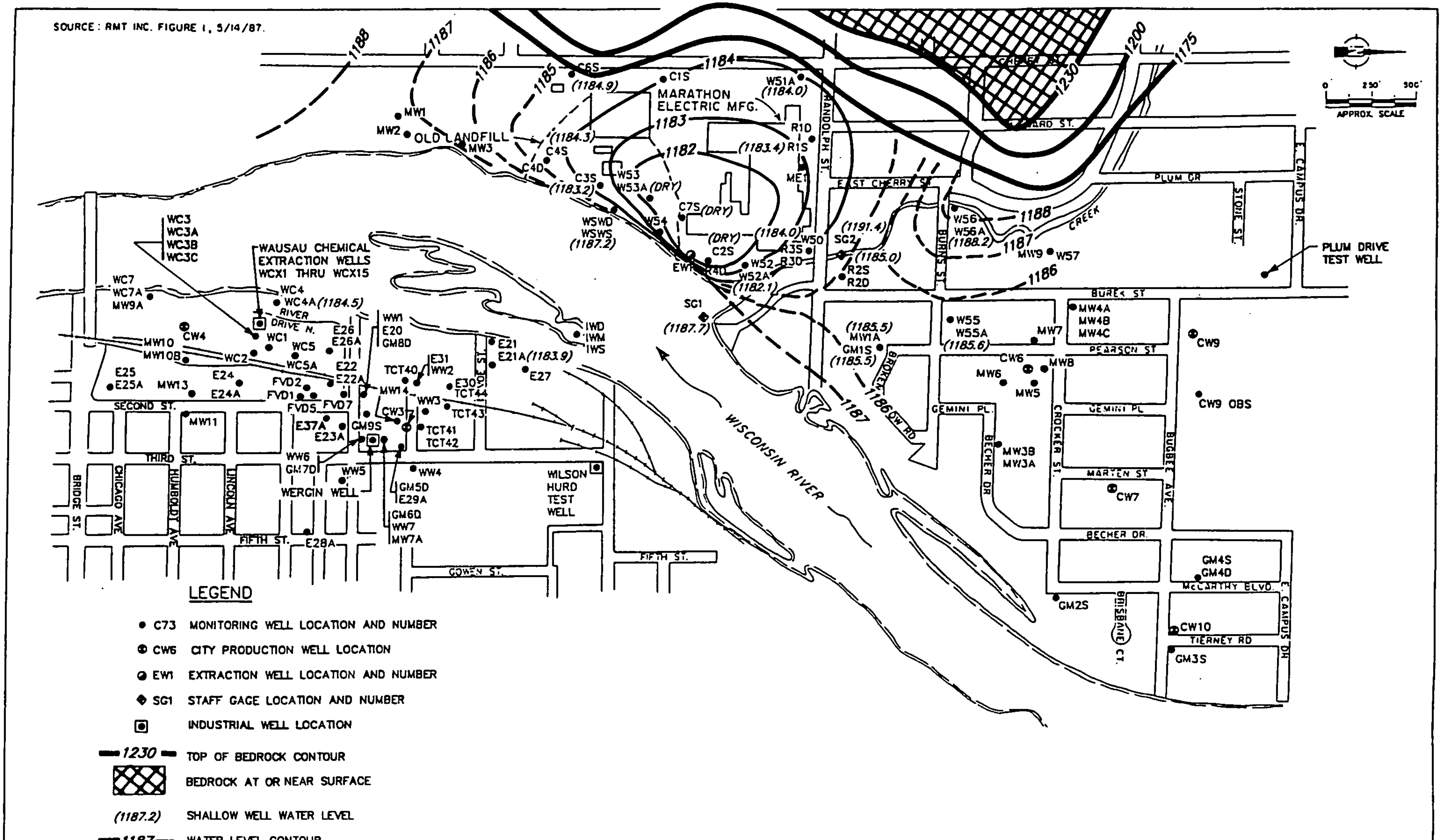
CRA

2115-16/01/91-18-0



SHALLOW WELL WATER LEVEL CONTOURS (12/17/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

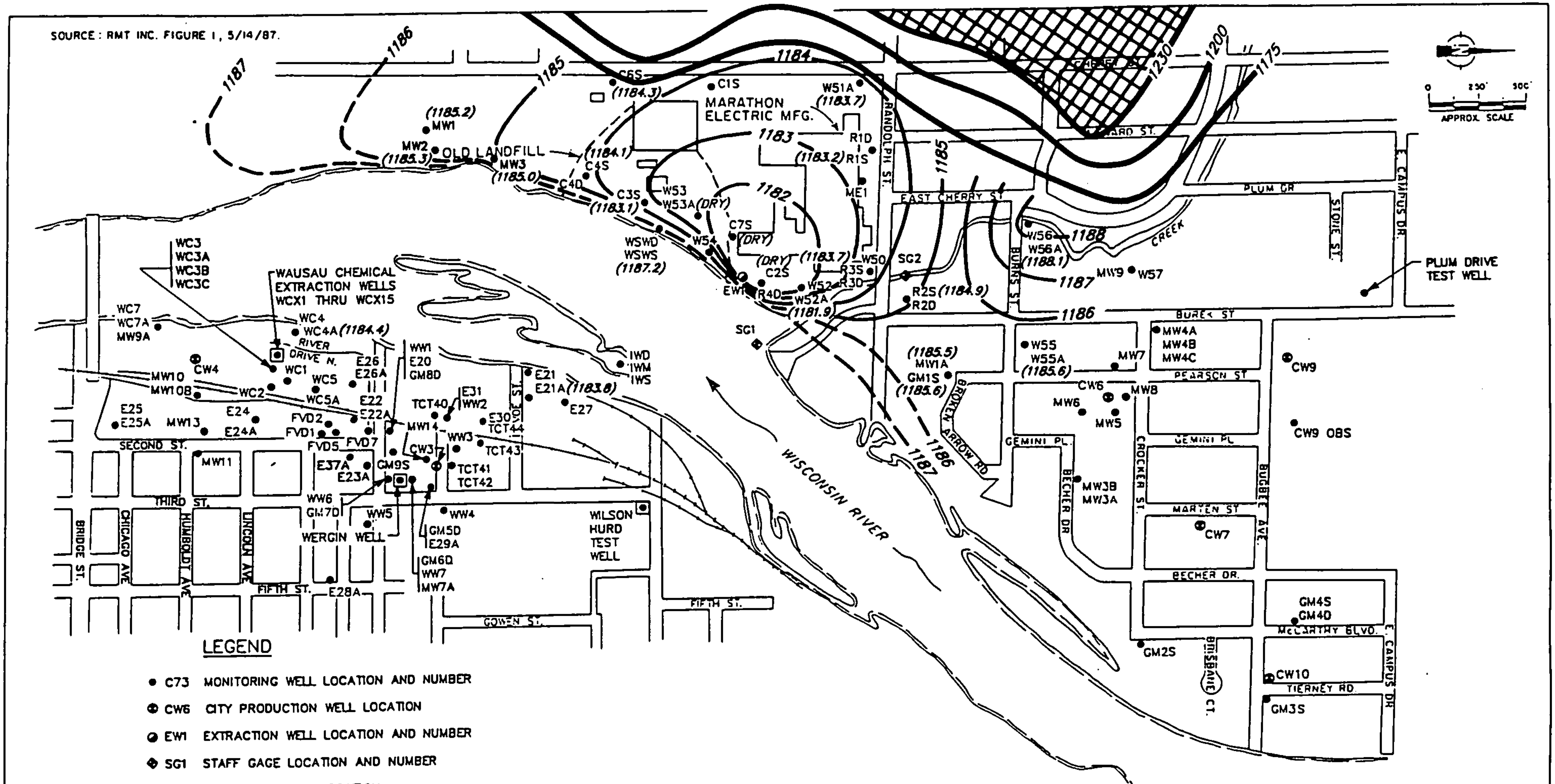
2115-16/01/91-18-0



SHALLOW WELL WATER LEVEL CONTOURS (01/07/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

CRA

2115-16/01/91-18-0



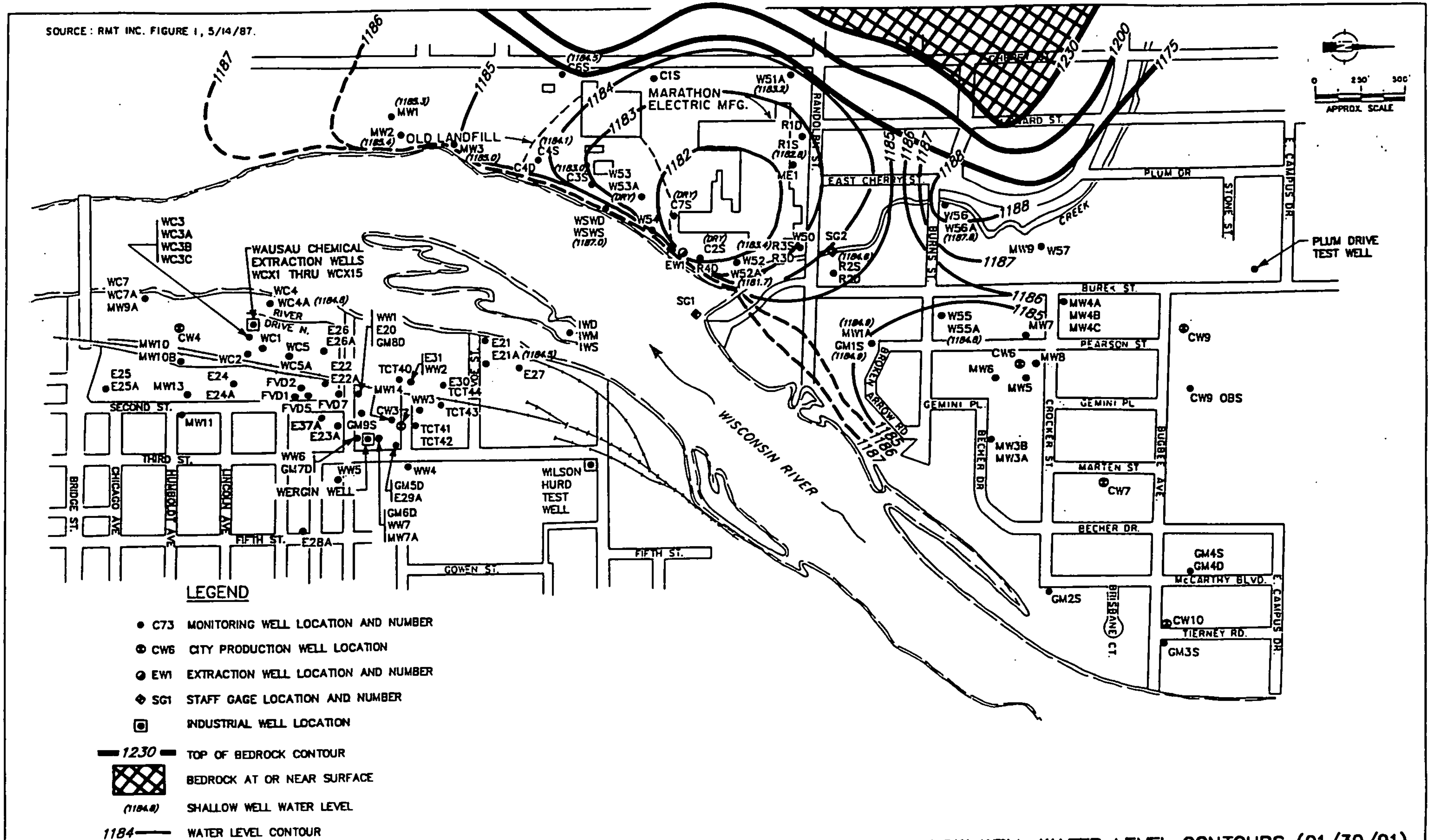
LEGEND

- C73 MONITORING WELL LOCATION AND NUMBER
- CW6 CITY PRODUCTION WELL LOCATION
- EW1 EXTRACTION WELL LOCATION AND NUMBER
- SG1 STAFF GAGE LOCATION AND NUMBER
- INDUSTRIAL WELL LOCATION
- 1230 TOP OF BEDROCK CONTOUR
- BEDROCK AT OR NEAR SURFACE
- (1187.2) SHALLOW WELL WATER LEVEL
- 1185 WATER LEVEL CONTOUR

SHALLOW WELL WATER LEVEL CONTOURS (01/14/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

CRA

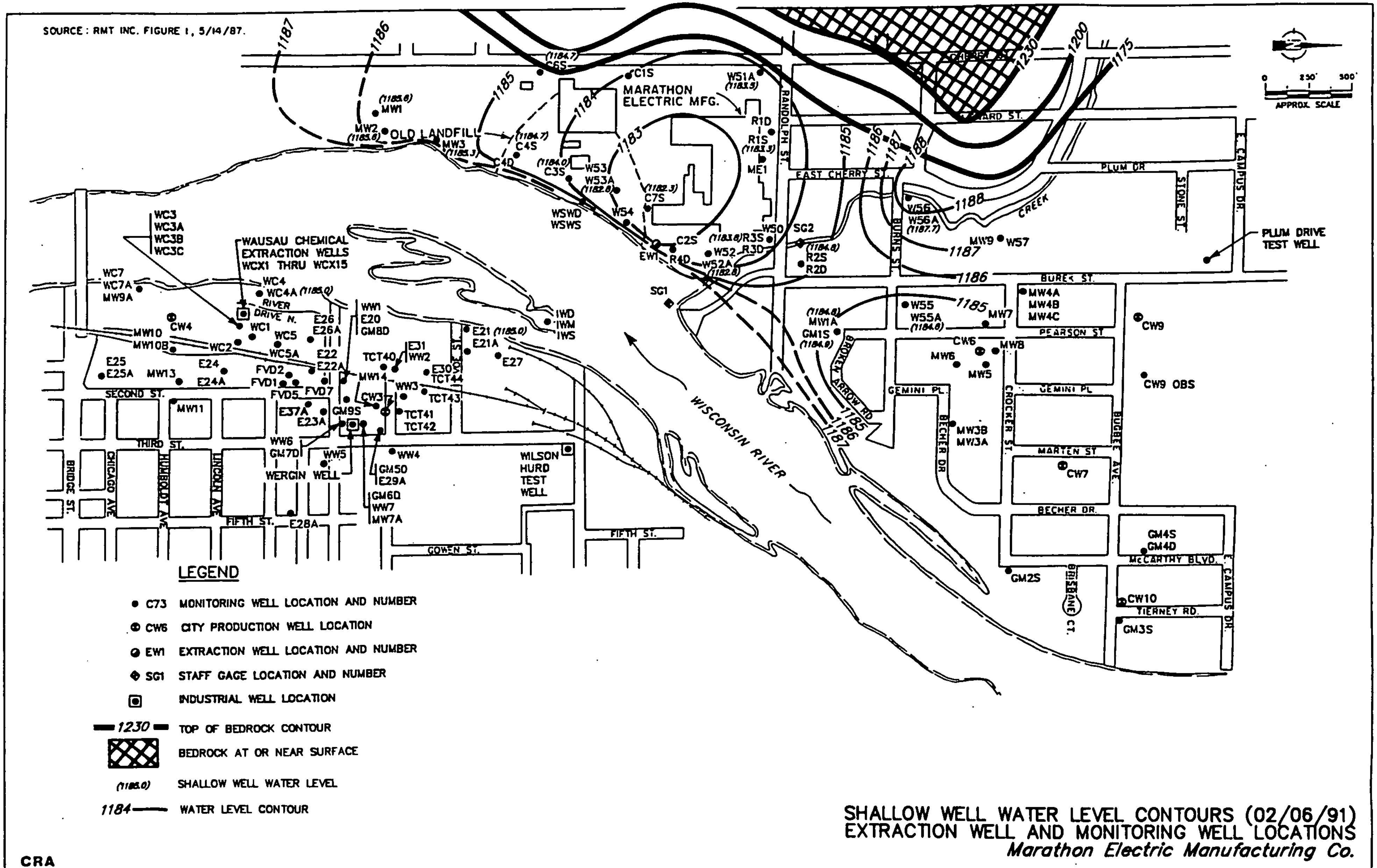
2115-16/01/91-18-0



SHALLOW WELL WATER LEVEL CONTOURS (01/30/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

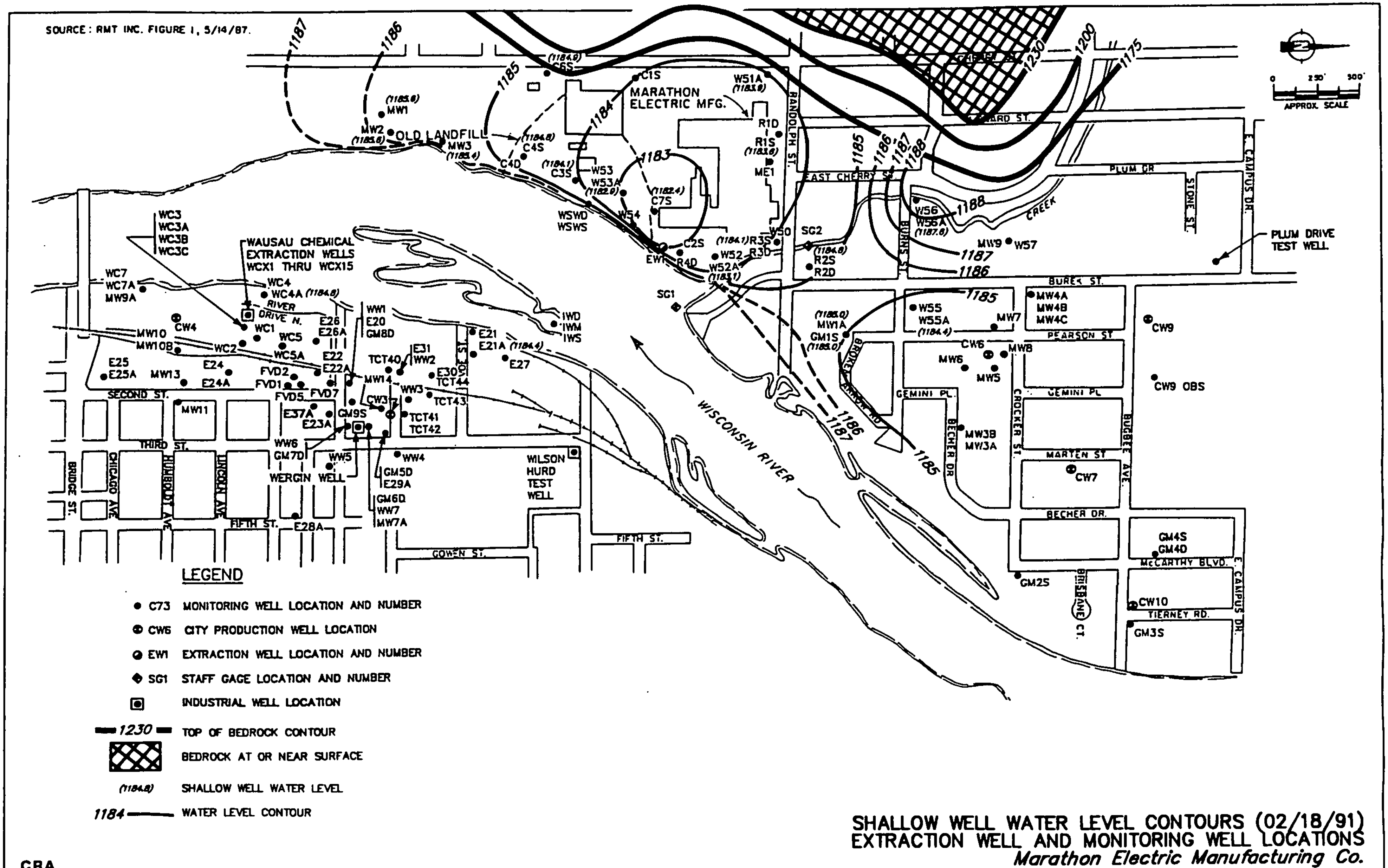
CRA

2115-09/07/91-19-0



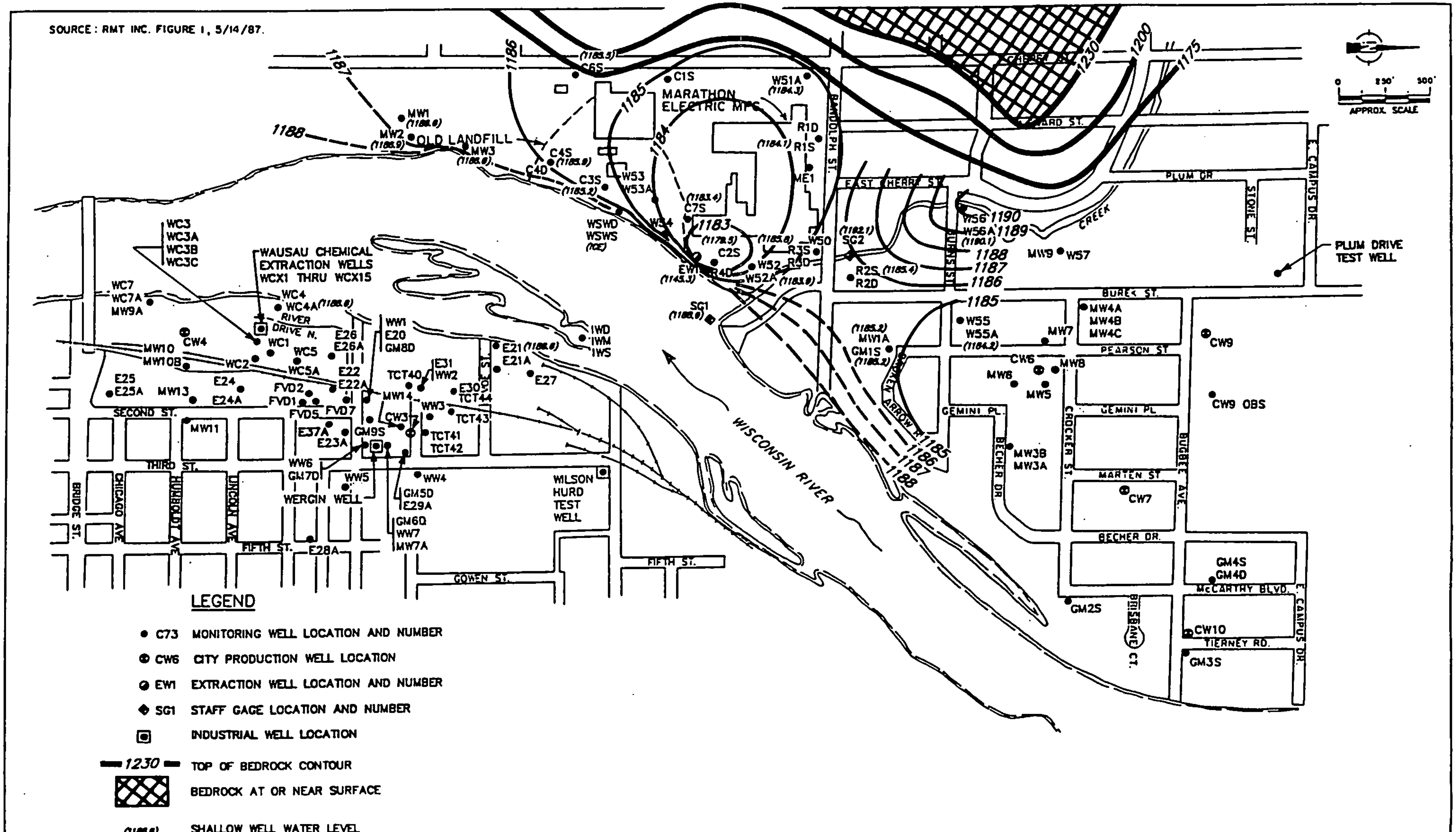
SHALLOW WELL WATER LEVEL CONTOURS (02/06/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-25/02/91-L-0



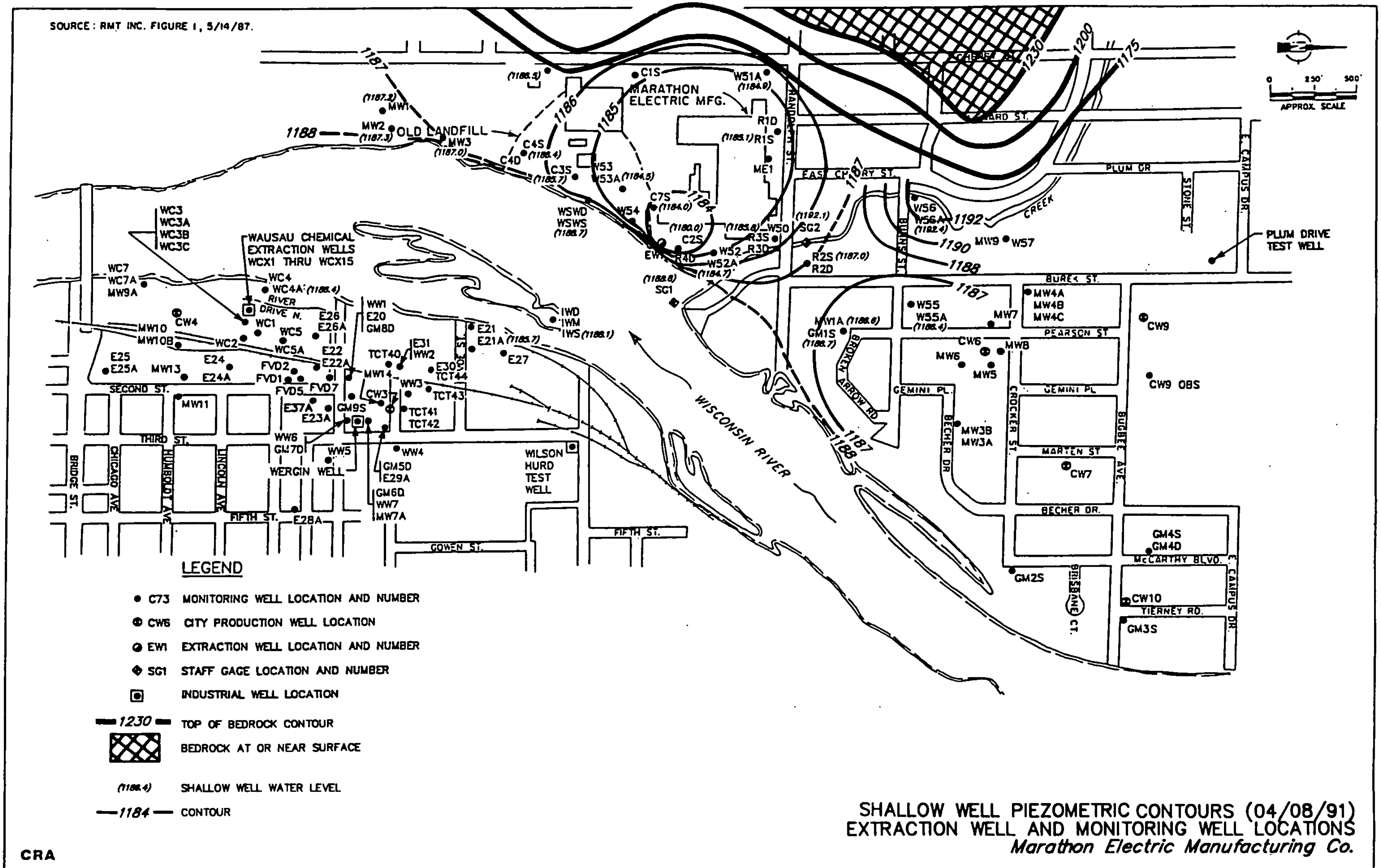
SHALLOW WELL WATER LEVEL CONTOURS (02/18/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-25/02/91-L-0



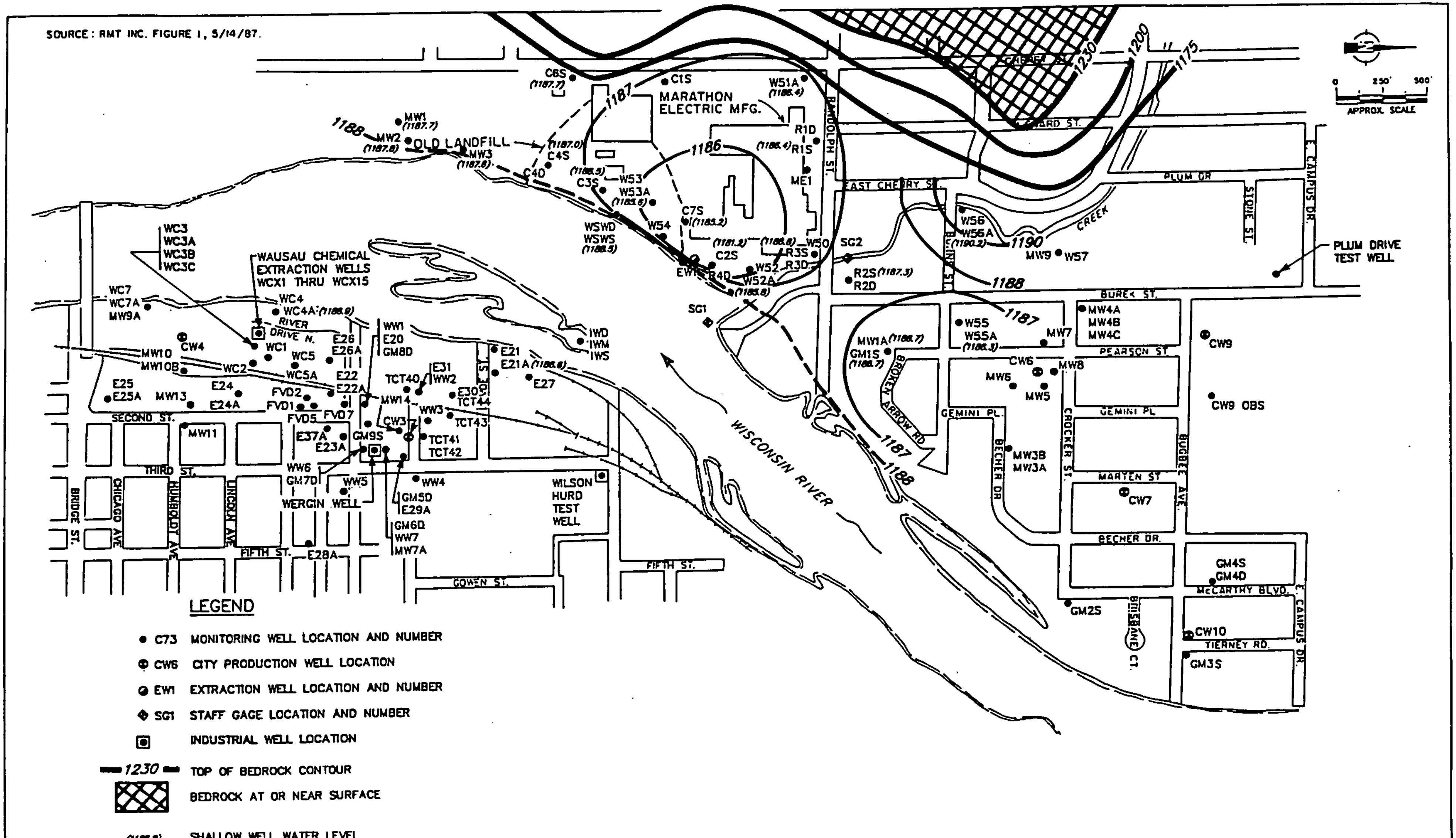
SHALLOW WELL PIEZOMETRIC CONTOURS (03/25/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-09/07/91-19-0



SHALLOW WELL PIEZOMETRIC CONTOURS (04/08/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-9/05/91-L-0



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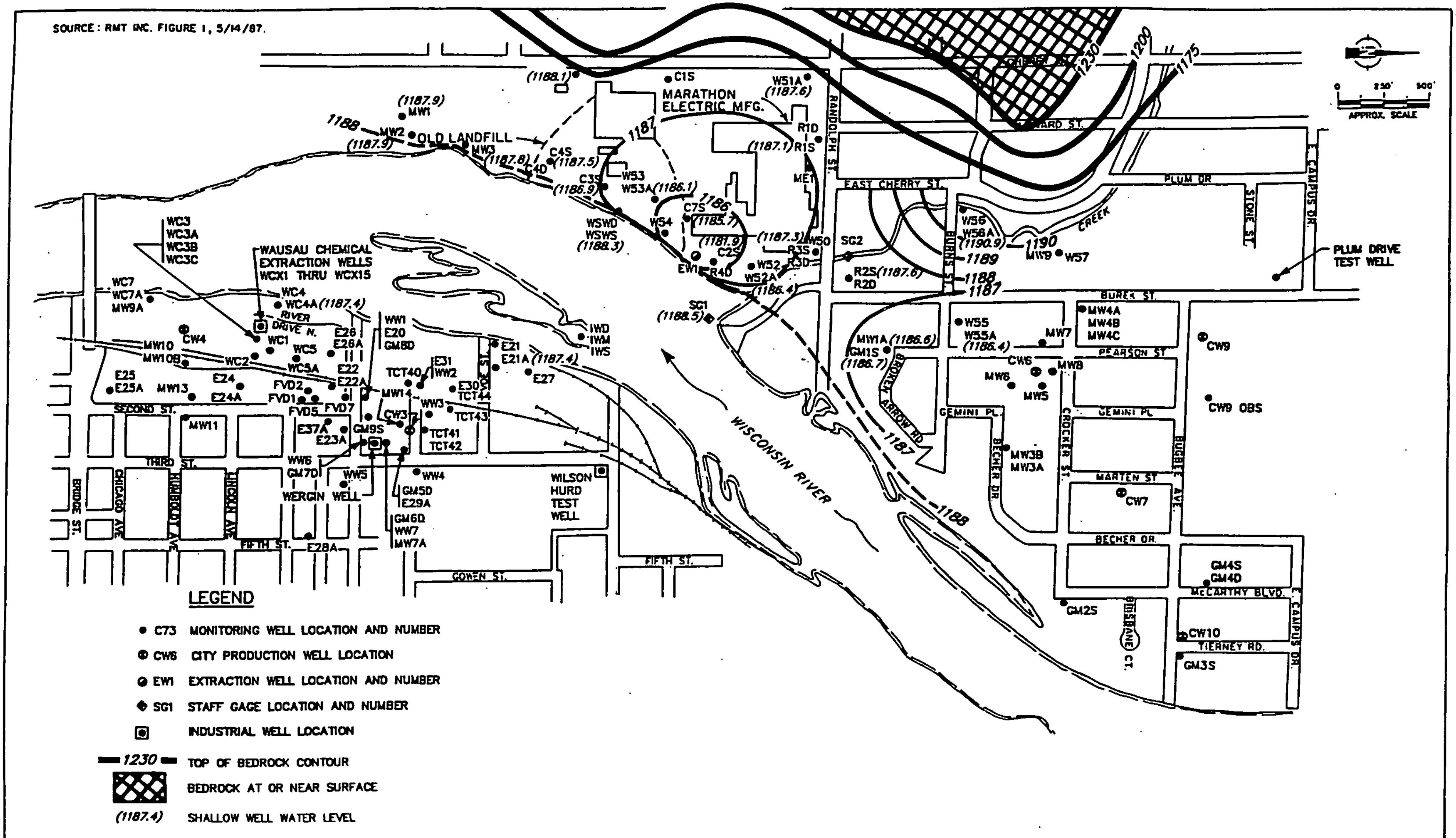
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-9/05/91-L-0

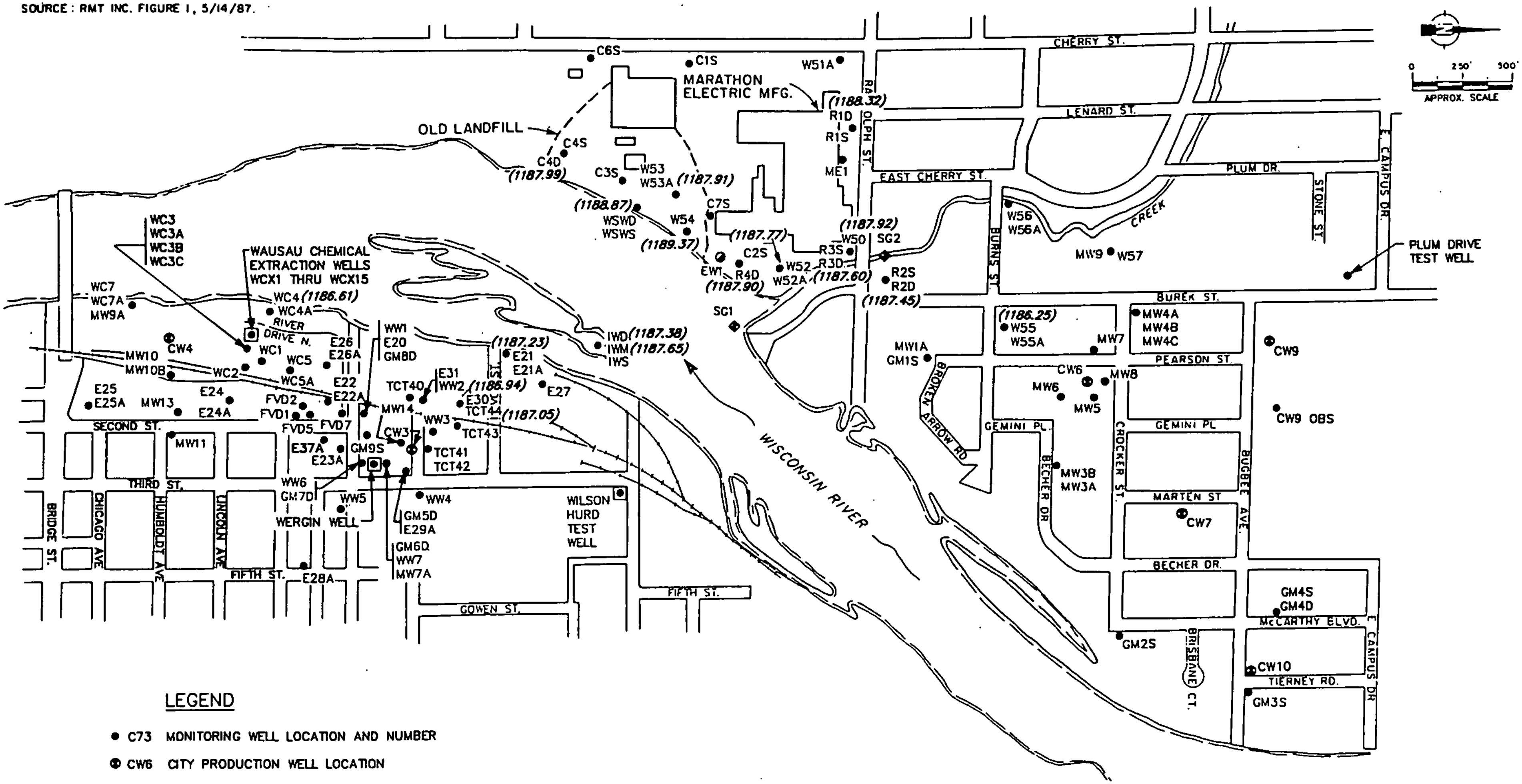


SHALLOW WATER PIEZOMETRIC CONTOURS (06/27/91)
EXTRACTION WELL AND MONITORING WELL LOCAITONS
Marathon Electric Manufacturing Co.

CRA

2115-05/07/91-19-0

SOURCE: RMT INC. FIGURE I, 5/14/87.



