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ANNUAL PROGRESS REPORT
GROUND WATER MONITORING
FORMER MOBIL SERVICE STATION
4201 HIAWATHA AVENUE
MINNEAPOLIS, MINNESOTA
MPCA SITE ID#: LEAK00001485

FEBRUARY 11, 1993

Prepared for:

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1.0 INTRODUCTION

1.1 PURPOSE

This report summarizes the results of one year of quarterly ground water monitoring for the Former Mobil Service Station site located at 4201 Hiawatha Avenue, Minneapolis, Minnesota. One year of quarterly ground water monitoring was implemented at the site as part of corrective actions in response to a petroleum release from former underground storage tanks (USTs).

Peer Environmental & Engineering Resources, Inc. (PEER) was retained by Agate Properties. The services were performed in accordance with PEER's Cost Estimate for Quarterly Ground Water Monitoring dated March 25, 1992.

1.2 SCOPE OF WORK

The scope of work included:

- Obtaining water level measurements in the three on-site ground water monitoring wells.
- Sampling ground water from the monitoring wells.
- Analytical testing of the ground water samples.
- Data evaluation.
- Preparation of this report including conclusions and recommendations.

The work was completed between March 1992 and February 1993.

1.3 BACKGROUND

The site location is shown on Figure 1. The locations of the on-site monitoring wells are shown on Figure 2.

A remedial investigation (RI) was completed by PEER at the site in March 1992. The results of the RI are presented in the report entitled "Remedial Investigation, Former Mobil Service Station, 4201 Hiawatha Avenue, Minneapolis, Minnesota, MPCA Leak No. 1485" dated March 26, 1992. One year of quarterly ground water monitoring was recommended in the RI report to assist in evaluating if further corrective actions are warranted at the site. The Minnesota Pollution Control Agency (MPCA) issued a letter dated August 21, 1992, which approved the quarterly monitoring plan as an appropriate Corrective Action Design (CAD) for the site.

An initial round of ground water sampling was completed on December 26, 1992 as part of the RI. Quarterly ground water sampling events were conducted on the following dates:

- March 26, 1992
- June 25, 1992
- September 24, 1992
- December 31, 1992

The results of the March 26 and June 25, 1992 ground water sampling events are documented in the following reports prepared by PEER:

- Quarterly Ground Water Monitoring Results, Former Mobil Service Station, 4201 Hiawatha Avenue, Minneapolis, Minnesota, MPCA Leak No. 1485, April 16, 1992.
- Quarterly Ground Water Monitoring Results, Former Mobil Service Station, 4201 Hiawatha Avenue, Minneapolis, Minnesota, MPCA Leak No. 1485, July 14, 1992.

This report summarizes the results of all ground water monitoring completed to date, and provides specific documentation for the September 24 and December 31, 1992 sampling events.

2.0 METHODS AND PROCEDURES

2.1 WELL CONSTRUCTION

Three, 2 inch I.D. (inside diameter) monitoring wells were installed as part of the RI between December 17 and 20, 1991. The wells consist of 10 foot, Schedule 40 PVC screens and low carbon riser pipe. The monitoring wells were screened to intersect the water table. Two of the wells were completed above grade and one (MW-2) was finished at-grade. Well construction data is summarized in the following table.

MONITORING WELL CONSTRUCTION DATA			
ITEM	MW-1	MW-2	MW-3
Date Installed	12/20/91	12/20/91	12/20/91
Ground Surface Elevation (feet)	837.40	837.21	837.84
Top of Riser Elevation (feet)	839.79	837.21	840.29
Top of Filter Pack Elevation (feet)	812.10	813.52	811.55
Top of Screen Elevation (feet)	810.10	811.52	809.55
Bottom of Screen Elevation (feet)	800.10	801.52	799.55
Depth of Well from Top of Riser (feet)	39.69	35.69	40.74
MDH Unique Well Number	498841	498842	498843

NOTES:

Elevations are referenced to top nut of fire hydrant at northeast corner of Hiawatha Avenue and 42nd Street.

The monitoring wells were developed on December 24, 1991. Additional details regarding the monitoring wells are provided in the March 20, 1992 RI report.

2.2 MONITORING WELL SAMPLING

The three monitoring wells were sampled on five occasions from December 26, 1991 to December 31, 1992.

Specific details regarding the methods and procedures used for the December 26, 1991, and March 26 and June 25, 1992 sampling events are provided in the previously referenced reports. A detailed description of ground water sampling methods and procedures for the September 24, and December 31, 1992 events is included in Appendix A of this report. Monitoring well sampling data forms are included in Appendix B. The sampling protocol was consistent between all of the sampling events.