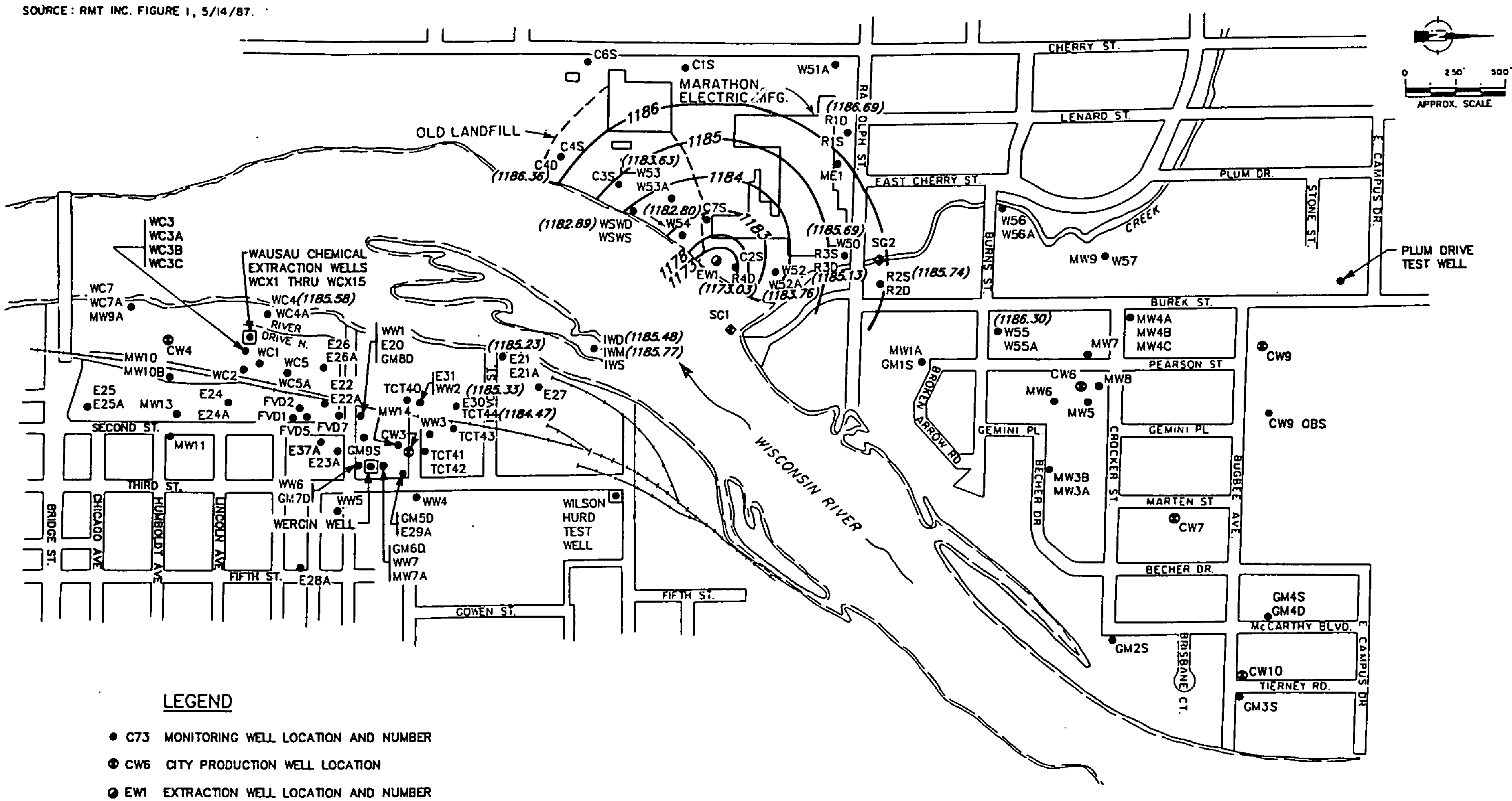
LEGEND

- ● C73 MONITORING WELL LOCATION AND NUMBER
- ⊕ CW6 CITY PRODUCTION WELL LOCATION
- ◒ EW1 EXTRACTION WELL LOCATION AND NUMBER
- ◈ SG1 STAFF GAGE LOCATION AND NUMBER
- ▣ INDUSTRIAL WELL LOCATION
- *(1186.94)* DEEP WELL WATER LEVEL

DEEP WELL WATER LEVEL ELEVATIONS (11/13/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

CRA

2115-16/01/91-18-0



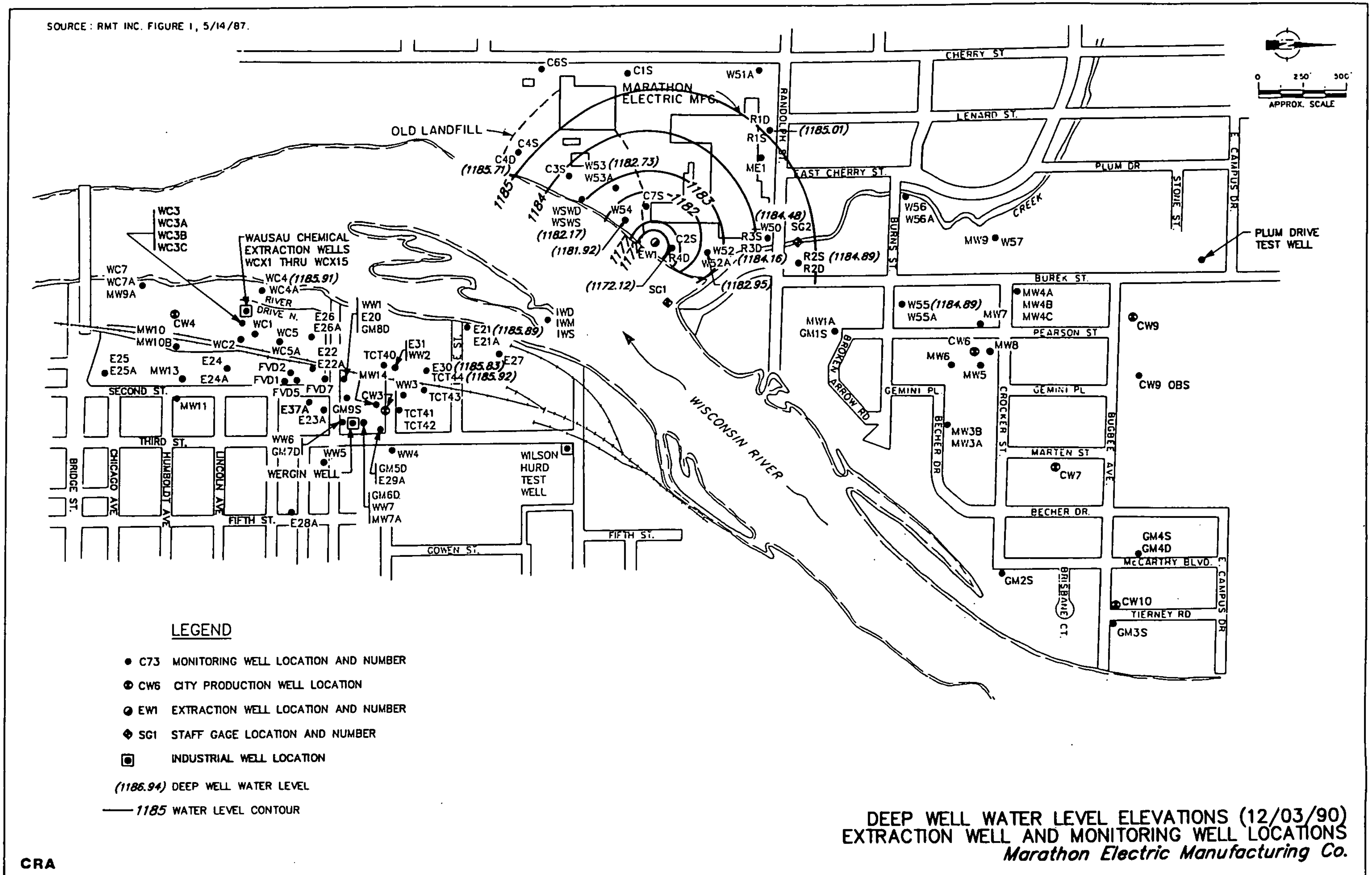
LEGEND

- ● C73 MONITORING WELL LOCATION AND NUMBER
- CW6 CITY PRODUCTION WELL LOCATION
- EW1 EXTRACTION WELL LOCATION AND NUMBER
- SG1 STAFF GAGE LOCATION AND NUMBER
- INDUSTRIAL WELL LOCATION
- *(1186.94)* DEEP WELL WATER LEVEL
- —*1186*— WATER LEVEL CONTOUR

CRA

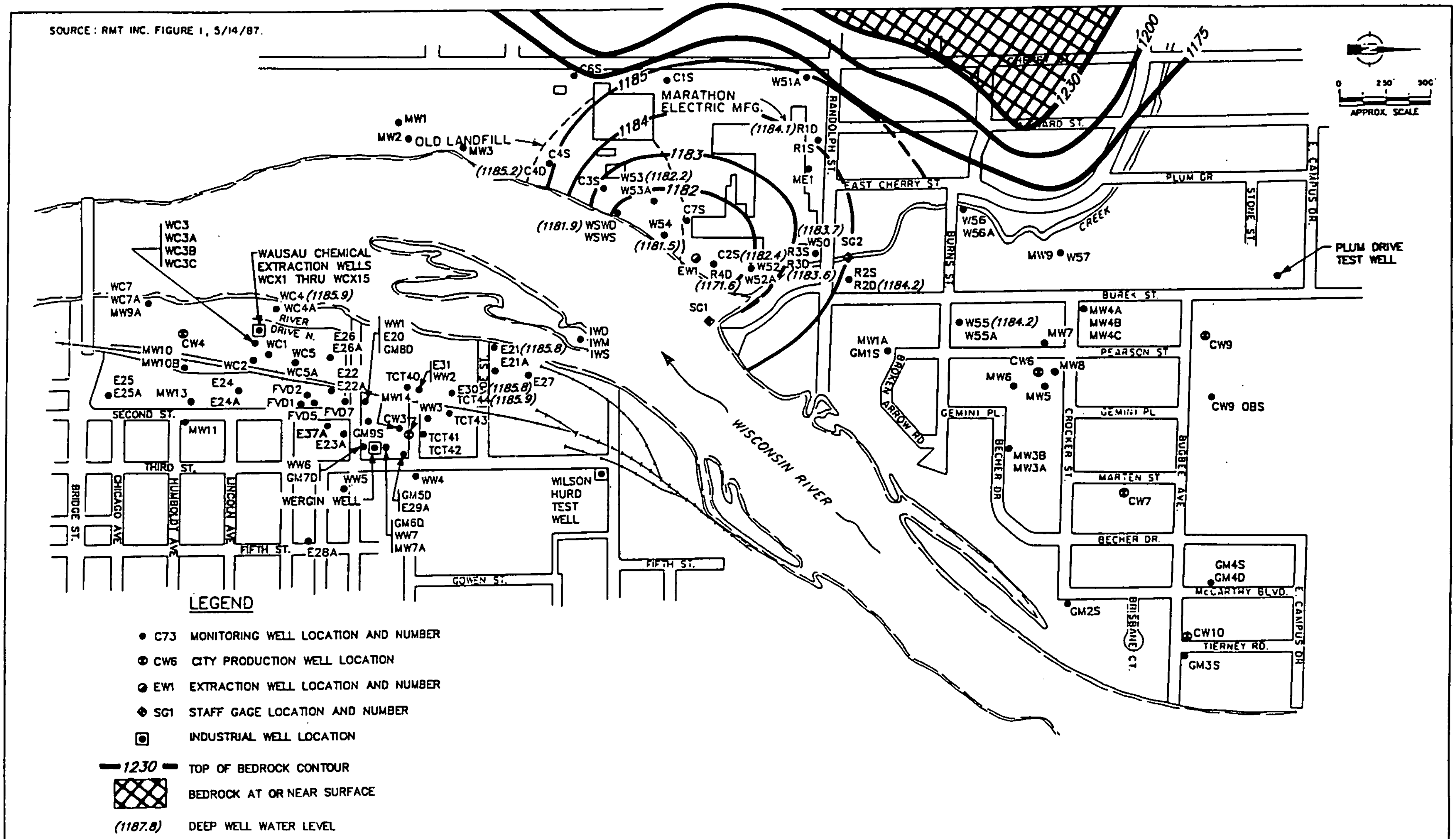
DEEP WELL WATER LEVEL ELEVATIONS (11/21/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-16/01/91-18-0



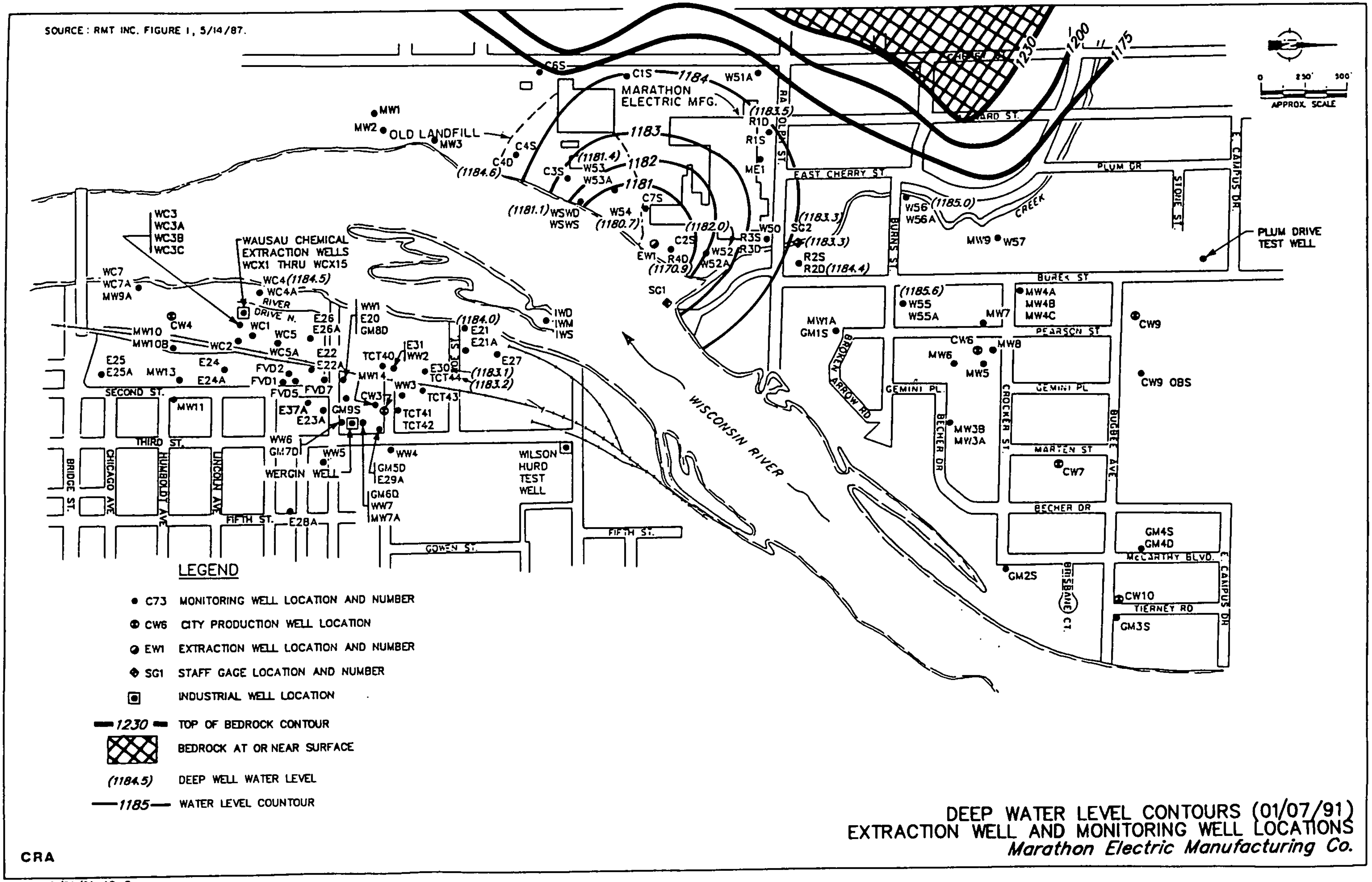
DEEP WELL WATER LEVEL ELEVATIONS (12/03/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-16/01/91-18-0



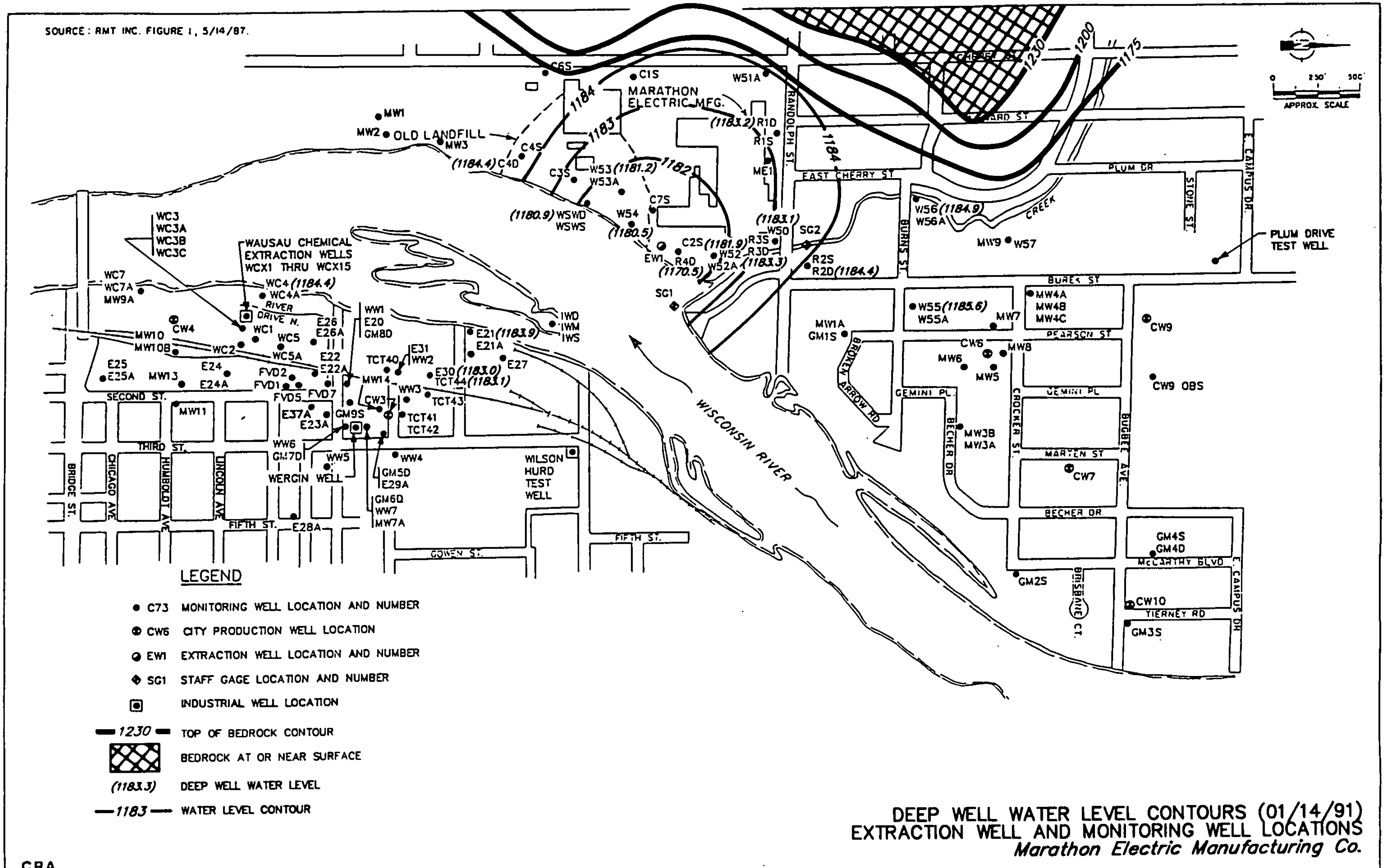
DEEP WELL WATER LEVEL CONTOURS (12/17/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-16/01/91-18-0



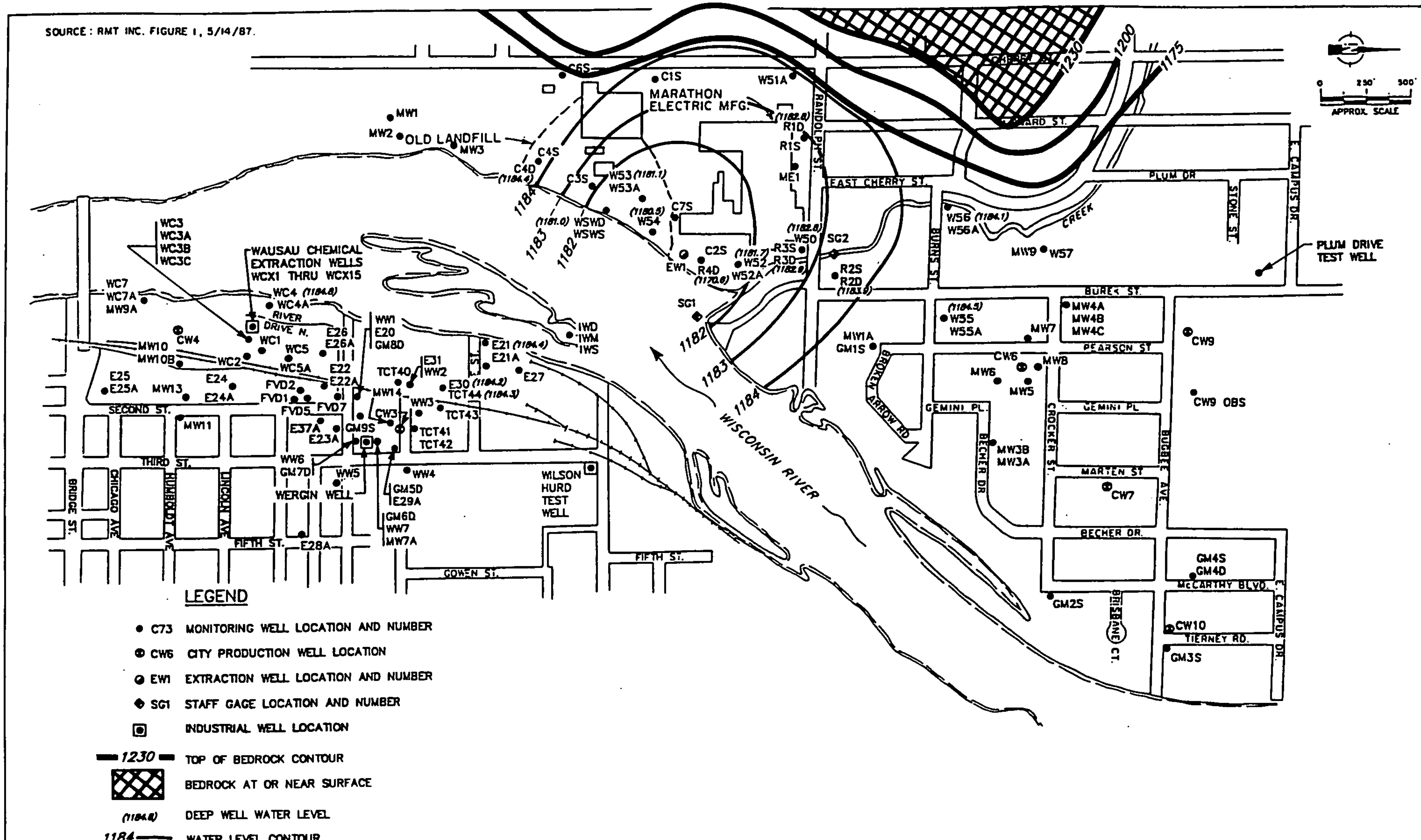
DEEP WATER LEVEL CONTOURS (01/07/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-16/01/91-18-0



DEEP WELL WATER LEVEL CONTOURS (01/14/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

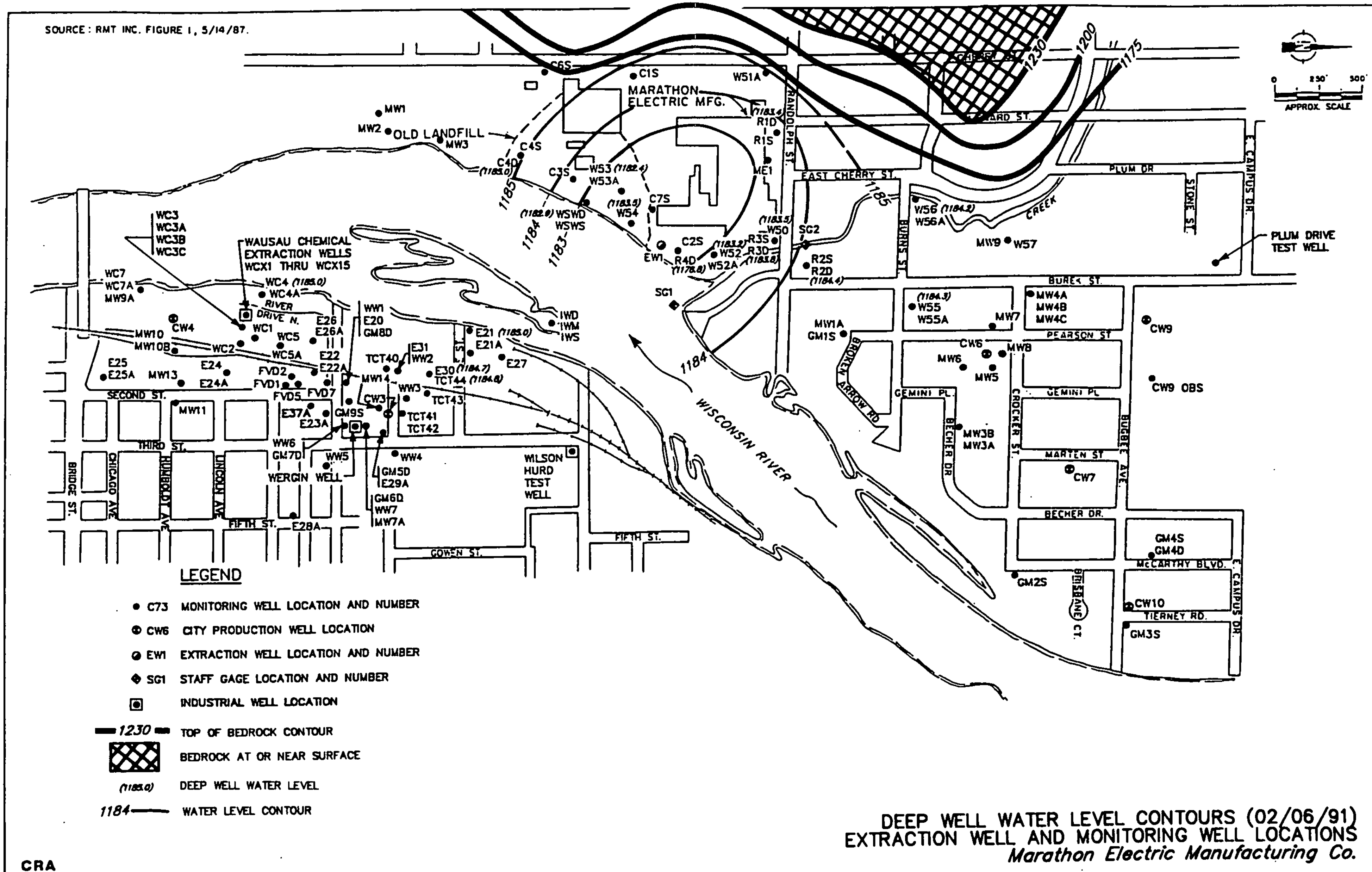
2115-16/01/91-18-0



DEEP WELL WATER LEVEL CONTOURS (01/30/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

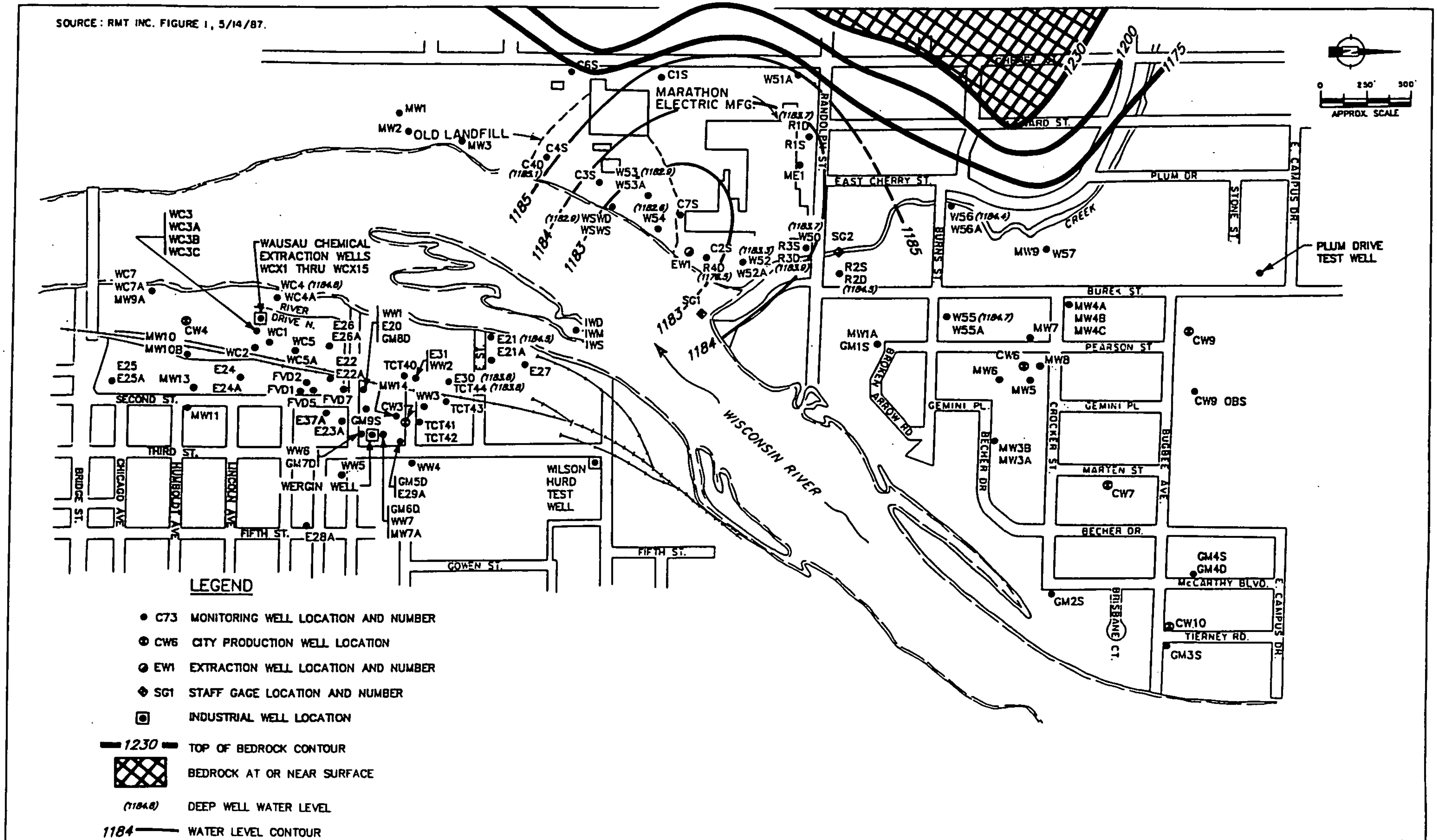
CRA

2115-09/07/91-19-0



DEEP WELL WATER LEVEL CONTOURS (02/06/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-25/02/91-L-0



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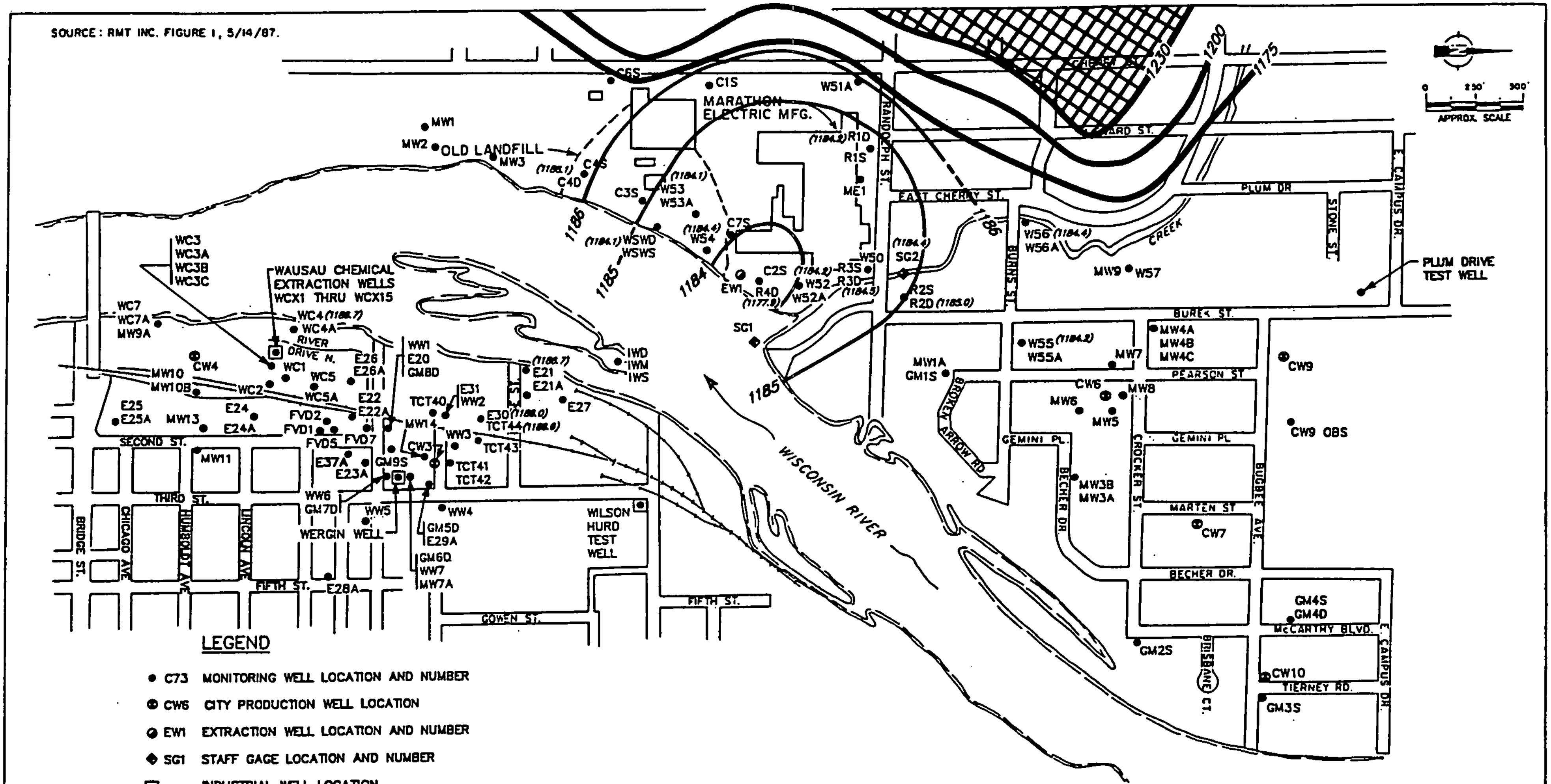
DEEP WELL WATER LEVEL CONTOURS (02/18/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-25/02/91-L-0



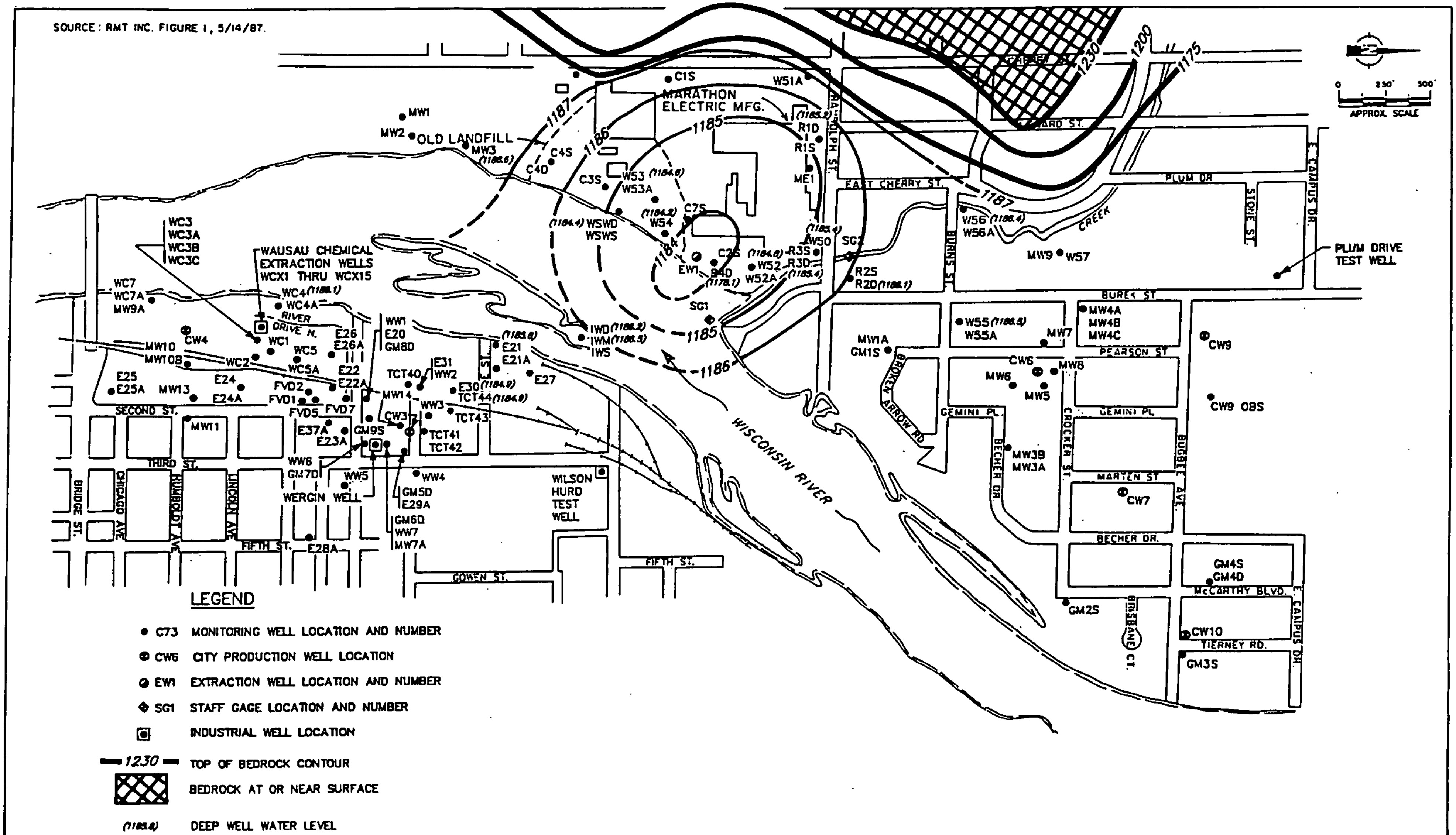
LEGEND

- • C73 MONITORING WELL LOCATION AND NUMBER
- ⊕ CW6 CITY PRODUCTION WELL LOCATION
- EW1 EXTRACTION WELL LOCATION AND NUMBER
- ◆ SG1 STAFF GAGE LOCATION AND NUMBER
- INDUSTRIAL WELL LOCATION
- 1230 TOP OF BEDROCK CONTOUR
- BEDROCK AT OR NEAR SURFACE
- (1188.7) DEEP WELL WATER LEVEL
- 1184 CONTOUR

DEEP WELL PIEZOMETRIC CONTOURS (03/25/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

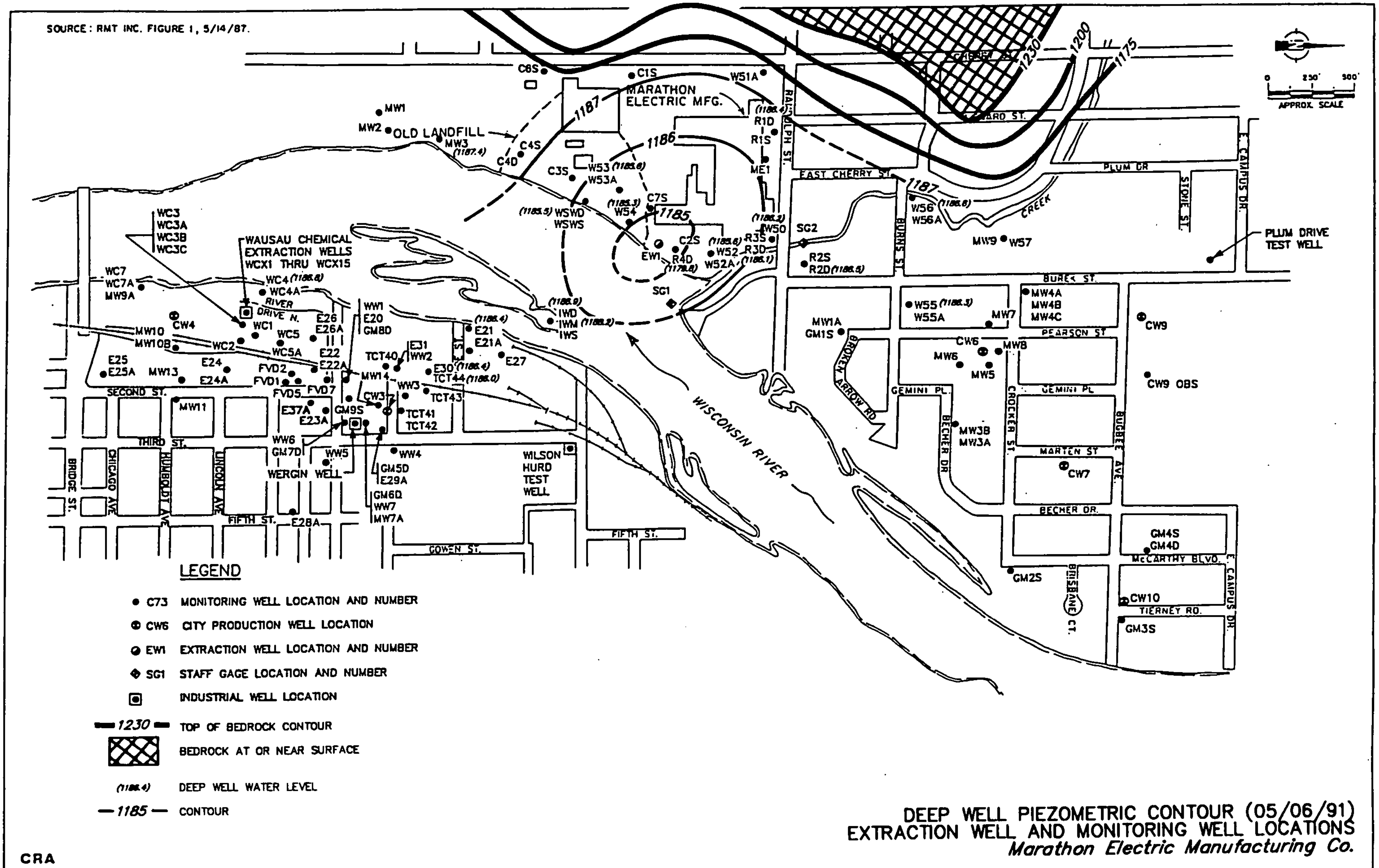
CRA

2115-09/07/91-19-0



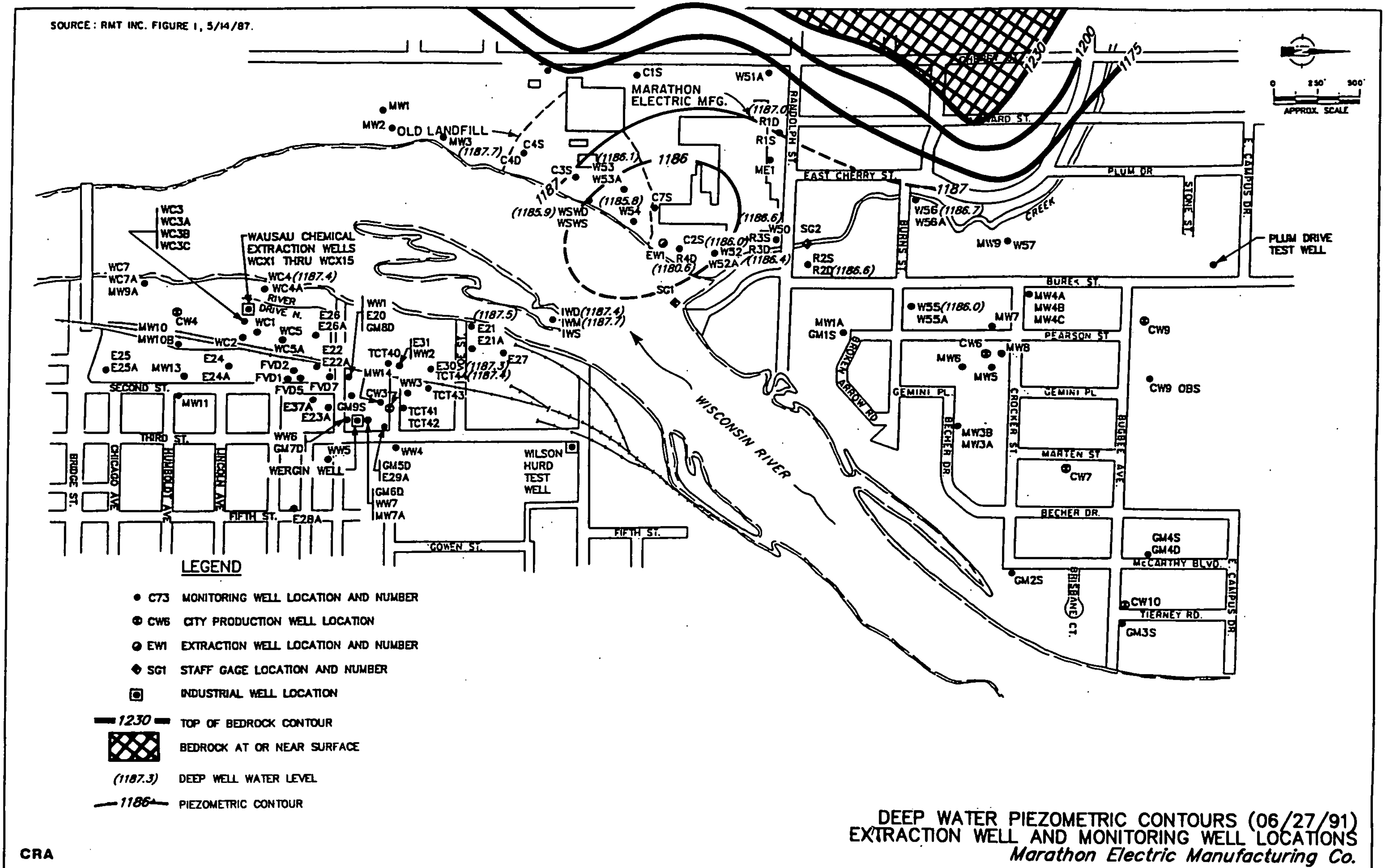
DEEP WELL PIEZOMETRIC CONTOURS (04/08/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-9/05/91-L-0



DEEP WELL PIEZOMETRIC CONTOUR (05/06/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-9/05/91-L-0



DEEP WATER PIEZOMETRIC CONTOURS (06/27/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-05/07/91-19-0

APPENDIX C

EVALUATION OF THE PUMPING RATE IN EXTRACTION WELL NO. 1 REPORT

EVALUATION OF THE PUMPING RATE IN EXTRACTION WELL NO. 1

Marathon Electric Manufacturing Company
Wausau, Wisconsin

JANUARY 1991
REF. NO. 2115 (18)

CONESTOGA-ROVERS & ASSOCIATES

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

The USEPA Consent Order Decree indicated that at the Marathon Electric Manufacturing Company Site located in Wausau, Wisconsin, extraction well EW1 be pumped at a discharge rate of 1600 gallons per minute (gpm).