2.3 ANALYTICAL TESTING

The ground water samples from the various sampling events were analyzed for a combination of the following parameters:

- Benzene, ethyl benzene, toluene and xylene (BETX) or petroleum volatile organic compounds (PVOCs).
- Volatile organic compounds (VOCs) using Minnesota Department of Health (MDH) Method 465C or MDH Method 465D.
- Total hydrocarbons as Gasoline or Gasoline Range Organics (GRO).
- Total hydrocarbons as #2 fuel oil (12/26/91 sampling event only).
- Lead (3/26/92 sampling event only).

Table 1 identifies the analytical parameters and testing laboratory utilized for each sampling event.

3.0 RESULTS

3.1 HYDROGEOLOGY

Water Table Elevations

Water level measurement and water table elevation data for the period of monitoring are summarized in Table 2. Figure 3 presents a hydrograph of monitoring well MW-1 which depicts the water table elevations versus time. The hydrograph for MW-1 is representative of water table elevation trends for MW-2 and MW-3. Overall, the water levels in all of the monitoring wells have risen during the one year period of monitoring. However, slight decreases in the water levels were measured in each well during the March 26 and September 24, 1992 sampling events.

Ground Water Flow

Water level data from the various sampling events was evaluated to determine the water table configuration and hydraulic gradient at the site. The water table configuration based on the December 31, 1992 data is presented in Figure 3. Based on this data, ground water flow is predominantly to the west. The hydraulic gradient was calculated to be 0.0012. This ground water flow interpretation and the calculated hydraulic gradient are consistent with the data from all previous sampling events.

3.2 ANALYTICAL TESTING

The analytical testing results for the initial December 26, 1991 sampling event and the four subsequent events are summarized in Table 3. Table 3 also includes a summary of applicable Minnesota Department of Health (MDH) Recommended Allowable Limits (RALs) for Drinking Water Contaminants. Copies of the Laboratory analytical reports and chain-of-custody forms for the September and December 1992 events are included in Appendix C. Laboratory analytical reports for the earlier events are included in the previously referenced reports.

4.0 DISCUSSION

During the one year of monitoring, ground water impacts have been primarily identified in monitoring well MW-1, which is located immediately downgradient of the former underground gasoline storage (UST) tank basin. Minor ground water impacts, have also been identified in MW-2 (during the December 31, 1992 sampling event), which is located adjacent to the former fuel oil UST basin.

The analytical testing results for MW-1 indicate the presence of gasoline and petroleum-related volatile organic compounds (VOCs). The primarily petroleum-related VOCs which have been detected include ethyl benzene, toluene, xylene, and cumene (a high octane gasoline additive). The most recent VOC analyses using MDH Method 465D have identified a number of other petroleum-related VOCs which are also present including: benzene, butylbenzene, isopropyltoluene, naphthalene, propylbenzene, and trimethylbenzene.

Ethyl benzene and toluene were detected in MW-1 at concentrations above the MDH RALs for the December 26, 1991, March 26, 1992 and September 24, 1992 sampling events. The concentrations of these compounds were below the RALs for the December 31, 1992 sampling event. The only compound which currently exceeds the RAL is naphthalene, which was detected in MW-1 at a concentration of 180 ug/L (6 times the RAL of 30 ug/L).

Figure 4 presents a graph of total petroleum hydrocarbon - TPH (THC as gasoline and GRO) concentrations in MW-1 versus the time since the initial sampling event. The graph shows that TPH concentrations have decreased from 14,000 ug/L to 10,000 ug/L during the one year period of monitoring. A slight increase in the TPH concentration occurred during September 24, 1992 sampling event. The increase in TPH corresponds to a rise in the elevation of the water table (Figure 3). The increased TPH concentration most likely resulted when rising ground water came in contact with overlying residual soil contamination.

Figure 5 presents a graph of the ethyl benzene, toluene and total xylenes concentrations in MW-1 versus time since the initial sampling event. The graph depicts the same decreasing trend for these petroleum-related VOCs. A slight increase in VOC concentrations correlates with the water table rise noted for the September 24, 1992 sampling event.

During the initial December 26, 1991 sampling event, chloroform and methylene chloride were detected at low concentrations in the ground water samples. These compounds were not detected during either the September 24 or December 31, 1992 sampling events when full VOC analyses were performed. These non-petroleum related VOCs are assumed to represent laboratory cross-contamination.

Two additional non-petroleum related VOCs, acetone and methyl ethyl ketone (MEK), were detected in the MW-1 samples from the September 24 and December 31, 1992 sampling events. These compounds were not detected during the initial December 26, 1991 sampling event. In the September 24, 1992 sample, acetone was detected at 1,900 ug/L and MEK was detected at 3,000 ug/L. The Twin City Testing laboratory report indicates that the presence of acetone and MEK is from possible laboratory contamination. A representative of Twin City Testing verbally indicated that acetone and MEK were detected in laboratory method blanks throughout the day the samples were analyzed, and that if the concentrations detected in the blanks were subtracted from that reported for the MW-1 sample, the resulting concentrations would be below detection limits.