Evaluation of existing pumping test data and evaluation of additional hydraulic monitoring data collected since startup of the system on November 14, 1990, indicates that the pumping rate of 1550 gpm at extraction well EW1 is creating a larger than necessary cone of depression. Therefore, the purpose of this report is to recommend an appropriate pumping rate for EW1.

Section 2.0 of this report provides an evaluation of the existing and additional data collected at the Site, including the pumping test and hydraulic monitoring data. Selection of an optimum pumping rate at extraction well EW1 is discussed in Section 3.0 with particular reference to the design criteria and an evaluation of the proposed pumping rate for extraction well EW1. Section 4.0 of this report provides a summary of the data evaluation and results.

2.0 ADDITIONAL DATA COLLECTION

2.1 PUMPING TEST DATA

On August 15, 1990, following a step test, a 24-hour constant rate test pumping program was conducted in extraction well EW1. The details of this test pumping program were provided in the report entitled, "Extraction Well No. 1 Well Installation and Pump Testing, Marathon Electric Manufacturing Company, Wausau, Wisconsin" prepared by Conestoga-Rovers & Associates (CRA) and dated December 14, 1990 (CRA's 1990 report).

The 24-hour test pumping program was conducted at an average discharge rate of 1,695 gallons per minute. A comprehensive network included monitoring wells EW1, W52, W52A, C25, C75, R4D, WSWS, WSWD and the Wisconsin River.

Table 6 of CRA's 1990 report provided a summary of transmissivity (T) and storativity (S) computed from drawdown and recovery data obtained from the 24-hour constant rate test pumping program.

The geometric means of the transmissivity and storativity values obtained from the test pumping program were determined to be 122,230 gal/day/ft. (735 m^2/day) and 4.73×10^{-3}, respectively.

Examination of the data, both transmissivity and storativity of the aquifer indicates that these values are significantly lower than the transmissivity and storativity values reported in the document entitled, "Remedial Investigation Report, Wausau Water Supply NPL Site, Wausau, Wisconsin", prepared by Warzyn Engineering Inc. and dated July 28, 1989 (1989 RI report).

Transmissivity values were reported as ranging between 247,000 gal/day/ft. and 716,000 gal/day/ft. on page 5-20 of the 1989 RI report. The storage coefficient was estimated to be approximately 0.24.

2.2 HYDRAULIC MONITORING

Prior and during pumping of extraction well EW1, piezometric elevations were recorded on several occasions. A summary of the piezometric elevations measured to date are provided on Table 2.1.

Water level contours were constructed for the shallow and deep wells from selected sets of water level data to assess the areal extent of the cone of depression caused by pumping EW1 at an average rate of approximately 1550 gpm.

In order to assess conditions prior to pumping of extraction well EW1 in the shallow part of the aquifer, water level contours were constructed using the November 13, 1990 set of water level data. These contours are presented in Figure 2.1. Examination of the contours indicate that the general groundwater flow direction is to the east-northeast towards

TABLE 2.1

PIEZOMETRIC ELEVATIONS
GROUNDWATER MONITORING PROGRAM
MARATHON ELECTRIC COMPANY
WAUSAU, WISCONSIN

Monitoring Well No.	*Top of Casing Elevation (ft. AMSL)*	*Piezometric Elevations (ft. AMSL)*				
		11/13/90	*11/15/90*	*11/19/90*	*11/21/90*	*11/23/90*
C1S	1,223.69	1,195.08	1,194.99	1,194.69	1,194.66	1,194.46
C2S (1)	1,216.23	1,187.89	1,181.09	Dry	Dry	Dry
C3S	1,220.24	1,187.63	1,186.84	1,185.51	1,185.21	1,184.95
C4S	1,216.84	1,187.74	1,187.37	1,186.40	1,186.11	1,185.87
C4D	1,216.50	1,187.99	1,187.62	1,186.64	1,186.36	1,186.14
C6S	1,221.69	1,188.04	1,188.04	1,187.66	1,187.40	1,187.10
C7S (2)	1,221.00	1,187.86	1,185.89	1,183.67	1,183.24	1,182.90
R1S	1,222.13	1,188.51	1,188.43	1,187.43	1,187.03	1,186.63
R1D	1,222.39	1,188.32	1,188.06	1,187.03	1,186.69	1,186.30
R2S	1,209.88	1,188.15	1,187.84	1,187.12	1,186.94	1,186.79
R2D	1,209.66	1,187.43	1,187.35	1,185.85	1,185.72	1,185.61
R3S	1,215.29	1,188.49	1,188.38	1,187.46	1,187.09	1,186.74
R3D	1,215.53	1,187.60	1,186.23	1,185.33	1,185.13	1,184.93
R4D	1,219.07	1,187.90	1,175.19	1,173.47	1,173.03	1,172.81
E21	1,197.61	1,187.23	1,186.95	1,185.45	1,185.23	1,185.08
E21A	1,197.95	1,187.19	1,186.55	1,185.39	1,185.15	1,185.03
E30	1,204.58	1,186.94	1,186.86	1,184.60	1,184.33	1,184.19
TCT44	1,204.57	1,187.05	1,186.97	1,184.75	1,184.47	1,184.29
W50	1,215.67	1,187.92	1,187.20	1,186.00	1,185.69	1,185.41
W51A	1,224.50	Blockage	1,188.93	1,188.48	1,188.20	1,187.87
W52A	1,219.08	1,187.99	1,187.53	1,185.50	1,185.04	1,184.63
W52	1,219.25	1,187.77	1,185.22	1,184.05	1,183.76	1,183.56
W53A (3)	1,217.12	1,187.80	1,186.05	1,183.95	1,183.55	1,183.27
W53	1,216.91	1,187.91	1,185.98	1,184.01	1,183.63	1,183.33
W54	1,216.44	1,189.37	1,185.31	1,183.17	1,182.80	1,182.54
W55A	1,217.40	1,186.92	1,186.48	1,186.43	1,186.48	1,186.45
W55	1,217.29	1,186.24	1,185.64	1,186.29	1,186.29	1,186.29
IWD	1,192.08	1,187.38	1,186.78	1,185.62	1,185.48	1,185.35
IWM	1,192.91	1,187.65	1,187.05	1,185.91	1,185.77	1,185.65
IWS	1,193.17	1,187.90	1,187.52	1,187.00	1,187.01	1,186.92
WSWD	1,193.25	1,188.87	1,187.87	1,183.17	1,182.89	1,182.67
WSWS	1,193.24	1,188.49	1,187.63	1,187.58	1,187.78	1,187.75
WC4	1,196.86	1,186.61	1,186.61	1,185.76	1,185.58	1,185.46
WC4A	1,196.69	--	1,186.59	1,185.76	1,185.58	1,185.46
Staff Gages						
SG1	1,189.37	1,188.36	1,187.88	1,187.75	1,187.96	1,187.89
SG2	1,193.94	1,191.58	1,191.88	1,191.57	1,191.61	1,191.52

Notes:

(1) Bottom of well measured at approximately 1,178.8 ft. AMSL.
(2) Bottom of well measured at approximately 1,181.3 ft. AMSL.
(3) Bottom of well measured at approximately 1,181.7 ft. AMSL.

TABLE 2.1

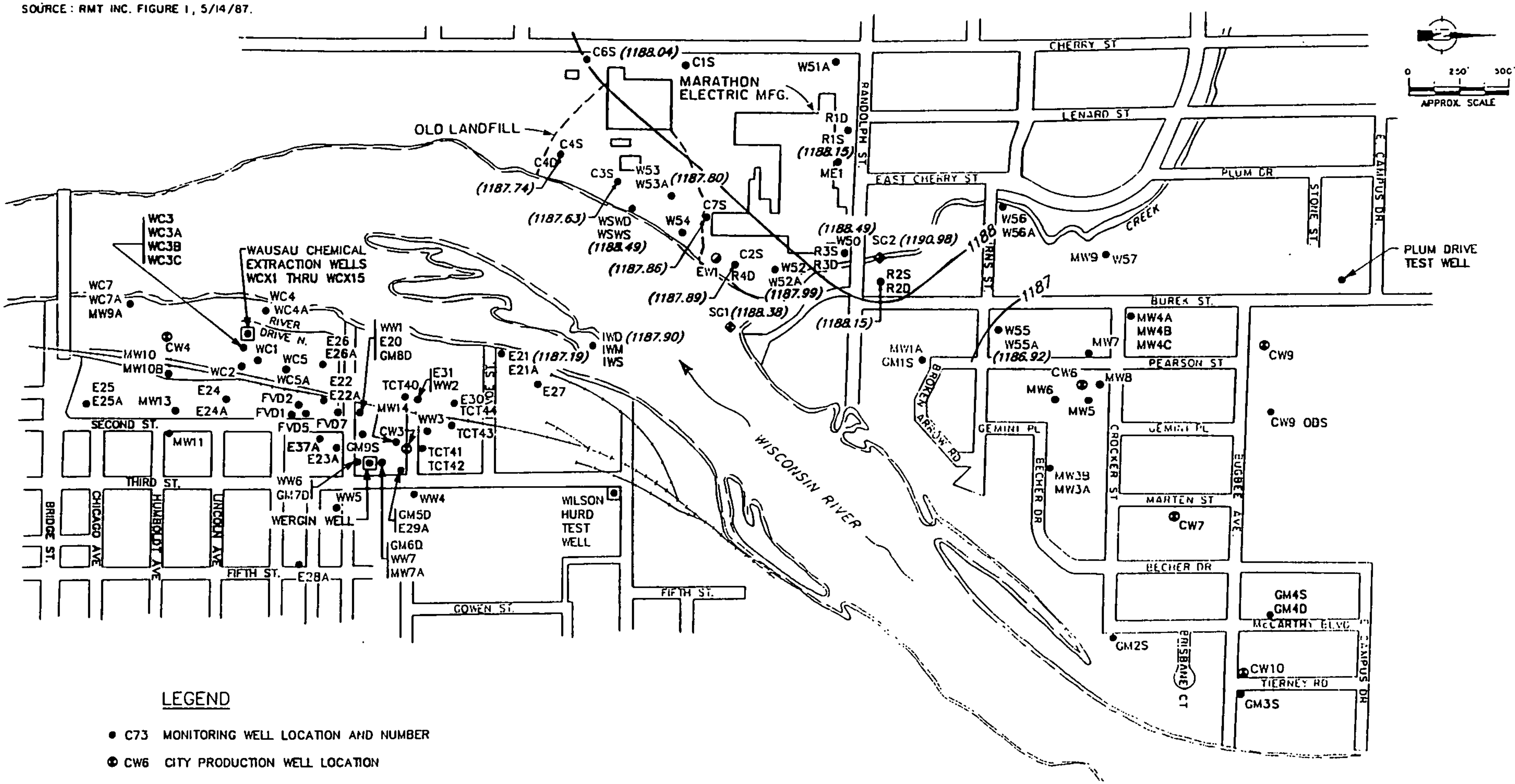
PIEZOMETRIC ELEVATIONS
GROUNDWATER MONITORING PROGRAM
MARATHON ELECTRIC COMPANY
WAUSAU, WISCONSIN

Monitoring Well No.	*Top of Casing Elevation (ft. AMSL)*	*Piezometric Elevations (ft. AMSL)* 11/26/90	12/03/90	12/10/90	12/17/90	01/07/91	01/14/91
C1S	1,223.69	–	1,194.34	1,193.94	1,193.62	1,193.13	1,193.13
C2S (1)	1,216.23	Dry	Dry	Dry	Dry	Dry	Dry
C3S	1,220.24	–	1,184.43	1,184.14	1,184.10	1,183.24	1,183.06
C4S	1,216.84	–	1,185.43	1,185.18	1,185.14	1,184.30	1,184.12
C4D	1,216.50	1,185.99	1,185.71	1,185.48	1,185.40	1,184.55	1,184.38
C6S	1,221.69	–	1,186.17	1,185.91	1,185.65	1,184.86	1,184.29
C7S (2)	1,221.00	–	1,182.07	1,181.72	1,181.50	Dry	Dry
R1S	1,222.13	–	1,185.33	1,184.74	1,184.29	1,183.39	1,183.15
R1D	1,222.39	–	1,185.09	1,184.60	1,184.12	1,183.54	1,183.19
R2S	1,209.88	–	1,186.08	1,185.58	1,185.27	1,185.03	1,184.94
R2D	1,209.66	1,185.69	1,184.87	1,184.81	1,184.32	1,184.39	1,184.34
R3S	1,215.29	–	1,185.64	1,185.11	1,184.70	1,183.96	1,183.74
R3D	1,215.53	–	1,184.16	1,183.93	1,183.58	1,183.33	1,183.25
R4D	1,219.07	1,172.43	1,172.12	1,171.75	1,171.60	1,170.87	1,170.54
E21	1,197.61	–	1,185.89	1,184.92	1,185.83	1,183.99	1,183.85
E21A	1,197.95	–	1,185.85	1,184.87	1,185.79	1,183.93	1,183.80
E30	1,204.58	–	1,185.83	1,184.13	1,185.83	1,183.09	1,182.95
TCT44	1,204.57	–	1,185.92	1,184.27	1,185.92	1,183.20	1,183.06
W50	1,215.67	–	1,184.48	1,184.11	1,183.71	1,183.27	1,183.13
W51A	1,224.50	–	1,186.40	1,185.76	1,185.16	1,183.98	1,183.65
W52A	1,219.08	–	1,184.63	1,183.14	1,182.79	1,182.13	1,181.90
W52	1,219.25	1,183.32	1,182.95	1,182.67	1,182.41	1,181.95	1,181.87
W53A (3)	1,217.12	1,182.92	1,181.60	1,182.29	1,182.17	Dry	Dry
W53	1,216.91	1,183.01	1,182.73	1,182.33	1,182.21	1,181.39	1,181.19
W54	1,216.44	1,182.24	1,181.92	1,181.61	1,181.49	1,180.65	1,180.51
W55A	1,217.40	–	1,185.63	1,185.39	1,184.75	1,185.58	1,185.62
W55	1,217.29	1183.30*	1,184.88	1,185.43	1,184.21	1,185.57	1,185.64
W56	1,200.17	–	–	–	–	1,184.97	1,184.91
W56A	1,200.95	–	–	–	–	1,188.19	1,188.07
IWD	1,192.08	–	–	–	–	–	–
IWM	1,192.91	–	–	–	–	–	–
IWS	1,193.17	–	–	–	–	–	–
WSWD	1,193.25	–	1,182.17	1,181.89	1,181.86	1,181.05	1,180.91
WSWS	1,193.24	–	1,187.44	1,187.68	1,187.49	1,187.24	1,197.18
WC4	1,196.86	–	1,185.91	1,185.39	1,185.93	1,184.53	1,184.40
WC4A	1,196.69	–	1,185.89	1,185.39	1,185.93	1,184.52	1,184.39
MW1A	1,215.79	–	–	–	–	1,185.51	1,185.54
GM1S	1,216.07	–	–	–	–	1,185.53	1,185.55
MW1	1,221.86	–	–	–	–	–	1,185.22
MW2	1,220.25	–	–	–	–	–	1,185.25
MW3	1,218.75	–	–	–	–	–	1,184.98
Staff Gages							
SG1	1,189.37	–	1,187.83	1,188.35	1,187.81	1,187.72	1,187.72
SG2	1,193.94	–	1,191.54	1,191.73	1,191.54	1,191.38	1,191.40

Notes:

* Measured on 11/27/90.
(1) Bottom of well measured at approximately 1,178.8 ft. AMSL.
(2) Bottom of well measured at approximately 1,181.3 ft. AMSL.
(3) Bottom of well measured at approximately 1,181.7 ft. AMSL.

SOURCE: RMT INC. FIGURE 1, 5/14/87.



LEGEND

- ● C73 MONITORING WELL LOCATION AND NUMBER
- ⊕ CW6 CITY PRODUCTION WELL LOCATION
- ◉ EW1 EXTRACTION WELL LOCATION AND NUMBER
- ◈ SG1 STAFF GAGE LOCATION AND NUMBER
- ▣ INDUSTRIAL WELL LOCATION
- *(1186.94)* SHALLOW WELL WATER LEVEL
- ——*1186* WATER LEVEL CONTOUR

figure 2.1

SHALLOW WELL WATER LEVEL ELEVATIONS (11/13/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

CRA

2115-16/01/91-18-0

the Wisconsin River, with a minor component of groundwater flow to the southeast.

Owing to the relatively flat nature of the deep piezometric elevations, water level elevations could not be constructed using the November 13, 1990 set of water level data. The water elevations, however, are shown on Figure 2.2. Examination of the water level elevations, indicates that the general groundwater flow direction is similar to the groundwater flow direction in the shallow part of the aquifer.

Pumping of extraction well EW1 commenced November 14, 1990. Water level contours were constructed for the shallow wells using water level data collected on November 21, December 3, December 17, 1990, January 7 and January 14, 1991. These contours are provided on Figures 2.3 to 2.7, respectively. Examination of the groundwater contours in these figures indicates that from the onset of pumping extraction well EW1, the areal extent of the cone of depression has steadily increased in a northeast-southwest direction parallel to the Wisconsin River. Water level contours constructed using the January 14, 1991 set of water level data also include water level elevations for monitoring wells MW1, MW2 and MW3, installed in 1990 and located approximately 1,500 feet south of extraction well EW1. The water level contours, as presented in Figure 2.7, indicate that the cone of influence produced from pumping of extraction well EW1 at a rate of 1,550 gpm has extended to distance in excess of 1,500 and 1,200 feet southwest and northeast of EW1, respectively.

SOURCE: RMT INC. FIGURE 1, 5/14/87

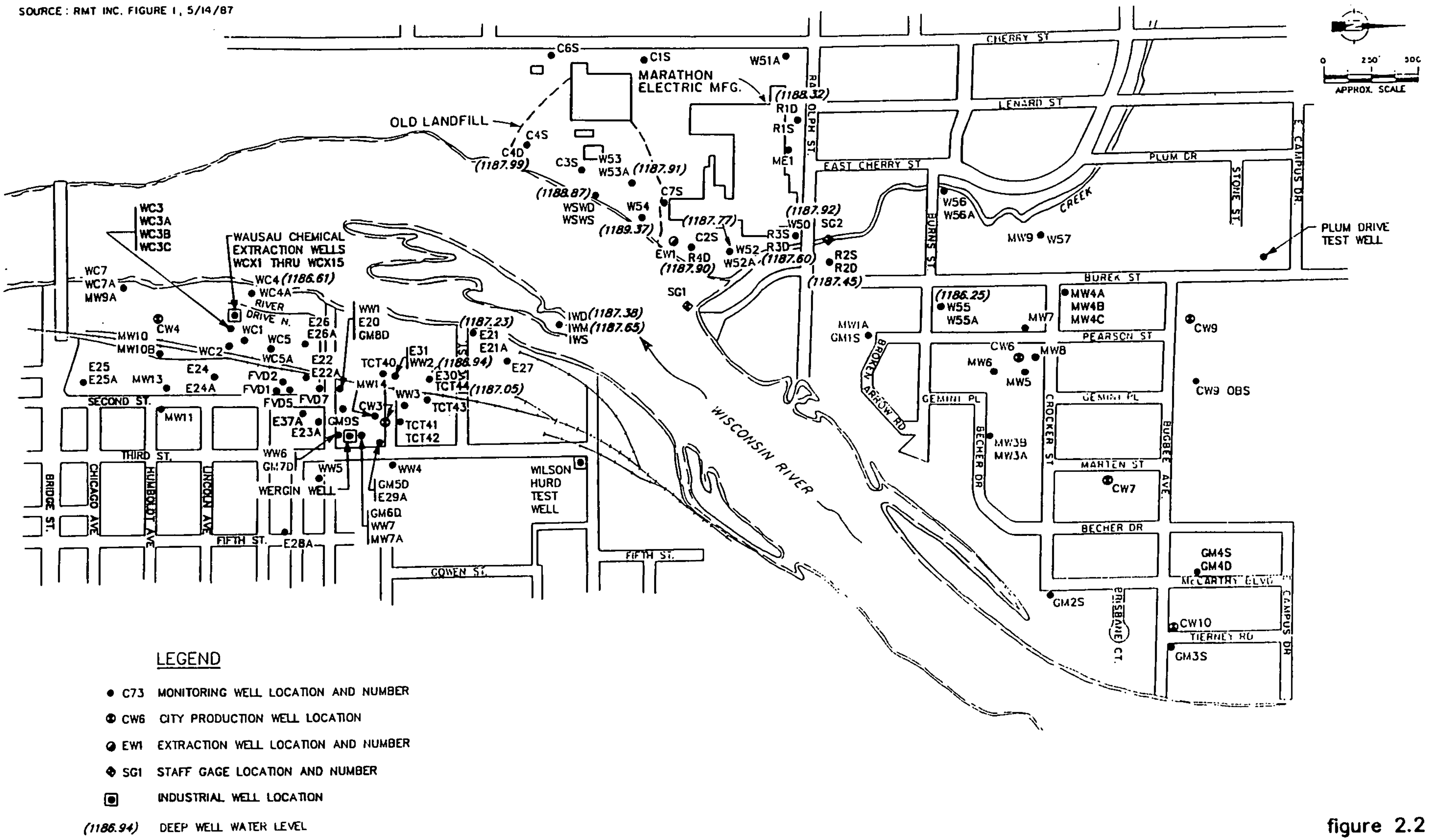


figure 2.2

DEEP WELL WATER LEVEL ELEVATIONS (11/13/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

CRA

2115-16/01/91-18-0

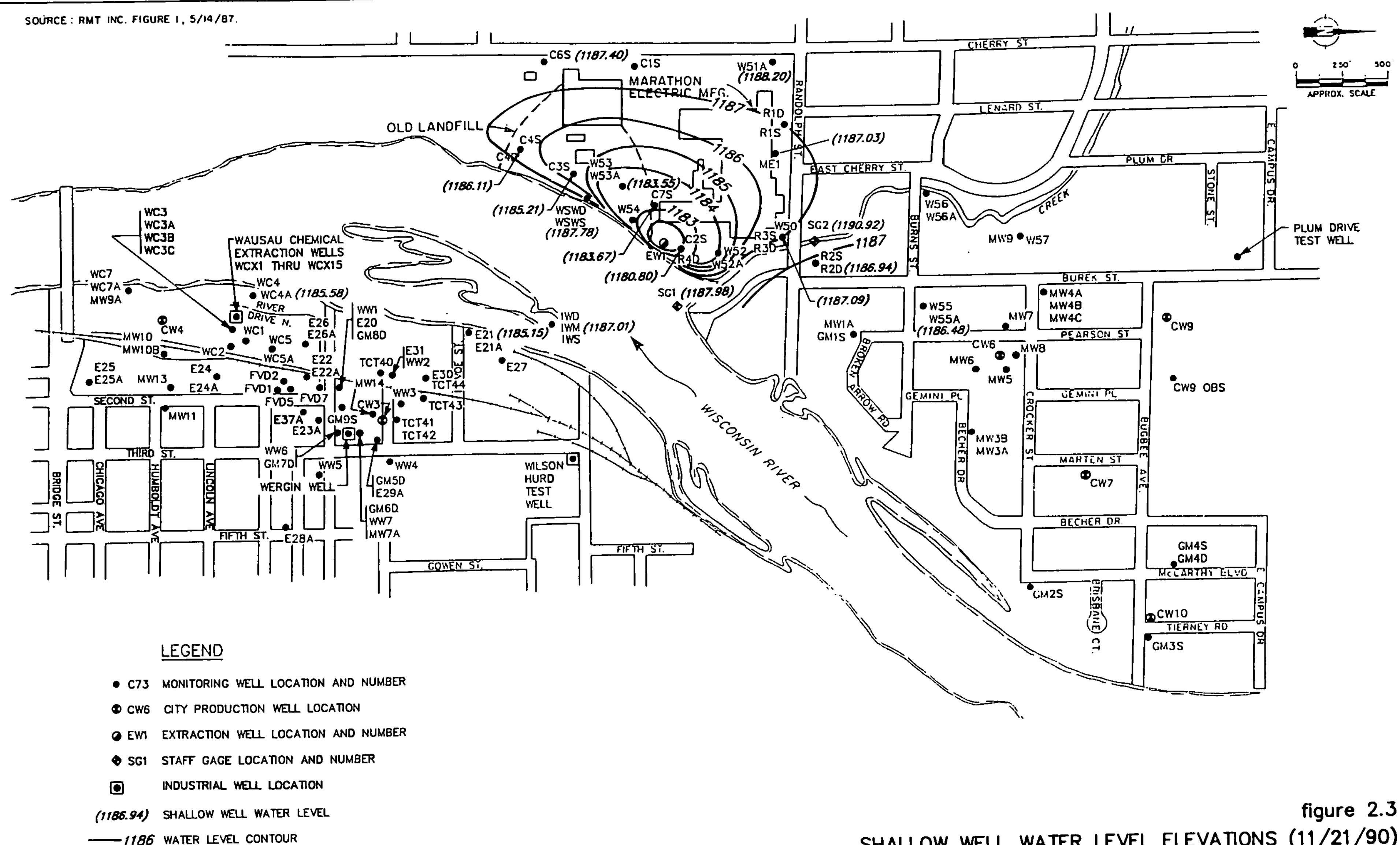
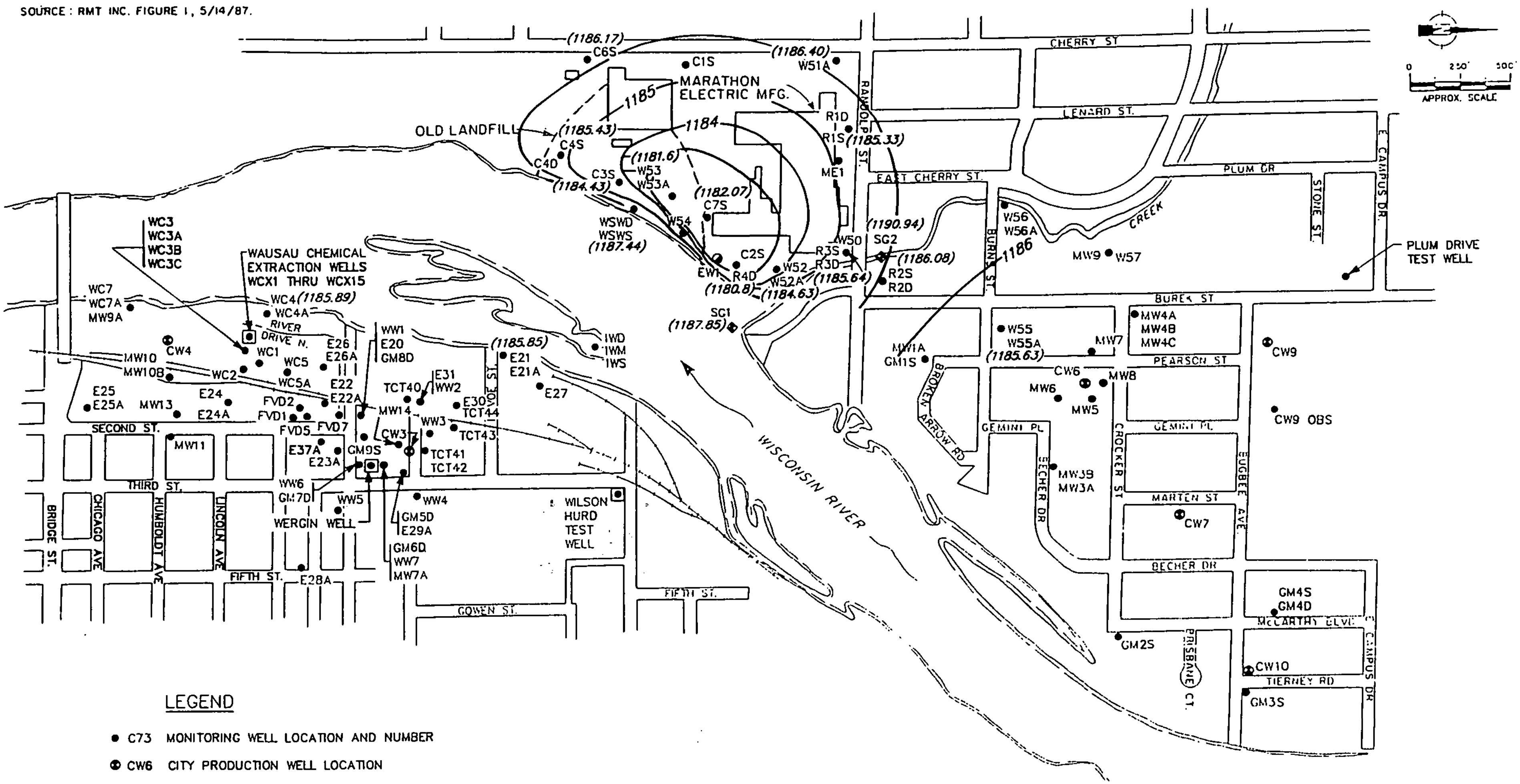


figure 2.3

SHALLOW WELL WATER LEVEL ELEVATIONS (11/21/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

CRA

2115-16/01/91-18-0



LEGEND

- C73 MONITORING WELL LOCATION AND NUMBER
- CW6 CITY PRODUCTION WELL LOCATION
- EW1 EXTRACTION WELL LOCATION AND NUMBER
- SG1 STAFF GAGE LOCATION AND NUMBER
- INDUSTRIAL WELL LOCATION
- (1186.94) SHALLOW WELL WATER LEVEL
- —1186— WATER LEVEL CONTOUR

figure 2.4

SHALLOW WELL WATER LEVEL ELEVATIONS (12/03/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

CRA

2115-16/01/91-18-0

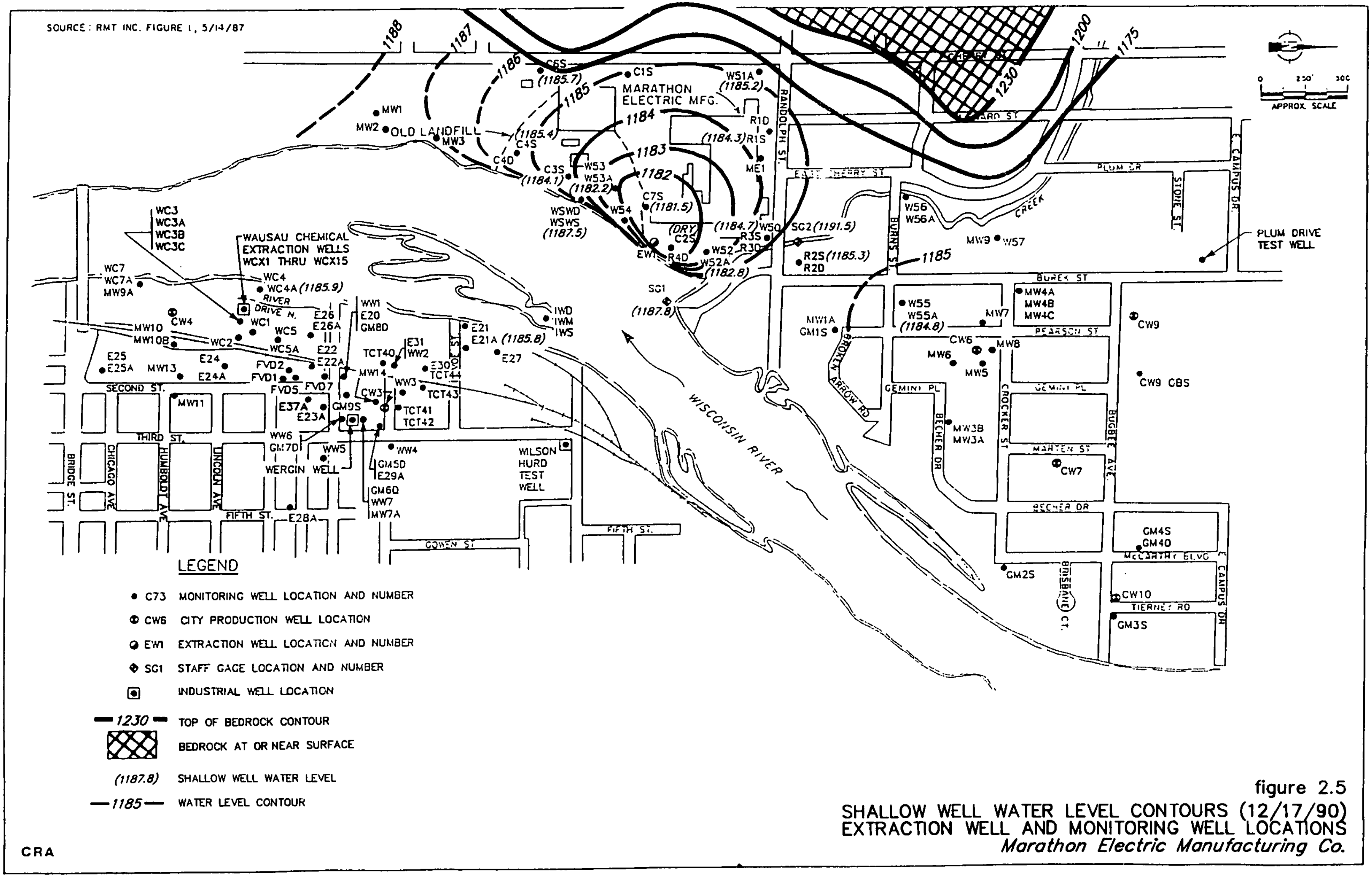


figure 2.5
SHALLOW WELL WATER LEVEL CONTOURS (12/17/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-16/01/91-18-D

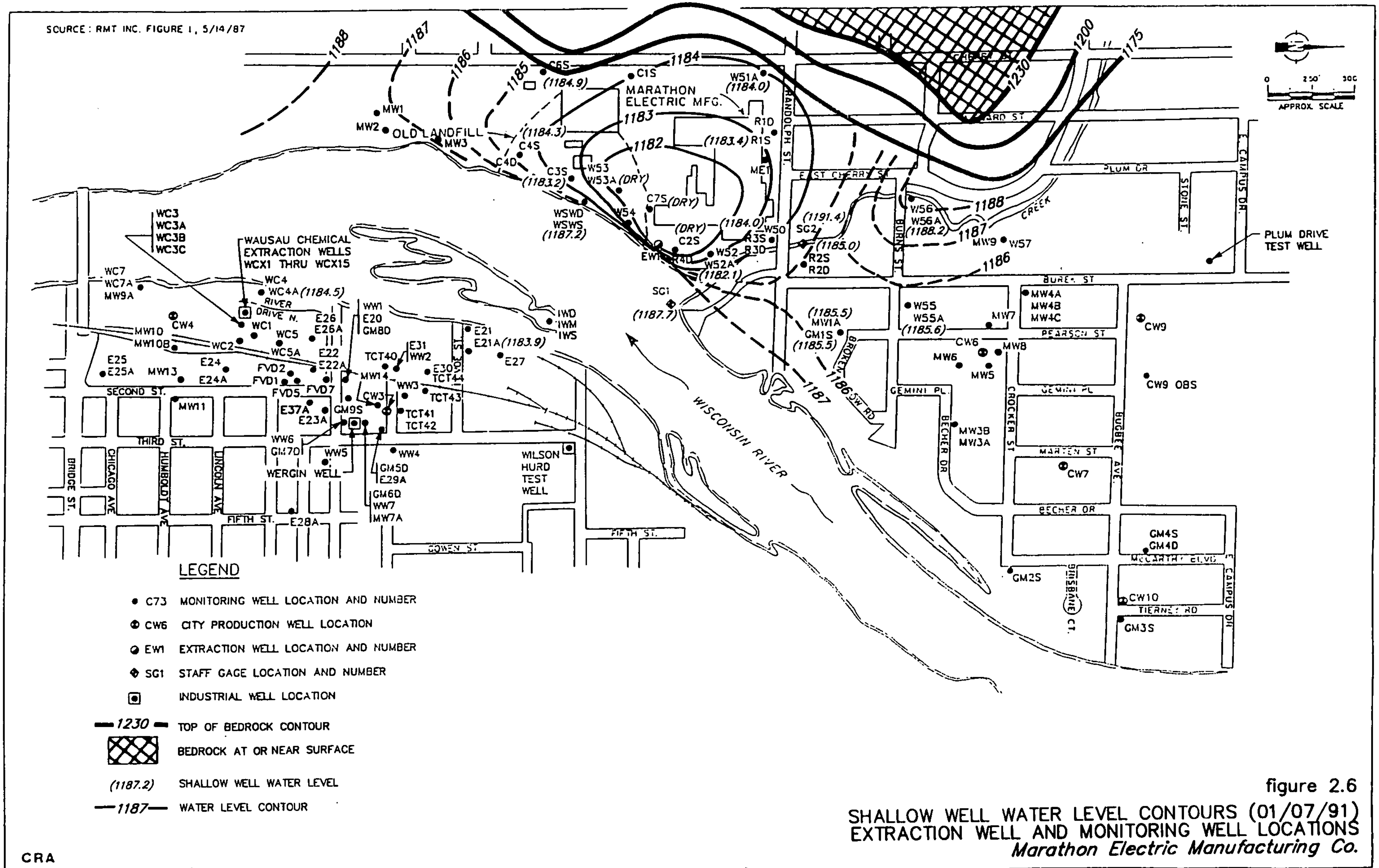


figure 2.6

SHALLOW WELL WATER LEVEL CONTOURS (01/07/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-16/01/91-18-0

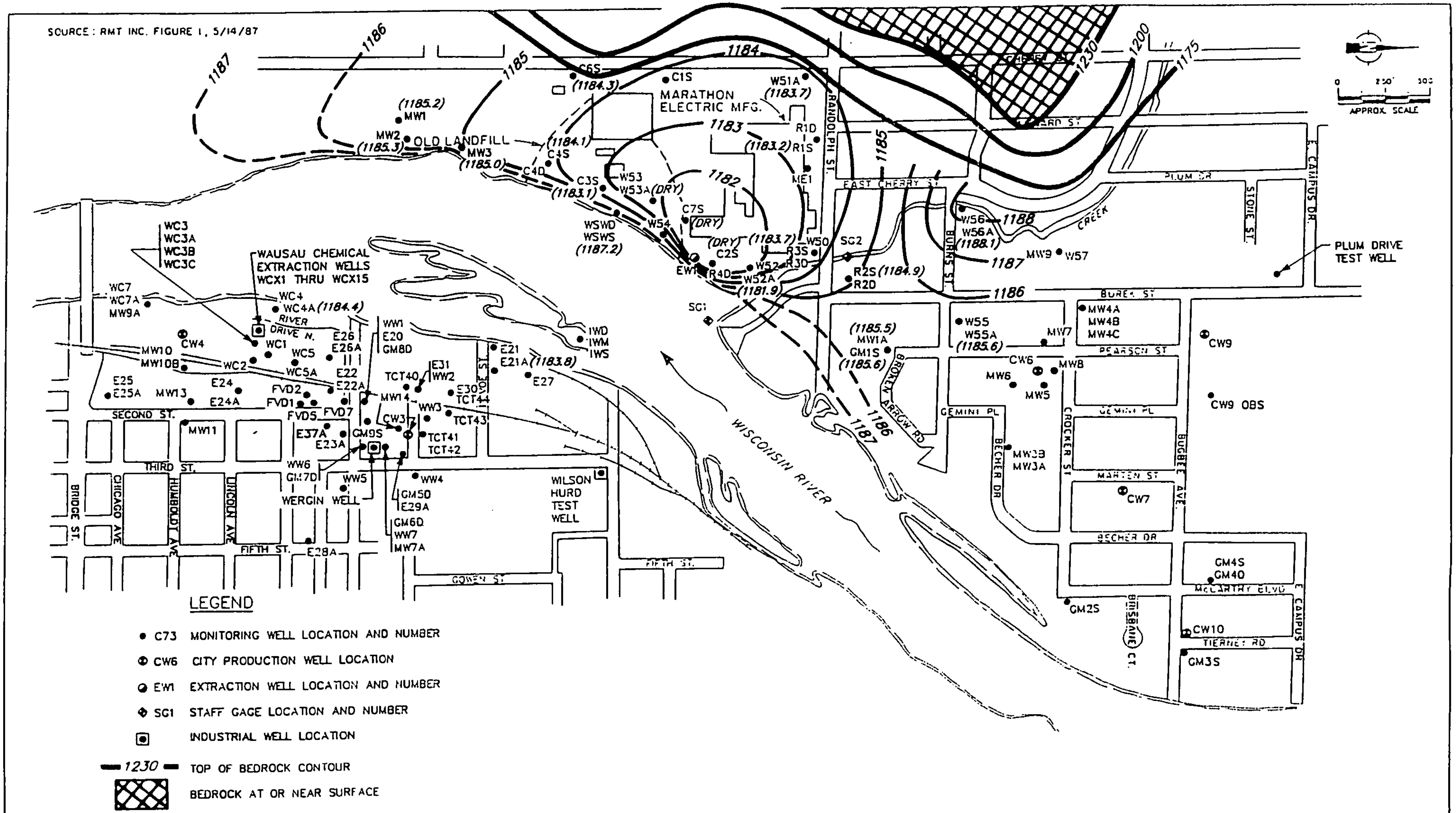


figure 2.7

SHALLOW WELL WATER LEVEL CONTOURS (01/14/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

CRA

2115-16/01/91-18-0

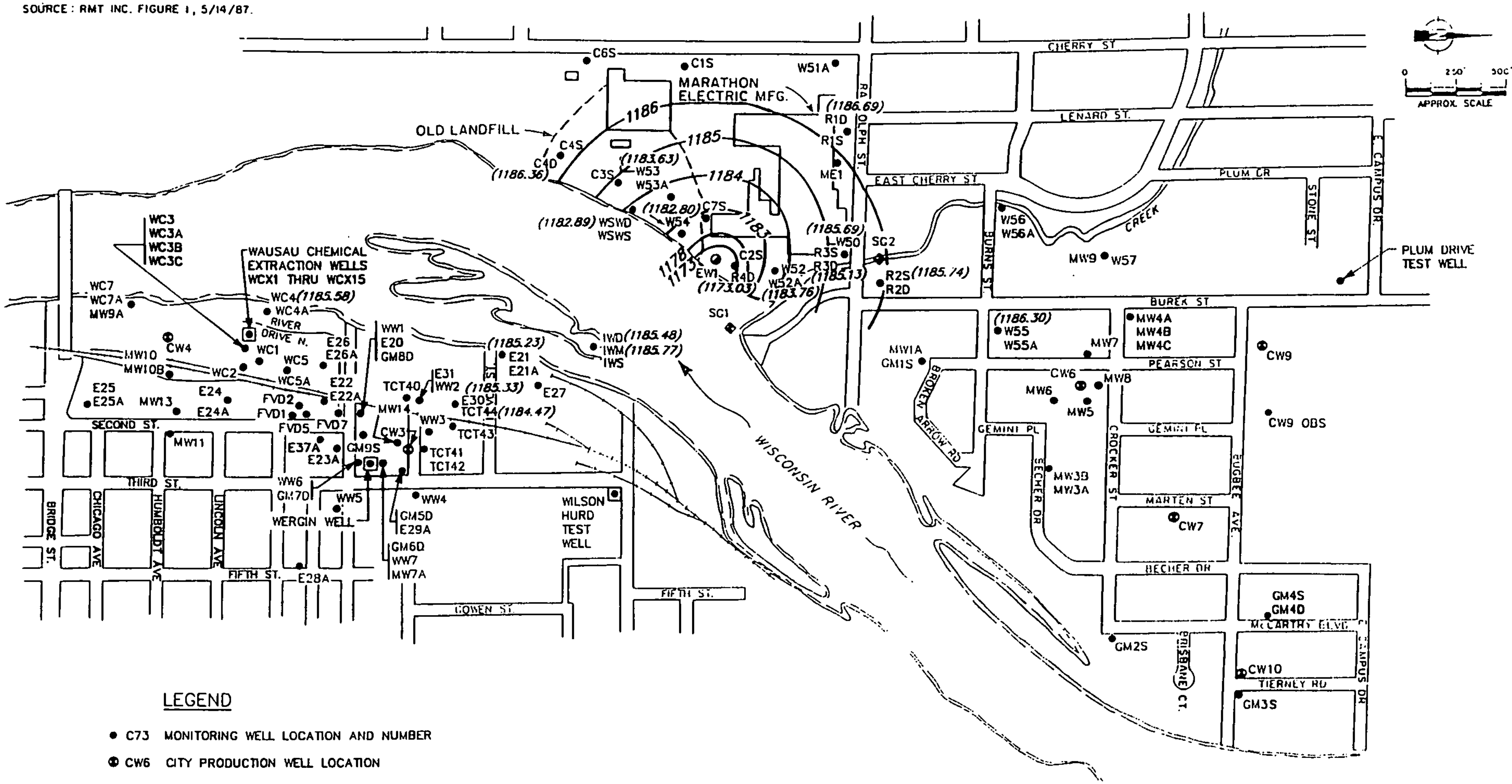
Water level contours were also constructed for the deep wells using water level data collected on the same dates as those for the shallow wells. These water level contours are provided on Figures 2.8 to 2.12, inclusive. Examination of the groundwater contours indicates that development of the cone of depression in the deep parts of the aquifer has occurred in a trend perpendicular to the Wisconsin River. The configuration of the cone of influence indicates that it bypasses the Wisconsin River to the Wausau Chemical Site.