Acetone and MEK were also detected in the MW-1 sample from December 31, 1992, but at low concentrations of 85 and 83 ug/L, respectively. These concentrations are below the MDH RALs for the compounds. A representative of Horizon Laboratories, Inc. indicated that acetone and MEK may not actual be present in the sample, and that the compounds identified as acetone and MEK may actually be gasoline additives which have the same retention times and thus coelute when using the MDH 465D analytical method (gas chromatography). Horizon Laboratories indicated that in order to confirm the presence of absence of these compounds, additional analysis using gas chromatography/mass spectrometry (GC/MS) would be required.

5.0 CONCLUSIONS

- Water level data indicates that ground water flow has consistently been westerly during the one year period of monitoring.
- No free product has been detected in the three on-site monitoring wells.
- Total petroleum hydrocarbon (TPH) and petroleum-related volatile organic compound (VOC) concentrations have shown decreasing trends. The petroleum related VOCs detected during the most recent sampling event are all below the MDH RALs, with the exception of naphthalene.

- Acetone and MEK have been identified in the samples from MW-1 during the last two sampling events. However, information provided by the analytical testing laboratories suggests that these compounds are not actually present in ground water at the site. Additional analysis using GC/MS methods would be required to conclusively determine the presence or absence of these compounds. It is PBER's opinion that additional analysis is not warranted since the compounds are below the MDH RALs and overall contaminant concentrations show a decreasing trend.
- The results of the receptor survey and vapor risk assessment completed as part of the Remedial Investigation (RI) indicate no significant risk of impacts to ground water receptors and underground utilities from the petroleum release.
- Based on the results of the RI and one year of quarterly ground water monitoring, further actions regarding the petroleum release do not appear warranted and site closure is recommended.

**TABLE 1
SUMMARY OF GROUND WATER SAMPLES SUBMITTED FOR ANALYTICAL TESTING**

GENERAL INFORMATION		PARAMETER							
Well Number	Sampling Date/Date Received by Laboratory	BETX	Lead	VOCs (465C)	THC as gasoline	THC as #2 fuel oil	VOCs (465D)	GRO	Laboratory
MW-1	12/26/91-12/26/91			X	X	X			Twin City Testing
MW-2	12/26/91-12/26/91			X	X	X			Twin City Testing
MW-3	12/26/91-12/26/91			X	X	X			Twin City Testing
Trip Blank	12/26/91-12/26/91			X					Twin City Testing
MW-1	3/26/92-3/26/92	X	X		X				Twin City Testing
MW-2	3/26/92-3/26/92	X	X		X				Twin City Testing
MW-3	3/26/92-3/26/92	X	X		X				Twin City Testing
Method Blank	3/26/92-3/26/92	X			X				Twin City Testing
MW-1	6/25/92-6/25/92	X			X				Twin City Testing
MW-2	6/25/92-6/25/92	X			X				Twin City Testing
MW-3	6/25/92-6/25/92	X			X				Twin City Testing
Method Blank	6/25/92-6/25/92	X			X				Twin City Testing
MW-1	9/24/92-9/24/92						X	X	Twin City Testing
MW-2	9/24/92-9/24/92						X	X	Twin City Testing
MW-3	9/24/92-9/24/92						X	X	Twin City Testing
MW-1	12/31/92-12/31/92						X	X	Horizon
MW-2	12/31/92-12/31/92						X	X	Horizon
MW-3	12/31/92-12/31/92						X	X	Horizon

NOTES:

BETX = Benzene, Ethylbenzene, Toluene and Xylenes

VOCs = Volatile Organic Compounds by Minnesota Department of Health Method 465C or 465D

THC = Total Hydrocarbons

GRO = Gasoline Range Organics

**TABLE 2
WATER LEVEL MEASUREMENT DATA**

Well	Date	Elevation of TOR	Water Level Below TOR	Water Level Elevation
MW-1	12/26/91	839.79	32.19	807.60
	3/26/92	839.79	32.25	807.54
	6/25/92	839.79	31.88	807.91
	9/24/92	839.79	31.61	808.18
	12/31/92	839.79	31.76	808.03
MW-2	12/26/91	837.21	29.50	807.71
	3/26/92	837.21	29.49	807.72
	6/25/92	837.21	29.14	808.07
	9/24/92	837.21	28.89	808.32
	12/31/92	837.21	29.05	808.16
MW-3	12/26/91	840.29	32.58	807.71
	3/26/92	840.29	32.59	807.70
	6/25/92	840.29	32.22	808.07
	9/24/92	840.29	31.92	808.37
	12/31/92	840.29	32.15	808.14

NOTES:

- No free product was detected on any date using petroleum product detecting paste or was observed by visually inspecting initial bailer removed from each well.
- Water level measurements were obtained using an electronic water level indicator.

810.10

811.52

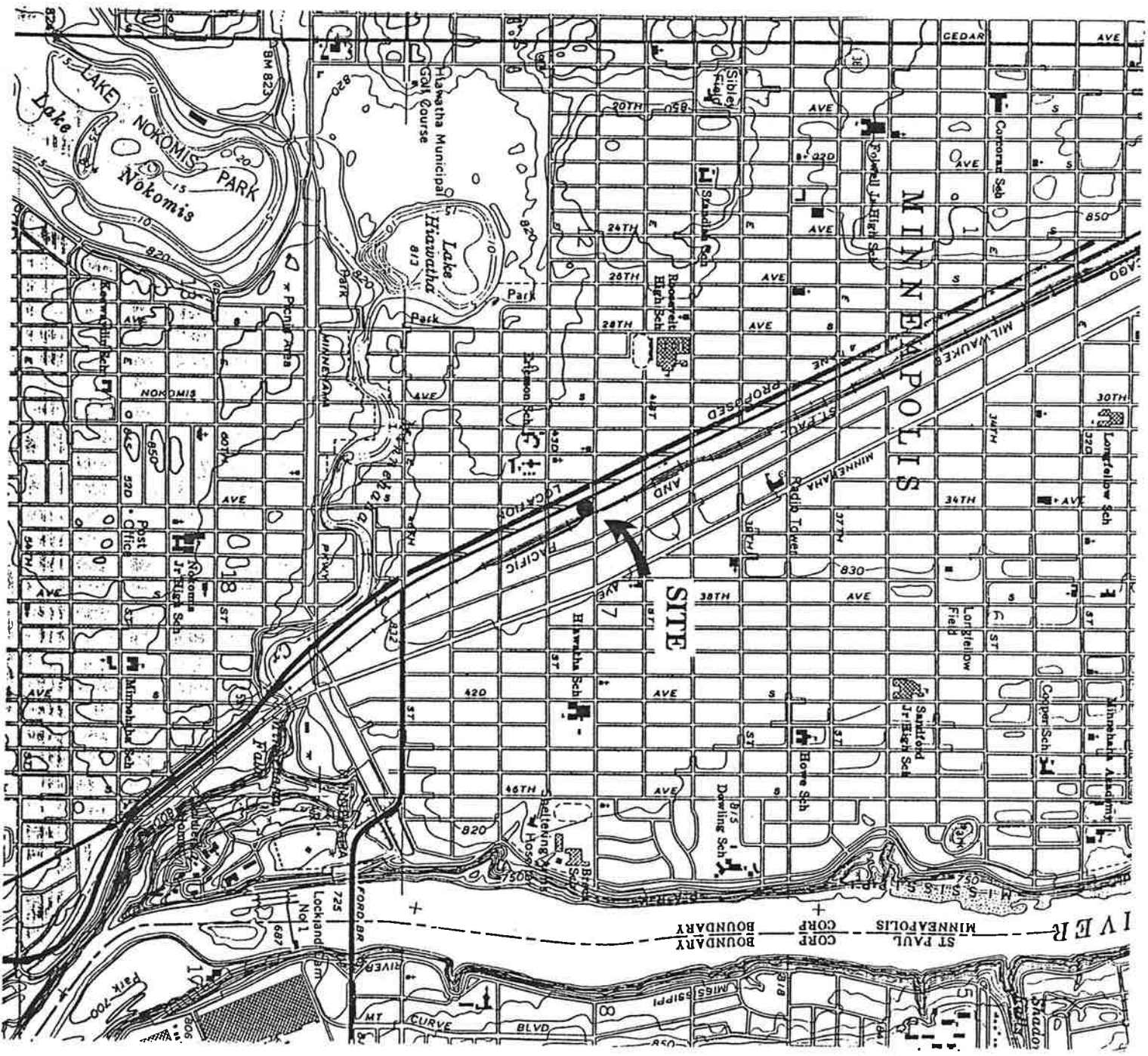
809.55

**TABLE 3
SUMMARY OF ANALYTICAL TESTING RESULTS FOR GROUND WATER SAMPLES**

COMPOUND/ PARAMETER	MONITORING WELL/SAMPLING DATE									
	MW-1					MW-2				
	12/26/91	3/26/92	6/25/92	9/24/92	12/31/92	12/26/91	3/26/92	6/25/92	9/24/92	12/31/92
Acetone	ND (500)	NA	NA	1,900*	85	ND (10)	NA	NA	ND (10)	ND (30)
Benzene	ND (50)	ND (250)	ND (50)	ND (100)	7.8	ND (1)	ND (5)	ND (5)	ND (1)	ND (0.1)
n-Butylbenzene	NA	NA	NA	120	110	NA	NA	NA	ND (1)	ND (0.09)
sec-Butylbenzene	NA	NA	NA	ND (100)	12	NA	NA	NA	ND (1)	ND (0.1)
Chloroform	ND (50)	NA	NA	ND (100)	ND (0.5)	2	NA	NA	ND (1)	ND (0.5)
Ethylbenzene	2,400	1,300	710	820	520	ND (1)	ND (5)	ND (5)	ND (1)	ND (0.1)
Isopropylbenzene (cumene)	97	NA	NA	ND (100)	40	ND (1)	NA	NA	ND (1)	ND (0.1)
p-Isopropyltoluene	NA	NA	NA	ND (100)	6.2	NA	NA	NA	ND (1)	ND (0.1)
Methyl Ethyl Ketone	ND (250)	NA	NA	3,000*	83	ND (5)	NA	NA	ND (5)	ND (15)
Methylene Chloride	300	NA	NA	ND (100)	ND (0.4)	6	NA	NA	ND (1)	ND (0.4)
Naphthalene	NA	NA	NA	260	180	NA	NA	NA	ND (1)	0.96
n-Propylbenzene	NA	NA	NA	130	91	NA	NA	NA	ND (1)	ND (0.1)
Toluene	7,000	1,700	860	1,200	560	ND (1)	ND (5)	ND (5)	ND (1)	ND (0.6)
1,2,4-Trimethylbenzene	NA	NA	NA	770	500	NA	NA	NA	ND (1)	0.12
1,3,5-Trimethylbenzene	NA	NA	NA	160	70	NA	NA	NA	ND (1)	ND (0.1)
Xylenes (total)	7,800	4,300	2,200	2,900	1,610	ND (1)	ND (5)	ND (5)	ND (1)	0.39
THC as gasoline	42,000	25,000	NA	NA	NA	ND (30)	ND (30)	NA	NA	NA
THC as fuel oil	ND (200)	NA	NA	NA	NA	ND (200)	NA	NA	NA	NA
Lead	NA	ND (3)	NA	NA	NA	NA	5	NA	NA	NA