In order to further investigate the areal and vertical extent of the cone of influence produced by pumping of extraction well EW1 at an average rate of approximately 1550 gpm, hydrographs from selected monitoring wells were constructed. The hydrographs for monitoring well nests C4S/C4D, R1S/R1D, R3S/R3D, W52A/W52 and WSWS/WSWD are provided in Appendix A.

Examination of the hydrographs indicates that water levels, particularly in the shallow wells have not stabilized as of January 7, 1991. Water levels in these monitoring wells, with the exception of WSWS are still being lowered at a rate of approximately two feet per month. Water levels in shallow monitoring well WSWS appear to have reached equilibrium, likely as a result of recharge from the Wisconsin River.

In summary, the existing data indicate that the present pumping rate of 1550 gpm at extraction well EW1 is exceedingly high as evidenced by the progressive increase in the areal extent of the cone of

SOURCE: RMT INC. FIGURE 1, 5/14/87.



LEGEND

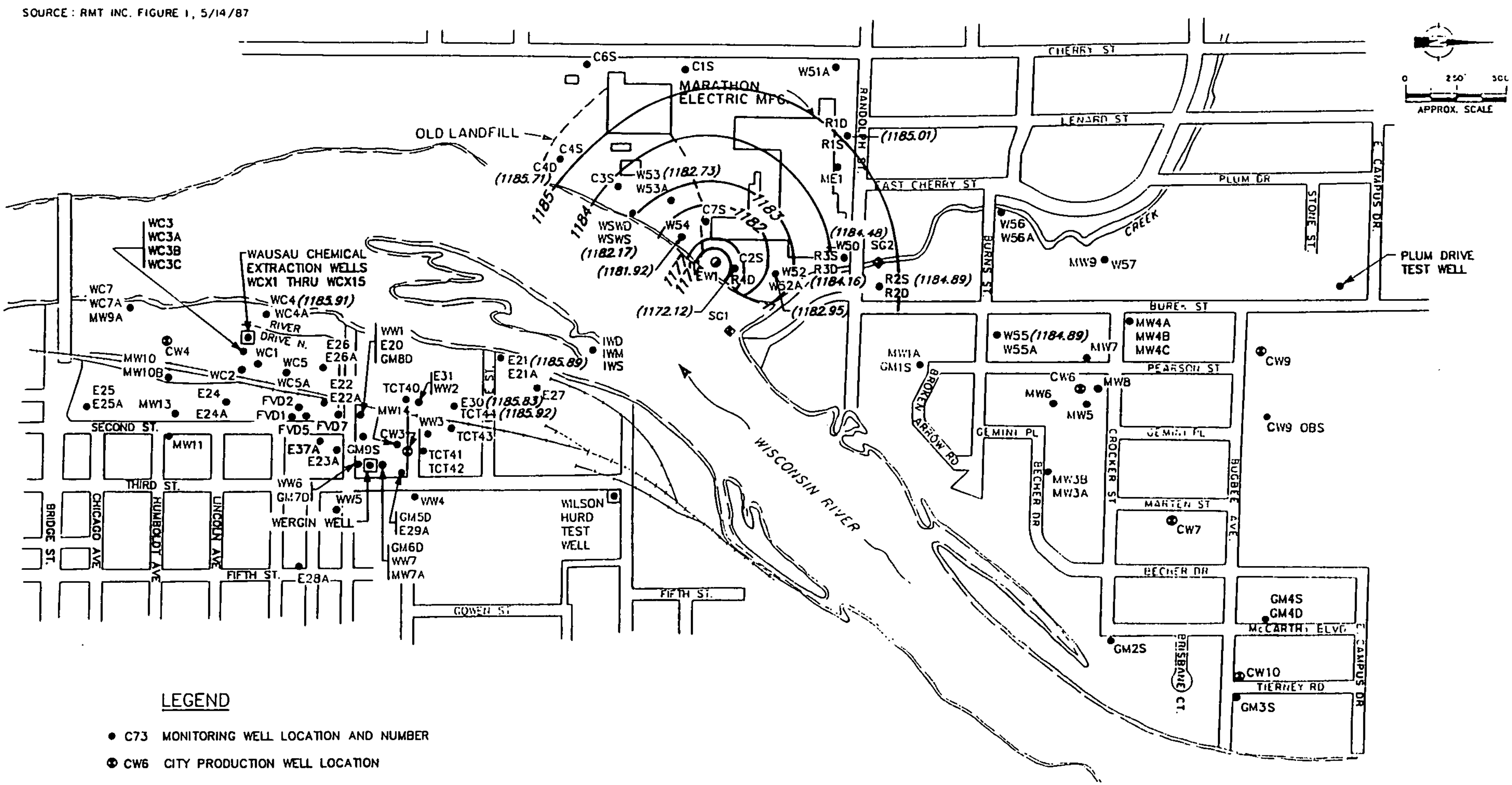
- ● C73 MONITORING WELL LOCATION AND NUMBER
- CW6 CITY PRODUCTION WELL LOCATION
- EW1 EXTRACTION WELL LOCATION AND NUMBER
- SG1 STAFF GAGE LOCATION AND NUMBER
- INDUSTRIAL WELL LOCATION
- (1186.94) DEEP WELL WATER LEVEL
- —1186— WATER LEVEL CONTOUR

figure 2.8

DEEP WELL WATER LEVEL ELEVATIONS (11/21/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

CRA

2115-16/01/91-18-0



LEGEND

- C73 MONITORING WELL LOCATION AND NUMBER
- CW6 CITY PRODUCTION WELL LOCATION
- EW1 EXTRACTION WELL LOCATION AND NUMBER
- SG1 STAFF GAGE LOCATION AND NUMBER
- INDUSTRIAL WELL LOCATION
- (1186.94) DEEP WELL WATER LEVEL
- 1185 WATER LEVEL CONTOUR

figure 2.9

DEEP WELL WATER LEVEL ELEVATIONS (12/03/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

CRA

2115-18/01/91-18-0

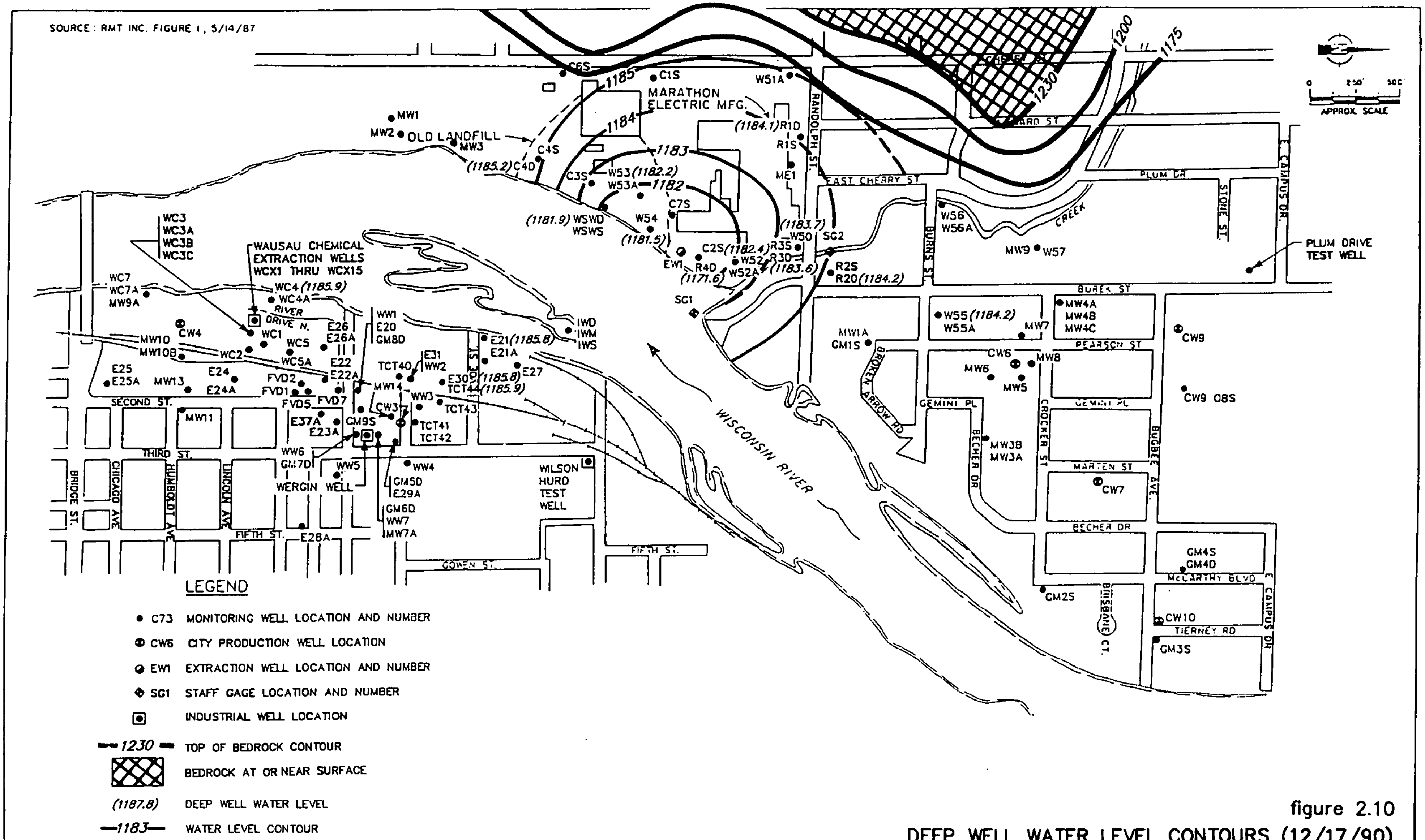


figure 2.10

DEEP WELL WATER LEVEL CONTOURS (12/17/90)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

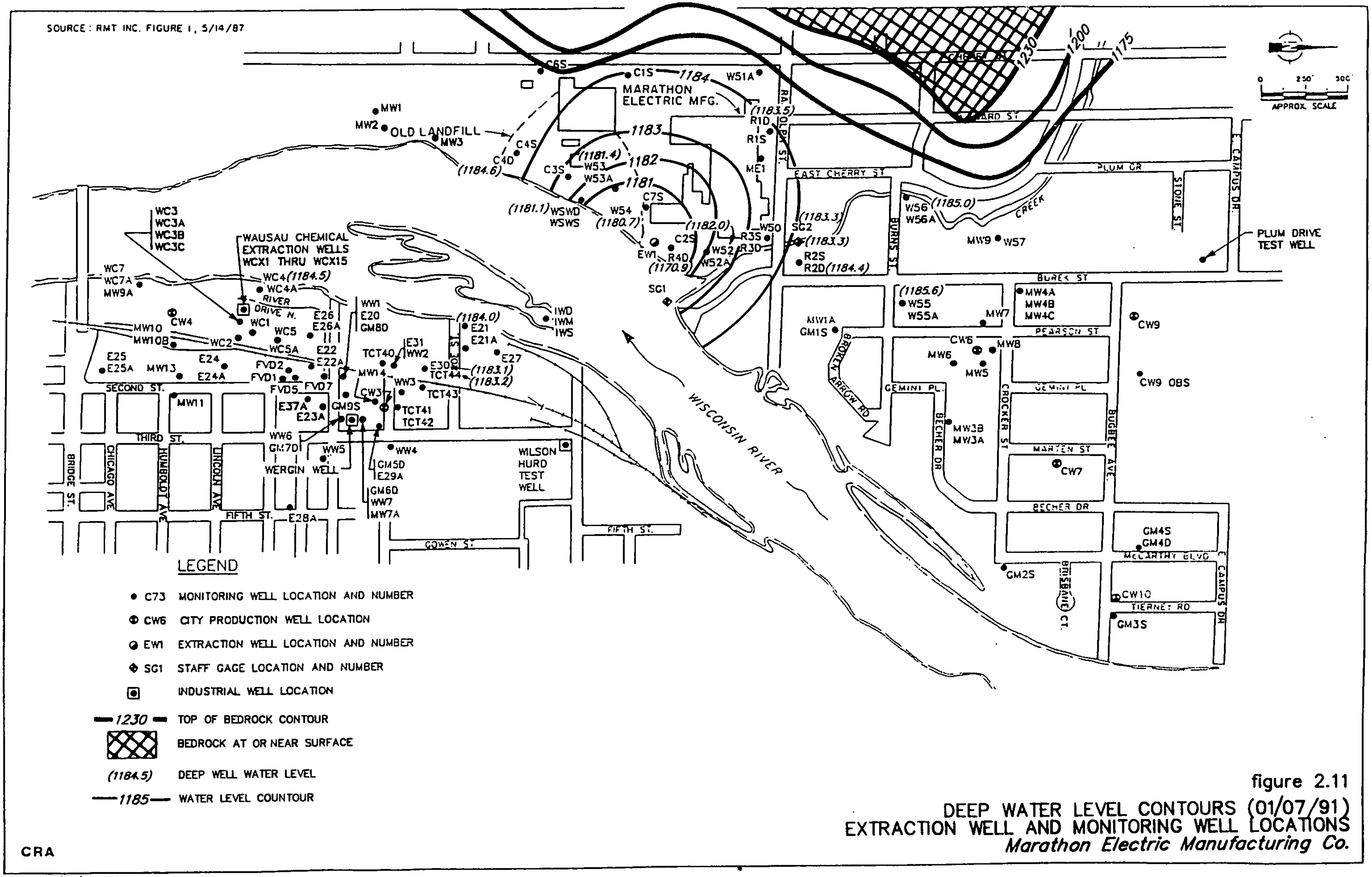


figure 2.11

DEEP WATER LEVEL CONTOURS (01/07/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-16/01/91-18-0

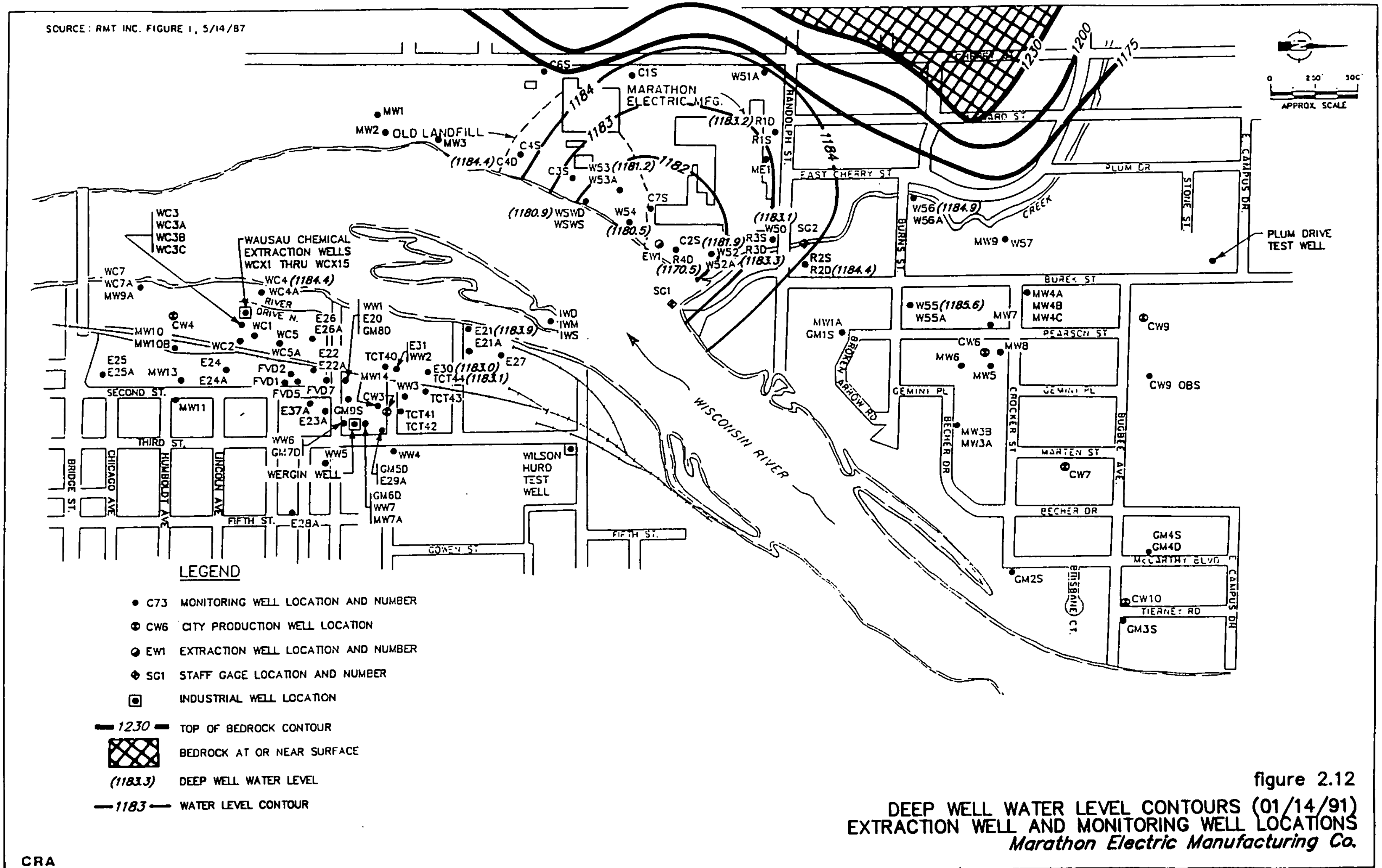


figure 2.12

DEEP WELL WATER LEVEL CONTOURS (01/14/91)
EXTRACTION WELL AND MONITORING WELL LOCATIONS
Marathon Electric Manufacturing Co.

2115-16/01/91-18-0

influence and a progressive decrease in water levels at a rate of approximately two feet per month.

3.0 OPTIMUM PUMPING RATE

3.1 DESIGN CRITERIA

As outlined in Section 2.2, the existing hydraulic monitoring data indicate that the present pumping rate of 1550 gpm at extraction well EW1 is creating a larger than necessary cone of influence.

The progressive expanding of the cone of influence produced from pumping of extraction well EW1 indicates present or potential interference to city production well CW6. In addition, the pumping rate at extraction well EW1 is capturing potentially contaminated groundwater from a source (as identified by the USEPA), located approximately 1,500 feet to the south of extraction well EW1.

In order to determine optimum pumping rates at extraction well EW1, the optimum widths of the capture zones must be determined to minimize potential interference to city production well CW6 and to avoid potential capture of potential contaminated groundwater south of the Old Landfill.

City production well CW6 is located at a distance of approximately 2600 feet northeast of extraction well EW1. Data presented in the 1989 RI report indicate that pumping of production well CW6 produces a cone of influence of large areal extent. As indicated in pages 5-18 and 5-19 of the 1989 RI report, pumping of production well at rates of 1450 and 1000 gpm produces minimum radii of influence of 2300 and 2100 feet, respectively.

In order to minimize well interference to CW6 and potential capture of contaminants south of the Old Landfill and the Marathon Electric Manufacturing Company, minimum and maximum zones of capture of 2200 (radius of influences of 1100 feet) and 3000 feet (radius of influence of 1500 feet), were utilized.

3.2 EVALUATION

In order to determine optimum pumping rates for the minimum and maximum zones of capture of 2200 and 3000 feet, respectively, outlined in Section 3.1, the Theis analytical solution was employed. The Theis analytical solution is based on the following equations:

$$u = \frac{r^2 S}{4Tt} \quad (1)$$

Where:

r = distance, in feet, from the center of a pumped well to a point where the drawdown is measured.

S = coefficient of storage or storativity (dimensionless).

T = coefficient of transmissivity (gal/day/ft).

t = time since pumping started (days).

$$s = \frac{Q}{4\pi T} W(u) \quad (2)$$

s = drawdown, in feet, at any point in the vicinity of a well discharging at a constant rate.

Q = pumping rate (gallons per minute).

T = coefficient of transmissivity (gal.day/feet).

W(u) = is the well function of u and represents an exponential integral.

In these calculations, a storage coefficient (S) of 4.73×10^{-3} and a transmissivity (T) of 122, 230 gal/day/ft were used. These values, as indicated in Section 2.2 are the geometric means of the storage coefficient and transmissivity values calculated from the data generated during the 24-hour test pumping program and reported in CRA's 1990 report. The magnitude of transmissivity is considered to be conservative since it is considerably lower than the transmissivity values reported in the 1989 RI report.

A drawdown of 0.1 feet (approaching zero drawdown) was selected at distances of 1100 and 1500 feet away from extraction well EW1 after 48 days of pumping to define the areal extent of the cone of influence. Results from the calculations employing the Theis analytical solution indicate that pumping rates of 415 and 468 gpm would be needed to produce capture zones of 2200 and 3000 feet, respectively. The calculations performed to determine the optimum pumping rates are detailed in Appendix B.

Based on the above-noted calculations and the fact the pumping of city production well CW6 at a rate of 1000 gpm produces a minimum radius of influence of 2100 feet (zone of capture of 4200 feet), it is recommended that pumping rate at EW1 should not exceed 800 gpm. The cone of influence in the deep bedrock produced from pumping extraction well EW1 at rates ranging from 415 and 800 gpm should extend as far east as monitoring well IWD located on the island.

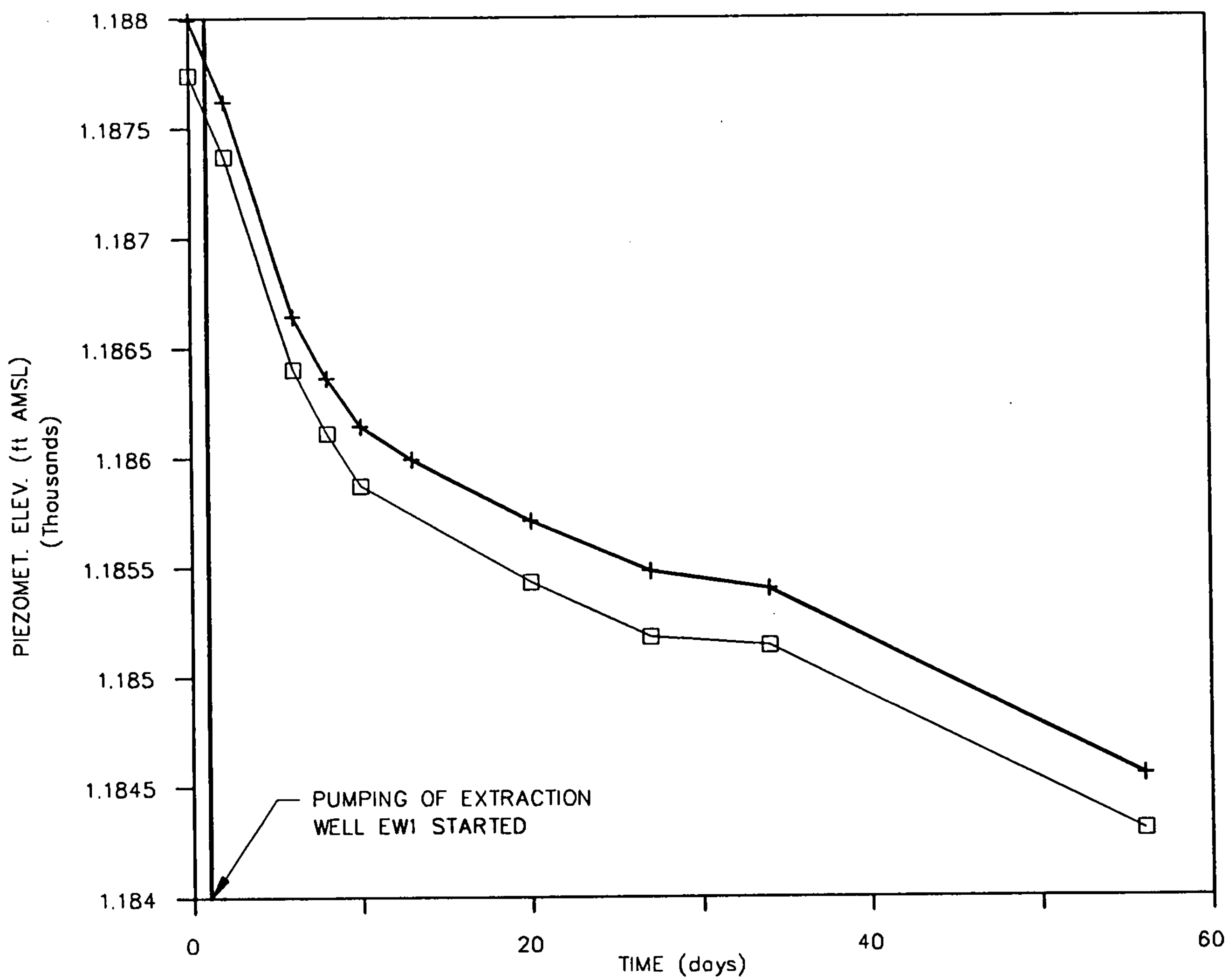
4.0 SUMMARY

Based on the evaluation of existing test pumping and additional hydraulic monitoring data, it is evident that a pumping rate of 1550 gpm at extraction well EW1 is creating a larger than necessary cone of depression. The areal extent of the cone of influence produced from this pumping rate is still expanding in a direction parallel to the Wisconsin River. The growth of the cone of influence indicates that a potential source of groundwater contamination located to the south of the Old Landfill is being captured by pumping EW1 at a rate of 1550 gpm. In addition, the continued growth of the cone of influence could cause well interference to city production well CW6.

It is recommended that extraction well EW1 be pumped at a rate ranging between a minimum of 415 and a maximum of 800 gpm.

APPENDIX A

HYDROGRAPHS FROM SELECTED MONITORING WELL NESTS



LEGEND

□ Shallow Wells

\+ Deep Wells

figure A.1

HYDROGRAPH FOR MONITORING WELL NEST C4S/C4D
WAUSAU WATER SUPPLY NPL SITE
Wausau, Wisconsin

CRA

2115-16/01/91-18-0

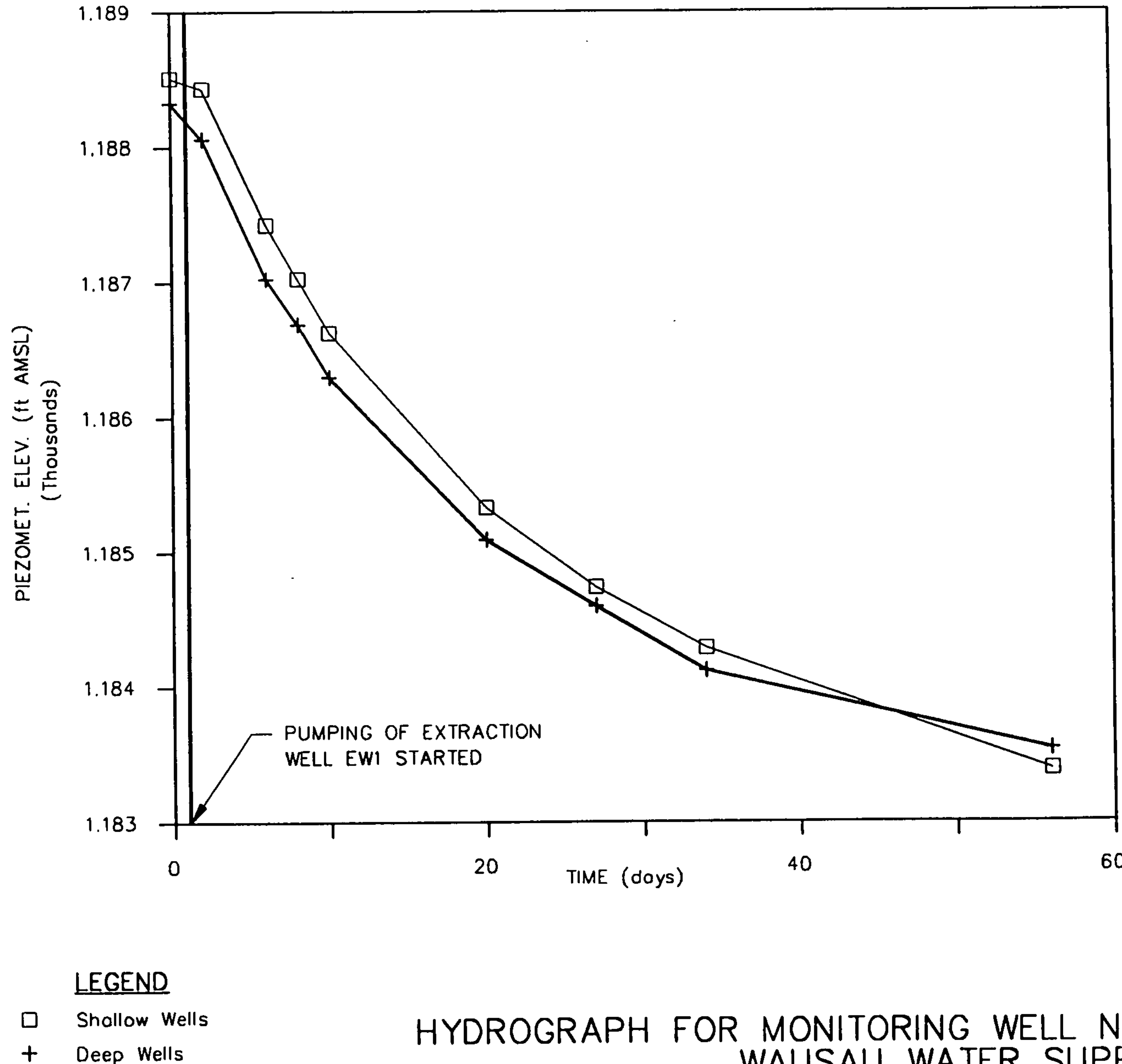
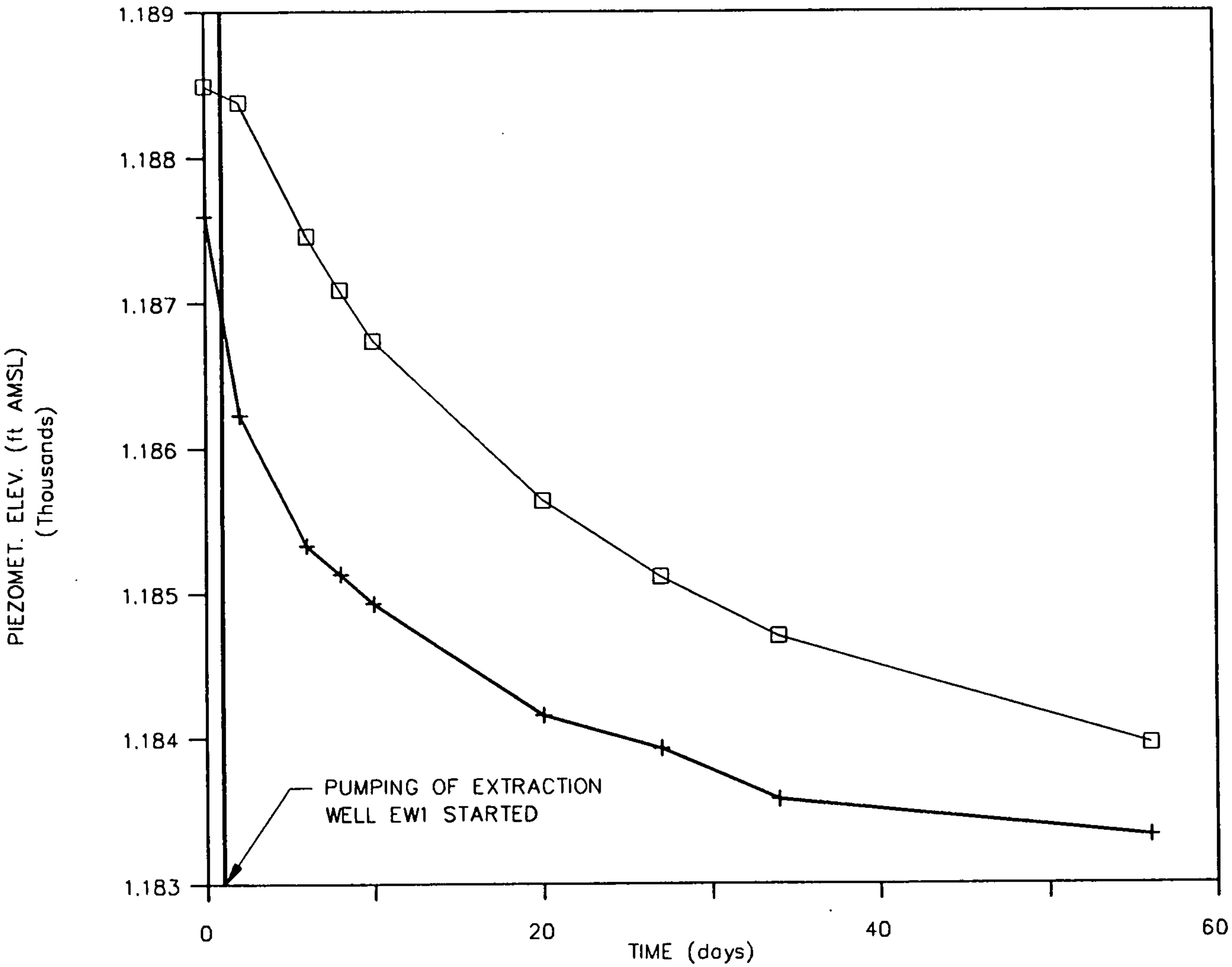


figure A.2

HYDROGRAPH FOR MONITORING WELL NEST R1S/R1D
WAUSAU WATER SUPPLY NPL SITE
Wausau, Wisconsin

CRA

2115-16/01/91-18-0



LEGEND

□ Shallow Wells

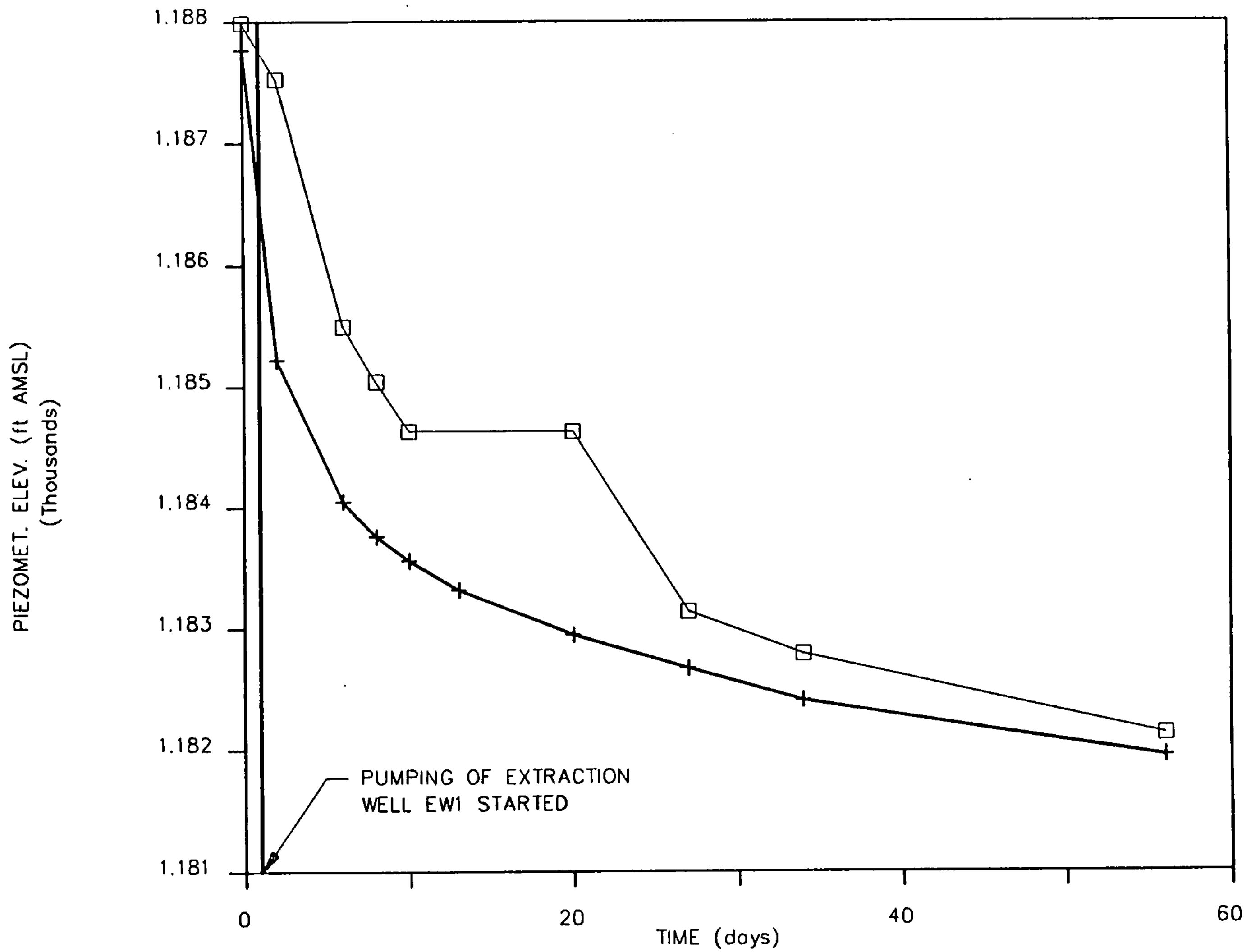
+ Deep Wells

figure A.3

HYDROGRAPH FOR MONITORING WELL NEST R3S/R3D
WAUSAU WATER SUPPLY NPL SITE
Wausau, Wisconsin

CRA

2115-16/01/91-18-0



LEGEND

□ Shallow Wells

+ Deep Wells

figure A.4

HYDROGRAPH FOR MONITORING WELL NEST W52A/W52
WAUSAU WATER SUPPLY NPL SITE
Wausau, Wisconsin

CRA

2115-16/01/91-18-0

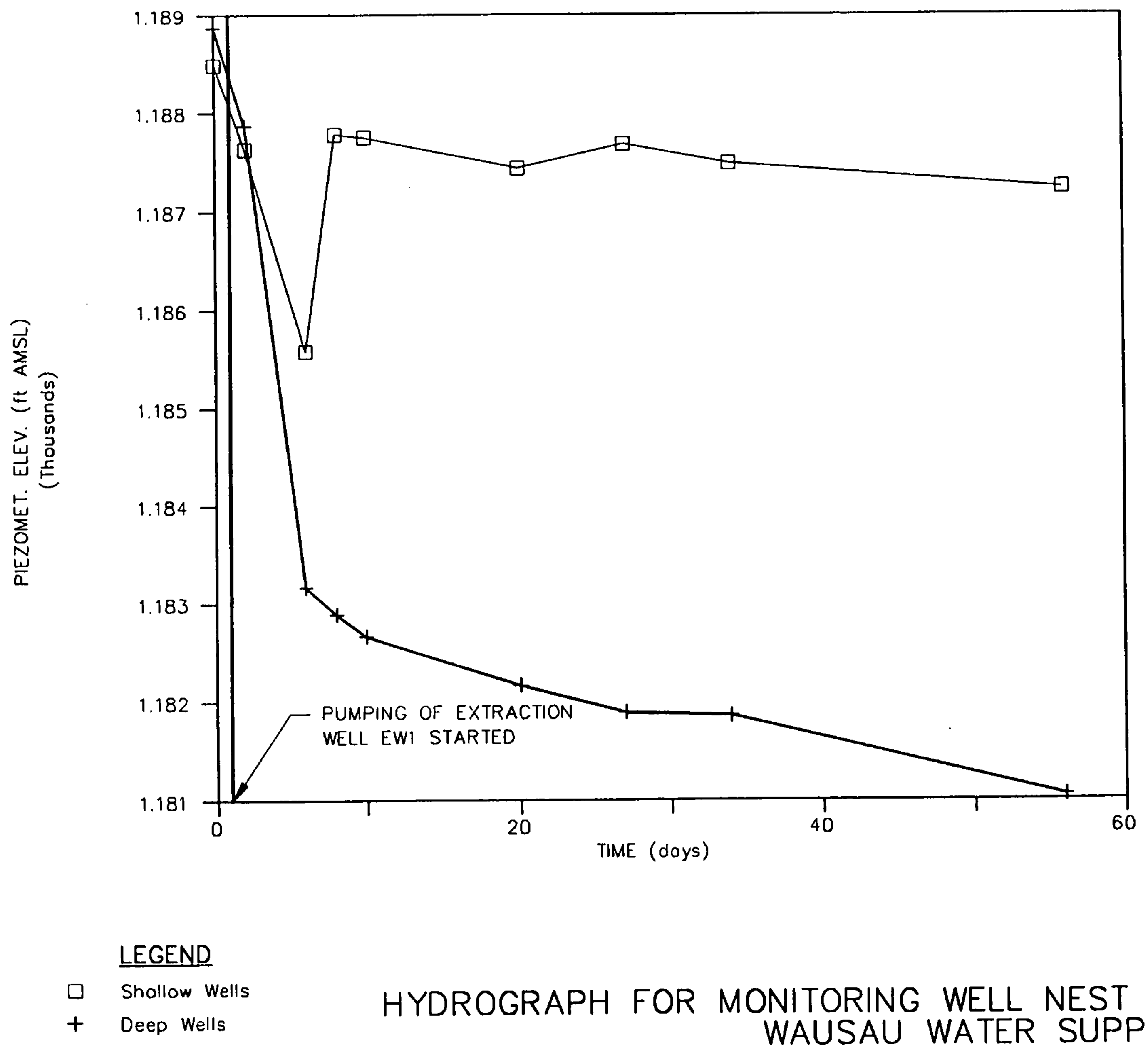


figure A.5

HYDROGRAPH FOR MONITORING WELL NEST WSWS/WSWD
WAUSAU WATER SUPPLY NPL SITE
Wausau, Wisconsin

CRA

2115-16/01/91-18-0

APPENDIX B

EXAMPLE CALCULATIONS PERFORMED
TO DETERMINE OPTIMUM PUMPING RATES
FOR EXTRACTION WELL EW1

B1 EXAMPLE CALCULATION NO. 1

Determination of an optimum pumping rate for extraction well EW1 to produce a zone of capture of 2200 feet (radius of influences of 1100 feet) was calculated using the Theis analytical solution as follows:

$$u = \frac{r^2 S}{4Tt} \quad (1)$$

$$u = \frac{(336\text{m})^2\,(4.73 \times 10^{-3})}{(4)\,(735\ \text{m}^2/\text{day})\,(48\ \text{days})}$$

$$u = 3.78 \times 10^{-3}$$

$W(u) = 4.95$ (Obtained from Table 8.1 of the book entitled "Groundwater" written by Freeze, R.A. and Cherry, J.A. and published by Prentice-Hall, Inc. in 1979)

$$S = \frac{Q}{4\pi T} W(u) \quad (2)$$

Equation (2) can be rearranged to solve for the pumping rate Q as follows:

$$Q = \frac{S 4\pi T}{W(u)}$$

$$Q = \frac{(0.03048\ \text{m})\ (4)\ (\pi)\ (735\ \text{m}^2/\text{day})}{4.95}$$

$$Q = 56.9\ \text{m}^3/\text{day}$$

$$Q = 415\ \text{gpm}$$

B2 EXAMPLE CALCULATION NO. 2

Determination of an optimum pumping rate for extraction well EW1 to produce a zone of capture of 3000 feet (radius of influence of 1500 feet) was calculated using the Theis analytical solution as follows:

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

$$u = \frac{(457\ \text{m})^2\ (4.73 \times 10^{-3})}{(4)\ (735\ \text{m}^2/\text{day})\ (48\ \text{days})}$$

$$u = 7.0 \times 10^{-3}$$

$W(u) = 4.39$ (Obtained from Table 8.1 of the book entitled "Groundwater" written by Freeze, R.A. and Cherry, J.A. and published by Prentice-Hall, Inc. in 1979)

$$s = \frac{Q}{4\pi T}W(u) \qquad (2)$$

Equation (2) can be rearranged to solve for the pumping rate Q as follows:

$$Q = \frac{s4\pi T}{W(u)}$$

$$Q = \frac{(0.03048\ \text{m})\ (4\pi)\ (735\ \text{m}^2/\text{day})}{4.39}$$

$$Q = 64.2\ \text{m}^3/\text{day}$$

$$Q = 468\ \text{gpm}$$

APPENDIX D

USEPA CORRESPONDENCE

MARATHON ELECTRIC

DAVID L. EISENREICH
VICE PRESIDENT
ADMINISTRATION

Rec'd CRA

JAN 28 1991

January 21, 1991

Ms. Margaret Guerriero
Wausau Project Manager
United States Environmental Protection Agency
Region V
230 South Dearborn Street
Chicago, Illinois 60604

Ms. Michelle Owens
Wisconsin Department of Natural Resources
North Central District Headquarters
Box 818
Rhinelander, Wisconsin 54501

RE: Marathon Electric Manufacturing Company, Wausau, Wisconsin
Consent Decree, Index No. II CERCLA-

Pursuant to paragraph 33 of the above-reference Consent Decree, this letter serves to notify the USEPA in writing, that Marathon Electric Manufacturing Company (Marathon) requires to invoke the force majeure condition of the Consent Decree.

On Friday, January 11, 1991, Conestoga-Rovers & Associates (CRA) was notified, orally, that Radian Laboratories, would not accept any more samples for chemical analyses. Radian Laboratories, the analytical facility approved in the Quality Assurance Project Plan (QAPP), to perform chemical analyses for the project, indicated that it would no longer serve as a commercial laboratory facility. Following oral confirmation of Radian's position on January 15, 1991, Mr. Ed Roberts of CRA notified Marathon (Mr. Dave Eisenreich). On January 16, 1991, CRA received a letter confirming Radian Laboratories position (copy attached).

Radian Laboratories has orally indicated that it will complete analyses and reporting for all samples currently in house. Therefore, groundwater samples collected from December 3/4, 1990 through to January 7/8, 1991, should be completed by Radian Laboratories. It is to be noted, however, that the above condition (completion of in-house samples) has not been confirmed by Radian Laboratories in writing and is based strictly on oral communication with the laboratory.

P. O. BOX 8003 WAUSAU, WISCONSIN 54402-8003 715/675-3311

Pursuant to the notification requirements of paragraph 33 of the Consent Decree, on Tuesday, January 15, 1991, Mr. Ed Roberts of CRA notified Ms. Margaret Guerriero (EPA Wausau Project Manager) of the above circumstances. Ms. Guerriero indicated to Mr. Roberts that she would inform Ms. Michelle DeBrook-Owens (WDNR State Project Coordinator). On Tuesday, January 15, 1991, Mr. Roberts received a faxed copy of current CLP certified laboratories from Ms. Guerriero.

In order to complete analytical activities associated with the Remedial Action Plan (RAP), a new laboratory(s) will be required to be retained. Therefore, pursuant to paragraph 33 of the Consent Decree, the following actions will be undertaken to minimize delay to the project:

1) CRA to meet with Radian Laboratories during week of January 21, 1991 to discuss status and completion of in-house samples;

2) Subsequent to meeting with Radian Laboratories, a conference call will be scheduled with the USEPA to discuss status of in-house samples;

3) A Request for Proposal (RFP) will be issued by CRA on or before January 23, 1991 to a minimum of three CLP laboratories for completing the remaining analyses for the project;

4) All laboratories will be required to provide a proposal to CRA on or before January 31, 1991;

5) A laboratory will be selected on or before February 4, 1991, subject to a laboratory(s) satisfying all requirements of the QAPP;

6) The name of the selected laboratory will be supplied to the USEPA on February 4, 1991;

7) Groundwater sampling activities will resume the week of February 11, 1991. It is recommended that extraction well samples currently scheduled to be collected on January 21, 1991 be omitted from the schedule and that sampling activities originally scheduled for February 4 and 5, 1991 be collected the week of February 11, 1991;

8) All remaining scheduled sampling activities and dates will remain unchanged.

Sincerely,

Dave Eminik

jbs

cc: Mark Thimke/Foley & Lardner
Ed Roberts/CRA

RADIAN
CORPORATION

15 January 1991

8501 Mo-Pac Blvd.
P.O. Box 201088
Austin, TX 78720-1088
(512)454-4797

Mr. Bruce Clegg
Conestoga-Rovers & Associates Limited
651 Colby Drive
Waterloo, Ontario, Canada N2V 1C2

Dear Mr. Clegg:

For several years, Radian has been providing routine analytical chemistry services for a variety of government and industrial clients as a stand-alone business. This service offering was made in anticipation of a rapidly expanding market for such fixed-price analytical services. The anticipation generated a large competitor base, but not the demand expansion expected. As a result, Radian has experienced major fluctuations in demand and heavy competition, which resulted in less than satisfactory profit margins for the analytical chemistry services business.

Upon review, Radian management has established that the primary mission of chemistry within Radian is to provide support for Radian's broad scope of environmental service offerings. Providing routine analytical services as a stand-alone business is not compatible with that mission and, consequently, will no longer be offered.

This action will preclude Radian's laboratories from participating in any CRA program, planned or ongoing, in which your firm had anticipated utilizing our services.

We sincerely appreciate the opportunities afforded Radian by our long and cordial relationship with CRA. We wish you and your firm the best of luck in your future enterprises.

If you should have any questions regarding the decision to terminate the analytical services business please call me. I will be happy to discuss it with you.

Yours very truly,

Robert Richardson

Robert Richardson
Senior Marketing Manager

cc: R. A. Magee

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

Rec'd CRA

FEB 8 1991

REPLY TO ATTENTION OF:

January 31, 1991

5HS-11

Mr. Ed Roberts
Conestoga-Rovers & Associates
651 Colby Drive
Waterloo, Ontario, Canada N2V 1C2

Dear Ed:

This letter is to document the resolution of several issues pertaining to the operation of the Marathon Electric extraction well. As has been discussed, the following problems have been identified with respect to the operation of the extraction well: closure of Radian Laboratory (lose of lab for analyses of samples); exceedance of the Wisconsin discharge limits for copper and zinc; and extension of the zone of influence from the extraction well beyond the proposed capture zone.

It is my understanding that you are currently reviewing bids from approved Contract Lab Program (CLP) laboratories to replace Radian. As we have discussed, the new lab will require EPA approval for the analyses approved in the QAPP. However, in the interim, we agreed that you would retain an approved CLP laboratory in good standings and resume sampling of the extraction system as soon as possible. Once you have identified a lab, I will initiate EPA approval of the lab. It is also my understanding that sampling activities originally scheduled for February 4 and 5, 1991 will be collected the week of February 11, 1991, and all future sampling activities will remain as scheduled.

Based on results from the first round of inorganic analyses, there is a possible exceedance of copper and zinc in the discharge stream of the extraction well. Since much of the data was estimated due to laboratory QA/QC problems, there is some uncertainty associated with this result. As we have discussed, a second round of samples, for analysis of inorganics and possibly organics (pending results), will be required once you have a new laboratory on board. In the interim, I understand Ken Weisner of WDNR has requested that a sample be collected from the extraction well discharge and analyzed for copper and zinc only. WDNR has agreed that Enviroscan is an acceptable lab for this purpose.

According to your January 16, 1991 submittal, Evaluation of the Pumping Rate in Extraction Well No. 1, Conestoga-Rovers estimates that the zone of influence of the extraction well has extended well beyond the originally proposed capture zone. Based on that conclusion, the report proposes to reduce the extraction rate of the well from 1550 gpm to between 415 and 800 gpm. On January 22, 1991, this issue was discussed during a conference call between EPA, WDNR, and Conestoga-Rovers. As a result of that phone call, EPA and WDNR agreed that the pumping rate should be turned down. We further agreed that the well would be turned down to 800 gpm initially; however, the final pumping rate will need to be determined based on monitoring of water levels in compliance monitoring wells.

Based on review of the consent decree for the interim action, it appears that the approved work plan for the extraction well will need to be amended to include this new strategy for determining the final pumping rate of the extraction well. Therefore, I am requesting that you submit a revision to the work plan to include this change. This submittal can be in the form of a work plan addendum; that is, it would not require submittal of the entire work plan but rather a document that addresses only this change. The title of the document should reflect, as accurately as possible, the purpose of the document.

Please contact me if you have questions or concerns regarding this matter.

Sincerely,

Margaret M. Guerriero

Margaret M. Guerriero
Wausau Project Manager

cc: M. DeBrock-Owens, WDNR
D. Grasser, WDNR
D. Eisenreich, Marathon Electric

APPENDIX E

DATA QUALITY ASSESSMENT AND VALIDATION
FOR GROUNDWATER SAMPLES

MEMORANDUM

TO: Ed Roberts

REFERENCE NO. 2115

FROM: David Dempsey

DATE: February 26, 1991

RE: Data Quality Assessment and Validation for Sixty-Three Groundwater Samples Collected during the November 1990 Sampling Events at the Wausau, Wisconsin, Site

---

The following details a data quality assessment and validation for 63 groundwater samples collected November 13 through November 29, 1990, at the Wausau, Wisconsin, site. All samples were analyzed for target compound list volatile organic compounds (TCL VOC) by the Radian Corporation-Sacramento.[1] Quality assurance criteria are defined in the associated quality assurance project plan (QAPP).[2]

Holding Time Period

The holding time period for VOC samples is defined in the QAPP and requires samples to be analyzed within 14 days from sample collection. Examining the analysis dates showed samples were analyzed within the allotted time frame.

Instrument Performance

Prior to analyzing samples, the gas chromatograph/mass spectrometer (GC/MS) performance was checked using 4-bromofluorobenzene. Relative peak intensities for selected ions were within limits specified in the QAPP. Therefore, the GC/MS was in proper working condition prior to sample analysis.

Initial Calibration Data

The initial calibration data were used to judge analyte response versus concentration. For system performance check compounds, the minimum response factor allowed is 0.300 (0.150 for bromoform).[3] All remaining analytes are required to have response factors greater than 0.050. Percent relative standard deviations for all analytes are required to be less than 30. Table 1 lists the outlying initial calibration data.

The 1,1,2,2-tetrachloroethane mean response factor on November 29 was below the limit of 0.300 (1,1,2,2-tetrachloroethane is a system performance check compound). Discussion with Radian technical advisor Marilyn Melton revealed 1,1,2,2-tetrachloroethane does not usually meet the 0.300 limit when using a 25 m*l* purge volume. I was told David Payne (USEPA) has reviewed previous Radian data and found this violation to have no impact on the data. A copy of a letter confirming this is presented as Attachment A.

---

[1]The analytical method was the Contract Laboratory Program-Statement of Work, February 1988, revised September 1988 and April 1989.

[2]Application of quality assurance criteria was consistent with "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses", February 1, 1988.

[3]This criterion is from the low level detection VOC CLP-SOW 1990 and has been extrapolated to these data as the CLP-SOW 1988 does not specify calibration criteria using a 25 m*l* purge volume.

Typographical errors were found for the butanone initial calibration data from November 23, 1990 and November 29, 1990. The mean response factors for butanone were reported to be 0.082 and 0.039, respectively; however, recalculating gives mean response factors of 0.103 and 0.065, respectively.

Only the acetone data from all samples were qualified as estimated (J or UJ). Thus, the GC/MS were properly calibrated prior to sample analysis.

Continuing Calibration Data

Continuing calibration data were used to assess analyte response versus concentration on a daily basis. For system performance check compounds, daily response factors are required to be greater than 0.300 (0.150 for bromoform). All remaining analytes are required to have daily response factors greater than 0.05. Percent differences between mean response factors and daily response factors for all analytes must be less than 25. Table 2 lists the outlying continuing calibration data.

Again, 1,1,2,2-tetrachloroethane had response factors below 0.300 and no action upon the data was necessary. Analytes with response factors below 0.05 had data qualified as estimated (J) if detected and unusable (R) if not detected. Analytes with percent differences greater than 25 had data from associated samples qualified as estimated (J or UJ).

Method Blank Samples

Extent of lab contamination of samples was measured using method blank samples. Table 3 summarizes the analytes detected in method blank samples. Note that only methylene chloride was detected often and had data qualified from associated samples as non-detect (U).

As a low level detection method was used, the lab stated acetone and methylene chloride in the range of 10 µg/*l* or less should be considered a lab artifact even if the associated method blank sample is clean. This criterion is applied to the actual result; therefore, dilutions were not taken into consideration. Table 4 lists the methylene chloride data, which were qualified as non-detect (U). Sample W-111690-MB-030 acetone datum was also qualified as non-detect (U).

Surrogate Compounds Percent Recoveries (Surrogate Recoveries)

Individual sample performance for VOC analyses was judged using surrogate recoveries. Control limits are set in the QAPP. All percent recoveries were within these limits.

The d_8-toluene recoveries were calculated using 1,4-difluorobenzene as the internal standard, rather than d_5-chlorobenzene. As d_8-toluene elutes nearly midway between these two internal standards, either may be used to calculate d_8-toluene recoveries. Thus, the method was in control during each sample analysis.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Percent Recoveries

Matrix efficacy with respect to analytical data was checked using MS/MSD analyses. Samples W-111490-MB-005, W-111490-RRR-012, W-111490-RRR-018, W-111590-RRR-023, PW-112390-RRR-004, PW-111990-RRR-002 and W-112990-RRR-008 underwent MS/MSD analyses.

The trichloroethene MS/MSD recoveries from sample W-111590-RRR-023 were 0 and -40; therefore, this datum was qualified as estimated (J). Sample PW-112390-RRR-004 had trichloroethene data qualified as estimated (J) as the MS/MSD recoveries were 66 and 54.

Samples W-111490-MB-005 and W-111490-RRR-012 had typographical errors in the MS/MSD data. The benzene MSD recovery from sample W-111490-RRR-012 was recalculated to be 72 and the relative percent difference for toluene was 30, not 40. The toluene datum was qualified as estimated (J), while no action was taken on the benzene datum. For sample W-111490-MB-005, all reported MS/MSD recoveries were miscalculated. Table 5 lists the correct recoveries. Trichloroethene datum from this sample was qualified as estimated (UJ).

Overall, no significant matrix effects were observed.

Internal Standard Summaries

Overall instrument performance was monitored using internal standard peak area and retention times. Peak areas are required to match within +100 percent and -50 percent the daily calibration sample internal standard peak areas. Retention time must match within 0.5 minutes. Examining the data showed both criteria were met. Therefore, the GC/MSs were in proper working order during each analysis.

Trip Blank Samples

Trip blank samples were used to monitor the extent of cross contamination of samples during shipment to Radian. Two such sample were sent from Radian, TB11/14 and TB11/16. Both sample contained methylene chloride; however, both results were qualified as non-detect (U).

No trip blank samples were sent with samples from November 19, 23, 26, 27 and 29.

Rinsate Samples

Rinsate samples were originally part of the field quality assurance plan. However, a switch to dedicated bailer made rinsate sampling unnecessary.

Prior to inserting bailers into wells, a rinsate sample should have been taken to insure the bailers were clean. This was not done. As the data have been consistent over the first month of sampling, the bailers apparently have had no effect upon the data.

Field Duplicate Samples

Overall precision for these sampling events was measured using field duplicate samples. A total of seven sets of field duplicate samples was collected. Table 6 lists the field duplicate sample sets. Note that not every sampling event, namely, November 19 and 23, contains a field duplicate sample as is required in the QAPP. No action upon the data was necessary despite this.

Agreement between field duplicate samples was acceptable; thereby indicating the overall sampling program was precise.

Overall Assessment

Overall the data were found to be accurate and precise. Exceptions have been discussed and documented in the above sections. These qualified data may be used for qualitative assessment purposes, except where the data have been rejected.

cc: Bruce Clegg

TABLE 1

OUTLYING INITIAL CALIBRATION DATA ASSOCIATED WITH THE NOVEMBER 1990 SAMPLING EVENTS AT THE WAUSAU, WISCONSIN SITE

Date	Analyte	RRF[1]	%RSD[2]	Qualifier[3]
11/23/90	Butanone[4]	0.082	16.0	NR
	Acetone	0.505	43.9	J/UJ
11/29/90	Butanone[4]	0.039	16.0	NR
	Acetone	0.244	40.0	J/UJ
	1,1,2,2-tetrachloroethane	0.260	8.1	NR

1 RRF = Mean Relative Response Factor
2 %RSD = Percent Relative Standard Deviation
3 Analyte reslts was qualified as:
J = The associated value is an estimated quantity, for detected analytes.
UJ = The analyte was checked for, but not detected. The associated value is an estimate.
NR = No additional qualifiers were required.
4 RRF values were miscalculated. For 11/23/90, RRF = 0.103 and for 11/29/90 RRF = 0.065.

TABLE 2

OUTLYING CONTINUING CALIBRATION DATA
ASSOCIATED WITH NOVEMBER 1990 SAMPLING EVENTS
AT THE WAUSAU, WISCONSIN, SITE

Date/Time	Analyte	RRF[1]	%D[2]	Qualifier[3]	Associated Samples
11/25, 09:13	Acetone	0.727	44.0	NR	W-111490-CH-009;
	Butanone	0.073	29.1	J/UJ	W-111390-MB-001;
	2-hexanone	0.187	31.8	J/UJ	W-111490-MB-003;
					W-111490-CH-004;
					W-111490-CH-006
11/26, 08:41	Butanone	0.069	33	J/UJ	W-111490-RRR-007;
					W-111490-JM-008;
					W-111490-RRR-010;
					W-111490-RRR-012
					through
					W-111490-RRR-018
11/27, 07:52	Acetone	0.306	39.4	NR	W-111390-RRR-002;
	Butanone	0.061	40.8	J/UJ	W-111490-RRR-011;
	4-methyl-2-pentanone	0.147	33.8	J/UJ	W-111490-RRR-012 MS/MSD;
	2-hexanone	0.163	40.5	J/UJ	W-111490-RRR-018 MS/MSD;
					W-111590-JM-019;
					W-111590-RRR-021;
					W-111590-RRR-023;
					W-111590-RRR-024;
					W-111590-RRR-027
11/29, 08:38	Butanone	0.131	27.2	J/UJ	W-111590-RRR-020;
					W-111590-RRR-022;
					W-111590-RRR-025;
					W-111590-RRR-026;
					W-111590-RRR-023 MS/MSD;
					W-111690-RRR-028;
					W-111690-RRR-034
11/30, 08:51	Chloromethane	1.886	27.6	J/UJ	W-111690-MB-029;
					W-111690-MB-030;
					W-111690-MB-031;
					W-111690-MB-032;
					W-111690-MB-033;
					W-111690-MB-035
11/30, 09:22	Chloromethane	1.953	26.9	J/UJ	PW-111990-RRR-01;
	Vinyl Acetate	0.058	83.5	J/UJ	PW-111990-RRR-02;
	Bromoform	0.144	6.5	NR	Starsample 11/19;
	1,1,2,2-tetrachloroethane	0.233	13.1	NR	Starsample 11/23

TABLE 2 (CONT'D)

OUTLYING CONTINUING CALIBRATION DATA
ASSOCIATED WITH NOVEMBER 1990 SAMPLING EVENTS
AT THE WAUSAU, WISCONSIN, SITE

Date/Time	Analyte	RRF[1]	%D[2]	Qualifier[3]	Associated Samples
12/3, 10:59	1,1,2,2-tetrachloroethane	0.287	7.1	NR	PW-112390-RRR-003;
	Chloromethane	1.108	28	J/UJ	PW-112390-RRR-004
	Carbon Disulfide	4.707	34	J/UJ	
	Vinyl Acetate	0.058	83.5	J/UJ	
	2-hexanone	0.177	25.3	NR	
12/4, 11:52	Chloromethane	1.087	29.4	J/UJ	W-112690-JM-036;
	Carbon Disulfide	4.881	31.5	J/UJ	W-112690-JM-038;
					W-112690-JM-039;
					W-112690-JM-041
12/5, 11:43	1,1,2,2-tetrachloroethane	0.224	16.4	NR	W-112690-JM-037;
	Acetone	0.134	45.1	NR	W-112690-JM-042;
	Carbon Disulfide	5.255	26.3	J/UJ	W-112690-JM-044;
	Vinyl Acetate	0.186	17.2	J/UJ	W-112790-JM-045;
	2-hexanone	0.125	47.3	J/UJ	W-112790-JM-046;
					W-112790-JM-049
12/6, 08:31	Acetone	0.157	35.7	NR	W-112790-JM-005;
	Butanone	0.049	24.6	J/R	W-112790-JM-005 MS/MSD;
	4-methyl-2-pentanone	0.091	25.4	NR	W-112790-JM-006;
	Tetrachloroethene	0.520	31.7	J/UJ	W-112790-JM-007;
					Starsample 11/27
12/7, 10:27	Butanone	0.016	75.4	J/R	W-112990-008;
	1,1,2,2-tetrachloroethane	0.239	10.8	NR	W-112990-009;
	Acetone	0.152	37.7	NR	W-112990-010;
	Trichloroethene	0.548	28.9	J/UJ	Starsample 11/29
	4-methyl-2-pentanone	0.091	25.4	J/UJ	
	2-hexanone	0.111	53.2	J/UJ	
	d_4-1,2-dichloroethane[4]	0.727	30.2	J/UJ	

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[1]RRF = Daily Relative Response Factor

[2]%D = Percent Difference

[3]Analyte data from associated samples were qualified as:

J = The associated value is an estimated quantity, for detected analytes.

UJ = The analyte was checked for, but not detected. The associated value is an estimate.

R = The data are unusable, for non-detected analytes.

NR = No additional qualifiers were necessary.

[4]Surrogate Compound

TABLE 3

ANALYTES DETECTED IN METHOD BLANK SAMPLES ASSOCIATED WITH THE NOVEMBER 1990 SAMPLING EVENTS AT THE WAUSAU, WISCONSIN, SITE

Blank ID	Analyte	Concentration (μg/l)	Associated Samples[1]
VBLK3-11/26	Methylene Chloride	0.6 J[2]	TB11/14; W-111490-RRR-007; W-111490-JM-008; W-111490-RRR-010; W-111490-RRR-012; W-111490-RRR-013
VBLK2-11/29	Methylene Chloride	0.5 J	W-111590-RRR-020; W-111590-RRR-022; W-111590-RRR-025; W-111590-RRR-026; W-111690-RRR-028; W-111690-MB-034;
VBLK3-11/29	Methylene Chloride	0.9 J	TB11/18; W-111690-MB-029; W-111690-MB-030; W-111690-MB-031; W-111690-MB-032; W-111690-MB-033; W-111690-MB-035
VBLK1-11/30	Styrene Xylenes	0.4 J 0.2 J	
VBLK1-12/4	Methylene Chloride	0.8 J	W-112690-JM-038; W-112690-JM-039
VBLK3-12/7	Styrene	0.2 J	
VBLK4-12/11	Methylene Chloride 2-hexanone Acetone	0.6 J 1 J 2 J	

[1]Analyte data from associated samples were qualified as non-detect (U).
[2]The associated value is an estimate.

TABLE 4

ADDITIONAL METHYLENE CHLORIDE DATA QUALIFIED AS NON-DETECT NOVEMBER 1990 SAMPLING EVENTS AT THE WAUSAU, WISCONSIN, SITE

Sample ID[1]
W-111490-JM-005
W-111490-CH-004
W-111390-RRR-002
W-111490-MB-006
W-111490-MB-003
W-111590-RRR-023
W-111590-JM-027
W-111590-RRR-024
W-111590-RRR-021
W-111590-JM-019
W-112690-JM-044
W-112690-JM-042
W-112790-JM-049
W-112790-JM-045
W-112790-JM-046
W-112790-JM-006
W-112790-JM-007

[1]Methylene chloride data for these samples were qualified as non-detect (U).

TABLE 5

CORRECTED MS/MSD RECOVERIES FOR SAMPLE W-111490-MB-005 COLLECTED DURING THE NOVEMBER 1990 SAMPLING EVENTS AT THE WAUSAU, WISCONSIN, SITE

Analyte	Percent Recoveries		Limits[1]	Qualifier[2]
	MS	MSD		
1,1-dichloroethene	162	144	61-145	NR
Trichloroethene	182	125	71-120	J
Benzene	129	130	76-127	NR
Toluene	129	125	76-125	NR
Chlorobenzene	124	121	75-130	NR

[1] Limits are specified in the QAPP.
[2] Analyte datum for sample W-111490-MB-005 was qualified as:
J - The associated value is an estimated quantity.
NR - No additional qualifiers were required.

TABLE 6

LIST OF FIELD DUPLICATE SAMPLE SETS COLLECTED DURING THE NOVEMBER 1990 SAMPLING EVENTS AT THE WAUSAU, WISCONSIN, SITE

Sample IDs
W-111490-RRR-015/W-111490-RRR-016
W-111490-RRR-017/W-111490-RRR-018
W-111590-JM-025/W-111590-JM-026
W-112690-JM-037/W-112690-JM-038
W-111590-RRR-021/W-111590-RRR-022
W-111490-RRR-010/W-111490-RRR-011
W-112990-RRR-009/W-112990-RRR-010
W-112790-JM-006/W-112790-JM-007

ATTACHMENT A

RADIAN
CORPORATION

8501 Mo-Pac Blvd.
P.O. Box 201088
Austin, TX 78720-1088
(512) 454-4797

19 February 1991

Rec CRA

FEB 25 91

Mr. David Dempsey
Conestoga-Rovers & Associates
382 West County Road D
St. Paul, MN 55112

Dear Dave:

You had raised a question about the Rf value of 1,1,2,2-tetrachloroethane in some 8240 work the Sacramento laboratory did for CRA. CLP requires that the Rf for this compound be 0.3 or greater for a 5 mL purge. CRA asked us to run a 25 mL purge, which is less efficient than a 5 mL purge. While all other analytes met the required criteria, this compound did not.

To obtain this Rf with a 25 mL purge, conditions were required which caused other analytes to perform badly. When these results were discussed with David Paine from EPA Region V, he sanctioned the use of the lower Rf for tetrachloroethane.

If you should have any further questions regarding this matter, please feel free to call me.

Sincerely,

Marilyn

Marilyn A. Melton, Ph.D.

mam/dg

cc: Robert Richardson
Wanda Brown

MEMORANDUM

TO: Ed Roberts

REFERENCE NO. 2115

FROM: David Dempsey

DATE: March 3, 1991

RE: Data Quality Assessment and Validation for Thirty Eight Groundwater Samples Collected during the December 1990 Sampling Events at the Wausau, Wisconsin, Site

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The following details a data quality assessment and validation for 38 groundwater samples collected December 3 through December 17, 1990, at the Wausau, Wisconsin, site. All samples were analyzed for target compound list volatile organic compounds (TCL VOC), while six samples were also analyzed for TCL base-neutral/acid extractable organic compounds (BN/A), TCL pesticides/polychlorinated biphenyls (PEST/PCB), target analyte list (TAL) metals and cyanide. All analyses were performed by the Radian Corporation-Sacramento.[1] Quality assurance/quality control criteria are defined in the associated quality assurance project plan (QAPP).[2]

Holding Time Periods

Holding time periods are defined in the QAPP and are summarized below:

VOC - 14 days from sample collection to completion of analysis

BN/A - 7 days from sample collection to extraction
- 40 days from extraction to completion of analysis

PEST/PCB - 7 days from sample collection to extraction
- 40 days from extraction to completion of analysis

metals - 6 months from sample collection to completion of analysis, except for mercury
- 28 days from sample collection to completion of mercury analysis

cyanide - 14 days from sample collection to completion of analysis

Samples W-120390-MB-042, W-120490-MB-045 and W-120490-MB-048 were reanalyzed for BN/A. These samples were re-extracted 55 and 54 days, respectively, from dates of sample collection; therefore, the reanalyses data were qualified as estimated (UJ).

All remaining analyses were completed within the prescribed holding time periods.

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[1]The analytical methods were the Contract Laboratory Program-Statement of Work, February 1988, revised September 1988 and April 1989.

[2]Application of quality assurance/quality control criteria was consistent with "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses", February 1, 1988 and "Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses", July 1, 1988.

Instrument Performance

Prior to VOC and BN/A analyses, the gas chromatograph/mass spectrometer (GC/MS) performance was checked using 4-bromofluorobenzene and decafluorotriphenylphosphine, respectively. Selected ion peak relative intensities were within limits specified in the QAPP. Therefore, the GC/MSs were in proper working condition prior to sample analysis.

Prior to PEST/PCB analyses, the gas chromatograph performance was checked using 4,4'-DDT retention times, endrin/4,4'-DDT breakdown percentages and dibutylchlorendate retention times. All criteria were met for both qualitative and quantitative columns.

Initial Calibration Data

The initial calibration data were used to judge analyte response versus concentration. For system performance check compounds, the minimum response factor allowed is 0.300 (0.100 for bromoform[3]) and 0.050 for VOC and BN/A analyses, respectively. All remaining analytes are required to have response factors greater than 0.050. Percent relative standard deviations (%RSD) for all analytes are required to be less than 30. Table 1 lists the outlying initial calibration data. Acetone and butanone data for all samples were qualified as estimated (J or UJ) as a result. Other analyte data were qualified as estimated (J or UJ) or unusable (R) for samples listed in Table 1.

The initial calibration curve for PEST/PCB analyses consists of three standards. The %RSD for aldrin, endrin, dibutylchlorendate and 4,4'-DDT are required to be less than ten. Calibration data for qualitative and quantitative columns met this criterion. Therefore, the gas chromatograph was properly calibrated prior to sample analyses.

Initial calibration curves for metals consisted of a minimum of two points. Metals analyzed by atomic absorption and cyanide required curves with minimum of four points. Five points were used in determining the mercury calibration curve. Linear regression calculations were performed and the correlation factors were greater than 0.995. Thus, these methods were properly calibrated.

Continuing Calibration Data

Continuing calibration data were used to assess analyte response versus concentration on a daily basis. For system performance check compounds, daily response factors are required to be greater than 0.300 (0.100 for bromoform) and 0.050 for VOC and BN/A analyses, respectively. All remaining analytes are required to have daily response factors greater than 0.050. Percent differences between mean response factors and daily response factors for all analytes must be less than 25. Table 2 lists the outlying continuing calibration data. These data were qualified as estimated (J or UJ).

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[3]This criterion is from the low level detection VOC CLP-SOW 1990 (draft). As the VOC CLP-SOW 1988 does not allow for a 25 m*l* sample purge volume, the criterion has been extrapolated to these data.

be

Calibration factors for PEST/PCB analyses were required to within 15 percent for the quantitative column and 20 percent for the qualitative column with respect to initial calibration factors. As both criteria were met, the gas chromatograph was properly calibrated throughout the PEST/PCB analyses.

Calibration standards were analyzed to check the metals and cyanide calibrations. Due to the sample case, no calibration standard analyses were required.

Method Blank Samples

Extent of lab contamination of samples was measured using method blank samples. Table 3 summarizes the analytes detected in method blank samples. Analyte data listed in Table 3 were attributed to lab contamination and were qualified as non-detect (U) for associated samples.

As a low level detection method was used, the lab stated acetone and methylene chloride in the range of 10 μg/*l* or less should be considered a lab artifact even if the associated method blank sample is clean. This criterion is applied to the actual result; therefore, dilutions are not taken into consideration. Table 4 lists the methylene chloride data below 10 μg/*l* and were qualified as non-detect (U).

ICP Interference Check Samples

The ICP method is shown to be free of interelemental interferences using a check sample. Percent recoveries were within required limits. Thus, no significant interelemental interferences are suspected.

Laboratory Control Sample

Accuracy of metals and cyanide methods was demonstrated using control samples. Percent recoveries were within specified limits. Thus, these methods were accurate at time of samples analyses.

Surrogate Compounds Percent Recoveries (Surrogate Recoveries)

Individual sample performance for VOC, BN/A and PEST/PCB analyses was judged using surrogate recoveries. Control limits are set in the QAPP. Table 5 lists outlying surrogate recoveries for VOC and BN/A analyses. No action upon the VOC data was necessary, as the surrogate compound d_4-1,2-dichloroethane data were qualified as estimated based upon calibration data.

The d_8-toluene recoveries were calculated using 1,4-difluorobenzene as the internal standard, rather than d_5-chlorobenzene. As d_8-toluene elutes nearly midway between these two internal standards, either may be used to calculate d_8-toluene recoveries.

The acid fraction data of samples listed in Table 5 were qualified as estimated (J) or unusable (R) as the outlying surrogate recoveries were below ten. The base-neutral fraction data were not qualified based upon the surrogate recoveries.

All dibutylchlorendate recoveries were in required limits. Thus, the PEST/PCB method was in control for all analyses.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Percent Recoveries

Matrix efficacy with respect to analytical data was checked using MS/MSD analyses. Samples W-120490-MB-045, PW-121790-JM-014DL[4], W-120690-MH-011, W-121090-RR-057, W-120490-MB-043 and W-120390-MB-042RE[5] underwent MS/MSD analyses. Table 6 lists the outlying MS/MSD recoveries.

The metals matrix spike analyses were performed upon sample W-120490-MB-045. The majority of metals had recoveries below the control window. As a result, these data were qualified as estimated (J or UJ). As the spikes added were less than one-fourth the amount of manganese or zinc detected, no qualifier was required for the manganese or zinc data although these recoveries were out of control limits. Due to the excessive amounts of calcium and magnesium detected in this sample no matrix spike recoveries could be calculated. Therefore, these results were qualified as estimated (J).

Samples PW-121790-JM-014DL, W-120690-MH-011, W-120390-MB-043 and W-121090-RR-057 underwent MS/MSD analyses for VOC. Although trichloroethene and toluene recoveries from sample PW-121790-JM-014DL were out of specified limits, no action upon the data was taken. However, the trichloroethene data from samples W-120690-MH-011 and W-120390-MB-043 were qualified as estimated (J), while 1,1-dichloroethene, trichloroethene and benzene data from sample W-121090-RR-057 were qualified as estimated (J or UJ).

The BN/A MS/MSD recoveries from sample W-120390-MB-042RE were qualified as estimated (J) as this sample was analyzed out of the holding time period. Therefore, these recoveries could not be used to quantitate matrix effects. However, reviewing the data showed no major matrix effects.

No MS/MSD analyses were performed upon PEST/PCB analytes. Also, no matrix spike data for cyanide were reported.

Duplicate Analyses

Precision for metals and cyanide methods was measured using duplicate analyses upon sample W-120390-MB-042. Table 7 summarizes the duplicate analyses results. All zinc data were qualified as estimated (J or UJ) based upon low analytical precision. Precisions for remaining analytes, excluding cyanide, were acceptable.

No duplicate analysis for cyanide was reported. Coupled with a lack of matrix spike data, all cyanide results were qualified as estimated (UJ).

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[4]The suffix 'DL' denotes sample was reanalyzed after being diluted.
[5]The suffix 'RE' denotes sample was reanalyzed.

ICP Dilution Recoveries

Matrix effects with respect to ICP data were also checked for using a five-fold dilution of sample W-120390-MB-045. Agreement between five times the five-fold dilution data and undiluted data showed no significant matrix effects.

Method of Standard Addition

Lead results for samples W-120390-MB-038 and W-120390-MD-045 were obtained using method of standard addition. As the correlation coefficients are greater than 0.995, these data are acceptable.

Internal Standard Summaries

Overall instrument performance for VOC and BN/A analyses was monitored using internal standard peak area and retention times. Peak areas from each sample are required to match within +100 percent and -50 percent the daily calibration sample internal standard peak areas. Retention time must match within 0.5 minutes. Examining the data showed both criteria were met. Therefore, the GC/MSs were in proper working order during each analysis.

Trip Blank Samples

Trip blank samples were used to monitor the extent of cross contamination of samples during shipment to Radian. Five trip blank samples were sent from Radian. Each sample contained methylene chloride; however, these results were qualified as non-detect (U). Trichloroethene, 4-methyl-2-pentanone and 1,2-dichloroethane were also detected within selected trip blank samples. However, these concentrations were not comparable to the investigative samples.

Chloromethane was detected at 1 $\mu g/l$ in trip blank sample TB12/4. The chloromethane datum from sample W-120390-MB-038 was qualified as estimated (J) as this concentration was within five time the amount detected in TB12/4.

Rinsate Samples

Rinsate samples were originally part of the field quality assurance plan. However, a switch to dedicated bailer made rinsate samples unnecessary.

Field Duplicate Samples

Overall precision for these sampling events was measured using field duplicate samples. A total of five sets of field duplicate samples was collected. Table 8 lists the field duplicate sample sets.

Field duplicate samples W-121790-JM-014 and W-121790-JM-015 were reanalyzed for VOC due to necessary dilutions. Comparing the reanalyses showed acceptable precision, as did the majority of field duplicate samples.

Samples W-120490-MB-048 and W-120490-MB-050 were analyzed for VOC, BN/A, PEST/PCB, metals and cyanide. Table 9 summarizes detected analyte concentrations for these samples. The overall precision was acceptable.

Overall Assessment

Based on the data packages, the majority of data are acceptable for quantitative assessment purposes. Qualified data are suitable for qualitative assessments, except where the data have been rejected.

TABLE 1

OUTLYING INITIAL CALIBRATION DATA ASSOCIATED WITH SAMPLES COLLECTED DURING THE DECEMBER 1990 EVENTS

Analyte	Date	Analyte	RRF[1]	%RSD[2]	Qualifier[3]	Associated Samples
VOC	11/23/90	Acetone	0.505	43.9	J/UJ	All Samples
		Butanone	0.082	58.8	J/UJ	
BN/A	12/10/90	Benzoic Acid	0.040	29.8	J/R	W-120390-MB-038; W-120390-MB-039; W-120390-MB-042; W-120490-MB-045; W-120490-MB-048; W-120490-MB-049; W-120490-MB-050;
	2/12/92	Nitrobenzene	0.026	63.4	J/R	W-120390-MB-042RE; W-120490-MB-045RE; W-120490-MB-048RE
		2-chloronaphthalene	1.433	37.0	UJ	
		Indeno(1,2,3-cd)pyrene	0.534	36.9	J/UJ	
		Benzo(g,h,i)perylene	0.587	33.0	J/UJ	

1 RRF = Mean Relative Response Factor
2 %RSD = Percent Relative Standard Deviation
3 Associated samples had analyte data qualified as:
J - The associated value is an estimated quantity, for detected analytes.
UJ - The analyte was checked for, but not detected. The associated value is an estimate.
R - The data are unusable.