Gasoline Range Organics	NA	NA	11,000	14,000	10,000	NA	NA	ND (3)	ND (30)	ND (20)

TABLE 3 (CONTINUED)
SUMMARY OF ANALYTICAL TESTING RESULTS FOR GROUND WATER SAMPLES

COMPOUND/ PARAMETER	MONITORING WELL/SAMPLING DATE						MDH RAL	NOTES
	MW-3							
	12/26/91	3/26/92	6/25/92	9/24/92	12/31/92			
Acetone	ND (10)	NA	NA	ND (10)	ND (30)	700	All units reported in ug/L (ppb). NA = sample not analyzed for this parameter. N/A = not available. ND () = compound not detected at or above concentration indicated in parenthesis. *Laboratory report indicates presence of compound may be due to possible laboratory contamination.	
Benzene	ND (1)	ND (5)	ND (5)	ND (1)	ND (0.1)	10		
n-Butylbenzene	NA	NA	NA	ND (1)	ND (0.09)	N/A		
sec-Butylbenzene	NA	NA	NA	ND (1)	ND (0.1)	N/A		
Chloroform	ND (1)	NA	NA	ND (1)	ND (0.5)	60		
Ethylbenzene	ND (1)	ND (5)	ND (5)	ND (1)	ND (0.1)	700		
Isopropylbenzene (cumene)	ND (1)	NA	NA	ND (1)	ND (0.1)	300		
p-Isopropyltoluene	NA	NA	NA	ND (1)	ND (0.1)	N/A		
Methyl Ethyl Ketone	ND (5)	NA	NA	ND (5)	ND (15)	300		
Methylene Chloride	4	NA	NA	ND (1)	ND (0.4)	50		
Naphthalene	NA	NA	NA	ND (1)	ND (0.2)	30		
n-Propylbenzene	NA	NA	NA	ND (1)	ND (0.1)	N/A		
Toluene	ND (1)	ND (5)	NA	ND (1)	ND (0.6)	1,000		
1,2,4-Trimethylbenzene	NA	NA	NA	ND (1)	ND (0.1)	N/A		
1,3,5-Trimethylbenzene	NA	NA	NA	ND (1)	ND (0.1)	N/A		
Xylenes (total)	ND (1)	ND (5)	ND (5)	ND (1)	ND (0.1)	10,000		
THC as gasoline	ND (30)	ND (30)	NA	NA	NA	N/A		
THC as fuel oil	ND (200)	NA	NA	NA	NA	N/A		
Lead	NA	5	NA	NA	NA	20		
Gasoline Range Organics	NA	NA	ND (30)	ND (30)	ND (20)	N/A		