TABLE 2

OUTLYING CONTINUING CALIBRATION DATA
ASSOCIATED WITH SAMPLES COLLECTED
DURING THE DECEMBER 1990 EVENTS

Analysis	Time/Date	Analyte	RRF[1]	%D[2]	Qualifier[3]	Associated Samples
VOC	12-7;10:36	Butanone	0.129	25.2	NR	
	12-10;10:51	Acetone	0.890	76.2	NR	
		Butanone	0.129	25.2	NR	
	12-11;10:57	Chloromethane	1.88	27.9	J/UJ	W-120690-MH-011; W-120690-MH-011 MS/MSD; W-120690-MH-012; W-120690-MH-013; TB12/6; W-120390-MB-043 MS/MSD
	12-19;10:31	Acetone	0.362	28.3	NR	W-121090-RR-053;
		4-methyl-2-pentanone	0.155	30.2	J/UJ	W-121090-RR-054;
		2-hexanone	0.194	29.2	J/UJ	W-121090-RR-055;
		Xylenes	0.701	27.5	J/UJ	W-121090-RR-056; W-121090-RR-057; W-121090-RR-059
	12/21;11:47	Bromoform	0.110	61	NR	W-121790-JM-014;
		1,2-dichloroethane	1.500	28.7	J/UJ	W-121790-JM-015;
		Vinyl Acetate	2.074	36.6	J/UJ	W-121790-JM-016;
		4-methyl-2-pentanone	0.143	35.6	J/UJ	W-121090-JM-058;
		2-hexanone	0.200	27.0	J/UJ	W-121090-RR-057 MS;
		Xylenes	0.713	26.3	J/UJ	TB12/17;
		d_4-1,2-dichloroethane[4]	0.508	31.9	J/UJ	W-121090-RR-058DL
	12-26;12:37	Chloromethane	3.287	26.1	J/UJ	W-121790-JM-014 DL;
		Bromomethane	4.632	27.5	J/UJ	W-121790-JM-015 DL;
		Acetone	1.910	99.9	NR	W-121790-JM-016 RE;
		Carbon Disulfide	8.583	32.7	J/UJ	W-121790-JM-014 MS/MSD;
		Butanone	0.163	58.3	NR	W-121090-RR-057 MSD;
		Xylenes	0.715	26.1	J/UJ	TB12/17RE

TABLE 2 (CONT'D)

OUTLYING CONTINUING CALIBRATION DATA
ASSOCIATED WITH SAMPLES COLLECTED
DURING THE DECEMBER 1990 EVENTS

Analysis	Time/Date	Analyte	RRF[1]	%D[2]	Qualifier[3]	Associated Samples
BN/A	12-19;09:51	Benzoic Acid	0.024	31.4	NR	W-120390-MB-038;
		Acenaphthylene	0.820	37.3	UJ	W-120390-MB-039;
		4-nitrophenol	0.103	42.5	UJ	W-120390-MB-042;
						W-120490-MB-045;
						W-120490-MB-049;
						W-120490-MB-050
	12-26;11:22	Benzoic Acid	0.023	34.3	NR	W-120490-MB-048
		2-chloronaphthalene	2.203	42.5	UJ	
		Acenaphthylene	0.797	39.1	UJ	
		4-nitrophenol	0.093	48.0	UJ	

[1]RRF = Daily Response Factors
[2]%D = Percent Difference
[3]Associated samples had analyte data qualified as:
J - The associated value is an estimated quantity, for detection analytes.
UJ - The analyte was checked for, but not detected. The associated value is an estimate.
R - The data are unusable.
NR - No additional qualifiers were required.
[4]Surrogate Compound

TABLE 3

ANALYTES DETECTED IN METHOD BLANK SAMPLE

Blank ID	Analyte	Concentration (µg/l)	Associated Samples[1]
VBLK12/11	Methylene Chloride	0.6 J[2]	W-120690-MH-011; W-120690-MH-012; W-120690-MH-013; TB12/6
	Acetone	2	
	2-hexanone	1 J	
VBLK12/07	Methylene Chloride	1	W-120390-MB-038; W-120390-MB-039; W-120390-MB-042; W-120490-MB-045; W-120490-MB-047; W-120490-MB-049; TB12/4
	Acetone	2	W-120390-MB-038
	2-hexanone	0.9 J	
VBLK12/10	Methylene Chloride	0.5 J	W-120390-MB-036; W-120390-MB-037; W-120390-MB-040; W-120390-MB-041; W-120490-MB-043; W-120490-MB-044; W-120490-MB-046; W-120490-MB-048; W-120490-MB-050;
	Acetone	1 J	
	2-hexanone	1 J	
VBLK12/19	Methylene Chloride	0.5 J	W-121090-RR-053; W-121090-RR-054; W-121090-RR-055; W-121090-RR-056; W-121090-RR-057; W-121090-RR-059
	2-hexanone	0.6 J	
VBLK12/20	Methylene Chloride	0.3 J	W-121090-RR-060; W-121190-RR-061; W-121190-RR-062; W-121190-RR-063; W-121190-RR-064; W-121190RR-065; TB12/11

TABLE 3 (CONT'D)

ANALYTES DETECTED IN
METHOD BLANK SAMPLE

Blank ID	Analyte	Concentration (µg/l)	Associated Samples[1]
VBLK12/21	Acetone	2	
VBLK12/26	2-hexanone	0.5 J	
SBLK2/13	Di-*n*-butylphthalate	0.4 J	
	Bis(2-ethylhexyl)phthalate	0.9 J	W-120390-MB-042RE
Metals	Aluminum	44.2 J	W-120390-MB-042; W-120490-MB-049
	Beryllium	0.6 J	
	Calcium	40.9 J	
	Copper	5.9 J	W-120390-MB-038; W-120390-MB-039
	Iron	18 J	W-120390-MB-039
	Magnesium	42 J	
	Zinc	3 J	

[1]Associated samples had analyte result qualified as non-detect.
[2]The associated value is an estimate.

TABLE 4

ADDITIONAL METHYLENE CHLORIDE DATA QUALIFIED AS NON-DETECT

Sample ID
W-121790-MH-014
W-121790-MH-014DL
W-121790-MH-015
W-121790-MH-016
W-121090-RR-058
W-121090-RR-058DL

TABLE 5

OUTLYING SURROGATE COMPOUND PERCENT RECOVERIES

Sample ID	Analysis	Compound	%R[1]	Limits[2]	Qualifier[3]
W-121790-JM-014	VOC	d_4-1,2-dichloroethane	128	76-114	NR
W-121790-JM-014MSD	VOC	4-bromofluorobenzene	116	86-115	NR
W-121790-JM-015	VOC	d_4-1,2-dichloroethane	134	76-114	NR
W-121790-JM-016	VOC	d_4-1,2-dichloroethane	127	76-114	NR
TB12/17	VOC	d_4-1,2-dichloroethane	134	76-114	NR
W-120490-MB-045	BN/A[4]	d_5-phenol	7	10-94	J/R
		2-fluorophenol	0	21-100	
		2,4,6-tribromophenol	1	10-123	
W-120490-MB-045RE	BN/A[4]	2-fluorophenol	1	21-100	J/R
		2,4,6-tribromophenol	2	10-123	
W-120490-MB-048	BN/A[4]	2-fluorophenol	3	21-100	J/R
W-121090-RR-057MS	VOC	d_4-1,2-dichloroethane	123	76-114	NR
W-121090-RR-058	VOC	d_4-1,2-dichloroethane	124	76-114	NR
W-121090-RR-058DL	VOC	d_4-1,2-dichloroethane	122	76-114	NR

---

[1] %R = Percent Recovery

[2] Limits were specified in the QAPP.

[3] Sample data were qualified as:

J - The associated value is an estimated quantity, for detected analytes.

R - The data are usable.

NR - No qualifiers were required.

[4] Only the acid fraction was qualified.

TABLE 6

OUTLYING MS/MSD RECOVERIES

Sample ID	Analysis	Analyte	Percent Recovery MS	Percent Recovery MSD	Limits[1]	Qualifier[2]
W-120690-MH-011	VOC	Trichloroethene	68	66	71-120	J
W-121790-014DL	VOC	Trichloroethene	68	78	71-120	NR
		Toluene	74	77	76-125	NR
W-120390-MB-043	VOC	Trichloroethene	84	98	71-120	J
W-120490-MB-045	Metals	Aluminum	54.8	-	75-125	J
		Antimony	58.1	-	75-125	J
		Barium	55.1	-	75-125	J
		Beryllium	62.2	-	75-125	J
		Cadmium	61.2	-	75-125	J
		Calcium	NC[3]	-	75-125	J
		Chromium	57.2	-	75-125	J
		Cobalt	56.6	-	75-125	J
		Copper	6.8	-	75-125	J
		Iron	46.2	-	75-125	J
		Lead	64	-	75-125	J
		Magnesium	NC	-	75-125	J
		Manganese	22.2	-	75-125	J
		Nickel	56.7	-	75-125	J
		Potassium	NC	-	75-125	J
		Selenium	66.0	-	75-125	J
		Silver	46.2	-	75-125	J
		Sodium	NC	-	75-125	J
		Vanadium	56.2	-	75-125	J
		Zinc	120	-	75-125	J
W-121090-RR-057	VOC	1,1-dichloroethene	116	91	61-145	J
		Trichloroethene	100	150	71-120	J
		Benzene	91	78	76-127	J
		Chlorobenzene	73	77	75-130	NR

---

[1]Limits were specified in the QAPP.

[2]Sample result for analytes were qualified as:

J - The associated value is an estimated quantity, for detected analytes.

UJ - The analyte was checked for, but not detected. The associated value is an estimate.

NR - No qualifiers were required.

[3]Recovery was not calculated.

TABLE 7

SUMMARY OF LABORATORY DUPLICATE ANALYSES

Sample ID	Analysis	Analyte	Concentration ($\mu g/l$) Initial	Duplicate	RPD[1]	Qualifier[2]
W-120390-MB-042	Metals	Antimony	28.2 J[3]	2.10 J	-	NR
		Cadmium	3.8 J	2.4 J	-	NR
		Cobalt	6.5 J	5.2 J	-	NR
		Copper	178.5 J	70.5 J	-	NR
		Nickel	18.8 J	13.8 J	-	NR
		Potassium	1,432 J	1,991 J	-	NR
		Sodium	12,770	12,860	0.7	NR
		Zinc	157.9	107.9	38	J
	Cyanide		Not Reported		-	UJ

[1]RPD = relative percent difference
[2]Analyte data for all samples were qualified as:
J - The associated value is an estimated quantity, for detected analytes.
UJ - The analyte was looked for, but not detected. The associated value is an estimate.
NR - No qualifiers were required.
[3]The associated value is an estimate.

TABLE 8

LIST OF FIELD DUPLICATE SAMPLE SETS

Sample IDs
W-120390-MB-040/W-120390-MB-041
W-121090-RR-053/W-121090-RR-055
W-120490-MB-048/W-120490-MB-050
W-121790-JM-014/W-121790-JM-015
W-121190-RR-064/W-121190-JM-065

TABLE 9

COMPARING FIELD DUPLICATE SAMPLE DATA
FROM W-120490-MB-048 AND W-120490-MB-050

Analysis	Analyte	Concentration (µg/l) W-120490-MB-048	W-120490-MB-050	RPD[1]
VOC	Methylene Chloride	36 U[2]	36 U	-
	1,2-dichloroethane	75	78	3.9
	1,1,1-trichloroethane	8 J[3]	9 J	-
	Trichloroethene	440	440	0
Metals	Antimony	19.1 J	13 J	-
	Barium	59.4 J	35.1 J	-
	Calcium	32,400 J	18,700 J	-
	Cobalt	4.2 J	2.7 J	-
	Copper	54.4	63.6 J	-
	Iron	1,290	1,050	20
	Lead	38.9 J	ND (<1) UJ[4]	-
	Manganese	373 J	219 J	-
	Magnesium	10,700 J	6,150 J	-
	Mercury	ND (<0.1)	0.11 J	-
	Sodium	21,300 J	1,200 J	-
	Zinc	90.8 J	90.6 J	-

[1]RPD = Relative Percent Difference
[2]The associated result is qualified as non-detect.
[3]The associated value is an estimate.
[4]The quantitation limit is an estimate.

MEMORANDUM

TO: Ed Roberts

REFERENCE NO. 2115

FROM: David Dempsey

DATE: March 26, 1991

RE: Data Quality Assessment and Validation for Fifteen Groundwater Samples Collected during the January 1991 Sampling Event at the Wausau, Wisconsin, Site

---

The following details a data quality assessment and validation for 15 groundwater samples collected January 7 and 8, 1991, at the Wausau, Wisconsin, site. All samples were analyzed for target compound list volatile organic compounds (TCL VOC) by the Radian Corporation-Sacramento.[1] Quality assurance criteria are defined in the associated quality assurance project plan (QAPP).[2]

Holding Time Period

The holding time period for VOC samples is defined in the QAPP and requires samples to be analyzed within 14 days from sample collection. Examining the analysis dates showed samples were analyzed within the allotted time frame.

Instrument Performance

Prior to analyzing samples, the gas chromatograph/mass spectrometer (GC/MS) performance was checked using 4-bromofluorobenzene. Relative peak intensities for selected ions were within limits specified in the QAPP. Therefore, the GC/MS was in proper working condition prior to sample analysis.

Initial Calibration Data

The initial calibration data were used to judge analyte response versus concentration. For system performance check compounds, the minimum response factor allowed is 0.300 (0.100 for bromoform[3]). All remaining analytes are required to have response factors greater than 0.050. Percent relative standard deviations for all analytes are required to be less than 30. Table 1 lists the outlying initial calibration data.

The 1,1,2,2-tetrachloroethane mean response factor below the limit of 0.300 (1,1,2,2-tetrachloroethane is a system performance check compound). As reported in the November 1990 data validation memo, this violation has no impact on the data.

The %RSD value for acetone was less than one percent above 30. Thus, the acetone data were not qualified based upon the initial calibration data.

---

[1]The analytical method was the Contract Laboratory Program-Statement of Work, February 1988, revised September 1988 and April 1989.

[2]Application of quality assurance criteria was consistent with "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses", February 1, 1988.

[3]This criterion is from the low level detection VOC CLP-SOW 1990 (draft) and has been extrapolated to these data as the CLP-SOW 1988 does not specify calibration criteria using a 25 ml purge volume.

Continuing Calibration Data

Continuing calibration data were used to assess analyte response versus concentration on a daily basis. For system performance check compounds, daily response factors are required to be greater than 0.300 (0.100 for bromoform). All remaining analytes are required to have daily response factors greater than 0.050. Percent differences between mean response factors and daily response factors for all analytes must be less than 25. Table 2 lists the outlying continuing calibration data.

On January 16 and 21, the 1,1,2,2-tetrachloroethane had response factors below 0.300 and no action upon the data was necessary. Acetone data for all samples were qualified as estimated (J or UJ) as the percent differences between the initial mean and daily calibration factors were greater than 25. Chloromethane data for samples analyzed on January 21 were also qualified as estimated (J or UJ) for this reason.

Method Blank Samples

Extent of lab contamination upon samples was measured using method blank samples. Table 3 summarizes the analytes detected in method blank samples. Note that only methylene chloride was detected and methylene chloride data from associated samples were qualified as non-detect (U).

As a low level detection method was used, the lab stated acetone and methylene chloride in the range of 10 µg/l or less should be considered a lab artifact even if the associated method blank sample is clean. This criterion is applied to the actual result; therefore, dilutions are not taken into consideration. Therefore, samples W-010791-RR-068, W-010791-RR-072 and W-010791-RR-073 methylene chloride data were also qualified as non-detect (U).

Surrogate Compounds Percent Recoveries (Surrogate Recoveries)

Individual sample performance for VOC analyses was judged using surrogate recoveries. Control limits are set in the QAPP. All percent recoveries were within these limits. Thus, the method was in control during each sample analysis.

The d_8-toluene recoveries were calculated using 1,4-difluorobenzene as the internal standard, rather than d_5-chlorobenzene. As d_8-toluene elutes nearly midway between these two internal standards, either may be used to calculate d_8-toluene recoveries.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Percent Recoveries

Matrix efficacy with respect to analytical data was checked using MS/MSD analyses. Sample W-010791-RR-068 underwent MS/MSD analyses.

The trichloroethene MS/MSD recoveries from this sample were 85 and 67, which results in an relative percent difference greater than 14. Therefore, these data were qualified as estimated (J), due to the poor precision. All remaining MS/MSD recoveries showed no significant matrix effects.

Internal Standard Summaries

Overall instrument performance was monitored using internal standard peak areas and retention times. Peak areas from each sample are required to match within +100 percent and -50 percent the daily calibration sample internal standard peak areas. Retention time must match within 0.5 minutes. Examining the data showed both criteria were met. Therefore, the GC/MS was in proper working order during each analysis.

Trip Blank Sample

A trip blank sample was used to monitor the extent of cross contamination of samples during shipment to Radian. Table 4 lists the analytes detected in this sample. The methylene chloride result was qualified as non-detect (U) based upon method blank sample data, and no samples contained 1,2-dichloroethane. The trichloroethene result from sample W-010891-RR-072 was qualified as estimated (J) as this value was within five times the amount in the trip blank sample. Overall, no significant cross contamination had occurred.

Rinsate Samples

Rinsate samples were originally part of the field quality assurance plan. However, a switch to dedicated bailer made rinsate samples unnecessary.

Field Duplicate Samples

Overall precision for these sampling events was measured using field duplicate samples. Two sets of field duplicate samples were collected, namely, W-010791-RR-068 and W-010791-RR-069, W-010891-RR-078 and W-010891-RR-079. Agreement between field duplicate samples was acceptable; indicating the overall sampling program was precise.

Overall Assessment

Overall the data were found to be accurate and precise. Exceptions have been discussed and documented in the above sections. These qualified data may be used for qualitative assessment purposes.

TABLE 1

OUTLYING VOC INITIAL CALIBRATION DATA

Date	Analyte	RRF[1]	% RSD[2]
1/15/91	1,1,2,2-tetrachloroethane	0.293	6.6
	Acetone	0.450	30.2

[1]RRF = mean relative response factor.
[2]% RSD = percent relative standard deviation.

TABLE 2

OUTLYING VOC CONTINUING CALIBRATION DATA

Date/Time	Analyte	RRF[1]	% D[2]	Qualifier[3]	Associated Samples
1/16/91; 10:33	1,1,2,2-tetrachloroethane	0.262	10.6	J/UJ	W-010791-RR-067
	Acetone	0.964	99.9	J/UJ	W-010791-RR-067
					W-010791-RR-068 MSD
					W-010791-RR-071
					W-010891-RR-078
					W-010891-RR-079
					W-010891-RR-080
					TB 1/4
1/21/91; 09:02	1,1,2,2-tetrachloroethane	0.285	2.7	NR	W-010791-RR-066
	Chloromethane	0.897	29.6	J/UJ	W-010791-RR-068 MSD
	Acetone	0.646	43.6	J/UJ	W-010791-RR-074
	Vinyl Acetate	2.365	25.3	NR	W-010891-RR-075
					W-010891-RR-076
					W-010891-RR-077

[1]RRF = daily relative response factor.
[2]% D = Percent difference.
[3]Analyte data for associated samples were qualified as:

J - associated value is an estimated quantity.
UJ - the analyte was checked for, but not detected. The associated value is an estimate.
NR - no qualifiers were required.

TABLE 3

METHYLENE CHLORIDE CONCENTRATIONS IN METHOD BLANK SAMPLES

Blank ID	Concentration (µg/l)	Associated Samples[1]
VBLK 1/16	0.3 J[2]	W-010791-RR-067; W-010791-RR-071; W-010891-RR-078; W010891-RR-079; W-010891-RR-080; TB 1/7
VBLK 1/21	0.3 J	W-010791-RR-066; W-0101791-RR-074; W-010891-RR-075; W-010891-RR-076; W-010891-RR-077

[1]Assocated samples had methylene chloride data qualified as non-detect (U).
[2]The associated value is an estimate.

TABLE 4

ANALYTES DETECTED IN SAMPLE TB1/7

Analyte	Concentration (µg/l)	Associated Samples[1]
Methylene Chloride	0.8 U[2]	
1,2-dichloroethane	0.2 J[3]	
Trichloroethene	0.3 J	W-010791-RR-072

[1]Associated samples had analyte data qualified as estimated (J).
[2]The analyte datum was qualified as non-detect.
[3]The associated value is an estimate.

MEMORANDUM

TO: Ed Roberts

REFERENCE NO. 2115

FROM: David Dempsey

DATE: April 5, 1991

RE: Data Quality Assessment and Validation for Seventeen Groundwater Samples Collected during the February 1991 Sampling Events at the Wausau, Wisconsin, Site

---

The following details a data quality assessment and validation for 17 groundwater samples collected February 12 and 13, 1991, at the Wausau, Wisconsin, site. All samples were analyzed for target compound list volatile organic compounds (TCL VOC) by S-Cubed.[1] Quality assurance/quality control criteria are defined in the associated quality assurance project plan (QAPP).[2]

Holding Time Period

The holding time period for VOC samples is defined in the QAPP and requires samples to be analyzed within 14 days from sample collection. Examining the analysis dates showed samples were analyzed within the allotted time frame.

Instrument Performance

Prior to analyzing samples, the gas chromatograph/mass spectrometer (GC/MS) performance was checked using 4-bromofluorobenzene. Relative peak intensities for selected ions were within limits specified in the QAPP. Therefore, the GC/MS was in proper working condition prior to sample analysis.

Initial Calibration Data

The initial calibration data were used to judge analyte response versus concentration. For system performance check compounds, the minimum response factor allowed is 0.300 (0.100 for bromoform).[3] All remaining analytes are required to have response factors greater than 0.050. Percent relative standard deviations for all analytes are required to be less than 30. Table 1 lists the outlying initial calibration data.

Bromoform and 1,1,2,2-tetrachloroethane mean response factors were below these limits. However, discussing the matter with S-Cubed revealed bromoform and 1,1,2,2-tetrachloroethane do not usually meet these limits when using a 25 m*l* purge volume and a packed column. Thus, these violations have no impact on the data. A copy of a letter confirming this is presented as Attachment A.

Butanone data for all samples were qualified as estimated (J) or unusable (R) as the mean relative response factor was 0.045. Acetone data for all samples were qualified as estimated (J or UJ) as the percent relative standard deviation was 32.5.

---

[1]The analytical method was the Contract Laboratory Program-Statement of Work, February 1988, revised September 1988 and April 1989.

[2]Application of quality assurance/quality control criteria was consistent with "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses", February 1, 1988.

[3]These criteria are from the low level detection VOC CLP-SOW 1990 (draft) and have been extrapolated to these data as the CLP-SOW 1988 does not specify calibration criteria using a 25 m*l* purge volume.

Continuing Calibration Data

Continuing calibration data were used to assess analyte response versus concentration on a daily basis. For system performance check compounds, daily response factors are required to be greater than 0.300 (0.100 for bromoform). All remaining analytes are required to have daily response factors greater than 0.05. Percent differences between mean response factors and daily response factors for all analytes must be less than 25. Table 2 lists the outlying continuing calibration data.

Again, bromoform and 1,1,2,2-tetrachloroethane had response factors below these limits and no action upon the data was necessary. Butanone was the only other analyte to fail continuing calibration criteria; however, as these data were qualified based upon the initial calibration data, no additional action was necessary.

Method Blank Samples

Extent of lab contamination of samples was measured using method blank samples. Table 3 summarizes the analytes detected in method blank samples. Note that only methylene chloride was detected often and had data qualified from associated samples as non-detect (U).

Surrogate Compounds Percent Recoveries (Surrogate Recoveries)

Individual sample performance for VOC analyses was judged using surrogate recoveries. Control limits are set in the QAPP. All percent recoveries were within these limits.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Percent Recoveries

Matrix efficacy with respect to analytical data was checked using MS/MSD analyses. Sample W-021291-RR-090 underwent MS/MSD analyses. The relative percent difference for trichloroethene MS/MSD recoveries was reported to be 9. Recalculating yields a value of 24, which is correct. As a result, the trichloroethene datum for this sample was qualified as estimated (J). Thus, no significant matrix effects were observed.

Internal Standard Summaries

Overall instrument performance was monitored using internal standard peak area and retention times. Peak areas are required to match within +100 percent and -50 percent the daily calibration sample internal standard peak areas. Retention time must match within 0.5 minutes. Examining the data showed both criteria were met. Therefore, the GC/MS was in proper working order during each analysis.

Trip Blank Samples

A trip blank sample was used to monitor the extent of cross contamination of samples during shipment to S-Cubed. This sample contained methylene chloride; however, this datum was qualified as non-detect (U). Thus, no significant cross contamination was observed.

Rinsate Samples

Rinsate samples were originally part of the field quality assurance plan. However, a switch to dedicated bailers made rinsate samples unnecessary.

Field Duplicate Samples

Overall precision for this sampling event was measured using field duplicate samples. Two sets of field duplicate samples were collected, namely, W-021291-RR-090 and W-021291-RR-091, W-021391-RR-095 and W-021391-RR-096. The latter set was reanalyzed as dilutions to bring all analyte peaks on scale were required. Agreement between the field duplicate samples showed this event was precise.

Overall Assessment

Overall the data were found to be accurate and precise. Exceptions have been discussed and documented in the above sections. These qualified data may be used for qualitative assessment purposes, except where the data have been rejected.

TABLE 1

OUTLYING INITIAL CALIBRATION DATA

Analyte	RRF[1]	%RSD[2]	Qualifier[3]
Bromoform	0.094	11.7	NR
1,1,2,2-tetrachloroethane	0.273	9.8	NR
Acetone	0.227	32.5	J/UJ
Butanone	0.045	15.7	J/R

---

[1]RRF = Mean Relative Response Factor
[2]%RSD = Percent Relative Standard Deviation
[3]All samples had analyte data qualified as:
J - The associated value is an estimated quantity, for detected analytes.
UJ - The analyte was checked for, but not detected. The associated value is an estimate.
R - The datum is unusable, for non-detected results.

TABLE 2

OUTLYING CONTINUING CALIBRATION DATA

Date/Time	Analyte	RRF[1]	%D[2]	Qualifier[3]
2/19; 10:47	Bromoform	0.093	1.5	NR
	1,1,2,2-tetrachloroethane	0.288	5.5	NR
	Butanone	0.049	8.6	NR
2/20; 08:18	Bromoform	0.087	7.8	NR
	1,1,2,2-tetrachloroethane	0.249	8.9	NR

[1] RRF = Daily Relative Response Factor
[2] %D = Percent Difference
[3] No data were qualified based upon continuing calibrations.

TABLE 3

ANALYTES DETECTED WITH METHOD BLANK SAMPLES

Method Blank	Analyte	Concentration (µg/l)	Associated Samples[1]
VBLK11	Methylene Chloride	3.3	W-021291-RR-084; W-021291-RR-086;
	Acetone	8.4	W-021291-RR-081; W-021291-RR-083; W-021291-RR-084; W-021291-RR-085; W-021291-RR-086
VBLK12	Methylene Chloride	2.2	W-021291-RR-086DL[2]
VBLK13	Methylene Chloride	3.1	W-021391-RR-092DL; W-021391-RR-093DL; W-021391-RR-096DL; W-021391-RR-097DL; TB02/12-13

[1] Associates samples had analyte datum qualified as non-detect (U).
[2] Sample was diluted and re-analyzed.

ATTACHMENT A

S-CUBED
A Division of Maxwell Laboratories, Inc.

Rec'd CRA

April 4, 1991

APR 05 91

David Dempsey
Conestoga-Rovers and Associates
382 W. County Road D
St. Paul, MN 55112

Dear Mr. Dempsey:

This letter is to confirm our recent discussion concerning the mean relative response factors for bromoform and 1,1,2,2-tetrachloroethane. EPA 2/88 SOW VOA procedures call for minimum RRFs for these compounds of 0.25 and 0.30, respectively. When modifying the method by introducing a 25-mL purge in place of a 5-mL purge, the achievable RRFs for these compounds are reduced. 1,1,2,2-Tetrachloroethane RRFs are generally in the range of 0.20 and 0.30. Bromoform is affected more significantly especially when a packed column is used. The RRFs generally achieved under these circumstances range from 0.08 to 0.15. Detection limit studies performed by S-Cubed under these analytical conditions for bromoform have demonstrated a detection limit of 0.2 µg/L. This indicates that the lower response does not affect the quality of the data produced.

We are currently one of two laboratories that are performing low detection VOA analysis for Region V's residential well program and using the draft CLP 25-mL procedure. This procedure utilizes a capillary column for the GC separation. By utilizing a capillary column instead of a packed column (as we currently do for the MEM project). Bromoform RRFs are generally in the 0.15 to 0.22 range and pass the criteria. 1,1,2,2-Tetrachloroethane is still reduced and does not meet the criteria and we take exception to this requirement. Some versions of the method do allow two compounds to be out.

If I can provide more information concerning this issue, please let me know.

Sincerely,

John DeWald
Manager, Commerical Analysis

P.O. Box 1620, La Jolla, California 92038-1620 3398 Carmel Mountain Road, San Diego, California 92121-1095
Tel: (619) 453-0060 TWX: 910-337-1253 FAX: (619) 755-0474

MEMORANDUM

TO: Ed Roberts

REFERENCE NO. 2115

FROM: David Dempsey

DATE: April 18, 1991

RE: Data Quality Assessment and Validation for Sixteen Groundwater Samples Collected during the March 1991 Sampling Event at the Wausau, Wisconsin Site

---

The following details a data quality assessment and validation for 16 groundwater samples collected March 4 and 5, 1991, at the Wausau, Wisconsin, site. All samples were analyzed for target compound list volatile organic compounds (TCL VOC) by S-Cubed.[1] Seven samples were also analyzed for target analyte list metals by S-Cubed. Quality assurance/quality control criteria are defined in the associated quality assurance project plan (QAPP).[2]

Holding Time Period

The holding time period for VOC samples is defined in the QAPP. VOC samples must be analyzed within 14 days from sample collection. Metals samples must be analyzed within 6 months (28 days-mercury) from sample collection. Examining the analysis dates showed samples were analyzed within allotted time frames.

Instrument Performance

Prior to analyzing samples, the gas chromatograph/mass spectrometer (GC/MS) performance was checked using 4-bromofluorobenzene. Selected ion relative peak intensities were within limits specified in the QAPP. Therefore, the GC/MS was in proper working condition prior to sample analysis.

Initial Calibration Data

The initial calibration data were used to judge analyte response versus concentration. For system performance check compounds, the minimum response factor allowed is 0.300 (0.100 for bromoform[3]). All remaining analytes are required to have response factors greater than 0.050. Percent relative standard deviations for all analytes are required to be less than 30. Bromoform and 1,1,2,2-tetrachloroethane mean response factors were below these limits However, discussing the matter with S-Cubed revealed bromoform and 1,1,2,2-tetrachloroethane do not usually meet these limits when using a 25 m*l* purge volume and a packed column. As reported in the data validation memo for the February 1991 event, these violations have no impact on the data.

---

[1]The analytical method was the Contract Laboratory Program-Statement of Work, February 1988, revised September 1988 and April 1989.

[2]Application of quality assurance/quality control criteria was consistent with "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses", February 1, 1988 and "Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses", July 1, 1988.

[3]This criterion is from the low level detection VOC CLP-SOW 1990 (draft) and has been extrapolated to these data as the CLP-SOW 1988 does not specify calibration criteria using a 25 m*l* purge volume.

Calibration curves for metals consisted at least of two points. Atomic absorption method calibration curves had four points, while the mercury calibration curve had five points. Calibration coefficients for all curves were greater than 0.995. Thus, the instruments used for metals analyses were properly calibrated.

Continuing Calibration Data

Continuing calibration data were used to assess analyte response versus concentration on a daily basis. For system performance check compounds, daily response factors are required to be greater than 0.300 (0.100 for bromoform). All remaining analytes are required to have daily response factors greater than 0.05. Percent differences between mean response factors and daily response factors for all analytes must be less than 25. Table 1 lists the outlying VOC continuing calibration data.

Again, bromoform and 1,1,2,2-tetrachloroethane had response factors below these limits and no action upon the data was necessary. Acetone, butanone and 2-hexanone also failed continuing calibration criteria. Therefore, these analyte data were qualified as directed in Table 1 as estimated (J or UJ) or unusable (R).

Calibration standards were analyzed to verify the metals calibration curves. Thallium, selenium and arsenic had standards with recoveries below the control limits. However, as these recoveries were less than one percent below the limits, no action upon the data was necessary. Thus, the instruments used for metals analyses were properly calibrated.

Method Blank Samples

Extent of lab contamination of samples was measured using method blank samples. Table 2 summarizes the analytes detected in method blank samples. Note that only methylene chloride was detected in both VOC method blank samples and had data qualified from associated samples as non-detect (U). Copper, iron, lead and zinc were all detected in the metals method blank sample and had data qualified as non-detect (U).

Initially, nickel was reported in the method blank sample at -129 μg/*l*. S-Cubed reported instrument problems and recalculated nickel concentrations for all samples. Thus, no extensive lab contamination was observed.

Laboratory Control Samples

Accuracy for metals methods was measured using control samples. Percent recoveries are required to between 80 and 120. However, lead and arsenic percent recoveries were 136 and 144 percent, respectively. Therefore, all detected data for each analyte were qualified as estimated (J). Accuracy for remaining metals was acceptable.

ICP Interference Check Sample

The ICP method was shown to be free of interelemental interferences via a check sample. As the percent recoveries were within specified limits, no interelemental interferences were observed.

Surrogate Compounds Percent Recoveries (Surrogate Recoveries)

Individual sample performance for VOC analyses was judged using surrogate recoveries. Control limits are set in the QAPP. All percent recoveries were within these limits.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Percent Recoveries

Matrix efficacy with respect to analytical data was checked using MS/MSD analyses. Sample W-030491-RR-102 underwent VOC MS/MSD analyses. The relative percent difference for trichloroethene MS/MSD recoveries was reported to be 10. Recalculating gives a value of 11, which is correct. Thus, no significant matrix effects were observed for VOC analyses.

Samples W-030491-RR-104, W-030591-RR-112 and W-030591-RR-115 underwent metals MS/MSD analyses. Table 3 lists the outlying recoveries. As a result, thallium data for all samples were qualified as estimated (J) or unusable (R), mercury data for all samples were qualified as estimated (J or UJ), and silver data for all samples were qualified as estimated (J) for detected results only. No severe matrix effects were observed for the remaining metals.

Laboratory Duplicate Analyses

Precision for metals analyses was measured using duplicate analyses of samples W-030591-RR-112 and W-030591-RR-115. Thallium duplicate analyses for sample W-030591-RR-112 showed poor precision; however, as thallium datum for this sample was already qualified as unusable (R), no additional action was taken. Duplicate analyses for sample W-030591-RR-115 showed an acceptable degree of precision. Therefore, these methods were precise when investigative samples were analyzed.

Internal Standard Summaries

Overall instrument performance was monitored using internal standard peak area and retention times. Peak areas are required to match within +100 percent and -50 percent the daily calibration sample internal standard peak areas. Retention time must match within 0.5 minutes. Examining the data showed both criteria were met. Therefore, the GC/MS were in proper working order during each analysis.

Trip Blank Samples

A trip blank sample was used to monitor the extent of cross contamination of samples during shipment to S-Cubed. This sample contained trichloroethene at 1.2 µg/*l*. Trichloroethene data from samples W-030491-RR-102, W-030491-RR-107 and W-030591-RR-111 were qualified as estimated as these data were within five times the amount detected in the trip blank sample. Overall, no significant cross contamination was observed.

Rinsate Samples

Rinsate samples were originally part of the field quality assurance plan. However, a switch to dedicated bailers made rinsate samples unnecessary.

Field Duplicate Samples

Overall precision for these sampling events was measured using field duplicate samples. Two sets of field duplicate samples were collected, namely, W-030491-RR-102 and W-030491-RR-103, W-030591-RR-112 and W-030591-RR-113. Both sets were analyzed for VOC only. Based on these data, the overall event was precise for VOC.

No field duplicate samples for metals were collected.

Overall Assessment

Overall the data were found to be accurate and precise. Exceptions have been discussed and documented in the above sections. These qualified data may be used for qualitative assessment purposes, except where the data have been rejected.

TABLE 1

OUTLYING VOC CONTINUING CALIBRATION DATA ASSOCIATED WITH THE WAUSAU, WISCONSIN SITE

Date/Time	Analyte	RRF[1]	%D[2]	Qualifier[3]	Associated Samples
3/11, 10:48	Butanone	0.043	14.1	J/R	W-030491-RR-100
	Bromoform	0.110	10	NR	W-030491-RR-101
	1,1,2,2-tetrachloroethane	0.263	3.6	NR	W-030491-RR-103
	Acetone	0.118	45.7	J/UJ	W-030491-RR-104
	2-hexane	0.095	31.7	J/UJ	W-030491-RR-105
					W-030491-RR-106
					W-030591-RR-108
					W-030591-RR-109
					W-030591-RR-110
					W-030591-RR-111
					W-030591-RR-112
					W-030591-RR-113
					W-030591-RR-114
					TB 3/91

TABLE 1 (CONT'D)

OUTLYING VOC CONTINUING CALIBRATION DATA ASSOCIATED WITH THE WAUSAU, WISCONSIN SITE

Date/Time	Analyte	RRF[1]	%D[2]	Qualifier[3]	Associated Samples
3/12, 8:40	Acetone	0.319	46.8	J/UJ	W-030491-RR-102
	Butone	0.072	42.2	J/UJ	W-030491-RR-107
	Bromoform	0.107	1.9	NR	W-030491-RR-101DL
	1,1,2,2-tetrachloroethane	0.265	3.0	NR	W-030491-RR-103DL
					W-030491-RR-105DL
					W-030591-RR-109DL
					W-030591-RR-112DL
					W-030591-RR-113DL
					W-030591-RR-114DL
3/13; 9:40	Chloromethane	1.277	34.9	J/UJ	W-030591-RR-108DL
	Acetone	0.300	37.8	J/UJ	W-030591-RR-110DL
	Butanone	0.068	35.4	J/UJ	
	Bromoform	0.080	26.3	J/UJ	
	1,1,2,2-tetrachloroethane	0.238	12.9	NR	

[1]RRF = Daily Relative Response Factor
[2]%D = Percent Difference
[3]Analyte datum for associated samples was qualified as:
J = The associated value is an estimated quantity, for detected analytes.
UJ = The analyte was checked for, but not detected. The associated value is an estimate.
R = The datum is rejected, for non-detected analytes.
NR = No additional qualifiers were required.

TABLE 2

ANALYTES DETECTED IN METHOD BLANK SAMPLES ASSOCIATED WITH THE WAUSAU, WISCONSIN, SITE

Blank ID	Analyte	Concentration (µg/*l*)	Associated Samples[1]
VBLK11	Methylene Chloride	1.5	W-030491-RR-103
	Acetone	5.8	
VBLK12	Methylene Chloride	2.2	W-030491-RR-103DL
Metals	Copper	22 *J*[2]	W-030491-RR-102; W-030491-RR-104; W-030491-RR-105; W-030591-RR-111; W-030591-RR-112; W-030591-RR-114; W-030591-RR-115
	Iron	71 *J*	W-030491-RR-105
	Lead	1.5 *J*	W-030491-RR-102; W-030591-RR-112; W-030591-RR-114; W-030591-RR-115
	Zinc	59	W-030591-RR-102; W-030591-RR-114; W-030591-RR-115

[1] Analyte data from associated samples were qualified as non-detect (U).
[2] The associated value is an estimate.

TABLE 3

OUTLYING METALS/MATRIX SPIKE RECOVERIES FOR SAMPLES COLLECTED AT THE WAUSAU, WISCONSIN, SITE

Blank ID	Analyte	Percent Recovery	Limits[1]	Qualifier[2]
W-030491-RR-105	Mercury	61.4	75-125	J/UJ
W-030591-RR-112	Thallium	18	75-125	J/R
W-030591-RR-115	Silver	144	75-125	J/NR

[1]Limits are specified in the QAPP.
[2]Analyte data for all samples are qualified as:
J - the associated value is an estimated quantity for detected analytes.
UJ - the analyte was checked for, but not detected. The associated value is an estimate.
R - The datum is rejected, for non-detected analytes.
NR - No additional qualifiers are necessary.

MEMORANDUM

TO: Ed Roberts

REFERENCE NO. 2115

FROM: David Dempsey

DATE: April 30, 1991

RE: Addendum to the March 1991 Data Validation and Assessment Memo for the March 1991 Sampling event at the Wausau, Wisconsin Site

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S-Cubed reported lead data for seven groundwater samples collected during the March 1991 sampling event at the Wausau, Wisconsin site. The lead control sample percent recovery was out of control limits. Therefore, S-Cubed reanalyzed these samples. The following details a data quality assessment and validation for these reanalyses.

Holding Time Period

Holding time period for lead analysis is six months from sample collection to completion of analysis. Examining the analysis dates showed the lead holding time period was met.

Continuing Calibration

The initial calibration curve consisted of one blank and four standards. The correlation coefficient was greater than 0.995; therefore, the initial calibration was acceptable.

Calibration standards were analyzed prior to sample analyses. The percent recoveries were within ten percent of the standard's concentration. Therefore, the instrument was properly calibrated.

Continuing Calibrations

Calibration standards were used to verify the instrument calibration during sample analyses. As the percent recoveries were within ten percent of the standard's concentration, the instrument calibration was verified for all sample analyses.

Method Blank Samples

Lab contamination was measured using a method blank sample. This sample was free of lead; therefore, no lab contamination was observed.

Lab Control Sample

Overall accuracy for this method was measured using a check sample. As the percent recovery was within ten percent of the sample concentration, the method was accurate.

Matrix Spike Analyses

Matrix effects were checked for using a matrix spike analysis upon sample W-030491-RR-102. As the percent recovery was within limits, no significant matrix effects were observed.

Lab Duplicate Analysis

Analytical precision was measured using duplicate analysis of sample W-030491-RR-102. As both analyses were in agreement, the precision was acceptable.

Field Quality Assurance Samples

No field quality assurance samples were analyzed for lead.

Overall Assessment

The data are accurate and precise. Therefore, the data may be used for quantitative assessment of lead concentrations.

MEMORANDUM

TO: Ed Roberts

FROM: David Dempsey

REFERENCE NO. 2115

DATE: May 9, 1991

RE: Data Quality Assessment and Validation for Fifteen Groundwater Samples Collected during the April 1991 Sampling Event at the Wausau, Wisconsin Site

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The following details a data quality assessment and validation for 15 groundwater samples collected on April 1, 1991, at the Wausau, Wisconsin site. All samples were analyzed for target compound list volatile organic compounds (TCL VOC) by S-Cubed.[1] Quality assurance/quality control criteria are defined in the associated quality assurance project plan (QAPP).[2]

<u>Holding Time Period</u>

The holding time period for VOC samples is defined in the QAPP. All VOC samples must be analyzed within 14 days from sample collection. Examining the analysis dates showed samples were analyzed within the allotted time frame.

<u>Instrument Performance</u>

Prior to analyzing samples, the gas chromatograph/mass spectrometer (GC/MS) performance was checked using 4-bromofluorobenzene. Selected ion relative peak intensities were within limits specified in the QAPP. Therefore, the GC/MS was in proper working condition prior to sample analysis.

<u>Initial Calibration Data</u>

The initial calibration data were used to judge analyte response versus concentration. For system performance check compounds, the minimum response factor allowed is 0.300 (0.100 for bromoform[3]). All remaining analytes are required to have response factors greater than 0.050. Percent relative standard deviations for all analytes are required to be less than 30. Bromoform and 1,1,2,2-tetrachloroethane mean response factors were below these limits However, discussing the matter with S-Cubed revealed bromoform and 1,1,2,2-tetrachloroethane do not usually meet these limits when using a 25 m*l* purge volume and a packed column. As reported in the data validation memo for the February 1991 event, these violations have no impact on the data.

Acetone failed the percent relative percent difference criteria for both initial calibration curves. Therefore all acetone data are qualified as estimated (J or UJ).

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[1]The analytical method was the Contract Laboratory Program-Statement of Work, February 1988, revised September 1988 and April 1989.

[2]Application of quality assurance/quality control criteria was consistent with "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses", February 1, 1988.

[3]This criterion is from the low level detection VOC CLP-SOW 1990 (draft) and has been extrapolated to these data as the CLP-SOW 1988 does not specify calibration criteria using a 25 m*l* purge volume.

Continuing Calibration Data

Continuing calibration data were used to assess analyte response versus concentration on a daily basis. For system performance check compounds, daily response factors are required to be greater than 0.300 (0.100 for bromoform). All remaining analytes are required to have daily response factors greater than 0.05. Percent differences between mean response factors and daily response factors for all analytes must be less than 25. Table 1 lists the outlying VOC continuing calibration data.

Again, bromoform and 1,1,2,2-tetrachloroethane had response factors below these limits and no action upon the data was necessary. On April 10, vinyl acetate and 4-methyl-2-pentanone also failed continuing calibration criteria. Therefore, these analyte data from samples listed in Table 1 are qualified as estimated (J or UJ).

Method Blank Samples

Extent of lab contamination of samples was measured using method blank samples. Methylene chloride was detected in the method blank sample from April 10. As a result, methylene chloride data from samples W-040191-RR-133 and TB4/2 are qualified as non detect (U). As no other action upon the data based upon method blank sample data was necessary, no significant lab contamination was observed.

However, methylene chloride and acetone were detected in diluted analyses for several samples, which are listed in Table 2. These analytes were not detected in initial analyses; therefore, the water used to dilute these samples is the most likely source. These data are believed to be lab artifacts, even though the associated method blank samples are VOC free. Therefore, these data are qualified as non detect (U).

Surrogate Compounds Percent Recoveries (Surrogate Recoveries)

Individual sample performance for VOC analyses was judged using surrogate recoveries and control limits are set in the QAPP. All percent recoveries were within these limits, indicating the method was in control for all analyses.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Percent Recoveries

Matrix efficacy with respect to analytical data was checked using MS/MSD analyses. Sample W-040191-RR-130 underwent VOC MS/MSD analyses. The reported percent difference recoveries were miscalculated due to rounding errors. Table 3 presents the corrected MS/MSD recoveries, which indicate that there are no significant matrix effects upon the data.

Internal Standard Summaries

Overall instrument performance was monitored using internal standard peak area and retention times. Peak areas are required to match within +100 percent and -50 percent the daily calibration sample internal standard peak areas. Retention time must match within 0.5 minutes. Examining the data showed both criteria were met. Therefore, the GC/MS was in proper working order during each analysis.

Trip Blank Samples

A trip blank sample was used to monitor the extent of cross contamination of samples during shipment to S-Cubed. This sample contained methylene chloride, acetone and trichloroethene. Concentrations are given in Table 4. Samples listed in Table 4 have the analyte datum qualified as estimated (J) as the sample concentration is less than five times the amount detected in the trip blank sample.

Rinsate Samples

Rinsate samples were originally part of the field quality assurance plan. However, a switch to dedicated bailers made rinsate samples unnecessary.

Field Duplicate Samples

Overall precision for these sampling events was measured using field duplicate samples. Two sets of field duplicate samples were collected, namely, W-040191-RR-127 and W-040191-RR-128, W-040191-RR-130 and W-040191-RR-131. Based on these data, the overall event was precise.

Overall Assessment

Overall the data were found to be accurate and precise. Exceptions have been discussed and documented in the above sections. These qualified data may be used for qualitative assessment purposes.

TABLE 1

OUTLYING VOC CONTINUING CALIBRATION DATA ASSOCIATED WITH THE WAUSAU, WISCONSIN SITE

Date/Time	Analyte	RRF[1]	%D[2]	Qualifier[3]	Associated Samples[4]
4/10; 8:08	Vinyl Acetate	0.073	31.2	J/UJ	W-040191-RR-128
	4-methyl-2-pentanone	0.17	28.2	J/UJ	W-040191-RR-129
	Bromoform	0.095	23.7	NR	W-040191-RR-130
	1,1,2,2-tetrachloroethane	0.281	20.7	NR	W-040191-RR-132
					W-040191-RR-133
					W-040191-RR-134
					W-040191-RR-123DL
					W-040191-RR-124DL
					W-040191-RR-125DL
					W-040191-RR-126DL
					W-040191-RR-127DL
					TB 4/2
4/12; 8:26	Bromoform	0.083	1.3	NR	W-040191-RR-130DL
	1,1,2,2-tetrachloroethane	0.239	13.9	NR	

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1 RRF = Daily relative response factor
2 %D = Percent difference
3 Analyte datum for associated samples is qualified as:
J - The associated value is an estimated quantity.
UJ - The analyte was checked for, but not detected. The associated value is an estimate.
NR - No additional qualifers are necessary.
4 Sufix 'DL' represents a diluted analysis.

TABLE 2

SUMMARY OF DILUTED ANALYSES WITH DETECTABLE AMOUNTS OF ACETONE AND/OR METHYLENE CHLORIDE WAUSAU, WISCONSIN

Sample ID	Qualified[1]
W-040191-RR-128DL	Acetone
W-040191-RR-129DL	Acetone
W-040191-RR-130DL	Methylene Chloride Acetone

[1] Analyte datum from the sample is qualified as non-detect (U).

TABLE 3

CORRECTED MS/MSD RECOVERIES
WAUSAU, WISCONSIN

Sample ID	Analyte	Percent Recovery MS	Percent Recovery MSD	Limits[1]
W-040191-RR-130	1,1-dichloroethene	131	135	61-145 (14)
	Trichloroethene	68	75	71-120 (14)
	Benzene	124	127	76-127 (11)
	Toluene	110	107	76-125 (13)
	Chlororbenzene	113	111	75-130 (13)

[1] Limits are specified in the QAPP.

TABLE 4

ANALYTES DETECTED IN THE TRIP BLANK SAMPLE
WAUSAU, WISCONSIN

Analyte	Concentration (mg/l)	Associated Samples[1]
Methylene Chloride	2.7 U[2]	
Acetone	19	W-040191-RR-122 W-040191-RR-124 W-040191-RR-127 W-040191-RR-132 W-040191-RR-137
Trichloroethene	1.2	W-040191-RR-122 W-040191-RR-134

[1] Analyte datum is qualified as estimated (J).
[2] Analyte datum is qualified as non-detect, based upon method blank samples data.

MEMORANDUM

TO: Ed Roberts

FROM: David Dempsey

REFERENCE NO. 2115

DATE: June 8, 1991

RE: Data Quality Assessment and Validation for Eighteen Groundwater Samples Collected during the May 1991 Sampling Event at the Wausau, Wisconsin Site

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The following details a data quality assessment and validation for 18 groundwater samples collected on May 6 and 7, 1991, at the Wausau, Wisconsin site. All samples were analyzed for target compound list volatile organic compounds (TCL VOC) by S-Cubed.[1] Quality assurance/quality control criteria are defined in the associated quality assurance project plan (QAPP).[2]

Holding Time Period

The holding time period for VOC samples is defined in the QAPP. All VOC samples must be analyzed within 14 days from sample collection. Examining the analysis dates showed samples were analyzed within the allotted time frame.

Instrument Performance

Prior to analyzing samples, the gas chromatograph/mass spectrometer (GC/MS) performance was checked using 4-bromofluorobenzene. Selected ion relative peak intensities are within limits specified in the QAPP. Therefore, the GC/MS was in proper working condition prior to sample analysis.

Initial Calibration Data

The initial calibration data were used to judge analyte response versus concentration. For system performance check compounds, the minimum response factor allowed is 0.300 (0.100 for bromoform[3]). All remaining analytes are required to have response factors greater than 0.050. The 1,1,2,2-tetrachloroethane mean response factors were below this limit However, discussing the matter with S-Cubed revealed 1,1,2,2-tetrachloroethane does not usually meet this limit when using a 25 m*l* purge volume and a packed column. As reported in the data validation memo for the February 1991 sampling event, these violations have no impact on the data. Percent relative standard deviations for all analytes are required to be less than 30.

On May 16, butanone and vinyl acetate failed the minimum response factor criterion. Butanone also failed this criterion on May 20. Therefore, all butanone data and vinyl chloride data from samples analyzed before May 20 are qualified as estimated (J) or

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[1]The analytical method was the Contract Laboratory Program-Statement of Work, February 1988, revised September 1988 and April 1989.

[2]Application of quality assurance/quality control criteria was consistent with "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses", February 1, 1988.

[3]This criterion is from the low level detection VOC CLP-SOW 1990 (draft) and has been extrapolated to these data as the CLP-SOW 1988 does not specify calibration criteria using a 25 m*l* purge volume.

unusable (R). On May 20, acetone failed the percent difference criterion for both initial calibration curves. Therefore, acetone data from samples analyzed on May 20 are qualified as estimated (J or UJ). These violations are summarized in Table 1.

Continuing Calibration Data

Continuing calibration data were used to assess analyte response versus concentration on a daily basis. For system performance check compounds, daily response factors are required to be greater than 0.300 (0.100 for bromoform). All remaining analytes are required to have daily response factors greater than 0.050. Percent differences between mean response factors and daily response factors for all analytes must be less than 25. Table 2 lists the outlying VOC continuing calibration data.

Again, 1,1,2,2-tetrachloroethane had response factors below the required limit and no action upon the data was necessary. Butanone and vinyl acetate violated the continuing calibration criteria on each day samples were analyzed (excluding vinyl acetate on May 20.) However, as these data have been qualified based upon the initial calibration data, no additional action upon is necessary.

Method Blank Samples

Extent of lab contamination of samples was measured using method blank samples. Methylene chloride was detected in the method blank samples from May 17 and May 20. As a result, methylene chloride data from sample W-050791-RR-149 is qualified as non detect (U). As no other action upon the data based upon method blank sample data was necessary, no significant lab contamination was observed.

Surrogate Compounds Percent Recoveries (Surrogate Recoveries)

Individual sample performance for VOC analyses was judged using surrogate recoveries and control limits are set in the QAPP. All percent recoveries were within these limits, indicating the method was in control for all analyses.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Percent Recoveries

Matrix efficacy with respect to analytical data was checked using MS/MSD analyses. Sample W-050691-RR-140 underwent VOC MS/MSD analyses. The reported percent difference values were miscalculated due to rounding errors. Table 3 presents the corrected percent difference values, which indicate the analytical precision is acceptable. No matrix effects upon the data were observed.

Internal Standard Summaries

Overall instrument performance was monitored using internal standard peak area and retention times. Peak areas are required to match within +100 percent and -50 percent the daily calibration sample internal standard peak areas. Retention time must match within 0.5 minutes. Examining the data showed all samples met these criteria. Therefore, the GC/MS was in proper working order during each analysis.

Trip Blank Samples

A trip blank sample was used to monitor the extent of cross contamination of samples during shipment to S-Cubed. This sample contained chloromethane and butanone. As samples did not contain either analytes within five times the amount detected in the trip blank sample, no cross contamination was observed.

Rinsate Samples

Rinsate samples were originally part of the field quality assurance plan. However, a switch to dedicated bailers made rinsate samples unnecessary.

Field Duplicate Samples

Overall precision for these sampling events was measured using field duplicate samples. Two sets of field duplicate samples were collected, namely, W-050691-RR-140 and W-050691-RR-151, W-050791-RR-143 and W-050791-RR-144. Based on these data, the overall event was precise.

Overall Assessment

Overall the data were found to be accurate and precise. Exceptions have been discussed and documented in the above sections. These qualified data may be used for qualitative assessment purposes, except where the data have been rejected.

TABLE 1

OUTLYING INITIAL CALIBRATION DATA

Date	Analyte	RRF[1]	%RSD[2]	Qualifier[3]	Associated Samples[4]
5/16	Butanone	0.034	31.7	J/R	W-050691-RR-135
	Vinyl Acetate	0.032	11.1	J/R	W-050691-RR-136
	1,1,2,2-tetrachloroethane	0.272	6.2	NR	W-050691-RR-136 DL
					W-050691-RR-137
					W-050691-RR-138
					W-050691-RR-139
					W-050691-RR-140
					W-050791-RR-141
					W-050791-RR-142
					W-050791-RR-142 DL
					W-050791-RR-143
					W-050791-RR-143 DL
					W-050791-RR-144
					W-050791-RR-145
					W-050791-RR-145 DL
					W-050791-RR-146
					W-050791-RR-147
					W-050791-RR-148
					W-050791-RR-149
					W-050791-RR-150
					W-050691-RR-151
					W-050691-RR-151 DL
					Trip Blank
5/20	Acetone	0.170	31.6	J/UJ	W-050791-RR-141 DL
	Butanone	0.046	47.1	J/R	W-050791-RR-144 DL
	1,1,2,2-tetrachloroethane	0.155	3.2	NR	W-050791-RR-146 DL
					W-050791-RR-147 DL
					W-050791-RR-152
					W-050791-RR-152 DL

1 RRF = Relative Response Factor
2 %RSD = Percent Relative Standard Deviation
3 Analyte result is qualified as:
- J - The associated value is an estimated quantity for detected analytes.
- UJ - The analyte was checked for, but not detected. The associated value is an estimate.
- R - The datum is rejected, for non-detected analytes.
- NR - No additional qualifiers are necessary.

4 Suffix 'DL' means samples was diluted and reanalyzed.

TABLE 2

OUTLYING CONTINUING CALIBRATION DATA

Date/Time	Analyte	RRF[1]	%D[2]	Qualifier[3]	Associated Samples[4]
5/17; 08:11	Chloromethane	1.468	27.4	J/UJ	W-050791-RR-144
	Butanone	0.037	6.8	NR	W-050791-RR-145
	Vinyl Acetate	0.021	34.9	NR	W-050791-RR-146
	1,1,2,2-tetrachloroethane	0.205	24.7	NR	W-050791-RR-147
					W-050791-RR-148
					W-050791-RR-149
					W-050791-RR-150
					W-050691-RR-151
					W-050691-RR-140
5/18; 0:44	Acetone	0.159	51.3	J/UJ	Trip Blank
	Butanone	0.043	24.5	NR	W-050691-RR-136 DL
	Vinyl Acetate	0.019	40.8	NR	W-050791-RR-142 DL
	2-hexanone	0.101	39.8	J/UJ	W-050791-RR-143 DL
	1,1,2,2-tetrachloroethane	0.211	22.4	NR	W-050791-RR-145 DL
					W-050691-RR-151 DL
5/20; 16:51	Butanone	0.040	14.2	NR	W-050791-RR-141 DL
	1,1,2,2-tetrachloroethane	0.169	8.9	NR	W-050791-RR-144 DL
					W-050791-RR-146 DL
					W-050791-RR-147 DL
					W-050791-RR-152 DL

1 RRF = Relative Response Factor
2 %D = Percent Difference
3 Analyte result is qualified as:
- J - The associated value is an estimated quantity, for detected analytes.
- UJ - The analyte was checked for, but not detected. The associated value is an estimate.
- NR - No additional qualifiers are necessary.

4 Suffix 'DL' means sample was diluted and reanalyzed.

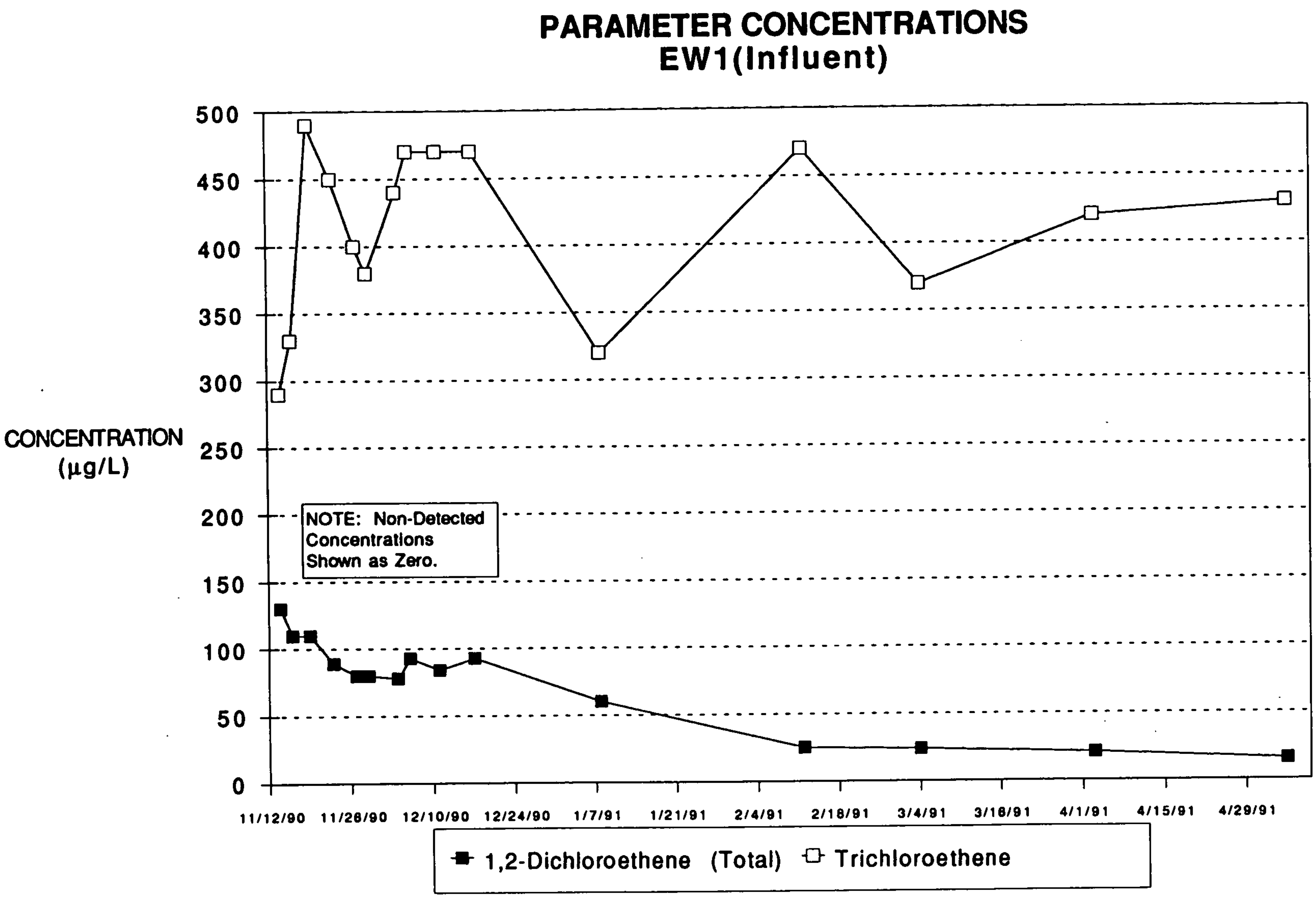
TABLE 3

CORRECTED PERCENT DIFFERENCE VALUES FROM MS/MSD ANALYSES UPON SAMPLE W-050691-RR-140

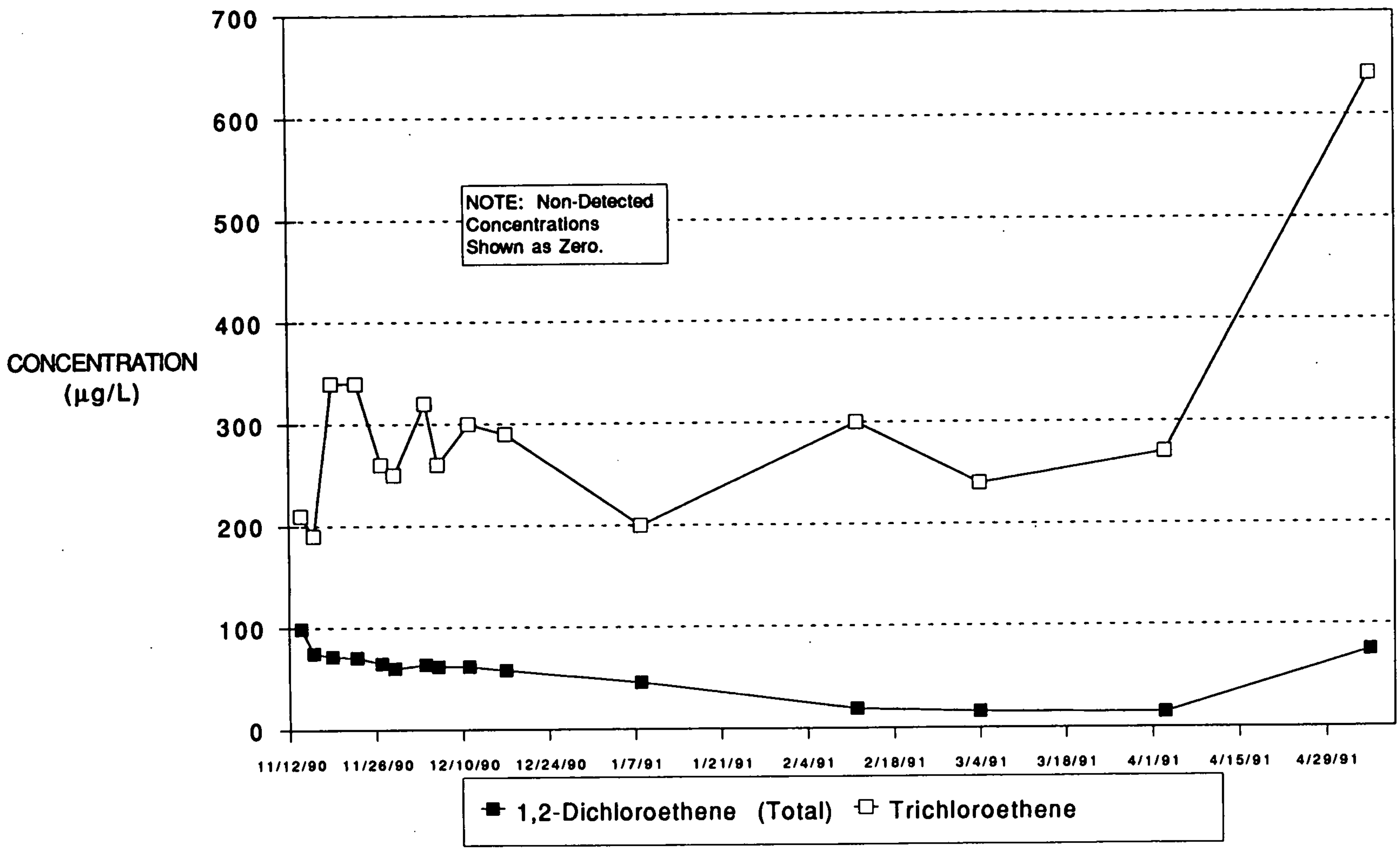
Analyte	Percent Difference	
	Reported	Corrected
1,1-dichloroethene	1	0.1
Trichloroethene	0	0.1
Benzene	1	0.8
Toluene	3	3.2
Chlorobenzene	2	2.0

APPENDIX F

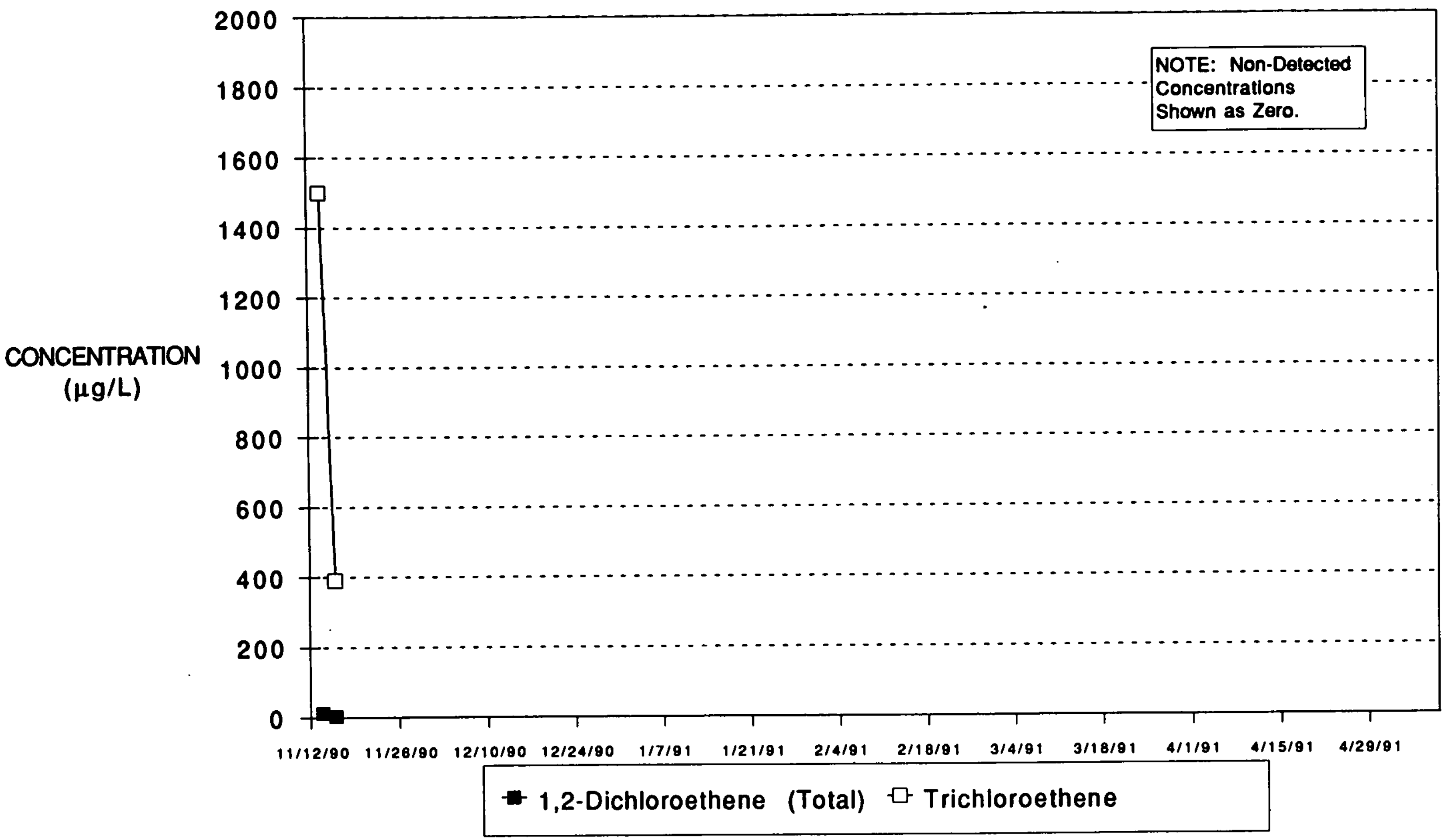
TRICHLOROETHENE AND 1,2-DICHLOROETHENE CONCENTRATION VERSUS TIME PLOTS

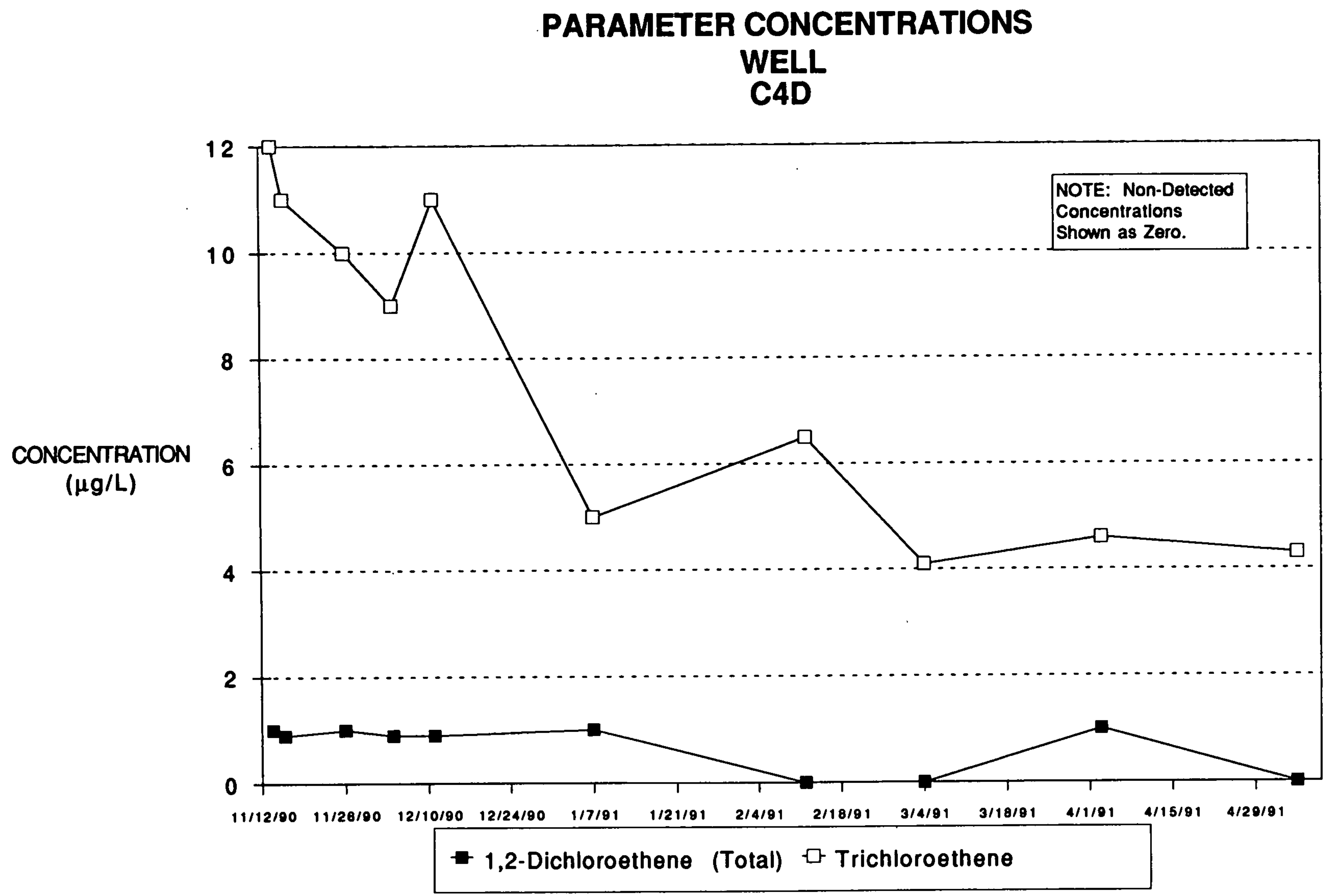

PARAMETER CONCENTRATIONS
EW1(Influent)
CONCENTRATION (µg/L)
500
450
400
350
300
250
200
150
100
50
0
NOTE: Non-Detected Concentrations Shown as Zero.
11/12/90
11/26/90
12/10/90
12/24/90
1/7/91
1/21/91
2/4/91
2/18/91
3/4/91
3/18/91
4/1/91
4/15/91
4/29/91
1,2-Dichloroethene (Total)
Trichloroethene

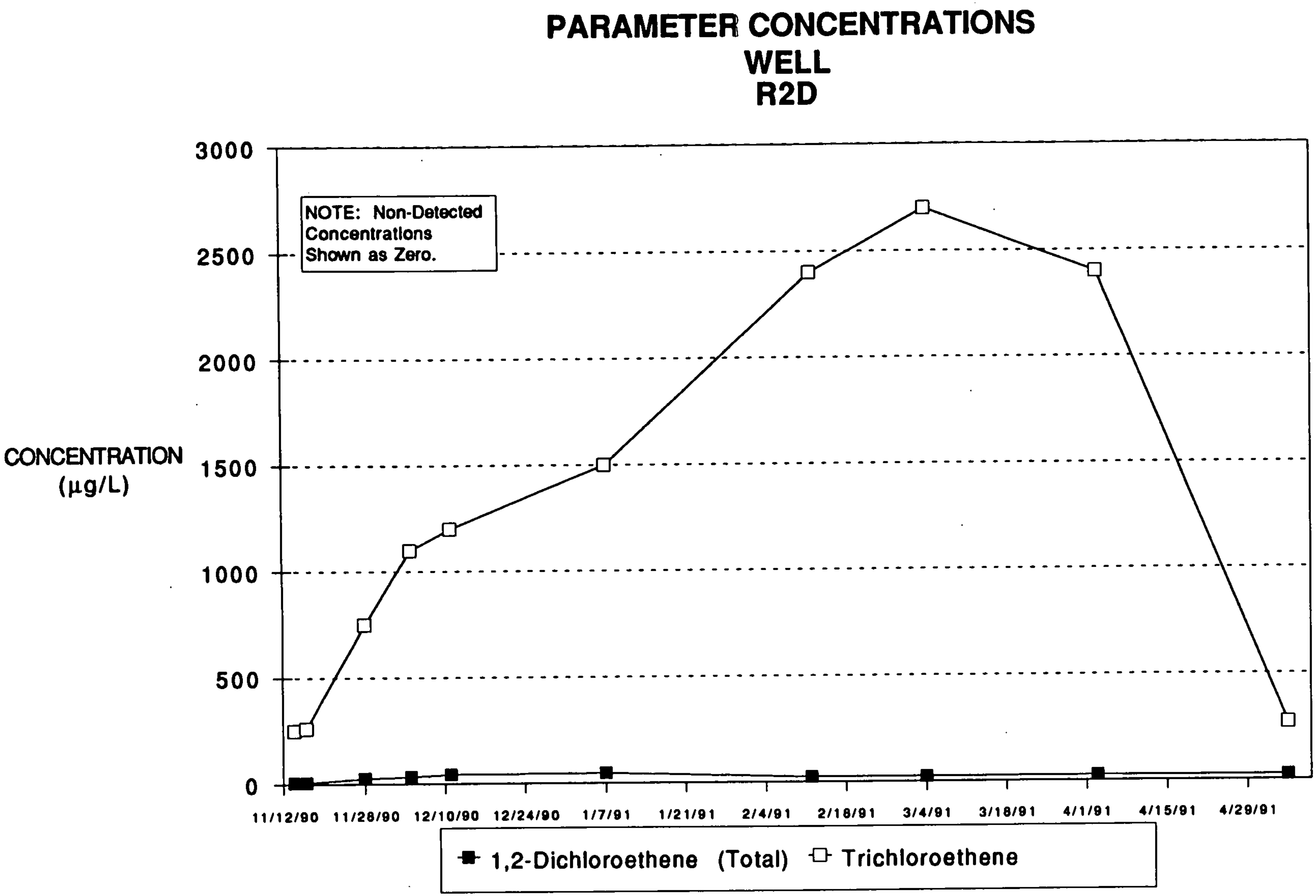
PARAMETER CONCENTRATIONS
EW1(Effluent)

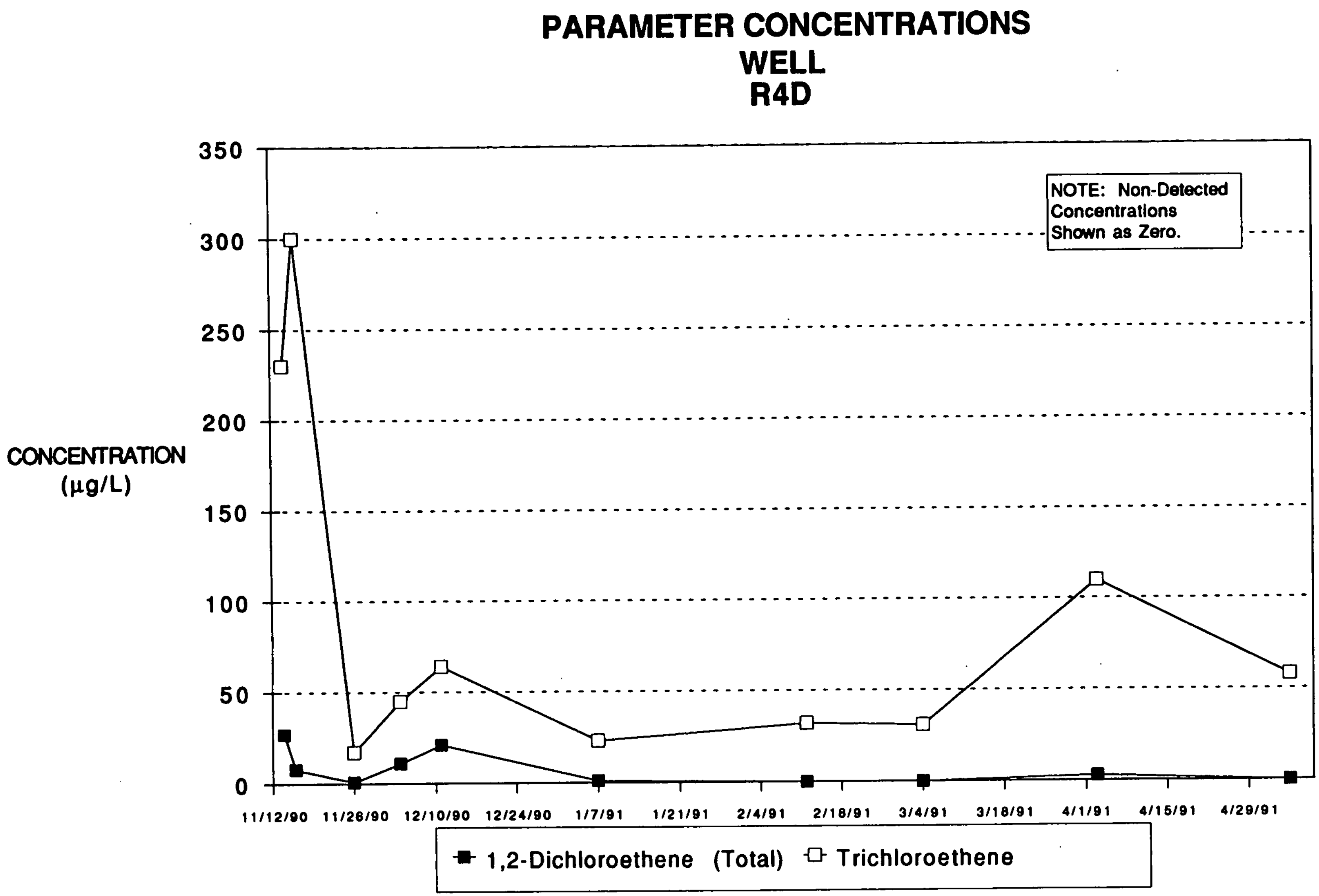


PARAMETER CONCENTRATIONS
WELL
C2S

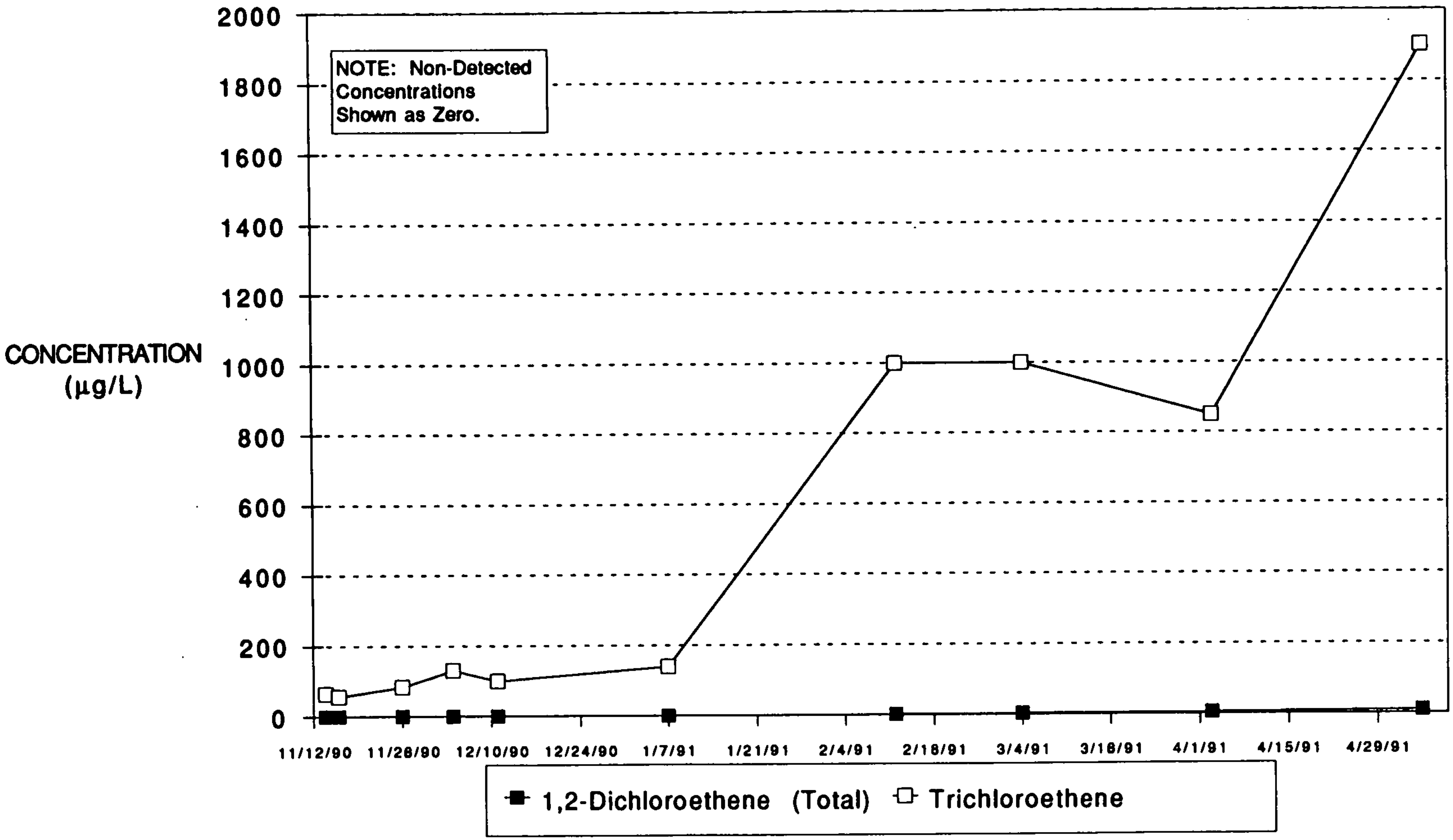


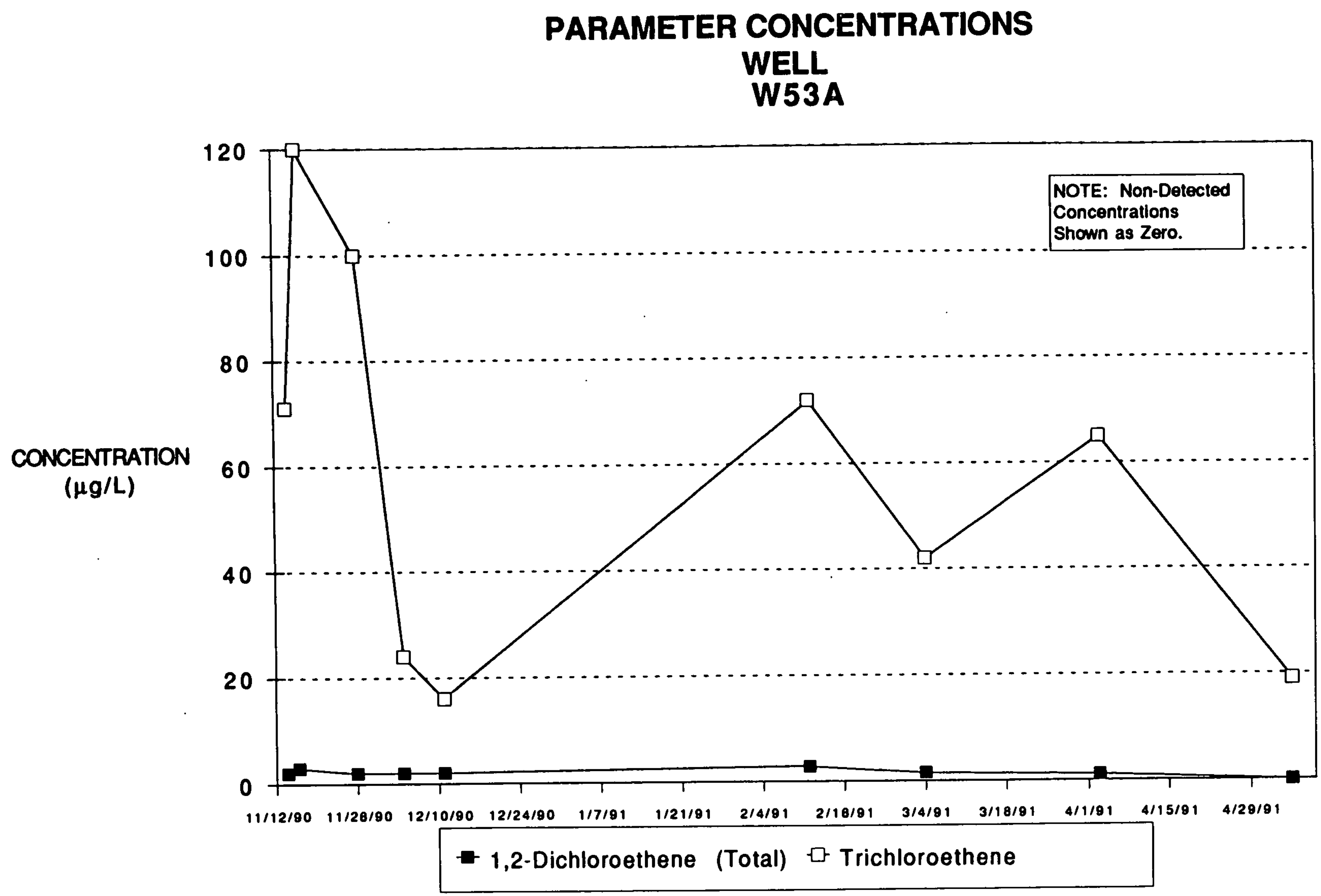

PARAMETER CONCENTRATIONS
WELL
C4D
NOTE: Non-Detected Concentrations Shown as Zero.
CONCENTRATION (µg/L)
12
10
8
6
4
2
0
11/12/90
11/26/90
12/10/90
12/24/90
1/7/91
1/21/91
2/4/91
2/18/91
3/4/91
3/18/91
4/1/91
4/15/91
4/29/91
1,2-Dichloroethene (Total)
Trichloroethene