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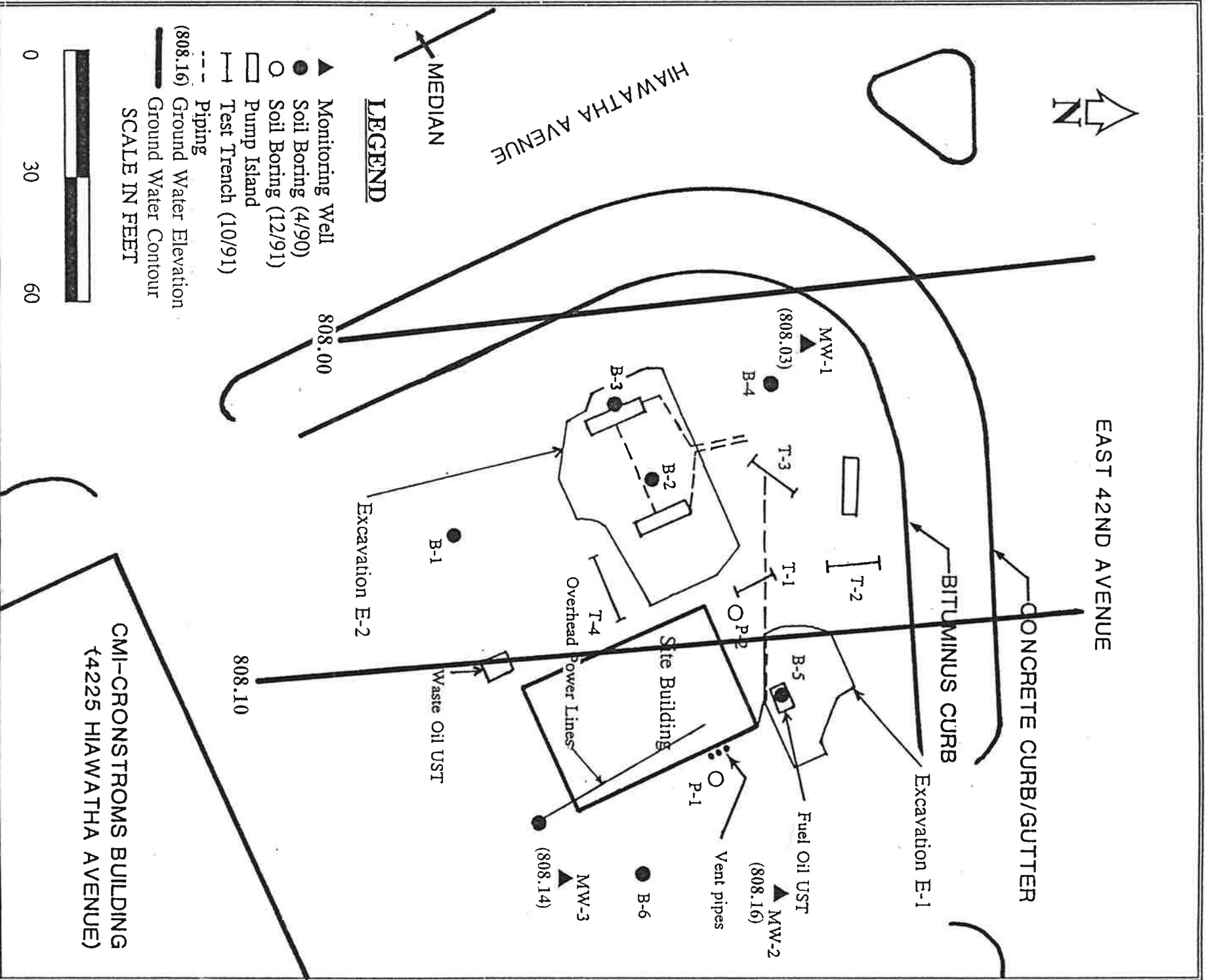


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Site Location Map
Former Mobil Service Station
4201 Hiawatha Avenue
Minneapolis, Minnesota