PARAMETER CONCENTRATIONS
WELL
R2D
NOTE: Non-Detected Concentrations Shown as Zero.
CONCENTRATION (µg/L)
3000
2500
2000
1500
1000
500
0
11/12/90
11/26/90
12/10/90
12/24/90
1/7/91
1/21/91
2/4/91
2/18/91
3/4/91
3/18/91
4/1/91
4/15/91
4/29/91
1,2-Dichloroethene (Total)
Trichloroethene

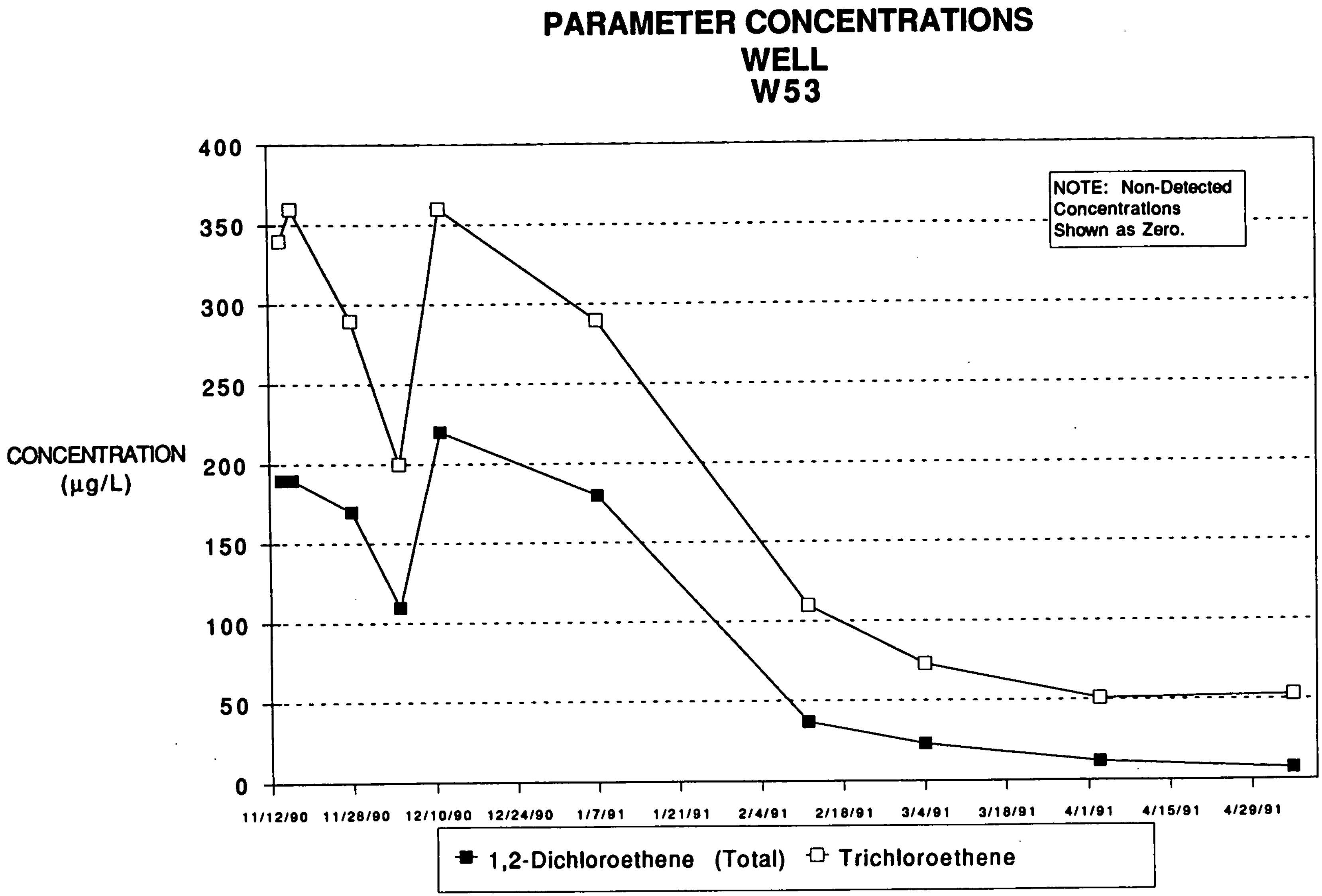

PARAMETER CONCENTRATIONS
WELL
R4D
NOTE: Non-Detected Concentrations Shown as Zero.
CONCENTRATION (µg/L)
350
300
250
200
150
100
50
0
11/12/90
11/26/90
12/10/90
12/24/90
1/7/91
1/21/91
2/4/91
2/18/91
3/4/91
3/18/91
4/1/91
4/15/91
4/29/91
1,2-Dichloroethene (Total)
Trichloroethene

PARAMETER CONCENTRATIONS
WELL
W52



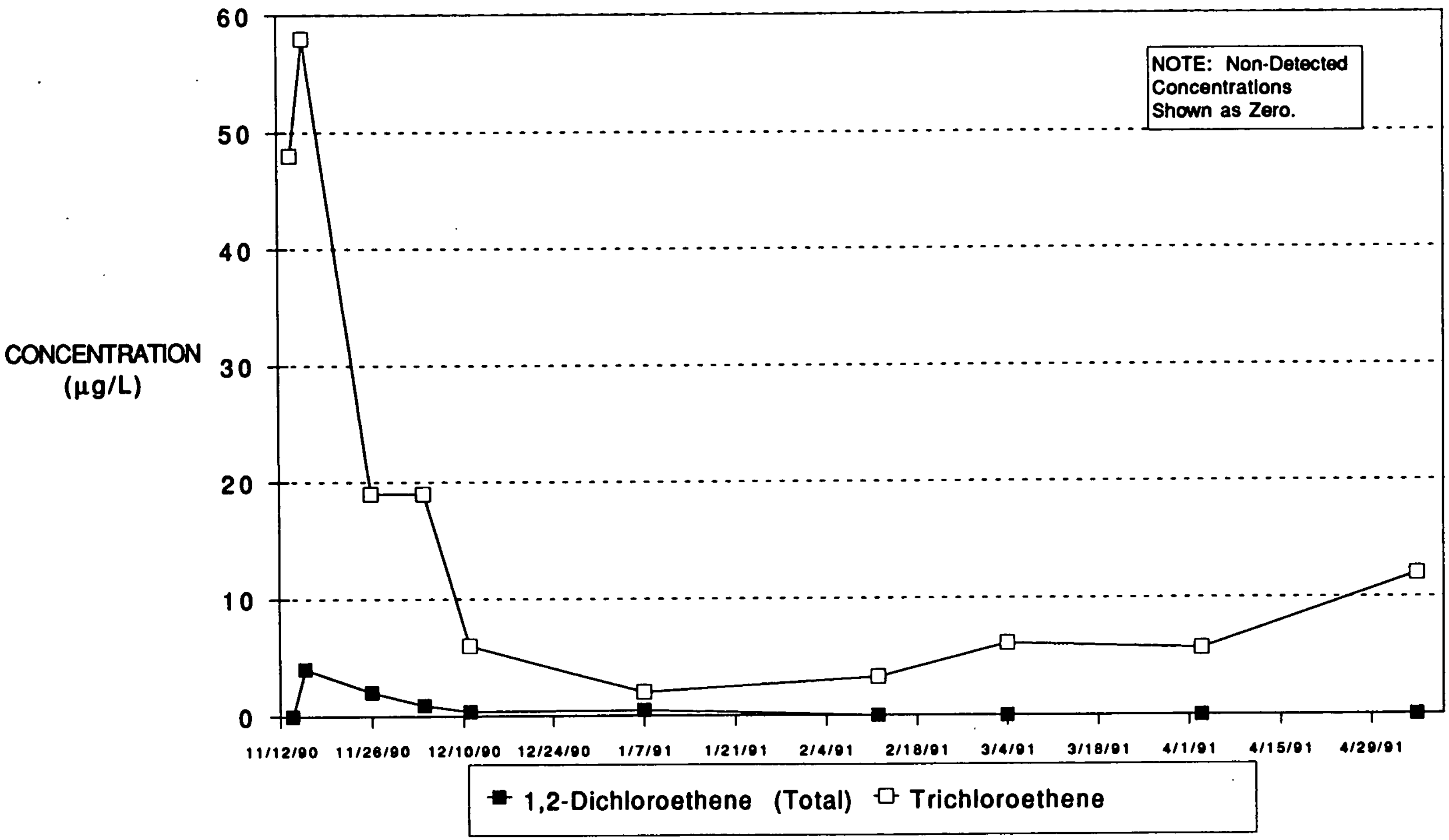


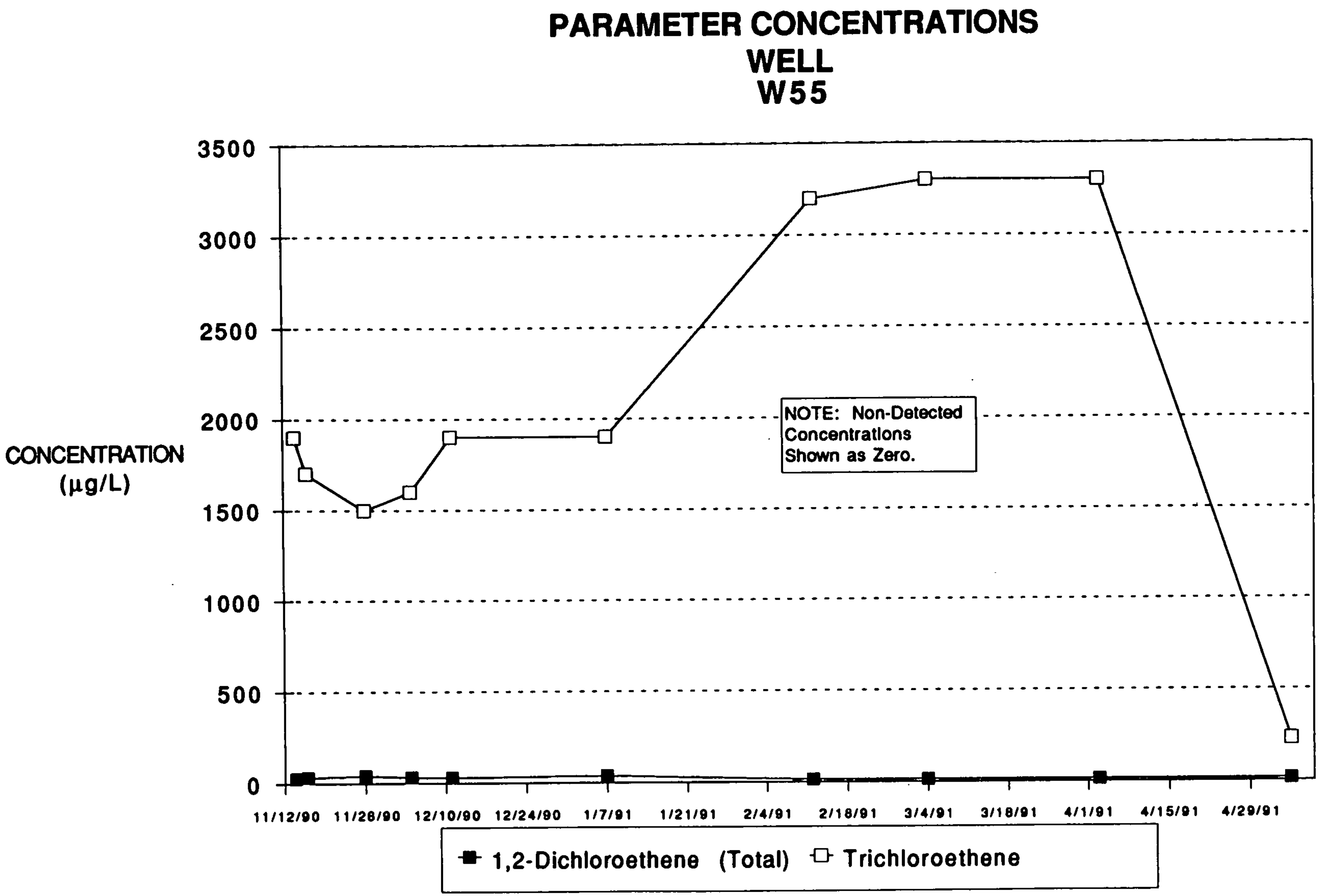
PARAMETER CONCENTRATIONS
WELL
W53A
NOTE: Non-Detected Concentrations Shown as Zero.
CONCENTRATION (µg/L)
120
100
80
60
40
20
0
11/12/90
11/26/90
12/10/90
12/24/90
1/7/91
1/21/91
2/4/91
2/18/91
3/4/91
3/18/91
4/1/91
4/15/91
4/29/91
1,2-Dichloroethene (Total)
Trichloroethene



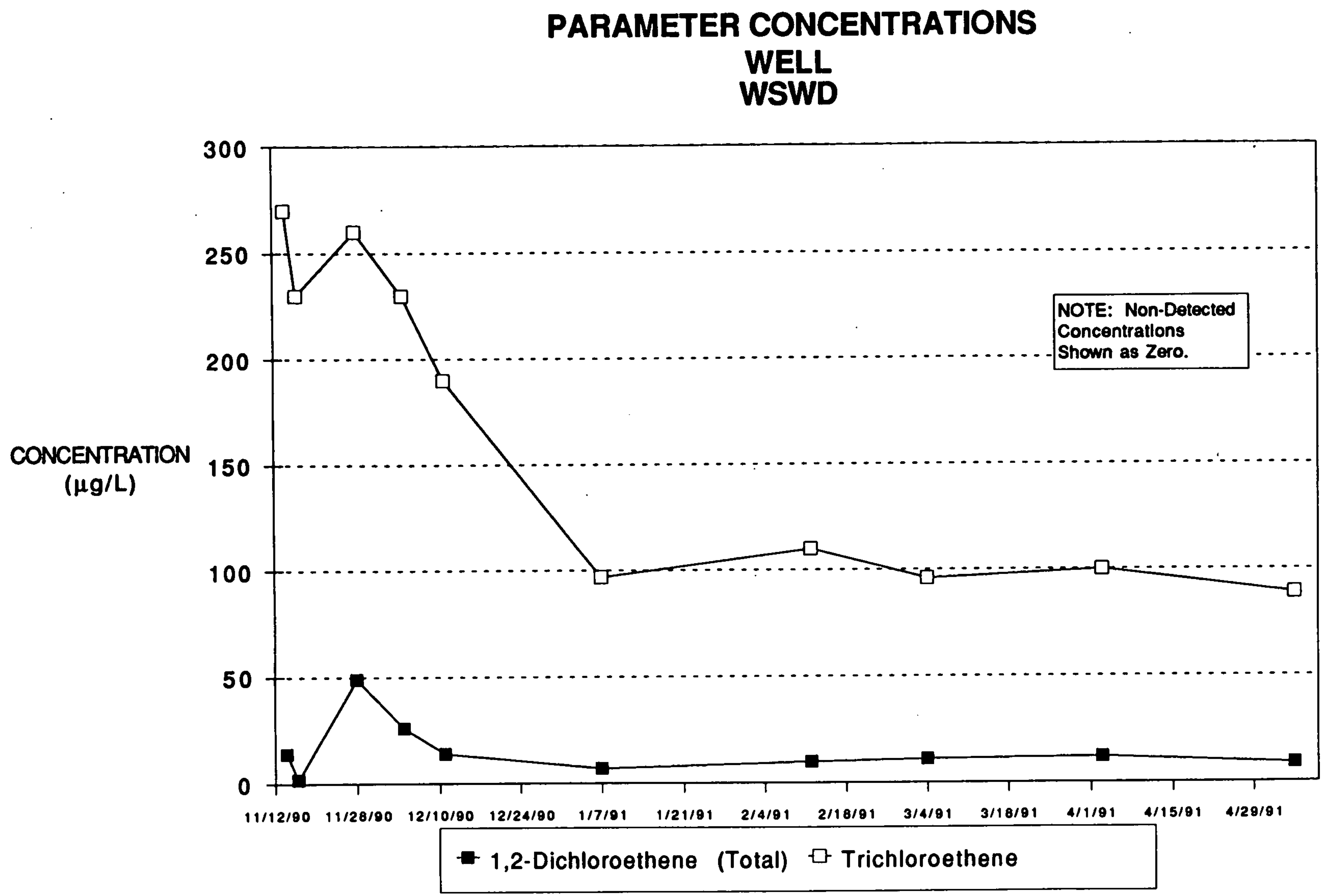
PARAMETER CONCENTRATIONS
WELL
W53
CONCENTRATION (µg/L)
400
350
300
250
200
150
100
50
0
11/12/90
11/28/90
12/10/90
12/24/90
1/7/91
1/21/91
2/4/91
2/18/91
3/4/91
3/18/91
4/1/91
4/15/91
4/29/91
NOTE: Non-Detected Concentrations Shown as Zero.
1,2-Dichloroethene (Total)
Trichloroethene

**PARAMETER CONCENTRATIONS
WELL
W54**

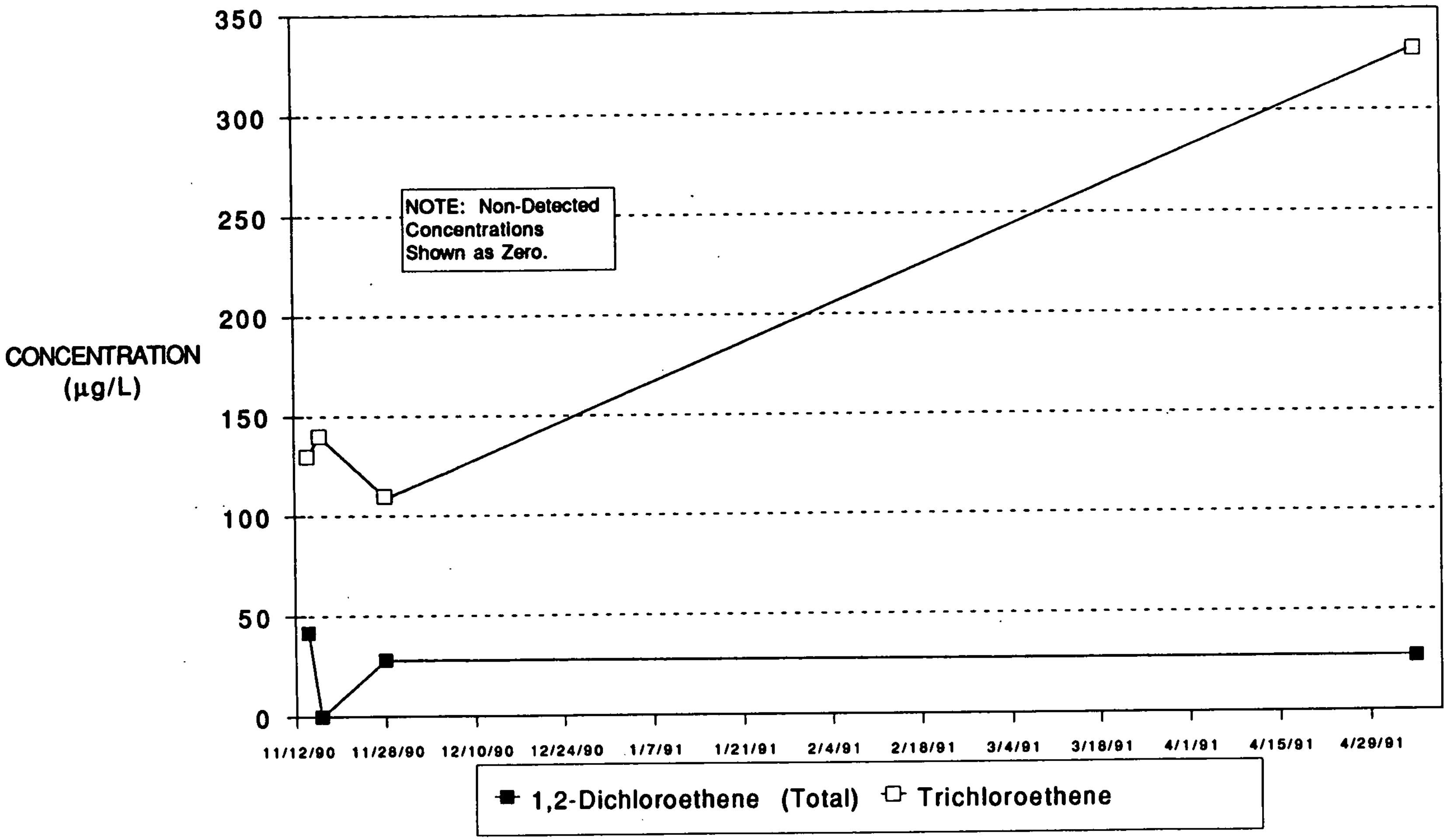




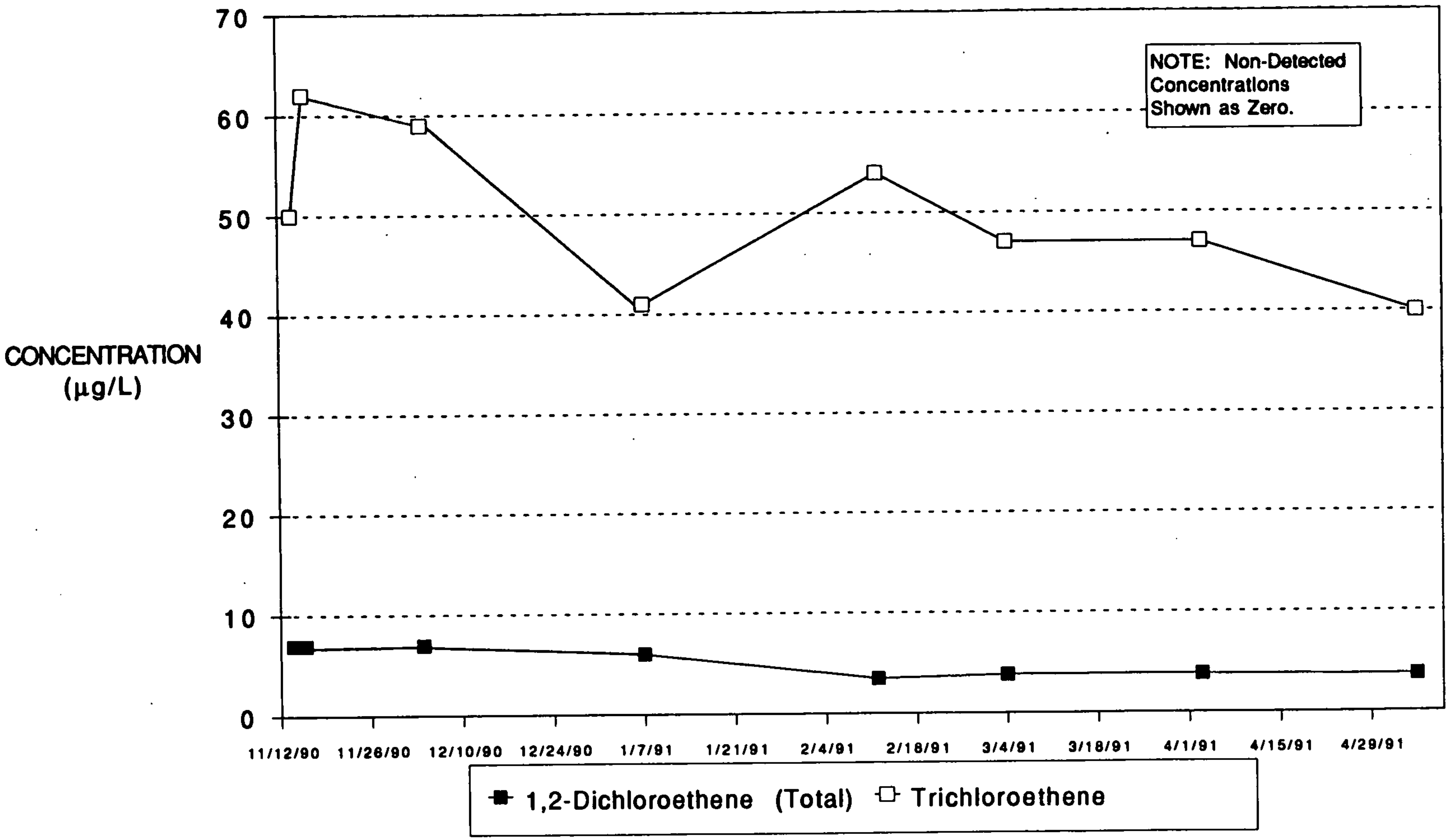
PARAMETER CONCENTRATIONS
WELL
W55
CONCENTRATION (µg/L)
3500
3000
2500
2000
1500
1000
500
0
11/12/90
11/26/90
12/10/90
12/24/90
1/7/91
1/21/91
2/4/91
2/18/91
3/4/91
3/18/91
4/1/91
4/15/91
4/29/91
NOTE: Non-Detected Concentrations Shown as Zero.
1,2-Dichloroethene (Total)
Trichloroethene

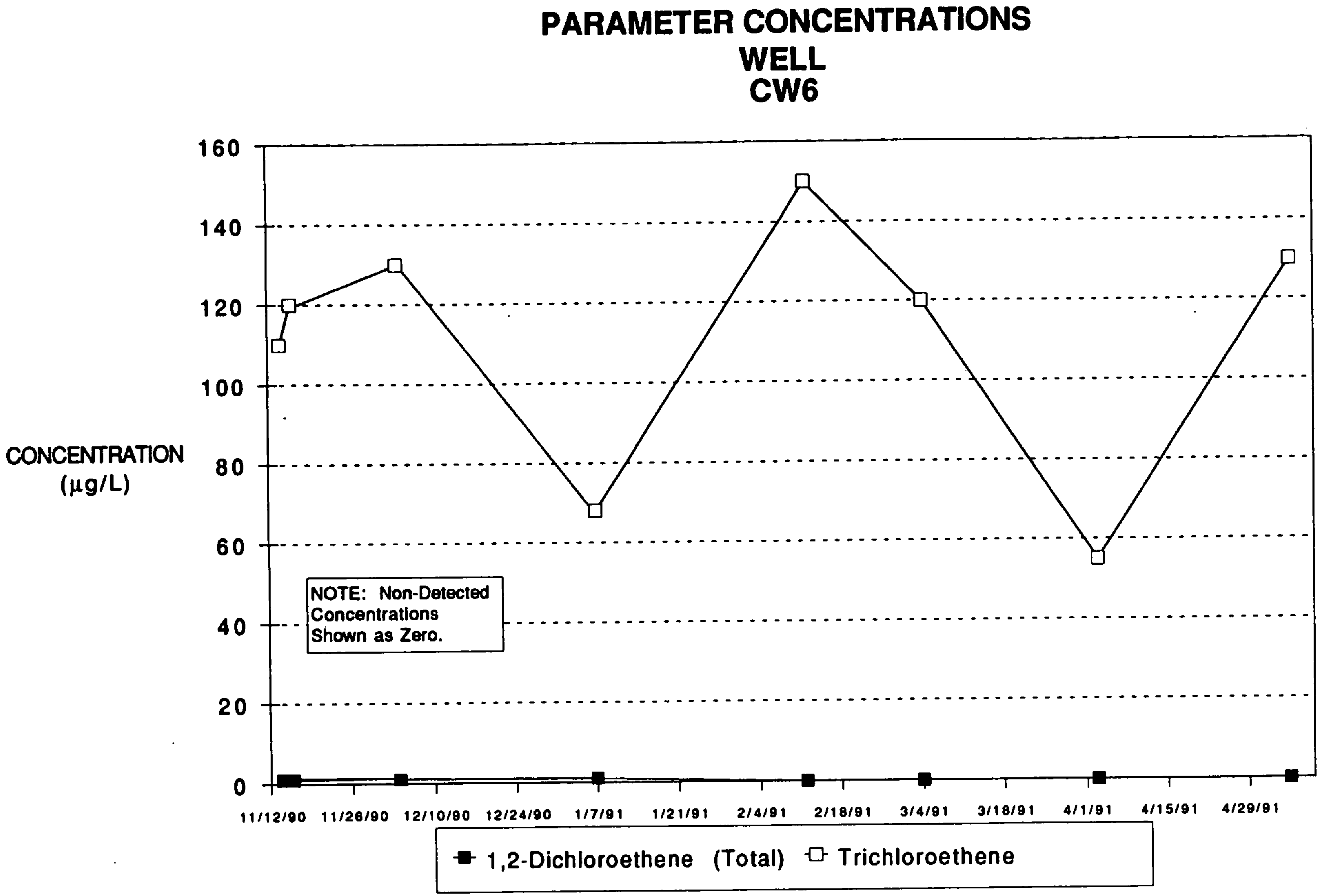

PARAMETER CONCENTRATIONS
WELL
WSWD
CONCENTRATION (µg/L)
300
250
200
150
100
50
0
11/12/90
11/26/90
12/10/90
12/24/90
1/7/91
1/21/91
2/4/91
2/18/91
3/4/91
3/18/91
4/1/91
4/15/91
4/29/91
NOTE: Non-Detected Concentrations Shown as Zero.
1,2-Dichloroethene (Total)
Trichloroethene

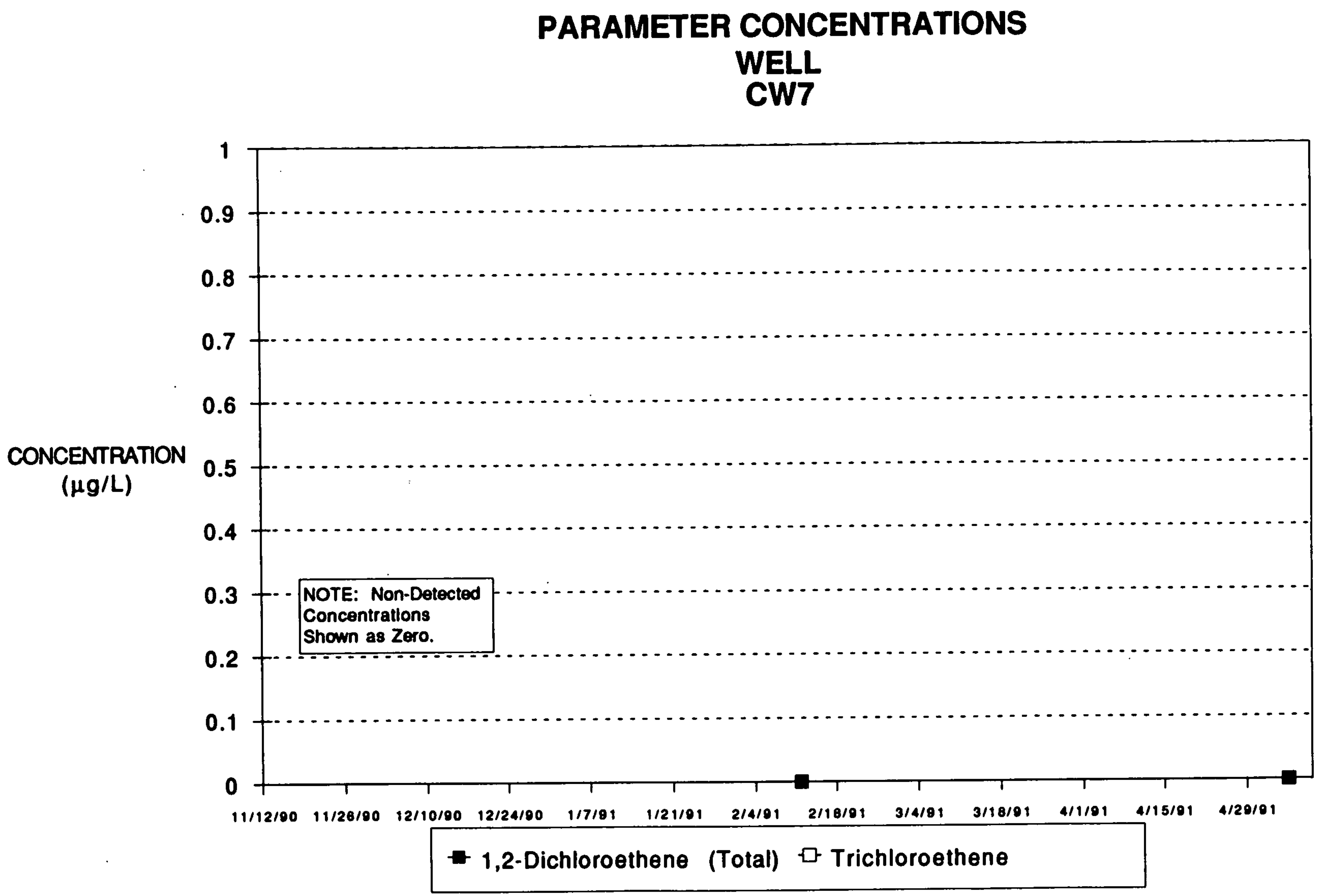
PARAMETER CONCENTRATIONS
WELL
IWD



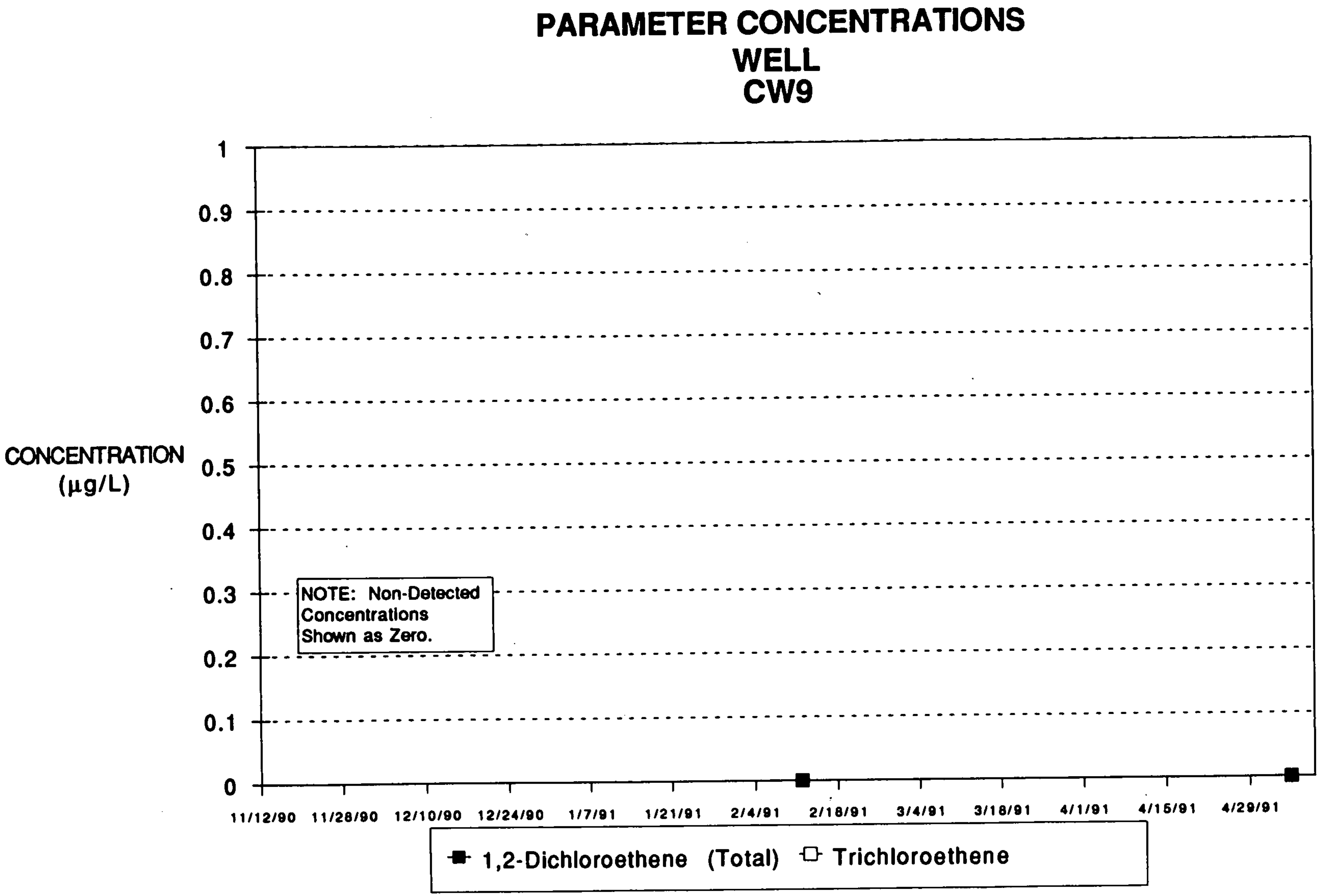
PARAMETER CONCENTRATIONS
WELL
CW3




PARAMETER CONCENTRATIONS
WELL
CW6
CONCENTRATION
(µg/L)
160
140
120
100
80
60
40
20
0
NOTE: Non-Detected Concentrations Shown as Zero.
11/12/90
11/26/90
12/10/90
12/24/90
1/7/91
1/21/91
2/4/91
2/18/91
3/4/91
3/18/91
4/1/91
4/15/91
4/29/91
1,2-Dichloroethene (Total)
Trichloroethene



PARAMETER CONCENTRATIONS
WELL
CW7
CONCENTRATION
(µg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
NOTE: Non-Detected
Concentrations
Shown as Zero.
11/12/90
11/26/90
12/10/90
12/24/90
1/7/91
1/21/91
2/4/91
2/18/91
3/4/91
3/18/91
4/1/91
4/15/91
4/29/91
1,2-Dichloroethene (Total)
Trichloroethene



PARAMETER CONCENTRATIONS
WELL
CW9
CONCENTRATION (µg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
NOTE: Non-Detected Concentrations Shown as Zero.
11/12/90
11/28/90
12/10/90
12/24/90
1/7/91
1/21/91
2/4/91
2/18/91
3/4/91
3/18/91
4/1/91
4/15/91
4/29/91
1,2-Dichloroethene (Total)
Trichloroethene