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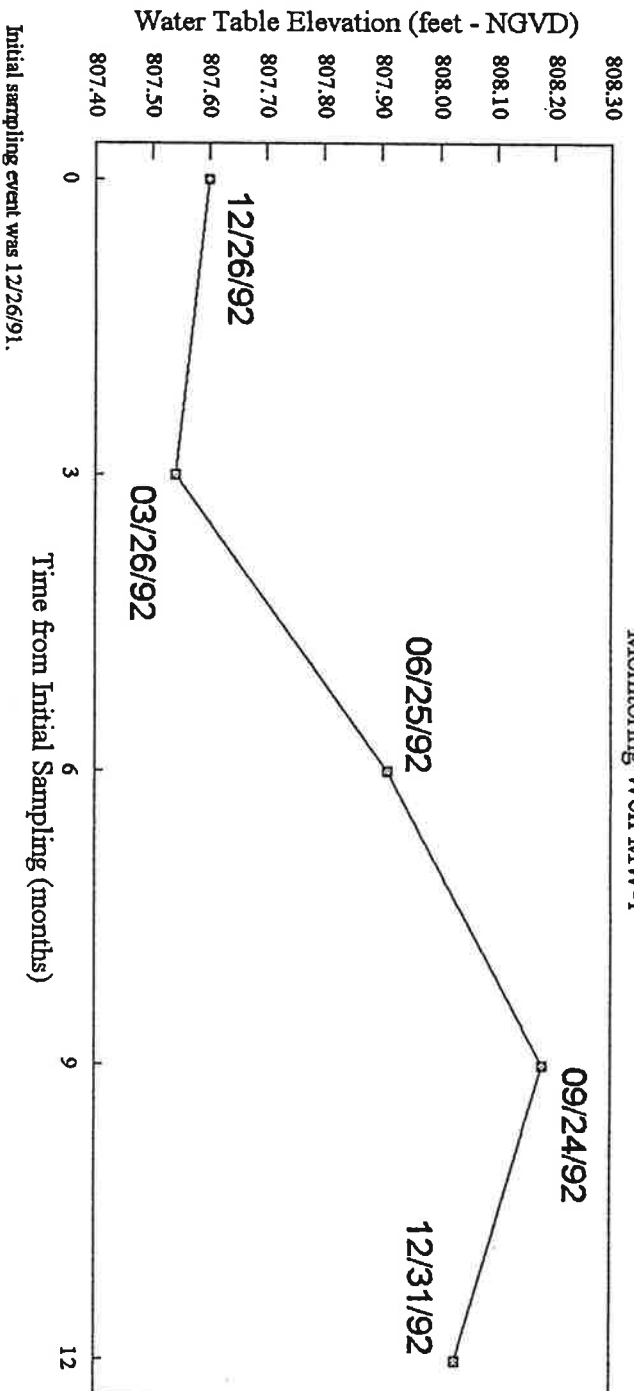
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Water Table Configuration Map (12/31/92)
 Former Mobil Service Station
 4201 Hiawatha Avenue
 Minneapolis, Minnesota

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HYDROGRAPH

Monitoring Well MW-1



Sampling Event Date	Time from Initial Sampling (months)	Water Level Elevation (NGVD)
12/26/91	0	807.60
03/26/92	3	807.54
06/25/92	6	807.91
09/24/92	9	808.18
12/31/92	12	808.03

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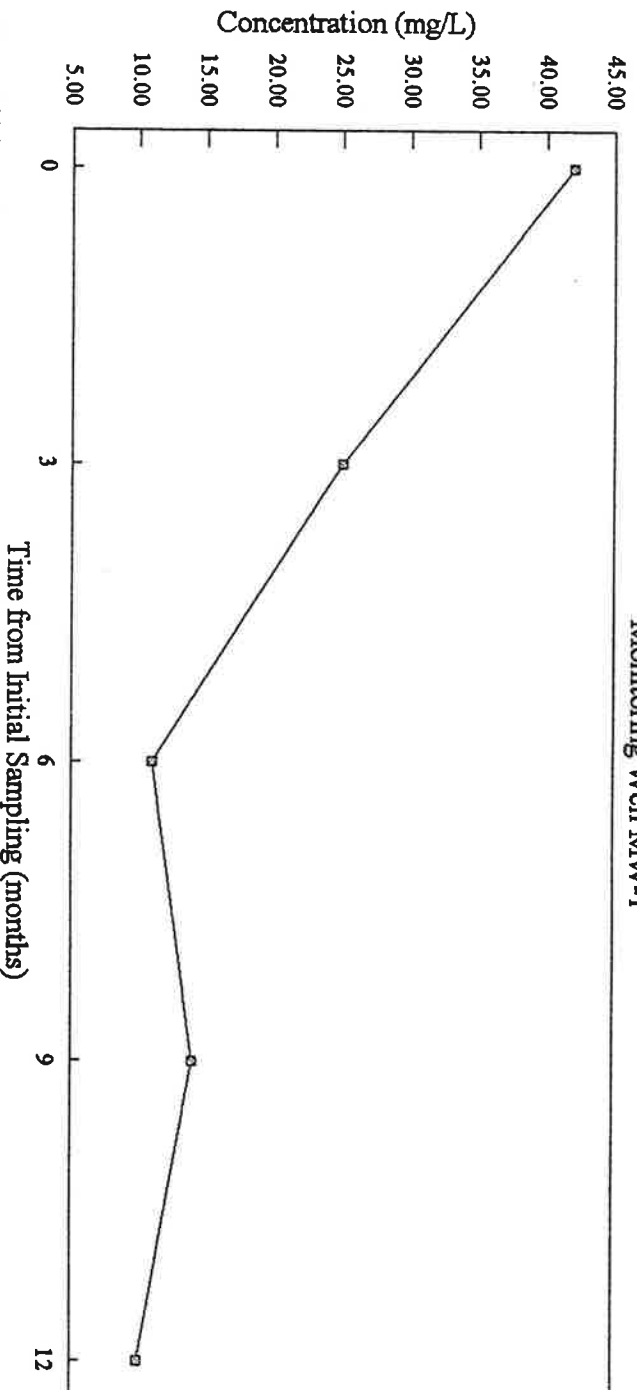
Hydrograph - Monitoring Well MW-1
Former Mobil Service Station
4201 Hiawatha Avenue
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3

TPH CONCENTRATION TREND

Monitoring Well MW-1



Note: Initial sampling event was 12/26/91.

Sampling Event Date	Time from Initial Sampling (months)	TPH Concentration (mg/L)
12/26/91	0	42.00
03/26/92	3	25.00
06/25/92	6	11.00
09/24/92	9	14.00
12/31/92	12	10.00

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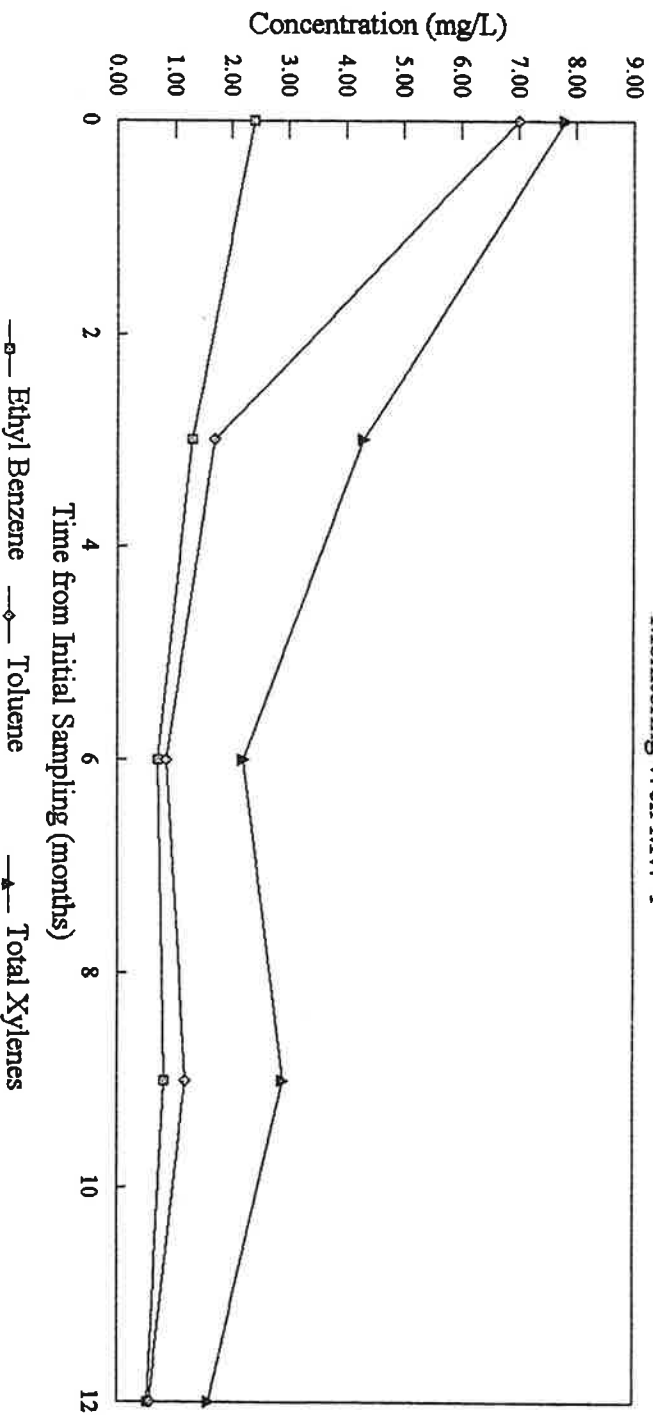
Total Petroleum Hydrocarbon Concentration Trend
 Former Mobil Service Station
 4201 Hiawatha Avenue
 Minneapolis, Minnesota

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VOC CONCENTRATION TRENDS

Monitoring Well MW-1



Sampling Event Date	Time from Initial Sampling (months)	Ethyl benzene Concentration (mg/L)	Toluene Concentration (mg/L)	Total xylenes Concentration (mg/L)
12/26/91	0	2.40	7.00	7.80
03/26/92	3	1.30	1.70	4.30
06/25/92	6	0.71	0.86	2.20
09/24/92	9	0.82	1.20	2.90
12/31/92	12	0.52	0.56	1.61

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VOC Concentration Trends
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